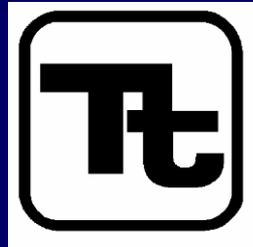


# Illicit Discharge Detection and Elimination

*Introduction and Lessons Learned*

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Barry Toning  
Tetra Tech

# Acknowledgements

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- USEPA Office of Water (Bryan Rittenhouse, Wendy Bell, and Jack Faulk)
- Dr. Bob Pitt, University of Alabama
- Survey Respondents
- CWP staff



# Presentation Overview

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- Terminology Review
- Phase II MS4 Requirements
- IDDE Manual Overview
- Phase I Survey Design
- Major Findings
  - Legal Authority
  - Mapping
  - Methods to Identify
  - Correcting Problems
  - Education
- Recommendations/Implications for Phase II Communities



# What is an Illicit Discharge?

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- A discharge to an MS4 that is not composed entirely of storm water, except permitted discharges and fire fighting related discharges

40 CFR 122.26(b)(2)

- Unique frequency, composition & mode of entry
- Interaction of the sewage disposal system & the storm drain system
- Produced from “generating sites”



# What is a Storm Sewer?

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*A municipal separate storm sewer system (MS4) is...*

A conveyance or system of conveyances owned by a state, city, town, or other public entity that discharges to waters of the U.S. and is:

- ✓ designed/used for collecting or conveying stormwater
    - ✓ not a combined sewer
  - ✓ not part of a Publicly Owned Treatment Works (POTW)
-

# Discharge Frequency Types

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- **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
-

# Discharge Flow Types

- Sewage & septage flows
- Washwater flows
- Liquid wastes
- Tap water \*
- Landscape irrigation flows \*
- Groundwater & spring water flows \*

*\* Not typically considered illicit*

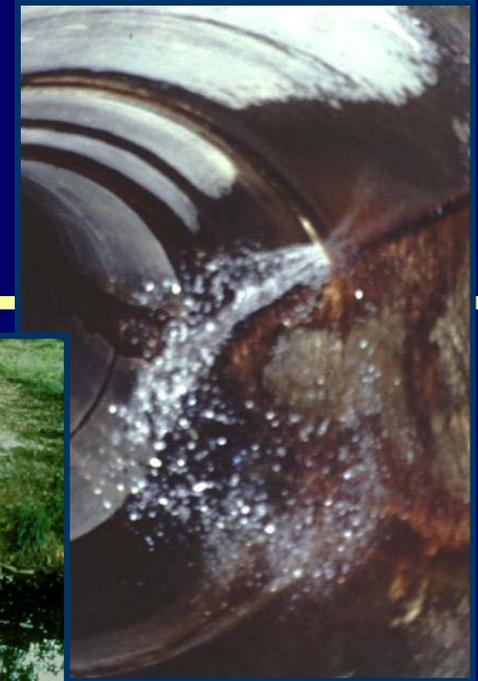


# Mode of Entry

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- *Direct entry*

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



- *Indirect entry*

- Groundwater seepage
- Spills
- Dumping
- Outdoor washing activities
- Contaminated irrigation runoff



