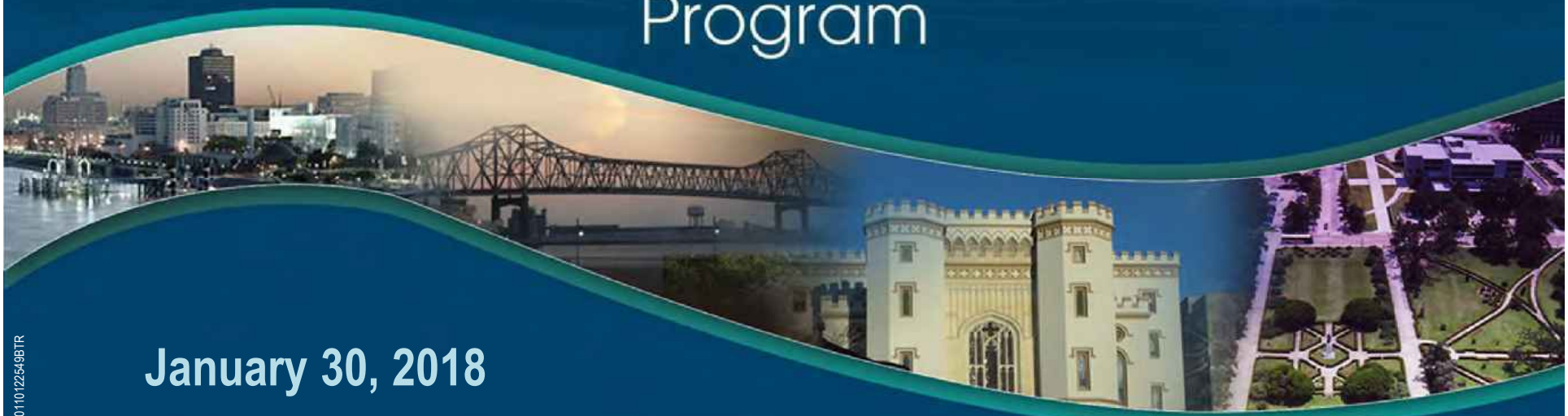
UCT Underground Construction Technology
International Conference & Exhibition

Lessons Learned on Baton Rouge SSO Comprehensive Rehabilitation Program

BATON ROUGE SSO Program

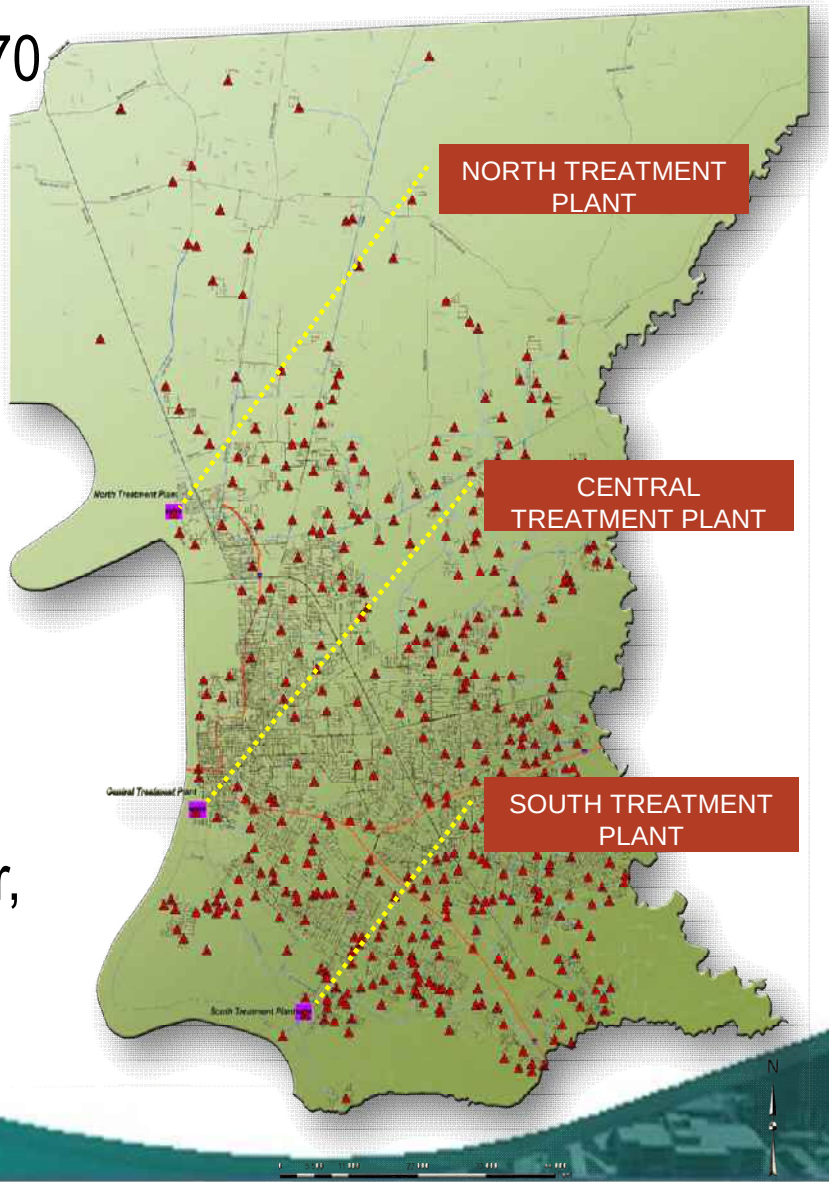


January 30, 2018

WBG100110122549BTR

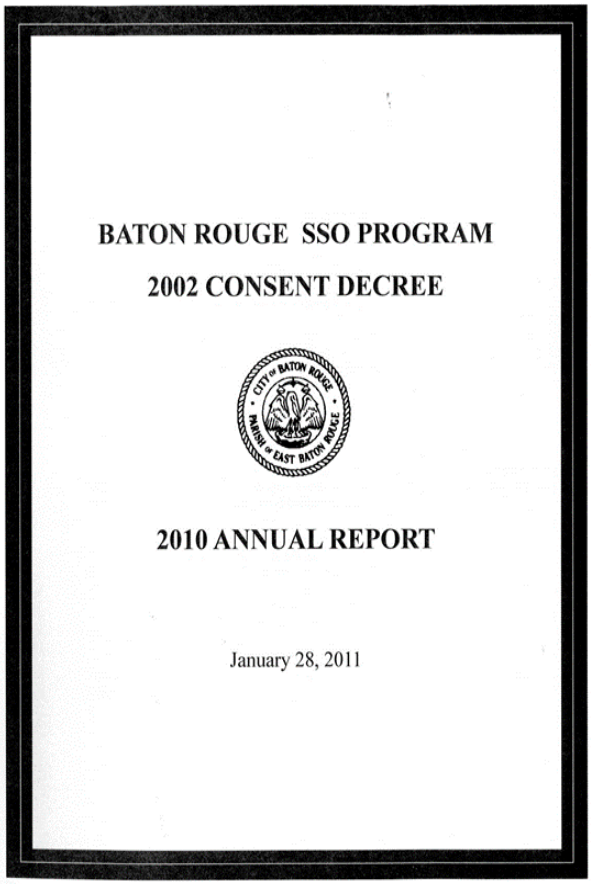
Baton Rouge's Sewer System

- Total area of East Baton Rouge Parish is 470 square miles
- Portions of system over 100 years old
- The system comprises:
  - Over 1,650 miles of sewer line
  - 37,500 Manholes
  - 468 lift stations
  - 200 miles of sewer force main
  - 3 Treatment Plants
    - North 130 MGD
    - South 120 MGD (Increased to 200MGD)
    - Central 65 MGD (Decommissioned)
- It includes the Cities of Baton Rouge, Baker, Zachary and Central



Background

- Mandated by a USEPA Consent Decree to reduce SSOs in the C-P by December 31, 2018
- In 2006, City-Parish selected CH2M, Sigma, ILSI Team as Program Managers
- $1.6B Infrastructure Improvement Program
- 105 SSO Projects
  - 67 Capacity Improvement Projects
  - 32 Rehabilitation Projects
  - 6 Wastewater Treatment and Storage Facilities Projects
- 11 Master Plan Projects


