Hampton Roads IDDE Workshop

June 13, 2016

HRPDC

National Fish and Wildlife Foundation

Virginia Environmental Endowment

HAMPTON ROADS PDC PLANNING DISTRICT COMMISSION

CENTER FOR WATERSHED PROTECTION

Lori A Lilly Environmental Solutions

How You Know An IDDE Investigator?

Agenda: AM

- IDDE 101
- IDDE & Water Quality
- Desktop Analysis & Prioritizing
- Indicator Methods
- Hampton Roads Discussion
- Fixing/Source Tracking

Agenda: PM

Break-Out 1

- Field Investigations
- Hands-On Use of Testing Kits

Break-Out 2

- Expert Panel Protocols – Crediting Discharge Elimination
- Hands-on Exercises & Discussion

What is an Illicit Discharge?

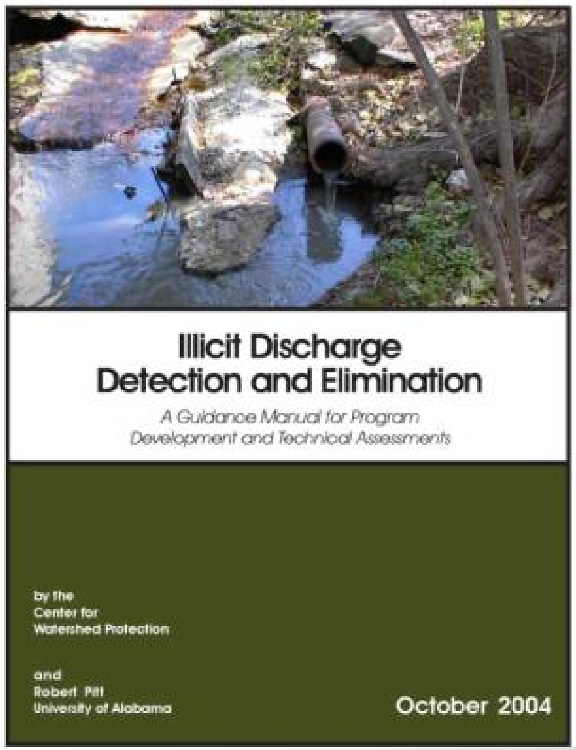
A dry weather discharge to the storm sewer system that contains pollutants except:

i. discharges pursuant to a NPDES permit and

ii. discharges resulting from fire fighting activities (40 CFR 122.26)

IDDE Guidance Manual

- Joint EPA-funded project between CWP and University of Alabama
- 8 Program Components
- Desktop Methods
- Field and Lab Protocols
- Model Ordinance
- Technical Appendices
- Download at www.cwp.org or http://cfpub.epa.gov/npdes/



What are common illicit discharges?

Sewage:
- Broken or leaking sanitary sewer line
- Sewer cross-connections
- Connection of floor drains to storm sewer
- Sanitary sewer overflows
- Pump station failure
- Straight-pipe sewer discharge
- Failing septic systems

Miscellaneous
- Concrete washout water
- Illegal dumping practices: motor oil, paint
- Restaurant grease

Wash Water
- Laundry wash water
- Commercial car washing
- Floor drains connected to stormwater pipes

Sources of Illicit Discharges

- Illegal dumping practices (95%)
- Broken sanitary sewer line (81%)
- Cross-connections (71%)
- Connection of floor drains to storm sewer (62%)
- Sanitary sewer overflows (52%)
- Inflow / infiltration (48%)
- Straight pipe sewer discharge (38%)
- Failing septic systems (33%)
- Improper RV waste disposal (33%)
- Pump station failure (14%)

Discharge Frequency

- Continuous discharges
- Intermittent discharges
- Transitory discharges

Continuous Discharges

- Occur all or most of the time
  - Broken sewage pipes
  - Direct connections (sometimes)
- Worst pollutant source
- Easiest to find
- *Best way to find them: comprehensive outfall surveys and tracking to source*

Sanitary Sewer Cross Connections

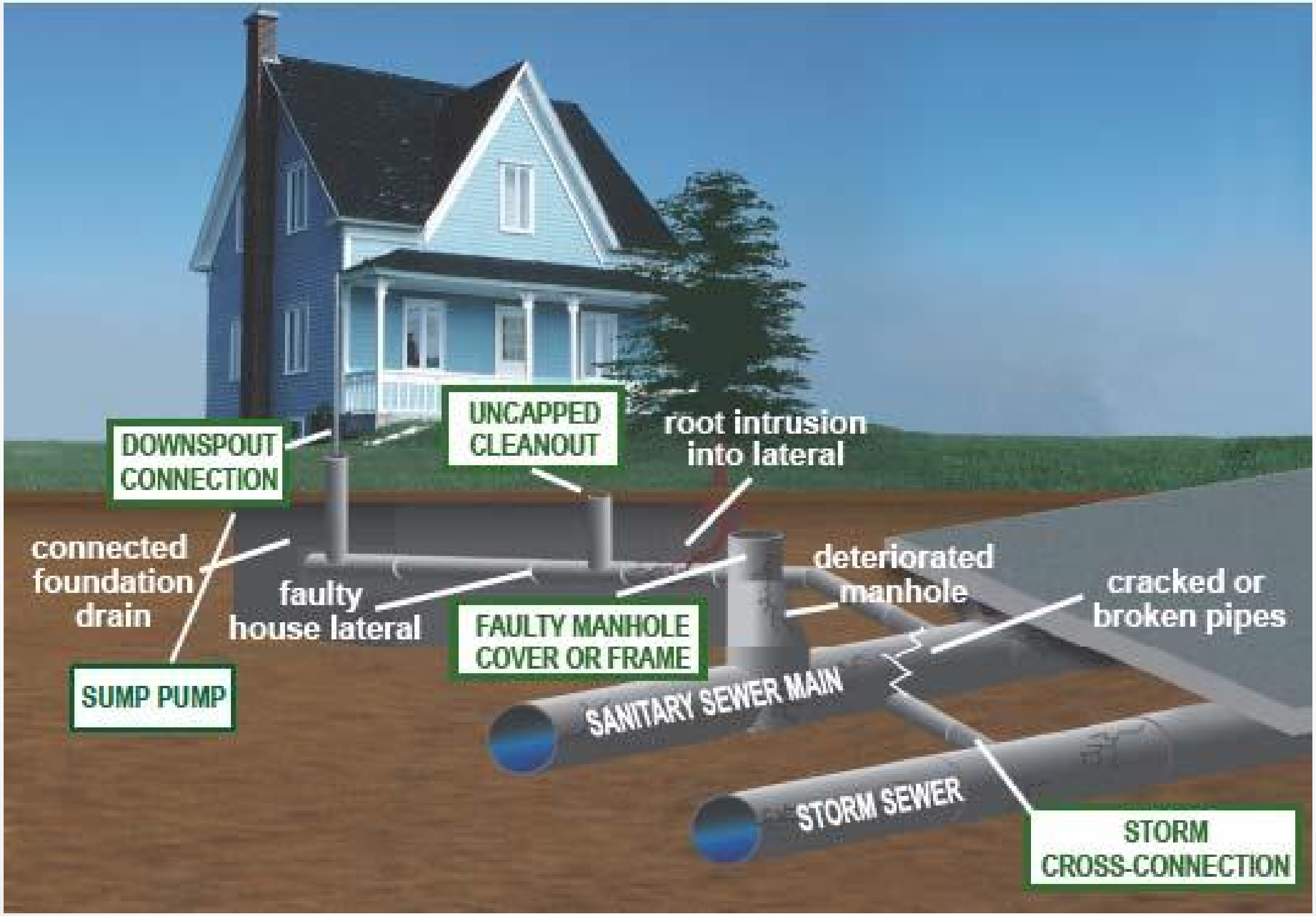


Image credit: Amick and Burgess (2000)

Sewer Pipe Leakage

Intermittent Discharges

- Occur over a ***shorter period of time*** (e.g., a few hours per day or a few days per year)
- Likely to come back
- May "miss them" of you don't look for clues and patrol regularly
- *Best way to find them: Look for signs of past flow; look at different hours/days; use hotlines or citizen reporting*

Laundry Washwater

- Laundry water directly or indirectly connected to storm drain system

Commercial Car Washing

- Wash water drains to the stormdrain system

Floor Drains

- Directly connected to stormdrain system

Photo credit: Regional Water Quality Control Board

Mop Water Dumping

Transitory Discharges

- Occur once or infrequently
- Examples Include:
  - Spills
  - One-Time Dumping
- *Best way to deal with them: education, prevention, safety plans, hotlines*

Paint wash

- Washing out brushes and buckets on the ground or into storm drains

Chemical and oil leaks/dumping

Concrete washout

- Washing out concrete truck without proper containment

Concrete washout

The right way!

Relationship To Good Housekeeping

- Sites where routine operations can generate indirect discharges
- Discharges are generally intermittent or transitory
- Generating sites can be identified and discharges can be prevented

Land Use	Generating Site	Example Discharges
Residential	Apartments, multi-family, single family homes	Septic, dumping, swimming pools, car washing
Commercial	Car dealers, commercial laundry, marinas, restaurants	Outdoor washing, food waste disposal, vehicle maintenance and repair, power washing, dumpster juice
Industrial	Auto recyclers, metal plating, paper and wood, printing	Rinse, process, wash, and cooling water disposal; spills and leaks; leaking underground storage tanks
Institutional	Churches, hospitals, schools / universities	Vehicle maintenance and repair; power washing, outdoor storage, loading/unloading (washdowns / spills)
Municipal	Public works yards, airports, ports, landfills, municipal fleet storage areas	Outdoor fluid storage, vehicle maintenance and repair, power washing, dumping / spills

Regulatory Context

Permit No.: VA0088625
Effective Date:
Expiration Date: [5 years after effective date]

AUTHORIZATION TO DISCHARGE UNDER THE
VIRGINIA STORMWATER MANAGEMENT PROGRAM AND THE VIRGINIA STORMWATER MANAGEMENT ACT

F ... ulations adopted
p ... tions, monitoring
r ...

VIRGINIA
REGISTER OF REGULATIONS

VOL. 29 ISS. 17 — PUBLISHED EVERY OTHER WEEK BY THE VIRGINIA CODE COMMISSION — APRIL 22, 2013

TABLE OF CONTENTS

Phase II

- Storm sewer map
- Ordinance or other legal mechanism to prevent discharges
- Written procedures
- Program plan & annual reporting

Written Procedures

- Field screening
- Schedule
- Methodologies
- Tracking
- Public reporting

Table 3. Illicit Discharge Tracking Sheet

Date Illicit Discharge Observed & Reported:	**Report Initiated by:** Phone, drop-in, contact information, etc.	**Location of Discharge:** If known – lat/long, stream address or outfall #, nearby landmark, etc.	**Description of Discharge:** E.g. – dumping, wash water suds, oil, etc.	**Actions to be Taken:** Who What, When and How…(what should be done)	**Results & Follow-Up of Investigation:** Outcome of Actions taken and any necessary follow-up (what was done)	**Date Investigation Resolved or Closed:**

Phase II MS4 Minimum Measure #3

Schedule (Table 1)

What MS4s HAVE To Do

IDDE Procedures	12 months from coverage
Outfall Map	**48 months, keep updated**

Phase 1

- Notes allowable discharges unless significant pollutant source
- 189,000 lf of sanitary sewer inspections (annual)
- Reduce floatables, oils, fluids, hazardous waste, grass clippings, etc.
- “Dry” weather screening
- Eliminate discharges within 30 days or other plan
- Spill response
- Industrial & high risk runoff – inspections every 5 years

Field Guide & Procedures

- Common Pollution Problems
- Illicit Discharge Characteristics
  - Odor
  - Color
  - Turbidity
  - Floatables
- Written Procedures
- **WILL be adapted to HR Area**

Shenandoah Valley MS4 Communities

Illicit Discharge Detection and Elimination Field Guide:
How to Identify and Quickly Report Pollution Problems

Funding: Virginia Environmental Endowment
Written by: Center for Watershed Protection

December 2014

MS4 Pollutant Credits, Expert Panel (2014)

Recommendations of the Expert Panel to Define Removal Rates for the Elimination of Discovered Nutrient Discharges from Grey Infrastructure

FINAL APPROVED REPORT

Submitted by:

Marianne Walch, Megan Brosh, Lori Lilly, Jenny Tribo, June Whitehurst, Barbara Brumbaugh, Diana Handy, Mark Hoskins, Kevin Utt, Robert Pitt, Tanya Spano and Whitney Katchmark

Approved by Urban Stormwater Workgroup: **September 23, 2014**
Approved by Watershed Technical Workgroup: **November 6, 2014**
Approved by Water Quality Goal Implementation Team: **November 10, 2014**

Photo credit: Arlington County DES

Prepared by:
Tom Schueler and Cecilia Lane, Chesapeake Stormwater Network
Bill Stack, Center for Watershed Protection, Inc.

- Enhanced Program
- **Individual Discharge Removal & Documentation**

Program Self-Assessment

IDDE Program Self Assessment

Gathering Basic Information

The first portion of the self assessment focuses on gathering basic information about the community's infrastructure and general water quality concerns.

Infrastructure Profile		
What is the total area of the jurisdiction?	________ acres	
What is the total area regulated under the MS4?	________ acres	
How many miles of streams exist in the jurisdiction?		GIS available? ☐
How many miles of storm drains exist in the jurisdiction?		GIS available? ☐
What total area is serviced by storm drains?		GIS available? ☐
What is the general age and condition of the infrastructure?		GIS available? ☐
How many storm drain outfalls exist in the jurisdiction?		GIS available? ☐
What total area is serviced by sanitary sewers?		GIS available? ☐
What total area is serviced by septic systems?		GIS available? ☐
What total area is serviced by a combined sewer system?		GIS available? ☐
What total area is serviced with water lines carrying treated drinking water?		GIS available? ☐
What total area is serviced by wells?		GIS available? ☐
Land Use		

Hampton Roads IDDE Workshop

IDDE & Water Quality

Center for Watershed Protection

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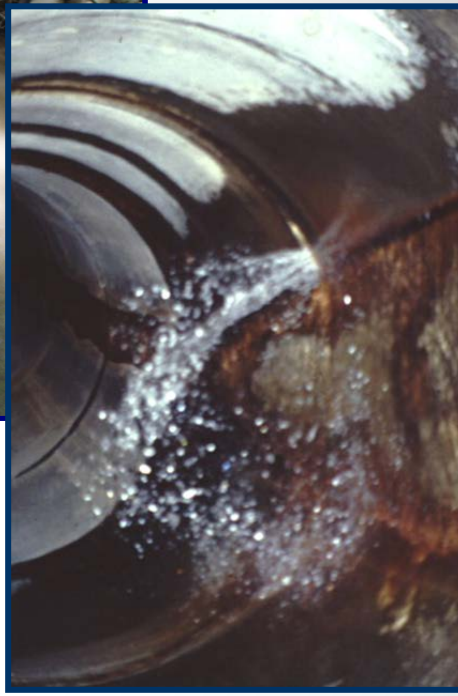
Discharge Flow Types

- Pathogenic & toxic discharges
  - Sanitary wastewater
  - Commercial & Industrial discharges
- Nuisance & aquatic life threatening discharges
  - Landscaped irrigation runoff
  - Construction site dewatering
  - Automobile washing
  - Laundry wastes
- Unpolluted discharges
  - Infiltrating groundwater
  - Natural springs
  - Domestic water line leaks

Mode of Entry



Direct entry

- Sewage, industrial, commercial cross-connection
- Straight pipe

Indirect entry

- Groundwater seepage
- Spills
- Dumping
- Outdoor washing activities
- “Nuisance” or non-target water

Discharge Frequency

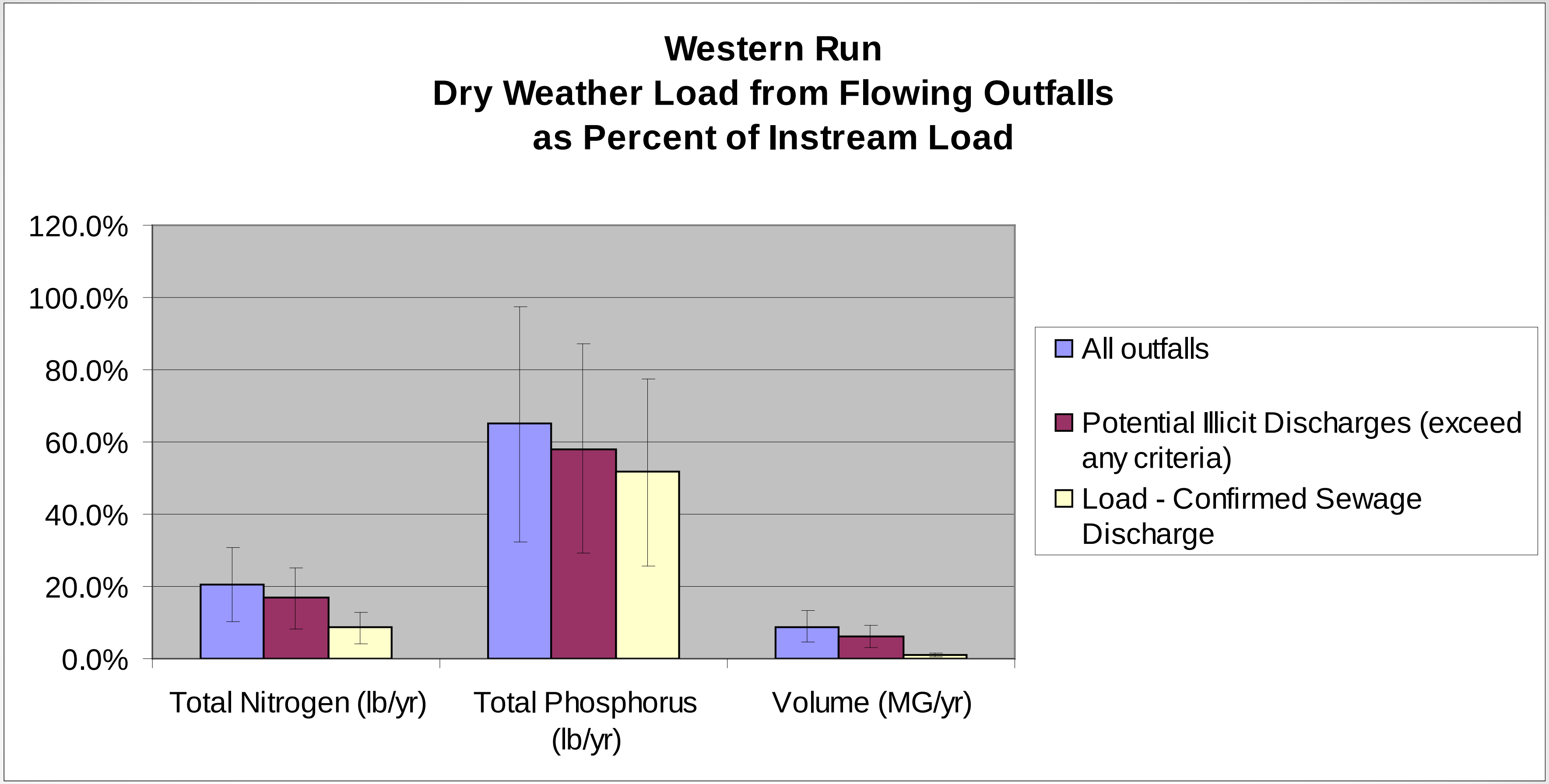
- **Continuous discharges**
  - Occur ***most or all of the time***
- **Intermittent discharges**
  - Occur over a ***shorter period of time*** (e.g., a few hours per day or a few days per year)
- **Transitory discharges**
  - ***Occur rarely***, usually in response to a singular event such as an industrial spill, ruptured tank, sewer break, transport accident or illegal dumping episode

