# STORMWATER MANAGEMENT PLAN (SWMP)

# FOR THE

# TOWN OF NEWBURGH

## July 2024

## TOWN OF NEWBURGH

## ORANGE COUNTY, NEW YORK

**PREPARED FOR:**
Town of Newburgh
1496 Route 300
Newburgh, NY 12550

**PREPARED BY:**
MHE Engineering D.P.C
33 Airport Center Dr., Suite 202
New Windsor, NY 12553

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## A. INTRODUCTION

The Town of Newburgh is located in the Northeast portion of Orange County, NY. The Town shares jurisdictional boundaries with the City of Newburgh, the Town of New Windsor and the Town of Montgomery, in Orange County. The Town shares the municipal boundary with the Town of Marlborough, Town of Plattekill and Town of Shawangunk located in Ulster County. The Marlborough/Newburgh municipal boundary is also the Orange County/Ulster County boundary. The Town of Newburgh consists of 47+/-square miles of land and water.

In 2003, the Town of Newburgh obtained coverage under the NYSDEC MS4 Program. The Town has been assigned permit number NYR-20A237. The Town had no Stormwater Management Plan in place prior to 2021. This Stormwater Management Plan (SWMP, or Plan) will serve as an update to the 2021 Plan and is based on NYSDEC's General Permit GP-0-24-001, Municipal Separate Storm Sewer Systems (MS4s). This General Permit (Permit) was adopted by the NYSDEC on December 13, 2023 and its Effective Date of Coverage (EDC) is January 3, 2024. The Permit is included as ATTACHMENT 1 to this Plan.

The Permit identifies actions that must be taken by MS4 communities, outlining general requirements as well as six (6) individual regulatory programs called Minimum Control Measures (MCMs), each of which has measurable goals and required timelines. As a traditional land use control MS4 as defined in the Permit, the Town of Newburgh's SWMP must address the following six (6) MCMs:

1. Public Education and Outreach
2. Public Involvement/Participation
3. Illicit Discharge Detection and Elimination (IDDE)
4. Construction Site Stormwater Runoff Control
5. Post Construction Stormwater Management
6. Pollution Prevention/Good Housekeeping for Municipal Operations

General MS4 stormwater regulations as well as the requirements for each of the six MCMs are further described in sections B and C of this SWMP. These sections emphasize the timeline requirements defined within the Permit. As milestone tasks are completed in accordance with the required time frames, this SWMP will be updated to detail the Town's actions, thus reflecting compliance with the Permit.

## B. GENERAL STORMWATER REGULATIONS

### 1) Stormwater Management Plan Coverage Area

The Town of Newburgh's SWMP shall cover construction and post construction activities throughout the entire Town of Newburgh, all of which is within an Automatically Designated MS4 Area. The MS4 Coverage Area and "Focus Areas" are shown on the Town's Stormwater Basemap, which is included as ATTACHMENT 2 of this Plan.

### 2) Administration and Reporting

As of the writing of this Plan, the Town has completed the actions that the Permit requires within six (6) months of the EDC, including:

i. The Town has completed the **comprehensive system mapping** of stormwater infrastructure. In accordance with Part IV.D.1 of the Permit, this mapping includes MS4 outfalls, interconnections, sewershed boundaries, conveyance systems, culvert crossings and stormwater structures. These features are shown in the Town's MS4 Basemap and sewershed maps, included as ATTACHMENTS 2 and 4 to this Plan.

ii. The Town has completed an **Enforcement Response Plan** (ERP, ATTACHMENT 3) that outlines the processes for reviewing and documenting potential illicit discharges and potential stormwater violations at construction sites. Attachment A of that Plan includes a Violation and Enforcement Documentation form that the Town will be using when potential or actual violations arise. These forms will be filed digitally as well as in the Town Clerk's office with other MS4 materials.

iii. As displayed in the Town's **organizational chart**, which is Attachment C of the ERP, the Supervisor of the Town of Newburgh (currently Gilbert Piaquadio) has been designated to be the MS4 Operator. He can be reached at Town Hall at 845-564-4552. The Operator has assigned staff to administer, track, enforce, and report on the various MCM activities defined in the Permit as being due in the first six months of the EDC. The Town has identified a Stormwater Program Coordinator, who will oversee the implementation and enforcement of this SWMP in coordination with the MS4 Operator, other staff and other parties, as necessary. The Coordinator will also be responsible for filing Annual Reports to the NYSDEC. As of this 2024 SWMP, the Coordinator is the Town Engineer (currently James Osbourne), who can be reached by email at engineering@townofnewburgh.org or by phone at 845-564-7814. Together, the Coordinator and the MS4 Operator will ensure that all mapping, reporting, and other requirements established by the Permit are completed and will update this SWMP as needed, no less frequently than **annually**.

iv. This SWMP is available online at the Town's website and in hard copy form at the Town Hall during normal business hours in order for the public, municipal employees and representatives of NYSDEC and EPA to review the Plan, offer comments, and ask questions.

- ***Interim and Annual Reporting beginning within six (6) months of the EDC:***
    - **Annually**, MS4 Operators will submit an Annual Report to the NYSDEC using the form provided by the NYSDEC. Reports submitted to the NYSDEC on an annual and semiannual basis will be saved electronically with hard copies being placed in a separate file entitled "MS4 Reporting" to be kept in the Town Clerk's Office.
    - An Interim Progress Certification for the period of January 3 through June 30 of the same year must be submitted to the Department by October 1 of the same year. An Interim Progress Certification for the period of July 1 through January 2

of the following year must be submitted to the Department by April 1 of the following year along with the Annual Report. Submission of the Annual Report is not a substitute for submission of the Interim Progress Certification.

- ***Once every five (5) years:***
    - The *MS4* Operator must evaluate the SWMP for compliance with the terms and conditions of the Permit, including the effectiveness or deficiencies of components of the individual SWMP Plan, and the status of achieving the requirements outlined in the Permit.

### 3) Exempt Activities

This SWMP exempts activities for non-stormwater discharges including those activities identified in the Town's Storm Water Management Regulations and the NYSDEC General Permit. Exempt activities include the following:

- Stormwater discharges associated with an industrial activity provided the discharges are covered by the SPDES Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity, GP-0-23-001 (MSGP); and
- Individual SPDES permitted stormwater discharges provided the discharges are in compliance with their individual SPDES permit limitations.

### 4) Enforcement Measures and Tracking

The Town is committed to identifying and documenting stormwater violations and has described its process of ensuring compliance in its Enforcement Response Plan (ERP, ATTACHMENT 3). As described in the ERP, the MS4 Operator must address violations to stormwater regulations and attempt to remediate the issue through a well-documented process. Ongoing and completed Violation and Enforcement Documentation forms

(Attachment A of the ERP) will be saved electronically with hard copies being placed in a separate file entitled "Violation and Enforcement Documentation" to be kept in the Town Clerk's Office.

## C. MINIMUM CONTROL MEASURES

### 1) Minimum Control Measure #1: Public Education and Outreach

***"The MS4 Operator must develop and implement an education and outreach program to increase public awareness of pollutant generating activities and behaviors. This MCM is designed to inform the public about the impacts of stormwater on water quality, the general sources of stormwater pollutants, and the steps the general public can take to reduce pollutants in stormwater runoff."***

As shown in Attachment C of the ERP (ATTACHMENT 3), the MS4 Operator has delegated management of this MCM to the Town Clerk (currently Lisa Vance-Ayres who will oversee distribution of the Town's Stormwater Education and Outreach pamphlet (ATTACHMENT 5) and will ensure that the goals and obligations of this MCM are met in a timely manner. As of the writing of this Plan and as per the 6-month requirement in the Permit, the Town of Newburgh has made information available to municipal employees, businesses, and the public by posting information on the Town's website. This information includes:

i. What types of discharges are allowable (Part I.A.3.);
ii. What an illicit discharge is and why they are prohibited (Part VI.C.);
iii. The environmental hazards associated with illicit discharges and improper disposal of waste;
iv. Proper handling and disposal prac□ces for the most common behaviors within the community (e.g., sep□c care, car washing, household hazardous waste, swimming pool draining, or other ac□vi□es resul□ng in illicit discharges to the MS4); and

v. How to report illicit discharges they may observe (Part VI.C.1.a.).

- ***Within three (3) years of the EDC:***
  - **Focus Areas**: the *MS4 Operator* must identify and document the focus areas in the *SWMP Plan*. The focus areas to be considered are as follows:
    i. Areas *discharging* to waters with Class AA-S, A-S, AA, A, B, SA, or SB (mapped in accordance with Part IV.D.1.e.ii.a));
    ii. *Sewersheds* for impaired waters listed in Appendix C (subject to Part VIII. requirements; mapped in accordance with Part IV.D.1.c. for *MS4 Operators* continuing coverage and Part IV.D.2.a.ii. for newly designated *MS4 Operators*);
    iii. *TMDL* watersheds (subject to Part IX. requirements; mapped in accordance with Part IV.D.1.e.ii.c));
    iv. Areas with *construction activities*.
    v. Areas with on-site wastewater systems (subject to Part VIII. or Part IX. requirements);
    vi. Residential, commercial, and industrial areas (mapped in accordance with Part IV.D.1.e.iii.);
    vii. *Stormwater hotspots*; and
    viii. Areas with *illicit discharges*.
  - **Target Audience and Associated Pollutant Generating Activities:** The MS4 Operator must identify and document the applicable target audience(s) and associated pollutant generating activities that the outreach and education will address for each focus area identified by the MS4 Operator in Part VI.A.1.a. in the SWMP Plan. The target audiences are as follows:
    a) Residents;

b) Commercial:[1] Business owners and staff;

c) Institutions:[2] Managers, staff, and students;

d) Construction: Developers, contractors, and design professionals;

e) Industrial:[3] Owners and staff; and

f) MS4 Operator's municipal staff.

- **Education and Outreach Topics:** The MS4 Operator must identify and document in the SWMP Plan the education and outreach topics and how the education and outreach topics will reduce the potential for *pollutants* to be generated by the target audience(s) (Part VI.A.1.b.) for the focus area(s) (Part VI.A.1.a.).

- ***Once every five (5) years of the EDC:***

  - **Distribution Method of Educational Messages:** The *MS4 Operator* must identify and document in the *SWMP Plan* which of the following method(s) are used for the distribution of educational messages:

    i. Printed materials (e.g., mail inserts, brochures, and newsletters);

    ii. Electronic materials (e.g., websites, email listservs);

    iii. Mass media (e.g., newspapers, public service announcements on radio or cable);

    iv. Workshops or focus groups;

    v. Displays in public areas (e.g., Town halls, library, parks); or

    vi. Social Media (e.g., Facebook, Twitter, blogs).

  - **Frequency**: After completion of focus areas, target audience identification and educational and outreach topic development, *MS4 Operator* must:

    ✓ Deliver an educational message to each target audience(s) (Part VI.A.1.b.) for each focus area(s) (Part VI.A.1.a.) based on the defined

[1] Business, retail stores, and restaurants.
[2] Hospitals, churches, colleges, and schools.
[3] Factories, recyclers, auto-salvage, and mines.

education and outreach topic(s) (Part VI.A.1.c.); and

- ✓ Document the completion of this requirement in the *SWMP Plan*.

- Upon completion of the above, **annually**, by April 1, the MS4 Operator must:
  - Review and update the focus areas, target audiences and/or education and outreach topics, and
  - Document the completion of this requirement in the SWMP.

2) **Minimum Control Measure #2: Public Involvement/Participation**

***"The MS4 Operator must provide opportunities to involve the public in the development, review, and implementation of the SWMP. This MCM is designed to give the public the opportunity to include their opinions in the implementation of this SPDES general permit."***

As shown in Attachment C of the ERP (ATTACHMENT 3), the MS4 Operator has delegated management of MCM 2 to the Code Compliance Supervisor, (currently Gerald Canfield), who can be reached by phone at 845-564-7801. The Building Inspector will work in concert with the Stormwater Program Coordinator to address stormwater issues received from the public, staff, or otherwise, and ensure enforcement issues are documented in compliance with the guidelines set forth in the ERP.

- ***Annually, beginning one year after the EDC:***
  - **Public Involvement/Participation**: The MS4 Operator must provide an opportunity for public involvement/participation in the development and implementation of the SWMP. The MS4 Operator must document the public involvement/participation opportunities in the SWMP Plan. The opportunities for public involvement/participation are as follows:

i. Citizen advisory group on stormwater management;

ii. Public hearings or meetings;

iii. Citizen volunteers to educate other individuals about the SWMP;

iv. Coordination with other pre-existing public involvement/participation opportunities;

v. Reporting concerns about activities or behaviors observed; or

vi. Stewardship activities.

- **Public Involvement/Participation**: The *MS4 Operator* must inform the public of the opportunity (Part VI.B.1.a.) for their involvement/participation in the development and implementation of the *SWMP* and how they can become involved. The *MS4 Operator* must document the method for distribution of this information in the *SWMP Plan*. The methods for distribution are as follows:

  i. Public notice;

  ii. Printed materials (e.g., mail inserts, brochures and newsletters);

  iii. Electronic materials (e.g., websites, email listservs);

  iv. Mass media (e.g., newspapers, public service announcements on radio or cable);

  v. Workshops or focus groups;

  vi. Displays in public areas (e.g., Town halls, library, parks); or

  vii. Social Media (e.g., Facebook, Twitter, blogs).

- **Public Notice and Input Requirements for SWMP**: The *MS4 Operator* must provide an opportunity for the public to review and comment on the publicly available *SWMP Plan* (Part IV.B.2.b.). The public must have the ability to ask questions and submit comments on the *SWMP Plan*. The completion of this permit requirement must be documented in the *SWMP Plan*. This requirement may be satisfied by Part VI.B.1.

- **Public Notice and Input Requirements for Draft Annual Report**: The *MS4 Operator*

must provide an opportunity for the public to review and comment on the draft Annual Report. The completion of this permit requirement must be documented in the *SWMP Plan*. This
requirement may be satisfied by either:

a) Presentation of the draft Annual Report at a regular meeting of an existing board (e.g., administrative, planning, zoning) or a separate meeting specifically for *stormwater*, as designated by the *MS4* or if requested by the public. The public must have the ability to ask questions about and make comments on the draft annual report during that presentation; or
b) Posting of the draft Annual Report on a public website. The website must provide information on the timeframes and procedures to submit comments and/or request a meeting. However, if a public meeting is requested by two or more persons, the *MS4 Operator* must hold such a meeting.

- **Consideration of Public Input**: The *MS4 Operator* must include a summary of comments received on the *SWMP Plan* and draft Annual Report in the *SWMP Plan*. And, within thirty (30) days of when public input is received, the *MS4 Operator* must update the *SWMP Plan*, where appropriate, based on the public input received.

### 3) Minimum Control Measure #3: Illicit Discharge Detection and Elimination (IDDE)

***"The MS4 Operator must develop, implement, and enforce a program which systematically detects, tracks down, and eliminates illicit discharges to the MS4. This MCM is designed to manage the MS4 so it is not conveying pollutants associated with flows other than those directly attributable to stormwater runoff."***

As shown in the Town's ERP (ATTACHMENT 3), the Town of Newburgh has designated the Code Compliance Supervisor, (currently Gerald Canfield), to oversee the

implementation of the Town's Illicit Discharge Detection and Elimination Program (IDDE Program). He will receive illicit discharge reports from the public via emails to codecompliance@townofnewburg.org and by phone at 845-564-7801.

Confirmed violations and enforcement actions will be taken as per the ERP (ATTACHMENT 3) and documented using Attachment A of the ERP. Within thirty (30) days of confirmation of an illicit discharge, the Code Compliance Supervisor must visit the site again and document conditions to determine if the violation has been resolved. All Violation and Enforcement Documentation reports will be kept in a separate file in the Town Clerk's office with all other MS4-related files.

Illicit Discharge Detection & Elimination is a priority component of the Towns SWMP and in support of this, the Town has included Article II – Illicit Discharges, Activities and Connections as part of their Stormwater Management and Control section of the Town Code. This is included in ATTACHMENT 8 to this plan. ATTACHMENT 6 to this Plan contains the EPA publication, 'Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessment." This document is used as a guide for the Town personnel involved with stormwater management. Town employees periodically perform evaluations of the outfall system as funding and time constraints allow, using the Outfall Reconnaissance Inventory form found in this publication.

Monitoring locations used to detect illicit discharges include:

1) MS4 Outfalls,
2) Interconnections, and
3) Municipal Facility intraconnections

- ***Within two (2) years of the EDC:***
    - **Illicit Discharge Detection: Monitoring Locations Inspection and Sampling**

**Program.** The MS4 Operator must develop and implement a monitoring locations inspection and sampling program. The monitoring locations inspection and sampling program must be documented in the SWMP Plan specifying:

a) The monitoring locations inspection and sampling procedures including:
    i. During dry weather,18 one (1) inspection of each monitoring location identified in the inventory (Part VI.C.1.c.) every five (5) years following the most recent inspection;
    ii. Documentation of all monitoring location inspections, including any sampling results, using the Monitoring Locations Inspection and Sampling Field Sheet (Appendix D to the MS4 Permit) or an equivalent form containing the same information and include the completed monitoring location inspections and sampling results in the SWMP Plan (e.g., the completed Monitoring Locations Inspection and Sampling Field Sheets);
    iii. Provisions to sample all monitoring locations which had inspections which resulted in a suspect or obvious illicit discharge characterization.
    iv. The sampling requirement is based on the number and severity of physical indicators present in the flow to better inform track down procedures (Part VI.C.2.). If the source of the illicit discharge is clear and discernable (e.g., sewage), sampling is not necessary; Sampling may be done with field test kits or field instrumentation that are sufficiently sensitive to detect the parameter below the sampling action level used and are not subject to 40 CFR Part 136 requirements for approved methods and certified laboratories;
    v. Provisions to initiate, or cause to initiate, track down procedures

(Part VI.C.2.a.), in accordance with the timeframes specified in Part VI.C.2.a.iii, for monitoring locations with an overall characterization as suspect illicit discharge or obvious illicit discharge or that exceed any sampling action level used;

vi. Provisions to re-inspect the monitoring location within thirty (30) days of initial inspection if there is a physical indicator not related to flow, potentially indicative of intermittent or transitory discharges, utilizing techniques described in Chapter 12.6 of the Center for Watershed Protection Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assistance, October 2004 (CWP 2004) or equivalent. If those same physical indicators persist, the MS4 Operator must initiate illicit discharge track down procedures (Part VI.C.2.a)

b) The training provisions for the *MS4 Operator*'s monitoring locations inspection and sampling procedures (Part VI.C.1.e.i.).

i. If new staff are added, training on the *MS4 Operator*'s monitoring locations inspection and sampling procedures (Part VI.C.1.e.i.) must be given prior to conducting monitoring locations inspections and sampling procedures.

ii. For existing staff, training on the *MS4 operato*r's monitoring locations inspection and sampling procedures Part VI.C.1.e.i.) must be given prior to conducting monitoring locations inspections and sampling and once every five (5) years, thereafter; and

iii. If the monitoring locations inspection and sampling procedures (Part VI.C.1.e.i.) are updated (Part VI.C.1.e.iv.), training on the updates must be given to all staff prior to conducting monitoring

locations inspections and sampling.

c) The names, titles, and contact information for the individuals who have received monitoring locations inspection and sampling procedures training and update annually; and

d) Annually, by April 1, the *MS4 Operator* must:

   i. Review and update the monitoring location inspection and sampling procedures (Part VI.C.1.e.i.) based on monitoring location inspection results (e.g., trends, patterns, areas with *illicit discharges*, and common problems); and

   ii. Document the completion of this requirement in the *SWMP Plan*.

- **Illicit Discharge Track Down Program:** The MS4 Operator must develop and implement an *illicit discharge* track down program to identify the source of *illicit discharges* and the responsible party. The *illicit discharge* track down program must be documented in the *SWMP Plan* specifying:

  a) The *illicit discharge* track down procedures including:

     i. Procedures as described in Chapter 13 of CWP 2004 or equivalent;

     ii. Steps taken for *illicit discharge* track down procedures;

     iii. The following timeframes to initiate *illicit discharge* track down:

        - Within twenty-four (24) hours of discovery, the *MS4 Operator* must initiate track down procedures for flowing *MS4* monitoring locations with *obvious illicit discharges*
        - Within two (2) hours of discovery, the MS4 Operator must initiate track down procedures for obvious illicit discharges of sanitary wastewater that would affect bathing areas during bathing season, shell fishing areas or public water intakes and report orally or electronically to the Regional Water Engineer and local

health department; and

- Within five (5) days of discovery, the MS4 Operator must initiate track down procedures for suspect illicit discharges.

b) The training provisions for the MS4 Operator's illicit discharge track down procedures (Part VI.C.2.a.).
   i. If new staff are added, training on the MS4 Operator's illicit discharge track down procedures (Part VI.C.2.a.) must be given prior to conducting illicit discharge track downs;
   ii. For existing staff, training on the MS4 Operator's illicit discharge track down procedures (Part VI.C.2.a.) must be given prior to conducting illicit discharge track downs and once every five (5) years, thereafter; and
   iii. If the illicit discharge track down procedures (Part VI.C.2.a.) are updated (Part VI.C.2.d.), training on the updates must be given to all staff prior to conducting illicit discharge track downs.
c) The names, titles, and contact information for the individuals who have received illicit discharge track down procedures training and update annually; and
d) Annually, by April 1, the MS4 Operator must:
   i. Review and update the illicit discharge track down procedures (Part VI.C.2.a.); and
   ii. Document the completion of this requirement in the SWMP Plan.

- **Illicit Discharge Elimination Program:** The MS4 Operator must *develop* and implement an *illicit discharge* elimination program. The *illicit discharge* elimination program must be documented in the *SWMP Plan* specifying:

a) The *illicit discharge* elimination procedures including:

i. Provisions for escalating enforcement and tracking, both consistent with the ERP required in Part IV.F. of this *SPDES* general permit;
ii. Provisions to confirm the corrective actions have been taken;
iii. Steps taken for *illicit discharge* elimination procedures; and
iv. The following timeframes for *illicit discharge* elimination:
    - Within twenty-four (24) hours of identification of an *illicit discharge* that has a reasonable likelihood of adversely affecting human health or the environment, the *MS4 Operator* must eliminate the *illicit discharge*;
    - Within five (5) days of identification of an *illicit discharge* that does not have a reasonable likelihood of adversely affecting human health or the environment, the *MS4 Operator* must eliminate the *illicit discharge; a*nd
    - Where elimination of an *illicit discharge* within the specified timeframes (Part VI.C.3.a.iv.) is not possible, the *MS4 Operator* must notify the Regional Water Engineer.

*b)* The training provisions for the *MS4 Operator*'s *illicit discharge* elimination procedures (Part VI.C.3.a.).

*i.* If new staff are added, training on the *MS4 Operator*'s *illicit discharge* elimination procedures (Part VI.C.3.a.) must be given prior to conducting *illicit discharge* eliminations;
ii. For existing staff, training on the *MS4 Operator*'s *illicit discharge* elimination procedures (Part VI.C.3.a.) must be given prior to conducting *illicit discharge* eliminations and once every five (5) years, thereafter; and
iii. If the *illicit discharge* elimination procedures (Part VI.C.3.a.) are updated (Part VI.C.3.d.), training on the updates must be given to all

staff prior to conducting *illicit discharge* eliminations.

c) The names, titles, and contact information for the individuals who have received *illicit discharge* elimination procedures training and update annually; and

d) **Annually**, by April 1, the *MS4 Operator* must review and update the *illicit discharge* elimination procedures (Part VI.C.3.a.) and document the completion of this requirement in the *SWMP Plan*.

- ***Within three (3) years of the EDC:***

  - **Monitoring Locations Inventory:** The MS4 Operator must develop and maintain an inventory of the monitoring locations in the SWMP. The following information must be included in the inventory and must be updated **annually**:

    a) Inventory information for *MS4 outfall*s

       i. ID;
       ii. Prioritization (high or low) (Part VI.C.1.d.);
       iii. Type of monitoring location (Part VI.C.1.b.);
       *iv*. Name of *MS4 Operator's municipal facility*, if located at a *municipal facility*;17
       v. Receiving waterbody name and class (mapped in accordance with Part IV.D.1.e.ii.a));
       vi. Receiving waterbody WI/PWL Segment ID (mapped in accordance with Part IV.D.1.e.ii.b));
       vii. Land use in drainage area;
       viii. Type of conveyance (open drainage or closed pipe);
       ix. Material;
       x. Shape;
       xi. Dimensions;

xii. Submerged in water; and

xiii. Submerged in sediment.

*b)* Inventory information for *interconnections*

i. ID;

ii. Prioritization (high or low) (Part VI.C.1.d.);

iii. Type of monitoring location (Part VI.C.1.b.);

iv. Name of *MS4 Operator* receiving *discharge* or private storm system;

*v.* Name of *MS4 Operator*'s *municipal facility*, if located at a *municipal facility*; and

vi. Receiving waterbody name and class (mapped in accordance with Part IV.D.1.e.ii.a)).

*c)* Inventory information for *municipal facility interconnection*

i. ID;

ii. Prioritization (high or low) (Part VI.C.1.d.);

iii. Type of monitoring location (Part VI.C.1.b.);

iv. Name of *MS4 Operator*'s *municipal facility*; and

v. Receiving waterbody name and class (mapped in accordance with Part IV.D.1.e.ii.a).

- **Monitoring Locations Prioritization:** The *MS4 Operator* must prioritize monitoring locations which are included in the monitoring locations inventory (Part VI.C.1.c.) as follows:

a) High priority monitoring locations include monitoring locations:

i. At a high priority *municipal facility*, as defined in Part VI.F.2.c;

ii. *Discharging* to impaired waters (subject to Part VIII. requirements;

iii. mapped in accordance with Part IV.D.1.e.ii.b));

iv. *Discharging* within a TMDL watershed (subject to Part IX. requirements;

mapped in accordance with Part IV.D.1.e.ii.c));

v. *Discharging* to waters with Class AA-S, A-S, AA, A, B, SA, or SB (mapped in accordance with Part IV.D.1.e.ii.a)); and/or

vi. Confirmed citizen complaints on three or more separate occasions in the last twelve (12) months.

b) All other monitoring locations are considered low priority.

**Within thirty (30) days** of when a monitoring location is constructed or the *MS4 Operator* discovers it, the *MS4 Operator* must prioritize those monitoring locations; and **Annually**, after the initial prioritization (Part VI.C.1.d.i.), the *MS4 Operator* must update the monitoring location prioritization in the inventory (Part VI.C.1.c.) based on information gathered as part of the monitoring location inspection and sampling program (Part VI.C.1.e.). The completion of this permit requirement must be documented in the SWMP.

**4) <u>Minimum Control Measure #4: Construction Site Storm water Run Off Control</u>**

***"The MS4 Operator must develop, implement, and enforce a program to ensure construction sites are effectively controlled. This MCM is designed to prevent pollutants from construction related activities as well as promote the proper planning and installation of post-construction stormwater management practices (SMPs)."***

As shown in Attachment C of the ERP (ATTACHMENT 3), the MS4 Operator has delegated management of this MCM to the Consulting Engineer, (currently Dave Fritts, CPESC, CESSWI of MHE Engineering). He will receive complaints related to construction stormwater activity from the public via emails to dfritts@mhepc.com and by phone at 845-567-3100. Confirmed violations will be addressed as per the ERP (ATTACHMENT 3) and documented along with enforcement action documentation using Attachment A of the ERP. All records related to construction site complaints, violations, and enforcement actions will

be included in ATTACHMENT 10 and kept in a separate file in the Town Clerk's office with all other MS4-related files.

The Town maintains an inventory of active construction sites in the Town Clerk's office. ATTACHMENT 9 to this SWPPP includes a current list of active construction sites in the Town as of preparation of this report.

- ***Within one (1) year of the EDC:***
    - ***Construction Oversight Program:*** The MS4 Operator must develop and implement a construction oversight program. The construction oversight program must be documented in the SWMP Plan specifying:
        a) The construction oversight procedures including:
            i. When the construction site stormwater control program applies (Part VI.D.1.);
            ii. What types of construction activity require a SWPPP;
            iii. The procedures for submission of SWPPPs;
            iv. SWPPP review requirements (Part VI.D.6.)
            v. Pre-construction oversight requirements (Part VI.D.7.)
            vi. Construction site inspection requirements (Part VI.D.8.);
            vii. Construction site close-out requirements (Part VI.D.9.);
            viii. Enforcement process/expectations for compliance; and
            ix. Other procedures associated with the control of stormwater runoff from applicable construction activities.
        b) The training provisions for the MS4 Operator's construction oversight procedures (Part VI.D.3.a.).
            i. If new staff are added, training on the MS4 Operator's construction oversight procedures (Part VI.D.3.a.) must be given prior to conducting any construction oversight activities;

ii. For existing staff, training on the MS4 Operator's construction oversight procedures (Part VI.D.3.a.) must be given prior to conducting any construction oversight activities and once every five (5) years, thereafter; and

iii. If the construction oversight procedures (Part VI.D.3.a.) are updated (Part VI.D.3.a.), training on the updates must be given to all staff prior to conducting construction oversight.

c) The names, titles, and contact information for the individuals who have received construction oversight training and update annually;

d) Procedures to ensure those involved in the construction activity itself (e.g., contractor, subcontractor, qualified inspector, SWPPP reviewers) have received four (4) hours of Department endorsed training in proper erosion and sediment control principles from a Soil & Water Conservation District, or other Department endorsed entity; and

- **Annually**, by April 1, the MS4 Operator must review and update the construction oversight procedures (Part VI.D.3.a.); and document the completion of this requirement in the SWMP Plan.

- ***Construction Site Prioritization:***

a) The MS4 Operator must prioritize all construction sites which are included in the construction site inventory (Part VI.D.4.) as follows:

i. High priority construction sites include construction sites:

i. With a direct conveyance (e.g., channel, ditch, storm sewer) to a *surface water of the State* that is:

- Listed in Appendix C with silt/sediment, phosphorus, or nitrogen as the POC;
- Classified as AA-S, AA, or A (mapped in

accordance with Part IV.D.1.e.ii.a)); or

- Classified with a trout (T) or trout spawning (TS) designation (mapped in accordance with Part IV.D.1.e.ii.a));

- With greater than five (5) acres of disturbed earth at any one time;
- With earth disturbance within one hundred (100) feet of any lake or pond (mapped in accordance with Part IV.D.1.e.ii.b)); and/or
- Within fifty (50) feet of any rivers or streams (mapped in accordance with Part IV.D.1.e.ii.b));

ii. All other construction sites are considered low priority.

b) Within thirty (30) days of when a construction site becomes active, the *MS4 Operator* must prioritize those construction sites; and

c) **Annually**, after the initial prioritization (Part VI.D.5.a.), the *MS4 Operator* must update the construction site prioritization in the inventory (Part VI.D.4.a.) based on information gathered as part of the construction oversight program (Part VI.D.3.). The completion of this permit requirement must be documented in the *SWMP Plan*. If the prioritization of the construction site changes priority based on information gathered as part of the construction oversight program, the *MS4 Operator* must comply with the requirements that apply to that prioritization.

- **SWPPP Review:** The Operator must:
  a) Ensure individual(s), responsible for reviewing SWPPPs for acceptance, receive:

i. Four (4) hours of *Department* endorsed training in proper erosion and
sediment control principles from a Soil & Water Conservation District, or other *Department* endorsed entity. This training must be completed within three (3) years of the EDC and every three (3) years thereafter.

ii. Document the completion of this requirement in the SWMP Plan.

b) Ensure SWPPP reviewers receive this training (Part VI.D.6.a.) prior to conducting SWPPP reviews for acceptance.
   i. Individuals without these trainings cannot review SWPPPs for acceptance.
   ii. Individuals who meet the definition of a qualified professional or qualified inspector are exempt from this requirement.

c) Ensure individuals responsible for reviewing SWPPPs review all SWPPPs for applicable *construction activities* (Part VI.D.1.) and for conformance with the requirements of the CGP, including:
   a) Erosion and sediment controls must be reviewed for conformance with the NYS E&SC 2016, or equivalent;
   b) Individuals responsible for review of post-construction stormwater management practices (*SMPs)* must be *qualified professionals* or under the supervision of a *qualified professional*; and
   c) Post-construction *SMPs* must be reviewed for conformance with the NYS SWMDM 2015 or equivalent, including:
      - All post-construction *SMPs* must meet the *sizing criteria* contained in the CGP and NYS SWMDM 2015.

- Deviations from the performance criteria of the NYS SWMDM 2015must demonstrate that they are equivalent.
- The SWPPP must include an O&M plan that includes inspection and maintenance schedules and actions to ensure continuous and effective operation of each post-construction *SMP*. The SWPPP must identify the entity that will be responsible for the long-term operation and maintenance of each practice.

d) In the *SWMP Plan*, document and update annually the names, titles, and contact information for the individuals who have received the trainings listed in Part VI.D.6.a.
e) In the *SWMP Plan*, document the SWPPP review including the information found in Part III.B. of the CGP;
f) Prioritize new *construction activities* (Part VI.D.5.a.); and
g) Notify construction site owner/operators that their SWPPP has been accepted using the MS4 SWPPP Acceptance Form25 created by the Department and required by the CGP, signed in accordance with Part X.J.

- **Pre-Construction Meeting:** Prior to commencement of construction activities, the Operator must ensure a pre-construction meeting is conducted. The date and content of the preconstruction inspection/meeting must be documented in the SWMP Plan. The owner/operator listed on the CGP NOI (if different from the MS4 Operator), the MS4 Operator, contractor(s) responsible for implementing the SWPPP for the construction activity, and the qualified inspector (if required

for the construction activity by Part IV.C. the CGP) must attend the meeting in order to:

a) Confirm the approved project has received, or will receive26, coverage under the CGP or an individual *SPDES* permit;
b) Verify contractors and subcontractors selected by the owner/operator of the *construction activity* have identified at least one individual that has received four (4) hours of *Department* endorsed training in proper erosion and sediment control principles from a Soil & Water Conservation District or other endorsed entity as required by the CGP and Part VI.D.3.d; and
c) Review the construction oversight program (Part VI.D.3.) and expectations for compliance.

- ***Within three (3) years of the EDC:***
  - **Construction Site Inspections:** The Operator must:
    a) Ensure individuals(s), responsible for construction site inspections, receive four (4) hours of Department endorsed training in proper erosion and sediment control principles from a Soil & Water Conservation District, or other Department endorsed entity. This training must be complete, within three (3) years of the EDC and every three (3) years thereafter and document the completion of this requirement in the SWMP Plan.
    b) Ensure all MS4 Construction Site Inspectors receive this training prior to conducting construction site inspections.
        i. Individuals without these trainings cannot inspect construction sites.
        ii. Individuals who meet the definition of a qualified professional or qualified inspector are exempt from this requirement.

c) Annually inspect all sites with construction activity identified in the inventory (Part VI.D.4.) during active construction after the pre-construction meeting (Part VI.D.7.), or sooner if deficiencies are noted that require attention. Follow up to construction site inspections must confirm corrective actions are completed within timeframes established by the CGP and the MS4 Operator's ERP (Part IV.F.1.).

d) In the SWMP Plan, document and update annually the names, titles, and contact information for the individuals who have received the trainings listed in Part VI.D.8.a.

e) Document all inspections using the Construction Site Inspection Report Form
(Appendix D) or an equivalent form containing the same information. The MS4 Operator must include the completed Construction Site Inspection Reports in the SWMP Plan

- **Construction Site Closeout:**

*a)* The MS4 Operator must ensure a final construction site inspection is conducted and documentation of the final construction site inspection must be maintained in the *SWMP Plan*. The final construction site inspection must be documented using the Construction Site Inspection Report Form (Appendix D), or an equivalent form containing the same information, or accept the construction site owner/operator's *qualified inspector* final inspection certification required by the CGP.

*b)* The Notice of Termination (NOT)27 must be signed by the MS4 Operator as required by the CGP for projects determined to be complete. The NOT must be signed in accordance with Part X.J.

**5) <u>Minimum Control Measure #5: Post-Construction Stormwater Management</u>**

***"The MS4 Operator must develop, implement, and enforce a program to ensure proper operation and maintenance of post construction SMPs for new or redeveloped sites. This MCM is designed to promote the long-term performance of post-construction SMPs in removing pollutants from stormwater runoff."***

The Town of Newburgh has a standard Stormwater Management Agreement which is required for projects coming through the Planning Board process that will require the maintenance of post construction stormwater devices. These agreements are executed and filed with the Orange County Clerk's Office prior to the project being granted final Planning Board Approval. A copy of this agreement has been included in ATTACHMENT 11 of this report.

The Town also requires a private road and access agreement (that includes management of stormwater devices) for any applicable project that come through the Town Planning Board. The Town does not have a standard form of this agreement as they are specifically created for each project by the applicant's and Towns' Attorneys, with the fully executed versions of these agreements being filed with the Orange County Clerk's Office.

- **Applicable Post-Construction *SMPs***

The post-construction *SMP* program must address *stormwater* runoff to the *MS4* from *publicly owned/operated* and *privately owned/operated* post-construction *SMPs* that meet the following:

a) Post-construction *SMPs* that have been installed as part of any CGP covered construction site or individual *SPDES* permit (since March 10, 2003); and
b) All new post-construction SMPs constructed as part of the construction site stormwater runoff control program (Part VI.D.).

- **Post-Construction *SMP Inventory and Inspection Tracking***

- The MS4 Operator's continuing coverage must:
    i. Maintain the inventory from previous iterations of this SPDES general permit for post-construction SMPs installed after March 10, 2003; and
    ii. Develop the inventory for post-construction SMPs installed after March 10, 2003 including post-construction SMPs:
        - As they are approved or discovered; or
        - After the owner/operator of the construction activity has filed the NOT with the Department (Part VI.D.9.b.).
- The newly designated MS4 Operators must develop and maintain the inventory for post-construction SMPs installed after March 10, 2003 including post-construction SMPs:
    i. As they are approved or discovered; or
    ii. ii. After the owner/operator of the construction activity has filed the NOT with
    the Department (Part VI.D.9.b.).

- **Annually**, the MS4 Operator must update the inventory of post-construction SMPs to include the post-construction SMPs in Part VI.E.2.a. and Part VI.E.2.b.

- MS4 Operators must document the inventory of post-construction SMPs in the SWMP Plan.

- ***Within one (1) year of the EDC:*** The MS4 Operator must develop and implement a post-construction SMP inspection and maintenance program. The postconstruction SMP inspection and maintenance program must be documented in the SWMP Plan specifying:
    a) The post-construction SMP inspection and maintenance procedures including:
        i. Provisions to ensure that each post-construction SMP identified in the

post-construction SMP inventory (Part VI.E.2.) is inspected at the frequency specified in the NYS DEC Maintenance Guidance 2017 or as specified in the O&M plan contained in the approved SWPPP (Part VI.D.6.), if available; The MS4 Operator can only accept Level 1 inspections (NYS DEC Maintenance Guidance 2017) by private owners inspecting postconstruction SMPs.

ii. Documentation of post-construction SMP inspections using the Post-Construction SMP Inspection Checklist30 or an equivalent form containing the same information. The MS4 Operator must include the completed post-construction SMP inspections (i.e., the completed Post-Construction SMP Inspection Checklist) in the SWMP Plan;

iii. Provisions to initiate follow-up actions (i.e., maintenance, repair, or higher-level inspection) within thirty (30) days of post-construction SMP inspection; and

iv. Provisions to initiate enforcement within sixty (60) days of the inspection if follow-up actions are not complete.

b) The training provisions for the MS4 Operator's post-construction SMP inspection and maintenance procedures (Part VI.E.4.a.).

i. If new staff are added, training on the MS4 Operator's post-construction SMP inspection and maintenance procedures (Part VI.E.4.a.) and procedures outlined in the Department endorsed program must be given prior to conducting any post-construction SMP inspection and maintenance.

ii. For existing staff, training on the MS4 Operator's post-construction SMP inspection and maintenance procedures (Part VI.E.4.a.) and procedures outlined in the Department endorsed program must be given prior to conducting any post-construction SMP inspection and maintenance and

once every five (5) years, thereafter; and

iii. If the post-construction SMP inspection and maintenance procedures (Part VI.E.4.a.) are updated (Part VI.E.4.d.), training on the updates must be given to all staff prior to conducting post-construction SMP inspection and maintenance.

c) The names, titles, and contact information for the individuals who have received post-construction SMP inspection and maintenance procedures training and update annually; and

d) **Annually**, by April 1, the MS4 Operator must:

i. Review and update the post-construction SMP inspection and maintenance procedures (Part VI.E.4.a.); and

ii. Document the completion of this requirement in the SWMP Plan.

- ***Within five (5) years of the EDC:***

  - Within five (5) years of the EDC, the following information must be included in the inventory either by using the MS4 Operator maintenance records or by verification of maintenance records provided by the owner of the postconstruction SMP:

i. Street address or tax parcel;

ii. Type;29

iii. Receiving waterbody name and class (mapped in accordance with Part

iv. IV.D.1.e.ii.a)

v. Receiving waterbody WI/PWL Segment ID (mapped in accordance with Part IV.D.1.e.ii.b));

vi. Date of installation (if available) or discovery;

vii. Ownership;

viii. Responsible party for maintenance;

ix. Contact information for party responsible for maintenance;
x. Location of documentation depicting O&M requirements and legal agreements for post-construction SMP;
xi. Frequency for inspection of post-construction SMP, as specified in the New York State Department of Environmental Conservation Maintenance Guidance: Stormwater Management Practices, March 31, 2017 (NYS DEC Maintenance Guidance 2017) or as specified in the O&M plan contained in the approved SWPPP (Part VI.D.6.);
xii. Reason for installation (e.g., new development, redevelopment, retrofit, flood control), if known;
xiii. Date of last inspection;
xiv. Inspection results; and
xv. Any corrective actions identified and completed.

**6) Minimum Control Measure #6: Pollution Prevention/Good Housekeeping for Municipal Operations**

***"The MS4 Operator must develop and implement a pollution prevention and good housekeeping program for municipal facilities and municipal operations to minimize pollutant discharges. This MCM is designed to ensure the MS4 Operator's own activities do not contribute pollutants to surface waters of the State."***

As shown in Attachment C of the ERP (ATTACHMENT 3), the MS4 Operator has delegated management of this MCM to the Town Highway Superintendent, (currently Mark Hall).

The Town of Newburgh performs street sweeping operations of all roads within the Town twice/year. Town staff complete a Sweeping Log (ATTACHMENT 12) to document such maintenance. If contaminated material is identified, a licensed contractor would be utilized

to remove the material.

- ***Within two (2) years of the EDC:***
  - **Municipal Facility Inventory:** The *MS4 Operator* must *develop* and maintain an inventory of all *municipal* facilities in the *SWMP* Plan. The following information must be included in the inventory:
    - Name of *municipal facility*;
    - Street address;
    - Type of *municipal facility*;
    - Prioritization (high or low) (Part VI.F.2.c.);
    - Receiving waterbody name and class (mapped in accordance with Part IV.D.1.e.ii.a)) ;
    - Receiving waterbody WI/PWL Segment ID (mapped in accordance with Part IV.D.1.e.ii.b));
    - Contact information;
    - Responsible department;
    - Location of SWPPP (if high priority; when completed);
    - Type of activities present on site;
    - Size of facility (acres);
    - Date of last assessment;
    - *BMPs* identified; and

- Projected date of next comprehensive site assessment (Part VI.F.2.d.ii.c) or Part VI.F.2.e.ii.c), depending on the *municipal facility* prioritization (Part VI.F.2.c.)).

▪ **Annually**, the *MS4 Operator* must update the inventory if new *municipal* facilities are added.

- ***Within three (3) years of the EDC:***

- ***Best Management Practices (BMPs) for Municipal Facilities and Operations:*** The MS4 Operator must incorporate best management practices (BMPs) into the municipal facility program and municipal operations program to minimize the discharge of pollutants associated with municipal facilities and municipal operations, respectively. The BMPs to be considered are as follows and must be documented in the SWMP Plan:

  - Minimize Exposure. Exposure of materials to rain, snow, snowmelt, and runoff must be minimized, unless not technologically possible or not economically practicable and achievable in light of best industry practices, including areas used for loading and unloading, storage, disposal, cleaning, maintenance, and fueling operations, with the following *BMP*s:

    a) Locate materials and activities inside or protect them with storm resistant coverings;

    b) Use grading, berming, or curbing to prevent runoff of contaminated flows and divert run-on away from these areas;

    c) Locate materials, equipment, and activities so leaks and spills are contained in existing containment and diversion systems;

d) Clean up spills and leaks promptly using dry methods (e.g., absorbents) to prevent the *discharge* of *pollutants*;

e) Store leaky vehicles and equipment indoors or, if stored outdoors, use drip pans and absorbents;

f) Use spill/overflow protection equipment;

g) Perform all vehicle and/or equipment cleaning operations indoors, under cover, or in bermed areas that prevent runoff and run-on and also captures any overspray;

h) Drain fluids, indoors or under cover, from equipment and vehicles that will be decommissioned, and, for any equipment and vehicles that will remain unused for extended periods of time, inspect at least monthly for leaks; and/or

i) Minimize exposure of chemicals by replacing with a less toxic alternative (e.g., use non-hazardous cleaners).

- *No Exposure* Certification for High Priority *Municipal Facilities*

  a) *Municipal facilities* may qualify for *No Exposure* Certification (Appendix D) when all activities and materials are completely sheltered from exposure to rain, snow, snowmelt and/or runoff.

  b) High priority *municipal* facilities (Part VI.F.2.c.i.a)) with uncovered parking areas for vehicles awaiting maintenance may be considered a low priority *municipal facility* (Part VI.F.2.c.i.c)) if only routine maintenance is performed inside and all other n*o exposure* criteria are met.

c) *Municipal* facilities accepting or repairing disabled vehicles and/or vehicles that have been involved in accidents are not eligible for the *No Exposure* Certification.

d) *Municipal* facilities must maintain the *No Exposure* Certification and document in the *SWMP Plan*. The *No Exposure* Certification ceases to apply when activities or materials become exposed.

- **Follow a Preventive Maintenance Program**
  - Implement a preventative maintenance program that includes routine inspection, testing, maintenance, and repair of all fueling areas, vehicles and equipment and systems to prevent leaks, spills and other releases. This includes:
    a) Performing inspections and preventive maintenance of *stormwater* drainage, source controls, treatment systems, and plant equipment and systems;
    b) Maintaining non-structural *BMPs* (e.g., keep spill response supplies available, personnel appropriately trained, containment measures, covering fuel areas); and
    c) Ensure vehicle washwater is not *discharged* to the *MS4* or to *surface waters of the State*. Wash equipment/vehicles in a designated and/or covered area where washwater is collected to be recycled or *discharged* to the sanitary sewer (Part I.B.2.d.).
  - Routine maintenance must be performed to ensure *BMPs* are operating properly.
  - When a *BMP* is not functioning to its designed effectiveness and needs repair or replacement:

a) Maintenance must be performed before the next anticipated storm event, or as necessary to maintain the continued effectiveness of *stormwater* controls. If maintenance prior to the next anticipated storm event is impracticable, maintenance must be scheduled and accomplished as soon as practicable; and

b) Interim measures must be taken to prevent or minimize the *discharge* of *pollutants* until the final repair or replacement is implemented, including cleaning up any contaminated surfaces so that the material will not be *discharged* during subsequent storm events.

- **Spill Prevention and Response Procedures**
  - Minimize the potential for leaks, spills and other releases that may be exposed to *stormwater* and *develop* plans for effective response to such spills if or when they occur. At a minimum, the *MS4 Operator* must:
    a) Store materials in appropriate containers;
    b) Label containers (e.g., “Used Oil,” “Spent Solvents,” “Fertilizers and Pesticides”) that could be susceptible to spillage or leakage to encourage proper handling and facilitate rapid response if spills or leaks occur;
    c) Implement procedures for material storage and handling, including the use of secondary containment and barriers between material storage and traffic areas, or a similarly effective means designed to prevent the *discharge* of *pollutants* from these areas;
    d) *Develop* procedures for stopping, containing, and cleaning up leaks, spills, and other releases. As appropriate, execute such procedures as soon as possible;

e) Keep spill kits on-site, located near areas where spills may occur or where a rapid response can be made;

f) *Develop* procedures for notification of the appropriate facility personnel, emergency response agencies, and regulatory agencies when a leak, spill, or other release occurs. If possible, one of these individuals should be a member of the *stormwater* pollution prevention team (Part VI.F.2.d.i.a)). Any spills must be reported in accordance with 6 NYCRR 750-2.7; and

g) Following any spill or release, the *MS4 Operator* must evaluate the adequacy of the *BMPs* identified in the *municipal facility* specific SWPPP. If the *BMPs* are inadequate, the SWPPP must be updated to identify new *BMPs* that will prevent reoccurrence and improve the emergency response to such releases.

- Measures for cleaning up spills or leaks must be consistent with applicable petroleum bulk storage, chemical bulk storage, or hazardous waste management regulations at 6 NYCRR Parts 596-599, 613 and 370-373.

- This *SPDES* general permit does not relieve the *MS4 Operator* of any reporting or other requirements related to spills or other releases of petroleum or hazardous substances. Any spill of a hazardous substance must be reported in accordance with 6 NYCRR 597.4. Any spill of petroleum must be reported in accordance with 6 NYCRR 613.6 or 17 NYCRR 32.3.

- **Manage Vegetated Areas and Open Space on *Municipal* Property**

  - Maintain vegetated areas on *MS4 Operator* owned/operated property and right of ways:

a) Specify proper use, storage, and disposal of pesticides, herbicides, and fertilizers including minimizing the use of these products and using only in accordance manufacturer's instruction;

b) Use lawn maintenance and landscaping practices that are protective of water quality. Protective practices include: reduced mowing frequencies; proper disposal of lawn clippings; and use of alternative landscaping materials (e.g., drought resistant planting);

c) Place pet waste disposal containers and signage concerning the proper collection and disposal of pet waste at all parks and openspace where pets are permitted; and

d) Address waterfowl congregation areas where needed to reduce waterfowl droppings from entering the *MS4*.

- **Municipal Facilities Program**: The MS4 Operator must develop and implement a municipal facility program. The municipal facility program must be documented in the SWMP Plan specifying:
    - The *municipal facility* procedures including:
        a) The *BMPs* (Part VI.F.1.) incorporated into the *municipal facility* program;
        b) The high priority *municipal facility* requirements (Part VI.F.2.d.) as applied to the specific *municipal facility*; and
        c) The low priority *municipal facility* requirements (Part VI.F.2.e.) as applied to the specific *municipal facility*.
    - The training provisions for the *MS4 Operator*'s *municipal facility* procedures (Part VI.F.2.a.i.).

a) If new staff are added, training on the *MS4 Operator*'s *municipal facility* procedures (Part VI.F.2.a.i.) must be given prior to conducting *municipal facility* procedures;

b) For existing staff, training on the *MS4 Operator*'s *municipal facility* procedures (Part VI.F.2.a.i.) must be given prior to conducting *municipal facility* procedures and once every five (5) years, thereafter; and

c) If the *municipal facility* procedures (Part VI.F.2.a.i.) are updated(Part VI.F.2.a.iv.), training on the updates must be given to all staff prior to conducting *municipal facility* procedures.

- The names, titles, and contact information for the individuals who have received *municipal facility* training and update annually; and
- Annually, by April 1, the *MS4 Operator* must:

a) Review and update the *municipal facility* procedures (PartVI.F.2.a.i.); and

b) Document the completion of this requirement in the *SWMP Plan*.

- **Municipal Facility Prioritization**: The *MS4 Operator* must prioritize all known *municipal* facilities as follows:

a) High priority *municipal facilities* include *municipal* facilities that have one or more of the following on site and exposed to *stormwater*:

i) Storage of chemicals, salt, petroleum, pesticides, fertilizers, anti- freeze, lead-acid batteries, tires, waste/debris;

ii) Fueling stations; and/or

iii) Vehicle or equipment maintenance/repair.

b) Low priority *municipal facilities* include any *municipal* facilities that do not meet the criteria for a high priority (Part VI.F.2.c.i.a)) *municipal facility*.

c) High priority *municipal facilities* (Part IV.F.2.c.i.a)) which qualify for a *No Exposure* Certification (Part VI.F.1.a.ii.) are low priority *municipal* facilities.

- Within thirty (30) days of when a *municipal facility* is added to the inventory, the *MS4 Operator* must prioritize those *municipal* facilities; and
- Annually, after the initial prioritization (Part VI.F.2.c.i.), the *MS4 Operator* must update the *municipal facility* prioritization in the inventory (Part VI.F.2.b.i.) based on information gathered as part of the *municipal facility* program (Part VI.F.2.a.), including cases where a *No Exposure* Certification (Part VI.F.1.a.ii.) ceases to apply. The completion of this permit requirement must be documented in the *SWMP Plan*.

- ***Municipal Operations* & Maintenance**

a) ***Municipal Operations* Program**: *Municipal operations* are: street and bridge maintenance; winter road maintenance; *MS4* maintenance; open space maintenance; solid waste management; new construction and land disturbances; right-of-way maintenance; marine operations; or hydrologic habitat modification. Within **three (3) years** of the EDC, the *MS4 Operator* must *develop* and implement a *municipal operations* program. The *municipal operations* program must be documented in the *SWMP Plan* specifying:

i. The *municipal operations* procedures including:

a) The *BMPs* (Part VI.F.1.) incorporated into the *municipal operations* program;

b) The *municipal operations* corrective actions requirements (Part I.F.3.b.);

c) *Catch basin* inspection and maintenance requirements (PartVI.F.3.c.);

d) Roads, bridges, parking lots, and right of way maintenance requirements (Part VI.F.3.d.); and

e) All other *municipal operations* maintenance requirements.

*ii.* The training provisions for the *MS4 Operator*'s *municipal operations* procedures (Part VI.F.3.a.i.).

a) If new staff are added, training on the *MS4 Operator*'s *municipal operations* procedures (Part VI.F.3.a.i.) must be given prior to conducting *municipal operations* procedures;

b) For existing staff, training on the *MS4 Operator*'s *municipal operations* procedures (Part VI.F.3.a.i.) must be given prior to conducting *municipal operations* procedures and once every five (5) years, thereafter; and

c) If the *municipal operations* procedures (Part VI.F.3.a.i.) are updated (Part VI.F.3.a.iv.), training on the updates must be given to all staff prior to conducting *municipal operations* procedures.

i. The names, titles, and contact information for the individuals who have received *municipal operations* training and update annually; and

ii. Annually, by April 1, the *MS4 Operator* must:

iii. Review and update the *municipal operations* procedures (Part VI.F.3.a.i.); and

iv. Document the completion of this requirement in the *SWMP Plan*.

b) ***Municipal Operations*** **Corrective Actions:** For *municipal operations*, *MS4 Operators* must either:

a) Ensure compliance with the terms and conditions of the Permit; or

b) Implement corrective actions according to the following schedule and, after implementation, ensure the operations are in compliance with the terms and conditions of this *SPDES* general permit:

i) **Within twenty-four (24) hours of discovery** for situations that have a reasonable likelihood of adversely affecting human health or the environment;

ii) Initiated within seven (7) days of inspection and completed within thirty (30) days of inspection for situations that do not have a reasonable likelihood of adversely affecting human health or the environment; and

iii) For corrective actions that require special funding or construction that will take longer than thirty (30) days to complete, a schedule must be prepared that specifies interim milestones that will ensure compliance in the shortest reasonable time.

- ***Catch Basin*** **Inspection and Maintenance**

**Within three (3) years of the EDC**, the MS4 Operator must:

i. Identify when *catch basin* inspection is needed with consideration for:

a) Areas with *construction activities* (mapped in accordance with Part IV.D.2.a.iii.);

b) Residential, commercial, and industrial areas (mapped in accordance with Part IV.D.1.d.iii.);

c) Recurring or history of issues; or

d) Confirmed citizen complaints on three or more separate occasions in the last twelve (12) months.

ii. Inventory *catch basin* inspection information including:

a) Date of inspection;

b) Approximate level of trash, sediment, and/or debris captured at time of clean-out (no trash, sediment, and/or debris, <50% of the depth of the *sump*, >50% of the depth of the *sump*);

c) Depth of structure;

d) Depth of *sump*; and

e) Date of clean out, if applicable (Part VI.F.3.c.iii.).

iii. Based on inspection results, clean out *catch basins* within the following timeframes:

a) Within six (6) months after the *catch basin* inspection, *catch basins* which had trash, sediment, and/or debris exceeding 50% of the depth of the *sump* as a result of a *catch basin* inspection must be cleaned out;

b) Within one (1) year after the *catch basin* inspection, *catch basins* which had trash, sediment, and/or debris at less than 50% of the depth

of the *sump* as a result of a *catch basin* inspection must be cleaned out; and

c) MS4 Operators are not required to clean out *catch basins* if the *catch basins* are operating properly and:

i. There is no trash, sediment, and/or debris in the *catch basin*; or

ii. The *sump* depth of the *catch basin* is less than or equal to two (2) feet.

iv. Properly manage (handling and disposal) materials removed from *catch basins* during clean out so that:

a) Water removed during the *catch basin* cleaning process will not reenter the *MS4* or *surface waters of the State*;

Material removed from *catch basins* is disposed of in accordance with any applicable environmental laws and regulations; and

Material removed during the *catch basin* cleaning process will not reenter the *MS4* or *surface waters of the State*.

v. Determine if there are signs/evidence of *illicit discharges* and procedures for referral/follow-up if *illicit discharges* are encountered.

- ***Within five (5) years of the EDC:***

- **Municipal Facility Specific SWPPP**: The *MS4 Operator* must *develop* and implement a *municipal facility* specific SWPPP for each high priority *municipal facility* (Part VI.F.2.c.i.a)) and retain a copy of the *municipal facility* specific SWPPP on site of the respective *municipal facility*. The SWPPP must contain:

a) *Stormwater* Pollution Prevention Team

The *municipal facility* specific SWPPP must identify the individuals (by name and/or title) and their role/responsibilities in *developing*, implementing, maintaining, and revising the *municipal facility* specific SWPPP. The activities and responsibilities of the team must address all aspects of the *municipal facility* specific SWPPP.

b) General Site Description

A written description of the nature of the activities occurring at the *municipal facility* with a potential to *discharge pollutants*, type of *pollutants* expected, and location of key features as detailed in the site map (Part VI.F.2.d.i.e)).

c) Summary of potential *pollutant* sources

The *municipal facility* specific SWPPP must identify each area at the *municipal facility* where materials or activities are exposed to *stormwater* or from which authorized non-*stormwater discharges* (Part I.A.3.) originate, including any potential *pollutant* sources for which the *municipal facility* has reporting requirements under the Emergency Planning and Community Right-To-Know Act (EPCRA), Section 313.

i) Materials or activities include: machinery; raw materials; intermediate products; byproducts; final products or waste products; and, material handling activities which includes storage, loading and unloading, transportation or conveyance of any raw material, intermediate product, final product or waste product.

ii) For each separate area identified, the description must include:

a) Activities - A list of the activities occurring in the area (e.g., material storage, equipment fueling and cleaning);

b) *Pollutants* - A list of the associated *pollutant(s)* for each activity. The *pollutant(s)* list must include all materials that are exposed to *stormwater*; and

c) Potential for presence in *stormwater* - For each area of the *municipal facility* that generates *stormwater discharges,* a prediction of the direction of flow, and the likelihood of the activity to contaminate the *stormwater discharge*. Factors to consider include the toxicity of chemicals, quantity of chemicals used, produced or *discharge*d, the likelihood of contact with *stormwater*; and history of leaks or spills of toxic or hazardous *pollutants*.

d) Spills and Releases

For areas that are exposed to precipitation or that otherwise drain to a *stormwater* conveyance to be covered under this *SPDES* general permit, the *municipal facility* specific SWPPP must include a list of spills or releases[4] of petroleum and hazardous substances or other *pollutants*, including unauthorized *non-stormwater discharges*, that may adversely affect water quality that occurred during the last three-year period. The list must be updated when spills or releases occur.

e) Site Map

The *municipal facility* specific SWPPP must include a site map

[4] This may also include releases of petroleum or hazardous substances that are not in excess of reporting quantities but which may still cause or contribute to significant water quality impairment.

identifying the following, as applicable:

i) Property boundaries and size in acres;

ii) Location and extent of significant structures (including materials shelters), and impervious surfaces;

iii) Monitoring locations (mapped in accordance with Part IV.D.2.a.i.) with its approximate *sewershed*. Each monitoring location must be labeled with the monitoring location identification;

iv) Location of all post-construction *SMPs* (mapped in accordance with Part IV.D.2.a.iv.) and *MS4* infrastructure (mapped in accordance with Part IV.D.2.b.i.);

v) Locations of *discharges* authorized under other *SPDES* permits;

vi) Locations where potential spills or releases can contribute to *pollutants* in *stormwater discharges* and their accompanying drainage points;

vii) Locations of haul and access roads; viii)Rail cars and tracks;

ix) Arrows showing direction of *stormwater* flow;

x) Location of all receiving waters in the immediate vicinity of the *municipal facility*, indicating if any of the waters are impaired and, if so, whether the waters have *TMDLs* established for them (mapped in accordance with Part IV.D.1.e.ii.);

xi) Locations where *stormwater* flows have significant potential to cause erosion;

xii) Location and source of run-on from adjacent property containing significant quantities of *pollutants* and/or volume of concern to the *municipal facility*; and

xiii) Locations of the following areas where such areas are exposed to precipitation or *stormwater*:

a) Fueling stations;
b) Vehicle and equipment maintenance and/or cleaning areas;
c) Loading/unloading areas;
d) Locations used for the treatment, storage or disposal of wastes;
e) Liquid storage tanks;
f) Processing and storage areas;
g) Locations where significant materials, fuel or chemicals are stored and transferred;
h) Locations where vehicles and/or machinery are stored when not in use
i) Transfer areas for substances in bulk;
j) Location and description of non-*stormwater discharges* (Part I.A.3.);
k) Locations where spills[5] or leaks have occurred; and
l) Locations of all existing structural *BMP*s.

*f) Stormwater Best Management Practices (BMPs)*

The *municipal facility* specific SWPPP must document the location and type of *BMPs* implemented at the *municipal facility* (Part VI.F.1.). The

[5] A spill includes: any spill of a hazardous substance that must be reported in accordance with 6 NYCRR 597.4 and any spill of petroleum that must be reported in accordance with 6 NYCRR 613.6 or 17 NYCRR 32.3.

*municipal facility* specific SWPPP must describe how each *BMP* is being implemented for all the potential *pollutant* sources.

g) *Municipal facility* assessments
The *municipal facility* specific SWPPP must include a schedule for completing and recording results of routine and comprehensive site assessments (Part VI.F.2.d.ii.c)).

- **Municipal Facility Assessments**

a) Wet Weather Visual Monitoring: **Once every five (5) years,** the *MS4 Operator* must conduct wet weather visual monitoring of the monitoring locations (Part VI.C.1.b.) and other sites of *stormwater* leaving the site that are *discharging stormwater* from fueling areas, storage areas, vehicle and equipment maintenance/fueling areas, material handling areas and similar potential *pollutant* generating areas (Part VI.F.2.d.i.e)xiii)).

i. All samples must be collected from *discharges* resulting from a *qualifying storm event*. The storm event must be documented using the Storm Event Data Form (Appendix D) and kept with the *municipal facility* specific SWPPP. The sample must be taken during the first thirty (30) minutes (or as soon as practical, but not to exceed one hour) of the *discharge* at the monitoring location.

ii. No analytical tests are required to be performed on the samples for the purpose of meeting the visual monitoring requirements.

iii. The visual examination must document observations of color, odor, clarity, floating solids, settled solids, suspended

solids, foam, oil sheen, and any other obvious indicators of *stormwater* pollution.

iv. The visual examination of the sample must be conducted in a well-lit area.

v. Where practicable, the same individual should carry out the collection and examination of *discharges* for the entire permit term for consistency.

vi. The *MS4 Operator* must document the visual examination using the Visual Monitoring Form (Appendix D) and keep it with the *municipal facility* specific SWPPP to record:

(1) Monitoring location ID;

(2) Examination date and time;

(3) Personnel conducting the examination;

(4) Nature of the *discharge* (runoff or snowmelt);

(5) Visual quality of the *stormwater discharge* including observations of color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, and other obvious indicators of *stormwater* pollution; and

(6) Probable sources of any observed *stormwater* contamination.

(7) Corrective and follow up actions – If the visual examination indicates the presence of color, odor, floating solids, settled solids, suspended solids, foam, oil sheen, or other indicators of *stormwater* pollution,

the *MS4 Operator* must, at minimum, complete and document the following actions:

- Evaluate the facility for potential sources;
- Remedy the problems identified;
- Revise the *municipal facility* specific SWPPP; and
- Perform an additional visual inspection during the first *qualifying storm event* following implementation of the corrective action. If the first *qualifying storm event* does not occur until the next visual monitoring period, this follow up action may be used as the next visual inspection.

b) The monitoring locations inspection and sampling program must be implemented at the *municipal facility* (Part VI.C.1.e.).

c) Comprehensive Site Assessments: **Once every five (5) years** following the most recent assessment, the *MS4 Operator* must complete a comprehensive site assessment for each high priority *municipal facility* as identified in the inventory (Part VI.F.2.b.) using the Municipal Facility Assessment Form (Appendix D) or an equivalent form containing the same information, and document in the *municipal facility*

specific SWPPP and *SWMP Plan* that:

a) The *municipal facility* is in compliance with the terms and conditions of this *SPDES* general permit;

b) Deficiencies were identified and all reasonable steps will be taken to minimize any *discharge* in violation of the permit, which

has a reasonable likelihood of adversely affecting human health or the environment;

i. Within twenty-four (24) hours, the *MS4 Operator* must prepare a schedule that includes corrective actions and specific interim milestones to be implemented until the corrective action is implemented; or

c) Deficiencies were identified and all reasonable steps will be taken to minimize any *discharge* in violation of the permit, which does not have a reasonable likelihood of adversely affecting human health or the environment;

d) Within seven (7) days, the MS4 Operator must prepare a schedule that includes corrective actions and specific interim milestones to be implemented until the corrective action is implemented.

- **Low Priority *Municipal Facility* Requirements**
  - The *MS4 Operator* must identify procedures outlining *BMPs* for the types of activities that occur at the low priority *municipal* facilities as described in Part VI.F.1. A *municipal facility* specific SWPPP is not required.
  - *Municipal Facility* Assessments
    a) Low priority *municipal* facilities are not required to conduct wet weather visual monitoring.
    b) The monitoring locations inspection and sampling program must be implemented at the *municipal facility* (Part VI.C.1.e.).
    c) Comprehensive Site Assessments

i) **Once every five (5) years** following the most recent assessment, the *MS4 Operator* must complete a comprehensive site assessment for each low priority *municipal facility* as identified in the inventory (Part VI.F.2.b.) using the Municipal Facility Assessment Form (Appendix D) or an equivalent form containing the same information, and document in the *SWMP Plan* that:

a) The *municipal facility* is in compliance with the terms and conditions of this *SPDES* general permit;

b) Deficiencies were identified and all reasonable steps will be taken to minimize any *discharge* in violation of the permit, which has a reasonable likelihood of adversely affecting human health or the environment;

i. Within twenty-four (24) hours, the *MS4 Operator* must prepare a schedule that includes corrective actions and specific interim milestones to be implemented until the corrective action is implemented; or

c) Deficiencies were identified and all reasonable steps will be to minimize any *discharge* in violation of the permit, which does not have a reasonable likelihood of adversely affecting human health or the environment;

i. Within seven (7) days, the *MS4 Operator* must prepare a schedule that includes corrective actions and specific interim milestones to be implemented until the corrective action is implemented.

- **Roads, Bridges, Parking Lots, & Right of Way Maintenance**

*a)* *Maintenance:*

**Within five (5) years of the EDC**, in addition to the *BMPs* (Part VI.F.1.), the

*MS4 Operator* must implement the following provisions:

a) Pave, mark, and seal in dry conditions;

b) Stage road operations and maintenance activity (e.g., patching, potholes) to reduce the potential discharge of pollutants to the *MS4* or *surface waters of the State*;

c) Restrict the use of herbicides/pesticide application to roadside vegetation; and

d) Contain *pollutants* associated with bridge maintenance activities (e.g., paint chips, dust, cleaning products, other debris).

*b)* *Winter Road Maintenance*

**Within five (5) years of the EDC**, in addition to the *BMPs* (Part VI.F.1.), the

*MS4 Operator* must implement the following provisions:

a) Routinely calibrate equipment to control salt/sand application rates; and

b) Ensure that routine snow disposal activities comply with the Division of Water Technical and Operation Guidance Series 5.1.11, Snow Disposal.

END OF REPORT

# ATTACHMENT 1

# NYSDEC SPDES GENERAL PERMIT

# GP-0-24-001

NEW YORK STATE | Department of Environmental Conservation

FINAL

PERMIT

for

NEW YORK STATE

DEPARTMENT OF ENVIRONMENTAL CONSERVATION

SPDES GENERAL PERMIT

for

STORMWATER DISCHARGES

from

**MUNICIPAL SEPARATE STORM SEWER SYSTEMS (MS4s)**

Permit No. GP-0-24-001

Issued Pursuant to Article 17, Titles 7, 8 and Article 70
of the Environmental Conservation Law

Issuance Date: December 13, 2023

Effective Date: January 3, 2024

Expiration Date: January 2, 2029

Scott Sheeley
Chief Permit Administrator

Scott E. Sheeley — DECEMBER 13, 2023

Authorized Signature — Date

Address: NYS DEC
Division of Environmental Permits
625 Broadway, 4th Floor
Albany, NY 12233

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**NOTE**

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# Part I. Permit Coverage and Limitations

## A. Permit Authorization

This *SPDES* general permit authorizes the *discharge* of *stormwater* from small *MS4*s.

1. An *MS4 Operator* is eligible for coverage under this *SPDES* general permit if the *MS4* is *automatically* or *additionally designated (Appendix B)*.

   Only portions of the *MS4* which are located within the *automatically* or *additionally designated areas* are subject to, and authorized to *discharge* by, the requirements of this *SPDES* general permit (Part IV.C.).

2. This *SPDES* general permit contains terms and conditions specific for each of the following types of *MS4 Operators* that are authorized to *discharge* under this *SPDES* general permit, in accordance with Part I.A.1:

   a. *Traditional Land Use Control MS4 Operators;*

   b. *Traditional Non-land Use Control MS4 Operators;* and

   *c. Non-traditional MS4 Operators.*

   The minimum control measures (MCMs) for *traditional land use MS4 Operators* are listed in Part VI. The MCMs for *traditional non-land use control MS4 Operators* and *non-traditional MS4 Operators* are listed in Part VII. Part III.B, Part VIII, and Part IX. list additional requirements for all *MS4 Operators' MS4*s *discharging* to impaired waters.

3. Non-*stormwater discharges* through outfalls listed in Part 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York (NYCRR) 750-1.2(a)(29)(vi) and 40 CFR 122.34(b)(3)(ii), are authorized by this *SPDES* general permit provided they do not violate Environmental Conservation Law (ECL) Section 17-0501. If the *Department* or *MS4 Operator* determines that one or more of the *discharges* are in violation of ECL Section 17-0501, the identified *discharges* are illicit and the *MS4 Operator* must eliminate such *discharges* by following the *illicit discharge* MCM requirements found in Part VI.C. or Part VII.C, depending on the *MS4 Operator* type.

   *Discharges* from firefighting activities are authorized only when the firefighting activities are emergencies/unplanned.

### B. Exemption and Limitations on Coverage

1. The following *discharges* from *MS4 Operators* are exempt from the requirements of this *SPDES* general permit:
   a. *Stormwater discharges* associated with an *industrial activity* provided the *discharges* are covered by the SPDES Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity, GP-0-23-001 (MSGP); and
   b. Individual *SPDES* permitted *stormwater discharges* provided the *discharges* are in compliance with their individual *SPDES* permit limitations.
2. The following *discharges* from *MS4 Operators* are not authorized by this *SPDES* general permit:
   a. *Stormwater discharges* that may adversely affect an endangered or threatened species, or its designated critical habitat, unless the *MS4 Operator* has obtained a permit issued pursuant to 6 NYCRR Part 182 or the *Department* has issued a letter of non-jurisdiction.
   b. *Stormwater discharges* which adversely affect properties listed or eligible for listing in the National Register of Historic Places unless the covered entity is in compliance with requirements of the National Historic Preservation Act and has coordinated with the appropriate State Historic Preservation Office any activities necessary to avoid or minimize impacts.
   c. *Stormwater discharges*, the permitting of which is prohibited under 40 CFR 122.4 and 6 NYCRR 750-1.3.
   d. The *discharge* of vehicle and equipment washwater from *municipal facilities*, including tank cleaning operations.
3. All documentation necessary to demonstrate *discharge* eligibility (Part I.B.1. and Part I.B.2.) must be documented in the *Stormwater Management Program Plan (SWMP Plan)* (Part IV.B.).

## Part II. Obtaining Permit Coverage

A. *MS4 Operators*, meeting the eligibility requirements in Part I.A.1. of this *SPDES* general permit, must submit the notice of intent (NOI) electronically (eNOI) unless the *MS4 Operator* has obtained a waiver from the electronic submittal requirement (Part II.B.) in order to be authorized to *discharge* under this *SPDES* general permit. Access and directions for use, for electronic submission of the NOI, are located on the *Department*'s website. *MS4 Operators* must submit the eNOI as indicated in Table 1 and in accordance with Part X.J.

| Table 1. eNOI Submittal for Permit Coverage | | | |
|---|---|---|---|
| **Type of permit coverage** | **Deadline to submit complete eNOI** | **Effective Date of Coverage (EDC)** | **Form to file with the *Department*** |
| Newly designated *MS4 Operator* | 180 days[1] from written notification from the *Department* | The submission of the complete eNOI | eNOI |
| *MS4 Operators* continuing coverage from GP-0-15-003 | Forty-five (45) days from the effective date of the permit (EDP) | EDP | eNOI |

*MS4 Operators* continuing coverage from GP-0-15-003 are eligible for continued coverage under this SPDES general permit (GP-0-24-001) on an interim basis for up to sixty (60) calendar days from the EDP. During this interim period, an MS4 Operator must comply with the requirements of GP-0-15-003.

By submitting the complete e*NOI*, the *MS4 Operator* certifies that the *MS4 Operator* has read and agrees to comply with the terms and conditions of this *SPDES* general permit including the provisions to update the *SWMP Plan* (Part IV.B.) in accordance with the timeframes set forth in this *SPDES* general permit.

*MS4 Operators* must document the complete NOI in the *SWMP Plan* (Part IV.B.). As information in the completed NOI changes, within thirty (30) days, the *MS4 Operators* must update the information on the NOI and resubmit the completed NOI to the Department. The *MS4 Operator* must document information from the Department acknowledging previous coverage or designation in the *SWMP Plan* (Part IV.B.).

Where there is a permit condition to *develop,* newly designated *MS4 Operators* must create that permit requirement. Where there is a permit condition to *develop, MS4 Operators* continuing coverage must continue to implement their current *SWMP* and update the *SWMP* to comply with the permit requirement.

For newly designated *MS4 Operators*, timeframes for compliance begin on the effective date of coverage (EDC).

B. Electronic Submission Waiver

1. *MS4 Operators* must submit all NOIs electronically unless the *MS4 Operator* has received a waiver from the Department based on one of the following conditions:

   a. If the *MS4 Operator* is physically located in a geographical area (i.e., zip code or census tract) that is identified as under-served for broadband internet

[1] In this *SPDES* general permit, days refer to calendar days.

access in the most recent report from the Federal Communications Commission; or

b. If the *MS4 Operator* has limitations regarding available computer access or computer capability.

2. If an *MS4 Operator* wishes to obtain a waiver from submitting an NOI electronically, the *MS4 Operator* must submit a request using the Application for Electronic Submittal Waiver to the *Department* at the following address:

   NYS DEC Bureau of Water Compliance

   MS4 NOTICE OF INTENT WAIVER

   625 Broadway, 4th Floor

   Albany, New York 12233-3505

3. A waiver may only be considered granted once the *MS4 Operator* receives written confirmation from the *Department*.

4. *MS4 Operators* must document the eNOI waiver in the *SWMP Plan* (Part IV.B.), if applicable.

C. *MS4 Operators* who submit a complete NOI are authorized to *discharge stormwater* under the terms and conditions of this *SPDES* general permit.

1. NOI Content

   The NOI shall include:

   a. Legal name and address of the *MS4 Operator*;

   b. Receiving waterbodies; and

   c. *Municipal Separate Storm Sewer System (MS4)* NPDES Permit-Related Information of 40 CFR Part 127 Appendix A.

# Part III. Special Conditions

## A. *Discharge* Compliance with *Water Quality Standards*

1. The *MS4 Operator* must implement the required controls contained in Part III. through Part IX. of this *SPDES* general permit. The *Department* expects that compliance with the terms and conditions of this *SPDES* general permit will assure *MS4 discharges* meet applicable *water quality standards*.

2. It shall be a violation of the ECL for any *discharge* authorized by this *SPDES* general permit to either cause or contribute to a violation of *water quality standards* as contained in 6 NYCRR 700-705.

3. The *MS4 Operator* must take all necessary actions to ensure *discharges* comply with the terms and conditions of this *SPDES* general permit. If at any time an *MS4 Operator* becomes aware (e.g., through self-monitoring or by notification from the *Department*) that a *discharge* causes or contributes to the violation of an applicable *water quality standard*, the *MS4 Operator* must implement corrective

actions and the *MS4 Operator* must document these actions in the *SWMP Plan* (Part IV.B.).

4. Compliance with this *SPDES* general permit does not preclude, limit, or eliminate any enforcement activity as provided by Federal and/or State law. Additionally, if violations of applicable *water quality standards* occur, then coverage under this *SPDES* general permit may be terminated by the *Department* in accordance with 6 NYCRR 750-1.21(e), and the *Department* may require an application for an alternative *SPDES* general permit or an individual *SPDES* permit may be issued.

## B. Water Quality Improvement Strategies for Impaired Waters

### 1. List of Impaired Waters (Appendix C)

Part VIII. requirements must be implemented in addition to the applicable requirements of the six (6) MCMs in Part VI. or Part VII, depending on the *MS4 Operator* type.

For *MS4 Operators* whose *MS4 outfall*s and *additionally designated area MS4 outfalls* (*ADA MS4 outfalls*) *discharge* to waters impaired for phosphorus, silt/sediment, pathogens, nitrogen, or floatables (Appendix C), the *MS4 Operator* must *develop* and implement the *pollutant* specific *best management practices (BMPs*), listed in Part VIII, targeted towards the *pollutant of concern (POC)* causing the impairment.

For *MS4 Operators discharging* to waters within a *total maximum daily load (TMDL)* watershed that does not specify a *pollutant* load reduction necessary for *MS4*s and listed in Appendix C, the *MS4 Operator* must implement the enhanced *BMP* requirements of Part VIII. for the applicable *pollutant* of concern of the *TMDL*.

The enhanced *BMP* requirements in Part VIII. are written to address the *POCs* listed in Table 2.

**Table 2. *Pollutant* Specific BMPs for Impaired Waters listed in Appendix C**

| ***POC*** | **Part VIII. Reference** |
|---|---|
| Phosphorus | A |
| Silt/Sediment | B |
| Pathogens | C |
| Nitrogen | D |
| Floatables | E |

## 2. Watershed Improvement Strategy Requirements for *TMDL* Implementation (Part IX.)

Part IX. requirements must be implemented in addition to the applicable requirements of the six (6) MCMs in Part VI. or Part VII, depending on the *MS4 Operator* type.

a. *MS4 Operators discharging* to waters within the watersheds listed in Table 3 must implement additional *BMPs* and applicable *retrofit* plans as specified in Part IX. to achieve the *pollutant* load reductions specified in the referenced *TMDL* or respective implementation plan.

**Table 3. Approved *TMDL* Watersheds with *MS4* Contribution**

| *TMDL* | POC | Part IX. Reference |
|---|---|---|
| Phase II Phosphorus TMDLs for Reservoirs in the NYC Watershed, June 2000 | Phosphorus | A |
| Total Maximum Daily Load (TMDL) for Phosphorus in Lake Carmel, October 2016 | | |
| Total Maximum Daily Load (TMDL) for Phosphorus in Palmer Lake, March 2015 | | |
| Impaired Waters Restoration Plan for Greenwood Lake – Total Maximum Daily Load for Total Phosphorus, September 2005 | Phosphorus | B |
| Updated Phosphorus Total Maximum Daily Load for Onondaga Lake, June 2012 | | |
| Total Maximum Daily Load (TMDL) for Phosphorus in Lake Oscawana, September 2008 | | |
| None | Pathogen | C |
| TMDL for Nitrogen in the Peconic Estuary Program Study Area, Including Waterbodies Currently Impaired Due to Low Dissolved Oxygen: the Lower Peconic River and Tidal Tributaries; Western Flanders Bay and Lower Sawmill Creek; and Meetinghouse Creek, Terry Creek and Tributaries, September 2007 | Nitrogen | D |

b. Each *MS4 Operator* is responsible for a waste load reduction as specified in the applicable *TMDL* or *TMDL* implementation plan referenced in Part IX. *MS4 Operators* may form a *Regional Stormwater Entity (RSE)* to implement *stormwater retrofits* collectively where compliance with the *pollutant* reduction requirements would be achieved on a regional basis. The individual load reduction for each participating *MS4 Operator* is aggregated to create a *RSE* load reduction. The *RSE* then designs and installs *retrofits* where they are most feasible within the boundaries of the *RSE*. Each participating *MS4*

*Operator* of an *RSE* complies if the aggregated *RSE pollutant* load reduction is met.

### 3. Impaired waters with an approved *TMDL* and listed in Appendix C

Part VIII. and Part IX. requirements must be implemented in addition to the applicable requirements of the six (6) MCMs in Part VI. or Part VII, depending on the *MS4 Operator* type.

An *MS4 discharging* to a waterbody listed in Appendix C must meet the requirements of Part VIII. for the *POC*(s) listed in Appendix C.

An *MS4 discharging* to a waterbody listed in Table 3 must meet the requirements of Part IX. for the specific *POC* identified in the *TMDL*.

# Part IV. *Stormwater Management Program (SWMP)* Requirements

*MS4 Operators* must *develop*, implement, and enforce a *SWMP*. The *SWMP* must be retained in written format, hardcopy or electronic. The written *SWMP* is referred to as the *SWMP Plan* (Part IV.B.). The *MS4 Operator* must use the *SWMP Plan* (Part IV.B.) to document *developed*, planned, and implemented elements of the *SWMP*.

## A. Administrative

### 1. Alternative Implementation Options

a. *MS4 Operators* may utilize other entities or the resources of those entities to assist with any portion of the *SWMP* development, implementation, or enforcement. These entities may consist of other *MS4 Operators*, an *RSE*, a Coalition of *MS4 Operators*, other public entities (e.g., non-*MS4 Operators*), or a private third-party contractor. If the *MS4 Operator* is relying upon another entity for compliance with any portion of this *SPDES* general permit, there must be an agreement in place that:

i. Is legally binding;

ii. Is documented in writing;

iii. Is signed and dated by all parties including a certification statement that explains that the *MS4 Operator* is responsible for compliance with this *SPDES* general permit;

iv. Identifies the activities that the entity will be responsible for including the particular MCM, the location and type of work;

v. Includes the name, address, and telephone number of the contact person representing the entity;

vi. Is kept up-to-date and part of the *SWMP Plan*; and

vii. Is retained by each party for the duration of the permit term.

b. In the *SWMP Plan*, the *MS4 Operator* must *develop* and maintain an inventory of entities assisting in permit implementation that includes the following information:

   i. Name of entity performing permit implementation; and

   ii. Permit requirement being implemented performed by entity.

c. Irrespective of any agreements, each party remains legally responsible for obtaining its own permit coverage, for filing the *NOI,* and satisfying all requirements of this *SPDES* general permit for its own *discharges*.

d. Within thirty (30) days signing, alternative implementation agreements (Part IV.A.1.) must be documented in the *SWMP Plan* (Part IV.B.).

e. Annually review and update any alternative implementation agreements in the *SWMP Plan*, as necessary.

### 2. Staffing plan/Organizational chart

Individual *SWMP* components may be *developed*, implemented, or enforced by different titles associated with the *MS4 Operator*, or other entities as described in Part IV.A.1. Within six (6) months of the EDC, the *MS4 Operator* must *develop* a written staffing plan/organizational chart which includes job titles and other entities as identified in Part IV.A.1, and the roles and responsibilities for each corresponding to the required elements of the *SWMP*. The staffing plan must describe how information will be communicated and coordinated among all those with identified responsibilities. All staffing plan/organization charts must be documented in the *SWMP Plan* (Part IV.B.).

## B. *SWMP Plan*

The *SWMP Plan* must contain, at a minimum, all permit requirements implemented to meet the terms and conditions of this *SPDES* general permit, and documentation required by this *SPDES* general permit. The *SWMP Plan* may incorporate by reference any documents that meet the requirements of this *SPDES* general permit. If an *MS4 Operator* relies upon other documents to describe how the *MS4 Operator* will comply with the requirements of this SPDES general permit, the *MS4 Operator* must attach to the *SWMP Plan* a copy of these documents.

The *SWMP Plan* must identify if any requirements from Part VI. through Part IX. do not require updates and include the rationale behind the determination. The *SWMP Plan* must identify if any requirements from Part VI. through Part IX. are not applicable and include the rationale behind the determination.

### 1. *Stormwater* Program Coordinator

On the NOI, the *MS4 Operator* must designate a *Stormwater* Program Coordinator who must be knowledgeable in the principles and practices of *stormwater* management, the requirements of this *SPDES* general permit, and the *SWMP*. The *Stormwater* Program Coordinator oversees the *development*, implementation, and enforcement of the *SWMP;* coordinates all elements of the

*SWMP* to ensure compliance with this *SPDES* general permit; and *develops* and submits the Annual Report (Part V.B.2.). The name, title, and contact information of the *Stormwater* Program Coordinator must be documented in the *SWMP Plan*.

### 2. Availability of *SWMP Plan*

a. Within six (6) months of the EDC, the *MS4 Operator* must make the current *SWMP Plan*, and documentation associated with the implementation of the *SWMP Plan*, available during normal business hours to the *MS4 Operator*'s management and staff responsible for implementation as well as the *Department* and United States Environmental Protection Agency (USEPA) staff.[2] The completion of this permit requirement must be documented in the *SWMP Plan*.

b. Within six (6) months of the EDC, the *MS4 Operator* must make a copy of the current *SWMP Plan* available for public inspection during normal business hours at a location that is accessible to the public or on a public website. The location of the *SWMP Plan* must be kept current. The completion of this permit requirement must be documented in the *SWMP Plan*.

### 3. Timeframes for *SWMP* Plan Development or Updates

*MS4 Operators* must *develop* and implement their *SWMP Plan* in accordance with the timeframes set forth in this *SPDES* general permit. Annually, after the end of the Reporting Year and by April 1, the *SWMP Plan* must be updated to ensure the permit requirements are implemented. More frequent updates to the *SWMP Plan* are noted throughout this *SPDES* general permit in specific permit requirements.

## C. Minimum Control Measures (MCMs)

The MCMs for *traditional land use MS4 Operators* are listed in Part VI. while those for *traditional non-land use control MS4 Operators* and *non-traditional MS4 Operators* are listed in Part VII. Parts III.B, Part VIII, and Part IX. list additional requirements for all *MS4 Operators discharging* to impaired waters.

#### *MS4 Operators* subject to Part VI.

For *MS4 Operators* subject to Part VI. requirements, all MCMs must be implemented within the *automatically designated area* or an *additionally designated area* subject to Criterion 1 or 2 of the Additional Designation Criteria (Appendix B).

For *MS4 Operators* subject to Part VI. requirements, MCM 4 and MCM 5 must also be implemented within an *additionally designated area* subject to Criterion 3 of the Additional Designation Criteria (Appendix B).

#### *MS4 Operators* subject to Part VII.

For *MS4 Operators* subject to Part VII. requirements, all MCMs must be implemented within the *automatically designated area* or an *additionally designated area* subject to Criterion 1 or 2 of the Additional Designation Criteria (Appendix B).

[2] Part X.F. contains the duty for the *MS4 Operator* to provide information.

*MS4 Operators* subject to Part VIII.

Part VIII. requirements must be implemented in addition to the applicable requirements of the six (6) MCMs in Part VI. or Part VII, depending on the *MS4 Operator* type.

For all *MS4 Operators* subject to Part VIII. requirements, all MCMs must be implemented within the *automatically designated area*.

For *MS4 Operators* subject to Part VI. requirements and subject to Part VIII. requirements, MCM 4 and MCM 5 must also be implemented within an *additionally designated area* subject to Criterion 3 of the Additional Designation Criteria (Appendix B).

*MS4 Operators* subject to Part IX.

Part IX. requirements must be implemented in addition to the applicable requirements of the six (6) MCMs in Part VI. or Part VII, depending on the *MS4 Operator* type.

For all *MS4 Operators* subject to Part IX. requirements, all MCMs must be implemented within the *automatically designated area* or an *additionally designated area* subject to Criterion 1 of the Additional Designation Criteria (Appendix B).

## D. Mapping

The *MS4 Operator* must *develop* and maintain comprehensive system mapping to include the mapping components within the MS4 Operator's *automatically designated area* or an *additionally designated area* subject to Criterion 1 or 2 of the Additional Designation Criteria (Appendix B), unless otherwise specified. The comprehensive system mapping must be documented in the *SWMP Plan*. The comprehensive system mapping must be in a readily accessible format, with scale and detail appropriate to provide a clear understanding of the *MS4*, to serve as a planning tool to allow for prioritization of efforts and facilitate management decisions by the *MS4 Operator*. Annually, after Phase I (Part IV.D.2.a.) completion, the *MS4 Operator* must update the comprehensive system mapping including updates to prioritization information of monitoring locations (Part VI.C.1.d. or Part VII.C.1.d, depending on the *MS4 Operator* type), construction sites (Part VI.D.5. or Part VII.D.5, depending on the *MS4 Operator* type), and *municipal facilities* (Part VI.F.2.c.i. or Part VII.F.2.c.i, depending on the *MS4 Operator* type).

1. Within six (6) months of the EDC, the comprehensive system mapping must include the following information:
    a. *MS4 outfall*s (as required for *MS4 Operators* continuing coverage from previous iterations of this *SPDES* general permit);
    b. *Interconnections* (as required for *MS4 Operators* continuing coverage from previous iterations of this *SPDES* general permit);
    c. Preliminary *storm-sewershed* boundaries (as required for *MS4 Operators* continuing coverage from previous iterations of this *SPDES* general permit);

d. *MS4* infrastructure (as required for *MS4 Operators* continuing coverage from previous iterations of this *SPDES* general permit that were subject to Part IX.A. or Part IX.D.), including:
   i. Conveyance system
      a) Type (closed pipe or open drainage);
      b) Conveyance description for closed pipes (material, shape, dimensions);
      c) Conveyance description for open drainage (channel/ditch lining material, shape, dimensions); and
      d) Direction of flow;
   ii. Culvert crossings (location and dimensions)
   iii. Stormwater structures
      a) Type (drop inlet, *catch basin*, or manhole); and
      b) Number of connections to *catch basins*, and manholes;

e. Basemap information:
   i. *Automatically*[3] and *additionally designated areas* (based on criterion 3 of Additional Designation Criteria in Appendix B);[4]
   ii. Names and location of all *surface waters of the State*, including:
      a) Waterbody classification;[5]
      b) Waterbody Inventory/Priority Waterbodies List (WI/PWL);[6]
         i) Impairment status; and
         ii) *POC,* if applicable;
      c) *TMDL* watershed areas;[7]
   iii. Land use, including:
      a) Industrial;
      b) Residential;
      c) Commercial;
      d) Open space; and
      e) Institutional;
   iv. Roads; and
   v. Topography.[8]

2. The comprehensive system mapping must be updated with the data collected for each phase of mapping within the timeframe for each phase as outlined below:
   a. Phase I: Within three (3) years of the EDC, the comprehensive system mapping must include the following information:

[3]Utilizing the Stormwater Interactive Map on the Department's website or the NYS GIS Clearinghouse.
[4]Utilizing the Stormwater Interactive Map on the Department's website.
[5]Utilizing the Stormwater Interactive Map on the Department's website or the NYS GIS Clearinghouse.
[6]Utilizing the Stormwater Interactive Map on the Department's website or the NYS GIS Clearinghouse.
[7]Utilizing the Stormwater Interactive Map on the Department's website.
[8] Utilizing USGS Quadrangle Map or finer.

i. Monitoring locations, with associated prioritization (Part VI.C.1.d. or Part VII.C.1.d, depending on the *MS4 Operator* type);
ii. Preliminary *storm-sewershed* boundaries (for newly designated *MS4 Operators*);
iii. Focus areas (Part VI.A.1.a. or Part VII.A.1.a, depending on the *MS4 Operator* type);
iv. *Publicly owned/operated* post-construction *stormwater management practices* (*SMPs)* (Part VI.E.3. or Part VII.E.3, depending on the *MS4 Operator* type). The *publicly owned/operated* post-construction *SMPs* subject to this requirement are in the *automatically designated area* or an *additionally designated area* subject to Criterion 1, 2, or 3 of the Additional Designation Criteria (Appendix B); and
v. *Municipal facilities,* with associated prioritization (Part VI.F.2.c. or Part VII.F.2.c, depending on the *MS4 Operator* type).

b. Phase II: Within five (5) years of the EDC, the comprehensive system mapping must include the following information:

i. *MS4* infrastructure, including:
a) Conveyance system
i) Type (closed pipe or open drainage); and
ii) Direction of flow;[9]

b) *Stormwater* structures
i) Type (drop inlet, *catch basin*, or manhole); and
ii) Number of connections to and from drop inlets, *catch basins*, and manholes;

ii. *Privately owned/operated* post-construction *SMPs* which *discharge* to the *MS4* (Part VI.E.2.). The *privately owned/operated* post-construction *SMPs* subject to this requirement are in the *automatically designated area* or an *additionally designated area* subject to Criterion 1, 2, or 3 of the Additional Designation Criteria (Appendix B).
a) If the location of the privately-owned post-construction SMPs cannot be determined without accessing the private property, the *MS4 Operator* must map the location of the property that the post-construction SMP is located on using street address or tax parcel.

## E. Legal Authority

For *MS4 Operators* continuing coverage from previous iterations of this *SPDES* general permit, adequate legal authority must be maintained in accordance with Part IV.E.1. or Part IV.E.2.

For a newly designated *MS4 Operator*, within three (3) years, the *MS4 Operator* must, to the extent allowable by State and local law, *develop* and implement

[9] Direction of flow can be a written description or indicated as an arrow on the feature.

adequate legal authority to control *pollutant discharges* to implement this *SPDES* general permit. An *MS4 Operator* must either be in conformance with Part IV.E.1. or Part VI.E.2:

1. Adopt the following model local laws and include a copy of the resolution in their *SWMP Plan*:
   a. The New York State Department of Environmental Conservation Model Local Law to Prohibit Illicit Discharges, Activities and Connections to Separate Storm Sewer Systems, April 2006 (NYS DEC Model IDDE Local Law 2006); and
   b. The New York State Department of Environmental Conservation Sample Local Law for Stormwater Management and Erosion & Sediment Control, March 2006 (NYS DEC Sample SM and E&SC Local Law 2006).
2. Enact a legal mechanism or ensure that written policies/procedures are in place with content equivalent to the model local law, with documentation in the *SWMP Plan* from the attorney representing the *MS4 Operator* of the equivalence. Equivalent legal mechanisms or written policies/procedures must include the following:
   a. For *illicit discharges*:
      i. A prohibition of:
         a) *Illicit discharges*, spills or other release of *pollutants*;
         b) Unauthorized connections into the *MS4*;
      ii. A mechanism to:
         a) Receive and collect information related to the introduction of *pollutants* into the *MS4*;
         b) Require installation, implementation, and maintenance of post-construction *SMPs*;
         c) Require compliance and take enforcement action; and,
         d) Access property for inspection.
   b. To be adequate the legal mechanism must also ensure:
      i. Applicable *construction activities* are effectively controlled and include post-construction runoff controls for new development and redevelopment projects; and
      ii. Post-construction *SMPs* are properly operated and maintained by requiring the following:
         a) A stormwater pollution prevention plan (SWPPP) with erosion and sediment controls that meets or exceed the New York State, Standards and Specifications for Erosion & Sediment Control, November 2016 (NYS E&SC 2016) and requires post-construction *SMPs* for applicable *construction activity* described in Part VI.D.1 in conformance with the

SPDES General Permit for Stormwater from Construction Activities, GP-0-20-001 (CGP);

b) Post-construction *SMPs* as required by CGP meet the *sizing criteria* specified in the New York State Stormwater Management Design Manual, January 2015 (NYS SWMDM 2015), and performance criteria, or equivalent, including Operation & Maintenance Plans for long term maintenance;

c) Construction site operators to control waste such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste, all of which may cause adverse impacts to water quality; and

d) Receive and collect information related to compliance with the approved SWPPP including verification of maintenance of post-construction *SMPs* (if conducted by private entities).

## F. Enforcement Measures & Tracking

### 1. Enforcement Response Plan

Within six (6) months, the *MS4 Operator* must *develop* and implement an enforcement response plan (ERP) which clearly describes the action(s) to be taken for violations that the *MS4 Operator* has enacted for illicit *discharge* (Part VI.C. or Part VII.C, depending on the MS4 Operator type), construction (Part VI.D. or Part VII.D, depending on the MS4 Operator type), and post-construction (Part VI.E. or Part VII.E, depending on the MS4 Operator type). The ERP must be documented in the *SWMP Plan*. The ERP must set forth a protocol to address repeat and continuing violations through progressively stricter responses (i.e., escalation of enforcement) as needed to achieve compliance with the terms and conditions of this *SPDES* general permit.

a. The ERP must describe how the *MS4 Operator* will use the following types of enforcement responses or combination of responses:

   i. Verbal warnings;

   ii. Written notices;

   iii. Citations (and associated fines);

   iv. Stop work orders;

   v. Withholding of plan approvals or other authorizations affecting the ability to *discharge* to the *MS4*; and

   vi. Additional measures, supported in local legal authorities, such as collecting against the project's bond or directly billing the responsible party to pay for work and materials to correct violations.

b. Enforcement responses are based on the type, magnitude, and duration of the violation, effect of the violation on the receiving water, compliance history of the operator, and good faith of the operator in compliance efforts.

c. Efforts to obtain a voluntary correction of deficiencies through informal enforcement, such as verbal warnings or written notices, must not exceed sixty (60) days in duration (from the time of the *MS4 Operator's* initial determination until a return to compliance).

### 2. Enforcement Tracking

The *MS4 Operator* must track instances of non-compliance in the *SWMP Plan*. The enforcement case documentation must include, at a minimum, the following:

a. Name of the owner/operator of the facility or site of the violation (can be redacted from the publicly available SWMP Plan);

b. Location of the *stormwater* source (e.g., construction project);

c. Description of the violation;

d. Schedule for returning to compliance;

e. Description of enforcement response used, including escalated responses if repeat violations occur or violations are not resolved in a timely manner;

f. Accompanying documentation of enforcement response (e.g., notices of noncompliance, notices of violations);

g. Any referrals to different departments or agencies; and

h. Date violation was resolved.

# Part V. Recordkeeping, Reporting, and *SWMP* Evaluation

## A. Recordkeeping

The *MS4 Operator* must keep records required by this *SPDES* general permit for five (5) years after they are generated. Records must be submitted to the *Department* within a reasonable specified time period of a written *Department* request for such information. Documents can be maintained in electronic format if the manner reasonably assures the integrity of the records, in accordance with NYCRR 750-2.5(e)(1). Records, including the NOI and the SWMP Plan, must be made available to the public at reasonable times during regular business hours.

## B. Reporting

### 1. Report Submittal

a. Reports must be submitted electronically to the *Department* using the forms located on the Department's website (http://www.dec.ny.gov/).

b. Electronic Submission Waiver

ii. *MS4 Operators* must submit all reports electronically unless the *MS4 Operator* has received a waiver from the *Department* based on one of the following conditions:

a) If the *MS4 Operator* is physically located in a geographical area (i.e., zip code or census tract) that is identified as under-served for broadband internet access in the most recent report from the Federal Communications Commission; or

b) If the *MS4 Operator* has limitations regarding available computer access or computer capability.

iii. If an *MS4 Operator* wishes to obtain a waiver from submitting a report electronically, the *MS4 Operator* must submit a request using the Application for Electronic Submittal Waiver to the *Department* at the following address:

NYS DEC Bureau of Water Compliance

MS4 NOTICE OF INTENT WAIVER

625 Broadway, 4th Floor

Albany, New York 12233-3505

iv. A waiver may only be considered granted once the *MS4 Operator* receives written confirmation from the *Department*.

v. *MS4 Operators* must document the electronic submission waiver in the *SWMP Plan*, if applicable.

## 2. Annual Reports

a. Annually, *MS4 Operators* must submit an Annual Report to the *Department* using the form provided by the *Department*. The completion of this permit requirement must be documented in the *SWMP Plan*.

b. The reporting period for the Annual Report is January 3 of the current year to January 2 of the following year (Reporting Year).

c. For *MS4 Operators* continuing coverage, the Annual Report must be submitted to the *Department* by April 1 of the year following the end of the Reporting Year.

d. For newly designated *MS4 Operators*, if authorization to discharge is granted:

i. Before September 30, the first Annual Report must be submitted by April 1 of the year following the end of the Reporting Year; or

ii. After September 30, the first Annual Report must be submitted by April 1 following their first complete Reporting Year.

## 3. Interim Progress Certifications

a. Twice a year, *MS4 Operators* must submit to the *Department* an Interim Progress Certification that verifies the activities included in this *SPDES* general permit have been completed by the date specified using the form provided by the *Department*. The completion of this permit requirement must be documented in the *SWMP Plan*.

b. *MS4 Operators* located within the watersheds listed in Table 3 must include additional information to identify the activities that have been performed during the reporting period to demonstrate progress made by the *MS4 Operator* towards completion of the reduction requirements, prescribed in Part IX.

c. An Interim Progress Certification for the period of January 3 through June 30 of the same year must be submitted to the *Department* by October 1 of the same year. An Interim Progress Certification for the period of July 1 through January 2 of the following year must be submitted to the *Department* by April 1 of the following year along with the Annual Report. Submission of the Annual Report is not a substitute for submission of the Interim Progress Certification.

### 4. Shared Annual Reporting

*MS4 Operators* working together to implement their *SWMPs* may complete and submit a shared Annual Report to satisfy the reporting requirements specified in Part V.B.2.

a. The shared Annual Report must outline and explain group activities, but also include the tasks performed by each individual *MS4 Operator*.

b. On or before the reporting deadline, April 1, each *MS4 Operator* within the group, must sign the certification section of the Annual Report to take responsibility for the information in the Annual Report, which includes specific endorsement or acceptance of both the shared Annual Report information and Annual Report information on behalf of the individual *MS4 Operator.*

### 5. Certification

All reports specified within this Part must be signed and certified in accordance with Part X.J.

### 6. Annual Report and Interim Progress Certification Content

The Annual Report and Interim Progress Certifications shall summarize the activities performed throughout the Reporting Year, including:

a. The status of compliance with permit requirements;

b. Information documented in the *SWMP Plan*, as specified throughout this *SPDES* general permit; and

c. A certification statement in accordance with 40 CFR 122.22(d).

## C. *SWMP* Evaluation

Once every five (5) years, the *MS4 Operator* must evaluate the *SWMP* for compliance with the terms and conditions of this *SPDES* general permit, including the effectiveness or deficiencies of components of the individual *SWMP Plan*, and

the status of achieving the requirements outlined in this *SPDES* general permit. The *SWMP* evaluation must be documented in the *SWMP Plan*.

# Part VI. Minimum Control Measures (MCMs) for *Traditional Land Use Control MS4 Operators*

In addition to the requirements contained in Part I. through Part V, *traditional land use control MS4 Operators* must comply with the MCMs contained in this Part.

## A. MCM1 – Public Education and Outreach Program

The *MS4 Operator* must *develop* and implement an education and outreach program to increase public awareness of *pollutant* generating activities and behaviors. This MCM is designed to inform the public about the impacts of *stormwater* on water quality, the general sources of *stormwater pollutants*, and the steps the general public can take to reduce *pollutants* in *stormwater* runoff.

### 1. Development

#### a. Focus Areas

Within three (3) years of the EDC, the *MS4 Operator* must identify and document the focus areas in the *SWMP Plan*. The focus areas to be considered are as follows:

i. Areas *discharging* to waters with Class AA-S, A-S, AA, A, B, SA, or SB (mapped in accordance with Part IV.D.1.e.ii.a));

ii. *Sewersheds* for impaired waters listed in Appendix C (subject to Part VIII. requirements; mapped in accordance with Part IV.D.1.c. for *MS4 Operators* continuing coverage and Part IV.D.2.a.ii. for newly designated *MS4 Operators*);

iii. *TMDL* watersheds (subject to Part IX. requirements; mapped in accordance with Part IV.D.1.e.ii.c));

iv. Areas with *construction activities*;

v. Areas with on-site wastewater systems (subject to Part VIII. or Part IX. requirements);

vi. Residential, commercial, and industrial areas (mapped in accordance with Part IV.D.1.e.iii.);

vii. *Stormwater hotspots*; and

viii. Areas with *illicit discharges*.

#### b. Target Audiences and Associated *Pollutant* Generating Activities

Within three (3) years of the EDC, the *MS4 Operator* must identify and document the applicable target audience(s) and associated *pollutant* generating activities that the outreach and education will address for each focus area identified by the *MS4 Operator* in Part VI.A.1.a. in the *SWMP Plan*. The target audiences are as follows:

i. Residents;

ii. Commercial:[10] Business owners and staff;

iii. Institutions:[11] Managers, staff, and students;

iv. Construction: Developers, contractors, and design professionals;

v. Industrial:[12] Owners and staff; and

vi. *MS4 Operator*'s *municipal* staff.

c. Education and Outreach Topics

Within three (3) years of the EDC, the *MS4 Operator* must identify and document in the *SWMP Plan* the education and outreach topics and how the education and outreach topics will reduce the potential for *pollutants* to be generated by the target audience(s) (Part VI.A.1.b.) for the focus area(s) (Part VI.A.1.a.).

d. *Illicit Discharge* Education

Within six (6) months of the EDC, the *MS4 Operator* must make information related to the prevention of *illicit discharges*, available to *municipal* employees, businesses, and the public and document the completion of this requirement in the *SWMP Plan*. The information related to the prevention of illicit discharges must include the following:

i. What types of *discharges* are allowable (Part I.A.3.);

ii. What is an *illicit discharge* and why is it prohibited (Part VI.C.);

iii. The environmental hazards associated with *illicit discharges* and improper disposal of waste;

iv. Proper handling and disposal practices for the most common behaviors within the community (e.g., septic care, car washing, household hazardous waste, swimming pool draining, or other activities resulting in *illicit discharges* to the *MS4*); and

v. How to report *illicit discharges* they may observe (Part VI.C.1.a.).

## 2. Implementation and Frequency

a. Distribution Method of Educational Messages

Once every five (5) years, the *MS4 Operator* must identify and document in the *SWMP Plan* which of the following method(s) are used for the distribution of educational messages:

i. Printed materials (e.g., mail inserts, brochures, and newsletters);

ii. Electronic materials (e.g., websites, email listservs);

[10] Business, retail stores, and restaurants.
[11] Hospitals, churches, colleges, and schools.
[12] Factories, recyclers, auto-salvage, and mines.

iii. Mass media (e.g., newspapers, public service announcements on radio or cable);

iv. Workshops or focus groups;

v. Displays in public areas (e.g., town halls, library, parks); or

vi. Social Media (e.g., Facebook, Twitter, blogs).

#### b. Frequency

Following the completion of Part VI.A.1.a, Part VI.A.1.b, and Part VI.A.1.c, within five (5) years of the EDC, and once every five (5) years, thereafter, the *MS4 Operator* must:

i. Deliver an educational message to each target audience(s) (Part VI.A.1.b.) for each focus area(s) (Part VI.A.1.a.) based on the defined education and outreach topic(s) (Part VI.A.1.c.); and

ii. Document the completion of this requirement in the *SWMP Plan*.

#### c. Updates to the Public Education and Outreach Program

Following the completion of Part VI.A.1.a, Part VI.A.1.b, and Part VI.A.1.c, annually, by April 1, the *MS4 Operator* must:

i. Review and update the focus areas, target audiences, and/or education and outreach topics; and

ii. Document the completion of this requirement in the *SWMP Plan*.

## B. MCM 2 - Public Involvement/Participation

The *MS4 Operator* must provide opportunities to involve the public in the development, review, and implementation of the *SWMP*. This MCM is designed to give the public the opportunity to include their opinions in the implementation of this *SPDES* general permit.

### 1. Public Involvement/Participation

*a.* Annually, the *MS4 Operator* must provide an opportunity for public involvement/participation in the development and implementation of the *SWMP*. The *MS4 Operator* must document the public involvement/participation opportunities in the *SWMP Plan*. The opportunities for public involvement/participation are as follows:

i. Citizen advisory group on *stormwater* management;

ii. Public hearings or meetings;

iii. Citizen volunteers to educate other individuals about the *SWMP*;

iv. Coordination with other pre-existing public involvement/participation opportunities;

v. Reporting concerns about activities or behaviors observed; or

vi. Stewardship activities.

b. Annually, the *MS4 Operator* must inform the public of the opportunity (Part VI.B.1.a.) for their involvement/participation in the development and implementation of the *SWMP* and how they can become involved. The *MS4 Operator* must document the method for distribution of this information in the *SWMP Plan*. The methods for distribution are as follows:

i. Public notice;

ii. Printed materials (e.g., mail inserts, brochures and newsletters);

iii. Electronic materials (e.g., websites, email listservs);

iv. Mass media (e.g., newspapers, public service announcements on radio or cable);

v. Workshops or focus groups;

vi. Displays in public areas (e.g., town halls, library, parks); or

vii. Social Media (e.g., Facebook, Twitter, blogs).

c. Within six (6) months of the EDC, the *MS4 Operator* must identify a local point of contact to receive and respond to public concerns regarding *stormwater* management and compliance with permit requirements. The name or title of this individual, with contact information, must be published on public outreach and public participation materials and documented in the *SWMP Plan*.

## 2. Public Notice and Input Requirements

### a. Public Notice and Input Requirements for *SWMP Plan*

Annually, the *MS4 Operator* must provide an opportunity for the public to review and comment on the publicly available *SWMP Plan* (Part IV.B.2.b.). The public must have the ability to ask questions and submit comments on the *SWMP Plan*. The completion of this permit requirement must be documented in the *SWMP Plan*. This requirement may be satisfied by Part VI.B.1.

### b. Public Notice and Input Requirements for Draft Annual Report

i. Annually, the *MS4 Operator* must provide an opportunity for the public to review and comment on the draft Annual Report. The completion of this permit requirement must be documented in the *SWMP Plan*. This requirement may be satisfied by either:

a) Presentation of the draft Annual Report at a regular meeting of an existing board (e.g., administrative, planning, zoning) or a separate meeting specifically for *stormwater*, as designated by the *MS4* or if requested by the public. The public must have the ability to ask

questions about and make comments on the draft annual report during that presentation; or

b) Posting of the draft Annual Report on a public website. The website must provide information on the timeframes and procedures to submit comments and/or request a meeting. However, if a public meeting is requested by two or more persons, the *MS4 Operator* must hold such a meeting.

c. Consideration of Public Input

i. Annually, the *MS4 Operator* must include a summary of comments received on the *SWMP Plan* and draft Annual Report in the *SWMP Plan*.

ii. Within thirty (30) days of when public input is received, the *MS4 Operator* must update the *SWMP Plan*, where appropriate, based on the public input received.

## C. MCM 3 - *Illicit Discharge* Detection and Elimination

The *MS4 Operator* must *develop*, implement, and enforce a program which systematically detects, tracks down, and eliminates *illicit discharges* to the *MS4*. This MCM is designed to manage the *MS4* so it is not conveying *pollutants* associated with flows other than those directly attributable to *stormwater* runoff.

### 1. *Illicit Discharge* Detection

a. Public Reporting of *Illicit Discharges*

i. Within six (6) months of the EDC, the *MS4 Operator* must establish and document in the *SWMP Plan* an email or phone number (with message recording capability) for the public to report *illicit discharges*.

ii. Within thirty (30) days of an *illicit discharge*, the *MS4 Operator* must document each report of an *illicit discharge* in the *SWMP Plan* with the following information:

a) Date of the report;

b) Location of the *illicit discharge;*

c) Nature of the *illicit discharge;*

d) Follow up actions taken or needed (including response times); and

e) Inspection outcomes and any enforcement taken.

b. Monitoring Locations

The monitoring locations used to detect *illicit discharges* are identified as follows:

i. *MS4 outfalls;*[13]

[13] *MS4 outfall*s can be found at a *municipal facility*.

ii. *Interconnections*;[14] and
iii. *Municipal facility intraconnections*.[15]

### c. Monitoring Locations Inventory

i. Within three (3) years of the EDC, the *MS4 Operator* must *develop* and maintain an inventory of the monitoring locations in the *SWMP Plan*. The following information must be included in the inventory:[16]

a) Inventory information for *MS4 outfall*s

i) ID;
ii) Prioritization (high or low) (Part VI.C.1.d.);
iii) Type of monitoring location (Part VI.C.1.b.);
iv) Name of *MS4 Operator's municipal facility*, if located at a *municipal facility*;[17]
v) Receiving waterbody name and class (mapped in accordance with Part IV.D.1.e.ii.a));
vi) Receiving waterbody WI/PWL Segment ID (mapped in accordance with Part IV.D.1.e.ii.b));
vii) Land use in drainage area;
viii) Type of conveyance (open drainage or closed pipe);
ix) Material;
x) Shape;
xi) Dimensions;
xii) Submerged in water; and
xiii) Submerged in sediment.

b) Inventory information for *interconnections*

i) ID;
ii) Prioritization (high or low) (Part VI.C.1.d.);
iii) Type of monitoring location (Part VI.C.1.b.);
iv) Name of *MS4 Operator* receiving *discharge* or private storm system;
v) Name of *MS4 Operator*'s *municipal facility*, if located at a *municipal facility*; and
vi) Receiving waterbody name and class (mapped in accordance with Part IV.D.1.e.ii.a)).

c) Inventory information for *municipal facility intraconnections*

i) ID;
ii) Prioritization (high or low) (Part VI.C.1.d.);

[14] *Interconnections* can be found at a *municipal facility*.
[15] *Municipal facility intraconnections* can be found only at a *municipal facility*.
[16] The information included in the inventory is collected during inspections on the Monitoring Locations Inspection and Sampling Field Sheet (Appendix D) unless otherwise specified by the permit conditions.
[17] This information is collected as part of the *municipal facility* inventory.

iii) Type of monitoring location (Part VI.C.1.b.);
iv) Name of *MS4 Operator*'s *municipal facility*; and
v) Receiving waterbody name and class (mapped in accordance with Part IV.D.1.e.ii.a)).

ii. Annually, the *MS4 Operator* must update the inventory if monitoring locations are created or discovered.

d. Monitoring Locations Prioritization

i. Within three (3) years of the EDC, the *MS4 Operator* must prioritize monitoring locations which are included in the monitoring locations inventory (Part VI.C.1.c.) as follows:
a) High priority monitoring locations include monitoring locations:
i) At a high priority *municipal facility*, as defined in Part VI.F.2.c;
ii) *Discharging* to impaired waters (subject to Part VIII. requirements; mapped in accordance with Part IV.D.1.e.ii.b));
iii) *Discharging* within a TMDL watershed (subject to Part IX. requirements; mapped in accordance with Part IV.D.1.e.ii.c));
iv) *Discharging* to waters with Class AA-S, A-S, AA, A, B, SA, or SB (mapped in accordance with Part IV.D.1.e.ii.a)); and/or
v) Confirmed citizen complaints on three or more separate occasions in the last twelve (12) months.
b) All other monitoring locations are considered low priority.

ii. Within thirty (30) days of when a monitoring location is constructed or the *MS4 Operator* discovers it, the *MS4 Operator* must prioritize those monitoring locations; and

iii. Annually, after the initial prioritization (Part VI.C.1.d.i.), the *MS4 Operator* must update the monitoring location prioritization in the inventory (Part VI.C.1.c.) based on information gathered as part of the monitoring location inspection and sampling program (Part VI.C.1.e.). The completion of this permit requirement must be documented in the *SWMP Plan*.

e. Monitoring Locations Inspection and Sampling Program

Within two (2) years of the EDC, the *MS4 Operator* must *develop* and implement a monitoring locations inspection and sampling program. The monitoring locations inspection and sampling program must be documented in the *SWMP Plan* specifying:

i. The monitoring locations inspection and sampling procedures including:

a) During *dry weather,*[18] one (1) inspection of each monitoring location identified in the inventory (Part VI.C.1.c.) every five (5) years following the most recent inspection;

b) Documentation of all monitoring location inspections, including any sampling results, using the Monitoring Locations Inspection and Sampling Field Sheet (Appendix D) or an equivalent form containing the same information and include the completed monitoring location inspections and sampling results in the *SWMP Plan* (e.g., the completed Monitoring Locations Inspection and Sampling Field Sheets);

c) Provisions to sample all monitoring locations which had inspections which resulted in a *suspect* or *obvious illicit discharge* characterization. The sampling requirement is based on the number and severity of *physical indicators present in the flow* to better inform track down procedures (Part VI.C.2.). If the source of the *illicit discharge* is clear and discernable (e.g., sewage), sampling is not necessary;

d) Sampling may be done with field test kits or field instrumentation that are sufficiently sensitive to detect the parameter below the sampling action level used[19] and are not subject to 40 CFR Part 136 requirements for approved methods and certified laboratories;

e) Provisions to initiate, or cause to initiate,[20] track down procedures (Part VI.C.2.a.), in accordance with the timeframes specified in Part VI.C.2.a.iii, for monitoring locations with an overall characterization[21] as *suspect illicit discharge* or *obvious illicit discharge* or that exceed any sampling action level used;

f) Provisions to re-inspect the monitoring location within thirty (30) days of initial inspection if there is a *physical indicator not related to flow*, potentially indicative of *intermittent* or *transitory discharges,* utilizing techniques described in Chapter 12.6 of the Center for Watershed Protection Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assistance, October 2004 (CWP 2004) or equivalent.

   i) If those same physical indicators persist, the *MS4 Operator* must initiate *illicit discharge* track down procedures (Part VI.C.2.a.).

[18] MS4 Operators can reference the Center for Watershed Protection Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assistance, October 2004 (CWP 2004) for other factors to consider when determining when to conduct monitoring location inspection and sampling.
[19] Refer to Chapter 12 of the CWP 2004 for parameters, sampling action levels, and procedures.
[20] If track down is conducted by individuals or entities other than those conducting the monitoring locations inspections.
[21] Reference to the Monitoring Locations Inspection and Sampling Field Sheet, adapted from CWP 2004, Section 6: Overall Monitoring Location Characterization based on the Relative Severity Index of physical indicators for flowing monitoring locations only.

ii. The training provisions for the *MS4 Operator*'s monitoring locations inspection and sampling procedures (Part VI.C.1.e.i.).

a) If new staff are added, training on the *MS4 Operator*'s monitoring locations inspection and sampling procedures (Part VI.C.1.e.i.) must be given prior to conducting monitoring locations inspections and sampling procedures;

b) For existing staff, training on the *MS4 Operator*'s monitoring locations inspection and sampling procedures (Part VI.C.1.e.i.) must be given prior to conducting monitoring locations inspections and sampling and once every five (5) years, thereafter; and

c) If the monitoring locations inspection and sampling procedures (Part VI.C.1.e.i.) are updated (Part VI.C.1.e.iv.), training on the updates must be given to all staff prior to conducting monitoring locations inspections and sampling.

iii. The names, titles, and contact information for the individuals who have received monitoring locations inspection and sampling procedures training and update annually; and

iv. Annually, by April 1, the *MS4 Operator* must:

a) Review and update the monitoring location inspection and sampling procedures (Part VI.C.1.e.i.) based on monitoring location inspection results (e.g., trends, patterns, areas with *illicit discharges*, and common problems); and

b) Document the completion of this requirement in the *SWMP Plan*.

### 2. *Illicit Discharge* Track Down Program

Within two (2) years of the EDC, the *MS4 Operator* must *develop* and implement an *illicit discharge* track down program to identify the source of *illicit discharges* and the responsible party. The *illicit discharge* track down program must be documented in the *SWMP Plan* specifying:

a. The *illicit discharge* track down procedures including:

i. Procedures as described in Chapter 13 of CWP 2004 or equivalent;

ii. Steps taken for *illicit discharge* track down procedures;

iii. The following timeframes to initiate *illicit discharge* track down:

a) Within twenty-four (24) hours of discovery, the *MS4 Operator* must initiate track down procedures for flowing *MS4* monitoring locations with *obvious illicit discharges;*[22]

[22] Reference to the Monitoring Locations Inspection and Sampling Field Sheet, adapted from CWP 2004, Section 6: Overall Monitoring Location Characterization based on the Relative Severity Index of physical indicators for flowing monitoring locations only.

b) Within two (2) hours of discovery, the *MS4 Operator* must initiate track down procedures for *obvious illicit discharges* of sanitary wastewater that would affect bathing areas during bathing season, shell fishing areas or public water intakes and report orally or electronically to the Regional Water Engineer and local health department; and

c) Within five (5) days of discovery, the *MS4 Operator* must initiate track down procedures for *suspect illicit discharges*.

b. The training provisions for the *MS4 Operator*'s *illicit discharge* track down procedures (Part VI.C.2.a.).

i. If new staff are added, training on the *MS4 Operator*'s *illicit discharge* track down procedures (Part VI.C.2.a.) must be given prior to conducting *illicit discharge* track downs;

ii. For existing staff, training on the *MS4 Operator*'s *illicit discharge* track down procedures (Part VI.C.2.a.) must be given prior to *conducting illicit discharge* track downs and once every five (5) years, thereafter; and

iii. If the *illicit discharge* track down procedures (Part VI.C.2.a.) are updated (Part VI.C.2.d.), training on the updates must be given to all staff prior to conducting *illicit discharge* track downs.

c. The names, titles, and contact information for the individuals who have received *illicit discharge* track down procedures training and update annually; and

d. Annually, by April 1, the *MS4 Operator* must:

i. Review and update the *illicit discharge* track down procedures (Part VI.C.2.a.); and

ii. Document the completion of this requirement in the *SWMP Plan*.

### 3. *Illicit Discharge* Elimination Program

Within two (2) years of the EDC, the *MS4 Operator* must *develop* and implement an *illicit discharge* elimination program. The *illicit discharge* elimination program must be documented in the *SWMP Plan* specifying:

a. The *illicit discharge* elimination procedures including:

i. Provisions for escalating enforcement and tracking, both consistent with the ERP required in Part IV.F. of this *SPDES* general permit;

ii. Provisions to confirm the corrective actions have been taken;

iii. Steps taken for *illicit discharge* elimination procedures; and

iv. The following timeframes for *illicit discharge* elimination:

a) Within twenty-four (24) hours of identification of an *illicit discharge* that has a reasonable likelihood of adversely affecting human health or the environment, the *MS4 Operator* must eliminate the *illicit discharge*;

b) Within five (5) days of identification of an *illicit discharge* that does not have a reasonable likelihood of adversely affecting human health or the environment, the *MS4 Operator* must eliminate the *illicit discharge;* and

c) Where elimination of an *illicit discharge* within the specified timeframes (Part VI.C.3.a.iv.) is not possible, the *MS4 Operator* must notify the Regional Water Engineer.

b. The training provisions for the *MS4 Operator*'s *illicit discharge* elimination procedures (Part VI.C.3.a.).

i. If new staff are added, training on the *MS4 Operator*'s *illicit discharge* elimination procedures (Part VI.C.3.a.) must be given prior to conducting *illicit discharge* eliminations;

ii. For existing staff, training on the *MS4 Operator*'s *illicit discharge* elimination procedures (Part VI.C.3.a.) must be given prior to conducting *illicit discharge* eliminations and once every five (5) years, thereafter; and

iii. If the *illicit discharge* elimination procedures (Part VI.C.3.a.) are updated (Part VI.C.3.d.), training on the updates must be given to all staff prior to conducting *illicit discharge* eliminations.

c. The names, titles, and contact information for the individuals who have received *illicit discharge* elimination procedures training and update annually; and

d. Annually, by April 1, the *MS4 Operator* must:

i. Review and update the *illicit discharge* elimination procedures (Part VI.C.3.a.); and

ii. Document the completion of this requirement in the *SWMP Plan*.

## D. MCM 4 - Construction Site *Stormwater* Runoff Control

The *MS4 Operator* must *develop*, implement, and enforce a program to ensure construction sites are effectively controlled. This MCM is designed to prevent *pollutants* from construction related activities,[23] as well as promote the proper planning and installation of post-construction *SMPs*.

### 1. Applicable Construction Activities/Projects/Sites

a. The construction site *stormwater* runoff control program must address *stormwater* runoff to the *MS4* from sites with *construction activities* that:

i. Result in a total land disturbance of greater than or equal to one acre; or

[23] Projects that comply with the terms and conditions of the CGP or an individual *SPDES* permit for *stormwater* for which they obtained coverage and local erosion and sediment control requirements are effectively controlled.

ii. Disturb less than one acre if part of a larger common plan of development or sale.

b. For *construction activities* where the *MS4 Operator* is listed as the owner/operator on the Notice of Intent for coverage under the CGP:

i. The *MS4 Operator* must ensure compliance with the CGP; and

ii. The additional requirements for construction oversight described in Part VI.D.6 through Part VI.D.9 are not required.

### 2. Public Reporting of Construction Site Complaints

a. Within six (6) months of the EDC, the *MS4 Operator* must establish and document in the *SWMP Plan* an email or phone number (with message recording capability) for the public to report complaints related to construction *stormwater* activity.

b. The *MS4 Operator* must document reports of construction site complaints in the *SWMP Plan* with the following information:

i. Date of the report;

ii. Location of the construction site;

iii. Nature of complaint;

iv. Follow up actions taken or needed; and

v. Inspection outcomes and any enforcement taken.

### 3. Construction Oversight Program

Within one (1) year of the EDC, the *MS4 Operator* must *develop* and implement a construction oversight program. The construction oversight program must be documented in the *SWMP Plan* specifying:

a. The construction oversight procedures including:

i. When the construction site *stormwater* control program applies (Part VI.D.1.);

ii. What types of *construction activity* require a SWPPP;

iii. The procedures for submission of SWPPPs;

iv. SWPPP review requirements (Part VI.D.6.)

v. Pre-construction oversight requirements (Part VI.D.7.)

vi. Construction site inspection requirements (Part VI.D.8.);

vii. Construction site close-out requirements (Part VI.D.9.);

viii. Enforcement process/expectations for compliance; and

ix. Other procedures associated with the control of *stormwater* runoff from applicable *construction activities*.

b. The training provisions for the *MS4 Operator*'s construction oversight procedures (Part VI.D.3.a.).
    i. If new staff are added, training on the *MS4 Operator*'s construction oversight procedures (Part VI.D.3.a.) must be given prior to conducting any construction oversight activities;
    ii. For existing staff, training on the *MS4 Operator*'s construction oversight procedures (Part VI.D.3.a.) must be given prior to conducting any construction oversight activities and once every five (5) years, thereafter; and
    iii. If the construction oversight procedures (Part VI.D.3.a.) are updated (Part VI.D.3.a.), training on the updates must be given to all staff prior to conducting construction oversight.
c. The names, titles, and contact information for the individuals who have received construction oversight training and update annually;
d. Procedures to ensure those involved in the *construction activity* itself (e.g., contractor, subcontractor, *qualified inspector*, SWPPP reviewers) have received four (4) hours of *Department* endorsed training in proper erosion and sediment control principles from a Soil & Water Conservation District, or other *Department* endorsed entity; and
e. Annually, by April 1, the *MS4 Operator* must:
    i. Review and update the construction oversight procedures (Part VI.D.3.a.); and
    ii. Document the completion of this requirement in the *SWMP Plan*.

### 4. Construction Site Inventory & Inspection Tracking

a. Within six (6) months of the EDC, the *MS4 Operator* must *develop* and maintain an inventory of all applicable construction sites (Part VI.D.1.a.) in the *SWMP Plan*. The following information must be included in the inventory:
    i. Location of the construction site;
    ii. Owner/operator contact information, if other than the *MS4 Operator*;
    iii. Receiving waterbody name and class (mapped in accordance with Part IV.D.1.e.ii.a));
    iv. Receiving waterbody WI/PWL Segment ID (mapped in accordance with Part IV.D.1.e.ii.b));
    v. Prioritization (high or low) (Part VI.D.5.);
    vi. Construction project *SPDES* identification number;
    vii. SWPPP approval date;
    viii. Inspection history, including dates and ratings (satisfactory, marginal, or unsatisfactory, when available); and

ix. Current status of the construction site/project (i.e., active, temporarily shut down, complete[24]).

b. Annually, the *MS4 Operator* must update the inventory if construction projects are approved or completed.

### 5. Construction Site Prioritization

a. Within one (1) year of the EDC, the *MS4 Operator* must prioritize all construction sites which are included in the construction site inventory (Part VI.D.4.) as follows:

i. High priority construction sites include construction sites:

a) With a direct conveyance (e.g., channel, ditch, storm sewer) to a *surface water of the State* that is:

i) Listed in Appendix C with silt/sediment, phosphorus, or nitrogen as the POC;

ii) Classified as AA-S, AA, or A (mapped in accordance with Part IV.D.1.e.ii.a)); or

iii) Classified with a trout (T) or trout spawning (TS) designation (mapped in accordance with Part IV.D.1.e.ii.a));

b) With greater than five (5) acres of disturbed earth at any one time;

c) With earth disturbance within one hundred (100) feet of any lake or pond (mapped in accordance with Part IV.D.1.e.ii.b)); and/or

d) Within fifty (50) feet of any rivers or streams (mapped in accordance with Part IV.D.1.e.ii.b));

ii. All other construction sites are considered low priority.

b. Within thirty (30) days of when a construction site becomes active, the *MS4 Operator* must prioritize those construction sites; and

c. Annually, after the initial prioritization (Part VI.D.5.a.), the *MS4 Operator* must update the construction site prioritization in the inventory (Part VI.D.4.a.) based on information gathered as part of the construction oversight program (Part VI.D.3.). The completion of this permit requirement must be documented in the *SWMP Plan*.

i. If the prioritization of the construction site changes priority based on information gathered as part of the construction oversight program, the *MS4 Operator* must comply with the requirements that apply to that prioritization.

[24] Construction projects listed on the inventory must be inspected and tracked as described in Part VI.D.8. until a final site inspection has been completed as specified in Part VI.D.9. and the construction site status changes to complete.

## 6. SWPPP Review

The *MS4 Operator* must:

a. Ensure individual(s), responsible for reviewing SWPPPs for acceptance, receive:

   i. Four (4) hours of *Department* endorsed training in proper erosion and sediment control principles from a Soil & Water Conservation District, or other *Department* endorsed entity. This training must be completed within three (3) years of the EDC and every three (3) years thereafter.

   ii. Document the completion of this requirement in the *SWMP Plan*.

b. Ensure SWPPP reviewers receive this training (Part VI.D.6.a.) prior to conducting SWPPP reviews for acceptance.

   i. Individuals without these trainings cannot review SWPPPs for acceptance.

   ii. Individuals who meet the definition of a *qualified professional* or *qualified inspector* are exempt from this requirement.

c. Ensure individuals responsible for reviewing SWPPPs review all SWPPPs for applicable *construction activities* (Part VI.D.1.) and for conformance with the requirements of the CGP, including:

   i. Erosion and sediment controls must be reviewed for conformance with the NYS E&SC 2016, or equivalent;

   ii. Individuals responsible for review of post-construction *SMPs* must be *qualified professionals* or under the supervision of a *qualified professional*; and

   iii. Post-construction *SMPs* must be reviewed for conformance with the NYS SWMDM 2015 or equivalent, including:

      a) All post-construction *SMPs* must meet the *sizing criteria* contained in the CGP and NYS SWMDM 2015.

      b) Deviations from the performance criteria of the NYS SWMDM 2015 must demonstrate that they are equivalent.

      c) The SWPPP must include an O&M plan that includes inspection and maintenance schedules and actions to ensure continuous and effective operation of each post-construction *SMP*. The SWPPP must identify the entity that will be responsible for the long-term operation and maintenance of each practice.

d. In the *SWMP Plan*, document and update annually the names, titles, and contact information for the individuals who have received the trainings listed in Part VI.D.6.a.

e. In the *SWMP Plan*, document the SWPPP review including the information found in Part III.B. of the CGP;

f. Prioritize new *construction activities* (Part VI.D.5.a.); and

g. Notify construction site owner/operators that their SWPPP has been accepted using the *MS4* SWPPP Acceptance Form[25] created by the *Department* and required by the CGP, signed in accordance with Part X.J.

### 7. Pre-Construction Meeting

Prior to commencement of *construction activities*, the *MS4 Operator* must ensure a pre-construction meeting is conducted. The date and content of the pre-construction inspection/meeting must be documented in the *SWMP Plan*. The owner/operator listed on the CGP NOI (if different from the *MS4 Operator*), the *MS4 Operator*, contractor(s) responsible for implementing the SWPPP for the *construction activity,* and the *qualified inspector* (if required for the *construction activity* by Part IV.C. the CGP) must attend the meeting in order to:

a. Confirm the approved project has received, or will receive[26], coverage under the CGP or an individual *SPDES* permit;

b. Verify contractors and subcontractors selected by the owner/operator of the *construction activity* have identified at least one individual that has received four (4) hours of *Department* endorsed training in proper erosion and sediment control principles from a Soil & Water Conservation District or other endorsed entity as required by the CGP and Part VI.D.3.d; and

c. Review the construction oversight program (Part VI.D.3.) and expectations for compliance.

### 8. Construction Site Inspections

The *MS4 Operator* must:

a. Ensure individuals(s), responsible for construction site inspections, receive:

   i. Four (4) hours of *Department* endorsed training in proper erosion and sediment control principles from a Soil & Water Conservation District, or other *Department* endorsed entity. This training must be complete, within three (3) years of the EDC and every three (3) years thereafter.

   ii. Document the completion of this requirement in the *SWMP Plan*.

b. Ensure all *MS4* Construction Site Inspectors receive this training prior to conducting construction site inspections.

   i. Individuals without these trainings cannot inspect construction sites.

   ii. Individuals who meet the definition of a *qualified professional* or *qualified inspector* are exempt from this requirement.

[25] The *MS4* SWPPP Acceptance Form can be found on the Department's website.

[26] Preconstruction meetings may occur prior to the issuance of the MS4 SWPP Acceptance Form, however, the MS4 Operator must confirm coverage under the CGP will be applied for by the construction site owner/operator prior to commencement of construction of *construction activities*.

c. Annually inspect all sites with *construction activity* identified in the inventory (Part VI.D.4.) during active construction after the pre-construction meeting (Part VI.D.7.), or sooner if deficiencies are noted that require attention.

   i. Follow up to construction site inspections must confirm corrective actions are completed within timeframes established by the CGP and the *MS4 Operator's* ERP (Part IV.F.1.).

d. In the *SWMP Plan*, document and update annually the names, titles, and contact information for the individuals who have received the trainings listed in Part VI.D.8.a.

e. Document all inspections using the Construction Site Inspection Report Form (Appendix D) or an equivalent form containing the same information. The *MS4 Operator* must include the completed Construction Site Inspection Reports in the *SWMP Plan*.

### 9. Construction Site Close-out

a. The *MS4 Operator* must ensure a final construction site inspection is conducted and documentation of the final construction site inspection must be maintained in the *SWMP Plan*. The final construction site inspection must be documented using the Construction Site Inspection Report Form (Appendix D), or an equivalent form containing the same information, or accept the construction site owner/operator's *qualified inspector* final inspection certification required by the CGP.

b. The Notice of Termination (NOT)[27] must be signed by the *MS4 Operator* as required by the CGP for projects determined to be complete. The NOT must be signed in accordance with Part X.J.

## E. MCM 5 – Post-Construction *Stormwater* Management

The *MS4 Operator* must *develop*, implement, and enforce a program to ensure proper operation and maintenance of post construction *SMPs* for new or redeveloped sites. This MCM is designed to promote the long-term performance of post-construction *SMPs* in removing *pollutants* from *stormwater* runoff.

### 1. Applicable Post-Construction *SMPs*

The post-construction *SMP* program must address *stormwater* runoff to the *MS4* from *publicly owned/operated* and *privately owned/operated* post-construction *SMPs* that meet the following:

a. Post-construction *SMPs* that have been installed as part of any CGP covered construction site or individual *SPDES* permit (since March 10, 2003); and

[27] The NOT can be found on the Department's website.

b. All new post-construction *SMPs* constructed as part of the construction site *stormwater* runoff control program (Part VI.D.).

### 2. Post-Construction *SMP* Inventory & Inspection Tracking[28]

a. The *MS4 Operators* continuing coverage must:

   i. Maintain the inventory from previous iterations of this *SPDES* general permit for post-construction *SMPs* installed after March 10, 2003; and

   ii. *Develop* the inventory for post-construction *SMPs* installed after March 10, 2003 including post-construction *SMPs:*

      a) As they are approved or discovered; or

      b) After the owner/operator of the *construction activity* has filed the NOT with the *Department* (Part VI.D.9.b.).

b. The newly designated *MS4 Operators* must *develop* and maintain the inventory for post-construction *SMPs* installed after March 10, 2003 including post-construction *SMPs:*

   i. As they are approved or discovered; or

   ii. After the owner/operator of the *construction activity* has filed the NOT with the *Department* (Part VI.D.9.b.).

c. Annually, the MS4 Operator must update the inventory of post-construction SMPs to include the post-construction *SMPs* in Part VI.E.2.a. and Part VI.E.2.b.

d. Within five (5) years of the EDC, the following information must be included in the inventory either by using the *MS4 Operator* maintenance records or by verification of maintenance records provided by the owner of the post-construction *SMP*:

   i. Street address or tax parcel;

   ii. Type;[29]

   iii. Receiving waterbody name and class (mapped in accordance with Part IV.D.1.e.ii.a));

   iv. Receiving waterbody WI/PWL Segment ID (mapped in accordance with Part IV.D.1.e.ii.b));

   v. Date of installation (if available) or discovery;

   vi. Ownership;

   vii. Responsible party for maintenance;

[28] Post-construction *SMPs* can be found at a *municipal facility*.
[29] Post-construction *SMP* types are defined in the New York State Department of Environmental Conservation Maintenance Guidance: Stormwater Management Practices, March 31, 2017 (NYS DEC Maintenance Guidance 2017).

viii. Contact information for party responsible for maintenance;

ix. Location of documentation depicting O&M requirements and legal agreements for post-construction *SMP*;

x. Frequency for inspection of post-construction *SMP*, as specified in the New York State Department of Environmental Conservation Maintenance Guidance: Stormwater Management Practices, March 31, 2017 (NYS DEC Maintenance Guidance 2017) or as specified in the O&M plan contained in the approved SWPPP (Part VI.D.6.);

xi. Reason for installation (e.g., new development, redevelopment, *retrofit*, flood control), if known;

xii. Date of last inspection;

xiii. Inspection results; and

xiv. Any corrective actions identified and completed.

e. *MS4 Operators* must document the inventory of post-construction *SMPs* in the *SWMP Plan*.

### 3. SWPPP Review

For post-construction *SMP* SWPPP review requirements, see Part VI.D.6.

### 4. Post-Construction *SMP* Inspection & Maintenance Program

Within one (1) year of the EDC, the *MS4 Operator* must *develop* and implement a post-construction *SMP* inspection and maintenance program. The post-construction *SMP* inspection and maintenance program must be documented in the *SWMP Plan* specifying:

a. The post-construction *SMP* inspection and maintenance procedures including:

i. Provisions to ensure that each post-construction *SMP* identified in the post-construction *SMP* inventory (Part VI.E.2.) is inspected at the frequency specified in the NYS DEC Maintenance Guidance 2017 or as specified in the O&M plan contained in the approved SWPPP (Part VI.D.6.), if available;

a) The *MS4 Operator* can only accept Level 1 inspections (NYS DEC Maintenance Guidance 2017) by private owners inspecting post-construction *SMPs*.

ii. Documentation of post-construction *SMP* inspections using the Post-Construction SMP Inspection Checklist[30] or an equivalent form containing the same information. The *MS4 Operator* must include the completed

[30] The *Department* developed checklist forms specific to each post-construction *SMP* designed to assist *MS4 Operators* in conducting inspections and maintenance activities of standard practices. The Post-Construction SMP Inspection Checklist, March 31, 2017, can be found on the Department's website.

post-construction *SMP* inspections (i.e., the completed Post-Construction SMP Inspection Checklist) in the *SWMP Plan*;

iii. Provisions to initiate follow-up actions (i.e., maintenance, repair, or higher-level inspection) within thirty (30) days of post-construction *SMP* inspection; and

iv. Provisions to initiate enforcement within sixty (60) days of the inspection if follow-up actions are not complete.

b. The training provisions for the *MS4 Operator*'s post-construction *SMP* inspection and maintenance procedures (Part VI.E.4.a.).

i. If new staff are added, training on the *MS4 Operator*'s post-construction *SMP* inspection and maintenance procedures (Part VI.E.4.a.) and procedures outlined in the *Department* endorsed program must be given prior to conducting any post-construction *SMP* inspection and maintenance;

ii. For existing staff, training on the *MS4 Operator*'s post-construction *SMP* inspection and maintenance procedures (Part VI.E.4.a.) and procedures outlined in the *Department* endorsed program must be given prior to conducting any post-construction *SMP* inspection and maintenance and once every five (5) years, thereafter; and

iii. If the post-construction *SMP* inspection and maintenance procedures (Part VI.E.4.a.) are updated (Part VI.E.4.d.), training on the updates must be given to all staff prior to conducting post-construction *SMP* inspection and maintenance.

*c.* The names, titles, and contact information for the individuals who have received post-construction *SMP* inspection and maintenance procedures training and update annually; and

d. Annually, by April 1, the *MS4 Operator* must:

i. Review and update the post-construction *SMP* inspection and maintenance procedures (Part VI.E.4.a.); and

ii. Document the completion of this requirement in the *SWMP Plan*.

## F. MCM 6 – Pollution Prevention and Good Housekeeping

The *MS4 Operator* must *develop* and implement a pollution prevention and good housekeeping program for *municipal facilities* and *municipal operations* to minimize *pollutant discharges*. This MCM is designed to ensure the *MS4 Operator*'s own activities do not contribute *pollutants* to *surface waters of the State*.

### 1. *Best Management Practices (BMPs)* for *Municipal Facilities & Operations*

Within three (3) years of the EDC, the *MS4 Operator* must incorporate *best management practices* (*BMPs*) into the *municipal facility* program *and municipal operations* program to minimize the *discharge* of *pollutants* associated with *municipal facilities* and *municipal operations, respectively*. The *BMPs* to be considered are as follows and must be documented in the *SWMP Plan*:

a. Minimize Exposure

i. Exposure of materials to rain, snow, snowmelt, and runoff must be minimized, unless not technologically possible or not economically practicable and achievable in light of best industry practices, including areas used for loading and unloading, storage, disposal, cleaning, maintenance, and fueling operations, with the following *BMP*s:

a) Locate materials and activities inside or protect them with storm resistant coverings;

b) Use grading, berming, or curbing to prevent runoff of contaminated flows and divert run-on away from these areas;

c) Locate materials, equipment, and activities so leaks and spills are contained in existing containment and diversion systems;

d) Clean up spills and leaks promptly using dry methods (e.g., absorbents) to prevent the *discharge* of *pollutants*;

e) Store leaky vehicles and equipment indoors or, if stored outdoors, use drip pans and absorbents;

f) Use spill/overflow protection equipment;

g) Perform all vehicle and/or equipment cleaning operations indoors, under cover, or in bermed areas that prevent runoff and run-on and also captures any overspray;

h) Drain fluids, indoors or under cover, from equipment and vehicles that will be decommissioned, and, for any equipment and vehicles that will remain unused for extended periods of time, inspect at least monthly for leaks; and/or

i) Minimize exposure of chemicals by replacing with a less toxic alternative (e.g., use non-hazardous cleaners).

ii. *No Exposure* Certification for High Priority *Municipal Facilities*

a) *Municipal facilities* may qualify for *No Exposure* Certification (Appendix D) when all activities and materials are completely sheltered from exposure to rain, snow, snowmelt and/or runoff.

b) High priority *municipal* facilities (Part VI.F.2.c.i.a)) with uncovered parking areas for vehicles awaiting maintenance may be considered a low priority *municipal facility* (Part VI.F.2.c.i.c)) if only routine maintenance is performed inside and all other n*o exposure* criteria are met.

c) *Municipal* facilities accepting or repairing disabled vehicles and/or vehicles that have been involved in accidents are not eligible for the *No Exposure* Certification.

d) *Municipal* facilities must maintain the *No Exposure* Certification and document in the *SWMP Plan*. The *No Exposure* Certification ceases to apply when activities or materials become exposed.

b. Follow a Preventive Maintenance Program

i. Implement a preventative maintenance program that includes routine inspection, testing, maintenance, and repair of all fueling areas, vehicles and equipment and systems to prevent leaks, spills and other releases. This includes:

a) Performing inspections and preventive maintenance of *stormwater* drainage, source controls, treatment systems, and plant equipment and systems;

b) Maintaining non-structural *BMPs* (e.g., keep spill response supplies available, personnel appropriately trained, containment measures, covering fuel areas); and

c) Ensure vehicle washwater is not *discharged* to the *MS4* or to *surface waters of the State*. Wash equipment/vehicles in a designated and/or covered area where washwater is collected to be recycled or *discharged* to the sanitary sewer (Part I.B.2.d.).

ii. Routine maintenance must be performed to ensure *BMPs* are operating properly.

iii. When a *BMP* is not functioning to its designed effectiveness and needs repair or replacement:

a) Maintenance must be performed before the next anticipated storm event, or as necessary to maintain the continued effectiveness of *stormwater* controls. If maintenance prior to the next anticipated storm event is impracticable, maintenance must be scheduled and accomplished as soon as practicable; and

b) Interim measures must be taken to prevent or minimize the *discharge* of *pollutants* until the final repair or replacement is implemented,

including cleaning up any contaminated surfaces so that the material will not be *discharged* during subsequent storm events.

c. Spill Prevention and Response Procedures

i. Minimize the potential for leaks, spills and other releases that may be exposed to *stormwater* and *develop* plans for effective response to such spills if or when they occur. At a minimum, the *MS4 Operator* must:
   a) Store materials in appropriate containers;
   b) Label containers (e.g., “Used Oil,” “Spent Solvents,” “Fertilizers and Pesticides”) that could be susceptible to spillage or leakage to encourage proper handling and facilitate rapid response if spills or leaks occur;
   c) Implement procedures for material storage and handling, including the use of secondary containment and barriers between material storage and traffic areas, or a similarly effective means designed to prevent the *discharge* of *pollutants* from these areas;
   d) *Develop* procedures for stopping, containing, and cleaning up leaks, spills, and other releases. As appropriate, execute such procedures as soon as possible;
   e) Keep spill kits on-site, located near areas where spills may occur or where a rapid response can be made;
   f) *Develop* procedures for notification of the appropriate facility personnel, emergency response agencies, and regulatory agencies when a leak, spill, or other release occurs. If possible, one of these individuals should be a member of the *stormwater* pollution prevention team (Part VI.F.2.d.i.a)). Any spills must be reported in accordance with 6 NYCRR 750-2.7; and
   g) Following any spill or release, the *MS4 Operator* must evaluate the adequacy of the *BMPs* identified in the *municipal facility* specific SWPPP. If the *BMPs* are inadequate, the SWPPP must be updated to identify new *BMPs* that will prevent reoccurrence and improve the emergency response to such releases.

ii. Measures for cleaning up spills or leaks must be consistent with applicable petroleum bulk storage, chemical bulk storage, or hazardous waste management regulations at 6 NYCRR Parts 596-599, 613 and 370-373.

iii. This *SPDES* general permit does not relieve the *MS4 Operator* of any reporting or other requirements related to spills or other releases of petroleum or hazardous substances. Any spill of a hazardous substance must be reported in accordance with 6 NYCRR 597.4. Any spill of petroleum must be reported in accordance with 6 NYCRR 613.6 or 17 NYCRR 32.3.

d. Erosion and Sediment Controls[31]

i. Stabilize exposed areas and control runoff using structural and/or non-structural controls to minimize onsite erosion and sedimentation.

ii. The *MS4 Operator* must consider:

a) Structural and/or non-structural controls found in the NYS E&SC 2016;

b) Areas that, due to topography, land disturbance (e.g., construction), or other factors, have potential for significant soil erosion;

c) Whether structural, vegetative, and/or stabilization *BMPs* are needed to limit erosion;

d) Whether velocity dissipation devices (or equivalent measures) are needed at *discharge* locations and along the length of any channel to provide a non-erosive flow velocity from the structure to a water course; and

e) Address erosion or areas with poor vegetative cover, especially if the erosion is within fifty (50) feet of a *surface water of the State*.

e. Manage Vegetated Areas and Open Space on *Municipal* Property

i. Maintain vegetated areas on *MS4 Operator* owned/operated property and right of ways:

a) Specify proper use, storage, and disposal of pesticides, herbicides, and fertilizers including minimizing the use of these products and using only in accordance manufacturer's instruction;

b) Use lawn maintenance and landscaping practices that are protective of water quality. Protective practices include: reduced mowing frequencies; proper disposal of lawn clippings; and use of alternative landscaping materials (e.g., drought resistant planting);

c) Place pet waste disposal containers and signage concerning the proper collection and disposal of pet waste at all parks and open space where pets are permitted; and

d) Address waterfowl congregation areas where needed to reduce waterfowl droppings from entering the *MS4*.

f. Salt[32] Storage Piles or Pile Containing Salt

Enclose or cover storage piles of salt, or piles containing salt, used for deicing or maintenance of paved surfaces, except during loading, unloading, and handling. Implement appropriate measures (e.g., good housekeeping, routine sweeping, diversions, containment) to minimize exposure resulting from adding to or removing materials from the pile.

[31] The use of the term "controls" in Part VI.F.1.d. aligns with the use of the term "controls" in the CGP.
[32] For purposes of this *SPDES* general permit, salt means any chloride-containing material used to treat paved surfaces for deicing, including sodium chloride, calcium chloride, magnesium chloride, and brine solutions.

g. Waste, Garbage, and Floatable Debris

i. Keep all dumpster lids closed when not in use. For dumpsters and roll off boxes that do not have lids and could leak, ensure that *discharges* have a control (e.g., secondary containment, treatment); and

ii. Keep exposed areas free of waste, garbage, and debris or intercept them before they are *discharged*:

a) Manage trash containers at parks and open space (scheduled cleanings; sufficient number);

b) Pick up trash and debris on *MS4 Operator* owned/operated property and rights of way; and

c) Clean out *catch basins* within the appropriate timeframes (Part VI.F.3.c.iii.).

h. Alternative Implementation Options

When alternative implementation options (Part IV.A.1.) are utilized, require the parties performing *municipal operations* as contracted services, including but not limited to street sweeping, snow removal, and lawn/grounds care, to meet permit requirements as the requirements apply to the activity performed.

## 2. *Municipal Facilities*[33]

a. *Municipal Facility* Program

Within three (3) years of the EDC, the *MS4 Operator* must *develop* and implement a *municipal facility* program. The *municipal facility* program must be documented in the *SWMP Plan* specifying:

i. The *municipal facility* procedures including:

a) The *BMPs* (Part VI.F.1.) incorporated into the *municipal facility* program;

b) The high priority *municipal facility* requirements (Part VI.F.2.d.) as applied to the specific *municipal facility*; and

c) The low priority *municipal facility* requirements (Part VI.F.2.e.) as applied to the specific *municipal facility*.

ii. The training provisions for the *MS4 Operator*'s *municipal facility* procedures (Part VI.F.2.a.i.).

a) If new staff are added, training on the *MS4 Operator*'s *municipal facility* procedures (Part VI.F.2.a.i.) must be given prior to conducting *municipal facility* procedures;

b) For existing staff, training on the *MS4 Operator*'s *municipal facility* procedures (Part VI.F.2.a.i.) must be given prior to conducting

[33] *Municipal facilities* that have coverage under a separate *SPDES* permit (either individual or MSGP) must comply with the terms and conditions of that permit and the requirements set forth in this Part are not applicable.

*municipal facility* procedures and once every five (5) years, thereafter; and

c) If the *municipal facility* procedures (Part VI.F.2.a.i.) are updated (Part VI.F.2.a.iv.), training on the updates must be given to all staff prior to conducting *municipal facility* procedures.

iii. The names, titles, and contact information for the individuals who have received *municipal facility* training and update annually; and

iv. Annually, by April 1, the *MS4 Operator* must:

a) Review and update the *municipal facility* procedures (Part VI.F.2.a.i.); and

b) Document the completion of this requirement in the *SWMP Plan*.

b. *Municipal Facility* Inventory

i. Within two (2) years of the EDC, the *MS4 Operator* must *develop* and maintain an inventory of all *municipal* facilities in the *SWMP* Plan. The following information must be included in the inventory:

a) Name of *municipal facility*;

b) Street address;

c) Type of *municipal facility*;

d) Prioritization (high or low) (Part VI.F.2.c.);

e) Receiving waterbody name and class (mapped in accordance with Part IV.D.1.e.ii.a)) ;

f) Receiving waterbody WI/PWL Segment ID (mapped in accordance with Part IV.D.1.e.ii.b));

g) Contact information;

h) Responsible department;

i) Location of SWPPP (if high priority; when completed);

j) Type of activities present on site;

k) Size of facility (acres);

l) Date of last assessment;

m) *BMPs* identified; and

n) Projected date of next comprehensive site assessment (Part VI.F.2.d.ii.c) or Part VI.F.2.e.ii.c), depending on the *municipal facility* prioritization (Part VI.F.2.c.)).

ii. Annually, the *MS4 Operator* must update the inventory if new *municipal* facilities are added.

c. *Municipal Facility* Prioritization

i. Within three (3) years of the EDC, the *MS4 Operator* must prioritize all known *municipal* facilities as follows:

a) High priority *municipal facilities* include *municipal* facilities that have one or more of the following on site and exposed to *stormwater*:

i) Storage of chemicals, salt, petroleum, pesticides, fertilizers, anti-freeze, lead-acid batteries, tires, waste/debris;

ii) Fueling stations; and/or

iii) Vehicle or equipment maintenance/repair.

b) Low priority *municipal facilities* include any *municipal* facilities that do not meet the criteria for a high priority (Part VI.F.2.c.i.a)) *municipal facility*.

c) High priority *municipal facilities* (Part IV.F.2.c.i.a)) which qualify for a *No Exposure* Certification (Part VI.F.1.a.ii.) are low priority *municipal* facilities.

ii. Within thirty (30) days of when a *municipal facility* is added to the inventory, the *MS4 Operator* must prioritize those *municipal* facilities; and

iii. Annually, after the initial prioritization (Part VI.F.2.c.i.), the *MS4 Operator* must update the *municipal facility* prioritization in the inventory (Part VI.F.2.b.i.) based on information gathered as part of the *municipal facility* program (Part VI.F.2.a.), including cases where a *No Exposure* Certification (Part VI.F.1.a.ii.) ceases to apply. The completion of this permit requirement must be documented in the *SWMP Plan*.

d. High Priority *Municipal Facility* Requirements

*i. Municipal Facility Specific SWPPP*

Within five (5) years of the EDC, *MS4 Operators* must *develop* and implement a *municipal facility* specific SWPPP for each high priority *municipal facility* (Part VI.F.2.c.i.a)) and retain a copy of the *municipal facility* specific SWPPP on site of the respective *municipal facility*. The SWPPP must contain:

a) *Stormwater* Pollution Prevention Team

The *municipal facility* specific SWPPP must identify the individuals (by name and/or title) and their role/responsibilities in *developing*, implementing, maintaining, and revising the *municipal facility* specific SWPPP. The activities and responsibilities of the team must address all aspects of the *municipal facility* specific SWPPP.

b) General Site Description

A written description of the nature of the activities occurring at the *municipal facility* with a potential to *discharge pollutants*, type of

*pollutants* expected, and location of key features as detailed in the site map (Part VI.F.2.d.i.e)).

c) Summary of potential *pollutant* sources

The *municipal facility* specific SWPPP must identify each area at the *municipal facility* where materials or activities are exposed to *stormwater* or from which authorized non-*stormwater discharges* (Part I.A.3.) originate, including any potential *pollutant* sources for which the *municipal facility* has reporting requirements under the Emergency Planning and Community Right-To-Know Act (EPCRA), Section 313.

i) Materials or activities include: machinery; raw materials; intermediate products; byproducts; final products or waste products; and, material handling activities which includes storage, loading and unloading, transportation or conveyance of any raw material, intermediate product, final product or waste product.

ii) For each separate area identified, the description must include:

(a) Activities - A list of the activities occurring in the area (e.g., material storage, equipment fueling and cleaning);

(b) *Pollutants* - A list of the associated *pollutant(s)* for each activity. The *pollutant(s)* list must include all materials that are exposed to *stormwater*; and

(c) Potential for presence in *stormwater* - For each area of the *municipal facility* that generates *stormwater discharges,* a prediction of the direction of flow, and the likelihood of the activity to contaminate the *stormwater discharge*. Factors to consider include the toxicity of chemicals, quantity of chemicals used, produced or *discharge*d, the likelihood of contact with *stormwater*; and history of leaks or spills of toxic or hazardous *pollutants*.

d) Spills and Releases

For areas that are exposed to precipitation or that otherwise drain to a *stormwater* conveyance to be covered under this *SPDES* general permit, the *municipal facility* specific SWPPP must include a list of spills or releases[34] of petroleum and hazardous substances or other *pollutants*, including unauthorized *non-stormwater discharges*, that may adversely affect water quality that occurred during the last three-year period. The list must be updated when spills or releases occur.

e) Site Map

[34] This may also include releases of petroleum or hazardous substances that are not in excess of reporting quantities but which may still cause or contribute to significant water quality impairment.

The *municipal facility* specific SWPPP must include a site map identifying the following, as applicable:

i) Property boundaries and size in acres;

ii) Location and extent of significant structures (including materials shelters), and impervious surfaces;

iii) Monitoring locations (mapped in accordance with Part IV.D.2.a.i.) with its approximate *sewershed*. Each monitoring location must be labeled with the monitoring location identification;

iv) Location of all post-construction *SMPs* (mapped in accordance with Part IV.D.2.a.iv.) and *MS4* infrastructure (mapped in accordance with Part IV.D.2.b.i.);

v) Locations of *discharges* authorized under other *SPDES* permits;

vi) Locations where potential spills or releases can contribute to *pollutants* in *stormwater discharges* and their accompanying drainage points;

vii) Locations of haul and access roads;

viii) Rail cars and tracks;

ix) Arrows showing direction of *stormwater* flow;

x) Location of all receiving waters in the immediate vicinity of the *municipal facility*, indicating if any of the waters are impaired and, if so, whether the waters have *TMDLs* established for them (mapped in accordance with Part IV.D.1.e.ii.);

xi) Locations where *stormwater* flows have significant potential to cause erosion;

xii) Location and source of run-on from adjacent property containing significant quantities of *pollutants* and/or volume of concern to the *municipal facility*; and

xiii) Locations of the following areas where such areas are exposed to precipitation or *stormwater*:

(a) Fueling stations;
(b) Vehicle and equipment maintenance and/or cleaning areas;
(c) Loading/unloading areas;
(d) Locations used for the treatment, storage or disposal of wastes;
(e) Liquid storage tanks;
(f) Processing and storage areas;
(g) Locations where significant materials, fuel or chemicals are stored and transferred;
(h) Locations where vehicles and/or machinery are stored when not in use
(i) Transfer areas for substances in bulk;

(j) Location and description of non-*stormwater discharges* (Part I.A.3.);
(k) Locations where spills[35] or leaks have occurred; and
(l) Locations of all existing structural *BMP*s.

f) *Stormwater Best Management Practices (BMPs)*

The *municipal facility* specific SWPPP must document the location and type of *BMPs* implemented at the *municipal facility* (Part VI.F.1.). The *municipal facility* specific SWPPP must describe how each *BMP* is being implemented for all the potential *pollutant* sources.

g) *Municipal facility* assessments
The *municipal facility* specific SWPPP must include a schedule for completing and recording results of routine and comprehensive site assessments (Part VI.F.2.d.ii.c)).

*ii.* *Municipal Facility Assessments*

a) Wet Weather Visual Monitoring

i) Once every five (5) years, the *MS4 Operator* must conduct wet weather visual monitoring of the monitoring locations (Part VI.C.1.b.) and other sites of *stormwater* leaving the site that are *discharging stormwater* from fueling areas, storage areas, vehicle and equipment maintenance/fueling areas, material handling areas and similar potential *pollutant* generating areas (Part VI.F.2.d.i.e)xiii)).

(a) All samples must be collected from *discharges* resulting from a *qualifying storm event*. The storm event must be documented using the Storm Event Data Form (Appendix D) and kept with the *municipal facility* specific SWPPP. The sample must be taken during the first thirty (30) minutes (or as soon as practical, but not to exceed one hour) of the *discharge* at the monitoring location.

(b) No analytical tests are required to be performed on the samples for the purpose of meeting the visual monitoring requirements.

(c) The visual examination must document observations of color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, and any other obvious indicators of *stormwater* pollution.

(d) The visual examination of the sample must be conducted in a well-lit area.

[35] A spill includes: any spill of a hazardous substance that must be reported in accordance with 6 NYCRR 597.4 and any spill of petroleum that must be reported in accordance with 6 NYCRR 613.6 or 17 NYCRR 32.3.

(e) Where practicable, the same individual should carry out the collection and examination of *discharges* for the entire permit term for consistency.

(f) The *MS4 Operator* must document the visual examination using the Visual Monitoring Form (Appendix D) and keep it with the *municipal facility* specific SWPPP to record:

(i) Monitoring location ID;

(ii) Examination date and time;

(iii) Personnel conducting the examination;

(iv) Nature of the *discharge* (runoff or snowmelt);

(v) Visual quality of the *stormwater discharge* including observations of color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, and other obvious indicators of *stormwater* pollution; and

(vi) Probable sources of any observed *stormwater* contamination.

(vii) Corrective and follow up actions – If the visual examination indicates the presence of color, odor, floating solids, settled solids, suspended solids, foam, oil sheen, or other indicators of *stormwater* pollution, the *MS4 Operator* must, at minimum, complete and document the following actions:

(1) Evaluate the facility for potential sources;

(2) Remedy the problems identified;

(3) Revise the *municipal facility* specific SWPPP; and

(4) Perform an additional visual inspection during the first *qualifying storm event* following implementation of the corrective action. If the first *qualifying storm event* does not occur until the next visual monitoring period, this follow up action may be used as the next visual inspection.

b) The monitoring locations inspection and sampling program must be implemented at the *municipal facility* (Part VI.C.1.e.).

c) Comprehensive Site Assessments

i) Once every five (5) years following the most recent assessment, the *MS4 Operator* must complete a comprehensive site assessment for each high priority *municipal facility* as identified in the inventory (Part VI.F.2.b.) using the Municipal Facility Assessment Form (Appendix D) or an equivalent form containing

the same information, and document in the *municipal facility* specific SWPPP and *SWMP Plan* that:

(a) The *municipal facility* is in compliance with the terms and conditions of this *SPDES* general permit;

(b) Deficiencies were identified and all reasonable steps will be taken to minimize any *discharge* in violation of the permit, which has a reasonable likelihood of adversely affecting human health or the environment;

(i) Within twenty-four (24) hours, the *MS4 Operator* must prepare a schedule that includes corrective actions and specific interim milestones to be implemented until the corrective action is implemented; or

(c) Deficiencies were identified and all reasonable steps will be taken to minimize any *discharge* in violation of the permit, which does not have a reasonable likelihood of adversely affecting human health or the environment;

(i) Within seven (7) days, the *MS4 Operator* must prepare a schedule that includes corrective actions and specific interim milestones to be implemented until the corrective action is implemented.

### e. Low Priority *Municipal Facility* Requirements

i. The *MS4 Operator* must identify procedures outlining *BMPs* for the types of activities that occur at the low priority *municipal* facilities as described in Part VI.F.1. A *municipal facility* specific SWPPP is not required.

ii. *Municipal Facility* Assessments

a) Low priority *municipal* facilities are not required to conduct wet weather visual monitoring.

b) The monitoring locations inspection and sampling program must be implemented at the *municipal facility* (Part VI.C.1.e.).

c) Comprehensive Site Assessments

i) Once every five (5) years following the most recent assessment, the *MS4 Operator* must complete a comprehensive site assessment for each low priority *municipal facility* as identified in the inventory (Part VI.F.2.b.) using the Municipal Facility Assessment Form (Appendix D) or an equivalent form containing the same information, and document in the *SWMP Plan* that:

(a) The *municipal facility* is in compliance with the terms and conditions of this *SPDES* general permit;

(b) Deficiencies were identified and all reasonable steps will be taken to minimize any *discharge* in violation of the permit, which

has a reasonable likelihood of adversely affecting human health or the environment;

(i) Within twenty-four (24) hours, the *MS4 Operator* must prepare a schedule that includes corrective actions and specific interim milestones to be implemented until the corrective action is implemented; or

(c) Deficiencies were identified and all reasonable steps will be to minimize any *discharge* in violation of the permit, which does not have a reasonable likelihood of adversely affecting human health or the environment;

(i) Within seven (7) days, the *MS4 Operator* must prepare a schedule that includes corrective actions and specific interim milestones to be implemented until the corrective action is implemented.

### 3. *Municipal Operations* & Maintenance

#### a. *Municipal Operations* Program

*Municipal operations* are: street and bridge maintenance; winter road maintenance; *MS4* maintenance; open space maintenance; solid waste management; new construction and land disturbances; right-of-way maintenance; marine operations; or hydrologic habitat modification.

Within three (3) years of the EDC, the *MS4 Operator* must *develop* and implement a *municipal operations* program. The *municipal operations* program must be documented in the *SWMP Plan* specifying:

i. The *municipal operations* procedures including:

a) The *BMPs* (Part VI.F.1.) incorporated into the *municipal operations* program;

b) The *municipal operations* corrective actions requirements (Part VI.F.3.b.);

c) *Catch basin* inspection and maintenance requirements (Part VI.F.3.c.);

d) Roads, bridges, parking lots, and right of way maintenance requirements (Part VI.F.3.d.); and

e) All other *municipal operations* maintenance requirements.

ii. The training provisions for the *MS4 Operator*'s *municipal operations* procedures (Part VI.F.3.a.i.).

a) If new staff are added, training on the *MS4 Operator*'s *municipal operations* procedures (Part VI.F.3.a.i.) must be given prior to conducting *municipal operations* procedures;

b) For existing staff, training on the *MS4 Operator*'s *municipal operations* procedures (Part VI.F.3.a.i.) must be given prior to conducting *municipal operations* procedures and once every five (5) years, thereafter; and

c) If the *municipal operations* procedures (Part VI.F.3.a.i.) are updated (Part VI.F.3.a.iv.), training on the updates must be given to all staff prior to conducting *municipal operations* procedures.

iii. The names, titles, and contact information for the individuals who have received *municipal operations* training and update annually; and

iv. Annually, by April 1, the *MS4 Operator* must:

a) Review and update the *municipal operations* procedures (Part VI.F.3.a.i.); and

c) Document the completion of this requirement in the *SWMP Plan*.

### b. *Municipal Operations* Corrective Actions

i. For *municipal operations*, *MS4 Operators* must either:

a) Ensure compliance with the terms and conditions of this *SPDES* general permit; or

b) Implement corrective actions according to the following schedule and, after implementation, ensure the operations are in compliance with the terms and conditions of this *SPDES* general permit:

i) Within twenty-four (24) hours of discovery for situations that have a reasonable likelihood of adversely affecting human health or the environment;

ii) Initiated within seven (7) days of inspection and completed within thirty (30) days of inspection for situations that do not have a reasonable likelihood of adversely affecting human health or the environment; and

iii) For corrective actions that require special funding or construction that will take longer than thirty (30) days to complete, a schedule must be prepared that specifies interim milestones that will ensure compliance in the shortest reasonable time.

### c. *Catch Basin* Inspection and Maintenance

Within three (3) years of the EDC, the MS4 Operator must:

i. Identify when *catch basin* inspection is needed with consideration for:

a) Areas with *construction activities* (mapped in accordance with Part IV.D.2.a.iii.);

b) Residential, commercial, and industrial areas (mapped in accordance with Part IV.D.1.d.iii.);

c) Recurring or history of issues; or

d) Confirmed citizen complaints on three or more separate occasions in the last twelve (12) months.

ii. Inventory *catch basin* inspection information including:

a) Date of inspection;

b) Approximate level of trash, sediment, and/or debris captured at time of clean-out (no trash, sediment, and/or debris, <50% of the depth of the *sump*, >50% of the depth of the *sump*);

c) Depth of structure;

d) Depth of *sump*; and

e) Date of clean out, if applicable (Part VI.F.3.c.iii.).

iii. Based on inspection results, clean out *catch basins* within the following timeframes:

a) Within six (6) months after the *catch basin* inspection, *catch basins* which had trash, sediment, and/or debris exceeding 50% of the depth of the *sump* as a result of a *catch basin* inspection must be cleaned out;

b) Within one (1) year after the *catch basin* inspection, *catch basins* which had trash, sediment, and/or debris at less than 50% of the depth of the *sump* as a result of a *catch basin* inspection must be cleaned out; and

c) MS4 Operators are not required to clean out *catch basins* if the *catch basins* are operating properly and:

i. There is no trash, sediment, and/or debris in the *catch basin*; or

ii. The *sump* depth of the *catch basin* is less than or equal to two (2) feet.

iv. Properly manage (handling and disposal) materials removed from *catch basins* during clean out so that:

a) Water removed during the *catch basin* cleaning process will not reenter the *MS4* or *surface waters of the State*;

b) Material removed from *catch basins* is disposed of in accordance with any applicable environmental laws and regulations; and

c) Material removed during the *catch basin* cleaning process will not reenter the *MS4* or *surface waters of the State*.

v. Determine if there are signs/evidence of *illicit discharges* and procedures for referral/follow-up if *illicit discharges* are encountered.

### d. Roads, Bridges, Parking Lots, & Right of Way Maintenance

#### *i. Sweeping*

Within six (6) months of the EDC, the *MS4 Operator* must *develop* and implement procedures for sweeping and/or cleaning *municipal* streets, bridges, parking lots, and right of ways owned/operated by the *MS4 Operator*. The procedures and completion of permit requirements must be documented in the *SWMP Plan* specifying:

a) All roads, bridges, parking lots, and right of ways must be swept and/or cleaned once every five (5) years in the spring (following winter activities such as sanding). This requirement is not applicable to:

   i) Uncurbed roads with no *catch basins*;

   ii) High-speed limited access highways; or

   iii) Roads defined as interstates, freeways and expressways, or arterials by the United States Department of Transportation, Federal Highway Administration, Highway Functional Classification Concepts, Criteria and Procedures, 2013.

b) Annually, from April 1 through October 31, roads in business and commercial areas must be swept. This requirement is not applicable to:

   i) Uncurbed roads with no *catch basins*;

   ii) High-speed limited access highways; or

   iii) Roads defined as interstates, freeways and expressways, or arterials by the USDOT 2013.

#### *ii. Maintenance*

Within five (5) years of the EDC, in addition to the *BMPs* (Part VI.F.1.), the *MS4 Operator* must implement the following provisions:

a) Pave, mark, and seal in dry conditions;

b) Stage road operations and maintenance activity (e.g., patching, potholes) to reduce the potential discharge of pollutants to the *MS4* or *surface waters of the State*;

c) Restrict the use of herbicides/pesticide application to roadside vegetation; and

d) Contain *pollutants* associated with bridge maintenance activities (e.g., paint chips, dust, cleaning products, other debris).

#### *iii. Winter Road Maintenance*

Within five (5) years of the EDC, in addition to the *BMPs* (Part VI.F.1.), the *MS4 Operator* must implement the following provisions:

a) Routinely calibrate equipment to control salt/sand application rates; and

b) Ensure that routine snow disposal activities comply with the Division of Water Technical and Operation Guidance Series 5.1.11, Snow Disposal.[36]

[36] The Division of Water Technical and Operation Guidance Series 5.1.11, Snow Disposal can be found on the Department's website.

# Part VII. Minimum Control Measures (MCMs) for *Traditional Non-Land Use Control & Non-Traditional MS4 Operators*

In addition to the requirements contained in Part I. through Part V*, traditional non-land use* and *non-traditional MS4 Operators* must comply with the MCMs contained in this Part. These *MS4 Operators* should consider their public to be:

- Employees (i.e., staff, faculty);
- User population/visitors;
- Students;
- Tenants; and
- Contractors & developers working for *MS4 Operator*.

## A. MCM1 – Public Education and Outreach Program

The *MS4 Operator* must *develop* and implement an education and outreach program to increase public awareness of *pollutant* generating activities and behaviors. This MCM is designed to inform the public about the impacts of *stormwater* on water quality, the general sources of *stormwater pollutants*, and the steps the general public can take to reduce *pollutants* in *stormwater* runoff.

### 1. Development

#### a. Focus Areas

Within three (3) years of the EDC, the *MS4 Operator* must identify and document the focus areas in the *SWMP Plan*. The focus areas to be considered are as follows:

i. Areas *discharging* to waters with Class AA-S, A-S, AA, A, B, SA, or SB (mapped in accordance with Part IV.D.1.e.ii.a));

ii. *Sewersheds* for impaired waters listed in Appendix C (subject to Part VIII. requirements; mapped in accordance with Part IV.D.1.c. for *MS4 Operators* continuing coverage and Part IV.D.2.a.ii. for newly designated *MS4 Operators*);

iii. *TMDL* watersheds (subject to Part IX. requirements; mapped in accordance with Part IV.D.1.e.ii.c));

iv. Areas with *construction activities*;

v. Areas with on-site wastewater systems (subject to Part VIII. or Part IX. requirements);

vi. Residential, commercial, and industrial areas (mapped in accordance with Part IV.D.1.e.iii.);

vii. *Stormwater hotspots*; and

viii. Areas with *illicit discharges*.

b. Target Audiences and Associated *Pollutant* Generating Activities

Within three (3) years of the EDC, the *MS4 Operator* must identify and document the applicable target audience(s) and associated *pollutant* generating activities that the outreach and education will address for each focus area identified by the *MS4 Operator* in Part VII.A.1.a. in the *SWMP Plan*. The target audiences are as follows:

i. Residents;

ii. Commercial:[37] Business owners and staff;

iii. Institutions:[38] Managers, staff, and students;

iv. Construction: Developers, contractors, and design professionals;

v. Industrial:[39] Owners and staff; and

vi. *MS4 Operator*'s *municipal* staff.

c. Education and Outreach Topics

Within three (3) years of the EDC, the *MS4 Operator* must identify and document in the *SWMP Plan* the education and outreach topics and how the education and outreach topics will reduce the potential for *pollutants* to be generated by the target audience(s) (Part VII.A.1.b.) for the focus area(s) (Part VII.A.1.a.).

e. *Illicit Discharge* Education

Within six (6) months of the EDC, the *MS4 Operator* must make information related to the prevention of *illicit discharges*, available to *municipal* employees, businesses, and the public and document the completion of this requirement in the *SWMP Plan*. The information related to the prevention of illicit discharges must include the following:

i. What types of *discharges* are allowable (Part I.A.3.);

ii. What is an *illicit discharge* and why is it prohibited (Part VII.C.);

iii. The environmental hazards associated with *illicit discharges* and improper disposal of waste;

iv. Proper handling and disposal practices for the most common behaviors within the community (e.g., septic care, car washing, household hazardous waste, swimming pool draining, or other activities resulting in *illicit discharges* to the *MS4*); and

v. How to report *illicit discharges* they may observe (Part VII.C.1.a.).

[37] Business, retail stores, and restaurants.
[38] Hospitals, churches, colleges, and schools.
[39] Factories, recyclers, auto-salvage, and mines.

### 2. Implementation and Frequency

#### a. Distribution Method of Educational Messages

Once every five (5) years, the *MS4 Operator* must identify and document in the *SWMP Plan* which of the following method(s) are used for the distribution of educational messages:

i. Printed materials (e.g., mail inserts, brochures, and newsletters);

ii. Electronic materials (e.g., websites, email listservs);

iii. Mass media (e.g., newspapers, public service announcements on radio or cable);

iv. Workshops or focus groups;

v. Displays in public areas (e.g., town halls, library, parks); or

vi. Social Media (e.g., Facebook, Twitter, blogs).

