

THE CITY OF COLUMBUS



EXTENDING THE USEFUL LIFE OF SEWER ACCESS SHAFTS THROUGH CONDITION ASSESSMENT AND REHABILITATION

Five Cities 2017 Conference



Department of Public Utilities
Division of Sewerage and Drainage
Sewer System Engineering Section

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AGENDA

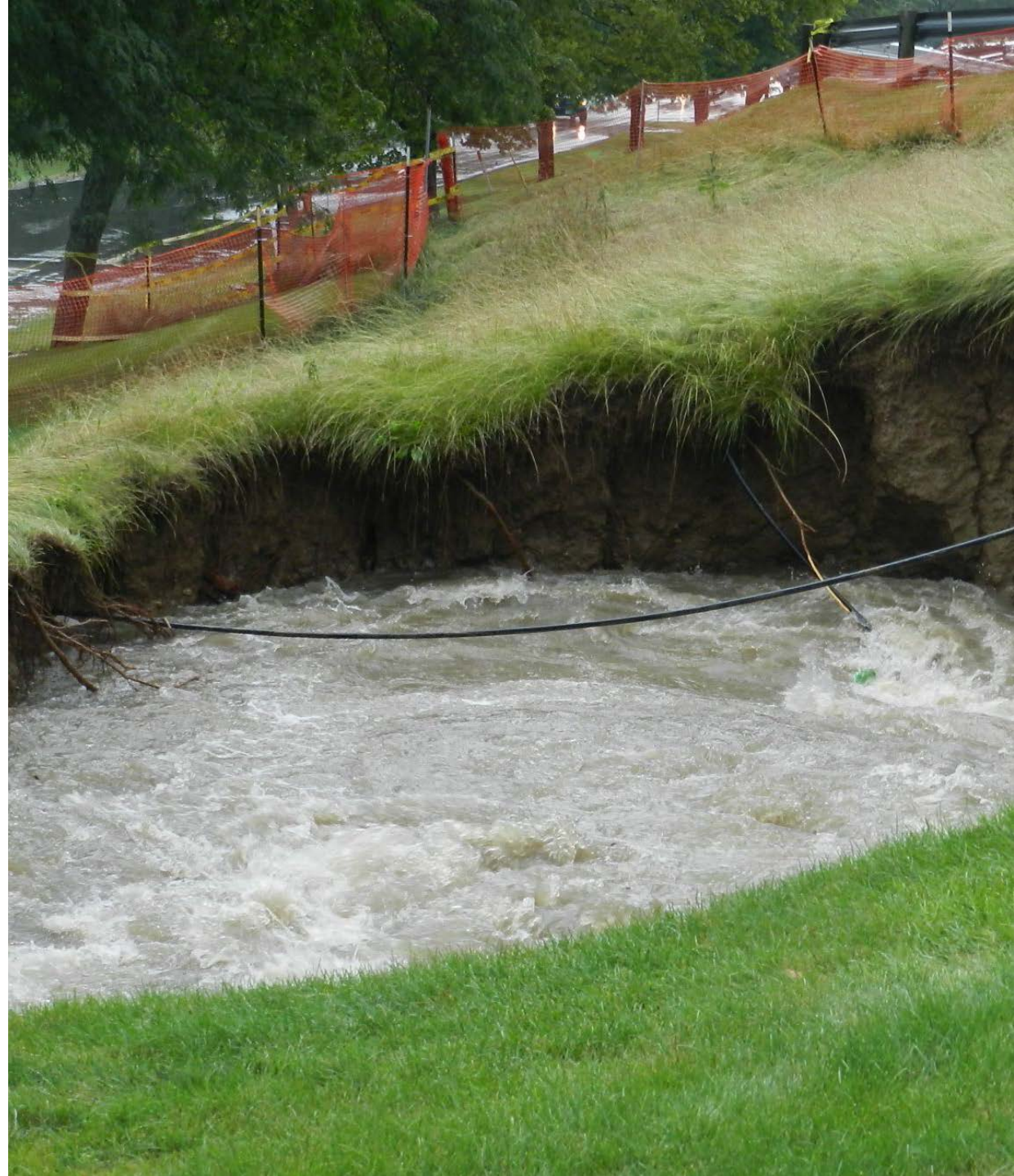
- 01 INTRODUCTION
- 02 PROJECT BACKGROUND
- 03 CONDITION ASSESSMENT AND INSPECTION
- 04 DESIGN CONSIDERATIONS
- 05 CONCLUSION - TAKEAWAYS