Wastewater

Color	Odor	Effects on Water
Gray	Sewage	Lowers oxygen / kills life; contributes pathogenic bacteria

"Sewage Fungus" – a filamentous bacterium, appears after 2-3 days of continuous sewage discharge

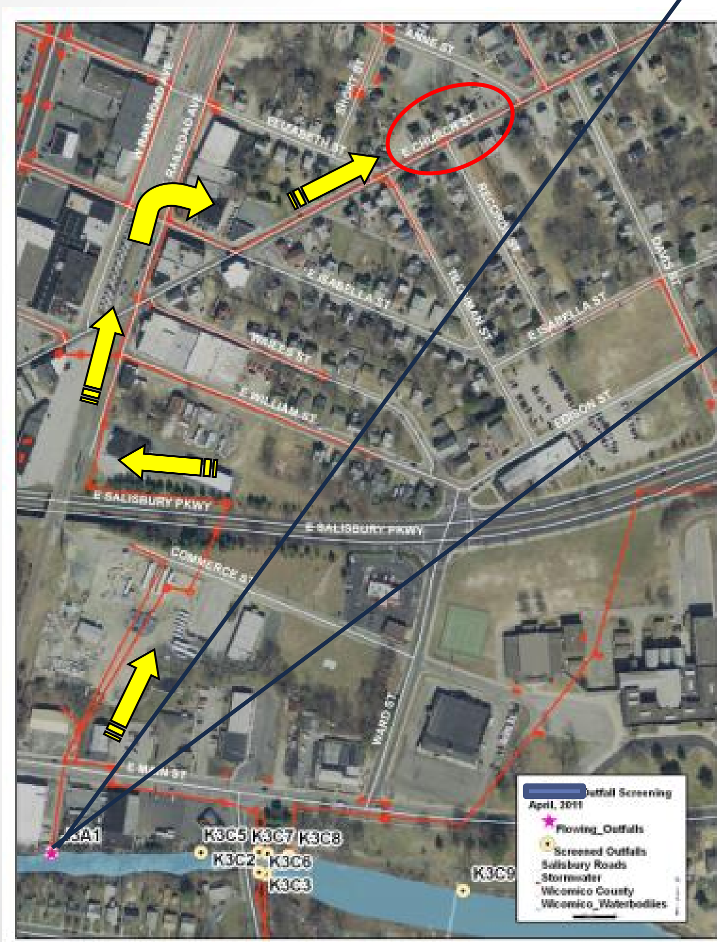
"Floatables" – TP, suds

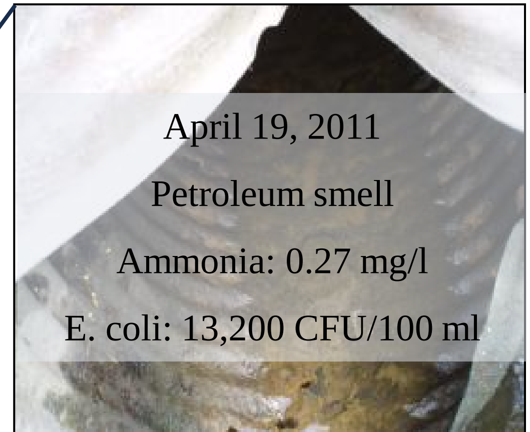

Western Run
Dry Weather Load from Flowing Outfalls
as Percent of Instream Load
120.0%
100.0%
80.0%
60.0%
40.0%
20.0%
0.0%
Total Nitrogen (lb/yr)
Total Phosphorus (lb/yr)
Volume (MG/yr)
All outfalls
Potential Illicit Discharges (exceed any criteria)
Load - Confirmed Sewage Discharge

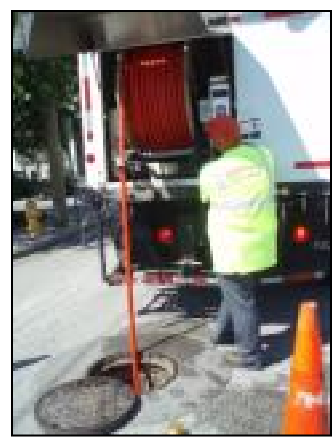
Illicit discharges in pipes <36" in diameter (Lilly & Sturm, 2010)

- 45% of all potential illicit flows
- 100% of small pipes with dry weather flow exceeded 1 or more criteria
- Volume: 49-146 MG/yr
- TP: 26-78 lb/yr
- TN: 726-2,179 lb/yr
- Avg. E. coli concentration: 16,714 CFU/100ml

Case Study – Salisbury, MD

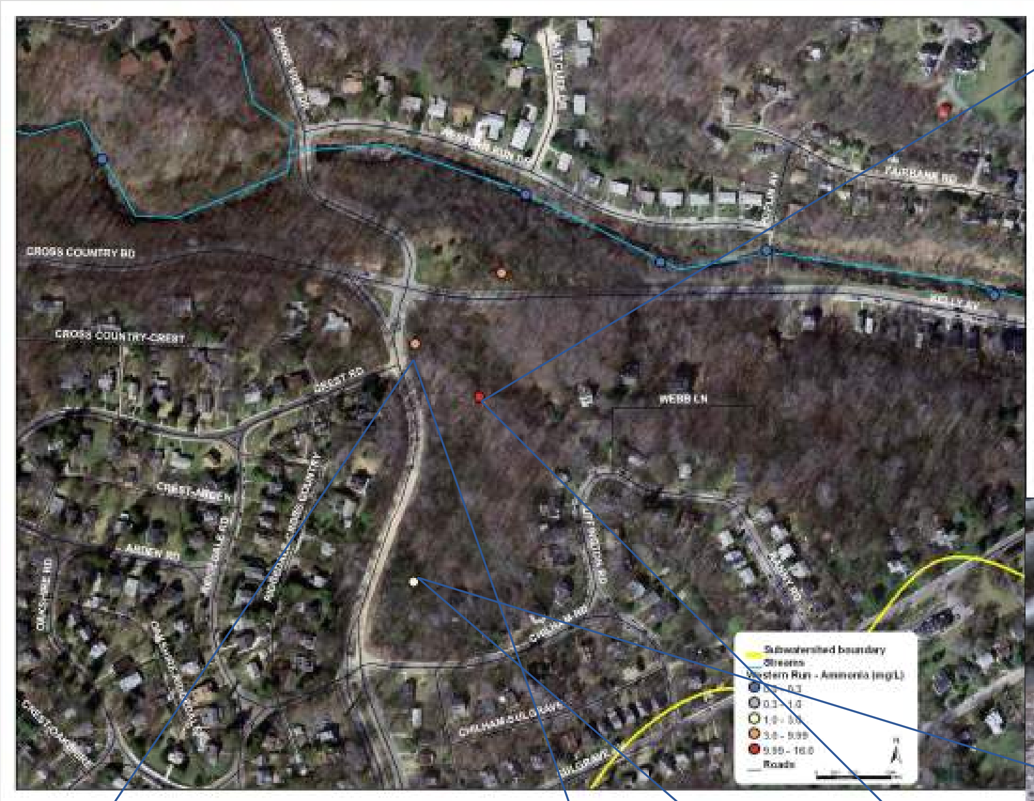






IDDE Cost-effectiveness Case Study – Salisbury, MD

	Total Nitrogen	**Total Phosphorus**
Illicit Discharge Daily Load	9.9 lbs	0.3 lbs
Illicit Discharge Annual Load	3,614 lbs	110 lbs
Actual cost to repair	$1,000	
Cost / pound reduced (annual)	$0.28	$9.09



= 143 ½-acre bioretentions to treat TP (49 to treat TN); cost of 590-1,700 K

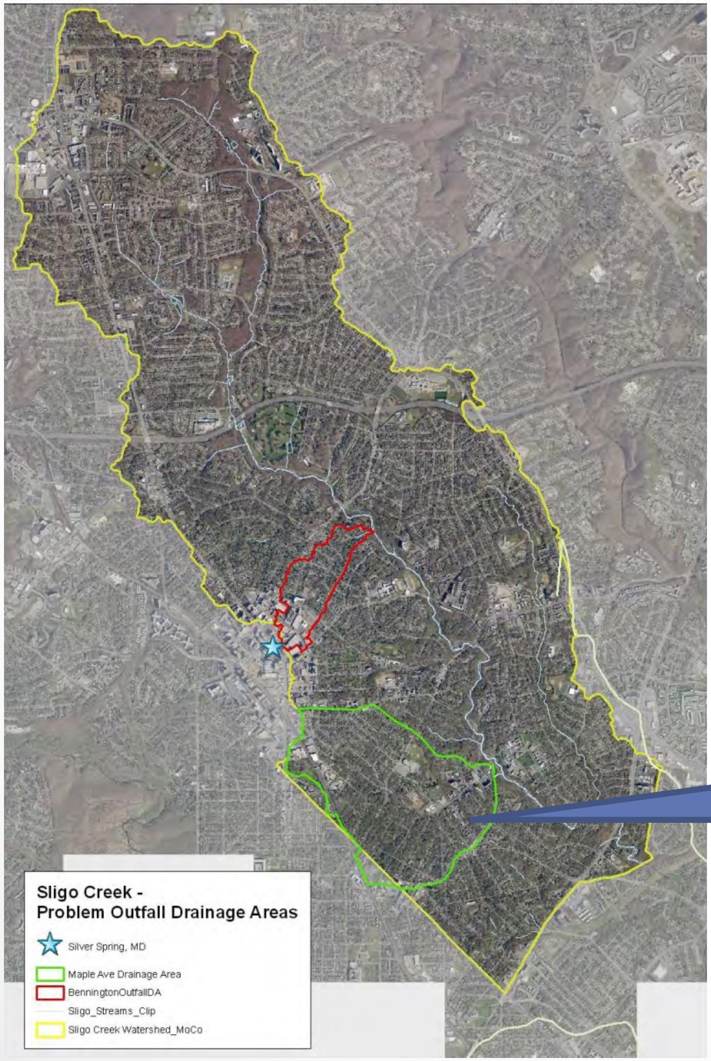
Washwater

Floatable	Odor	Effects on water
Suds	Sweet, fruity, detergent, chlorine	Destroys the external mucus layers that protect fish from bacteria and parasites; causes severe damage to the gills.; kills fish eggs; decreases surface tension of water and increases the potential for contaminants to be absorbed.

Puget Sound study – "A single uncontrolled residential car wash activity might be inconsequential, however, when extrapolated over an entire urban area for a year, the pollutant loading becomes significant."

- Petroleum hydrocarbon waste: gasoline, diesel, and motor oil (estimated 190 gallons of annual mass loading).
- Nutrients: phosphorous and nitrogen (estimated 400 pounds of annual mass loading).
- Ammonia (estimated 60 pounds of annual mass loading).
- Surfactants (estimated 2,200 pounds of annual mass loading
- Solids (estimated 30,000 pounds of annual mass loading).

Maple Ave ID Investigations Takoma Park, MD



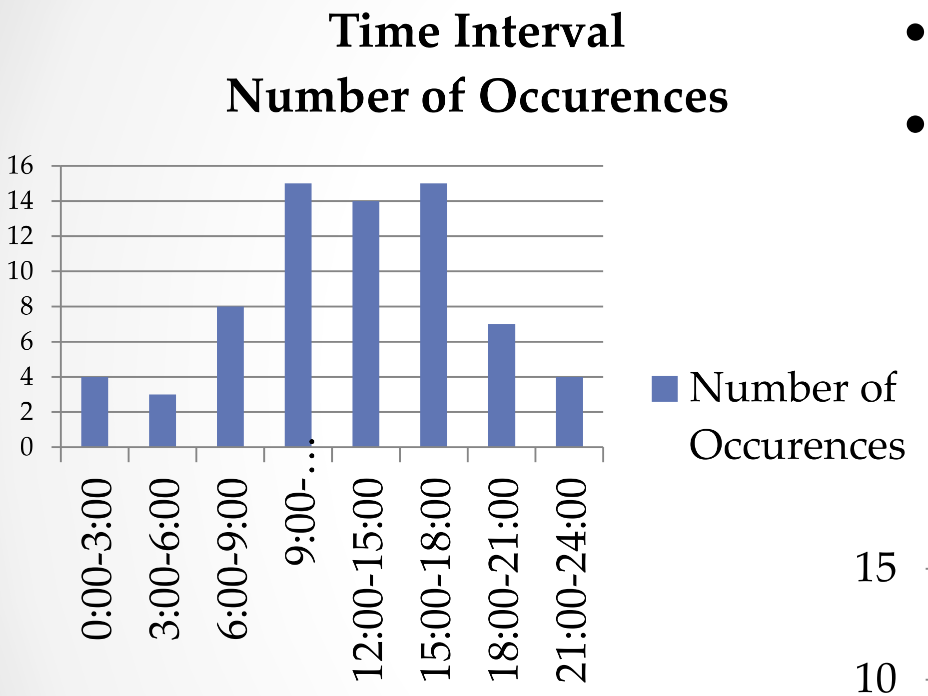
Maple Ave - 550 acres

Maple Ave Outfall

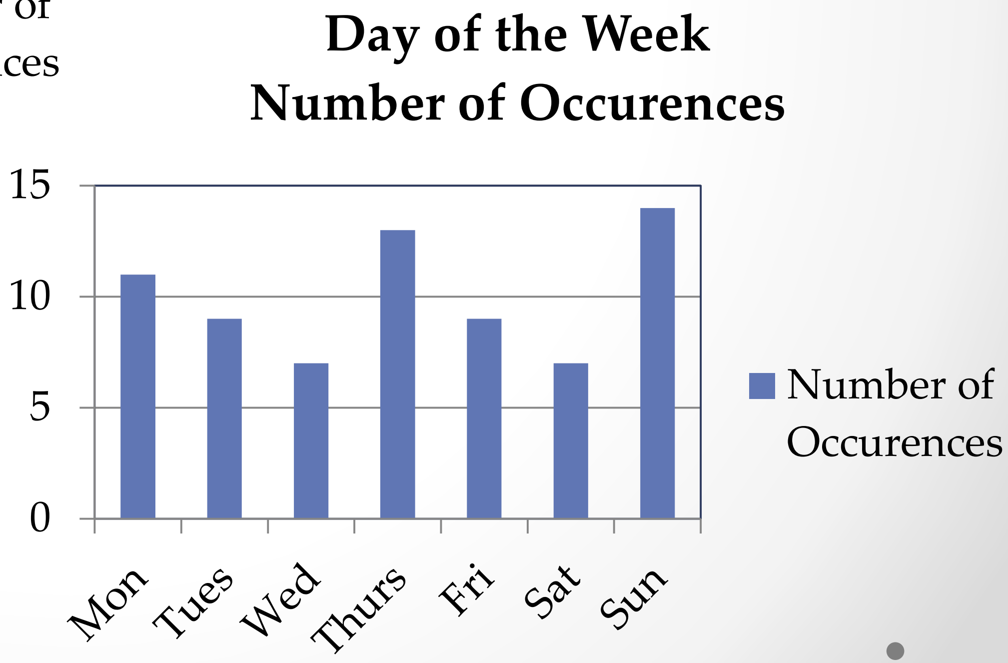
- Suds discharges known to occur frequently
- Smells like detergent
- Any patterns on times of day or days of the week when these are seen?
- Enter the Moultrie game camera...

Maple Ave Outfall Suds Discharges

Suds Tracking



- 12/3-12/17/2015
- ~70 suds discharges detected



Other Pollutants: Air Conditioner Condensate…??

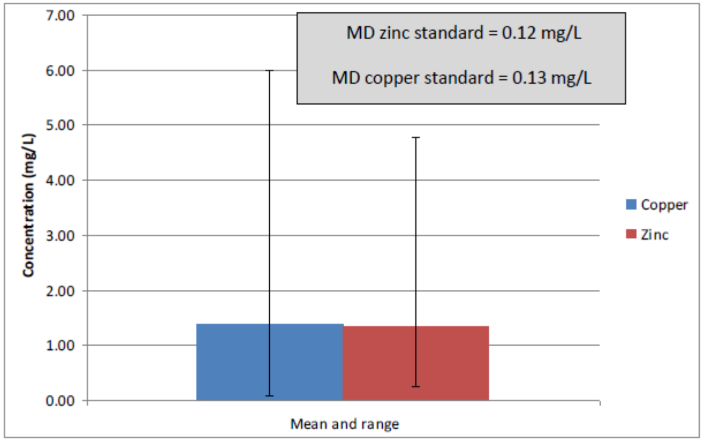


Figure 3. Heavy metal concentrations from HVAC discharges (n = 9).

