CIPP Lining for Infiltration Reduction and Asset Renewal

October 3, 2019
Agenda

• Location and Issues
• Planning and Decisions
• Public Outreach Process
• Project Bidding
• Construction
• Final Construction Statistics and Cost
• Post Construction Monitoring
• Thoughts on Private Property
Project Location and Issues

- Lakehaven Water and Sewer District (LWSD)
  - 2 WWTPs
    - Redondo WWTP
    - Lakota WWTP
  - 32 pump stations
  - 312 miles of separated sewer pipes
Project Location and Issues

- Lakehaven Water and Sewer District (LWSD)
  - 2 WWTPS
    - Redondo WWTP
    - Lakota WWTP
  - 32 pump stations
  - 312 miles of separated sewer pipes
  - Aging infrastructure leading to increased treatment and O&M costs
Why is I/I an Issue?

- Increases peak flows >14 fold
- Risk of sanitary sewer overflows (SSOs) and basement backups
- “Steals” system, treatment, and outfall capacity
- Increases operational costs
- Dilutes/cools sewage <200 mg/l
  - 85% removal rule lowers effluent limits
- Element of NPDES permit
- Problem increases as system ages
Development of a Program

• BC developed I/I program goals and identified project location
• Completed 2 years of flow monitoring
• Developed a prioritization method to meet identified goals
Program Goals

1. Meet hydraulic capacity of Redondo WWTP
2. Reduce flows to protect against SSOs
3. Reduce flows to EPA and WA Ecology I/I guidance
   • <120 gpcd wet season dry weather flow rate
   • <275 gpcd peak wet weather flow rate
   • Pump Station Capacity
4. Meet industry target goals
   • <1,500 gpad within drainage basins
Pump Station 5

- Highest I/I rates
- Repeated wet-weather SSOs
- Aging assets (1960s vintage concrete pipes)
Pump Station 5A-2

- PS5 sub-dived into 3 areas
- Area A-2 chosen for pilot program
  - Reduce infiltration
  - Renew aging assets
Pump Station 5A-2 Left

- 85–100 houses
- 4,000 LF of 8-inch-diameter sewer main
- All basins had equal WW response
- Chose “Left”
  - No observed surcharging
  - Good hydraulics for metering
Pilot Project Planning and Decisions

- Needed to address side sewers
  - District funded side sewer work to maximize participation
- Access required ROE permits
  - 75-80% of ROEs needed to proceed with construction

Lining of Shared Side Sewers

- Mainline liner
- Lateral T-liner (lower lateral)
- Small portion left unlined
- Lateral liner from house (upper lateral)
Public Outreach Process

- Necessary to inform neighborhood and gain acceptance
- Methods:
  - Mailer
  - Door-to-door contact
  - Public Meeting at local High School
- Coordination through construction
Project Overview

- Bidding
- Pre-lining work
  - Pre-inspection
  - Cleanout installation
- Mainline lining
- Upper lateral lining
- Lower lateral lining
Bidding

- Advertised on July 2017
  - Left CIPP method open (steam cure vs UV cure)
- Received 1 bid
  - 20% over engineers estimate
- Vetted contractor references and reviewed prices
- Awarded to Iron Horse, LLC.
  - Decided on UV lining method
Pre-Lining Work

- CCTV of mainline and side sewers
- Cleanout locations
- VAC-A-TEE cleanout installations
Mainline Lining

- UV Lining Process
Mainline Lining

• UV Lining Process:
  • Side sewer locations measured
Mainline Lining

- UV Lining Process:
  - Side sewer locations measured
  - Line jetted
  - Flows plugged/diverted
  - Sleeved UV liner pulled through

UV liner inserted through manhole
Mainline Lining

- UV Lining Process:
  - Side sewer locations measured
  - Line jetted
  - Flows plugged/diverted
  - Sleeved liner pulled through
  - Light train pulled through to opposite end
Mainline Lining

- UV Lining Process:
  - Side sewer locations measured
  - Line jetted
  - Flows plugged/diverted
  - Sleeved liner pulled through
  - Light train pulled through to opposite end
  - “Safety Caps” installed
Mainline Lining

- UV Lining Process:
  - Side sewer locations measured
  - Line jetted
  - Flows plugged/diverted
  - Sleeved liner pulled through
  - Light train pulled through to opposite end
  - “Safety Caps” installed
  - Pipe pressurized to specifications
  - Light train pulled back according to specified rate and pressure