BATON ROUGE SSO PROGRAM

2002 CONSENT DECREE

2010 ANNUAL REPORT

January 28, 2011

32 Rehabilitation Projects

- Inspect, clean & remove obstructions to improve hydraulic capacity
- Use trenchless technologies whenever possible to minimize disruption
- Reduce sewer overflows by minimizing rainfall infiltration & groundwater inflow
- Extend life of existing system
- Last 3 projects currently in construction
- Preparing 2 new projects post-program

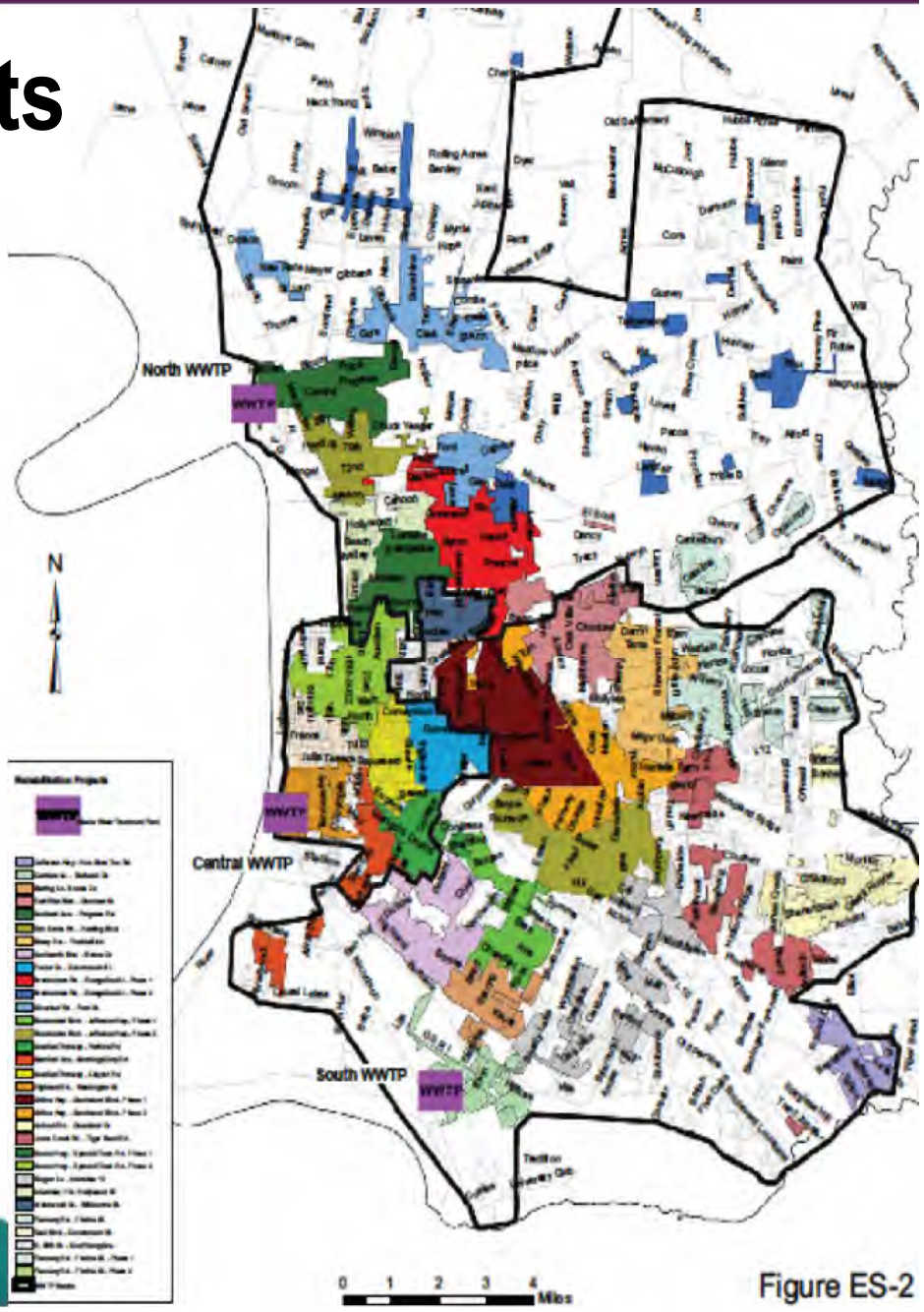


Figure ES-2

Comprehensive Rehabilitation

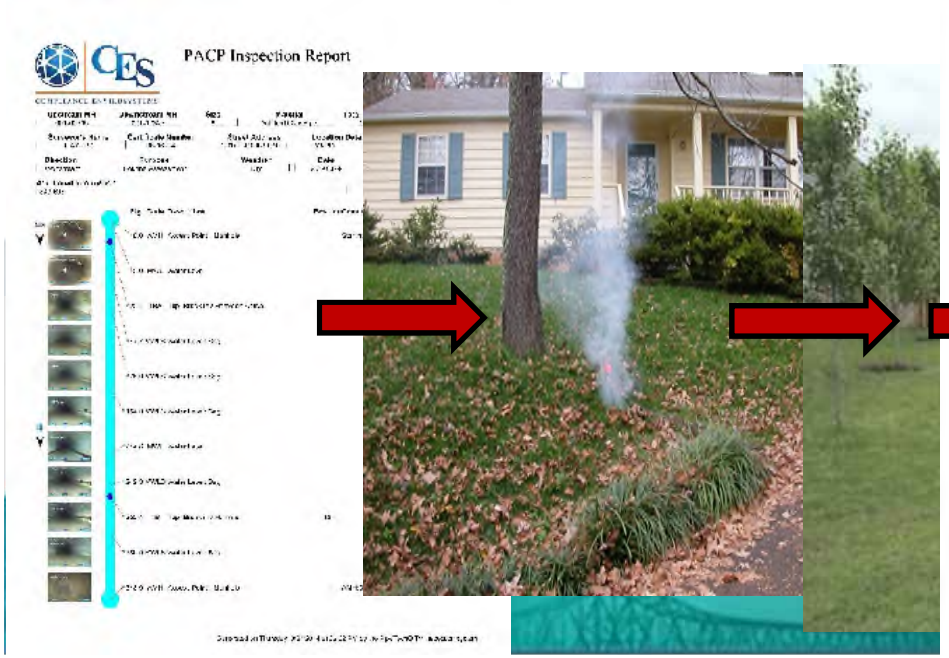
- Average Project Area Included
  - 217,000 LF of mainline pipe (8” – 36” diameter)
  - ~ 2,000 service laterals
  - 900 manholes
- Physical Inspection (3 - 4 months)
  - Clean & root cut
  - CCTV inspection of mainlines, laterals, & manholes
  - Smoke testing
  - Up to 12 CCTV crews at one time
  - Average cost for inspection = $585,000

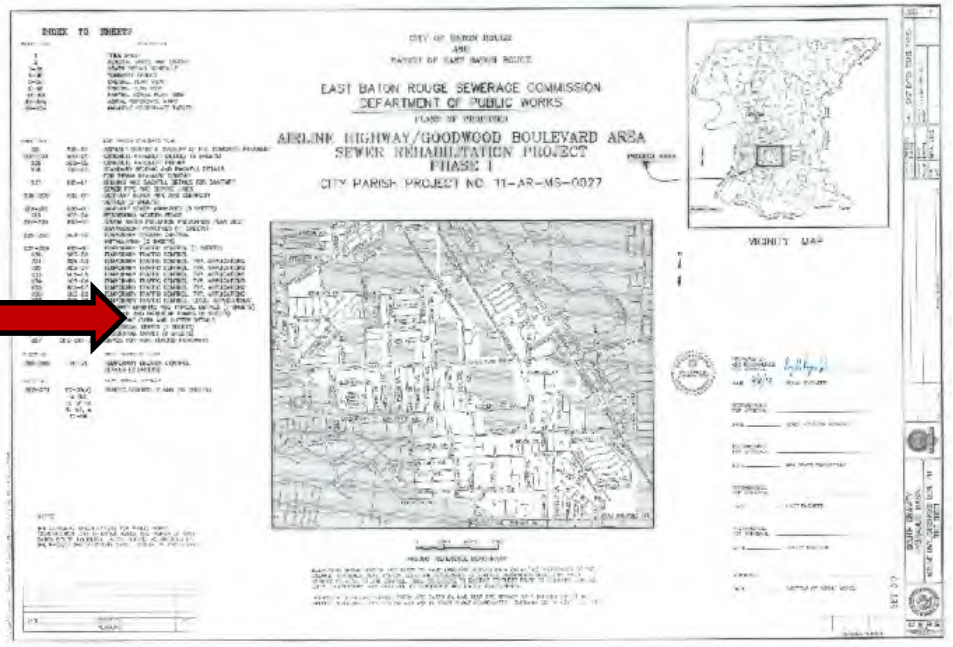
Sewer Pipe in Baton Rouge area BEFORE CCTV Cleaning

Sewer Pipe in Baton Rouge area after CCTV Cleaning

Comprehensive Rehabilitation (cont.)

