Dissecting Proprietary Stormwater Treatment BMPs to Develop Practical Solutions – Unbiased Research and Case Studies

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Portland, Maine

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Outline

- ▶ Introduction
- ▶ Need and problem
- ▶ Study approach
- ▶ Device selection
- ▶ Device installation

Introduction

Study Partners

- ▶ Amtrak Environment & Sustainability Group
  - o Environmental programs for northeast corridor
  - o Stormwater case studies at Boston, MA and Groton, CT facilities

- ▶ Amec Foster Wheeler Environment & Infrastructure, Inc.
  - o Nationwide contractor for Amtrak
  - o Engineering and stormwater compliance for Amtrak in New England

- ▶ University of New Hampshire Stormwater Center (UNHSC)
  - o Stormwater research center of excellence
  - o Providing unbiased research for over 15 years

Introduction

Amtrak Stormwater Management Needs

- ▶ Programs to manage stormwater and potential pollutants:
  - Stormwater Pollution Prevention Plans
  - Spill Prevention, Control & Countermeasure Plans
  - Environmental Monitoring Programs and Audits

- ▶ Primary pollutants of concern:
  - Petroleum products
  - Sediment
- ▶ Potential pollutant sources:
  - Locomotive fuels, engine fluids, and lubricants
  - Winter sanding, traction sand, ballast and gravel surface wear

Introduction

Need, Problem, and Study Goals

▶ Need:

- Amtrak contractor proposed an alternate manufactured (in-ground) stormwater treatment device (Device) for a project.
- Adequate information was not available to compare the two Devices in order to select the Device with the best performance.

▶ Problem:

- Selecting the most cost-effective and easy to maintain technology for a stormwater treatment Device can be difficult.

▶ Study Goals:

- Conduct an unbiased evaluation of stormwater treatment Devices.
- Better understand how to select these Devices for use at Amtrak facilities.
- Develop cost-effective solutions that can be readily implemented at existing Amtrak facilities as a “standard retrofit”.
- Provide guidance for good engineering design based on stormwater needs.

Problem
Overview

- ▶ Manufactured stormwater treatment Devices and supporting performance data:
  - Can vary significantly
  - Can be confusing to owners, designers, and contractors
  - Can be misleading or incomparable
- ▶ For example:
  - Does a "Downstream Defender®" perform the same as a "Stormceptor®" when sized according to the manufacturer's specifications?
  - Does each Device perform the same in terms of pollutant removal (e.g., sediment capture and storage)?
  - How is performance affected by installation configuration and what about bypassing high flows?
  - What about maintenance needs and constraints?
  - Where can you find independent research that compares various Devices?

Study Approach

Summary

- Review and compare available technologies and manufacturers of proprietary (manhole-style) stormwater treatment Devices
- Evaluate and compare the following:
  - Configuration options (online versus offline)
  - Pollutant removal strategy (e.g., swirl or chambered)
  - Manufacturer claimed pollutant removal rates
  - Flow rate versus storage capacity for sediment and oil
  - High flow considerations
  - Maintenance considerations
  - Cost

Device Selection

Data and Study Results

▶ UNHSC participated in the study and provided monitoring data for total suspended solids (TSS) and total petroleum hydrocarbons (TPH)

		Total Suspended Solids				Total Petroleum Hydrocarbons - Diesel			
BMP	Performance Evaluation Year	Storm Count	Median EMC IN (mg/L)	Median EMC OUT (mg/L)	Median %RE	Storm Count	Median EMC IN (µg/L)	Median EMC OUT (µg/L)	Median %RE
VortSentry†‡	2004-2005	13	45	30	22%	11	788	372	53%
Continuous Deflection Separator†	2004-2005	14	41	22	33%	12	781	390	44%
V2B1†	2004-2005	14	41	28	27%	12	781	550	30%
Downstream Defender†	2007-2008	21	35	37	9%	21	870	480	31%
Up-Flow Filter†	2007-2008	17	36	33	29%	20	800	435	51%
Deep Sump Catch Basin†	2007-2008	21	48	34	9%	19	510	440	14%
Offline Vortechnics‡	2010-2011	36	120	21	75%	15	570	180	64%
Offline Deep Sump Catch Basin w/ SNOUT ©**	2012	5	230	50	73%	2	700	243	62%

*EMC= event mean concentration; IN= influent; OUT= effluent; and RE= removal efficiency

**SNOUT used was the 18R Split SNOUT Oil & Debris Stop

† Tested in an online configuration

‡ The VortSentry and the Vortechnics are comparable units, therefore the two units can be compared to represent the difference between an online and an offline configuration.

