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APWA WA
APRIL 10-11, VANCOUVER WA
2024 SPRING CONFERENCE

Structural Rehabilitation Under Severe Access Constraints

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Jerry Barnett, PE | Clark Regional Wastewater District

LEARNING OBJECTIVES

Objective 1 - Identify, evaluate, and select rehabilitation technologies to meet project goals

Objective 2 - Develop an approach to mitigate project risks

Objective 3 - Utilize the latest technological advances to ensure project success

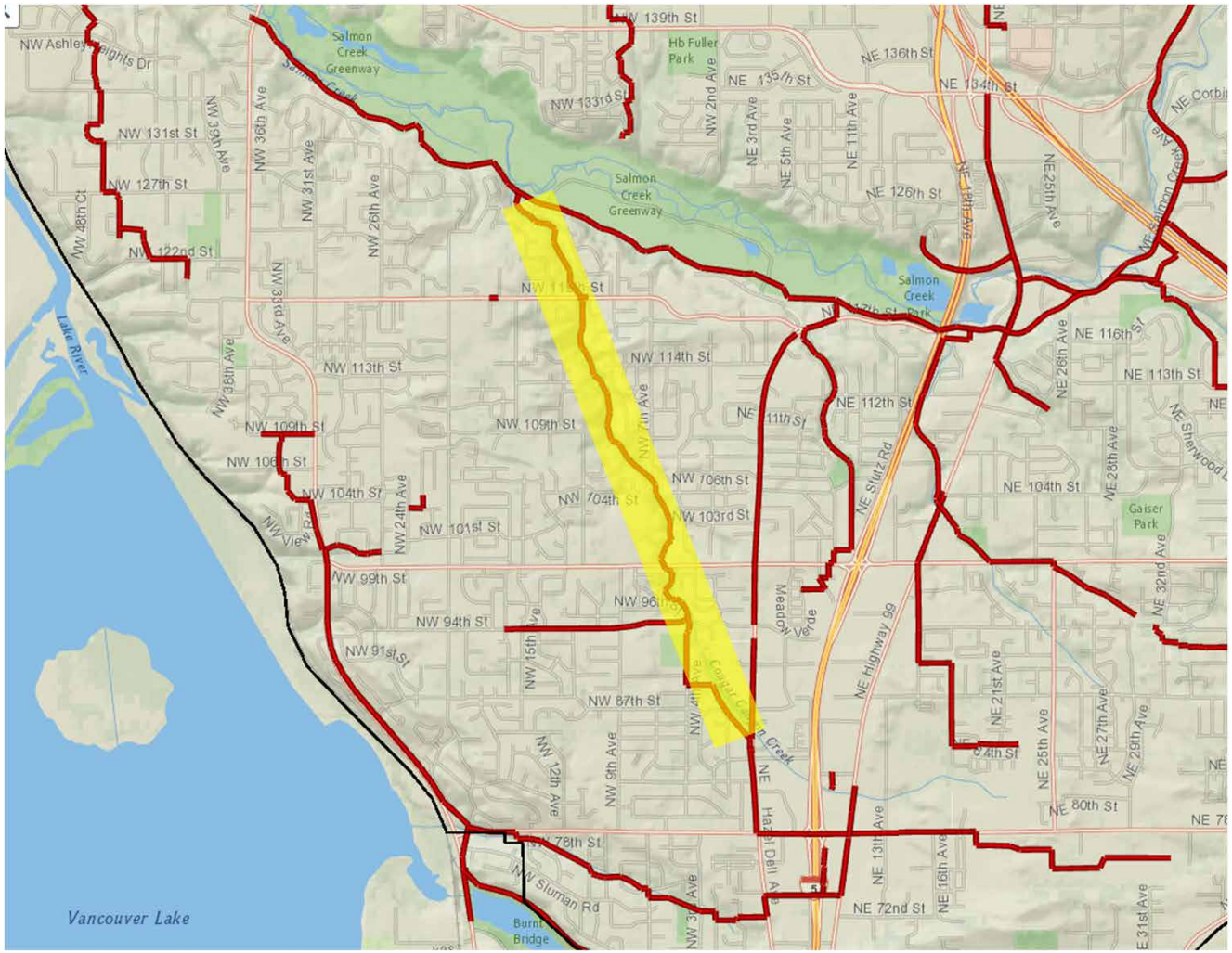
Agenda

- Background
- Overview
- Project Goals
- Timeline
- Condition Assessment
- Design
- Permitting Strategy
- Construction
- Project Takeaways

Background

- **Owner:** Clark Regional Wastewater District
- **Location:** Vancouver, WA
  - Cougar Canyon
- **Trunk Characteristics:**
  - 10,078 Linear-feet
  - 12- to 15-inch diameter RCP
  - Constructed 1978-79

Background


NW 139th St
Salmon Creek Greenway
Hb Fuller Park
NE 136th St
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NE 104th St
Gaiser Park
NW 101st St
NW 99th St
NW 94th St
NW 91st St
NW 87th St
NE 80th St
NW 78th St
NE 72nd St
Lake River
Vancouver Lake
Burnt Bridge
NW Sluman Rd
NE Highway 99

