

RUTGERS

New Jersey Agricultural
Experiment Station



Hamilton Township (Mercer County)

ILLICIT DISCHARGE DETECTION AND ELIMINATION PROGRAM

Developed by the Rutgers Cooperative Extension Water Resources Program
Funded by Hamilton Township, Mercer County, New Jersey

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Introduction

An understanding of the nature of illicit discharges in urban watersheds is essential to find, fix, and prevent them. The 2004 Tier A Municipal Separate Storm Sewer System (MS4) New Jersey Pollutant Discharge Elimination System (NJPDES) permit implemented these regulations as a statewide basic requirement or SBR named “Illicit Connection Elimination and MS4 Outfall Pipe Mapping.” This permit condition requires the Tier A Municipality to adopt an ordinance prohibiting illicit connections to the Tier A Municipality’s small MS4, map the location of the end of small MS4 outfall pipes, train employees on illicit connections, outfall pipe mapping, and outfall pipe stream scouring, and create and maintain a program to inspect outfall pipe maps.

MS4s are designed to convey stormwater only. Unlike discharges into sanitary sewers, discharges into MS4s receive no treatment before entering surface waters. EPA recognized that non-stormwater discharges to MS4s can be significant sources of pollutants to surface water bodies. These discharges can be the result of direct connections (physical connections to the MS4 pipes) or other means, such as overland flow that eventually reaches a storm drain. Illicit discharges can result from outside sources (private entities or other MS4s) or from the municipality itself (floor drains, vehicle or equipment washwater). Examples of other illicit discharges include washwater from commercial car washes or illegal dumping of oil into storm drain inlets.

The term “illicit discharge” has many meanings in regulation and practice, but a four-part definition is typically used.

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.

It is also important to identify the complete list of non-stormwater discharges that are not considered illicit discharges, which include:

- Potable water line flushing and discharges from potable water sources, excluding the discharge of filter backwash and first flush water from potable well development/redevelopment activities utilizing chemicals in accordance with N.J.A.C. 7:9D [The volume of first flush water, which is a minimum of three times the volume of the well water column, must be handled and disposed of properly.]
- Uncontaminated groundwater (e.g., infiltration, crawl space or basement sump pumps, foundation or footing drains, rising ground waters)
- Air conditioning condensate (excluding contact and non-contact cooling water and industrial refrigerant condensate)
- Irrigation water (including landscape and lawn watering runoff)
- Flows from springs, riparian habitats, wetlands, water reservoir discharges, and diverted stream flows
- Residential car washing water and dechlorinated swimming pool discharges from single family residential homes
- Sidewalk, driveway, and street wash water
- Flows from firefighting activities including the washing of fire fighting vehicles
- Flows from clean water rinsing of beach maintenance equipment immediately following use and only if the equipment is used for its intended purpose
- Flows from clean water rinsing of equipment and vehicles used in the application of salt and de-icing materials [Prior to rinsing, all equipment shall be cleaned using dry methods such as shoveling and sweeping. Recovered materials are to be returned to storage or properly discarded.]

- Rinsing of equipment above is limited to exterior, undercarriage and exposed parts and does not apply to engines or other enclosed machinery

Illicit Discharge Detection and Elimination

The Tier A MS4 NJPDES permit requires municipalities to develop, update, implement, and enforce an ongoing Illicit Discharge Detection and Elimination Program. As part of this program, Hamilton Township will do the following:

- conduct visual dry weather inspection of all outfall pipes owned or operated by the municipality at least once every five years
- investigate the source if evidence of illicit discharge is found
- eliminate non-stormwater discharges that are traced to their source and found to result from illicit connections
- document investigations and actions taken
- inspect any newly identified outfall pipes for illicit discharges
- investigate dry weather flows discovered during routine inspection and maintenance
- investigate all complaints and reports of illicit discharges within three months of receipt

MS4 outfall pipes generally should not be discharging during substantial dry periods. Flow that occurs 72 hours or more after a rain event is referred to as dry weather flow. Dry weather flow can originate from various non-stormwater sources, including those eligible non-stormwater discharges discussed above. However, dry weather flow can also be an indication of an illicit discharge. Therefore, the first step in inspecting an outfall pipe for an illicit discharge is to look for dry weather flow. Some illicit discharges, such as those from a connected sanitary sewer, can cause continuous dry weather flow. Others, such as discharges of cooling water from industrial sites, can be intermittent. Therefore, Hamilton Township will regularly inspect the outfalls for dry weather flow. Other potential indicators of dry weather flow include staining of the outfall pipes, odors, or deterioration of the outfall structure. If these or other indicators of illicit discharges are found, follow up investigations will be conducted to identify whether they are being caused by an illicit discharge. If Hamilton Township finds dry weather flows, they should collect information that will allow them to identify the source of the flow.