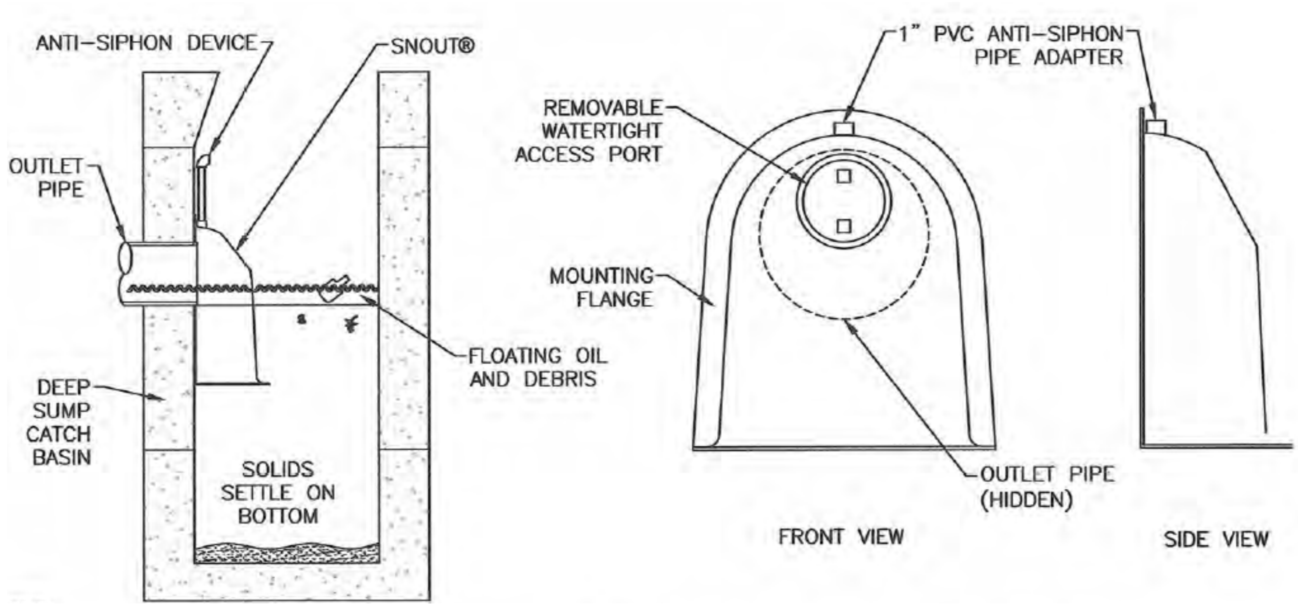
Note: this data is intended to provide an unbiased evaluation of the relative performance of different types of BMPs and is not intended to represent the primary basis for BMP selection. Additionally, since testing has occurred over time, not all proprietary BMP devices have been tested and some devices, such as the VortSentry, are no longer available and have been replaced by similar models.

- Overall, the data does not clearly support the selection of one proprietary stormwater treatment device over another.

Device Selection

Data and Study Results

- ▶ The UNHSC data and study suggest:
  - An offline, deep sump catch basin (DSCB) with a hooded outlet performs at least as well as similar devices tested to remove TSS and TPH.
    - 73% TSS removal efficiency
    - 62% TPH removal efficiency
  - A DSCB with a hooded outlet also appears to be the most cost-effective option.

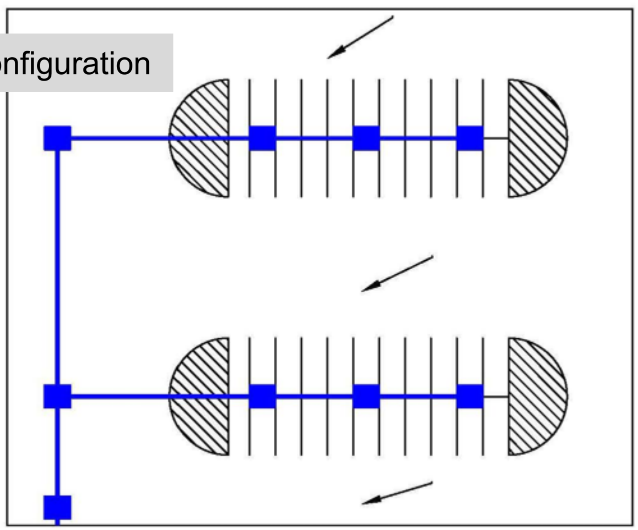


Device Selection

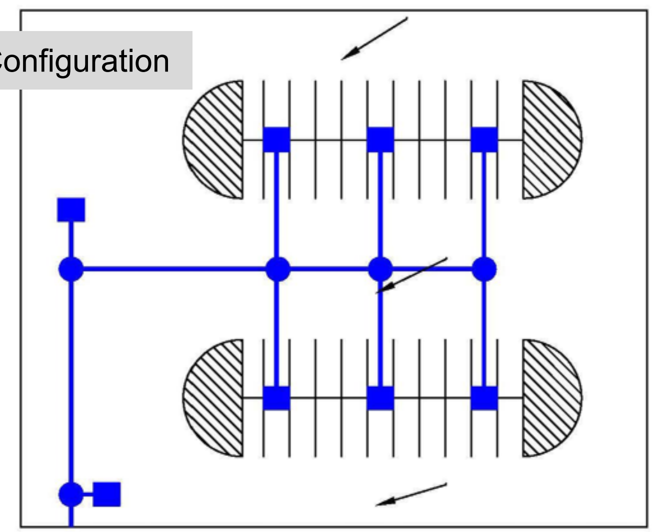
Data and Study Results

- The factors that have the greatest influence on pollutant removal efficiency from stormwater flows appear to be:
  1. Bypassing high flows via offline configuration or an engineered flow bypass
  2. Adequate sizing of the Device
  3. Sediment and floatable (petroleum) storage capacity (to reduce maintenance frequency)
  4. Ease of maintenance (proper maintenance is critical to performance)