01 INTRODUCTION

INTRODUCTION

- Need for structure management
 - Aging infrastructure
 - Risk management
 - Planned vs. Emergency outages
 - Financial implications



STRUCTURE DETERIORATION Symptoms

- Visual signs of structural cracking
- Lining deterioration / falling off
- Sinkholes
- Rust spots
- Water leakage
- Material build up
- Odor issues

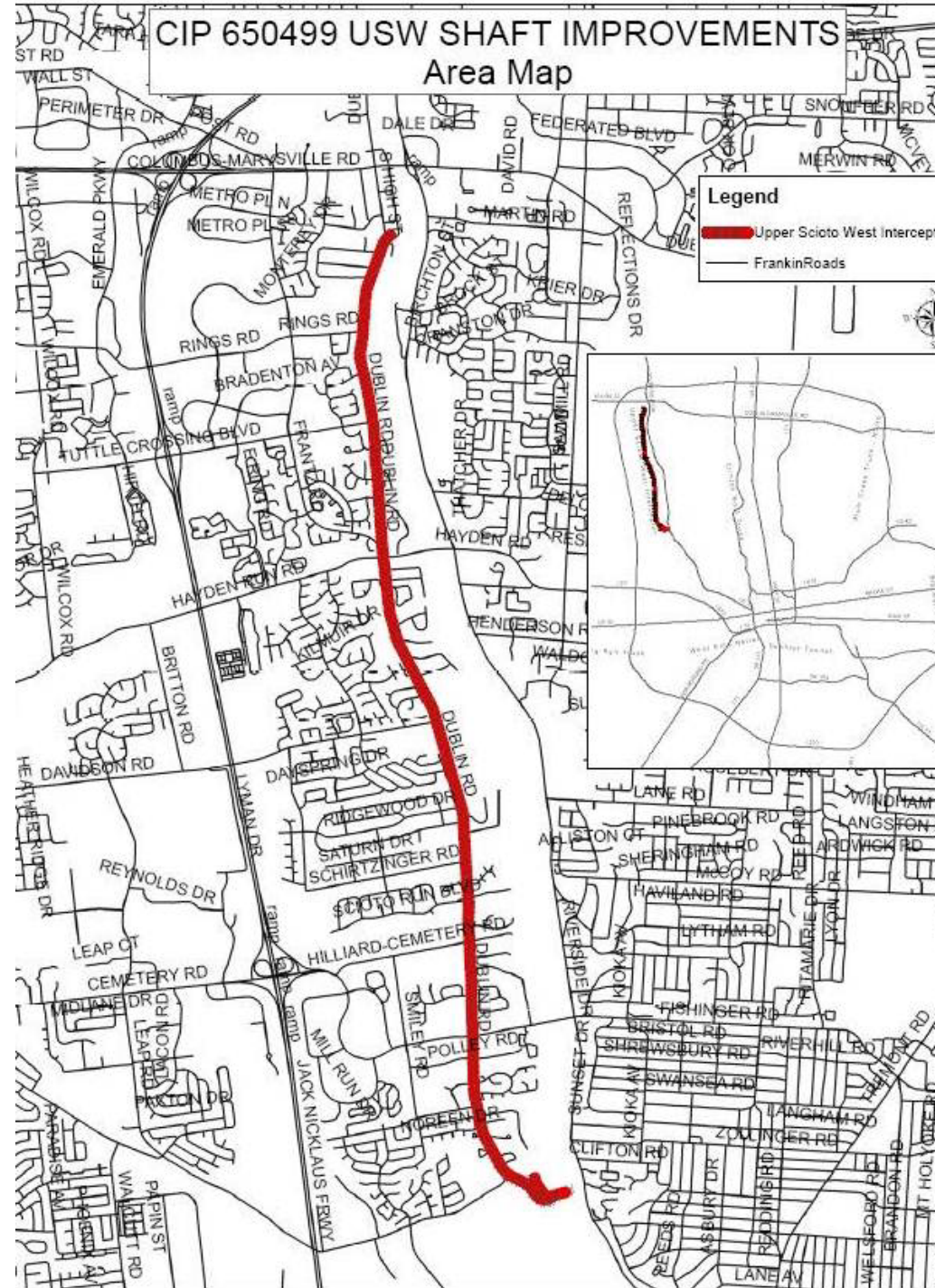




02 PROJECT BACKGROUND

BACKGROUND

- Upper Scioto West Interceptor Sewer (USWIS)
 - 30,000 linear feet tunnel
 - 4' – 7' diameter
 - 14 access shafts, between 14' -90' deep
 - 2 bio-filters – odor control
