U-6 ELIMINATION OF INDIVIDUAL NUTRIENT DISCHARGES FROM GRAY INFRASTRUCTURE

PRACTICE AT A GLANCE

- There is conclusive evidence that high nutrient discharges increase Nitrogen and Phosphorus levels in dry weather urban stream flow. These discharges can collectively account for as much as 20 to 40% of the annual nutrient load in urban watersheds, depending on the age and condition of its gray infrastructure.

- More than a thousand Bay communities are already required to have an Illicit Discharge Detection and Elimination (IDDE) program, which can be used to find the dirty discharges.

- Individual Nutrient Discharge Removal Credit can be earned for the discovery and elimination of eight different types of nutrient discharges. These credits can be calculated by using one of three computational protocols.

- Individual nutrient credits will expire after 10 years and cannot be renewed.

PRACTICE DESCRIPTION

The term "Nutrient Discharges" refers to the complex range of non-stormwater flows that export nutrients and other pollutants into urban waters during dry weather due to spills, leaks, and overflows from gray infrastructure. These discharges are created by the interaction of aging gray infrastructure (sanitary sewers, drinking water pipes and storm sewers) with stormwater runoff and groundwater. Communities that invest in strategic upgrades to their gray infrastructure to reduce or eliminate nutrient discharges can be eligible for nutrient reduction credits toward meeting the Chesapeake Bay Pollution Diet.

The **Individual Nutrient Discharge Credit** is available to "discovered" nutrient discharges if:

(1) The nutrient discharges are detected and physically eliminated,

(2) The on-site discharge is sampled to define one or more critical parameters -- nutrient concentration, flow rate and flow duration, and

(3) Subsequent inspections or sampling occur to verify that the discharge no longer exists.

There are 8 discharge types that are potentially eligible for nutrient reduction credit:

1. **Laundry washwater**: Flows that discharge washwater into the storm drain system or directly to the stream. May derive from a private residence or a commercial laundry operation.
2. **Commercial car washing**: Vehicle washing from a fixed or mobile commercial operation that results in the discharge of car washwater into storm drains.
3. **Floor drains**: Floor or foundation drains that are illegally connected and discharge nutrients to storm drains.
4. **Miscellaneous**: Nutrient discharges from various non-sanitary sources, such as rooftop heating ventilation and air conditioning (HVAC) drainage flows.
5. **Sanitary direct connections**: A sewer pipe that is improperly connected to the storm drain system (either through a cross-connection or from a straight pipe) causes a continuous discharge of raw sewage into the storm sewers or directly to a stream.
6. **Sewage pipe exfiltration**: Cracks or leaks in the sanitary sewer pipes that allow sewage to migrate through groundwater and then into storm drains.
7. **Drinking water transmission loss**: Drinking water lost as it is delivered through pipes to consumer taps, that ultimately reaches the stream via storm drains or groundwater.
8. **Dry weather sanitary sewer overflows**: A sanitary sewer overflow that occurs during dry weather periods as a function of either a blockage or failure at some point in the

DISCHARGE TYPES

1. Example of laundry washwater discharge.

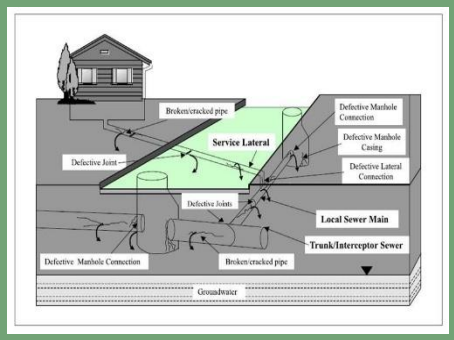
2. Example of commercial car washing.

3. Example of a floor drain generated discharge.

4. Example of a rooftop HVAC discharge.

DISCHARGE TYPES

5. Sewer lateral directly connected to the storm drain system.



6. Schematic of sewage pipe exfiltration.

7. Drinking water transmission loss.

8. Sanitary sewer overflow.

sanitary sewer network, which sends sewage directly to streams.

You can find out more details about each of the eight eligible discharges in the Profile Sheets in the Resources section.

