Bend Plant Interceptor Condition Assessment

Prepared for

City of Bend, OR

February 2, 2015

Bend Plant Interceptor Condition Assessment

Prepared for
City of Bend, Oregon
February 2, 2015

Brown AND Caldwell
6500 SW Macadam Avenue, Suite 200
Portland, OR 97239
Phone: 503.244.7005
Fax: 503.244.9095

Table of Contents

Executive Summary vii
1. Introduction 1-1
   1.1 Plant Interceptor 1-1
   1.2 Inspection History 1-2
2. Sewer Inspection 2-1
   2.1 Pre-Inspection Activities 2-1
      2.1.1 Pre-Inspection Workshop 2-1
      2.1.2 Public Notification 2-2
      2.1.3 Siphon Access 2-4
   2.2 Inspection Methodology 2-5
      2.2.1 Digital Scanning 2-6
      2.2.2 Laser Profiling 2-7
      2.2.3 Sonar Inspection 2-8
   2.3 Field Work 2-8
      2.3.1 Gravity Inspection 2-8
      2.3.2 Siphon Inspection 2-8
   2.4 Inspection Data Management 2-9
3. Condition Assessment 3-1
   3.1 Pipe Condition Assessment Approach 3-1
      3.1.1 Pipe Condition Grades 3-1
   3.2 Plant Interceptor (PI) Structural and Operational Condition Grades 3-2
   3.3 Manholes 3-8
4. Corrosion Control 4-1
   4.1 Hydrogen Sulfide Production 4-1
   4.2 Liquid Phase Sulfide Control 4-2
   4.3 Sewer Headspace Ventilation 4-3
      4.3.1 Results and Recommendations 4-4
5. Rehabilitation Options 5-1
   5.1 Gravity Rehabilitation Options 5-1
      5.1.1 Option 1: Address Grades 4 and 5 Segments 5-2
      5.1.2 Option 2: Address Grade 5 Segments and Implement Corrosion Control 5-4
      5.1.3 Option 3: Address Grade 4 and 5 Segments and Implement Corrosion Control 5-6
      5.1.4 Option 4: Rehabilitate the Entire PI 5-9
      5.1.5 Option 5: Replace the Entire PI 5-11
   5.2 Siphon Options 5-13
   5.3 Recommendations 5-14

6. Limitations 6-1
Appendix A: Pre-Inspection Presentations and Meeting Minutes A-1
Appendix B: Inspection Technology Memorandum B-1
Appendix C: Property Owner Handouts C-1
Appendix D: Intertie Slab Removal, Storage, and Replacement Specification D-1
Appendix E: RedZone Robotics Final Report E-1
Appendix F: Manhole Inspection Reports F-1
Appendix G: 2007 Yeoman Interceptor CCTV Report G-1
Appendix H: Brenford Siphon Cleaning Quotation H-1
Appendix I: Influent Fan Testing Results and Recommendations Report I-1

List of Figures

Figure 1-1. PI size and material 1-1
Figure 1-2. Screen shots of defects from original 2005 inspection 1-3
Figure 2-1. Public and private access areas along PI 2-2
Figure 2-2. Inspected manholes located on private property 2-3
Figure 2-3. Siphon profile 2-4
Figure 2-4. Plan view of the intertie box 2-4
Figure 2-5. Removal of the intertie box top slab 2-5
Figure 2-6. HD profiler rear view to show CCTV camera 2-6
Figure 2-7. Digital scanner used for manhole inspections 2-7
Figure 2-8. HD profiler with laser wand 2-7
Figure 2-9. Sonar and laser inspection float in pipe 2-8
Figure 2-10. Couch cushion and grease blocking the 36-inch siphon barrel 2-9
Figure 3-1. Structural grades for the PI 3-4
Figure 3-2. Sonar inspection of the 21-inch siphon barrel 3-5
Figure 3-3. Sonar cross-sections of the 21-inch siphon barrel 3-5
Figure 3-4. Sonar inspection of the 36-inch siphon 3-6
Figure 3-5. Sonar cross-sections of the 36-inch siphon barrel 3-6
Figure 3-6. Operational grades for the PI 3-7
Figure 3-7. Scrape test results 3-8
Figure 3-8. Manhole structural score 3-9

Figure 4-1. Formation of H_2S in the slime layer 4-1
Figure 4-2. Percentage of each sulfur constituent as a function of pH....4-2
Figure 5-1. Address Grades 4 and 5 segment defects....5-3
Figure 5-2. Address Grade 5 segment defects and implement corrosion control....5-5
Figure 5-3. Address Grades 4 and 5 segment defects and implement corrosion control 5-8
Figure 5-4. Rehabilitate the entire PI.... 5-10
Figure 5-5. Replace the entire PI 5-12
Figure 5-6. Brenford's Sewer Hog.... 5-13

List of Tables

Table ES-1. Rehabilitation Options for PI viii
Table ES-2. BC Recommendations Based on Hydraulic Requirements viii
Table 1-1. ASTM Requirements For Reinforced Concrete Pipe 1-2
Table 2-1. Summary of Inspection Technologies....2-1
Table 3-1. Structural and Operational Condition Grades for Sewers 3-2
Table 3-2. Structural Results for the Gravity Portion of the PI 3-2
Table 3-3. Summary of Manhole Scrape Test Results 3-8
Table 3-4. PI Inspection Results 3-10
Table 3-5. Manhole Scrape Tests Details.... 3-11
Table 5-1. Option 1 Project Costs 5-2
Table 5-2. Option 2 Project Costs 5-4
Table 5-3. Option 3 Project Costs 5-6
Table 5-3A. Option 3 Project Costs 5-7
Table 5-4. Option 4 Project Costs 5-9
Table 5-5: Option 5 Project Costs 5-11
Table 5-6. Rehabilitation Options for PI.... 5-14
Table 5-7. BC Recommendations Based on Hydraulic Requirements 5-15

Executive Summary

The City of Bend (City) hired Brown and Caldwell (BC) to inspect the Plant Interceptor (PI) that conveys sewage roughly 5 miles from the sanitary collection system to the Water Reclamation Facility (WRF). The purpose of the inspection was to identify areas of required maintenance as well as any defects that may compromise the sewer's structural and operational integrity. Inspected sewers include the following:

- 11,400 linear feet (LF) of 30- to 42-inch American Society of Testing and Materials (ASTM) C76 Class III reinforced concrete pipe (RCP)
- 8,800 LF of 36- to 42-inch ASTM C361 low-head pressure RCP
- 9,800 LF of ASTM C361 low-head pressure pipe in a siphon from the siphon structure to the WRF. The siphon is comprised of parallel 21-inch and 36 inch pipes.

The gravity portion of the PI was inspected using a combination of digital scanning, laser profiling, and sonar profiling. The manholes and access structures were inspected using a combination of digital scanning and man-entry inspection. Both barrels of the siphon were inspected using sonar profiling. The general condition of each trunk is summarized as follows:

- Gravity Portion: Approximately 37 percent of the pipe segments in the gravity portion exhibit structural Grade 5 defects with reinforcement visible being the most prominent Grade 5 defect. Approximately 31 percent of the gravity portion exhibit Grade 4 defects, such as localized reinforcement visible. The laser profiling indicated a significant loss of pipe wall which corroborated with the visual observation of corrosion. The majority of the manholes were in good condition with only ten exhibiting grade 4 or 5 defects. Operationally, the gravity portion of the PI is in good condition.
- Siphons: The sonar profiling did not detect any structural issue in either siphon barrels. However, there is a large accumulation of grease and debris which has restricted the flow significantly and reduced hydraulic capacity. Approximately a cumulative 700 cubic yards of debris is estimated to be in both siphon barrels.

The possible options for addressing the structural and operational defects in the PI are summarized in Table ES-1, with the estimated remaining useful life of the PI after the rehabilitation option is implemented.

Table ES-1. Rehabilitation Options for PI		
Option	Project cost, $	Remaining useful life, years
Option 1: Address Grades 4 and 5 segments	4,526,000	7 to 10
Option 2: Address Grade 5 segments and implement corrosion control	4,288,000	10 to 15 for Grade 4 20 to 30 for Grade 3 and below
Option 3: Address Grade 4 segments with short liners and Grade 5 segments with full CIPP and implement corrosion control	4,799,000	20 to 30
Option 3A: Address Grade 4/5 segments with full CIPP and implement corrosion control	6,418,000	30 to 40
Option 4: Rehabilitate the entire PI	8,701,000	50+
Option 5: Replace the entire PI	21,826,000	50+
Siphon cleaning and inspection	600,000	N/A
New siphon junction box	85,000	50+

BC's recommendations depend on the hydraulic capacity needs of the City, both now and in the future. Table ES-2 summarizes BC's recommendations based on the various hydraulic requirements of the City.

Table ES-2. BC Recommendations Based on Hydraulic Requirements		
Hydraulic capacity need	Recommended option	Project cost, $
Adequate capacity for next 20 years	Option 3 + siphon cleaning + siphon junction box	5,484,000
Adequate capacity for foreseeable future	Option 4 + siphon cleaning + siphon junction box	9,386,000

Section 1

Introduction

Brown and Caldwell (BC) was retained by the City of Bend (City) to inspect the Plant Interceptor (PI). As the sole means of conveyance for most of Bend, the primary objectives for performing this work include the following:

- Obtain a thorough understanding of the PI's condition.
- Estimate the remaining useful life of the PI.
- Develop a strategy to implement the appropriate upgrades at the appropriate times.

The inspection work was conducted with these objectives in mind. This document provides an overview of the condition assessment and findings.

1.1 Plant Interceptor

The PI was constructed in 1978 and is the sole means of conveyance from the sanitary sewer collection system to the Water Reclamation Facility (WRF). The PI measures approximately 25,300 feet and includes the following:

- 11,400 linear feet (LF) of 30- to 42-inch American Society of Testing and Materials (ASTM) C76 Class III reinforced concrete pipe (RCP)
- 8,800 LF of 36- to 42-inch ASTM C361 low-head pressure RCP
- 4,900 LF of ASTM C361 low-head pressure pipe in a siphon from the siphon structure to the WRF. The siphon is comprised of parallel 21- and 36-inch-diameter pipes.

Figure 1-1 illustrates the PI configuration and material. The PI varies in diameter with larger sewer diameters discharging into smaller sewer pipe.

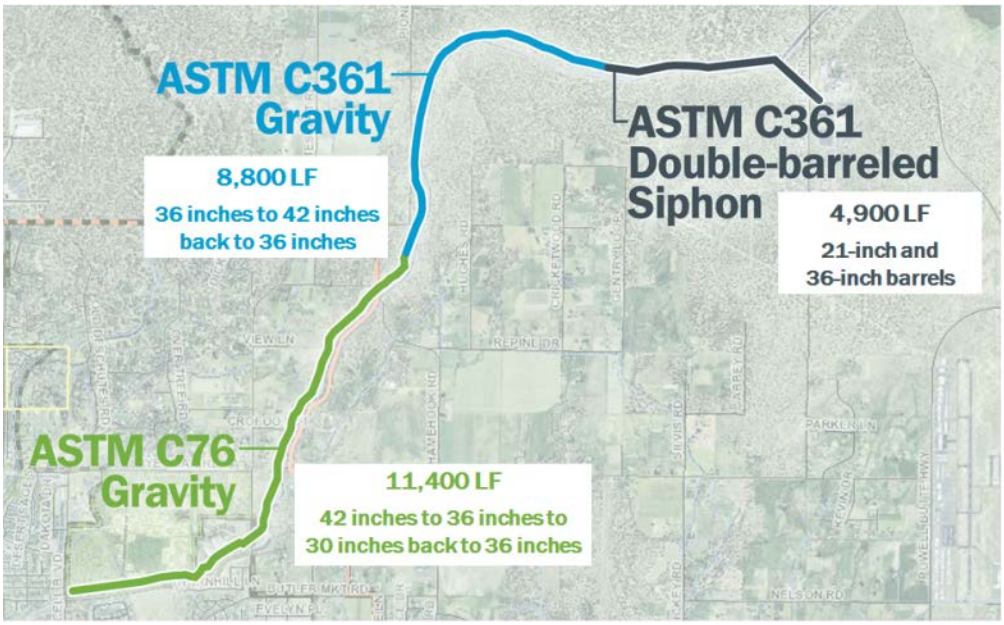


Figure 1-1. PI size and material

While the actual details of construction were not available, current ASTM manufacturing standards present a wide range of tolerances. Pipe characteristics for each of these standards are listed in Table 1-1.

Table 1-1. ASTM Requirements For Reinforced Concrete Pipe

Pipe diameter, inches	ASTM C76 (Class III RCP)	ASTM C361 (Low-head pressure RCP)
21	N/A	• Single cage of reinforcement • Wall thickness 2-3/8 to 3 inches • 0.95-inch minimum concrete cover over rebar
30	• Single cage of reinforcement • Wall thickness 2-3/4 to 4-1/4 inches • 0.5-inch minimum concrete cover over rebar	N/A
36	• Single or double cage of reinforcement • Wall thickness 3 to 4-1/4 inches • 0.5-inch minimum concrete cover over rebar	• Single cage of reinforcement • Wall thickness 3-1/4 to 5 inches • 0.75-inch minimum concrete cover over rebar
42	• Double cage of reinforcement • Wall thickness 3-1/2 to 5-1/4 inches • 0.5-inch minimum concrete cover over rebar	• Double cage of reinforcement • Wall thickness 3-3/4 to 5 inches • 0.75-inch minimum concrete cover over rebar

1.2 Inspection History

The PI was last inspected in 2005. Recommendations are provided in the 2007 Yeoman Interceptor CCTV Review Report. The inspection indicated the presence of large quantities of grease throughout the PI. However, the pipe was reported to be in good condition with no major structural defects identified. Minor defects such as surface roughness increased and surface aggregate visible were detected in the downstream reaches with minimal to no defects in the upstream portions of the PI. The remaining useful life, as stated in the 2007 Yeoman Interceptor report, ranged from 25 to 50 percent of the original 50 year design life. Because none of the segments were in need of immediate repair or rehabilitation, implementation of the improvement work could be delayed. The report recommended the City to re-inspect within the next 7 to 10 years. In the meantime, the City was advised to plan for a $9.2 million cured-in-place pipe project and undergo high-pressure cleaning to remove the grease.

In 2013, the City issued a request for proposals for re-inspection of the PI. As part of the proposal process, BC reviewed the 2005 inspection video and determined that six pipe segments had major structural defects due to corrosion, such as reinforcement visible. Example screen shots from the 2005 inspections are shown in Figure 1-2.

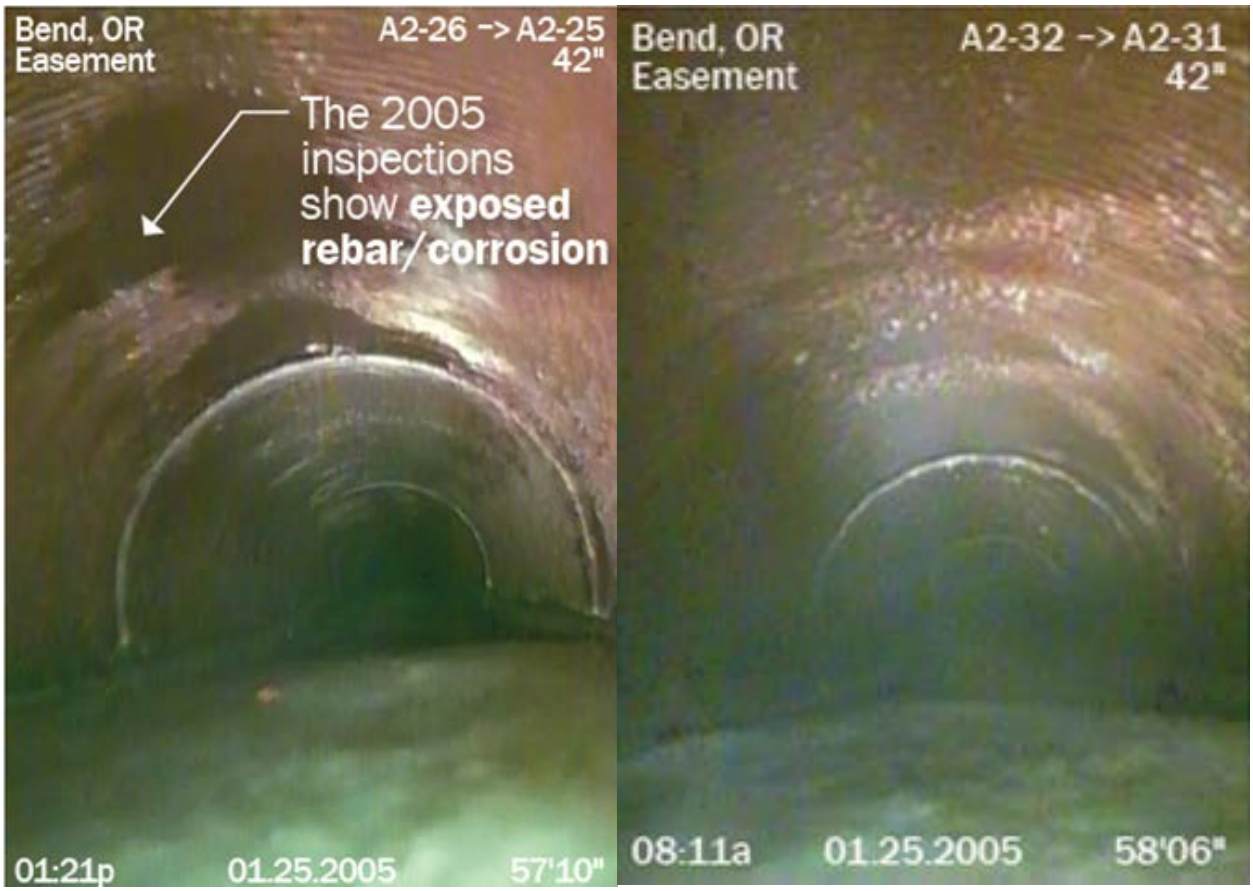


Figure 1-2. Screen shots of defects from original 2005 inspection

The discovery of severe defects within the PI helped to determine the most appropriate inspection technologies for its 2013 re-inspection.

Section 2

Sewer Inspection

This section describes the pre-inspection activities, equipment, and methods used to perform the fieldwork inspection of the sewer pipe and manholes along the Plant Interceptor (PI).

2.1 Pre-Inspection Activities

Prior to implementation of the PI inspection, planning activities were conducted that include a planning workshop, property owner notifications, and contracting access to the siphon box.

2.1.1 Pre-Inspection Workshop

Brown and Caldwell (BC) and the City of Bend (City) participated in a pre-inspection workshop. The purpose of the workshop was to discuss the following topics: project critical success factors, scheduling constraints, current and future hydraulic capacity of the PI and Water Reclamation Facility (WRF), inspection technologies, and end goals for the inspection project. Copies of the presentations given at the workshop and resulting meeting minutes are provided in Appendix A.

At the workshop, the project team determined the critical success factors (CSFs) that would need to be met for the success of the project. The following CSFs were identified:

- Meet the project objectives within the project cost.
- Obtain high quality data that can be used to track degradation of pipes over time.
- Confirm the remaining useful life of the pipe and determine whether the capacity is sufficient to support future population growth projections.

Numerous inspection technologies are available to serve specific purposes. BC presented the City with multiple options with the purpose of identifying those that would best meet the City's goals within the budget and time frame. The following technologies were reviewed: closed-circuit television (CCTV), digital scanning, laser, sonar, pipe penetrating radar, zoom cameras, electro scanning, and gyroscopic positioning. Table 2-1 summarizes the various technologies. A memorandum comparing and contrasting these technologies is included in Appendix B.

Table 2-1. Summary of Inspection Technologies

Technology	Data provided	Purpose
CCTV	Visual inspection	Qualitative assessment
Sewer scanners	High-resolution visual inspection	Qualitative assessment (higher confidence)
Sonar	Under-the-flow inspection (holes, grease, debris)	Hydraulic capacity, cleaning, gross defect identification
2D laser ring profiling	Geometric data	Precise defect identification (particularly siphons)
3D LIDAR scanning	Geometric data	Corrosion measurement, rehabilitation design (straight pipe)
Electro-scan	Leak potential	Corrosion measurement, rehabilitation design (larger diameters, non-round pipe, bends)
Pipe-penetrating radar	Wall thickness, rebar cover, voids beyond pipe	Corrosion measurement, estimating remaining service life
XYZ mapping	Gyroscopic mapping	Precise locating

Based on the workshop and information present, the project team determined that visual inspection coupled with the quantitative data gleaned from laser profiling or scanning and sonar were the best technologies for this application.

BC contacted HydroMax USA, Northwest Underwater Construction, AquaCoustic Remote Technologies, RedZone Robotics, and Interactive Pipeline Inspections to obtain proposals for the work. RedZone Robotics was chosen to perform the inspections based on experience, scheduling availability, and comparable costs.

2.1.2 Public Notification

The PI conveys wastewater through a sparsely inhabited area on the eastern side of Bend. Most of the manholes could be accessed via a public dirt road that parallels a canal. However, a number of the manholes were located on private property and/or were located behind fences or under private property improvements. Prior permission for access was required to inspect the gravity portion of the PI as well as the manholes themselves. A letter was sent in advance to the property owners to solicit consent to perform the inspections. Door hangers were also delivered to each property as a notification of work to occur within 48 hours.

Examples of public and private property access types are shown in Figure 2-1. Copies of the various types of materials provided to property owners are included in Appendix C. Figure 2-2 is a map that shows the locations of the inspected manholes.

Manhole on private property

Public road paralleling the PI

Figure 2-1. Public and private access areas along PI

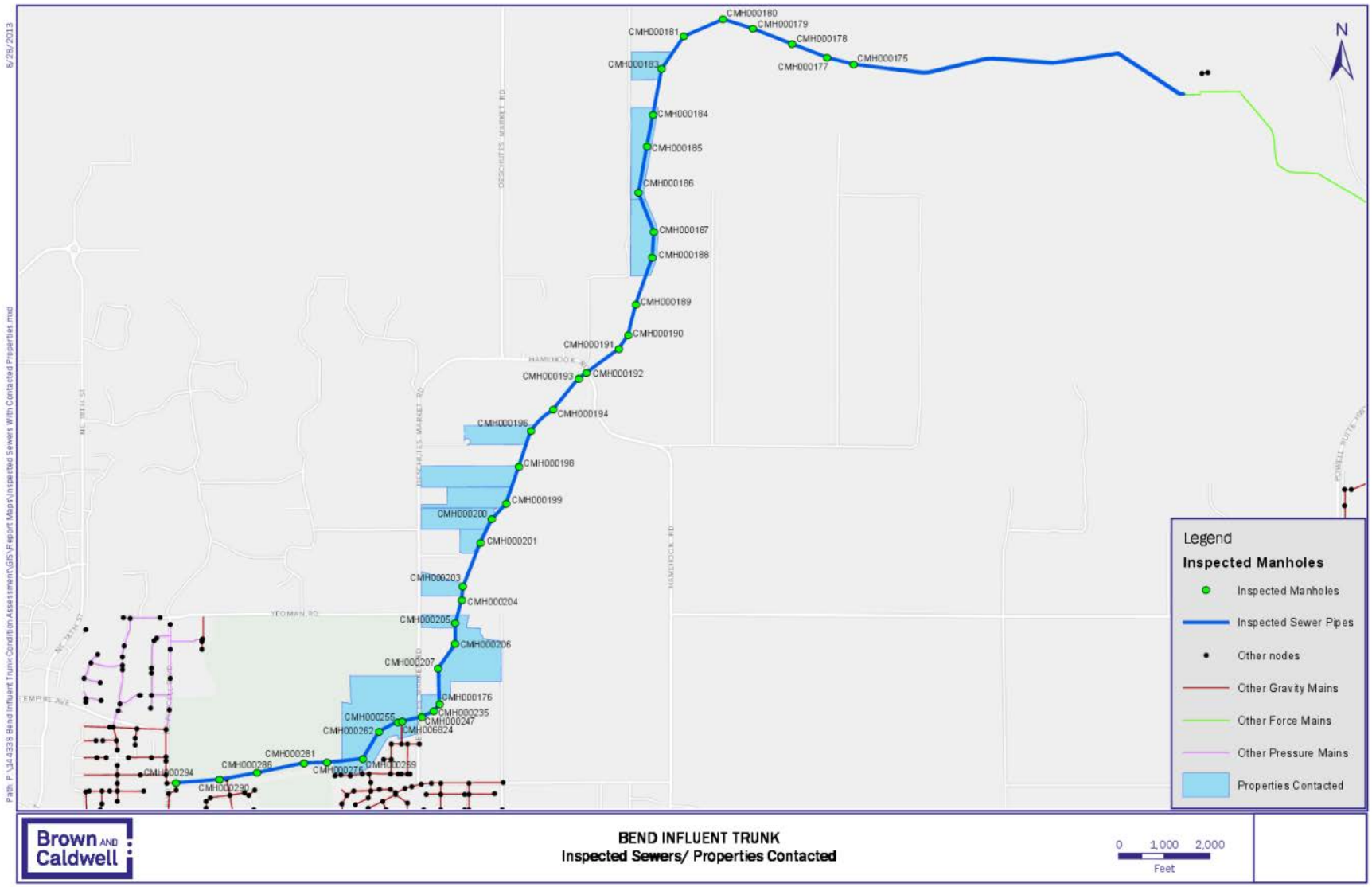


Figure 2-2. Inspected manholes located on private property

2.1.3 Siphon Access

The siphon conveys flows for a little under a mile underneath the main irrigation canal and back up to the WRF. The numerous bends within the siphon created ideal conditions for debris accumulation. The siphon barrels were not inspected in 2005 and have never been cleaned nor inspected since they were originally constructed. The siphon profile is shown in Figure 2-3.

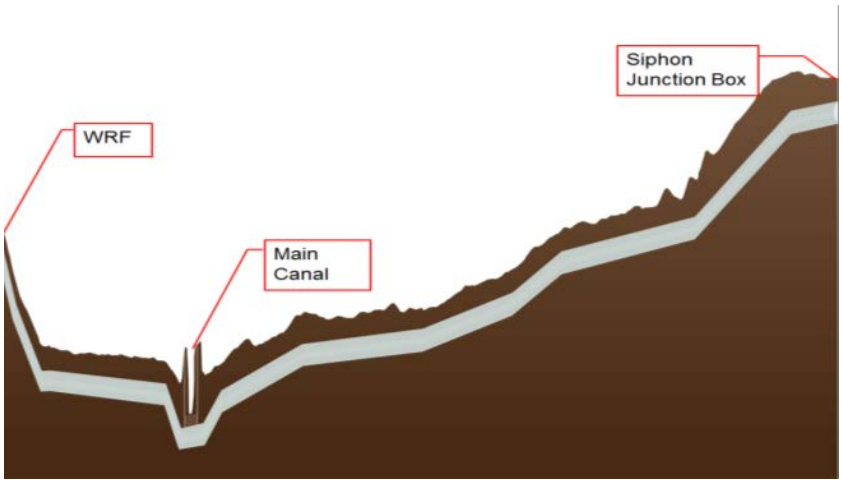


Figure 2-3. Siphon profile

2.1.3.1 Intertie Box

Inspection of the double-barreled siphon required preplanning due to some unique issues. First, the barrels are just under a mile in length with no intermediate access. The only point of access is the upstream siphon junction box. While remote-operated vehicles (ROV) could be used to propel the sonar probe through the siphon, the length, numerous bends, unknown amount of debris, the typical floatables associated with a wastewater stream (e.g., rags, grease) that could hinder the ROV propellers, and cost were all factors that made this option less attractive. To perform the inspection cost-effectively, access at both ends of the siphon was investigated to allow for a more traditional winch-assisted sonar inspection. The siphon enters the WRF at an intertie box, as shown in Figure 2-4. The intertie box is capped with a fixed concrete slab.

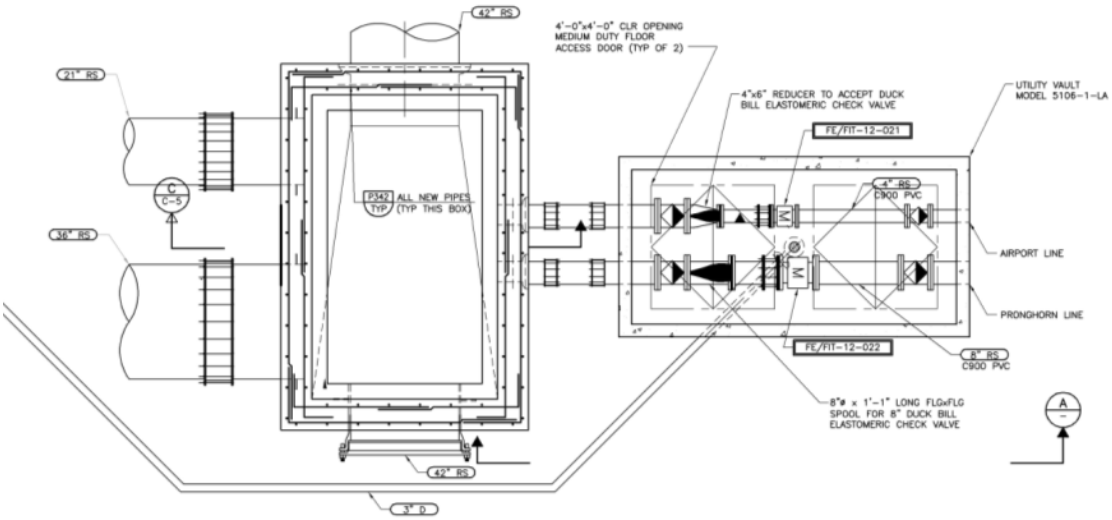


Figure 2-4. Plan view of the intertie box

A concern that was raised was that the intertie box was pressurized and once the top slab was removed, raw sewage would overtop the box with diurnal changes in flow. After visually observing the available freeboard within the intertie box once the top slab was removed, overtopping was no longer deemed to be a concern. A specification was developed to direct the contractor to remove and store the top slab for the duration of the inspection and replace the top slab post-inspection. The specification is provided in Appendix D.

A crane lifting the top slab from the intertie box is shown in Figure 2-5.

Figure 2-5. Removal of the intertie box top slab

2.2 Inspection Methodology

The inspection technologies used for the condition assessment include digital scanning, sonar, and laser scanning.

2.2.1 Digital Scanning

Digital scanning is a method that uses an optical sensor to inspect the inner surface of pipelines or manholes, capturing multiple images per second. The images are recorded digitally and stitched together to produce an image that gives the reviewer the ability to focus, pan, tilt, or zoom the camera to investigate potential defects after the inspections are complete. Unlike CCTV which returns a live feed to the operator, the digital scans can be reviewed only after the inspection is completed. More information about the technology can be found in Appendix B.

2.2.1.1 Interceptor Digital Scanning

The camera used by RedZone Robotics is mounted to the front of the float and is shown in Figure 2-6. Digital data were recorded for the gravity sewer totaling roughly 20,000 linear feet (LF) of footage.

Figure 2-6. HD profiler rear view to show CCTV camera

2.2.1.2 Manhole Digital Scanning and Inspection

Digital scanning was also used to inspect the 40 manholes along the interceptor. The digital scanning equipment and setup used by RedZone Robotics is shown in Figure 2-7.

Figure 2-7. Digital scanner used for manhole inspections

In addition to the digital scans, the manholes were entered manually to perform hardness and scrape tests. Hardness and scrape tests consisted of scraping the concrete at various points within the manhole to determine its competency.

2.2.2 Laser Profiling

Laser profiling is an emerging technology that is often used to supplement visual inspection technologies such as CCTV. The laser profiler is used in low visibility conditions and provides information such as accurate pipeline dimensions and shape, protruding lateral length, water depth, deformations, pipe wall material loss, and offset joint distance. The laser used for the PI consists of a laser wand that projects a ring of light onto the wall of the pipeline in a circular pattern. The rear facing camera obtains digital images of the laser ring and post-processing converts the optical images into geometric measurements. The laser wand on the RedZone Robotics float is shown in Figure 2-8. More information about the technology can be found in Appendix B.

Figure 2-8. HD profiler with laser wand

2.2.3 Sonar Inspection

Sonar profiling occurs below the water surface and measures the speed and distance of travel of acoustic sound in water. Sonar profiling systems consist of a sonar emitting head mounted to a camera transporter such as a moving float platform. An example is depicted in Figure 2-9. Sonar is used to make measurements of pipeline dimensions and shape, water depth, large deformations, gross pipe wall material loss, offset joint distance, and volume of sediment deposition. In this case, sonar was used to inspect the 10,000 total linear feet (LF) of the 21- and 36-inch siphon barrels.

Additional information about the technology can be found in Appendix B.

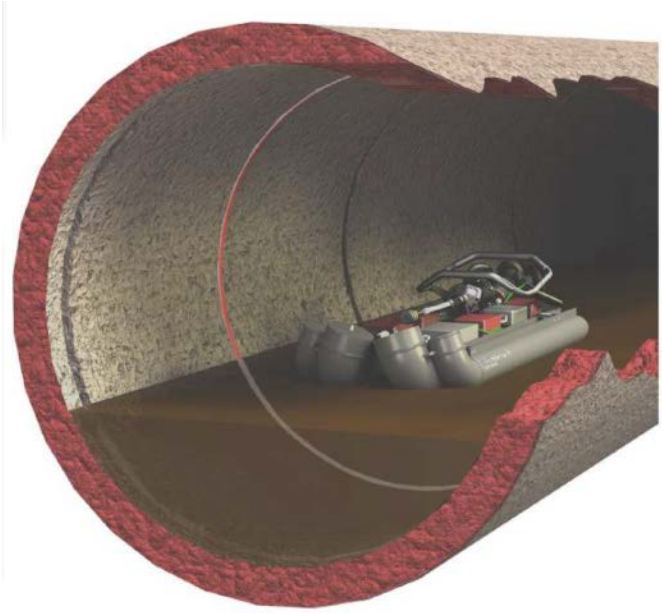


Figure 2-9. Sonar and laser inspection float in pipe

2.3 Field Work

The actual inspection work began on July 15, 2013 and concluded on July 26, 2013. The first week was planned for the inspection of the gravity components of the PI and the second week was set aside for the sonar inspection of the siphon barrels.

2.3.1 Gravity Inspection

The gravity pipe portion of the PI was inspected in in five deployments. RedZone Robotics used its HD Profiler, a multi-sensor platform deployed on a float using digital scanning, laser profiling, and sonar. As mentioned above, the manholes were inspected using digital scanning combined with man-entry inspections to gauge the competency of the concrete. The manhole inspections were originally conducted concurrently with the gravity inspections but improper data collection required reinspection of the manholes to obtain the needed scrape test information. The reinspection was completed in October 2013.

2.3.2 Siphon Inspection

The siphon inspections consisted of floating a tag line from the upstream siphon junction box, retrieving the tag line at the downstream WRF intertie box, and pulling the sonar probe through the siphon. A parachute was used to propel the tag line through the 36-inch siphon barrel initially, but

numerous attempts were unsuccessful due a large amount of debris and grease buildup within. Ultimately, a combination of neutrally-buoyant bottles combined with plug-and-release of flow to propel the bottles through the suspected constrictions resulted in successful tagging of the line. Significant volumes of grease and debris, as well as large obstructions, were moved through the 36-inch barrel as a result of the inspection work. Information regarding the remaining debris in the 36-inch barrel is described in Section 3.

The 21-inch siphon barrel was tagged and inspected successfully on the first attempt.

Figure 2-10 illustrates the debris, grease, and other obstacles removed from the intertie box during the inspection of the siphon.

Figure 2-10. Couch cushion and grease blocking the 36-inch siphon barrel

2.4 Inspection Data Management

Inspection data including the digital scanning, laser, and sonar were post-processed and delivered via the RedZone's proprietary software platform, ICOM3. A separate software program, FlyViewer, is required to utilize the full-functionality of the in-pipe digital scanning data. Both software programs were made available to the City.

Video files of the gravity inspections were created. A Pipeline Assessment and Certification Program-compliant database with all the defect codes was exported and delivered to the City for importation into the City's computerized maintenance management system, Granite XP.

Section 3

Condition Assessment

This section presents the approach used to assess the condition of the sewers and the findings of the inspections.

3.1 Pipe Condition Assessment Approach

The City of Bend uses the National Association of Sewer Service Companies' Pipeline Assessment Certification Program (PACP) for defect coding its sanitary sewers. Sewer defects identified during the inspections were recorded using the PACP standardized defect identification procedure, which assigns a score for each defect.

Two levels of classification are used to evaluate pipe condition: structural and operational. Defect ratings are based on the defects observed during the inspections and are used as the basis for assigning a rating to each pipe.

- Structural defects: Structural defects are those that impair the structural condition of the pipeline directly, such as joint separations, joint deflections, cracks, fractures, holes, broken and collapsed pipe, corrosion, worn inverts, and reinforcement visible.
- Operational defects: Operational defects include a range of conditions that can either directly affect the performance of the sewer or are indicators of potential structural defects, such as debris, grease, intrusions (root or service laterals), sags, and hydraulic (undersized pipe) problems. The PACP classifies infiltration as an operational defect.

The inspection firm, RedZone Robotics, was required to code the defects per PACP standards. RedZone provided coding of the pipe initially, but RedZone's coding was not consistent with PACP standards, with numerous defects missed or not coded properly. Brown and Caldwell (BC) disagreed with the level of coding and performed an independent review of the inspections. For each pipe segment, BC discovered on average over 15 additional defect codes that RedZone either missed or did not agree with even though the laser data demonstrated otherwise (e.g., RedZone did not code "Surface Damage Reinforcement Visible" even though the laser data demonstrated a significant loss of inner pipe wall). As a result, the final PACP coding was completed by BC.

The final RedZone Robotics report is included in Appendix E.

3.1.1 Pipe Condition Grades

Based on the defects identified, BC assigned an overall structural and operational rating to each sewer pipe or reach. Often the score was based on the most critical or **peak** structural and operation defect score within each sewer reach.

Peak defect ratings are calculated for the two primary defect categories (structural and operational) described above according to their impact on the system. The peak rating is the highest single structural or operational defect score within any section of sewer. The peak condition rating helps to identify serious flaws or defects in the sewer and becomes the primary basis for the structural and operational grades. A secondary criterion for determining the structural and operational grades is the presence of continuous defects. A continuous defects is defined as a defect that continues down the length of the pipe for greater than 3 to 5 linear feet (LF).

Structural and operational condition grades are assigned to each inspected pipe reach to provide a summary of the structural and operational conditions of the sewer, respectively. Grade 5 represents the worst condition and Grade 1 represents a sewer in excellent condition. Table 3-1 provides a definition for each condition grade.

Table 3-1. Structural and Operational Condition Grades for Sewers

Condition grade	Grade description	Defect description
5	Immediate attention	Sewers requiring immediate attention
4	Poor	Severe defects that will continue to degrade with likely failure in 5 to 10 years
3	Fair	Moderate defects that will continue to deteriorate
2	Good	Minor and few moderate defects
1	Excellent	No defects; condition like new

Structural condition grades can be used to prioritize rehabilitation or replacement. Operational condition grades can be used to prioritize maintenance, such as cleaning or additional inspection. The required activity could include rehabilitation, replacement, major repair, or maintenance, depending on the type and severity of the observed defects.

Professional judgment is used to assign the final structural and operational condition grades. In this way, the variability of a given defect can be assessed. For example, in a 36-inch-diameter pipe, visible reinforcement at a break-in connection and visible reinforcement for hundreds of LF within a pipe reach will yield the same rating of 5; however, the extensive length of visible reinforcement presents a much greater risk of failure. Thus, for each pipe reach, a final recommendation is given that takes into account peak score as well as the variability of the defects. During post-inspection review of the digital videos, the severity of defects were noted and used to develop the rehabilitation recommendations.

3.2 Plant Interceptor (PI) Structural and Operational Condition Grades

The inspection results indicate there are two main regions of the gravity portion of the PI with advanced corrosion. These areas exhibited extensive Grade 5 defects with surface reinforcement visible (SRV) totaling 7,319 LF of pipe. This area makes up roughly 37 percent of the gravity portion of the PI, as listed in Table 3-2.

Table 3-2. Structural Results for the Gravity Portion of the PI

Condition grade	LF of pipe segments	Percent coverage
5	7,319	37
4	6,112	31
3	4,627	23
2	1,717	9
1	-	0

As described above, the structural condition grades assigned to each pipe segment represent the peak defect score based on BC's best professional engineering judgment. The majority of pipe within the gravity portion was assigned a Grade 5 or 4 defect score. Most of the Grade 4 pipe contains SRV defects but with much fewer instances within a segment and each instance is over a much smaller area of pipe. The Grade 3 defects found in roughly 4,600 LF of pipe were primarily surface aggregate visible (SAV). This is an early indicator of surface degradation of the concrete comprising the pipe walls. Concrete is a combination of aggregate and cement. In this case, the cement has sufficiently degraded such that the aggregate becomes visible. Finally, the remaining 9 percent of segments exhibited surface spalling. This is the earliest stage of degradation when the surface of the pipe begins to degrade or slough off the wall in patches.

Laser data collected indicate that the pipe continues to hold its round shape, meaning that the rigid pipe has not been structurally compromised to the point of fracturing and displacement. However, the laser data also corroborate very well with the visual indications of severe corrosion.

For the siphon, the sonar results were relied upon to determine structural condition grades. Concrete pipes that are constantly full are generally not expected to have significant corrosion, because sewer head space and oxygen are necessary for the biogenic reactions that lead to concrete corrosion. The sonar did not reveal any gross structural defects in either the 21- or 36-inch siphon barrels. However, there were areas of the 36-inch siphon barrel where the water level was below the crown, either due to grease accumulation on the crown or air pockets. In either case, these areas of the siphon could be susceptible to concrete corrosion over time and should be investigated further.

Figure 3-1 summarizes the structural condition grades of the PI. Table 3-4 summarizes each pipe reach.

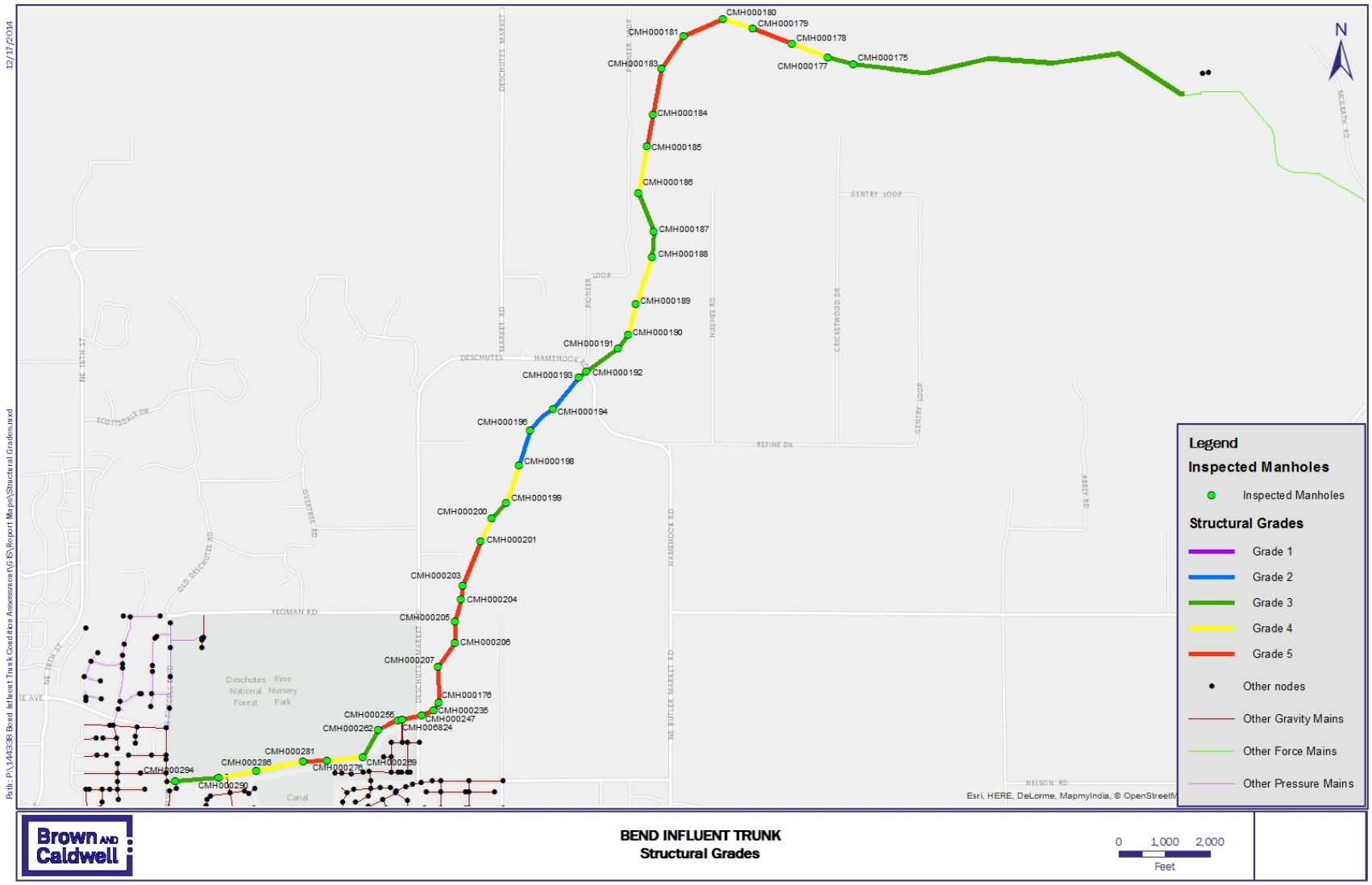


Figure 3-1. Structural grades for the PI

The results of the sonar inspection for the 21-inch barrel are shown in Figure 3-2. The blue line represents the crown of the pipe and the red line represents the pipe channel. The blue line appears continuous at 21 inches along the crown of the pipe indicating that there are no structural defects and the 21-inch barrel is completely full. The red line oscillates indicating buildup or debris accumulation along the floor of the pipe.

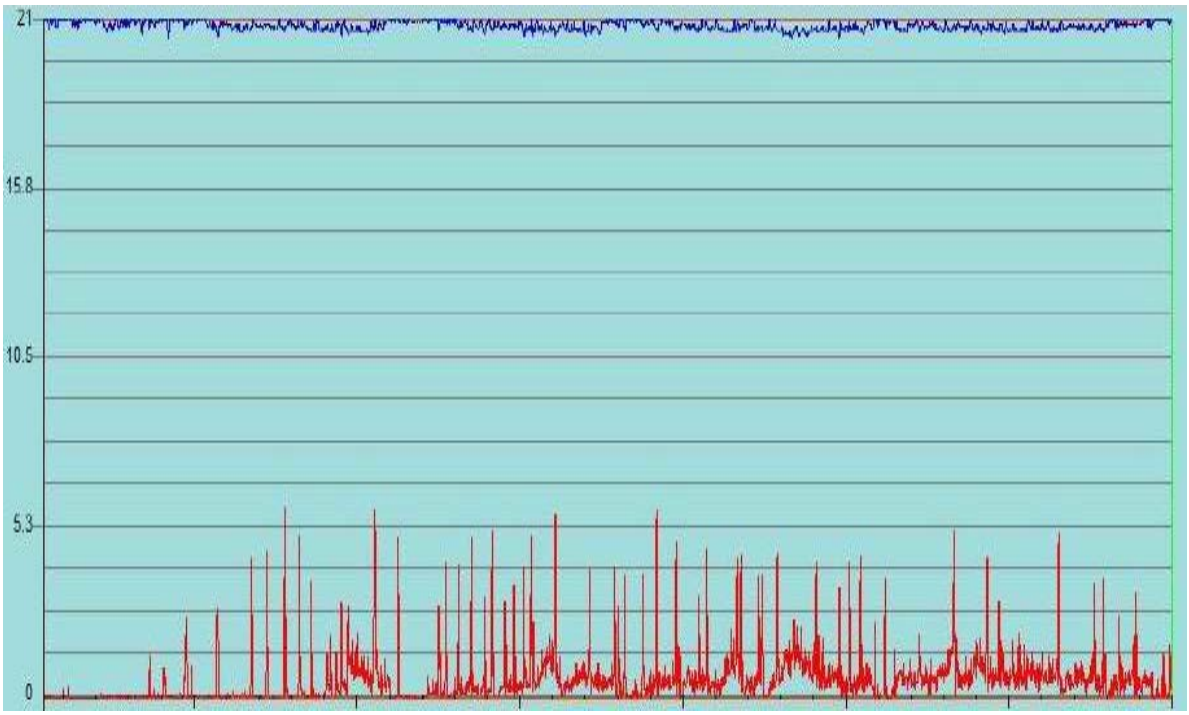


Figure 3-2. Sonar inspection of the 21-inch siphon barrel

Figure 3-3 shows examples of the cross-sections in the 21-inch barrel. In some locations the debris accumulation is as great as several inches, reducing the hydraulic capacity of the pipe by as much as 25 percent.

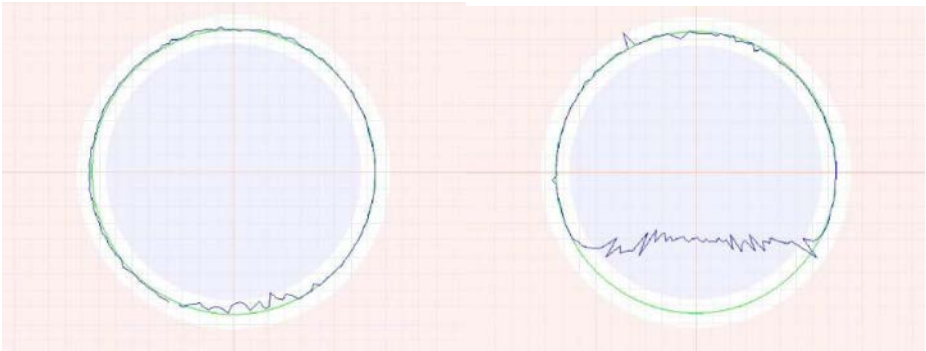


Figure 3-3. Sonar cross-sections of the 21-inch siphon barrel

The sonar data for the 36-inch barrel is much different than it is for the 21-inch siphon barrel. At the upper end of the siphon barrel between 11 and 455 LF, the pipe was not fully submerged due to its configuration and because the WRF opened up the primary screens to pass the maximum amount of

flow during the sonar inspections. Just after 455 LF, debris accumulation on the floor of the pipe is approximately 14.5 inches. However, from 2,600 to 3,200 LF, there is significant loss of hydraulic capacity due to either grease accumulation or air pockets at the crown of the 36-inch siphon barrel. From about 4,000 LF onward in the lower end of the siphon barrel (as-builts indicate that this is on the WRF side of the Main Canal crossing), the blue and red lines oscillate erratically. This is because grease and debris were loosened during passage of the sonar probes and most likely interfered or weakened the sonar signal.

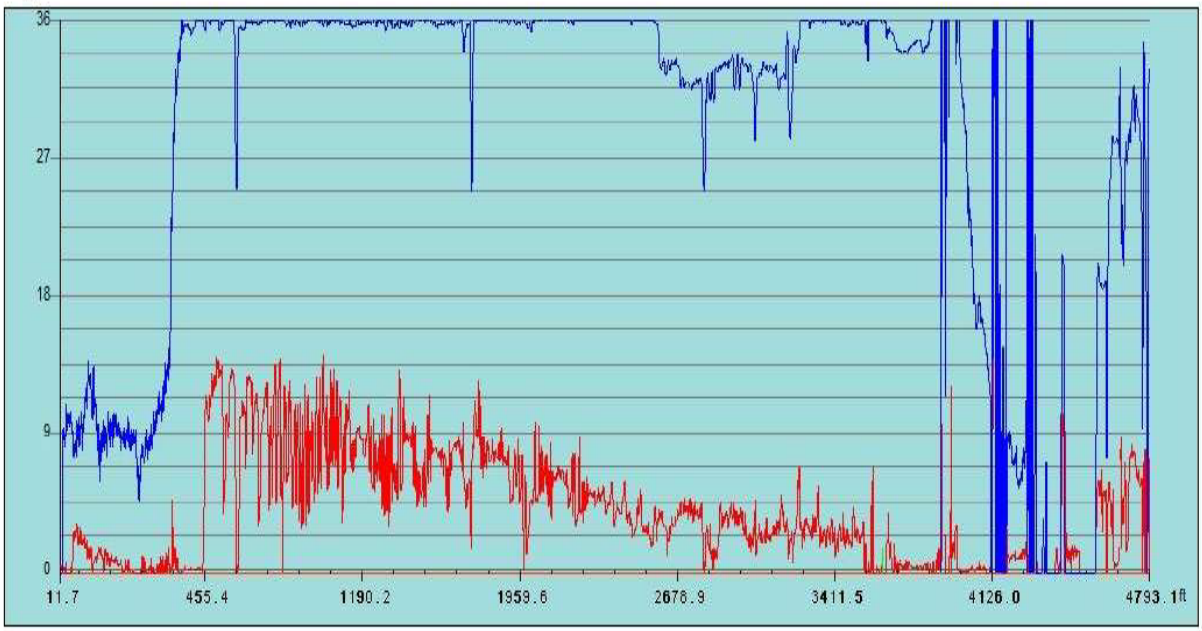


Figure 3-4. Sonar inspection of the 36-inch siphon

Figure 3-5 shows examples of the cross sections in the 36-inch barrel. However, significant hydraulic restrictions exist due to the accumulation of grease and debris.

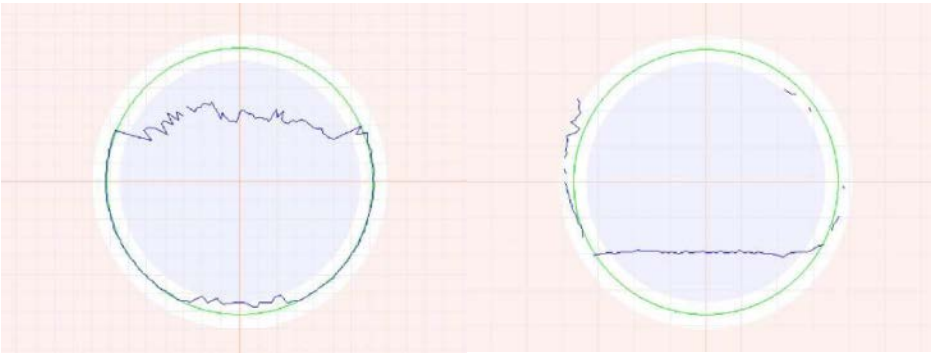


Figure 3-5. Sonar cross-sections of the 36-inch siphon barrel

Operationally, the gravity portion of the PI did not exhibit any significant operational defects. There was only minor debris detected by the sonar probe, and only a few instances of infiltration, roots, or other operational defects. Figure 3-6 summarizes the operational condition grades of the PI.

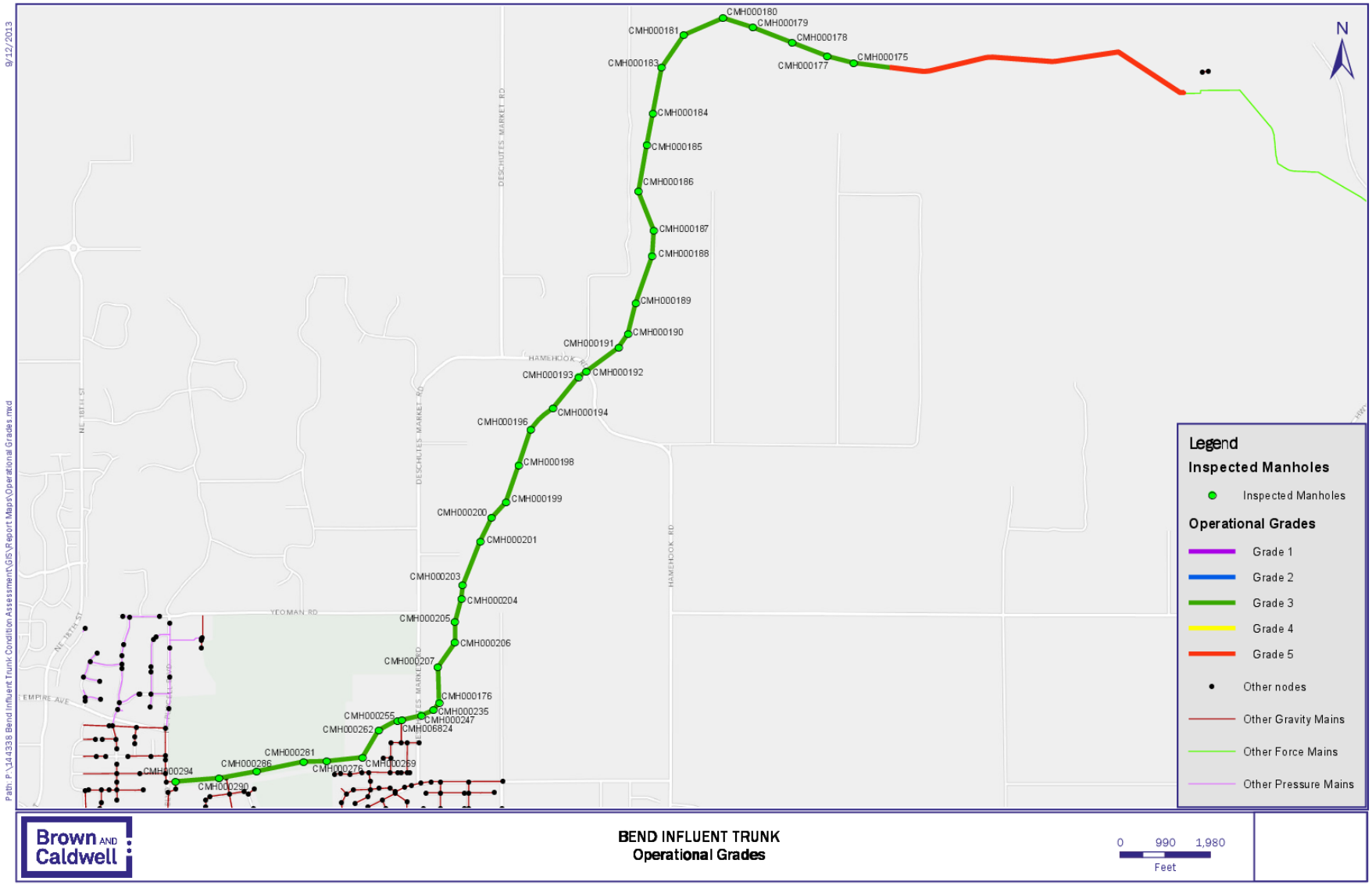


Figure 3-6. Operational grades for the PI

3.3 Manholes

Each manhole was inspected by digital scanning to obtain a visual record and inspected by man-entry to perform scrape and hardness tests to determine the relative competency of the concrete. Manhole scrapes were conducted at three clock positions at three different vertical points in each manhole (top, middle, and bottom) and the depth of the scrape is measured in 1/8-inch increments. Scrape photos are shown in Figure 3-7. Manholes were assessed using a simplified version of NASSCO's Manhole Assessment Certification Program (MACP). Gross defects were noted. Manhole inspection reports are included in Appendix F.

Figure 3-7. Scrape test results

While these tests seem rudimentary, they provide crucial knowledge of the competency of the concrete within the manholes. The results are summarized in Table 3-3. The majority of manholes were in good to fair structural condition; only ten had scrapes equal to or greater than 1/4-inch in depth. The siphon junction structure was in fair structural condition. The inner cement layer is beginning to corrode away with aggregate becoming visible. The presence of the ventilation stacks most likely helped limit the rate of corrosion; removal of these stacks will likely accelerate the rate of deterioration of the concrete.

Table 3-3. Summary of Manhole Scrape Test Results

Maximum depths, inch	Structural condition grade	No. of manholes
0	2	6
1/8	3	24
1/4	4	8
1/2	5	1
1	5	1

Table 3-4 contains detailed PI inspection results and Table 3-5 contains detailed manhole scrape test results.

Figure 3-8 summarizes the overall structural grades of the PI, including manholes Figures 3-9 through 3-50 show pipe inspection video screen shots.

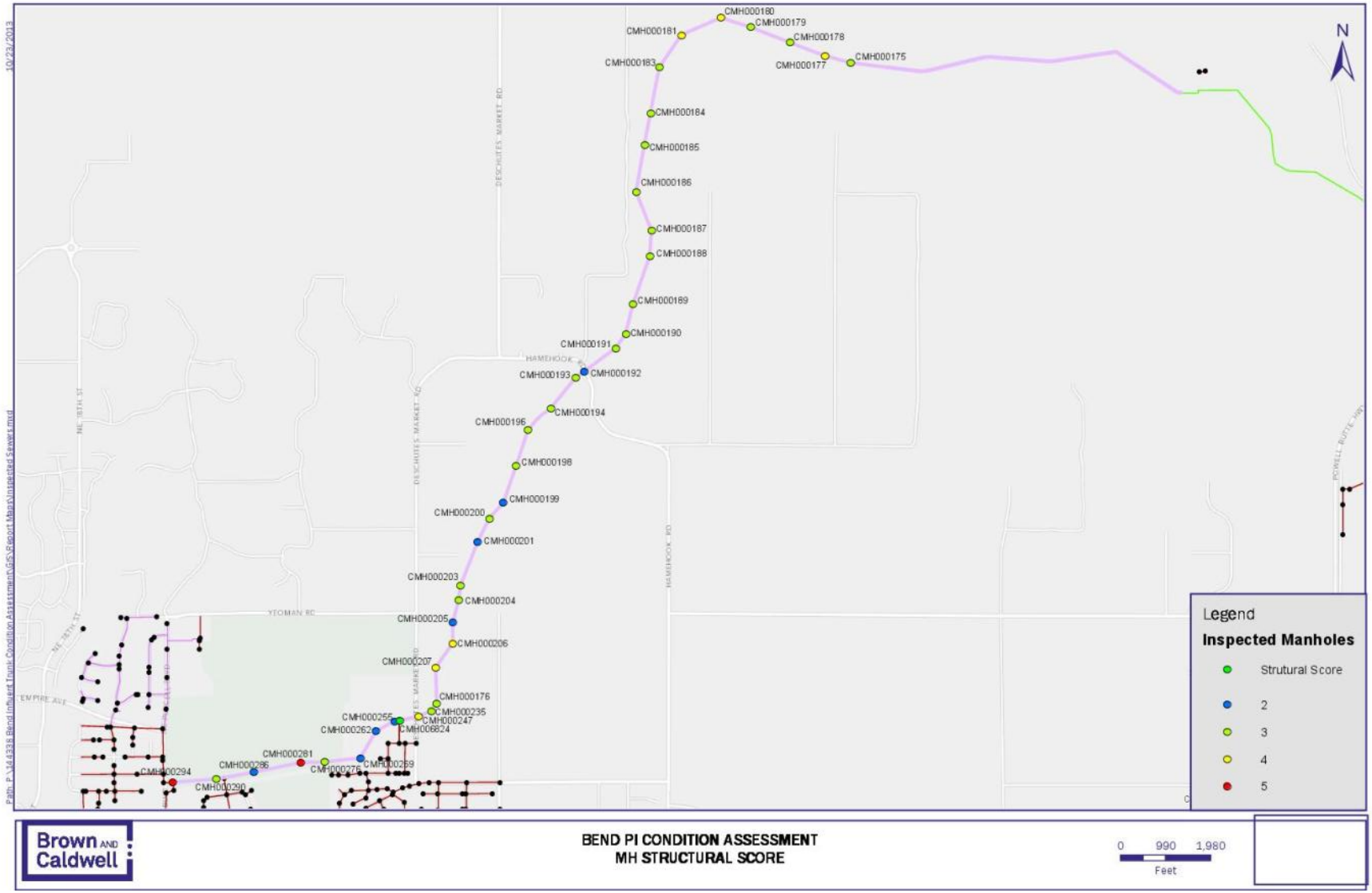


Figure 3-8. Manhole structural score

Table 3-4. PI Inspection Results

US MH	DS MH	Diameter, inches	Material	CCTV length, LF	GIS length, LF	Structural condition grade		Operational condition			
						Structural grade	Structural defect summary	Grade	Defect summary	Max corrosion, inches	Max debris accumulation, inches
CMH000294	CMH000290	42	RCP	690	686	3	SAV from 83 to 372 LF	2	Deposits attached grease throughout	0.91	2.82
CMH000290	CMH000286	42	RCP	607	604	4	Surface roughness increased throughout; SRV at 120 LF (exposed rebar at tap)	2	Tap break in intruding	0.8	1.9
CMH000286	CMH000281	42	RCP	766	757	4	SAM at 436 LF; SAV at 152 and 411 LF	2	Deposits attached grease throughout	0.98	0.31
CMH000281	CMH000276	36	RCP	377	373	5	SRV at 72, 103, 165 to 180, 196 to 203, 243 to 252 and 269to 306 LF	2	Deposits attached grease throughout	1.23	0.25
CMH000276	CMH000269	36	RCP	578	568	4	SRV at 144 and 236 to 247	2	Deposits attached grease throughout	1.54	0.21
CMH000269	CMH000262	36	RCP	497	491	3	16 instances of SAV from 2 to 432 LF	2	Deposits attached grease throughout	2.15	0.17
CMH000262	CMH000255	36	RCP	331	334	5	SRV at 55 to 83, 217 to 224,and 269 LF	2	Deposits attached grease throughout	1.27	0.27
CMH000255	CMH000255A	36	RCP	73	0	5	SRV at 48 to 69 LF	2	Deposits attached grease throughout	1.16	0.21
CMH000255A	CMH000247	36	RCP	319	0	5	SRV at 34, 62, 98 to 106, 109 to 118, and 145 to 161 LF	2	Deposits attached grease throughout	1.34	0
CMH000247	CMH000235	36	RCP	209	212	5	SRV at 135 and 147 to 153 LF	2	Deposits attached grease throughout	0.71	0.2
CMH000235	CMH000176	36	RCP	144	147	5	SRV at 34 to 49 and 96 to 134 LF	2	Deposits attached grease throughout	0.79	0.7
CMH000176	CMH000207	30	RCP	560	561	5	15 instances of SRV from 51 to 504 LF	2	Deposits attached grease throughout	0.93	0.38
CMH000207	CMH000206	30	RCP	467	467	5	SRV at 25, 55 to 72, 124 to 139, and 220 to 261 LF	2	Deposits attached grease throughout	1.61	0
CMH000206	CMH000205	36	RCP	326	325	5	SRV at 116 to 131, 163, 210, 236 to 245, and 284 to 321 LF	2	Deposits attached grease throughout	1.75	0.4
CMH000205	CMH000204	36	RCP	371	372	5	SRV at 7, 17, 30 to 133, and 362 to 369 LF	2	Deposits attached grease throughout	1.39	0.28
CMH000204	CMH000203	36	RCP	218	218	5	SRV at 22 to 67and 113 LF	2	Deposits attached grease throughout	1.24	0
CMH000203	CMH000201	36	RCP	733	740	5	SRV at 336 to 344, 375 to 387, 400 to 425, 555 to 573, 627 to 646, 669 to 674 and 689 LF	2	Deposits attached grease throughout	1.29	0.2
CMH000201	CMH000200	36	RCP	409	410	4	SRV at 128 LF	2	Deposits attached grease throughout	1.18	0.54
CMH000200	CMH000199	36	RCP	331	331	3	SAV at 7 LF	2	Deposits attached grease throughout	1.25	0.39
CMH000199	CMH000198	42	RCP	622	619	4	SRV at 212 to 222 LF	2	Deposits attached grease throughout	0.91	0.38
CMH000198	CMH000196	42	RCP	591	589	2	Crack longitudinal (CL) at 163, 509, and567 to 578 LF	2	Deposits attached grease throughout	0.93	0.43
CMH000196	CMH000194	42	RCP	491	492	2	CL at 209 to 214 and 401 to 408 LF	2	Deposits attached grease throughout	1.25	1.61
CMH000194	CMH000193	42	RCP	635	632	2	Surface spalling at 373, 392 to 396 LF	2	Deposits attached grease throughout	0.66	0.18
CMH000193	CMH000192	42	RCP	160	161	3	SAV at 4 to 157 LF	2	Deposits attached grease throughout	1.29	0
CMH000192	CMH000191	42	RCP	620	621	3	SAV at 11 to 618 LF	2	Deposits attached grease throughout	0.7	0
CMH000191	CMH000190	36	RCP	266	269	3	SAV at 52 to 60, 63 to 68, 78 to 90, 99 to 104, and 117 to 258 LF	2	Deposits attached grease throughout	1.47	0
CMH000190	CMH000189	36	RCP	490	487	4	SRV at 1 LF; 14 instances of SAV from 2 to 481 LF	2	Deposits attached grease throughout	1.48	0
CMH000189	CMH000188	36	RCP	799	795	4	SRV at 491, 551 to 561, and 644 LF	2	Deposits attached grease throughout	1.6	0.41
CMH000188	CMH000187	36	RCP	406	403	3	18 instances of SAV from 1 to 400 LF	2	Deposits attached grease throughout	1.19	0.23
CMH000187	CMH000186	36	RCP	658	652	3	12 instances of SAV from 1 to 644 LF	2	Deposits attached grease throughout	1.5	0
CMH000186	CMH000185	36	RCP	758	750	4	SRV at 483 and 750 LF; 10 instances of SAV from 7 to 366 LF	2	Deposits attached grease throughout	3.47	0.17
CMH000185	CMH000184	42	RCP	490	500	5	SRV at 99 to 115, 150 to157, 163 to 192, 235 to 244, 253 to 364, 372, and 385 to 445 LF	2	Deposits attached grease throughout	1.7	0.18
CMH000184	CMH000183	42	RCP	732	733	5	SRV at 17, 25, 30, 55 to 72, 124 to 139, and 220 to 261 LF	2	Deposits attached grease throughout	1.74	0
CMH000183	CMH000181	42	RCP	621	619	5	SRV at 133 to 189, 196, 196 to 212, 261, 286 to 354, 495, and 504 to 584 LF	2	Deposits attached grease throughout	1.58	0.44
CMH000181	CMH000180	42	RCP	677	677	5	SRV at 93 to 100, 126 to 157, 181 to 251, 611 LF	2	Deposits attached grease throughout	1.71	0.47
CMH000180	CMH000179	42	RCP	490	491	4	SRV at 362, 380 to 412, and 450 to 463 LF	2	Deposits attached grease throughout	1.77	0.31
CMH000179	CMH000178	42	RCP	671	668	5	10 instances of SRV with defect lengths of 10 to 15 LF in each instance	2	Deposits attached grease throughout	1.5	0.3
CMH000178	CMH000177	36	RCP	593	595	4	SRV at 4 to 16 LF	2	Deposits attached grease throughout	1.79	0
CMH000177	CMH000175	36	RCP	421	418	3	SAV at 0 to 416 LF	2	Deposits attached grease throughout	1.7	0.19
CMH000175	CSS000001	36	RCP	578	0	3	SAV at 0 to 576 LF	2	Deposits attached grease throughout	1.58	0.47
CSS000001	WRF intertie box	36	RCP	4751	0	2	No defects noted	5	Heavy deposits attached / settled	NA	13
CSS000001	WRF intertie box	21	RCP	4785	0	2	No defects noted	5	Heavy deposits attached / settled	NA	6

Table 3-5. Manhole Scrape Tests Details

MH	Depth	Median	Max	Rehabilitation recommendation	MH structural grade
CMH000294	7'6"	3/4"	1"	Structural fiber reinforced cementitious liner	5
CMH000290	6'4"	0	1/8"	None	3
CMH000286	7'9"	0	0	None	2
CMH000281	4'6"	1/8"	1/2"	Epoxy coating	5
CMH000276	8'	0	1/8"	None	3
CMH000269	4'6"	0	0	None	2
CMH000262				None	2
CMH000255				Epoxy coating	2
CMH000255A				Epoxy coating	2
CMH000247	5'4"	0	1/4"	None	4
CMH000235	4'	1/8"	1/8"	Epoxy coating	3
CMH000176	3'	1/8"	1/8"	Epoxy coating	3
CMH000207	3'8"	1/8"	1/4"	Epoxy coating	4
CMH000206	5'6"	1/8"	1/4"	Epoxy coating	4
CMH000205	3'	0	0	Epoxy coating	2
CMH000204	3'	0	1/8"	Epoxy coating	3
CMH000203	6'	1/8"	1/8"	Epoxy coating	3
CMH000201	3'	0	0	None	2
CMH000200	3'6"	1/8"	1/8"	None	3
CMH000199	2'6"	0	0	None	2
CMH000198	5'	0	1/8"	None	3
CMH000196	6'	1/8"	1/8"	None	3
CMH000194	5'	0	1/8"	None	3
CMH000193	4'	1/8"	1/8"	None	3
CMH000192	6'	0	0	None	2
CMH000191	4'	0	1/8"	None	3
CMH000190	4'	1/8"	1/8"	None	3
CMH000189	8'	0	1/8"	None	3
CMH000188	4'	0	1/8"	None	3
CMH000187	7'	1/8"	1/8"	None	3
CMH000186	8'	1/8"	1/8"	None	3
CMH000185	4'	1/8"	1/8"	Epoxy coating	3
CMH000184	4'	1/8"	1/8"	Epoxy coating	3
CMH000183	5'	0	1/8"	Epoxy coating	3
CMH000181	3'	1/8"	1/4"	Epoxy coating	4
CMH000180	4'	1/8"	1/4"	None	4
CMH000179	7'	0	1/8"	None	3
CMH000178	4'	1/8"	1/8"	None	3
CMH000177	4'	1/8"	1/4"	None	4
CMH000175	4'	1/8"	1/8"	None	3
Siphon out - 36"	8.5'	-	1/8"		3
Siphon out - 21"	9'	-	1/4"		4
Siphon in	8'	-	1/4"		4

Figure 3-9. Grade 1 surface roughness increased

Figure 3-10. MH CMH000290 to CMH000286 (SRV next to Tap)

Figure 3-11. Grade 2 surface spalling

Figure 3-12. MH CMH000286 to CMH000281 (SAM)

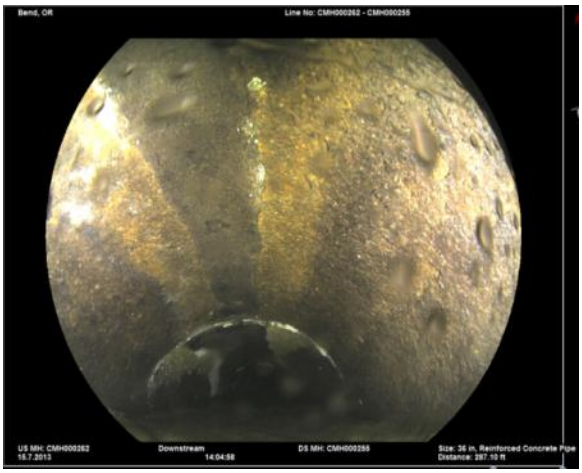


Figure 3-13. Grade 3 SAV

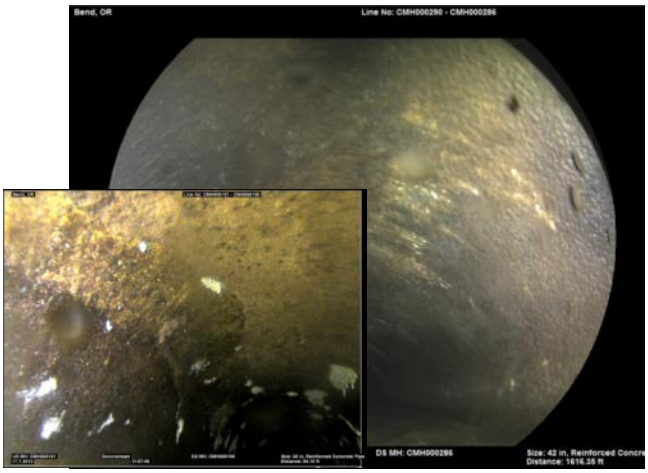


Figure 3-14. MH CMH000281 to CMH000276 (SRV)

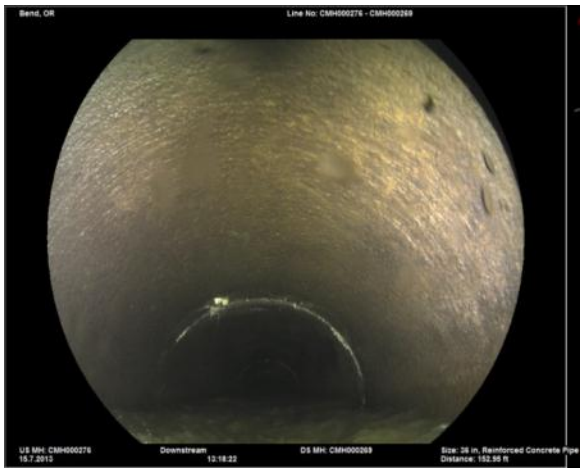


Figure 3-15. MH CMH000276 to CMH000269 (SRV)

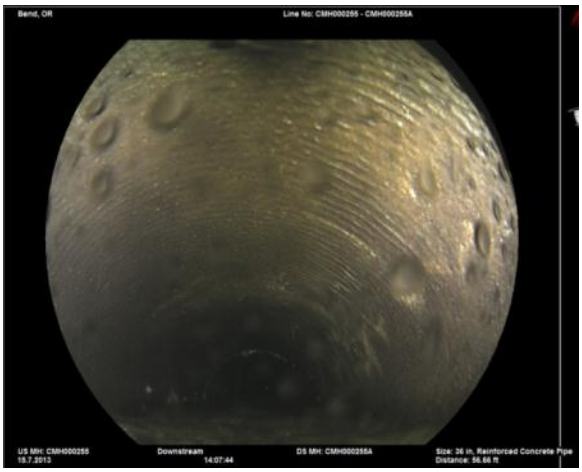


Figure 3-16. MH CMH000255 to CMH000255A (SRV)

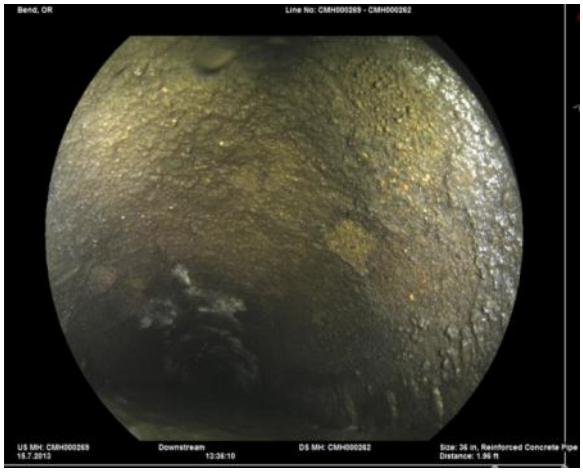


Figure 3-17. MH CMH000269 to CMH000262 (SAV)

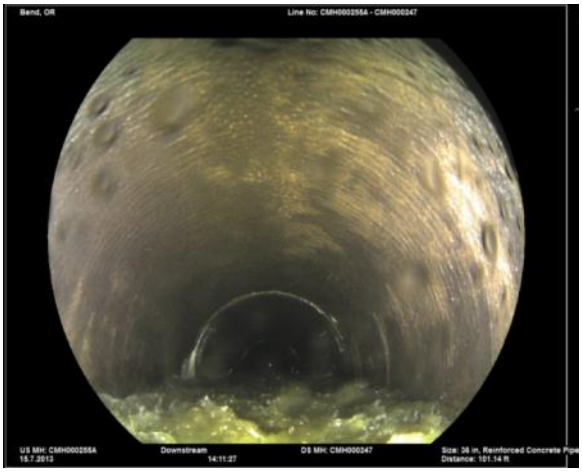


Figure 3-18. MH CMH000255A to CMH000247 (SRV)

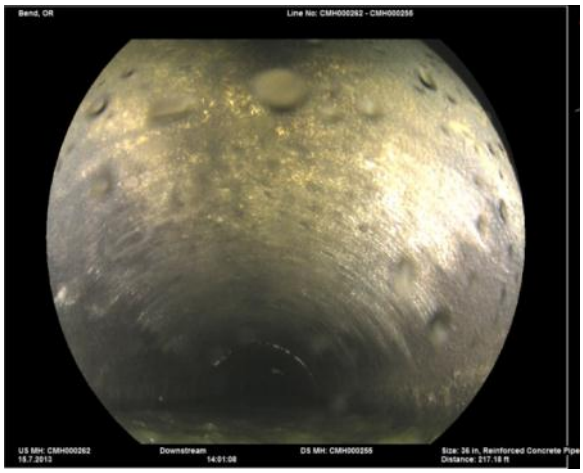


Figure 3-19. MH CMH000262 to CMH000255 (SRV)

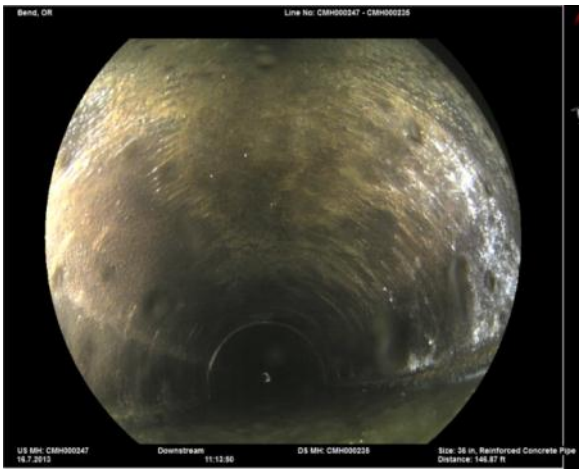


Figure 3-20. MH CMH000247 to CMH000235 (SRV)

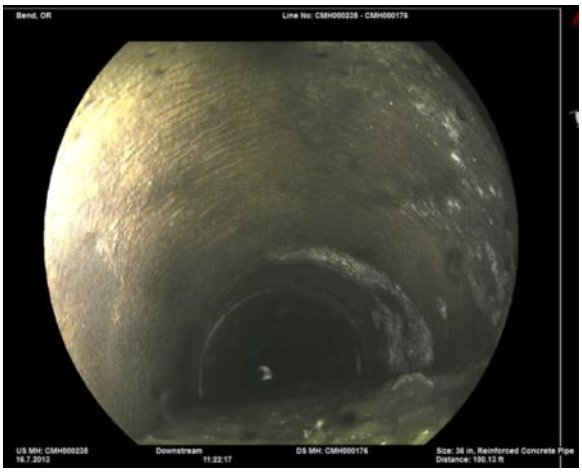


Figure 3-21. MH CMH000235 to CMH000176 (SRV)

Figure 3-22. MH CMH000206 to CMH000205 (SRV)

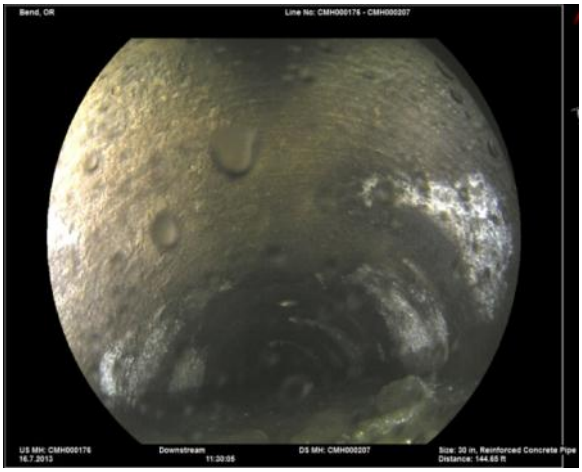


Figure 3-23. MH CMH000176 to CMH000207 (SRV)

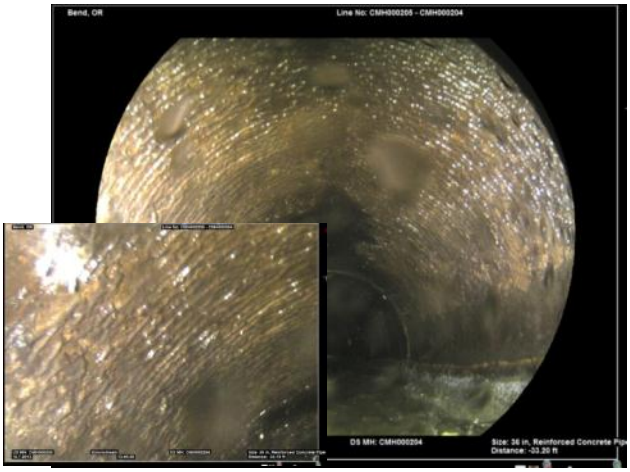


Figure 3-24. MH CMH000205 to CMH000204 SRV

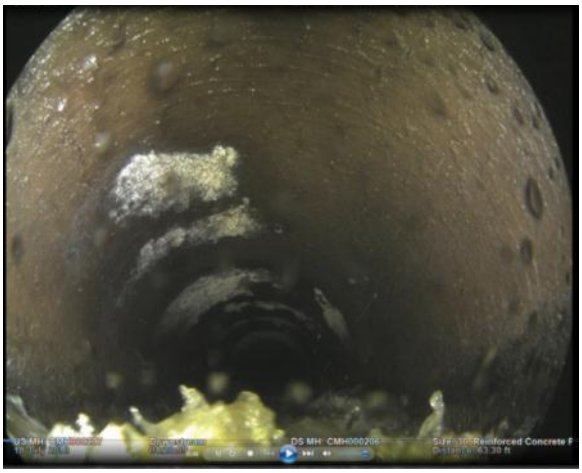


Figure 3-25. MH CMH000207 to CMH000206 (SRV)

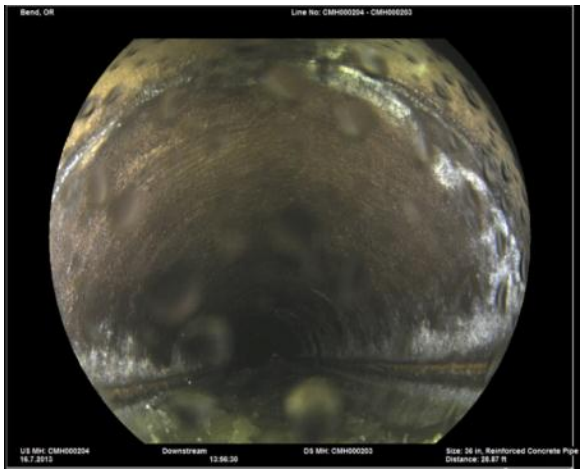


Figure 3-26. MH CMH000204 to CMH000203 SRV

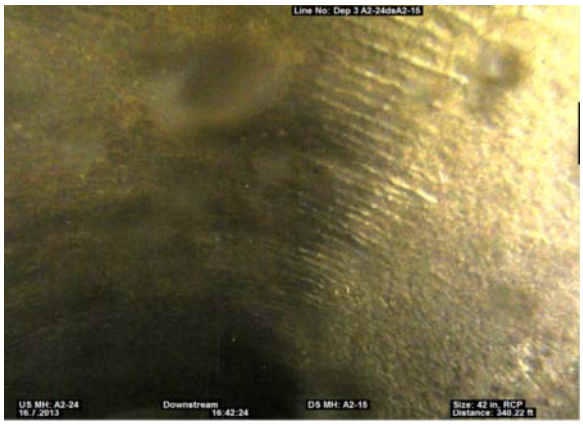


Figure 3-27. MH CMH000203 to CMH000201 SRV

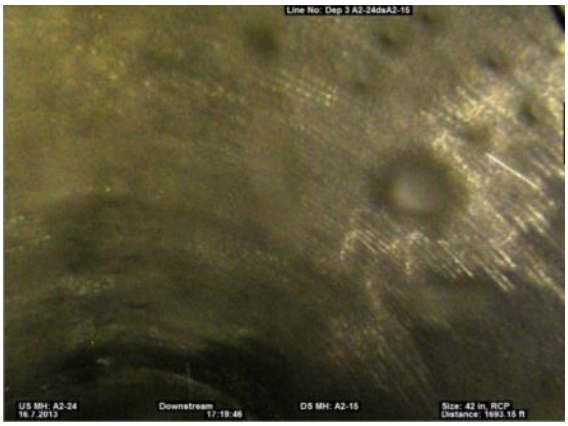


Figure 3-28. MH CMH000199 to CMH000198 SRV

Figure 3-29. MH CMH000201 to CMH000200 SRV

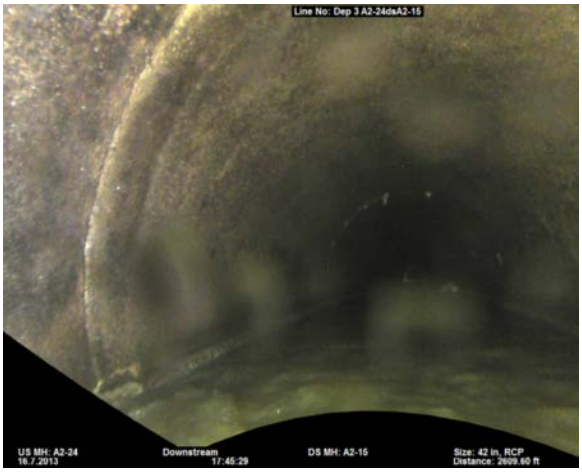


Figure 3-20. MH CMH000198 to CMH000196 CC

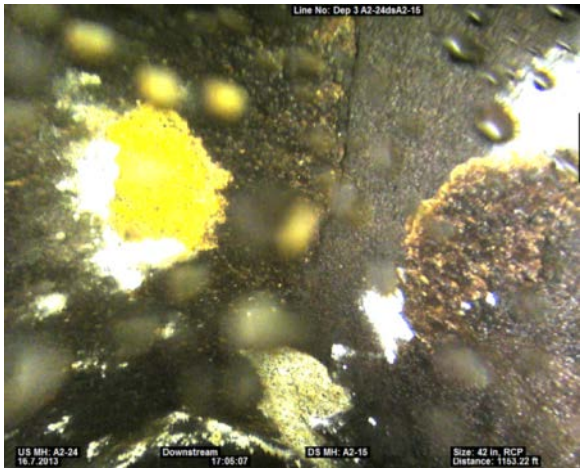


Figure 3-31. MH CMH000200 to CMH000199 SAV

Figure 3-32. MH CMH000196 to CMH000194 CL

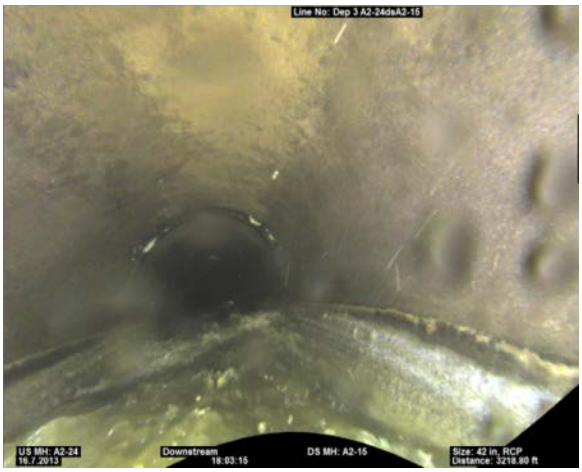


Figure 3-33. MH CMH000194 to CMH000193 (SRI)

Figure 3-34. MH CMH000191 to CMH000190 (SAV)

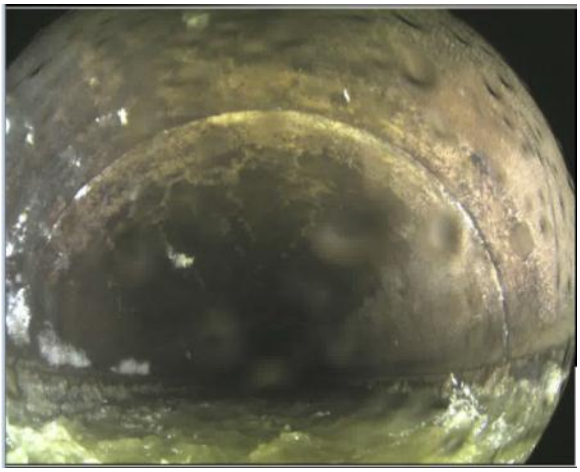


Figure 3-35. MH CMH000193 to CMH000192 (SAV)

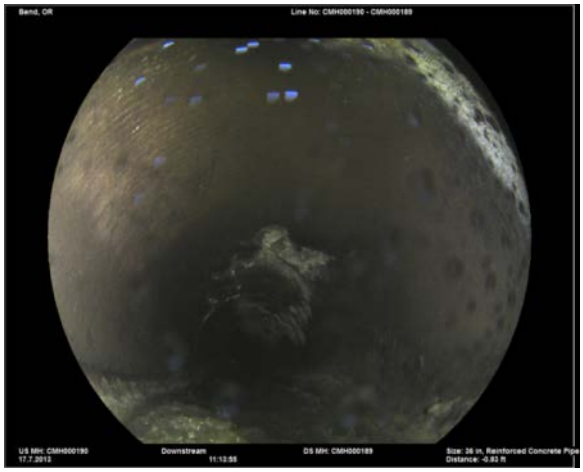


Figure 3-36. MH CMH000190 to CMH000189 (SRV)

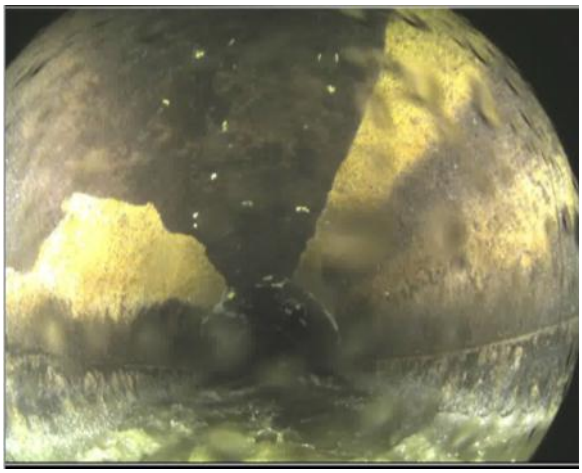


Figure 3-37. MH CMH000192 to CMH000191 (SAV)

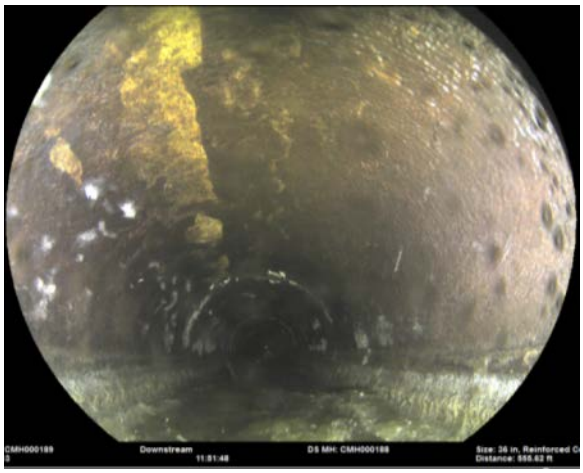


Figure 3-38. MH CMH000189 to CMH000188 SRV

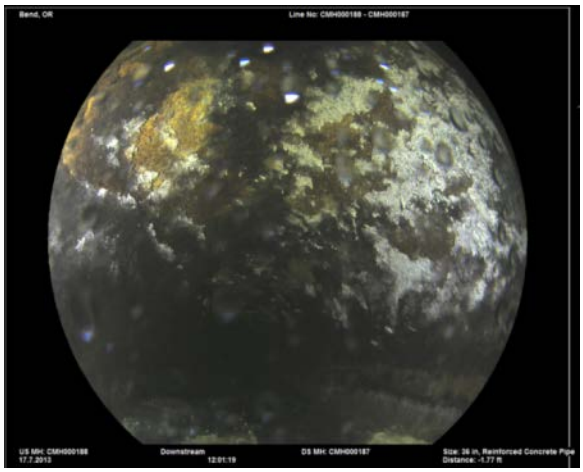


Figure 3-39. MH CMH000188 to CMH000187 SAV

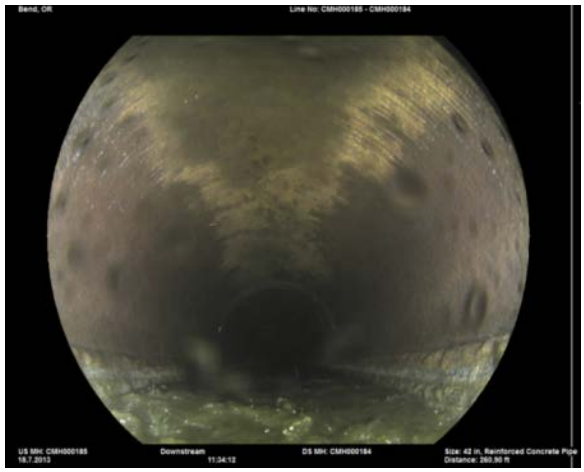


Figure 3-40. MH CMH000185 to CMH000184 (SRV)

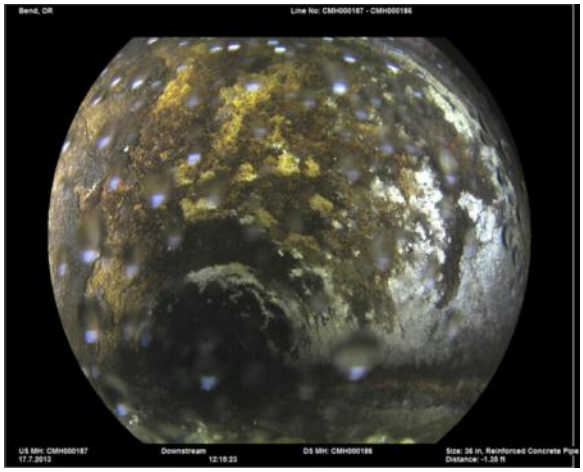


Figure 3-41. MH CMH000187 to CMH000186 SAV

Figure 3-42. MH CMH000184 to CMH000183 (SRV)

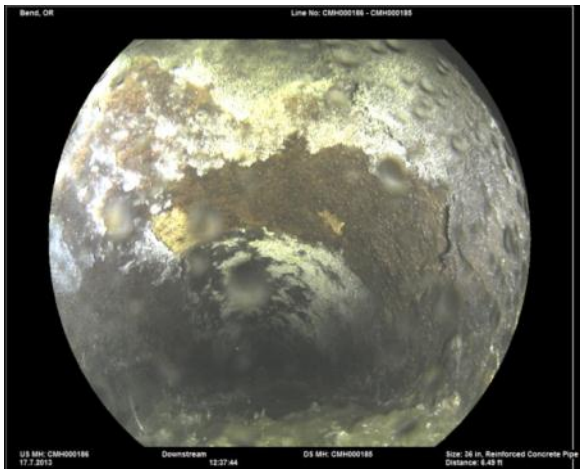


Figure 3-43. MH CMH000186 to CMH000185 SAV

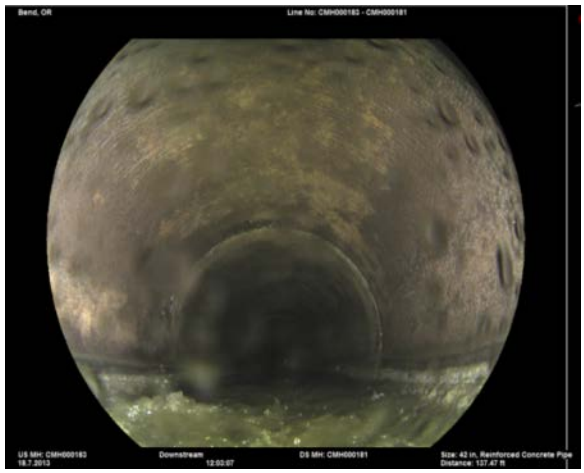


Figure 3-44. MH CMH000183 to CMH000181 (SRV)

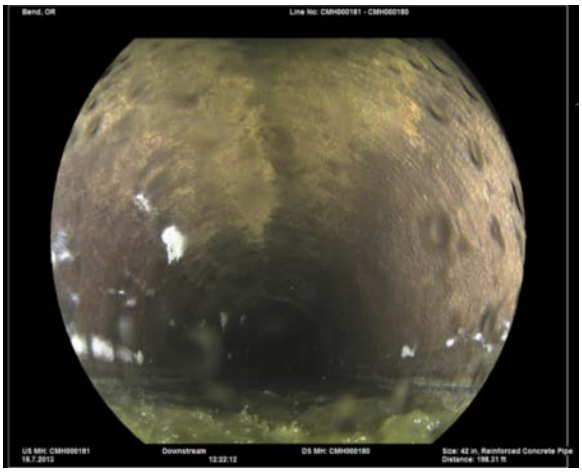


Figure 3-45. MH CMH000181 to CMH000180 (SRV)

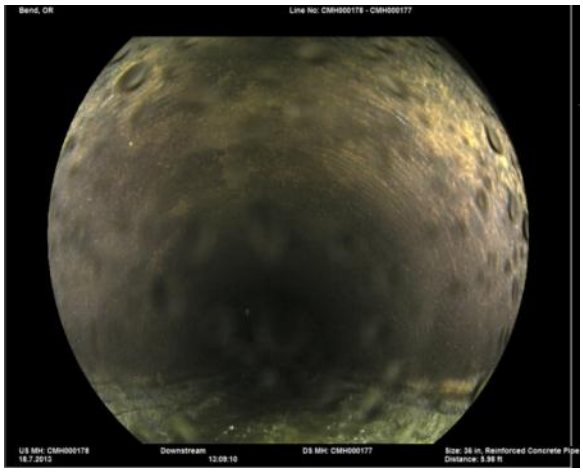


Figure 3-46. MH CMH000178 to CMH000177 (SRV)

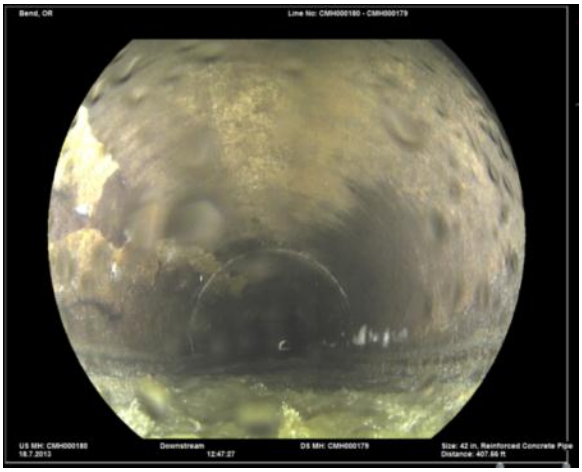


Figure 3-47. MH CMH000180 to CMH000179 (SRV)

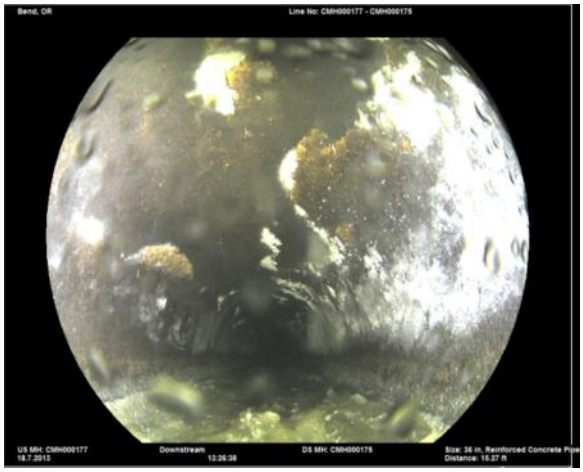


Figure 3-48. MH CMH000177 to CMH000175 (SAV)

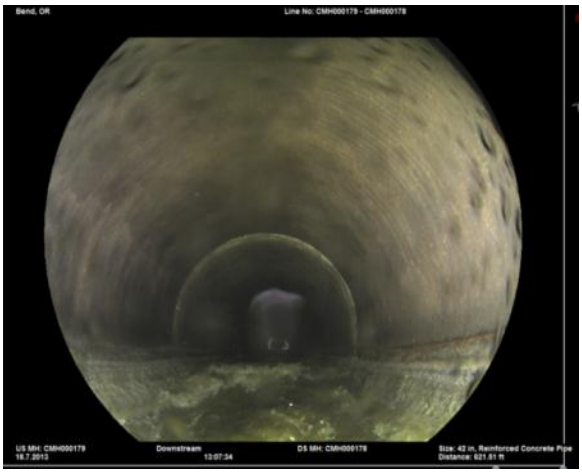


Figure 3-49. MH CMH000179 to CMH000178 (SRV)

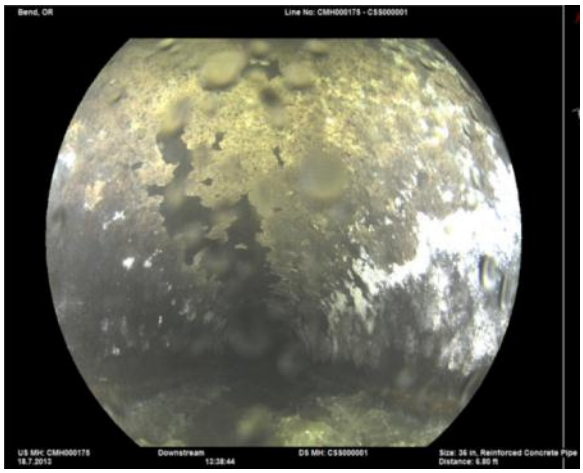


Figure 3-50. MH CMH000175 to CSS00001 (SAV)

Section 4

Corrosion Control

The primary cause for the defects found within the gravity portion of the Plant Interceptor (PI) is exposure of the pipe surface to corrosive air. Factors leading to the production and mitigation of this corrosive environment are discussed below.

4.1 Hydrogen Sulfide Production

The sulfate ion $(SO_4)^{2-}$ is one of the most prevalent anions occurring in natural waters. $(SO_4)^{2-}$ is biochemically reduced by bacteria residing in the so-called slime layer that forms along the wetted perimeter of a sanitary sewer pipe. Once reduced, sulfate is converted to hydrogen sulfide (H_2S), a highly corrosive compound.

When the dissolved oxygen level is below approximately 1.0 milligram per liter (mg/L), as it is in most municipal waste streams, sulfate reduction to liquid sulfide will occur. Sulfate is present in abundance in most municipal waste streams. Sulfate reduction is performed by bacteria residing in the slime layer that lies beneath the wastewater surface on the inside wall of the sewer pipe or wet well. Figure 4-1 illustrates this phenomenon (Figure 4-1 indicates sulfate reduction will occur at a DO less than 1.0 mg/L; newer information indicates this is an overly conservative number and sulfate reduction occurs even when DO is at 1.0 mg/L).