Hamilton Township will conduct an initial physical inspection of all outfall pipes during the mapping process. Hamilton Township will use the NJDEP Illicit Connection Inspection Report Form to conduct these investigations. Also each inspection form will be kept on file. Outfall pipes that are found to have dry weather flow or evidence of an intermittent non-stormwater flow will be rechecked to include an estimate of flow, determination of odor, color, turbidity, floatable matter, temperature, deposits, stains, vegetation, and algal growth.

If a dry weather flow exists after making all physical observations, the flow will be tested for detergents (i.e., surfactants). Monitoring for detergents, using a testing procedure with a detection limit of 0.06 mg/L, can accurately distinguish between discharges that are contaminated by sanitary wastewater and those that are not. Dry weather flows that contain detergents in excess of the detection limit require further investigation and are to be given the highest priority. Dry weather flows that do not test positive for detergents and do not show physical characteristics of sanitary wastewater (e.g., odor, floatables, and/or color) are unlikely to be from sanitary wastewater sources, yet they may still be illicit discharges of industrial wastewater, rinse water, backwash, or cooling water.

Non-stormwater discharges that are detergent-free, and therefore not sanitary, will be tested for fluoride. Fluoride concentration is a reliable indicator of whether the non-stormwater flow is from a potable or non-potable water source. Fluoride concentrations greater than 0.6 mg/L indicate that potable water is the most likely source. Non-stormwater discharges that test below the detection limit for fluoride are likely to be groundwater infiltration, springs, or streams. In some instances, a Tier A Municipality may find a non-stormwater discharge that originates from an on-site well used for industrial cooling water which will test non-detect for both detergents and fluoride. The Tier A Municipality will have to rely on temperature to differentiate between these cooling water discharges and groundwater infiltration and other natural flows. Fluoride testing will not be able to pinpoint the source of the illicit discharge but is a helpful tool in further narrowing the search. The ratio of ammonia (as N) to potassium can be used to help distinguish a sanitary wastewater source from a washwater source. Detergents will be present in both sanitary sewage and washwater. Generally, the ammonia/potassium ratio of sanitary sewage will be greater than 1.0.

Non-stormwater flows with an ammonia/potassium ratio less than 1.0 are likely to be a washwater source.

All of the tests recommended for the tracing of illicit discharges will be performed in the field by employees of Hamilton Township or will be contracted out. Although lab certification for these parameters is not required, samples may be sent to the lab for analysis in lieu of performing field testing. It is advised that the person taking the field sample be familiar and trained in appropriate field-testing protocol and be familiar with the equipment to be used. Analysis for detergents, fluoride, ammonia, and potassium may be conducted by using a field spectrophotometer produced by various lab instrument manufacturers. The spectrophotometers are accurate, easy to use with limited training, and are designed to be used in the field. The flow chart in Attachment 1 illustrates the recommended steps to use when identifying an illicit discharge.

Investigation

Any storm sewer outfall pipe found during the initial inspection, or on any subsequent inspection, to have a non-stormwater discharge, or indications of an intermittent non-stormwater discharge, will be investigated by Hamilton Township to identify and locate the specific source. Non-stormwater discharges suspected of being sanitary sewage and/or significantly contaminated will be prioritized and investigated first. Dry weather flows believed to be an immediate threat to human health or the environment will be reported immediately to the NJDEP Hotline at 1-877-WARNDEP (1-877-927-6337). Investigations of non-stormwater discharges suspected of being cooling water, washwater, or natural flows may be delayed until after all suspected sanitary sewage and/or significantly contaminated discharges have been investigated, eliminated, and/or resolved. The use of field or laboratory testing further narrows the potential sources of the non-stormwater discharge. However, it is unlikely that either the physical observations or the testing alone will pinpoint the exact source of the dry weather discharge. As a result, Hamilton Township will perform upstream investigations to identify potential illicit discharges. Common approaches to identifying potential sources of illicit discharges may include drainage system surveys (e.g., testing at upstream manholes, visual inspections, video/televised, smoke and dye testing) and industrial and commercial site assessments.