- Design (4 - 6 months)
  - Review of CCTV & manhole inspection data
  - Basin Observations – field visits
  - Pipeline, lateral, & manhole condition characterization & preliminary rehabilitation recommendations
  - Topographic survey, final rehabilitation determination, & plan preparation





Comprehensive Rehabilitation (cont.)

- Construction (12 - 18 months)
  - Up to 12 construction crews per project
  - Need 1 Project Engineer
  - 1 CM assigned to project
  - Utilize trenchless construction
  - Other utilities are major conflicts
  - Average construction price ~ $8 M

Hurdles along the Way

1. Dealing with Obstacles & Unknowns of Rehabbing Existing Infrastructure
2. Construction Access Issues
3. Public Inconvenience & Perception
4. Utility Conflicts – the “Known Unknown”
5. Rethinking Rehab Design Criteria
6. Other Concerns to Keep in Mind

Dealing with Obstacles and Unknowns

1. Handling condition changes from design to construction timeframe – stale inspection data
2. Storm water infrastructure – pipes & inlets, material type unknown, earthen & concrete lined canals (erosion issues & panel failures), aerial crossings
3. Above ground obstructions – sheds, pools, decks, etc.
4. Underground obstructions
5. Unable to locate manholes

Lessons Learned & Implemented

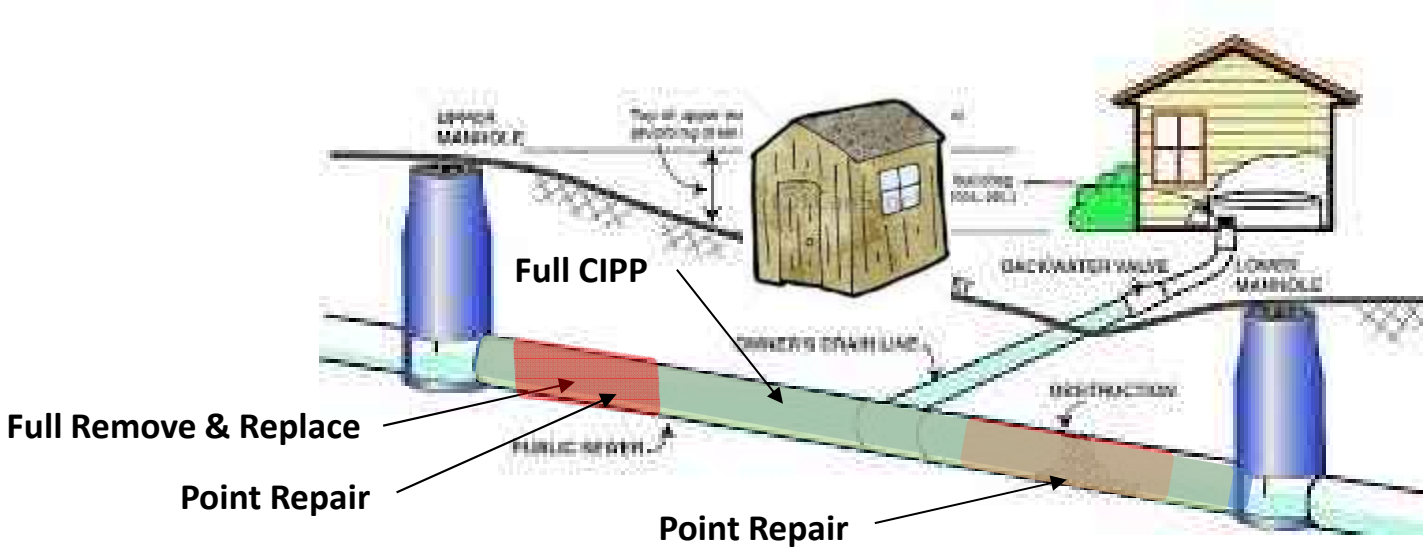
1. Utilize unit price contract & include flexibility in pay items to account for unknowns & variability in field
   - Separated pay items for excavation by depth range from pipe pay item
     - Allows for payment of potholing as directed
     - Allows for over-excavation to extend repair if needed
   - Include SD pipe diameter pay items incase encountered
   - Add point repair diameter pay items based on CIPP diameters & vice versa

Lessons Learned & Implemented

2. Stake servitude limits and repair limits to demonstrate to homeowners need for moving structures and pipe defect screenshot.

Lessons Learned & Implemented

3. Creative rehab implementation to avoid conflicts and/or obstructions



4. Utilize tracking beacon on CCTV camera for aiding in manhole locates

33. LOCATING MANHOLES AND REPAIR LOCATIONS IS INCIDENTAL TO OTHER WORK ITEMS. GPS COORDINATES FOR MANY MANHOLES ARE INCLUDED IN THESE DOCUMENTS FOR THE CONTRACTOR'S REFERENCE. TYPICAL MEANS AND METHODS FOR LOCATING MANHOLES WOULD BE USE OF GPS EQUIPMENT, MARKING OFF FOOTAGES FROM CONNECTING MANHOLES, ROD PROBING, USE OF METAL DETECTING WANDS, ETC. CONTRACTOR SHALL NOTIFY CONSTRUCTION MANAGER IF AFTER UTILIZING ALL OF TYPICAL MEANS & METHODS CONTRACTOR IS UNABLE TO LOCATE MANHOLE. ENGINEER MAY DIRECT CONTRACTOR TO USE SEWER MAINLINE CAMERA BEACON WITH GROUND WALKOVER TO LOCATE MANHOLE. THE CONTRACTOR SHALL PERFORM THIS BEACON LOCATE WORK AS DIRECTED BY THE ENGINEER AT THE ESTABLISHED CONTRACT UNIT BID PRICES FOR REGULAR SEWER LINE CLEANING AND TELEVISION INSPECTION OF SEWER MAINLINE.

Hurdles along the Way

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Construction Access Issues

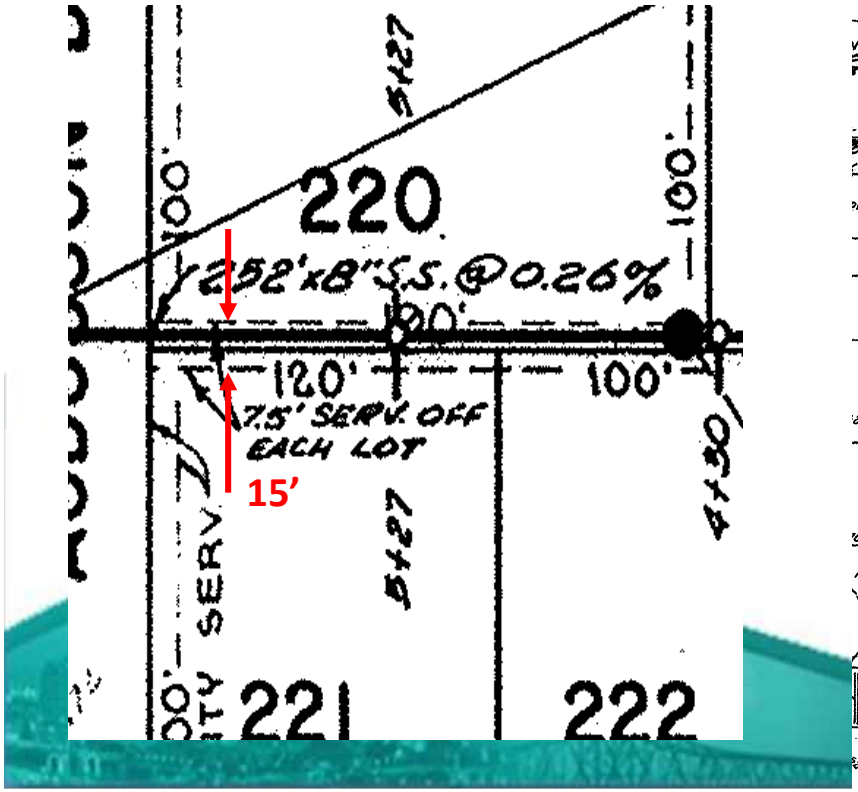
1. Rehab typically occurs on sewers within long established, developed areas and neighborhoods.