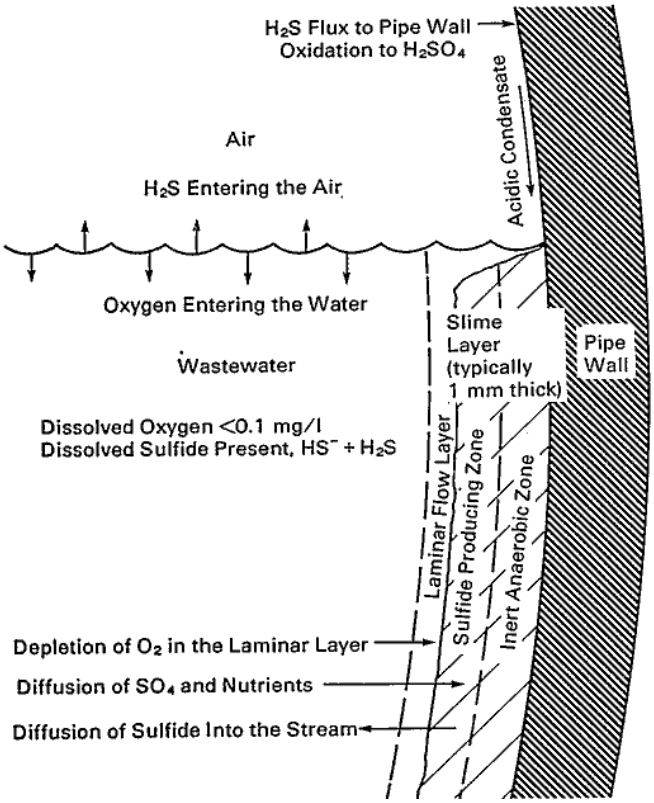


Figure 4-1. Formation of H_2S in the slime layer

The reduced sulfate exists as sulfide (S^{2-}), bi-sulfide (HS^-), and H_2S in varying concentrations, depending on the pH of the wastewater. For example, between a pH of 8 and 10, most of the reduced sulfate exists as S^{2-} and HS^-. At a pH equal to or below 7.1, the reduced sulfate exists as HS^- and H_2S. Figure 4-2 shows a chart of the percentage of each constituent as a function of wastewater pH.

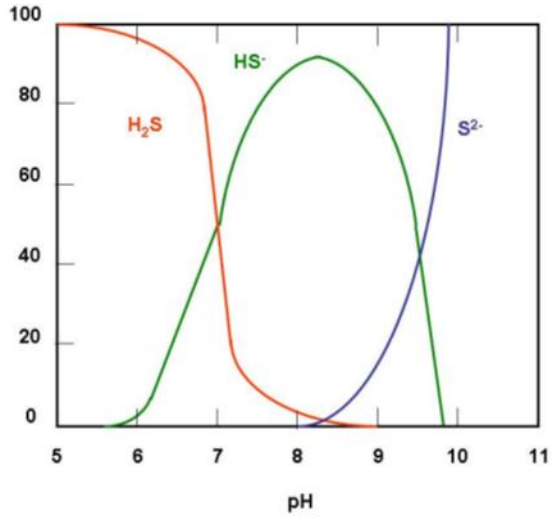


Figure 4-2. Percentage of each sulfur constituent as a function of pH

When H_2S is stripped from raw wastewater to the gas phase, it is oxidized to corrosion-inducing sulfuric acid (H_2SO_4) by bacteria, *Thiobacillus thiooxidans*, that reside in a very thin water layer on the exposed surfaces of pipes and structures. When these bacteria are deprived of either the moist surface or the gas phase H_2S from which they draw their energy, they fail to thrive and associated concrete corrosion on exposed surfaces can be significantly reduced.

Given this set of conditions, it then becomes possible to induce this reduction in concrete corrosion rates by reducing the amount of sulfide produced in the liquid phase and/or by drying the exposed concrete surfaces by means of forced-air ventilation. The following discussion provides a summary of liquid and gas phase modeling and analysis done towards these ends for the Bend Influent Trunk Sewer.

4.2 Liquid Phase Sulfide Control

A sulfide generation model was developed for the PI. This model is based on the physical characteristics of the Bend Influent Trunk Sewer and sulfide generation equations developed by Pomeroy and Parkhurst for sulfide generation in gravity sewer systems as documented in the U.S. Environmental Protection Agency's publication EPA/625/1-85/018, "Odor and Corrosion Control in Sanitary Sewerage Systems and Treatment Plants." The following wastewater characteristic input parameters were used to develop the model:

- Upstream [S^{2-}] at MH CMH000294 = 0.5 mg/L
- Average wastewater flow = 5.73 million gallons per day (mgd)
- Biochemical oxygen demand = 250 mg/L
- Wastewater temperature = 25 degrees Celsius
- Wastewater pH = 7.1

Under these conditions, the model predicted the following sulfide generation results:

- Resulting downstream [S_2-] at MH CMH000175 = 0.8 mg/L (60 percent increase from upstream to downstream)
- Resulting pounds of sulfide per day at 0.8 mg/L [S_2-] = 39.

This information was used to predict an average yearly cost for chemical feed to reduce the total sulfide concentration in the wastewater to non-detectable levels. Several chemicals were analyzed, including 60 percent calcium nitrate, 37 percent ferrous chloride and 39 percent ferric chloride. These chemicals were chosen for their proven effectiveness in similar applications and their relative safety. At this stage of analysis the average annual cost for the use of any one of these chemicals for this application is predicted to be approximately $200,000 per year. However with any liquid phase sulfide control measure, full-scale pilot testing would be necessary to verify the predicted chemical feed requirements. Such a system would be deployed in the upstream reaches of the influent sewer and carry a capital equipment cost of approximately $75,000.

4.3 Sewer Headspace Ventilation

Using the same sewer physical characteristic data, a second model was developed to predict the maximum expected airflow that is induced in the headspace by the flowing wastewater. The equations for this model are based on wastewater flow and corresponding induced dragged-headspace air velocity relationships observed and documented by Pescod and Price in “Major Factors in Sewer Ventilation,” (*Journal of the Water Pollution Control Federation*, April 1982). The following flow conditions were modeled to determine the predicted maximum induced headspace air flow:

- Average flow condition = 5.73 mgd
- 20 mgd
- 30 mgd

The maximum wastewater flow induced headspace airflow was predicted to be 650 cubic feet per minute (cfm). Applying a safety factor of 1.5 to this airflow value results in a forced air withdrawal ventilation requirement of approximately 1,000 cfm. Such a system, if coupled with an odor control device such as a biological scrubber or carbon adsorption system, typically carries capital equipment and annual operating costs of approximately $100,000 and $7,500, respectively.

To verify the effectiveness of a forced-air ventilation corrosion control solution along the entire alignment of the PI, a full-scale pilot test was implemented in the late summer of 2014. The test consisted of the deployment of a trailer-mounted 1,000-cfm fan that would withdraw air at the approximate midpoint of the sewer alignment, such as at manhole (MH) CMH 000194 and at the downstream end of the alignment, near the upstream end of the twin barrel siphons, at MH CMH000175. The purpose was to test the effectiveness of the fan at moving air through the headspace along the upstream half of the sewer from the two locations. The zone of influence of air withdrawal from each location was determined by differential air pressure responses to the air withdrawal by the fans. These responses were recorded by differential air pressure data loggers specially designed for the purpose and installed in manholes along the entire alignment. Clear air pressure reduction responses to fan ON/OFF conditions would indicate induced air movement in the headspace of the sewer that would result in dry pipe and manhole wall conditions in those sections of the sewer alignment. While no set of standards exist regarding the necessary air velocities or flow rates needed to dry the pipe, based on actual physical inspection projects where forced-air ventilation was being employed, 1000 cfm should be sufficient to dry out the pipe wall in the sewer head space.

Forced-air ventilation will not impact any aspect of the WRF, as the airflow will control corrosion in the exposed concrete in the gravity portion of the PI. The ventilation will not have any impact downstream of the siphons since the siphons are running full at all times, preventing the movement of air. Any corrosion occurring at the headworks or any other location at the WRF will need to be addressed separately.

4.3.1 Results and Recommendations

Based on the forced air ventilation tests results, the following conclusions were made:

- 1,000 cfm air withdrawal efforts resulted in significant air pressure reductions along the entire length of the PI.
- The withdrawal of air at manhole CMH000175 had a much greater overall pressure reduction effect along the alignment than the air withdrawal at manhole CMH000194. At CMH000194 the fan was pulling against the momentum of the flowing wastewater in the downstream direction, in addition to pulling air from the upstream reaches of the pipe. This resulted in less significant pressure reduction in the downstream reaches of the sewer. At manhole CMH000175 all of the air withdrawn by the fan was drawn from the upstream reaches of the sewer, resulting in lower overall negative pressures.
- Given the pressure reduction effects measured during the fan test, it is surmised that the maximum air velocity in the open headspace of the PI was increased by a factor of 6, up to approximately 600 feet per minute. Experience has shown that forcibly moving air at such velocities through the open headspace of a sewer such as the PI will be effective at controlling and reducing the rate of corrosion in the exposed concrete surfaces of the pipe wall

The following recommendations were made:

- Design and build a 1,000 cfm forced-air withdrawal facility at CMH000175 to withdraw air and slow the rate of corrosion. At a minimum, the purpose of this facility would be to move sufficient amounts of air to dry the exposed concrete pipe walls along the PI; however, this facility could also be designed and built as a dedicated odor control facility to help reduce historical odor complaints that have been recorded along the alignment of the PI.
    - The City should make the determination if an odor control facility is worth the cost to construct and maintain. The odor control facility's primary purpose would be to reduce customer complaints; an odor control facility will not impact the ability of the forced-air withdrawal facility from successfully controlling corrosion. If an odor control facility is desired, it is recommended that a biotrickling filter be designed and built; however, before proceeding with the design of any odor control facility along the PI, a routine H_2S data logging exercise, involving recording continuously monitored H_2S data at MH CMH000175, should be conducted to further understand the concentrations of H_2S that are stripped from solution along the PI alignment.

The full results and conceptual design layouts are presented in the Influent Fan Testing Results and Recommendations report, included in Appendix H.

Section 5

Rehabilitation Options

The City of Bend (City) has a variety of options for resolving the defects discovered within the Plant Interceptor (PI). Rehabilitation or replacement can be deferred, but Brown and Caldwell (BC) recommends implementing rehabilitation to address the most structurally compromised (i.e., Grade 4 and Grade 5) sewers, at a minimum. The following is a discussion of the viable alternatives for addressing the gravity sewer and siphon portions of the PI.

5.1 Gravity Rehabilitation Options

Small instances of Grade 5 defects were detected during BC's review of the 2005 inspection video and the 2007 Yeoman Interceptor CCTV Report, included in Appendix G. The gravity pipe has functioned as intended for approximately 8 years, but the structural defects are currently more extensive and it is obvious that the rate of corrosion is fairly significant.

Roughly 68 percent of the pipe segments found in the gravity sewer portion of the PI exhibited Grade 4 or 5 defects. Based on this observation and assuming that the pipe will continue to operate under open channel flow conditions except in rare instances, BC has developed five options for moving forward:

Option 1 Address Grades 4 and 5 segments

Option 2 Address Grade 5 segments and implement corrosion control

Option 3 Address Grade 4 and Grade 5 segments and implement corrosion control

Option 4 Rehabilitate the entire PI

Option 5 Replace the entire PI

With the advancement of trenchless rehabilitation options, there are no pipe reaches that have deteriorated beyond the capabilities of trenchless rehab, such as cured-in-place pipe (CIPP) or slip-lining.

The City's 2014 Collection System Master Plan (CSMP) has identified four segments of the PI that require upsizing:

- CMH000207 to CMH000205 (two segments), 900 LF of 30-inch RCP replaced with 36-inch, $542,000
- CMH000191 to CMH000189 (two segments), 800 LF of 36-inch RCP replaced with 42-inch, $488,000

All of the below options include these recommended upsized pipe segments as part of the rehabilitation costs. BC assumes that the CSMP costs include the manholes associated with these segments as well as using corrosion resistant pipe and manhole materials. BC assumes that no additional costs are required to make these new upsized segments and associated manholes corrosion resistant.

5.1.1 Option 1: Address Grades 4 and 5 Segments

As mentioned previously, the corrosion observed in 2005 has continued to worsen. Pipe reaches that appeared to be a structural condition Grade 3 have deteriorated to a Grade 4 or 5.

Grade 4 segments indicate localized sections of reinforcement visible that are most cost effective to be addressed by short sectional cured-in-place pipe (CIPP) lining instead of full manhole-to-manhole segmental lining. There are eight segments requiring 16 sectional liners covering defects totaling 82 linear feet (LF). Given the time and labor required for installation of each sectional liner, it generally is more cost-effective to rehabilitate the entire pipe reach with CIPP than it is to install more than three sectional CIPP liners within the same pipe reach, so using segmental liners in these eight segments is the more cost-effective option

For pipe reaches that are rated as Grade 5 or have extensive lengths of reinforcement, full-length segmental CIPP is recommended under this option. Fifteen pipe reaches totaling 6,526 LF would require full-length CIPP. The two manholes that have experienced corrosion and concrete degradation should be rehabilitated structurally using an interior fiber-reinforced cementitious lining. An additional 10 manholes should be coated with an epoxy coating to protect the existing concrete from further deterioration. The four segments (and associated manholes) requiring upsizing by the CSMP are included in Option 1. Figure 5-1 shows the components of the PI recommended for rehabilitation using sectional and full length CIPP. Full bypassing of the PI from the upstream-most manhole to the siphon junction structure is included in the capital costs. For budgetary purposes, bypassing will be parallel along the Main Canal access road and that road ramps will be used to cross roadways.

The total project cost for Option 1 would be approximately $4.5 million and is summarized in Table 5-1. However, this alternative does not address any sewers beyond Grade 4. Based on the rate of corrosion observed from 2005 to the current inspections, this option likely extends the life of the PI for 7 to 10 years, with a recommended reinspection of PI (including laser profiling or scanning to quantify the rate of deterioration) in 7 to 10 years.

Table 5-1. Option 1 Project Costs

Description	Cost, $
Rehabilitation capital cost	2,411,000
Contingency (20 percent)	482,000
Design and construction management (25 percent)	603,000
Upsizing project costs (per CSMP)	1,030,000
Total	4,526,000

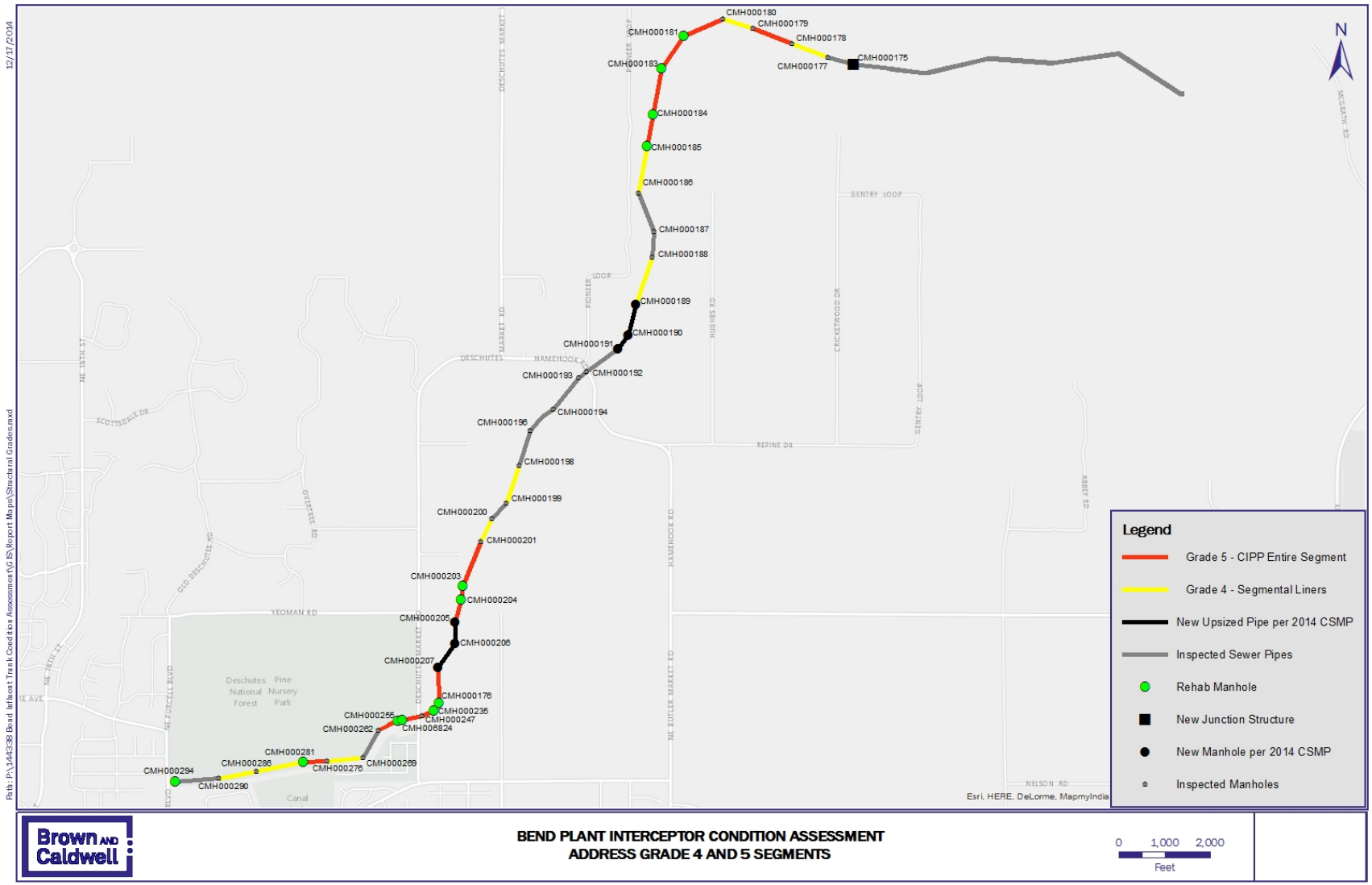


Figure 5-1. Address Grades 4 and 5 segment defects

5.1.2 Option 2: Address Grade 5 Segments and Implement Corrosion Control

A second option would be to repair all the Grade 5 defects and significantly slow the rate of corrosion through ventilation. This option would use CIPP on all Grade 5 sewer reaches. A total of 6,526 LF would be rehabilitated as well as two structurally compromised manholes. The corrosion control is assumed to be a forced-air ventilation system with a biotrickling filter as described in Section 4, which had an initial capital cost of $188,000 with an annual operating cost of $8,500. This option likely extends the life of the Grade 4 segments for approximately 10 to 15 years and extends the life of Grade 3 and below segments for approximately 20 to 30 years. The forced air ventilation system will also provide the added benefit of addressing odor issues. Full bypassing of the PI from the upstream-most manhole to the siphon junction structure is included in the capital costs. For budgetary purposes, bypassing will be parallel along the Main Canal access road and that road ramps will be used to cross roadways. Figure 5-2 shows the components of the PI recommended for rehabilitation using full-length CIPP.

The total project cost for Option 2 is approximately $4.3 million and is summarized in Table 5-2. The four segments (and associated manholes) requiring upsizing by the CSMP are included in Option 2.

Table 5-2. Option 2 Project Costs

Description	Cost, $
Capital cost	2,247,000
Contingency (20 percent)	449,000
Design and construction management (25 percent)	562,000
Upsizing project costs (per CSMP)	1,030,000
Total	4,288,000
Annual Operating Costs (forced-air ventilation, 25 years)	255,000

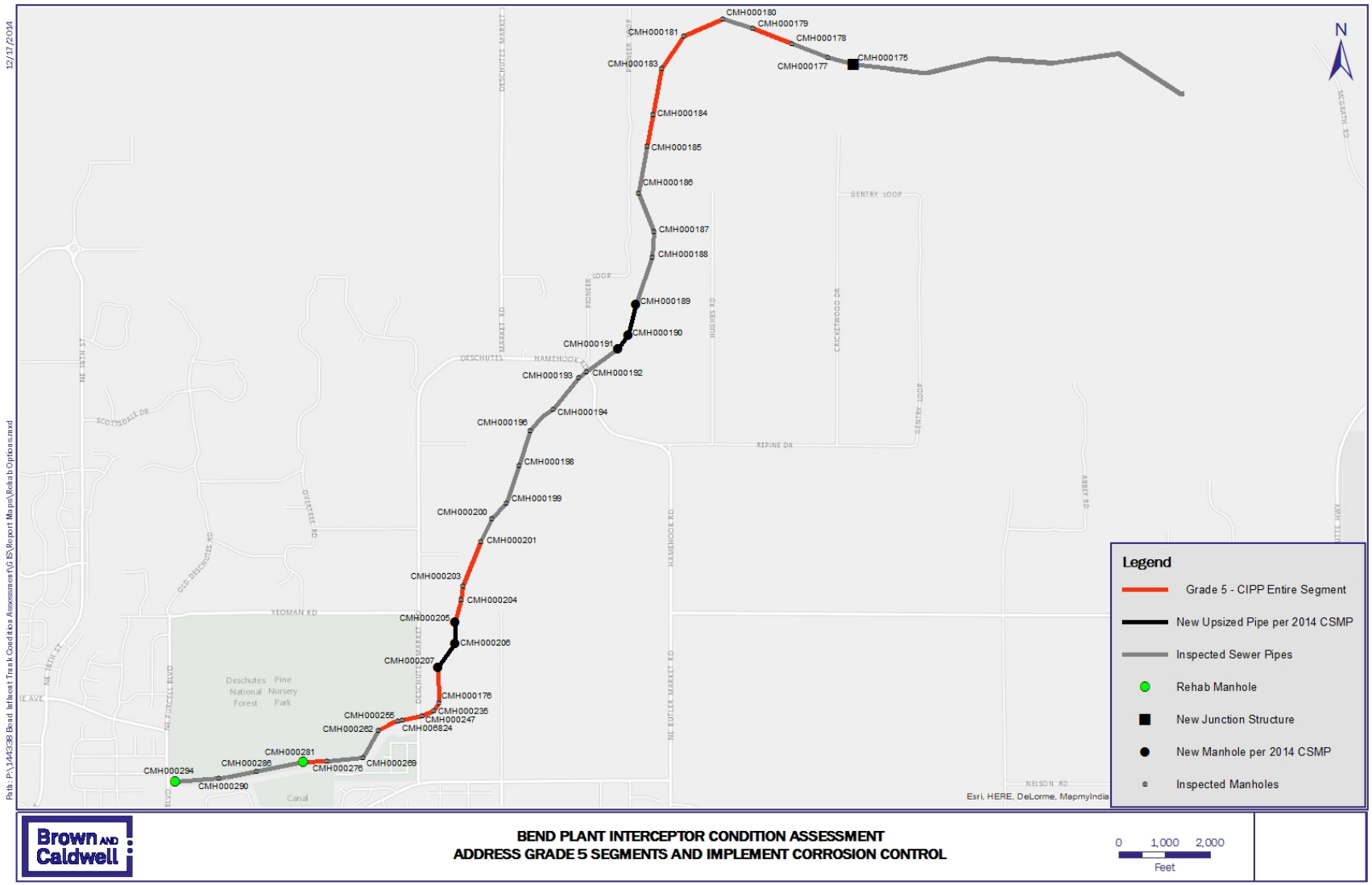


Figure 5-2. Address Grade 5 segment defects and implement corrosion control

5.1.3 Option 3: Address Grade 4 and 5 Segments and Implement Corrosion Control

A third option would be to repair all the Grade 4 and Grade 5 defects and significantly slow the rate of corrosion through forced-air ventilation, as described in Section 4. This option would be similar to Option 1, where eight Grade 4 segments are rehabilitated with 16 sectional liners covering defects totaling 82 LF and fifteen segments totaling 6,526 LF would receive full-length CIPP. The two manholes that have experienced corrosion and concrete degradation should be rehabilitated structurally using an interior fiber-reinforced cementitious lining. An additional 10 manholes should be coated with an epoxy coating to protect the existing concrete from further deterioration. Figure 5-3 shows the components of the PI recommended for rehabilitation using sectional and full-length CIPP.

The corrosion control is assumed to be a forced-air ventilation system with biotrickling filter as described in Section 4, which had an initial capital cost of $188,000 with an annual operating cost of $8,500. This option likely extends the life of the Grade 3 and below segments for approximately 20-30 years, with the CIPP rehabilitated portions having a design life of 50+ years. The forced air ventilation system will also provide the added benefit of addressing odor issues. Full bypassing of the PI from the upstream-most manhole to the siphon junction structure is included in the capital costs. For budgetary purposes, bypassing will be parallel along the Main Canal access road and that road ramps will be used to cross roadways.

The total project cost for Option 3 is approximately $4.8 million and is summarized in Table 5-3. The four segments requiring upsizing by the CSMP and associated manholes are included in Option 3.

Table 5-3. Option 3 Project Costs

Description	Cost
Capital cost	$2,599,000
Contingency (20 percent)	$520,000
Design and construction management (25 percent)	$650,000
Upsizing project costs (per CSMP)	$1,030,000
Total	$4,799,000
Annual Operating Costs (forced-air ventilation, 25 years)	$255,000

5.1.3.1 Option 3A – Address Grade 4 and 5 Segments using Full-Length CIPP and Implement Corrosion Control

A variation to Option 3 would be to fully rehabilitate all Grade 4 and Grade 5 defects and significantly slow the rate of corrosion through forced-air ventilation, as described in Section 4. All eight Grade 4 segments and all 15 Grade 5 segments totaling 12,148 LF would receive full-length CIPP. The two manholes that have experienced corrosion and concrete degradation should be rehabilitated structurally using an interior fiber-reinforced cementitious lining. An additional ten manholes should be coated with an epoxy coating to protect the existing concrete from further deterioration.

The corrosion control is assumed to be a forced-air ventilation system with biotrickling filter as described in Section 4, which had an initial capital cost of $188,000 and an annual operating cost of $8,500. This option likely extends the life of the Grade 3 and below segments for approximately 20 to 30 years, with the CIPP-rehabilitated portions having a design life in excess of 50 years. The forced air ventilation system will also provide the added benefit of addressing odor issues. Full bypassing of the PI from the upstream-most manhole to the siphon junction structure is included in

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

the capital costs. For budgetary purposes, bypassing will be parallel along the Main Canal access road and that road ramps will be used to cross roadways. Figure 5-3 shows the components of the PI recommended for rehabilitation using full-length CIPP.

The total project cost for Option 3A is approximately $6.4 million and is summarized in Table 5-3A. The four segments requiring upsizing by the CSMP and associated manholes are included in Option 3A.

Table 5-3A. Option 3 Project Costs

Description	Cost, $
Capital cost	3,716,000
Contingency (20 percent)	743,000
Design and construction management (25 percent)	929,000
Upsizing project costs (per CSMP)	1,030,000
Total	6,418,000
Annual Operating Costs (forced-air ventilation, 25 years)	255,000

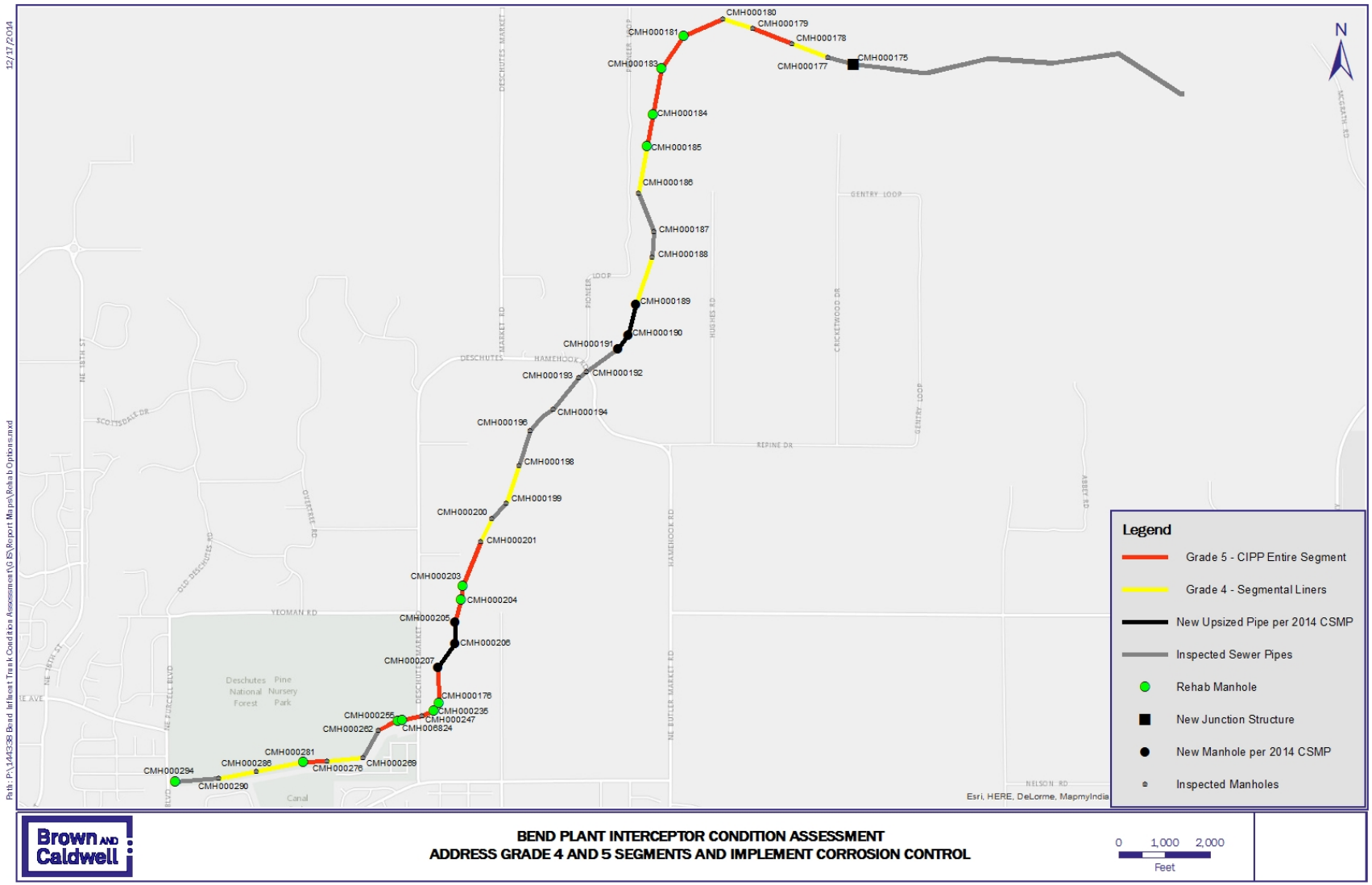


Figure 5-3. Address Grades 4 and 5 segment defects and implement corrosion control

5.1.4 Option 4: Rehabilitate the Entire PI

A fourth option would be to rehabilitate the entire gravity portion of the PI with CIPP and rehabilitate the manholes. The result of implementing this option would be a fully structural pipe that closely fits the existing PI and is fully corrosion-resistant. Thirty-six segments of the PI totaling 18,226 LF would be rehabilitated, with four segments upsized per the 2014 CSMP. Six new manholes will be replaced per the 2014 CSMP with the 33 remaining structures rehabilitated and coated with epoxy. The remaining useful life of the PI would be in excess of 50 years, assuming the hydraulic capacity needs of the City would continue to be served by the existing PI. Full bypassing of the PI from the upstream-most manhole to the siphon junction structure is included in the capital costs. For budgetary purposes, bypassing will be parallel along the Main Canal access road and that road ramps will be used to cross roadways. Figure 5-4 shows the entire length of the PI recommended for rehabilitation using full-length CIPP.

The four segments (and associated manholes) requiring upsizing by the CSMP are included in Option 4. The total project cost for Option 4 is approximately $8.7 million and is summarized in Table 5-4.

Table 5-4. Option 4 Project Costs

Description	Cost, $
Capital cost	5,291,000
Contingency (20 percent)	1,058,000
Design and construction management (25 percent)	1,323,000
Upsizing project costs (per CSMP)	1,030,000
Total	8,701,000

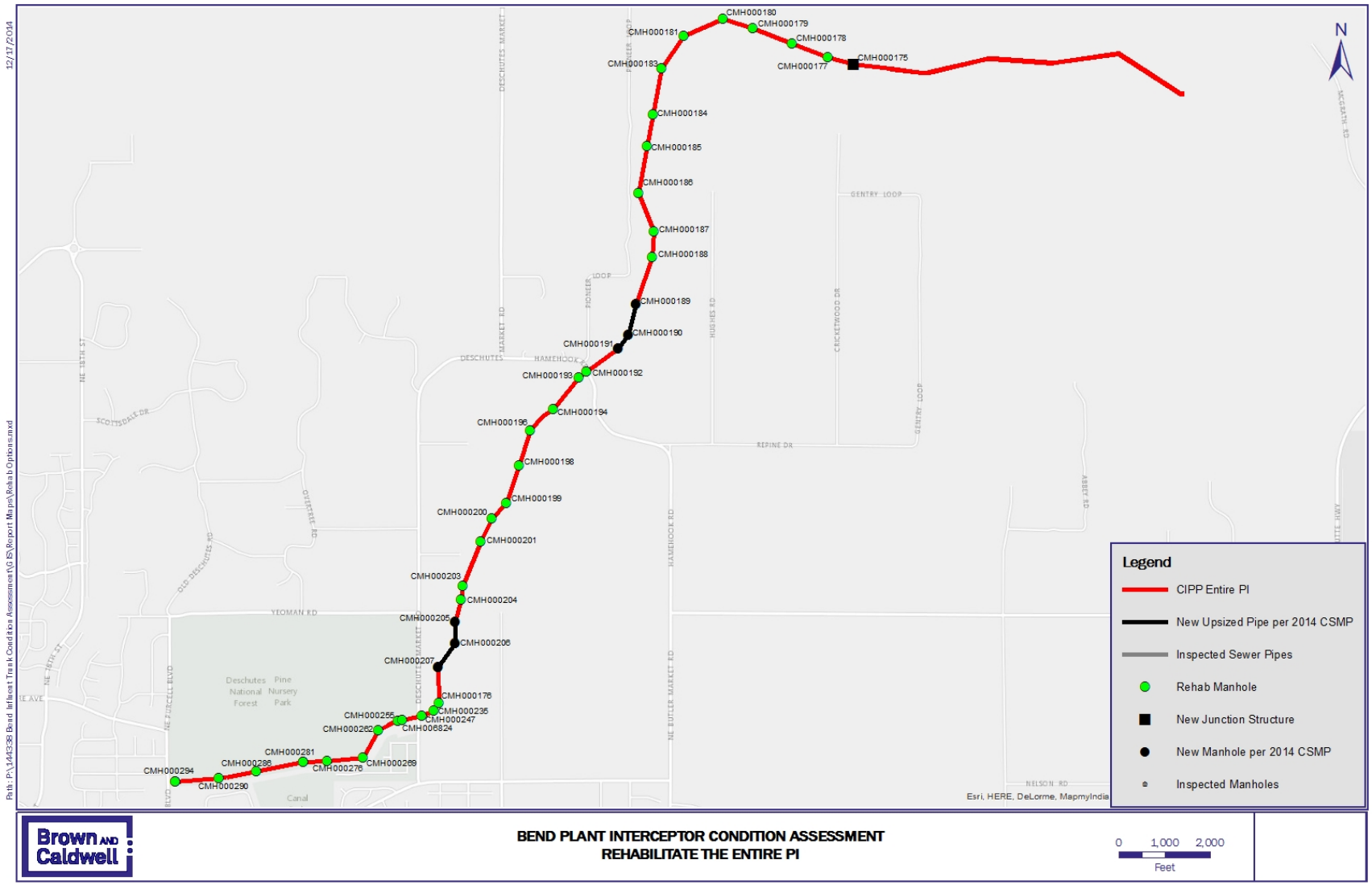


Figure 5-4. Rehabilitate the entire PI

5.1.5 Option 5: Replace the Entire PI

A fifth option would be to replace the entire gravity portion of the PI with a new corrosion-resistant pipe adequately sized for future growth. This option would be recommended if the current PI is undersized and cannot provide adequate wastewater conveyance in the near future. Figure 5-5 shows the entire length of the PI recommended for rehabilitation using full-length CIPP.

While the size and the cost of a replacement interceptor and siphon are not fully known, using costs from the City's 2007 Collection Sewer Master Plan (CSMP) and escalating to 2013 dollars indicates a capital cost of $14.6 million. Full bypassing of the PI from the upstream-most manhole to just downstream of the siphon junction structure was included in the CSMP costs. It is assumed that bypassing across the Main Canal is not required, and that the bypass discharge will take place immediately downstream of the siphon junction structure. Assuming this capital cost can be used for planning purposes, the total project cost for Option 5 is approximately $21.8 million and is summarized in Table 5-5.

Table 5-5: Option 5 Project Costs

Description	Cost, $
Capital cost	14,551,000
Contingency (20 percent)	2,910,000
Design and construction management (25 percent)	4,365,000
Total	21,826,000

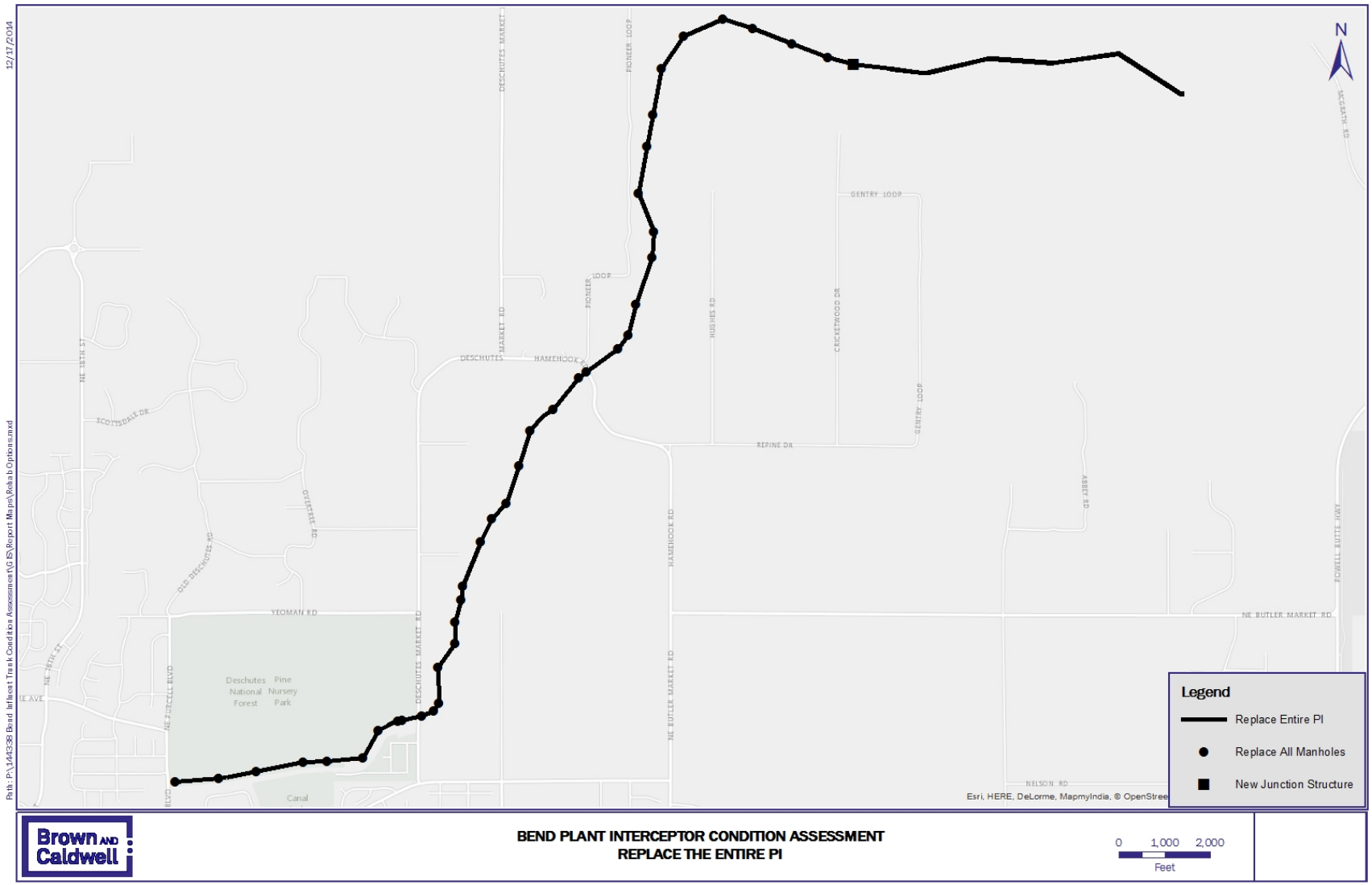


Figure 5-5. Replace the entire PI

5.2 Siphon Options

The sonar inspections determined that the siphon exhibited no gross structural issues. However, the presence of debris and grease accumulation has drastically reduced the hydraulic capacity of the pipes. Also, the lack of a full pipe in the lower portion of the 36-inch siphon barrel is a potential corrosion concern that should be explored more fully. Cleaning of the siphon is recommended. While expensive, the City could bypass the siphon by constructing a temporary pipe bridge across the Main Canal, construct an access structure near the low point of the siphons to dewater the siphon barrels, and clean and further inspect the siphon barrels to confirm there are no structural issues in the lower portion of the 36-inch siphon barrel.

Another option for cleaning would be to retain the services of a national cleaning firm with specialized equipment, such as Brenford Environmental Services. Brenford's Sewer Hog and Grit Gator system could be well suited for cleaning this difficult siphon. This closed-loop system has been used to clean pipes 18-inches in diameter and larger and is one of the largest and most powerful jetters in the nation, using high flow rates of up to 350 gallons per minute at pressures of up to 2,000 pounds per square inch. The Sewer Hog utilizes active flow in the lines as the water source and returns the filtered water back to the system. The high-pressure nozzle suspends materials and the high volume flow forces them down the sewer pipe to the downstream access point where a 6-inch submersible pump directs the debris and water up to the dewatering box. The sand and grit is captured in the dewatering box and water is returned to the sewer line mostly free of debris. In cases where hydrant water is not available, the decanted water is reused to power the jetter. Line segments up to 4,000 LF can be cleaned without repositioning the equipment, so two setups would be required for the PI, one at each end of the siphon. Figure 5-6 shows the Sewer Hog setup.

Figure 5-6. Brenford's Sewer Hog

After successful cleaning with the Sewer Hog and having use of the powerful jet nozzle that can easily propel a tag line through the siphon, the lower third of the 36-inch siphon barrel could be reinspected using sonar to confirm that no gross structural defects exist. While the sonar inspections did not detect any gross structural defects in the siphons that would be of concern during this high-pressure cleaning, there was significant debris in the siphons such that the entire pipe wall could not be reached with the sonar signal. The City should explore the risks of this cleaning operation with Brenford.

The budgetary cost for Brenford to clean the siphon barrels and have a subcontractor reinspect the lower third of the 36-inch siphon barrel is approximately $600,000. An estimate of the work was provided by Brenford and is included in Appendix H.

The current operational strategy of the upstream siphon junction box should be evaluated. With both siphon barrels fully opened, during lower flows the scouring velocity of the flow may not be constantly maintained, leading to the accumulation of grease and debris. Directing flows to the 21-inch barrel while utilizing the 36-inch barrel for diurnal peak and wet-weather flows may be feasible. Simple strategies such as constructing a regulating overflow weir with a trash rack between the barrels may be feasible but require more maintenance and would require City input. More complex strategies, such as installing actuating gate valves tied to the flow meters at the WRF, could be used to provide a more expensive solution with less maintenance. For the purposes of this condition assessment report, a replacement precast junction box with a cast-in-place regulating overflow weir and lined with epoxy is assumed with a budgetary cost of $85,000. This cost assumes full installation at the same time as other rehabilitation work.

Other management strategies of grease and debris should be considered at points upstream, including industrial pretreatment requirements, grease management, and installation of debris sumps.

5.3 Recommendations

Table 5-6 summarizes the options discussed above. Costs are capital costs only; annual operating costs are not included.

Table 5-6. Rehabilitation Options for PI

Option	Project cost, $	Remaining useful life, years
Option 1: Address Grades 4 and 5 segments	4,526,000	7 to 10
Option 2: Address Grade 5 segments and implement corrosion control	4,288,000	10 to 15 for Grade 4 20 to 30 for Grade 3 and below
Option 3: Address Grade 4 segments with short liners and Grade 5 segments with full CIPP and implement corrosion control	4,799,000	20-30
Option 3A: Address Grade 4/5 segments with full CIPP and implement corrosion control	6,418,000	30 to 40
Option 4: Rehabilitate the entire PI	8,701,000	50+
Option 5: Replace the entire PI	21,826,000	50+
Siphon cleaning and inspection	600,000	N/A
New siphon junction box	85,000	50+

The timing and scope for any rehabilitation or replacement work must coincide with a proper hydraulic analysis to determine the conveyance needs now and in the future. Based on the information provided in the City's CSMP, both the gravity and siphon portions of the PI have sufficient hydraulic capacity to serve the City for the next 20 years. BC recommends Option 3 in conjunction with cleaning of the siphon and the siphon junction box replacement. However, if adequate capacity is anticipated for well beyond the 20- to 30-year planning window, BC recommends Option 4 in conjunction with cleaning of the siphon and siphon junction box replacement.

Table 5-7 summarizes BC's recommendations that depend on the current updates to the City's CSMP.

Table 5-7. BC Recommendations Based on Hydraulic Requirements		
Hydraulic capacity need	Recommended option	Project cost, $
Adequate capacity for next 20 years	Option 3 + siphon cleaning + siphon junction box	5,484,000
Adequate capacity for foreseeable future	Option 4 + siphon cleaning + siphon junction box	9,386,000

Depending on the City's preference and timing of rehabilitation, the Grade 4 and Grade 5 segments of the PI should be inspected every 2 years. Grade 3 segments and below should be inspected in the next five years. Ideally laser data would be collected and compared to the laser data from this inspection to determine additional pipe wall loss and estimate the rate of deterioration.

Since there were very few operational defects, cleaning of the gravity portions of the PI is strongly discouraged. The cleaning operations are likely to worsen the already poor concrete in the sewer head space.

Section 6

Limitations

This document was prepared solely for the City of Bend, Oregon (City) in accordance with professional standards at the time the services were performed and in accordance with the contract between the City and Brown and Caldwell (BC) dated April 15, 2013. This document is governed by the specific scope of work authorized by the City; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by the City and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

Further, BC makes no warranties, express or implied, with respect to this document, except for those, if any, contained in the agreement pursuant to which the document was prepared. All data, drawings, documents, or information contained this report have been prepared exclusively for the person or entity to whom it was addressed and may not be relied upon by any other person or entity without the prior written consent of BC unless otherwise provided by the agreement pursuant to which these services were provided.

Appendix A: Pre-Inspection Presentations and Meeting Minutes

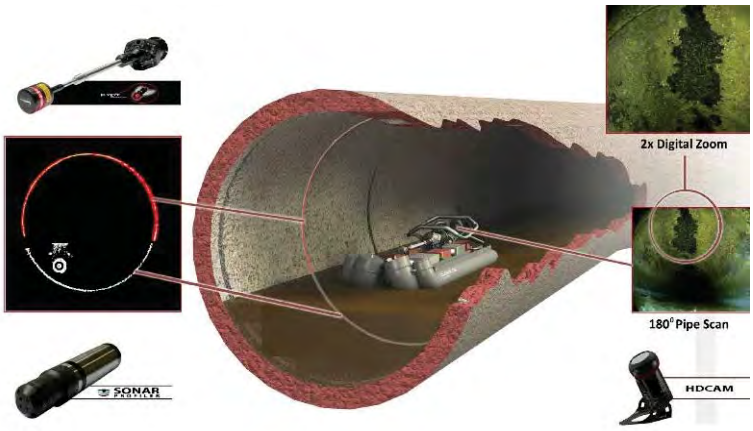
City of Bend

Existing Plant Interceptor Condition Assessment

April 30, 2013

Agenda

- Technology Overview
  - Objectives
  - Access
  - Restoration
  - Schedule
  - Deliverables
- Recommendations

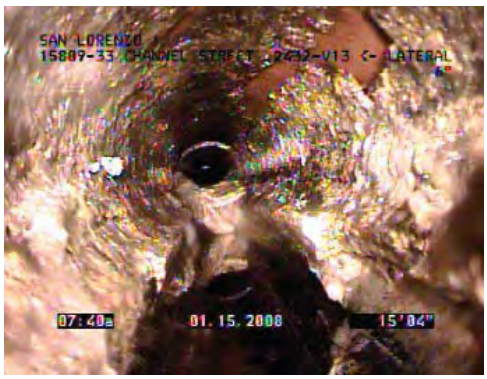


Inspection Technologies

- Closed-Circuit Televising
- Digital Scanning
- Laser
- Sonar
- Pipe Penetrating Radar
- Zoom Cameras (NA)
- Electro-Scanning (NA)
- Gyroscopic Positioning (NA)

Closed Circuit Television (CCTV)

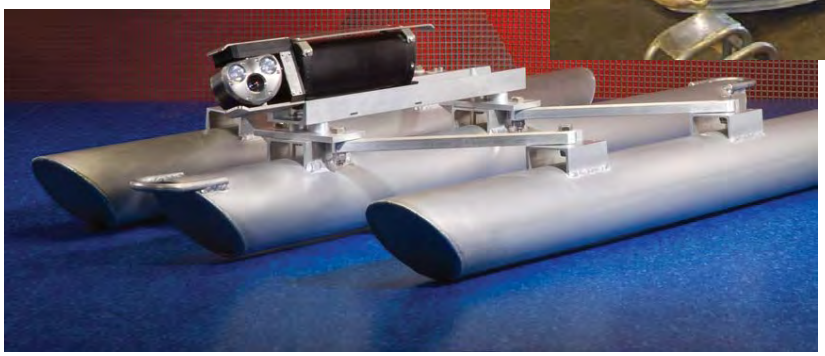
- Traditional equipment
- Pan and tilt, rotate
- Data coded and recorded in the field
- Visual (Qualitative) Assessment of Asset's Condition



New Long-Range Transporters

Inspection Distances of 5,000 to 8,000 feet are now an option for pipes as small as 12” diameter

Float Mounted Equipment



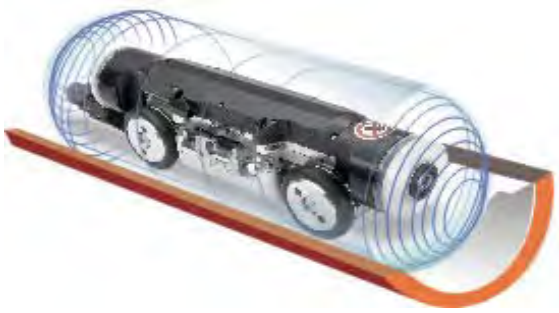
Digital Scanning

Optical Visual Scanning

- Inspection above water surface in pipe
- Record of 100% of visible surface
- Advantages
  - Enhanced defect classification
  - Defects are Measurable
  - Enables future defect classification comparison and trend analysis
  - Manufacturers claim faster than CCTV

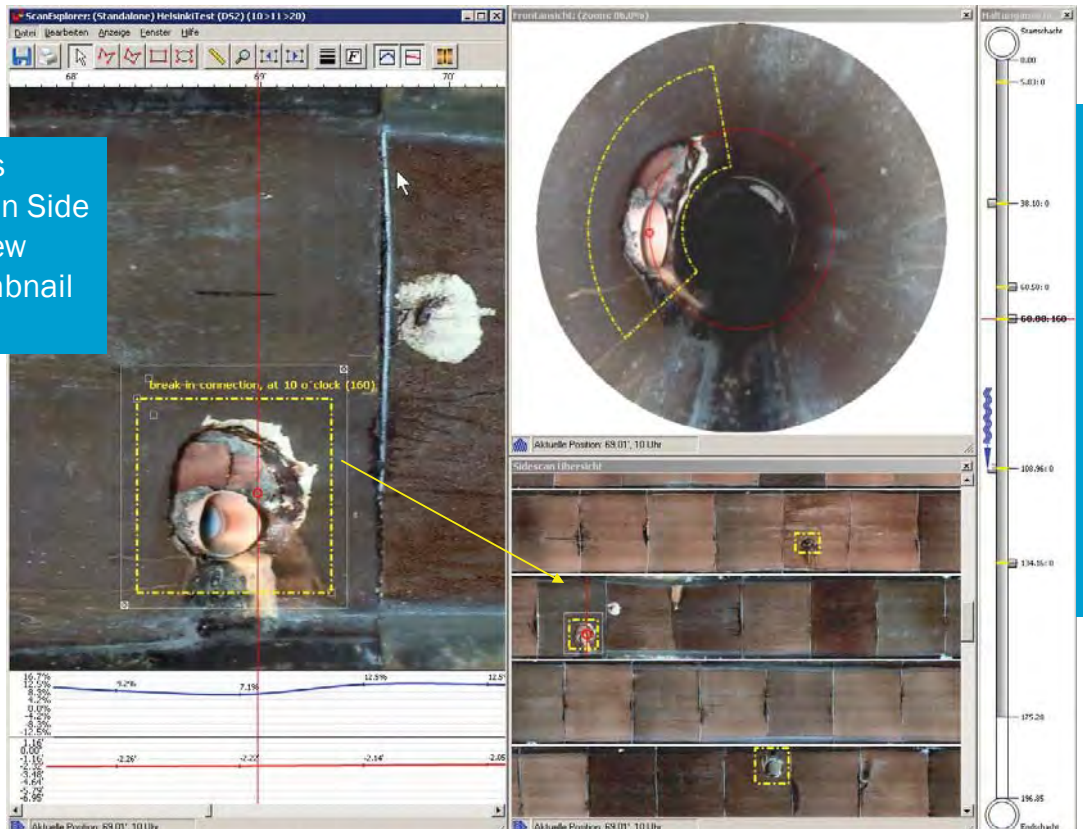
360 degree scanned image

Cylindrical scan to flat image



Digital Scanning Sample Output

Observations highlighted on Side and Front View seen in thumbnail view



2D Plan View of Pipeline

Digital Manhole Scanning

IBAK's Panaromo MH Camera

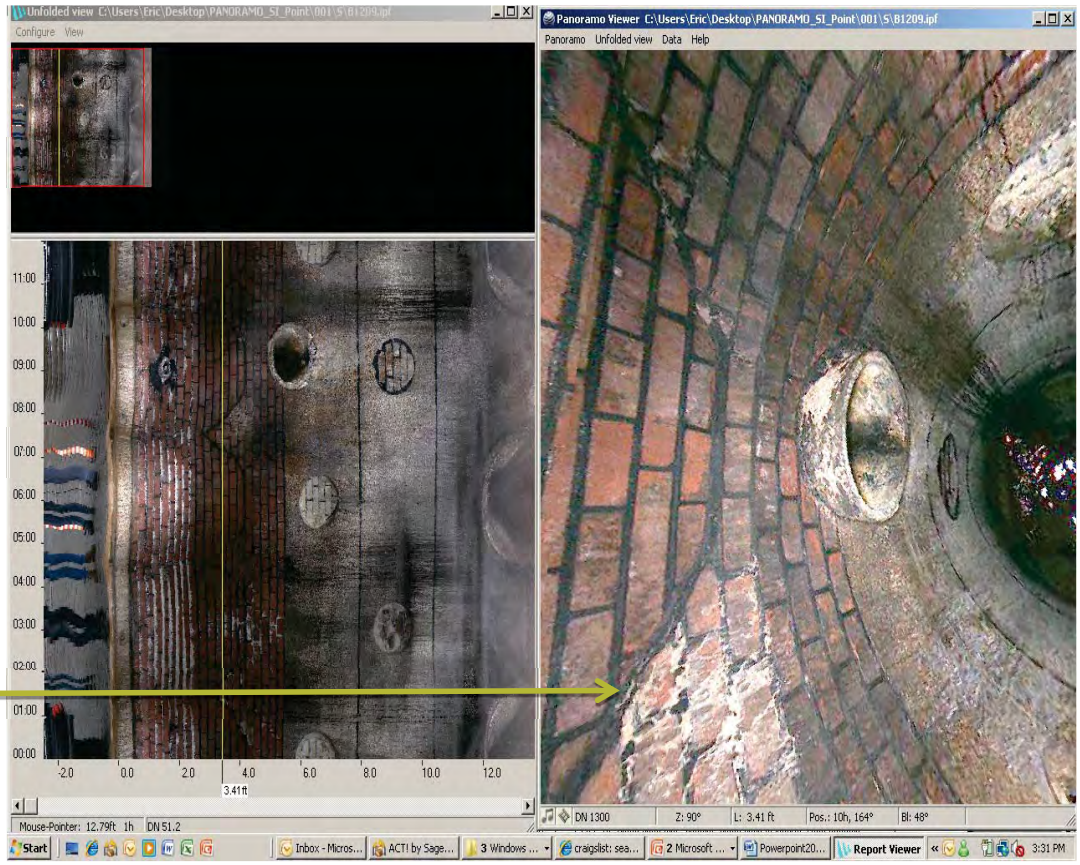
- Digital 3D Optoscanner
- 100% manhole scanning
- Pan and rotate direction of view
- Inspection speeds of ~ 1 ft/sec

Manhole Digital Scanning Output

Side-Scan Overview

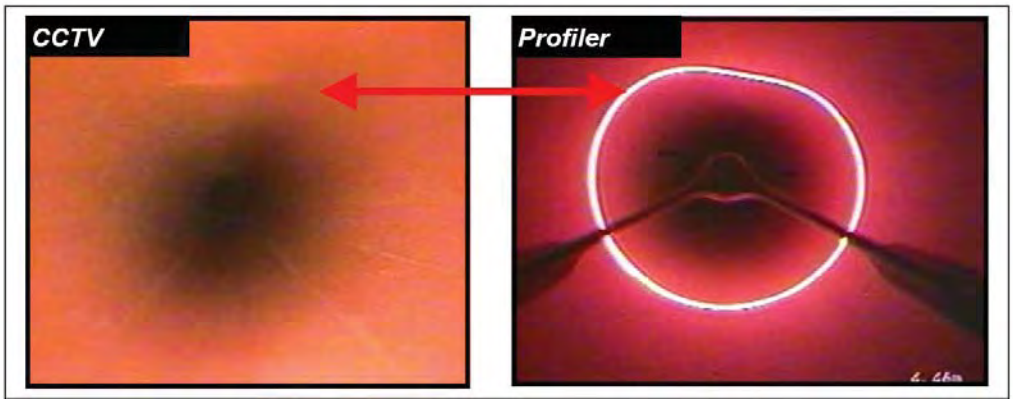
Enlarged Flat View

Virtual Pan & Tilt



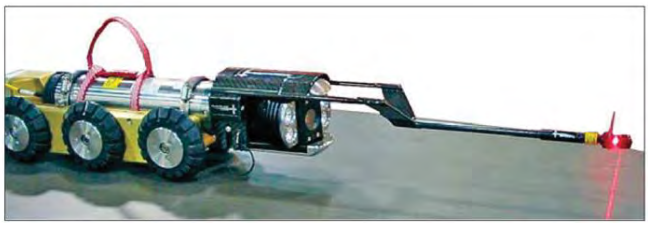
Laser Profiling (2D Laser)

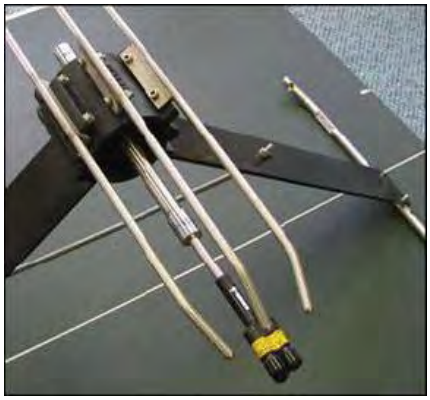
- Projected ring of laser light
- Laser image in conjunction with CCTV
- Analysis is performed on the laser light ring to build a digital profile via dimensional measurements

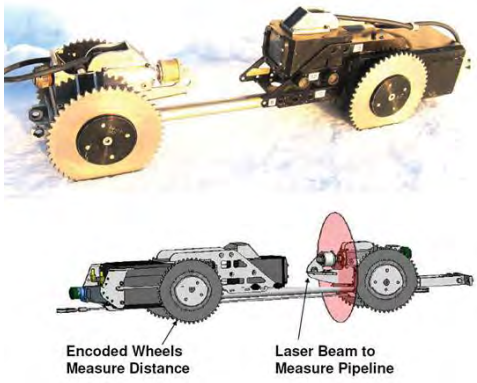


Laser Profilers

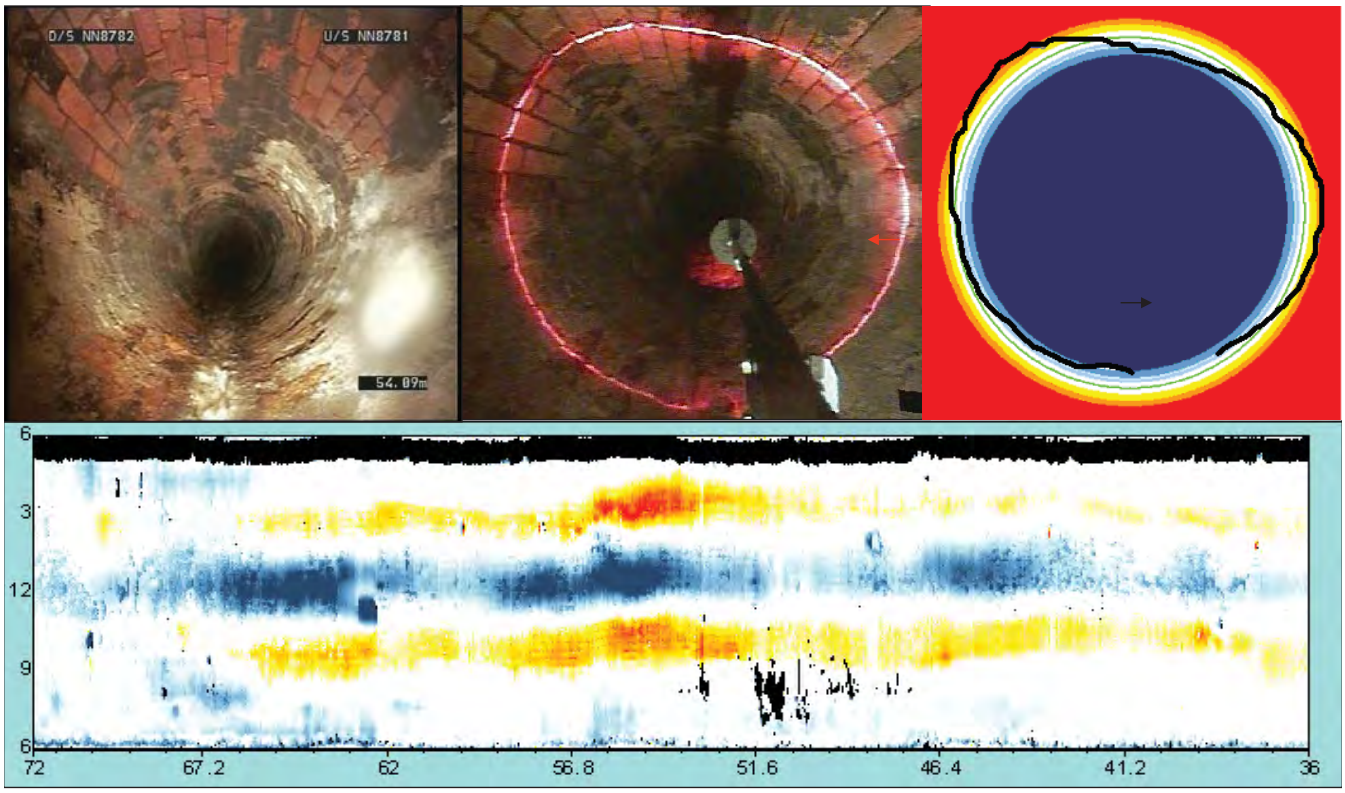
- Separate Unit (Towed)
- Camera Mounted





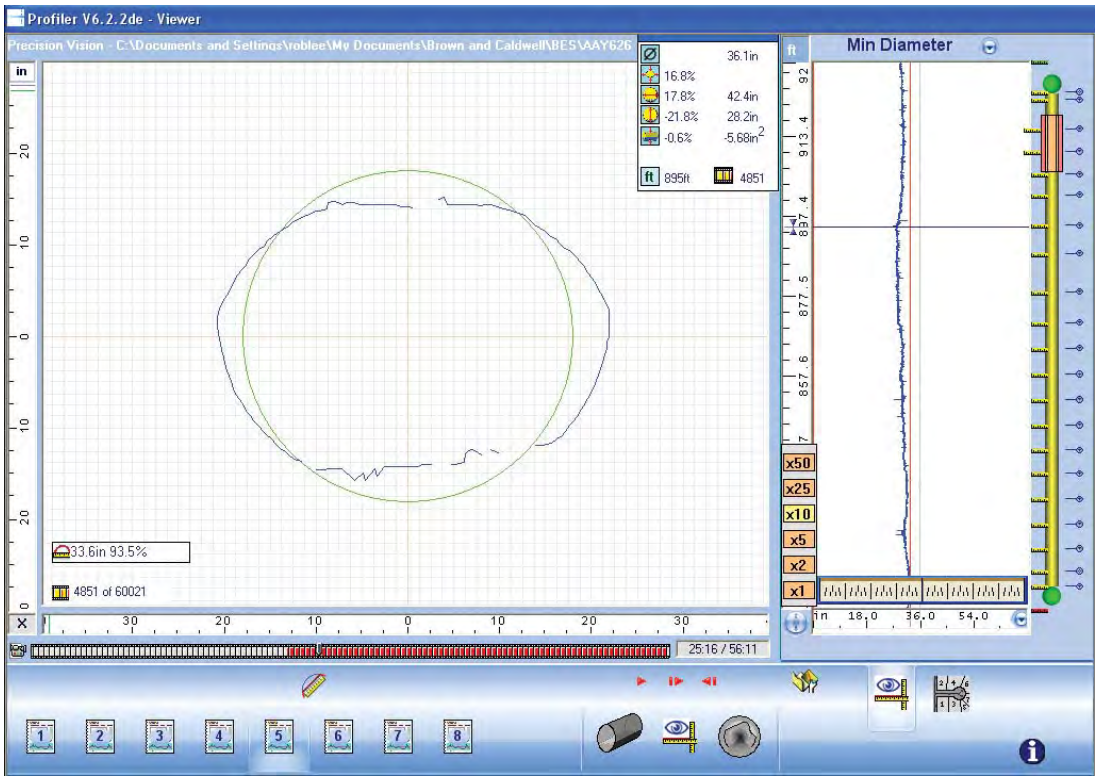


Geometric Measurements

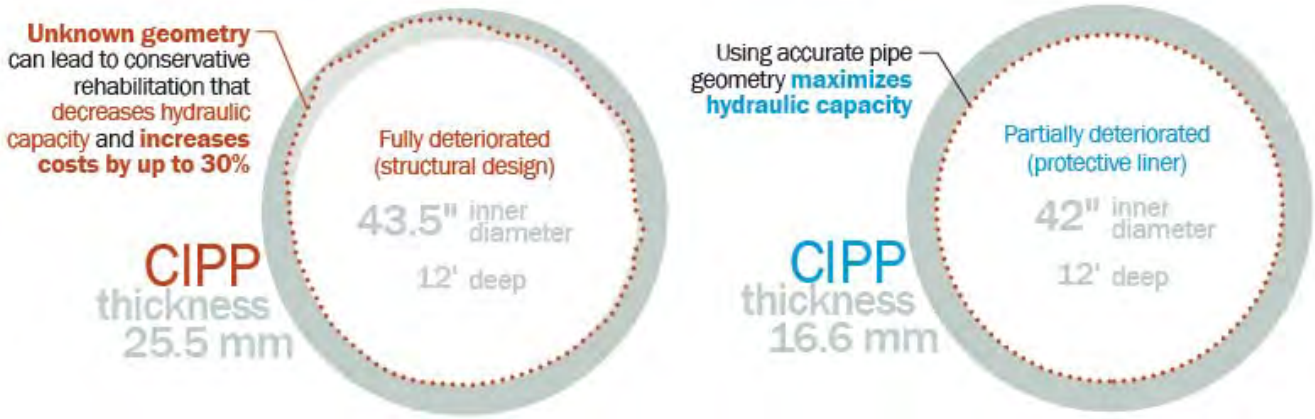


Difficult to Measure Visually

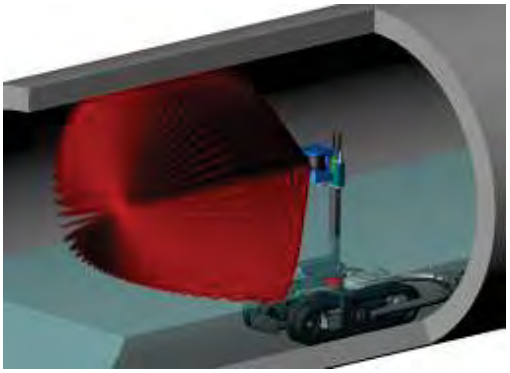
Laser Profiling Output

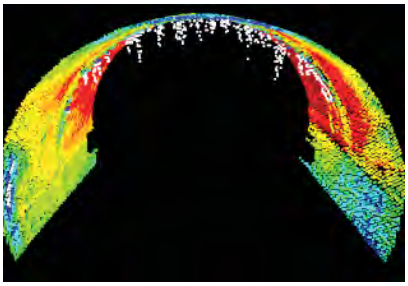


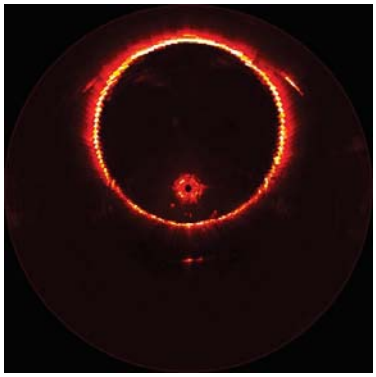
Laser Benefits



Laser Scanning (3D Laser)





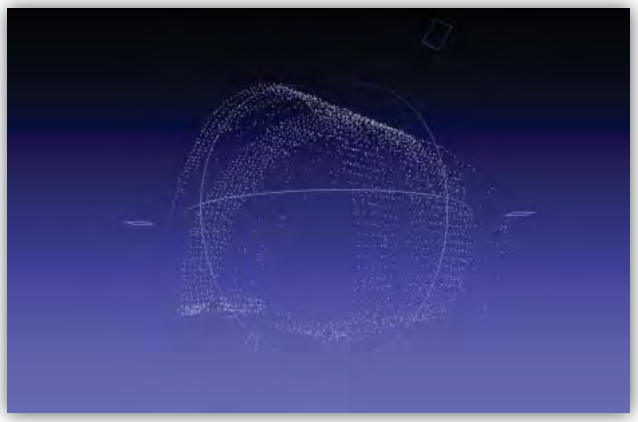


Advantages of 3-D vs. 2-D Ring Laser

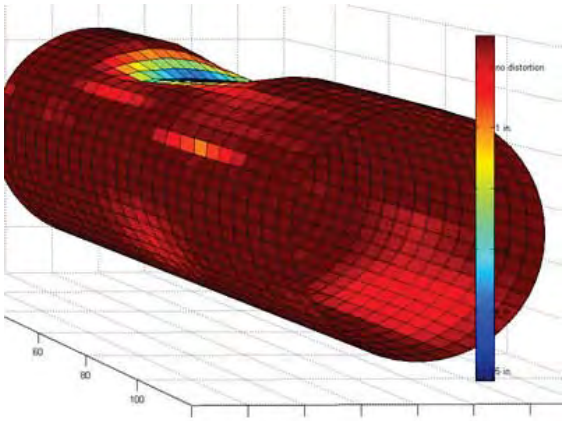
- Allows a time-based ranging analysis
- More precise defect measurement
- Error sources are minimized

Laser Scanning Output

- AutoCAD and Polygon Renderings



3D Point Cloud of Pipe

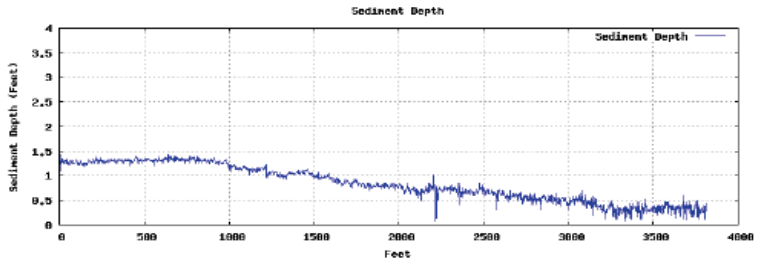


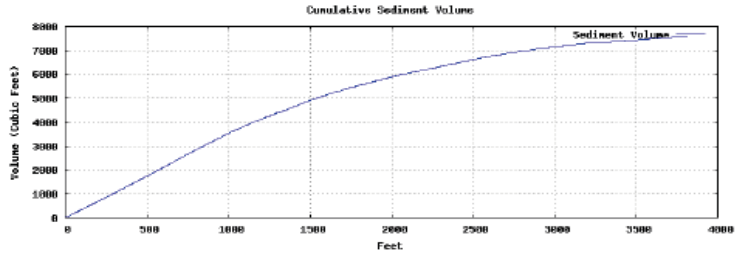
Geometry and Corrosion

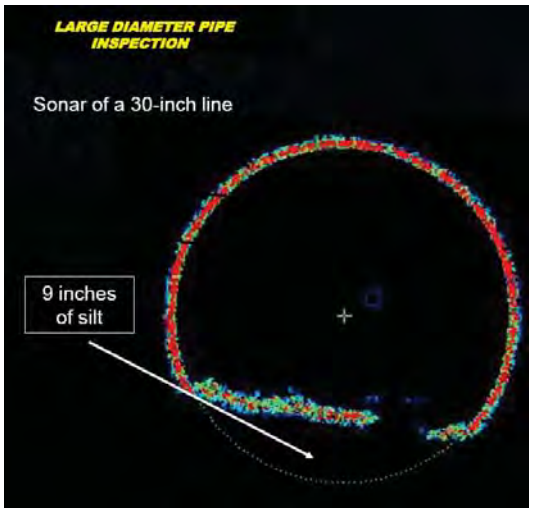
Sonar Inspection

Sonar below the Water Surface

- Total Cumulative Sediment
- Capacity Loss due to Sediment
- Pipe Blockage Identification
- Pipe Shape and Gross Defects

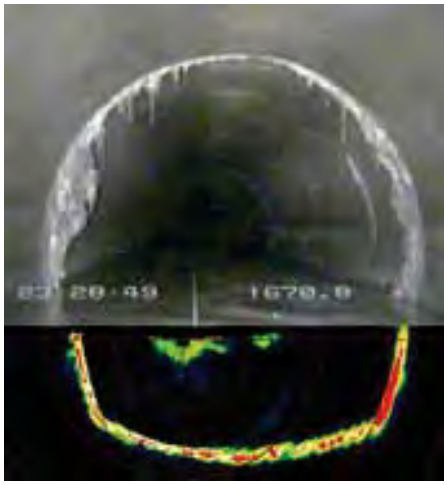






Limitations

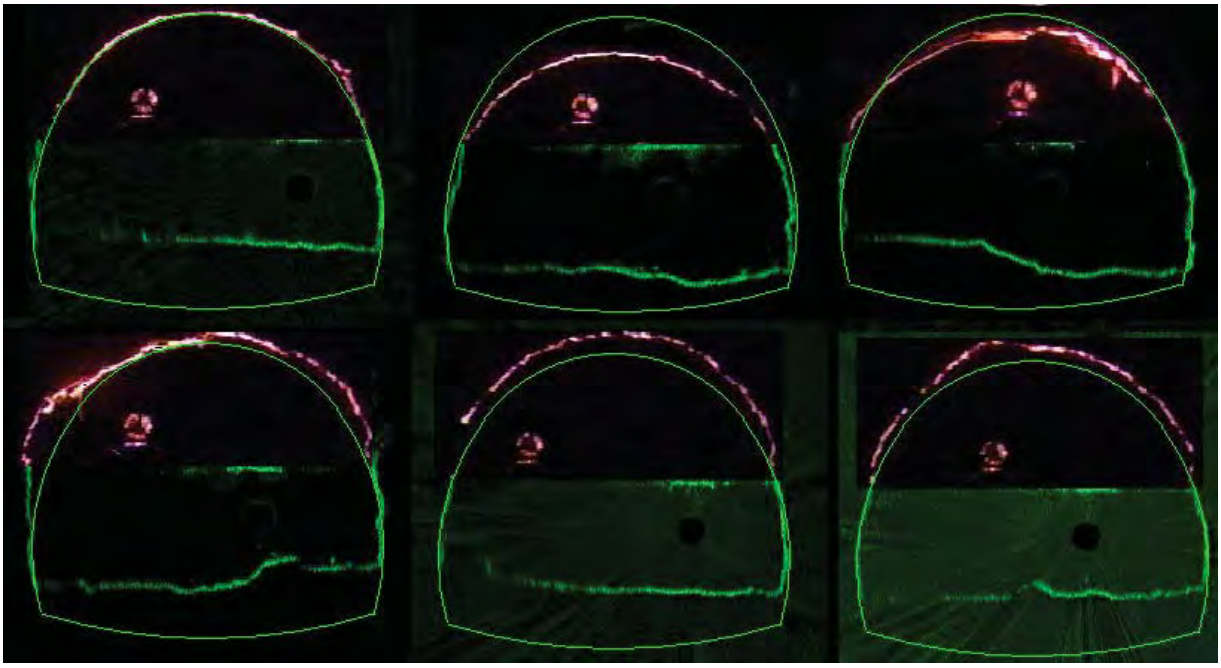
- Minimum water depth
- Generally float-based
- Limited resolution
- Excel spreadsheet



Siphon Inspections

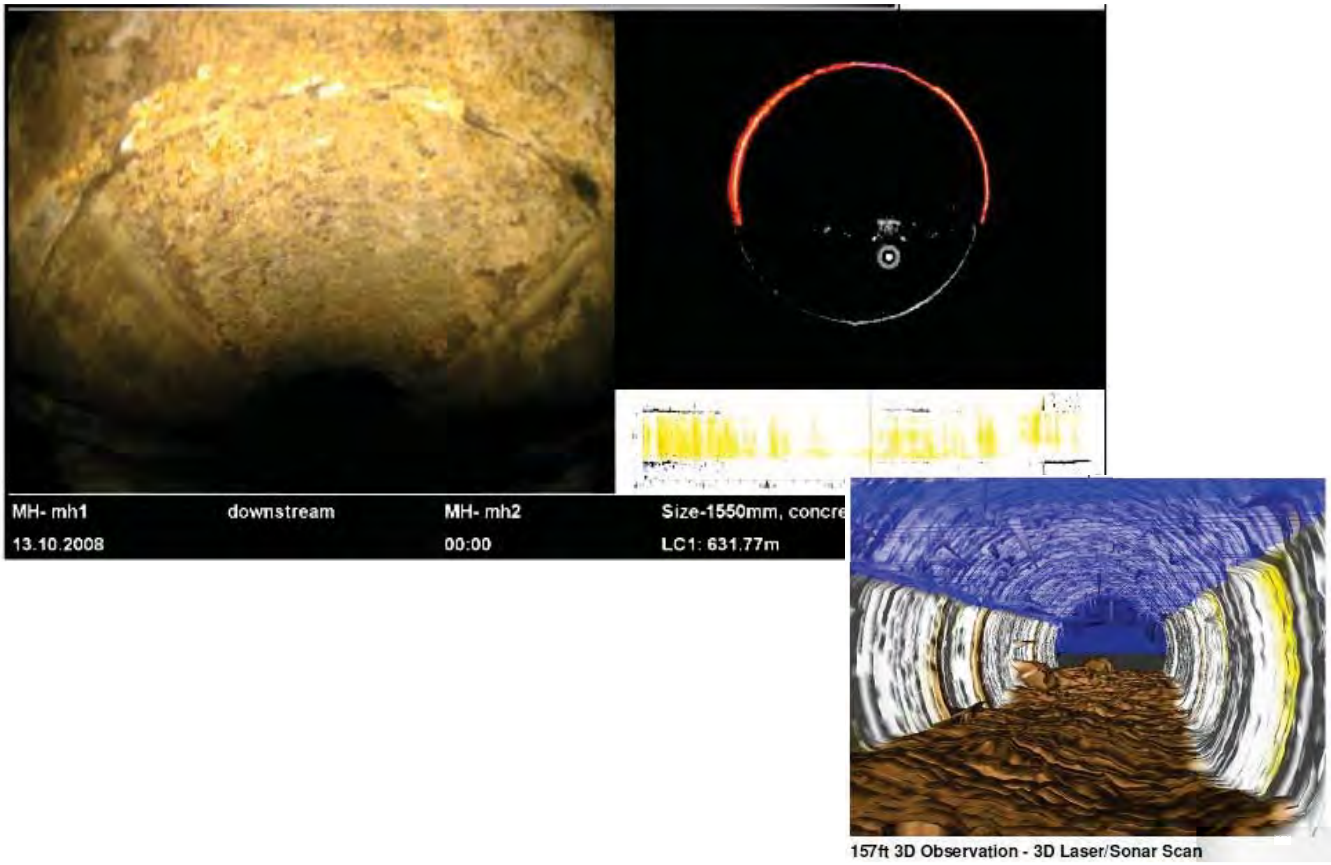
- Typically Towed
- Neutrally Buoyant
- Data Logging

Combined Laser and Sonar Profiling

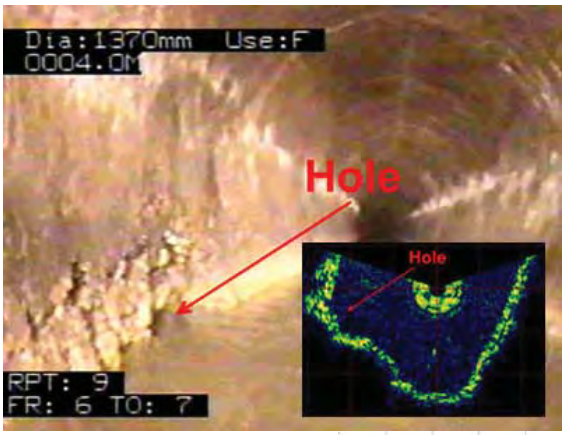


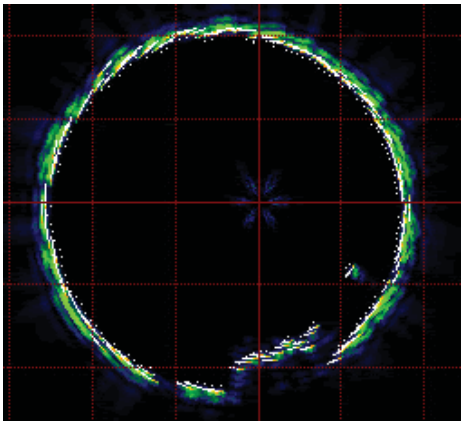
Laser Scanning uses light above the water surface,
Sonar uses acoustics below the water surface

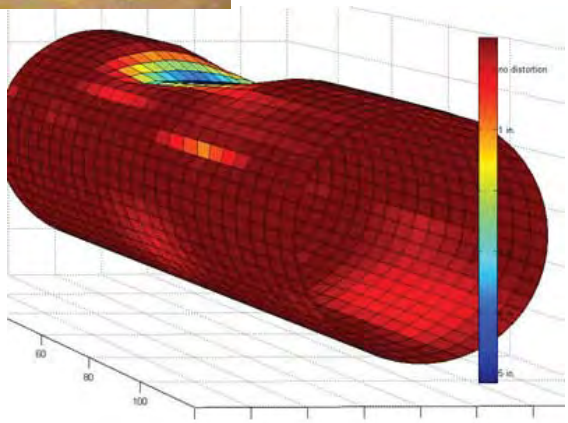
Multi-Sensor Output Example



Multi-Sensor Output Example





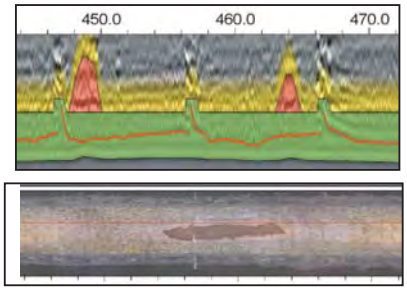


Pipe Penetrating Radar

- High frequency radar
- Same principles as ground-penetrating radar
- Non-ferrous pipes
- Pipe wall thickness, reinforcement placement, voids

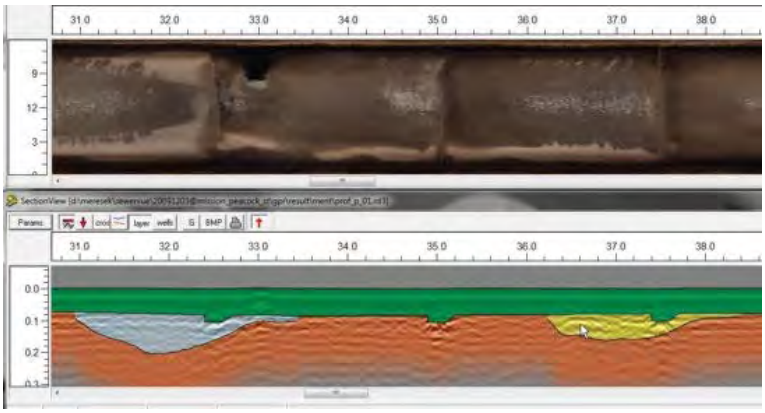
Results

- Correlation between visual and PPR
- Pipe wall integrity
- Leakage, gaskets, voids

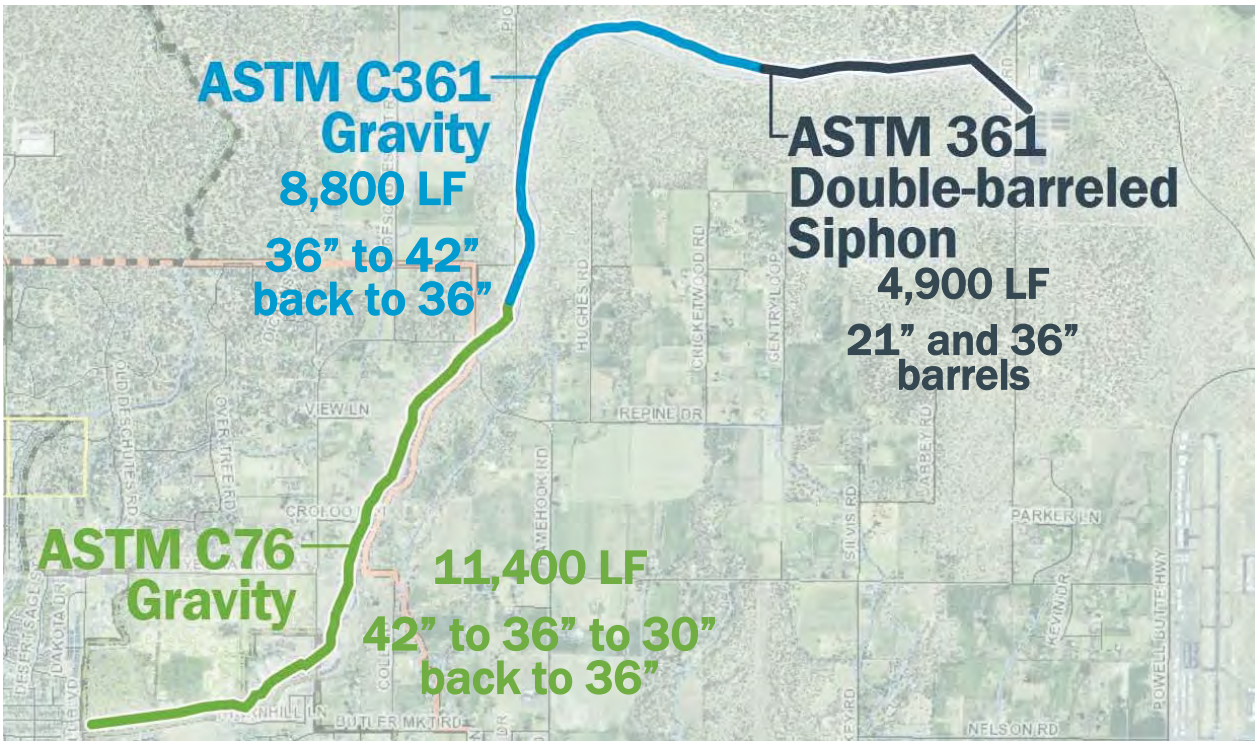


Limitations

- 21” to 36” diameter
- Post processing confirmation is destructive
- Lengths ~500 LF



Plant Interceptor Size and Material



End Goal Drives Inspection Technologies

Option A

- Upgrade and replace

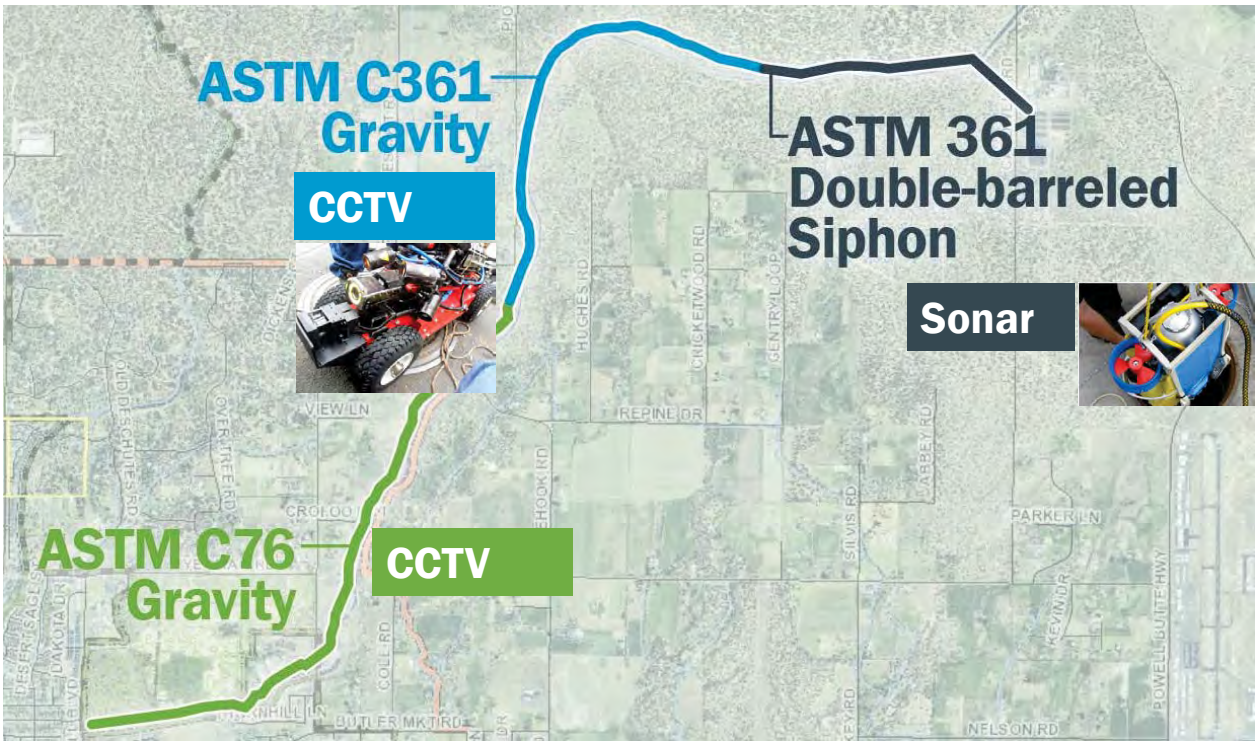
Option B

- Structurally Renew

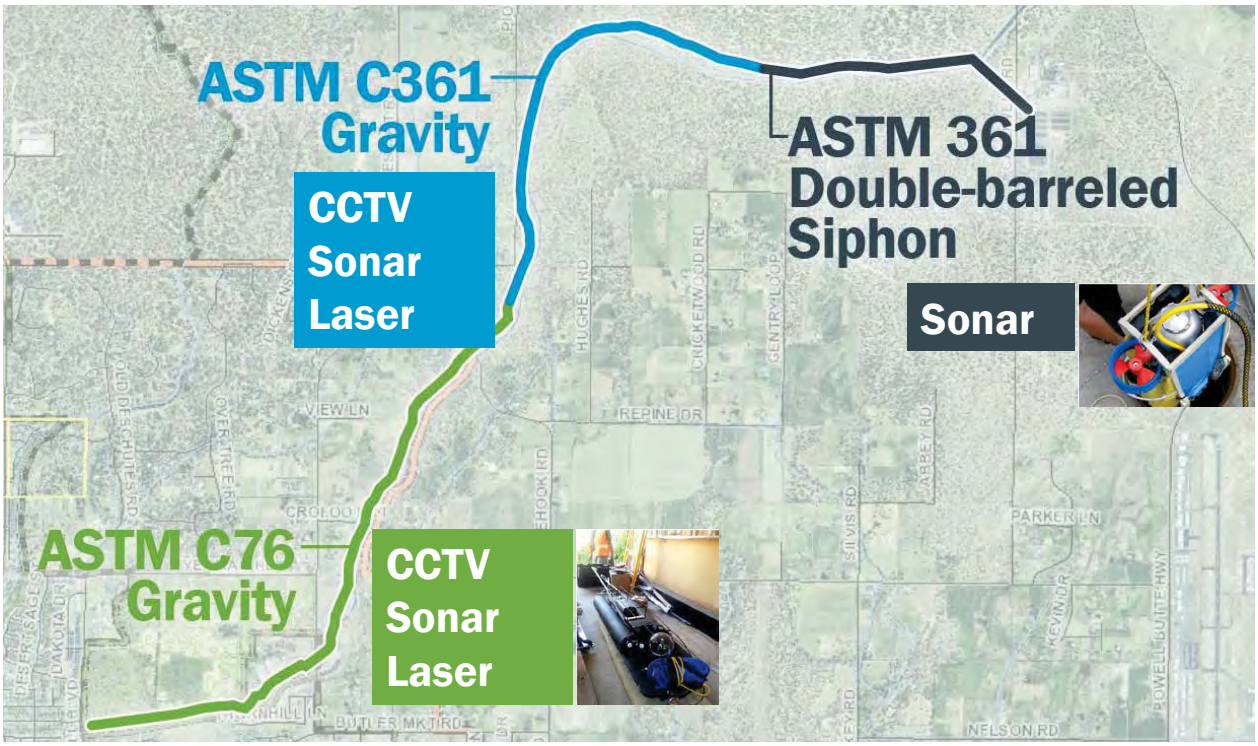
Option C

- Fix Critical Sections
- Corrosion/Sulfide Control

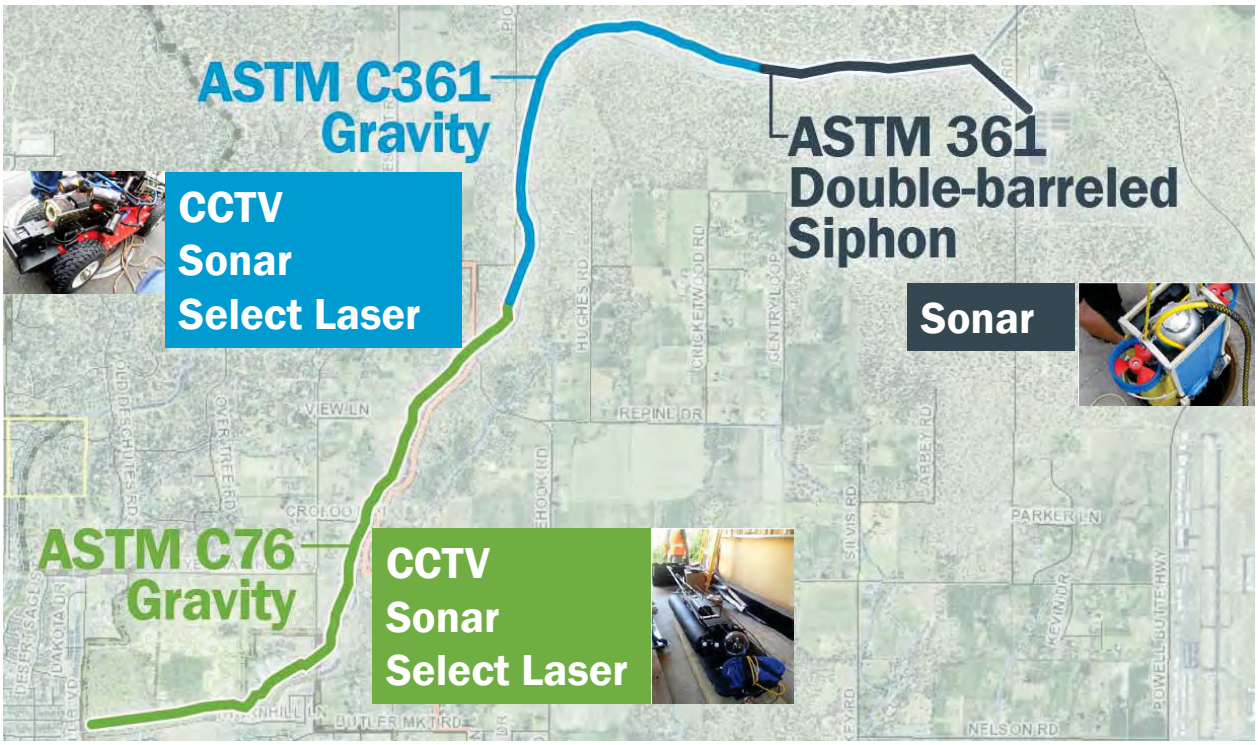
Option A: Upgrade



Option B: Full Structural Renewal



Option C: Fix Critical Sections/Corrosion Control



Inspection Recommendations

Component	Inspection Technology	Duration
Manholes	• Manhole Scanning (Frequency?) • Scrape and Hardness Tests (Frequency?)	1 week
Gravity Pipe	• CCTV • Sonar (or bypass pumping) • Laser (2D acceptable)	2 to 3 weeks
Siphons	• Sonar (ROV or winch-assisted)	1 to 2 weeks

Project Constraints

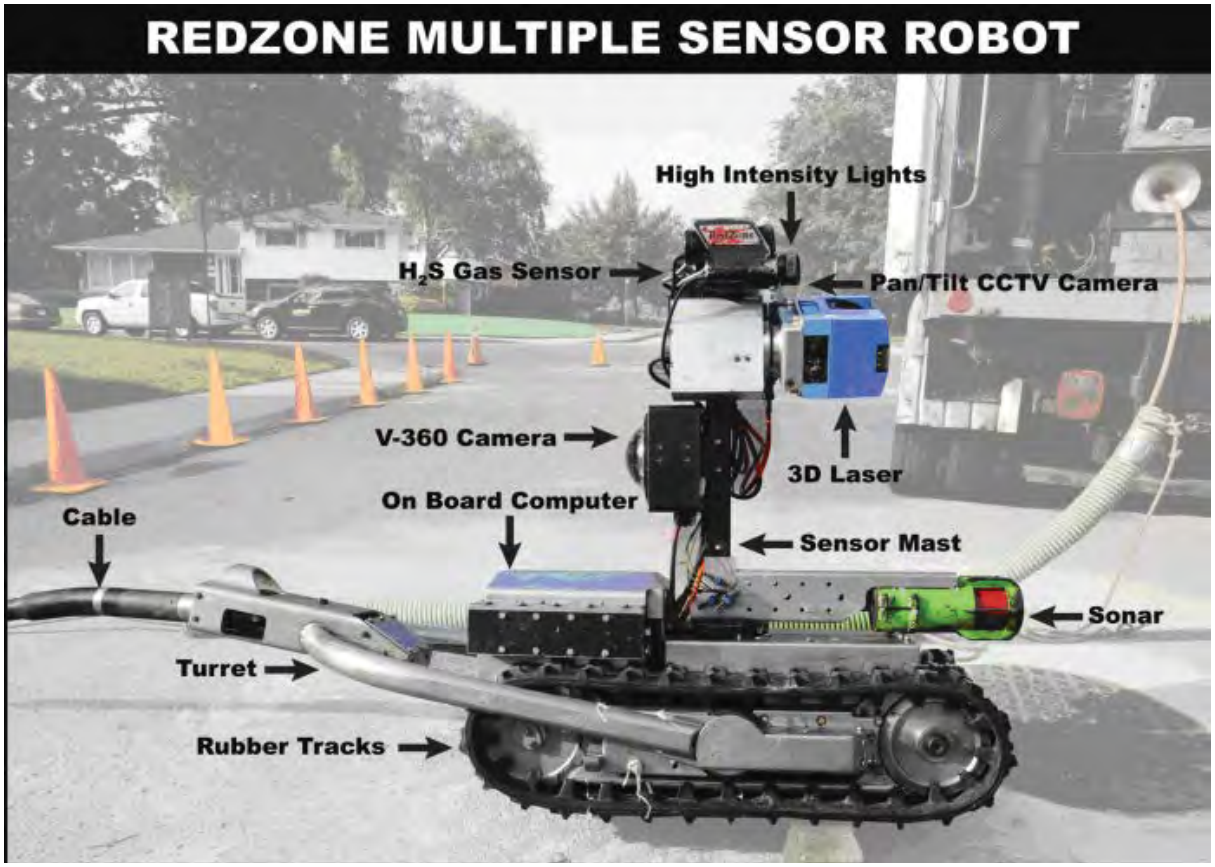
- Access (walkthrough completed 4/26)
- Schedule
  - Other work
  - SSMP updates
  - Seasonal issues

Inspection Firms

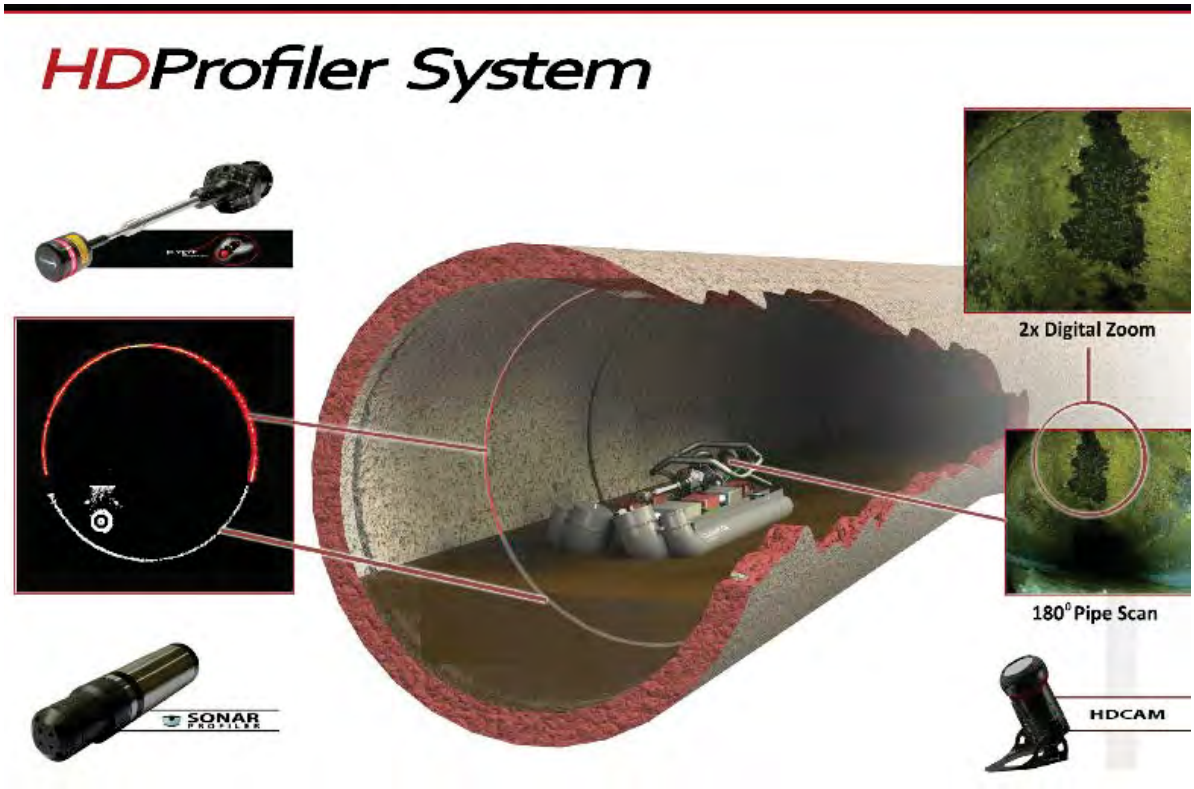
- RedZone Robotics (Pittsburgh, PA)
- Interactive Pipeline Inspections (Tumwater, WA)
- AquaCoustic Remote Technologies (Vancouver, BC)
- HydroMax USA (Louisville, KY)
- Northwest Underwater Construction (Vancouver, WA)
- SewerVue (Vancouver, BC)

RedZone Robotics – MSI Float

RedZone Robotics – Responder



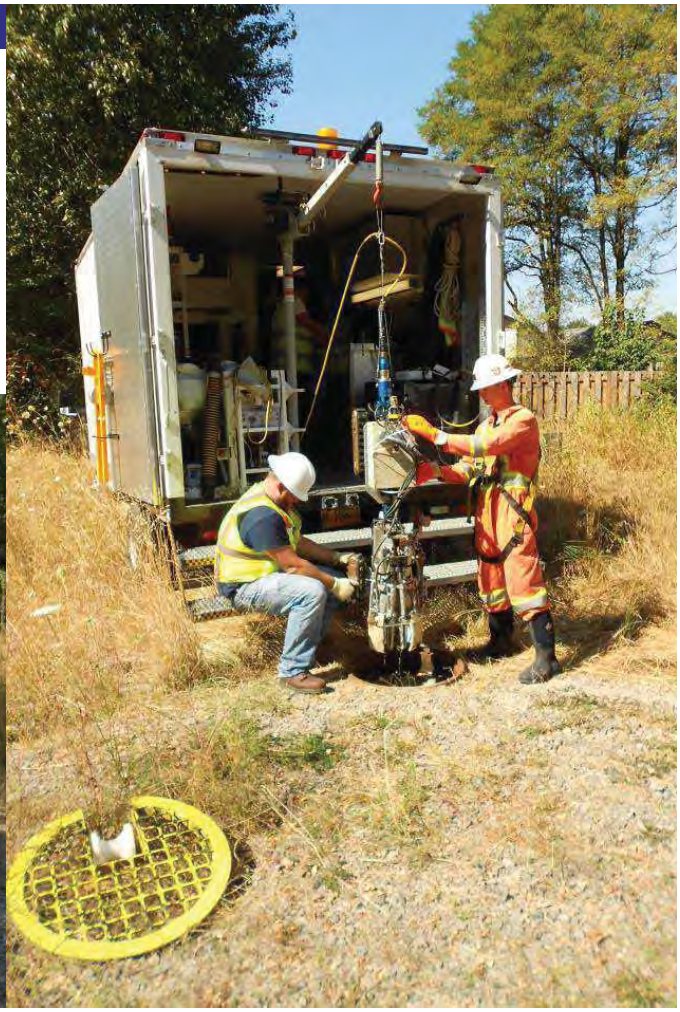
HydroMax/RedZone Profiler



AquaCoustic Remote Technologies

AquaCoustic Remote Technologies

SewerVue



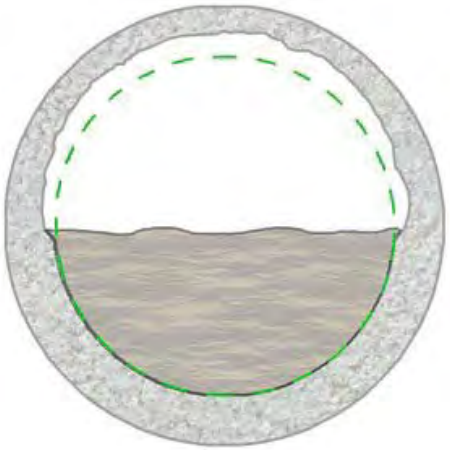
Summary of Inspection Firms

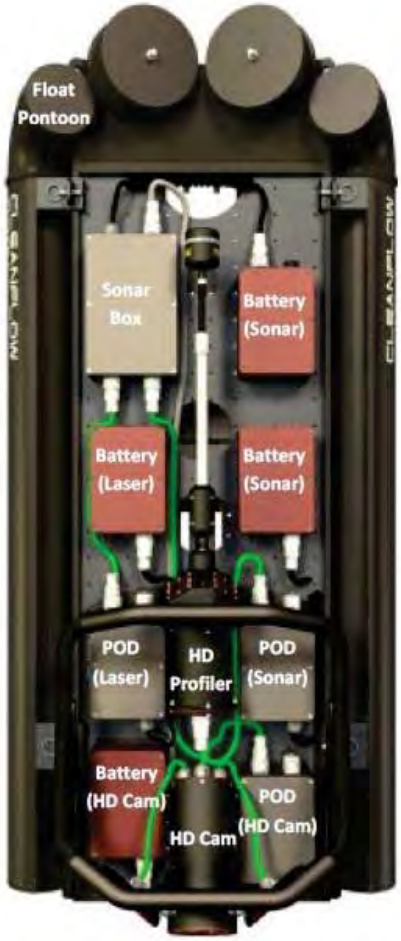
Firm	CCTV	Digital MH Scanning	Sonar	Laser	Availability	Limitations
RedZone	✓		✓	2D	May/June	3D on Responder
IPI	✓	✓	✓	3D	May/June	Data processing
AquaCoustic	✓	✓	✓	3D	Aug/Sept	Tag Lines
HydroMax	✓		✓	2D	Aug/Sept	
Northwest Underwater Construction	✓		ROV		Summer	Higher cost
SewerVue	✓			3D	June/July	500' Cable

Inspection Recommendations

Option	Capital Cost	Inspection Costs
A Upgrade	$18.2M	$150k
B Full Structural Rehab	$7.5M	$250k
C Fix Critical Sections/Corrosion Control	$600k / $400k	$215k

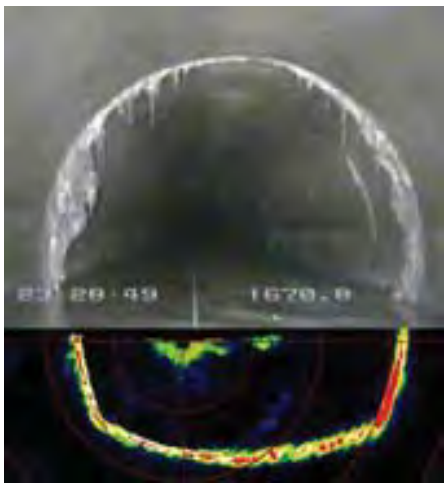
Q&A

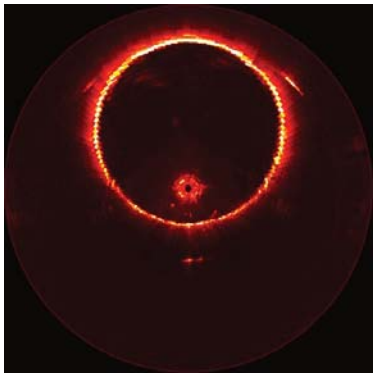




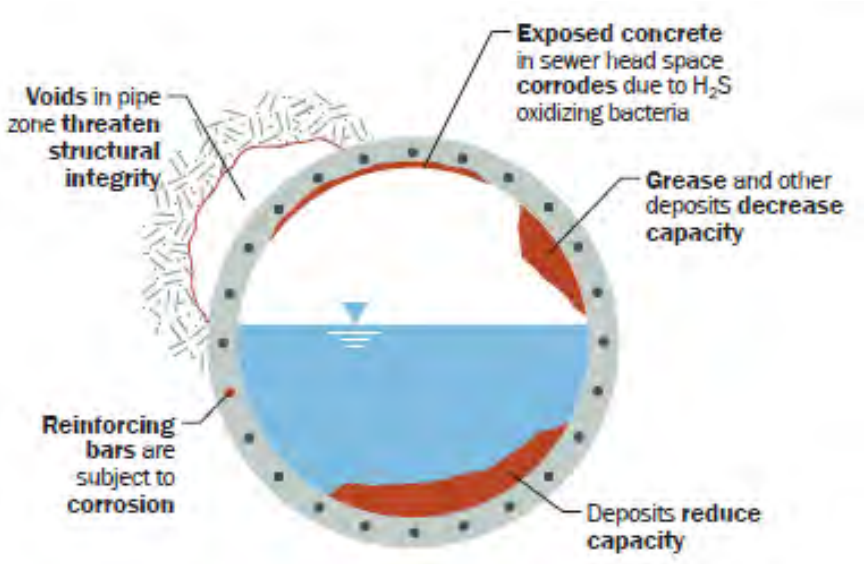
Challenge 1: Wide variety of narrowly focused inspection technologies increase project complexity

Approach to Challenge 1: Tailoring inspection technologies to specific project needs

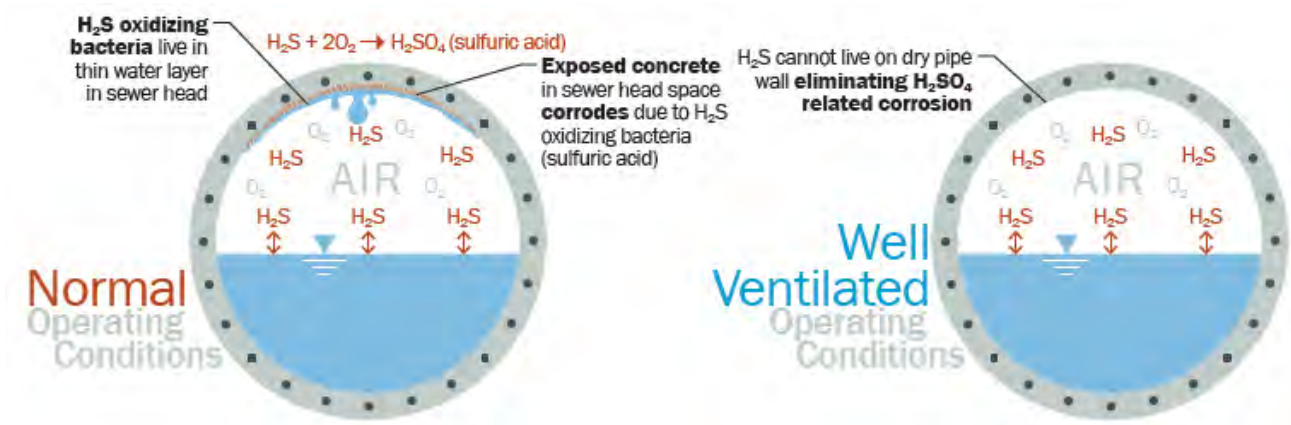




Challenge 2: Determining remaining useful life is an inexact science due to limited information and project-specific variables

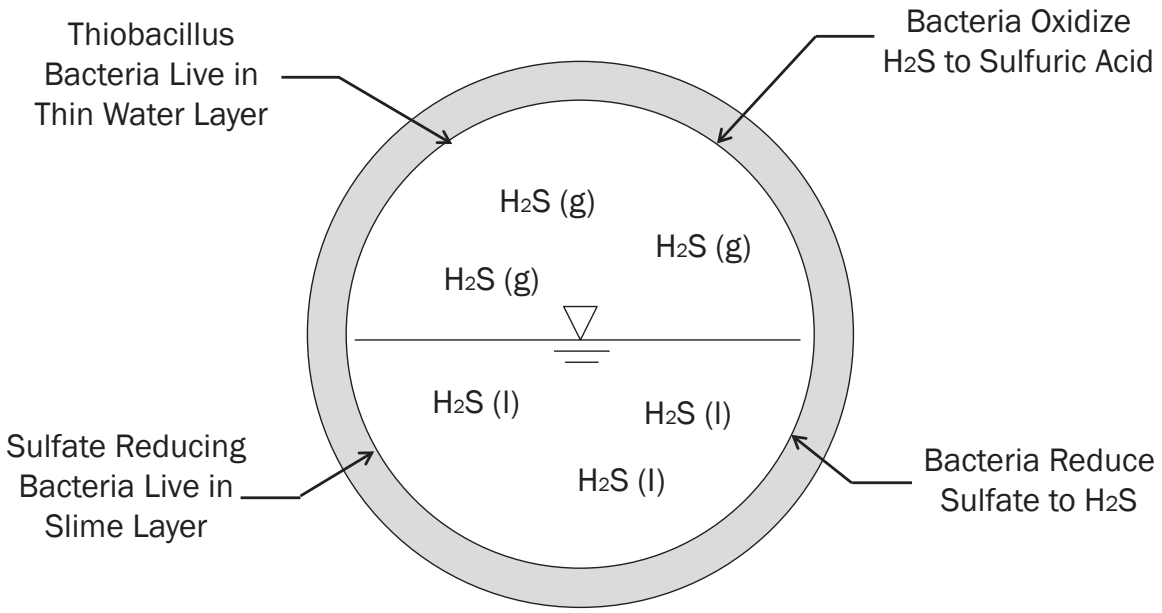


Extension of Existing Pipe Service Life

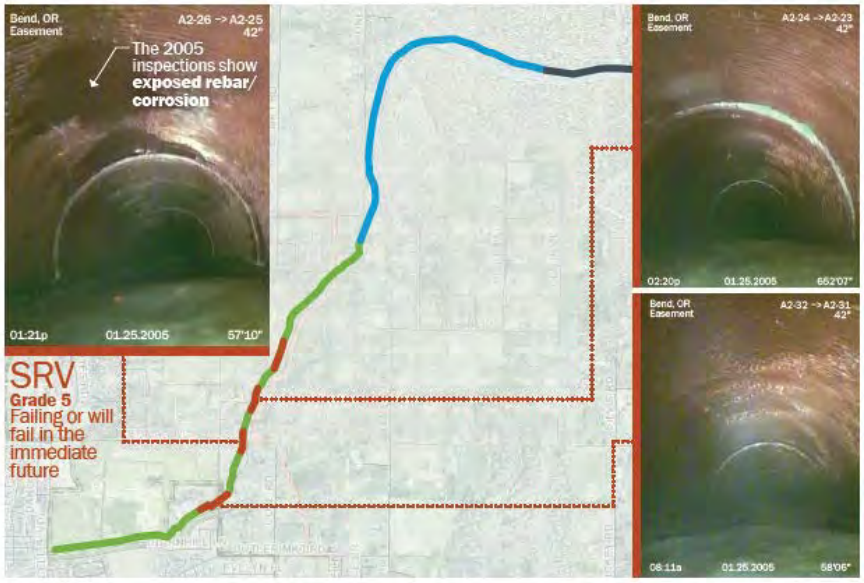


Well-ventilated pipeline dramatically reduces H2S accumulation on inside pipe walls and extends useful life.

