

# Illicit Discharge Detection and Elimination (IDDE) in Racine – a Case Study

"TECH Water Star Wisconsin Express Webinar #7 - Illicit Discharge"

November 29, 2012



# City of Racine Statistics

- Population ~ 80,000
- “Fully Urbanized”
- Former combined sewer system
- ~200,000 feet of storm sewer (38 miles)
- 141 outfalls
- 55 “major outfalls”



# Program Development (2005)

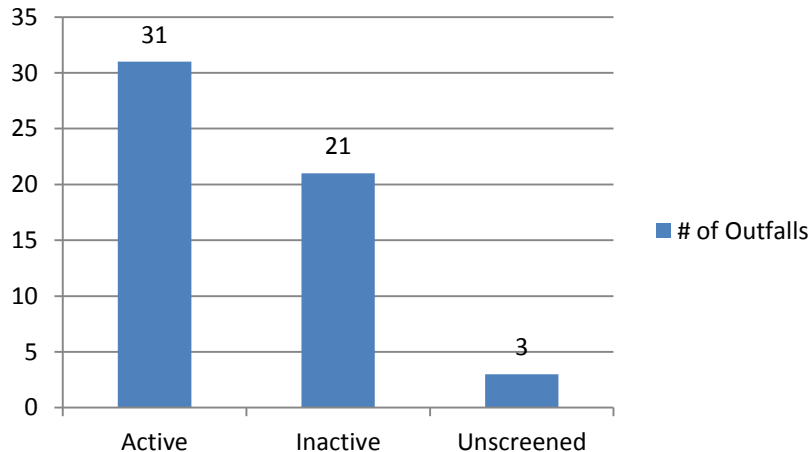
- Field screening forms and maps
- Outfall photographs
- CHEMetrics test kit (detergents, chlorine, copper, phenols), pH and temperature, visual/physical



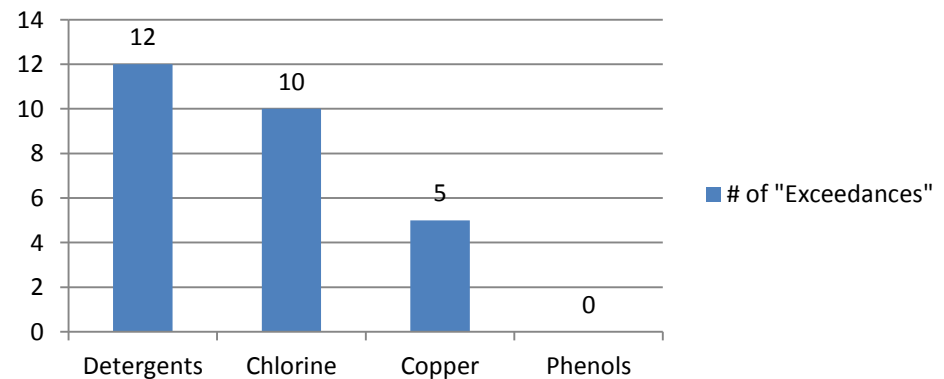
# 2005 Summer Screening

- 55 Outfalls Identified for Screening
  - 31 Outfalls Active
    - 21 Outfalls with exceeded threshold limits (6 with 2 parameters)
      - 12 Detergents ( $\geq 0.25$  mg/l)
      - 10 Chlorine ( $\geq 0.2$  mg/l)
      - 5 Copper ( $\geq 0.1$  mg/l)
      - 0 Phenols ( $\geq 0.5$  mg/l) – (later reduced to  $\geq 0.1$  mg/l)