#### b. Frequency

Following the completion of Part VII.A.1.a, Part VII.A.1.b, and Part VII.A.1.c, within five (5) years of the EDC, and once every five (5) years, thereafter, the *MS4 Operator* must:

i. Deliver an educational message to each target audience(s) (Part VII.A.1.b.) for each focus area(s) (Part VII.A.1.a.) based on the defined education and outreach topic(s) (Part VII.A.1.c.); and

ii. Document the completion of this requirement in the *SWMP Plan*.

#### c. Updates to the Public Education and Outreach Program

Following the completion of Part VII.A.1.a, Part VII.A.1.b, and Part VII.A.1.c, annually, by April 1, the *MS4 Operator* must:

i. Review and update the focus areas, target audiences, and/or education and outreach topics; and

ii. Document the completion of this requirement in the *SWMP Plan*.

## B. MCM 2 - Public Involvement/Participation

The *MS4 Operator* must provide opportunities to involve the public in the development, review, and implementation of the *SWMP*. This MCM is designed to give the public the opportunity to include their opinions in the implementation of this *SPDES* general permit.

### 1. Public Involvement/Participation

*a.* Annually, the *MS4 Operator* must provide an opportunity for public involvement/participation in the development and implementation of the *SWMP*. The *MS4 Operator* must document the public involvement/participation opportunities in the *SWMP* Plan. The opportunities for public involvement/participation are as follows:

i. Citizen advisory group on *stormwater* management;

ii. Public hearings or meetings;

iii. Citizen volunteers to educate other individuals about the *SWMP*;

iv. Coordination with other pre-existing public involvement/participation opportunities;

v. Reporting concerns about activities or behaviors observed; or

vi. Stewardship activities.

b. Annually, the *MS4 Operator* must inform the public of the opportunity (Part VII.B.1.a.) for their involvement/participation in the development and implementation of the *SWMP* and how they can become involved. The *MS4 Operator* must document the method for distribution of this information in the *SWMP Plan*. The methods for distribution are as follows:

i. Public notice;

ii. Printed materials (e.g., mail inserts, brochures and newsletters);

iii. Electronic materials (e.g., websites, email listservs);

iv. Mass media (e.g., newspapers, public service announcements on radio or cable);

v. Workshops or focus groups;

vi. Displays in public areas (e.g., town halls, library, parks); or

vii. Social Media (e.g., Facebook, Twitter, blogs).

c. Within six (6) months of the EDC, the *MS4 Operator* must identify a local point of contact to receive and respond to public concerns regarding *stormwater* management and compliance with permit requirements. The name or title of this individual, with contact information, must be published on public outreach and public participation materials and documented in the *SWMP Plan*.

## 2. Public Notice and Input Requirements

### a. Public Notice and Input Requirements for *SWMP Plan*

Annually, the *MS4 Operator* must provide an opportunity for the public to review and comment on the publicly available *SWMP Plan* (Part IV.B.2.b.). The public must have the ability to ask questions and submit comments on the *SWMP Plan*. The completion of this permit requirement must be documented in the *SWMP Plan*. This requirement may be satisfied by Part VII.B.1.

b. Public Notice and Input Requirements for Draft Annual Report

i. Annually, the *MS4 Operator* must provide an opportunity for the public to review and comment on the draft Annual Report. The completion of this permit requirement must be documented in the *SWMP Plan*. This requirement may be satisfied by either:

a) Presentation of the draft Annual Report at a regular meeting of an existing board (e.g., administrative, planning, zoning) or a separate meeting specifically for *stormwater*, as designated by the *MS4* or if requested by the public. The public must have the ability to ask questions about and make comments on the draft annual report during that presentation; or

b) Posting of the draft Annual Report on a public website. The website must provide information on the timeframes and procedures to submit comments and/or request a meeting. However, if a public meeting is requested by two or more persons, the *MS4 Operator* must hold such a meeting.

c. Consideration of Public Input

i. Annually, the *MS4 Operator* must include a summary of comments received on the *SWMP Plan* and draft Annual Report in the *SWMP Plan*.

ii. Within thirty (30) days of when public input is received, the *MS4 Operator* must update the *SWMP Plan*, where appropriate, based on the public input received.

## C. MCM 3 - *Illicit Discharge* Detection and Elimination

The *MS4 Operator* must *develop*, implement, and enforce a program which systematically detects, tracks down, and eliminates *illicit discharges* to the *MS4*. This MCM is designed to manage the *MS4* so it is not conveying *pollutants* associated with flows other than those directly attributable to *stormwater* runoff.

### 1. *Illicit Discharge* Detection

a. Public Reporting of *Illicit Discharges*

i. Within six (6) months of the EDC, the *MS4 Operator* must establish and document in the *SWMP Plan* an email or phone number (with message recording capability) for the public to report *illicit discharges*.

ii. Within thirty (30) days of an *illicit discharge*, the *MS4 Operator* must document each report of an *illicit discharge* in the *SWMP Plan* with the following information:

a) Date of the report;

b) Location of the *illicit discharge;*

c) Nature of the *illicit discharge;*

d) Follow up actions taken or needed (including response times); and

e) Inspection outcomes and any enforcement taken.

### b. Monitoring Locations

The monitoring locations used to detect *illicit discharges* are identified as follows:

i. *MS4 outfalls;*[40]
ii. *Interconnections*;[41] and
iii. *Municipal facility intraconnections*.[42]

### c. Monitoring Locations Inventory

i. Within three (3) years of the EDC, the *MS4 Operator* must *develop* and maintain an inventory of the monitoring locations in the *SWMP Plan*. The following information must be included in the inventory:[43]

a) Inventory information for *MS4 outfall*s

i) ID;
ii) Prioritization (high or low) (Part VII.C.1.d.);
iii) Type of monitoring location (Part VII.C.1.b.);
iv) Name of *MS4 Operator's municipal facility*, if located at a *municipal facility*;[44]
v) Receiving waterbody name and class (mapped in accordance with Part IV.D.1.e.ii.a));
vi) Receiving waterbody WI/PWL Segment ID (mapped in accordance with Part IV.D.1.e.ii.b));
vii) Land use in drainage area;
viii) Type of conveyance (open drainage or closed pipe);
ix) Material;
x) Shape;
xi) Dimensions;
xii) Submerged in water; and
xiii) Submerged in sediment.

b) Inventory information for *interconnections*

i) ID;
ii) Prioritization (high or low) (Part VII.C.1.d.);
iii) Type of monitoring location (Part VII.C.1.b.);
iv) Name of *MS4 Operator* receiving *discharge* or private storm system;

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[40] *MS4 outfall*s can be found at a *municipal facility*.
[41] *Interconnections* can be found a *municipal facility*.
[42] *Municipal facility intraconnections* can be found only at a *municipal facility*.
[43] The information included in the inventory is collected during inspections on the Monitoring Locations Inspection and Sampling Field Sheet (Appendix D) unless otherwise specified by the permit conditions.
[44] This information is collected as part of the *municipal facility* inventory.

v) Name of *MS4 Operator*'s *municipal facility*, if located at a *municipal facility*; and
vi) Receiving waterbody name and class (mapped in accordance with Part IV.D.1.e.ii.a)).

c) Inventory information for *municipal facility intraconnections*

i) ID;
ii) Prioritization (high or low) (Part VII.C.1.d.);
iii) Type of monitoring location (Part VII.C.1.b.);
iv) Name of *MS4 Operator*'s *municipal facility*; and
v) Receiving waterbody name and class (mapped in accordance with Part IV.D.1.e.ii.a)).

ii. Annually, the *MS4 Operator* must update the inventory if monitoring locations are created or discovered.

d. Monitoring Locations Prioritization

i. Within three (3) years of the EDC, the *MS4 Operator* must prioritize monitoring locations which are included in the monitoring locations inventory (Part VII.C.1.c.) as follows:

a) High priority monitoring locations include monitoring locations:

vi) At a high priority *municipal facility*, as defined in Part VII.F.2.c;

vii) *Discharging* to impaired waters (subject to Part VIII. requirements; mapped in accordance with Part IV.D.1.e.ii.b));

viii) *Discharging* within a TMDL watershed (subject to Part IX. requirements; mapped in accordance with Part IV.D.1.e.ii.c));

ix) *Discharging* to waters with Class AA-S, A-S, AA, A, B, SA, or SB (mapped in accordance with Part IV.D.1.e.ii.a)); and/or

x) Confirmed citizen complaints on three or more separate occasions in the last twelve (12) months.

b) All other monitoring locations are considered low priority.

ii. Within thirty (30) days of when a monitoring location is constructed or the *MS4 Operator* discovers it, the *MS4 Operator* must prioritize those monitoring locations; and

iii. Annually, after the initial prioritization (Part VII.C.1.d.i.), the *MS4 Operator* must update the monitoring location prioritization in the inventory (Part VII.C.1.c.) based on information gathered as part of the monitoring location inspection and sampling program (Part VII.C.1.e.). The completion of this permit requirement must be documented in the *SWMP Plan*.

### e. Monitoring Locations Inspection and Sampling Program

Within two (2) years of the EDC, the *MS4 Operator* must *develop* and implement a monitoring locations inspection and sampling program. The monitoring locations inspection and sampling program must be documented in the *SWMP Plan* specifying:

i. The monitoring locations inspection and sampling procedures including:

a) During *dry weather,*[45] one (1) inspection of each monitoring location identified in the inventory (Part VII.C.1.c.) every five (5) years following the most recent inspection;

b) Documentation of all monitoring location inspections, including any sampling results, using the Monitoring Locations Inspection and Sampling Field Sheet (Appendix D) or an equivalent form containing the same information and include the completed monitoring location inspections and sampling results in the *SWMP Plan* (e.g., the completed Monitoring Locations Inspection and Sampling Field Sheets);

c) Provisions to sample all monitoring locations which had inspections which resulted in a *suspect* or *obvious illicit discharge* characterization. The sampling requirement is based on the number and severity of *physical indicators present in the flow* to better inform track down procedures (Part VII.C.2.). If the source of the *illicit discharge* is clear and discernable (e.g., sewage), sampling is not necessary;

d) Sampling may be done with field test kits or field instrumentation that are sufficiently sensitive to detect the parameter below the sampling action level used[46] and are not subject to 40 CFR Part 136 requirements for approved methods and certified laboratories;

e) Provisions to initiate, or cause to initiate,[47] track down procedures (Part VII.C.2.a.), in accordance with the timeframes specified in Part VII.C.2.a.iii, for monitoring locations with an overall characterization[48] as *suspect illicit discharge* or *obvious illicit discharge* or that exceed any sampling action level used;

f) Provisions to re-inspect the monitoring location within thirty (30) days of initial inspection if there is a *physical indicator not related to flow*, potentially indicative of *intermittent* or *transitory discharges,* utilizing techniques described in Chapter 12.6 of the Center for Watershed

[45] MS4 Operators can reference the Center for Watershed Protection Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assistance, October 2004 (CWP 2004) for other factors to consider when determining when to conduct monitoring location inspection and sampling.
[46] Refer to Chapter 12 of the CWP 2004 for parameters, sampling action levels, and procedures.
[47] If track down is conducted by individuals or entities other than those conducting the monitoring locations inspections.
[48] Reference to the Monitoring Locations Inspection and Sampling Field Sheet, adapted from CWP 2004, Section 6: Overall Monitoring Location Characterization based on the Relative Severity Index of physical indicators for flowing monitoring locations only.

Protection Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assistance, October 2004 (CWP 2004) or equivalent.

i) If those same physical indicators persist, the *MS4 Operator* must initiate *illicit discharge* track down procedures (Part VII.C.2.a.).

ii. The training provisions for the *MS4 Operator*'s monitoring locations inspection and sampling procedures (Part VII.C.1.e.i.).

a) If new staff are added, training on the *MS4 Operator*'s monitoring locations inspection and sampling procedures (Part VII.C.1.e.i.) must be given prior to conducting monitoring locations inspections and sampling procedures;

b) For existing staff, training on the *MS4 Operator*'s monitoring locations inspection and sampling procedures (Part VII.C.1.e.i.) must be given prior to conducting monitoring locations inspections and sampling and once every five (5) years, thereafter; and

c) If the monitoring locations inspection and sampling procedures (Part VII.C.1.e.i.) are updated (Part VII.C.1.e.iv.), training on the updates must be given to all staff prior to conducting monitoring locations inspections and sampling.

iii. The names, titles, and contact information for the individuals who have received monitoring locations inspection and sampling procedures training and update annually; and

iv. Annually, by April 1, the *MS4 Operator* must:

a) Review and update the monitoring location inspection and sampling procedures (Part VII.C.1.e.i.) based on monitoring location inspection results (e.g., trends, patterns, areas with *illicit discharges*, and common problems); and

b) Document the completion of this requirement in the *SWMP Plan*.

### 2. *Illicit Discharge* Track Down Program

Within two (2) years of the EDC, the *MS4 Operator* must *develop* and implement an *illicit discharge* track down program to identify the source of *illicit discharges* and the responsible party. The *illicit discharge* track down program must be documented in the *SWMP Plan* specifying:

a. The *illicit discharge* track down procedures including:

i. Procedures as described in Chapter 13 of CWP 2004 or equivalent;

ii. Steps taken for *illicit discharge* track down procedures;

iii. The following timeframes to initiate *illicit discharge* track down:

a) Within twenty-four (24) hours of discovery, the *MS4 Operator* must initiate track down procedures for flowing *MS4* monitoring locations with *obvious illicit discharges;*[49]

b) Within two (2) hours of discovery, the *MS4 Operator* must initiate track down procedures for *obvious illicit discharges* of sanitary wastewater that would affect bathing areas during bathing season, shell fishing areas or public water intakes and report orally or electronically to the Regional Water Engineer and local health department; and

c) Within five (5) days of discovery, the *MS4 Operator* must initiate track down procedures for *suspect illicit discharges*.

b. The training provisions for the *MS4 Operator*'s *illicit discharge* track down procedures (Part VII.C.2.a.).

i. If new staff are added, training on the *MS4 Operator*'s *illicit discharge* track down procedures (Part VII.C.2.a.) must be given prior to conducting *illicit discharge* track downs;

ii. For existing staff, training on the *MS4 Operator*'s *illicit discharge* track down procedures (Part VII.C.2.a.) must be given prior to *conducting illicit discharge* track downs and once every five (5) years, thereafter; and

iii. If the *illicit discharge* track down procedures (Part VII.C.2.a.) are updated (Part VII.C.2.d.), training on the updates must be given to all staff prior to conducting *illicit discharge* track downs.

c. The names, titles, and contact information for the individuals who have received *illicit discharge* track down procedures training and update annually; and

d. Annually, by April 1, the *MS4 Operator* must:

i. Review and update the *illicit discharge* track down procedures (Part VII.C.2.a.); and

ii. Document the completion of this requirement in the *SWMP Plan*.

### 3. *Illicit Discharge* Elimination Program

Within two (2) years of the EDC, the *MS4 Operator* must *develop* and implement an *illicit discharge* elimination program. The *illicit discharge* elimination program must be documented in the *SWMP Plan* specifying:

a. The *illicit discharge* elimination procedures including:

i. Provisions for escalating enforcement and tracking, both consistent with the ERP required in Part IV.F. of this *SPDES* general permit;

ii. Provisions to confirm the corrective actions have been taken;

[49] Reference to the Monitoring Locations Inspection and Sampling Field Sheet, adapted from CWP 2004, Section 6: Overall Monitoring Location Characterization based on the Relative Severity Index of physical indicators for flowing monitoring locations only.

iii. Steps taken for *illicit discharge* elimination procedures; and

iv. The following timeframes for *illicit discharge* elimination:

a) Within twenty-four (24) hours of identification of an *illicit discharge* that has a reasonable likelihood of adversely affecting human health or the environment, the *MS4 Operator* must eliminate the *illicit discharge*;

b) Within five (5) days of identification of an *illicit discharge* that does not have a reasonable likelihood of adversely affecting human health or the environment, the *MS4 Operator* must eliminate the *illicit discharge;* and

c) Where elimination of an *illicit discharge* within the specified timeframes (Part VII.C.3.a.iv.) is not possible, the *MS4 Operator* must notify the Regional Water Engineer.

b. The training provisions for the *MS4 Operator*'s *illicit discharge* elimination procedures (Part VII.C.3.a.).

i. If new staff are added, training on the *MS4 Operator*'s *illicit discharge* elimination procedures (Part VII.C.3.a.) must be given prior to conducting *illicit discharge* eliminations;

ii. For existing staff, training on the *MS4 Operator*'s *illicit discharge* elimination procedures (Part VII.C.3.a.) must be given prior to conducting *illicit discharge* eliminations and once every five (5) years, thereafter; and

iii. If the *illicit discharge* elimination procedures (Part VII.C.3.a.) are updated (Part VII.C.3.d.), training on the updates must be given to all staff prior to conducting *illicit discharge* eliminations.

c. The names, titles, and contact information for the individuals who have received *illicit discharge* elimination procedures training and update annually; and

d. Annually, by April 1, the *MS4 Operator* must:

i. Review and update the *illicit discharge* elimination procedures (Part VII.C.3.a.); and

ii. Document the completion of this requirement in the *SWMP Plan*.

## D. MCM 4 - Construction Site *Stormwater* Runoff Control

The *MS4 Operator* must *develop*, implement, and enforce a program to ensure construction sites are effectively controlled. This MCM is designed to prevent *pollutants* from construction related activities,[50] as well as promote the proper planning and installation of post-construction *SMPs*.

[50] Projects that comply with the terms and conditions of the CGP or an individual *SPDES* permit for *stormwater* for which they obtained coverage and local erosion and sediment control requirements are effectively controlled.

## 1. Applicable Construction Activities/Projects/Sites

a. The construction site *stormwater* runoff control program must address *stormwater* runoff to the *MS4* from sites with *construction activities* permitted, approved, funded, or owned/operated by the *MS4 Operator* that:

i. Result in a total land disturbance of greater than or equal to one acre; or,

ii. Disturb less than one acre if part of a larger common plan of development or sale.

b. For *construction activities* where the *MS4 Operator* is listed as the owner/operator on the Notice of Intent for coverage under the CGP:

i. The *MS4 Operator* must ensure compliance with the CGP; and

ii. The additional requirements for construction oversight described in Part VII.D.6 through Part VII.D.9 are not required.

## 2. Public Reporting of Construction Site Complaints

a. Within six (6) months of the EDC, the *MS4 Operator* must establish and document in the *SWMP Plan* an email or phone number (with message recording capability) for the public to report complaints related to construction *stormwater* activity.

b. The *MS4 Operator* must document reports of construction site complaints in the *SWMP Plan* with the following information:

i. Date of the report;

ii. Location of the construction site;

iii. Nature of complaint;

iv. Follow up actions taken or needed; and

v. Inspection outcomes and any enforcement taken.

## 3. Construction Oversight Program

Within one (1) year of the EDC, the *MS4 Operator* must *develop* and implement a construction oversight program. The construction oversight program must be documented in the *SWMP Plan* specifying:

a. The construction oversight procedures including:

i. When the construction site *stormwater* control program applies (Part VII.D.1.);

ii. What types of *construction activity* require a SWPPP;

iii. The procedures for submission of SWPPPs;

iv. SWPPP review requirements (Part VII.D.6.)

v. Pre-construction oversight requirements (Part VII.D.7.)

vi. Construction site inspection requirements (Part VII.D.8.);

vii. Construction site close-out requirements (Part VII.D.9.);

viii. Enforcement process/expectations for compliance; and

ix. Other procedures associated with the control of *stormwater* runoff from applicable *construction activities*.

b. The training provisions for the *MS4 Operator*'s construction oversight procedures (Part VII.D.3.a.).

i. If new staff are added, training on the *MS4 Operator*'s construction oversight procedures (Part VII.D.3.a.) must be given prior to conducting any construction oversight activities;

ii. For existing staff, training on the *MS4 Operator*'s construction oversight procedures (Part VII.D.3.a.) must be given prior to conducting any construction oversight activities and once every five (5) years, thereafter; and

iii. If the construction oversight procedures (Part VII.D.3.a.) are updated (Part VII.D.3.a.), training on the updates must be given to all staff prior to conducting construction oversight.

c. The names, titles, and contact information for the individuals who have received construction oversight training and update annually;

d. Procedures to ensure those involved in the *construction activity* itself (e.g., contractor, subcontractor, *qualified inspector*, SWPPP reviewers) have received four (4) hours of *Department* endorsed training in proper erosion and sediment control principles from a Soil & Water Conservation District, or other *Department* endorsed entity; and

e. Annually, by April 1, the *MS4 Operator* must:

i. Review and update the construction oversight procedures (Part VII.D.3.a.); and

ii. Document the completion of this requirement in the *SWMP Plan*.

### 4. Construction Site Inventory & Inspection Tracking

a. Within six (6) months of the EDC, the *MS4 Operator* must *develop* and maintain an inventory of all applicable construction sites (Part VII.D.1.a.) in the *SWMP Plan*. The following information must be included in the inventory:

i. Location of the construction site;

ii. Owner/operator contact information, if other than the *MS4 Operator*;

iii. Receiving waterbody name and class (mapped in accordance with Part IV.D.1.e.ii.a));

iv. Receiving waterbody WI/PWL Segment ID (mapped in accordance with Part IV.D.1.e.ii.b));

v. Prioritization (high or low) (Part VII.D.5.);

vi. Construction project *SPDES* identification number;

vii. SWPPP approval date;

viii. Inspection history, including dates and ratings (satisfactory, marginal, or unsatisfactory, when available); and

ix. Current status of the construction site/project (i.e., active, temporarily shut down, complete[51]).

b. Annually, the *MS4 Operator* must update the inventory if construction projects are approved or completed.

## 5. Construction Site Prioritization

a. Within one (1) year of the EDC, the *MS4 Operator* must prioritize all construction sites which are included in the construction site inventory (Part VII.D.4.) as follows:

i. High priority construction sites include construction sites:

a) With a direct conveyance (e.g., channel, ditch, storm sewer) to a *surface water of the State* that is:

i) Listed in Appendix C with silt/sediment, phosphorus, or nitrogen as the POC;

ii) Classified as AA-S, AA, or A (mapped in accordance with Part IV.D.1.e.ii.a)); or

iii) Classified with a trout (T) or trout spawning (TS) designation (mapped in accordance with Part IV.D.1.e.ii.a));

b) With greater than five (5) acres of disturbed earth at any one time;

c) With earth disturbance within one hundred (100) feet of any lake or pond (mapped in accordance with Part IV.D.1.e.ii.b)); and/or

d) Within fifty (50) feet of any rivers or streams (mapped in accordance with Part IV.D.1.e.ii.b));

ii. All other construction sites are considered low priority.

b. Within thirty (30) days of when a construction site becomes active, the *MS4 Operator* must prioritize those construction sites; and

c. Annually, after the initial prioritization (Part VII.D.5.a.), the *MS4 Operator* must update the construction site prioritization in the inventory (Part VII.D.4.a.) based on information gathered as part of the construction oversight program (Part VII.D.3.). The completion of this permit requirement must be documented in the *SWMP Plan*.

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[51] Construction projects listed on the inventory must be inspected and tracked as described in Part VII.D.8. until a final site inspection has been completed as specified in Part VII.D.9. and the construction site status changes to complete.

i. If the prioritization of the construction site changes priority based on information gathered as part of the construction oversight program, the *MS4 Operator* must comply with the requirements that apply to that prioritization.

### 6. SWPPP Review

The *MS4 Operator* must:

a. Ensure individual(s), responsible for reviewing SWPPPs for acceptance, receive:

i. Four (4) hours of *Department* endorsed training in proper erosion and sediment control principles from a Soil & Water Conservation District, or other *Department* endorsed entity. This training must be completed within three (3) years of the EDC and every three (3) years thereafter.

ii. Document the completion of this requirement in the *SWMP Plan*.

b. Ensure SWPPP reviewers receive this training (Part VII.D.6.a.) prior to conducting SWPPP reviews for acceptance.

i. Individuals without these trainings cannot review SWPPPs for acceptance.

ii. Individuals who meet the definition of a *qualified professional* or *qualified inspector* are exempt from this requirement.

c. Ensure individuals responsible for reviewing SWPPPs review all SWPPPs for applicable *construction activities* (Part VII.D.1.) and for conformance with the requirements of the CGP, including:

i. Erosion and sediment controls must be reviewed for conformance with the NYS E&SC 2016, or equivalent;

ii. Individuals responsible for review of post-construction *SMPs* must be *qualified professionals* or under the supervision of a *qualified professional*; and

iii. Post-construction *SMPs* must be reviewed for conformance with the NYS SWMDM 2015 or equivalent, including:

a) All post-construction *SMPs* must meet the *sizing criteria* contained in the CGP and NYS SWMDM 2015.

b) Deviations from the performance criteria of the NYS SWMDM 2015 must demonstrate that they are equivalent.

c) The SWPPP must include an O&M plan that includes inspection and maintenance schedules and actions to ensure continuous and effective operation of each post-construction *SMP*. The SWPPP must identify the entity that will be responsible for the long-term operation and maintenance of each practice.

d. In the *SWMP Plan*, document and update annually the names, titles, and contact information for the individuals who have received the trainings listed in Part VII.D.6.a.

e. In the *SWMP Plan*, document the SWPPP review including the information found in Part III.B. of the CGP;

f. Prioritize new *construction activities* (Part VII.D.5.a.); and

g. Notify construction site owner/operators that their SWPPP has been accepted using the *MS4* SWPPP Acceptance Form[52] created by the *Department* and required by the CGP, signed in accordance with Part X.J.

## 7. Pre-Construction Meeting

Prior to commencement of *construction activities*, the *MS4 Operator* must ensure a pre-construction meeting is conducted. The date and content of the pre-construction inspection/meeting must be documented in the *SWMP Plan*. The owner/operator listed on the CGP NOI (if different from the *MS4 Operator*), the *MS4 Operator*, contractor(s) responsible for implementing the SWPPP for the *construction activity,* and the *qualified inspector* (if required for the *construction activity* by Part IV.C. the CGP) must attend the meeting in order to:

a. Confirm the approved project has received, or will receive[53], coverage under the CGP or an individual *SPDES* permit;

b. Verify contractors and subcontractors selected by the owner/operator of the *construction activity* have identified at least one individual that has received four (4) hours of *Department* endorsed training in proper erosion and sediment control principles from a Soil & Water Conservation District or other endorsed entity as required by the CGP and Part VII.D.3.d; and

c. Review the construction oversight program (Part VII.D.3.) and expectations for compliance.

## 8. Construction Site Inspections

The *MS4 Operator* must:

a. Ensure individuals(s), responsible for construction site inspections, receive:

   i. Four (4) hours of *Department* endorsed training in proper erosion and sediment control principles from a Soil & Water Conservation District, or other *Department* endorsed entity. This training must be complete, within three (3) years of the EDC and every three (3) years thereafter.

   ii. Document the completion of this requirement in the *SWMP Plan*.

[52] The *MS4* SWPPP Acceptance Form can be found on the Department's website.

[53] Preconstruction meetings may occur prior to the issuance of the MS4 SWPP Acceptance Form, however, the MS4 Operator must confirm coverage under the CGP will be applied for by the construction site owner/operator prior to commencement of construction of *construction activities*.

b. Ensure all *MS4* Construction Site Inspectors receive this training prior to conducting construction site inspections.

   i. Individuals without these trainings cannot inspect construction sites.

   ii. Individuals who meet the definition of a *qualified professional* or *qualified inspector* are exempt from this requirement.

c. Annually inspect all sites with *construction activity* identified in the inventory (Part VII.D.4.) during active construction after the pre-construction meeting (Part VII.D.7.), or sooner if deficiencies are noted that require attention.

   i. Follow up to construction site inspections must confirm corrective actions are completed within timeframes established by the CGP and the MS4 Operator's ERP (Part IV.F.1.).

d. In the *SWMP Plan*, document and update annually the names, titles, and contact information for the individuals who have received the trainings listed in Part VII.D.8.a.

e. Document all inspections using the Construction Site Inspection Report Form (Appendix D) or an equivalent form containing the same information. The *MS4 Operator* must include the completed Construction Site Inspection Reports in the *SWMP Plan*.

### 9. Construction Site Close-out

a. The *MS4 Operator* must ensure a final construction site inspection is conducted and documentation of the final construction site inspection must be maintained in the *SWMP Plan*. The final construction site inspection must be documented using the Construction Site Inspection Report Form (Appendix D), or an equivalent form containing the same information, or accept the construction site owner/operator's *qualified inspector* final inspection certification required by the CGP.

b. The Notice of Termination (NOT)[54] must be signed by the *MS4 Operator* as required by the CGP for projects determined to be complete. The NOT must be signed in accordance with Part X.J.

## E. MCM 5 – Post-Construction *Stormwater* Management

The *MS4 Operator* must *develop*, implement, and enforce a program to ensure proper operation and maintenance of post-construction *SMPs* for new or redeveloped sites. This MCM is designed to promote the long-term performance of post-construction *SMPs* in removing *pollutants* from *stormwater* runoff.

[54] The NOT can be found on the Department's website.

## 1. Applicable Post-Construction *SMPs*

The post-construction *SMP program* must address *stormwater* runoff to the *MS4* from *publicly owned/operated* post-construction *SMPs* that meet the following:

a. Post-construction *SMPs* that have been installed as part of any CGP covered construction site or individual *SPDES* permit (since March 10, 2003); and

b. All new post-construction *SMPs* constructed as part of the construction site *stormwater* runoff control program (Part VII.D.).

## 2. Post-Construction *SMP* Inventory & Inspection Tracking[55]

a. The *MS4 Operators* continuing coverage must:

   i. Maintain the inventory from previous iterations of this *SPDES* general permit for post-construction *SMPs* installed after March 10, 2003; and

   ii. *Develop* the inventory for post-construction *SMPs* installed after March 10, 2003 including post-construction *SMPs:*

      a) As they are approved or discovered; or

      b) After the owner/operator of the *construction activity* has filed the NOT with the *Department* (Part VII.D.9.b.).

b. The newly designated *MS4 Operators* must *develop* and maintain the inventory for post-construction *SMPs* installed after March 10, 2003 including post-construction *SMPs:*

   i. As they are approved or discovered; or

   ii. After the owner/operator of the *construction activity* has filed the NOT with the *Department* (Part VII.D.9.b.).

c. Annually, the MS4 Operator must update the inventory of post-construction SMPs to include the post-construction *SMPs* in Part VII.E.2.a. and Part VII.E.2.b.

d. Within five (5) years of the EDC, the following information must be included in the inventory either by using the *MS4 Operator* maintenance records or by verification of maintenance records provided by the owner of the post-construction *SMP*:

   i. Street address or tax parcel;

   ii. Type;[56]

   iii. Receiving waterbody name and class (mapped in accordance with Part IV.D.1.e.ii.a));

[55] Post-construction *SMPs* can be found at a *municipal facility*.
[56] Post-construction *SMP* types are defined in the New York State Department of Environmental Conservation Maintenance Guidance: Stormwater Management Practices, March 31, 2017 (NYS DEC Maintenance Guidance 2017).

iv. Receiving waterbody WI/PWL Segment ID (mapped in accordance with Part IV.D.1.e.ii.b));

v. Date of installation (if available) or discovery;

vi. Ownership;

vii. Responsible party for maintenance;

viii. Contact information for party responsible for maintenance;

ix. Location of documentation depicting O&M requirements and legal agreements for post-construction *SMP*;

x. Frequency for inspection of post-construction *SMP*, as specified in the New York State Department of Environmental Conservation Maintenance Guidance: Stormwater Management Practices, March 31, 2017 (NYS DEC Maintenance Guidance 2017) or as specified in the O&M plan contained in the approved SWPPP (Part VII.D.6.);

xi. Reason for installation (e.g., new development, redevelopment, *retrofit*, flood control), if known;

xii. Date of last inspection;

xiii. Inspection results; and

xiv. Any corrective actions identified and completed.

e. *MS4 Operators* must document the inventory of post-construction *SMPs* in the *SWMP Plan*.

### 3. SWPPP Review

For post-construction *SMP* SWPPP review requirements, see Part VII.D.6.

### 4. Post-Construction *SMP* Inspection & Maintenance Program

Within one (1) year of the EDC, the *MS4 Operator* must *develop* and implement a post-construction *SMP* inspection and maintenance program. The post-construction *SMP* inspection and maintenance program must be documented in the *SWMP Plan* specifying:

a. The post-construction *SMP* inspection and maintenance procedures including:

i. Provisions to ensure that each post-construction *SMP* identified in the post-construction *SMP* inventory (Part VII.E.2.) is inspected at the frequency specified in the NYS DEC Maintenance Guidance 2017 or as specified in the O&M plan contained in the approved SWPPP (Part VII.D.6.), if available;

ii. Documentation of post-construction *SMP* inspections using the Post-Construction SMP Inspection Checklist[57] or an equivalent form containing the same information. The *MS4 Operator* must include the completed post-construction *SMP* inspections (i.e., the completed Post-Construction SMP Inspection Checklist) in the *SWMP Plan*;

iii. Provisions to initiate follow-up actions (i.e., maintenance, repair, or higher-level inspection) within thirty (30) days of post-construction *SMP* inspection; and

iv. Provisions to initiate enforcement within sixty (60) days of the inspection if follow-up actions are not complete.

b. The training provisions for the *MS4 Operator*'s post-construction *SMP* inspection and maintenance procedures (Part VII.E.4.a.).

i. If new staff are added, training on the *MS4 Operator*'s post-construction *SMP* inspection and maintenance procedures (Part VII.E.4.a.) and procedures outlined in the *Department* endorsed program must be given prior to conducting any post-construction *SMP* inspection and maintenance;

ii. For existing staff, training on the *MS4 Operator*'s post-construction *SMP* inspection and maintenance procedures (Part VII.E.4.a.) and procedures outlined in the *Department* endorsed program must be given prior to conducting any post-construction *SMP* inspection and maintenance and once every five (5) years, thereafter; and

iii. If the post-construction *SMP* inspection and maintenance procedures (Part VII.E.4.a.) are updated (Part VII.E.4.d.), training on the updates must be given to all staff prior to conducting post-construction *SMP* inspection and maintenance.

c. The names, titles, and contact information for the individuals who have received post-construction *SMP* inspection and maintenance procedures training and update annually; and

d. Annually, by April 1, the *MS4 Operator* must:

i. Review and update the post-construction *SMP* inspection and maintenance procedures (Part VII.E.4.a.); and

ii. Document the completion of this requirement in the *SWMP Plan*.

## F. MCM 6 – Pollution Prevention and Good Housekeeping

The *MS4 Operator* must *develop* and implement a pollution prevention and good housekeeping program for *municipal facilities* and *municipal operations* to minimize

[57] The *Department* developed checklist forms specific to each post-construction *SMP* designed to assist *MS4 Operators* in conducting inspections and maintenance activities of standard practices. The Post-Construction SMP Inspection Checklist, March 31, 2017, can be found on the Department's website.

*pollutant discharges*. This MCM is designed to ensure the *MS4 Operator*'s own activities do not contribute *pollutants* to *surface waters of the State*.

### 1. *Best Management Practices (BMPs)* for *Municipal Facilities & Operations*

Within three (3) years of the EDC, the *MS4 Operator* must incorporate *best management practices* (*BMPs*) into the *municipal facility* program *and municipal operations* program to minimize the *discharge* of *pollutants* associated with *municipal facilities* and *municipal operations, respectively*. The *BMPs* to be considered are as follows and must be documented in the *SWMP Plan*:

a. Minimize Exposure

i. Exposure of materials to rain, snow, snowmelt, and runoff must be minimized, unless not technologically possible or not economically practicable and achievable in light of best industry practices, including areas used for loading and unloading, storage, disposal, cleaning, maintenance, and fueling operations, with the following *BMP*s:

a) Locate materials and activities inside or protect them with storm resistant coverings;

b) Use grading, berming, or curbing to prevent runoff of contaminated flows and divert run-on away from these areas;

c) Locate materials, equipment, and activities so leaks and spills are contained in existing containment and diversion systems;

d) Clean up spills and leaks promptly using dry methods (e.g., absorbents) to prevent the *discharge* of *pollutants*;

e) Store leaky vehicles and equipment indoors or, if stored outdoors, use drip pans and absorbents;

f) Use spill/overflow protection equipment;

g) Perform all vehicle and/or equipment cleaning operations indoors, under cover, or in bermed areas that prevent runoff and run-on and also captures any overspray;

h) Drain fluids, indoors or under cover, from equipment and vehicles that will be decommissioned, and, for any equipment and vehicles that will remain unused for extended periods of time, inspect at least monthly for leaks; and/or

i) Minimize exposure of chemicals by replacing with a less toxic alternative (e.g., use non-hazardous cleaners).

ii. *No Exposure* Certification for High Priority *Municipal Facilities*

a) *Municipal facilities* may qualify for *No Exposure* Certification (Appendix D) when all activities and materials are completely sheltered from exposure to rain, snow, snowmelt and/or runoff.

b) High priority *municipal facilities* (Part VII.F.2.c.i.a)) with uncovered parking areas for vehicles awaiting maintenance may be considered a low priority *municipal facility* (Part VII.F.2.c.i.c)) if only routine maintenance is performed inside and all other n*o exposure* criteria are met.

c) *Municipal facilities* accepting or repairing disabled vehicles and/or vehicles that have been involved in accidents are not eligible for the *No Exposure* Certification.

d) *Municipal facilities* must maintain the *No Exposure* Certification and document in the *SWMP Plan*. The *No Exposure* Certification ceases to apply when activities or materials become exposed.

b. Follow a Preventive Maintenance Program

i. Implement a preventative maintenance program that includes routine inspection, testing, maintenance, and repair of all fueling areas, vehicles and equipment and systems to prevent leaks, spills and other releases. This includes:

a) Performing inspections and preventive maintenance of *stormwater* drainage, source controls, treatment systems, and plant equipment and systems;

b) Maintaining non-structural *BMPs* (e.g., keep spill response supplies available, personnel appropriately trained, containment measures, covering fuel areas); and

c) Ensure vehicle washwater is not *discharged* to the *MS4* or to *surface waters of the State*. Wash equipment/vehicles in a designated and/or covered area where washwater is collected to be recycled or *discharged* to the sanitary sewer (Part I.B.2.d.).

ii. Routine maintenance must be performed to ensure *BMPs* are operating properly.

iii. When a *BMP* is not functioning to its designed effectiveness and needs repair or replacement:

a) Maintenance must be performed before the next anticipated storm event, or as necessary to maintain the continued effectiveness of *stormwater* controls. If maintenance prior to the next anticipated storm event is impracticable, maintenance must be scheduled and accomplished as soon as practicable; and

b) Interim measures must be taken to prevent or minimize the *discharge* of *pollutants* until the final repair or replacement is implemented, including cleaning up any contaminated surfaces so that the material will not be *discharged* during subsequent storm events.

### c. Spill Prevention and Response Procedures

i. Minimize the potential for leaks, spills and other releases that may be exposed to *stormwater* and *develop* plans for effective response to such spills if or when they occur. At a minimum, the *MS4 Operator* must:
   a) Store materials in appropriate containers;
   b) Label containers (e.g., "Used Oil," "Spent Solvents," "Fertilizers and Pesticides") that could be susceptible to spillage or leakage to encourage proper handling and facilitate rapid response if spills or leaks occur;
   c) Implement procedures for material storage and handling, including the use of secondary containment and barriers between material storage and traffic areas, or a similarly effective means designed to prevent the *discharge* of *pollutants* from these areas;
   d) *Develop* procedures for stopping, containing, and cleaning up leaks, spills, and other releases. As appropriate, execute such procedures as soon as possible;
   e) Keep spill kits on-site, located near areas where spills may occur or where a rapid response can be made;
   f) *Develop* procedures for notification of the appropriate facility personnel, emergency response agencies, and regulatory agencies when a leak, spill, or other release occurs. If possible, one of these individuals should be a member of the *stormwater* pollution prevention team (Part VII.F.2.d.i.a)). Any spills must be reported in accordance with 6 NYCRR 750-2.7; and
   g) Following any spill or release, the *MS4 Operator* must evaluate the adequacy of the *BMPs* identified in the *municipal facility* specific SWPPP. If the *BMPs* are inadequate, the SWPPP must be updated to identify new *BMPs* that will prevent reoccurrence and improve the emergency response to such releases.

ii. Measures for cleaning up spills or leaks must be consistent with applicable petroleum bulk storage, chemical bulk storage, or hazardous waste management regulations at 6 NYCRR Parts 596-599, 613 and 370-373.

iii. This *SPDES* general permit does not relieve the *MS4 Operator* of any reporting or other requirements related to spills or other releases of petroleum or hazardous substances. Any spill of a hazardous substance must be reported in accordance with 6 NYCRR 597.4. Any spill of petroleum must be reported in accordance with 6 NYCRR 613.6 or 17 NYCRR 32.3.

### d. Erosion and Sediment Controls[58]

i. Stabilize exposed areas and control runoff using structural and/or non-structural controls to minimize onsite erosion and sedimentation.

[58] The use of the term "controls" in Part VII.F.1.d. aligns with the use of the term "controls" in the CGP.

ii. The *MS4 Operator* must consider:

a) Structural and/or non-structural controls found in the NYS E&SC 2016;

b) Areas that, due to topography, land disturbance (e.g., construction), or other factors, have potential for significant soil erosion;

c) Whether structural, vegetative, and/or stabilization *BMPs* are needed to limit erosion;

d) Whether velocity dissipation devices (or equivalent measures) are needed at *discharge* locations and along the length of any channel to provide a non-erosive flow velocity from the structure to a water course; and

e) Address erosion or areas with poor vegetative cover, especially if the erosion is within fifty (50) feet of a *surface water of the State*.

e. Manage Vegetated Areas and Open Space on *Municipal* Property

i. Maintain vegetated areas on *MS4 Operator* owned/operated property and right of ways:

a) Specify proper use, storage, and disposal of pesticides, herbicides, and fertilizers including minimizing the use of these products and using only in accordance manufacturer's instruction;

b) Use lawn maintenance and landscaping practices that are protective of water quality. Protective practices include: reduced mowing frequencies; proper disposal of lawn clippings; and use of alternative landscaping materials (e.g., drought resistant planting);

c) Place pet waste disposal containers and signage concerning the proper collection and disposal of pet waste at all parks and open space where pets are permitted; and

d) Address waterfowl congregation areas where needed to reduce waterfowl droppings from entering the *MS4*.

f. Salt[59] Storage Piles or Pile Containing Salt

Enclose or cover storage piles of salt, or piles containing salt, used for deicing or maintenance of paved surfaces, except during loading, unloading, and handling. Implement appropriate measures (e.g., good housekeeping, routine sweeping, diversions, containment) to minimize exposure resulting from adding to or removing materials from the pile.

g. Waste, Garbage, and Floatable Debris

i. Keep all dumpster lids closed when not in use. For dumpsters and roll off boxes that do not have lids and could leak, ensure that *discharges* have a control (e.g., secondary containment, treatment); and

[59] For purposes of this *SPDES* general permit, salt means any chloride-containing material used to treat paved surfaces for deicing, including sodium chloride, calcium chloride, magnesium chloride, and brine solutions.

ii. Keep exposed areas free of waste, garbage, and debris or intercept them before they are *discharged*:

a) Manage trash containers at parks and open space (scheduled cleanings; sufficient number);

b) Pick up trash and debris on *MS4 Operator* owned/operated property and rights of way; and

c) Clean out *catch basins* within the appropriate timeframes (Part VII.F.3.c.iii.).

h. Alternative Implementation Options

When alternative implementation options (Part IV.A.1.) are utilized, require the parties performing *municipal operations* as contracted services, including but not limited to street sweeping, snow removal, and lawn/grounds care, to meet permit requirements as the requirements apply to the activity performed.

## 2. *Municipal Facilities*[60]

### a. *Municipal Facility* Program

Within three (3) years of the EDC, the *MS4 Operator* must *develop* and implement a *municipal facility* program. The *municipal facility* program must be documented in the *SWMP Plan* specifying:

i. The *municipal facility* procedures including:

a) The *BMPs* (Part VII.F.1.) incorporated into the *municipal facility* program;

b) The high priority *municipal facility* requirements (Part VII.F.2.d.) as applied to the specific *municipal facility*; and

c) The low priority *municipal facility* requirements (Part VII.F.2.e.) as applied to the specific *municipal facility*.

ii. The training provisions for the *MS4 Operator*'s *municipal facility* procedures (Part VII.F.2.a.i.).

a) If new staff are added, training on the *MS4 Operator*'s *municipal facility* procedures (Part VII.F.2.a.i.) must be given prior to conducting *municipal facility* procedures;

b) For existing staff, training on the *MS4 Operator*'s *municipal facility* procedures (Part VII.F.2.a.i.) must be given prior to conducting *municipal facility* procedures and once every five (5) years, thereafter; and

[60] *Municipal facilities* that have coverage under a separate *SPDES* permit (either individual or MSGP) must comply with the terms and conditions of that permit and the requirements set forth in this Part are not applicable.

c) If the *municipal facility* procedures (Part VII.F.2.a.i.) are updated (Part VII.F.2.a.iv.), training on the updates must be given to all staff prior to conducting *municipal facility* procedures.

iii. The names, titles, and contact information for the individuals who have received *municipal facility* training and update annually; and

iv. Annually, by April 1, the *MS4 Operator* must:

a) Review and update the *municipal facility* procedures (Part VII.F.2.a.i.); and

b) Document the completion of this requirement in the *SWMP Plan*.

b. *Municipal Facility* Inventory

i. Within two (2) years of the EDC, the *MS4 Operator* must *develop* and maintain an inventory of all *municipal* facilities in the *SWMP* Plan. The following information must be included in the inventory:

a) Name of *municipal facility*;

b) Street address;

c) Type of *municipal facility*;

d) Prioritization (high or low) (Part VII.F.2.c.);

e) Receiving waterbody name and class (mapped in accordance with Part IV.D.1.e.ii.a));

f) Receiving waterbody WI/PWL Segment ID (mapped in accordance with Part IV.D.1.e.ii.b));

g) Contact information;

h) Responsible department;

i) Location of SWPPP (if high priority; when completed);

j) Type of activities present on site;

k) Size of facility (acres);

l) Date of last assessment;

m) *BMPs* identified; and

n) Projected date of next comprehensive site assessment (Part VII.F.2.d.ii.c) or Part VII.F.2.e.ii.c), depending on the *municipal facility* prioritization (Part VII.F.2.c.)).

ii. Annually, the *MS4 Operator* must update the inventory if new *municipal* facilities are added.

c. *Municipal Facility* Prioritization

i. Within three (3) years of the EDC, the *MS4 Operator* must prioritize all known *municipal* facilities as follows:

a) High priority *municipal* facilities include *municipal* facilities that have one or more of the following on site and exposed to *stormwater*:

i) Storage of chemicals, salt, petroleum, pesticides, fertilizers, anti-freeze, lead-acid batteries, tires, waste/debris;

ii) Fueling stations; and/or

iii) Vehicle or equipment maintenance/repair.

b) Low priority *municipal* facilities include any *municipal* facilities that do not meet the criteria for a high priority (Part VII.F.2.c.i.a)) *municipal facility*.

c) High priority *municipal* facilities (Part IV.F.2.c.i.a)) which qualify for a *No Exposure* Certification (Part VII.F.1.a.ii.) are low priority *municipal* facilities.

ii. Within thirty (30) days of when a *municipal facility* is added to the inventory, the *MS4 Operator* must prioritize those *municipal* facilities; and

iii. Annually, after the initial prioritization (Part VII.F.2.c.i.), the *MS4 Operator* must update the *municipal facility* prioritization in the inventory (Part VII.F.2.b.i.) based on information gathered as part of the *municipal facility* program (Part VII.F.2.a.), including cases where a *No Exposure* Certification (Part VII.F.1.a.ii.) ceases to apply. The completion of this permit requirement must be documented in the *SWMP Plan*.

### d. High Priority *Municipal Facility* Requirements

#### *i. Municipal Facility Specific SWPPP*

Within five (5) years of the EDC, *MS4 Operators* must *develop* and implement a *municipal facility* specific SWPPP for each high priority *municipal facility* (Part VII.F.2.c.i.a)) and retain a copy of the *municipal facility* specific SWPPP on site of the respective *municipal facility*. The SWPPP must contain:

a) *Stormwater* Pollution Prevention Team

The *municipal facility* specific SWPPP must identify the individuals (by name and/or title) and their role/responsibilities in *developing*, implementing, maintaining, and revising the *municipal facility* specific SWPPP. The activities and responsibilities of the team must address all aspects of the *municipal facility* specific SWPPP.

b) General Site Description

A written description of the nature of the activities occurring at the *municipal facility* with a potential to *discharge pollutants*, type of *pollutants* expected, and location of key features as detailed in the site map (Part VII.F.2.d.i.e)).

c) Summary of potential *pollutant* sources

The *municipal facility* specific SWPPP must identify each area at the *municipal facility* where materials or activities are exposed to *stormwater* or from which authorized non-*stormwater discharges* (Part I.A.3.) originate, including any potential *pollutant* sources for which the *municipal facility* has reporting requirements under the Emergency Planning and Community Right-To-Know Act (EPCRA), Section 313.

i) Materials or activities include: machinery; raw materials; intermediate products; byproducts; final products or waste products; and material handling activities which includes storage, loading and unloading, transportation or conveyance of any raw material, intermediate product, final product or waste product.

ii) For each separate area identified, the description must include:

(a) Activities - A list of the activities occurring in the area (e.g., material storage, equipment fueling and cleaning);

(b) *Pollutants* - A list of the associated *pollutant(s)* for each activity. The *pollutant(s)* list must include all materials that are exposed to *stormwater*; and

(c) Potential for presence in *stormwater* - For each area of the *municipal facility* that generates *stormwater discharges,* a prediction of the direction of flow, and the likelihood of the activity to contaminate the *stormwater discharge*. Factors to consider include the toxicity of chemicals, quantity of chemicals used, produced or *discharge*d, the likelihood of contact with *stormwater*; and history of leaks or spills of toxic or hazardous *pollutants*.

d) Spills and Releases

For areas that are exposed to precipitation or that otherwise drain to a *stormwater* conveyance to be covered under this *SPDES* general permit, the *municipal facility* specific SWPPP must include a list of spills or releases[61] of petroleum and hazardous substances or other *pollutants*, including unauthorized *non-stormwater discharges,* that may adversely affect water quality that occurred during the last three-year period. The list must be updated when spills or releases occur.

e) Site Map

The *municipal facility* specific SWPPP must include a site map identifying the following, as applicable:

i) Property boundaries and size in acres;

[61] This may also include releases of petroleum or hazardous substances that are not in excess of reporting quantities but which may still cause or contribute to significant water quality impairment.

ii) Location and extent of significant structures (including materials shelters), and impervious surfaces;

iii) Monitoring locations (mapped in accordance with Part IV.D.2.a.i.) with its approximate *sewershed*. Each monitoring location must be labeled with the monitoring location identification;

iv) Location of all post-construction *SMPs* (mapped in accordance with Part IV.D.2.a.iv.) and *MS4* infrastructure (mapped in accordance with Part IV.D.2.b.i.);

v) Locations of *discharges* authorized under other *SPDES* permits;

vi) Locations where potential spills or releases can contribute to *pollutants* in *stormwater discharges* and their accompanying drainage points;

vii) Locations of haul and access roads;

viii) Rail cars and tracks;

ix) Arrows showing direction of *stormwater* flow;

x) Location of all receiving waters in the immediate vicinity of the *municipal facility*, indicating if any of the waters are impaired and, if so, whether the waters have *TMDLs* established for them (mapped in accordance with Part IV.D.1.e.ii.);

xi) Locations where *stormwater* flows have significant potential to cause erosion;

xii) Location and source of run-on from adjacent property containing significant quantities of *pollutants* and/or volume of concern to the *municipal facility*; and

xiii) Locations of the following areas where such areas are exposed to precipitation or *stormwater*:

(a) Fueling stations;
(b) Vehicle and equipment maintenance and/or cleaning areas;
(c) Loading/unloading areas;
(d) Locations used for the treatment, storage or disposal of wastes;
(e) Liquid storage tanks;
(f) Processing and storage areas;
(g) Locations where significant materials, fuel or chemicals are stored and transferred;
(h) Locations where vehicles and/or machinery are stored when not in use
(i) Transfer areas for substances in bulk;
(j) Location and description of non-*stormwater discharges* (Part I.A.3.);

(k) Locations where spills[62] or leaks have occurred; and
(l) Locations of all existing structural *BMP*s.

f) *Stormwater Best Management Practices (BMPs)*

The *municipal facility* specific SWPPP must document the location and type of *BMPs* implemented at the *municipal facility* (Part VII.F.1). The *municipal facility* specific SWPPP must describe how each *BMP* is being implemented for all the potential *pollutant* sources.

g) *Municipal facility* assessments
The *municipal facility* specific SWPPP must include a schedule for completing and recording results of routine and comprehensive site assessments (Part VII.F.2.d.ii.c)).

*ii. Municipal Facility Assessments*

a) Wet Weather Visual Monitoring

i) Once every five (5) years, the *MS4 Operator* must conduct wet weather visual monitoring of the monitoring locations (Part VII.C.1.b.) and other sites of *stormwater* leaving the site that are *discharging stormwater* from fueling areas, storage areas, vehicle and equipment maintenance/fueling areas, material handling areas and similar potential *pollutant* generating areas (Part VII.F.2.d.i.e)xiii)).

(a) All samples must be collected from *discharges* resulting from a *qualifying storm event*. The storm event must be documented using the Storm Event Data Form (Appendix D) and kept with the *municipal facility* specific SWPPP. The sample must be taken during the first thirty (30) minutes (or as soon as practical, but not to exceed one hour) of the *discharge* at the monitoring location.

(b) No analytical tests are required to be performed on the samples for the purpose of meeting the visual monitoring requirements.

(c) The visual examination must document observations of color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, and any other obvious indicators of *stormwater* pollution.

(d) The visual examination of the sample must be conducted in a well-lit area.

(e) Where practicable, the same individual should carry out the collection and examination of *discharges* for the entire permit term for consistency.

[62] A spill includes: any spill of a hazardous substance that must be reported in accordance with 6 NYCRR 597.4 and any spill of petroleum that must be reported in accordance with 6 NYCRR 613.6 or 17 NYCRR 32.3.

(f) The *MS4 Operator* must document the visual examination using the Visual Monitoring Form (Appendix D) and keep it with the *municipal facility* specific SWPPP to record:

(i) Monitoring location ID;

(ii) Examination date and time;

(iii) Personnel conducting the examination;

(iv) Nature of the *discharge* (runoff or snowmelt);

(v) Visual quality of the *stormwater discharge* including observations of color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, and other obvious indicators of *stormwater* pollution; and

(vi) Probable sources of any observed *stormwater* contamination.

(vii) Corrective and follow up actions – If the visual examination indicates the presence of color, odor, floating solids, settled solids, suspended solids, foam, oil sheen, or other indicators of *stormwater* pollution, the *MS4 Operator* must, at minimum, complete and document the following actions:

(1) Evaluate the facility for potential sources;

(2) Remedy the problems identified;

(3) Revise the *municipal facility* specific SWPPP; and

(4) Perform an additional visual inspection during the first *qualifying storm event* following implementation of the corrective action. If the first *qualifying storm event* does not occur until the next visual monitoring period, this follow up action may be used as the next visual inspection.

b) The monitoring locations inspection and sampling program must be implemented at the *municipal facility* (Part VII.C.1.e.).

c) Comprehensive Site Assessments

i) Once every five (5) years following the most recent assessment, the *MS4 Operator* must complete a comprehensive site assessment for each high priority *municipal facility* as identified in the inventory (Part VII.F.2.b.) using the Municipal Facility Assessment Form (Appendix D) or an equivalent form containing the same information, and document in the *municipal facility* specific SWPPP and *SWMP Plan* that:

(a) The *municipal facility* is in compliance with the terms and conditions of this *SPDES* general permit;

(b) Deficiencies were identified and all reasonable steps will be taken to minimize any *discharge* in violation of the permit, which has a reasonable likelihood of adversely affecting human health or the environment;

(i) Within twenty-four (24) hours, the *MS4 Operator* must prepare a schedule that includes corrective actions and specific interim milestones to be implemented until the corrective action is implemented; or

(c) Deficiencies were identified and all reasonable steps will be taken to minimize any *discharge* in violation of the permit, which does not have a reasonable likelihood of adversely affecting human health or the environment;

(i) Within seven (7) days, the *MS4 Operator* must prepare a schedule that includes corrective actions and specific interim milestones to be implemented until the corrective action is implemented.

### e. Low Priority *Municipal Facility* Requirements

i. The *MS4 Operator* must identify procedures outlining *BMPs* for the types of activities that occur at the low priority *municipal* facilities as described in Part VII.F.1. A *municipal facility* specific SWPPP is not required.

ii. *Municipal Facility* Assessments

a) Low priority *municipal* facilities are not required to conduct wet weather visual monitoring.

b) The monitoring locations inspection and sampling program must be implemented at the *municipal facility* (Part VII.C.1.e.).

c) Comprehensive Site Assessments

i) Once every five (5) years following the most recent assessment, the *MS4 Operator* must complete a comprehensive site assessment for each low priority *municipal facility* as identified in the inventory (Part VII.F.2.b.) using the Municipal Facility Assessment Form (Appendix D) or an equivalent form containing the same information, and document in the *SWMP Plan* that:

(a) The *municipal facility* is in compliance with the terms and conditions of this *SPDES* general permit;

(b) Deficiencies were identified and all reasonable steps will be taken to minimize any *discharge* in violation of the permit, which has a reasonable likelihood of adversely affecting human health or the environment;

(i) Within twenty-four (24) hours, the *MS4 Operator* must prepare a schedule that includes corrective actions and specific interim milestones to be implemented until the corrective action is implemented; or

(c) Deficiencies were identified and all reasonable steps will be to minimize any *discharge* in violation of the permit, which does not have a reasonable likelihood of adversely affecting human health or the environment;

(i) Within seven (7) days, the *MS4 Operator* must prepare a schedule that includes corrective actions and specific interim milestones to be implemented until the corrective action is implemented.

## 3. *Municipal Operations* & Maintenance

### a. *Municipal Operations* Program

*Municipal operations* are: street and bridge maintenance; winter road maintenance; *MS4* maintenance; open space maintenance; solid waste management; new construction and land disturbances; right-of-way maintenance; marine operations; or hydrologic habitat modification.

Within three (3) years of the EDC, the *MS4 Operator* must *develop* and implement a *municipal operations* program. The *municipal operations* program must be documented in the *SWMP Plan* specifying:

i. The *municipal operations* procedures including:

a) The *BMPs* (Part VII.F.1.) incorporated into the *municipal operations* program;

b) The *municipal operations* corrective actions requirements (Part VII.F.3.b.);

c) *Catch basin* inspection and maintenance requirements (Part VII.F.3.c.);

d) Roads, bridges, parking lots, and right of way maintenance requirements (Part VII.F.3.d.); and

e) All other *municipal operations* maintenance requirements.

ii. The training provisions for the *MS4 Operator*'s *municipal operations* procedures (Part VII.F.3.a.i.).

a) If new staff are added, training on the *MS4 Operator*'s *municipal operations* procedures (Part VII.F.3.a.i.) must be given prior to conducting *municipal operations* procedures;

b) For existing staff, training on the *MS4 Operator*'s *municipal operations* procedures (Part VII.F.3.a.i.) must be given prior to conducting

*municipal operations* procedures and once every five (5) years, thereafter; and

c) If the *municipal operations* procedures (Part VII.F.3.a.i.) are updated (Part VII.F.3.a.iv.), training on the updates must be given to all staff prior to conducting *municipal operations* procedures.

iii. The names, titles, and contact information for the individuals who have received *municipal operations* training and update annually; and

iv. Annually, by April 1, the *MS4 Operator* must:

a) Review and update the *municipal operations* procedures (Part VII.F.3.a.i.); and

b) Document the completion of this requirement in the *SWMP Plan*.

b. *Municipal Operations* Corrective Actions

i. For *municipal operations*, *MS4 Operators* must either:

a) Ensure compliance with the terms and conditions of this *SPDES* general permit; or

b) Implement corrective actions according to the following schedule and, after implementation, ensure the operations are in compliance with the terms and conditions of this *SPDES* general permit:

i) Within twenty-four (24) hours of discovery for situations that have a reasonable likelihood of adversely affecting human health or the environment;

ii) Initiated within seven (7) days of inspection and completed within thirty (30) days of inspection for situations that do not have a reasonable likelihood of adversely affecting human health or the environment; and

iii) For corrective actions that require special funding or construction that will take longer than thirty (30) days to complete, a schedule must be prepared that specifies interim milestones that will ensure compliance in the shortest reasonable time.

c. *Catch Basin* Inspection and Maintenance

Within three (3) years of the EDC, the MS4 Operator must:

i. Identify when *catch basin* inspection is needed with consideration for:

a) Areas with *construction activities* (mapped in accordance with Part IV.D.2.a.iii.);

b) Residential, commercial, and industrial areas (mapped in accordance with Part IV.D.1.d.iii.);

c) Recurring or history of issues; or

d) Confirmed citizen complaints on three or more separate occasions in the last twelve (12) months.

ii. Inventory *catch basin* inspection information including:

a) Date of inspection;

b) Approximate level of trash, sediment, and/or debris captured at time of clean-out (no trash, sediment, and/or debris, <50% of the depth of the *sump*, >50% of the depth of the *sump*);

c) Depth of structure;

d) Depth of *sump*; and

e) Date of clean out, if applicable (Part VII.F.3.c.iii.).

iii. Based on inspection results, clean out *catch basins* within the following timeframes:

a) Within six (6) months after the *catch basin* inspection, *catch basins* which had trash, sediment, and/or debris exceeding 50% of the depth of the *sump* as a result of a *catch basin* inspection must be cleaned out;

b) Within one (1) year after the *catch basin* inspection, *catch basins* which had trash, sediment, and/or debris at less than 50% of the depth of the *sump* as a result of a *catch basin* inspection must be cleaned out; and

c) MS4 Operators are not required to clean out *catch basins* if the *catch basins* are operating properly and:

i. There is no trash, sediment, and/or debris in the *catch basin*; or

ii. The *sump* depth of the *catch basin* is less than or equal to two (2) feet.

iv. Properly manage (handling and disposal) materials removed from *catch basins* during clean out so that:

a) Water removed during the *catch basin* cleaning process will not reenter the *MS4* or *surface waters of the State*;

b) Material removed from *catch basins* is disposed of in accordance with any applicable environmental laws and regulations; and

c) Material removed during the *catch basin* cleaning process will not reenter the *MS4* or *surface waters of the State*.

v. Determine if there are signs/evidence of *illicit discharges* and procedures for referral/follow-up if *illicit discharges* are encountered.

## d. Roads, Bridges, Parking Lots, & Right of Way Maintenance

### *i. Sweeping*

Within six (6) months of the EDC, the *MS4 Operator* must *develop* and implement procedures for sweeping and/or cleaning *municipal* streets, bridges, parking lots, and right of ways owned/operated by the *MS4 Operator*. The procedures and completion of permit requirements must be documented in the *SWMP Plan* specifying:

a) All roads, bridges, parking lots, and right of ways must be swept and/or cleaned once every five (5) years in the spring (following winter activities such as sanding). This requirement is not applicable to:

   i) Uncurbed roads with no *catch basins*;

   ii) High-speed limited access highways; or

   iii) Roads defined as interstates, freeways and expressways, or arterials by the United States Department of Transportation, Federal Highway Administration, Highway Functional Classification Concepts, Criteria and Procedures, 2013.

b) Annually, from April 1 through October 31, roads in business and commercial areas must be swept. This requirement is not applicable to:

   i) Uncurbed roads with no *catch basins*;

   ii) High-speed limited access highways; or

   iii) Roads defined as interstates, freeways and expressways, or arterials by the USDOT 2013.

### *ii. Maintenance*

Within five (5) years of the EDC, in addition to the *BMPs* (Part VII.F.1.), the *MS4 Operator* must implement the following provisions:

a) Pave, mark, and seal in dry conditions;

b) Stage road operations and maintenance activity (e.g., patching, potholes) to reduce the potential discharge of pollutants to the *MS4* or *surface waters of the State*;

c) Restrict the use of herbicides/pesticide application to roadside vegetation; and

d) Contain *pollutants* associated with bridge maintenance activities (e.g., paint chips, dust, cleaning products, other debris).

### *iii. Winter Road Maintenance*

Within five (5) years of the EDC, in addition to the *BMPs* (Part VII.F.1.), the *MS4 Operator* must implement the following provisions:

a) Routinely calibrate equipment to control salt/sand application rates; and

b) Ensure that routine snow disposal activities comply with the Division of Water Technical and Operation Guidance Series 5.1.11, Snow Disposal.[63]

[63] The Division of Water Technical and Operation Guidance Series 5.1.11, Snow Disposal can be found on the Department's website.

# Part VIII. Enhanced Requirements for Impaired Waters

Part VIII. requirements must be implemented in addition to the applicable requirements of the six (6) MCMs in Part VI. or Part VII, depending on the *MS4 Operator* type. Part VIII. requirements apply in the *sewersheds* which *discharge* to waters impaired for phosphorus, silt/sediment, pathogens, nitrogen, or floatables (Appendix C). *MS4 outfalls* are in the *automatically designated area*. *ADA MS4 outfalls* are in the *additionally designated area* subject to Criterion 3 of the Additional Designation Criteria (Appendix B).

*MS4 Operator's* subject to Part VIII. that implement pollutant specific *BMPs* after the EDC but prior to *MS4* infrastructure and *sewershed* mapping can use those *BMPs* to satisfy the permit requirements in this section.

The Part VIII. requirements, applicable to the *POC*, must be incorporated in the *MS4 Operator*'s *SWMP* and *SWMP Plan*.

## A. *Pollutant* Specific BMPs for Phosphorus

Part VIII.A. must be implemented for all phosphorus impaired waters listed in Appendix C.

### 1. Mapping

In accordance with the timeframes listed below, the *MS4 Operator* must update, in geographic information system (GIS) format with a scale of 1:24,000 or finer, the comprehensive system mapping (Part IV.D.) to include:

a. Within three (3) years of the EDC, *MS4* infrastructure mapping requirements (Part IV.D.2.b.i.) and *sewersheds* for each:
   i. *MS4 outfall;* and
   ii. *ADA MS4 outfall.*
b. Within three (3) years of the EDC, the following information for each *MS4 outfall*:
   i. Retail and wholesale plant nurseries (including big box stores);
   ii. Commercial lawn care facilities; and
   iii. Golf courses.
c. Within three (3) years of the EDC, *ADA MS4 outfalls.*

### 2. Public Education and Outreach

a. Within six (6) months of the EDC, the *MS4 Operator* must make available information on how the impairment is being addressed by implementation of the MS4 Operator's local law or legal mechanism with content equivalent to the model local law (Part IV.E.1 and Part IV.E.2.). *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

b. Following the completion of Part VIII.A.1, twice a year, once from March to August and once from September to February, the *MS4 Operator* must provide educational messages with information specific to phosphorus to the applicable target audiences within the *sewersheds* for impaired waters listed in Appendix C focus area, identified in Part VI.A.1.b. or Part VII.A.1.b, depending on the MS4 Operator type. The *SWMP Plan* must be updated with changes made to public education and outreach program (Part VI.A or Part VII.A, depending on the *MS4 Operator* type). *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

### 3. Public Involvement/Participation

No additional requirements.

### 4. *Illicit Discharge* Detection and Elimination

Following the completion of Part VIII.A.1, within five (5) years of the EDC, the MS4 Operator must include on the *MS4 outfall* inventory (Part VI.C.1.c. or Part VII.C.1.c, depending on the MS4 Operator type) the number of each item identified in Part VIII.A.1.b. for each associated *MS4 outfall*.

### 5. Construction Site *Stormwater* Runoff Control

For Following the completion of Part VIII.A.1, high priority construction sites must be inspected during active construction after the pre-construction meeting (Part VI.D.7. or Part VII.D.7, depending on the *MS4 Operator* type).

a. If the *MS4 Operator* is completing the inspection, the construction site must be inspected every ninety (90) days; or

b. If the *MS4 Operator* utilizes the *qualified inspector's* weekly inspection reports, as required by the CGP, to satisfy this requirement, the *MS4 Operator* must inspect the construction site once every six (6) months, or sooner if any deficiencies are noted that require attention.

*MS4 Operators* must document the construction site inspections in the *SWMP Plan*.

### 6. Post-Construction *Stormwater* Management

No additional requirements.

### 7. Pollution Prevention and Good Housekeeping

Following the completion of Part VIII.A.1:

a. Annually, from April 1 through October 31, all streets located in *sewersheds discharging* to phosphorus impaired segments must be swept. *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*. This requirement is not applicable to:

   i. Uncurbed roads with no *catch basins*;

ii. High-speed limited access highways; or

iii. Roads defined as interstates, freeways and expressways, or arterials by the United States Department of Transportation, Federal Highway Administration, Highway Functional Classification Concepts, Criteria and Procedures, 2013.

b. Within six (6) months of *MS4 outfall* inspection, the *MS4 Operator* must initiate actions to repair all *MS4 outfall* protection and/or bank stability problems identified during the inspection. Repairs must be completed in accordance with the NYS E&SC 2016. *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

### 8. Planned Upgrades to *Municipal Facilities* in *Sewersheds* to Impaired Waters

Incorporate, where feasible,[64] cost-effective runoff reduction techniques[65] during planned *municipal* upgrades including *municipal* right of ways (e.g., bioswales, green streets, porous pavement, replacement of closed drainage with grass swales, replacement of the existing islands in the parking lots with bioretention or curb cuts to route the flow through below-grade infiltration areas or other low-cost improvements that provide runoff treatment or reduction).

## B. *Pollutant* Specific BMPs for Silt/Sediment

Part VIII.B. must be implemented for all silt/sediment impaired waters listed in Appendix C.

### 1. Mapping

In accordance with the timeframes listed below, the *MS4 Operator* must update, in geographic information system (GIS) format with a scale of 1:24,000 or finer, the comprehensive system mapping (Part IV.D.) to include:

a. Within three (3) years of the EDC, *MS4* infrastructure mapping requirements (Part IV.D.2.b.i.) and *sewersheds* for each:

i. *MS4 outfall;* and

ii. *ADA MS4 outfall.*

b. Within three (3) years of the EDC, facilities with *SPDES* permit coverage under the MSGP with *stormwater discharges* applicable under Sector C, E, L, or J with facility contact.

c. Within three (3) years of the EDC, *ADA MS4 outfalls.*

[64] Consideration of feasibility should include type of land use or *municipal operation*, suitability of soils, presence of utilities, potential for exacerbating existing contamination problems, safety issues, maintenance requirements, and expected lifespans of available technologies.

[65] Runoff reduction techniques can be found in Chapters 4 and 5 of the NYS SWMDM 2015.

### 2. Public Education and Outreach

a. Within six (6) months of the EDC, the *MS4 Operator* must make available information on how the impairment is being addressed by implementation of the MS4 Operator's local law or legal mechanism with content equivalent to the model local law (Part IV.E.1 and Part IV.E.2.). *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

b. Following the completion of Part VIII.B.1, each year of active construction, the *MS4 Operator* must educate individuals involved in *construction activity* (e.g., contractor, subcontractor, qualified inspector, SWPPP reviewers) within the *sewershed* boundary on the use of post-construction *SMPs* that are intended to collect and separate silt and sediment debris from *stormwater* before *discharging* to waters of the State (e.g., sediment forebays) as detailed in the NYS SWMDM 2015. *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

### 3. Public Involvement/Participation

No additional requirements.

### 4. *Illicit Discharge* Detection and Elimination

Following the completion of Part VIII.B.1, within five (5) years of the EDC, the MS4 Operator must include on the *MS4 outfall* inventory (Part VI.C.1.c. or Part VII.C.1.c, depending on the MS4 Operator type) the number of each item identified in Part VIII.B.1.b. for each associated *MS4 outfall*.

### 5. Construction Site *Stormwater* Runoff Control

Following the completion of Part VIII.B.1, high priority construction sites must be inspected during active construction after the pre-construction meeting (Part VI.D.7. or Part VII.D.7, depending on the *MS4 Operator* type).

a. If the *MS4 Operator* is completing the inspection, the construction site must be inspected every ninety (90) days; or

b. If the *MS4 Operator* utilizes the *qualified inspector's* weekly inspection reports, as required by the CGP, to satisfy this requirement, the *MS4 Operator* must inspect the construction site once every six (6) months, or sooner if any deficiencies are noted that require attention.

*MS4 Operators* must document the construction site inspections in the *SWMP Plan*.

### 6. Post-Construction *Stormwater* Management

No additional requirements.

### 7. Pollution Prevention and Good Housekeeping

Following the completion of Part VIII.B.1:

a. Annually, from April 1 through October 31, all streets located in *sewersheds discharging* to silt/sediment impaired segments must be swept. *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*. This requirement is not applicable to:

   i. Uncurbed roads with no *catch basins*;

   ii. High-speed limited access highways; or

   iii. Roads defined as interstates, freeways and expressways, or arterials by the United States Department of Transportation, Federal Highway Administration, Highway Functional Classification Concepts, Criteria and Procedures, 2013.

b. For areas within the *sewershed* that are compacted, poorly drained, contain areas of exposed soil, or nutrient deficient, the *MS4 Operator* must:

   i. Refer to Section 4 of the NYS E&SC 2016 for Soil Stabilization practices, and follow BMP procedures; and

   ii. *Develop* and implement procedures for watering and maintenance of implemented BMPs appropriate to establish root and vegetative cover, utilizing products which provide critical support to vegetation and soil stabilization.

   *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

c. Within six (6) months of *MS4 outfall* inspection, the *MS4 Operator* must initiate actions to repair all *MS4 outfall* protection and/or bank stability problems identified during the inspection. Repairs must be completed in accordance with the NYS E&SC 2016. *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

### 8. Planned Upgrades to *Municipal Facilities* in *Sewersheds* to Impaired Waters

Incorporate, where feasible,[66] cost-effective runoff reduction techniques[67] during planned *municipal* upgrades including *municipal* right of ways (e.g., bioswales, green streets, porous pavement, replacement of closed drainage with grass swales, replacement of the existing islands in the parking lots with bioretention or curb cuts to route the flow through below-grade infiltration areas or other low-cost improvements that provide runoff treatment or reduction).

[66] Consideration of feasibility should include type of land use or *municipal operation*, suitability of soils, presence of utilities, potential for exacerbating existing contamination problems, safety issues, maintenance requirements, and expected lifespans of available technologies.

[67] Runoff reduction techniques can be found in Chapters 4 and 5 of the NYS SWMDM 2015.

## C. *Pollutant* Specific BMPs for Pathogens

Part VIII.C. must be implemented for all pathogen impaired waters listed in Appendix C.

### 1. Mapping

In accordance with the timeframes listed below, the *MS4 Operator* must update, in geographic information system (GIS) format with a scale of 1:24,000 or finer, the comprehensive system mapping (Part IV.D.) to include:

a. Within three (3) years of the EDC, *MS4* infrastructure mapping requirements (Part IV.D.2.b.i.) and *sewersheds* for each:

   i. *MS4 outfall;* and

   ii. *ADA MS4 outfall.*

b. Within three (3) years of the EDC, the following information for each *MS4 outfall*:

   i. Areas with a history of sanitary sewer overflows;

   ii. Waterfowl congregation areas on *municipal* property or right of way;

   iii. Areas where pets/domestic animals may frequent (i.e., public trails, dog parks, and zoos); and

   iv. Waste disposal areas (e.g., active landfills, transfer stations).

c. Within three (3) years of the EDC, *ADA MS4 outfalls.*

### 2. Public Education and Outreach

a. Within six (6) months of the EDC, the *MS4 Operator* must make available information on any how the impairment is being addressed by implementation of the MS4 Operator's local law or legal mechanism with content equivalent to the model local law (Part IV.E.1 and Part IV.E.2.). *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

b. Following the completion of Part VIII.C.1, twice a year, once from March to August and once from September to February, the *MS4 Operator* must provide educational messages with information specific to pathogens to the applicable target audiences within the *sewersheds* for impaired waters listed in Appendix C focus area, identified in Part VI.A.1.b. or Part VII.A.1.b, depending on the MS4 Operator type. The *SWMP Plan* must be updated with changes made to public education and outreach program (Part VI.A. or Part VII.A, depending on the *MS4 Operator* type). *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

### 3. Public Involvement/Participation

No additional requirements.

### 4. *Illicit Discharge* Detection and Elimination

Following the completion of Part VIII.C.1, within five (5) years of the EDC, the MS4 Operator must include on the *MS4 outfall* inventory (Part VI.C.1.c. or Part VII.C.1.c, depending on the MS4 Operator type) the number of each item identified in Part VIII.C.1.b. for each associated *MS4 outfall*.

### 5. Construction Site *Stormwater* Runoff Control

No additional requirements.

### 6. Post-Construction *Stormwater* Management

No additional requirements.

### 7. Pollution Prevention and Good Housekeeping

Following the completion of Part VIII.C.1:

a. *Infrastructure Maintenance*

i. Annually, from April 1 through October 31, all streets located in *sewersheds discharging* to pathogen impaired segments must be swept. *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*. This requirement is not applicable to:

a) Uncurbed roads with no *catch basins*;

b) High-speed limited access highways; or

c) Roads defined as interstates, freeways and expressways, or arterials by the United States Department of Transportation, Federal Highway Administration, Highway Functional Classification Concepts, Criteria and Procedures, 2013.

ii. Within six (6) months of *MS4 outfall* inspection, the *MS4 Operator* must initiate actions to repair all *MS4 outfall* protection and/or bank stability problems identified during the inspection. Repairs must be completed in accordance with the NYS E&SC 2016. *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

b. *Wildlife Control*

i. Within six (6) months of the EDC, the *MS4 Operator* must identify *municipal facilities* with nuisance bird populations that have the potential to contribute pathogens (e.g., Canada Geese) and document those *municipal facilities* in the *SWMP Plan*.

ii. Within six (6) months of the EDC, signage must be available at these municipal facilities, instructing the public not to feed wildlife. *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

iii. Within six (6) months of the EDC, the *MS4 Operator* must remove accumulated trash and debris from *municipal* facilities when necessary to

eliminate potential food sources for wildlife. *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

iv. Within one (1) year of the EDC, *MS4 Operators* must evaluate the effectiveness of deterrents, population controls, and other measures that may reduce bird related pathogen contributions and document the results of the evaluation in the *SWMP Plan*.

*c. Animal Waste Control*

Within one (1) year of the EDC, the *MS4 Operator* must make dog waste receptacles available in areas where pets/domestic animals may frequent (e.g., public trails, dog parks). *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

### 8. Planned Upgrades to *Municipal Facilities* in *Sewersheds* to Impaired Waters

Incorporate, where feasible,[68] cost-effective runoff reduction techniques[69] during planned *municipal* upgrades including *municipal* right of ways (e.g., bioswales, green streets, porous pavement, replacement of closed drainage with grass swales, replacement of the existing islands in the parking lots with bioretention or curb cuts to route the flow through below-grade infiltration areas or other low-cost improvements that provide runoff treatment or reduction).

## D. *Pollutant* Specific BMPs for Nitrogen

Part VIII.D. must be implemented for all nitrogen impaired waters listed in Appendix C.

### 1. Mapping

In accordance with the timeframes listed below, the *MS4 Operator* must update, in geographic information system (GIS) format with a scale of 1:24,000 or finer, the comprehensive system mapping (Part IV.D.) to include:

a. Within three (3) years of the EDC, *MS4* infrastructure mapping requirements (Part IV.D.2.b.i.) and *sewersheds* for each:

i. *MS4 outfall;* and

ii. *ADA MS4 outfall.*

b. Within three (3) years of the EDC, the following information for each *MS4 outfall*:

i. Retail and wholesale plant nurseries (including big box stores);

ii. Commercial lawn care facilities; and

[68] Consideration of feasibility should include type of land use or *municipal operation*, suitability of soils, presence of utilities, potential for exacerbating existing contamination problems, safety issues, maintenance requirements, and expected lifespans of available technologies.

[69] Runoff reduction techniques can be found in Chapters 4 and 5 of the NYS SWMDM 2015.

iii. Golf courses.

c. Within three (3) years of the EDC, *ADA MS4 outfalls.*

## 2. Public Education and Outreach

a. Within six (6) months of the EDC, the *MS4 Operator* must make available information on any how the impairment is being addressed by implementation of the MS4 Operator's local law or legal mechanism with content equivalent to the model local law (Part IV.E.1 and Part IV.E.2.). *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

b. Following the completion of Part VIII.D.1, twice a year, once from March to August and once from September to February, the *MS4 Operator* must provide educational messages with information specific to nitrogen to the applicable target audiences within the *sewersheds* for impaired waters listed in Appendix C focus area, identified in Part VI.A.1.b. or Part VII.A.1.b, depending on the MS4 Operator type. The *SWMP Plan* must be updated with changes made to public education and outreach program (Part VI.A or Part VII.A, depending on the *MS4 Operator* type). *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

## 3. Public Involvement/Participation

No additional requirements.

## 4. *Illicit Discharge* Detection and Elimination

Following the completion of Part VIII.D.1 , within five (5) years of the EDC, the MS4 Operator must include on the *MS4 outfall* inventory (Part VI.C.1.c. or Part VII.C.1.c, depending on the MS4 Operator type) the number of each item identified in Part VIII.D.1.b for each associated *MS4 outfall*.

## 5. Construction Site *Stormwater* Runoff Control

Following the completion of Part VIII.D.1, high priority construction sites must be inspected during active construction after the pre-construction meeting (Part VI.D.7. or Part VII.D.7, depending on the *MS4 Operator* type).

a. If the *MS4 Operator* is completing the inspection, the construction site must be inspected every ninety (90) days; or

b. If the *MS4 Operator* utilizes the *qualified inspector's* weekly inspection reports, as required by the CGP, to satisfy this requirement, the *MS4 Operator* must inspect the construction site once every six (6) months, or sooner if any deficiencies are noted that require attention.

*MS4 Operators* must document the construction site inspections in the *SWMP Plan*.

## 6. Post-Construction *Stormwater* Management

No additional requirements.

### 7. Pollution Prevention and Good Housekeeping

Following the completion of Part VIII.D.1:

a. Annually, from April 1 through October 31, all streets located in *sewersheds discharging* to nitrogen impaired segments must be swept. *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*. This requirement is not applicable to:

   i. Uncurbed roads with no *catch basins*;

   ii. High-speed limited access highways; or

   iii. Roads defined as interstates, freeways and expressways, or arterials by the United States Department of Transportation, Federal Highway Administration, Highway Functional Classification Concepts, Criteria and Procedures, 2013.

b. Within six (6) months of *MS4 outfall* inspection, the *MS4 Operator* must initiate actions to repair all *MS4 outfall* protection and/or bank stability problems identified during the inspection. Repairs must be completed in accordance with the NYS E&SC 2016. *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

### 8. Planned Upgrades to *Municipal Facilities* in *Sewersheds* to Impaired Waters

Incorporate, where feasible,[70] cost-effective runoff reduction techniques[71] during planned *municipal* upgrades including *municipal* right of ways (e.g., bioswales, green streets, porous pavement, replacement of closed drainage with grass swales, replacement of the existing islands in the parking lots with bioretention or curb cuts to route the flow through below-grade infiltration areas or other low-cost improvements that provide runoff treatment or reduction).

## E. *Pollutant* Specific BMPs for Floatables

Part VIII.E. must be implemented for all floatable impaired waters listed in Appendix C.

### 1. Mapping

In accordance with the timeframes listed below, the *MS4 Operator* must update, in geographic information system (GIS) format with a scale of 1:24,000 or finer, the comprehensive system mapping (Part IV.D.) to include:

a. Within three (3) years of the EDC, *MS4* infrastructure mapping requirements (Part IV.D.2.b.i.) and *sewersheds* for each:

[70] Consideration of feasibility should include type of land use or *municipal operation*, suitability of soils, presence of utilities, potential for exacerbating existing contamination problems, safety issues, maintenance requirements, and expected lifespans of available technologies.

[71] Runoff reduction techniques can be found in Chapters 4 and 5 of the NYS SWMDM 2015.

i. *MS4 outfall;* and

ii. *ADA MS4 outfall.*

b. Within three (3) years of the EDC, *ADA MS4 outfalls.*

### 2. Public Education and Outreach

a. Within six (6) months of the EDC, the *MS4 Operator* must make available information on any how the impairment is being addressed by implementation of the MS4 Operator's local law or legal mechanism with content equivalent to the model local law (Part IV.E.1 and Part IV.E.2.). *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

b. Following the completion of Part VIII.E.1, twice a year, once from March to August and once from September to February, the *MS4 Operator* must provide educational messages with information specific to floatables to the applicable target audiences within the *sewersheds* for impaired waters listed in Appendix C focus area, identified in Part VI.A.1.b. or Part VII.A.1.b, depending on the MS4 Operator type. The *SWMP Plan* must be updated with changes made to public education and outreach program (Part VI.A or Part VII.A, depending on the *MS4 Operator* type). *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

### 3. Public Involvement/Participation

No additional requirements.

### 4. *Illicit Discharge* Detection and Elimination

No additional requirements.

### 5. Construction Site *Stormwater* Runoff Control

No additional requirements.

### 6. Post-Construction *Stormwater* Management

No additional requirements.

### 7. Pollution Prevention and Good Housekeeping

Following completion of Part VIII.E.1:

a. Annually, from April 1 through October 31, all streets located in *sewersheds discharging* to floatables impaired segments must be swept. *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*. This requirement is not applicable to:

i. Uncurbed roads with no *catch basins*;

ii. High-speed limited access highways; or

iii. Roads defined as interstates, freeways and expressways, or arterials by the United States Department of Transportation, Federal Highway Administration, Highway Functional Classification Concepts, Criteria and Procedures, 2013.

b. Within six (6) months of *MS4 outfall* inspection, the *MS4 Operator* must initiate actions to repair all *MS4 outfall* protection and/or bank stability problems identified during the inspection. Repairs must be completed in accordance with the NYS E&SC 2016. *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

### 8. Planned Upgrades to *Municipal Facilities* in *Sewersheds* to Impaired Waters

Incorporate, where feasible,[72] cost-effective runoff reduction techniques[73] during planned *municipal* upgrades including *municipal* right of ways (e.g., bioswales, green streets, porous pavement, replacement of closed drainage with grass swales, replacement of the existing islands in the parking lots with bioretention or curb cuts to route the flow through below-grade infiltration areas or other low-cost improvements that provide runoff treatment or reduction).

[72] Consideration of feasibility should include type of land use or *municipal operation*, suitability of soils, presence of utilities, potential for exacerbating existing contamination problems, safety issues, maintenance requirements, and expected lifespans of available technologies.

[73] Runoff reduction techniques can be found in Chapters 4 and 5 of the NYS SWMDM 2015.

# Part IX. Watershed Improvement Strategy Requirements for TMDL Implementation

Part IX. requirements must be implemented in addition to the applicable requirements of the six (6) MCMs in Part VI. or Part VII, depending on the *MS4 Operator* type. Part IX. requirements apply in the watersheds where the *Department* developed implementation plans for which USEPA has approved a TMDL (Table 3). Finalized TMDL implementation plans referenced in this Part are incorporated into and enforceable under this *SPDES* general permit.

*MS4 Operator's* subject to Part IX. that implement TMDL specific *BMPs* after the EDC but prior to *MS4* infrastructure and *sewershed* mapping can use those *BMPs* to satisfy the permit requirements in this section.

The Part IX. requirements must be incorporated in the *MS4 Operator*'s *SWMP* and *SWMP Plan*.

## A. NYC East of Hudson Phosphorus Impaired Watershed *MS4*s

| ***Table 4. Phosphorus Impaired Watershed(s)*** | | | |
|---|---|---|---|
| **Areas where requirements apply** | **New York City East of Hudson (EOH)** | | |
| EPA Approved TMDL | *Phase II Phosphorus TMDLs for Reservoirs in the NYC Watershed, June 2000* | *Total Maximum Daily Load (TMDL) for Phosphorus in Lake Carmel, October 2016* | *Total Maximum Daily Load (TMDL) for Phosphorus in Palmer Lake,*[2] *March 2015* |
| Implementation Plan | Croton Watershed Phase II TMDL Implementation Plan (January 2009) | | |
| *POC* | Phosphorus | | |
| Area where requirements Apply | NYC EOH Watershed | | |
| Achievement of *Pollutant* Load Reduction | Continued *retrofit* implementation to achieve the pollutant load reduction specified in that Phase II Implementation Plan | | |

*MS4 Operators* located within the watersheds listed in Table 4 must *develop* and implement the following phosphorus-specific *BMPs* in addition to the Croton Watershed Phase II TMDL Implementation Plan (January 2009) and the applicable requirements in Part VI. or Part VII, depending on the *MS4 Operator* type.

### 1. Mapping

In accordance with the timeframes listed below, the *MS4 Operator* must update, in geographic information system (GIS) format with a scale of 1:24,000 or finer, the comprehensive system mapping (Part IV.D.) to include:

a. Within three (3) years of the EDC, areas with potential to contribute phosphorus to the TMDL waterbody, which include:
   i. Retail and wholesale plant nurseries (including big box stores);
   ii. Commercial lawn care facilities;
   iii. Golf courses;
   iv. Commercial or industrial yard waste storage areas (e.g., yard waste composting and disposal areas); and
   v. *MS4* infrastructure with a history of issues (e.g., clogged infrastructure, infiltration and inflow (I/I)).

b. Within three (3) years of the EDC, the following information for all post-construction *SMPs* as identified in the post-construction *SMP* inventory (Part VI.E.2. or Part VII.E.2, depending on the *MS4 Operator* type):
   i. Type;[74] and
   ii. Ownership.

### 2. Public Education and Outreach on *Stormwater* Impacts

a. Within six (6) months of the EDC, the *MS4 Operator* must make available information on how the impairment is being addressed by implementation of the MS4 Operator's local law or legal mechanism with content equivalent to the model local law (Part IV.E.1 and Part IV.E.2.). *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

b. Following the completion of Part IX.A.1, twice a year, once from March to August and once from September to February, the *MS4 Operator* must provide educational messages with information specific to phosphorus to the applicable target audiences within the TMDL watershed focus area, identified in Part VI.A.1.b. or Part VII.A.1.b, depending on the MS4 Operator type. The *SWMP Plan* must be updated with changes made to public education and outreach program (Part VI.A. or Part VII.A, depending on the *MS4 Operator* type). *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

### 3. Public Involvement/Participation

No additional requirements.

[74] Post-construction *SMP* types are defined in the New York State Department of Environmental Conservation Maintenance Guidance: Stormwater Management Practices, March 31, 2017 (NYS DEC Maintenance Guidance 2017).

## 4. *Illicit Discharge* Detection and Elimination

### a. Inventory of Potential Phosphorus Sources

Following the completion of Part IX.A.1, within five (5) years of the EDC, the MS4 Operator must include on the *MS4 outfall* inventory (Part VI.C.1.c. or Part VII.C.1.c, depending on the MS4 Operator type) the number of each item identified in Part IX.A.1.a. for each associated *MS4 outfall*.

### b. On-site wastewater systems

The *MS4 Operator* must *develop*, implement, and enforce a program that ensures on-site wastewater systems (i.e., septic tanks, cesspools, absorption fields or distribution systems) are properly operated and do not contribute *pollutants* to the *MS4*. To ensure this, the *MS4 Operator* must:

i. Once every five (5) years, ensure that residential septic tanks/cesspools are pumped out and system components (i.e., septic tanks, cesspools and installed absorption field) are inspected;

ii. Ensure the following information is collected and document the completion of this requirement in the *SWMP Plan*:

   a) Individual performing inspection;

   b) Inspection date;

   c) Address;

   d) Location of system on property; and

   e) Evidence of failed systems.

iii. Refer failures to the appropriate agency to ensure corrective actions are taken; and

iv. Eliminate *illicit discharges* from on-site wastewater systems to the *MS4* in accordance with the time frames specified in Part VI.C.3. or Part VII.C.3, depending on the *MS4 Operator* type.

## 5. Construction Site *Stormwater* Runoff Control

a. The *MS4 Operator* must include construction projects that disturb between 5000 square feet (sf) and one (1) acre in the construction site runoff control program as described in Part VI.D. or Part VII.D, depending on the *MS4 Operator* type. Construction projects meeting this threshold are low priority construction sites.

b. The legal authority used to satisfy Part IV.E.2.b. must include the following language:

"Land activity is defined as *construction activity* including clearing, grading, excavating, soil disturbance or placement of fill that results in land disturbance of equal to or greater than 5000 sf and activities disturbing less

than 5000 sf of total land area that are part of a *larger common plan of development or sale* and will occur under one plan."

c. High priority construction sites must be inspected during active construction after the pre-construction meeting (Part VI.D.7. or Part VII.D.7, depending on the *MS4 Operator* type).

   i. If the *MS4 Operator* is completing the inspection, the construction site must be inspected every ninety (90) days; or

   ii. If the *MS4 Operator* utilizes the *qualified inspector's* weekly inspection reports, as required by the CGP, to satisfy this requirement, the *MS4 Operator* must inspect the construction site once every six (6) months, or sooner if any deficiencies are noted that require attention.

*MS4 Operators* must document the construction site inspections in the *SWMP Plan*.

### 6. Post-Construction *Stormwater* Management

a. The *MS4 Operator* must require the use of the Enhanced Phosphorus Removal design standards contained in Chapter 10 of the NYS SWMDM 2015 for all new development and redevelopment projects that disturb greater than or equal to one (1) acre and construction projects less than one acre that are part of a larger common plan of development or sale.

b. The legal authority used to satisfy Part IV.E. must also meet the following provisions:

   Land development activities requiring water quantity and quality controls (post-construction *stormwater* runoff controls) must include: "Single-family home construction located in the NYC East of Hudson watershed" and "Single-family residential subdivisions located in the NYC East of Hudson watershed."

c. Requirements for SWPPPs that include post-construction *stormwater* controls must include: "Post-construction *SMPs* in the SWPPP must be designed in conformance with Chapter 10 of the NYS SWMDM 2015 for Enhanced Phosphorus Removal Design Standards."

d. Performance Standards must include the following enhanced stabilization requirements: "For construction sites located in the NYC East of Hudson watershed, where soil disturbance activity has temporarily or permanently ceased, the application of soil stabilization measures must be initiated by the end of the next business day and completed within seven (7) days from the date the current soil disturbance activity ceased. The soil stabilization measures selected must be in conformance with the NYS E&SC 2016."

e. Inspections of land development activities during construction must include requirements for a *qualified inspector* to conduct two (2) site inspections every seven (7) calendar days for single-family homes, and single-family residential, subdivisions within the NYC East of Hudson watersheds.

f. *Retrofit* program

i. All *MS4 Operators* identified within the Croton Watershed Phase II TMDL Implementation Plan, January 2009, must continue to implement the *retrofit* program according to the following schedule:

a) Within one (1) year of the EDC, the *MS4 Operator* must submit to the *Department* a *retrofit* plan that identifies the following:

i) Project name;

ii) Location;

iii) Proposed *retrofit* type;

iv) Anticipated date for construction;

v) Estimated phosphorus reduction (using the criteria in the Croton Watershed Phase II TMDL Implementation Plan, January 2009); and

vi) Estimated total phosphorus reduction for all projects demonstrating they will meet the reduction specified in the Croton Watershed Phase II TMDL Implementation Plan, January 2009.

b) Within five (5) years of the EDC, all *retrofit* projects must be constructed to achieve the five (5) year phosphorus reduction assigned to the *MS4 Operator*, as required by the Croton Watershed Phase II TMDL Implementation Plan, January 2009.

ii. Annually, by December 31, *MS4 Operators* (or *RSE* representing *MS4 Operators* as described in Part III.B.2.b.) must submit to the *Department* any changes made to the *retrofit* plan including the information in Part IX.A.6.e.i.

iii. *MS4 Operators* must document the retrofit program in the *SWMP Plan* specifying:

a) Progress on *retrofit* projects already commenced; and

b) Identification of *retrofit* projects for the upcoming construction season; and

c) Certification that completed retrofit projects have been constructed in accordance with the *retrofit* plans.

## 7. Pollution Prevention/Good Housekeeping

a. Twice a year, once from March to August and once from September to February, all *catch basins* located in the TMDL watershed(s) must be inspected (Part VI.F.3.c. or Part VII.F.3.c, depending on the MS4 Operator type). *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

b. Following the completion of Part IX.A.1, annually, from April 1 through October 31, all streets located in the TMDL watershed(s) must be swept. *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*. This requirement is not applicable to:

   i. Uncurbed roads with no *catch basins*;

   ii. High-speed limited access highways;

   iii. Roads defined as interstates, freeways and expressways, or arterials by the United States Department of Transportation, Federal Highway Administration, Highway Functional Classification Concepts, Criteria and Procedures, 2013.

c. Within six (6) months of *MS4 outfall* inspection, the *MS4 Operator* must initiate actions to repair all *MS4 outfall* protection and/or bank stability problems identified during the inspection. Repairs must be completed in accordance with the NYS E&SC 2016. *MS4 Operators* must document the completion of this requirement in the *SWMP Plan.* Within thirty (30) days of inspection, the *MS4 Operator* must initiate all necessary maintenance and repair activities discovered for *municipally* owned or operated post-construction *SMPs*. *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

### 8. Planned Upgrades to *Municipal Facilities* in Watersheds to Impaired Waters

Incorporate, where feasible,[75] cost-effective runoff reduction techniques[76] during planned *municipal* upgrades including *municipal* right of ways (e.g., bioswales, green streets, porous pavement, replacement of closed drainage with grass swales, replacement of the existing islands in the parking lots with bioretention or curb cuts to route the flow through below-grade infiltration areas or other low-cost improvements that provide runoff treatment or reduction).

[75] Consideration of feasibility should include type of land use or *municipal operation*, suitability of soils, presence of utilities, potential for exacerbating existing contamination problems, safety issues, maintenance requirements, and expected lifespans of available technologies.

[76] Runoff reduction techniques can be found in Chapters 4 and 5 of the NYS SWMDM 2015.

## B. Other Phosphorus Impaired Watershed *MS4*s

| *Table 5. Other Phosphorus Impaired Watersheds* | | | |
|---|---|---|---|
| **Area where Requirements Apply** | **Greenwood Lake** | **Onondaga Lake** | **Oscawana Lake** |
| EPA Approved TMDL | *Impaired Waters Restoration Plan for Greenwood Lake – Total Maximum Daily Load for Total Phosphorus, Sept 2005* | *Updated Phosphorus Total Maximum Daily Load for Onondaga Lake, June 2012* | *Total Maximum Daily Load (TMDL) for Phosphorus in Lake Oscawana, September 2008* |
| Implementation Plan | Greenwood Lake Watershed Phosphorus TMDL Implementation Plan, October 2019 | None | None |
| *POC* | Phosphorus | | |
| Achievement of *Pollutant* Load Reduction | In accordance with Implementation Plan | In accordance with approved TMDL | In accordance with approved TMDL |

*MS4 Operators* located in the watersheds listed in Table 5 must *develop* and implement the following phosphorus-specific *BMPs* in addition to the applicable Implementation Plan and applicable requirements in Part VI. or Part VII, depending on the *MS4* Operator type:

### 1. Mapping

In accordance with the timeframes listed below, the *MS4 Operator* must update, in geographic information system (GIS) format with a scale of 1:24,000 or finer, the comprehensive system mapping (Part IV.D.) to include:

a. Within three (3) years of the EDC, include areas with potential to contribute phosphorus to the TMDL waterbody, which include:

   i. Retail and wholesale plant nurseries (including big box stores);

   ii. Commercial lawn care facilities;

   iii. Golf courses; and

   iv. Commercial or industrial yard waste storage areas (e.g., yard waste composting and disposal areas).

b. Within three (3) years of the EDC, include the following information for all post-construction *SMPs* as identified in the post-construction *SMP* inventory (Part VI.E.2. or Part VII.E.2, depending on the *MS4 Operator* type):

i. Type[77]; and

ii. Ownership.

## 2. Public Education and Outreach on Stormwater Impacts

a. Within six (6) months of the EDC, the *MS4 Operator* must make available information on any how the impairment is being addressed by implementation of the MS4 Operator's local law or legal mechanism with content equivalent to the model local law (Part IV.E.1 and Part IV.E.2.). *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

b. Following the completion of Part IX.B.1, twice a year, once from March to August and once from September to February, the *MS4 Operator* must provide educational messages with information specific to phosphorus to the applicable target audiences within the TMDL watershed focus area, identified in Part VI.A.1.b. or Part VII.A.1.b, depending on the MS4 Operator type. The *SWMP Plan* must be updated with changes made to public education and outreach program (Part VI.A. or Part VII.A, depending on the *MS4 Operator* type). *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

c. Twice a permit term, separated by a minimum of one (1) year, the *MS4 Operator* must educate residential on-site wastewater system users on the on-site wastewater inspection program described in Part IX.B.4.c and proper maintenance practices. The *SWMP Plan* must be updated with changes made to public education and outreach program (Part VI.A or Part VII.A, depending on the *MS4 Operator* type). *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

## 3. Public Involvement/Participation

No additional requirements.

## 4. *Illicit Discharge* Detection and Elimination

### a. Inventory of Potential Phosphorus Sources

Following the completion of Part IX.B.1, within five (5) years of the EDC, the MS4 Operator must include on the *MS4 outfall* inventory (Part VI.C.1.c. or Part VII.C.1.c, depending on the MS4 Operator type) the number of each item identified in Part VIII.B.1.a. for each associated MS4 outfall.

### b. On-site wastewater systems

The *MS4 Operator* (with the exclusion of *MS4 Operators* located in the Onondaga Lake watershed) must *develop*, implement, and enforce a program that ensures residential on-site wastewater systems (i.e., septic tanks,

[77] Post-construction *SMP* types are defined in the New York State Department of Environmental Conservation Maintenance Guidance: Stormwater Management Practices, March 31, 2017 (NYS DEC Maintenance Guidance 2017).

cesspools, absorption fields or distribution systems) are properly operated and do not contribute *pollutants* to the *MS4*. The *MS4 Operator* must:

i. Once every five (5) years, ensure that residential septic tanks/cesspools are pumped out and system components (i.e., septic tanks, cesspools and installed absorption field) are inspected;

ii. Ensure the following information is collected and document the completion of this requirement in the *SWMP Plan*:

a) Individual performing inspection;

b) Inspection date;

c) Address;

d) Location of system on property;

e) Inspection rating (pass/fail);

f) Evidence of failed systems;

iii. Refer failures to the appropriate agency to ensure corrective actions are taken; and

iv. Eliminate *illicit discharges* from on-site wastewater systems to the *MS4* in accordance with the time frames specified in Part VI.C.3. or Part VII.C.3, depending on the *MS4 Operator* type.

### 5. Construction Site *Stormwater* Runoff Control

High priority construction sites must be inspected during active construction after the pre-construction meeting (Part VI.D.7. or Part VII.D.7, depending on the *MS4 Operator* type).

a. If the *MS4 Operator* is completing the inspection, the construction site must be inspected every ninety (90) days; or

b. If the *MS4 Operator* utilizes the *qualified inspector's* weekly inspection reports, as required by the CGP, to satisfy this requirement, the *MS4 Operator* must inspect the construction site once every six (6) months, or sooner if any deficiencies are noted that require attention.

*MS4 Operators* must document the construction site inspections in the *SWMP Plan*.

### 6. Post Construction *Stormwater* Management

a. The *MS4 Operator* must require the use of the Enhanced Phosphorus Removal design standards contained in Chapter 10 of the NYS SWMDM 2015 for all new development and redevelopment projects within the listed watersheds.

b. The legal authority used to satisfy Part IV.E.2.b. must also include the following language requiring the use of the Enhanced Phosphorus Removal

Design Standards in accordance with the NYS SWMDM 2015 for the applicable watershed:

"Land development activities requiring water quantity and quality controls (post-construction *stormwater* runoff controls) must include: "Single-family home construction located in the <insert watershed name> watershed" and "Single-family residential subdivisions located in the <insert watershed name> watershed."

c. Requirements for SWPPPs that include post-construction *stormwater* controls must include: "Post-construction *SMPs* in the SWPPP must be designed in conformance with the Enhanced Phosphorus Removal Design Standards in the NYS SWMDM 2015."

d. Performance Standards must include the following enhanced stabilization requirements: "Where soil disturbance activity has temporarily or permanently ceased, the construction site is located in the <*insert watershed name*> watershed, the application of soil stabilization measures must be initiated by the end of the next business day and completed within seven (7) days from the date the current soil disturbance activity ceased. The soil stabilization measures selected must be in conformance with the Erosion Control Manual."

e. Inspections of land development activities during construction must include requirements for a *qualified inspector* to conduct two (2) site inspections every seven (7) calendar days for single-family homes and subdivisions within the <*insert watershed name*> watersheds.

f. *Retrofit* program

   i. All *MS4 Operators* identified within the Greenwood Lake Watershed Phosphorus TMDL Implementation Plan, October 2019, must continue to implement the *retrofit* program according to the following schedule:

      a) Within one (1) year of the EDC, the *MS4 Operator* must submit to the *Department* a *retrofit* plan that identifies the following:

         i) Project name;

         ii) Location;

         iii) Proposed *retrofit* type;

         iv) Anticipated date for construction;

         v) Estimated phosphorus reduction (using the criteria in the Greenwood Lake Watershed Phosphorus TMDL Implementation Plan, October 2019); and

         vi) Estimated total phosphorus reduction for all projects demonstrating they will meet the reduction specified in the Greenwood Lake Watershed Phosphorus TMDL Implementation Plan, October 2019.

      b) Within five (5) years of the EDC, all *retrofit* projects must be constructed to achieve the five (5) year phosphorus reduction assigned

to the *MS4 Operator*, as required by the Greenwood Lake Watershed Phosphorus TMDL Implementation Plan, October 2019.

ii. Annually, by December 31, *MS4 Operators* (or *RSE* representing *MS4 Operators* as described in Part III.B.2.b.) must submit to the *Department* any changes made to the *retrofit* plan including the information in Part IX.A.6.e.i.

iii. *MS4 Operators* must document the retrofit program in the *SWMP Plan* specifying:

a) Progress on *retrofit* projects already commenced; and

b) Identification of *retrofit* projects for the upcoming construction season; and

c) Certification that completed retrofit projects have been constructed in accordance with the *retrofit* plans.

### 7. Pollution Prevention/Good Housekeeping

Following the completion of Part IX.B.1:

a. Annually, from April 1 through October 31, all streets located in the TMDL watershed(s) must be swept. *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*. This requirement is not applicable to:

i. Uncurbed roads with no *catch basins*;

ii. High-speed limited access highways; or

iii. Roads defined as interstates, freeways and expressways, or arterials by the United States Department of Transportation, Federal Highway Administration, Highway Functional Classification Concepts, Criteria and Procedures, 2013.

b. Within six (6) months of *MS4 outfall* inspection, the *MS4 Operator* must initiate actions to repair all *MS4 outfall* protection and/or bank stability problems identified during the inspection. Repairs must be completed in accordance with the NYS E&SC 2016. *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

c. Within thirty (30) days of inspection, the *MS4 Operator* must initiate all necessary maintenance and repair activities discovered for *municipally* owned or operated post-construction *SMPs*. *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

### 8. Planned Upgrades to *Municipal Facilities* in Watersheds to Impaired Waters

Incorporate, where feasible,[78] cost-effective runoff reduction techniques[79] during planned *municipal* upgrades including *municipal* right of ways (e.g., bioswales, green streets, porous pavement, replacement of closed drainage with grass swales, replacement of the existing islands in the parking lots with bioretention or curb cuts to route the flow through below-grade infiltration areas or other low-cost improvements that provide runoff treatment or reduction).

## C. Pathogen Impaired Watersheds *MS4*s

No Pathogen TMDL requirements.

## D. Nitrogen Impaired Watershed *MS4*s

| ***Table 6. Nitrogen Impaired Watershed(s)*** | |
|---|---|
| **Area where Requirements Apply** | **Peconic** |
| EPA Approved TMDL | *TMDL for Nitrogen in the Peconic Estuary Program Study Area, Including Waterbodies Currently Impaired Due to Low Dissolved Oxygen: the Lower Peconic River and Tidal Tributaries; Western Flanders Bay and Lower Sawmill Creek; and Meetinghouse Creek, Terry Creek and Tributaries (September 2007)* |
| Implementation Plan | *TMDL for Nitrogen in the Peconic Estuary Program Study Area, Including Waterbodies Currently Impaired Due to Low Dissolved Oxygen: the Lower Peconic River and Tidal Tributaries; Western Flanders Bay and Lower Sawmill Creek; and Meetinghouse Creek, Terry Creek and Tributaries (September 2007)* |
| *POC* | Nitrogen |
| *Pollutant* Load Reduction | In accordance with approved TMDL |
| Waterbodies | Terrys Creek & Tributaries |
| | Meetinghouse Creek |
| | Western Flanders Bay & Lower Sawmill Creek |
| | Lower Peconic River and tidal tributaries |

[78] Consideration of feasibility should include type of land use or *municipal operation*, suitability of soils, presence of utilities, potential for exacerbating existing contamination problems, safety issues, maintenance requirements, and expected lifespans of available technologies.

[79] Runoff reduction techniques can be found in Chapters 4 and 5 of the NYS SWMDM 2015.

*MS4 Operators* located in the watersheds listed in Table 6 must *develop* and implement the following nitrogen-specific *BMPs* in addition to the applicable Implementation Plan and applicable requirements in Part VI. or Part VII, depending on the *MS4 Operator* type:

### 1. Mapping

Within three (3) years of the EDC, the *MS4 Operator* must update, in geographic information system (GIS) format with a scale of 1:24000 or finer, the comprehensive system mapping (Part IV.D.) to include:

a. Areas with potential to contribute nitrogen to the *TMDL* waterbody, which include:

   i. Retail and wholesale plant nurseries (including big box stores);

   ii. Commercial lawn care facilities;

   iii. Golf courses; and

   iv. Commercial or Industrial yard waste storage areas (e.g., yard waste composting and disposal areas).

b. Information for all post-construction *SMPs* as identified in the post-construction *SMP* inventory (Part VI.E.2. or Part VII.E.2, depending on the *MS4 Operator* type):

   i. Type;[80] and

   ii. Ownership of *SMP*.

### 2. Public Education and Outreach on *Stormwater* Impacts

a. Within six (6) months of the EDC, the *MS4 Operator* must make available information on any how the impairment is being addressed by implementation of the MS4 Operator's local law or legal mechanism with content equivalent to the model local law (Part IV.E.1 and Part IV.E.2.). *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

b. Following the completion of Part IX.D.1, twice a year, once from March to August and once from September to February, the *MS4 Operator* must provide educational messages with information specific to nitrogen to the applicable target audiences within the TMDL watershed focus area, identified in Part VI.A.1.b. or Part VII.A.1.b, depending on the MS4 Operator type. The *SWMP Plan* must be updated with changes made to public education and outreach program (Part VI.A. or Part VII.A, depending on the *MS4 Operator* type). *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

[80] Post-construction *SMP* types are defined in the New York State Department of Environmental Conservation Maintenance Guidance: Stormwater Management Practices, March 31, 2017 (NYS DEC Maintenance Guidance 2017).

### 3. Public Involvement/Participation

No additional requirements.

### 4. *Illicit Discharge* Detection and Elimination

Following the completion of Part IX.D.1, within five (5) years of the EDC, the MS4 Operator must include on the *MS4 outfall* inventory (Part VI.C.1.c. or Part VII.C.1.c, depending on the MS4 Operator type) the number of each item identified in Part VIII.D.1.a. for each associated MS4 outfall.

### 5. Construction Site *Stormwater* Runoff Control

High priority construction sites must be inspected during active construction after the pre-construction meeting (Part VI.D.7. or Part VII.D.7, depending on the *MS4 Operator* type).

a. If the *MS4 Operator* is completing the inspection, the construction site must be inspected every ninety (90) days; or

b. If the *MS4 Operator* utilizes the *qualified inspector's* weekly inspection reports, as required by the CGP, to satisfy this requirement, the *MS4 Operator* must inspect the construction site once every six (6) months, or sooner if any deficiencies are noted that require attention.

*MS4 Operators* must document the construction site inspections in the *SWMP Plan*.

### 6. Post-Construction *Stormwater* Management

The *MS4 Operator* must ensure on-site retention of the 1-year storm or greater from new development or redevelopment projects using runoff reduction techniques[81] selected from the NYS SWMDM 2015.

### 7. Pollution Prevention/Good Housekeeping

Following the completion of Part IX.D.1:

a. Annually, from April 1 through October 31, all streets located in the TMDL watershed(s) must be swept. *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*. This requirement is not applicable to:

   i. Uncurbed roads with no *catch basins*;

   ii. High-speed limited access highways; or

   iii. Roads defined as interstates, freeways and expressways, or arterials by the United States Department of Transportation, Federal Highway Administration, Highway Functional Classification Concepts, Criteria and Procedures, 2013.

[81] Runoff reduction techniques can be found in Chapters 4 and 5 of the NYS SWMDM 2015.

b. Within six (6) months of *MS4 outfall* inspection, the *MS4 Operator* must initiate actions to repair all *MS4 outfall* protection and/or bank stability problems identified during the inspection. Repairs must be completed in accordance with the NYS E&SC 2016. *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

c. Within thirty (30) days of inspection, the *MS4 Operator* must initiate all necessary maintenance and repair activities discovered for *municipally* owned or operated post-construction *SMPs*. *MS4 Operators* must document the completion of this requirement in the *SWMP Plan*.

### 8. Planned Upgrades to *Municipal Facilities* in Watersheds to Impaired Waters

Incorporate, where feasible,[82] cost-effective runoff reduction techniques[68] during planned *municipal* upgrades including *municipal* right of ways (e.g., bioswales, green streets, porous pavement, replacement of closed drainage with grass swales, replacement of the existing islands in the parking lots with bioretention or curb cuts to route the flow through below-grade infiltration areas or other low-cost improvements that provide runoff treatment or reduction).

[82] Consideration of feasibility should include type of land use or *municipal operation*, suitability of soils, presence of utilities, potential for exacerbating existing contamination problems, safety issues, maintenance requirements, and expected lifespans of available technologies.

# Part X. Standard Permit Conditions

For the purposes of this *SPDES* general permit, examples of contractors and subcontractors include:

## A. Duty to Comply

The owner/operator, and all contractors or subcontractors, must comply with all terms and conditions of this *SPDES* general permit. Any non-compliance with the terms and conditions of this *SPDES* general permit constitutes a violation of the New York State Environmental Conservation Law, and its implementing regulations, and is grounds for enforcement action. Filing of a request for transfer or termination of coverage under this *SPDES* general permit, or a notification of planned changes or anticipated non-compliance, does not limit, diminish or stay compliance with any terms and conditions of this *SPDES* general permit.

## B. Need to Halt or Reduce Activity is Not a Defense

The necessity to halt or reduce the activity regulated by this *SPDES* general permit, in order to maintain compliance with the conditions of this *SPDES* general permit, shall not be a defense in an enforcement action.

## C. Penalties

There are substantial criminal, civil, and administrative penalties associated with violating the terms and conditions of this *SPDES* general permit. Fines of up to $37,500 per day for each violation and imprisonment for up to fifteen (15) years may be assessed depending upon the nature and degree of the offense.

## D. False Statements

Any person who knowingly makes any false material statement, representation, or certification in any application, record, report or other document filed or required to be maintained under this *SPDES* general permit, including monitoring reports or reports of compliance or noncompliance shall, upon conviction, be punished in accordance with New York State Environmental Conservation Law §71-1933 and or New York State Penal Law Articles 175 and 210.

## E. Reopener Clause

Upon issuance of this *SPDES* general permit, a determination has been made on the basis of a submitted Notice of Intent, plans, or other available information, that compliance with the specified general permit terms and conditions will reasonably protect classified water use and assure compliance with applicable *water quality standards*. Satisfaction of the conditions of this *SPDES* general permit notwithstanding, if operation pursuant to this *SPDES* general permit causes or contributes to a condition in contravention of State *water quality standards* or guidance values, or if the *Department* determines that a modification is necessary to prevent impairment of the best use of the waters or to assure maintenance of *water*

*quality standards* or compliance with other provisions of New York State Environmental Conservation Law Article 17 or the Clean Water Act, or any regulations adopted pursuant thereto, the *Department* may require such modification and the Commissioner may require abatement action to be taken by the owner/operator and may also prohibit such operation until the modification has been implemented.

## F. Duty to Mitigate

The owner/operator, and its contractors and subcontractors, shall take all reasonable steps to minimize or prevent any *discharge* in violation of this *SPDES* general permit which has a reasonable likelihood of adversely affecting human health or the environment.

## G. Requiring Another General Permit or Individual *SPDES* Permit

The *Department* may require any discharger authorized to *discharge* in accordance with this *SPDES* general permit to apply for and obtain an individual *SPDES* permit or apply for authorization to *discharge* in accordance with another general permit.

(1) Cases where an individual *SPDES* permit or authorization to *discharge* in accordance with another general permit may be required include, but is not limited to the following:

(i) the discharger is not in compliance with the conditions of this *SPDES* general permit or does not meet the criteria for coverage under this *SPDES* general permit;

(ii) a change has occurred in the availability of demonstrated technology or practices for the control or abatement of *pollutants* applicable to the point source;

(iii) new effluent limitation guidelines or new source performance standards are promulgated that are applicable to point sources authorized to *discharge* in accordance with this *SPDES* general permit;

(iv) existing effluent limitation guidelines or new source performance standards that are applicable to point sources authorized to *discharge* in accordance with this *SPDES* general permit are modified;

(v) a water quality management plan containing requirements applicable to such point sources is approved by the *Department*;

(vi) circumstances have changed since the time of the request to be covered so that the discharger is no longer appropriately controlled under this *SPDES* general permit, or either a temporary or permanent reduction or elimination of the authorized *discharge* is necessary;

(vii) the *discharge* is in violation of section 17-0501 of the New York State Environmental Conservation Law;

(viii) the *discharge*(s) is a significant contributor of *pollutants*. In making this determination, the *Department* may consider the following factors:

(a) the location of the *discharge*(s) with respect to waters of New York State;
(b) the size of the *discharge*(s);
(c) the quantity and nature of the *pollutants discharged* to waters of New York State; and
(d) other relevant factors including compliance with other provisions of New York State Environmental Conservation Law Article 17, or the Clean Water Act.

(1) When the *Department* requires any discharger authorized by this *SPDES* general permit to apply for an individual *SPDES* permit as provided for in this subdivision, it shall notify the discharger in writing that a permit application is required. This notice shall include a brief statement of the reasons for this decision, an application form, a statement setting a time for the owner/operator to file the application for an individual *SPDES* permit, and a deadline, not sooner than 180 days from the owner/operator's receipt of the notification letter, whereby the authorization to discharge under this *SPDES* general permit shall be terminated. The *Department* may grant additional time upon demonstration, to the satisfaction of the Regional Water Engineer, that additional time to apply for an alternative authorization is necessary or where the *Department* has not provided a permit determination in accordance with 6 NYCRR Part 621.

(2) When an individual *SPDES* permit is issued to a discharger authorized to *discharge* under this *SPDES* general permit for the same *discharge*(s), this *SPDES* general permit authorization for outfalls authorized under the individual *SPDES* permit is automatically terminated on the effective date of the individual *SPDES* permit unless termination is earlier in accordance with 6 NYCRR Part 750.

## H. Duty to Provide Information

The owner/operator shall furnish to the *Department*, within five (5) business days, unless otherwise set forth by the *Department*, any information that the *Department* may request to determine whether cause exists to determine compliance with this *SPDES* general permit or to determine whether cause exists for requiring an individual *SPDES* permit in accordance with 6 NYCRR 750-1.21l (see G. Requiring Another General Permit or Individual Permit). The owner/operator shall make available to the *Department*, for inspection and copying, or furnish to the *Department* within 25 business days of receipt of a *Department* request for such information, any information retained in accordance with this *SPDES* general permit. Where the owner/operator becomes aware that it failed to submit any relevant facts on the Notice of Intent, or submitted incorrect information in a Notice of Intent or in any report to the *Department*, the owner/operator shall promptly submit such facts or corrected information to the *Department*.

## I. Extension

In the event a new *SPDES* general permit is not issued prior to the expiration of this *SPDES* general permit, and this *SPDES* general permit is extended pursuant to the State Administrative Procedure Act and 6 NYCRR Part 621, then the owner/operator

with coverage under this *SPDES* general permit may continue to operate and *discharge* in accordance with the terms and conditions of this *SPDES* general permit until a new *SPDES* general permit is issued.

## J. Signatories and Certification

The Notice of Intent, Notice of Termination and reports required by this *SPDES* general permit shall be signed as provided in 40 CFR §122.22

(a) All Notices of Intent and Notices of Termination shall be signed as follows:

(1) For a corporation. By a responsible corporate officer. For the purpose of this section, a responsible corporate officer means:

(i) A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or

(ii) The manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for Notice of Intent or Notice of Termination requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

Note: The *Department* does not require specific assignments or delegations of authority to responsible corporate officers identified in 40 CFR §122.22(a)(1)(i). The *Department* will presume that these responsible corporate officers have the requisite authority to sign the Notice of Intent or Notice of Termination unless the corporation has notified the *Department* to the contrary. Corporate procedures governing authority to sign a Notice of Intent or Notice of Termination may provide for assignment or delegation to applicable corporate positions under 40 CFR §122.22(a)(1)(ii) rather than to specific individuals.

(2) For a partnership or sole proprietorship. By a general partner or the proprietor, respectively; or

(3) For a *municipality*, State, Federal, or other public agency. By either a principal executive officer or ranking elected official. For purposes of this section, a principal executive officer of a Federal agency includes:

(i) The chief executive officer of the agency, or

(ii) A senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrators of EPA).

(b) All reports required by this *SPDES* general permit, and other information requested by the *Department* shall be signed by a person described in paragraph (a) of this section, or by a duly authorized representative of that person. A person is a duly authorized representative only if:
(1) The authorization is made in writing by a person described in (a);
(2) The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company (A duly authorized representative may thus be either a named individual or any individual occupying a named position.), and
(3) The written authorization is submitted to the *Department*.

(c) Changes to authorization. If an authorization under (b) is no longer accurate because a different individual or position has responsibility for the overall operation of the facility or activity, a new authorization satisfying the requirements of (b) must be submitted to the *Department* prior to or together with any reports, information, or applications to be signed by an authorized representative.

(d) Certification. Any person signing a document under (a) or (b) shall make the following certification:

*I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.*

(e) Electronic reporting. If documents described in (a) or (b) are submitted electronically by or on behalf of the activity with coverage under this *SPDES* general permit, any person providing the electronic signature for such documents shall meet all relevant requirements of this section, and shall ensure that all of the relevant requirements of 40 CFR Part 3 (including, in all cases, subpart D to Part 3) (Cross-Media Electronic Reporting) and 40 CFR Part 127 (NPDES Electronic Reporting Requirements) are met for that submission.

## K. Inspection & Entry

The owner/operator shall allow the *Department*, the USEPA Regional Administrator, the applicable county health department, or any authorized representatives of those entities, upon the presentation of credentials and other documents as may be required by law, to:

(a) enter upon the owner/operator's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this *SPDES* general permit;
(b) have access to and copy, at reasonable times, any records that must be kept under the conditions of this *SPDES* general permit, including records required to be maintained for purposes of operation and maintenance;
(c) inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this *SPDES* general permit;
(d) sample or monitor at reasonable times, for the purposes of assuring *SPDES* general permit compliance or as otherwise authorized by the Clean Water Act or New York State Environmental Conservation Law, any substances or parameters at any location; and
(e) enter upon the property of any contributor to the regulated facility or activity under authority of the owner/operator.

## L. Confidentiality of Information

The following shall not be held confidential: this *SPDES* general permit, the fact sheet for this *SPDES* general permit, the name and address of any owner/operator, effluent data, the Notice of Intent, and information regarding the need to obtain an individual permit or an alternative general permit. This includes information submitted on forms themselves and any attachments used to supply information required by the forms (except information submitted on usage of substances). Upon the request of the owner/operator, the *Department* shall make determinations of confidentiality in accordance with 6 NYCRR Part 616, except as set forth in the previous sentence. Any information accorded confidential status shall be disclosed to the Regional Administrator upon his or her written request. Prior to disclosing such information to the Regional Administrator, the *Department* will notify the Regional Administrator of the confidential status of such information.

## M. Other Permits May Be Required

Nothing in this *SPDES* general permit relieves the owner/operator from a requirement to obtain any other permits required by law.

## N. Property Rights

Coverage under this *SPDES* general permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations, nor does it obviate the necessity of obtaining the assent of any other jurisdiction as required by law for the *discharge* authorized.

## O. Compliance with Interstate Standards

If the activity covered by this *SPDES* general permit originates within the jurisdiction of an interstate water pollution control agency, then the activity must also comply

with any applicable effluent standards or *water quality standards* promulgated by that interstate agency and as set forth in this *SPDES* general permit for such activities.

## P. Oil & Hazardous Substance Liability

Coverage under this *SPDES* general permit does not affect the imposition of responsibilities upon, or the institution of any legal action against, the owner or operator under section 311 of the Clean Water Act, which shall be in conformance with regulations promulgated pursuant to section 311 governing the applicability of section 311 of the Clean Water Act to *discharges* from facilities with NPDES permits, nor shall such issuance preclude the institution of any legal action or relieve the owner or operator from any responsibilities, liabilities, or penalties to which the owner or operator is or may be subject pursuant to the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. section 9601 et seq. (CERCLA).

## Q. Severability

The provisions of this *SPDES* general permit are severable, and if any provision of the permit, or the application of any provision of the permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of the permit, shall not be affected thereby.

# Appendix A. Acronyms and Definitions

## Acronym List

BMP – Best Management Practice

CFR – Code of Federal Regulations

CGP – SPDES General Permit for Stormwater from Construction Activities, GP-0-20-001

CWA – Clean Water Act

ECL – Environmental Conservation Law

EDC – Effective Date of Coverage

EDP– Effective Date of the Permit

eNOI – Electronic Notice of Intent

EPCRA - Emergency Planning and Community Right-To-Know Act

ERP – Enforcement Response Plan

IDDE – Illicit Discharge Detection and Elimination

MCM – Minimum Control Measure

MS4 – Municipal Separate Storm Sewer System

MS4 GP – SPDES General Permit for Stormwater Discharges from the Municipal Separate Storm Sewer Systems, GP-0-24-001

MSGP – SPDES Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity, GP-0-23-001

NOI – Notice of Intent

NPDES – National Pollutant Discharge Elimination System

NYCRR – New York Codes, Rules and Regulations

NYS DEC – New York State Department of Environmental Conservation

O&M – Operations and Maintenance

ORI – Outfall Reconnaissance Inventory

POC – Pollutant of Concern

RSE – Regional Stormwater Entity

SPDES – State Pollutant Discharge Elimination System

SMP – Stormwater Management Practice

SWMP – Stormwater Management Program

SWMP Plan – Stormwater Management Program Plan

SWPPP – Stormwater Pollution Prevention Plan

TMDL – Total Maximum Daily Load

USEPA – United States Environmental Protection Agency

## Definitions

All definitions in this section are solely for the purposes of this permit. If a word is not defined below, use it how it is commonly defined.

**Additionally Designated Areas** – those areas that meet the additional designation criteria, Designation Criteria for Identifying Regulated Municipal Separate Storm Sewer Systems (*MS4*s), January 2010, revised January 2023 and found in Appendix B.

**Additionally Designated Area MS4 Outfall (ADA MS4 outfall)** – any point of *stormwater discharge* from pipes, ditches, and swales, as well as other points of concentrated flow*,* to impaired waters listed in Appendix C from an *MS4 Operator's MS4*. Areas of *sheet flow* which drain to impaired waters listed in Appendix C are not considered *ADA MS4 outfalls.*

**Automatically Designated Areas** – those areas served by *MS4*s that meet the automatic designation criteria, Designation Criteria for Identifying Regulated Municipal Separate Storm Sewer Systems (*MS4*s), January 2010, revised January 2023 and found in Appendix B.

**Best Management Practice (BMP)** – schedules of activities, practices, and prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the state. BMPs also include treatment requirements, operating procedures, and practices to control runoff, spillage and leaks, sludge or waste disposal, or drainage from areas that could contribute pollutants to *stormwater discharges*.

**Catch Basin(s)** – a cistern, vault, chamber, or well that is part of the MS4 and designed to capture trash, sediment, and/or debris in its *sump*.

**Construction Activity(ies)** – any clearing, grading, excavation, demolition or stockpiling activity that results in soil disturbance. Clearing activities can include but are not limited to logging equipment operation, the cutting and skidding of trees, stump removal and/or brush root removal. *Construction activity* does not include routine maintenance that is performed to maintain the original line and grade, hydraulic capacity, or original purpose of a facility.

**Department** – the New York State *Department* of Environmental Conservation as well as meaning the *Department*'s designated agent.

**Develop (Developed)** – for *MS4 Operators* continuing coverage, *develop* means to continue to implement their current SWMP and update the SWMP to comply with the permit requirement; for newly designated *MS4 Operators*, *develop* means to create that permit requirement.

**Discharge (Discharging)** – any addition of any pollutant to *surface waters of the State* through an outlet or point source (6 NYCRR 750-1.2(a)(28)).

**Dry Weather** – prolonged dry periods (at least 48 hours after the last runoff event).

**Groundwater** – waters in the saturated zone. The saturated zone is a subsurface zone in which all the interstices are filled with water under pressure greater than that of the atmosphere. Although the zone may contain gas-filled interstices or interstices filled with fluids other than water, it is still considered saturated.

**Illicit Discharge** – any *discharge* into an *MS4* that is not entirely composed of *stormwater*, except those identified in Part I.A.3. Examples of *illicit discharges* are non-permitted sanitary sewage, garage drain effluent, and waste motor oil. However, an *illicit discharge* could be any other non-permitted discharge which the *MS4 Operator* or *Department* has determined to be a substantial contributor of pollutants to the *MS4*. *Illicit discharges* can occur throughout the *MS4*, including at post-construction *SMPs*.

**Industrial Activity** – the eleven (11) categories of industrial activities included in the definition of "*stormwater discharges* associated with industrial activity," as defined in 40 CFR 122.26(b)(14)(i)-(ix) and (xi).

**Interconnection** – any point of *stormwater discharge* from pipes, ditches, and swales, as well as other points of concentrated flow*,* where the *MS4 Operator*'s *MS4* is *discharging* to another *MS4* or private storm sewer system. Areas of *sheet flow* which drain to another *MS4* or private storm sewer system are not considered *interconnections*.

**Intermittent Discharge** – a *discharge* which occurs over a shorter period of time (e.g., a few hours per day or a few days per year) (CWP 2004).

**Larger Common Plan of Development or Sale** – a contiguous area where multiple separate and distinct *construction activities* are occurring, or will occur, under one plan. The term **"**plan" in "larger common plan of development or sale" is broadly defined as any announcement or piece of documentation (including a sign, public notice or hearing, sales pitch, advertisement, drawing, permit application, State Environmental Quality Review Act Application, zoning request, computer design, etc.) or physical demarcation (including boundary signs, lot stakes, surveyor markings, etc.) indicating that *construction activities* may occur on a specific plot.

For discrete construction projects that are located within a *larger common plan of development or sale* that are at least 1/4 mile apart, each project can be treated as a separate plan of development or sale provided any interconnecting road, pipeline or utility project that is part of the same "common plan" is not concurrently being disturbed.

**MS4 Operator** – the person, persons, or legal entity that obtains coverage and is responsible for the *MS4*.

**MS4 Outfall** – any point of *stormwater discharge* from pipes, ditches, and swales, as well as other points of concentrated flow*,* to *surface waters of the State* from an *MS4 Operator's MS4*. Areas of *sheet flow* which drain to *surface waters of the State* are not considered *MS4 outfalls.*

**Municipal (Municipally)** – a county, town, city, village, district corporation, special improvement district, sewer authority or agency thereof. Examples of other public entities that are included in this program include State University Campuses, federal and State prisons, State and federal hospitals, Dormitory Authorities, public housing authorities, school and other special districts.

**Municipal Facility** – an *MS4 Operator* owned and/or operated facility with the potential to *discharge* pollutants to the *MS4* and/or *surface water of the State* of the State.

**Municipal Facility Intraconnection** – any point where stormwater is conveyed from the MS4 Operator's municipal facility to the MS4 Operator's own MS4. This is the most down-drainage end of the MS4 infrastructure located on the municipal facility prior to discharge to the MS4.

**Municipal Operations (Operations)** – activities conducted by the MS4 Operator with the potential to discharge pollutants to the *MS4* and/or *surface water of the State*.

**Municipal Separate Storm Sewer System (*MS4*)** – a conveyance or system of conveyances (including roads with drainage systems, *municipal* streets, *catch basins*, curbs, gutters, ditches, man-made channels, or storm drains):

1. owned or operated by a State, city, town, village, borough, county, parish, district, association, or other public body (created by or pursuant to State law) having jurisdiction over disposal of sewage, industrial wastes, *stormwater*, or other wastes, including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the CWA, that *discharges* to *surface waters of the State*;
2. designed or used for collecting or conveying *stormwater*;
3. which is not a combined sewer; and
4. which is not part of a Publicly Owned Treatment Works (POTW) as defined at 40 CFR 122.2.

**National Pollutant Discharge Elimination System** – the national system for the issuance of wastewater and *stormwater* permits under the Federal Water Pollution Control Act (Clean Water Act).

**No Exposure** – all industrial materials or activities are protected by a storm-resistant shelter to prevent exposure to rain, snow, snowmelt, and/or runoff.

**Non-traditional MS4 Operators**– state, federal, county and other publicly owned properties such as state university campuses, prisons, office complexes, hospitals, military installations public housing authorities, school and other special districts.

**Obvious Illicit Discharge** –an *illicit discharge* from a flowing *MS4 outfall* that does not require sample collection for confirmation; this references the Monitoring Locations Inspection and Sampling Field Sheet, adapted from CWP 2004, Section 6: Overall Outfall Characterization.

**Physical Indicator Present in the Flow** – a sensory indicator present in the *discharge* from *monitoring location* including odor, color, turbidity and floatables; this references the Monitoring Locations Inspection and Sampling Field Sheet, adapted from CWP 2004, Section 4: Physical Indicators for Flowing Monitoring Locations Only.

**Physical Indicator not Related to Flow** – an indicator of past *discharges*, potentially *intermittent* or *transitory discharge,* including *monitoring location* damage, *monitoring location* deposits or stains, abnormal vegetation growth, poor pool quality or pipe benthic growth; this references the Monitoring Locations Inspection and Sampling Field Sheet, adapted from CWP 2004, Section 5: Physical Indicators for Both Flowing and Non-Flowing Monitoring Locations. These physical indicators can be present at both flowing and non-flowing monitoring locations.

**Pollutant** – dredged spoil, filter backwash, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand and industrial, *municipal*, agricultural waste and ballast *discharged* into water; which may cause or might reasonably be expected to cause pollution of the waters of the State in contravention of the standards or guidance values adopted as provided in Parts 700 et seq of this Title. For the purposes of this *SPDES* general permit, relevant pollutants include, but are not limited to, nitrogen, phosphorus, chloride, silt and sediment, pathogens, herbicides/pesticides, floatables, petroleum hydrocarbons, heavy metals, and polycyclic aromatic hydrocarbons (PAHs).

**Pollutant of Concern (POC)** – a pollutant causing the impairment of an impaired water segment with an approved TMDL and/or listed in Appendix C, including phosphorus, silt/sediment, pathogens, nitrogen, and floatables.

**Privately Owned/Operated** – not owned/operated by the *MS4 Operator* or another *MS4 Operator*.

**Publicly Owned/Operated** – owned/operated by the *MS4 Operator.*

**Qualified Inspector** – a person who is knowledgeable in the principles and practices of erosion and sediment control, such as a licensed Professional Engineer, Certified Professional in Erosion and Sediment Control (CPESC), Registered Landscape Architect, or other *Department* endorsed individual(s).

It can also mean someone working under the direct supervision of, and at the same company as, the licensed Professional Engineer or Registered Landscape Architect, provided that person has training in the principles and practices of erosion and sediment control. Training in the principles and practices of erosion and sediment control means that the individual working under the direct

supervision of the licensed Professional Engineer or Registered Landscape Architect has received four (4) hours of *Department* endorsed training in proper erosion and sediment control principles from a Soil and Water Conservation District, or other *Department* endorsed entity. After receiving the initial training, the individual working under the direct supervision of the licensed Professional Engineer or Registered Landscape Architect must receive four (4) hours of training every three (3) years.

It can also mean a person that meets the *qualified professional* qualifications in addition to the *qualified inspector* qualifications.

Note: Inspections of any post-construction *SMPs* that include structural components, such as a dam for an impoundment, must be performed by a licensed Professional Engineer.

**Qualified Professional** – a person who is knowledgeable in the principles and practices of *stormwater* management and treatment, such as a licensed Professional Engineer, Registered Landscape Architect, or other *Department* endorsed individual(s). Individuals preparing SWPPPs that require the post-construction *SMP* component must have an understanding of the principles of hydrology, water quality management practice design, water quantity control design, and, in many cases, the principles of hydraulics in order to prepare a SWPPP that conforms to the *Department's* technical standard. All components of the SWPPP that involve the practice of engineering, as defined by the NYS Education Law (see Article 145), must be prepared by, or under the direct supervision of, a professional engineer licensed to practice in the State of New York.

**Qualifying Storm Event** – a storm event with at least 0.1 inch of precipitation, providing the interval from the preceding measurable storm is at least 72 hours. The 72-hour storm interval is waived if the preceding measurable storm did not result in a *stormwater discharge* (e.g., a storm events in excess of 0.1 inches may not result in a *stormwater discharge* at some facilities), or if the *MS4 Operator* is able to document that less than a 72-hour interval is representative for local storm events during the sampling period.

**Regional Stormwater Entity (RSE) –** an organization made up of multiple cooperating regulated and/or nonregulated entities located in the same geographical region of the State who share resources to improve overall *stormwater* management in their area.

**Retrofit** – to modify or add to existing *stormwater* infrastructure for the purpose of reducing pollutant loadings.

**Sheet Flow** – *stormwater* runoff flowing in a thin layer over the ground surface.

**Sizing Criteria** – the criteria included in the CGP that are used to size post-construction *stormwater* management control practices. The criteria include; Water Quality Volume (WQv), Runoff Reduction Volume (RRv), Channel Protection Volume (Cpv), Overbank Flood (Qp), and Extreme Flood (Qf).

**State Pollutant Discharge Elimination System** (SPDES) – the system established pursuant to Article 17 of the ECL and 6 NYCRR Part 750 for issuance of permits authorizing *discharges* to the waters of the State.

**Stormwater** – that portion of precipitation that, once having fallen to the ground, is in excess of the evaporative or infiltrative capacity of soils, or the retentive capacity of surface features, which flows or will flow off the land by surface runoff to waters of the State.

**Stormwater Hotspots** - a land use or activity that generates higher concentrations of hydrocarbons, trace metals or toxicants than are found in typical *stormwater* runoff, based on monitoring studies. For further detail, see Section 4.11 of the NYS SWMDM 2015.

**Stormwater Management Practices (SMPs)** – measures, either structural or nonstructural, that are constructed as part of new development or redevelopment projects and are intended to capture, treat, reduce and/or retain *stormwater* runoff.

**Stormwater Management Program (SWMP)** – the program *developed* and implemented by the *MS4 Operator* which provides a comprehensive integrated planning approach involving public participation and, where necessary, intergovernmental coordination, to reduce the *discharge* of POCs and specified pollutants to the *MEP*, using management practices, control techniques and systems, design and engineering methods, and other appropriate provisions. *MS4 Operators* are required at a minimum to *develop*, implement, and enforce a *SWMP* designed to address POCs and reduce the *discharge* of pollutants from the *MS4* to the *MEP*, to protect water quality, and to satisfy the appropriate water quality requirements of the ECL and the Clean Water Act. The *SWMP* must address all permit requirements in this *SPDES* general permit.

**Stormwater Management Program Plan (SWMP Plan)** – is used by the *MS4 Operator* to document and detail the activities and measures that will be implemented to meet the terms and conditions of this *SPDES* general permit. The *SWMP Plan* must be updated during the permit term as the *MS4 Operator's* activities are modified to meet permit conditions. The *SWMP Plan* can be hardcopy or digital.

**Storm-sewershed (sewershed**) – the catchment that drains to a waterbody based on the *MS4* and surface topography. Adjacent catchment areas that drain to the same waterbody are not separate storm-*sewersheds*.

**Sump –** the part of the *catch basin* between the bottom interior of the *catch basin* and the invert of the deepest outlet of the *catch basin*.

**Surface Water(s) of the State** – must be construed to include lakes, bays, sounds, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, marshes, inlets, canals, the Atlantic ocean within the territorial seas of the state of New York and all other bodies of surface water, natural or artificial, inland or coastal, fresh or salt, public or private (except those private waters that

do not combine or effect a junction with natural surface or underground waters), which are wholly or partially within or bordering the state or within its jurisdiction.

Waters of the state are further defined in 6 NYCRR Parts 800 to 941. Storm sewers are not waters of the state unless they are classified in 6 NYCRR Parts 800 to 941. Nonetheless, a *discharge* to a storm sewer must be regulated as a *discharge* at the point where the storm sewer *discharges* to waters of the state.

**Suspect Illicit Discharge** – an *illicit discharge* from flowing monitoring locations with high severity (score of 3) on one or more physical indicators based on the relative severity index of physical indicators for flowing *MS4 outfall*s only; this references the Monitoring Locations Inspection and Sampling Field Sheet, adapted from CWP 2004, Section 6: Overall Outfall Characterization.

**Total Maximum Daily Load (TMDL)** – the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. It is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources. A TMDL stipulates Waste Load Allocations (WLA) for point source *discharges*, Load Allocations (LA) for nonpoint sources, and a margin of safety (MOS).

**Traditional Land Use Control *MS4 Operators*** – a city, town, or village with land use control authority.

**Traditional Non-land Use Control *MS4 Operators*** – any county agency without land use control.

**Transitory Discharge** – a *discharge* which occurs rarely, usually in response to a singular event such as an industrial spill, ruptured tank, sewer break, transport accident or illegal dumping episode (CWP 2004).

**Water Quality Standard** – such measures of purity or quality for any waters in relation to their reasonable and necessary use as promulgated in 6 NYCRR Part 700 et seq.

# Appendix B. Designation Criteria for Identifying Regulated *Municipal Separate Storm Sewer Systems* (*MS4*s), January 2010, revised January 2023

The universe of small *municipal* separate storm sewer systems (*MS4*s) is quite large. However, only a sub-set of small *MS4*s, referred to as "regulated" small *MS4*s, are covered by the Federal *stormwater* regulations. A small *MS4* can be designated as a regulated *MS4* through *automatic designation* by the USEPA or by meeting designation criteria developed by the NPDES permitting authority, the New York State Department of Environmental Conservation (*Department*) in New York State.

Automatic Designation Criteria Required by USEPA

The USEPA's automatic designation criteria are based strictly on population and density. An area is *automatically designated* if the population is at least 50,000 and has an overall population density of at least 1,000 people per square mile based on the 2000 and 2010 censuses.

Additional Designation Criteria

The USEPA requires the *Department* to develop a set of criteria for *additionally designated areas*. The following criteria, using a combination of population and environmental factors, have been adopted to designate additional *MS4*s in NYS.

Criterion 1: *MS4*s *discharging* to waters for which an USEPA-approved Total Maximum Daily Load (TMDL) requires reduction of a *pollutant of concern* beyond what can be achieved with existing programs (and the area is not already covered under automatic designation).

Criterion 2: *MS4*s, contiguous to *automatically designated areas* (municipal lines), that *discharge* to sensitive waters classified as AA-Special (fresh surface waters), AA (fresh surface waters) with filtration avoidance determination or SA (saline surface waters).

Criterion 3: *Automatically designated areas* are extended to town, village, or city boundaries, but only for town, village or city implementation of minimum control measure 4 construction site stormwater runoff control and minimum control measure 5 post-construction stormwater management in development and redevelopment. This additional designation may be waived, by written request to the *Department*, where the *automatically designated area* is a small portion of the total area of the town, village or city (less than 15 %) and where there is little or no *construction activity* in the area outside of the *automatically designated area* (less than 5 disturbed acres per year).

# Appendix C. List of Impaired Waters

NOTES FOR THE TABLE BELOW:

1. *MS4 Operators* must implement Part VIII.A. Pollutant Specific BMPs for Phosphorus for waterbodies with the pollutant listed as "phosphorus."
2. *MS4 Operators* must implement Part VIII.B. Pollutant Specific BMPs for Silt/Sediment for waterbodies with the pollutant listed as "silt/sediment."
3. *MS4 Operators* must implement Part VIII.C. Pollutant Specific BMPs for Pathogens for waterbodies with the pollutant listed as "pathogens" or "fecal coliform."
4. *MS4 Operators* must implement Part VIII.D. Pollutant Specific BMPs for Nitrogen for waterbodies with the pollutant listed as "nitrogen" or "ammonia."
5. *MS4 Operators* must implement Part VIII.E. Pollutant Specific BMPs for Floatables for waterbodies with the pollutant listed as "garbage & refuse," "oil/grease," or "oil & floating substances."

| County | Waterbody Inventory/Priority Waterbody List Name (WI/PWL Number) | Pollutant |
|---|---|---|
| Albany | Ann Lee (Shakers) Pond, Stump Pond (1201-0096) | Phosphorus |
| Bronx | Bronx River, Lower (1702-0006) 18 | Fecal Coliform |
| Bronx | Bronx River, Lower (1702-0006) 18 | Garbage & Refuse |
| Bronx | Bronx River, Middle, and tribs (1702-0106) 18 | Fecal Coliform |
| Bronx | Bronx River, Middle, and tribs (1702-0106) 18 | Garbage & Refuse |
| Bronx | Hutchinson River, Lower, and tribs (1702 0003) 18 | Garbage & Refuse |
| Bronx | Long Island Sound, Western Portion (1702-0027) | Nitrogen |
| Bronx | Van Cortlandt Lake (1702-0008) | Phosphorus |
| Bronx | Westchester Creek (1702-0012) 18 | Garbage & Refuse |
| Broome | Minor Tribs to Lower Susquehanna (0603-0044) | Phosphorus |
| Chautauqua | Chadakoin River and tribs (0202-0018) | Phosphorus |
| Chautauqua | Lake Erie (Main Lake, South) (0105-0033) | Fecal Coliform |
| Chautauqua | Lake Erie, Dunkirk Harbor (0105-0009) | Fecal Coliform |
| Dutchess | Fallkill Creek (1301-0087) | Phosphorus |
| Dutchess | Wappingers Lake (1305-0001) | Phosphorus |
| Dutchess | Wappingers Lake (1305-0001) | Silt/Sediment |
| Erie | Delaware Park Pond (0101-0026) | Phosphorus |
| Erie | Ellicott Creek, Lower, and tribs (0102-0018) | Phosphorus |
| Erie | Ellicott Creek, Lower, and tribs (0102-0018) | Silt/Sediment |

| | | |
|---|---|---|
| Erie | Green Lake (0101-0038) | Phosphorus |
| Erie | Lake Erie (Main Lake, North) (0104-0037) | Fecal Coliform |
| Erie | Lake Erie (Northeast Shoreline) (0104-0036) | Fecal Coliform |
| Erie | Rush Creek and tribs (0104-0018) | Fecal Coliform |
| Erie | Rush Creek and tribs (0104-0018) | Phosphorus |
| Erie | Scajaquada Creek, Lower, and tribs (0101-0023) | Fecal Coliform |
| Erie | Scajaquada Creek, Lower, and tribs (0101-0023) | Oils & Floating Sub. |
| Erie | Scajaquada Creek, Lower, and tribs (0101-0023) | Phosphorus |
| Erie | Scajaquada Creek, Middle, and tribs (0101-0033) | Fecal Coliform |
| Erie | Scajaquada Creek, Middle, and tribs (0101-0033) | Oils & Floating Sub. |
| Erie | Scajaquada Creek, Middle, and tribs (0101-0033) | Phosphorus |
| Erie | Scajaquada Creek, Upper, and tribs (0101-0034) | Fecal Coliform |
| Erie | Scajaquada Creek, Upper, and tribs (0101-0034) | Phosphorus |
| Erie | South Branch Smoke Cr, Lower, and tribs (0101-0036) | Phosphorus |
| Erie | South Branch Smoke Cr, Lower, and tribs (0101-0036) | Silt/Sediment |
| Genesee | Tonawanda Cr, Middle, Main Stem (0102-0002) | Phosphorus |
| Genesee | Tonawanda Cr, Middle, Main Stem (0102-0006) | Fecal Coliform |
| Herkimer | Mohawk River, Main Stem (1201-0093) | Fecal Coliform |
| Herkimer | Mohawk River, Main Stem (1201-0093) | Oils & Floating Sub. |
| Kings | Coney Island Creek (1701-0008) 18 | Fecal Coliform |
| Kings | Coney Island Creek (1701-0008) 18 | Garbage & Refuse |
| Kings | Gowanus Canal (1701 0011) 18 | Garbage & Refuse |
| Kings | Hendrix Creek (1701-0006) 18 | Fecal Coliform |
| Kings | Hendrix Creek (1701-0006) 18 | Garbage & Refuse |
| Kings | Hendrix Creek (1701-0006) 18 | Nitrogen |
| Kings | Mill Basin and tidal tribs (1701 0178) 18 | Garbage & Refuse |
| Kings | Paerdegat Basin (1701-0363) 18 | Garbage & Refuse |
| Kings | Prospect Park Lake (1701-0196) | Phosphorus |
| Monroe | Buck Pond (0301-0017) | Phosphorus |
| Monroe | Cranberry Pond (0301-0016) | Phosphorus |

| | | |
|---|---|---|
| Monroe | Long Pond (0301-0015) | Phosphorus |
| Monroe | Minor Tribs to Irondequoit Bay (0302-0038) | Fecal Coliform |
| Monroe | Minor Tribs to Irondequoit Bay (0302-0038) | Phosphorus |
| Monroe | Rochester E–bayment - East (0302-0002) | Fecal Coliform |
| Monroe | Rochester E–bayment - West (0301-0068) | Fecal Coliform |
| Monroe | Thomas Creek/White Brook and tribs (0302-0023) | Phosphorus |
| Nassau | Beaver Lake (1702-0152) | Phosphorus |
| Nassau | Camaans Pond (1701-0052) | Phosphorus |
| Nassau | Cold Spring Harbor, and tidal tribs (1702-0018) | Pathogens |
| Nassau | Dosoris Pond (1702-0024) | Fecal Coliform |
| Nassau | East Bay (1701-0202) | Fecal Coliform |
| Nassau | East Meadow Brook, Upper, and tribs (1701-0211) | Silt/Sediment |
| Nassau | East Rockaway Inlet (1701-0217) | Fecal Coliform |
| Nassau | Glen Cove Creek, Lower, and tribs (1702-0146) | Fecal Coliform |
| Nassau | Glen Cove Creek, Lower, and tribs (1702-0146) | Silt/Sediment |
| Nassau | Grant Park Pond (1701-0054) | Phosphorus |
| Nassau | Hempstead Bay (1701-0032) | Fecal Coliform |
| Nassau | Hempstead Harbor, north, and tidal tribs (1702-0022) | Pathogens |
| Nassau | Hempstead Harbor, south, & tidal tribs (1702-0263) | Fecal Coliform |
| Nassau | Hempstead Lake (1701-0015) | Phosphorus |
| Nassau | Long Island Sound, Nassau County Waters (1702-0028) | Fecal Coliform |
| Nassau | Long Island Sound, Nassau County Waters (1702-0028) | Nitrogen |
| Nassau | Manhasset Bay, and tidal tribs (1702-0021) | Fecal Coliform |
| Nassau | Manhasset Bay, and tidal tribs (1702-0141) | Fecal Coliform |
| Nassau | Massapequa Creek, Upper, and tribs (1701-0174) | Fecal Coliform |
| Nassau | Massapequa Creek, Upper, and tribs (1701-0174) | Phosphorus |
| Nassau | Middle Bay (1701-0208) | Fecal Coliform |
| Nassau | Milburn/Parsonage Creeks, Upp, and tribs (1701-0212) | Phosphorus |
| Nassau | Mill Neck Creek and tidal tribs (1702-0151) | Pathogens |
| Nassau | Oyster Bay Harbor (1702-0016) | Pathogens |
| Nassau | Reynolds Channel, east (1701-0215) | Fecal Coliform |

| | | |
|---|---|---|
| Nassau | Seafords/Seamans Creeks, Upper, and tribs (1701-0201) | Fecal Coliform |
| Nassau | Shell Creek and Barnums Channel (1701-0213386) | Fecal Coliform |
| Nassau | South Oyster Bay (1701-0041) | Fecal Coliform |
| Nassau | Tidal Tribs to Hempstead Bay (1701-0218) | Fecal Coliform |
| Nassau | Tidal Tribs to Hempstead Bay (1701-0218) | Nitrogen |
| Nassau | Tidal Tribs to South Oyster Bay (1701-0200) | Fecal Coliform |
| Nassau | Tribs (fresh) to East Bay (1701-0204) | Fecal Coliform |
| Nassau | Tribs (fresh) to East Bay (1701-0204) | Phosphorus |
| Nassau | Tribs (fresh) to East Bay (1701-0204) | Silt/Sediment |
| Nassau | Tribs to Smith Pond/Halls Pond (1701-0221) | Phosphorus |
| Nassau | Woodmere Channel (1701-0219) | Fecal Coliform |
| Nassau | Woodmere Channel (1701-0219) | Nitrogen |
| New York | East River, Lower (1702-0011) 18 | Garbage & Refuse |
| New York | Harlem River (1702-0004) 18 | Garbage & Refuse |
| New York | Harlem Meer (1702-0103) | Phosphorus |
| New York | The Lake in Central Park (1702-0105) | Phosphorus |
| Niagara | Bergholtz Creek and tribs (0101-0004) | Fecal Coliform |
| Niagara | Bergholtz Creek and tribs (0101-0004) | Phosphorus |
| Niagara | Hyde Park Lake (0101-0030) | Phosphorus |
| Oneida | Ballou, Nail Creeks (1201-0203) | Phosphorus |
| Oneida | Mohawk River, Main Stem (1201-0010) | Fecal Coliform |
| Oneida | Mohawk River, Main Stem (1201-0094) | Fecal Coliform |
| Oneida | Utica Harbor (1201-0228) | Fecal Coliform |
| Onondaga | Bloody Brook and tribs (0702 0006) 10 | Fecal Coliform |
| Onondaga | Ley Creek and tribs (0702 0001) 10 | Fecal Coliform |
| Onondaga | Ley Creek and tribs (0702-0001) 10 | Ammonia (NH3) |
| Onondaga | Ley Creek and tribs (0702-0001) 10 | Phosphorus |
| Onondaga | Minor Tribs to Onondaga Lake (0702-0022) 10 | Nitrogen (NH3, NO2) |
| Onondaga | Minor Tribs to Onondaga Lake (0702-0022) 10 | Phosphorus |
| Onondaga | Minor Tribs to Onondaga Lake (0702-0022) 10 | Fecal Coliform |
| Onondaga | Onondaga Creek, Lower (0702-0023) 10 | Ammonia (NH3) |
| Onondaga | Onondaga Creek, Lower (0702-0023) 10 | Fecal Coliform |

| | | |
|---|---|---|
| Onondaga | Onondaga Creek, Lower (0702-0023) 10 | Phosphorus |
| Onondaga | Onondaga Creek, Middle, and tribs (0702-0004) 10 | Fecal Coliform |
| Onondaga | Onondaga Lake, Southern End (0702-0021) [10] | Fecal Coliform |
| Ontario | Great Brook and minor tribs (0704-0034) | Phosphorus 2 |
| Ontario | Great Brook and minor tribs (0704-0034) | Silt/Sediment |
| Orange | Greenwood Lake (1501-0001) | Phosphorus |
| Orange | Monhagen Brook and tribs (1306-0074) | Phosphorus |
| Orange | Orange Lake (1301-0008) [16] | Phosphorus |
| Oswego | Lake Neatahwanta (0701-0018) | Phosphorus |
| Putnam | Bog Brook Reservoir (1302-0041) | Phosphorus |
| Putnam | Boyd Corners Reservoir (1302-0045) | Phosphorus |
| Putnam | Croton Falls Reservoir (1302-0026) | Phosphorus |
| Putnam | Diverting Reservoir (1302-0046) | Phosphorus |
| Putnam | East Branch Reservoir (1302-0040) | Phosphorus |
| Putnam | Middle Branch Reservoir (1302-0009) | Phosphorus |
| Putnam | Oscawana Lake (1301-0035) | Phosphorus |
| Putnam | Palmer Lake (1302-0103) | Phosphorus |
| Putnam | West Branch Reservoir (1302-0022) | Phosphorus |
| Queens | Alley Creek/Little Neck Bay Trib (1702-0009) 18 | Fecal Coliform |
| Queens | Atlantic Ocean Coastline (1701-0014) | Fecal Coliform |
| Queens | Bergen Basin (1701-0009) 18 | Fecal Coliform |
| Queens | Bergen Basin (1701-0009) 18 | Garbage & Refuse |
| Queens | Bergen Basin (1701-0009) 18 | Nitrogen |
| Queens | East River, Upper (1702-0010) 18 | Garbage & Refuse |
| Queens | East River, Upper (1702-0032) 18 | Garbage & Refuse |
| Queens | Flushing Creek/Bay (1702 0005) 18 | Garbage & Refuse |
| Queens | Flushing Creek/Bay (1702-0005) | Nitrogen |
| Queens | Flushing Creek/Bay (1702-0005) 18 | Fecal Coliform |
| Queens | Jamaica Bay, Eastern, and tribs, Queens (1701-0005) 18 | Fecal Coliform |
| Queens | Jamaica Bay, Eastern, and tribs, Queens (1701-0005) 18 | Garbage & Refuse |
| Queens | Jamaica Bay, Eastern, and tribs, Queens (1701-0005) 18 | Nitrogen |

| | | |
|---|---|---|
| Queens | Kissena Lake (1702-0258) | Phosphorus |
| Queens | Little Neck Bay (1702-0029) | Fecal Coliform |
| Queens | Meadow Lake (1702-0030) | Phosphorus |
| Queens | Newtown Creek and tidal tribs (1702 0002) 18 | Garbage & Refuse |
| Queens | Newtown Creek and tidal tribs (1702-0002) 18 | Fecal Coliform |
| Queens | Shellbank Basin (1701-0001) 18 | Nitrogen |
| Queens | Spring Creek and tribs (1701-0361) 18 | Garbage & Refuse |
| Queens | Thurston Basin (1701-0152) 18 | Fecal Coliform |
| Queens | Thurston Basin (1701-0152) 18 | Garbage & Refuse |
| Queens | Willow Lake (1702-0031) | Phosphorus |
| Rensselaer | Nassau Lake (1310-0001) | Phosphorus |
| Richmond | Arthur Kill, Class I, and minor tribs (1701 0010) 18 | Garbage & Refuse |
| Richmond | Arthur Kill, Class SD, and minor tribs (1701-0182) 18 | Garbage & Refuse |
| Richmond | Grassmere Lake/Bradys Pond (1701-0357) | Phosphorus |
| Richmond | Kill Van Kull (1701 0184) 18 | Garbage & Refuse |
| Richmond | Newark Bay (1701 0183) 18 | Garbage & Refuse |
| Richmond | Raritan Bay, Class SA (1701-0002) | Fecal Coliform |
| Rockland | Congers Lake, Swartout Lake (1501-0019) | Phosphorus |
| Rockland | Rockland Lake (1501-0021) | Phosphorus |
| Rockland | Sparkill Creek, Lower (1301-0088) | Fecal Coliform |
| Saratoga | Ballston Lake (1101-0036) | Phosphorus |
| Saratoga | Dwaas Kill and tribs (1101-0007) | Phosphorus |
| Saratoga | Dwaas Kill and tribs (1101-0007) | Silt/Sediment |
| Saratoga | Lake Lonely (1101-0034) | Phosphorus |
| Saratoga | Tribs to Lake Lonely (1101-0001) | Fecal Coliform |
| Saratoga | Tribs to Lake Lonely (1101-0001) | Phosphorus |
| Schenectady | Collins Lake (1201-0077) | Phosphorus |
| Schenectady | Duane Lake (1311-0006) | Phosphorus |
| Schenectady | Mariaville Lake (1201-0113) | Phosphorus |
| Suffolk | Acabonack Harbor (1701-0047) | Pathogens |
| Suffolk | Agawam Lake (1701-0117) | Phosphorus |
| Suffolk | Beaverdam Creek and tribs (1701-0104) | Ammonia |
| Suffolk | Bellport Bay (1701-0320) | Pathogens |

| | | |
|---|---|---|
| Suffolk | Big/Little Fresh Ponds (1701-0125) | Phosphorus |
| Suffolk | Canaan Lake (1701-0018) | Phosphorus |
| Suffolk | Canaan Lake (1701-0018) | Silt/Sediment |
| Suffolk | Centerport Harbor (1702-0229) | Pathogens |
| Suffolk | Conscience Bay and tidal tribs (1702-0091) | Pathogens |
| Suffolk | Flanders Bay, East/Center, and tribs (1701-0030) | Pathogens |
| Suffolk | Flanders Bay, West/Lower Sawmill Creek (1701-0254) | Nitrogen |
| Suffolk | Flanders Bay, West/Lower Sawmill Creek (1701-0254) | Pathogens |
| Suffolk | Flax Pond (1702-0240) | Fecal Coliform |
| Suffolk | Forge River, Lower and Cove (1701-0316) | Fecal Coliform |
| Suffolk | Fresh Pond (1701-0241) | Phosphorus |
| Suffolk | Goldsmith Inlet (1702-0026) | Pathogens |
| Suffolk | Goose Creek (1701-0236) | Pathogens |
| Suffolk | Great Cove (1701-0376) | Fecal Coliform |
| Suffolk | Great South Bay, East (1701-0039) | Nitrogen |
| Suffolk | Great South Bay, Middle (1701-0040) | Nitrogen |
| Suffolk | Great South Bay, West (1701-0173) | Nitrogen |
| Suffolk | Hashamomuck Pond (1701-0162) | Pathogens |
| Suffolk | Heady and Taylor Creeks and tribs (1701-0294) | Pathogens |
| Suffolk | Huntington Harbor (1702-0228) | Pathogens |
| Suffolk | Lake Montauk (1701-0031) | Pathogens |
| Suffolk | Lake Ronkonkoma (1701-0020) | Fecal Coliform |
| Suffolk | Lake Ronkonkoma (1701-0020) | Phosphorus |
| Suffolk | Little Sebonac Creek (1701-0253) | Pathogens |
| Suffolk | Long Island Sound, Suffolk Co, Central (1702-0265) | Fecal Coliform |
| Suffolk | Mattituck Inlet/Cr, Low, and tidal tribs (1702-0020) | Pathogens |
| Suffolk | Meetinghouse/Terrys Creeks and tribs (1701-0256) | Pathogens |
| Suffolk | Mill and Seven Ponds (1701-0113) | Phosphorus |
| Suffolk | Millers Pond (1702-0013) | Phosphorus |
| Suffolk | Moriches Bay, East (1701-0305) | Nitrogen |
| Suffolk | Moriches Bay, West (1701-0038) | Nitrogen |
| Suffolk | Mt Sinai Harbor and tidal tribs (1702-0019) | Pathogens |

| | | |
|---|---|---|
| Suffolk | Mud Creek, Upper, and tribs (1701-0101) | Fecal Coliform |
| Suffolk | Narrow Bay (1701-0318) | Pathogens |
| Suffolk | Nicoll Bay (1701-0375) | Fecal Coliform |
| Suffolk | North Sea Harbor and tribs (1701-0037) | Pathogens |
| Suffolk | Northport Harbor (1702-0230) | Pathogens |
| Suffolk | Northwest Creek and tidal tribs (1701-0046) | Pathogens |
| Suffolk | Noyack Creek and tidal tribs (1701-0237) | Pathogens |
| Suffolk | Ogden Pond (1701-0302) | Pathogens |
| Suffolk | Patchogue Bay (1701-0326) | Pathogens |
| Suffolk | Peconic River, Lower, and tidal tribs (1701-0259) | Nitrogen |
| Suffolk | Peconic River, Lower, and tidal tribs (1701-0259) | Pathogens |
| Suffolk | Penniman Creek and tidal tribs (1701-0300) | Pathogens |
| Suffolk | Penny Pond, Wells and Smith Creeks (1701-0298) | Pathogens |
| Suffolk | Phillips Creek, Lower, and tidal tribs (1701-0299) | Fecal Coliform |
| Suffolk | Port Jefferson Harbor, North, and tribs (1702-0015) | Pathogens |
| Suffolk | Quantuck Bay (1701-0042) | Pathogens |
| Suffolk | Quantuck Bay (1701-0042) | Nitrogen |
| Suffolk | Quantuck Canal/Moneybogue Bay (1701-0371) | Pathogens |
| Suffolk | Quogue Canal (1701-0301) | Fecal Coliform |
| Suffolk | Reeves Bay and tidal tribs (1701-0272) | Pathogens |
| Suffolk | Richmond Creek and tidal tribs (1701-0245) | Pathogens |
| Suffolk | Sag Harbor and Sag Harbor Cove (1701-0035) | Pathogens |
| Suffolk | Sebonac Cr/Bullhead Bay and tidal tribs (1701-0051) | Pathogens |
| Suffolk | Setauket Harbor (1702-0242) | Pathogens |
| Suffolk | Shinnecock Bay and Inlet (1701 0033) | Nitrogen |
| Suffolk | Stirling Creek and Basin (1701-0049) | Pathogens |
| Suffolk | Stony Brook Harbor and West Meadow Creek (1702-0047) | Pathogens |
| Suffolk | Tidal Tribs to Gr Peconic Bay, Northshr (1701-0247) | Pathogens |
| Suffolk | Tidal Tribs to West Moriches Bay (1701-0312) | Fecal Coliform |
| Suffolk | Tidal Tribs to West Moriches Bay (1701-0312) | Nitrogen |
| Suffolk | Town/Jockey Creeks and tidal tribs (1701-0235) | Pathogens |
| Suffolk | Tuthill, Harts, Seatuck Coves (1701-0309) | Pathogens |
| Suffolk | Weesuck Creek and tidal tribs (1701-0111) | Pathogens |

| | | |
|---|---|---|
| Suffolk | West Creek and tidal tribs (1701-0246) | Fecal Coliform |
| Suffolk | Wooley Pond (1701-0048) | Pathogens |
| Tompkins | Cayuga Lake, Southern End (0705-0040) | Phosphorus |
| Tompkins | Cayuga Lake, Southern End (0705-0040) | Silt/Sediment |
| Warren | Hague Brook and tribs (1006-0006) | Silt/Sediment |
| Warren | Huddle/Finkle Brooks and tribs (1006-0003) | Silt/Sediment |
| Warren | Indian Brook and tribs (1006-0002) | Silt/Sediment |
| Warren | Lake George (1006-0016) and tribs | Silt/Sediment |
| Warren | Tribs to Lake George, East Shore (1006-0020) | Silt/Sediment |
| Warren | Tribs to Lake George, Lk.George Village (1006-0008) | Silt/Sediment |
| Wayne | Lake Ontario Shoreline, Central (0302-0044) | Fecal Coliform |
| Westchester | Amawalk Reservoir (1302-0044) | Phosphorus |
| Westchester | Bronx River, Upper, and tribs (1702-0107) | Fecal Coliform |
| Westchester | Cross River Reservoir (1302-0005) | Phosphorus |
| Westchester | Hutchinson River, Middle, and tribs (1702-0074) | Fecal Coliform |
| Westchester | Hutchinson River, Middle, and tribs (1702-0074) | Oil/Grease |
| Westchester | Lake Katonah (1302-0136) | Phosphorus |
| Westchester | Lake Lincolndale (1302-0089) | Phosphorus |
| Westchester | Lake Meahagh (1301-0053) | Phosphorus |
| Westchester | Lake Mohegan (1301-0149) | Phosphorus |
| Westchester | Lake Shenorock (1302-0083) | Phosphorus |
| Westchester | Larchmont Harbor (1702-0116) | Fecal Coliform |
| Westchester | Long Island Sound, Westchester Co Waters (1702-0001) | Fecal Coliform |
| Westchester | Long Island Sound, Westchester Co Waters (1702-0001) | Nitrogen |
| Westchester | Mamaroneck Harbor (1702-0125) | Fecal Coliform |
| Westchester | Mamaroneck River, Lower (1702-0071) | Silt/Sediment |
| Westchester | Mamaroneck River, Upp, & minor tribs (1702-0123) | Silt/Sediment |
| Westchester | Milton Harbor/Lower Blind Brook (1702-0063) | Fecal Coliform |
| Westchester | Muscoot/Upper New Croton Reservoir (1302-0042) | Phosphorus |
| Westchester | New Croton Reservoir (1302-0010) | Phosphorus |
| Westchester | New Rochelle Harbor (1702-0259) | Fecal Coliform |
| Westchester | Port Chester Harbor/Lower Byram River (1702-0260) | Fecal Coliform |

| | | |
|---|---|---|
| Westchester | Reservoir No.1/Lake Isle (1702-0075) | Phosphorus |
| Westchester | Saw Mill River (1301-0007) | Fecal Coliform |
| Westchester | Saw Mill River (1301-0007) | Phosphorus |
| Westchester | Saw Mill River, Middle, and tribs (1301-0100) | Fecal Coliform |
| Westchester | Saw Mill River, Middle, and tribs (1301-0100) | Phosphorus |
| Westchester | Sheldrake River (1702-0069) | Phosphorus |
| Westchester | Sheldrake River (1702-0069) | Silt/Sediment |
| Westchester | Silver Lake (1702-0040) | Phosphorus |
| Westchester | Teatown Lake (1302-0150) | Phosphorus |
| Westchester | Titicus Reservoir (1302-0035) | Phosphorus |
| Westchester | Truesdale Lake (1302-0054) | Phosphorus |
| Westchester | Wallace Pond (1301-0140) | Phosphorus |

# Appendix D. Forms

Included in this section are the following documents, in order:

- Monitoring Locations Inspection and Sampling Field Sheet
- Construction Site Inspection Report Form
- No Exposure Certification
- Municipal Facility Assessment Form
- Storm Event Data Form
- Visual Monitoring Form

# Monitoring Locations Inspection and Sampling Field Sheet

## Section 1: Background Data

| | | | |
|---|---|---|---|
| Subwatershed: | | Monitoring Location ID: | |
| Today's date: | | Time (Military): | |
| Investigators: | | Form completed by: | |
| Temperature (°F): | Rainfall (in.): Last 24 hours: Last 48 hours: | | |
| Latitude: | Longitude: | GPS Unit: | GPS LMK #: |
| Camera: | | Photo #s: | |

Land Use in Drainage Area (Check all that apply):

| | |
|---|---|
| ☐ Industrial | ☐ Open Space |
| ☐ Ultra-Urban Residential | ☐ Institutional |
| ☐ Suburban Residential | Other: _____ |
| ☐ Commercial | Known Industries: _____ |

Notes (e.g., origin, if known):

## Section 2: Monitoring Location Description

| LOCATION | MATERIAL | SHAPE | DIMENSIONS (IN.) | SUBMERGED |
|---|---|---|---|---|
| ☐ **Closed Pipe** | ☐ RCP ☐ CMP<br>☐ PVC ☐ HDPE<br>☐ Steel<br>☐ Other: _____ | ☐ Circular ☐ Single<br>☐ Elliptical ☐ Double<br>☐ Box ☐ Triple<br>☐ Other: _____ ☐ Other: _____ | Diameter/Dimensions:<br>_____ | In Water:<br>☐ No ☐ Partially ☐ Fully<br>With Sediment:<br>☐ No ☐ Partially ☐ Fully |
| ☐ **Open drainage** | ☐ Concrete<br>☐ Earthen<br>☐ Rip-Rap<br>☐ Other: ____ | ☐ Trapezoid<br>☐ Parabolic<br>☐ Other: ____ | Depth: ____<br>Top Width: ___<br>Bottom Width: ____ | |
| ☐ **In-Stream** | **(applicable when collecting samples)** | | | |
| **Flow Present?** | ☐ Yes ☐ No | ***If No, Skip to Section 5*** | | |
| **Flow Description (If present)** | ☐ Trickle ☐ Moderate ☐ Substantial | | | |

## Section 3: Quantitative Characterization

| FIELD DATA FOR FLOWING MONITORING LOCATIONS | | | | |
|---|---|---|---|---|
| **PARAMETER** | | **RESULT** | **UNIT** | **EQUIPMENT** |
| ☐ Flow #1 | Volume | | Liter | Bottle |
| | Time to fill | | Sec | |
| ☐ Flow #2 | Flow depth | | In | Tape measure |
| | Flow width | ____' ____" | Ft, In | Tape measure |
| | Measured length | ____' ____" | Ft, In | Tape measure |
| | Time of travel | | S | Stopwatch |
| Temperature | | | °F | Thermometer |
| pH | | | pH Units | Test strip/Probe |
| Ammonia | | | mg/L | Test strip |

## Monitoring Locations Inspection and Sampling Field Sheet

### Section 4: Physical Indicators for Flowing Monitoring Locations Only

Are Any Physical Indicators Present in the flow? ☐ Yes ☐ No (*If No, Skip to Section 5)*

| INDICATOR | CHECK if Present | DESCRIPTION | RELATIVE SEVERITY INDEX (1-3) | | |
|---|---|---|---|---|---|
| Odor | ☐ | ☐ Sewage ☐ Rancid/sour ☐ Petroleum/gas ☐ Sulfide ☐ Other: | ☐ 1 - Faint | ☐ 2 – Easily detected | ☐ 3 – Noticeable from a distance |
| Color | ☐ | ☐ Clear ☐ Brown ☐ Gray ☐ Yellow ☐ Green ☐ Orange ☐ Red ☐ Other: | ☐ 1 – Faint colors in sample bottle | ☐ 2 – Clearly visible in sample bottle | ☐ 3 – Clearly visible in flow |
| Turbidity | ☐ | See severity | ☐ 1 – Slight cloudiness | ☐ 2 - Cloudy | ☐ 3 – Opaque |
| Floatables -Does Not Include Trash!! | ☐ | ☐ Sewage (Toilet Paper, etc.) ☐ Suds ☐ Petroleum (oil sheen) ☐ Other: | ☐ 1 – Few/slight; origin not obvious | ☐ 2 - Some; indications of origin (e.g., possible suds or oil sheen) | ☐ 3 - Some; origin clear (e.g., obvious oil sheen, suds, or floating sanitary materials) |

### Section 5: Physical Indicators for Both Flowing and Non-Flowing Monitoring Locations

Are physical indicators that are not related to flow present? ☐ Yes ☐ No (*If No, Skip to Section 6)*

| INDICATOR | CHECK if Present | DESCRIPTION | COMMENTS |
|---|---|---|---|
| Monitoring Location Damage | ☐ | ☐ Spalling, Cracking or Chipping ☐ Peeling Paint ☐ Corrosion | |
| Deposits/Stains | ☐ | ☐ Oily ☐ Flow Line ☐ Paint ☐ Other: | |
| Abnormal Vegetation | ☐ | ☐ Excessive ☐ Inhibited | |
| Poor pool quality | ☐ | ☐ Odors ☐ Colors ☐ Floatables ☐ Oil Sheen ☐ Suds ☐ Excessive Algae ☐ Other: | |
| Pipe benthic growth | ☐ | ☐ Brown ☐ Orange ☐ Green ☐ Other: | |

### Section 6: Overall Monitoring Location Characterization

☐ Unlikely ☐ Potential (presence of two or more indicators) ☐ Suspect (one or more indicators with a severity of 3) ☐ Obvious

### Section 7: Data Collection

| | | | | | |
|---|---|---|---|---|---|
| 1. | Sample for the lab? | ☐ Yes | ☐ No | | |
| 2. | If yes, collected from: | ☐ Flow | ☐ Pool | | |
| 3. | Intermittent flow trap set? | ☐ Yes | ☐ No | If Yes, type: ☐ OBM | ☐ Caulk dam |

### Section 8: Any Non-Illicit Discharge Concerns (e.g., trash or needed infrastructure repairs)?

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF WATER

## New York State Department of Environmental Conservation

## Construction Site Inspection Report for SPDES MS4 General Permit GP-0-24-001

| | | | |
|---|---|---|---|
| Project Name: | | Date: | |
| Project Location: | | Weather: | |
| Permit # (if any): **NYR** | Contacted: ☐Yes ☐No | Entry Time: | Exit Time: |
| Name of SPDES Permittee: | | Inspection Type: | ☐NOT ☐ Complaint |
| Phone Number(s): | | | ☐ Compliance ☐ Referral |
| On-site Representative(s) and Company(s): | | MS4 Operator Name: | |
| | | MS4 Permit ID: NYR20A | |

**SPDES Authority**

| | Yes | No | N/A | | Citation |
|---|---|---|---|---|---|
| 1. | ☐ | ☐ | ☐ | Does the project have permit coverage? | GP-0-20-001: I.A & II. B |
| 2. | ☐ | ☐ | ☐ | Is a copy of the NOI and Acknowledgment Letter available on site and accessible for viewing? | GP-0-20-001: II.D.2 |
| 3. | ☐ | ☐ | ☐ | Is a copy of the MS4 SWPPP Acceptance Form available on site and accessible for viewing? | GP-0-20-001: II.D.2 |
| 4. | ☐ | ☐ | ☐ | Is an up-to-date copy of the signed SWPPP retained at the construction site? | GP-0-20-001: II.D.2. & III.A.4 |
| 5. | ☐ | ☐ | ☐ | Is a copy of the SPDES General Permit retained at the construction site? | GP-0-20-001: II.D.2 |
| 6. | ☐ | ☐ | ☐ | Does the NOI accurately report the number of acres to be disturbed? | GP-0-20-001: II.B.4 |

**SWPPP Content**

| | Yes | No | N/A | | Citation |
|---|---|---|---|---|---|
| 7. | ☐ | ☐ | ☐ | Does the SWPPP describe and identify the erosion and sediment control measures to be employed? | GP-0-20-001: III.B.1.e |
| 8. | ☐ | ☐ | ☐ | Does the SWPPP provide an inspection schedule and maintenance requirements for the E&SC measures? | GP-0-20-001: III.B.1.i |
| 9. | ☐ | ☐ | ☐ | Does the SWPPP describe and identify the stormwater management practices to be employed? | GP-0-20-001: III.B.2 |
| 10. | ☐ | ☐ | ☐ | Does the SWPPP identify the contractor(s) and subcontractor(s) responsible for each measure? | GP-0-20-001: III.A.6 |
| 11. | ☐ | ☐ | ☐ | Does the SWPPP identify at least one trained individual from each contractor(s) and subcontractor(s) companies? | GP-0-20-001: III.A.6 |
| 12. | ☐ | ☐ | ☐ | Does the SWPPP include all the necessary Contractor Certification Statements and signatures? | GP-0-20-001: III.A.6 |
| 13. | ☐ | ☐ | ☐ | Is the SWPPP signed by the permittee? | GP-0-20-001: VII.H.2 |
| 14. | ☐ | ☐ | ☐ | Is the SWPPP prepared by a qualified professional (if post-construction stormwater management required)? | GP-0-20-001: III.A.3 |
| 15. | ☐ | ☐ | ☐ | Do the SMPs conform to the Enhanced Phosphorus Removal Standards (projects in TMDL watersheds)? | GP-0-20-001: III.B.3 |

**Recordkeeping**

| | Yes | No | N/A | | Citation |
|---|---|---|---|---|---|
| 16. | ☐ | ☐ | ☐ | Are self-inspections performed as required by the permit (weekly, or twice weekly for >5 acres disturbed)? | GP-0-20-001:IV.C.2.a. & b |
| 17. | ☐ | ☐ | ☐ | Are the self-inspections performed and signed by a qualified inspector and retained on site? | GP-0-20-001:II.C.2.,IV.C.6 & VII.H.3 |
| 18. | ☐ | ☐ | ☐ | Do the qualified inspector's reports include the minimum reporting requirements? | GP-0-20-001: IV.C.4 |
| 19. | ☐ | ☐ | ☐ | Do inspection reports identify corrective measures that have not been implemented or are recurring? | GP-0-20-001: IV.C.5 |

**Visual Observations**

| | Yes | No | N/A | | Citation |
|---|---|---|---|---|---|
| 20. | ☐ | ☐ | ☐ | Are all erosion and sediment control measures installed properly? | GP-0-20-001: VII.L |
| 21. | ☐ | ☐ | ☐ | Are all erosion and sediment control measures being maintained properly? | GP-0-20-001: IV.A.1 |
| 22. | ☐ | ☐ | ☐ | Was written authorization issued for any disturbance greater than 5 acres? | GP-0-20-001: II.D.3 |
| 23. | ☐ | ☐ | ☐ | Have stabilization measures been implemented in inactive areas per Permit (>5acres) or ESC Standard? | GP-0-20-001: II.D.3.b & III.B.1.f |
| 24. | ☐ | ☐ | ☐ | Are post-construction stormwater management practices constructed/installed correctly? | GP-0-20-001: III.B.2 |
| 25. | ☐ | ☐ | ☐ | Has final site stabilization been achieved and temporary E&SC measures removed prior to NOT submittal? | GP-0-20-001: V.A.2 |
| 26. | ☐ | ☐ | ☐ | Was there a discharge from the site on the day of inspection? | |
| 27. | ☐ | ☐ | ☐ | Is there evidence that a discharge caused or contributed to a violation of water quality standards? | ECL 17-0501, 6 NYCRR 703.2 & GP-0-20-001: I.D |

**Water Quality Observations**

Describe the discharge(s): location, source(s), impact on receiving water(s), etc.