Sulfide-based Corrosion Control

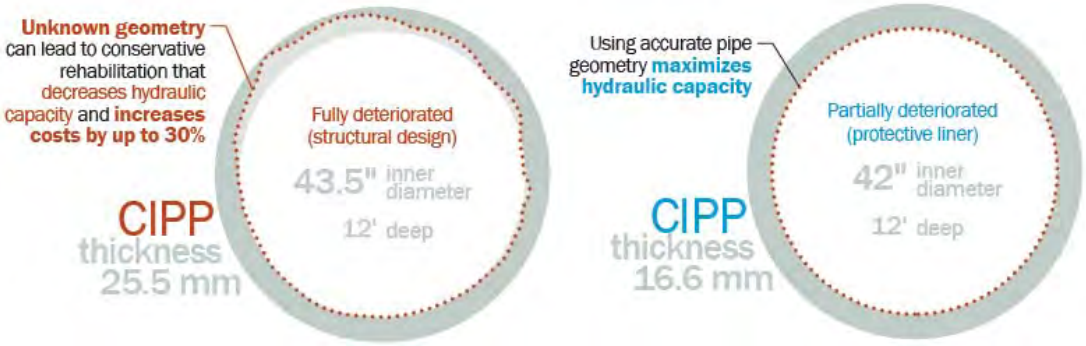


Challenge 1: Wide variety of narrowly focused inspection technologies increase project complexity



PACP ratings assessed from a 2005 video of the plant interceptor indicate immediate actions are required to extend its useful life.

Challenge 2: Determining remaining useful life is an inexact science due to limited information and project-specific variables



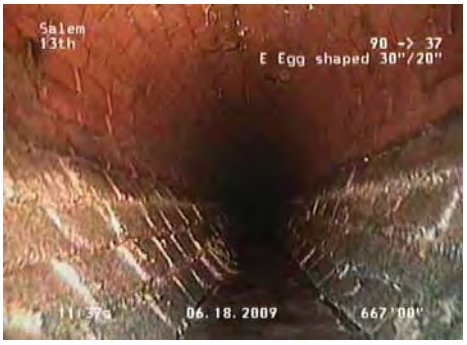
Obtaining accurate dimensions of the existing pipe allows optimal rehabilitation design using cured-in-place pipe.

Use of laser data refined rehabilitation design

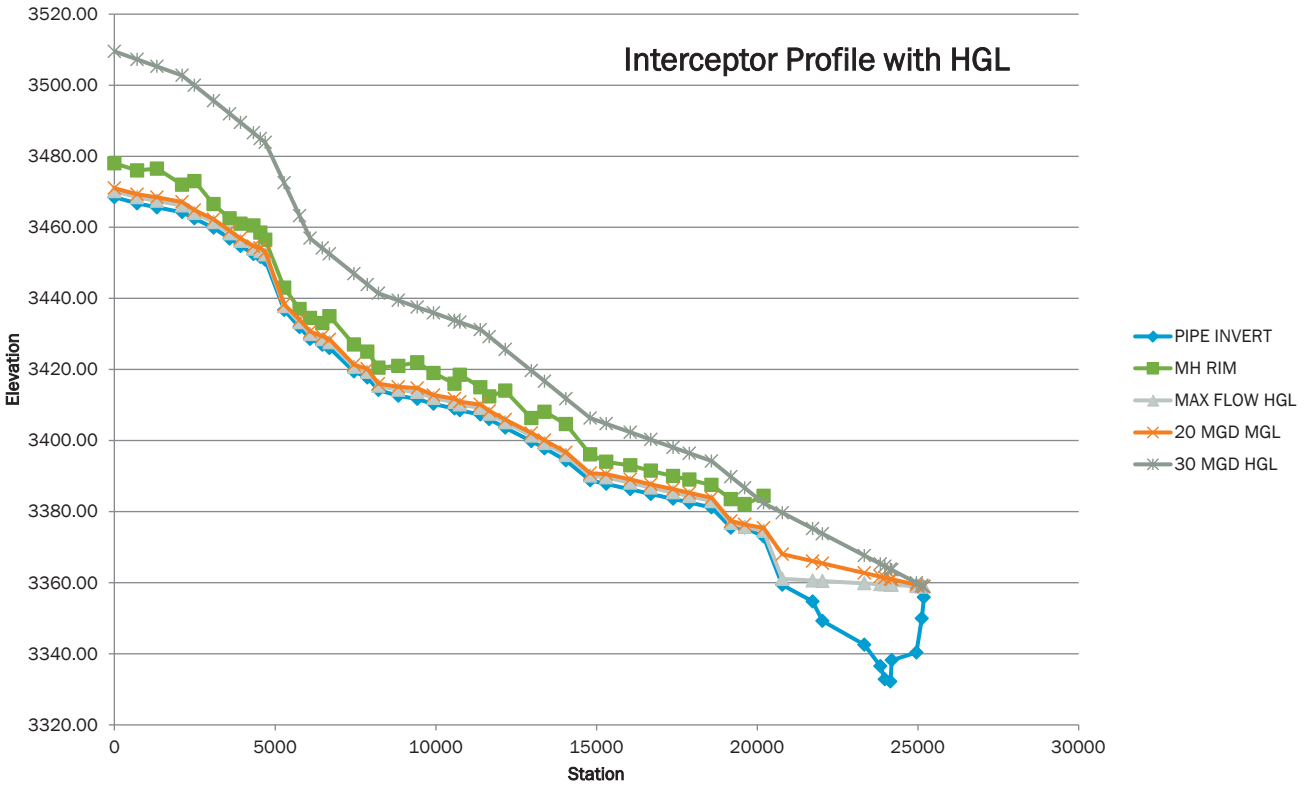
City of Salem

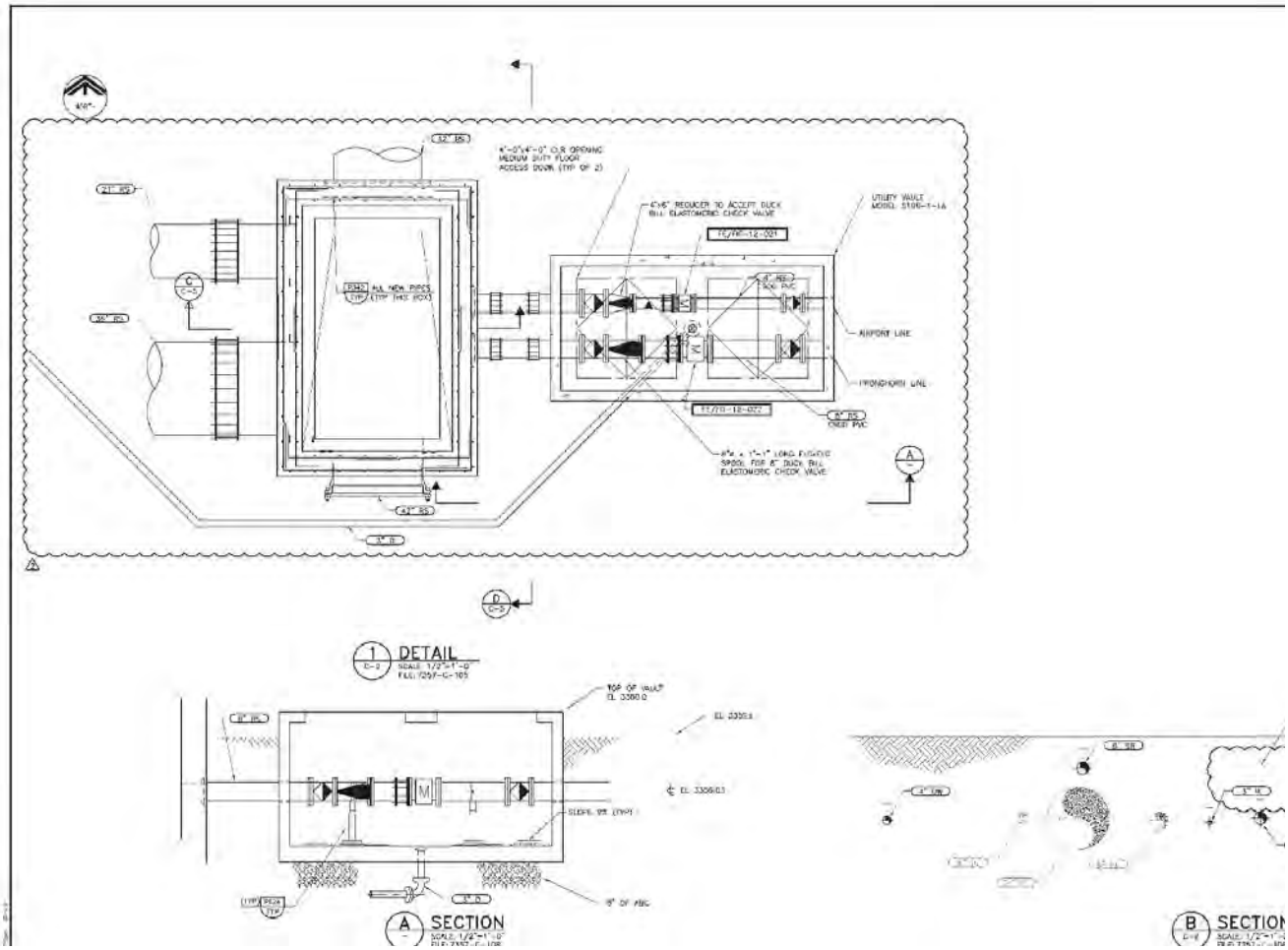
Center Street Brick Sewer (2010)

- 800 LF of 29”x19” using CCTV and 2D Laser
- Rob Lee: PM
- Key Subs: JenCourt employees (CCTV and 2D Laser)



Profile of Existing Hydraulic Condition




4'-0"x4'-0" O.R OPENING
MEDIUM DUTY FLOOR
ACCESS DOOR (TYP OF 2)
6"x6" REDUCER TO ACCEPT DUCK
BILL ELASTOMERIC CHECK VALVE
UTILITY VAULT
MODEL 5106-1-1A
AIRPORT LINE
IRONHORSE LINE
8" PVC
CHEST PVC
8"x 1'-1" LONG FVSC/FVC
SPOOL FOR 8" DUCK BILL
ELASTOMERIC CHECK VALVE
ALL NEW PIPES
(TYP THIS BOX)
DETAIL
SCALE 1/2"=1'-0"
TOP OF VAULT
EL 3300.0
EL 3306.5
EL 3306.03
SLOPE 1V:2H (TYP)
6" OF ABC
SECTION
SECTION

City of Bend

Existing Plant Interceptor Condition Assessment

April 30, 2013

Agenda

- Introductions
- Critical Success Factors
- Constraints
- Hydraulic Capacity

The Consultant Team

City of Bend
AARON COLLETT, P.E.
Project Manager

TECHNICAL ADVISORS
Gary Skipper, P.E. *Inspection Technology Expert*

PROJECT MANAGER
Rob Lee, P.E.

PROJECT DELIVERY OFFICER
Bryan Paulson, P.E.

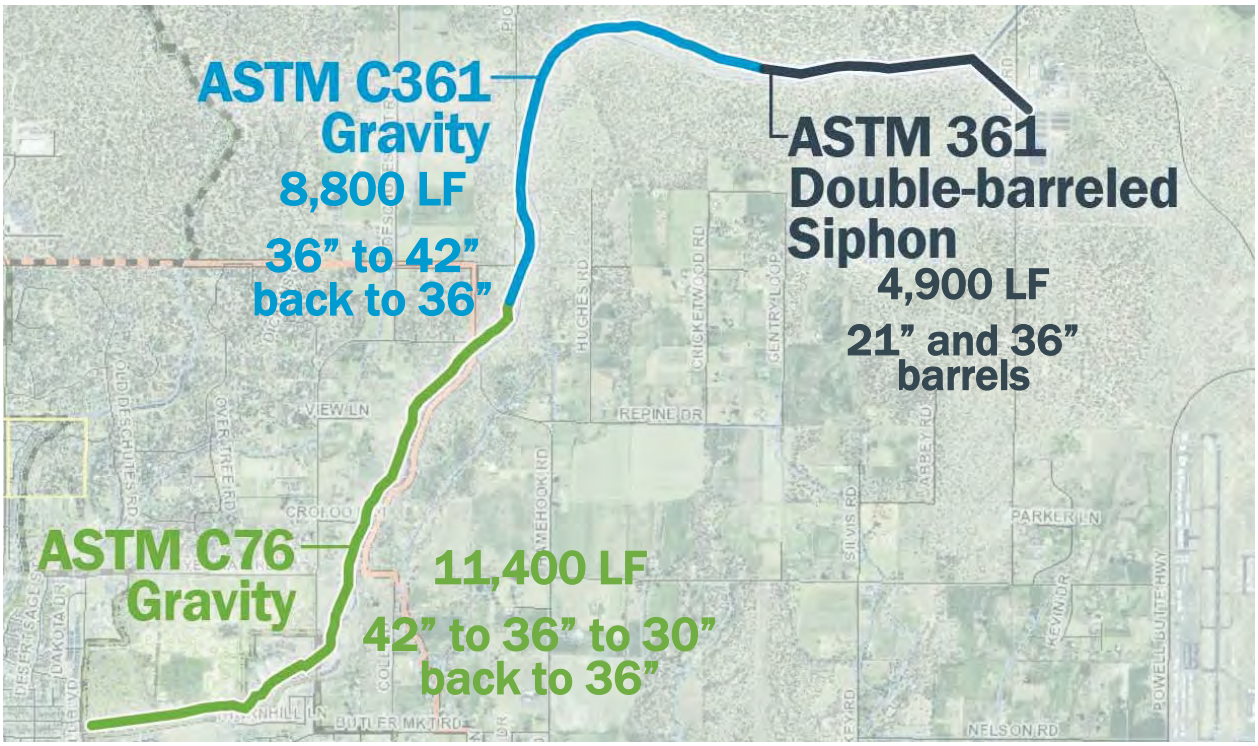
FIELD COORDINATION
John Graham (JenCourt)

CONDITION ASSESSMENT/REHABILITATION RECOMMENDATION
Jim Hansen, P.E.
Peter Armans, E.I.T.

CORROSION CONTROL
Mark Smith, P.E.

INSPECTION FIRMS
AquaCoustic Remote Technologies
JenCourt Environmental
Interactive Pipe Inspection
Northwest Underwater Construction
RedZone Robotics
SewerVUE

Plant Interceptor Size and Material



Primary Critical Success Factors

Thorough understanding of condition

Confidence in remaining useful life

Right upgrades at the right times

Secondary Success Factors

Data integration into City's system

Minimal disturbance to private property owners

Appropriate level of inspection costs

Coordination with other work (e.g., WRF)?

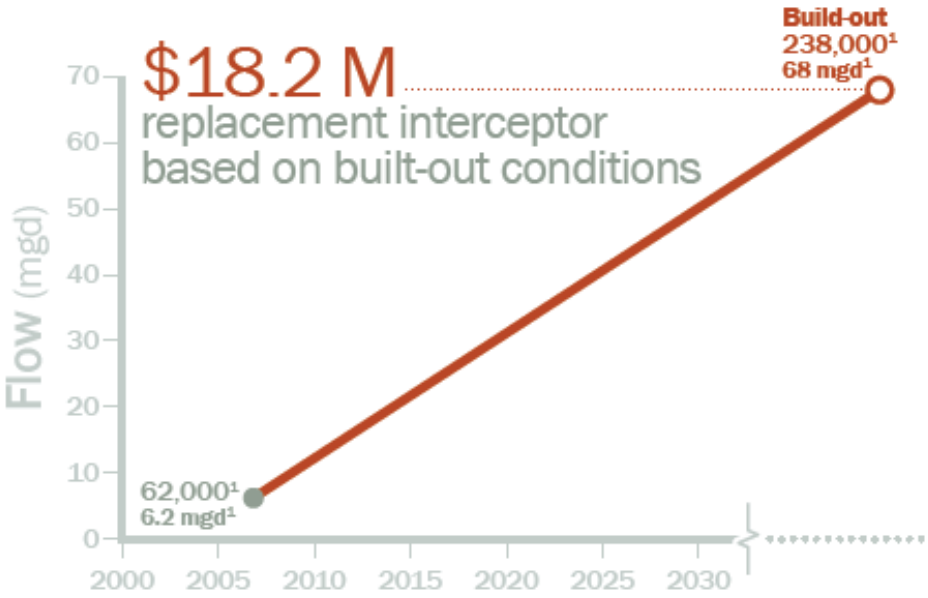
M/W/ESB participation?

Any others?

Project Constraints

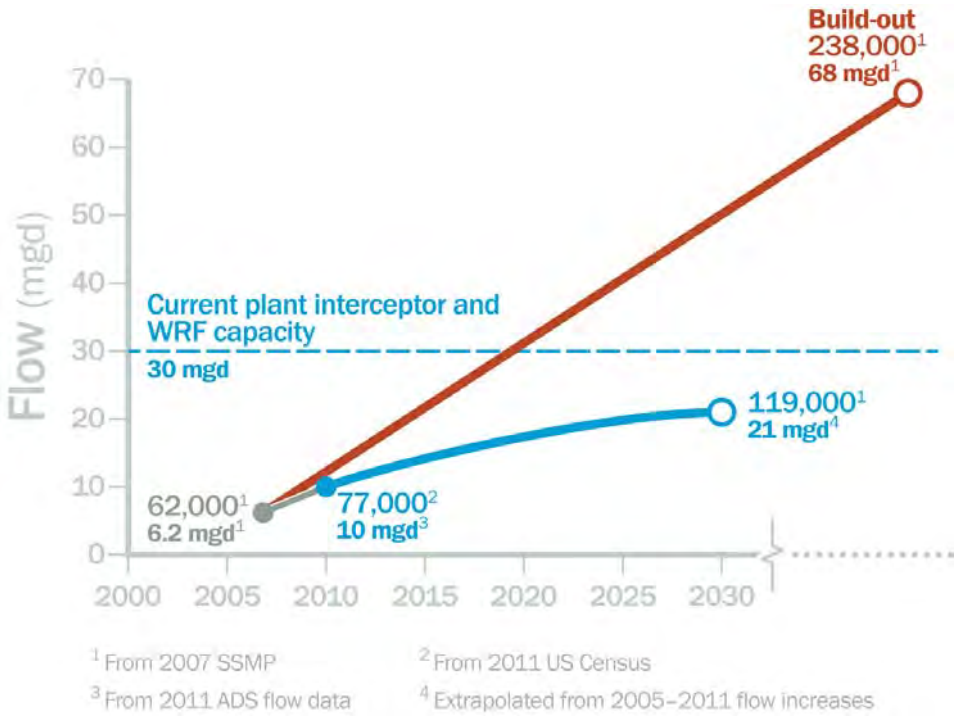
- Access (walkthrough completed 4/26)
- Schedule
  - Other work
  - SSMP updates
  - Seasonal issues

Hydraulic Capacity Understanding



¹ From 2007 SSMP

Existing Plant Interceptor may have adequate capacity



Flow Conditions

Condition	Peak Flow (MGD)	PI Percent Full
2005 (pop: 68,000)	6.2 MGD	33%
2011 (pop: 77,000)	10 MGD	50%
2030 (pop: 119,000)	21 MGD (extrapolated)	75%
Build-out (pop: 238,000)	68 MGD	Undersized

Q&A

Meeting Minutes

Prepared for: City of Bend
Project Title: Existing Plant Interceptor Condition Assessment
Project No.: 144338 (Bend Project #SW10AA)

Purpose of Meeting: Water Reclamation Facility Siphon Access **Date:** May 2, 2013
Meeting Location: Water Reclamation Facility
Minutes Prepared by: Dana Devin-Clarke, Brown and Caldwell (BC)

Invitees:
Aaron Collett, City of Bend
Reese Moody, City of Bend
Rob Lee, BC
Dana Devin-Clarke, BC
Tom Hickman, City of Bend
Jeff England, City of Bend
Kelly Ristoff, City of Bend

Meeting Minutes

The PICA kickoff meeting occurred in two separate sessions. The morning session covered important project critical success factors, scheduling constraints and hydraulic capacity. The afternoon session covered inspection technologies, end goals for the inspection, and inspection recommendations.

Morning Session:

1. Primary Critical Success Factors (CSF)

   JE – There are 2 aspects involved in the criteria "confidence in remaining useful life" These include: physical condition of the pipe and hydraulic capacity. It is important to compare how long the pipe will last with whether the capacity of the pipe is sufficient for future population growth.

   AC & RM – The City wants measurable baseline data that can be used to track degradation of pipes over time and that can be easily converted into hard facts that can be presented to the City Council. When analyzing the data it would be good to take screenshots or video soundbytes that can also be used for public involvement later on in the process.

   TH – The recently completed flow monitoring project conducted by MSA indicates that 6 MGD is flowing through the interceptor. However, the SCADA at the plant indicates that only 5 MGD is entering the WRF. This project needs to be completed in a timely fashion so that the roughly 1 MGD loss in flow is identified as a leak in the siphon or a problem with the flow meters.

   RM – An additional idea for proactively smoothing public relations would be to identify particularly odorous manholes and install locking lids with seals.

   JE – Meet the project goals at cost. The expectation for this project is that all parties involved feel positive about the project and that a good product was achieved at a fair and reasonable price.

2. Secondary Critical Success Factors (CSF)

   RM – Provide a clear non-assumptive deliverable that provides a good understanding of the condition of the interceptor.

   TH – Create an accurate map/graphic that color codes the condition of the interceptor particularly so that the problem areas that may have pipe failure can be identified quickly. (red = pipe failure, green = good condition, with a gradient in the middle)

   RL – The goal will be to have a graphic that represents the structural and operational rating of each pipe from MH to MH. Also the data will be compiled in a manner that is easily imported into Granite XP.

   AC – Bend does not have a M/W/ESB requirement. Only if the qualifications and pricing for the subcontractors are equal can this be used as criteria in the decision process.

   RM – The secondary plant expansion is coming up in the summer schedule. It would be good to coordinate inspection of the siphon with the expansion when the siphon is already open.

   JE – Need to ensure that the field crews have extensive experience and abilities. The pipeline integrity must be maintained.

   AC – In the other proposals for the project, the PM was going to be onsite the whole time. It would be great if the BC field representative has equivalent experience and oversight. We want a field guy that works well with contractors but will bring any risky decisions back to the group to make a decision. We really want to minimize the "cowboy stuff". It would be good to present a plan on what can go wrong and how to mitigate it at the field work kickoff meeting.

   RM – The riskiest will be working in the siphon. It is important to inspect the 36" first before tackling the 21".

   JE – What is happens if a "catastrophic failure" is discovered with the CCTV?

   RL – Based on the 2005 data, we don't expect anything catastrophic. However we won't rely solely on the subcontractor to inform us. Each member of the team will be out in the field with the subcontractor over the inspection period.

   AC – Reese or Aaron will check in everyday. A sheet will be put together for appropriate chain of contact.

3. Schedule Constraints

   JE – We need to establish the expectations for the schedule today. Based on the MSA data and corrosion in the siphon, we are afraid that the this may be a "sleeper" problem. So getting started sooner is better.

   RL – Data processing always runs over. CCTV is instantaneous. Contractors always quote four weeks for processing of the quantitative data, but processing always takes longer. We need to move quickly in contacting the inspection firms as summer is their busiest time of year.

   AC – It would be good to complete the initial screening for CCTV completed in the early summer and it would be reasonable to receive the additional data by the end of summer. We should get the schedule WRF expansion and put together a schedule for the condition assessment to share with the plant.

   RL – Are there any scheduling constraints that we should be aware of? The contractors will want to work over a 24 hour period occasionally.

   JE – Noise ordinance is typical with work allowed between 7:00 am to 7:00 pm.

AC – City staff will be available during the work week but should keep in mind that access to staff will be limited over the 4th of July

RM – Don't want overruns to occur into the weekends. Prefer not to do any of the riskier inspection work on a Friday as it is hard to get access to contractors on week-ends in case anything goes wrong.

AC – A detailed MH to MH schedule needs to be produced and can be put on the website as a first line of communication. If any loud equipment is brought on site, a decibel meter should be available and the property owners should be contacted for their schedules.

4. Hydraulic Capacity

RL – the current understanding of the hydraulic capacity is based on the 2007 report. Are there any updates? IS the capacity of 30 mgd sufficient to support the buildout population?

JE – We need to coordinate with the SSMP and MSA to get better numbers.

AC – Aaron will coordinate with MSA to get updated numbers to BC.

Afternoon Session:

5. Inspection Technologies

KR – The city does all its own inspection work for up to 40" pipe. Use PACP, CUES, and 1500' cable.

RL – The digital scans for manholes cannot be linked into Granite XP. However, we could provide screen captures that could save Bend from purchasing the proprietary software.

RL – Laser data is important for pipe rehabilitation and developing a baseline. However, it is irrelevant if the pipe is upsized or replaced. So the hydraulic capacity issue may need to be settled before this technology is chosen.

RM – The laser technology seems susceptible to scatter. How are outliers dealt with?

RL – These are removed during data processing. One way to reduce cost is to wait for the CCTV to identify areas of concern where we can request data processing.

RL – Are we interested in Pipe penetrating radar?

RM – It is common to see voids outside the of the pipe zone in this region so this technology may not be ideal.

AC – Are cores recommended as a replacement for PPR?

RL – Generally, yes, assuming corrosion is uniform through multiple pipe segments.

RL – One subcontractor can accomplish bypass pumping at a reasonable cost. What is the City's view on bypass pumping?

RM – Bypass pumping around certain 300' to 500' sections may be reasonable.

AC – It is better to avoid bypass pumping and keep it simple. But if there is a case study on bypass pumping in this manner (4 pipes of 4") they would be willing to look at it.

RL – The City should think about the risks of bypass pumping, but BC will move forward as-suming that the inspections will occur in active flow.

6. Inspection recommendations

   a) Manholes Recommendation – Manhole Digital Scanning and Scrape and Hardness Tests

      AC – To be conservative we should try to inspect all the manholes

      RM – It probably warrants looking at every MH that allows access, however, if MH conditions are following a trend in a certain region it would be reasonable to skip a few if needed.

      AC – The easement information was not found. But keep in mind some of the manholes were actually constructed outside of the right of way.

      KR – In the past all the property owners are really easy to deal with and he doesn't foresee having any trouble getting access.

      RL – BC will contact appropriate firms and plan on inspecting every MH unless we run into any problem areas. The duration of MH inspections should take a week.

   b) Gravity Pipe Recommendations – CCTV, Sonar, 2D Laser

      AC – If the budget is reasonable, Bend is willing to look at 3D laser as well

   c) Siphon Recommendations – Winch or pulled Sonar

      RM – Is it possible that the plant flow was miscalculated or there is another reason other than a leak in the siphon for the flow discrepancy pointed out by MSA?

      RL- Definitely need to double check how the flow meters were calibrated. It is a good idea to put another flow meter on each end of the siphon to recheck the plant data before going ahead with a more expensive inspection technology to find a leak in the siphon if that isn't the problem

      KR – It might be possible to demo a pulse Doppler to recheck the flows, however, Bend will need to verify the data most likely using a subcontractor.

      AC – The City's inclined to give the go ahead and use Sonar. The money is already allocated for this inspection, but go ahead and contact a flow metering company as well.

      RL – BC will contact a flow metering company as well. Also does Bend have any recommendations for local contractors to use to get access to the siphon?

      AC – Will check in with Scott at the WRF for any recommendations.

      AC – What is BCs initial recommendation in terms of inspection firms?

      RL – Redzone due to their extensive experience, especially with larger distances on bigger park. However, we have reservations about the fact they don't have real time feedback on the float. The Responder does have real-time.

      AC – It would be interesting to push back on Redzone about the responder.

      RL – BC will put together a summary cost sheet similar to a bid form and a schedule of availability for the subcontactors.

7. Final thoughts

   AC – The City needs to think about the field work pre-meeting and develop questions associated with risk. If Rob would be willing to call in for a discussion or put together a template of typical questions asked, it would be appreciated.

   RM – We should wait to pilot PPR until after the inspections have been completed to see if we can identify a problem area.

Action Items

- AC to get updated hydraulic capacity numbers to BC
- BC to put together a cost spreadsheet and subcontractor schedule

Appendix B: Inspection Technology Memorandum

Technical Memorandum

6500 SW Macadam Ave, Suite 200
Portland OR, 97209

T: 503-244-7005
F: 503-244-9095

Prepared for: City of Bend

Project Title: Bend Plant Interceptor Condition Assessment

Project No.: 144338

Technical Memorandum

Subject: Basis of Inspection Technology Selection

To: Aaron Collett, P.E.

From: Rob Lee, P.E.

Prepared by: Robert K. Lee, P.E. 82099 (12/14)
Name, License No., Expiration

Limitations:

This document was prepared solely for the City of Bend in accordance with professional standards at the time the services were performed and in accordance with the contract between the City of Bend and Brown and Caldwell dated April 15, 2013. This document is governed by the specific scope of work authorized by the City of Bend; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by the City of Bend and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

Table of Contents

Introduction 1
Section 1: Current Inspection Technologies 1
1.1 Visual Inspection Methods 1
1.1.1 Traditional CCTV 1
1.1.2 Digital Pipeline Scanning 2
1.2 Quantitative Inspection Methods 2
1.2.1 Laser Profiling and Scanning 2
1.2.2 Sonar Profiling 3
1.2.3 Pipe Penetrating Radar 3
Section 2: Inspection Technology Recommendations 4

List of Figures

Figure 1. CCTV Screenshots 1
Figure 2. Digital Scanner (left), 360 Degree Scanned Image (center) and Scan to Flat Image (right) 2
Figure 3. CCTV (Left) and CCTV with 2D Laser Profiler (Right) 3
Figure 4. Sonar only (Left) and sonar combined with CCTV (Right) 3
Figure 5. Robotic PPR sensors detect voids and measures pipe wall 4

Introduction

The City of Bend's (City) sanitary collection system provides sewer collection via a mix of gravity and pressure sewer system for the developed areas of the City. The collected wastewater is then transported through the Plant Interceptor five miles to the City's Water Reclamation Facility. The City is planning to conduct an inspection on the Plant Interceptor to identify areas of required maintenance as well as any defects that may compromise the sewer's future structural and operational integrity.

Section 1: Current Inspection Technologies

A wide variety of sewer inspection technologies are available. This section provides an overview, benefits and drawbacks of a few technologies that are used in gravity and pressure sewers. This information can be used to assist Bend in making decisions with regards to future inspections.

1.1 Visual Inspection Methods

Visual inspection methods are qualitative and require that the pipe contains only partial flow to allow visual inspection of the pipe interior. Each of these technologies utilizes a remote-control transporter (track, wheel, or float) with a camera mount that is coupled via a coaxial cable to a computer control system in a truck/van. The cable tether relays real-time visual observation data to the operator. The operator controls the camera and will focus, pan, tilt or zoom the camera to investigate potential defects. The operator then makes notes of visual observations. Multiple techologies fall within the category of visual inspection technolgoies and are discussed below.

1.1.1 Traditional CCTV

CCTV inspection is an analog video technology that is the primary technology used by most cities and utilities to assess sewer conditions. Due to the wide use of this technology, industry standards have been developed and the large number of competing contractors keeps the inspection technology economical. However, CCTV cannot be used to take physical measurements, is unable to provide information below the water surface and is limited by the cable length, usually greater than 1500 feet.

Figure 1. CCTV Screenshots

1.1.2 Digital Pipeline Scanning

Digital scanning is a method of inspection that uses a digital optical sensor to scan the inner surface of pipelines capturing multiple images per second. Once the data is processed the images are used to produce a high resolution video with a variety of viewing option including an unfolded view which allows use of measurement tools. Benefits of this technology include the high quality output that allows the ability to re-review the data in the office as well as make measurements. Some of the drawbacks include the expense of these inspections, the large file size requiring increased data storage capacity and some systems cannot provide the true pipe shape as the images are wrapped into a perfect circular shape. The digital pipeline scanning can also be used for 3-D scanning of a manhole.

Figure 2. Digital Scanner (left), 360 Degree Scanned Image (center) and Scan to Flat Image (right)

1.2 Quantitative Inspection Methods

1.2.1 Laser Profiling and Scanning

Laser profiling and scanning is an emerging technology that is often used to supplement visual inspection technologies such as CCTV. Laser profiling systems, also commonly known as 2D laser profiling, consist of a laser wand mounted to a camera transporter. Laser profilers project a ring of laser light onto the wall of the pipeline in a circular pattern and geometric measurements are built from the visual interpretation of the data. The laser profiler can be used in low visibility conditions and provides information such as accurate pipeline dimensions and shape, protruding lateral length, water depth, deformations, pipe wall material loss, offset joint distance, and finally sediment depth measurements in dry pipes. However, the data requires extensive post-processing and has a high cost.

Laser scanning, also commonly known as 3D laser scanning, uses multiple sensors to measure the time of flight or the time required for the laser signal to be returned back to the sensor. Laser scanning provides additional benefits over 2D such as reduced occurrence of misalignment within the pipe, more precise measurement of defects and multiple point measurement of individual points allows an averaging benefit. However, 3D laser scanning is more costly and results in much more cumbersome data deliverables.

Figure 3 shows an example of laser profiling.

Figure 3. CCTV (Left) and CCTV with 2D Laser Profiler (Right)

1.2.2 Sonar Profiling

Sonar profiling technology is increasing in popularity and is often coupled with a visual inspection technology when the pipe has partial flow. Unlike visual inspection or laser profiling and scanning, sonar profiling occurs below the water surface and measures the speed and distance of travel of acoustic sound in water. Sonar profiling systems consist of a sonar emitting head mounted to a camera transporter such as a moving boat platform or multi-sensor inspection transporter. Similarly to the visual inspection technologies, sonar is normally coupled to a computer control system via a coaxial cable. Sonar profiling can provide high quality data when visual inspections are difficult due to high water level. Similarly to laser profiling, sonar is used to make measurements of pipeline dimensions and shape, protruding lateral length, water depth, deformations, pipe wall material loss, offset joint distance, and finally volume of sediment deposition. Drawbacks to this technology include specialized post-processing of data, limited system availability in the Pacific Northwest, and inability to obtain precise measurements.

Figure 4 shows examples of sonar profiling output.

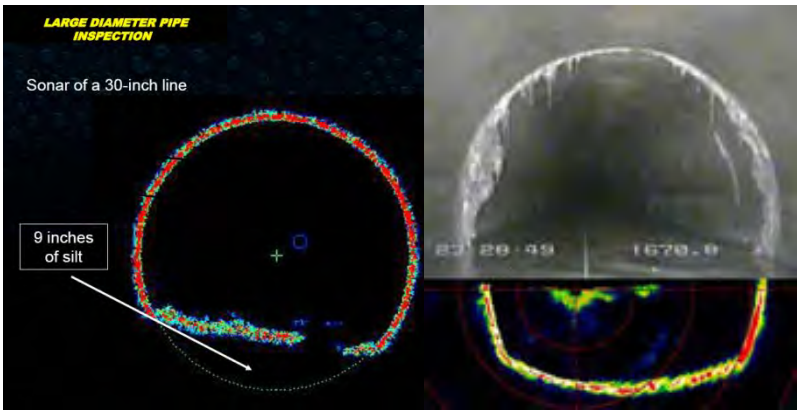


Figure 4. Sonar only (Left) and sonar combined with CCTV (Right)

1.2.3 Pipe Penetrating Radar

Pipe Penetrating Radar (PPR) employs radio waves to profile a sewer pipe. Signal penetration depth is dependent on the dielectric properties of the pipe and the host material and on the antenna frequency. Detectability of targets in the ground depends on their size, shape and orientation relative to the antennas, contrast with the host medium as well as external radio frequency noise and interferences. PPR can be used to detect pipe wall fractures, changes in material, reinforcement location and placement, presence of voids

outside the pipe wall, and pipe wall thickness. The primary factor determining signal penetration is the conductivity of the soil, therefore it is important to note that PPR works only where traditional "above ground" GPR does not. PPR requires proprietary software to process the data. In addition, PPR is not exact and requires coring and excavation to calibrate the results.

Figure 5 shows a graphic depicting the theory of PPR.

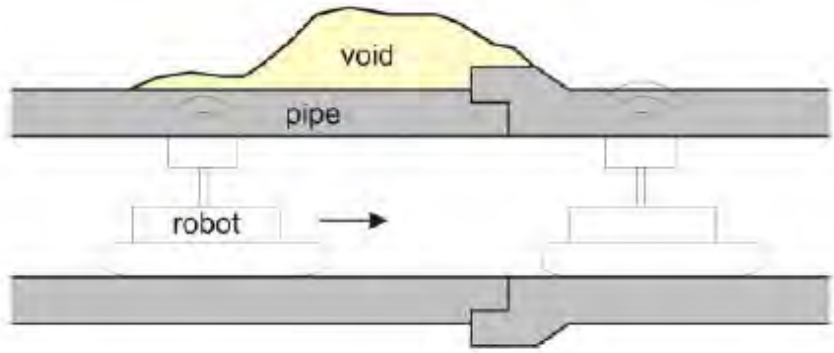


Figure 5. Robotic PPR sensors detect voids and measures pipe wall

Section 2: Inspection Technology Recommendations

The City of Bend has placed an emphasis on the obtaining high quality qualitative and quantitative data that can be used to assess pipe condition for future decisions. Based on this primary critical success factor the following technologies were recommended and selected to conduct the inspections.

- Manhole inspections – Manhole digital scanning with scraping and hardness tests
- Gravity Sewer Inspections- CCTV or digital scanning, sonar profiling, and laser profiling
- Pressure Sewer Inspections – Sonar profiling

Digital scans will be taken of each manhole. The 360 degree view will capture any visible defects within the manhole. The scraping and hardness tests will provide insight into the condition of the manhole walls. Inspection of the gravity sewer will primarily be conducted using CCTV or digital scanning with sonar profiling to assess the condition of the PI below the flow line. Laser data will be collected but not post-processed until after the review of the visual data has been completed and assessed. The laser data will be valuable both in confirming any visible evidence of corrosion, providing data needed for future rehabilitation design, and to baseline the interior dimensions of the pipe to compare against future inspections. The siphons will be inspected using sonar only due to full pipe nature of the siphons.

PPR was not recommended or selected due to the wide-variability of manufacturing standards of concrete pipe and the need for excavation and confirmatory corings. Other developing technologies, such as Electro-Scanning, require infeasible conditions (e.g., completely full pipes) or are not available in the diameters and lengths of the PI.

Appendix C: Property Owner Handouts

Notification of Sewer Inspection Work

Type of Work: Pipeline Inspections / Manhole Inspections

Work to Occur:_____

Typical Truck and Crew Performing Sewer Inspection Work

Questions about the project?	**Questions about scheduling or access?**
Robert Lee (Primary Contact) Brown and Caldwell 503-977-6625 roblee@brwncald.com	John Graham (Primary contact) Field Oversight 541-337-2186 john.graham@nwps.info
Aaron Collett Project Manager City of Bend 541-693-2194	Andy Zachodni Field Superintendent RedZone Robotics 724-462-8669

(Please see other side for more information)

Notification of Sewer Inspection Work

Type of Work: Pipeline Inspections / Manhole Inspections

Work to Occur:_____

As described in the information packet sent to you on June 19, the City of Bend (City) will be conducting inspections of the Plant Interceptor, the City's primary source of conveyance of sanitary sewage to the City's Water Reclamation Facility.

The City has retained Brown and Caldwell (BC) to assist with inspections. BC has hired RedZone Robotics to perform the inspections. The inspections will require access to the sanitary sewer manholes located on or adjacent to your property. The work at the manholes will consist of accessing the manholes with box trucks containing the inspection equipment (see photo on opposite side). **There will never be a need for anyone to ever enter your house.**

In addition to this door hanger, you will also receive a courtesy phone call 24 hours in advance of the need to access your property to conduct the inspection work. There may be the need to access your property on a two separate occasions, one to inspect the pipeline and other to inspect the manholes. You will receive another copy of this door hanger and a courtesy phone call prior to that 2nd inspection.

If you have any general questions regarding the project, please contact Rob Lee of Brown and Caldwell. If you have scheduling or access questions or concerns, please contact John Graham. Contact information is listed on the opposite side of this hanger.

(Please see other side for more information)

City of Bend Plant Interceptor Inspection Project

Background Information Packet

The City of Bend's (City) sanitary collection system provides sewer collection via a mix of gravity and pressure sewer system for the developed areas of the City. The collected wastewater is then transported through the Plant Interceptor five miles to the City's Water Reclamation Facility. The City needs to conduct an inspection on the Plant Interceptor to identify areas of required maintenance as well as any defects that may compromise the sewer's future structural and operational integrity.

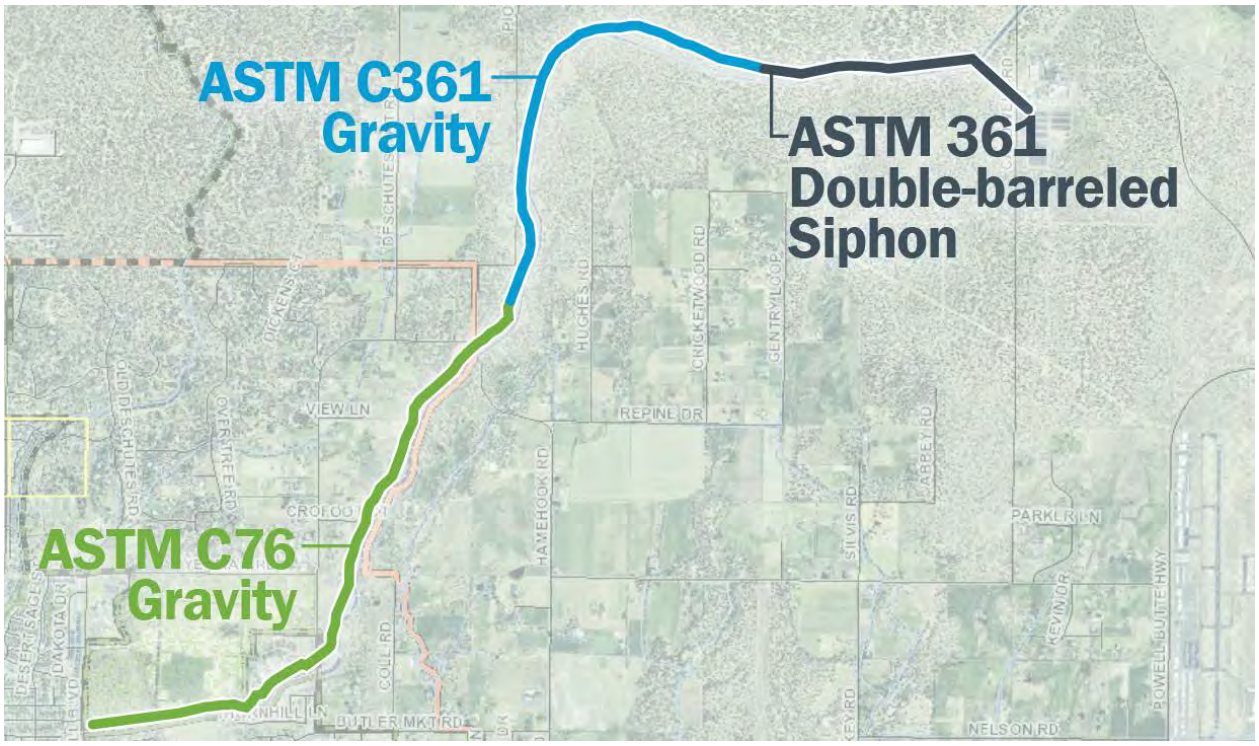


Figure 1. Three distinct components of the Bend Interceptor Sewer

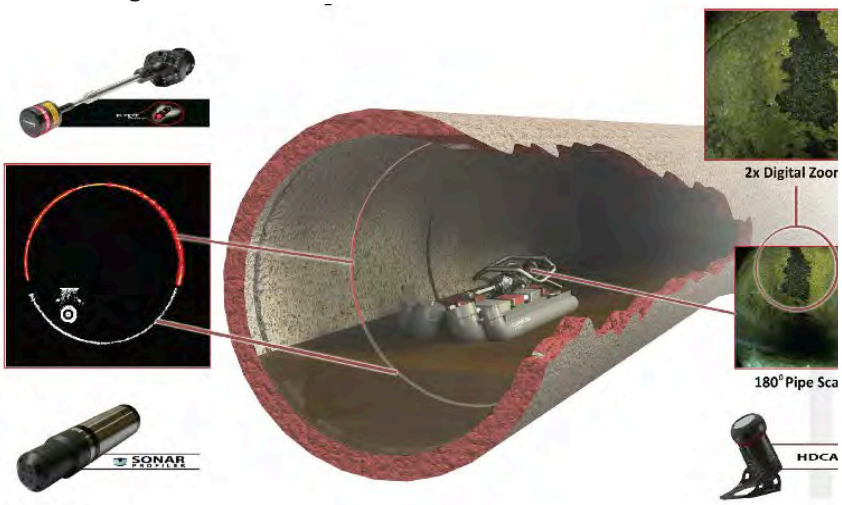
Overview of Inspection Process

To accomplish this task, the City has retained a consulting engineering firm, Brown and Caldwell, to conduct the inspections. Brown and Caldwell has retained inspection firms and will use several different inspection technologies including digital scanning, closed-circuit television (CCTV), sonar, and laser scanning to obtain a complete understanding of this critical pipe's condition. Representative photos of the various equipment are shown in Figure 2.

Digital manhole scanner

Float CCTV

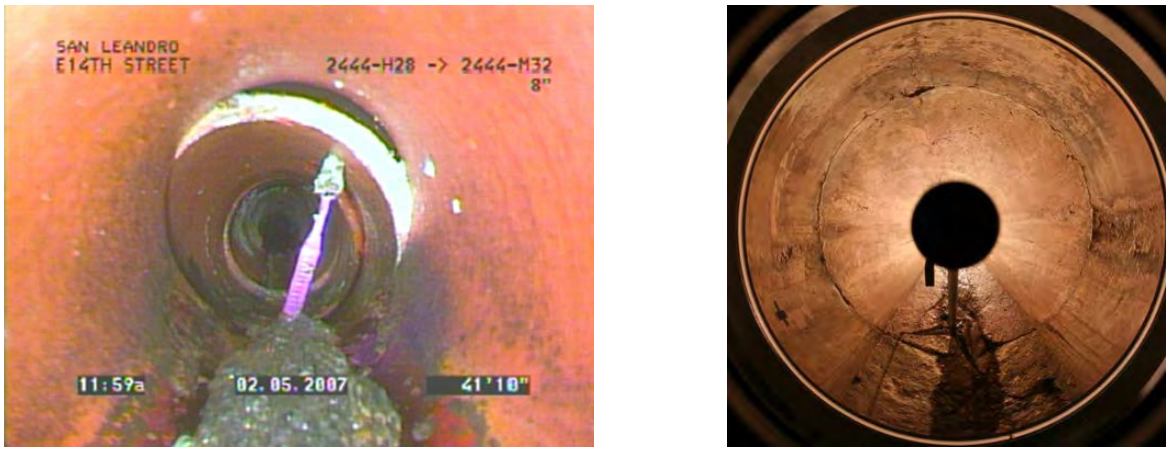
Sonar



Laser

Figure 2. Inspection equipment

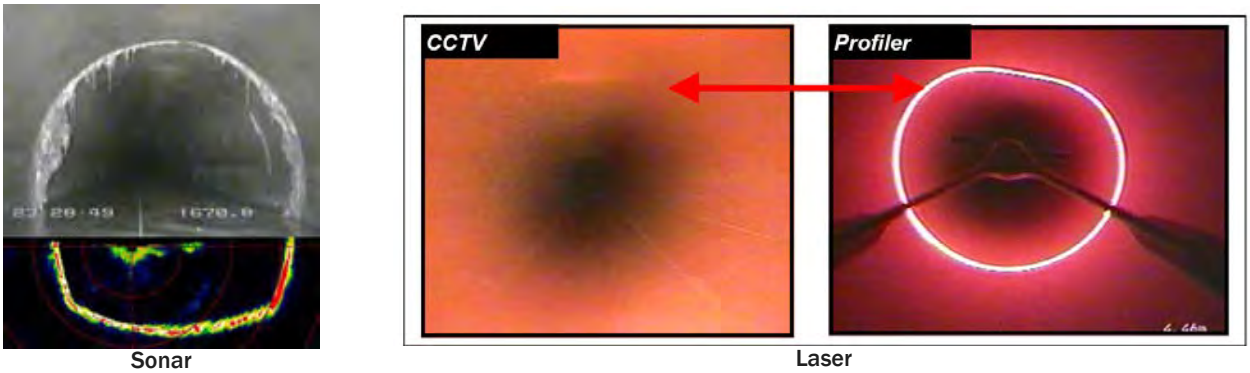
Digital scanning and CCTV technology take pictures above the water surface of the pipe interior (Figure 3). Defects within the pipe are identified by visually reviewing the video footage and/or digital scans.



CCTV Digital

Figure 3. Examples of CCTV and digital scanning images

Sonar and laser technologies can be used when portions of the pipe are submerged (Figure 4).



Sonar Laser

Figure 4. Images generated by sonar and laser scanning technologies

Inspection activity will take up to 10 hours at each access point or manhole. At each manhole, digital scans will be taken of the interior to record manhole quality. In addition, a worker will enter the space to test the hardness of the cement within each manhole. Finally, inspection equipment will be lowered into the sewer system; the inspection equipment will either drive or float between manholes, while recording data for the length of that sewer segment. As the data is being collected, video inspection personnel remain in the vehicles to monitor the path of the inspection equipment as well as the quality of data. A winch lowering a camera into a manhole is shown in Figure 5.

Figure 5. Lowering equipment into sewer system

Figure 6 shows typical trucks used for on site CCTV work. This truck and crew will need to gain access to the manholes and remain parked at the manhole for the duration of the inspection.

Figure 6. CCTV trucks

Disturbance and Restoration

The timing of the work is aimed to be at the driest time of the year when vehicle access to the manholes will result in the least amount of disturbance. Figure 7 shows typical site access conditions.

Figure 7. Typical manhole location conditions of the Plant Interceptor

Preconstruction photos will be taken both by City representatives and the inspection firm to document the conditions of your property prior to commencing the work. After the work is complete, the area will be restored to best possible preconstruction conditions. Since inspection work is an all above-ground activities, restoration activities are anticipated to be relatively minor.

If you have any concerns or questions about the project, please contact:

Aaron Collett, P.E., Project Manager
City of Bend
541-693-2194

Robert Lee, P.E.
Brown and Caldwell
503-977-6625 (office)
503-828-7542 (mobile)

Appendix D: Intertie Slab Removal, Storage, and Replacement Specification

SECTION 13900

MODIFICATION TO EXISTING STRUCTURES

PART 1--GENERAL

1.01 DESCRIPTION

A. Furnish all labor, material, equipment including any associated incidentals required to modify the existing Plant Influent Intertie Box (Intertie Box) specified in this Section. Throughout the execution of this project, coordinate work so as not to interrupt existing operations and protect those portions of the facilities being operated by plant staff from dust, debris, water, sludge or other damage resulting from construction activities.

B. Prior to initiating modification work, field verify all pertinent features of existing facilities, including but not limited to the Intertie Box. The Contractor is responsible for identifying and resolving conflicts between existing facilities and modification work. Coordinate with the Owner work hour restrictions and access to the Water Reclamation Facility (WRF). Plan the modification work such that field verification, conflict identification, conflict resolution, and Engineer and Owner approval are accomplished prior to initiating modification work in the field.

1.02 SUBMITTALS

A. Submit a detailed plan outlining all work activities including proposed works hours and locations of ingress egress, any proposed modifications to the actual Intertie Box for the purposes of conducting the inspections, and proposed methods for removing, storing and protecting, and replacing the Intertie Box top slab. Include in the plan methods of restricting unauthorized access to the Intertie Box while the top slab is removed, and contingency plans in the case of heavy rainfall while the Intertie Box is uncovered. The plan must be submitted to the Engineer for approval prior to conducting any work.

PART 2--PRODUCTS

2.01 TOPSLAB HYDROPHILIC WATERSTOP SEALANT

A. Technical data sheet on proposed sealant. Sealant shall be a gunnable mastic hydrophilic waterstop suitable for being placed between existing concrete interfaces. Sealant shall be DeNeef SwellSeal WA, or approved equal.

PART 3--EXECUTION

3.01 GENERAL STRUCTURAL MODIFICATIONS

A. Perform all work, herein specified or as necessary to permit completion of the inspection work. The Work shall include removing the Intertie Box top slab, storing and protecting the slab adjacent to the structure, and resealing and replacing the slab after the inspection work has been completed.

3.02 SIPHON ACCESS STRUCTURE

A. The Intertie Box top slab is approximately 9’10” x 6’ x 1’. Four lifting eyes are available for removing the top slab. The structure is depicted in Figures 1-4. Figure 5 (included at the end of this Section) is an overall plan view showing the location of the Intertie Box relative to the WRF grounds.

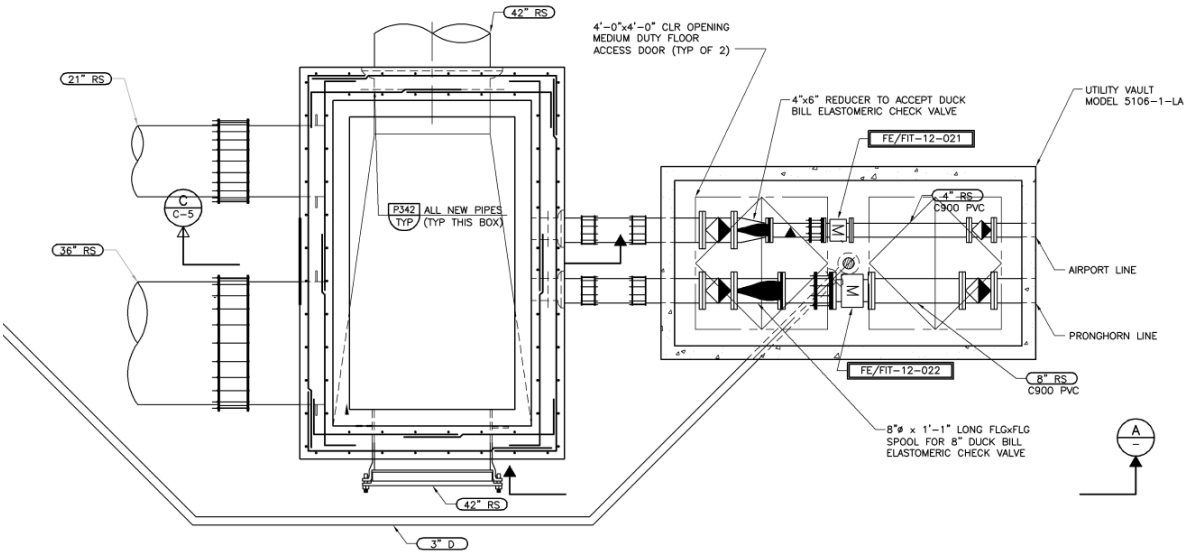


Figure 1. Plan View of the Intertie Box

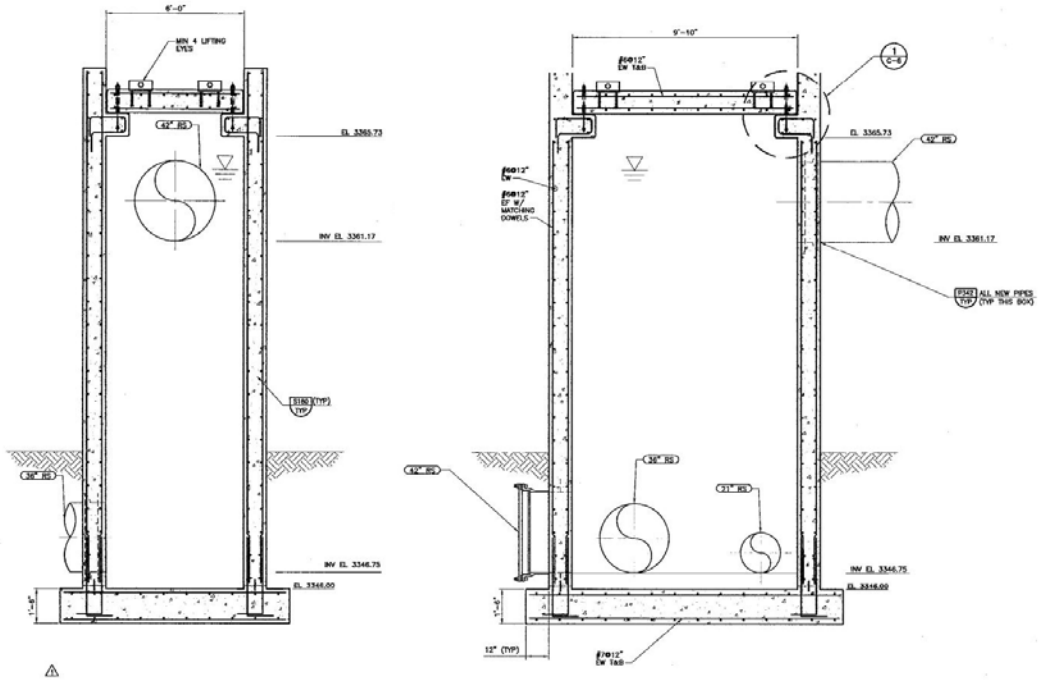


Figure 2. Cross-sections of the Intertie Box

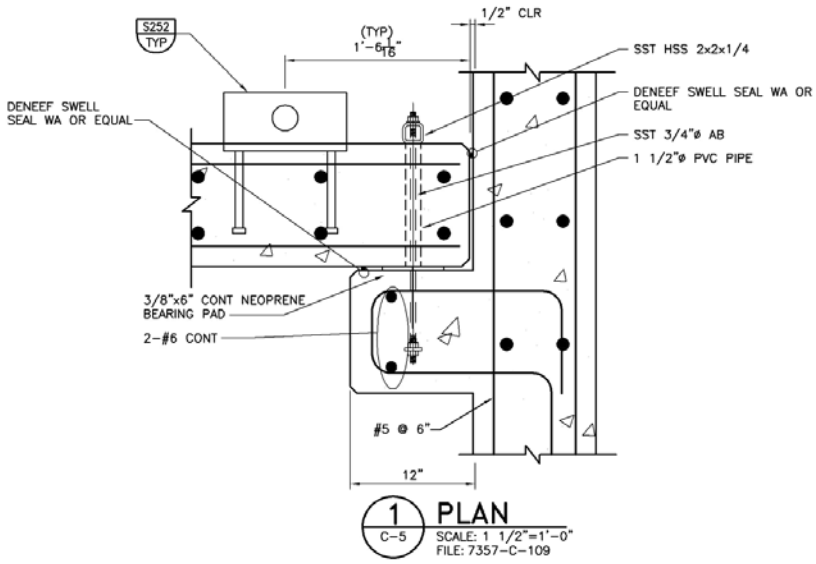


Figure 3. Detail of Intertie Box Top Slab Interface with Ledge

Figure 4. Photo of Intertie Box

3.03 TOP SLAB REMOVAL AND PROTECTION

A. Use existing lifting eyes to remove top slab. Other means of attaching equipment to the top slab will not be allowed unless authorized in writing by the Owner.

B. Store and protect top slab for the duration of the inspection work.

C. Restrict access to the Intertie Box in a manner approved by the Owner at all times while the top slab is removed.

3.04 TOP SLAB REPLACEMENT

A. Anchors placed in existing concrete shall be stainless steel and cut flush and covered with metallic aggregate grout, Masters Builders Embeco 636, or equal, ~~cementitious or epoxy grout~~ after completion of modification work. All loose or unsound material adjacent to the opening shall be removed and, if necessary, replaced with new material.

B. Remove all loose or unsound material and apply two continuous 1/2-inch beads of hydrophilic sealant all around on the Intertie Box ledge in accordance with Figure 3.

C. Prior to replacing lid, the Owner must provide approval of the acceptability of the existing structure to receive the lid.

3.05 FINAL INSPECTION

A. A final visual inspection will be made by the Engineer after replacement of the top slab. Any deficiencies evident will be marked and Contractor shall repair such deficiencies.

B. Upon successful replacement of the top slab, remove surplus materials, protective coverings, and accumulated rubbish. Restore any impacted areas to the satisfaction of the Owner.

PART 4--MEASUREMENT AND PAYMENT

4.01 GENERAL

A. The work shall be conducted under a time and materials basis for all labor and equipment specifically for the removal, storage and protection, and replacement of the top slab. Labor related to the inspection work is included in the unit costs for the inspection and will not be counted.

END OF SECTION

Appendix E: RedZone Robotics Final Report

Bend Utilities Division
- Plant Interceptor Condition Assessment V4.0

Reported Lines

CMH000294 - WRF Intertie Box

For

Brown AND Caldwell

27 September 2013

RedZone® ROBOTICS

©2013

TABLE OF CONTENTS

Project Overview Tables **6**
Report Interpretation - Laser **9**
Report Interpretation - Sonar **10**
Report Interpretation - Combined **11**
Flat Graph Summary **12**
CMH000175 - CSS000001 - Overview 22
CMH000175 - CSS000001 - Debris Graph Table 24
CMH000175 - CSS000001 - Observation Report 25

CMH000176 - CMH000207 - Overview 31
CMH000176 - CMH000207 - Debris Graph Table 33
CMH000176 - CMH000207 - Observation Report 34

CMH000177 - CMH000175 - Overview 40
CMH000177 - CMH000175 - Debris Graph Table 41
CMH000177 - CMH000175 - Observation Report 42

CMH000178 - CMH000177 - Overview 46
CMH000178 - CMH000177 - Debris Graph Table 48
CMH000178 - CMH000177 - Observation Report 49

CMH000179 - CMH000178 - Overview 55
CMH000179 - CMH000178 - Debris Graph Table 57
CMH000179 - CMH000178 - Observation Report 58

CMH000180 - CMH000179 - Overview 64
CMH000180 - CMH000179 - Debris Graph Table 65
CMH000180 - CMH000179 - Observation Report 66

CMH000181 - CMH000180 - Overview 71
CMH000181 - CMH000180 - Debris Graph Table 73
CMH000181 - CMH000180 - Observation Report 74

CMH000183 - CMH000181 - Overview 80
CMH000183 - CMH000181 - Debris Graph Table 82
CMH000183 - CMH000181 - Observation Report 83

©2013

TABLE OF CONTENTS

CMH000184 - CMH000183 - Overview 89
CMH000184 - CMH000183 - Debris Graph Table 91
CMH000184 - CMH000183 - Observation Report 92

CMH000185 - CMH000184 - Overview 99
CMH000185 - CMH000184 - Debris Graph Table 100
CMH000185 - CMH000184 - Observation Report 101

CMH000186 - CMH000185 - Overview 106
CMH000186 - CMH000185 - Debris Graph Table 108
CMH000186 - CMH000185 - Observation Report 109

CMH000187 - CMH000186 - Overview 116
CMH000187 - CMH000186 - Debris Graph Table 118
CMH000187 - CMH000186 - Observation Report 119

CMH000188 - CMH000187 - Overview 125
CMH000188 - CMH000187 - Debris Graph Table 126
CMH000188 - CMH000187 - Observation Report 127

CMH000189 - CMH000188 - Overview 131
CMH000189 - CMH000188 - Debris Graph Table 133
CMH000189 - CMH000188 - Observation Report 134

CMH000190 - CMH000189 - Overview 141
CMH000190 - CMH000189 - Debris Graph Table 142
CMH000190 - CMH000189 - Observation Report 143

CMH000191 - CMH000190 - Overview 148
CMH000191 - CMH000190 - Debris Graph Table 149
CMH000191 - CMH000190 - Observation Report 150

CMH000192 - CMH000191 - Overview 153
CMH000192 - CMH000191 - Debris Graph Table 155
CMH000192 - CMH000191 - Observation Report 156

©2013

TABLE OF CONTENTS

CMH000193 - CMH000192 - Overview 162
CMH000193 - CMH000192 - Debris Graph Table 163
CMH000193 - CMH000192 - Observation Report 164

CMH000194 - CMH000193 - Overview 167
CMH000194 - CMH000193 - Debris Graph Table 169
CMH000194 - CMH000193 - Observation Report 170

CMH000196 - CMH000194 - Overview 176
CMH000196 - CMH000194 - Debris Graph Table 177
CMH000196 - CMH000194 - Observation Report 178

CMH000198 - CMH000196 - Overview 183
CMH000198 - CMH000196 - Debris Graph Table 185
CMH000198 - CMH000196 - Observation Report 186

CMH000199 - CMH000198 - Overview 192
CMH000199 - CMH000198 - Debris Graph Table 194
CMH000199 - CMH000198 - Observation Report 195

CMH000200 - CMH000199 - Overview 201
CMH000200 - CMH000199 - Debris Graph Table 202
CMH000200 - CMH000199 - Observation Report 203

CMH000201 - CMH000200 - Overview 207
CMH000201 - CMH000200 - Debris Graph Table 208
CMH000201 - CMH000200 - Observation Report 209

CMH000203 - CMH000201 - Overview 213
CMH000203 - CMH000201 - Debris Graph Table 215
CMH000203 - CMH000201 - Observation Report 216

CMH000204 - CMH000203 - Overview 223
CMH000204 - CMH000203 - Debris Graph Table 224
CMH000204 - CMH000203 - Observation Report 225

©2013

TABLE OF CONTENTS

CMH000205 - CMH000204 - Overview 228
CMH000205 - CMH000204 - Debris Graph Table 229
CMH000205 - CMH000204 - Observation Report 230

CMH000206 - CMH000205 - Overview 234
CMH000206 - CMH000205 - Debris Graph Table 235
CMH000206 - CMH000205 - Observation Report 236

CMH000207 - CMH000206 - Overview 240
CMH000207 - CMH000206 - Waterlevel Graph Table 242
CMH000207 - CMH000206 - Observation Report 243

CMH000235 - CMH000176 - Overview 248
CMH000235 - CMH000176 - Debris Graph Table 249
CMH000235 - CMH000176 - Observation Report 250

CMH000247 - CMH000235 - Overview 252
CMH000247 - CMH000235 - Debris Graph Table 253
CMH000247 - CMH000235 - Observation Report 254

CMH000255 - CMH000255A - Overview 257
CMH000255 - CMH000255A - Debris Graph Table 258
CMH000255 - CMH000255A - Observation Report 259

CMH000255A - CMH000247 - Overview 261
CMH000255A - CMH000247 - Debris Graph Table 262
CMH000255A - CMH000247 - Observation Report 263

CMH000262 - CMH000255 - Overview 267
CMH000262 - CMH000255 - Debris Graph Table 268
CMH000262 - CMH000255 - Observation Report 269

CMH000269 - CMH000262 - Overview 273
CMH000269 - CMH000262 - Debris Graph Table 274
CMH000269 - CMH000262 - Observation Report 275

©2013

TABLE OF CONTENTS

CMH000276 - CMH000269 - Overview 280
CMH000276 - CMH000269 - Debris Graph Table 282
CMH000276 - CMH000269 - Observation Report 283

CMH000281 - CMH000276 - Overview 289
CMH000281 - CMH000276 - Debris Graph Table 290
CMH000281 - CMH000276 - Observation Report 291

CMH000286 - CMH000281 - Overview 295
CMH000286 - CMH000281 - Debris Graph Table 297
CMH000286 - CMH000281 - Observation Report 298

CMH000290 - CMH000286 - Overview 305
CMH000290 - CMH000286 - Debris Graph Table 307
CMH000290 - CMH000286 - Observation Report 308

CMH000294 - CMH000290 - Overview 314
CMH000294 - CMH000290 - Debris Graph Table 316
CMH000294 - CMH000290 - Observation Report 317

CSS000001-WRFIntertie36in - Overview 324
CSS000001-WRFIntertie36in - Debris Graph Table 328
CSS000001-WRFIntertie36in - Observation Report 329

CSS000001-WRFIntertie21in - Overview 346
CSS000001-WRFIntertie21in - Debris Graph Table 350
CSS000001-WRFIntertie21in - Observation Report 351

Contact Details Page 368

©2013

PROJECT OVERVIEW

PROJECT OVERVIEW	
Project Name	Bend Utilities Division - Plant Interceptor Condition Assessment
Profiler System	Profiler HD - HDProfiler, HDCam, Sonar
Client	Bend Utilities Division
Contractor	RedZone Robotics
Date Profiled	July 2013
Date Reported	27 September 2013

PIPE OVERVIEW

Asset No.	Distance Profiled (ft)	Debris (ft^3)	Average Water Level (in)	Diameter (in)
CMH000175 - CSS000001	578	0	16	36
CMH000176 - CMH000207	557	1	14	30
CMH000177 - CMH000175	419	0	17	36
CMH000178 - CMH000177	591	0	17	36
CMH000179 - CMH000178	668	1	14	42
CMH000180 - CMH000179	489	0	14	42
CMH000181 - CMH000180	675	1	14	42
CMH000183 - CMH000181	618	1	13	42
CMH000184 - CMH000183	729	0	12	42
CMH000185 - CMH000184	487	0	12	42
CMH000186 - CMH000185	756	0	15	36
CMH000187 - CMH000186	655	0	14	36
CMH000188 - CMH000187	404	0	14	36
CMH000189 - CMH000188	795	1	14	36

PROJECT OVERVIEW

PROJECT OVERVIEW	
Project Name	Bend Utilities Division - Plant Interceptor Condition Assessment
Profiler System	Profiler HD - HDProfiler, HDCam, Sonar
Client	Bend Utilities Division
Contractor	RedZone Robotics
Date Profiled	July 2013
Date Reported	27 September 2013

PIPE OVERVIEW				
Asset No.	Distance Profiled (ft)	Debris (ft^3)	Average Water Level (in)	Diameter (in)
CMH000190 - CMH000189	487	0	12	36
CMH000191 - CMH000190	264	0	13	36
CMH000192 - CMH000191	615	0	13	42
CMH000193 - CMH000192	157	0	14	42
CMH000194 - CMH000193	635	1	13	42
CMH000196 - CMH000194	488	1	15	42
CMH000198 - CMH000196	590	1	15	42
CMH000199 - CMH000198	621	1	14	42
CMH000200 - CMH000199	330	0	16	36
CMH000201 - CMH000200	407	1	16	36
CMH000203 - CMH000201	732	1	16	36
CMH000204 - CMH000203	216	0	17	36
CMH000205 - CMH000204	371	0	17	36
CMH000206 - CMH000205	325	0	16	36

PROJECT OVERVIEW

PROJECT OVERVIEW	
Project Name	Bend Utilities Division - Plant Interceptor Condition Assessment
Profiler System	Profiler HD - HDProfiler, HDCam, Sonar
Client	Bend Utilities Division
Contractor	RedZone Robotics
Date Profiled	July 2013
Date Reported	27 September 2013

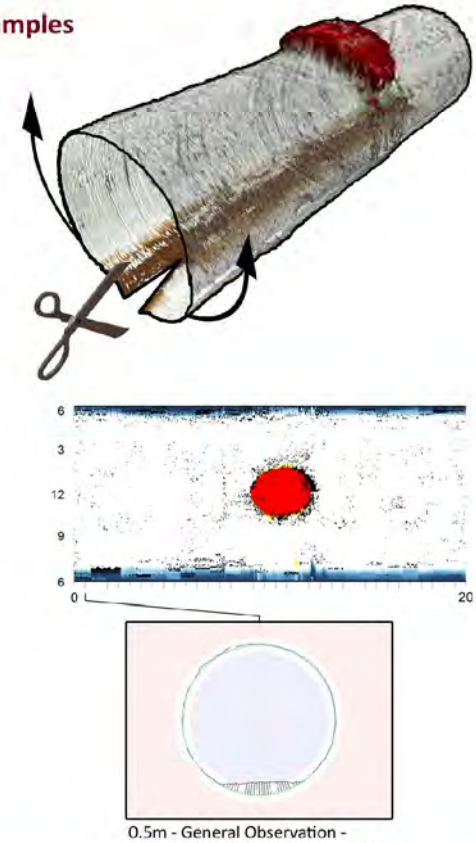
PIPE OVERVIEW				
Asset No.	Distance Profiled (ft)	Debris (ft^3)	Average Water Level (in)	Diameter (in)
CMH000207 - CMH000206	465	N/A	19	30
CMH000235 - CMH000176	144	0	13	36
CMH000247 - CMH000235	208	0	13	36
CMH000255 - CMH000255A	72	0	16	36
CMH000255A - CMH000247	319	0	16	36
CMH000262 - CMH000255	330	0	16	36
CMH000269 - CMH000262	497	0	16	36
CMH000276 - CMH000269	579	1	16	36
CMH000281 - CMH000276	376	0	16	36
CMH000286 - CMH000281	767	0	16	42
CMH000290 - CMH000286	606	1	16	42
CMH000294 - CMH000290	688	2	16	42
CSS000001-WRFIntertie36in	4786	2120	27	36
CSS000001-WRFIntertie21in	4790	83	21	21
Totals	**29286 ft**	**2218 ft^3**	**-**	**-**

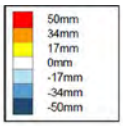
Flat Graph™

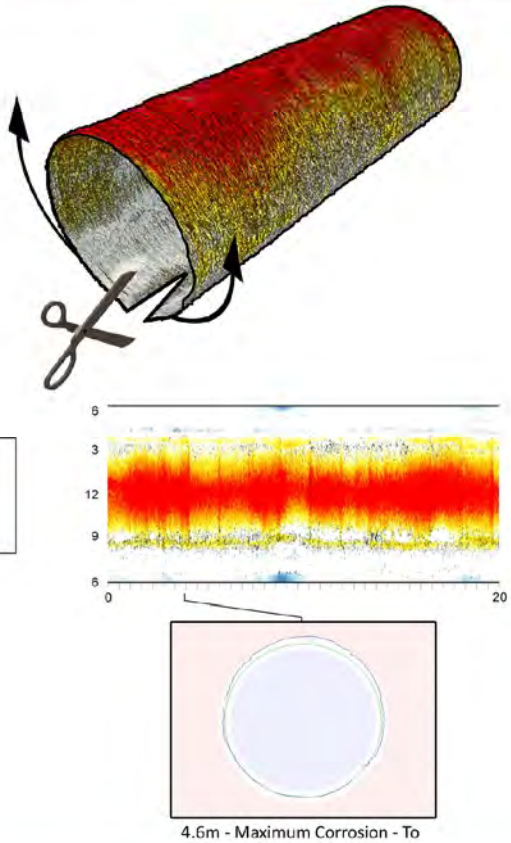
The Flat Graph is used to topographically map pipe radial variances from the reference shape and size from start to end of the pipe. Based upon this reference shape and size the Flat Graph is drawn with the pipe being split at the 6 o'clock position and flattened out. Colours represent how the data matches the reference shape by:

- Appearing white when the data lies close to the reference shape
- Appearing on a yellow to red scale when there is any deviation outside of the reference shape (e.g. corrosion)
- Appearing on a blue scale when there is any deviation inside the reference shape (e.g. debris)

Examples



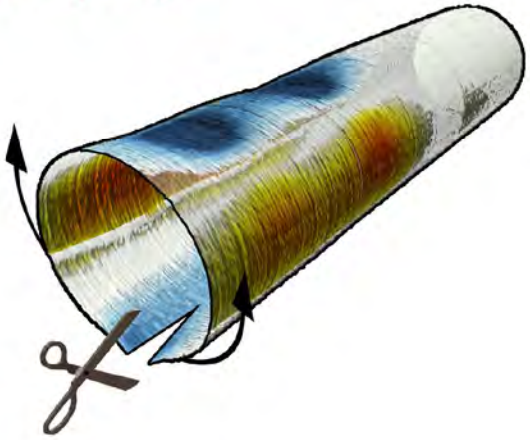


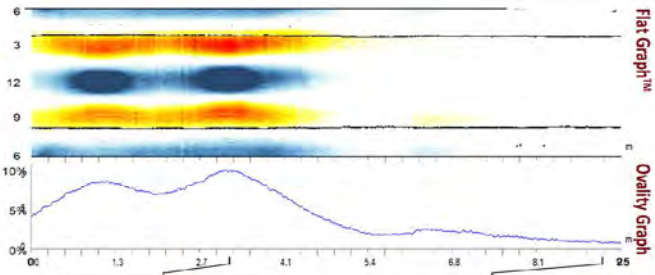


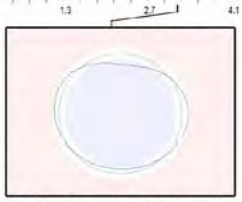
0.5m - General Observation - Corrosion to 10mm, Debris to 44mm

4.6m - Maximum Corrosion - To 67mm

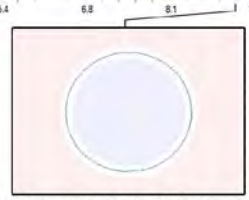
Ovality Example







9.4m - Maximum Ovality - To 10.9%



24.5m - Match to Reference Shape and Size - ø1300mm

©2013

Sonar Profiling

Sonar profiling can be achieved by mounting the Sonar Profiler in one of the two following ways:

1. In pipes ranging from 450mm to 2200mm in size (18" to 87") with a flow height from 1/3 to surcharged, the HDSub can be used.
2. In pipes ranging from 1000mm to 3000mm in size (39" to 118") with a flow height from 1/4 to 3/4, the HDFloat should be used.

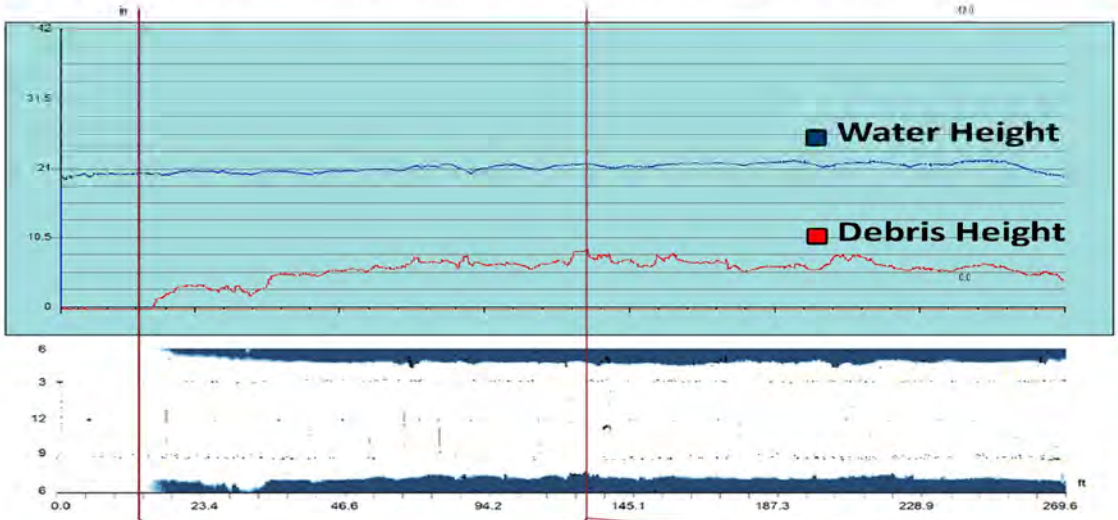
The sonar images are recorded into a video format (combined with Laser where available) which is analysed and reported using Profiler software.

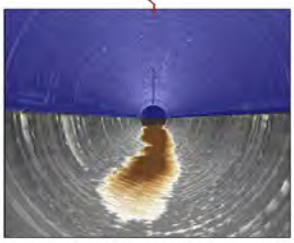
// HDSub

// HDFloat

Debris Graph

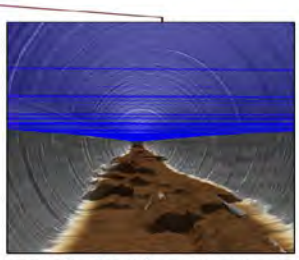
Below is an example Debris Graph with the corresponding Flat Graph™ and observations. In this example the full HD Profiler System has been used (Sonar and Laser) although both the Debris Graph and Flat Graph™ can be created with only Sonar used. The Flat Graph™ is used to topographically map pipe radial variances from the reference shape and size from start to end of pipe. The Debris Graph displays the debris and water height over the length of the asset. The average debris depth, average water level and debris volume accompany the graph in reports.





10.6ft 3D Observation - 3D Laser-Sonar Scan

128.9ft Maximum Debris - To 8.6"



128.9ft 3D Observation - 3D Laser-Sonar Scan

©2013

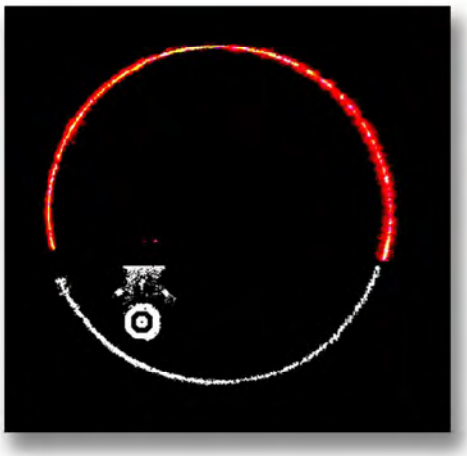
REPORT INTERPRETATION

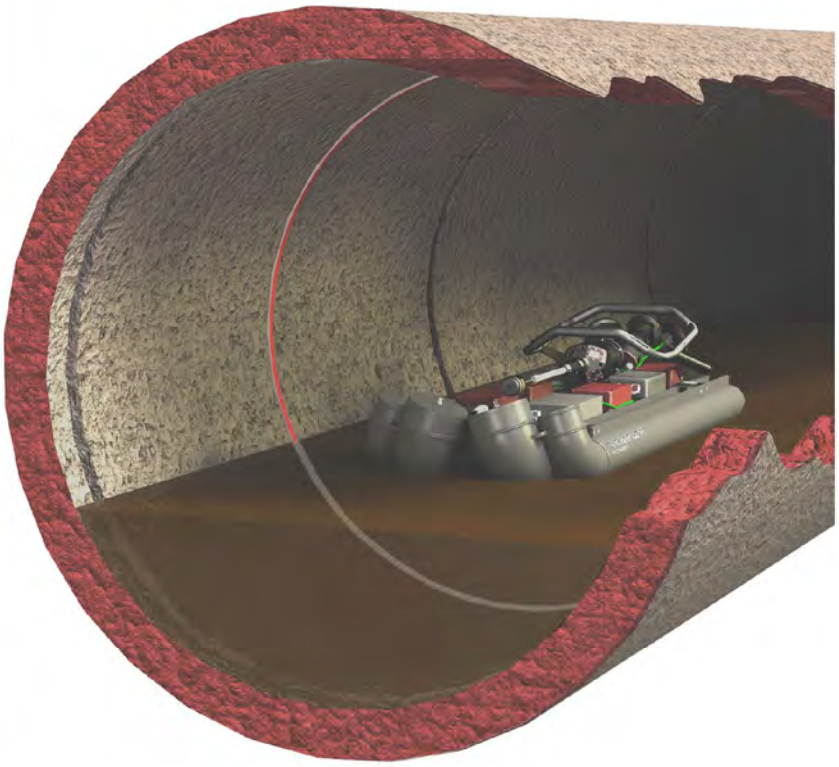
RedZone® ROBOTICS

HD Profiler System Module Overview

Through the use of the data received from both the laser and sonar a complete picture of the condition of the pipe can be ascertained. The output data from the two units is then merged into one complete inspection video that can be analysed and reported within the Profiler software. Each video frame has a corresponding FlyEye data frame, from which accurate measurements can be determined. There are approximately six laser frames for every sonar frame captured per second.