> 86 sites visited
> 38% of sites had a discharge
> All discharges (n=33) exceeded ammonia threshold of 0.2 mg/l, 58% > 5.0 mg/L
> All samples (n=9) exceeded water quality standards for zinc and copper

Sources of Contamination in HVAC Discharges

- Microbial biocides
- Illicit cooling tower water
- Copper piping
- Refrigerant leaks

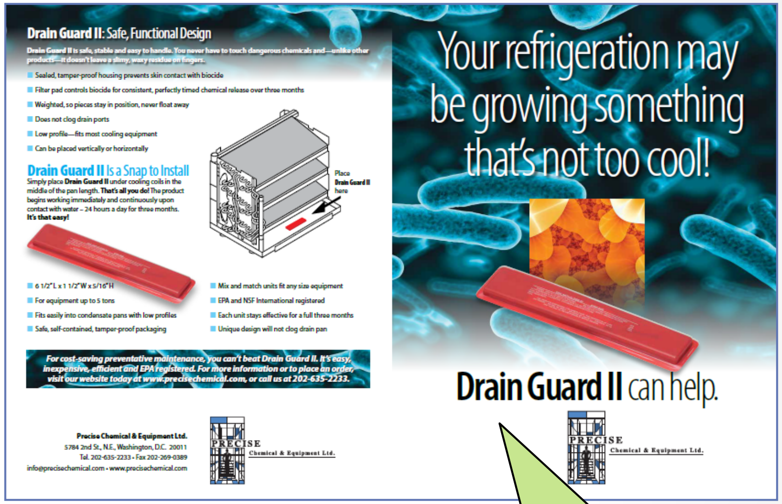


Table 4. Measured pollutant load estimates from all discharges (n = 33).

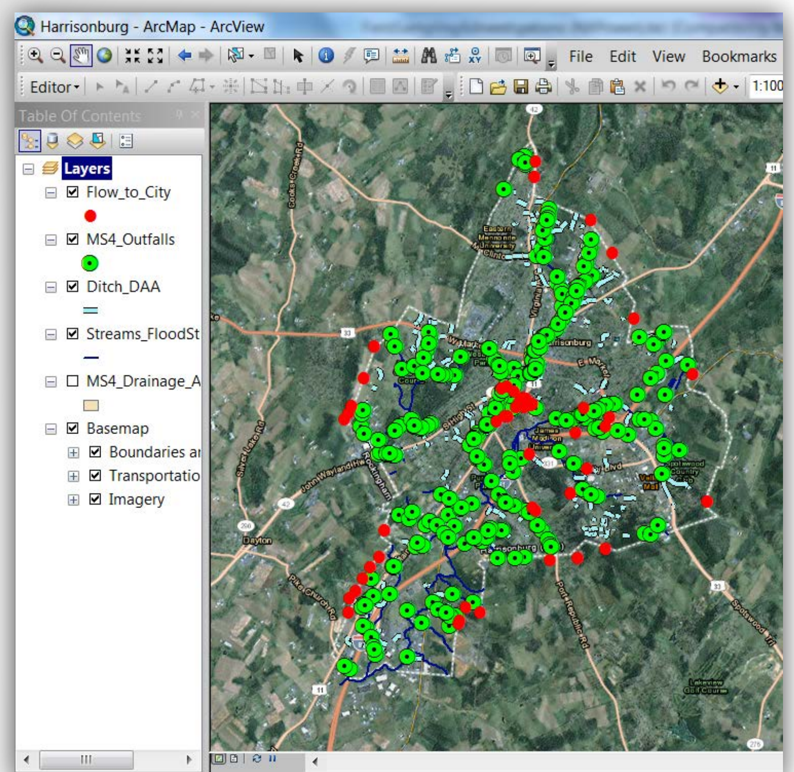
	50%–100% Annual Load, 150 Days (lb/year)
Total Nitrogen	14.0–28.0
Copper	0.6–1.1
Zinc	0.5–1.0

- 5-30% ammonium chloride
- Kills bacteria that cause Legionnaires
- Toxic to aquatic organisms and should not be released into the environment

Conclusion

- Illicit discharges have varying toxicity, modes of entry and frequency patterns.
- These factors determine their overall impact to water quality.
- Continuous discharges typically have the most impact, even with small volumes.
- Intermittent discharges can also have a big impact on water quality but can be much harder to track down.

Q/A



Desktop Analysis & Prioritization

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Desktop Analysis of Illicit Discharge Potential (IDP)

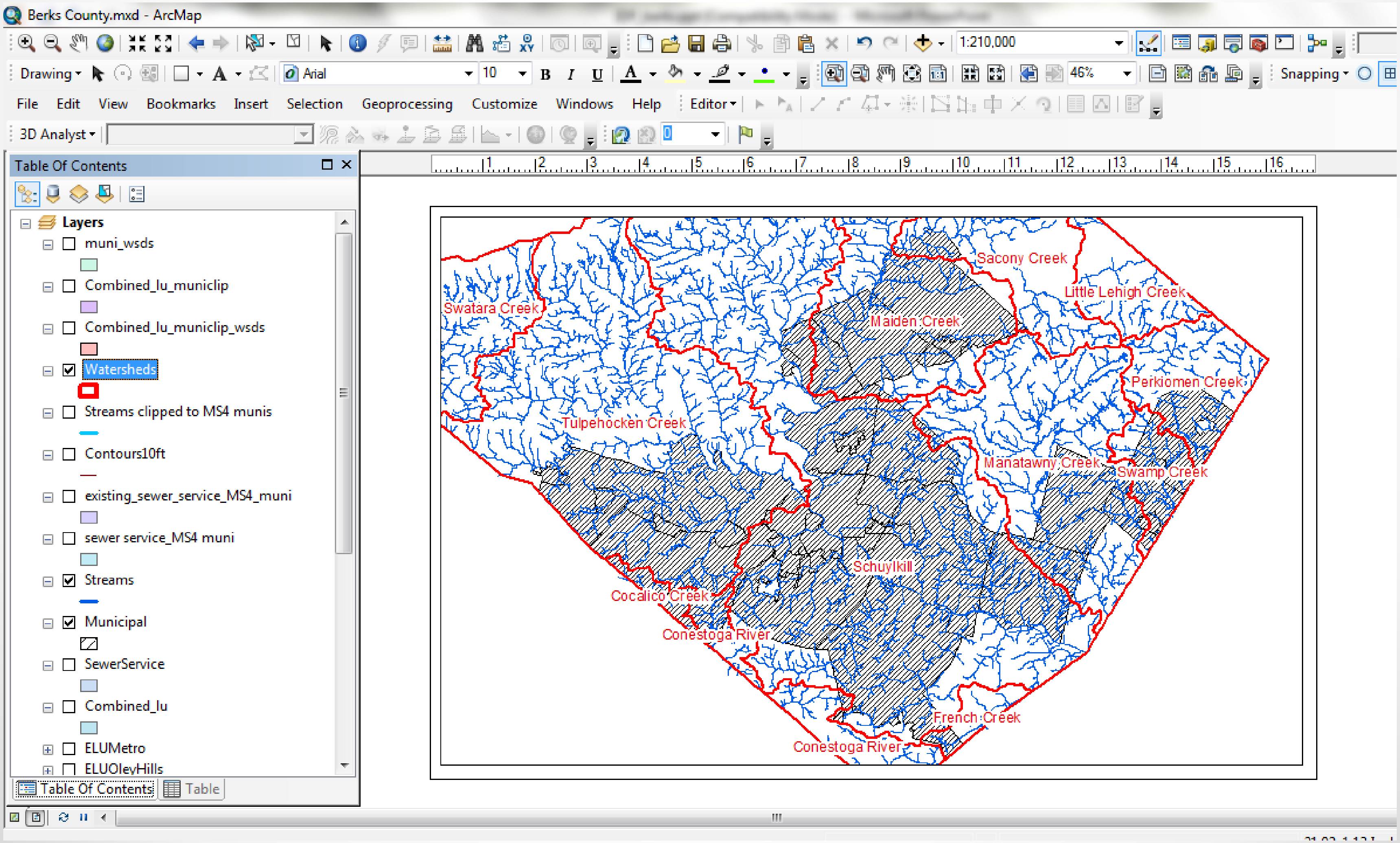
- A method of developing a targeted approach to identify priority areas subject to a higher rate of illicit discharges, while using a GIS-based program

- Answers the question … **"Where should we focus our resources?"**

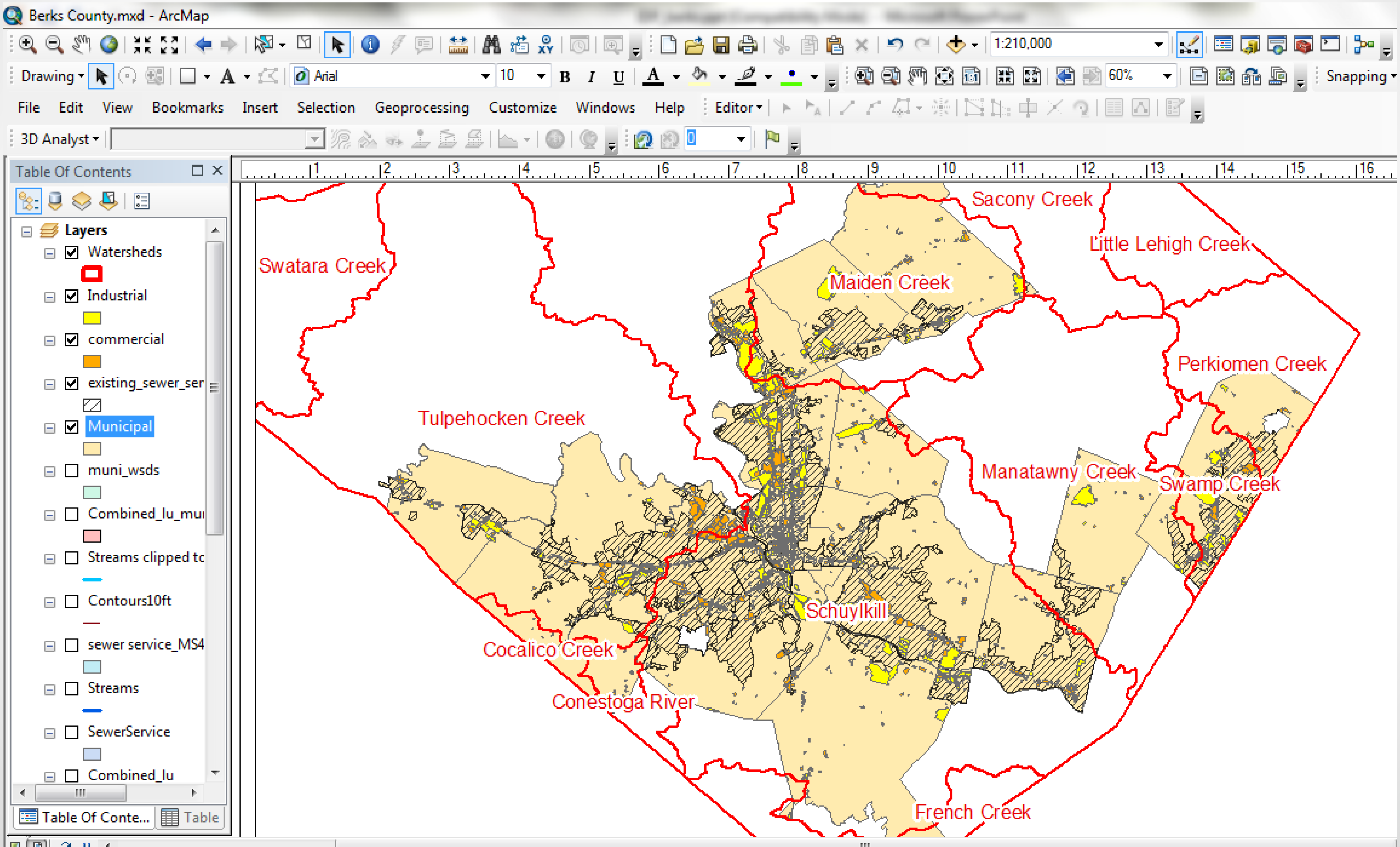
GIS-based Analysis:

1. Delineate subwatersheds
2. Compile mapping and data
3. Compute discharge screening factors
4. Characterize IDP across subwatersheds
5. Generate maps to support field investigation

1. Delineate Subwatersheds



2. Available Data



"Wish List" of GIS Data (Screening Factors)

- Past Discharge Complaints
- Poor Dry Weather Water Quality
- Density of Generating Sites
- Density of Industrial NPDES Permits
- Stormwater Outfall Density
- Age of Subwatershed Development
- Water Monitoring Data
- Former Combined Sewers
- Older Industrial Operations
- Aging or Failing Sewers
- Density of Older Septic Systems
- Past Sewer Conversions

Collaborate to prioritize and develop a robust GIS dataset

3. Calculate Discharge Screening Factors

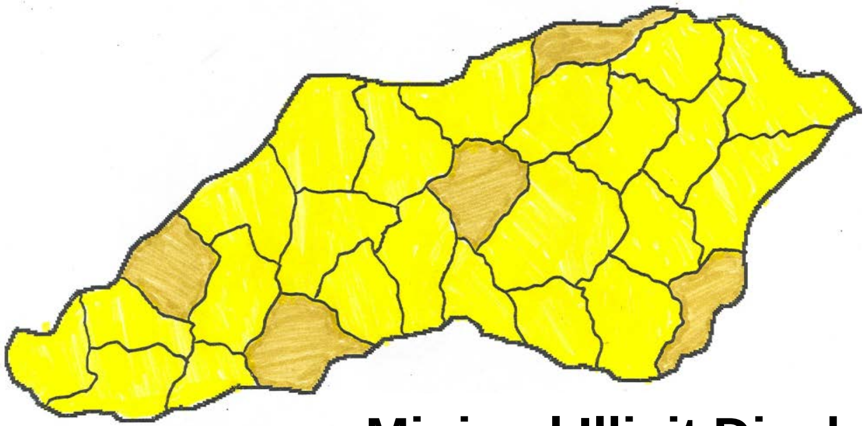
Watershed Name	Commercial (Acres)	%	Industrial (Acres)	%	Total Wsd Acres in MS4
Cocalico Creek	1.97	0.07	7.21	0.24	2943.48
Conestoga River	37.42	1.46	3.77	0.15	2563.17
Maiden Creek	438.50	1.61	1129.77	4.15	27204.73
Manatawny Creek	104.04	0.68	341.26	2.24	15203.89
Perkiomen Creek	64.99	1.26	28.82	0.56	5162.45
Sacony Creek	5.38	0.28	5.26	0.28	1910.62
Schuylkill	3700.19	3.97	4193.85	4.50	93148.72
Swamp Creek	286.04	3.88	610.16	8.28	7369.76
Tulpehocken Creek	1379.10	3.86	592.46	1.66	35701.74

4. Prioritize Subwatersheds Using IDP Screening Factors

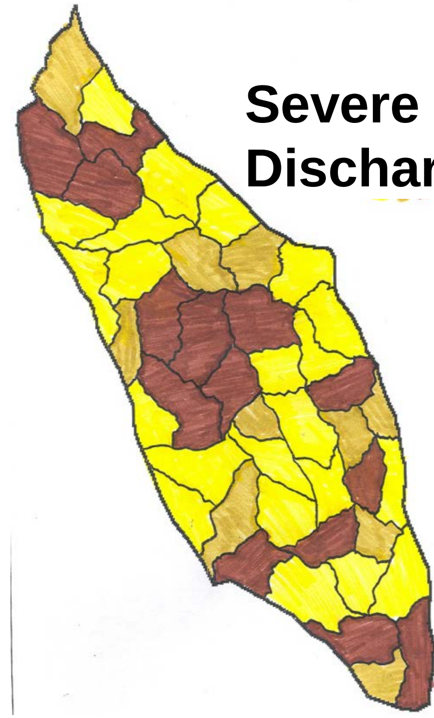
Subwatershed	Past discharge complaints	Poor dry weather WQ	Density of SW outfalls	Average age of dev.	Raw IDP score	Normalized IDP score
Subwatershed A	8 **(2)**	30% **(2)**	14 **(2)**	40 **(2)**	**8**	**2**
Subwatershed B	3 **(1)**	15% **(1)**	10 **(2)**	10 **(1)**	**5**	**1.25**
Subwatershed C	13 **(3)**	60% **(3)**	16 **(2)**	75 **(3)**	**11**	**2.75**
Subwatershed D	1 **(1)**	25% **(1)**	9 **(1)**	15 **(2)**	**5**	**1.25**

Basis for Assigning Scores…	**1**	**2**	**3**
Past discharge complaints/reports (total # logged)	< 5	5 - 10	> 10
Dry weather water quality (# times bacteria stds exceeded)	< 25%	25 - 50%	> 50%
Storm water outfall density (# outfalls / stream mile)	< 10	10 - 20	20
Average age of development (years)	< 25	25 - 50	> 50