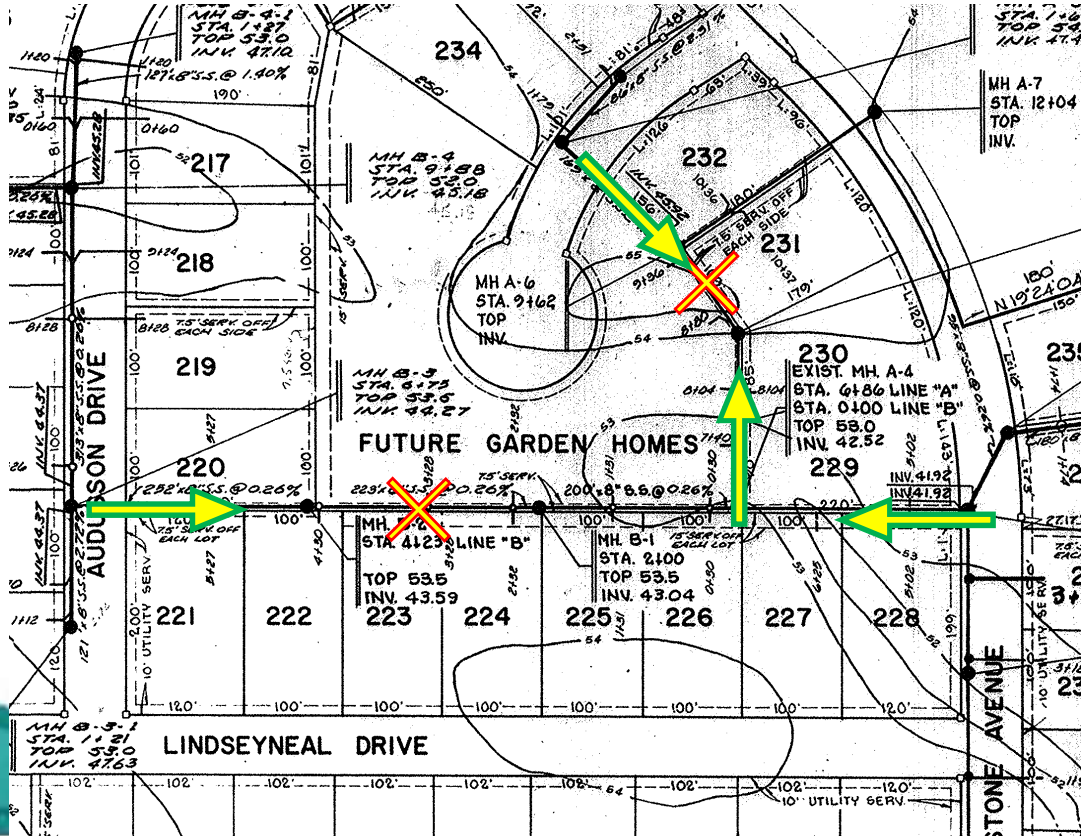
2. Many property owners have built fences and infrastructure across public servitudes without permits. In addition, these servitudes are shared by other utilities.

Construction Access Issues

3. Can only access through public servitudes – typically only 10’ to 15’ wide and generally located in back of lots.

4. These generally have to be accessed at the end of the block and traversed to the actual repair location with construction equipment.





Construction Access Issues

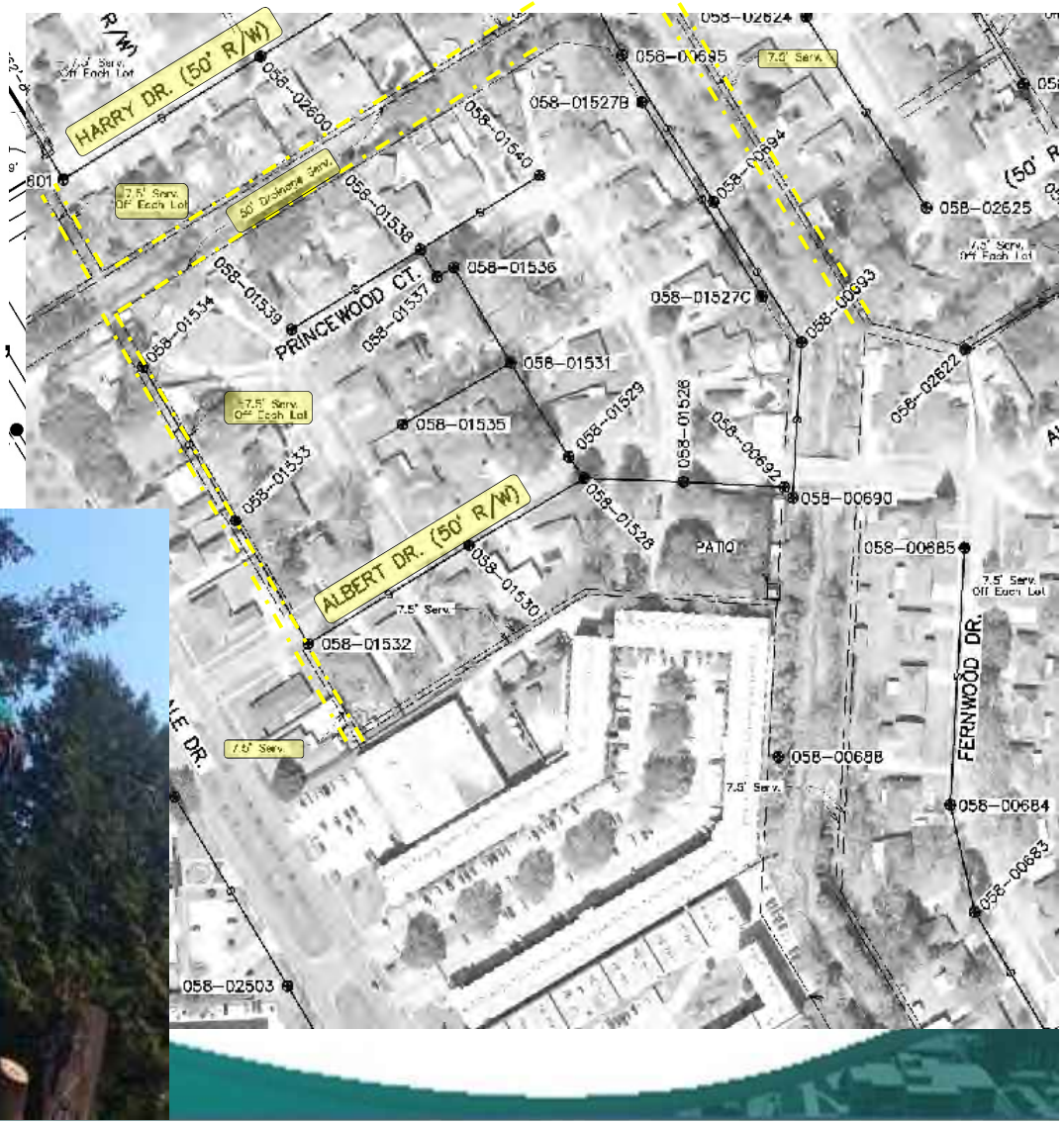
5. This presents potential conflicts with fences, trees, sheds, pools, decks, landscaping, watering systems, etc.