2x Digital Zoom

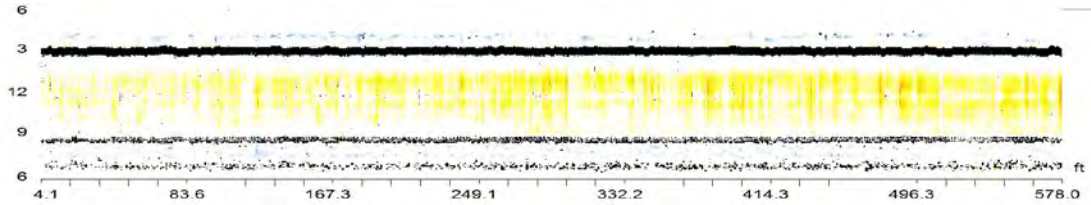




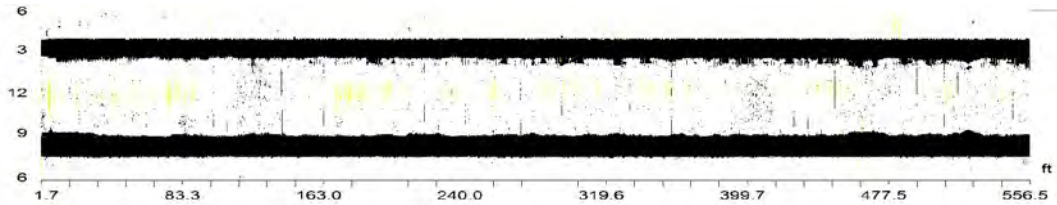
©2013

FLAT GRAPH SUMMARY

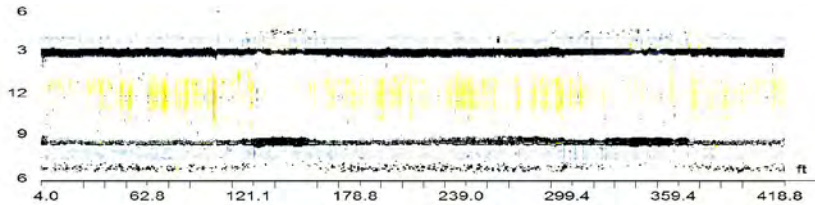
CMH000175 - CSS000001, 36in Page 22 CCTV LASER SONAR



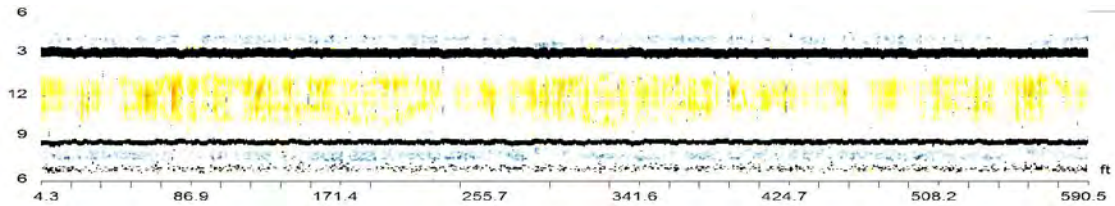
CMH000176 - CMH000207, 30in Page 31 CCTV LASER SONAR



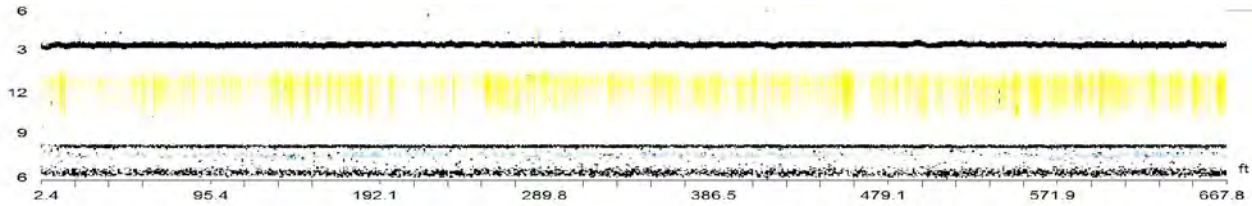
CMH000177 - CMH000175, 36in Page 40 CCTV LASER SONAR



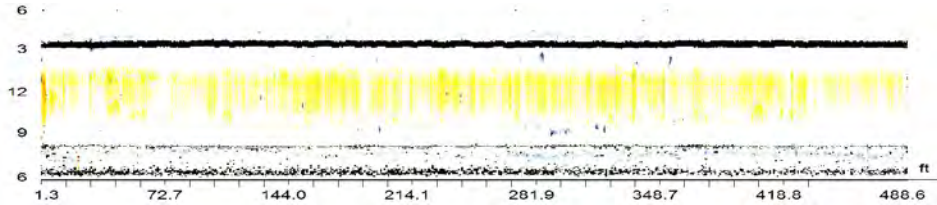
CMH000178 - CMH000177, 36in Page 46 CCTV LASER SONAR



CMH000179 - CMH000178, 42in Page 55 CCTV LASER SONAR



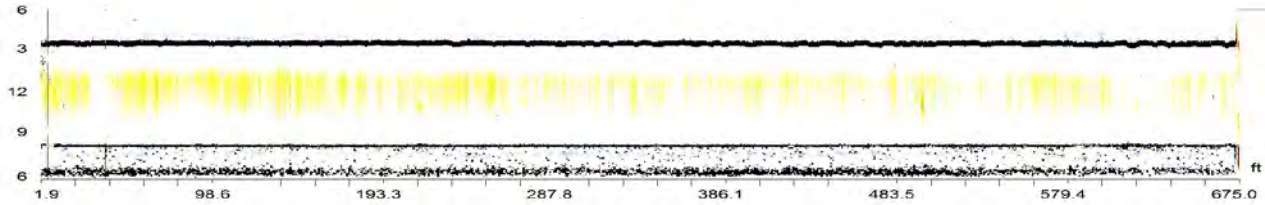
CMH000180 - CMH000179, 42in Page 64 CCTV LASER SONAR



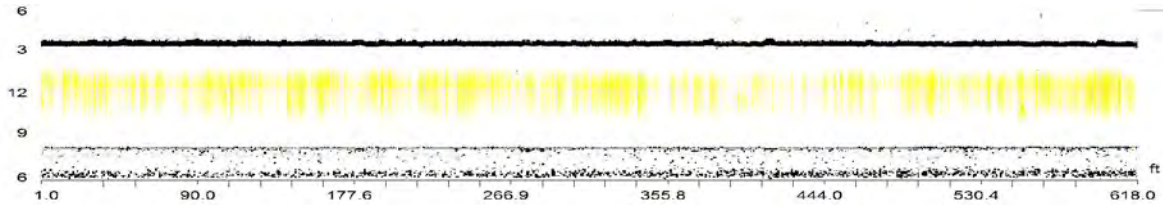
©2013

FLAT GRAPH SUMMARY

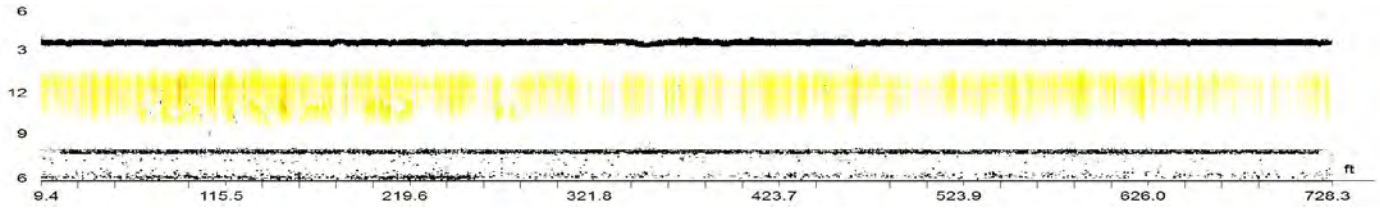
CMH000181 - CMH000180, 42in Page 71 CCTV LASER SONAR



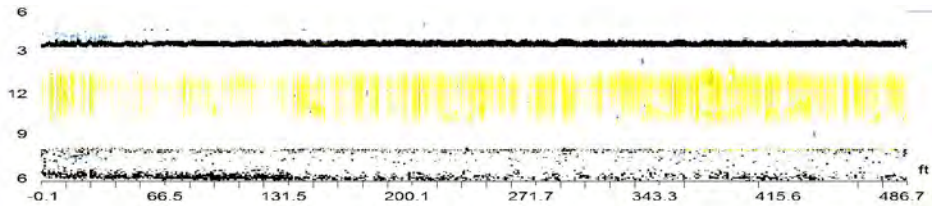
CMH000183 - CMH000181, 42in Page 80 CCTV LASER SONAR



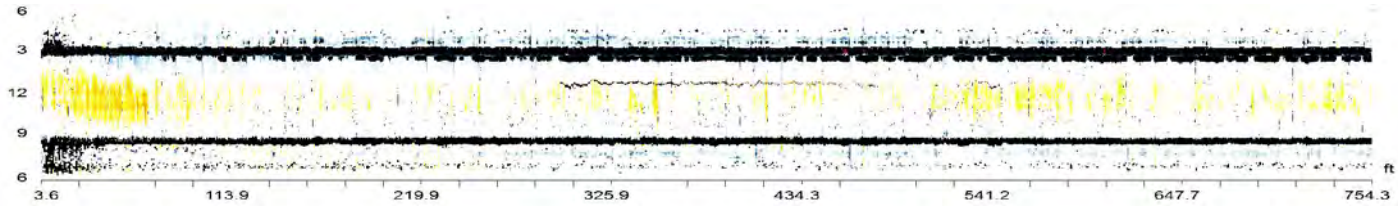
CMH000184 - CMH000183, 42in Page 89 CCTV LASER SONAR



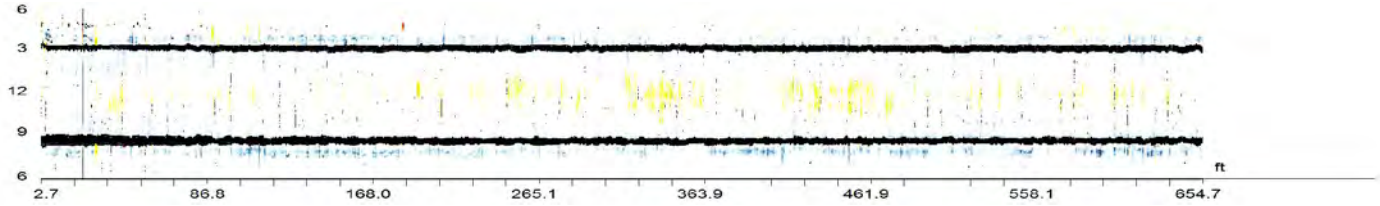
CMH000185 - CMH000184, 42in Page 99 CCTV LASER SONAR



CMH000186 - CMH000185, 36in Page 106 CCTV LASER SONAR

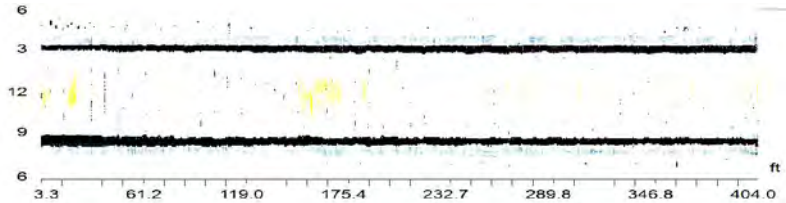


CMH000187 - CMH000186, 36in Page 116 CCTV LASER SONAR

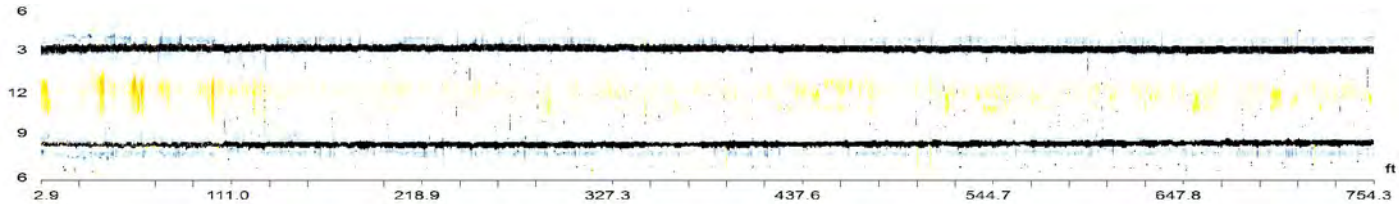


©2013

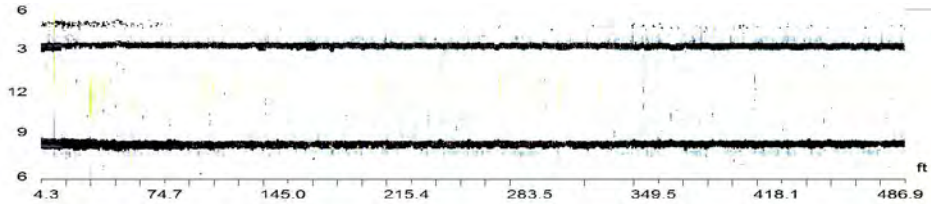
CMH000188 - CMH000187, 36in Page 125 CCTV LASER SONAR



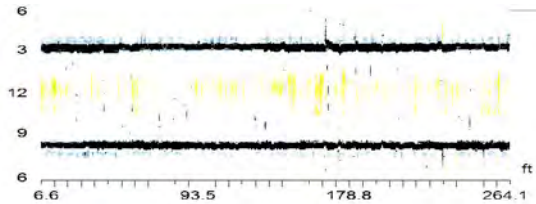
CMH000189 - CMH000188, 36in Page 131 CCTV LASER SONAR



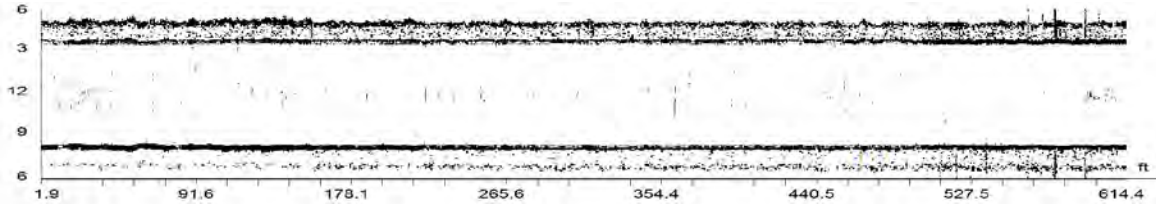
CMH000190 - CMH000189, 36in Page 141 CCTV LASER SONAR



CMH000191 - CMH000190, 36in Page 148 CCTV LASER SONAR



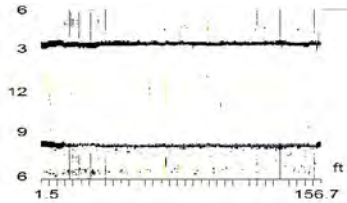
CMH000192 - CMH000191, 42in Page 153 CCTV LASER SONAR



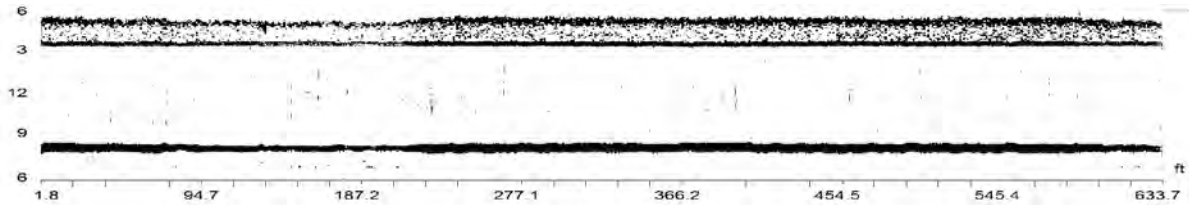
©2013

FLAT GRAPH SUMMARY

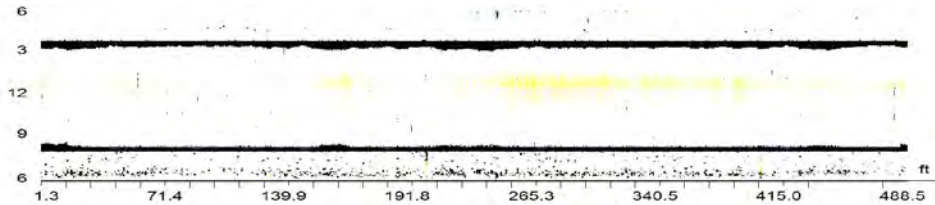
CMH000193 - CMH000192, 42in Page 162 CCTV LASER SONAR



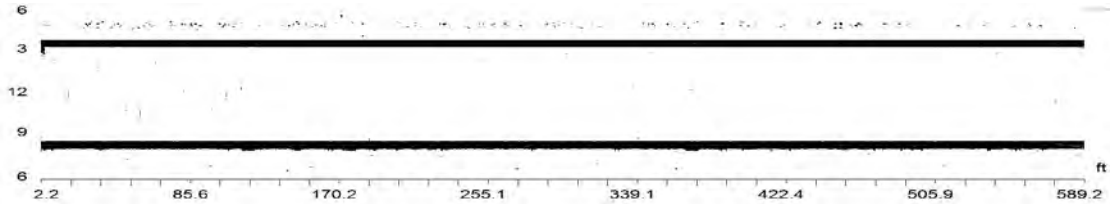
CMH000194 - CMH000193, 42in Page 167 CCTV LASER SONAR



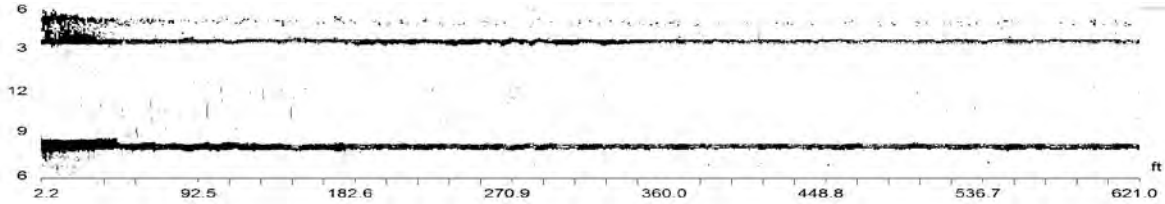
CMH000196 - CMH000194, 42in Page 176 CCTV LASER SONAR



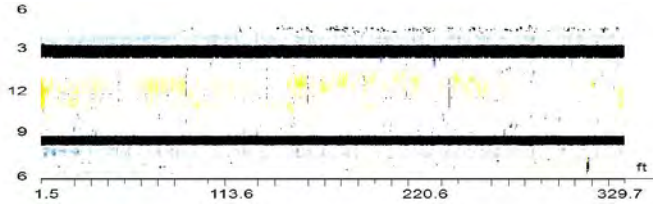
CMH000198 - CMH000196, 42in Page 183 CCTV LASER SONAR



CMH000199 - CMH000198, 42in Page 192 CCTV LASER SONAR



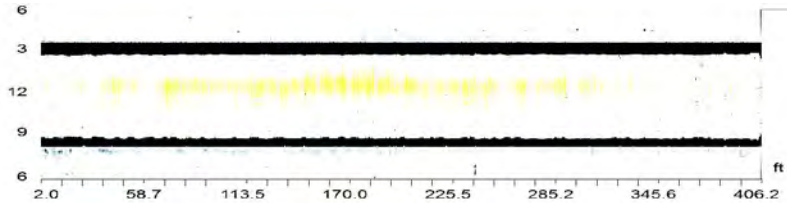
CMH000200 - CMH000199, 36in Page 201 CCTV LASER SONAR



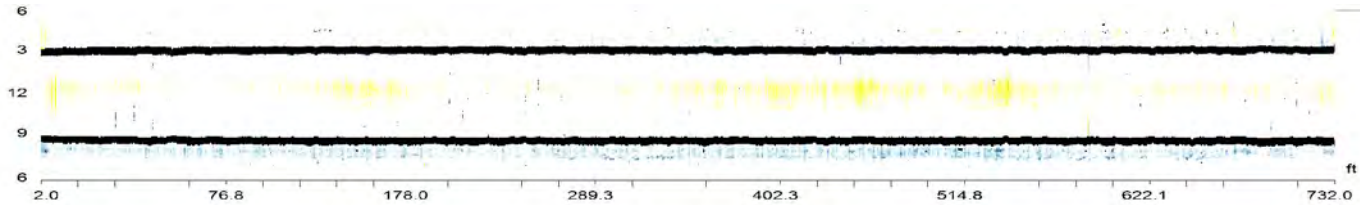
©2013

FLAT GRAPH SUMMARY

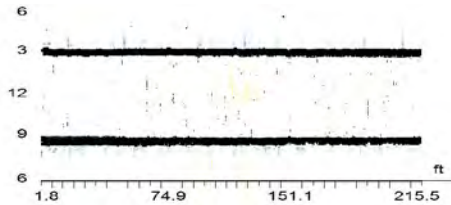
CMH000201 - CMH000200, 36in Page 207 CCTV LASER SONAR



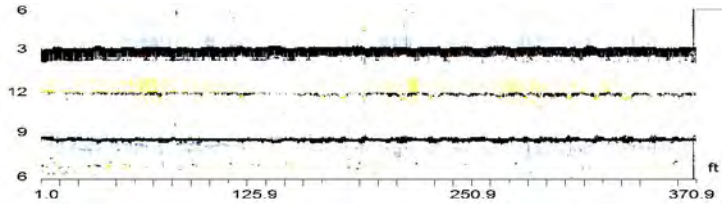
CMH000203 - CMH000201, 36in Page 213 CCTV LASER SONAR



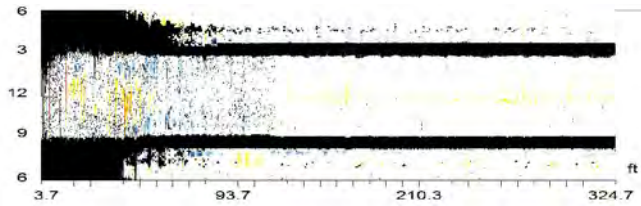
CMH000204 - CMH000203, 36in Page 223 CCTV LASER SONAR



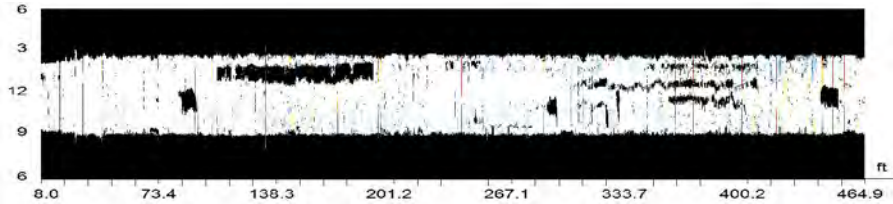
CMH000205 - CMH000204, 36in Page 228 CCTV LASER SONAR



CMH000206 - CMH000205, 36in Page 234 CCTV LASER SONAR



CMH000207 - CMH000206, 30in Page 240 CCTV LASER ~~SONAR~~

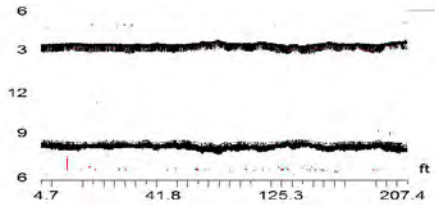


©2013

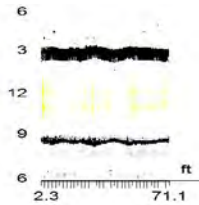
FLAT GRAPH SUMMARY

CMH000235 - CMH000176, 36in Page 248 CCTV LASER SONAR

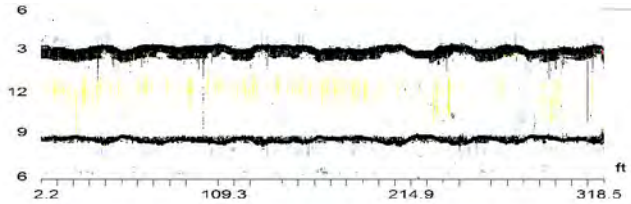
CMH000247 - CMH000235, 36in Page 252 CCTV LASER SONAR



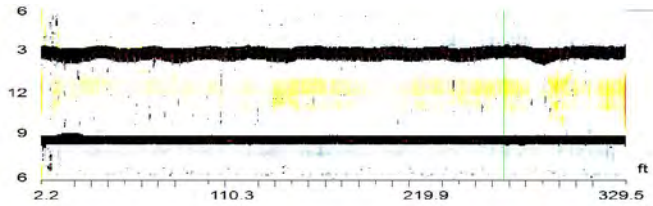
CMH000255 - CMH000255A, 36in Page 257 CCTV LASER SONAR



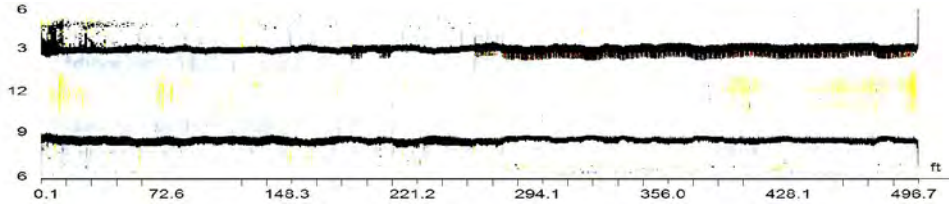
CMH000255A - CMH000247, 36in Page 261 CCTV LASER SONAR



CMH000262 - CMH000255, 36in Page 267 CCTV LASER SONAR



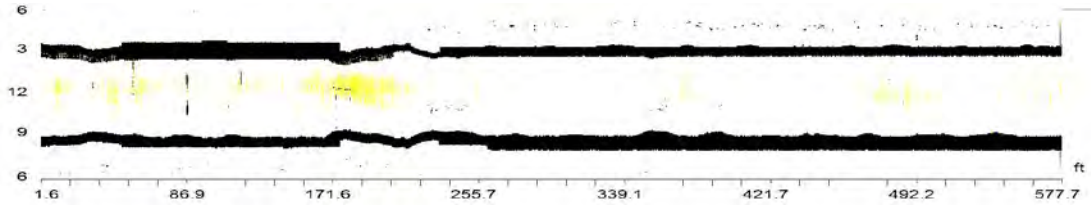
CMH000269 - CMH000262, 36in Page 273 CCTV LASER SONAR



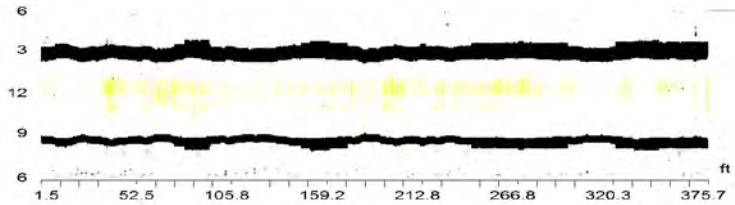
©2013

FLAT GRAPH SUMMARY

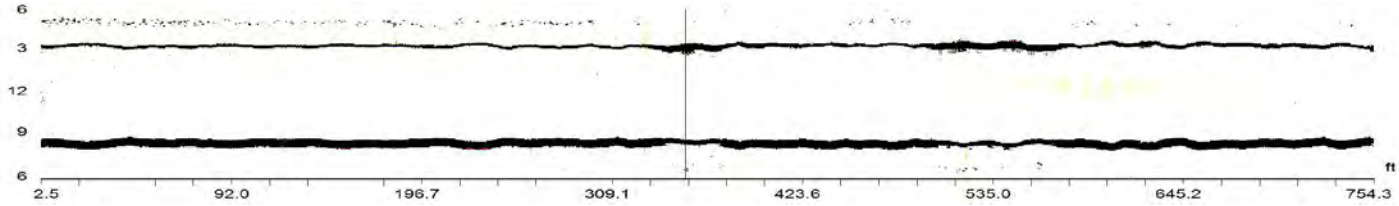
CMH000276 - CMH000269, 36in Page 280 CCTV LASER SONAR

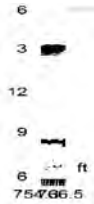


CMH000281 - CMH000276, 36in Page 289 CCTV LASER SONAR

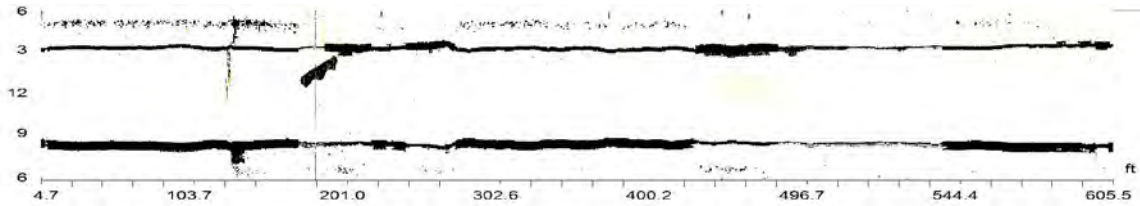


CMH000286 - CMH000281, 42in Page 295 CCTV LASER SONAR

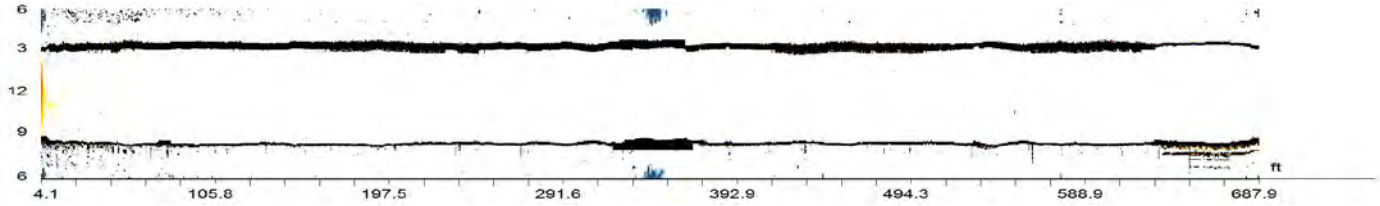




CMH000290 - CMH000286, 42in Page 305 CCTV LASER SONAR



CMH000294 - CMH000290, 42in Page 314 CCTV LASER SONAR

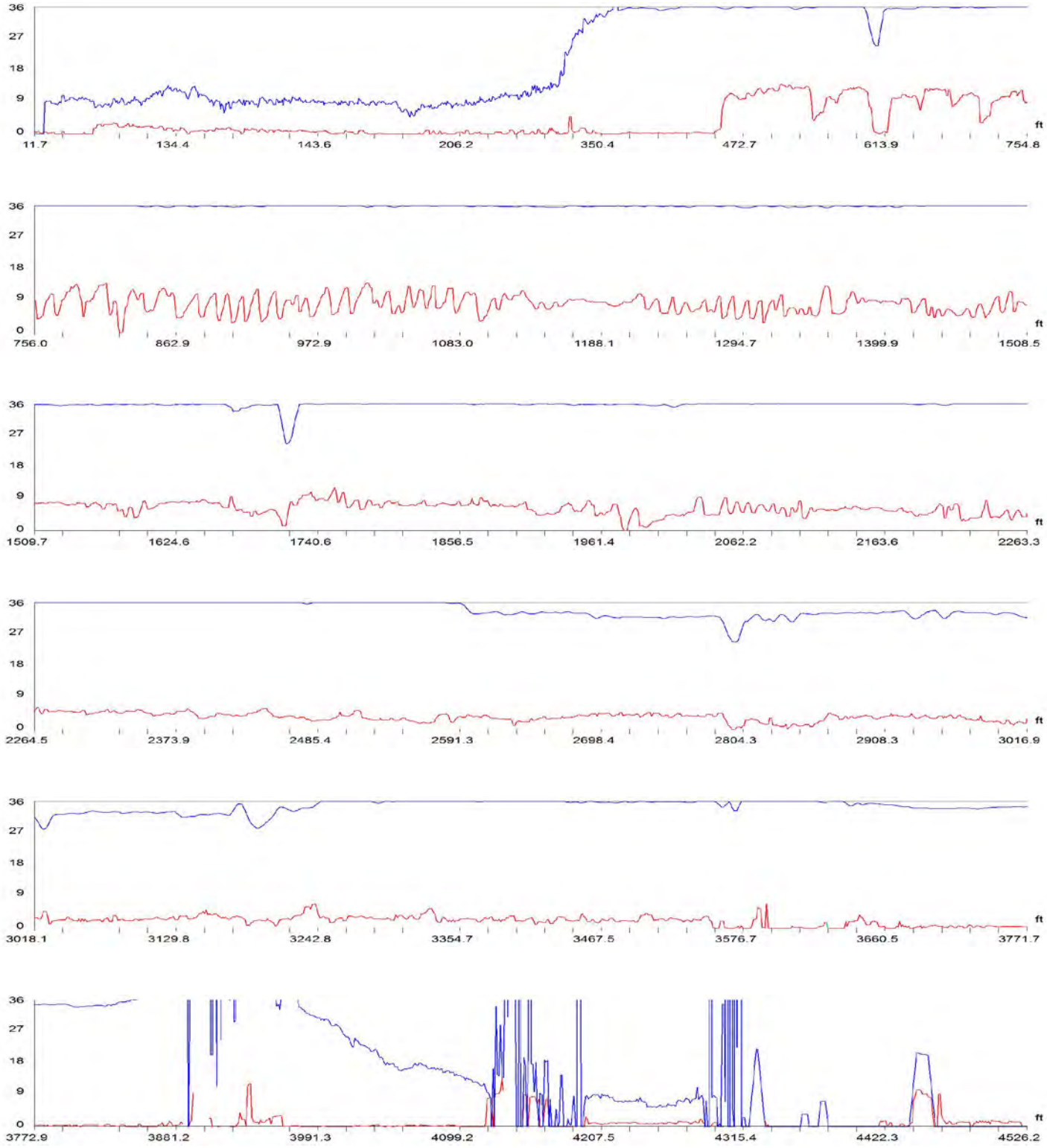


©2013

FLAT GRAPH SUMMARY

CSS000001-WRFIntertie36in, 36in Page 324

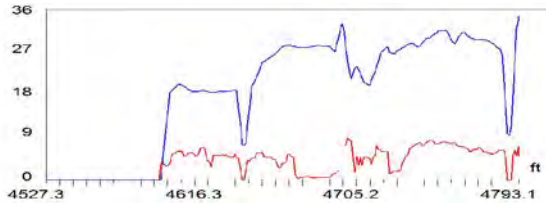
~~CCTV~~ ~~LASER~~ SONAR



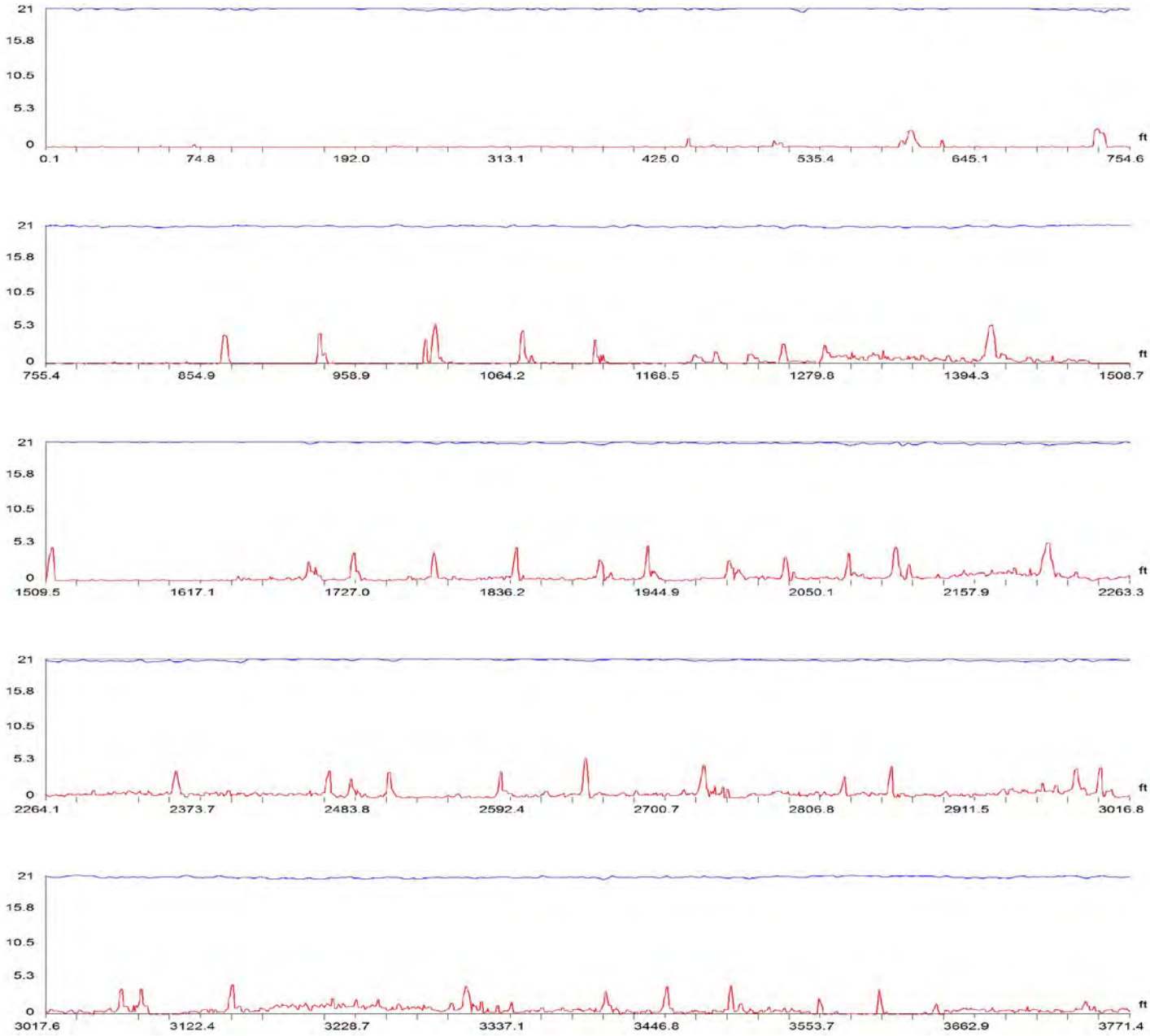
©2013

FLAT GRAPH SUMMARY

CSS000001-WRFIntertie36in, 36in Page 324 ~~CCTV~~ ~~LASER~~ SONAR



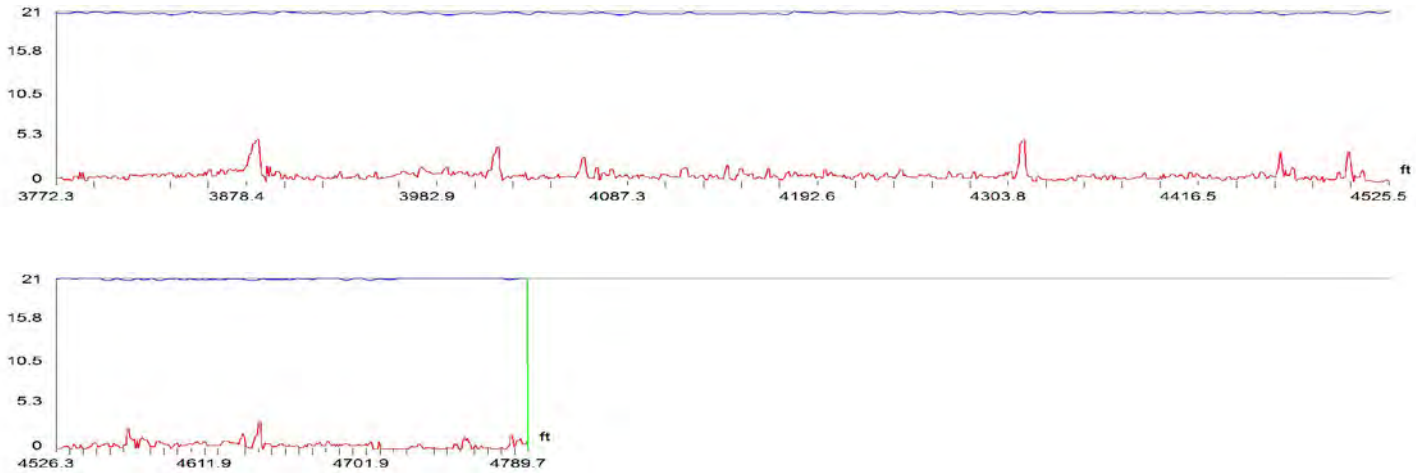
CSS000001-WRFIntertie21in, 21in Page 346 ~~CCTV~~ ~~LASER~~ SONAR



©2013

FLAT GRAPH SUMMARY

CSS000001-WRFIntertie21in, 21in Page 346 ~~CCTV~~ ~~LASER~~ SONAR



©2013

OVERVIEW - CMH000175 - CSS000001

Asset Number	CMH000175 - CSS000001		
Upstream MH	CMH000175	Material	Reinforced Concrete Pipe
Downstream MH	CSS000001	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	84.5 ft

Distance	Observation	Comment
4.1 ft	**Beginning of Inspection**	**CMH000175**
5	General Observation	Corrosion to 0.8"
24.9	General Observation	Corrosion to 1.1"
50.1	General Observation	Corrosion to 0.7"
75.3	General Observation	Corrosion to 0.7"
84.5	Match to Reference Shape and Size	ø36"
99.6	General Observation	Corrosion to 1"
99.8	General Observation	Corrosion to 0.6"
124.8	General Observation	Corrosion to 0.9"
150.1	General Observation	Corrosion to 0.7"
150.7	General Observation	Corrosion to 0.8"
175.2	General Observation	Corrosion to 0.8"
199.8	General Observation	Corrosion to X
200	General Observation	Corrosion to 0.9"
225.3	General Observation	Corrosion to 0.8"
249.8	General Observation	Corrosion to 1.1"
274.8	General Observation	Corrosion to 1"
300	General Observation	Corrosion to 0.5"
325.1	General Observation	Corrosion to 0.8"
349.9	General Observation	Corrosion to 0.9"
375.3	General Observation	Corrosion to 1.1"
400	General Observation	Corrosion to 0.8"
425.1	General Observation	Corrosion to 1"
441.2	3D Laser Sonar Scan	Pipe Overview
449.8	General Observation	Corrosion to 1.0"

OVERVIEW - CMH000175 - CSS000001

Asset Number	CMH000175 - CSS000001		
Upstream MH	CMH000175	Material	Reinforced Concrete Pipe
Downstream MH	CSS000001	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	84.5 ft

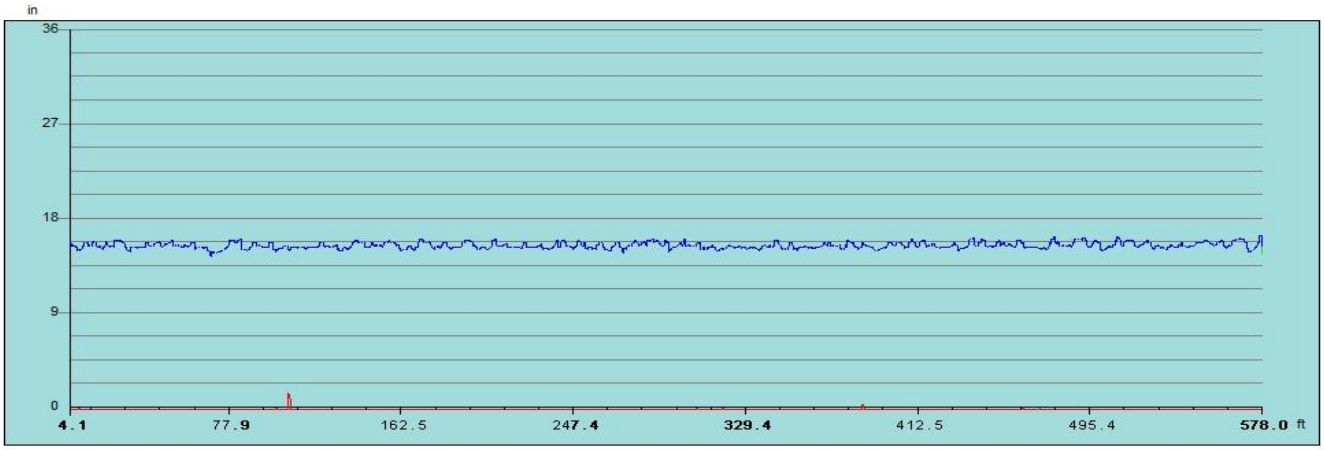
Distance	Observation	Comment
449.8	General Observation	Corrosion to 1.0"
475.2	General Observation	Corrosion to 1"
487	Maximum Corrosion	To 1.5"
499.7	General Observation	Corrosion to 1.2"
525.6	General Observation	Corrosion to 1.2"
549.9	General Observation	Corrosion to 1.2"
574.8	General Observation	Corrosion to 0.9"
577.9 ft	**End of Inspection**	**CSS000001**

CMH000175 - CSS000001			
Asset Number	CMH000175 - CSS000001	Length	578 ft
Upstream MH	CMH000175	Diameter	36 in
Downstream MH	CSS000001	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	84.5 ft
Date Profiled	18 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	16 in
Debris Volume	0 cubic feet

Debris Graph



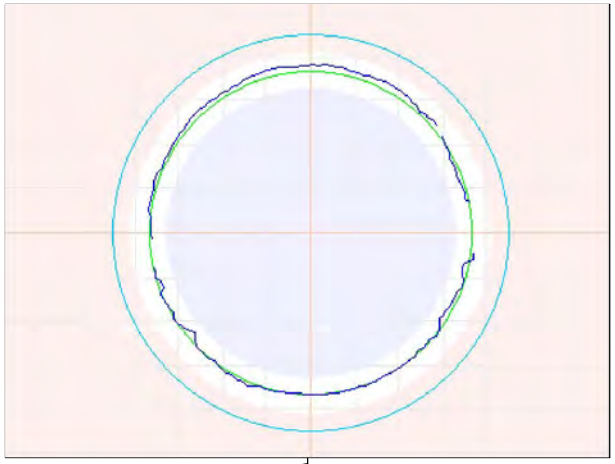
Inspection Distance (ft)

Water Level Debris Level

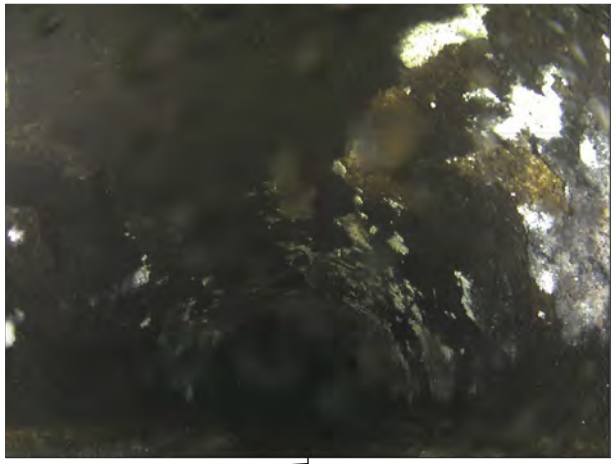
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

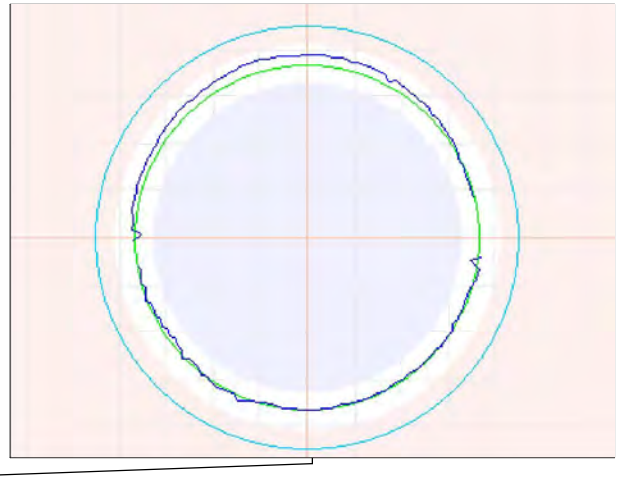
5ft General Observation - Corrosion to 0.8"

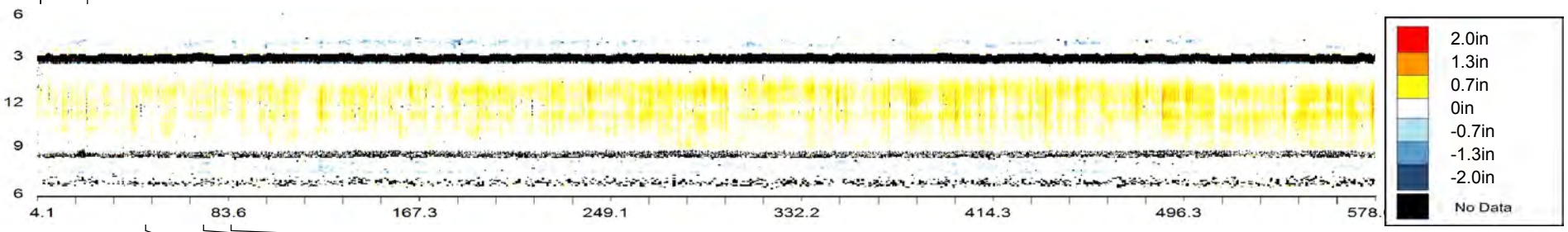


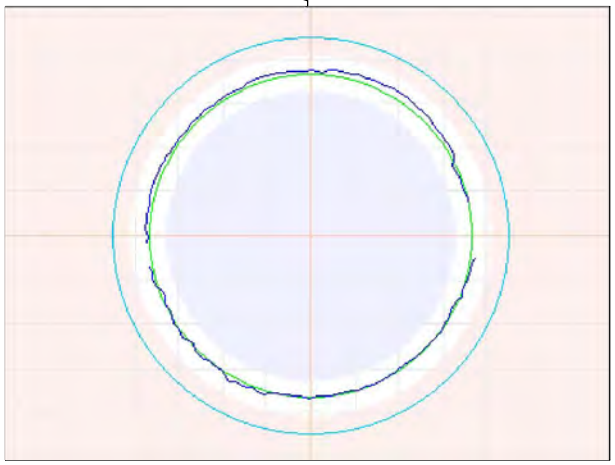
5ft General Observation - Corrosion to 0.8"



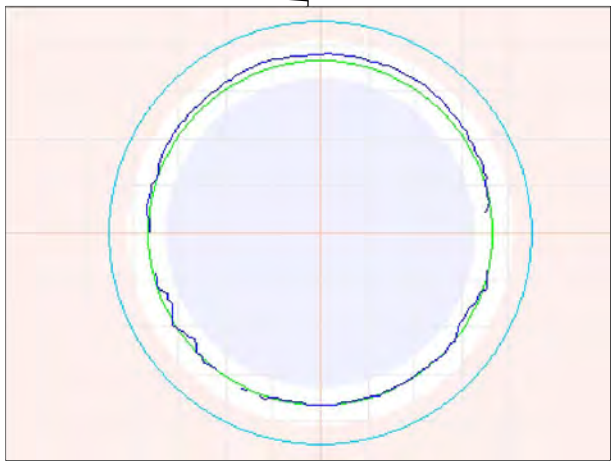
24.9ft General Observation - Corrosion to 1.1"



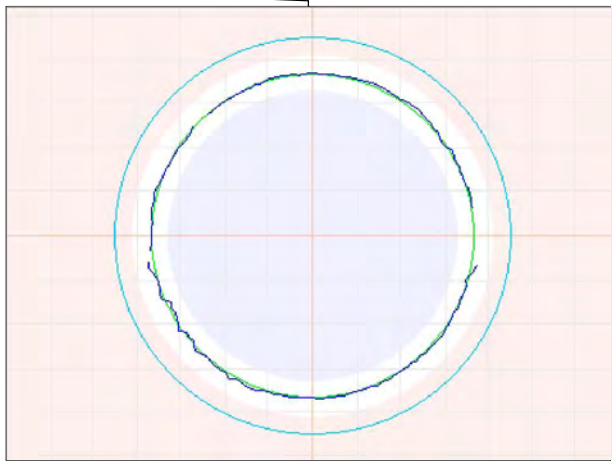




50.1ft General Observation - Corrosion to 0.7"



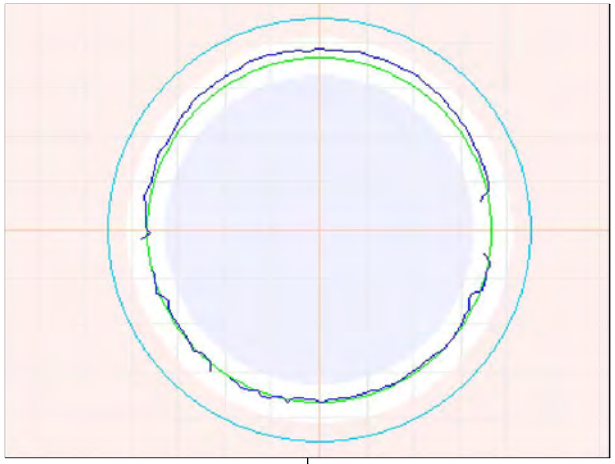
75.3ft General Observation - Corrosion to 0.7"



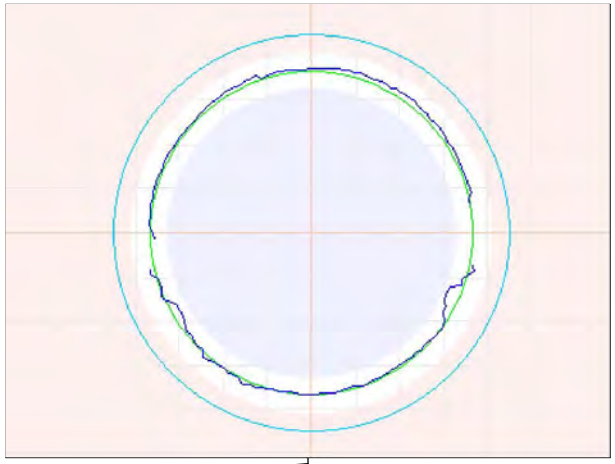
84.5ft Match to Reference Shape and Size - ø36"

Observation Report

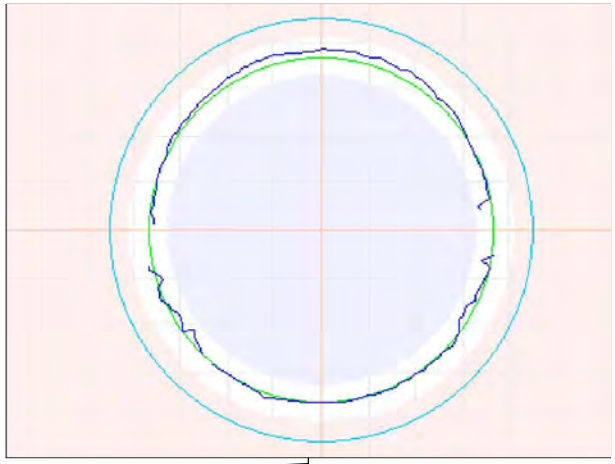
99.6ft General Observation - Corrosion to 1"

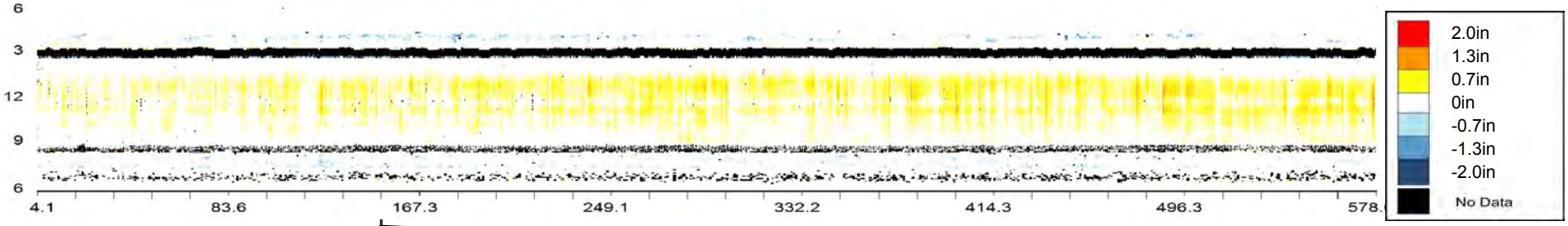


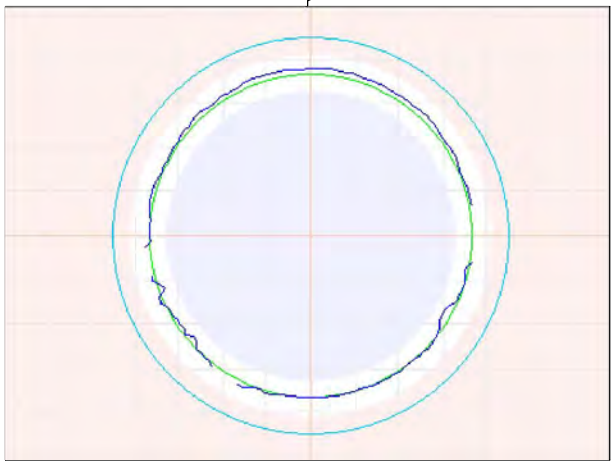
99.8ft General Observation - Corrosion to 0.6"



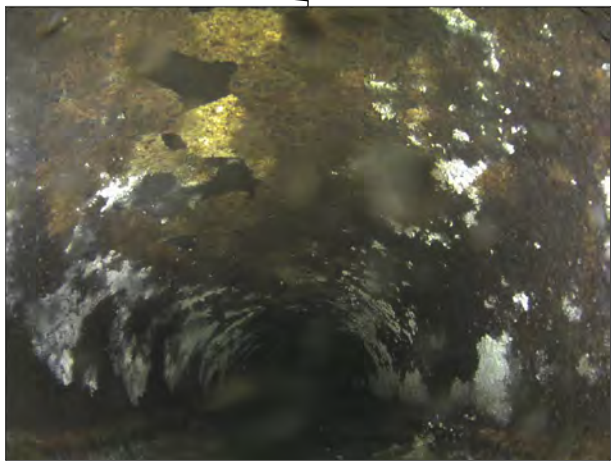
124.8ft General Observation - Corrosion to 0.9"



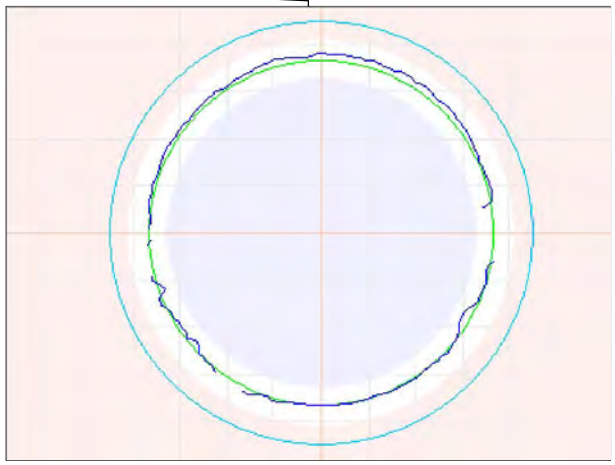




150.1ft General Observation - Corrosion to 0.7"



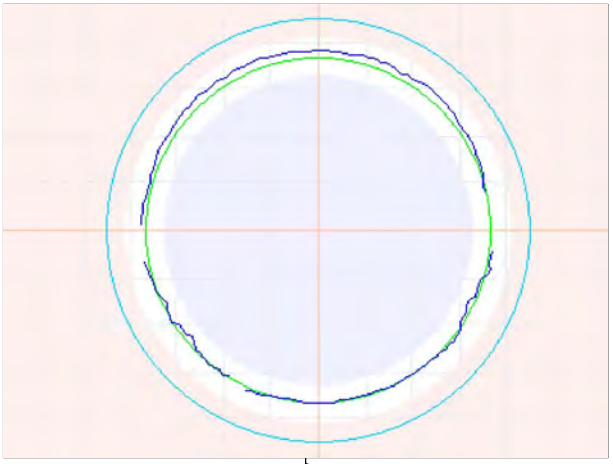
150.1ft General Observation - Corrosion to 0.7"



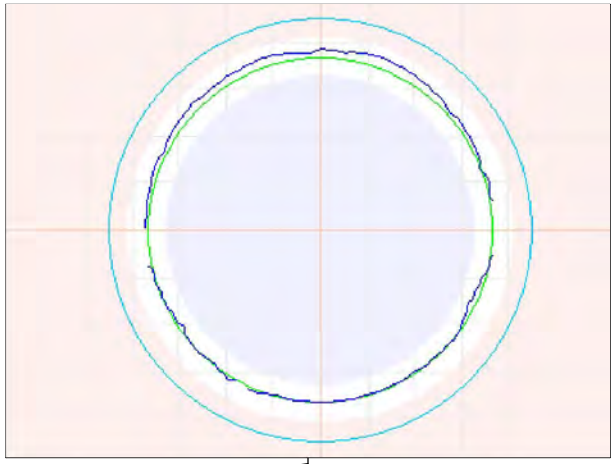
150.7ft General Observation - Corrosion to 0.8"

Observation Report

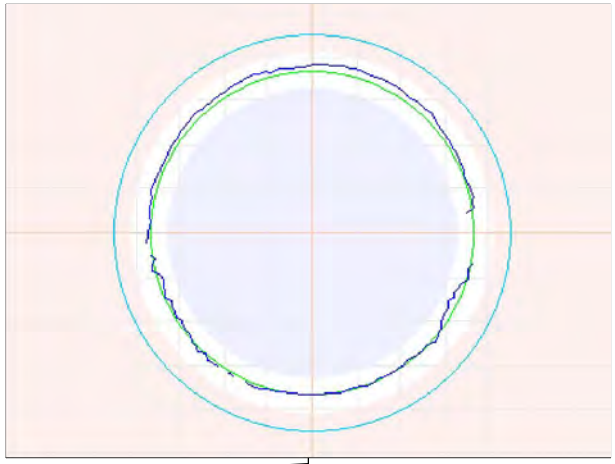
175.2ft General Observation - Corrosion to 0.8"

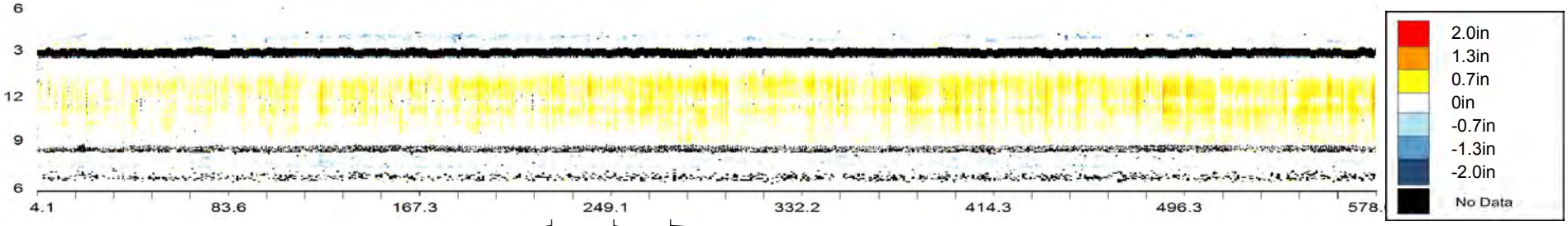


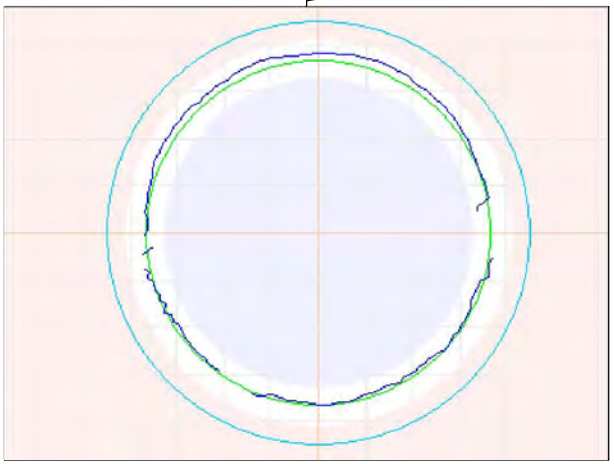
199.8ft General Observation - Corrosion to X



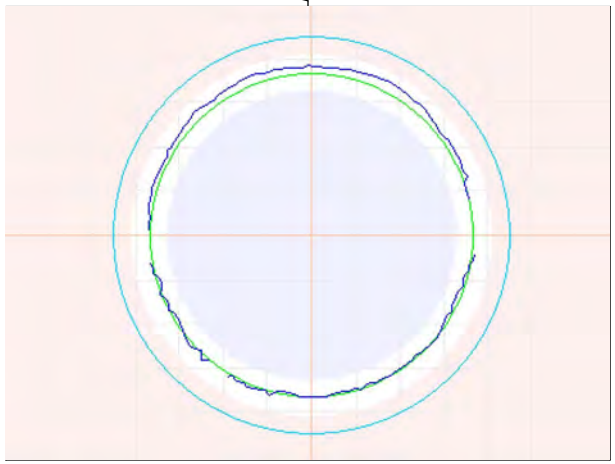
200ft General Observation - Corrosion to 0.9"



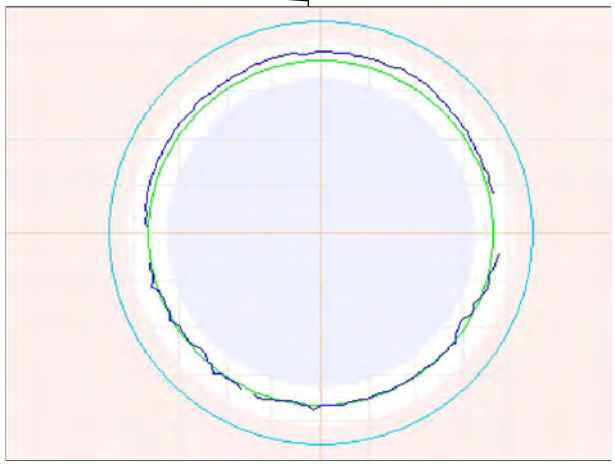




225.3ft General Observation - Corrosion to 0.8"



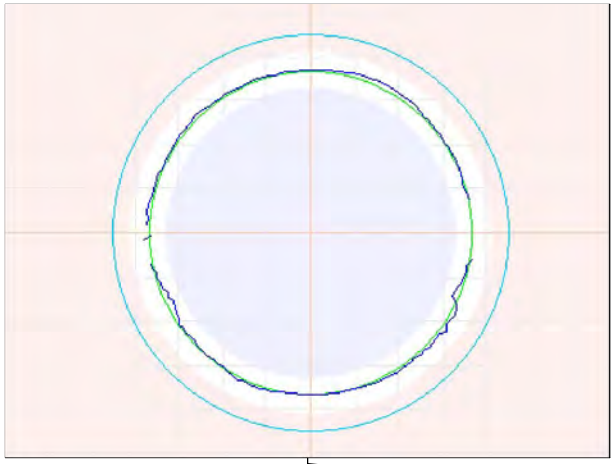
249.8ft General Observation - Corrosion to 1.1"



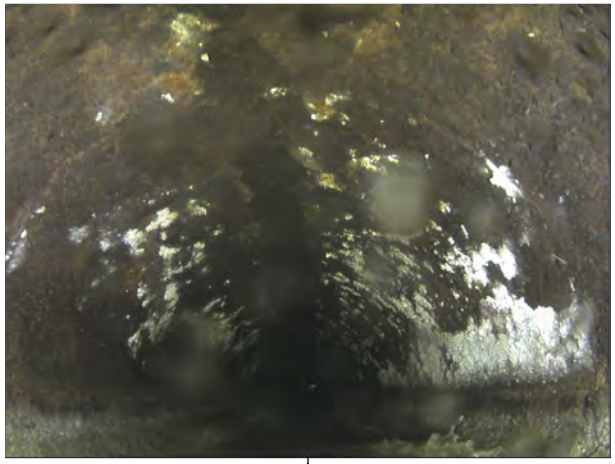
274.8ft General Observation - Corrosion to 1"

Observation Report

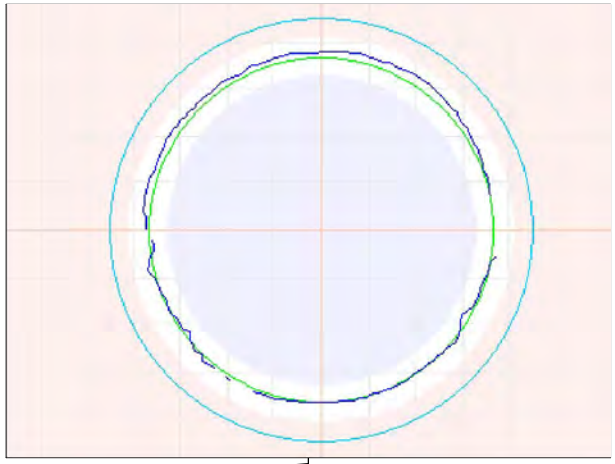
300ft General Observation - Corrosion to 0.5"

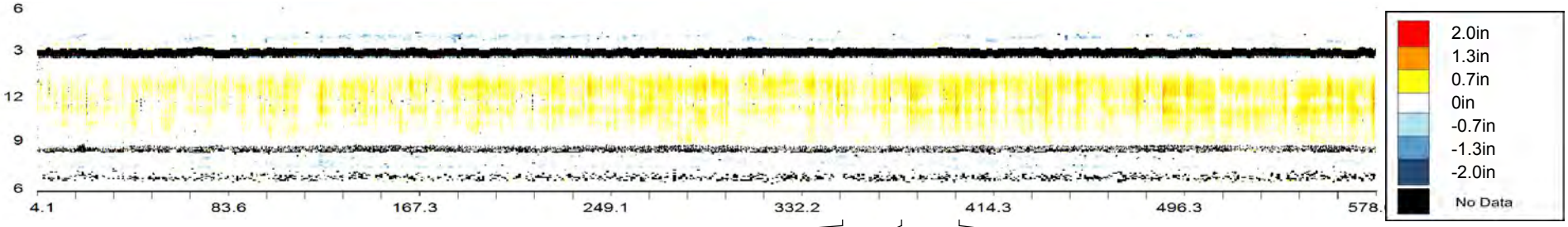


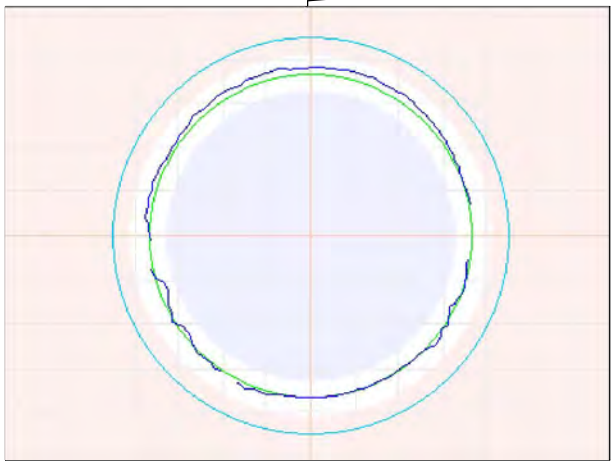
300ft General Observation - Corrosion to 0.5"



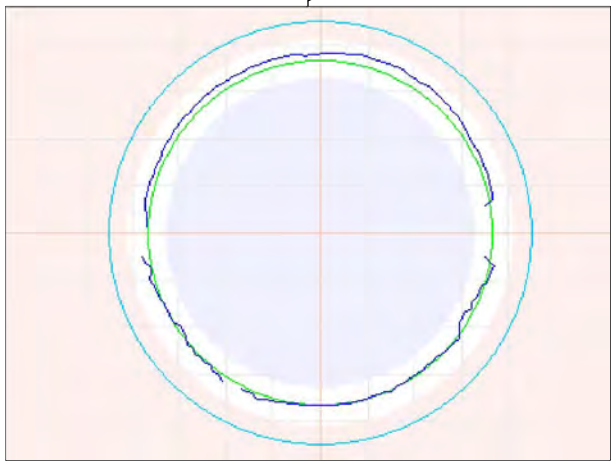
325.1ft General Observation - Corrosion to 0.8"



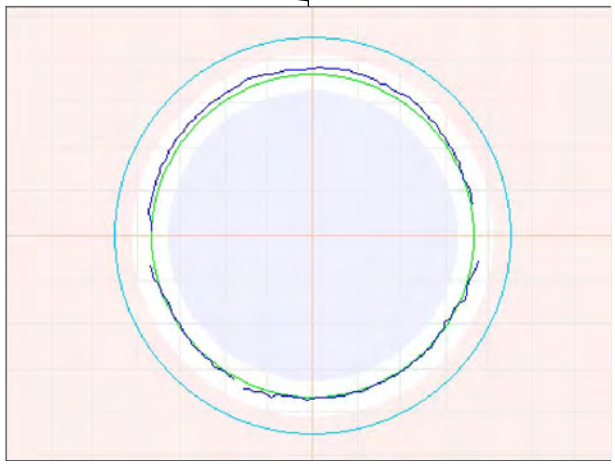




349.9ft General Observation - Corrosion to 0.9"



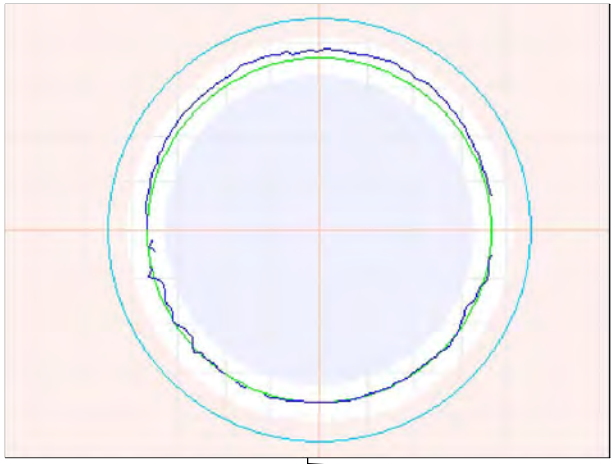
375.3ft General Observation - Corrosion to 1.1"



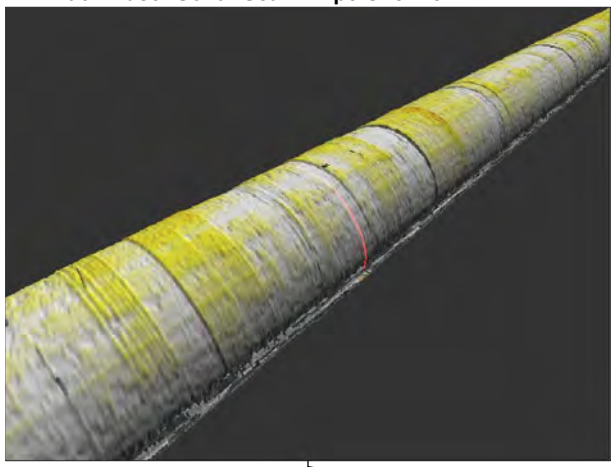
400ft General Observation - Corrosion to 0.8"

Observation Report

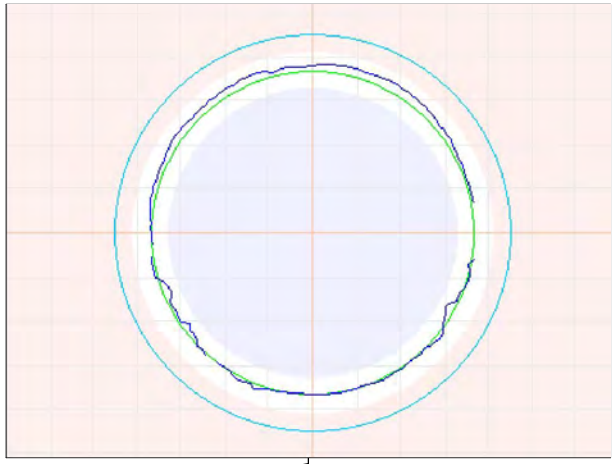
425.1ft General Observation - Corrosion to 1"

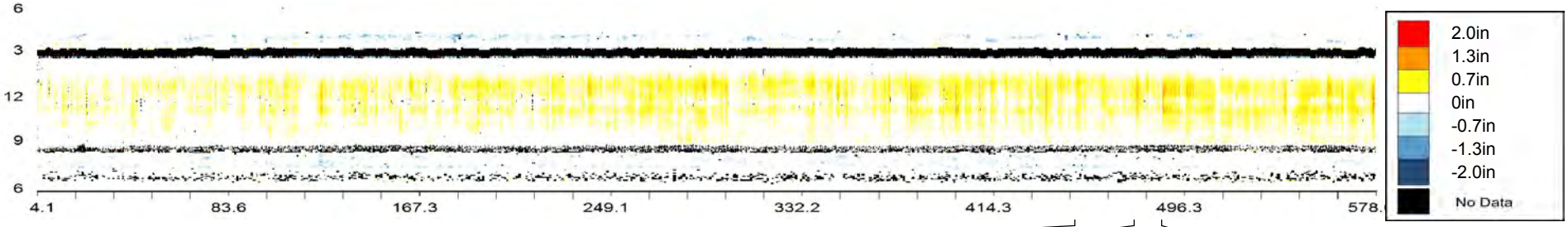


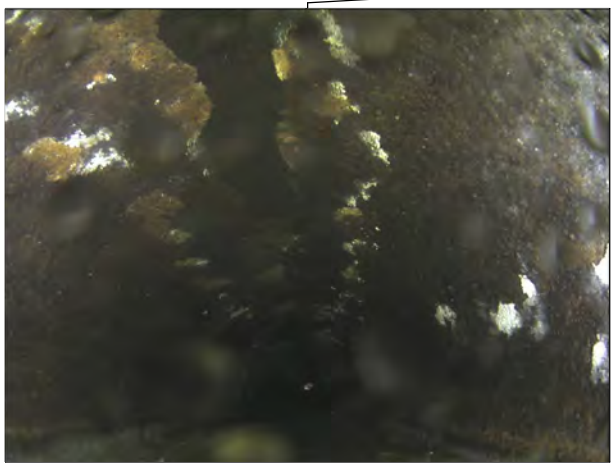
441.2ft 3D Laser Sonar Scan - Pipe Overview



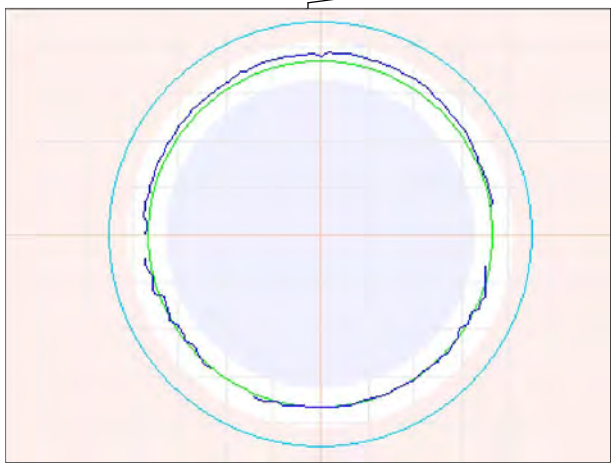
449.8ft General Observation - Corrosion to 1.0"



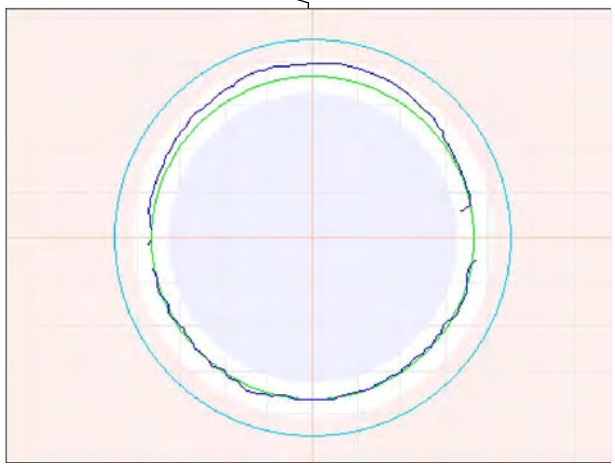




449.8ft General Observation - Corrosion to 1.0"



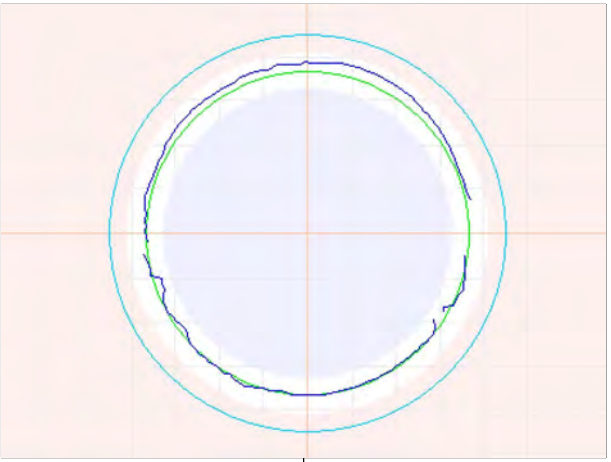
475.2ft General Observation - Corrosion to 1"



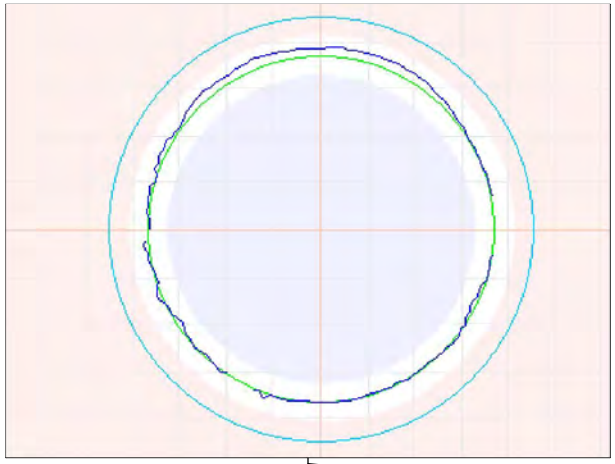
487ft Maximum Corrosion - To 1.5"

Observation Report

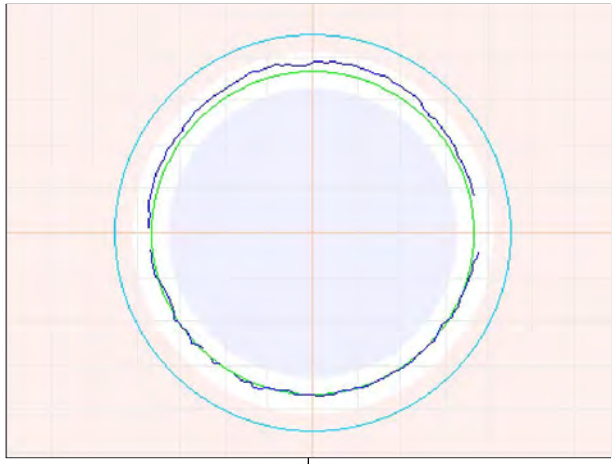
499.7ft General Observation - Corrosion to 1.2"

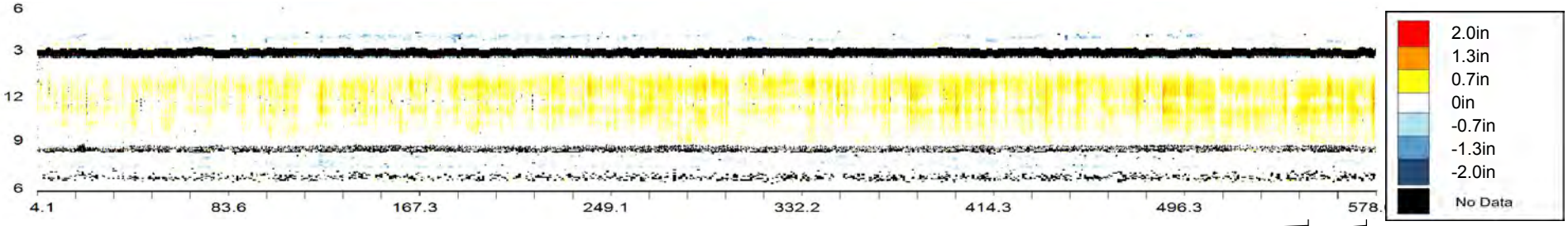


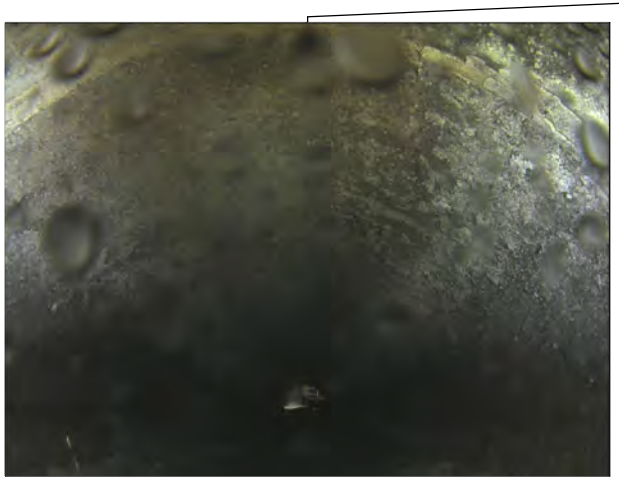
525.6ft General Observation - Corrosion to 1.2"



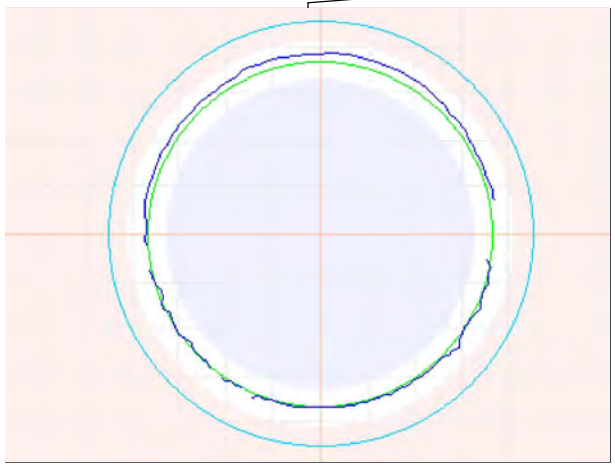
549.9ft General Observation - Corrosion to 1.2"







549.9ft General Observation - Corrosion to 1.2"



574.8ft General Observation - Corrosion to 0.9"

OVERVIEW - CMH000176 - CMH000207

Asset Number	CMH000176 - CMH000207		
Upstream MH	CMH000176	Material	Reinforced Concrete Pipe
Downstream MH	CMH000207	Size & Shape	30 in Circle
Survey Direction	Downstream	Match to Reference	545.5 ft

Distance	Observation	Comment
1.6 ft	**Beginning of Inspection**	**CMH000176**
2.3	General Observation	
2.3	Point of Interest	Spalling throughout
24.8	General Observation	Corrosion to 0.3"
49.9	General Observation	
75.3	General Observation	Corrosion to 0.7"
99.9	General Observation	
124.9	General Observation	Corrosion to 0.1"
149.8	General Observation	
175.2	General Observation	Corrosion to 0.6"
196.8	Maximum Corrosion	To 0.8"
199.9	General Observation	Corrosion to 0.6"
225	General Observation	Corrosion to 0.5"
250.1	General Observation	
274.7	General Observation	Corrosion to 0.1"
300	General Observation	Corrosion to 0.6"
315	3D Laser Sonar Scan	Corrosion
324.8	General Observation	Corrosion to 0.5"
349.9	General Observation	
374.8	General Observation	Corrosion to 0.3"
399.8	General Observation	
425.1	General Observation	Corrosion to0.3"
450	General Observation	Corrosion to 0.7"
474.8	General Observation	Corrosion to 0.3"
499.8	General Observation	Corrosion to 0.4"
524.8	General Observation	Corrosion to 0.2"

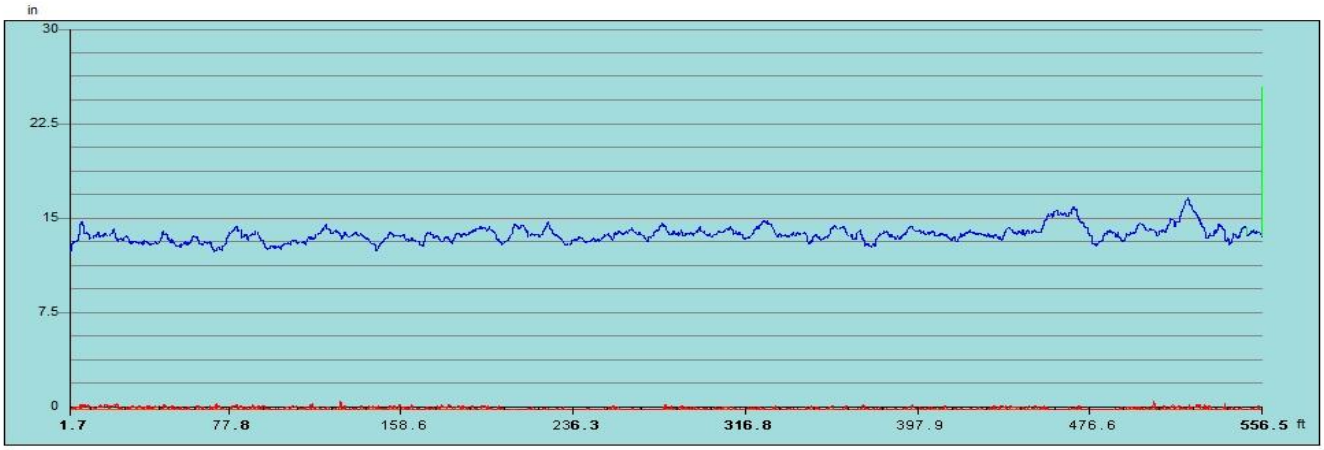
OVERVIEW - CMH000176 - CMH000207			
Asset Number	CMH000176 - CMH000207		
Upstream MH	CMH000176	Material	Reinforced Concrete Pipe
Downstream MH	CMH000207	Size & Shape	30 in Circle
Survey Direction	Downstream	Match to Reference	545.5 ft

Distance	Observation	Comment
545.5	Match to Reference Shape and Size	ø30"
549.9	General Observation	
556.4 ft	**End of Inspection**	**CMH000207**

CMH000176 - CMH000207			
Asset Number	CMH000176 - CMH000207	Length	557 ft
Upstream MH	CMH000176	Diameter	30 in
Downstream MH	CMH000207	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	545.5 ft
Date Profiled	16 July 2013	Operator	

Observations	
Average Debris Depth	0 in
Average Water Level	14 in
Debris Volume	1 cubic feet

Debris Graph



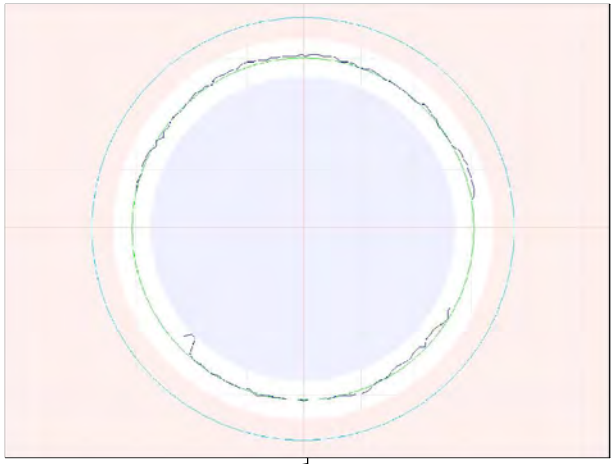
Inspection Distance (ft)

Water Level Debris Level

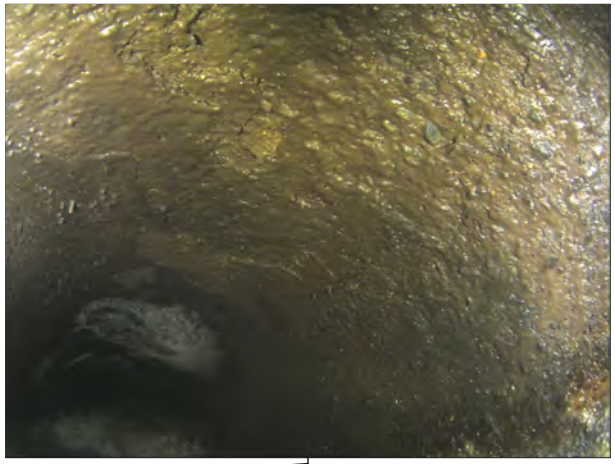
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

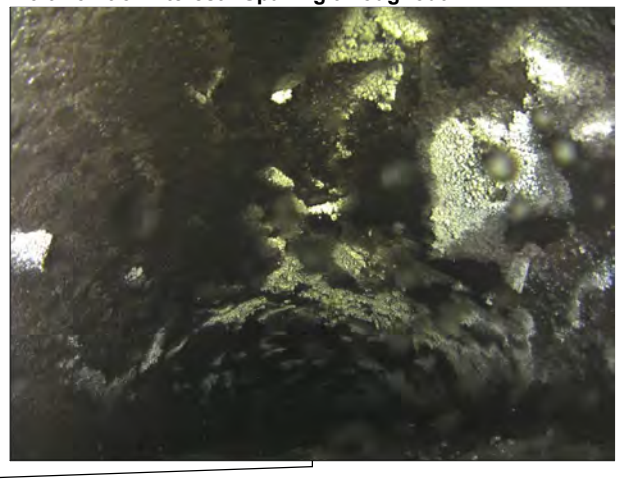
2.3ft General Observation

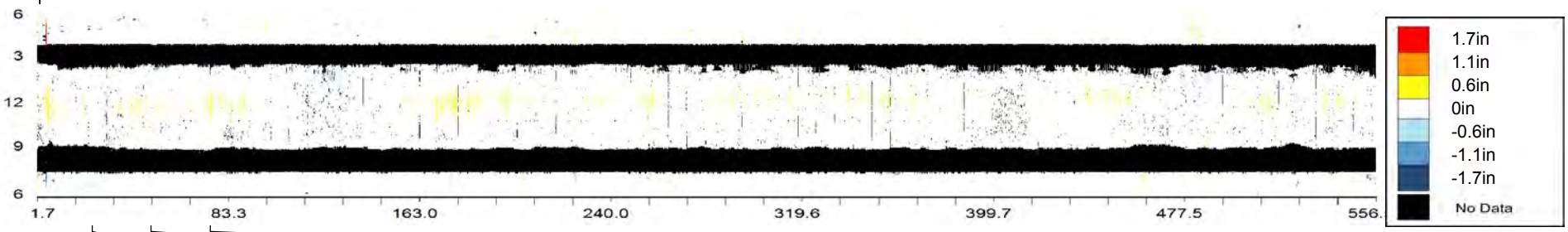


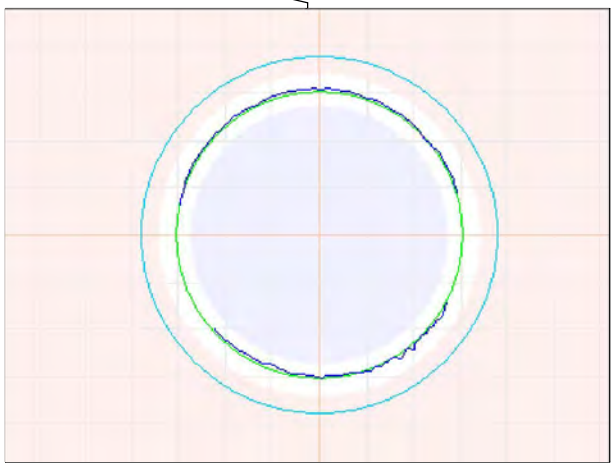
2.3ft General Observation



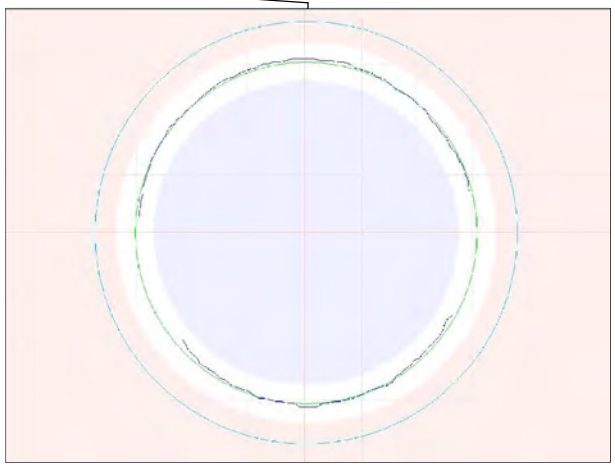
2.3ft Point of Interest - Spalling throughout



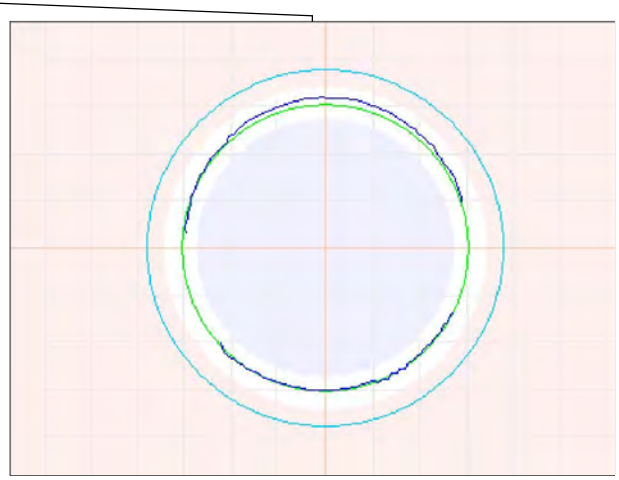




24.8ft General Observation - Corrosion to 0.3"



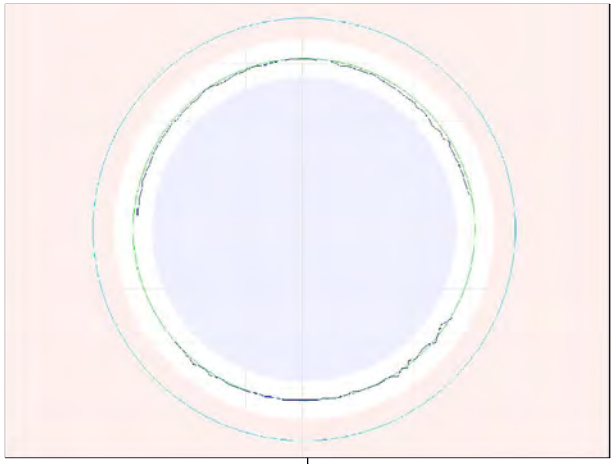
49.9ft General Observation



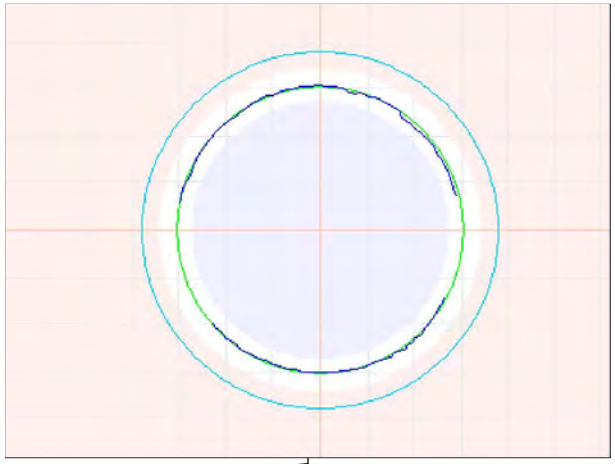
75.3ft General Observation - Corrosion to 0.7"

Observation Report

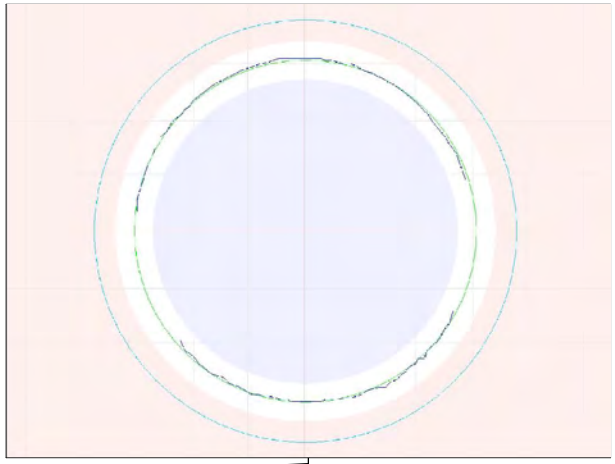
99.9ft General Observation

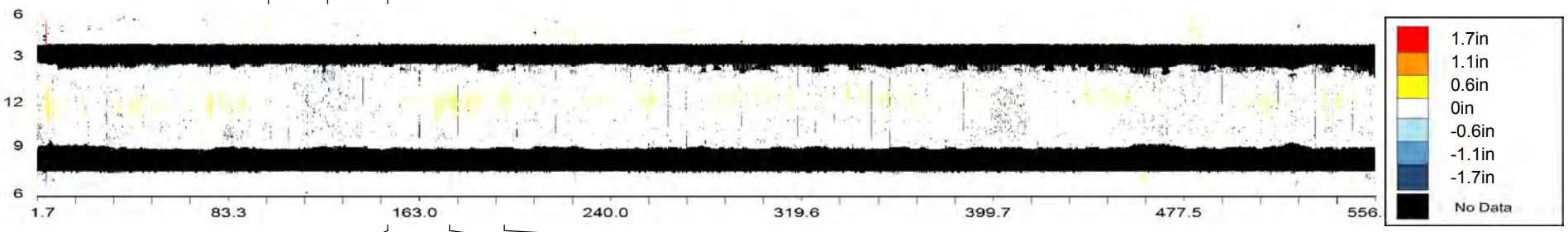


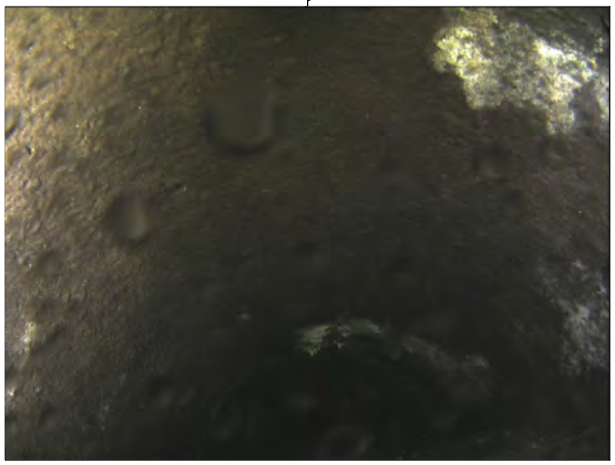
124.9ft General Observation - Corrosion to 0.1"



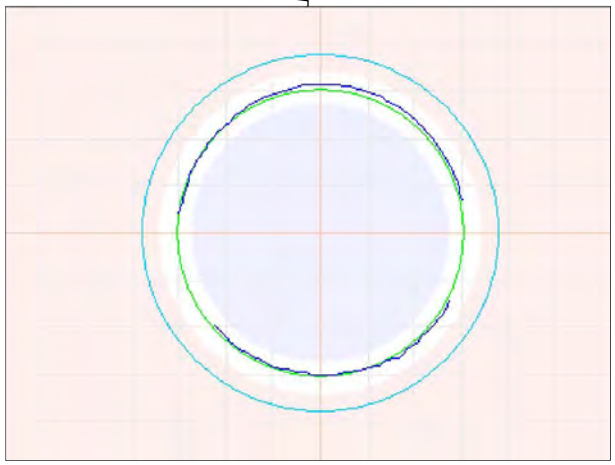
149.8ft General Observation



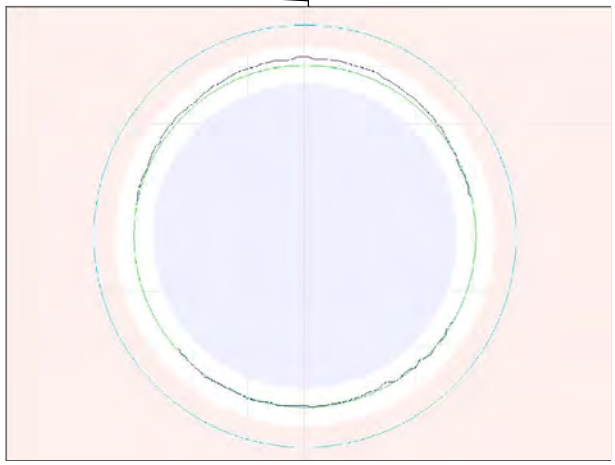




149.8ft General Observation



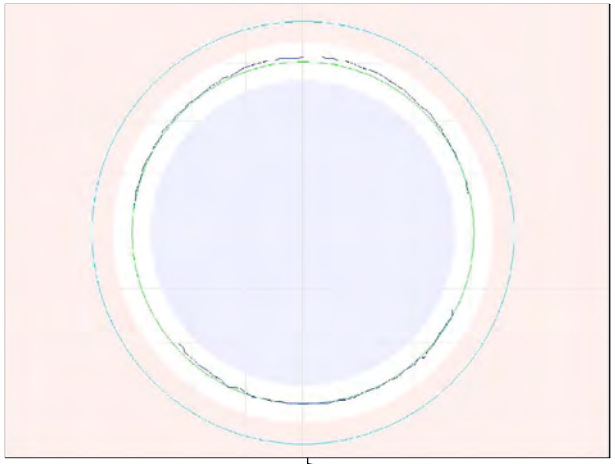
175.2ft General Observation - Corrosion to 0.6"



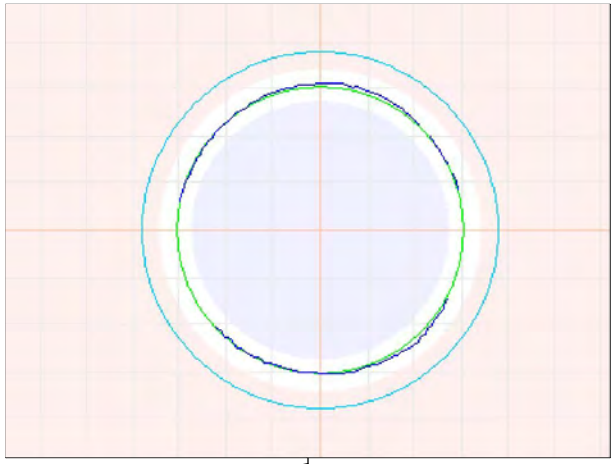
196.8ft Maximum Corrosion - To 0.8"

Observation Report

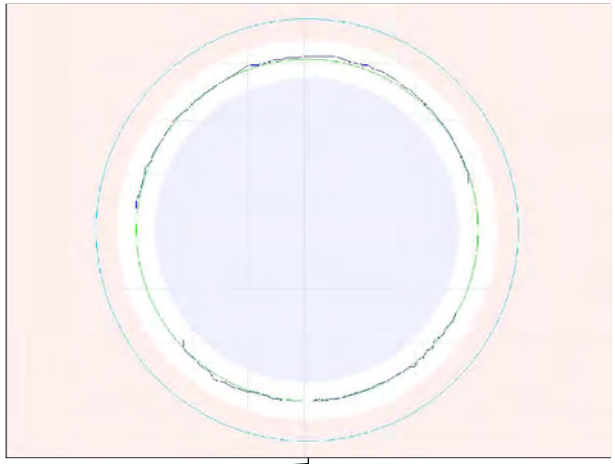
199.9ft General Observation - Corrosion to 0.6"

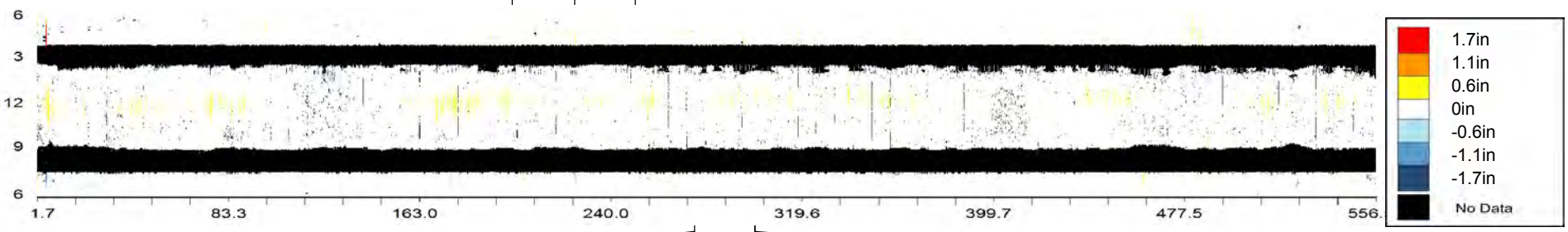


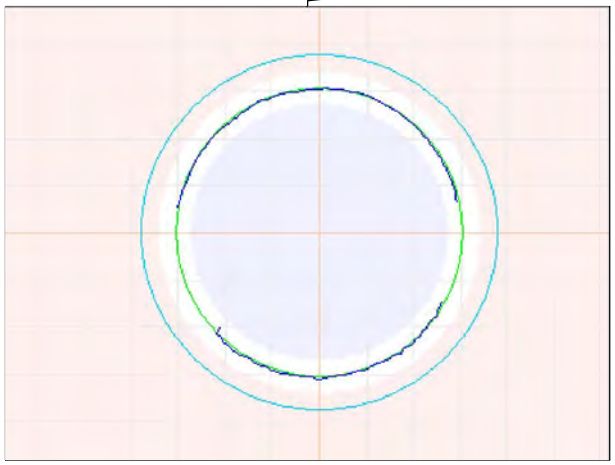
225ft General Observation - Corrosion to 0.5"



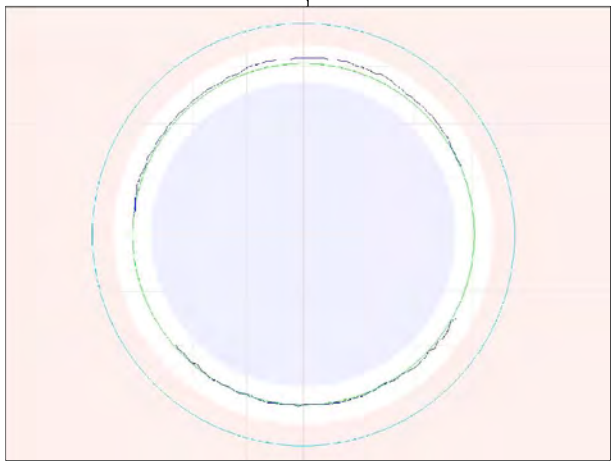
250.1ft General Observation



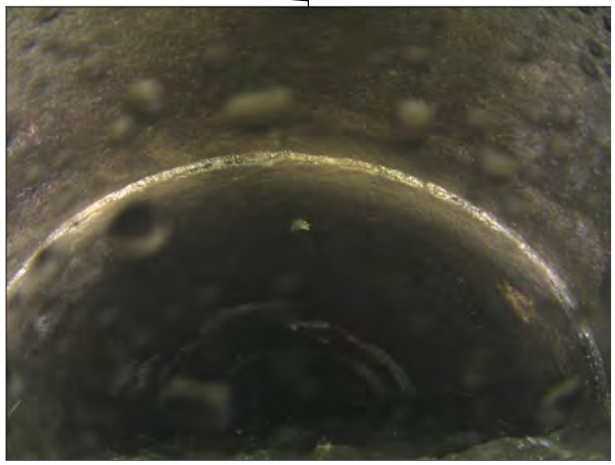




274.7ft General Observation - Corrosion to 0.1"



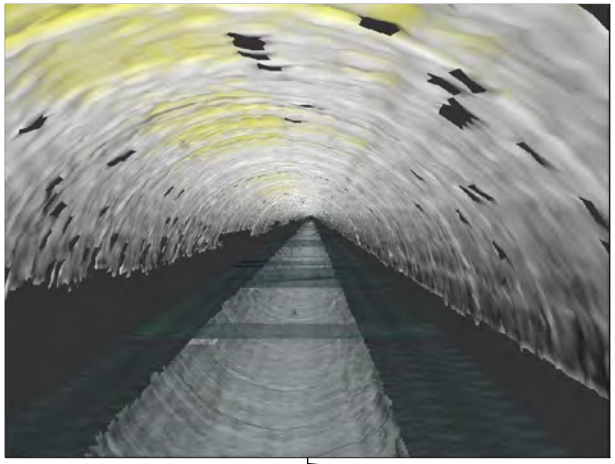
300ft General Observation - Corrosion to 0.6"



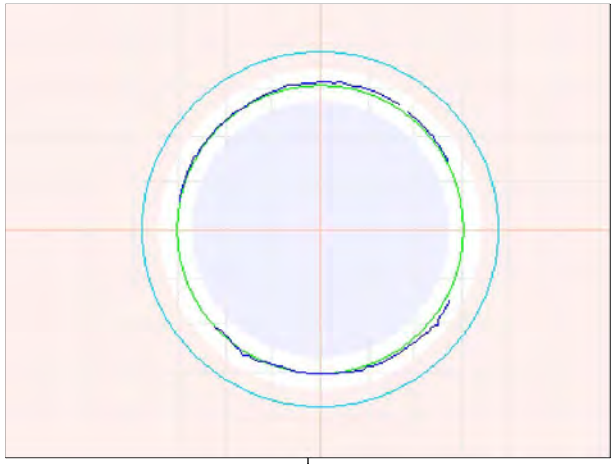
300ft General Observation - Corrosion to 0.6"

Observation Report

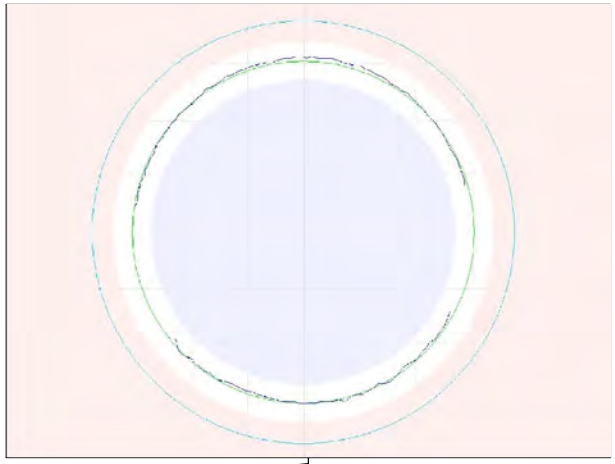
315ft 3D Laser Sonar Scan - Corrosion

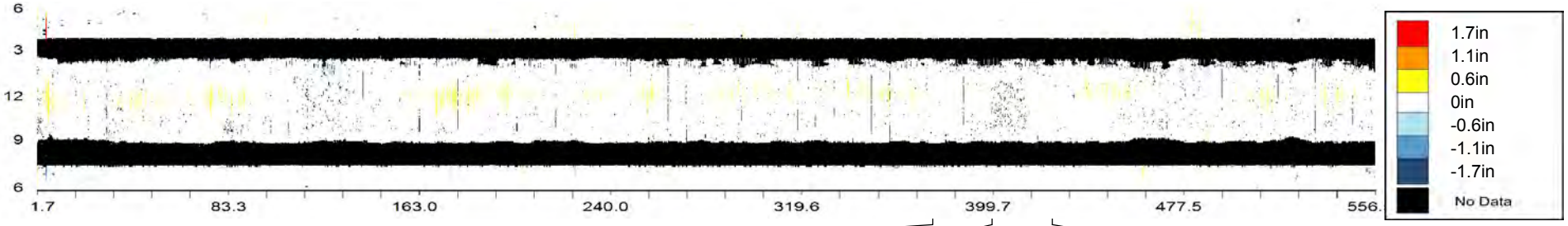


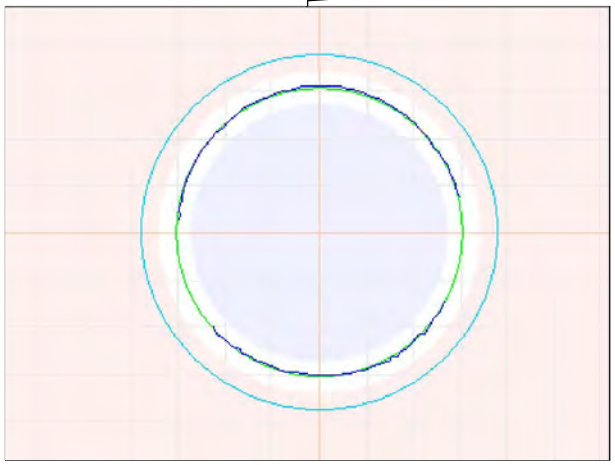
324.8ft General Observation - Corrosion to 0.5"



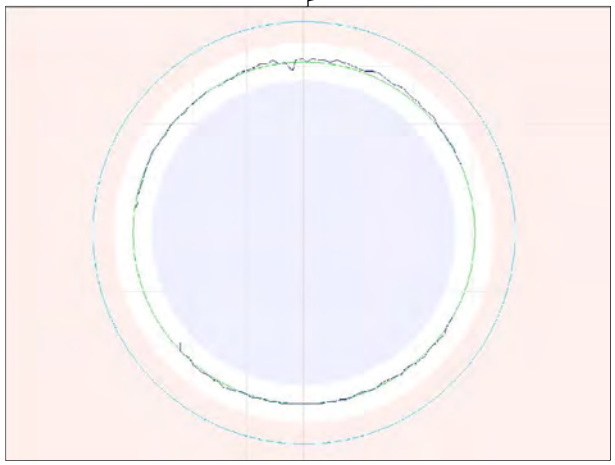
349.9ft General Observation



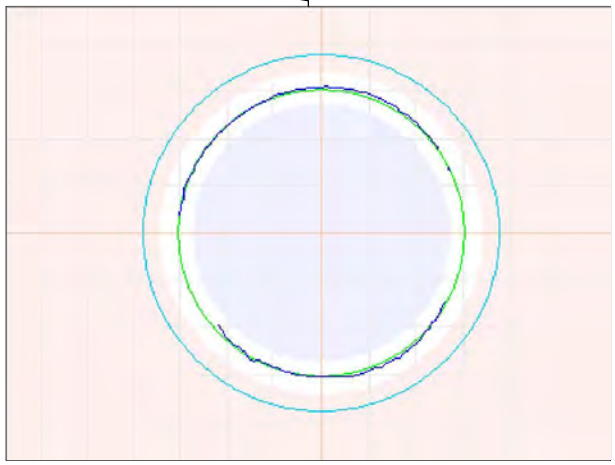




374.8ft General Observation - Corrosion to 0.3"



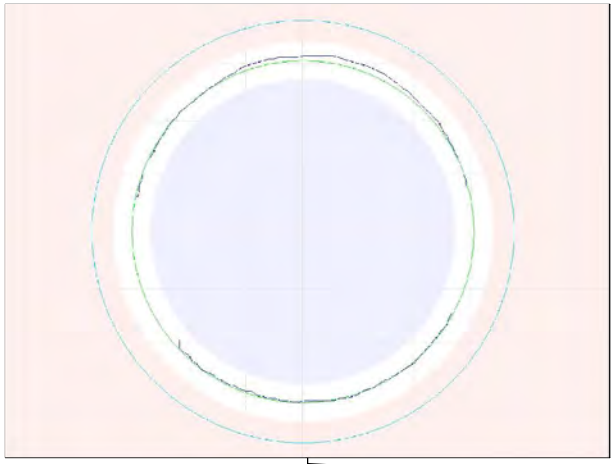
399.8ft General Observation



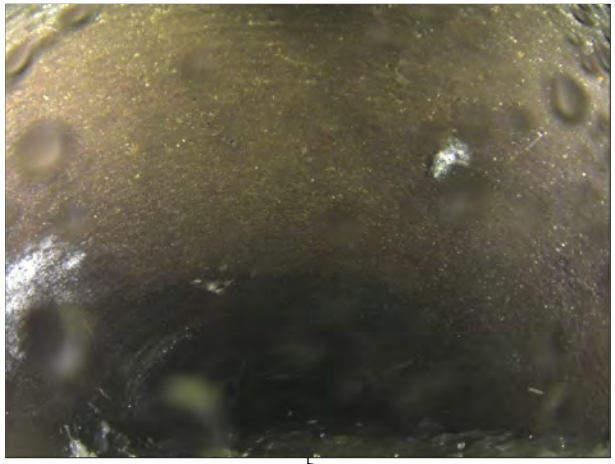
425.1ft General Observation - Corrosion to0.3"