# Land Use & Potential Generating Sites

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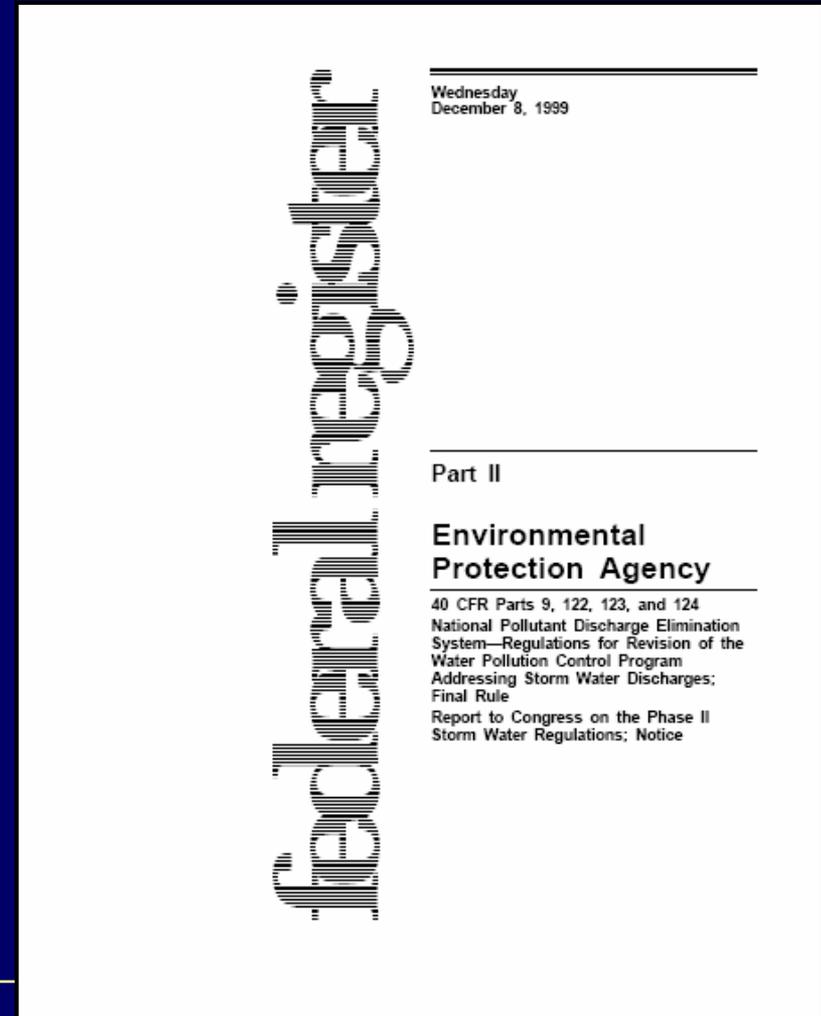
- Residential
- Commercial
- Industrial
- Institutional
- Municipal



# Phase II Program Requirements

(Source: 64 FR 68722 – December 8, 1999)

- Storm sewer system map
- Regulatory mechanism (e.g. ordinance) to prevent illicit discharges
- Plan to detect & address non-storm water discharges
- Education
- Measurable goals



# Phase II Program Requirements (EPA Guidance)

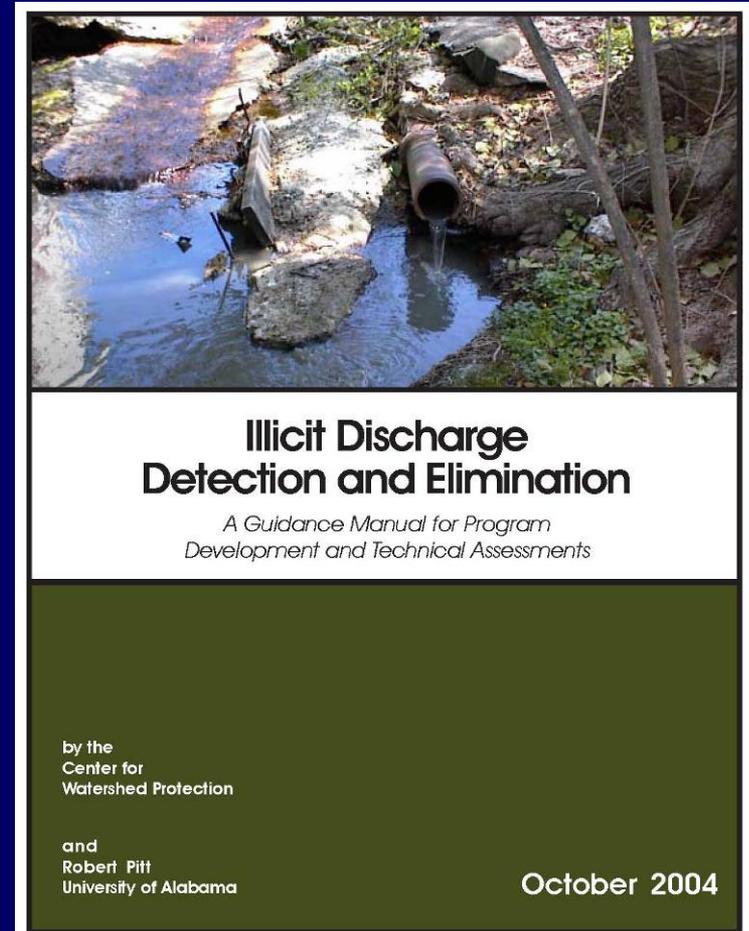
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- Plan to detect and address illicit discharges should include:
  - Procedures for locating priority areas with likely illicit discharges
  - Procedures for tracing the source of an illicit discharge
  - Procedures for removing the source of the discharge, and
  - Procedures for program evaluation and assessment