Describe the quality of the receiving water(s) both upstream and downstream of the discharge:

Describe any other water quality standards or permit violations:

Additional Comments:

☐ Photographs attached

| | |
|---|---|
| Overall Inspection Rating: ☐ Satisfactory ☐ Marginal ☐ Unsatisfactory | |
| Name/Agency of Lead Inspector: | Signature of Lead Inspector: |
| Names/Agencies of Other Inspectors: | |

NEW YORK STATE | Department of Environmental Conservation

# NO EXPOSURE CERTIFICATION

## For High Priority Municipal Facilities

## in SPDES MS4 General Permit, GP-0-24-001

The completed No Exposure Certification must be documented in the SWMP Plan.
***Please do not submit this form to the Department unless requested.***

**I. Owner/Facility Information**

| | | |
|---|---|---|
| Owner/Operator Name: | | |
| Mailing Address: | City/State/Zip: | |
| Contact Name: | Phone No.: | |
| Facility Name: | | |
| Street Address: | City/State/Zip: | |
| County: | Latitude: | Longitude: |

**II. Exposure Checklist**

| | Are any of the following materials or activities exposed to precipitation, now or in the foreseeable future? (Please check either "Yes" or "No" in the appropriate box.) If you answer "Yes" to any of these questions (1) through (11), you are not eligible for no exposure. | YES | NO |
|---|---|---|---|
| 1 | Using, storing or cleaning machinery or equipment, and areas where residuals from using, storing or cleaning machinery or equipment remain and are exposed to stormwater | | |
| 2 | Materials or residuals on the ground or in stormwater inlets from spills/leaks | | |
| 4 | Material handling equipment (except adequately maintained vehicles) | | |
| 5 | Materials or products during loading/unloading or transporting activities | | |
| 6 | Materials or products stored outdoors (except final products intended for outside use [e.g., new cars] where exposure to stormwater does not result in the discharge of pollutants) | | |
| 7 | Materials contained in open, deteriorated or leaking storage drums, barrels, tanks, and similar containers | | |
| 8 | Materials or products handled/stored on roads or railways owned or maintained by the discharger | | |
| 9 | Waste material (except waste in covered, non-leaking containers [e.g., dumpster]) | | |

**III. Certification**

I certify under penalty of law that I have read and understand the eligibility requirements for claiming a condition of "no exposure" and obtaining an exclusion from SPDES stormwater permitting. I certify under penalty of law that there are no discharges of storm water contaminated by exposure to industrial activities or materialsfrom the industrial facility or site identified in this document (except as allowed under 40 CFR 122.26(g)(2)). I understand that I am obligated to submit a no exposure certification form upon request to the NPDES permitting authority or to the operator of the local municipal separate storm sewer system (MS4) into which the facility discharges (where applicable). I understand that I must allow the SPDES permitting authority, or MS4 Operator where the discharge is into the local MS4, to perform inspections to confirm the condition of no exposure and to make such inspection reports publicly available upon request.

| | |
|---|---|
| Printed Name: | Title/Position: |
| Signature: | Date: |

| NEW YORK STATE Department of Environmental Conservation | **Municipal Facility Assessment Form For SPDES MS4 General Permit, GP-0-24-001** |
|---|---|

Assessments must be conducted by a person with the knowledge and skills to assess conditions and activities that could impact stormwater quality at the facility and evaluate the effectiveness of best management practices required by the SPDES MS4 General Permit (GP-0-24-001).

| | | |
|---|---|---|
| MS4 Permit ID: | MS4 Operator Name: | |
| Facility Name: | Facility Type: | Date: |
| Weather Conditions: | | |
| Is stormwater runoff present during this assessment? ☐ Yes ☐ No | | |
| Comments: | | |

| **General** | | **Yes** | **No** |
|---|---|---|---|
| 1 | Is this a high priority municipal facility? | ☐ | ☐ |
| 2 | If this is a high priority municipal facility, does the facility qualify for a No Exposure Certification? | ☐ | ☐ |
| 3 | If this is a high priority municipal facility, is there a completed SWPPP available? | ☐ | ☐ |
| 4 | Does the facility have any MS4 outfalls? | ☐ | ☐ |
| 5 | Does the facility have any interconnections? | ☐ | ☐ |
| 6 | Does the facility have any municipal facility intraconnections? | ☐ | ☐ |
| Comments: | | | |
| **Good Housekeeping** | | **Yes** | **No** |
| 7 | Are paved surfaces free of trash, sediment, and/or debris? | ☐ | ☐ |
| 8 | Date the paved area was last swept or vacuumed. | ☐ | ☐ |
| 9 | Do outdoor waste receptacles have covers? | ☐ | ☐ |
| 10 | Are the waste receptacles emptied on a regular basis? | ☐ | ☐ |
| 11 | Are there signs of leaks, contaminants or overfilling at the waste receptacle area? | ☐ | ☐ |
| 12 | Are the following facility areas free of accumulated trash, sediment, debris, contaminants, and spills: | ☐ | ☐ |
| | - Salt storage areas | ☐ | ☐ |
| | - Container storage areas | ☐ | ☐ |
| | - Maintenance areas | ☐ | ☐ |

| | | | |
|---|---|---|---|
| | - Staging areas | ☐ | ☐ |
| | - Material stockpile areas | ☐ | ☐ |
| Comments: | | | |

| **Vehicle and Equipment Areas** | | ☐ N/A | Yes | No |
|---|---|---|---|---|
| 13 | Are vehicle/equipment parked indoors or under a roof? | | ☐ | ☐ |
| 14 | Are vehicles/equipment washed in only designated areas? | | ☐ | ☐ |
| 15 | Are vehicles washed regularly to remove contamination and prevent them from polluting stormwater? | | ☐ | ☐ |
| 16 | Is all wash water treated in an oil water separator prior to discharge? | | ☐ | ☐ |
| 17 | Is all wash water managed so it does not enter the MS4? | | ☐ | ☐ |
| Comments | | | | |

| **Vehicle/Equipment Maintenance** | | ☐ N/A | Yes | No |
|---|---|---|---|---|
| 18 | Is equipment stored under shelter or elevated and covered? | | ☐ | ☐ |
| 19 | Are fluids drained over a drip pan or pad? | | ☐ | ☐ |
| 20 | Are funnels or pumps used when transferring fluids? | | ☐ | ☐ |
| 21 | Are waste rags and used absorbent pads disposed of properly? | | ☐ | ☐ |
| 22 | Are any vehicles and/or equipment leaking fluids? | | ☐ | ☐ |
| 23 | Are drip pans immediately placed under leaks? | | ☐ | ☐ |
| 24 | Are materials, equipment, and activities located so that leaks are contained in existing containment and diversion systems (confine the storage of leaky or leak-prone vehicles and equipment awaiting maintenance to protected areas)? | | ☐ | ☐ |
| 25 | Are vehicles inspected daily for leaks? | | | |
| Comments: | | | | |

| **Fueling areas** | | ☐ N/A | Yes | No |
|---|---|---|---|---|
| 26 | Is fueling performed under a canopy or roof? | | ☐ | ☐ |
| 27 | Are spill cleanup materials available at the fueling area? | | ☐ | ☐ |
| 28 | Are breakaway valves used on fueling hoses? | | ☐ | ☐ |
| 29 | Is the fueling handle lock disconnected so the operator must attend the fueling? | | ☐ | ☐ |
| 30 | Is stormwater runoff from fueling area treated in an oil/water separator? | | ☐ | ☐ |
| 31 | Is the fueling automatic stop inspected regularly to ensure it is working properly? | | ☐ | ☐ |
| 32 | Are all fuel deliveries monitored? | | ☐ | ☐ |
| Comments: | | | | |

| | Salt Storage Piles or Pile Containing Salt | ☐ N/A | Yes | No |
|---|---|---|---|---|
| 33 | Is salt stored in a salt storage building or under a roof? | | ☐ | ☐ |
| 34 | Are controls in place to minimize spills while adding or removing material from the pile? | | ☐ | ☐ |
| 35 | Are salt spills cleaned up promptly? | | ☐ | ☐ |
| 36 | Is overflow and tracked salt removed promptly from loading areas? | | ☐ | ☐ |
| 37 | Is stormwater draining away from the salt pile directed to a vegetated filter area | | ☐ | ☐ |
| Comments: | | | | |

| | Fluids Management | ☐ N/A | Yes | No |
|---|---|---|---|---|
| 38 | Are all drums and containers of fluids stored with proper cover and containment? | | ☐ | ☐ |
| 39 | Are fluids stored in appropriate containers and/or storage cabinets? | | ☐ | ☐ |
| 40 | Are all fluids kept in original containers or labeled in a manner that describes the contents adequately? | | ☐ | ☐ |
| 41 | Are Material Safety Data Sheets (MSDS/SDS) readily available? | | ☐ | ☐ |
| 42 | Are all containers that are stored free of leaks or deposits? | | ☐ | ☐ |
| 43 | Are containers of product inspected regularly? | | ☐ | ☐ |
| 44 | Is used oil and antifreeze stored indoors and/or on spill containment pallets? | | ☐ | ☐ |
| 45 | Is used oil and antifreeze properly disposed of or recycled? | | ☐ | ☐ |
| Comments: | | | | |

| | Lead Acid Batteries | ☐ N/A | Yes | No |
|---|---|---|---|---|
| 46 | Are lead-acid batteries stored indoors on spill containment pallets or in bins? | | ☐ | ☐ |
| 47 | Are intact batteries stored on an acid-resistant rack or tub? | | ☐ | ☐ |
| 48 | Are cracked or leaking batteries stored in labeled, closed, leak-proof containers? | | ☐ | ☐ |
| 49 | Is the date each battery was placed in storage recorded? | | ☐ | ☐ |
| 50 | Are batteries stacked more than 5 high? | | ☐ | ☐ |
| 51 | Are batteries inspected regularly for leaks? | | ☐ | ☐ |
| Comments: | | | | |

| | Spill Prevention and Response Procedures | ☐ N/A | Yes | No |
|---|---|---|---|---|
| 52 | Are vehicles inspected daily for leaks? | | ☐ | ☐ |

| | | | |
|---|---|---|---|
| 53 | Is spill control equipment and absorbents readily available? | ☐ | ☐ |
| 54 | Are emergency phone numbers posted in conspicuous areas? | ☐ | ☐ |
| 55 | Are spills contained and cleaned up immediately? | ☐ | ☐ |
| Comments: | | | |

| **General Material Storage Areas** | ☐ N/A | Yes | No |
|---|---|---|---|
| 56 | Are leaking or damaged materials stored inside a building or another type of storm resistance shelter? | ☐ | ☐ |
| 57 | Are all material stockpiles within containment structures (e.g., concrete barriers, earthen berms) or stored in a manner that does not allow discharge of impacted stormwater? | ☐ | ☐ |
| 58 | Are used fuel tanks and other scrap metal and parts drained of fluids and stored under cover? | ☐ | ☐ |
| 59 | Are outdoor containers covered? | ☐ | ☐ |
| 60 | Are piles of spoils, asphalt, debris, etc. stored under a roof or cover? | ☐ | ☐ |
| 61 | Are spills of material or debris cleaned up promptly? | ☐ | ☐ |
| 62 | Are used tire storage piles placed away from storm drains or conveyances? | ☐ | ☐ |
| 63 | Are tires recycled frequently to keep the number of stored tires manageable? | ☐ | ☐ |
| Comments: | | | |

| **Stormwater Management** | | Yes | No |
|---|---|---|---|
| 64 | Are employees trained on the municipal facility procedures? | ☐ | ☐ |
| 66 | Are BMPs and treatment structures working as designed? | ☐ | ☐ |
| 67 | Are BMPs and treatment structures free from debris buildup or overgrown vegetation that may impair function? | ☐ | ☐ |
| 68 | Catch basins should be cleaned in accordance with the timeframes listed in Part VI.F.3.c.iii. / Part VII.F.3.c.iii, depending on the MS4 Operator type. Based on this, do any catch basins need to be cleaned? | ☐ | ☐ |
| 69 | Are berms, curbing or other methods used to divert and direct discharges adequate and in good condition? | ☐ | ☐ |
| 70 | Are rooftop drains directed to areas away from pavement? | ☐ | ☐ |
| Comments: | | | |

| **Erosion and Sediment Controls** | | Yes | No |
|---|---|---|---|
| 71 | Are soil stabilization measures (e.g., seed and mulch, rolled erosion control products) considered in areas that have the potential for significant soil erosion? | ☐ | ☐ |
| 72 | Are natural buffers maintained around surface waters? | ☐ | ☐ |
| 73 | Are flow velocity dissipation devices in place at monitoring locations and channel outlets (rock riprap, stone check dams, concrete baffles)? | ☐ | ☐ |
| 74 | Do controls conform to the NYS Standards and Specifications for Erosion and Sediment Control (2016), or equivalent? | ☐ | ☐ |

| Comments: |
|---|
| **Corrective Actions and Comment** |
| Describe Inspection findings and if necessary, the corrective actions taken |
| |

| Inspector Signature | | Date: | |
|---|---|---|---|

NEW YORK STATE | Department of Environmental Conservation

# Storm Event Data Form for SPDES MS4 General Permit, GP-0-24-001

Do not submit this form to the Department; keep this form with the municipal facility's SWPPP and in the MS4 Operator's SWMP Plan.

Permit Number:

| N | Y | R | 2 | 0 | A | | | |
|---|---|---|---|---|---|---|---|---|

Facility Name:

Contact First Name:

Contact Last Name:

Contact Phone:

Contact Email:

Storm Event Date:

Storm Duration (in hours):

Rainfall Measurement from Storm Event (in inches):

Date of Last Measurable Storm Event:

Duration Between Storm Event Sampled and End of Previous Measurable Storm (in hours):

## Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Facility Operator First Name (please print or type)

Facility Operator Last Name (please print or type)

/ /

Date

Signature

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

# Visual Monitoring Form MS4 GP-0-24-001

All high priority municipal facilities covered under the MS4 GP-0-24-001 must perform Visual Monitoring twice a permit term, separated by a minimum of one (1) year. Please see the permit Part VI.F/VII.F for additional requirements. This form is part of the facilities records and should be retained onsite with the facility's Stormwater Pollution Prevention Plan. ***Please do not submit this form to the Department.***

MS4 Operator Permit ID

Facility Name

Outfall Number

Examiner's Name

Examiner's Title

Reporting Year

Rainfall Amount

Qualifying Storm? ◯Yes ◯No

Runoff Source? ◯Rainfall ◯Snowmelt

Date/Time Collected __ / __ / __ __ : __ __ AM / PM

Date/Time Examined __ / __ / __ __ : __ __ AM / PM

1. Does the stormwater appear to be colored? ..... ◯Yes ◯No

If yes, describe

2. Is the stormwater clear or transparent? ..... ◯Yes ◯No

If yes, which of the following best describes the clarity of the stormwater: ..... ◯Clear ◯Milky ◯Opaque

3. Can you see a rainbow sheen effect on the water surface?..... ◯Yes ◯No

If yes, which best describes the sheen?..... ◯Rainbow Sheen ◯Floating Oil Globules

4. Does the sample have an odor? ..... ◯Yes ◯No

If yes, describe

5. Is there something floating on the surface of the sample? ..... ◯Yes ◯No

If yes, describe

6. Is there something suspended in the water column of the sample? ..... ◯Yes ◯No

If yes, describe

7. Is there something settled on the bottom of the sample?..... ..... ◯Yes ◯No

If yes, describe

8. Is there foam or material forming on the top of the sample surface?..... ◯Yes ◯No

If yes, describe

Detail any concerns, corrective actions taken and any other indicators of pollution present in the sample:

# Works Cited

Center for Watershed Protection, Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assistance, October 2004 (CWP 2004)

New York State Department of Environmental Conservation, Maintenance Guidance: Stormwater Management Practices, March 31, 2017 (NYS DEC Maintenance Guidance 2017)

New York State Department of Environmental Conservation, Model Local Law to Prohibit Illicit Discharges, Activities and Connections to Separate Storm Sewer Systems, April 2006 (NYS DEC Model IDDE Local Law 2006)

New York State Department of Environmental Conservation, Sample Local Law for Stormwater Management and Erosion & Sediment Control, March 2006 (NYS DEC Sample SM and E&SC Local Law 2006)

New York State, Standards and Specifications for Erosion & Sediment Control, November 2016 (NYS E&SC 2016)

New York State, Stormwater Management Design Manual, January 2015 (NYS SWMDM 2015)

SPDES Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity, GP-0-23-001 (MSGP)

SPDES General Permit for Stormwater from Construction Activities, GP-0-20-001 (CGP)

SPDES General Permit for Stormwater Discharges from the Municipal Separate Storm Sewer Systems, GP-0-24-001 (MS4 GP)

United States Department of Transportation Federal Highway Administration, Highway Functional Classification Concepts, Criteria and Procedures, 2013 (USDOT 2013)

# ATTACHMENT 2

# TOWN OF NEWBURGH

# STORMWATER BASEMAP

# ATTACHMENT 2: Stormwater Basemap

## Town of Newburgh
## Stormwater Management Plan 2024

Town of Plattekill
Town of Shawangunk
Town of Marlboro
Town of Montgomery
Town of Wappinger
City of Newburgh
City of Beacon
Town of New Windsor
Hudson River
Chadwick Lake
Orange Lake
Brookside Pond
Crest View Lake
Crystal Lake
Lake Washington
Brunkhorst Ck
Quassaic Creek
Gidneytown Ck
Tin Brook

0 0.5 1 2 Miles

N W E S

**Automatically-Designated MS4 Area**
**Additionally-Designated MS4 Area**
Contours_100ft

**Stream Classifications**
A
B
C
Lakes and Reservoirs

**Land Use**
Industrial
Residential
Commercial
Open Space
Institutional

**Roads**
Interstates
State Route
County Road
Local Roads
Private Roads

# ATTACHMENT 3

# ENFORCEMENT RESPONSE PLAN
# WITH ATTACHMENTS

# Enforcement Response Plan

for the Town of Newburgh

As per Part IV.F of the New York State Department of Environmental Conservation's SPDES General Permit No. GP-0-24-001(Permit), effective January 3, 2024 (EDC), MS4 Operators (Operator[s]) must develop and implement an Enforcement Response Plan in order to document how violations to State and local stormwater laws will be addressed in their area of jurisdiction. State stormwater regulations relate to illicit discharges, construction activities, and post-construction activities. Regulations are defined and explained in detail in the following documents:

1. NYS Standards and Specifications for Erosion and Sediment Control (Blue Book, November 2016)
2. NYS Stormwater Management Design Manual (January 2015)
3. NYSDEC SPDES General Permit for Construction
4. NYS Municipal Stormwater Management Code

It is the responsibility of the Operator to implement State stormwater regulations by enforcing the documents listed above as well as through six (6) Minimum Control Measures (MCMs) that are described in Part VI of the Permit.

Violations may come to the attention of the Operator through public complaints or other third-party notifications as well as observations by municipal staff, including the Operator or a designee, during regular inspections or other site visits to construction or post-construction sites. When a non-compliant stormwater activity has been observed by or reported to the Operator, the Operator will consider the type, magnitude, and duration of the violation when initiating the enforcement proceedings. Minor and/or first time violations will be addressed through verbal or written warning from the operator, with significant and/or repeat violations being subject to additional enforcement actions including Stop Work Orders and fines with the potential for revocation of permits/approvals and/or calling of a projects bond and/or direct billing to the responsible party for remedial work to correct the violation(s).

The Operator will use the attached Violation and Enforcement Documentation form (Attachment A) to record and track all communications, correspondence, and enforcement actions. This form should be signed by the Operator when each violation is ultimately

resolved. Completed Violation and Enforcement Documentation forms will be kept on file in the municipal clerk's office with all other MS4 permit-related information.

As referenced above, the Operator is also responsible for implementing the six (6) MCMs prescribed within the Permit. Attachments B and C describe the actions that need to be taken within the first six (6) months of the EDC and assign responsibility for each activity, with the Operator being the responsible party who ensures these measures are met and documented in the municipality's Stormwater Management Plan.

Attachments:

A. Violation and Enforcement Documentation form
B. Description of Six (6) Month Activities
C. Staffing plan/organizational chart

# Violation and Enforcement Documentation

As per the procedures outlined in the municipality's Enforcement Response Plan, this form should be completed by the MS4 Operator or the assigned Stormwater Program Coordinator when a stormwater violation has occurred.

Municipality Town of Newburgh

Date Time

Enforcement Response Number (ER #) 24 -

Location of violation

Is violation within an MS4 area? ☐ YES ☐ NO ☐ Uncertain

Category of Violation and/or Illicit Discharge

☐ Construction ☐ Post-construction ☐ Municipally-owned Facility

☐ Public Observation ☐ Other

Land/facility ownership type ☐ Public ☐ Private ☐ Unknown

Name of owner/operator

Source of illicit discharge and/or description of violation

Description of discharge (color, clarity, odor, duration, approx. flow rate/volume, etc)

Who detected discharge? ☐ Public ☐ Municipal Staff ☐ Other

Name and, if applicable, title

Municipal staff receiving notification of discharge

Name

Title

## Enforcement Actions Taken and Responses

| Date | MS4 Action | Required timeframe for remedial action | Remedial Action/Response | Date |
|---|---|---|---|---|
| | Verbal warning | | | |
| | Written notice of violation | | | |
| | Citation | | | |
| | Fine amount | $ | Date paid | |
| | Stop Work Order | | | |
| | Withholding of plan approvals or other authorization for discharging into MS4 | | | |
| | Additional measures taken by MS4 | | | |

Additional Notes

Date of Final Compliance

Compliance verified by

Name

Title

Signature of MS4 Operator

**ATTACHMENT B**

# Activities to Complete within Six (6) Months of the Effective Date of Coverage (EDC)

## General Requirements

- **Staffing plan/Organizational chart (IV.A.2)**

    - Within six (6) months of the EDC, the MS4 Operator must develop a written staffing plan/organizational chart which includes job titles and other entities as identified in Part IV.A.1, and the roles and responsibilities for each corresponding to the required elements of the SWMP. The staffing plan must describe how information will be communicated and coordinated among all those with identified responsibilities. All staffing plan/organization charts must be documented in the SWMP Plan (Part IV.B.).

- **Availability of SWMP Plan (IV.B.2.a&b)**

    - Within six (6) months of the EDC, the MS4 Operator must make the current SWMP Plan, and documentation associated with the implementation of the SWMP Plan, available during normal business hours to the MS4 Operator's management and staff responsible for implementation as well as the Department and United States Environmental Protection Agency (USEPA) staff. The completion of this permit requirement must be documented in the SWMP Plan.

    - Within six (6) months of the EDC, the MS4 Operator must make a copy of the current SWMP Plan available for public inspection during normal business hours at a location that is accessible to the public or on a public website. The location of the SWMP Plan must be kept current. The completion of this permit requirement must be documented in the SWMP Plan

- **Comprehensive Mapping (IV.D.1)**

    - Within six (6) months of the EDC, the comprehensive system mapping must include the following information:
        a. *MS4 outfall*s (as required for *MS4 Operators* continuing coverage from previous iterations of this *SPDES* general permit);

b. *Interconnections* (as required for *MS4 Operators* continuing coverage from previous iterations of this *SPDES* general permit);

*c.* Preliminary *storm-sewershed* boundaries (as required for *MS4 Operators* continuing coverage from previous iterations of this *SPDES* general permit);

d. *MS4* infrastructure (as required for *MS4 Operators* continuing coverage from previous iterations of this *SPDES* general permit that were subject to Part IX.A. or Part IX.D.), including:
   i. Conveyance system
      a) Type (closed pipe or open drainage);
      b) Conveyance description for closed pipes (material, shape, dimensions);
      c) Conveyance description for open drainage (channel/ditch lining material, shape, dimensions); and
      d) Direction of flow;
   ii. Culvert crossings (location and dimensions)
   iii. Stormwater structures
      a) Type (drop inlet, *catch basin*, or manhole); and
      b) Number of connections to *catch basins*, and manholes;

e. Basemap information:
   i. *Automatically* and *additionally designated areas* (based on criterion 3 of Additional Designation Criteria in Appendix B);
   ii. Names and location of all *surface waters of the State*, including:
      a) Waterbody classification;
      b) Waterbody Inventory/Priority Waterbodies List (WI/PWL);
         1. Impairment status; and
         2. *POC,* if applicable;
      c) *TMDL* watershed areas;
   iii. Land use, including:
      a) Industrial;
      b) Residential;
      c) Commercial;
      d) Open space; and
      e) Institutional;
   iv. Roads; and
   v. Topography.

- **Enforcement Measures & Tracking - Enforcement Response Plan (IV.F.1)**

  - Within six (6) months, the *MS4 Operator* must *develop* and implement an enforcement response plan (ERP) which clearly describes the action(s) to be taken for violations that the *MS4 Operator* has enacted for illicit *discharge* (Part VI.C. or Part VII.C, depending on the MS4 Operator type), construction (Part VI.D. or Part VII.D, depending on the MS4 Operator type), and post-construction (Part VI.E. or Part VII.E, depending on the MS4 Operator type). The ERP must be documented in the *SWMP Plan*. The ERP must set

forth a protocol to address repeat and continuing violations through progressively stricter responses (i.e., escalation of enforcement) as needed to achieve compliance with the terms and conditions of this *SPDES* general permit.

- An Interim Progress Certification for the period of January 3 through June 30 of the same year must be submitted to the *Department* by October 1 of the same year. An Interim Progress Certification for the period of July 1 through January 2 of the following year must be submitted to the *Department* by April 1 of the following year along with the Annual Report. Submission of the Annual Report is not a substitute for submission of the Interim Progress Certification.

## MCM 1 Requirements

- **Illicit Discharge Education (VI.A.1.d)**

    - Within six (6) months of the EDC, the *MS4 Operator* must make information related to the prevention of *illicit discharges*, available to *municipal* employees, businesses, and the public and document the completion of this requirement in the *SWMP Plan*. The information related to the prevention of illicit discharges must include the following:

        i. What types of *discharges* are allowable (Part I.A.3.);

        ii. What is an *illicit discharge* and why is it prohibited (Part VI.C.);

        iii. The environmental hazards associated with *illicit discharges* and improper disposal of waste;

        iv. Proper handling and disposal practices for the most common behaviors within the community (e.g., septic care, car washing, household hazardous waste, swimming pool draining, or other activities resulting in *illicit discharges* to the *MS4*); and

        v. How to report *illicit discharges* they may observe (Part VI.C.1.a.).

## MCM 2 Requirements (VI.B.1.c)

- Within six (6) months of the EDC, the *MS4 Operator* must identify a local point of contact to receive and respond to public concerns regarding *stormwater* management and compliance with permit requirements. The name or title of this individual, with contact information, must be published on public outreach and public participation materials and documented in the *SWMP Plan*.

## MCM 3 Requirements (VI.C.1.a.i)

- Within six (6) months of the EDC, the MS4 Operator must establish and document in the SWMP Plan an email or phone number (with message recording capability) for the public to report illicit discharges.

## MCM 4 Requirements

- Within six (6) months of the EDC, the MS4 Operator must establish and document in the SWMP Plan an email or phone number (with message recording capability) for the public to report complaints related to construction stormwater activity. (VI.D.2.a)

- Within six (6) months of the EDC, the *MS4 Operator* must *develop* and maintain an inventory of all applicable construction sites (Part VI.D.1.a.) in the *SWMP Plan*. The following information must be included in the inventory:
    i. Location of the construction site;
    ii. Owner/operator contact information, if other than the *MS4 Operator*;
    iii. Receiving waterbody name and class (mapped in accordance with Part IV.D.1.e.ii.a));
    iv. Receiving waterbody WI/PWL Segment ID (mapped in accordance with Part IV.D.1.e.ii.b));
    v. Prioritization (high or low) (Part VI.D.5.);
    vi. Construction project *SPDES* identification number;
    vii. SWPPP approval date;
    viii. Inspection history, including dates and ratings (satisfactory, marginal, or unsatisfactory, when available);

    (VI.D.5.a)

## MCM 6 Requirements (VI.F.3.d.i)

- **Sweeping**
  Within six (6) months of the EDC, the *MS4 Operator* must *develop* and implement procedures for sweeping and/or cleaning *municipal* streets, bridges, parking lots, and right of ways owned/operated by the *MS4 Operator*. The procedures and completion of permit requirements must be documented in the *SWMP Plan* specifying:

a) All roads, bridges, parking lots, and right of ways must be swept and/or cleaned once every five (5) years in the spring (following winter activities such as sanding). This requirement is not applicable to:

   i. Uncurbed roads with no *catch basins*;

   ii. High-speed limited access highways; or

   iii. Roads defined as interstates, freeways and expressways, or arterials by the United States Department of Transportation, Federal Highway Administration, Highway Functional Classification Concepts, Criteria and Procedures, 2013.

**ATTACHMENT C:**
**Staff Plan/Organizational Chart**

Municipality

Town of Newburgh

MS4 Operator

Name: Gilbert Piaquadio

Title: Town Supervisor

Stormwater Program Coordinator

Name: James Osbourne

Title: Town Engineer

## MCM 1:

Public Education and Outreach Program

**Task**: Make information related to the prevention of illicit discharges available to municipal employees, businesses, and the public.

**Responsible party:**

Lisa Vance-Ayres
Name
Town Clerk
Title

Involved parties (optional):

_____
Name
_____
Title

_____
Name
_____
Title

## MCM 2:

Public Involvement/Participation

**Task**: Identify local point of contact to receive and respond to public stormwater mgmt. and permit compliance concerns.

**Responsible party:**

Gerald Canfield
Name
Code Compliance Supervisor
Title

Point of Contact:

_____
Name
_____
Title

_____
Email address
_____
Phone number

## MCM 3:

Illicit Discharge Detection and Elimination

**Task**: Establish email or phone number for public reporting of illicit discharges.

**Responsible party:**

Gerald Canfield
Name
Code Compliance Supervisor
Title

codecompliance@townofnewburgh.org
Email address
845-564-7801
Phone number

## MCM 4:

Construction Site Stormwater Runoff Control

**Task 1**: Establish email or phone number for public complaints related to construction activity.

**Responsible party:**

David Fritts
Name
Consulting Engineer
Title

dfritts@mhepc.com
Email address
845-567-3100
Phone number

**Task 2**: Develop and maintain inventory of applicable construction sites.

**Responsible party:**

David Fritts
Name
Consulting Engineer
Title

## MCM 5:

Post-Construction Stormwater Management

*No tasks are required for MCM 5 during the first six (6) months of the Effective Date of Coverage (EDC).*

## MCM 6:

Pollution Prevention and Good Housekeeping

**Task**: Develop and implement procedures for sweeping and/or cleaning municipal streets, bridges, parking lots, and rights-of-way owned by the MS4 Operator.

**Responsible party:**

Mark Hall
Name
Highway Superintendent
Title

Involved parties (optional):

_____
Name
_____
Title

_____
Name
_____
Title

# ATTACHMENT 4

# STORMWATER SYSTEMS MAP

# ATTACHMENT 4: Stormwater System Map

## Town of Newburgh

## Stormwater Management Plan 2024

TOWN OF PLATTEKILL

TOWN OF SHAWANGUNK

TOWN OF MARLBOROUGH

TOWN OF WAPPINGER

TOWN OF MONTGOMERY

TOWN OF FISHKILL

CITY OF NEWBURGH

CITY OF BEACON

TOWN OF NEW WINDSOR

Chadwick Lake
Class A

Orange Lake
Class B

Brookside Pond

Crest View Lake
Unassessed

Crystal Lake

Muchattoes Lake

Lake Washington
Class A

Plattekill Cr

Quassaic Cr

Silver Stream

Bushkill Cr

Quassaic Creek

Jacobus Creek

Tin Brook

0 0.5 1 2 Miles

N W E S

- Automatically-Designated MS4 Areas
- Additionally-Designated MS4 Areas
- HUC 12 Watersheds
- Catch Basins
- Outfalls
- Local Roads
- Highways

WI/PWL Status

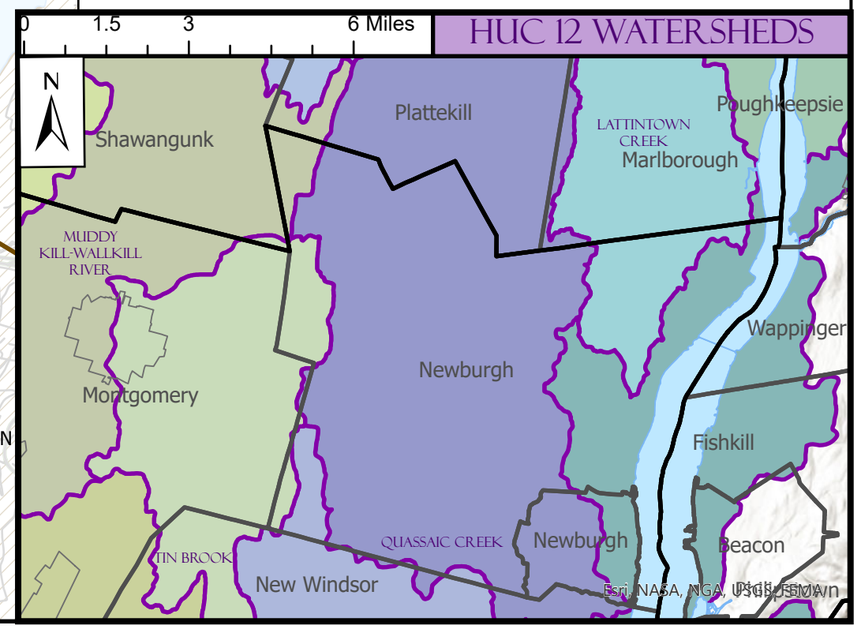
- Impaired Seg
- Threatened
- Threat(Poss)
- MinorImpacts
- NoKnownImpct
- Need Verific
- UnAssessed

WI/PWL Status

- Impaired
- Threatened
- Minor Impacts
- No Known Impact
- Needs Verification
- UnAssessed

0 1.5 3 6 Miles

### HUC 12 WATERSHEDS



# ATTACHMENT 5

# TOWN OF NEWBURGH

# PUBLIC EDUCATION & OUTREACH BROCHURE

# WHAT IS STORMWATER RUNOFF AND HOW DOES IT BECOME A PROBLEM

Stormwater pollution occurs when rainfall or snowmelt runoff travels across loose soils or impervious surfaces and transports sediment, vehicle fluids, chemicals, fertilizers, salts, and other contaminants into natural water supplies and sensitive environments. It can also run directly into storm drainage systems and catchment areas. From there, it's carried without treatment into our streams, ponds, reservoirs and rivers.

Stormwater pollution can be problematic due to the pollutants it can pick up and transport to sensitive areas like potable water sources or polluted/threatened environments.



## COMMON POLLUTANTS

- Salts
- Fertilizers (Phosphorus and Nitrogen)
- Car Fluids (Oils and Gas)
- Soaps
- Sediment
- Sewage
- Trash



## CONTACT US


33 Airport Center Drive
Suite 202
New Windsor, NY 12553

845-567-3100

David A. Fritts, CPESC, CESSWI, Associate
dfritts@mhepc.com
Shawn E. Arnott, P.E., Associate
sarnott@mhepc.com


**TOWN OF NEWBURGH**
**1496 ROUTE 300**
**NEWBURGH, NY 12550**
**845-564-4554**



# *POLLUTION SOURCES AND SOLUTIONS*

## EDUCATION

Polluted stormwater runoff can have many adverse effects on plants, fish, animals and people. Homeowners have the most impact at reducing Stormwater Pollution and Phosphorus Loading from:

Fertilizers, pesticides, yard clippings and leaves can wash into the drainage networks and pollute waterbodies via nutrient loading. Compost yard waste and use that as fertilizer in place of commercial fertilizers.

Don't over water your lawn. Have a rain barrel to catch roof runoff and utilize that for lawn care. Avoid or minimize the use of fertilizers and pesticides for lawn care.

## ILLICIT DISCHARGE DETECTION AND ELIMINATION (IDDE)

Homeowners, businesses and contractors can accidently/intentionally dump pollutants into the drainage network or directly into water bodies.

The general public should report any suspicious discharges (dirty/cloudy/tinted water, unusual smells, floating debris and random dumping) to Municipal offices. Municipal offices will investigate and attempt to identify the source.

## PHOSPHORUS POLLUTION

Phosphorus is the most common form of stormwater pollution due multiple sources of pollution (sediment erosion, sewer overflow and fertilizer application).

This can cause algae blooms in aquatic habits that depletes dissolved oxygen through overproduction and mass die off.

## EDUCATIONAL AWARENESS

1. Sediment can cloud the water and make it difficult or impossible for aquatic plants to grow. Sediment also can destroy aquatic habits and fill in streams, ponds and lakes.
2. Polluted stormwter can often affect drinking water sources. This, in turn, can create human health issues and increase drinking water treatment costs.
3. Bacteria and other pathogens can wash into swimming areas and create health hazards, often making beach closures necessary.
4. Debris, plastic bags, drink containers, cigarette butts and litter washing into waterbodies can choke, suffocate or disable aquatic life like ducks, fish, turtles and birds.
5. Excess nutrients can cause algae blooms. When algae dies, it sinks to the bottom and decomposes in a process that removes oxygen from water called eutrophication. Fish and other aquatic organisms can't exist in water with low dissolved oxygen levels.
6. Household hazardous waste like insectides, paint solvents, used motor oil, and other auto fluids can poison aquatic life.

## SEPTIC SYSTEMS

Leaking and poorly maintained septic systems release nutrients and pathogents (bacteria and viruses) that can be picked up by stormwater and discharged into nearby waterbodies. Pathogens can cause public health problems and environmental concerns.

Inspect your system every 3 years and pump your tank as necessary (every 3 to 5 years).

## PET WASTE

Pet waste can be a major source of bacteria and excess nutrients in local waters.

When walking your pet, remember to pick up the waste and dispose of it properly. Flushing pet waste is the best disposal method.

## AUTO CARE

Washing your car and degreasing your auto parts at home can send detergents and other contaminants through the storm sewer system. Dumping automotive fluids into storm drains has the same result as dumping the materials directly into a waterbody.

Use a commercial car wash that treats or recycles its wastewater, or wash your car in your yard so the water infiltrates into the ground.

Don't dispose of any hazardous materials (cleaning chemicals, auto fluids, greases) into storm drains. Property dispose of them in sealed containers and take to a certified disposal facility. All facilities that change oil must accept used waste oil.

# ATTACHMENT 6

# EPA PUBLICATION ON ILLICIT DISCHAGE DETECTION AND ELIMINATION



# Illicit Discharge Detection and Elimination

*A Guidance Manual for Program Development and Technical Assessments*

by the
Center for
Watershed Protection

and
Robert Pitt
University of Alabama

October 2004

# Notice

The information in this document has been funded wholly or in part by the United States Environmental Protection Agency under cooperative agreement X-82907801-0. Although it has been subjected to the Agency's peer and administrative review, it does not necessarily reflect the views of the Agency, and no official endorsement should be inferred. Also, the mention of trade names or commercial products does not imply endorsement by the United States government, the Center for Watershed Protection, or the University of Alabama.

# Illicit Discharge Detection and Elimination

## *A Guidance Manual for Program Development and Technical Assessments*

by

Edward Brown and Deb Caraco
Center for Watershed Protection
Ellicott City, Maryland 21043

and

Robert Pitt
University of Alabama
Tuscaloosa, Alabama 35487

EPA Cooperative Agreement
X-82907801-0

Project Officer

Bryan Rittenhouse
Water Permits Division
Office of Water and Wastewater
U.S. Environmental Protection Agency
Washington, D.C.

**October 2004**

# Photo Acknowledgments

| Figure Number | Source |
|---|---|
| 2 | Snohomish County, WA |
| 4 | Fort Worth Department of Environmental Management (DEM) |
| 5 | Fort Worth DEM |
| 8 | Dr. Robert Pitt, University of Alabama |
| 16 | Fort Worth DEM |
| 18 | Horsley Whitten |
| 28 (fire hydrant) | Fort Worth DEM |
| 34 (highly turbid discharge) | Rachel Calabro, Massachusetts Department of Environmental Protection |
| 34 (industrial discharge) | Dr. Robert Pitt |
| 34 (paint) | Dr. Robert Pitt |
| 34 (Toronto industrial spill) | Dr. Robert Pitt |
| 34 (blood) | Fort Worth DEM |
| 34 (failing septic) | Snohomish County, WA |
| 34 (construction site) | Don Green, Franklin, TN |
| 34 (discharge of rinse water) | Rachel Calabro |
| 35 (natural foam) | Snohomish County, WA |
| 35 (high severity suds) | Fort Worth DEM |
| 35 (moderate severity oil) | R. Frymire |
| 35 (high severity oil) | Kelly Dinsmore, City of Newark, DE |
| 38 (bright red bacteria) | R. Frymire |
| 38 (Sporalitis filamentous) | Robert Ressl, City of Arlington, TX |
| 38 (extreme algal growth) | Mark Sommerfield, Montgomery Co., Maryland |
| 38 (brownish algae) | R. Frymire |
| 39 (*all* but 'brownish stain') | R. Frymire |
| 41 (*all*) | R. Frymire |
| 42 | Galveston, TX |
| 48 | Fort Worth DEM |
| 49 | Dr. Robert Pitt |
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| 58-59 | Jewell, 2001 |
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| 69 | www.superiorsignal.com |
| 70 | www.darrscleaning.com |
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| 71 (b) | King County, WA |
| 72 | Mecklenburg, NC Water Quality Program |
| 73 | U.S. EPA, 1999 |

# Foreword

A number of past projects have found that dry-weather flows discharging from storm drainage systems can contribute significant pollutant loadings to receiving waters. If these loadings are ignored (by only considering wet-weather stormwater runoff, for example), little improvement in receiving water conditions may occur. Illicit dry-weather flows originate from many sources. The most important sources typically include sanitary wastewater or industrial and commercial pollutant entries, failing septic tank systems, and vehicle maintenance activities.

Provisions of the Clean Water Act (1987) require National Pollutant Discharge Elimination System (NPDES) permits for storm water discharges. Section 402 (p)(3)(B)(ii) requires that permits for municipal separate storm sewers shall include a requirement to effectively prohibit problematic non-storm water discharges into storm sewers. Emphasis is placed on the elimination of inappropriate connections to urban storm drains. This requires affected agencies to identify and locate sources of non-storm water discharges into storm drains so they may institute appropriate actions for their elimination.

This Manual is intended to provide support and guidance, primarily to Phase II NPDES MS4 communities, for the establishment of Illicit Discharge Detection and Elimination (IDDE) programs and the design and procedures of local investigations of non-storm water entries into storm drainage systems. It also has application for Phase I communities looking to modify existing programs and community groups such as watershed organizations that are interested in providing reconnaissance and public awareness services to communities as part of watershed restoration activities.

This Manual was submitted in partial fulfillment of cooperative agreement X-82907801-0 under the sponsorship of the U.S. Environmental Protection Agency. This report covers a period from July 2001 to July 2004 and was prepared by the Center for Watershed Protection, Ellicott City, MD in cooperation with Robert Pitt of the University of Alabama.

Some references in the document pertain to work conducted during this project. This internal support information was developed as work tasks were completed and research findings were developed. In some cases, memoranda or technical support documents were prepared. Most of these documents are in “draft” form and have not been published. As a result, they should be considered supplemental and preliminary information that is not intended for widespread citation or distribution. In the References section, these documents are identified as “IDDE project support material” at the end of each citation. Interested readers can access these documents through the website link to the project archive and support information.

# Acknowledgments

This Guidance Manual could not have been completed had it not been for the contributions of many individuals. Much of the field survey and laboratory analysis guidance in this manual reflects an update to information presented in Pitt *et. al.* (1993). Bob Pitt and his students and researchers have been instrumental in furthering the science to develop and identify safe, quick, accurate and cost effective methods to collect and analyze dry weather flow samples. Team members from the University of Alabama that contributed to this manual include: Bob Pitt, Soumya Chaturvedula, Sanju Jacob, Veera Karri, Uday Khambhammettu, Alex Maestre, Renee Morquecho, Yukio Nara, and Sumandeep Shergill. Team members from the Center for Watershed Protection include Jessica Brooks, Ted Brown, Karen Cappiella, Deb Caraco, Tom Schueler, Stephanie Sprinkle, Paul Sturm, Chris Swann, Tiffany Wright, and Jennifer Zielinski.

Support from EPA has been constant and valuable. We would like to thank Wendy Bell and Jack Faulk of the Office of Wastewater, and in particular, project officer, Bryan Rittenhouse.

We are grateful to the many communities that agreed to fill out our extensive surveys and questionnaires including:

- Erica Anderson Maguire, Ada County Highway District, ID
- Charles Caruso, City of Albuquerque, NM
- Bill Hicks, City of Alexandria, VA
- Jason Papacosma, Arlington County, VA
- Roger Glick and Roxanne Jackson, City of Austin, TX
- Bill Stack, Baltimore City, MD
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- John Nardone and James Wilcox, City of Cambridge, MA
- Andrew Swanson, Clackamas County, OR
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- John H. Cox, City of Durham, NC
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- Alan Searcy, City of Lakewood, CO
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- Michael Loffa, City of Phoenix, AZ
- Ali Dirks, City of Portland, OR
- Mark Senior, City of Raleigh, NC
- Beth Schmoyer, City of Seattle, WA
- Todd Wagner, City of Springfield, MO
- Arne Erik Anselm, City of Thousand Oaks, CA
- Dean Tuomari, Wayne County, MI
- David Harris, City of Worcester, MA

Others that provided useful insight into their community programs include Michael Hunt, City of Nashville, TN; Mecklenburg

County, NC; and Steve Jadlocki, City of Charlotte, NC.

The communities of Baltimore City, MD; Baltimore County, MD; Boston Water and Sewer Commission, MA; Cambridge, MA, Dayton, OH; Fort Worth, TX; Raleigh, NC; Tuscaloosa, AL; and Wayne County, MI were extremely generous in hosting project team members and sharing the details of their programs. A special thanks goes to Baltimore City, MD and Baltimore County, MD for providing access to laboratory and field equipment, and allowing protocols to be tested in their subwatersheds. Baltimore City staff members we would like to recognize include: Bill Stack, Dr. Freddie Alonzo, Ted Eucare, Shelly Jesatko, Hector Manzano, Umoja Muleyyar, Van Sturtevant, and Joan White. Baltimore County staff we would like to recognize include Steve Stewart and Steve Adamski.

Many of the outstanding graphics in the Manual were provided by outside sources. While sources are noted on the back of the title page, we would like to especially thank the following:

- Rachel Calabro, MA DEP
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- Barry Tonning, Tetra Tech

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# Introduction

An up-to-date and comprehensive manual on techniques to detect and correct discharges in municipal storm drains has been unavailable until now. This has been a major obstacle for both Phase I and Phase II National Pollutant Discharge Elimination System (NPDES) municipal separate storm sewer system (MS4) communities that must have programs in place that detect, eliminate, and prevent illicit discharges to the storm drain system. Smaller Phase II communities, in particular, need simple but effective program guidance to comply with permits issued by the Environmental Protection Agency (EPA) and states. This manual provides communities with guidance on establishing and implementing an effective Illicit Discharge Detection and Elimination (IDDE) program.

Studies have shown that dry weather flows from the storm drain system may contribute a larger annual discharge mass for some pollutants than wet weather storm water flows (EPA, 1983 and Duke, 1997). Detecting and eliminating these illicit discharges involves complex detective work, which makes it hard to establish a rigid prescription to "hunt down" and correct all illicit connections. Frequently, there is no single approach to take, but rather a variety of ways to get from detection to elimination. Local knowledge and available resources can play significant roles in determining which path to take. At the very least, communities need to systematically understand and characterize their stream, conveyance, and storm sewer infrastructure systems. When illicit discharges are identified, they need to be removed. The process is ongoing and the effectiveness of a program should improve with time. In fact, well-coordinated IDDE programs can benefit from and contribute to other community-wide water resources-based programs, such as public education, storm water management, stream restoration, and pollution prevention.

This manual incorporates the experience of more than 20 Phase I communities that were surveyed about their practices, levels of program effort, and lessons learned (CWP, 2002). These communities took many different approaches to solve the IDDE problem, and provided great insights on common obstacles, setting realistic expectations and getting a hard job done right. Many of the IDDE methods presented in this manual were first developed and tested in many Phase I communities. Specific techniques applied in a community should be adapted to local conditions, such as dominant discharge types, land use, and generating sites.

Designed with a broad audience in mind, including agency heads, program managers, field technicians and water quality analysts, this manual is primarily focused on providing the thousands of Phase II communities that are now in the process of developing IDDE programs with guidance for the development and implementation of their own programs. The manual has been organized to address the broad range of administrative and technical considerations involved with setting up an effective IDDE program. The first 10 chapters of the Manual focus on "big picture" considerations needed to successfully get an IDDE program off

the ground. The final four chapters provide detailed technical information on the methods to screen, characterize and remove illicit discharges in MS4 communities. These chapters present the state-of-the-practice on specific monitoring techniques and protocols.

In general, the content of this manual gets progressively more complex and technical toward the end. The basic organization of the manual is outlined below. The information is provided to help:

- Define important terminology and understand key illicit discharge concepts
- Conduct an audit to understand community needs and capabilities
- Establish adequate legal authority
- Develop a tracking system to map outfalls and document reported illicit discharges
- Conduct desktop analyses to prioritize targets for illicit discharge control
- Conduct rapid reconnaissance of the stream corridor to find problem outfalls
- Apply new analytical and field methods to find and fix illicit discharges
- Educate municipal employees and the public to prevent discharges
- Estimate costs to run a program and conduct specific investigations

**Chapter 1. The Basics of Illicit Discharges**– The many different sources and generating sites that can produce illicit discharges are described in Chapter 1. The chapter also outlines key concepts and terminology needed to understand illicit discharges, why they cause water quality problems and the regulatory context for managing them.

**Chapter 2. Components of an Effective Illicit Discharge Program**– This chapter presents an overall framework to build an IDDE program, by outlining eight key components of good programs. Each of the following eight chapters is dedicated to a key program component. The first page of the program component chapters is notated with a puzzle icon labeled with the applicable program component number.

**Chapter 3. Audit Existing Resources and Programs**– This chapter provides guidance on evaluating existing resources, regulations, and ongoing activities in your community to better address illicit discharges.

**Chapter 4. Establish Responsibility, Authority and Tracking**– This chapter presents guidance on how to identify the local agency who will be responsible for administering the IDDE program, and how to establish the legal authority to control illicit discharges by adapting an existing ordinance or adopting a new one. The chapter also describes how to set up a program tracking system needed to document discharges and local actions to respond to them.

**Chapter 5. Desktop Assessment of Illicit Discharge Potential**– The fifth chapter describes desktop analyses to process available mapping data to quickly characterize and screen illicit discharge problems at the community and subwatershed scale. Key factors include water quality, land use, development age, sewer infrastructure and outfall density. Rapid screening techniques are presented to define where to begin searching for illicit discharge problems in your community.

**Chapter 6. Developing Program Goals and Implementation** Strategies–

Communities are required to establish and track measurable goals for their IDDE program under the NPDES MS4 permit program. This chapter recommends a series of potential program goals that can guide local efforts, as well as guidance on how to measure and track progress toward their achievement.

**Chapter 7. Searching for Illicit Discharge Problems in the Field** – This chapter briefly summarizes the major monitoring techniques to find illicit discharges, and discusses how to select the right combination of monitoring methods to incorporate into your local program.

**Chapter 8. Isolating and Fixing Individual Illicit Discharges** – The methods used to find and remove illicit discharges are briefly described in this chapter and include citizen hotlines and techniques to trace, locate and remove illicit discharge sources.

**Chapter 9. Preventing Illicit Discharges** – Prevention is a cost effective way to reduce pollution from illicit discharge. This chapter highlights a series of carrot and stick strategies to prevent illicit discharges.

**Chapter 10. IDDE Program Evaluation** – IDDE programs must continually evolve to changing local conditions. This chapter describes how to review and revisit program goals to determine if they are being met and to make any needed adjustments.

**Chapter 11. The Outfall Reconnaissance Inventory (ORI)** – The chapter presents detailed protocols to conduct rapid field screening of problem outfalls. The chapter also outlines the staff and equipment costs needed to conduct an ORI, and presents methods to organize, manage and interpret the data you collect.

**Chapter 12. Chemical Monitoring** – This chapter presents detailed guidance on the wide range of chemical monitoring options that can be used to identify the composition of illicit discharge flows. The chapter begins by describing different chemical indicators that have been used to identify illicit discharges, and presents guidance on how to collect samples for analysis. The chapter recommends a flow chart approach that utilizes four chemical indicators to distinguish the flow type. The chapter provides specific information on other analytical methods that can be used, as well as proper safety, handling, and disposal procedures. Simple and more sophisticated methods for interpreting monitoring data are discussed, along with comparative cost information.

**Chapter 13. Tracking Discharges to Their Source** – This chapter describes how to investigate storm drain systems to narrow and remove individual illicit discharges. These techniques include "trunk" investigations (e.g., video surveillance, damming, and infiltration and inflow studies) and on-site investigations (e.g., dye tests, smoke tests, and pollution prevention surveys). The pros and cons of each investigation technique are discussed, and comparative cost estimates are given.

**Chapter 14. Techniques to Fix Discharges** – This chapter provides tips on the best methods to repair or eliminate discharges. Specific advice is presented on how to identify responsible parties, develop pre-approved subcontractor lists, and estimate unit costs for typical repairs.

**Appendices** – Eleven technical appendices are provided at the end of the manual.

# Chapter 1: The Basics of Illicit Discharges

An understanding of the nature of illicit discharges in urban watersheds is essential to find, fix and prevent them. This chapter begins by defining the terms used to describe illicit discharges, and then reviews the water quality problems they cause. Next, the chapter presents the regulatory context for controlling illicit discharges, and reviews the experience local communities have gained in detecting and eliminating them.

## 1.1 Important Terminology and Key Concepts

This Manual uses several important terms throughout the text that merit upfront explanation. This section defines the terminology to help program managers perform important illicit discharge detective work in their communities. Key concepts are presented to classify illicit discharges, generating sites and control techniques.

### *Illicit Discharge*

The term "illicit discharge" has many meanings in regulation[1] and practice, but we use a four-part definition in this manual.

1. Illicit discharges are defined as a storm drain that has measurable flow during dry weather containing pollutants and/or pathogens. A storm drain with measurable flow but containing no pollutants is simply considered a discharge.
2. Each illicit discharge has a unique frequency, composition and mode of entry in the storm drain system.
3. Illicit discharges are frequently caused when the sewage disposal system interacts with the storm drain system. A variety of monitoring techniques is used to locate and eliminate illegal sewage connections. These techniques trace sewage flows from the stream or outfall, and go back up the pipes or conveyances to reach the problem connection.
4. Illicit discharges of other pollutants are produced from specific source areas and operations known as "generating sites." Knowledge about these generating sites can be helpful to locate and prevent non-sewage illicit discharges. Depending on the regulatory status of specific "generating sites," education, enforcement and other pollution prevention techniques can be used to manage this class of illicit discharges.

Communities need to define illicit discharges as part of an illicit discharge ordinance. Some non-storm water discharges to the MS4 may be allowable, such as discharges resulting from fire fighting activities and air conditioning condensate. Chapter 4 provides more detail on ordinance development.

[1] 40 CFR 122.26(b)(2) defines an illicit discharge as any discharge to an MS4 that is not composed entirely of storm water, except allowable discharges pursuant to an NPDES permit, including those resulting from fire fighting activities.

## Storm Drain

A **storm drain** can be either an *enclosed pipe or an open channel.* From a regulatory standpoint, **major** storm drains are defined as enclosed storm drain pipes with a diameter of 36 inches, or greater or open channels that drain more than 50 acres. For industrial land uses, major drains are defined as enclosed storm drain pipes 12 inches or greater in diameter and open channels that drain more than two acres. **Minor** storm drains are smaller than these thresholds. Both major and minor storm drains can be a source of illicit discharges, and both merit investigation.

Some "pipes" found in urban areas may look like storm drains but actually serve other purposes. Examples include foundation drains, weep holes, culverts, etc. These pipes are generally not considered storm drains from a regulatory or practical standpoint. Small diameter "straight pipes," however, are a common source of illicit discharges in many communities and should be investigated to determine if they are a pollutant source.

Not all dry weather storm drain flow contains pollutants or pathogens. Indeed, many communities find that storm drains with dry weather flow are, in fact, relatively clean. Flow in these drains may be derived from springs, groundwater seepage, or leaks from water distribution pipes. Consequently, field testing and/or water quality sampling are needed to confirm whether pollutants are actually present in dry weather flow, in order to classify them as an illicit discharge.

## Discharge Frequency

The **frequency** of dry weather discharges in storm drains is important, and can be classified as *continuous, intermittent or transitory.*

**Continuous** discharges occur most or all of the time, are usually easier to detect, and typically produce the greatest pollutant load. **Intermittent** discharges occur over a shorter period of time (e.g., a few hours per day or a few days per year). Because they are infrequent, intermittent discharges are hard to detect, but can still represent a serious water quality problem, depending on their flow type. **Transitory** discharges occur rarely, usually in response to a singular event such as an industrial spill, ruptured tank, sewer break, transport accident or illegal dumping episode. These discharges are extremely hard to detect with routine monitoring, but under the right conditions, can exert severe water quality problems on downstream receiving waters.

## Discharge Flow Types

Dry weather discharges are composed of one or more possible **flow types**:

- *Sewage and septage* flows are produced from sewer pipes and septic systems.
- *Washwater* flows are generated from a wide variety of activities and operations. Examples include discharges of gray water (laundry) from homes, commercial carwash wastewater, fleet washing, commercial laundry wastewater, and floor washing to shop drains.
- *Liquid wastes* refers to a wide variety of flows, such as oil, paint, and process water (radiator flushing water, plating bath wastewater, etc.) that enter the storm drain system.
- *Tap water* flows are derived from leaks and losses that occur during the distribution of drinking water in the water supply system. Tap water discharges in the storm drain system may be more prevalent in communities

with high loss rates (i.e., greater than 15%) in their potable water distribution system. (source of 15% is from National Drinking Water Clearinghouse http://www.nesc.wvu.edu/ndwc/articles/OT/FA02/Economics_Water.html)

- *Landscape irrigation* flows occur when excess potable water used for residential or commercial irrigation ends up in the storm drain system.
- *Groundwater and spring water* flows occur when the local water table rises above the bottom elevation of the storm drain (known as the invert) and enters the storm drain either through cracks and joints, or where open channels or pipes associated with the MS4 may intercept seeps and springs.

Water quality testing is used to conclusively identify flow types found in storm drains. Testing can distinguish illicit flow types (sewage/septage, washwater and liquid wastes) from cleaner discharges (tap water, landscape irrigation and ground water).

Each flow type has a distinct chemical fingerprint. Table 1 compares the pollutant fingerprint for different flow types in Alabama. The chemical fingerprint for each flow type can differ regionally, so it is a good idea to develop your own "fingerprint" library by sampling each local flow type.

In practice, many storm drain discharges represent a blend of several flow types, particularly at larger outfalls that drain larger catchments. For example, groundwater flows often dilute sewage thereby masking its presence. Chapter 12 presents several techniques to help isolate illicit discharges that are blended with cleaner discharges. Illicit discharges are also masked by high volumes of storm water runoff making it difficult and frequently impossible to detect them during wet weather periods.

## Mode of Entry

Illicit discharges can be further classified based on how they enter the storm drain system. The **mode of entry** can either be **direct** or **indirect. Direct entry** means that the discharge is directly connected to the storm drain pipe through a sewage pipe, shop drain, or other kind of pipe. Direct entry usually produces discharges that are continuous or intermittent. Direct entry usually occurs when two different kinds of "plumbing" are improperly connected. The three main situations where this occurs are:

*Sewage cross-connections:* A sewer pipe that is improperly connected to the storm drain system produces a continuous discharge of raw sewage to the pipe (Figure 1). Sewage cross-connections can occur in catchments where combined sewers or septic systems are converted to a separate sewer system, and a few pipes get "crossed."

*Straight pipe:* This term refers to relatively small diameter pipes that intentionally bypass the sanitary connection or septic drain fields, producing a direct discharge into open channels or streams as shown in Figure 2.

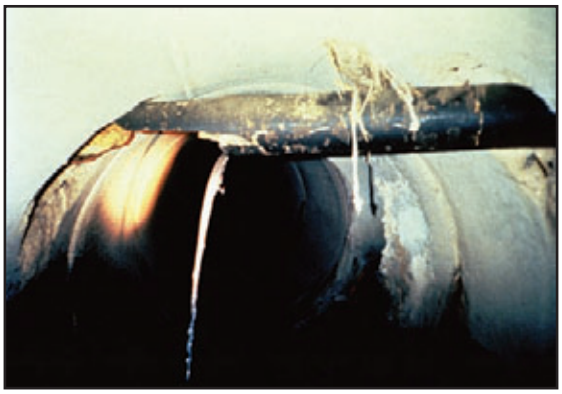


**Figure 1: Sewer Pipe Discharging to the Storm Drain System**

| Table 1: Comparative "Fingerprint" (Mean Values) of Flow Types | | | | | | |
|---|---|---|---|---|---|---|
| **Flow Type** | **Hardness (mg/L as CaCO3)** | **$NH_3$ (mg/L)** | **Potassium (mg/L)** | **Conductivity (µS/cm)** | **Fluoride (mg/L)** | **Detergents (mg/L)** |
| Sewage | 50 (0.26)* | 25 (0.53)* | 12 (0.21)* | 1215 (0.45)* | 0.7 (0.1)* | 9.7 (0.17)* |
| Septage** | 57(0.36) | 87 (0.4) | 19 (0.42) | 502 (0.42) | 0.93 (0.39) | 3.3 (1.33) |
| Laundry Washwater | 45 (0.33) | 3.2 (0.89) | 6.5 (0.78) | 463.5 (0.88) | 0.85 (0.4) | 758 (0.27) |
| Car Washwater | 71 (0.27) | 0.9 (1.4) | 3.6 (0.67) | 274 (0.45) | 1.2 (1.56) | 140 (0.2) |
| Plating Bath (Liquid Industrial Waste**) | 1430 (0.32) | 66 (0.66) | 1009 (1.24) | 10352 (0.45) | 5.1 (0.47) | 6.8 (0.68) |
| Radiator Flushing (Liquid Industrial Waste**) | 5.6 (1.88) | 26 (0.89) | 2801 (0.13) | 3280 (0.21) | 149 (0.16) | 15 (0.11) |
| Tap Water | 52 (0.27) | <0.06 (0.55) | 1.3 (0.37) | 140 (0.07) | 0.94 (0.07) | 0 (NA) |
| Groundwater | 38 (0.19) | 0.06 (1.35) | 3.1 (0.55) | 149 (0.24) | 0.13 (0.93) | 0 (NA) |
| Landscape Irrigation | 53 (0.13) | 1.3 (1.12) | 5.6 (0.5) | 180 (0.1) | 0.61 (0.35) | 0 (NA) |

** The number in parentheses after each concentration is the Coefficient of Variation; NA = Not Applicable*
*** All values are from Tuscaloosa, AL monitoring except liquid wastes and septage, which are from Birmingham, AL.*
*Sources: Pitt (project support material) and Pitt et al. (1993)*



**Figure 2: Direct Discharge from a Straight Pipe**

*Industrial and commercial cross-connections:* These occur when a drain pipe is improperly connected to the storm drain system producing a discharge of wash water, process water or other inappropriate flows into the storm drain pipe. A floor shop drain that is illicitly connected to the storm drain system is illustrated in Figure 3.

**Sewage** has the greatest potential to produce *direct* illicit discharges within any urban subwatershed, regardless of the diverse land uses that it comprises. The most commonly reported sewage-related direct discharges are broken sanitary sewer lines (81% of survey respondents), cross-connections (71% of survey respondents), and straight pipe discharges (38% of survey respondents). (CWP, 2002).

Older industrial areas tend to have a higher potential for illicit cross-connections.

**Indirect** entry means that flows generated outside the storm drain system enter through storm drain inlets or by infiltrating through the joints of the pipe. Generally, indirect modes of entry produce intermittent or transitory discharges, with the exception of groundwater seepage. The five main modes of indirect entry for discharges include:

*Groundwater seepage into the storm drain pipe:* Seepage frequently occurs in storm

drains after long periods of above average rainfall. Seepage discharges can be either continuous or intermittent, depending on the depth of the water table and the season. Groundwater seepage usually consists of relatively clean water that is not an illicit discharge by itself, but can mask other illicit discharges. If storm drains are located close to sanitary sewers, groundwater seepage may intermingle with diluted sewage.

*Spills that enter the storm drain system at an inlet:* These transitory discharges occur when a spill travels across an impervious surface and enters a storm drain inlet. Spills can occur at many industrial, commercial and transport-related sites. A very common example is an oil or gas spill from an accident that then travels across the road and into the storm drain system (Figure 4).

*Dumping a liquid into a storm drain inlet:* This type of transitory discharge is created when liquid wastes such as oil, grease, paint, solvents, and various automotive fluids are dumped into the storm drain (Figure 5). Liquid dumping occurs intermittently at sites that improperly dispose of rinse water and wash water during maintenance and cleanup operations. A common example is cleaning deep fryers in the parking lot of fast food operations.

*Outdoor washing activities that create flow to a storm drain inlet:* Outdoor washing may or may not be an illicit discharge, depending on the nature of the generating site that produces the wash water. For example, hosing off individual sidewalks and driveways may not generate significant flows or pollutant loads. On the other hand, routine washing of fueling areas, outdoor storage areas, and parking lots (power washing), and construction equipment cleanouts may result in unacceptable pollutant loads (Figure 6).

*Non-target irrigation from landscaping or lawns that reaches the storm drain system:* Irrigation can produce intermittent discharges from over-watering or misdirected sprinklers that send tap water over impervious areas (Figure 7). In some instances, non-target irrigation can produce unacceptable loads of nutrients, organic matter or pesticides. The most common example is a discharge from commercial landscaping areas adjacent to parking lots connected to the storm drain system.




**Figure 3: A common industrial cross connection is a floor drain that is illicitly connected to a storm drain**



**Figure 4: Accident spills are significant sources of illicit discharges to the storm drain system**



**Figure 5: Dumping at a storm drain inlet**



**Figure 6: Routine outdoor washing and rinsing can cause illicit discharges**



**Figure 7: Non-target landscaping irrigation water**

### *Land Use and Potential Generating Sites*

**Land use** can predict the potential for indirect discharges, which are often intermittent or transitory. Many indirect discharges can be identified and prevented using the concept of "generating sites," which are sites where common operations can generate indirect discharges in a community. Both research and program experience indicate that a small subset of generating sites within a broader land use category can produce most of the indirect discharges. Consequently, the density of potential generating sites within a subwatershed may be a good indicator of the severity of local illicit discharge problems. Some common generating sites within major land use categories are listed in Table 2, and described below.

*Residential Generating Sites:* Failing septic systems were the most common residential discharge reported in 33% of IDDE programs surveyed (CWP, 2002). In addition, indirect residential discharges were

also frequently detected in 20% of the IDDE programs surveyed, which consisted of oil dumping, irrigation overflows, swimming pool discharges, and car washing. Many indirect discharges are caused by common residential behaviors and may not be classified as "illicit" even though they can contribute to water quality problems. With the exception of failing septic systems and oil dumping, most communities have chosen education rather than enforcement as the primary tool to prevent illicit discharges from residential areas.

*Commercial Generating Sites:* Illicit discharges from commercial sites were reported as frequent in almost 20% of local IDDE programs surveyed (CWP, 2002). Typical commercial discharge generators included operations such as outdoor washing; disposal of food wastes; car fueling, repair, and washing; parking lot power washing; and poor dumpster management. Recreational areas, such as marinas and campgrounds, were also reported to be a notable source of sewage discharges. It is important to note that not all businesses within a generating category actually produce illicit discharges; generally only a relatively small fraction do. Consequently, on-site inspections of individual businesses are needed to confirm whether a property is actually a generating site.

**Sewage** can also be linked to significant *indirect* illicit discharges in the form of sanitary sewer overflows (52% of survey respondents), sewage infiltration/inflow (48% of survey respondents), and sewage dumping from recreational vehicles (33% of survey respondents) (CWP, 2002).

| Table 2: Land Uses, Generating Sites and Activities That Produce Indirect Discharges | | |
|---|---|---|
| **Land Use** | **Generating Site** | **Activity that Produces Discharge** |
| Residential | • Apartments<br>• Multi-family<br>• Single Family Detached | • Car Washing<br>• Driveway Cleaning<br>• Dumping/Spills (e.g., leaf litter and RV/boat holding tank effluent)<br>• Equipment Washdowns<br>• Lawn/Landscape Watering<br>• Septic System Maintenance<br>• Swimming Pool Discharges |
| Commercial | • Campgrounds/RV parks<br>• Car Dealers/Rental Car Companies<br>• Car Washes<br>• Commercial Laundry/Dry Cleaning<br>• Gas Stations/Auto Repair Shops<br>• Marinas<br>• Nurseries and Garden Centers<br>• Oil Change Shops<br>• Restaurants<br>• Swimming Pools | • Building Maintenance (power washing)<br>• Dumping/Spills<br>• Landscaping/Grounds Care (irrigation)<br>• Outdoor Fluid Storage<br>• Parking Lot Maintenance (power washing)<br>• Vehicle Fueling<br>• Vehicle Maintenance/Repair<br>• Vehicle Washing<br>• Washdown of greasy equipment and grease traps |
| Industrial | • Auto recyclers<br>• Beverages and brewing<br>• Construction vehicle washouts<br>• Distribution centers<br>• Food processing<br>• Garbage truck washouts<br>• Marinas, boat building and repair<br>• Metal plating operations<br>• Paper and wood products<br>• Petroleum storage and refining<br>• Printing | • All commercial activities<br>• Industrial process water or rinse water<br>• Loading and un-loading area washdowns<br>• Outdoor material storage (fluids) |
| Institutional | • Cemeteries<br>• Churches<br>• Corporate Campuses<br>• Hospitals<br>• Schools and Universities | • Building Maintenance (e.g., power washing)<br>• Dumping/Spills<br>• Landscaping/Grounds Care (irrigation)<br>• Parking Lot Maintenance (power washing)<br>• Vehicle Washing |
| Municipal | • Airports<br>• Landfills<br>• Maintenance Depots<br>• Municipal Fleet Storage Areas<br>• Ports<br>• Public Works Yards<br>• Streets and Highways | • Building Maintenance (power washing)<br>• Dumping/Spills<br>• Landscaping/Grounds Care (irrigation)<br>• Outdoor Fluid Storage<br>• Parking Lot Maintenance (power washing)<br>• Road Maintenance<br>• Spill Prevention/Response<br>• Vehicle Fueling<br>• Vehicle Maintenance/Repair<br>• Vehicle Washing |

*Industrial Generating Sites:* Industrial sites produce a wide range of flows that can cause illicit discharges. The most common continuous discharges are operations involving the disposal of rinse water, process water, wash water and contaminated, non-contact cooling water. Spills and leaks, ruptured pipes, and leaking underground storage tanks are also a source of indirect discharges. Illicit discharges from industry were detected in nearly 25% of the local IDDE programs surveyed (CWP, 2002).

Industries are classified according to hundreds of different Standard Industrial Classification (SIC) codes. The SIC coding system also includes commercial, institutional and municipal operations[2]. Many industries are required to have storm water pollution prevention and spill response plans under EPA's Industrial Storm Water NPDES Permit Program. A complete list of the industries covered by the Storm Water NPDES Permit Program can be found in Appendix A. The appendix also rates each industrial category based on its potential to produce illicit discharges, based on analysis by Pitt (2001).

*Institutional Generating Sites:* Institutions such as hospitals, corporate campuses, colleges, churches, and cemeteries can be generating sites if routine maintenance practices/operations create discharges from parking lots and other areas. Many large institutional sites have their own areas for fleet maintenance, fueling, outdoor storage, and loading/unloading that can produce indirect discharges.

[2]More recently, federal agencies including EPA, have adopted the North American Industry Classification System (NAICS, pronounced "Nakes") as the industry classification system. For more information on the NAICS and how it correlates with SIC, visit http://www.census.gov/epcd/www/naics.html.

*Municipal Generating Sites:* Municipal generating sites include operations that handle solid waste, water, wastewater, street and storm drain maintenance, fleet washing, and yard waste disposal. Transport-related areas such as streets and highways, airports, rail yards, and ports can also generate indirect discharges from spills, accidents and dumping.

## Finding, Fixing, and Preventing Illicit Discharges

The purpose of an IDDE program is to find, fix and prevent illicit discharges, and a series of techniques exist to meet these objectives. The remainder of the manual describes the major tools used to build a local IDDE program, but they are briefly introduced below:

### Finding Illicit Discharges

The highest priority in most programs is to find any continuous and intermittent sewage discharges to the storm drain system. A range of monitoring techniques can be used to find sewage discharges. In general, monitoring techniques are used to find problem areas and then trace the problem back up the stream or pipe to identify the ultimate generating site or connection. Monitoring can sometimes pick up other types of illicit discharge that occur on a continuous or intermittent basis (e.g., wash water and liquid wastes). Monitoring techniques are classified into three major groups:

- Outfall Reconnaissance Inventory
- Indicator Monitoring at Storm Water Outfalls and In-stream
- Tracking Discharges to their Source

**!!! Caution !!!**

Using land use as an indicator for certain flow types such as sewage is often less reliable than other factors in predicting the potential severity of sewage discharges. More useful assessment factors for illicit sewage discharges include the age of the sewer system, which helps define the physical integrity and capacity of the pipe network, as well as age of development, which reveals the plumbing codes and practices that existed when individual connections were made over time. Two particular critical phases in the sewer history of a subwatershed are when sanitary sewers were extended to replace existing septic systems, or when a combined sewer was separated. The large number of new connections and/or disconnections during these phases increases the probability of bad plumbing.

## *Fixing Illicit Discharges*

Once sewage discharges or other connections are discovered, they can be fixed, repaired or eliminated through several different mechanisms. Communities should establish targeted education programs along with legal authority to promote timely corrections. A combination of carrots and sticks should be available to deal with the diversity of potential dischargers.

## *Preventing Illicit Discharges*

The old adage "an ounce of prevention is worth a pound of cure" certainly applies to illicit discharges. Transitory discharges from generating sites can be minimized through pollution prevention practices and well-executed spill management and response plans. These plans should be frequently practiced by local emergency response agencies and/or trained workers at generating sites. Other pollution prevention practices are described in Chapter 9 and explored in greater detail in Manual 8 of the Urban Subwatershed Restoration Manual Series (Schueler *et al.*, 2004).

**National Urban Runoff Project**

EPA's National Urban Runoff Project (NURP) studies highlighted the significance of pollutants from illicit entries into urban storm sewerage (EPA, 1983). Such entries may be evidenced by flow from storm sewer outfalls following substantial dry periods. Such flow, frequently referred to as "baseflow" or "dry weather flow", could be the result of direct "illicit connections" as mentioned in the NURP final report (EPA, 1983), or could result from indirect connections (such as leaky sanitary sewer contributions through infiltration). Many of these dry weather flows are continuous and would therefore occur during rain induced runoff periods. Pollutant contributions from dry weather flows in some storm drains have been shown to be high enough to significantly degrade water quality because of their substantial contributions to the annual mass pollutant loadings to receiving waters (project research).

## 1.2 The Importance of Illicit Discharges in Urban Water Quality

Dry and wet weather flows have been monitored during several urban runoff studies. These studies have found that discharges observed at outfalls during dry weather were significantly different from wet weather discharges. Data collected during the 1984 Toronto Area Watershed Management Strategy Study monitored and characterized both storm water flows and baseflows (Pitt and McLean, 1986). This project involved intensive monitoring in two test areas (a mixed residential/commercial area and an industrial area) during warm, cold, wet, and dry weather. The annual mass discharges of many pollutants were found to be greater in dry weather flows than in wet weather flows.

A California urban discharge study identified commercial and residential discharges of oil and other automobile-related fluids as a common problem based on visual observations (Montoya, 1987). In another study, visual inspection of storm water pipes discharging to the Rideau River in Ontario found leakage from sanitary sewer joints or broken pipes to be a major source of storm drain contamination (Pitt, 1983).

Several urban communities conducted studies to identify and correct illicit connections to their storm drain systems during the mid-1980s. These studies were usually taken in response to receiving water quality problems or as part of individual NURP research projects. The studies indicated the magnitude and extent of cross-connection problems in many urban watersheds. For example, Washtenaw County, Michigan tested businesses to locate direct illicit connections to the county storm drain system. Of the 160 businesses tested, 38% were found to have illicit storm drain connections (Schmidt and Spencer, 1986). An investigation of the separate storm sewer system in Toronto, Ontario revealed 59% of outfalls had dry weather flows, while 14% of the total outfalls were characterized as "grossly polluted," based on a battery of chemical tests (GLA, 1983). An inspection of the 90 urban storm water outfalls draining into Grays Harbor in Washington showed that 32% had dry weather flows (Pelletier and Determan, 1988). An additional 19 outfalls were considered suspect, based on visual observation and/or elevated pollutant levels compared to typical urban storm water runoff.

The Huron River Pollution Abatement Program ranks as one of the most thorough and systematic early investigations of illicit discharges (Washtenaw County, 1988). More than a thousand businesses, homes and other buildings located in the watershed were dye tested. Illicit connections were found at 60% of the automobile-related businesses tested, which included service stations, automobile dealerships, car washes, and auto body and repair shops. All plating shops inspected were found to have illicit storm drain connections. Additionally, 67% of the manufacturers, 20% of the private service agencies and 88% of the wholesale/retail establishments tested were found to have illicit storm sewer connections. Of the 319 homes dye tested, 19 were found to have direct sanitary connections to storm drains. The direct discharge of rug-cleaning wastes into storm drains by carpet cleaners was also noted as a common problem.

Eliminating illicit discharges is a critical component to restoring urban watersheds. When bodies of water cannot meet designated uses for drinking water, fishing, or recreation, tourism and waterfront home

values may fall; fishing and shellfish harvesting can be restricted or halted; and illicit discharges can close beaches, primarily as a result of bacteria contamination. In addition to the public health and economic impacts associated with illicit discharges, significant impacts to aquatic life and wildlife are realized. Numerous fish kills and other aquatic life losses have occurred in watersheds as a result of illicit or accidental dumping and spills that have resulted in lethal pollutant concentrations in receiving waters.

## 1.3 Regulatory Background For Illicit Discharges

The history of illicit discharge regulations is long and convoluted, reflecting an ongoing debate as to whether they should be classified as a point or nonpoint source of pollution. The Clean Water Act amendments of 1987 contained the first provisions to specifically regulate discharges from storm drainage systems. Section 402(p)(3)(B) provides that "permits for such discharges:

(i) May be issued on a system or jurisdiction-wide basis

(ii) Shall include a requirement to effectively prohibit non-storm water discharges into the storm sewers; and

(iii) Shall require controls to reduce the discharge of pollutants to the maximum extent practical including management practices, control techniques and system design and engineering methods, and such provisions as the Administrator or the State determines appropriate for the control of such pollutants."

In the last 15 years, NPDES permits have gradually been applied to a greater range of communities. In 1990, EPA issued a final rule, known as Phase I to implement section 402(p) of the Clean Water Act through the NPDES permit system. The EPA effort expanded in December 1999, when the Phase II final rule was issued. A summary of how both rules pertain to MS4s and illicit discharge control is provided below.

### *Summary of NPDES Phase I Requirements*

The NPDES Phase I permit program regulates municipal separate storm sewer systems (MS4s) meeting the following criteria:

- Storm sewer systems located in an incorporated area with a population of 100,000 or more
- Storm sewer systems located in 47 counties identified by EPA as having populations over 100,000 that were unincorporated but considered urbanized areas
- Other storm sewer systems that are specially designated based on the location of storm water discharges with respect to waters of the United States, the size of the discharge, the quantity and nature of the pollutants discharged, and the interrelationship to other regulated storm sewer systems, among other factors

An MS4 is defined as any conveyance or system of conveyances that is owned or operated by a state or local government entity designed for collecting and conveying storm water, which is not part of a Publicly Owned Treatment Works. The total number of permitted MS4s in the Phase I program is 1,059.

**PHASE I HIGHLIGHTS**

| | |
|---|---|
| **Who must meet the requirements?** | MS4s with population ≥100,00 |
| **How many Phase I communities exist nationally?** | 1,059 |
| **What are the requirements related to illicit discharges?** | Develop programs to prevent, detect and remove illicit discharges |



Phase I MS4s were required to submit a two-part application. The first part required information regarding existing programs and the capacity of the municipality to control pollutants. Part 1 also required identification of known "major" outfalls[3] discharging to waters of the United States, and a field screening analysis of representative major outfalls to detect illicit connections. Part 2 of the application required identification of additional major outfalls, limited monitoring, and a proposed storm water management plan (EPA, 1996).

Phase I communities were required to develop programs to detect and remove illicit discharges, and to control and prevent improper disposal into the MS4 of materials such as used oil or seepage from municipal sanitary sewers. The illicit discharge programs were required to include the following elements:

- Implementation and enforcement of an ordinance, orders or similar means to prevent illicit discharges to the MS4
- Procedures to conduct ongoing field screening activities during the life of the permit
- Procedures to be followed to investigate portions of the separate storm sewer system that, based on the results of the field screening required in Part 2 of the application, indicate a reasonable potential for containing illicit discharges or other sources of non-storm water
- Procedures to prevent, contain, and respond to spills that may discharge into the MS4
- A program to promote, publicize, and facilitate public reporting of the presence of illicit discharges or water quality impacts associated with discharges from the MS4
- Educational activities, public information activities, and other appropriate activities to facilitate the proper management and disposal of used oil and toxic materials
- Controls to limit infiltration of seepage from municipal sanitary sewers to the MS4

[3]A "major" outfall is defined as an MS4 outfall that discharges from a single pipe with an inside diameter of at least 36 inches, or discharges from a single conveyance other than a circular pipe serving a drainage area of more than 50 acres. An MS4 outfall with a contributing industrial land use that discharges from a single pipe with an inside diameter of 12 inches or more or discharges from a single conveyance other than a circular pipe serving a drainage area of more than two acres.

### Summary of NPDES Phase II Requirements

The Phase II Final Rule, published in the Federal Register regulates MS4s that meet both of the following criteria:

- Storm sewer systems that are not a medium or large MS4 covered by Phase I of the NPDES Program
- Storm sewer systems that are located in an Urbanized Area (UA) as defined by the Bureau of the Census, or storm sewer systems located outside of a UA that are designated by NPDES permitting authorities because of one of the following reasons:
  - The MS4's discharges cause, or have the potential to cause, an adverse impact on water quality
  - The MS4 contributes substantially to the pollutant loadings of a physically interconnected MS4 regulated by the NPDES storm water program

MS4s that meet the above criteria are referred to as regulated small MS4s. Each regulated small MS4 must satisfy six minimum control measures:

1. Public education and outreach
2. Public participation/involvement
3. Illicit discharge detection and elimination
4. Construction site runoff control
5. Post-construction runoff control
6. Pollution prevention/Good housekeeping

Under the third minimum measure, an illicit discharge is defined as any discharge to an MS4 that is not composed entirely of storm water, except allowable discharges pursuant to an NPDES permit, including those resulting from fire fighting activities (40 CFR 122.26(b)(2)). To satisfy this minimum measure, the regulated small MS4 must include the following five components:

- Develop a storm sewer system map that shows the location of all outfalls and the names and locations of all waters of the United States that receive discharges from those outfalls
- Prohibit, through ordinance or other regulatory mechanism, non-storm water discharges into the storm sewer system and implement appropriate enforcement procedures and actions
- Develop and implement a plan to detect and address illicit discharges to the MS4
- Educate public employees, businesses, and the general public of hazards associated with illicit discharges and improper disposal of waste
- Identify the appropriate best management practices and measurable goals for this minimum measure

**PHASE II HIGHLIGHTS**

| | |
|---|---|
| **Who must meet the requirements?** | Selected small MS4s  |
| **How many Phase II communities exist nationally?** | EPA estimates 5,000–6,000 |
| **What are the requirements related to illicit discharges?** | Develop programs to prevent, detect and remove illicit discharges |
| **What is the deadline for meeting these requirements?** | Permits issued by March 10, 2003. Programs must be fully implemented by the end of first permit term (5 years) |

In the regulation, EPA recommends that the plan to detect and address illicit discharges include procedures for:

- Locating priority areas likely to have illicit discharges (which may include visually screening outfalls during dry weather and conducting field tests of selected pollutants)
- Tracing the source of an illicit discharge
- Removing the source of the discharge
- Program evaluation and assessment

## 1.4 Experience Gained in Phase I

The Center for Watershed Protection conducted a series of surveys and interviews with Phase I communities to determine the current state of the practices utilized in local IDDE programs, and to identify the most practical, low-cost, and effective techniques to find, fix and prevent discharges. The detailed survey included 24 communities from various geographic and climatic regions in the United States. Some of the key findings of the survey are presented below (CWP, 2002)[4].

- Lack of staff significantly hindered implementation of a successful IDDE program. Phase I communities rely heavily on the expertise of their field staff—practical expertise that has been acquired over many years as programs gradually developed. Methods or approaches recommended for Phase II communities should be less dependent on professional judgment.

[4] Survey results are based on responses from 24 jurisdictions from 16 states. Surveys were supplemented by on-site interviews of staff of eight IDDE programs: Baltimore City, MD; Baltimore County, MD; Boston Water and Sewer Commission (BWSC), MA; Cambridge, MA; Dayton, OH; Raleigh, NC; Wayne County, MI; and Fort Worth, TX. Jurisdictions selected for the survey and interviews represent a variety of geographic and climatic regions. The EPA storm water coordinators for each region of the country were contacted for recommendations on jurisdictions to include in the survey. Also, a variety of jurisdiction sizes in terms of population, IDDE program service area, and land use was targeted.

- Clear and effective ordinance language should be adopted by Phase II communities to ensure that all potential sources of illicit discharges are prohibited, and that the community has sufficient legal authority to inspect private properties and enforce corrections.
- Many communities lacked up-to-date mapping resources, and found that mapping layers such as storm sewers, open drainage channels, waters of the U.S., outfalls, and land use were particularly useful to conduct and prioritize effective field investigations.
- Outfall screening required the greatest staff and equipment resources, and did not always find problem outfalls. Communities recommended a fast and efficient sampling approach that utilizes a limited number of indicator parameters at each outfall to find problem outfalls.
- When purchasing equipment, Phase II programs should communicate with other jurisdictions to consider sharing field equipment and laboratory costs.
- Use of some discharge tracers has proven challenging and sometimes fruitless, because of false or ambiguous results and complex or hazardous analytical methods. Accurate, cost-effective, and safe monitoring methods are needed to effectively use tracers.
- Municipal IDDE programs worked best when they integrated illicit discharge control in the wider context of urban watershed restoration. Table 3 provides some examples of how greater interagency cooperation can be achieved by linking restoration program areas.

In summary, survey communities expressed a strong need for relatively simple guidance to perform illicit discharge investigations. To address this need, the Manual has been designed to make simple program and technical recommendations for Phase II communities to develop cost-effective IDDE programs.

| Table 3: Linking Other Municipal Programs to IDDE Program Needs | |
|---|---|
| **Watershed-Related Program** | **How Program Relates to IDDE Program Needs** |
| Subwatershed Mapping and Analysis | • Mapping and aerial photography are critical tools needed for illicit connection detection surveys. GIS tax map layers are often useful to identify property ownership. |
| Rapid Assessment of Stream Corridors | • Observations from physical stream assessments are often useful in identifying problem areas, including dry weather flow outfalls, illegal dumping, and failing infrastructure locations. |
| Watershed Monitoring and Reporting | • Compiled water quality and other indicator data can be useful in targeting problem areas. |
| Stream Restoration Opportunities | • Stream restoration opportunities can often be coordinated with sewer infrastructure upgrades and maintenance. |
| Watershed Education | • Educating the public about unwanted discharges can save programs money by generating volunteer networks to report and locate problem areas. Better awareness by the public can also reduce the likelihood of unintentional cross-connections. |
| Pollution Prevention for Generating Sites | • Providing incentives to businesses to inspect and correct connections can save programs money. |

# Chapter 2: Components of an Effective IDDE Program

The prospect of developing and administering an IDDE program can be daunting, complex and challenging in many communities. This Chapter organizes and simplifies the basic tasks needed to build a program. In general, a community should consider eight basic program components, as follows:

**1. Audit Existing Resources and Programs –** The first program component reviews existing local resources, regulations, and responsibilities that bear on illicit discharge control in the community. A systematic audit defines local needs and capabilities, and provides the foundation for developing the initial IDDE program plan over the first permit cycle.

**2. Establish Responsibility, Authority and Tracking –** This component finds the right "home" for the IDDE program within existing local departments and agencies. It also establishes the local legal authority to regulate illicit discharges, either by amending an existing ordinance, or crafting a new illicit discharge ordinance. This program component also involves creation of a tracking system to report illicit discharges, suspect outfalls, and citizen complaints, and to document local management response and enforcement efforts.

**3. Complete a Desktop Assessment of Illicit Discharge Potential –** Illicit discharges are not uniformly distributed across a community, but tend to be clustered within certain land uses, subwatersheds, and sewage infrastructure eras. This program component helps narrow your search for the most severe illicit discharge problems, through rapid analysis of existing mapping and water quality monitoring data.

**4. Develop Program Goals and Implementation Strategies –** This program component integrates information developed from the first three program components to establish measurable goals for the overall IDDE program during the first permit cycle. Based on these goals, managers develop specific implementation strategies to improve water quality and measure program success.

**5. Search for Illicit Discharge Problems in the Field –** This component involves rapid outfall screening to find problem outfalls within priority subwatersheds. Results of outfall surveys are then used to design a more sophisticated outfall monitoring system to identify flow types and trace discharge sources. Many different monitoring options exist, depending on local needs and discharge conditions.

**6. Isolate and Fix Individual Discharges –** Once illicit discharge problems are found, the next step is to trace them back up the pipe to isolate the specific source or improper connection that generates them. Thus, this program component improves local capacity to locate specific discharges, make needed corrections, and take any enforcement actions.

**7. Prevent Illicit Discharges –** Many transitory and intermittent discharges are produced by careless practices at the home or workplace. This important program component uses a combination of education and enforcement to promote better

pollution prevention practices. A series of carrots and sticks is used to reach out to targeted individuals to prevent illegal or unintentional illicit discharges.

**8. Evaluate the Program –** The last component addresses the ongoing management of the IDDE program. The measurable goals set for the IDDE program are periodically reviewed and revisited to determine if progress is being made, or implementation strategies need to be adjusted.

Within each program component, a community has many options to choose, based on its size, capability and the severity of its illicit discharge problems. Chapters 3 through 10 address each IDDE program component in more detail, and summarize its purpose, methods, desired product or outcome, and budget implications. The remainder of each chapter provides program managers with detailed guidance to choose the best options to implement the program component in their community.

Scheduling of the eight IDDE program components is not always sequential and may overlap in some cases. In general, the first four program components should be scheduled for completion within the first year of the permit cycle in order to develop an effective program for the remaining years of the permit. Table 4 summarizes the specific tasks and products associated with each IDDE program component. The scheduling, costs and expertise needed for each IDDE program component are compared in Table 5.

**Table 4: Key Tasks and Products in IDDE Program Implementation**

| Program Component | Key Tasks | Products |
|---|---|---|
| 1. Audit existing programs | • Infrastructure Profile<br>• Existing Legal Authority<br>• Available Mapping<br>• Experienced Field Crews<br>• Access to Lab Services<br>• Education and Outreach Outlets<br>• Discharge Removal Capability<br>• Program Budget and Financing | • Agreement on Lead Agency<br>• 5 year Program Development Plan<br>• First Year Budget and Scope of Work |
| 2. Establish responsibility and authority | • Review Existing Ordinances<br>• Define “Illicit”<br>• Provisions for Access/Inspections<br>• Select Enforcement Tools<br>• Design Tracking System | • Adopt or Amend Ordinance<br>• Implement Tracking System |
| 3. Desktop assessment of illicit discharge potential | • Delineate Subwatersheds<br>• Compile Mapping Layers/Data<br>• Define Discharge Screening Factors<br>• Screen Subwatersheds for Illicit Discharge Potential<br>• Generate Maps for Field Screening | • Prioritize Subwatersheds for Field Screening |
| 4. Develop program goals and strategies | • Community Analysis of Illicit Discharge<br>• Public Involvement | • Measurable Program Goals<br>• Implementation Strategies |

| Table 4: Key Tasks and Products in IDDE Program Implementation | | |
|---|---|---|
| **Program Component** | **Key Tasks** | **Products** |
| 5. Search for illicit discharges problems in the field | • Outfall Reconnaissance Inventory (ORI)<br>• Integrate ORI data in Tracking System<br>• Follow-up Monitoring at Suspect Outfalls | • Initial Storm Drain Outfall Map<br>• Develop Monitoring Strategy |
| 6. Isolate and fix individual discharges | • Implement Pollution Hotline<br>• Trunk and On-site Investigations<br>• Corrections and Enforcement | • Maintain Tracking System |
| 7. Prevent illicit discharges | • Select Key Discharge Behaviors<br>• Prioritize Outreach Targets<br>• Choose Effective Carrots and Sticks<br>• Develop Budget and Delivery System | • Implement Residential, Commercial, Industrial or Municipal Pollution Prevention Programs |
| 8. Program evaluation | • Analyze Tracking System<br>• Characterize Illicit Discharges Detected<br>• Update Goals and Strategies | • Annual Reports<br>• Permit Renegotiation |

| Table 5: Comparison of IDDE Program Components | | | | | |
|---|---|---|---|---|---|
| **IDDE Program Component** | **When To Do It** | **Startup Costs** | **Annual Cost** | **Expertise Level** | **Type of Expertise** |
| 1. Audit | Immediately | $ | -0- | ?? | Planning/Permitting |
| 2. Authority | Year 1 | $$ | $ | ?? | Legal |
| 3. Desktop Analysis | Year 1 | $$ | -0- | ??? | GIS |
| 4. Goals/Strategies | Year 1 | $ | -0- | ?? | Stakeholder Management |
| 5. Field Search/Monitoring | Year 2 to 5 | $$ | $$$$ | ??? | Monitoring |
| 6. Isolate and Fix | Year 2 to 5 | $ | $$ | ??? | Pipe and Site Investigations |
| 7. Prevention | Year 2 to 5 | $$ | $$$ | ?? | Education |
| 8. Evaluation/Tracking | Annually | -0- | $ | ? | Data Analysis |

*Key:* *$ = <$10,000*
*$$ = $10,000 - 25,000*
*$$$ = $25,000 - 50,000*
*$$$$ = > $50,000*

*? - Simple*
*?? - Moderately Difficult*
*??? - Complex*

## 2.1 Management Tips To Develop an Effective IDDE Program

Every community will develop a unique IDDE program that reflects its size, development history, land use, and infrastructure. Still, some common threads run through effective and well-managed local IDDE programs. Below are some tips on building an effective local.

*1. Go after continuous sewage discharges first.* Effective programs place a premium on keeping sewage out of the storm drain system. Continuous sewage discharges pose the greatest threat to water quality and public health, produce large pollutant loads, and can generally be permanently corrected when the offending connection is finally found. Intermittent or indirect discharges are harder to detect, and more difficult to fix.

*2. Put together an interdisciplinary and interagency IDDE development team*. A broad range of local expertise needs to be coordinated to develop the initial IDDE plan, as indicated in Table 5. Effective programs assemble an interagency program development team that possesses the diverse skills and knowledge needed for the program, ranging from legal analysis, GIS, monitoring, stakeholder management and pipe repairs.

*3. Educate everybody about illicit discharges.* Illicit discharge control is a new and somewhat confusing program to the public, elected officials, and many local agencies. Effective programs devote considerable resources to educate all three groups about the water quality impacts of illicit discharges.

*4. Understand your infrastructure.* Finding illicit discharges is like finding a needle in a haystack on a shoestring budget. Many indirect or transitory discharges are extremely difficult to catch through outfall screening. Therefore, effective programs seek to understand the history and condition of their storm water and sewer infrastructure to find the combinations that create the greatest risk for illicit discharge. Effective programs also screen land uses to locate generating sites within targeted subwatersheds. For example, knowing the proximity of the infrastructure to the groundwater table or knowing that the sewer collection system has a long transit time can influence the indicator parameters and associated thresholds that a community chooses to target.

*5. Walk all of your streams in the first permit cycle.* Perform a rapid Outfall Reconnaissance Inventory (ORI) on every mile of stream or channel in the community, starting with the subwatersheds deemed to have the greatest risk. The ORI allows you to rapidly develop an accurate outfall map and quantify the severity of your discharge problems. ORI data and field photos are extremely effective in documenting local problems. Stream walks and the ORI should be conducted regularly as part of an IDDE program. In many areas, it may require as many as three stream walks to identify all outfall locations.

*6. Use GPS to create your outfall map.* In most communities, the storm water system and sewer pipe networks are poorly mapped, and consist of a confusing blend of pipes and structures that were constructed in many different eras. Effective programs perform a field reconnaissance to ground truth the precise locations of all outfalls using GPS technologies. Effective programs have learned to quickly evaluate outfalls of all sizes, and not just major ones ( >36 inches in diameter).

*7. Understand your discharges before developing a monitoring plan.* Monitoring is usually the most expensive component of any local IDDE program, so it is extremely important to understand your discharges before committing to a particular monitoring method or tracer. Compiling a simple discharge "fingerprint" library that characterizes the chemistry of major flow types in the community (e.g., sewage, septage, washwater, groundwater, tap water, or non-target irrigation water) is recommended. This library can distinguish flow types and adjust monitoring benchmarks.

*8. Consider establishing an ambient (in-stream) chemical and/or biological monitoring program.* Prioritizing outfall screening and investigation can save time in the field. An ambient chemical or biological monitoring program can provide supplemental

information to help prioritize sites and can be used to document long-term success.

*9. Utilize a simple outfall tracking system to organize all your IDDE program data.* Illicit discharges are hard enough to find if an organized system to track individual outfalls is lacking. Effective programs develop a unified geospatial tracking system to locate each outfall, and store information on its address, characteristics, photos, complaints and monitoring data. The tracking system should be developed early in the permit cycle so that program managers can utilize it as an evaluation and reporting tool.

*10. Outsource some IDDE functions to local watershed groups.* Staffing is the greatest single line item expense associated with a local IDDE program, although staffing needs are often temporary or seasonal in nature. Some effective programs have addressed this staffing imbalance by contracting with watershed groups to screen outfalls, monitor stream quality, and handle storm water education. This strategy reduces overall program costs, and increases local watershed awareness and stewardship.

*11. Utilize a hotline as an education and detection tool.* Citizen hotlines are a low-cost strategy to engage the public in illicit discharge surveillance, and are probably the only effective way to pick up intermittent and transitory discharges that escape outfall screening. When advertised properly, hotlines are also an effective tool to increase awareness of illicit discharges and dumping. Effective programs typically respond to citizen reports within 24 hours, acknowledge their help, and send them storm water education materials. When citizens play a stronger role in reporting illicit discharge problems, local staff can focus their efforts on tracing the problem to its source and fixing it.

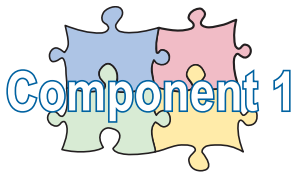
*12. Cross-train all local inspectors to recognize discharges and report them for enforcement.* Effective programs make sure that fire, building, plumbing, health, safety, erosion control and other local inspectors understand illicit discharges and know whom to contact locally for enforcement.

*13. Target your precious storm water education dollars.* Most programs never have enough resources to perform the amount of storm water education needed to reduce indirect and transitory discharges in their community. Consequently, effective programs target their discharges of concern, and spend their scarce dollars in the subwatersheds, neighborhoods or business sectors most likely to generate them.

*14. Stress public health and safety benefits of sewage-free streams.* Effective programs publicize the danger of sewage discharges, and notify the public and elected officials about the discharges that need to be prevented or corrected.

*15. Calibrate your program resources to the magnitude of the illicit discharge problem.* After a few years of analysis and surveys, communities get a good handle on the actual severity of their illicit discharge problems. In some communities, storm drains will be relatively clean, whereas others may have persistent problems. Effective programs are flexible and adaptive, and shift program resources to the management measure that will reduce the greatest amount of pollution.

*16. Think of discharge prevention as a tool of watershed restoration.* Discharge prevention is considered one of the seven primary practices used to restore urban watersheds (Schueler, 2004). Effective programs integrate illicit discharge control as a part of a comprehensive effort to restore local watersheds.




# Chapter 3: Auditing Existing Resources and Programs

*Purpose:* This program component identifies the most capable local agency to staff and administer the IDDE program, analyzes staffing and resource gaps, and searches for all available local resources and expertise that can be applied to the IDDE program.

*Method:* The key method used for this program component is a local IDDE "audit," which consists of external research, agency interviews, and interagency meetings to determine existing resources and program gaps. The audit typically looks at eight major factors needed to build an IDDE program:

- Profile of existing storm water and sewer infrastructure, as well as historical plumbing codes
- Existing legal authority to regulate illicit discharges
- Available mapping data and GIS resources
- Field staff availability and expertise
- Lab/monitoring equipment and analytical capability
- Education and outreach resources and outlets
- Discharge removal capability and emergency response
- Program budgeting and financing

*Desired Product or Outcome(s):* The desired outcome is an initial five-year IDDE program development plan over the current permit cycle. This will usually consist of an internal agreement on the lead agency, an initial scope of work, the first year budget, and a budget forecast for the entire permit cycle.

*Budget and/or Staff Resources Required:* The cost to conduct an audit depends on the size of the community, the degree of interagency cooperation, and the local budget process. Plan for less than one staff month for smaller communities, and up to three staff months for larger ones.

*Integration with Other Programs:* The audit is the best time to integrate the other five minimum management measures required under NPDES Phase II permits, including public education and outreach, public involvement, construction site runoff control, post-construction runoff control, and pollution prevention/good housekeeping for municipal operations.

## 3.1 Audit Overview

A community should conduct a quick audit of existing and needed capacity when developing its IDDE program. The audit helps develop realistic program goals, implementation strategies, schedules, and budgets to comply with NPDES permit requirements and improve water quality. The audit consists of external research, agency interviews and interagency meetings to determine existing resources and program gaps. The audit examines the community's current capabilities in eight topic areas: infrastructure profile, legal authority, available mapping, field staff experience, access to monitoring labs, education and outreach resources, discharge removal capability, and program budgets and financing.

Existing expertise is likely divided among multiple agencies (see Table 6) that should be contacted during the audit. Some of these agencies can become important partners in the development and implementation of the IDDE program, and contribute resources, program efficiencies and overall cost savings. The first agencies to interview are local emergency responders that already deal with spills, accidents, hazardous materials and sewage leaks that occur. In addition, it is worth getting to know the local agency responsible for plumbing code inspection during construction.

Table 7 provides representative examples of questions that the audit should ask to determine the needs and capabilities of a community associated with each program element.

**Table 6: Potential Local Agencies and Departments to Contact During an Audit**

| Audit Topic | Potential Agencies and Departments | |
|---|---|---|
| Infrastructure Profile | • Water and Sewer Authority | • Public Works |
| Existing Legal Authority | • Public Works<br>• Planning Department<br>• Parks and Recreation<br>• Environmental Protection | • Local Health Department<br>• Road Engineering<br>• Fire, Police or Rescue (Hazardous material responders) |
| Available Mapping | • Public Works<br>• Local Streets/Utilities | • Planning and Zoning<br>• Emergency Responders |
| Field Staff | • Public Works<br>• Environmental Compliance<br>• Development Review | • Watershed Groups<br>• Fire, Building, Health and Code Inspectors |
| Access to Lab Services | • Public Works<br>• Local College or University | • Drinking Water or Wastewater Treatment Plant<br>• Private Contract Monitoring Laboratories<br>• Health Department |
| Education and Outreach Resources | • Parks and Schools<br>• Water and Sewer Utility | • Community Liaison Office<br>• Civic and Watershed Groups |
| Discharge Removal Capability | • Fire, Rescue and Police<br>• Public Works | • Water and Sewer Utilities<br>• Private Plumbing Contractors |
| Program Budget and Financing | • Grants<br>• Fines<br>• Application fees | • Utility Fees<br>• Department Operating Budget |

| Table 7: Potential IDDE Audit Questions | |
|---|---|
| **Audit Topics** | **Questions** |
| Infrastructure Profile | • How many miles of streams and storm drains exist in the MS4?<br>• What is the area served by storm drains, sewers, and septics?<br>• What is the general age and condition of the infrastructure? |
| Existing Legal Authority | • Does an illicit discharge ordinance already exist?<br>• Does effective inter-departmental coordination and cooperation currently occur?<br>• Is there an existing reporting and tracking system (e.g., hotline)?<br>• Is the municipality involved with industrial storm water NPDES permit activities or pre-treatment programs? |
| Available Mapping Data | • Does current GIS data exist and does it include coverage of sanitary and storm sewer networks?<br>• Is there a centralized location for the data?<br>• Are digital and hardcopy versions of mapping data readily available? |
| Field Staff | • Are municipal staff available to walk stream miles and record information?<br>• Do municipal staff have the training and expertise to lead a field team?<br>• Are basic field supplies already owned by the municipality and available for use? |
| Access to Lab Services | • Does the municipality have access to an analytical laboratory?<br>• Is there a local university or institution that might be a willing partner?<br>• If yes, is the existing equipment and instrumentation considered to be safe, accurate and reliable?<br>• Are experienced municipal staff available to conduct analytical analyses?<br>• Does the lab and staff have the capability to conduct more sophisticated special studies? |
| Education and Outreach Resources | • Does the community already have an Internet website to post outreach materials?<br>• Are there regular community events that can be used to spread the message?<br>• Are good inter-agency communication mechanisms in place?<br>• Do outreach materials on illicit discharges already exist? |
| Discharge Removal Capability | • Who currently responds to spills, overflows and hazardous material emergencies?<br>• Are municipal staff properly equipped and trained to repair most common types of illicit connections?<br>• Does the municipality have clear authority identifying responsible parties?<br>• Is there a response time commitment to known and reported problems?<br>• Is there a list of pre-approved contractors to perform corrections? |
| Program Budget and Financing | • Is there a dedicated annual budget line item planned for the IDDE program?<br>• Are there cost-share arrangements/opportunities available with other departments?<br>• Have grant awards been awarded to the municipality for special studies associated with watershed restoration in the past? |

## 3.2 Develop Infrastructure Profile

The first part of the audit profiles current and historic storm water and sewer infrastructure in the community. The basic idea is to get a general sense of the magnitude of the task ahead, by looking at the size, age and condition of the storm drain system (and the sewers within the MS4 as well). Some useful planning statistics include:

- Number of storm drain outfalls
- Miles of storm drain pipe
- Total stream and channel miles
- Total area serviced by storm drains
- Total area serviced by sewers
- Total area serviced by septic systems

These statistics are extremely helpful in getting a handle on the total effort required to assess the overall system. Any data on the nature and age of storm drains and sewers can be useful (e.g., open vs. enclosed, young vs. old). The basic infrastructure statistics can be generated from a quick analysis of infrastructure and topographic maps. At this stage, ballpark estimates are fine; more detailed estimates can be developed later in the desktop analysis component.

It is also worth examining historic plumbing codes to determine what kinds of connections were allowed in the past. Often, interviews with "old-timers" who remember past building codes and practices can provide insights about historical construction as to where illicit connections may be a problem.

## 3.3 Establish Legal Authority

This part of the audit examines whether a community currently has adequate legal authority to regulate illicit discharges through the following actions:

- Evaluate and modify plumbing codes[5]
- Prohibit illicit discharges
- Investigate suspected illicit discharges
- Require elimination of illicit discharges
- Carry out enforcement actions

The audit of existing legal authority entails a search and review of all existing ordinances that could conceivably bear on illicit discharge control, and interviews with the agencies that administer them. Some common local ordinances that may address illicit discharges are outlined in Table 8. Many communities already have regulations prohibiting specific illicit discharges, such as hazardous chemicals, litter or sewage. Often, public health ordinances may prohibit certain sewage discharges. Local utilities may have plumbing codes and staff capability to track down and remove illicit connections on the system they operate.

[5] In some states such as NC, plumbing codes are established through a state process. In these cases, local governments typically need specific authority to adopt any local modifications, which can be difficult to obtain. In such states, it may be prudent for the storm water program managers of several local governments to organize as a single cooperative group to modify codes at the state level.

| Table 8: Codes and Ordinances with Potential Links to IDDE | |
|---|---|
| • Fire codes<br>• Hazardous wastes/spill controls<br>• Health codes<br>• Industrial storm water compliance<br>• Litter control regulations<br>• Nuisance ordinances<br>• Plumbing codes | • Pollution prevention permitting requirements<br>• Restaurant grease regulations<br>• Septic system regulations<br>• Sewer/drain ordinances<br>• Storm water ordinance<br>• Street/highway codes |

To establish legal authority, communities will need to either develop a new IDDE ordinance or modify an existing ordinance that addresses illicit discharges. Language from existing ordinances that addresses illicit discharges should be incorporated or cross-referenced into any new IDDE ordinance to minimize conflicts and confusion. Furthermore, existing code ordinances may need to be amended or superceded to be consistent with the new IDDE ordinance.

In some instances, communities may want to consider collaborating with neighboring or nearby MS4s to develop ordinance language and legal authority, particularly if they share a common receiving water. Non-municipal permittees such as Departments of Transportation and special districts may also look to collaborate with municipal MS4s when considering ordinance language and legal responsibility.

## 3.4 Review Available Mapping

The third part of the audit looks at the coverage and quality of mapping resources available to support the IDDE program. Specifically, efforts should be made to see if a Geographic Information System (GIS) exists, and what digital mapping layers it contains. If a community does not possess a GIS, a community may choose to establish one (which can be quite expensive), or rely on available hardcopy maps. GIS and hardcopy maps are frequently available from the following local agencies: planning, tax assessment, public works, parks and recreation, emergency response, environmental, transportation, utilities, or health. If a watershed extends beyond the boundaries of a community, it may be necessary to acquire mapping data from adjacent communities.

Non-local sources of mapping data include state and federal agencies and commercial vendors. EPA and state environmental regulatory agencies maintain lists of NPDES dischargers; Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites; Resource Conservation and Recovery Act (RCRA) sites; and other industrial or hazardous material discharge sites. These sites are readily available as GIS layers[6]. Commercial vendors are good sources for low-altitude aerial photos of your community. These can be expensive but are often the best way to get a high-resolution recent 'snapshot' of the jurisdiction. Chapter 5 presents more detail on mapping layers needed for an IDDE program.

## 3.5 Availability of Field Staff

Field staff play a critical role in any IDDE program as they walk streams, assess outfalls, collect samples, respond to discharge complaints, and handle

[6] Some readily available GIS layers provided by regulatory agencies can be incomplete and inaccurate (particularly with location information). Communities should use their IDDE program and the associated data collection efforts to update their local information associated with these databases.

enforcement. This part of the audit evaluates the availability of local staff to perform these functions, and their training needs. Phase I communities report that experienced field staff are a major factor in IDDE program success.

Experienced staff can be supplemented with support staff such as interns and local watershed groups, if they are properly trained (CWP, 2002). As part of the audit, program managers should investigate whether existing staff can be used or whether new hires are anticipated, and explore intern opportunities with local universities and community colleges. Any local staff with experience in water quality sampling or development inspection should be identified. Fire, building, health, safety and erosion control inspectors are all potential field crew draftees.

An initial estimate of the staff time needed for field crews should be made at this time. Phase I IDDE programs allocated a median of 1.0 person-year for field investigations, with a range of 0.1 to 10 person-years each year (CWP, 2002). Several communities utilized interns to assist with field monitoring and office work. Since many IDDE surveys are short term and seasonal, several communities hired or transferred employees to serve on field crews on a temporary basis. Many Phase I programs found it hard to precisely quantify actual staff time dedicated to IDDE field work because staff were assigned from many departments, or performed other unrelated tasks (building inspections, erosion and sediment control inspections, etc.).

## 3.6 Access to Laboratory Analysis

This part of the audit identifies the best options for laboratory analysis of water quality samples collected in the field. Four basic options exist to get access to laboratory services, including:

1. Contract services from a private lab
2. Use existing lab facilities at local drinking water or wastewater treatment plants
3. Partner with a local water and sewer district, university or community college
4. Develop your own “in-house” monitoring and lab capability

The last three options may require purchasing special monitoring analysis equipment, depending on the water quality indicators ultimately selected. If a community is considering developing “in-house” monitoring capabilities, it will need to address quality control, training needs, safety, and hazardous waste disposal. At this point, a community simply wants to acquire data on costs, indicator parameters, quality control, and experience for each of the options being evaluated. Chapter 12 provides more detail on factors to consider when selecting lab analysis options.

## 3.7 Education and Outreach

The next part of the audit looks at existing educational and outreach resources in the community. To begin, look for other groups that are already involved in storm water or watershed education, including parks, schools, watershed groups, utilities and any other agencies performing this role. Next, look for the current tools the public can use to report water quality problems, such as complaint hotlines, websites or community liaison offices. When these exist, it may be possible to “piggy back” illicit discharge reporting at little additional cost. If reporting tools do not exist, program managers should look for opportunities to share start-up costs

with other agencies that may stand to benefit from improved community interaction (e.g., erosion and sediment control, sanitary sewer overflows, abandoned cars, etc.).

The audit should also look at community-wide events and education outlets to spread the IDDE message, such as fairs, festivals, earth day events, school presentations, and homeowner association meetings. For a complete review of how to craft an effective outreach and education plan, consult Pollution Source Control Practices (Schueler *et al.*, 2004). Excellent education and outreach materials have already been developed by Phase I communities that are available at little or no cost (see Chapter 9). Program managers should consult these resources and modify them as needed to meet their local needs.

## 3.8 Discharge Removal Capability and Tracking

This part of the audit evaluates local capacity to locate specific discharges, make needed corrections or repairs, and take any enforcement actions. These responsibilities are frequently split among several local agencies. For example, spills are often handled by the fire department hazmat response team, whereas dumping may be enforced by public works. Communities should always coordinate their IDDE program with any experienced hazmat response teams that exist. Similarly, local water and sewer utilities or private contractors that are in the business of repairing pipes should always be consulted. Their experience in specialized techniques such as dye or video testing of pipe interiors is essential for many illicit discharge source investigations. Alternatively, communities can opt to contract out many of these services.

Illicit discharges often occur due to "bad plumbing" connections. Therefore, the audit should identify key building inspectors to determine what, if any, procedures are in place to prevent these deficiencies. Lastly, where corrections to plumbing are required, communities should maintain a list of "pre-approved" plumbing contractors that can promptly and professionally repair the problem.

To ensure coordination, an up-to-date tracking system should be shared among all agencies involved.

## 3.9 Program Funding

The last part of the audit explores how much the local IDDE program will cost, and how it will be funded. This section provides some general budgeting guidance on the costs to expect for the eight program components. Overall IDDE program costs vary depending on the severity of the illicit discharge problem, the size of the community (and storm drain systems), and the IDDE program choices you make.

Planning level budget estimates can be derived for the eight IDDE program components in three ways. The first way is to look at the cost of IDDE program compliance for Phase I NPDES communities. These costs were assessed in a CWP (2002) survey, and can be used to budget overall annual costs for an IDDE program. Table 9 summarizes median program costs for selected Phase I IDDE program activities. The second technique is to construct unit cost budgets for each program component, based on an assumed level of effort. The third technique relies on EPA's overall average estimate of compliance costs for Phase II IDDE program of $1.30 per capita (with a staggering range $0.04 to $2.61/capita).

## Phase I IDDE Program Costs

The bulk of the cost for most IDDE programs is related to staffing – typically, about 75% of the total budget. Equipment costs were fairly reasonable, with programs spending a median of $1,000 on office computers and software, and about $4,000 on field equipment. Many equipment costs can typically be shared across other community programs. Lab costs, for either the purchase of lab equipment or the cost associated with sending samples to labs, were as high as $87,000 annually, with a median of $8,000. Finally, most programs had additional budgets for "other" which included items such as education, training, travel, consultants, and contractors.

It is worth noting that program costs presented in Table 9 do not reflect expenditures associated with special investigations, which may be pursued by communities to isolate specific sources or test new methods or the direct costs to fix problem connections. However, five communities provided data on typical correction costs, with an average cost of $2,500 per correction (Table 10).

## Estimated Phase II IDDE Program Unit Cost

Cost estimates for the eight IDDE program components are outlined in Table 11; more detailed guidance on budgeting for individual program components is provided in subsequent chapters. Under this presentation of cost, data, staff, equipment, and supply costs are combined and incorporated into a primary program element, such as conducting an outfall reconnaissance inventory. This approach assumes a hypothetical scenario of stream/MS4 miles and outfalls to investigate (see Table 11 notes).

**Table 9: Summary of Annual Phase I IDDE Program Costs**

| Program Element | Median Annual Cost |
|---|---|
| Staff | $85,100 |
| Office Equipment (Computer/Software) | $1,000 |
| Field Equipment | $4,000 |
| Lab Equipment/Testing | $8,000 |
| Other | $10,000 |
| **Total** | **$121,825** |

**Table 10: Average Correction Costs**

| Jurisdiction | Average Cost Per Correction |
|---|---|
| Cambridge, MA | $5,000 |
| Boston, MA | $3,570 |
| Knoxville, TN | $2,000 |
| Raleigh, NC | $1,000 |
| Springfield, MO | $1,000 |
| **Average** | **$2,500** |

**Table 11: IDDE Program Costs**

| IDDE Program Component | | Start Up Cost | | Annual Cost | |
|---|---|---|---|---|---|
| | | Low | High | Low | High |
| Component 1: | a) Perform Audit | $3,000 | $9,000 | NA | NA |
| | b) Initial Program Plan | $1,000 | $3,000 | NA | NA |
| Component 2: | a) Adopt Ordinance | $1,000 | $17,000 | NA | NA |
| | b) Tracking System | $2,000 | $15,000 | $2,000 | $2,000 |
| Component 3: | a) Desktop Analysis | $1,000 | $4,000 | NA | NA |
| | b) Field Mapping | $500 | $1,000 | NA | NA |
| Component 4: | a) Develop Goals | $1,000 | $3,000 | NA | NA |
| | b) Field Monitoring Strategy | $1,000 | $3,000 | NA | NA |
| Component 5: | a) Outfall Reconnaissance Inventory (ORI) | NA | NA | $5,700 | $12,800 |
| | b) Establish Hotline | $1,300 | $7,700 | $1,500 | $11,400 |
| | c) Sample Analysis | $500 | $15,500 | $9,000 | $21,200 |
| | d) Outfall Map | NA | NA | $500 | $1,000 |
| Component 6: | a) Isolate | NA | NA | $2,000 | $5,200 |
| | b) Fix | NA | NA | $10,000 | $30,000 |
| Component 7: | a) Education | $1,000 | $8,100 | $1,300 | $13,900 |
| | b) Enforcement | NA | NA | $1,000 | $14,000 |
| Component 8: | a) Program Administration | $10,000 | $15,000 | $10,000 | $15,000 |
| **TOTAL** | | **$23,300** | **$101,300** | **$43,000** | **$126,500** |

*Notes:* NA = Not Applicable
Component 1 – Audit assumes $25/hr, 120 hours for low and 360 hrs for high. Program plan assumes 40 hrs for low and 120 hrs for high.
Component 2 – Ordinance low cost from Reese (2000), high cost from CWP (1998) adjusted and rounded for inflation (2002 $). Tracking system low cost assumes 40 hrs of development and $1K of equipment for start up. Annual cost for low assumes 40 hrs per year. High estimates are adapted from Reese (2000) and assume 200 hrs for development and $3k for equipment at start-up. High annual costs assume 100 hrs per year.
Component 3 – Desktop analysis assumes 1 week for low and 4 weeks for high. Mapping costs assume paper maps (CWP, 1998) under low and GIS under high (40 hrs)
Component 4 – Goals and strategies take 2 weeks for low and 6 weeks for high. Assume even split in time between two tasks.
Component 5 –
a) ORI costs are from Ch 11 and assume 10 miles with 2-person crew for low and 20 miles with 3-person crew for high. ORI costs assume work completed in one year, but not necessarily every year (permit cycle cost).
Low hotline costs are adapted from Reese (2000). High costs are from CWP research. Low annual costs assume an increased volume of calls due to advertisement and assume 50 hours per year dedicated to this plus annual training.
Sample analyses are from various sources and are presented in Chapter 12. Estimates based on 80 samples per year for both (shown as annual cost). Low start up costs are based on contract lab arrangements. High start up costs assume flow type library is developed for eight distinct flow types. Low annual costs assume in-house analysis for Flow Chart Method parameters. High annual costs assume contract lab analysis for 11 parameters.
Outfall map costs are same as the component 3 mapping task
Component 6 – Isolate and fix have no assumed start up costs and are both vary depending on the community conditions. Low annual isolation costs assume a one day investigation by a 2-person team per incident ($400) and four incidents per year plus $400 in equipment and supplies. High assumes one incident per month. Estimates include on-site inspections. Fix costs are from average costs from Phase I survey and assume same number of incidents as isolate. These costs can often be passed on to responsible parties.
Component 7 – Education estimate adapted from Reese (2000) and assumed to be 1/3 of total Phase I education budget. Some adjustments were made based on assumptions by CWP.
Component 8 – Low assumes 1/6 FTE, high assumes 1/4 FTE at an annual salary of $60K.

### *Financing an IDDE Program*

Once the initial budget has been estimated, the next step is to investigate how to pay for it. A full discussion of how to finance local storm water management programs is beyond the scope of this manual, but it is worth consulting APWA (2001). The most common financing mechanisms include:

- Operating budgets
- Debt financing
- State grants and revolving loans
- Property assessments
- Local improvement districts
- Wastewater utility fees
- Storm water utility or district fees
- Connection fees
- Plan review/inspection fees
- Water utility revenues

Of these, storm water utilities or districts are generally considered one of the best dedicated financing mechanisms. Some useful resources to consult to finance your local storm water programs include the following:

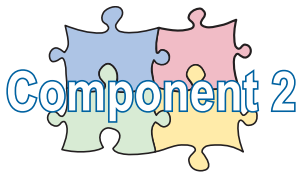
- An Internet Guide to Financing Storm Water Management. 2001 http://stormwaterfinance.urbancenter.iupui.edu
- Establishing a Storm Water Utility http://www.florida-stormwater.org/manual.html
- Florida Association of Storm Water Utilities. http://www.fasu.org
- How to Create a Storm Water Utility http://www.epa.gov/nps/urban.html
- The Storm Water Utility: Will It Work in Your Community? www.forester.net/sw_0011_utility.html

## 3.10 The Initial IDDE Program Plan

The local IDDE audit reveals resource gaps, and expertise and staffing needed to build an effective IDDE program. The next step is to organize how you plan to phase in the eight program components over the permit cycle. The process results in the development of an initial IDDE program plan that normally includes five elements:

- Overall schedule for plan implementation, with milestones
- Detailed work plan for the first year
- Budget for the first year
- Five-year budget forecast
- Process for gaining approval for first-year budget

Program managers should consult the next seven chapters for more guidance on planning and budgeting individual IDDE program components.




# Chapter 4: Establishing Responsibility and Legal Authority

*Purpose:* This program component is where the legal and administrative authority is established to regulate, respond and enforce illicit discharges in the community. The component also reviews local plumbing codes to ensure that inappropriate connections are prohibited, and develops a tracking system to locate illicit discharges and track management response.

*Method(s):* Several methods are used to implement this program component, including development of a new or amended illicit discharge control ordinance and the creation of a relational computer database for internal and external tracking of illicit discharges.

*Desired Product or Outcome(s):*

a) Pass or amend a local ordinance that defines the lead regulatory agency, defines the range of illicit discharges to be covered, and specifies the range of enforcement mechanisms.

b) Establish an internal and external reporting and tracking system. The internal system is structured around the training/education of municipal staff to define and facilitate appropriated response and enforcement procedures. An external system or hotline links to the internal system and assists in response and enforcement by providing access to the public for reporting.

*Budget and/or Staff Resources Required:* Establishing responsibility, legal authority and an effective tracking system can take as little as a month of staff effort to complete if no major surprises or unforeseen costs are encountered in the process. However, the actual time-frame to adopt an ordinance or fund a response system, for example, is often much longer, given the crowded schedules of elected officials and timing of the local budget processes. Adoption of the ordinance and the actual budget authorization may require multiple votes over many months or years. Continuous engagement and education of key advisors, agency staff and elected officials are needed throughout the effort. Where hotlines exist (covering a range of municipal functions), significant staff and infrastructure savings should be realized. The primary hurdle in this instance will be employee training and education.

*Integration with Other Programs:* Public education to advertise the hotline and municipal training to educate employees across departments and agencies are the primary areas where this program component can be integrated with other community-wide initiatives. The hotline can be used to report other watershed and water quality problems (e.g., ESC, dumping, sanitary sewer overflows). Good coordination should occur between tracking repair costs and determining appropriate fine levels for enforcement purposes.

Three critical decisions are needed to implement this program component—what local agency will be responsible for administering the IDDE program, will it have adequate legal authority to do its job, and how will illicit discharges be tracked. Guidance is offered below to help program managers make these decisions.

## 4.1 Identify Responsible Department/Agency

For most communities, the IDDE program will be established under the same agency or department that oversees all other MS4 NPDES requirements (e.g., Department of Environmental Protection, Department of Public Works, Department of Health, etc.). For small communities, IDDE program administration and implementation may be wrapped into the broad duties of just a few staff. For larger communities, or where there are significant known problems associated with illicit discharges, a community may elect to have a dedicated department division with core staff. In either event, the agency and individuals responsible for the program should be well identified along with a clear understanding of program purpose, goals and actions.

Other local departments may already have authority over certain aspects of illicit discharges. Therefore, close coordination and communication with different departments is essential, and consideration should be given to consolidating responsibilities and authority. If consolidation is not pursued, regular inter-departmental briefings, training sessions, and data sharing will enhance program effectiveness and reduce the likelihood of significant lag times between discovery of a discharge and enforcement or correction due to split responsibilities between departments.

In some cases, communities may want to consider collaborating with adjacent or nearby permittees in order to form a regional approach to addressing illicit discharges. This might be appropriate in situations where municipalities share a common receiving water, and program implementation is conducted on a watershed management basis.

## 4.2 Develop Local Illicit Discharge Ordinance

A community must demonstrate that it has adequate legal authority to successfully implement and enforce its IDDE program. In fact, establishing legal authority is one of the required components identified in Phase II regulations, and can be identified as a measurable goal. Guidance is provided below on how to develop an IDDE ordinance to establish legal authority.

### *Reviewing What You Have*

Communities with illicit discharge prohibitions in place have typically invoked legal authority using one or more of three mechanisms:

1. Storm water ordinance that prohibits illicit discharges to the drainage network
2. Plumbing code that prohibits illicit connections to the drainage network
3. Health code that regulates the discharge of harmful substances to the drainage network

A few concerns arise with the second and third mechanisms. One example is plumbing codes that only prohibit illicit connections fail to address other common discharges, such as indirect discharges, illegal dumping, or failing infrastructure. Similarly, exclusive reliance on health codes to regulate illicit discharges may not pick up discharges that are not harmful to human health, such as groundwater or potable water infiltration and residential irrigation return flows. With some revision and expansion, one or all of these existing mechanisms can meet the needs of the IDDE program. Alternatively, a new, stand-alone illicit discharge ordinance can be developed that supercedes all other related codes.

**CASE STUDY**

The City of Raleigh is an NPDES Phase I community. The Water Quality Group (WQG) within the Public Works Department oversees the City's illicit discharges program. The WQG was created in the early 1990s to be responsible for surface water quality across the City and to ensure compliance with the City's NPDES permits. Prior to that, various departments within city government handled water quality issues.

Raleigh's Illicit Discharge Ordinance was adopted in the second year of their original NPDES Phase I permit. The ordinance clearly defines and prohibits illicit discharges and illicit connections; requires containment and clean-up of spills/discharges to, or having the potential to be transported to, the storm drain system (it is also standard operating procedure that the City fire chief be notified of any spills immediately); allows for guaranteed right of entry for inspection of suspected discharges and connections; and outlines escalating enforcement measures, including civil penalties, injunctive relief, and criminal penalties.

Although the WQG runs the IDDE program, some functions are undertaken by the City's Public Utilities Department (e.g., fixing problems in the sanitary line, conducting dye and smoke testing, television inspection of the lines).

Raleigh began with a flat annual IDDE budget based on their past experience of what the program costs to run. More recently, the program began receiving additional funds from the City's storm water utility. A portion of the budget is allocated for testing. Cleaning and correction costs are funded through various budgets depending on the illicit discharge source. The WQG also budgets for two specialists: one is responsible for enforcement and dealing with citizen complaints and the other is responsible for monitoring and tracing the source of problems. The cost of television inspection and smoke testing is included in the Public Utilities Department budget.

*Source: Senior (2002, 2004)*

The length and complexity of an IDDE ordinance is largely a local community decision. Appendix B provides a model ordinance that may be adapted to meet the specific needs of local communities.

Some key components that should be addressed to ensure full authority to prevent and correct illicit discharges include the following:

- Prohibit illicit discharges
- Investigate suspected illicit discharges
- Require and enforce elimination of illicit discharges
- Address unique conditions or requirements

## Defining What is Illicit

An IDDE ordinance should clearly define and/or identify illicit discharges and clearly state that these discharges are prohibited. Some communities may prefer to provide a short, concise definition of illicit discharges, while others may wish to list specific substances or practices that qualify as illicit discharges. However, if a detailed list is provided in the ordinance, a qualifying statement should follow in order to include polluting discharges not specifically listed.

Illicit connections should also be defined in the ordinance. These connections include pipes, drains, open channels, or other conveyances that have the potential to allow an illicit discharge to enter the storm drain system. The prohibition of illicit connections should be retroactive to include connections made in the past, whether or not the connection was permissible at the time. This is especially important if historic plumbing codes or standards of practice allowed for connection of laterals and drains (e.g., shop floor drains) to the MS4.

Lastly, the ordinance should identify categories of non-storm water discharges or other flows to the MS4 that are not considered illicit. For example, the Phase II rule exempts discharges resulting from fire fighting activities. Other activities that are commonly exempt include discharges from dye testing and non-storm water discharges permitted under an NPDES permit, provided that the discharger is in full compliance with the permit. The following categories of non-storm water discharges do not need to be addressed in the IDDE program unless the operator of the regulated small MS4 designates them as significant contributors of pollutants:

- Water line flushing
- Landscape irrigation
- Diverted stream flows
- Rising ground waters
- Uncontaminated ground water infiltration
- Uncontaminated pumped ground water
- Discharges from potable water sources
- Foundation and footing drain water
- Air conditioning condensation
- Irrigation water
- Springs
- Water from crawl space pumps
- Lawn watering
- Individual residential car washing
- Flows from riparian habitats and wetlands

In some cases, communities will need to assess unique local discharges of concern and ensure that they are properly addressed within the ordinance. Examples of unique conditions or requirements sometimes included in IDDE ordinances are septic system provisions, plumbing codes, point of sale dye testing, and pollution prevention plan requirements for certain generating sites.

## Provisions for Access and Inspection

Although many communities report that most property owners cooperate when asked for access for illicit discharge investigations, this should never be taken for granted. Indeed, the right of access to private property for inspections is an essential provision of any IDDE ordinance. The ordinance should provide for guaranteed right of entry in case of an emergency or a suspected discharge or at any time for routine inspections, such as dye or smoke tests.

The ordinance should also clarify that right of entry applies to all land uses in the community, and that proof of discharge is not required to obtain entry. It should also state the responsibility of the property owner to disarm security systems and remove obstructions to safe and easy access. Enforcement actions should be established for property owners that refuse access, including the ability to obtain a search warrant through the court system.

### Types of Enforcement Tools

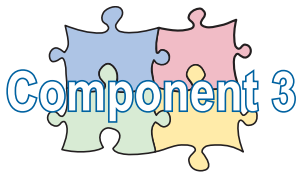
An IDDE ordinance should define a range of enforcement tools so the responsible agency can effectively handle the wide range of illicit discharge violations it is likely to encounter. Potential enforcement tools can range from warnings to criminal prosecution. The choice of enforcement tools should be based on volume and type of discharge, its impact on water quality and whether it was intentional or accidental. In addition, it is helpful to spell out the specific activities that trigger progressively greater enforcement. Table 12 summarizes the range of enforcement tools that have been used by communities to respond to illicit discharges.

The ordinance should provide for escalating enforcement measures to notify operators of violations and to require corrective action. Voluntary compliance should be used for first-time, minor offenders, while more serious violations or continued non-compliance may warrant a more aggressive enforcement approach. Finally, the ordinance should include methods for appeal to provide owners with avenues for compliance.

### Establish a Tracking and Reporting System

Communities need to develop tracking and reporting systems to support the entire IDDE program, including enforcement. A relational database with geospatial features provides the greatest flexibility to cover multiple program objectives. From a legal standpoint, tracking systems are important for historical documentation of problems and corrective actions. More details on designing and operating a tracking system are described in subsequent chapters.

| Table 12: Summary of IDDE-Related Enforcement Tools | |
|---|---|
| **Type of Enforcement Action** | **Description** |
| Written Warning with Voluntary Compliance | • Applies to first time, minor violations (Field staff should have authority to do this) |
| Written Notice of Violation Ordering Compliance | • Should clearly state description of remedial measures necessary, time schedule, penalties assessed if it doesn't happen, and timeframe for appeal |
| Administrative Penalties | • Daily financial penalty imposed by a responsible department for each day violation remains unfixed |
| Civil Penalties | • Daily financial penalty imposed by judicial authority for each day violation remains unfixed |
| Compensatory Action | • In lieu of enforcement proceedings or penalties, impose alternative compensatory action, e.g., storm drain stenciling, etc. |
| Criminal Prosecution | • Applies to intentional and flagrant violations of ordinance<br>• Each day discharge continues is typically a separate offense<br>• Can result in fines and imprisonment |
| Cost of Abatement of the Violation/Property Liens | • Applies when jurisdiction remedies the discharge or conducts cleanup, but may also be used to recoup administrative costs<br>• May constitute a property lien if not paid within certain timeframe |
| Emergency Cease and Desist Order | • Applies when ordinance continues to be violated<br>• Requires immediate compliance with ordinance by halting operations/ terminating discharges<br>• May be a written or verbal order to remove illicit discharge |
| Suspension of Water or Sewer Service | • Applied in emergency situations to immediately discontinue discharge to MS4<br>• May be applied as enforcement measure when property owner does not comply/fix the problem within timely manner |
| Stop Work Order | • Typically applies to discharges associated with construction activity<br>• No further work can be done until compliance is achieved |




# Chapter 5: Desktop Assessment of Illicit Discharge Potential

*Purpose:* This program component uses mapping and other available data to determine the potential severity of illicit discharges within a community, and identifies which subwatersheds or generating land uses merit priority investigation.

*Method(s):* A simple desktop assessment method can rapidly determine the severity of illicit discharge problems in a community. If an MS4 has fewer than 20 stream miles, this component can be skipped and a community can proceed directly to an ORI. The desktop assessment method has five basic elements:

1. Delineate subwatersheds or other drainage units within your community
2. Compile available mapping and data for each drainage unit (e.g., land use, age, outfalls, infrastructure history)
3. Derive subwatershed discharge screening factors using GIS analysis
4. Screen and rank illicit discharge potential at the subwatershed and community level
5. Generate maps to support field investigations

*Desired Product or Outcome(s):* The desktop assessment is used to guide initial field screening, and support initial IDDE program decisions. Key outcomes include:

a) Screening problem catchments or subwatersheds

b) Creation of GIS or other database system to track outfalls

c) Gaining an overall assessment as to the severity of illicit discharge problems in the community

d) Generation of basic mapping for subsequent field work

*Budget and/or Staff Resources Required:* The initial desktop assessment of illicit discharge potential should not be a long or arduous process, and should generally take less than four staff weeks. The quality and accuracy of the desktop assessment, however, will vary depending on the extent of available mapping information and GIS data. If mapping information is poor, the desktop assessment should be skipped, and program managers should go directly to the field to inventory outfalls.

*Integration with Other Programs:* If the desktop assessment suggests few potential illicit discharge problems, program managers may want to combine outfall surveys with broader stream corridor assessment tools such as the Unified Stream Assessment (Kitchell and Schueler, 2004). The desktop assessment provides insight on how to narrow your illicit discharge search, and is helpful when designing a discharge tracking system to best suit your needs. Finally, the desktop assessment can identify subwatersheds, generating sites, and neighborhoods where storm water education should be targeted to address illicit discharge problems.

## 5.1 Overview of Desktop Assessment of Illicit Discharge Potential

A community should understand the extent of water quality problems caused by illicit discharges. The desktop assessment should not be a time-consuming research effort, but should draw on existing background data and anecdotal information to initially characterize illicit discharge potential at the subwatershed level.

Subwatersheds are then screened based on their composite score, and are designated as having a low, medium or high risk:

- Low – no known illicit discharge problems in the subwatershed
- Medium – problems are confined to a few stream reaches, outfalls or specific generating sites in the subwatershed
- High – Problems are suspected to be severe throughout the subwatershed

The desktop assessment also shapes the overall direction of a local IDDE program. For example, if the desktop assessment indicates that the risk of illicit discharges is low in the community, program managers may want to shift resources to other minimum management measures and integrate them into a broader watershed assessment and restoration effort. For example, IDDE programs may emphasize storm water education, public involvement and hotline setup. By contrast, if the desktop assessment reveals significant potential for severe discharges, program managers will need to allocate significant program resources to find and fix the discharge problems.

The recommended scale for desktop assessments is the subwatershed or sewershed, which typically range from two to 10 square miles in area. These small planning units are easily delineated on maps or a GIS system. Next, mapping, monitoring and other data are analyzed to identify subwatersheds with the greatest potential to contribute illicit discharges. The sophistication of the analysis varies depending on the data available, but can encompass up to 10 different screening factors. The desktop assessment consists of five basic steps:

Limited mapping or data should not hinder a desktop assessment. Most communities will have some gaps, but should make the most out of what they have. The desktop assessment is an office exercise to locate the most promising subwatersheds to find illicit discharge; subsequent outfall screening is needed to discover the problem outfalls in the field.

Step 1: Delineate subwatersheds

Step 2: Compile mapping layers and subwatershed data

Step 3: Compute discharge screening factors

Step 4: Screen for illicit discharge potential at the subwatershed and community level

Step 5: Generate maps to support field investigations

### *Step 1: Delineate Subwatersheds*

Since hundreds of outfalls and many stream miles exist in most communities, the MS4 should be divided into smaller, more manageable planning units known as subwatersheds. If the community already does watershed planning, these subwatersheds may already be delineated, and should be used for subsequent characterization and screening. Working at the subwatershed scale is usually the

most efficient way to conduct both desktop assessments and field surveys.

In small, heterogeneous or densely developed MS4s, conducting the assessment on a smaller scale may be more effective. In this case, sewersheds or catchments that are less than one square mile in area and have a common outfall or discharge point should be delineated. This finer level delineation allows for a refined characterization that can pinpoint probable sources of illicit discharges, but can obviously consume a lot of time. It should be noted that sewersheds do not always follow topographic delineations and therefore can provide a more accurate picture of the contributing areas to a particular outfall.

If subwatersheds are not yet defined, hydrologic, infrastructure and topographic map layers are needed to delineate the boundaries. Guidance on the techniques for accurately delineating subwatershed boundaries can be found at www.stormwatercenter.net (click "Slideshows," then scroll down to "Delineating Subwatershed Boundaries"). The use of digital elevation models (DEMs) and GIS can also make subwatershed delineation an easier and faster, automated process.

Some subwatersheds extend beyond the political boundaries of a community. Where possible, it is recommended that the entire subwatershed be delineated and assessed in conjunction with neighboring municipalities. This helps to ensure that all potential sources of illicit discharges are identified in the subwatershed, regardless of the community from which they originate.

## *Step 2: Compile Mapping Layers and Subwatershed Data*

Once subwatersheds (or catchments) are delineated, a community can begin to acquire and compile existing data for each drainage area, preferably with a Geographic Information System (GIS). A GIS allows the user to analyze and manipulate spatial data, rapidly update data and create new data layers, associate data tables with each map layer, and create paper maps to display subwatershed information. A GIS can greatly speed up data compilation and provides greater accuracy in mapping specific locations. The mapping information facilitates the interpretation and understanding of the discharge screening factors (Step 3).

If a community does not currently have a GIS, developing a system from scratch may seem daunting, however, most GIS software can be installed on basic PCs, and free GIS data layers are often available online. The basic elements of a GIS program include a PC, Global Positioning System (GPS) units, a plotter, a digitizer, GIS software, data and staff training. As with many technologies, both low-end and high-end versions are available, as are many add-ons, extensions and tools. While a GIS is not necessary for the IDDE desktop assessment, it does make the process more efficient and accurate, which can save money in the long run. Moreover, other agencies within a community usually need or use GIS and may be willing to share hardware, software, support and development costs[7].

Acquiring data for each subwatershed is the next step in the desktop assessment process.

The extent and quality of the data available for mapping directly influence subsequent analyses and field investigations. A list of recommended data layers to acquire for the desktop assessment is provided in Table 13.

[7] If a community plans to defer using GIS, all databases it develops should have location information suitable for later use with GIS (i.e., using suitable georeferencing technology such as GPS).

Some mapping data may exist in GIS format, whereas others are only available in digital or hardcopy formats that need to be converted to GIS. Digital data with a geo-spatial reference such as latitude and longitude, parcel ID numbers or addresses can be directly entered into a GIS, if an existing road or parcel GIS layer can be associated to it. Hardcopy maps can also be digitized to create new GIS data layers. This can be a labor-intensive process, but will only need to be done once and can be easily updated. If GIS is not an option, hardcopy maps and data can be analyzed, with an emphasis on tax maps, topographic maps, historic aerial surveys, and storm drain and outfall maps.

Most data layers can be obtained from local sources, such as the city planning office, emergency response agency, or public works department. If a subwatershed extends beyond the boundaries of your community, you may need to acquire data from another local government. Some data layers may be available from state and federal agencies and commercial vendors. EPA and most state environmental agencies maintain databases of industrial NPDES, CERCLA, RCRA and other sites that handle or discharge pollutants or hazardous materials. These searchable permit databases are often available as GIS layers (see Appendix A). Commercial vendors are good sources for low-altitude aerial photos of your community. Aerial photos can be expensive but are often the best way to get a recent high-resolution 'snapshot' of subwatershed conditions.

**Table 13: Useful Data for the Desktop Assessment**

| | Data | Likely Format |
|---|---|---|
| Recommended | Aerial photos or orthophotos | Digital map |
| | Subwatershed or catchment boundaries | Digital or hardcopy map |
| | Hydrology including piped streams | Digital or hardcopy map |
| | Land use or zoning | Digital or hardcopy map |
| | NPDES storm water permittees | Digital data or map |
| | Outfalls | Digital or hardcopy map |
| | Sewer system, 1" = 200' scale or better | Digital or hardcopy map |
| | Standard Industrial Classification codes for all industries | Digital or hardcopy data |
| | Storm drain system, 1" = 200' scale or better | Digital or hardcopy map |
| | Street map or equivalent GIS layers | Digital or hardcopy map |
| | Topography (5 foot contours or better) | Digital or hardcopy map |
| Optional | Age of development | Narrative data |
| | As-builts or construction drawings | Hardcopy map |
| | Condition of infrastructure | Narrative data |
| | Field inspection records | Hardcopy or digital data |
| | Depth to water table and groundwater quality | Digital data or maps |
| | Historical industrial uses or landfills | Narrative data or hardcopy map |
| | Known locations of illicit discharges (current and past) | Narrative data or digital map |
| | Outfall and stream monitoring data | Digital data |
| | Parcel boundaries | Digital or hardcopy map |
| | Pollution complaints | Narrative data |
| | Pre-development hydrology | Narrative data or hardcopy map |
| | Sanitary sewer Infiltration and Inflow (I/I) surveys | Hardcopy or digital data |
| | Septic tank locations or area served by septic systems | Hardcopy or digital map |
| | Sewer system evaluation surveys | Hardcopy or digital data |

Alternatively, TerraServer (http://terraserver.microsoft.com/default.aspx) is a free mapping resource that most communities can use to get good quality aerial and other coverages (Figure 8 is an example). Higher quality photos may be desirable as more detailed investigations are pursued.

As GIS technology has become more affordable and easier to use, Phase II communities should harness their capabilities to develop the storm sewer system maps required by NPDES permits. GIS can become a powerful tool to track and manage the entire IDDE program, and demonstrate compliance in annual reports. In addition to being a powerful tool for analysis, GIS is also a great tool for communicating with the public. The images that can be created with GIS can summarize tables of data in a way that the public appreciates. If the recommended data layers are not available, a community may want to devote program resources to create or obtain them. Once data layers have been collected and digitized, they can be entered into the GIS to create a map of each subwatershed (Figure 8). Make sure all data layers are in the same coordinate system, and perform any conversions needed. Clip data layers to subwatersheds to enable calculation of factors such as land use, area, and outfall density. Summary data on subwatershed water quality and statistics on the age and condition of infrastructure should be entered into a database created for analysis in the next step.

### *Step 3: Compute Discharge Screening Factors*

The third step of the desktop assessment defines and computes discharge factors to screen subwatersheds based on their illicit discharge potential (IDP). As many as 10 different discharge screening factors can be derived during the screening process, but not all may apply to every community. The potential screening factors are described in Table 14, along with how they are measured or defined. Keep in mind that

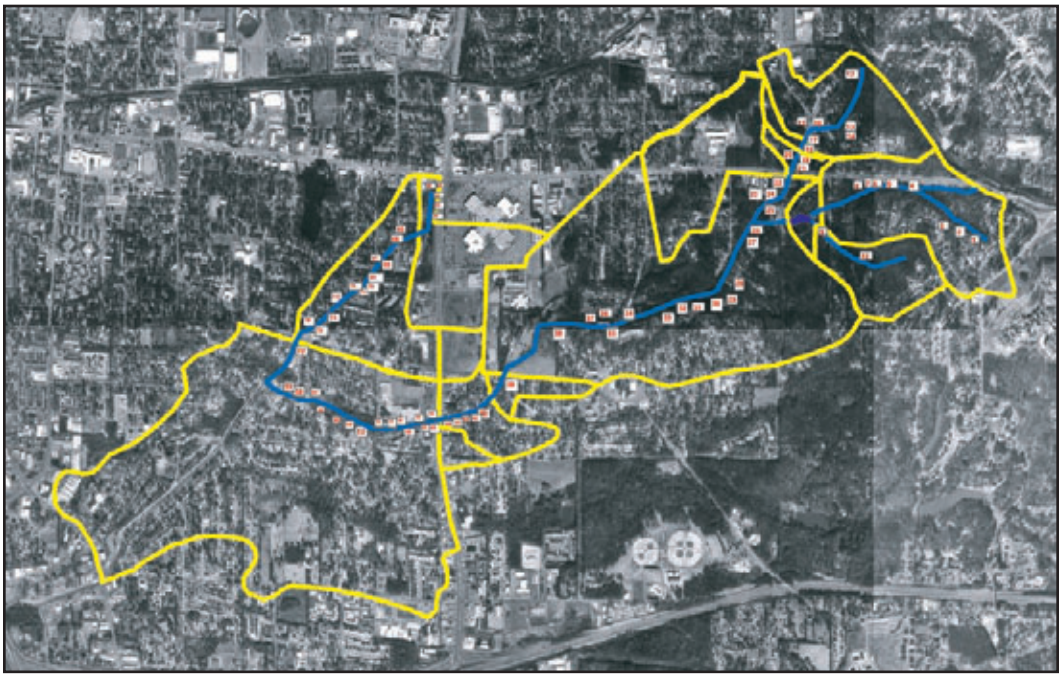


**Figure 8: GIS Layers of Outfalls in a Subwatershed**

*Markings illustrate Tuscaloosa, AL outfalls and drainage areas surveyed as part of this project.*

| Table 14: Defining Discharge Screening Factors in a Community | |
|---|---|
| **Discharge Screening Factors** | **Defining and Deriving the Factor** |
| 1. Past Discharge Complaints and Reports | Frequency of past discharge complaints, hotline reports, and spill responses per subwatershed. Any subwatershed with a history of discharge complaints should automatically be designated as having high IDP. |
| 2. Poor Dry Weather Water Quality | Frequency that individual samples of dry weather water quality exceed benchmark values for bacteria, nutrients, conductivity or other predetermined indicators. High risk if two or more exceedances are found in any given year. |
| 3. Density of Generating Sites or Industrial NPDES Storm Water Permits | Density of more than 10 generating sites or five industrial NPDES storm water sites per square mile indicates high IDP. Density determined by screening business or permit databases (Appendix A). |
| 4. Storm Water Outfall Density | Density of mapped storm water outfalls in the subwatershed, expressed as the average number per stream or channel mile. A density of more than 20 outfalls per stream mile indicates high IDP. |
| 5. Age of Subwatershed Development | Defined as the average age of the majority of development in a subwatershed. High IDP is often indicated for developments older than 50 years. Determined from tax maps and parcel data, or from other known information about neighborhoods. |
| 6. Sewer Conversion | Subwatersheds that had septic systems but have been connected to the sanitary sewer system in the last 30 years have high IDP. |
| 7. Historic Combined Sewer Systems | Subwatersheds that were once served by combined sewer system but were subsequently separated have a high IDP. |
| 8. Presence of Older Industrial Operations | Subwatersheds with more than 5% of its area in industrial sites that are more than 40 years old are considered to have high IDP. Determined from historic zoning, tax maps, and “old-timers.” |
| 9. Aging or Failing Sewer Infrastructure | Defined as the age and condition of the subwatershed sewer network. High IDP is indicated when the sewer age exceeds design life of its construction materials (e.g., 50 years) or when clusters of pipe breaks, spills, overflows or I/I are reported by sewer authorities. |
| 10. Density of Aging Septic Systems | Subwatersheds with a density of more than 100 older drain fields per square mile are considered to have high IDP. Determined from analysis of lot size outside of sewer service boundaries. |

these screening factors are a guide and not a guarantee. Each screening factor is described in detail in the following section.

### *1. Past Discharge Complaints and Reports*

Many communities already have some handle on where illicit discharges have occurred in the past, based on past complaints, reports and interviews with spill responders and public works repair crews. Pollution complaints made to the local environmental or health department are also worth analyzing. Each of these historical sources should be analyzed to determine if any patterns or clusters where illicit discharges have historically occurred can be found. Ideally, the number of past discharge complaints should be expressed on a subwatershed basis. Even if there is not enough data to quantify past discharges, it may be helpful to get a qualitative opinion from public works crews.

### 2. Poor Dry Weather Water Quality

If dry weather water quality monitoring data have been collected for local streams, it can be an extremely useful resource to screen subwatersheds for IDP. In particular, look for extreme concentrations of enterococci or *E. coli*, or high ammonia-nitrogen or conductivity. Remember to edit out any samples that were collected during or shortly after storm events, as they reflect the washoff of pollutants during storm water runoff. In general, most communities have more subwatersheds than baseflow monitoring stations, so complete coverage is usually lacking. The following benchmarks are recommended to flag streams with high IDP, based on individual samples of dry weather water quality that exceed:

- Fecal coliform or *E. coli* standards (e.g., typically 1,000 to 5,000 MPN/100 ml)
- Ammonia-nitrogen levels of 0.30 mg/l
- Total phosphorus of 0.40 mg/l
- Conductivity levels that exceed the 90$^{th}$ percentile value for the pooled dataset

Subwatersheds can be classified as having a moderate risk if stream water quality values exceed half the benchmark value. An alternative approach is to statistically analyze long-term dry weather water quality monitoring dataset to define breakpoints (e.g., 50$^{th}$, 75$^{th}$, and 90$^{th}$ percentiles).

### 3. Density of Generating Sites or Industrial NPDES Storm Water Permits

The density of potential generating sites in a subwatershed can be a good screening factor, if land use and business databases are available. The basic database screening method used to locate commercial, industrial, institutional, municipal and transport-related generating sites is described in Chapter 1 and Appendix A. From the standpoint of discharge screening, the key variable to derive is the density of potential generating sites (e.g., sites/square mile). As a rule of thumb, more than 10 potential generating sites per square mile would indicate a high IDP, while subwatersheds with three to 10 generating sites per square mile might suggest a medium IDP.

Alternatively, communities may want to develop screening factors based on the density of industrial storm water permits in place within the subwatershed. State or federal regulatory agencies often have geospatial databases of industrial NPDES discharges that can be rapidly screened. Pretreatment programs are another valuable source of information on industrial and non-domestic discharges to the sanitary system.

### 4. Storm Water Outfall Density

The density of outfalls in a subwatershed is an effective discharge screening factor, and is expressed in terms of the number of outfalls per stream mile. Outfall density can be determined by analyzing storm drain maps, if they exist (although they often miss the smaller diameter outfalls that can also produce discharges). In general, subwatersheds that have more than 20 mapped outfalls per stream mile may indicate a higher risk for IDP. Alternatively, the breakpoints for outfall density can be statistically analyzed based on the frequency across all subwatersheds.

### 5. Age of Subwatershed Development

The average age of development in a subwatershed may predict the potential for illicit discharge problems. For example, a subwatershed where the average age of development is more than 100 years was

probably constructed before sewer service was widely available, and many of the pipes and connections may have changed over the years as a result of modernization and redevelopment. Presumably, the risk of potential discharges would be higher in these older subwatersheds. By contrast, a recently developed subwatershed may have a lower discharge risk due to improved construction materials, codes and inspections. Therefore, high IDP may be indicated when subwatershed development is more than 50 years old, with medium IDP for 20 to 50 year old development, and low IDP if fewer than 20 years old. You should always check with local building and plumbing inspectors to confirm the building eras used in the screening analysis. The actual age of development can be estimated by checking tax maps and plats, or based on architecture, or common knowledge of neighborhoods.

### 6. Sewer Conversion

Subwatersheds that were once served by septic systems but were subsequently connected often have a high IDP. These subwatersheds are identified by reviewing past sewer construction projects to determine when and why sewer service was extended.

### 7. Historic Combined Sewer Systems

Subwatersheds that were once served by combined sewer systems but were subsequently separated often have a high IDP. They can be identified by reviewing past municipal separation projects.

### 8. Presence of Older Industrial Operations

Older industrial areas tend to have a high potential for illicit cross-connections for several reasons. First, sanitary sewers may not have been installed to handle wash water, process water and other discharge flows when the operation was originally constructed. In the past, storm drains were often used to handle non-sewage discharges at older industrial facilities. In addition, sanitary and storm drain lines built in different eras are poorly mapped, which increases the chance that someone gets the plumbing wrong during an expansion or change in operations at the facility. As a result, older industries may inadvertently discharge to floor drains or other storm drain connections thinking they are discharging pretreated water to the sanitary sewer. Finally, older industries that produce large volumes of process water may not have enough sanitary sewer capacity to handle the entire discharge stream, causing them to improperly discharge excess water through the storm drain system.

For these reasons, subwatersheds where older industry is present should be regarded as having a high IDP. For operational purposes, older industry is defined as sites that predate the Clean Water Act (e.g., 40 years old or more). They can be identified from historic zoning and land use maps, old parcel records or talking with old-timers.

### 9. Aging or Failing Sewer Infrastructure

Aging or failing sewer infrastructure often signals potential illicit discharges, and can be defined by the age and condition of the subwatershed sewer network. High IDP is indicated when the sewer age exceeds the design life of its construction materials (e.g., 50 years) or when clusters of pipe breaks, spills, overflows or infiltration and inflow (I&I) are reported by sewer authorities. Older and aging sewer infrastructure experience more leaks, cross-connections and broken pipes that can contribute sewage to the storm drain system. The key factor

to determine is the approximate age of the sewer pipes and their construction materials, which can be gleaned from sewer maps I&I studies, or interviews with crews that regularly repair broken or leaking sewer pipes.

### *10. Density of Aging Septic Systems*

Subwatersheds located outside of the sewer service area are presumably served by septic systems. Septic systems more than 30 years old are prone to failure, based on many site factors (Swann, 2001). In general, a high IDP is indicated if older septic tank density exceeds 100 per square mile. Sewer envelope boundaries or sewer network maps can be helpful to identify subwatersheds that are served by septic systems. Actual density is determined by counting or estimating the total number of septic households in the subwatershed. Tank density should be expressed as septic system units per square mile (average lot size can also be used as a surrogate estimator).

## *Step 4: Screen for Illicit Discharge Potential at the Subwatershed and Community Level*

The process for screening IDP at the subwatershed level is fairly simple. The first step is to select the group of screening factors that apply most to your community, and assign them a relative weight. Next, points are assigned for each subwatershed based on defined scoring criteria for each screening factor. The total subwatershed score for all of the screening factors is then used to designate whether it has a low, medium or high risk to produce illicit discharges. Table 15 provides an example. Based on this comparison, high-risk subwatersheds are targeted for priority field screening. It is important for program managers to track and understand which screening factors contributed to identifying a watershed as "high-risk," as this may affect the type of investigatory strategy that is used for a particular watershed.

**Table 15: Prioritizing Subwatersheds Using IDP Screening Factors**

| | **Past Discharge Complaints/ Reports** (total number logged) | **Poor dry weather water quality** (% of times bacteria standards are exceeded) | **Density of storm water outfalls** (# of outfalls per stream mile) | **Average age of development** (years) | **Raw IDP score** | **Normalized IDP score**** |
|---|---|---|---|---|---|---|
| Subwatershed A | 8 (2)* | 30% (2)* | 14 (2)* | 40 (2)* | 8 | 2 |
| Subwatershed B | 3 (1) | 15% (1) | 10 (2) | 10 (1) | 5 | 1.25 |
| Subwatershed C | 13 (3) | 60% (3) | 16 (2) | 75 (3) | 11 | 2.75 |
| Subwatershed D | 1 (1) | 25% (1) | 9 (1) | 15 (2) | 5 | 1.25 |
| Subwatershed E | 5 (1) | 15% (1) | 21 (3) | 20 (1) | 6 | 1.5 |

*Notes:*

* The number in parentheses is the IDP "score" (with 3 having a high IDP) earned for that subwatershed and screening factor. Basis for assigning scores (based on benchmarks) to assess IDP is as follows:
Past discharge complaints/reports: <5 = 1; 5-10 = 2; >10 = 3
Dry weather water quality: <25% = 1; 25-50% = 2; >50% = 3
Storm water outfall density: <10 = 1; 10-20 = 2; >20 = 3
Average age of development: <25 = 1; 25- 50 = 2; >50 = 3

** Normalizing the raw IDP scores (by dividing the raw score by the number of screening factors assessed) will produce scores that fall into the standard scale of 1 to 3 for low to high IDP, respectively.

The example provided in Table 15 uses four screening factors to assess five subwatersheds in a community. Data for each factor are compared against assigned benchmarks, as shown in the table. Each subwatershed receives a specific score for each individual screening factor. These scores are then totalled for each subwatershed, and the one with the highest score is given top priority screening. In this case, the screening priority would be given to Subwatershed C, then A, followed by E. Subwatersheds B and D, with the lowest potential for illicit discharges, have the lowest priority.

A similar screening process can be used to evaluate the IDP for the community as a whole. In this case, the entire population of subwatersheds in the community is analyzed to collectively determine the frequency of the three risk areas: high, medium, and low. Predefined criteria for classifying the community's IDP should be developed.

Table 16 and Figure 9 present an example system for classifying IDP as minimal, clustered or severe, based on the proportion of subwatersheds in each risk category. The community-wide assessment helps program managers define their initial IDDE program goals and implementation strategies, and target priority subwatersheds for field investigations.

### *Step 5: Generate Maps to Support Field Investigations*

The last step in this program component involves generating the maps that field crews need to screen outfalls in priority subwatersheds. More detail on mapping requirements is provided in Chapter 11. The basic idea is to create relatively simple maps that show streams, channels, streets, landmarks, property boundaries and known outfall locations. The idea is to provide enough information so crews can find their way in the field without getting lost, but otherwise keep them uncluttered. Low altitude aerial photos are also a handy resource when available.

**Table 16: Community-wide Rating of Illicit Discharge Potential**

| Rating | Indicators |
|---|---|
| Minimal (no known problems) | Majority of subwatersheds have a Low IDP risk, with the remainder having Medium IDP risk |
| Clustered (isolated problems) | More than 20% of subwatersheds with a Medium or High IDP risk that are in close proximity to each other |
| Severe (severe problems) | More than 50% of subwatersheds with a Medium or High IDP risk or more than 20% of subwatersheds with a High IDP risk |

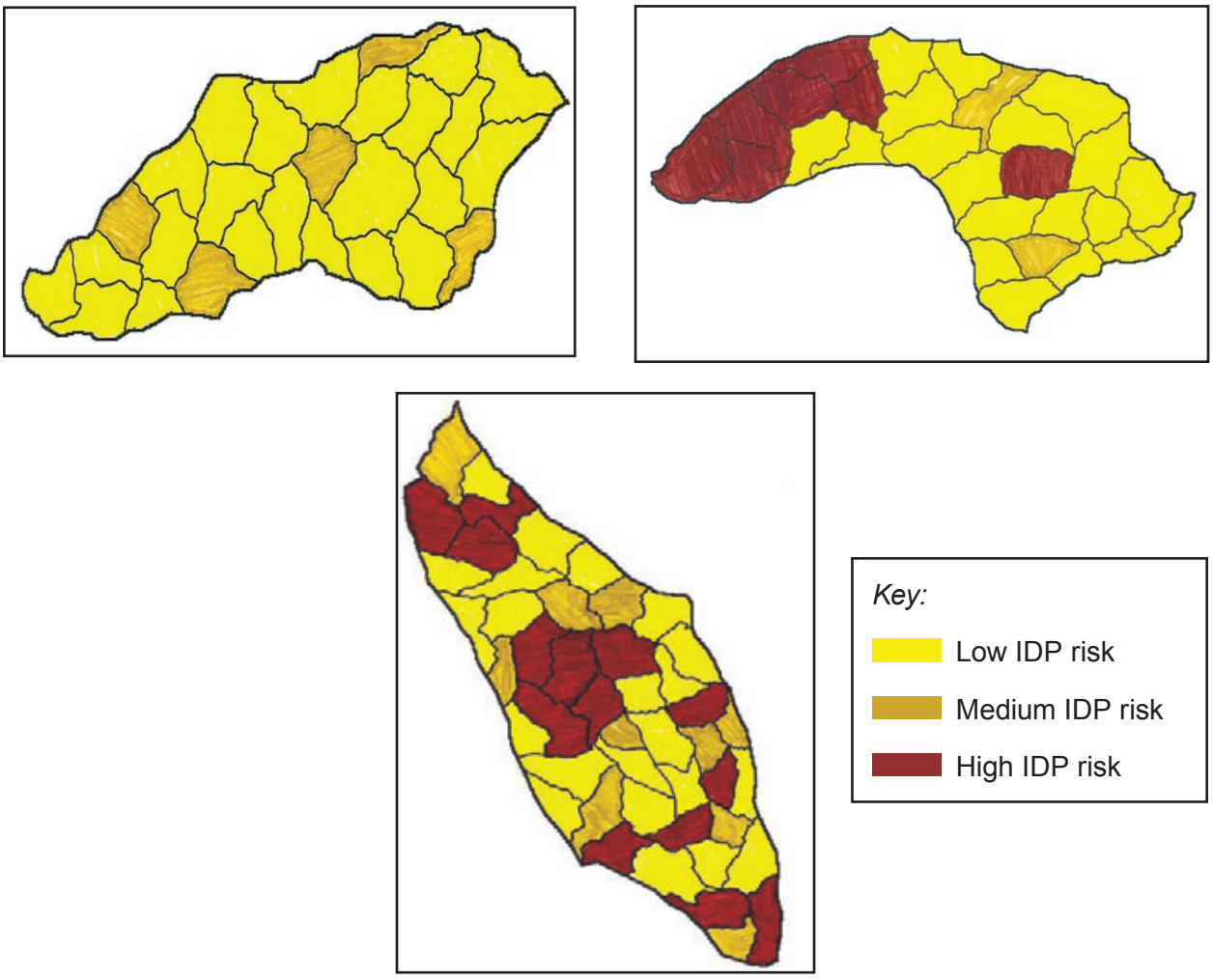
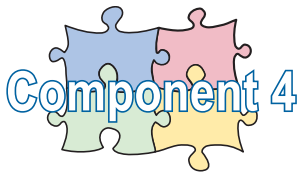



**Figure 9: Communities with Minimal (a), Clustered (b), and Severe (c) Illicit Discharge Problems**




# Chapter 6: Developing Program Goals and Implementation Strategies

*Purpose:* This program component defines the goals and performance milestones to measure progress in IDDE program implementation during the first permit cycle, and selects the most appropriate and cost-effective strategies to find, fix and prevent illicit discharges. The goals and strategies ensure that scarce local resources are allocated to address the most severe illicit discharge problems that cause the greatest water quality problems in the community.

*Method:* The basic method is to analyze the results of the IDDE audit, desktop analysis and local water quality conditions to develop realistic, achievable and measurable goals for the program. The public and other stakeholders should be involved in the goal setting process. Once goals are selected, program managers need to select the appropriate implementation strategies and develop a timeline to make them happen. Both goals and strategies should closely align with the type and severity of water quality problems and local watershed management priorities. The probable contribution of illicit discharges to specific water quality problems should be estimated or modeled to determine the degree to which control efforts can meet local TMDLs, bacteria standards for water contact recreation, or other local water quality concerns.

*Desired Product or Outcome(s):* Agreement on program goals, measurable indicators and implementation strategies that address four key areas:

- Overall program administration
- Outfall assessment
- Finding and fixing illicit discharges
- Prevention of illicit discharges

*Budget and/or Staff Resources Required:* Staff effort to draft the goals and strategies, conduct needed meetings, respond to comments and finalize ranges from two to six weeks. Goals and strategies should be revisited and updated annually and at the end of each permit cycle. Staff and budget costs are not anticipated to be high unless a fundamental shift in program goals occurs.

*Integration with Other Programs:* Goal setting is always a good opportunity for public involvement, storm water education and watershed outreach. Effective implementation strategies often involve cost sharing with other departments and even other communities for monitoring equipment and lab facilities, hotlines, and education (e.g., public health/septic system programs).

## 6.1 Overview of Goals and Strategies Development

Communities can define program goals and implementation strategies once they understand the extent of their illicit discharge problem and how it influences local water quality. Initial program goals should be realistic and provide specific completion milestones to measure program compliance. Measurable goals enable a community to track and evaluate permit compliance over time, and to reassess and modify the program over time. The most basic measure of program effectiveness is to assess whether program goals are being met. So, if a program goal is to walk all stream miles and inventory all outfalls in the MS4 within the first permit cycle, this becomes a benchmark that determines program effectiveness. If a community finds that they only managed to walk and inventory 80% of stream miles, the program may need to be modified so that a full screening sweep is completed in a permit cycle, or they may need to adjust the goal or benchmark.

## 6.2 Develop Initial Program Goals

The NPDES Phase II MS4 permit regulations grant communities considerable flexibility to develop program goals, as long as they are defined in a measurable way to gauge permit compliance and program effectiveness. EPA (2000e) states that goals "should reflect the needs and characteristics of the operator and the area served by its small MS4. Furthermore, they should be chosen using an integrated approach that fully addresses the requirements and intent of the minimum control measure."

With this in mind, a series of representative goals that might be set for an IDDE program are presented in Table 17, along with proposed milestones. Four broad types of goals should be developed for every program:

1. Overall program administration
2. Outfall assessment
3. Preventing illicit discharges
4. Finding and fixing illicit discharge

The assumed timeframe is based on a five-year permit cycle. Some of the program goals outlined in Table 17 are considered essential while others are optional or recommended. Communities should feel free to adapt these suggested program goals to reflect their unique conditions and capabilities, or create new ones. The key point is that program goals should always have a timeframe to serve as a benchmark for whether the goal has been achieved.

Implementation strategies are designed to achieve program goals, and vary depending on the types and severity of illicit discharge problems in the community. These are outlined in more detail in the next section.

| Table 17: Measurable Goals for an IDDE Program | | |
|---|---|---|
| **EXAMPLE MEASURABLE GOALS** | **TIMEFRAME** | **PRIORITY** |
| **Goals related to overall program administration** | | |
| Audit existing capabilities and identify needs | Immediately | ● |
| Designate one program head and identify key support staff | | ● |
| Develop a complete list of ongoing activities related to IDDE | | ❍ |
| Coordinate and communicate with other affected agencies | At program start up and continuously and regularly after that | ● |
| Develop a projected 5-year budget | | ● |
| Secure funding to match 5-year goals | | ● |
| Draft and promulgate new or modified ordinance | Year 1 | ● |
| Establish a tracking and reporting system | Year 1 | ● |
| **Goals related to outfall assessment** | | |
| Define and characterize drainage areas or sewer sheds | Year 1 | ● |
| Walk all stream miles | Begin in Year 1 and complete first screening by end of permit cycle. Repeat once per permit cycle | ● |
| Develop a digital (e.g., GIS) map of all outfalls, land use, and other relevant infrastructure | Year 1 and continuously and regularly after that | ● |
| Secure analytical laboratory services either internally or by arrangement with a private laboratory | Initiate in conjunction with field screening | ● |
| Sample and trace the source of a percentage of flowing outfalls each year of permit cycle | Initiate during first permit cycle and expand and enhance where problems are observed | ● |
| Conduct regular in-stream assessments | | ❍ |
| Conduct investigations at a percentage of non-flowing outfalls with poor in-stream water quality to look for intermittent flows | | ❍ |
| Integrate all collected stream data and citizen complaints into the GIS system | Initiate during first year and expand and enhance with time | ❍ |
| **Goals related to preventing illicit discharges** | | |
| Distribute educational materials to citizens and industries | Initiate during first year and expand and enhance with time | ❍ |
| Conduct storm drain stenciling | Initiate during first permit cycle and expand and enhance where problems are observed | ❍ |
| Hold hazardous waste collection days at least annually | | ❍ |
| Conduct upland subwatershed site reconnaissance surveys to better characterize generating site potential | | ❍ |
| **Goals related to finding and fixing illicit discharges** | | |
| Develop a spill response plan and coordinate emergency response with other agencies | Immediately | ● |
| Remove all obvious illicit discharges | Ongoing in conjunction with field screening and in response to hotline reports | ● |

| Table 17: Measurable Goals for an IDDE Program | | |
|---|---|---|
| **EXAMPLE MEASURABLE GOALS** | **TIMEFRAME** | **PRIORITY** |
| Train staff on techniques to find the source of an illicit discharge | Initiate during first year and expand and enhance with time | ● |
| Repair a fraction of the illicit discharges identified through field screening or citizen complaints | Initiate during first permit cycle and expand and enhance where problems are observed | ● |
| Establish a hotline for public to call in and report incidents (consider establishing performance standards, such as guaranteed response time) | Initiate during first year and expand and enhance with time | ❍ |
| Inspect and dye-test all industrial facilities | Initiate during first permit cycle and expand and enhance where problems are observed | ❍ |
| Develop a system to track results of on-site inspections | Initiate during first year and expand and enhance with time | ❍ |
| Establish an Adopt-a-Stream program | Initiate during first permit cycle and expand and enhance where problems are observed | ❍ |
| Establish pre-approved list of plumbers and contractors to make corrections | Initiate during first year and expand and enhance with time | ❍ |
| *Key:* ● Essential ❍ Optional but Recommended | | |

Ultimately, IDDE program goals should be linked to water quality goals. Some common examples of water quality goals include:

- Keep raw or poorly-treated sewage out of streams
- Reduce pollutant loads during dry weather to help meet the TMDL for a water body
- Meet bacteria water quality standards for contact recreation during dry weather flows
- Reduce toxicant and other pollutant discharges to a stream to restore the abundance and diversity of aquatic insects or fish

A well-designed IDDE program may not guarantee that water quality goals will be always be achieved. Indeed, if program managers can document that illicit discharges do not contribute to poor water quality, they may want to shift resources to other pollution sources or practices that do. Burton and Pitt (2002) offer a complete discussion on designing and conducting a receiving water investigation.