Background

Planned Corridor Projects

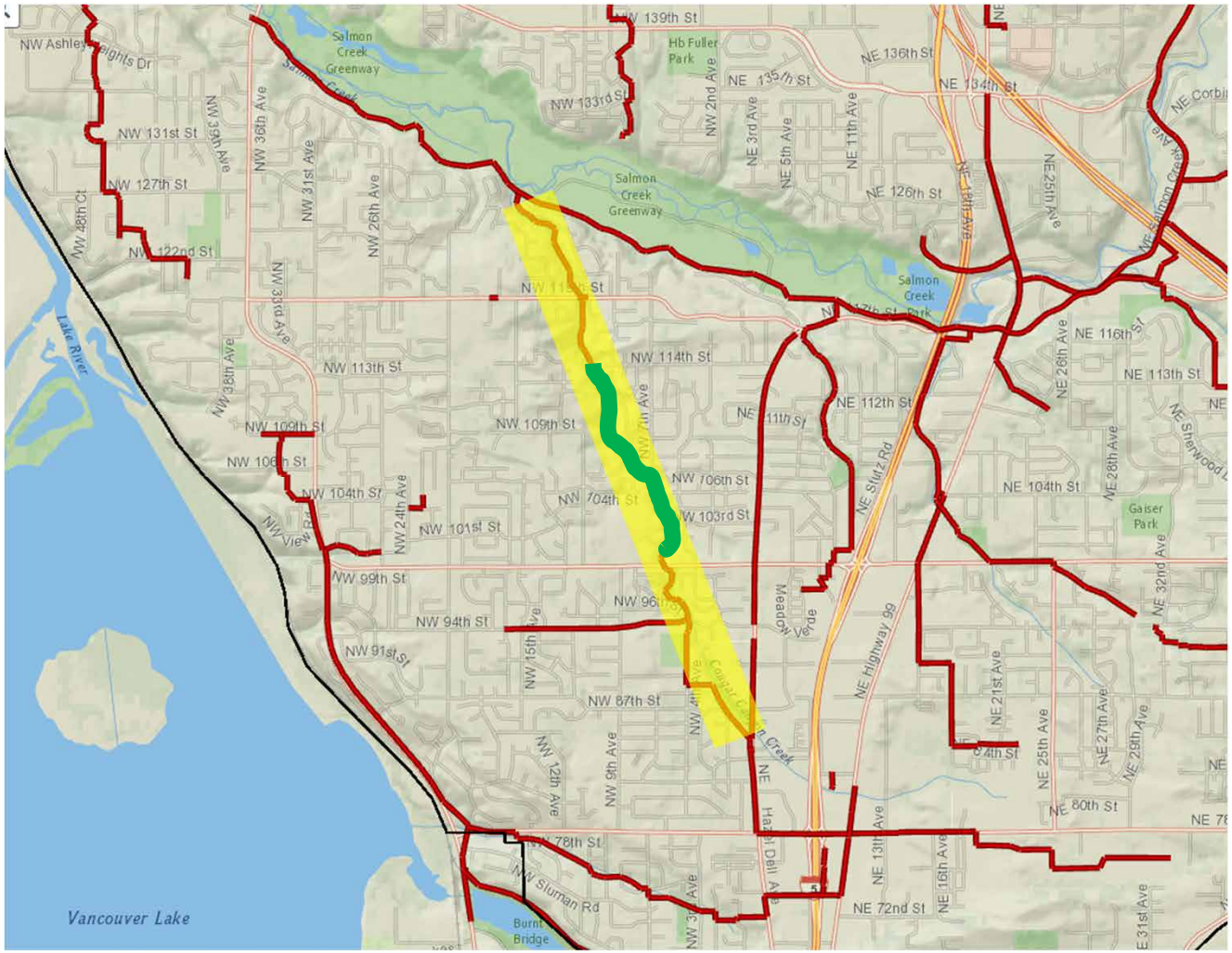
1. Hazard Mitigation / Exposed Pipe
2. Structural Rehab of Trunk
3. Stream Resiliency and banks stability – Future/Pending

Project Overview

Rehabilitation of:

- 4,078 Linear-feet
- 15-inch diameter RCP
- 19 Manholes
  - Interior coating
  - Lids, steps, & concrete

Project Map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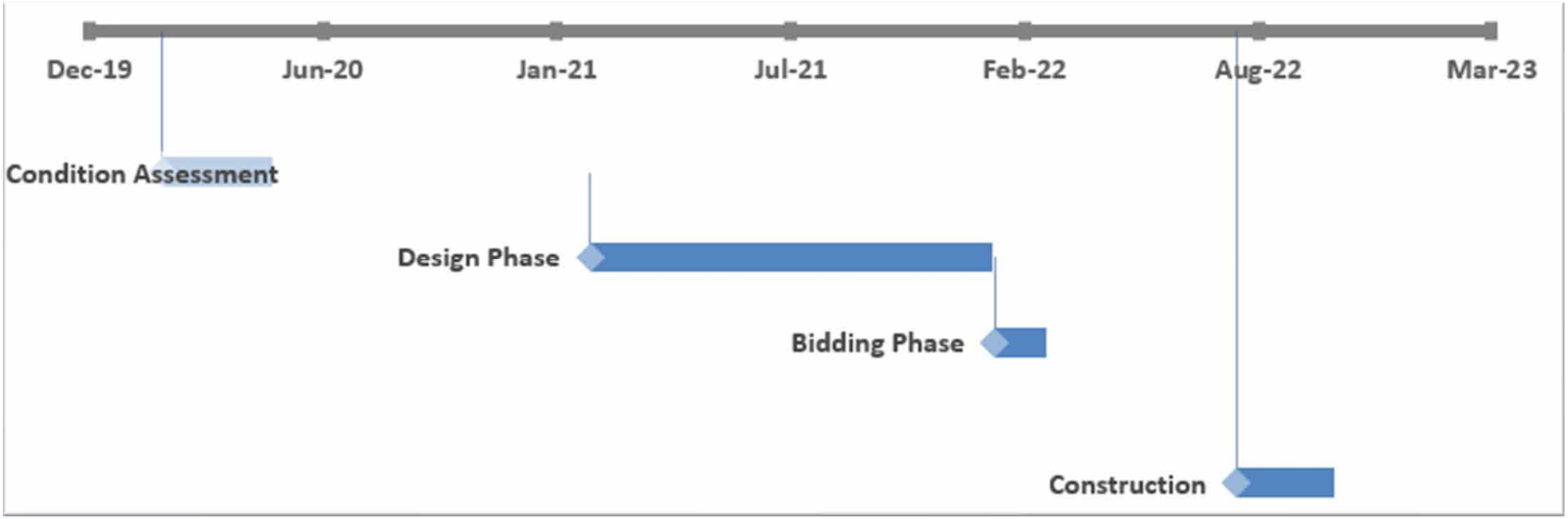
NW 36th Ave
NW 38th Ave
NW 24th Ave
NW 15th Ave
NW 12th Ave
NW 9th Ave
NE 3rd Ave
NE 5th Ave
NE 11th Ave
NE 25th Ave
NE 27th Ave
NE 28th Ave
NE 32nd Ave
NE 13th Ave
NE 16th Ave
NE Highway 99
NW Sluman Rd
NE Hazel Dell Ave