 - 2 flow monitors
 - Large service area
 - City of Columbus
 - City of Dublin
 - City of Hilliard
 - Asset Management
 - Construction completed in 1999
 - Annual shaft inspections
 - » Requires special cage for manned entry
 - » Access challenges
 - Bio-filter rehabilitation



PROBLEM SYMPTOMS

- Broken concrete at the base of the shafts
- Lining falling off
- Material build-up
- Water leaks evident along the shaft walls
- Cracks on the shaft walls



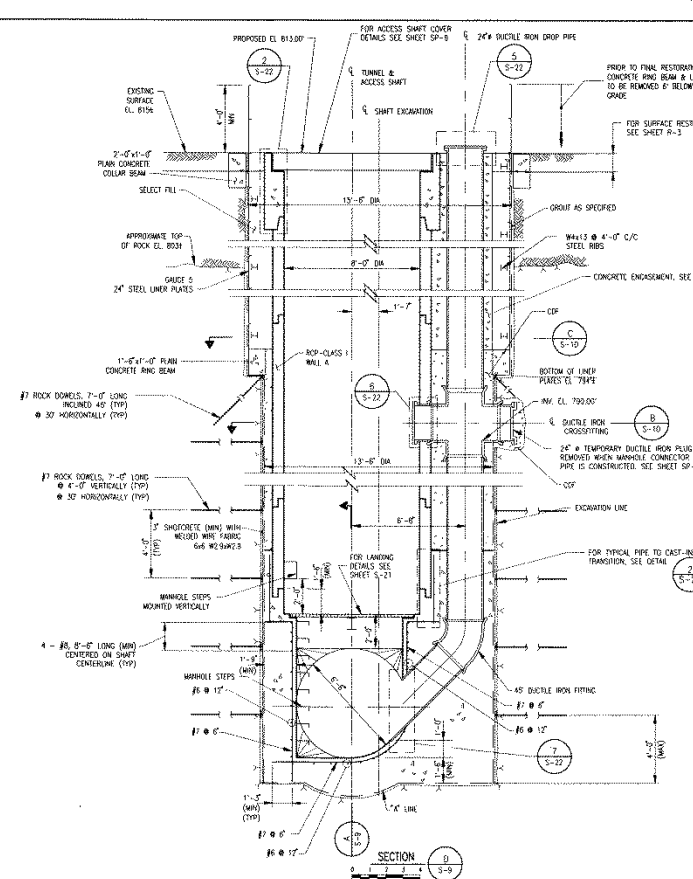
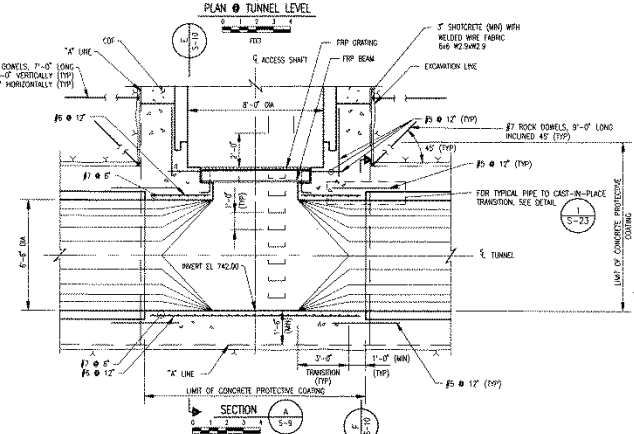
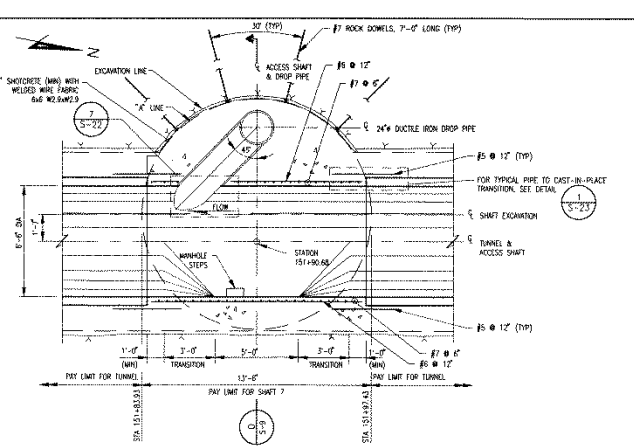