## 6.3 Crafting Implementation Strategies

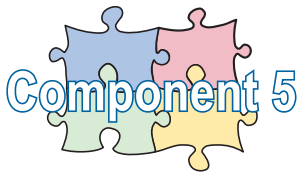
In order to meet program goals, managers must devise cost-effective implementation strategies that are most appropriate for the types of illicit discharge problems they actually have. The community-wide illicit discharge potential (IDP) developed during the desktop analysis can be quite helpful in choosing implementation strategies. Table 18 presents implementation strategies that are geared to the findings of the community-wide IDP. As the community acquires more program experience, they can refine the strategies to better address program goals or unique watershed conditions (Table 19).

Perhaps the most important implementation strategy is targeting—screening, education and enforcement efforts should always be focused on subwatersheds, catchments or generating sites with the greatest IDP. Adaptability after program startup is also an important strategy. Strategies developed from the desktop analysis should be constantly adjusted to reflect knowledge gained from field screening, hotline reports and other monitoring information.

**Table 18: Linking Implementation Strategies to Community–wide IDP**

| Type | Examples of Implementation Strategy |
|---|---|
| **Minimal IDP** | • Conduct field screening of outfalls in the context of broader watershed assessment and restoration initiatives using the Unified Stream Assessment (CWP, 2004) or a comparable physical stream assessment approach that has broader focus and benefits.<br>• Integrate IDDE program efforts into more comprehensive watershed assessment and restoration efforts where multiple objectives are being pursued (e.g., storm water education).<br>• Target and coordinate with existing small watershed organizations as partners to accomplish inventory and data collection efforts.<br>• Establish hotline to report suspicious discharges. |
| **Clustered IDP** | • Conduct limited sampling in the suspect areas. The most cost-effective approach will likely involve using outside laboratory services to avoid capital costs for special equipment (in some cases a municipal laboratory may be available for limited cost).<br>• Select a small set of indicator parameters using the nature of historic problems and land use as a guide.<br>• Target education program in problem areas.<br>• Look for partnerships with local watershed groups to regularly monitor problem areas.<br>• Establish a hotline to report suspicious discharges. |
| **Severe IDP** | • Establish a hotline to report suspicious discharges.<br>• Conduct and repeat screening in all subwatersheds<br>• Plan for more rigorous sampling approach to make establishment of internal laboratory set up more cost effective (i.e., plan for equipment expenditures for sample collection and analysis). Considerations include: expanding set of parameters to use as indicators, adopting a strategy for targeting intermittent discharges, and establishing in-stream stations to supplement screening effort.<br>• Develop a community-specific chemical “fingerprint” of various flow sources to facilitate differentiation between likely flow sources.<br>• Develop community-wide educational messages aimed at increasing public awareness and targeted education programs tailored to problem areas.<br>• Look for partnerships with local watershed groups to be regular monitors of problem areas through an adopt-a-stream approach.<br>• Emphasize cross-training of municipal employees to develop a broader reach of program efforts and lead by example by ensuring municipal facilities are not contributing to illicit discharge problem. |

| Table 19: Customizing Strategies for Unique Subwatershed Screening Factors | | |
|---|---|---|
| **Initial Problem Assessment** | **Screening Factor** (from Table 14) | **Example Implementation Strategies** |
| **Aging Sewer Infrastructure and/or Converted Combined System** | • Complaints of sewage discharges<br>• Poor dry weather quality<br>• High outfall density<br>• Septic to sewer conversion<br>• Historic combined system<br>• Aging sewers | • Institute a point of sale inspection and verification process.<br>• Select a small set of indicator parameters that focuses on sewage connections.<br>• Develop cost share program to assist property owners with connection correction. |
| **Aging Septic Infrastructure and/or Converted Combined System** | • Aging septic systems | • Develop targeted education program for septic system maintenance and institute a point of sale inspection and verification process.<br>• Develop cost share capabilities to assist property owners with upgrade of system. |
| **Discharges from Generating Sites** | • Density of generating sites<br>• Older industry<br>• Past complaints and reports | • Link IDDE program to existing industrial NPDES discharge permits, and inspect storm water management pollution prevention plans.<br>• Develop targeted training and technical assistance programs tailored to specific generating sites.<br>• Aggressively enforce fines and other measures on chronic violators. |
| **High Spill or Dumping Potential** | • Past complaints and reports | • Establish a hotline and develop community-wide educational messages aimed at increasing public awareness.<br>• Look for partnerships with local watershed groups to regularly monitor or adopt problem sites.<br>• Increase number and frequency of used oil and hazardous waste recycling stations.<br>• Post signs, with hotline reporting number at dumping sites. |




# Chapter 7: Searching for Illicit Discharge Problems in the Field

*Purpose:* This program component consists of detective work, and involves rapid field screening of outfalls in priority subwatersheds followed by indicator monitoring at suspect outfalls to characterize flow types and trace sources.

*Method(s):* The primary field screening tool is the Outfall Reconnaissance Inventory (ORI), which is used to find illicit discharge problems and develop a systematic outfall inventory and map of the MS4. The ORI is frequently supplemented with more intensive indicator monitoring methods to test suspect outfalls. A wide range of monitoring methods can be used; this chapter describes a framework for choosing the safest, most accurate and repeatable methods for a community.

*Desired Product or Outcome(s):* The search for illicit discharge problems yields several important management products, including:

- An updated map of the locations of all outfalls within the MS4
- Incorporation of ORI data into the outfall inventory/tracking system
- Design and implementation of an indicator monitoring strategy to test suspect outfalls
- Creation of a local chemical "fingerprint" library of pollutant concentrations for various discharge flow types
- Data reports that evaluate the significance and distribution of illicit discharge problems in the community

*Budget and/or Staff Resources Required:* Field screening and indicator monitoring can consume substantial staff and budget resources. Monitoring costs are closely related to the number of outfalls screened and the complexity of illicit discharge problems discovered. An MS4 that screens 10 stream miles and analyzes 80 indicator samples each year can expect to spend about $15,000 to $35,000. Consequently, choosing which indicator(s) to use in a community (and when and where to use them) ranks as one of the most important budget decisions for any project manager.

*Integration with Other Programs:* Program managers should explore two strategies to integrate field screening and indicator monitoring with other programs to achieve cost savings. The first strategy links outfall screening to broader stream corridor assessments that support local watershed restoration efforts. Often, watershed organizations and "stream waders" can be enlisted and trained to conduct outfall screening. The second strategy is to find a local agency partner to conduct laboratory analysis (such as a drinking water or wastewater treatment plant).

## 7.1 Overview of Searching for Illicit Discharge Problems in the Field

This chapter provides basic information about the field and laboratory strategies needed to detect illicit discharges, beginning with a field screening technique designed to gather basic information and identify highly suspect outfalls or obvious discharges. Next, it provides a basic framework for using the data from this screening to address obvious discharges, develop a chemical monitoring program, and make future program decisions. Finally, it summarizes the basic options for conducting an ongoing chemical monitoring program. The approaches outlined here are only summarized briefly, and primarily in the context of overall program management. Much more detailed and "hands-on" information is provided in Chapters 11 and 12 that provide specific methods and technical guidance for field crew and laboratory staff.

## 7.2 The Outfall Reconnaissance Inventory (ORI)

The field screening technique recommended for an IDDE program is the Outfall Reconnaissance Inventory or ORI. The ORI is a stream walk designed to inventory and measure storm drain outfalls, and find and correct continuous and intermittent discharges without in-depth laboratory analysis (Figure 10). The ORI should be completed for every stream mile or open channel within the community during the first permit cycle, starting with priority subwatersheds identified in the desktop analysis. Outfall screening requires relatively little expertise, and can be incorporated into other stream assessments such as the Unified Stream Assessment (Kitchell and Schueler, 2004).

The ORI can discover obvious discharges that are indicated by flowing outfalls with very high turbidity, strong odors and colors, or an "off the chart" value on a simple field test strip. When obvious discharges are found, field crews should immediately track down and remove the source (see Chapters 8 and 13). In other instances, ORI crews may encounter a transitory discharge, such as a liquid or oil spill that should be immediately referred to the appropriate agency for cleanup (Figure 11).




**Figure 10: Measuring an outfall as part of the ORI**



**Figure 11: Some discharges are immediately obvious**

The ORI is not meant to be a "one size fits all" method, and should be adapted to suit the unique needs of each community. Program managers should also modify the ORI over time to reflect field observations, crew experience, new or modified indicators, and any other innovations that make fieldwork easier or faster. Table 20 summarizes the four basic steps to conduct an ORI, and more detail on ORI protocols is provided in Chapter 11.

## 7.3 Interpreting ORI Data

Once the first few ORI surveys are conducted, data can be analyzed to confirm and update the desktop analysis originally used for targeting subwatersheds. The ORI data analysis follows four basic steps, which are described in Table 21. Ideally, ORI data should be stored within a continuously-updated geospatial tracking system.

**Table 20: Field Screening for an IDDE Program**

| Step | Strategies |
|---|---|
| Step 1. Acquire necessary mapping, equipment and staff | • Use basic street maps or detailed maps from initial assessment<br>• Minimal field equipment required; use a portable spectrophotometer if desired<br>• Two staff per crew with basic field training required; more specialized staff or training is optional |
| Step 2. Determine when to conduct field screening | • During dry season and leaf off conditions<br>• After a dry period of at least 48 hours<br>• Low groundwater levels |
| Step 3. Identify where to conduct field screening (based on desktop assessment) | • Minimal: integrate field screening with broader watershed or stream assessments<br>• Clustered: screen drainage areas ranking High and Medium first for illicit discharge potential<br>• Severe: screen all outfalls systematically |
| Step 4. Conduct field screening | • Mark and photograph all outfalls<br>• Record outfall characteristics<br>• Simple monitoring at flowing outfalls<br>• Take flow sample at outfalls with likely problems<br>• Deal with major problems immediately |

| Table 21: Field Data Analysis for an IDDE Program | |
|---|---|
| **Step** | **Considerations** |
| Step 1. Compile data from the ORI | • Compile GPS data and photographs of outfall locations<br>• Enter ORI data into database<br>• Send any samples for lab analysis |
| Step 2. Develop ORI designation for outfalls | • Use ORI data to designate outfalls as having obvious, suspect, potential, or unlikely discharge potential |
| Step 3. Characterize the extent of illicit discharge problems | • Use data from initial assessment<br>• Use outfall designation data<br>• Update initial assessment of illicit discharge problems as minimal, clustered, severe |
| Step 4. Develop a monitoring strategy | • At a minimum, sample 10% of flowing outfalls per year<br>• Repeat field screening in second permit cycle<br>• Use various monitoring methods depending on outfall designation and subwatershed characteristics |

## 7.4 Design and Implementation of an Indicator Monitoring Strategy

The next step is to design an indicator monitoring program to test suspect or problem outfalls to confirm whether they are actually an illicit discharge, and determine the type of flow. From a program management standpoint, six core issues need to be considered during the design of the monitoring strategy, as shown in Table 22.

The indicator monitoring strategy should be concentrated primarily on continuous and intermittent discharges, and can be adapted to isolate the specific flow type found in a discharge. Figure 12 presents an overall monitoring design framework that organizes some of the key indicators and monitoring techniques that may be needed. In general, different indicators and monitoring methods are used depending on whether flow is present at an outfall or not. The details of the discharge monitoring framework are described in Chapter 12. The basic framework should be adapted to reflect the unique discharge problems and analytical capabilities of individual communities.

Some of the recommended monitoring strategies are discussed below. The preferred method to test flowing outfalls is the **flow chart method** that uses a small set of indicator parameters to determine whether a discharge is clean or dirty, and predicts its or flow type (Pitt, 2004). The flow chart method is particularly suited to distinguish sewage and washwater flow types. Industrial sites may require special testing, and the **benchmark concentrations method** includes several supplemental indicators to distinguish industrial sources.

| Table 22: Indicator Monitoring Considerations |
|---|
| • Use ORI data to prioritize problem outfalls or drainage areas<br>• Select the type of indicators needed for your discharge problems<br>• Decide whether to use in-house or contract lab analytical services<br>• Consider the techniques to detect intermittent discharges<br>• Develop a chemical library of concentrations for various flow types<br>• Estimate staff time, and costs for equipment and disposable supplies |

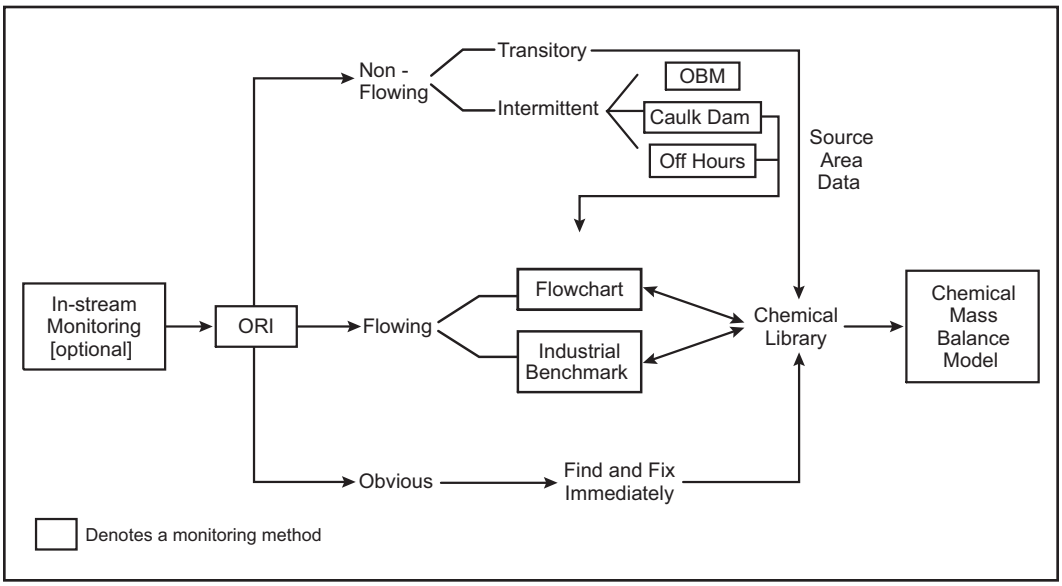



**Figure 12: IDDE Monitoring Framework**

Non-flowing outfalls are more challenging to diagnose. Intermittent flows can be diagnosed using specialized monitoring techniques such as:

- Off hours monitoring
- Caulk dams
- Optical brightener monitoring traps

When intermittent discharges are captured by these specialized techniques, samples are normally diagnosed using the flow chart method.

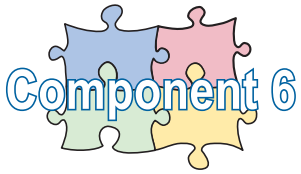
Transitory discharges are extremely difficult to detect with routine indicator monitoring, and are frequently identified from hotline reports. Transitory discharges are usually diagnosed by inspection, although water quality samples may be collected to support enforcement measures.

As communities acquire more monitoring data, they should consider creating a **chemical "fingerprint" library**, which is a database of the chemical make-up of the many different flow types in the community. Chemical libraries should include sewage, septage, washwater, and common industrial flows. Default values for the chemical library can initially be established based on existing research and literature values. Data are then updated based on local monitoring to develop more accurate decision points in the flow chart or benchmark methods. Clean water sources such as tap water, groundwater, spring water, and irrigation water are also important entries in the chemical library. The chemical library should also characterize the water quality of known or unknown transitory discharges sampled in the field. Over time, chemical library data should help a community better understand the potential pollutant loads delivered to receiving waters from various generating activities.

These library data can be used to support more advanced strategies such as the **Chemical Mass Balance Model** (CMBM) method. This method, developed by the University of Alabama as part of this project (Karri, 2004), is particularly useful in identifying flow types in blended discharges, where groundwater or tap water is diluted or commingled with sewage and other illicit discharges. The CMBM requires substantial upfront work to develop an accurate chemical library for local flow types. Specifically, the library requires 10-12 samples for each flow type (for industrial flow types, samples can be obtained in association with NPDES pre-treatment programs). A user's guide for the CMBM can be found in Appendix I.

## Section 7.5 Field and Lab Safety Considerations

Program managers should take into account and fully plan for all necessary field and laboratory safety precautions. Most communities already have well established standard operating procedures they follow when conducting field and lab work, and these typically provide an excellent starting point for IDDE programs. Chapters 11, 12, and 13 along with Appendices F and G provide guidance on specific considerations associated with IDDE programs. Of particular note is that program managers may want to consider requiring/recommending field crews be vaccinated against Hepatitis B, particularly if the crews will be accessing waters known to be contaminated with illicit sewage discharges. Program managers should contact local health department officials to explore this issue in more detail prior to making a decision.




# Chapter 8: Isolating and Fixing Individual Illicit Discharges

*Purpose:* This program component uses a variety of tools to trace illicit discharge problems back up the pipe to isolate the specific source or improper connection that generates the discharge. This often requires improved local capacity to locate specific discharges, make needed corrections and maintain an enforcement program to ensure repairs.

*Method(s):* Five basic tools exist to isolate and fix individual discharges, including:

- Pollution reporting hotline
- Drainage area investigations
- Trunk investigations
- On-site discharge investigations
- Correction and enforcement

*Desired Product or Outcome(s):* Finding and fixing illicit discharges is the core goal of any IDDE program. The process of finding and fixing discharges has several desirable outcomes, such as:

- Improved water quality
- Increased homeowner and business awareness about pollution prevention
- Maintenance of a tracking system to document repairs and identify repeat offenders.

*Budget and/or Staff Resources Required:* Budget and staff resources needed to find illicit discharges vary greatly. Some discharge sources will be immediately obvious, while others will require extensive investigations up the pipe until the source can be sufficiently narrowed. Fixing the problem once it is identified is more predictable and can often involve qualified contractors. Costs associated with repairs can also be fully incurred by the offending party or shared, depending on the nature and extent of the illicit discharge.

*Integration with Other Programs:* Two important aspects of this program component can be integrated with other NPDES minimum management measures and storm water permitting. First, the pollution hotline can be an important element of any local storm water education initiative. Second, on-site illicit discharge investigations should be closely coordinated with industrial NPDES storm water site inspections.

## 8.1 Overview of Isolating and Fixing Individual Illicit Discharges

The ultimate goal of every IDDE program is to find and fix illicit discharges, and a range of tools are available to meet this objective. The ensuing chapter discusses each of the tools in more detail. The choice of which tools are used depends on the nature of the local storm drain system, and the type and mode of entry of the discharges.

## 8.2 Isolating Illicit Discharges

Outfall screening and monitoring are excellent for finding illicit discharge problems, but they often cannot detect most intermittent or transient flows, nor can they always isolate the exact source, particularly when the outfall has a large contributing area and an extensive pipe network. This section provides guidance on four tools to find individual illicit discharges. The first tool is a pollution complaint hotline, which is particularly effective at finding obvious illicit discharges, such as transitory flows from generating sites and sewer overflows. Citizens provide free surveillance around the clock, and their reports should prompt rapid investigations and enforcement. The other three investigative tools involve drainage area, trunk, and on-site investigations.

### *Pollution Complaint Hotline*

A complaint hotline is a dedicated phone number or website where citizens can easily report illicit discharge and pollution concerns. The hotline should always be supported by prompt investigations of each complaint by trained inspectors, usually within 24 hours. Many Phase I communities have utilized hotlines to track down intermittent and transitory discharges, and regard them as one of their most effective tools to isolate illicit discharges (CWP, 2002). Some of the benefits and challenges Phase I communities have encountered in administering an IDDE complaint hotline in summarized in Table 23.

Six basic steps are needed to establish and maintain a successful IDDE complaint hotline, which are outlined in Table 24. More detailed guidance on establishing a hotline is provided in Appendix C, along with a sample illicit discharge incident tracking form.

It is important to keep in mind that a successful hotline requires considerable advertising and outreach to keep the phone number fresh in the public's mind. Also, program managers should continuously monitor response times, inspection outcomes, and any enforcement taken. All complaints should be entered into the IDDE tracking system so that complaints can be analyzed.

The cost to establish and maintain a hotline varies, but savings can be realized if it can

**Table 23: Benefits and Challenges of a Complaint Hotline**

| Benefits | Challenges |
|---|---|
| • Leads to early detection and correction of illicit discharges<br>• Encourages active public stewardship<br>• Can "piggyback" on other call response needs<br>• Identifies suspected facilities for further investigation and education<br>• Increases facilities' and municipalities' sense of accountability<br>• Increases likelihood of discovering intermittent discharges | • Time and money to provide 24/7 service<br>• Marketing the hotline number<br>• Establishing inter- and intra-departmental process |

| Table 24: Steps to Creating and Maintaining Successful IDDE Hotline | |
|---|---|
| **Steps** | **Key Elements** |
| 1. Define the scope | • Determine if a hotline is needed<br>• Define the intent of the hotline<br>• Define the extent of the hotline |
| 2. Create a tracking and reporting system | • Design reporting method<br>• Design response method |
| 3. Train personnel | • The basics and importance of IDDE<br>• The complaint hotline reporting, investigation and tracking process<br>• How to provide good customer service<br>• Expected responsibilities of each department/agency |
| 4. Advertise | • Advertise hotline frequently through flyers, magnets, newspapers, displays, etc.<br>• Publicize success stories |
| 5. Respond to complaints | • Provide friendly, knowledgeable customer service<br>• Send an investigator to respond to complaints in a timely manner<br>• Submit incident reports to the hotline database system |
| 6. Track incidents | • Identify recurring problems and suspected offenders<br>• Measure program success<br>• Comply with annual report requirements |

be piggy-backed on an existing community hotline or cost shared with other communities in the region. Also, hotline costs are related to the volume of calls and the staff effort needed for follow-up investigations. A budgeting framework for establish and maintaining a hotline from scratch is provided in Table 25.

## *Illicit Discharge Investigations*

Once an illicit discharge is detected at an outfall or stream, one of four types of illicit discharge investigations is triggered to track down the individual source. These investigations are often time consuming and expensive, require special training and staff expertise, and may result in legal action. They include:

- Storm drain network investigations
- Drainage area investigations
- On-site investigations
- Septic system investigations

Each type of investigation handles a different type of discharge problem and has its advantages and disadvantages. More detail on these investigations is provided in Chapter 13.

### *Storm drain network investigations*

Storm drain or "trunk" investigations narrow the source of a discharge

| Table 25: IDDE Complaint Hotline Costs | | |
|---|---|---|
| **Steps** | **Initial Cost** | **Annual Costs** |
| Define the scope | $1,500 | $0 |
| Create a tracking and reporting system | $2,500 | $2,440 |
| Train personnel | $2,200 | $1,000 |
| Advertise | $1,500 | $2,920 |
| Respond to complaints | $0 | $5,000 |
| Track incidents | | |
| **TOTAL** | **$7,700** | **$11,360** |

problem to a single segment of a storm sewer. The investigation starts at the outfall, and the field crew must decide how it will explore the upstream pipe network. The three options include:

- Work progressively up the trunk from the outfall and test manholes along the way
- Split the trunk into equal segments and test manholes at strategic points of the storm drain system
- Work progressively down the trunk (i.e., from the headwaters of the storm drain network and move downstream)

The decision to move up, split, or move down the trunk depends on the nature of the drainage system and the surrounding land use. The three options also require different levels of advance preparation. Moving up the trunk can begin immediately when an illicit discharge is detected at an outfall, and only a map of the storm drain system is required. Splitting the trunk requires a little more preparation to examine the storm drain system and find the most strategic manholes to sample. Moving down the trunk requires even more advance preparation, since the most upstream segments of the storm drain network may be poorly understood.

Once crews choose one of these options, they need to select the most appropriate investigative methods to track down the source. Common methods include:

- Visual inspection at manholes
- Sandbagging or damming the trunk
- Dye testing
- Smoke testing
- Video testing

### *Drainage area investigations*

Drainage area investigations are initially conducted in the office, but quickly move into the field. They involve a parcel by parcel analysis of potential generating sites within the drainage area of a problem outfall. They are most appropriate when the drainage area to the outfall is large or complex, and when the flow type in the discharge appears to be specific to a certain type of land use or generating site. These investigations may include the following techniques:

- Land use investigations
- SIC code review (see Appendix A)
- Permit review
- As-built review
- Aerial photography analysis
- Infrared aerial photography analysis
- Property ownership certification

### *On-site investigations*

Once the illicit discharge has been isolated to a specific section of storm drain, an on-site investigation can be performed to find the specific source of the discharge. In some situations, such as subwatersheds dominated by industrial land uses or many generating sites, on-site investigations may be immediately pursued.

On-site investigations are typically performed by dye testing the plumbing systems of households and buildings. Where septic systems are prevalent, inspections of tanks and drain fields may be needed.

On-site investigations are excellent opportunities to combine IDDE efforts with industrial site inspections that target review and verification of proper Storm Water

Pollution Prevention Plans. Appendix A provides a list of industrial activities that typically require industrial NPDES discharge permits.

### *Septic system investigations*

Communities with areas of on-site sewage disposal systems (i.e., septic systems) need to consider alternative investigatory methods to track illicit discharges that enter streams as indirect discharges, through surface breakouts of septic fields, or through straight pipe discharges from bypassed septic systems. Techniques can involve on-site investigations or imagery analysis (e.g., infrared aerials).

## 8.3 Fixing Illicit Discharges

Once the source of an illicit discharge has been identified, steps should be taken to fix or eliminate the discharge. Four questions should be answered for each individual illicit discharge to determine how to proceed; the answers will usually vary depending on the source of the discharge.

- Who is responsible?
- What methods will be used to repair?
- How long will the repair take?
- How will removal be confirmed?

Financial responsibility for source removal will typically fall on property owners, MS4 operators, or a combination of the two. Methods for removing illicit discharges usually involve a combination of education and enforcement. A process for addressing illicit discharges that focuses on identifying the responsible party and enforcement procedures is presented in Figure 13, while Table 26 presents various options for removing illicit discharges from various sources. Additional information on common removal actions and associated costs can be found in Chapter 14.

Program managers should use judgment in exercising the right mix of compliance assistance and enforcement. The authority and responsibility for correction and enforcement should be clearly defined in the local IDDE ordinance developed earlier in the program. An escalating enforcement approach is often warranted and is usually a reasonable process to follow. Voluntary compliance should be used for first-time, minor offenders. Often, property owners are not even aware of a problem, and are willing to fix it when educated. More serious violations or continued non-compliance may warrant a more aggressive, enforcement-oriented approach.

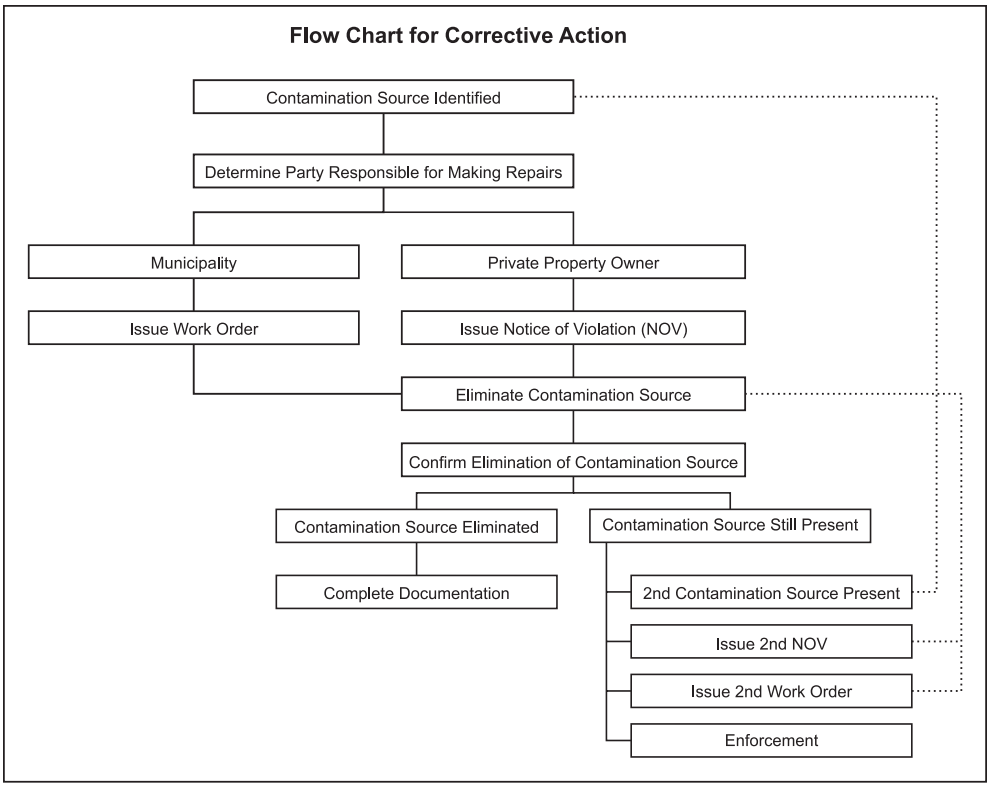
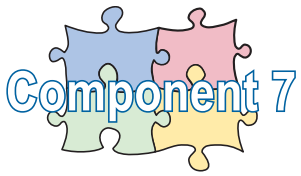



**Figure 13: Process for Removing or Correcting an Illicit Discharge**

**Table 26: Methods to Fix Illicit Discharges**

| Type of Discharge | Source | Removal Action(s) |
|---|---|---|
| **Sewage** | Break in right-of-way | Repair by municipality |
| | Commercial or industrial direct connection | Enforcement |
| | Residential direct connection | Enforcement; Incentive or aid |
| | Infrequent discharge (e.g., RV dumping) | Enforcement; Spill response |
| | Straight pipes/septic | Enforcement; Incentive or aid |
| **Wash water** | Commercial or industrial direct connection | Enforcement; Incentive or aid |
| | Residential direct connection | Enforcement; Incentive or aid |
| | Power wash/car wash (commercial) | Enforcement |
| | Commercial wash down | Enforcement |
| | Residential car wash or household maintenance-related activities | Education |
| **Liquid wastes** | Professional oil change/car maintenance | Enforcement; Spill response |
| | Heating oil/solvent dumping | Enforcement; Spill response |
| | Homeowner oil change and other liquid waste disposal (e.g., paint) | Warning; Education; Fines |
| | Spill (trucking) | Spill response |
| | Other industrial wastes | Enforcement; Spill response |




# Chapter 9: Preventing Illicit Discharges

*Purpose:* This program component identifies key behaviors of neighborhoods, generating sites, and municipal operations that produce intermittent and transitory discharges. These key "discharge behaviors" are then targeted for improved pollution prevention practices that can prevent or reduce the risk of discharge. Communities then apply a wide range of education and enforcement tools to promote the desired pollution prevention practices.

*Method(s):* The Unified Subwatershed and Site Reconnaissance (USSR; Wright *et al.*, 2004) and the desktop analysis of potential generating sites (Chapter 5) are two methods used to identify the major behaviors that generate intermittent and transitory discharges. These methods, used alone or in combination, are extremely helpful to identify the specific discharge behaviors and generating sites that will be targeted for education and enforcement efforts. A Source Control Plan is then performed to select the right pollution prevention message, choose the appropriate combination of carrots and sticks to change behaviors, and develop a budget and delivery system to implement the prevention program. Refer to Schueler *et al.* (2004) for information on developing a Source Control Plan and the many carrots and sticks available to communities.

*Desired Product or Outcome(s):* The desired outcome is a mix of local prevention programs that target the most common intermittent and transitory discharges in the community. Program managers need to develop targeted pollution prevention programs for three sectors of the community:

- *Neighborhood Discharges.* The pollution prevention practices related to discharge prevention in residential neighborhoods include storm drain stenciling, lawn care, septic system maintenance, vehicle fluid changing, car washing, household hazardous waste disposal and swimming pool draining.
- *Generating Sites.* This group of pollution prevention practices can reduce spills and transitory discharges generated during common business operations. Practices include business outreach, spill prevention and response plans, employee training and site inspections.
- *Municipal Housekeeping.* This group of pollution prevention practices is performed during municipal operations, such as sewer and storm drain maintenance, plumbing code revision, and provision of household hazardous waste and used oil collection services.

*Budget and/or Staff Resources Required:* The budget and staff resources needed for prevention programs can be considerable, and should be coordinated with other storm water education, public involvement and municipal housekeeping initiatives required under NPDES Phase II MS4 permits. Special emphasis should be placed on cross-training staff, partnering with local watershed groups, and pooling educational resources with other communities.

*Integration with Other Programs:* Illicit discharge prevention is linked to three of the

six NPDES Phase II minimum management measures, and should be closely integrated with local watershed restoration efforts.

## 9.1 Overview of Preventing Illicit Discharges

Intermittent and transitory discharges are difficult to detect through outfall screening or indicator monitoring. Indeed, the best way to manage these discharges is to promote pollution prevention practices in the community that prevent them from occurring. Effective IDDE programs develop education and outreach materials targeted toward neighborhoods, generating sites, and municipal operations. The discharge prevention message is normally integrated with other storm water education programs required under MS4 NPDES Phase II permits such as

- Public education and outreach
- Public participation/involvement
- Municipal pollution prevention/good housekeeping

## 9.2 Methods to Identify Opportunities for Illicit Discharge Prevention

The USSR and the desktop analysis of potential generating sites both help identify the major behaviors that generate intermittent and transitory discharges. These assessment methods are briefly described below:

### *The Unified Subwatershed and Site Reconnaissance (USSR)*

The USSR is a field survey that rapidly evaluates potential pollution sources and restoration potential in urban subwatersheds. The survey quickly characterizes upland areas in order to inventory problem sites that may contribute pollutants and identifies pollution source controls and other restoration projects. For more information on how to conduct the USSR, consult Wright *et al.* (2004). The USSR has four major assessment components, three of which directly relate to illicit discharge prevention:

- *Neighborhood Source Assessment (NSA)*, which helps discover residential pollution source areas and potential restoration opportunities within the many neighborhoods found in urban subwatersheds
- *Hotspot Site Investigation (HSI)*, which ranks the potential severity of each commercial, industrial, institutional, municipal or transport-related hotspot site found within a subwatershed
- *Analysis of Streets and Storm Drains (SSD)*, which measures the average pollutant accumulation in the streets, curbs, and catch basins of a subwatershed

### *Desktop Analysis of Generating Sites*

The desktop analysis method screens local business and permit databases to identify specific commercial, industrial, institutional, municipal, and transport-related sites that are known to have a higher risk of producing illicit discharges. Chapter 5 and Appendix A provide discussions of this analysis.

## 9.3 Preventing Illicit Discharges from Neighborhoods

Many common neighborhood behaviors can cause transitory discharges that are seldom defined or regulated as illicit discharges by most communities. Individually, these behaviors cause relatively small discharges, but collectively, they can produce significant

pollutant loads. Most communities use outreach and education to promote pollution prevention practices, and some of the more effective practices to influence these behaviors are described in this section:

- Storm drain stenciling
- Septic system maintenance
- Vehicle fluid changing
- Car washing
- Household hazardous waste storage and disposal
- Swimming pool draining

## Storm Drain Stenciling

Storm drain stenciling sends a clear message to keep trash and debris, leaf litter, and pollutants out of the storm drain system, and may deter illegal dumping and discharges (Figure 14). Stenciling may increase watershed awareness and neighborhood stewardship and can be used in any neighborhood with enclosed storm drains.

Stenciling is an excellent way to involve the public, and just a few trained volunteers can systematically stencil all the storm drains within a neighborhood in a short time. Volunteers can be recruited from scouting, community service, and watershed organizations, or from high schools and neighborhood associations. Program managers should designate a staff person to coordinate storm drain stenciling and be responsible for recruiting, training, managing, and supplying volunteers.




**Figure 14: Storm drain stenciling may help reduce illicit discharges.**

Storm drain stenciling programs are relatively inexpensive. Most communities use stencils, although some are now using permanent markers made of tile, clay, or metal. Stencils cost about 45 cents per linear inch and can be used for 25 to 500 drains, depending on whether paint is sprayed or applied with a brush or roller. Permanent signs are generally more costly; ceramic tiles cost $5 to $6 each and metal stencils can cost $100 or more. More guidance on designing a stenciling program can be found in Schueler *et al.* (2004).

## Septic System Maintenance

Failing septic systems can be a major source of bacteria, nitrogen, and phosphorus, depending on the overall density of systems present in a subwatershed (Swann, 2001). Failure results in illicit surface or subsurface discharges to streams. According to U.S. EPA (2002), more than half of all existing septic systems are more than 30 years old, which is well past their design life. The same study estimates that about 10% of all septic systems are not functioning properly at any given time, with even higher failure rates in some regions and soil conditions.

Septic systems are a classic case of out of sight and out of mind. Many owners take their septic systems for granted, until they back up or break out on the surface of their lawn. Subsurface failures, which are the most common, go unnoticed. In addition, inspections, pump outs, and repairs can be costly, so many homeowners tend to put off the expense until there is a real problem. Lastly, many septic system owners are not

**CASE STUDY**

In 1997, Madison County, NC implemented a project to address straight piping problems. In 1999, a survey identified 205 households with black water straight-piping (toilet waste), 243 households with gray water straight-piping (sink, shower, washer waste), and 104 households with failing septic systems. The project facilitated more than 10 community meetings, and issued more than 20 educational articles on straight-piping and water quality in the local papers. In addition, the project leveraged $903,000 from the N.C. Clean Water Management Trust Fund to establish a Revolving Loan and Grant Program for low and moderate income county residents that need assistance installing a septic system or repairing a failing one. (Land of Sky Regional Council website, 2002).

aware of the link between septic systems and water quality. Communities can employ a range of tools to improve septic system maintenance. These include:

- Media campaigns and conventional outreach materials to increase awareness about septic system maintenance and water quality (e.g., billboards, radio, newspapers, brochures, bill inserts, and newsletters)
- Discount coupons for septic system maintenance
- Low interest loans for septic system repairs
- Mandatory inspections
- Performance certification upon property transfer
- Creation of septic management districts
- Certification and training of operation/ maintenance professionals
- Termination of public services for failing systems

## *Vehicle Fluid Changing*

Dumping of automotive fluids into storm drains can cause major water quality problems, since only a few quarts of oil or a few gallons of antifreeze can severely degrade a small stream. Dumping delivers hydrocarbons, oil and grease, metals, xylene and other pollutants to streams, which can be toxic during dry-weather conditions when existing flow cannot dilute these discharges. The major culprit has been the backyard mechanic who changes his or her own automotive fluids (Figure 15). Communities have a range of tools to prevent illegal dumping of car fluids, including:

- Outreach materials distributed at auto parts store and service stations
- Community oil recycling centers
- Directories of used oil collection stations
- Free or discounted oil disposal containers
- Pollution hotlines
- Fines and other enforcement actions



**Figure 15: Home mechanic changing his automotive fluids**

## Car Washing

Car washing is a common neighborhood behavior that can produce transitory discharges of sediment, nutrients and other pollutants to the curb, and ultimately the storm drain. Communities have utilized many innovative outreach tools to promote environmentally safe car washing, including:

- Media campaigns
- Brochures promoting nozzles with shut off valves
- Storm drain plug and wet vac provisions for charity car wash events
- Water bill inserts promoting environmentally safe car washing products
- Discounted tickets for use at commercial car washes

## Household Hazardous Waste Storage and Disposal

The average garage contains a lot of products that are classified as hazardous wastes, including paints, stains, solvents, used motor oil, pesticides and cleaning products. While some household hazardous waste (HHW) may be dumped into storm drains, most enters the storm drain system as a result of outdoor rinsing and cleanup. Improper disposal of HHW can result in acute toxicity to downstream aquatic life. The desired neighborhood behavior is to participate in HHW collection days, and to use appropriate pollution prevention techniques when conducting rinsing, cleaning and fueling operations (Figure 16).

Convenience and awareness appear to be the critical factors in getting residents to participate in household hazardous waste collection programs. Participation depends on the number of days each year collection events are held and is inversely related to both the distance homeowners must travel to recycle waste and the restrictions on what is accepted. Communities have used a variety of techniques to promote and expand HHW collection, including:




**Figure 16: Household hazardous wastes should be properly contained to avoid indirect discharges**

- Mass media campaigns to educate residents about proper outdoor cleaning/ rinsing techniques
- Conventional outreach materials notifying residents about HHW and collection days
- More frequent HHW collection days
- Providing curbside disposal options for some HHW
- Establishing permanent collection facilities at solid waste facilities
- Providing mobile HHW pickup
- Waiving disposal fees at landfills

## Swimming Pool Draining

Routine and end-of-season maintenance tasks for aboveground or in-ground pools can cause the discharge of chlorinated water or filter back flush water into the storm drain

system or the stream (Figure 17). The ideal practice is to discharge chlorinated pool water into the sanitary sewer system, or hold it until chlorine and temperature levels are acceptable to permit spreading it over a suitable pervious surface.

Most pool owners understand that regular maintenance is essential to keep pools safe and clean, and they may be more receptive to changing discharge behaviors with proper education. Effective outreach methods include:

- Conventional outreach techniques on proper discharge (pamphlets, water bill inserts, posters)
- Educational kiosks at the retail outlets selling pool chemicals
- Changes in local plumbing codes to require discharge to sanitary sewer systems
- Local ordinances that allow for fines/ enforcement for unsafe pool discharges




**Figure 17: Swimming pools can be a source of illicit discharges.**

## 9.4 Preventing Illicit Discharges from Generating Sites

Many indirect discharges can be identified and prevented using the concept of generating sites, which are a small subset of commercial, industrial, institutional, municipal and transport-related operations that have the greatest risk of generating indirect discharges. Program managers should become intimately familiar with the types of generating sites found in their community, particularly those regulated by industrial NPDES storm water permits. Some of the more common operations that generate spills and transitory discharges are profiled in Table 27.

Most communities consider nearly all non-storm water discharges from generating sites to be illicit, and take a more regulatory approach. Consequently, pollution prevention practices are more prescriptive, and are frequently incorporated into a pollution prevention plan for a facility or operation. Like anyone else, businesses respond better to carrots than sticks, but often need both. Communities possess four broad tools to promote effective pollution prevention practices at generating sites:

- Business outreach and education
- Spill prevention and response planning
- Employee training
- Site inspections

| Table 27: Common Discharges Produced at Generating Sites | |
|---|---|
| **Generating Site** | **Activity Generating the Discharge** |
| **Vehicle Operations** (Maintenance, Repair, Fueling, Washing, Storage) | • Improper disposal of fluids down shop and storm drains<br>• Spilled fuel, leaks and drips from wrecked vehicles<br>• Hosing of outdoor work areas<br>• Wash water from cleaning<br>• Spills |
| **Outdoor Materials** (Loading/unloading, Outdoor storage) | • Liquid spills at loading areas<br>• Hosing/washing of loading areas into shop or storm drains<br>• Leaks and spills of liquids stored outside |
| **Waste Management** (Spill prevention and response, Dumpster management) | • Spills and leaks of liquids<br>• Dumping into storm drains<br>• Leaking dumpsters |
| **Physical Plant Maintenance** (Building Repair, Remodeling and maintenance, Parking lot maintenance) | • Discharges from power washing and steam cleaning<br>• Rinse water and wash water discharges during cleanup<br>• Runoff from degreasing and re-surfacing |
| **Turf and Landscaping** (Turf Management Landscaping/Grounds care) | • Non-target irrigation<br>• Improper rinsing of fertilizer/pesticide applicators |
| **Unique Hotspot Operations** (Pools, Golf Courses, Marinas, Construction, Restaurants, Hobby farms) | • Discharge of chlorinated water from pools<br>• Dumping of sewage and grease |

## *Business Outreach and Education*

Targeted distribution of educational materials to specific business sectors in the subwatershed is the most common method of promoting pollution prevention. Outreach materials are designed to educate owners and employees about polluting behaviors, recommend appropriate pollution prevention practices, and notify them of any local or state regulations. Useful outreach materials include brochures, training manuals, posters, directories of pollution prevention vendors, and signs. Passive business outreach works best when it is specially adapted and targeted to a specific business sector (e.g., vehicle repair, landscaping, restaurants) and is routinely and directly presented to local business groups and trade associations. Business outreach materials require employees to read or hear them, and then take active steps to change their behavior.

Communities can also provide direct technical assistance to develop a customized pollution prevention prescription for individual generating sites. In this case, local staff work closely with owners and operators to inspect the site and develop an effective pollution prevention plan. In other cases, pollution prevention workshops or model plans are offered to businesses and trade groups that represent specific groups of generating sites. In either case, the locality acts as a technical partner to provide ongoing consultation to individual businesses to support their pollution prevention efforts.

## Spill Prevention and Response

A spill prevention and response plan is useful for any potential generating site, and is mandatory for any operation that uses, generates, produces, or transports hazardous materials, petroleum products or fertilizers. These operations are known as SARA 312 operators and are regulated by state environmental agencies. In addition, all industrial sites regulated by individual or group NPDES storm water permits must have an updated spill prevention and response plan on its premises. Spill containment and response plans should also be prepared for major highways that cross streams and other water bodies, since truck and tanker accidents often represent the greatest potential spill risk in most communities (Figure 18).

Spill prevention and response plans describe the operational procedures to reduce the risks of spills and accidental discharge and ensure that proper controls are in place in the event they do occur. Spill prevention plans standardize everyday procedures and rely on employee training to reduce potential liability, fines and costs associated with clean up. Planning begins with an analysis of how pollutants are handled at the site and how they interact with storm water. Spill prevention and response plans have five major components:

1. A site map and evaluation of past spills and leaks
2. An inventory of materials at the site
3. Identification of potential spill areas
4. A list of required spill response equipment
5. Employee training

When spills do occur, a good spill prevention and response plan will clearly:

- Identify potential spill sites and their drainage points
- Specify material handling procedures
- Describe spill response procedures
- Ensure that adequate spill clean-up equipment is available

## Employee Training

Effective and repeated employee training is essential to maintain pollution prevention practices at generating sites. Indeed, continuous employee training is an essential component of any pollution prevention plan, particularly at generating sites where the work force turns over frequently. Many businesses perceive time devoted to pollution prevention training as reducing their bottom line, and may be hesitant to develop training materials or allocate time for training. In some cases, local agencies supply free or low cost videos, posters, shop signs, or training brochures (often in multilingual formats). In other cases, short training classes are offered for employees or supervisors that are scheduled for down times of the year (e.g., winter classes for landscaping companies or construction contractors) or coincide with regular employee safety meetings.



**Figure 18: Spill response often involves portable booms and pumps**

Program managers can refer to Schueler *et al.* (2004) for more guidance on developing effective pollution practices at generating sites and storm water hotspots. Employee training should be conducted at least annually to educate workers on the proper practices to avoid illicit discharges and respond to spills. Training can be reinforced with signs, and posters.

### *Site Inspections*

Regular inspections of generating sites are a key tool to foster pollution prevention and reduce the risk of illicit discharges. Communities that possess an MS4 permit should ensure that they have the authority to inspect non-regulated sites that connect to the municipal storm drain system they operate. These inspections can be used to assess the site and educate owners/operators about recommended pollution prevention practices. Site inspections are staff intensive and therefore are best suited to high-risk generating sites.

An industrial NPDES storm water permit is an extremely important compliance tool at many generating sites. NPDES permits require operators to prepare a pollution prevention plan for the site and implement the practices specified in the plan. Significant penalties can be imposed for non-compliance.

To date, compliance with the industrial storm water permit program has been spotty, and a significant fraction of regulated industries has failed to file their required permits. According to Duke and Shaver (1999) and Pronold (2000), as many as 50% of industrial sites that are required to have a permit do not actually have one. These sites are termed "non-filers," and are often small businesses or operations that are unaware of the relatively new regulations. It is therefore quite likely that many hotspots in a subwatershed may not have a valid NPDES permit. These operations should be educated about the industrial permit program, and encouraged to apply for permit coverage. Non-filers should be referred to the NPDES permitting authority for details on how to obtain permit coverage.

Inspections are an important stick to improve compliance at generating sites subject to industrial NPDES permits. Inspectors should frequently observe site operations to ensure that the right mix of pollution prevention practices is routinely employed. Communities with MS4 permits have the authority to inspect storm water NPDES sites that discharge to their storm drain system, and refer any violations for subsequent state or federal enforcement.

Voluntary inspections of non-regulated generating sites are a good tool to educate owners/operators about recommended pollution prevention practices. When generating sites are inspected, existing fire, building or health inspectors should be considered since they are already acquainted with how to deal with small businesses.

## 9.5 Preventing Illicit Discharges from Municipal Operations

Many municipal operations and services have the potential to create or reduce illicit discharges. Program managers should review all municipal operations and services to make sure good housekeeping is practiced. In addition, program managers should examine:

- Routine sewer and storm drain maintenance
- Plumbing code revisions
- HHW collection services
- Used motor oil collection services

### Routine Sewer And Storm Drain Maintenance

Failure to regularly inspect and maintain local sewer and storm water infrastructure can cause illicit discharges to receiving waters. Within the storm drain system, maintenance should focus on frequent cleaning to keep trash, debris and illegally dumped material from entering the storm drain system. In the sanitary sewer network, maintenance should focus on finding damaged infrastructure that allows sewage discharges from the sanitary sewer. In-stream monitoring, historical data reviews of past complaints, or aging sewer infrastructure can often be used to identify likely problem areas.[8]

### Plumbing Code Revisions

Communities need to establish the legal authority to prohibit illicit connections to the storm drain system. When the illicit discharge ordinance is being prepared, communities should thoroughly review all of their plumbing codes to prevent any misinterpretation that might create cross connections to the storm drain system. Program managers should also specifically target licensed plumbers to educate them on any code changes.

### Household Hazardous Waste Collection Services

Households generate a lot of hazardous wastes, and communities need to educate residents about proper household hazardous waster (HHW) handling and disposal, and provide convenient options for pick up and disposal. Communities have experimented with several innovative ways to deal with HHW including:

- A permanent facility that accepts HHW year-round and can serve as a central location for HHW exchange and recycling
- Mobile collection at temporary facilities. On designated special collection days, mobile units can move through communities accepting HHW and take the form of curbside pickup or central collection locations
- Some local businesses may act as drop off centers for certain products. Some local garages, for example, may accept used motor oil for recycling

Overall, the costs for implementing HHW collection programs can be high. Factors such as frequency of the collection, size of community, environmental awareness, level of staff training, and level of outreach all contribute to the overall cost. Participation in collection programs usually ranges from 1% to 5% of the population (HGAC, 2001), and the cost per participant can vary greatly (Table 28).

### Used Motor Oil Collection Services

Used motor oil collection has been a common municipal service for many years, however, program managers may need to refine their programs to increase participation. Suggested outreach approaches include:

- Conventional outreach materials provided at points of sale (e.g., auto parts stores, service stations)
- Multilingual outreach materials
- Directories of used oil collection stations
- Free or discounted oil disposal containers

[8] Preliminary sewer system investigations are not discussed further in this manual. For more detail on how to conduct these investigations consult the EPA handbook, "Sewer System Infrastructure Analysis and Rehabilitation." (U.S. EPA, 1991)

**CASE STUDY**

The City of Denver operates a pilot, door-to-door collection program to assist residents in the proper disposal and recycling of HHW. To be eligible for collection, residents must currently be receiving trash collection service from City Solid Waste Management crews. Residents are permitted one HHW collection annually and are asked to have at least three different materials before calling for a pickup. Residents then receive a collection date and an HHW Kit that holds up to 75 pounds. Residents are instructed on what items can be placed inside the Kit, and can have additional items picked up for a small fee. The program also educates citizens on how to prevent the accumulation of chemicals in the home environment. The key element of this service is convenience for area residents. Customers can make a phone call, put their waste in a container, and schedule a pickup (City of Denver, 2003).

**Table 28: Summary of Local Household Hazardous Waste Collection Programs**

| Location | Budget | Households Served | Participants | Cost per Participant | Program Description |
|---|---|---|---|---|---|
| Fort Worth TX (2002) | $937,740 | 26 cities | 15,629 | $60 | Accept 3 days a week at permanent facility, plus approx 24 mobile units |
| Monmouth County, NJ (2002) | $900,000 | 620,000 | 6,200 | $145.16 | Permanent facility plus 2-3 remote days |
| Nashville, TN (2002) | $149,000 | 180,000 | 5,800 | $26 | 361 day drop off at permanent facility |
| Putnam County, NY (1997) | $20,279 | 27,409 | 349 | $58.10 | One collection day per year |
| Town of East Hampton, NY (1997) | $36,495 | 4,878 | 452 | $80 | Three collection days per year |

**CASE STUDY**

Municipal cross-training is a proven and effective tool for identifying illicit discharges. Wayne County, Michigan has a very active IDDE program that has included efforts to train all County "field" staff to identify and report suspicious discharges in the course of their duties. The Illicit Discharge Elimination Training Program includes presentations for general field staff that instructs them in the identification and reporting of suspicious discharges. To date, 734 people from various agencies and communities throughout Michigan have attended the training sessions (Tuomari and Thompson, 2002). The information these individuals gained from attending the training session helped identify 82 illicit discharges in the counties of Oakland, Washtenaw, and Wayne. Road division staff trained in recognizing illicit discharges discovered 12 septic systems in Wayne County that were failing or had direct discharges to surface water. Other counties found 70 illicit discharges during their investigations. The elimination of these illicit discharges will prevent an estimated 3.5 million gallons of polluted water from reaching Michigan surface waters each year (associated load reductions are estimated at 7,200 pounds/year of Biological Oxygen Demand and 25, 000 lbs/yr of Total Suspended Solids)

## 9.6 Budgeting and Scoping Pollution Prevention

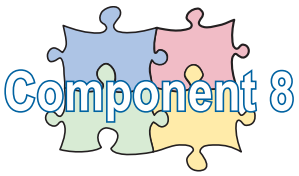
The cost of preventing illicit discharges is directly related to the scope of the education effort. Larger communities often employ education staff on a full-time basis, or at least have one staff member who spends much of their time doing outreach on issues such as illicit discharges. Smaller communities often spread the education effort out over several departments, and try to use already established programs such as cooperative extensions or citizen watershed groups. Table 29 provides some cost data for storm water education in one community.

In reality, program managers have to do a lot of homework to scope and budget their pollution prevention education program. Normally, these education efforts are integrated with other storm water education programs. One of the best tools to develop an overall education budget is the Source Control Plan, which is described in Schueler *et al.* (2004).

**Table 29: Estimated Costs for Public Awareness Program Components**
***(Adapted from Wayne County, MI. 2001)***

| Education Component | Estimated Cost | Assumptions |
|---|---|---|
| Information Brochures | $100/hour for development<br>$0.10-$0.20/pamphlet for black and white printing<br>$0.30/pamphlet for mailing | 160-320 hours |
| Technical Manuals | $100/hour for development<br>$100.00/manual for printing | 160-480 hours |
| Business Education | $50/hour for business/activity list<br>$100/hour for development<br>$50/hour for employee presentation | 40-80 hours for compilation<br>80-160 hours for development.<br>8 hours for presentation, including prep time. |
| Program Planning and Administration | $10,000 per year | 0.2 Full Time Equivalents (FTE) per year |

*Source: Wayne County, MI. 2001. Planning and Cost Estimating Criteria for Best Management Practices. Rouge River Wet Weather Demonstration Project. TR-NPS25.00*




# Chapter 10: IDDE Program Tracking and Evaluation

*Purpose:* This last program component addresses the ongoing management of the IDDE program and reviews progress made in meeting the measurable program goals established earlier in the permit cycle. Adaptive management is critical since most communities initially have a poor understanding of the scope and nature of their illicit discharge problem. Frequent program review can ensure that the most severe illicit discharges are eliminated in the most cost-effective way during the permit cycle. Program evaluation should also be directly tied to program goals (see Chapter 6 on Developing Program Goals and Implementation Strategy)

*Method(s):* The primary method is frequent maintenance and analysis of the IDDE tracking system developed as part of the program. The integrated tracking system contains geospatial data on ORI results, indicator monitoring, on-site investigations, dumping and spill sites and hotline calls. The tracking system is important from both an enforcement and program evaluation standpoint. Each of the eight program components should be reviewed annually and prior to new permit negotiation, using data collected, compiled, and assessed from the tracking system.

*Desired Product or Outcome(s):* Updated tracking database and annual report with summary of progress to date, findings, recommendations for program revisions, and work plan (including milestones and goals) for the upcoming year.

*Budget and/or Staff Resources Required:* Program assessment is an ongoing responsibility of the program manager. The staff effort to prepare an annual report is about three to four weeks. In general, the first annual report will require more effort than subsequent ones.

*Integration with Other Programs:* Program managers should always consider other programs and regulatory requirements when assessing program performance and revising goals. At a minimum, the annual report should be shared with other departments and agencies to head off duplication of efforts and to look for opportunities to pool resources.

## 10.1 Establish a Tracking and Reporting System

An accurate and user-friendly system to track, report and respond to illicit discharge problems is critical for program managers. Ideally, the tracking system should be designed and operational within the first year of the program. The tracking system enables managers to measure program indicators, and gives field crews a home to store the data they collect. The ideal tracking system consists of a relational database that is linked to a GIS system, which can be used to store and analyze data and produce maps.

The fundamental units to track are individual outfalls, along with any supporting information about their contributing drainage area. Some of the key information to include when tracking outfalls includes:

- Geospatial coordinates of each outfall location
- The subwatershed and watershed address
- Any supporting information about the contributing land use
- Diameter and physical characteristics of the outfall
- Outfall Reconnaissance Inventory (ORI) data, as it is collected
- Any accompanying digital photos
- Any follow-up monitoring at the outfall or further up the pipe
- Any hotline complaints logged for the outfall, along with the local response
- Status and disposition of any enforcement actions
- Maintenance and inspection data

## 10.2 Evaluate the Program

Since IDDE programs are a first time endeavor for many communities, program managers need to be extremely adaptable in how they allocate their resources. Effective IDDE programs are dynamic and flexible to respond to an ever-changing set of discharge problems, program obstacles, and emerging technologies. At a minimum, program managers should maintain and evaluate their IDDE tracking system annually, and modify program components as needed. Tracking systems should be designed so that progress toward measurable goals (see Chapter 6) can be easily reported. Communities that develop and maintain a comprehensive tracking system should realize program efficiencies. The tracking system should contain the following features at a minimum:

- Updated mapping to reflect outfalls located during the ORI
- Surveyed stream reaches with locations of obvious, suspect, and potential discharges, and locations of dumping sites
- Indicator sampling results for specific streams, outfalls and storm drains
- Frequency of hotline use and associated number of “hits” or confirmed illicit discharges
- Costs for each of the eight program components (e.g., office, field, lab, education, enforcement, etc.)
- Number of discharges corrected
- Status and disposition of enforcement actions

Regular analysis of the tracking system sheds light on program strengths and

deficiencies, and improves targeting of limited program resources. For example, if hotline complaints are found to uncover the most severe illicit discharge problems, program managers may want to allocate more resources to increase public awareness about the hotline, and shift resources from outfall screening and indicator monitoring.

# Chapter 11: The Outfall Reconnaissance Inventory

This chapter describes a simple field assessment known as the Outfall Reconnaissance Inventory (ORI). The ORI is designed to fix the geospatial location and record basic characteristics of individual storm drain outfalls, evaluate suspect outfalls, and assess the severity of illicit discharge problems in a community. Field crews should walk all natural and man-made streams channels with perennial and intermittent flow, even if they do not appear on available maps (Figure 19). The goal is to complete the ORI on every stream mile in the MS4 within the first permit cycle, starting with priority subwatersheds identified during the desktop analysis. The results of the ORI are then used to help guide future outfall monitoring and discharge prevention efforts.

## 11.1 Getting Started

The ORI requires modest mapping, field equipment, staffing and training resources. A complete list of the required and optional resources needed to perform an ORI is presented in Table 30. The ORI can be combined with other stream assessment tools, and may be supplemented by simple indicator monitoring. Ideally, a Phase II community should plan on surveying its entire drainage network at least once over the course of each five-year permit cycle. Experience suggests that it may take up to three stream walks to identify all outfalls.



**Figure 19: Walk all streams and constructed open channels**

### *Best Times to Start*

Timing is important when scheduling ORI field work. In most regions of the country, spring and fall are the best seasons to perform the ORI. Other seasons typically have challenges such as over-grown vegetation or high groundwater that mask illicit discharges, or make ORI data hard to interpret[9].

Prolonged dry periods during the non-growing season with low groundwater levels are optimal conditions for performing an ORI. Table 31 summarizes some of the regional factors to consider when scheduling ORI surveys in your community. Daily weather patterns also determine whether ORI field work should proceed. In general, ORI field work should be conducted at least 48 hours after the last runoff-producing rain event.

### *Field Maps*

The field maps needed for the ORI are normally generated during the desktop assessment phase of the IDDE program described in Chapter 5. This section

[9] Upon initial program start-up, the ORI should be conducted during periods of low groundwater to more easily identify likely illicit discharges. However, it should be noted that high water tables can increase sewage contamination in storm drain networks due to infiltration and inflow interactions. Therefore, in certain situations, seasonal ORI surveys may be useful at identifying these types of discharges. Diagnosis of this source of contamination, however, can be challenging.

| Table 30: Resources Needed to Conduct the ORI | | |
|---|---|---|
| **Need Area** | **Minimum Needed** | **Optional but Helpful** |
| **Mapping** | • Roads<br>• Streams | • Known problem areas<br>• Major land uses<br>• Outfalls<br>• Specific industries<br>• Storm drain network<br>• SIC-coded buildings<br>• Septics |
| **Field Equipment** | • 5 one-liter sample bottles<br>• Backpack<br>• Camera (preferably digital)<br>• Cell phones or hand-held radios<br>• Clip boards and pencils<br>• Field sheets<br>• First aid kit<br>• Flash light or head lamp<br>• GPS unit<br>• Spray paint (or other marker)<br>• Surgical gloves<br>• Tape measure<br>• Temperature probe<br>• Waders (snake proof where necessary)<br>• Watch with a second hand | • Portable Spectrophotometer and reagents (can be shared among crews)<br>• Insect repellant<br>• Machete/clippers<br>• Sanitary wipes or biodegradable soap<br>• Wide-mouth container to measure flow<br>• Test strips or probes (e.g., pH and ammonia) |
| **Staff** | • Basic training on field methodology<br>• Minimum two staff per crew | • Ability to track discharges up the drainage system<br>• Knowledge of drainage area, to identify probable sources.<br>• Knowledge of basic chemistry and biology |

| Table 31: Preferred Climate/Weather Considerations for Conducting the ORI | | |
|---|---|---|
| **Preferred Condition** | **Reason** | **Notes/Regional Factors** |
| Low groundwater (e.g., very few flowing outfalls) | High groundwater can confound results | In cold regions, do not conduct the ORI in the early spring, when the ground is saturated from snowmelt. |
| No runoff-producing rainfall within 48 hours | Reduces the confounding influence of storm water | The specific time frame may vary depending on the drainage system. |
| Dry Season | Allows for more days of field work | Applies in regions of the country with a “wet/ dry seasonal pattern.” This pattern is most pronounced in states bordering or slightly interior to the Gulf of Mexico or the Pacific Ocean. |
| Leaf Off | Dense vegetation makes finding outfalls difficult | Dense vegetation is most problematic in the southeastern United States.<br>This criterion is helpful but not required. |

provides guidance on the basic requirements for good field maps. First, ORI field maps do not need to be fancy. The scale and level of mapping detail will vary based on preferences and navigational skills of field crews. At a minimum, maps should have labeled streets and hydrologic features (USGS blue line streams, wetlands, and lakes), so field crews can orient themselves and record their findings spatially.

Field maps should delineate the contributing drainage area to major outfalls, but only if they are readily available. Urban landmarks such as land use, property boundaries, and storm drain infrastructure are also quite useful in the field. ORI field maps should be used to check the accuracy and quality of pre-existing mapping information, such as the location of outfalls and stream origins.

Basic street maps offer the advantage of simplicity, availability, and well-labeled road networks and urban landmarks. Supplemental maps such as a 1": 2000' scale USGS Quad sheet or finer scale aerial photograph are also recommended for the field. USGS Quad sheets are readily available and display major transportation networks and landmarks, "blue line" streams, wetlands, and topography. Quad maps may be adequate for less developed subwatersheds, but are not always accurate in more urban subwatersheds.

Recent aerial photographs may provide the best opportunity to navigate the subwatershed and assess existing land cover. Aerial photos, however, may lack topography and road names, can be costly, and are hard to record field notes on due to their darkness. GIS-ready aerial photos and USGS Quad sheets can be downloaded from the internet or obtained from local planning, parks, or public works agencies.

## Field Sheets

ORI field sheets are used to record descriptive and quantitative information about each outfall inventoried in the field. Data from the field sheets represent the building blocks of an outfall tracking system allowing program managers to improve IDDE monitoring and management. A copy of the ORI field sheet is provided in Appendix D, and is also available as a Microsoft Word™ document. Program managers should modify the field sheet to meet the specific needs and unique conditions in their community.

Field crews should also carry an authorization letter and a list of emergency phone numbers to report any emergency leaks, spills, obvious illicit discharges or other water quality problems to the appropriate local authorities directly from the field. Local law enforcement agencies may also need to be made aware of the field work. Figure 20 shows an example of a water pollution emergency contact list developed by Montgomery County, MD.

## Equipment

Basic field equipment needed for the ORI includes waders, a measuring tape, watch, camera, GPS unit, and surgical gloves (see Table 30). GPS units and digital cameras are usually the most expensive equipment items; however, some local agencies may already have them for other applications. Adequate ranging, water-resistant, downloadable GPS units can be purchased for less than $150. Digital cameras are preferred and can cost between $200 and $400, however, conventional or disposable cameras can also work, as long as they have flashes. Hand-held data recorders and customized software can be used to record text, photos, and GPS coordinates electronically in the field. While

these technologies can eliminate field sheets and data entry procedures, they can be quite expensive. Field crews should always carry basic safety items, such as cell phones, surgical gloves, and first aid kits.

### *Staffing*

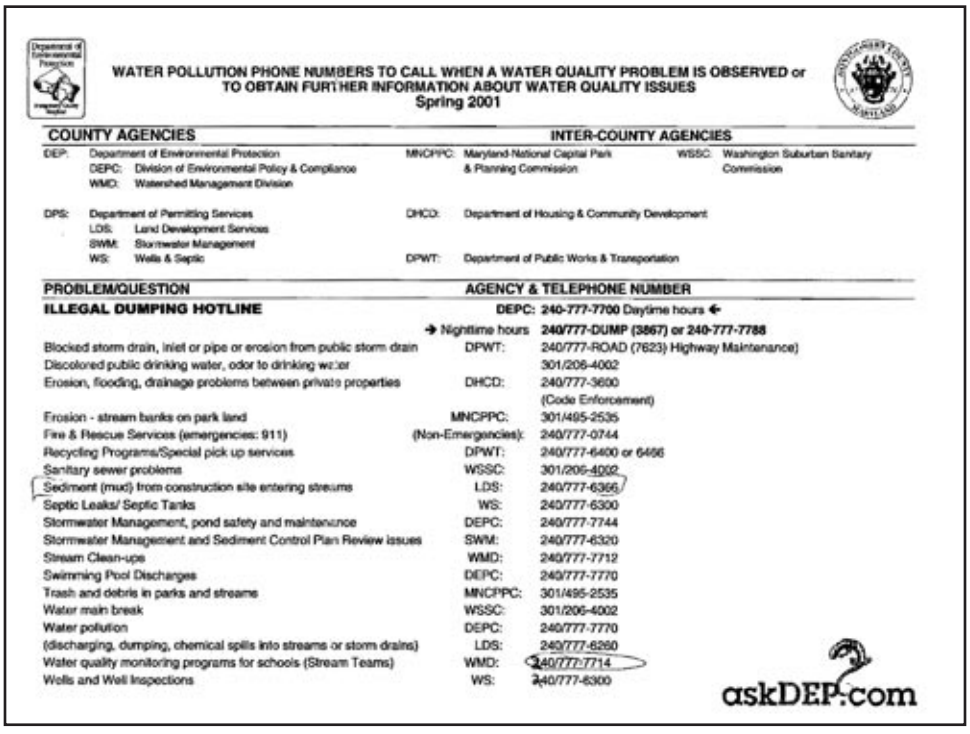
The ORI requires at least a two-person crew, for safety and logistics. Three person crews provide greater safety and flexibility, which helps divide tasks, allows one person to assess adjacent land uses, and facilitates tracing outfalls to their source. All crew members should be trained on how to complete the ORI and should have a basic understanding of illicit discharges and their water quality impact. ORI crews can be staffed by trained volunteers, watershed groups and college interns. Experienced crews can normally expect to cover two to three stream miles per day, depending on stream access and outfall density.

## 11.2 Desktop Analysis to Support the ORI

Two tasks need to be done in the office before heading out to the field. The major ORI preparation tasks include estimating the total stream and channel mileage in the subwatershed and generating field maps. The total mileage helps program managers scope out how long the ORI will take and how much it will cost. As discussed before, field maps are an indispensable navigational aid for field crews working in the subwatershed.

### *Delineating Survey Reaches*

ORI field maps should contain a preliminary delineation of **survey reaches**. The stream network within your subwatershed should be delineated into discrete segments of relatively uniform character. Delineating survey reaches provides good stopping and starting points for field crews, which



**WATER POLLUTION PHONE NUMBERS TO CALL WHEN A WATER QUALITY PROBLEM IS OBSERVED or TO OBTAIN FURTHER INFORMATION ABOUT WATER QUALITY ISSUES**
**Spring 2001**

**COUNTY AGENCIES**

DEP: Department of Environmental Protection
DEPC: Division of Environmental Policy & Compliance
WMD: Watershed Management Division

DPS: Department of Permitting Services
LDS: Land Development Services
SWM: Stormwater Management
WS: Wells & Septic

**INTER-COUNTY AGENCIES**

MNCPPC: Maryland-National Capital Park & Planning Commission

WSSC: Washington Suburban Sanitary Commission

DHCD: Department of Housing & Community Development

DPWT: Department of Public Works & Transportation

| PROBLEM/QUESTION | AGENCY & TELEPHONE NUMBER | |
|---|---|---|
| **ILLEGAL DUMPING HOTLINE** | **DEPC:** | **240-777-7700** Daytime hours ← |
| | → Nighttime hours | **240/777-DUMP (3867) or 240-777-7788** |
| Blocked storm drain, inlet or pipe or erosion from public storm drain | DPWT: | 240/777-ROAD (7623) Highway Maintenance) |
| Discolored public drinking water, odor to drinking water | | 301/206-4002 |
| Erosion, flooding, drainage problems between private properties | DHCD: | 240/777-3600 (Code Enforcement) |
| Erosion - stream banks on park land | MNCPPC: | 301/495-2535 |
| Fire & Rescue Services (emergencies: 911) | (Non-Emergencies): | 240/777-0744 |
| Recycling Programs/Special pick up services | DPWT: | 240/777-6400 or 6456 |
| Sanitary sewer problems | WSSC: | 301/206-4002 |
| Sediment (mud) from construction site entering streams | LDS: | 240/777-6366 |
| Septic Leaks/ Septic Tanks | WS: | 240/777-6300 |
| Stormwater Management, pond safety and maintenance | DEPC: | 240/777-7744 |
| Stormwater Management and Sediment Control Plan Review issues | SWM: | 240/777-6320 |
| Stream Clean-ups | WMD: | 240/777-7712 |
| Swimming Pool Discharges | DEPC: | 240/777-7770 |
| Trash and debris in parks and streams | MNCPPC: | 301/495-2535 |
| Water main break | WSSC: | 301/206-4002 |
| Water pollution | DEPC: | 240/777-7770 |
| (discharging, dumping, chemical spills into streams or storm drains) | LDS: | 240/777-6260 |
| Water quality monitoring programs for schools (Stream Teams) | WMD: | 240/777-7714 |
| Wells and Well Inspections | WS: | 240/777-6300 |

askDEP.com

**Figure 20: Example of a comprehensive emergency contact list for Montgomery County, MD**

is useful from a data management and logistics standpoint. Each survey reach should have its own unique identifying number to facilitate ORI data analysis and interpretation. Figure 21 illustrates some tips for delineating survey reaches, and additional guidance is offered below:

- Survey reaches should be established above the confluence of streams and between road crossings that serve as a convenient access point.
- Survey reaches should be defined at the transition between major changes in land use in the stream corridor (e.g. forested land to commercial area).
- Survey reaches should generally be limited to a quarter mile or less in length. Survey reaches in lightly developed subwatersheds can be longer than those in more developed subwatersheds, particularly if uniform stream corridor conditions are expected throughout the survey reach.
- Access through private or public property should be considered when delineating survey reaches as permission may be required.

It should be noted that initial field maps are not always accurate, and changes may need to be made in the field to adjust survey reaches to account for conditions such as underground streams, missing streams or long culverts. Nevertheless, upfront time invested in delineating survey reaches makes it easier for field crews to perform the ORI.

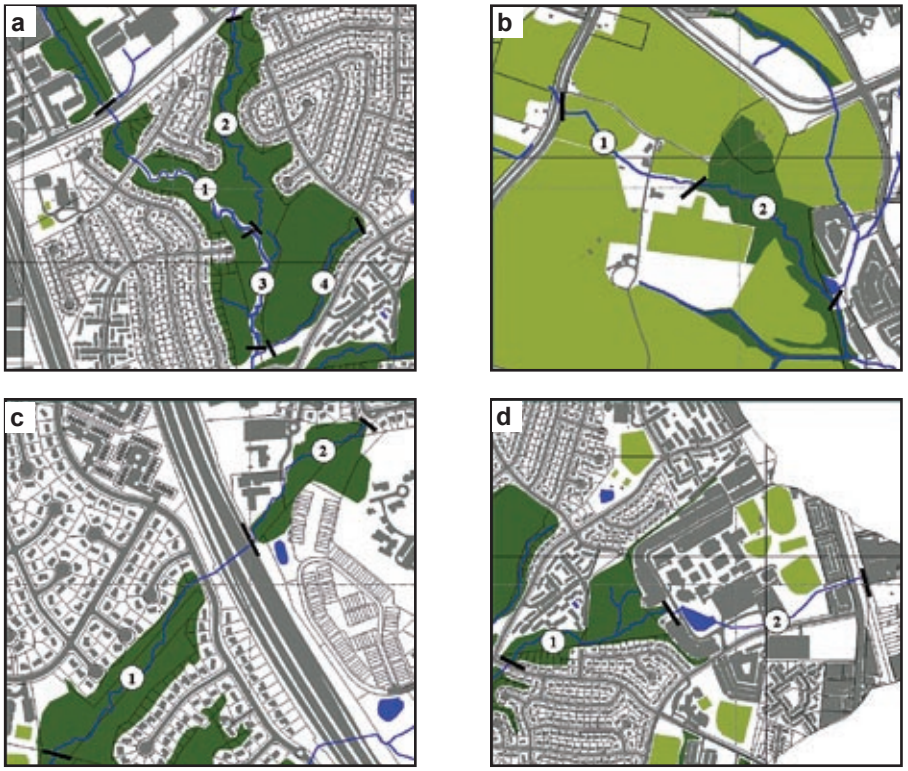



**Figure 21:** Various physical factors control how survey reaches are delineated. (a) Survey reaches based on the confluence of stream tributaries. (b) A long tributary split into ¼ mile survey reaches. (c) Based on a major road crossing (include the culvert in the downstream reach). (d) Based on significant changes in land use (significant changes in stream features often occur at road crossings, and these crossings often define the breakpoints between survey reaches).

## 11.3 Completing the ORI

Field crews conduct an ORI by walking all streams and channels to find outfalls, record their location spatially with a GPS unit and physically mark them with spray paint or other permanent marker. Crews also photograph each outfall and characterize its dimensions, shape, and component material, and record observations on basic sensory and physical indicators. If dry weather flow occurs at the outfall, additional flow and water quality data are collected. Field crews may also use field probes or test strips to measure indicators such as temperature, pH, and ammonia at flowing outfalls.

The ORI field sheet is divided into eight sections that address both flowing and non-flowing outfalls (Appendix D). Guidance on completing each section of the ORI field sheet is presented below.

### *Outfalls to Survey*

The ORI applies to **all** outfalls encountered during the stream walk, regardless of diameter, with a few exceptions noted in Table 32. Common outfall conditions seen in communities are illustrated in Figure 22 As a rule, crews should only omit an outfall if they can definitively conclude it has no potential to contribute to a transitory illicit discharge. While EPA's Phase I guidance only targeted major outfalls (diameter of 36 inches or greater), documenting all outfalls is recommended, since smaller pipes make up the majority of all outfalls and frequently have illicit discharges (Pitt *et al.*, 1993 and Lalor, 1994). A separate ORI field sheet should be completed for each outfall.

**Table 32: Outfalls to Include in the Screening**

| Outfalls to Record | Outfalls to Skip |
|---|---|
| • Both large and small diameter pipes that appear to be part of the storm drain infrastructure<br>• Outfalls that appear to be piped headwater streams<br>• Field connections to culverts<br>• Submerged or partially submerged outfalls<br>• Outfalls that are blocked with debris or sediment deposits<br>• Pipes that appear to be outfalls from storm water treatment practices<br>• Small diameter ductile iron pipes<br>• Pipes that appear to only drain roof downspouts but that are subsurface, preventing definitive confirmation | • Drop inlets from roads in culverts (unless evidence of illegal dumping, dumpster leaks, etc.)<br>• Cross-drainage culverts in transportation right-of-way (i.e., can see daylight at other end)<br>• Weep holes<br>• Flexible HDPE pipes that are known to serve as slope drains<br>• Pipes that are clearly connected to roof downspouts via above-ground connections |

| | | |
|---|---|---|
|  Ductile iron round pipe |  4-6” HDPE; Check if roof leader connection (legal) |  Field connection to inside of culvert; Always mark and record. |
|  Small diameter (<2”) HDPE; Often a sump pump (legal), or may be used to discharge laundry water (illicit). |  Elliptical RCP; Measure both horizontal and vertical diameters. |  Double RCP round pipes; Mark as separate outfalls unless known to connect immediately up-pipe |
|  Culvert (can see to other side); Don’t mark as an outfall |  Open channel “chute” from commercial parking lot; Very unlikely illicit discharge. Mark, but do not return to sample (unless there is an obvious problem). |  Small diameter PVC pipe; Mark, and look up-pipe to find the origin. |
|  CMP outfall; Crews should also note upstream sewer crossing. |  Box shaped outfall |  CMP round pipe with two weep holes at bridge crossing. (Don’t mark weep holes) |

**Figure 22: Typical Outfall Types Found in the Field**

### *Obvious Discharges*

Field crews may occasionally encounter an obvious illicit discharge of sewage or other pollutants, typified by high turbidity, odors, floatables and unusual colors. When obvious discharges are encountered, field crews should STOP the ORI survey, track down the source of the discharge and immediately contact the appropriate water pollution agency for enforcement. Crews should photo-document the discharge, estimate its flow volume and collect a sample for water quality analysis (if this can be done safely). All three kinds of evidence are extremely helpful to support subsequent enforcement. Chapter 13 provides details on techniques to track down individual discharges.

## 11.4 ORI Section 1 - Background Data

The first section of the ORI field sheet is used to record basic data about the survey, including time of day, GPS coordinates for the outfall, field crew members, and current and past weather conditions (Figure 23). Much of the information in this section is self-explanatory, and is used to create an accurate record of when, where, and under what conditions ORI data were collected.

Every outfall should be photographed and marked by directly writing a unique identifying number on each outfall that serves as its subwatershed "address" (Figure 24). Crews can use spray paint or another temporary marker to mark outfalls, but may decide to replace temporary markings with permanent ones if the ORI is repeated later. Markings help crews confirm outfall locations during future investigations, and gives citizens a better way to report the location of spills or discharges when calling a water pollution hotline. Crews should mark the spatial location of all outfalls they encounter directly on field maps, and record the coordinates with a GPS unit that is accurate to within 10 feet. Crews should take a digital photo of each outfall, and record photo numbers in Section 1 of the field sheet.

**Section 1: Background Data**

| | | | |
|---|---|---|---|
| Subwatershed: | | Outfall ID: | |
| Today's date: | | Time (Military): | |
| Investigators: | | Form completed by: | |
| Temperature (°F): | Rainfall (in.): Last 24 hours: Last 48 hours: | | |
| Latitude: | Longitude: | GPS Unit: | GPS LMK #: |
| Camera: | | Photo #s: | |
| Land Use in Drainage Area (Check all that apply): | | | |
| ☐ Industrial | | ☐ Open Space | |
| ☐ Ultra-Urban Residential | | ☐ Institutional | |
| ☐ Suburban Residential | | Other: _____ | |
| ☐ Commercial | | Known Industries: _____ | |
| Notes (e.g., origin of outfall, if known): | | | |

**Figure 23: Section 1 of the ORI Field Sheet**



**Figure 24: Labeling an outfall (a variety of outfall naming conventions can be used)**

The land use of the drainage area contributing to the outfall should also be recorded. This may not always be easy to characterize at large diameter outfalls that drain dozens or even hundreds of acres (unless you have aerial photographs). On the other hand, land use can be easily observed at smaller diameter outfalls, and in some cases, the specific origin can be found (e.g., a roof leader or a parking lot; Figure 25). The specific origin should be recorded in the "notes" portion of Section 1 on the field sheet.

## 11.5 ORI Section 2 - Outfall Description

This part of the ORI field sheet is where basic outfall characteristics are noted (Figure 26). These include material, and presence of flow at the outfall, as well as the pipe's dimensions (Figure 27). These measurements are used to confirm and supplement existing storm drain maps (if they are available). Many communities only map storm drain outfalls that exceed a given pipe diameter, and may not contain data on the material and condition of the pipe.



**Figure 25: The origin of this corrugated plastic pipe was determined to be a roof leader from the house up the hill.**

Section 2 of the field sheet also asks if the outfall is submerged in water or obstructed by sediment and the amount of flow, if present. Figure 28 provides some photos that illustrate how to characterize relative submergence, deposition and flow at outfalls. If no flow is observed at the outfall, you can skip the next two sections of the ORI field sheet and continue with Section 5.

**Section 2: Outfall Description**

| LOCATION | MATERIAL | SHAPE | | DIMENSIONS (IN.) | SUBMERGED |
|---|---|---|---|---|---|
| ☐ **Closed Pipe** | ☐ RCP ☐ CMP<br>☐ PVC ☐ HDPE<br>☐ Steel<br>☐ Other: _____ | ☐ Circular<br>☐ Eliptical<br>☐ Box<br>☐ Other: _____ | ☐ Single<br>☐ Double<br>☐ Triple<br>☐ Other: _____ | Diameter/Dimensions:<br>_____ | In Water:<br>☐ No<br>☐ Partially<br>☐ Fully<br>With Sediment:<br>☐ No<br>☐ Partially<br>☐ Fully |
| ☐ **Open drainage** | ☐ Concrete<br>☐ Earthen<br>☐ rip-rap<br>☐ Other: _____ | ☐ Trapezoid<br>☐ Parabolic<br>☐ Other: _____ | | Depth: _____<br>Top Width: _____<br>Bottom Width: _____ | |
| ☐ **In-Stream** | **(applicable when collecting samples)** | | | | |
| **Flow Present?** | ☐ Yes ☐ No *If No, Skip to Section 5* | | | | |
| **Flow Description (If present)** | ☐ Trickle ☐ Moderate ☐ Substantial | | | | |

**Figure 26: Section 2 of the ORI Field Sheet**




**Figure 27: Measuring Outfall Diameter**



Submerged: More than ½ below water



Partially submerged: Bottom is below water



Fully submerged: Can't see outfall



Outfall fully submerged by debris



Fully submerged from downstream trees trapping debris



Partially submerged by leaf debris "back water"



Trickle Flow: Very narrow stream of water



Moderate Flow: Steady stream, but very shallow depth



Significant flow (Source is a fire hydrant discharge)

**Figure 28: Characterizing Submersion and Flow**

## 11.6 ORI Section 3 - Quantitative Characterization for Flowing Outfalls

This section of the ORI records direct measurements of **flowing outfalls**, such as flow, temperature, pH and ammonia (Figure 29). If desired, additional water quality parameters can be added to this section. Chapter 12 discusses the range of water quality parameters that can be used.

Field crews measure the rate of flow using one of two techniques. The first technique simply records the time it takes to fill a container of a known volume, such as a one liter sample bottle. In the second technique,

**Section 3: Quantitative Characterization**

| FIELD DATA FOR FLOWING OUTFALLS | | | | |
|---|---|---|---|---|
| **PARAMETER** | | **RESULT** | **UNIT** | **EQUIPMENT** |
| ☐Flow #1 | Volume | | Liter | Bottle |
| | Time to fill | | Sec | |
| ☐Flow #2 | Flow depth | | In | Tape measure |
| | Flow width | ____' ____" | Ft, In | Tape measure |
| | Measured length | ____' ____" | Ft, In | Tape measure |
| | Time of travel | | S | Stop watch |
| Temperature | | | °F | Thermometer |
| pH | | | pH Units | Test strip/Probe |
| Ammonia | | | mg/L | Test strip |

**Figure 29: Section 3 of the ORI Field Sheet**

the crew measures the velocity of flow, and multiplies it by the estimated cross sectional area of the flow.

To use the flow volume technique, it may be necessary to use a "homemade" container to capture flow, such as a cut out plastic milk container that is marked to show a one liter volume. The shape and flexibility of plastic containers allows crews to capture relatively flat and shallow flow (Figure 30). The flow volume is determined as the volume of flow captured in the container per unit time.

The second technique measures flow rate based on velocity and cross sectional area, and is preferred for larger discharges where containers are too small to effectively capture the flow (Figure 31). The crew measures and marks off a fixed flow length (usually about five feet), crumbles leaves or other light material, and drops them into the discharge (crews can also carry peanuts or ping pong balls to use). The crew then measures the time it takes the marker to travel across the length. The velocity of flow is computed as the length of the flow path (in feet) divided by the travel time (in seconds). Next, the cross-sectional flow area is measured by taking multiple readings of the depth and width of flow. Lastly, cross-sectional area (in square feet) is multiplied by flow velocity (feet/second) to calculate the flow rate (in cubic feet/second).

Crews may also want to measure the quality of the discharge using relatively inexpensive probes and test strips (e.g., water temperature, pH, and ammonia). The choice of which indicator parameters to measure is usually governed by the overall IDDE monitoring framework developed by the community. Some communities have used probes or test strips to measure additional indicators such as conductivity, chlorine, and hardness. Research by Pitt (for this project) suggests that probes by Horiba for pH and conductivity are the most reliable and



**Figure 30: Measuring flow (as volume per time)**

accurate, and that test strips have limited value.

When probes or test strips are used, measurements should be made from a sample bottle that contains flow captured from the outfall. The exact measurement recorded by the field probe should be recorded in Section 3 of the field sheet. Some interpolation may be required for test strips, but do not interpolate further than the mid-range between two color points.

## 11.7 ORI Section 4 – Physical Indicators for Flowing Outfalls Only

This section of the ORI field sheet records data about four sensory indicators associated with **flowing outfalls**—odor, color, turbidity and floatables (Figure 32). Sensory indicators can be detected by smell or sight, and require no measurement equipment. Sensory indicators do not always reliably predict illicit discharge, since the senses can be fooled, and may result in a "false negative" (i.e., sensory indicators fail to detect an illicit discharge when one is actually present). Sensory indicators are important, however, in detecting the most severe or obvious discharges. Section 4 of the field sheet asks whether the sensory indicator is present, and if so, what is its severity, on a scale of one to three.

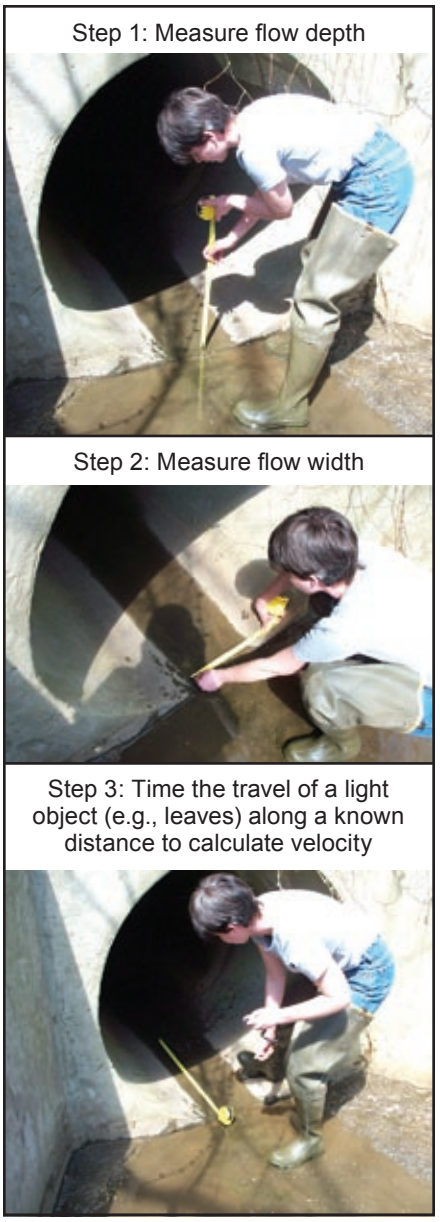



**Figure 31: Measuring flow (as velocity times cross-sectional area)**

**Section 4: Physical Indicators for Flowing Outfalls Only**

Are Any Physical Indicators Present in the flow? ☐ Yes ☐ No *(If No, Skip to Section 5)*

| INDICATOR | CHECK if Present | DESCRIPTION | RELATIVE SEVERITY INDEX M(1-3) | | |
|---|---|---|---|---|---|
| Odor | ☐ | ☐ Sewage ☐ Rancid/sour ☐ Petroleum/gas ☐ Sulfide ☐ Other: | ☐ 1 – Faint | ☐ 2 – Easily detected | ☐ 3 – Noticeable from a distance |
| Color | ☐ | ☐ Clear ☐ Brown ☐ Gray ☐ Yellow ☐ Green ☐ Orange ☐ Red ☐ Other: | ☐ 1 – Faint colors in sample bottle | ☐ 2 – Clearly visible in sample bottle | ☐ 3 – Clearly visible in outfall flow |
| Turbidity | ☐ | See severity | ☐ 1 – Slight cloudiness | ☐ 2 – Cloudy | ☐ 3 – Opaque |
| Floatables -Does Not Include Trash!! | ☐ | ☐ Sewage (Toilet Paper, etc.) ☐ Suds ☐ Petroleum (oil sheen) ☐ Other: | ☐ 1 – Few/slight; origin not obvious | ☐ 2 – Some; indications of origin (e.g., possible suds or oil sheen) | ☐ 3 - Some; origin clear (e.g., obvious oil sheen, suds, or floating sanitary materials) |

**Figure 32: Section 4 of the ORI Field Sheet**

## Odor

Section 4 asks for a description of any odors that emanate from the outfall and an associated severity score. Since noses have different sensitivities, the entire field crew should reach consensus about whether an odor is present and how severe it is. A severity score of one means that the odor is faint or the crew cannot agree on its presence or origin. A score of two indicates a moderate odor within the pipe. A score of three is assigned if the odor is so strong that the crew smells it a considerable distance away from the outfall.

**TIP**

Make sure the origin of the odor is the outfall. Sometimes shrubs, trash or carrion, or even the spray paint used to mark the outfall can confuse the noses of field crews.

## Color

The color of the discharge, which can be clear, slightly tinted, or intense is recorded next. Color can be quantitatively analyzed in the lab, but the ORI only asks for a visual assessment of the discharge color and its intensity. The best way to measure color is to collect the discharge in a clear sample bottle and hold it up to the light (Figure 33). Field crews should also look for downstream plumes of color that appear to be associated with the outfall. Figure 34 illustrates the spectrum of colors that may be encountered during an ORI survey, and offers insight on how to rank the relative intensity or strength of discharge color. Color often helps identify industrial discharges; Appendix K provides guidance on colors often associated with specific industrial operations.

## Turbidity

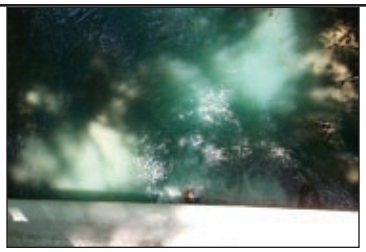
The ORI asks for a visual estimate of the turbidity of the discharge, which is a measure of the cloudiness of the water. Like color, turbidity is best observed in a clear sample bottle, and can be quantitatively measured using field probes. Crews should also look for turbidity in the plunge pool below the outfall, and note any downstream turbidity plumes that appear to be related to the outfall. Field crews can sometimes confuse turbidity with color, which are related but are not the same. Remember, turbidity is a measure of how easily light can penetrate through the sample bottle, whereas color is defined by the tint or intensity of the color observed. Figure 34 provides some examples of how to distinguish turbidity from color, and how to rank its relative severity.



**Figure 33: Using a sample bottle to estimate color and turbidity**



Color: Brown; Severity: 2
Turbidity Severity: 2



Color: Blue-green; Severity: 3
Turbidity Severity: 2



Highly Turbid Discharge
Color: Brown; Severity: 3
Turbidity Severity: 3



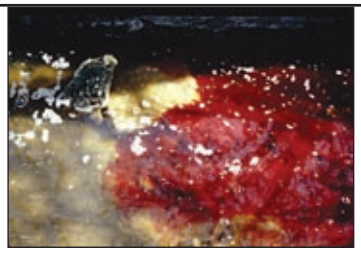
Sewage Discharge
Color: 3
Turbidity: 3



Paint
Color: White; Severity: 3
Turbidity: 3



Industrial Discharge
Color: Green; Severity: 3
Turbidity Severity: 3



Blood
Color: Red; Severity: 3
Turbidity Severity: None



Failing Septic System:
Turbidity Severity: 3



Turbidity in Downstream Plume
Turbidity Severity: 2
(also confirm with sample bottle)



High Turbidity in Pool
Turbidity Severity: 2
(Confirm with sample bottle)



Iron Floc
Color: Reddish Orange; Severity: 3
(Often associated with a natural source)



Slight Turbidity
Turbidity: 1
(Difficult to interpret this observation; May be natural or an illicit discharge)

Construction Site Discharge
Turbidity Severity: 3





Discharge of Rinse from Floor Sanding
(Found during wet weather)
Turbidity Severity: 3

**Figure 34: Interpreting Color and Turbidity**

## Floatables

The last sensory indicator is the presence of any floatable materials in the discharge or the plunge pool below. Sewage, oil sheen, and suds are all examples of floatable indicators; trash and debris are generally not in the context of the ORI. The presence of floatable materials is determined visually, and some guidelines for ranking their severity are provided in Figure 35, and described below.

If you think the floatable is sewage, you should automatically assign it a severity score of three since no other source looks quite like it. Surface oil sheens are ranked based on their thickness and coverage. In some cases, surface sheens may not be related to oil discharges, but instead are created by in-stream processes, such as shown in Figure 36. A thick or swirling sheen associated with a petroleum-like odor may be diagnostic of an oil discharge.

Suds are rated based on their foaminess and staying power. A severity score of three is designated for thick foam that travels many feet before breaking up. Suds that break up quickly may simply reflect water turbulence, and do not necessarily have an illicit origin. Indeed, some streams have naturally occurring foams due to the decay of organic matter. On the other hand, suds that are accompanied by a strong organic or sewage-like odor may indicate a sanitary sewer leak or connection. If the suds have a fragrant odor, they may indicate the presence of laundry water or similar wash waters.

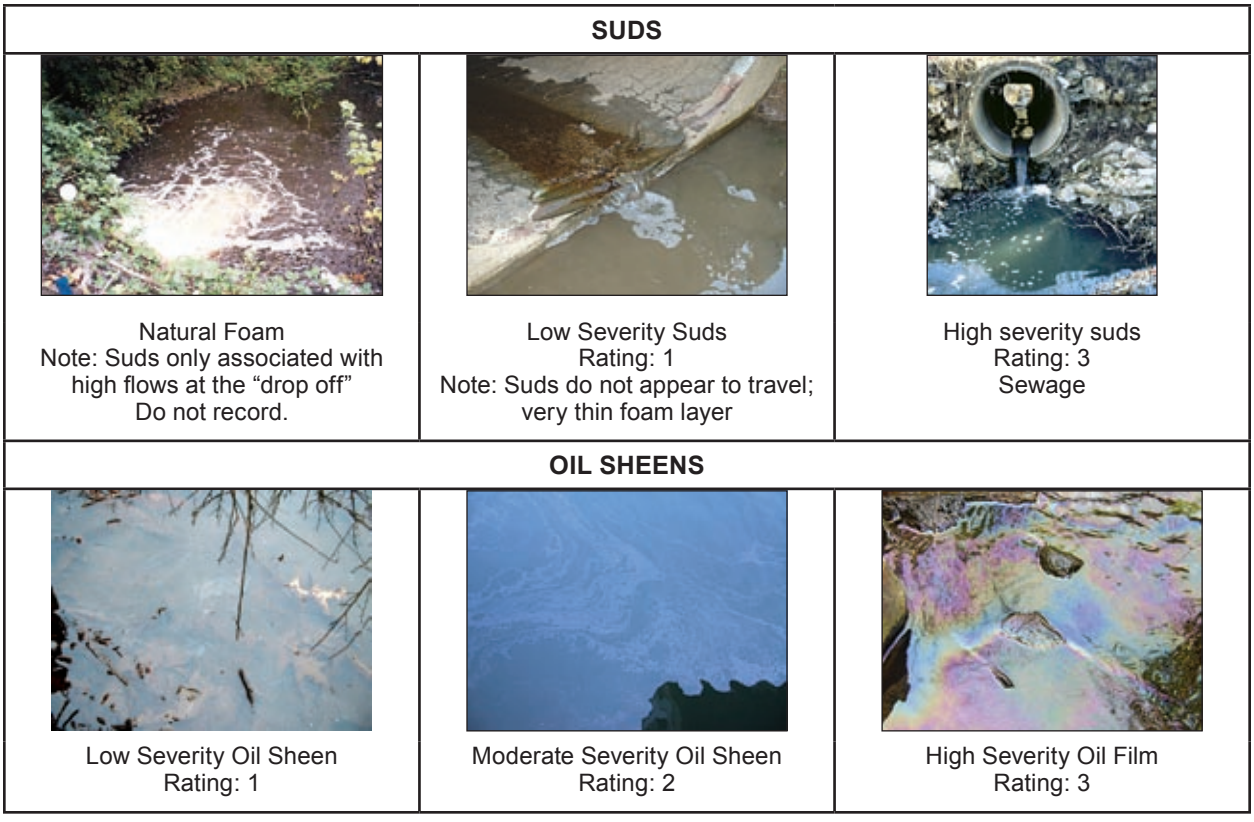



**Figure 35: Determining the Severity of Floatables**

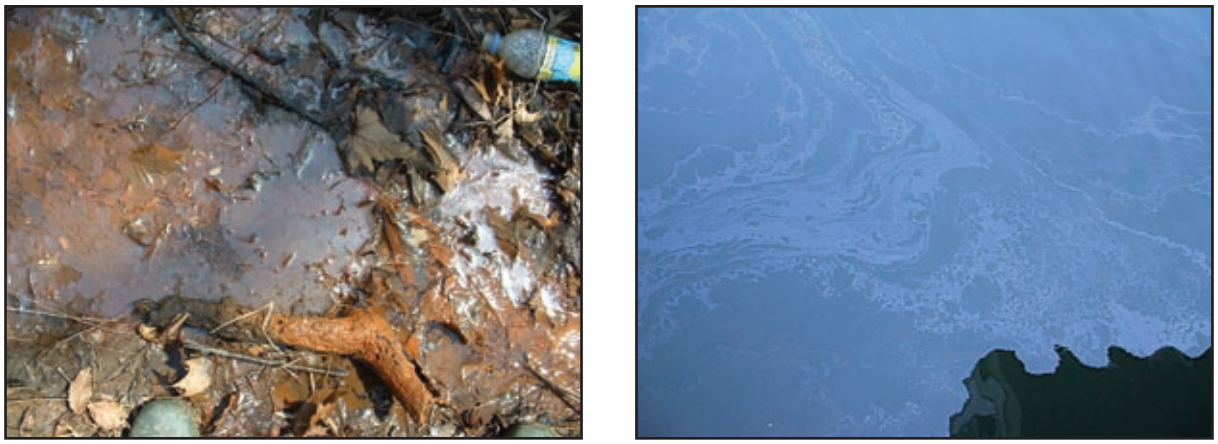


**Figure 36: Synthetic versus Natural Sheen (a) Sheen from bacteria such as iron floc forms a sheet-like film that cracks if disturbed (b) Synthetic oil forms a swirling pattern**

## 11.8 ORI Section 5 - Physical Indicators for Both Flowing and Non-Flowing Outfalls

Section 5 of the ORI field sheet examines physical indicators found at both **flowing and non-flowing** outfalls that can reveal the impact of past discharges (Figure 37). Physical indicators include outfall damage, outfall deposits or stains, abnormal vegetation growth, poor pool quality, and benthic growth on pipe surfaces. Common examples of physical indicators are portrayed in Figures 38 and 39. Many of these physical conditions can indicate that an intermittent or transitory discharge has occurred in the past, even if the pipe is not currently flowing. Physical indicators are not ranked according to their severity, because they are often subtle, difficult to interpret and could be caused by other sources. Still, physical indicators can provide strong clues about the discharge history of a storm water outfall, particularly if other discharge indicators accompany them.

**Section 5: Physical Indicators for Both Flowing and Non-Flowing Outfalls**
Are physical indicators that are not related to flow present? ☐ Yes ☐ No *(If No, Skip to Section 6)*

| INDICATOR | CHECK if Present | DESCRIPTION | COMMENTS |
|---|---|---|---|
| Outfall Damage | ☐ | ☐ Spalling, Cracking or Chipping ☐ Peeling Paint ☐ Corrosion | |
| Deposits/Stains | ☐ | ☐ Oily ☐ Flow Line ☐ Paint ☐ Other: | |
| Abnormal Vegetation | ☐ | ☐ Excessive ☐ Inhibited | |
| Poor pool quality | ☐ | ☐ Odors ☐ Colors ☐ Floatables ☐ Oil Sheen ☐ Suds ☐ Excessive Algae ☐ Other: | |
| Pipe benthic growth | ☐ | ☐ Brown ☐ Orange ☐ Green ☐ Other: | |

**Figure 37: Section 5 of the ORI Field Sheet**



Bacterial growth at this outfall indicates nutrient enrichment and a likely sewage source.



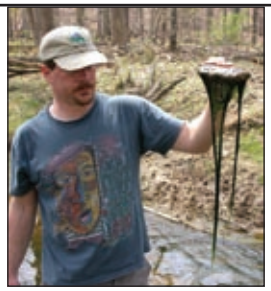
This bright red bacterial growth often indicates high manganese and iron concentrations. Surprisingly, it is not typically associated with illicit discharges.



Sporalitis filamentous bacteria, also known as “sewage fungus” can be used to track down sanitary sewer leaks.



Algal mats on lakes indicate eutrophication. Several sources can cause this problem. Investigate potential illicit sources.



Illicit discharges or excessive nutrient application can lead to extreme algal growth on stream beds.



The drainage to this outfall most likely has a high nutrient concentration. The cause may be an illicit discharge, but may be excessive use of lawn chemicals.



This brownish algae indicates an elevated nutrient level.

**Figure 38: Interpreting Benthic and Other Biotic Indicators**



Reddish staining on the rocks below this outfall indicate high iron concentrations.



Toilet paper directly below the storm drain outlet.



Watershed Protection??



Trash is not an indicator of illicit discharges, but should be noted.



Staining at the base of the outfall may indicate a persistent, intermittent discharge.



Excessive vegetation may indicate enriched flows associated with sewage.



Brownish stain of unclear origin. May be from degradation of the brick infrastructure.



Cracked rock below the outfall may indicate an intermittent discharge.



Poor pool quality. Consider sampling from the pool to determine origin.

**Figure 39: Typical Findings at Both Flowing and Non-Flowing Outfalls**

## 11.9 ORI Sections 6-8 - Initial Outfall Designation and Actions

The last three sections of the ORI field sheet are where the crew designates the illicit discharge severity of the outfall and recommends appropriate management and monitoring actions (Figure 40). A discharge rating is designated as obvious, suspect, potential or unlikely, depending on the number and severity of discharge indicators checked in preceding sections.

It is important to understand that the ORI designation is only an initial determination of discharge potential. A more certain determination as to whether it actually is an illicit discharge is made using a more sophisticated indicator monitoring method. Nevertheless, the ORI outfall

designation gives program managers a better understanding of the distribution and severity of illicit discharge problems within a subwatershed.

Section 7 of the ORI field sheet records whether indicator samples were collected for laboratory analysis, or whether an intermittent flow trap was installed (e.g., an optical brightener trap or caulk dam described in Chapter 13). Field crews should record whether the sample was taken from a pool or directly from the outfall, and the type of intermittent flow trap used, if any. This section can also be used to recommend follow-up sampling, if the crew does not carry sample bottles or traps during the survey.

The last section of the ORI field sheet is used to note any unusual conditions near the outfall such as dumping, pipe failure, bank erosion or maintenance needs. While these maintenance conditions are not directly related to illicit discharge detection, they often are of interest to other agencies and utilities that maintain infrastructure.

## 11.10 Customizing the ORI for a Community

The ORI method is meant to be adaptable, and should be modified to reflect local conditions and field experience. Some indicators can be dropped, added or modified in the ORI form. This section looks at four of the most common adaptations to the ORI:

- Open Channels
- Submerged/Tidally Influenced Outfalls
- Cold Climates
- Use of Biological Indicators

In each case, it may be desirable to revise the ORI field sheet to collect data reflecting these conditions.

### *Open Channels*

Field crews face special challenges in more rural communities that have extensive open channel drainage. The ditches and channels serve as the primary storm water conveyance system, and may lack storm drain and sewer pipes. The open channel network is often very long with only a few obvious outfalls that are located far apart. While the network can have illicit discharges from septic systems, they can typically only be detected in the ORI if a straight pipe is found. Some adaptations for open channel systems are suggested in Table 33.

**Section 6: Overall Outfall Characterization**

☐ Unlikely ☐ Potential (presence of two or more indicators) ☐ Suspect (one or more indicators with a severity of 3) ☐ Obvious

**Section 7: Data Collection**

| | | | | |
|---|---|---|---|---|
| 1. | Sample for the lab? | ☐ Yes | ☐ No | |
| 2. | If yes, collected from: | ☐ Flow | ☐ Pool | |
| 3. | Intermittent flow trap set? | ☐ Yes | ☐ No | If Yes, type: ☐ OBM ☐ Caulk dam |

**Section 8: Any Non-Illicit Discharge Concerns (e.g., trash or needed infrastructure repairs)?**

**Figure 40: Sections 6-8 of the ORI Field Sheet**

## Submerged/Tidally Influenced Outfalls

The ORI can be problematic in coastal communities where outfalls are located along the waterfront and may be submerged at high tide. The ORI methods need to be significantly changed to address these constraints. Often, outfalls are initially located from offshore using canoes or boats, and then traced landward to the first manhole that is not tidally influenced. Field crews then access the storm drain pipe at the manhole and measure whatever indicators they can observe in the confined and dimly lit space. Table 33 recommends strategies to sample outfalls in the challenging environment of coastal communities.

## Winter and Ice

Ice can be used as a discharge indicator in northern regions when ice forms in streams and pipes during the winter months (Figure 41). Because ice lasts for many weeks, and most illicit discharges are warm, astute field crews can interpret outfall history from ice melting patterns along pipes and streams. For example, exaggerated melting at a frozen or flowing outfall may indicate warm water from sewage or industrial discharge. Be careful, because groundwater is warm enough to cause some melting at below freezing temperatures. Also, ice acts like an intermittent flow trap, and literally freezes these discharges. Crews should also look for these traps to find any discolored ice within the pipe or below the outfall.

A final winter indicator is "rime ice," which forms when steam freezes. This beautiful ice formation is actually a good indicator of sewage or other relatively hot discharge that causes steam to form (Figure 41).

## Biological Indicators

The diversity and pollution tolerance of various species of aquatic life are widely used as an indicator of overall stream health, and has sometimes been used to detect illicit discharges. One notable example is the presence of the red-eared slider turtle, which is used in Galveston, Texas to find sewage discharges, as they have a propensity for the nutrient rich waters associated with sewage (Figure 42).

**Table 33: Special Considerations for Open Channels/Submerged Outfalls**

| OPEN CHANNELS | |
|---|---|
| **Challenge** | **Suggested Modification** |
| Too many miles of channel to walk | Stop walking at a given channel size or drainage area |
| Difficulty marking them | Mark on concrete or adjacent to earth channel |
| Interpreting physical indicators | For open channels with mild physical indicators, progress up the system to investigate further. |
| **SUBMERGED/TIDALLY INFLUENCED OUTFALLS** | |
| **Challenge** | **Suggested Modification** |
| Access for ORI – Tidal Influence | Access during low tide |
| Access for ORI – Always submerged | Access by boat or by shore walking |
| Interpreting physical indicators | For outfalls with mild physical indicators, also inspect from the nearest manhole that is not influenced by tides |
| Sampling (if necessary) | Sample "up pipe" |




**Figure 41: Cold climate indicators of illicit discharges**



**Figure 42: One biological indicator is this red-eared slider turtle**

## 11.11 Interpreting ORI Data

The ORI generates a wealth of information that can provide managers with valuable insights about their illicit discharge problems, if the data are managed and analyzed effectively. The ORI can quickly define whether problems are clustered in a particular area or spread across the community. This section presents a series of methods to compile, organize and interpret ORI data, including:

1. Basic Data Management and Quality Control
2. Outfall Classification
3. Simple Suspect Outfall Counts
4. Mapping ORI Data
5. Subwatershed and Reach Screening
6. Characterizing IDDE Problems at the Community Level

The level of detail for each analysis method should be calibrated to local resources, program goals, and the actual discharge problems discovered in the stream corridor. In general, the most common conditions and problems will shape your initial monitoring strategy, which prioritizes the subwatersheds or reaches that will be targeted for more intensive investigations.

Program managers should analyze ORI data well before every stream mile is walked in the community, and use initial results to modify field methods. For example, if initial results reveal widespread potential problems, program managers may want to add more indicator monitoring to the ORI to track down individual discharge sources (see Chapter 12). Alternatively, if the same kind of discharge problem is repeatedly found, it may be wise to investigate whether there is a common source or activity generating it (e.g., high turbidity observed at many flowing outfalls as a result of equipment washing at active construction sites).

## Basic Data Management and Quality Control

The ORI produces an enormous amount of raw data to characterize outfall conditions. It is not uncommon to compile dozens of individual ORI forms in a single subwatershed. The challenge is to devise a system to organize, process, and translate this data into simpler outputs and formats that can guide illicit discharge elimination efforts. The system starts with effective quality control procedures in the field.

Field sheets should be managed using either a three-ring binder or a clipboard. A small field binder offers the ability to quickly flip back and forth among the outfall forms. Authorization letters, emergency contact lists, and extra forms can also be tucked inside.

At the end of each day, field crews should regroup at a predetermined location to compare notes. The crew leader should confirm that all survey reaches and outfalls of interest have been surveyed, discuss initial findings, and deal with any logistical problems. This is also a good time to check whether field crews are measuring and recording outfall data in the same way, and are consistent in what they are (or are not) recording. Crew leaders should also use this time to review field forms for accuracy and thoroughness. Illegible handwriting should be neatened and details added to notes and any sketches. The crew leader should also organize the forms together into a single master binder or folder for future analysis.

Once crews return from the field, data should be entered into a spreadsheet or database. A Microsoft Access database is provided with this Manual as part of Appendix D (Figure 43), and is supplied on a compact disc with each hard copy. It can also be downloaded with Appendix D from http://www.stormwatercenter.net. Information stored in this database can easily be imported into a GIS for mapping purposes. The GIS can generate its own database table that allows the user to create subwatershed maps showing outfall characteristics and problem areas.

Once data entry is complete, be sure to check the quality of the data. This can be done quickly by randomly spot-checking 10% of the entered data. For example, if 50 field sheets were completed, check five of the spreadsheet or database entries. When transferring data into GIS, quality control maps that display labeled problem outfalls should be created. Each survey crew is responsible for reviewing the accuracy of these maps.

## Outfall Classification

A simple outfall designation system has been developed to summarize the discharge potential for individual ORI field sheets. Table 34 presents the four outfall designations that can be made.

**Table 34: Outfall Designation System Using ORI Data**

| Designation | Description |
|---|---|
| **1.** Obvious Discharge | Outfalls where there is an illicit discharge that doesn't even require sample collection for confirmation |
| **2.** Suspect Discharge | Flowing outfalls with high severity on one or more physical indicators |
| **3.** Potential Discharge | Flowing or non-flowing outfalls with presence of two or more physical indicators |
| **4.** Unlikely Discharge | Non-flowing outfalls with no physical indicators of an illicit discharge |

### Simple Suspect Outfall Counts

The first priority is to count the frequency of each outfall designation in the subwatershed or the community as a whole. This simple screening analysis counts the number of problem outfalls per stream mile (i.e., the sum of outfalls designated as having potential, suspected or obvious illicit discharge potential). The density of problem outfalls per stream mile is an important metric to target and screen subwatersheds.

Based on problem outfall counts, program managers may discover that a particular monitoring strategy may not apply to the community. For example, if few problem outfalls are found, an extensive follow-up monitoring program may not be needed, so that program resources can be shifted to pollution hotlines to report and control transitory discharges such as illegal dumping. The key point of this method is to avoid getting lost in the raw data, but look instead to find patterns that can shape a cost-effective IDDE program.

### Mapping ORI Data

Maps are an excellent way to portray outfall data. If a GIS system is linked to the ORI database, maps that show the spatial distribution of problem outfalls, locations of dumping, and overall reach conditions can be easily generated. Moreover, GIS provides flexibility that allows for rapid updates to maps as new data are collected and compiled. The sophistication and detail of maps will depend on the initial findings, program goals, available software, and GIS capability.

Subwatershed maps are also an effective and important communication and education tool to engage stakeholders (e.g., public officials, businesses and community residents), as they can visually depict reach quality and the location of problem outfalls. The key point to remember is that maps are tools for understanding data. Try to map with a purpose in mind. A large number of cluttered maps may only confuse, while a smaller number with select data may stimulate ideas for the follow-up monitoring strategy.

### Subwatershed and Survey Reach Screening

Problem outfall metrics are particularly valuable to screen or rank priority subwatersheds or survey reaches. The basic approach is simple: select the outfall metrics that are most important to IDDE program goals, and then see how individual subwatersheds or reaches rank in the process. This screening process can help determine which subwatersheds will be priorities for initial follow-up monitoring efforts. When feasible, the screening process should incorporate non-ORI data, such as existing dry weather water quality data, citizen complaints, permitted facilities, and habitat or biological stream indicators.

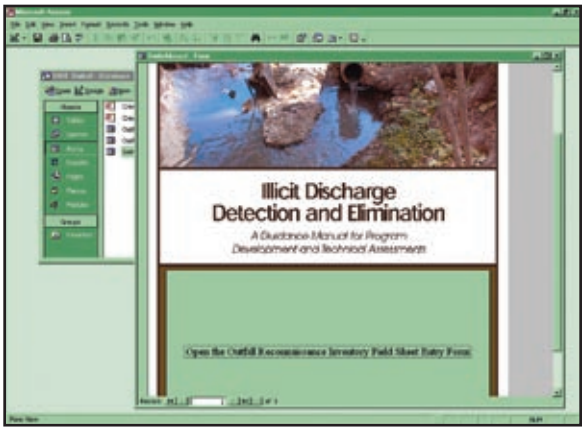



**Figure 43: Sample screen from ORI Microsoft Access database**

An example of how outfall metrics can screen subwatersheds is provided in Table 35. In this hypothetical example, four metrics were used to screen three subwatersheds within a community: number of suspect discharges, subwatershed population as a percent of the total community, number of industrial discharge permits, and number of outfalls per stream mile. Given these screening criteria, subwatershed C was selected for the next phase of detailed investigation.

## Characterizing the IDDE Problem at the Community Level

ORI data should be used to continuously revisit and revise the IDDE program as more is learned about the nature and distribution of illicit discharge problems in the community. For example, ORI discharge designation should be compared against illicit discharge potential (IDP) predictions made during the original desktop analysis (Chapter 5) to refine discharge screening factors, and formulate new monitoring strategies.

In general, community illicit discharge problem can be characterized as minimal, clustered, or severe (Table 36). In the minimal scenario, very few and scattered problems exist; in the clustered scenario, problems are located in isolated subwatersheds; and in the severe scenario, problems are widespread.

**Table 35: An Example of ORI Data Being Used to Compare Across Subwatersheds**

| | # of suspect discharges | Population as % of total community | # of industrial discharge permits | # of outfalls per stream/ conveyance mile |
|---|---|---|---|---|
| Subwatershed A | 2 | 30 | 4 | 6 |
| Subwatershed B | 1 | 10 | 0 | 3 |
| Subwatershed C | 8 | 60 | 2 | 12 |

**Table 36: Using Stream and ORI Data to Categorize IDDE Problems**

| Extent | ORI Support Data |
|---|---|
| **Minimal** | • Less than 10% of total outfalls are flowing<br>• Less than 20% of total outfalls with obvious, suspect or potential designation |
| **Clustered** | • Two thirds of the flowing outfalls are located within one third of the subwatersheds<br>• More than 20% of the communities subwatersheds have greater than 20% of outfalls with obvious, suspect or potential designation |
| **Severe** | • More than 10% of total outfalls are flowing<br>• More than 50% of total outfalls with obvious, suspect or potential designation<br>• More than 20% of total outfalls with obvious or suspect designation |

## 11.12 Budgeting and Scoping the ORI

Many different factors come into play when budgeting and scoping an ORI survey: equipment needs, crew size and the stream miles that must be covered. This section presents some simple rules of thumb for ORI budgeting.

Equipment costs for the ORI are relatively minor, with basic equipment to outfit one team of three people totaling about $800 (Table 37). This cost includes one-time expenses to acquire waders, a digital camera and a GPS unit, as well as disposable supplies.

The majority of the budget for an ORI is for staffing the desktop analysis, field crews and data analysis. Field crews can consist of two or three members, and cover about two to three miles of stream (or open channel) per day. Three staff-days should be allocated for pre- and post-field work for each day spent in the field.

Table 38 presents example costs for two hypothetical communities that conduct the ORI. Community A has 10 miles of open channel to investigate, while Community B has 20 miles. In addition, Community A has fewer staff resources available and therefore uses two-person field crews, while Community B uses three-person field crews. Total costs are presented as annual costs, assuming that each community is able to conduct the ORI for all miles in one year.

**Table 37: Typical Field Equipment Costs for the ORI**

| Item | Cost |
|---|---|
| 100 Latex Disposable Gloves | $25 |
| 5 Wide Mouth Sample Bottles (1 Liter) | $20 |
| Large Cooler | $25 |
| 3 Pairs of Waders | $150 |
| Digital Camera | $200 |
| 20 Cans of Spray Paint | $50 |
| Test Kits or Probes | $100-$500 |
| 1 GPS Unit | $150 |
| 1 Measuring Tape | $10 |
| 1 First Aid Kit | $30 |
| Flashlights, Batteries, Labeling tape, Clipboards | $25 |
| **Total** | **$785-$1185** |

| Table 38: Example ORI Costs | | |
|---|---|---|
| **Item** | **Community A** | **Community B** |
| Field Equipment[1] | $700 | $785 |
| Staff Field Time[2] | $2,000 | $6,000 |
| Staff Office Time[3] | $3,000 | $6,000 |
| **Total** | **$5,700** | **$12,785** |

*[1] From Table 44*
*[2] Assumes $25/hour salary (2 person teams in Community A and three- person teams in Community B) and two miles of stream per day.*
*[3] Assumes three staff days for each day in field.*

# Chapter 12: Indicator Monitoring

Indicator monitoring is used to confirm illicit discharges, and provide clues about their source or origin. In addition, indicator monitoring can measure improvements in water quality during dry weather flow as a result of the local IDDE program. This chapter reviews the suite of chemical indicator parameters that can identify illicit discharges, and provides guidance on how to collect, analyze and interpret each parameter.

Program managers have a wide range of indicator parameters and analytical methods to choose from when determining the presence and source of illicit discharges. The exact combination of indicator parameters and methods selected for a community is often unique. This chapter recommends some general approaches for communities that are just starting an indicator monitoring program or are looking for simple, cost-effective, and safe alternatives to their current program.

## Organization of the Chapter

This chapter provides technical support to implement the basic IDDE monitoring framework shown in Figure 44, and is organized into eight sections as follows:

1. Review of indicator parameters
2. Sample collection considerations
3. Methods to analyze samples
4. Methods to distinguish flow types
5. Chemical library
6. Special monitoring methods for intermittent and transitory discharges
7. In-stream dry weather monitoring
8. Costs for indicator monitoring

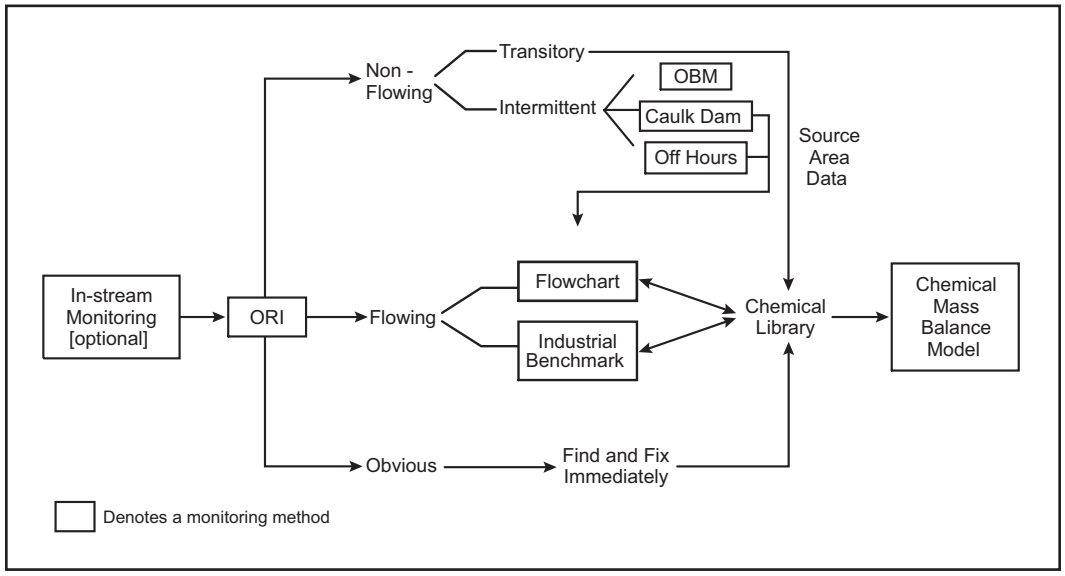



**Figure 44: IDDE Monitoring Framework**

Program managers developing an indicator monitoring program need a solid background in basic water chemistry, and field and laboratory methods. This chapter describes the major factors to consider when designing an indicator monitoring program for illicit discharges, and assumes some familiarity with water quality sampling and analysis protocols.

Indicator monitoring terminology can be confusing, so some of the basic terms are defined as they specifically relate to illicit discharge control. Some of the common terms introduced in this Chapter are defined below:

*Chemical Library:* A database and statistical summary of the chemical characteristics, or "fingerprint" of various discharge flow types in a community (e.g., sewage, wash water, shallow groundwater, tap water, irrigation water, and liquid wastes). The library is assembled by collecting and analyzing representative samples from the source of each major flow type in the community.

*Chemical Mass Balance Model (CMBM):* A computer model that uses flow characteristics from a chemical library file of flow types to estimate the most likely source components that contribute to dry weather flows.

*Detergents:* Commercial or retail products used to wash clothing. Presence of detergents in flow is usually measured as surfactants or fluorescence.

*False Negative:* An indicator sample that identifies a discharge as uncontaminated when it actually is contaminated.

*False Positive:* An indicator sample that identifies a discharge as contaminated when it is not.

*Flow Chart Method:* The use of four indicators (surfactants, ammonia, potassium, and fluoride) to identify illicit discharges.

*Indicator Parameter:* A water quality measurement that can be used to identify a specific discharge flow type, or discriminate between different flow types.

*Monitoring:* A strategy of sample collection and laboratory analysis to detect and characterize illicit discharges.

*Optical Brightener Monitoring (OBM) Traps:* Traps that use absorbent pads to capture dry weather flows, which can later be observed under a fluorescent light to determine if detergents using optical brighteners were present.

*Reagent:* A chemical added to a sample to create a reaction that enables the measurement of a target chemical parameter.

*Sampling:* Water sample collection from an outfall, pipe or stream, along with techniques to store and preserve them for subsequent laboratory analysis.

*Surfactants:* The main component of commercial detergents that detaches dirt from the clothing. The actual concentration of surfactants is much lower than the concentration of detergent, but analytical methods that measure surfactants are often referred to as "detergents." To avoid confusion, this chapter expresses the concentration of surfactants as "detergents as surfactants."

## 12.1 Indicator Parameters to Identify Illicit Discharges

At least fifteen different indicator parameters can confirm the presence or origin of an illicit discharge. These parameters are discussed in detail in Appendix F and include:

- Ammonia
- Boron
- Chlorine
- Color
- Conductivity
- Detergents
- *E. coli*, enterococci, and total coliform
- Fluorescence
- Fluoride
- Hardness
- pH
- Potassium
- Surface Tension
- Surfactants
- Turbidity

In most cases, however, only a small subset of indicator parameters (e.g., three to five) is required to adequately characterize an illicit discharge. This section summarizes the different indicator parameters that have been used.

An ideal indicator parameter should reliably distinguish illicit discharges from clean water and provide clues about its sources. In addition, they should have the following characteristics:

- Have a significantly different concentration for major flow or discharge types
- Exhibit relatively small variations in concentrations within the same flow or discharge type
- Be conservative (i.e., concentration will not change over time due to physical, chemical or biological processes)
- Be easily measured with acceptable detection limits, accuracy, safety and repeatability.

No single indicator parameter is perfect, and each community must choose the combination of indicators that works best for their local conditions and discharge types. Table 39 summarizes the parameters that meet most of the indicator criteria, compares their ability to detect different flow types, and reviews some of the challenges that may be encountered when measuring them. More details on indicator parameters are provided in Appendix F.

Data in Table 39 are based on research by Pitt (Appendix E) conducted in Alabama, and therefore, the percentages shown to distinguish "hits" for specific flow types should be viewed as representative and may shift for each community. Also, in some instances, indicator parameters were "downgraded" to account for regional variation or dilution effects. For example, both color and turbidity are excellent indicators of sewage based on discharge fingerprint data, but both can vary regionally depending on the composition of clean groundwater.

**Table 39: Indicator Parameters Used to Detect Illicit Discharges**

| Parameter | Discharge Types It Can Detect | | | | Laboratory/Analytical Challenges |
|---|---|---|---|---|---|
| | Sewage | Washwater | Tap Water | Industrial or Commercial Liquid Wastes | |
| Ammonia | ● | ◉ | ○ | ◉ | Can change into other nitrogen forms as the flow travels to the outfall |
| Boron | ◉ | ◉ | ○ | N/A | |
| Chlorine | ○ | ○ | ○ | ◉ | High chlorine demand in natural waters limits utility to flows with very high chlorine concentrations |
| Color | ◉ | ◉ | ○ | ◉ | |
| Conductivity | ◉ | ◉ | ○ | ◉ | Ineffective in saline waters |
| Detergents – Surfactants | ● | ● | ○ | ◉ | Reagent is a hazardous waste |
| *E. coli*<br>Enterococci<br>Total Coliform | ◉ | ○ | ○ | ○ | 24-hour wait for results<br>Need to modify standard monitoring protocols to measure high bacteria concentrations |
| Fluoride* | ○ | ○ | ● | ◉ | Reagent is a hazardous waste<br>Exception for communities that do not fluoridate their tap water |
| Hardness | ◉ | ◉ | ◉ | ◉ | |
| pH | ○ | ◉ | ○ | ◉ | |
| Potassium | ◉ | ○ | ○ | ● | May need to use two separate analytical techniques, depending on the concentration |
| Turbidity | ◉ | ◉ | ○ | ◉ | |

● Can almost always (>80% of samples) distinguish this discharge from clean flow types (e.g., tap water or natural water). For tap water, can distinguish from natural water.
◉ Can sometimes (>50% of samples) distinguish this discharge from clean flow types depending on regional characteristics, or can be helpful in combination with another parameter
○ Poor indicator. Cannot reliably detect illicit discharges, or cannot detect tap water
N/A: Data are not available to assess the utility of this parameter for this purpose.
Data sources: Pitt (this study)
*Fluoride is a poor indicator when used as a single parameter, but when combined with additional parameters (such as detergents, ammonia and potassium), it can almost always distinguish between sewage and washwater.

## 12.2 Sample Collection Considerations

Sample collection is an important aspect of an IDDE program. Program managers need to be well informed about the key facets of sampling such as sample handling, QA/QC, and safety. The guidance in this section is limited to an overview of sample collection considerations including: equipment needed for collecting samples, elements of sampling protocols, and general tips. Several useful documents are available that detail accepted water quality sampling protocols such as the following:

- Burton and Pitt (2002) - Stormwater Effects Handbook: A Toolbox for Watershed Managers, Scientists, and Engineers

- USGS National Field Manual for the Collection of Water-Quality Data http://water.usgs.gov/owq/FieldManual/
- *Standard Methods for the Examination of Water and Wastewater* http://www.standardmethods.org/
- *EPA NPDES Stormwater Sampling Guidance Document* http://cfpub.epa.gov/npdes (Note: while this document is oriented towards wet weather sampling, there are still many sampling procedures that apply to dry weather sampling)

State environmental agencies are also a good resource to contact for recommended or required sampling protocols.

## Equipment Needed for Field Sampling

The basic equipment needed to collect samples is presented in Table 40. Most sampling equipment is easily available for purchase from scientific supply companies and various retail stores.

## Developing a Consistent Sample Collection Protocol

Samples should never be collected haphazardly. To get reliable, accurate, and defensible data, it is important to develop a consistent field sampling protocol to collect each indicator sample. A good field sampling protocol incorporates eight basic elements:

1. Where to collect samples
2. When to collect samples
3. Sample bottle preparation
4. Sample collection technique
5. Storage and preservation of samples
6. Sample labeling and chain of custody plan
7. Quality assurance/control samples
8. Safety considerations

Appendix G provides more detail on each monitoring element. Some communities already have established sampling protocols that are used for in-stream or wet weather sampling. In most cases these existing sampling protocols are sufficient to conduct illicit discharge sampling.

## Tips for Collecting Illicit Discharge Samples

The following tips can improve the quality of your indicator monitoring program.

1. Remember to fill out an ORI field form at every outfall where samples are collected. The ORI form documents sample conditions, outfall characteristics and greatly aids in interpreting indicator monitoring data.
2. Most state water quality agencies have detailed guidance on sampling protocols. These resources should be consulted and the appropriate guidelines followed. Another useful guidance on developing a quality assurance plan is the "Volunteer Monitor's Guide to Quality Assurance Project Plans" (EPA, 1996).

**Table 40: Equipment Needed for Sample Collection**

- A cooler (to be kept in the vehicle)
- Ice or "blue ice" (to be kept in the vehicle)
- Permanent marker (for labeling the samples)
- Labeling tape or pre-printed labels
- Several dozen one-liter polyethylene plastic sample bottles
- A "dipper," a measuring cup at the end of a long pole, to collect samples from outfalls that are hard to reach
- Bacteria analysis sample bottles (if applicable), typically pre-cleaned 120mL sample bottles, to ensure against contamination

3. Sample in batches where feasible to cut down on field and mobilization time.

4. Avoid sampling lagged storm water flows by sampling at least 48 to 72 hours after runoff producing events.

5. It may be necessary to collect multiple samples at a single outfall if preservatives are going to be used. Preservatives are typically necessary when long hold times are required for samples before analysis occurs. Appendix G contains guidance on the required preservation and maximum allowable hold times for various parameters.

## 12.3 Methods to Analyze Indicator Samples

This section reviews methods to analyze indicator samples, and begins with a discussion of whether they should be analyzed in-house or sent to an independent contract lab. Next, recommended methods for analyzing indicator parameters are outlined, along with data on their comparative cost, safety, and accuracy. Lastly, tips are offered to improve an indicator monitoring program.

### *Analyzing Samples In-house vs. Contract Lab*

Program managers need to decide whether to analyze samples in-house, or through an independent monitoring laboratory. The decision on which route to take is often based on the answers to the following questions:

- *What level of precision or accuracy is needed for the indicator parameter(s)?* Precise and accurate data are needed when indicator monitoring is used to legally document a violation or enforcement action. The lab setting is important, since the quality of the data may be challenged. Precise data are also needed for outfalls that have very large drainage areas. These discharges are often diluted by groundwater, so lab methods must be sensitive and have low detection limits to isolate illicit discharges that are masked or blended with other flow types. Accurate data are also needed for large outfalls since the cost and effort triggered by a false positive reading to track and isolate discharges in a large and complex drainage area is much greater.

- *How quickly are sampling results needed?* Fast results are essential if the community wants to respond instantly to problem outfalls. In this case, the capability to collect and analyze indicator samples in-house is desirable to provide quick response.

- *How much staff time and training is needed to support in-house analysis?* Local staff that perform lab analysis must be certified in laboratory safety, quality control and proper analytical procedures. Communities that do not expect to collect many indicator samples may want to utilize a contract lab to reduce staff training costs.

- *Does a safe environment exist to analyze samples and dispose of wastes?* A safe environment is needed for lab analysis including storage in a fireproof environment, eyewash stations, safety showers, fume hoods and ventilation. Lab workers should have standard safety equipment such as gloves, safety glasses and lab coats. Lastly, many of the recommended analytical methods create small quantities of hazardous wastes that need to be properly disposed. Program

managers should carefully evaluate in-house work space to determine if a safe lab environment can be created.

- *What is the comparative cost for sample analysis in each option?* The initial up-front costs to use an independent laboratory are normally lower than those required to establish an in-house analysis capability. An in-house analysis capability normally becomes cost-effective when a community expects to analyze more than 100 indicator samples per year. Section 12.8 outlines some of the key budget factors to consider when making this decision, but program managers should always get bids from reputable and certified contract labs to determine analysis costs.
- *Are existing monitoring laboratories available in the community?* Cost savings are often realized if an existing wastewater treatment or drinking water lab can handle the sample analysis. These labs normally possess the equipment, instruments and trained staff to perform the water quality analyses for indicator parameters.

## Considerations for In-house Analysis Capability

Three basic settings can be used to analyze indicator parameters in-house: direct field measurements, small office lab, and a more formal municipal lab. The choice of which in-house setting to use depends on the indicator parameters selected, the need for fast and accurate results and safety/disposal considerations.

*In-Field Analysis* – A few indicator parameters can be analyzed in the field with probes and other test equipment (Figure 45). While most field parameters can identify problem outfalls, they generally cannot distinguish the specific type of discharge. Some of the situations where in-field analysis[10] is best applied are:

- When a community elects to use one or two indicator parameters, such as ammonia and potassium, that can be measured fairly easily in the field
- When field crews measure indicator parameters to trace or isolate a discharge in a large storm drain pipe network, and need quick results to decide where to go next

*Office Analysis* – Many of the recommended indicator parameters can be analyzed in an informal "office" lab with the possible exception of surfactants and fluoride (Figure 46). The office analysis option makes sense in communities that have available and trained staff, and choose analytical methods that are safe and have few hazardous waste disposal issues. Another option is to use the office lab to conduct most indicator analyses, but send out fluoride and surfactant indicator samples to a contract lab.

**TIP**

The methodology for any bacteria analysis also has a waste disposal issue (e.g., biohazard). Check state guidance for appropriate disposal procedures.

[10] Some communities have had success with in-field analysis; however, it can be a challenging environment to conduct rapid and controlled chemical analysis. Therefore, it is generally recommended that the majority of analyses be conducted in a more controlled "lab" setting.

*Formal Laboratory Setting* – The ideal option in many communities is to use an existing municipal or university laboratory. Existing labs normally have systems in place to dispose of hazardous material, have room and facilities for storing samples, and are equipped with worker safety features. Be careful to craft a schedule that does not interfere with other lab activities.

When in-house analysis is used, program managers need to understand the basic analytical options, safety considerations, equipment needs and analysis costs for each analytical method used to measure indicator parameters. This understanding helps program managers choose what indicator parameters to collect and where they should be analyzed. Much of this information is detailed in Appendix F and summarized below.

### Supplies and Equipment

The basic supplies needed to perform lab analysis are described in Table 41, and are available from several scientific equipment suppliers. In addition, reagents, disposable supplies and some specialized instruments may be needed, depending on the specific indicator parameters analyzed. For a partial list of suppliers, consult the Volunteer Stream Monitoring Manual (US EPA, 1997), which can be accessed at www.epa.gov/owow/monitoring/volunteer/stream/appendb.html. Table 42 summarizes the equipment needed for each analytical method.



**Figure 45: Analyzing samples in the back of a truck**



**Figure 46: Office/lab set up in Fort Worth, TX**

**Table 41: Basic Lab Supplies**

| Disposable Supplies | Glassware/Tools |
|---|---|
| • Deionized water (start with about 10 gallons, unless a reverse osmosis machine is available)<br>• Nitric acid for acid wash (one or two gallons to start) | • About two dozen each of 100 and 200 mL beakers<br>• Two or three 100 mL graduated cylinders<br>• Two or three tweezers<br>• Pipettes to transfer samples in small quantities |
| **Safety** | |
| • Lab or surgical gloves<br>• Lab coats<br>• Safety glasses | |

| Table 42: Analytical Methods Supplies Needed | | | | |
|---|---|---|---|---|
| **Indicator Parameter** | **Specific Glassware** | **Equipment** | **Reagents or Kits** | **Unique Suppliers** |
| Ammonia | Sample Cells | Spectrophotometer or Colorimeter | Hach reagents for method 8155 | www.hach.com |
| Boron | None | Spectrophotometer or Colorimeter | Hach reagents for method 10061 | www.hach.com |
| Chlorine | None | Spectrophotometer or Colorimeter | Hach reagents for method 8021 | www.hach.com |
| Color | None | None | Color Kit | www.hach.com |
| Conductivity | None | Horiba probe | Standards | www.horiba.com |
| Detergents - Surfactants (MBAS) | None | None | Chemets Detergents Test | www.chemetrics.com |
| *E. Coli* | None | Sealer<br>Black Light Comparator | Colilert Reagent<br>Quanti-Tray Sheets | IDEXX Corporation<br>www.idexx.com |
| Fluorescence | Cuvettes | Fluorometer | None | Several |
| Fluoride | None | Spectrophotometer or Colorimeter | Hach reagents for method 8029 | www.hach.com |
| Hardness | Erlenmeyer Flask | Burette and Stand<br>or<br>Digital Titrator | EDTA Cartridges or Reagent<br>and Buffer Solution | www.hach.com |
| pH | None | Horiba Probe | Standards | www.horiba.com |
| Potassium | None | Horiba Probe | Standards | www.horiba.com |
| Potassium (Colorimetric) | None | Spectrophotometer or Colorimeter | Hach Reagents for method 8012 | www.hach.com |

## *Cost*

Table 43 compares the per sample cost to analyze indicator parameters. In general, the per sample cost is fairly similar for most parameters, with the exception of bacteria analyses for *E. coli*, total coliform, or Enterococci. Reagents typically cost less than $2.00 per sample, and equipment purchases seldom exceed $1,000. The typical analysis time averages less than 10 minutes per sample. More information on budgeting indicator monitoring programs can be found in Section 12.8.

| Table 43: Chemical Analysis Costs | | | | | |
|---|---|---|---|---|---|
| Parameter | Analysis Cost | | | | |
| | Per Sample Costs | | | | Approximate Initial Equipment Cost (Item) |
| | Disposable Supplies | Analysis Time (min/ sample) | Staff Cost (@$25/hr) | Total Cost Per Sample | |
| Ammonia | $1.81 | 25[3] | $10.42 | $12.23 | $950[4] (Colorimeter) |
| Boron | $0.50 | 20[3] | $8.33 | $8.83 | $950[4] (Colorimeter) |
| Chlorine | $0.60 | 5 | $2.08 | $2.68 | $950[4] (Colorimeter) |
| Color | $0.52 | 1 | $0.42 | $0.94 | $0 |
| Conductivity | $0.65[2] | 4[3] | $1.67 | $2.32 | $275 (Probe) |
| Detergents – Surfactants[1] | $3.15 | 7 | $2.92 | $6.07 | $0 |
| Enterococci, *E. Coli* or Total Coliform[1] | $6.75 | 7 (24 hour waiting time) | $2.92 | $9.67 | $4,000 (Sealer and Incubator) |
| Fluoride[1] | $0.68 | 3 | $1.25 | $1.93 | $950[4] (Colorimeter) |
| Hardness | $1.72 | 5 | $2.08 | $3.80 | $125 (Digital Titrator) |
| pH | $0.65[2] | 3.5[3] | $1.46 | $2.11 | $250 (Probe) |
| Potassium (High Range) | $0.50[2] | 5.5[3] | $2.29 | $2.79 | $250 (Probe) |
| Potassium (Low Range) | $1.00 | 5 | $2.08 | $3.08 | $950[4] (Colorimeter) |
| Turbidity | $0.50[2] | 6[3] | $2.50 | $3.00 | $850 (Turbiditimeter) |

*[1] Potentially high waste disposal cost for these parameters.*
*[2] The disposable supplies estimates are based on the use of standards to calibrate a probe or meter.*
*[3] Analysts can achieve significant economies of scale by analyzing these parameters in batches.*
*[4] Represents the cost of a colorimeter. The price of a spectrophotometer, which measures a wider range of parameters, is more than $2,500. This one-time cost can be shared among chlorine, fluoride, boron, potassium and ammonia.*

### *Additional Tips for In-house Laboratory Analysis*

The following tips can help program managers with in-house laboratory analysis decisions:

- Program managers may want to use both in-house analysis and contract labs to measure the full range of indicator parameters needed in a safe and cost-effective manner. In this case, a split sample analysis strategy is used, where some samples are sent to the contract lab, while others are analyzed in house.

- Remember to order enough basic lab supplies, because they are relatively cheap and having to constantly re-order supplies and wash glassware can be time-consuming. In addition, some scientific supply companies have minimum order amounts, below which additional shipping and handling is charged.
- Be careful to craft a sample analysis schedule that doesn't interfere with other lab operations, particularly if it is a municipal lab. With appropriate preservation, many samples can be stored for several weeks.

### Considerations for Choosing a Contract Lab

When a community elects to send samples to an independent contract lab for analysis, it should investigate seven key factors:

1. Make sure that the lab is EPA-certified for the indicator parameters you choose. A state-by-state list of EPA certified labs for drinking water can be found at: http://www.epa.gov/safewater/privatewells/labs.html. State environmental agencies are also good resources to contact for pre-approved laboratories.
2. Choose a lab with a short turn-around time. Some Phase I communities had problems administering their programs because of long turn-around times from local labs (CWP, 2002). As a rule, a lab should be able to produce results within 48 hours.
3. Clearly specify the indicator parameter and analysis method you want, using the guidance in this manual or advice from a water quality expert.
4. Ensure that the maximum hold time for each indicator parameter exceeds the time it takes to ship samples to the lab for analysis.
5. Carefully review and understand the shipping and preservation instructions provided by the contract lab.
6. Look for labs that offer electronic reporting of sample results, which can greatly increase turn-around time, make data analysis easier, and improve response times.
7. Periodically check the lab's QA/QC procedures, which should include lab spikes, lab blanks, and split samples. The procedures for cleaning equipment and calibrating instruments should also be evaluated. These QA/QC procedures are described below.
   - *Lab spikes* – Samples of known concentration are prepared in the laboratory to determine the accuracy of instrument readings.
   - *Lab blanks* – Deionized water samples that have a known zero concentration are used to test methods, or in some methods to "zero" the instruments.
   - *Split samples* – Samples are divided into two separate samples at the laboratory for a comparative analysis. Any difference between the two sample results suggests the analysis method may not be repeatable.
   - *Equipment cleaning and instrument maintenance protocols* – Each lab should have specific and routine procedures to maintain equipment and clean glassware and tubing. These procedures should be clearly labeled on each piece of equipment.

- *Instrument calibration* – Depending on the method, instruments may come with a standard calibration curve, or may require calibration at each use. Lab analysts should periodically test the default calibration curve.

Table 44 summarizes estimated costs associated with sample analyses at a contract lab.

## 12.4 Techniques to Interpret Indicator Data

Program managers need to decide on the best combination of indicator parameters that will be used to confirm discharges and identify flow types. This section presents guidance on four techniques to interpret indicator parameter data:

- Flow Chart Method (recommended)
- Single Parameter Screening
- Industrial Flow Benchmarks
- Chemical Mass Balance Model (CMBM)

**Table 44: Typical Per Sample Contract Lab Costs**

| Parameter | Costs |
|---|---|
| Ammonia | $12 - $25 |
| Boron | $16 - $20 |
| Chlorine | $6 - $10 |
| Color | $7 - $11 |
| Conductivity | $2 - $6 |
| Detergents – Surfactants | $17- $35 |
| Enterococci, *E. Coli* or Total Coliform | $17 - $35 |
| Fluoride | $14 - $25 |
| Hardness | $8 - $16 |
| pH | $2 - $7 |
| Potassium | $12 - $14 |
| Turbidity | $9 - $12 |

All four techniques rely on benchmark concentrations for indicator parameters in order to distinguish among different flow types. Program managers are encouraged to adapt each technique based on local discharge concentration data, and some simple statistical methods for doing so are provided throughout the section.

### *The Flow Chart Method*

The Flow Chart Method is recommended for most Phase II communities, and was originally developed by Pitt *et al.* (1993) and Lalor (1994) and subsequently updated based on new research by Pitt during this project. The Flow Chart Method can distinguish four major discharge types found in residential watersheds, including sewage and wash water flows that are normally the most common illicit discharges. Much of the data supporting the method were collected in Alabama and other regions, and some local adjustment may be needed in some communities. The Flow Chart Method is recommended because it is a relatively simple technique that analyzes four or five indicator parameters that are safe, reliable and inexpensive to measure. The basic decision points involved in the Flow Chart Method are shown in Figure 47 and described below:

#### *Step 1: Separate clean flows from contaminated flows using detergents*

The first step evaluates whether the discharge is derived from sewage or washwater sources, based on the presence of detergents. Boron and/or surfactants are used as the primary detergent indicator, and values of boron or surfactants that exceed 0.35 mg/L and 0.25 mg/L, respectively, signal that the discharge is contaminated by sewage or washwater.

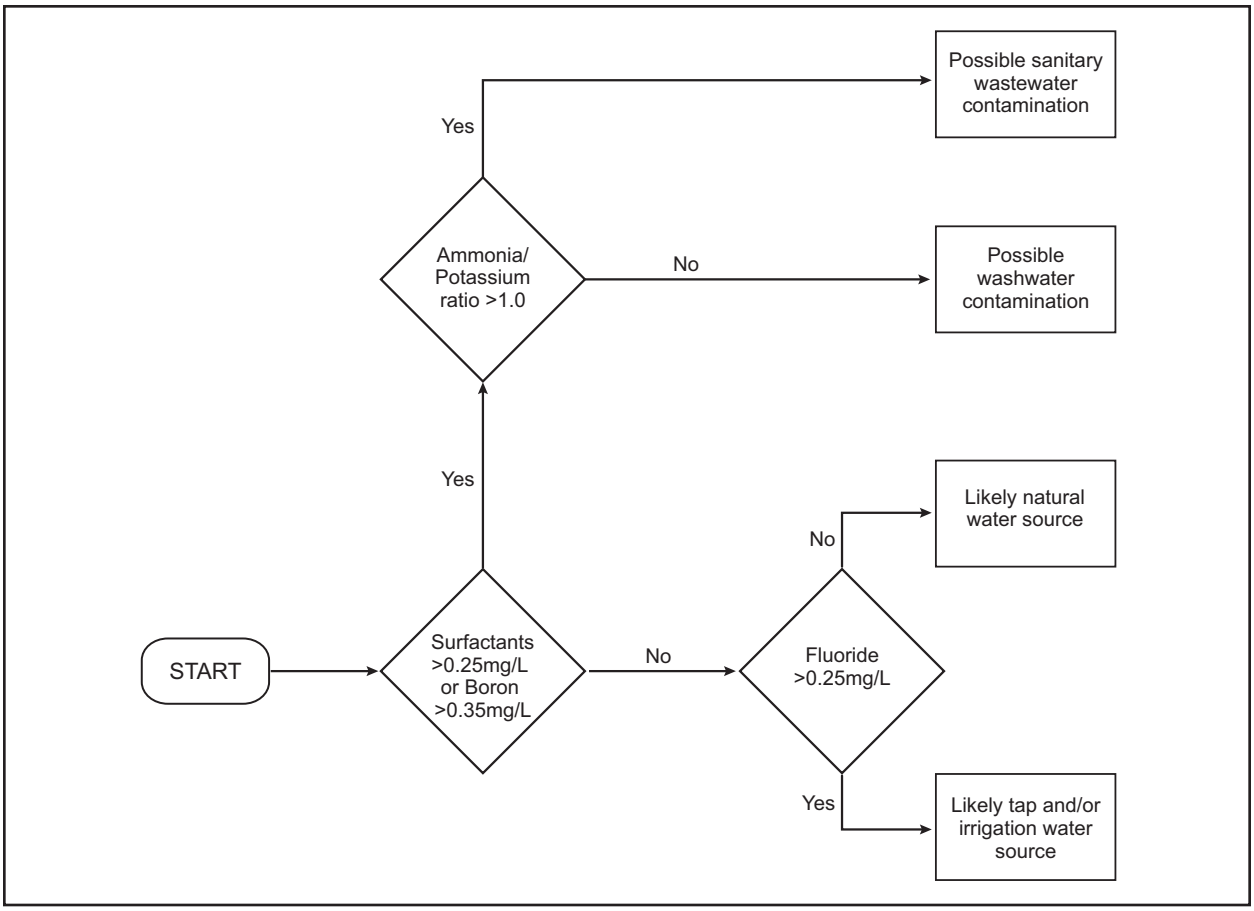



**Figure 47: Flow Chart to Identify Illicit Discharges in Residential Watersheds**

### *Step 2: Separate washwater from wastewater using the Ammonia/ Potassium ratio*

If the discharge contains detergents, the next step is to determine whether they are derived from sewage or washwater, using the ammonia to potassium ratios. A ratio greater than one suggests sewage contamination, whereas ratios less than one indicate washwater contamination. The benchmark ratio was developed by Pitt *et al.* (1993) and Lalor (1994) based on testing in urban Alabama watersheds.

### *Step 3: Separate tap water from natural water*

If the sample is free of detergents, the next step is to determine if the flow is derived from spring/groundwater or comes from tap water. The benchmark indicator used in this step is fluoride, with concentrations exceeding 0.60 mg/L indicating that potable water is the source. Fluoride levels between 0.13 and 0.6 may indicate non-target irrigation water. The purpose of determining the source of a relatively "clean discharge" is that it can point to water line breaks, outdoor washing, non-target irrigation and other uses of municipal water that generate flows with pollutants.

### Adapting the Flow Chart Method

The Flow Chart Method is a robust tool for identifying illicit discharge types, but may need to be locally adapted, since much of the supporting data was collected in one region of the country. Program managers should look at four potential modifications to the flow chart in their community.

1) Is boron or surfactants a superior local indicator of detergents?

Surfactants are almost always a more reliable indicator of detergents, except for rare cases where groundwater has been contaminated by sewage. The disadvantage of surfactants is that the recommended analytical method uses a hazardous chemical as the reagent. Boron uses a safer analytical method. However, if boron is used as a detergent indicator, program managers should sample boron levels in groundwater and tap water, since they can vary regionally. Also, not all detergent formulations incorporate boron at high levels, so it may not always be a strong indicator.

2) Is the ammonia/potassium ratio of one the best benchmark to distinguish sewage from washwater?

The ammonia/potassium ratio is a good way to distinguish sewage from washwater, although the exact ratio appears to vary in different regions of the country. The benchmark value for the ratio was derived from extensive testing in one Alabama city. In fact, data collected in another Alabama city indicated an ammonia/potassium ratio of 0.6 distinguished sewage from wash water. Clearly, program managers should evaluate the ratio in their own community, although the proposed ratio of 1.0 should still capture the majority of sewage discharges. The ratio can be refined over time using indicator monitoring at local outfalls, or through water quality sampling of sewage and washwater flow types for the chemical library.

3) Is fluoride a good indicator of tap water?

Usually. The two exceptions are communities that do not fluoridate their drinking water or have elevated fluoride concentrations in groundwater. In both cases, alternative indicator parameters such as hardness or chlorine may be preferable.

4) Can the flow chart be expanded?

The flow chart presented in Figure 47 is actually a simplified version of a more complex flow chart developed by Pitt for this project, which is presented in Appendix H. An expanded flow chart can provide more consistent and detailed identification of flow types, but obviously requires more analytical work and data analysis. Section 12.5 provides guidance on statistical techniques to customize the flow chart method based on your local discharge data.

## Single Parameter Screening

Research by Lalor (1994) suggests that detergents is the best single parameter to detect the presence or absence of the most common illicit discharges (sewage and washwater). The recommended analytical method for detergents uses a hazardous reagent, so the analysis needs to be conducted in a controlled laboratory setting with proper safety equipment. This may limit the flexibility of a community if it is conducting analyses in the field or in a simple office lab.

Ammonia is another single parameter indicator that has been used by some communities with widespread or severe

sewage contamination. An ammonia concentration greater than 1 mg/L is generally considered to be a positive indicator of sewage contamination. Ammonia can be analyzed in the field using a portable spectrophotometer, which allows for fairly rapid results and the ability to immediately track down sources and improper connections (see Chapter 13 for details on tracking down illicit discharges) [11]. Since ammonia can be measured in the field, crews can get fast results and immediately proceed to track down the source of the discharge using pipe testing methods (see Chapter 13 for details).

As a single parameter, ammonia has some limitations. First, ammonia by itself may not always be capable of identifying sewage discharges, particularly if they are diluted by "clean" flows. Second, while some washwaters and industrial discharges have relatively high ammonia concentrations, not all do, which increases the prospects of false negatives. Lastly, other dry weather discharges, such as non-target irrigation, can also have high ammonia concentrations that can occasionally exceed 1 mg/L. Supplementing ammonia with potassium and looking at the ammonia/potassium ratio is a simple adjustment to the single parameter approach that helps to further and more accurately characterize the discharge. Ratios greater than one indicate a sewage source, while ratios less than or equal to one indicate a washwater source. Potassium is easily analyzed using a probe (Horiba Cardy™ is the recommended probe).

[11] In-field analysis may be appropriate when tracking down illicit flows, but it is typically associated with challenging and uncontrollable conditions. Therefore, it is generally recommended that analyses be conducted in a controlled lab setting.

## *Industrial Flow Benchmark*

If a subwatershed has a high density of industrial generating sites, additional indicator parameters may be needed to detect and trace these unique discharges. They are often needed because industrial and commercial generating sites produce discharges that are often not composed of either sewage or washwater. Examples include industrial process water, or wash down water conveyed from a floor drain to the storm drain system.

This guidance identifies seven indicator parameters that serve as industrial flow benchmarks to help identify illicit discharges originating from industrial and other generating sites. The seven indicators (ammonia, color, conductivity, hardness, pH, potassium and turbidity) are used to identify liquid wastes and other industrial discharges that are not always picked up by the Flow Chart Method. Table 45 summarizes typical benchmark concentrations that can distinguish between unique industrial or commercial liquid wastes. Note that two of the seven indicator parameters, ammonia and potassium, are already incorporated into the flow chart method.

Table 46 illustrates how industrial benchmark parameters can be used independently or as a supplement to the flow chart method, based on data from Alabama (Appendix E). The best industrial benchmark parameters are identified in pink shading and can distinguish industrial sources from residential washwater in 80% of samples. Supplemental indicator parameters denoted by yellow shading, can distinguish industrial source from residential washwater in 50% of samples, or roughly one in two samples.

Most industrial discharges can consistently be identified by extremely high potassium levels. However, these discharges would be misclassified as washwater when just the Flow Chart Method is used. Other benchmark parameters have value in identifying specific industrial types or operations. For example, metal plating bath waste discharges are often indicated by extremely high conductivity, hardness and potassium concentrations.

### Adapting Industrial Flow Benchmark

By their very nature, industrial and other generating sites can produce a bewildering diversity of discharges that are hard to classify. Therefore, program managers will experience some difficulty in differentiating industrial sources. Over time, the composition of industrial discharges can be refined as chemical libraries for specific industrial flow types and sources are developed. This can entail a great deal of sampling, but can reduce the number of false positive or negative readings.

**Table 45: Benchmark Concentrations to Identify Industrial Discharges**

| Indicator Parameter | Benchmark Concentration | Notes |
|---|---|---|
| Ammonia | ≥50 mg/L | • Existing "Flow Chart" Parameter<br>• Concentrations higher than the benchmark can identify a few industrial discharges. |
| Color | ≥500 Units | • Supplemental parameter that identifies a few specific industrial discharges. Should be refined with local data. |
| Conductivity | ≥2,000 µS/cm | • Identifies a few industrial discharges<br>• May be useful to distinguish between industrial sources. |
| Hardness | ≤10 mg/L as CaCO3<br>≥2,000 mg/L as CaCO3 | • Identifies a few industrial discharges<br>• May be useful to distinguish between industrial sources. |
| pH | ≤5 | • Only captures a few industrial discharges<br>• High pH values may also indicate an industrial discharge but residential wash waters can have a high pH as well. |
| Potassium | ≥20 mg/L | • Existing "Flow Chart" Parameter<br>• Excellent indicator of a broad range of industrial discharges. |
| Turbidity | ≥1,000 NTU | • Supplemental parameter that identifies a few specific industrial discharges. Should be refined with local data. |

**Table 46: Usefulness of Various Parameters to Identify Industrial Discharges**

| Industrial Benchmark Concentration | Detergents as Surfactants (mg/L) | Ammonia (mg/L) | Potassium (mg/L) | Initial "Flow Chart" Class | Color (Units) | Conductivity (:S/cm)1 | Hardness (mg/L as $CaCO_3$) | pH | Turbidity (NTU) | Best Indicator Parameters to Identify This Flow Type | Additional Indicator Parameters to Identify This Flow Type |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | -- | ≥50 | ≥20 | | ≥500 | ≥2000 | ≤10<br>≥2,000 | ≤5 | ≥1,000 | | |
| *Concentrations in Industrial and Commercial Flow Types* | | | | | | | | | | | |
| Automotive Manufacturer[1] | 5 | 0.6 | 66 | **Wash water** | 15 | 220 | 30 | 6.7 | 118 | Potassium | |
| Poultry Supplier[1] | 5 | 4.2 | 41 | **Wash water** | 23 | 618 | 31 | 6.3 | 111 | Potassium | |
| Roofing Product Manufacturing[1] | 8 | 10.2 | 27 | **Wash water** | >100[2] | 242 | 32 | 7.1 | 229 | None | Potassium Color |
| Uniform Manufacturing[1] | 6 | 6.1 | 64 | **Wash water** | >100[2] | 798 | 35 | 10.4 | 2,631 | Potassium | Color Turbidity |
| Radiator Flushing | 15 | (26.3) | (2,801) | **Wash water** | (3,000) | (3,278) | (5.6) | (7.0) | - | Potassium Conductivity Color | Hardness |
| Metal Plating Bath | 7 | (65.7) | (1,009) | **Wash water** | (104) | (10,352) | (1,429) | (4.9) | - | Ammonia Potassium Conductivity Hardness | pH |
| Commercial Car Wash | 140 | 0.9; (0.2) | 4; (43) | **Wash water** | >61; (222) | 274; (485) | 71; (157) | 7.7; (6.7) | 156 | | Potassium Turbidity |
| Commercial Laundry | (27) | (0.8) | 3 | **Wash water** | 47 | (563) | (36) | (9.1) | - | | |

*Best Indicators, shaded in pink, distinguish this source from residential wash water in 80% of samples in both Tuscaloosa and Birmingham, AL.*
*Supplemental indicators, shaded in yellow, distinguish this source from residential wash water in 50% of samples, or in only one community.*
*(Data in parentheses are mean values from Birmingham); Data not in parentheses are from Tuscaloosa*
*[1] Fewer than 3 samples for these discharges.*
*[2] The color analytical technique used had a maximum value of 100, which was exceeded in all samples. Color may be a good indicator of these industrial discharges and the benchmark concentration may need adjustment downward for this specific community.*

### Chemical Mass Balance Model (CMBM) for Blended Flows

The Chemical Mass Balance Model (CMBM) is a sophisticated technique to identify flow types at outfalls with blended flows (i.e., dry weather discharges originating from multiple sources). The CMBM, developed by Karri (2004) as part of this project is best applied in complex sewersheds with large drainage areas, and relies heavily on the local chemical library discussed in **the next section.**

The CMBM can quantify the fraction of each flow type present in dry weather flow at an outfall (e.g., 20% spring water; 40% sewage; 20% wash water). The CMBM relies on a computer program that generates and solves algebraic mass balance equations, based on the statistical distribution of specific flow types derived from the chemical library. The CMBM is an excellent analysis tool, but requires significant advance preparation and sampling support. More detailed guidance on how to use and interpret CMBM data can be found in Appendix I.

The chemical library requires additional statistical analysis to support the CMBM. Specifically, indicator parameter data for each flow type need to be statistically analyzed to determine the **mean**, the **coefficient of variation**, and the **distribution type**. In its current version, the CMBM accepts two distribution types: normal or lognormal distributions. Various statistical methodologies can determine the distribution type of a set of data. Much of this analysis can be conducted using standard, readily-available statistical software, such as the Engineering Statistics Handbook which is available from the National Institute of Standards and Technology, and can be accessed at http://www.itl.nist.gov/div898/handbook/.

## 12.5 The Chemical Library

The chemical library is a summary of the chemical composition of the range of discharge types found in a community. The primary purpose of the library is to characterize distinct flow types that may be observed at outfalls, including both clean and contaminated discharges. A good library includes data on the composition of tap water, groundwater, sewage, septage, non-target irrigation water, industrial process waters, and washwaters (e.g., laundry, car wash, etc.). The chemical library helps program managers customize the flow chart method and industrial benchmarks, and creates the input data needed to drive the CMBM.

To develop the library, samples are collected directly from the discharge source (e.g., tap water, wastewater treatment influent, shallow wells, septic tanks, etc.). Table 47 provides guidance on how and where to sample each flow type in your community. As a general rule, about 10 samples are typically needed to characterize each flow type, although more samples may be needed if the flow type has a high coefficient of variation. The measure of error can be statistically defined by evaluating the coefficient of variation of the sample data (variability relative to the mean value), and the statistical distribution for the data (the probable spread in the data beyond the mean). For more guidance on statistical techniques for assessing sampling data, consult Burton and Pitt (2002) and US EPA (2002), which can be accessed at http://galton.uchicago.edu/~cises/resources/EPA-QA-Sampling-2003.pdf.

Chemical libraries should also be compared to databases that summarize indicator monitoring of dry weather flows at suspect

outfalls. Outfall samples may not always be representative of individual flow types because of mixing of flows and dilution, but they can serve as a valuable check if the discharge source is actually confirmed. Program managers can also use both the chemical library and indicator database to refine flow chart or industrial benchmarks (see Appendix J for an example).

Over time, communities may want to add other flow types to the chemical library, such as transitory discharges that generate small volume flows such as "dumpster juice," power washing and residential car washing. Transitory discharges are hard to detect with outfall monitoring, but may cumulatively contribute significant dry weather loads. Understanding the chemical makeup of the transitory discharges can help program managers prioritize education and pollution prevention efforts.

**Table 47: Where and How to Sample for Chemical "Fingerprint" Library**

| Flow Type | Places to Collect the Data | Any Other Potential Sources? |
|---|---|---|
| Shallow Groundwater | • From road cuts or stream banks<br>• Samples from shallow wells<br>• USGS regional groundwater quality data<br>• Dry weather in-stream flows at headwaters with no illicit discharges | None. Locally distinct. |
| Spring Water | • Directly from springs | None. Locally distinct. |
| Tap water | • Individual taps throughout the community<br>• or analyze local drinking water monitoring reports or annual consumer confidence reports | None. Locally distinct. |
| Irrigation | • Collect irrigation water from several different sites. May require a hand operated vacuum pump to collect these shallow flows (see Burton and Pitt, 2002) | None. Locally distinct. |
| Sewage | • Reported sewage treatment plant influent data provides a characterization of raw sewage and is usually available from discharge monitoring reports. Because the characteristics of sewage will vary within the collection system depending upon whether the area is serving residential or commercial uses, climate, residence time in the collection system, etc, it is often more accurate and valuable to collect "fingerprint" samples from within the system, rather than at the treatment plant. | Data in Appendix E can provide a starting point, but local data are preferred. |
| Septage | • Outflow of several individual septic tanks or leach fields | |
| Most Industrial Discharges | • Direct effluent from the industrial process (Obtain samples as part of industrial pre-treatment program in local community) | Data in Appendix E characterize some specific industrial flows. Industrial NPDES permit monitoring can also be used. |
| Commercial Car Wash; Commercial Laundry | • Sumps at these establishments | Data in Appendix E can provide a starting point, but local data are preferred. |

### *Evaluating Interpretive Techniques Using Outfall Indicator Monitoring Data*

Outfall sampling data for confirmed sources or flow types can be used to test the accuracy and reliability of all four interpretive techniques. The sampling record is used to determine the number of false positives or false negatives associated with a specific interpretive technique. A simple tabulation of false test readings can identify the types and levels of indicator parameters that are most useful.

Table 48 provides an example of how the Flow Chart Method was tested with outfall monitoring data from Birmingham, AL (Pitt *et al*., 1993). In this case, the Flow Chart Method was applied without adaptation to local conditions, and the number of correctly (and incorrectly) identified discharges was tracked. Tests on 10 Birmingham outfalls were mostly favorable, with the flow chart method correctly identifying contaminated discharges in all cases (i.e., washwater or sewage waste water). At one outfall, the flow chart incorrectly identified sewage as washwater, based on an ammonia ($NH_3$)/ potassium (K) ratio of 0.9 that was very close to the breakpoint in the Flow Chart Method (ratio of one). Based on such tests, program managers may want to slightly adjust the breakpoints in the Flow Chart Method to minimize the occurrence of errors.

## 12.6 Special Monitoring Techniques for Intermittent or Transitory Discharges

The hardest discharges to detect and test are intermittent or transitory discharges to the storm drain system that often have an indirect mode of entry. With some ingenuity, luck, and specialized sampling techniques, however, it may be possible to catch these discharges. This section describes some specific monitoring techniques to track down intermittent discharges. Transitory discharges cannot be reliably detected using conventional outfall monitoring techniques, and are normally found as a result of hotline complaints or spill events. Nevertheless, when transitory discharges are encountered, they should be sampled if possible.

### *Techniques for Monitoring Intermittent Discharges*

An outfall may be suspected of having intermittent discharges based on physical indicators (e.g., staining), poor in-stream dry weather water quality, or the density of generating sites in the contributing subwatershed. The only sure way to detect an intermittent discharge is to camp out at the outfall for a long period of time, which is obviously not very cost-effective or feasible. As an alternative, five special monitoring techniques can be used to help track these elusive problems:

- Odd hours monitoring
- Optical brightener monitoring traps
- Caulk dams
- Pool sampling
- Toxicity monitoring

**Table 48: Evaluation of the Flow Chart Method Using Data from Birmingham, Alabama**
***(Adapted from Pitt* et al.*, 1993)***

| Outfall ID | Outfall Concentrations (mg/L) | | | | | Predicted Flow Type | Confirmed Flow Type | Result |
|---|---|---|---|---|---|---|---|---|
| | Detergents-Surfactants (>0.25 is sanitary or wash water) | NH3 | K | NH3/K (>1.0 is sanitary) | Fluoride (>0.25 is tap, if no detergents) | | | |
| 14 | 0 | 0 | 0.69 | 0.0 | 0.04 | Natural Water | Spring Water | Correct |
| 20 | 0 | 0.03 | 1.98 | 0.0 | 0.61 | Tap Water | Rinse Water (Tap) and Spring Water | Correct |
| 21 | 20 | 0.11 | 5.08 | 0.0 | 2.80 | Washwater | Washwater (Automotive) | Correct |
| 26 | 0 | 0.01 | 0.72 | 0.0 | 0.07 | Natural Water | Spring Water | Correct |
| 28 | 0.25[1] | 2.89 | 5.96 | 0.5 | 0.74 | Washwater | Washwater (Restaurant) | Correct |
| 31 | 0.95 | 0.21 | 3.01 | 0.1 | 1.00 | Washwater | Laundry (Motel) | Correct |
| 40z | 0.25[1] | 0.87 | 0.94 | 0.9 | 0.12 | Washwater | Shallow Groundwater and Septage | Identifies Contaminated but Incorrect Flow Type |
| 42 | 0 | 0 | 0.81 | 0.0 | 0.07 | Natural Water | Spring Water | Correct |
| 48 | 3.0 | 5.62 | 4.40 | 1.3 | 0.53 | Sanitary Wastewater | Spring Water and Sewage | Correct |
| 60a | 0 | 0.31 | 2.99 | 0.1 | 0.61 | Tap Water | Landscaping Irrigation Water | Correct |

*[1] These values were increased from reported values of 0.23 mg/L (outfall 28) and 0.2 mg/L (outfall 40z). The analytical technique used in Birmingham was more precise (but more hazardous) than the method used to develop the flow chart in Figure 47. It is assumed that these values would have been interpreted as 0.25 mg/L using the less precise method.*

## *Odd Hours Monitoring*

Many intermittent discharges actually occur on a regular schedule, but unfortunately not the same one used by field crews during the week. For example, some generating sites discharge over the weekend or during the evening hours. If an outfall is deemed suspicious, program managers may want to consider scheduling "odd hours" sampling at different times of the day or week. Some key times to visit suspicious outfalls include:

- Both morning and afternoon
- Weekday evenings
- Weekend mornings and evenings

## *Optical Brightener Monitoring Traps*

Optical brightener monitoring (OBM) traps are another tool that crews can use to gain insight into the "history" of an outfall without being physically present. OBM traps can be fabricated and installed using a variety of techniques and materials. All configurations involve an absorbent, unbleached cotton pad or fabric swatch and a holding or anchoring device such as

a wire mesh trap (Figure 48) or a section of small diameter (e.g., 2-inch) PVC pipe. Traps are anchored to the inside of outfalls at the invert using wire or monofilament that is secured to the pipe itself or rocks used as temporary weights.

Field crews retrieve the OBM traps after they have been deployed for several days of dry weather, and place them under a fluorescent light that will indicate if they have been exposed to detergents. OBM traps have been used with some success in Massachusetts (Sargent *et al*., 1998) and northern Virginia (Waye, 2000). Although each community used slightly different methods, the basic sampling concept is the same. For more detailed guidance on how to use OBM traps and interpret the results, consult the guidance manual found at: http://www.naturecompass.org/8tb/sampling/index.html and http://www.novaregion.org/obm.htm.

Although OBM traps appear useful in detecting some intermittent discharges, research during this project has found that OBM traps only pick up the most contaminated discharges, and the detergent level needed to produce a "hit" was roughly similar to pure washwater from a washing machine (see Appendix F for results).

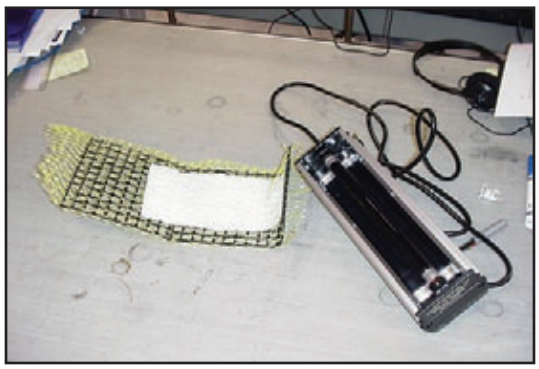


**Figure 48: OBM Equipment includes a black light and an OBM Trap that can be placed at an outfall**
*Source: R. Pitt*

Consequently, OBM traps may be best suited as a simple indicator of presence or absence of intermittent flow or to detect the most concentrated flows. OBM traps need to be retrieved before runoff occurs from the outfalls, which will contaminate the trap or wash it away.

### Caulk Dams

This technique uses caulk, plumber's putty, or similar substance to make a dam about two inches high within the bottom of the storm drain pipe to capture any dry weather flow that occurs between field observations. Any water that has pooled behind the dam is then sampled using a hand-pump sampler, and analyzed in the lab for appropriate indicator parameters.

### Pool Sampling

In this technique, field crews collect indicator samples directly from the "plunge pool" below an outfall, if one is present. An upstream sample is also collected to characterize background stream or ditch water quality that is not influenced by the outfall. The pool water and stream sample are then analyzed for indicator parameters, and compared against each other. Pool sampling results can be constrained by stream dilution, deposition, storm water flows, and chemical reactions that occur within the pool.

### Toxicity Monitoring

Another way to detect intermittent discharges is to monitor for toxicity in the pool below the outfall on a daily basis. Burton and Pitt (2002) outline several options to measure toxicity, some of which can be fairly expensive and complex. The Fort Worth Department of Environmental Management has developed a simple low-cost outfall toxicity testing technique known as the Stream Sentinel program. Stream sentinels

place a bottle filled with minnows in the pool below suspected outfalls and measure the survival rate of the minnows as an indicator of the toxicity of the outfall [12] (see Figure 49).

One advantage of the sentinel program is that volunteer monitors can easily participate, by raising and caring for the minnows, placing bottles at outfalls, and visiting them everyday to record mortality. The long-term nature of sentinel monitoring can help pick up toxicity trends at a given outfall. For example, Fort Worth observed a trend of mass mortality on the second Tuesday of each month at some outfalls, which helped to pinpoint the industry responsible for the discharges, and improved sample scheduling (City of Fort Worth, 2003). More information about the Stream Sentinel program can be found at: www.fortworthgov.org/DEM/stream_sentinel.pdf.







**Figure 49: Float and wire system to suspend a bottle in a stream sentinel station deployed in Fort Worth, TX (a); Minnows in the perforated bottle below the water surface (b).**

Due to the cost and difficulty of interpreting findings, toxicity testing is generally not recommended for communities unless they have prior experience and expertise with the method.

### *Techniques for Monitoring Transitory Discharges*

Transitory discharges, such as spills and illegal dumping, are primarily sampled to assign legal responsibility for enforcement actions or to reinforce ongoing pollution prevention education efforts. In most cases, crews attempt to trace transitory discharges back up the pipe or drainage area using visual techniques (see Chapter 13). However, field crews should always collect a sample to document the event. Table 49 summarizes some follow-up monitoring strategies to document transitory discharges.

## 12.7 Monitoring of Stream Quality During Dry Weather

In-stream water quality monitoring can help detect sewage and other discharges in a community or larger watershed. Stream monitoring can identify the subwatersheds with the greatest illicit or sewage discharge potential that is then used to target outfall indicator monitoring. At the smaller reach scale, stream monitoring may sometimes detect major individual discharges to the stream.

[12] It may be necessary to obtain approval from the appropriate state of federal regulatory agency before conducting toxicity monitoring using vertebrates.

| Table 49: Follow-Up Monitoring for Transitory Discharges | |
|---|---|
| **Condition** | **Response** |
| Oils or solvents | Special hydrocarbon analysis to characterize the source of the oil |
| Unknown but toxic material | Full suite of metals, pesticides, other toxic materials |
| Probable sewage | Monitor for parameters associated with the Flow Chart Technique (detergents, ammonia, potassium, fluoride) for residential drainage areas |

## *Stream Monitoring to Identify Problem Reaches or Subwatersheds*

Stream monitoring data can be used to locate areas in subwatersheds where illicit discharges may be present, and where human or aquatic health risks are higher. To provide this information, stream monitoring should be conducted regularly during dry weather conditions to track water quality (at least monthly) and to document changes in water quality over a period of time. Stream monitoring data are particularly effective when combined with ORI data. For example, a subwatershed with many ORI physical indicators of illicit discharges (e.g., a high number of flowing outfalls) that also has poor stream water quality would be an obvious target for intensive outfall monitoring.

Stream monitoring parameters should reflect local water quality goals and objectives, and frequently include bacteria and ammonia. Bacteria are useful since sewage discharges can contribute to violations of water contact standards set for recreation during dry weather conditions. Table 50 summarizes water quality standards for *E. coli* that EPA recommends for water contact recreation. It is important to note that individual states may use different action levels or bacteria indicators (e.g., Enterococci or fecal coliform) to regulate water contact recreation. For a review of the impacts bacteria exert on surface waters, consult CWP (2000).

An important caveat when interpreting stream monitoring data is that a violation of bacteria standards during dry weather flow does not always mean that an illicit discharge or sewage overflow is present. While raw sewage has bacteria concentrations that greatly exceed bacteria standards (approximately 12,000 MPN/100 mL) other bacteria sources, such as urban wildlife, can also cause a stream to violate standards. Consequently, stream monitoring data need to be interpreted in the context of other information, such as upstream land use, past complaints, age of infrastructure, and ORI surveys.