Project Goals

1. Structural Rehab
2. Corrosion Protection
3. Maximize Capacity
4. Construct in 2022

Timeline



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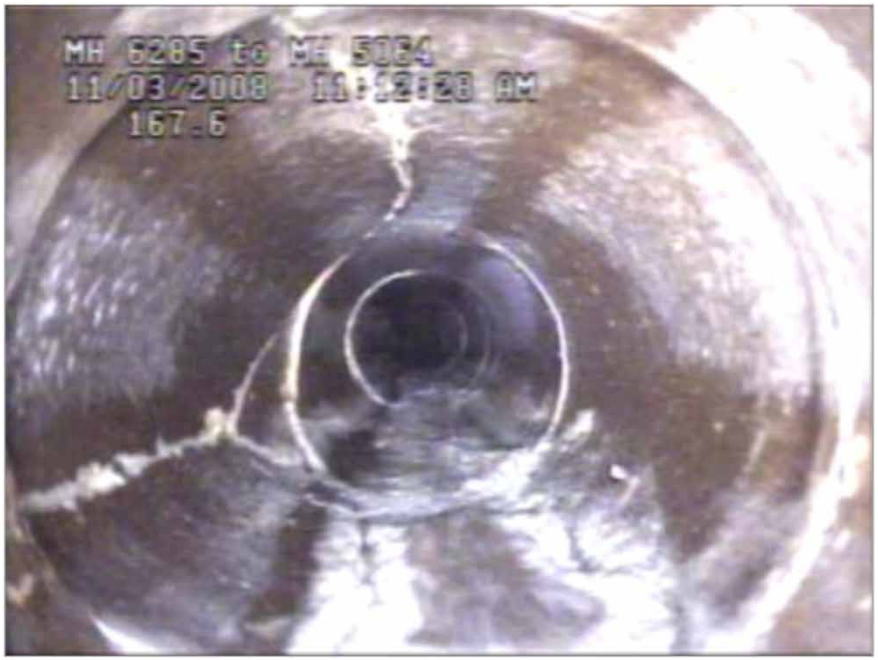
Preliminary Design

Condition Assessment

- Phase 1: CCTV Inspection
- Phase 2: Supplemental CCTV



Condition Assessment

- Phase 1:
  - CCTV Inspection
  - Visual Inspection of exposed pipe

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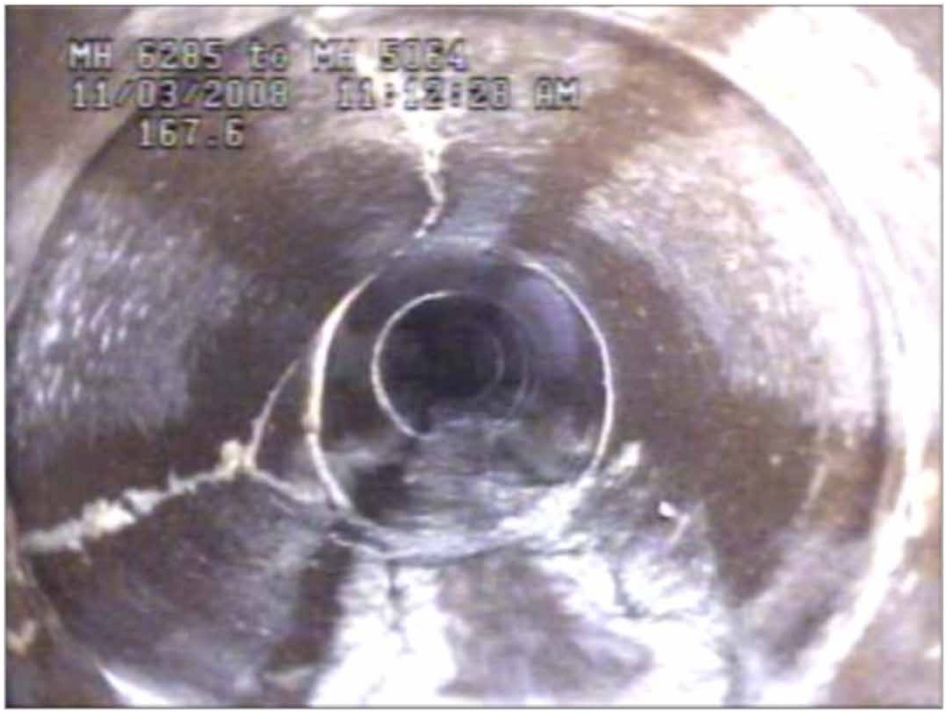
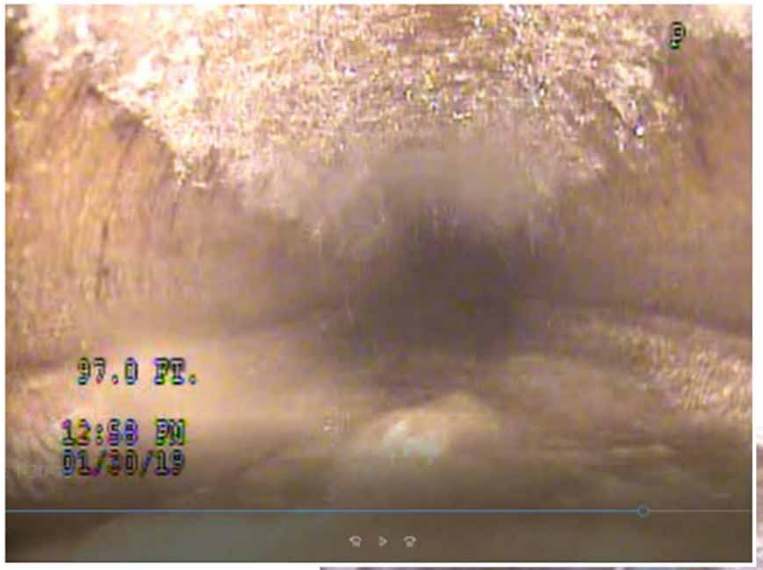
Condition Assessment