Online Configuration

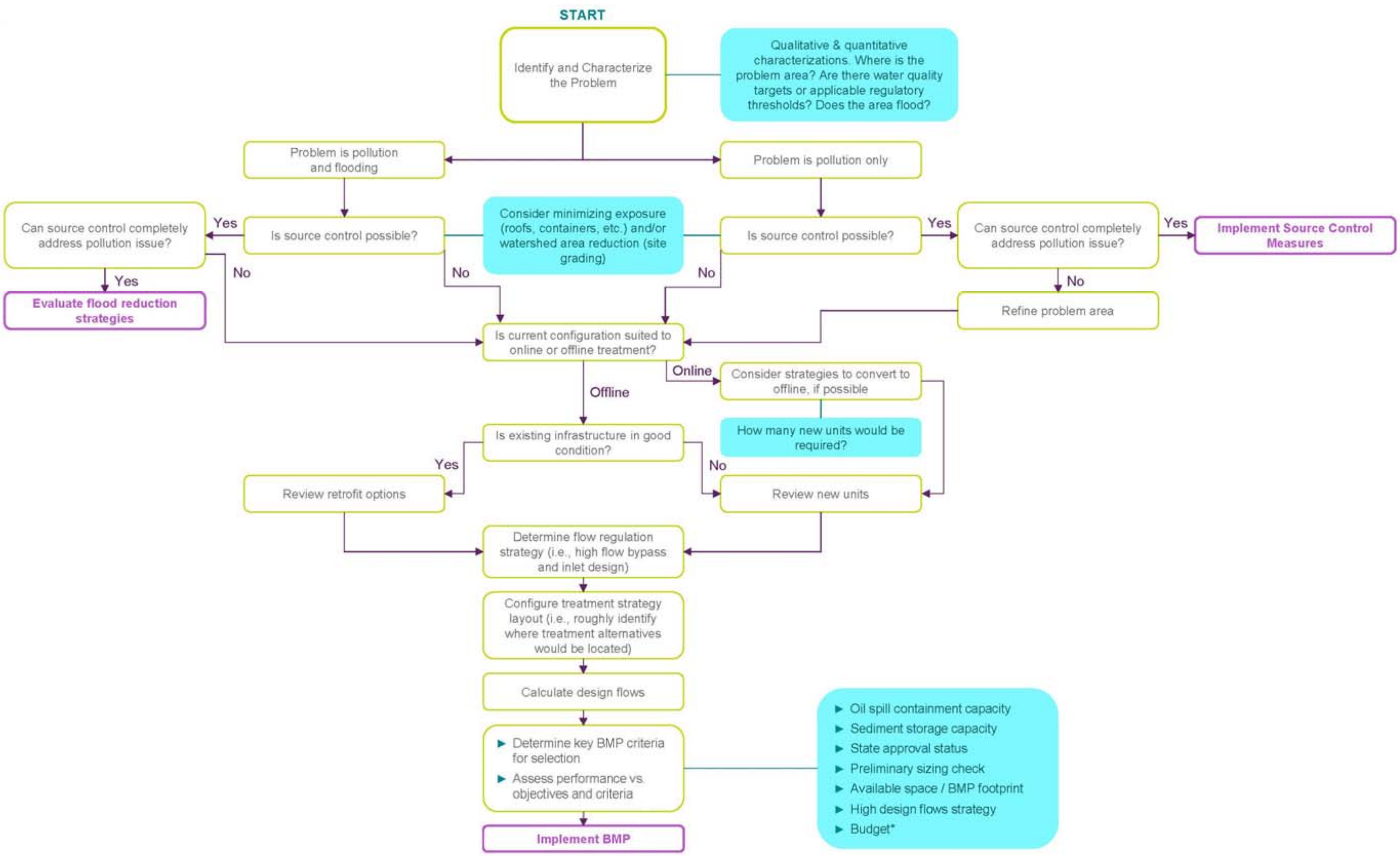


Offline Configuration



Device Selection

Amtrak Stormwater BMP Design and Selection Flow Chart



Device Selection

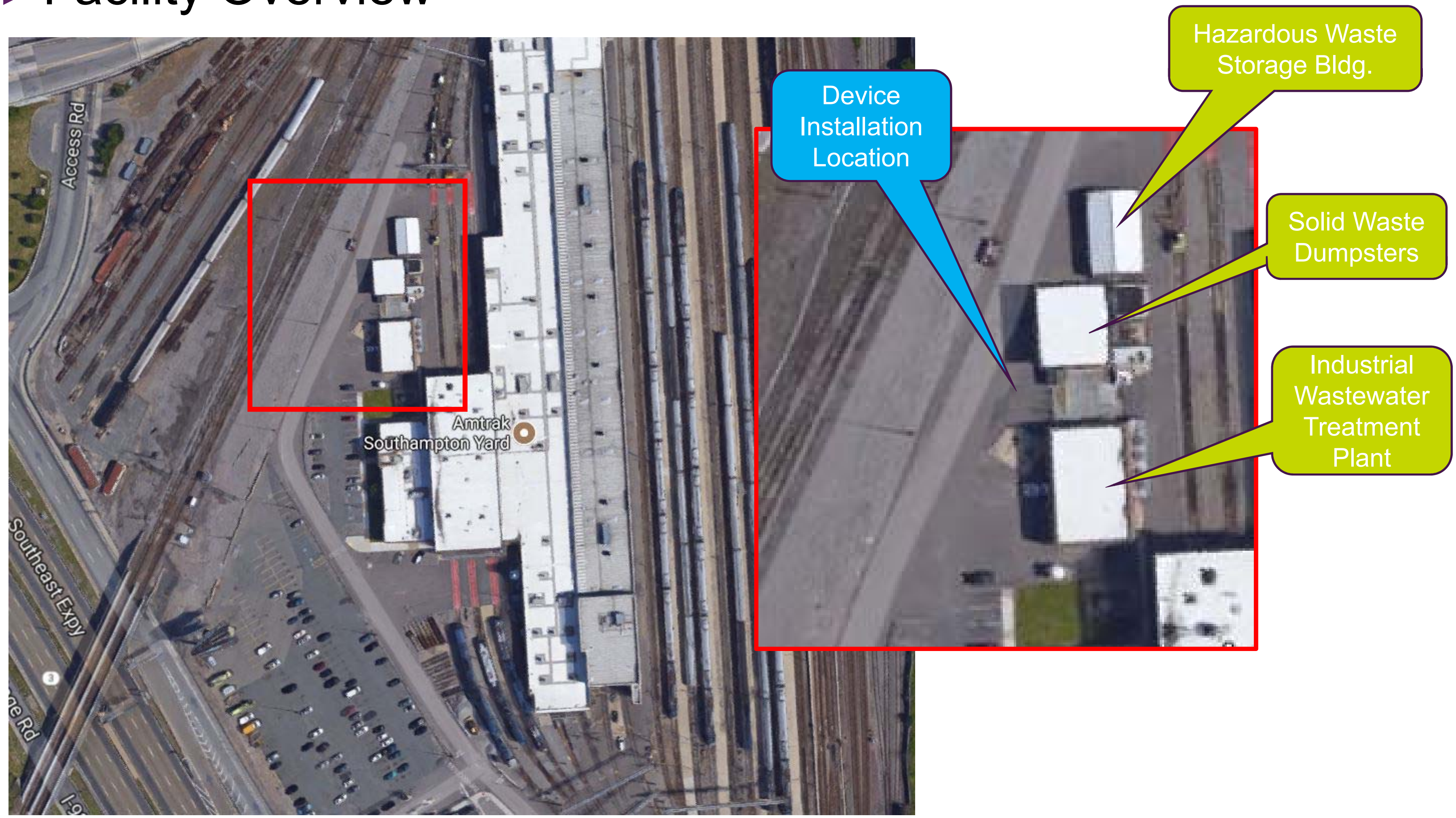
Summary

- An off-line DSCB with a hooded outlet (SNOUT®) was selected by Amtrak as the preferred Device:
  - 5 foot diameter manhole
  - Sump depth = 3 feet below bottom of SNOUT®
  - SNOUT® model 18R
- Characteristics and benefits:
  - Materials are accessible and inexpensive (standard manhole, cover, grate and SNOUT®)