# IDDE Guidance Manual

- Joint EPA-funded project between CWP and University of Alabama
- 8 Program Elements
- Desktop Methods
- Field and Lab Protocols
- Model Ordinance
- Technical Appendices
- Download at [www.cwp.org](http://www.cwp.org)



# Design of Program Survey

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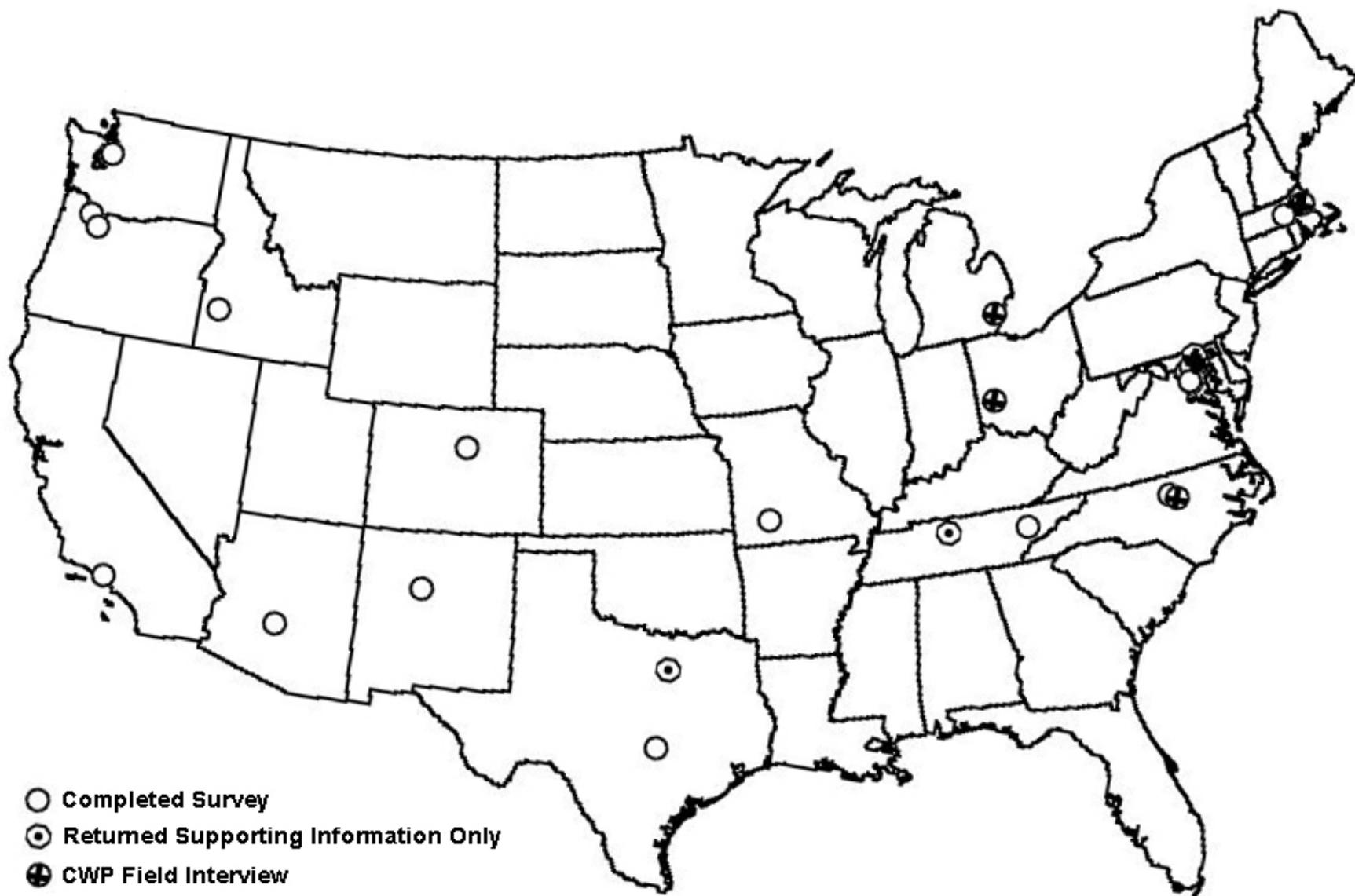
- Community Characterization
- System Characterization
- IDDE Program Characterization and Cost
- Legal Authority
- System Mapping
- Methods to Identify & Confirm Inappropriate Discharges
- Inappropriate Discharge Corrections Program
- Education, Outreach, & Pollution Prevention Programs