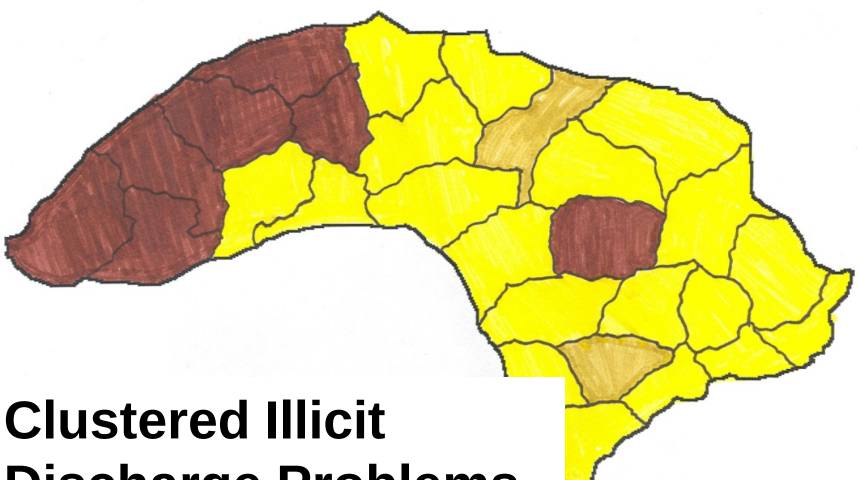
5. Results Shown by Subwatershed



Minimal Illicit Discharge Problems



Severe Illicit Discharge Problems



Clustered Illicit Discharge Problems

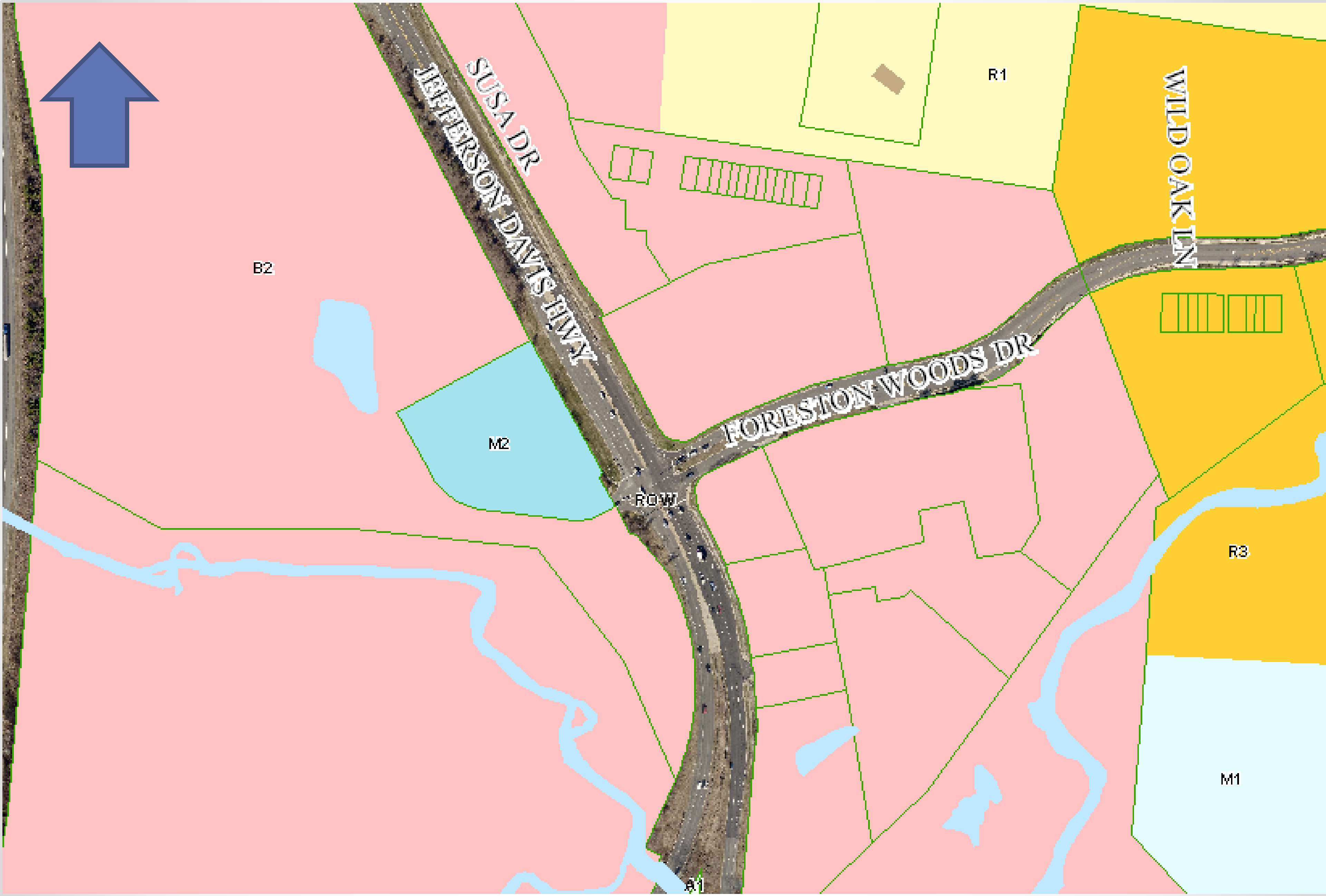
Key:
- Low IDP risk
- Medium IDP risk
- High IDP risk

EXAMPLE

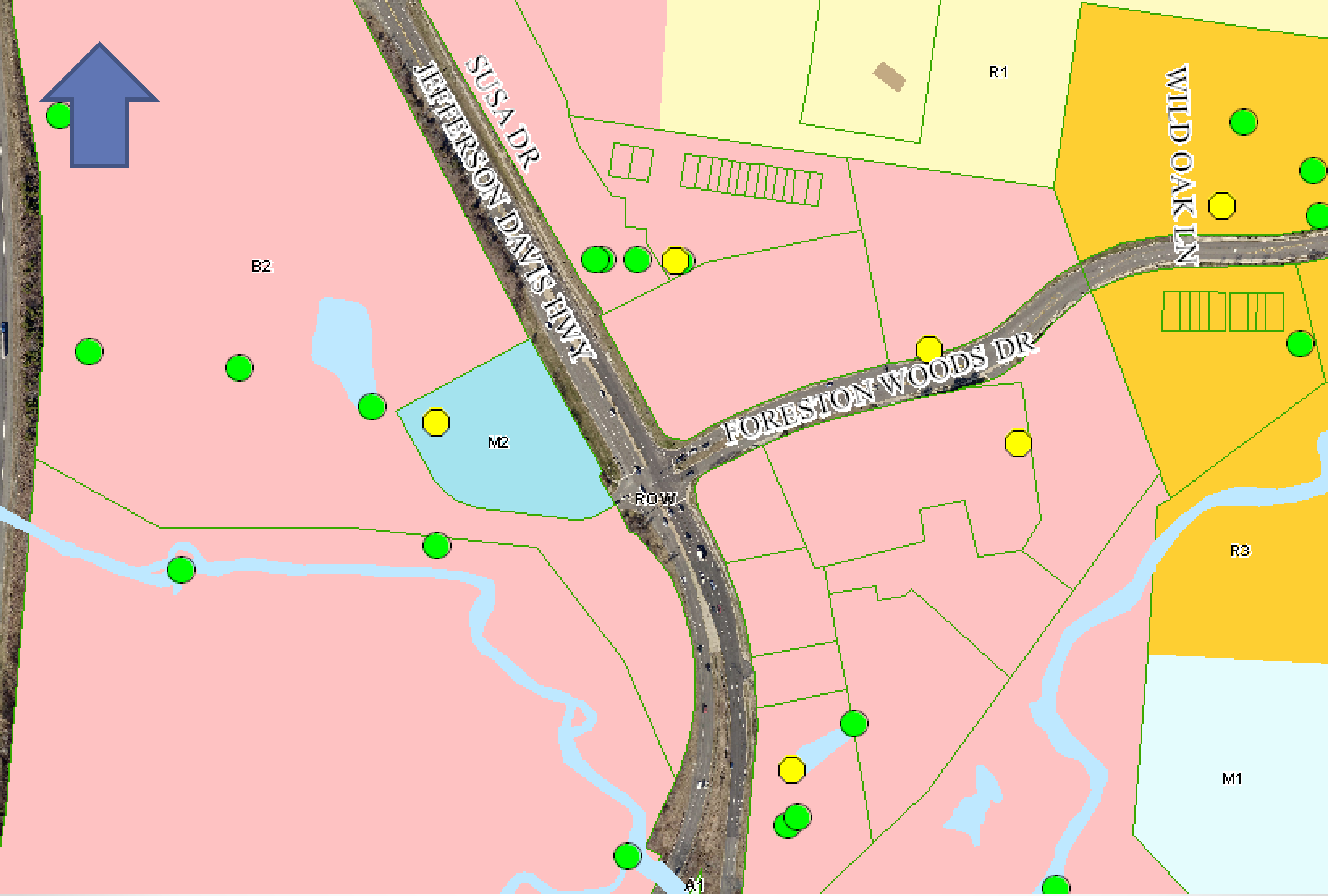
Stafford County, VA

(slides courtesy of Paul Santay)

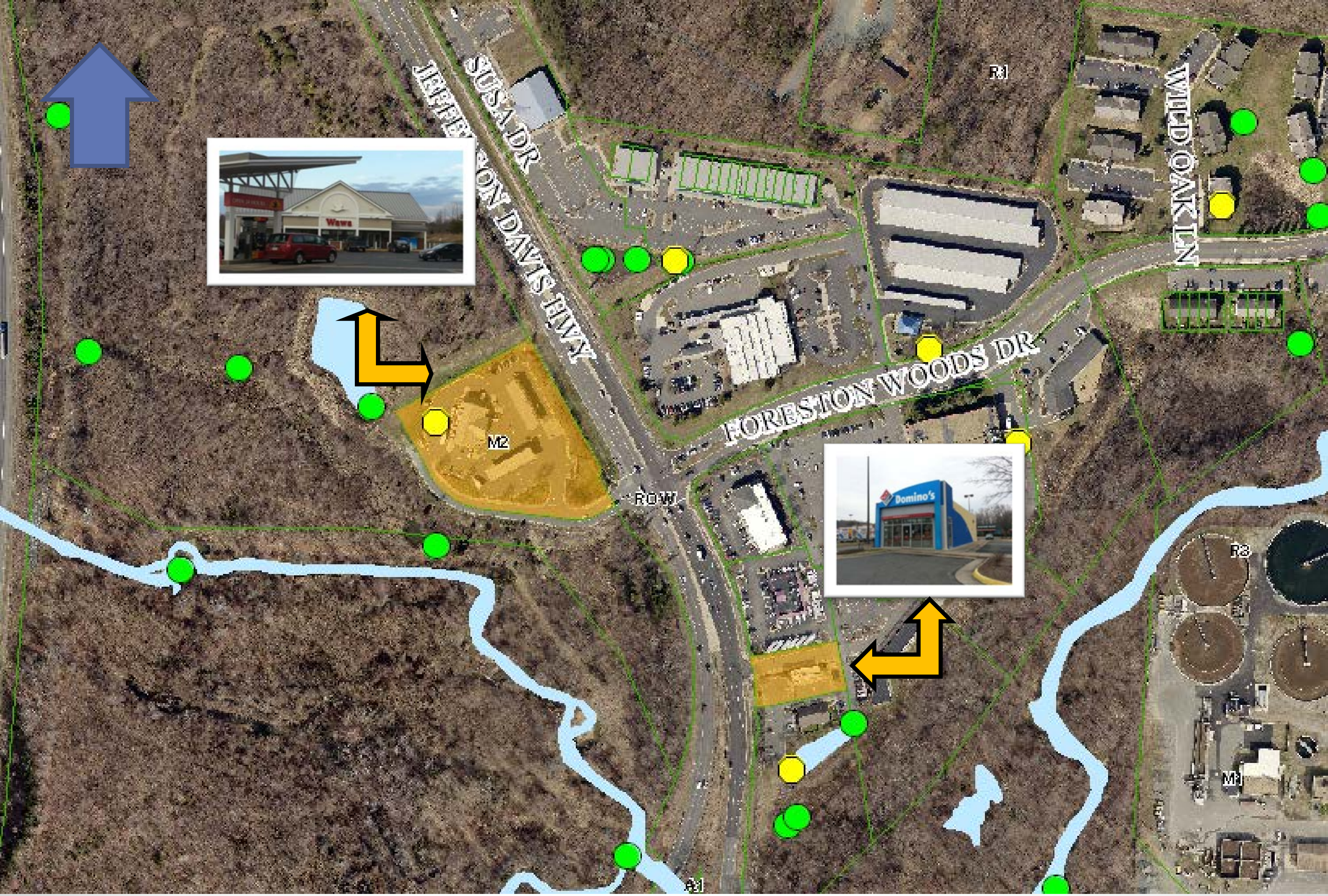
Aerial Photo: Intersection of Jefferson Davis Highway & Foreston Woods Drive.
Austin Run (VA Impaired Water) from west-to-east



GIS layer (ZONING DISTRICT) added:
R1 & R3 – Residential; B2 – Commercial; M1 &M2 – Industrial



GIS layer (OUTFALLS & BMP) added:
Green Dot – Outfalls (ACoE); Yellow Dot (BMPs)

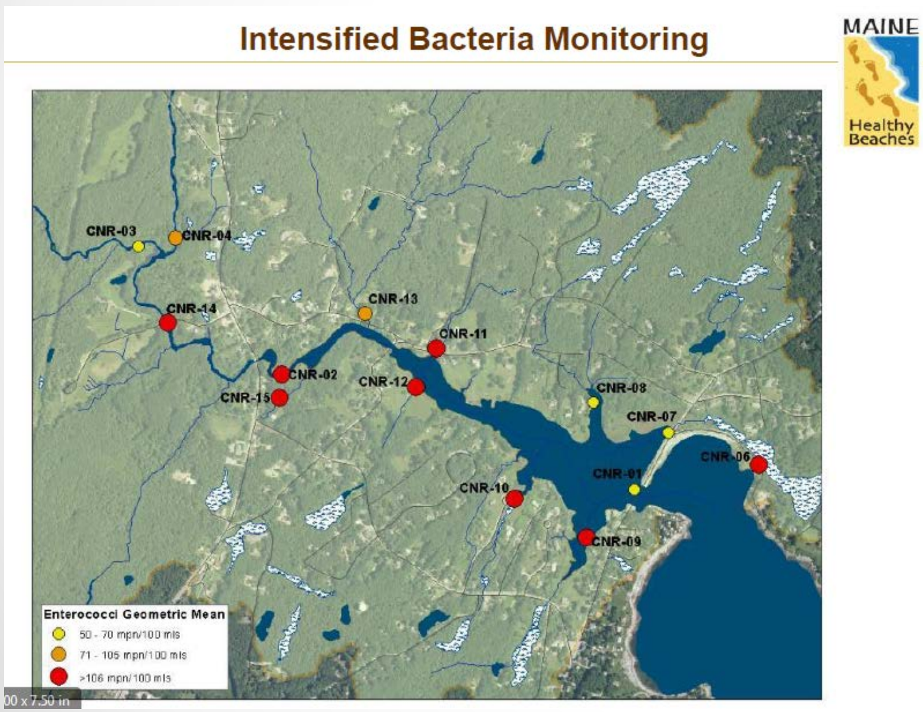


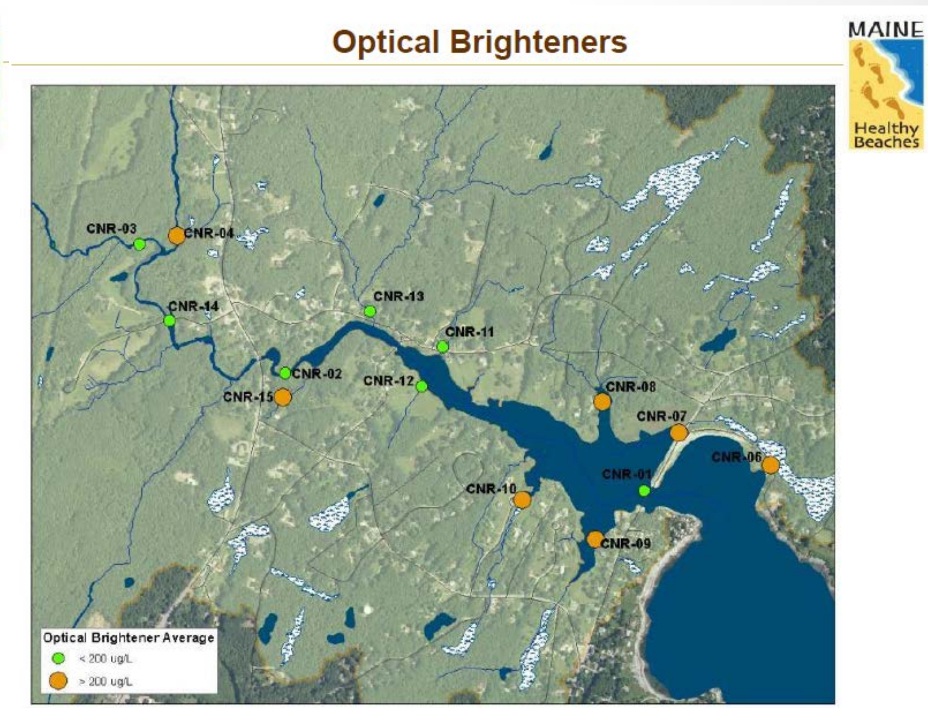
Aerial Photo: GIS layer (HOTSPOT) added

Aerial Photo: Only include OUTFALLS within 500 ft.