Curing of UV Lining
Mainline Lining

- UV Lining Process:
  - Side sewer locations measured
  - Line jetted
  - Flows plugged/diverted
  - Sleeved liner pulled through
  - Light train pulled through to opposite end
  - “Safety Caps” installed
  - Pipe pressurized to specifications
  - Light train pulled back according to specified rate and pressure
  - **Side sewers reinstated**
Mainline Lining

- UV Lining Process:
  - Side sewer locations measured
  - Line jetted
  - Flows plugged/diverted
  - Sleeved liner pulled through
  - Light train pulled through to opposite end
  - “Safety Caps” installed
  - Pipe pressurized to specifications
  - Light train pulled back according to specified rate and pressure
  - Side sewers reinstated

- Construction Issues
  - **None occurred**
Upper Lateral Lining

- Ambient cured lining of 4-inch-diameter side sewer process
Upper Lateral Lining

- Ambient cured lining of 4-inch-diameter side sewer process
  - Line inspected, repairs made to remove roots etc.
  - Liner prepared in trailer
    - Pre-cut or cut on site
Upper Lateral Lining

- Ambient cured lining of 4-inch-diameter side sewer process
  - Line inspected, repairs made to remove roots etc.
  - Liner prepared in trailer
    - Pre-cut or cut on site
    - Resin mixed
Upper Lateral Lining

- Ambient cured lining of 4-inch-diameter side sewer process
  - Line inspected, repairs made to remove roots etc.
- Liner prepared in trailer
  - Pre-cut or cut on site
  - Resin mixed
- Liner wetted out
Upper Lateral Lining

- Ambient cured lining of 4-inch-diameter side sewer process
  - Line inspected, repairs made to remove roots etc.
  - Liner prepared in trailer
    - Pre-cut or cut on site
    - Resin mixed
    - Liner wetted out
  - Inserted into inversion tank

Inserting into inversion tank
Upper Lateral Lining

- Ambient cured lining of 4-inch-diameter side sewer process
  - Line inspected, repairs made to remove roots etc.
  - Liner prepared in trailer
    - Pre-cut or cut on site
    - Resin mixed
    - Liner wetted out
    - Inserted into inversion tank
  - Liner transported to cleanout in inversion tank
  - Liner inserted into cleanout
Upper Lateral Lining

- Ambient cured lining of 4-inch-diameter side sewer process
  - Line inspected, repairs made to remove roots etc.
  - Liner prepared in trailer
    - Pre-cut or cut on site
    - Resin mixed
    - Liner wetted out
    - Inserted into inversion tank
  - Liner transported to cleanout in inversion tank
  - Liner inserted into cleanout
    - **Pressure cap installed or inversion tank remains connected**
  - Liner resin cures under pressure for 2 hours
Upper Lateral Lining

- Ambient cured lining of 4-inch-diameter side sewer process
  - Line inspected, repairs made to remove roots etc.
  - Liner prepared in trailer
    - Pre-cut or cut on site
    - Resin mixed
  - Liner wetted out
  - Inserted into inversion tank
  - Liner transported to cleanout in inversion tank
  - Liner inserted into cleanout
    - Pressure cap installed or inversion tank remains connected
  - Liner resin cures under pressure for 2 hours
  - **Bladder removed, cleanout capped**
Upper Lateral Lining

- Construction issues
  - Improper curing
  - Issues with pressure caps malfunctioning
  - Bladder failure causing pressure loss
  - Resin/BPO ratios
Lower Lateral Lining

- Steam cured lining and T-lining of 6-inch-diameter side sewer process
Lower Lateral Lining

- Steam cured lining and T-lining of 6-inch-diameter side sewer process
  - Line inspected, repairs made to remove roots etc.
  - Liner prepared in trailer
    - Hydrophilic gaskets installed
Lower Lateral Lining

- Steam cured lining and T-lining of 6-inch-diameter side sewer process
  - Line inspected, repairs made to remove roots etc.
  - Liner prepared in trailer
    - Hydrophilic gaskets installed
    - Mixing and wetting out resin
    - Inserted into steam cure bladder and launcher
Lower Lateral Lining

• Steam cured lining and T-lining of 6-inch-diameter side sewer process
  • Line inspected, repairs made to remove roots etc.
• Liner prepared in trailer
  • Hydrophilic gaskets installed
  • Mixing and wetting out resin
  • Inserted into steam cure bladder and launcher
• Transported to manhole
Lower Lateral Lining