## Summer 2005 Status of Outfalls



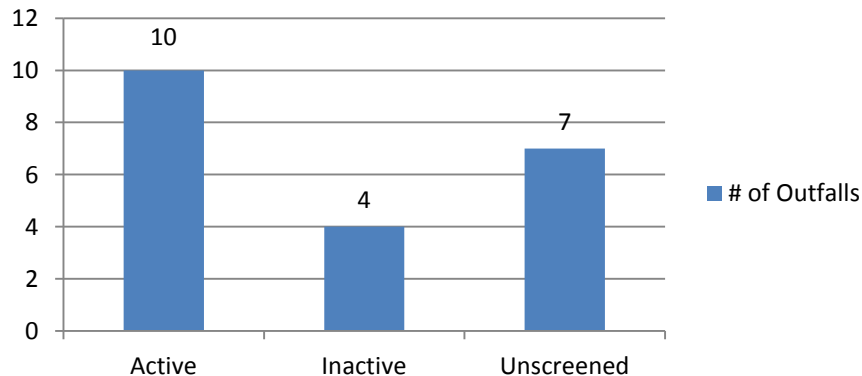
## Summer 2005 Parameter Exceedances



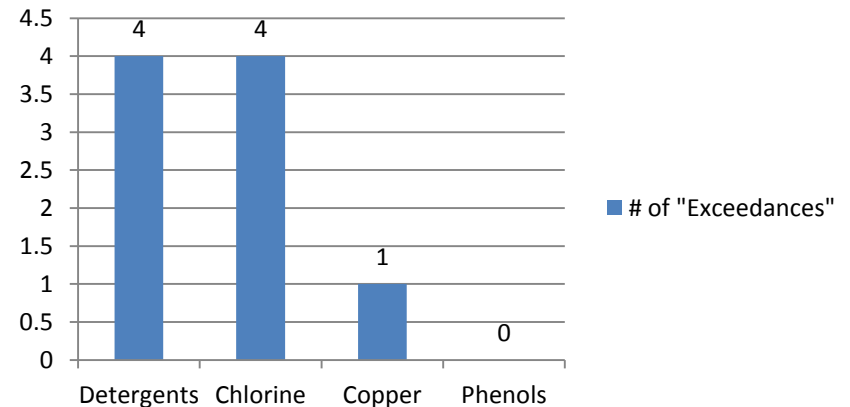
# 2005 Fall Screening

- 21 Outfalls Identified for Screening
  - 10 Outfalls Active
    - 8 Outfalls exceeded thresholds (1 with 2 parameters)
      - 4 Detergents
      - 4 Chlorine
      - 1 Copper
      - 0 Phenols
  - Good Correlation to Prior Results for Active Outfalls

**Fall 2005 Status of Outfalls**



**Fall 2005 Parameter Exceedances**





# Basin RR57 (2005)

- “Minor Outfall” - Basin RR57
- Wet – variable ‘milky’ flow (with floatables)
- Tested positive for detergents and copper
- Reported to City following observation
- Utilized City televising contract
- Identified improper direct connection
- Recent Redevelopment Project
- Notified owner
- Owner corrected



# 2006 Screening

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- Guided by 2005 Findings
- Started more rigorous upstream investigations
- Chlorine was a commonly present indicator parameter
  - Investigations sometimes led to identifiable potable water sources, leaking hydrant valve, and permitted discharges
  - Other sources were diffuse and could not be clearly identified
- Incorporated E. Coli screening into program

# 2006 Screening

- Health Department weekly E.Coli screening
- Led to prioritized follow-up investigation at 6 outfalls

Sample Sites	Outfall	Samples	
		MPN > 1,000	MPN > 10,000
Johnson Park (1)	None	1	0
Horlick Dam (2)	RR06	2	0
Cedar Bend (3)	None	7	2
Washington Park Outfall 1 (4)	RR37E2	5	4
Water Street Outfall (5)	RR36	12	7
State Street Bridge (6)	None	0	0
Chartroom (7)	RR49	2	0
Washington Park Outfall 2	RR37E1	9	3
Washington Park Outfall 3	RR37W	7	0
Luedtke and Rupert	RR18	0	2
Luedtke Ct off Domanik Dr	RR61	4	17
Luedtke Ct off Spring	RR16	9	2



# Basin RR61 (2006)

- Upstream system investigations identified illicit discharge
- Sanitary system 'direct' cross connection
- City corrected connection deficiency
- E. Coli levels persisted



# Basin RR61 (2007)

- Investigation History

- Exceeded detergents
- E. Coli >10,000 mpn in 5 of 7 samples
- Upstream investigation led to isolation of sewer segment
- Smoke testing showed lateral connections
- Dyed water test verified location and number of connections
- CCTV indicated indirect connections (leaking sanitary sewer laterals)
- Laterals under private ownership