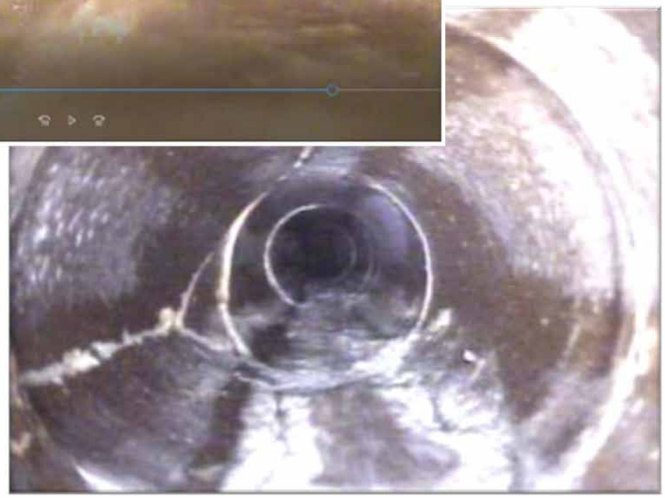
- Phase 2:
  - Supplemental CCTV Inspection
  - Verification
  - Recommendations



Condition Assessment - Results

- PACP Grades 4 and 5
- Wall loose ½" to 1"
- Exposed reinforcement
- Cracking





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Bypass Flows

- Flow Monitoring

  Range = 175 to 1,200 gpm

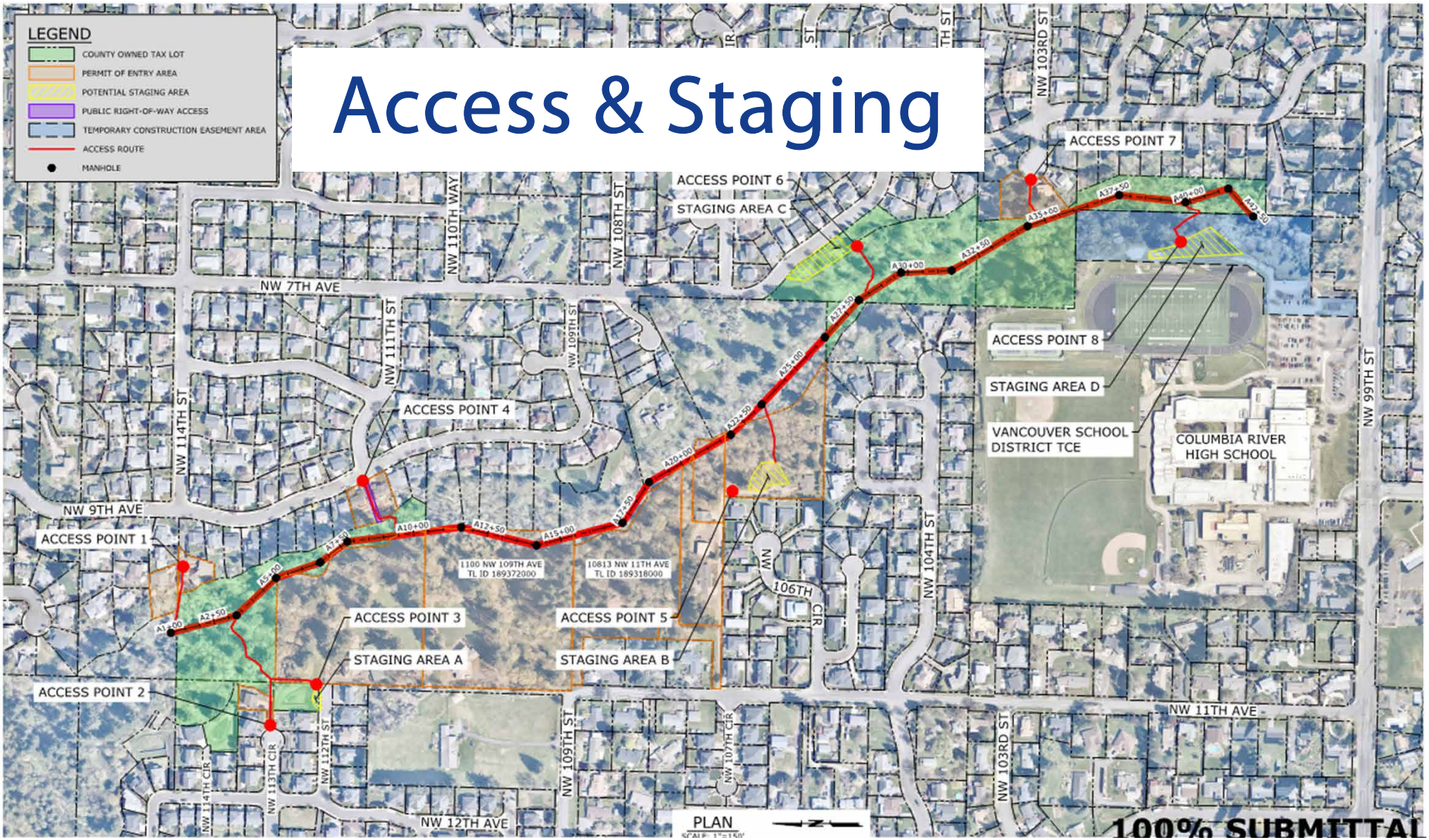
  Average = 572 gpm

Design Phase

Design Challenges

- Access Constraints
- Staging Limitations
- Environmental Corridor
- Permitting Timeline

Access & Staging



Permitting

Existing Conditions:

- Creek Corridor
- Environmental Sensitive Area
- Delineated Wetlands

Strategy:

- Avoid permit triggers

Approach:

- Minimize disturbed area
- Use technology suited to strategy

Permitting

Triggers to avoid:

- No vehicles
- No tree felling
- Minor limbing only
- No excavation
- No fill

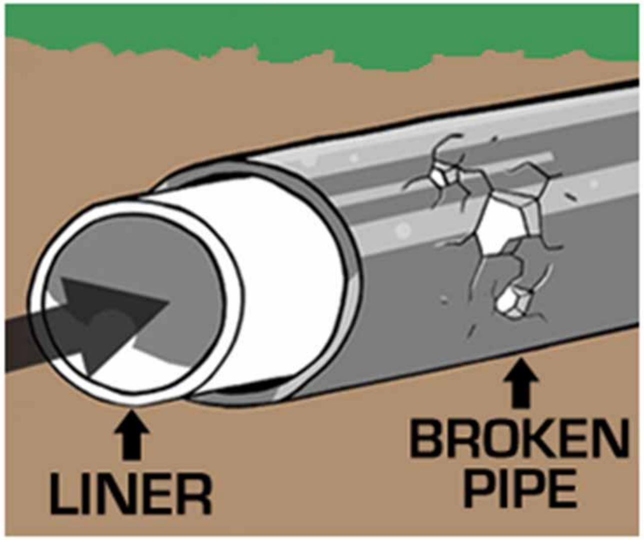
Design – Alternatives Analysis

Criteria:

- Fully structural rehab
- Feasibility / Constructability
- Contractor availability & experience
- Capacity Retention
- Cost

Design – Alternatives Analysis

- Technologies
  - Sliplining
  - Spiral Wound Pipe
  - Cured-In-Place Pipe (CIPP)
    - Thermal Cure
    - UV Cure



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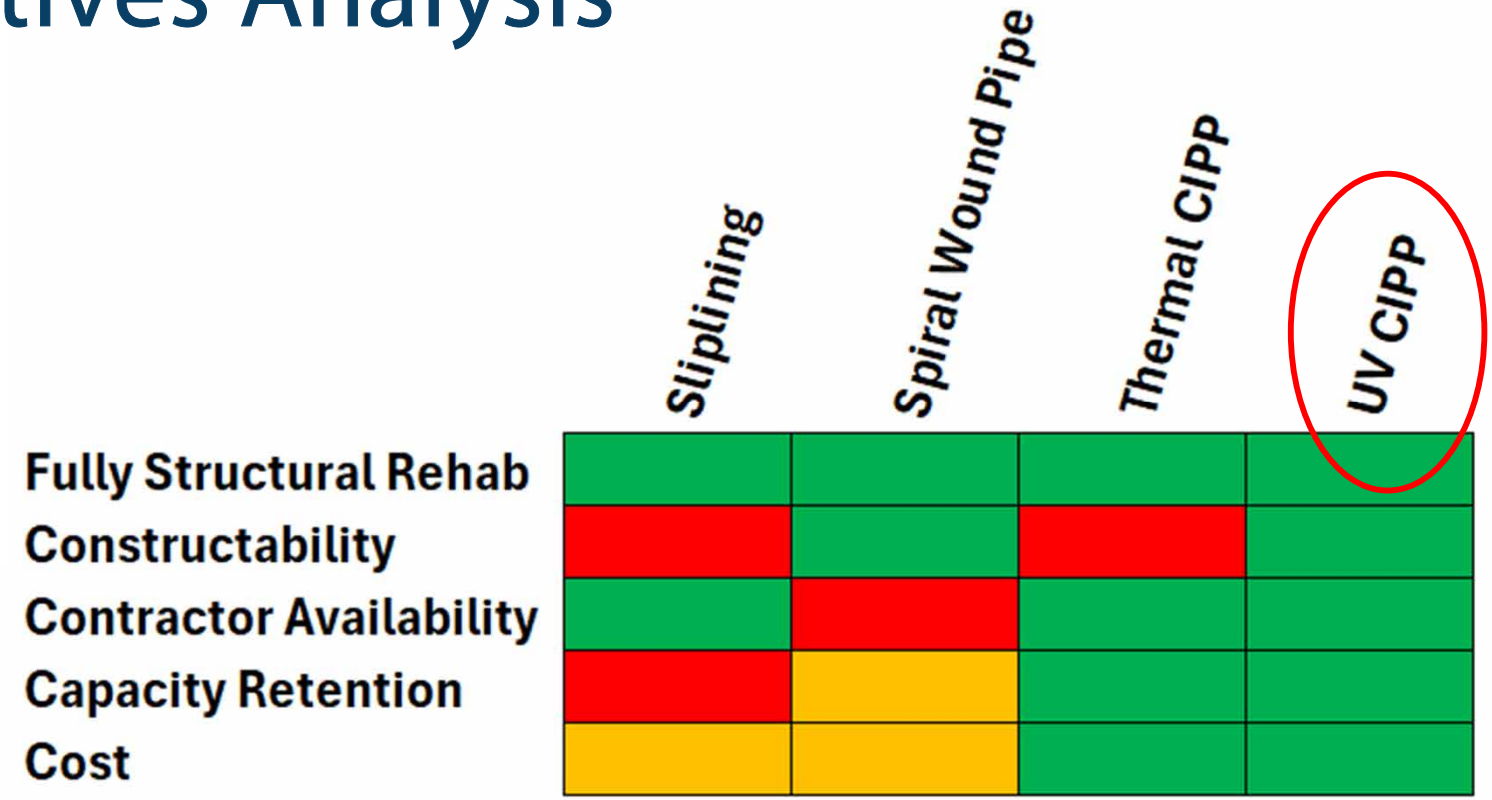
Design – Alternatives Analysis



Design – CIPP Liner

Characteristics	Parameter
Initial Flex Strength	6,500 psi
Initial Flex Modulus	1,245,000 psi
Condition	Fully Deteriorated
Design Life	> 50 years
Factor of Safety	2

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Bidding & Construction

Bid Results

	Bid Amount
Bidder #1	$1,960,208.04
EOPCC	$1,973,042.60
Bidder #2	$2,145,373.16
Bidder #3	$2,168,000.00
Bidder Average	$2,156,686.58

Bid Analysis

- Bid Spread = 9.9% or $196,500
- Ave. Unit Cost of 15" CIPP = $265/LF
  - Low = $195/LF High = $302.50
- Largest variations in Coating and Site Restoration bid items