Prioritization

Courtesy: Keri Lindberg, Maine Healthy Beaches





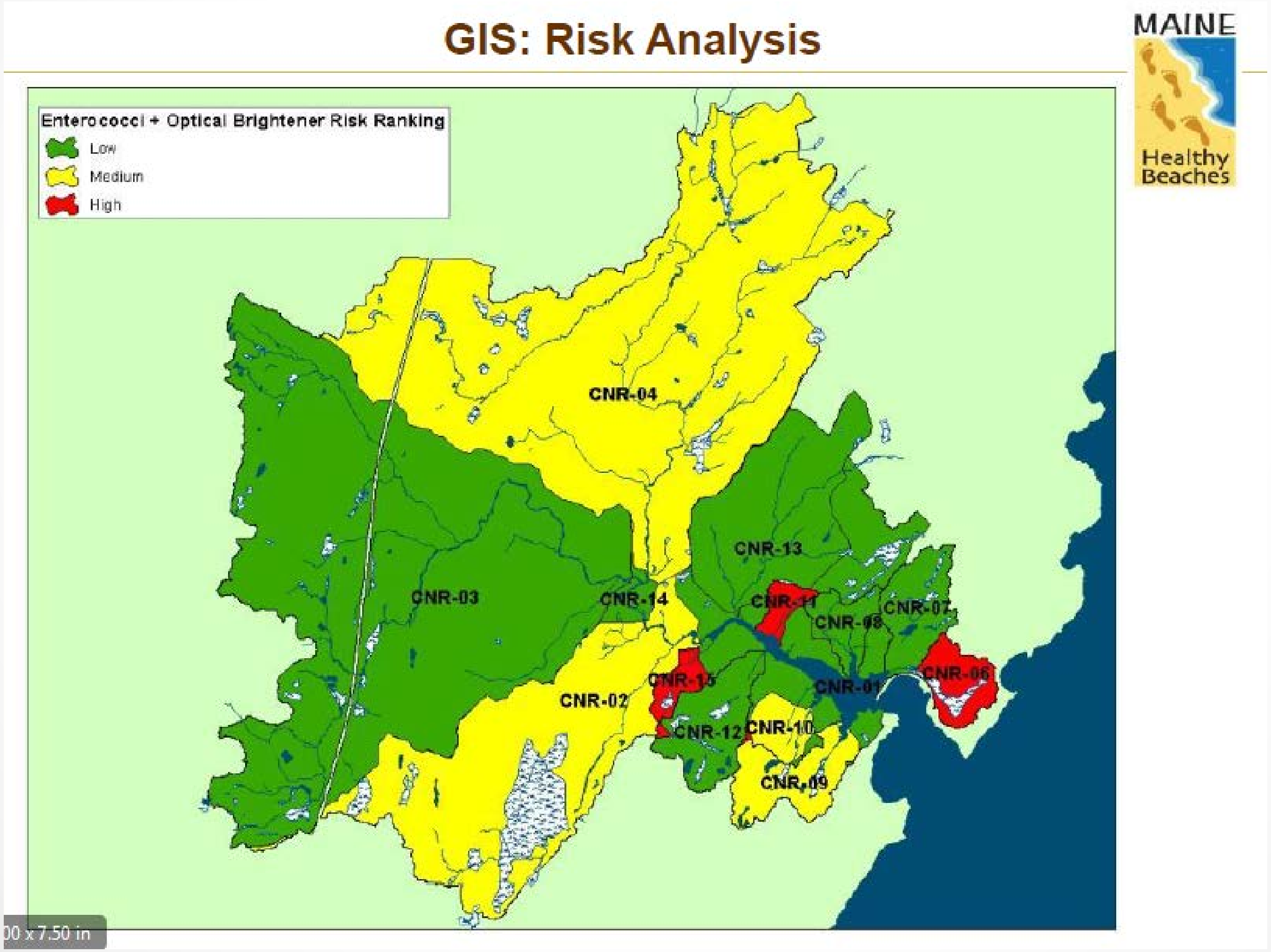
Prioritization

Courtesy: Keri Lindberg, Maine Healthy Beaches

	High Bacteria	Low Bacteria
High Optical Brightener	Black water (e.g. human sources- malfunctioning septic system, sanitary sewer cross connection)	Grey or Gray water (e.g. laundry, wash water)
Low Optical Brightener	Human or non-human sources	Potentially low or no fecal contamination

Prioritization

Courtesy: Keri Lindberg, Maine Healthy Beaches



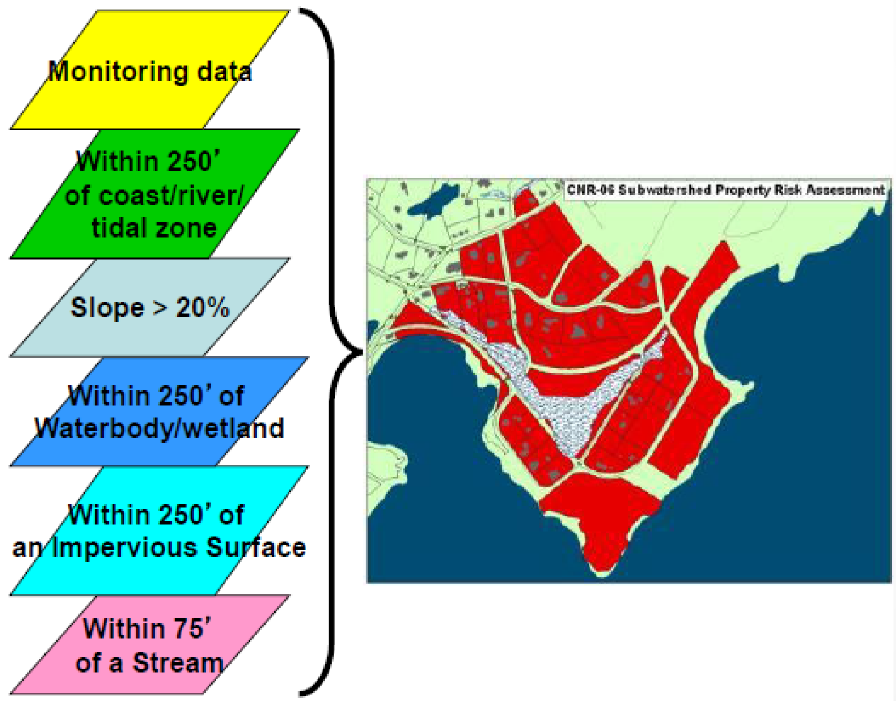
Prioritization

Courtesy: Keri Lindberg, Maine Healthy Beaches

GIS: Risk Analysis

MAINE Healthy Beaches

- Transforming data to usable information
- Priority areas to survey for malfunctioning septic systems
- Multiple towns & agency partners share data & remediation strategies



Desktop Assessment Benefits

- GIS or other database system to track outfalls
- Understand severity of IDDE problems
- Creating basic mapping for IDDE field work
- Prioritize field efforts to find and fix illicit discharges

Q/A

Hampton Roads IDDE Workshop

Indicator Methods

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Visual Indicators of Pollution at Outfall Pipes

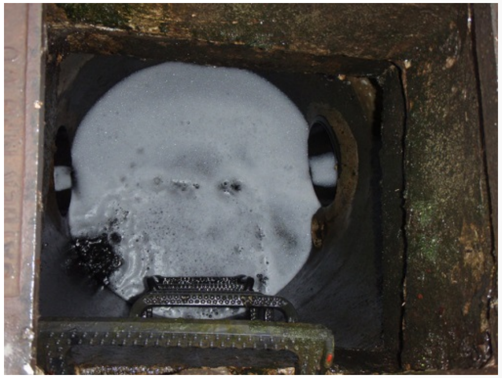
Outfall Damage

Deposits/Stains

Abnormal Vegetation

Poor Pool Quality

Pipe Benthic Growth



Indicators

Source	Indicator
Wastewater	Gray, sewage odor, sewage fungus, floatables
Washwater	Suds, detergent or sweet smell
Sediment	Orange/brown color
Tap water	Chlorine smell (maybe)
Paint	Color, turbidity
Concrete washout	Turbidity
Industrial	Color, odors

Foam

"Natural" foam

- Formed when organic matter decomposes
- Can be caused by turbulence (e.g. Waterfalls)
- Does not "last"
- Brownish / tannish edges

"Un-natural" Foam

- Has "staying" power
- Whiter
- May have an odor

Jury is out – a water sample is needed for a definitive answer

Iron Floc

- Normally a naturally occurring phenomenon resulting from iron bacteria growth.
- These harmless bacteria "bloom" when oxygen, water and iron combine. The bacteria are typically rust-colored and appear oily.
- Generally associated with acidic soils.
- May be especially evident after heavy rains, when iron leaches from the soil.

Sheens

- Sheens can occur from naturally occurring bacteria – these break into pieces when touched with a stick or other object
- Petroleum-based sheens break apart and then come back together when disturbed

Synthetic oil forms a swirling pattern.

Chemical Indicator monitoring

- Purpose:
  - Identify problem outfalls not apparent from physical indicators / visual assessments alone
  - Verify suspect or problem outfalls for confirmation of the presence of an illicit discharge
  - Determine potential flow type
  - Provide more information on intermittent discharges

Indicators to Identify Sources of Contamination

Ideal indicator to identify major flow sources has the following characteristics:

- Significant difference in concentrations between possible pollutant sources;
- Small variations in concentrations within each likely pollutant source category;
- Conservative behavior (i.e., no significant concentration change due to physical, chemical or biological processes);
- Ease of measurement with adequate detection limits, good sensitivity and repeatability.

Simple and Inexpensive Analytical Methods

- Can be used in the field, but usually much easier, safer, and more efficient in lab
- Comparative colorimetric methods (apparent color, detergents after extraction)
- Simple probes (pH, conductivity, ion selective potassium)
- Spectrophotometric (fluoride, ammonia, boron)

Equipment Considerations

- Accuracy (proximity to true value)
- Precision (repeatability or reproducibility)
- Range (min and max)
- Single parameter vs multi-parameter
- Waste
- Portability
- Safety
- Cost – up-front, per sample, standards/buffer solutions/sterile dilution bottles, carrying cases

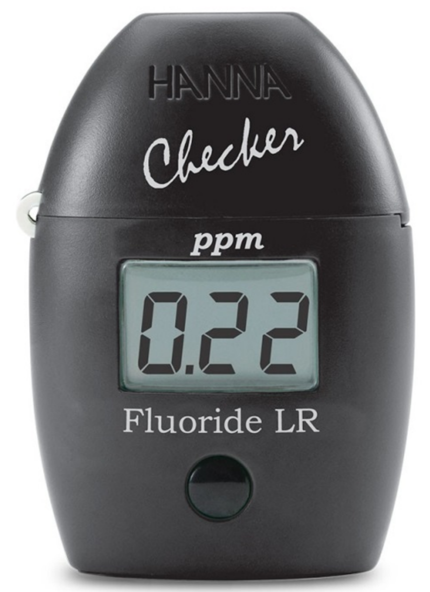

HACH


CHEMets® REFILL
DETERGENTS
K-9400
CHEMets® KIT
DETERGENTS
K-9400
ATTENTION

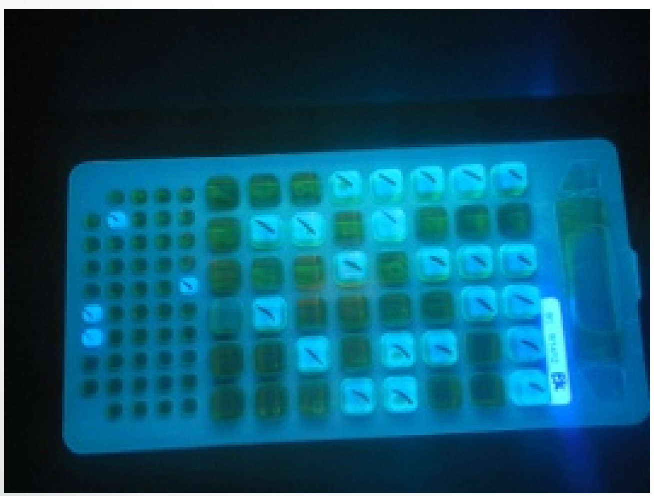

EcoSense pH100A
7.00
22.9
Mode

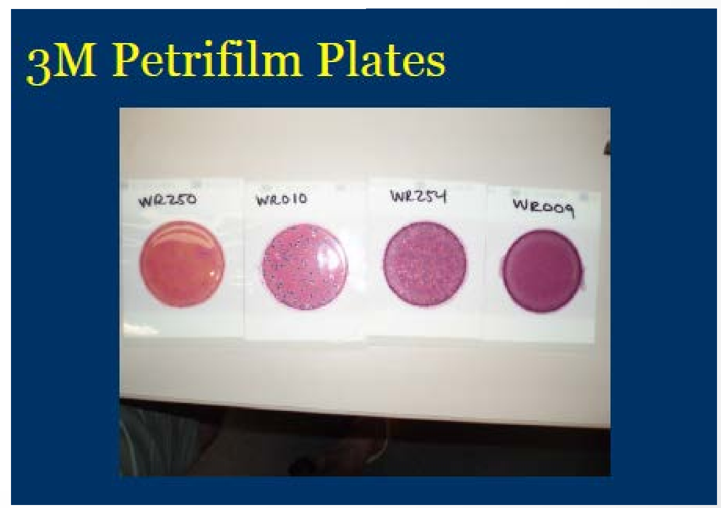

EcoSense pH10A
09-18-04 12:45
M12 7.00 pH
25.0°C
SCROLL: SELECT
NEXT SET DATA
Cal