  - Ease of maintenance – same as standard catch basins
  - Solids storage capacity = ~1.45 cubic yards at recommended cleaning threshold (50% sump to outlet)
  - Petroleum storage capacity (max. static) = ~115 gallons

Device Installation

Southampton Street Yard, Boston, MA

▶ Facility Overview

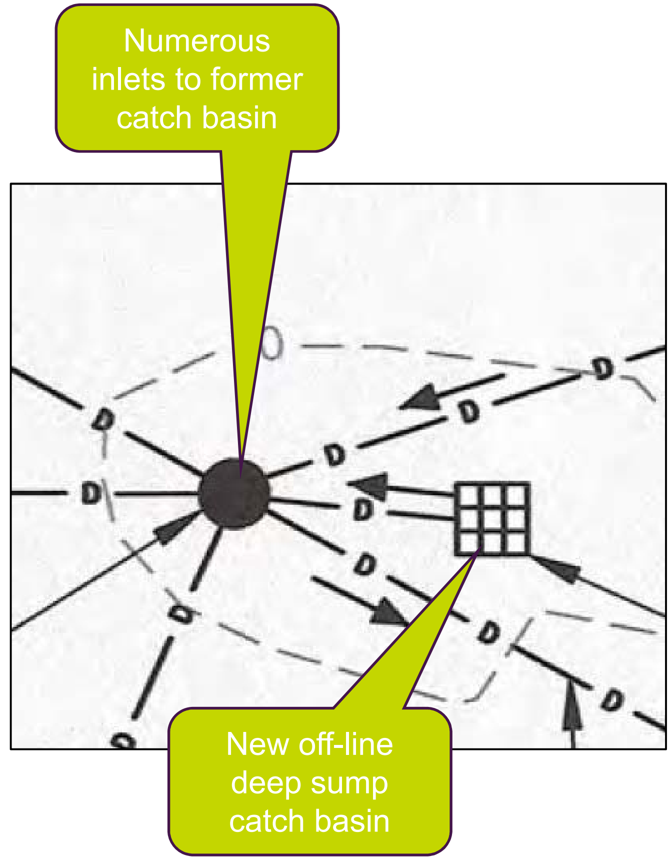


Device Installation

Southampton Street Yard, Boston, MA

▶ Retrofit during an adjacent construction project

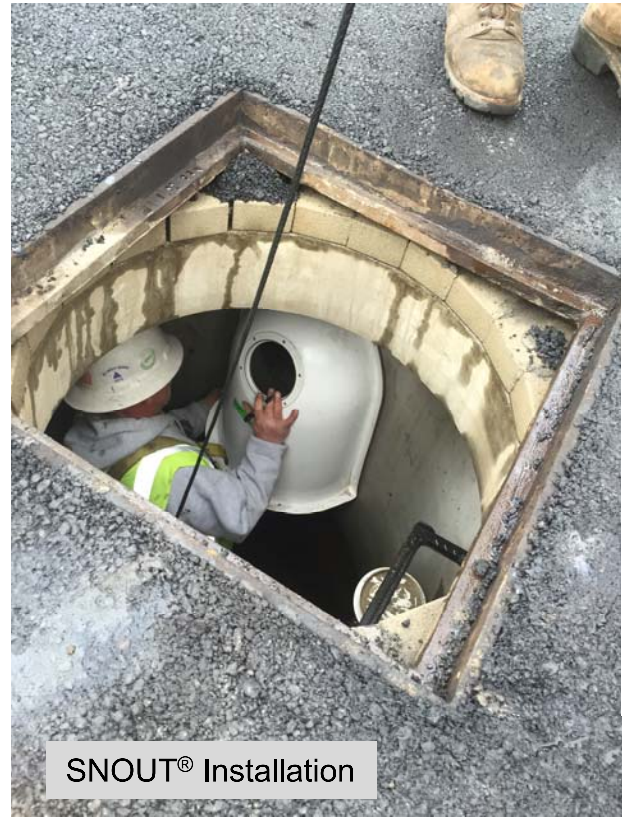
- Offline: multiple inflows were disconnected
- DSCB with SNOUT®