Observation Report

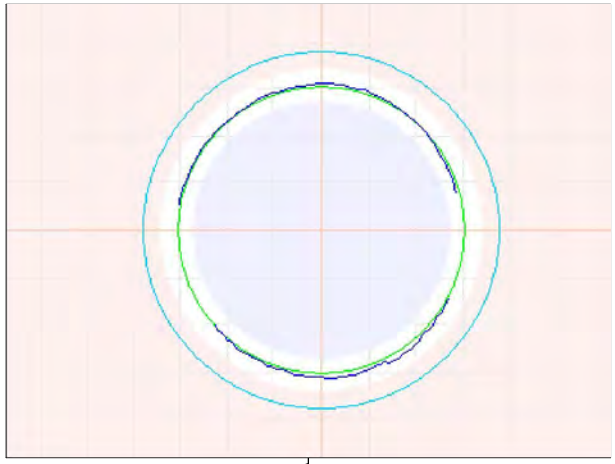
450ft General Observation - Corrosion to 0.7"

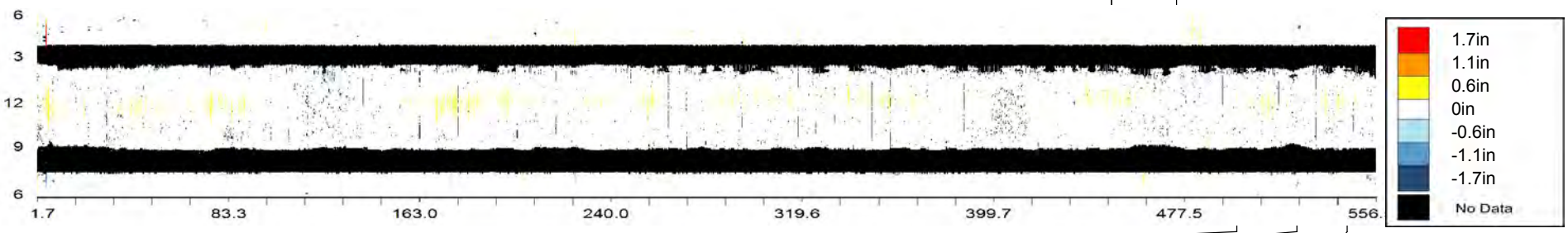


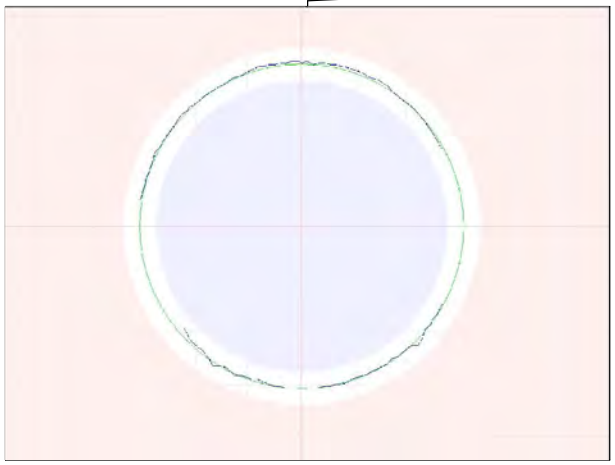
450ft General Observation - Corrosion to 0.7"



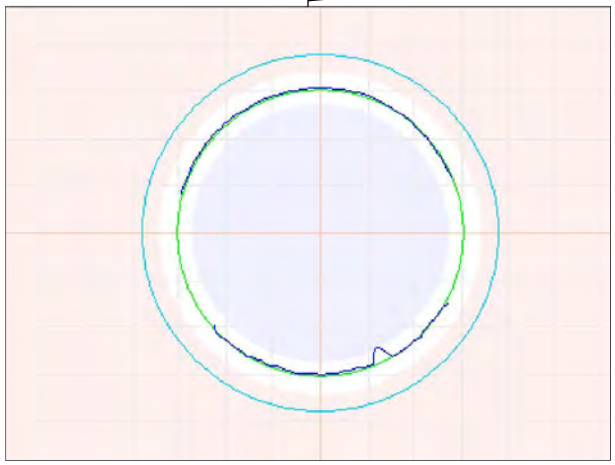
474.8ft General Observation - Corrosion to 0.3"



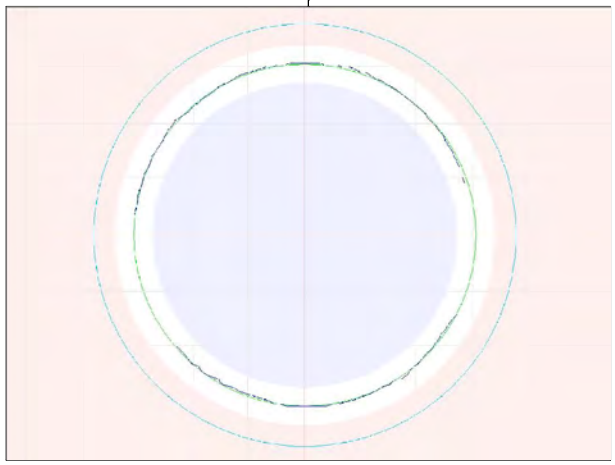




499.8ft General Observation - Corrosion to 0.4"



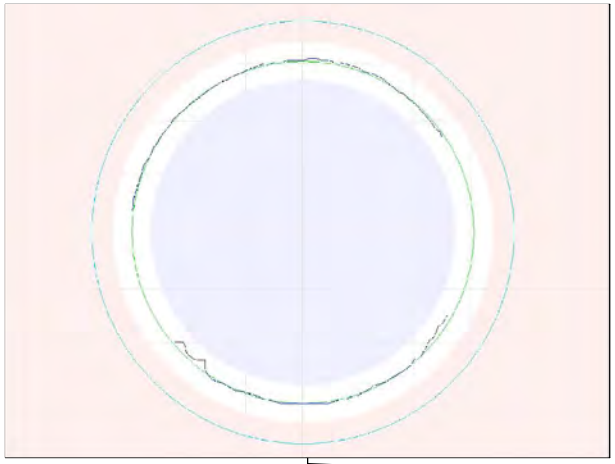
524.8ft General Observation - Corrosion to 0.2"

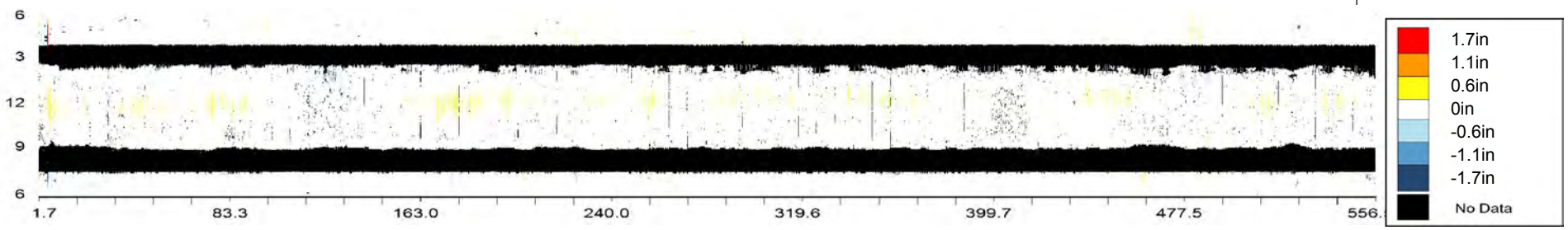


545.5ft Match to Reference Shape and Size - ø30"

Observation Report

549.9ft General Observation





OVERVIEW - CMH000177 - CMH000175

Asset Number	CMH000177 - CMH000175		
Upstream MH	CMH000177	Material	Reinforced Concrete Pipe
Downstream MH	CMH000175	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	136.5 ft

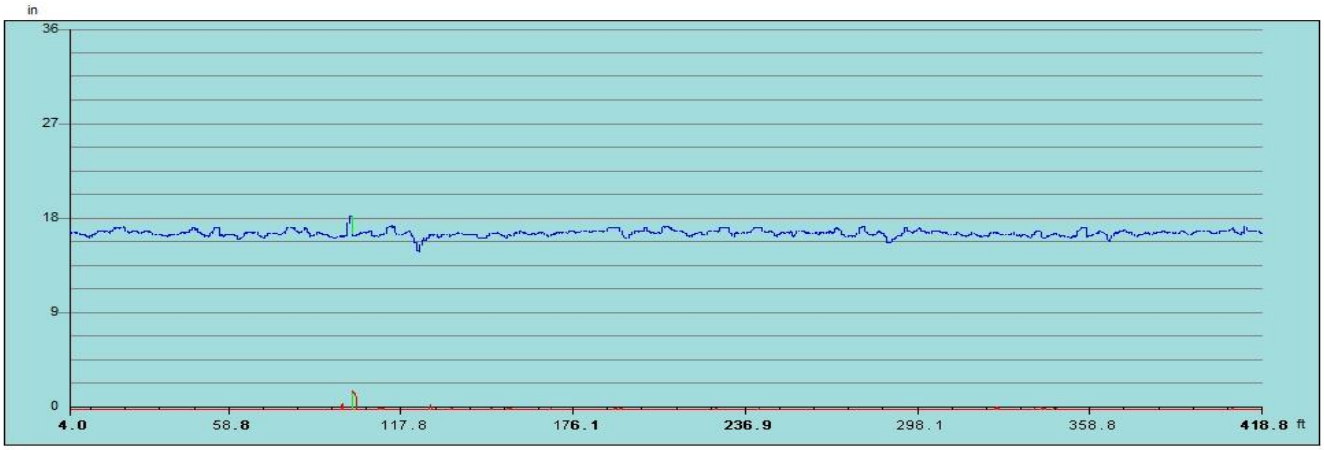
Distance	Observation	Comment
4 ft	**Beginning of Inspection**	**CMH000177**
5	General Observation	Corrosion to 0.7"
25.3	General Observation	Corrosion to 0.7"
50	General Observation	Corrosion to 0.8"
72.2	Maximum Corrosion	To 1.2"
75.2	General Observation	Corrosion to 0.8"
100.1	General Observation	Corrosion to 1.0"
125	General Observation	Corrosion to0.3"
136.5	Match to Reference Shape and Size	ø36"
149.8	General Observation	Corrosion to 0.6"
175.1	General Observation	Corrosion to 0.8"
200	General Observation	Corrosion to 0.7"
225.3	General Observation	Corrosion to 0.5"
250.1	General Observation	Corrosion to 0.8"
275.3	General Observation	Corrosion to 0.7"
300	General Observation	Corrosion to 0.7"
320.1	3D Laser Sonar Scan	Pipe Overview
324.8	General Observation	Corrosion to 0.5"
349.8	General Observation	Corrosion to 0.4"
375.8	General Observation	Corrosion to 0.7"
400	General Observation	Corrosion to 0.7"
418.7 ft	**End of Inspection**	**CMH000175**

CMH000177 - CMH000175			
Asset Number	CMH000177 - CMH000175	Length	419 ft
Upstream MH	CMH000177	Diameter	36 in
Downstream MH	CMH000175	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	136.5 ft
Date Profiled	18 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	17 in
Debris Volume	0 cubic feet

Debris Graph



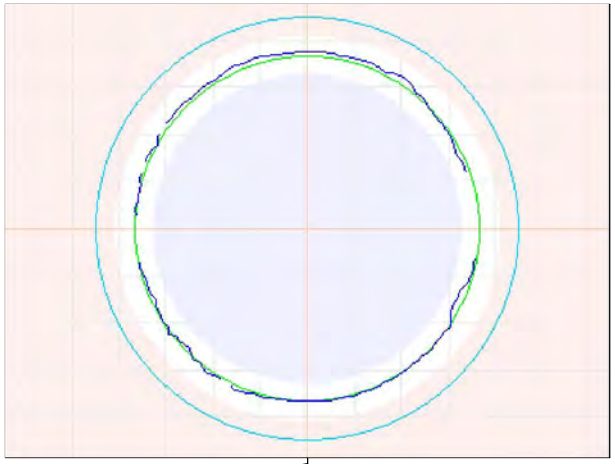
Inspection Distance (ft)

Water Level Debris Level

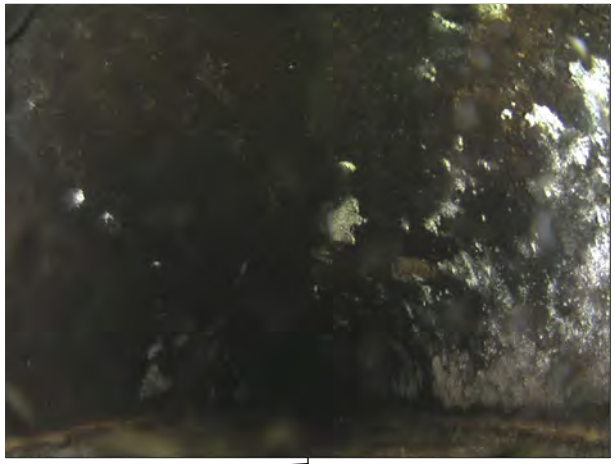
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

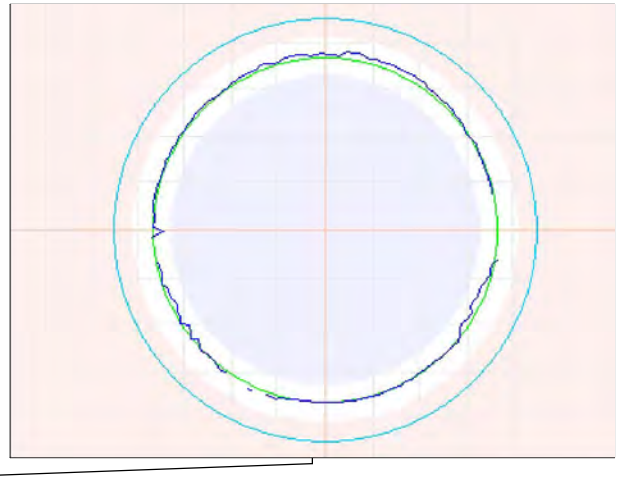
5ft General Observation - Corrosion to 0.7"

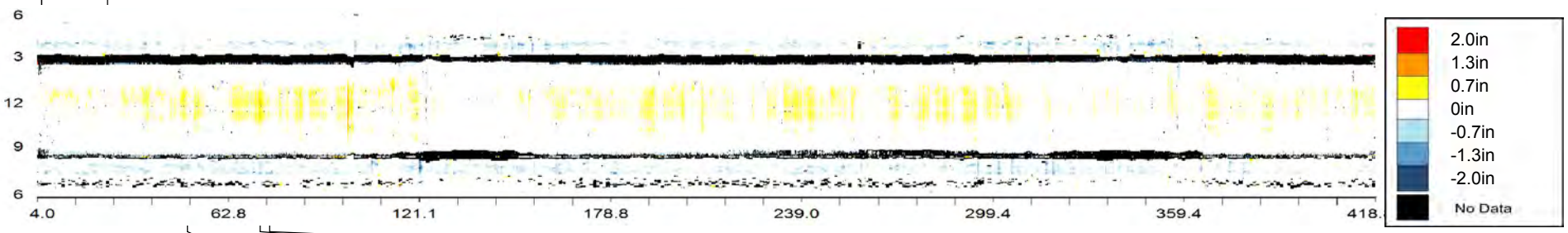


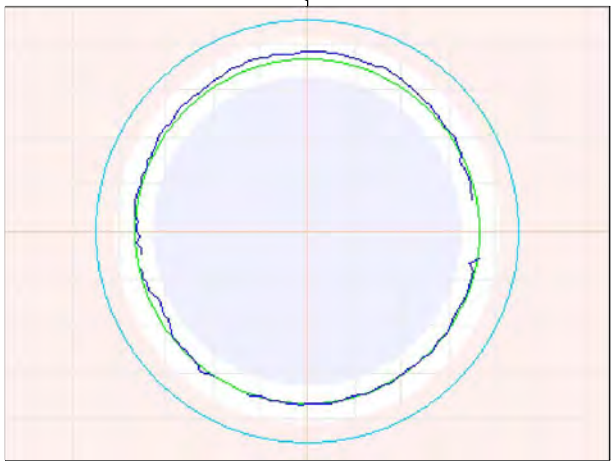
5ft General Observation - Corrosion to 0.7"



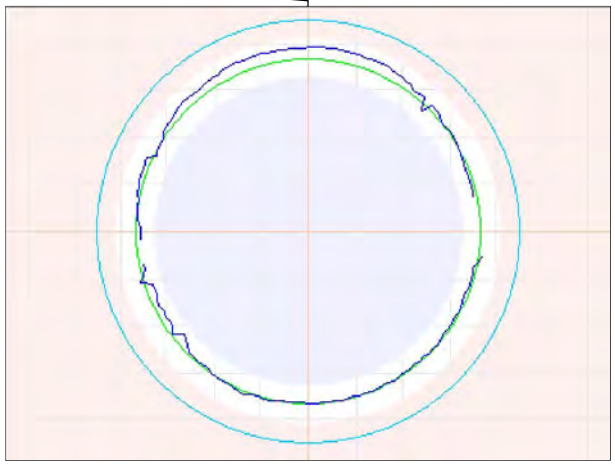
25.3ft General Observation - Corrosion to 0.7"



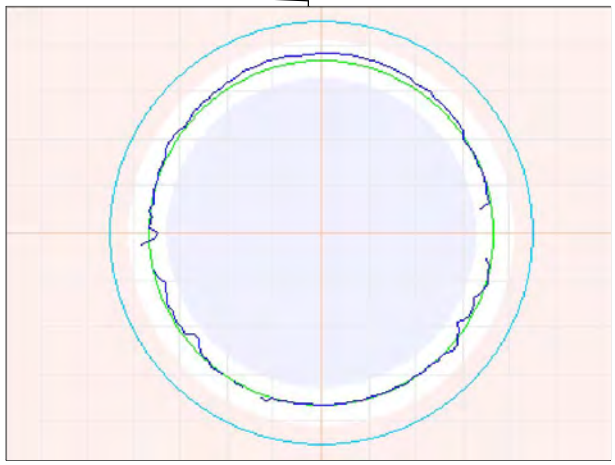




50ft General Observation - Corrosion to 0.8"



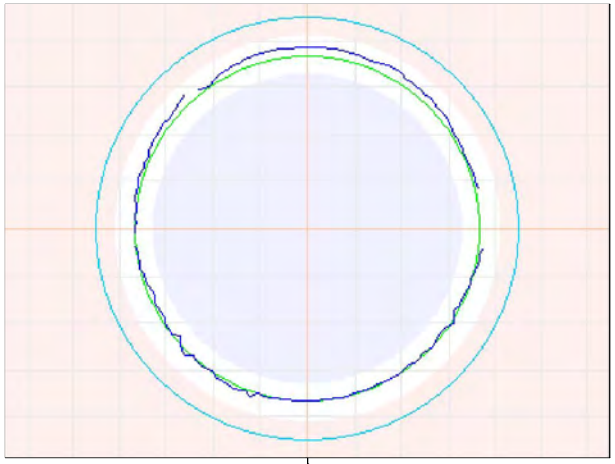
72.2ft Maximum Corrosion - To 1.2"



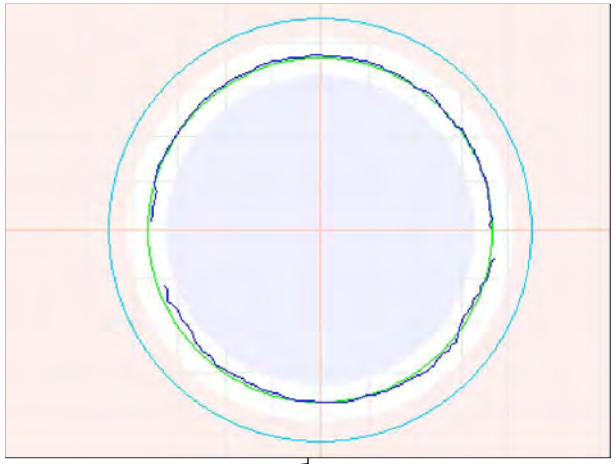
75.2ft General Observation - Corrosion to 0.8"

Observation Report

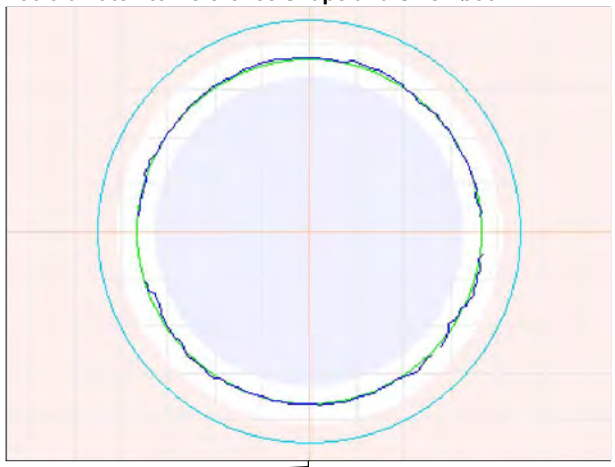
100.1ft General Observation - Corrosion to 1.0"

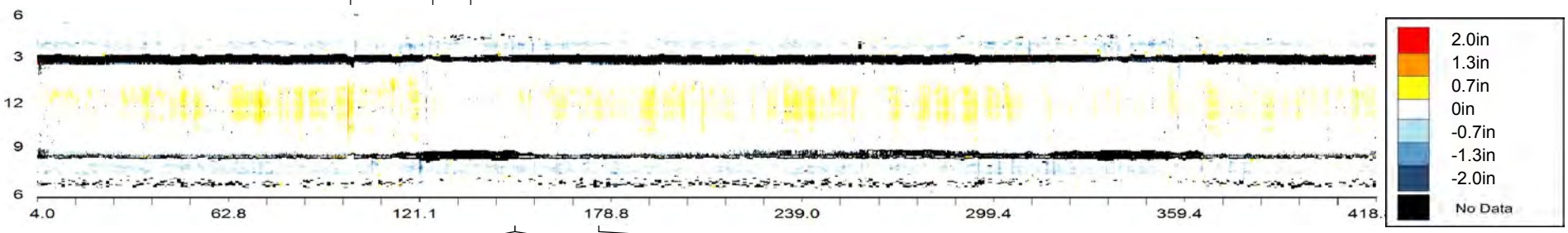


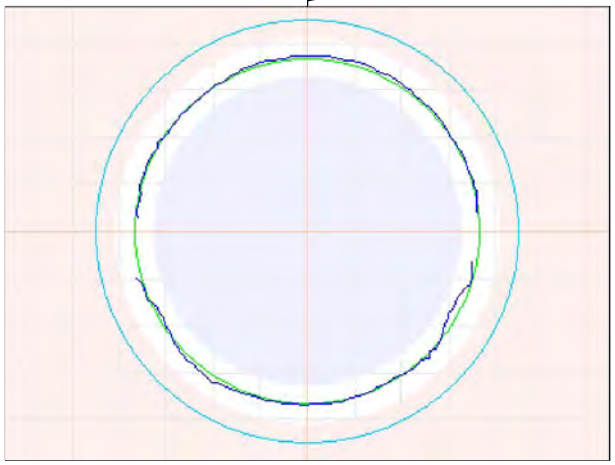
125ft General Observation - Corrosion to0.3"



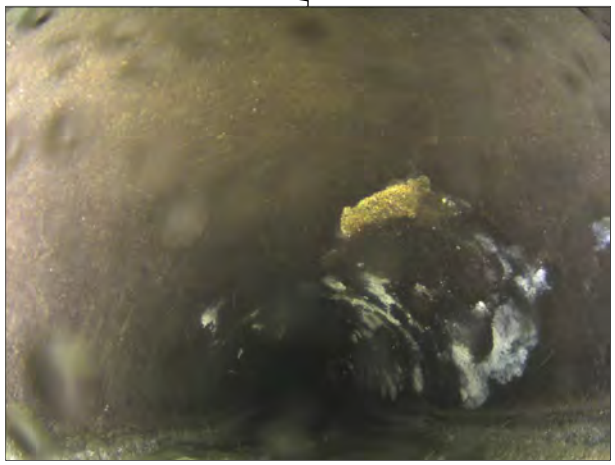
136.5ft Match to Reference Shape and Size - ø36"



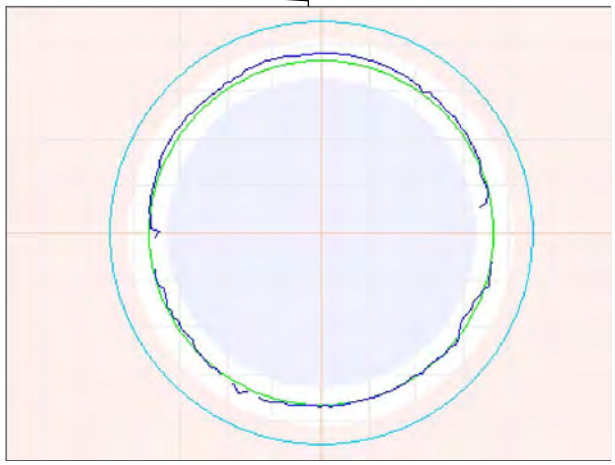




149.8ft General Observation - Corrosion to 0.6"



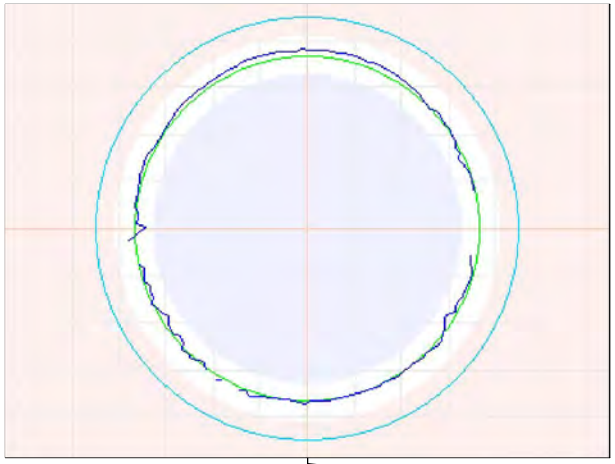
149.8ft General Observation - Corrosion to 0.6"



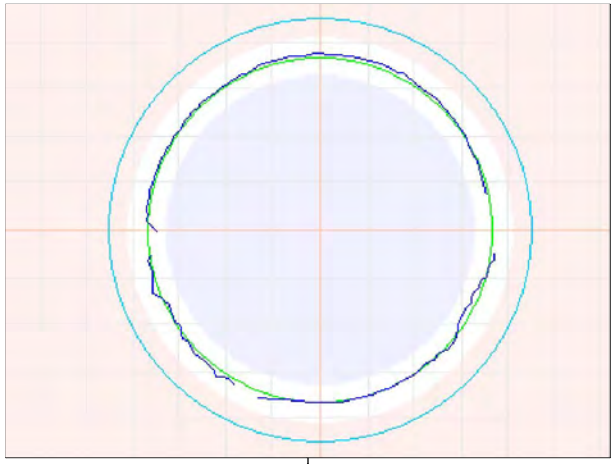
175.1ft General Observation - Corrosion to 0.8"

Observation Report

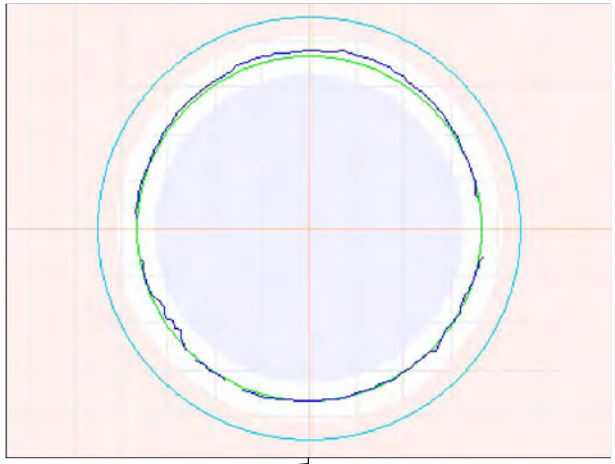
200ft General Observation - Corrosion to 0.7"

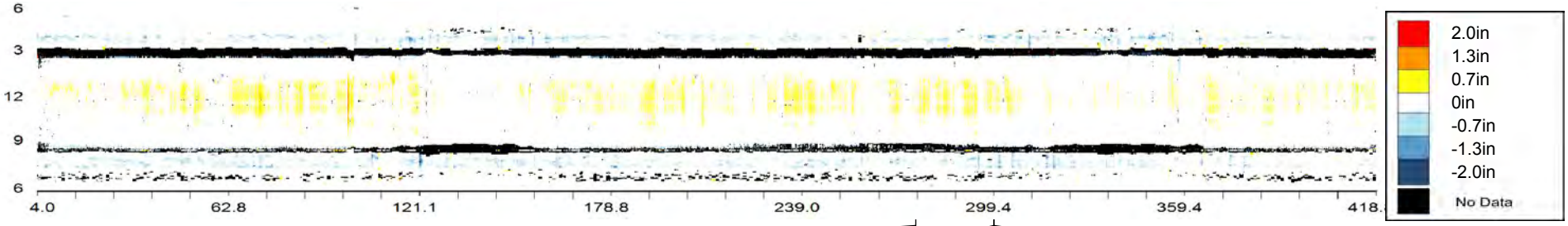


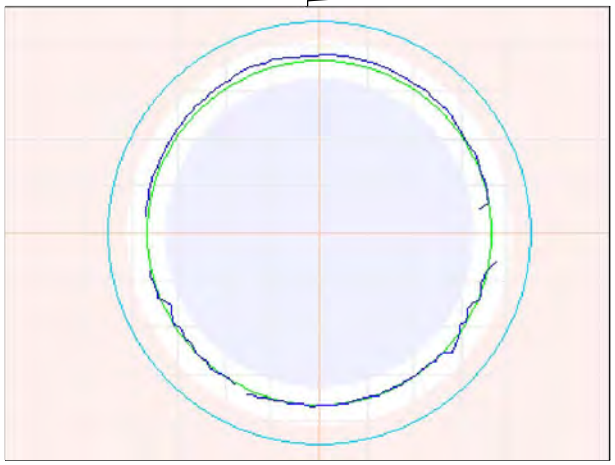
225.3ft General Observation - Corrosion to 0.5"



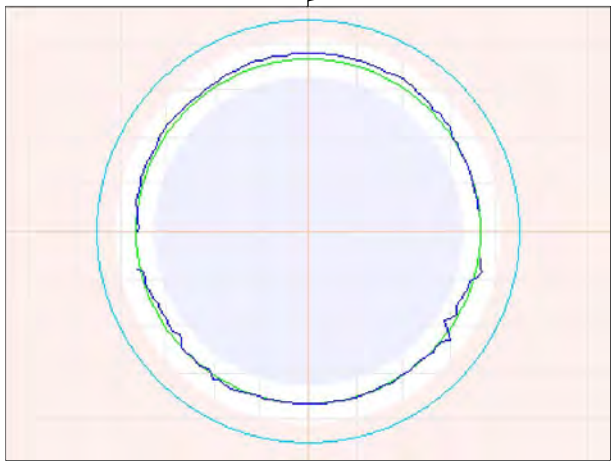
250.1ft General Observation - Corrosion to 0.8"



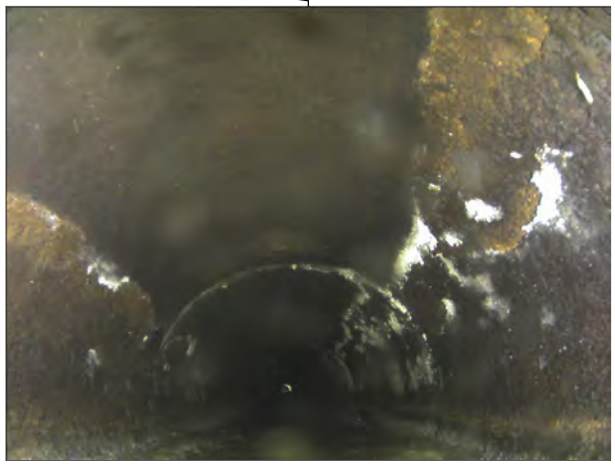




275.3ft General Observation - Corrosion to 0.7"



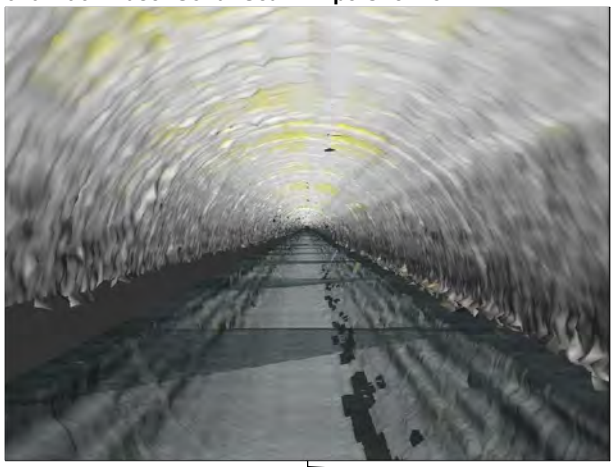
300ft General Observation - Corrosion to 0.7"



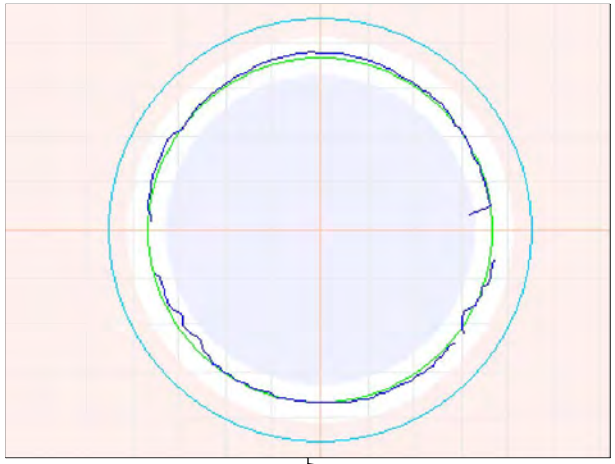
300ft General Observation - Corrosion to 0.7"

Observation Report

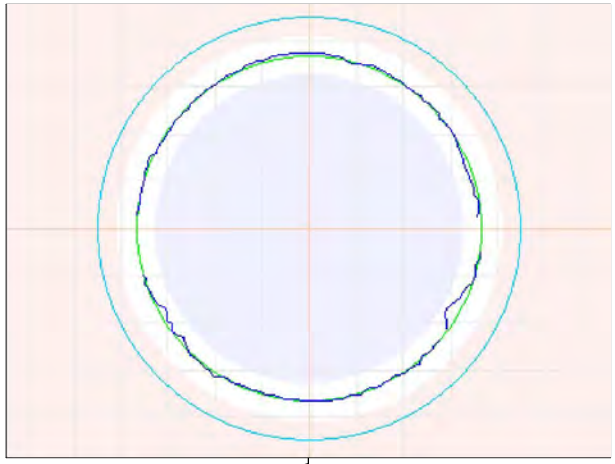
320.1ft 3D Laser Sonar Scan - Pipe Overview

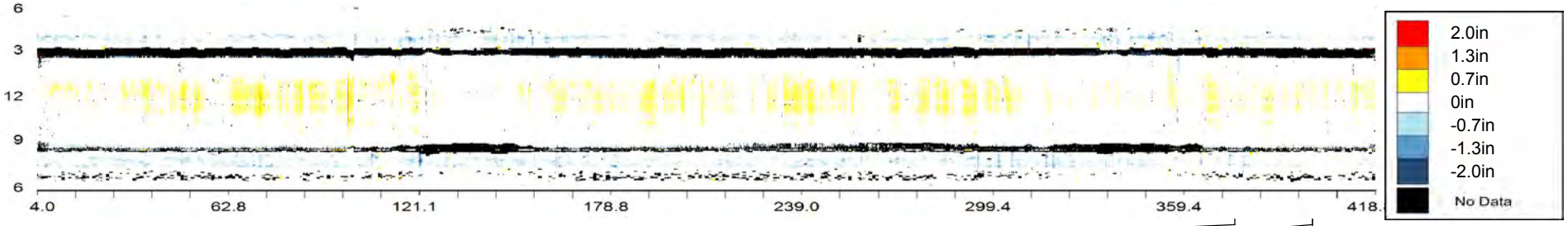


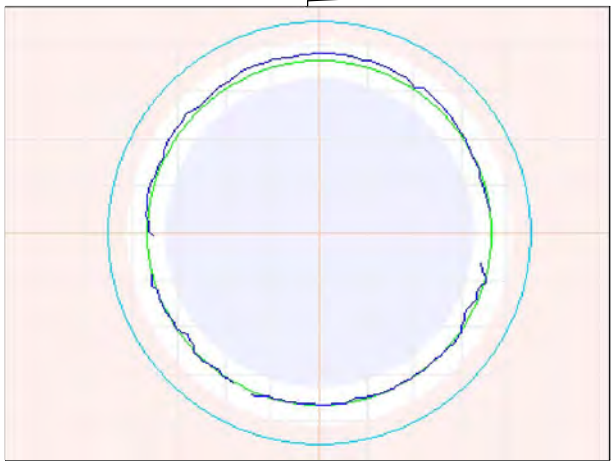
324.8ft General Observation - Corrosion to 0.5"



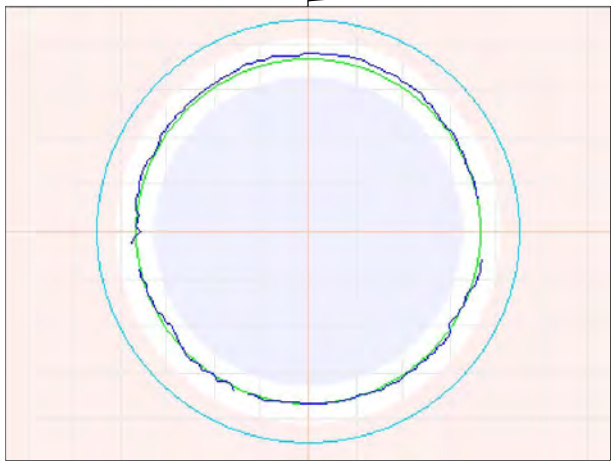
349.8ft General Observation - Corrosion to 0.4"



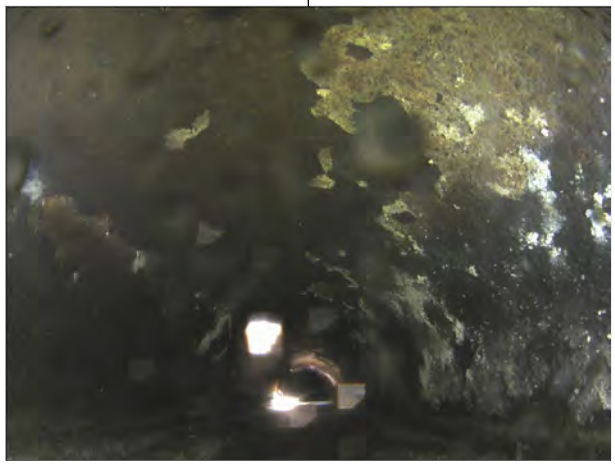




375.8ft General Observation - Corrosion to 0.7"



400ft General Observation - Corrosion to 0.7"



400ft General Observation - Corrosion to 0.7"

OVERVIEW - CMH000178 - CMH000177

Asset Number	CMH000178 - CMH000177		
Upstream MH	CMH000178	Material	Reinforced Concrete Pipe
Downstream MH	CMH000177	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	464.5 ft

Distance	Observation	Comment
4.3 ft	**Beginning of Inspection**	**CMH000178**
5.1	General Observation	Corrosion to 1.0"
24.6	General Observation	Corrosion to 0.8"
49.8	General Observation	Corrosion to 1.1"
61.9	Maximum Corrosion	To 1.8"
75.2	General Observation	Corrosion to 1.2"
99.8	General Observation	Corrosion to 1.2"
125.7	General Observation	Corrosion to 1.3"
149.8	General Observation	Corrosion to 0.8"
175.3	General Observation	Corrosion to 1.1"
199.8	General Observation	Corrosion to 0.8"
225	General Observation	Corrosion to 1"
249.9	General Observation	Corrosion to 0.8"
275.1	General Observation	Corrosion to 0.9"
287.2	3D Laser Sonar Scan	Pipe Overview
299.9	General Observation	Corrosion to 0.9"
325.3	General Observation	Corrosion to 0.9"
350	General Observation	Corrosion to 1.0"
375.2	General Observation	Corrosion to 0.9"
399.7	General Observation	Corrosion to 1.0"
425.6	General Observation	Corrosion to 1"
449.9	General Observation	Corrosion to 1.0"
464.5	Match to Reference Shape and Size	ø36"
474.6	General Observation	Corrosion to 1.2"
499.7	General Observation	Corrosion to 0.8"

OVERVIEW - CMH000178 - CMH000177			
Asset Number	CMH000178 - CMH000177		
Upstream MH	CMH000178	Material	Reinforced Concrete Pipe
Downstream MH	CMH000177	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	464.5 ft

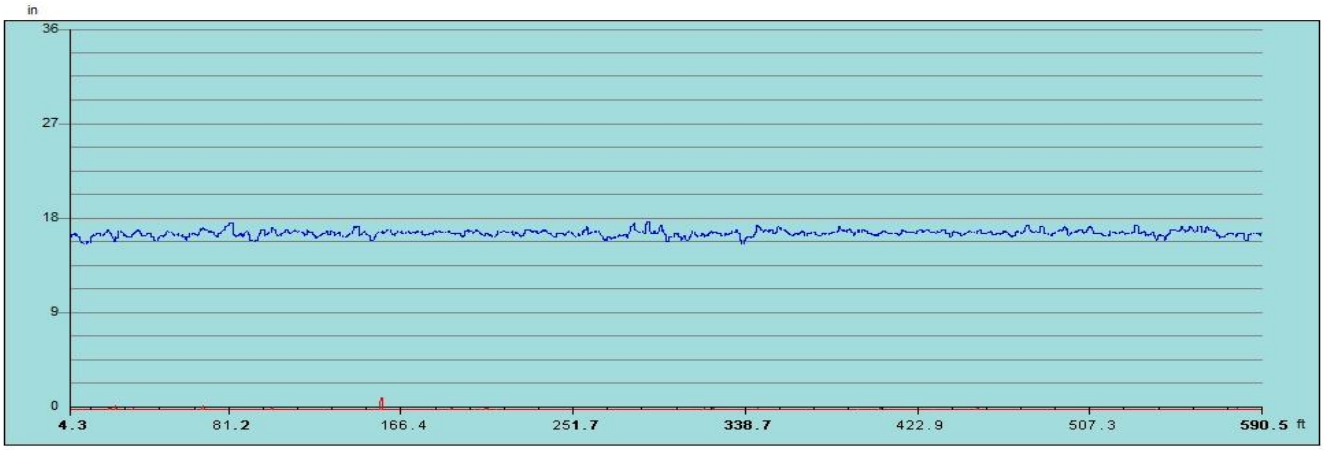
Distance	Observation	Comment
525.2	General Observation	Corrosion to 0.8"
550	General Observation	Corrosion to 1.0"
575.1	General Observation	Corrosion to 0.8"
590.4 ft	**End of Inspection**	**CMH000177**

CMH000178 - CMH000177			
Asset Number	CMH000178 - CMH000177	Length	591 ft
Upstream MH	CMH000178	Diameter	36 in
Downstream MH	CMH000177	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	464.5 ft
Date Profiled	18 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	17 in
Debris Volume	0 cubic feet

Debris Graph



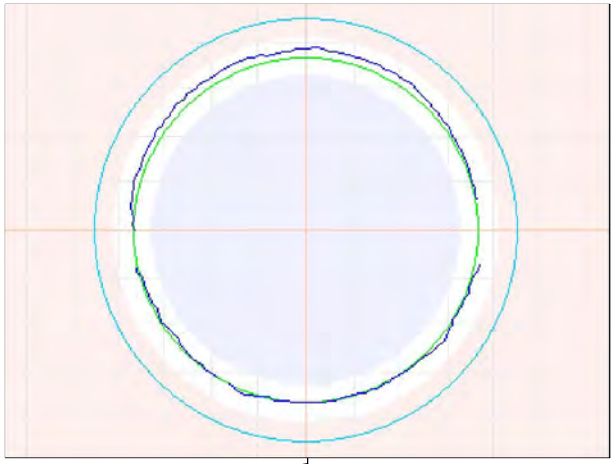
Inspection Distance (ft)

Water Level Debris Level

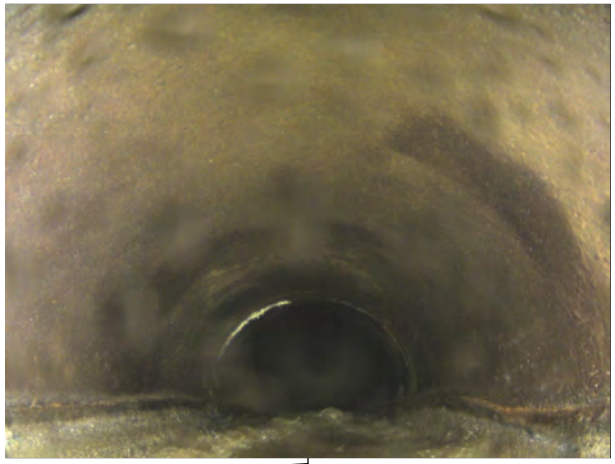
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

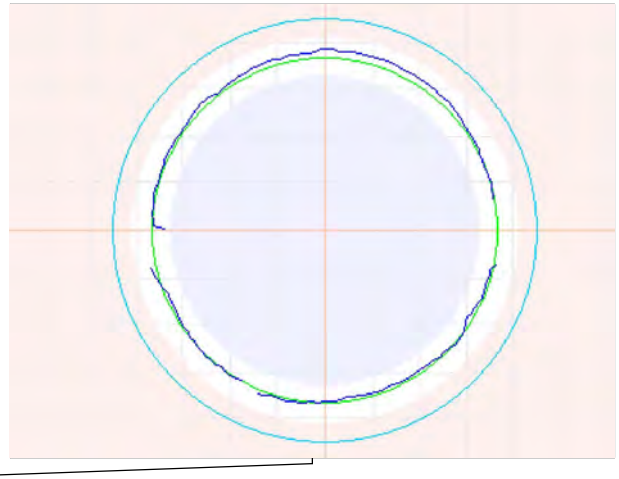
5.1ft General Observation - Corrosion to 1.0"

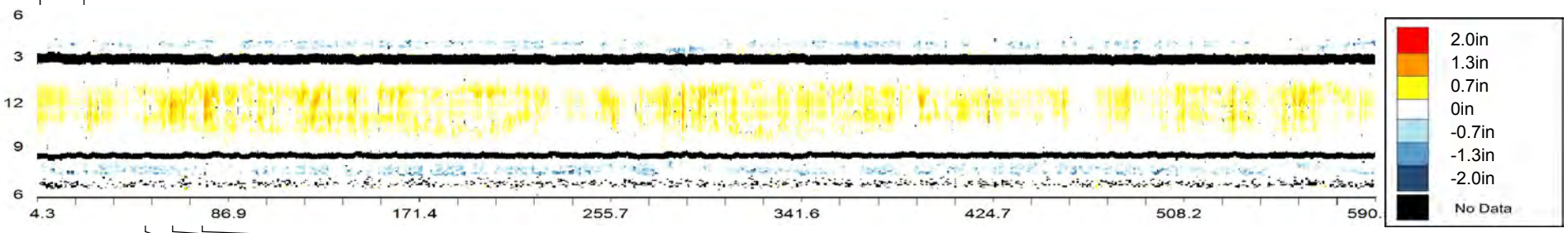


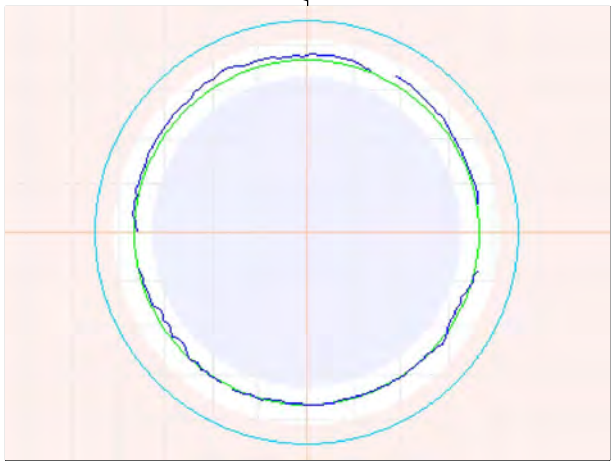
5.1ft General Observation - Corrosion to 1.0"



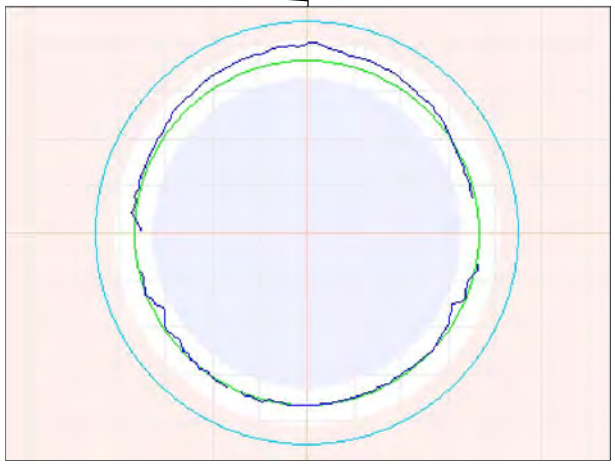
24.6ft General Observation - Corrosion to 0.8"



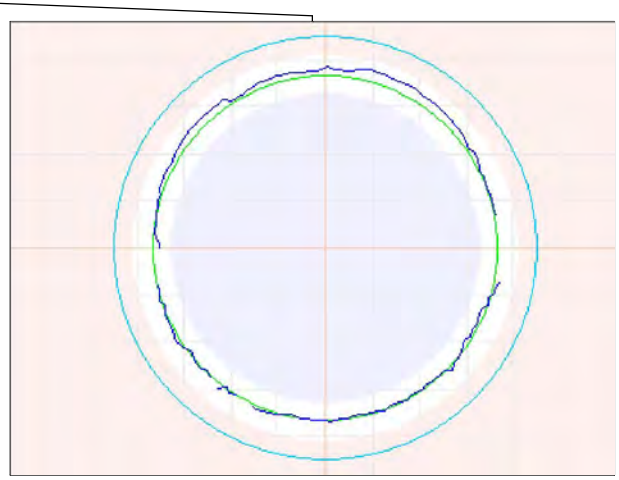




49.8ft General Observation - Corrosion to 1.1"



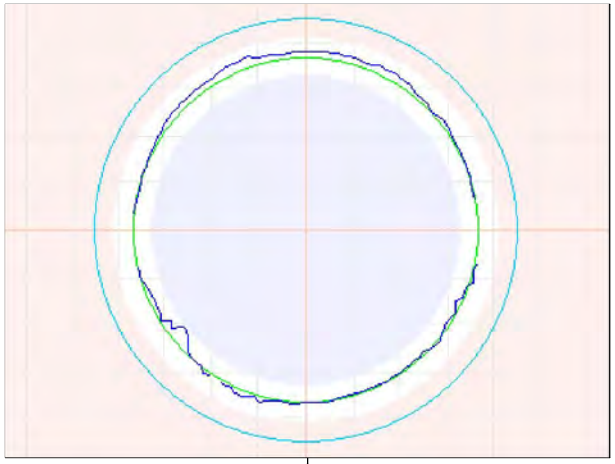
61.9ft Maximum Corrosion - To 1.8"



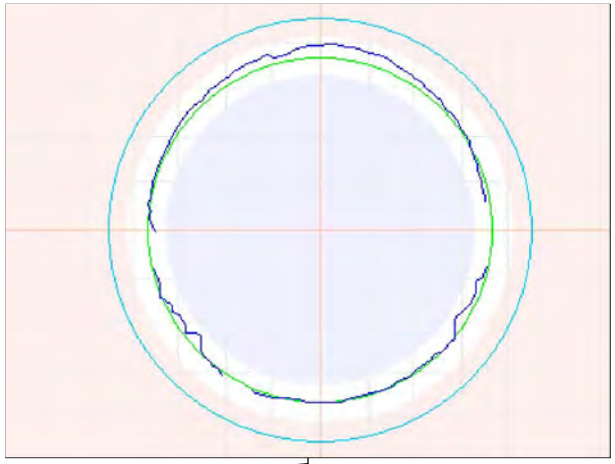
75.2ft General Observation - Corrosion to 1.2"

Observation Report

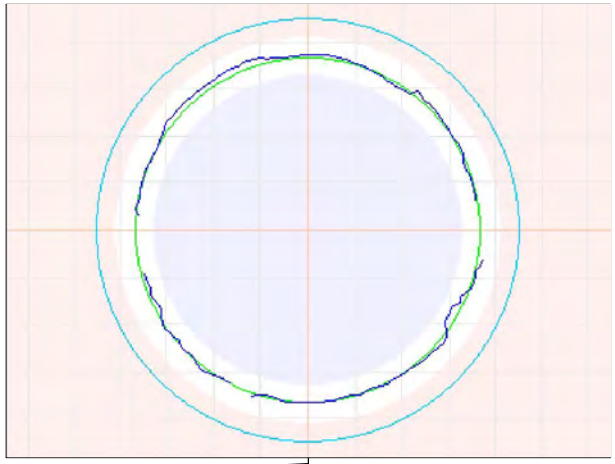
99.8ft General Observation - Corrosion to 1.2"

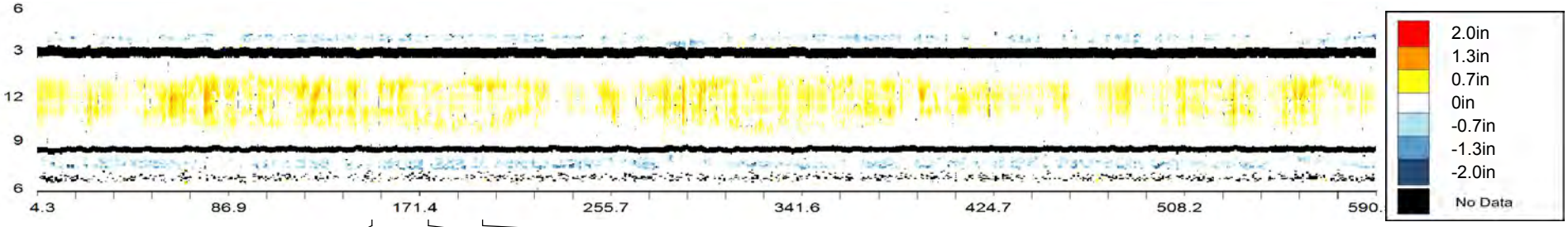


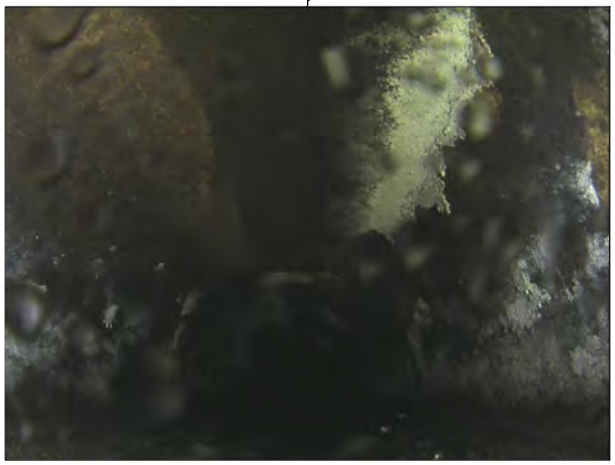
125.7ft General Observation - Corrosion to 1.3"



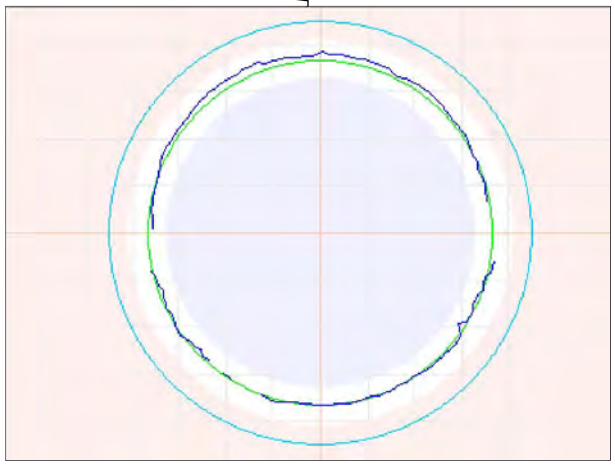
149.8ft General Observation - Corrosion to 0.8"



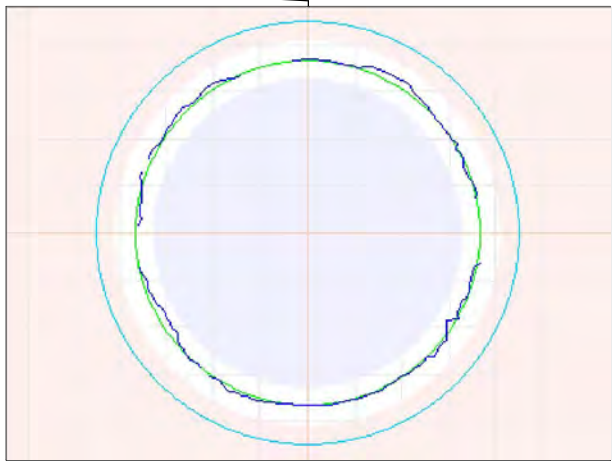




149.8ft General Observation - Corrosion to 0.8"



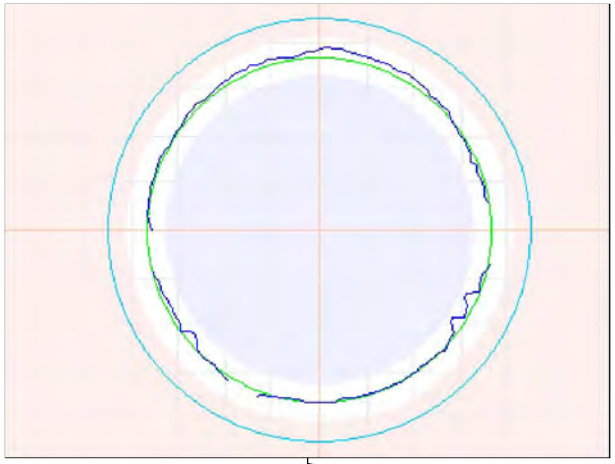
175.3ft General Observation - Corrosion to 1.1"



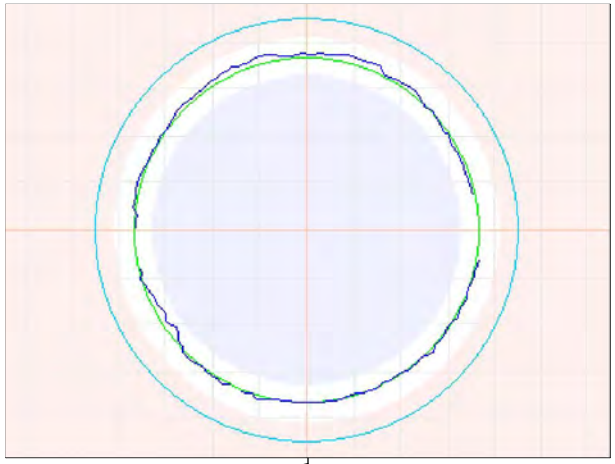
199.8ft General Observation - Corrosion to 0.8"

Observation Report

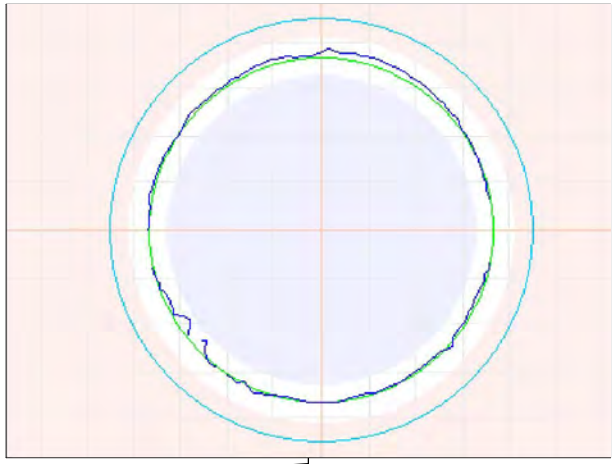
225ft General Observation - Corrosion to 1"

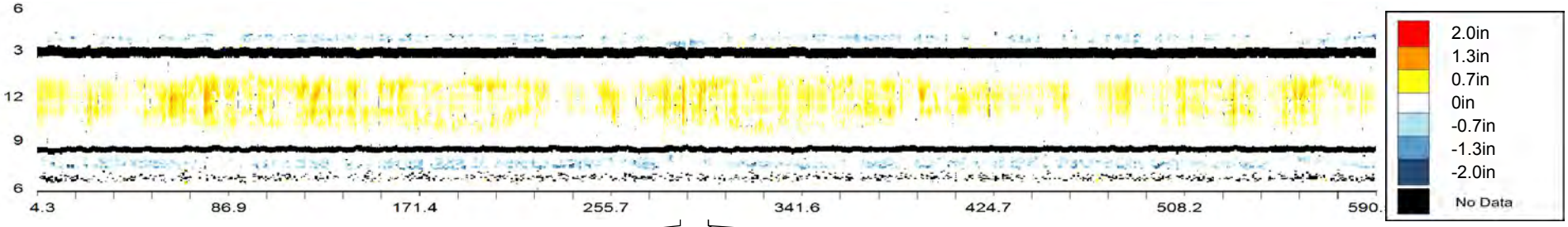


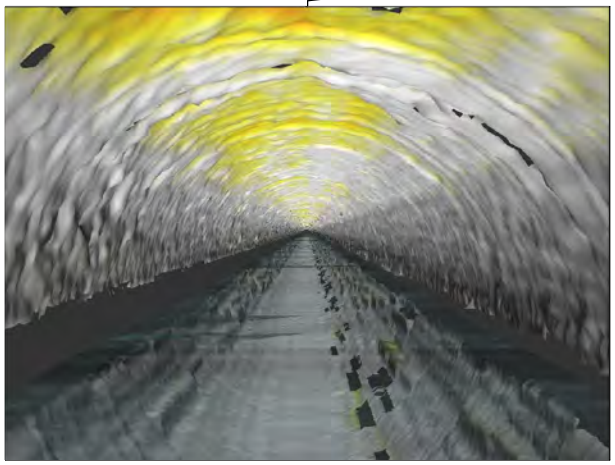
249.9ft General Observation - Corrosion to 0.8"



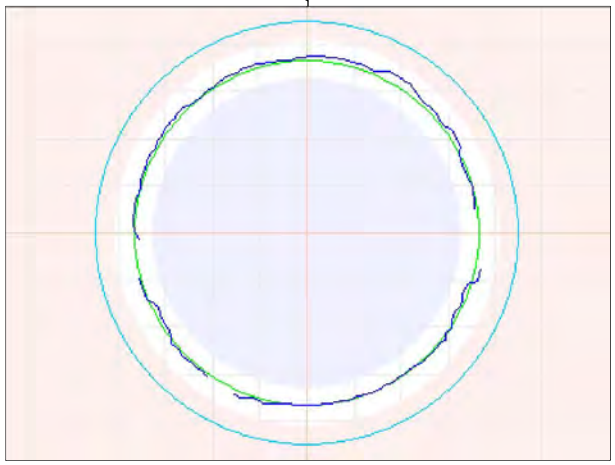
275.1ft General Observation - Corrosion to 0.9"



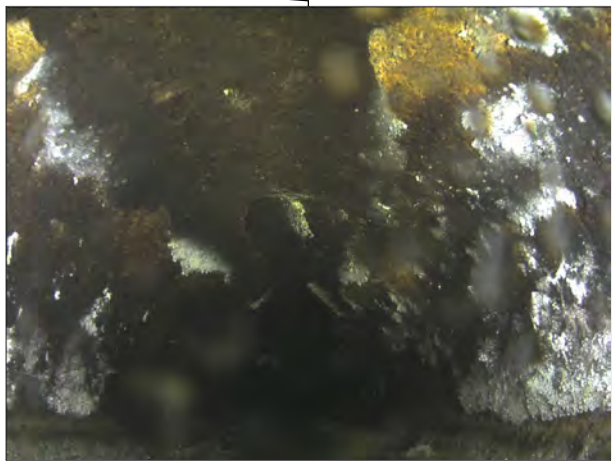




287.2ft 3D Laser Sonar Scan - Pipe Overview



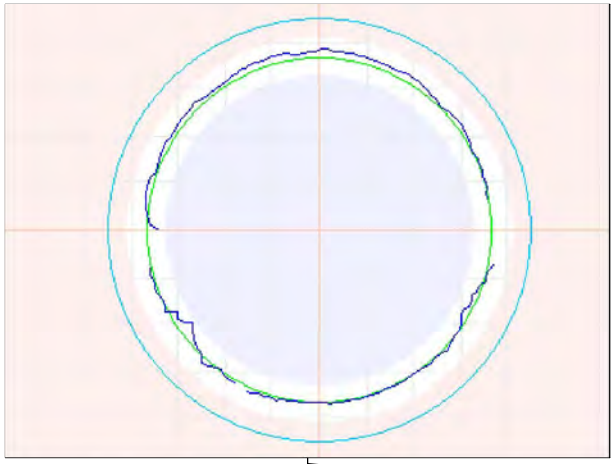
299.9ft General Observation - Corrosion to 0.9"



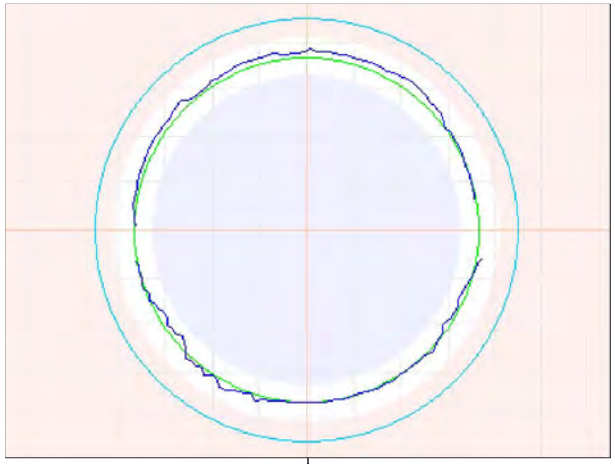
299.9ft General Observation - Corrosion to 0.9"

Observation Report

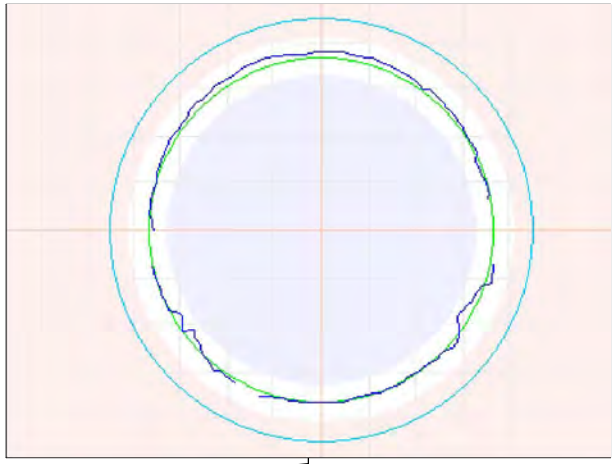
325.3ft General Observation - Corrosion to 0.9"

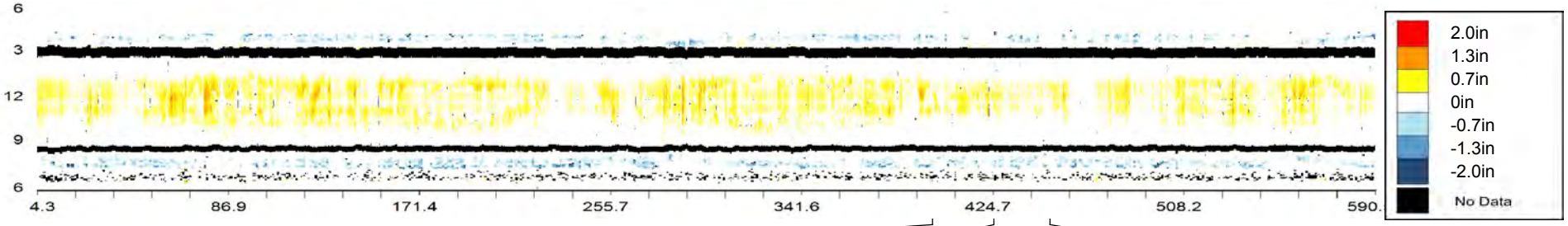


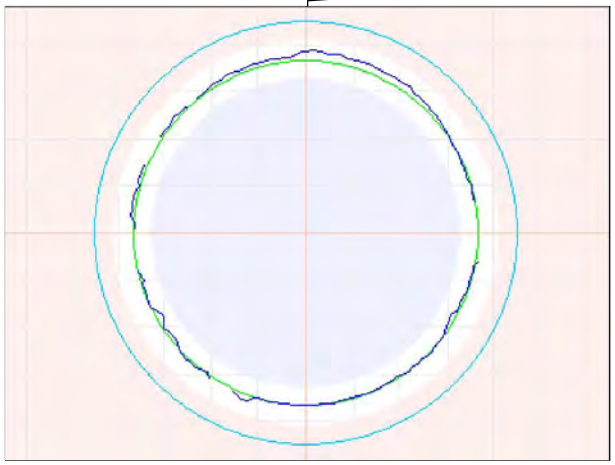
350ft General Observation - Corrosion to 1.0"



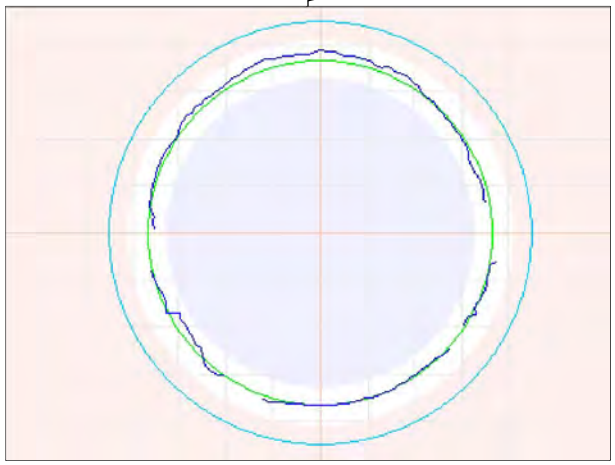
375.2ft General Observation - Corrosion to 0.9"



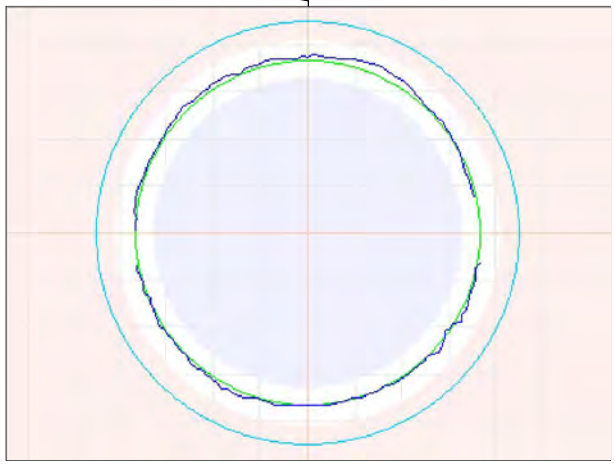




399.7ft General Observation - Corrosion to 1.0"



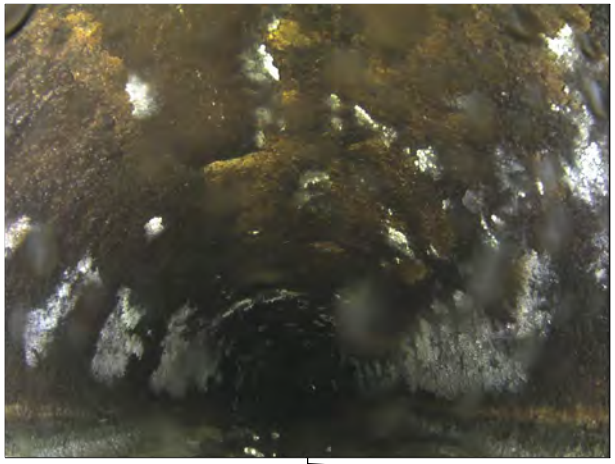
425.6ft General Observation - Corrosion to 1"



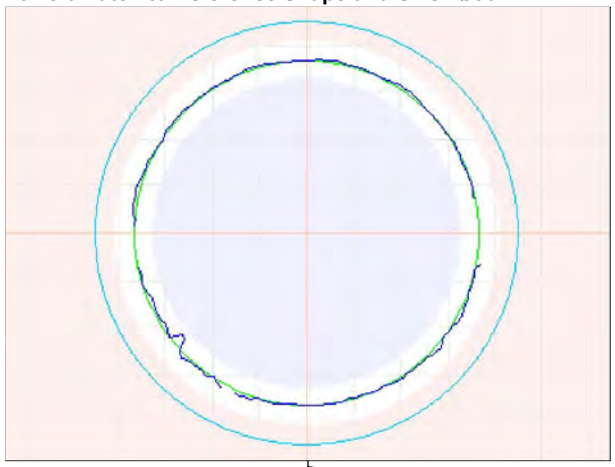
449.9ft General Observation - Corrosion to 1.0"

Observation Report

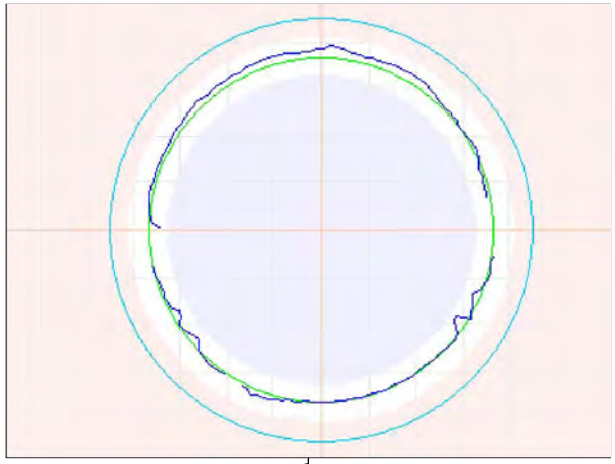
449.9ft General Observation - Corrosion to 1.0"

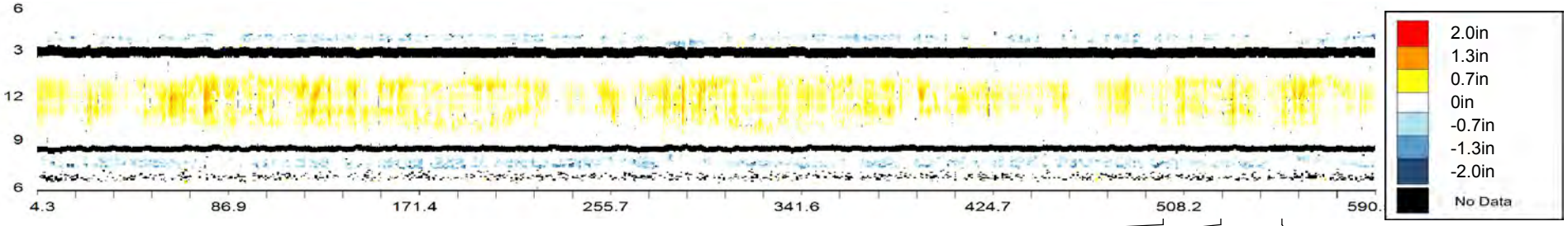


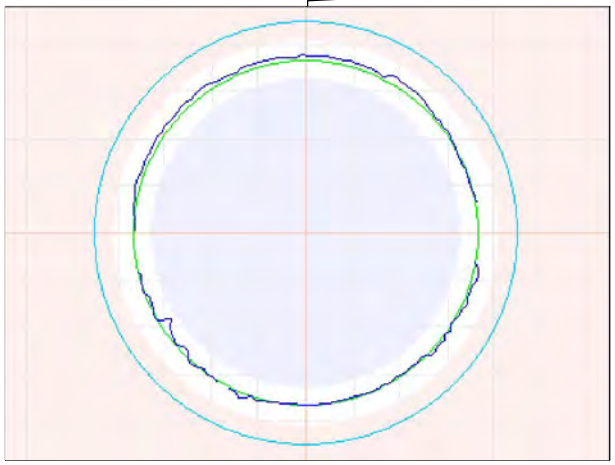
464.5ft Match to Reference Shape and Size - ø36"



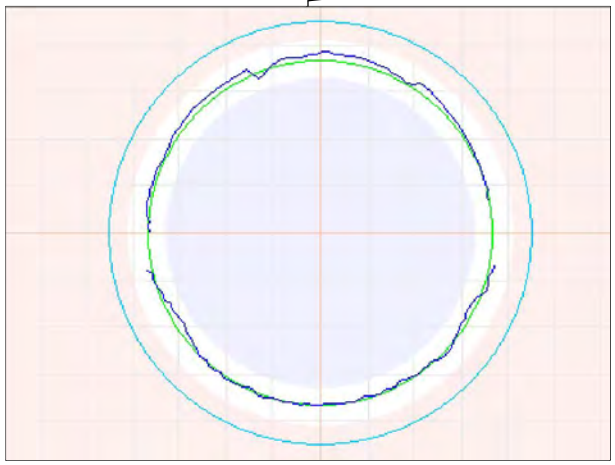
474.6ft General Observation - Corrosion to 1.2"



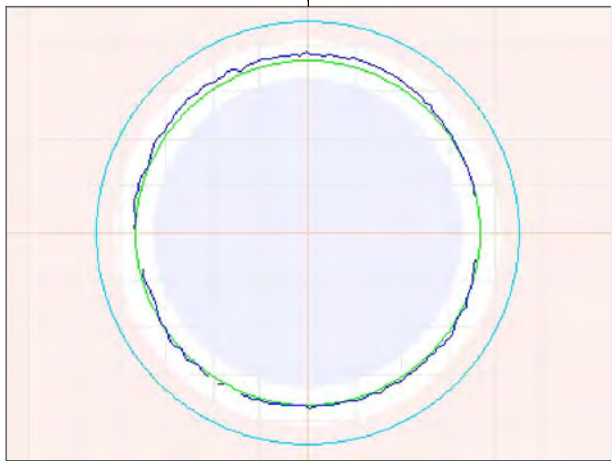




499.7ft General Observation - Corrosion to 0.8"



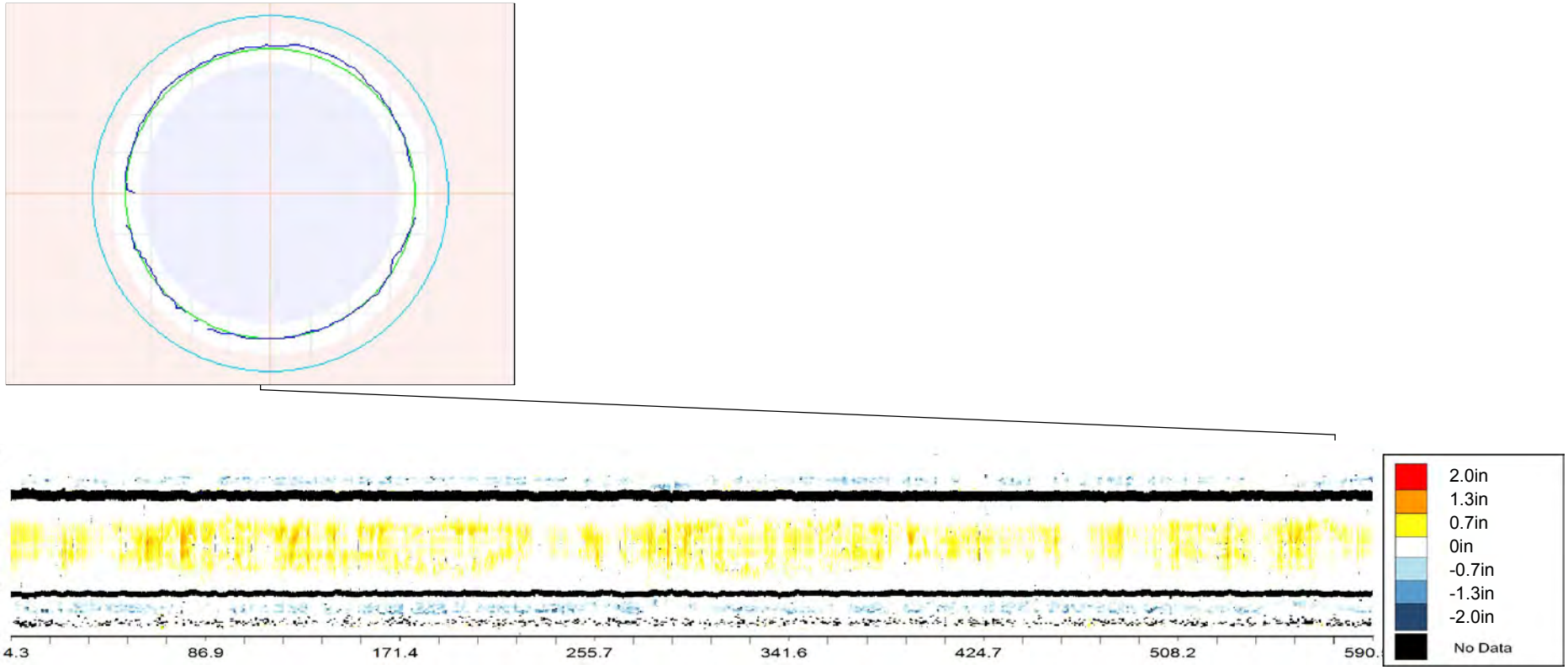
525.2ft General Observation - Corrosion to 0.8"



550ft General Observation - Corrosion to 1.0"

Observation Report

575.1ft General Observation - Corrosion to 0.8"



OVERVIEW - CMH000179 - CMH000178

Asset Number	CMH000179 - CMH000178		
Upstream MH	CMH000179	Material	Reinforced Concrete Pipe
Downstream MH	CMH000178	Size & Shape	42 in Circle
Survey Direction	Downstream	Match to Reference	218.4 ft

Distance	Observation	Comment
2.4 ft	**Beginning of Inspection**	**CMH000179**
3	General Observation	Corrosion to 0.9"
24.8	General Observation	Corrosion to 0.5"
49.9	General Observation	Corrosion to 0.7"
74.6	General Observation	Corrosion to 0.9"
99.8	General Observation	Corrosion to 0.7"
125.3	General Observation	Corrosion to 0.7"
149.9	General Observation	Corrosion to 0.9"
175.2	General Observation	Corrosion to 1"
200	General Observation	Corrosion to 0.9"
218.4	Match to Reference Shape and Size	ø42"
225.1	General Observation	Corrosion to 0.8"
249.8	General Observation	Corrosion to 0.6"
275.2	General Observation	Corrosion to 0.7"
299.8	General Observation	Corrosion to 0.9"
325.1	General Observation	Corrosion to 1"
349.8	General Observation	Corrosion to 1.0"
375.3	General Observation	Corrosion to 0.9"
399.7	General Observation	Corrosion to 1.0"
425.3	General Observation	Corrosion to 1"
449.8	General Observation	Corrosion to 0.9"
475.2	General Observation	Corrosion to 0.7"
500	General Observation	Corrosion to 0.9"
524.9	General Observation	Corrosion to 0.9"
540.7	3D Laser Sonar Scan	Pipe Overview

OVERVIEW - CMH000179 - CMH000178

Asset Number	CMH000179 - CMH000178		
Upstream MH	CMH000179	Material	Reinforced Concrete Pipe
Downstream MH	CMH000178	Size & Shape	42 in Circle
Survey Direction	Downstream	Match to Reference	218.4 ft

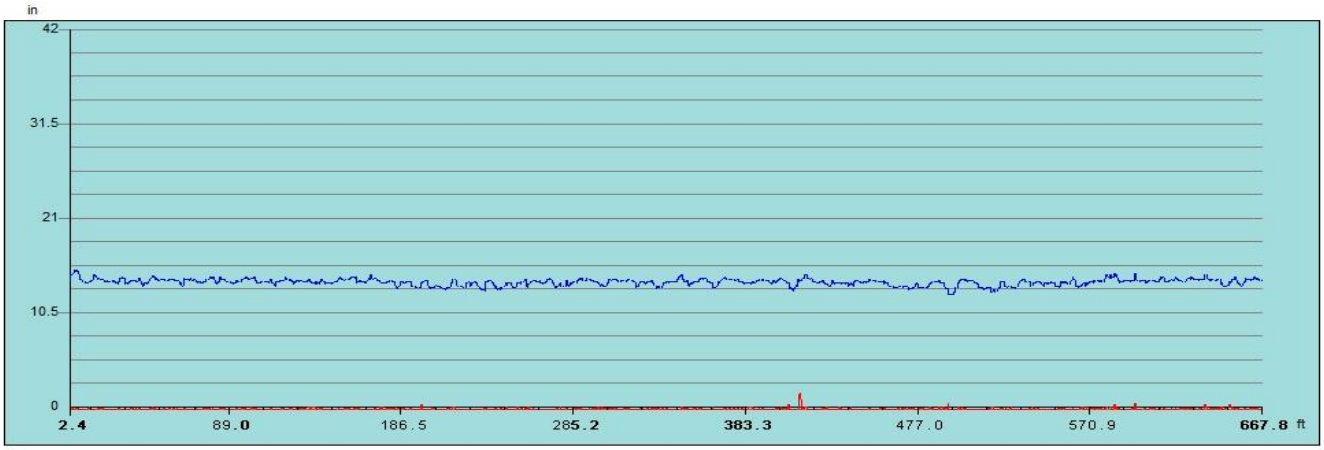
Distance	Observation	Comment
550	General Observation	Corrosion to 1.0"
550.9	Maximum Corrosion	To 1.3"
575	General Observation	Corrosion to 1"
599.7	General Observation	Corrosion to 1.0"
624.8	General Observation	Corrosion to 0.8"
650	General Observation	Corrosion to 1.1"
667.7 ft	**End of Inspection**	**CMH000178**

CMH000179 - CMH000178			
Asset Number	CMH000179 - CMH000178	Length	668 ft
Upstream MH	CMH000179	Diameter	42 in
Downstream MH	CMH000178	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	218.4 ft
Date Profiled	18 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	14 in
Debris Volume	1 cubic feet

Debris Graph



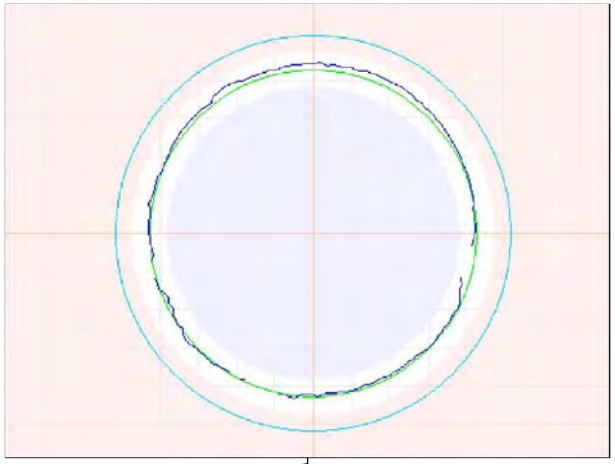
Inspection Distance (ft)

Water Level Debris Level

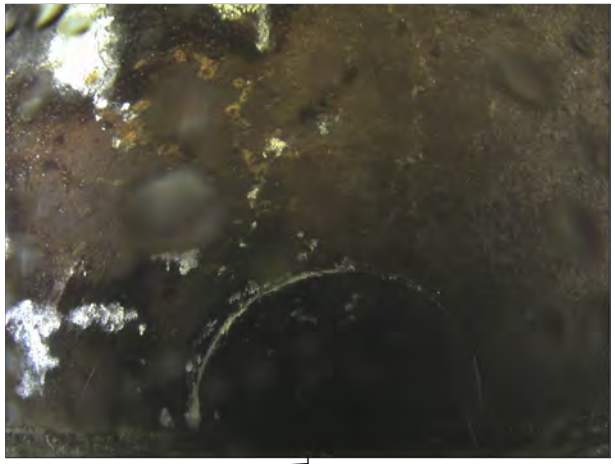
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

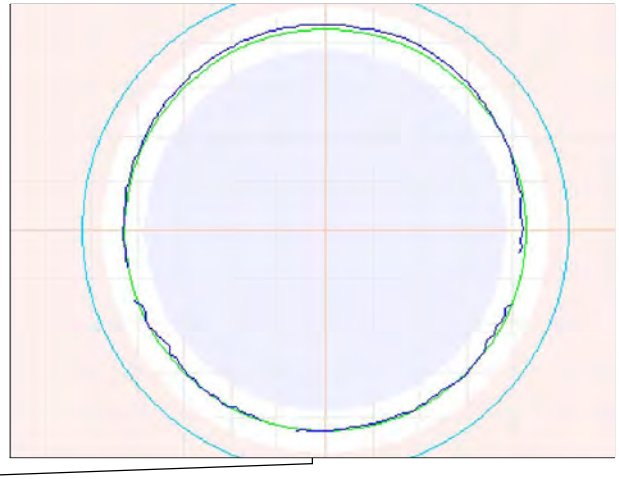
3ft General Observation - Corrosion to 0.9"

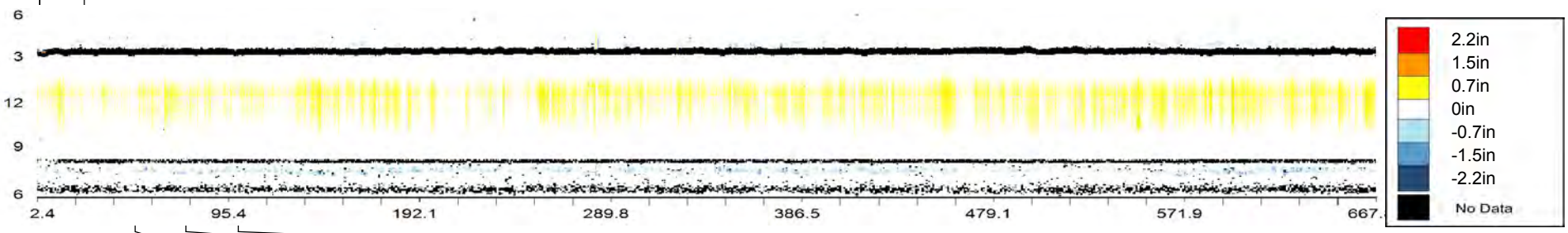


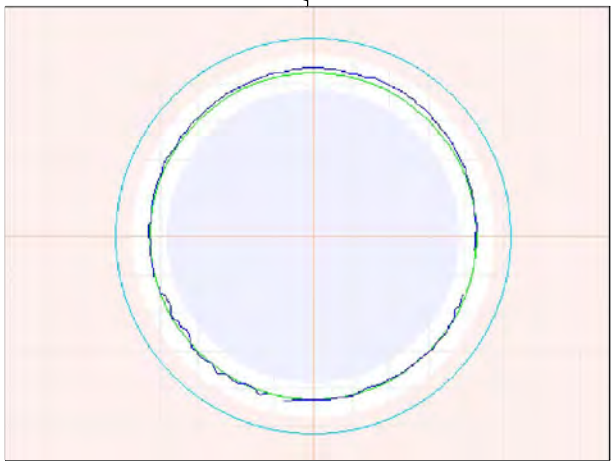
3ft General Observation - Corrosion to 0.9"



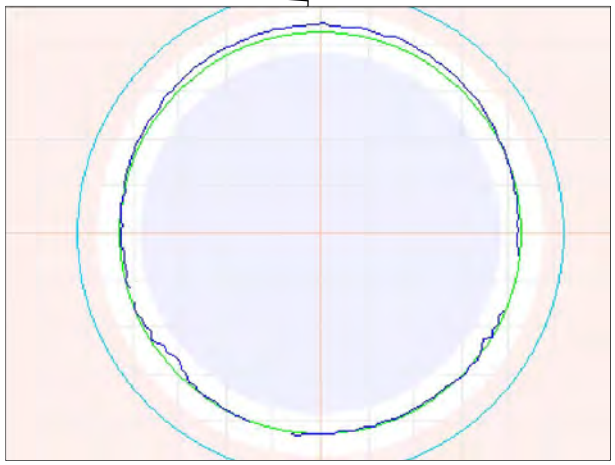
24.8ft General Observation - Corrosion to 0.5"



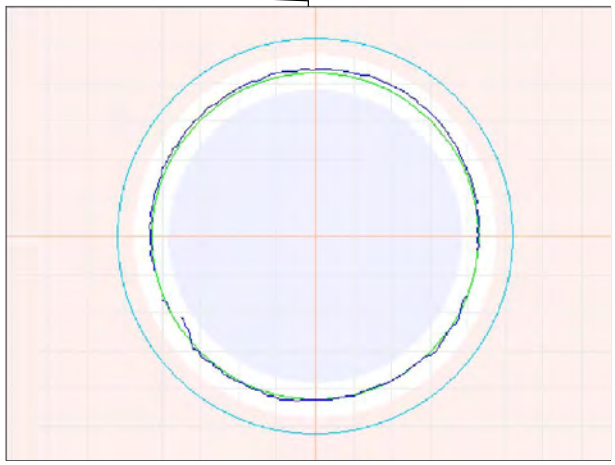




49.9ft General Observation - Corrosion to 0.7"



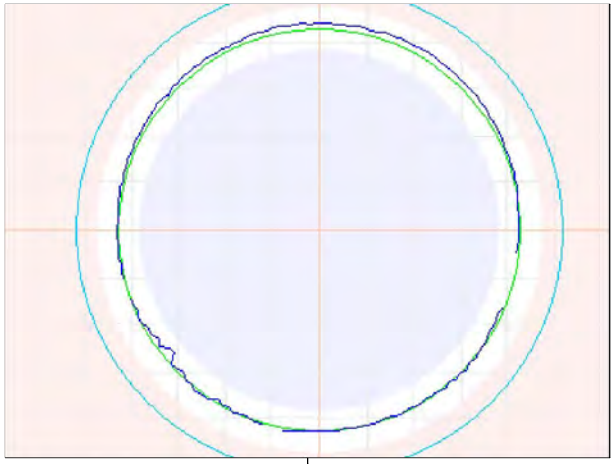
74.6ft General Observation - Corrosion to 0.9"



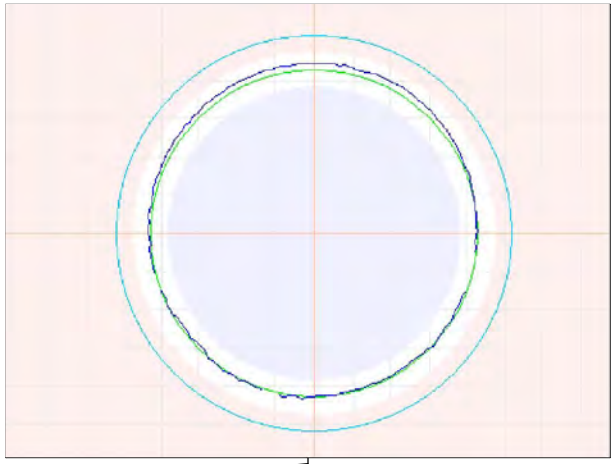
99.8ft General Observation - Corrosion to 0.7"

Observation Report

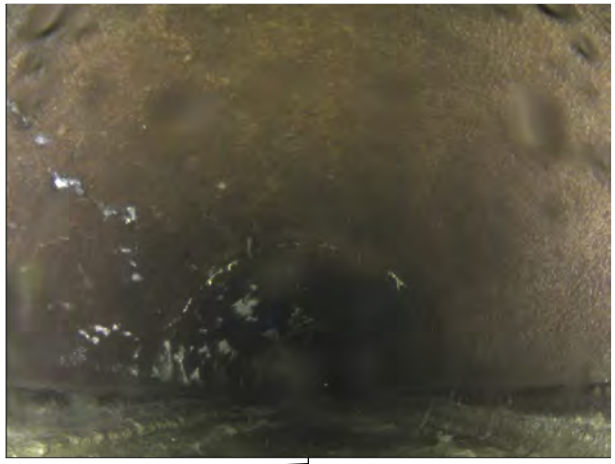
125.3ft General Observation - Corrosion to 0.7"

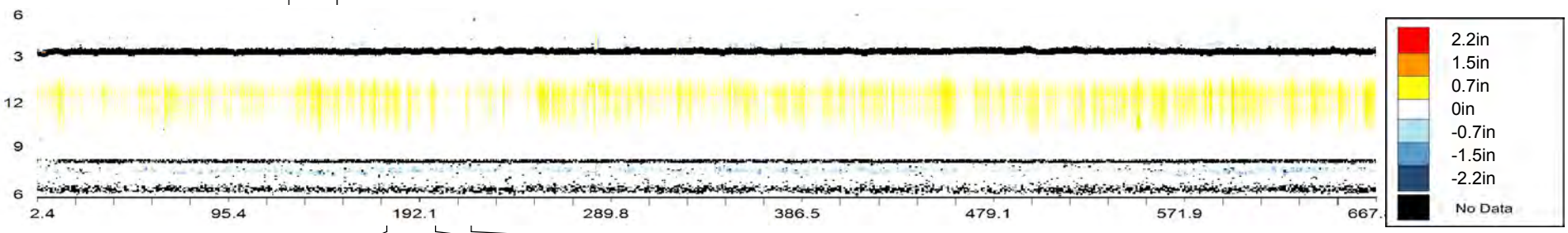


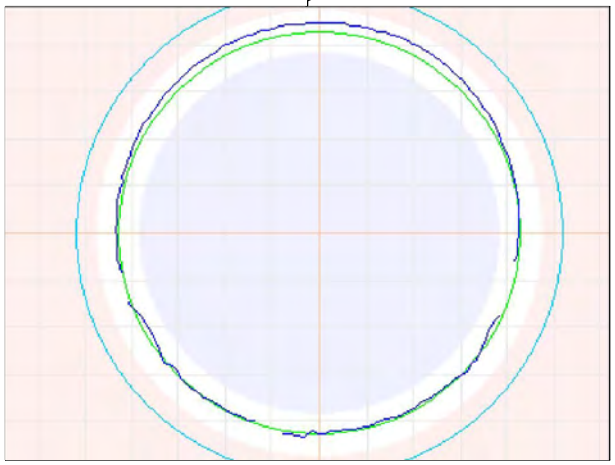
149.9ft General Observation - Corrosion to 0.9"



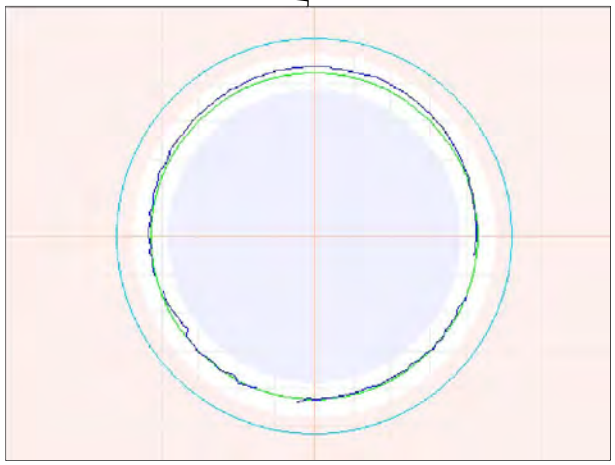
149.9ft General Observation - Corrosion to 0.9"



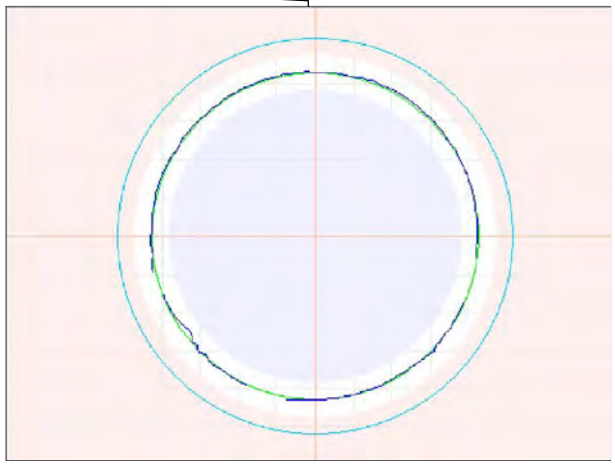




175.2ft General Observation - Corrosion to 1"



200ft General Observation - Corrosion to 0.9"

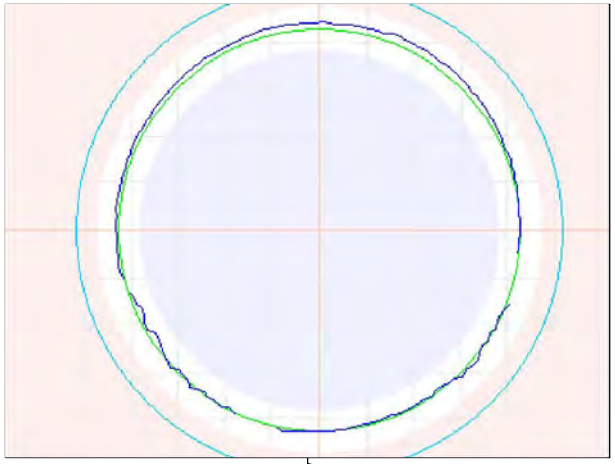


218.4ft Match to Reference Shape and Size - ø42"

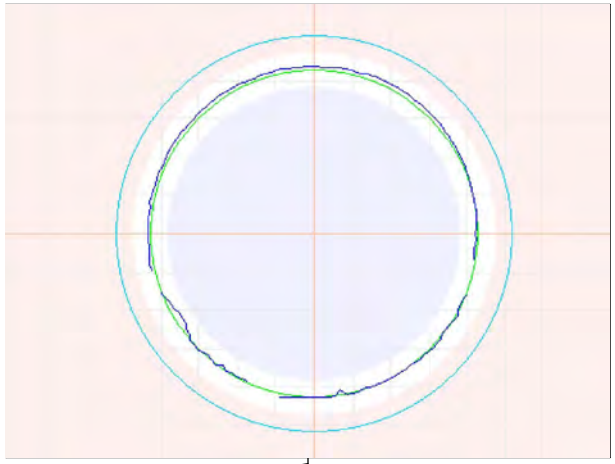
Observation Report

60

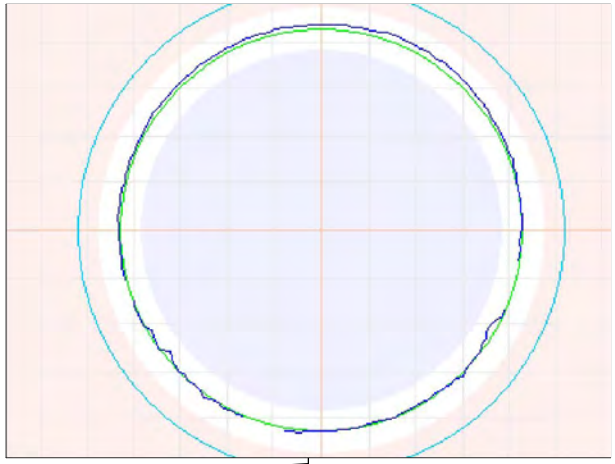
225.1ft General Observation - Corrosion to 0.8"

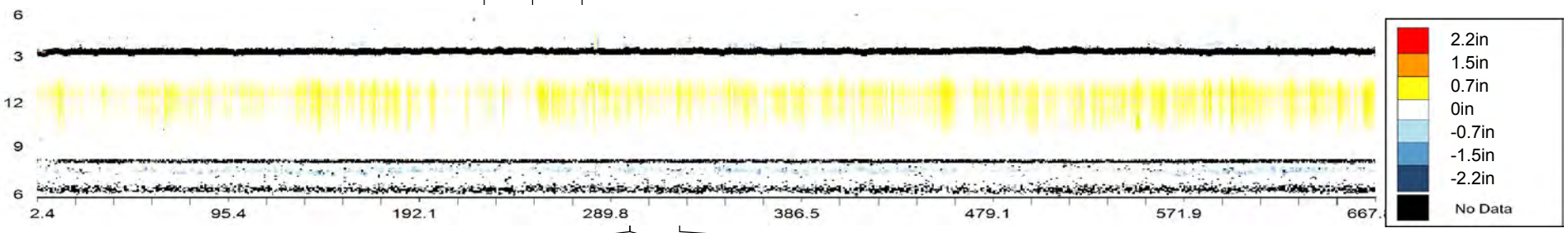


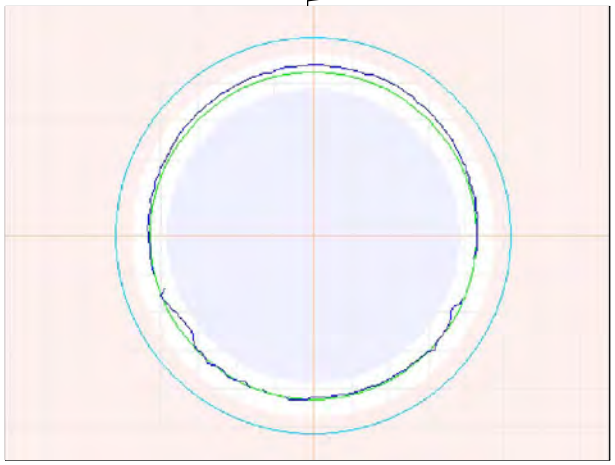
249.8ft General Observation - Corrosion to 0.6"



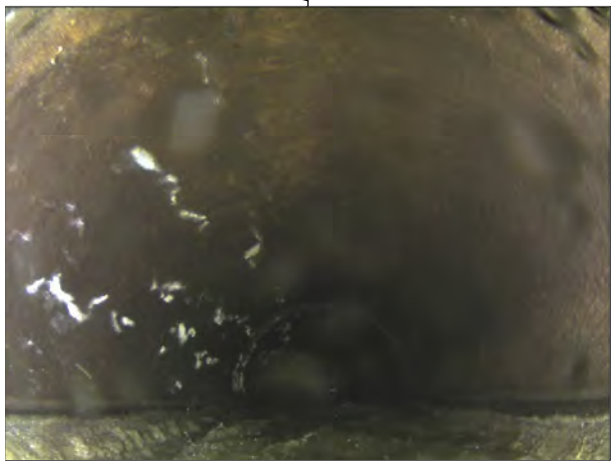
275.2ft General Observation - Corrosion to 0.7"