HORIBA
K+
PURE
K+
20
K+
15

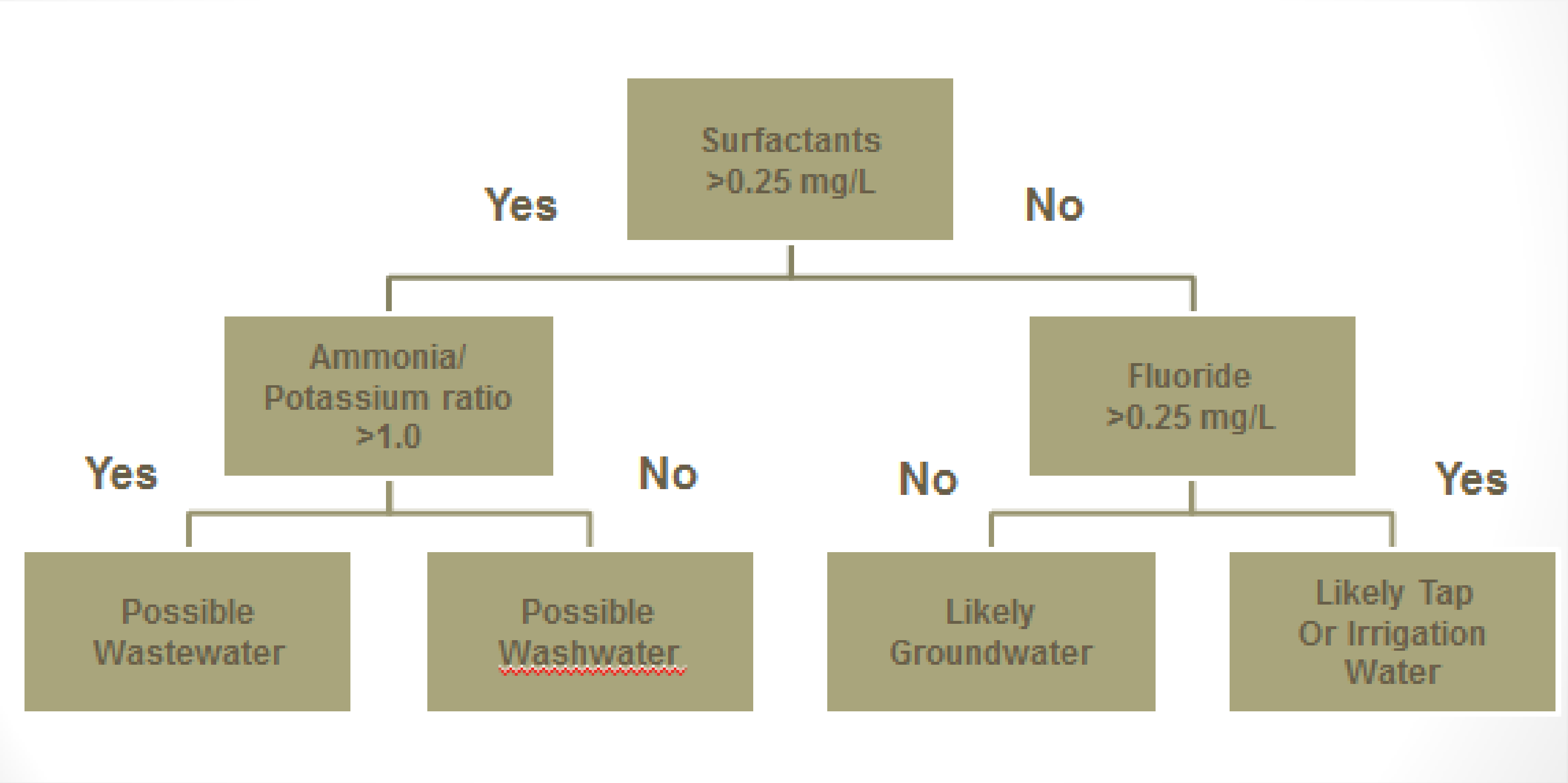

HANNA
Checker
ppm
0.22
Fluoride LR


HANNA
1.00
HI 96729

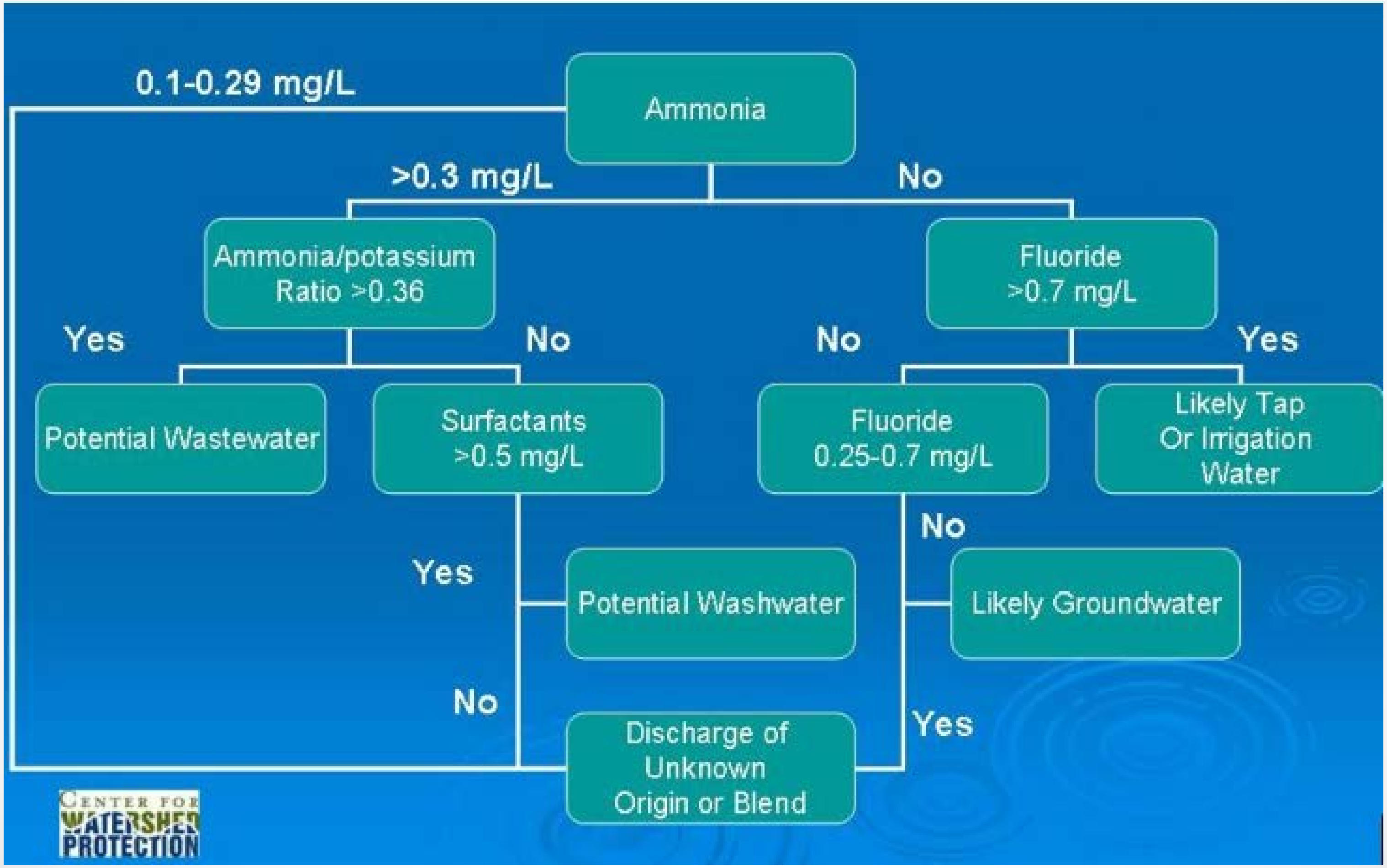



3M Petrifilm Plates
WR250
WR010
WR254
WR009

IDDE Flow Chart (Brown et al, 2004)



Flow Chart Should Modified for Your Community



Single Parameter Screening

- Detergents
  - Best single parameter to detect illicit discharge
  - Analysis best conducted in controlled lab setting
- Ammonia
  - Concentrations >1mg/L is positive indicator of sewage
  - Analysis in field using portable spectrophotometer or colorimeter

Industrial Indicators

Benchmark	Concentration	Notes
Ammonia (mg/L)	≥50	▪ Existing "Flow Chart" Parameter ▪ Concentrations higher than the benchmark can identify a few industrial discharges
Potassium (mg/L)	≥ 20	▪ Existing "Flow Chart" Parameter ▪ Excellent indicator of a broad range of industrial discharges
Color (Units)	≥ 500	▪ Supplemental parameter that identifies a few specific industrial discharges
Conductivity (μS/cm)	≥ 2,000	▪ Identifies a few industrial discharges ▪ May be useful to distinguish between industrial sources
Hardness (mg/L as $CaCO_3$)	≤10 ≥ 2,000	▪ Identifies a few industrial discharges ▪ May be useful to distinguish between industrial sources
pH (Units)	≤ 5	▪ Only captures a few industrial discharges ▪ High pH values may also indicate an industrial discharge but residential wash waters can have a high pH as well
Turbidity (NTU)	≥ 1,000	▪ Supplemental parameter that identifies a few specific industrial discharges

Chemical Fingerprint Library

- Shallow Groundwater
- Spring Water
- Tap water
- Irrigation
- Sewage
- Septic Tank Discharge
- Common Industrial Discharges
- Commercial Car Wash
- Commercial Laundry

Richmond Chemical Fingerprint Library

Sampling Location	Fluoride	Total Coliform P/A- Colilert	Conductivity	Anionic detergents	Ammonia	Total nitrogen	Total phos
Commercial Car Wash							
First Collection Date	10/31/2002		10/31/2002	10/31/2002	10/31/2002	3/29/2016	6/:
Mean	4.626		375.680	75.640	0.948	9.797	
Weighted Mean	1.863		379.821	39.636	1.169	9.797	
Std Dev	5.711		137.502	54.444	1.909	9.322	
COV	32.619		18,906.727	2,964.197	3.643	86.908	
Commercial Laundry							
First Collection Date	1/1/2003		1/1/2003	1/1/2003	1/1/2003	3/29/2016	3/:
Mean	23.878		554.615	22.723	0.958	11.247	
Weighted Mean	8.255		591.750	13.325	1.047	11.247	
Std Dev	18.837		257.993	10.580	0.409	7.129	
COV	354.818		66,560.423	111.945	0.167	50.823	
Drinking Water							
First Collection Date	5/17/2002	7/4/2016	5/17/2002	5/17/2002	5/17/2002	7/4/2016	7,
Mean	0.695	31.000	144.769	0.008	0.056	1.100	
Weighted Mean	0.691	31.000	149.286	0.014	0.088	1.100	
Std Dev	0.076		20.985	0.021	0.139		
COV	0.006		440.359	0.000	0.019		
Ground Water							
First Collection Date	9/30/2002		9/30/2002	9/30/2002	9/30/2002	4/7/2016	4,
Mean	0.097		158.467	0.019	0.053	8.067	
Weighted Mean	0.075		164.444	0.031	0.051	8.067	

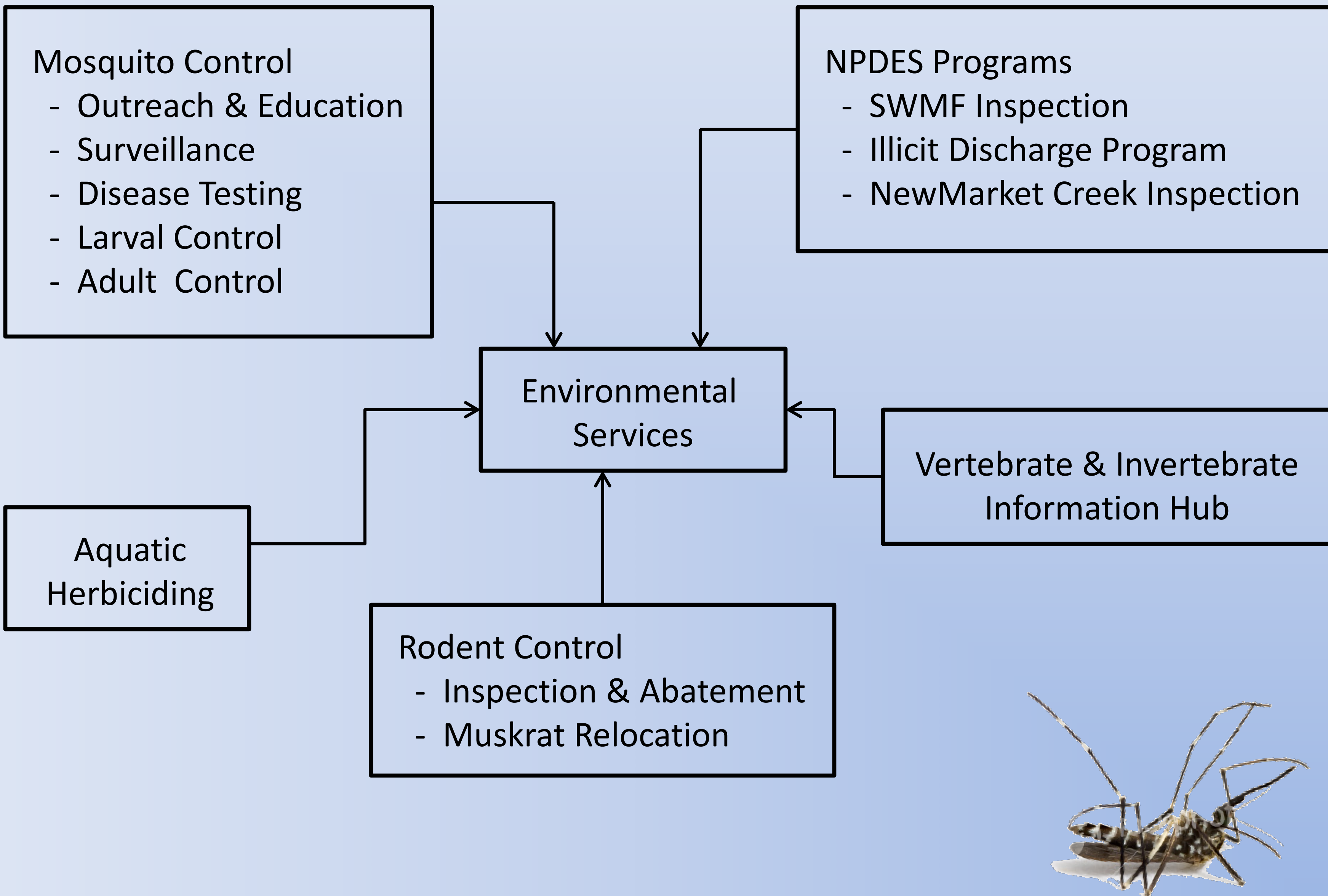
Q/A

HAMPTON

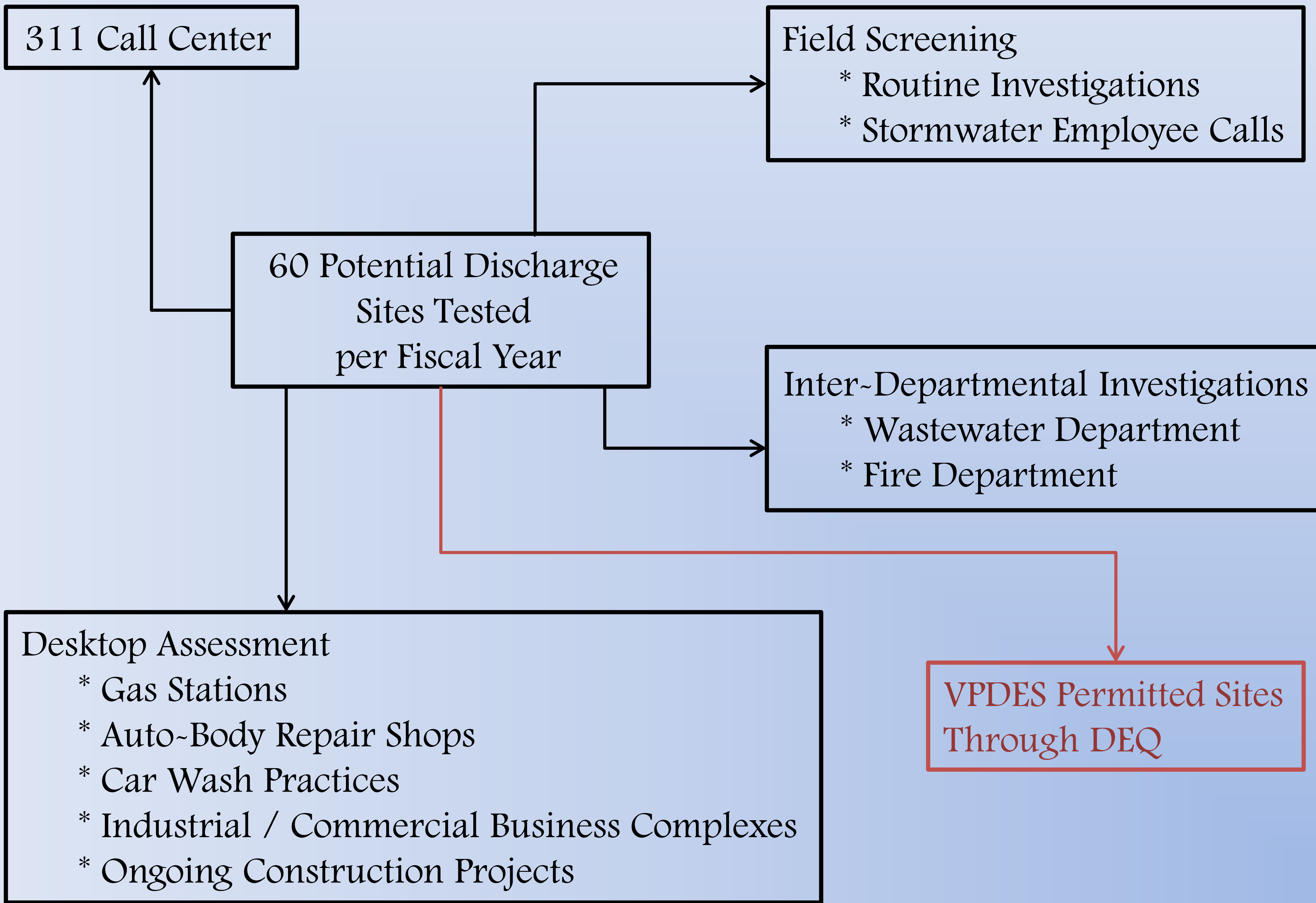
ENVIRONMENTAL SERVICES

Illicit Discharge Detection & Elimination

Tracking and Enforcement Procedures


Mosquito Control
- Outreach & Education
- Surveillance
- Disease Testing
- Larval Control
- Adult Control
NPDES Programs
- SWMF Inspection
- Illicit Discharge Program
- NewMarket Creek Inspection
Environmental Services
Vertebrate & Invertebrate Information Hub
Aquatic Herbiciding
Rodent Control
- Inspection & Abatement
- Muskrat Relocation

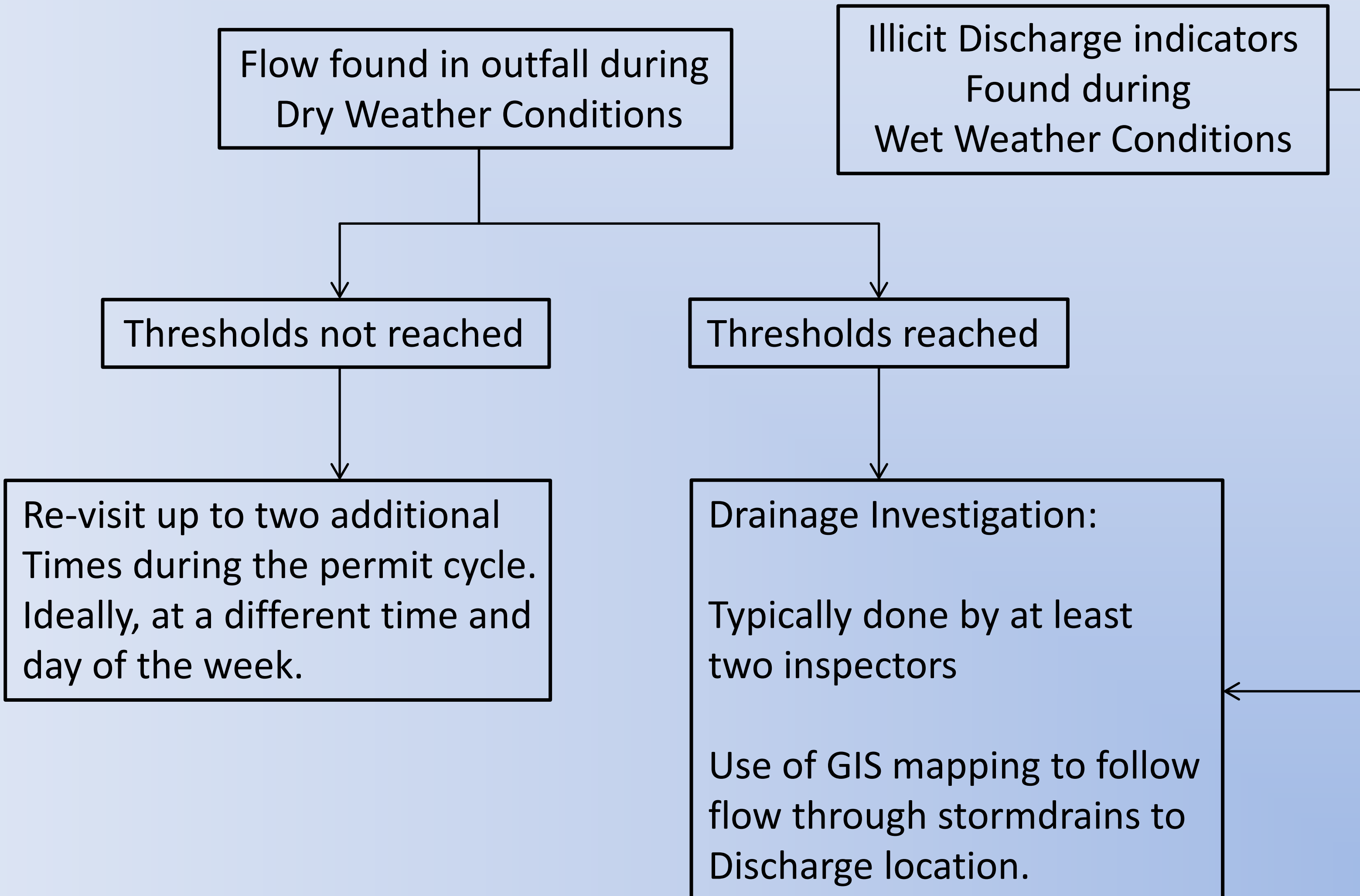
Illicit Discharge Detection & Elimination



Testing Procedures

- Use of Photometer 9500
  - Ammonia
  - Bromine
  - Chlorine LR
  - Copper
  - Phosphate LR
  - Phenols
- Detergents
- pH and Temperature Meter
- Refractometer
- E. Coli

Tracking Procedures



Enforcement Procedures

- Introduction and Purpose of Visit
- Compliance is main goal
- Paperwork is given explaining violation
- Meet with Stormwater and Legal Team to discuss if fines are to be given.
- Notice of Violation letter sent via Certified Mail to formally address violation and/or levy fines.