Device Installation

Southampton Street Yard, Boston, MA

▶ Constructed in November 2016



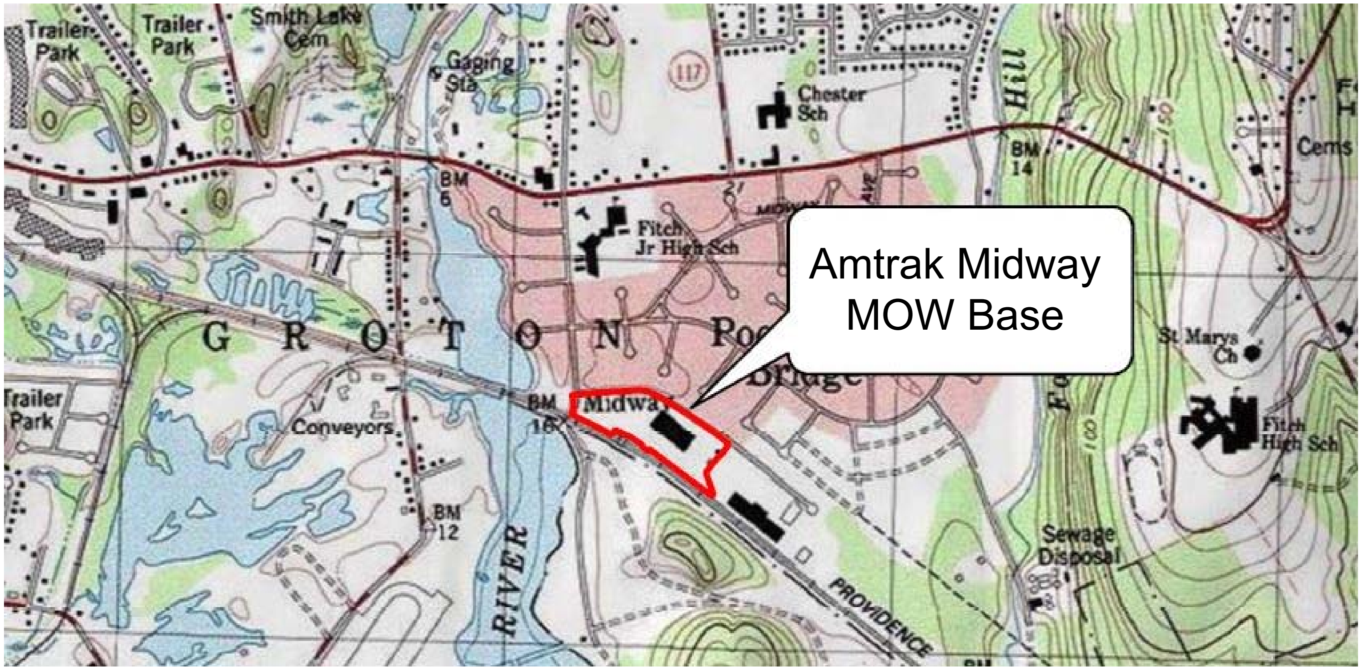
SNOUT® Installation

Device Installation

Midway MOW Base, Groton, CT

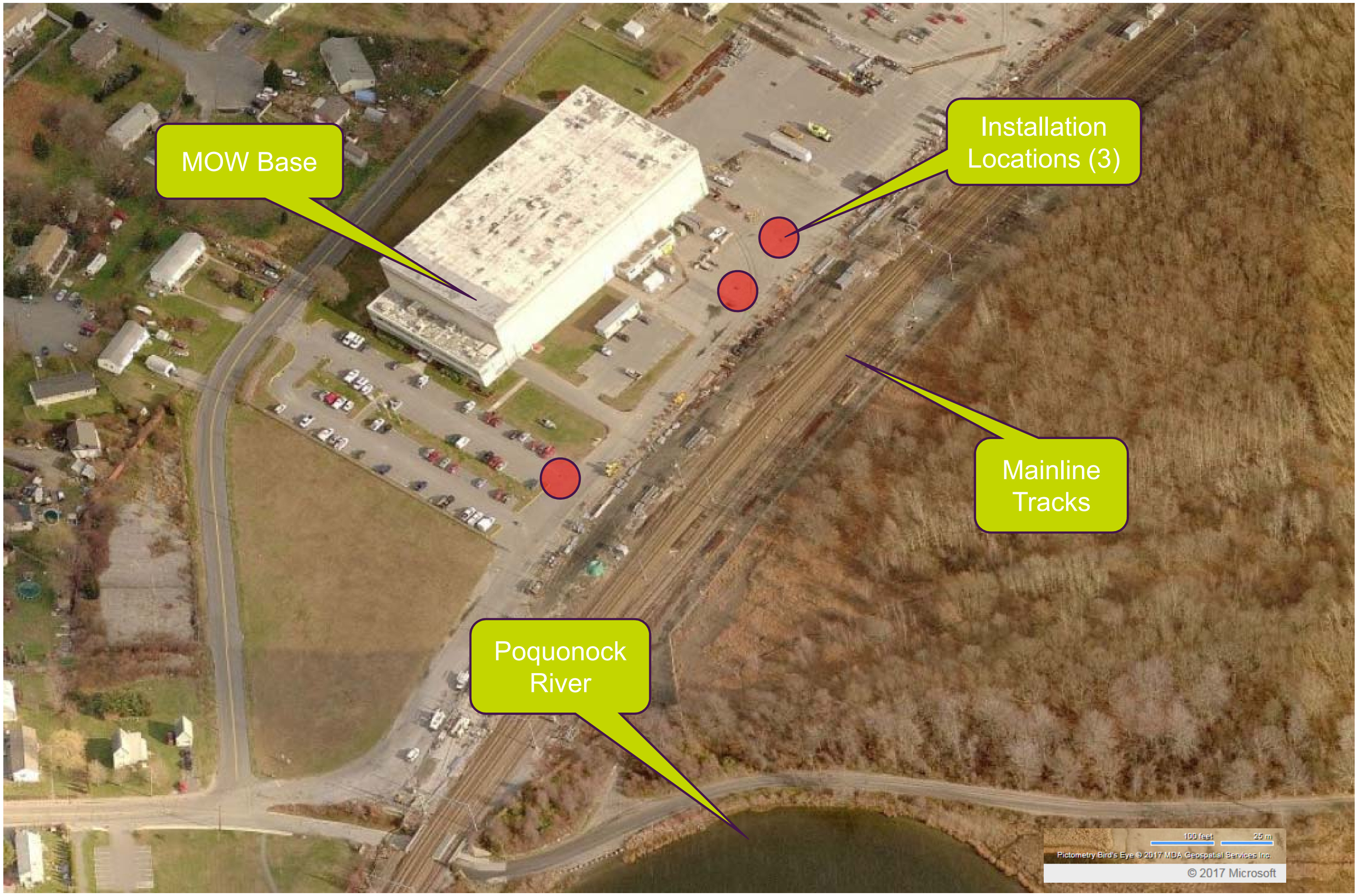
▶ Facility Overview

- Stormwater discharges to Poquonock River
- Little or no sumps in catch basin manholes
- SWPP and SPCC Plans in place to control pollutants and prevent spills
- Amtrak wanted to provide a greater level of water quality protection