6. These are costly to remove and restore, difficult to identify/quantify prior to construction, and causes logistic and production delays for contractors.

Lessons Learned & Implemented

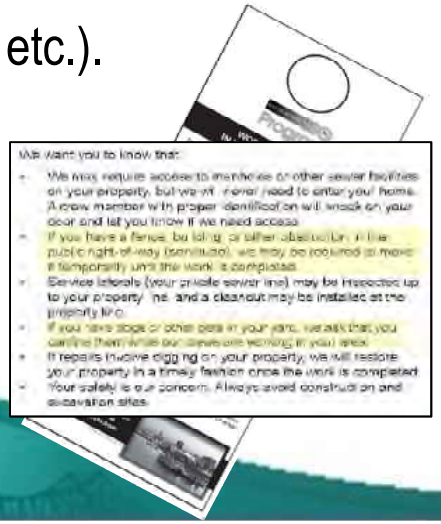
1. Include aerials and identify servitude locations and widths on construction plans.

2. Include appropriate pay items and adequate quantity for things like fence, sod, and tree removal.



Lessons Learned & Implemented

3. Look for potential pipe reroutes to avoid access issues or conflicts during design phase.
4. Identify potential access routes through private property & negotiate Right of Entry agreements prior to construction.
5. Allow contractor to negotiate their own agreements with private property owners for access at their own cost.
6. Be open to paying contractor for restoration across private property access if cost justified.
7. Utilize door hangers to notify homeowners of contractor schedule & need for access in backyards (unlock gates, secure dogs, etc.).



Hurdles along the Way

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Public Inconvenience and Perception

1. Homeowners inconvenienced with construction work in or near their yards
2. Lack of understanding of what construction is for and when restoration will occur.
3. Removal of private structures built over public servitudes or rights-of-way.
4. Damage of private property.

Public Inconvenience and Perception

5. Lane and road closures cause inconvenience and delays.

6. If not maintained properly, temporary road surfacing may cause damage to vehicles.

7. After construction, streets are littered with patches – public left feeling like they are worse off after construction.

8. Digging up newly restored roadways and/or sidewalks left public with poor perception of City and Program services.

Lessons Learned & Implemented

1. Worked with PIO's to mail out flyers describing the project need and what to expect during construction to homeowner's within project area prior to advertisement for bids.

Flannery Rd – Florida Blvd Area Rehabilitation Project (Phase 2)
Project #14-AR-MS-0034

SSO Program

Dear Neighbor:

Thank you for your patience as we begin sewer improvements in your neighborhood, which will include cleaning, inspecting, repairing, and replacing sewer pipes and manholes. These upgrades will help alleviate chronic Sanitary Sewer Overflows (SSOs) and improve the environment. Work is scheduled to be completed during the 3rd Quarter of 2018.

Important things for you to know

- Construction crews often access the sewer system through manholes in sidewalks, streets, and in front or rear yards. We never ask to enter your home.
- Work may be required in your rear servitude. If you have outside pets, please confine them while crews are working in your area.
- Service laterals (your private sewer line) may be inspected up to your property line, and a cleanout may be installed. Smoke testing may be performed to identify defects.
- Once construction is complete, all sidewalks, driveways, streets, and yards will be restored. Restoration typically begins *a minimum of 4 weeks after work is completed in the area.*

You will be notified with door hangers before work begins near your property. We want to minimize your inconvenience as much as possible.

Questions or comments? Call 225.588.5678 or email help@BRprojects.com
For more information, visit our project website at BRprojects.com

THANK YOU FOR YOUR COOPERATION AND UNDERSTANDING

2. Required contractors to place door hangers seven (7) days prior and personal notification day of construction.

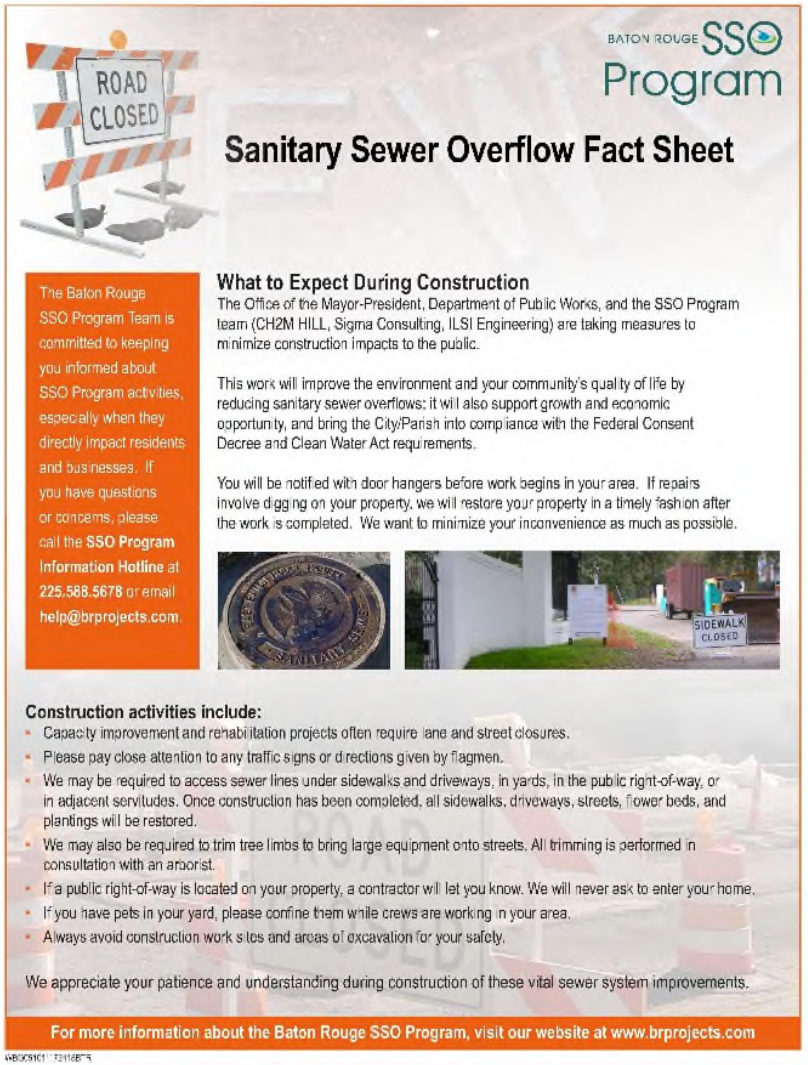
Lessons Learned & Implemented

3. Setup of contact “hotline” specific to SSO Program work for information and complaints. Have PIO’s investigate and talk to homeowners.