# Survey Respondents

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- 57 surveys sent
  - 24 surveys completed (5 Counties, 1 Special Purpose District, 18 Cities)
  - 3 additional jurisdictions submitted supporting information
  - Number of respondents by EPA Region:
    - ⊕ Region 1 – 3 (3 MA)
    - ⊕ Region 2 – 0
    - ⊕ Region 3 – 6 (3 MD, 3 VA)
    - ⊕ Region 4 – 3 (1 TN, 2 NC)
    - ⊕ Region 5 – 2 (1 OH, 1 MI)
    - ⊕ Region 6 – 2 (1 TX, 1 NM)
    - ⊕ Region 7 – 1 (MO)
    - ⊕ Region 8 – 1 (CO)
    - ⊕ Region 9 – 2 (1 AZ, 1 CA)
    - ⊕ Region 10 – 4 (1 WA, 2 OR, 1 ID)
-



# Jurisdiction Characterization

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	<b>Median</b>	<b>Minimum</b>	<b>Maximum</b>
Population Density (people/mi <sup>2</sup> )	2,641	175	15,000
Service Area (mi <sup>2</sup> )	70	2	498
Total Length of Storm Drainage Network (mi)	582	81	3,500
# of Major Outfalls	250	6	7,165
Outfall / Mile of Drainage Network	0.33	0.01	3.1

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# Annual Program Staffing

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- Dedicated staff time ranged from 0.08 to 10 person-years, with a median of 1.5 person-years
- Difficult to quantify because:
  - IDDE responsibilities spread among many departments
  - IDDE staff also perform many other unrelated tasks and activities



**The Wayne County, MI Team**

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# The Value of Field Staff

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- Typically, 67% of program staff time is dedicated to field work
- Experienced field staff are a valuable asset
- Lack of staff expertise & experience is a top problem in identifying inappropriate discharges



# Annual Program Costs

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- Total Program Expenditures
  - Range = \$3,500 to \$613,560
  - Median = \$121,825
- Median program expenditures:
  - Staff = \$85,100 (75% of total budget)
  - Office Computer / Software = \$1,000 (1% of total budget)
  - Field Equipment = \$4,000 (3% of total budget)
  - Lab Equipment / Testing = \$8,000 (5% of total budget)
  - Other\* = \$10,000 (11% of total budget)

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\* education, training, travel, consultants, contractors, etc.