Example #1

02.25.2014 14:42
02.25.2014 14:34
W Queen St
W Queen St
415
Azalea Dr
Dillingham Ct
Hawkstone Cove
Hampshire Glen Pkwy
Kilverstone Way
Hampshire Glen Pkwy
Hampshire Glen Pkwy
351
02.25.2014 15:04

Example #2

Example #3

Key Notes to Enforcement

- Keep data at all times
  - Photographs
    (Date and Time Stamps)
  - Paperwork, Business Cards, Contacts
  - Certified Letters
- Communication
  - Operations Team
    (Inspectors & Management)
  - Legal Team
  - Other Departments
  - Property or Business Owner


Thank You

Hampton Roads IDDE Workshop Overview of Expert Panel Protocols

CENTER FOR WATERSHED PROTECTION

June 13, 2016

HRPDC

Lori A Lilly Environmental Solutions

Presentation Credit

Chesapeake Stormwater Network

http://chesapeakestormwater.net/events/nutrient-discharges-from-grey-infrastructure/

Expert Panel

Timeline

- Began in Summer 2012
- Deliberated for two years
- Findings released June 2014
- Final approval by EPA/Bay Program 11/10/2014

Expert Panel Roster

EXPERT BMP REVIEW PANEL Grey Infrastructure Upgrades	
Panelist	***Affiliation***
Panel Chair: Jenny Tribo	Hampton Roads Planning District Commission
Megan Brosh	Baltimore County Department of Environmental Protection and Sustainability
Barbara Brumbaugh	City of Chesapeake, VA
Diana Handy	Arlington County Department of Environmental Services
Mark Hoskins	Dewberry, VA
Whitney Katchmark	Hampton Roads Planning District Commission
Lori Lilly	Independent Consultant
Bob Pitt	University of Alabama
Tanya Spano	Metropolitan Washington Council of Governments
Kevin Utt	City of Fredericksburg, VA
Marianne Walch	Delaware Department of Transportation
June Whitehurst	City of Norfolk, VA
Special thanks to Bill Stack, Center for Watershed Protection	

Nutrient Discharges

- Refers to the complex range of non-stormwater flows that deliver nutrients into receiving waters during dry and wet weather – cause by spills leaks, and overflows
- Created by pollutant generating activties / sources
- Associated with grey infrastructure
- Transported by stormwater runoff and groundwater migration

Discovered Nutrient Discharges from Grey Infrastructure

Schueler et al (2014)

- 20-40% of dry weather loading
- 1-2% of wet weather loading
- Option1 Credit for Advanced Nutrient Discovery programs – NO LONGER AN OPTION
- Option 2 Credit for Elimination of Individual Nutrient Discharges (IND; beginning in 2016)

Discovered Nutrient Discharges from Grey Infrastructure

Discovered versus Reported NDs

- **Discovered Nutrient Discharge:** An existing nutrient discharge that is found through systematic assessment of a catchment, sewershed or stream corridor by the designated MS4 permit agency or local sewer utility, using the screening, tracing and analysis methods described in this report. Nutrient discharges that are discovered using these methods may be eligible for a credit if they lead to the prevention or elimination of the discharge.

- **Reported Nutrient Discharge**: Unexpected discharges from pipe breaks, spills, leaks and overflows that are reported to the local authority 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 that is easily observed. Reported nutrient discharges are generally NOT eligible for nutrient reduction credits.

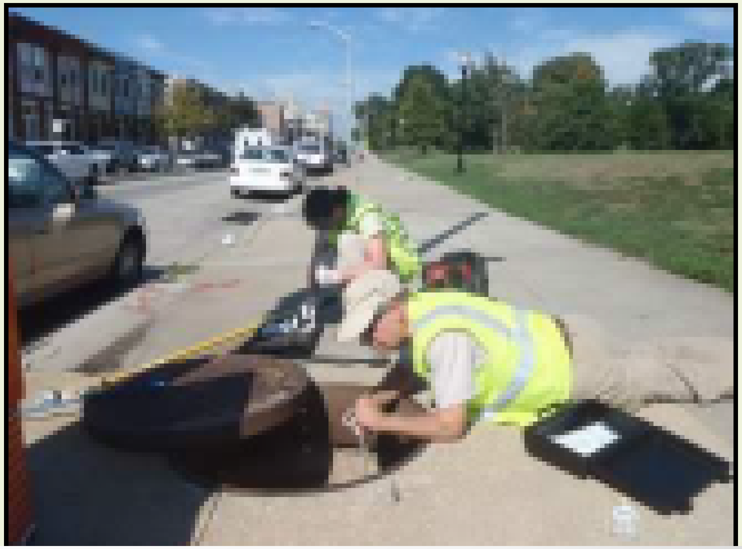
Discovered Nutrient Discharge

Reported Nutrient Discharge

Photo credit: The Washington Post

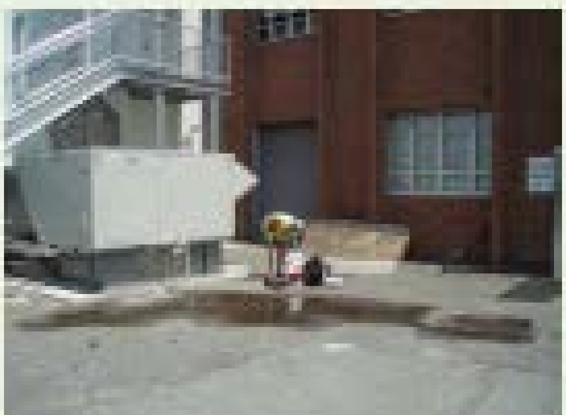
Discharge Detectives

- Need to use nutrient-based indicators during routine outfall screening
- Once a discharge is found, other discovery methods are needed to track it back to its source





Crediting for Individual Discharges



8 Individual Nutrient Discharges Credited

No.	Discharge Type
N-1	Laundry Wash Water
N-2	Commercial Car Wash
N-3	Floor Drains
N-4	Misc. High Nutrient Discharges
N-5	Sanitary Direct Connection
N-6	Sewer Pipe Exfiltration
N-7	Drinking Water Transmission Loss
N-8	Dry Weather Sanitary Sewer Overflows

Non-Eligible Nutrient Discharges

- Unexpected nutrient discharges from pipe breaks, spills, leaks and overflows that are reported to the local authority by the public or first responders and require immediate emergency repairs to stop the discharge.
- Residential car washing
- Transitory illicit discharges associated with power-washing, dumpster juice, transport accidents, and illegal sewage disposal by boats and RVs.
- Wet Weather Sanitary Sewer Overflows
- Catastrophic wet weather sanitary sewer overflows that exceed the sewer design capacity
- Combined Sewer Overflows *
- Septic field discharges caused by system failure *

The Crediting Approach

The guiding principle is that elimination of a discovered nutrient discharge could only be considered as a urban BMP, if they:

- Are detected and physically eliminated
- On-site sampling of the discharge that has been eliminated to define one or more of the following parameters -- nutrient concentration, flow rate and duration
- Subsequent inspections and/or monitoring verify or otherwise confirm that discharge no longer exists

Summary of the 3 Protocols to Estimate Nutrient Reduction Credits

The Panel defined three protocols to determine conservative and verifiable nutrient reduction. In this context the term "protocol" refers to the method used to define and verify the load reduction credit associated with finding and fixing an individual nutrient discharge, as follows:

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 FOG pretreatment or infrastructure upgrades

Empirical Approach to Crediting

Table 5
Data Requirements to Compute Reduction Credits

No.	Discharge Type	Method	Nutrients	Flow Volume	Flow Duration
N-1	Laundry Wash Water	1	S or D	E or M	E
N-2	Commercial Car Wash	1	S	E or M	E
N-3	Floor Drains	1	S	E or M	E
N-4	Misc. High Nutrient Discharges	1	S	E or M	E
N-5	Sanitary Direct Connection	1	S or D	E or M	E
N-6	Sewer Pipe Exfiltration	2	S or D	M	E
N-7	Drinking Water Transmission Loss	2	S or D	M	E
N-8	Dry Weather SSOs	3	S or D	E	M

KEY: S= SAMPLE, D=Use DEFAULT VALUE, E=ESTIMATE, M= MEASURE

Default Values

Table 1 Default Nutrient Concentrations Associated Different Discharge Types				
ND	Name	TN (mg/L)	TP (mg/L)	Notes/Sources
N-1	Laundry	3.2	0*	Brown, 2004, Appendix E
N-2	Car Wash	0.9	0.1	Brown, 2004, Appendix E
N-3	Floor Drain	4.9	--	Requires sampling
N-4	Misc. Discharge	N/A	N/A	Requires sampling
N-5	Sanitary Direct	33.0	6.0	EPA, 2004
N-6	Sewage Exfiltration	33	6.0	Subject to Discount
N-7	DW transmission	1.7	0.3	Or From DW CCR's and Subject to Discount
N-8	Dry Weather SSO	33	6.0	EPA, 2004

* assumed to be zero as to reflect P ban in laundry detergent (Litke, 1999).

N-1: Laundry Washwater

Definition: Washwater flows that result in the discharge of washwater into the storm drain system. It may involve a residential situation or a commercial laundry operation.

DISCHARGE CHARACTERISTICS

- Intermittent discharge
- Enters stream directly through straight pipe
- Multiple Methods of Discovery
- Regulated by MS4 Permit
- Pipe reconnection to eliminate discharge
- Protocol 1 used to calculate credit
- Requires measurement or estimation of flow rate
- Verification involves inspection confirming the reconnection

N-2: Commercial Car Wash

Definition: Washing of vehicles that results in the discharge of washwater into the storm drains system. It may involve a commercial car wash operation (fixed or mobile).

DISCHARGE CHARACTERISTICS

- Intermittent
- Multiple Methods of Discovery
- Regulated by MS4 Permit
- Pipe reconnection to eliminate discharge
- Protocol 1 used to calculate credit
- Requires measurement of nutrient concentration and estimation of flow rate and duration
- Verification includes: Confirmation inspection after reconnection AND confirmation screening during business hours

N-3: Floor Drains

Definition: Floor or foundation drains illegally connected to the storm drain system.

DISCHARGE CHARACTERISTICS

- Intermittent
- Multiple Methods of Discovery
- Regulated by MS4 Permit
- Pipe reconnection to eliminate discharge
- Protocol 1 used to calculate credit
- Requires measurement of nutrient concentration and estimation of flow rate and duration
- Verification includes inspection confirming reconnection

N-4: Misc. High Nutrient Discharges

Definition: This discharge category applies to other non-sanitary, high-nutrient discharges that are discovered during nutrient-based outfall screening. The most common so far has been nutrient-associated cleaning agents used to keep outdoor HVAC systems healthy. If other such discharges are discovered, then direct monitoring is required to establish the credit.

DISCHARGE CHARACTERISTICS

- Intermittent
- Indirect Entry through an inlet
- Methods of Discovery:
  - Nutrient source sampling
  - Rooftop inspection
- Pollution Prevention to eliminate discharge
- Protocol 1 used to calculate credit
- Requires nutrient concentration measurement and estimation of flow rate
- Verification methods are discharge dependent:

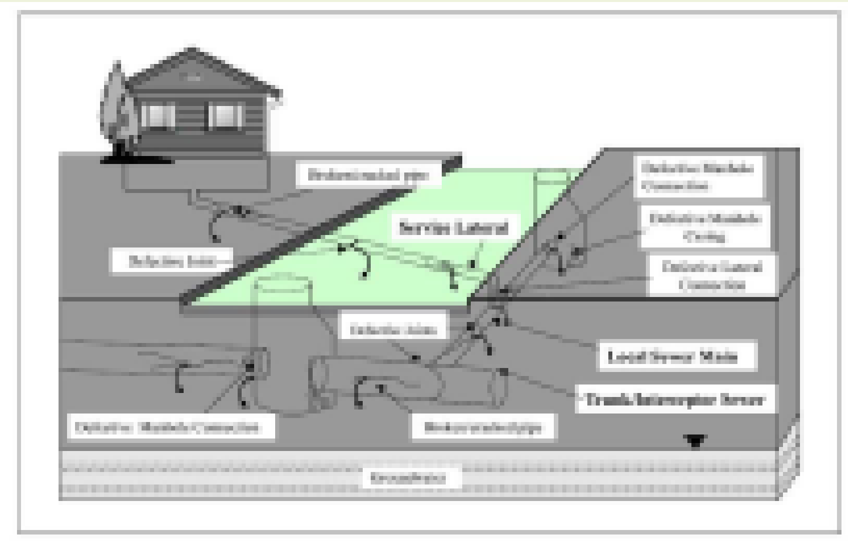
N-5: Sanitary Direct

Definition: A sewer pipe that is improperly connected to the storm drain system either through a cross-connection or from a straight pipe. This discharge category produces a continuous discharge of raw sewage into the storm sewer system or directly to a stream.

DISCHARGE CHARACTERISTICS

- Continuous
- Direct Entry to storm sewer or stream
- Multiple Methods of Detection
- Regulated by MS4 Permit and/or WW permit
- Pipe reconnection to eliminate discharge
- Protocol 1 used to calculate credit
- Requires measurement of nutrient concentration
- Verification includes: Confirmation inspection after reconnection AND Outfall screening once a year for at least 3 years

N-6: Sewer pipe Exfiltration



Definition: Loss of sewage from sanitary sewer pipes during dry weather through the groundwater matrix to the storm drain system as a result of cracks or leaks in sewer pipes.

DISCHARGE CHARACTERISTICS

- Continuous or Intermittent
- Multiple Methods of Detection
- Regulated by NPDES WW permit
- Multiple Elimination Methods:
  - Slip-lining of Pipes
  - Pipe Replacement
  - Manhole Sealing
- Protocol 2 used to calculate credit
- Requires 6 mos of before and after sewer metering to measure flow and estimate conc.

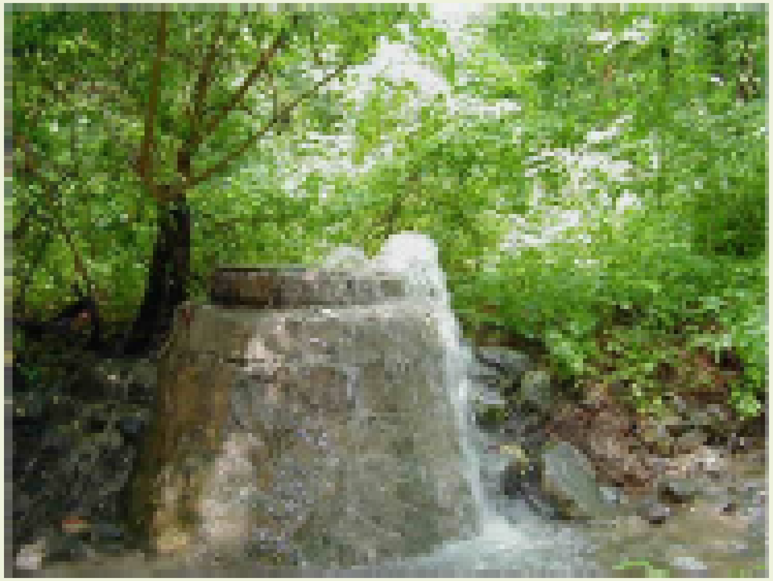
N-7: Drinking Water Transmission Loss

Definition: The loss of drinking water as it is delivered in pipes to the consumer that reaches the stream through storm drain pipes and/or groundwater migration.

DISCHARGE CHARACTERISTICS

- Continuous
- Regulated differently by each state
- Multiple Elimination Methods:
  - Slip-lining of Pipes
  - Pipe Replacement
  - Pipe upgrades
- Protocol 2 used to calculate credit
- Requires 6 mos of before and after sewer metering to measure flow
- Nutrient concentrations derived from CCRs
- Verification includes:
  - Flow monitoring at the site of repair and above and below the problem water line for one year

N-8: Dry Weather SSOs



Definition: A sanitary sewer overflow that occurs during dry weather periods as a function of either a blockage or failure of the sanitary sewer system.