Device Installation

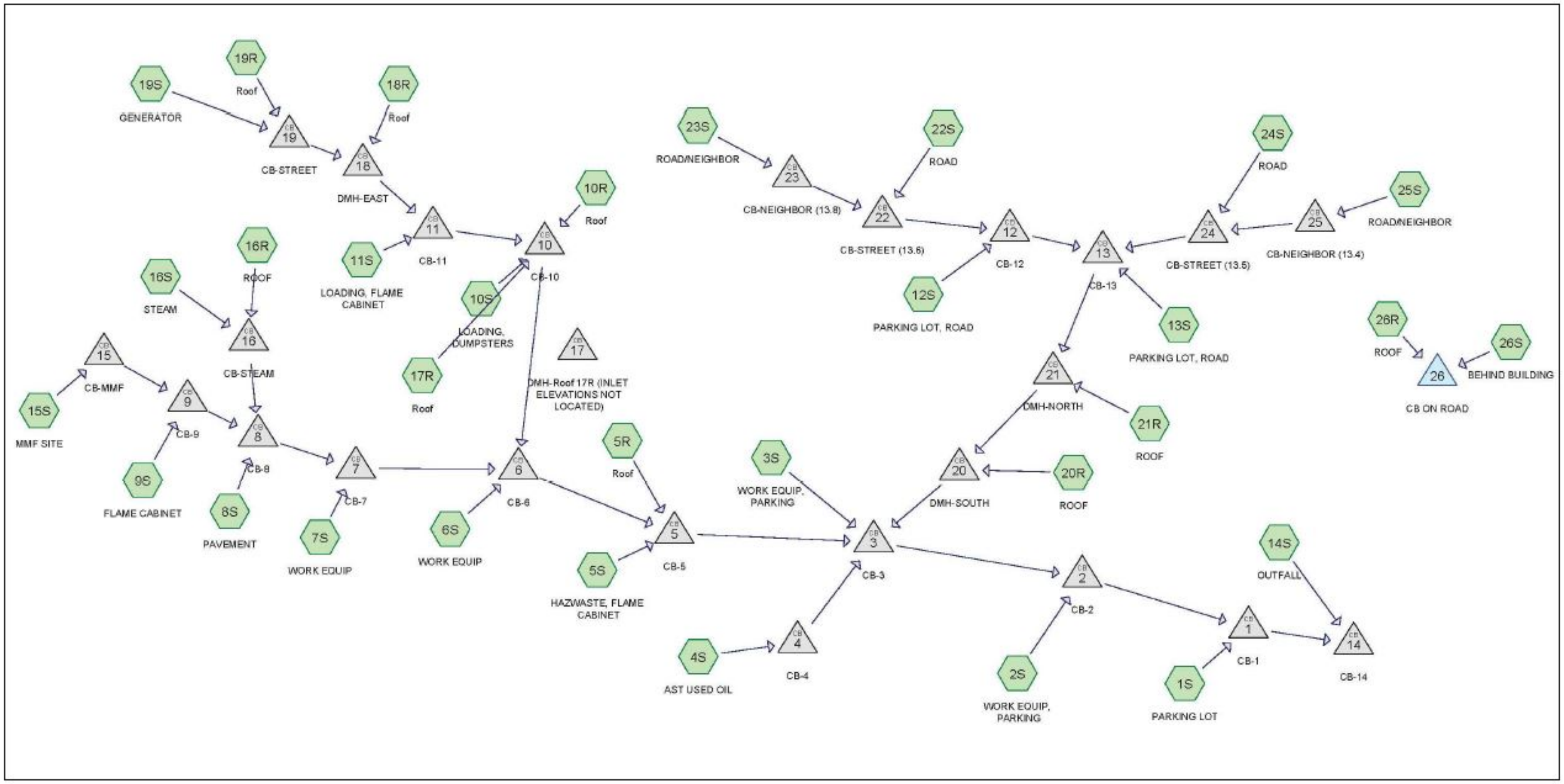
Midway MOW Base, Groton, CT



Case Study

Groton, CT

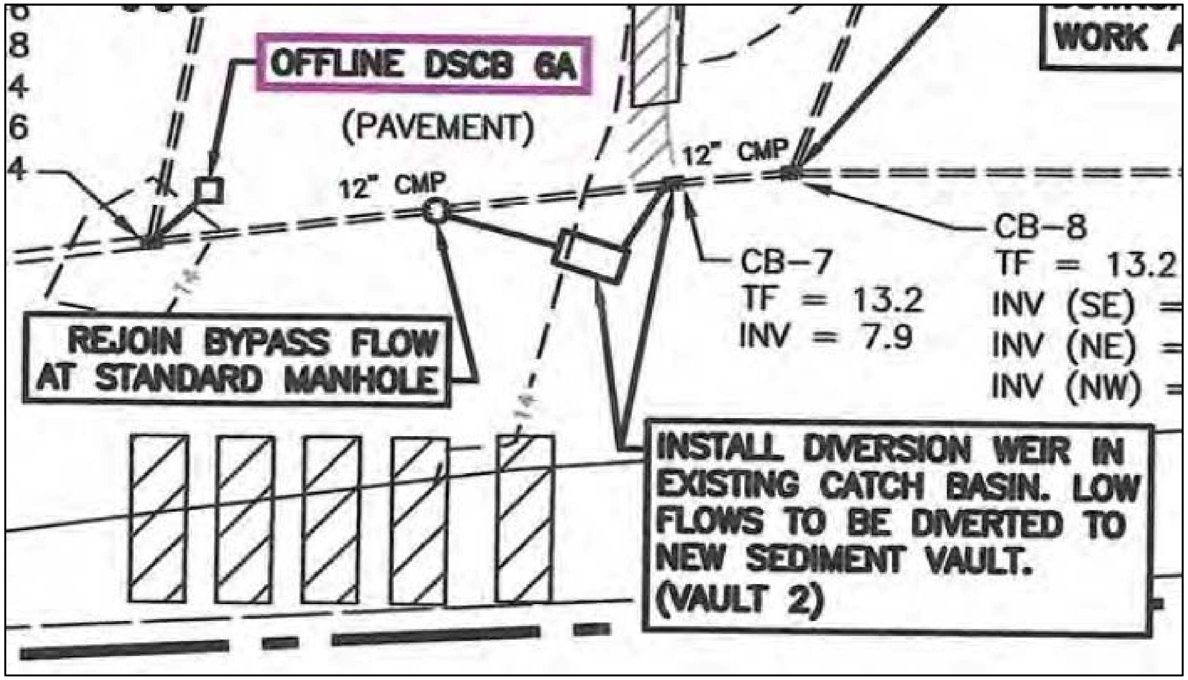
- ▶ HydroCAD model developed to evaluate flows, pollutant sources, and priority areas for BMP retrofits