03 CONDITION ASSESSMENT AND INSPECTION

INSPECTION SAFETY

- Confined Space Entry
 - Documentation
 - Three man crew + City cage operator
- Safety Plan
 - Inspection Procedure
 - Contact Information
 - Emergency Plan
 - Nearest Hospital
- Personal Safety Equipment





TITLE BLOCK CITY OF COLUMBUS, OHIO DEPARTMENT OF PUBLIC UTILITIES DIVISION OF SEWERAGE AND DRAINAGE	PROJECT: WEST INTERCEPTOR SEWER SHEET: S-22 DATE: 10/25/19	DRAWN BY: [Name] CHECKED BY: [Name]	SCALE: AS SHOWN UNIT: FEET	SHEET: S-22 PART: 2	ISSUED: 5.1 DATE: 10/25/19
	CITY OF COLUMBUS, OHIO DEPARTMENT OF PUBLIC UTILITIES DIVISION OF SEWERAGE AND DRAINAGE		UPPER SCIOTO WEST INTERCEPTOR SEWER CIP 710010 PART 2		SHEET: S-22 DATE: 10/25/19
	PROJECT: WEST INTERCEPTOR SEWER SHEET: S-22 DATE: 10/25/19		SCALE: AS SHOWN UNIT: FEET		SHEET: S-22 DATE: 10/25/19
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CITY OF COLUMBUS

UPPER SCIOTO WEST INTERCEPTOR SEWER



INSPECTIONS PERFORMED

- Visual site inspection
- Visual shaft inspection
 - City assisted with use of their inspection cage
- Sounding
- Schmidt Hammer testing
- Isopleth testing
- Concrete cores removed and petrographic analysis