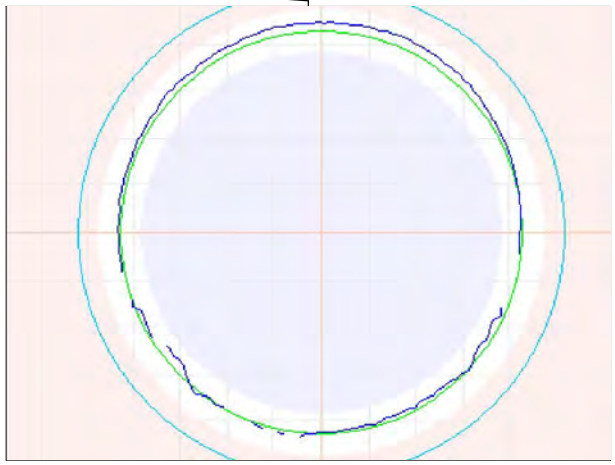




299.8ft General Observation - Corrosion to 0.9"



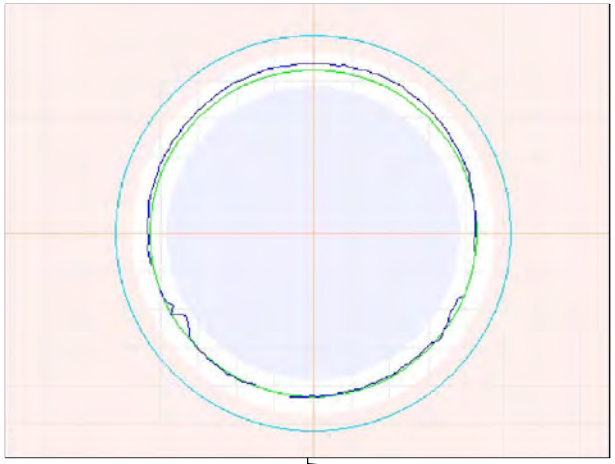
299.8ft General Observation - Corrosion to 0.9"



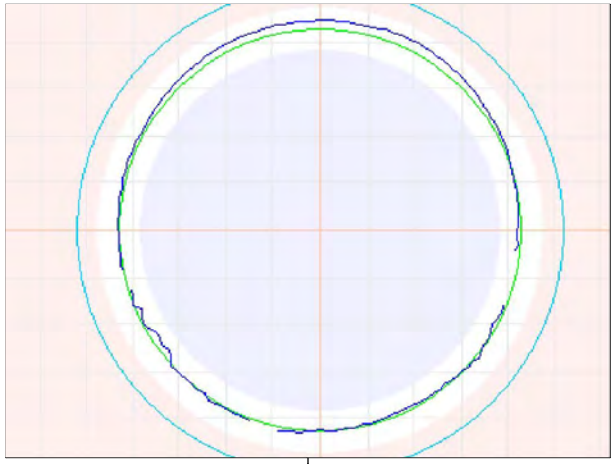
325.1ft General Observation - Corrosion to 1"

Observation Report

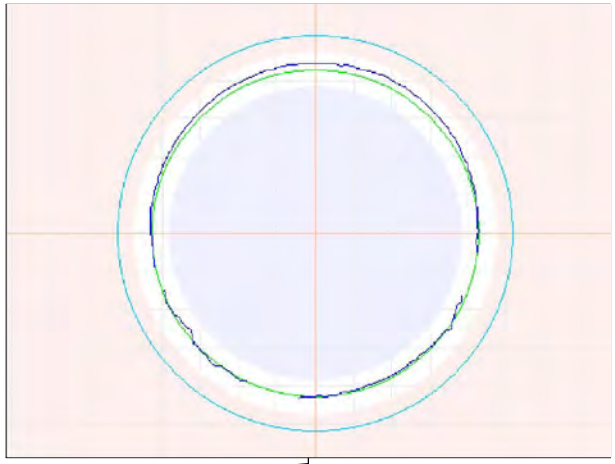
349.8ft General Observation - Corrosion to 1.0"

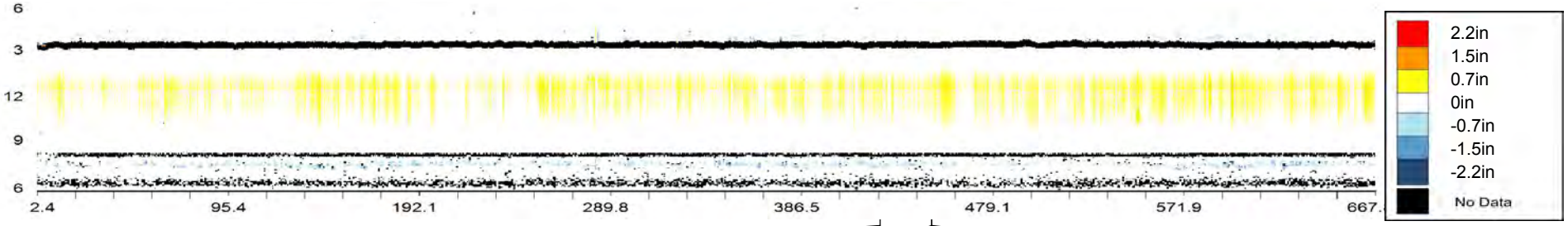


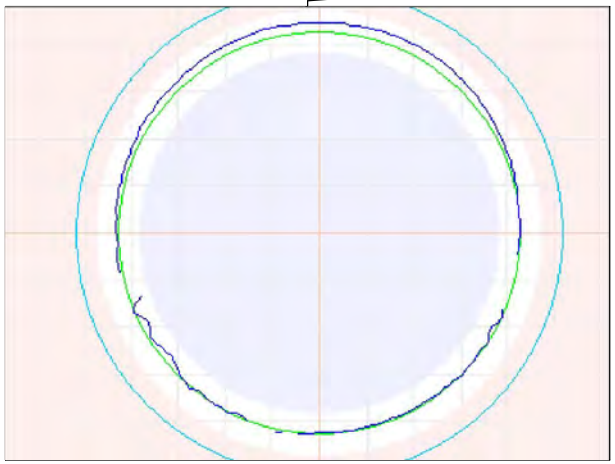
375.3ft General Observation - Corrosion to 0.9"



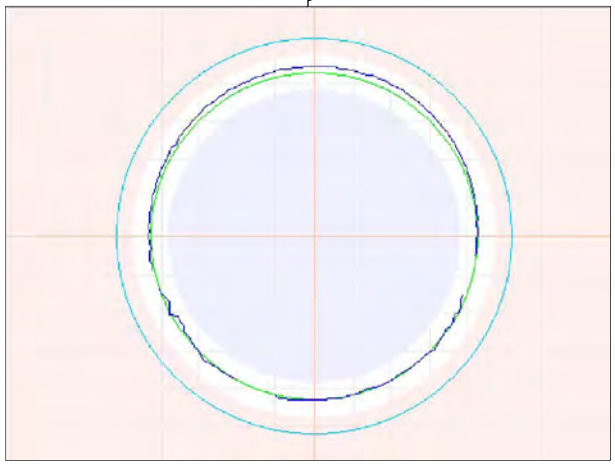
399.7ft General Observation - Corrosion to 1.0"



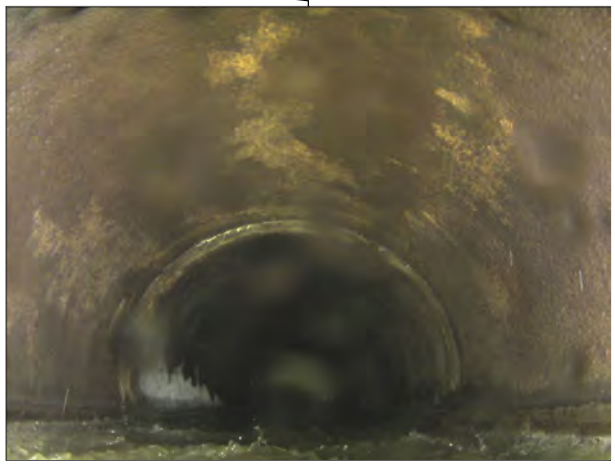




425.3ft General Observation - Corrosion to 1"



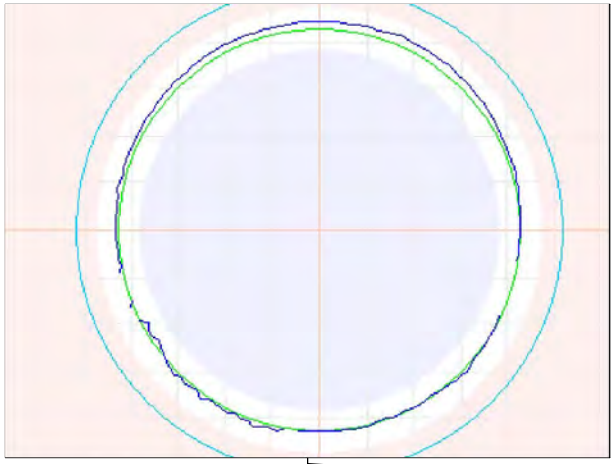
449.8ft General Observation - Corrosion to 0.9"



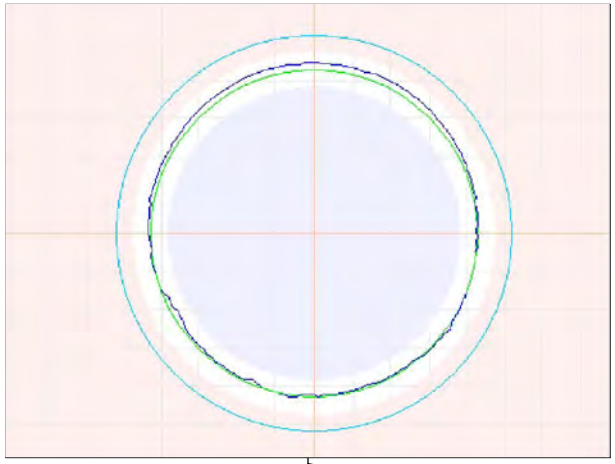
449.8ft General Observation - Corrosion to 0.9"

Observation Report

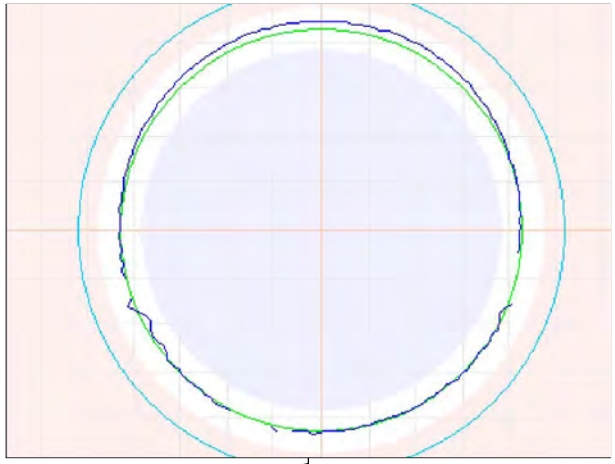
475.2ft General Observation - Corrosion to 0.7"

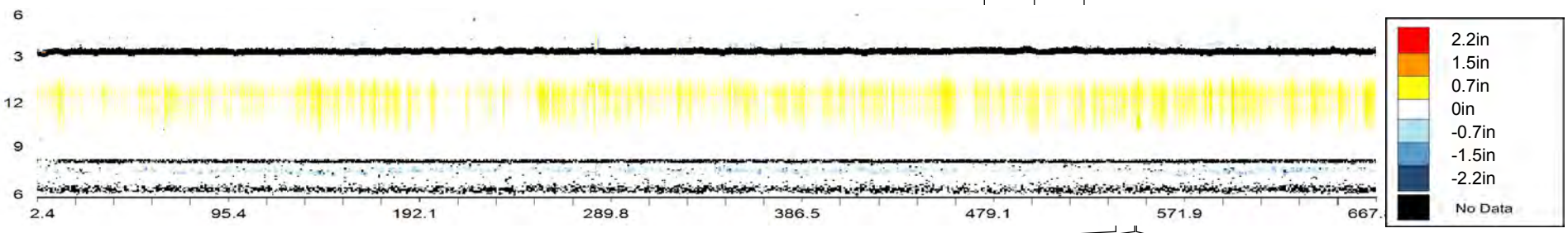


500ft General Observation - Corrosion to 0.9"



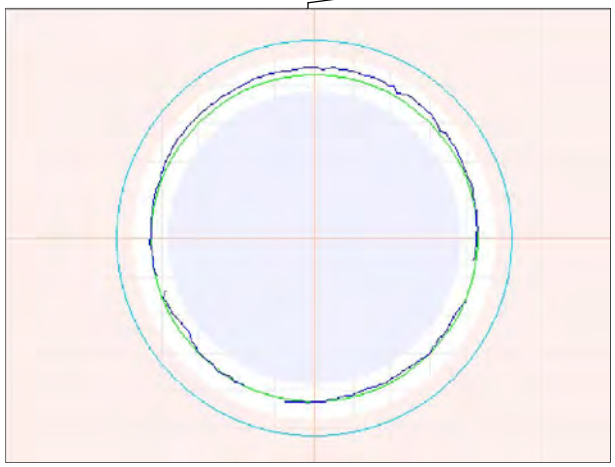
524.9ft General Observation - Corrosion to 0.9"



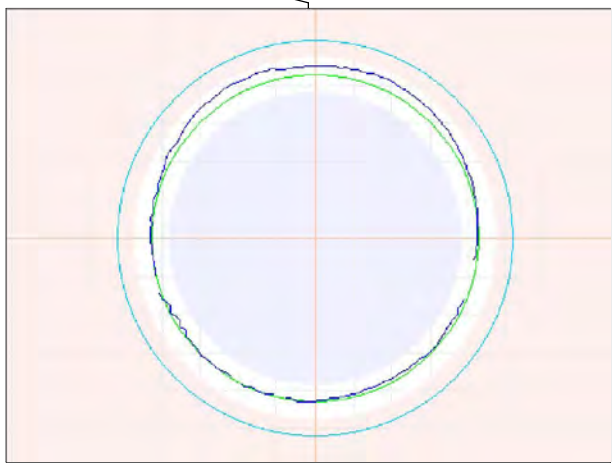


540.7ft 3D Laser Sonar Scan - Pipe Overview

550ft General Observation - Corrosion to 1.0"

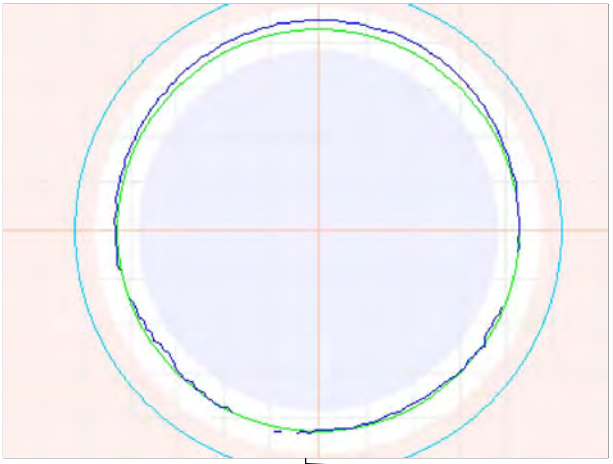


550.9ft Maximum Corrosion - To 1.3"

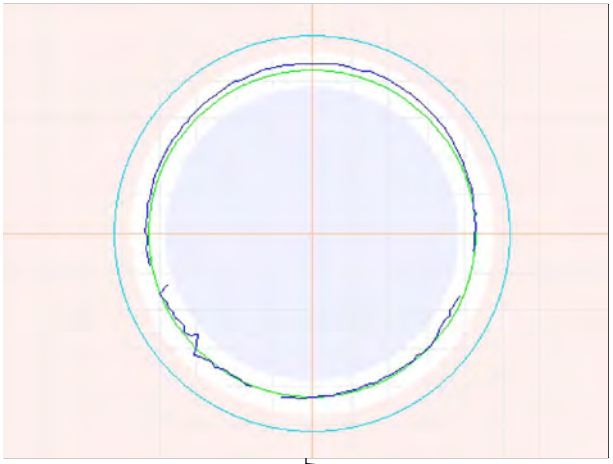


Observation Report

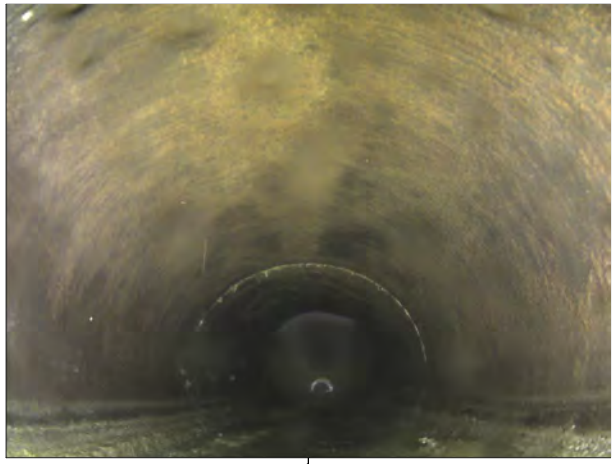
575ft General Observation - Corrosion to 1"

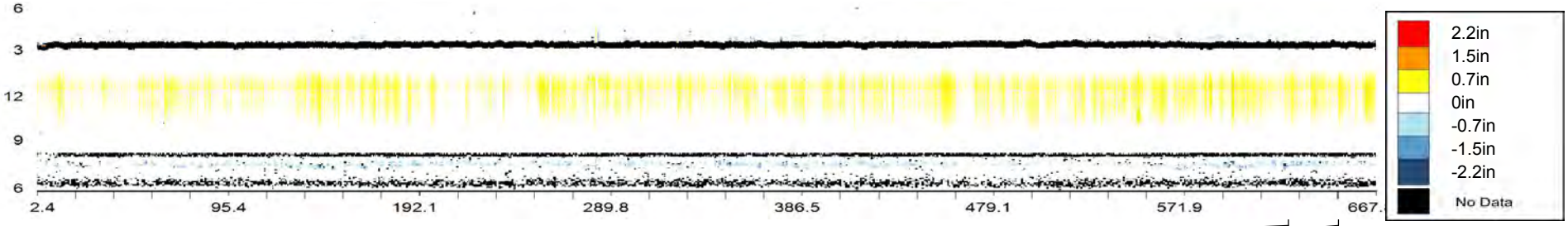


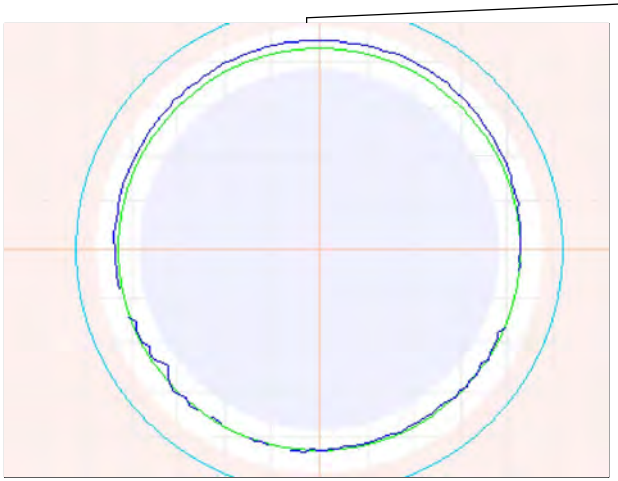
599.7ft General Observation - Corrosion to 1.0"



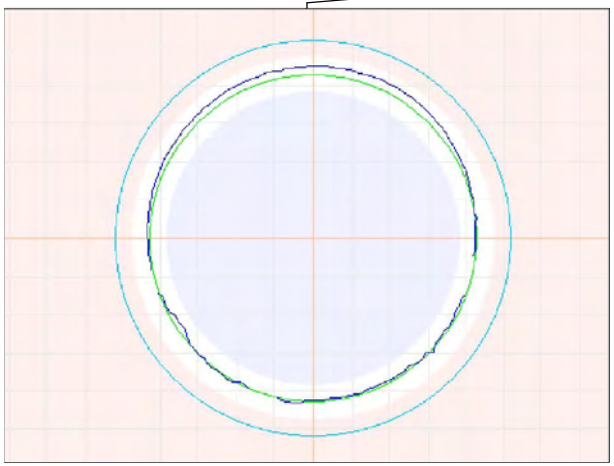
599.7ft General Observation - Corrosion to 1.0"







624.8ft General Observation - Corrosion to 0.8"



650ft General Observation - Corrosion to 1.1"

OVERVIEW - CMH000180 - CMH000179

Asset Number	CMH000180 - CMH000179		
Upstream MH	CMH000180	Material	Reinforced Concrete Pipe
Downstream MH	CMH000179	Size & Shape	42 in Circle
Survey Direction	Downstream	Match to Reference	216.8 ft

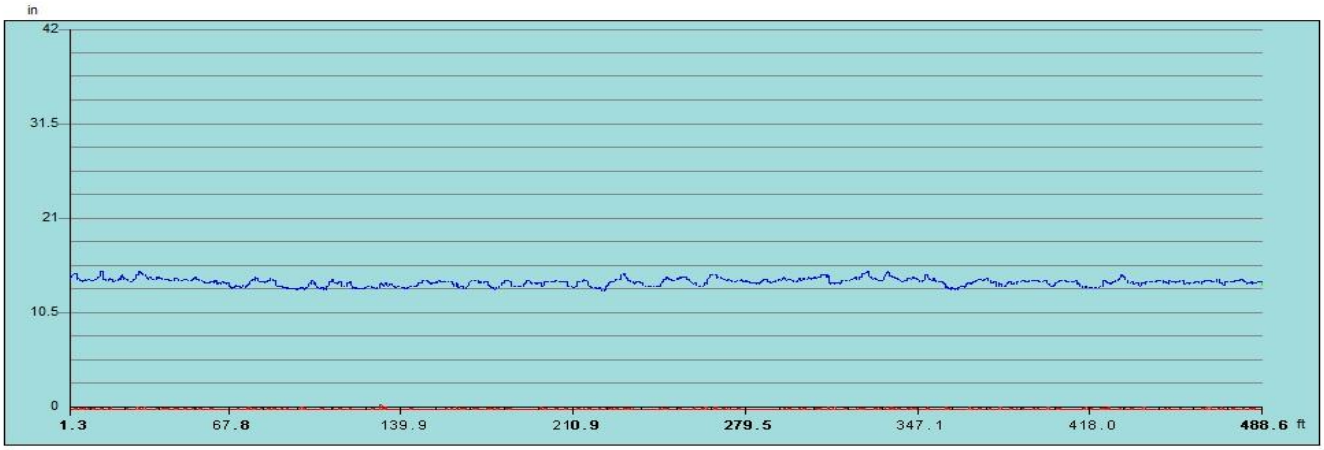
Distance	Observation	Comment
1.3 ft	**Beginning of Inspection**	**CMH000180**
2.1	Maximum Corrosion	To 2.0"
4	General Observation	Corrosion to 1.7"
25	General Observation	Corrosion to 0.7"
50	General Observation	Corrosion to 1.0"
75	General Observation	Corrosion to 1"
99.9	General Observation	Corrosion to 0.8"
125.1	General Observation	Corrosion to 0.9"
149.9	General Observation	Corrosion to 0.9"
175.3	General Observation	Corrosion to 1.1"
200.1	General Observation	Corrosion to 0.9"
216.8	Match to Reference Shape and Size	ø42"
225.3	General Observation	Corrosion to 1"
249.8	General Observation	Corrosion to 0.8"
275.3	General Observation	Corrosion to 0.8"
295.3	Point of Interest	Spalling
299.8	General Observation	Corrosion to 0.9"
324.9	General Observation	Corrosion to 1.3"
337.9	3D Laser Sonar Scan	Pipe Overview
350	General Observation	Corrosion to 0.9"
374.9	General Observation	Corrosion to 1"
399.9	General Observation	Corrosion to 0.9"
425	General Observation	Corrosion to 0.8"
449.7	General Observation	Corrosion to 0.8"
475	General Observation	Corrosion to 0.8"
488.4 ft	**End of Inspection**	**CMH000179**

CMH000180 - CMH000179			
Asset Number	CMH000180 - CMH000179	Length	489 ft
Upstream MH	CMH000180	Diameter	42 in
Downstream MH	CMH000179	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	216.8 ft
Date Profiled	18 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	14 in
Debris Volume	0 cubic feet

Debris Graph



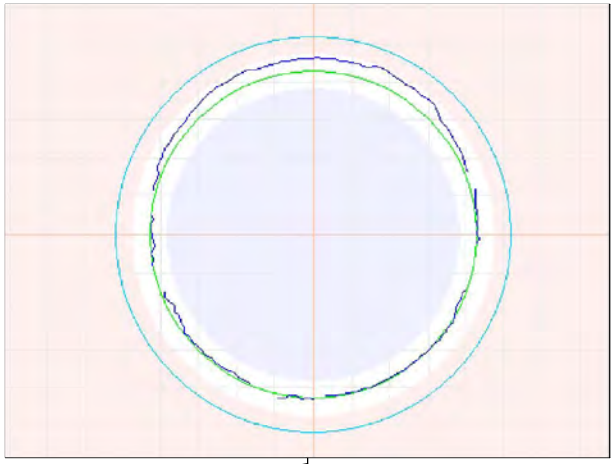
Inspection Distance (ft)

Water Level Debris Level

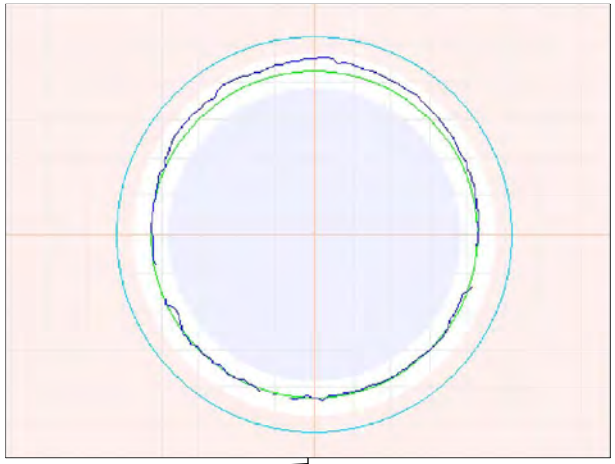
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

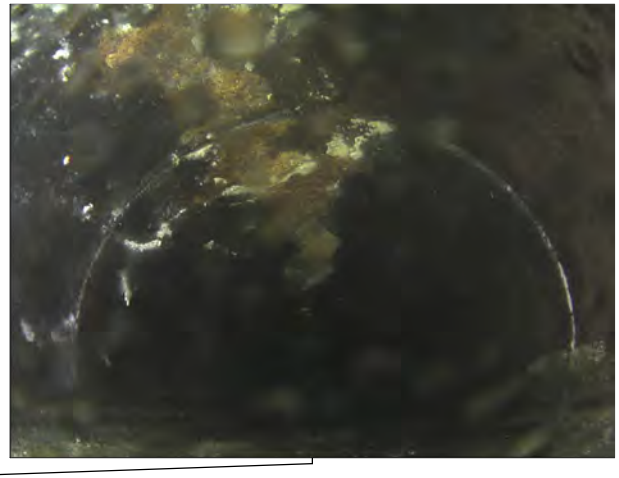
2.1ft Maximum Corrosion - To 2.0"

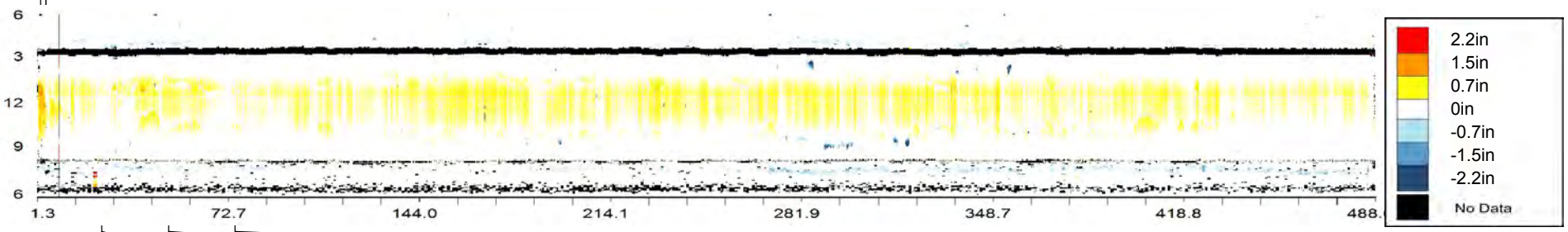


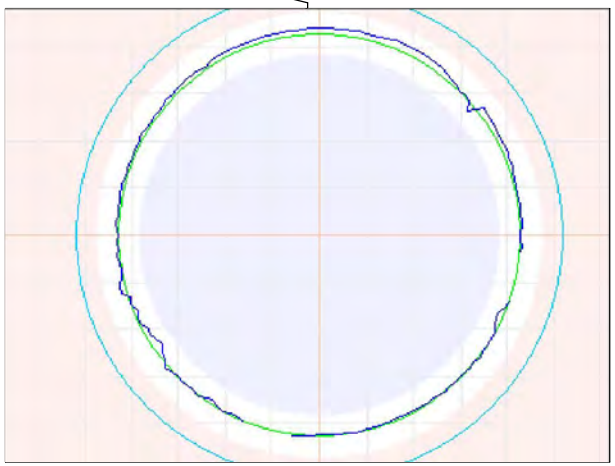
4ft General Observation - Corrosion to 1.7"



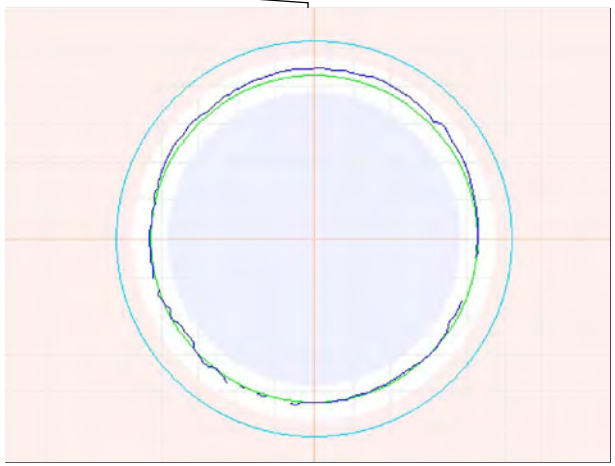
4ft General Observation - Corrosion to 1.7"



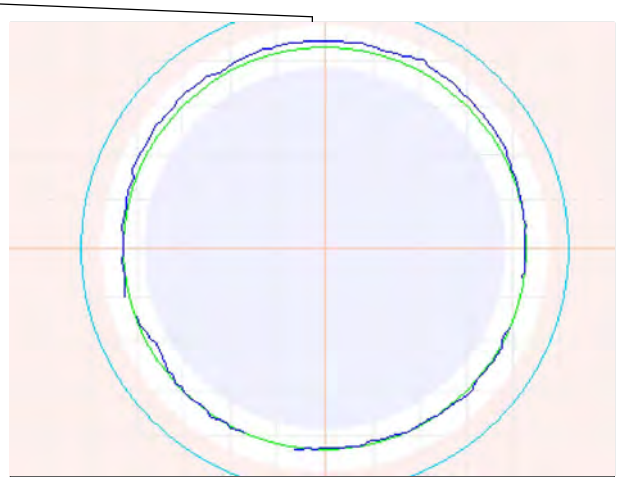




25ft General Observation - Corrosion to 0.7"



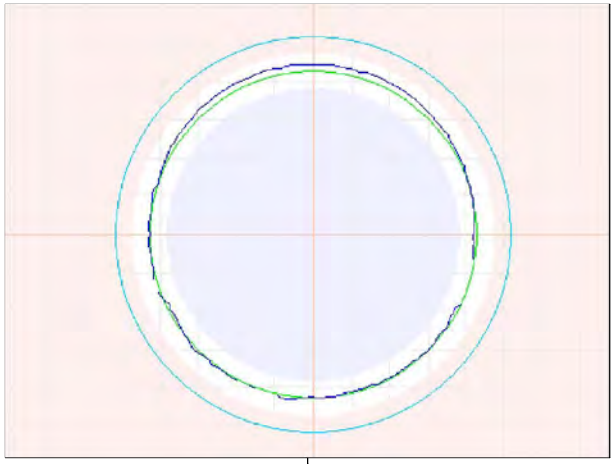
50ft General Observation - Corrosion to 1.0"



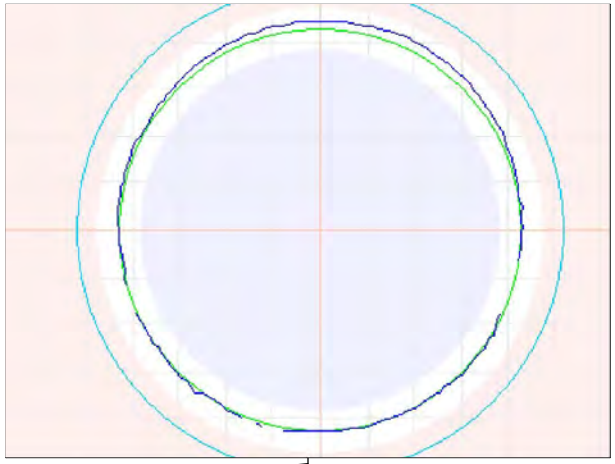
75ft General Observation - Corrosion to 1"

Observation Report

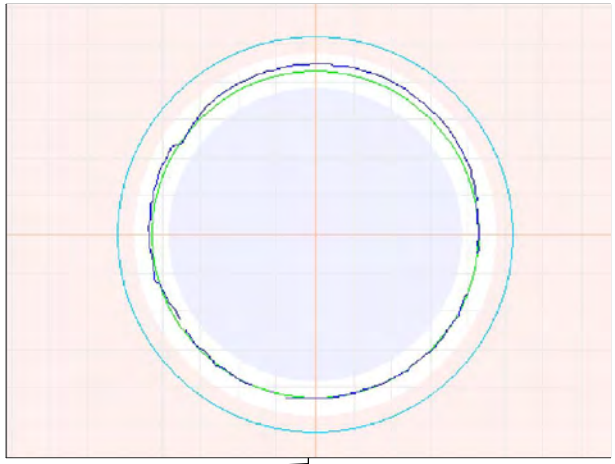
99.9ft General Observation - Corrosion to 0.8"

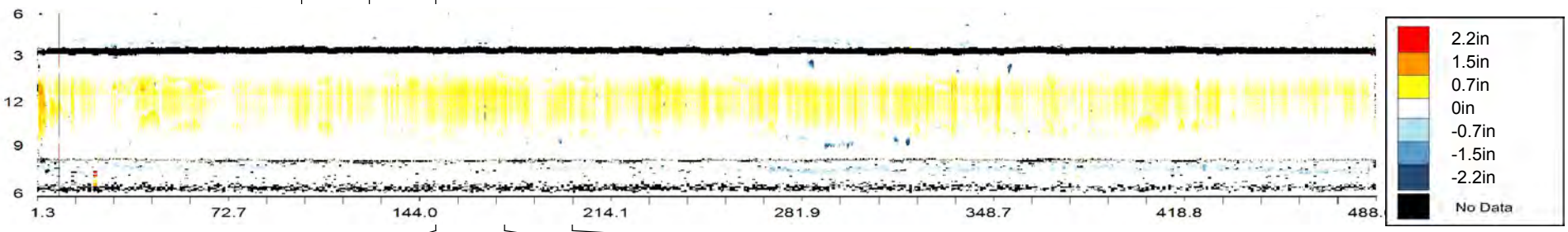


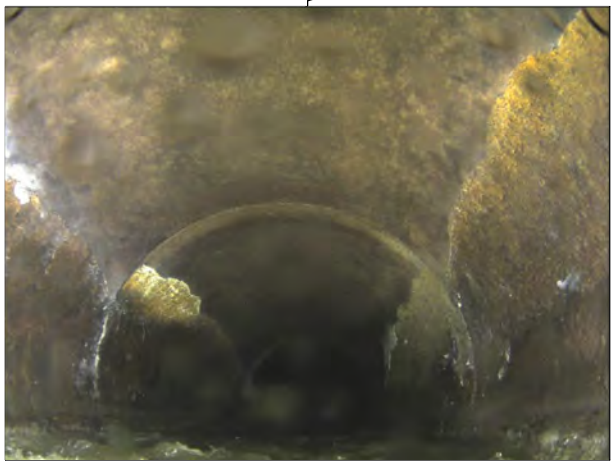
125.1ft General Observation - Corrosion to 0.9"



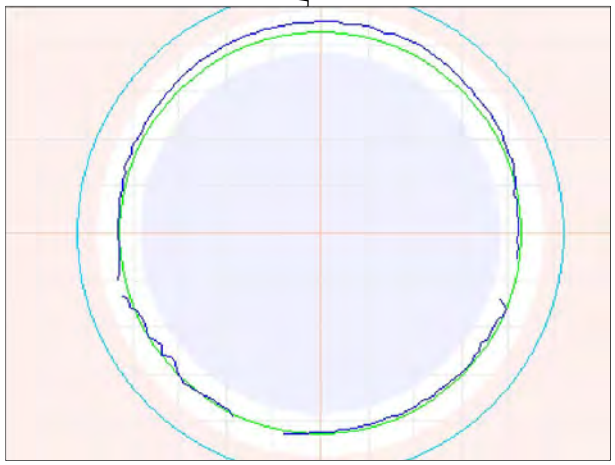
149.9ft General Observation - Corrosion to 0.9"



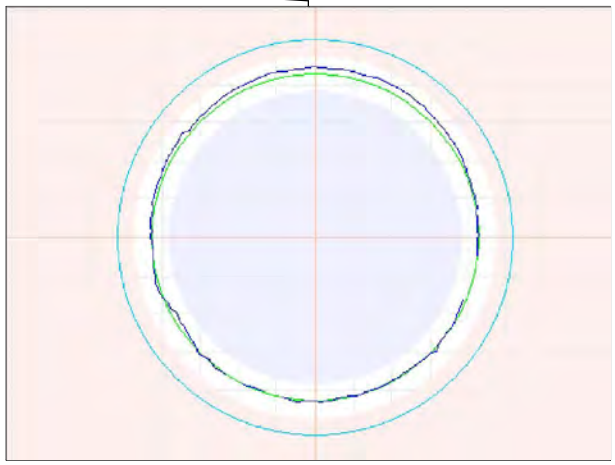




149.9ft General Observation - Corrosion to 0.9"



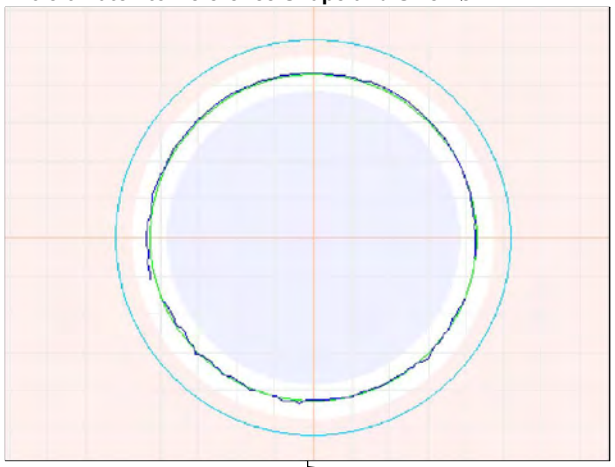
175.3ft General Observation - Corrosion to 1.1"



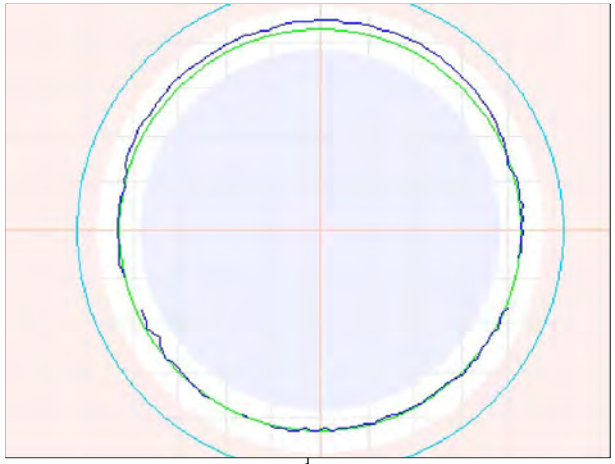
200.1ft General Observation - Corrosion to 0.9"

Observation Report

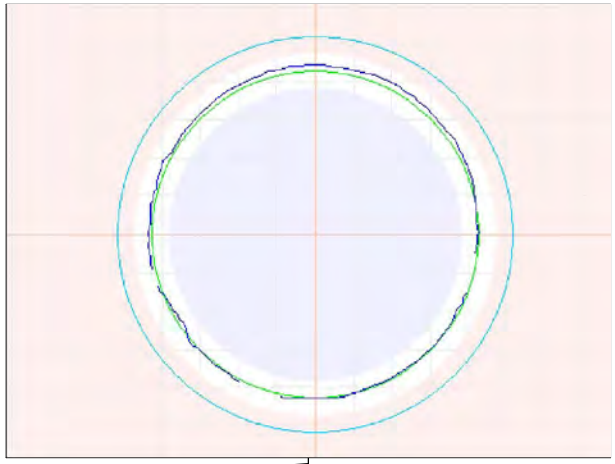
216.8ft Match to Reference Shape and Size - ø42"

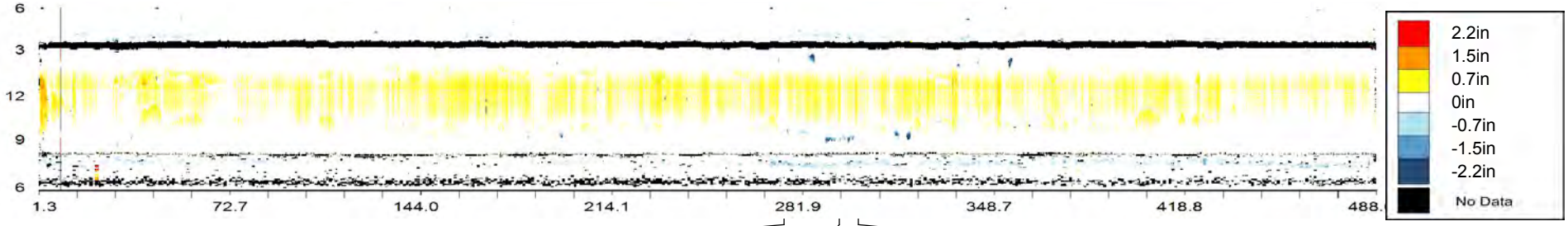


225.3ft General Observation - Corrosion to 1"

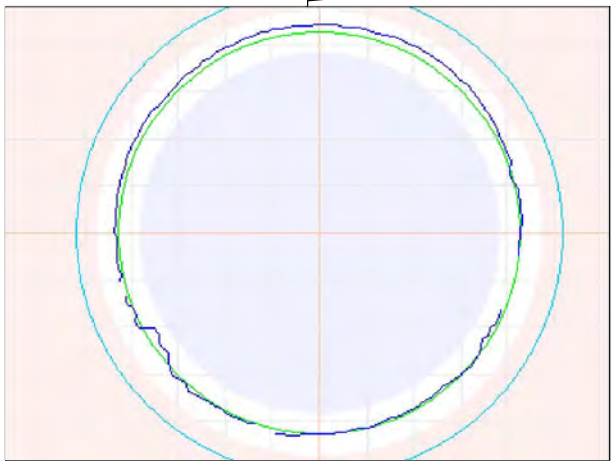


249.8ft General Observation - Corrosion to 0.8"

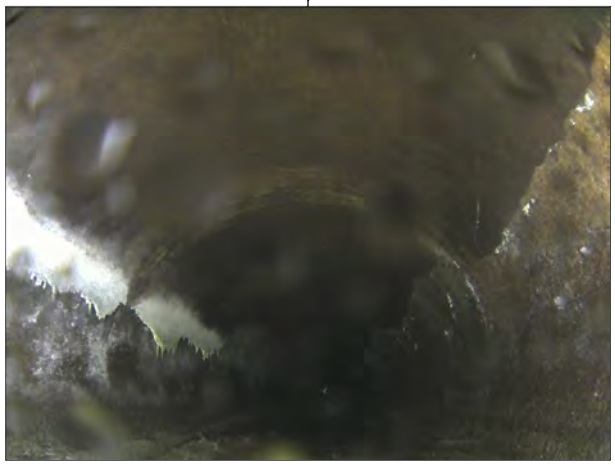




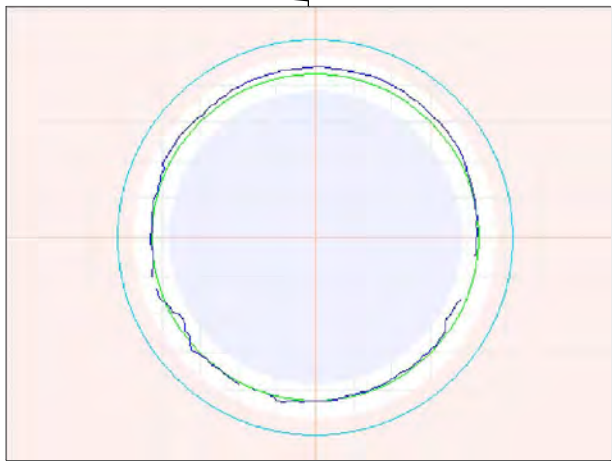
275.3ft General Observation - Corrosion to 0.8"



295.3ft Point of Interest - Spalling

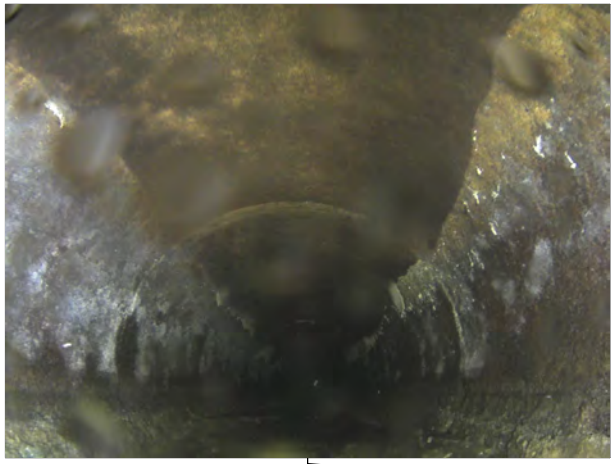


299.8ft General Observation - Corrosion to 0.9"

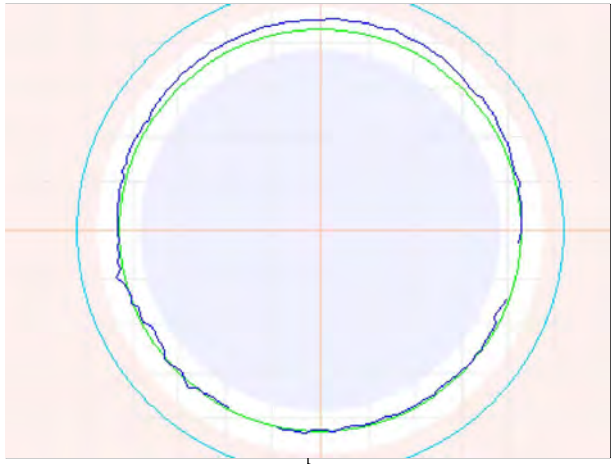


Observation Report

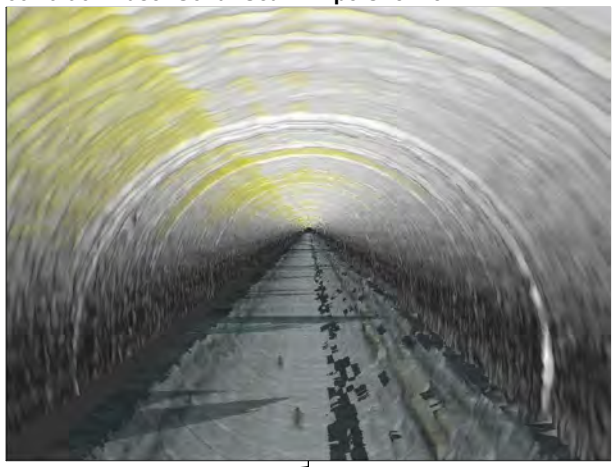
299.8ft General Observation - Corrosion to 0.9"

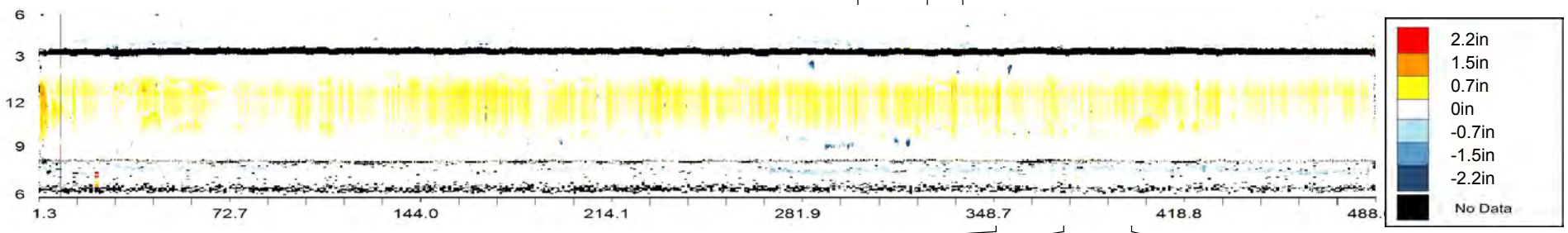


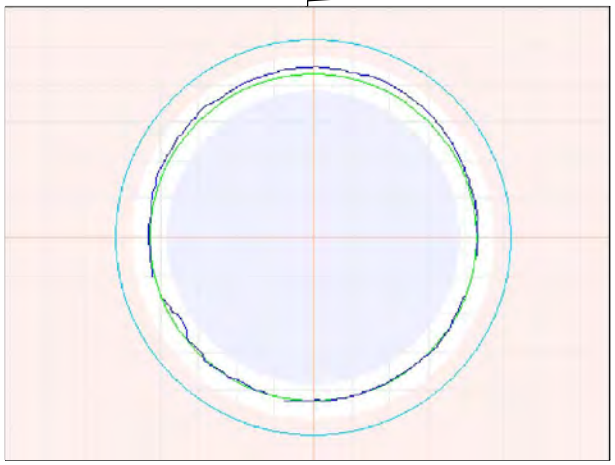
324.9ft General Observation - Corrosion to 1.3"



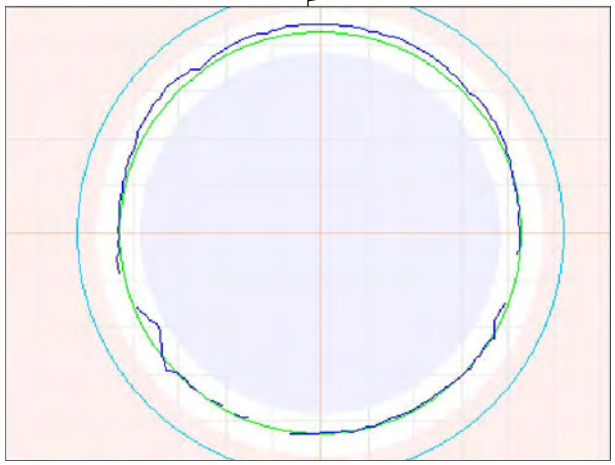
337.9ft 3D Laser Sonar Scan - Pipe Overview



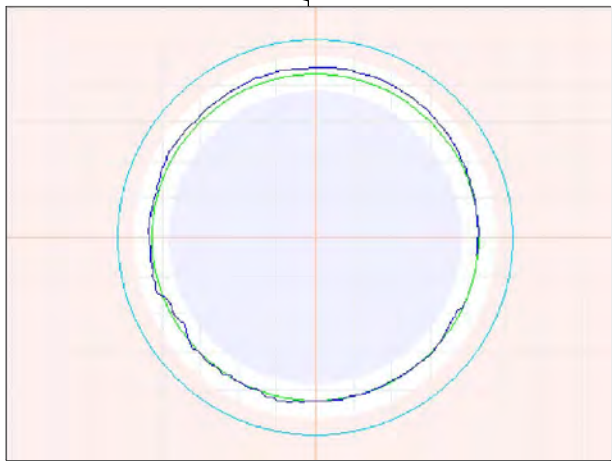




350ft General Observation - Corrosion to 0.9"



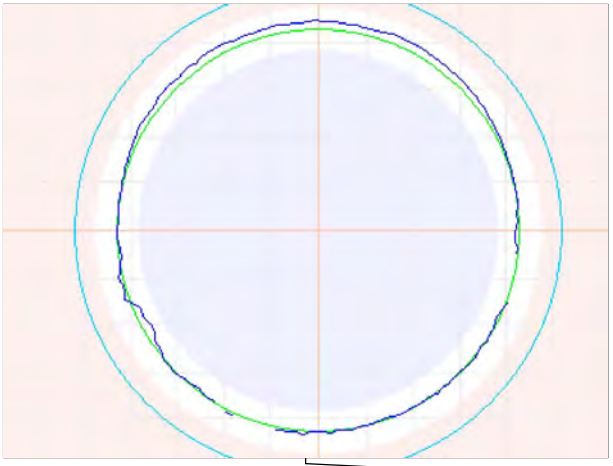
374.9ft General Observation - Corrosion to 1"



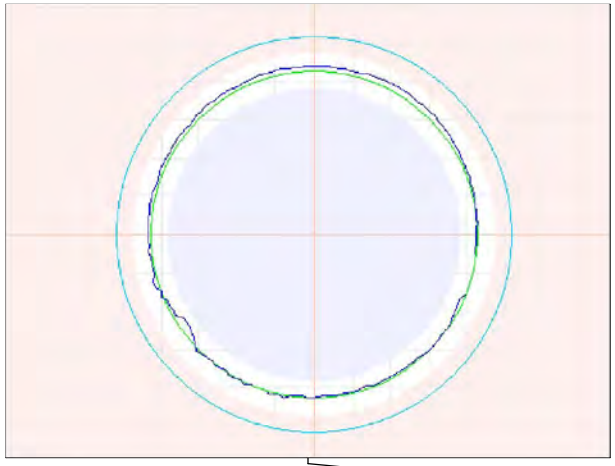
399.9ft General Observation - Corrosion to 0.9"

Observation Report

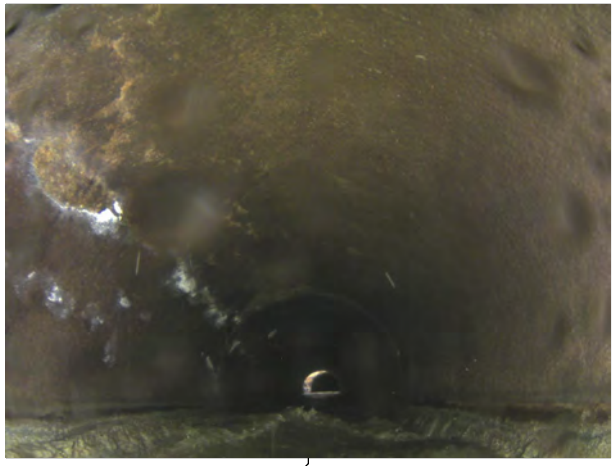
425ft General Observation - Corrosion to 0.8"

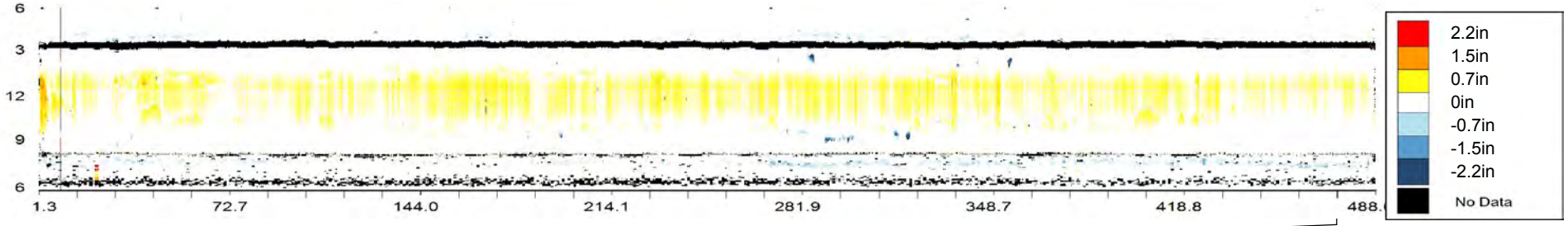


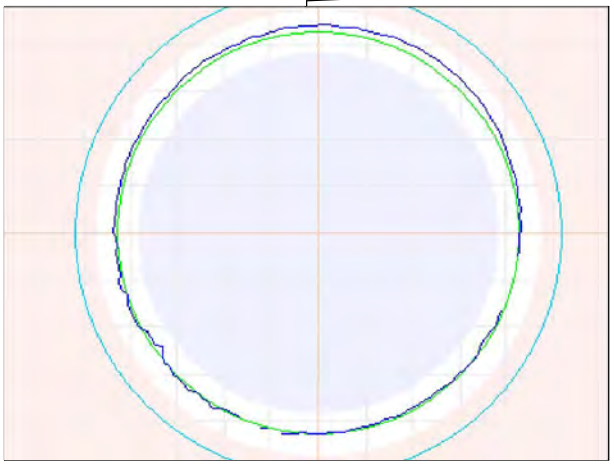
449.7ft General Observation - Corrosion to 0.8"



449.7ft General Observation - Corrosion to 0.8"







475ft General Observation - Corrosion to 0.8"

OVERVIEW - CMH000181 - CMH000180

Asset Number	CMH000181 - CMH000180		
Upstream MH	CMH000181	Material	Reinforced Concrete Pipe
Downstream MH	CMH000180	Size & Shape	42 in Circle
Survey Direction	Downstream	Match to Reference	360.2 ft

Distance	Observation	Comment
1.9 ft	**Beginning of Inspection**	**CMH000181**
5	General Observation	Corrosion to 1.0"
25.3	General Observation	Corrosion to 1.1"
50	General Observation	Corrosion to 1.0"
67.7	Maximum Corrosion	To 1.3"
75	General Observation	Corrosion to 1.1"
100.1	General Observation	Corrosion to 0.9"
125.3	General Observation	Corrosion to 1.1"
149.9	General Observation	Corrosion to 0.7"
175.1	General Observation	Corrosion to 0.9"
200.1	General Observation	Corrosion to 0.5"
225.3	General Observation	Corrosion to 0.8"
250.1	General Observation	Corrosion to 1.2"
275.7	General Observation	Corrosion to 1"
299.8	General Observation	Corrosion to 0.7"
324.8	General Observation	Corrosion to 0.9"
349.8	General Observation	Corrosion to 0.9"
360.2	Match to Reference Shape and Size	ø42"
399.8	General Observation	Corrosion to 0.8"
425.2	General Observation	Corrosion to 0.8"
449.8	General Observation	Corrosion to 0.8"
475	General Observation	Corrosion to 0.6"
499.9	General Observation	Corrosion to 0.7"
525.1	General Observation	Corrosion to 0.7"
539.7	3D Laser Sonar Scan	Pipe Overview

OVERVIEW - CMH000181 - CMH000180

Asset Number	CMH000181 - CMH000180		
Upstream MH	CMH000181	Material	Reinforced Concrete Pipe
Downstream MH	CMH000180	Size & Shape	42 in Circle
Survey Direction	Downstream	Match to Reference	360.2 ft

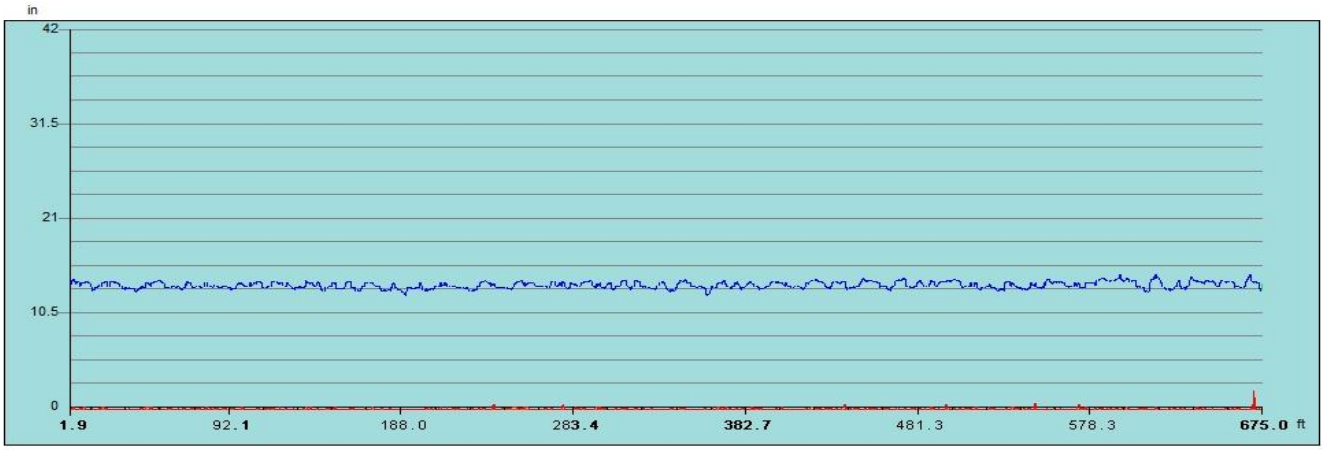
Distance	Observation	Comment
549.8	General Observation	Corrosion to 0.7"
575.2	General Observation	Corrosion to 0.7"
599.9	General Observation	Corrosion to 0.8"
624.9	General Observation	Corrosion to 0.8"
649.7	General Observation	Corrosion to 0.6"
674.4	General Observation	Corrosion to 1.3"
674.9 ft	**End of Inspection**	**CMH000180**

CMH000181 - CMH000180			
Asset Number	CMH000181 - CMH000180	Length	675 ft
Upstream MH	CMH000181	Diameter	42 in
Downstream MH	CMH000180	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	360.2 ft
Date Profiled	18 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	14 in
Debris Volume	1 cubic feet

Debris Graph



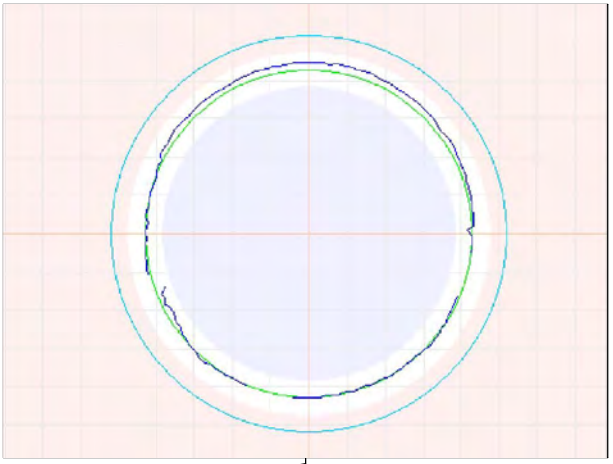
Inspection Distance (ft)

Water Level Debris Level

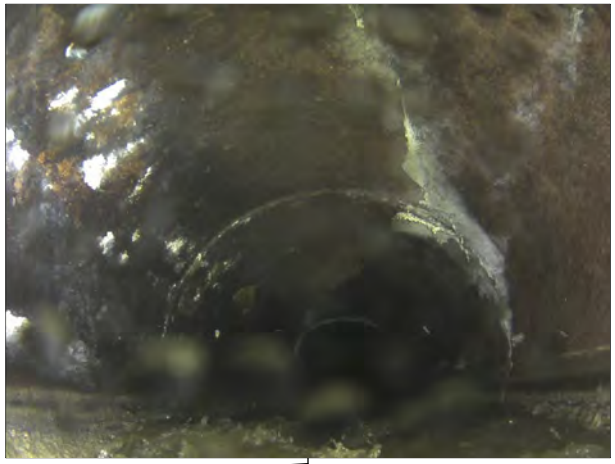
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

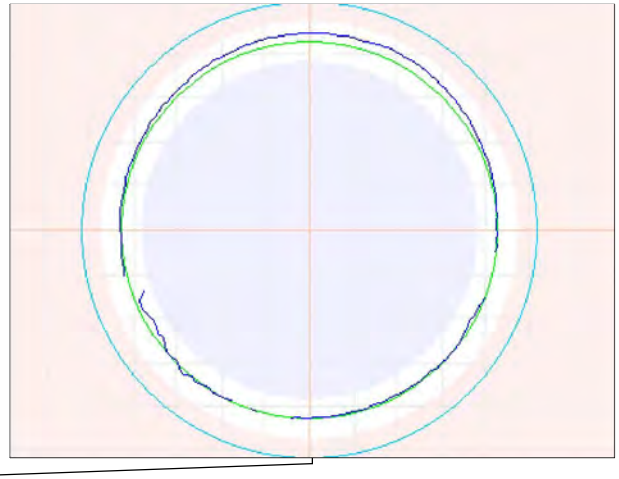
5ft General Observation - Corrosion to 1.0"

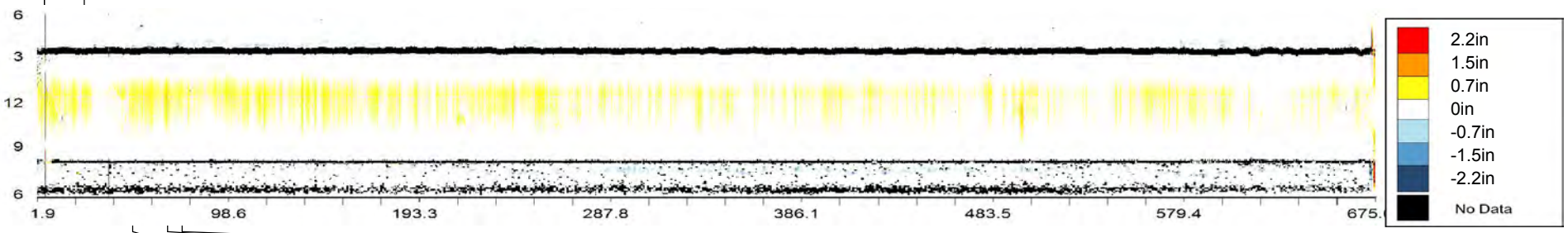


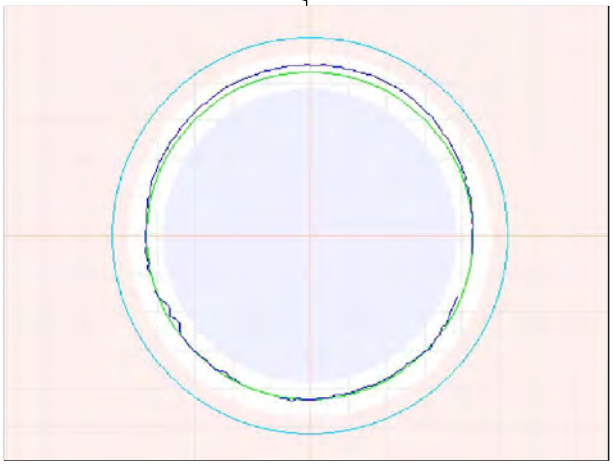
5ft General Observation - Corrosion to 1.0"



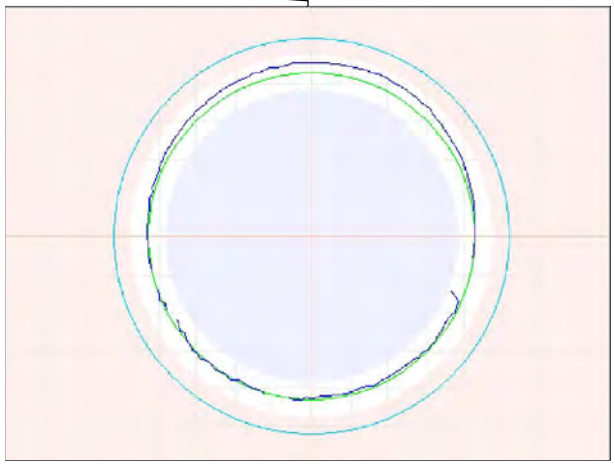
25.3ft General Observation - Corrosion to 1.1"



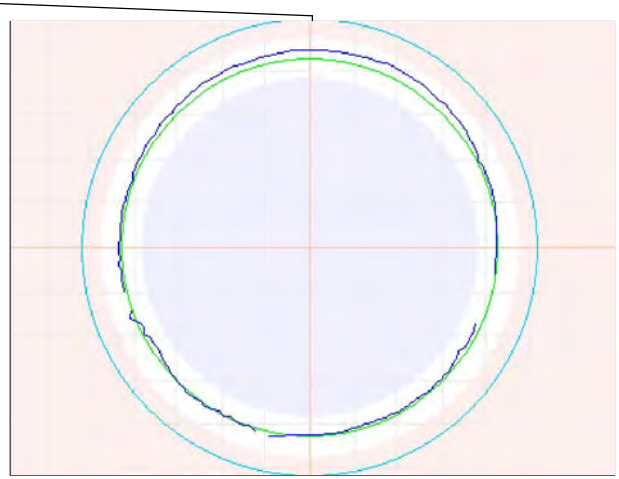




50ft General Observation - Corrosion to 1.0"



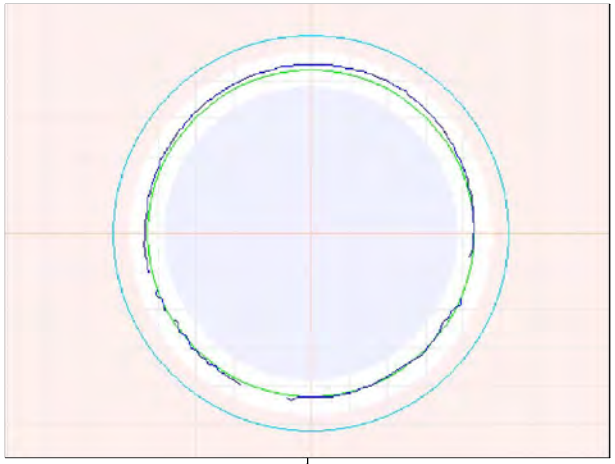
67.7ft Maximum Corrosion - To 1.3"



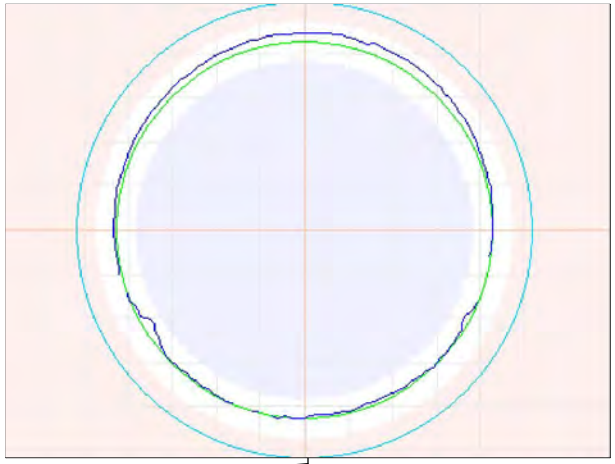
75ft General Observation - Corrosion to 1.1"

Observation Report

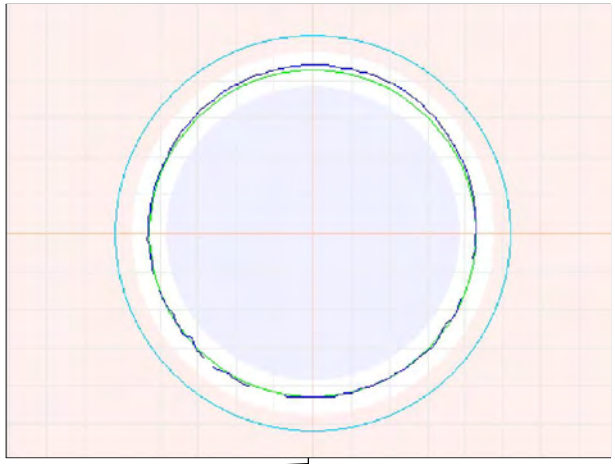
100.1ft General Observation - Corrosion to 0.9"

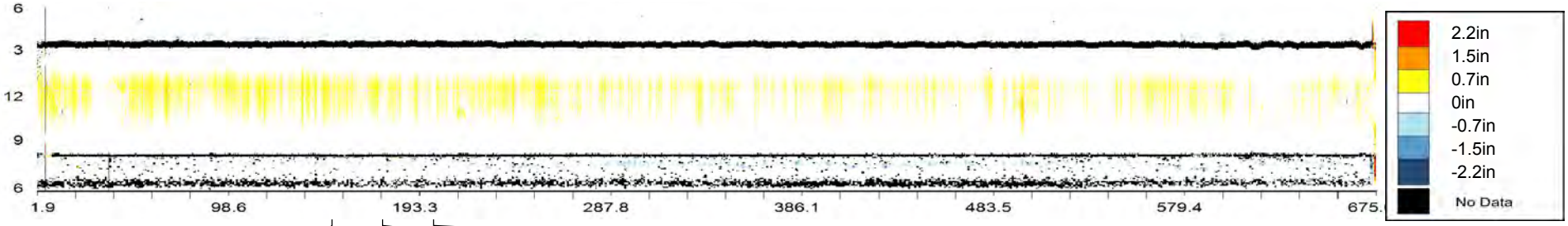


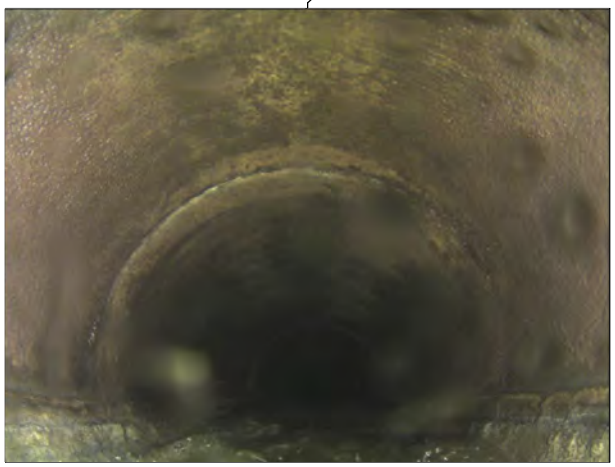
125.3ft General Observation - Corrosion to 1.1"



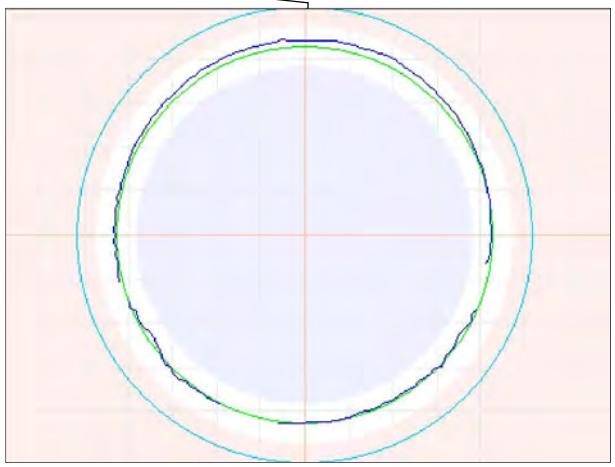
149.9ft General Observation - Corrosion to 0.7"



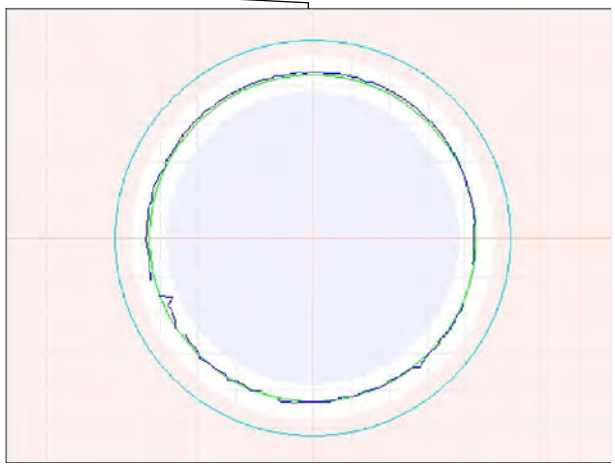




149.9ft General Observation - Corrosion to 0.7"



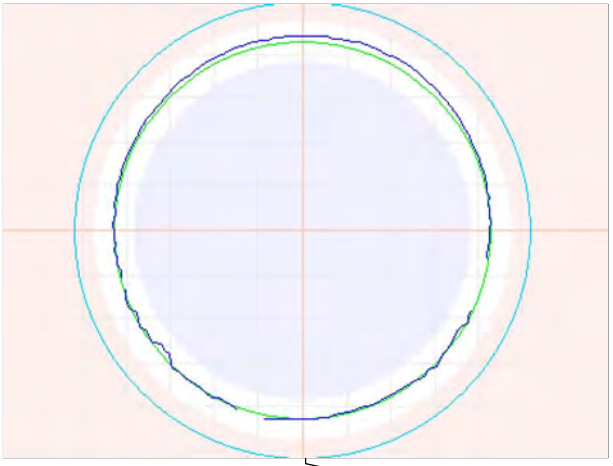
175.1ft General Observation - Corrosion to 0.9"



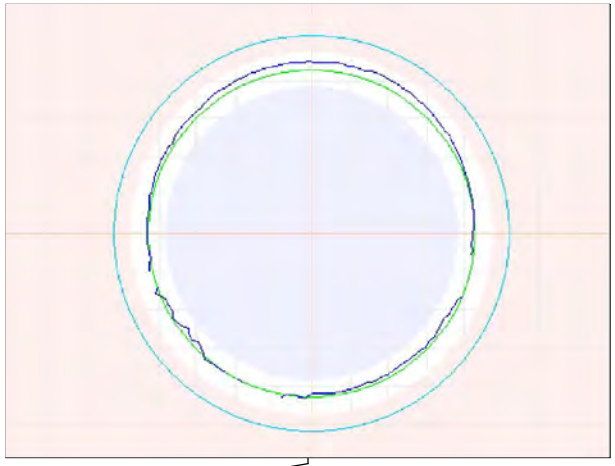
200.1ft General Observation - Corrosion to 0.5"

Observation Report

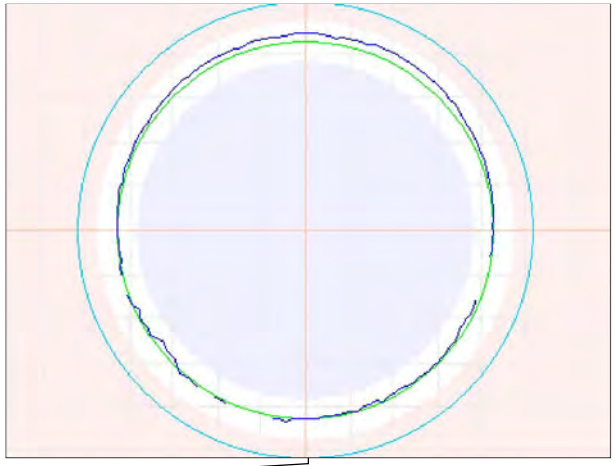
225.3ft General Observation - Corrosion to 0.8"

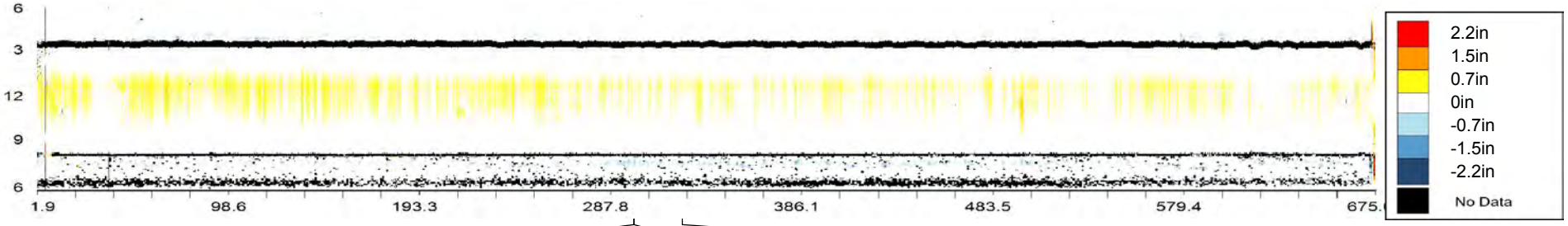


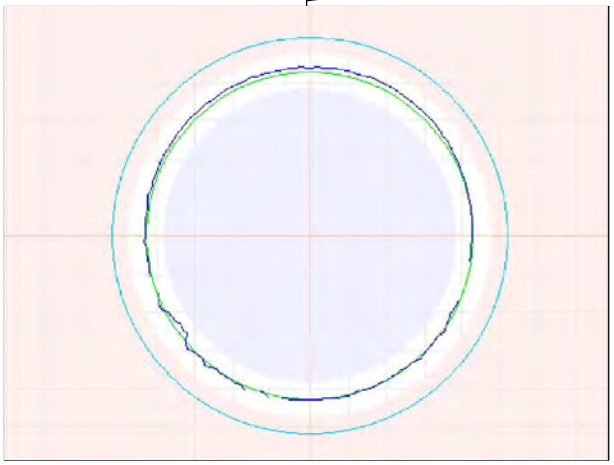
250.1ft General Observation - Corrosion to 1.2"



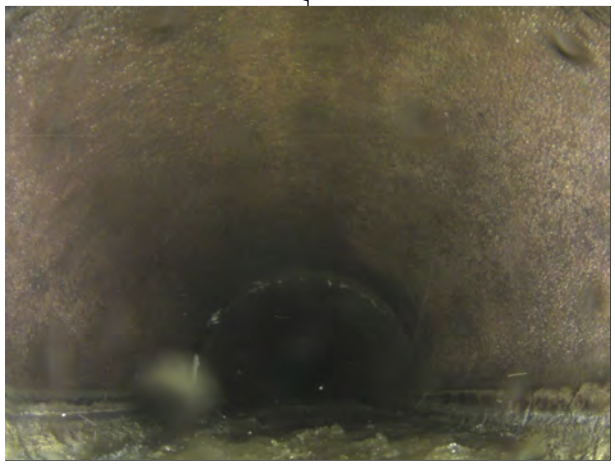
275.7ft General Observation - Corrosion to 1"



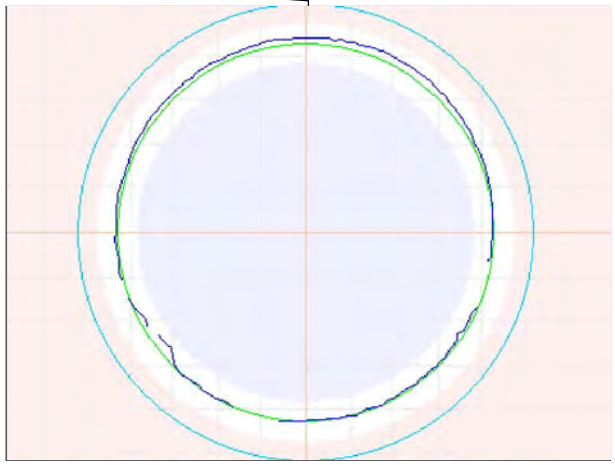




299.8ft General Observation - Corrosion to 0.7"



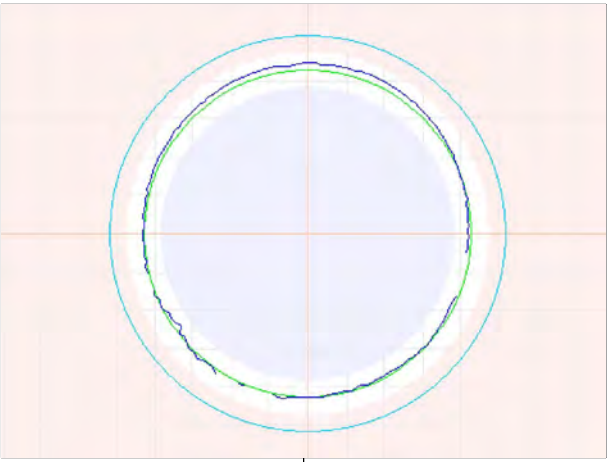
299.8ft General Observation - Corrosion to 0.7"



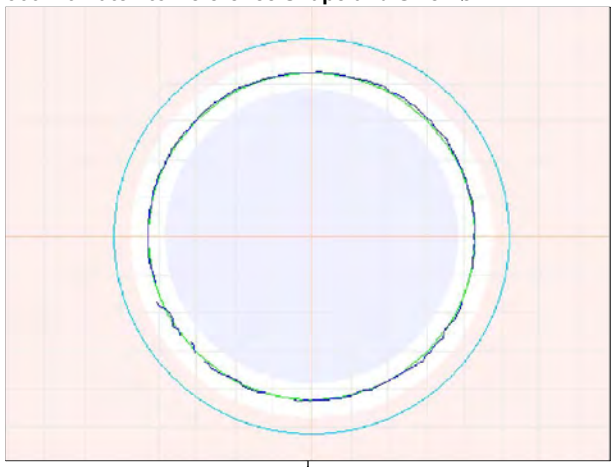
324.8ft General Observation - Corrosion to 0.9"

Observation Report

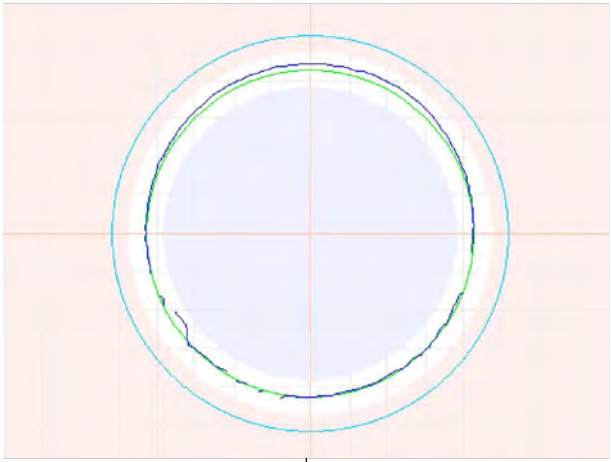
349.8ft General Observation - Corrosion to 0.9"

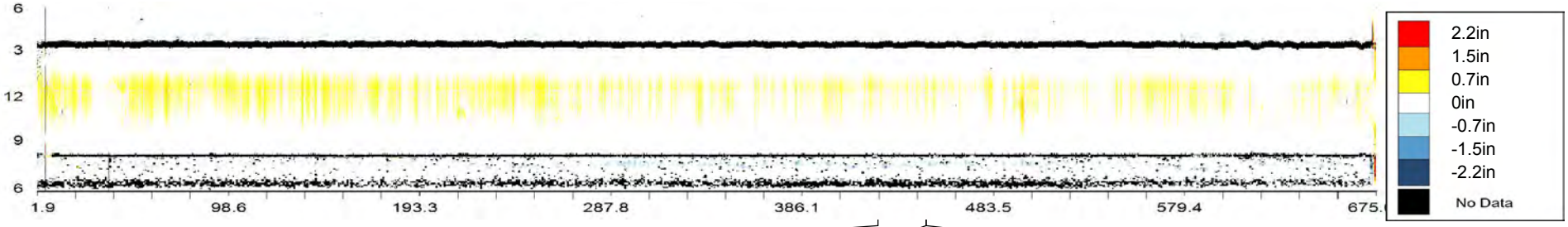


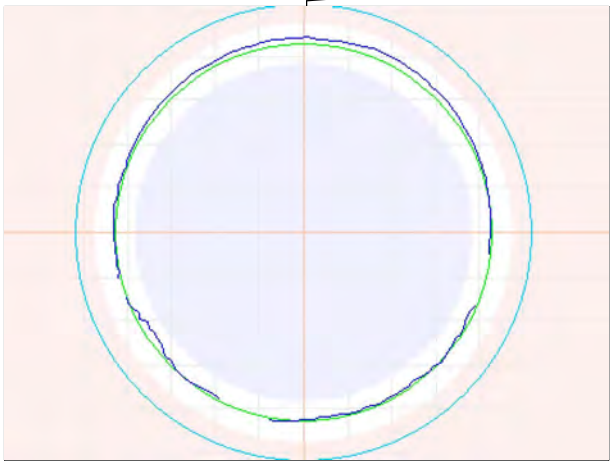
360.2ft Match to Reference Shape and Size - ø42"



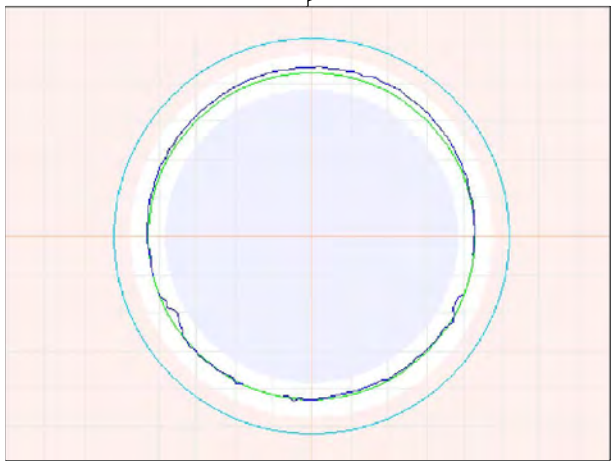
399.8ft General Observation - Corrosion to 0.8"



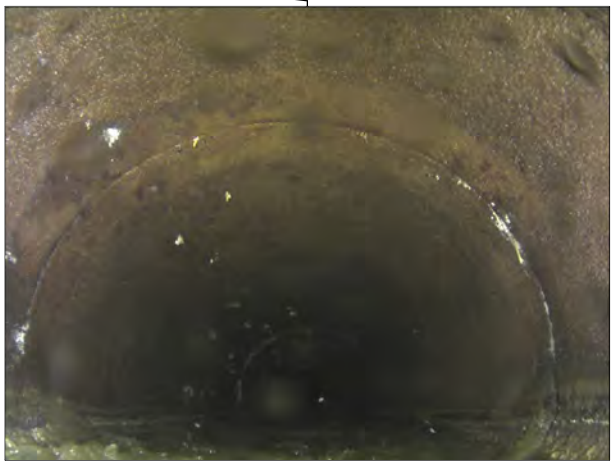




425.2ft General Observation - Corrosion to 0.8"



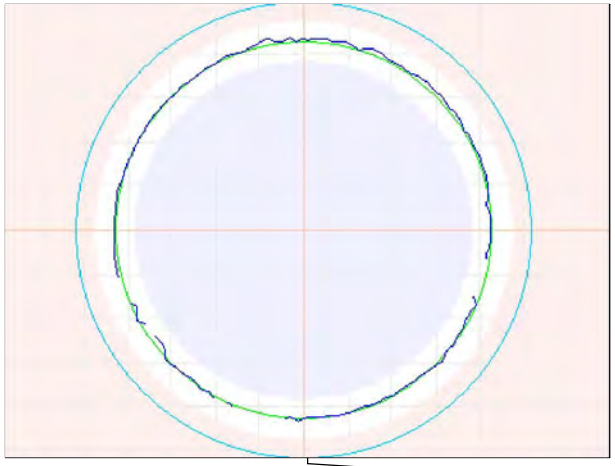
449.8ft General Observation - Corrosion to 0.8"



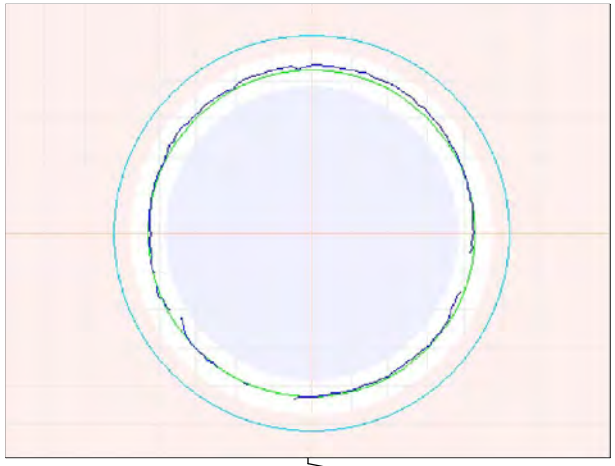
449.8ft General Observation - Corrosion to 0.8"

Observation Report

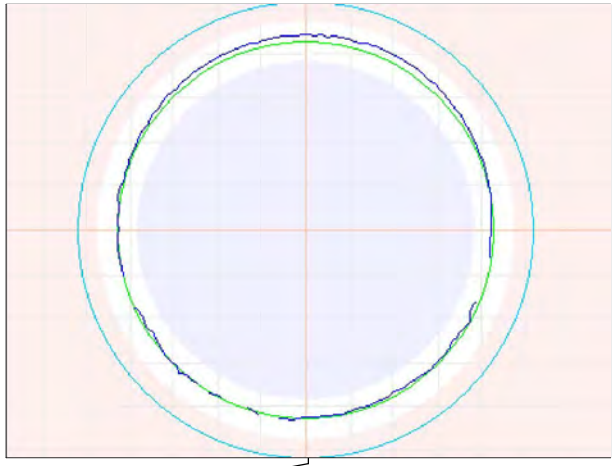
475ft General Observation - Corrosion to 0.6"

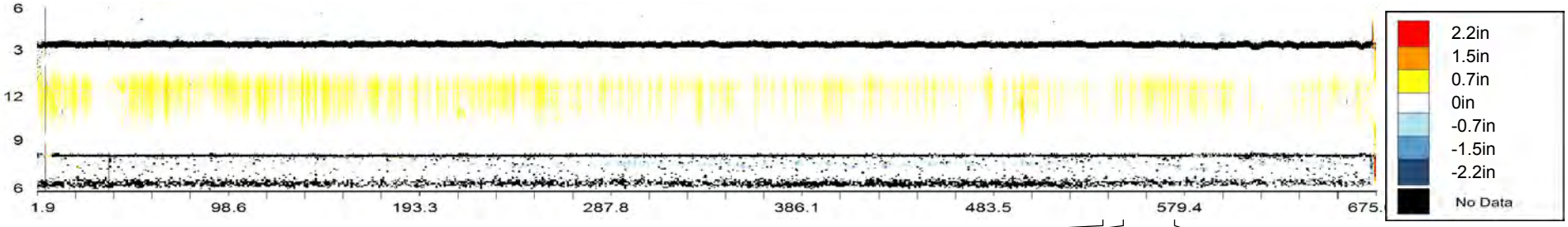


499.9ft General Observation - Corrosion to 0.7"



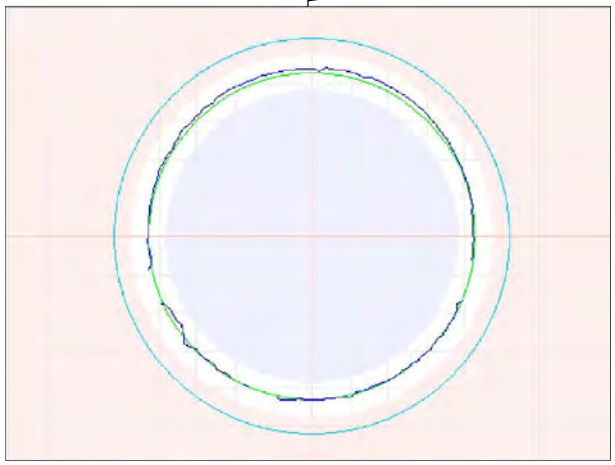
525.1ft General Observation - Corrosion to 0.7"



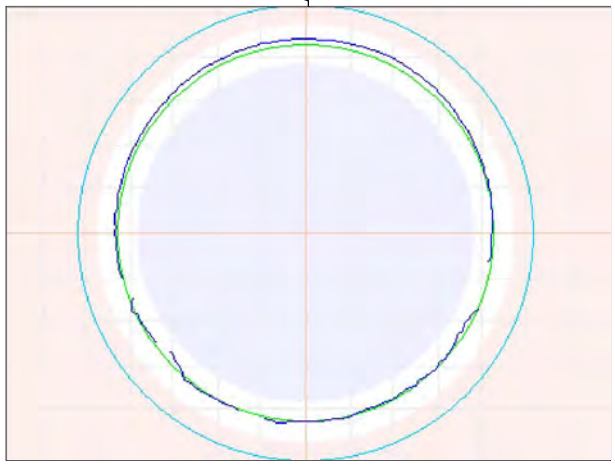


539.7ft 3D Laser Sonar Scan - Pipe Overview

549.8ft General Observation - Corrosion to 0.7"

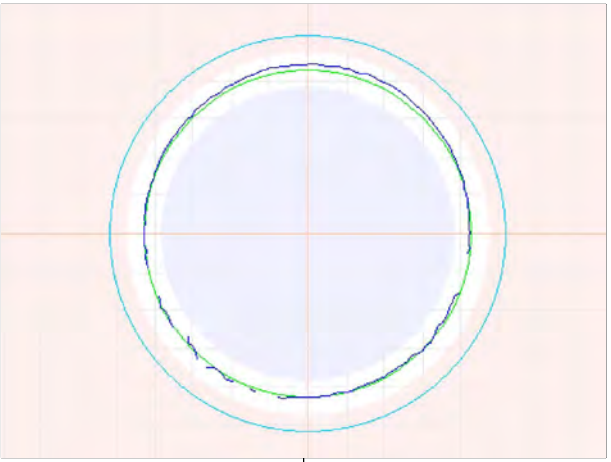


575.2ft General Observation - Corrosion to 0.7"

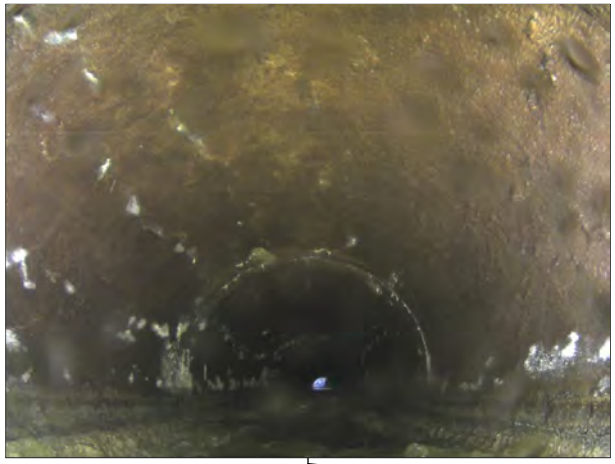


Observation Report

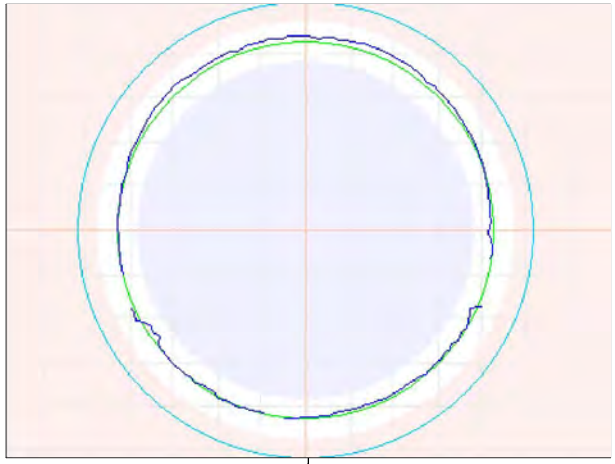
599.9ft General Observation - Corrosion to 0.8"

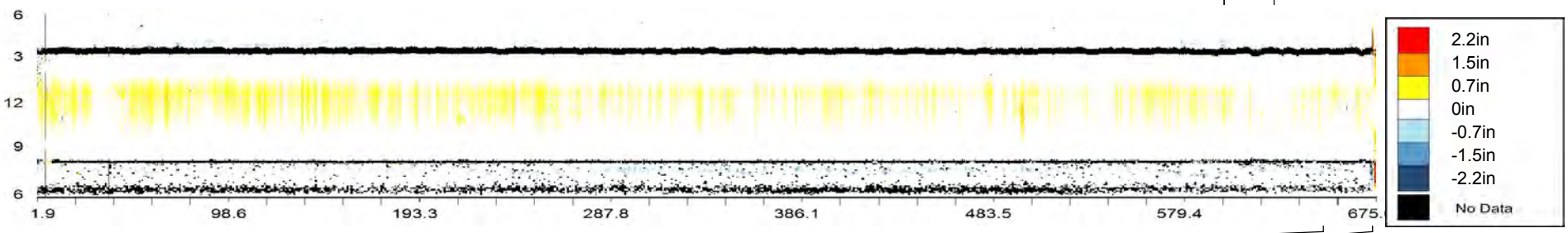


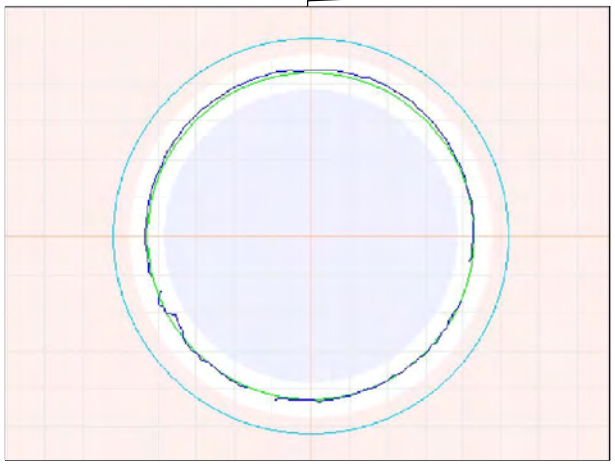
599.9ft General Observation - Corrosion to 0.8"



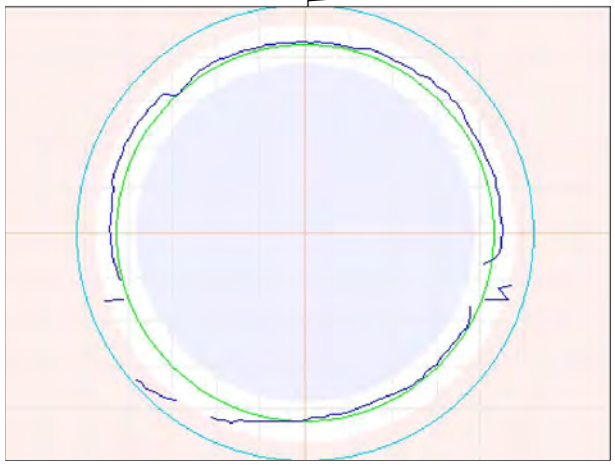
624.9ft General Observation - Corrosion to 0.8"







649.7ft General Observation - Corrosion to 0.6"



674.4ft General Observation - Corrosion to 1.3"

OVERVIEW - CMH000183 - CMH000181

Asset Number	CMH000183 - CMH000181		
Upstream MH	CMH000183	Material	Reinforced Concrete Pipe
Downstream MH	CMH000181	Size & Shape	42 in Circle
Survey Direction	Downstream	Match to Reference	353 ft

Distance	Observation	Comment
1 ft	**Beginning of Inspection**	**CMH000183**
4	General Observation	Corrosion to 1.1"
25	General Observation	Corrosion to 1"
50.1	General Observation	Corrosion to 1.0"
75.2	General Observation	Corrosion to 0.8"
99.8	General Observation	Corrosion to 0.9"
125.6	General Observation	Corrosion to 0.9"
149.9	General Observation	Corrosion to 1.0"
174.9	General Observation	Corrosion to 0.8"
199.9	General Observation	Corrosion to 1.0"
225.3	General Observation	Corrosion to 1"
249.8	General Observation	Corrosion to 1.0"
275.6	General Observation	Corrosion to 0.8"
300.1	General Observation	Corrosion to 0.8"
324.9	General Observation	Corrosion to 1.2"
350.1	General Observation	Corrosion to 0.8"
353	Match to Reference Shape and Size	ø42"
375.1	General Observation	Corrosion to 0.8"
399.8	General Observation	Corrosion to 0.9"
425.2	General Observation	Corrosion to 0.7"
449.8	General Observation	Corrosion to 0.9"
474.7	General Observation	Corrosion to 0.9"
500	General Observation	Corrosion to 1.0"
525.2	General Observation	Corrosion to 0.9"
550	General Observation	Corrosion to 0.9"

OVERVIEW - CMH000183 - CMH000181			
Asset Number	CMH000183 - CMH000181		
Upstream MH	CMH000183	Material	Reinforced Concrete Pipe
Downstream MH	CMH000181	Size & Shape	42 in Circle
Survey Direction	Downstream	Match to Reference	353 ft

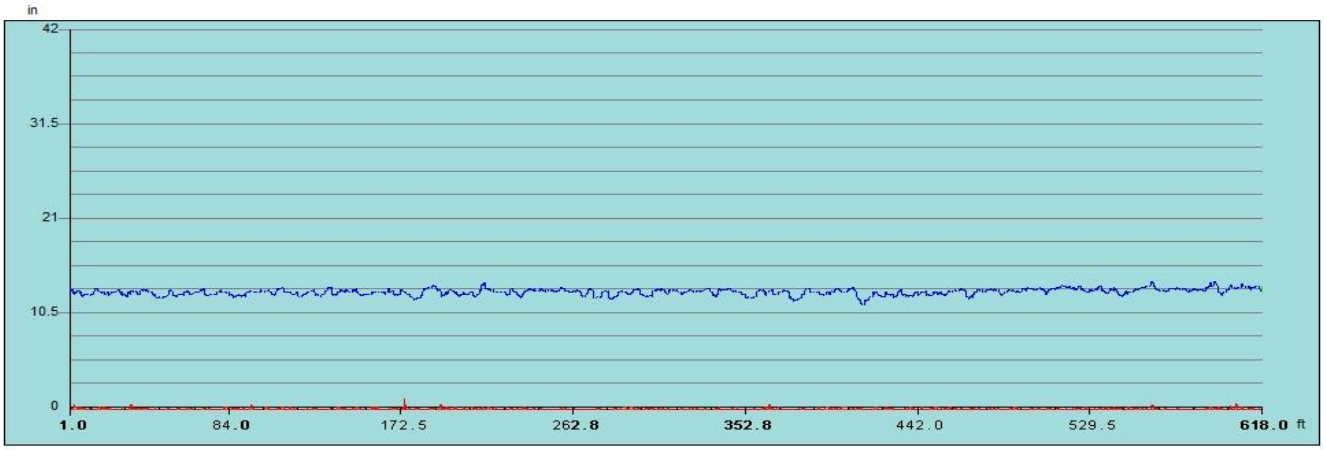
Distance	Observation	Comment
563.8	Maximum Debris	To 1.6"
568.5	3D Laser Sonar Scan	Pipe Overview
574.7	General Observation	Corrosion to 0.9"
593.8	Maximum Corrosion	To 1.3"
599.7	General Observation	Corrosion to 1.2"
617.8 ft	**End of Inspection**	**CMH000181**

CMH000183 - CMH000181			
Asset Number	CMH000183 - CMH000181	Length	618 ft
Upstream MH	CMH000183	Diameter	42 in
Downstream MH	CMH000181	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	353 ft
Date Profiled	18 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	13 in
Debris Volume	1 cubic feet