# Sources of Inappropriate Discharges

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- 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%)



# IDDE Program Legal Authority

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- Most have legal authority necessary to inspect private properties for illegal discharges
- Few have found it necessary to invoke that authority
- Property owners are usually cooperative with respect to property inspections and achieving compliance is not usually problematic



# Legal Authority Approaches

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- Stormwater Ordinance
  - addresses inappropriate discharges to the storm sewer system or receiving waters
- Plumbing Code
  - addresses illegal connections to the storm sewer system
- Health Code
  - regulates the discharge of harmful substances to the storm sewer system or receiving waters



# IDDE Program Mapping Elements

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- Storm sewers (96%)
  - Waters of the US receiving discharges from outfalls (83%)
  - Outfalls (79%)
  - Open channels (71%)
  - Land use (67%)
  - Sanitary sewers (63%)
  - Industrial discharge permit holders (33%)
  - Building connections to storm sewers (25%)
  - Connections to adjacent systems (25%)
  - Building connections to sanitary sewers (21%)
  - Watershed, outfall drainage area boundaries (13%)
  - Hotspot areas (13%)
-

# Program Mapping Considerations

*Storm Drain Outfalls in Tuscaloosa, AL*



- ✓ Most utilize some combination of paper & digital approaches for maps
- ✓ Historic system & topography mapping used to determine pre-development stream locations
- ✓ Mapping is useful to prioritize areas for outfall screening or dye testing; to track areas that have been investigated; and to track areas that need to be investigated

# Investigative Methods

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- Most of the jurisdictions use several different methods
- Some found initial outfall screening successful at identifying chronic problems, but following screening less useful
- For sporadic discharges, jurisdictions are relying heavily on hotlines and cross-training of staff
- Special studies, in-stream monitoring and targeted problem area screening supplement efforts



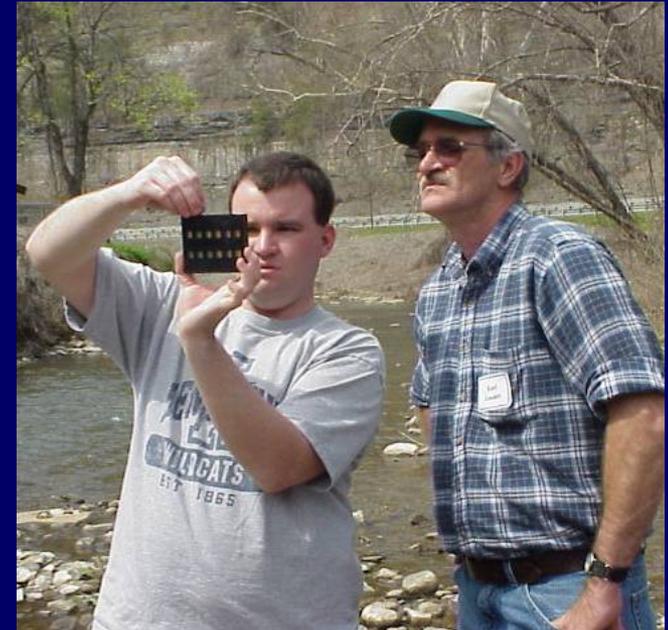
# Investigative Procedures

Investigative Procedure	% of Respondents (n = 21)
Pollution reporting hotline for citizens to call	86%
Regular inspection of outfalls by jurisdiction	76%
Water quality monitoring of receiving waters	71%
Regular inspection of storm sewers	62%
Regular inspection of sanitary sewers	48%
Dye- or smoke-testing of buildings in problem areas	48%
Sporadic outfall inspection by watershed/citizen organization	38%
Regular outfall inspection by watershed/citizen organization	24%
Sporadic inspection of outfalls by jurisdiction	24%
Dye- or smoke-testing of buildings at the time of sale	5%
Water quality monitoring of discharge waters	5%
Septic system inspection at time of sale	5%