Ideally, stream monitoring stations should be strategically located with a minimum of one station per subwatershed, and additional stations at stream confluences and downstream of reaches with a high outfall density. Stations should also be located at beaches, shellfish harvesting and other areas where discharges represent a specific threat to public health. See Burton and Pitt (2002) for guidance on stream monitoring.

## *Stream Monitoring to Identify Specific Discharges*

Stream monitoring data can help field crews locate individual discharges within a specific stream reach. Immediate results are needed for this kind of monitoring, so indicator parameters should be analyzed using simple field test kits or portable analytical

instruments (e.g., spectrophotometer). Bacteria is not a good indicator parameter to use for this purpose because lab results cannot be received for at least one day (analytical method requires a "hold time" of 24 hours). Table 51 summarizes nutrient indicator parameters along with their "potential problem level" benchmarks. It is important to note that other factors, such as animal operations, can elevate stream nutrient concentrations, so data should always be interpreted in the context of surrounding land use. Stream monitoring benchmarks should be continuously refined as communities develop a better understanding of what dry weather baseline concentrations to expect.

If stream monitoring indicates that a potential problem level benchmark has been exceeded, field crews continue stream sampling to locate the discharge through a process of elimination. Crews walk upstream taking regular samples above and below stream confluences until the benchmark concentration declines. The crews then take samples at strategic points to narrow down the location of the discharge, using the in-pipe monitoring strategy described in Chapter 13.

**Table 50: Typical "Full Body Contact Recreation" Standards for *E. coli***
*(Source: EPA, 1986)*[1]

| Use | Criterion |
|---|---|
| Designated beach area | 235 MPN /100 mL |
| Moderately-used full body contact recreation area | 298 MPN /100 mL |
| Lightly-used full body contact recreation | 406 MPN /100 mL |
| Infrequently-used full body contact recreation | 576 MPN /100 mL |

*[1] These concentrations represent standards for a single sampling event. In all waters, a geometric mean concentration of 126 MPN/100 mL cannot be exceeded for five samples taken within one month.*

**Table 51: Example In-Stream Nutrient Indicators of Discharges**
*(Zielinski, 2003)*

| Parameter | Potential Problem Level* | Possible Cause of Water Quality Problem |
|---|---|---|
| Total Nitrogen (TN) | 3.5 mg/l | High nutrients in ground water from agriculture, lawn practices, or sewage contamination from illicit connection, sanitary line break or failing septic system. |
| Total Phosphorus (TP) | 0.4 mg/l | Contamination from lawn practices, agriculture, sewage or washwater. |
| Ammonia ($NH_3$) | 0.3 mg/l | Sewage or washwater contamination from illicit connection, sanitary line break or failing septic system. |

**Nutrient parameters are based on USGS NAWQA data with 85% of flow weighted samples being less than these values in urban watersheds (Note: data from Nevada were not used, due to climatic differences and for some parameters they were an order of magnitude higher). Communities can modify these benchmarks to reflect local data and experience.*

## 12.8 The Costs of Indicator Monitoring

This section provides general guidance on scoping and budgeting an indicator monitoring program. The required budget will ultimately be dictated by the monitoring decisions and local conditions within a community. The budgeting data presented in this section are based on the level of indicator sampling effort in two hypothetical communities, using different numbers of samples, indicator parameters, and analysis methods.

### *Budgets for Indicator Monitoring in a Hypothetical Community*

Communities can develop annual budgets for indicator monitoring if the degree of sampling effort can be scoped. This is normally computed based on the expected number of samples to analyze and is a function of stream miles surveyed and outfall density. For example, if a community collects samples from 10 stream miles with eight outfalls per mile, it will have 80 samples to analyze. This number can be used to generate start-up and annual monitoring cost estimates that represent the expected level of sampling effort. Table 52 summarizes how indicator monitoring budgets were developed for two hypothetical communities, each with 80 outfalls to sample. Budgets are shown using both in-house and contract lab set-ups, and are split between initial start-up costs and annual costs.

#### *Community A: Primarily Residential Land Use, Flow Chart Method*

In this scenario, six indicator parameters were analyzed, several of which were used to support the Flow Chart Method. The community took no additional samples to create a chemical library, and instead relied on default values to identify illicit discharges. The community analyzed the samples in-house at a rate of one sample (includes analysis of all six parameters) per staff hour.

#### *Community B: Mixed Land Use - Multiple Potential Sources, Complex Analysis*

In the second scenario, the community analyzed 11 indicator parameters, including a bacteria indicator, and took samples of eight distinct flow types to create a chemical library, for a total of 88 samples. The community analyzed the samples in-house at a rate of one sample per 1.5 staff hours.

Some general rules of thumb that were used for this budget planning example include the following:

- $500 in initial sampling equipment (e.g., sample bottles, latex gloves, dipper, cooler, etc).
- Outfall samples are collected in batches of 10. Each batch of samples can be collected and transported to the lab in two staff days (two-person crew required to collect samples for safety purposes).
- Staff rate is $25/hr.
- Overall effort to collect samples for the chemical library and statistically analyze the data is approximately one staff day per source type.
- The staff time needed to prepare for field work and interpret lab results is roughly two times that required for conducting the field work (i.e., eight days of collecting samples requires 16 days of pre- and post-preparation).

### *Costs for Intermittent Discharge Analyses*

Equipment costs for most specialized intermittent discharge techniques tend to be low (<$500), and are dwarfed by staff effort. As a rule of thumb, assume about four hours of staff time to deploy, retrieve and analyze samples collected from a single outfall using these techniques.

**Table 52: Indicator Monitoring Costs: Two Scenarios**

| | Community A: In-House | Community A: Contract Lab | Community B: In-House | Community B: Contract Lab |
|---|---|---|---|---|
| ***Initial Costs*** | | | | |
| Initial Sampling Supplies and Lab Equipment [1] | $1,700 | $500 | $7,500 | $500 |
| Staff Cost: Library Development [2] | $0 | $0 | $4,600[3] | $2,000 |
| Analysis Costs: Library Development (Reagents or Contract Lab Cost) | $0 | $0 | $1,400 | $13,000[4] |
| **Total Initial Costs** | **$1,700** | **$500** | **$13,500** | **$15,500** |
| ***Annual Costs in Subsequent Years*** | | | | |
| Staff Field Cost (Sample Collection) [2, 5, 6] | $3,200 | $3,200 | $3,200 | $3,200 |
| Staff Costs: Chemical Analysis [2] | $2,000 | $200[7] | $3,000 | $200 |
| Staff Time to Enter/ Interpret Data [2, 6] | $3,200 | $3,200 | $4,800 | $4,800 |
| Analysis Costs: Annual Outfall Sampling (Reagents or Contract Lab Cost) | $600 | $8,400[4] | $1,400 | $13,000[4] |
| ***Total Annual Cost*** | **$9,000** | **$15,000** | **$12,400** | **$21,200** |

*Notes:*
*[1] $500 in initial sampling equipment.*
*[2] Samples can be shipped to a contract lab using one staff hour.*
*[3] Overall effort to collect samples for the library and statistically analyze the data is approximately one staff day per source type.*
*[4] For contract lab analysis, assume a cost that is an average between the two extremes of the range in Table 43.*
*[5] Outfall samples are collected in batches of 10. Each batch of samples can be collected and transported to the lab in two staff days (two-person crew required to collect samples for safety purposes).*
*[6] Assume that the staff time needed to interpret lab results and prepare for field work is roughly 16 staff days. An additional eight days are required for the flow type pre- and post-preparation for Community 2.*
*[7] Staff rate is $25/hr.*

# Chapter 13: Tracking Discharges To A Source

Once an illicit discharge is found, a combination of methods is used to isolate its specific source. This chapter describes the four investigation options that are introduced below.

### *Storm Drain Network Investigation*

Field crews strategically inspect manholes within the storm drain network system to measure chemical or physical indicators that can isolate discharges to a specific segment of the network. Once the pipe segment has been identified, on-site investigations are used to find the specific discharge or improper connection.

### *Drainage Area Investigation*

This method relies on an analysis of land use or other characteristics of the drainage area that is producing the illicit discharge. The investigation can be as simple as a "windshield" survey of the drainage area or a more complex mapping analysis of the storm drain network and potential generating sites. Drainage area investigations work best when prior indicator monitoring reveals strong clues as to the likely generating site producing the discharge.

### *On-site Investigation*

On-site methods are used to trace the source of an illicit discharge in a pipe segment, and may involve dye, video or smoke testing within isolated segments of the storm drain network.

### *Septic System Investigation*

Low-density residential watersheds may require special investigation methods if they are not served by sanitary sewers and/or storm water is conveyed in ditches or swales. The major illicit discharges found in low-density development are failing septic systems and illegal dumping. Homeowner surveys, surface inspections and infrared photography have all been effectively used to find failing septic systems in low-density watersheds.

## 13.1 Storm Drain Network Investigations

This method involves progressive sampling at manholes in the storm drain network to narrow the discharge to an isolated pipe segment between two manholes. Field crews need to make two key decisions when conducting a storm drain network investigation—where to start sampling in the network and what indicators will be used to determine whether a manhole is considered clean or dirty.

### *Where to Sample in the Storm Drain Network*

The field crew should decide how to attack the pipe network that contributes to a problem outfall. Three options can be used:

- Crews can work progressively up the trunk from the outfall and test manholes along the way.
- Crews can split the trunk into equal segments and test manholes at strategic junctions in the storm drain system.
- Crews can work progressively down from the upper parts of the storm drain network toward the problem outfall.

The decision to move up, split, or move down the trunk depends on the nature and land use of the contributing drainage area. Some guidance for making this decision is provided in Table 53. Each option requires different levels of advance preparation. Moving up the trunk can begin immediately when an illicit discharge is detected at the outfall, and only requires a map of the storm drain system. Splitting the trunk and moving down the system require a little more preparation to analyze the storm drain map to find the critical branches to strategically sample manholes. Accurate storm drain maps are needed for all three options. If good mapping is not available, dye tracing can help identify manholes, pipes and junctions, and establish a new map of the storm drain network.

### Option 1: Move up the Trunk

Moving up the trunk of the storm drain network is effective for illicit discharge problems in relatively small drainage areas. Field crews start with the manhole closest to the outfall, and progressively move up the network, inspecting manholes until indicators reveal that the discharge is no longer present (Figure 50). The goal is to isolate the discharge between two storm drain manholes.

**Table 53: Methods to Attack the Storm Drain Network**

| Method | Nature of Investigation | Drainage System | Advance Prep Required |
|---|---|---|---|
| Follow the discharge up | Narrow source of an individual discharge | Small diameter outfall (< 36”) Simple drainage network | No |
| Split into segments | Narrow source of a discharge identified at outfall | Large diameter outfall (> 36”), Complex drainage Logistical or traffic issues may make sampling difficult. | Yes |
| Move down the storm drain | Multiple types of pollution, many suspected problems—possibly due to old plumbing practices or number of NPDES permits | Very large drainage area (> one square mile). | Yes |

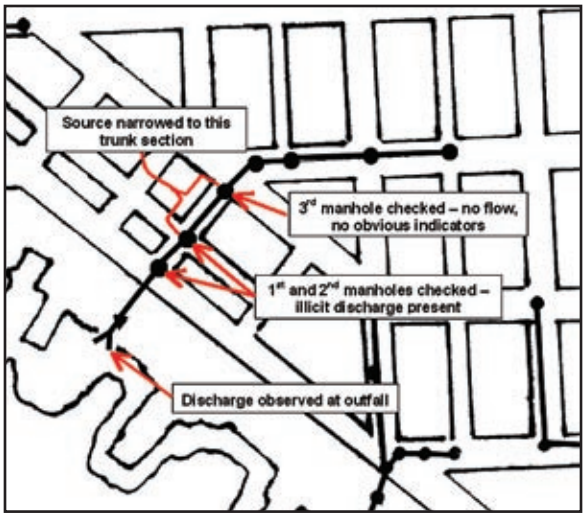



**Figure 50: Example investigation following the source up the storm drain system**

### Option 2: Split the storm drain network

When splitting the storm drain network, field crews select strategic manholes at junctions in the storm drain network to isolate discharges. This option is particularly suited in larger and more complex drainage areas since it can limit the total number of manholes to inspect, and it can avoid locations where access and traffic are problematic.

The method for splitting the trunk is as follows:

1. Review a map of the storm drain network leading to the suspect outfall.
2. Identify major contributing branches to the trunk. The trunk is defined as the largest diameter pipe in the storm drain network that leads directly to the outfall. The "branches" are networks of smaller pipes that contribute to the trunk.
3. Identify manholes to inspect at the farthest downstream node of each contributing branch and one immediately upstream (Figure 51).
4. Working up the network, investigate manholes on each contributing branch and trunk, until the source is narrowed to a specific section of the trunk or contributing branch.
5. Once the discharge is narrowed to a specific section of trunk, select the appropriate on-site investigation method to trace the exact source.
6. If narrowed to a contributing branch, move up or split the branch until a specific pipe segment is isolated, and commence the appropriate on-site investigation to determine the source.

### Option 3: Move down the storm drain network

In this option, crews start by inspecting manholes at the "headwaters" of the storm drain network, and progressively move down pipe. This approach works best in very large drainage areas that have many potential continuous and/or intermittent discharges. The Boston Water and Sewer Commission has employed the headwater option to investigate intermittent discharges in complex drainage areas up to three square miles (Jewell, 2001). Field crews certify that each upstream branch of the storm drain network has no contributing discharges before moving down pipe to a "junction manhole" (Figure 52). If discharges are found, the crew performs dye testing to pinpoint the discharge. The crew then confirms that the discharge is removed before moving farther down the pipe network. Figure 53 presents a detailed flow chart that describes this option for analyzing the storm drain network.

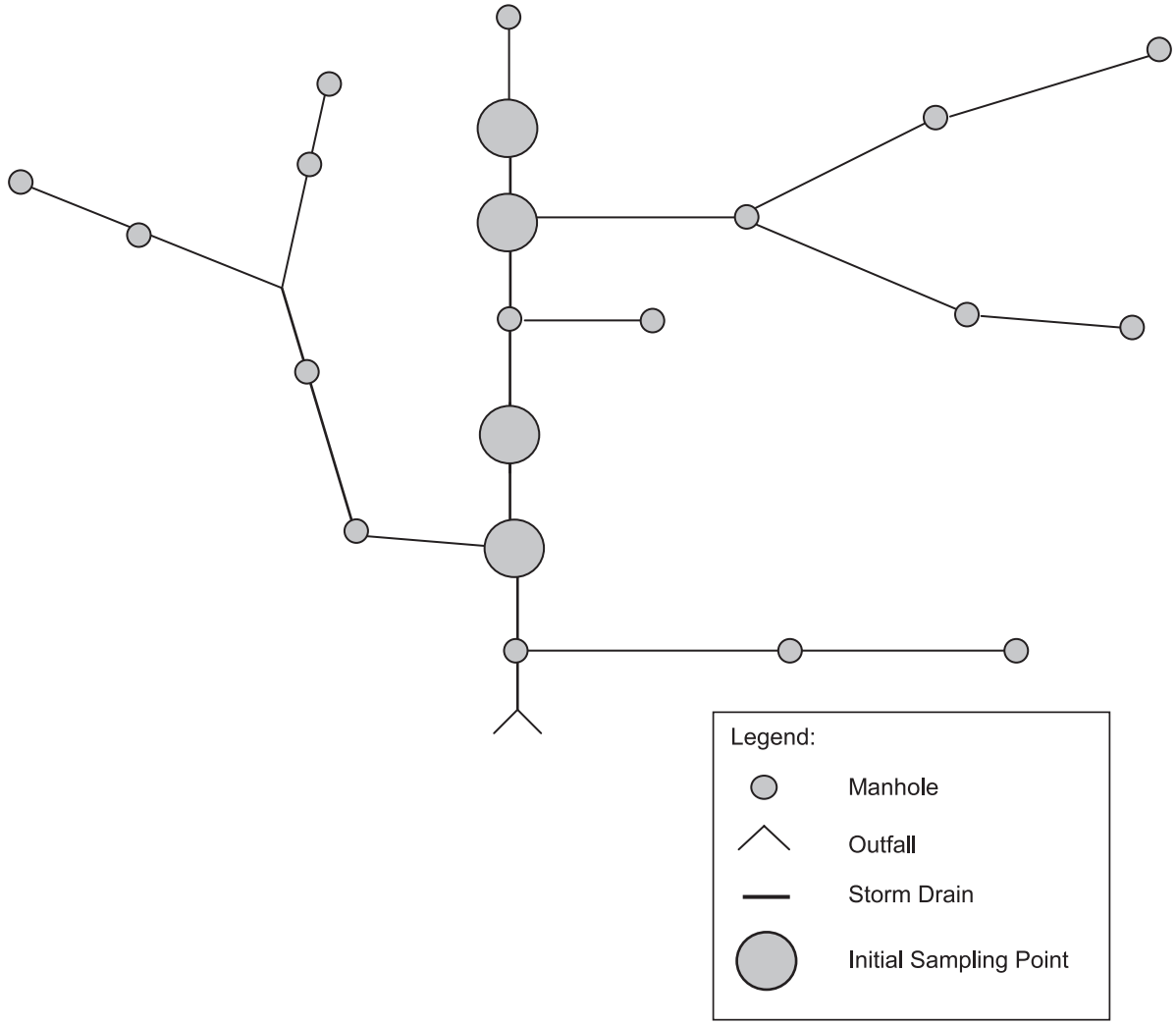



**Figure 51: Key initial sampling points along the trunk of the storm drain**

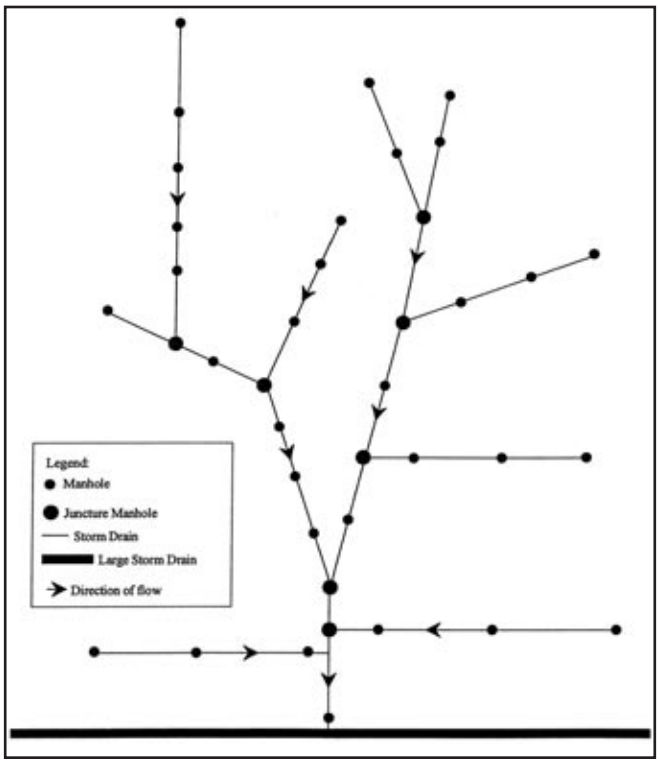



**Figure 52: Storm Drain Schematic Identifying "Juncture Manholes" (Source: Jewell, 2001)**

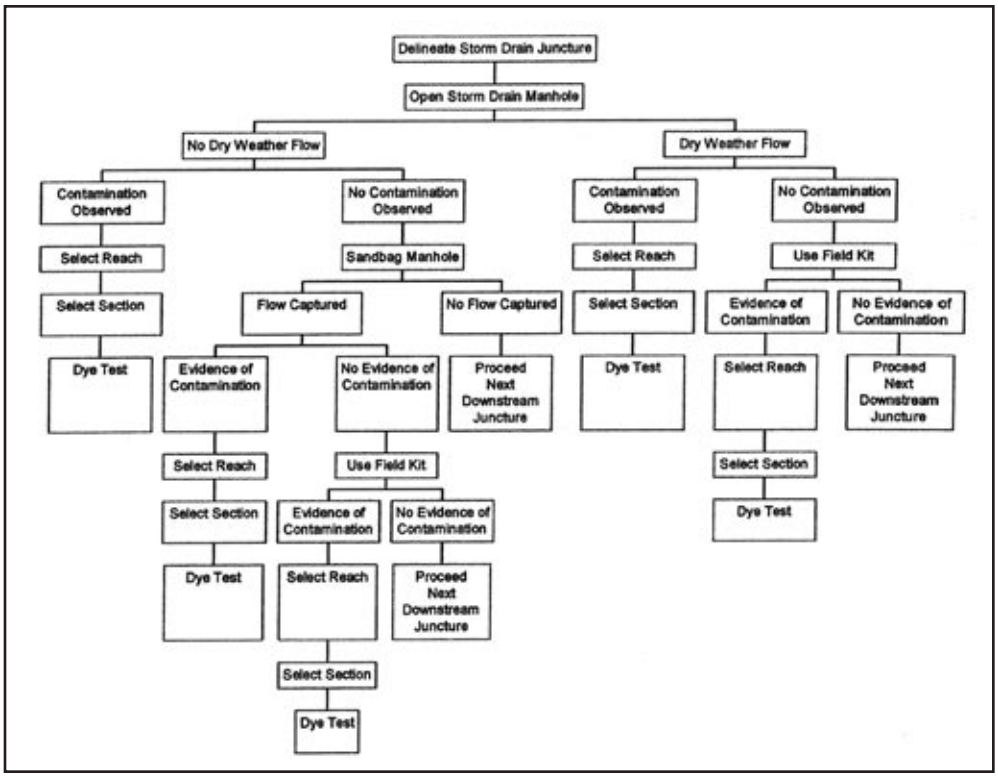



**Figure 53: A Process for Following Discharges Down the Pipe (Source: Jewell, 2001)**

## Dye Testing to Create a Storm Drain Map

As noted earlier, storm drain network investigations are extremely difficult to perform if accurate storm drain maps are not available. In these situations, field crews may need to resort to dye testing to determine the flowpath within the storm drain network. Fluorescent dye is introduced into the storm drain network and suspected manholes are then inspected to trace the path of flow through the network (U.S. EPA, 1990). Two or three member crews are needed for dye testing. One person drops the dye into the trunk while the other(s) looks for evidence of the dye down pipe.

To conduct the investigation, a point of interest or down pipe "stopping point" is identified. Dye is then introduced into manholes upstream of the stopping point to determine if they are connected. The process continues in a systematic manner until an upstream manhole can no longer be determined, whereby a branch or trunk of the system can be defined, updated or corrected. More information on dye testing methods is provided in Section 13.3.

## Manhole Inspection: Visual Observations and Indicator Sampling

Two primary methods are used to characterize discharges observed during manhole inspections—visual observations and indicator sampling. In both methods, field crews must first open the manhole to determine whether an illicit discharge is present. Manhole inspections require a crew of two and should be conducted during dry weather conditions.

Basic field equipment and safety procedures required for manhole inspections are outlined in Table 54. In particular, field crews need to be careful about how they will safely divert traffic (Figure 54). Other safety considerations include proper lifting of manhole covers to reduce the potential for back injuries, and testing whether any toxic or flammable fumes exist within the manhole before the cover is removed. Wayne County, MI has developed some useful operational procedures for inspecting manholes, which are summarized in Table 55.

**Table 54: Basic Field Equipment Checklist**

- Camera and film or digital camera
- Clipboards
- Field sheets
- Field vehicle
- First aid kit
- Flashlight or spotlight
- Gas monitor and probe
- Manhole hook/crow bar
- Mirror
- Storm drain, stream, and street maps
- Reflective safety vests
- Rubber / latex gloves
- Sledgehammer
- Spray paint
- Tape measures
- Traffic cones
- Two-way radios
- Waterproof marker/ pen
- Hand held global positioning satellite (GPS) system receiver (best resolution available within budget, at least 6' accuracy)



**Figure 54: Traffic cones divert traffic from manhole inspection area**

**Table 55: Field Procedure for Removal of Manhole Covers**
*(Adapted from: Pomeroy et al., 1996)*

**Field Procedures:**

1. Locate the manhole cover to be removed.
2. Divert road and foot traffic away from the manhole using traffic cones.
3. Use the tip of a crowbar to lift the manhole cover up high enough to insert the gas monitor probe. Take care to avoid creating a spark that could ignite explosive gases that may have accumulated under the lid. Follow procedures outlined for the gas monitor to test for accumulated gases.
4. If the gas monitor alarm sounds, close the manhole immediately. Do not attempt to open the manhole until some time is allowed for gases to dissipate.
5. If the gas monitor indicates the area is clear of hazards, remove the monitor probe and position the manhole hook under the flange. Remove the crowbar. Pull the lid off with the hook.
6. When testing is completed and the manhole is no longer needed, use the manhole hook to pull the cover back in place. Make sure the lid is settled in the flange securely.
7. Check the area to ensure that all equipment is removed from the area prior to leaving.

**Safety Considerations:**

1. Do not lift the manhole cover with your back muscles.
2. Wear steel-toed boots or safety shoes to protect feet from possible crushing injuries that could occur while handling manhole covers.
3. Do not move manhole covers with hands or fingers.
4. Wear safety vests or reflective clothing so that the field crew will be visible to traffic.
5. Manholes may only be entered by properly trained and equipped personnel and when all OSHA and local rules a.

## *Visual Observations During Manhole Inspection*

Visual observations are used to observe conditions in the manhole and look for any signs of sewage or dry weather flow. Visual observations work best for obvious illicit discharges that are not masked by groundwater or other "clean" discharges, as shown in Figure 55. Typically, crews progressively inspect manholes in the storm drain network to look for contaminated flows. Key visual observations that are made during manhole inspections include:

- Presence of flow
- Colors
- Odors
- Floatable materials
- Deposits or stains (intermittent flows)



**Figure 55: Manhole observation (left) indicates a sewage discharge. Source is identified at an adjacent sewer manhole that overflowed into the storm drain system (right).**

### Indicator Sampling

If dry weather flow is observed in the manhole, the field crew can collect a sample by attaching a bucket or bottle to a tape measure/rope and lowering it into the manhole (Figure 56). The sample is then immediately analyzed in the field using probes or other tests to get fast results as to whether the flow is clean or dirty. The most common indicator parameter is ammonia, although other potential indicators are described in Chapter 12.

Manhole indicator data is analyzed by looking for "hits," which are individual samples that exceed a benchmark concentration. In addition, trends in indicator concentrations are also examined throughout the storm drain network.



**Figure 56: Techniques to sample from the storm drain**

Figure 57 profiles a storm drain network investigation that used ammonia as the indicator parameter and a benchmark concentration of 1.0 mg/L. At both the outfall and the first manhole up the trunk, field crews recorded finding "hits" for ammonia of 2.2 mg/L and 2.3 mg/L, respectively. Subsequent manhole inspections further up the network revealed one manhole with no flow, and a second with a hit for ammonia (2.4 mg/L). The crew then tracked the discharge upstream of the second manhole, and found a third manhole with a low ammonia reading (0.05 mg/L) and a fourth with a much higher reading (4.3 mg/L). The crew then redirected its effort to sample above the fourth manhole with the 4.3 mg/L concentration, only to find another low reading. Based on this pattern, the crew concluded the discharge source was located between these two manholes, as nothing else could explain this sudden increase in concentration over this length of pipe.

The results of storm drain network investigations should be systematically documented to guide future discharge investigations, and describe any infrastructure maintenance problems encountered. An example of a sample manhole inspection field log is displayed in Figure 58.

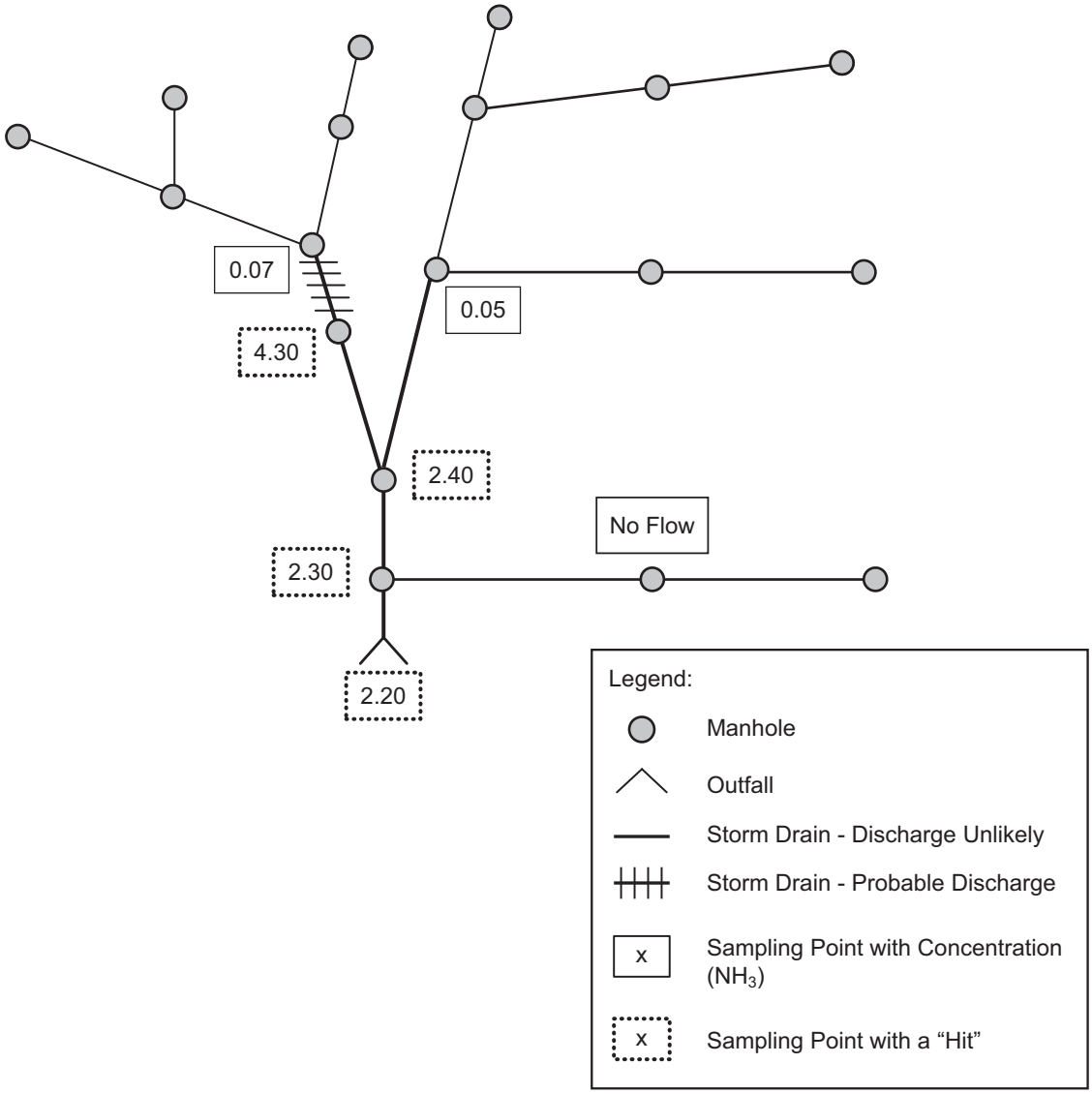
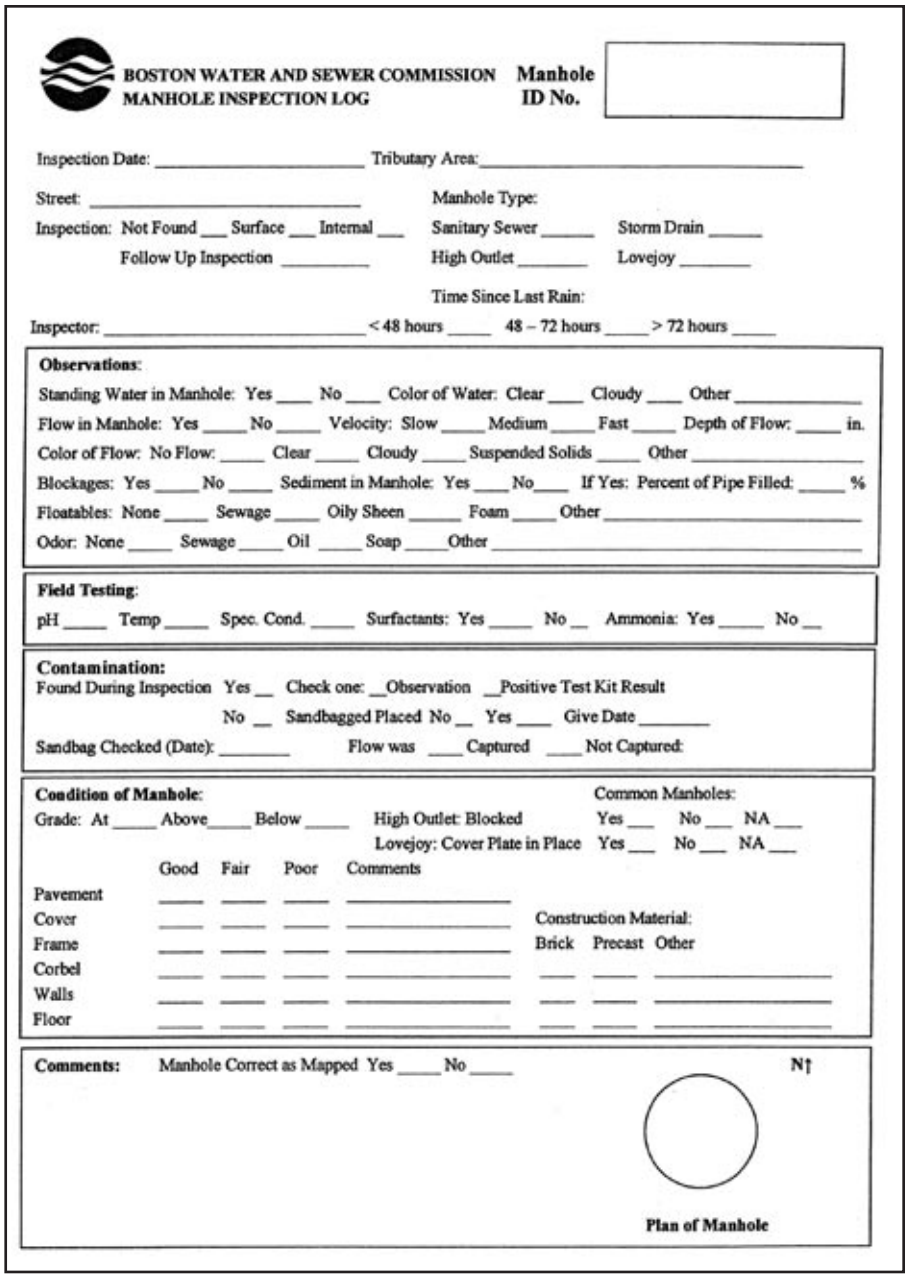



**Figure 57: Use of ammonia as a trace parameter to identify illicit discharges**



**BOSTON WATER AND SEWER COMMISSION**
**MANHOLE INSPECTION LOG**

**Manhole ID No.** _____

Inspection Date: _____ Tributary Area: _____

Street: _____ Manhole Type:

Inspection: Not Found ___ Surface ___ Internal ___ Sanitary Sewer _____ Storm Drain _____

Follow Up Inspection _____ High Outlet _____ Lovejoy _____

Time Since Last Rain:

Inspector: _____ < 48 hours _____ 48 – 72 hours _____ > 72 hours _____

**Observations:**

Standing Water in Manhole: Yes ____ No ____ Color of Water: Clear ____ Cloudy ____ Other _____

Flow in Manhole: Yes _____ No _____ Velocity: Slow _____ Medium _____ Fast _____ Depth of Flow: _____ in.

Color of Flow: No Flow: _____ Clear _____ Cloudy _____ Suspended Solids _____ Other _____

Blockages: Yes _____ No _____ Sediment in Manhole: Yes ____ No____ If Yes: Percent of Pipe Filled: _____ %

Floatables: None _____ Sewage _____ Oily Sheen _____ Foam _____ Other _____

Odor: None _____ Sewage _____ Oil _____ Soap _____ Other _____

**Field Testing:**

pH _____ Temp _____ Spec. Cond. _____ Surfactants: Yes _____ No __ Ammonia: Yes _____ No __

**Contamination:**

Found During Inspection Yes __ Check one: __Observation __Positive Test Kit Result

No __ Sandbagged Placed No __ Yes ____ Give Date _____

Sandbag Checked (Date): _____ Flow was ____ Captured ____ Not Captured:

**Condition of Manhole:**

Grade: At _____ Above _____ Below _____ High Outlet: Blocked Yes ___ No ___ NA ___

Lovejoy: Cover Plate in Place Yes ___ No ___ NA ___

Common Manholes:

| | Good | Fair | Poor | Comments | Construction Material: Brick | Precast | Other |
|---|---|---|---|---|---|---|---|
| Pavement | ____ | ____ | ____ | _____ | | | |
| Cover | ____ | ____ | ____ | _____ | | | |
| Frame | ____ | ____ | ____ | _____ | | | |
| Corbel | ____ | ____ | ____ | _____ | ___ | ___ | _____ |
| Walls | ____ | ____ | ____ | _____ | ___ | ___ | _____ |
| Floor | ____ | ____ | ____ | _____ | ___ | ___ | _____ |

**Comments:** Manhole Correct as Mapped Yes _____ No _____

N↑

**Plan of Manhole**

**Figure 58: Boston Water and Sewer Commission Manhole Inspection Log (Source: Jewell, 2001)**

## *Methods to isolate intermittent discharges in the storm drain network*

Intermittent discharges are often challenging to trace in the storm drain network, although four techniques have been used with some success.

### *Sandbags*

This technique involves placement of sandbags or similar barriers within strategic manholes in the storm drain network to form a temporary dam that collects any intermittent flows that may occur. Any flow collected behind the sandbag is then assessed using visual observations or by indicator sampling. Sandbags are lowered on a rope through the manhole to form a dam along the bottom of the storm drain, taking care not to fully block the pipe (in case it rains before the sandbag is retrieved). Sandbags are typically installed at junctions in the network to eliminate contributing branches from further consideration (Figure 59). If no flow collects behind the sandbag, the upstream pipe network can be ruled out as a source of the intermittent discharge.

Sandbags are typically left in place for no more than 48 hours, and should only be installed when dry weather is forecast. Sandbags should not be left in place during a heavy rainstorm. They may cause a blockage in the storm drain, or, they may be washed downstream and lost. The biggest downside to sandbagging is that it requires at least two trips to each manhole.

### *Optical Brightener Monitoring (OBM) Traps*

Optical brightener monitoring (OBM) traps, profiled in Chapter 12, can also be used to detect intermittent flows at manhole junctions. When these absorbent pads are anchored in the pipe to capture dry weather flows, they can be used to determine the presence of flow and/or detergents. These OBM traps are frequently installed by lowering them into an open-grate drop inlet or storm drain inlet, as shown in Figure 60. The pads are then retrieved after 48 hours and are observed under a fluorescent light (this method is most reliable for undiluted washwaters).

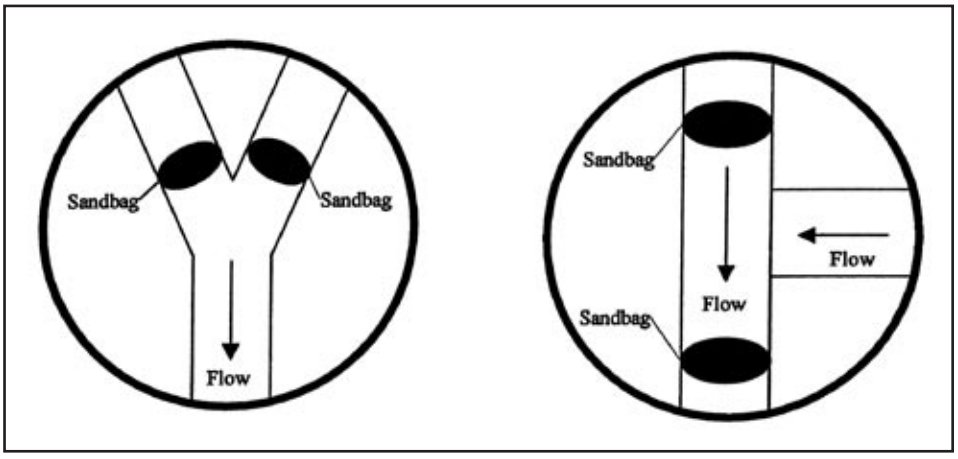



**Figure 59: Example sandbag placement (Source: Jewell, 2001)**



**Figure 60: Optical Brightener Placement in the Storm Drain**
*(Source: Sargent and Castonguay, 1998)*

### *Automatic Samplers*

A few communities have installed automated samplers at strategic points within the storm drain network system that are triggered by small dry weather flows and collect water quality samples of intermittent discharges. Automated sampling can be extremely expensive, and is primarily used in very complex drainage areas that have severe intermittent discharge problems. Automated samplers can pinpoint the specific date and hours when discharges occur, and characterize its chemical composition, which can help crews fingerprint the generating source.

### *Observation of Deposits or Stains*

Intermittent discharges often leave deposits or stains within the storm drain pipe or manhole after they have passed. Thus, crews should note whether any deposits or stains are present in the manhole, even if no dry weather flow is observed. In some cases, the origin of the discharge can be surmised by collecting indicator samples in the water ponded within the manhole sump. Stains and deposits, however, are not always a conclusive way to trace intermittent discharges in the storm drain network.

## 13.2 Drainage Area Investigations

The source of some illicit discharges can be determined through a survey or analysis of the drainage area of the problem outfall. The simplest approach is a rapid windshield survey of the drainage area to find the potential discharger or generating sites. A more sophisticated approach relies on an analysis of available GIS data and permit databases to identify industrial or other generating sites. In both cases, drainage area investigations are only effective if the discharge observed at an outfall has distinct or unique characteristics that allow crews to quickly ascertain the probable operation or business that is generating it. Often, discharges with a unique color, smell, or off-the-chart indicator sample reading may point to a specific industrial or commercial source. Drainage area investigations are not helpful in tracing sewage discharges, since they are often not always related to specific land uses or generating sites.

### *Rapid Windshield Survey*

A rapid drive-by survey works well in small drainage areas, particularly if field crews are already familiar with its business operations. Field crews try to match the characteristics of the discharge to the most likely type of generating site, and then inspect all of the sites of the same type within the drainage area until the culprit is found. For example, if fuel is observed at an outfall, crews might quickly check every business operation in the catchment that stores or dispenses fuel. Another example is illustrated in Figure 61 where extremely dense algal growth was observed in a small stream during the winter. Field crews were aware of a fertilizer storage site in the drainage area, and a quick inspection identified it as the culprit.



**Figure 61: Symptom (left): Discoloration of stream; Diagnosis: Extra hydroseed leftover from an upstream application (middle) was dumped into a storm drain by municipal officials (right).**

A third example of the windshield survey approach is shown in Figure 62, where a very thick, sudsy and fragrant discharge was noted at a small outfall. The discharge appeared to consist of wash water, and the only commercial laundromat found upstream was confirmed to be the source. On-site testing may still be needed to identify the specific plumbing or connection generating the discharge.

### *Detailed Drainage Area Investigations*

In larger or more complex drainage areas, GIS data can be analyzed to pinpoint the source of a discharge. If only general land use data exist, maps can at least highlight suspected industrial areas. If more detailed SIC code data are available digitally, the GIS can be used to pull up specific hotspot operations or generating sites that could be potential dischargers. Some of the key discharge indicators that are associated with hotspots and specific industries are reviewed in Appendix K.

## 13.3 On-site Investigations

On-site investigations are used to pinpoint the exact source or connection producing a discharge within the storm drain network. The three basic approaches are dye, video and smoke testing. While each approach can determine the actual source of a discharge, each needs to be applied under the right conditions and test limitations (see Table 56). It should be noted that on-site investigations are not particularly effective in finding *indirect* discharges to the storm drain network.




**Figure 62: The sudsy, fragrant discharge (left) indicates that the laundromat is the more likely culprit than the florist (right).**

| Table 56: Techniques to Locate the Discharge | | |
|---|---|---|
| **Technique** | **Best Applications** | **Limitations** |
| Dye Testing | • Discharge limited to a very small drainage area (<10 properties is ideal)<br>• Discharge probably caused by a connection from an individual property<br>• Commercial or industrial land use | • May be difficult to gain access to some properties |
| Video Testing | • Continuous discharges<br>• Discharge limited to a single pipe segment<br>• Communities who own equipment for other investigations | • Relatively expensive equipment<br>• Cannot capture non-flowing discharges<br>• Often cannot capture discharges from pipes submerged in the storm drain |
| Smoke Testing | • Cross-connection with the sanitary sewer<br>• Identifying other underground sources (e.g., leaking storage techniques) caused by damage to the storm drain | • Poor notification to public can cause alarm<br>• Cannot detect all illicit discharges |

**TIP**

The Wayne County Department of the Environment provides excellent training materials on on-site investigations, as well as other illicit discharge techniques. More information about this training can be accessed from their website: http://www.wcdoe.org/Watershed/Programs___Srvcs_/IDEP/idep.htm.



**Figure 63: Dye Testing Plumbing (NEIWPCC, 2003)**

## *Dye Testing*

Dye testing is an excellent indicator of illicit connections and is conducted by introducing non-toxic dye into toilets, sinks, shop drains and other plumbing fixtures (see Figure 63). The discovery of dye in the storm drain, rather than the sanitary sewer, conclusively determines that the illicit connection exists.

Before commencing dye tests, crews should review storm drain and sewer maps to identify lateral sewer connections and how they can be accessed. In addition, property owners must be notified to obtain entry permission. For industrial or commercial properties, crews should carry a letter to document their legal authority to gain access to the property. If time permits, the letter can be sent in advance of the dye testing. For residential properties, communication can be more challenging. Unlike commercial properties, crews are not guaranteed access to homes, and should call ahead to ensure that the owner will be home on the day of testing.

Communication with other local agencies is also important since any dye released to the storm drain could be mistaken for a spill or pollution episode. To avoid a costly and embarrassing response to a false alarm,

crews should contact key spill response agencies using a "quick fax" that describes when and where dye testing is occurring (Tuomari and Thomson, 2002). In addition, crews should carry a list of phone numbers to call spill response agencies in the event dye is released to a stream.

At least two staff are needed to conduct dye tests – one to flush dye down the plumbing fixtures and one to look for dye in the downstream manhole(s). In some cases, three staff may be preferred, with two staff entering the private residence or building for both safety and liability purposes.

The basic equipment to conduct dye tests is listed in Table 57 and is not highly specialized. Often, the key choice is the type of dye to use for testing. Several options are profiled in Table 58. In most cases, liquid dye is used, although solid dye tablets can also be placed in a mesh bag and lowered into the manhole on a rope (Figure 64). If a

**Table 57: Key Field Equipment for Dye Testing**
*(Source: Wayne County, MI, 2000)*

**Maps, Documents**
- Sewer and storm drain maps (sufficient detail to locate manholes)
- Site plan and building diagram
- Letter describing the investigation
- Identification (e.g., badge or ID card)
- Educational materials (to supplement pollution prevention efforts)
- List of agencies to contact if the dye discharges to a stream.
- Name of contact at the facility

**Equipment to Find and Lift the Manhole Safely (small manhole often in a lawn)**
- Probe
- Metal detector
- Crow bar
- Safety equipment (hard hats, eye protection, gloves, safety vests, steel-toed boots, traffic control equipment, protective clothing, gas monitor)

**Equipment for Actual Dye Testing and Communications**
- 2-way radio
- Dye (liquid or "test strips")
- High powered lamps or flashlights
- Water hoses
- Camera



**Figure 64: Dye in a mesh bag is placed into an upstream manhole (left); Dye observed at a downstream manhole traces the path of the storm drain (right)**

longer pipe network is being tested, and dye is not expected to appear for several hours, charcoal packets can be used to detect the dye (GCHD, 2002). Charcoal packets can be secured and left in place for a week or two, and then analyzed for the presence of dye. Instructions for using charcoal packets in dye testing can be accessed at the following website: http://bayinfo.tamug.tamu.edu/gbeppubs/ms4.pdf.

The basic drill for dye tests consists of three simple steps. First, flush or wash dye down the drain, fixture or manhole. Second, pop open downgradient sanitary sewer manholes and check to see if any dye appears. If none is detected in the sewer manhole after an hour or so, check downgradient storm drain manholes or outfalls for the presence of dye. Although dye testing is fairly straightforward, some tips to make testing go more smoothly are offered in Table 59.

**Table 58: Dye Testing Options**

| Product | Applications |
|---|---|
| Dye Tablets | • Compressed powder, useful for releasing dye over time<br>• Less messy than powder form<br>• Easy to handle, no mess, quick dissolve<br>• Flow mapping and tracing in storm and sewer drains<br>• Plumbing system tracing<br>• Septic system analysis<br>• Leak detection |
| Liquid Concentrate | • Very concentrated, disperses quickly<br>• Works well in all volumes of flow<br>• Recommended when metering of input is required<br>• Flow mapping and tracing in storm and sewer drains<br>• Plumbing system tracing<br>• Septic system analysis<br>• Leak detection |
| Dye Strips | • Similar to liquid but less messy |
| Powder | • Can be very messy and must dissolve in liquid to reach full potential<br>• Recommended for very small applications or for very large applications where liquid is undesirable<br>• Leak detection |
| Dye Wax Cakes | • Recommended for moderate-sized bodies of water<br>• Flow mapping and tracing in storm and sewer drains |
| Dye Wax Donuts | • Recommended for large sized bodies of water (lakes, rivers, ponds)<br>• Flow mapping and tracing in storm and sewer drains<br>• Leak detection |

**Table 59: Tips for Successful Dye Testing**
***(Adapted from Tuomari and Thompson, 2002)***

**Dye Selection**
- Green and liquid dyes are the easiest to see.
- Dye test strips can be a good alternative for residential or some commercial applications. (Liquid can leave a permanent stain).
- Check the sanitary sewer before using dyes to get a "base color." In some cases, (e.g., a print shop with a permitted discharge to the sanitary sewer), the sewage may have an existing color that would mask a dye.
- Choose two dye colors, and alternate between them when testing multiple fixtures.

**Selecting Fixtures to Test**
- Check the plumbing plan for the site to isolate fixtures that are separately connected.
- For industrial facilities, check most floor drains (these are often misdirected).
- For plumbing fixtures, test a representative fixture (e.g., a bathroom sink).
- Test some locations separately (e.g., washing machines and floor drains), which may be misdirected.
- If conducting dye investigations on multiple floors, start from the basement and work your way up.
- At all fixtures, make sure to flush with plenty of water to ensure that the dye moves through the system.

**Selecting a Sewer Manhole for Observations**
- Pick the closest manhole possible to make observations (typically a sewer lateral).
- If this is not possible, choose the nearest downstream manhole.

**Communications Between Crew Members**
- The individual conducting the dye testing calls in to the field person to report the color dye used, and when it is dropped into the system.
- The field person then calls back when dye is observed in the manhole.
- If dye is not observed (e.g., after two separate flushes have occurred), dye testing is halted until the dye appears.

**Locating Missing Dye**
- The investigation is not complete until the dye is found. Some reasons for dye not appearing include:
- The building is actually hooked up to a septic system.
- The sewer line is clogged.
- There is a leak in the sewer line or lateral pipe.

## *Video Testing*

Video testing works by guiding a mobile video camera through the storm drain pipe to locate the actual connection producing an illicit discharge. Video testing shows flows and leaks within the pipe that may indicate an illicit discharge, and can show cracks and other pipe damage that enable sewage or contaminated water to flow into the storm drain pipe.

Video testing is useful when access to properties is constrained, such as residential neighborhoods. Video testing can also be expensive, unless the community already owns and uses the equipment for sewer inspections. This technique will not detect all types of discharges, particularly when the illicit connection is not flowing at the time of the video survey.

Different types of video camera equipment are used, depending on the diameter and condition of the storm sewer being tested.

Field crews should review storm drain maps, and preferably visit the site before selecting the video equipment for the test. A field visit helps determine the camera size needed to fit into the pipe, and if the storm drain has standing water.

In addition to standard safety equipment required for all manhole inspections, video testing requires a Closed-Circuit Television (CCTV) and supporting items. Many commercially available camera systems are specifically adapted to televise storm sewers, ranging from large truck or van-mounted systems to much smaller portable cameras. Cameras can be self-propelled or towed. Some specifications to look for include:

- The camera should be capable of radial view for inspection of the top, bottom, and sides of the pipe and for looking up lateral connections.
- The camera should be color.
- Lighting should be supplied by a lamp on the camera that can light the entire periphery of the pipe.

When inspecting the storm sewer, the CCTV is oriented to keep the lens as close as possible to the center of the pipe. The camera can be self-propelled through the pipe using a tractor or crawler unit or it may be towed through on a skid unit (see Figures 65 and 66). If the storm drain has ponded water, the camera should be attached to a raft, which floats through the storm sewer from one manhole to the next. To see details of the sewer, the camera and lights should be able to swivel both horizontally and vertically. A video record of the inspection should be made for future reference and repairs (see Figure 67).

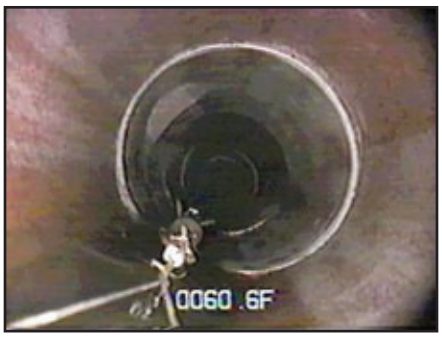



**Figure 65: Camera being towed**

## *Smoke Testing*

Smoke testing is another "bottom up" approach to isolate illicit discharges. It works by introducing smoke into the storm drain system and observing where the smoke surfaces. The use of smoke testing to detect illicit discharges is a relatively new application, although many communities have used it to check for infiltration and inflow into their sanitary sewer network. Smoke testing can find improper



**Figure 66: Tractor-mounted camera**



**Figure 67: Review of an inspection video**

connections, or damage to the storm drain system (Figure 68). This technique works best when the discharge is confined to the upper reaches of the storm drain network, where pipe diameters are to small for video testing and gaining access to multiple properties renders dye testing infeasible.

Notifying the public about the date and purpose of smoke testing before starting is critical. The smoke used is non-toxic, but can cause respiratory irritation, which can be a problem for some residents. Residents should be notified at least two weeks prior to testing, and should be provided the following information (Hurco Technologies, Inc., 2003):

- Date testing will occur
- Reason for smoke testing
- Precautions they can take to prevent smoke from entering their homes or businesses
- What they need to do if smoke enters their home or business, and any health concerns associated with the smoke
- A number residents can call to relay any particular health concerns (e.g., chronic respiratory problems)

Program managers should also notify local media to get the word out if extensive smoke testing is planned (e.g., television, newspaper, and radio). On the actual day of testing, local fire, police departments and 911 call centers should be notified to handle any calls from the public (Hurco Technologies, Inc., 2003).

The basic equipment needed for smoke testing includes manhole safety equipment, a smoke source, smoke blower, and sewer plugs. Two smoke sources can be used for smoke testing. The first is a smoke "bomb," or "candle" that burns at a controlled rate and releases very white smoke visible at relatively low concentrations (Figure 69). Smoke bombs are suspended beneath a blower in a manhole. Candles are available in 30 second to three minute sizes. Once opened, smoke bombs should be kept in a dry location and should be used within one year.

The second smoke source is liquid smoke, which is a petroleum-based product that is injected into the hot exhaust of a blower where it is heated and vaporized (Figure 70). The length of smoke production can vary depending on the length of the pipe being

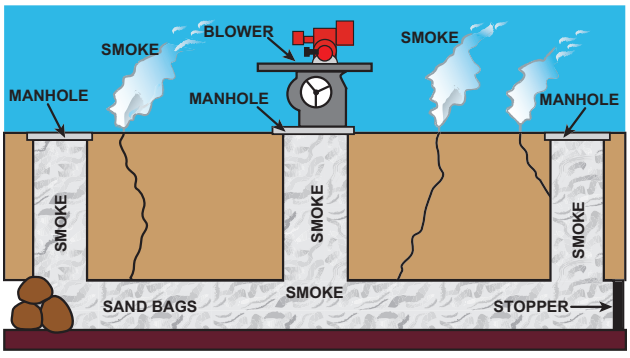



**Figure 68: Smoke Testing System Schematic**



**Figure 69: Smoke Candles**



**Figure 70: Smoke blower**

tested. In general, liquid smoke is not as consistently visible and does not travel as far as smoke from bombs (USA Blue Book).

Smoke blowers provide a high volume of air that forces smoke through the storm drain pipe. Two types of blowers are commonly used: "squirrel cage" blowers and direct-drive propeller blowers. Squirrel cage blowers are large and may weigh more than 100 pounds, but allow the operator to generate more controlled smoke output. Direct-drive propeller blowers are considerably lighter and more compact, which allows for easier transport and positioning.

Three basic steps are involved in smoke testing. First, the storm drain is sealed off by plugging storm drain inlets. Next, the smoke is released and forced by the blower through the storm drain system. Lastly, the crew looks for any escape of smoke above-ground to find potential leaks.

One of three methods can be used to seal off the storm drain. Sandbags can be lowered into place with a rope from the street surface. Alternatively, beach balls that have a diameter slightly larger than the drain can be inserted into the pipe. The beach ball is then placed in a mesh bag with a rope attached to it so it can be secured and retrieved. If the beach ball gets stuck in the pipe, it can simply be punctured, deflated and removed. Finally, expandable plugs are available, and may be inserted from the ground surface.

Blowers should be set up next to the open manhole after the smoke is started. Only one manhole is tested at a time. If smoke candles are used, crews simply light the candle, place it in a bucket, and lower it in the manhole. The crew then watches to see where smoke escapes from the pipe. The two most common situations that indicate an illicit discharge are when smoke is seen rising from internal plumbing fixtures (typically reported by residents) or from sewer vents. Sewer vents extend upward from the sewer lateral to release gas buildup, and are not supposed to be connected to the storm drain system.

## 13.4 Septic System Investigations

The techniques for tracing illicit discharges are different in rural or low-density residential watersheds. Often, these watersheds lack sanitary sewer service and storm water is conveyed through ditches or swales, rather than enclosed pipes. Consequently, many illicit discharges enter the stream as indirect discharges, through surface breakouts of septic fields or through straight pipe discharges from bypassed septic systems.

The two broad techniques used to find individual septic systems—on-site investigations and infrared imagery—are described in this section.

## On-Site Septic Investigations

Three kinds of on-site investigations can be performed at individual properties to determine if the septic system is failing, including homeowner survey, surface condition analysis and a detailed system inspection. The first two investigations are rapid and relatively simple assessments typically conducted in targeted watershed areas. Detailed system inspections are a much more thorough investigation of the functioning of the septic system that is conducted by a certified professional. Detailed system inspections may occur at time of sale of a property, or be triggered by poor scores on the rapid homeowner survey or surface condition analysis.

### Homeowner Survey

The homeowner survey consists of a brief interview with the property owner to determine the potential for current or future failure of the septic system, and is often done in conjunction with a surface condition analysis.

Table 60 highlights some common questions to ask in the survey, which inquire about resident behaviors, system performance and maintenance activity.

### Surface Condition Analysis

The surface condition analysis is a rapid site assessment where field crews look for obvious indicators that point to current or potential production of illicit discharges by the septic system (Figure 71). Some of the key surface conditions to analyze have been described by Andrews *et al*., (1997) and are described below:

- Foul odors in the yard
- Wet, spongy ground; lush plant growth; or burnt grass near the drain field
- Algal blooms or excessive weed growth in adjacent ditches, ponds and streams
- Shrubs or trees with root damage within 10 feet of the system
- Cars, boats, or other heavy objects located over the field that could crush lateral pipes
- Storm water flowing over the drain field
- Cave-ins or exposed system components
- Visible liquid on the surface of the drain field (e.g., surface breakouts)
- Obvious system bypasses (e.g., straight pipe discharges)

**Table 60: Septic System Homeowner Survey Questions**
*(Adapted from Andrews et al., 1997 and Holmes Inspection Services)*

- How many people live in the house?[1]
- What is the septic tank capacity?[2]
- Do drains in the house empty slowly or not at all?
- When was the last time the system was inspected or maintained?
- Does sewage back up into the house through drain lines?
- Are there any wet, smelly spots in the yard?
- Is the septic tank effluent piped so it drains to a road ditch, a storm sewer, a stream, or is it connected to a farm drain tile?

*[1] Water usage ranges from 50 to 100 gallons per day per person. This information can be used to estimate the wastewater load from the house (Andrews et. al, 1997).*
*[2] The septic tank should be large enough to hold two days' worth of wastewater (Andrews et. al, 1997).*

a.  b. 

**Figure 71: (a) Straight pipe discharge to nearby stream. (b) Algal bloom in a nearby pond.**
*(Sources: a- Snohomish County, WA, b- King County, WA)*

## Detailed System Inspection

The detailed system inspection is a much more thorough inspection of the performance and function of the septic system, and must be completed by a certified professional. The inspector certifies the structural integrity of all components of the system, and checks the depth of solids in the septic tank to determine if the system needs to be pumped out. The inspector also sketches the system, and estimates distance to groundwater, surface water, and drinking water sources. An example septic system inspection form from Massachusetts can be found at http://www.state.ma.us/dep/brp/wwm/soilsys.htm.

Although not always incorporated into the inspection, dye testing can sometimes point to leaks from broken pipes, or direct discharges through straight pipes that might be missed during routine inspection. Dye can be introduced into plumbing fixtures in the home, and flushed with sufficient running water. The inspector then watches the septic field, nearby ditches, watercourses and manholes for any signs of the dye. The dye may take several hours to appear, so crews may want to place charcoal packets in adjacent waters to capture dye until they can return later to retrieve them.

### Infrared Imagery

Infrared imagery is a special type of photography with gray or color scales that represent differences in temperature and emissivity of objects in the image (www.stocktoninfrared.com), and can be used to locate sewage discharges. Several different infrared imagery techniques can be used to identify illicit discharges. The following discussion highlights two of these: aerial infrared thermography[13] and color infrared aerial photography.

### Infrared Thermography

Infrared thermography is increasingly being used to detect illicit discharges and failing septic systems. The technique uses the temperature difference of sewage as a marker to locate these illicit discharges. Figure 72 illustrates the thermal difference

[13] Infrared thermography is also being used by communities such as Mecklenburg County and the City of Charlotte in NC to detect illicit discharges at outfalls.

between an outfall discharge (with a higher temperature) and a stream.

The equipment needed to conduct aerial infrared thermography includes an aircraft (plane or helicopter); a high-resolution, large format, infrared camera with appropriate mount; a GPS unit; and digital recording equipment. If a plane is used, a higher resolution camera is required since it must operate at higher altitudes. Pilots should be experienced since flights take place at night, slowly, and at a low altitude. The camera may be handheld, but a mounted camera will provide significantly clearer results for a larger area. The GPS can be combined with a mobile mapping program and a video encoder-decoder that encodes and displays the coordinates, date, and time (Stockton, 2000). The infrared data are analyzed after the flight by trained analysts to locate suspected discharges, and field crews then inspect the ground-truthed sites to confirm the presence of a failing septic system.

Late fall, winter, and early spring are typically the best times of year to conduct these investigations in most regions of the country. This allows for a bigger difference between receiving water and discharge temperatures, and interference from vegetation is minimized (Stockton, 2004b). In addition, flights should take place at night to minimize reflected and direct daylight solar radiation that may adversely affect the imagery (Stockton, 2004b).




**Figure 72: Aerial thermography showing sewage leak**

## *Color Infrared Aerial Photography*

Color infrared aerial photography looks for changes in plant growth, differences in soil moisture content, and the presence of standing water on the ground to primarily identify failing septic systems (Figure 73).

The Tennessee Valley Authority (TVA) uses color infrared aerial photography to detect failing septic systems in reservoir watersheds. Local health departments conduct follow-up ground-truthing surveys to determine if a system is actually failing (Sagona, 1986). Similar to thermography, it is recommended that flights take place at night, during leaf-off conditions, or when the water table is at a seasonal high (which is when most failures typically occur (U.S. EPA, 1999).

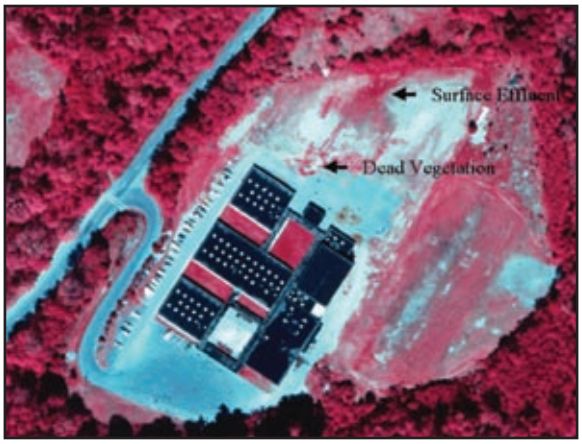



**Figure 73: Dead vegetation and surface effluent are evidence of a septic system surface failure.**
*(Source: U.S. EPA, 1999)*

## 13.5 The Cost to Trace Illicit Discharge Sources

Tracing illicit discharges to their source can be an elusive and complex process, and precise staffing and budget data are difficult to estimate. Experience of Phase I NPDES communities that have done these investigations in the past can shed some light on cost estimates. Some details on unit costs for common illicit discharge investigations are provided below.

### *Costs for Dye, Video, and Smoke Testing*

The cost of smoke, dye, and video testing can be substantial and staff intensive, and often depend on investigation specific factors, such as the complexity of the drainage network, density and age of buildings, and complexity of land use. Wayne County, MI, has estimated the cost of dye testing at $900 per facility. Video testing costs range from $1.50 to $2.00 per foot, although this increases by $1.00 per foot if pipe cleaning is needed prior to testing.

Table 61 summarizes the costs of start-up equipment for basic manhole entry and inspection, which is needed regardless of which type of test is performed. Tables 62 through 64 provide specific equipment costs for dye, video and smoke testing, respectively.

**Table 61: Common Field Equipment Needed for Dye, Video, and Smoke Testing**

| Item | Cost |
|---|---|
| 1 Digital Camera | $200 |
| Clipboards, Pens, Batteries | $25 |
| 1 Field vehicle | $15,000 - $35,000 |
| 1 First aid kit | $30 |
| 1 Spotlight | $40 |
| 1 Gas monitor and probe | $900 - $2,100 |
| 1 Hand-held GPS Unit | $150 |
| 2 Two-way radios | $250 - $750 |
| 1 Manhole hook | $80 - $130 |
| 1 Mirror | $70 - $130 |
| 2 Reflective safety vests | $40 |
| Rubber/latex gloves (box of 100) | $25 |
| 1 Can of Spray Paint | $5 |
| 4 Traffic Cones | $50 |

| Table 62: Equipment Costs for Dye Testing | | |
|---|---|---|
| **Product** | **Water Volume** | **Cost** |
| Dye Strips | 1 strip/500 gallons | $75 – $94 per 100 strips |
| Dye Tablets | 0 – 50,000 gallons | $40 per 200 tablets |
| Liquid Concentrate (Rhodamine WT) | 0 – 50,000 gallons | $80 – $90 per gallon<br>$15 – $20 per pint |
| Powder | 50,000 + gallons | $77 per lb |
| Dye Wax Cakes | 20,000 – 50,000 gallons | $12 per one 1.25 ounce cake |
| Dye Wax Donuts | 50,000 + gallons | $104 – $132 per 42 oz. donut |
| *Price Sources:*<br>*Aquatic Eco-Systems http://www.aquaticeco.com/*<br>*Cole Parmer http:/www.coleparmer.com*<br>*USA Blue Book http:/www.usabluebook.com* | | |

| Table 63: Equipment Costs for Video Testing | |
|---|---|
| **Equipment** | **Cost** |
| GEN-EYE 2™ B&W Sewer Camera with VCR & 200' Push Cable | $5,800 |
| 100' Push Rod and Reel Camera for 2" – 10" Pipes | $5,300 |
| 200' Push Rod and Reel Camera for 8" – 24" Pipes | $5,800 |
| Custom Saturn III Inspection System<br>500' cable for 6-16" Lines | $32,000<br>($33,000 with 1000 foot cable) |
| **OUTPOST**<br>• Box with build-out<br>• Generator<br>• Washdown system | <br>$6,000<br>$2,000<br>$1,000 |
| **Video Inspection Trailer**<br>• 7'x10' trailer & build-out<br>• Hardware and software package<br>• Incidentals | <br>$18,500<br>$15,000<br>$5,000 |
| **Sprinter Chassis Inspection Vehicle**<br>• Van (with build-out for inspecting 6" – 24" pipes)<br>• Crawler (needed to inspect pipes >24")<br>• Software upgrade (optional but helpful for extensive pipe systems) | <br>$130,000<br>$18,000<br>$8,000 |
| *Sources: USA Blue Book and Envirotech* | |

| Table 64: Equipment Costs for Smoke Testing | |
|---|---|
| **Equipment** | **Cost** |
| Smoke Blower | $1,000 to $2,000 each |
| Liquid Smoke | $38 to $45 per gallon |
| Smoke Candles, 30 second (4,000 cubic feet) | $27.50 per dozen |
| Smoke Candles, 60 Second (8,000 cubic feet) | $30.50 per dozen |
| Smoke Candles, 3 Minute (40,000 cubic feet) | $60.00 per dozen |
| *Sources: Hurco Tech, 2003 and Cherne Industries, 2003* | |

## Costs for Septic System Investigations

Most septic system investigations are relatively low cost, but factors such as private property access, notification, and the total number of sites investigated can increase costs. Unit costs for the three major septic system investigations are described below.

### Homeowner Survey and Surface Condition Analysis

Both the homeowner survey and the surface condition analysis are relatively low cost investigation techniques. Assuming that a staff person can investigate one home per hour, the average cost per inspection is approximately $25. A substantial cost savings can be realized by using interns or volunteers to conduct these simple investigations.

### Detailed System Inspection

Septic system inspections are more expensive, but a typical unit cost is about $250, and may also include an additional cost of pumping the system, at roughly $150, if pumping is required to complete the inspection (Wayne County, 2003). This cost is typically charged to the homeowner as part of a home inspection.

### Aerial Infrared Thermography

The equipment needed to conduct aerial infrared thermography is expensive; cameras alone may range from $250,000 to $500,000 (Stockton, 2004a). However, private contractors provide this service. In general, the cost to contract an aerial infrared thermography investigation depends on the length of the flight (flights typically follow streams or rivers); how difficult it will be to fly the route; the number of heat anomalies expected to be encountered; the expected post-flight processing time (typically, four to five hours of analysis for every hour flown); and the distance of the site from the plane's "home" (Stockton, 2004a). The cost range is typically $150 to $400 per mile of stream or river flown, which includes the flight and post-flight analyses (Stockton, 2004a).

As an alternative, local police departments may already own an infrared imaging system that may be used. For instance, the Arkansas Department of Health used a state police helicopter with a Forward Looking Infrared (FLIR) imaging system, GPS, video equipment, and maps (Eddy, 2000). The disadvantage to this is that the equipment may not be available at optimal times to conduct the investigation. In addition, infrared imaging equipment used by police departments may not be sensitive enough to detect the narrow range of temperature difference (only a few degrees) often expected for sewage flows (Stockton, 2004a).

# Chapter 14: Techniques to Fix Discharges

Quick and efficient correction of illicit discharges begins with having well defined legal authority and responsibilities coupled with strong enforcement and follow-up measures. Chapter 4 discussed important considerations with respect to legal authority and responsibility and Appendix B contains a model illicit discharge ordinance that provides language on violations, enforcement and penalties.

Most illicit discharge corrective actions involve some form of infrastructure modification or repair. These structural repairs are used to eliminate a wide variety of **direct discharges** such as sewage cross-connections, straight pipes, industrial cross-connections, and commercial cross-connections. Fixes range from simple plumbing projects to excavation and replacement of sewer lines. In some cases, structural repairs are necessary when **indirect** discharges, such as sewage from a sewer break or pump station failure enter the MS4 through an inlet, or flows directly into receiving waters. Most **transitory** discharges are corrected simply with spill containment and clean-up procedures. Section 8.3 previously discussed an overview of the correction process. The following section discusses more specific correction considerations.

## 14.1 Implementation Considerations

Once the source of an illicit discharge has been identified, steps should be taken to fix or eliminate the discharge. The following four questions should be answered for each individual illicit discharge to determine how to proceed:

- Who is responsible?
- What methods will be used to fix it?
- How long will it take?
- How will removal be confirmed?

The answer to each of these questions depends on the source of the discharge. Illicit discharges generally originate from one of the following sources:

- *An internal plumbing connection* (e.g., the discharge from a washing machine is directed to the building's storm lateral; the floor drain in a garage is connected to the building's storm lateral)
- *A service lateral cross-connection* (e.g., the sanitary lateral from a building is connected to the MS4)
- *An infrastructure failure within the sanitary sewer or MS4* (e.g., a collapsed sanitary line is discharging into the MS4)
- *An indirect transitory discharge resulting from leaks, spills, or overflows.*

Financial responsibility for source removal will typically fall on property owners, MS4 operators, or some combination of the two.

### *Who's responsible for fixing the problem?*

Ultimate responsibility for removing the source of a discharge is generally that of either the property owner or the municipality/utility (e.g., primary owner/operator of the MS4).

### Internal Plumbing Connection

The responsibility for correcting an internal plumbing connection is generally the responsibility of the building owner. Communities may wish to develop a list of certified contractors that property owners can hire for corrections.

### Service Lateral

As with internal plumbing connections, the responsibility for correcting a problem within a service lateral is typically that of the property owner being served by the lateral. However, the cost of correcting a service lateral problem can be significantly higher than that of fixing an internal plumbing problem, so communities may want to consider alternative remedial approaches than those for internal plumbing corrections. For example, communities can have on-call contractors fix lateral connections allowing the problem to be fixed as soon as it is discovered. The community can then: 1) pay for correction costs through the capital budget, or state or federal funding options, or 2) share the cost with the owner, or 3) pass on the full cost to the property owner.

### Infrastructure Failure Within the Sanitary Sewer or MS4

Illicit discharges related to some sort of infrastructure failure within the sanitary sewer or MS4 should be corrected by the jurisdiction, utility, or agency responsible for maintenance of the sewers and drains.

### Transitory Discharge

Repair of transitory discharge sources will usually be the responsibility of the property owner where the discharge originates. Ordinances should clearly stipulate the time frame in which these discharges should be repaired.

## What methods will be used to fix the problem?

The methods used to eliminate discharges will vary depending on the type of problem and the location of the problem. Internal plumbing corrections can often be performed using standard plumbing supplies for relatively little cost. For correction locations that occur outside of the building, such as service laterals or infrastructure in the right of way, costs tend to be significantly more due to specialized equipment needs. Certified contractors are recommended for these types of repairs. Table 65 provides a summary of a range of methods for fixing these more significant problems along with estimated costs. The last six techniques described in Table 68 are used for sanitary sewer line repair and rehabilitation. These activities are typically used when there is evidence of significant seepage from the sanitary system to the storm drain system.

## How long should it take?

The timeframe for eliminating a connection or discharge should depend on the type of connection or discharge and how difficult elimination will be. A discharge that poses a significant threat to human or environmental health should be discontinued and eliminated immediately. Clear guidance should be provided in the local ordinance on the timeframe for removing discharges and connections. Typically, discharges should be stopped within seven days of notification by the municipality, and illicit connections should be repaired within 30 days of notification.

## How is the removal or correction confirmed?

Removal and correction of a discharge or connection should be confirmed both at the

source, to ensure that the correction has been made, and downstream, to ensure that it is the only local discharge present.

For discharges resulting from internal plumbing and lateral connections, dye testing can confirm the correction. Also, sandbagging should be done in the first accessible storm drain manhole downstream of the correction to verify that this was the only discharge present.

The correction of discharges resulting from some sort of infrastructure failure in the sanitary sewer or MS4 can be verified by dye testing or televising the line in conjunction with sandbagging and sampling at an accessible downstream manhole.

**Table 65: Methods to Eliminate Discharges**

| Technique | Application | Description | Estimated Cost |
|---|---|---|---|
| 1. Service Lateral Disconnection, Reconnection | Lateral is connected to the wrong line | Lateral is disconnected and reconnected to appropriate line | $2,500[1] |
| 2. Cleaning | Line is blocked or capacity diminished | Flushing (sending a high pressure water jet through the line); pigging (dragging a large rubber plug through the lines); or rodding | $1/linear foot[2] |
| 3. Excavation and Replacement | Line is collapsed, severely blocked, significantly misaligned, or undersized | Existing pipe is removed, new pipe placed in same alignment; Existing pipe abandoned in place, replaced by new pipe in parallel alignment | For 14” line, $50-$100/linear foot (higher number is associated with repaving or deeper excavations, if necessary)[2] |
| 4. Manhole Repair | Decrease ponding; prevent flow of surface water into manhole; prevent groundwater infiltration | Raise frame and lid above grade; install lid inserts; grout, mortar or apply shortcrete inside the walls; install new precast manhole. | Vary widely, from $250 to raise a frame and cover to ~ $2,000 to replace manhole[2] |
| 5. Corrosion Control Coating | Improve resistance to corrosion | Spray- or brush-on coating applied to interior of pipe. | < $10/linear foot[2] |
| 6. Grouting | Seal leaking joints and small cracks | Seals leaking joints and small cracks. | For a 12” line, ~ $36-$54/linear foot[2] |
| 7. Pipe Bursting | Line is collapsed, severely blocked, or undersized | Existing pipe used as guide for inserting expansion head; expansion head increases area available for new pipe by pushing existing pipe out radially until it cracks; bursting device pulls new pipeline behind it | For 8” pipe, $40-$80/linear foot[4] |
| 8. Slip Lining | Pipe has numerous cracks, leaking joints, but is continuous and not misaligned | Pulling of a new pipe through the old one. | For 12” pipe, $50-$75 /linear foot[2] |
| 9. Fold and Formed Pipe | Pipe has numerous cracks, leaking joints | Similar to sliplining but is easier to install, uses existing manholes for insertion; a folded thermoplastic pipe is pulled into place and rounded to conform to internal diameter of existing pipe | For 8-12” pipe, $60-$78/linear foot[3] |

| Table 65: Methods to Eliminate Discharges | | | |
|---|---|---|---|
| **Technique** | **Application** | **Description** | **Estimated Cost** |
| 10. Inversion Lining | Pipe has numerous cracks, leaking joints; can be used where there are misalignments | Similar to sliplining but is easier to install, uses existing manholes for insertion; a soft resin impregnated felt tube is inserted into the pipe, inverted by filling it with air or water at one end, and cured in place. | $75-$125/linear foot[2] |
| *1 CWP (2002)*<br>*2 1991 costs from Brown (1995)*<br>*3 U.S. EPA (1991)*<br>*4 U.S. EPA (1999b)* | | | |

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# Illicit Discharge Detection and Elimination

*TECHNICAL APPENDICES*

**by the**
**Center for**
**Watershed Protection**

**and**
**Robert Pitt**
**University of Alabama**

**October 2004**

# TECHNICAL APPENDICES

# ILLICIT DISCHARGE DETECTION AND ELIMINATION: A GUIDANCE MANUAL FOR PROGRAM DEVELOPMENT AND TECHNICAL ASSESSMENTS

by

Edward Brown and Deb Caraco
Center for Watershed Protection
Ellicott City, Maryland 21043

and

Robert Pitt
University of Alabama
Tuscaloosa, Alabama 35487

EPA Cooperative Agreement
X-82907801-0

Project Officer

Bryan Rittenhouse
Water Permits Division
Office of Water and Wastewater
U.S. Environmental Protection Agency
Washington, D.C.

**October 2004**

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# APPENDIX A

## GENERATING SITES, STORM WATER REGULATORY STATUS, AND DISCHARGE POTENTIAL

The information presented in this Appendix refers to the Standard Industrial Classification (SIC) system. This system has historically been used to classify industries and other businesses for census, tax, permit and other purposes. It should be noted that, more recently, federal agencies, including EPA, have adopted the North American Industry Classification System (NAICS, pronounced "Nakes") as the industry classification system. For more information on the NAICS and how it correlates with SIC, visit http://www.census.gov/epcd/www/naics.html.

## Overview

Identification of land uses that may impact water quality in local streams can be a difficult and time-consuming task. Research suggests that program managers might wish to preferentially investigate certain land uses when looking for the sources of possible pollutant loads. These land uses are all considered to be generating sites where routine operations can produce higher levels of storm water pollutants, and/or present a higher potential risk for spills, leaks or illicit discharges. There are two basic types of generating sites: *regulated hotspots* that are known sources of pollution and are subject to federal or state regulations, and *unregulated hotspots* which are operations suspected to be potential pollution sources, but which are not currently regulated.

## Identifying Potential Generating Sites

The number and type of generating sites present in a subwatershed may vary greatly, and currently there is no public database available to identify all the regulated sites in a subwatershed. Instead, multiple databases need to be queried to identify generating sites that may be targets for source control or illicit discharge investigations. A three-phase approach is useful for gathering as much information as possible on generating sites within a subwatershed that may qualify for more intensive scrutiny.

*Phase 1. Consult publicly available databases*

The federal government has a number of databases that may help identify locations for investigation. The Environmental Protection Agency (EPA) operates two such databases. The first is the Enforcement and Compliance History Online (ECHO) database. With this system, facility compliance history can be queried and facilities can be found based on geographic location (county level), or zip code (http://www.epa.gov/echo/index.html). The other database is Envirofacts (http://www.epa.gov/enviro/). This website provides access to multiple EPA databases to provide information about environmental activities (including Resource Conservation and Recovery Act [RCRA] and Toxic Release Inventory [TRI] facilities) that may affect air, water, and land anywhere in the United States. The website also provides access to Enviromapper, which will display the location of regulated facilities.
There are also commercial databases that can provide information on regulated industries based on manufacturing or industrial SIC codes. These databases are not free, and have limitations since they are designed primarily for marketing.

*Phase 2. Consult State and Local Agencies*

Most states have NPDES permit programs, and track permit application to some extent. You can consult state or local regulatory agencies to obtain lists of industries that have filed NOIs (Notices of Intent) to obtain storm water permits, as well as those that have filed under TRI requirements. Other agencies that may have information on local generating sites include fire departments (for

hazardous waste), and sanitation or wastewater treatment agencies.

*Phase 3. Permit Review*

The final source for information is through a review of local permits. Most permit databases have SIC codes as one of the fields. These codes can be matched against the SIC codes in Table A.1 that list common generating sites under major land use headings. If a local permit database does not exist, it may be worthwhile to simply get the local phone book and do a quick look for businesses that are similar to those listed in Table A.1.

Compiling the findings from the various databases will provide an initial list of potential generating sites for future investigation. However, research has found that most of these databases can miss many of the industries that are subject to regulation (Duke *et al.*, 1999; Duke and Shaver, 1999), and further identification may be necessary. Field investigations using techniques such as the Unified Subwatershed and Site Reconnaissance (Wright *et al.*, 2004) can assist in identifying many of these generating sites that should likely be regulated by communities.

## Reference Tables

This appendix is designed to assist in identifying the land uses and associated generating sites in a subwatershed where routine activities may result in pollution being discharged to the storm drain system. There are two tables provided, each of which is described below.

Table A.1 presents a listing of potential generating sites under common land uses where illicit discharges can occur based on regular activities or practices. Column one describes the general industry type. Column two lists their associated SIC codes, if known. Column three identifies whether an industry type is subject to NPDES industrial storm water permit requirements (designated by "X"). Facilities where only certain activities or facilities at the site are subject to regulation are noted (this pertains mostly to the transport-related industries). In addition, for many "light" industrial facilities, storm water permits are required only if material handling equipment or activities, raw materials, immediate products, final products, waste materials, by-products, or industrial machinery are exposed to storm water. Industries where this applies are noted with an "**". If only specific SIC codes within a major group qualify for this exception they are noted in parentheses. Municipal facilities that are subject to NPDES MS4 permit requirements are designated by "MS4." Column four identifies those businesses that can be considered an unregulated storm water hotspot (also designated by "X"). Column five looks at the illicit discharge potential of each of the businesses listed. The potential for a business to produce an illicit discharge is rated as either high (H) medium (M) or Low (L) based on the likelihood that it has a direct connection to the storm drain system (direct) or that it can produce a transitory discharge (indirect).

Table A.2 is a list of the SIC Codes that are regulated by the Industrial Multi Sector General Permit (MSGP). The list includes the four-digit SIC code level along with the official description. This table is provided for those who wish to know the full description of each SIC code that is regulated by NPDES industrial storm water permits.

**Table A.1: Common Generating Sites and their Pollution Potential**

| Land Use Generating Site Description | Associated SIC Code(s) | Regulated Storm Water Hotspot | Unregulated Storm Water Hotspot | Illicit Discharge Potential* | |
|---|---|---|---|---|---|
| | | | | Direct | Indirect |
| **Commercial** | | | | | |
| Animal Care Services | 0742, 0752 | | X | L | L |
| Auto Repair | 7532-7539, 7549 | | X | M | M |
| Automobile Parking | 7521 | | | L | M |
| Building Materials | 5211-5251 | | X | L | L |
| Campgrounds/RV parks | 7033 | | X | L | M |
| Car Dealers | 5511-5599, | | X | M | M |
| Car Washes | 7542 | | X | L | L |
| Commercial Laundry/Dry Cleaning | 7211-7219 | | X | L | L |
| Convenience Stores | 5399 | | X | L | L |
| Food Stores and Wholesale Food and Beverage | 5141-5149 5411-5499 | | X | L | M |
| Equipment Repair | 7622-7699 | | X | L | L |
| Gasoline Stations | 5541 | | X | M | M |
| Heavy Construction Equipment Rental and Leasing | 7353 | | X | L | H |
| Building and Heavy Construction (For land disturbing activities) | 1521-1542 1611-1629 | X | | L | H |
| Marinas | 4493 | X | | L | M |
| Nurseries and garden centers | 5261 | | X | L | M |
| Oil Change Shops | 7549 | | X | | M |
| Restaurants | 5812,5813,7011 | | X | M | L |
| Swimming Pools | 7997, 7999 | | X | L | L |
| Warehouses | 4221-4226 | X** (4221-4225) | | L | L |
| Wholesalers of Chemical and Petroleum | 5162-5169,5172 | | X | L | L |
| **Industrial** | | | | | |
| Apparel and Other Fabrics | 2311–2399 3131–3199 | X** | | 2300 L 3100 H | L M |
| Auto Recyclers and Scrap Yards | 5015, 5093 | X | | L | H |
| Beverages and Brewing | 2082-2087 | X** | | L | L |
| Boat Building and Repair | 3731,3732 | X | | L | H |
| Chemical Products | 2812-2899 | X** (2830, 2850) | | 2810 H 2820 H 2840 H 2860 M 2830 L 2850 L 2870 L 2890 L | 2810 L 2820 L 2840 L 2860 L 2830 L 2850 L 2870 L 2890 L |

| Table A.1: Common Generating Sites and their Pollution Potential | | | | | |
|---|---|---|---|---|---|
| **Land Use Generating Site Description** | **Associated SIC Code(s)** | **Regulated Storm Water Hotspot** | **Unregulated Storm Water Hotspot** | **Illicit Discharge Potential*** | |
| | | | | **Direct** | **Indirect** |
| **Industrial (continued)** | | | | | |
| Food Processing | 2011–2141 | X** | | 2010 H<br>2020 H<br>2030 H<br>2040 H<br>2050 L.<br>2060 L<br>2070 M<br>2090 L<br>2110 M | 2010 L<br>2020 L<br>2030 L<br>2040 L<br>2050 L.<br>2060 L<br>2070 L<br>2090 L<br>2110 L |
| Garbage Truck Washout Activities | 4212 | | X | L | H |
| Industrial or Commercial Machinery, Electronic Equipment | 3511–3599<br>3612–3699 | X** | | L | L |
| Instruments; Photographic and Optical Goods, Watches and Clocks and other Miscellaneous Manufacturing | 3812–3873<br>3933-3999 | X** | | L | L |
| Leather Tanners | 3411 | X | | H | M |
| Metal Production, Plating and Engraving Operations | 2514, 2522, 2542, 3312-3399, 3411-3499, 3590 | X**<br>(2514,2522, 2542, 3411-3433, 3442-3499, 3590) | | H | L |
| Paper and Wood Products | 2411-2499, 2511, 2512, 2517, 2519, 2521, 2541, 2611–2679 | X**<br>(2434, 2652–2657, 2671–2679) | | 2400 L<br>2500 L<br>2600 H | 2400 H<br>2500 L<br>2600 H |
| Petroleum Storage and Refining | 2911 | X | | 2911 H | H |
| Printing | 2711–2796 | X** | | L | L |
| Rubber and Plastics | 3011-3089 | X** | | M | L |
| Stone, Glass, Clay, Cement, Concrete, and Gypsum Product | 3211-3299 | X**<br>(3233) | | L | L |
| Textile Mills | 2211–2299 | X** | | H | L |
| Transportation Equipment | 3711–3728, 3743-3799 | X** | | H | M |
| **Institutional** | | | | | |
| Cemeteries | 6553 | | X | L | L |
| Churches | 8661 | | X | L | L |
| Colleges and Universities | 8221-8222 | | X | L | M |
| Corporate Office Parks | | | X | L | L |
| Hospitals | 8062-8069<br>8071-8072 | | X | L | L |
| Private Golf Courses | 7997 | | X | L | L |
| Private Schools | 8211 | | X | L | L |

| Table A.1: Common Generating Sites and their Pollution Potential | | | | | |
|---|---|---|---|---|---|
| **Land Use Generating Site Description** | **Associated SIC Code(s)** | **Regulated Storm Water Hotspot** | **Unregulated Storm Water Hotspot** | **Illicit Discharge Potential*** | |
| | | | | **Direct** | **Indirect** |
| **Municipal** | | | | | |
| Composting Facilities | 2875 | X | | L | L |
| Public Golf Courses | 7992 | | X | L | L |
| Landfills and Hazardous Waste Material Disposal | 4953, HZ, LF | X | | L | H |
| Local Streets | | MS4 | X | L | H |
| Maintenance Depots | 4173 | MS4 | | M | H |
| Municipal Fleet Washing | 4100 | MS4 | | L | M |
| Public Works Yards | | MS4 | | M | H |
| Steam Electric Plants | SE | X | | L | L |
| Treatment Works | TW | X | | L | L |
| **Transport Related (NPDES regulation is for the portion of the facility dedicated to vehicle maintenance shops, equipment-cleaning operations, and airport deicing operations).** | | | | | |
| Airports | 4581 | X | | L | M |
| Streets and Highways Construction | 1611, 1622 | X | | L | H |
| Ports | 4449, 4499 | X | | L | H |
| Railroads | 4011, 4013 | X | | L | H |
| Rental Car Lots | 7513-7519 | X | | L | M |
| US Postal Service | 4311 | X | | L | M |
| Trucking Companies and Distribution Centers | 4212-4215, 4231 | X | | L | M |
| Petroleum Bulk Stations or Terminals | 5171 | X | | L | H |

*Adapted from Pitt (2001)
** Generating sites where storm water permits are required only if material handling equipment or activities, raw materials, immediate products, final products, waste materials, by-products, or industrial machinery are exposed to storm water.

| Table A.2: SIC and Activity Codes for EPA's Multi-Sector General Permit for Industrial Activity | |
|---|---|
| **Sector A. Timber Products** | |
| 2411 | Log Storage and Handling |
| 2421 | General Sawmills and Planning Mills |
| 2426 | Hardwood Dimension and Flooring Mills |
| 2429 | Special Product Sawmills, Not Elsewhere Classified |
| 2431–2439 | Millwork, Veneer, Plywood, and Structural Wood (except 2434) |
| 2448, 2449 | Wood Containers |
| 2451, 2452 | Wood Buildings and Mobile Homes |
| 2491 | Wood Preserving |
| 2493 | Reconstituted Wood Products |
| 2499 | Wood Products, Not Elsewhere Classified |
| **Sector B. Paper and Allied Products Manufacturing** | |
| 2611 | Pulp Mills |
| 2621 | Paper Mills |
| 2631 | Paperboard Mills |
| 2652–2657 | Paperboard Containers and Boxes |
| 2671–2679 | Converted Paper and Paperboard Products, Except Containers and Boxes |
| **Sector C. Chemical and Allied Products Manufacturing** | |
| 2812–2819 | Industrial Inorganic Chemicals |
| 2821–2824 | Plastics Materials and Synthetic Resins, Synthetic Rubber, Cellulosic and Other Manmade Fibers Except Glass |
| 2833–2836 | Medicinal chemicals and botanical products; pharmaceutical preparations; invitro and invivo diagnostic substances; biological products, except diagnostic substances |
| 2841–2844 | Soaps, Detergents, Cleaning Preparations; Perfumes, Cosmetics, Other Toilet |
| 2851 | Preparations |
| 2861–2869 | Paints, Varnishes, Lacquers, Enamels, and Allied Products |
| 2873–2879 | Industrial Organic Chemicals |
| 2891–2899 | Agricultural Chemicals, Including Facilities that Make Fertilizer Solely from Leather Scraps and Leather Dust |
| 3952 (limited to list) | Miscellaneous Chemical Products<br>Inks and Paints, Including China Painting Enamels, India Ink, Drawing Ink, Platinum Paints for Burnt Wood or Leather Work, Paints for China Painting, Artist's Paints and Watercolors |
| **Sector D. Asphalt Paving and Roofing Materials Manufacturers and Lubricant Manufacturers** | |
| 2951, 2952 | Asphalt Paving and Roofing Materials |
| 2992, 2999 | Miscellaneous Products of Petroleum and Coal |
| **Sector E. Glass, Clay, Cement, Concrete, and Gypsum Product Manufacturing** | |
| 3211 | Flat Glass |
| 3221, 3229 | Glass and Glassware, Pressed or Blown |
| 3231 | Glass Products Made of Purchased Glass |
| 3241 | Hydraulic Cement |
| 3251-3259 | Structural Clay Products |
| 3261-3269 | Pottery and Related Products |
| 3271-3275 | Concrete, Gypsum and Plaster Products |
| 3281 | Cut Stone and Stone Products |
| 3291–3292 | Abrasive and Asbestos Products |
| 3295 | Minerals and Earth's, Ground, or Otherwise Treated |
| 3296 | Mineral Wool |
| 3297 | Non-Clay Refractories |
| 3299 | Nonmetallic Mineral Products, Not Elsewhere Classified |

| Table A.2: SIC and Activity Codes for EPA's Multi-Sector General Permit for Industrial Activity | |
|---|---|
| **Sector F. Primary Metals** | |
| 3312–3317 | Steel Works, Blast Furnaces, and Rolling and Finishing Mills |
| 3321–3325 | Iron and Steel Foundries |
| 3331–3339 | Primary Smelting and Refining of Nonferrous Metals |
| 3341 | Secondary Smelting and Refining of Nonferrous Metals |
| 3351–3357 | Rolling, Drawing, and Extruding of Nonferrous Metals |
| 3363–3369 | Nonferrous Foundries (Castings) |
| 3398, 3399 | Miscellaneous Primary Metal Products |
| **Sector G. Metal Mining (Ore Mining and Dressing)** | |
| 1011 | Iron Ores |
| 1021 | Copper Ores |
| 1031 | Lead and Zinc Ores |
| 1041, 1044 | Gold and Silver Ores |
| 1061 | Ferroalloy Ores, Except Vanadium |
| 1081 | Metal Mining Services |
| 1094, 1099 | Miscellaneous Metal Ores |
| **Sector H. Coal Mines and Coal Mining-Related Facilities** | |
| 1221–1241 | Coal Mines and Coal Mining-Related Facilities Sector |
| **Sector I. Oil and Gas Extraction and Refining** | |
| 1311 | Crude Petroleum and Natural Gas |
| 1321 | Natural Gas Liquids |
| 1381–1389 | Oil and Gas Field Services |
| 2911 | Petroleum refining |
| **Sector J. Mineral Mining and Dressing** | |
| 1411 | Dimension Stone |
| 1422–1429 | Crushed and Broken Stone, Including Rip Rap |
| 1481 | Nonmetallic Minerals, Except Fuels |
| 1442, 1446 | Sand and Gravel |
| 1455, 1459 | Clay, Ceramic, and Refractory Materials |
| 1474–1479 | Chemical and Fertilizer Mineral Mining |
| 1499 | Miscellaneous Nonmetallic Minerals, Except Fuels |
| **Sector K. Hazardous Waste Treatment Storage or Disposal Facilities** | |
| HZ | Hazardous Waste Treatment, Storage or Disposal |
| **Sector L. Landfills and Land Application Sites** | |
| LF | Landfills, Land Application Sites and Open Dumps |
| **Sector M. Automobile Salvage Yards** | |
| 5015 | Automobile Salvage Yards |
| **Sector N. Scrap Recycling Facilities** | |
| 5093 | Scrap Recycling Facilities |
| **Sector O. Steam Electric Generating Facilities** | |
| SE | Steam Electric Generating Facilities |
| **Sector P. Land Transportation** | |
| 4011, 4013 | Railroad Transportation |
| 4111–4173 | Local and Highway Passenger Transportation |
| 4212–4231 | Motor Freight Transportation and Warehousing |
| 4311 | United States Postal Service |
| 5171 | Petroleum Bulk Stations and Terminals |
| **Sector Q. Water Transportation** | |
| 4412–4499 | Water Transportation |
| **Sector R. Ship and Boat Building or Repairing Yards** | |
| 3731, 3732 | Ship and Boat Building or Repairing Yards |
| **Sector S. Air Transportation Facilities** | |
| 4512–4581 | Air Transportation Facilities |

| Table A.2: SIC and Activity Codes for EPA's Multi-Sector General Permit for Industrial Activity | |
|---|---|
| **Sector T. Treatment Works** | |
| TW | Treatment Works |
| **Sector U. Food and Kindred Products** | |
| 2011–2015 | Meat Products |
| 2021–2026 | Dairy Products |
| 2032 | Canned, Frozen and Preserved Fruits, Vegetables and Food Specialties |
| 2041–2048 | Grain Mill Products |
| 2051–2053 | Bakery Products |
| 2061–2068 | Sugar and Confectionery Products |
| 2074–2079 | Fats and Oils |
| 2082–2087 | Beverages |
| 2091–2099 | Miscellaneous Food Preparations and Kindred Products |
| 2111–2141 | Tobacco Products |
| **Sector V. Textile Mills, Apparel, and Other Fabric Product Manufacturing** | |
| 2211–2299 | Textile Mill Products |
| 2311–2399 | Apparel and Other Finished Products Made From Fabrics and Similar Materials |
| 3131–3199 | Leather Products (except 3111) |
| **Sector W. Furniture and Fixtures** | |
| 2511–2599 | Furniture and Fixtures |
| 2434 | Wood Kitchen Cabinets |
| **Sector X. Printing and Publishing** | |
| 2711–2796 | Printing, Publishing and Allied Industries |
| **Sector Y. Rubber, Miscellaneous Plastic Products, and Miscellaneous Manufacturing Industries** | |
| 3011 | Tires and Inner Tubes |
| 3021 | Rubber and Plastics Footwear |
| 3052, 3053 | Gaskets, Packing, and Sealing Devices and Rubber and Plastics Hose and Belting |
| 3061, 3069 | Fabricated Rubber Products, Not Elsewhere Classified |
| 3081–3089 | Miscellaneous Plastics Products |
| 3931 | Musical Instruments |
| 3942–3949 | Dolls, Toys, Games and Sporting and Athletic Goods |
| 3951–3955 | Pens, Pencils, and Other Artists' Materials (except 3952) |
| 3961, 3965 | Costume Jewelry and Novelties, Buttons, and Miscellaneous Notions, Except Precious Metal |
| 3991–3999 | Miscellaneous Manufacturing Industries |
| **Sector Z. Leather Tanning and Finishing** | |
| 3111 | Leather Tanning and Finishing |
| **Sector AA. Fabricated Metal Products** | |
| 3411–3499 | Fabricated Metal Products, Except Machinery and Transportation Equipment and Cutting, Engraving and Allied Services |
| 3911–3915 | Jewelry, Silverware, and Plated Ware |
| 3479 | Coating, Engraving, and Allied Services |
| **Sector AB. Transportation Equipment, Industrial or Commercial Machinery** | |
| 3511–3599 | Industrial and Commercial Machinery (except 3571–3579) |
| 3711–3799 | Transportation Equipment (except 3731, 3732) |
| **Sector AC. Electronic, Electrical, Photographic and Optical Goods** | |
| 3612–3699 | Electronic, Electrical Equipment and Components, Except Computer Equipment |
| 3812–3873 | Measuring, Analyzing and Controlling Instrument, Photographic/Optical Goods, |
| 3571–3579 | Watches/Clocks |
| | Computer and Office Equipment |
| **Miscellaneous** | |
| 1521-1542 | Building Construction General Contractors And Operative Builders |
| 1611-1629 | Heavy Construction Other Than Building Construction Contractors |

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# APPENDIX B

## MODEL ILLICIT DISCHARGE AND CONNECTION ORDINANCE

### Introduction to the Model Illicit Discharge and Connection Ordinance

The model ordinance provided in this Appendix is intended to be a tool for communities who are responsible for meeting the illicit discharge detection and correction requirements of the National Pollutant Discharge Elimination System (NPDES) regulations. This model ordinance is provided to assist communities in creating their own illicit discharge ordinances. In designing this model, an attempt was made to avoid creating too complex an ordinance, and instead to provide standard language and concepts that a good illicit discharge ordinance might contain. The language was borrowed from a number of ordinances.

Feel free to use and alter any and all portions of this document to meet the needs of the local community. Throughout the ordinance, there are sections in which the name of the agency to which regulatory power over illicit discharges has been given should be filled in to customize it. These sections are denoted by text placed in brackets – [authorized enforcement agency].

Italicized text with this symbol should be interpreted as comments, instructions, or information to assist local governments in tailoring the ordinance. This text would not appear in a final adopted ordinance.
This ordinance should not be construed as an exhaustive listing of all the language needed for a local ordinance, but represents a good base that communities can build upon and customize to be consistent with the staff resources available in their locality. It is recommended that this document be used in conjunction with other sources, such as existing ordinances created by other IDDE programs in the same geographic region and with similar objectives. In addition, several state agencies, councils of governments, and other regional groups have developed model ordinances. Two very comprehensive yet different examples of ordinances are:

- Model Storm Water Ordinance
  Source: North Central Texas Council of Governments
  (www.dfwstormwater.com/illicits)

- Model Illicit Discharge and Illegal Connection Ordinance
  Source: Metropolitan North Georgia Water Planning District
  (www.northgeorgiawater.com)

For those areas where septic systems are commonly used for wastewater treatment, language requiring inspection of these systems should also be added. The Washtenaw County (MI) *Regulation for the Inspection of Residential On-site Water and Sewage Disposal Systems at Time of Property Transfer* is an example of an ordinance that specifies requirements for inspection and maintenance of septic systems.

# MODEL ILLICIT DISCHARGE AND CONNECTION ORDINANCE

ORDINANCE NO. _____

## SECTION 1. PURPOSE/INTENT.

The purpose of this ordinance is to provide for the health, safety, and general welfare of the citizens of **[jurisdiction]** through the regulation of non-storm water discharges to the storm drainage system to the maximum extent practicable as required by federal and state law. This ordinance establishes methods for controlling the introduction of pollutants into the municipal separate storm sewer system (MS4) in order to comply with requirements of the National Pollutant Discharge Elimination System (NPDES) permit process. The objectives of this ordinance are:

(1) To regulate the contribution of pollutants to the MS4 by storm water discharges by any user.

(2) To prohibit illicit connections and discharges to the MS4.

(3) To establish legal authority to carry out all inspection, surveillance, monitoring, and enforcement procedures necessary to ensure compliance with this ordinance.

## SECTION 2. DEFINITIONS.

For the purposes of this ordinance, the following shall mean:

Authorized Enforcement Agency. Employees or designees of the director of the municipal agency designated to enforce this ordinance.

Best Management Practices (BMPs). Schedules of activities, prohibitions of practices, general good house keeping practices, pollution prevention and educational practices, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants directly or indirectly to storm water, receiving waters, or storm water conveyance systems. BMPs also include treatment practices, operating procedures, and practices to control site runoff, spillage or leaks, sludge or water disposal, or drainage from raw materials storage.

Clean Water Act. The federal Water Pollution Control Act (33 U.S.C. § 1251 et seq.), and any subsequent amendments thereto.

Construction Activity. Activities subject to NPDES Construction Permits. These include construction projects resulting in land disturbance of one acre or more. Such activities include but are not limited to clearing and grubbing, grading, excavating, and demolition.

Hazardous Materials. Any material, including any substance, waste, or combination thereof, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause, or significantly contribute to, a substantial present or potential hazard to human health, safety, property, or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

Illegal Discharge. Any direct or indirect non-storm water discharge to the storm drain system, except as exempted in Section 8 of this ordinance.

Illicit Connections. An illicit connection is defined as either of the following:

- Any drain or conveyance, whether on the surface or subsurface that allows an illegal discharge to enter the storm drain system including but not limited to any conveyances that allow any non-storm water discharge including sewage, process wastewater, and wash water to enter the storm drain system and any connections to the storm drain system from indoor drains and sinks, regardless of whether said drain or connection had been previously allowed, permitted, or approved by an authorized enforcement agency or,
- Any drain or conveyance connected from a commercial or industrial land use to the storm drain system that has not been documented in plans, maps, or equivalent records and approved by an authorized enforcement agency.

Industrial Activity. Activities subject to NPDES Industrial Storm Water Permits as defined in 40 CFR, Section 122.26 (b)(14).

Municipal Separate Storm Sewer System (MS4). The system of conveyances (including sidewalks, roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains) owned and operated by the **[jurisdiction]** and designed or used for collecting or conveying storm water, and that is not used for collecting or conveying sewage.

National Pollutant Discharge Elimination System (NPDES) Storm Water Discharge Permit. means a permit issued by EPA (or by a State under authority delegated pursuant to 33 USC § 1342(b)) that authorizes the discharge of pollutants to waters of the United States, whether the permit is applicable on an individual, group, or general area-wide basis.

Non-Storm Water Discharge. Any discharge to the storm drain system that is not composed entirely of storm water.

Person. Any individual, association, organization, partnership, firm, corporation or other entity recognized by law and acting as either the owner or as the owner's agent.

Pollutant. Anything which causes or contributes to pollution. Pollutants may include, but are not limited to: paints, varnishes, and solvents; oil and other automotive fluids; non-hazardous liquid and solid wastes and yard wastes; refuse, rubbish, garbage, litter, or other discarded or abandoned objects, ordinances, and accumulations, so that same may cause or contribute to pollution; floatables; pesticides, herbicides, and fertilizers; hazardous substances and wastes; sewage, fecal coliform and pathogens; dissolved and particulate metals; animal wastes; wastes and residues that result from constructing a building or structure; and noxious or offensive matter of any kind.

Premises. Any building, lot, parcel of land, or portion of land whether improved or unimproved including adjacent sidewalks and parking strips.

Storm Drainage System. Publicly-owned facilities by which storm water is collected and/or conveyed, including but not limited to any roads with drainage systems, municipal streets, gutters, curbs, inlets, piped storm drains, pumping facilities, retention and detention basins, natural and human-made or altered drainage channels, reservoirs, and other drainage structures.

Storm Water. Any surface flow, runoff, and drainage consisting entirely of water from any form of natural precipitation, and resulting from such precipitation.

Storm Water Management Plan. A document which describes the Best Management Practices and activities to be implemented by a person or business to identify sources of pollution or contamination at a site and the actions to eliminate or reduce pollutant discharges to Storm Water, Storm Water Conveyance Systems, and/or Receiving Waters to the Maximum Extent Practicable.

Wastewater. Any water or other liquid, other than uncontaminated storm water, discharged from a facility.

**SECTION 3. APPLICABILITY.**

This ordinance shall apply to all water entering the storm drain system generated on any developed and undeveloped lands unless explicitly exempted by the **[authorized enforcement agency]**.

**SECTION 4. RESPONSIBILITY FOR ADMINISTRATION.**

The **[authorized enforcement agency]** shall administer, implement, and enforce the provisions of this ordinance. Any powers granted or duties imposed upon the **[authorized enforcement agency]** may be delegated in writing by the Director of the **[authorized enforcement agency]** to persons or entities acting in the beneficial interest of or in the employ of the agency.

**SECTION 5. COMPATIBILITY WITH OTHER REGULATIONS.**

This ordinance is not intended to modify or repeal any other ordinance, rule, regulation, or other provision of law. The requirements of this ordinance are in addition to the requirements of any other ordinance, rule, regulation, or other provision of law, and where any provision of this ordinance imposes restrictions different from those imposed by any other ordinance, rule, regulation, or other provision of law, whichever provision is more restrictive or imposes higher protective standards for human health or the environment shall control.

**SECTION 6. SEVERABILITY.**

The provisions of this ordinance are hereby declared to be severable. If any provision, clause, sentence, or paragraph of this ordinance or the application thereof to any person, establishment, or circumstances shall be held invalid, such invalidity shall not affect the other provisions or application of this ordinance.

**SECTION 7. ULTIMATE RESPONSIBILITY.**

The standards set forth herein and promulgated pursuant to this ordinance are minimum standards; therefore this ordinance does not intend or imply that compliance by any person will ensure that there will be no contamination, pollution, or unauthorized discharge of pollutants.

## SECTION 8. DISCHARGE PROHIBITIONS.

### 8.1. Prohibition of Illegal Discharges.

No person shall throw, drain, or otherwise discharge, cause, or allow others under its control to throw, drain, or otherwise discharge into the MS4 any pollutants or waters containing any pollutants, other than storm water.

The commencement, conduct or continuance of any illegal discharge to the storm drain system is prohibited except as described as follows:

(1) The following discharges are exempt from discharge prohibitions established by this ordinance: water line flushing, landscape irrigation, diverted stream flows, rising ground waters, uncontaminated ground water infiltration, uncontaminated pumped ground water, discharges from potable water sources, foundation drains, air conditioning condensation, irrigation water, springs, water from crawl space pumps, footing drains, lawn watering, individual residential car washing, flows from riparian habitats and wetlands, dechlorinated swimming pool discharges, and street wash water.

(2) Discharges or flow from firefighting, and other discharges specified in writing by the **[authorized enforcement agency]** as being necessary to protect public health and safety.

(3) Discharges associated with dye testing, however this activity requires a verbal notification to the **[authorized enforcement agency]** prior to the time of the test.

(4) The prohibition shall not apply to any non-storm water discharge permitted under an NPDES permit, waiver, or waste discharge order issued to the discharger and administered under the authority of the United States Environmental Protection Agency (EPA), provided that the discharger is in full compliance with all requirements of the permit, waiver, or order and other applicable laws and regulations, and provided that written approval has been granted for any discharge to the storm drain system.

***The local government may evaluate and remove any of the above exemptions if it is determined that they are causing an adverse impact.***

### 8.2. Prohibition of Illicit Connections.

(1) The construction, use, maintenance or continued existence of illicit connections to the storm drain system is prohibited.

(2) This prohibition expressly includes, without limitation, illicit connections made in the past, regardless of whether the connection was permissible under law or practices applicable or prevailing at the time of connection.

(3) A person is considered to be in violation of this ordinance if the person connects a line conveying sewage to the MS4, or allows such a connection to continue.

(4) Improper connections in violation of this ordinance must be disconnected and redirected, if necessary, to an approved onsite wastewater management system or the sanitary sewer system upon approval of the **[authorized enforcement agency]**.

(5) Any drain or conveyance that has not been documented in plans, maps or equivalent, and which may be connected to the storm sewer system, shall be located by the owner or occupant of that property upon receipt of written notice of violation from the **[authorized**

**enforcement agency]** requiring that such locating be completed. Such notice will specify a reasonable time period within which the location of the drain or conveyance is to be determined, that the drain or conveyance be identified as storm sewer, sanitary sewer or other, and that the outfall location or point of connection to the storm sewer system, sanitary sewer system or other discharge point be identified. Results of these investigations are to be documented and provided to the **[authorized enforcement agency]**.

## SECTION 9. WATERCOURSE PROTECTION.

Every person owning property through which a watercourse passes, or such person's lessee, shall keep and maintain that part of the watercourse within the property free of trash, debris, excessive vegetation, and other obstacles that would pollute, contaminate, or significantly retard the flow of water through the watercourse. In addition, the owner or lessee shall maintain existing privately owned structures within or adjacent to a watercourse, so that such structures will not become a hazard to the use, function, or physical integrity of the watercourse.

## SECTION 10. INDUSTRIAL OR CONSTRUCTION ACTIVITY DISCHARGES.

### 10.1. Submission of NOI to [jurisdiction].

(1) Any person subject to an industrial or construction activity NPDES storm water discharge permit shall comply with all provisions of such permit. Proof of compliance with said permit may be required in a form acceptable to the **[authorized enforcement agency]** prior to the allowing of discharges to the MS4.

(2) The operator of a facility, including construction sites, required to have an NPDES permit to discharge storm water associated with industrial activity shall submit a copy of the Notice of Intent (NOI) to the **[authorized enforcement agency]** at the same time the operator submits the original Notice of Intent to the EPA as applicable.

(3) The copy of the Notice of Intent may be delivered to the **[authorized enforcement agency]** either in person or by mailing it to:

Notice of Intent to Discharge Storm Water

**[authorized enforcement agency]**

**[street address]**

**[city, state, zip code]**

(4) A person commits an offense if the person operates a facility that is discharging storm water associated with industrial activity without having submitted a copy of the Notice of Intent to do so to the **[authorized enforcement agency]**.

## SECTION 11. COMPLIANCE MONITORING

### 11.1. Right of Entry: Inspection and Sampling.

The **[authorized enforcement agency]** shall be permitted to enter and inspect facilities subject to regulation under this ordinance as often as may be necessary to determine compliance with this ordinance.

(1) If a discharger has security measures in force which require proper identification and clearance before entry into its premises, the discharger shall make the necessary arrangements to allow access to representatives of the **[authorized enforcement agency]**.

(2) Facility operators shall allow the **[authorized enforcement agency]** ready access to all parts of the premises for the purposes of inspection, sampling, examination and copying of records that must be kept under the conditions of an NPDES permit to discharge storm water, and the performance of any additional duties as defined by state and federal law.

(3) The **[authorized enforcement agency]** shall have the right to set up on any permitted facility such devices as are necessary in the opinion of the **[authorized enforcement agency]** to conduct monitoring and/or sampling of the facility's storm water discharge.

(4) The **[authorized enforcement agency]** has the right to require the discharger to install monitoring equipment as necessary. The facility's sampling and monitoring equipment shall be maintained at all times in a safe and proper operating condition by the discharger at its own expense. All devices used to measure storm water flow and quality shall be calibrated to ensure their accuracy.

(5) Any temporary or permanent obstruction to safe and easy access to the facility to be inspected and/or sampled shall be promptly removed by the operator at the written or oral request of the **[authorized enforcement agency]** and shall not be replaced. The costs of clearing such access shall be borne by the operator.

(6) Unreasonable delays in allowing the **[authorized enforcement agency]** access to a permitted facility is a violation of a storm water discharge permit and of this ordinance. A person who is the operator of a facility with an NPDES permit to discharge storm water associated with industrial activity commits an offense if the person denies the **[authorized enforcement agency]** reasonable access to the permitted facility for the purpose of conducting any activity authorized or required by this ordinance.

### 11.2. Search Warrants.

If the **[authorized enforcement agency]** has been refused access to any part of the premises from which storm water is discharged, and he/she is able to demonstrate probable cause to believe that there may be a violation of this ordinance, or that there is a need to inspect and/or sample as part of a routine inspection and sampling program designed to verify compliance with this ordinance or any order issued hereunder, or to protect the overall public health, safety, and welfare of the community, then the **[authorized enforcement agency]** may seek issuance of a search warrant from any court of competent jurisdiction.

## SECTION 12. REQUIREMENT TO PREVENT, CONTROL, AND REDUCE STORM WATER POLLUTANTS BY THE USE OF BEST MANAGEMENT PRACTICES.

**[Authorized enforcement agency]** will adopt requirements identifying Best Management Practices for any activity, operation, or facility which may cause or contribute to pollution or contamination of storm water, the storm drain system, or waters of the United States. The owner or operator of such activity, operation, or facility shall provide, at their own expense, reasonable protection from accidental discharge of prohibited materials or other wastes into the municipal storm drain system or watercourses through the use of these structural and non-structural BMPs. Further, any person responsible for a property or premise that is, or may be, the source of an illicit discharge, may be required to implement, at said person's expense, additional structural and non-structural BMPs to prevent the further discharge of pollutants to the MS4. Compliance with all terms and conditions of a valid NPDES permit authorizing the discharge of storm water associated with industrial activity, to the extent practicable, shall be deemed compliance with the provisions of this section. These BMPs shall be part of a storm water management plan (SWMP) as necessary for compliance with requirements of the NPDES permit.

## SECTION 13. NOTIFICATION OF SPILLS.

Notwithstanding other requirements of law, as soon as any person responsible for a facility or operation, or responsible for emergency response for a facility or operation has information of any known or suspected release of materials which are resulting or may result in illegal discharges or pollutants discharging into storm water, the storm drain system, or waters of the United States, said person shall take all necessary steps to ensure the discovery, containment, and cleanup of such release. In the event of such a release of hazardous materials said person shall immediately notify emergency response agencies of the occurrence via emergency dispatch services. In the event of a release of non-hazardous materials, said person shall notify the **[authorized enforcement agency]** in person or by phone or facsimile no later than the next business day. Notifications in person or by phone shall be confirmed by written notice addressed and mailed to the **[authorized enforcement agency]** within **[___]** business days of the phone notice. If the discharge of prohibited materials emanates from a commercial or industrial establishment, the owner or operator of such establishment shall also retain an on-site written record of the discharge and the actions taken to prevent its recurrence. Such records shall be retained for at least **[___]** years.

Failure to provide notification of a release as provided above is a violation of this ordinance.

## SECTION 14. VIOLATIONS, ENFORCEMENT, AND PENALTIES.

### 14.1. Violations.

It shall be unlawful for any person to violate any provision or fail to comply with any of the requirements of this ordinance. Any person who has violated or continues to violate the provisions of this ordinance, may be subject to the enforcement actions outlined in this section or may be restrained by injunction or otherwise abated in a manner provided by law.

In the event the violation constitutes an immediate danger to public health or public safety, the **[authorized enforcement agency]** is authorized to enter upon the subject private property,

without giving prior notice, to take any and all measures necessary to abate the violation and/or restore the property. The **[authorized enforcement agency]** is authorized to seek costs of the abatement as outlined in Section 17.

### 14.2. Warning Notice.

When the **[authorized enforcement agency]** finds that any person has violated, or continues to violate, any provision of this ordinance, or any order issued hereunder, the **[authorized enforcement agency]** may serve upon that person a written Warning Notice, specifying the particular violation believed to have occurred and requesting the discharger to immediately investigate the matter and to seek a resolution whereby any offending discharge will cease. Investigation and/or resolution of the matter in response to the Warning Notice in no way relieves the alleged violator of liability for any violations occurring before or after receipt of the Warning Notice. Nothing in this subsection shall limit the authority of the **[authorized enforcement agency]** to take any action, including emergency action or any other enforcement action, without first issuing a Warning Notice.

### 14.3. Notice of Violation.

Whenever the **[authorized enforcement agency]** finds that a person has violated a prohibition or failed to meet a requirement of this ordinance, the **[authorized enforcement agency]** may order compliance by written notice of violation to the responsible person.

The Notice of Violation shall contain:

(1) The name and address of the alleged violator;

(2) The address when available or a description of the building, structure or land upon which the violation is occurring, or has occurred;

(3) A statement specifying the nature of the violation;

(4) A description of the remedial measures necessary to restore compliance with this ordinance and a time schedule for the completion of such remedial action;

(5) A statement of the penalty or penalties that shall or may be assessed against the person to whom the notice of violation is directed;

(6) A statement that the determination of violation may be appealed to the **[authorized enforcement agency]** by filing a written notice of appeal within **[___]** days of service of notice of violation; and

(7) A statement specifying that, should the violator fail to restore compliance within the established time schedule, the work will be done by a designated governmental agency or a contractor and the expense thereof shall be charged to the violator.

Such notice may require without limitation:

(1) The performance of monitoring, analyses, and reporting;

(2) The elimination of illicit connections or discharges;

(3) That violating discharges, practices, or operations shall cease and desist;

(4) The abatement or remediation of storm water pollution or contamination hazards and the

restoration of any affected property

(5) Payment of a fine to cover administrative and remediation costs; and

(6) The implementation of source control or treatment BMPs.

### 14.5. Compensatory Action.

In lieu of enforcement proceedings, penalties, and remedies authorized by this ordinance, the **[authorized enforcement agency]** may impose upon a violator alternative compensatory actions, such as storm drain stenciling, attendance at compliance workshops, creek cleanup, etc.

### 14.6. Suspension Of MS4 Access.

#### 14.6.1. Emergency Cease and Desist Orders

When the **[authorized enforcement agency]** finds that any person has violated, or continues to violate, any provision of this ordinance, or any order issued hereunder, or that the person's past violations are likely to recur, and that the person's violation(s) has (have) caused or contributed to an actual or threatened discharge to the MS4 or waters of the United States which reasonably appears to present an imminent or substantial endangerment to the health or welfare of persons or to the environment, the **[authorized enforcement agency]** may issue an order to the violator directing it immediately to cease and desist all such violations and directing the violator to:

(1) Immediately comply with all ordinance requirements; and

(2) Take such appropriate preventive action as may be needed to properly address a continuing or threatened violation, including immediately halting operations and/or terminating the discharge.

Any person notified of an emergency order directed to it under this Subsection shall immediately comply and stop or eliminate its endangering discharge. In the event of a discharger's failure to immediately comply voluntarily with the emergency order, the **[authorized enforcement agency]** may take such steps as deemed necessary to prevent or minimize harm to the MS4 or waters of the United States, and/or endangerment to persons or to the environment, including immediate termination of a facility's water supply, sewer connection, or other municipal utility services. The **[authorized enforcement agency]** may allow the person to recommence its discharge when it has demonstrated to the satisfaction of the **[authorized enforcement agency]** that the period of endangerment has passed, unless further termination proceedings are initiated against the discharger under this ordinance. A person that is responsible, in whole or in part, for any discharge presenting imminent endangerment shall submit a detailed written statement, describing the causes of the harmful discharge and the measures taken to prevent any future occurrence, to the **[authorized enforcement agency]** within **[___]** days of receipt of the emergency order. Issuance of an emergency cease and desist order shall not be a bar against, or a prerequisite for, taking any other action against the violator.

#### 14.6.2. Suspension due to Illicit Discharges in Emergency Situations

The **[authorized enforcement agency]** may, without prior notice, suspend MS4 discharge access to a person when such suspension is necessary to stop an actual or threatened discharge which presents or may present imminent and substantial danger to the environment, or to the health or welfare of persons, or to the MS4 or waters of the United States. If the violator fails to

comply with a suspension order issued in an emergency, the **[authorized enforcement agency]** may take such steps as deemed necessary to prevent or minimize damage to the MS4 or waters of the United States, or to minimize danger to persons.

**14.6.3. Suspension due to the Detection of Illicit Discharge**

Any person discharging to the MS4 in violation of this ordinance may have their MS4 access terminated if such termination would abate or reduce an illicit discharge. The **[authorized enforcement agency]** will notify a violator of the proposed termination of its MS4 access. The violator may petition the **[authorized enforcement agency]** for a reconsideration and hearing.

A person commits an offense if the person reinstates MS4 access to premises terminated pursuant to this Section, without the prior approval of the **[authorized enforcement agency]**.

**14.7. Civil Penalties.**

In the event the alleged violator fails to take the remedial measures set forth in the notice of violation or otherwise fails to cure the violations described therein within **[___]** days, or such greater period as the **[authorized enforcement agency]** shall deem appropriate, after the **[authorized enforcement agency]** has taken one or more of the actions described above, the **[authorized enforcement agency]** may impose a penalty not to exceed $**[___]** (depending on the severity of the violation) for each day the violation remains unremedied after receipt of the notice of violation.

**14.8. Criminal Prosecution.**

Any person that has violated or continues to violate this ordinance shall be liable to criminal prosecution to the fullest extent of the law, and shall be subject to a criminal penalty of $**[___]** per violation per day and/or imprisonment for a period of time not to exceed **[___]** days. Each act of violation and each day upon which any violation shall occur shall constitute a separate offense.

**SECTION 15. APPEAL OF NOTICE OF VIOLATION.**

Any person receiving a Notice of Violation may appeal the determination of the **[authorized enforcement agency]**. The notice of appeal must be received within **[___]** days from the date of the Notice of Violation. Hearing on the appeal before the appropriate authority or his/her designee shall take place within **[___]** days from the date of receipt of the notice of appeal. The decision of the municipal authority or their designee shall be final.

**SECTION 16. ENFORCEMENT MEASURES AFTER APPEAL.**

If the violation has not been corrected pursuant to the requirements set forth in the Notice of Violation, or, in the event of an appeal, within **[___]** days of the decision of the municipal authority upholding the decision of the **[authorized enforcement agency]**, then representatives of the **[authorized enforcement agency]** shall enter upon the subject private property and are authorized to take any and all measures necessary to abate the violation and/or restore the property. It shall be unlawful for any person, owner, agent or person in possession of any

premises to refuse to allow the government agency or designated contractor to enter upon the premises for the purposes set forth above.

**SECTION 17. COST OF ABATEMENT OF THE VIOLATION.**

Within **[___]** days after abatement of the violation, the owner of the property will be notified of the cost of abatement, including administrative costs. The property owner may file a written protest objecting to the amount of the assessment within **[___]** days. If the amount due is not paid within a timely manner as determined by the decision of the municipal authority or by the expiration of the time in which to file an appeal, the charges shall become a special assessment against the property and shall constitute a lien on the property for the amount of the assessment.

Any person violating any of the provisions of this article shall become liable to the **[jurisdiction]** by reason of such violation. The liability shall be paid in not more than **[___]** equal payments. Interest at the rate of **[___]** percent per annum shall be assessed on the balance beginning on the **[___]** day following discovery of the violation.

**SECTION 18. VIOLATIONS DEEMED A PUBLIC NUISANCE.**

In addition to the enforcement processes and penalties provided, any condition caused or permitted to exist in violation of any of the provisions of this ordinance is a threat to public health, safety, and welfare, and is declared and deemed a nuisance, and may be summarily abated or restored at the violator's expense, and/or a civil action to abate, enjoin, or otherwise compel the cessation of such nuisance may be taken.

**SECTION 19. REMEDIES NOT EXCLUSIVE.**

The remedies listed in this ordinance are not exclusive of any other remedies available under any applicable federal, state or local law and it is within the discretion of the **[authorized enforcement agency]** to seek cumulative remedies.

The **[authorized enforcement agency]** may recover all attorney's fees court costs and other expenses associated with enforcement of this ordinance, including sampling and monitoring expenses.

**SECTION 20. ADOPTION OF ORDINANCE.**

This ordinance shall be in full force and effect **[___]** days after its final passage and adoption. All prior ordinances and parts of ordinances in conflict with this ordinance are hereby repealed.

PASSED AND ADOPTED this ____ day of _____, 20__, by the following vote:

# APPENDIX C

## SIX STEPS TO ESTABLISHING A HOTLINE AND REPORTING AND TRACKING SYSTEM

## Introduction

A complaint hotline is a dedicated phone number or website where citizens can easily report illicit discharge and pollution concerns. A prompt investigation of each complaint by trained inspectors should always follow a reported incident, usually within 24 hours. Many Phase I communities utilize hotlines to track down intermittent and transitory discharges, and regard them as one of their most effective tools to isolate illicit discharges (CWP, 2002).

This appendix describes the six steps needed to establish a hotline to report and track illicit discharges.

## Step 1. Define the scope

The community must first determine its need for an IDDE complaint hotline and should not establish one simply because it does not currently exist. An IDDE hotline may be appropriate for a community for the following reasons:

- The municipality already receives a high volume of complaint calls associated with illicit discharges. Without a designated number, complaints may be received by several different departments, which can lead to inconsistent handling of concerns. If a community is unsure of the number of complaints received across the municipality, it may want to quickly survey departments likely to receive calls. A hotline can help promote stakeholder reporting of incidents and make the reporting process more efficient rather than relying on calls making it to the correct office.
- A community hotline exists that cannot be altered to accommodate the needs of the IDDE program. Situations that would make two hotlines incompatible include: significantly different concerns (e.g., IDDE vs. emergency services); varying jurisdictional limits (e.g., regional vs. city only); and funding restrictions (e.g., hotline is developed with a grant that prevents it from overlapping with other programs).
- Related municipal programs exist that would benefit from the establishment of a hotline, such as erosion and sediment control or storm water management programs. Combining similar services can lead to a significant savings in cost and time.

Communities that have no pressing need for a hotline may still choose to institute a department phone number or email address to field complaints and incident reports during normal business hours, or a website that provides guidance on how to report potential illicit discharges.

Once a community has decided to implement a hotline, the scope of the IDDE hotline should be defined, including the intent and extent of the program. The intent of the hotline may be to process the incident/complaint, and investigate and enforce violations, or to take a more educational approach that also provides information and guidance. It is recommended that communities initiating a hotline for the first time limit the scope to the former intent.

The extent of the hotline refers to the geographic area of coverage as well as the types of incidents that fall under the responsibility of the responding agency or department. Often hotlines are restricted to

one specific jurisdiction to minimize complications with investigating and enforcing violations across jurisdictional lines. Significant coordination and planning are required if the hotline is intended to serve a region or watershed with several jurisdictions. Similar coordination efforts are necessary if a wide range of incidents is handled by the hotline that require multiple agencies or departments to respond. It is important for communities to predetermine what agency or department is best suited and trained to respond to specific incident reports, and for all hotline operators to be well trained and knowledgeable about these distinctions.

## Step 2. Create a tracking and reporting system

The next step to establishing an IDDE hotline is to create a tracking and reporting system. The two key features that should be considered are the methods of reporting and methods of responding.

At a minimum, the reporting method should include a telephone call-in system and may also include a website. The phone number and/or internet address should be easy to remember and toll-free if any areas under the jurisdiction of the IDDE program are long-distance from the reporting office. The reporting method should be available 24 hours a day, seven days a week. This around the clock process encourages stakeholders to call as soon as a problem is identified.

Providing an option for anonymous reporting also encourages calls because it can be done without fear of retribution from neighbors, employers, or others. In most cases this is achieved by providing an "Incident ID" that may also be used to allow the caller to track the investigation and know that their concerns are being addressed, as well as build in accountability within the department to respond to hotline callers.

The level of detail collected during an incident report will vary depending on system design and complaint responder training. Many hotlines collect only basic information, however, more detailed information will help prioritize investigations and take advantage of a database system to expand reporting options. A sample Illicit Discharge Incident Tracking Sheet is provided at the end of this Appendix to help facilitate this process. The sheet is intended for use with a phone reporting system, and is designed so that the responder can prompt the caller through each section. This sheet may be modified into a simple, multiple-choice questionnaire if reporting is done through a website or email. The basic information collected during an incident report is described below.

- *Incident ID* - Each incident should receive a unique identification code to ensure accurate tracking and public feedback.

- *Reporter Information* - Reporter contact information may be recorded, however, anonymous reporting is often preferred because it frees the reporter from potential backlash. The date and time of incident must be noted, as it may be different than the time it was called in.

- *Responder Information* - The name of the responder and the time and date of the call should be recorded. The amount of precipitation in the past 24-48 hours is also recorded for reporting purposes.

- *Incident Location* - The location of the potential illicit discharge is one of the most important yet difficult pieces of information to accurately collect. Unique

and visible outfall numbering allows reports to be precisely located. In the absence of outfall IDs, callers should be encouraged to provide the nearest street/intersection information and any general descriptions that tie the site to a nearby landmark or major land use (e.g., shopping center, school, etc.), as well as indicate whether the incident site is located in the stream corridor or in an upland area. Other options are to include blank space for narrative descriptions or for the response team to meet the caller at a nearby known location if the caller cannot provide sufficient locational information.

- *Problem Type* - Providing a list of likely problems and problem descriptions can help to readily identify the potential source. The problem types will likely fall into the following five categories: unnatural stream conditions, sewage, wash water, oil/solvents, and industrial wastes. "Other" should also be included, as exceptions will occur. By identifying a suspected origin, the field team may have a head start on the investigation and suspected repeat offenders can be screened through trend analysis.

- *Problem Indicator Description* - A description of the discharge odor and color, and type of floatables present permits investigators to know what they are looking for and start preparing for how to handle the situation.

- *Investigation Notes* - To properly track and report suspected illicit discharges, the investigation needs to be documented. Key information to record for the initial and follow-up investigation (if applicable) include: date, time, step taken to respond to incident report (not all require follow up), investigators, length of time spent for investigation, corrective actions taken, date case closed, and any other pertinent information.

Due to the intermittent nature of illicit discharges, a 24-hour investigation response can increase the likelihood of identifying and eliminating problems. While some problems require more immediate attention than others, investigators should always respond as soon as appropriate. Calls should be screened by a "live" person so only the most urgent calls are passed through a pager system in order to minimize the pressure that 24-hour response places on investigators at odd hours. The complaint questions should be detailed enough to help support this basic prioritization.

Some communities may determine that 24-hour response is cost prohibitive, and that non-emergency response will only occur during normal working hours (e.g., 8AM - 5PM). In these situations, it is essential that explicit instructions be provided to the caller in case of a true emergency.

Another aspect of responding to complaints is determining when another department or agency should handle the problem. An incident may need to be passed on because the reported problem falls under the responsibility of another department, such as the fire or health department. Having specific guidelines for the call responder and investigators is imperative to handling these incidents appropriately.

### Step 3. Train personnel

Training of complaint respondents should include how to provide good customer service, the basics of illicit discharge identification and details of the tracking and reporting process. The responder should be

trained so that he/she understands the significance of the information being collected and can go beyond the "check boxes" when necessary to answer the reporter questions, as well as guide the caller through the data collection process. This ensures that the incident is handled correctly, and that the caller feels that the concern is in good hands.

An initial screening of the potential illicit source by the responder can be useful. Table C1 provides a list of descriptions of common illicit discharges called in and the likely source or situation.

Inter- and intra-department training should focus on the importance of IDDE, the complaint hotline investigation and tracking process, and the expected responsibilities of each involved entity. Such training can greatly increase watershed wide awareness of illicit discharge problems and is essential to developing good working relationships with other departments.

## Step 4. Advertise

Public relations are an important aspect of a pollution hotline. Many municipalities have noted that there is always a peak in incident reporting following an advertising campaign. Advertising the hotline phone number or web address several times a year keeps the message fresh in public minds. Effective methods include magnets, stickers, phone book advertisements, flyers, bill inserts, displays, fair booths and newspaper articles.

Advertising, including publicizing success stories about the hotline serves several purposes. First it highlights the responsiveness of the program to the general public. Second, it serves as a means to further promote the hotline. Third, it builds public support for the program and fosters public stewardship. Success stories can be published through newspaper articles, TV broadcasts or other highly visible means of advertising. The stories will build general awareness of illicit discharge issues and promote greater public stewardship and accountability by both those reporting the problems and potential violators.

**Table C1: Types of Potential IDDE Hotline Complaints**

| Typical Call-in Indicators | Likely Source |
|---|---|
| Sewage smell, or floatables from storm drain outfall during dry weather flow | Storm and sanitary sewer cross-connection |
| Small (<6" diameter) pipe directly discharging to receiving water | Straight pipe discharge from home or business |
| Greatly discolored or unnatural smelling liquid (often hydrocarbons) flowing from or pooling on property or from outfall below property | Dumping |
| Sewage smell; extra green vegetation; saturated ground | Failing septic system |
| Muddy water; sediment deposits, up stream construction site | Poor erosion and sediment control |

### Step 5. Respond to complaints

Hotline customer service staff should provide friendly and knowledgeable service to callers that might include an overview of the investigation process, how long a response should take, and an incident tracking ID so the caller can follow-up on the complaint. Hotline staff should arrange to send an investigator out to the incident site as soon as possible.

Investigators should respond to complaints in a timely manner, and provide the necessary feedback to the database system. The type of complaint will dictate the necessary response, as well as the timing of the response (e.g., a failing septic system may not be as high a priority as a sanitary sewer overflow). Information submitted to the reporting database might include: time from initial call to investigation, steps taken to investigate, and actions taken to solve the problem.

### Step 6. Track incidents

Illicit discharge complaints and incidents should be reported and tracked through a database system in order to meet the following program goals:

- Identify recurring problems and suspected offenders
- Measure program success
- Comply with annual report requirements

Basic data to be compiled and analyzed include the following:

- Number of calls received per year
- Number of incidents investigated
- Number of actual IDDE incidents
- Average time to follow up on incident report
- Average time to remedy identified illicit problem
- Most common problems identified by public

### Costs

Table C2 provides planning level costs to establish and maintain a hotline and tracking system. Certain costs can undoubtedly be reduced through sharing of services across departments and even jurisdictions.

| Table C2: Cost to Create and Maintain a Successful IDDE Hotline | | | |
|---|---|---|---|
| **Steps** | **Key Elements/ Consideration** | **Initial Costs** | **Annual Costs** |
| 1. Define the scope | Planning Costs: 60 hrs @ $25/hr to coordinate with other departments and design program basics | $1,500 | $0 |
| 2. Create a tracking and reporting system | Initial web design: 80hrs @ $25/hr<br>Annual web hosting @ 200/yr[1] | $2,000 | $200 |
| | 800 toll free number set-up: free<br>Monthly costs: $20/month ($240/yr) + $0.20 per minute (assume average call of 10 minutes and 1000 calls/yr, or $2,000/yr)[2] | $0 | $2,240 |
| | Database design: 20 hrs @ $25/hr[1] | $500 | $0 |
| 3. Train personnel | *Initial*: 3 days (Approx $25/hr) including full day introductory Access training course ($400) = $1,000[3]<br>*Annual*: approx 1/2 day refresher = $200 | $1,000 | $200 |
| | *Initial*: presentation prep (24 hrs @ $50/hr)<br>*Annual*: mini-refresher training (16 hrs @ $25/hr to rotate through other departments) | $1,200 | $800 |
| 4. Advertise | *Initial*: Design brochure and magnets ($1,000)[4,] Design 30 second PSA video spot ($500)[5]<br>*Annual*: 4,000 magnets ($920), 10,000 brochures printed and mailed ($1,500) + 20 hrs or coordination ($500) | $1,500 | $2,920 |
| 5. Respond to complaints | Assumes 1,000 calls per year at 10 min per complaint[6] to handle including receiving the call, forwarding to appropriate place, logging into a database, and tracking investigation. This time represents approximately 15% of a full time position. | $0 | $5,000 |
| 6. Track incidents | | | |
| **TOTAL** | | **$7,700** | **$11,360** |

Ways to reduce cost: Use in-house or donated database, brochure and web design services; combine with other pollution prevention hotlines (e.g., storm water); combine with other local, regional or state IDDE hotline programs; use existing web page hosting services; hire staff with database experience

Notes:

[1] Personal communication with Center for Watershed Protection staff performing similar duties

[2] Sprint Small Business website

[3] ExecuTrain - computer training business

[4] CWP, 1998

[5] CSG, 1998

[6] adapted from TCEQ, 2003

## References

Center for Watershed Protection (CWP). 1998. *Rapid Watershed Planning Handbook – A Comprehensive Guide for Managing Urbanizing Watersheds*. Ellicott City, MD.

Center for Watershed Protection. 2002. Unpublished Task I Technical Memorandum in Support of *Illicit Discharge Detection and Elimination Guidance Manual*. Ellicott City, MD.

Council of State Governments (CSG). 1998. *Getting in Step: A Guide to Effective Outreach in Your Watershed*.

Sprint Small Business web site (www.sprintbiz.com.). Accessed May 14, 2003.

Texas Commission of Environmental Quality (TCEQ) Personal Communication. May 9, 2003. Email Jim Reed.

# Illicit Discharge Hotline Incident Tracking Sheet

**Incident ID:**

| **Responder Information** | |
|---|---|
| Call taken by: | Call date: |
| Call time: | Precipitation (inches) in past 24-48 hrs: |
| **Reporter Information** | |
| Incident time: | Incident date: |

Caller contact information (*optional*):

## Incident Location *(complete one or more below)*

Latitude and longitude:

Stream address or outfall #:

Closest street address:

Nearby landmark:

| **Primary Location Description** | **Secondary Location Description:** | | |
|---|---|---|---|
| ☐ Stream corridor (*In or adjacent to stream)* | ☐ Outfall | ☐ In-stream flow | ☐ Along banks |
| ☐ Upland area *(Land not adjacent to stream)* | ☐ Near storm drain | ☐ Near other water source (storm water pond, wetland, etc.): | |

Narrative description of location:

## Upland Problem Indicator Description

| | | |
|---|---|---|
| ☐ Dumping | ☐ Oil/solvents/chemicals | ☐ Sewage |
| ☐ Wash water, suds, etc. | ☐ Other: _____ | |

## Stream Corridor Problem Indicator Description

| | | | | |
|---|---|---|---|---|
| Odor | ☐ None | ☐ Sewage | ☐ Rancid/Sour | ☐ Petroleum (gas) |
| | ☐ Sulfide (rotten eggs); natural gas | ☐ Other: Describe in "Narrative" section | | |
| Appearance | ☐ "Normal" | ☐ Oil sheen | ☐ Cloudy | ☐ Suds |
| | ☐ Other: Describe in "Narrative" section | | | |
| Floatables | ☐ None: | ☐ Sewage (toilet paper, etc) | ☐ Algae | ☐ Dead fish |
| | ☐ Other: Describe in "Narrative" section | | | |

Narrative description of problem indicators:

Suspected Violator (name, personal or vehicle description, license plate #, etc.):

| Investigation Notes | |
|---|---|
| Initial investigation date: | Investigators: |
| ☐ No investigation made | Reason: |
| ☐ Referred to different department/agency: | Department/Agency: |
| ☐ Investigated: No action necessary | |
| ☐ Investigated: Requires action | Description of actions: |
| Hours between call and investigation: | Hours to close incident: |
| Date case closed: | |
| Notes: | |

# APPENDIX D

## OUTFALL RECONNAISSANCE INVENTORY FIELD SHEET

# OUTFALL RECONNAISSANCE INVENTORY/ SAMPLE COLLECTION FIELD SHEET

## Section 1: Background Data

| | | | |
|---|---|---|---|
| Subwatershed: | | Outfall ID: | |
| Today's date: | | Time (Military): | |
| Investigators: | | Form completed by: | |
| Temperature (°F): | Rainfall (in.): Last 24 hours: | Last 48 hours: | |
| Latitude: | Longitude: | GPS Unit: | GPS LMK #: |
| Camera: | | Photo #s: | |

Land Use in Drainage Area (Check all that apply):

☐ Industrial
☐ Ultra-Urban Residential
☐ Suburban Residential
☐ Commercial
☐ Open Space
☐ Institutional
Other: _____
Known Industries: _____

Notes (e.g., origin of outfall, if known):

## Section 2: Outfall Description

| LOCATION | MATERIAL | SHAPE | | DIMENSIONS (IN.) | SUBMERGED |
|---|---|---|---|---|---|
| ☐ **Closed Pipe** | ☐ RCP ☐ CMP<br>☐ PVC ☐ HDPE<br>☐ Steel<br>☐ Other: _____ | ☐ Circular<br>☐ Eliptical<br>☐ Box<br>☐ Other: _____ | ☐ Single<br>☐ Double<br>☐ Triple<br>☐ Other: _____ | Diameter/Dimensions:<br>_____ | In Water:<br>☐ No<br>☐ Partially<br>☐ Fully<br>With Sediment:<br>☐ No<br>☐ Partially<br>☐ Fully |
| ☐ **Open drainage** | ☐ Concrete<br>☐ Earthen<br>☐ rip-rap<br>☐ Other: _____ | ☐ Trapezoid<br>☐ Parabolic<br>☐ Other: _____ | | Depth: _____<br>Top Width: _____<br>Bottom Width: _____ | |
| ☐ **In-Stream** | **(applicable when collecting samples)** | | | | |
| **Flow Present?** | ☐ Yes ☐ No | ***If No, Skip to Section 5*** | | | |
| **Flow Description (If present)** | ☐ Trickle ☐ Moderate ☐ Substantial | | | | |

## Section 3: Quantitative Characterization

| FIELD DATA FOR FLOWING OUTFALLS | | | | |
|---|---|---|---|---|
| **PARAMETER** | | **RESULT** | **UNIT** | **EQUIPMENT** |
| ☐Flow #1 | Volume | | Liter | Bottle |
| | Time to fill | | Sec | |
| ☐Flow #2 | Flow depth | | In | Tape measure |
| | Flow width | _____' _____" | Ft, In | Tape measure |
| | Measured length | _____' _____" | Ft, In | Tape measure |
| | Time of travel | | S | Stop watch |
| Temperature | | | °F | Thermometer |
| pH | | | pH Units | Test strip/Probe |
| Ammonia | | | mg/L | Test strip |

# Outfall Reconnaissance Inventory Field Sheet

**Section 4: Physical Indicators for Flowing Outfalls Only**

Are Any Physical Indicators Present in the flow? ☐ Yes ☐ No (*If No, Skip to Section 5)*

| INDICATOR | CHECK if Present | DESCRIPTION | RELATIVE SEVERITY INDEX (1-3) | | |
|---|---|---|---|---|---|
| Odor | ☐ | ☐ Sewage ☐ Rancid/sour ☐ Petroleum/gas ☐ Sulfide ☐ Other: | ☐ 1 – Faint | ☐ 2 – Easily detected | ☐ 3 – Noticeable from a distance |
| Color | ☐ | ☐ Clear ☐ Brown ☐ Gray ☐ Yellow ☐ Green ☐ Orange ☐ Red ☐ Other: | ☐ 1 – Faint colors in sample bottle | ☐ 2 – Clearly visible in sample bottle | ☐ 3 – Clearly visible in outfall flow |
| Turbidity | ☐ | See severity | ☐ 1 – Slight cloudiness | ☐ 2 – Cloudy | ☐ 3 – Opaque |
| Floatables -Does Not Include Trash!! | ☐ | ☐ Sewage (Toilet Paper, etc.) ☐ Suds ☐ Petroleum (oil sheen) ☐ Other: | ☐ 1 – Few/slight; origin not obvious | ☐ 2 – Some; indications of origin (e.g., possible suds or oil sheen) | ☐ 3 - Some; origin clear (e.g., obvious oil sheen, suds, or floating sanitary materials) |

**Section 5: Physical Indicators for Both Flowing and Non-Flowing Outfalls**

Are physical indicators that are not related to flow present? ☐ Yes ☐ No (*If No, Skip to Section 6)*

| INDICATOR | CHECK if Present | DESCRIPTION | COMMENTS |
|---|---|---|---|
| Outfall Damage | ☐ | ☐ Spalling, Cracking or Chipping ☐ Peeling Paint ☐ Corrosion | |
| Deposits/Stains | ☐ | ☐ Oily ☐ Flow Line ☐ Paint ☐ Other: | |
| Abnormal Vegetation | ☐ | ☐ Excessive ☐ Inhibited | |
| Poor pool quality | ☐ | ☐ Odors ☐ Colors ☐ Floatables ☐ Oil Sheen ☐ Suds ☐ Excessive Algae ☐ Other: | |
| Pipe benthic growth | ☐ | ☐ Brown ☐ Orange ☐ Green ☐ Other: | |

**Section 6: Overall Outfall Characterization**

☐ Unlikely ☐ Potential (presence of two or more indicators) ☐ Suspect (one or more indicators with a severity of 3) ☐ Obvious

**Section 7: Data Collection**

| | | | |
|---|---|---|---|
| 1. Sample for the lab? | ☐ Yes | ☐ No | |
| 2. If yes, collected from: | ☐ Flow | ☐ Pool | |
| 3. Intermittent flow trap set? | ☐ Yes | ☐ No | If Yes, type: ☐ OBM ☐ Caulk dam |

**Section 8: Any Non-Illicit Discharge Concerns (e.g., trash or needed infrastructure repairs)?**

# APPENDIX E

## FLOW TYPE DATA FROM TUSCALOOSA AND BIRMINGHAM, AL

# Appendix E1: Data Tables for Tuscaloosa

**Table E1.1: Tap Water Reference ("Library") Samples**

| Sample number | Sampling Location | Date | pH | Spec. cond. (µS/cm) | Temp. (°F) | Turb. (NTU) | Color (APHA Platinum Cobalt Units) | F (mg/L) | Hard. (mg/L $CaCO_3$) | Detergent (mg/L as MBAS) | Fluorescence (raw signal strength) | Fluorescence (mg/L as "Tide") |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | B.B.Commer Hall | 5/17/2002 | 8.19 | 132 | N/A | N/A | 0 | 0.97 | 63.6 | 0 | N/A | N/A |
| 2 | Rose Towers | 5/17/2002 | 7.92 | 145 | N/A | N/A | 0 | 0.97 | 68.4 | 0 | N/A | N/A |
| 3 | H.C.Commer Hall | 5/17/2002 | 8.46 | 125 | N/A | N/A | 0 | 0.96 | 60.8 | 0 | N/A | N/A |
| 4 | Rec Centre | 5/17/2002 | 8.11 | 130 | N/A | N/A | 0 | 0.92 | 64.8 | 0 | N/A | N/A |
| 5 | Coleman Coliseum | 5/17/2002 | 8.28 | 130 | N/A | N/A | 0 | 0.94 | 72.8 | 0 | N/A | N/A |
| 6 | Mib (UA) | 5/29/2003 | 7.81 | 146 | N/A | 1.15 | 0 | 1.04 | 28 | 0 | 2115 | 4.88 |
| 7 | Alex Appt. | 5/30/2003 | 7.38 | 156 | N/A | 0.761 | 0 | 0.82 | 44 | 0 | 92 | 0.21 |
| 8 | Georgas Library (UA) | 6/3/2003 | 8.13 | 152 | N/A | 0.811 | 0 |  | 42 | 0 | 1255 | 2.9 |
| 9 | Rodgers Library | 6/8/2003 | 7.5 | 141 | N/A | 0.566 | 0 | 0.84 | 40 | 0 | 165 | 0.38 |
| 10 | Alexander Property Appt. | 6/8/2003 | 7.5 | 138 | N/A | 0.61 | 0 | 0.89 | 46 | 0 | 637 | 1.47 |
| 11 | Pslidea Court Appt. | 6/8/2003 | 7.68 | 139 | N/A | 0.433 | 0 | 1.00 | 44 | 0 | 566 | 1.3 |
| 12 | University Plaza Appt. | 6/8/2003 | 7.5 | 140 | N/A | 0.856 | 0 | 0.94 | 46 | 0 | 1003 | 2.31 |
| **Mean** | | | 7.87 | 140 | - | 0.74 | 0 | 0.94 | 52 | 0 | 833 | 1.92 |
| **Standard Deviation** | | | 0.36 | 9.3 | - | 0.23 | 0 | 0.065 | 14 | 0 | 702 | 1.62 |
| **COV** | | | 0.05 | 0.07 | - | 0.32 | - | 0.07 | 0.27 | - | 0.84 | 0.84 |
| **Anderson Darling Probability Test Value (Normal)** | | | **1.138** | **1.004** | - | **1.57** | - | **1.144** | **1.331** | - | - | **1.601** |
| **Anderson Darling Probability Test Value (Log-normal)** | | | - | 0.998 | - | 1.543 | - | 1.185 | 1.307 | - | - | 1.639 |

*Data provided by Robert Pitt, University of Alabama*

| Table E1.1: Tap Water Reference ("Library") Samples, CONT. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Sample number** | **Sampling Location** | **Date** | **K (mg/L)** | **$NH_3$ (mg/L as N)** | **$NH_3$/K (ratio)** | **B (mg/L)** | **Total Coliforms (MPN/100 mL)** | ***E. coli* (MPN/100 mL)** | **Enterococci (MPN/100 mL)** |
| 1 | B.B.Commer Hall | 5/17/2002 | 1 | <LD | N/A | N/A | N/A | N/A | N/A |
| 2 | Rose Towers | 5/17/2002 | 1 | <LD | N/A | N/A | N/A | N/A | N/A |
| 3 | H.C.Commer Hall | 5/17/2002 | 1 | <LD | N/A | N/A | N/A | N/A | N/A |
| 4 | Rec Centre | 5/17/2002 | 1 | <LD | N/A | N/A | N/A | N/A | N/A |
| 5 | Coleman Coliseum | 5/17/2002 | 1 | <LD | N/A | N/A | N/A | N/A | N/A |
| 6 | Mib (UA) | 5/29/2003 | 2 | 0.01 | 0.005 | 0.19 | 1 | <1 | <1 |
| 7 | Alex Appt. | 5/30/2003 | 2 | <LD | N/A | 0.1 | <1 | <1 | <1 |
| 8 | Georgas Library (UA) | 6/3/2003 | 1 | <LD | N/A | 0.12 | <1 | <1 | <1 |
| 9 | Rodgers Library | 6/8/2003 | 1 | <LD | N/A | 0.04 | 21.6 | <1 | <1 |
| 10 | Alexander Property Appt. | 6/8/2003 | 1 | 0.07 | 0.07 | 0.14 | <1 | <1 | <1 |
| 11 | Pslidea Court Appt. | 6/8/2003 | 2 | 0.07 | 0.035 | 0.27 | <1 | <1 | <1 |
| 12 | University Plaza Appt. | 6/8/2003 | 2 | 0.07 | 0.035 | 0.11 | <1 | <1 | <1 |
| **Mean** | | | 1.3 | <0.055 | 0.036 | 0.14 | <11 | <1 | <1 |
| **Standard Deviation** | | | 0.49 | 0.03 | 0.026 | 0.07 | 15 | - | - |
| **COV** | | | 0.37 | 0.55 | 0.73 | 0.53 | 1.3 | - | - |
| **Anderson Darling Probability Test Value (Normal)** | | | **3.809** | **3.199** | **2.539** | **1.663** | 4.103 | - | - |
| **Anderson Darling Probability Test Value (Log-normal)** | | | 3.809 | 3.199 | 2.703 | 1.685 | 4.103 | - | - |

*Data provided by Robert Pitt, University of Alabama*

**Table E1.2: Spring Water Reference ("Library") Samples**

| Sample number | Sampling Location | Date | pH | Spec. cond. (µS/cm) | Temp. (°F) | Turb. (NTU) | Color (APHA Platinum Cobalt Units) | F (mg/L) | Hard. (mg/L $CaCO_3$) | Detergent (mg/L as MBAS) | Fluorescence (raw signal strength) | Fluorescence (mg/L as "Tide") |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Marrs Spring | 9/30/2002 | 5.77 | 128 | 30 | 56 | 0 | 0.01 | 24.6 | 0 | N/A | 0.94 |
| 2 | Jack Warner Pkwy | 10/11/2002 | 6.46 | 124 | 30 | 67 | 0 | 0.01 | 34.4 | 0 | N/A | 0.56 |
| 3 | Marrs Spring | 11/3/2002 | 6.21 | 166 | N/A | 0.85 | 0 | 0.01 | 40.2 | 0 | N/A | 4.84 |
| 4 | Jack Warner Pkwy | 11/3/2002 | 6.36 | 112 | N/A | 42 | 0 | 0.01 | 28.6 | 0 | N/A | 6.64 |
| 5 | Marrs Spring | 3/11/2003 | 6.64 | 230 | N/A | 0.591 | 0 | 0.08 | 38 | 0 | N/A | 0.46 |
| 6 | Jack Warner Pkwy | 5/16/2003 | 6.45 | 126 | N/A | 19.3 | 0 | 0.21 | 32 | 0 | 20754 | 47.97 |
| 7 | Jack Warner Pkwy | 5/17/2003 | 6.16 | 128 | N/A | 19.6 | 0 | 0.17 | 44 | 0 | 2296 | 5.30 |
| 8 | Marrs Spring | 5/18/2003 | 6.82 | 182 | N/A | 1.78 | 0 | 0.39 | 42 | 0 | 1542 | 3.56 |
| 9 | Marrs Spring | 5/30/2003 | 6.43 | 143 | N/A | 1.12 | 5 | 0.31 | 40 | 0 | 1130 | 2.61 |
| 10 | Marrs Spring | 6/3/2003 | 6.81 | 200 | N/A | 21.2 | 27 | 0.07 | 42 | 0 | 6537 | 15.11 |
| 11 | Jack Warner Pkwy | 6/3/2003 | 5.63 | 125 | 72 | 4.08 | 0 | 0.14 | 48 | 0 | 7855 | 18.15 |
| 12 | Jack Warner Pkwy | 6/5/2003 | 6.04 | 130 | 68 | 4.89 | 0 | 0.24 | 48 | 0 | 5343 | 12.35 |
| **Mean** | | | **6.3** | **149** | **50** | **19.8** | **2.6** | **0.13** | **38** | **0** | **6493** | **9.8** |
| **Standard Deviation** | | | **0.37** | **36** | **23** | **23** | **7.7** | **0.12** | **7.3** | **0** | **6800** | **13.3** |
| **COV** | | | **0.05** | **0.24** | **0.46** | **1.16** | **2.92** | **0.93** | **0.19** | **-** | **-** | **1.3** |
| **Anderson Darling Probability Test (Normal)** | | | **1.046** | **1.046** | **1.795** | **-** | **1.726** | **5.451** | **1.215** | **1.08** | **-** | **-** |
| **Anderson Darling Probability Test (Log-normal)** | | | **-** | **-** | **1.633** | **-** | **1.192** | **4.201** | **1.664** | **1.213** | **-** | **-** |

*Data provided by Robert Pitt, University of Alabama*

**Table E1.2: Spring Water Reference ("Library") Samples, CONT.**

| Sample number | Sampling Location | Date | K (mg/L) | $NH_3$ (mg/L as N) | $NH_3$/K (ratio) | B (mg/L) | Total Coliforms (MPN/100 mL) | *E. coli* (MPN/100 mL) | Enterococci (MPN/100 mL) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Marrs Spring | 9/30/2002 | 8 | 0.01 | 0.001 | N/A | 1203.3 | 4.1 | 4.1 |
| 2 | Jack Warner Pkwy | 10/11/2002 | 1 | 0.02 | 0.02 | N/A | 275.5 | 1 | 36.4 |
| 3 | Marrs Spring | 11/3/2002 | 3 | 0.04 | 0.013 | N/A | N/A | N/A | N/A |
| 4 | Jack Warner Pkwy | 11/3/2002 | 2 | 0.02 | 0.01 | N/A | N/A | N/A | N/A |
| 5 | Marrs Spring | 3/11/2003 | 3 | 0.08 | 0.026 | N/A | N/A | N/A | N/A |
| 6 | Jack Warner Pkwy | 5/16/2003 | 3 | 0.01 | 0.0033 | 0.15 | 116.2 | <1 | <1 |
| 7 | Jack Warner Pkwy | 5/17/2003 | 2 | 0.29 | 0.14 | 0.15 | >2419.2 | 290.9 | 412 |
| 8 | Marrs Spring | 5/18/2003 | 4 | 0.01 | 0.0025 | 0.14 | >2419.2 | 172.3 | 140.8 |
| 9 | Marrs Spring | 5/30/2003 | 3 | 0.05 | 0.016 | 0.09 | 111.2 | <1 | 3.1 |
| 10 | Marrs Spring | 6/3/2003 | 2 | 0.05 | 0.025 | 0.16 | >2419.2 | 9.7 | 65.7 |
| 11 | Jack Warner Pkwy | 6/3/2003 | 4 | 0.05 | 0.012 | 0.09 | 4.1 | 1 | <1 |
| 12 | Jack Warner Pkwy | 6/5/2003 | 3 | 0.05 | 0.016 | 0.04 | 7.2 | <1 | <1 |
| **Mean** | | | 3.1 | 0.057 | 0.024 | 0.117 | >286 | <80 | <110 |
| **Standard Deviation** | | | 1.7 | 0.077 | 0.039 | 0.045 | 460 | 123 | 156 |
| **COV** | | | 0.55 | 1.35 | 1.592 | 0.381 | 1.60 | 1.54 | 1.41 |
| **Anderson Darling Probability Test Value (Normal)** | | | 1.9 | 3.01 | 3.498 | **1.864** | 2.06 | 3.27 | 2.66 |
| **Anderson Darling Probability Test Value (Log-normal)** | | | **1.4** | **1.2** | **1.3** | 2.04 | 1.55 | 2.14 | 1.47 |

*Data provided by Robert Pitt, University of Alabama*

**Table E1.3: Car Wash Reference ("Library") Samples**

| Sample number | Sampling Location | Date | pH | Spec. cond. (µS/cm) | Temp. (°F) | Turb. (NTU) | Color (APHA Platinum Cobalt Units) | F (mg/L) | Hard. (mg/L $CaCO_3$) | Detergent (mg/L as MBAS) | Fluorescence (raw signal strength) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Gee's Car Wash-Self Service | 10/31/2002 | 6.62 | 320 | 26 | 263 | 100 | <LD | 56 | | N/A |
| 2 | Texaco Gas Station - Automatic Carwash | 10/31/2002 | 6.90 | 300 | 28 | 232 | >100 | 0.04 | 15 | 150 | N/A |
| 3 | Chevey Gas Station - Automatic Carwash | 5/16/2003 | 7.00 | 260 | N/A | 383 | 80.00 | 6.45 | 68 | 120 | 46162 |
| 4 | Self service carwash-University Blvd. | 5/17/2003 | 9.04 | 380 | N/A | 81 | >100 | 1.70 | 76 | 150 | 19192 |
| 5 | Self service carwash-University Blvd. | 5/17/2003 | 7.37 | 390 | N/A | 239 | >100 | 0.56 | 78 | 140 | 294014 |
| 6 | Chevey Gas Station - Automatic Carwash | 5/17/2003 | 9.34 | 570 | N/A | 264 | >100 | <LD | 82 | 80 | 39262 |
| 7 | Chevey Gas Station-McFarland - Automatic Carwash | 5/29/2003 | 7.79 | 210 | N/A | 62 | 77.00 | 1.47 | 83 | 200 | 41341 |
| 8 | Parade gas station (McFarland) - Automatic Carwash | 6/3/2003 | 8.57 | 200 | N/A | 207 | >100 | 0.05 | 84 | 150 | 54268 |
| 9 | Stop and go self service carwash-Skyland Blvd. | 6/3/2003 | 6.81 | 200 | 70 | 65 | 80.00 | 0.42 | 76 | 120 | 70180 |
| 10 | Parade gas station-(Skyland Blvd.) - Automatic Carwash | 6/3/2003 | 7.53 | 192 | 70 | 69 | 60.00 | 0.19 | 74 | 150 | 35731 |
| 11 | Shell gas station (Skyland Blvd.) - Automatic Carwash | 6/3/2003 | 7.2 | 120 | 71 | 1 | 30.00 | 0.50 | 82 | 150 | 14937 |
| 12 | Parade gas station (Skyland Blvd.) - Automatic Carwash | 6/8/2003 | 7.89 | 154 | N/A | 14 | 0.00 | 0.87 | 80 | 140 | 13681 |
| **Mean** | | | 7.67 | 274 | 53 | 156 | >61 | 1.22 | 71 | 140 | 62876 |
| **Standard Deviation** | | | 0.89 | 126 | 23 | 122 | 34 | 1.92 | 19 | 29 | 83144 |
| **COV** | | | 0.11 | 0.45 | 0.44 | 0.77 | 0.56 | 1.56 | 0.27 | 0.20 | 1.32 |
| **Anderson Darling Probability Test (Normal)** | | | **1.22** | **1.27** | - | **1.33** | **1.96** | 2.66 | **1.72** | **1.87** | - |
| **Anderson Darling Probability Test (Log-normal)** | | | - | 1.02 | - | 1.79 | 2.18 | **1.20** | 1.81 | 3.12 | - |

*Data provided by Robert Pitt, University of Alabama*

**Table E1.3: Car Wash Reference ("Library") Samples, CONT.**

| Sample number | Sampling Location | Date | Fluorescence (mg/L as "Tide") | K (mg/L) | $NH_3$ (mg/L as N) | $NH_3$/K (ratio) | B (mg/L) | Total Coliforms (MPN/100 mL) | *E. coli* (MPN/100 mL) | Enterococci (MPN/100 mL) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Gee's Car Wash-Self Service | 10/31/2002 | 132 | 10 | 0.44 | 0.044 | N/A | >2419.2 | 1553.1 | >2419.2 |
| 2 | Texaco Gas Station - Automatic Carwash | 10/31/2002 | 130 | 2 | 0.65 | 0.33 | N/A | >2419.2 | 1413.60 | 6.20 |
| 3 | Chevey Gas Station - Automatic Carwash | 5/16/2003 | 106 | 2 | 0.37 | 0.19 | 0.50 | >2419.2 | 4.1 | 5.2 |
| 4 | Self service carwash-University Blvd. | 5/17/2003 | 44 | 5 | 0.28 | 0.06 | 0.65 | >2419.2 | 14.6 | 3.1 |
| 5 | Self service carwash-University Blvd. | 5/17/2003 | 55 | 2 | 0.03 | 0.02 | 1.23 | >2419.2 | >2419.2 | 1 |
| 6 | Chevey Gas Station - Automatic Carwash | 5/17/2003 | 90 | 3 | 4.50 | 1.50 | 1.74 | >2419.2 | 1413.6 | >2419.2 |
| 7 | Chevey Gas Station-McFarland - Automatic Carwash | 5/29/2003 | 95 | 3 | 0.75 | 0.25 | 0.37 | >2419.2 | 15.8 | <1 |
| 8 | Parade gas station (McFarland) - Automatic Carwash | 6/3/2003 | 125 | 2 | 0.25 | 0.13 | 0.48 | >2419.2 | 11.9 | 11.1 |
| 9 | Stop and go self service carwash-Skyland Blvd. | 6/3/2003 | 162 | 6 | 1 | 0.17 | 0.70 | >2419.2 | 235.9 | <1 |
| 10 | Parade gas station-(Skyland Blvd.) - Automatic Carwash | 6/3/2003 | 82 | 2 | 0.25 | 0.13 | 0.50 | >2419.2 | 15.5 | <1 |
| 11 | shell gas station (Skyland Blvd.) - Automatic Carwash | 6/3/2003 | 34 | 3 | 0.05 | 0.02 | 0.09 | >2419.2 | 1553.1 | 2419.2 |
| 12 | parade gas station (Skyland Blvd.) - Automatic Carwash | 6/8/2003 | 31 | 3 | 2.25 | 0.75 | 0.28 | <1 | <1 | <1 |
| **Mean** | | | 90 | 3.6 | 0.90 | 0.29 | 0.65 | >2419.2 | >623 | >407 |
| **Standard Deviation** | | | 42 | 2.4 | 1.2 | 0.42 | 0.48 | - | 744 | 985 |
| **COV** | | | 0.46 | 0.667 | 1.4 | 1.4 | 0.74 | - | 1.1 | 2.4 |
| **Anderson Darling Probability Test (Normal)** | | | **1.029** | 2.313 | 2.6 | 2.58 | 1.678 | - | 2.158 | 4.467 |
| **Anderson Darling Probability Test (Log-normal)** | | | 1.254 | **1.71** | **1.103** | **0.999** | **1.34** | - | 1.626 | 2.372 |

*Data provided by Robert Pitt, University of Alabama*

**Table E1.4: Laundry Reference ("Library") Samples**

| Sample number | Sampling Location | Date | pH | Spec. cond. (µS/cm) | Temp. (°F) | Turb. (NTU) | Color (APHA Platinum Cobalt Units) | F (mg/L) | Hard. (mg/L $CaCO_3$) | Detergent (mg/L as MBAS) | Fluorescence (raw signal strength) | Fluorescence (mg/L as "Tide") |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Renee's House (unknown) | 11/3/2002 | 6.52 | 220 | 26 | 90.40 | 20 | 1.27 | 13.00 | 1000.00 | N/A | 1231 |
| 2 | Renee's House (unknown) | 12/14/2002 | 6.22 | 180 | 26 | 66.20 | 30 | 0.98 | 18.00 | 920.00 | N/A | 1002 |
| 3 | Renee's House (unknown) | 5/11/2003 | 9.06 | 440 | N/A | 366.00 | 20 | 0.82 | 54 | 900 | 644924 | 1490 |
| 4 | Renee's House (unknown) | 5/11/2003 | 7.73 | 1690 | N/A | 85.70 | 20 | 0.78 | 60 | 1020 | 744120 | 1720 |
| 5 | Renee's House (unknown) | 5/11/2003 | 9.63 | 360 | N/A | 398.00 | 20 | 1.07 | 58 | 1000 | 131046 | 302 |
| 6 | Yukio's apartment (Purex) | 5/30/2003 | 7.10 | 590 | N/A | 226.00 | 20 | 0.84 | 42 | 920 | 886425 | 2049 |
| 7 | Yukio's apartment (Purex) | 5/31/2003 | 8.7 | 370 | 81 | 344 | 20 | 0.76 | 46 | 800 | 606787 | 1402 |
| 8 | Suman (Tide) | 5/30/2003 | 7.1 | 430 | 70 | 25 | >100 | 0.05 | 52 | 620 | 1280468 | 2805 |
| 9 | Yukio's apartment (Purex) | 6/3/2003 | 8.2 | 470 | 84 | 128 | >100 | 0.38 | 50 | 760 | 583967 | 1349 |
| 10 | Soumya (Tide) | 6/3/2003 | 8.03 | 420 | 110 | 304 | >100 | 1.04 | 56 | 420 | 745300 | 1722 |
| 11 | Veera (Gain) | 6/3/2003 | 9.45 | 240 | N/A | 135 | 45 | 1.12 | 54 | 580 | 186050 | 430 |
| 12 | Sanju (Tide) | 6/8/2003 | 7.2 | 152 | N/A | 59.1 | 40 | 1.09 | 44 | 480 | 260002 | 601 |
| **Mean** | | | 7.91 | 463.5 | 26 | 185 | >26 | 0.85 | 45 | 785 | 532069 | 1342 |
| **Standard Deviation** | | | 1.12 | 408 | 26 | 134 | 9.93 | 0.34 | 15 | 212 | 271933 | 709 |
| **COV** | | | 0.14 | 0.880 | N/A | 0.72 | 0.38 | 0.40 | 0.33 | 0.27 | 0.51 | 0.52 |
| **Anderson Darling Probability Test Value (Normal)** | | | **1.013** | 2.641 | N/A | 1.401 | **2.578** | **1.42** | **1.841** | **1.28** | - | **1.035** |
| **Anderson Darling Probability Test Value (Log-normal)** | | | - | 1.298 | N/A | **1.132** | 2.587 | 2.71 | 2.583 | 1.435 | - | 1.32 |

*Data provided by Robert Pitt, University of Alabama*

**Table E1.4: Laundry Reference ("Library") Samples, CONT.**

| Sample number | Sampling Location | Date | K (mg/L) | $NH_3$ (mg/L as N) | $NH_3$/K (ratio) | B (mg/L) | Total Coliforms (MPN/100 mL) | *E. coli* (MPN/100 mL) | Enterococci (MPN/100 mL) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Renee's House (unknown) | 11/3/2002 | 2 | 1.10 | 0.55 | N/A | N/A | N/A | N/A |
| 2 | Renee's House (unknown) | 12/14/2002 | 2 | 0.89 | 0.44 | N/A | N/A | N/A | N/A |
| 3 | Renee's House (unknown) | 5/11/2003 | 7 | 2.50 | 0.35 | 0.53 | 290.9 | <1 | <1 |
| 4 | Renee's House (unknown) | 5/11/2003 | 4 | 0.50 | 0.12 | 0.36 | <1 | <1 | <1 |
| 5 | Renee's House (unknown) | 5/11/2003 | 15 | 0.53 | 0.03 | 0.67 | <1 | <1 | <1 |
| 6 | Yukio's apartment (Purex) | 5/30/2003 | 15 | 1.50 | 0.1 | 0.75 | >2419.2 | >2419.2 | <1 |
| 7 | Yukio's apartment (Purex) | 5/31/2003 | 9 | 5 | 0.55 | 0.58 | >2419.2 | 20.1 | <1 |
| 8 | Suman (Tide) | 5/30/2003 | 5 | 8 | 1.6 | 7.90 | >2419.2 | <1 | <1 |
| 9 | Yukio's apartment (Purex) | 6/3/2003 | 12 | 3 | 0.25 | 0.97 | >2419.2 | 19.7 | <1 |
| 10 | Soumya (Tide) | 6/3/2003 | 2 | 5 | 2.5 | 10.80 | <1 | <1 | <1 |
| 11 | Veera (Gain) | 6/3/2003 | 2 | 2 | 1 | 1.16 | <1 | <1 | <1 |
| 12 | Sanju (Tide) | 6/8/2003 | 3 | 9 | 3 | 0.70 | <1 | <1 | <1 |
| **Mean** | | | 6.5 | 3.2 | 0.87 | 2.4 | >2419.2 | - | <1 |
| **Standard Deviation** | | | 5.0 | 2.8 | 0.98 | 3.7 | - | - | - |
| **COV** | | | 0.78 | 0.89 | 1.12 | 1.59 | - | - | - |
| **Anderson Darling Probability Test Value (Normal)** | | | 1.568 | 1.468 | 1.871 | 3.419 | - | - | - |
| **Anderson Darling Probability Test Value (Log-normal)** | | | **1.294** | **0.982** | **0.99** | **2.106** | - | - | - |

*Data provided by Robert Pitt, University of Alabama*

| Table E1.5: Sewage (Dry Weather) Reference ("Library") Samples | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample number** | **Sampling Location** | **Date** | **pH** | **Spec. cond. (µS/cm)** | **Temp. (°F)** | **Turb. (NTU)** | **Color (APHA Platinum Cobalt Units)** | **F (mg/L)** | **Hard. (mg/L $CaCO_3$)** | **Detergent (mg/L as MBAS)** | **Fluorescence (raw signal strength)** | **Fluorescence (mg/L as "Tide")** |
| 1 | Tuscaloosa WWTP (Dry Season) | 12/18/2002 | 6.44 | 780 | N/A | 192 | >100 | 0.64 | 36 | 10 | N/A | 260 |
| 2 | Tuscaloosa WWTP (Dry Season) | 1/8/2003 | 6.56 | 2100 | N/A | 306 | >100 | 0.74 | 42 | 10 | N/A | 156 |
| 3 | Tuscaloosa WWTP (Dry Season) | 1/15/2003 | 6.42 | 1500 | N/A | 203 | >100 | 0.64 | 52 | 12.5 | N/A | 142 |
| 4 | Tuscaloosa WWTP (Dry Season) | 3/11/2003 | 6.9 | 1280 | N/A | 53.6 | >100 | 0.68 | 68 | 10 | N/A | 189 |
| 5 | Tuscaloosa WWTP (Dry Season) | 5/18/2003 | 7.1 | 540 | N/A | 230 | 70 | 0.65 | 65 | 8 | 114406 | 264 |
| 6 | Tuscaloosa WWTP (Dry Season) | 5/29/2003 | 6.99 | 1090 | N/A | 128 | 100 | 0.82 | 42 | 8 | 115847 | 267 |
| **Mean** | | | 6.73 | 1215 | - | 185 | >100 | 0.695 | 50 | 9.7 | 115126 | 213 |
| **Standard Deviation** | | | 0.29 | 553 | - | 86 | - | 0.072 | 13 | 1.66 | 1018 | 57 |
| **COV** | | | 0.04 | 0.45 | - | 0.46 | - | 0.104 | 0.260 | 0.171 | 0.009 | 0.27 |
| **Anderson Darling Probability Test Value (Normal)** | | | **1.878** | **1.96** | - | **1.77** | **-** | **1.992** | **1.874** | **2.012** | - | **2.042** |
| **Anderson Darling Probability Test Value (Log-normal)** | | | - | 1.913 | - | 1.996 | - | 1.96 | 1.846 | 2 | - | 2.025 |

| **Sample number** | **Sampling Location** | **Date** | **K (mg/L)** | **$NH_3$ (mg/L as N)** | **$NH_3$/K (ratio)** | **B (mg/L)** | **Total Coliforms (MPN/100 mL)** | ***E. coli* (MPN/100 mL)** | **Enterococci (MPN/100 mL)** |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Tuscaloosa WWTP (Dry Season) | 12/18/2002 | 11 | 11 | 1 | N/A | >2419.2 | >2419.2 | >2419.2 |
| 2 | Tuscaloosa WWTP (Dry Season) | 1/8/2003 | 10 | 14 | 1.4 | N/A | N/A | N/A | N/A |
| 3 | Tuscaloosa WWTP (Dry Season) | 1/15/2003 | 15 | 18 | 1.2 | N/A | >2419.2 | >2419.2 | >2419.2 |
| 4 | Tuscaloosa WWTP (Dry Season) | 3/11/2003 | 11 | 45 | 4.0 | N/A | >2419.2 | 816.4 | 43.6 |
| 5 | Tuscaloosa WWTP (Dry Season) | 5/18/2003 | 15 | 37.5 | 2.5 | N/A | N/A | N/A | N/A |
| 6 | Tuscaloosa WWTP (Dry Season) | 5/29/2003 | 9 | 27 | 3 | 0.97 | >24192000 | 12033000 | 613000 |
| **Mean** | | | 11.8 | 25.4 | 2.19 | 0.97 | >2419.2 | 6000000 | 300000 |
| **Standard Deviation** | | | 2.5 | 13.6 | 1.21 | - | - | 8500000 | 430000 |
| **COV** | | | 0.21 | 0.53 | 0.55 | - | - | 1.41 | 1.41 |
| **Anderson Darling Probability Test Value (Normal)** | | | **2.026** | **1.77** | **1.81** | - | - | 3.066 | 3.065 |
| **Anderson Darling Probability Test Value (Log-normal)** | | | 1.955 | 1.737 | 1.785 | - | - | 2.846 | 2.672 |