- Corrective Action

- City relocated storm sewer
- City established sanitary sewer maintenance fee and took responsibility for laterals from property line to main connection

- Follow-up

- E. Coli dropped in subsequent tests



# 2008 Screening

- Continued IDDE Program Evolution
  - HACH Spectrophotometer
  - Modified parameters
    - potassium (>3.1 mg/l)
    - fluoride (>0.25 mg/l)
    - ammonia (>0.1 mg/l)
  - CHEMetrics detergents (>0.5 mg/l)
  - Added Bacteroides



**SLUDG DISCHARGE INSPECTION FORM**  
OUTFALL SYSTEM UNIT  
City of Racine, WI

Pipe (Outfall) Location/Description: East of Steer 11.8 Location No. 20000000000000000000  
Screening Location: \_\_\_\_\_  
Inspector's Name: \_\_\_\_\_  
Date/Time of Inspection: \_\_\_\_\_  
Date & Amount of last sample: \_\_\_\_\_  
Is pipe/outfall active? \_\_\_\_\_  
Ambient Temperature: \_\_\_\_\_ °C  
Water Temperature: \_\_\_\_\_ °F

**OUTFALL SCREENING RESULTS**

Date/Time of this inspection: _____	<b>SCREENING RESULTS</b>
Color: _____	pH: _____ @ Sample # 0.5
Color: _____	Ammonia: _____ mg/l (sample # 0.5)
Turbidity: _____	Detergent: _____ mg/l (sample # 0.5)
Fluoride: _____	Fluoride: _____ mg/l (sample # 0.5)
Surface Shear: _____	Potassium: _____ mg/l (sample # 0.5)
	Chromia: _____ mg/l (sample # 0.5)
	<b>E. Coli</b> : _____ mg/l (sample # 10.000)
	Bacteroides: _____ (not present)

**SLUDG DISCHARGE RESULTS**

Velocity: Slow (1-2 ft/s) Moderate (2-6 ft/s) Fast (6-8 ft/s) Water Level in Pipe/Channel: \_\_\_\_\_ inches  
Additional Comments/Observations: \_\_\_\_\_

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**Follow Up Screening Results**

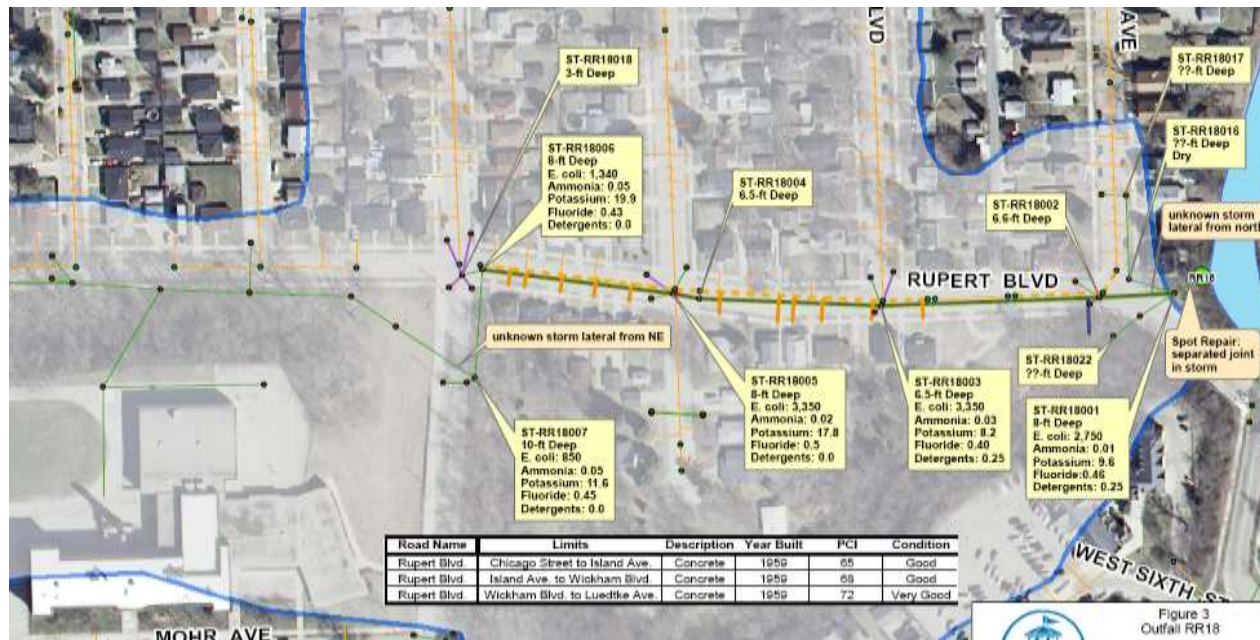
Screening Location: \_\_\_\_\_ Date & Amount of last sample: \_\_\_\_\_  
Date/Time of this inspection: \_\_\_\_\_ Is pipe/outfall active? \_\_\_\_\_

