Reducing Overflows using a Baffling Solution

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Northeast Ohio Regional Sewer District

URS
NEORSD Responsibility

• Wastewater Collection and Treatment
  – Created in 1972 by court order
  – Governed by 7 trustees: 3 - Cleveland; 1 - Cuyahoga County; 3 - Suburban Council of Governments
  – Serving all or part of 62 communities, 355 square miles, > 1 million customers
  – 3 wastewater plants, 280 MGD on average
  – 280 miles of large interceptor sewers
  – 25-year, $3 Billion CSO Control Program started in 2011 (Project Clean Lake)
NEORSD Service Area and Plants

Easterly: 85/1,600 MGD
Westerly: 70/1,800 MGD
Southerly: 125/1,100 MGD
Combined and Separate Sewer Areas

Combined Sewer Area

Separate Sewer Area

Project Location
Existing Conditions at CSO-063

- Serves a 72 acre sewershed
- Activates 76 times in a typical year
- Discharges 29 MG of combined sewage To West Creek in a typical year (not including storm water discharged from I-480 corridor)
CSO-063 Control Project Goal

• Reduce the numbers of overflows to 1 overflow or fewer in a typical year by diverting flow from the BC-09 regulator SWO pipe to SWI via drop shaft.
Identifying the Challenge

• Per consent decree “Interbasin diversion of combined flows to the Southwest Interceptor via 4’ diameter pipe and new SWI drop structure”
  – Local System: Combined sewer system
  – SWI: Sanitary only system

• Drop flows from combined system to sanitary system without negatively affecting the downstream conditions
Consent Decree – Control Measure 24

• Consent Decree Milestones:
  – Construction NTP by end of 2013
  – Fully operational by end of 2014

• Control Measure 24 will be first of 28 control measures in consent decree to be operational

• Verify performance criteria is met through one year of post-construction monitoring of flow, level, and activation
Critical Project Issues

- Tight design/construction schedule
- Space limitations at BC-09 site
- Close proximity of residential properties
- Community impact during construction
- Connection to a live interceptor
- Constructing drop structure above unreinforced tunnel
# Project Schedule

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<th>2015</th>
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- Design NTP: 01/18/13
- Pre-design: 4 MTHS
- Basis of Design Report: 5/13
- Design Complete: 09/13
- Construction NTP: 11/25/13
- Substantial Completion: 12/30/2014
- Final Completion: 5/29/15
Project Assumptions at Issuance of RFP

- Peak flow rate for 5-year, 6-hour storm
  - 55 MGD to new regulating structure
  - 25 MGD to SWI via drop structure; 30 MGD to CSO-063
- Southwest Interceptor has capacity to accept flow
- Drop shaft excavation largely in Cleveland (black) and Chagrin (gray) shales
Plan w/ Proposed Improvements

- Ground Elev. 762
- West 12th Street
- DWO – 12” VCP
- Sound Barrier
- Invert Elev. 642
- Regulating Structure
- Drop Structure
- SWO – 66” RCP
- SWI – 114” CIP
- I-176 South to I-480 West
Alt. Plan w/ Proposed Improvements
Alt. Plan w/ Proposed Improvements
Disadvantages of Drill Drop Alternative

• Air entrainment
• No energy dissipation
• Maintenance issues
• Lack of access
• Precision of drill drop construction
Proposed Alternative/Configuration

• Key Decisions:
  – What type of drop structure is best suited for this project?
Types of Drops within NEORSD System

• Vortex Drops – numerous; the standard for deep drops in NEORSD’s collection system in the 1980s.
• Baffle Drops – used more frequently in the last 25 years.
• Plunge Drops – numerous; the standard for shallow drops in NEORSD’s collection system
  • Southwest Interceptor – 10 vortex, 1 deep plunge, 2 shallow plunge (20’ & 70’)
  • 7A/7C/VARS – 1 vortex, 9 baffle
  • Mill Creek Tunnel – 6 vortex, 4 baffle, 1 deep plunge
  • Euclid Creek/Dugway Tunnel – 9 baffle
Proposed Alternative/Configuration

- Analyzed three types of drop structures
  - Vortex Drops
Proposed Alternative/Configuration

• Vortex Drops
  – Tangential Inlet forces the sewage to the wall of a vertical drop shaft
  – De-aeration chamber will remove excess air
  – Well suited for large flows
  – Typically more expensive than other types of drops
Proposed Alternative/Configuration

• Analyzed three types of drop structures
  – Baffle Drops
Proposed Alternative/Configuration

• Baffle Drop
  – Also known as a “Cascade Drop”
  – Flow cascades from baffle to baffle
  – Wet Side / Dry Side
  – Well suited for large flows
  – Typically less expensive than Vortex Drops
  – Typically shorter construction durations
Proposed Alternative/Configuration

- Analyzed three types of drop structures
  - Plunge Drops
Proposed Alternative/Configuration

- Plunge Drop
  - Most common type of drop
  - Flow free falls, does not dissipate energy or limit air entrainment
  - Well suited for smaller flow rates and shorter drops
  - Least expensive to construct
Drop Type Selection

• Baffle Drop Advantages
  – Less expensive than Vortex Drop
  – Limits air entrainment
  – Provides additional access point to SWI
  – Odor control has not been an issue with these drops within the NEORSD system
Schematic w/ Designed Improvements

BIG CREEK INTERCEPTOR (TO SOUTHERLY WWTC)

Reg. BC-02

Reg. BC-010

Reg. 4

DWO

NO. 1

24”

NO. 2

60” BRICK

NO. 3

24”

Reg. BC-09

SOUTH WEST INTERCEPTOR (TO SOUTHERLY WWTC)

New Reg.

SOUTHERLY WWTC

SOUTH POINT

CREEK

WEST

REG.

RCO

NO. 4

30”

54” BRICK

24”

54” BRICK

12” RCP

60” BRICK

24”

66” RCP

66” RCP

118” x 78” CMP

DROP SHAFT

114”

CIP

DWO & SWO

Schematic w/ Designed Improvements

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DROP SHAFT

114”

CIP

DWO & SWO
Plan w/ Designed Improvements

- WEST 12TH STREET
- WEST 13TH STREET
- VCP WEST 12TH STREET
- DWO – 12" VCP
- SWI – 114" CIP
- COMBINED SEWER – 66" RCP
- FLOW REGULATING STRUCTURE
- FLOW DROP STRUCTURE

I-176 SOUTH TO I-480 WEST
Diversion Structure Layout
Baffle Drop Sections
Baffle Drop in Action

• NEORSD ECT-4
Baffle Drop in Action

- Working installation – New Zealand
## System Hydraulics

<table>
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<tr>
<th>Storm Event</th>
<th>Peak Flow to:</th>
<th>Peak Flow in MGD</th>
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<td>5-Year, 6-Hour Storm</td>
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* Storm 60 is the only storm in the group of 121 synthetic storms representing a typical year where CSO-063 activates

* Storm 60 is a 1-year, 1-hour storm producing 0.94 inches of rainfall
CSO-063 Site – Before Construction
CSO-063 Site – During Construction
Liner Plates & Ribs in Soft Ground
Rock Bolts & Shotcrete in Shale
Placing Baffle Form
Pouring Baffle Concrete
Thank you!