Debris Graph



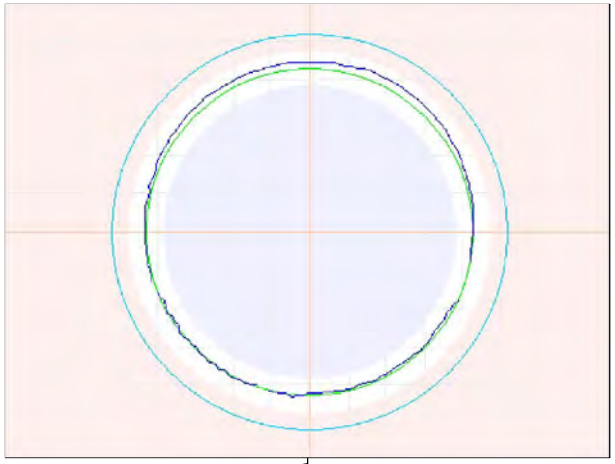
Inspection Distance (ft)

Water Level Debris Level

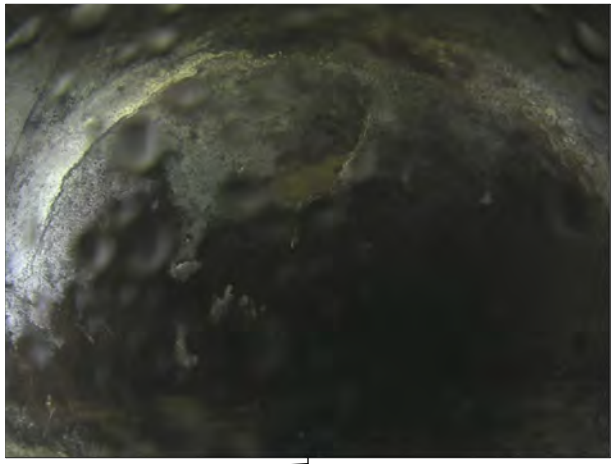
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

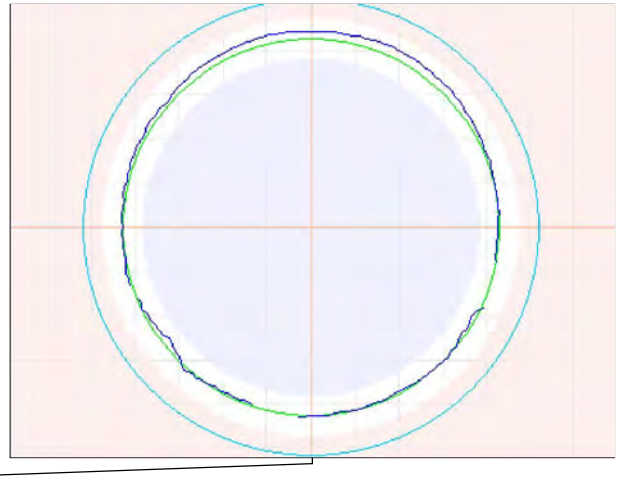
4ft General Observation - Corrosion to 1.1"

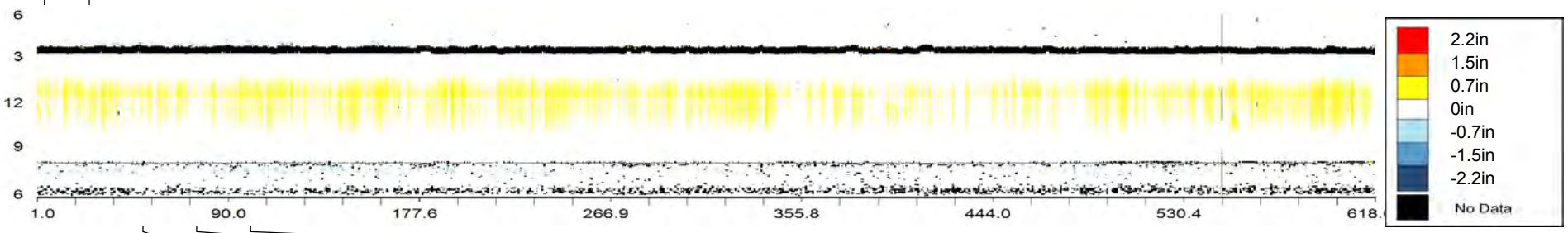


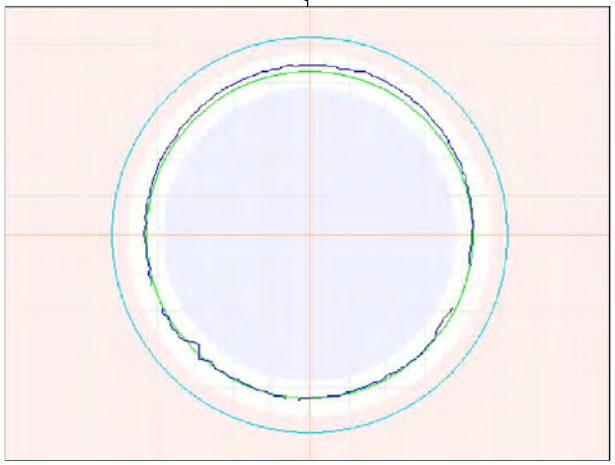
4ft General Observation - Corrosion to 1.1"



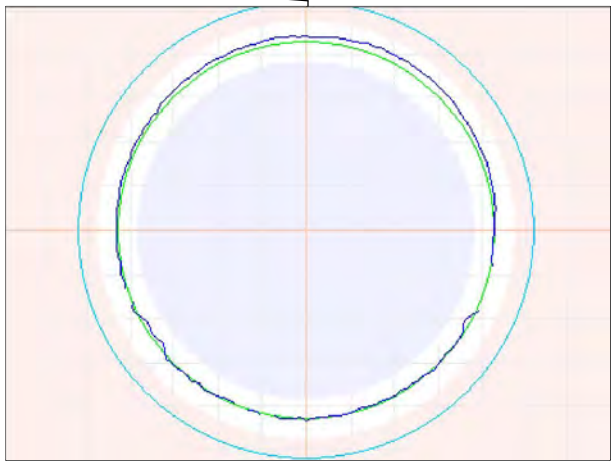
25ft General Observation - Corrosion to 1"



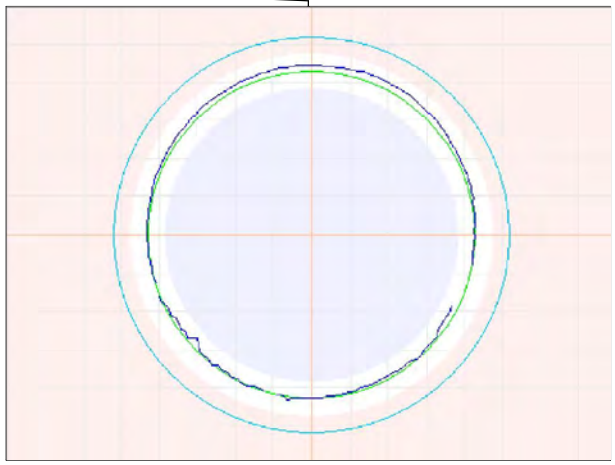




50.1ft General Observation - Corrosion to 1.0"



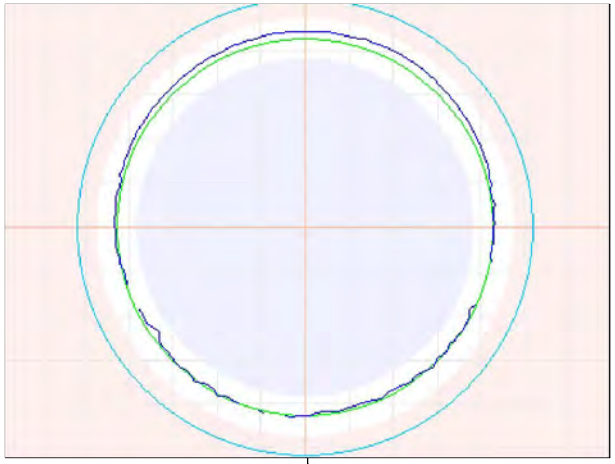
75.2ft General Observation - Corrosion to 0.8"



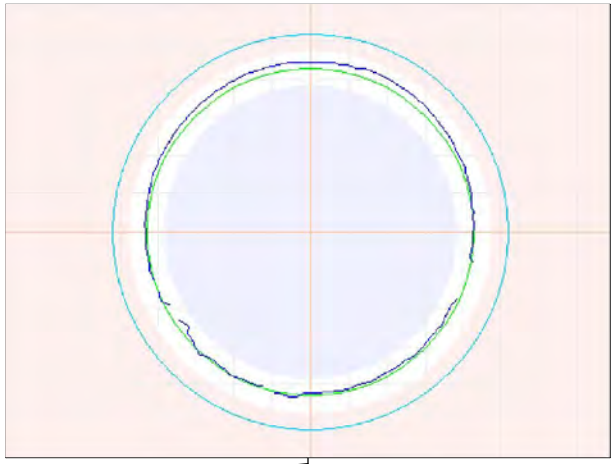
99.8ft General Observation - Corrosion to 0.9"

Observation Report

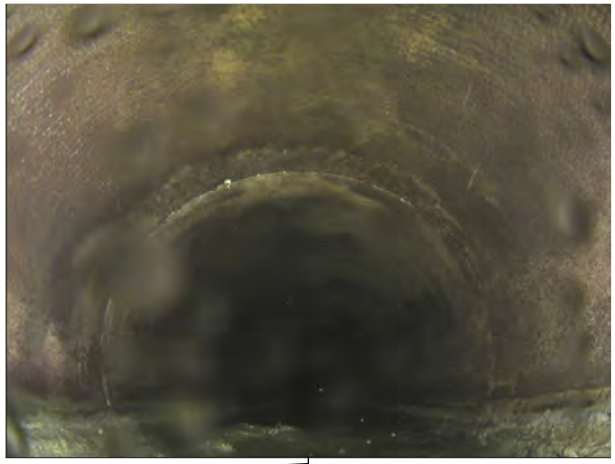
125.6ft General Observation - Corrosion to 0.9"

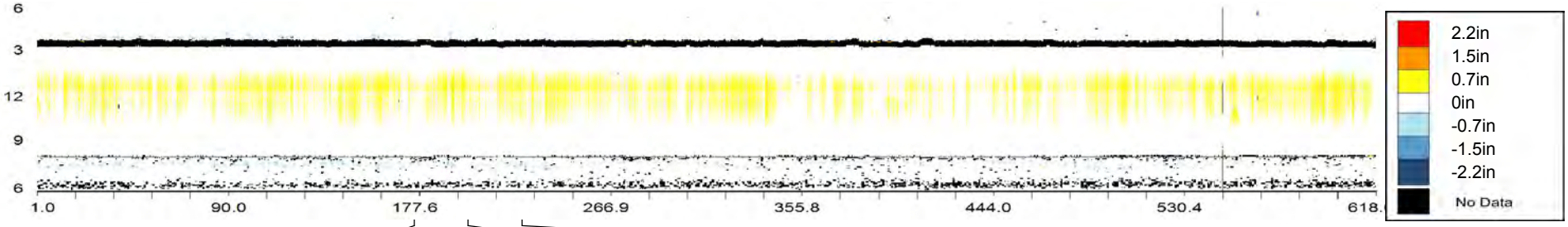


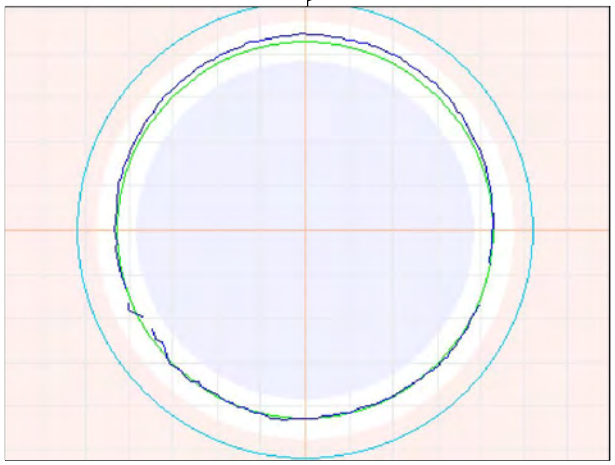
149.9ft General Observation - Corrosion to 1.0"



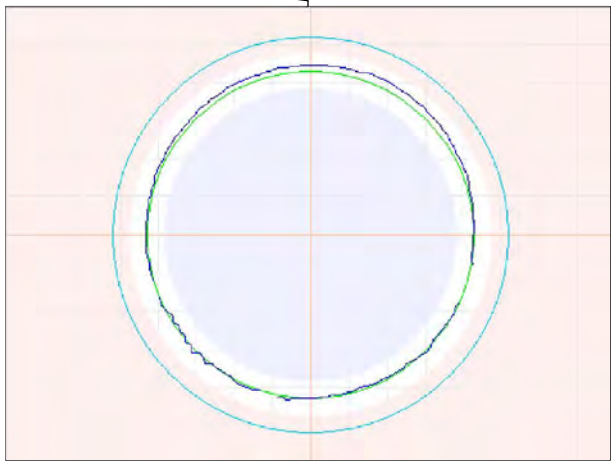
149.9ft General Observation - Corrosion to 1.0"



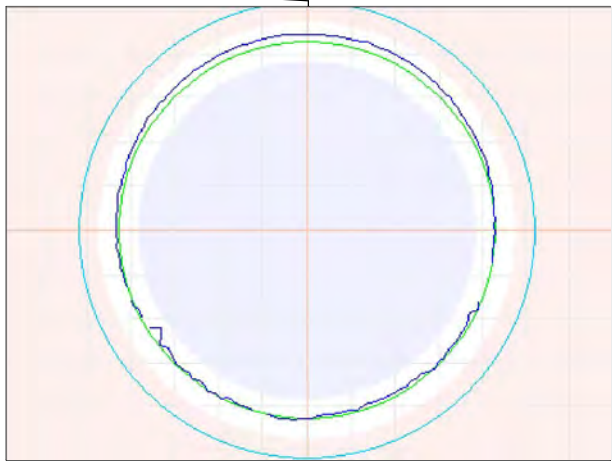




174.9ft General Observation - Corrosion to 0.8"



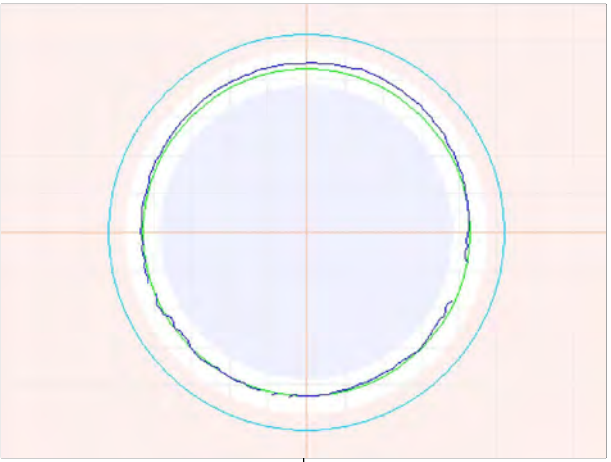
199.9ft General Observation - Corrosion to 1.0"



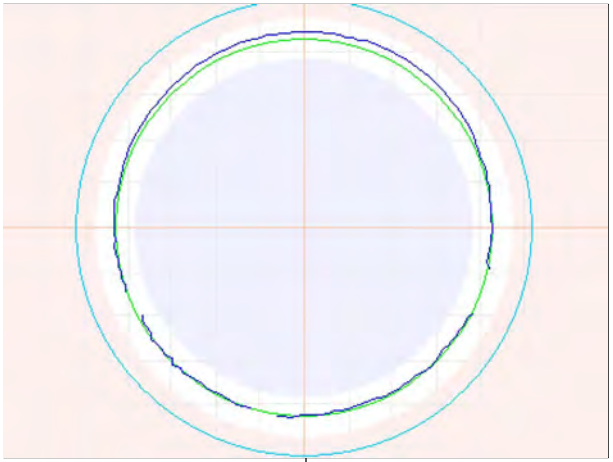
225.3ft General Observation - Corrosion to 1"

Observation Report

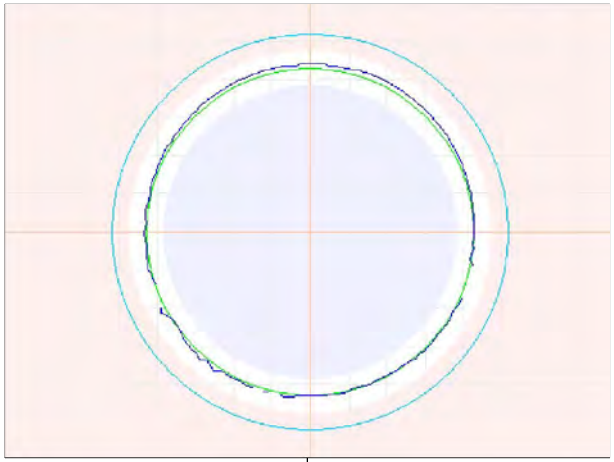
249.8ft General Observation - Corrosion to 1.0"

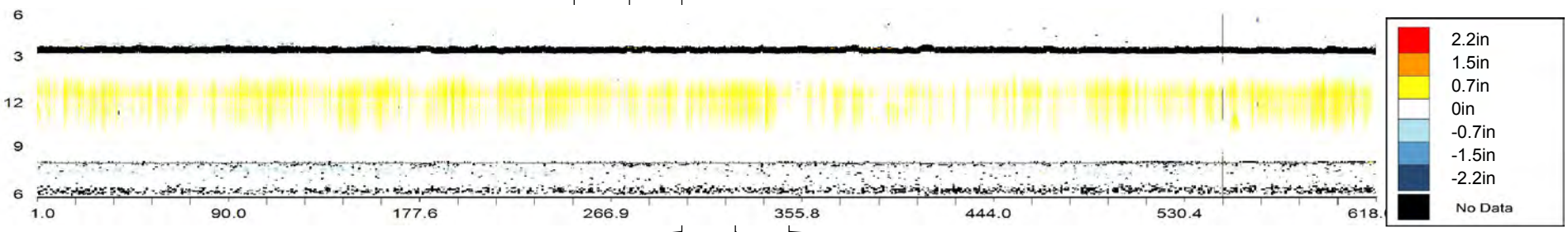


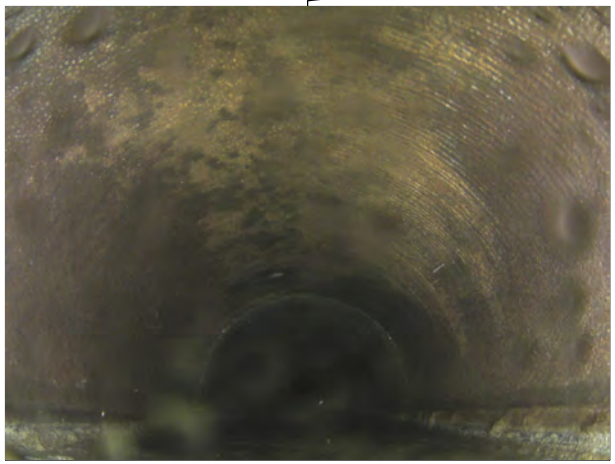
275.6ft General Observation - Corrosion to 0.8"



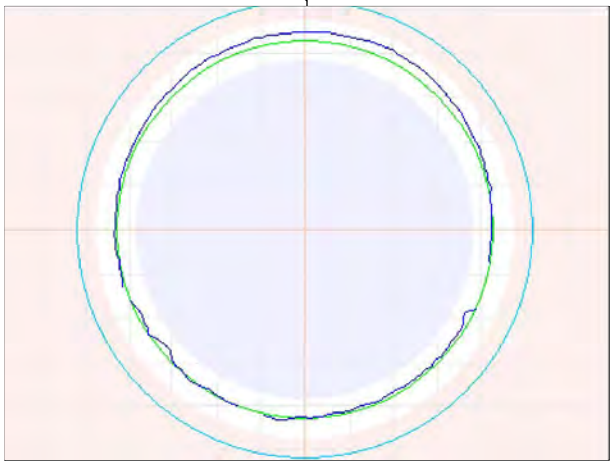
300.1ft General Observation - Corrosion to 0.8"



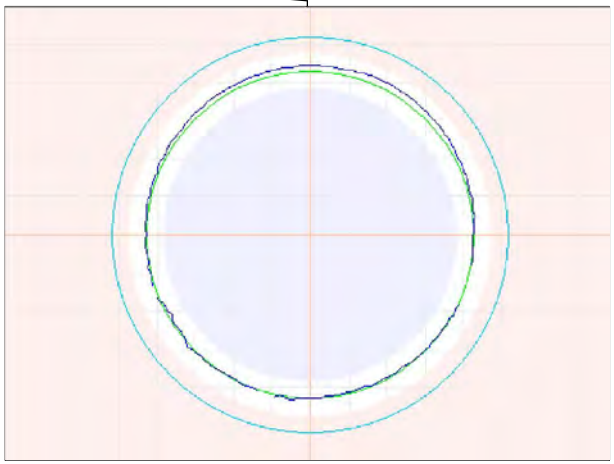




300.1ft General Observation - Corrosion to 0.8"



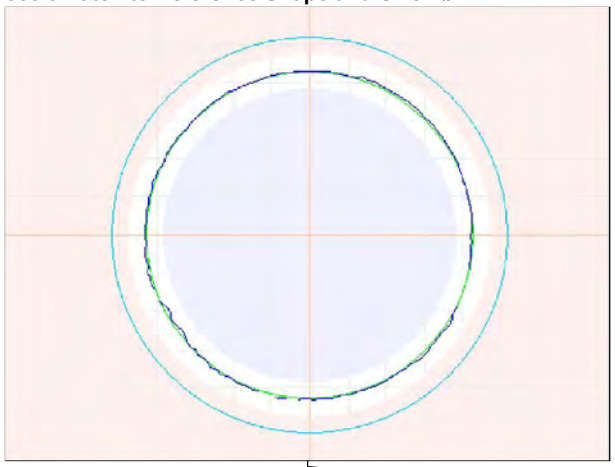
324.9ft General Observation - Corrosion to 1.2"



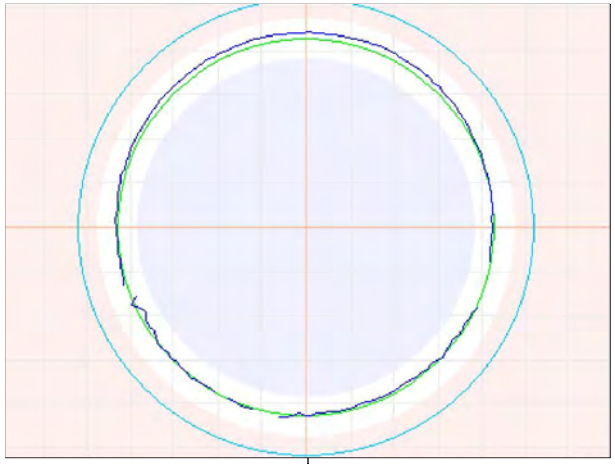
350.1ft General Observation - Corrosion to 0.8"

Observation Report

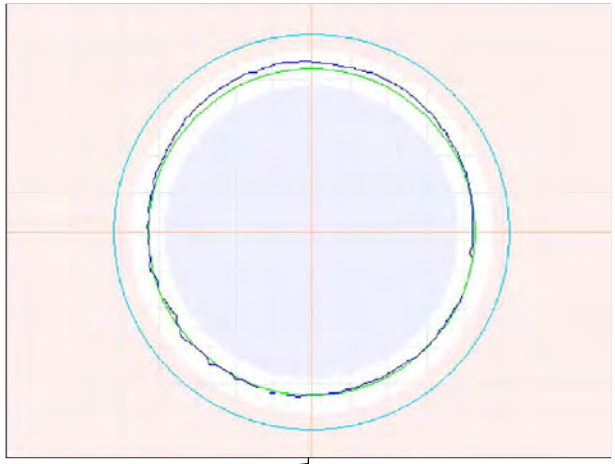
353ft Match to Reference Shape and Size - ø42"

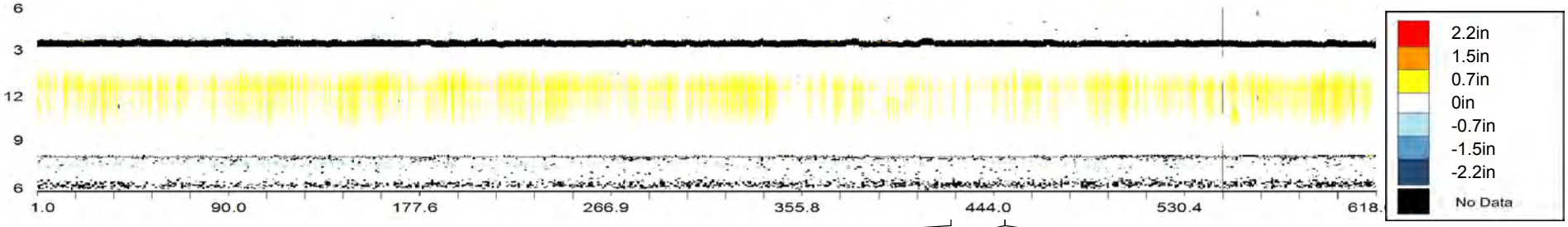


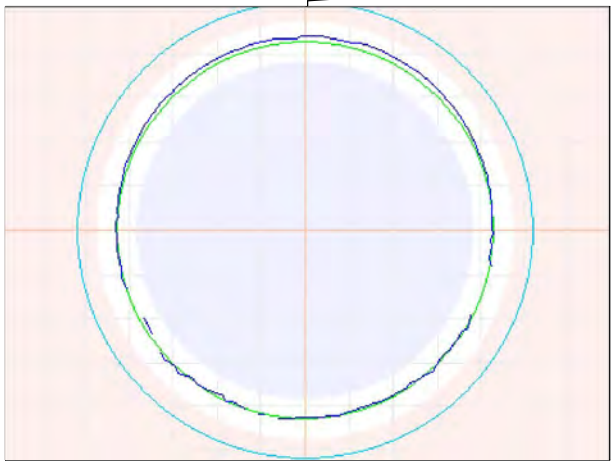
375.1ft General Observation - Corrosion to 0.8"



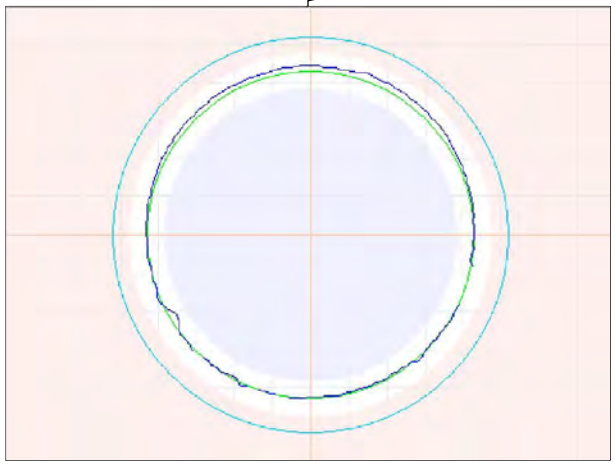
399.8ft General Observation - Corrosion to 0.9"



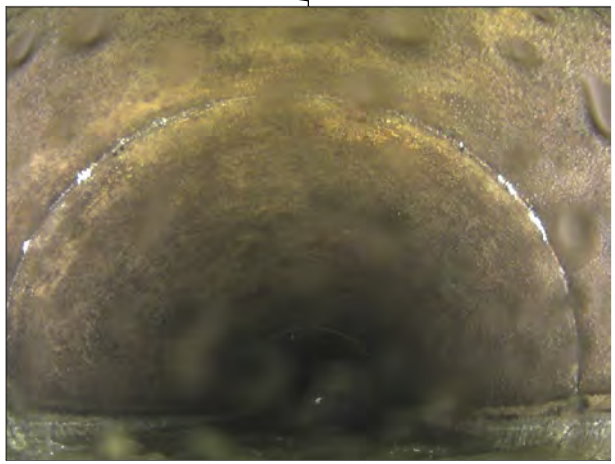




425.2ft General Observation - Corrosion to 0.7"



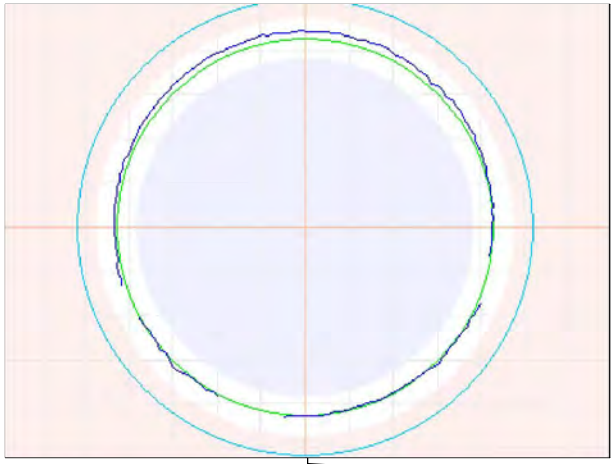
449.8ft General Observation - Corrosion to 0.9"



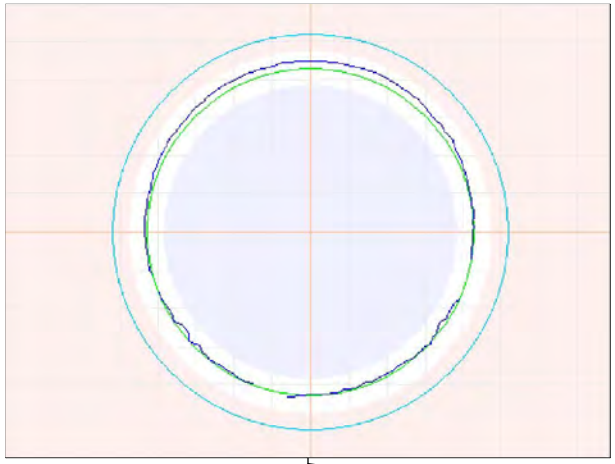
449.8ft General Observation - Corrosion to 0.9"

Observation Report

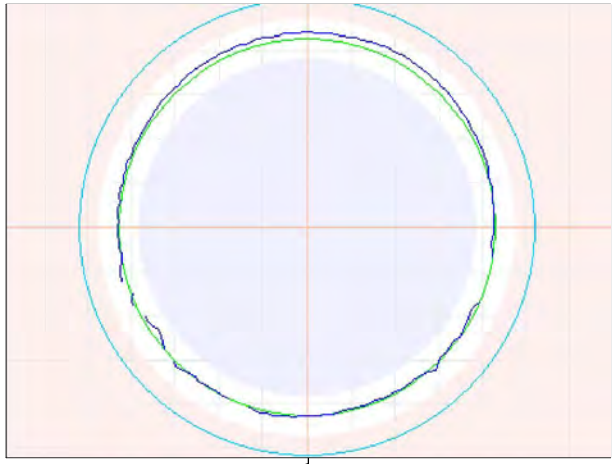
474.7ft General Observation - Corrosion to 0.9"

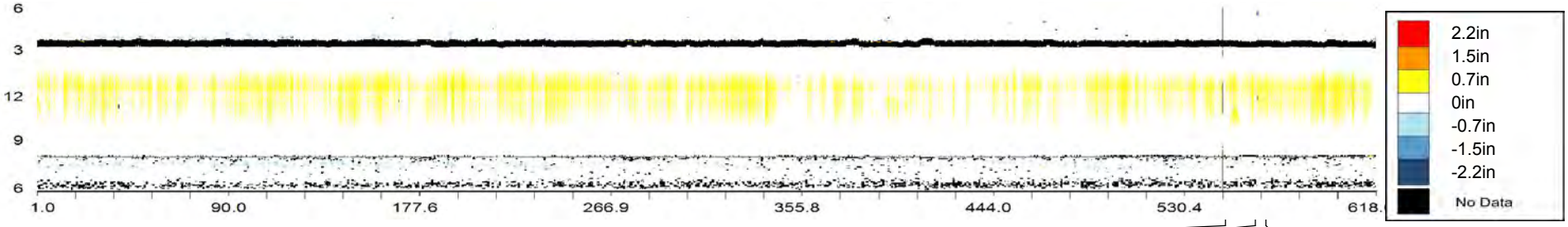


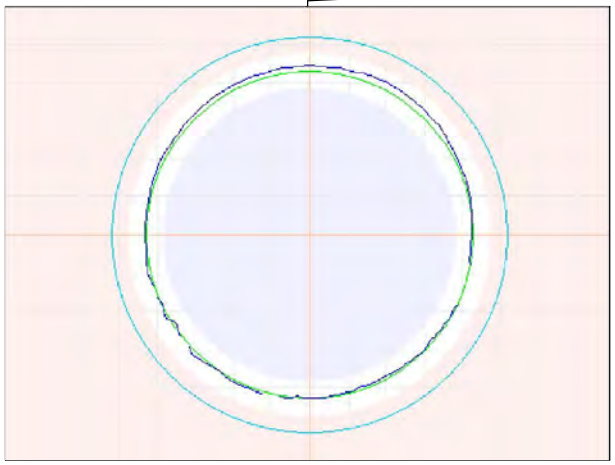
500ft General Observation - Corrosion to 1.0"



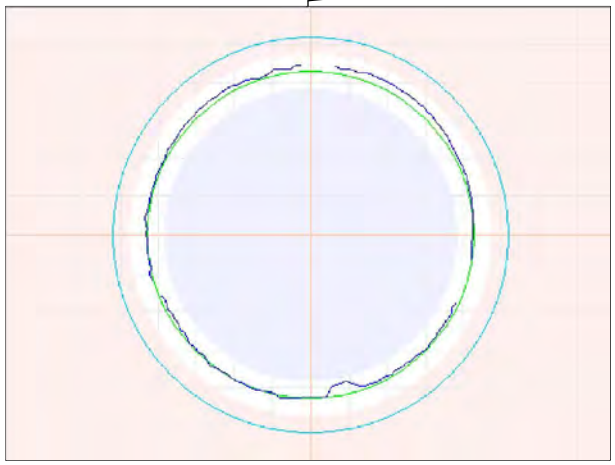
525.2ft General Observation - Corrosion to 0.9"



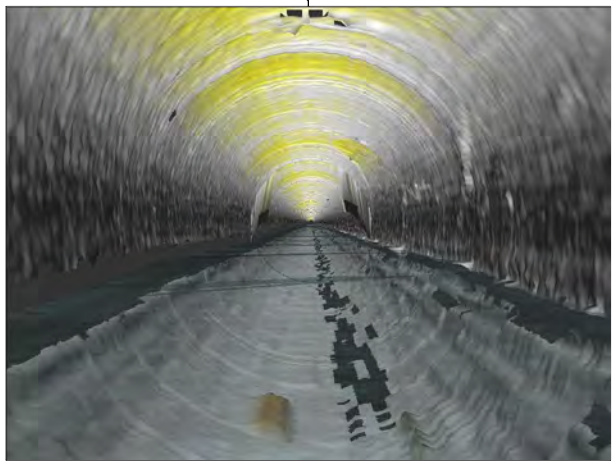




550ft General Observation - Corrosion to 0.9"



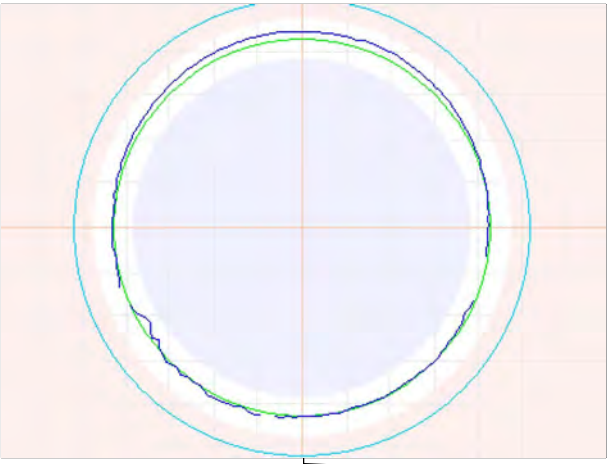
563.8ft Maximum Debris - To 1.6"



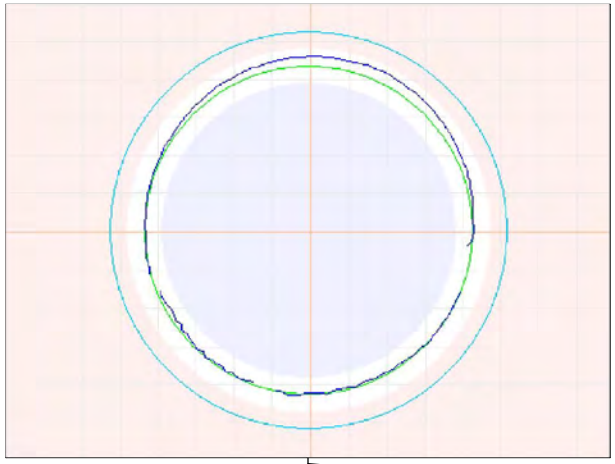
568.5ft 3D Laser Sonar Scan - Pipe Overview

Observation Report

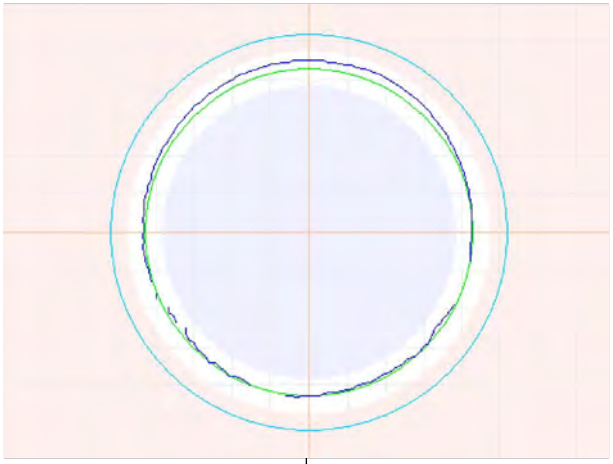
574.7ft General Observation - Corrosion to 0.9"

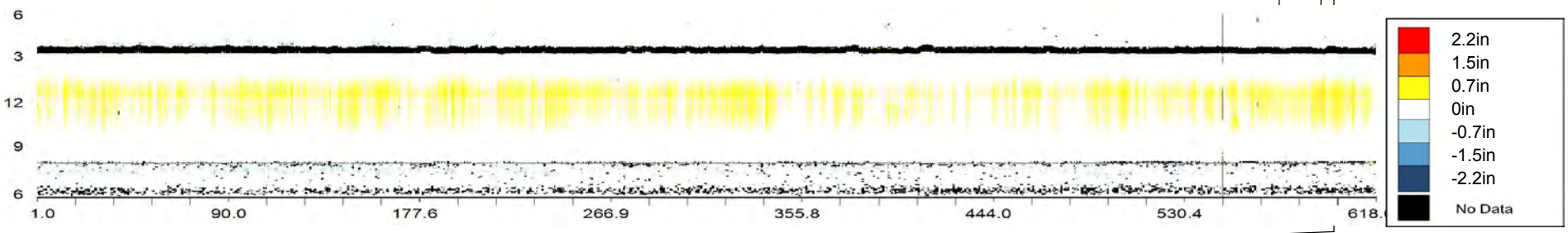


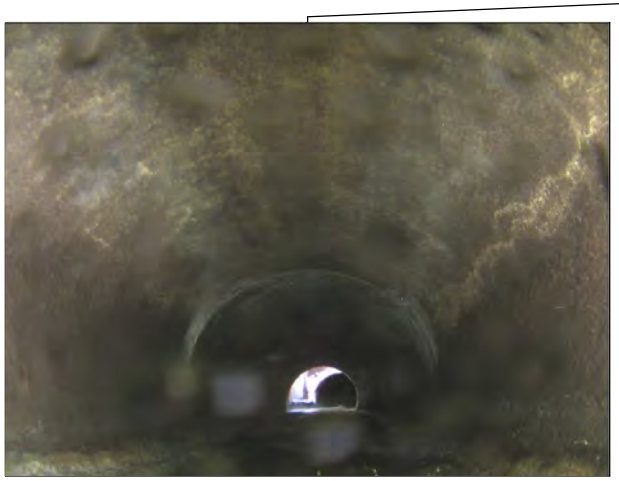
593.8ft Maximum Corrosion - To 1.3"



599.7ft General Observation - Corrosion to 1.2"







599.7ft General Observation - Corrosion to 1.2"

OVERVIEW - CMH000184 - CMH000183

Asset Number	CMH000184 - CMH000183		
Upstream MH	CMH000184	Material	Reinforced Concrete Pipe
Downstream MH	CMH000183	Size & Shape	42 in Circle
Survey Direction	Downstream	Match to Reference	273.4 ft

Distance	Observation	Comment
9.4 ft	**Beginning of Inspection**	**CMH000184**
10	General Observation	Corrosion to 1.0"
25.3	General Observation	Corrosion to 1"
50	General Observation	Corrosion to 1.2"
75.5	General Observation	Corrosion to 1.2"
99.9	General Observation	Corrosion to 1.1"
124.7	General Observation	Corrosion to 1"
150.1	General Observation	Corrosion to 1.0"
174.7	General Observation	Corrosion to 1.4"
183.5	Maximum Corrosion	To 1.7"
200.1	General Observation	Corrosion to 0.9"
224.8	General Observation	Corrosion to 0.8"
249.8	General Observation	Corrosion to 1.2"
273.4	Match to Reference Shape and Size	ø42"
275.2	General Observation	Corrosion to 0.9"
299.8	General Observation	Corrosion to 0.9"
325.1	General Observation	Corrosion to 0.6"
350.1	General Observation	Corrosion to 0.8"
375.4	General Observation	Corrosion to 0.9"
399.8	General Observation	Corrosion to 0.7"
424.6	General Observation	Corrosion to 1"
449.8	General Observation	Corrosion to 1.0"
475.5	General Observation	Corrosion to 0.8"
487.9	3D Laser Sonar Scan	Pipe Overview
500	General Observation	Corrosion to 0.7"

OVERVIEW - CMH000184 - CMH000183

Asset Number	CMH000184 - CMH000183		
Upstream MH	CMH000184	Material	Reinforced Concrete Pipe
Downstream MH	CMH000183	Size & Shape	42 in Circle
Survey Direction	Downstream	Match to Reference	273.4 ft

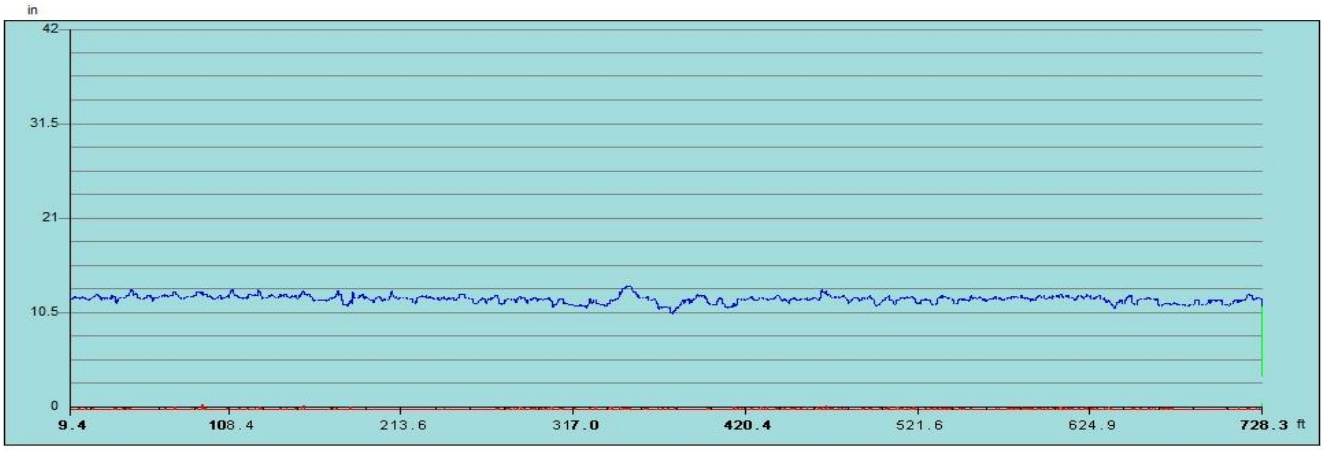
Distance	Observation	Comment
524.6	General Observation	Corrosion to 0.9"
550	General Observation	Corrosion to 1.1"
575.2	General Observation	Corrosion to 1"
600	General Observation	Corrosion to 1.0"
625.1	General Observation	Corrosion to 1"
649.7	General Observation	Corrosion to 1.0"
674.8	General Observation	Corrosion to 0.9"
699.9	General Observation	Corrosion to 0.7"
724.9	General Observation	Corrosion to 0.9"
728.1 ft	**End of Inspection**	**CMH000183**

CMH000184 - CMH000183			
Asset Number	CMH000184 - CMH000183	Length	729 ft
Upstream MH	CMH000184	Diameter	42 in
Downstream MH	CMH000183	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	273.4 ft
Date Profiled	18 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	12 in
Debris Volume	0 cubic feet

Debris Graph



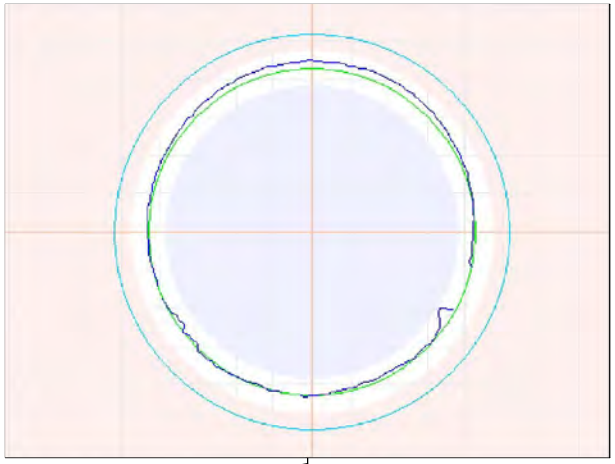
Inspection Distance (ft)

Water Level Debris Level

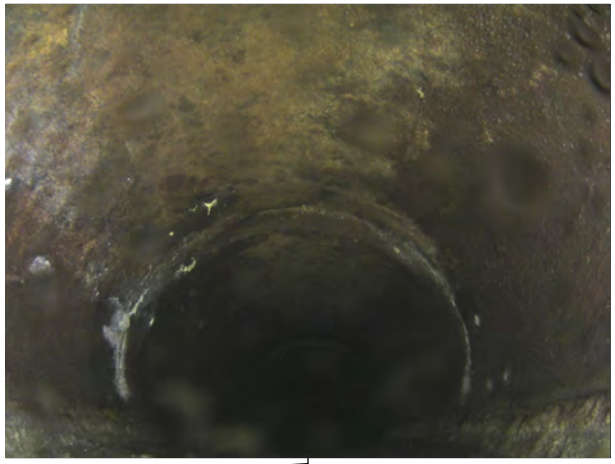
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

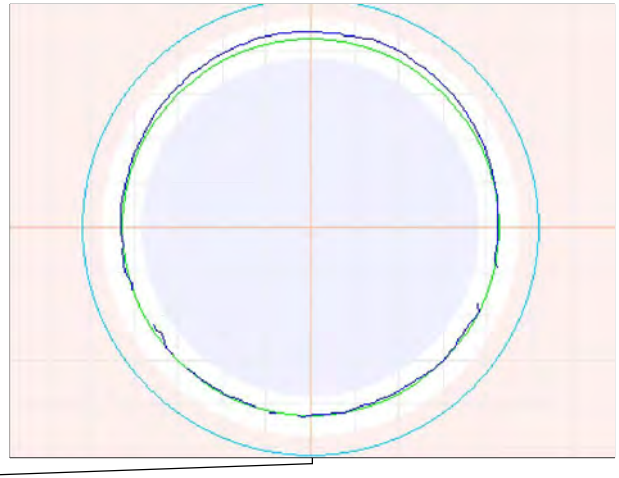
10ft General Observation - Corrosion to 1.0"

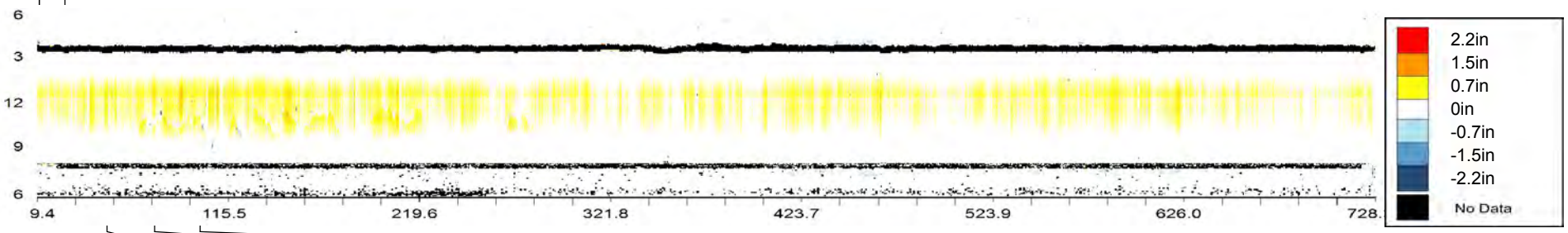


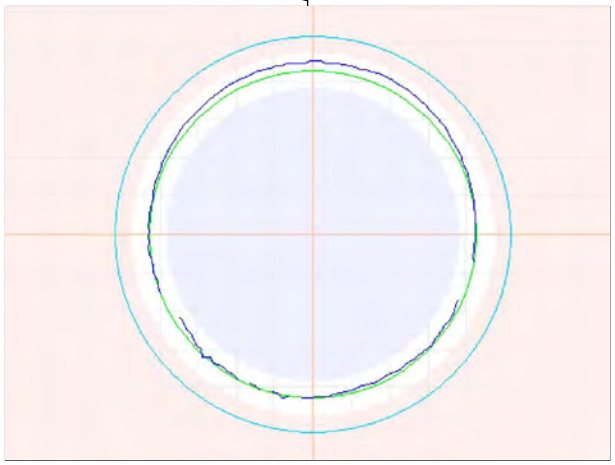
10ft General Observation - Corrosion to 1.0"



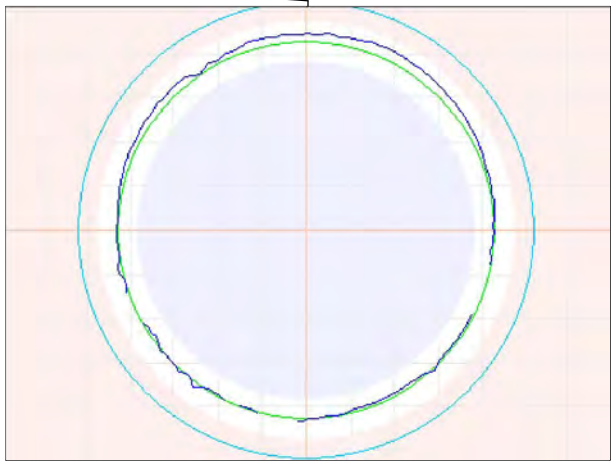
25.3ft General Observation - Corrosion to 1"



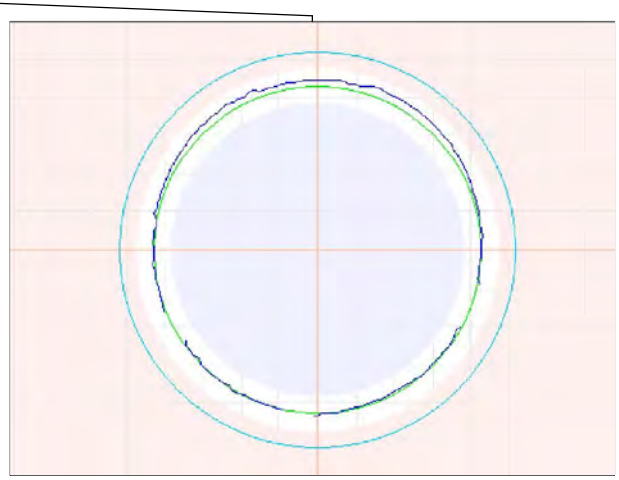




50ft General Observation - Corrosion to 1.2"



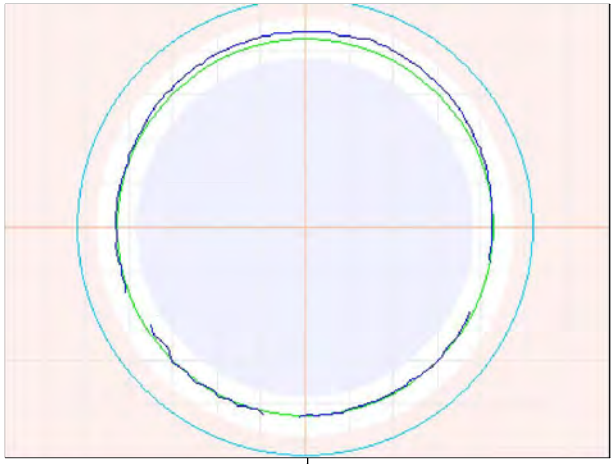
75.5ft General Observation - Corrosion to 1.2"



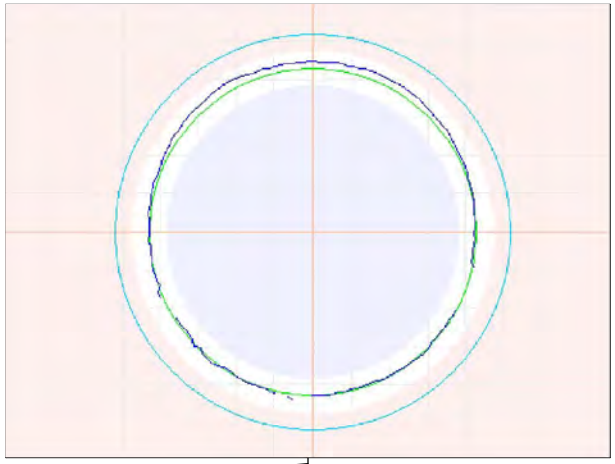
99.9ft General Observation - Corrosion to 1.1"

Observation Report

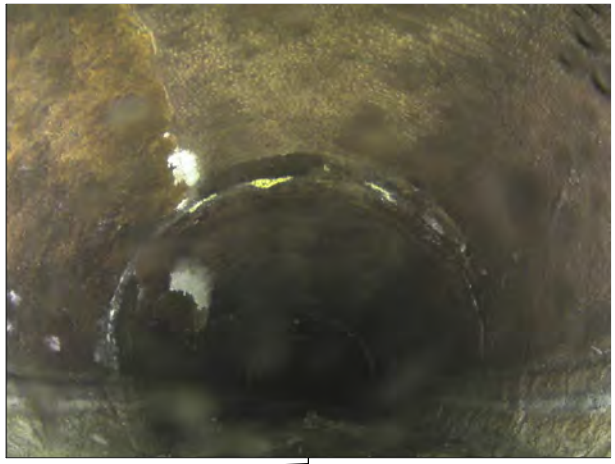
124.7ft General Observation - Corrosion to 1"

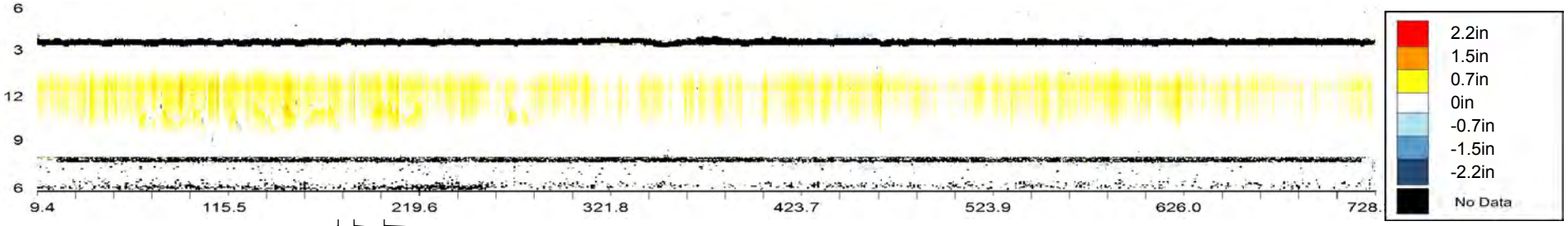


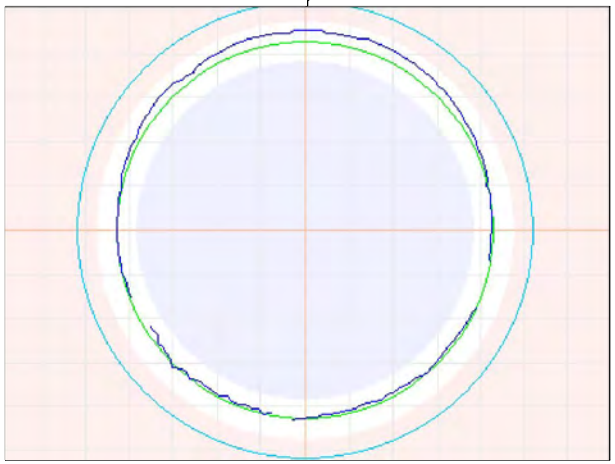
150.1ft General Observation - Corrosion to 1.0"



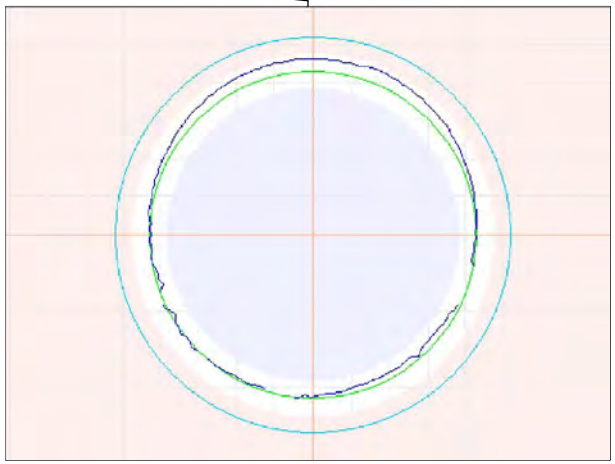
150.1ft General Observation - Corrosion to 1.0"



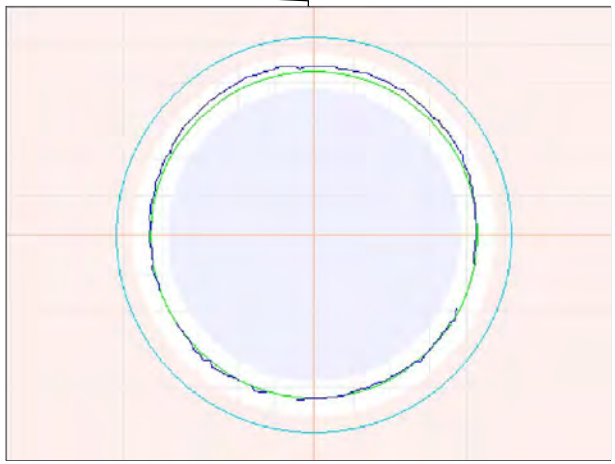




174.7ft General Observation - Corrosion to 1.4"



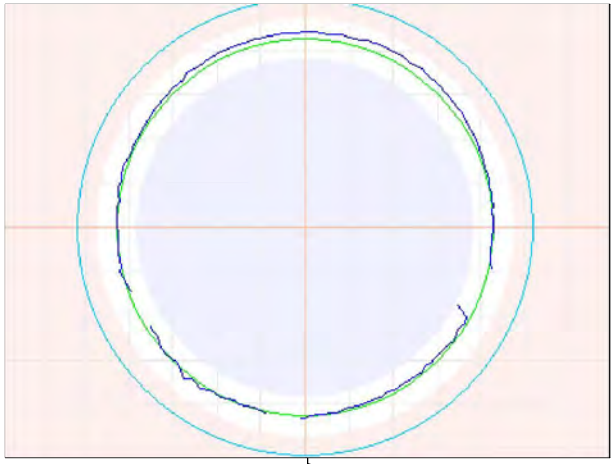
183.5ft Maximum Corrosion - To 1.7"



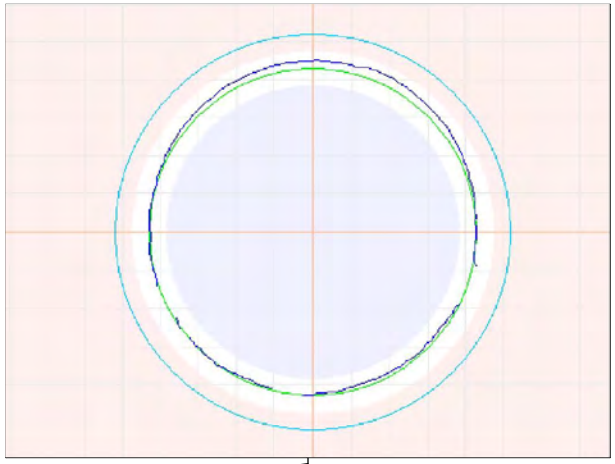
200.1ft General Observation - Corrosion to 0.9"

Observation Report

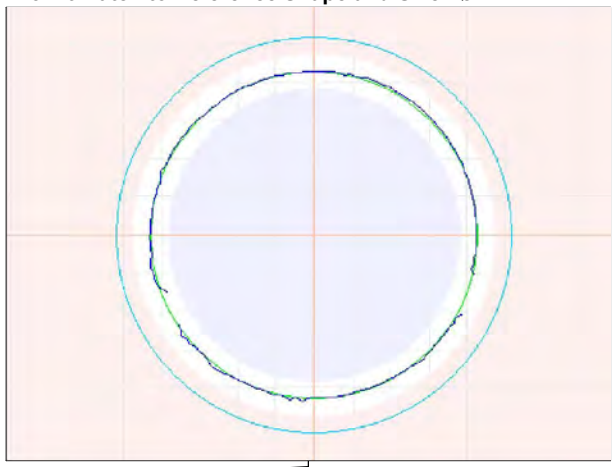
224.8ft General Observation - Corrosion to 0.8"

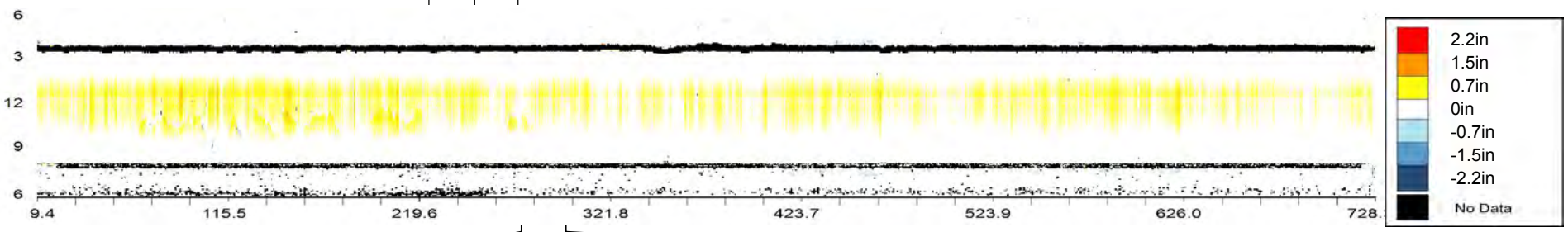


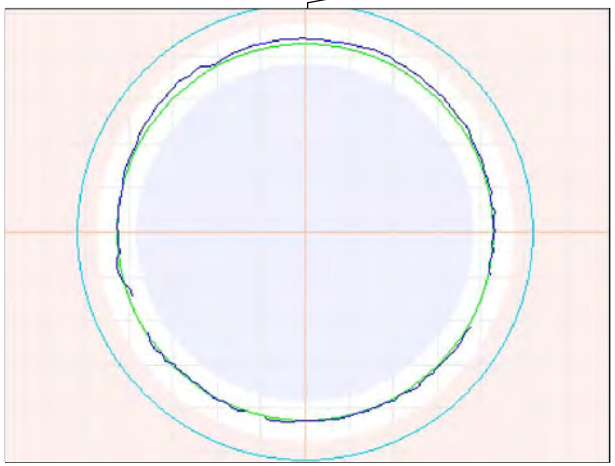
249.8ft General Observation - Corrosion to 1.2"



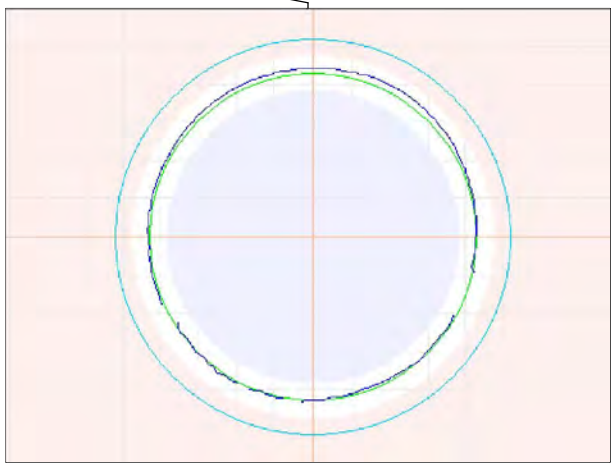
273.4ft Match to Reference Shape and Size - ø42"



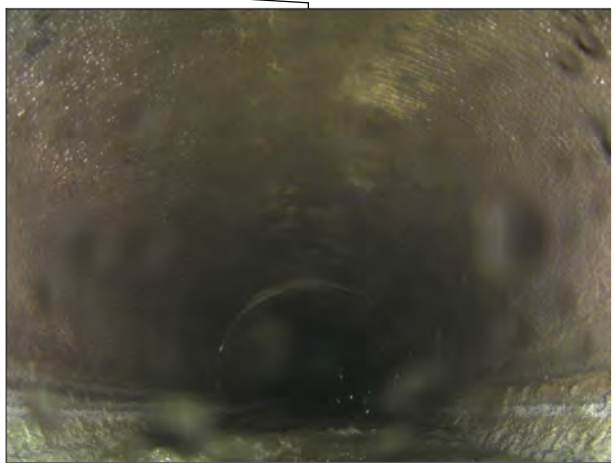




275.2ft General Observation - Corrosion to 0.9"



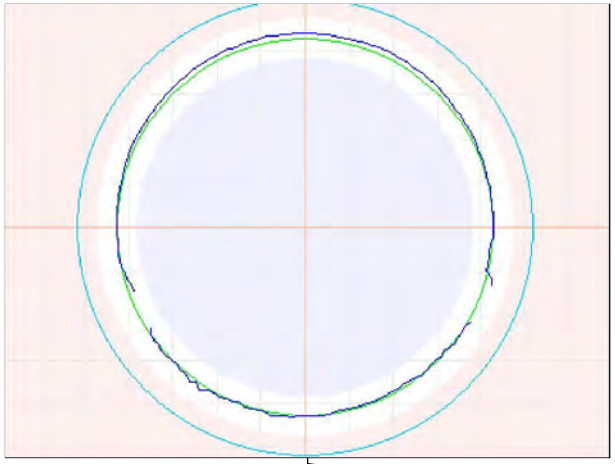
299.8ft General Observation - Corrosion to 0.9"



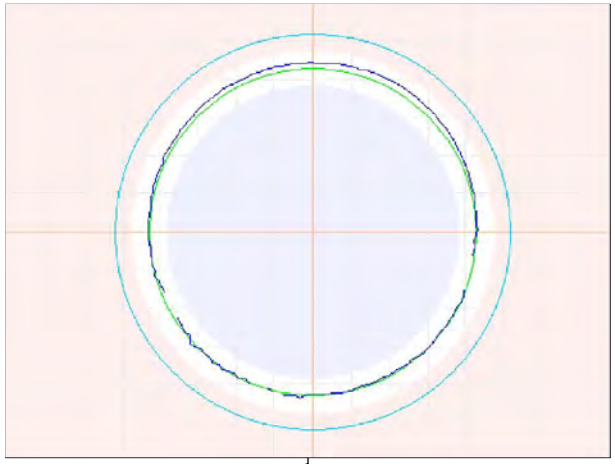
299.8ft General Observation - Corrosion to 0.9"

Observation Report

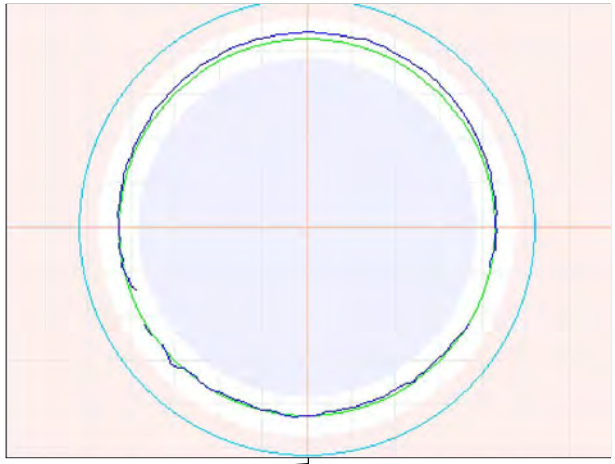
325.1ft General Observation - Corrosion to 0.6"

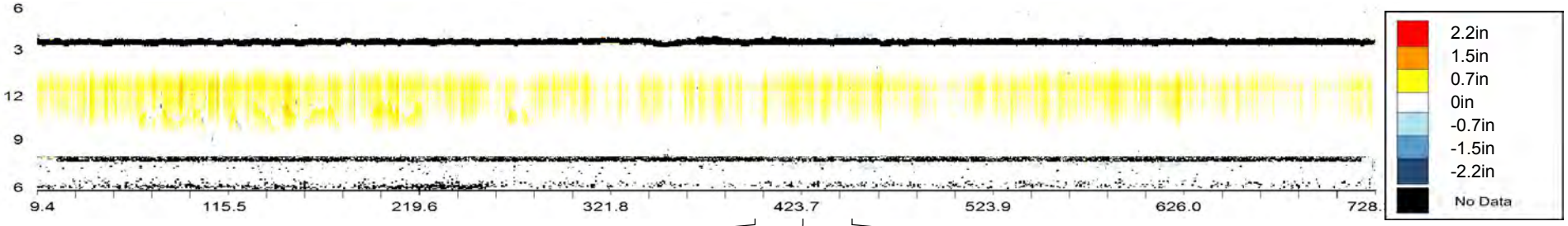


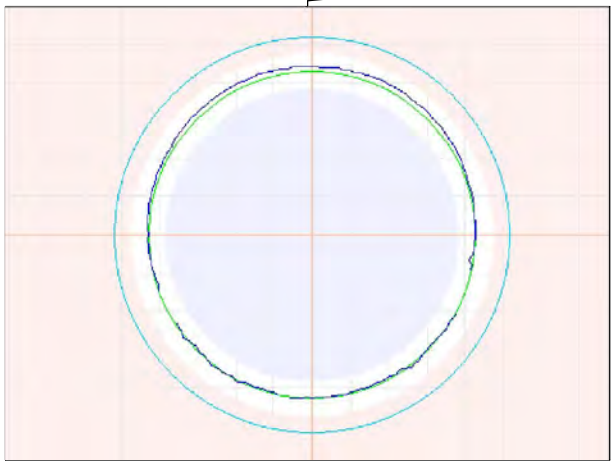
350.1ft General Observation - Corrosion to 0.8"



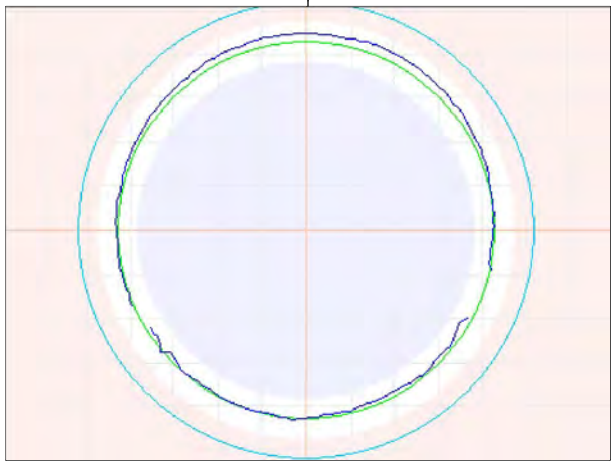
375.4ft General Observation - Corrosion to 0.9"



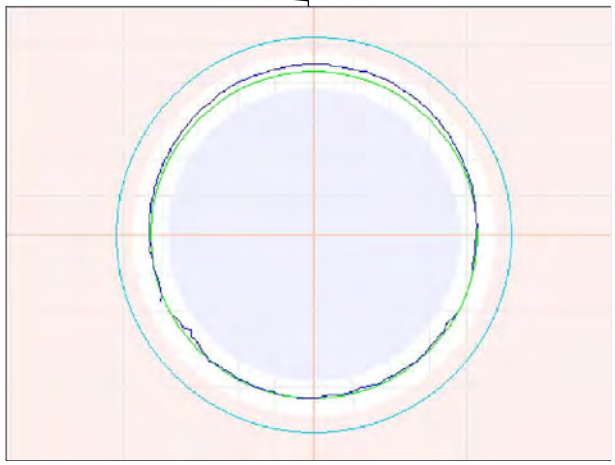




399.8ft General Observation - Corrosion to 0.7"



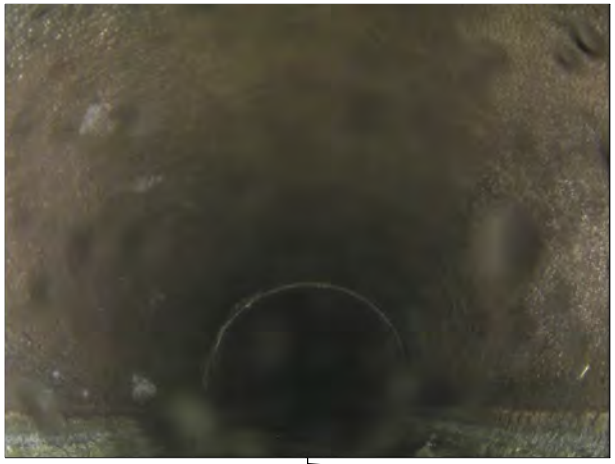
424.6ft General Observation - Corrosion to 1"



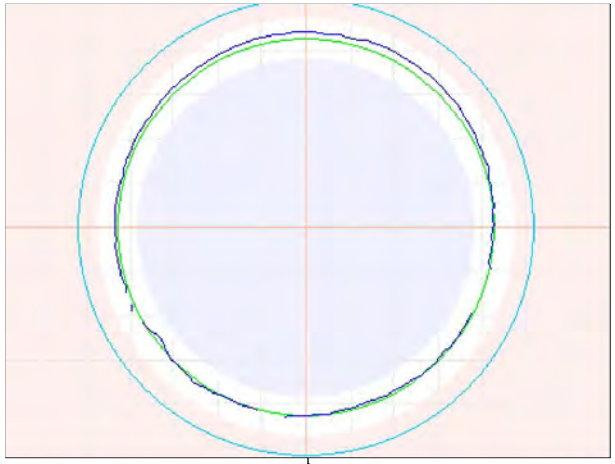
449.8ft General Observation - Corrosion to 1.0"

Observation Report

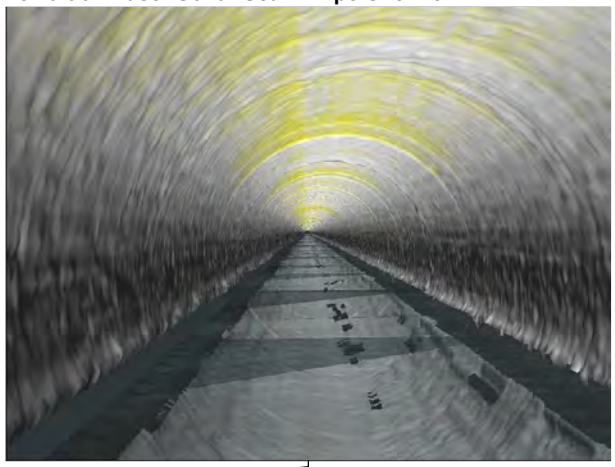
449.8ft General Observation - Corrosion to 1.0"

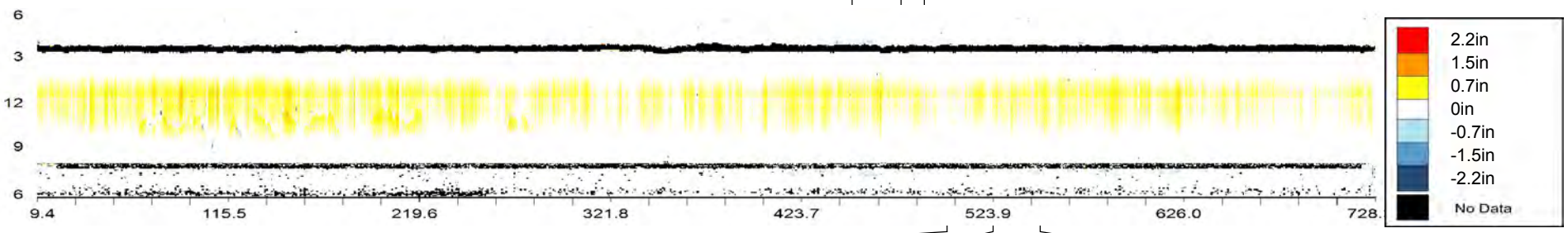


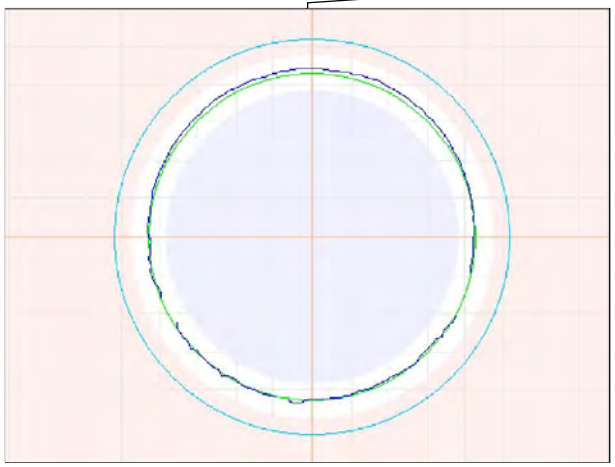
475.5ft General Observation - Corrosion to 0.8"



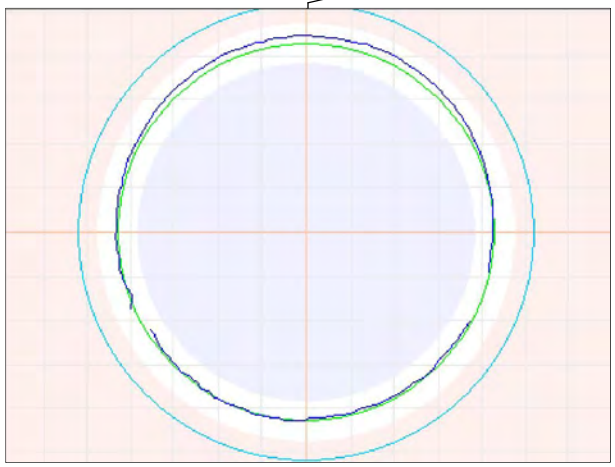
487.9ft 3D Laser Sonar Scan - Pipe Overview



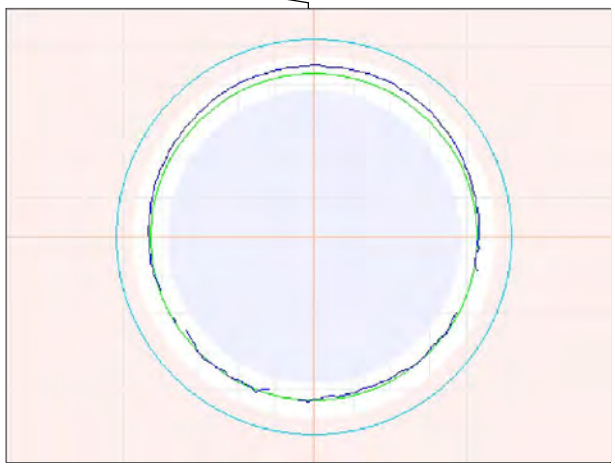




500ft General Observation - Corrosion to 0.7"



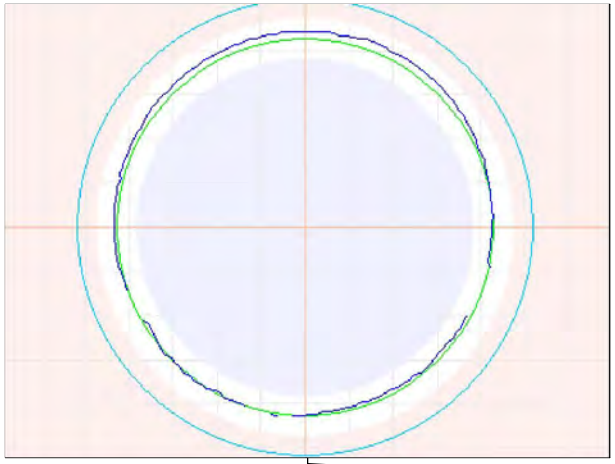
524.6ft General Observation - Corrosion to 0.9"



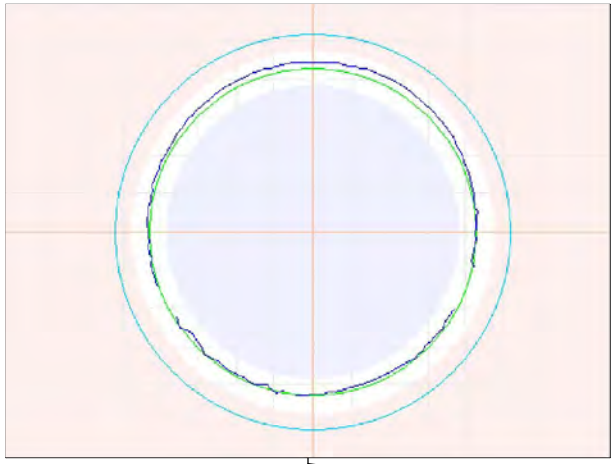
550ft General Observation - Corrosion to 1.1"

Observation Report

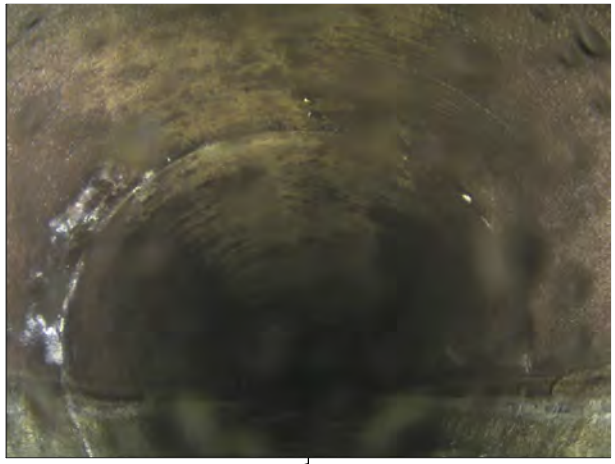
575.2ft General Observation - Corrosion to 1"

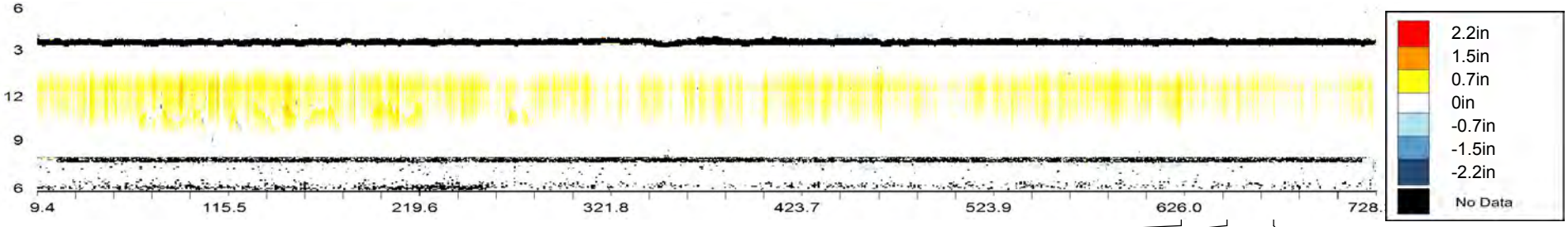


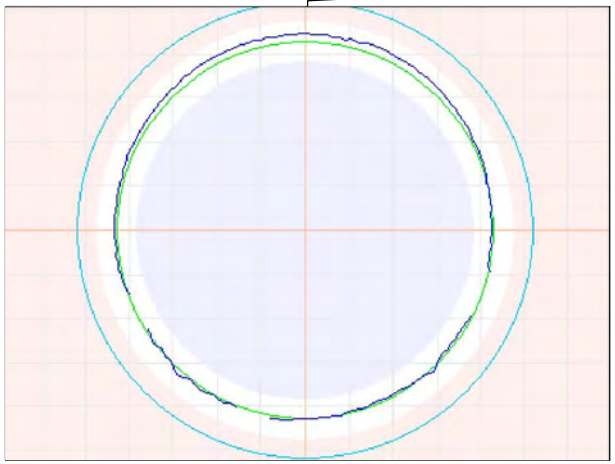
600ft General Observation - Corrosion to 1.0"



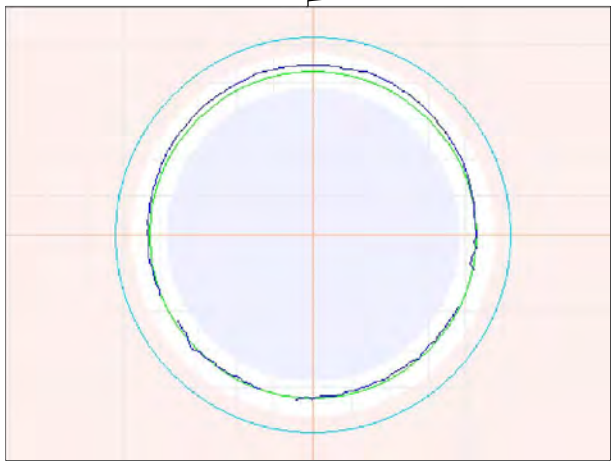
600ft General Observation - Corrosion to 1.0"



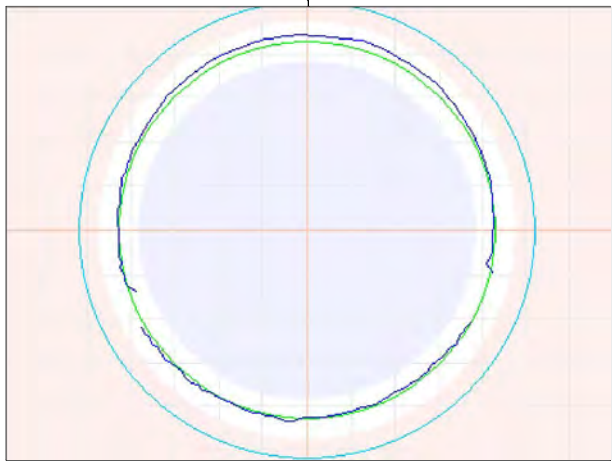




625.1ft General Observation - Corrosion to 1"



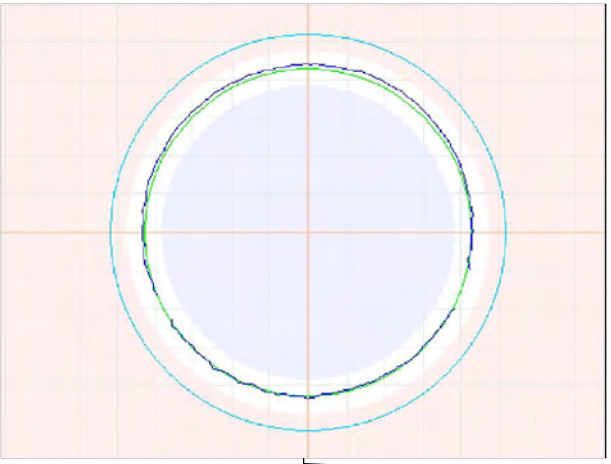
649.7ft General Observation - Corrosion to 1.0"



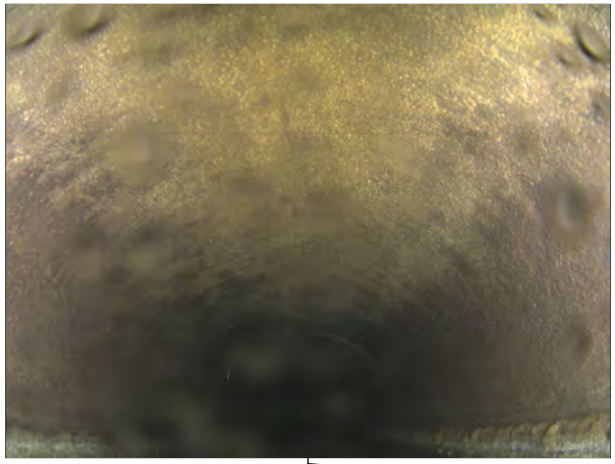
674.8ft General Observation - Corrosion to 0.9"

Observation Report

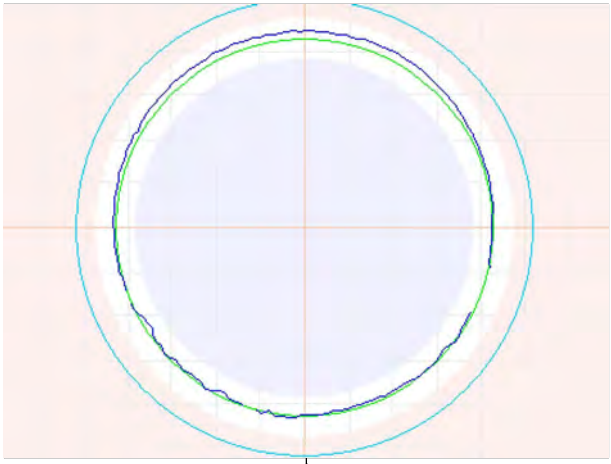
699.9ft General Observation - Corrosion to 0.7"

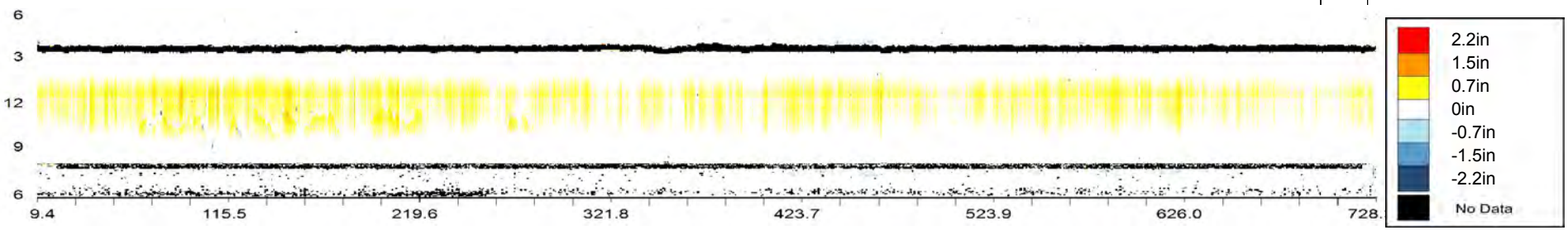


699.9ft General Observation - Corrosion to 0.7"



724.9ft General Observation - Corrosion to 0.9"





OVERVIEW - CMH000185 - CMH000184

Asset Number	CMH000185 - CMH000184		
Upstream MH	CMH000185	Material	Reinforced Concrete Pipe
Downstream MH	CMH000184	Size & Shape	42 in Circle
Survey Direction	Downstream	Match to Reference	166 ft

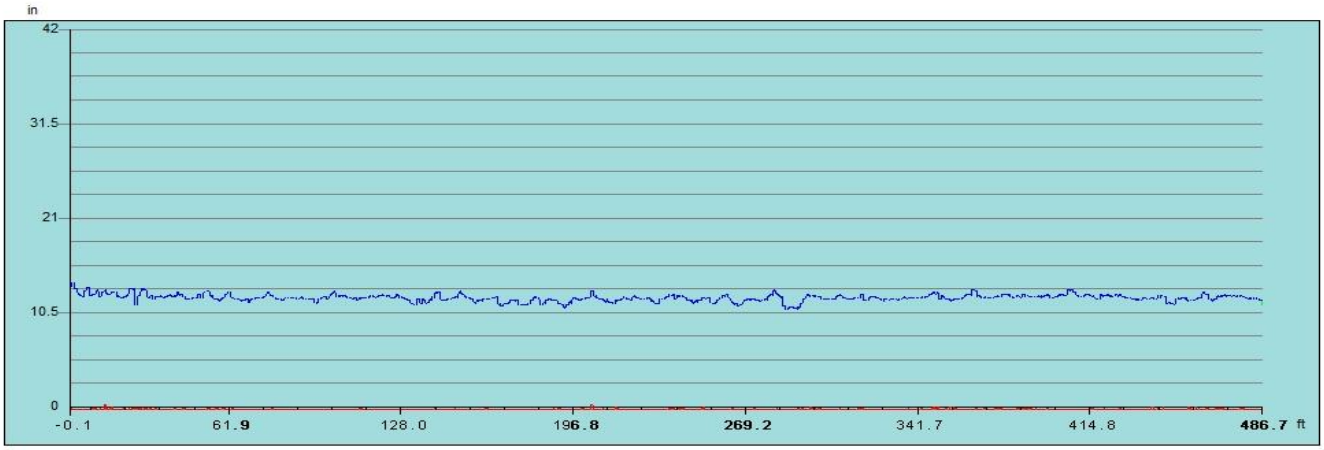
Distance	Observation	Comment
-0.1 ft	**Beginning of Inspection**	**CMH000185**
1	General Observation	Corrosion to 0.9"
5.3	Maximum Corrosion	To 1.7"
25.5	General Observation	Corrosion to 0.5"
50	General Observation	Corrosion to 1.0"
75.5	General Observation	Corrosion to 1"
100.1	General Observation	Corrosion to 0.7"
125.3	General Observation	Corrosion to 0.7"
149.9	General Observation	Corrosion to 0.8"
166	Match to Reference Shape and Size	ø42"
175.4	General Observation	Corrosion to 0.7"
199.8	General Observation	Corrosion to 0.9"
225	General Observation	Corrosion to 1.1"
250	General Observation	Corrosion to 1.0"
275.1	General Observation	Corrosion to 1"
299.8	General Observation	Corrosion to 0.8"
324.8	General Observation	Corrosion to 1.1"
349.8	General Observation	Corrosion to 0.9"
375	General Observation	Corrosion to 1.5"
392.4	3D Laser Sonar Scan	Pipe Overview
399.7	General Observation	Corrosion to 0.9"
425.1	General Observation	Corrosion to 0.9"
449.8	General Observation	Corrosion to 0.7"
475.2	General Observation	Corrosion to 0.8"
486.6 ft	**End of Inspection**	**CMH000184**

CMH000185 - CMH000184			
Asset Number	CMH000185 - CMH000184	Length	487 ft
Upstream MH	CMH000185	Diameter	42 in
Downstream MH	CMH000184	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	166 ft
Date Profiled	18 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	12 in
Debris Volume	0 cubic feet

Debris Graph



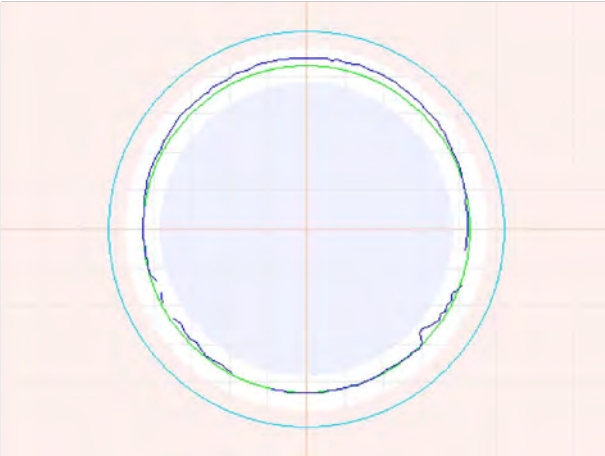
Inspection Distance (ft)

Water Level Debris Level

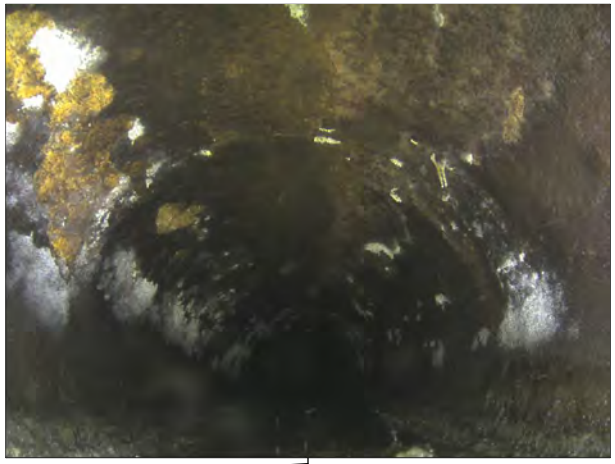
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

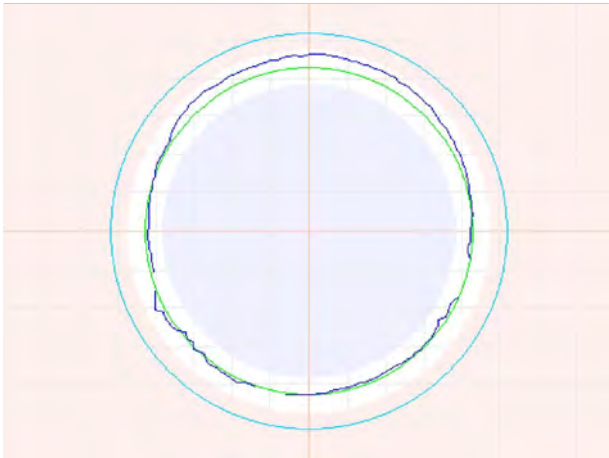
1ft General Observation - Corrosion to 0.9"

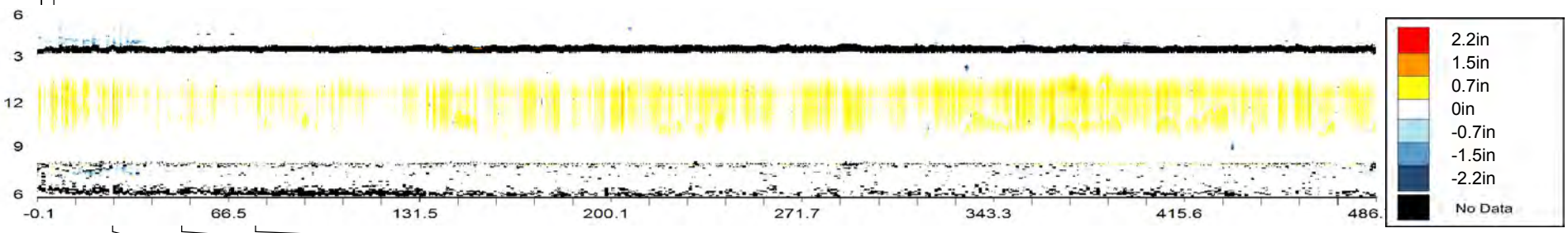


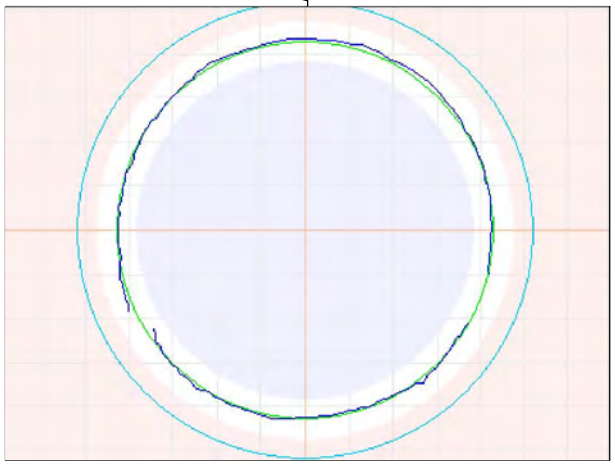
1ft General Observation - Corrosion to 0.9"



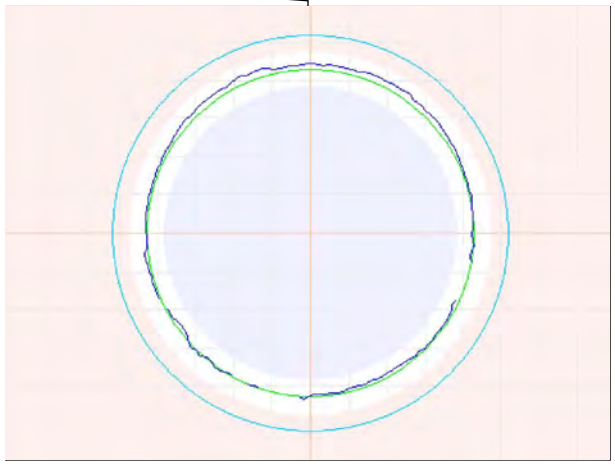
5.3ft Maximum Corrosion - To 1.7"



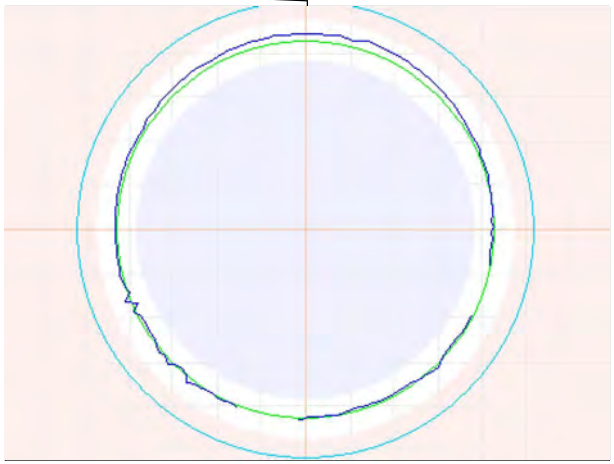




25.5ft General Observation - Corrosion to 0.5"



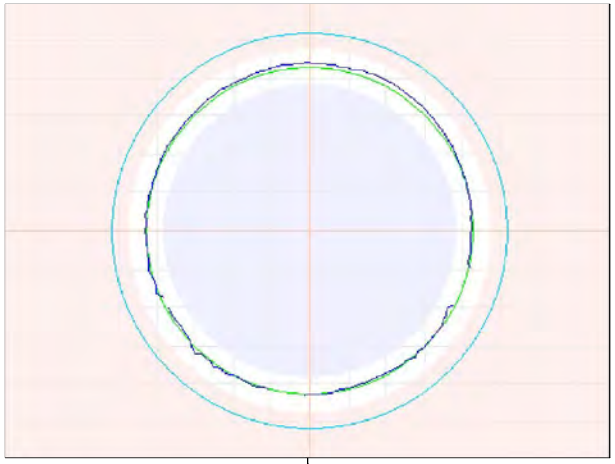
50ft General Observation - Corrosion to 1.0"



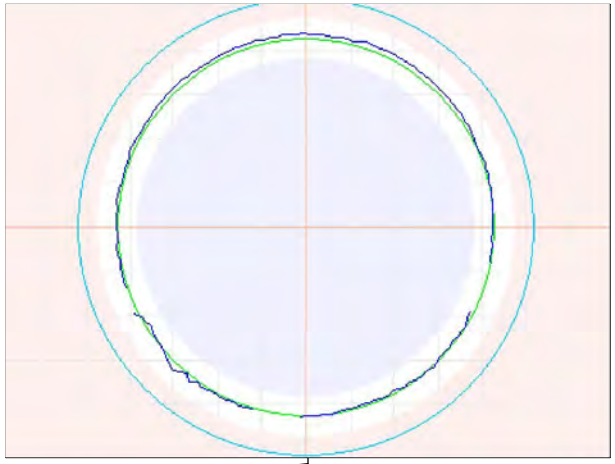
75.5ft General Observation - Corrosion to 1"

Observation Report

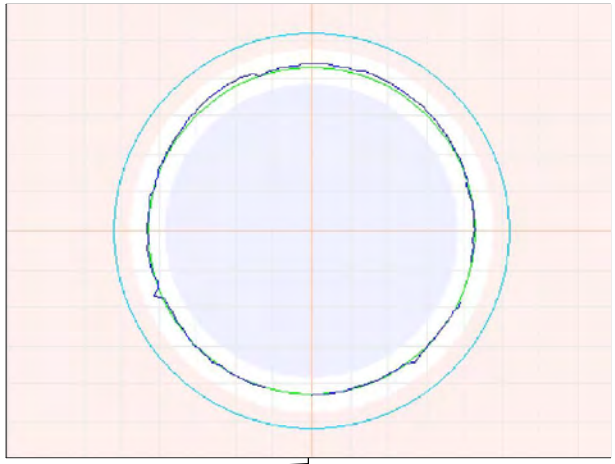
100.1ft General Observation - Corrosion to 0.7"

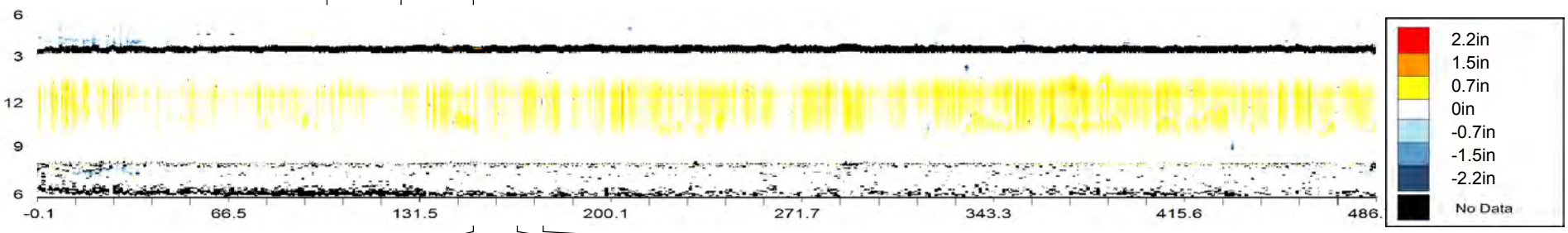


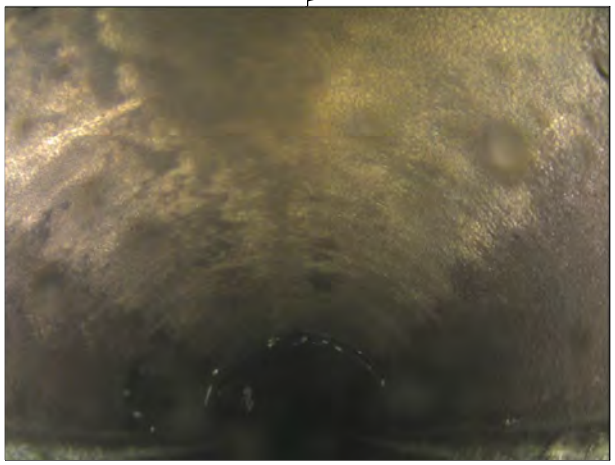
125.3ft General Observation - Corrosion to 0.7"