<b>SCREENING RESULTS</b>	
Color: _____	pH: _____ @ Sample # 0.5
Color: _____	Ammonia: _____ mg/l (sample # 0.5)
Turbidity: _____	Detergent: _____ mg/l (sample # 0.5)
Fluoride: _____	Fluoride: _____ mg/l (sample # 0.5)
Surface Shear: _____	Potassium: _____ mg/l (sample # 0.5)
Ambient Temperature: _____ °C	Chromia: _____ mg/l (sample # 0.5)
Water Temperature: _____ °F	<b>E. Coli</b> : _____ mg/l (sample # 10.000)
	Bacteroides: _____ (not present)

**SLUDG DISCHARGE RESULTS**

Velocity: Slow (1-2 ft/s) Moderate (2-6 ft/s) Fast (6-8 ft/s) Water Level in Pipe/Channel: \_\_\_\_\_ inches  
Additional Comments/Observations: \_\_\_\_\_

# Basin RR18 (2008-09)



## • Investigation History

- Exceeded potassium, fluoride, E.Coli
- Sanitary sewer higher than storm sewer, many lateral crossings
- Smoke testing inconclusive
- CCTV indicated some defects
- Leaking laterals and sewers prime suspect (sanitary sewer exfiltration)

## • Corrective Action

- Spot repair
- Lining of sanitary sewer where higher than the storm sewer
- Lateral lining or replacement for lines that cross storm sewer