4. Setup informational meetings with HOA groups to get information out prior to construction.

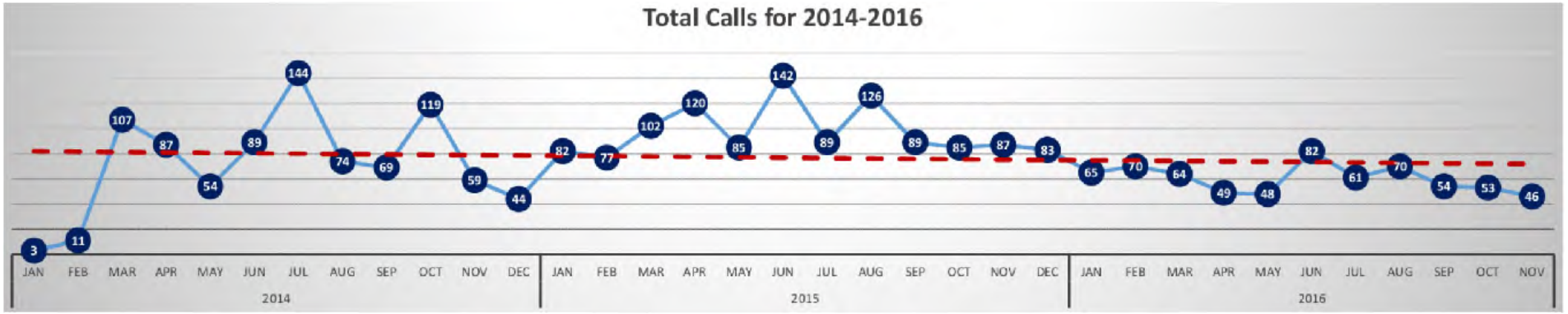
BATON ROUGE SSO Program

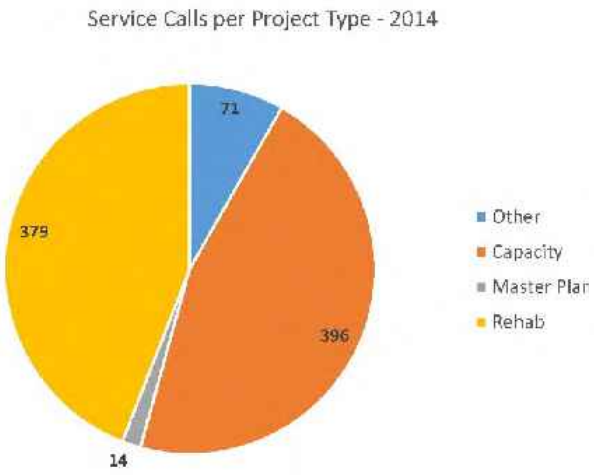
Questions or Concerns?
SSO Hotline: 225.588.5678 or
email to: help@brprojects.com

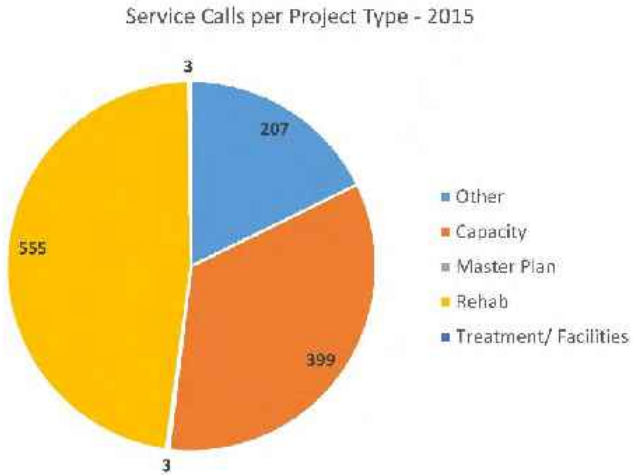


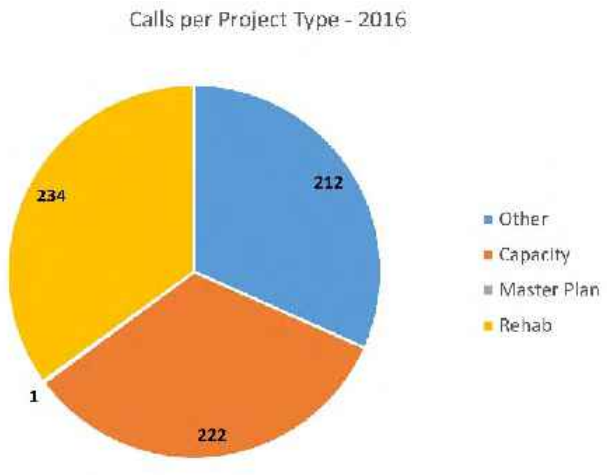
Lessons Learned & Implemented

5. Develop and manage complaint log for timely response and resolution accountability.



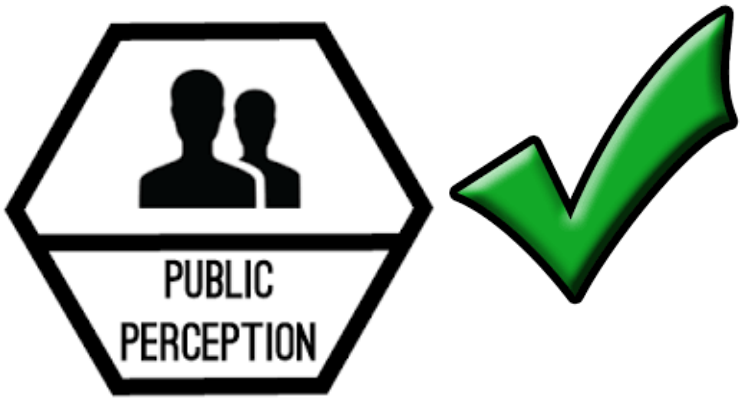






Lessons Learned & Implemented

6. Began including asphalt overlay for full lane or full width of roadways with multiple patches or long (remove & replace repairs) patches.



7. Better coordination and communication with other departments and programs and their ongoing infrastructure construction.

Hurdles along the Way

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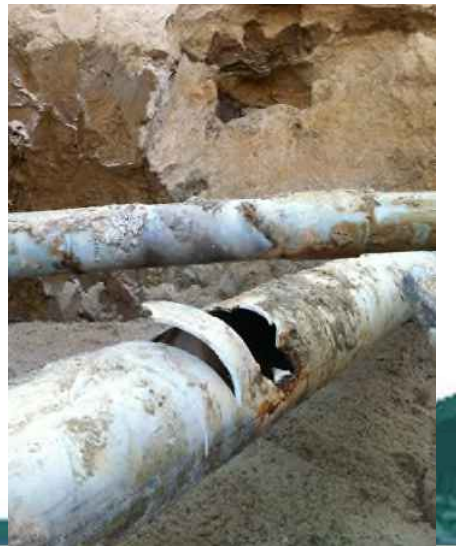
Utility Conflicts & Coordination

1. Typically sewers are first utility installed & at greater depths.
2. Private utilities are installed subsequently above sewers & locations are not typically recorded.
3. Private utilities have little motivation, resources, or budget to locate, relocate, or even coordinate their existing utilities or proposed utilities with others.
4. Utility companies will not locate utilities in field for engineering or survey crews, only construction crews (digging). This made planning during design problematic.



Utility Conflicts & Coordination

5. Typically utilities would not do anything in the field until construction started & contractor was mobilizing to site of conflict – this presented unknown construction delay.

6. Difficult to identify utility type & owner when utility was identified as damaging sewer pipe. Even then they were reluctant to cooperate with addressing repair.

Lessons Learned & Implemented

1. Identify & locate possible utility conflicts visible above ground during design phase through field investigations & topo surveys.

2. Designated a Program Utility Manager to serve as one POC for utility issues.

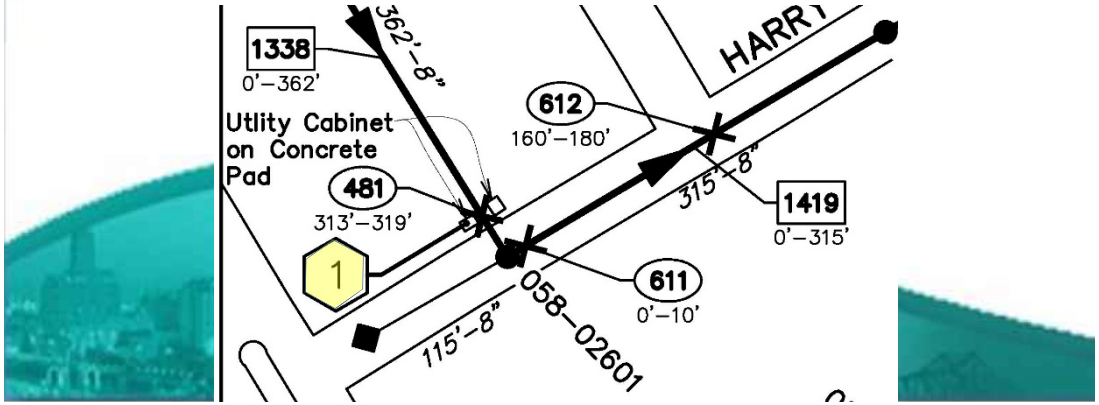
Lessons Learned & Implemented

3. Began collecting screen shots of visible utility conflicts from CCTV reports, providing physical address for conflict points, working with Utility Manager to identify utility owner, & coordinate these conflicts specifically prior to construction.