# Outfall Monitoring

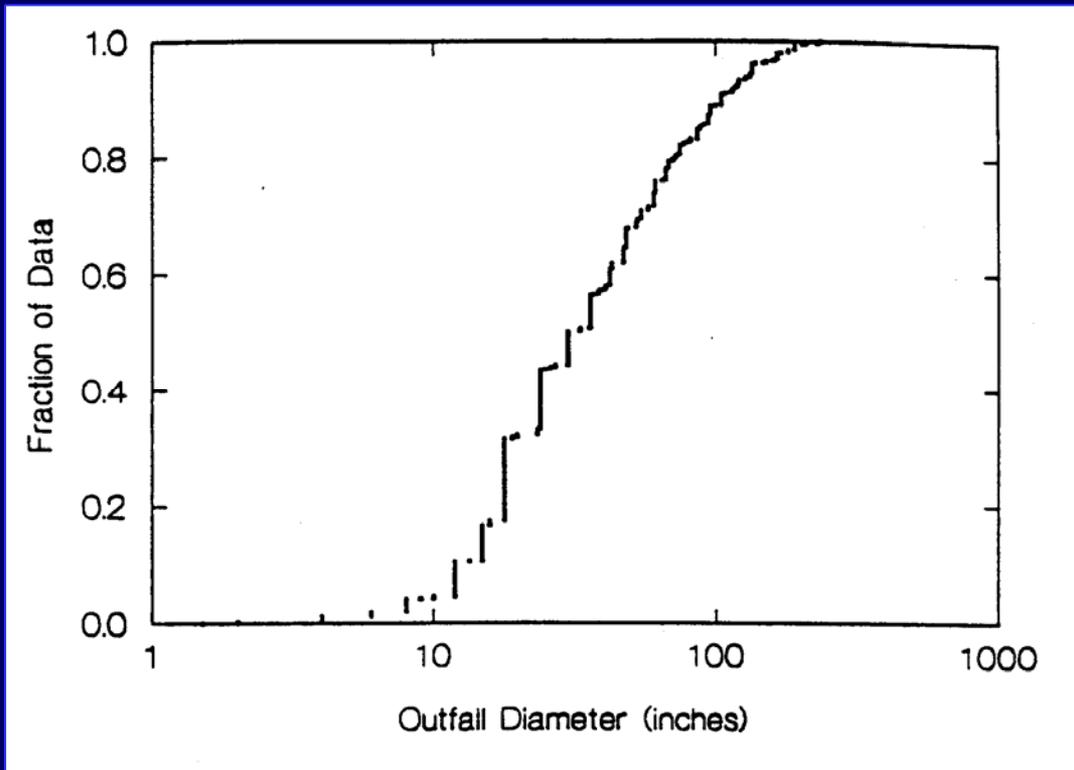
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- Most IDDE programs conduct targeted outfall monitoring on a “regular basis”:
  - Screen each targeted outfall at least once over the NPDES Phase I permit cycle (5 years)
  - Screen each targeted outfall at least once a year
  - Screen targeted outfalls in the MS4 on a staggered schedule, based on contributing land use & history of chronic problems



# All outfalls should be screened

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Small outfalls (<36")  
represent 50% of  
outfalls in  
Birmingham, AL



4" septic system sewage "relief line"

# Most Common Approach to Outfall Screening

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- Visual inspection of the outfall
  - Qualitative assessment of any flow present, including examination of water color, odor, turbidity, floatables, & sedimentation
  - Follow-up grab sample for quantitative analysis, either using more sophisticated field equipment or a laboratory
-

# Typical Physical Indicators

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- Color (95%\*)
- Odor (95%)
- Deposits and stains (90%)
- Floatable matter (86%)
- Temperature (86%)
- Turbidity (76%)
- Changes in flow (62%)
- Vegetation change (62%)
- Structural damage (52%)
- Grease / oil (10%)

\* % of respondents



# Typical Chemical Indicators

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- pH (86%)
- Chlorine (76%)
- Specific conductivity (62%)
- Ammonia / ammonium (52%)
- Surfactants (48%)
- Fecal coliform (33%)
- Fluoride (33%)
- Copper (29%)
- Florescence (24%)
- Phenols (14%)
- Potassium (14%)
- Detergents (10%)
- Dissolved oxygen (10%)
- Hardness (10%)
- Iron (10%)



Many jurisdictions bypass the quantitative tests and immediately go **“up the trunk”** to find the source of the discharge



# Top Problems in Identifying Inappropriate Discharge Sources

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- The source of the discharge makes identification difficult
  - Periodic nature (76%)
  - Illegal dumping / one-time dischargers (14%)
  - Illegal connections (10%)
  - Inflow/infiltration from sanitary sewers (10%)
  - After-hours discharges (5%)