Inspections Performed



Isopleth Testing



Concrete Cores Removed for Testing



Schmidt Hammer Testing

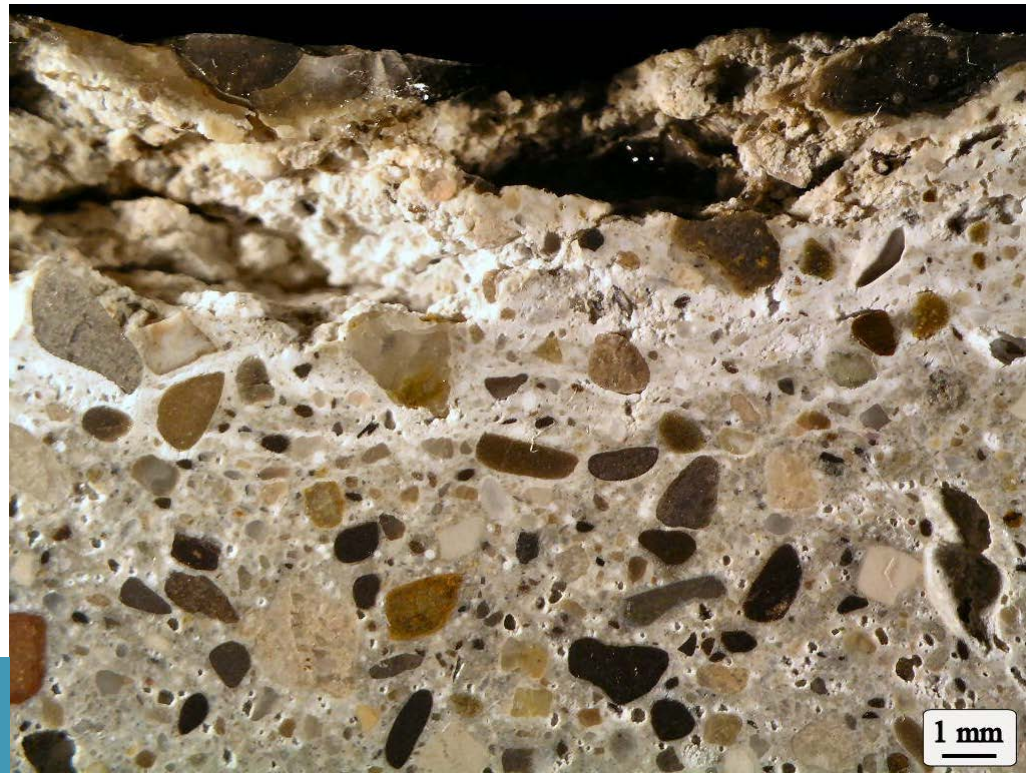


Visual Inspection



Petrographic Analysis

- Concrete cores removed from 6 shafts
- Surface analysis performed
 - Signs of chemical attack
 - Sulfuric Acid
 - Sulfate
 - Reduction in surface material
 - Calcite and gypsum deposits present
 - Water intrusion
- Cement paste tests
 - Cement beyond the surface in good shape
- Compressive strength tests
 - Results varied between 6,630 and 10,400 psi



Inspection results

- Shafts placed in four categories based the inspection results
 - Minor Damage
 - Shaft door corrosion
 - Minimal loss of protective lining
 - Moderate Damage
 - More severe corrosion/cracking/lining/localized damage than Minor Category
 - Some water intrusion
 - Significant Damage
 - More severe corrosion/cracking/lining/localized damage than Moderate Category
 - Multiple areas of water intrusion
 - Some structural damage
 - Major Damage
 - More severe corrosion/cracking/localized damage than Significant Category
 - Structural damage that could cause failure

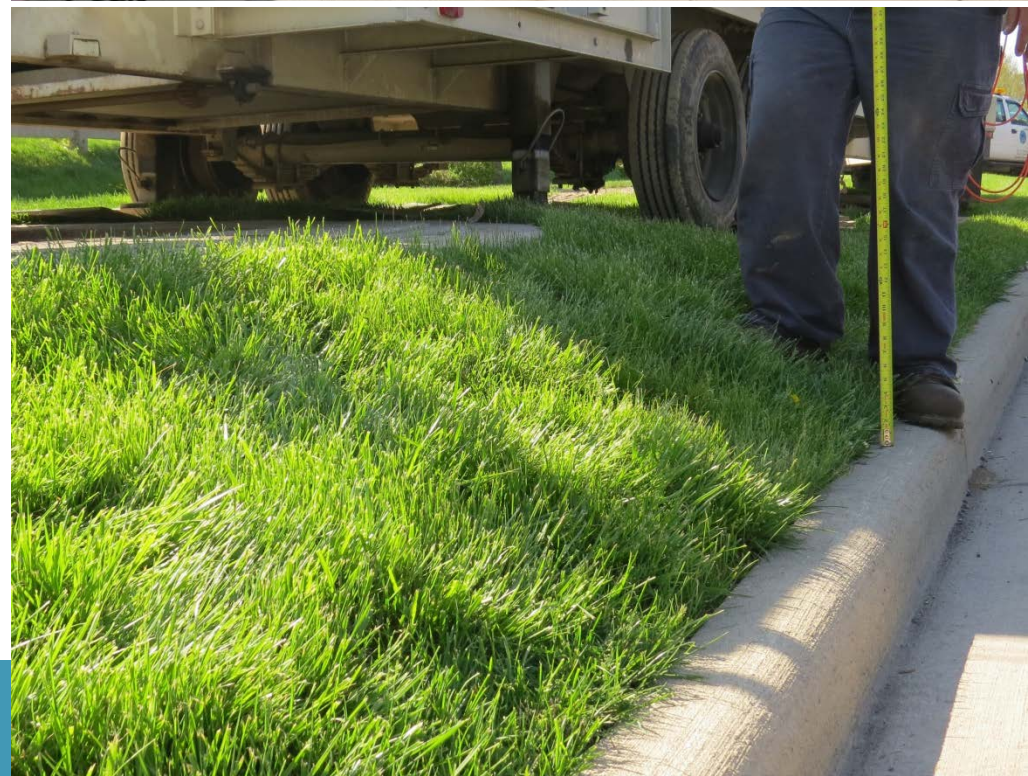
Table 2: USWIS Shafts Current Conditions