4. Provide clear language in contract documents related to required utility coordination by contractor, likelihood and difficulties of utility conflicts whether identified or not, & how these instances should be handled by all parties.

Utility Conflict

DESIGNATED REPAIR NUMBER 481 HAS A VISIBLE UTILITY THAT PASSES THROUGH THE SEWER PIPE AS DETERMINED BY CCTV INSPECTION REVIEW AT FOOTAGE 315.6 LF FROM USMH. THE CONTRACTOR SHALL COORDINATE WITH THE APPLICABLE UTILITY COMPANIES WITHIN THE FIRST 30 CALENDAR DAYS AFTER THE ISSUANCE OF THE NOTICE TO PROCEED AND ALLOW EACH TO VERIFY, EXCAVATE, AND RELOCATE ALL EXISTING UTILITY CONFLICTS WITHIN DESIGNATED REPAIR IN ACCORDANCE WITH THE GENERAL NOTES SHOWN ON SHEET 2.



Project:	Bluebonnet Jefferson Ph 2 Rehab Area
Upstream MH:	058-08384
Downstream MH:	058 08383
Conflict Location (From Upstream MH):	18.8 lf
Total Pipe Length:	111 lf
Location:	Roadway
EBROSCO Map:	360-694/360-690

Lessons Learned & Implemented

5. Created & implemented utility conflict protocol process as contract requirement.

Project Name:Flannery Florida Ph1 Area Rehab — 1/17/2018

Contract #: 14-AR-MS-0033

Work that has not been done due to conflict

Repair #	Date Added	Address	Sheet	USMH	DSMH	Depth	Repair Limits begin	Repair Limits End	Type	Comments	Action (From SSO)	Status
18	5/17/16	1647 N. Marque Ann Dr.	7	021-00066	1200058	5.3	197	211	CLY	Electric Box too close and utilities right on top. PR 017: 75-81. PR 018: 197-211.	Answered 9/28/16: Contractor to take field pictures to depict the location of repair in relation to in place utilities. Lateral @ 193.1' has 40% rootball and will require PR. Large tap root in mainline from 198' to 244'. If root can be cut and removed, PR# 18 can be adjusted accordingly and pipe lined.	CIPP to be prepped
33	8/9/16	12222 E. Glenhaven Dr.	19	031-00009	031-00378	5.6	8	20	CLY	Big Concrete Box on top on this Point Repair also electric box very close	Answered 9/28/16: Delete PR 033.	Deleted
65	5/17/16	11555 Manorwood	12	031-00041	031-00040	3.5	50	57	CLY	Homeowner at 11555 Manorwood refused to allow repair.	Answered 9/28/16: Corrdinate with project PIO and CM to gain access to public survitude and complete repair. Answered on 11/16/16: PIO to assist in gaining access.	Repair completed 5/25/16
79	5/17/16	11775 Parkwood Dr.	18	031-00076	031-00075	8.7	0	6	CLY	ATT utility pole is directly over mainline at repair	Answered 9/28/16: Repair #79 is required. Visible utility conflict through pipe (Possibly pole guide wire) . Contractor to take field pictures to depict the location of repair in relation to in place utilities. Contractor to coordinate with utility owner in order to complete repair.	Repair 364A added on 10-24 to fix surcharge. Entergy to move and brace pole week of 3/6/17.
84	5/17/16	11680 Mollylea Dr.	18	031-00078	013-00076	8.7	72	81	CLY	Storage Building right on top of the point repair	Answered 9/28/16: Repair is intended to remove heavy sediment deposits in flowline. If contractor can remove deposit through cleaning. Repair # 84 can be deleted.	Deleted
118	5/17/16	11485 Glenhaven Dr.	12	031-00100	031-00099	5.2	130	137	CLY	Utility Pole right on point repair.	Answered 9/28/16: Contractor can delete PR# 118 only if rootball at 134.4 can be cut and removed.	Deleted
131	5/17/16	12747 Goodwood Blvd.	22	031-00141	031-00140	6.4	80	93	CLY	Big tree and flower bed just on top of the Point Repair	Answered 9/28/16: Delete Repair # 131 and proceed with CIPP # 1063.	Deleted
137	8/9/16	12741 E Miliburn Ave.	24	031-00159	031-00157	5.3	136	143	CLY	Swimming pool too close & nice flower bed on the P.R.	Answered 9/28/16: Proceed with CIPP 1068 prevideo. Only if intruding lateral at 141' can be trimmed and lined through can PR 137 be deleted.	Deleted
139	5/17/16	735 Stockton Dr.	19	031-00177	031-00170	8.4	0	6	CON	Utilities on top; Electric Box, At&t Lines, Cox Cable	Answered 9/28/16: Repair # 139 can be deleted only if contractor can line through broken pipe (minor damage). Proceed with CIPP.	Deleted
144	5/17/16	12543 Parkwood Dr.	19	031-00217	031-00156	7.7	108	114	CON	Building too close and utility Lines on top of Point Repair	Answered 9/28/16: Delete Repair 144.	Deleted
149	5/17/16	12260 Brookshire Ave.	21	031-00242	031-00241	6.2	113	134	CON	AT&T and Entergy over repair.	Answered 9/28/16: Reduce repair limits to 125'-134' Answered 11/16/16: Answered on 11/16/16: Comments section revised to reflect true conflict, underground AT&T and Entergy lines. CIPP Sub to preform pre-video on CIPP #1085 to determine if they can line through hole at 127 ft. If so, delete PR and line through.	Deleted
154	8/9/16	12638 Brookshire Ave.	21	031-00249	031-00248	7.0	114	120	CON	Big Palm Tree right on top of this point repair	Answered 9/28/16: Contractor to proceed with CIPP 1088 once remaining PR's are completed. If hole and roots at 117' can be lined through PR 154 be deleted.	Deleted
156	8/9/16	12614 Brookshire Ave.	21	031-00249	031-00248	7.0	288	300	CON	Utility Lines, At&t Box, also big pine tree on top of this Repair	Answered 9/28/16: Contractor to proceed with CIPP 1088 once remaining PR's are completed. If defects at 288-300' can be lined through PR 156 be deleted.	Deleted
163	8/9/16	12561 Lockhaven Ave.	13	031-00286	031-00285	3.4	0	6	CON	Utility Lines, At&t, Cox Cable and Electric above the point repair	Answered 9/28/16: Contractor to proceed with CIPP 1091 prevideo. If defects (broken pipe) at 0-6 ft can be cleared and lined through then PR 163 can be deleted.	Deleted

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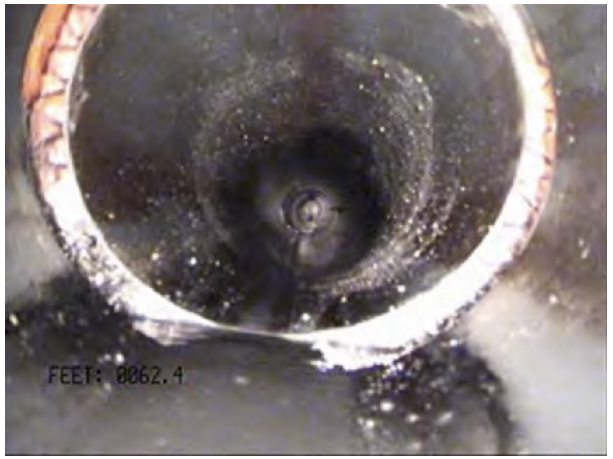
Sewer Rehabilitation Design Criteria