Project Name: Cougar Creek Trunk Repair
Project #: 26-2019-0008
Data Entered By L Bauer on: 02/17/22
Data Entry Reviewed By T [illegible] on: [illegible]

Item No.	Item Description	Quantity	Unit	Engineer's Estimate Unit Price	Engineer's Estimate Total	IRON HORSE, LLC Unit Price	IRON HORSE, LLC Total	INSTA-PIPE, INC. Unit Price	INSTA-PIPE, INC. Total	ALLIED TRENCHLESS Unit Price	ALLIED TRENCHLESS Total	Average of other bidders Total	low compared to other bidders Total	low compared to engineer's estimate Total	low compared to other bidders Total	low compared to engineer's estimate Total
1	MOBILIZATION	1	LS	LS	[illegible]	LS	$150,000.00	LS	$169,599.03	LS	$200,000.00	$184,799.52	-19%	-37%	-$34,799.52	-$87,410.00
2	MINOR CHANGE	[illegible]	LS	LS	$90,000.00	LS	[illegible]	LS	$90,000.00	LS	$90,000.00	$90,000.00	0%	0%	$0.00	$0.00
3	TEMPORARY TRAFFIC CONTROL	1	LS	LS	$10,200.00	LS	$30,000.00	LS	$1,000.00	LS	$50,000.00	$25,500.00	18%	194%	$4,500.00	$19,800.00
4	ACCESS ROUTE CLEARING AND MAINTENANCE	1	LS	LS	$288,000.00	LS	[illegible]	LS	$104,000.00	LS	$10,000.00	$57,000.00	14%	-77%	$8,000.00	-$223,000.00
5	15" CURED-IN-PLACE PIPE, UV CURED	[illegible]	[illegible]	[illegible]	$569,100.00	[illegible]	[illegible]	[illegible]	$1,229,662.50	$300.00	$1,219,500.00	$1,224,581.25	-35%	39%	-$431,906.25	$223,575.00
6	PROJECT TEMPORARY BYPASS PUMPING SYSTEM	1	LS	LS	$300,000.00	LS	$320,000.00	LS	$99,450.00	LS	$100,000.00	$99,725.00	221%	7%	$220,275.00	$20,000.00
7	COATING	19	EA	$12,000.00	$228,000.00	$6,785.00	$128,915.00	$7,495.00	$142,405.00	$11,000.00	$209,000.00	$175,702.50	-27%	-43%	-$46,787.50	-$99,085.00
8	MANHOLE BENCH REHABILITATION	14	EA	$2,400.00	$33,600.00	$2,300.00	$32,200.00	$3,250.00	$45,500.00	$1,000.00	$14,000.00	$29,750.00	8%	-4%	$2,450.00	-$1,400.00
9	MANHOLE FRAME AND COVER REPLACEMENT	19	EA	$1,200.00	[illegible]	$3,220.00	$61,180.00	$3,770.00	[illegible]	$3,000.00	[illegible]	$64,315.00	-5%	168%	-$3,135.00	$38,380.00
10	IN	[illegible]	EA	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-31%	-33%	-$2,900.00	-$3,160.00
11	IN	1	EA	$3,600.00	$3,600.00	$2,875.00	$2,875.00	$3,250.00	$3,250.00	$5,500.00	$5,500.00	$4,375.00	-34%	-20%	-$1,500.00	-$725.00
12	IN	1	EA	$900.00	$900.00	$1,725.00	$1,725.00	$1,040.00	$1,040.00	$5,000.00	$5,000.00	$3,020.00	-43%	92%	-$1,295.00	$825.00
13	IN	1	EA	$1,440.00	$1,440.00	$2,300.00	$2,300.00	$1,560.00	$1,560.00	$10,000.00	$10,000.00	$5,780.00	-60%	60%	-$3,480.00	$860.00
14	SITE RESTORATION	1	LS	LS	$24,000.00	LS	$120,000.00	LS	$14,350.00	LS	$15,000.00	$14,675.00	718%	400%	$105,325.00	$96,000.00
15	$1,000)	1	LS	LS	$1,500.00	LS	$5,000.00	LS	$1,000.00	LS	$1,000.00	$1,000.00	400%	233%	$4,000.00	$3,500.00
	Subtotal				$1,820,150.00		$1,808,310.00		$1,979,126.53		$2,000,000.00	$1,989,563.27	-9%	-1%	-$181,253.27	-$11,840.00
	Washington State Sales Tax at	8.40%			$152,892.60		$151,898.04		$166,246.63		$168,000.00	$167,123.32	-9%	-1%	-$15,225.28	-$994.56
	TOTAL				$1,973,042.60		$1,960,208.04		$2,145,373.16		$2,168,000.00	$2,156,686.58	-9%	-1%	-$196,478.54	-$1[illegible]834.56
	Percentage of Difference from Engineer's Estimate						-0.7%		8.7%		9.9%					

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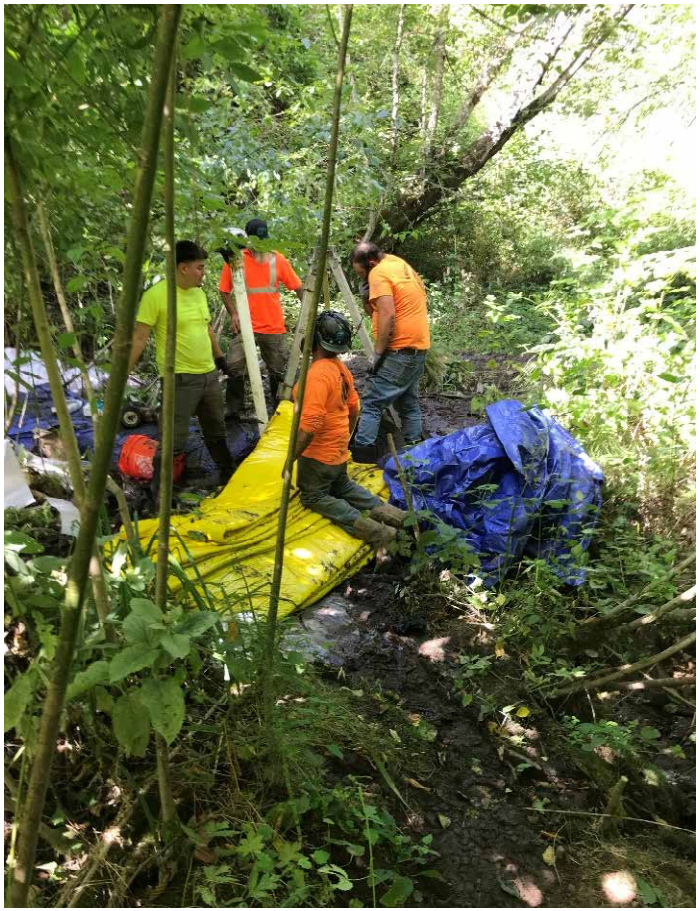
Construction Challenges