DISCHARGE CHARACTERISTICS

- Transitory
- Regulated by NPDES WW permit
- Multiple Elimination Methods:
  - FOG Reduction Programs
  - Pretreatment Requirements
  - Sewer Realignment
  - Pipe Replacement
  - Manhole Casing
- Protocol 3 used to calculate credit
- 2 years of before and after tracking of the number and flow volume of overflows within the sewershed
- Verification includes:
  - See confirmation monitoring above

Individual Credit Reporting

- Type of discharge eliminated (e.g. N-1, N-2, etc)
- Total N and P load removed (lbs)
- Protocol used (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
- Year that discharge was eliminated

MS4 Recordkeeping

- Whether direct monitoring or default values were used for calculating the load reduction. If default values, report the values used in the calculations.
- The date that the nutrient discharge was detected and the date that it was eliminated.
- All monitoring data used to establish the concentration, including duplicate sample, analytical methods and QA/QC procedures.
- The method used to measure the flow rate, and at least three flow measurements collected before and after the discharge is eliminated.
- Defining the flow as either continuous or intermittent and if, intermittent, the technical assumptions used to determine the percentage of the year the flow occurred.
- The final load reduction calculations that were performed in pounds per year (lb/yr).
- Confirmation that the DND was eliminated

Q/A

Field Investigations & Safety

CENTER FOR WATERSHED PROTECTION

June 13, 2016

HRPDC

Lori A Lilly Environmental Solutions

"Dry Weather" Outfall Screening

- Looking at and testing flow from pipes, not in-stream
- At least 48 hours after precipitation (runoff-producing rain event)
- During period of low groundwater

Time of Year Considerations

Frozen flows

Safety

Road salt

Temperature effects on equipment

High groundwater table

Excess vegetation – hard to find outfalls

A/C condensate

Time of Year Considerations

- Vegetation died back
- Not too cold; good time for field work
- Road salt and groundwater influences at a minimum

If you find an illicit discharge:

- Take photos and notes
- Collect a sample – if safe
- Mark the outfall or manhole
- Try to track down source of discharge

Use a Field Form

OUTFALL RECONNAISSANCE INVENTORY/ SAMPLE COLLECTION FIELD SHEET

Section 1: Background Data

Subwatershed:		Outfall ID:	
Today's date:		Time (Military):	
Investigators:		Form completed by:	
Air 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 ☐ PVC ☐ Steel ☐ Other:	☐ CMP ☐ HDPE	☐ Circular ☐ Elliptical ☐ Box ☐ Other:	☐ Single ☐ Double ☐ Triple ☐ Other:	Diameter, circular: Dimensions, Box: h - w - Elliptical: h - w -	In Water: ☐ No ☐ Partially ☐ Fully With Sediment: ☐ No ☐ Partially ☐ Fully
☐ Open drainage	☐ Concrete ☐ Earthen ☐ rip-rap ☐ Other:		☐ Trapezoid ☐ Parabolic ☐ Other:		Depth: Top Width: Bottom Width:	
☐ In-Stream	Complete Stream Discharge form					
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	Stopwatch
☐ Flow #2	Flow depth	1. 2. 3. 4.	In	Tape measure
	Flow width	' "	Ft, In	Tape measure
	Measured length	' "	Ft, In	Tape measure
	Time of travel	1. 2. 3. 4.	S	Stop watch
Water Temperature			°F	Thermometer
Ammonia			mg/L	Ammonia photometer
Salinity		Dilution? %	ppm	Refractometer
Conductivity		Dilution? %	µs	Conductivity meter
pH			pH	pH meter
Potassium			ppm	Potassium ion meter
Fluoride			mg/L	Fluoride photometer
Detergents			ppm	Colorimeter

Center for Watershed Protection –revised 11/3/14

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. Sterile sample for bacteria analysis?	☐ Yes	☐ No
3. If yes, collected from:	☐ Flow	☐ Pool	4. Sample for optical brightener?	☐ Yes	☐ No
5. 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)?

Center for Watershed Protection –revised 11/3/14

Take Notes About:

- Specific location (GPS)
- Odor/smell
- Color
- Clarity/murkiness
- Floatables
- Anything you find about where it's coming from

Photo credit: Snohomish County, WA

Record Basic Characteristics

- Dimensions
- Material
- Vegetation
- Receiving channel conditions

Physical Indicators
(for flowing outfalls)

- Is there flow?
- Odor
- Color
- Transparency
- Floatables

Source: Fort Worth DEM

Other Information

- Outfall Damage
- Deposits/Stains
- Abnormal Vegetation
- Poor Pool Quality
- Pipe Benthic Growth







Quick and Dirty Outfall Inspection Exercise

Taking a Sample

- DO NOT take sample if discharge has strong smell or is hard to reach
- Only take sample if it seems safe
- Use sample bottle or bags that can seal well
- Wear gloves
- Avoid touching inside lip of container
- Record site id, date, location and sample collectors on bottle and on form
- Keep sample on ice if testing for bacteria

Holding Samples

Parameter	Holding Time	Notes
Bacteria	6 hours	Cool, 4ºC
Ammonia	Process immediately	Can preserve with sulfuric acid and hold for 28 days
Fluoride	28 days (HDPE plastic container only)	Cool, 4ºC
Anionic Surfactants	2 days	Cool, 4ºC
Potassium	6 months	Frozen
Total nitrogen / Total phosphorus	24 hours 30 days	Cool, 4ºC Frozen below -20ºC
pH	Process immediately	
Temperature	Process immediately	

Bags or Bottles?

Considerations: What parameter are you collecting for (bacteria - sterile, nutrients - autoclaved bottle)? Does the sample need to be frozen? Are you on foot or in a car?

- Don't break
- Need to be clean
- Bulky to carry around in backpacks
- Can re-use

- Sterile bottle

- Easy to carry when empty
- No prep needed
- Sterile
- Can leak if not closed properly

- Not true!

Partially submerged outfalls

- Mixing with stream water (dilution or masking of a potential problem)
- Collect from pool or move to an up-pipe manhole to collect a sample

Trickle Flows

- Can be difficult to collect samples
- Plumbers putty can be used to direct flow to a “spout”
- Use smaller volume containers for collecting flow measurement
- Concern for sterile samples

Sampling From Manhole

- Necessary when dealing with submerged outfalls or tracking illicit discharges
- Can be difficult to collect, esp. if just a trickle
- Concern is collecting flow measurement and sterile samples

Sampling From Bridge

Nasco sampler can fit with different size Whirlpack

Simple, Low-Cost Equipment

- **Comparative colorimetric methods** (apparent color, detergents)
- **Simple probes** (pH, conductivity)
- **Spectrophotometric** (fluoride, ammonia, potassium)
- **Refractometer** (salinity)

Bacteria Testing

Quanti-Tray
by IDEXX

Petrifilm plates
by 3M

Optical Brightener Traps

Optical brighteners are present in laundry washwater, intermittently present in wastewater

Optical Brightener Traps:

- Detects detergents that are *intermittently* present
- Anchor absorbent pads in storm drains (2-7 days)
- Dry & view under black light

Field vs. Lab Analysis

- Real time
- Can follow-up right away
- Waste disposal

- Controlled conditions (fewer mistakes)
- More accuracy
- Materials readily available

In-House vs. Outsourcing

Questions to ask:

- How quickly are sampling results needed?
- How much staff time and training is needed to support in-house analysis?
- Do you have a safe environment to analyze samples and dispose of waste?
  - Sinks, ventilation, eyewash station
- What is comparative cost for sample analysis in each option?
- Do you have access to space/resources in a lab in your community?
  - Wastewater treatment plant or drinking water lab

Field Safety

Do

- Wear waders, with good grip – streams can be slippery
- Wear rubber gloves when collecting samples
- Wear goggles when handling reagents
- Wear steel toed boots and use a pick (not your fingers) when pulling manholes
- Wear a safety vest
- Carry a flashlight, a cell phone and keep emergency numbers handy
- Use safety cones and an appropriate number of staff to safely work in the road
- Carry a (stocked and up-to-date) first aid kit

Field Safety

Don't

- Pull a manhole with your back toward the street
- Enter a manhole or outfall without confined space entry training
- Dispose of reagents or other chemicals in the stream
- Conduct any sampling if the discharge is very severe – call emergency services

Waste Disposal

- Ammonia waste – flush with cold water in sink
- Fluoride waste – flush with cold water in sink
- Bacteria plates – soak in bleach solution, put in trash

Lab Safety

Do

- Wear latex gloves when processing samples
- Wear goggles when handling reagents
- Wear closed-toe shoes and pull hair back
- Dispose of materials properly, according to MSDS sheets and local regulations
- Soak bacteria plates in bleach after counting
- Use a hood, if / when necessary – consult MSDS sheet
- Stay organized when running multiple tests – keep separate data sheets, stopwatches, etc.
- Store materials in appropriate containers when not in use
- Wash and dry all equipment when you are done

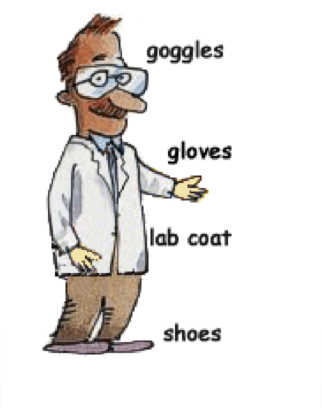
Lab Safety

Do

- Know where the eye wash station, fire extinguisher and other safety equipment are before beginning lab work
- Wash your hands before leaving the lab

Don't

- Wear loose hanging clothing
- Eat in the lab (esp. while conducting tests) – *ew!*



Source Tracking

Center for Watershed Protection

June 13, 2016

HRPDC

Lori A Lilly Environmental Solutions

Methods to Track Down Sources

Common Methods

- **Tracking Up Storm Drain Network**
- **Drainage Area Investigation**
- **Video Surveys**
- **Dye Testing**
- Smoke Testing

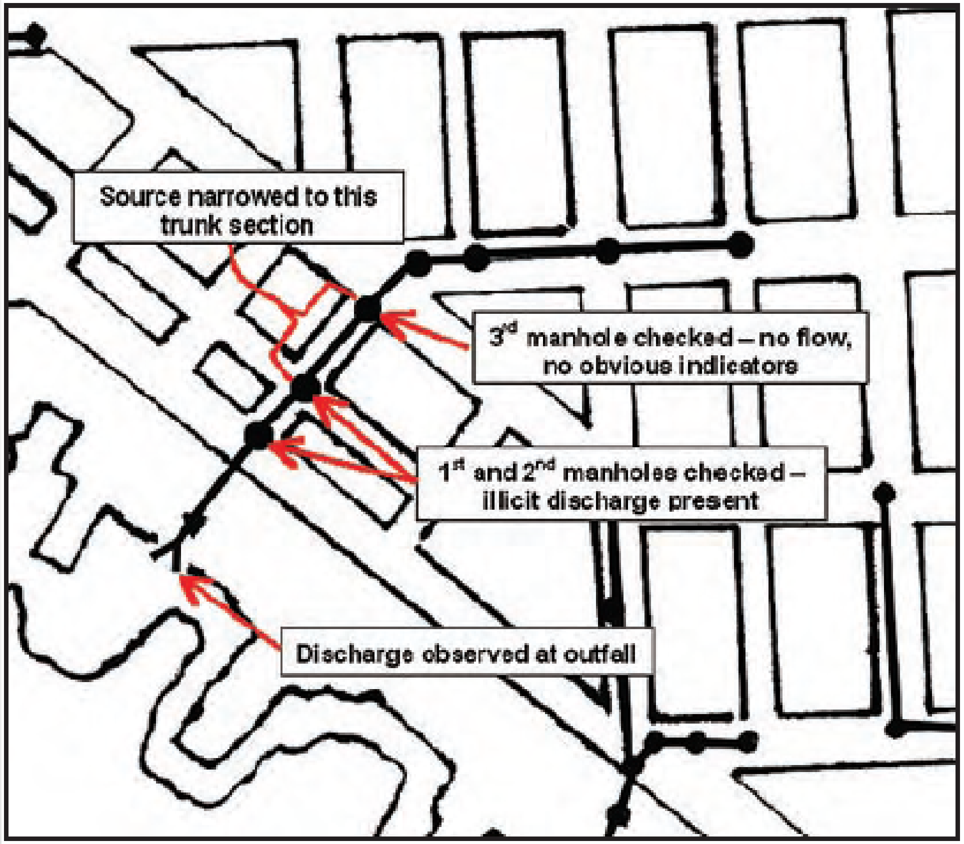
Other Methods

- **Trained Sewage Sniffing Dogs**
- Sewer pipe flow metering
- Continuous tracers in sewers

Track Up Storm Drain Network

- During dry weather only
- Isolate flow at manholes
- Look for physical indicators
- Sample in manholes & test for chemical indicators

Isolating Flow in Storm Drain

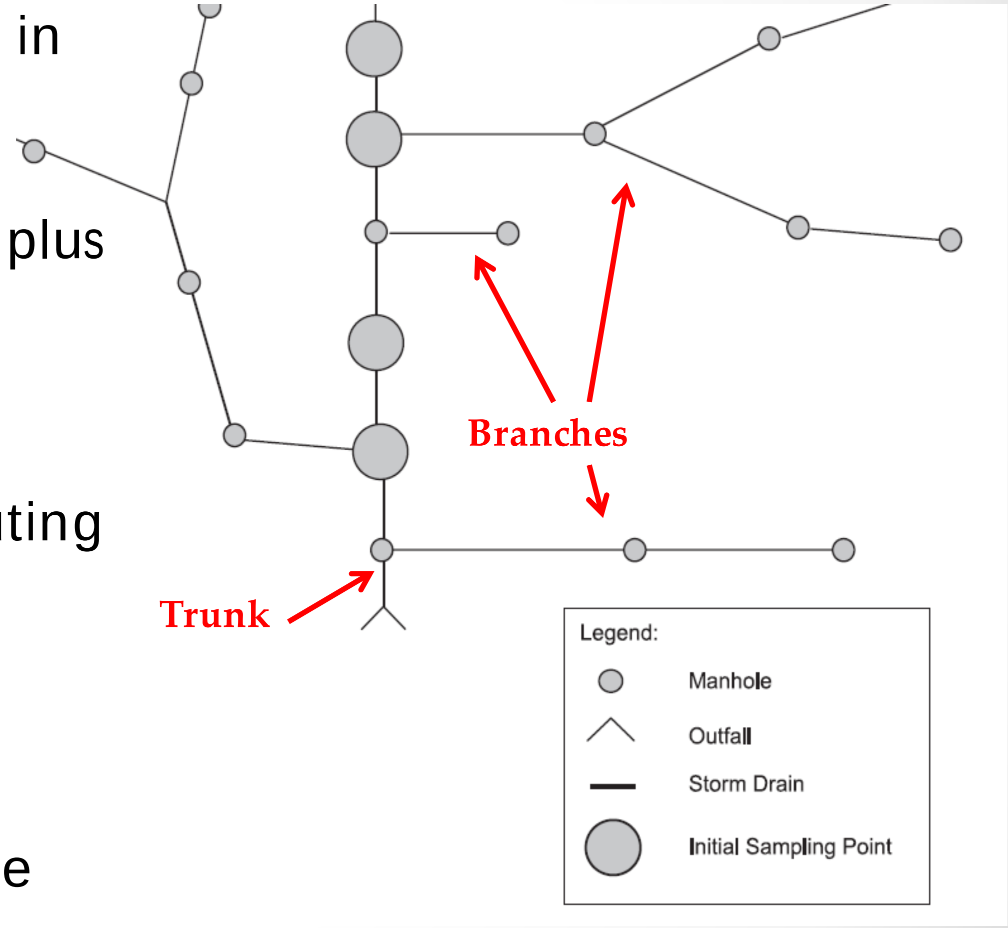


From Brown et al (2004)

- Start at outfall & move up pipe network
- **Goal:** Isolate flow to between 2 manholes

Splitting the Trunk

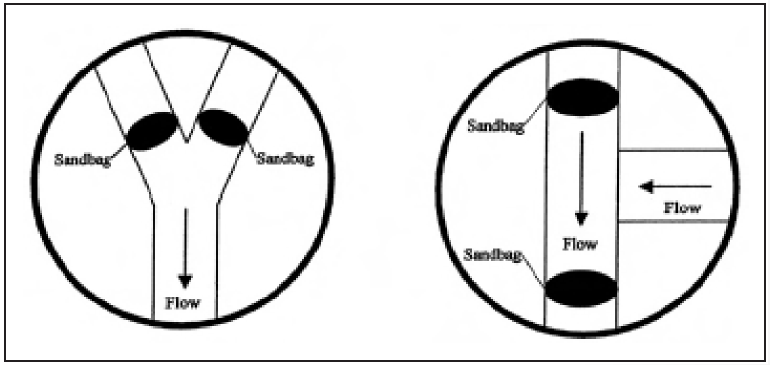
1. Identify major branches to the trunk (largest diameter pipe in the network)
2. Identify manholes where branches connect to trunk, plus one immediately upstream.
3. Working up the network, investigate
4. manholes on each contributing branch and trunk
5. Narrow the discharge to a specific section of trunk or contributing branch
6. Move up until a specific pipe segment is isolated



For Intermittent Flows

Catch the flow:

- Dam flow with sandbags (if not tidal)
- Install when no rain is predicted
- Leave in for 48 hours or less



(Source: Jewell, 2001)

Drainage Area Investigation

- Drive or walk around looking at potential discharge source sites
- Only works if flow is distinct (e.g., color, odor, or high indicator reading)
- Not very helpful for finding sewage leaks

Video Surveys

- Closed caption television (CCTV) – robot camera
- Use for sanitary sewer or storm pipes
- Live image to see cracks, leaks, breaks, and blockages
- Best for continuous discharges

Dye Testing

- Add to plumbing fixtures to see if/where dye comes into storm sewers (cross-connection)
- Use when discharge has been isolated to very small drainage area (<10 properties)
- Must gain access to private property; inform residents & agencies
- Requires extra staff to find dye

IDDE Canine Unit

ENVIRONMENTAL CANINE SERVICES LLC
Protecting Our Precious Resources with Nature's Gift
www.ecsk9s.com

- Dogs trained to detect smell of sewage (presence/absence)
- Outfall screening and tracking up storm drain network
- Faster than us humans
- Environmental Canine Services LLC (based in Maine)

Fixing

Key Elements of Success:

- Well defined legal authority
- Strong enforcement
- Follow-up measures

Four Questions:

- Who is responsible?
- Methods to fix?
- How long should it take?
- How is removal or correction confirmed?

Who is responsible?

The property owner or municipality/utility? ...

Generally, if illicit discharge from:

- Internal plumbing connection property owner
- Service lateral cross-connection ➔ property owner
- Infrastructure failure w/in sanitary sewer or MS4 ➔ municipality/utility
- Transitory discharge ➔ property owner

Methods to Fix?

- Varies depending on type and location.

Develop a pre-approved list of certified/licensed contractors.

Use in-house contractors/staff to repair as part of routine maintenance activities.

How long should it take?

Varies depending on type and location – though local ordinance may provide time frame for removing discharge and repairing.

Generally –

- If illicit discharge is significant health or environmental threat ➔ fix immediately
- After notification by municipality
  - ➔ Stop discharge w/in 7 days
  - ➔ Repair w/in 30 days

Q/A