1. Truss Pipe repair recommendations are limited to either “leave as is” or a full remove and replace.



Sewer Rehabilitation Design Criteria

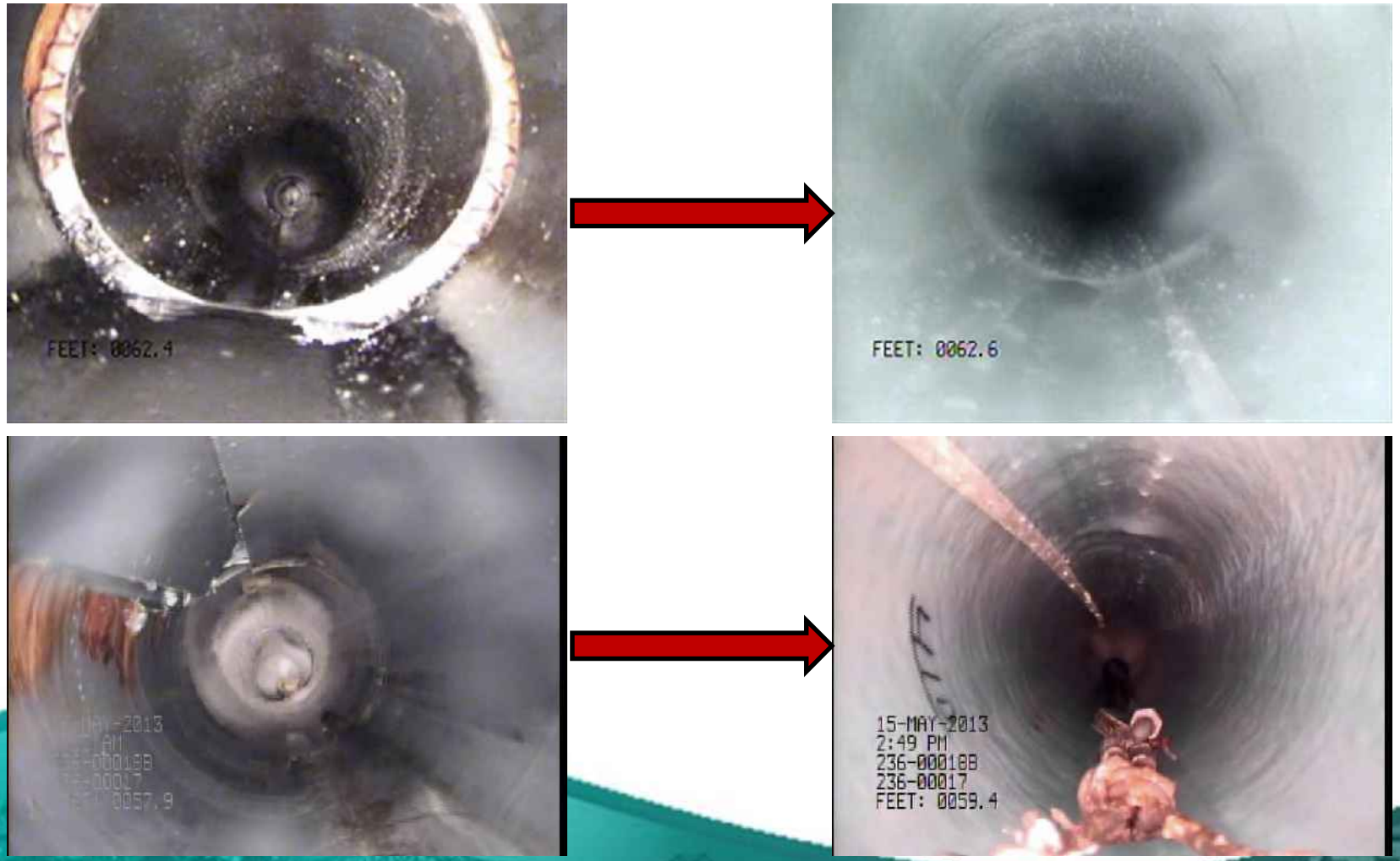
2. Roots in laterals require a replacement of the lateral (digging).
3. Portions of pipe with sags greater than 20% require replacement.
4. Intruding service laterals require a point repair (digging).

Sewer Rehabilitation Design Criteria

5. All joint offsets must be repaired (digging) before installing a CIPP liner.
6. Roots at joints require a point repair before installing a CIPP liner.
7. Any defects on existing lined pipe require a full remove and replacement.

Lessons Learned & Implemented

1. CIPP liners were installed in truss pipe as long as certain criteria was met.

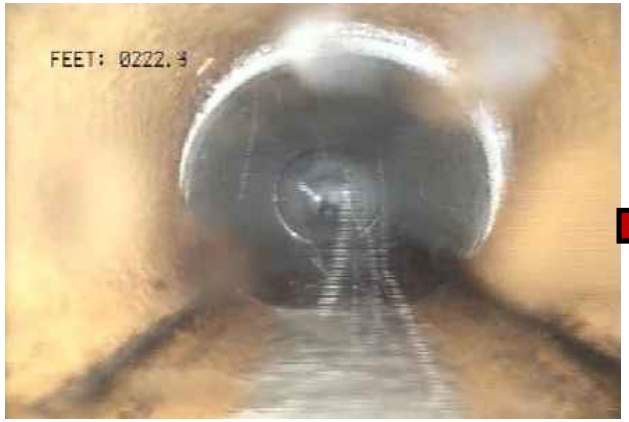


Lessons Learned & Implemented

2. Roots inside laterals were able to be removed internally along with the installation of a top hat.
3. Portions of pipe with sags greater than 40% require replacement.
4. Intruding service laterals are able to be trimmed internally.

Lessons Learned & Implemented

5. Many joint offsets do not prevent the installation of a CIPP liner.
6. Most roots at joints can be trimmed & lined over. Only large tap roots require a point repair before installing a CIPP liner.
7. Defects on existing lined pipe are repaired with a point repair & partial CIPP liner.



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Other Concerns to Keep in Mind

1. Budgetary Issues
   - How to know when to stop?
   - Focus on real-world SSOs and severity of impact – Risk Analysis
   - Develop cost/benefit strategy to target specific I/I reduction based major I & I contributing defects

2. WW SSO focus vs. DW SSO reduction
   - Blockage abatement program
   - FOG program
   - Review industrial user permitting
   - Public Education on the topic

Accomplishments

11 Year Timeframe

- Parish wide system = 8.7M LF of pipe & 37,500 manholes
- 32 Projects rehabilitated:
  - 6.7 Million LF of pipe (77%)
  - 28,000 manholes (75%)
- $10M spent on cleaning and inspection
- $275M spent on rehabilitation construction
- Preliminary pre/post flow monitoring results:
  - Average RDII reduction ~ 55%
  - Average basin RDII reduction target ~ 20%

Lessons Learned on Baton Rouge SSO Comprehensive Rehabilitation Program

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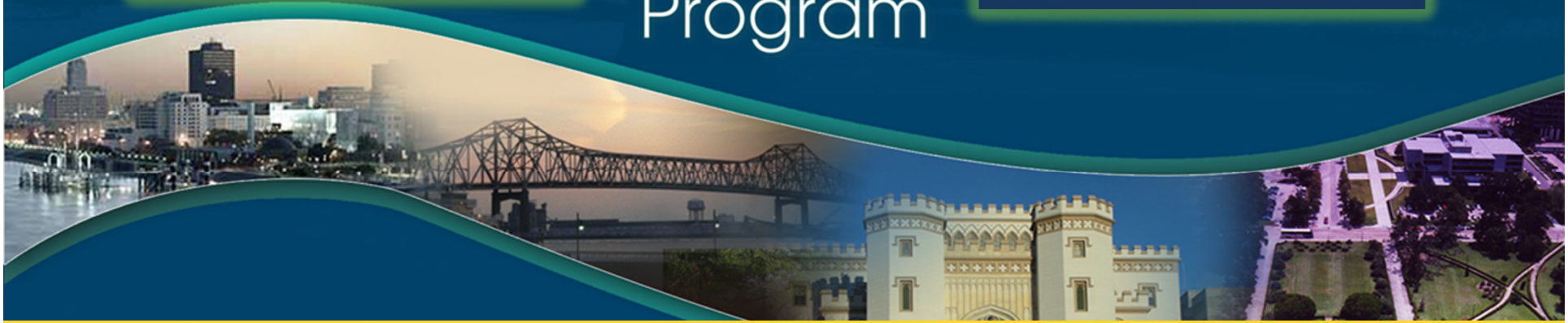
BATON ROUGE SSO Program



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