Shaft Number	Minor Damage	Moderate Damage	Significant Damage	Major Damage
1			X	
2			X	
3			X	
4			X	
5			X	
6			X	
7			X	
8			X	
9			X	
10			X	
11				X
12		X		
13		X		
14	X			



Site Inspection results

- Each shaft site was inspected for access ease
- To gain access to the shafts a heavy trailer carrying the inspection cage must be backed up to the shaft access hatches
- Many of the access hatches are in grass or low lying areas that cannot be accessed during wet conditions





04 DESIGN CONSIDERATIONS

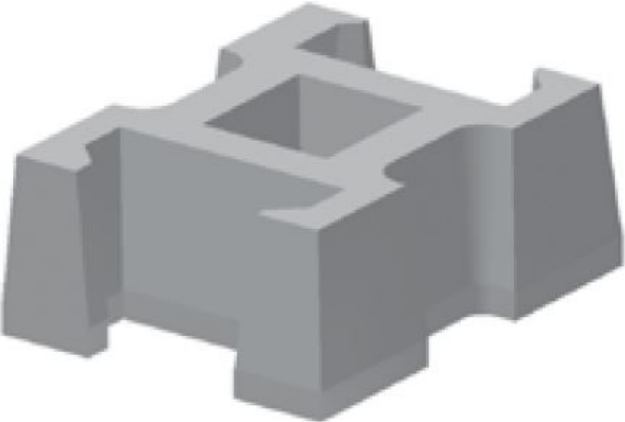
Site Recommendations

- Provide access pads to 10 shafts to allow for access in any condition
 - Costs range between \$20,000 - \$80,000 per site
- Fix all access hatches
- Coordinate site improvements with appropriate agency
 - City of Columbus
 - Franklin County
 - City of Hilliard
 - City of Dublin



Site Access Pad Considerations

- Structural
- Aesthetics
- Cost
- Installation
- Durability



ArmorLoc®



Shaft Recommendations

- Recommendations were given depending on the damage category the shaft inspection dictated
- Annual inspections were recommended for all shafts
 - Minor – 1 Shaft - \$10,000 per shaft
 - Hatch repair and painting
 - Moderate- 2 Shafts - \$40,000 – per shaft
 - Same as Minor
 - Spot crack/concrete repair
 - Lining installed around all joints/cracks/pipe penetrations
 - Significant – 10 Shafts - \$100,000 – per shaft
 - Same as Moderate
 - Spot crack , concrete and structural repairs
 - New lining in the entire shaft
 - Major – 1 Shaft - \$200,000 per shaft
 - Same as Significant
 - Extensive concrete structural repairs