A drainage system survey may require Hamilton Township to inspect storm sewer lines that lead to the outfall pipe where evidence of an illicit discharge was found. Physical observations and additional testing will help Hamilton Township locate the dry weather flow while tracing the source of the discharge. Depending on the size and complexity of the storm drain system, it may be possible to isolate smaller portions of the system for more intensive investigations including smoke tests, dye testing, and televised inspections.

Hamilton Township may be able to work with industrial or commercial facilities to try to locate the source of the illicit discharge. Hamilton Township will perform inspections of industrial or commercial sites or request the owners or operators of the sites to perform inspections of likely sources of illicit discharges, such as floor drains, wash bays, and cooling water systems. NJDEP Compliance and Enforcement may also aid the municipality in performing inspections when the suspected source of an illicit discharge is a site covered under a NJPDES permit. To help narrow the list of potential sources, Hamilton Township will distribute questionnaires or use another method to collect information. Facilities may not be aware that these connections are illicit discharges and may be able to find and eliminate the sources on their own. However, it is important to note that illicit discharges may also sometimes originate from residential properties or other interconnected MS4 systems.

Elimination

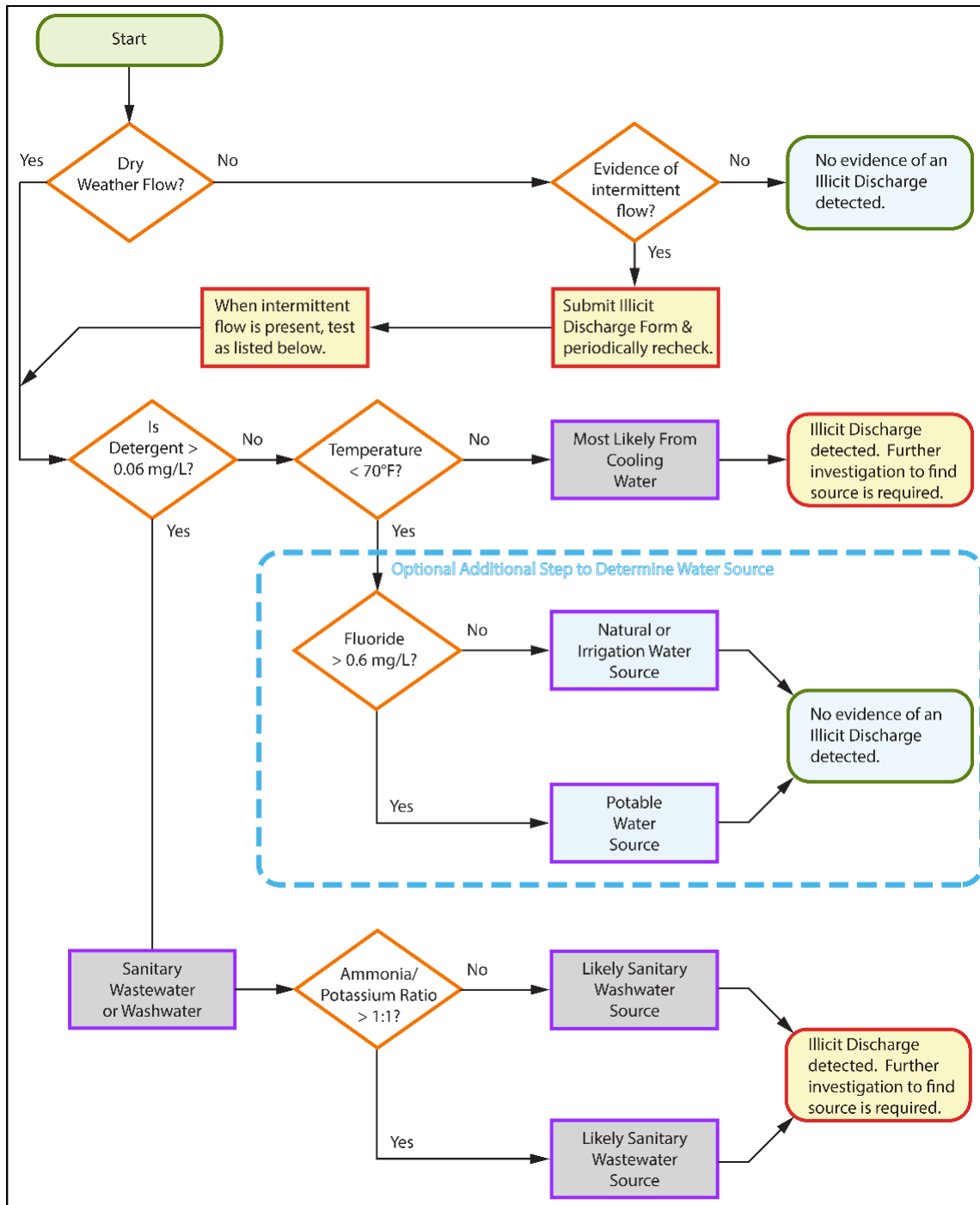
Non-stormwater discharges traced to their source and found to be Hamilton Township's own illicit discharges will be eliminated. Hamilton Township may apply for a NJPDES permit for the discharge, but the discharge must be ceased until a valid NJPDES permit has been issued by the Department. Otherwise, Hamilton Township will verify that the illicit discharge was eliminated and ensure that measures taken to cease the discharge are permanent and are not done in such a manner that would allow easy reconnection to the MS4.

