# Stormwater Illicit Discharge Detection and Elimination



Todd Borci EPA Region 1

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Boston Harbor Cleanup – Since 2005, EPA enforcement of IDDE has resulted in excess of 205,000 gallons of sewage per day removed from stormwater outfalls (over 75 MG/year)



Investigations in the Boston Harbor watershed alone have resulted in 15 Administrative Orders and Four Consent Decrees that include IDDE since 2005 – this number will increase.

# **Illicit Discharges**



- Most often sanitary sewage entering a municipal stormwater system
- Either through aging infrastructure or incorrectly-plumbed connections
- A significant source of pollutants
- Sewer Problems (often) = Illicit Discharges
- Identify through a weight-of-evidence approach (EPA R1 uses bacteria, surfactants, ammonia, and selected pharmaceutical compounds)



### The "Raccoon Defense" . . .





The "Raccoon Defense" . . .



### An Attempt at a Solution . . .



#### **Forensic Methods**

Screening Methods

> Bacterial Water Quality

# Sample Collection Summary



- 335 sample sets collected at nearly 250 sites
- In excess of 3,650 laboratory samples
- In excess of 2,000 field kit analyses

80% of bacteria results did not meet Water Quality Standards

# Recommended Minimum Screening Tests





Bacteria test E. coli or

Enterococcus



Ammonia test strips



Chlorine (total) test kit

https://www3.epa.gov/region1/npdes/stormwater/ma/epa-ne-bacterial-source-tracking-protocol.pdf



Surfactant test kit

### Mill Brook - Arlington, MA





Site name: 91Mys

Site	Date	E.coli MPN	Surf mg/L	NH <sub>3</sub> mg/L	
91Mys*	6/2/09	>241,960	1.25	3	Dry
MillB*	6/2/09	550	0.2	ND	Dry



Site name: MillB





Target	Major Use	RL	Daily Dose
Compound		(ng/L)	(ng)
Caffeine	Natural Stimulant	5.0	200,000,000
1,7-DMX	Metabolite of caffeine	2.5	N/A
Acetaminophen	Pain Reliever	2.5	650,000,000
Carbamazepine	Anti- depressant / bi-polar Anti-convulsant (epilepsy)	0.5	400,000,000
Metoprolol	High Blood Pressure	2.0	100,000,000
Atenolol	Beta Blocker High Blood Pressure	2.0	50,000,000
Cotinine	Metabolite of Nicotine	0.5	3,500-7,200 (ng/mL)





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	High Blood Pressure		
Cotinine	Metabolite of Nicotine	0.5	3,500-7,200 (ng/mL)

### Spot Pond Brook, Stoneham, MA



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Analyte	Result
E. coli (MPN)	21
Surfactants	ND
Ammonia	ND
Caffeine	9.9 ng/L
1,7- Dimethylzanthine	7 ng/L
Urobilin	ND (2.0 ng/L)
Cotinine	ND (0.2 ng/L)
Acetaminophen	ND (1.0 ng/L)
Carbamazepine	ND (0.2 ng/L)
Atenolol	ND (2.0 ng/L)
Azithromycin	ND (2.0 ng/L)
Primidone	ND (2.0 ng/L)

### Boston, MA





Canterbury Brook

Analyte	Result
E. coli (MPN)	198,630
Enterococcus	34,658
Surfactants	1.5 mg/L
Ammonia	5.5 mg/L
Caffeine	5,000 ng/L
1,7-Dimethylzanthine	3,500 ng/L
Urobilin	17,000 ng/L
Cotinine	13 ng/L
Acetaminophen	27,000 ng/L
Carbamazepine	5.1 ng/L
Atenolol	150 ng/L
Azithromycin	61 ng/L
Primidone	ND (2.0 ng/L)

### Laconia, NH





Human or Goose?