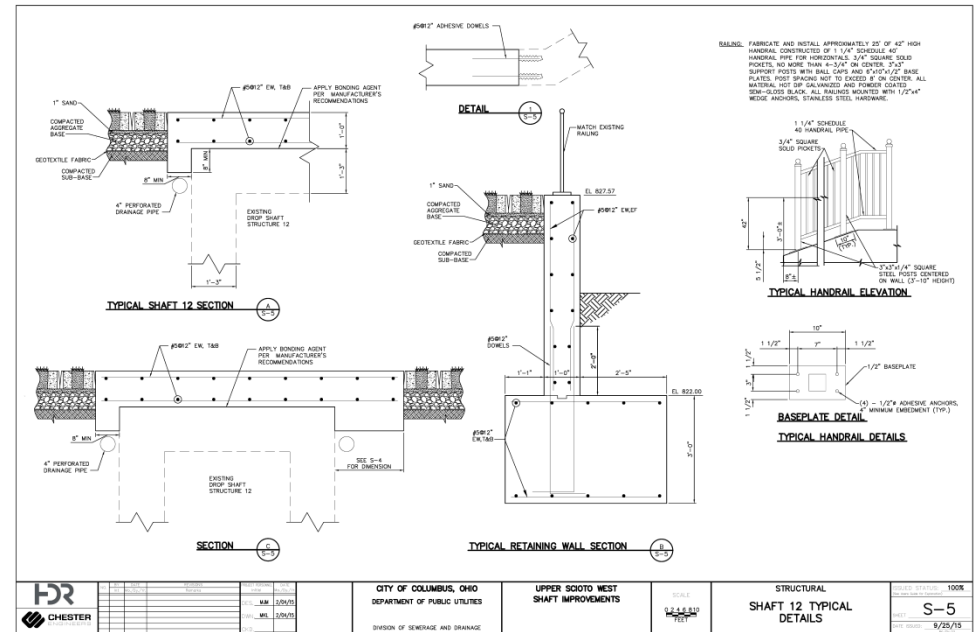
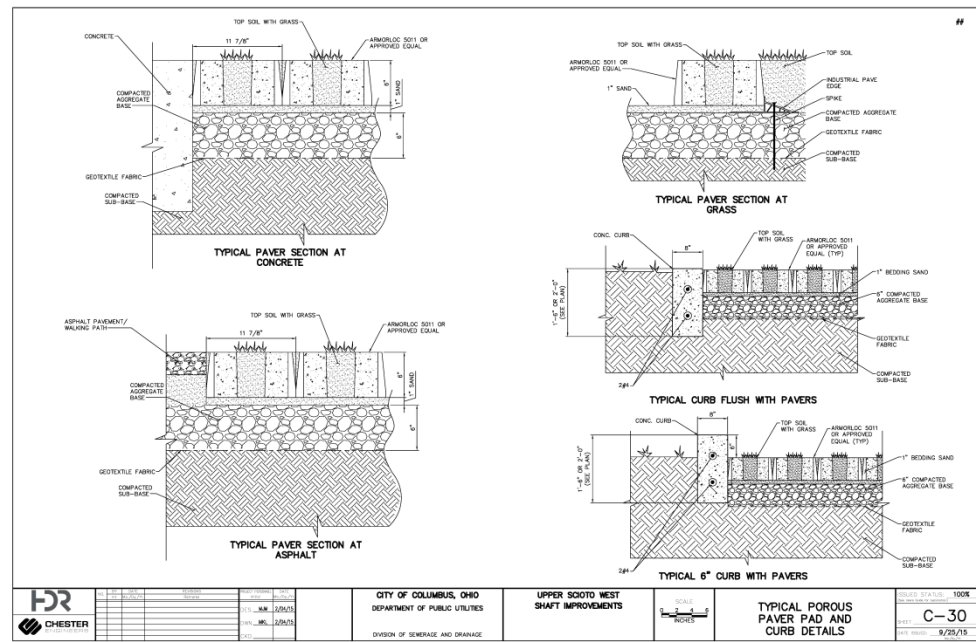
Lining Considerations

- Corrosion resistance
- Shaft humidity
- Water intrusion
- Structural requirements
- Past performance within the City
- Lining Manufacturers
 - SprayWall by SprayRoq
 - PolySpray FS-250 by HydraTech
 - SewerGard No. 210S by Sauereisen



Project Details

- New lining of 13 shafts
- Access to 10 sites improved with new concrete pavers
- Hardware replacement and new painting of all access hatches
- Shaft 11 concrete base rehabilitation
- Concrete repair to all cracks, hollow areas, exposed rebar
- Chemical grout injection for water intrusion





05 CONCLUSION - TAKEAWAYS

CONSTRUCTION

- Construction to begin in 2017
- Project Cost \$1,961,000
- Contractor
 - Sunesis Construction Company



CONCLUSION - TAKEAWAYS

- There are many benefits to managing underground structures
 - Risk Management
 - Avoid costly emergency by-pass pumping and repairs
 - Prevents sink holes – pedestrian safety issues
 - Prevents debris from getting into the system
 - Scheduling Inspection
 - Easier access for inspections of the shafts and the tunnel
 - Easier access for future tunnel rehabilitation projects
 - Financial Planning
 - Extend the useful life of your assets
 - Cost savings from delayed new construction
 - More bang for your buck



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QUESTIONS?

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