*Data provided by Robert Pitt, University of Alabama*

| Table E1.6: Sewage (Wet Weather) Reference ("Library") Samples | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample number** | **Sampling Location** | **Date** | **pH** | **Spec. cond. (µS/cm)** | **Temp. (°F)** | **Turb. (NTU)** | **Color (APHA Platinum Cobalt Units)** | **F (mg/L)** | **Hard. (mg/L $CaCO_3$)** | **Detergent (mg/L as MBAS)** | **Fluorescence (raw signal strength)** | **Fluorescence (mg/L as "Tide")** |
| 1 | Tuscaloosa WWTP (Wet Season) | 5/30/2003 | 6.8 | 1240 | N/A | 202 | >100 | 0.19 | 52 | 8 | 115770 | 267 |
| 2 | Tuscaloosa WWTP (Wet Season) | 6/2/2003 | 6.81 | 1250 | N/A | 270 | >100 | 0.22 | 48 | 7.5 | 126580 | 292 |
| 3 | Tuscaloosa WWTP (Wet Season) | 6/3/2003 | 6.99 | 440 | N/A | 255 | 100 | 0.25 | 44 | 6 | 108689 | 251 |
| 4 | Tuscaloosa WWTP (Wet Season) | 6/4/2003 | 6.92 | 440 | N/A | 231 | 100 | 0.14 | 52 | 8 | 129110 | 298 |
| 5 | Tuscaloosa WWTP (Wet Season) | 6/5/2003 | 7.00 | 550 | N/A | 113 | 57 | 0.20 | 54 | 7.5 | 109058 | 252 |
| 6 | Tuscaloosa WWTP (Wet Season) | 6/6/2003 | 7.00 | 850 | N/A | 259 | 60 | 0.17 | 47 | 7.5 | 105607 | 244 |
| **Mean** | | | 6.9 | 795 | - | 221 | >79 | 0.19 | 49 | 7.4 | 115802 | 267 |
| **Standard Deviation** | | | 0.09 | 379 | - | 58 | 24 | 0.03 | 3.78 | 0.73 | 9932 | 22 |
| **COV** | | | 0.01 | 0.47 | - | 0.26 | 0.30 | 0.197 | 0.07 | 0.0996 | 0.086 | 0.086 |
| **Anderson Darling Probability Test Value (Normal)** | | | **2.097** | **1.722** | - | **2.097** | **2.72** | **1.708** | **1.83** | **2.357** | - | **1.911** |
| **Anderson Darling Probability Test Value (Log-normal)** | | | - | 1.725 | - | 2.3 | 2.706 | 1.734 | 1.838 | 2.43 | - | 1.898 |

| **Sample number** | **Sampling Location** | **Date** | **K (mg/L)** | **$NH_3$ (mg/L as N)** | **$NH_3$/K (ratio)** | **B (mg/L)** | **Total Coliforms (MPN/100 mL)** | ***E. coli* (MPN/100 mL)** | **Enterococci (MPN/100 mL)** |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Tuscaloosa WWTP (Wet Season) | 5/30/2003 | 11 | 30 | 2.72 | 1.38 | >24192000 | 2851000 | 833000 |
| 2 | Tuscaloosa WWTP (Wet Season) | 6/2/2003 | 12 | 35 | 2.91 | 0.98 | >24192000 | 3654000 | 598000 |
| 3 | Tuscaloosa WWTP (Wet Season) | 6/3/2003 | 12 | 22.5 | 1.87 | 0.93 | >24192000 | 2187000 | 292000 |
| 4 | Tuscaloosa WWTP (Wet Season) | 6/4/2003 | 10 | 22.5 | 2.25 | 1.05 | >24192000 | 1785000 | 328000 |
| 5 | Tuscaloosa WWTP (Wet Season) | 6/5/2003 | 11 | 36 | 3.27 | 1.01 | >24192000 | 3255000 | 369000 |
| 6 | Tuscaloosa WWTP (Wet Season) | 6/6/2003 | 14 | 27.5 | 1.96 | 0.78 | >24192000 | 2282000 | 609000 |
| **Mean** | | | 11.6 | 28.9 | 2.500 | 1.02 | >24192000 | 2669000 | 504833 |
| **Standard Deviation** | | | 1.3 | 5.8 | 0.55 | 0.19 | - | 708561 | 210828 |
| **COV** | | | 0.11 | 0.203 | 0.22 | 0.195 | - | 0.265 | 0.418 |
| **Anderson Darling Probability Test Value (Normal)** | | | **1.891** | **1.809** | **1.751** | **1.984** | - | 1.744 | 1.854 |
| **Anderson Darling Probability Test Value (Log-normal)** | | | 1.858 | 1.825 | 1.761 | 1.906 | - | 1.747 | 1.833 |

*Data provided by Robert Pitt, University of Alabama*

## Table E1.7: Industrial Reference ("Library") Samples

| Sample number | Sampling Location | Date | pH | Spec. cond. (µS/cm) | Temp. (°F) | Turb. (NTU) | Color (APHA Platinum Cobalt Units) | F (mg/L) | Hard. (mg/L $CaCO_3$) | Detergent (mg/L as MBAS) | Fluores-cence (raw signal strength) | Fluores-cence (mg/L as "Tide") |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | DELPHI (Automotive manufacture)(Water supply unknown) | 12/18/2002 | 6.72 | 240 | N/A | 91.6 | 20 | 0.04 | 23 | 7.5 | N/A | 722 |
| 2 | PECO FOODS (Poultry Supplier) (City water supply) | 12/18/2002 | 6.44 | 850 | N/A | 309 | 40 | 0.89 | 34 | 10 | N/A | 149 |
| 3 | TAMKO (Roofing Products)(Water supply unknown) | 12/18/2002 | 7 | 380 | N/A | 251 | >100 | 0.02 | 32 | 12.5 | N/A | 309 |
| 4 | DELPHI (Automotive manufacture)(Water supply unknown) | 1/8/2003 | 6.88 | 340 | N/A | 225 | 10 | LD | 30 | 0.25 | N/A | 101 |
| 5 | PECO FOODS (Poultry Supplier)(City water supply) | 1/8/2003 | 6.22 | 960 | N/A | 14.8 | 10 | 0.72 | 32 | 0.5 | N/A | 130 |
| 6 | TAMKO (Roofing Products)(Water supply unknown) | 1/8/2003 | 6.9 | 310 | N/A | 210 | >100 | 0.01 | 38 | 2 | N/A | 410 |
| 7 | DELPHI (Automotive manufacture)(Water supply unknown) | 1/15/2003 | 6.42 | 81 | N/A | 37.4 | 15 | 0.01 | 36 | 6 | N/A | 599 |
| 8 | PECO FOODS (Poultry Supplier)(City water supply) | 1/15/2003 | 6.36 | 45 | N/A | 10 | 20 | 0.81 | 28 | 5 | N/A | 150 |
| 9 | TAMKO (Roofing Products)(Water supply unknown) | 1/15/2003 | 7.3 | 37 | N/A | 226 | >100 | 0.01 | 26 | 10 | N/A | 375 |
| **Mean** | | | 6.6 | 360 | - | 152 | >19 | 0.31 | 31 | 5.9 | - | 327 |
| **Standard Deviation** | | | 0.35 | 335 | - | 114 | 11 | 0.41 | 4.7 | 4.4 | - | 221 |
| **COV** | | | 0.053 | 0.930 | - | 0.748 | 0.58 | 1.309 | 0.155 | 0.741 | - | 0.67 |
| **Anderson Darling Probability Test Value (Normal)** | | | **1.321** | 1.629 | - | **1.538** | 2.056 | 2.414 | **1.21** | **1.276** | - | **1.451** |
| **Anderson Darling Probability Test Value (Log-normal)** | | | - | **1.408** | - | 1.792 | **1.833** | **1.982** | 1.254 | 1.763 | - | 1.386 |

| Sample number | Sampling Location | Date | K (mg/L) | $NH_3$ (mg/L as N) | $NH_3$/K (ratio) | B (mg/L) | Total Coliforms (MPN/100 mL) | *E. coli* (MPN/100 mL) | Enterococci (MPN/100 mL) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | DELPHI (Automotive manufacture)(Water supply unknown) | 12/18/2002 | 24 | 0.55 | 0.02 | N/A | 920.8 | 66.3 | 0 |
| 2 | PECO FOODS (Poultry Supplier) (City water supply) | 12/18/2002 | 37 | 6 | 0.16 | N/A | >2419.2 | >2419.2 | >2419.2 |
| 3 | TAMKO (Roofing Products)(Water supply unknown) | 12/18/2002 | 8 | 10 | 1.25 | N/A | >2419.2 | 3 | >2419.2 |
| 4 | DELPHI (Automotive manufacture)(Water supply unknown) | 1/8/2003 | 92 | 0.4 | 0.004 | N/A | N/A | N/A | N/A |
| 5 | PECO FOODS (Poultry Supplier)(City water supply) | 1/8/2003 | 42 | 4.5 | 0.10 | N/A | N/A | N/A | N/A |
| 6 | TAMKO (Roofing Products)(Water supply unknown) | 1/8/2003 | 32 | 12 | 0.37 | N/A | N/A | N/A | N/A |
| 7 | DELPHI (Automotive manufacture)(Water supply unknown) | 1/15/2003 | 81 | 0.9 | 0.01 | N/A | >2419.2 | <1 | <1 |
| 8 | PECO FOODS (Poultry Supplier)(City water supply) | 1/15/2003 | 45 | 2 | 0.04 | N/A | >2419.2 | >2419.2 | 866.4 |
| 9 | TAMKO (Roofing Products)(Water supply unknown) | 1/15/2003 | 37 | 8.5 | 0.22 | N/A | 204.6 | <1 | <1 |
| **Mean** | | | 44 | 4.9 | 0.24 | - | >562 | >34 | >433.2 |
| **Standard Deviation** | | | 26.5 | 4.3 | 0.39 | - | 506 | 44 | 612 |
| **COV** | | | 0.60 | 0.88 | 1.6 | - | 0.89 | 1.2 | 1.4 |
| **Anderson Darling Probability Test Value (Normal)** | | | **1.611** | **1.371** | 2.499 | - | 2.575 | 2.668 | 2.172 |
| **Anderson Darling Probability Test Value (Log-normal)** | | | 1.536 | 1.436 | 1.203 | - | 2.603 | 1.963 | 2.467 |

*Data provided by Robert Pitt, University of Alabama*

**Table E1.8: Industrial (Cintas) Reference ("Library") Samples**

| Sample number | Sampling Location | Date | pH | Spec. cond. (µS/cm) | Temp. (°F) | Turb. (NTU) | Color (APHA Platinum Cobalt Units) | F (mg/L) | Hard. (mg/L $CaCO_3$) | Detergent (mg/L as MBAS) | Fluorescence (raw signal strength) | Fluorescence (mg/L as "Tide") |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | CINTAS (Cooperate uniform mfg.)(City water supply) | 12/18/2002 | 11.44 | 1460 | N/A | 3388 | >100 | <LD | 35 | 5 | N/A | 29 |
| 2 | CINTAS (Cooperate uniform mfg.)(City water supply) | 1/8/2003 | 9.56 | 850 | N/A | 483 | >100 | <LD | 40 | 10 | N/A | 285 |
| 3 | CINTAS (Cooperate uniform mfg.)(City water supply) | 1/15/2003 | 10.22 | 85 | N/A | 4023 | >100 | 0.02 | 32 | 3 | N/A | 66 |
| **Mean** | | | 10.4 | 798 | - | 2631 | >100 | <0.02 | 35 | 6 | - | 127 |
| **Standard Deviation** | | | 0.95 | 688 | - | 1887 | - | - | 4.0 | 3.6 | - | 138 |
| **COV** | | | 0.091 | 0.86 | - | 0.71 | - | - | 0.11 | 0.6 | - | 1.08 |
| **Anderson Darling Probability Test Value (Normal)** | | | **3.067** | **3.072** | - | **3.21** | - | - | **3.063** | **3.084** | - | **3.15** |
| **Anderson Darling Probability Test Value (Log-normal)** | | | - | 3.201 | - | 3.298 | - | - | 3.06 | 3.059 | - | 3.067 |

| Sample number | Sampling Location | Date | K (mg/L) | $NH_3$ (mg/L as N) | $NH_3$/K (ratio) | B (mg/L) | Total Coliforms (MPN/100 mL) | *E. coli* (MPN/100 mL) | Enterococci (MPN/100 mL) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | CINTAS (Cooperate uniform mfg.)(City water supply) | 12/18/2002 | 53 | 7.5 | 0.14 | N/A | 0 | 0 | 0 |
| 2 | CINTAS (Cooperate uniform mfg.)(City water supply) | 1/8/2003 | 56 | 6 | 0.10 | N/A | N/A | N/A | N/A |
| 3 | CINTAS (Cooperate uniform mfg.)(City water supply) | 1/15/2003 | 85 | 5 | **0.05** | N/A | 0 | <1 | 22.2 |
| **Mean** | | | 64 | 6.1 | 0.10 | - | 0 | - | 11.1 |
| **Standard Deviation** | | | 17 | 1.2 | 0.04 | - | 0 | - | 15.6 |
| **COV** | | | 0.27 | 0.20 | 0.40 | - | - | - | 1.4 |
| **Anderson Darling Probability Test Value (Normal)** | | | **3.182** | **3.06** | **3.079** | - | 4.201 | - | 4.201 |
| **Anderson Darling Probability Test Value (Log-normal)** | | | 3.167 | 3.059 | 3.118 | - | - | - | - |

*Data provided by Robert Pitt, University of Alabama*

**Table E1.9: Irrigation Reference ("Library") Samples**

| Sample number | Sampling Location | Date | pH | Spec. cond. (µS/cm) | Temp. ($^{o}$F) | Turb. (NTU) | Color (APHA Platinum Cobalt Units) | F (mg/L) | Hard. (mg/L $CaCO_3$) | Detergent (mg/L as MBAS) | Fluorescence (raw signal strength) | Fluorescence (mg/L as "Tide") |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Ferguson Parking (UA) - Run over concrete | 5/16/2003 | 7.91 | 200 | N/A | 16.2 | 0 | 0.69 | 62 | 0 | 21226 | 49 |
| 2 | B.B. Commer (UA) - Run over concrete | 5/18/2003 | 7.38 | | N/A | 4.03 | 10 | 0.68 | 60 | 0 | 13915 | 32 |
| 3 | Art Building (UA) - Taken at a little puddle, NO concrete | 5/16/2003 | 7.46 | 200 | N/A | 64.6 | 0 | 0.76 | 55 | 0 | 40040 | 92 |
| 4 | MIB (UA) - Run over concrete | 5/19/2003 | 7.18 | 163 | N/A | 9.95 | 20 | 0.83 | 58 | 0 | 19234 | 44 |
| 5 | MIB (UA) - Run over concrete | 5/30/2003 | 7.1 | 148 | 89 | 21.8 | 50 | 0.30 | 40 | 0 | 26851 | 62 |
| 6 | Art Building (UA) - Taken at a little puddle, NO concrete | 5/30/2003 | 7.46 | 200 | 70 | 96.6 | 56 | 0.39 | 44 | 0 | 38389 | 88 |
| 7 | Quad(UA) - Taken at a little puddle, NO concrete | 5/30/2003 | 6.99 | 181 | 70 | 826 | 54 | 0.23 | 52 | 0 | 30820 | 53 |
| 8 | MIB (UA) - Run over concrete | 6/5/2003 | 7.26 | 183 | 82 | 14.5 | 50 | 0.64 | 54 | 0 | 23353 | 53 |
| 9 | MIB (UA) - Taken at a little puddle, NO concrete | 6/5/2003 | 7.16 | 182 | 78 | 16.5 | 30 | 0.91 | 52 | 0 | 17788 | 41 |
| 10 | Bevil (UA) - Taken at a little puddle, NO concrete | 6/5/2003 | 6.91 | 156 | 72 | 32 | 27 | 0.57 | 48 | 0 | 24149 | 55 |
| 11 | MIB (UA) - Run over concrete | 6/9/2003 | 7.4 | 183 | 78 | 9 | 40 | 0.84 | 66 | 0 | 23160 | 53 |
| 12 | MIB (UA) - Taken at a little puddle, NO concrete | 6/9/2003 | 7.3 | 194 | 80 | 16.6 | 50 | 0.57 | 54 | 0 | 23260 | 53 |
| **Mean** | | | 7.2 | 180 | 77 | 93 | 32 | 0.61 | 53 | 0 | 25182 | 56 |
| **Standard Deviation** | | | 0.26 | 18 | 6.5 | 232 | 20 | 0.21 | 7.3 | 0 | 7831 | 17 |
| **COV** | | | 0.03 | 0.10 | 0.08 | 2.46 | 0.64 | 0.35 | 0.13 | - | 0.31 | 0.31 |
| **Anderson Darling Probability Test Value (Normal)** | | | **1.147** | **1.401** | | 5.099 | **1.296** | **1.103** | **1.002** | - | - | 1.718 |
| **Anderson Darling Probability Test Value (Log-normal)** | | | - | 1.457 | | **1.516** | 1.677 | 1.457 | 1.006 | - | - | **1.383** |

*Data provided by Robert Pitt, University of Alabama*

| Table E1.9: Irrigation Reference ("Library") Samples, CONT. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Sample number** | **Sampling Location** | **Date** | **K (mg/L)** | **$NH_3$ (mg/L as N)** | **$NH_3$/K (ratio)** | **B (mg/L)** | **Total Coliforms (MPN/100 mL)** | ***E. coli* (MPN/100 mL)** | **Enterococci (MPN/100 mL)** |
| 1 | Ferguson Parking (UA) - Run over concrete | 5/16/2003 | 2 | <LD | N/A | 0.14 | >2419.2 | 27.8 | >2419.2 |
| 2 | B.B. Commer (UA) - Run over concrete | 5/18/2003 | 9 | 1.0 | 0.111 | 0.20 | >2419.2 | 8.3 | 2 |
| 3 | Art Building (UA) - Taken at a little puddle, NO concrete | 5/16/2003 | 5 | 0.08 | 0.016 | 0.25 | >2419.2 | >2419.2 | >2419.2 |
| 4 | MIB (UA) - Run over concrete | 5/19/2003 | 3 | 0.21 | 0.07 | 0.13 | >2419.2 | >2419.2 | >2419.2 |
| 5 | MIB (UA) - Run over concrete | 5/30/2003 | 2 | 3.5 | 1.75 | 0.2 | >2419.2 | 31.8 | >2419.2 |
| 6 | Art Building (UA) -Taken at a little puddle, NO concrete | 5/30/2003 | 4 | 0.5 | 0.125 | 0.36 | >2419.2 | >2419.2 | 287.7 |
| 7 | Quad(UA) - Taken at a little puddle, NO concrete | 5/30/2003 | 5 | 1 | 0.2 | 0.5 | >2419.2 | >2419.2 | >2419.2 |
| 8 | MIB (UA) - Run over concrete | 6/5/2003 | 9 | 4.5 | 0.5 | 0.22 | >2419.2 | >2419.2 | >2419.2 |
| 9 | MIB (UA) - Taken at a little puddle, NO concrete | 6/5/2003 | 8 | 0.5 | 0.06 | 0.14 | >2419.2 | >2419.2 | >2419.2 |
| 10 | Bevil (UA) - Taken at a little puddle, NO concrete | 6/5/2003 | 4 | 1 | 0.25 | 0.23 | >2419.2 | 1299.7 | >2419.2 |
| 11 | MIB (UA) - Run over concrete | 6/9/2003 | 7 | 0.5 | 0.07 | 0.25 | >4838.4 | >4838.4 | >4838.4 |
| 12 | MIB (UA) - Taken at a little puddle, NO concrete | 6/9/2003 | 10 | 1 | 0.1 | 0.35 | >4838.4 | >4838.4 | >4838.4 |
| **Mean** | | | 5.6 | 1.25 | 0.29 | 0.24 | >2419.2 | >2419.2 | >2419.2 |
| **Standard Deviation** | | | 2.8 | 1.41 | 0.50 | 0.10 | - | - | - |
| **COV** | | | 0.50 | 1.12 | 1.69 | 0.43 | - | - | - |
| **Anderson Darling Probability Test Value (Normal)** | | | **1.144** | 2.471 | 3.343 | 1.366 | - | - | - |
| **Anderson Darling Probability Test Value (Log-normal)** | | | 1.146 | **1.325** | **1.277** | **1.094** | - | - | - |
| *Data provided by Robert Pitt, University of Alabama* | | | | | | | | | |

# Appendix E-2. Data Tables for Birmingham

| Table E2.1: Spring Water Samples | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample #** | **Conductivity (µS/cm)** | **Fluoride (mg/L)** | **Hardness (mg/L) (as $CaCO_3$)** | **Detergent (mg/L)** | **Fluoresc. (% scale)** | **Potassium (mg/L)** | **Ammonia (mg/L)** | **pH** | **Color (units)** | **Chlorine (mg/L)** | **Toxicity (I25) (% reduc.)** | **Copper (mg/L)** | **Phenols (mg/L)** |
| 1 | 310 | 0.09 | 231 | 0 | 11 | 0.83 | 0.02 | 6.92 | 0 | 0.00 | 0 | NA | NA |
| 2 | 288 | 0.01 | 239 | 0 | 4 | 0.76 | 0.00 | 6.89 | 0 | 0.00 | 0 | NA | NA |
| 3 | 327 | 0.01 | 255 | 0 | 5 | 0.69 | 0.01 | 7.01 | 0 | 0.00 | 0 | NA | NA |
| 4 | 310 | 0.03 | 248 | 0 | 5 | 0.72 | 0.05 | 6.98 | 0 | 0.01 | 0 | 0 | 0 |
| 5 | 301 | 0.05 | 240 | 0 | 10 | 0.74 | 0.00 | 7.00 | 0 | 0.01 | 0 | 0 | 0 |
| 6 | 295 | 0.00 | 243 | 0 | 2 | 0.73 | 0.00 | 6.87 | 0 | 0.00 | 0 | 0 | 0 |
| 7 | 298 | 0.03 | 241 | 0 | 6 | 0.56 | 0.00 | 6.99 | 0 | 0.00 | 0 | 0 | 0 |
| 8 | 290 | 0.03 | 229 | 0 | 8 | 0.72 | 0.00 | 6.95 | 0 | 0.00 | 0 | 0 | 0 |
| 9 | 295 | 0.05 | 233 | 0 | 10 | 0.76 | 0.00 | 6.99 | 0 | 0.01 | 0 | 0 | 0 |
| 10 | 298 | 0.01 | 239 | 0 | 7 | 0.77 | 0.01 | 7.01 | 0 | 0.00 | 0 | 0 | 0 |
| **Mean** | 301 | 0.03 | 240 | 0 | 7 | 0.73 | 0.01 | 6.96 | 0 | 0.00 | 0 | 0 | 0 |
| **St. Dev.** | 11.6 | 0.03 | 7.83 | 0 | 2.9 | 0.07 | 0.02 | 0.05 | 0 | 0.00 | 0 | 0 | 0 |
| **95% conf limits (mean +/-)** | 6.87 | 0.02 | 4.63 | 0 | 1.7 | 0.04 | 0.01 | 0.03 | 0 | 0.00 | 0 | 0 | 0 |
| **Median** | 298 | 0.03 | 240 | 0 | 7 | 0.74 | 0.00 | 6.99 | 0 | 0.00 | 0 | 0 | 0 |
| **Coefficient of Variability** | 0.04 | 1.00 | 0.03 | -- | 0.43 | 0.10 | 2.00 | 0.01 | -- | -- | -- | -- | -- |
| **Distribution** | normal | normal | normal | uniform | normal | normal | l-norm | normal | uniform | uniform | uniform | uniform | uniform |
| *Data provided by Robert Pitt, University of Alabama* | | | | | | | | | | | | | |

NA: Data not available

| Table E2.2: Shallow Ground Water Samples | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample #** | **Conductivity (µS/cm)** | **Fluoride (mg/L)** | **Hardness (mg/L) (as $CaCO_3$)** | **Detergent (mg/L)** | **Fluoresc. (% scale)** | **Potassium (mg/L)** | **Ammonia (mg/L)** | **pH** | **Color (units)** | **Chlorine (mg/L)** | **Toxicity (I25) (% reduc.)** | **Copper (mg/L)** | **Phenols (mg/L)** |
| 1 | 5 | 0.08 | 5 | 0 | 7 | NA | NA | NA | 5 | 0.04 | 0 | 0.01 | 0 |
| 2 | 5 | 0.03 | 22 | 0 | 12 | NA | NA | NA | 20 | 0.00 | 0 | 0.01 | 0 |
| 3 | 32 | 0.14 | 18 | 0 | 160 | NA | NA | 7.8 | 35 | 0.08 | 0 | 0.00 | 0 |
| 4 | 128 | 0.07 | 41 | 0 | 34 | 1.70 | 0.38 | 6.2 | 0 | 0.02 | 0 | 0.00 | 0 |
| 5 | 119 | 0.05 | 38 | 0 | 22 | 2.15 | 0.89 | 5.4 | 0 | 0.00 | 0 | 0.00 | 0 |
| 6 | 77 | 0.04 | 29 | 0 | 15 | 0.81 | 0.08 | 6.4 | 10 | 0.01 | 0 | 0.00 | 0 |
| 7 | 31 | 0.05 | 32 | 0 | 8 | 0.91 | 0.05 | 6.5 | 5 | 0.00 | 0 | 0.00 | 0 |
| 8 | 43 | 0.06 | 35 | 0 | 11 | 0.89 | 0.09 | 6.7 | 0 | 0.00 | 0 | 0.00 | 0 |
| 9 | 46 | 0.04 | 27 | 0 | 17 | 1.01 | 0.13 | 6.4 | 5 | 0.01 | 0 | 0.00 | 0 |
| 10 | 28 | 0.07 | 26 | 0 | 13 | 0.83 | 0.08 | 6.3 | 0 | 0.00 | 0 | 0.00 | 0 |
| **Mean** | 51 | 0.06 | 27 | 0 | 30 | 1.19 | 0.24 | 6.46 | 8 | 0.02 | 0 | 0.00 | 0 |
| **St. Dev.** | 43.3 | 0.03 | 10.5 | 0 | 46.4 | 0.53 | 0.31 | 0.66 | 11.4 | 0.03 | 0 | 0.00 | 0 |
| **95% conf limits (mean +/-)** | 34.6 | 0.03 | 8.48 | 0 | 37.1 | 0.42 | 0.25 | 0.53 | 9 | 0.02 | | 0.00 | 0 |
| **Median** | 38 | 0.06 | 28 | 0 | 14 | 0.91 | 0.09 | 6.40 | 5 | 0.01 | 0 | 0.00 | 0 |
| **Coefficient of Variability** | 0.84 | 0.50 | 0.39 | -- | 1.55 | 0.44 | 1.26 | 0.10 | 1.42 | 1.50 | -- | -- | -- |
| **Distribution** | normal | l-normal | normal | uniform | l-normal | normal | normal | normal | l-normal | normal | uniform | uniform | uniform |

*Data provided by Robert Pitt, University of Alabama*

NA: Data not available

| Table E2.3: Samples from Irrigation of Landscaped Areas | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample #** | **Conductivity (µS/cm)** | **Fluoride (mg/L)** | **Hardness (mg/L) (as $CaCO_3$)** | **Detergent (mg/L)** | **Fluoresc. (% scale)** | **Potassium (mg/L)** | **Ammonia (mg/L)** | **pH** | **Color (units)** | **Chlorine (mg/L)** | **Toxicity (I25) (% reduc.)** | **Copper (mg/L)** | **Phenols (mg/L)** |
| 1 | 109 | 0.98 | 42.3 | 0 | 132.1 | 6.46 | 0.28 | 6.88 | 5 | 0.03 | 0.0 | 0.00 | 0.00 |
| 2 | 119 | 0.93 | 39.0 | 0 | 218.6 | 9.42 | 0.24 | 6.90 | 15 | 0.05 | 0.0 | 0.00 | 0.00 |
| 3 | 92 | 1.65 | 41.4 | 0 | 267.6 | 3.21 | 0.55 | 7.09 | 15 | 0.08 | 0.0 | 0.00 | 0.00 |
| 4 | 98 | 1.94 | 40.4 | 0 | 199.9 | 6.32 | 0.40 | 7.04 | 10 | 0.02 | 0.0 | 0.00 | 0.00 |
| 5 | 107 | 0.97 | 39.4 | 0 | 231.6 | 5.44 | 0.41 | 6.90 | 10 | 0.03 | 0.0 | 0.00 | 0.00 |
| 6 | 110 | 0.81 | 38.0 | 0 | 242.0 | 6.71 | 0.37 | 7.02 | 13 | 0.00 | 0.0 | 0.00 | 0.00 |
| 7 | 100 | 0.93 | 39.0 | 0 | 212.4 | 6.49 | 0.31 | 7.01 | 10 | 0.03 | 0.0 | 0.00 | 0.00 |
| 8 | 102 | 0.89 | 41.0 | 0 | 201.2 | 4.98 | 0.48 | 6.89 | 7 | 0.01 | 0.0 | 0.00 | 0.00 |
| 9 | 106 | 0.91 | 42.0 | 0 | 223.6 | 5.79 | 0.35 | 6.91 | 5 | 0.00 | 0.0 | 0.00 | 0.00 |
| 10 | 107 | 0.98 | 39.0 | 0 | 215.0 | 6.01 | 0.32 | 6.98 | 10 | 0.00 | 0.0 | 0.00 | 0.00 |
| **Mean** | 105 | 0.90 | 40.2 | 0 | 214.4 | 6.08 | 0.37 | 6.96 | 10 | 0.03 | 0.0 | 0.00 | 0.00 |
| **St. Dev.** | 7.28 | 0.10 | 1.47 | 0 | 35.20 | 1.56 | 0.09 | 0.08 | 3.62 | 0.03 | 0.00 | 0.00 | 0.00 |
| **95% conf. limits (mean +/-)** | 5.83 | 0.08 | 1.18 | 0 | 28.17 | 1.25 | 0.07 | 0.06 | 2.90 | 0.02 | 0.00 | 0.00 | 0.00 |
| **Median** | 106 | 0.93 | 39.9 | 0 | 216.80 | 6.17 | 0.36 | 6.95 | 10 | 0.03 | 0.0 | 0.00 | 0.00 |
| **Coefficient of Variability** | 0.07 | 0.11 | 0.04 | -- | 0.16 | 0.26 | 0.25 | 0.01 | 0.36 | 1.00 | -- | -- | -- |
| **Distribution** | normal | normal | normal | uniform | normal | normal | normal | bi-modal | normal | normal | uniform | uniform | uniform |
| *Data provided by Robert Pitt, University of Alabama* | | | | | | | | | | | | | |

NA: Data not available

| Table E2.4: Residential/Commercial Sanitary Sewage Samples | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sample #** | **Collection Date** | **Collection Time** | **Conductivity (µS/cm)** | **Fluoride (mg/L)** | **Hardness (mg/L) (as $CaCO_3$)** | **Detergent (mg/L)** | **Fluoresc. (% scale)** | **Potassium (mg/L)** |
| 1 | 1-Aug | 10 p.m. | 265 | 0.90 | 149 | 0.96 | 240 | 5.25 |
| 2 | 2-Aug | 12 a.m. | 320 | 0.72 | 161 | 3.80 | 200 | 4.79 |
| 3 | 2-Aiug | 2 a.m. | 360 | 0.46 | 172 | 0.58 | 170 | 3.44 |
| 4 | 2-Aug | 4 a.m. | 350 | 0.58 | 181 | 0.54 | 155 | 3.09 |
| 5 | 2-Aug | 6 a.m. | 410 | 0.74 | 167 | 0.54 | 205 | 4.51 |
| 6 | 2-Aug | 8 a.m. | 435 | 0.87 | 154 | 0.99 | 265 | 5.88 |
| 7 | 2-Aug | 10 a.m. | 410 | 1.08 | 150 | 0.48 | 265 | 5.99 |
| 8 | 2-Aug | 12 p.m. | 400 | 0.77 | 145 | 3.60 | 270 | 5.70 |
| 9 | 2-Aug | 2 p.m. | 410 | 0.83 | 149 | 0.54 | 280 | 7.50 |
| 10 | 2-Aug | 4 p.m. | 460 | 0.93 | 151 | 0.95 | 265 | 7.20 |
| 11 | 2-Aug | 6 p.m. | 410 | 0.88 | 156 | 0.98 | 265 | 6.78 |
| 12 | 2-Aug | 8 p.m. | 430 | 0.88 | 158 | 0.96 | 300 | 7.56 |
| 13 | 4-Aug | 6 p.m. | 550 | 0.69 | 145 | 4.20 | 280 | 7.00 |
| 14 | 4-Aug | 8 p.m. | 460 | 0.64 | 133 | 4.40 | 280 | 6.73 |
| 15 | 4-Aug | 10 p.m. | 500 | 0.74 | 123 | 0.97 | 265 | 6.05 |
| 16 | 5-Aug | 12 a.m. | 420 | 0.60 | 142 | 0.99 | 227 | 4.03 |
| 17 | 5-Aug | 2 a.m. | 360 | 0.54 | 148 | 0.65 | 175 | 3.55 |
| 18 | 5-Aug | 4 a.m. | 365 | 0.43 | 158 | 0.64 | 120 | 4.94 |
| 19 | 5-Aug | 6 a.m. | 390 | 0.60 | 142 | 0.62 | 230 | 7.47 |
| 20 | 5-Aug | 8 a.m. | 500 | 1.04 | 126 | 0.65 | 310 | 7.13 |
| 21 | 5-Aug | 10 a.m. | 450 | 0.80 | 125 | 0.96 | 315 | 6.87 |
| 22 | 5-Aug | 12 p.m. | 430 | 0.97 | 126 | 0.98 | 310 | 6.88 |
| 23 | 5-Aug | 2 p.m. | 420 | 0.85 | 126 | 0.90 | 300 | 7.07 |
| 24 | 5-Aug | 4 p.m. | 460 | 0.83 | 122 | 0.94 | 290 | 7.55 |
| 25 | 6-Aug | 6 p.m. | 440 | 0.81 | 127 | 2.40 | 280 | 7.14 |
| 26 | 6-Aug | 8 p.m. | 435 | 0.66 | 123 | 1.60 | 290 | 6.75 |
| 27 | 6-Aug | 10 p.m. | 400 | 0.77 | 120 | 0.97 | 265 | 6.12 |
| 28 | 7-Aug | 12 a.m. | 390 | 0.67 | 133 | 0.96 | 210 | 5.06 |
| 29 | 7-Aug | 2 a.m. | 340 | 0.44 | 149 | 0.89 | 175 | 3.59 |
| 30 | 7-Aug | 4 a.m. | 400 | 0.43 | 141 | 0.76 | 170 | 3.57 |
| 31 | 7-Aug | 6 a.m. | 420 | 0.68 | 138 | 0.98 | 300 | 6.65 |
| 32 | 7-Aug | 8 a.m. | 465 | 1.04 | 136 | 0.95 | 260 | 5.68 |
| 33 | 7-Aug | 10 a.m. | 460 | 0.94 | 141 | 3.00 | 280 | 6.69 |
| 34 | 7-Aug | 12 p.m. | 460 | 0.89 | 138 | 3.60 | 285 | 6.93 |
| 35 | 7-Aug | 2 p.m. | 490 | 0.85 | 135 | 4.00 | 265 | 7.11 |
| 36 | 7-Aug | 4 p.m. | 450 | 0.83 | 155 | 2.00 | 270 | 6.69 |
| **Mean** | | | 420 | 0.76 | 143 | 1.50 | 251 | 5.97 |
| **St. Dev.** | | | 55.14 | 0.17 | 15.04 | 1.22 | 49.88 | 1.36 |
| **95% conf. limits (mean +/-)** | | | 18.01 | 0.06 | 4.91 | 0.40 | 16.33 | 0.45 |
| **Median** | | | 420 | 0.79 | 142 | 0.96 | 265 | 6.67 |
| **Coefficient of Variability** | | | 0.13 | 0.23 | 0.11 | 0.82 | 0.20 | 0.23 |
| **Distribution** | | | normal | normal | normal | normal | normal | normal |

*Data provided by Robert Pitt, University of Alabama*

**Table E2.4 (cont.)**

| Sample # | Collection Date | Collection Time | Ammonia (mg/L) | pH | Color (units) | Chlorine (mg/L) | Toxicity (I25) (% reduc.) | Copper (mg/L) | Phenols (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1-Aug | 10 p.m. | 8.59 | 7.35 | 42 | 0.01 | 23.8 | 0.01 | 0.00 |
| 2 | 2-Aug | 12 a.m. | 7.25 | 7.23 | 10 | 0.03 | 29.2 | 0.00 | 0.00 |
| 3 | 2-Aiug | 2 a.m. | 5.02 | 7.33 | 12 | 0.03 | 30.3 | 0.00 | 0.00 |
| 4 | 2-Aug | 4 a.m. | 5.22 | 7.24 | 8 | 0.01 | 26.0 | 0.00 | 0.00 |
| 5 | 2-Aug | 6 a.m. | 13.04 | 7.35 | 11 | 0.02 | 16.3 | 0.00 | 0.00 |
| 6 | 2-Aug | 8 a.m. | 14.23 | 7.30 | 12 | 0.00 | 23.8 | 0.00 | 0.00 |
| 7 | 2-Aug | 10 a.m. | 13.03 | 7.17 | 15 | 0.01 | 20.6 | 0.01 | 0.00 |
| 8 | 2-Aug | 12 p.m. | 9.67 | 6.97 | 31 | 0.00 | 21.7 | 0.02 | 0.00 |
| 9 | 2-Aug | 2 p.m. | 8.00 | 6.98 | 28 | 0.00 | 15.3 | 0.00 | 0.00 |
| 10 | 2-Aug | 4 p.m. | 8.81 | 7.12 | 22 | 0.00 | 11.0 | 0.00 | 0.00 |
| 11 | 2-Aug | 6 p.m. | 7.82 | 7.03 | 23 | 0.00 | 17.4 | 0.00 | 0.00 |
| 12 | 2-Aug | 8 p.m. | 7.32 | 7.09 | 21 | 0.05 | 19.5 | 0.01 | 0.00 |
| 13 | 4-Aug | 6 p.m. | 10.03 | 7.21 | 75 | 0.00 | 43.3 | NA | NA |
| 14 | 4-Aug | 8 p.m. | 9.18 | 6.94 | 61 | 0.03 | 47.2 | NA | NA |
| 15 | 4-Aug | 10 p.m. | 11.82 | 7.10 | 45 | 0.00 | 41.7 | NA | NA |
| 16 | 5-Aug | 12 a.m. | 11.04 | 6.89 | 49 | 0.00 | 41.1 | NA | NA |
| 17 | 5-Aug | 2 a.m. | 6.38 | 7.10 | 26 | 0.02 | 46.7 | NA | NA |
| 18 | 5-Aug | 4 a.m. | 6.00 | 7.05 | 19 | 0.01 | 49.6 | NA | NA |
| 19 | 5-Aug | 6 a.m. | 12.83 | 7.16 | 22 | 0.00 | 52.2 | NA | NA |
| 20 | 5-Aug | 8 a.m. | 19.49 | 7.06 | 50 | 0.01 | 52.8 | NA | NA |
| 21 | 5-Aug | 10 a.m. | 12.34 | 6.88 | 60 | 0.00 | 37.8 | NA | NA |
| 22 | 5-Aug | 12 p.m. | 10.67 | 7.00 | 64 | 0.00 | 48.9 | NA | NA |
| 23 | 5-Aug | 2 p.m. | 8.57 | 6.98 | 54 | 0.01 | 47.8 | NA | NA |
| 24 | 5-Aug | 4 p.m. | 9.25 | 7.06 | 48 | 0.00 | 53.3 | NA | NA |
| 25 | 6-Aug | 6 p.m. | 11.00 | 7.03 | 62 | 0.02 | 65.4 | NA | NA |
| 26 | 6-Aug | 8 p.m. | 9.99 | 6.98 | 48 | 0.04 | 99.6 | NA | NA |
| 27 | 6-Aug | 10 p.m. | 10.66 | 7.01 | 43 | 0.10 | 99.4 | NA | NA |
| 28 | 7-Aug | 12 a.m. | 8.29 | 7.06 | 15 | 0.03 | 40.5 | NA | NA |
| 29 | 7-Aug | 2 a.m. | 5.53 | 7.13 | 16 | 0.00 | 4.2 | NA | NA |
| 30 | 7-Aug | 4 a.m. | 5.84 | 7.13 | 18 | 0.01 | 3.1 | NA | NA |
| 31 | 7-Aug | 6 a.m. | 17.28 | 7.16 | 42 | 0.02 | 54.0 | NA | NA |
| 32 | 7-Aug | 8 a.m. | 15.74 | 7.18 | 68 | 0.00 | 98.3 | NA | NA |
| 33 | 7-Aug | 10 a.m. | 10.99 | 7.03 | 80 | 0.00 | 68.6 | NA | NA |
| 34 | 7-Aug | 12 p.m. | 10.03 | 7.08 | 54 | 0.00 | 71.9 | NA | NA |
| 35 | 7-Aug | 2 p.m. | 7.43 | 6.86 | 52 | 0.01 | 69.7 | NA | NA |
| 36 | 7-Aug | 4 p.m. | 8.58 | 7.11 | 58 | 0.03 | 71.9 | NA | NA |
| **Mean** | | | 9.92 | 7.09 | 38 | 0.01 | 43.4 | 0.00 | 0.00 |
| **St. Dev.** | | | 3.33 | 0.13 | 20.95 | 0.02 | 25.47 | 0.01 | 0.00 |
| **95% Conf. limits (mean +/-)** | | | 1.09 | 0.04 | 6.84 | 0.01 | 8.32 | 0.00 | 0.00 |
| **Median** | | | 9.46 | 7.09 | 42 | 0.01 | 42.5 | 0.00 | 0.00 |
| **Coefficient of Variability** | | | 0.34 | 0.02 | 0.55 | 2.00 | 0.59 | -- | -- |
| **Distribution** | | | L-normal | normal | normal | L-normal | normal | uniform | uniform |

*Data provided by Robert Pitt, University of Alabama*

NA: Data not available

| Table E2.5: Residential Septic Tank Discharge Samples | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample #** | **Conductivity (µS/cm)** | **Fluoride (mg/L)** | **Hardness (mg/L) (as $CaCO_3$)** | **Detergent (mg/L)** | **Fluoresc. (% scale)** | **Potassium (mg/L)** | **Ammonia (mg/L)** | **pH (units)** | **Color (units)** | **Chlorine (mg/L)** | **Toxicity (I25) (% reduc.)** | **Copper (mg/L)** | **Phenols (mg/L)** |
| 1 | 82 | 0.75 | 252 | 0.03 | 511 | 30.06 | 117.80 | 7.23 | 38 | 0.03 | 100 | NA | NA |
| 2 | 108 | 0.70 | 186 | 0.00 | 547 | 32.06 | 124.60 | 7.38 | 38 | 0.01 | 100 | NA | NA |
| 3 | 56 | 0.62 | 186 | 0.00 | 536 | 27.26 | 114.40 | 7.16 | 18 | 0.00 | 100 | NA | NA |
| 4 | 397 | 1.19 | 36 | 10.00 | 266 | 8.16 | 26.07 | 6.61 | 68 | 0.01 | 100 | NA | NA |
| 5 | 482 | 0.70 | 29 | 5.00 | 321 | 8.83 | 135.75 | 6.53 | 87 | 0.03 | 100 | NA | NA |
| 6 | 362 | 1.12 | 36 | 12.00 | 351 | 8.16 | 26.77 | 6.67 | 77 | 0.00 | 100 | NA | NA |
| 7 | 812 | 0.92 | 80 | 0.50 | 466 | 20.85 | 89.60 | 6.63 | 54 | 0.00 | 100 | NA | NA |
| 8 | 812 | 1.55 | 84 | 0.15 | 431 | 23.25 | 91.60 | 6.59 | 64 | 0.01 | 100 | NA | NA |
| 9 | 762 | 1.26 | 82 | 0.57 | 471 | 22.25 | 86.10 | 6.54 | 91 | 0.03 | 100 | NA | NA |
| 10 | 432 | 0.61 | 45 | 2.50 | 455 | 24.51 | 95.90 | 7.39 | 55 | 0.20 | 100 | 0.00 | 0.00 |
| 11 | 297 | 0.42 | 53 | 1.00 | 253 | 18.66 | 107.80 | 6.19 | 10 | 0.00 | 100 | 0.00 | 0.00 |
| 12 | 236 | 0.56 | 61 | 0.50 | 463 | 21.73 | 99.30 | 6.59 | 100 | 0.19 | 100 | 0.40 | 0.00 |
| 13 | 327 | 0.87 | 63 | 0.45 | 339 | 31.81 | 113.20 | 6.72 | 100 | 0.20 | 100 | 0.35 | 0.00 |
| **Mean** | 502 | 0.93 | 57 | 3.27 | 382 | 18.82 | 87.21 | 6.65 | 70.60 | 0.07 | 100 | 0.19 | 0.00 |
| **St. Dev.** | 209.87 | 0.36 | 20.52 | 4.35 | 84.95 | 7.97 | 35.11 | 0.30 | 27.28 | 0.09 | 0.00 | 0.22 | 0.00 |
| **95% conf. limits (mean +/-)** | 114.09 | 0.20 | 11.16 | 2.37 | 46.18 | 4.33 | 19.09 | 0.16 | 14.83 | 0.05 | 0.00 | 0.12 | 0.00 |
| **Median** | 414 | 0.90 | 57 | 0.79 | 391 | 21.29 | 93.75 | 6.60 | 72.50 | 0.02 | 100 | 0.18 | 0.00 |
| **Coefficient of Variability** | 0.42 | 0.39 | 0.36 | 1.33 | 0.22 | 0.42 | 0.40 | 0.04 | 0.39 | 1.28 | 0.00 | 1.16 | -- |
| **Distribution** | normal | normal | log-normal | log-normal | normal | normal | normal | normal | normal | normal | uniform | bi-modal | uniform |

*Data provided by Robert Pitt, University of Alabama*

NA: Data not available

| Table E2.6: Commercial Carwash Samples | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample #** | **Conductivity (µS/cm)** | **Fluoride (mg/L)** | **Hardness (mg/L) (as $CaCO_3$)** | **Detergent (mg/L)** | **Fluoresc. (% scale)** | **Potassium (mg/L)** | **Ammonia (mg/L)** | **pH** | **Color (units)** | **Chlorine (mg/L)** | **Toxicity (I25) (% reduc.)** | **Copper (mg/L)** | **Phenols (mg/L)** |
| 1 | 448 | 16.5 | 145 | 50.4 | 1325 | 22.00 | 0.28 | 6.49 | 380 | 0.00 | 100 | 0.00 | 0.00 |
| 2 | 450 | 11.5 | 149 | 52.2 | 1350 | 22.00 | 0.32 | 6.46 | 340 | 0.00 | 100 | 0.00 | 0.00 |
| 3 | 550 | 12.5 | 152 | 52.5 | 1400 | 78.40 | 0.20 | 7.11 | 190 | 0.00 | 100 | 0.00 | 0.00 |
| 4 | 490 | 15.5 | 150 | 49.0 | 1100 | 40.70 | 0.23 | 6.90 | 190 | 0.01 | 100 | 0.00 | 0.00 |
| 5 | 495 | 12.5 | 158 | 56.7 | 1075 | 47.70 | 0.19 | 6.84 | 190 | 0.00 | 100 | 0.00 | 0.00 |
| 6 | 470 | 8.0 | 160 | 50.3 | 1095 | 35.40 | 0.14 | 6.77 | 240 | 0.02 | 100 | 0.00 | 0.00 |
| 7 | 480 | 10.2 | 172 | 38.0 | 1005 | 48.20 | 0.23 | 6.76 | 200 | 0.08 | 100 | NA | NA |
| 8 | 473 | 11.8 | 165 | 49.0 | 1155 | 46.20 | 0.25 | 6.67 | 175 | 0.23 | 100 | NA | NA |
| 9 | 492 | 12.3 | 159 | 43.5 | 1190 | 16.70 | 0.19 | 6.40 | 160 | 0.12 | 100 | 0.00 | 0.00 |
| 10 | 505 | 12.2 | 155 | 48.0 | 1205 | 39.60 | 0.36 | 6.80 | 150 | 0.15 | 100 | 0.00 | 0.00 |
| **Mean** | 485 | 12.3 | 157 | 49.0 | 1190 | 42.69 | 0.24 | 6.72 | 222 | 0.07 | 100 | 0.00 | 0.00 |
| **St. Dev.** | 9.41 | 2.40 | 8.07 | 5.14 | 130.79 | 15.92 | 0.07 | 0.22 | 77.46 | 0.08 | 0.00 | 0.00 | 0.00 |
| **95% conf. limits (mean +/-)** | 8.23 | 1.49 | 5.00 | 3.19 | 81.06 | 9.87 | 0.04 | 0.14 | 48.01 | 0.05 | 0.00 | 0.00 | 0.00 |
| **Median** | 485 | 12.3 | 157 | 49.7 | 1173 | 43.45 | 0.23 | 6.77 | 190 | 0.05 | 100 | 0.00 | 0.00 |
| **Coefficient of Variability** | 0.06 | 0.19 | 0.05 | 0.10 | 0.11 | 0.37 | 0.28 | 0.03 | 0.35 | 1.14 | 0.00 | -- | -- |
| **Distribution** | normal | normal | normal | normal | normal | normal | normal | normal | normal | bi-modal | uniform | uniform | uniform |
| *Data provided by Robert Pitt, University of Alabama* | | | | | | | | | | | | | |

NA: Data not available

| Table E2.7: Commercial Laundry Samples | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample #** | **Conductivity (µS/cm)** | **Fluoride (mg/L)** | **Hardness (mg/L) (as $CaCO_3$)** | **Detergent (mg/L)** | **Fluoresc. (% scale)** | **Potassium (mg/L)** | **Ammonia (mg/L)** | **pH** | **Color (units)** | **Chlorine (mg/L)** | **Toxicity (I25) (% reduc.)** | **Copper (mg/L)** | **Phenols (mg/L)** |
| 1 | 752 | 15.89 | 32 | 37.0 | 1169.6 | 3.47 | 0.94 | 9.37 | 25 | 0.57 | 100 | NA | NA |
| 2 | 462 | 23.98 | 40 | 21.5 | 1144.6 | 3.97 | 0.96 | 9.40 | 59 | 0.51 | 100 | NA | NA |
| 3 | 422 | 54.48 | 38 | 17.0 | 844.6 | 3.37 | 0.62 | 8.37 | 61 | 0.44 | 100 | NA | NA |
| 4 | 589 | 42.48 | 36 | 32.5 | 819.6 | 3.67 | 0.70 | 8.60 | 43 | 0.38 | 100 | NA | NA |
| 5 | 657 | 48.98 | 34 | 35.0 | 1169.6 | 3.57 | 0.84 | 9.10 | 49 | 0.21 | 100 | NA | NA |
| 6 | 565 | 31.48 | 37 | 31.0 | 1094.6 | 3.27 | 0.91 | 9.20 | 30 | 0.33 | 100 | NA | NA |
| 7 | 485 | 22.48 | 38 | 20.0 | 994.6 | 3.77 | 0.78 | 9.41 | 55 | 0.42 | 100 | NA | NA |
| 8 | 715 | 26.98 | 33 | 25.0 | 1019.6 | 2.57 | 0.88 | 9.05 | 38 | 0.47 | 100 | 0.00 | 0.00 |
| 9 | 545 | 35.98 | 32 | 24.0 | 1019.6 | 3.67 | 0.69 | 9.36 | 57 | 0.33 | 100 | 0.00 | 0.00 |
| 10 | 437 | 25.48 | 37 | 26.0 | 969.9 | 3.47 | 0.84 | 9.12 | 50 | 0.35 | 100 | 0.00 | 0.00 |
| **Mean** | 563 | 32.82 | 36 | 26.9 | 1024.6 | 3.48 | 0.82 | 9.10 | 47 | 0.40 | 100 | 0.00 | 0.00 |
| **St. Dev.** | 115.81 | 12.45 | 2.78 | 6.69 | 124.61 | 0.38 | 0.12 | 0.35 | 12.41 | 0.10 | 0.00 | 0.00 | 0.00 |
| **95% conf. limits (mean +/-)** | 68.44 | 7.36 | 1.64 | 3.96 | 73.64 | 0.22 | 0.07 | 0.21 | 7.33 | 0.06 | 0.00 | 0.00 | 0.00 |
| **Median** | 555 | 29.23 | 37 | 25.5 | 1019.6 | 3.52 | 0.84 | 9.16 | 50 | 0.40 | 100 | 0.00 | 0.00 |
| **Coefficient of Variability** | 0.21 | 0.38 | 0.08 | 0.25 | 0.12 | 0.11 | 0.14 | 0.04 | 0.27 | 0.26 | 0.00 | -- | -- |
| **Distribution** | normal | normal | normal | normal | normal | normal | normal | normal | normal | normal | uniform | uniform | uniform |
| *Data provided by Robert Pitt, University of Alabama* | | | | | | | | | | | | | |

NA: Data not available

**Table E2.8: Radiator Waste Samples**

| Sample # | Conductivity (µS/cm) | Fluoride (mg/L) | Hardness (mg/L) (as $CaCO_3$) | Detergent (mg/L) | Fluoresc. (% scale) | Potassium (mg/L) | Ammonia (mg/L) | pH | Color (units) | Chlorine (mg/L) | Toxicity (I25) (% reduc.) | Copper (mg/L) | Phenols (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4250 | 136.5 | 0 | 17.4 | 20850 | 3230 | 16.9 | 6.95 | 2933 | 0.04 | 100 | NA | NA |
| 2 | 3350 | 177.0 | 0 | 13.8 | 24000 | 2446 | 32.4 | 6.99 | 3000 | 0.02 | 100 | NA | NA |
| 3 | 4200 | 172.5 | 32 | 14.7 | 20500 | 3473 | 21.0 | 6.25 | 3066 | 0.06 | 100 | NA | NA |
| 4 | 3321 | 133.3 | 12 | 14.2 | 21940 | 2694 | 18.1 | 7.01 | 3000 | 0.03 | 100 | NA | NA |
| 5 | 3289 | 129.8 | 0 | 15.1 | 22210 | 2902 | 22.3 | 6.85 | 3000 | 0.04 | 100 | NA | NA |
| 6 | 3510 | 121.5 | 12 | 18.3 | 22240 | 2907 | 12.2 | 6.50 | 3000 | 0.00 | 100 | NA | NA |
| 7 | 1900 | 183.0 | 0 | 13.5 | 22650 | 2282 | 8.9 | 7.61 | 2933 | 0.03 | 100 | NA | NA |
| 8 | 2510 | 124.5 | 0 | 13.5 | 22250 | 2364 | 90.1 | 7.38 | 3000 | 0.03 | 100 | NA | NA |
| 9 | 2987 | 170.1 | 0 | 14.6 | 21920 | 2899 | 23.8 | 6.98 | 3066 | 0.02 | 100 | NA | NA |
| 10 | 3466 | 145.0 | 0 | 15.3 | 21900 | 2821 | 17.5 | 7.11 | 3000 | 0.03 | 100 | NA | NA |
| **Mean** | 3278 | 149.3 | 5.6 | 15.04 | 22046 | 2801 | 26.3 | 6.96 | 3000 | 0.03 | 100 | NA | NA |
| **St. Dev.** | 704.32 | 23.76 | 10.53 | 1.62 | 952.08 | 374.89 | 23.32 | 0.39 | 44.33 | 0.02 | 0.00 | NA | NA |
| **95% conf. limits (mean +/-)** | 436.54 | 14.73 | 6.53 | 1.00 | 590.10 | 323.36 | 14.45 | 0.24 | 27.48 | 0.01 | 0.00 | NA | NA |
| **Median** | 3335 | 140.8 | 0 | 14.65 | 22075 | 2864 | 24.5 | 6.99 | 3000 | 0.03 | 100 | NA | NA |
| **Coefficient of Variability** | 0.21 | 0.16 | 1.88 | 0.11 | 0.04 | 0.13 | 0.89 | 0.06 | 0.01 | 0.52 | 0.00 | NA | NA |
| **Distribution** | normal | normal | normal | normal | normal | normal | normal | normal | normal | normal | uniform | NA | NA |

*Data provided by Robert Pitt, University of Alabama*

NA: Data not available

| Table E2.9: Plating Bath Waste Samples | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample #** | **Conductivity (µS/cm)** | **Fluoride (mg/L)** | **Hardness (mg/L) (as $CaCO_3$)** | **Detergent (mg/L)** | **Fluoresc. (% scale)** | **Potassium (mg/L)** | **Ammonia (mg/L)** | **pH** | **Color (units)** | **Chlorine (mg/L)** | **Toxicity (I25) (% reduc.)** | **Copper (mg/L)** | **Phenols (mg/L)** |
| 1 | 16200 | 9.00 | 1408 | 15.0 | 640.0 | 774 | 105.00 | 1.78 | 60 | 0.12 | 100 | 0.27 | 0 |
| 2 | 3620 | 1.68 | 950 | 1.8 | 505.0 | 552 | 74.20 | 4.82 | 90 | 0.27 | 100 | 0.00 | 0 |
| 3 | 8500 | 1.86 | 775 | 10.0 | 77.5 | 1730 | 3.05 | 5.20 | 368 | 0.01 | 89.4 | 0.00 | 0 |
| 4 | 9700 | 6.00 | 1452 | 9.0 | 225.0 | 186 | 139.37 | 6.15 | 70 | 0.08 | 100 | 0.21 | 0 |
| 5 | 10200 | 5.52 | 1476 | 11.4 | 390.0 | 220 | 29.33 | 3.36 | 90 | 0.00 | 100 | 0.32 | 0 |
| 6 | 7000 | 5.85 | 1818 | 1.5 | 88.0 | 490 | 76.00 | 8.60 | 50 | 0.04 | 68.4 | 0.07 | 0 |
| 7 | 8000 | 6.00 | 2433 | 1.6 | 75.0 | 356 | 58.60 | 7.60 | 50 | 0.03 | 90.5 | 0.05 | 0 |
| 8 | 12500 | 7.95 | 1484 | 6.9 | 510.5 | 380 | 60.90 | 3.10 | 75 | 0.02 | 100 | 0.35 | 0 |
| 9 | 8100 | 4.20 | 1398 | 3.9 | 147.5 | 1100 | 101.00 | 2.50 | 110 | 0.00 | 100 | 0.48 | 0 |
| 10 | 19700 | 3.20 | 1091 | 7.0 | 275.0 | 4300 | 9.05 | 6.20 | 75 | 0.19 | 100 | 0.00 | 0 |
| **Mean** | 10352 | 5.13 | 1429 | 6.8 | 293.4 | 1009 | 65.65 | 4.93 | 104 | 0.08 | 94.8 | 0.18 | 0.00 |
| **St. Dev.** | 4681.35 | 2.41 | 464.03 | 4.63 | 206.61 | 1247.85 | 43.37 | 2.25 | 94.71 | 0.09 | 10.15 | 0.17 | 0.00 |
| **95% conf. limits (mean +/-)** | 2901.53 | 1.49 | 287.61 | 2.87 | 128.06 | 773.42 | 26.88 | 1.39 | 58.70 | 0.06 | 6.29 | 0.11 | 0.00 |
| **Median** | 9100 | 5.69 | 1430 | 6.9 | 250.0 | 521 | 67.55 | 5.01 | 75 | 0.04 | 100 | 0.14 | 0.00 |
| **Coefficient of Variability** | 0.45 | 0.47 | 0.32 | 0.68 | 0.70 | 1.24 | 0.66 | 0.46 | 0.91 | 1.20 | 0.11 | 0.94 | -- |
| **Distribution** | normal | normal | normal | normal | normal | log-normal | normal | normal | normal | normal | bi-modal | uniform | uniform |

*Data provided by Robert Pitt, University of Alabama*

# APPENDIX F

## ANALYTICAL PROCEDURES FOR OUTFALL MONITORING

# APPENDIX F1: INDICATOR PARAMETER OVERVIEW

## Ammonia

Ammonia is a good indicator of sewage, since its concentration is much higher there than in groundwater or tap water. High ammonia concentrations may also indicate liquid wastes from some industrial sites. Ammonia is relatively simple and safe to analyze. Some challenges include the tendency for ammonia to volatilize (i.e., turn into a gas and become non-conservative) and its potential generation from non-human sources, such as pets or wildlife.

## Boron

Boron is an element present in the compound borax, which is often found in detergent and soap formulations. Consequently, boron is a good potential indicator for both laundry wash water and sewage. Preliminary research from Alabama supports this contention, particularly when it is combined with other detergent indicators, such as surfactants (Pitt, IDDE Project Support Material). Boron may not be a useful indicator everywhere in the country since it may be found at elevated levels in groundwater in some regions and is a common ingredient in water softeners products. Program mangers should collect data on boron concentrations in local tap water and groundwater sources to confirm whether it will be an effective indicator of illicit discharges.

## Chlorine

Chlorine is used throughout the country to disinfect tap water, except where private wells provide the water supply. Chlorine concentrations in tap water tend to be significantly higher than most other discharge types. Unfortunately, chlorine is extremely volatile, and even moderate levels of organic materials can cause chlorine levels to drop below detection levels. Because chlorine is non-conservative, it is not a reliable indicator, although if very high chlorine levels are measured, it is a strong indication of a water line break, swimming pool discharge, or industrial discharge from a chlorine bleaching process.

## Color

Color is a numeric computation of the color observed in a water quality sample, as measured in cobalt-platinum units (APHA, 1998). Both industrial liquid wastes and sewage tend to have elevated color values. Unfortunately, some "clean" flow types can also have high color values. Field testing by Pitt (IDDE Project Support Material) found high color values associated for all contaminated flows, but also many uncontaminated flows, which yielded numerous false positives. Overall, color may be a good first screen for problem outfalls, but needs to be supplemented by other indicator parameters.

## Conductivity

Conductivity, or specific conductance, is a measure of how easily electricity can flow through a water sample. Conductivity is often strongly correlated with the total amount of dissolved material in water, known as Total Dissolved Solids. The utility of conductivity as an indicator depends on whether concentrations are elevated in "natural" or clean waters. In particular, conductivity is a poor indicator of illicit discharge in estuarine waters or in northern regions where deicing salts are used (both have high conductivity readings).

Field testing in Alabama suggests that conductivity has limited value to detect sewage or wash water (Pitt, IDDE Project Support Material). Conductivity has some

value in detecting industrial discharges that can exhibit extremely high conductivity readings. Conductivity is extremely easy to measure with field probes, so it has the potential to be a useful supplemental indicator in subwatersheds that are dominated by industrial land uses.

## Detergents

Most illicit discharges have elevated concentration of detergents. Sewage and washwater discharges contain detergents used to clean clothes or dishes, whereas liquid wastes contain detergents from industrial or commercial cleansers. The nearly universal presence of detergents in illicit discharges, combined with their absence in natural waters or tap water, makes them an excellent indicator. Research has revealed three indicator parameters that measure the level of detergent or its components-- surfactants, fluorescence, and surface tension (Pitt, IDDE Project Support Material). Surfactants have been the most widely applied and transferable of the three indicators. Fluorescence and surface tension show promise, but only limited field testing has been performed on these more experimental parameters. Methods and laboratory protocols for each of the three detergent indicator parameters are reviewed in Appendix F2.

## *E. coli*, Enterococci and Total Coliform

Each of these bacteria is found at very high concentrations in sewage compared to other flow types, and is a good indicator of sewage or septage discharges, unless pet or wildlife sources exist in the subwatershed. Overall, bacteria are good supplemental indicators and can be used to find "problem" streams or outfalls that exceed public health standards. Relatively simple analytical methods are now available to test for bacteria indicators, although they still suffer from two monitoring constraints. The first is the relatively long analysis time (18-24 hours) to get results, and the second is that the waste produced by the tests may be classified as a biohazard and require special disposal techniques.

## Fluorescence

Laundry detergents are highly fluorescent because optical brighteners are added to the formula to produce "brighter whites." Optical brighteners are the reason that white clothes appear to have a bluish color when placed under a fluorescent light. Fluorescence is a very sensitive indicator of the presence of detergents in discharges, using a fluorometer to measure fluorescence at specific wavelengths of light. Since no chemicals are needed for testing, fluorometers have minimal safety and waste disposal concerns.

Some technical concerns do limit the utility of fluorescence as an indicator of illicit discharges. The concerns include the presence of fluorescence in non-illicit flow types such as irrigation water, the considerable variation of fluorescence between different detergent brands, and the lack of a readily standard or benchmark concentration for optical brighteners. For example, Pitt (IDDE Project Support Material) measured fluorescence in mg/L of Tide™ brand detergent, and found the degree of fluorescence varied regionally, temporally, and between specific detergent formulations.

Given these current limitations, fluorescence is best combined with other detergent indicators such as surfactants. Appendix F3 should be consulted for more detailed information on analytical methods and experimental field testing using fluorescence as an indicator parameter.

## Fluoride

Fluoride is added to drinking water supplies in most communities to improve dental health, and normally found at a concentration of two parts per million in tapwater. Consequently, fluoride is an excellent conservative indicator of tap water discharges or leaks from water supply pipes that end up in the storm drain. Fluoride is obviously not a good indicator in communities that do not fluoridate drinking water, or where individual wells provide drinking water. One key constraint is that the reagent used in the recommended analytical method for fluoride is considered a hazardous waste, and must be disposed of properly.

## Hardness

Hardness measures the positive ions dissolved in water and primarily include magnesium and calcium in natural waters, but are sometimes influenced by other metals. Field testing by Pitt (IDDE Project Support Material) suggests that hardness has limited value as an indicator parameter, except when values are extremely high or low (which may signal the presence of some liquid wastes). Hardness may be applicable in communities where hardness levels are elevated in groundwater due to karst or limestone terrain. In these regions, hardness can help distinguish natural groundwater flows present in outfalls from tap water and other flow types.

## pH

Most discharge flow types are neutral, having a pH value around 7, although groundwater concentrations can be somewhat variable. pH is a reasonably good indicator for liquid wastes from industries, which can have very high or low pH (ranging from 3 to 12). The pH of residential wash water tends to be rather basic (pH of 8 or 9). The pH of a discharge is very simple to monitor in the field with low cost test strips or probes. Although pH data is often not conclusive by itself, it can identify problem outfalls that merit follow-up investigations using more effective indicators.

## Potassium

Potassium is found at relatively high concentrations in sewage, and extremely high concentrations in many industrial process waters. Consequently, potassium can act as a good first screen for industrial wastes, and can also be used in combination with ammonia to distinguish wash waters from sanitary wastes. (See Chapter 12). Simple field probes can detect potassium at relatively high concentrations (5 mg/L), whereas more complex colorimetric tests are needed to detect potassium concentrations lower than 5 mg/L.

## Surface Tension

Surfactants remove dirt particles by reducing the surface tension of the bubbles formed in laundry water when it is agitated. Reduced surface tension makes dirt particles less likely to settle on a solid surface (e.g., clothes or dishes) and become suspended instead on the water's surface. The visible manifestation of reduced surface tension is the formation of foam or bubbles on the water surface. Pitt (IDDE Project Support Material) tested a very simple procedure to measure surface tension that quantifies the formation of foam and bubbles in sample bottles. Initial laboratory tests suggest that surface tension is a good indicator of surfactants, but only when they are present at relatively high concentrations. Section F3 provides a more detailed description of the surface tension measurement procedure.

## Surfactants

Surfactants are the active ingredient in most commercial detergents, and are typically measured as Methyl Blue Active Substances (or MBAS). They are a synthetic replacement for soap, which builds up deposits on clothing over time. Since surfactants are not found in nature, but are always present in detergents, they are excellent indicators of sewage and wash waters. The presence of surfactants in cleansers, emulsifiers and lubricants also makes them an excellent indicator of industrial or commercial liquid wastes. In fact, research by Pitt (IDDE Project Support Material) found that detergents were an excellent indicator of "contaminated" discharges in Alabama (i.e., discharges that were not tap water or groundwater). Several analytical methods are available to monitor surfactants. Unfortunately, the reagents used involve toluene, chloroform, or benzene, each of which is considered hazardous waste with a potential human health risk. The most common analysis method uses chloroform as a reagent, and is recommended because it is relatively safer when compared to other reagents.

## Turbidity

Turbidity is a quantitative measure of cloudiness in water, and is normally measured with a simple field probe. While turbidity itself cannot always distinguish between contaminated flow types, it is a potentially useful screening indicator to determine if the discharge is contaminated (i.e., not composed of tap water or groundwater).

## Research Indicators

In recent years, researchers have explored a series of other indicators to identify illicit discharges, including fecal steroids (such as coprostanol), caffeine, specific fragrances associated with detergents and stable isotopes of oxygen. Each of these research indicators is profiled in Pitt (IDDE Project Support Material) and summarized below in Table F1. Most research indicators require sophisticated equipment and specific expertise that limit their utility as a general indicator, given the high sampling cost and long turn-around times needed. To date, field tests of research indicators have yielded mixed results, and they are currently thought to be more appropriate for special research projects than for routine outfall testing. While they are not discussed further in this manual, future research and testing may improve their utility as indicators of illicit discharges.

| Table F1: Summary of Research Indicators Used for Identifying Inappropriate Discharges into Storm Drainage | | |
|---|---|---|
| **Parameter Group** | **Comments** | **Recommendation** |
| Coprostanol and other fecal sterol compounds | Used to indicate presence of sanitary sewage | Possibly useful. Expensive analysis with GC/MSD. Not specific to human wastes or recent contamination. Most useful when analyzing particulate fractions of wastewaters or sediments. |
| Specific detergent compounds (LAS, fabric whiteners, and perfumes) | Used to indicate presence of sanitary sewage | Possibly useful. Expensive analyses with HPLC. A good and sensitive confirmatory method. |
| Pharmaceuticals (colfibric acid, aspirin, ibuprofen, steroids, illegal drugs, etc.) | Used to indicate presence of sanitary sewage | Possibly useful. Expensive analyses with HPLC. A good and sensitive confirmatory method. |
| Caffeine | Used to indicate presence of sanitary sewage | Not very useful. Expensive analyses with GC/MSD. Numerous false negatives, as typical analytical methods not suitably sensitive. |
| DNA profiling of microorganisms | Used to identify sources of microorganisms | Likely useful, but currently requires extensive background information on likely sources in drainage. Could be very useful if method can be simplified, but with less specific results. |
| UV absorbance at 228 nm | Used to identify presence of sanitary sewage | Possibly useful, if UV spectrophotometer available. Simple and direct analyses. Sensitive to varying levels of sanitary sewage, but may not be useful with dilute solutions. Further testing needed to investigate sensitivity in field trials. |
| Stable isotopes of oxygen | Used to identify major sources of water | May be useful in area having distant domestic water sources and distant groundwater recharge areas. Expensive and time consuming procedure. Can not distinguish between wastewaters if all have common source. |
| GC/MSD - Gas Chromatography/Mass Selective Detector<br>HPLC - High Performance Liquid Chromatography | | |

# Appendix F2: "Off-the Shelf" Analytical Methodologies

## F2.1 AMMONIA (0 TO 0.50 MG/L $NH_3$-N)

### Equipment/Supplies Needed

- Hach bench top or portable spectrophotometer or colorimeter (see ordering information below)
- ammonia nitrogen reagent set for 25-mL samples
- ammonia nitrogen standard solution

### Procedure

Refer to Hach method 8155 for Nitrogen, Ammonia Salicylate Method (0 to 0.50 mg/L $NH_3$-N) for a 25mL sample. In this method, ammonia compounds combine with chlorine to form monochloramine. Monochloramine reacts with salicylate to form 5-aminosalicylate. The 5-aminosalicylate is oxidized in the presence of sodium nitroprusside catalyst to form a blue-colored compound. The blue color is masked by the yellow color from the excess reagent present to give a final green-colored solution.

### Duration of Test for Each Sample

Because of the duration of this test, samples should be run in batches of about six. From start to finish, each batch of six samples takes about 25 minutes, including the time taken to clean the sample cells and reset the instrument between each batch.

### Hazardous Reagents

According to good laboratory practice, the contents of each sample cell, after the analysis, should be poured into another properly-labeled container for proper disposal.

### Ease of Analysis

This procedure is time-consuming and should be performed indoors.

### Ordering Information

Vendor: Hach Company
PO Box 389
Loveland, CO 80539-0389
Tel: 800-227-4224
Fax: 970-669-2932
Website: www.hach.com

[Note: The direct-Nessler method may be preferred due to its faster reaction times, but Nessler reagent is toxic and corrosive. Nessler reagent, according to its MSDS, causes severe burns, is an acute and a cumulative poison, and is a teratogen. It also contains from 5 to 10% mercuric iodide. It is now recommended that the more sensitive salicylate method because of the lower concentrations experienced in this research, and because of its lower toxicity and easier disposal requirements. The salicylate method was therefore used for this project, although prior research found it to be somewhat less satisfactory than the Nessler method.]

| Equipment/Supplies Needed for Ammonia Analysis | | |
|---|---|---|
| **Item (Catalog Number)** | **Quantity** | **Price** |
| *One of the colorimeters, or spectrophotometers, listed previously will be needed. Alternatively, a dedicated colorimeter can be used, but that will only be useable for a single analyte.* | | |
| Ammonia-Nitrogen Reagent Set (25mL test) salicylate method (2243700) | 1 set of 100 tests | $180.56 |
| Ammonia cyanurate reagent powder pillows (2395566) | 1 pk of 50 pillows | $ 20.20 |
| Ammonia salicylate reagent powder pillows (2395366) | 1 pk of 50 pillows | $ 25.55 |

## F2.2 BORON (Low range 0 to 1.50 mg/L as B)

### Equipment/Supplies Needed

- A Hach bench top or portable spectrophotometer or colorimeter (see ordering information below)
- Boron test kit
- 1-inch plastic sample cells (at least 2).

### Procedure

Refer to Hach Azomethine-H Method 10061, which is adapted from ISO method 9390. In this procedure, Azomethine-H, a Schiff base, is formed by the condensation of an aminonaphthol with an aldehyde by the catalytic action of boron. The boron concentration in the sample is proportional to the developed color. Follow the Hach instructions that come with the reagent set for the specific procedure.

### Duration of Test for Each Sample

Each batch of six samples takes approximately 20 minutes.

### Hazardous Reagents

Standard laboratory practice requires that all unwanted chemicals be properly disposed.

### Ease of Analysis

The procedure is a little time consuming, but several samples can be analyzed together.

### Ordering information

Vendor: Hach Company
PO Box 389
Loveland, CO 80539-0389
Tel: 800-227-4224
Fax: 970-669-2932
Website: www.hach.com

| Equipment/Supplies Needed for Boron Analysis | | |
|---|---|---|
| **Item (Catalog Number)** | **Quantity** | **Price*** |
| Boron Test Kit (0-1.5 mg/L) BoroTrace (Azomethine-H) Method (2666900) | 1 set of 100 tests | $50.00 |
| BoroTrace 2 reagent (2666669) | 1 pk of 100 pillows | $30.00 |
| BoroTrace 3 reagent (2666799) | 1 pk of 100 pillows | $20.65 |
| EDTA Solution 1M (2241925) | 50 mL | |
| DR/890 portable colorimeter Programmed with 90 tests. Includes 2 sample cells, COD & TnT tube adapter, instrument, procedure manual and batteries. Portable instrument that can be used for many different analytes, but fewer than the following instruments. (48470000)[1] | 1 | $929.00 |
| DR/2500 spectrophotometer includes 6 one-inch round sample cells, instrument and procedure manual, and DR/Check Absorbance Standards. Compact laboratory instrument having many capabilities. (5900000)[1] | 1 | $2200.00 |
| DR/2400 portable spectrophotometer includes one-inch sample cells, instrument and procedures manuals. Portable instrument having many capabilities. (5940000)[1] | 1 | $1,995.00 |
| DR/4000 V Spectrophotometer. Visible spectrum only (320 to 1100nm). Includes 1-inch matched sample cells/ AccuVacc and 16-mm vial adapters; a Single Cell Module; 1-inch and 1-cm cell adapters; dust cover; replacement lamp kit; an illustrated manual set; and a power cord. UV-Vis laboratory instrument having vast capabilities. (48100-00)[1] | 1 | $5500.00 |
| [1]*Only one spectrophotometer is needed*<br>**The per-sample expendable cost is therefore about $2.00.* | | |

## F2.3 COLOR (0 – 100 APHA Platinum Cobalt Units)

### Equipment/Supplies needed

One Hach color test kit Model CO-1 which measures color using a color disc for comparison.

### Procedure

The following procedure is described in the test kit.

*Low Range*

1. Place the lengthwise viewing adapter in the comparator.
2. fill one sample tube to the line underlining "Cat. 1730-00" with the sample. This will be approximately 15mL. If not using 1730-00 tubes, fill to the line founds at approximately 3 inches up from the bottom of the tube.
3. Place the tube containing the water sample into the comparator in the right-hand position.
4. Fill the other sample tube with colorless water to the line underlining "Cat. 1730-00." Insert this tube in the left-side comparator opening.
5. Hold the comparator with the tube tops pointing to a window or light source at approximately a 45 degree angle (with the light coming in through the top of the tubes). View through the openings in the front of the comparator. When viewing, use care to not spill samples from unstoppered tubes.
6. Rotate the disc until a color match is obtained. The reading obtained through the scale window is the apparent color in APHA Platinum Cobalt Units.

*High Range*

1. If the lengthwise viewing adapter is in place, remove it.
2. Fill one of the tubes to the 5mL mark with the water sample.
3. Insert the tube in the right top opening of the comparator.
4. Fill the other tube to the 5mL mark with clear water and insert this tube into the left opening of the comparator.
5. Hold the comparator up to a light source as explained above. The reading obtained through the scale window is multiplied by 5 to obtained the apparent color.

### Duration of Test for Each Sample

One minute

### Hazardous Reagents

None.

### Ease of Analysis

This procedure easy and fast and can be performed outside of the laboratory.

### Ordering Information

Vendor: Hach Company
PO Box 389
Loveland, CO 80539-0389
Tel: 800-227-4224
Fax: 970-669-2932
Website: www.hach.com

| Equipment/Supplies Needed for Color Analysis | | |
|---|---|---|
| **Item (Catalog Number)** | **Quantity** | **Price** |
| Color Test Kit (0-100 mg/L) (223400) | one kit | $51.50 |

## F2.4 CONDUCTIVITY

### Equipment/Supplies Needed

- Cardy pocket-sized conductivity meter model B-173 made by Horiba
- Conductivity standard that comes with the meter.

### Calibration

Before any measurements can be performed the instrument must first be calibrated. The meter should hold its calibration for an extended period, but it is best to check the calibration before each sample batch.

1. Press the POWER button.
2. Place a drop of the 1.41 µs/cm standard solution onto the sensor cell.
3. Press the CAL/MODE button to display the CAL mark and 1.41. Calibration is complete when the CAL mark disappears.
4. Wash the sensor with tap water, and dry with a tissue.

### Measurement

1. Check first to see which mode the instrument is in by looking for the arrow pointing at the mS/cm or µS/cm.
2. Add a drop of the sample onto the sensor cell using a pipette (or the sensor may be immersed into the sample).
3. When the smiley face ☺ appears, take a reading. Be sure to note the units.

### Duration of Test for Each Sample

1 minute

### Hazardous Reagents

None

### Ease of Analysis

Simple and fast. Can be used in the field.

### Ordering Information

Vendor: Cole-Parmer Instrument Company
625 East bunker Court
Vernon Hills, IL 60061-1844
Phone: 1-800-323-4340
FAX: 847-247-2929
Website: www.coleparmer.com

| Equipment/Supplies Needed for Conductivity Analysis | |
|---|---|
| **Item (Catalog Number)** | **Price** |
| Cardy pocket-sized conductivity meter and accessories (EW-05751-10) | $269.00 |
| Replacement cardy conductivity sensor cartridge (EW-05751-52) | $ 82.00 |
| Replacement cardy conductivity solution kit (EW-05751-70) | $ 43.00 |

## F2.5 DETERGENTS (0-3 ppm)

### Equipment/Supplies needed

- Detergents (anionic surfactants) kit from *CHEMetrics*.

### Procedure

The following procedure comes with the Detergents kit. The Detergents CHEMets® test employs the methylene blue extraction method. Anionic detergents react with methylene blue to form a blue complex that is extracted into an immiscible organic solvent. The intensity of the blue color is directly related to the concentration of "methylene blue active substances (MBAS)" in the sample. Anionic detergents are one of the most prominent methylene blue active substances. Test results are expressed in mg/L linear alkylbenzene sulfonate.

1. Rinse the reaction tube with sample, and then fill it to the 5 mL mark with sample.
2. While holding the double-tipped ampoule in a vertical position, snap the upper tip using the tip-breaking tool.
3. Invert the ampoule and position the open end over the reaction tube. Snap the upper tip and allow the contents to drain into the reaction tube.
4. Cap the reaction tube and shake it vigorously for 30 seconds. Allow the tube to stand undisturbed for approximately 1 minute.
5. Make sure that the flexible tubing is firmly attached to the CHEMet ampoule tip.
6. Insert the CHEMet assembly (tubing first) into the reaction tube making sure that the end of the flexible tubing is at the bottom of the tube. Break the tip of the CHEMet ampoule by gently pressing it against the side of the reaction tube. The ampoule should draw in fluid only from the organic phase (bottom layer).
7. When filling is complete, remove the CHEMet assembly from the reaction tube.
8. Invert the ampoule several times, allowing the bubble to travel from end to end each time.
9. Using a tissue, remove the tubing from the ampoule tip. Wipe all liquid from the exterior of the ampoule, then place a small white cap firmly onto the tip of the ampoule.
10. Place the CHEMet ampoule, flat end downward into the center tube of the comparator. Direct the top of the comparator up toward a source of bright light while viewing from the bottom. Rotate the comparator until the color standard below the CHEMet ampoule shows the closest match. If the color of the CHEMet ampoule is between two color standards, a concentration estimate can be made.

### Duration of Test for Each Sample

Approximately 7 minutes per sample.

### Hazardous Reagents

The main components of the double-tipped ampoule are considered hazardous, and possibly carcinogenic (contains chloroform). The used ampoule should be placed back in the test kit box for later disposal at a hazardous waste facility. Use proper safety protection when performing this test: laboratory coat, gloves, and safety glasses. It is also strongly recommended that the test be performed under a laboratory fume hood. Wash hands thoroughly after handling the kit.

## Ease of Analysis

This procedure may be performed outside of a standard laboratory, if well ventilated. Produces hazardous chemicals.

## Ordering Information

Vendor: *CHEMetrics*, Inc
4295 Catlett Rd
*Calverton, VA 20138*
Phone 1-800-356-3072
FAX 1-540-788-4856
Website: www.chemetrics.com

| Equipment/Supplies Needed for Detergents Analysis | | |
|---|---|---|
| **Item (Catalog Number)** | **Quantity** | **Price*** |
| Detergent kit (anionic surfactants) (K-9400) | 20 tests | $63.15 |
| Detergent kit refill (R-9400) | 20 tests | $50.45 |
| **The per-sample expendable cost is therefore $2.52.* | | |

## F2.6 *E. COLI*

### Equipment/Supplies Needed

- Colilert reagent, sterile sample bottles for 100 mL samples
- Quanti-Tray 2000
- Colilert comparator predispensed in a Quanti-Tray/2000incubator
- UV light from IDEXX.

### Enumeration Procedure

1. Add contents of one Colilert snap pack to a 100 mL room temperature water sample in a sterile vessel. The standard Colilert reagent is recommended when evaluating Enterococci simultaneously so the samples are both ready to read in 24 hours. If only *E. coli* are to be evaluated, then the faster Colilert-18 reagent can be used if reading the results in 18 hours instead of 24 hours is important.
2. Cap vessel and shake until dissolved.
3. Pour sample/reagent mixture into a Quanti-Tray/2000 and seal in an IDEXX Quanti-Tray Sealer.
4. Place the sealed tray in a 35±0.5° C incubator for 24 hours.
5. Read results according to the Results Interpretation table below. Count the number of positive wells and refer to the MPN table provided with the Quanti-Trays to obtain a Most Probable Number.

### Results Interpretation

| Appearance | Result |
|---|---|
| Less yellow than the comparator | Negative for total coliforms and *E. coli* |
| Yellow equal to or greater than the comparator | Positive for total coliforms |
| Yellow and fluorescence equal to or greater than the comparator | Positive for *E. coli* |

### Duration of Test for Each Sample

Once the Quanti-Tray sealer is warm (10 min), it takes approximately 5 minutes per sample to label, seal and incubate the Quanti-Tray. After 24 hours, it takes 1-2 minutes to read the sample results under the UV lamp.

### Hazardous Reagents

Used Quanti-Trays must be disposed of in a biohazard bag and handled by appropriate biohazard disposal facility, using similar practices as for alternative bacteria analysis methods.

### Ease of Analysis

Not a difficult procedure to learn. Knowledge of proper handling of bacterial specimens is necessary. Cannot be performed in the field.

### Ordering information

Vendor: IDEXX
1 IDEXX Drive
Westbrook, ME 04092
Phone: 1-800-321-0207
Fax: 207-856-0630
E-mail: water@idexx.com
Website: www.idexx.com/water

| Equipment/Supplies Needed for *E. coli* Analysis | | |
|---|---|---|
| **Item (Catalog Number)[1]** | **Quantity** | **Price*** |
| *Colilert reagent for 100mL sample (WP200)* | 200-pack | $1,020.00 |
| 120mL vessel with 100mL line, sodium thiosulfate & label (WV120ST-200) | 200-pack | $90.00 |
| 97-well sterile Quanti-Tray/2000 trays (WQT-2K) | 100-pack | $110.00 |
| Quality control kit (E. coli, Klebsiela, Pseudomonas A). (WKT 1001) | n/a | $120.00 |
| Colilert comparator predispensed in a Quanti-Tray/2000 (WQT2KC) | 1 | $6.00 |
| Quanti-Tray Sealer (115V) with 51-well rubber insert (WQTS2X-115) | 1 | $3,500.00 |
| 6 watt UV lamp 110 volt (WL160) | 1 | $89.00 |
| Incubator 120V, 30-65$^{o}$C, 14"x14"x14" (WI300) | 2 | $389.00 |
| *[1] See the Enterococci table above for equipment that can be shared when conducting both analyses.* | | |
| **The per-sample expendable cost (reagent, bottle, and tray) is about $6.65.* | | |

## F2.7 ENTEROCOCCI

### Equipment/Supplies Needed

- Enterolert reagent
- Sterile sample bottles for 100 mL samples
- Quanti-Tray 2000
- Incubator
- UV light from IDEXX

### Enumeration Test Procedure

1. Carefully separate a Snap Pack from its strip, taking care not to accidentally open the next pack.
2. Tap the reagent snap pack to ensure that all of the Enterolert powder is in the bottom part of the pack.
3. Open the pack by snapping back the top at the score line. Caution: Do not touch the opening of the pack.
4. Add the reagent to a 100 mL water sample in a sterile bottle.
5. Aseptically cap and seal the vessel.
6. Shake to completely dissolve reagent.
7. Pour the sample/reagent mixture into a Quanti-Tray avoiding contact with the foil pull tab. Seal the tray according to Quanti-Tray instructions.
8. Incubate for 24 hours at $41^{o}\pm5^{o}$ C.
9. Read the results at 24 hours by placing a 6 watt, 365 nm wavelength UV light within five inches of the Quanti-Tray in a dark environment. Be sure the light is facing away from your eyes and toward the Quanti-Tray. Count the number of fluorescent Quanti-Tray wells. The fluorescence intensity of positive wells may vary.
10. Refer to the MPN table provided with the Quanti-Tray to determine the Most Probable Number of Enterococci in your sample.

### Procedural Notes

If the sample is inadvertently incubated over 28 hours without observation, the following guidelines apply:

- Lack of fluorescence after 28 hours is a valid negative test
- Fluorescence after 28 hours is an invalid result
- Use sterile water, not buffered water for making dilutions. Enterolert is already buffered. Always add Enterolert to the proper volume of diluted sample after making dilutions.
- For comparison, a water blank can be used when interpreting results.

### Duration of Test for Each Sample

Once the Quanti-Tray sealer is warm (10 min), it takes approximately 5 minutes per sample to mix, label, seal and place the Quanti-Tray in the incubator. After 24 hours, it takes 1-2 minutes to read the sample results under the UV lamp.

### Hazardous Reagents

Used Quanti-Trays must be disposed of in a biohazard bag and handled by appropriate biohazard disposal facility, just like any other bacteria analysis materials.

### Ease of Analysis

Not difficult procedure to learn. Knowledge of proper handling of bacterial specimens is necessary. Cannot be performed in the field.

### Ordering information

Vendor: IDEXX
1 IDEXX Drive
Westbrook, ME 04092
Phone: 1-800-321-0207
Fax: 207-856-0630
E-mail: water@idexx.com
Website: www.idexx.com/water

| Equipment/Supplies Needed for Enterococci Analysis | | |
|---|---|---|
| **Item (Catalog Number)** | **Quantity** | **Price*** |
| *Enteroletert reagent for 100 mL samples (WENT200)* | 200-pack | $ 1,020.00 |
| 120 mL pre-sterilized vessel with 100 mL line, sodium thiosulfate & label (WV120ST-200)[1] | 200-pack | $ 90.00 |
| 97-well sterile Quanti-Tray/2000 trays (WQT-2K) [1] | 100-pack | $ 110.00 |
| Quality control kit (E. coli, Klebsiela, Pseudomonas A). (WKT 1001) | n/a | $ 120.00 |
| Quanti-Tray Sealer (115V) with 51-well rubber insert (WQTS2X-115) [1] | 1 | $ 3,500.00 |
| 6 watt UV lamp 110 volt (WL160) [2] | 1 | $ 89.00 |
| Incubator 120V, 30-65$^{o}$C, 14"x14"x14" (WI300) [3] | 2 | $ 389.00 |

*[1] Same expendable materials as for the E. coli method, additional should be ordered for each method*

*[2] Same as for the E. coli method and can be shared*

*[3] Although the same, a second incubator is needed for the E. coli method because of the different temperature settings and the normal need to evaluate Enterococci and E. coli simultaneously*

** The per-sample expendable cost (reagent, bottle, and tray) is about $6.65.*

## F2.8 FLUORIDE (0 TO 2.00 MG/L $F^-$)

### Equipment/Supplies Needed

- Hach bench top or portable spectrophotometer or colorimeter (see ordering information below)
- AccuVac Vial Adaptor (for older spectrophotometers)
- SPADNS Fluoride Reagent AccuVac Ampuls.

### Procedure

Refer to Hach SPADNS Method 8029 which is adapted from Standard Methods for the Examination of Water and Wastewater. This procedure involves the reaction of fluoride with a red zirconium-dye solution. The fluoride combines with part of the zirconium to form a colorless complex, thus bleaching the red color in an amount proportional to the fluoride concentration.

### Duration of Test for Each Sample

Each samples takes an average of 3 minutes to test.

### Hazardous Reagents

The SPANDS reagent is a hazardous solution. The used AccuVacs should be placed back in the Styrofoam shipping container for storage and then disposed properly through a hazardous waste disposal company.

### Ease of Analysis

The procedure is relatively easy and fast and can be performed in the field using a portable spectrophotometer or colorimeter. However, as for all tests, it is recommended that the analyses be conducted in a laboratory, or at least in a work room having good lighting and water.

### Ordering information

Vendor: Hach Company
PO Box 389
Loveland, CO 80539-0389
Tel: 800-227-4224
Fax: 970-669-2932
Website: www.hach.com

| Equipment/Supplies Needed for Fluoride Analysis | |
|---|---|
| **Item (Catalog Number)** | **Price** |
| Fluoride Reagent (SPADNS) AccuVac Ampuls [1 set of 25 AccuVacs (2 needed per test)] (2506025) | $ 17.00 |
| Adapter, AccuVac vial (needed for older spectrophotometers DR/2000 and DR/3000) (43784-00) | $ 5.40 |
| DR/890 portable colorimeter programmed with 90 tests. Includes 2 sample cells, COD & TnT tube adapter, instrument, procedure manual and batteries. Portable instrument that can be used for many different analytes, but fewer than the following instruments. (48470000) [1] | $ 929.00 |
| DR/2500 spectrophotometer includes 6 one-inch round sample cells, instrument and procedure manual, and DR/Check Absorbance Standards. Compact laboratory instrument having many capabilities. (5900000) [1] | $ 2,200.00 |
| DR/2400 portable spectrophotometer includes one-inch sample cells, instrument and procedures manuals. Portable instrument having many capabilities. (5940000) [1] | $ 1,995.00 |
| DR/4000 V Spectrophotometer. Visible spectrum only (320 to 1100nm). Includes 1-inch matched sample cells/ AccuVacc and 16-mm vial adapters; a Single Cell Module; 1-inch and 1-cm cell adapters; dust cover; replacement lamp kit; an illustrated manual set; and a power cord. UV-Vis laboratory instrument having vast capabilities. (48100-00) [1] | $ 5,500.00 |
| *[1] only one spectrophotometer is needed*<br>**The per-sample expendable cost is about $1.36.* | |

## F2.9 pH

### Equipment/Supplies Needed

- Cardy pocket-sized pH meter model B-213 made by Horiba
- pH standards that come with the meter.

### Calibration

The meter should hold its calibration for an extended period, but it is best to check the calibration before each sample batch.

1. Press the ON/OFF button.
2. Place approximately 1 mL of the yellow pH 7.0 standard solution onto the sensor cell (be careful not to touch the sensor with the dropper or pipette, the cell is covered with a very thin and fragile glass cover slip).
3. Press the CAL button to display the black CAL mark in the upper right corner and 7.0.
4. Calibration is complete when the CAL mark disappears. Wash the sensor with tap or distilled water and dry with a tissue.
5. Press CAL again so that 4.01 and CAL are displayed to calibrate using the pink pH 4.01 buffer. Follow the same procedure as above.

### Measurement

1. Place a drop of the sample water onto the sensor cell (usually around 1 mL). Alternatively, you may dip the meter into the water to be tested.
2. When the smiley face ☺ appears, read the number.
3. Press the ON/OFF button to turn the power OFF.
4. Wash the sensor with tap water or distilled water. Wipe off any residual water on the sensor with a tissue.
5. Be sure the protective cap is covering the sensor and put the pH meter back in its protective case.

### Duration of Test for Each Sample

Calibration takes around 3 minutes, and testing of each sample is only about 30 seconds.

### Hazardous Reagents

None

### Ease of Analysis

Simple and fast. Can be used in the field.

### Ordering Information

Vendor: Cole-Parmer Instrument Co.
625 East Bunker Court
Vernon Hills, IL 60061-1844
Phone: 1-800-323-4340
FAX: 847-247-2929
Website: www.coleparmer.com

| Equipment/Supplies Needed for pH Analysis | |
|---|---|
| **Item (Catalog Number)** | **Price** |
| Cardy twin pH meter and accessories (EW-05759-00) | $238.00 |
| Replacement pH sensor cartridge (EW-05759-0) | $105.00 |
| Replacement pH solution kit (EW-05751-70) | $ 29.00 |

## F2.10 POTASSIUM

### Equipment/Supplies Needed

- Cardy potassium compact meter by Horiba model C-131
- Accessories that come with the meter.

### Two-Point Calibration (Monthly)

1. Turn the power ON
2. Open the sensor cover and wipe the sensor pad clean with a piece of tissue and deionized water, then wipe it dry with a piece of tissue. Repeat this several times.
3. Place a piece of sampling sheet onto the sensor pad, and drip 2 to 5 drops of the standard STD solution onto it (or drip the solution directly onto the sensor pad).
4. After the readout has stabilized, adjust the STD dial so that the display reads 20X100. After cleaning the sensor according to step (2), follow the same procedure using the standards SLOPE solution and after the readout has stabilized, adjust slope volume so that the display reads 15X10.
5. After cleaning several times with deionized water, measure the standard STD solution again.
6. Recalibrate if the reading is not (20±2)X100.
7. Wipe the sensor pad with deionized water, then wipe it dry.

### One-Point Calibration (Daily)

1. Turn the power ON.
2. Open the sensor cover, and wipe the sensor pad clean with deionized water, then wipe it dry.
3. Repeat this procedure several times.
4. Place a piece of sampling sheet onto the sensor pad, and drip 2 to 5 drops of the standard STD solution on it (or drip the solution directly onto the sensor pad).
5. After the readout has stabilized, adjust the STD dial so that the display reads 20X100.
6. Wipe the sensor pad with deionized water, and then wipe it dry.
7. If the sample is below 500 ppm (mg/L), use the SLOPE solution and adjust the STD dial to read 15X10.

### Measurement

1. Place the sample directly onto the sensor pad or measurement can be aided by placing the sample onto a piece of sampling sheet.
2. Read the concentration directly from the display.
3. Clean the sensor with deionized water and wipe it clean after each sample is analyzed.
4. When finished with all samples, turn the power OFF.
5. Clean the surface of the sensor pad with deionized water and wipe dry for storage.

### Duration of Test for Each Sample

Calibration takes around 5 minutes and testing of each sample is only 30 seconds.

### Hazardous Reagents

None

### Ease of Analysis

Simple and fast. Can be used in the field.

### Ordering information

Vendor: Cole-Parmer Instrument Company
625 East Bunker Court
Vernon Hills, IL 60061-1844
Phone: 1-800-323-4340
FAX: 847-247-2929
Website: www.coleparmer.com

| Equipment/Supplies Needed for pH Analysis | |
|---|---|
| **Item (Catalog Number)** | **Price** |
| Cardy potassium compact meter and accessories (EW-05755-00) | $239.00 |
| Replacement cardy potassium sensor cartridge (EW-05755-500) | $ 64.00 |
| Replacement cardy potassium solution kit (EW-05755-60) | $ 33.00 |

*Note*: This procedure is rapid and inexpensive, however, it only has a detection limit of about 1 mg/L, and reads in increments of 1 mg/L. This level of precision is not typically a problem for moderately contaminated samples (when the results are most useful); however, it presents challenges when used for cleaner water. Specifically, since the Flow Chart Method relies on the ammonia to potassium ratio to distinguish between washwaters and sanitary wastewaters, a "non detect" (i.e., <1) potassium concentration results in an indeterminant ratio value. Where clean water is being analyzed and more sensitive potassium values are needed, the only real option is to use other laboratory methods (either ICP or atomic absorption). Other simple field procedures (such as the method supplied by HACH) rely on a photometric measurement of a floc and are not very repeatable for these types of samples.

## F2.11 TOTAL HARDNESS (10 – 4000 mg/L as CaCO3)

### Equipment/Supplies Needed

- Hach digital titrator
- Total hardness titration cartridge
- ManVer 2 hardness indicator
- Hardness 1 buffer solution.

### Procedure

Refer to Hach Method 8213 for Hardness, Total (10-4000 mg/L as $CaCO_3$) digital titrator method using EDTA. This procedure involves buffering the sample first to pH 10.1, adding of the ManVer 2 Hardness Indicator, which forms a red complex with a portion of the calcium and magnesium in the sample, and then titrating with EDTA. The EDTA titrant reacts first with the free calcium and magnesium ions, then with those bound to the indicator, causing it to change to a blue color at the end point.

### Duration of Test for Each Sample

Approximately 5 minutes.

### Hazardous Reagents

The mixture of sample, buffer solution, hardness indicator, and EDTA must be stored properly in a labeled container until disposal by a hazardous waste disposal facility.

### Ease of Analysis

This procedure is not recommended to be performed in the field. Produces hazardous chemicals.

### Ordering information

Vendor: Hach Company
PO Box 389
Loveland, CO 80539-0389
Tel: 800-227-4224
Fax: 970-669-2932
Website: www.hach.com

| Equipment/Supplies Needed for Total Hardness Analysis | | |
|---|---|---|
| **Item (Catalog Number)** | **Quantity** | **Price*** |
| Digital Titrator with plastic case, manual and 5 straight delivery tubes (1690001) | 1 titrator | $105.00 |
| Total hardness titration cartridge (EDTA 0.0800M) (1436401) | 1 | $10.70 |
| Total hardness titration cartridge (EDTA 0.800M) (1439901) | 1 | $10.70 |
| Delivery tube, (straight with J hook) for titration (1720500) | Pack of 5 | $4.85 |
| ManVer 2 Hardness Indicator Powder Pillow (85199) | 1 pack of 100 pillows | $9.85 |
| Hardness 1 buffer solution (42432) | One 100 mL bottle | $8.40 |
| **The per sample expendable cost is about $0.25, depending on the hardness level.* | | |

## F2.12 TURBIDITY

### Equipment/Supplies Needed

- Benchtop or portable turbidimeter. The range of readings in NTU will depend upon the instrument.

### Procedure

(This is a general procedure for turbidity. Follow your turbidimeter's instructions):

1. First, the instrument must be calibrated using the standards supplied with the instrument. If calibration is satisfactory, continue with sample measurement.
2. Samples are normally stored under refrigeration. Before analyzing for turbidity, the samples must first be brought back to room temperature. This is done to prevent the formation of frost on the outside of the glass sample cells used in the turbidity measurement.
3. Pour the sample into a sample cell (until almost full or to the fill line), cap the cell, then turn it upside down 2 to 3 times for mixing. Do not shake vigorously.
4. Keep the sample cell vertical for 4-5 seconds and wipe the outside to remove fingerprints.
5. Place the cell into the turbidity meter and take a reading.

### Duration of test for each sample

Approximately one minute. This does not include the time spent bringing the sample to room temperature.

### Hazardous Reagent

None

### Ease of Analysis

Relatively simple and may be performed outside of the laboratory using a portable turbidimeter.

### Ordering Information

Vendor: Hach Company
PO Box 389
Loveland, CO 80539-0389
Tel: 800-227-4224
Fax: 970-669-2932
Website: www.hach.com

| Equipment/Supplies Needed for Turbidity Analysis | | |
|---|---|---|
| **Item (Catalog Number)** | **Quantity** | **Price** |
| 2100P Portable Turbidimeter range 1-1000 NTU Includes nine sample cells, primary standards, silicone oil & oiling cloth, manual, quick reference card and case. (4650000) | 1 | $837.00 |

# Appendix F3. METHODOLOGIES AND LAB TESTING OF TECHNIQUES TO MEASURE DETERGENTS

## F3.1 *CHEMETRICS* DETERGENT TEST KIT

Detergents were measured using the *CHEMetrics* detergent test kit, which detects Methylene Blue Active Substances (MBAS), an important ingredient of detergent products. The minimum detection limit (MDL) of the kit is 0.25mg/L. This is a very simple test, but the accuracy of the tests depends on the analyst's skill with the color comparator. One of the problems with this method is the upper limit of 3 mg/L. Higher values can only be measured with dilution of the sample prior to analysis. This extra step requires extra time when measuring laundry, carwash and sewage samples, when the detergent values are in hundreds of mg/L.

This kit also contains chloroform, an expected carcinogen. Great care must therefore be taken when conducting this analysis and when handling the kit materials. The alternative detergent field test kit from HACH uses much larger quantities of benzene, also a known carcinogen, and is not as well contained as the chloroform in this preferred kit. An important aspect of this research was investigating alternative analytes that could be used instead of detergents.

The main components of the *CHEMetrics* detergent test kit (Figure F3.1) are:

1. Test tube
2. Comparator device
3. Snapper
4. Double tipped ampoule containing chloroform and other reagents (blue stained)
5. CHEMets ampoule (empty vacuum ampoule)



**Figure F3.1: *CHEMetrics* detergent test kit components**

### Test Procedure Summary

This test should preferably be conducted in a laboratory fume hood due to the possibility of exposure to chloroform.

1. Pour 5 mL of the sample into the test tube.
2. Snap one tip of the double tipped ampoule, keeping the other tip inside the tube, but above the sample level. Invert the snapped tip into the tube and snap the other tip of the ampoule. Let the blue chemical (containing chloroform) completely empty into the test tube.
3. Cap the tube tightly and shake the solution for 30 seconds. Keep the solution undisturbed for 1 minute in a test tube rack.
4. Remove the cap from the tube and insert the vacuum CHEMets ampoule into the test tube. Care must be taken so that the small plastic tube at the tip of the ampoule touches the bottom of the tube.
5. Snap the CHEMets ampoule tip by the side of the test tube and let the solution flow through the tube into the CHEMets ampoule.
6. Take off the plastic tube and wipe off the tip of the ampoule. Put the provided white cap on the tip of the ampoule and place it in the color comparator.
7. Compare the color of the solution inside the ampoule with the color comparator. The colors range from light blue (0.25 mg/L) to dark blue (3 mg/L). If the color is darker than the given colors in the comparator, the sample needs to be diluted and retested. No color indicates <0.25 mg/L value for detergents. The test tube needs to be disposed of carefully because it contains a hazardous chemical (chloroform).

### Harmful Chemicals in *CHEMetrics* Detergent Test Kit

The main components of the double tipped ampoule are methylene blue, sulfuric acid, sodium phosphate, water and chloroform. Chloroform may affect the liver, kidney and central nervous system, and is a known carcinogen. On exposure, it causes irritation to eyes, skin and mucous membranes. It may also cause burning of the throat, mouth esophagus and stomach. It may also cause nausea, vomiting and diarrhea. Wash your hands thoroughly after handling the kit and conduct the analysis in a well-ventilated area, preferably in a laboratory fume hood. Avoid contact with the eyes. Safety glasses and gloves are required while doing this test. If there is a spill, take up with an absorbent material. Keep the reagents in the ampoule for final disposal, in accordance with regulations.

## F3.2 Fluorescence Monitoring using the GFL-1 Fluorometer

### Introduction

Fluorescence is the property of the whiteners in detergents that cause treated fabrics to fluoresce in the presence of ultraviolet rays, giving laundered materials an impression of extra cleanliness. These are also referred to as bluing, brighteners or optical brighteners and have been an important ingredient of most laundry detergents for many years. The effectiveness of the brighteners varies by the concentration of the detergents in the wash water. The detection of optical brighteners has been used as an indicator for the presence of laundry wastewater, and municipal sewage, in urban waters.

One method of quantifying fluorescence in the laboratory is by using a fluorometer calibrated for detergents. In our tests, we used the GFL-1 Portable Field fluorometer (Figure F3.2).

The components of the GFL-1 Fluorometer are the power switch, sample chamber, battery compartment, source module, detector filter cartridge, display, keypad, and the interface port. A 1.2 Ah rechargeable lead-acid battery powers the unit when in the field. The fluorometer contains high efficiency interference filters optimized for fluorescence detection. It contains a silicon photodiode detector and a LED source. The interface port is also used as the battery charger port. A 192 X 192 dot LCD screen is used for text and graphical data presentation.




**Figure F3.2: GFL-1 Portable Field Fluorometer**

## Calibration

Before the instrument is used, it should be calibrated with a detergent solution. No general standard detergent solution is available, so a commercially available detergent is used to prepare standard solutions. For this research, a common commercial detergent, Procter & Gamble's *Tide ™* was used. The purpose of calibrating the fluorometer is to set the instrument fluorescent signal levels to correspond to different concentrations of this commercial detergent. Single point and multipoint calibrations are available with this fluorometer. The manufacturers report that the solution used in calibration is unimportant in that the procedure is the same regardless of the solution used. A five-point calibration method is used for instrument calibration. To test a sample, the instrument must be in "test mode." The test mode cannot be used until a calibration table has been built, or an existing one is made active. If there is no active calibration table, the test mode screen will automatically default to the "calibration menu" screen.

To install a new calibration table, select CREATE CAL TABLE by pressing 1 on the keypad. Soon the cal table builder screen appears on the display. Since a five point calibration is being done, six different concentrations of Tide detergent were made: 0.5mg/L, 5mg/L, 10mg/L, 50mg/L, 100mg/L, 500mg/L. A concentration of 25 mg/L of Tide corresponds to a typical working solution for a batch of laundry. The sample bottles for the GFL-1 fluorometer come with the instrument. These are the only sample bottles that can be used for the measurement of fluorescence. There are five steps in making a calibration table:

***Step 1***

The screen will prompt to insert the most concentrated reference in order to set the detector gain. In this case, the highest concentration is 500mg/L. Press ENTER.

***Step 2***

Insert the blank and press ENTER.

***Step 3***

The next step is to enter the calibration units (e.g., mg/L). Pressing the ENTER key takes takes the user to the next step.

***Step 4***

This step prompts the user to insert a reference sample of any concentration. After inserting the reference sample, press ENTER. The screen will then prompt the user to enter the concentration value for the inserted reference sample. After setting the known reference, the screen will ask whether or not to do another point. Press YES and repeat the above sequence until you have inserted all the prepared reference samples. The reference samples should be inserted in a random fashion and not in the order of increasing or decreasing values of concentration.

***Step 5***

The last step prompts the user to name the calibration table. It should be noted that calibration tables are not saved until a name is given to the table. Then press ENTER.

Now the fluorometer is ready to start running samples.

## Sample Test Mode

Figure F3.3 is the first screen display shown after switching on the fluorometer. Press 1 for the test mode, since the calibration table has already been saved.

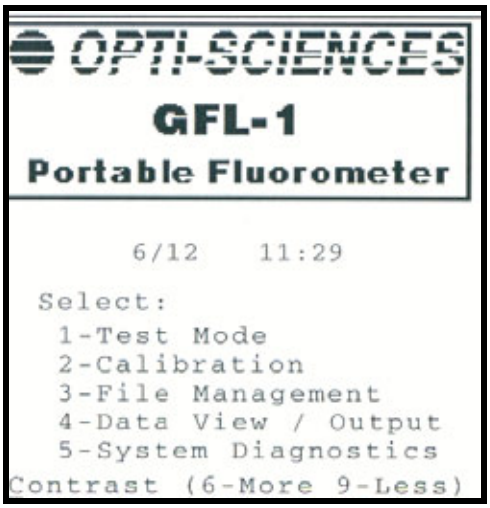



**Figure F3.3: Main Menu**

The screen will then display the following (Figure F3.4):




**Figure F3.4: Calibration Menu**

Press 2 for using the saved calibration table as the active calibration table in the memory. The next screen would prompt you to enter the desired table number saved. If you have saved only one calibration table, press 1.

Place a blank sample in the sample chamber and press ENTER (Figure F3.5). You will then see the screen displayed in Figure F3.6.




**Figure F3.5: Placing Sample into Sample Chamber**

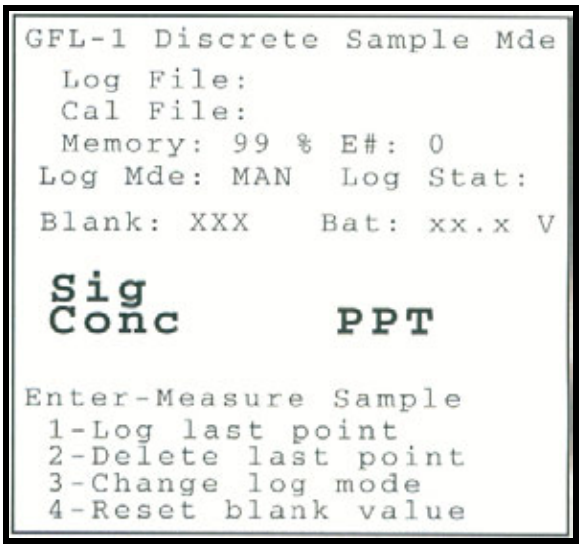



**Figure F3.7: Discrete Sample Mode**

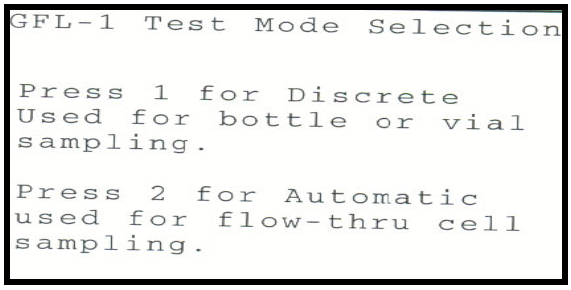



**Figure F3.6: Test Mode Selection**

Press 1 for doing discrete bottle sampling.
A new screen will appear (Figure F3.7).

With calibration complete, the instrument is ready to analyze the samples. To run a test, simply load a sample into the chamber and press ENTER. The unit will measure the sample and present the data a few seconds later. A busy message indicates that the test is in progress. Press ESC to return to the main menu.

### Initial Tests using the Fluorometer

Initial tests were conducted after the first calibration to get an indication of the repeatability and drift of the results obtained from the new instrument. Five different concentrations of Tide detergent samples were made and tested for fluorescence after varying periods of time. The results of these tests are shown in Figure F3.8.

It is obvious that the fluorescence signal from Tide degrades with time and that the analyses should be evaluated within two hours. Other samples of commercial and household detergents were also evaluated and degradation of fluorescence with time was also identified. The largest changes occurred between about one and two hours after sample preparation. There was very little change after this initial two hour period. In the real world, the time between mixing of a laundry detergent with the washwater at the laundry, its discharge, and its analysis in the laboratory is at least two hours. Therefore, the fluorescence values used are those obtained after the signals have reached a relatively constant value. The results of the tests on certain commercial and household detergents are shown in Figure F3.9.

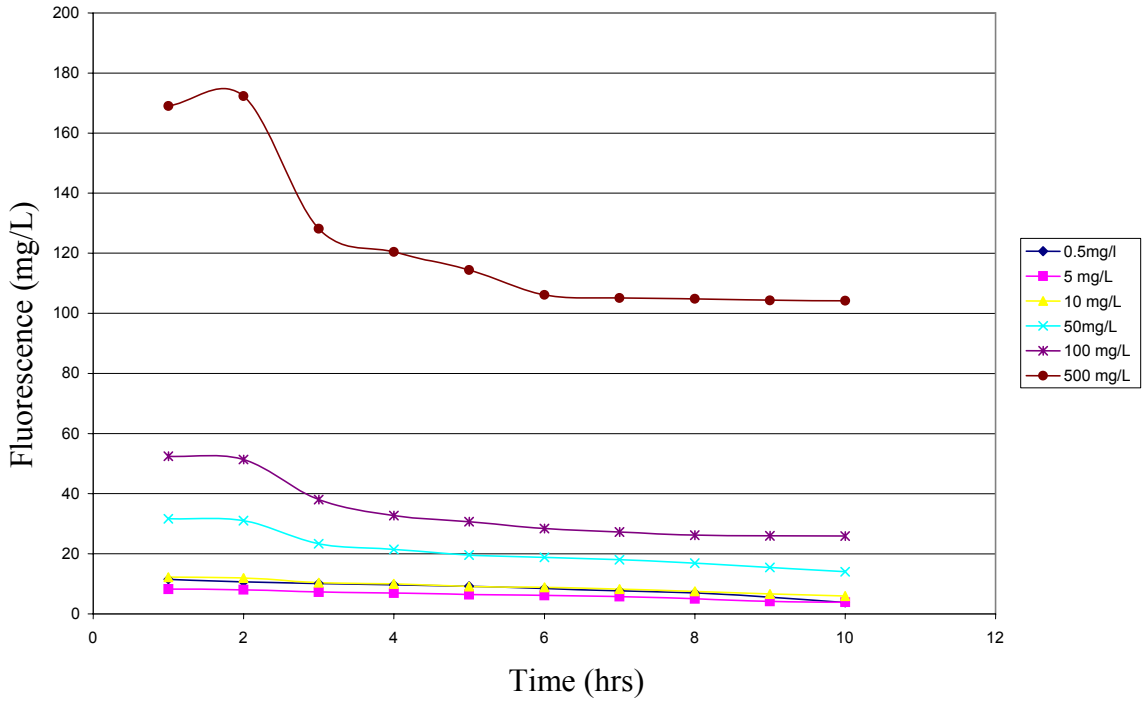



**Figure F3.8: Changes in Tide DetergentFluorescence over Time**

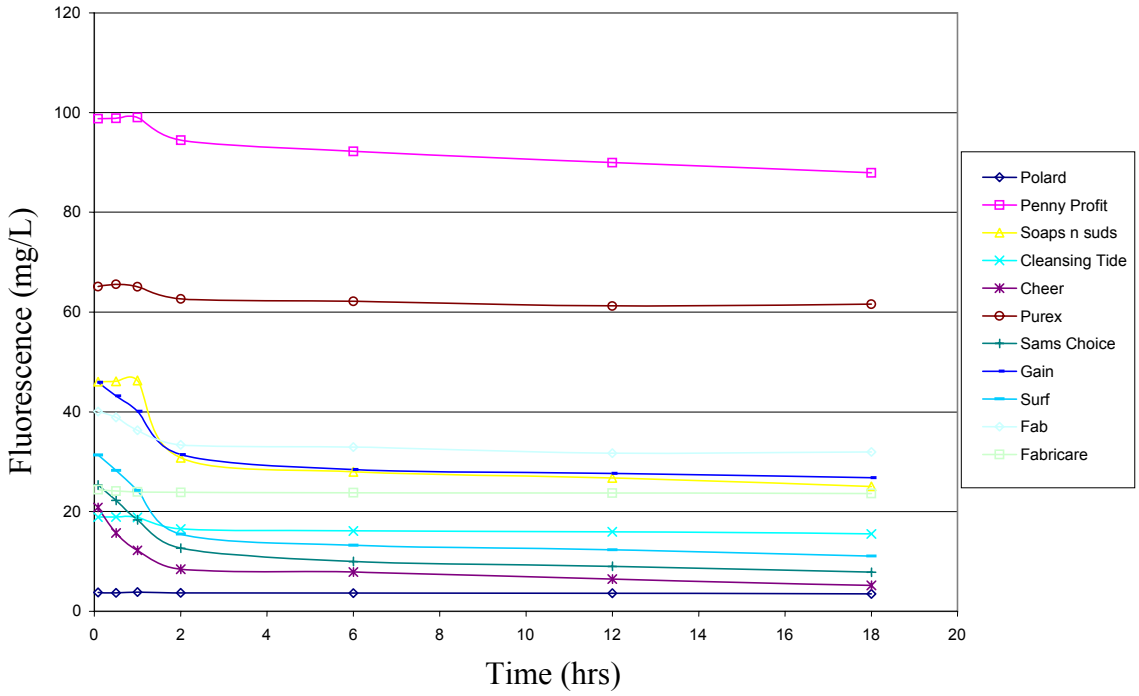



**Figure F3.9: Changing Fluorescence with Time**

The commercial laundry detergent samples in this graph were *Polard, Penny Profit, Soaps n Suds, and Cleansing Tide*. The others are household detergents (*Cheer, Purex, Sam's Choice, Gain, Surf, Fab, and Fabricare*). *Soaps n Suds* had a steep drop in fluorescence after one hour of preparation of the sample. After two hours, the fluorescence values stayed relatively constant without further changes. There was only one sample (*Polard*, a commercial detergent) that did not show any change in its fluorescence value. This detergent also had the lowest fluorescence signal of any of the samples. Although equal concentrations of all of these detergents were evaluated (50 mg/L), the fluorescence values ranged from 5 mg/L to 100 mg/L, as Tide. Obviously, the ingredients of the different detergents varied greatly.

## F3.3 Surface Tension Test for the Detection of Detergents

### Introduction

This discussion presents a proposed sensitive method to detect detergents without hazardous chemicals and with standard laboratory equipment. The method uses the property of the detergent to decrease the surface tension of the bubbles formed when the sample is agitated. Different detergents at different pHs were used during these tests. Results indicate that the method can be used to detect detergent concentrations above 1 mg/L, and can be used as a presence/absence test for concentrations above 0.3 mg/L. The method also was verified with samples collected from a known inappropriate detergent discharge.

One of the effects of detergents in water is the reduction in surface tension. When a sample of water with detergent is agitated, air is mixed with water, creating bubbles. Because the surface tension is reduced, the tension that controls the pressure of the air is low and the surface film is not destroyed. This property can be used to estimate the detergent concentration based on the amount of foam produced after the sample is agitated.

The amount of foam formed after a sample of water with detergent is agitated can be affected by various parameters. Temperature can affect the surface tension of the water. An increase in the temperature will reduce the surface tension. Foam production can also be affected by the chemical composition of the water. As an example, low pH will decrease the foam production.

The following discussion presents an inexpensive, safe, and reasonably sensitive method to estimate the detergent concentrations in a water sample using common laboratory equipment and without hazardous reagents.

## Methods

General laboratory equipment was used to generate foam from samples of distilled water and detergent at different concentrations. The idea of the experiment was to drop the sample inside a burette from a constant elevation and to measure the height of the foam created 10 seconds and 1 minute after the last drop fell.

*Apparatus*:

- A rectangular base support and rod assembly
- A 50 mL burette
- A clamp to hold the burette
- A 25 mL blowout pipette
- Two 10 mL pipettes
- A stop watch
- A 200 mL volumetric flask
- A portable pH meter

A rectangular base support was used to hold the burette vertically. Using a 25 mL pipette, a 25 mL sample was released into the 50 mL burette. The sample was released by free fall from near the top of the burette, taking care that the sample does not touch the wall of the burette to maximize the amount of bubbles that can be produced. An initial reading of the foam height was taken 10 seconds after the pipette was drained. A final reading was obtained 50 seconds later.

*Reagents*:

- Detergent (Tide)
- Distilled water
- 500 mL NaOH 1N
- 500 mL $H_2SO_4$ 0.02N

Four samples at the same concentration were created at the same time. Four stands and four burettes were used for each concentration. After the reading, the burettes were washed for more than 2 minutes until they were clean.

To obtain more foam during the experiment, the pH was increased up to 12. The sample was diluted with distilled water and 10 mL of 1N NaOH added. The sample was prepared in a 200 mL volumetric flask. NaOH was selected because it is present in most of the detergents. After the reading was taken, the sample (200 mL) was neutralized with 100 mL 0.05N $H_2SO_4$ before disposal.

## Results

Table F3.11 shows the foam reading above the water surface 10 seconds and 1 minute after the last drop.

The results indicate that this method can be used as a presence/absence test for detergent concentrations between 0.2 and 1 mg/L (as Tide) and to estimate concentrations above 1 mg/L. The method is simple and does not require specialized equipment.

An advantage of this method is that the equipment is easily available and inexpensive. The disadvantages are the variability in readings due to changes in temperature and characteristics of the detergents.

Figure F3.10 shows the results from concentrations between 10 and 50 mg/L. For readings above 10 mg/L, if the level of detergent increases the height of the foam also increases in a parabolic shape. It was also observed that the repeatability of the results decrease at high levels.

For levels of detergent lower than 10 mg/L, there is not an important change in the reading. The minimum reading that can be obtained from the burette is 0.05 mL. For samples in this range the reading is close to the precision of the instrument. Figure F3.11 shows the results from concentrations between 0 and 5 mg/L.

Readings below 1.0 mg/L create a circle of bubbles around the wall of the pipette. This circle was not present when distilled water was used. This procedure can be used as a presence/absence test. The circle was observed for concentration of detergent higher than 0.2 mg/L.

## Conclusions

The new method is an inexpensive, safe and moderately accurate method to estimate the presence of detergents in concentrations above 0.2 mg/L. For detergent concentrations above 10 mg/L, the method can be used to quantify the concentrations. These higher concentrations have been observed in sewage, industrial discharges, laundries and car wash areas.

**Table F3.11: Foam Readings Over Time**

| Concentration (mg/L, as Tide) | Foam Height after 10 sec. (mL) | Foam Height after 1 min. (mL) |
|---|---|---|
| 0 | 0 | 0 |
| 0.1 | 0 | 0 |
| 0.2 | T | T |
| 0.3 | T | T |
| 0.4 | T | T |
| 0.5 | T | T |
| 0.7 | T | T |
| 1 | 0.05, 0.05, 0.05, 0.05 | 0.05, 0.05, 0.05, 0.05 |
| 2 | 0.1, 0.1, 0.1, 0.1 | 0.1, 0.1, 0.1, 0.1 |
| 3 | 0.1, 0.1, 0.15, 0.15 | 0.1, 0.1, 0.15, 0.15 |
| 5 | 0.15, 0.15, 0.15, 0.15 | 0.15, 0.15, 0.15, 0.15 |
| 10 | 0.2, 0.2, 0.2, 0.2 | 0.35, 0.4, 0.4, 0.4 |
| 20 | 0.8, 0.6, 0.6, 0.6 | 1.5, 1.3, 1.4, 1.3 |
| 50 | 2.6, 2.6, 3.0, 2.8 | 3.8, 3.5, 3.7, 3.6 |

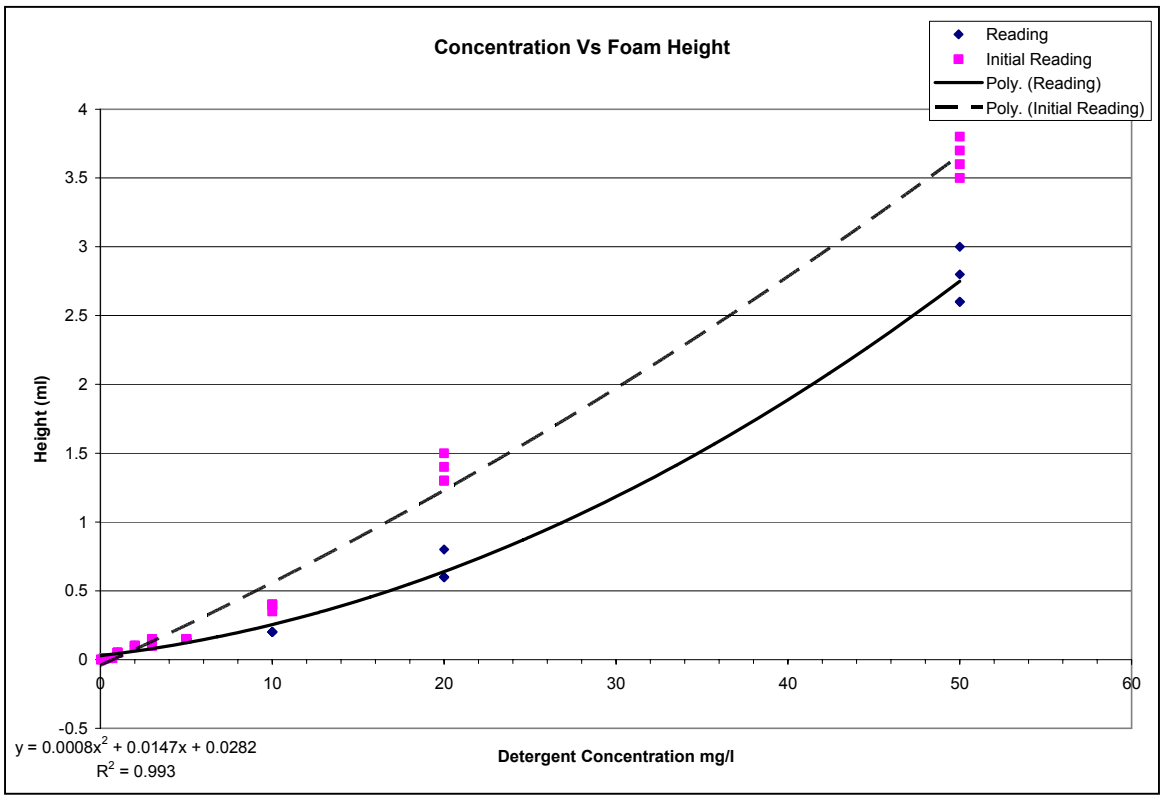



**Figure F3.10: Correlation Between Concentration and Foam Height at Higher Concentrations**

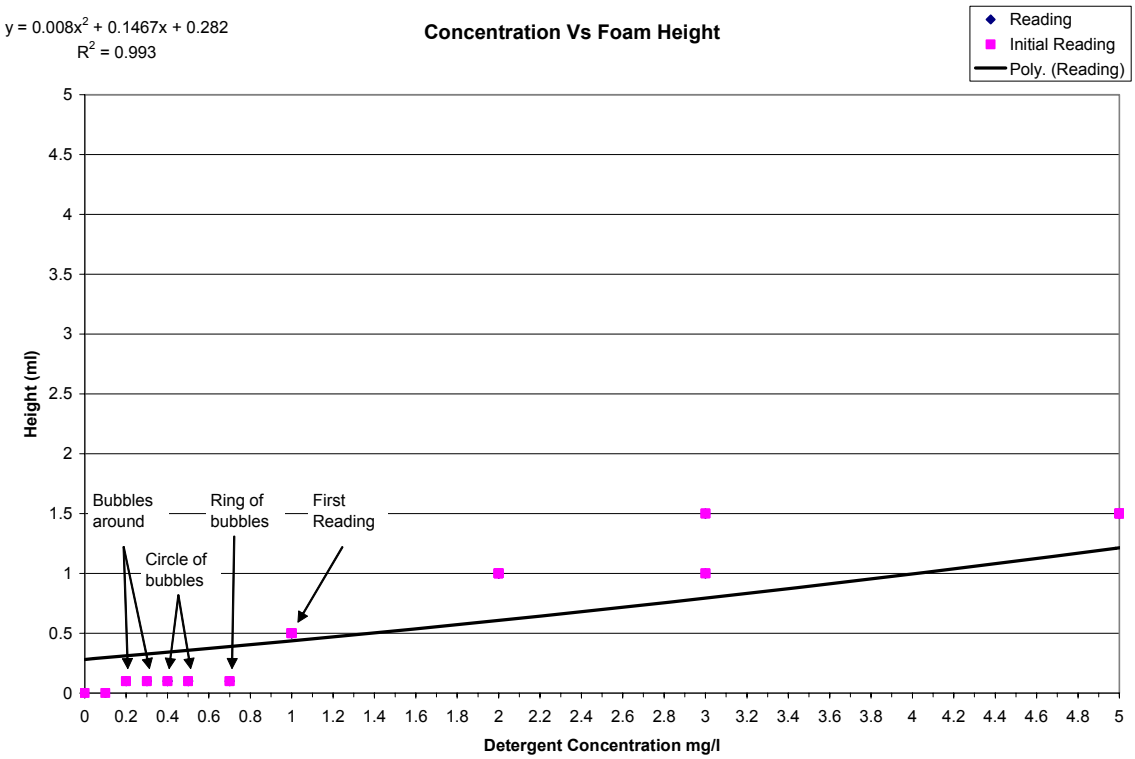



**Figure F3.11: Correlation Between Concentration and Foam Height at Lower Concentrations**

# APPENDIX F4: LAB TESTING OF "OPTICAL BRIGHTENER MONITORING" TO FIND INTERMITTENT DISCHARGES

## Introduction

Fabric brighteners are fluorescent dyes added to soaps and detergents. These are used to produce a brightening effect after laundering. They absorb the UV rays of the sunlight and then fluoresce as a bright blue.

Optical Brightener Monitoring (OBM) is a new method for detecting fluorescent materials in water samples. It is based on a method used to measure the presence of strongly fluorescent tracer dyes.

Briefly, cotton pads that are free of fabric brighteners are used for checking the presence of optical brighteners in water samples. Cotton pads are soaked in the water sample and then dried in a darkened room. The pads are then viewed with ultraviolet (UV) light to check for the presence of fluorescence. This is an inexpensive, but much less sensitive, method for the detection of fluorescence compared to fluorometers.

Homemade OBM traps are inexpensive and easy to make. Table F4.1 lists the average costs of the supplies needed to make OBM traps, most of which can be found at a local hardware or home improvement store.

The following tests were conducted to determine how effective this test would be to detect inappropriate discharges originating from washwaters or sanitary wastewaters to storm drainage systems. This test may have several advantages compared to other methods used to detect these wastewaters: fluorometers are very expensive, detergent analyses can be hazardous, and the boron content of detergents varies widely. In addition, the OBM method usually involves placing the test pads in the targeted water for extended periods (up to several days) and may therefore be sensitive to intermittent discharges. These tests were therefore conducted to determine the sensitivity of the OBM method and to investigate its reliability under both field and laboratory conditions.

**Table F4.1: Start-Up Costs for Optical Brightener Monitoring**
*(Source: Sargent and Castonguay, 1998)*

| Equipment | Cost |
|---|---|
| 25 - 1/2” wire mesh (cages) | $ 75.75 |
| 42 feet black plastic mesh | $ 4.50 |
| 100 yards 20 lb. test monofilament | $ 2.00 |
| 500 elastics | $ 10.00 |
| 1000 staples | $ 5.00 |
| Unexposed labels | $ 12.00 |
| 5 boxes plastic bags | $ 5.00 |
| 200 craft sticks | $ 2.00 |
| 25 aluminum spikes | $ 23.00 |
| 1 case unwashed cotton pads | $ 88.00 |
| 12 rubber gloves | $ 16.00 |
| 6 watt UV light with 2 bulbs | $ 240.00 |
| **Total** | **$ 483.25** |

## Test Procedure

***Step One:***
Care should be taken so that samples are handled properly with no cross contamination. Gloves free of fabric brightener should be worn at all times when handling the test materials. The field test kit includes brightener-free cotton pads and a sampler cage to hold the pads in place if they are to be deployed for extended periods. The sampler cage is a non-metallic plastic, or a vinyl coated black wire cage having 0.5" openings. The cage consists of two hinged pieces approximately 5" by 5". This cage should be fabricated so that it will hold the fabric pads at approximately a 30 to 45 degree angle. The open end of this cage is held closed with an elastic band. A 4 to 6 watt long-wave fluorescent UV ultraviolet light is used to observe fluorescence on the fabric.

***Step Two:*** (Placement)
At an outfall or small stream sampling location, the wire cage is secured by a heavy monofilament fishing line tied to a branch, a rock, or an aluminum spike. In sampling catchbasins, the wire cage is lowered into the catch basin by the monofilament fishing line that is then tied to the grate cover or other object. The wire cage is suspended within the water flow. The fabric pad is generally exposed for seven days. If intermittent flows are present, the device may be kept for an even longer period. However for quick sampling, the pad needs to be exposed to a water sample for at least one hour. If rust or sediment obscures the sample, then the duration needs to be shortened.

***Step Three:*** (Retrieval)
After the samplers are retrieved from the water, the pads are removed from the sampling device. The pads are then rinsed in the sampling water to remove any surface sediment, and squeezed to remove excess water without tearing or ripping the pads. The pads are also labeled (see Figure F4.2).

All labels must be analyzed using the UV light to check for the presence of brighteners, as most white paper contains optical brighteners that can interfere with the optical brightener measurements of the pads. Label information should include, location, day/time of placement, and day/time of removal. The stiff paper labels are stapled to the retrieved sampling pads, placed in a zip lock bag, and kept in the dark as they are being transported to the laboratory. Upon arrival at the laboratory, the pads are dried in a darkened room (where they will not come into contact with direct sunlight) by hanging on a non-cotton monofilament line (see Figure F4.2). The line should either be replaced or cleaned by a cotton pad after every use.

***Step Four:*** (Analysis)
The pads are viewed in a darkened room using a long-wavelength UV light source. The pads are easiest to examine in a dark room using a special UV lamp viewing cabinet. A non-exposed pad is used as a control. The pad will fluoresce if it is positive for brighteners, while it will be noticeably drab like the control pad if it is negative. Uneven exposure of the pad to optical brighteners may result in uneven fluorescence of the pad. If the reason for partial fluorescence can be explained then the pad should be regarded as positive. Specks or spots of fluorescence on the pads may be ignored.



**Figure F4.2: Labeling the Pad**



**Figure F4.3: Drying the Pads**

## Method Modifications

While reviewing the prior methods for the OBM for inappropriate discharge detection, the following issues were brought up:

a) Do the pads need to be left in the field for extended periods and how long should the pads be exposed to the sample water?

b) Are there any detrimental effects of direct exposure to sunlight while drying the cotton pads?

c) What is the sensitivity of the OBM compared to the other tests used to detect washwaters and sanitary wastewaters?

The above points are discussed in the following paragraphs.

### Leaving the cotton pad and the sampling device at the sampling location

If there is continuous flow at an outfall, there is no need to keep the pads at the outfall for extended periods. If grab samples are collected from the flowing outfalls for later chemical tests, a separate sample bottle can be conveniently collected for optical brightener tests. During our analyses, the cotton pads were immersed in the sample bottles at the time of sample collection. This sampling modification greatly reduced the time and effort needed to conduct the tests. Our initial tests indicated that the high sediment loads associated with the outfall discharges would hinder the ability to measure the fluorescence due to coating the fabrics with silt. If the pads were placed in the OBM sample bottles when the water was collected, the time required to bring the samples to the laboratory was thought to be sufficient to affect the pads. Tests were conducted in the laboratory to determine the time needed to affect the pads. The standard procedure used at least a one hour exposure period.

### Direct exposure to sunlight while drying the cotton pads.

There was a concern related to the degradation of fabric fluorescence in the presence of sunlight, especially after the fluorometer tests indicated significant decreases in water sample fluorescence during the first hour or two after detergent mixing. In order to test this concern, two samples were prepared with the same concentration of detergents. Two cotton pads were immersed in each of the bottles. One was dried under the direct exposure of sunlight, while the other one was dried in a dark room. After 24 hours, both sets of pads gave the same fluorescence under the ultraviolet light. Therefore, it was concluded that direct sunlight exposure to the dried cotton pads did not affect the test results.

Other sampling and laboratory practices that were important included using gloves while handling the pads, and testing the cotton pads for fluorescence under the UV lamp before their use.

### Laboratory Verification using Standard Samples and Field Use in Cribbs Mill Creek

The basic OBM method is a presence/absence test, with unknown sensitivity. In order to make this test more useful, additional tests were conducted. The initial test used different Tide detergent standards. Tide detergent samples were made with concentrations of 0.5 mg/L, 5 mg/L, 10 mg/L, 20 mg/L, 30 mg/L 50 mg/L, 100 mg/L, and 500 mg/L. Samples from each dried test pad were attached onto a card, as shown in Figure F4.4.

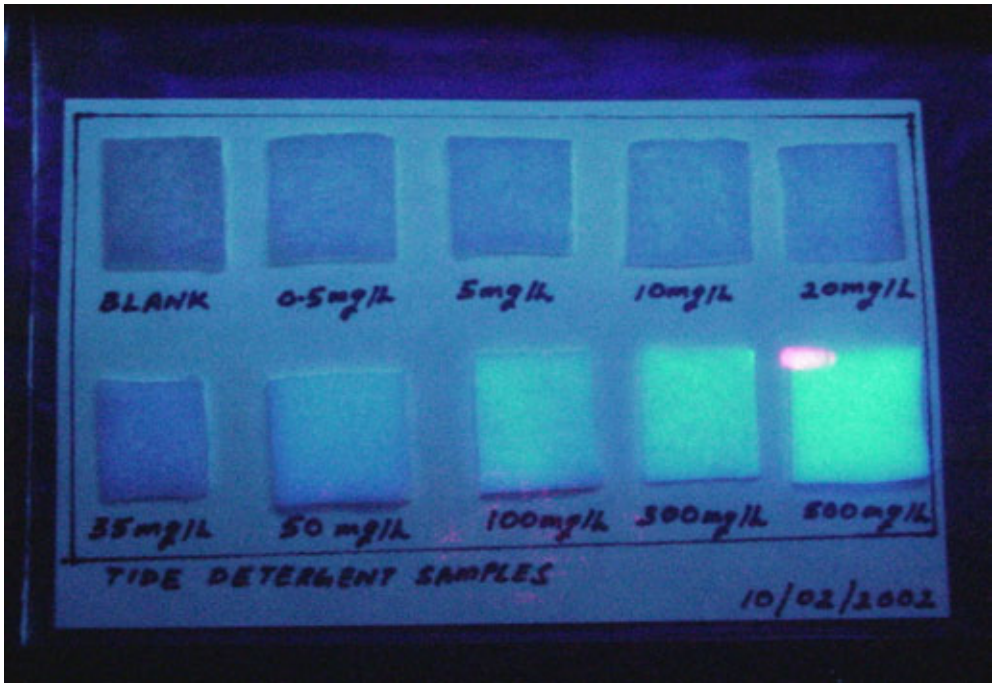



**Figure F4.4: Standard Tide OBM Pads**

As can be seen in Figure F3.4, concentrations below 35 mg/L all look identical. The 50 mg/L Tide solution (the first one with an obvious fluorescence response) is representative of a full-strength washwater as typically used in household laundry. Thus, it may be concluded that the OBM method may not be useful for samples having anything less than full-strength washwaters.

The maximum fluorescence concentration obtained from the Cribbs Mill Creek samples was 17mg/L (as Tide), and no positive responses for fluorescence using the OBM method were found.

## Conclusion

This test was originally designed to identify faulty septic systems and storm drainage systems using fluorescent dyes. The fluorescent dyes (Fluorescence and Rhodamine FWT) used in these types of tests are very strong dyes and are used in moderate concentrations. They are therefore much easier to be detected by the cotton pads and the OBM method than the fabric brighteners in washwaters. OBM is a quick, easy, and inexpensive method, but can only reliably detect undiluted washwaters, and likely will miss the more common diluted washwaters found as inappropriate discharges. Other simple methods exist that are more sensitive, although the OBM method may be most suitable if intermittent discharges of undiluted washwaters are expected.

# Appendix F5. IN-HOUSE ANALYTICAL CONSIDERATIONS FOR INDICATOR PARAMETERS

## Introduction

Program managers need to understand the basic analytical options and safety considerations, for each analytical method used to measure indicator parameters. This understanding helps program managers choose what indicator parameters to collect and where they should be analyzed. This section provides a summary of the basics.

Table F5.1 summarizes the recommended analysis method associated with each indicator parameter. An extended description of each analysis method is provided below.

*Colorimetric* – Colorimetric methods utilize specialized instruments such as a colorimeter or a spectrophotometer (Figure F5.1). The two instruments are similar and quantify parameter concentrations by adding reagents to the sample and passing through a defined spectrum of light. In general, spectrophotometers can analyze a much broader range of parameters than colorimeters.

**Table F5.1: Analytical Considerations for Illicit Discharge Indicator Parameters**

| Indicator Parameter | Method | Analysis Type | Limit of Detection |
|---|---|---|---|
| Ammonia | *HACH Method 8155* | Colorimetric | 0.01 mg/L |
| Boron | *HACH Method 10061* | Colorimetric | 0.02 mg/L |
| Chlorine | *HACH Method 8021* | Colorimetric | 0.02 mg/L |
| Color | *HACH Color Wheel* | Color Comparator | 1 color unit |
| Conductivity | Various Probe or Meter Techniques | Probe or Meter | N/A |
| Detergents – Surfactants | *Chemetrics Chemets* | Color Comparator | 0.25 mg/L |
| *E. coli*, Total Coliform, Enterococci | IDEXX: Colilert Or Enterolert | IDEXX: Colilert Or Enterolert | 1 MPN/100 mL |
| Fluoride | *HACH Method 8029* | Colorimetric | 0.01 mg/L |
| Hardness | *HACH Method 8213* | Titration | 1 mg/L |
| Potassium | *HACH Method 8049* | Colorimetric | 0.1 mg/L |
| | *Horiba Probe* | Probe | 5 mg/L |
| PH | Probe (Various) | Probe or Meter | 1 pH unit |
| Turbidity | Various Turbidity Meters | Probe or Meter | 1 NTU |



**Figure F5.1: Spectrophotometer**

*Color Comparator* – This analysis method is a less quantitative version of the colorimetric method. Samples are prepared by adding reagents, and assessing the color in comparison to a color cube (see Figure F5.2) or color disk that assigns a concentration for different color shades.



**Figure F5.2: HACH Color Cube Comparator**

*Probes* – These methods use a probe to pass an electrical current through the sample for specific light wavelength (for most indicators) or measure the scatter of light (for turbidity). While results are immediate, lab analysts need to frequently calibrate the probe using standard solutions to assure accurate data.

*Titration* – Titration techniques measure the concentration of indicator parameters by determining the amount of a reagent needed to produce a specific reaction in the sample, which is often indicated by a color change. Lab analysts carefully record the amount of reagent added to the sample using a "burette," which is a graduated cylinder with a valve-controlled opening at the bottom. An alternative and more precise technique is a digital titrator. Both methods rely on equations or lookup tables that relate to the amount of reagent added to the estimated concentration of the indicator parameter.

*IDEXX Techniques: Colilert or Colisure* - These proprietary methods are used to measure *E. coli*, total coliform and Enterococci bacteria. Samples are sealed along with a reagent in a specialized tray that is then placed into an incubator for 24 hours. The analyst then measures the number of cells in the tray that have changed color or shine under a fluorescent bulb, which is used to indicate the amount of bacteria in the sample (Figure F5.3). The IDEXX method uses a standard chart to relate the number of cells that have a positive reaction to the presence of bacteria. The IDEXX method is fairly simple and safe, but requires fairly expensive equipment.

## Safety and Waste Management Considerations

Each analysis method has special safety and waste disposal considerations, which are outlined in Table F5.2.

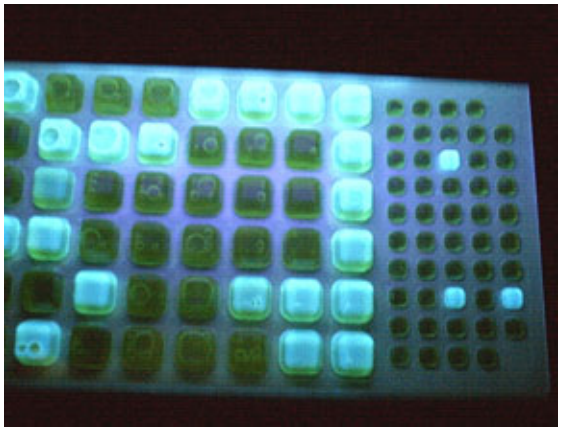


**Figure F5.3: IDEXX Results**

| Table F5.2: Special Safety and Waste Management Considerations | | | |
|---|---|---|---|
| **Indicator Parameter** | **Method** | **Major Health Risks** | **Special Disposal Requirements** |
| Detergents – Surfactants | Chemetrics Chemets | Carcinogenic. Causes dermatitis and lung infection. Need to provide ventilation. | Hazardous Waste |
| *E. coli*; Total Coliform; Enterococci | *IDEXX: Colilert Or Enterolert* | OK | Potential Biohazard (Consult State Health Agency for requirements) |
| Fluoride | HACH Method 8029 | Causes erosion of teeth. | Reagent is a hazardous waste. |
| Hardness | HACH Method 8213 | No major | Reaction produces a hazardous waste. |

**TIP**

The IDEXX technique requires a special adaptation when used to measure *E. coli* in discharges from storm drain outfalls. The concentration that distinguishes sewage from other dischares is greater than 12,000MPN/100ml. Using this method, the maximum redable concentration is only 2,619MPN/ml. Dilute outfall samples to 10-20% of their original concentrations with deionized water in order to read the very high concentrations of *E. coli* that identify sewage discharges.

## References

Pitt, R. 2004. *Methods for Detection of Inappropriate Discharge to Storm Drain Systems.* IDDE Project Support Material.

Pitt, R. 2001. *Methods for Detection of Inappropriate Discharges to Storm Drainage Systems: Background Literature and Summary of Findings*. IDDE Project Support Material.

Sargent, D. and W. Castonguay. 1998. *An Optical Brightener Handbook.* Prepared for: The Eight Towns and the Bay Committee. Ipswich, MA. Available at: http://www.naturecompass.org/8tb/sampling/index.html

# APPENDIX G

## SAMPLING PROTOCOL CONSIDERATIONS

# Developing a Consistent Sample Collection Protocol

A good field sampling protocol incorporates eight basic elements:

1. Where to collect samples
2. When to collect samples
3. Sample bottle preparation
4. Sample collection technique
5. Storage and preservation of samples
6. Sample labeling and chain of custody plan
7. Quality assurance/control samples
8. Safety considerations

## 1. Where to Collect Samples

Indicator sampling normally occurs at three principle locations in the storm drain system to detect illicit discharges - at the outfall, in the stream, and within the storm drain pipe network.

Monitoring of dry weather flows from outfalls is the most common location in most IDDE programs, and the majority of this chapter focuses on these techniques.

In-stream monitoring involves sample collection at perennial stream channels during dry weather flow conditions. Stream monitoring is less precise than outfall monitoring at detecting individual discharges. It can, however, screen stream reaches for those with the greatest illicit discharge potential, detect the most severe or high volume discharges, and measure progress over time in terms changes in stream water quality.

In-pipe sampling is often needed to track down and isolate individual discharges once a potential discharge problem is encountered at an outfall. Many of the sample collection protocols discussed in this section can be applied for in-pipe sampling, although additional testing methods to track down sources are described in Chapter 13.

## 2. When to Collect Samples

Indicator samples should be collected during dry weather periods to avoid flowing outfalls caused by storm water or groundwater infiltration. While the traditional definition of dry weather has been 72 hours without rainfall, some communities have shortened this window to 48 hours to make sampling more practical. An exception to this rule is sampling to respond to hotline complaints, which should be conducted immediately. Time of day that sampling is conducted is particularly important when the suspected source is residential sewage. Peak water usage occurs in the morning and evening, therefore sampling in the early morning (i.e., beginning of the work day) is recommended in these situations. In some regions of the country, sampling should be scheduled to coincide with the seasons where shallow groundwater influence is minimal.

## 3. Sample Bottle Preparation

Most indicator samples are stored in a polyethylene plastic sample bottle that is opaque or clear. Sample bottles can be reused, but only if they are acid-washed between field visits. If bacteria samples are collected, a new 120 ml sealed sample bottle is needed for each sample. Samples requiring a preservative are addressed in element 5.

## 4. Protocols for Sample Collection

Sample collection should reduce the potential for contamination, and prevent the field crew from being exposed to harmful

pollutants. Some considerations for sample collection include:

- Wear surgical gloves (unpowdered nytrile gloves are recommended to limit chances of contamination) when collecting the sample, and wash hands with sanitary wipes after the sample(s) is collected.
- Dry weather flows can be shallow, have low flow volumes, and be hard to reach. In some cases, alternative sample collectors may be used. A "dipper," consisting of a measuring cup at the end of a long pole, can be used to catch flows from the outfall. A pre-measured, cut-off plastic milk jug can be used to capture shallow flows from the pipe (see Figure G.1). In either case, make sure not to disturb any sediments or benthic growth in the pipe as a sample is taken. Also, be sure to rinse these alternative sample collectors three times with sample water before collecting the sample.
- Fill the bottle completely to the top (i.e., with the meniscus at the rim).
- Do not touch the inside of the lid or bottle.
- Add any needed preservative at the time of sample collection. (See Step 5).
- Label the bottle immediately. Ensure that samples stay at 4°C (40°F). On a hot day, put samples in an ice-filled cooler immediately, or carry "blue ice" in a backpack.

## 5. Sample Storage and Preservation

If the field crew cannot get the samples back for analysis within the same day, they will need to preserve the samples using the techniques outlined in Table G.1. Some suppliers and contract labs provide pre-packaged sample bottles that contain required preservatives. Each indicator parameter has a unique sample preservation technique and a maximum hold time for laboratory analysis.

**Tip**

When analyzing multiple parameters and preserving samples, the field crew may need to collect up to four samples at a site: one preserved with $H_2SO_4$, one preserved with $HNO_3$, one sealed new bottle preserved with $Na_2SO_3$ for bacteria, and one unpreserved.




**Figure G.1: A dipper (a) is helpful when the outfall is hard to reach. A milk jug (b) can be used to collect samples from shallow flow.**

**Table G.1: Sample Preservation and Storage Requirements for Typical Outfall Monitoring Parameters**
*(Primary Source: APHA, 1998)*

| Parameter | Preservation[3] | Maximum Hold Time[4] |
|---|---|---|
| Ammonia | $H_2SO_4$ to pH<2<br>Refrigerate to 4°C | 7 to 28 days |
| Boron | $HNO_3$ to pH<2 | 28 days to 6 months |
| Chlorine[1] | Not Applicable | 15 minutes |
| Color | Refrigerate to 4°C | 48 hours |
| Conductivity | Refrigerate to 4°C | 28 days |
| Detergents – Surfactants[2] | None Required | 48 hours |
| Bacteria (*E. coli*, Enterococci, Total Coliform)[2] | $Na_2S_2O_3$ in chlorinated waters<br>Refrigerate to 4°C | 6 to 24 hours |
| Fluoride | None Required | 28 days |
| Hardness | $HNO_3$ or $H_2SO_4$ to pH<2 | 6 months |
| pH[1] | Not Applicable | 15 minutes |
| Potassium[2] | $HNO_3$ to pH<2 | 28 days |
| Turbidity | Refrigerate to 4°C<br>Store in the dark | 24-48 hours |

1. Indicates parameters that should be analyzed in the field.
2. Data for these parameters taken from the National Environmental Methods Index (www.nemi.gov)
3. Many contract labs will provide sample bottles with preservative already added.
4. For parameters with a range, the lower number is recommended by the reference, and the higher number is the regulatory requirement for sample storage.

## 6. Sample Labeling and Chain of Custody

The labeling and integrity of each sample are important parts of the sampling protocol. Program managers should develop a process to track the "chain of custody" from the time the sample is initially collected until it is analyzed and reported as data. The process limits errors resulting from mis-labeling, lost samples, and improper laboratory analysis. Table G.2 outlines the nine minimum elements of a chain of custody, recommended by APHA (1998).

| Table G.2: Nine Elements of a Chain of Custody | |
|---|---|
| **Element of Chain of Custody** | **Description** |
| 1. Sample Labels | Labels should include a unique ID, type of sample, name of collector, date and time of collection, date and time of preservation, and preservative used (if applicable). |
| 2. Sample Seals | Seals the lid on the label to ensure they are not tampered with. |
| 3. Field Log Book | Includes basic information about sample collection, usually the Outfall Reconnaissance Inventory (ORI) field form can be used for this purpose. |
| 4. Chain-of-Custody Record | A sheet that tracks the transfer of samples between individuals. |
| 5. Sample Analysis Request Sheet | A sheet that requests specific analysis types from the laboratory. |
| 6. Sample Delivery to the Laboratory | Ensure that sample delivery is timely. Include chain of custody records with the sample. |
| 7. Receipt and Logging of Sample | The lab needs to document time of receipt of the sample |
| 8. Assignment of Sample for Analysis | The lab supervisor assigns an analyst to the sample. The lab supervisor or analyst is responsible at this point. |
| 9. Disposal | Save samples until results are confirmed and finalized. Dispose of according to US EPA approved methods. |

## 7. Quality Assurance Measures During Sample Collection

To ensure sampling results are accurate, it is important to institute quality assurance measures as part of the sampling protocol. Quality assurance samples serve as a check against biases introduced during sample collection, or within the laboratory. Quality assurance samples also assess the accuracy of the analysis method and its consistency for samples collected at the same site. The sampling protocol should define a minimum fraction of samples that will be used for quality assurance purposes (typically about 5% - 10% of all samples collected). Examples of quality assurance samples include field blanks, duplicate samples, split samples and spiked samples, which are described below:

*Field Blanks* – Field blanks are deionized water samples prepared in the field at the time of sample collection. If the lab results for field blanks have non-zero values, it indicates that impurities were introduced to the sample during collection or lab analysis. The distilled deionized water should be placed in whatever is used to collect samples (e.g., sample scoop, dipper, plastic milk bottle) and then poured in the sample bottle, just as if it had been scooped or dipped as a real sample.

*Duplicate (Replicate) Samples* – This quality assurance technique relies on the collection of two or more samples from the same location and flow source during the same field visit. A discrepancy between the two sample measurements indicates a lack of precision or repeatability introduced during sample collection or lab analysis.

*Field Spikes* – A field spike is a sample to which a known concentration of an indicator parameter is added (e.g., an ammonia concentration of 1.0 mg/L). Any difference between the known concentration and the final laboratory measurement reveals errors introduced during sampling and laboratory analysis.

*Split Samples* – Splits consist of a single field sample that is divided into two separate sub-samples for subsequent laboratory analysis. Typically, split samples are submitted to different laboratories, or analyzed by different analysts to determine the precision of laboratory results. Alternatively, split samples can be analyzed at a single laboratory without knowledge of the sample origin (referred to as a "blind sample"). Any discrepancy between the two sub-samples suggests a lack of precision or repeatability introduced during sample collection or lab analysis.

## 8. Safety Considerations

Whenever sampling is done there are safety considerations that require planning. This is even more important when sampling is being conducted in urban stream environments where there is potential for contact with contaminated water, sharp debris and objects, and threatening individuals (both animals and humans). Field crews should be comprised of at least two individuals, each equipped with proper foot (e.g., sturdy boots or waders) and hand wear (latex gloves). Key equipment for crews to carry include cell phones, a list of contact and emergency numbers, a gps unit, and a first aid kit. Private properties should not be accessed unless proper notification has been provided, preferably in advance. Lastly, program managers may want to consider requiring/recommending field crews to be vaccinated against Hepatitis B, particularly if the crews will be accessing waters known to be contaminated with illicit sewage discharges.

## References

American Public Health Association (APHA).1998. *Standard Methods for the Examination of Water and Wastewater – 20th Edition*. Washington, D.C.

# APPENDIX H

## TWO ALTERNATIVE FLOW CHARTS

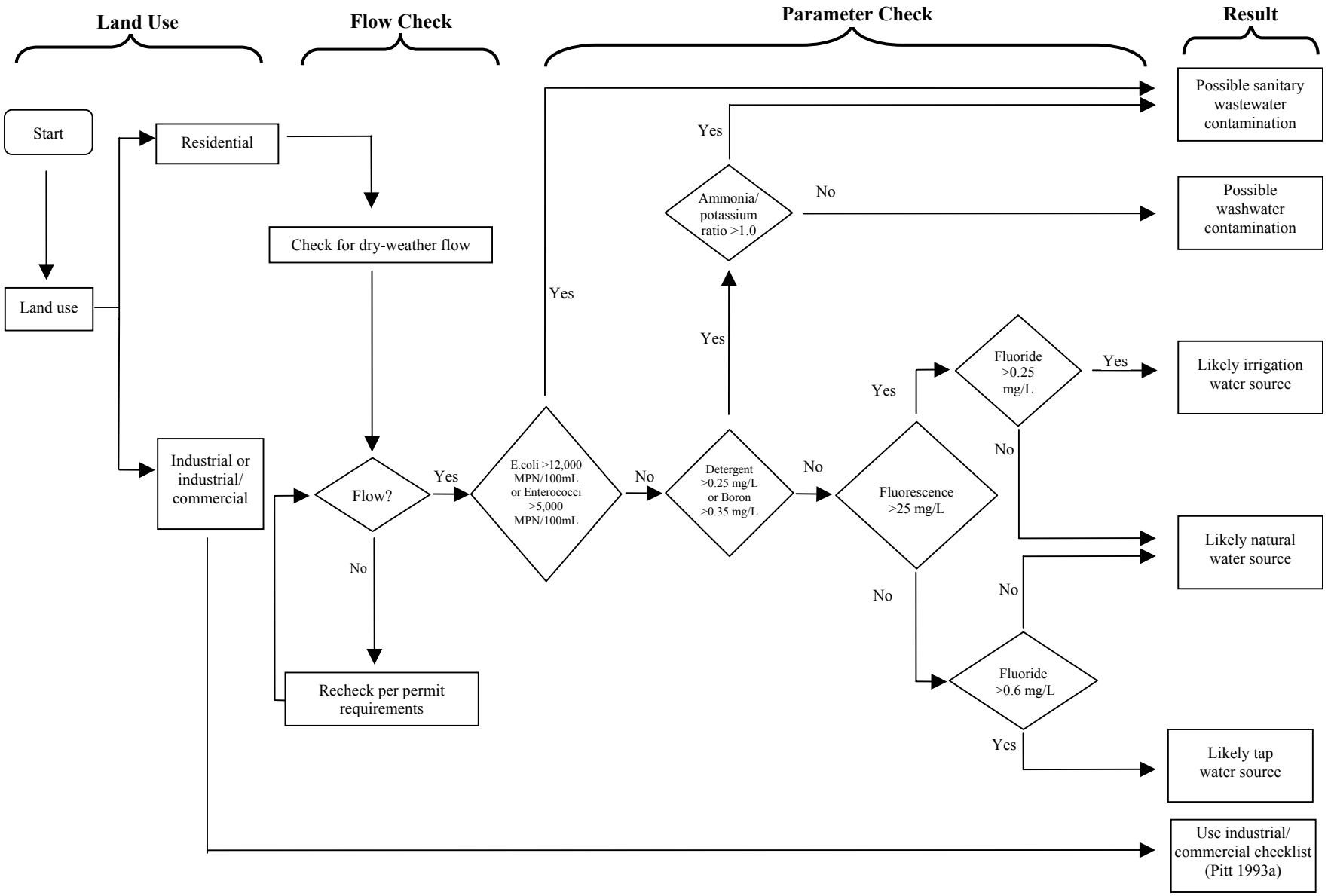
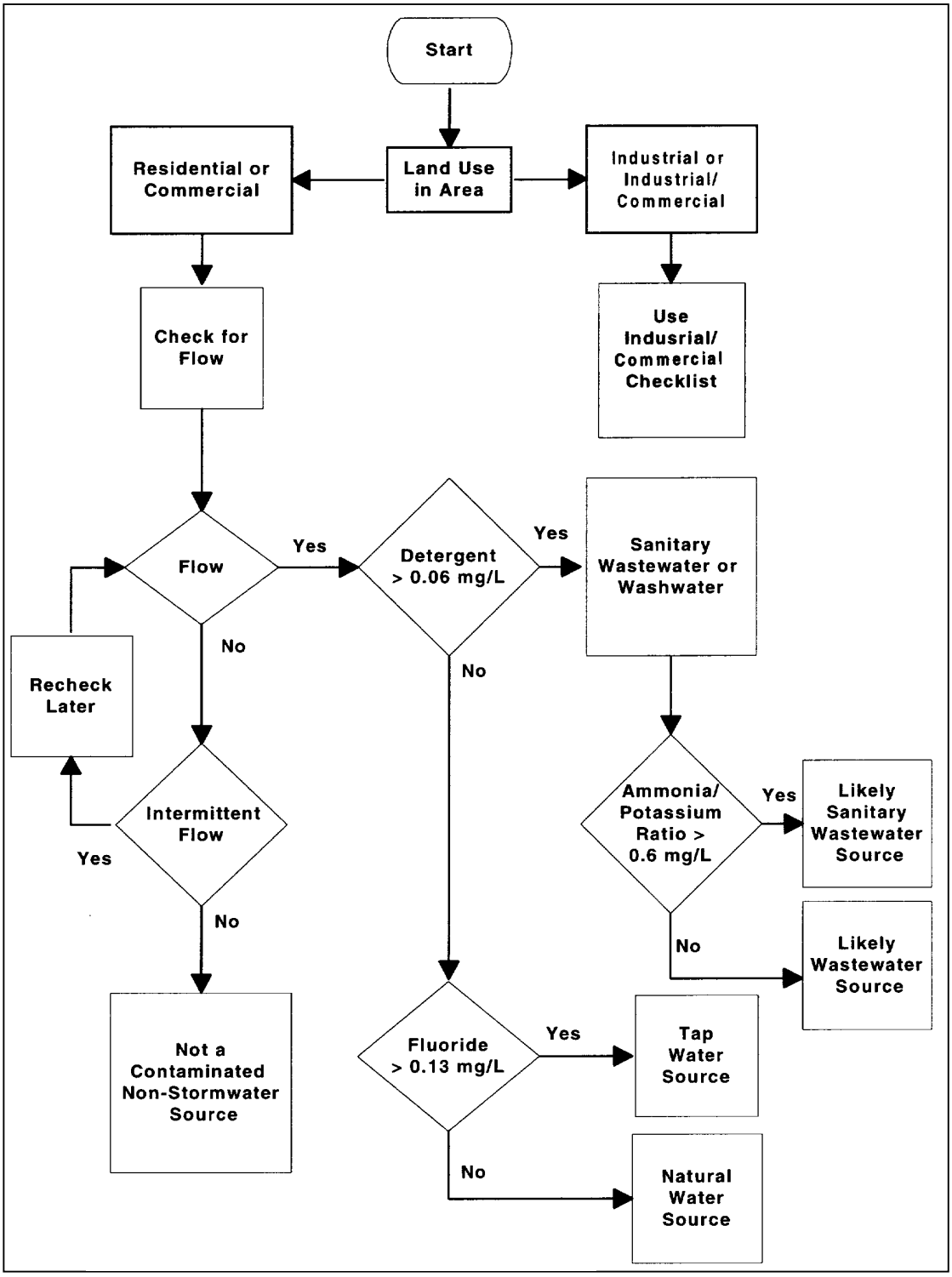



**Figure H.1 Complete Flow Chart (Including Additional Confirmatory Parameters) from Tuscaloosa, Alabama**

*Source: Pitt (2004)*

**Figure H.2 Original Flow Chart Derived from Data in Birmingham**
(Pitt and Lalor, 1993)



## References

Pitt, R. 2004. *Methods for Detection of Inappropriate Discharge to Storm Drain Systems.* IDDE Project Support Material.

Pitt, R. and M. Lalor. 1993. *A User's Guide for the Assessment of Non-Stormwater Dischargers Into Separate Storm Drainage Systems.* EPA/600-R-92-238. Risk Reduction Engineering Laboratory, USEPA. Cincinnati, OH.

# APPENDIX I

## USER'S GUIDE FOR THE CHEMICAL MASS BALANCE MODEL VERSION 1.0

(Adapted from Karri, 2004)

## Overview of the Model

The Chemical Mass Balance Model (CMBM) estimates the most likely source components that contribute to outfall flows during dry weather. In order to use the model, the user must have a Library File in the form of an Excel file in a specified format. This library file describes the concentration characteristics of potential local contributing flows. In the CMBM, the user selects the sources to be evaluated for an outfall, enters the values of the concentrations of the tracers measured at the outfall, and obtains a plot of the most likely source component in tabular form, and in probability plots.

## Installation of the Model

The user must first install the model by inserting the disk and then clicking the 'CMBM_setup.exe' icon and following the on-screen instructions.

## Model Inputs

The user enters the following data:

1. The potential sources to be evaluated for a particular outfall. The number of sources is entered in the first form (Figure I.1) and the user must then select the same number of sources and tracers when the lists of the sources and tracers are loaded.
2. The source library file containing source flow characteristics (median, COV, and distribution type) for the Monte Carlo statistical simulations (Figure I.2).
3. The tracer parameters for these sources and outfall contained in the library file. The user selects the specific tracers to be used from the check boxes when they are loaded in the first form.
4. The number of Monte Carlo simulations that are to be used by the model, up to 10,000 runs.
5. The observed outfall concentrations of the selected tracer parameters measured for a particular outfall (in the second form of the model). Press the continue button when these concentrations are entered.

### *In the first form*

- Navigation from one step to another can be done by using either the mouse or the 'tab' button.
- Changing the value entered for 'Number of contributing sources to be evaluated' after entering subsequent steps will likely result in an error message. If the user wishes to change this value after starting on later forms, the user must use the 'Start over again' button (third form) and re-enter the earlier forms.
- The model can run up to eight sources and tracers in a single trial.

### *In the third form*

- The user must first save the output file to run the Monte Carlo simulation.
- The user must first save the graph to view or print it.
- The user must first save the table to print it.
- If the table cannot be viewed properly, it can be resized.

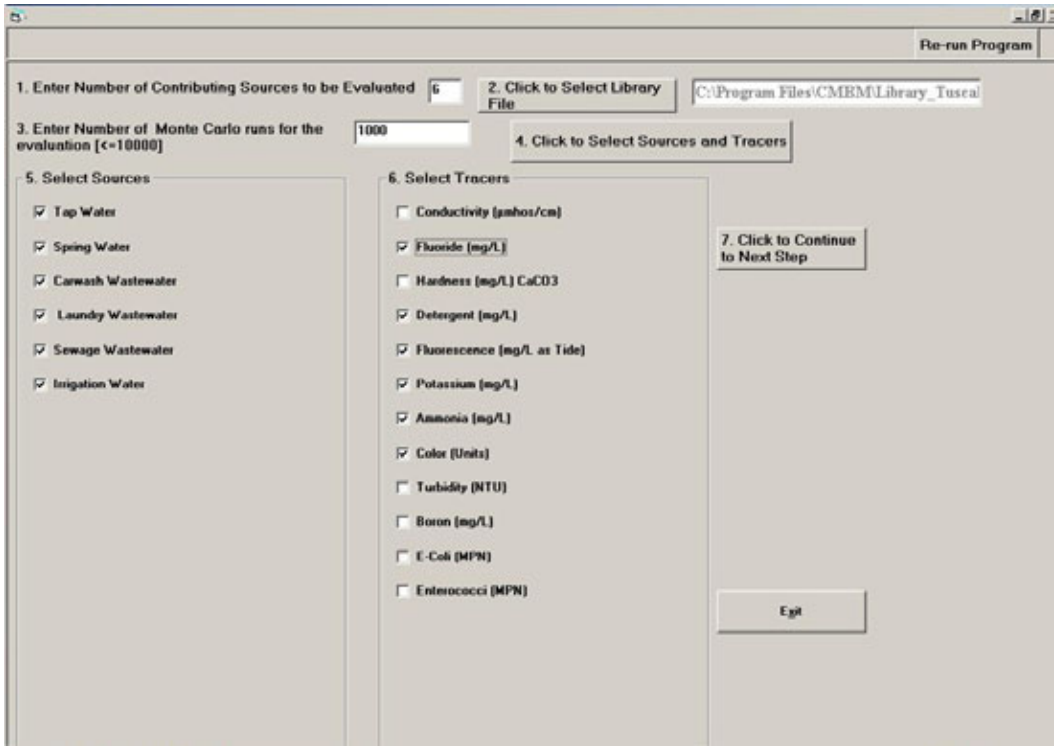



**Figure I.1: Form-1 (Model inputs)**

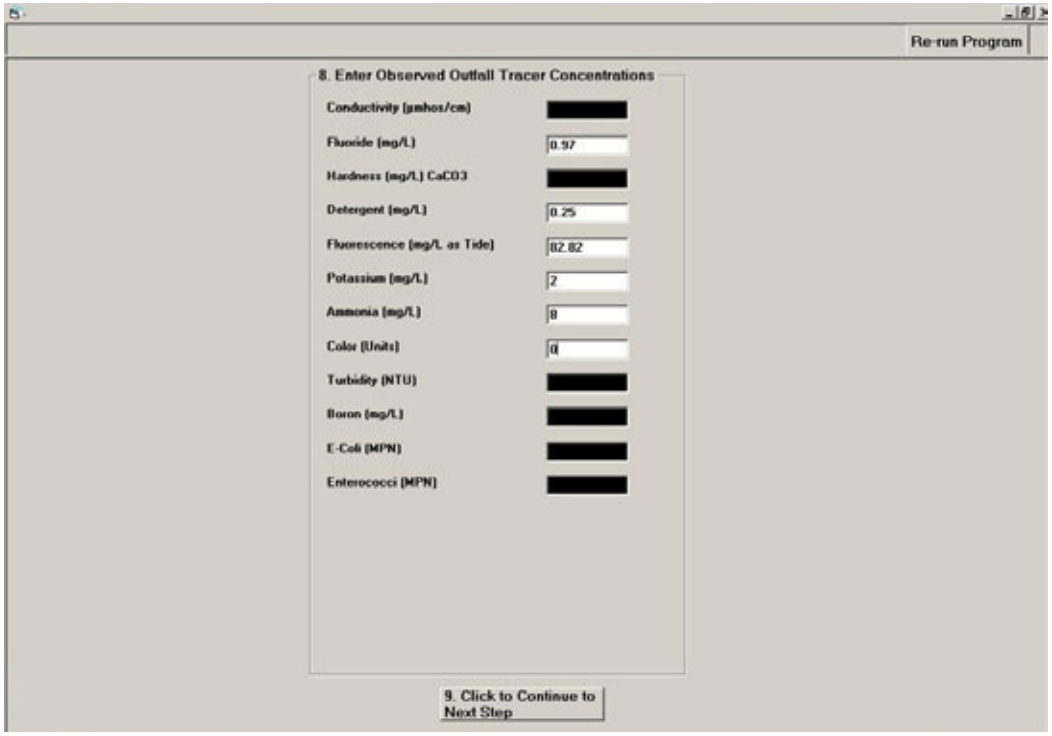



**Figure I.2: Form-2 (Model inputs)**

## Model Outputs

The output of the model is in two forms:

- *A summary table lists the 95$^{th}$ percentile confidence interval (the 2.5$^{th}$ and the 97.5$^{th}$ percentile values) and the 50$^{th}$ percentile (median) values of the mass fraction for each source contributing to the outfall dry weather flow, as calculated by the CMBM and using the number of Monte Carlo simulations specified. This table also shows these values for an error term, μ (Mu):* This table can be saved and printed by selecting the options in the third form. In order to print the table (a small Excel spreadsheet), it must first be saved on the computer.

- *A probability plot of the calculated mass fractions for each selected source flow and also for the error term, μ (Mu)*: This plot (see Figure I.3) can be saved and printed by selecting the options in the third form. In order to print each figure, they must first be selected and saved on the computer.

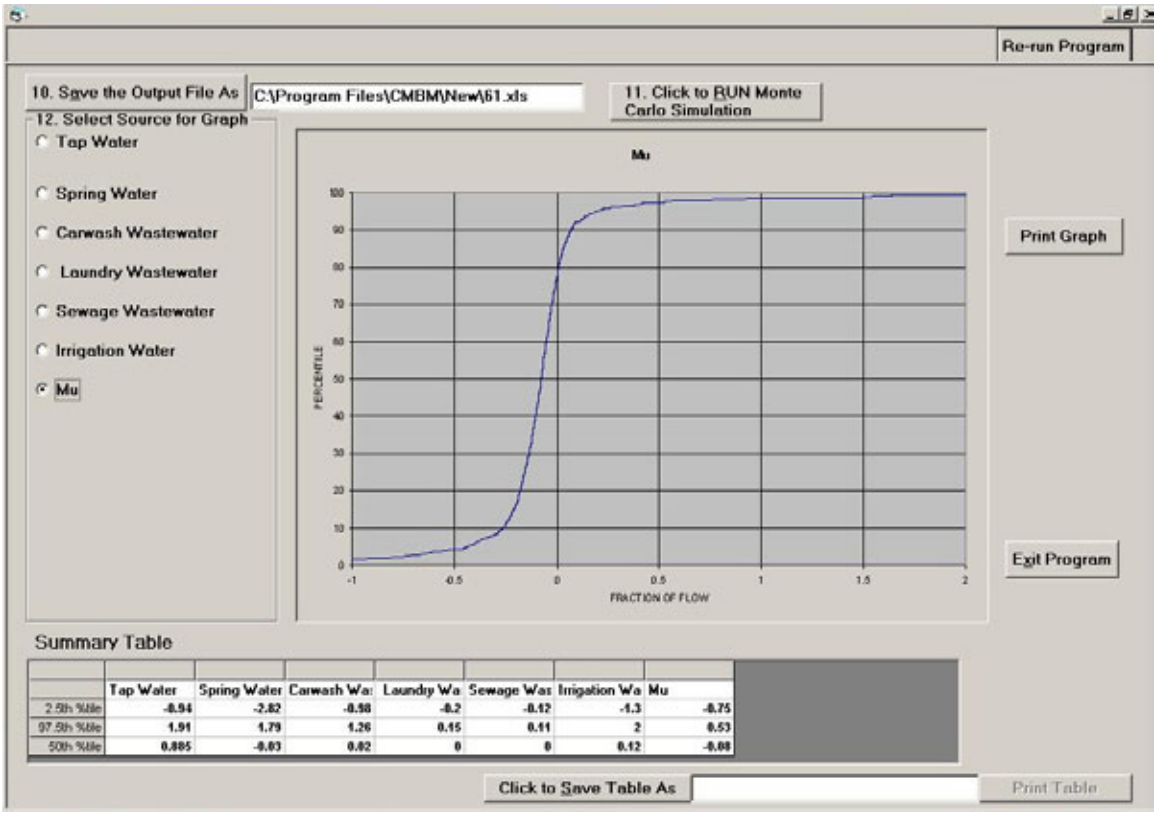



**Figure I.3: Form-3 (Model output)**

## Library File Format

This model recognizes the source file for evaluation, only when it is in a specific format in an Excel spreadsheet.