# Top Problems in Identifying Inappropriate Discharge Sources

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- The MS4 infrastructure complicates the tracking of a discharge up the system
  - Accessibility (building, stream, outfall, traffic) (38%)
  - Complexity of network (14%)
  - Natural influences (tidal, groundwater) (10%)
  - Size of drainage basin (10%)
  - Multiple sources w/in system (5%)



# Top Problems in Identifying Inappropriate Discharge Sources

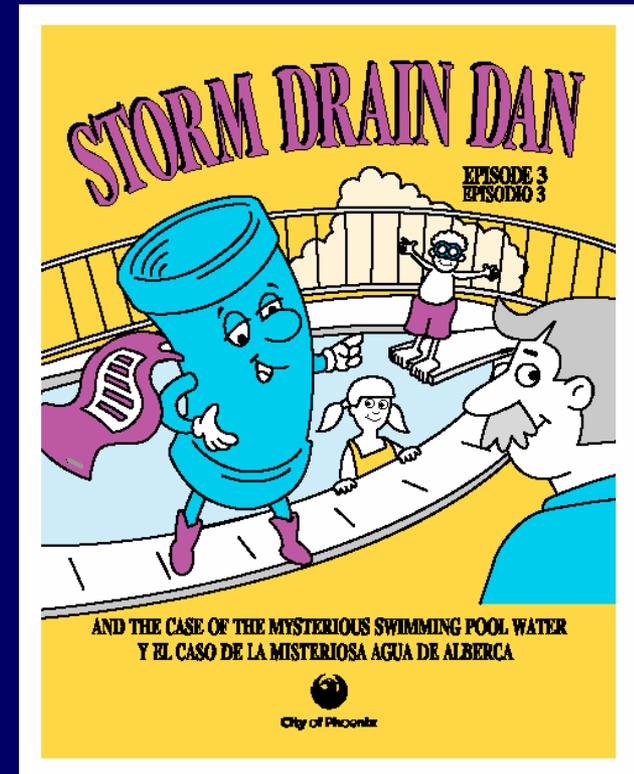
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- The IDDE program does not have the resources available to determine the potential source of the discharge
  - Accuracy of mapping (38%)
  - Timeliness of complaint (14%)
  - Insufficient staffing (10%)
  - Insufficient expertise (5%)
  - Slow laboratory analysis (5%)
  - Unreliable equipment (5%)
  - Use of unreliable indicators (5%)



# IDDE Education Target Audiences

- Resident Education (100%)
  - Storm drain stenciling, outfall signage, hotline promotion
- Schoolchildren
  - School presentations
- Commercial (95%)/ Industrial (79%)
  - Targeted at “hotspot” activity
- Public Employees (63%)
  - Field crew & inspector cross-training



Source: City of Phoenix, AZ

# Primary Conclusions

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- 67% of program staff time is in field. Experienced field staff is a valuable asset.
  - budgets drive methods used by the programs to identify potential inappropriate discharges.
  - Effective and comprehensive legal authority is critical.
  - A good program starts with good mapping.
  - Much of the field equipment is commonly available in various municipal departments.
-

# What this means for Phase II

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- Staffing & training will be a challenge, but critical for program success. An approach that is less dependent on professional judgment is desirable.
  - Ordinance language should ensure that all sources of inappropriate discharges are prohibited, and should provide the necessary legal authority to inspect private properties and to enforce corrections.
  - Accurate mapping of storm sewers, open drainage channels, waters of the US, outfalls, and land use will allow field staff to conduct more effective field investigations, and will serve as a basis for prioritizing field investigations.
-

# What this means for Phase II

- Outfall screening can require significant resources. An efficient approach that examines a limited number of parameters at each outfall is necessary.
- Cross-training and communication with other jurisdictional programs can save money on equipment and field time.
- Accurate, cost effective, and safe methodologies need to be adopted if tracers are going to be used successfully.
- Hotlines and other education/outreach approaches are effective tools and contribute to other Phase II measures.