In addition, there is a critical difference between two types of nutrient discharges:

- **Discovered Nutrient Discharge** are existing nutrient discharges found through systematic assessment of a catchment, sewershed or stream corridor using advanced detective methods and technologies. These discharges are available for nutrient reduction credit.
- **Reported Nutrient Discharge** on the other hand, are unexpected discharges from pipe breaks, spills, and leaks that are reported by the public or first responders and require immediate emergency repairs to stop the discharge. Most of these involve sudden pipe and/or infrastructure failure and are **NOT** eligible for nutrient reduction credit.

COMMUNITY BENEFITS FROM IDDE PROGRAMS

By finding and fixing high nutrient discharges from our leaky infrastructure, we can:

- Reduce the input of partially diluted sewage
- Improve public health and safety
- Keep toxic pollutants and harmful bacteria out of our local waterways
- Improve stream habitat and aquatic life
- Inform and engage the public in urban stream monitoring

WHERE TO FIND THE BEST OPPORTUNITIES IN YOUR COMMUNITY

Nutrient discharges from gray infrastructure are not uniformly distributed across a community, but tend to be clustered within certain land uses, subwatersheds and sewage eras. To effectively hunt down the worst nutrient offenders, communities should:

- Prioritize catchments with the highest nutrient and bacteria levels
- Analyze locations where storm and sanitary lines cross
- Conduct targeted outreach to businesses and industrial facilities

GENERAL COST INFORMATION

The cost of finding and fixing high nutrient discharges from gray infrastructure can vary widely from project to project. But when done smartly, local IDDE programs can be a cost-effective strategy to reduce urban nutrient loads.

The largest IDDE program costs involve staff efforts to walk streams, test outfalls and map the storm sewer system. Potential cost savings occur when volunteers and watershed groups monitor streams and outfalls and help with initial data collection.

Another cost-effective approach is to work with other departments to assess existing municipal infrastructure for their sewage discharge potential. For example, the wastewater department can help assess the condition of older sanitary pipes and determine which ones have the greatest potential discharge risk.

TIPS FOR GETTING STARTED IN YOUR COMMUNITY

Pollution from gray infrastructure is already regulated under existing MS4 permits that require illicit discharge detection and elimination programs, or NPDES wastewater permits to abate sanitary sewer overflows (SSO). More than 1,000 communities across the Bay watershed are now subject to one or both permits, but to date, most have not focused yet on their potential nutrient reductions needed to meet the Bay TMDL.

WHAT DEGREE OF TECHNICAL SUPPORT IS NEEDED

Nutrient-based indicators are used to screen storm drains to find high nutrient discharges during dry weather flow. These indicators may require:

- Training for local government staff
- Better outfall monitoring protocols
- Purchases of sampling equipment

Several great resources for learning about the field and desktop work needed to find illicit discharges can be found in the Resources section.

To receive credit for eliminating an individual nutrient discharge, a community must collect on-site samples to define the nutrient concentration, flow rates and flow durations of the discharge. These samples are used to calculate the credit and for reporting the credit to the state. The exact parameters sampled are specific to each type of discharge. Check out the Profile Sheets, accessed in the Resources section, for more information on these details.

KEY DELIVERY ISSUES TO KEEP IN MIND

Outfall screening is effective for finding suspect outfalls and sewer pipes, but much more sleuthing is often required to track down and find the specific nutrient discharge location. These special tracking and discovery methods are used to discover major nutrient discharges and include:

- Visual Inspection and Outfall Screening
- Flow Chart Method to Sample Suspect Outfalls
- Stream Walks
- GIS Risk Analysis
- Smoke Testing
- Dye Testing
- Closed Circuit Television
- Sewage Sniffing Dogs

