Vermont’s Statewide Stormwater Infrastructure Mapping and Illicit Discharge Detection and Elimination (IDDE) Program
Why a Statewide Approach?

Voluntary-Non Regulatory-River Basin Scale

• This program assists with:
  
  – Improving water quality & protecting public health
  – Stormwater retrofit projects.
  – Reduced local flooding.
  – Asset management
  – A local stormwater ordinance, plan or program.
  – Hazardous materials emergency response.
  – Eliminating water leaks.
  – Eliminating connections to combined sewers which can increase WWTP capacity.
Why focus on IDDE first?

Average **residential** wastewater contributes 3-6 lbs. TP/yr\(^1\)

2018 Average cost for 1 lb. of Phosphorus removal:

@WWTP - $9-1230/lb.+\(^2\)
IDDE - $54 -16,000/lb.+\(^3,4\)
STP retrofit - $9,000-24,000/lb.\(^4\)

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1. 2.7 g per capita/day (EPA, 2002) x 2.47 persons/home (US Census data, Chittenden County, VT) x 365 days
2. EPA, 2008; Eckles, 2007; VTDEC 2007
3. VTDEC, 2018
Over $500 million in municipal wastewater treatment systems to eliminate straight piped and combined sewers, but rarely did we “check our work” by sampling outfalls.

Marshfield, Vermont straight pipe sewer “record drawing”, 1950
Statewide sanitary surveys to eliminate direct discharges and require septic systems from rural homes and businesses. Rarely did we “check our work” with instream sampling or assessments.
Example of a missed direct discharge:

2016 Septic system to replace existing dry well/cesspool with overflow to Main Street, South Hero, VT
Infrastructure Mapping Status

~12 Phase 2 MS4 municipalities
~197 of 239 villages/hamlets to be mapped
~Maps complete: 164
~Mapping underway: 32
~Mapping planned: 1
IDDE Survey Status

~ 12 Phase 2 MS4 municipalities
~ 197 of 239 villages/hamlets to be surveyed
~ 87 Completed
~ 93 Underway
~ 17 Planned
Program Results:

- 3,836 discharge points assessed.
- 30% were flowing.
- Wastewater source at 230 discharge points (6% of total, 20% of flowing).
- Types of contaminants: sewage, petroleum, heated water, pet waste, cleaning fluids, and paint.
- Types of problems: missing, broken or leaking sewers, bad plumbing, illegal dumping.

- An estimated 300 kg (661 lbs.)/year of Phosphorus eliminated from Lake Champlain, and a reduced risk of pathogen exposure to the public.

- 197 drainage inventories.
- GIS database and digital library.
- All reports, maps on the web.
- A web portal for easy infrastructure data viewing.
Program costs typically include mapping, inspection, sampling, administration costs.

**National & Vermont IDDE Program Costs**

Program Cost per Illicit Discharge Found

- **2018 Dollars**

**National Average** = $7,814, Median = $6,156 for 10 Regional Programs

**Vermont Average** = $13,717, Median = $9,574 for 13 Regional Contracts
National & Vermont IDDE Repair Costs

N=1952*

National Data = 6 average costs based on 1910 repairs. Average costs shown with ▲.
National Average=$8254. Median=$9024.

Vermont Data=42 repair costs
VT Average=$3052. Median=$2872.

*Costs reported as categories-$0-1000, $1000-5000, $5000-10,000, $10,000-15,000 or exact price if available.
Conclusions

(1) Average Survey Cost + Average Repair Cost = Average IDDE Cost

National: $7814 + $8254 = $16,068 (2018 dollars)
Vermont: $13,717 + $3052 = $16,769 (2018 dollars)

(2) Large urbanized areas tend to have greater IDDE program efficiencies which results in lower mapping & survey costs. Large urbanized areas have higher IDDE repair costs due to construction access, utility conflicts, traffic management, etc. Rural areas tend to have the reverse scenario.

(3) ~4.5 lbs. of Total Phosphorus are removed per residential discharge eliminated. Therefore, a national IDDE repair has a TP-removal cost of about $3571/lb. TP ($16,068/4.5 lbs.)

(4) A typical VT STP retrofit has a median cost of $18,000/lb.TP removed. The National STP retrofit median cost is $20,971 (2018 dollars).