Summary of Procedure

- To help reduce costs, Hamilton Township or its contractor will look for signs of illicit discharges and outfall pipe stream scouring every time the outfalls are mapped or inspected. This will reduce the need for multiple visits to the same outfall pipes.

- The entire MS4 system has been mapped and incorporated into a GIS. This will aid in the investigation and elimination of illicit discharges and allow for better stormwater facilities management and better planning of new development. Hamilton Township will work closely with Rutgers Cooperative Extension Water Resources Program to continue to map and inspect outfalls.
- Since the storm sewer system is mapped in GIS, land use data layers and aerial photography are available to help further identify sources of illicit connections.
- The procedure for detecting and eliminating illicit connections, as described in this document, will be completed in a timely fashion.

Attachment 1: Illicit Discharge Identification Flow Chart



Attachment 2: MS4 Outfall Pipe Mapping and Illicit Discharge Guide

Characteristic	Indicators
<p>Odor</p>	<p><i>Sewage</i>: smell associated with stale/septic sanitary wastewater</p> <p><i>Sulfur (“rotten eggs”)</i>: industries that discharge sulfide compounds or organics (meat packers, canneries, dairies, etc.)</p> <p><i>Oil and gas</i>: petroleum refineries or many facilities associated with vehicle maintenance or petroleum product storage</p> <p><i>Rancid-sour</i>: food preparation facilities (restaurants, hotels, etc.)</p>
<p>Color</p>	<p>Important indicator of inappropriate industrial sources. Industrial dry weather discharges may be of any color, but dark colors, such as brown, gray, or black, are most common.</p> <p><i>Yellow</i>: chemical plants, textile and tanning plants</p> <p><i>Brown</i>: meat packers, printing plants, metal works, stone and concrete, fertilizers, and petroleum refining facilities</p> <p><i>Red</i>: meat packers</p> <p><i>Gray</i>: dairies, sewage</p>
<p>Turbidity</p>	<p>Often affected by the degree of gross contamination. Dry weather industrial flows with moderate turbidity can be cloudy, while highly turbid flows can be opaque. High turbidity is often a characteristic of undiluted dry weather industrial discharges.</p> <p>Cloudy: sanitary wastewater, concrete or stone operations, fertilizer facilities, and automotive dealers</p> <p>Opaque: food processors, lumber mills, metal operations, pigment plants</p>
<p>Floatable Matter</p>	<p>A contaminated flow may contain floating solids or liquids directly related to industrial or sanitary wastewater pollution. Floatables of industrial origin may include animal fats, spoiled foods, solvents, sawdust, foams, packing materials, or fuel. Floatables in sanitary wastewater include fecal matter, toilet paper, sanitary napkins and condoms.</p>
<p>Deposits and Stains</p>	<p>Deposits and stains on outfall structures may be evidence of intermittent non- stormwater discharges. Deposits and stains include coatings, residues or fragments of materials. Grayish-black deposits that contain animal flesh or hair may be from leather tanneries. White crystalline powder is usually due to nitrogenous fertilizer wastes. Excessive sediment deposits may be attributed to construction site erosion. Sources of oily residues may include petroleum refineries, storage facilities, and/or vehicle service facilities.</p>
<p>Vegetation</p>	<p>Vegetation surrounding an outfall may show the effects of industrial pollutants. Decaying organic materials coming from food processors may cause increased vegetation growth. Other toxic materials from industrial discharges may decrease or kill vegetation. Non-stormwater discharges that contain excessive nutrients from concentrated animal feeding activities may also kill vegetation.</p>
<p>Damage to Outfall Structures</p>	<p>Cracking, deterioration, and scouring of concrete or peeling of paint at an outfall pipe may be caused by severely contaminated industrial discharges that are extremely acid or basic. Primary metal industries may discharge highly acidic batch dumps. Food processors with discharges that become “septic” produce hydrogen sulfide gas, which quickly deteriorates metal surfaces.</p>
<p>Temperature</p>	<p>Both sanitary wastewater and cooling water may substantially increase the outfall discharge temperature. Elevated temperature measurements in discharges that test negative for detergents are likely to be cooling water discharges. Sources of cooling water discharges would be industrial facilities in the drainage area.</p>