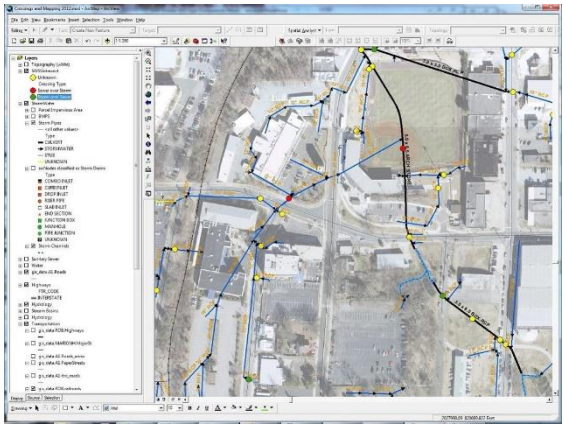
It helps to engage other departments in your locality, including public works, sewer districts, utilities, highway departments or first responders, to help discover discharge sources.

The methods to eliminate the newly discovered nutrient discharge are fairly straightforward. They include:

- Reconnecting Pipe to Sewer Network
- Changing HVAC Management Practices
- Slip-lining Sewer or Water Pipes
- Reducing Infiltration and Inflow into Sewer System
- Replacing Sewer or Water Pipe
- Re-aligning Sewer or Water Pipe
- Implementing Fats Oil and Grease (FOG) Pretreatment in Sewer

Methods to Discover Discharge Sources

GIS Risk Analysis



Mapping locations where sanitary and storm sewer lines cross to target areas where discharges could occur.

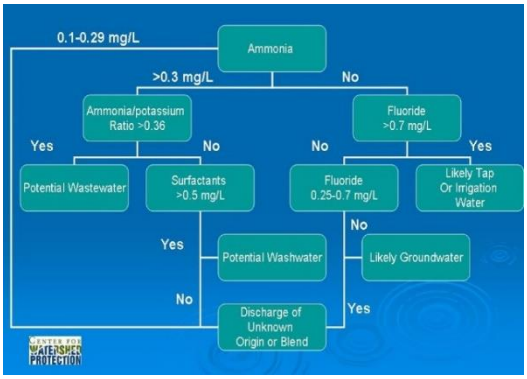
Visual Inspection and Outfall Screening

Visual inspections are used to look for any signs of flow discharges in storm drain manholes or outfalls. If found, samples are taken to measure flow, color, odor, oils, floatables and water quality parameters.

Stream Walks

Walk streams in the watershed to inventory <u>all outfalls</u> in the MS4, visually assess and collect samples to identify possible high nutrient discharges.

Flow Chart Method to Sample Suspect Outfalls



A relatively simple method uses indicator parameters to help fingerprint specific discharge types.

Methods to Track Down Discharge Sources	
Smoke Testing  Smoke is introduced into the sewer to see where it surfaces to find the source of the discharge.	**Dye Testing**  Fluorescent dye is introduced into the sewer network and suspected manholes are inspected to trace the flow through the network to locate the specific discharge.
Closed Circuit Television  A remote video camera assesses the condition of a storm or sewer pipe to look for discharges.	**Sewage Sniffing Dogs**  Specially trained dogs can detect and track human sewage in stormwater drainage systems.

COMPUTING THE INDIVIDUAL POLLUTANT REMOVAL CREDIT

Three computational protocols are used to estimate nutrient reduction credits for the elimination of an individual nutrient discharge, as shown in Table 1.

The protocol uses are specific to each of the eight discharge types. The nutrient reduction credit for each discharge is calculated based on the measured or estimated nutrient concentration, flow rate and discharge duration over the year.

A short profile sheet describes each eligible discharge, its unique crediting approach and a short design example to demonstrate how the credit is calculated (see Profile Sheets in Resources section).

Table 1. The Three Protocols

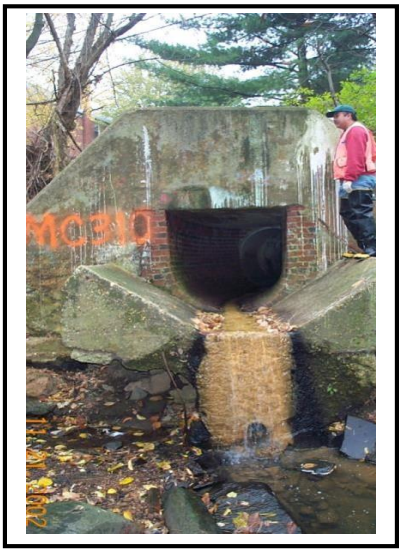
Protocol	Requirements
Protocol 1: The Prevented Load Calculation	Requires direct sampling of flow and concentration or the use of default values
Protocol 2: The Before and After Load Approach	Requires metering or tracing of changes in sewer or drinking water flow before and after infrastructure upgrades
Protocol 3: The Overflow Reduction Tracking Method	Requires tracking dry weather overflow events in a sewershed before and after fat oil and grease (FOG) pretreatment or infrastructure upgrades