(5) The available data indicate that there is a 6x difference in removal cost for 1 lb. TP between an IDDE program and the implementation of an STP. For nutrient impaired waters a comprehensive IDDE effort before STP implementation is a more cost-effective approach.
Two National Examples:

- **Baltimore’s Western Run illicit discharges for TN were approximately 63% of the TN reduction needed.**

- **In DC’s Sligo Creek, the IDDE load was 17% of the TN TMDL reduction, and 21% of the needed bacterial TMDL reduction.*

Other Reasons:

- **NY MS4 TMDL requirement for lower Hudson E. coli impaired streams and shellfish waters requires IDDE**
  [https://www.dec.ny.gov/docs/water_pdf/lims4impplndraft.pdf](https://www.dec.ny.gov/docs/water_pdf/lims4impplndraft.pdf)

- **Mass & NH MS4 TMDL requirement for pathogen impaired streams requires IDDE**

- **Rhode Island Blackstone River E.coli TMDL requires implementation of IDDE**

- **Conn MS4 permit requires enhanced IDDE**

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IDDE Methods

- Kickoff meetings with municipal officials prior to field work to gather information and plan the assessment.

- Dry weather assessment:
  1. Record physical characteristics
  2. At all flowing outfalls and selected catchbasins and manholes:
     - Measure specific conductivity, chlorine, ammonia, and detergents (MBAS)
     - Place an optical brightener pad (collected and analyzed later)
  3. At outfalls where OB or ammonia are detected, collect samples for *E. coli* and nutrient analysis.

- Bracket sources of contaminants by sampling adjacent structures.

- Work with the public works staff to identify specific sources, using engineering plans, dye testing, smoke testing, and camera inspection.
Optical Brightener Test

- Fluorescent dyes used in most laundry detergents.
- Cotton pads exposed for 5-10 days, then rinsed, dried, and viewed under a UV lamp.

- Inexpensive and sensitive method to screen for wastewater flows.
- When positive, best way to bracket contaminant sources.
Geographic Scope

“Entire extent of municipal closed drainage systems”

- All mapped outfalls except those on highways with no sanitary sewer or adjacent development.
- Selected catchbasins and manholes in large systems (because outfall monitoring may not be sufficient to detect sources high up in the system).
- Access structures along public roads or from receiving waterbody.
- Structures on private property if connected to a municipal system (assuming permission is granted).
- Relict pipes from buildings abutting streams.
- Combined sewer overflow structures (for SSOs).
Types of wastewater discharges
(situations to watch for)

**Type:** Missed connection on old sanitary sewer converted to stormdrain

**Examples:** Barton (2), Hyde Park (3), Middlebury (4), Montpelier (3), Poultney, Proctor (3), Swanton (4)
Types of wastewater discharges  
(situations to watch for)

**Type:** Leaking sanitary sewer crossing through stormwater structure

**Examples:** Barre City, Brattleboro
Types of wastewater discharges
(situations to watch for)

**Type:** Wastewater connections to internal roof leaders

**Examples:** Hardwick Elementary School, Newport City Elementary School, Montpelier (5), Rutland Town
Types of wastewater discharges  
(situations to watch for)

**Type:** Leaking residential sewer laterals crossing over stormdrain

**Examples:** Barre City (5), Enosburg Falls, Fair Haven, Gilman (2), Morrisville, and St. Johnsbury
Types of wastewater discharges
(situations to watch for)

Type: Graywater connections to stormdrain
Examples: Barre Town, Enosburg Falls, Georgia, Middlebury, Orleans Village, Newport City, North Troy (2), Plymouth, and Rutland Town
Types of wastewater discharges
(situations to watch for)

**Type:** Failed septic systems

**Examples:** Barton, Concord (2), Derby (2), Fair Haven, Groton, St. Johnsbury, Wallingford, and Wolcott.
Types of wastewater discharges (situations to watch for)

Type: Dry weather overflows at CSO structures
Examples: Montpelier, Rutland, and St. Johnsbury
Favorite Techniques

- Optical brightener!!!
- Smoke testing: Watch for smoke from sewer vents when smoking sanitary sewer and entry of smoke into stormdrain.
- Use sewer camera in conjunction with smoke and dye testing. Place the camera inside the pipe before conducting a smoke or dye test and move it toward the incoming smoke or dye until the entry point is reached.
Questions?

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http://dec.vermont.gov/watershed/cwi/manage/idde