- **Access**
  - Steep slopes
  - Narrow paths
- **Bypass Pumping**
- **Wet Weather Potential**

Access Challenges



Bypass Systems

- Two Systems
  - Main
  - Lateral
- Two Set-ups

Bypass Systems – Main & Lateral

Mainline System:

- 6″ HDPE piping
- Two 6″ Dri-Prime pumps
- Floats & auto-dialers

Lateral System:

- 4″ HDPE piping
- 3″ trash pumps

Bypass System - Flows

- Expected = 210 gpm
- Actual = 574 gpm

UV CIPP

- Thicknesses
  - 3.0 and 3.8 mm

- Test Results
  - Flex Mod = 2,310,000 psi
  - Flex Strength = 64,900 psi

UV CIPP

UV CIPP

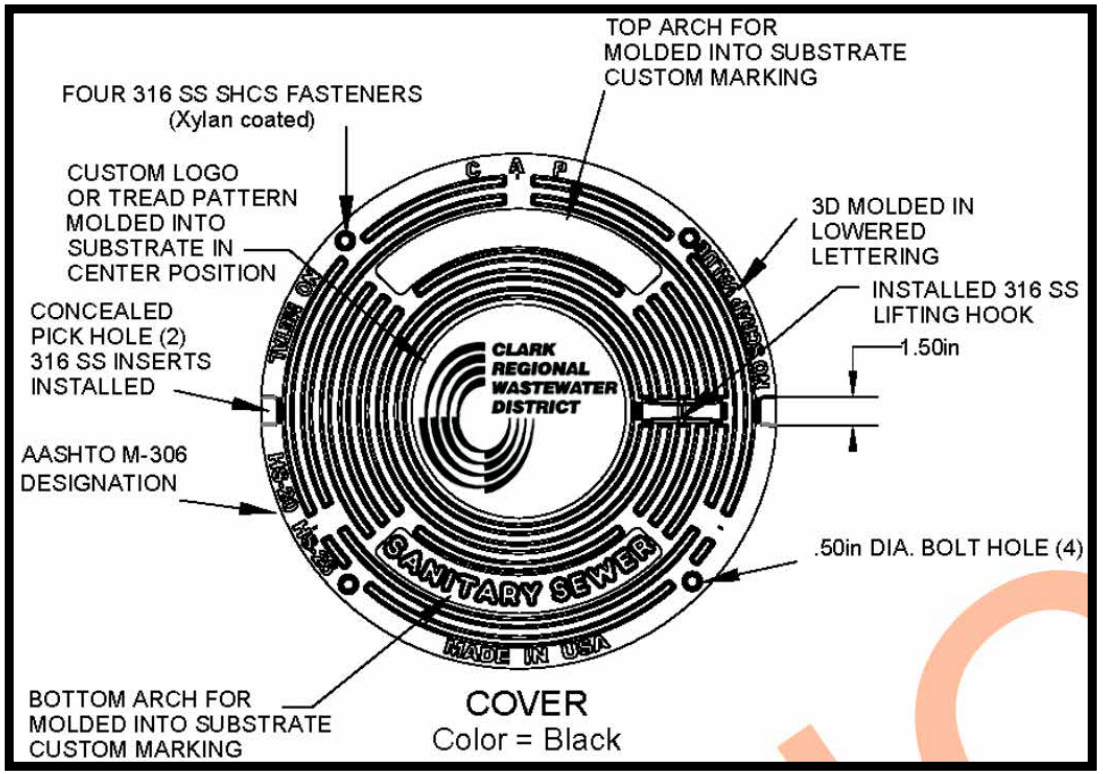

10/4/2022 5:31:17 PM
Upstream node: Manhole 14-3509
Downstream node: Manhole 14-4110
Doesn't meet specs
>1"
123.9 ft.


9/26/2022 2:49:06 PM
Upstream node: Manhole 14-3844
Downstream node: Manhole 14-3534
133.5 ft.

Manhole Rehabilitation

Two categories:

1. Rehabilitation
2. Improvements



Manhole Rehabilitation

Rehabilitation:

- Silicate mortar concrete rehab
- Epoxy coating

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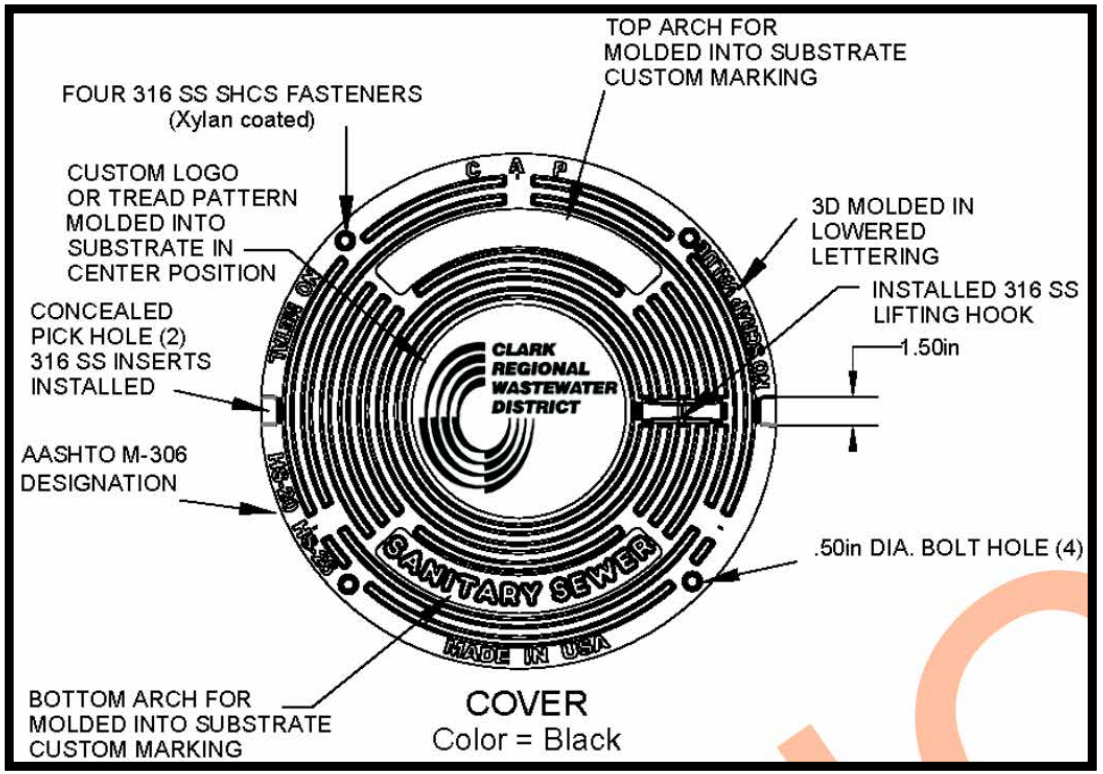
Manhole Rehabilitation

Improvements:

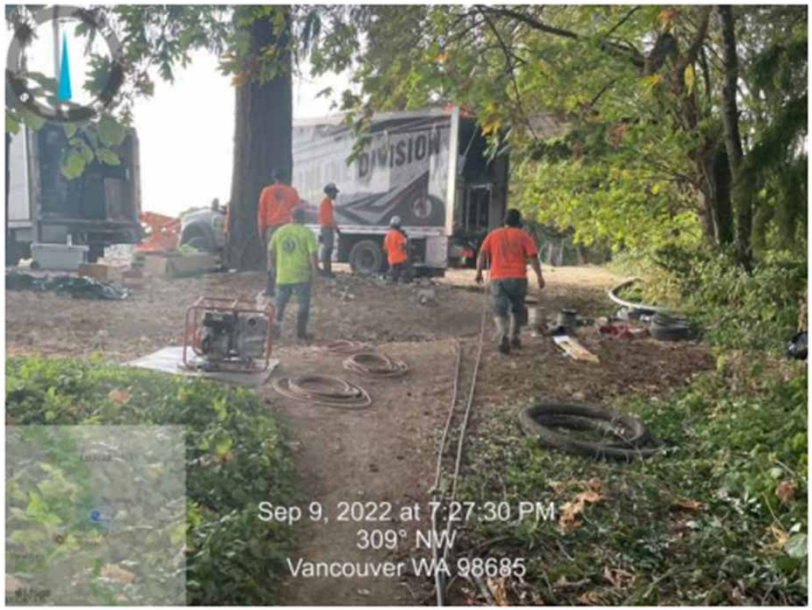
- Composite locking lid
- Polypropylene steps

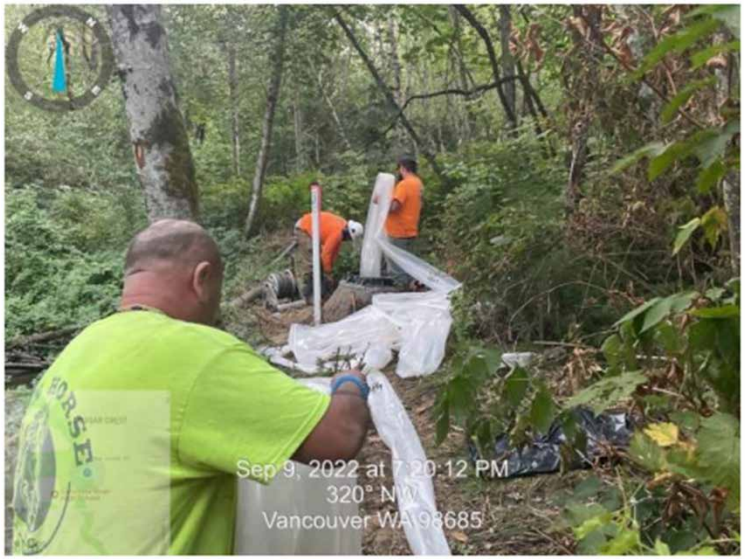


Manholes – Before & After

Project Takeaways

- Communication
  - Internal Team / Contractor
  - Public / Residences
- Match strategies to technology
- Match technology to conditions
- Risks mitigation





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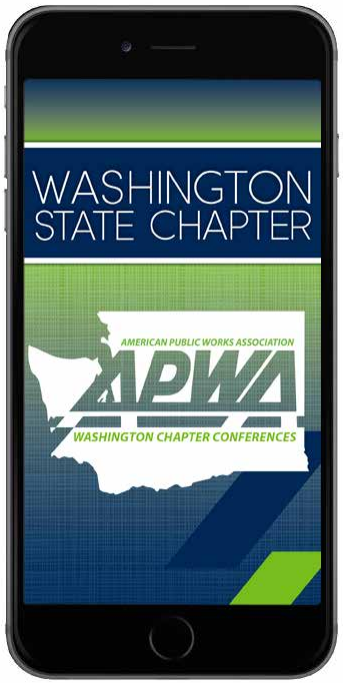
Special Thanks!

- CRWWD:
  - Jose Gonzalez
  - John Parela
  - Tom Grange

- Contractors:
  - Iron Horse, LLC
  - Olsen Brothers Pro-vac, LLC



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Questions?

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