- Steam cured lining and T-lining of 6-inch-diameter side sewer process
  - Line inspected, repairs made to remove roots etc.
  - Liner prepared in trailer
    - Hydrophilic gaskets installed
    - Mixing and wetting out resin
    - Inserted into steam cure bladder and launcher
  - Transported to manhole
- **Camera inserted into cleanout**
- **T-liner pulled through and lined up with side sewer**
- Inverted into side sewer
Lower Lateral Lining

- Steam cured lining and T-lining of 6-inch-diameter side sewer process
  - Line inspected, repairs made to remove roots etc.
  - Liner prepared in trailer
    - Hydrophilic gaskets installed
    - Mixing and wetting out resin
    - Inserted into steam cure bladder and launcher
  - Transported to manhole
  - Camera inserted into cleanout
  - T-liner pulled through and lined up with side sewer
  - Inverted into side sewer
  - **Steam cured for 30 minutes**
Lower Lateral Lining

- Steam cured lining and T-lining of 6-inch-diameter side sewer process
  - Line inspected, repairs made to remove roots etc.
  - Liner prepared in trailer
    - Hydrophilic gaskets installed
    - Mixing and wetting out resin
    - Inserted into steam cure bladder and launcher
  - Transported to manhole
  - Camera inserted into cleanout
  - T-liner pulled through and lined up with side sewer
  - Inverted into side sewer
  - Steam cured for 30 minutes

Reinstated lower lateral
Lower Lateral Lining

- Construction Issues
  - Blind shot from MH without cleanout.
    - Liner hung-up in pipe and did not invert
  - Portion of pipe vactored and repaired
  - T-liner seam seal
  - Lined over side sewer caused home backup
  - Steam truck ran out of gas during a cure

- Repair pit for un-inverted liner portion
- Infiltration at T-liner seam
Post-Lining Process

• Completion CCTV/Review of final results
• Emergency repairs made
  • Side sewer lined over

• Final repairs of remaining issues
  • Seam with infiltration
  • Cleanup of rough transitions
Final Construction Statistics and Cost

84 out of 86 houses participated

73 Vac-A-Tee clean outs installed

44 T-Liners installed

3,890 feet of 8-inch mainline UV liner

4,725 feet of side sewer:
  1,170 feet of 6-inch side sewer
  3,015 feet of 4-inch side sewer

$1,141,084 total construction value (before tax)
  $155/ft for side sewers with cleanouts, $125/ft without cleanouts
  $105/ft for mainlines

5 months of construction
Post Construction Monitoring

- Meter reinstalled 5/1/2018

- Average rain over time period: 37.8 inches
- Received rain over time period: 30.9 inches
Post Construction Monitoring

- Meter reinstalled 5/1/2018
- Estimated flow reduction:
Post Construction Monitoring

- Meter reinstalled 5/1/2018
- Estimated flow reduction:
Post Construction Monitoring

- Meter reinstalled 5/1/2018
  - Estimated flow reduction:
    - [\(\_\)(ツ)\(_\)]
    - Suspect post metering data
    - Completing Pilot Project 2 (mainlines only)
    - Will continue to monitor through the 2019/20 wet weather season
Thoughts on Private Property Work

- Needs planning and upfront communication
- Don’t over promise
- Not scary
- Construction crews need to be willing to talk to private property owners
- Law is on your side
- Does Owner Contribute any $$$

AGO 2009 No. 5:
- Municipal sewer districts have statutory authority to use public funds to repair or replace side sewers located on private property if doing so will increase sewer capacity by reducing infiltration and inflow. Use of public funds to do so does not constitute an unconstitutional gift or loan of public funds if the district acts without donative intent and can demonstrate that the action will result in significant benefit to the public.
Phase 2

• Completing Phase 2 today!
  • Mainlines, connections at the main, and MH’s
  • CIPP lining of 6,130’ of 8” and 10” pipe
  • 73 connections with the main (3’ T-Liners)
  • Coating of 34 MH’s
  • $950,000 w/tax
CIPP Lining – Not Just for I/I

- District has leveraged larger I/I projects to get commodity pricing for smaller structural repairs
Thank you.

Questions?

Ken Miller, PE
kmiller@lakehaven.org
253-946-5405

Bob Jacobsen, PE
bjacobsen@brwncald.com
206-749-2307