- The data for each source is entered in an Excel file, with a separate worksheet being used for each individual source. Worksheets should be named according to the source (e.g., tap water, spring water, sewage, etc.)
- The first column of the Excel data sheet must contain the names of the tracers, starting with the second row, the second column must contain values of mean concentration, the third column, the coefficient of variation, and the fourth column the type of distribution. "N" is for "normal", or Gaussian, distributions, while "L" if for log-normal distributions. Figure I.4 is an example spreadsheet file for source area library flows.

| Tracer | Mean Concentration | COV | Distribution |
|---|---|---|---|
| Conductivity (µmhos/cm) | 274.67 | 0.46 | N |
| Fluoride (mg/L) | 1.23 | 1.57 | L |
| Hardness (mg/L) $CaCO_3$ | 71.17 | 0.27 | N |
| Detergent (mg/L) | 140.91 | 0.21 | N |
| Fluorescence (mg/L as Tide) | 90.98 | 0.47 | N |
| Potassium (mg/L) | 3.58 | 0.67 | L |
| Ammonia (mg/L) | 0.90 | 1.42 | L |
| Color (Units) | 100.00 | 0.01 | N |
| Turbidity (NTU) | 156.81 | 0.78 | N |
| Boron (mg/L) | 0.65 | 0.74 | L |
| E-Coli (MPN) | 100.00 | 0.00 | L |
| Enterococci (MPN) | 10.00 | 0.00 | L |

**Figure I.4: Excel Sheet in Library File**

## Example Problems

*Example 1*
This first example illustrates a verification procedure that is used to ensure the model is functioning as expected. It assumes the analysis of an undiluted flow.

Consider an outfall, which has the same data for the tracer parameters as were observed at the sewage treatment plant (which is the same as the library data for sewage wastewater). This means that the model must predict the most likely source component to be sewage and with a predicted fraction of flow for sewage close to one.

The library file used here is the Birmingham library file 'Library_BHM.xls' (which is included with the program). Let the number of Monte Carlo simulations considered be 1000, and the number of sources selected for evaluation be 4 (sewage wastewater, tap water, spring water, and landscape irrigation runoff). The tracers selected are conductivity, fluoride, potassium and ammonia. Figure I.5 shows these corresponding entries, while Figure I.6 shows the Excel spreadsheet for the library file used.

Figure I.7 shows the entries made in the second form. It should be noted that the values for the tracers entered are the same as those in the library file for sewage.

Figure I.8 shows the output form. The 50$^{th}$ percentile value for Sewage Wastewater flow in the summary table is 1.06, while the 95 percent confidence interval is 0.54 to 2.2. This table shows that the most likely source at the outfall is Sewage Wastewater, which is the same as the initial assumption. Also, the fraction of flow that is sewage is 1.06, very close to 1.0. Also, the sum of all 50$^{th}$ percentile flow contributions is 0.98, also very close to 1.0, indicating good agreement. The potential mass contributions for the other source flows are also close to zero.

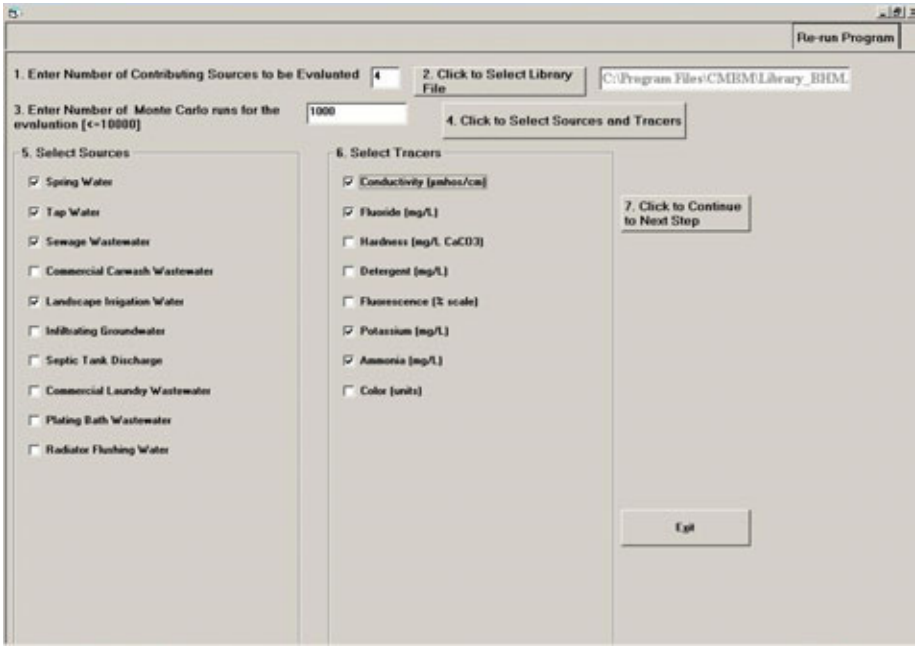



**Figure I.5: Form 1 (Input for Example 1)**

| Tracer | Median Concentration | COV | Distribution |
|---|---|---|---|
| Conductivity (µmhos/cm) | 419.86 | 0.13 | N |
| Fluoride (mg/L) | 0.76 | 0.23 | N |
| Hardness (mg/L $CaCO_{3)}$ | 142.92 | 0.11 | N |
| Detergent (mg/L) | 1.5 | 0.82 | N |
| Fluorescence (mg/L) | 250.89 | 0.2 | N |
| Potassium (mg/L) | 5.97 | 0.23 | N |
| Ammonia (mg/L) | 9.92 | 0.34 | L |
| Color (mg/L) | 37.89 | 0.55 | N |

**Figure I.6: Library File Excel Sheet (Sewage Wastewater)**

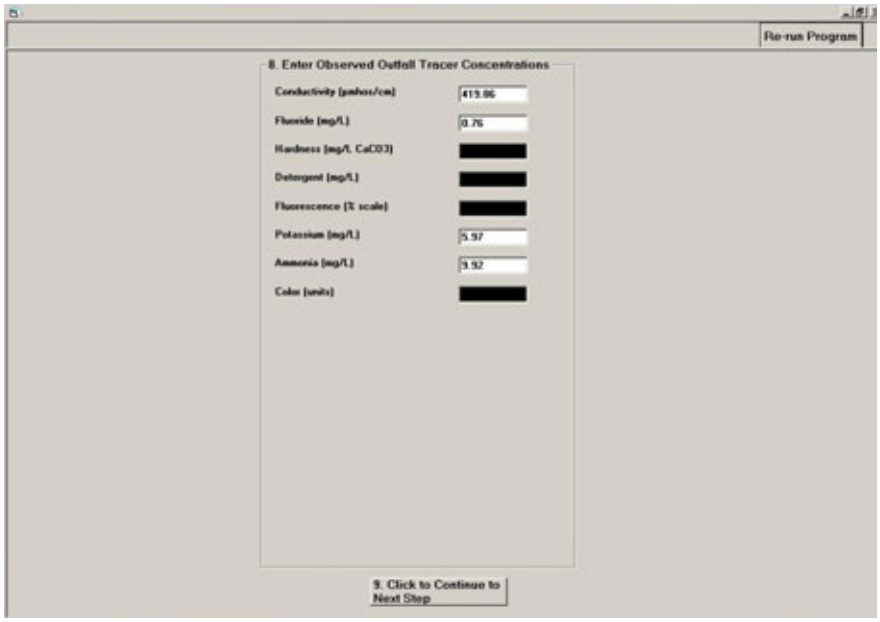



**Figure I.7: Form 2 (Input)**

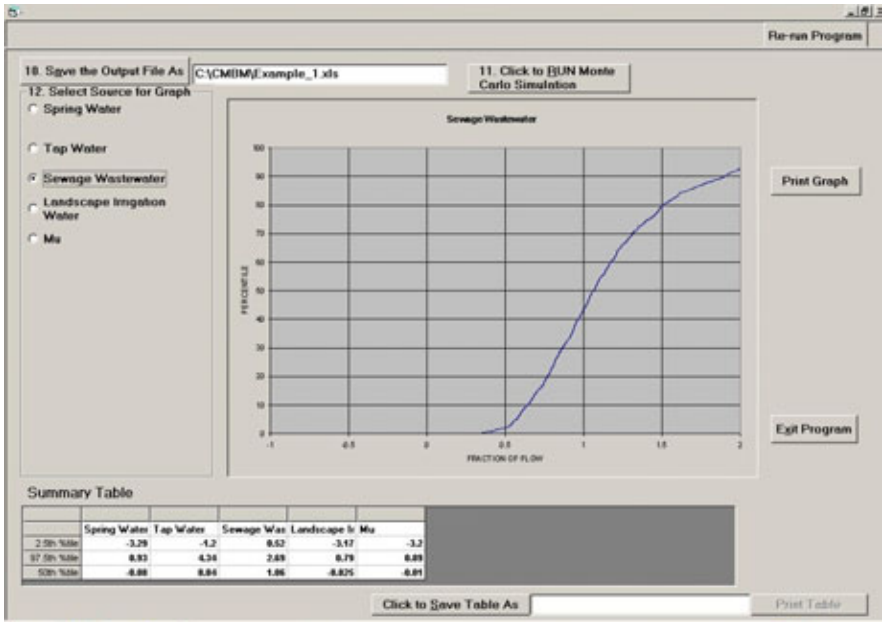



**Figure I.8: Form 3 (Output for Example 1)**

*Example 2*
In this example, eight possible source types and eight tracer parameters are selected, based on sample data from outfall # 20 in Birmingham, AL, collected on March 3, 1993.

The library file used in this example is also the Birmingham library file: 'Library_BHM.xls'. Let the number of Monte Carlo simulations be 1000, the number of sources selected for evaluation be 7 (spring water, tap water, sewage wastewater, commercial carwash wastewater, landscape irrigation water, infiltrating groundwater, and septic tank discharge. The seven tracers selected are conductivity, fluoride, hardness, detergents, fluorescence, potassium, and ammonia.

Figure I.9 shows all the corresponding entries using this information. Figure I.10 shows the entries made in the second form. Figure I.11 shows the output form. The fraction of flow as indicated for the 50$^{th}$ percentile value for tap water on the summary table is the highest value (0.72) compared to the other potential source flows. This indicates that the most likely source at the outfall is tap water, as verified through field observations. The spring water mass fraction is also relatively high (0.42), indicating that this source water may also be present.

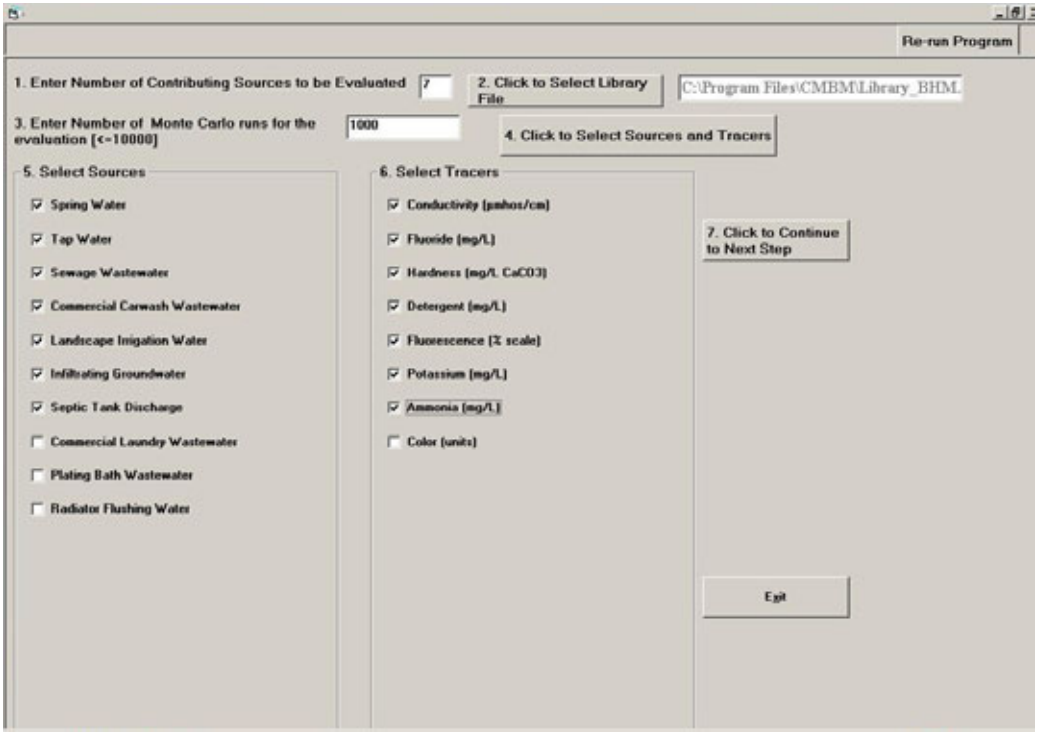



**Figure I.9: Form 1 (Input for Example 2)**

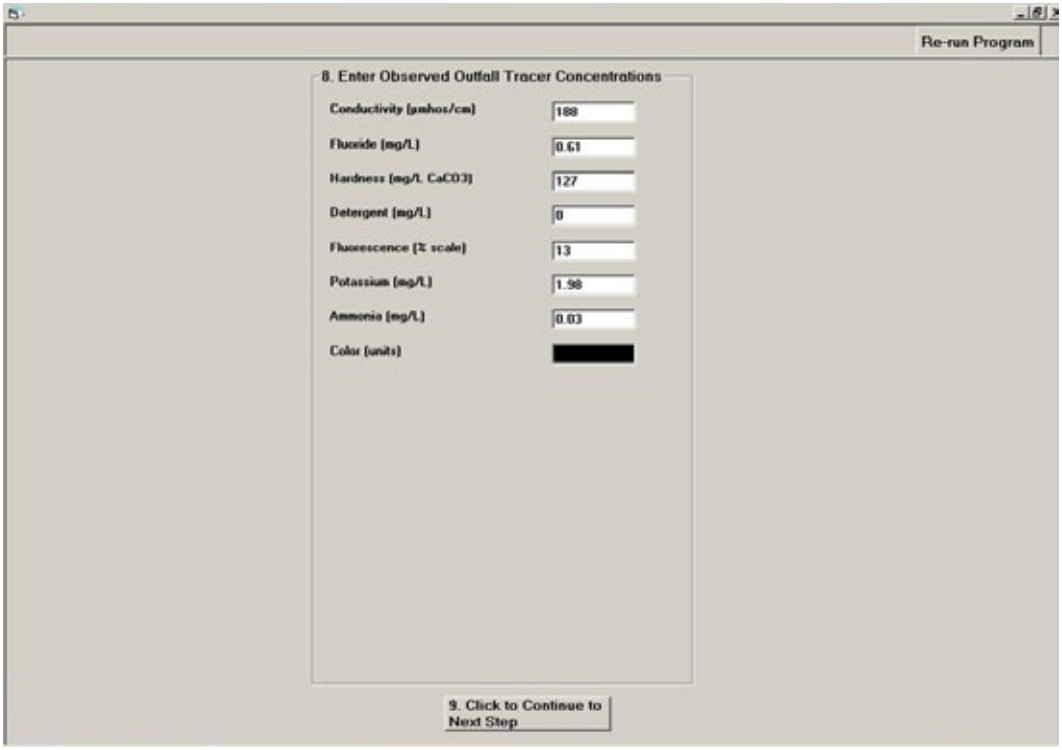



**Figure I.10: Form 2 (Input for Example 2)**

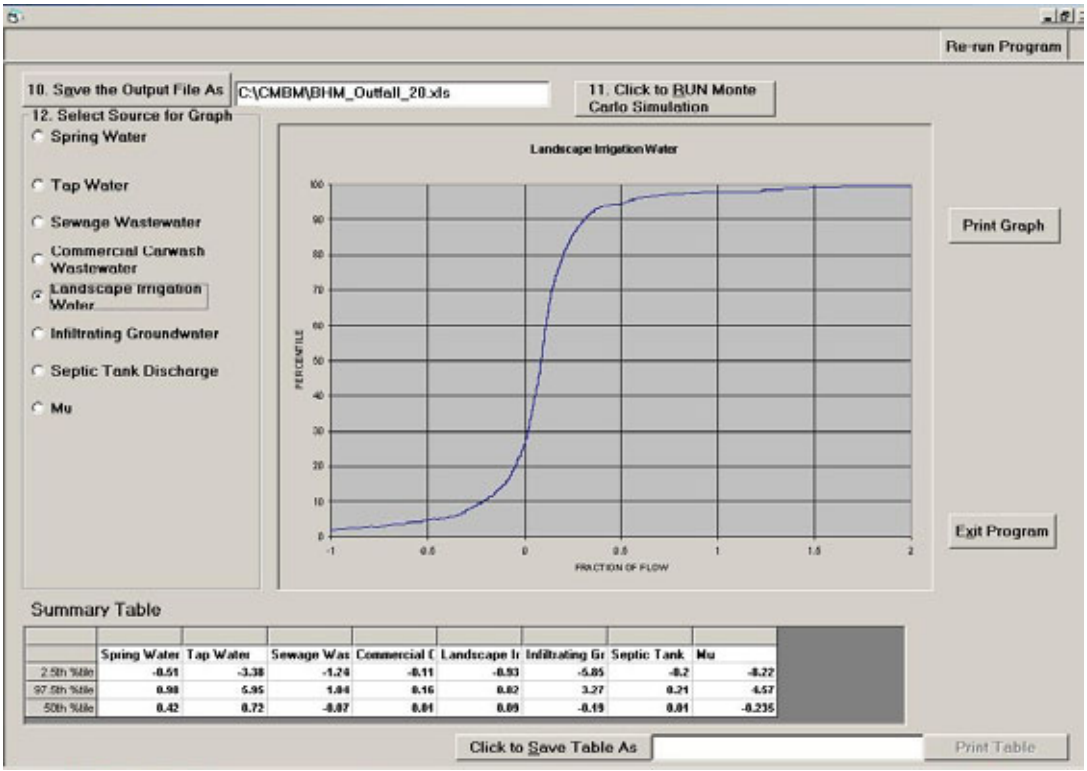



**Figure I.11: Form 3 (Output for Example 2)**

# APPENDIX J

## USING THE CHEMICAL LIBRARY TO DETERMINE THE UTILITY OF BORON AS AN INDICATOR OF ILLICIT DISCHARGES

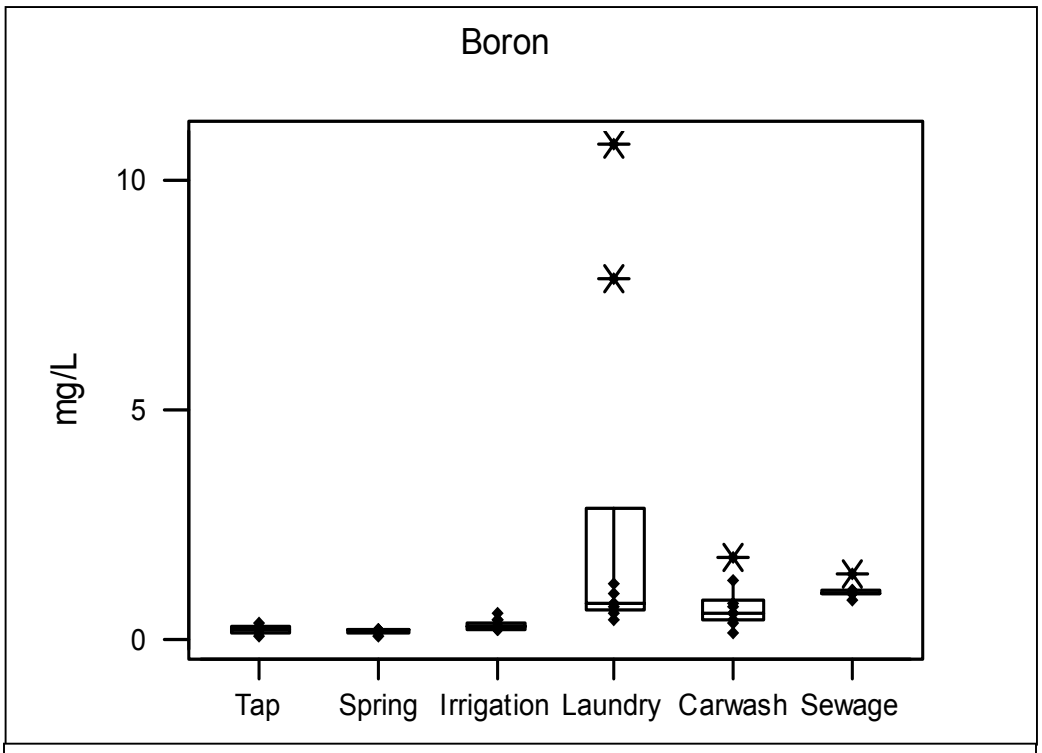
## Introduction

In this example, library data from several flow types are analyzed to determine a good cut-off point to use boron as an indicator of illicit discharges. Both the data and the selected concentrations are derived from research in Tuscaloosa, Alabama (Pitt, 2004). Investigators examined the data from their chemical flow library both graphically and then in detail to select a concentration.

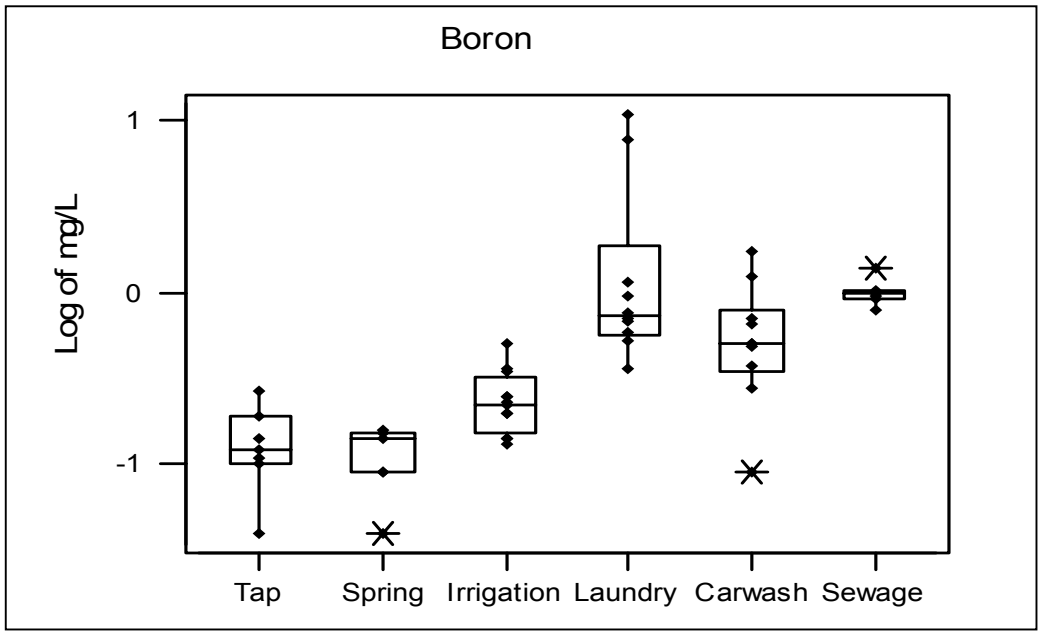
## Step 1: Visually Analyze Data Using Box Plots

After collecting data from a select group of flow types, researchers assembled the data into box plots (see Plots 1 and 2). These plots help quickly identify the range of data. The "box" portion of the plot shows the first quartile, median, and third quartile for the data, and the individual data points show the data above and below this range.

A first look at the data shows that sewage, laundry, and wash water sources all have a higher concentration than the non-illicit flows: irrigation, tap water, and spring water. A closer look, using the log plot (i.e., the log of each concentration), shows some overlap between irrigation water and two of the illicit flow types: laundry and car wash. Although this overlap means that there will be some "false negatives" or "false positives" using this parameter, investigators select a concentration that is lower than the lowest concentration in laundry. This value appears to be somewhere between $10^{-0.5}$ (or 0.3 mg/L) and $10^{0}$ (or 1.0 mg/L).




**Plot 1: Boron Concentration**
*(Source: Pitt, 2004)*




**Plot 2: Boron Concentration in Log Space**
*(Source: Pitt, 2004)*

## Step 2: Evaluate Tabular Data

The first step is a good general indicator of how to use boron as an indicator. The second step refines the initial evaluation to come up with a specific value to use as an indicator, and a numeric estimate of the number of "false positives" (i.e., identifying a non-illicit flow as illicit) and "false negatives" (i.e., identifying an illicit flow as non-illicit) that would result from using the parameter. (See Table below for the data used in this investigation).

Using data from the three sources with overlap, investigators select a concentration of >0.35 mg/L as an indicator of sewage or wash water. (This value captures all laundry flows). Using this value, two of 12 irrigation samples are identified as illicit (a 17% false positive rate) and two of 10 car wash samples are not captured as an illicit discharge (a 20% false negative rate).

| Boron Concentration (mg/L) For Six Flow Types (Concentrations >0.35 mg/L indicate illicit discharges) | | | | | |
|---|---|---|---|---|---|
| **Tap Water** | **Spring Water** | **Irrigation** | **Laundry** | **Car Wash** | **Sewage** |
| 0.04 | 0.04 | 0.13 | 0.36 | 0.09 | 0.78 |
| 0.1 | 0.09 | 0.14 | 0.53 | 0.28 | 0.93 |
| 0.11 | 0.09 | 0.14 | 0.58 | 0.37 | 0.97 |
| 0.12 | 0.14 | 0.2 | 0.67 | 0.48 | 0.98 |
| 0.14 | 0.15 | 0.2 | 0.7 | 0.5 | 1.01 |
| 0.19 | 0.15 | 0.22 | 0.75 | 0.5 | 1.05 |
| 0.27 | 0.16 | 0.23 | 0.97 | 0.65 | 1.38 |
| | | 0.25 | 1.16 | 0.7 | |
| | | 0.25 | 7.9 | 1.23 | |
| | | 0.35 | 10.8 | 1.74 | |
| | | 0.36 | | | |
| | | 0.5 | | | |

Yellow shading indicates a false positive.

Pink shading indicates a false negative.

*Source: Pitt (2004)*

## Step 3: Make a Determination

Based on these data, boron shows high promise as an indicator of illicit discharges. It correctly categorizes all flows from tap water, spring water, laundry and sewage, and has fairly low false positive or negative rates for identifying irrigation and car wash discharges. One potential concern, however, is that dilution occurring at the outfall may mask some illicit discharges. For example, a 50% dilution with spring water (using the median concentration of 0.14 mg/L) would result in a 20% false negative rate for laundry waters and a 60% false negative for car wash waters.

**VERDICT: GOOD CANDIDATE FOR FLOW CHART METHOD. NEEDS FIELD TESTING!**

## References

Pitt, R. 2004. *Methods for Detection of Inappropriate Discharge to Storm Drain Systems.* IDDE Project Support Material.

# APPENDIX K

## SPECIFIC CONSIDERATIONS FOR INDUSTRIAL SOURCES OF INAPPROPRIATE POLLUTANT ENTRIES TO THE STORM DRAINAGE SYSTEM

(Adapted from Pitt, 2001)

## Industrial Site Surveys

Additional pollutants associated with local commercial and industrial activities need to be monitored during outfall screening activities if these activities exist in the watersheds of interest. This monitoring will assist in identifying the classes of commercial or industrial activities responsible for the contamination. The first step in this process is to identify which industrial and commercial activities may contribute non-storm water discharges to the drainage system. The review of industrial user surveys or reports that are available needs to be done initially. It may be necessary to also send a questionnaire to industries in the watershed that are draining to the storm drainage system to identify the specific activities that may affect runoff quality and dry weather discharges. Site inspections will still be required because questionnaires may not be returned or may give incorrect details (either deliberately or unknowingly).

Industrial areas are known to contribute excessive wet-weather storm water discharges, along with contaminated dry weather entries into the storm drainage system. Therefore, additional industrial site investigations are needed to identify activities that most obviously contribute these contaminants to the storm drainage system. Figure K.1 is an example industrial site survey form prepared by the Non-Point Source and Land Management Section of the Wisconsin Department of Natural Resources (Bannerman, 2003). This form has been used to help identify industrial activities that contribute dry- and wet-weather non-storm water entries into the storm drainage system.

This form only considers outside sources that would affect the storm drainage system by entering through inlets or through sheetflow runoff into drainage channels. This sheet does not include any information concerning indoor activities, or direct plumbing connections to the storm drainage system. However, the information included on this sheet can be very helpful in devising runoff control programs for industrial areas. This information most likely affects wet-weather discharges much more than dry weather discharges. Obvious dry weather leaching or spillage problems are also noted on the form.

Table K.1 presents the types of activities in industrial areas that may contribute dry weather discharges to storm drainage systems. This table can be used to rank the most likely industries that may produce non-storm water discharges to a storm drainage system in an area. This table is used in conjunction with the industrial site survey form to catalog specific activities in the watershed that may need correction. After a listing of the candidate activities is known in the watersheds, additional tracer parameters may then be selected to add to the screening efforts.

## Likely Dry Weather Discharge Characteristics for Different Industries

*Chemical and Physical Properties*
Table K.1 summarizes possible chemical and physical characteristics of non-storm water discharges, which could come from various industries. The properties considered are pH, total dissolved solids, odor, color, clarity, floatable materials, vegetation, and structural damage potential. The descriptions in each of these categories contain the most likely conditions for a non-storm water discharge coming from a

particular industry. It should be noted that a combination of just a few of these characteristics, or perhaps all of them, might occur at an outfall affected by a potential source. In addition, outfalls are likely to be affected by several sources simultaneously, further confusing the situation. Again, a complete watershed analysis describing the industrial and commercial facilities operating in each outfall watershed will be of great assistance in identifying which industries may be contributing harmful dry weather discharges to the storm system.

City: _____ Industry Name: _____
Site Number: _____ Photo # _____
Street Address: _____ Roll# _____
Type of industry: _____
Instructions: Fill in blanks or circle best answer in following (use back of sheet if necessary):

Material/waste Storage Areas

1. Type of material/waste: _____
2. Method of storage: pile tank dumpster other: _____
3. Area occupied by material/waste (acres): _____
4. Type of surface under material/waste: paved unpaved
5. Material/waste is disturbed: often sometimes never unsure
6. Description of spills (material, quantity & frequency): _____
7. Nearest drainage (feet) and drainage type: _____
8. Control practice: berm tarp buffer none other: _____
9. Tributary drainage area, including roofs (acres): _____
10. Does storage area drain to parking lot: yes no unsure

Heavy equipment storage

1. Type of equipment: _____
2. Area covered by equipment (acres): _____
3. Type of surface under equipment: paved unpaved
4. Nearest drainage (feet) and drainage type: _____
5. Control practice: berm tarp buffer none other: _____
6. Tributary drainage area, including roofs (acres): _____
7. Does storage area drain to parking lot: yes no unsure

Air pollution

1. Description of settleable air pollutants (types & quantities): _____
2. Description of particulate air pollutant controls: _____

Railroad yard

1. Size of yard (number of tracks): _____
2. General condition of yard: _____
3. Description of spills in yard (material, quantity & frequency): _____
4. Type of surface in yard: paved unpaved
5. Nearest drainage (feet) and drainage type: _____
6. Type of control practice: berm buffer other: _____
7. Does yard drain to parking lot: yes no unsure
8. Tributary drainage area, including roofs (acres): _____

Loading Docks

1. Number of truck bays: _____
2. Type of surface: paved unpaved
3. Description of spills in yard (material, quantity & frequency): _____
4. Nearest drainage (feet) and drainage type: _____
5. Type of control practice: berm buffer other: _____
6. Does loading area drain to parking lot: yes no unsure
7. Tributary drainage area, including roofs (acres): _____

**Figure K.1: Industrial Inventory Field Sheet**
*Source: (Source: Bannerman, 2003)*

| Table K.1: Chemical and Physical Properties of Industrial Non-Storm Water Discharges | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Industrial Categories Major Classifications SIC Group Numbers** | **Odor** | **Color** | **Turbidity** | **Floatables** | **Debris and Stains** | **Structural Damage** | **Vegetation** | **pH** | **Total Dissolved Solids** |
| **Primary Industries** | | | | | | | | | |
| 20: Food and Kindred Products | | | | | | | | | |
| 201 Meat Products | Spoiled Meats, Rotten Eggs and Flesh | Brown to Reddish-Brown | High | Animal Fats, Byproducts, Pieces of Processed Meats | Brown to Black | High | Flourish | Normal | High |
| 202 Dairy Products | Spoiled Milk, Rancid Butter | Gray to White | High | Animal Fats, Spoiled Milk Products | Gray to Light Brown | High | Flourish | Acidic | High |
| 203 Canned and Preserved Fruits and Vegetables | Decaying Products Compost Pile | Various | High | Vegetable Waxes, Seeds, Skins, Cores, Leaves | Brown | Low | Normal | Wide Range | High |
| 204 Grain Mill Products | Slightly Sweet & Musty, Grainy | Brown to Reddish Brown | High | Grain Hulls and Skins, Straw & Plant Fragments | Light Brown | Low | Normal | Normal | High |
| 205 Bakery Products | Sweet and or Spoiled | Brown to Black | High | Cooking Oils, Lard, Flour, Sugar | Gray to Light Brown | Low | Normal | Normal | High |
| 206 Sugar and Confectionary Products | NA | NA | Low | Low Potential | White Crystals | Low | Normal | Normal | High |
| 207 Fats and Oils | Spoiled Meats, Lard or Grease | Brown to Black | High | Animal Fats, Lard | Gray to Light Brown | Low | Normal | Normal | High |
| 208 Beverages | Flat Soda, Beer or Wine, Alcohol, Yeast | Various | Mod. | Grains, Hops, Broken Glass, Discarded Canning Items | Light Brown | High | Inhibited | Wide Range | High |
| 21: Tobacco Manufactures | Dried Tobacco, Cigars, Cigarettes | Brown to Black | Low | Tobacco Stems & Leaves, Papers and Fillers | Brown | Low | Normal | Normal | Low |
| 22: Textile Mill Products | Wet Burlap, Bleach, Soap, Detergents | Various | High | Fibers, Oils, Grease | Gray to Black | Low | Inhibited | Basic | High |
| 23: Apparel and Other Finished Products | NA | Various | Low | Some Fabric Particles | NA | Low | Normal | Normal | Low |
| **Material Manufacture** | | | | | | | | | |
| 24: Lumber & Wood Products | NA | NA | Low | Some Sawdust | Light Brown | Low | Normal | Normal | Low |
| 25: Furniture & Fixtures | Various | Various | Low | Some Sawdust, Solvents | Light Brown | Low | Normal | Normal | Low |
| 26: Paper & Allied Products | Bleach, Various Chemicals | Various | Mod. | Sawdust, Pulp Paper, Waxes, Oils | Light Brown | Low | Normal | Wide Range | Low |
| 27: Printing, Publishing, and Allied Industries | Ink, Solvents | Brown to Black | Mod. | Paper Dust, Solvents | Gray to Light Brown | Low | Inhibited | Normal | High |
| 31: Leather & Leather Products | Leather, Bleach, Rotten Eggs or Flesh | Various | High | Animal Flesh & Hair, Oils, Grease | Gray to Black, Salt Crystals | High | Highly Inhibited | Wide Range | High |
| 33: Primary Metal Industries | Various | Brown to Black | Mod. | Ore, Coke, Limestone, Millscale, Oils | Gray to Black | High | Inhibited | Acidic | High |

| Table K.1: Chemical and Physical Properties of Industrial Non-Storm Water Discharges | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Industrial Categories Major Classifications SIC Group Numbers** | **Odor** | **Color** | **Turbidity** | **Floatables** | **Debris and Stains** | **Structural Damage** | **Vegetation** | **pH** | **Total Dissolved Solids** |
| 34: Fabricated Metal Products | Detergents, Rotten Eggs | Brown to Black | High | Dirt, Grease, Oils, Sand, Clay Dust | Gray to Black | Low | Inhibited | Wide Range | High |
| 32: Stone, Clay, Glass, and Concrete Products | Wet Clay, Mud, Detergents | Brown to Reddish-Brown | Mod. | Glass Particles Dust from Clay or Stone | Gray to Light Brown | Low | Normal | Basic | Low |
| **Chemical Manufacture** | | | | | | | | | |
| 28: Chemicals & Allied Products | | | | | | | | | |
| 2812 Alkalies and Chlorine | Strong Halogen or Chlorine, Pungent, Burning | Alkalies – NA; Chlorine - Yellow to Green | Low | NA | Alkalies – White Carbonate Scale Chlorine - NA | High | Highly Inhibited | Basic | High |
| 2816 Inorganic Pigments | NA | Various | High | Low Potential | Various | Low | Highly Inhibited | Wide Range | High |
| 282 Plastic Materials and Synthetics | Pungent, Fishy | Various | High | Plastic Fragments, Pieces of Synthetic Products | Various | Low | Inhibited | Wide Range | High |
| 283 Drugs | NA | Various | High | Gelatin Byproducts for Capsulating Drugs | Various | Low | Highly Inhibited | Normal | High |
| 284 Soap, Detergents & Cleaning Preparations | Sweet or Flowery | Various | High | Oils, Grease | Gray to Black | Low | Inhibited | Basic | High |
| 285 Paints, Varnishes, Lacquers, Enamels and Allied Products (SB - Solvent Base) | Latex - Ammonia SB - Dependent Upon Solvent (Paint Thinner, Mineral Spirits) | Various | High | Latex - NA SB - All Solvents | Gray to Black | Low | Inhibited | Latex-Basic SB - Normal | High |
| 286 Indust. Organic Chemicals | | | | | | | | | |
| 2861 Gum and Wood Chemicals | Pine Spirits | Brown to Black | High | Rosins and Pine Tars | Gray to Black | Low | Inhibited | Acidic | High |
| 2865 Cyclic Crudes, & Cyclic Intermediates Dyes, & Organic Pigments | Sweet Organic Smell | NA | Low | Translucent Sheen | NA | Low | Highly Inhibited | Normal | Low |
| 287 Agricultural Chemicals | | | | | | | | | |
| 2873 Nitrogenous Fertilizers | NA | NA | Low | NA | White Crystalline Powder | High | Inhibited | Acidic | High |
| 2874 Phosphatic Fertilizers | Pungent Sweet | Milky White | High | NA | White Emorphous Powder | High | Inhibited | Acidic | High |
| 2875 Fertilizers, Mixing Only | Various | Brown to Black | High | Pelletized Fertilizers | Brown Emorphous Powder | Low | Normal | Normal | High |
| 29: Petroleum Refining and Related Industries | | | | | | | | | |
| 291 Petroleum Refining | Rotten Eggs, Kerosene, Gasoline | Brown to Black | High | Any Crude or Processed Fuel | Black Salt Crystals | Low | Inhibited | Wide Range | High |

| Table K.1: Chemical and Physical Properties of Industrial Non-Storm Water Discharges | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Industrial Categories Major Classifications SIC Group Numbers** | **Odor** | **Color** | **Turbidity** | **Floatables** | **Debris and Stains** | **Structural Damage** | **Vegetation** | **pH** | **Total Dissolved Solids** |
| 30 Rubber & Miscellaneous Plastic Products | Rotten Eggs, Chlorine, Peroxide | Brown to Black | Mod. | Shredded Rubber Pieces of Fabric or Metal | Gray to Black | Low | Inhibited | Wide Range | High |
| **Transportation & Construction** | | | | | | | | | |
| 15 Building Construction | Various | Brown to Black | High | Oils, Grease, Fuels | Gray to Black | Low | Normal | Normal | High |
| 16 Heavy Construction | Various | Brown to Black | High | Oils, Grease, Fuels, Diluted Asphalt or Cement | Gray to Black | Low | Normal | Normal | High |
| **Retail** | | | | | | | | | |
| 52 Building Materials, Hardware, Garden Supply, and Mobil Home Dealers | NA | Brown to Black | Low | Some Seeds, Plant Parts, Dirt, Sawdust, or Oil | Light Brown | Low | Normal | Normal | Low |
| 53 Gen. Merchandise Stores | NA | NA | NA | NA | NA | Low | Normal | Normal | Low |
| 54 Food Stores | Spoiled Produce, Rancid, Sour | Various | Low | Fragments of Food, Decaying Produce | Light Brown | Low | Flourish | Normal | Low |
| 55 Automotive Dealers & Gasoline Service Stations | Oil or Gasoline | Brown to Black | Mod. | Oil or Gasoline | Brown | Low | Inhibited | Normal | Low |
| 56 Apparel & Accessory Stores | NA | NA | Low | NA | NA | Low | Normal | Normal | Low |
| 57 Home Furniture, Furnishings, & Equip. Stores | NA | NA | Low | NA | NA | Low | Normal | Normal | Low |
| 58 Eating & Drinking Places | Spoiled Foods Oil & Grease | Brown to Black | Low | Spoiled or Leftover Foods | Brown | Low | Normal | Normal | Low |
| **Coal Steam Electric Power** | NA | Brown to Black | High | Coal Dust | Black Emorphous Powder | Low | Normal | Slightly Acidic | Low |
| **Nuclear Steam Electric Power** | NA | Light Brown | Low | Oils, Lubricants | Light Brown | Low | Normal | Normal | Low |

*Other Chemicals Indicative of Manufacturing Industrial Activities*
Table K.2 lists the various chemicals that may be associated with a variety of different industrial activities. It may be possible to examine non-storm water outfall flow for specific chemicals, such as shown on this list to identify which specific manufacturing industrial activities may be contributing the flows.

## Example Problems for Locating an Industrial Source

*Locating An Industrial Source*
Hypothetical examples have been created to demonstrate how dry weather discharges can be characterized so that their likely industrial sources can be identified. These examples show how observations of outfall conditions and simple chemical analyses, combined with a basic knowledge of wastewater characteristics of industrial and commercial operations located in the drainage area can be used to identify the possible pollutant sources. The initial activities include pollutant analyses of outfalls being investigated. This requires the characterization on the non-storm water flows, the identification of the likely industries responsible for the observed discharges, and finally, locating the possible specific sources in the watershed.

The industries identified in a hypothetical storm water drainage area (from the watershed analysis) included a vegetable cannery, general food store, fast food restaurant, cheese factory, used car dealer, cardboard box producer, and a wood treatment company. The methods used to determine the most likely industrial source of the dry weather discharges are considered for three hypothetical situations of outfall contamination.

*Case Example 1*
The hypothetical results of the pollutant analysis for the first situation found constant dry weather flow at the outfall. The measurements indicated a normal pH (6) and low total dissolved solids concentrations (300 mg/L). Other outfall characteristics included a strong odor of bleach, no distinguishing color, moderate turbidity, sawdust floatables, a small amount of structural corrosion, and normal vegetation.

The significant characteristic in this situation is the sawdust floatables (see Figure K.2). The industries that could produce sawdust and have dry weather flow drainage to this pipe are the cardboard box company and the wood treatment company. According to their SIC codes, these companies would fall under the category of "Paper and Wood Products." Looking up these two industries by their corresponding SIC group numbers in Table K.1 and comparing the listed properties indicates that the paper industry has a strong potential for the odor of bleach. Wood products does not indicate any particular smell.

Based upon these data, the most likely industrial source of the non-storm water discharge would be the cardboard box company. Table A.1 (Appendix A) indicates a high potential for direct connections at paper and wood product facilities. At this point, further testing should be conducted at the cardboard box company to determine if the constant source of contamination is coming from cooling waters, process waters, or direct piping connections (process waters are the most likely source, given the bleach and sawdust characteristics).

| Table K.2: Significant Chemicals in Industrial Wastewaters | |
|---|---|
| **Chemical** | **Industry** |
| Acetic acid | Acetate rayon, pickle and beetroot manufacture |
| Alkalies | Cotton and straw kiering, cotton manufacture, mercerizing, wool scouring, laundries |
| Ammonia | Gas and coke manufacture, chemical manufacture |
| Arsenic | Sheep-dipping, fell mongering |
| Chlorine | Laundries, paper mills, textile bleaching |
| Chromium | Plating, chrome tanning, aluminum anodizing |
| Cadmium | Plating |
| Citric acid | Soft drinks and citrus fruit processing |
| Copper | Plating, pickling, rayon manufacture |
| Cyanides | Plating, metal cleaning, case-hardening, gas manufacture |
| Fats, oils | Wool scouring, laundries, textiles, oil refineries |
| Fluorides | Gas and coke manufacture, chemical manufacture, fertilizer plants, transistor manufacture, metal refining, ceramic plants, glass etching |
| Formalin | Manufacture of synthetic resins and penicillin |
| Hydrocarbons | Petrochemical and rubber factories |
| Hydrogen peroxide | Textile bleaching, rocket motor testing |
| Lead | Battery manufacture, lead mining, paint manufacture, gasoline, manufacture |
| Mercaptans | Oil refining, pulp mills |
| Mineral acids | Chemical manufacture, mines, Fe and Cu pickling, brewing, textiles, photo-engraving, battery manufacture |
| Nickel | Plating |
| Nitro compounds | Explosives and chemical works |
| Organic acids | Distilleries and fermentation plants |
| Phenols | Gas and coke manufacture; synthetic resin manufacture; textiles; tanneries; tar, chemical, and dye manufacture; sheep-dipping |
| Silver | Plating, photography |
| Starch | Food, textile, wallpaper manufacture |
| Sugars | Dairies, foods, sugar refining, preserves, wood process |
| Sulfides | Textiles, tanneries, gas manufacture, rayon manufacture |
| Sulfites | Wood process, viscose manufacture, bleaching |
| Tannic acid | Tanning, sawmills |
| Tartaric acid | Dyeing; wine, leather, and chemical manufacture |
| Zinc | Galvanizing, plating, viscose manufacture, rubber process |

*Source*: Klein (1962). *River Pollution 2: Causes and Effects*. Butterworth & Co. presented in *The Water Encyclopedia*, D. Todd, Water Information Center, Port Washington, N.Y., 1979.

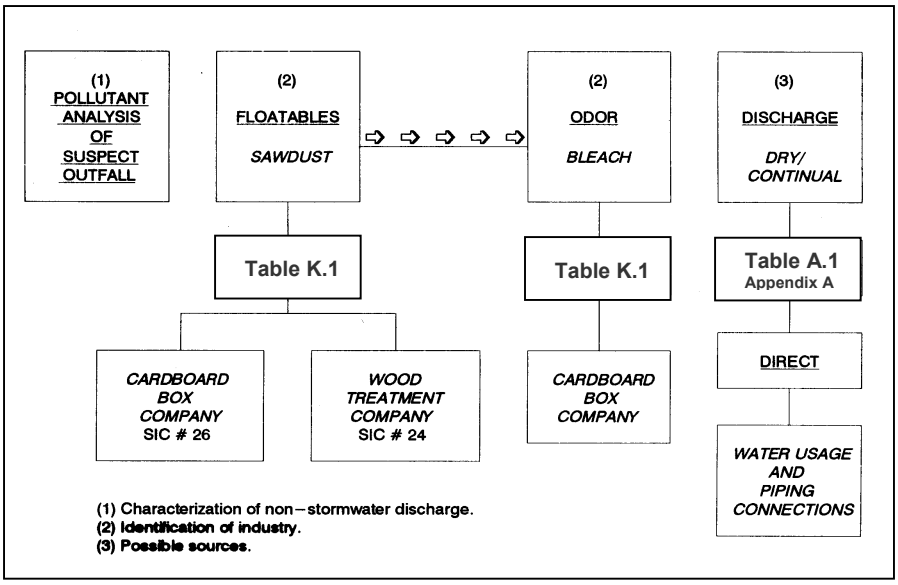



**Figure K.2: Flowsheet for Case Example 1**

*Case Example 2*

Pollutant analysis for the second situation found intermittent dry weather discharges at the outfall. The test measurements indicated an acidic pH (3) and high total dissolved solids concentrations (approximately 6,000 mg/L). Other characteristics included a rancid-sour odor, grayish color, high turbidity, gray deposits containing white gelatin-like floatable material, structural damage in the form of spalling concrete, and an unusually large amount of plant life.

The rancid-sour smell and the presence of floatable substances at this outfall indicate that some type of food product is probably spoiling. This narrows the possible suspect industries to the fast food restaurant, cheese factory, vegetable cannery, and food store (see Figure K.3). The corresponding SIC categories for each of these industries are "Eating and Drinking Places" (SIC# 58), "Dairy Products" (SIC# 202), "Canned and Preserved Fruits and Vegetables" (SIC# 203), and "Food Stores" (SIC# 54).

Comparison of the properties listed in Table K.1 for these SIC codes indicates that elevated plant life is common to industrial wastes for the "Dairy Products" and "Food Stores" categories. However, the deciding factor is the acidic pH, which is only listed for "Dairy Products". Thus, the white gelatin-like floatables are most likely spoiled cheese byproducts from the cheese factory, which are also the probable cause of the sour-rancid smell.

Since dry weather entry to the storm drainage system occurs intermittently, flow could be caused by either a direct or indirect connection. To locate the ultimate source of this discharge coming from the cheese factory, both direct and indirect industrial situations are considered under the category of "Food Processing" with SIC code of 2020 in Table A1 (see Appendix A). Thus, further examination of the loading dock procedures, water usage, and direct piping connections should be conducted since these categories all exhibit some potential for pollution in dairy production.

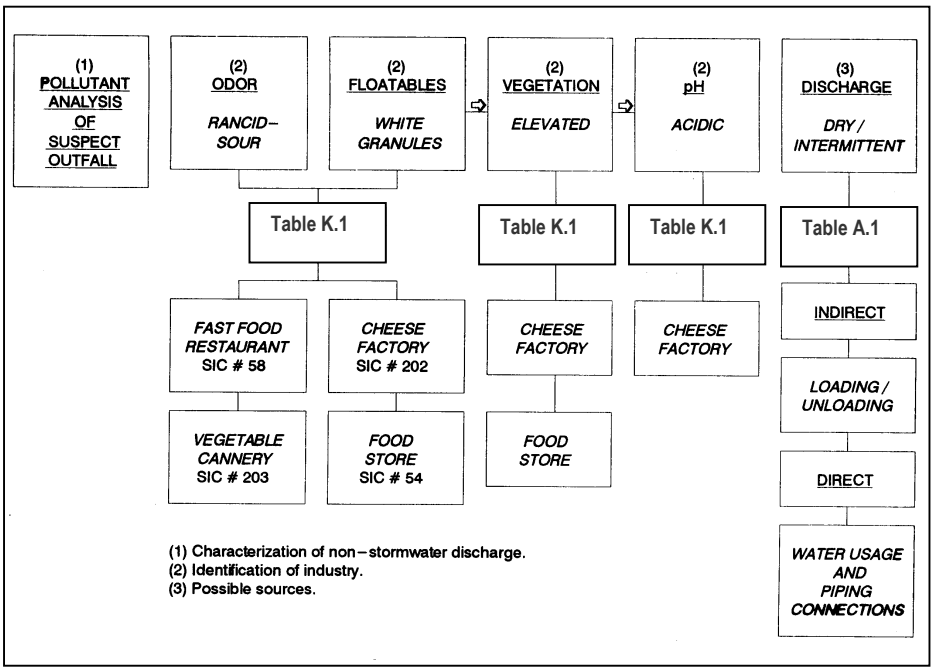



**Figure K.3: Flowsheet for Case Example 2**

*Case Example 3*

The results of the test measurements for the final situation found a normal pH (6) and low total dissolved solids (about 500 mg/L). Signs of contaminated discharges were found at the outfall only during and immediately following rainfalls. Other outfall properties observed included an odor of oil, deep brown to black color, a floating oil film, no structural damage, and inhibited plant growth (see Figure K.4).

According to Table K.1, the fast food restaurant and the used car dealer are the only two industrial sources in this hypothetical drainage area with a high potential for causing oily discharges. Their respective SIC categories are "Eating and Drinking Places" (SIC# 58) and "Automotive Dealers" (SIC# 55). Comparison of the properties shown in Table K.1 indicates inhibited vegetation only for the second category. Thus, the most likely source of the discharge is the used car dealer.

Furthermore, the source of contamination must likely be indirect, since the discharge occurs only during wet weather. Reference to Table A.1 (see Appendix A) under the category of "Car Dealers," indicates a medium potential for indirect contamination. This fact, plus the knowledge that most used cars are displayed outdoors, makes it clear that surface runoff is probably carrying spilled automotive oil into the storm drain during rains.

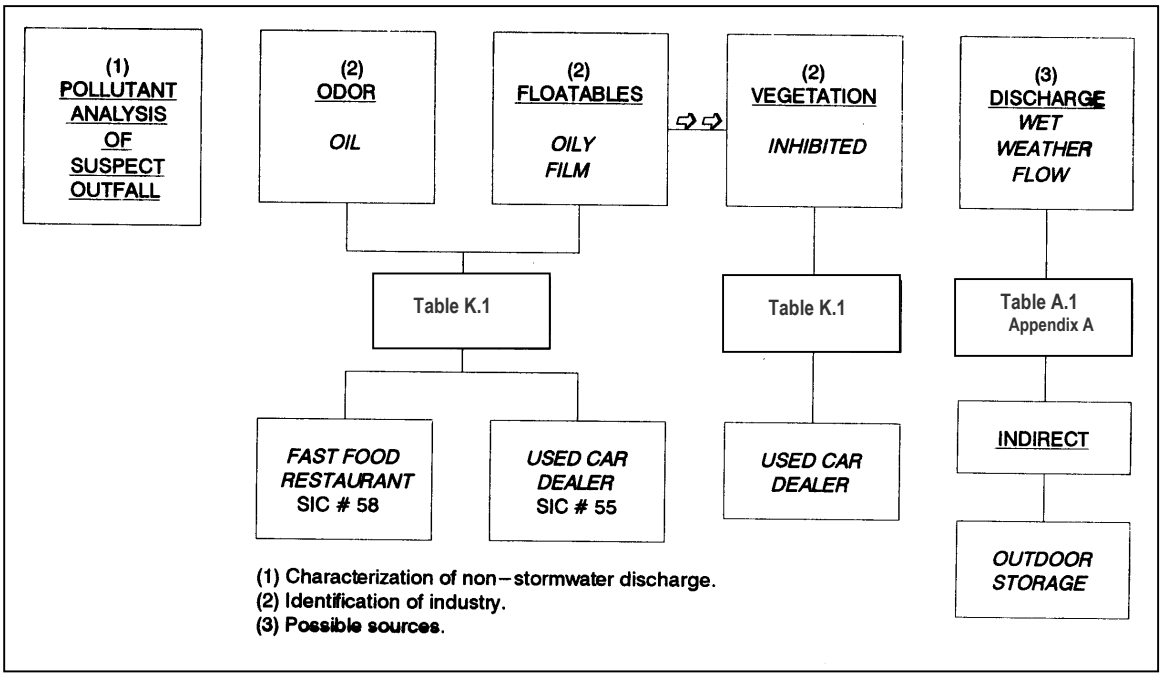



**Figure K.4: Flowsheet for Case Example 3**

## References

Bannerman, R. 2003. Personal communication with Dr. Robert Pitt, University of Alabama.

Klein, L. 1962. "River Pollution 2: Causes and Effects." in D. Todd. 1979. The Water Encyclopedia. Water Information Center. Port Washington, N.Y.

Pitt, R. 2001. *Methods for Detection of Inappropriate Discharges to Storm Drainage Systems: Background Literature and Summary of Findings*. IDDE Project Support Material.

# ATTACHMENT 7

# ILLICIT DISCHARGE REPORTS

See Town Clerk for copy of this report as it relates to stormwater outfall inspections.

# ATTACHMENT 8

# TOWN OF NEWBURGH
# STORMWATER MANAGEMENT AND ILLICIT DISCHARGE CODE AND REQUIREMENTS

# Chapter 157

# STORMWATER MANAGEMENT


ARTICLE I
**Stormwater Management Regulations**

**§ 157-1. Purpose.**
**§ 157-2. Objectives.**
**§ 157-3. Definitions and word usage.**
**§ 157-4. Applicability.**
**§ 157-5. Contents of stormwater management plan.**
**§ 157-6. Design standards.**
**§ 157-7. Performance standards.**
**§ 157-8. Easements and dedications.**
**§ 157-9. Maintenance.**
**§ 157-10. Performance security.**
**§ 157-11. Procedures and fees.**
**§ 157-12. Inspections and enforcement; penalties for offenses.**
**§ 157-13. Appeals.**

ARTICLE II
**Illicit Discharges, Activities and Connections to Separate Storm Sewer System**

**§ 157-14. Purpose.**
**§ 157-15. Definitions.**
**§ 157-16. Applicability.**
**§ 157-17. Responsibility for administration.**
**§ 157-18. Severability.**
**§ 157-19. Discharge and connection prohibitions; exceptions.**
**§ 157-20. Failing individual sewage treatment systems prohibited.**
**§ 157-21. Activities contaminating stormwater prohibited.**
**§ 157-22. Use of best management practices to prevent control, and reduce stormwater pollutants required.**
**§ 157-23. Suspension of access to MS4.**
**§ 157-24. Industrial or construction activity discharges.**
**§ 157-25. Access and monitoring of discharges.**
**§ 157-26. Notification of spills.**
**§ 157-27. Enforcement.**
**§ 157-28. Appeal of notice of violation.**
**§ 157-29. Corrective measures after appeal.**
**§ 157-30. Injunctive relief.**
**§ 157-31. Alternative remedies.**
**§ 157-32. Violations deemed public nuisance.**
**§ 157-33. Remedies not exclusive.**


**[HISTORY: Adopted by the Town Board of the Town of Newburgh as indicated in article histories. Amendments noted where applicable.]**

**GENERAL REFERENCES**

**Building construction — See Ch. 71.**

**Clearing and grading — See Ch. 83.**

**Environmental quality review — See Ch. 100.**

**Flood damage prevention — See Ch. 109.**

**Subdivision of land — See Ch. 163.**

**Zoning — See Ch. 185.**

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ARTICLE I
**Stormwater Management Regulations**
**[Adopted 5-15-1995 by L.L. No. 4-1995; amended in its entirety 12-21-2009 by L.L. No. 14-2009]**

## § 157-1. Purpose.

It is the purpose of these regulations to:

A. Establish minimum acceptable standards for stormwater management within the Town of Newburgh. These minimum acceptable standards must be met and paid for by the person or firm proposing the subdivision, development and/or site plan where the facilities will be used.

B. The amended limitations on construction of stormwater management facilities imposed herein specifically do not apply to mapped subdivisions, developments and site plans which have been finally approved by the Town of Newburgh Planning Board or other authorized authority for which a final map has been filed in the office of the Orange County Clerk or Town offices, as required by law. Previously enacted limitations remain in effect for those projects.

C. Meet the requirements of minimum measures 4 and 5 of the SPDES General Permit for Stormwater Discharges from Municipal Separate Stormwater Sewer Systems (MS4s), Permit No. GP 0-08-002 or as amended or revised.

D. Require land development activities to conform to the substantive requirements of the NYS Department of Environmental Conservation State Pollutant Discharge Elimination System (SPDES) General Permit for Construction Activities GP-0-08-001 or as amended or revised.

E. Minimize increases in stormwater runoff from land development activities in order to reduce flooding, siltation, increases in stream temperature, and stream bank erosion and maintain the integrity of stream channels.

F. Minimize increases in pollution caused by stormwater runoff from land development activities which would otherwise degrade local water quality.

G. Maintain the total annual volume of stormwater runoff which flows from any specific site during and following development to the maximum extent practicable.

H. Maintain stormwater runoff rates and volumes, minimize soil erosion and nonpoint source pollution, wherever possible, through stormwater management practices and to ensure that these management practices are properly maintained and eliminate threats to public safety.

## § 157-2. Objectives.

Since improperly managed stormwater runoff can increase the incidence of flooding and erosion which can adversely affect human life, flora and fauna, these regulations have the following objectives:

A. To protect, maintain and enhance both the immediate and long-term health, safety and general welfare of the citizens of the Town of Newburgh.

B. To prevent damage from flooding.

C. To protect, restore and maintain the chemical, physical and biological integrity of community waters.

D. To encourage protection of natural drainage systems, such as wetlands, and use them in ways that do

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not impair their beneficial functioning.

E. To protect, restore and maintain the habitat of fish and wildlife.

F. To assure the attainment of these objectives by requiring the approval and implementation of SWPPP's for all activities which may adversely impact surrounding areas.

**§ 157-3. Definitions and word usage.**

Unless specifically defined below, words or phrases shall be interpreted so as to give them the meanings they have in common usage and to give these regulations their most effective application. Words used in the singular shall include the plural, and the plural shall include the singular; words used in the present tense shall include the future tense. The word "shall" connotes mandatory and not discretionary; the word "may" is permissive.

ADVERSE IMPACTS — Any modifications, alterations or effects on a feature or characteristic of public waters, wetlands or adjacent lands, including their quality, quantity, hydrology, surface area, species composition, living resources, aesthetics or usefulness for human or natural uses which are or may potentially be harmful or injurious to human health, welfare, safety or property, to biological productivity, diversity or stability or which unreasonably interfere with the enjoyment of life or property, including outdoor recreation.

AGRICULTURAL ACTIVITY — The activity of an active farm, including grazing and watering livestock, irrigating crops, harvesting crops, using land for growing agricultural products, and cutting timber for sale, but shall not include the operation of a dude ranch or similar operation, or the construction of new structures associated with agricultural activities.

APPLICANT — A property owner or agent of a property owner who has filed an application for a land development activity.

BUILDING — Any structure, either temporary or permanent, having walls and a roof, designed for the shelter of any person, animal or property, and occupying more than 100 square feet of area.

CHANNEL — A natural or artificial watercourse with a definite bed and banks that conducts continuously or periodically flowing water.

CLEARING — Any activity that removes the vegetative surface cover.

DAM — Any artificial barrier, including any earthen barrier, together with its appurtenant works, which impounds or will impound water.

DEDICATION — The deliberate appropriation of property by its owner for general public use.

DEPARTMENT — The New York State Department of Environmental Conservation.

DESIGN MANUAL — The New York State Stormwater Management Design Manual, most recent version, including applicable updates, that serves as the official guide for stormwater management principles, methods and practices.

DETENTION STRUCTURE — A permanent structure for the temporary storage of runoff, designed so as not to create a permanent pool of water, which gradually releases water over 24 hours at a rate not exceeding the predevelopment rate of runoff. This structure is used to control the peak discharge rates of stormwater and provide gravity settling of pollutants.

DEVELOPER — Any person who engages in development either as the owner or the agent of the owner of property.

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DEVELOPMENT or DEVELOPMENT ACTIVITY —

A. Construction, installation, alteration, demolition or removal of a structure, impervious surface or drainage facility;

B. Clearing, scraping, grubbing or otherwise removing or killing the vegetation of a site; or

C. Adding, removing, exposing, excavating, leveling, grading, digging, burrowing, dumping, piling, dredging or otherwise significantly disturbing the soil, mud, sand or rock of a site.

DRAINAGE FACILITY — Any component of the drainage system.

DRAINAGE SYSTEM — The system through which the water flows from the land. It includes stormwater, watercourses, water bodies, groundwater and wetlands.

EROSION — The wearing away or washing away of soil by the action of wind or water.

EROSION CONTROL MANUAL — The most recent version of the New York Standards and Specifications for Erosion and Sediment Control Manual, commonly known as the "Blue Book."

FLOOD — The temporary rise in the level of any water body, watercourse or wetland which results in the inundation of areas not ordinarily covered by water.

GRADING — Excavation or fill of material, including the resulting conditions thereof.

IMPERVIOUS COVER — Those surfaces, improvements and structures that cannot effectively infiltrate rainfall, snow melt and water (e.g., building rooftops, pavement, sidewalks, driveways, etc.).

IMPERVIOUS SURFACE — A surface which has been compacted or covered with a layer of material so that it is highly resistant to infiltration by water. It includes semi-impervious areas such as compacted clay, as well as most conventionally surfaced streets, roofs, sidewalks, parking lots and other similar structures.

INDUSTRIAL STORMWATER PERMIT — A State Pollutant Discharge Elimination System permit issued to a commercial industry or group of industries which regulates the pollutant levels associated with industrial stormwater discharges or specifies pollution control strategies.

INFILTRATION — The process of percolating stormwater into the subsoil.

INFILTRATION BASIN — A permanent structure designed to recharge stormwater runoff to groundwater.

JURISDICTIONAL WETLAND — An area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions, commonly known as "hydrophytic vegetation."

LAND DEVELOPMENT ACTIVITY — Construction activity, including clearing, grading, excavating, soil disturbance or placement of fill, that results in land disturbance of equal to or greater than one acre, or activities disturbing less than one acre of total land area that is part of a larger common plan of development or sale, even though multiple separate and distinct land development activities may take place at different times on different schedules.

MAINTENANCE AGREEMENT — A legally recorded document that acts as a property deed restriction, and which provides for long-term maintenance of stormwater management practices.

NATURAL SYSTEMS — Systems which predominately consist of or use those communities of plants, animals, bacteria and other flora and fauna which occur indigenously on the land, in the soil or in the water.

NONPOINT SOURCE POLLUTION — Pollution from any source other than from any discernible, confined and discrete conveyances, and shall include, but not be limited to, pollutants from agricultural,

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silvicultural, mining, construction, subsurface disposal and urban runoff sources.

OWNER — The person in whom is vested the fee ownership, dominion or title of property, i.e., the proprietor. This term may also include a tenant, if chargeable under his lease for the maintenance of the property, and any agent of the owner or tenant, including a developer.

PERSON — Any and all persons, natural or artificial, and includes any individual, firm, corporation, government agency, business trust, partnership, association, two or more persons having a joint or common interest or any other legal entity.

PHASING — Clearing a parcel of land in distinct pieces or parts, with the stabilization of each piece completed before the clearing of the next.

POLLUTANT OF CONCERN — Sediment or a water quality measurement that addresses sediment (such as total suspended solids, turbidity or siltation) and any other pollutant that has been identified as a cause of impairment of any water body that will receive a discharge from the land development activity.

PROJECT — Land development activity.

RECHARGE — The replenishment of underground water reserves.

RECEIVING BODIES OF WATER — Any water bodies, watercourses or wetlands into which surface waters flow either naturally, in man-made ditches or in closed conduit systems.

RETENTION STRUCTURE — A permanent structure which provides for the storage of runoff by means of a permanent pool of water without release except by means of evaporation, infiltration or attenuated release when runoff volume exceeds the permanent storage capacity.

SEDIMENT — The fine particulate material, whether mineral or organic, that is in suspension or has settled in a water body.

SEDIMENT CONTROL — Measures that prevent eroded sediment from leaving the site.

SEDIMENT FACILITY — Any structure or area which is designed to hold runoff water until suspended particles have settled.

SENSITIVE AREAS — Cold water fisheries, shellfish beds, swimming beaches, groundwater recharge areas, water supply reservoirs, and habitats for threatened, endangered or special-concern species.

SITE — Any tract, lot or parcel of land, or combination of tracts, lots or parcels of land, which are in one ownership or are contiguous and in diverse ownership where development is to be performed as part of a unit, subdivision or project.

SPDES GENERAL PERMIT FOR CONSTRUCTION ACTIVITIES GP-0-08-001 — A permit under the New York State Pollutant Discharge Elimination System (SPDES) issued to developers of construction activities to regulate disturbance of one or more acres of land.

SPDES GENERAL PERMIT FOR STORMWATER DISCHARGES FROM MUNICIPAL SEPARATE STORMWATER SEWER SYSTEMS GP-0-08-002 — A permit under the New York State Pollutant Discharge Elimination System (SPDES) issued to municipalities to regulate discharges from municipal separate storm sewers for compliance with EPA established water quality standards and/or to specify stormwater control standards.

STABILIZATION — The use of practices that prevent exposed soil from eroding.

STOP-WORK ORDER — An order issued which requires that all construction activity on a site be stopped.

STORMWATER — Rainwater, surface runoff, snowmelt and drainage.

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STORMWATER HOTSPOT — A land use or activity that generates higher concentrations of hydrocarbons, trace metals or toxicants than are found in typical stormwater runoff, based on monitoring studies.

STORMWATER MANAGEMENT — The use of structural or nonstructural practices that are designed to reduce stormwater runoff and mitigate its adverse impacts on property, natural resources and the environment.

STORMWATER MANAGEMENT FACILITY — One or a series of stormwater management practices installed, stabilized and operating for the purpose of controlling stormwater runoff.

STORMWATER MANAGEMENT OFFICER — The Town of Newburgh Building Inspector or other employee or officer designated by the Town Board to accept and review stormwater pollution prevention plans, forward the plans to the applicable municipal board and inspect stormwater management practices.

STORMWATER MANAGEMENT PLAN — The detailed analysis of stormwater and drainage as described in and required by these regulations.

STORMWATER MANAGEMENT PRACTICES — Measures, either structural or nonstructural, that are determined to be the most effective, practical means of preventing flood damage and preventing or reducing point source or monopoint source pollution inputs to stormwater runoff and water bodies.

STORMWATER POLLUTION PREVENTION PLAN (SWPPP) — A plan for controlling stormwater runoff and pollutants from a site during and after construction activities.

STORMWATER RUNOFF — Flow on the surface of the ground, resulting from precipitation.

STRUCTURE — That which is built or constructed, an edifice or building or any piece of work artificially built or composed of parts joined together in some definite manner, but shall not include fences or signs.

SURFACE WATERS OF THE STATE OF NEW YORK —

A. Lakes, bays, sounds, ponds, impounding reservoirs, springs, wells, rivers, streams, creeks, estuaries, marshes, inlets, canals, the Atlantic Ocean within the territorial seas of the State of New York and all other bodies of surface water, natural or artificial, inland or coastal, fresh or salt, public or private (except those private waters that do not combine or effect a junction with natural surface or underground waters), which are wholly or partially within or bordering the state or within its jurisdiction.

B. Storm sewers and waste treatment systems, including treatment ponds or lagoons which also meet the criteria of this definition, are not waters of the state. This exclusion applies only to man-made bodies of water which neither were originally created in waters of the state (such as a disposal area in wetlands) nor resulted from impoundment of waters of the state.

TOWN ENGINEER — The duly appointed Town Engineer of the Town of Newburgh or his designated representative.

VEGETATION — All plant growth, including trees, shrubs, herbs, vines, ferns, mosses and grasses.

WATER BODY — Any natural or artificial pond, lake, reservoir or other area which ordinarily or intermittently contains water and which has a discernible shoreline.

WATERCOURSE — A permanent or intermittent stream or other body of water, either natural or man-made, which gathers or carries surface water.

WATERSHED — A drainage area or basin contributing to the flow of water in a receiving body of water.

WATERS or PUBLIC WATERS — Any and all water on or beneath the surface of the ground. It includes

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the water in any watercourse, water body or drainage system. It also includes diffused surface water and water standing, percolating or flowing beneath the surface of the ground.

WATERWAY — A channel that directs surface runoff to a watercourse or to the public storm drain.

WETLANDS — Any area meeting the requirements of the Federal Manual for Identifying and Delineating Jurisdictional Wetlands (latest edition), and/or any area identified by the New York State Department of Environmental Conservation (NYSDEC) as being a state-protected wetland.

### § 157-4. Applicability.

A. Unless exempted pursuant to Subsection B, a stormwater management plan must be submitted and approved before:

(1) A plat is recorded or land is subdivided;

(2) An existing drainage system is altered, rerouted, deepened, widened, enlarged, decreased or obstructed;

(3) The issuance of a building permit;

(4) A site plan approval or special use permit is granted by the Planning Board;

(5) Approval of a plan which proposes construction of a Town or private road;

(6) The issuance of a clearing or grading permit; or

(7) All land development activities, as defined in § 157-3 above, not otherwise subject to the approvals and permits listed in this Subsection A, are commenced.

B. Exemptions. The following development activities are exempt from the stormwater management plan requirements:

(1) Developments which do not disturb more than 10,000 square feet.

(2) Agricultural land-management activities.

(3) Any maintenance, alteration, use or improvement to an existing structure not changing or affecting quality, rate or location of surface water discharge.

(4) Residential developments consisting of single-family dwellings, which disturb less than one acre and not requiring construction of any new public or private road and not part of a larger development scheme which resulted or will result in cumulatively greater than one acre of disturbance. **[Amended 11-7-2011 by L.L. No. 8-2011]**

(5) Silvicultural activity.

(6) Routine maintenance activities that disturb less than one acre and are performed to maintain the original line and grade, hydraulic capacity or original purpose of a facility.

(7) Repairs to any stormwater management practice or facility deemed necessary by the Stormwater Management Officer or the Town's consultant.

(8) Land development activities for which a building permit has been approved on or before the effective date of this article.

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(9) Cemetery graves.

(10) Installation of fence, sign, telephone and electric poles and other kinds of posts or poles.

(11) Emergency activity immediately necessary to protect life, property or natural resources.

(12) Activities of an individual engaging in home gardening by growing flowers, vegetables and other plants primarily for use by that person and his or her family.

(13) Landscaping and horticultural activities in connection with an existing structure.

**§ 157-5. Contents of stormwater management plan.**

A. It is the responsibility of an applicant to include in the stormwater management plan sufficient information for the Town Engineer or his designated representative to evaluate the environmental characteristics of the affected areas, the potential and predicted impacts of the proposed activity on public waters and both public lands and private lands adjacent to the land development activity and the effectiveness and acceptability of those measures proposed by the applicant for reducing adverse impacts. The stormwater management plan shall contain all material necessary to communicate the information required by this section.

(1) All calculations, assumptions, criteria and references used in the design of new facilities, examination of existing facilities and comparison of predevelopment to postdevelopment discharges shall be included with the plan. Data must be provided which documents that new development does not adversely impact adjacent properties.

(2) All stormwater management data must be prepared and sealed by individuals registered in New York State to perform such duties.

B. The stormwater management plan shall contain the name, address and telephone number of the owner and the developer. In addition, the legal description of the property shall be provided, and its location with reference to such landmarks as major water bodies, adjoining roads, railroads, subdivisions or other municipalities shall be clearly identified by a map.

C. The existing environmental and hydrologic conditions of the site and of receiving waters and wetlands shall be described in detail, including the following:

(1) A plan showing the predevelopment conditions of the site at a scale of at least one inch equals 50 feet and a map at a scale of at least one inch equals 500 feet which shows all contributory drainage areas to the study point.

(2) The flow rate of stormwater runoff under existing conditions.

(3) A description of all watercourses, water bodies and wetlands on or adjacent to the site or into which the stormwater flows. Information regarding the existing water quality, if any, and the receiving water quality classification as determined by the NYSDEC shall be included.

(4) Groundwater levels from readily available data sources.

(5) The location of floodplains.

(6) Land cover.

(7) Topography at two-foot contour intervals.

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(8) Soils, including erodibility, percolation rate, depth to groundwater and depth to bedrock, etc.

D. Proposed alterations of the site shall be described in detail and shown on plans at a scale of at least one inch equals 50 feet, including:

(1) Changes in topography, with all grading shown with two-foot contour intervals or less;

(2) Limits of proposed disturbed area;

(3) Proposed ground coverage, i.e., pavement, gravel, houses, buildings, lawns, etc., and their areas;

(4) Construction phasing plan describing the intended sequence of construction activities, including clearing and grubbing, excavation and grading, utility and infrastructure installation and any other activity at the site that results in soil disturbance; consistent with the New York Standards and Specifications for Erosion and Sediment Control (Erosion Control Manual), not more than five acres shall be disturbed at any one time unless pursuant to an approved SWPPP;

(5) Description of the pollution prevention measures that will be used to control litter, construction chemicals and construction debris from becoming a pollutant source in stormwater runoff;

(6) Description of construction and waste materials expected to be stored on site with updates as appropriate, and a description of controls to reduce pollutants from these materials, including storage practices to minimize exposure of the materials to stormwater, and spill prevention and response;

(7) Temporary and permanent structural and vegetative measures to be used for soil stabilization, runoff control and sediment control for each stage of the project from initial land clearing and grubbing to project close-out;

(8) A site map/construction drawing(s) specifying the location(s), size(s) and length(s) of each erosion and sediment control practice;

(9) Dimensions, material specifications and installation details for all erosion and sediment control practices, including the siting and sizing of any temporary sediment basins;

(10) Temporary practices that will be converted to permanent control measures;

(11) Implementation schedule for tagging temporary erosion and sediment control practices, including the timing of initial placement and duration that each practice should remain in place;

(12) Maintenance schedule to ensure continuous and effective operation of the erosion and sediment control practice;

(13) Name(s) of the receiving water(s);

(14) Delineation of SWPPP implementation responsibilities for each part of the site;

(15) Description of structural practices designed to divert flows from exposed soils, store flows or otherwise limit runoff and the discharge of pollutant from exposed areas of the site to the degree attainable; and

(16) Any existing data that describes the stormwater runoff at the site.

E. All components of the drainage system and any measures for the detention, retention or infiltration of water or for the protection of water quality shall be described in detail, including:

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(1) The channel, direction, flow rate and quality of stormwater that will be conveyed from and/or through the site, with a comparison to the existing conditions. (In no case will any facility or construction be allowed that raises the existing water surface elevation on upstream or downstream properties, unless specifically agreed to by those property owners.)

(2) Detention, retention and/or infiltration structures, including plans for the discharge of contained waters, maintenance plans and predictions of water quality in those areas.

(3) A tabulation of water quality volumes and storage, discharge curves with corresponding water surface elevations, inflow hydrographs, outflow hydrographs and dewatering/infiltration times will be required to be submitted with all detention, retention and infiltration facilities.

(4) All plans, with defined subcatchment areas, and profiles of the proposed drainage facilities, including the size and type of material.

(5) Erosion control plans for all development activities.

(6) All calculations and design information in accordance with the design section of these regulations.

(7) General specifications for the construction of all components of the drainage system.

(8) Any other information which the Town Engineer or his designated representative believes is reasonably necessary for evaluation of the plans.

**§ 157-6. Design standards.**

To ensure attainment of the objectives of these regulations and to ensure that performance standards will be met, the design, construction and maintenance of drainage systems shall be consistent with the following standards:

A. In the interest of reducing the total area of impervious surface, preserving existing features, which are critical to stormwater management, and reducing the concentration of stormwater flow, maximum use shall be made of existing on-site natural and man-made stormwater management facilities.

B. Innovative stormwater management facilities may be proposed (e.g., rooftop storage, underground storage structures and infiltration systems), provided that they are accompanied by detailed engineering plans and demonstrate performance capabilities that are acceptable to the Town Engineer or his designated representative.

C. Stormwater management facilities shall be provided so the peak discharge of the calculated postdevelopment runoff to an adjacent property, watercourse or water body does not exceed the peak discharge of the predevelopment runoff. Point discharge of stormwater runoff to an adjacent property, watercourse or water body will not be allowed in the postdevelopment design if one did not exist in the predevelopment condition. Point discharge is required to be returned to sheet flow or an easement will be required to be obtained from the adjoining property owner if this condition cannot be met. Calculating and supporting documentation and designs will be required regarding point discharges being returned to sheet flows.

D. Runoff calculations for the predevelopment and postdevelopment comparison shall consider the 90% storm event one- , ten- , twenty-five-year for pipe sizing, and one-hundred-year storm frequencies.

E. For predevelopment computations, all runoff coefficients within the study area shall be based on

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actual land use conditions.

F. Stormwater management practices in compliance with NYSDEC standards and guidelines and other approved alternatives shall be used to retain and detain the increased and accelerated runoff and reduce pollutants in runoff which the development generates. Water shall be released from these areas at a rate equal to or less than the predevelopment conditions of the storm event. Measures shall be taken to protect the outfall area from erosion. Water quality volume shall be addressed by any proposed postdevelopment design.

G. Retention/detention basins shall be designed to safely discharge the peak discharge from the postdevelopment one-hundred-year storm frequency event through an emergency spillway in a manner which will not damage the integrity of the basin or cause damage to adjoining properties.

H. Retention/detention basins shall be landscaped in accordance with current engineering practices, the New York guidelines for Erosion and Sediment Control and any additional landscaping requirements imposed by a reviewing board of the Town pursuant to its authority.

I. Retention/detention basins which may be used to collect sediment during construction operations must have all sediment removed at any time that it is at 60% of its original capacity. Upon completion of all construction, any sediment in the basin must be removed and the basin shall be reshaped to the design dimensions and stabilized. A maintenance schedule must be provided that indicates how often the basin is to be cleaned thereafter and who is responsible for maintaining it.

J. Retention/detention basins which are designed with a dam shall incorporate the following minimum standards:

(1) The maximum water depth shall not exceed 10 feet unless approved by waiver of the Town Board.

(2) The minimum top width of dams shall be 10 feet.

(3) The side slopes of earth fill dams shall not be steeper than three feet horizontal to one foot vertical on the downstream side of the embankment.

(4) Basins designed with permanent opened water shall be fenced.

(5) A cutoff trench of impervious material shall be provided under all dams.

(6) All pipes and culverts through dams shall have properly spaced cutoff collars or factory welded antiseep collars.

(7) A minimum of one foot freeboard, computed from the maximum water surface elevation during the one-hundred-year storm event, shall be provided in all basins.

(8) The minimum floor elevation of all structures that would be affected by a basin or other water impoundments or open conveyance systems where ponding may occur shall be two feet above the one-hundred-year water surface elevation.

K. Runoff calculations for stormwater management facilities shall be based upon the following methods:

(1) SCS — TR-20 (latest revision) is the recommended and preferred method for the study of watersheds with a drainage area greater than 100 acres. SCS — TR20 or SCS — TR-55 Tabular Hydrograph Method (latest revision) may be used for the study of watersheds with a drainage area greater than 200 acres.

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(2) SCS — TR-55 Graphical Peak Method (latest revision) may be used in lieu of the Tabular Hydrograph Method for sizing conveyance systems or checking peak flows only. It shall not be used for basin routing or subarea routing as it does not provide an adequate hydrograph.

(3) Other standard engineering models with approval of the Town Engineer or his designated representative.

(4) Stormwater runoff shall be based on the following twenty-four-hour storm events with a Type III distribution:

| Storm Event | Inches of Rainfall |
|---|---|
| 1-year | 2.9 |
| 10-year | 5.5 |
| 25-year | 6.5 |
| 100-year | 8.0 |

Source: SCS Technical Release 55

(5) Use of other criteria, assumptions, references, calculation methods and computer programs may be utilized, provided that detailed design information and programming, with references, are submitted to and found acceptable by the Town Engineer or his designated representative prior to submission of the stormwater management plan.

(6) Pipe size calculation shall be based on twenty-five-year return frequency storm events.

L. The design plan and construction schedule shall incorporate measures to minimize soil erosion and sedimentation.

M. Consideration shall be given to the relationship of the subject property to the drainage pattern of the watershed.

N. Stormwater shall not be transferred from one watershed to another unless:

(1) The watersheds are subwatersheds of a common watershed which join together within the perimeter of the property.

(2) The effect of the transfer does not alter the peak discharge onto adjacent lands, watercourse or water bodies at any point.

(3) Easements from the affected landowners are provided.

O. Technical references. For the purpose of this article, the following documents shall serve as the official guides and specifications for stormwater management. Stormwater management practices that are designed and constructed in accordance with these technical documents shall be presumed to meet the standards imposed by this article:

(1) The New York State Stormwater Management Design Manual (New York State Department of Environmental Conservation, April 2008, most current version or its successor, hereafter referred to as the "Design Manual").

(2) New York Standards and Specifications for Erosion and Sediment Control (Empire State Chapter of the Soil and Water Conservation Society, August 2005, most current version or its

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successor, hereafter referred to as the "Erosion Control Manual").

P. Technical standards.

(1) For all swales and gutters, the "n" factors used to determine capacity and velocity shall be based on accepted engineering practices.

(2) Corrugated metal pipe will not be allowed to be used in any drainage system or facility without the approval of the Town Superintendent of Highways and the Town Engineer or his designated representative. If allowed, corrugated metal pipe shall be fully asphalt coated with paved inverts and the "n" factor shall be 0.022 for annular pipe and 0.017 for helical pipe.

(3) The "n" factor for concrete pipe shall be 0.013.

(4) The "n" factor for polyethylene pipe shall be 0.010 for smooth interior pipe and 0.019 for corrugated interior pipe.

(5) Manufacturer's specifications may be submitted to the Town Engineer or his designated representative for acceptance if other types of pipes or sizes of pipes indicate that another value of "n" should be used.

(6) Catch basins shall be designed with a sump of 16 inches.

(7) Catch basin inlet capacity shall be based on design data provided by the manufacturer.

(8) Any existing drainage structures within 200 feet of the subdivision/site shall be included in the stormwater management plan. Structures that convey streams shall be checked to determine if they have the capacity to carry the fifty-year-storm flows, and all other structures shall be checked for capacity to carry the twenty-five-year storm flows.

(9) A tabulation of flows through all drainage systems shall be submitted with the plans.

(10) Culvert design shall consider inlet/outlet control at each structure or hydraulic losses shall be calculated through the system. These calculations are to be submitted as part of the plans. At a minimum, when pipe sizes change, the tops of the pipes shall match in elevation.

(11) All culverts having diameters of 24 inches to 48 inches shall have a removable inlet grating of five-eighths-inch diameter (minimum) reinforcing bars spaced approximately six inches on center. All design calculations are to reflect this inlet control condition.

Q. Catch basins shall be located in the swale along open section roadways. The calculated depth of flow in the swale shall not exceed 1/2 of the total depth of the swale before placing a catch basin. The catch basin shall be capable of accepting 100% of the flow in the swale. On closed section roadways, catch basins shall be located along the curbline and are not permitted along the curb radius at intersections. For the purpose of catch basin placement, the depth of flow along the curb and across intersections shall not exceed two inches.

R. Manholes and catch basins shall not be spaced more than 300 feet apart. Structures shall be placed at all points of changes in horizontal or vertical direction.

S. Curves in pipes will only be allowed where manufacturer's information clearly demonstrates that the integrity of the pipe system will not be compromised by such curving. As a general rule, only pipes of 24 inches or larger in diameter may be curved.

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T. Stormwater collection systems shall have a minimum diameter of 15 inches and shall be designed to have a minimum velocity of three feet per second. However, at the terminus of the system, the flow velocity at the discharge point shall not exceed four feet per second prior to the flow entering a natural watercourse, water body or adjacent property.

U. The maximum swale, gutter or curb velocity of stormwater runoff shall be maintained at levels which result in a stable condition both during and after construction. Swales shall be designed and stabilized in accordance with New York Standards and Specification for Erosion and Sediment Control, current version or its successor. A minimum of six inches of freeboard shall be provided above the flow depth in the swale. Swales shall be designed to allow for infiltration of stormwater runoff and removal of pollutants from the runoff whenever possible. This can be accomplished by keeping the swale at as flat a slope as possible, stabilizing the swale with a water-tolerant, erosion-resistant grass that will not be mowed close to the ground, increasing the percolation ability of the swale by tilling the soil before establishing vegetative cover and installing check dams with rip rap on the downstream side to prevent scouring.

V. Drainage facilities not located within public rights-of-way shall be located within easements.

W. When plan applications are submitted in sections, each section shall control stormwater runoff and sedimentation as though it were a separate entity. If temporary facilities are required for construction of a section, they shall meet all of the requirements of these regulations. A construction or phasing schedule shall be submitted with each plan and shall demonstrate the methods to be used to minimize stormwater runoff and soil erosion and sedimentation.

X. Stormwater management facilities shall not be constructed within or discharge directly to wetland areas, wetland buffer areas or existing water bodies unless either:

(1) The appropriate permits from applicable regulatory agencies have been obtained; or

(2) A letter from said agencies has been obtained stating that a permit is not required for the proposed work. Copies of the permits or letters shall be submitted to the Town Planning Board for review by the Town Engineer or his designated representative prior to the final approval of the plan.

Y. Individual lots, buildings and dwellings shall be provided with drainage facilities to assure proper runoff from roofs, driveways, paved areas and footing drains. Footing drains shall discharge to free-flowing outlets. The installation of such facilities shall be in accordance with these regulations and the Town of Newburgh Street Specifications[1] and are required prior to the issuance of a certificate of occupancy.

Z. Water quality standards. Any land development activity shall not cause an increase in turbidity that will result in substantial visible contrast to natural conditions in surface waters of the State of New York.

AA. Stormwater discharges should be consistent with the thermal criteria found in Part 704 of the Water Quality Regulations, Title 6, Chapter X, New York State Codes, Rules and Regulations.

## § 157-7. Performance standards.

Stormwater management plans must demonstrate that the proposed development or land development

1. **Editor's Note: See Ch. 161, Street Specifications.**

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activity has been planned and designed and will be constructed and maintained to meet each of the following standards:

A. Ensure that, after development, runoff from the site equals or reduces the rate of flow and quality of runoff that would have occurred following the same rainfall under existing conditions.

B. Maintain the existing hydrologic characteristics of the watershed.

C. Protect the quality of groundwater and surface waters.

D. Protect groundwater levels.

E. Protect the beneficial functioning of wetlands as areas for the natural storage of surface waters and the chemical reduction and assimilation of pollutants.

F. Prevent increased flooding and damage that results from improper location, construction and design of structures in areas which are presently subject to an unacceptable danger of flooding.

G. Minimize injury to flora and fauna and adverse impacts to fish and wildlife habitat.

H. Otherwise further the objectives of these regulations.

**§ 157-8. Easements and dedications.**

A. The applicant shall reserve easements or drainage rights-of-way within the subdivision or over the site, as the case may be, where stormwater or surface water drainage facilities are existing or proposed, whether man-made or natural. The easements shall conform as closely as possible to the lines of such course and shall also meet the following criteria:

(1) Easements shall have a minimum width of 20 feet and shall be adequately designed to provide area for the collection and discharge of water, the maintenance and repair of the facility and the passage of equipment for such work.

(2) In the case of streams or open channel drainage, the easement shall encompass the one-hundred-year storm event or the flood of record, plus one foot freeboard above that elevation. Calculations acceptable to the Town Engineer or his designated representative supporting those elevations shall be submitted with the plans.

(3) When a proposed drainage system carries water onto adjacent lands where no discharge point existed in the predeveloped condition, stormwater will be returned to a sheet flow condition prior to exit from the site or an easement must be obtained from the downstream property owner(s).

(4) The plans shall clearly indicate who has the right of access and the responsibility of maintenance for all facilities.

(5) Easements shall include the right to trim, cut and remove any trees, limbs, shrubs, underbrush, debris, structures, fences, obstructions or other objects located within the easement which, in the sole judgment of the easement holder, may interfere with, obstruct or endanger the use and maintenance of the easement for drainage or stormwater management purposes.

B. Where a new stormwater management or drainage facility is proposed to be dedicated to the Town of Newburgh or a duly established drainage or improvement district of the Town and is outside a proposed, dedicated public street right-of-way, the facility shall be either:

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(1) Located on property proposed to be deeded in fee to the Town; or

(2) Located in an easement area which is outside the applicable minimum yard setback areas for each lot on which the facility is situated, and for which easement rights satisfactory to the Town can be conveyed by the applicant, its successors and assigns.

### § 157-9. Maintenance.

A. It is the financial responsibility of the owner and subsequent landowners to maintain the proposed stormwater management system as it was designed and constructed. Good maintenance involves periodic cleaning and dredging of pipes and basins and mowing and maintaining proper land cover. A stormwater management plan cannot be approved by the Town Planning Board unless the applicant can show that a financial mechanism will be established which ensures that the owner and subsequent landowners have the financial ability to maintain the stormwater management system in accordance with a maintenance schedule approved by the Board. Should the owner propose to transfer the ownership and management responsibility to a homeowners' association, the subdivision or site plan covenants must indicate how the association will bear the financial burden of maintaining the stormwater management facilities and collect the necessary funds. Additionally, the homeowners' association must be registered pursuant to § 352-e of the New York State General Business Law.

B. The Planning Board, at its discretion, may require that a maintenance security be posted to meet this obligation. The amount of the security shall be equal to the estimated cost of maintaining the system for a period of five years.

C. The systems maintained by the owner or homeowners' association shall have adequate easements to permit the Town Engineer or his designated representative to inspect and, if necessary, for the Town of Newburgh or its agents to enter upon the property and to take corrective measures should the owner fail to properly maintain the system. Before taking corrective action, the Town Board shall give the owner written notice of the nature of the existing defects. If the owner fails within 30 days from the date of notice to commence corrective action or to appeal the matter to the Board of Zoning Appeals, the Town Board may take necessary corrective action, the cost of which shall become a lien on the real property until paid. In the case of a homeowners' association, such lien may be placed on the real property of each of the members of the homeowners' association until payment is made. This remedy shall not be deemed to be exclusive and the Town shall retain all other enforcement rights.

D. Improvements may be dedicated in connection with the formation of a drainage district with approval by the Town Board in accordance with the procedures set forth in Articles 12 or 12-A of the Town Law. It shall be the owner's sole responsibility to submit to the Town a satisfactory map, plan and report prepared by a licensed professional engineer and a petition for the establishment of a drainage district satisfying the requirements of Article 12.

### § 157-10. Performance security.

A. Improvements and related measures. The estimated costs of the following improvements and related measures, where applicable, which are associated with the stormwater management plan are required to be included in the amount of the performance security:

(1) Storm drainage systems, including but not limited to catch basins, manholes, pipes, swales, basins and infiltration systems.

(2) Erosion and sediment control, including grading and stabilization, for both temporary and permanent restoration.

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(3) As-built or record drawings.

(4) Any other items which may be reasonably deemed to be required by the Town Engineer or his designated representative. The applicant's engineer is to prepare the estimate and submit it to the Town Engineer or his designated representative for review and recommendation to the Town Board.

B. Performance security. In order to ensure the full and faithful completion of all land development activities related to compliance with all conditions set forth by the Town in its approval of the stormwater management plan, a performance security shall be delivered to the Town Clerk to guarantee to the Town that the applicant will faithfully cause to be constructed and completed within a reasonable time the required improvements and related measures or permanently restore the areas of disturbance. Before the Planning Board grants final approval of a subdivision plat, site plan, special permit or other required approval, the applicant shall follow the procedure set forth below:

(1) In an amount set by the Town Board based on submission of final design plans, with reference to actual construction and landscaping costs, the applicant shall either file with the officer the Town designates a certified check to cover the full cost of the required improvements and related measures or to permanently restore the areas of disturbance, or an adequate and acceptable letter of credit or performance bond issued by a bank or surety company acceptable to the Town to cover the full cost of the required improvements and related measures or permanent restoration of the areas of disturbance, or any combination thereof. Any such performance security shall be satisfactory to the Town Board and the Town Attorney or attorney for the Town as to form, sufficiency, manner of execution and surety. The performance security shall remain in force until the surety is released from liability by the Town, provided that such period shall not be less than three years or one year from the date of final acceptance or such other certification that the improvements have been constructed in accordance with the approved plans and specifications and that a one-year inspection has been conducted and the improvements have been found to be acceptable to the Town, whichever is later, or in the case of a letter of credit, a minimum period of one year with provision for continuing automatic renewal for a total period of at least three years. The term of such performance security may be required to be extended and the amount of the security increased by the Town Board if improvements are not completed or areas of disturbance not permanently restored within the original term of the security.

(2) The required improvements shall not be considered to be completed until the installation of the improvements has been accepted by the Town Engineer or his designated representative and any appropriate Town department head and as-built or record drawings satisfactory to the Town Engineer or his designated representative have been submitted. The performance security or certified check for all required improvements specified in Subsection A(1) above shall not be released until such as-built plans are submitted and the performance security shall additionally secure the completion of the as-built or record drawing. The Town shall release the security upon certification of the Town Engineer or his designated representative that all requirements of the security have been satisfied.

(3) The applicant shall complete all required improvements or have posted the required performance security, either or both to the satisfaction of the Town Board, before any building permits shall be issued.

(4) If the Town Engineer or his designated representative, as the case may be, shall decide at any time during the term of performance that the required improvements and related measures have

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been installed as provided in this section and by the Town Engineer or his designated representative to a sufficient extent and amount to warrant reduction in the face amount of said security, or if the Town Engineer or his designated representative, as the case may be, shall determine that the character and extent of such development requires additional improvements previously waived for a period stated at the time of fixing the original terms of such security, the Town Board upon recommendation of the Town Engineer may modify its requirements for any or all such improvements, and the face value of such performance security shall thereupon be reduced or increased by an appropriate amount so that the new face value will cover the cost in full of the amended list of improvements required by the Planning Board or Town Engineer and any security deposited may be reduced or increased proportionately.

## § 157-11. Procedures and fees.

A. Any person planning a development as defined in these regulations or undertaking land development activity as defined by these regulations, unless exempted, shall submit a stormwater management plan to the Town Planning Board or Stormwater Officer, as appropriate. Developers and consultants are urged to discuss stormwater management approaches for specific projects with the Planning Board prior to submittal of preliminary plans.

B. The application fee, in accordance with Chapter 104, Fees, of the Code of the Town of Newburgh is to be paid at the time the stormwater management plan permit application is submitted. In the event that land development activity under an approved stormwater management plan is divided among separate owners or developers due to subdivision, lease or other arrangements, then a separate permit for each lot, lease or arrangement shall be required and an additional fee for administration and compliance inspection shall be paid at the time each permit or building permit application is submitted in such reasonable amount as the Town Board may by resolution establish and amend from time to time. **[Amended 11-7-2011 by L.L. No. 8-2011]**

C. Charges for technical review of the stormwater management plan may be charged against the escrow established for professional consultant reviews in accordance with Chapter 104, Fees, of the Code of the Town of Newburgh; all charges must be paid by the applicant prior to final approval of the plan.

D. Within the same time frame as is applicable to the approval of accompanying subdivision plats, site plans or special permits, as the case may be, or 62 days following submission of the completed stormwater management plan, the Town Planning Board shall approve, with or without specified conditions or modifications, or reject the plan and notify the applicant accordingly. The Town Engineer or his designated representative shall provide a written evaluation of the applicant's submission. If the Planning Board has not rendered a decision within the time frames specified above following completed plan submittal, it shall inform the applicant of the status of the review process and the anticipated completion date. If the plan is rejected or modified, the Planning Board shall state the reasons.

E. The stormwater management plan must meet all of the requirements as specified in these regulations in order to be approved.

F. The stormwater management plan will not be approved unless adequate provisions have been made for inspection of the property before any development activity begins. The applicant shall arrange with the Town Engineer or his designated representative for scheduling the following inspections:

(1) Initial inspection prior to approval of the stormwater management plan (this inspection is at the discretion of the Town Engineer or his designated representative).

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(2) Construction inspection to be made during construction of underground drainage structures and during construction of any basin dams.

(3) Erosion control inspection, to ensure erosion control practices are in accord with the Plan.

(4) As-built inspection to be made when all work has been completed. Although inspections will be made by the Town Engineer or his designated representative or his designate, it is the responsibility of the applicant to provide certification to the Town, in writing, with the as-built plans, that all work has been completed in accordance with these regulations. The applicant will be notified, in writing, of any deficiencies noted at the site. These items shall be promptly corrected by the applicant or the applicant will be subject to the penalty provisions of these regulations.

G. Contractor certification.

(1) Each contractor and subcontractor identified in the stormwater management plan who will be involved in soil disturbance and/or stormwater management practice installation shall sign and date a copy of the following certification statement before undertaking any land development activity: "I certify under penalty of law that I understand and agree to comply with the terms and conditions of the stormwater management plan. I also understand that it is unlawful for any person to cause or contribute to a violation of water quality standards."

(2) The certification must include the name and title of the person providing the signature, address and telephone number of the contracting firm, the address (or other identifying description) of the site, and the date the certification is made.

(3) The certification statement(s) shall become part of the stormwater management plan for the land development activity.

H. Prior to the signing of any plat or plan or the issuance of any special permit referenced in § 157-4 above containing stormwater management facilities proposed to be dedicated to the Town or a Town improvement district, the applicant shall deliver in form acceptable to the Town Attorney or attorney for the Town an irrevocable offer of dedication, acceptable for recording, describing the proposed easement or deed area of the facilities by metes and bounds, together with such other signed and completed documents, including but not limited to a Form TP-584, as are required for the recording of the offer of dedication.

I. Maintenance during construction.

(1) The applicant or developer of the land development activity shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the applicant or developer to achieve compliance with the conditions of this article. Sediment shall be removed from sediment traps or sediment ponds whenever their design capacity has been reduced by 50%.

(2) The applicant or developer or his or her representative shall be on site at all times when construction or grading activity and/or other development takes place and shall inspect and document the effectiveness of all erosion and sediment control practices. Inspection reports shall be completed at a minimum of every seven days. The reports shall be delivered to the Stormwater Management Officer or his designated representative and also copied to the site log book with the SWPPP.

(3) The applicant or developer shall provide for access to the facility at reasonable times for

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periodic inspection by the Town of Newburgh to ensure that the facility is maintained in proper working condition to meet design standards and any other provisions established by this article and shall secure all necessary easements from the owner and any subsequent landowner for such access.

J. Maintenance after construction. The owner or operator of permanent stormwater management practices installed in accordance with this article shall ensure that they are operated and maintained to achieve the goals of this article. Proper operation and maintenance also includes, as a minimum, the following:

(1) A preventive/corrective maintenance program for all critical facilities and systems of treatment and control (or related appurtenances) which are installed or used by the owner or operator to achieve the goals of this article.

(2) Written procedures for operation and maintenance and training new maintenance personnel.

(3) Discharges from the stormwater management practices shall not exceed design criteria or cause or contribute to water quality standard violations in accordance with § 157-6.

K. Maintenance agreements. A formal maintenance agreement executed by the landowner and the Town of Newburgh for stormwater management facilities binding on all subsequent landowners served by the facilities and all other parties having an interest in the property shall be recorded in the office of the County Clerk in the same manner as a deed restriction on the property prior to final plan approval. Documents required to record the maintenance agreement shall additionally be executed and delivered. The maintenance agreement shall be consistent with the terms and conditions of Schedule A of this chapter, entitled "Sample Stormwater Control Facility Maintenance Agreement."[2]

L. Dedications.

(1) The Town of Newburgh, at its sole discretion, may accept dedication of any existing or future stormwater management facility, provided that such facility meets all the requirements of this article and includes adequate and perpetual access and sufficient area, by fee title or perpetual easement, for inspection and regular maintenance. The requirements for dedication of stormwater management and drainage facilities to the Town of Newburgh or a duly established district of the Town include the following:

(a) A title insurance policy, insuring the Town, in the minimum amount of at least $35,000 for each deeded or easement area to be dedicated. The title insurance policy must be acceptable to the Town Attorney or attorney for the Town and must insure that the Town is obtaining title to the deeded areas or easements free and clear of all liens and encumbrances, excepting only such existing utility easements as the Town determines in its sole discretion will not interfere with the inspection, maintenance and repair of the facilities. Applicants may be required to submit title updates prior to acceptance of dedication.

(b) Full covenant and warranty deed, conveying to the Town title of the area to be dedicated or a perpetual easement for the diversion and discharge of drainage waters and for related drainage purposes, including but not limited to constructing, excavating, laying, installing, reconstructing, operating, maintaining, repairing, replacing and relocating the facilities, which is acceptable to the Town Attorney or attorney for the Town, together with such

2. **Editor's Note: Schedule A is on file in the Town offices.**

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other signed and completed documents, including but not limited to a Form TP-584 and an Equalization and Assessment Form, and recording fees as are required for the recording of the instrument.

(c) Certification by a professional engineer or surveyor that the facilities to be dedicated have been completed in accordance with the approved plans and specifications of the Town and that all construction has been completed in a workmanlike manner.

(d) As-built or record drawings of the facilities.

(e) A maintenance security, acceptable to the Town, guaranteeing to the Town that the applicant or developer will maintain the facilities to the Town's standards, normal wear and tear excepted, for a period of at least two years from the date of the acceptance of the dedication. The maintenance security must be in an amount equal to at least 10% of the original performance security.

(f) A maintenance security letter acknowledging the maintenance responsibilities of the applicant or developer, acceptable to the Town.

(g) If the developer is a corporation or limited liability company, the developer must deliver a corporate resolution certified by an appropriate corporate officer or a unanimous written consent of the board of directors and shareholders of the corporation or members of the limited liability company to the dedication.

(h) Payment of such fees for Town processing and recording expenses and such escrow deposits for reimbursements of professional service costs as the Town Board may establish and amend by resolution from time to time as are reasonably related to the complexity of the application and necessary review by the Town through its consultants' fees for services.

(2) The Town of Newburgh may require any person undertaking land development activities regulated by this article to pay reasonable costs at prevailing rates of stormwater management plan review and inspections, or stormwater management plan maintenance performed by the Town of Newburgh or performed by a third party for the Town of Newburgh.

## § 157-12. Inspections and enforcement; penalties for offenses.

A. Erosion and sediment control inspection.

(1) The Stormwater Management Officer or Town consultant may require such inspections as necessary to determine compliance with this article and may either approve that portion of the work completed or notify the applicant wherein the work fails to comply with the requirements of this article and the stormwater management plan as approved. To obtain inspections, the applicant shall notify the Stormwater Management Officer or, if so directed, Town consultant, or designee at least 48 hours before any of the following as required by the Stormwater Management Officer:

(a) Start of construction.

(b) Installation of sediment and erosion control measures.

(c) Completion of site clearing.

(d) Completion of rough grading.

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(e) Completion of final grading.

(f) Close of the construction season.

(g) Completion of final landscaping.

(h) Successful establishment of landscaping in public areas.

(2) If any violations are found, the applicant and developer shall be notified in writing of the nature of the violation and the required corrective actions. No further work shall be conducted except for site stabilization until any violations are corrected and all work previously completed has received approval by the Stormwater Management Officer or his designee.

B. Inspection of stormwater management practices and stormwater facilities after project completion.

(1) The Town Engineer or his designated representative is responsible for conducting inspections of stormwater management practices.

(2) Inspection programs shall be established on any reasonable basis, including but not limited to routine inspections; random inspections; inspections based upon complaints or other notice of possible violations; inspection of drainage basins or areas identified as higher than typical sources of sediment or other contaminants or pollutants; inspections of businesses or industries of a type associated with higher than usual discharges of contaminants or pollutants or with discharges of a type which are more likely than the typical discharge to cause violations of state or federal water or sediment quality standards or the SPDES stormwater permit; and joint inspections with other agencies inspecting under environmental or safety laws. Inspections may include but are not limited to reviewing maintenance and repair records; sampling discharges, surface water, groundwater and material or water in drainage control facilities; and evaluating the condition of drainage control facilities and other stormwater management practices.

C. Submission of reports. The Stormwater Management Officer may require monitoring and reporting from entities subject to this article as are necessary to determine compliance with this article.

D. Right-of-entry for inspection. When any new stormwater management facility is installed on private property or when any new connection is made between private property and the public stormwater system, the landowner shall grant to the Town of Newburgh the right to enter the property at reasonable times and in a reasonable manner for the purpose of inspection as specified in § 157-11H and I above.

E. Notice of violation.

(1) When the Town of Newburgh determines that a land development activity is not being carried out in accordance with the requirements of this article, it may issue a written notice of violation to the owner of the property. The notice of violation shall contain:

(a) The name and address of the owner, developer or applicant.

(b) The address, when available, or a description of the building, structure or land upon which the violation is occurring.

(c) A statement specifying the nature of the violation.

(d) A description of the remedial measures necessary to bring the land development activity into compliance with this article and a time schedule for the completion of such remedial

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action.

(e) A statement of the penalty or penalties that shall be assessed against the person to whom the notice of violation is directed.

(f) A statement that the determination of violation may be appealed to the Zoning Board of Appeals by filing a written notice of appeal within 15 days of service of notice of violation.

(2) The notice of violation shall be served upon the person(s) to whom it is directed either personally, in a manner provided for personal service of notices by the court of local jurisdiction, or by mailing a copy of the notice of the violation by certified mail, postage prepaid, return receipt requested, to such person(s) at his or her last known address. A notice of violation issued pursuant to this section constitutes a determination from which an administrative appeal may be taken to the Zoning Board of Appeals. The administrative appeal shall be subject to the same application fee as is set forth in Chapter 104, Fees, for variances, and the Zoning Board of Appeals Chairperson may require an applicant to deposit with the Secretary to the Zoning Board of Appeals an escrow deposit to cover the reasonable costs for consultant services in connection with the application upon the same terms as set forth in § 104-2E(4) for variances.

F. Stop-work orders. The Town of Newburgh may issue a stop-work order for violations of this article. Persons receiving a stop-work order shall be required to halt all land development activities, except those activities that address the violations leading to the stop-work order. The stop-work order shall be in effect until the Town of Newburgh confirms that the land development activity is in compliance and the violation has been satisfactorily addressed. Failure to address a stop-work order in a timely manner may result in civil, criminal or monetary penalties in accordance with the enforcement measures authorized in this article.

G. Violations. Any land development activity that is commenced or is conducted contrary to this article may be restrained by injunction or otherwise corrected or abated in a manner provided by law.

H. Penalties.

(1) Any person who violates the provisions of this article shall be guilty of a violation punishable by a fine not exceeding $350 or imprisonment for a period not to exceed six months, or both, for conviction of a first offense; for conviction of a second offense, both of which were committed within a period of five years, punishable by a fine not less than $350 nor more than $700 or imprisonment for a period not to exceed six months, or both; and upon conviction for a third or subsequent offense, all of which were committed within a period of five years, punishable by a fine not less than $700 nor more than $1,000 or imprisonment for a period not to exceed six months, or both. Each week's continued violation shall constitute a separate additional violation.

(2) In addition to or as an alternative to any penalty provided herein or by law, any person violating any provision of this article shall be subject to a civil penalty enforceable and collectible by the Town in an amount not exceeding $250 for each day the violation continues until the violation has been corrected or otherwise abated in a manner approved by the Stormwater Management Officer or his designated representative.

I. Withholding of certificate of occupancy. If any building or land development activity is installed or conducted in violation of this article, the Stormwater Management Officer may prevent the occupancy of said building or land.

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J. Restoration of lands. Any violator may be required to restore land to its undisturbed condition. In the event that restoration is not undertaken within a reasonable time after notice, the Town of Newburgh may take necessary corrective action, the cost of labor and materials for which shall become a lien upon the property until paid. In the event the land is titled in a homeowners' association which fails to pay for required corrective action, the Town may have a lien placed on the real property of members of the homeowners' association until payment is made.

## § 157-13. Appeals.

Any person aggrieved by the action of any official charged with the enforcement of this article, as the result of the disapproval of a stormwater management plan, issuance of a written notice of violation, or an alleged failure to properly enforce the article in regard to a specific application, shall have the right to appeal the action to the Zoning Board of Appeals. The appeal shall be filed in writing within 20 days of the date of official transmittal of the final decision or determination to the applicant, shall state clearly the grounds on which the appeal is based, and shall be processed in the manner prescribed for hearing administrative appeals under the Town's Zoning Code.[3]

3. **Editor's Note: See Ch.185, Zoning.**

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ARTICLE II
**Illicit Discharges, Activities and Connections to Separate Storm Sewer System**
**[Adopted 11-7-2011 by L.L. No. 8-2011]**

## § 157-14. Purpose.

The purpose of this article is to provide for the health, safety, and general welfare of the citizens of the Town of Newburgh through the regulation of nonstormwater discharges to the municipal separate storm sewer system (MS4) to the maximum extent practicable as required by federal and state law. This article establishes methods for controlling the introduction of pollutants into the MS4 in order to comply with requirements of the SPDES General Permit for Municipal Separate Storm Sewer Systems. The objectives of this article are:

A. To meet the requirements of the SPDES General Permit for Stormwater Discharges from MS4s, Permit No. GP-02-02, or as amended or revised;

B. To regulate the contribution of pollutants to the MS4 since such systems are not designed to accept, process or discharge nonstormwater wastes;

C. To prohibit illicit connections, activities and discharges to the MS4;

D. To establish legal authority to carry out all inspection, surveillance and monitoring procedures necessary to ensure compliance with this article and impose penalties and remedies for noncompliance; and

E. To promote public awareness of the hazards involved in the improper discharge of trash, yard waste, lawn chemicals, pet waste, wastewater, grease, oil, petroleum products, cleaning products, paint products, hazardous waste, sediment and other pollutants into the MS4.

## § 157-15. Definitions.

Whenever used in this article, unless a different meaning is stated in a definition applicable to only a portion of this article, the following terms will have meanings set forth below:

BEST MANAGEMENT PRACTICES (BMPs) — Schedules of activities, prohibitions of practices, general good housekeeping practices, pollution prevention and educational practices, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants directly or indirectly to stormwater, receiving waters, or stormwater conveyance systems. BMPs also include treatment practices, operating procedures, and practices to control site runoff, spillage or leaks, sludge or water disposal, or drainage from raw materials storage.

CLEAN WATER ACT — The Federal Water Pollution Control Act (33 U.S.C. § 1251 et seq.) and any amendments thereto.

CONSTRUCTION ACTIVITY — Activities requiring authorization under the SPDES Permit for Stormwater Discharges from Construction Activity, GP-02-01, as amended or revised. These activities include construction projects resulting in land disturbance of one or more acres. Such activities include but are not limited to clearing and grubbing, grading, excavating, and demolition.

DEPARTMENT — The New York State Department of Environmental Conservation.

DESIGN PROFESSIONAL — New York State licensed professional engineer or licensed architect.

HAZARDOUS MATERIALS — Any material, including any substance, waste, or combination thereof,

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which because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause, or significantly contribute to, a present or potential hazard to human health, safety, property, or the environment when improperly treated, stored, transported, disposed of or otherwise managed.

ILLICIT CONNECTIONS — Any drain or conveyance, whether on the surface or subsurface, which allows an illegal discharge to enter the MS4, including but not limited to:

A. Any conveyances which allow any nonstormwater discharge including treated or untreated sewage, process wastewater, and wash water to enter the MS4 and any connections to the storm drain system from indoor drains and sinks, regardless of whether said drain or connection had been previously allowed, permitted, or approved by an authorized enforcement agency; and/or

B. Any drain or conveyance connected from a commercial or industrial land use to the MS4 which has not been documented in plans, maps, or equivalent records and approved by an authorized enforcement agency.

ILLICIT DISCHARGE — Any direct or indirect nonstormwater discharge to the MS4, except as exempted in § 157-19 of this article.

INDIVIDUAL SEWAGE TREATMENT SYSTEM — A facility serving one or more parcels of land or residential households, or a private, commercial or institutional facility, that treats sewage or other liquid wastes for discharge into the groundwaters of New York State, except where a permit for such a facility is required under the applicable provisions of Article 17 of the Environmental Conservation Law.

INDUSTRIAL ACTIVITY — Activities requiring authorization under the SPDES Permit for Discharges from Industrial Activities Except Construction, GP-98-03, as amended or revised.

MUNICIPALITY — The Town of Newburgh.

MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4) — A conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains):

(1) Owned or operated by the Town of Newburgh;

(2) Designed or used for collecting or conveying stormwater;

(3) Which is not a combined sewer; and

(4) Which is not part of a publicly owned treatment works (POTW) as defined at 40 CFR 122.2.

NONSTORMWATER DISCHARGE — Any discharge to the MS4 that is not composed entirely of stormwater.

PERSON — Any and all persons, natural or artificial, and includes any individual, firm, corporation, government agency, business trust, partnership, association, two or more persons having a joint or common interest or any other legal entity acting as either the owner or occupant of premises, or as the owner's or occupant's agent.

POLLUTANT — Dredged spoil, filter backwash, solid waste, incinerator residue, treated or untreated sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand and industrial, municipal, agricultural waste and ballast discharged into water, which may cause or might reasonably be expected to cause pollution of the waters of the state in contravention of the standards.

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PREMISES — Any building, lot, parcel of land, or portion of land, whether improved or unimproved, including adjacent sidewalks and parking strips.

SPECIAL CONDITIONS —

(1) Discharge Compliance with Water Quality Standards. The condition that applies where a municipality has been notified that the discharge of stormwater authorized under its MS4 permit may have caused or has the reasonable potential to cause or contribute to the violation of an applicable water quality standard. Under this condition the municipality must take all necessary actions to ensure future discharges do not cause or contribute to a violation of water quality standards.

(2) 303(d)-Listed Waters. The condition in the municipality's MS4 permit that applies where the MS4 discharges to a 303(d)-listed water. Under this condition the stormwater management program must ensure no increase of the listed pollutant of concern to the 303(d)-listed water.

(3) Total Maximum Daily Load (TMDL) Strategy. The condition in the municipality's MS4 permit where a TMDL, including requirements for control of stormwater discharges, has been approved by EPA for a water body or watershed into which the MS4 discharges. If the discharge from the MS4 did not meet the TMDL stormwater allocations prior to September 10, 2003, the municipality was required to modify its stormwater management program to ensure that reduction of the pollutant of concern specified in the TMDL is achieved.

(4) Total Maximum Daily Load (TMDL) Implementation. The condition in the municipality's MS4 permit that applies if a TMDL is approved in the future by EPA for any water body or watershed into which an MS4 discharges. Under this condition the municipality must review the applicable TMDL to see if it includes requirements for control of stormwater discharges. If an MS4 is not meeting the TMDL stormwater allocations, the municipality must, within six months of the TMDL's approval, modify its stormwater management program to ensure that reduction of the pollutant of concern specified in the TMDL is achieved.

STATE POLLUTANT DISCHARGE ELIMINATION SYSTEM (SPDES) STORMWATER DISCHARGE PERMIT — A permit issued by the Department that authorizes the discharge of pollutants to waters of the state.

STORMWATER — Rainwater, surface runoff, snowmelt and drainage.

STORMWATER MANAGEMENT ADMINISTRATOR/OFFICER (SMA/SMO) — The Town of Newburgh Building Inspector, engineer, or other person designated by the Town Board to enforce this article. The SMA may also be designated by the municipality to accept and review stormwater pollution prevention plans, forward the plans to the applicable municipal board and inspect stormwater management practices.

303(d) LIST — A list of all surface waters in the state for which beneficial uses of the water (drinking, recreation, aquatic habitat, and industrial use) are impaired by pollutants, prepared periodically by the Department as required by Section 303(d) of the Clean Water Act. 303(d)-listed waters are estuaries, lakes and streams that fall short of state surface water quality standards and are not expected to improve within the next two years.

TOTAL MAXIMUM DAILY LOAD (TMDL) — The maximum amount of a pollutant to be allowed to be released into a water body so as not to impair uses of the water, allocated among the sources of

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that pollutant.

WASTEWATER — Water that is not stormwater, is contaminated with pollutants and is or will be discarded.

### § 157-16. Applicability.

This article shall apply to all water entering the MS4 generated on any developed and undeveloped lands unless explicitly exempted by an authorized enforcement agency.

### § 157-17. Responsibility for administration.

The Stormwater Management Administrator(s) [SMA(s)] shall administer, implement, and enforce the provisions of this article. Such powers granted or duties imposed upon the authorized enforcement official may be delegated in writing by the SMA as may be authorized by the Town Board.

### § 157-18. Severability.

The provisions of this article are hereby declared to be severable. If any provision, clause, sentence, or paragraph of this article or the application thereof to any person, establishment, or circumstances shall be held invalid, such invalidity shall not affect the other provisions or application of this article.

### § 157-19. Discharge and connection prohibitions; exceptions.

A. Prohibition of illegal discharges. No person shall discharge or cause to be discharged into the MS4 any materials other than stormwater except as provided in Subsections A(1) through (4) below. The commencement, conduct or continuance of any illegal discharge to the MS4 is prohibited except as described as follows:

(1) The following discharges are exempt from discharge prohibitions established by this article, unless the Department or the Town has determined them to be substantial contributors of pollutants: water line flushing or other potable water sources, landscape irrigation or lawn watering, existing diverted stream flows, rising groundwater, uncontaminated groundwater infiltration to storm drains, uncontaminated pumped groundwater, foundation or footing drains, crawl space or basement sump pumps, air conditioning condensate, irrigation water, springs, water from individual residential car washing, natural riparian habitat or wetland flows, dechlorinated swimming pool discharges, residential street wash water, water from fire-fighting activities, and any other water source not containing pollutants. Such exempt discharges shall be made in accordance with an appropriate plan for reducing pollutants.

(2) Discharges approved in writing by the SMA to protect life or property from imminent harm or damage, provided that such approval shall not be construed to constitute compliance with applicable laws and requirements, and further provided that such discharges may be permitted for a specified time period and under such conditions as the SMA may deem appropriate to protect such life and property while reasonably maintaining the purpose and intent of this article.

(3) Dye testing in compliance with applicable state and local laws is an allowable discharge, but requires a verbal notification to the SMA prior to the time of the test.

(4) The prohibition shall not apply to any discharge permitted under an SPDES permit, waiver, or waste discharge order issued to the discharger and administered under the authority of the Department, provided that the discharger is in full compliance with all requirements of the

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permit, waiver, or order and other applicable laws and regulations, and provided that written approval has been granted for any discharge to the MS4.

B. Prohibition of illicit connections.

(1) The construction, use, maintenance or continued existence of illicit connections to the MS4 is prohibited.

(2) This prohibition expressly includes, without limitation, illicit connections made in the past, regardless of whether the connection was permissible under law or practices applicable or prevailing at the time of connection.

(3) A person is considered to be in violation of this article if the person connects a line conveying sewage to the municipality's MS4, or allows such a connection to continue.

**§ 157-20. Failing individual sewage treatment systems prohibited.**

No person shall operate a failing individual sewage treatment system in areas tributary to the municipality's MS4. A failing individual sewage treatment system is one which has one or more of the following conditions:

A. The backup of sewage into a structure.

B. Discharges of treated or untreated sewage onto the ground surface.

C. A connection or connections to a separate stormwater sewer system.

D. Liquid level in the septic tank above the outlet invert.

E. Structural failure of any component of the individual sewage treatment system that could lead to any of the other failure conditions as noted in this section.

F. Contamination of off-site groundwater.

**§ 157-21. Activities contaminating stormwater prohibited.**

A. Activities that are subject to the requirements of this section are those types of activities that:

(1) Cause or contribute to a violation of the municipality's MS4 SPDES permit.

(2) Cause or contribute to the municipality being subject to the special conditions as defined in § 157-15 (Definitions) of this article.

B. Such activities include prohibited discharges or connections and failing individual sewage treatment systems as defined in § 157-20, improper management of animal waste or any other activity that causes or contributes to violations of the municipality's MS4 SPDES permit authorization.

C. Upon notification to a person that he or she is engaged in activities that cause or contribute to violations of the municipality's MS4 SPDES permit authorization, that person shall take all reasonable actions (as determined or approved by the SMA) to correct such activities such that he or she no longer causes or contributes to violations of the municipality's MS4 SPDES permit authorization.

**§ 157-22. Use of best management practices to prevent control, and reduce stormwater pollutants**

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**required.**

A. Best management practices. Where the SMA has identified illicit discharges as defined in § 157-15 or activities contaminating stormwater as defined in § 157-21, the Town may require implementation of best management practices (BMPs) to control those illicit discharges and activities.

(1) The owner or operator of a commercial or industrial establishment shall provide, at their own expense, reasonable protection from accidental discharge of prohibited materials or other wastes into the MS4 through the use of structural and nonstructural BMPs.

(2) Any person responsible for a property or premises, that is, or may be, the source of an illicit discharge as defined in § 157-15 or an activity contaminating stormwater as defined in § 157-21 may be required to implement, at said person's expense, additional structural and nonstructural BMPs to reduce or eliminate the source of pollutants) to the MS4.

(3) Compliance with all terms and conditions of a valid SPDES permit authorizing the discharge of stormwater associated with industrial activity, to the extent practicable, shall be deemed compliance with the provisions of this section.

B. Individual sewage treatment systems; response to special conditions requiring no increase of pollutants or requiring a reduction of pollutants. Where individual sewage treatment systems are contributing to the municipality's being subject to the special conditions as defined in § 157-15 of this article, the owner or operator of such individual sewage treatment systems shall be required to:

(1) Maintain and operate individual sewage treatment systems as follows:

(a) Inspect the septic tank annually to determine scum and sludge accumulation. Septic tanks must be pumped out whenever the bottom of the scum layer is within three inches of the bottom of the outlet baffle or sanitary tee at the top of the sludge is within 10 inches of the bottom of the outlet baffle or sanitary tee. Inspection of the tank for cracks, leaks and blockages shall be done by the septage hauler at the time of pumping of the tank contents;

(b) Avoid the use of septic tank additives;

(c) Avoid the disposal of excessive quantities of detergents, kitchen wastes, laundry wastes, and household chemicals; and

(d) Avoid the disposal of cigarette butts, disposable diapers, sanitary napkins, trash and other such items.

(2) Repair or replace individual sewage treatment systems as follows:

(a) In accordance with 10 NYCRR Appendix 75A to the maximum extent practicable.

(b) A design professional licensed to practice in New York State shall prepare design plans for any type of absorption field that involves:

[1] Relocating or extending an absorption area to a location not previously approved for such.

[2] Installation of a new subsurface treatment system at a new or the same location.

[3] Use of alternate system or innovative system design or technology.

(c) A written certificate of compliance shall be submitted by the design professional to the

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municipality at the completion of construction of the repair or replacement system.

### § 157-23. Suspension of access to MS4.

A. The SMA may, without prior notice, suspend MS4 discharge access to a person when such suspension is necessary to stop an actual or threatened discharge which presents or may present imminent and substantial danger to the environment, to the health or welfare of persons, or to the MS4. The SMA shall notify the person of such suspension within a reasonable time thereafter in writing of the reasons for the suspension. If the violator fails to comply with a suspension order issued in an emergency, the SMA may take such steps as deemed necessary to prevent or minimize damage to the MS4 or to minimize danger to persons.

B. Suspension due to the detection of illicit discharge. Any person discharging to the municipality's MS4 in violation of this article may have their MS4 access terminated if such termination would abate or reduce an illicit discharge. The SMA will notify a violator in writing of the proposed termination of its MS4 access and the reasons therefore. The violator may petition the SMA for a reconsideration and hearing. Access may be granted by the SMA if he/she finds that the illicit discharge has ceased and the discharger has taken steps to prevent its recurrence. Access may be denied if the SMA determines in writing that the illicit discharge has not ceased or is likely to recur. A person commits an offense if the person reinstates MS4 access to premises terminated pursuant to this section, without the prior approval of the SMA.

### § 157-24. Industrial or construction activity discharges.

Any person subject to an industrial or construction activity SPDES stormwater discharge permit shall comply with all provisions of such permit. Proof of compliance with said permit may be required in a form acceptable to the municipality prior to the allowing or continuance of discharges to the MS4.

### § 157-25. Access and monitoring of discharges.

A. Applicability. This section applies to all facilities that the SMA determines necessary to inspect to enforce any provision of this article, or whenever the authorized enforcement agency has cause to believe that there exists, or potentially exists, in or upon any premises any condition which constitutes a violation of this article.

B. Access to facilities.

(1) The SMA shall be permitted to enter and inspect facilities subject to regulation under this article as often as may be necessary to determine compliance with this article. If a discharger has security measures in forte which require proper identification and clearance before entry into its premises, the discharger shall make the necessary arrangements to allow access to the SMA.

(2) Facility operators shall allow the SMA ready access to all parts of the premises for the purposes of inspection, sampling, examination and copying of records as may be required to implement this article.

(3) The municipality shall have the right to set up on any facility subject to this article such devices as are necessary in the opinion of the SMA to conduct monitoring and/or sampling of the facility's stormwater discharge.

(4) The municipality has the right to require the facilities subject to this article to install monitoring equipment as is reasonably necessary (and subject to approval by the SMA) to determine

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compliance with this article. The facility's sampling and monitoring equipment shall be maintained at all times in a safe and proper operating condition by the discharger at its own expense. All devices used to measure stormwater flow and quality shall be calibrated to ensure their accuracy.

(5) Unreasonable delays in allowing the municipality access to a facility subject to this article is a violation of this article. A person who is the operator of a facility subject to this article commits an offense if the person denies the municipality reasonable access to the facility for the purpose of conducting any activity authorized, or required by this article.

(6) If the SMA has been refused access to any part of the premises from which stormwater is discharged, and he/she is able to demonstrate probable cause to believe that there may be a violation of this article, or that there is a need to inspect and/or sample as part of a routine inspection and sampling program designed to verify compliance with this article or any order issued hereunder, then the SMA may seek issuance of a search warrant from any court of competent jurisdiction.

## § 157-26. Notification of spills.

Notwithstanding other requirements of law, as soon as any person responsible for a facility or operation, or responsible for emergency response for a facility or operation, has information of any known or suspected release of materials which are resulting or may result in illegal discharges or pollutants discharging into the MS4, said person shall take all necessary steps to ensure the discovery, containment, and cleanup of such release. In the event of such a release of hazardous materials said person shall immediately notify emergency response agencies of the occurrence via emergency dispatch services. In the event of a release of non-hazardous materials, said person shall notify the Town in person or by telephone or facsimile no later than the next business day. Notifications in person or by telephone shall be confirmed by written notice addressed and mailed to the Town within three business days of the telephone notice. If the discharge of prohibited materials emanates from a commercial or industrial establishment, the owner or operator of such establishment shall also retain an on-site written record of the discharge and the actions taken to prevent its recurrence. Such records shall be retained for at least three years.

## § 157-27. Enforcement.

A. Notice of violation. When the Town's SMA finds that a person has violated a prohibition or failed to meet a requirement of this article or failed to comply with a permit or approval condition related to the subject matter of this article (all deemed a violation of this article), he/she may order compliance by written notice of violation to the responsible person. Such notice may require without limitation:

(1) The elimination of illicit connections or discharges;

(2) That violating discharges, practices, or operations shall cease and desist;

(3) The abatement or remediation of stormwater pollution or contamination hazards and the restoration of any affected property and the environment;

(4) The performance of monitoring, analyses, and reporting;

(5) Payment of a fine and/or civil monetary penalty; and

(6) The implementation of source control or treatment BMPs. If abatement of a violation and/or restoration of affected property or the environment is required, the notice shall set forth a

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deadline within which such remediation or restoration must be completed. Said notice shall further advise that, should the violator fail to remediate or restore within the established deadline, the work will be done by a designated governmental agency or a contractor and the expense thereof shall be charged to the violator, and, if unpaid, said amount may be assessed and levied as a lien against the violator's premises and collected in the same manner as a real property tax.

B. Penalties.

(1) In addition to or as an alternative to any penalty provided herein or by law, any person who violates this article shall be guilty of a violation punishable by a fine not exceeding $350 or imprisonment for a period not to exceed 15 days, or both, for conviction of a first offense; for conviction of a second offense, both of which were committed within a period of five years, punishable by a fine not less than $350 nor more than $700 or imprisonment for a period not to exceed 15 days, or both; and upon conviction for a third or subsequent offense, all of which were committed within a period of five years, punishable by a fine not less than $700 nor more than $1,000 or imprisonment for a period not to exceed six months, or both. Each day's continued violation shall constitute a separate additional violation.

(2) Civil penalties.

(a) In addition to and not in lieu of the above, any person who violates this article shall be liable to the Town for a civil penalty in an amount not to exceed $350 for a first violation; in an amount not less than $350 nor more than $700 for a second violation committed within a period of five years of the first violation; and in an amount of not less than $700 nor more than $1,000 for a third and each subsequent violation committed within a period of five years of the first violation. Each day's continued violation shall constitute a separate additional violation.

(b) Civil penalties may be ordered in any action or proceeding by and any court of competent jurisdiction, including but not limited to state and federal courts. All penalties shall be paid to the Town.

(c) The judgment amount of any civil penalty ordered pursuant to this section, if not paid, may be assessed and levied against the real property which is the subject of the penalty and collected in the same manner as a real property tax.

(3) In addition to and not in lieu of the remedies authorized above, the SMA or the Town Board may institute any appropriate action or proceeding to prevent, restrain, enjoin, correct or abate any violation or threatened violation or to enforce any provision of this article.

### § 157-28. Appeal of notice of violation.

A. Any person receiving a notice of violation may appeal the determination of the SMA to the Town Board within 15 days its issuance, which shall hear the appeal within 30 days after the filing of the appeal and, within five days of making its decision, file its decision in the office of the Town Clerk and mail a copy of its decision by certified mail to the appellant. Any person aggrieved by the decision of the Town Board may appeal such decision to the Supreme Court pursuant to Article 78 of the Civil Practice Law and Rules. Such proceeding must he commenced within 30 days after the decision is filed in the Town Clerk's office or shall be time-bared.

B. The appeal of a notice of violation shall stay an order contained in the notice of violation issued by

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the SMA, unless the SMA determines in writing that a stay of the order, or portion thereof, would cause undue harm to a person, property, equipment, the environment or the Town's storm sewer system. In such case, an appeal shall not stay the SMA's order.

### § 157-29. Corrective measures after appeal.

A. If the violation has not been corrected pursuant to the requirements set forth in the notice of violation or, in the event of an appeal, within five business days of the decision of the municipal authority upholding the decision of the SMA, then the SMA shall have authority to request the owner's permission for access to the subject private property to take any and all measures reasonably necessary to abate the violation and/or restore the property.

B. If refused access to the subject private property, the SMA may seek a warrant in a court of competent jurisdiction to be authorized to enter upon the property to determine whether a violation has occurred. Upon determination that a violation has occurred, the SMA may seek a court order to take any and all measures reasonably necessary to abate the violation and/or restore the property.

C. The cost of implementing and maintaining such measures shall be the sole responsibility of the discharger and may be collected in the same manner as set forth in § 157-27A(6).

### § 157-30. Injunctive relief.

It shall be a violation of this article for any person to violate any provision or fail to comply with any of the requirements of this article or fail to comply with a permit or approval condition related to the subject matter of this article. If a person has violated or continues to violate the provisions of this article, the SMA, may petition for a preliminary or permanent injunction restraining the person from activities which would create further, violations or compelling the person to perform abatement or remediation of the violation.

### § 157-31. Alternative remedies.

A. Where a person has violated a provision of this article, he/she may be eligible for alternative remedies in lieu of a civil penalty, upon recommendation of the Town Attorney or attorney for the Town and concurrence of the SMA, where:

(1) The violation was unintentional.

(2) The violator has no history of pervious violations of this article.

(3) Environmental damage was minimal.

(4) The violator acted quickly to remedy violation.

(5) The violator cooperated in investigation and resolution.

B. Alternative remedies may consist of one or more of the following:

(1) Attendance at compliance workshops.

(2) Storm drain stenciling or storm drain marking.

(3) River, steam or creek cleanup activities.

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### § 157-32. Violations deemed public nuisance.

In addition to the enforcement processes and penalties provided, any condition caused or permitted to exist in violation of any of the provisions of this article is a threat to public health, safety, and welfare, and is declared and deemed a nuisance, and may be summarily abated or restored at the violator's expense, and/or a civil action to abate, enjoin, or otherwise compel the cessation of such nuisance may be taken.

### § 157-33. Remedies not exclusive.

The remedies listed in this article are not exclusive of any other remedies available under any applicable federal, state or local law and it is within the discretion of the authorized enforcement agency to seek cumulative remedies.

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# ATTACHMENT 9

# CONSTRUCTION SITE INVENTORY

| Job Name | Active? | Job No. | Task No. | SPDES # | SWPPP Approval Date | MS4 Acceptance | NOT Date | Project Address/Location | Permittee | Project Contractor | Project Owner | SWPPP/MS4 Review Date |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Planning Board Projects: Town of Newburgh** | | | | | | | | | | | | |
| Gidneytown Plaza | Yes | 97-13 | | NYR10B153 | | | | North Plank Rd, Newburgh, NY | | | | |
| LANDS OF ZAZON | Yes | 04-29 | | NYR10T840 | 3/9/11 | | | FOSTERTOWN ROAD, Newburgh, NY | | | Joseph Zazon | |
| RWB BYPASS TUNNEL SHAFT 5B SITE | Yes | | | NYR10W175 | | | | 5503 NYS ROUTE 9W. Newburgh, NY | | | | |
| Drury Heights | Yes | 94-91 | 96-11.20 | NYR11B465 | | | | South Drury Lane, Newburgh, NY | Starlight Holding, LLC | | Starlight Holding, LLC | 2/22/2024 |
| DOMINGUES SUBDIVISION II | Yes | 15-29 | | NYR11C711 | 7/8/13 | | | Domingues Road, Newburgh, NY | CV Domingues Construction Corp | | CV Domingues Construction Corp | |
| Tarben Subdivision | Yes | 4-43 | 96-11.20 | NYR11H126 | 8/16/16 | | | Tarben Way | Tarben, Inc. | | Tarben, Inc. | |
| Solar Farm Site Plan for Darrigo Farm | Yes | 19-24 | | NYR11J306 | 2/8/22 | | | 84 Lakeside Avenue, Newburgh, NY | Frank Darrigo Revocable Trust | | Frank Darrigo Revocable Trust | |
| Newburgh Kingdom Hall of Jehovah's Witnesses | Yes | 22-31 | 96-11.20 | NYR11L520 | 6/15/2023 | | | 33 Old Little Britain Road, Newburgh, N | JW Congregation Support, Inc. | | JW Congregation Support, Inc. | 2/1/2024 |
| Hammond Subdivision | Yes | 20-08 | 96-11.20 | NYR11L554 | 4/15/2021 | | | Cronk Road, Newburgh, NY | John and Carmen Hammond | | John and Carmen Hammond | |
| Moffat Sunbelt Properties | Yes | 22-14 | 96-11.20 | NYR11L460 | 5/4/2023 | | | 224 & 226 Route 17K, Newburgh, NY | Craig Moffat | Mid Hudson Construtio | Craig Moffat | 2/6/2024 |
| Newburgh Commerce (Scannel 17K) | Yes | 21-21 | 96-11.20 | NYR11J850 | 5/2/2022 | | | 124 Route 17K, Newburgh, NY | Zachary Zweifler/Lauren McMahon | CMC Design, Thompkin | Zachary Zweifler/Lauren McMahon | 2/29/2024 |

# ATTACHMENT 10

# MS4 CONSTRUCTION SITE
# COMPLIANCE INSPECTION REPORT

MHE ENGINEERING

# CONSTRUCTION SITE INSPECTION REPORT FOR SPDES MS4 GENERAL PERMIT

| | | | |
|---|---|---|---|
| Project Name: | | Date: | |
| Project Location: | | Weather: | |
| Permit # (if any): NYR | Contacted: ☐ Yes ☐ No | Entry Time: | Exit Time: |
| Name of SPDES Permittee[1]/ SWPPP Contact Name: | | Inspection Type: | ☐ NOT ☐ Complaint |
| Phone Number(s): | | | ☐ Compliance ☐ Referral |
| On-site Representative(s) and Company(s): | | MS4 Operator Name: | |
| | | MS4 Permit ID: NYR20A | |

**SPDES AUTHORITY**

| | Yes | No | N/A | | Citation |
|---|---|---|---|---|---|
| 1. | ☐ | ☐ | ☐ | Does the project have permit coverage? | GP-0-20-001: I.A & II. B |
| 2. | ☐ | ☐ | ☐ | Is a copy of the NOI and Acknowledgment Letter available on site and accessible for viewing? | GP-0-20-001: II.D.2 |
| 3. | ☐ | ☐ | ☐ | Is a copy of the MS4 SWPPP Acceptance Form available on site and accessible for viewing? | GP-0-20-001: II.D.2 |
| 4. | ☐ | ☐ | ☐ | Is an up-to-date copy of the signed SWPPP retained at the construction site? | GP-0-20-001: II.D.2. & III.A.4 |
| 5. | ☐ | ☐ | ☐ | Is a copy of the SPDES General Permit retained at the construction site? | GP-0-20-001: II.D.2 |
| 6. | ☐ | ☐ | ☐ | Does the NOI accurately report the number of acres to be disturbed? | GP-0-20-001: II.B.4 |

**SWPPP CONTENT**

| | Yes | No | N/A | | Citation |
|---|---|---|---|---|---|
| 7. | ☐ | ☐ | ☐ | Does the SWPPP describe and identify the erosion and sediment control measures to be employed? | GP-0-20-001: III.B.1.e |
| 8. | ☐ | ☐ | ☐ | Does the SWPPP provide an inspection schedule and maintenance requirements for the E&SC measures? | GP-0-20-001: III.B.1.i |
| 9. | ☐ | ☐ | ☐ | Does the SWPPP describe and identify the stormwater management practices to be employed? | GP-0-20-001: III.B.2 |
| 10. | ☐ | ☐ | ☐ | Does the SWPPP identify the contractor(s) and subcontractor(s) responsible for each measure? | GP-0-20-001: III.A.6 |
| 11. | ☐ | ☐ | ☐ | Does the SWPPP identify at least one trained individual from each contractor(s) and subcontractor(s) companies? | GP-0-20-001: III.A.6 |
| 12. | ☐ | ☐ | ☐ | Does the SWPPP include all the necessary Contractor Certification Statements and signatures? | GP-0-20-001: III.A.6 |
| 13. | ☐ | ☐ | ☐ | Is the SWPPP signed by the permittee? | GP-0-20-001: VII.H.2 |

**NEW YORK OFFICE**
33 Airport Center Drive, Suite 202, New Windsor, NY 12553
845-567-3100 | F: 845-567-3232 | mheny@mhepc.com

**PENNSYLVANIA OFFICE**
111 Wheatfield Drive, Suite 1, Milford, PA 18337
570-296-2765 | F: 570-296-2767 | mhepa@mhepc.com

| | | |
|---|---|---|
| 14. ☐ ☐ ☐ | Is the SWPPP prepared by a qualified professional (if post-construction stormwater management required)? | GP-0-20-001: III.A.3 |
| 15. ☐ ☐ ☐ | Do the SMPs conform to the Enhanced Phosphorus Removal Standards (projects in TMDL watersheds)? | GP-0-20-001: III.B.3 |

**RECORDKEEPING**

| Yes No N/A | | Citation |
|---|---|---|
| 16. ☐ ☐ ☐ | Are self-inspections performed as required by the permit (weekly, or twice weekly for >5 acres disturbed)? | GP-0-20-001:IV.C.2.a & b |
| 17. ☐ ☐ ☐ | Are the self-inspections performed and signed by a qualified inspector and retained on site? | GP-0-20-001:II.C.2., IV.C.6 & VII.H.3 |
| 18. ☐ ☐ ☐ | Do the qualified inspector's reports include the minimum reporting requirements? | GP-0-20-001: IV.C.4 |
| 19. ☐ ☐ ☐ | Do inspection reports identify corrective measures that have not been implemented or are recurring? | GP-0-20-001: IV.C.5 |

**VISUAL OBSERVATIONS**

| Yes No N/A | | Citation |
|---|---|---|
| 20. ☐ ☐ ☐ | Are all erosion and sediment control measures installed properly? | GP-0-20-001: VII.L |
| 21. ☐ ☐ ☐ | Are all erosion and sediment control measures being maintained properly? | GP-0-20-001: IV.A.1 |
| 22. ☐ ☐ ☐ | Was written authorization issued for any disturbance greater than 5 acres? | GP-0-20-001: II.D.3 |
| 23. ☐ ☐ ☐ | Have stabilization measures been implemented in inactive areas per Permit (>5acres) or ESC Standard? | GP-0-20-001: II.D.3.b & III.B.1.f |
| 24. ☐ ☐ ☐ | Are post-construction stormwater management practices constructed/installed correctly? | GP-0-20-001: III.B.2 |
| 25. ☐ ☐ ☐ | Has final site stabilization been achieved and temporary E&SC measures removed prior to NOT submittal? | GP-0-20-001: V.A.2 |
| 26. ☐ ☐ ☐ | Was there a discharge from the site on the day of inspection? | |
| 27. ☐ ☐ ☐ | Is there evidence that a discharge caused or contributed to a violation of water quality standards? | ECL 17-0501, 6 NYCRR 703.2 |
| 28. ☐ ☐ ☐ | Have comments referenced in previous MS4 Inspection Reports been addressed? | & GP-0-20-001: I * |

**WATER QUALITY OBSERVATIONS**

Describe the discharge(s): location, source(s), impact on receiving water(s), etc.

Describe the quality of the receiving water(s) both upstream and downstream of the discharge:

*Citation only associated with Line 27

Describe any other water quality standards or permit violations:

Additional Comments:

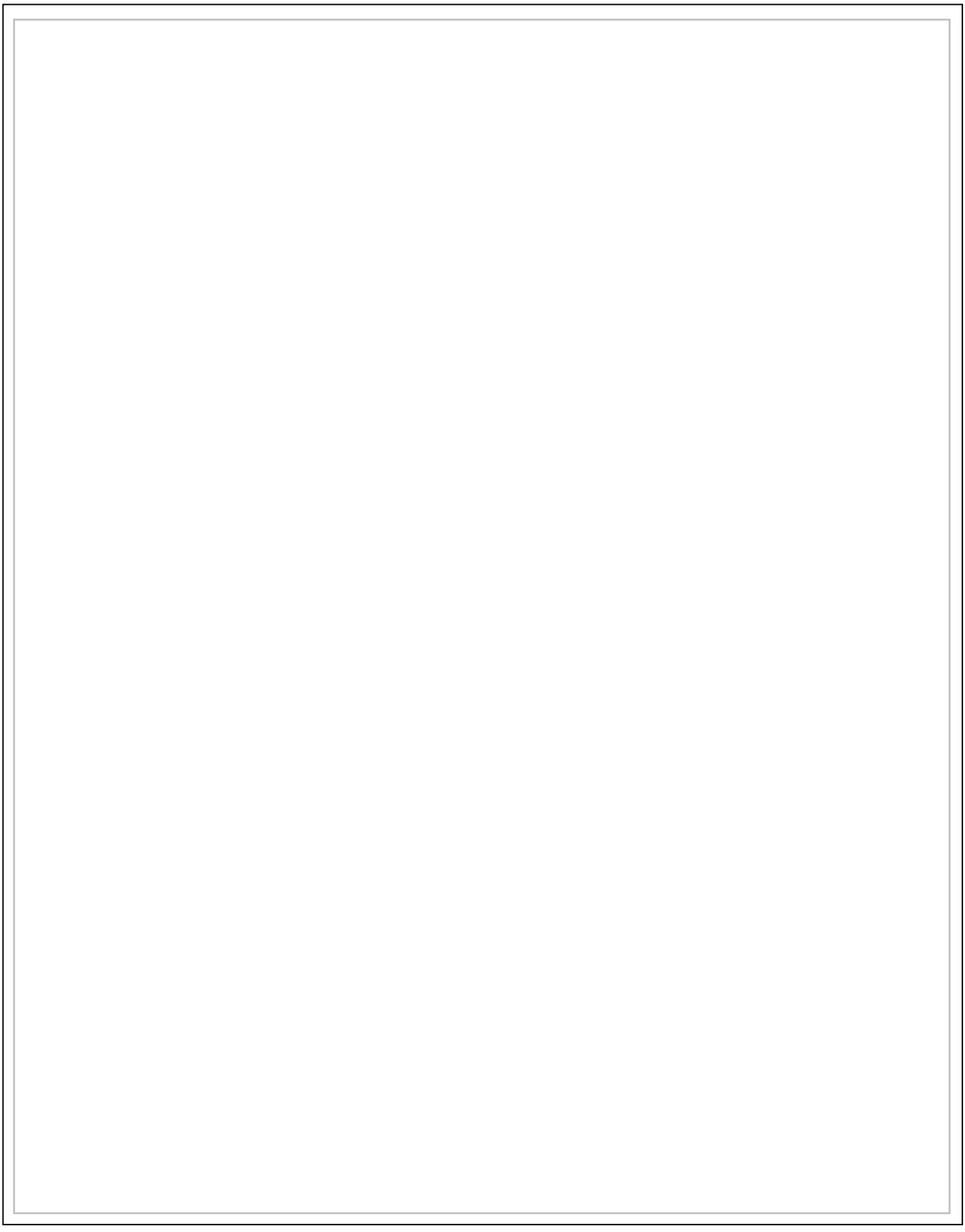
☐ Photographs attached

| | |
|---|---|
| Overall Inspection Rating: ☐ Satisfactory ☐ Marginal ☐ Unsatisfactory | |
| Name/Agency of Lead Inspector: | Signature of Lead Inspector: |
| Names/Agencies of Other Inspectors: | |

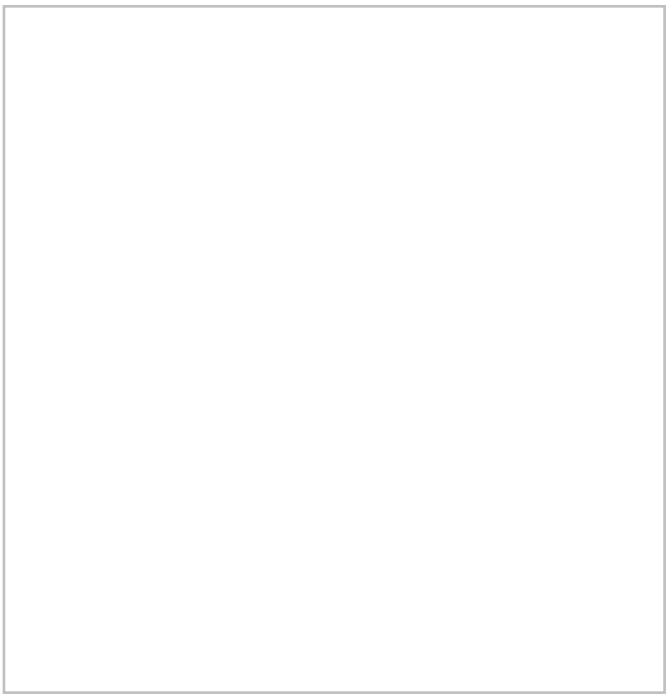
* Appendix D if the NYSDEC Permit MS4 GP-0-24-001 utilized as reference for this form

1 SWPPP Contact information referenced on NYSDEC Index of NOI Spreadsheet

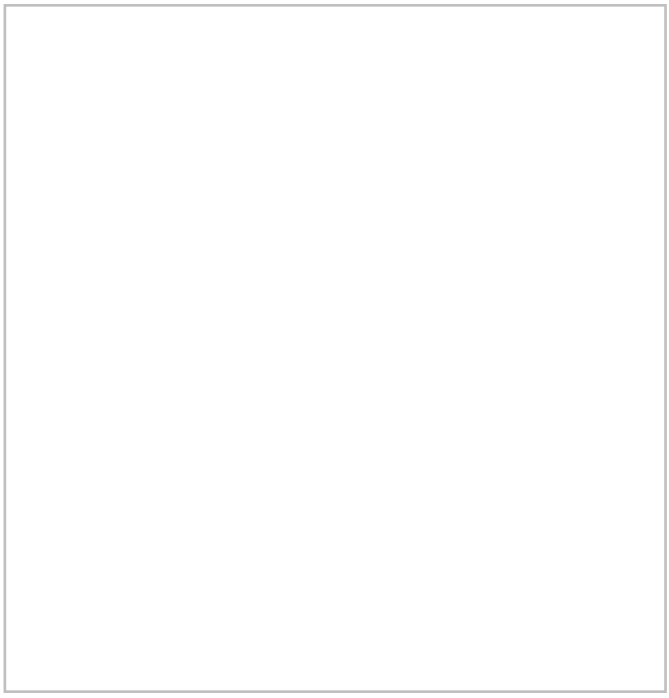
**PLAN**



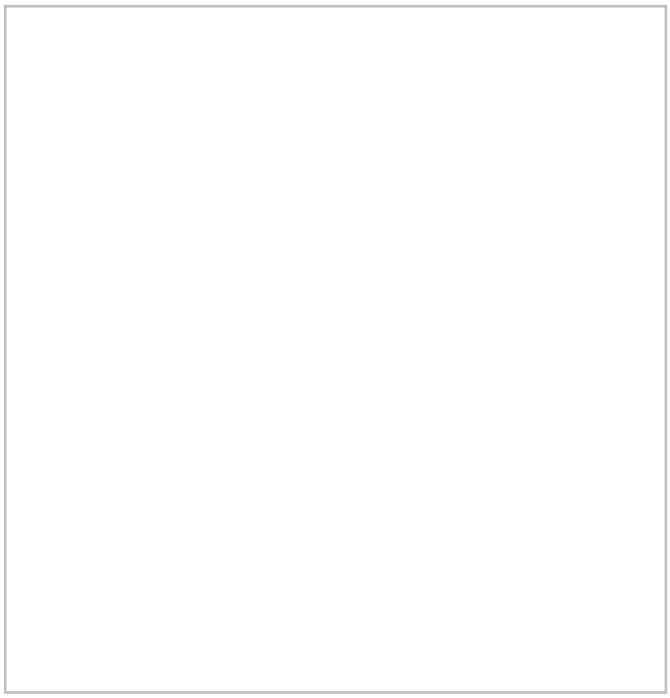
**PICTURES**



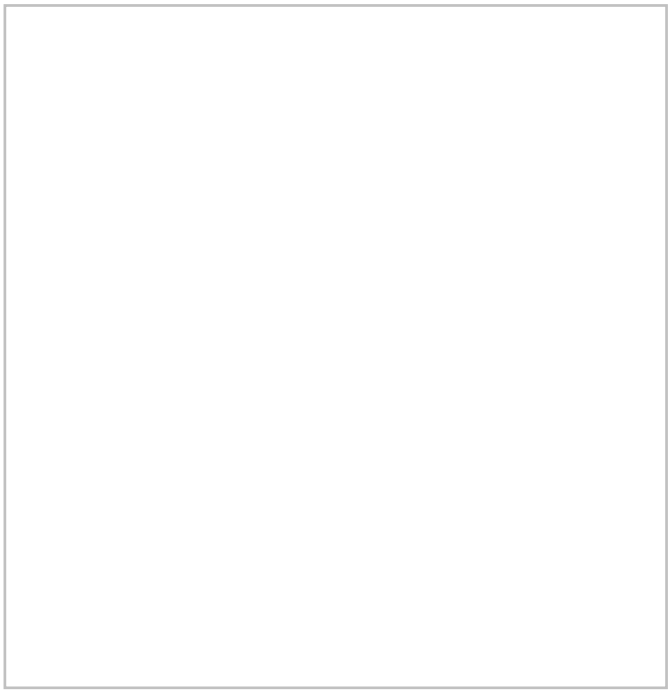
Description



Description



Description



Description

**PICTURES**

Description

Description

Description

Description

# ATTACHMENT 11

# STORMWATER MAINTENANCE AGREEMENT SAMPLE

**Town of Newburgh**

**Section __ Block __ Lot(s)**

# TOWN OF NEWBURGH

## Stormwater Control Facility Maintenance Agreement

THIS AGREEMENT is made this ____ day of _____, 2018 by and between the Town of Newburgh, having an address at 1496 Route 300, Newburgh, New York 12550 ("Municipality") and _____, having an address at _____ (the "Facility Owner").

Whereas, the Municipality and the Facility Owner want to enter into an agreement to provide for the long term maintenance and continuation of stormwater control measures approved by the Municipality for the below named project; and

Whereas, the Facility Owner is the owner of certain real property in the Town of Newburgh consisting of approximately +/- ____ acres more particularly described in Schedule "A" annexed hereto and made a part hereof (the "Property"); and

Whereas, the Municipality and the Facility Owner desire that the stormwater control measures be built in accordance with the approved project plans and thereafter be maintained, cleaned, repaired, replaced and continued in perpetuity in order to ensure optimum performance of the components.

Now, therefore, the Municipality and the Facility Owner agree as follows:

1. This agreement binds the Municipality and the Facility Owner, its successors and assigns to the maintenance provisions depicted in the approved project plans and Stormwater Pollution Prevention Plan which are on file with the Municipality's Stormwater Management Officer.

2. The Facility Owner shall maintain, clean, repair, replace and continue the stormwater control measures depicted on the approved project plans for the Facility known as _____ on and about the Property, as necessary to ensure optimum performance of the measures to design specifications. The stormwater control measures shall include, but shall not be limited to, the following: drainage ditches, swales, dry wells, infiltrators, drop inlets, pipes, culverts, soil absorption devices and retention ponds and other stormwater practices identified in the Stormwater Pollution Prevention Plan (SWPPP) approved by the Municipality [annexed hereto as Schedule "B." (Attaching the SWPPP plan and text, if any, as Schedule B is optional. If the Facility Owner wishes to do so, mylars must be provided to record with the signed Agreement and the Orange County Clerk's recording fee calculated to include that cost.

Delete or retain the text in blue from the final document as you determine. In any event delete this red parenthetical.) ]

3. The Facility Owner shall be responsible for all expenses related to the maintenance of the stormwater control measures and shall establish a means for the collection and distribution of expenses among parties for any commonly owned facilities.

4. The Facility Owner shall provide for the periodic inspection of the stormwater control measures, not less than once a year, to determine the condition and integrity of the measures. Such inspection shall be performed by a Professional Engineer licensed by the State of New York. The inspecting engineer shall prepare and submit to the Municipality within 30 days of the inspection, a written report of the findings including recommendations for those actions necessary for the continuation of the stormwater control measures.

5. The Facility Owner shall not authorize, undertake or permit alteration, abandonment, modification or discontinuation of the stormwater control measures except in accordance with written approval of the Municipality. The obligations of the Facility Owner under paragraphs 2, 3, 4 and 6 of this Agreement shall toll upon the completion of the establishment of a drainage district of the Municipality and the acceptance of the dedication of the stormwater control measures by the Municipality. The tolling period shall end upon the discontinuance or dissolution of the municipal drainage district.

6. The Facility Owner shall undertake necessary maintenance, repairs and replacement of the stormwater control measures at the direction of the Municipality or in accordance with the recommendations of the inspecting engineer.

7. The Facility Owner shall provide to the Municipality within 30 days of the date of this agreement, such security for the maintenance and continuation of the stormwater control measures as the Municipality may have required in its approval in the form acceptable to the Town Engineer and Town Attorney (a bond, letter of credit or escrow account).

8. This agreement shall be recorded in the Office of the County Clerk, County of Orange and shall be included in any offering plan and/or prospectus or lease. All rights, title and privileges herein granted, including all benefits and burdens, shall run with the land and shall be binding upon and inure to the benefit of the parties hereto, their respective heirs, executors, administrators, successors, assigns and legal representatives.

9. If ever the Municipality determines that the Facility Owner has failed to construct or maintain the stormwater control measures in accordance with the project plans or has failed to undertake corrective action specified by the Municipality or by the inspecting engineer, the Municipality is authorized to undertake such steps as reasonably necessary for the preservation, continuation or maintenance of the stormwater control measures and to affix the expenses

thereof as a lien against the property. The Facility Owner shall reimburse the Municipality for all costs and expenses, including reasonable attorneys' fees, incurred in enforcing this Agreement and curing a violation.

10. This agreement is effective _____ ____, 2018.

THE BALANCE OF THIS PAGE IS INTENTIONALLY LEFT BLANK

IN WITNESS WHEREOF, the parties have duly executed this agreement as of the day and year first above written.

**TOWN OF NEWBURGH** **_____**

**By:_____** **BY:_____**
**Gilbert J. Piaquadio, Supervisor** **Printed Name:_____**
**Title:_____**

STATE OF NEW YORK:)
) SS.
COUNTY OF ORANGE:)

On the _____ day of _____, in the year 2018 before me, the undersigned, personally appeared **GILBERT J. PIAQUADIO** personally known to me or proved to me on the basis of satisfactory evidence to be the individual (s) whose name (s) is (are) subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their capacity (ies), and that by his/her/their signature (s) on the instrument, the individual (s), or the person upon behalf of which the individual (s) acted, executed the instrument.

_____
Notary Public

STATE OF NEW YORK:)
) SS.
COUNTY OF ORANGE:)

On the _____ day of _____, in the year 2018 before me, the undersigned, personally appeared _____ personally known to me or proved to me on the basis of satisfactory evidence to be the individual (s) whose name (s) is (are) subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their capacity (ies), and that by his/her/their signature (s) on the instrument, the individual (s), or the person upon behalf of which the individual (s) acted, executed the instrument.

_____
Notary Public

**SCHEUDLE “A”**

# ATTACHMENT 12

# SWEEPING LOG

# MCM6 - SWEEPING LOG

**Municipality:**_____

**ROAD** ☐ **PARKING LOT** ☐ **BRIDGE** ☐ **RIGHT OF WAY** ☐
**OTHER** ☐

**DATE:**_____

**NAME/DESCRIPTION -** _____

**COMMENTS:**

**PROCEDURAL NARRATIVE:**

**All municipal roads, bridges, parking lots, and right of ways to be cleaned and swept once every five years in the spring (following winter activities such as sanding). Sweeping and cleaning of each area is to be documented in a sweeping log and the overall status tracked on municipal road mapping.**

**This requirement is not applicable to:**

i. **Uncurbed roads with no catch basins;**
ii. **High-speed limited access highways; or**
iii. **Roads defined as interstates, freeways, and expressways, or arterials by the United States Department of Transportation, Federal Highway Administration, Highway Functional Classification Concepts, Criteria and Procedures, 2013.**

**NAME/SIGNATURE:**_____

# ATTACHMENT 13

# POLLUTION PREVENTION AND GOOD HOUSEKEEPING PUBLICATION

# Stormwater Best Management Practice

# Municipal Employee Training and Education

**Minimum Measure:** Pollution Prevention/Good Housekeeping for Municipal Operations
**Subcategory:** Education

## Description

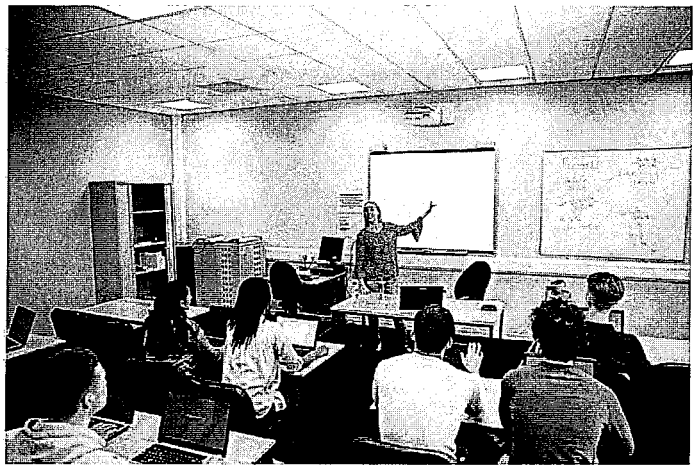
Employee training and education is critical to the proper implementation of pollution prevention and good housekeeping measures, which limit stormwater pollution associated with regular municipal activities. A municipality should design its employee training programs to teach staff about potential sources of stormwater contamination and ways to minimize the water quality impact of municipal activities, such as park and open space maintenance, fleet and building maintenance, construction and land disturbances, and storm drain system maintenance. Employee training and education also serves to create awareness of Phase II minimum control measures, including public education and outreach, public participation/involvement, illicit discharge detection and elimination, and runoff controls for construction and post-construction sites. A key factor in the success of training and education programs is training all employees and associated contractor personnel to incorporate pollution prevention/good housekeeping practices into their everyday activities.

## Applicability

Municipal employees who are directly involved in potentially polluting activities should receive both general stormwater and practice-specific training tailored to their responsibilities. These employees may include municipal staff, contractors, and even temporary or seasonal staff. Proper training helps protect storm drain systems and the receiving waters they discharge to from accidental spills, illicit discharges, and improperly managed stormwater discharges from poorly planned construction and development activities and incomplete or improper housekeeping practices.

## Implementation

Municipal training and education can take many forms and cover a wide range of content. It is important for municipal staff to design a training and education program around the specific needs of their municipality.



Routine stormwater training for all municipal employees and contractors is a crucial component of operating a successful stormwater program.

General stormwater awareness training is a good way to convey the importance of pollution prevention/good housekeeping practices, as demonstrated by this training from the New Castle County Department of Public Works.

### Training and Education Content

Training and education program content should begin with general material, including a general stormwater awareness message, an overview of applicable stormwater regulations, and an overview of NPDES Phase II minimum control measures. It is important that this content draw direct links between municipal employees' daily activities and the potential for impacts to a community's local water resources.

As well, a municipality should design program content around specific operations. For example, the Center for Water Protection's (CWP's) *Municipal Pollution Prevention/Good Housekeeping Practices* manual lists major municipal operations that may affect water quality, including:

- Hotspot facility management
- Construction project management
- Street repair and maintenance
- Street sweeping
- Storm drain maintenance
- Stormwater hotline response
- Park and landscape maintenance
- Residential stewardship
- Stormwater management practice maintenance

The CWP manual also provides a helpful, step-by-step guide for identifying, evaluating, and prioritizing municipal operations for incorporation into a custom training program.

## Training and Education Methods

Training on stormwater issues can take several forms, including in-house training programs, on-the-job training, videos or online content, general awareness and educational materials, and workshops or conferences. For all content types, it is important to keep records to document participation and progress.

Typically, in-house training formats include annual, formal classroom style programs as well as more frequent, informal "tailgate" meetings. Tailgate meetings—usually held frequently such as on a weekly basis—update staff on current issues and tasks but often incorporate short training sessions as well. Municipalities usually conduct more comprehensive training when hiring or promoting employees. Any of these training formats can include basic information and details about pollution prevention and stormwater treatment practices. Whenever possible, a municipality should provide additional in-field (i.e., hands-on) training to demonstrate proper implementation of operation and maintenance and good housekeeping measures.

Videos and online trainings are also useful tools. EPA and many other state and local agencies have developed their own online resources. Examples include:

- EPA's posters, fact sheets, guidebooks and other tools
- The North Central Texas Council of Governments' video "Preventing Stormwater Pollution: What We Can Do," with an accompanying series of training modules on stormwater pollution prevention
- The Minnesota Pollution Control Agency's "Parks Maintenance and Stormwater Protection Employee Training" video
- The New Jersey Department of Environmental Protection's series of NJPDES Municipal Stormwater Regulation Program employee training videos

Some municipalities provide general stormwater awareness information in new employee training. Paycheck inserts or email notices with information about household practices to reduce stormwater impacts or ways to recognize an illicit discharge can increase overall awareness. Stormwater posters or displays in common areas of municipal buildings educate both employees and members of the community.

Many federal agencies, state agencies, and professional and nonprofit organizations offer workshops and conferences about pollution prevention and stormwater controls and stormwater management best management practices (BMPs). For example, EPA sponsors workshops and conferences on a variety of stormwater topics, and many states provide local stormwater trainings. Employees can learn how to comply with the latest stormwater management regulations, how to develop required stormwater pollution prevention plans, which controls or BMPs to use at a particular facility or site, and methods for collecting and handling samples. By attending these outside events, municipal staff can keep up to date on current stormwater controls and stormwater management approaches while networking with other municipal employees and representatives from industry and regulatory agencies.

## Training and Education Follow-Up

After initial training, it is helpful for managers to periodically check employees' work practices. Periodic, unscheduled inspections of facilities and maintenance activities will allow managers to gauge what employees have learned and where they could improve. Posting reminders—such as markers above drains prohibiting discharges of vehicle fluids and wastes, or signs above faucets to not use water to clean up spills—will remind employees of proper procedures. Municipalities can place stickers that list important information and contact numbers for reporting illicit discharges, dumping or spills on all their vehicles. Stenciling or marking all storm drains at municipal facilities will prompt employees to be conscientious of discharges. Facility stormwater pollution prevention plans and stormwater BMP guidance documents should be available to all employees as a reference to use after trainings.

## Limitations

Limited staff time, employee turnover, funding constraints or lack of commitment from management can hamper comprehensive stormwater training. Often exacerbating these limitations is a lack of refresher trainings, as well as a lack of training course content updates to account for changes in regulations and best practices. To combat these problems, municipalities can incorporate stormwater training into their existing training programs. In doing so, they can draw on the many training materials and stormwater BMP guidance documents available online and free of charge.

## Cost Considerations

Costs for in-house employee training programs are related to labor and associated overhead costs. Trainers can reduce direct costs by using free educational materials or training tools that are already developed. CWP estimates a municipality would need 200 to 400 staff hours to improve employee training and education by following the step-by-step guidance in its *Municipal Pollution Prevention/Good Housekeeping Practices* manual (CWP, 2008).

Many private companies and groups offer training for a fee. Online searches can bring up an extensive range of training options: webinars, in-person courses and guidebooks for on-site stormwater practices, as well as information on developing stormwater management plans and examples of training that already exists.

**Additional Information**

Additional information on related practices and the Phase II MS4 program can be found at EPA's National Menu of Best Management Practices (BMPs) for Stormwater website

**Disclaimer**

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# Stormwater Best Management Practice

# Deicing Material Application and Storage

**Minimum Measure:** Pollution Prevention/Good Housekeeping for Municipal Operations
**Subcategory:** Municipal Activities

## Description

In areas where snow and ice are common during winter months, municipalities and transportation authorities apply deicing materials—most commonly salts, gravel or sand—to sidewalks, parking lots, and roadways to reduce ice buildup and improve traction for pedestrians and vehicles. Salts help lower the melting point of ice, allowing sidewalks, parking lots, and roadways to stay free of ice buildup during cold winters. But they are also soluble, can be toxic to some biota and environmentally persistent: applying and storing them can cause them to mix with stormwater, leading to water quality problems. Problems range from aquatic life impacts in downstream waters to contamination of drinking water supplies (Fay & Shi, 2012; Labashosky, 2015).

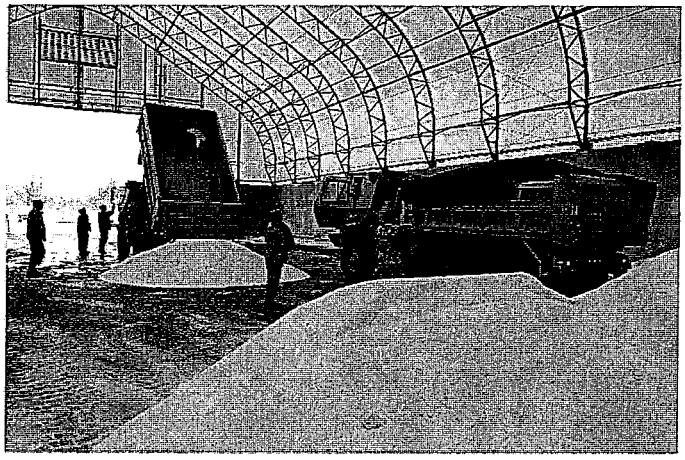
For more information on alternative deicers, see Terry et al.'s (2020) "Alternative Deicers for Winter Road Maintenance—A Review" and the comprehensive Transportation Research Board (2007) report *Guidelines for the Selection of Snow and Ice Control Materials to Mitigate Environmental Impacts.*

## Applicability

Deicing materials are applied and stored in areas that receive heavier snowfalls. Municipalities in these areas should use techniques to ensure proper storage and application for equipment and materials.

### Deicing Materials Management Program Considerations

During deicing materials application, certain best management practices can limit potential environmental impacts. Roadway managers and others generally outline these practices in a deicing materials management program or plan, which can help improve the efficiency of deicing efforts. Such a program plan should account for local considerations, as well as the general ones described below.



Keeping salt stored inside protects water quality and reduces salt loss from exposure to rain and snow.
Photo Credit: Staff Sgt. Jorge Intriago/Wikimedia

### Material Selection

U.S. municipalities and transportation departments use sodium chloride for deicing more than any other material, due to its low cost and wide availability (Table 1). Sodium chloride has its drawbacks, including minimal effectiveness at temperatures less than 15°F, high potential for contamination of downstream waters, and high corrosivity. Because of these drawbacks, roadway managers have looked to other chemicals or materials including other salts (e.g., calcium chloride, magnesium chloride), organic compounds (e.g., acetate compounds, glycol) and biomass-based agricultural byproducts (Terry et al., 2020; Transportation Research Board, 2007). Most of these alternative products are more expensive than sodium chloride and each has its own strengths and weaknesses. For example, municipalities should consider less corrosive alternative deicing materials like glycol, urea, or calcium magnesium acetate (CMA) for bridge deicing.

Table 1 does not include sand and gravel—often referred to as "abrasives"—which can improve traction on ice-covered roadways but do not melt ice.

## Table 1. Deicing Material Alternatives

| Material | Annual Usage, North America (Tons) | Median Cost per Ton (2020 Dollars)[a] | Characteristics |
|---|---|---|---|
| Sodium chloride (NaCl) | 4,773,000 | $51 | ■ Low cost<br>■ Widely available<br>■ Moderately effective at temperatures between 15°F and 25°F, most effective at temperatures above 25°F |
| Calcium chloride ($CaCl_2$) | 47,679 | $171 | ■ Melts ice at temperatures below 25°F<br>■ If used as recommended, will not harm vegetation |
| Magnesium chloride ($MgCl_2$) | 149,724 | $135 | ■ Lowest practical temperature: 5°F<br>■ If used as recommended, will not harm vegetation; however, $MgCl_2$, on a percentage basis, contains 17–56% more chloride ion than other salt-type deicers |
| Calcium magnesium acetate (CaMgAc) | 21,817 | $1,820 | ■ Will work below 0°F<br>■ Low toxicity and biodegradable |

Sources: Keating, 2004; Kelting & Laxson, 2010

[a] Cost data adjusted from 2009 to 2020 dollars using the Bureau of Labor Statistics CPI Inflation Calculator

### Application

Before applying salt, it is important to blow, shovel or plow accumulated snow to ensure more effective melting (NHDES, 2016).

Roadway managers should set application rates that reflect site-specific characteristics such as pavement temperature, road width and design, traffic concentration, and proximity to surface waters. Application rates should be as low as possible while remaining effective. Application plans should specify alternative deicing materials for areas too sensitive for chemical use.

To apply deicing materials to roadways and parking lots, most municipalities use specialized dump trucks with spreaders. When possible, they should employ electronically controlled spreading equipment that can lock in specific application rates, preventing operators from using more salt than necessary (MDOT, 2019). Municipalities should also calibrate all deicing material spreading equipment before the start of a winter season and check it periodically during the season for accuracy.

### Monitoring and Tracking

Keeping accurate records of application practices can help optimize deicing effectiveness and reduce harmful impacts. Roadway managers should develop a tracking system that maps application routes, logs application rates and notes areas of high accumulation of ice/snow. Benchmarking is also a good way to reduce salt use over time. For example, roadway managers can log application rates per degrees below 32°F or inch of snow and set reduction goals each year (MPCA, 2020).

Many DOTs are implementing road weather management strategies focusing on tools and technologies using real-time or archived road weather data from fixed and mobile road weather observations. In addition to vehicle location data from automatic vehicle location systems and radio communication between the driver and the maintenance center, mobile road weather observations can include more detailed maintenance vehicle information such as plow status and material usage, and/or road weather measurements such as pavement surface and air plus pavement temperatures. Survey data from the Federal Highway Administration (2017) reports that overall, 23 of the 40

States collect real-time field data from maintenance vehicles with plow status and material usage being the most common data collected.

### Storage

Municipalities should store deicing material piles in covered areas, protected from weather throughout the year. Although covering stored deicing materials may be costly, the benefits are often far greater than the perceived costs. Properly storing deicing materials prevents it from lumping together, which makes it easier to load and apply. Covering deicing materials storage piles reduces loss, as exposed piles will slowly dissolve from rain and snow throughout the year and wash into downstream waterbodies. Municipalities often store deicing materials in barns, domes, silos or other permanent structures. These structures should be outside the 100-year floodplain for further protection against flooding and surface water contamination.

### Training

Municipalities should regularly train their staff and contractors on proper storage and application practices. This training should stress the importance of using the smallest amount of material that will make roadways safe and passable (MDOT, 2019). Program managers should receive additional training on effective winter storm management, winter materials inventory management, the properties of salt and other winter deicing materials, and data collection and analysis.

## Maintenance Considerations

Salt is highly corrosive, so application equipment and storage facilities need regular maintenance to maintain functionality and integrity. Importantly, maintenance activities should also help reduce salt export as much as possible.

As well as carrying out standard vehicle and equipment maintenance, staff should wash applicator vehicles down after every use. To prevent contamination of downstream waters, municipalities should capture, treat, or recycle the salt-containing wash water. Staff can reuse this water as brine for salt pre-wetting (MPCA, 2020). Installing a wash area adjacent to a storage area so that it can also collect any spilled brine from the storage area is a good way to eliminate another potential source of salt contamination and improve overall salt use efficiency.

Staff should routinely inspect storage structures. During active months, they should immediately collect any material spilled during loading or unloading operations and return it to the storage structure. During the off-season, they should identify and fix any leaks, weak points or corroded areas.

## Limitations

Salt application requires specialized equipment that needs rigorous maintenance to limit corrosion from the salt. It also requires designated personnel and storage facilities that are generally only in use for a fraction of the year. Deicing becomes expensive at very cold temperatures: below 15°F, a community would typically need a prohibitive amount of sodium chloride, and suitable replacements are much more expensive (Kelting & Laxson, 2010).

Salt application also leads to long-term environmental impacts as well as infrastructure and automobile corrosion problems. Particularly across the northeast and Midwest, salt application has led to the designation of thousands of miles of streams and thousands of acres of lakes, reservoirs and ponds as threatened or impaired for chloride (U.S. EPA, 2020).

## Cost Considerations

Costs associated with a deicing materials application program include both direct and indirect costs. Direct costs, including the cost of the deicing materials (see Table 1), application equipment, storage facilities and labor, will vary depending on the frequency and duration of deicing materials activities. Using a typical range of application rates for sodium chloride of 200 to 800 pounds per lane mile (Transportation Research Board, 2007) and the median cost from Table 1, material costs can range from $5.10 to $20.40 per lane mile.

Indirect or "hidden" costs, on the other hand, tend to accumulate over time and are harder to quantify. In a review of the literature, Dindorf and Fortin (2014) found estimates of damage to infrastructure, automobiles, vegetation, human health and the environment due to salt to range from $800 to more than $3,000 per ton of salt used.