Attachment 3: NJDEP Illicit Connection Inspection Report Form

Illicit Connection Inspection Report Form	
Municipality Information	Municipality: ____ County ____ NJPDES # : ____ PI ID #: ____ Team Member: ____ Date ____ Effective Date of Permit Authorization (EDPA): ____
Outfall #: ____ Location: ____ Receiving Waterbody: ____ 1. Is there a dry weather flow? Y (<input checked="" type="radio"/>) N (<input type="radio"/>) 2. If "YES", what is the outfall flow estimate? ____ gpm (flow sample should be kept for further testing, and this form will need to be submitted with the Annual Report and Certification) 3. Are there any indications of an intermittent flow? Y (<input type="radio"/>) N (<input checked="" type="radio"/>) 4. If you answered "NO" to BOTH questions #1 and #3, there is probably not an illicit connection and you can skip to question #7. (NOTE: This form does not need to be submitted to the Department, but should be kept with your SPPP.) If you answered "YES" to either question, please continue on to question #5. (NOTE: This form will need to be submitted to the Department with the Annual Report and Certification.)	
5. PHYSICAL OBSERVATIONS: (a) ODOR: Oil (b) COLOR: Yellow (c) TURBIDITY: Cloudy (d) FLOATABLES: Petroleum (e) DEPOSITS/STAINS: Sediment (f) VEGETATION CONDITIONS: Excessive G (g) DAMAGE TO OUTFALL STRUCTURES: IDENTIFY STRUCTURE: ____ DAMAGE: Metal Corrosion	
6. ANALYSES OF OUTFALL FLOW SAMPLE: * field calibrate instruments in accordance with manufacturer's instructions prior to testing. (a) DETERGENTS: ____ mg/L (if sample is greater than 0.06 mg/L, the sample is contaminated with detergents [which may be from sanitary wastewater or other sources]. Further testing is required and this outfall should be given the highest priority.) (if the sample is not greater than 0.06 mg/L and it does not show physical characteristics of sanitary wastewater [e.g., odor, floatables, and/or color] it is unlikely that it is from sanitary wastewater sources, yet there may still be an illicit connection of industrial wastewater, rinse water, backwash or cooling water. Skip to question #6c.)	

(b) **AMMONIA (as N) TO POTASSIUM RATIO:** 112

(if the Ammonia to Potassium Ratio is greater than 0.6:1, then it is likely that the pollutant is sanitary sewage)

(if the Ammonia to Potassium Ratio is less than or equal to 0.6:1, then the pollutant is from another washwater source.)

(c) **FLUORIDE:** 123 mg/L

(if the fluoride levels are between 1.0 and 2.5 mg/L, then the flow is most likely from fluoride treated potable water.)

(if the sample tests below a detection limit of 0.1 mg/L for fluoride, it is likely to be from groundwater infiltration, springs or streams. In some cases, however, it is possible that the discharge could originate from an onsite well used for industrial cooling water, which will test non-detect for both detergents and fluoride. To differentiate between these cooling water discharges and groundwater infiltration, you will have to rely on temperature.)

(d) **TEMPERATURE:** _____ °F

(if the temperature of the sample is over 70°F, it is most likely cooling water)

(if the temperature of the sample is under 70°F, it is most likely from ground water infiltration)

7. Is there a suspected illicit connection? Y () N ()

If "YES", what is the suspected source? 12

If "NO", skip to signature block on the bottom of this form.

8. Has the investigation of the suspected illicit connection been completed?

Y () N ()

If "YES", proceed to question #9.

If "NO", skip to signature block on the bottom of this form.

9. Was the source of the illicit connection found? Y () N ()

If "YES", identify the source. _____

What plan of action will follow to eliminate the illicit connection?

Resolution:

If "NO", complete the Closeout Investigation Form and attach it to this Illicit Connection Inspection Report Form.

Inspector's Name: _____

Title: _____

Signature: _____

Date: _____

If there is a dry weather flow or evidence of an intermittent flow, be sure to include this form with your Annual Report and Certification.

If there is not a dry weather flow or evidence of an intermittent flow, this form should be retained with your SPPP.