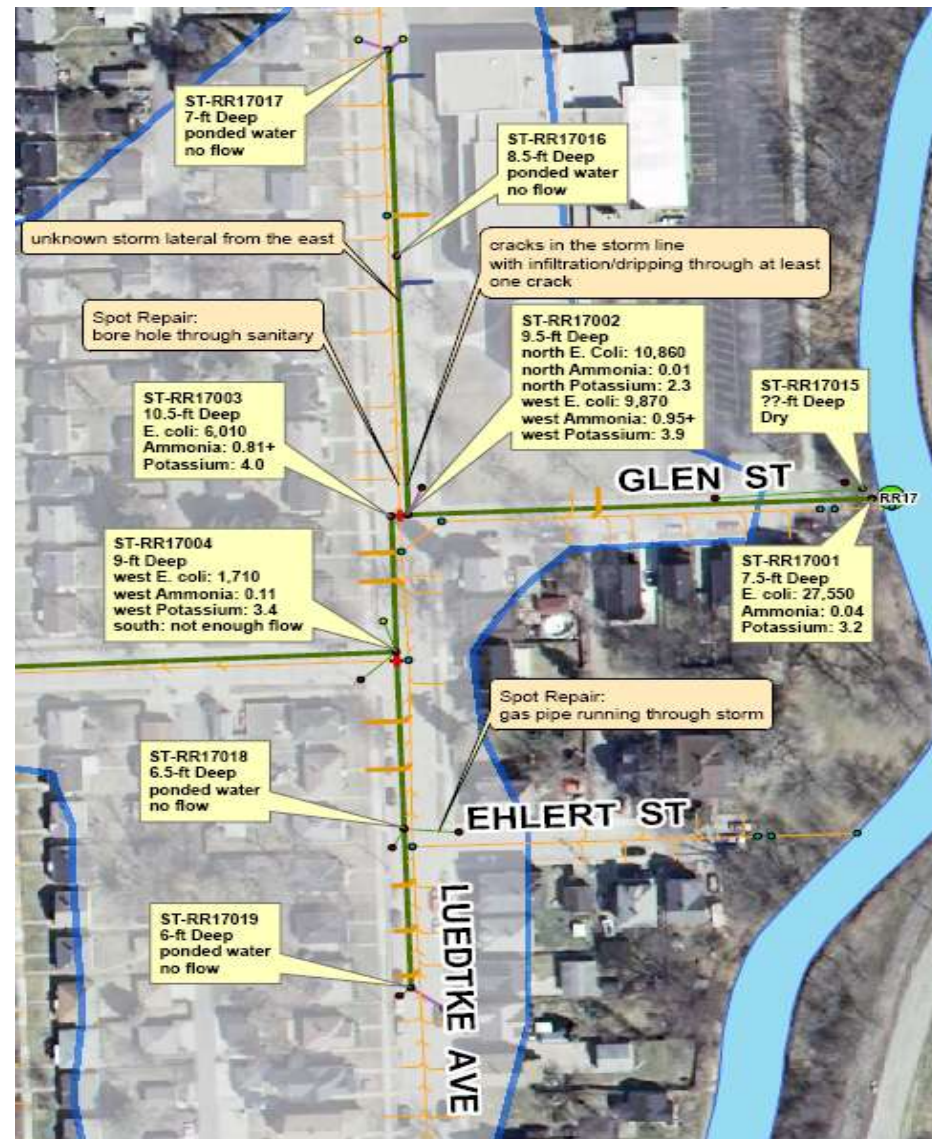
## • Follow-up Results

- Low/no flow in storm sewer



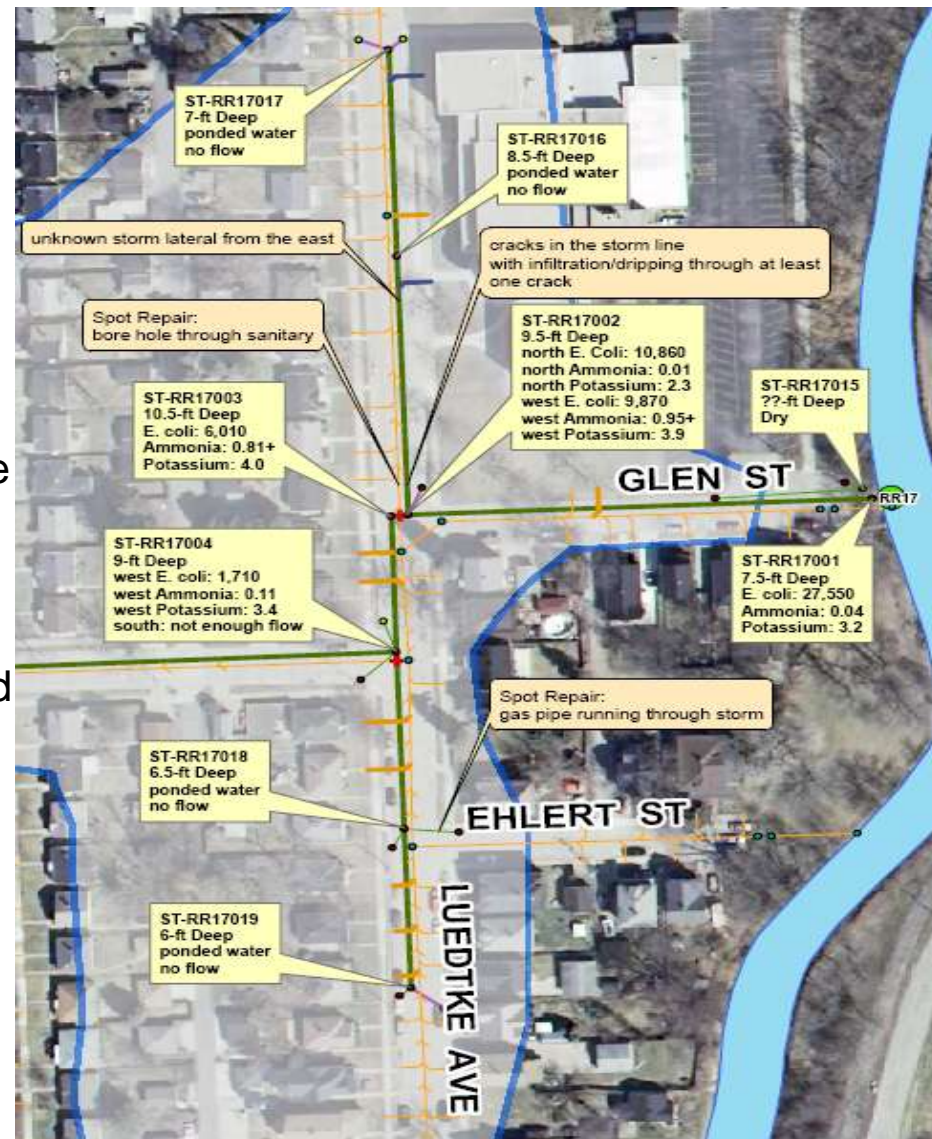
# Basin RR17 (2008-12)