Analyte	Result
E. coli (MPN)	17,200
Enterococcus	26,030
Surfactants	0.2 mg/L
Ammonia	ND
Caffeine	12 ng/L
1,7- Dimethylzanthine	12 ng/L
Urobilin	ND (4.0 ng/L)
Cotinine	ND (0.4 ng/L)
Acetaminophen	ND (2.0 ng/L)
Carbamazepine	ND (0.4 ng/L)
Atenolol	ND (2.0 ng/L)
Azithromycin	ND (2.0 ng/L)
Primidone	ND (4.0 ng/L)



## Investigation Planning and Design

Desktop Reconnaissance:

- Online aerial photos
- Historical Topo maps
- Outfall mapping
- SSO reports
- Tidal?
- Access points



### **Investigation Planning and Design**







Bing Maps "Bird's Eye" View



Field Inspection confirms turbid stream

#### Focus Area: Beach Closures – outfalls to beaches with beach closures a high priority







### Marblehead, MA



#### DLaunch

Mneck02



### Marblehead, MA

Analyte	Result
E. coli (MPN)	81,640
Surfactants	0.2 mg/L
Ammonia	0.75 mg/L
Caffeine	5.6 ng/L
1,7- Dimethylzanthine	4.4 ng/L
Urobilin	7.1 ng/L
Cotinine	0.75 ng/L
Acetaminophen	ND (2.0 ng/L)
Carbamazepine	ND (0.4 ng/L)
Atenolol	ND (2.0 ng/L)
Azithromycin	ND (0.4 ng/L)
Primidone	ND (0.4 ng/L)



Site Name: Mneck02

### Marblehead, MA





Analyte	Result
E. coli (MPN)	31,300
Surfactants	0.75 mg/L
Ammonia	0.25 mg/L
Caffeine	3,000 ng/L
1,7-	220 ng/L
Dimethylzanthine	
Urobilin	980 ng/L
Cotinine	8.4 ng/L
Acetaminophen	340 ng/L
Carbamazepine	6.5 ng/L
Atenolol	14 ng/L
Azithromycin	ND (0.4 ng/L)
Primidone	ND (0.4 ng/L)

Site Name: DLaunch



Lynn/Swampscott, MA



Kings Beach, Lynn, MA

### Stacey Brook, MA



Analyte	Result StaceyS	Result StaceyN
Enterococcus (MPN)	>68,000	161
Ammonia	0.75 mg/L	3.0 mg/L
Surfactants	0.2 mg/L	0.2 mg/L
Caffeine	350 ng/L	1,200 ng/L
Urobilin	8,000 ng/L	2,600 ng/L
Acetaminophen	62 ng/L	490 ng/L
Chlorine	ND (0.02 mg/L)	0.56 mg/L

### Most likely problem areas:



- Dense urban areas with aging infrastructure;
- Current or past sanitary sewer problems (SSOs);
- Areas with high sanitary sewer Inflow/Infiltration;
- Areas with state or watershed association data indicating water quality problems;
- Beaches with MS4 outfalls discharging onto or nearby.



### **Recommended Approach**

- Bacteria analyses in addition to surfactant, ammonia, and chlorine field kits
- End-of-pipe or within drain network sampling
- Enable watershed associations, municipalities, State and Federal personnel to collect more useful data
- Use pharmaceuticals as appropriate in confirmatory, problem solving, enforcement





## A Successful Program . . .

- Knows its system:
  - Maps match up with what is in the field
  - Which outfalls have dry-weather flow
- Collects analytical data screening or otherwise
- Understands illicit discharges and sanitary sewer issues often connected
- Tracks progress:
  - Number of illicit discharges identified
  - Number of illicit discharges removed
  - Gallons per day of sewage removed from storm drain system
  - Linear feet piping CCTV'd
  - Linear feet piping smoke tested
  - Linear feet of CIPP lining







### **Additional Contact Information**

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Assistance with water enforcement targeting, investigation design, analytical methods, data evaluation Assistance with analytical instrumentation set up, calibration, and data evaluation for Modified EPA Method 1694 – Selected Pharmaceuticals in Water



### **Outfall Observations**



Salem, MA: NorRO1P

Boston, MA: NR204

### Outfall Observations







#### Medford, MA: MHB

Chelsea, MA: Mill2

### **Outfall Observations**







Dorchester, MA: CantB

Concord, NH: Mer4120

# Arlington, MA





Grove Street Outfalls on Mill Brook