Device Installation

Midway MOW Base, Groton, CT

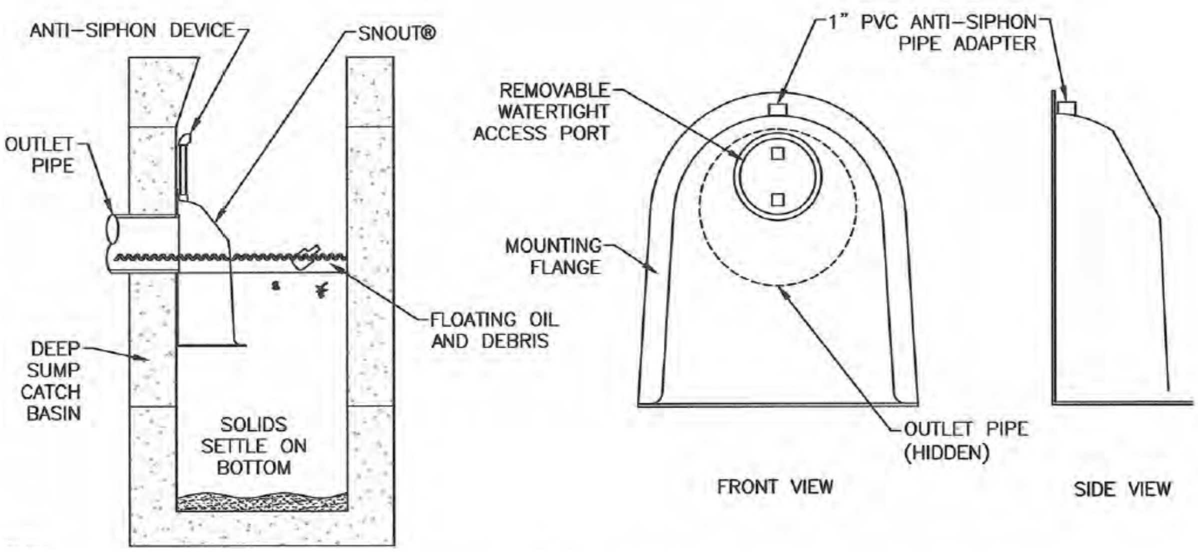
- 75% design for:
  - 9 offline DSCB with outlet hoods
  - 2 sediment vaults (baffled tanks)
- Final design for 3 DSCB (Phase I improvements)