- Investigation History
- Elevated E. Coli and indicator parameters were common (ammonia)
- Sanitary sewer higher than storm in many areas, many lateral crossings
- Smoke testing inconclusive
- CCTV indicated some defects and identified a third connection on the storm line that was undocumented
- Dye testing at school did not indicate any improper connections
- Probable sanitary sewer exfiltration



# Basin RR17 (2008-12)

- Corrective Action
  - Spot repairs at two locations
  - Sanitary sewer lateral lining or replacement for lines that cross storm sewer
- Follow-up Results
  - Low/no flow in some areas
  - Continued E. Coli at outfall and north storm line
  - Bacteroides Test was positive
- Additional Corrective Action
  - Lining of sanitary sewer in Luedtke Avenue and Glen Street
- Additional Follow-up Results
  - Bacteroides Tests Negative
  - Continued E. Coli at outfall
  - Animal Activity suspected for high E. Coli
  - Health Department “Keeping Watch”







# City of Racine Basin RR16 (2010-2012)



## • Investigation History

- 2005/2006 routine screening – inactive/standing water
- Elevated E. Coli
- CCTV showed deposits, seeping taps, debris, standing water
- 2011/12 – Bacteroides <5,000 CN/100ml in 9 of 10 samples
- Typically < 1% of all Bacteroides present (BUT up to 3% at times)

## • Follow-up Action

- Remains on “watch list”



# Basin RR23 – Liberty Street (2011-12)

- Investigation History
  - “Minor Outfall”
  - 2011 Health Dept. found elevated E. Coli in River, traced to outfall
  - Fluoride = 0.7 mg/l
  - Detergents = 1 – 7.5+ mg/l
  - Potassium = 3.0 – 7.6 mg/l
  - Ammonia = above limits of test
  - E. Coli > 10,000 mpn
  - Bacteroides (BacHuman) = 400,000-58,000,000 CN/ml  
(7 – 48% of total Bacteroides)
  - Dye test/CCTV confirmed direct connection of sanitary sewer lateral to storm sewer (legacy of combined sewer separation)
- Corrective Action
  - Disconnect sanitary sewer lateral
- Follow-up Results
  - Dry in virtually all visits



# Conclusions

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- Racine's IDDE program has been successful
- Sewer system flows are often seasonal
- Many sources are not clear
- Continual testing is required
- Some investigations and solutions take time
- IDDE programs should be modified as needed
- Big or small, should probably check them all

# Thank You Questions and Answers

A photograph of a construction site. In the foreground, several large, dark-colored pipes are stacked on the left side. The ground is a mix of dirt and concrete. In the background, there's a road with streetlights, a white truck, and some construction equipment. The sky is overcast. The entire image has a green tint.

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