In some cases, it is acceptable to substitute default estimates for monitoring parameters collected to quantify the credit for the discharge eliminated. These default rates can also be found in the Profile Sheets for the individual discharges in the Resources section.

HOW TO REPORT THE PRACTICE TO THE STATE

Localities should check with their state stormwater agency on what data to report to obtain credit. The following data may need to be reported:

- Type of discharge eliminated (e.g. N-1, N-2, etc)
- Total pounds of Nitrogen and Phosphorus removed
- Protocol used to calculate the load reduction (1, 2 or 3)
- Nutrient concentration, pre and post elimination (mg/l)
- Discharge flow volume prior to elimination (gallons)
- Estimated flow duration (up to maximum of one year)
- River basin segment where the discharge was corrected (or latitude and longitude)
- Year that the discharge was eliminated



Local governments should keep a file on each nutrient discharge they take credit for that documents the monitoring data and technical assumptions used to calculate load reductions using each protocol.

The local file should contain information on:

- Whether direct monitoring or default values were used to calculate the load reduction
- The date that the nutrient discharge was detected and the date that it was eliminated
- All monitoring data used to establish nutrient concentration
- The method used to measure the flow rate, and its duration
- The final load reduction calculations in pounds per year (lb/yr)

WHAT IS REQUIRED TO VERIFY THE PRACTICE OVER TIME

The specific method used to verify that individual discharges are eliminated depends on the type of discharge. The methods can involve post-removal inspection, screening, or monitoring to verify that the individual discharge will never re-occur. Verification is conducted at the point of repair, and can involve further downstream outfall sampling. More specific details on the verification methods for each discharge type can be found in the Resources section.

Individual nutrient credits will expire after 10 years and cannot be renewed.

RESOURCES

The following resources are available for help with all aspects of this practice:

Type of Resource	Title of Resource	Web link
Expert Panel Report	Recommendations of the Expert Panel to Define Removal Rates for the Elimination of Discovered Nutrient Discharges from Gray Infrastructure (2014)	http://chesapeakestormwater.net/wp-content/uploads/dlm_uploads/2014/11/GREY-INFRASTRUCTURE-Expert-Panel-Report_FINAL_LONG.pdf
Profile Sheets	Profile Sheets for Crediting Nutrient Reductions from Gray Infrastructure	http://chesapeakestormwater.net/wp-content/uploads/dlm_uploads/2016/01/Appendix-A.-Profile-Sheets.pdf
Fact Sheet	U-6: Elimination of Discovered Nutrient Discharges from Gray Infrastructure	Insert link here.
Archived webcast on Practice Accounting	Crediting Nutrient Discharges from Gray Infrastructure Webcast (2015)	http://chesapeakestormwater.net/events/nutrient-discharges-from-grey-infrastructure/
Archived webcast on Practice Techniques	Discharge Discovery Techniques (2015)	http://chesapeakestormwater.net/events/webcast-discharge-discovery-techniques/
IDDE Manual	Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments (2004)	http://chesapeakestormwater.net/wp-content/uploads/downloads/2012/06/final_idde_manual.pdf
	Illicit Discharge Detection and Elimination: Technical Appendices (2004)	http://chesapeakestormwater.net/wp-content/uploads/dlm_uploads/2015/02/IDDE_-Technical-Appendices.pdf
Additional Training Module(s) on the Illicit Discharge Detection and Elimination	Multiple resources	http://chesapeakestormwater.net/training-library/urban-restoration-techniques/illicit-discharge-prevention/