Device Installation

Midway MOW Base, Groton, CT

- Installed 3 DSCB with SNOUTs®
  - Drainage areas vary ~0.25-0.5 acre
  - Flows vary ~0.6-1.1 cfs (2-yr storm)



Drainage Structure	Feature	Elevation
DSCB 2A	Rim	12.70
	Sump	5.62
	Structure Base	4.95
	Invert Out	9.68
CB 2	Rim	12.88
	Invert In	9.28
DSCB 5A	Rim	13.60
	Sump	6.52
	Structure Base	5.85
	Invert Out	10.58
CB 5	Rim	13.78
	Invert In	10.18
DSCB 6A	Rim	13.70
	Sump	6.62
	Structure Base	5.95
	Invert Out	10.68
CB 6	Rim	13.88
	Invert In	10.28

Simplistic design approach and specifications

Device Installation

Midway MOW Base, Groton, CT

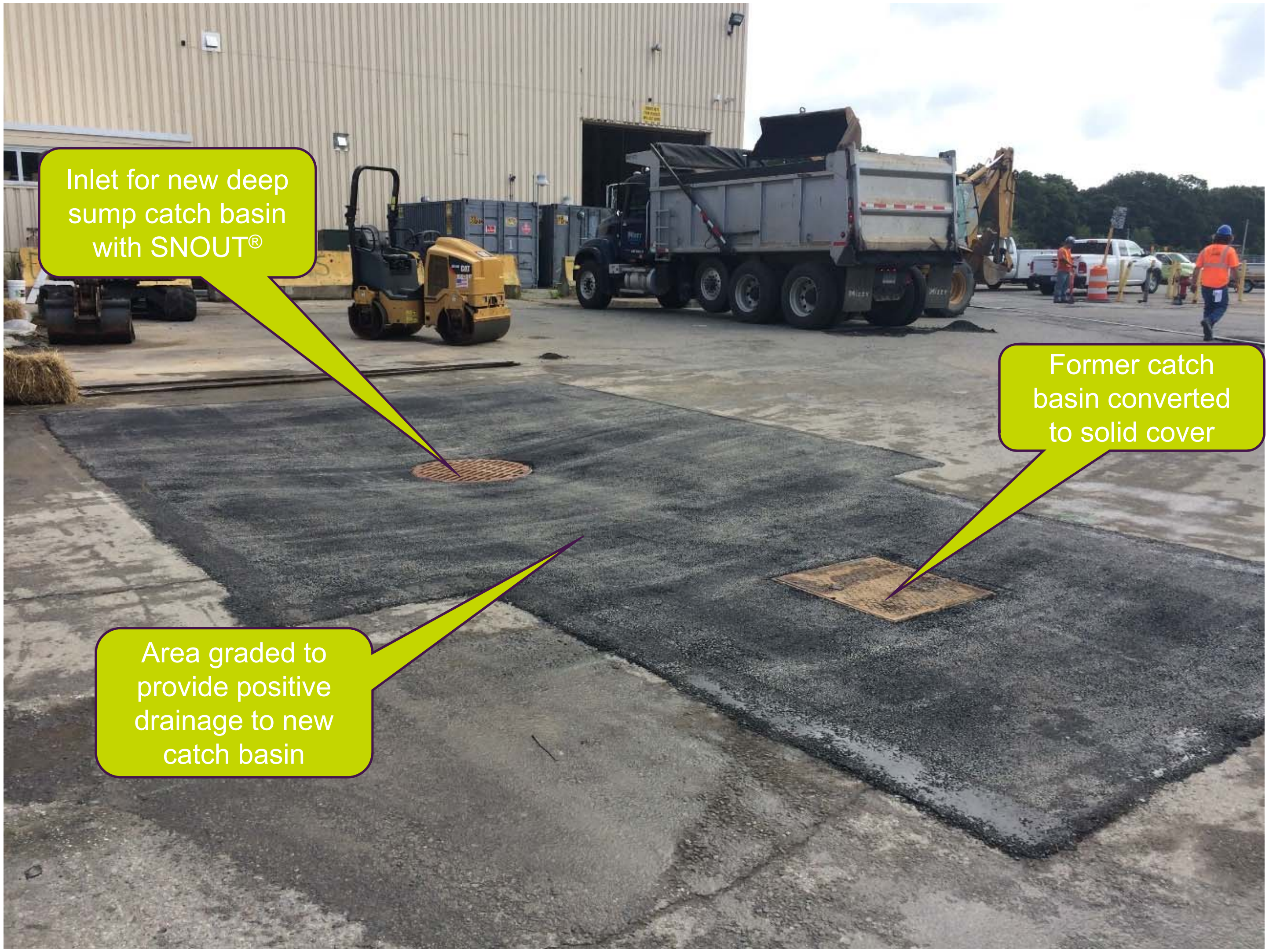
- ▶ Constructed in August 2017
  - o $39,500 construction cost

Device Installation

Midway MOW Base, Groton, CT

Device Installation

Midway MOW Base, Groton, CT



Closing Remarks

- ► Completed an unbiased review of manufactured (in-ground) stormwater treatment Devices
- ► A deep sump catch basin with a hooded outlet was selected as the preferred Device for Amtrak facilities
- ► Successfully installed the selected Device at two facilities

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