**Additional Information**

Additional information on related practices and the Phase II MS4 program can be found at EPA's National Menu of Best Management Practices (BMPs) for Stormwater website

## References

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Transportation Research Board. (2007). *Guidelines for the selection of snow and ice control materials to mitigate environmental Impacts*. National Academies Press.

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# Stormwater Best Management Practice

# Municipal Landscaping

**Minimum Measure:** Pollution Prevention/Good Housekeeping for Municipal Operations
**Subcategory:** Municipal Activities

## Description

Municipal landscaping involves a number of activities that can contribute to water quality impacts. Improper use of fertilizers and pesticides can lead to increased concentrations of nutrients and chemicals in stormwater, while poor grass and vegetation management can lead to export of soil and organic matter. Proper landscaping practices can reduce these impacts and can also provide water quality benefits.

There are many benefits to environmentally friendly landscape design. First, proper site planning can reduce maintenance requirements by using native species that often need less upkeep than non-native species. Soil analysis can prevent overfertilization by eliminating uncertainty regarding existing soil fertility. Minimizing turf area by replacing it with alternative ground cover, shrubs and trees increases infiltration and reduces mowing requirements, which subsequently reduces air, water and noise pollution. Mulches stabilize exposed soils, prevent growth of nuisance vegetation, and improve soil fertility through the slow release of nutrients from decomposition. Ensuring the proper application of pesticides and fertilizers and preventing overuse reduces the potential for contamination of downstream waterways. Finally, a diverse landscape can enhance a property's aesthetics.

Municipal landscaping programs also offer the opportunity to set a good example for residents. To reduce pesticide use and encourage the use of less-toxic alternatives by municipal crews, King County, Washington, and the City of Seattle began to phase out the use of dozens of pesticides in 1999 as part of an overall pesticide reduction strategy. The decision followed criticism that while the municipalities were urging residents to stop using weed killer and pesticides in yards to help endangered Chinook salmon, they were allowing municipal crews to apply herbicides in municipal parks and along roadsides (Johnson, 1999). Pesticide use and conversion of natural habitat to turfgrass also affects pollinators, which are vital to agricultural production. The Bee City USA program seeks to bolster pollinator habitat by increasing the abundance of native plants and reducing the use of harmful pesticides. Currently, over 100 cities are "Bee Cities," which means they commit to incorporating pollinator-friendly landscaping practices into their policies and plans.



Replacing turf with native species, trees and shrubs can reduce maintenance and fertilization requirements.
Photo Credit: Katrina Mueller/U.S. Fish & Wildlife Service

## Applicability

Turf or other vegetation can cover a significant percentage of the land a municipality owns—and it often needs regular maintenance. Municipalities can use environmentally friendly lawn and garden practices on their properties, and they can encourage residents to use the same practices in their yards. Such practices include landscape planning, integrated pest management, planting indigenous species, soil testing, and the reduction or elimination of fertilizers and pesticides. Planting drought-resistant plants and using water conservation practices can be especially useful in areas of low rainfall. Areas of high rainfall experience more erosion, so protecting exposed soils with vegetation and mulches is of particular importance in these areas.

## Siting and Design Considerations

The following guidelines describe ways in which municipalities can promote environmentally friendly landscaping techniques.

***Planning and design.*** It is important to develop a landscape plan that recognizes the property's natural conditions including drainage patterns, soils, existing vegetation and climate. The plan should group plants together according to their water needs. It should also consider the site's intended use. A thoughtful landscape plan will promote natural vegetation growth and minimize water loss and contamination. Alternatively, water-smart landscaping, similar to xeriscaping, uses drought-tolerant vegetation along with non-vegetation components such as gravel, rocks or mulch that can add aesthetic appeal, maintain infiltration rates and reduce irrigation requirements (EPA, 2013). Residents and municipal staff can partner with local nurseries and irrigation and lawn services to determine appropriate landscape designs for a specific site or facility. Planners can also incorporate green infrastructure into landscape designs (see the box to the right) to provide further stormwater benefits.

Several EPA resources are available to help municipalities identify ways to incorporate green infrastructure into existing municipal landscaping, including:

- *Green Infrastructure in Parks* guide
- *Green Infrastructure Operations That Arise During Municipal Operations*
- *Green Infrastructure Operations and Maintenance*

***Soil analysis and improvements.*** Soil testing every 3 to 4 years by residents and municipal staff can help determine the amount of nutrients necessary to maintain healthy vegetation and can prevent overfertilization. Municipalities can encourage home and garden centers to market and sell soil test kits so that property owners can perform such tests on their own. Local extension offices or universities can often perform soil tests and are a good source of information on fertilization and watering rates that are appropriate for local soils and vegetation.

***Vegetation selection.*** Vegetation selection is a critical component of good landscaping practices. It dictates water use, fertilizer and pesticide use, maintenance requirements and site stormwater discharge characteristics. Property owners and municipal crews should use local or regional plants, which are generally more water efficient and disease resistant. Furthermore, exotic plants can potentially invade surrounding natural areas and local waterways. Local nurseries can assist in choosing appropriate regional plant species.

***Turf areas.*** Property owners and municipal crews should plant non-turf areas, where possible, because turf typically needs more water and maintenance than wildflowers, shrubs and trees. If they do use turf, they should choose a type of turf grass that can withstand drought and that becomes dormant in hot, dry seasons. Local nurseries can help property owners and municipal crews choose grass types. In addition, when maintaining lawns, crew should not cut the grass shorter than 3 to 4 inches. They should leave clippings—which carry important nutrients—on the lawn and keep them from ending up in streets and sidewalks. This allows the grass to absorb nutrients as natural fertilizer and prevents those nutrients from reaching downstream waterways, where they can cause eutrophication.

***Efficient irrigation.*** Irrigation requirements vary by climate, soil and vegetation type. Maintenance crews should follow an irrigation schedule that is appropriate for their site and an irrigation rate that is water efficient. Applying water too quickly causes it to run off, along with the top layers of soil. To prevent this, it is important to encourage the use of low-volume watering approaches such as drip-type or low volume sprinkler systems. In addition, overwatering can actually discourage plants from developing deeper roots, which makes them less resistant to drought. Automated irrigation controllers are a good way to provide regular irrigation, and to reduce irrigation rates when it rains to prevent over-irrigation and excessive stormwater discharge.

***Use of mulches.*** Mulches help retain water, reduce weed growth, prevent erosion and improve the soil for plant growth. Mulches usually contain wood bark chips, wood grindings, pine straws, nut shells, small gravel or shredded landscape clippings. Municipalities should consider mulch use and encourage property owners to use mulches and inform them of the benefits of these materials. Additionally, municipalities can start programs

to collect plant materials from municipal maintenance activities as well as yard waste from property owners. They can then convert these materials to mulch and use them at their own properties or redistribute them to property owners.

***Fertilizers.*** Municipalities should discourage property owners and municipal crews from using fertilizers—or, if they do use them, from over-applying them. Municipalities should consider less-toxic alternatives to commercial fertilizers, such as composted organic material.

Municipalities can also recommend practices to reduce the amount of fertilizer entering stormwater. For example, slow-release fertilizers are less likely to enter stormwater. Application techniques, such as tilling fertilizers into moist soil to move the chemicals directly into the root zone, reduce the likelihood that the chemicals will mobilize in stormwater. Timing is also important: property owners should fertilize warm season grasses in the summer (in frequent and small doses) and cool season grasses in the fall. They should not apply fertilizer on a windy day or immediately before a heavy rain. Municipalities can recommend that municipal crews and property owners apply fertilizer at rates at or below those recommended on the packaging—or based on the needs of the soil, as determined by a soil test. Municipalities should also encourage safe disposal of excess fertilizer and containers.

Municipal crews and property owners should change fertilization rates if they use reclaimed water, or "purple pipe" water, for irrigation. Reclaimed water contains important nutrients like nitrogen and phosphorus in concentrations that are often high enough to completely eliminate the need for supplemental fertilizer. Local extension offices or environmental departments can help determine the amount of nutrients in reclaimed water and can help calculate revised fertilization rates.

*Pesticides.* Municipal crews and property owners should use pesticides (like fertilizer) on lawns and gardens only when necessary. They can avoid pesticide use by choosing hearty plants that are native to the area and by keeping them healthy. If they need to use chemical pesticides, they should choose the least toxic pesticide that targets the specific pest in question (boric acid, garlic, insects, etc.). A pesticide labeled "caution" is less toxic than one labeled "warning," which in turn is less toxic than one labeled "danger/poison."

It is important to follow the label directions on the pesticide product. Property owners and municipal crews should read and follow all safety precautions listed on pesticide labels, including wearing of personal protective equipment, using recommended application methods, and washing hands and face before smoking or eating. They should always rinse tools or equipment used for applying or incorporating pesticides in a bucket and handle the rinse water as if it were full-strength pesticide. They can save any unused pesticide and dispose of it at a hazardous waste collection location.

The following websites provide education and information on safe pesticide use:

- University of Nebraska's pesticide education resources
- Pennsylvania State University Extension's information on insects, pests and diseases
- Washington State University's Urban integrated pest management and pesticide safety courses
- Beyond Pesticides
- Cornell University's Pesticide Management Education Program
- National Pesticide Safety Education Center
- Californians for Alternatives to Toxics

*Ordinances.* Pollution due to the improper use or overuse of fertilizers and pesticides is a problem in places around the country. Fertilizer and pesticide ordinances are a way municipalities can reduce or even eliminate fertilizer and pesticide use. The following resources provide information on states or municipalities that have implemented fertilizer or pesticide ordinances, including integrated pest management programs that have become models for other communities:

- The State of Maine's Municipal Pesticide Ordinances Web page provides examples of communities throughout the state that have implemented ordinances specific to their locations and the pesticides of concern.
- The City of Portland, Oregon's Invasive Plant and Integrated Pest Management Program has become a model for communities throughout the Pacific Northwest.

- Fertilizer ordinances in Florida that reduce or completely ban fertilizer applications have become increasingly common to protect local surface water and groundwater quality. Florida state statute encourages every county and municipal government to adopt and enforce a model ordinance or the equivalent, and even requires it in watersheds that have existing nutrient impairments.

## Limitations

There are virtually no limitations for implementing environmentally friendly lawn, garden, and landscaping practices. Some practices are more applicable in certain climates (for example, there is little need for irrigation in areas of very high rainfall), but they are generally low cost and relatively easy to implement. With guidance from a local environmental agency, extension service or nursery, municipality and property owners can make proper decisions about which practices are best.

## Effectiveness

Proper landscaping techniques benefit the environment by reducing water use; decreasing energy use (by decreasing the need for water pumping and treatment); maximizing infiltration of storm and irrigation water; minimizing transport of soils, fertilizers and pesticides; and creating more habitat for plants and wildlife.

Conventional landscaping requires considerable amounts of water. Although municipal water use varies, about 30 percent of the average household's water consumption is for outdoor uses like irrigation (Mayer et al., 1999). In warmer areas, irrigation can exceed 60 percent of total household use (Haley et al., 2007). Xeriscape practices, including reducing turfgrass coverage, can reduce this water consumption (U.S. EPA, 2013, 2017). A study in Colorado Springs compared water use between a traditionally landscaped area and two xeriscaped areas and found xeriscaping to provide water savings of 22 to 63 percent over traditional turfgrass (Colorado WaterWise, 2010).

Good landscaping practices can reduce fertilizer and pesticide export from landscaped areas through better application, ordinances that restrict their use, or conversion to ground covers that do not require their use. A U.S. Geological Survey study of suburban lawns found that stormwater flow from unfertilized lawns had half as much phosphorus as discharge from regularly fertilized lawns (Garn, 2002). Similarly, a comparison of surface water quality data before and after Ann Arbor, Michigan's implementation of a phosphorus fertilizer ordinance found statistically significant reductions in phosphorus concentrations (Lehman et al., 2009). Xeriscape practices can help reduce export of both fertilizers and pesticides by incorporating ground covers that need neither to thrive.

Low-maintenance landscaping can also have positive effects on habitat and biodiversity. Landscaping requiring more maintenance like frequent mowing and pesticide use can lead to reduced vegetation diversity (Bertoncini et al., 2012), which in turn leads to lower biodiversity. In a study of 18 suburban lawns, Lerman et al. (2018) found that less frequent mowing allowed for greater abundance of bees and pollinators owing to greater abundance and diversity of the small weeds and wildflowers they rely on.

## Cost Considerations

Proper landscape activities can be very cost effective. Promoting the growth of healthy plants that need less fertilizer and pesticide minimizes labor and maintenance costs of lawn and garden care. Using water, pesticides, and fertilizers only when necessary and replacing store-bought fertilizers with compost material can increase the savings for a property owner as well as benefit the environment. Reducing turfgrass cover reduces labor and equipment costs associated with regular mowing. Actual cost savings will depend on how much existing labor, maintenance and equipment costs can be reduced.

Costs associated with alternative practices vary widely depending on the features that are incorporated. Features may include vegetation (e.g., wildflowers, grass, shrubs, trees), irrigation systems (drip, sprinkler or none), and "hardscape" features (e.g., rocks, pavers, gravel). The Colorado WaterWise *Guidebook of Best Practices* provides costs for different levels of implementation, which range from $3–$4 per square foot for simple plantings and no hardscape to $20 per square foot for elaborate installations featuring an array of plantings, drip irrigation and hardscape features (Colorado WaterWise, 2010).

**Additional Information**

Additional information on related practices and the Phase II MS4 program can be found at EPA's National Menu of Best Management Practices (BMPs) for Stormwater website

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# Stormwater Best Management Practice

# Municipal Vehicle Fueling

**Minimum Measure:** Pollution Prevention/Good Housekeeping for Municipal Operations
**Subcategory:** Municipal Activities

## Description

Fueling fleets of municipal vehicles can generate spills and leaks of fuel (gasoline and diesel fuel) and heavy metals—disproportionately toxic compounds that, if stormwater washes them into the storm drain system, can seriously impair the quality of nearby waterbodies. To prevent such discharges, municipal staff can employ practices that involve site design, regular maintenance and inspection, and focusing on pollution prevention during routine operations.

## Applicability

Municipalities use a variety of vehicles and equipment, such as transit buses, fire trucks, police cruisers, school buses, and public works and maintenance vehicles. The practices discussed below can apply to any location where fueling operations take place.

## Siting and Design Considerations

Municipal staff should design fueling areas to prevent spills and the contamination of stormwater discharges. Because spills can still occur, they should also incorporate features that contain spilled fuel. For example, the California Stormwater Quality Association recommends that designers pave fuel-dispensing areas with cement, concrete or an equivalent impervious surface (for asphalt paving, municipal staff should apply a suitable sealant); incorporate a 2 to 4 percent slope to prevent ponding, and separate the area from the rest of the site with a grade break or berm that keeps away stormwater (CASQA, 2003). Similarly, the City of Seattle requires that spill containment berms be at least 4 inches tall to both contain spilled liquids and keep stormwater away (City of Seattle, 2017).

Designers should cover fuel-dispensing areas, and the cover's minimum dimensions should be equal to or greater than the area within the grade break or the fuel-dispensing area. The cover should not drain onto the fuel-dispensing area. Designers can use a perimeter drain or sloped pavement to direct stormwater inward to a blind sump. Site conditions or local regulations may require the installation of an oil control device in catch basins that receive stormwater flow from the fueling area.




Fueling areas can be covered to reduce exposure to stormwater.

Vapor recovery nozzles can help control drips as well as reducing air pollution (CASQA, 2011). Fuel-dispensing nozzles should have "hold-open latches" (automatic shutoff) except where local fire departments prohibit them. Signs at the fuel dispenser or island should warn vehicle owners/operators against "topping off" vehicle fuel tanks.

For any facility where a mobile fuel truck fuels equipment, municipal staff should consider designating a fueling area and using temporary containment measures. Staff can place temporary cap seals over nearby catch basins or manhole covers to prevent any spills from entering the storm drain. Staff can also use a secondary containment device, such as an absorbent sock, when transferring fuel from a tank truck to a vehicle's fuel tank.

Facilities with fueling areas should have spill prevention plans and necessary spill kits nearby. A spill prevention

plan specifies material handling procedures and storage requirements and identifies spill cleanup procedures for areas and processes in which spills may occur. The plan standardizes operating procedures and training of employees and contractors to minimize accidental pollutant releases that could contaminate stormwater. (Consult the Spill Response and Prevention fact sheet for more information.)

## Operation and Maintenance Considerations

Regular operation and maintenance practices are just as important as proper facility design in preventing and containing spills. Municipal staff should routinely implement the following example measures:

- Check for external corrosion, leaks and structural failure in aboveground storage tanks.
- Check for spills and overfills due to operator error, including dried residue that may be evidence of past spills.
- Check for failure of any pumping, piping or dispensing systems.
- Check for leaks or spills during pumping of liquids or gases from a truck or rail car to a storage facility or vice versa.
- Visually inspect new tank or container installations for loose fittings, poor welds, and improper or poorly fitted gaskets.
- Inspect tank foundations, connections, coatings, tank walls and piping systems. Look for corrosion, leaks, cracks, scratches and other physical damage that may weaken the tank or container system.
- Periodically enlist a qualified professional to test the integrity of aboveground storage tanks.
- Ensure there is clear tagging or labeling on all fuel valves.

In the event of a spill, municipal staff should use dry cleanup methods. These include sweeping to remove litter and debris and using rags and adsorbents for leaks and spills. Staff should not use water to wash these areas. During routine cleaning, staff should use damp cloths on the pumps and damp mops on the pavement, rather than spraying with hoses.

Municipalities should provide written procedures that describe these practices to all employees who will be using fueling systems.

## Limitations

Municipalities often lack the funding for proper vehicle fueling practices. Old, outdated equipment and facilities can limit the implementation of appropriate practices. Many municipal fueling areas have no covering, have improper designs (e.g., no impervious surfaces), are in bad locations, have poor drainage (e.g., near downstream waterbodies), or use equipment prone to leaking or spills. It can be costly to retrofit existing facilities or build new fueling islands that provide better stormwater protection. Regularly training staff and inspecting facilities also requires funding that may not be available.

## Effectiveness

Vehicle fueling stations are well-known stormwater hot spots, with the potential to discharge hydrocarbons and heavy metals in concentrations far greater than those from surrounding land (Schueler & Shepp, 1995). As such, the potential environmental harm from accidental fuel spills can be significant. Although it is difficult to quantify the effectiveness of vehicle fueling practices, experience has shown that they make spills less likely to reach receiving waters. Additionally, studies have shown that certain treatment devices, such as oil-water separators or sand filters, can reduce the harmful effects of contaminated stormwater (Robbins, 2000; Schueler & Shepp, 1995).

Municipalities may develop metrics to assess relative progress against baseline conditions. Resources to help municipalities develop these metrics are available from California's State Water Resources Control Board.

## Cost Considerations

The costs of vehicle fueling pollution prevention practices are highly variable, as they depend on the need for new or retrofitted facilities, the condition of existing facilities, and ongoing maintenance requirements.

To reduce future maintenance costs, municipalities can design new facilities with high-quality features such as designated fueling areas with proper impermeable surfaces, protection from wet weather and sufficient containment structures. They should also consider staff time for training new hires, along with staff time for periodic retraining of other employees.

Municipalities should purchase spill kits and make them available at each fueling area and on each mobile fueling truck. Based on a review of current commercial supply companies, spill kits capable of cleaning up 5 to 6 gallons of spilled liquid range in cost from $25 to $100. These kits include standard items like absorbent socks, pads, gloves, one or more disposal bags, and a watertight container.

**Additional Information**

Additional information on related practices and the Phase II MS4 program can be found at EPA's National Menu of Best Management Practices (BMPs) for Stormwater website

## References

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# Stormwater Best Management Practice

# Municipal Vehicle and Equipment Maintenance

**Minimum Measure:** Pollution Prevention/Good Housekeeping for Municipal Operations
**Subcategory:** Municipal Activities

## Description

Municipal vehicle and equipment maintenance activities can generate a number of hazardous materials and wastes. If improperly managed, these materials can cause pollutant contributions to stormwater discharges and significant impacts to downstream water quality. This means that vehicle and equipment maintenance facilities might also be considered stormwater hot spots: areas that generate significant loads of hydrocarbons, trace metals and other pollutants that can affect the quality of stormwater discharges.

Vehicle maintenance facilities can generate wastes such as:

- Solvents (e.g., degreasers, paint thinners)
- Antifreeze
- Brake fluid and brake pad dust
- Battery acid
- Motor oil
- Fuel (gasoline, diesel, kerosene)
- Lubricating grease

Municipal staff who properly store automotive fluids, do maintenance in protected areas and thoroughly clean up spills can help reduce the effects of automotive maintenance practices on stormwater discharges and, consequently, local water resources.

## Applicability

Municipal activities require the use of various vehicles and equipment across many departments, such as public works operation and maintenance vehicles, police cars, fire trucks, and school and public transit buses. Because of this, a single community may have many maintenance facilities. Maintaining this equipment requires changing various parts and fluids, activities that can contribute to stormwater pollution through accidental spills or negligent practices. For example, in the United States about 350 million gallons of used engine oil each year is improperly disposed (DOE, 2006). Although governments often regulate stormwater discharges from most municipal facilities because of the "hot spot" nature of these activities, it is important to routinely implement best practices such as those outlined below.




A police car being maintained inside a municipal maintenance facility.

Photo Credit: U.S. Air Force photo/Senior Airman Nathanael Callon

## Siting and Design Considerations

The most effective way to minimize wastes generated by automotive maintenance activities is to prevent that waste's production in the first place.

For wastes a facility cannot avoid producing, "dry shop" techniques are a helpful way to reduce the potential for stormwater contamination from liquid discharges. Dry shop techniques limit comingling of waste materials with stormwater or wash water, which can wash pollutants into storm drains. Dry shop techniques include doing all maintenance activities inside or under cover and cleaning up spills immediately without water whenever possible. In addition, for activities that use solvents and generate a lot of waste liquids, a facility can hire a solvent service to supply parts and cleaning materials and to collect spent solvent.

In addition to dry shop practices, various structural and non-structural practices can further reduce pollutant discharges from vehicle maintenance facilities. The following list is not comprehensive; all facilities are different and should develop their own, specific targeted practices. Still, the following practices can serve as a starting point and as examples for a custom pollution prevention program.

For more information on related good housekeeping practices, see the following fact sheets:

- Materials Management
- Municipal Facilities Management
- Municipal Vehicle and Equipment Washing
- Municipal Employee Training and Education
- Municipal Vehicle Fueling
- Spill Response and Prevention
- Hazardous Materials Storage

## Structural Practices Examples

- Seal all floor drains.
- Label drains, wash sinks and other entry points to indicate outfall location (e.g., internal collection container, sanitary sewer, storm sewer).
- Install berms or other measures to contain spills and prevent surface drainage from entering storm drains.
- Locate work areas on impermeable surfaces (i.e., not on grass or gravel).
- If indoor storage space is limited, build covered hazardous material storage areas that include raised platforms for items like waste drums or corrodible containers.

## Waste Reduction Examples

- Keep the number of solvents used to a minimum. It makes recycling easier and reduces hazardous waste management costs.
- Perform all liquid cleaning at a centralized station to ensure that solvents and residues stay in one area.
- Locate drip pans and draining boards to direct solvents back into a solvent sink or holding tank for reuse.
- Reuse or recycle products on-site or through coordination with local recycling companies.

## Use of Safer Alternatives Examples

- Use non-hazardous cleaners instead of organic solvent degreasers when possible. Non-hazardous cleaners generally include detergent-based or water-based solutions.
- Replace chlorinated organic solvents like trichloroethylene (TCE) with non-chlorinated ones like kerosene or mineral spirits.
- Purchase recycled products, such as engines, oil, transmission fluid, antifreeze and hydraulic fluid, to help support the recycled products market.
- Steam clean or pressure wash parts (ensuring to collect and properly dispose of rinse water) instead of using solvents.

## Spill Containment and Cleanup Examples

- Update facility schematics to accurately reflect all plumbing and drainage connections.
- Use as little water as possible to clean spills, leaks and drips.
- Follow the spill prevention plan.
- Keep a supply of spill response materials appropriate for the activities performed on-site.
- In the event of a spill, cover drains with drain mats.

## Good Housekeeping Examples

- Store hazardous materials indoors or in covered areas.
- Conduct employee training and public outreach to reinforce proper disposal practices.
- Clearly label storage and disposal containers to prevent cross-contamination and accidental misuse.
- Closely monitor parked vehicles for leaks and place drip pans under any leaks to collect the fluids for proper disposal or recycling.
- Immediately remove fluids from wrecked vehicles to prevent leakage while in storage.
- Promptly transfer used fluids to recycling drums or hazardous waste containers.
- Dispose of liquid waste properly and regularly.
- Store cracked batteries in leakproof secondary containers.

Even with good housekeeping practices, local pretreatment requirements from the local sewer authority

or specific containment requirements for wellheads or water supply protection areas may direct facilities that discharge to sanitary sewer systems to treat their wastewater before releasing it. This is due to the sensitivity of most biological wastewater treatment processes to hazardous substances. Facilities often use structural pretreatment devices for this treatment. For example, they can use oil/water separators, settling chambers or filtration devices to remove solids, oil and grease. All drainage systems and wastewater treatment plants are different, however, and it is important for all maintenance facilities to follow all state and local requirements.

## Limitations

There are a number of limitations to implementing best practices at vehicle and equipment maintenance facilities. Space and time constraints may rule out indoor work. Containing spills from vehicles brought on-site after working hours may be impossible. Installing structural treatment devices for pretreatment of wastewater discharges can be expensive. Recycled materials and fluids may cost more than non-recycled materials, and municipalities may face a lack of recycled materials providers. They may also encounter an absence of businesses that provide hazardous waste removal, solvent recycling or other services.

## Maintenance Considerations

Routine maintenance is key to keeping best practices effective. Regular training of employees on current best practices should also be part of that maintenance program.

Staff should regularly inspect outdoor areas, especially parking areas for vehicles awaiting repair, for drips, spills and improperly stored materials (e.g., unlabeled containers, auto parts that might contain grease or fluids).

The proper functioning of structural practices is an important maintenance consideration for facilities that pretreat their wastewater before discharge. Systems like oil/water separators need routine cleanout of oil, grease and any other accumulated deposits—usually at least once a month, and more often during periods of heavy rainfall so that pollutants do not bypass the system altogether. For any structural treatment system, it is important to follow the manufacturer's recommended maintenance schedule.

## Effectiveness

It's difficult to quantify the effectiveness of vehicle and equipment maintenance best management practices at removing pollutants. However, some studies have evaluated individual practices with some success. In a review of a study of two auto recycler facilities, Robbins (2000) notes that structural and non-structural practices were measurably effective at reducing oil and grease concentrations as well as biological toxicity of stormwater discharge. The first site, evaluated over 10 years, incrementally implemented practices including draining vehicle fluids before stripping, sending stormwater through a multi-chambered oil-water separator, and building a roof over the dismantling area. The cumulative effect of all practices was a reduction in acute toxicity from 100 percent to 14 percent and a steady decline in discharged oil and grease concentrations. At another facility, an oil-water separator and an aeration-flocculation treatment system (more advanced and effective than a passive oil/water separator) together lowered lead and oil and grease concentrations by nearly 90 percent.

Municipalities may develop their own measurable performance standards to assess relative progress against baseline conditions. Keeping track of spill frequencies, documenting the volume of fluids recycled, and monitoring the use of chemical cleaning supplies are all ways to increase the efficiency of existing operations and motivate employees to implement best practices.

## Cost Considerations[1]

Purchase of new equipment or modification of existing facilities can be expensive. An oil/water separator can cost anywhere from several thousand dollars for a simple, single tank, above-ground version to nearly $200,000 for a professionally installed underground unit (RSMeans, 2020). Oil/water separators also need regular cleaning and maintenance, though other practices that reduce the total pollutant load to the system can lessen maintenance intervals.

Replacement or modification of existing equipment may be a more affordable option. For instance, installation of water-based cleaning equipment to replace solvent cleaning stations can cost between $700 and $17,000 depending on equipment type (EBMUD, 2004).

Many educational and non-structural measures cost little or nothing. Installing signage, improving labeling systems, adjusting storage and work areas, incorporating routine inspections and improving recordkeeping practices can be quick and relatively inexpensive practices.

Good housekeeping practices during vehicle and equipment maintenance can have additional cost benefits beyond waterway protection. For example, proper management of hazardous materials reduces employee exposure and potential work disruptions due to illness or injury. Pollution prevention efforts, meanwhile, reduce an organization's risk of enforcement action, private legal claims and damage to reputation.

[1] Prices updated to reflect inflation and reported in 2020 dollars. Inflation data obtained from the Bureau of Labor Statistics CPI Inflation Calculator website: https://data.bls.gov/cgi-bin/cpicalc.pl

**Additional Information**

Additional information on related practices and the Phase II MS4 program can be found at EPA's National Menu of Best Management Practices (BMPs) for Stormwater website

## References

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# Stormwater Best Management Practice

# Municipal Vehicle and Equipment Washing

**Minimum Measure:** Pollution Prevention/Good Housekeeping for Municipal Operations
**Subcategory:** Municipal Activities

## Description

Municipal vehicle and equipment washing can generate dry weather discharges contaminated with sediment, detergents, oils, grease and heavy metals. Both commercial and residential vehicle wash water can contain contaminants from vehicle fluid leaks, typical vehicle wear and the cleaning process itself. A study in a single city in Washington (City of Federal Way, 2009) estimated that vehicle washing had an annual contribution of:

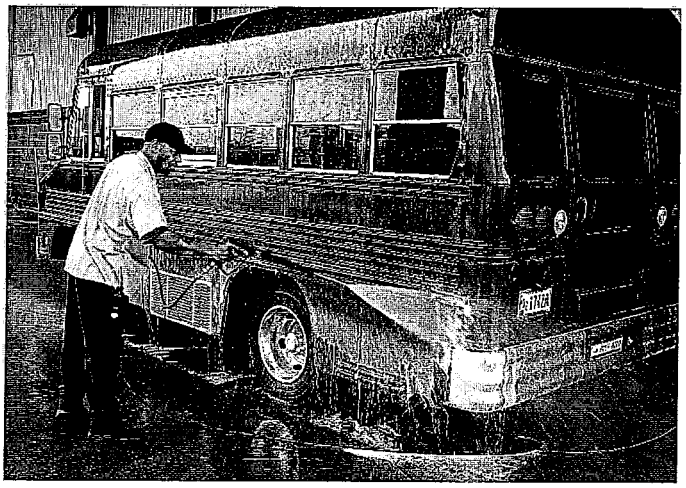
- 190 gallons of gasoline, diesel and motor oil
- 14 pounds of dissolved copper
- 400 pounds of phosphorus and nitrogen
- 60 pounds of ammonia
- 2,200 pounds of surfactants
- 3,000 pounds of solids

The impacts of these constituents discharging to downstream waterbodies can include increased toxicity to living organisms, increased eutrophication and reduced oxygen levels. Therefore, properly addressing these non-stormwater sources using pollution prevention/good housekeeping and other practices is an important component of a stormwater program to eliminate the impacts of these discharges.

Properly implemented vehicle and equipment washing practices can reduce wash water impacts by minimizing or preventing contaminated wash water discharges to downstream waters. They can also help municipalities meet general sustainability goals. For instance, incorporating water recycling systems reduces overall water usage—especially important in dry areas or during periods of drought.

## Applicability

Municipalities typically operate fleets of vehicles (e.g., public works trucks, fire trucks, ambulances, police cars, school buses) that they regularly wash and maintain. Municipalities with large fleets might operate their own washing facilities, while municipalities with small fleets might find it more economical to contract with commercial car washes.



Vehicle and equipment washing can contribute significant amounts of pollutants to stormwater if washwater is not properly captured and treated.
Photo Credit: Margo Wright/U.S. Air Force

In addition to the general washing practices discussed here, there are a number of related activities that other fact sheets discuss in more detail that may be helpful for municipally owned/operated vehicles/equipment or to share with contractors who manage such vehicles/equipment:

- For municipalities that own and operate concrete trucks, see the Concrete Washout fact sheet for more information on proper washout techniques.
- For municipalities that own and operate salt spreading equipment, see the Deicing Material Application and Storage fact sheet for more information on proper maintenance and storage of equipment.
- For municipalities looking to reduce the impacts of vehicle washing by the general public, see the fact sheets for Residential Car Washing and Developing Outreach Strategies for Residents and Businesses on the BMPs for Stormwater-Public Education page.

## Siting, Design and Operational Considerations

To limit impacts to downstream waters, municipalities should contain, treat or reuse vehicle and equipment wash water.

- For containment, a municipality can build drainage features that direct wash water to containers, sumps or a treatment system.
- Treatment systems (which regulations often require if a facility discharges wash water to sanitary sewers and subsequently municipal treatment plants) generally include oil/water separators or some type of filtration.
- Sometimes a facility can use more advanced treatment practices if it intends to reuse wash water on-site—a practice that not only limits discharge impacts but also reduces water consumption.

For all practices, municipalities should consider local regulatory requirements. These may include pretreatment requirements from the local sewer authority or specific containment requirements for wash areas in wellheads or water supply protection areas.

### Wash Areas

Wash areas (sometimes called wash racks) are designated areas—gratings, raised platforms, bermed areas, etc.—that incorporate drainage systems of some type to allow for containment and collection of wash water. When installing a wash area, a municipality should use paving to minimize loss of wash water and a berm or sloping to contain and direct wash water to a sump. It may connect the sump to the sanitary sewer or to a holding tank, process treatment system, or enclosed recycling system. For a sanitary sewer connection, the municipality would seek the permission of the sewer authority before discharging (because wash water may have special treatment requirements). Alternately, the municipality could design the wash area to recycle wash water, thereby eliminating pretreatment costs and discharges.

If municipal staff need to wash a vehicle outside a facility plumbed to the sanitary sewer, they should avoid direct discharges to storm drain systems. For a small job, they can use a bermed wash area and capture the wash water with a wet/dry vacuum for discharge to a sanitary sewer. For a larger job, they can use a combination of berms and a vacuum truck (such as those used to clean storm and sanitary sewer systems) to capture and safely dispose of wash water. If they use detergents, they should clean pavement to avoid discharging those detergents during the next storm event. Green infrastructure practices like bioretention systems, vegetated filter strips or stormwater wetlands can also help reduce stormwater impacts from wash area overflows. For wash areas that drain directly to storm drains, catch basin modifications can be a low-cost way to contain wash water without replumbing entire drainage systems.

### Non-Structural Considerations

The following examples of good housekeeping practices can minimize the risk of contamination from vehicle wash water discharges (adapted from CASQA, 2003):

- Wash all vehicles in areas designed to collect and hold wash water before its discharge to the sanitary sewer system.
- Clearly mark the designated wash area.
- Cover the wash area when not in use to keep out rainwater.
- Perform cleaning activities over an impermeable ground surface (e.g., concrete or asphalt).
- Avoid detergents whenever possible. If detergents are necessary, use phosphate-free, non-toxic, biodegradable soap. If you are using an oil/water separator for pretreatment before discharge to the sanitary sewer, source quick-break degreasers and monitor the oil/water separator output for effectiveness.
- Use a high-pressure hose nozzle to reduce the need for soaps and detergents.
- Municipal facilities that store vehicles should stencil their storm drains to remind employees to wash vehicles within designated wash areas. They can also post signage with this message.
- Mount spill kits with absorbent containment materials and instructions near wash racks. Immediately contain and clean up all spills.
- Train employees in proper vehicle washing and water management procedures; make sure they get regular refresher training.
- In some regions, the dry weather season (lowest stream flows) coincides with fish spawning, when aquatic populations are especially sensitive (EPI, 2007). If possible, schedule outdoor equipment washing and other potential contamination-causing work outside the highest-risk months for the area.

### Commercial Car Washes

Municipalities can negotiate with commercial car washes and steam cleaning businesses to handle their fleet vehicle washing. This option eliminates the cost of building and the liability of operating a wash facility. It may only be available for smaller vehicles, since many car washes do not have bays large enough to handle buses, fire trucks, ambulances and other large vehicles.

## Maintenance Considerations

Municipal staff should periodically inspect and clean a wash rack's paved surfaces and sump to remove buildups of particulate matter or other pollutants. Plumbing, recycling and pretreatment systems also need periodic inspection and maintenance. Staff should visually inspect the area surrounding the wash rack for leaks, overspray or other signs of ineffective containment due to faulty design or physical damage to berms. They should correct any defects.

## Limitations

If the appropriate facilities are available, vehicle washing measures are relatively inexpensive. However, if a municipality needs to build new facilities, implement new structural practices or use outside services, funding can be a limitation. Building a new wash rack can be expensive, and facilities that cannot recycle their wash water might face significant costs for pretreating wash water before discharge to the sanitary sewer. For municipalities using off-site commercial vehicle washing facilities, the employee and equipment time lost during travel to and from approved locations and wait times at wash locations may also be a limitation (CTC & Associates, 2016).

## Effectiveness

Although direct measurement of the effectiveness of good housekeeping practices is not common, studies have shown that certain related practices can address common contaminants in vehicle wash water. Combined with good housekeeping practices discussed above, several green infrastructure practices can greatly reduce stormwater impacts. Rain gardens can effectively remove or degrade surfactants—a common constituent of soap—and remove more than 90 percent of total suspended solids (Bakacs et al., 2013). Stormwater wetlands can also effectively remove contaminants like sediments, nutrients and heavy metals (Clary et al., 2017).

Using designated washing facilities can also result in significant water savings. A commercial car wash uses up to 60 percent less water in its entire wash cycle than just the final rinse step of residential hand washing (MASSDEP, n.d.).

For both pollutant reduction and water savings reasons, communities that establish municipal washing facilities or even commercial car washes for the public can reduce impacts to their local water resources. For example, the community of St. Albans, West Virginia, constructed a charity car wash station to reduce residential washing impacts and serve as a model for communities throughout the state. The station directs wash water into permeable pavers and adjacent rain gardens and vegetated areas (WVDEP, 2016). Not only does the facility reduce stormwater impacts, it provides an opportunity to educate the public on local stormwater problems and solutions.

## Cost Considerations[1]

As discussed above, a range of non-structural and structural practices are available for vehicle and equipment washing. Costs vary widely, from low-cost, non-structural practices like proper employee training and chemical storage to high-cost, capital improvement projects such as installing new wash areas.

[1] Prices updated to reflect inflation; reported in 2020 dollars. Inflation data obtained from the Bureau of Labor Statistics CPI Inflation Calculator website: https://data.bls.gov/cgi-bin/cpicalc.pl

### Non-structural Practices

Adopting "green" cleaning chemicals (biodegradable, non-corrosive, non-toxic) is a low-cost way to reduce discharge of hazardous chemicals. These more environmentally friendly chemicals may also be less corrosive to both vehicles and wash area equipment, providing further savings for long-term maintenance. In addition, regular maintenance and inspections by municipal staff in vehicle washing work areas can identify water or chemical leaks, which may save on operating costs or potential fines.

### Structural Practices

The cost of structural practices depends on site needs and constraints as well as system scale and design. The table below provides ranges of various practices.

| Practice | Cost Range | Factors That Affect Cost | Source |
|---|---|---|---|
| Berm construction | $700 to $6,000 | Wash area size, berm height | CASQA, 2003; MPCA, 2009 |
| Drainage retrofits | $7,000 to $35,000 | Drain line type, size, depth and length | CASQA, 2003; MPCA, 2009 |
| New fleet washing facility (installation) | $25,000 to $2,500,000 | Fleet size, fleet type, targeted pollutant | CTC & Associates, 2016 |
| Treatment or recycling system (installation) | $40,000 to $250,000 | Wash area size, targeted pollutant | CASQA, 2003; MPCA, 2009 |
| Wash bay (annual operating costs) | $3,000 to $5,500 | Wash area size, equipment age and type | CTC & Associates, 2016 |
| Commercial car wash (contract rate) | $13 to $55 per truck | Truck type, location | CTC & Associates, 2016 |

**Additional Information**

Additional information on related practices and the Phase II MS4 program can be found at EPA's National Menu of Best Management Practices (BMPs) for Stormwater website

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# Stormwater Best Management Practice

# Parking Lot and Street Sweeping

**Minimum Measure:** Pollution Prevention/Good Housekeeping for Municipal Operations
**Subcategory:** Municipal Activities

## Description

Streets, roads, highways and parking lots accumulate pollutants that, when combined with stormwater, can lead to water quality impacts. Street sweeping can minimize some of these pollutants, including sediment, debris, yard waste, trash, deicing materials and trace metals. It can also improve the aesthetics of municipal roadways, control dust and reduce the frequency of catch basin or storm drain cleaning. An effective municipal street sweeping program can meet regulatory requirements, assess street sweeping effectiveness, and minimize pollutants in roadways.

## Applicability

Most urban areas sweep their streets, often as an aesthetic practice to remove trash, built-up sediment and large debris from curb gutters and increasingly as a water quality practice to reduce stormwater pollutant loadings. Effective street sweeping programs can remove several tons of debris a year from city streets (Franklin Soil and Water Conservation District, 2017) minimizing pollutants in stormwater. In colder climates, street sweeping during the spring snowmelt can reduce pollutants in stormwater from deicing materials, sand and grit.

## Implementation

A municipality should account for several factors when designing and implementing an effective municipal street sweeping program.

### Schedule and Reporting

Creating (and following) a schedule can increase the efficiency of a street sweeping program. A successful program should be flexible to accommodate climate conditions and areas of concern. Municipalities should base their identification of areas of concern on traffic volume, land use, field observations of sediment and trash accumulation, and proximity to surface waters (MPCA, 2017). They should develop up-to-date maps and impervious surface inventories to help find and designate these areas. They may want to increase street sweeping and amend schedules for areas of concern. Schedules should include sweeping at least once a year. In cold climates prone to snowfall, the Connecticut Department of Energy and Environmental Protection recommends, municipalities should conduct street sweeping as soon as possible after the snow melts (DEEP, 2007). Removal of the accumulated sand, grit and debris from roads after the snow melts reduces the amount of pollutants that subsequent storms can mobilize.



Street sweepers, such as the one shown above, can be used to clean roadways on a regular schedule.
Photo Credit: Mark Mauno/Wikimedia

To evaluate the effectiveness of their street sweeping programs, municipalities should keep accurate logs of the number of curb-miles they sweep and the amount of waste they collect. They can measure monthly or yearly intakes (per ton) per district, road, season or mile. This information can inform a written plan, schedule and periodic re-evaluation that would target the following (Curtis, 2002):

- Roadways with contributing land uses (high imperviousness, high industrial activity) indicating high pollutant concentrations.

- Roadways that have consistently accumulated more materials (in pounds per mile swept) between sweeps.

Municipalities can present gross intake amounts to regulatory agencies and finance directors to measure performance. The City of Dana Point, California, reported a monthly debris intake of 23 tons when it conducted sweeping twice a month. Dana Point then moved to weekly sweeping and the monthly total increased to between 45 and 80 tons of debris (Franklin Soil and Water Conservation District, 2017). Some municipalities also try to estimate the types of trash typically swept to tailor other aspects of their stormwater programs, including the public education and outreach component.

## Parking Lots

Parking lot cleaning is similar to standard street sweeping with a few important exceptions. Like streets, parking lots need regular inspections and maintenance to identify specific areas of concern or times of high activity (e.g., fairs, farmers markets, special events). For privately owned parking lots, property owners and municipal staff should coordinate to limit pollutant discharge to public storm drains. In many cases, property owners can contact their municipal public works departments or private street sweeping companies to coordinate regular cleanings (Pace Partners, 2018).

## Street Sweepers

There are three common types of street sweepers available to municipalities: mechanical, regenerative air and vacuum. Each type of street sweeper has its advantages and disadvantages involving pollutant removal effectiveness, traveling speed and noise. Each targets large debris, though regenerative air and vacuum cleaners are much more effective at removing particles down to 10 microns in diameter (also known as $PM_{10}$). The three types differ in price, noise and maintenance requirements. A municipality should choose the most appropriate type according to its budget, local climate, street type, noise ordinances and major pollutants of concern. It may find it best to have a complement of each type of street sweeper in its fleet (CASQA, 2003).

Mechanical broom sweepers are typically the least expensive and are well suited to picking up large-grained sediment particles and cleaning wet surfaces. They tend to create more dust, however, potentially increasing atmospheric emissions as well as the amount of fine sediment that travels to surface waters. Some newer models can use water to suppress dust (Kuehl et al., 2008). Regenerative air and vacuum sweepers are more efficient, particularly with respect to fine-grained sediment, but are more expensive. Using a mechanical sweeper for large particles followed by a regenerative air cleaner can be an effective strategy (MPCA, 2017).

## Street Sweepings Storage, Disposal and Reuse

Street sweeping material often includes sand, deicing materials, leaves and miscellaneous debris. Often, the collected sweepings contain pollutants and the municipality should test them before disposal or reuse to determine if they are hazardous. Miller et al. (2016) provides a comprehensive review of studies that have analyzed pollutants of concern (heavy metals and petroleum hydrocarbons) in sweepings. Municipalities should adhere to all federal and state regulations that apply to the disposal and reuse of sweepings.

Municipalities should develop comprehensive management plans for the handling of sweepings. A critical aspect of a management plan is choosing a location for storing and processing street sweepings. Storage locations should have secondary containment and possibly overhead coverage to prevent stormwater from contacting the piles of sweeper tailings. It is also best to cover the piles of sweepings with tarps to prevent the generation of excessive dust. Storage locations should be large enough to completely contain the disposed sweepings.

To reduce disposal costs and prevent the landfilling of reusable material, some state and local regulations may allow the reuse of sweepings for general fill, parks, road shoulders and other applications. To reduce the chance of human or environmental exposure to pollutants, some states require municipalities to assess sweepings heavy metals and petroleum compounds before reuse; other states do not require assessment of materials that are not visibly contaminated (Miller et al., 2016). Municipalities should find beneficial reuse opportunities for street sweeping material and should follow all applicable local, state or federal regulations.

## Parking Policies

Parking policies can increase the effectiveness of street sweeping programs. They often have the following components:

- Restriction of parking in problematic areas during periods of street sweeping.
- Posting of permanent street sweeping signs (or temporary signs, if installing permanent ones is infeasible) in problematic areas.
- Inclusion in community newsletters or posting flyers on nearby poles notifying residents of upcoming street sweeping schedules.
- Municipalities can set parking policies as city ordinances.

## Operation and Maintenance Program

A municipality should dedicate time for daily and weekly equipment maintenance. Regular maintenance and daily startup inspections ensure that street sweepers are in good working condition. It is vital for municipalities to inventory and properly stock parts to prevent downtime and decreased productivity. They should also replace old sweepers with new, more advanced sweepers, preferably modern versions that maximize pollutant removal (CASQA, 2003). Installing an automatic greasing system on sweepers can decrease maintenance time and reduce wear on critical parts, which can keep the sweeper on the job longer with fewer unscheduled maintenance hassles. Maintaining surfaces through more frequent sweeping may also reduce the frequency necessary for catch basin cleaning (MPCA, 2017).

## Cost Considerations

Staffing and equipment are the largest expenditures associated with street sweeping programs (CASQA, 2003). The capital cost for a conventional street sweeper can range from $60,000 for a small mechanical sweeper to more than $250,000 for a newer vacuum or regenerative air sweeper, with make, model and specifications all affecting cost (Kuehl et al., 2008; MPCA, 2017). Street sweepers have an average life span of 4 to 8 years (though more modern street sweepers sometimes last longer). Municipal programs should budget for capital expenditures on equipment replacement depending on expected life spans. Municipalities can save costs by acquiring equipment with multiple uses. For example, the City of Jordan, Minnesota, purchased a sweeper that converts to a sander and snowplow in the winter (MCPA, 2017).

The following tables show street cleaning program cost estimates from nine surveyed cities.

**Table 1. Spending and staffing for street cleaning: eight surveyed cities and San Francisco, fiscal year 2016-17.**

| City | Population | Area (Square Miles, Land) | Street Cleaning Spending [a] | Spending per Capita | Street Cleaning FTE Count |
|---|---|---|---|---|---|
| Chicago | 2,704,958 | 227.3 | $8,548,428 | $3.16 | 71 |
| Long Beach | 470,130 | 50.3 | $5,313,421 | $11.30 | 15 |
| Minneapolis | 413,651 | 54.9 | $8,800,000 | $21.27 | 54 |
| Portland | 639,863 | 133.0 | $7,461,034 | $11.66 | 30 |
| Sacramento | 501,334 | 97.9 | $936,292 | $1.87 | 7 |
| San Diego | 1,406,630 | 325.2 | $3,282,000 | $2.33 | 40 |
| San Jose | 1,015,785 | 177.5 | $6,320,000 | $6.22 | 18 |
| Seattle | 713,700 | 83.9 | N/A | N/A | N/A |
| **Median** | **639,863** | **97.9** | **$ 8,004,731** | **$8.76** | **40** |
| San Francisco | 864,816 | 46.9 | $34,988,059 | $40.46 | 302 |

Source: Adapted from City and County of San Francisco, 2018

[a] Figures do not include overhead costs for cities.

**Table 2. Curb miles swept and expenditures per curb mile, seven surveyed cities and San Francisco, FY 2016-17.**

| City | Curb Miles Swept | Street Sweeping Expenditures [a] | $ per Curb Mile Swept |
|---|---|---|---|
| Chicago | 251,429 | $7,005,120 | $27.86 |
| Long Beach | 141,132 | N/A | N/A |
| Portland | 14,780 | $2,973,149 | $201.16 |
| Sacramento | 150,000 | $936,292 | $6.24 |
| San Diego | 106,000 | N/A | N/A |
| San Jose | 67,295 | $3,520,000 | $52.31 |
| Seattle | 27,360 | $2,588,400 | $94.61 |
| **Median** | **120,333** | **$3,744,878** | **$52.31** |
| San Francisco | 158,974 | $6,367,200 | $40.05 |

Source: Adapted from City and County of San Francisco, 2018

[a] Figures do not include overhead costs for cities.

## Effectiveness

Street sweeping can be an effective way to reduce sediment loadings to downstream waterbodies. This can be important, not just because of sediment export concerns, but because sweepings can have variable and sometimes high concentrations of heavy metals, petroleum hydrocarbons and nutrients. For example, Miller et al. (2016) compiled results from a literature review and an online survey of municipal street sweeping programs and found reported concentrations of lead and heavier petroleum hydrocarbons (e.g., motor oil) that were sometimes in excess of Ohio beneficial reuse standards.

The effectiveness of street sweeping varies considerably depending on geographic location, sweeping frequency and equipment used:

- In a survey of three towns in Ohio, Miller et al. (2016) found that over 3 years, collection rates (influenced by type of sweeper, traffic counts, precipitation, frequency, surrounding land use) varied from 44 to 7,550 pounds per mile, with median rates ranging from 332 to 938 pounds per mile. A similar study in Maryland found that for a program that swept about 14,373 miles of roadway, the overall collection rate was 343 pounds per mile (Curtis, 2002).
- Sweeper type is an important factor, especially when pollutant removal (as opposed to bulk sediment and debris removal) is the goal. Many studies are finding that pollutants are predominantly associated with finer particles (Miller et al., 2016) and that mechanical sweepers not only cannot effectively remove fines but often dislodge fines in cracks and crevices, resulting in minimal and sometimes negative removal rates for target pollutants (Miller et al., 2016; Schueler et al., 2016). Vacuum and regenerative air sweepers are more effective. Using a combination of previously published collection data and modeling, Schueler et al. (2016) found that for sweeping frequencies of six to 100 passes per year, removal efficiencies were 4–21 percent for total suspended solids, 0.7–4 percent for total nitrogen and 2–10 percent for total phosphorus.
- Traffic counts and surrounding land use (industrialized areas) are also important factors influencing elevated concentrations of total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAHs) and heavy metals in sweepings. In urban areas with high traffic counts, higher concentrations of heavy metals, TPH, and PAHs are expected in collected sweepings (Washington Department of Ecology, 2005). Irvine, et al, 2009 confirmed that heavy metals concentrations are elevated in street sweepings collected from urban roads with high traffic counts

and in industrialized areas. Both zinc and copper concentrations were higher in areas with high traffic counts, while manganese and iron concentrations were higher in industrialized Final Report 5 areas (Irvine, et al, 2009). Depree, 2008 found that PAH concentrations in street sweepings collected from arterial streets were approximately two times higher than those collected from non-arterial roads, while copper and lead concentrations were three times higher on high traffic volume roads than low traffic volume roads (Depree, 2008).

A street sweeping program can be an effective tool for municipalities for pollutant removal and good housekeeping. Using modern efficient street sweepers may reduce the need for other structural stormwater controls. Municipal stormwater managers should compare potential benefits and costs of street sweeping, especially in more urbanized areas with greater areas of pavement.

**Additional Information**

Additional information on related practices and the Phase II MS4 program can be found at EPA's National Menu of Best Management Practices (BMPs) for Stormwater website

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# Stormwater Best Management Practice

# Roadway and Bridge Maintenance

**Minimum Measure:** Pollution Prevention/Good Housekeeping for Municipal Operations
**Subcategory:** Municipal Activities

## Description

Daily roadway and bridge use, along with scheduled repairs, can generate substantial amounts of sediment and pollutants. The most common contaminants in highway discharges are heavy metals, inorganic salts, polycyclic aromatic hydrocarbons, and suspended solids. Salting and sanding practices, for example, leave concentrations of chloride, sodium and calcium on the roadway surface. Through ordinary operation and wear and tear, vehicles release metals, hydrocarbons, rubber particles and other solid materials on highway surfaces. Rain and melting snow often wash these materials off the highway and into adjacent waterways (FHWA, 1999).

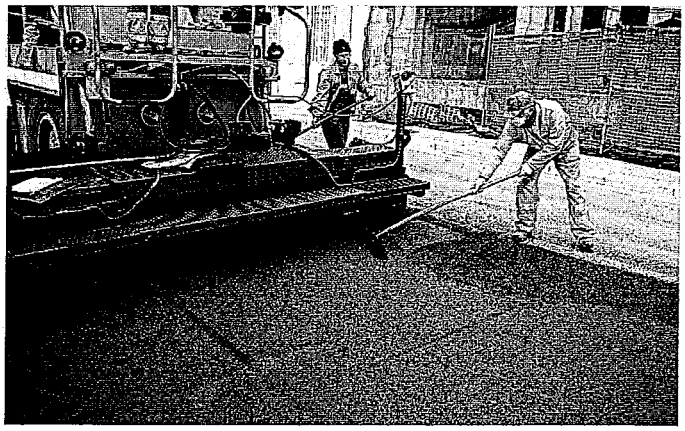
Roadway and bridge maintenance pollution prevention practices can reduce pollutant loadings from existing road surfaces as part of a larger operation and maintenance program. These practices include routine maintenance activities such as sweeping, vegetation maintenance, and cleaning of stormwater discharge control structures. They can also include modification of existing practices such as roadway resurfacing or deicing.

## Applicability

Roadway systems make up a large part of urban infrastructure. Because of traffic use and weathering, they need regular repairs and maintenance. The amount of pollutants found on roads and bridges varies, due to climate, traffic volume, and other factors including surrounding land use, the bridge or roadway's design, the presence of roadside vegetation, insecticide use, and the frequency of vehicle accidents and chemical spills. In colder climates, deicing materials applied to roadways can also influence pollutant levels in roadway discharges, thereby affecting local water quality.

## Siting and Design Considerations

Proper planning for road and bridge resurfacing is a simple but effective pollution control method. A municipality should schedule roadway inspections throughout the year, and should make sure each inspection includes a careful examination of the function and physical condition of roadway assets and systems including roadway surfaces, drainage structures, vegetation, guardrails and bridges. Municipalities should also map their inspection locations, paying special attention to places that may need extra attention and maintenance (Washington County DLUT, 2017).



Paving operations should be conducted in dry weather.

To prevent stormwater contamination during resurfacing, municipalities should only perform paving operations in dry weather. They should use proper staging techniques to reduce the spillage of paving materials during the repair of potholes and worn pavement. These techniques can include covering storm drain inlets and manholes during paving operations; using erosion and sediment controls to decrease discharges from repair sites; and using drip pans, absorbent materials and other pollution prevention materials to limit leaks of paving materials and fluids from paving machines. Lastly, using porous asphalt for shoulder repair can reduce the amount of stormwater generated from roadway systems. For more information on permeable materials, see the Permeable Pavement fact sheet.

Sweeping and vacuuming heavily traveled roadways to remove sediment and debris can reduce the amount of pollutants in stormwater (see the Parking Lot and Street Sweeping fact sheet). Regular cleaning of stormwater control structures, such as catch basins, can help reduce

sediment loads in discharges that will end up in local waterways (see the Stormwater Inlet BMPs and Storm Drain System Cleaning fact sheets).

Proper application of deicing materials on roadways also limits stormwater pollution. By routinely calibrating spreaders, a program manager can prevent the over-application of deicing materials. Besides reducing these materials' effects on the aquatic environment, this practice can save money through more efficient material use. Training transportation employees in proper deicer application techniques, timing and type will also help reduce impacts on water quality and aquatic habitat. See the Deicing Material Application and Storage fact sheet for more information.

Maintenance practices for roadside vegetation can improve its stormwater treatment performance. Restricting the use of herbicides and pesticides on roadside vegetation, and training employees on the proper handling and application of pesticides and other chemicals, can help prevent contamination of stormwater. Choosing roadside vegetation with higher salt tolerances will also help to maintain the health of practices such as vegetated swales and biofilters. For more information on roadside vegetated stormwater practices, see the Vegetated Filter Strip and Bioretention fact sheet.

The EPA's National Management Measures to Control Nonpoint Source Pollution from Urban Areas provides more information on how bridge and highway design and maintenance practices can address stormwater pollution.

Besides the roadway practices listed above, improved bridge siting, design and maintenance practices can help reduce water quality impacts. Several studies have shown that scupper drainage that directly enters adjacent waters can result in localized increases of metal concentrations in sediments and in aquatic biota (Transportation Research Board, 2002). Avoiding scupper drains in new bridges and routinely cleaning existing ones to prevent sediment and debris buildup can help. Program managers should also consider retrofitting scupper drains with catch basins or closed pipe systems to redirect stormwater to vegetated areas or other stormwater treatment practices. Other techniques to help reduce pollutant discharges to receiving waters include using suspended tarps, booms or vacuums to capture paint, solvents, rust, paint chips and other pollutants generated by regular bridge maintenance. Additionally, sodium chloride, a common deicer, corrodes metal bridge supports, not only increasing maintenance costs but often leaving corroded material in local waterways. Municipalities should consider less corrosive alternative deicing materials like glycol, urea or calcium magnesium acetate (CMA) for bridge deicing.

## Limitations

Pollution prevention practices for road and bridge maintenance come with costs for equipment, maintenance and training. However, since all communities already need to maintain roadways and bridges, they usually have staff and may not need to change their practices or add staffing or administrative labor.

A new bridge's location may be a limitation. If it is near sensitive waters, it may need a better design to adequately treat stormwater. Community requirements may restrict the size of paved areas to limit impervious surface; this can affect roadway and shoulder widths.

## Cost Considerations

Most community public works or transportation departments allocate considerable funding to the maintenance of local roads and bridges and the cost of incorporating pollutant reduction strategies will likely be insignificant relative to existing expenditures. New York state, for example, spent $3.6 billion on roadways and bridges in 2018, and more than a third of that went to maintenance and preservation (CBCNY, 2019). These costs attributed to stormwater-related maintenance and generally involve the training and equipment required to apply new stormwater practices.

Strategic planning may also help offset implementation costs. For example, incorporation of road and bridge pollution prevention practices by a community's transportation department may benefit the environmental or stormwater department. Communities working to address metal or sediment impairments through the Total Maximum Daily Load (TMDL) program may be able to gain credit for road and bridge practices that demonstrate a reduction in these pollutant loadings. Similarly, scupper retrofits that redirect stormwater to an approved treatment practice may help offset municipal treatment requirements.

**Additional Information**

Additional information on related practices and the Phase II MS4 program can be found at EPA's National Menu of Best Management Practices (BMPs) for Stormwater website

## References

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# Stormwater Best Management Practice

# Storm Drain System Cleaning

**Minimum Measure:** Pollution Prevention/Good Housekeeping for Municipal Operations
**Subcategory:** Municipal Activities

## Description

Municipal stormwater commonly flows through storm drains and from there, sometimes without treatment, into waterbodies. A storm drain consists of one or more conduits (closed pipes or open channels or ditches) connecting one or more inlets. If not routinely cleaned and maintained, these systems can accumulate large amounts of debris and pollutants, which can lead to clogging, flooding and water quality problems. The specifics depend on the type and amount of pollutant involved, but problems can include foul odors, excessive sediment export and reduced dissolved oxygen in receiving waters.

Some common pollutants found in storm drains include:

- Trash and debris
- Sediments
- Oil and grease
- Antifreeze
- Paints
- Cleaners and solvents
- Pesticides
- Fertilizers
- Animal waste
- Deicing materials
- Detergents



Debris from storm drains and catch basins should be collected and disposed of according to best practices and local regulations.

Photo Credit: Airman 1st Class Milton Hamilton/U.S. Air Force

## Implementation

### Cleaning Programs

Like all infrastructure, storm drain systems need regular inspection and cleaning. Municipal or contracted professional personnel should do this work, and they should have training on applicable regulations and cleaning and disposal procedures. Many municipalities have standard operating procedures for cleaning their storm drain systems, which include training, methods, equipment and frequencies for cleaning. For example, the Brighton, Colorado, utilities department has developed storm sewer cleaning guidelines. They recommend cleaning the storm drain systems every 5 years—in practice, this means that the city cleans 20 percent of the system every year (City of Brighton, 2018).

To increase the effectiveness of any cleaning program, a municipality can establish a pre-inspection program that maps and creates an asset inventory of all storm drains and conveyances. This makes it possible to identify and prioritize problem areas, and thus to set a more efficient cleaning schedule that takes into account storm drain accessibility, cleaning routes and any seasonal patterns. (For example, a system might need more frequent cleanouts during the fall when leaf litter increases. Another example could include a system in a high traffic area that is identified as a priority system to clean out more frequently.)

### Cleaning Methods

There are two main methods of storm drain system cleaning, dry cleaning and wet cleaning. The dry method—which should be performed first—involves direct removal by hand or using vacuums or shovels. The wet method typically involves jetting and flushing

(City of Brighton, 2018). For larger systems, municipalities tend to use vactor trucks (often called vacuum or jet trucks) with either method.

Having removed the sediment and debris, a municipality should treat or discard it according to applicable solid waste and hazardous materials regulations. This includes rinse water from wet cleaning: it is important to contain, collect and properly dispose of this rinse water, whose sediment and debris content may qualify as hazardous waste. The municipality should identify temporary storage areas for debris and protect those areas from wind, rain and surface stormwater flow.

Accurate recordkeeping is important for any cleaning method. Field staff should document the staff, location, cleaning date, equipment used, frequency of waste disposal, and number of drainage structures cleaned. They should also record the amount of sediment or debris collected or removed.

## Limitations

Several factors may limit the effectiveness of a storm drain cleaning program. For example, tree roots can clog storm drain systems, affecting overall structural integrity and making cleaning difficult. Storm drain systems may be in areas that are hard to access and clean. And municipalities often lack the resources to train employees or contractors, purchase the equipment they need, or actually do the cleaning. A targeted cleaning program (see the discussion of pre-inspection programs above) can at least help address known hot spots and help prioritize cleanings.

## Cost Considerations

Including equipment and labor, a storm drain cleaning program can be expensive. Vactor trucks can cost $80,000 to $150,000 (City of Manhattan, 2018). For total cleaning costs, a 2005 survey of NPDES stormwater compliance costs in California found actual cleaning expenditures of $8 per linear foot of drain line and $170 per catch basin, with all storm drain cleaning activities making up 10–20 percent of all stormwater costs (California State University, Sacramento, 2005). Municipalities should also factor in costs for properly disposing of the collected sediment and debris.

**Additional Information**

Additional information on related practices and the Phase II MS4 program can be found at EPA's National Menu of Best Management Practices (BMPs) for Stormwater website

## References

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# Stormwater Best Management Practice

# Hazardous Materials Storage

**Minimum Measure:** Pollution Prevention/Good Housekeeping for Municipal Operations
**Subcategory:** Municipal Facilities

## Description

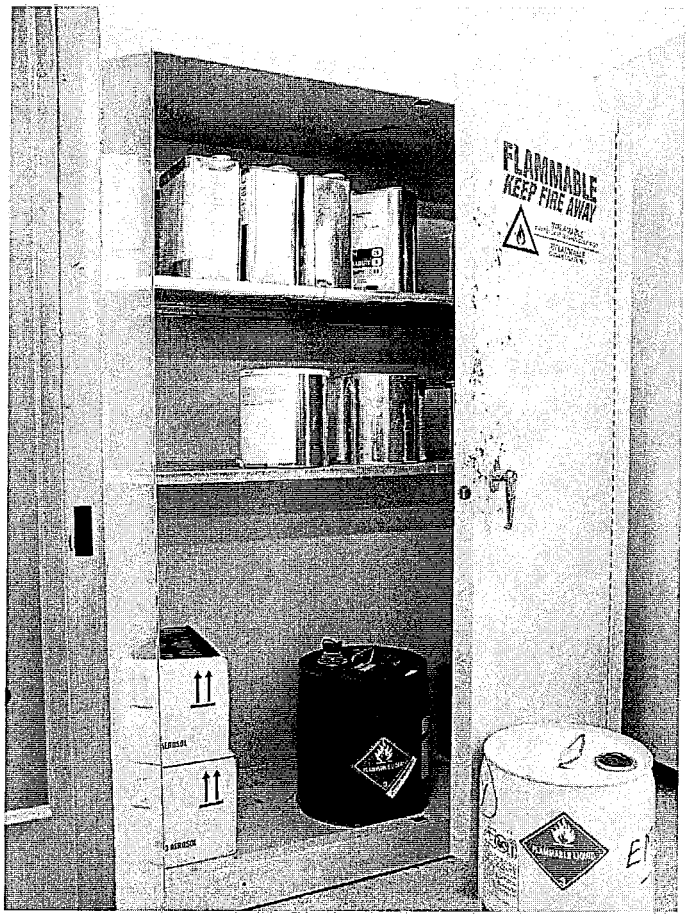
Generally, hazardous materials have properties that make them dangerous or capable of having a harmful effect on human health or the environment. Hazardous materials can be in many forms including liquids, solids or gases and sludges. They are often generated from common municipal activities, such as vehicle maintenance and fueling, firefighting, landscaping and park maintenance, roadway repairs and maintenance, and hazardous waste drop-off locations. Proper management, storage and handling of hazardous materials is critical for reducing the possibility of stormwater contamination through leakage and spills.

## Applicability

Hazardous materials storage is relevant to both urban and rural settings in all geographic regions. Some common hazardous material sources are:

- Petroleum products
- Fuels
- Asphalt products
- Concrete curing compounds
- Pesticides
- Pharmaceutical products
- Acids (e.g., from batteries)
- Paints, stains, and solvents
- Septic wastes
- Wood preservatives

The effects of hazardous materials contamination may be more pronounced in geographic areas with heavier rainfall due to the greater volume of stormwater and potential for contribution of pollutants to stormwater discharges.




Hazardous materials should be stored appropriately for the type of material, such as in a flammables cabinet.

## Siting and Design Considerations

### Regulatory Requirements

Municipal staff should store, manage and dispose of hazardous materials in accordance with all applicable federal, state and local regulations. Two common requirements include general safety requirements of The Occupational Safety and Health Administration (OSHA 29 CFR 1910.176) and storage requirements from the National Fire Protection Association Code 30 (NFPA 30) for flammables and combustibles.

## General Storage Considerations

Best practices for hazardous materials storage minimize the possibility of spills, weathering, leaks or improper handling from regular site activities. They include:

- Properly inspect, label and seal all containers.
- Segregate incompatible materials based on physical and chemical properties and secondary containment requirements (refer to Safety Data Sheets for useful information).
- Store all hazardous materials in areas that will not be subject to rain, flooding, or vandalism (under lock and key if necessary).
- For outdoor storage locations, provide proper ventilation, storage foundations (e.g., pallets or a concrete slab) and secondary containment as recommended by the manufacturer or required by regulation.
- Confine storage of hazardous materials to designated areas.
- Ensure enough aisle space to ease inspections and handling and minimize the chance of accidental spills.
- Store hazardous materials away from high-traffic areas.
- Perform loading and unloading operations in areas designed to contain potential spills.
- Make sure workers have easy access to spill cleanup materials.
- Use dry cleanup methods instead of wet (e.g., hosing areas down).
- Train employees on proper storage techniques.

A number of resources outline best practices for various contexts—see the box to the right for two of these.

## Vehicle Maintenance and Washing

Vehicle and equipment fueling, maintenance and washing may involve hazardous materials. Municipal staff should confine these activities to designated areas that contain the discharge. They should also follow all federal, state and local disposal requirements for disposing of generated hazardous waste. For more information, refer to the Vehicle Equipment and Maintenance and Vehicle and Equipment Washing fact sheets.

## Storage of Household Hazardous Materials

Residents waiting to dispose of their household hazardous materials should store them properly until their hazardous waste collection day. For example, they could:

- Put hazardous material—in its own, original container—into a plastic container with a lid (e.g., a 5-gallon bucket), filled halfway with unused cat litter.
- Fasten the bucket lid and clearly mark the contents of the container.
- Store the bucket away from children and anyone else who might ingest the stored hazardous material.
- Store the bucket off the ground to reduce the potential for corrosion.

## Limitations

Hazardous materials storage containers, structures and buildings all have finite life spans. For example, tarpaulins and plastic sheets used for coverings on outdoor storage locations may not last very long in some climates—though a roof or other covered storage building structure would last much longer.

Some hazardous materials or generated waste products may have limitations on the volume and length of time that anyone may store them. Refer to EPA's Hazardous Waste Generator Regulatory Summary page for more on storage requirements for specific hazardous wastes.

Resources on hazardous material storage best practices and requirements for different contexts:

- The U.S. EPA's Multi-Sector General Permit for Stormwater Discharges associated with Industrial Activity
- The U.S. EPA's Construction General Permit for Stormwater Discharges from Construction Activities

## Maintenance Considerations

Along with keeping storage areas neat, orderly and well lit, municipal staff should implement a regular inspection program. In particular, they should routinely inspect storage spaces and containers for leaks, signs of cracks or deterioration, or any other signs of leakage. They should immediately repair any leaks or containment weaknesses they find.

## Cost Considerations

Costs for storing hazardous materials depends on the substance, the type of storage facility, and the frequency with which that facility's operators store, transport or dispose of the materials. Cleanup costs vary widely depending on the type and amount of substance that has leaked, as well as the surfaces or environments the substance has come in contact with. Municipal staff should immediately protect any spilled hazardous material from stormwater, clean all contaminated surfaces and dispose of the waste, regardless of the expense. To offset the cost of covering or enclosing hazardous materials, they might reconsider procurement, inventory and disposal practices to minimize the amount of materials stored on-site.

### Additional Information

Additional information on related practices and the Phase II MS4 program can be found at EPA's National Menu of Best Management Practices (BMPs) for Stormwater website

### Disclaimer

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# Stormwater Best Management Practice

# Materials Management

**Minimum Measure:** Pollution Prevention/Good Housekeeping for Municipal Operations
**Subcategory:** Municipal Facilities

## Description

Many municipal activities involve common chemicals such as fertilizers, solvents, paints, cleaners and automotive products. These materials, if improperly managed, can enter storm drains and lead to water quality impacts. Properly using, storing and disposing of them can limit the likelihood of these accidental spills or releases.

## Applicability

Any municipal facility that might release harmful chemicals (through spills, leaks or otherwise) can use materials management practices to minimize or prevent releases. Such facilities or activities include:

- Municipal landscaping
- Municipal vehicle and equipment maintenance
- Municipal vehicle and equipment washing
- Municipal vehicle fueling
- Deicing material application and storage

(For more information on storing hazardous materials, refer to the Hazardous Materials Storage fact sheet.)

## Implementation

In many cases, facilities can implement simple housekeeping practices to manage materials more effectively. Before establishing such a routine, however, municipal staff should generate a material inventory to familiarize employees with their presence and proper use. Some facilities—for example, facilities that use and store large quantities of chemicals—may need to implement structural and non-structural practices.

### Material Inventory

Regular material inventories make hazardous material overstocking less likely, increase knowledge about what hazardous materials are present and what their storage requirements are, and document proper handling techniques. An inventory of hazardous materials has three major steps:



Keeping materials stored indoors and using controls such as drip pans can reduce the risk of a potential stormwater contamination.
Photo Credit: Kevin Stockton, U.S. EPA, 2020

- Identify all hazardous and nonhazardous substances by reviewing all purchase orders and walking through the facility. Obtain a Safety Data Sheet (SDS) for each substance present, as applicable.
- Label each container with the name of the chemical, unit number, expiration date, handling instructions, and health or environmental hazards. (The SDS will be the source of much of this information). Insufficient labeling can lead to improper handling or disposal of hazardous substances.
- Make special note of hazardous chemicals that need special handling, storage or disposal.

### Routine Housekeeping

Routine housekeeping practices, drawing on the now-complete material inventory, can reduce worker exposure to potentially harmful chemicals and limit the potential for spills and accidental discharges. These practices include:

- Implement routine cleaning and inspection of facilities or areas that store or process materials.
- Maintain clean, organized workplaces.
- Minimize the amounts of materials used and the wastes that municipal activities generate.
- Use environmentally friendly alternatives to toxic chemicals whenever possible.
- Store materials away from storm drains.

Employee education and training is critical to good materials management practices.

To learn more about how to implement training programs, see the Municipal Employee Training and Education fact sheet.

- Dispose of old or outdated chemicals at approved disposal locations.
- Educate employees about the benefits of proper materials management practices (see box to the right).

## Structural Controls

For facilities that store or handle large quantities of potentially harmful materials, structural controls can add a layer of protection against stormwater contamination. Structural controls include:

- Cover outdoor storage and handling areas to reduce exposure to precipitation, stormwater and wind.
- Build a designated, enclosed storage area.
- Install secondary containment structures surrounding material handling areas.

## Cost Considerations

Except for structural controls, costs associated with materials management practices are mostly labor costs. The necessary education of municipal employees, local businesses and the public will take up an amount of staff hours that depends on the program's extent. Producing items to encourage proper practices, such as posters and bulletin boards, may also incur minor material costs.

The cost of structural controls will depend on the size of the material handling or storage area.

### Additional Information

Additional information on related practices and the Phase II MS4 program can be found at EPA's National Menu of Best Management Practices (BMPs) for Stormwater website

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# Stormwater Best Management Practice

# Municipal Facilities Management

**Minimum Measure:** Pollution Prevention/Good Housekeeping for Municipal Operations
**Subcategory:** Municipal Facilities

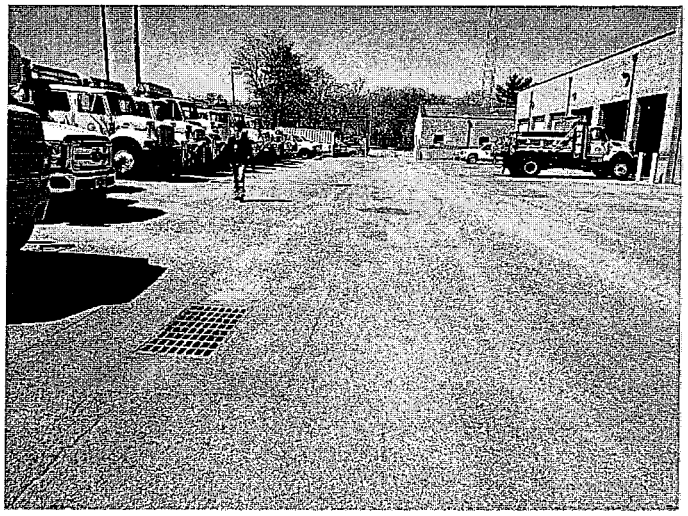
## Description

Municipalities own and operate many facilities, including maintenance yards, parks, office buildings and schools. Some regular activities at these facilities can release pollution that enters storm drain systems or receiving waters. Among these activities are automobile maintenance, residential car washing, hazardous materials storage, materials management, sign painting, pest control, parking lot and street sweeping, and waste storage and disposal.

To effectively manage stormwater and thus prevent or reduce stormwater pollution, a municipality should inventory its facilities and associated activities to assess potential impacts on stormwater quality and revise activities or implement new measures as needed. It should describe these activities and control measures in a stormwater pollution prevention plan (SWPPP) or a similar document. It should also provide training on stormwater best management practices (BMPs), which include stormwater control measures and good housekeeping practices, to all municipal facilities maintenance staff, giving them clear guidance on how to use appropriate stormwater practices during typical maintenance operations and facility management activities.

## Applicability

The Phase II rule establishes that permits should require the development and implementation of operation and maintenance programs that includes a training component and has the ultimate goal of preventing or reducing pollutant runoff from municipal operations. The program should include employee training to prevent or reduce stormwater pollution from activities such as park and open space maintenance, fleet and building maintenance, new construction and land disturbances, and storm water system maintenance. These programs should address, as applicable, areas such as municipal parking lots, maintenance and storage yards, fleet maintenance shops, deicing material storage locations, snow disposal areas, and waste transfer stations. The



Municipal facilities, such as an outdoor vehicle storage area, can be a source of stormwater pollution when not cleaned and maintained regularly.

Photo Credit: Anthony D'Angelo, taken for U.S. EPA

rule also requires that permits include storm water system maintenance. Programs often include procedures for properly disposing of waste removed from the separate storm sewers and areas listed above (such as dredge spoil, accumulated sediments, floatables and other debris). Municipal staff should also evaluate facilities that store chemicals, those with outdoor trash storage areas, and areas that store or dispose of potentially hazardous materials (e.g., animal shelters, hospitals, clinics) for pollution potential and need/opportunity for control practices.

Some municipalities should also have industrial stormwater permits covering the municipal facilities and activities they own and manage. If a municipal facility, such as a landfill or transportation facility, has activities included in one of the 11 categories of industrial activity described in 40 CFR 122.26(b)(14)(i)–(xi) that discharge stormwater, the operator may need coverage under a National Pollutant Discharge Elimination System (NPDES) industrial stormwater permit. For areas where EPA is the permitting authority (in some states, on Indian Country lands, and at some federal facilities), the Multi-Sector General Permit provides facility-specific

requirements for many types of industrial facilities in one permit. However, EPA has delegated and authorized most states to implement the NPDES stormwater program (click here for a list of authorized states) that have their own industrial stormwater permits.

## Implementation

Municipal facilities each will have different activities and pollutants of concern. Facility managers should consider the good housekeeping practices and pollution prevention controls outlined in EPA's menu of BMPs and develop a pollution prevention program, such as a SWPPP, that outlines how they will implement the BMPs. If an industrial stormwater permit covers the facility, the development and implementation of a SWPPP is one of the permit requirements.

SWPPP development and implementation consists of five general phases to minimize or prevent pollutants from entering a storm drain system or receiving waters. SWPPPs are designed to include facility-specific BMPs which may include scheduling activities to reduce the potential for off-site migration of pollutants, such as not scheduling activities immediately before or during rainstorms; prohibiting certain practices, such as the outside storage and use of chemicals; requiring specific maintenance procedures; and other management practices to prevent or reduce stormwater pollutants. The five major phases of developing a pollution prevention plan include (U.S. EPA, 2009):

1. ***Planning and organization.*** Staff should designate a person or team who will be responsible for developing and implementing the SWPPP and other existing environmental facility plans, such as plans governing pesticide use or hazardous materials storage, to ensure consistency across departments. The municipality should build on relevant portions of other environmental plans as appropriate, although it is important that the SWPPP be a comprehensive, stand-alone document that is reflective of facility-specific conditions.

2. ***Assessment.*** Municipal staff should inspect facilities that might contribute pollutants to the storm drain system to identify possible pollution sources and BMP opportunities. It is helpful to create a map of the facility that identifies pollutant sources, storm drains, drainage ditches, BMPs requiring periodic maintenance, and areas suitable for new BMP implementation or retrofit. The municipality should also take an inventory of potentially polluting materials, evaluate past spills and leaks, identify and eliminate sources of non-stormwater discharges and illicit connections, collect and evaluate any existing stormwater quality data, and summarize the findings of the assessment.

3. ***BMP and stormwater control selection and plan design.*** In choosing stormwater controls and BMPs, the municipality should give special consideration to material handling or storage areas, outdoor processing areas, loading and unloading areas, and on-site waste management and disposal areas. Municipal staff should consider both structural and non-structural control measures as well as the site-specific pollutants to be reduced to select the proper controls. Structural control measures may include practices such as inlet controls, vegetated swales, rain gardens and wet detention systems. Examples of non-structural control measures include good housekeeping practices that focus on pollution prevention.

> EPA has adapted a table from California's *Stormwater Best Management Practice Handbook* that provides a helpful table listing of potential pollutants likely to be associated with specific municipal facilities.

4. ***Implementation.*** The municipality should implement the selected stormwater BMPs according to a schedule that reflects their priority level and funding/labor constraints. Also, all municipal employees should receive training to understand and carry out the goals of the SWPPP. Employee training and education is itself a control measure and is critical in informing employees about potential sources of stormwater contamination and ways to minimize water quality impacts.

5. ***Evaluation and site inspection.*** Facility staff should conduct regular site evaluations to demonstrate adherence to the SWPPP and gage the SWPPP's effectiveness. Evaluations should document BMP implementation, illicit discharge or spill incidents, employee training, inspections, and monitoring (if applicable). Keeping records of site evaluations and their findings is important for

supporting corrective actions, demonstrating compliance with facility permits (if applicable) and adapting to changes in facility activities. The municipality should revise the SWPPP if elements prove ineffective or if activities or conditions at the facility change.

## Limitations

Developing and implementing an effective SWPPP requires time and commitment, not only from managers but also from staff and laborers. Lack of funding or staff time is therefore often a limitation. After development of the SWPPP, the facility should conduct regular inspections to detect leaks, spills or other pollution issues as soon as possible. Without the proper training, municipal employees can be unable or unwilling to conduct regular inspections and maintain the BMPs included in the SWPPP.

## Cost Considerations

The costs of formalizing stormwater management at municipal facilities will vary by facility and by municipality. The majority of the costs involve the staff time to develop a SWPPP, train staff and inspect the facilities to ensure that selected BMPs are applicable and effective.

**Additional Information**

Additional information on related practices and the Phase II MS4 program can be found at EPA's National Menu of Best Management Practices (BMPs) for Stormwater website

## References

U.S. Environmental Protection Agency (U.S. EPA). (2009). *Developing your stormwater pollution prevention plan: A guide for industrial operators.* EPA 833-B-09-002.

# Stormwater Best Management Practice

# Spill Response and Prevention

**Minimum Measure:** Pollution Prevention/Good Housekeeping for Municipal Operations
**Subcategory:** Municipal Facilities

## Description

Accidental spills of hazardous materials, petroleum products or common chemicals/ can endanger public health or the environment if they reach waterways. Spill response and prevention practices can help to prevent spills from happening and can minimize impacts when a spill does occur. A key practice is creating and implementing a spill response and prevention plan, which should clearly state how to prevent spills, stop the source of a spill, how to contain and clean up a spill, how to dispose of contaminated materials, and how to train personnel to prevent and control future spills.

## Applicability

See the Hazardous Materials Storage fact sheet and Materials Management fact sheet for more information on storing and managing hazardous materials.

Spill response and prevention practices apply to any facility that uses or stores hazardous materials. Hazardous materials include petroleum products, pesticides, paints, cleaners, fertilizers and solvents. Applicable facilities may include manufacturing areas, warehouses, service stations, roadways and parking lots. These facilities may be on public or private property, so municipal spill response and prevention practices pertain to both municipal activities on public properties and spill response procedures for private properties.

## Implementation

A municipality may implement spill response and prevention practices individually, within a stormwater management plan, or within a spill prevention and control plan. Being proactive to implement practices to prevent spills in the first place is pivotal. Instituting effective and coordinated response measures is key to responding quickly to prevent or limit any impacts that could occur from a spill.

### Prevention Practices

Municipalities should define material handling procedures and storage requirements and take actions to reduce the potential for spills. They can achieve this by:



Spills should be responded to swiftly and according to established response plans.
Photo Credit: Mark Herlihy/U.S. Air Force

- Recycling, reclaiming or reusing process materials, thereby reducing the amount of process materials they bring into facilities.
- Installing leak detection devices, overflow controls and diversion berms.
- Disconnecting drains from processing areas that lead to the storm sewer.
- Performing preventative maintenance on storm tanks, valves, pumps, pipes and other equipment.
- Using material transfer or filling procedures that minimize spills from tanks and other equipment.
- Replacing toxic materials with less or non-toxic products.

### Spill Response Plan

When a spill happens, it is critical to have a detailed plan in place. The plan should be clear and concise and should outline step-by-step instructions for spill containment, material cleanup and disposal, documentation, reporting, and follow-up procedures. The spill response plan can be in the form of a procedural handbook or a sign and should include the following components (EPA, 2007):

- Identification of potential spill or source areas such as loading and unloading, storage, and processing areas and areas designated for waste disposal.

- Identification of individuals responsible for implementing the plan.
- Description of safety measures to take with each kind of waste.
- Procedures for notifying appropriate authorities, such as police and fire departments, hospitals, or publicly owned treatment works.
- Procedures for containing, diverting, isolating and cleaning up the spill.
- Description of spill response equipment that staff should use, including safety and cleanup equipment.
- Storage of spill response supplies in easily accessible locations and in staff vehicles.
- Identification of a contractor for larger spill response.
- For spills on private property, procedures to collect cleanup and abatement costs from the responsible party.
- Procedures to document spills and spill response.

To make a spill response plan effective, municipalities need to make sure their staff understand it. They should also routinely train staff on best practices. In addition, municipalities should develop inspection checklists and response forms as part of the recordkeeping process.

A well-conceived plan reduces the likelihood of accidental spills and helps speed effective response if spills do occur.

### Public Education

In addition to the procedures described above, public education is essential for reducing spills outside municipal facilities. By informing the public of actions they can take to reduce spill potential, a municipality can reduce or prevent spills. Some municipalities have set up phone numbers that citizens can use to report spills. This helps ensure that municipalities can clean up spills safely, properly and promptly.

## Limitations

Municipalities need to plan their spill response and prevention programs well, define them clearly and execute them properly. One limitation of spill response and prevention is that municipalities are often largely reactive, focusing on response rather than prevention. Proper spill prevention requires that municipal staff participate in training and maintenance programs, and that plans have a strong public education component. Proper spill response also requires a proactive approach and enough funding to implement practices before a spill occurs. This includes staff training and having proper equipment and materials on hand, readily accessible and clearly marked so workers can respond according to plan.

## Maintenance Considerations

To prevent spills, staff should properly maintain potential sources of spills and leaks, keeping them in good operating condition. They should also regularly inspect areas where spills might occur to ensure that spill response procedures are in view and adequate stocks of cleanup equipment are readily accessible. If facility management changes any procedures or sites, it should update the spill prevention and response plan to reflect these changes.

## Cost Considerations

Costs of spill response and prevention include the cost of training municipal employees, purchasing spill kits or other on-site spill response equipment, and developing a public education program. This program will need a varying investment of staff hours and materials, depending on its extent. Spill response and prevention practices can be expensive—though arguably less so than cleaning up toxic spills that have already contaminated downstream waters and ecosystems.

**Additional Information**

Additional information on related practices and the Phase II MS4 program can be found at EPA's National Menu of Best Management Practices (BMPs) for Stormwater website

## References

U.S. Environmental Protection Agency (EPA). (2007). *MS4 program evaluation guidance.*

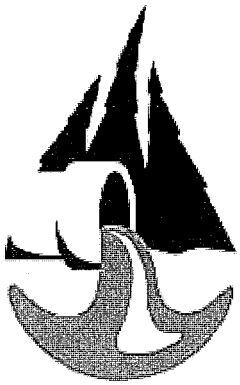
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# POLLUTION PREVENTION/GOOD HOUSEKEEPING

# FOR MUNICIPAL OPERATIONS:

## A GUIDANCE DOCUMENT
## OF
## BEST MANAGEMENT PRACTICES
## AND
## INSPECTION CHECKLISTS



WNY
Stormwater
Coalition

**Erie County Department of Environment and Planning**
**Division of Environmental Compliance Services**

# POLLUTION PREVENTION/GOOD HOUSEKEEPING FOR MUNICIPAL OPERATIONS:

# A GUIDANCE DOCUMENT OF BEST MANAGEMENT PRACTICES

# AND INSPECTION CHECKLISTS

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# INTRODUCTION

This group of (17) Pollution Prevention/Good Housekeeping Best Management Practices and Inspection checklists that relate to municipal operations and their potential effects on stormwater have been developed and assembled by a group of municipal officials that have a wealth of experience pertaining to operations and maintenance within municipalities. The information that has been formulated as guidance material for implementation of the Stormwater Phase II Municipal Separate Storm Sewer System Permit **has not** been designed to be comprehensive in all aspects of each topic. Municipalities should be "flexible" in their use of this information as pertains to their own unique municipal operations.

# STORMWATER REFERENCE INFORMATION

**Many sources of information concerning stormwater are available. The sources listed below were used to develop the Guidance Document:**

New York State Dept. of Transportation – (http://www.dot.state.ny.us) - use the search function to locate the Environmental Handbook for Transportation Operations document and other related information

Cornell University - (http://www.cornell.edu) – the Dept. of Horticulture has information pertaining to pest control, landscaping and lawn care

U.S. Environmental Protection Agency - (http://www.epa.gov) – the National Menu of Best Management Practices (BMPs) for NPDES Storm Water Phase II document can be found at http://cfpub.epa.gov/npdes/stormwater/menuofbmps/menu.cfm within the EPA website, along with other stormwater related information

Rick\StWtrOutlineInfo

# GLOSSARY OF TERMS

*Biochemical oxygen demand* – Depletion of dissolved oxygen in water caused by decomposition of chemical or biologic matter.

*Catch Basin* – A unit that is installed to capture and retain debris, particulate matter, or other solid materials, but allows stormwater to "flow through" to its discharge location

*Drip Irrigation* –irrigation via a perforated device (i.e. hose) that allows for a slow watering method with reduced evaporation and runoff losses

*Hydraulic* – Referring to water

*(IPM) Integrated Pesticide Management* – An environmentally sensitive approach to pest management (**not** elimination) that uses the least toxic control method – a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools.

*Loading* – Term used in conjunction with *sediment* and *hydraulic* to describe excessive amounts (of the term that is described)

*Naturescaping* – An alternative landscaping technique that incorporates native plants and creates beneficial wildlife habitat – also conserves water and energy, reduces soil/water pollution.

*Oil/Water Separator* – A unit that is installed "in line" to a wastewater discharge pipe which is devised to capture petroleum derived materials that float on water

*Pesticides* – Products that are toxic and are used to kill pests - can be classified as insecticides, herbicides, rodenticides, biocides, aquacides.

*POTW* – Publicly Owned Treatment Works - - a municipal wastewater treatment plant

*Scupper* – an opening (in a bridge deck) to allow water drainage – it does not capture debris, particulate matter, or other solid materials

*Sediments* - Small particles of matter that settle to the bottom of a body of water

*Silt* – Material consisting of mineral soil particles ranging in diameter from 0.02 millimeters to 0.002 millimeters

*Stormwater* - rainwater runoff or snow melt waters – these waters can interact with different types of materials, transporting contaminants to surface waters (i.e. streams, creeks, rivers)

*Toxicity* –The relative degree of being poisonous

*Xeriscaping* – An alternative landscaping technique that incorporates slow growing plants to conserve water and reduce yard trimmings

*Zero input, low input (lawns)* - have minimal need for care (i.e. addition of fertilizers/pesticides, water, etc.)

# LANDSCAPING AND LAWN CARE
# POLLUTION PREVENTION/GOOD HOUSEKEEPING PRACTICES

1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATERS (SURFACE WATERS)

    - Nutrient loading (nitrogen and phosphorous) from fertilizer runoff can cause excessive aquatic plant growth

2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

    - Biochemical Oxygen Demand

3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMP's)

    - Purchase only enough lawn care products necessary for one year – store properly to avoid waste generation (spills, leaks)
    - Use slow release or naturally derived (organic) fertilizers
    - Train employees in the proper application of lawn care products
    - Develop zero input/low input lawns
    - Consider alternative landscape techniques (i.e. naturescaping, xeriscaping)
    - Plant trees away from sewer lines or other underground utilities
    - Use drip irrigation techniques for landscaping

4. INSPECTION PROCEDURES

    - Routinely monitor lawns to identify problems during their early stages
    - Identify nutrient/water needs of plants, inspect for problems by testing soils

5. MAINTENANCE PROCEDURES

    - Minimize/eliminate fertilizer application
    - Leave grass clippings on lawn, or mulch clippings into lawn
    - Limit watering as necessary to supplement rainwater (1 inch/week is adequate)
    - Mow with sharpened blades set high (3 inches) – remove only the top 1/3 of the leaves
    - Water plants in the early A.M.

6. ADVISORY

    - Refer to the Cornell University website (Dept. of Horticulture)

# LANDSCAPING AND LAWN CARE INSPECTION CHECKLIST

Location: _____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/REPAIRS NECESSARY | ACTION |
|---|---|---|---|
| Grass/plant condition | Wilted/brown leaves | Yes No | ❑ Add water |
| General area | Barren soils | Yes No | ❑ Re-seed, cover with hay or burlap to prevent runoff |

Date of Inspection _____ Name_____

Frequency _____

**SPILL RESPONSE AND PREVENTION**
**POLLUTION PREVENTION/GOOD HOUSEKEEPING PRACTICES**

1. IDENTIFY MATERIALS THAT IMPACT STORMWATER/RECEIVING WATERS (SURFACE WATERS)

    - Liquids associated with vehicle/equipment maintenance products (oils, fuels, antifreeze, etc.)
    - Rock salt
    - Chemicals (fertilizers, pesticides)

2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

    - Toxicity
    - Biochemical oxygen demand

3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMP's)

    - Keep all materials properly stored in closed, labeled containment systems
    - Use secondary containment systems where appropriate
    - Obtain spill recovery materials for immediate response to a spill

4. INSPECTION PROCEDURES

    - Inspect secondary containment systems, oil/water separators periodically
    - Inspect containers for leaks, areas near storm receiver inlets and outlets, floor drains for indications of spills

5. MAINTENANCE PROCEDURES

    - Use reusable spill clean up materials (sponge mops, oil absorbent pads, etc.)
    - Pump out oil water separators as needed
    - Protect drains with oil absorbent materials
    - Clean out receivers on regular schedule
    - Remove spilled salt from salt loading area

6. ADVISORY

    - Report petroleum spills (as necessary) to the NYSDEC (851-7220 or 1-800-457-7362)
    - Refer to NYSDOT guidance information (Environmental Handbook for Transportation Operations)

# SPILL RESPONSE AND PREVENTION INSPECTION CHECKLIST

Location: _____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/REPAIRS NECESSARY | | ACTION |
|---|---|---|---|---|
| Products/waste storage areas | Uncovered/deteriorating containers<br>Materials spilled, leaks | Yes | No | ❑ Cover/replace<br>❑ Clean up |
| Equipment storage areas | Fluid leaks | Yes | No | ❑ Clean up |
| Secondary containment systems | Structural deterioration<br>Leakage of fluids | Yes | No | ❑ Repair/replace<br>❑ Clean up |
| Oil/water separators | Excessive amounts of contaminants | Yes | No | ❑ Pump out |
| Floor drains, storm receiver inlets and outlets | Accumulation of contaminants | Yes | No | ❑ Clean up/remove |

Date of Inspection _____ Name_____

Frequency _____

# PEST CONTROL
# POLLUTION PREVENTION/GOOD HOUSEKEEPING PRACTICES

1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATERS (SURFACE WATERS)

    - Runoff of pesticides may harm aquatic life, may contaminate water

2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

    - Toxicity to aquatic plants and animals

3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMP's)

    - Purchase only enough pesticides necessary for one year – store properly to avoid waste generation (spills, leaks, product deterioration)
    - Minimize/eliminate pesticide application, use lowest toxicity pesticides
    - Do not apply pesticides immediately prior to or during rain events
    - Ensure that employees are properly trained and certified in pesticide application techniques and safety
    - Develop zero input, low input lawns
    - Eliminate food, water, and shelter for pests
    - Adopt integrated pest management (IPM) techniques
    - Adopt alternatives to pesticides options (i.e. use mechanical traps, physical methods for removal, or biological controls)

4. INSPECTION PROCEDURES

    - Identify pests – are levels acceptable or must action be taken to control pests?
    - Inspect pesticide inventory – properly dispose of out-of-date pesticide materials

5. MAINTENANCE PROCEDURES

    - Inspect pest traps (i.e. bait boxes) regularly – remove (and properly dispose of) dead pests
    - Block/eliminate access to buildings/structures for pests
    - Remove pests (insects) by hand

6. ADVISORY

    - Abide by NYSDEC regulations (6NYCRR Part 325) pertaining to this topic
    - Refer to the Cornell University website (Dept. of Horticulture)

# PEST CONTROL INSPECTION CHECKLIST

Location: _____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/REPAIRS NECESSARY | | ACTION |
|---|---|---|---|---|
| Pesticide storage area | Excessive amounts of pesticides<br>Spilled pesticides<br>Empty containers<br>No security or access control | Yes | No | ❑ Reduce volumes, implement IPM<br>❑ Clean up<br>❑ Properly dispose<br>❑ install |
| Application equipment | Improper amounts of pesticides applied | Yes | No | ❑ Properly calibrate |
| Floor | Drain system<br>Not curbed around perimeter<br>No impermeable surface | Yes | No | ❑ Eliminate<br>❑ Install curbing<br>❑ Install impermeable surface |

Date of Inspection _____ Name_____

Frequency _____

# PET WASTE COLLECTION
# POLLUTION PREVENTION/GOOD HOUSEKEEPING PRACTICES

1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATERS (SURFACE WATERS)

    - Municipal animal shelters

2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

    - Biochemical oxygen demand
    - Solids loading

3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMP's)

    - House all animals in an enclosed, roofed structure
    - ID/utilize "permitted" waste disposal facilities for animal wastes

4. INSPECTION PROCEDURES

    - Inspect shelter regularly for necessary cleanup/removal of wastes

5. MAINTENANCE PROCEDURES

    - Remove spilled food, animal wastes on a regular basis

6. ADVISORY

    - None

# PET FACILITY MAINTENANCE INSPECTION CHECKLIST

Facility Location: _____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/REPAIRS NECESSARY | ACTION |
|---|---|---|---|
| Animal Housing area | Excessive amounts of waste<br><br>Dead animals | Yes No | ❑ Remove/rinse to floor drain (to sanitary sewer)<br>❑ Bag and remove |
| Facility's floor drain | Discharges directly to environment | Yes No | ❑ Connect to sanitary sewer |

Frequency of Inspection Daily _____ Name _____

Date _____

# SEPTIC SYSTEM MANAGEMENT
# POLLUTION PREVENTION/GOOD HOUSEKEEPING PRACTICES

1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATERS (SURFACE WATERS)

   - Ponding of improperly treated wastewaters (on the surface of a leach field or a sand filter system) can increase the biochemical oxygen demand of receiving waters.
   - Excessive amounts of disinfectant (i.e. chlorine) applied to a wastewater discharge from a sand filter system can cause toxicity to aquatic plants and animals

2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

   - Biochemical oxygen demand

3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMP's)

   - Divert stormwater runoff (i.e. from roof drains) away from septic system
   - Divert groundwater (sump pump) discharges away from septic system
   - Locate swimming pools away from the septic system (at least 20' from the septic tank, at least 35' from the closest edge of the leach field or sand filter system)
   - Prevent problems caused by vegetation - growth of woody plants on the system
   - Prevent hydraulic loading - "Spread out" the use of devices which use large volumes of water across the entire day – clothes washing, dish washing, bathing, repair leaky fixtures
   - Minimize water usage by using flow restrictors on potable water distribution devices (i.e. shower heads, water faucets)

4. INSPECTION PROCEDURES

   Physical evidence of problems:

   - "back up" of wastewater in sewer lines
   - sewage odors
   - leach field/sand filter - wetness/ponding on surface
   - overflow of wastes from system components
   - heavy vegetation (woody plants) growth on system components

5. MAINTENANCE PROCEDURES

   - "Pump out" the septic tank as needed (NYSDEC recommends once/year)
   - Mow surface vegetation regularly
   - Prevent "heavy equipment" from driving on top of the system components

6. ADVISORY

   - Obtain site plan/site sketch of system, and retain for reference.

# SEPTIC SYSTEM MANAGEMENT INSPECTION CHECKLIST

Unit ID:_____NYSDEC Permit #_____ Location_____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/REPAIRS NECESSARY | | ACTION |
|---|---|---|---|---|
| Septic tank cover | Broken/cracked? | Yes | No | ❑ Replace |
| Distribution box | sewage overflowing, distribution box level? | Yes | No | ❑ Clean out<br>❑ Re-level |
| Leach field or sand filter | sewage on surface, odors, excessive vegetation growth | Yes | No | ❑ Clean out distribution lines<br>❑ Cut vegetation |
| Disinfection system (if present) | Operating improperly | Yes | No | ❑ Check/repair equipment |
| Outfall | Improper chlorine residual | Yes | No | ❑ Perform monitoring, sampling/analysis as permit requires |

Frequency of Inspection _____ Last pump out (date) _____

Date of Inspection _____ Name_____

(If unit is a HOLDING TANK, pump out schedule)_____

# VEHICLE/EQUIPMENT MAINTENANCE
# POLLUTION PREVENTION/GOOD HOUSEKEEPING PRACTICES

1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATERS (SURFACE WATERS)

    - Trace amounts of metals/hydrocarbons are found in materials (i.e. fuels, antifreeze, batteries, motor oils, grease, parts cleaning solvents) that are typically used in maintenance operations

2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

    - Toxicity
    - Biochemical oxygen demand

3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMPs)

    - Conduct maintenance work indoors – if work must be performed outside, guard against spillage of materials that could discharge to storm receivers
    - Seal floor drains that discharge directly to the environment, if possible
    - Initiate single purpose use of vehicle bays – dedicate one (or more) bays that have no (or sealed) floor drains for repairs/maintenance
    - Clean up spilled materials immediately, using "dry" methods
    - Install pretreatment systems (oil/water separators) where necessary in sewer lines to capture contaminants (oil, grit), and maintain as needed
    - Never leave vehicles unattended while refueling
    - Identify appropriate recycling/disposal options for wastes

4. INSPECTION PROCEDURES

    - Inspect (for maintenance purposes) floor drain systems, oil/water separators
    - Monitor "parked" vehicles/equipment for leaks

5. MAINTENANCE PROCEDURES

    - Maintain a clean work area – remove contaminants from floors, drains, catch basins, using "dry" methods
    - Use non-hazardous cleaners. Use non chlorinated solvents instead of chlorinated solvents
    - Repair or replace any leaking containers
    - Use steam cleaning /pressure washing instead of solvent for parts cleaning
    - Store waste fluids in properly capped, labeled storage containers
    - Store batteries in leak-proof, compatible (i.e. non reactive) containers
    - Rinse grass from lawn care equipment on permeable (grassed) areas
    - Protect against pollution if outside maintenance is necessary (cover storm receivers, use secondary containment vessels, etc.)

6. ADVISORY

    - Report petroleum spills (as necessary) to the NYSDEC (851-7220 or 1-800-457-7362)
    - Refer to NYSDOT guidance information (Environmental Handbook for Transportation Operations)

# VEHICLE AND EQUIPMENT MAINTENANCE/STORAGE AREA INSPECTION CHECKLIST

Unit ID: _____ Location: _____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/REPAIRS NECESSARY | | ACTION |
|---|---|---|---|---|
| Truck/equipment | Leaks/spills | Yes | No | ❑ Clean spill, repair leak, capture fluids in drip pan |
| Salt/sand spreader | Improper amounts of product applied | Yes | No | ❑ Recalibrate |
| Lawn care equipment | Improper operation | Yes | No | ❑ Inspect/repair |

Date of Inspection _____ Name _____

Frequency _____

# VEHICLE/EQUIPMENT WASHING
# POLLUTION PREVENTION/GOOD HOUSEKEEPING PRACTICES

1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATERS (SURFACE WATERS)

   - Nutrients (biodegradable soaps)
   - Metals
   - Petroleum based wastes (organic pollutants)

2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

   - Biochemical oxygen demand from nutrient sources
   - Toxicity
   - Hydraulic loading

3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMPs)

   - Initiate single purpose use of vehicle bays - dedicate only one bay for washing (with floor drain system)
   - Perform cleaning with pressurized cold water, without the use of soaps, if wastewaters will flow to a **storm sewer** system
   - Use minimal amounts of biodegradable soaps **only** if wastewaters will discharge to a **sanitary sewer** system
   - Rinse with hoses that are equipped with automatic shutoff devices and spray nozzles
   - Steam clean (without soap) where wastes can be captured for proper disposal (i.e. oil/water separator)

4. INSPECTION PROCEDURES

   - Inspect floor drain systems regularly - use only those that discharge to a sanitary sewer, identify the need for cleaning of catch basins, oil/water separators

5. MAINTENANCE PROCEDURES

   - Map storm drain locations accurately to avoid illegal discharges
   - Perform steam cleaning or pressure washing where wastes can be captured for proper disposal
   - Take precautions against excess use of/spillage of detergents

6. ADVISORY

   - Require all facilities to connect floor drain systems to sanitary sewers (if available)
   - Refer to NYSDOT guidance information (Environmental Handbook for Transportation Operations)

# VEHICLE AND EQUIPMENT WASHING AREA INSPECTION CHECKLIST

Facility location: _____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/REPAIRS NECESSARY | ACTION |
|---|---|---|---|
| Designated "wash only" area | No impermeable pad with wastewater collection system | Yes No | ❑ Designate/construct area |
| Wastewater discharge location | Does not flow to either a holding tank or to sanitary sewers | Yes No | ❑ Properly relocate discharge |
| Washing/degreasing compounds | Solvent based | Yes No | ❑ Change to biodegradable products |
| Floor drain sump | Nonexistent | Yes No | ❑ Install and maintain sump, remove debris |
| Oil/water separator | Excessive oils/sludges | Yes No | ❑ Clean out contaminants |
| Catch basin | Non existent, accumulation of contaminants | Yes No | ❑ Install/maintain catch basin |

Date of Inspection _____ Name _____

Frequency _____

# ROADWAY AND BRIDGE MAINTENANCE
# POLLUTION PREVENTION/GOOD HOUSEKEEPING PRACTICES

1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATERS (SURFACE WATERS)

- Road salt components - sodium, calcium, and chlorides
- Hydrocarbons
- Particulates – such as dry paint or abrasive compounds, road debris
- Debris

2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

- Particulate matter
- Toxicity (paint – may contain metals such as lead, barium, cadmium)

3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMPs)

- Incorporate preventive maintenance and planning for regular operations & maintenance activities
- Pave in dry weather only.
- Stage road operations and maintenance activity (patching, potholes) to reduce spillage. Cover catch basins and manholes during this activity.
- Clean up fluid leaks or spills from paving equipment/materials immediately
- Restrict the use of herbicides/pesticide application to roadside vegetation
- Use porous asphalt for pothole repair and shoulder work
- Sweep and vacuum paved roads and shoulders to remove debris and particulate matter
- Maintain roadside vegetation; select vegetation with a high tolerance to road salt
- Control particulate wastes from bridge sandblasting operations
- Use calcium magnesium acetate for deicing around bridges to minimize corrosion
- Clean out bridge scuppers and catch basins regularly
- Direct water from bridge scuppers to vegetated areas
- Mechanically remove (i.e. sweep) debris from bridge deck and structure prior to washing

4. INSPECTION PROCEDURES

- Inspect paving, sweeping, vacuuming, and all other maintenance vehicles/equipment as appropriate
- Inspect roads and bridges for implementation of applicable BMP's

5. MAINTENANCE PROCEDURES

- Clean bridge scuppers routinely and keep free of debris
- Direct runoff water from bridges to vegetated areas
- Install catch basins in place of bridge scuppers
- Use tarps, booms, and vacuums during painting or blasting activities (refer to reference information to control/capture particulate matter)
- Repair leaking/defective containers or equipment on paving equipment

6. ADVISORY

- Refer to NYSDOT guidance information (Environmental Handbook for Transportation Operations

# ROADWAY AND BRIDGE MAINTENANCE INSPECTION CHECKLIST

Bridge No.: _____ BIN: _____ Carried: _____ Crossed: _____

Wetlands Present: Y N Stream Restriction: Y N If yes, Dates: _____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/ REPAIRS NECESSARY | ACTION |
|---|---|---|---|
| Bridge Deck (Top Side) | Debris Along Curb | Yes No | ❑ Sweep bridge, deposit debris on bank 50' from sweep and spread out<br>❑ Wash Bridge Deck |
| Bridge Seats at Abutment, or Top of Piers | Debris on Seat or Top of Pier | Yes No | ❑ Remove debris, deposit on stream banks<br>❑ Bird Nest Present? If yes, wait until nesting is complete.<br>❑ Wash Abutment & Pier |
| Washing of Superstructure | Debris – Salts on Superstructure | Yes No | ❑ Bird Nest Present? If yes, wait until nesting is complete.<br>❑ Flaking Paint Present? If yes, do not wash.<br>❑ Stream Restriction? If yes, wait until restrictions are removed.<br>❑ Wash Superstructure |

# ALTERNATIVE DISCHARGE OPTIONS FOR CHLORINATED WATER POLLUTION PREVENTION/GOOD HOUSEKEEPING PRACTICES

1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATERS (SURFACE WATERS)

    - Discharge of chlorinated (i.e. swimming pool, POTW) waters to surface waters can injure or kill aquatic life

2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

    - Toxicity – very low levels of chlorine can detrimentally affect aquatic life
    - Hydraulic loading

3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMPs)

    - Dechlorinate pool water before any discharge, be it over land or to the sanitary sewer, or allow the "disinfectant" to dissipate with sunlight, use, etc. prior to discharge
    - Use ultraviolet radiation or osmosis to disinfect water/wastewater
    - Backwash water should be discharged to the sanitary sewer, if available – if not available, discharge water over vegetated areas, not to surface waters

4. INSPECTION PROCEDURES

    - Check chlorine residuals prior to discharge.
    - Do not discharge wastewaters into the sanitary sewer system during periods of high flow.

5. MAINTENANCE PROCEDURES

    - Maintain proper levels of chlorine residuals in pool.
    - Allow disinfectant to dissipate prior to discharge of pool waters.

6. ADVISORY

    - Obtain permission from the municipal POTW prior to discharging any chlorinated pool waters to a sanitary sewer system.

## ALTERNATIVE DISCHARGE OPTIONS FOR CHLORINATED WATER INSPECTION CHECKLIST

Location: _____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/REPAIRS NECESSARY | ACTION |
|---|---|---|---|
| Pools, hot tubs | Need to empty unit and replace water | Yes No | ❑ Discharge to sanitary sewers or to vegetated areas after the disinfectant dissipates, not to storm sewers or surface waters |

Date of Inspection _____ Name_____

Frequency _____

# HAZARDOUS AND WASTE MATERIALS MANAGEMENT
# POLLUTION PREVENTION/GOOD HOUSEKEEPING PRACTICES

## 1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATERS (SURFACE WATERS)

- Lube oils
- Coatings and their compatible solvents (paints, thinners, etc.)
- Anti freeze
- Cleaning agents
- Fuels (gas, diesel, kerosene)

## 2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

- Biochemical oxygen demand
- Toxicity to aquatic plants and wildlife
- Particulate loading

## 3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMP's)

- Ensure that all materials are stored in closed, labeled containers – if stored outside, drums should be placed on pallets, away from storm receivers – inside storage areas should be located away from floor drains
- Eliminate floor drain systems that discharge to storm drains, if possible
- Use a pretreatment system to remove contaminants prior to discharge
- Reduce stock of materials "on hand" – use "first in/first out" management technique
- Use the least toxic material (i.e. non hazardous) to perform the work
- Install/use secondary containment devices where appropriate
- Eliminate wastes by reincorporating coating/solvent mixtures into the original coating material for reuse
- Recycle materials if possible, or ensure proper disposal of wastes

## 4. INSPECTION PROCEDURES

- Physical on-site verification of sealed floor drains (or redirected to sanitary sewer)
- Regular inspection of material storage areas (inside and outside)
- Regular inspection and cleaning of oil/water separators by qualified contractor
- Inspect stormwater discharge locations regularly (for contaminants, soil staining, plugged discharge lines)

## 5. MAINTENANCE PROCEDURES

- Repair or replace any leaking/defective containers, and replace labels as necessary
- Maintain caps and/or covers on containers
- Maintain aisle space for inspection of products/wastes

## 6. ADVISORY

- Abide by NYSDEC regulations (6NYCRR Part 372) and OSHA regulations (29 CFR Part 1910) pertaining to these topics
- Refer to NYSDOT guidance information (Environmental Handbook for Transportation Operations)

# HAZARDOUS AND WASTE MATERIALS MANAGEMENT INSPECTION CHECKLIST

Location: _____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/REPAIRS NECESSARY | | ACTION |
|---|---|---|---|---|
| Outside storage areas | Weathering | Yes | No | ❑ Protect from weathering – store on pallets, cover |
| Salt piles<br>Soil staging areas | Salt staining<br>Silt runoff | Yes<br>Yes | No<br>No | ❑ Cover with tarps<br>❑ Cover with tarps, install physical barriers |
| Aboveground storage tanks | Deterioration | Yes | No | ❑ Inspect/repair/maintain, install secondary containment |
| Inside storage areas | Potential for discharges | Yes | No | ❑ Seal floor drains, install secondary containment |
| Drums, other containers | Deterioration<br>Uncovered | Yes | No | ❑ Repair/replace<br>❑ Cover/cap |

Date of Inspection _____ Name _____

Frequency _____

# OPERATIONAL BY PRODUCTS/WASTES
# POLLUTION PREVENTION/GOOD HOUSEKEEPING PRACTICES

1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATERS (SURFACE WATERS)

    - Potential for leaching of toxic and biologic contaminants to receiving waters

2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

    - Toxicity
    - Biochemical oxygen demand

3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMP's)

    - Post "no dumping" signs
    - Illuminate area if possible
    - Prevent access – erect barriers
    - Identify the by products/wastes that should be recycled (i.e. paper, cardboard) or can be legally disposed of on municipal lands (i.e. deer carcasses) by referencing NYSDEC regulations (6NYCRR PART 360)

4. INSPECTION PROCEDURES

    - Regularly scheduled inspections - for maintenance concerns
    - Unscheduled patrolling of areas by police

5. MAINTENANCE PROCEDURES

    - Clean up and dispose of "illegally dumped" materials, trash/debris in accordance with environmental regulations
    - Cut and remove vegetation

6. ADVISORY

    - Abide by NYSDEC regulations (6NYCRR Part 360) pertaining to this topic
    - Refer to NYSDOT guidance information (Environmental Handbook for Transportation Operations)

## OPERATIONAL BY-PRODUCTS AND WASTES INSPECTION CHECKLIST

Location _____

(example. Temporary dumping areas for bulky trash items)

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/REPAIRS NECESSARY | | ACTION |
|---|---|---|---|---|
| Condition of general area | Possible runoff to/ contamination of storm sewer or water body | Yes | No | ❑ Remove<br>❑ Fix |
| Type of material/waste observed? | Appropriate? | Yes | No | ❑ Remove to appropriate container/location |
| Security | Regular policing of area, Location properly secured/closed/locked? | Yes | No | ❑ Secure waste area |
| Disposal | Past disposal date? | Yes | No | ❑ Dispose timely |

Inspection Frequency _____

Last Clean-up Date _____

Date of Inspection _____ Name_____

# CATCH BASIN AND STORM DRAIN SYSTEM CLEANING
# POLLUTION PREVENTION/ GOOD HOUSEKEEPING PRACTICES

1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATERS (SURFACE WATERS)

- **Catch basins** capture grit and debris, which, if not removed in a timely fashion, can discharge toxic and biological pollutants during rain and/or snow melt events
- **Storm drainage systems**, while not designed for capture of solid materials, can perform in the same manner with similar results.
- **Storm ditches**, if stripped of vegetation during cleaning, can result in silt deposition in receiving waters

2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

- Toxicity – heavy metals, organic compounds, etc.
- Biochemical oxygen demand
- Sediment loading

3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMP's)

- Address:
  - storm drain receivers and (below grade) storm sewer systems
  - parking lot receivers
  - open ditches
  - catch basins and floor drain systems inside of buildings should be either:
    - sealed to prevent discharge
    - "permitted" by NYSDEC
    - discharged to sanitary sewers
- Contaminated wastewaters should not be discharged to a catch basin/street receiver/ditch
- Increase frequency of cleaning, as necessary
- Repair/replace storm drain receiver and catch basin receiver grates as necessary

4. INSPECTION PROCEDURES

- Physical inspection – prioritize storm drain systems and catch basins – catch basins on steep grades may need more frequent cleaning
- Clean catch basin when depth of deposits are >1/3 the depth from the bottom of the basin to the invert of the lowest pipe/opening into or out of basin – Institute temporary street parking bans to facilitate access to catch basins
- Ditch inspections – ID problems while traveling to job site
- Storm event inspection – identify pollution problems (i.e. sediments) to determine the need for additional protective measures
- Post storm event inspection – ID problems (i.e. blockages)

5. MAINTENANCE PROCEDURES

- Catch basins/storm sewer pipe – cleaning in spring to remove sand/grit/salt from winter road maintenance, cleaning in fall to remove leaves/silt/debris
- Established ditch:
  - Maintain proper slope
  - Maintain vegetation by cutting (to capture sediment) – Do not allow vegetation to grow to a height that would impair sight lines of drivers of motor vehicles
  - Remove obstacles/ debris – (i.e. trash, tree branches, brush, cut vegetation)
  - Excavation/ditch scraping – if necessary, use devices (i.e. hay bales, silt fence) to capture sediment prior to stormwater discharge into receiving waters, reseed ditch
- New installation – capture particulate matter – install sediment basins/other devices in ditch
- Proper disposal of debris

6. ADVISORY

- Refer to NYSDOT guidance information (Environmental Handbook for Transportation Operations)

# CATCH BASIN AND STORM DRAIN SYSTEM CLEANING INSPECTION CHECKLIST

Road Name: _____ Road Number: _____ Road Section: From: _____ To: _____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/ REPAIRS NECESSARY | | ACTION | LOCATION (House number, distance from intersection) |
|---|---|---|---|---|---|
| Catch Basin/ Drop Inlet | Deterioration of Structure | Yes | No | ❑ Repair Structure or Grate<br>❑ Replace Structure or Grate | |
| | Clogged Inlets During or After Storm Event | Yes | No | ❑ Clean Grate / Inlet | |
| | Deposits in Structure | Yes | No | ❑ Clean Out Structure | |
| Storm Manhole | Deterioration of Structure | Yes | No | ❑ Repair Structure or Cover<br>❑ Replace Structure or Cover | |
| | Deposits in Structure | Yes | No | ❑ Clean Out Structure | |
| Storm Sewer Piping | Clogged Pipe | Yes | No | ❑ Clean Out Pipe | |
| | Deteriorated Pipe | Yes | No | ❑ Replace Pipe | |
| Ditches (Pollutants) | Excessive Vegetation | Yes | No | ❑ Mow Vegetation<br>❑ Scheduled Ditch Cleaning | |
| | Debris (branches, litter, garbage, etc.) | Yes | No | ❑ Clean Out Ditch | |
| | Excessive Siltation | Yes | No | ❑ Clean Out & Regrade Ditch | |
| Roadside / Cross Culverts | Clogged Pipe | Yes | No | ❑ Clean Out<br>❑ Review Size & Replace<br>❑ Clean Out & Regrade Ditch | |
| | Deteriorated Pipe | Yes | No | ❑ Replace Pipe<br>❑ Line Pipe | |
| Sediment Basins | Excessive Vegetation | Yes | No | ❑ Mow | |
| | Excessive Sediment Deposits | Yes | No | ❑ Clean Out Basin | |
| Outfall | Pollutants | Yes | No | ❑ Rip-rap | |

Date of Inspection _____ Name _____ Frequency _____

# STREET CLEANING AND MAINTENANCE
# POLLUTION PREVENTION/GOOD HOUSEKEEPING PRACTICES

## 1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATER (SURFACE WATERS)

- Poorly maintained streets allow for a "build up" of trash, grit, and debris, from which sediment and toxic/biological pollutants can be "washed out" during rain and /or snow melt events.
- Street repair/paving processes use materials that can contaminate receiving waters if they interact with stormwater.

## 2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

- Particulate matter – can cause sediment loading
- Biochemical oxygen demand
- Toxicity to aquatic plants and wildlife

## 3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMP's)

- Street sweeping/vacuuming - at regular intervals, and "as needed"
- Perform operations such as paving in dry weather only.
- Prior to road reconstruction, consider/evaluate the use of "shouldered roads" instead of "curbed roads"
- Maintain roadside vegetation; select plants/trees that can withstand the action of road salt. Direct runoff to these areas.

## 4. INSPECTION PROCEDURES

- Inspect streets, and plan (as needed) for maintenance/repairs
- Prioritize – some streets (i.e. those with high traffic flows, on flat grades, or with many trees) may need more frequent cleaning

## 5. MAINTENANCE PROCEDURES

- Spring sweeping/vacuuming – remove salt/sand residues
- Fall sweeping, collection of leaves at appropriate time intervals
- Dry sweep or vacuum streets during dry weather
- Initiate temporary street by street parking bans to allow access for cleaning
- Maintain equipment - check for/repair fluid leaks
- Stage road operations and maintenance activity (patching, pothole repair) to reduce spillage of materials. Cover catch basins and manholes during activity

## 6. ADVISORY

- Refer to NYSDOT guidance information (Environmental Handbook for Transportation Operations)

# STREET CLEANING AND MAINTENANCE INSPECTION CHECKLIST

Location/Section of Road _____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/REPAIRS NECESSARY | | ACTION |
|---|---|---|---|---|
| Roads (curb line) | Debris, grit, stone | Yes | No | ❑ Shovel or Vacuum |
| Milling | Broken pavement (excavated material) | Yes | No | ❑ Cover storm inlets, shovel, vacuum |
| Paving | Tack coat overspray | Yes | No | ❑ Cover storm inlets |
| Storm drain inlets | Broken brick, block, mortar | Yes | No | ❑ Repair |
| Roadside vegetation | Too high | Yes | No | ❑ Cut |
| | None observed | Yes | No | ❑ Re-seed |

Date of Inspection _____ Name _____

Frequency _____

# ROAD SALT STORAGE AND APPLICATION
# GOOD HOUSEKEEPING/POLLUTION PREVENTION PRACTICES

## 1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATERS (SURFACE WATERS)

- Salt is very soluble in water, and, in high concentrations, can have a deleterious effect on plants and aquatic life.

## 2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

- Toxicity

## 3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMP's)

- Require covered facility for salt storage (prevents lumping and run-off loss), and size properly for seasonal needs
- Store salt on highest ground elevation to allow for infiltration of stormwater
- Calibrate salt spreaders for proper application
- Consider alternative deicing materials (i.e. calcium chloride, magnesium chloride)
- Use a wetting agent with salt to minimize "bouncing" during application
- Cover salt loading area, or build into storage shed
- Unload salt deliveries directly into storage facility, or if not possible, move inside immediately

## 4. INSPECTION PROCEDURES

- Look for physical evidence of problems:

  - inspect salt storage shed for leaks, structural problems
  - inspect salt piles for proper coverage, tarps for leaks or tears
  - inspect salt application equipment
  - inspect salt regularly for lumping or water contamination
  - inspect surface areas for evidence of runoff – salt stains on ground near and around the salt shelter, loading area, or downslope
  - inspect for excessive amounts of salt on roads

## 5. MAINTENANCE PROCEDURES

- Service trucks and calibrate spreaders regularly to ensure accurate, efficient distribution of salt
- Educate and train operators on hazards of over-salting to roads and environment
- Repair salt storage shed – structural problems can lead to salt spillage
- Repair/replace tarps

## 6. ADVISORY

- Refer to NYSDOT guidance information (Environmental Handbook for Transportation Operations)

# ROAD SALT STORAGE AND APPLICATION INSPECTION CHECKLIST

Unit ID: _____ Location _____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/REPAIRS NECESSARY | | ACTION |
|---|---|---|---|---|
| Storage shed | Salt outside of shed | Yes | No | ❑ Move salt into shed |
| Truck loading area | Salt on ground | Yes | No | ❑ Pick up, load onto truck<br>❑ do not overfill truck |
| Roads – (sites of application) | Excessive salt on ground | Yes | No | ❑ Remove by sweeping? |
| Salt spreader | Excessive salt on ground | Yes | No | ❑ Recalibrate salt spreader? |

Date of Inspection _____ Name_____

# ROAD KILL COMPOSTING OPERATIONS
# GOOD HOUSEKEEPING/POLLUTION PREVENTION PRACTICES

1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATERS (SURFACE WATERS)

    - Potential for leaching of biologic contaminants to receiving waters

2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

    - Biochemical oxygen demand

3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMP's)

    - Establish compost pile/windrow on a well drained, impervious surface that has minimal slope – segregate from other operations
    - Identify the proper types of carcasses (typically, deer) that should be composted
    - Locate compost piles at least 200 ft. away from receiving waters or wetlands
    - Prevent access by vermin/scavengers – erect barriers (i.e. snow fence) around pile

4. INSPECTION PROCEDURES

    - Check for odors, temperature of compost, exposed carcasses
    - Keep records (use a daily log)

5. MAINTENANCE PROCEDURES

    - Monitor temperatures
    - Take samples, analyze for pathogens
    - Establish windrows
    - Prevent erosion
    - Recycle completely composted material

6. ADVISORY

    - Abide by NYSDEC regulations (6NYCRR Part 360) pertaining to this topic
    - Refer to NYSDOT guidance

# ROAD KILL COMPOST SITE INSPECTION CHECKLIST

Location: _____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/REPAIRS NECESSARY | | ACTION |
|---|---|---|---|---|
| Compost pile | Exposed Carcasses | Yes | No | ❑ Add cover material (wood chips, compost) |
| | Odors | Yes | No | ❑ Cover with wood chips<br>❑ Add lime |
| | Liquid runoff (leachate) | Yes | No | ❑ Absorb with wood chips, return to compost pile |
| | Animals scavenging | Yes | No | ❑ Fence area<br>❑ Temporarily cover with tarp |
| | Wood chips too dry<br>Wood chips too wet | Yes<br>Yes | No<br>No | ❑ Add water<br>❑ Allow to dry |
| | Insufficient compost temperature | Yes | No | ❑ Temporarily cover with tarp |

Date of Inspection _____ Name_____

Frequency _____

Rick\stwtr\insp cklsts

# MARINA OPERATIONS
# POLLUTION PREVENTION/GOOD HOUSEKEEPING PRACTICES

## 1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATERS (SURFACE WATERS)

- Liquids associated with boat maintenance products (oils, fuels, antifreeze, wood preservatives, etc. and particulate matter (i.e. boat bottom paint from hull sanding) can contain toxics
- Boat sewage can contain pathogenic bacteria that contribute increased biochemical oxygen demand to waterways
- Barren soils can contribute to sedimentation

## 2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

- Biochemical oxygen demand
- Toxicity
- Sediment loading

## 3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMP's)

- Construct and maintain pump out stations (for sanitary wastes)
- Build and maintain fish cleaning stations
- Stabilize shoreline
- Designate locations for boat maintenance away from the water
- Minimize impervious areas – install vegetated buffer strips (i.e. grass, shrubs)
- Provide covered trash receptacles, spill clean up kits at fueling stations
- Educate (posters, signage) boaters and other marina users of potential problems

## 4. INSPECTION PROCEDURES

- Identify areas of runoff that lack vegetation
- Regularly inspect fueling stations (including tanks and piping), maintenance areas for spills, other potential sources of pollution
- Regularly check (and empty as necessary) fish cleaning stations, sewage pump out stations, trash cans

## 5. MAINTENANCE PROCEDURES

- Empty trash cans and pump out stations as needed
- Maintain vegetated areas between the water and work areas
- Replace spill clean up kits as necessary

## 6. ADVISORY

- Refer to: Shipshape Shores and Waters: A Handbook for Marina Operators and Recreational Boaters - http://www.epa.gov/owow/nps/marinashdbk2003.pdf

# MARINA OPERATIONS INSPECTION CHECKLIST

Location: _____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/REPAIRS NECESSARY | | ACTION |
|---|---|---|---|---|
| Trash cans, sewage pump out stations, fish cleaning stations | Full | Yes<br>Yes | No<br>No | ❑ Empty, dispose of wastes properly |
| Fueling stations | Spills | Yes<br>Yes | No<br>No | ❑ Clean up |
| Vegetated areas | Barren soils | Yes | No | ❑ Re-vegetate |
| | | Yes | No | ❑ |
| | | Yes | No | ❑ |
| | | Yes | No | ❑ |

Date of Inspection _____ Name_____

Frequency_____

Rick\stwtr\insp cklsts

# CONSTRUCTION AND LAND DISTURBANCE
# POLLUTION PREVENTION/GOOD HOUSEKEEPING PRACTICES

1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATERS (SURFACE WATERS)

   - Sediment runoff (i.e. silt, debris) can affect fish reproduction and habitat
   - Removal of shade trees from stream banks can increase water temperature which can result in reduced dissolved oxygen content in streams

2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

   - Particulate matter – can cause sediment loading
   - Biochemical oxygen demand – increases with temperature, depletes oxygen

3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMP's)

   - Plan the construction and/or land clearing activities so that soil is not exposed for long periods of time
   - Minimize compaction of soils and impervious cover
   - Maximize opportunities for infiltration
   - Install sediment control devices before disturbing soil
   - Limit grading to small areas
   - Stabilize site to protect against sediment runoff
   - Protect against sediment flowing into storm drains
   - Maintain native vegetation (especially near waterways)
   - Install sediment barriers on slopes or divert stormwater

4. INSPECTION PROCEDURES

   - Regularly scheduled inspections (of sediment control devices, erosion safeguards)
   - Inspect during storm or snow melt events

5. MAINTENANCE PROCEDURES

   - Check/repair all devices that have been installed to ensure protection against erosion

6. ADVISORY

   - Refer to NYSDOT guidance information (Environmental Handbook for Transportation Operations)
   - NY State Standards and Specifications for Sediment and Erosion Control
   - NY State Stormwater Management Design Manual

# CONSTRUCTION AND LAND DISTURBANCE INSPECTION CHECKLIST

Location: _____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/REPAIRS NECESSARY | | ACTION |
|---|---|---|---|---|
| Sediment control devices | None observed<br>In disrepair | Yes<br>Yes | No<br>No | ❑ Install<br>❑ Repair |
| Sediment barrier devices | None observed<br>In disrepair | Yes<br>Yes | No<br>No | ❑ Install<br>❑ Repair |
| | | Yes | No | ❑ |
| | | Yes | No | ❑ |
| | | Yes | No | ❑ |
| | | Yes | No | ❑ |

Date of Inspection _____ Name _____

Frequency initial, and as needed (coinciding with storm events)

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# POLLUTION PREVENTION/GOOD HOUSEKEEPING

# FOR MUNICIPAL OPERATIONS:

## A GUIDANCE DOCUMENT
## OF
## BEST MANAGEMENT PRACTICES
## AND
## INSPECTION CHECKLISTS

WNY
Stormwater
Coalition

**Erie County Department of Environment and Planning**
**Division of Environmental Compliance Services**

# POLLUTION PREVENTION/GOOD HOUSEKEEPING FOR MUNICIPAL OPERATIONS:

# A GUIDANCE DOCUMENT OF BEST MANAGEMENT PRACTICES

# AND INSPECTION CHECKLISTS

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# INTRODUCTION

This group of (17) Pollution Prevention/Good Housekeeping Best Management Practices and Inspection checklists that relate to municipal operations and their potential effects on stormwater have been developed and assembled by a group of municipal officials that have a wealth of experience pertaining to operations and maintenance within municipalities. The information that has been formulated as guidance material for implementation of the Stormwater Phase II Municipal Separate Storm Sewer System Permit **has not** been designed to be comprehensive in all aspects of each topic. Municipalities should be "flexible" in their use of this information as pertains to their own unique municipal operations.

# STORMWATER REFERENCE INFORMATION

**Many sources of information concerning stormwater are available. The sources listed below were used to develop the Guidance Document:**

New York State Dept. of Transportation – (http://www.dot.state.ny.us) - use the search function to locate the Environmental Handbook for Transportation Operations document and other related information

Cornell University - (http://www.cornell.edu) – the Dept. of Horticulture has information pertaining to pest control, landscaping and lawn care

U.S. Environmental Protection Agency - (http://www.epa.gov) – the National Menu of Best Management Practices (BMPs) for NPDES Storm Water Phase II document can be found at http://cfpub.epa.gov/npdes/stormwater/menuofbmps/menu.cfm within the EPA website, along with other stormwater related information

Rick\StWtrOutlineInfo

# GLOSSARY OF TERMS

*Biochemical oxygen demand* – Depletion of dissolved oxygen in water caused by decomposition of chemical or biologic matter.

*Catch Basin* – A unit that is installed to capture and retain debris, particulate matter, or other solid materials, but allows stormwater to "flow through" to its discharge location

*Drip Irrigation* –irrigation via a perforated device (i.e. hose) that allows for a slow watering method with reduced evaporation and runoff losses

*Hydraulic* – Referring to water

*(IPM) Integrated Pesticide Management* – An environmentally sensitive approach to pest management (**not** elimination) that uses the least toxic control method – a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools.

*Loading* – Term used in conjunction with *sediment* and *hydraulic* to describe excessive amounts (of the term that is described)

*Naturescaping* – An alternative landscaping technique that incorporates native plants and creates beneficial wildlife habitat – also conserves water and energy, reduces soil/water pollution.

*Oil/Water Separator* – A unit that is installed "in line" to a wastewater discharge pipe which is devised to capture petroleum derived materials that float on water

*Pesticides* – Products that are toxic and are used to kill pests - can be classified as insecticides, herbicides, rodenticides, biocides, aquacides.

*POTW* – Publicly Owned Treatment Works - - a municipal wastewater treatment plant

*Scupper* – an opening (in a bridge deck) to allow water drainage – it does not capture debris, particulate matter, or other solid materials

*Sediments* - Small particles of matter that settle to the bottom of a body of water

*Silt* – Material consisting of mineral soil particles ranging in diameter from 0.02 millimeters to 0.002 millimeters

*Stormwater* - rainwater runoff or snow melt waters – these waters can interact with different types of materials, transporting contaminants to surface waters (i.e. streams, creeks, rivers)

*Toxicity* –The relative degree of being poisonous

*Xeriscaping* – An alternative landscaping technique that incorporates slow growing plants to conserve water and reduce yard trimmings

*Zero input, low input (lawns)* - have minimal need for care (i.e. addition of fertilizers/pesticides, water, etc.)

# LANDSCAPING AND LAWN CARE
# POLLUTION PREVENTION/GOOD HOUSEKEEPING PRACTICES

1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATERS (SURFACE WATERS)

    - Nutrient loading (nitrogen and phosphorous) from fertilizer runoff can cause excessive aquatic plant growth

2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

    - Biochemical Oxygen Demand

3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMP's)

    - Purchase only enough lawn care products necessary for one year – store properly to avoid waste generation (spills, leaks)
    - Use slow release or naturally derived (organic) fertilizers
    - Train employees in the proper application of lawn care products
    - Develop zero input/low input lawns
    - Consider alternative landscape techniques (i.e. naturescaping, xeriscaping)
    - Plant trees away from sewer lines or other underground utilities
    - Use drip irrigation techniques for landscaping

4. INSPECTION PROCEDURES

    - Routinely monitor lawns to identify problems during their early stages
    - Identify nutrient/water needs of plants, inspect for problems by testing soils

5. MAINTENANCE PROCEDURES

    - Minimize/eliminate fertilizer application
    - Leave grass clippings on lawn, or mulch clippings into lawn
    - Limit watering as necessary to supplement rainwater (1 inch/week is adequate)
    - Mow with sharpened blades set high (3 inches) – remove only the top 1/3 of the leaves
    - Water plants in the early A.M.

6. ADVISORY

    - Refer to the Cornell University website (Dept. of Horticulture)

# LANDSCAPING AND LAWN CARE INSPECTION CHECKLIST

Location: _____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/REPAIRS NECESSARY | ACTION |
|---|---|---|---|
| Grass/plant condition | Wilted/brown leaves | Yes No | ❑ Add water |
| General area | Barren soils | Yes No | ❑ Re-seed, cover with hay or burlap to prevent runoff |

Date of Inspection _____ Name_____

Frequency _____

**SPILL RESPONSE AND PREVENTION**
**POLLUTION PREVENTION/GOOD HOUSEKEEPING PRACTICES**

1. IDENTIFY MATERIALS THAT IMPACT STORMWATER/RECEIVING WATERS (SURFACE WATERS)

    - Liquids associated with vehicle/equipment maintenance products (oils, fuels, antifreeze, etc.)
    - Rock salt
    - Chemicals (fertilizers, pesticides)

2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

    - Toxicity
    - Biochemical oxygen demand

3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMP's)

    - Keep all materials properly stored in closed, labeled containment systems
    - Use secondary containment systems where appropriate
    - Obtain spill recovery materials for immediate response to a spill

4. INSPECTION PROCEDURES

    - Inspect secondary containment systems, oil/water separators periodically
    - Inspect containers for leaks, areas near storm receiver inlets and outlets, floor drains for indications of spills

5. MAINTENANCE PROCEDURES

    - Use reusable spill clean up materials (sponge mops, oil absorbent pads, etc.)
    - Pump out oil water separators as needed
    - Protect drains with oil absorbent materials
    - Clean out receivers on regular schedule
    - Remove spilled salt from salt loading area

6. ADVISORY

    - Report petroleum spills (as necessary) to the NYSDEC (851-7220 or 1-800-457-7362)
    - Refer to NYSDOT guidance information (Environmental Handbook for Transportation Operations)

# SPILL RESPONSE AND PREVENTION INSPECTION CHECKLIST

Location: _____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/REPAIRS NECESSARY | ACTION |
|---|---|---|---|
| Products/waste storage areas | Uncovered/deteriorating containers<br>Materials spilled, leaks | Yes No | ❑ Cover/replace<br>❑ Clean up |
| Equipment storage areas | Fluid leaks | Yes No | ❑ Clean up |
| Secondary containment systems | Structural deterioration<br>Leakage of fluids | Yes No | ❑ Repair/replace<br>❑ Clean up |
| Oil/water separators | Excessive amounts of contaminants | Yes No | ❑ Pump out |
| Floor drains, storm receiver inlets and outlets | Accumulation of contaminants | Yes No | ❑ Clean up/remove |

Date of Inspection _____ Name_____

Frequency _____

**PEST CONTROL**
**POLLUTION PREVENTION/GOOD HOUSEKEEPING PRACTICES**

1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATERS (SURFACE WATERS)

    - Runoff of pesticides may harm aquatic life, may contaminate water

2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

    - Toxicity to aquatic plants and animals

3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMP's)

    - Purchase only enough pesticides necessary for one year – store properly to avoid waste generation (spills, leaks, product deterioration)
    - Minimize/eliminate pesticide application, use lowest toxicity pesticides
    - Do not apply pesticides immediately prior to or during rain events
    - Ensure that employees are properly trained and certified in pesticide application techniques and safety
    - Develop zero input, low input lawns
    - Eliminate food, water, and shelter for pests
    - Adopt integrated pest management (IPM) techniques
    - Adopt alternatives to pesticides options (i.e. use mechanical traps, physical methods for removal, or biological controls)

4. INSPECTION PROCEDURES

    - Identify pests – are levels acceptable or must action be taken to control pests?
    - Inspect pesticide inventory – properly dispose of out-of-date pesticide materials

5. MAINTENANCE PROCEDURES

    - Inspect pest traps (i.e. bait boxes) regularly – remove (and properly dispose of) dead pests
    - Block/eliminate access to buildings/structures for pests
    - Remove pests (insects) by hand

6. ADVISORY

    - Abide by NYSDEC regulations (6NYCRR Part 325) pertaining to this topic
    - Refer to the Cornell University website (Dept. of Horticulture)

# PEST CONTROL INSPECTION CHECKLIST

Location: _____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/REPAIRS NECESSARY | ACTION |
|---|---|---|---|
| Pesticide storage area | Excessive amounts of pesticides<br>Spilled pesticides<br>Empty containers<br>No security or access control | Yes No | ❑ Reduce volumes, implement IPM<br>❑ Clean up<br>❑ Properly dispose<br>❑ install |
| Application equipment | Improper amounts of pesticides applied | Yes No | ❑ Properly calibrate |
| Floor | Drain system<br>Not curbed around perimeter<br>No impermeable surface | Yes No | ❑ Eliminate<br>❑ Install curbing<br>❑ Install impermeable surface |

Date of Inspection _____ Name_____

Frequency _____

**PET WASTE COLLECTION**
**POLLUTION PREVENTION/GOOD HOUSEKEEPING PRACTICES**

1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATERS (SURFACE WATERS)

    - Municipal animal shelters

2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

    - Biochemical oxygen demand
    - Solids loading

3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMP's)

    - House all animals in an enclosed, roofed structure
    - ID/utilize "permitted" waste disposal facilities for animal wastes

4. INSPECTION PROCEDURES

    - Inspect shelter regularly for necessary cleanup/removal of wastes

5. MAINTENANCE PROCEDURES

    - Remove spilled food, animal wastes on a regular basis

6. ADVISORY

    - None

# PET FACILITY MAINTENANCE INSPECTION CHECKLIST

Facility Location: _____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/REPAIRS NECESSARY | ACTION |
|---|---|---|---|
| Animal Housing area | Excessive amounts of waste<br><br>Dead animals | Yes No | ❑ Remove/rinse to floor drain (to sanitary sewer)<br>❑ Bag and remove |
| Facility's floor drain | Discharges directly to environment | Yes No | ❑ Connect to sanitary sewer |

Frequency of Inspection Daily_____ Name_____

Date _____

# SEPTIC SYSTEM MANAGEMENT
# POLLUTION PREVENTION/GOOD HOUSEKEEPING PRACTICES

1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATERS (SURFACE WATERS)

    - Ponding of improperly treated wastewaters (on the surface of a leach field or a sand filter system) can increase the biochemical oxygen demand of receiving waters.
    - Excessive amounts of disinfectant (i.e. chlorine) applied to a wastewater discharge from a sand filter system can cause toxicity to aquatic plants and animals

2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

    - Biochemical oxygen demand

3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMP's)

    - Divert stormwater runoff (i.e. from roof drains) away from septic system
    - Divert groundwater (sump pump) discharges away from septic system
    - Locate swimming pools away from the septic system (at least 20' from the septic tank, at least 35' from the closest edge of the leach field or sand filter system)
    - Prevent problems caused by vegetation - growth of woody plants on the system
    - Prevent hydraulic loading - "Spread out" the use of devices which use large volumes of water across the entire day – clothes washing, dish washing, bathing, repair leaky fixtures
    - Minimize water usage by using flow restrictors on potable water distribution devices (i.e. shower heads, water faucets)

4. INSPECTION PROCEDURES

    Physical evidence of problems:

    - "back up" of wastewater in sewer lines
    - sewage odors
    - leach field/sand filter - wetness/ponding on surface
    - overflow of wastes from system components
    - heavy vegetation (woody plants) growth on system components

5. MAINTENANCE PROCEDURES

    - "Pump out" the septic tank as needed (NYSDEC recommends once/year)
    - Mow surface vegetation regularly
    - Prevent "heavy equipment" from driving on top of the system components

6. ADVISORY

    - Obtain site plan/site sketch of system, and retain for reference.

# SEPTIC SYSTEM MANAGEMENT INSPECTION CHECKLIST

Unit ID:_____NYSDEC Permit #_____ Location_____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/REPAIRS NECESSARY | ACTION |
|---|---|---|---|
| Septic tank cover | Broken/cracked? | Yes No | ❑ Replace |
| Distribution box | sewage overflowing, distribution box level? | Yes No | ❑ Clean out<br>❑ Re-level |
| Leach field or sand filter | sewage on surface, odors, excessive vegetation growth | Yes No | ❑ Clean out distribution lines<br>❑ Cut vegetation |
| Disinfection system (if present) | Operating improperly | Yes No | ❑ Check/repair equipment |
| Outfall | Improper chlorine residual | Yes No | ❑ Perform monitoring, sampling/analysis as permit requires |

Frequency of Inspection _____ Last pump out (date) _____

Date of Inspection _____ Name_____

(If unit is a HOLDING TANK, pump out schedule)_____

# VEHICLE/EQUIPMENT MAINTENANCE
# POLLUTION PREVENTION/GOOD HOUSEKEEPING PRACTICES

1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATERS (SURFACE WATERS)

    - Trace amounts of metals/hydrocarbons are found in materials (i.e. fuels, antifreeze, batteries, motor oils, grease, parts cleaning solvents) that are typically used in maintenance operations

2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

    - Toxicity
    - Biochemical oxygen demand

3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMPs)

    - Conduct maintenance work indoors – if work must be performed outside, guard against spillage of materials that could discharge to storm receivers
    - Seal floor drains that discharge directly to the environment, if possible
    - Initiate single purpose use of vehicle bays – dedicate one (or more) bays that have no (or sealed) floor drains for repairs/maintenance
    - Clean up spilled materials immediately, using "dry" methods
    - Install pretreatment systems (oil/water separators) where necessary in sewer lines to capture contaminants (oil, grit), and maintain as needed
    - Never leave vehicles unattended while refueling
    - Identify appropriate recycling/disposal options for wastes

4. INSPECTION PROCEDURES

    - Inspect (for maintenance purposes) floor drain systems, oil/water separators
    - Monitor "parked" vehicles/equipment for leaks

5. MAINTENANCE PROCEDURES

    - Maintain a clean work area – remove contaminants from floors, drains, catch basins, using "dry" methods
    - Use non-hazardous cleaners. Use non chlorinated solvents instead of chlorinated solvents
    - Repair or replace any leaking containers
    - Use steam cleaning /pressure washing instead of solvent for parts cleaning
    - Store waste fluids in properly capped, labeled storage containers
    - Store batteries in leak-proof, compatible (i.e. non reactive) containers
    - Rinse grass from lawn care equipment on permeable (grassed) areas
    - Protect against pollution if outside maintenance is necessary (cover storm receivers, use secondary containment vessels, etc.)

6. ADVISORY

    - Report petroleum spills (as necessary) to the NYSDEC (851-7220 or 1-800-457-7362)
    - Refer to NYSDOT guidance information (Environmental Handbook for Transportation Operations)

# VEHICLE AND EQUIPMENT MAINTENANCE/STORAGE AREA INSPECTION CHECKLIST

Unit ID: _____ Location:_____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/REPAIRS NECESSARY | ACTION |
|---|---|---|---|
| Truck/equipment | Leaks/spills | Yes No | ❑ Clean spill, repair leak, capture fluids in drip pan |
| Salt/sand spreader | Improper amounts of product applied | Yes No | ❑ Recalibrate |
| Lawn care equipment | Improper operation | Yes No | ❑ Inspect/repair |

Date of Inspection _____ Name_____

Frequency _____

# VEHICLE/EQUIPMENT WASHING
# POLLUTION PREVENTION/GOOD HOUSEKEEPING PRACTICES

1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATERS (SURFACE WATERS)

    - Nutrients (biodegradable soaps)
    - Metals
    - Petroleum based wastes (organic pollutants)

2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

    - Biochemical oxygen demand from nutrient sources
    - Toxicity
    - Hydraulic loading

3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMPs)

    - Initiate single purpose use of vehicle bays - dedicate only one bay for washing (with floor drain system)
    - Perform cleaning with pressurized cold water, without the use of soaps, if wastewaters will flow to a **storm sewer** system
    - Use minimal amounts of biodegradable soaps **only** if wastewaters will discharge to a **sanitary sewer** system
    - Rinse with hoses that are equipped with automatic shutoff devices and spray nozzles
    - Steam clean (without soap) where wastes can be captured for proper disposal (i.e. oil/water separator)

4. INSPECTION PROCEDURES

    - Inspect floor drain systems regularly - use only those that discharge to a sanitary sewer, identify the need for cleaning of catch basins, oil/water separators

5. MAINTENANCE PROCEDURES

    - Map storm drain locations accurately to avoid illegal discharges
    - Perform steam cleaning or pressure washing where wastes can be captured for proper disposal
    - Take precautions against excess use of/spillage of detergents

6. ADVISORY

    - Require all facilities to connect floor drain systems to sanitary sewers (if available)
    - Refer to NYSDOT guidance information (Environmental Handbook for Transportation Operations)

# VEHICLE AND EQUIPMENT WASHING AREA INSPECTION CHECKLIST

Facility location: _____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/REPAIRS NECESSARY | ACTION |
|---|---|---|---|
| Designated "wash only" area | No impermeable pad with wastewater collection system | Yes No | ❑ Designate/construct area |
| Wastewater discharge location | Does not flow to either a holding tank or to sanitary sewers | Yes No | ❑ Properly relocate discharge |
| Washing/degreasing compounds | Solvent based | Yes No | ❑ Change to biodegradable products |
| Floor drain sump | Nonexistent | Yes No | ❑ Install and maintain sump, remove debris |
| Oil/water separator | Excessive oils/sludges | Yes No | ❑ Clean out contaminants |
| Catch basin | Non existent, accumulation of contaminants | Yes No | ❑ Install/maintain catch basin |

Date of Inspection _____ Name_____

Frequency _____

# ROADWAY AND BRIDGE MAINTENANCE
# POLLUTION PREVENTION/GOOD HOUSEKEEPING PRACTICES

1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATERS (SURFACE WATERS)

- Road salt components - sodium, calcium, and chlorides
- Hydrocarbons
- Particulates – such as dry paint or abrasive compounds, road debris
- Debris

2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

- Particulate matter
- Toxicity (paint – may contain metals such as lead, barium, cadmium)

3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMPs)

- Incorporate preventive maintenance and planning for regular operations & maintenance activities
- Pave in dry weather only.
- Stage road operations and maintenance activity (patching, potholes) to reduce spillage. Cover catch basins and manholes during this activity.
- Clean up fluid leaks or spills from paving equipment/materials immediately
- Restrict the use of herbicides/pesticide application to roadside vegetation
- Use porous asphalt for pothole repair and shoulder work
- Sweep and vacuum paved roads and shoulders to remove debris and particulate matter
- Maintain roadside vegetation; select vegetation with a high tolerance to road salt
- Control particulate wastes from bridge sandblasting operations
- Use calcium magnesium acetate for deicing around bridges to minimize corrosion
- Clean out bridge scuppers and catch basins regularly
- Direct water from bridge scuppers to vegetated areas
- Mechanically remove (i.e. sweep) debris from bridge deck and structure prior to washing

4. INSPECTION PROCEDURES

- Inspect paving, sweeping, vacuuming, and all other maintenance vehicles/equipment as appropriate
- Inspect roads and bridges for implementation of applicable BMP's

5. MAINTENANCE PROCEDURES

- Clean bridge scuppers routinely and keep free of debris
- Direct runoff water from bridges to vegetated areas
- Install catch basins in place of bridge scuppers
- Use tarps, booms, and vacuums during painting or blasting activities (refer to reference information to control/capture particulate matter)
- Repair leaking/defective containers or equipment on paving equipment

6. ADVISORY

- Refer to NYSDOT guidance information (Environmental Handbook for Transportation Operations

# ROADWAY AND BRIDGE MAINTENANCE INSPECTION CHECKLIST

Bridge No.: _____ BIN: _____ Carried: _____ Crossed: _____

Wetlands Present: Y N Stream Restriction: Y N If yes, Dates: _____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/ REPAIRS NECESSARY | ACTION |
|---|---|---|---|
| Bridge Deck (Top Side) | Debris Along Curb | Yes No | ❑ Sweep bridge, deposit debris on bank 50' from sweep and spread out<br>❑ Wash Bridge Deck |
| Bridge Seats at Abutment, or Top of Piers | Debris on Seat or Top of Pier | Yes No | ❑ Remove debris, deposit on stream banks<br>❑ Bird Nest Present? If yes, wait until nesting is complete.<br>❑ Wash Abutment & Pier |
| Washing of Superstructure | Debris – Salts on Superstructure | Yes No | ❑ Bird Nest Present? If yes, wait until nesting is complete.<br>❑ Flaking Paint Present? If yes, do not wash.<br>❑ Stream Restriction? If yes, wait until restrictions are removed.<br>❑ Wash Superstructure |

# ALTERNATIVE DISCHARGE OPTIONS FOR CHLORINATED WATER POLLUTION PREVENTION/GOOD HOUSEKEEPING PRACTICES

1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATERS (SURFACE WATERS)

    - Discharge of chlorinated (i.e. swimming pool, POTW) waters to surface waters can injure or kill aquatic life

2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

    - Toxicity – very low levels of chlorine can detrimentally affect aquatic life
    - Hydraulic loading

3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMPs)

    - Dechlorinate pool water before any discharge, be it over land or to the sanitary sewer, or allow the "disinfectant" to dissipate with sunlight, use, etc. prior to discharge
    - Use ultraviolet radiation or osmosis to disinfect water/wastewater
    - Backwash water should be discharged to the sanitary sewer, if available – if not available, discharge water over vegetated areas, not to surface waters

4. INSPECTION PROCEDURES

    - Check chlorine residuals prior to discharge.
    - Do not discharge wastewaters into the sanitary sewer system during periods of high flow.

5. MAINTENANCE PROCEDURES

    - Maintain proper levels of chlorine residuals in pool.
    - Allow disinfectant to dissipate prior to discharge of pool waters.

6. ADVISORY

    - Obtain permission from the municipal POTW prior to discharging any chlorinated pool waters to a sanitary sewer system.

**ALTERNATIVE DISCHARGE OPTIONS FOR CHLORINATED WATER INSPECTION CHECKLIST**

Location: _____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/REPAIRS NECESSARY | ACTION |
|---|---|---|---|
| Pools, hot tubs | Need to empty unit and replace water | Yes No | ❑ Discharge to sanitary sewers or to vegetated areas after the disinfectant dissipates, not to storm sewers or surface waters |

Date of Inspection _____ Name_____

Frequency _____

# HAZARDOUS AND WASTE MATERIALS MANAGEMENT
# POLLUTION PREVENTION/GOOD HOUSEKEEPING PRACTICES

## 1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATERS (SURFACE WATERS)

- Lube oils
- Coatings and their compatible solvents (paints, thinners, etc.)
- Anti freeze
- Cleaning agents
- Fuels (gas, diesel, kerosene)

## 2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

- Biochemical oxygen demand
- Toxicity to aquatic plants and wildlife
- Particulate loading

## 3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMP's)

- Ensure that all materials are stored in closed, labeled containers – if stored outside, drums should be placed on pallets, away from storm receivers – inside storage areas should be located away from floor drains
- Eliminate floor drain systems that discharge to storm drains, if possible
- Use a pretreatment system to remove contaminants prior to discharge
- Reduce stock of materials “on hand” – use “first in/first out” management technique
- Use the least toxic material (i.e. non hazardous) to perform the work
- Install/use secondary containment devices where appropriate
- Eliminate wastes by reincorporating coating/solvent mixtures into the original coating material for reuse
- Recycle materials if possible, or ensure proper disposal of wastes

## 4. INSPECTION PROCEDURES

- Physical on-site verification of sealed floor drains (or redirected to sanitary sewer)
- Regular inspection of material storage areas (inside and outside)
- Regular inspection and cleaning of oil/water separators by qualified contractor
- Inspect stormwater discharge locations regularly (for contaminants, soil staining, plugged discharge lines)

## 5. MAINTENANCE PROCEDURES

- Repair or replace any leaking/defective containers, and replace labels as necessary
- Maintain caps and/or covers on containers
- Maintain aisle space for inspection of products/wastes

## 6. ADVISORY

- Abide by NYSDEC regulations (6NYCRR Part 372) and OSHA regulations (29 CFR Part 1910) pertaining to these topics
- Refer to NYSDOT guidance information (Environmental Handbook for Transportation Operations)

# HAZARDOUS AND WASTE MATERIALS MANAGEMENT INSPECTION CHECKLIST

Location: _____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/REPAIRS NECESSARY | ACTION |
|---|---|---|---|
| Outside storage areas | Weathering | Yes No | ❑ Protect from weathering – store on pallets, cover |
| Salt piles<br>Soil staging areas | Salt staining<br>Silt runoff | Yes No<br>Yes No | ❑ Cover with tarps<br>❑ Cover with tarps, install physical barriers |
| Aboveground storage tanks | Deterioration | Yes No | ❑ Inspect/repair/maintain, install secondary containment |
| Inside storage areas | Potential for discharges | Yes No | ❑ Seal floor drains, install secondary containment |
| Drums, other containers | Deterioration<br>Uncovered | Yes No | ❑ Repair/replace<br>❑ Cover/cap |

Date of Inspection _____ Name_____

Frequency _____

**OPERATIONAL BY PRODUCTS/WASTES**
**POLLUTION PREVENTION/GOOD HOUSEKEEPING PRACTICES**

1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATERS (SURFACE WATERS)

    - Potential for leaching of toxic and biologic contaminants to receiving waters

2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

    - Toxicity
    - Biochemical oxygen demand

3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMP's)

    - Post “no dumping” signs
    - Illuminate area if possible
    - Prevent access – erect barriers
    - Identify the by products/wastes that should be recycled (i.e. paper, cardboard) or can be legally disposed of on municipal lands (i.e. deer carcasses) by referencing NYSDEC regulations (6NYCRR PART 360)

4. INSPECTION PROCEDURES

    - Regularly scheduled inspections - for maintenance concerns
    - Unscheduled patrolling of areas by police

5. MAINTENANCE PROCEDURES

    - Clean up and dispose of “illegally dumped” materials, trash/debris in accordance with environmental regulations
    - Cut and remove vegetation

6. ADVISORY

    - Abide by NYSDEC regulations (6NYCRR Part 360) pertaining to this topic
    - Refer to NYSDOT guidance information (Environmental Handbook for Transportation Operations)

# OPERATIONAL BY-PRODUCTS AND WASTES INSPECTION CHECKLIST

Location _____

(example. Temporary dumping areas for bulky trash items)

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/REPAIRS NECESSARY | ACTION |
|---|---|---|---|
| Condition of general area | Possible runoff to/ contamination of storm sewer or water body | Yes No | ❑ Remove<br>❑ Fix |
| Type of material/waste observed? | Appropriate? | Yes No | ❑ Remove to appropriate container/location |
| Security | Regular policing of area, Location properly secured/closed/locked? | Yes No | ❑ Secure waste area |
| Disposal | Past disposal date? | Yes No | ❑ Dispose timely |

Inspection Frequency _____

Last Clean-up Date _____

Date of Inspection _____ Name_____

# CATCH BASIN AND STORM DRAIN SYSTEM CLEANING
# POLLUTION PREVENTION/ GOOD HOUSEKEEPING PRACTICES

1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATERS (SURFACE WATERS)

- **Catch basins** capture grit and debris, which, if not removed in a timely fashion, can discharge toxic and biological pollutants during rain and/or snow melt events
- **Storm drainage systems**, while not designed for capture of solid materials, can perform in the same manner with similar results.
- **Storm ditches**, if stripped of vegetation during cleaning, can result in silt deposition in receiving waters

2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

- Toxicity – heavy metals, organic compounds, etc.
- Biochemical oxygen demand
- Sediment loading

3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMP's)

- Address:
  - storm drain receivers and (below grade) storm sewer systems
  - parking lot receivers
  - open ditches
  - catch basins and floor drain systems inside of buildings should be either:
    - sealed to prevent discharge
    - "permitted" by NYSDEC
    - discharged to sanitary sewers
- Contaminated wastewaters should not be discharged to a catch basin/street receiver/ditch
- Increase frequency of cleaning, as necessary
- Repair/replace storm drain receiver and catch basin receiver grates as necessary

4. INSPECTION PROCEDURES

- Physical inspection – prioritize storm drain systems and catch basins – catch basins on steep grades may need more frequent cleaning
- Clean catch basin when depth of deposits are >1/3 the depth from the bottom of the basin to the invert of the lowest pipe/opening into or out of basin – Institute temporary street parking bans to facilitate access to catch basins
- Ditch inspections – ID problems while traveling to job site
- Storm event inspection – identify pollution problems (i.e. sediments) to determine the need for additional protective measures
- Post storm event inspection – ID problems (i.e. blockages)

5. MAINTENANCE PROCEDURES

- Catch basins/storm sewer pipe – cleaning in spring to remove sand/grit/salt from winter road maintenance, cleaning in fall to remove leaves/silt/debris
- Established ditch:
  - Maintain proper slope
  - Maintain vegetation by cutting (to capture sediment) – Do not allow vegetation to grow to a height that would impair sight lines of drivers of motor vehicles
  - Remove obstacles/ debris – (i.e. trash, tree branches, brush, cut vegetation)
  - Excavation/ditch scraping – if necessary, use devices (i.e. hay bales, silt fence) to capture sediment prior to stormwater discharge into receiving waters, reseed ditch
- New installation – capture particulate matter – install sediment basins/other devices in ditch
- Proper disposal of debris

6. ADVISORY

- Refer to NYSDOT guidance information (Environmental Handbook for Transportation Operations)

**CATCH BASIN AND STORM DRAIN SYSTEM CLEANING INSPECTION CHECKLIST**

Road Name: _____ Road Number: _____ Road Section: From: _____ To: _____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/ REPAIRS NECESSARY | ACTION | LOCATION (House number, distance from intersection) |
|---|---|---|---|---|
| Catch Basin/ Drop Inlet | Deterioration of Structure | Yes No | ❑ Repair Structure or Grate<br>❑ Replace Structure or Grate | |
| | Clogged Inlets During or After Storm Event | Yes No | ❑ Clean Grate / Inlet | |
| | Deposits in Structure | Yes No | ❑ Clean Out Structure | |
| Storm Manhole | Deterioration of Structure | Yes No | ❑ Repair Structure or Cover<br>❑ Replace Structure or Cover | |
| | Deposits in Structure | Yes No | ❑ Clean Out Structure | |
| Storm Sewer Piping | Clogged Pipe | Yes No | ❑ Clean Out Pipe | |
| | Deteriorated Pipe | Yes No | ❑ Replace Pipe | |
| Ditches (Pollutants) | Excessive Vegetation | Yes No | ❑ Mow Vegetation<br>❑ Scheduled Ditch Cleaning | |
| | Debris (branches, litter, garbage, etc.) | Yes No | ❑ Clean Out Ditch | |
| | Excessive Siltation | Yes No | ❑ Clean Out & Regrade Ditch | |
| Roadside / Cross Culverts | Clogged Pipe | Yes No | ❑ Clean Out<br>❑ Review Size & Replace<br>❑ Clean Out & Regrade Ditch | |
| | Deteriorated Pipe | Yes No | ❑ Replace Pipe<br>❑ Line Pipe | |
| Sediment Basins | Excessive Vegetation | Yes No | ❑ Mow | |
| | Excessive Sediment Deposits | Yes No | ❑ Clean Out Basin | |
| Outfall | Pollutants | Yes No | ❑ Rip-rap | |

Date of Inspection _____Name_____ Frequency _____

**STREET CLEANING AND MAINTENANCE**
**POLLUTION PREVENTION/GOOD HOUSEKEEPING PRACTICES**

1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATER (SURFACE WATERS)

- Poorly maintained streets allow for a "build up" of trash, grit, and debris, from which sediment and toxic/biological pollutants can be "washed out" during rain and /or snow melt events.
- Street repair/paving processes use materials that can contaminate receiving waters if they interact with stormwater.

2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

- Particulate matter – can cause sediment loading
- Biochemical oxygen demand
- Toxicity to aquatic plants and wildlife

3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMP's)

- Street sweeping/vacuuming - at regular intervals, and "as needed"
- Perform operations such as paving in dry weather only.
- Prior to road reconstruction, consider/evaluate the use of "shouldered roads" instead of "curbed roads"
- Maintain roadside vegetation; select plants/trees that can withstand the action of road salt. Direct runoff to these areas.

4. INSPECTION PROCEDURES

- Inspect streets, and plan (as needed) for maintenance/repairs
- Prioritize – some streets (i.e. those with high traffic flows, on flat grades, or with many trees) may need more frequent cleaning

5. MAINTENANCE PROCEDURES

- Spring sweeping/vacuuming – remove salt/sand residues
- Fall sweeping, collection of leaves at appropriate time intervals
- Dry sweep or vacuum streets during dry weather
- Initiate temporary street by street parking bans to allow access for cleaning
- Maintain equipment - check for/repair fluid leaks
- Stage road operations and maintenance activity (patching, pothole repair) to reduce spillage of materials. Cover catch basins and manholes during activity

6. ADVISORY

- Refer to NYSDOT guidance information (Environmental Handbook for Transportation Operations)

# STREET CLEANING AND MAINTENANCE INSPECTION CHECKLIST

Location/Section of Road _____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/REPAIRS NECESSARY | ACTION |
|---|---|---|---|
| Roads (curb line) | Debris, grit, stone | Yes No | ❑ Shovel or Vacuum |
| Milling | Broken pavement (excavated material) | Yes No | ❑ Cover storm inlets, shovel, vacuum |
| Paving | Tack coat overspray | Yes No | ❑ Cover storm inlets |
| Storm drain inlets | Broken brick, block, mortar | Yes No | ❑ Repair |
| Roadside vegetation | Too high<br>None observed | Yes No<br>Yes No | ❑ Cut<br>❑ Re-seed |

Date of Inspection _____ Name_____

Frequency _____

# ROAD SALT STORAGE AND APPLICATION
# GOOD HOUSEKEEPING/POLLUTION PREVENTION PRACTICES

## 1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATERS (SURFACE WATERS)

- Salt is very soluble in water, and, in high concentrations, can have a deleterious effect on plants and aquatic life.

## 2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

- Toxicity

## 3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMP's)

- Require covered facility for salt storage (prevents lumping and run-off loss), and size properly for seasonal needs
- Store salt on highest ground elevation to allow for infiltration of stormwater
- Calibrate salt spreaders for proper application
- Consider alternative deicing materials (i.e. calcium chloride, magnesium chloride)
- Use a wetting agent with salt to minimize "bouncing" during application
- Cover salt loading area, or build into storage shed
- Unload salt deliveries directly into storage facility, or if not possible, move inside immediately

## 4. INSPECTION PROCEDURES

- Look for physical evidence of problems:

  - inspect salt storage shed for leaks, structural problems
  - inspect salt piles for proper coverage, tarps for leaks or tears
  - inspect salt application equipment
  - inspect salt regularly for lumping or water contamination
  - inspect surface areas for evidence of runoff – salt stains on ground near and around the salt shelter, loading area, or downslope
  - inspect for excessive amounts of salt on roads

## 5. MAINTENANCE PROCEDURES

- Service trucks and calibrate spreaders regularly to ensure accurate, efficient distribution of salt
- Educate and train operators on hazards of over-salting to roads and environment
- Repair salt storage shed – structural problems can lead to salt spillage
- Repair/replace tarps

## 6. ADVISORY

- Refer to NYSDOT guidance information (Environmental Handbook for Transportation Operations)

# ROAD SALT STORAGE AND APPLICATION INSPECTION CHECKLIST

Unit ID: _____ Location _____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/REPAIRS NECESSARY | ACTION |
|---|---|---|---|
| Storage shed | Salt outside of shed | Yes No | ❑ Move salt into shed |
| Truck loading area | Salt on ground | Yes No | ❑ Pick up, load onto truck<br>❑ do not overfill truck |
| Roads – (sites of application) | Excessive salt on ground | Yes No | ❑ Remove by sweeping? |
| Salt spreader | Excessive salt on ground | Yes No | ❑ Recalibrate salt spreader? |

Date of Inspection _____ Name_____

**ROAD KILL COMPOSTING OPERATIONS**
**GOOD HOUSEKEEPING/POLLUTION PREVENTION PRACTICES**

1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATERS (SURFACE WATERS)

    - Potential for leaching of biologic contaminants to receiving waters

2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

    - Biochemical oxygen demand

3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMP's)

    - Establish compost pile/windrow on a well drained, impervious surface that has minimal slope – segregate from other operations
    - Identify the proper types of carcasses (typically, deer) that should be composted
    - Locate compost piles at least 200 ft. away from receiving waters or wetlands
    - Prevent access by vermin/scavengers – erect barriers (i.e. snow fence) around pile

4. INSPECTION PROCEDURES

    - Check for odors, temperature of compost, exposed carcasses
    - Keep records (use a daily log)

5. MAINTENANCE PROCEDURES

    - Monitor temperatures
    - Take samples, analyze for pathogens
    - Establish windrows
    - Prevent erosion
    - Recycle completely composted material

6. ADVISORY

    - Abide by NYSDEC regulations (6NYCRR Part 360) pertaining to this topic
    - Refer to NYSDOT guidance

# ROAD KILL COMPOST SITE INSPECTION CHECKLIST

Location: _____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/REPAIRS NECESSARY | ACTION |
|---|---|---|---|
| Compost pile | Exposed Carcasses | Yes No | ❑ Add cover material (wood chips, compost) |
| | Odors | Yes No | ❑ Cover with wood chips<br>❑ Add lime |
| | Liquid runoff (leachate) | Yes No | ❑ Absorb with wood chips, return to compost pile |
| | Animals scavenging | Yes No | ❑ Fence area<br>❑ Temporarily cover with tarp |
| | Wood chips too dry<br>Wood chips too wet | Yes No<br>Yes No | ❑ Add water<br>❑ Allow to dry |
| | Insufficient compost temperature | Yes No | ❑ Temporarily cover with tarp |

Date of Inspection _____ Name_____

Frequency _____

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# MARINA OPERATIONS
# POLLUTION PREVENTION/GOOD HOUSEKEEPING PRACTICES

## 1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATERS (SURFACE WATERS)

- Liquids associated with boat maintenance products (oils, fuels, antifreeze, wood preservatives, etc. and particulate matter (i.e. boat bottom paint from hull sanding) can contain toxics
- Boat sewage can contain pathogenic bacteria that contribute increased biochemical oxygen demand to waterways
- Barren soils can contribute to sedimentation

## 2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

- Biochemical oxygen demand
- Toxicity
- Sediment loading

## 3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMP's)

- Construct and maintain pump out stations (for sanitary wastes)
- Build and maintain fish cleaning stations
- Stabilize shoreline
- Designate locations for boat maintenance away from the water
- Minimize impervious areas – install vegetated buffer strips (i.e. grass, shrubs)
- Provide covered trash receptacles, spill clean up kits at fueling stations
- Educate (posters, signage) boaters and other marina users of potential problems

## 4. INSPECTION PROCEDURES

- Identify areas of runoff that lack vegetation
- Regularly inspect fueling stations (including tanks and piping), maintenance areas for spills, other potential sources of pollution
- Regularly check (and empty as necessary) fish cleaning stations, sewage pump out stations, trash cans

## 5. MAINTENANCE PROCEDURES

- Empty trash cans and pump out stations as needed
- Maintain vegetated areas between the water and work areas
- Replace spill clean up kits as necessary

## 6. ADVISORY

- Refer to: Shipshape Shores and Waters: A Handbook for Marina Operators and Recreational Boaters - http://www.epa.gov/owow/nps/marinashdbk2003.pdf

# MARINA OPERATIONS INSPECTION CHECKLIST

Location: _____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/REPAIRS NECESSARY | ACTION |
|---|---|---|---|
| Trash cans, sewage pump out stations, fish cleaning stations | Full | Yes No<br>Yes No | ❑ Empty, dispose of wastes properly |
| Fueling stations | Spills | Yes No<br>Yes No | ❑ Clean up |
| Vegetated areas | Barren soils | Yes No | ❑ Re-vegetate |
| | | Yes No | ❑ |
| | | Yes No | ❑ |
| | | Yes No | ❑ |

Date of Inspection _____ Name_____

Frequency_____

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**CONSTRUCTION AND LAND DISTURBANCE**
**POLLUTION PREVENTION/GOOD HOUSEKEEPING PRACTICES**

1. IDENTIFY IMPACTS TO/ON STORMWATER/RECEIVING WATERS (SURFACE WATERS)

    - Sediment runoff (i.e. silt, debris) can affect fish reproduction and habitat
    - Removal of shade trees from stream banks can increase water temperature which can result in reduced dissolved oxygen content in streams

2. PROBLEM EVALUATION: ASSESS IMPACT ON RECEIVING WATERS, PRIORITIZE

    - Particulate matter – can cause sediment loading
    - Biochemical oxygen demand – increases with temperature, depletes oxygen

3. IDENTIFY (AND CHOOSE APPROPRIATE) SOLUTIONS (BMP's)

    - Plan the construction and/or land clearing activities so that soil is not exposed for long periods of time
    - Minimize compaction of soils and impervious cover
    - Maximize opportunities for infiltration
    - Install sediment control devices before disturbing soil
    - Limit grading to small areas
    - Stabilize site to protect against sediment runoff
    - Protect against sediment flowing into storm drains
    - Maintain native vegetation (especially near waterways)
    - Install sediment barriers on slopes or divert stormwater

4. INSPECTION PROCEDURES

    - Regularly scheduled inspections (of sediment control devices, erosion safeguards)
    - Inspect during storm or snow melt events

5. MAINTENANCE PROCEDURES

    - Check/repair all devices that have been installed to ensure protection against erosion

6. ADVISORY

    - Refer to NYSDOT guidance information (Environmental Handbook for Transportation Operations)
    - NY State Standards and Specifications for Sediment and Erosion Control
    - NY State Stormwater Management Design Manual

# CONSTRUCTION AND LAND DISTURBANCE INSPECTION CHECKLIST

Location: _____

| COMPONENTS/ITEMS TO CHECK | PROBLEMS OBSERVED | MAINTENANCE/REPAIRS NECESSARY | ACTION |
|---|---|---|---|
| Sediment control devices | None observed<br>In disrepair | Yes No<br>Yes No | ❑ Install<br>❑ Repair |
| Sediment barrier devices | None observed<br>In disrepair | Yes No<br>Yes No | ❑ Install<br>❑ Repair |
| | | Yes No | ❑ |
| | | Yes No | ❑ |
| | | Yes No | ❑ |
| | | Yes No | ❑ |

Date of Inspection _____ Name_____

Frequency __initial, and as needed (coinciding with storm events)

Rick\stwtr\insp cklsts

# ATTACHMENT 14

# GOOD HOUSEKEEPING FORM

**Town/Village**
**Minimum Control Measure 6: Quarterly Good Housekeeping Checklist**

**Year:_____ Quarter:___ Date:_____**

**Visual Inspection:**

| Item: | Condition: | Comments: |
|---|---|---|
| Petroleum Storage | | |
| Chemicals | | |
| Salt Stockpile | | |
| Vehicles/ Equipment Parking Areas | | |
| Litter/ Debris | | |
| Floor/ Floor Drains | | |

**Any Reported Spills in Quarter?_____**

**If so: What type:_____ How much:_____**

**Did spill enter floor/storm drain?:_____**

**Description of all maintenance conducted as a result of inspection:**

_____

_____

_____

List of Employee MS4 Training Dates and Type:

| Employee: | Class/ Type of Training: |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

List of Dates of Street Cleanings: _____

_____

_____

List of Dates of which catch basins were cleaned:

| Date: | Catch Basin ID #s: |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

Employee Signature:_____Date:_____

Superintendent's Signature:_____Date:_____

# ATTACHMENT 15

# LIST OF ACRONYMS

# Appendix A. Acronyms and Definitions

## Acronym List

BMP – Best Management Practice

CFR – Code of Federal Regulations

CGP – SPDES General Permit for Stormwater from Construction Activities, GP-0-20-001

CWA – Clean Water Act

ECL – Environmental Conservation Law

EDC – Effective Date of Coverage

EDP– Effective Date of the Permit

eNOI – Electronic Notice of Intent

EPCRA - Emergency Planning and Community Right-To-Know Act

ERP – Enforcement Response Plan

IDDE – Illicit Discharge Detection and Elimination

MCM – Minimum Control Measure

MS4 – Municipal Separate Storm Sewer System

MS4 GP – SPDES General Permit for Stormwater Discharges from the Municipal Separate Storm Sewer Systems, GP-0-24-001

MSGP – SPDES Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity, GP-0-23-001

NOI – Notice of Intent

NPDES – National Pollutant Discharge Elimination System

NYCRR – New York Codes, Rules and Regulations

NYS DEC – New York State Department of Environmental Conservation

O&M – Operations and Maintenance

ORI – Outfall Reconnaissance Inventory

POC – Pollutant of Concern

RSE – Regional Stormwater Entity

SPDES – State Pollutant Discharge Elimination System

SMP – Stormwater Management Practice

SWMP – Stormwater Management Program

SWMP Plan – Stormwater Management Program Plan

SWPPP – Stormwater Pollution Prevention Plan

TMDL – Total Maximum Daily Load

USEPA – United States Environmental Protection Agency