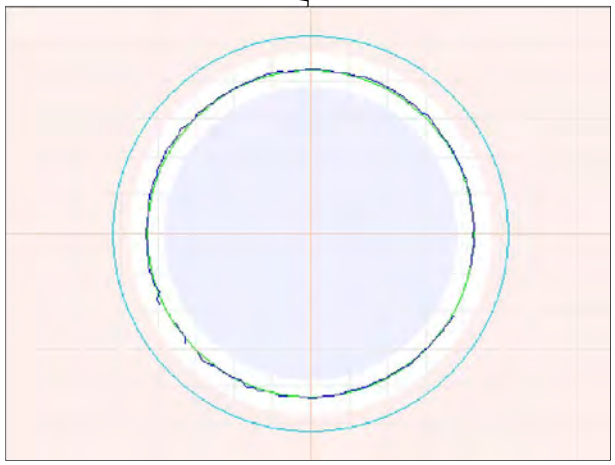
149.9ft General Observation - Corrosion to 0.8"



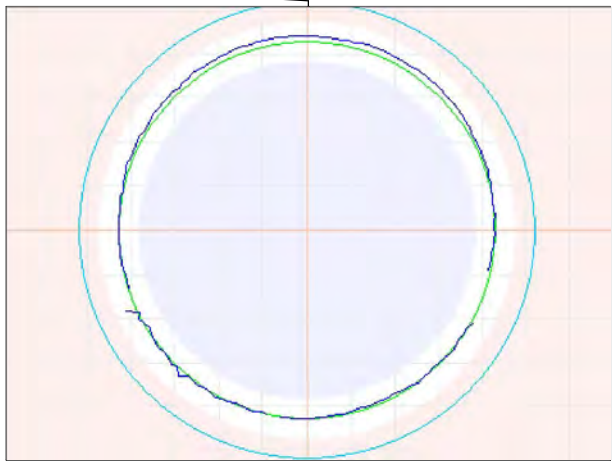




149.9ft General Observation - Corrosion to 0.8"



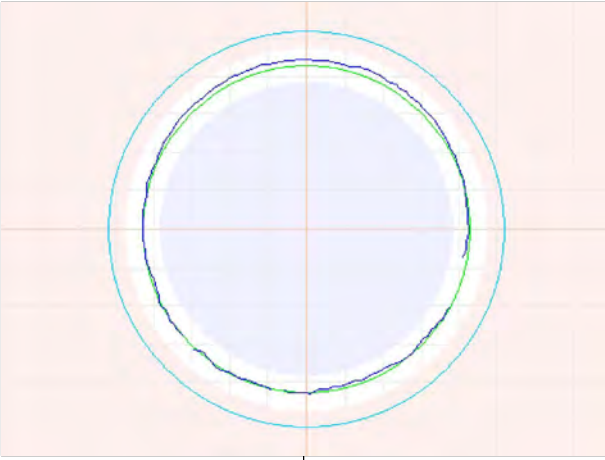
166ft Match to Reference Shape and Size - ø42"



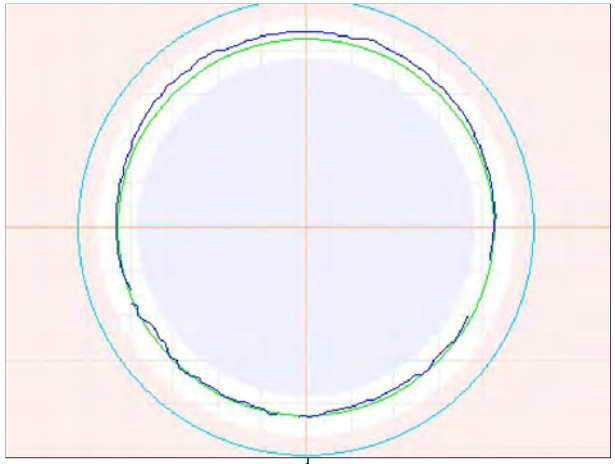
175.4ft General Observation - Corrosion to 0.7"

Observation Report

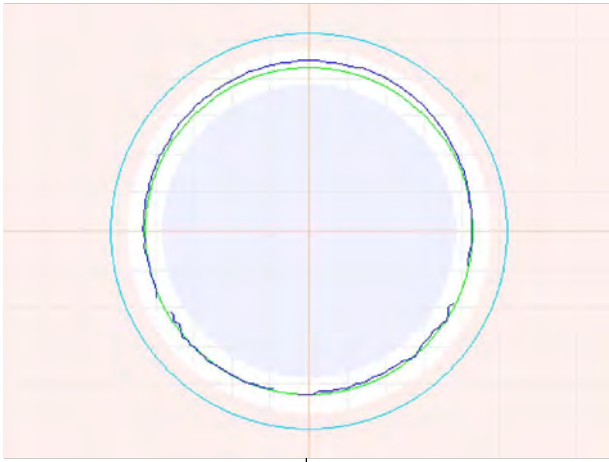
199.8ft General Observation - Corrosion to 0.9"

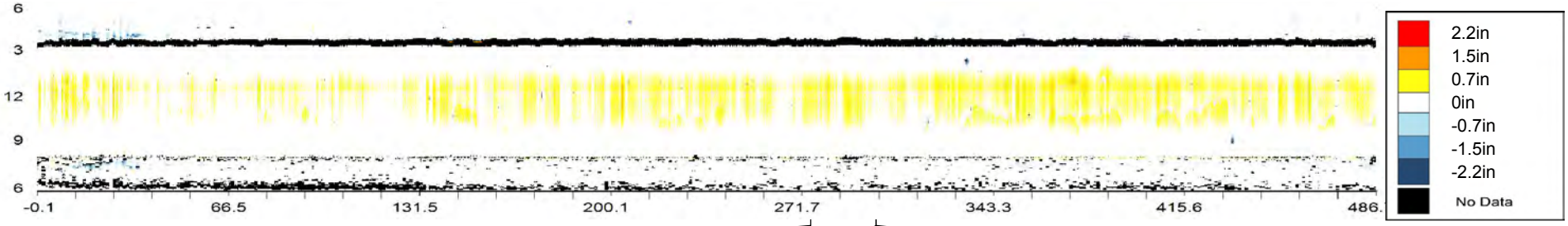


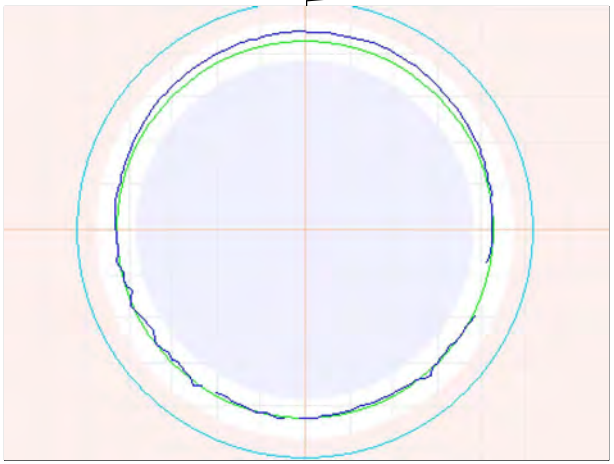
225ft General Observation - Corrosion to 1.1"



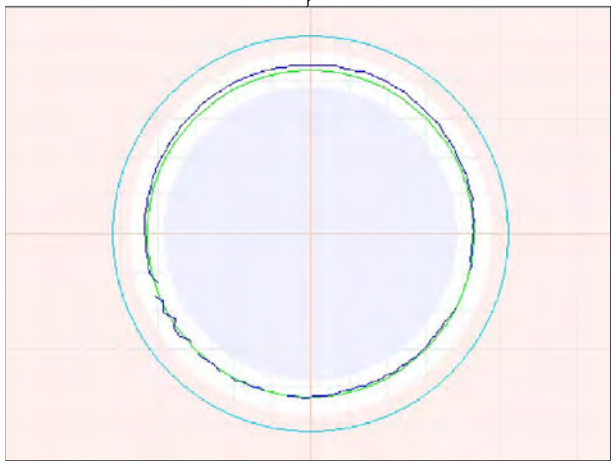
250ft General Observation - Corrosion to 1.0"



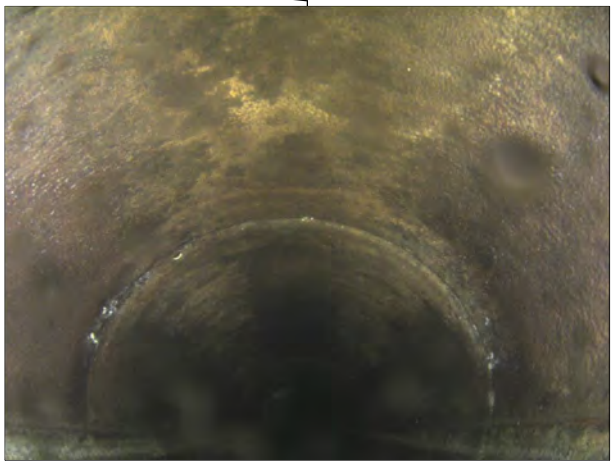




275.1ft General Observation - Corrosion to 1"



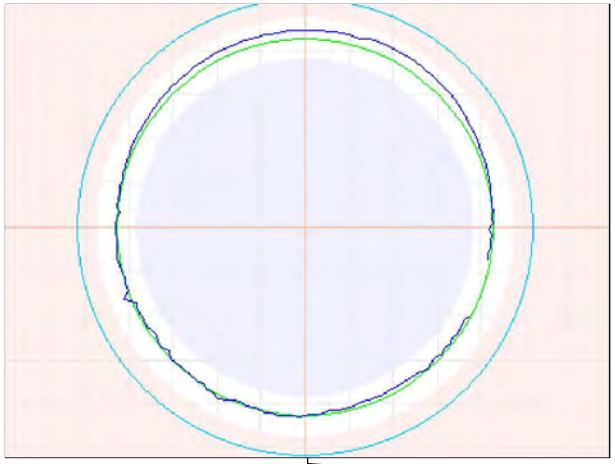
299.8ft General Observation - Corrosion to 0.8"



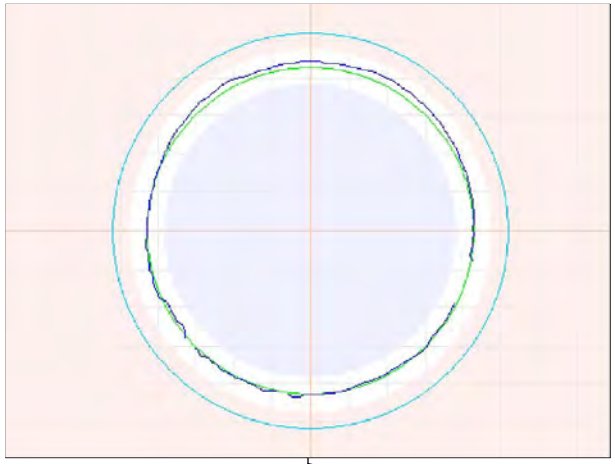
299.8ft General Observation - Corrosion to 0.8"

Observation Report

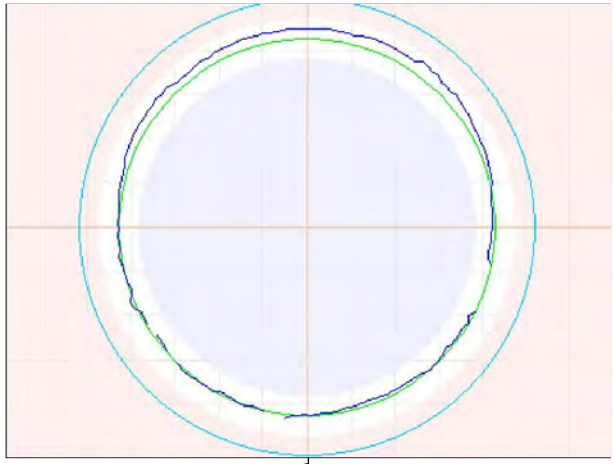
324.8ft General Observation - Corrosion to 1.1"

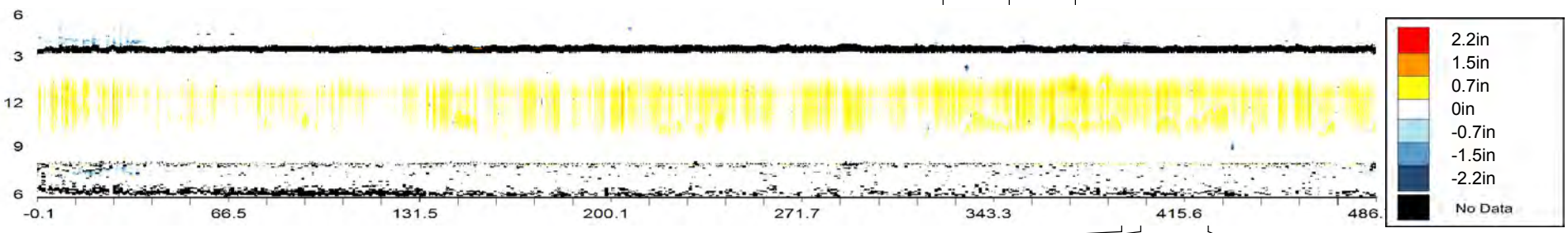


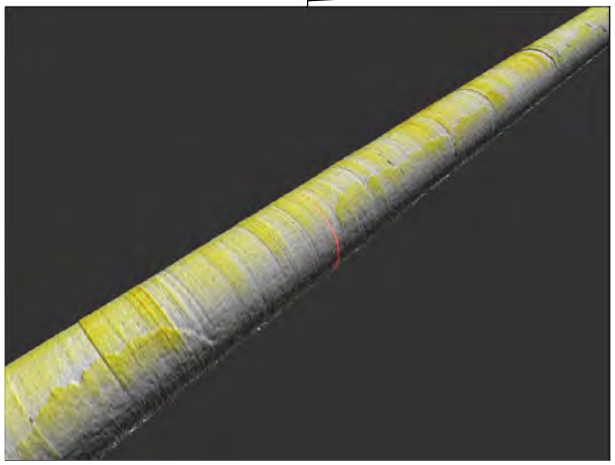
349.8ft General Observation - Corrosion to 0.9"



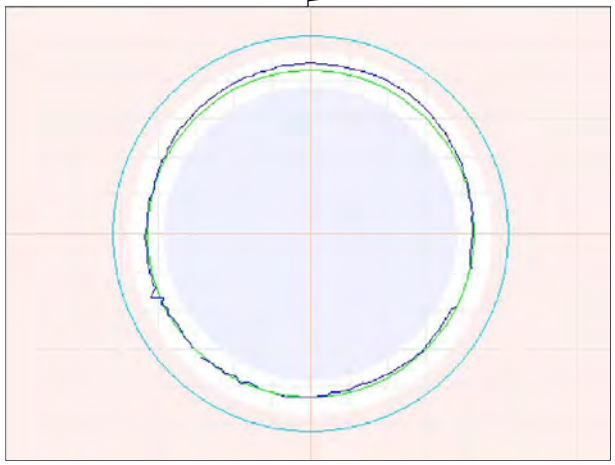
375ft General Observation - Corrosion to 1.5"



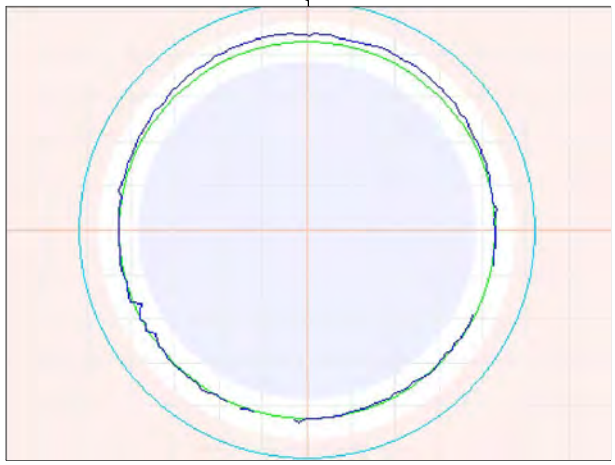




392.4ft 3D Laser Sonar Scan - Pipe Overview



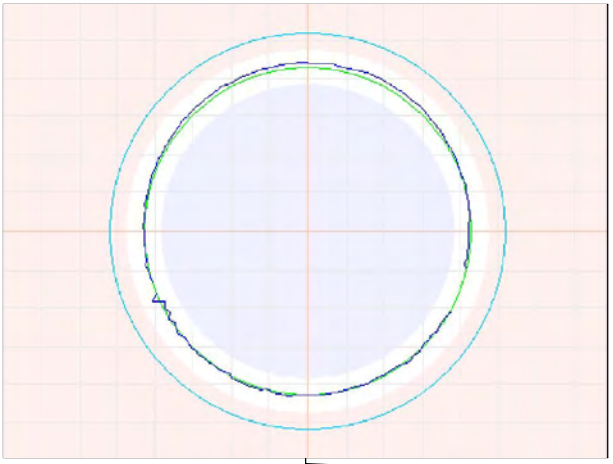
399.7ft General Observation - Corrosion to 0.9"



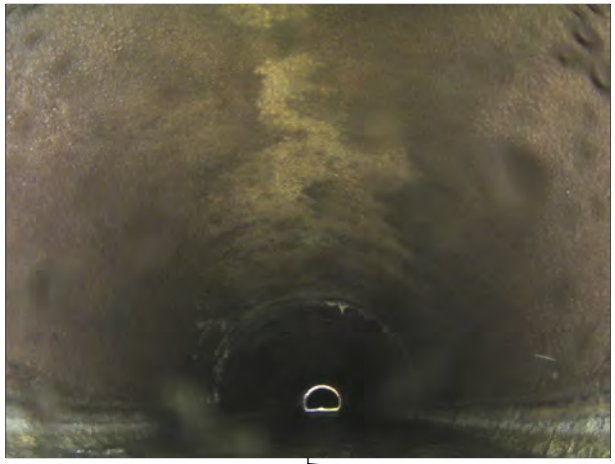
425.1ft General Observation - Corrosion to 0.9"

Observation Report

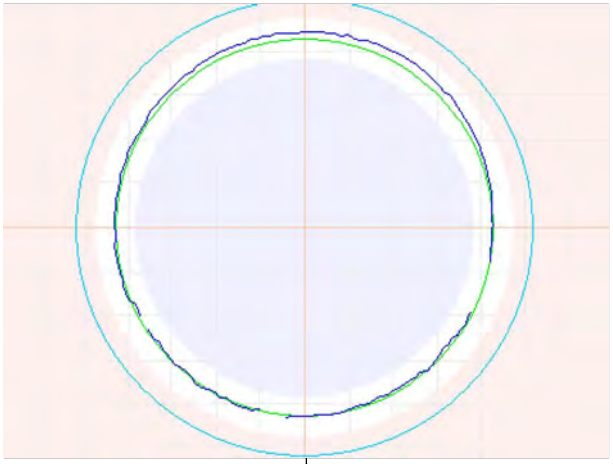
449.8ft General Observation - Corrosion to 0.7"

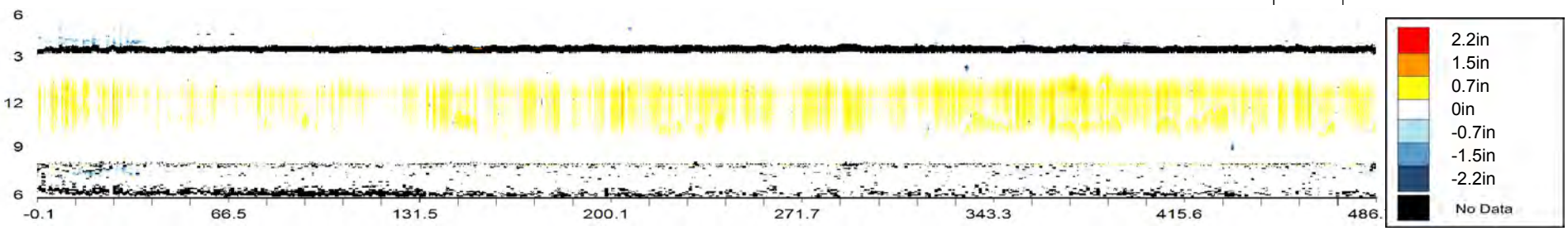


449.8ft General Observation - Corrosion to 0.7"



475.2ft General Observation - Corrosion to 0.8"





OVERVIEW - CMH000186 - CMH000185

Asset Number	CMH000186 - CMH000185		
Upstream MH	CMH000186	Material	Reinforced Concrete Pipe
Downstream MH	CMH000185	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	197.8 ft

Distance	Observation	Comment
3.5 ft	**Beginning of Inspection**	**CMH000186**
4	General Observation	Corrosion to 0.6"
24.9	General Observation	Corrosion to 1.1"
39.9	3D Laser Sonar Scan	Pipe overview
50	Maximum Corrosion	To 1.5"
50.1	General Observation	Corrosion to 1.4"
74.8	General Observation	Corrosion to 0.4"
100.1	General Observation	Corrosion to 0.4"
125.3	General Observation	Corrosion to 0.5"
150.1	General Observation	Corrosion to 0.5"
174.6	General Observation	Corrosion to 0.6"
197.8	Closest Match to Reference Size	ø36"
200.1	General Observation	Corrosion to 0.7"
224.9	General Observation	Corrosion to 1"
249.8	General Observation	Corrosion to 1.2"
275	General Observation	Corrosion to 0.6"
299.9	General Observation	
324.7	General Observation	Corrosion to 0.7"
349.8	General Observation	Corrosion to 1.0"
374.7	General Observation	Corrosion to 0.6"
399.7	General Observation	
424.9	General Observation	Corrosion to 0.6"
449.9	General Observation	Corrosion to 0.5"
475	General Observation	Corrosion to 0.6"
499.8	General Observation	
524.9	General Observation	Corrosion to 0.8"

OVERVIEW - CMH000186 - CMH000185

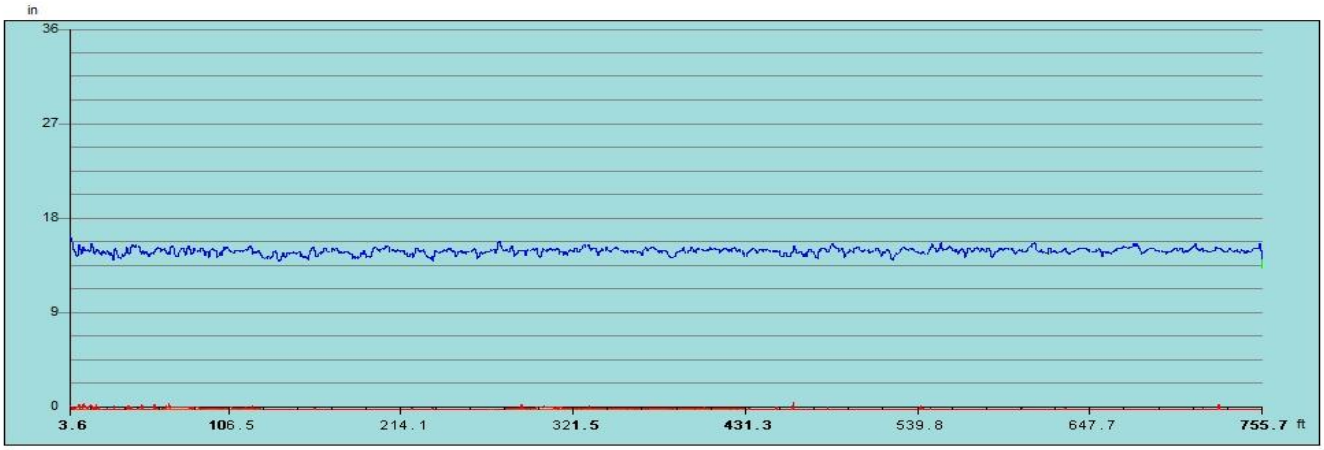
Asset Number	CMH000186 - CMH000185		
Upstream MH	CMH000186	Material	Reinforced Concrete Pipe
Downstream MH	CMH000185	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	197.8 ft

Distance	Observation	Comment
549.8	General Observation	Corrosion to 0.5"
574.8	General Observation	Corrosion to 0.7"
600	General Observation	Corrosion to 0.7"
625.2	General Observation	Corrosion to 0.6"
650	General Observation	Corrosion to 0.5"
674.5	General Observation	Corrosion to 0.4"
699.7	General Observation	Corrosion to 0.6"
724.7	General Observation	Corrosion to 0.6"
749.9	General Observation	Corrosion to 0.5"
755.5 ft	**End of Inspection**	**CMH000185**

CMH000186 - CMH000185			
Asset Number	CMH000186 - CMH000185	Length	756 ft
Upstream MH	CMH000186	Diameter	36 in
Downstream MH	CMH000185	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	197.8 ft
Date Profiled	17 July 2013	Operator	

Observations	
Average Debris Depth	0 in
Average Water Level	15 in
Debris Volume	0 cubic feet

Debris Graph



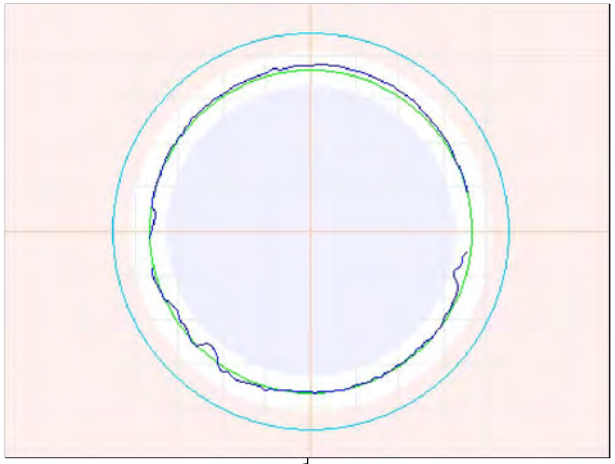
Inspection Distance (ft)

Water Level Debris Level

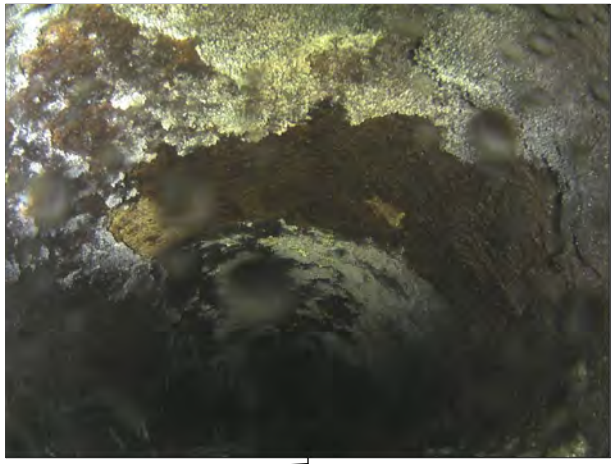
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

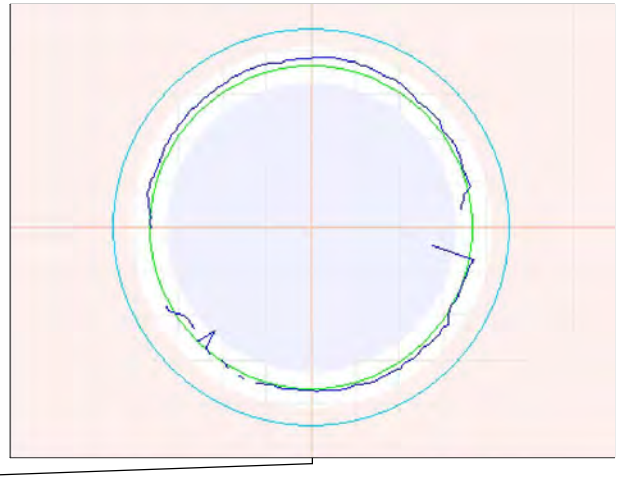
4ft General Observation - Corrosion to 0.6"

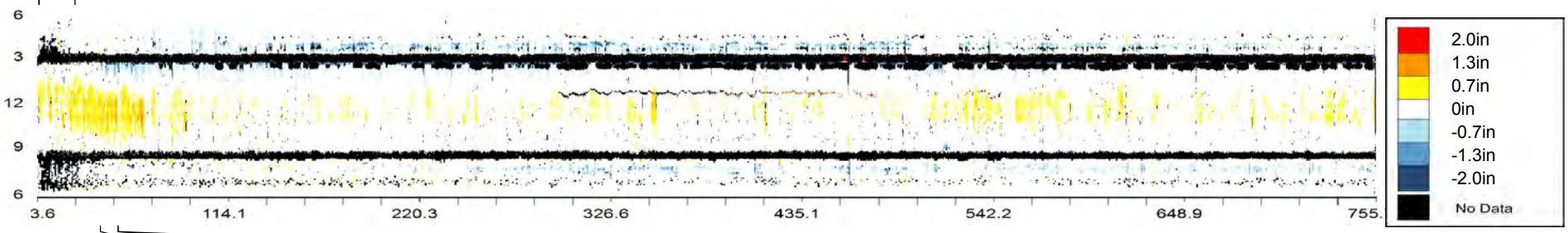


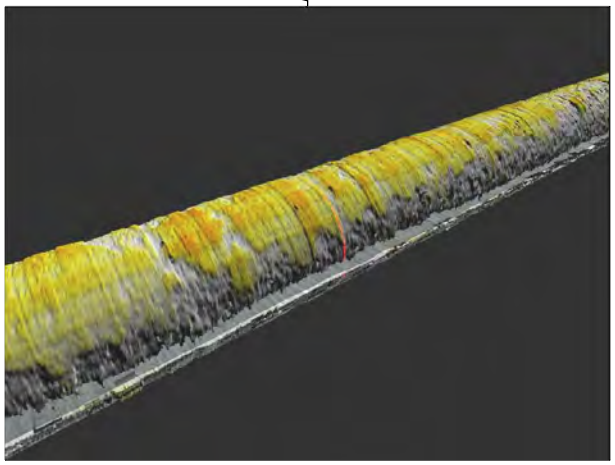
4ft General Observation - Corrosion to 0.6"



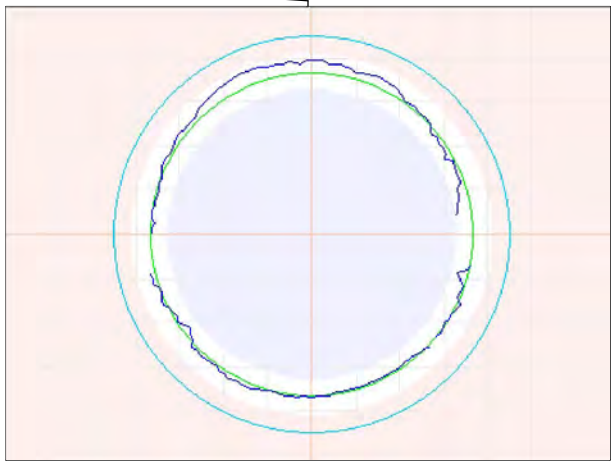
24.9ft General Observation - Corrosion to 1.1"



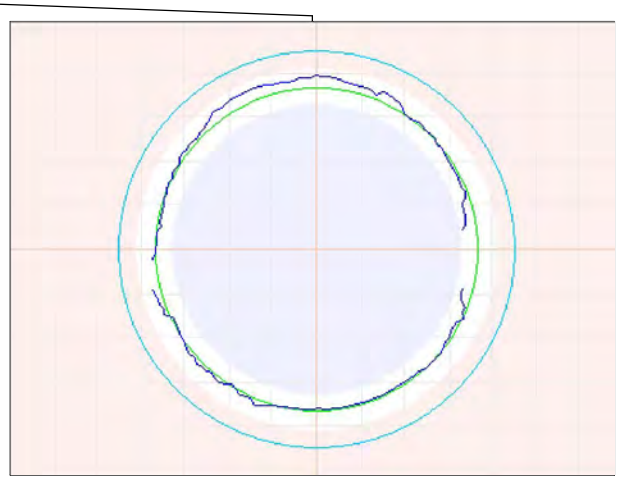




39.9ft 3D Laser Sonar Scan - Pipe overview



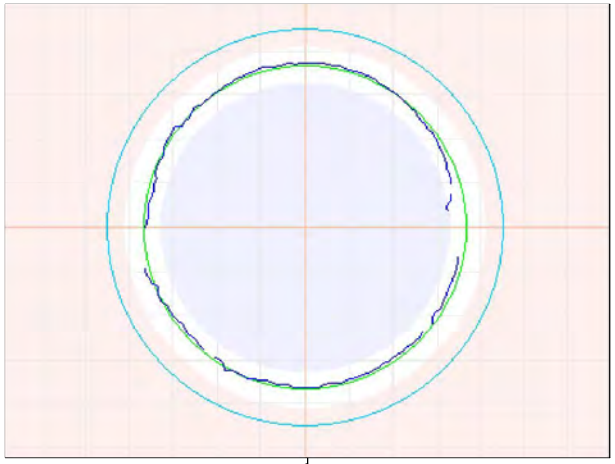
50ft Maximum Corrosion - To 1.5"



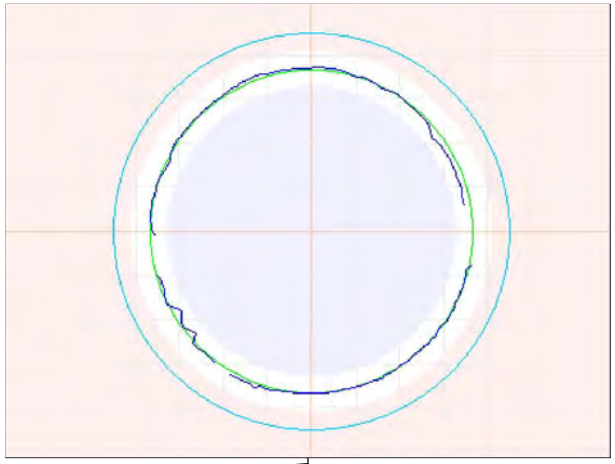
50.1ft General Observation - Corrosion to 1.4"

Observation Report

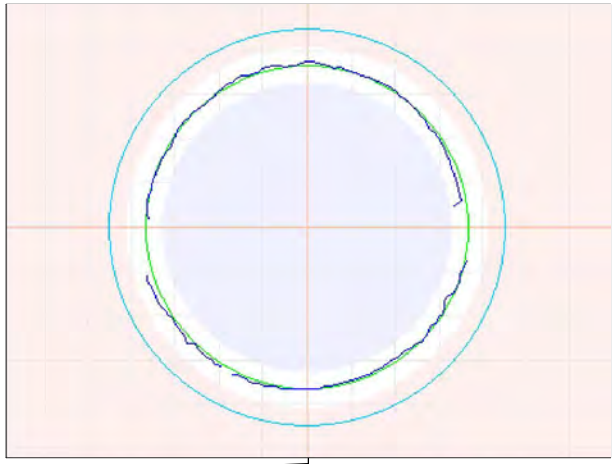
74.8ft General Observation - Corrosion to 0.4"

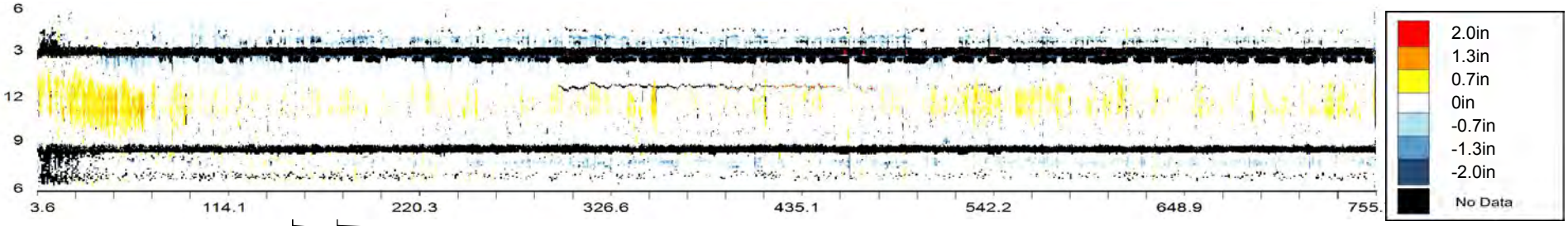


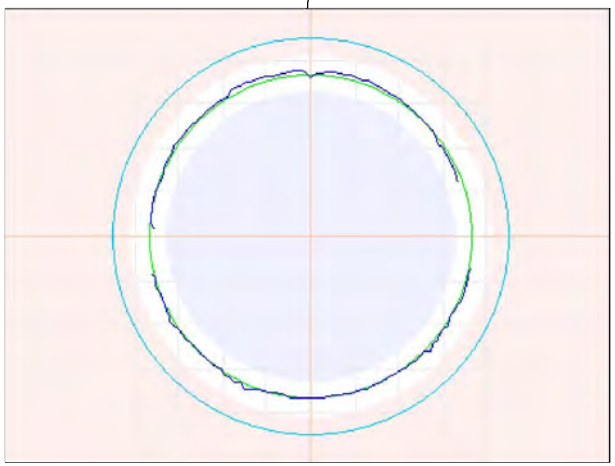
100.1ft General Observation - Corrosion to 0.4"



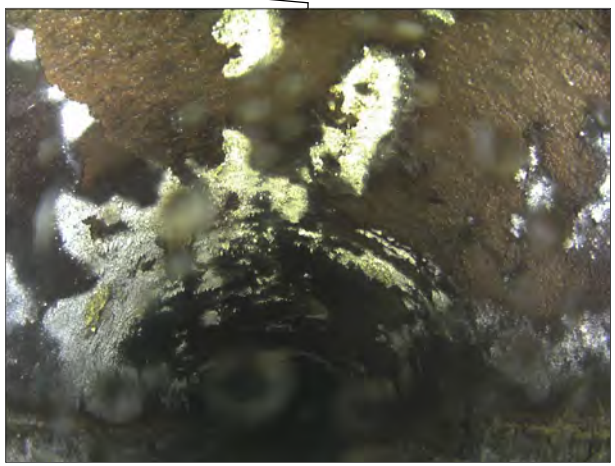
125.3ft General Observation - Corrosion to 0.5"



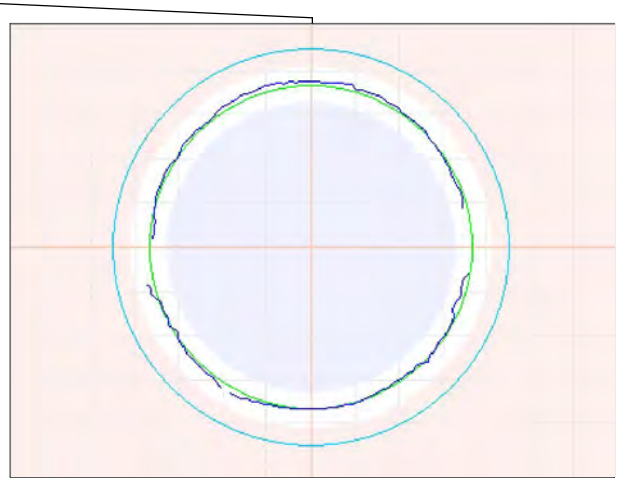




150.1ft General Observation - Corrosion to 0.5"



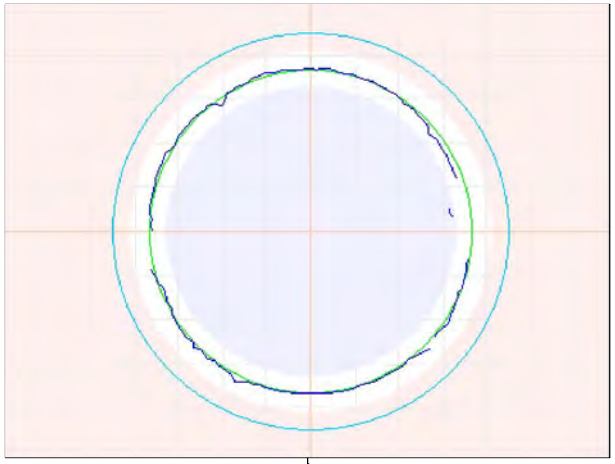
150.1ft General Observation - Corrosion to 0.5"



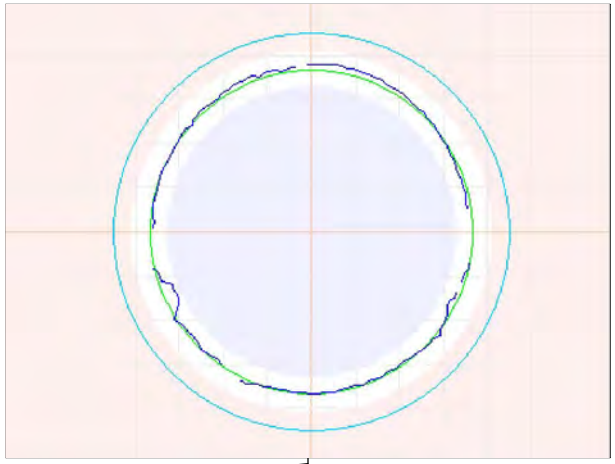
174.6ft General Observation - Corrosion to 0.6"

Observation Report

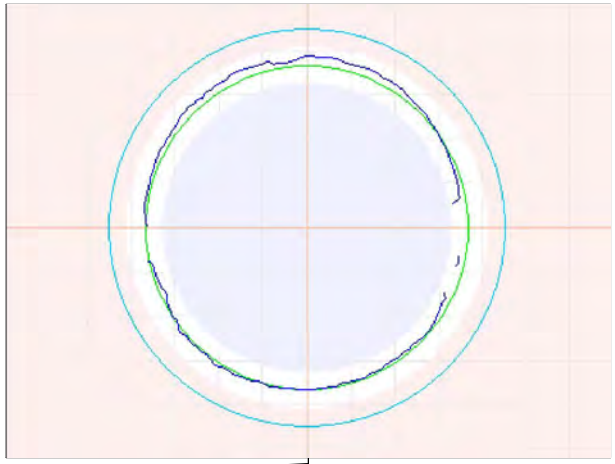
197.8ft Closest Match to Reference Size - ø36"

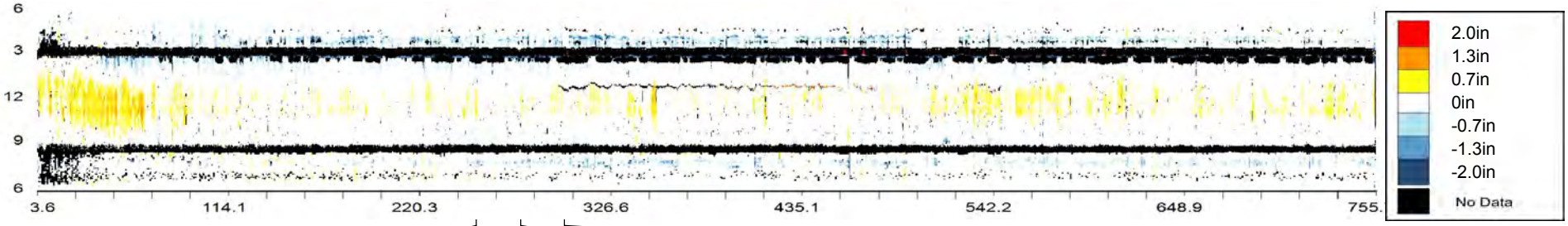


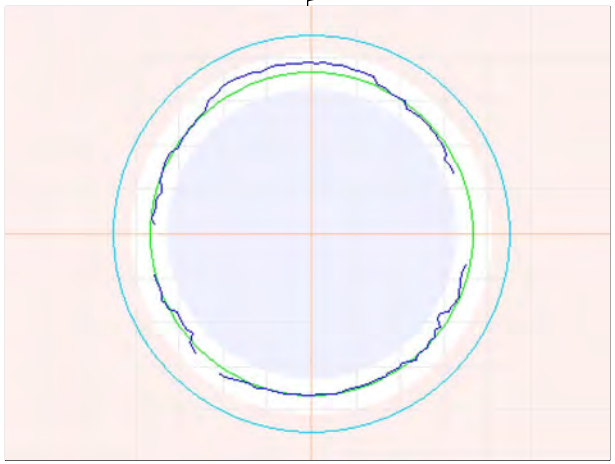
200.1ft General Observation - Corrosion to 0.7"



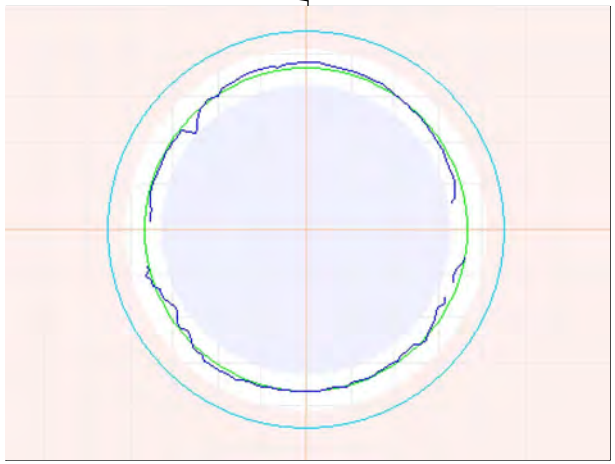
224.9ft General Observation - Corrosion to 1"



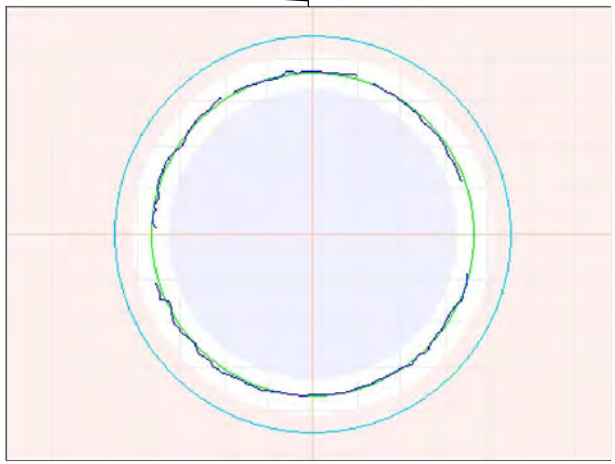




249.8ft General Observation - Corrosion to 1.2"



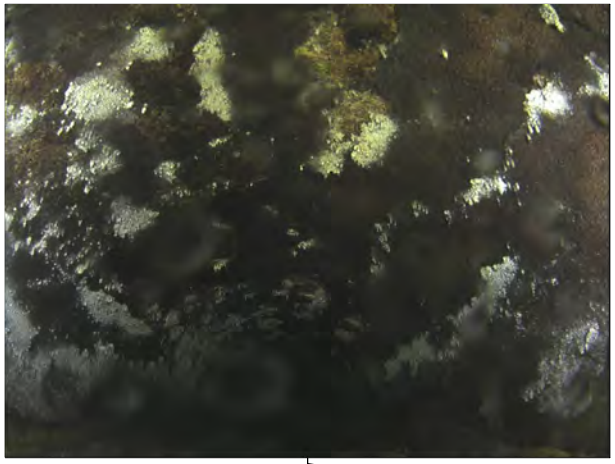
275ft General Observation - Corrosion to 0.6"



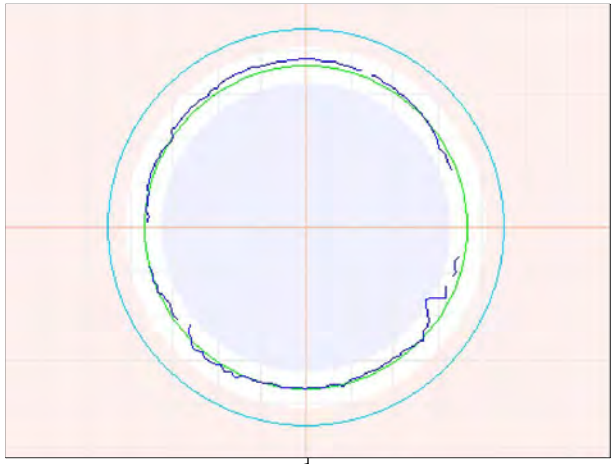
299.9ft General Observation

Observation Report

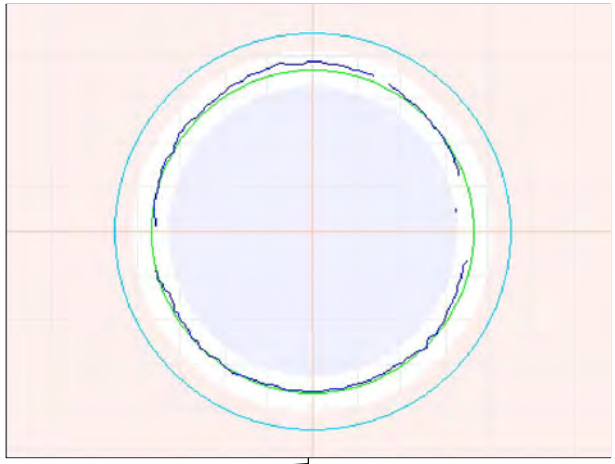
299.9ft General Observation

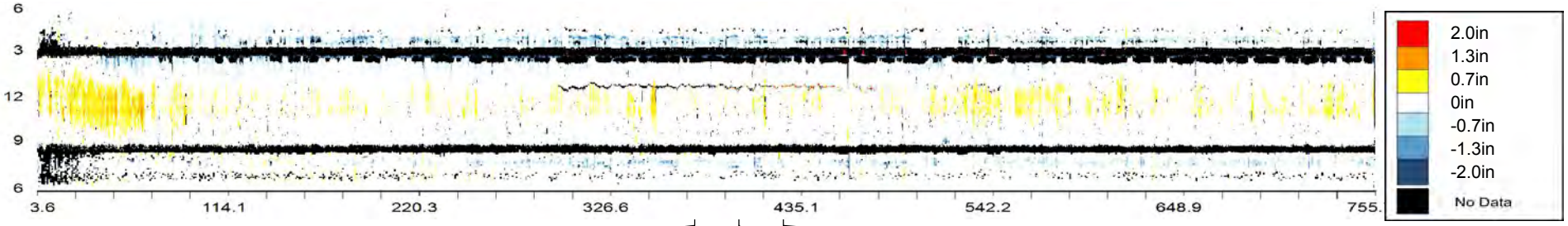


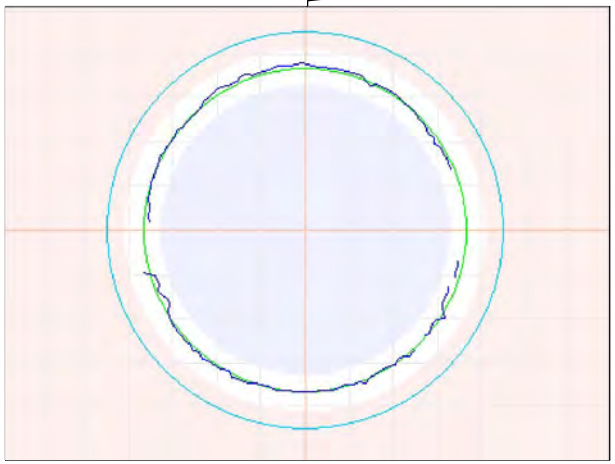
324.7ft General Observation - Corrosion to 0.7"



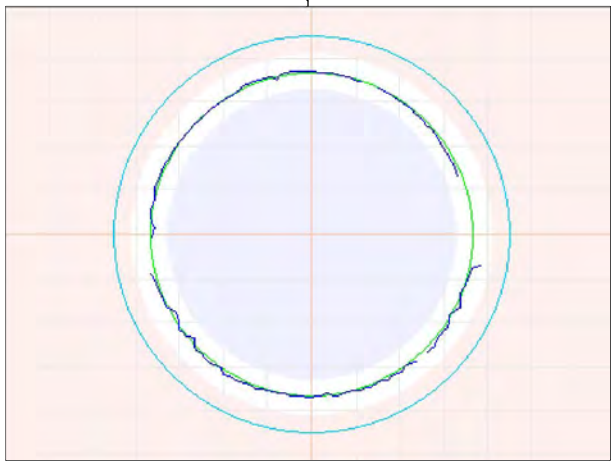
349.8ft General Observation - Corrosion to 1.0"



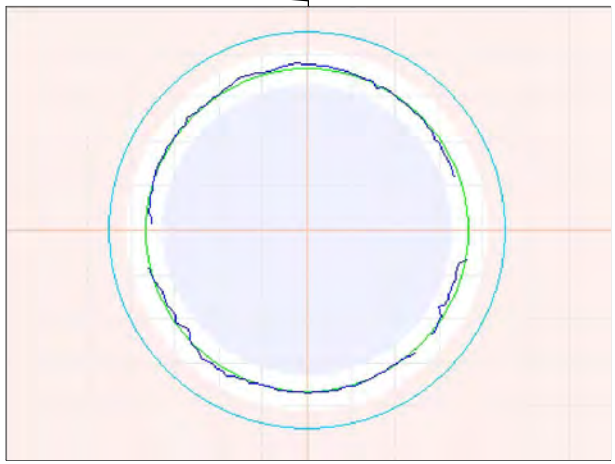




374.7ft General Observation - Corrosion to 0.6"



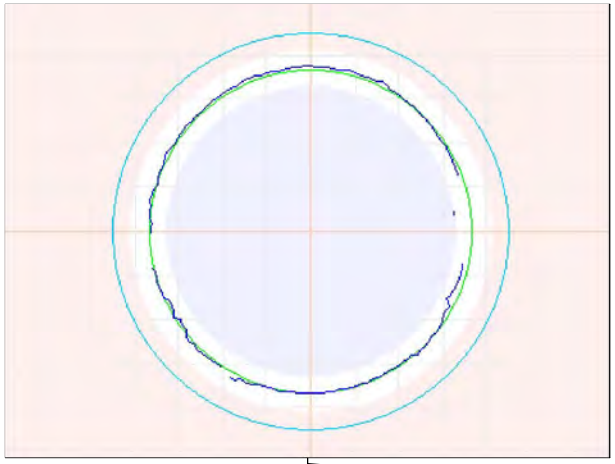
399.7ft General Observation



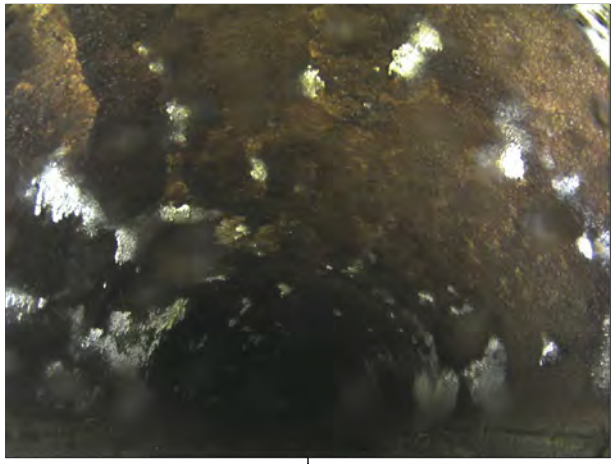
424.9ft General Observation - Corrosion to 0.6"

Observation Report

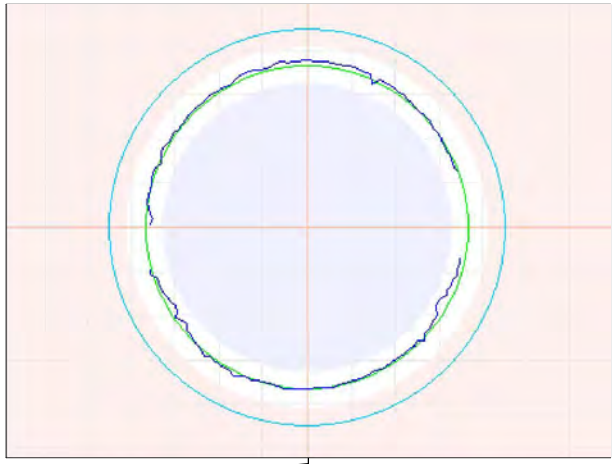
449.9ft General Observation - Corrosion to 0.5"

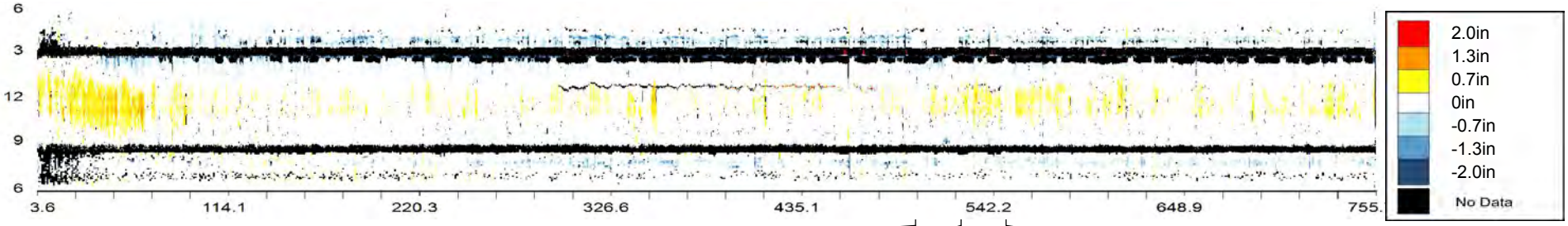


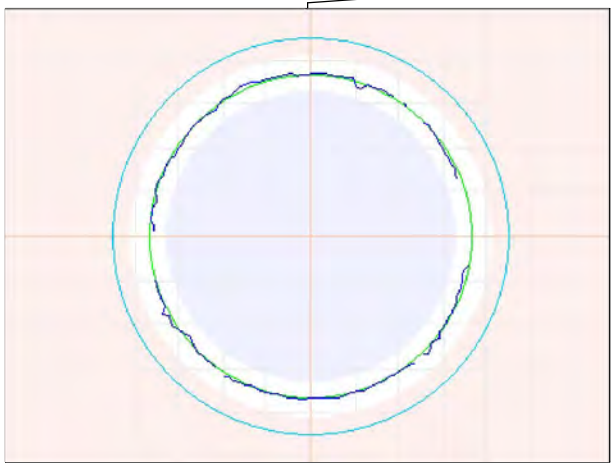
449.9ft General Observation - Corrosion to 0.5"



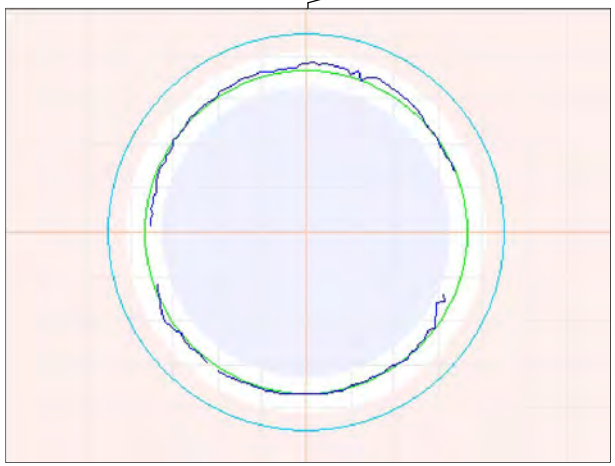
475ft General Observation - Corrosion to 0.6"



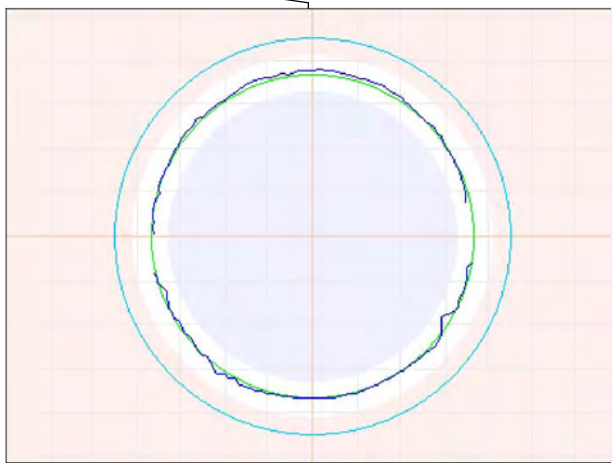




499.8ft General Observation



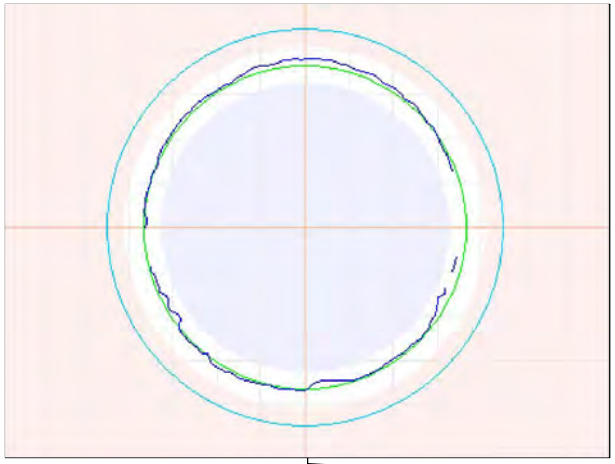
524.9ft General Observation - Corrosion to 0.8"



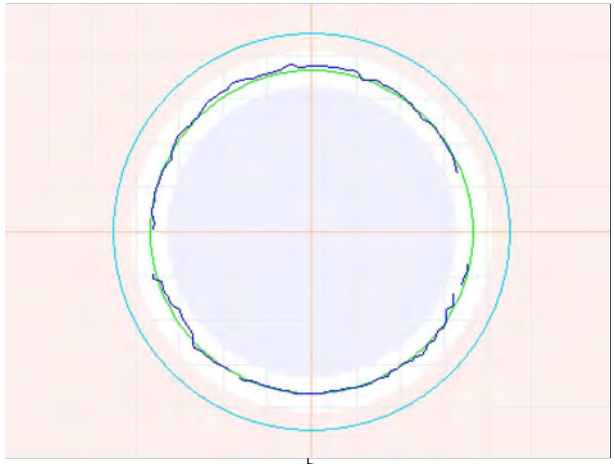
549.8ft General Observation - Corrosion to 0.5"

Observation Report

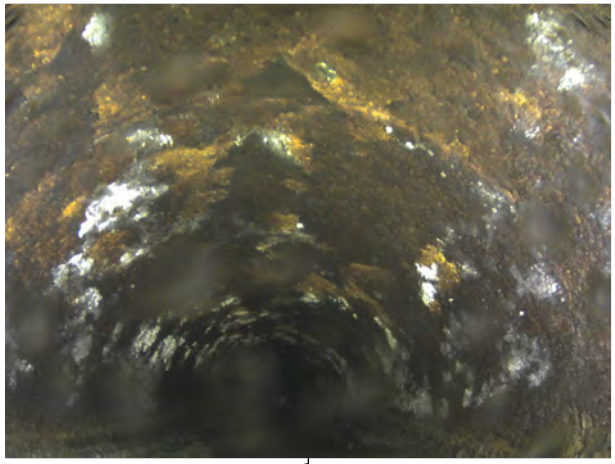
574.8ft General Observation - Corrosion to 0.7"

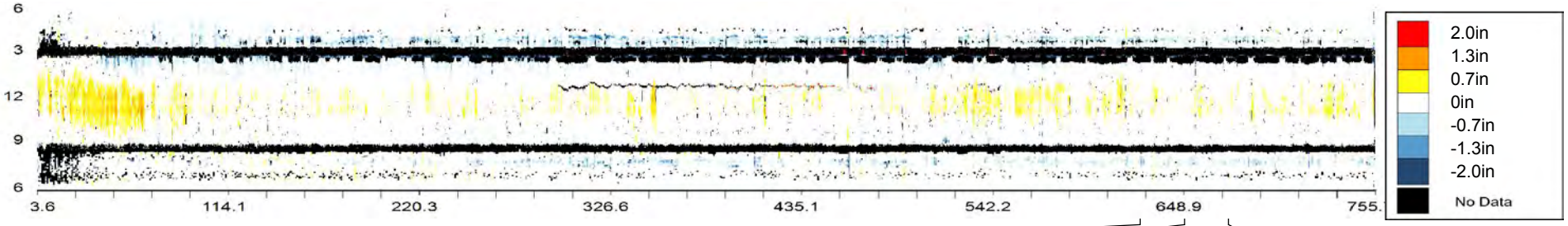


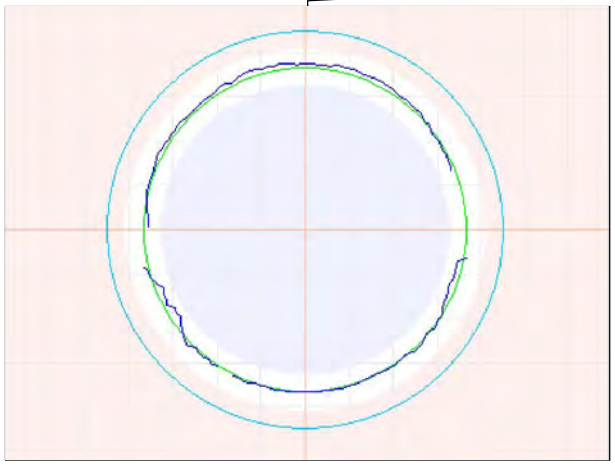
600ft General Observation - Corrosion to 0.7"



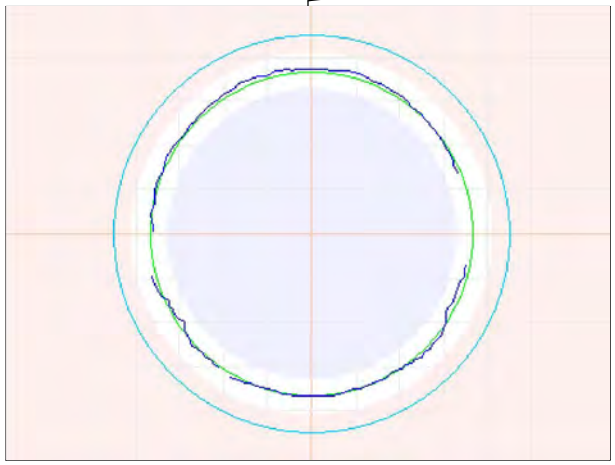
600ft General Observation - Corrosion to 0.7"



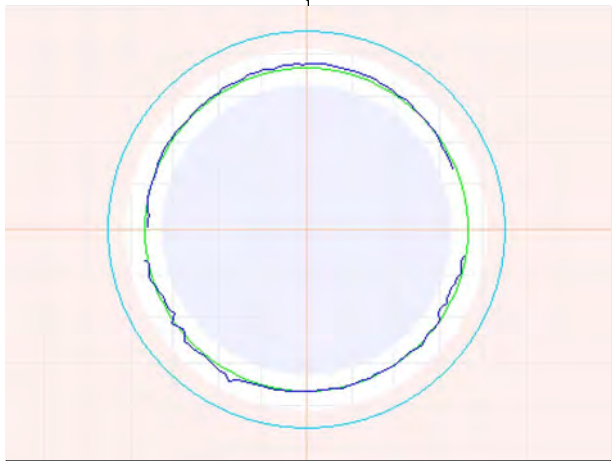




625.2ft General Observation - Corrosion to 0.6"



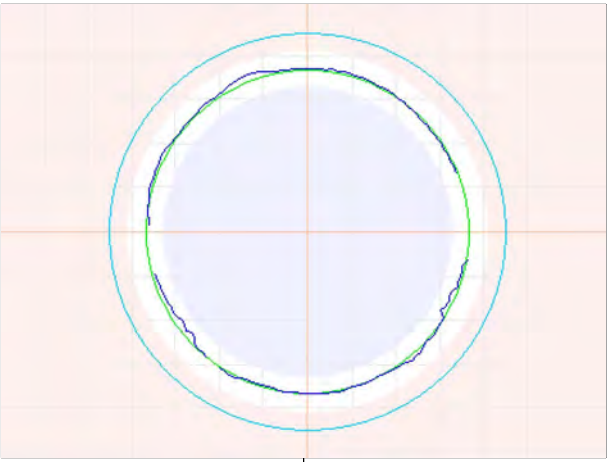
650ft General Observation - Corrosion to 0.5"



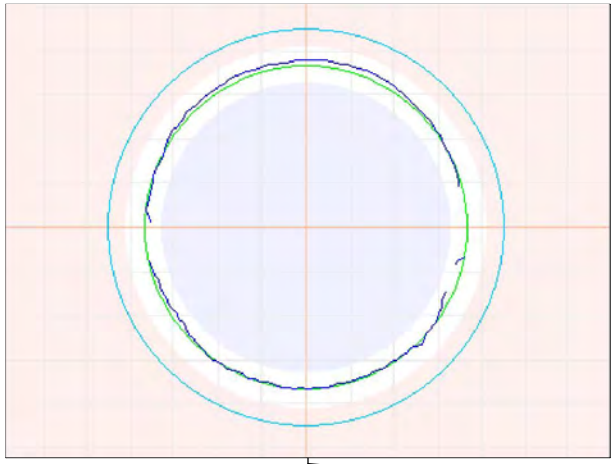
674.5ft General Observation - Corrosion to 0.4"

Observation Report

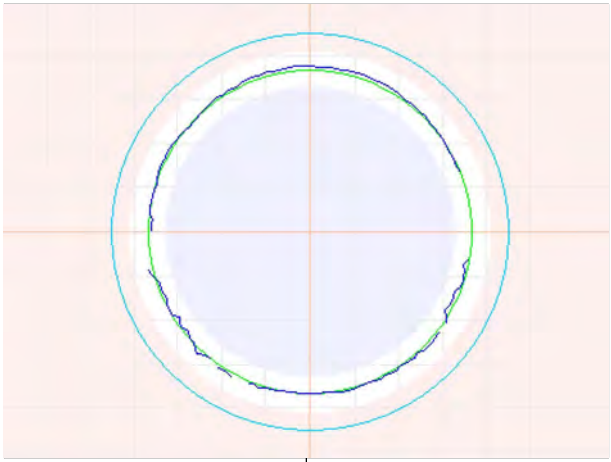
699.7ft General Observation - Corrosion to 0.6"

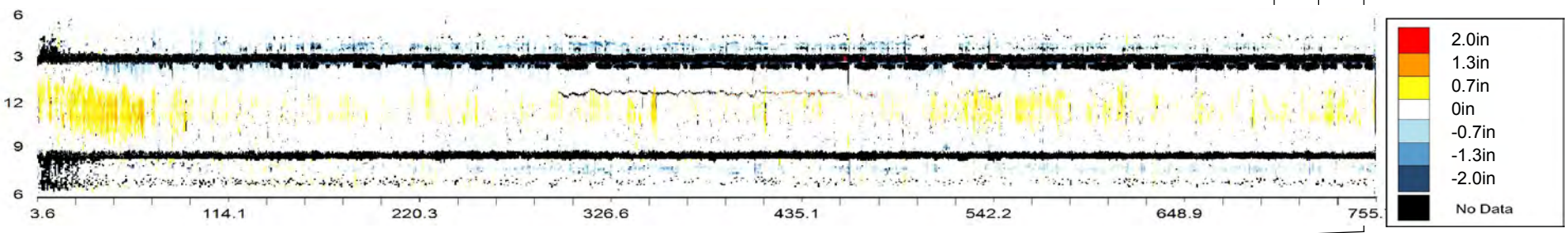


724.7ft General Observation - Corrosion to 0.6"



749.9ft General Observation - Corrosion to 0.5"





749.9ft General Observation - Corrosion to 0.5"

OVERVIEW - CMH000187 - CMH000186

Asset Number	CMH000187 - CMH000186		
Upstream MH	CMH000187	Material	Reinforced Concrete Pipe
Downstream MH	CMH000186	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	284.7 ft

Distance	Observation	Comment
2.7 ft	**Beginning of Inspection**	**CMH000187**
4.9	General Observation	
25.2	General Observation	Corrosion to 0.5"
50	General Observation	Corrosion to 0.5"
74.9	General Observation	Corrosion to 0.7"
100	General Observation	Corrosion to 0.6"
125	General Observation	Corrosion to 0.1"
149.9	General Observation	
175.2	General Observation	Corrosion to 0.6"
200	General Observation	Corrosion to 0.3"
225.4	General Observation	Corrosion to 0.7"
249.9	General Observation	Corrosion to 0.6"
275.1	General Observation	Corrosion to 0.5"
284.7	Match to Reference Shape and Size	ø36"
300.1	General Observation	Corrosion to 0.6"
325.1	General Observation	Corrosion to 0.6"
343.7	Maximum Corrosion	To 1.5"
350	General Observation	Corrosion to 0.9"
375.2	General Observation	Corrosion to 0.6"
399.8	General Observation	Corrosion to 0.4"
425.1	General Observation	Corrosion to 0.5"
449.9	General Observation	Corrosion to 1.1"
451.1	3D Laser Sonar Scan	Pipe Overview
474.8	General Observation	Corrosion to 0.7"
500	General Observation	Corrosion to 0.8"

OVERVIEW - CMH000187 - CMH000186

Asset Number	CMH000187 - CMH000186		
Upstream MH	CMH000187	Material	Reinforced Concrete Pipe
Downstream MH	CMH000186	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	284.7 ft

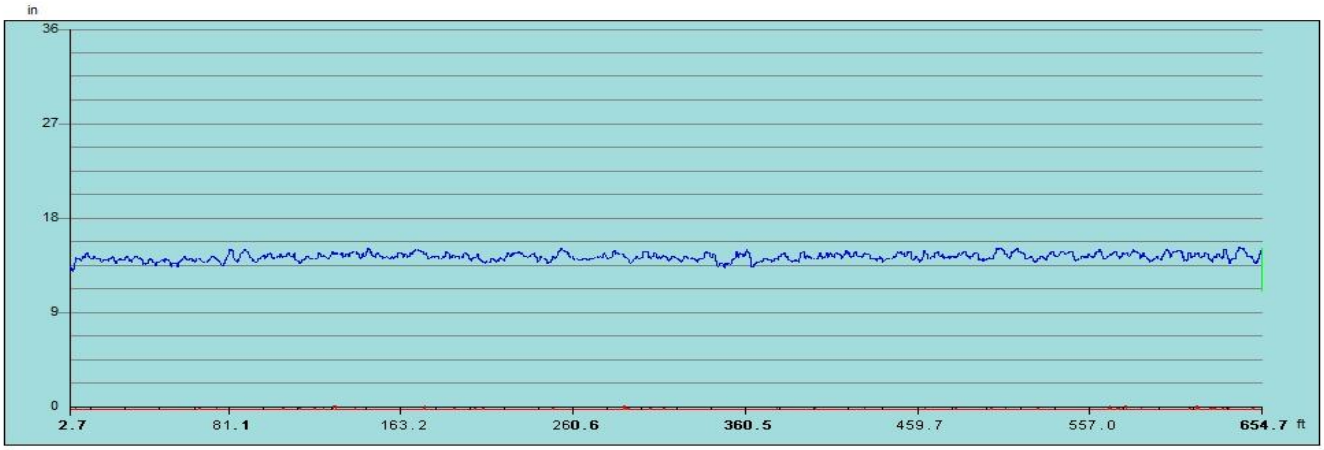
Distance	Observation	Comment
525.1	General Observation	Corrosion to 1"
549.7	General Observation	
575.1	General Observation	Corrosion to 0.4"
599.9	General Observation	Corrosion to 0.6"
625.2	General Observation	Corrosion to 0.2"
649.8	General Observation	
654.5 ft	**End of Inspection**	**CMH000186**

CMH000187 - CMH000186			
Asset Number	CMH000187 - CMH000186	Length	655 ft
Upstream MH	CMH000187	Diameter	36 in
Downstream MH	CMH000186	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	284.7 ft
Date Profiled	17 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	14 in
Debris Volume	0 cubic feet

Debris Graph



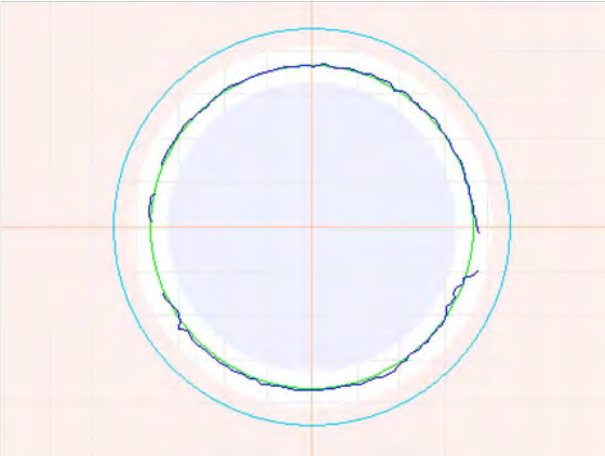
Inspection Distance (ft)

Water Level Debris Level

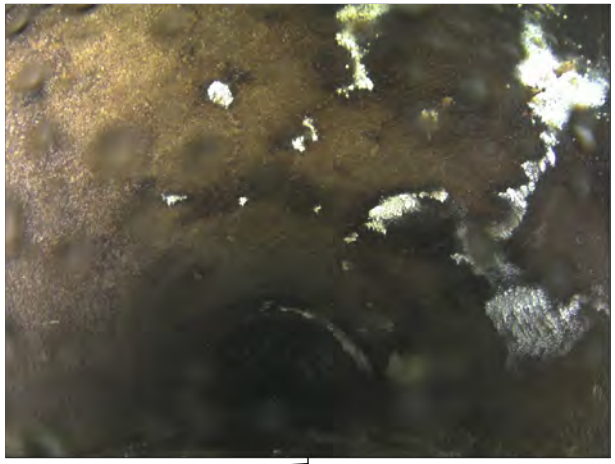
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

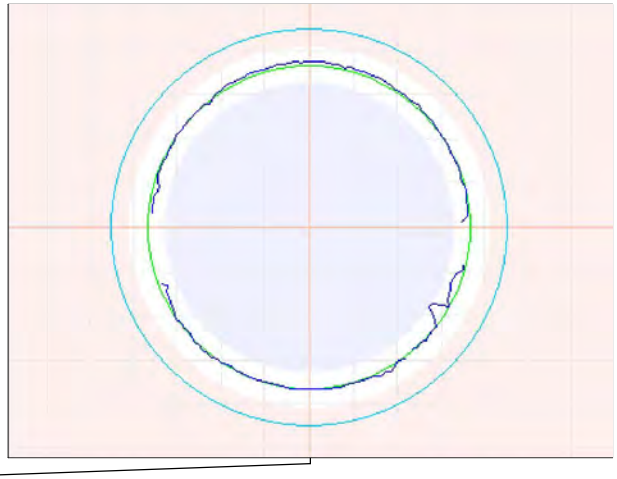
4.9ft General Observation

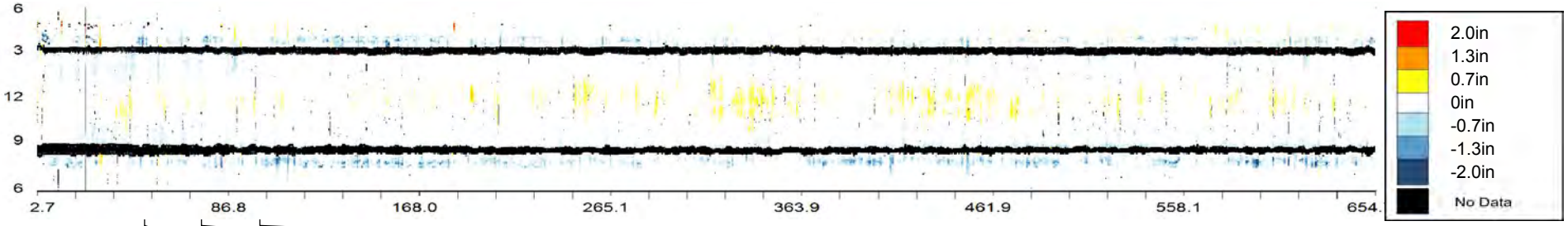


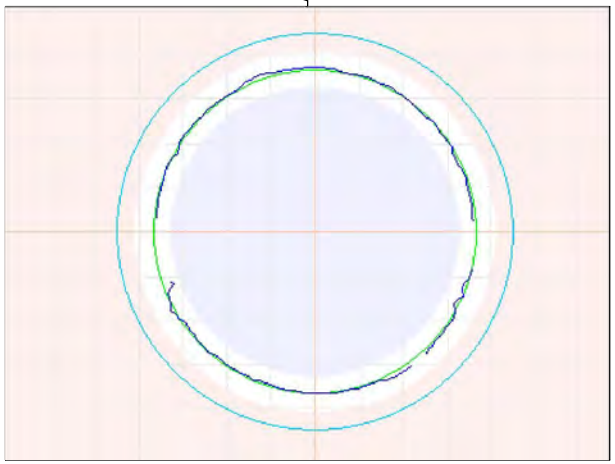
4.9ft General Observation



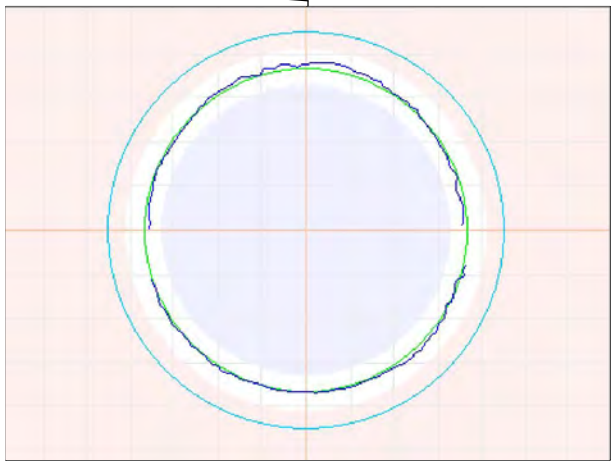
25.2ft General Observation - Corrosion to 0.5"



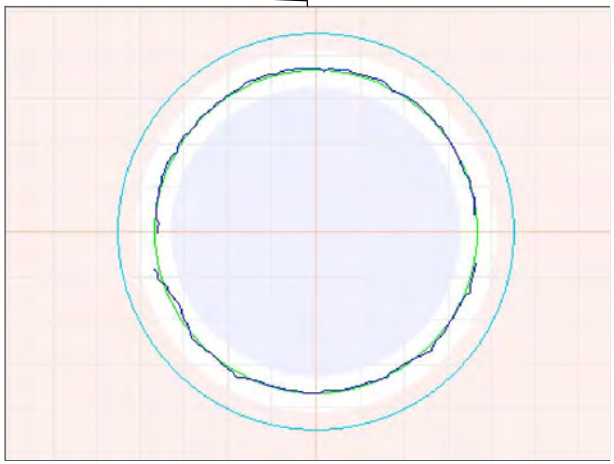




50ft General Observation - Corrosion to 0.5"



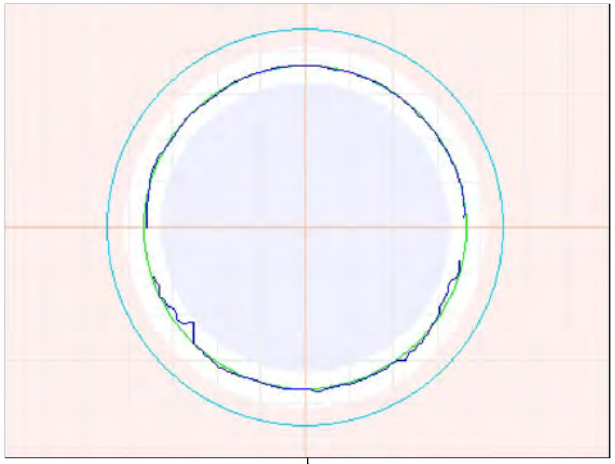
74.9ft General Observation - Corrosion to 0.7"



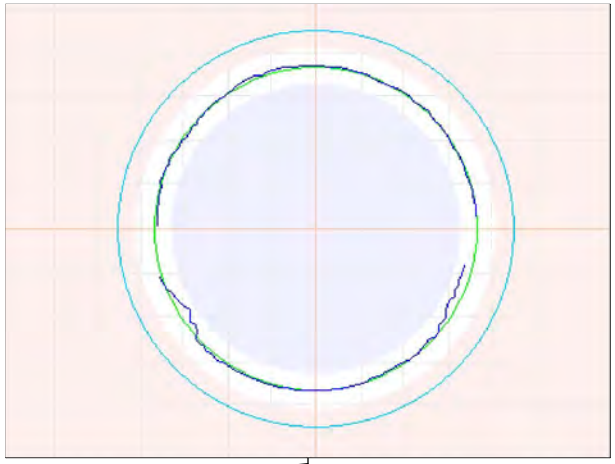
100ft General Observation - Corrosion to 0.6"

Observation Report

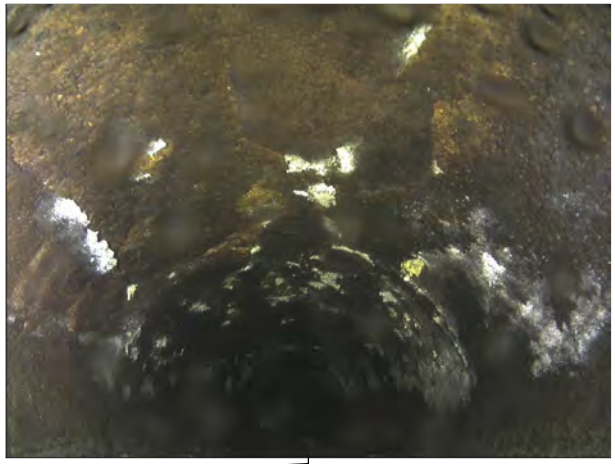
125ft General Observation - Corrosion to 0.1"

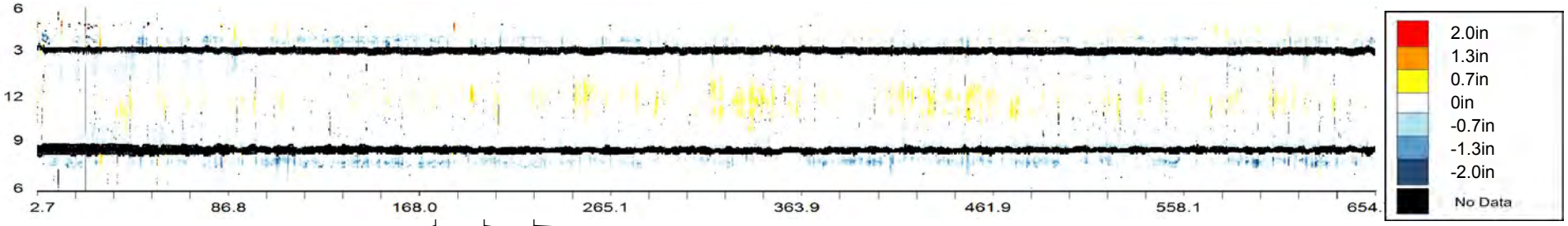


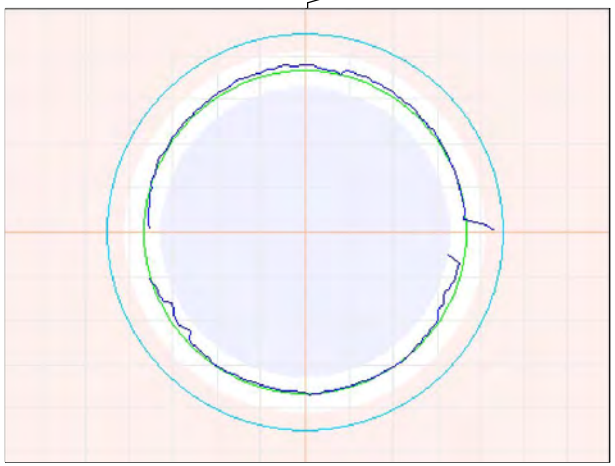
149.9ft General Observation



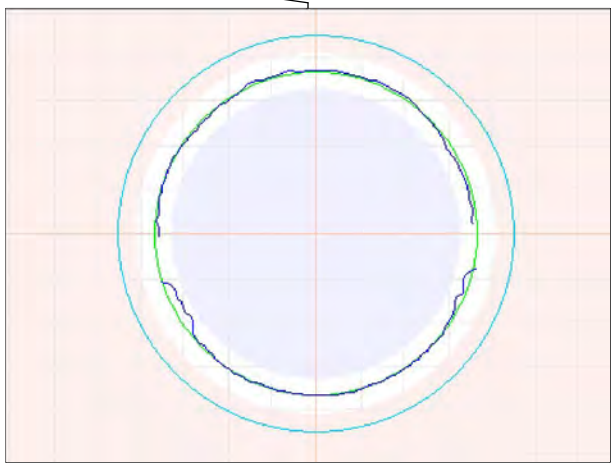
149.9ft General Observation



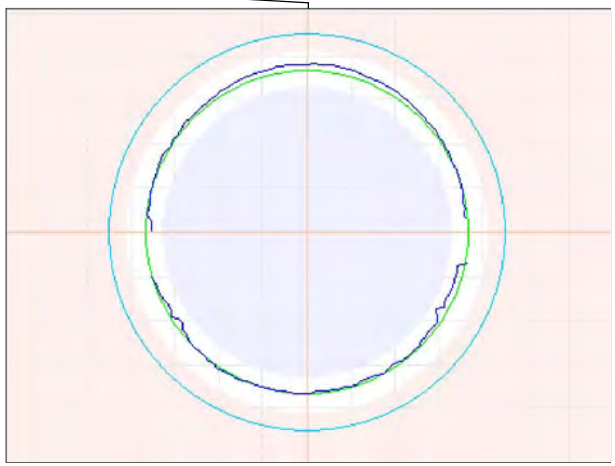




175.2ft General Observation - Corrosion to 0.6"



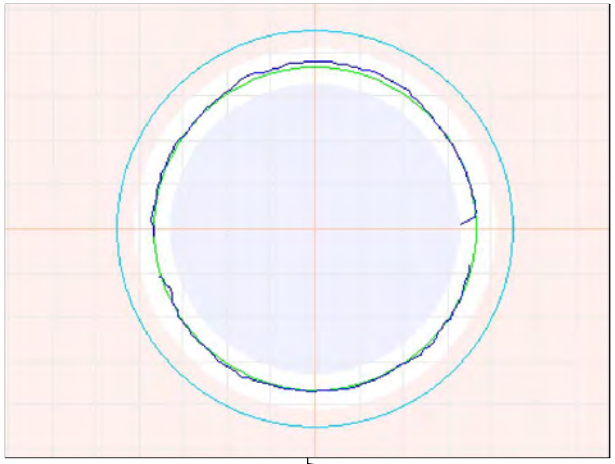
200ft General Observation - Corrosion to 0.3"



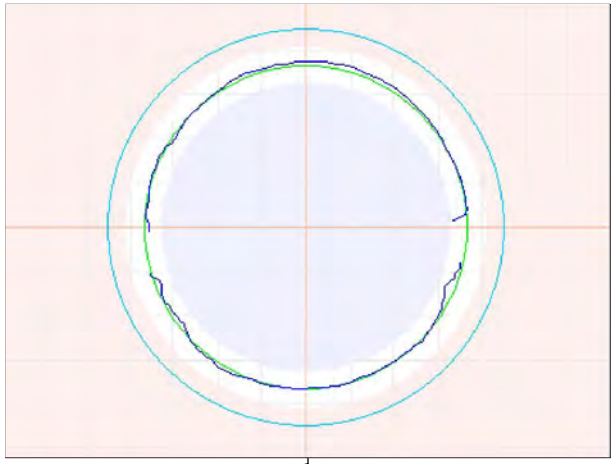
225.4ft General Observation - Corrosion to 0.7"

Observation Report

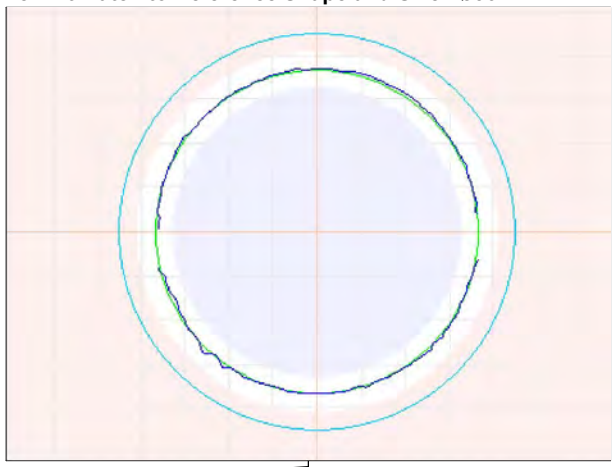
249.9ft General Observation - Corrosion to 0.6"

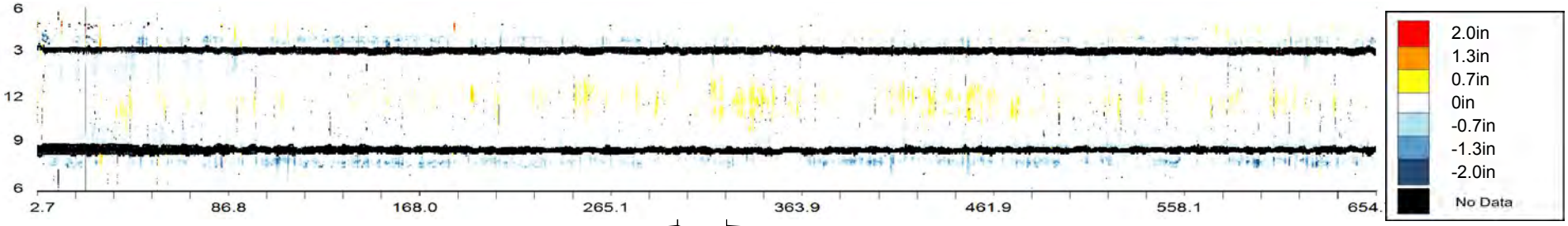


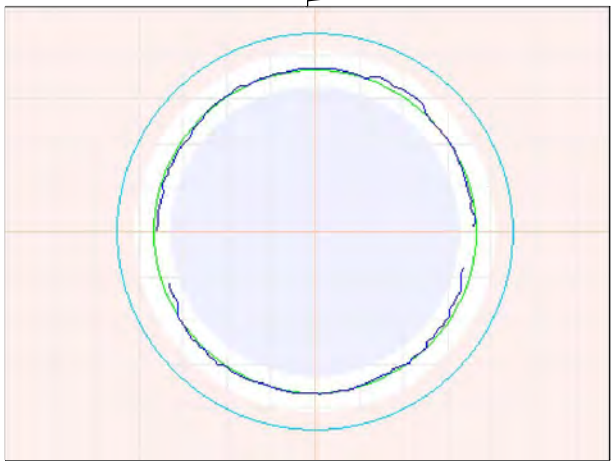
275.1ft General Observation - Corrosion to 0.5"



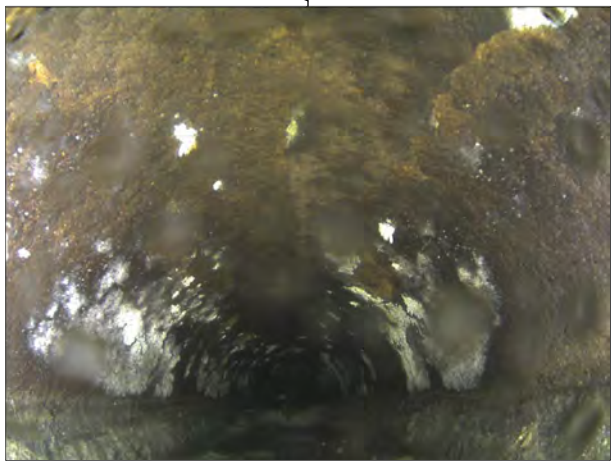
284.7ft Match to Reference Shape and Size - ø36"



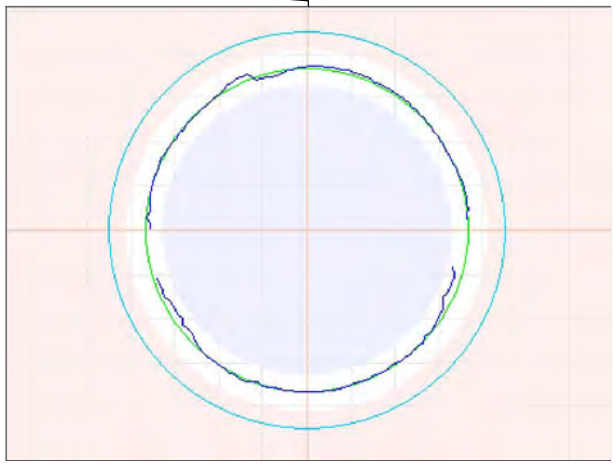




300.1ft General Observation - Corrosion to 0.6"



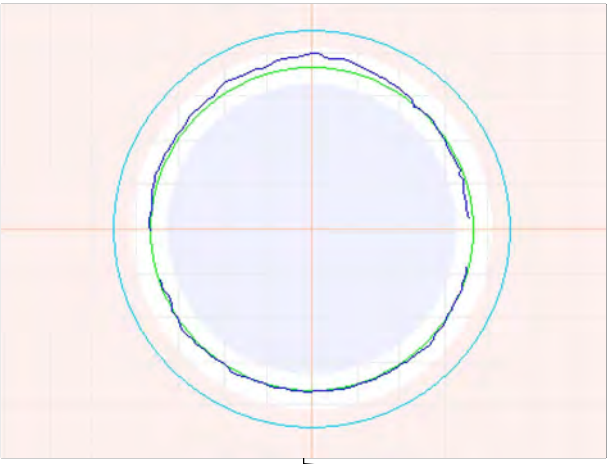
300.1ft General Observation - Corrosion to 0.6"



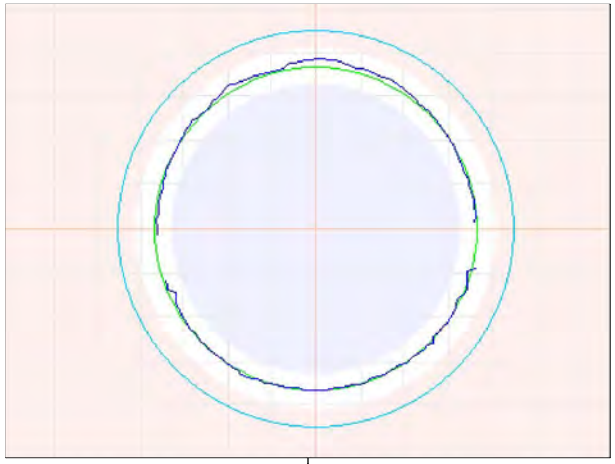
325.1ft General Observation - Corrosion to 0.6"

Observation Report

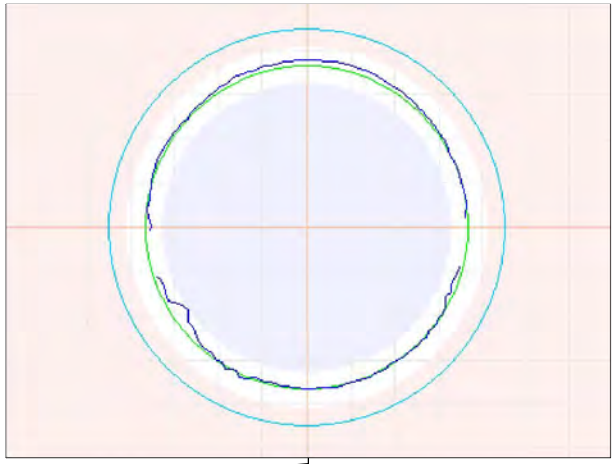
343.7ft Maximum Corrosion - To 1.5"

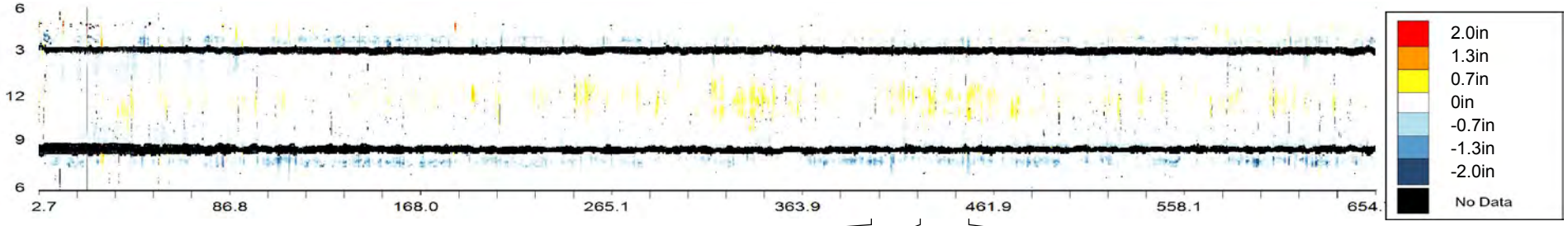


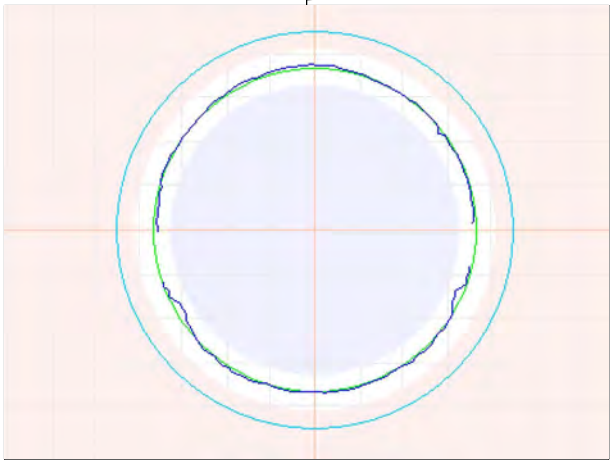
350ft General Observation - Corrosion to 0.9"



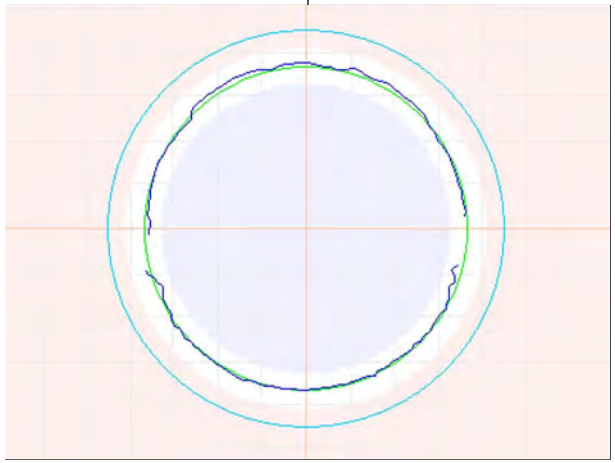
375.2ft General Observation - Corrosion to 0.6"



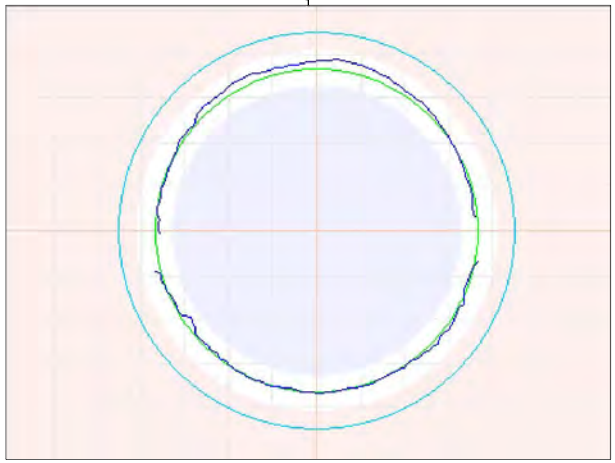




399.8ft General Observation - Corrosion to 0.4"



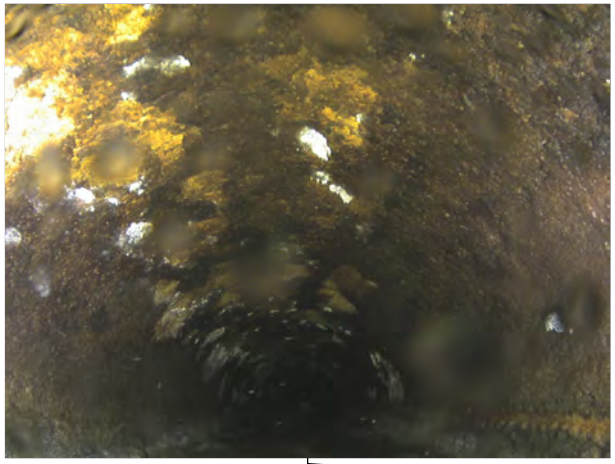
425.1ft General Observation - Corrosion to 0.5"



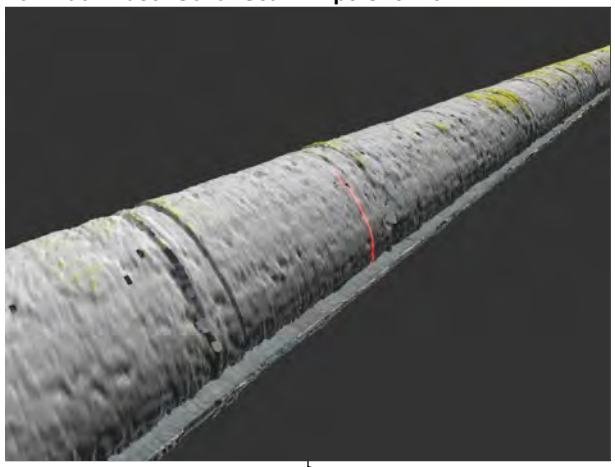
449.9ft General Observation - Corrosion to 1.1"

Observation Report

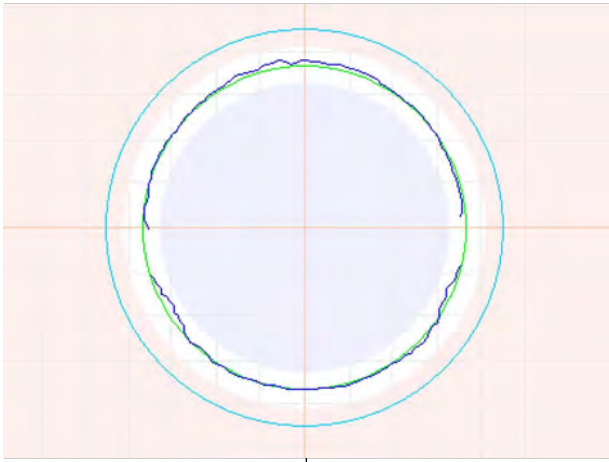
449.9ft General Observation - Corrosion to 1.1"

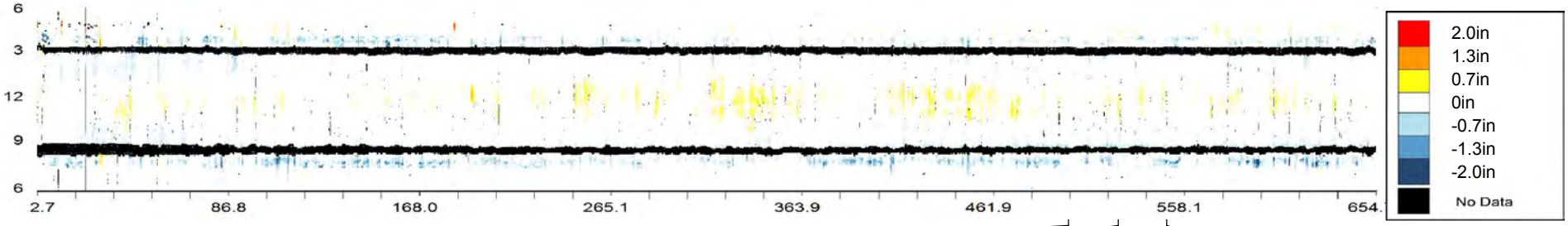


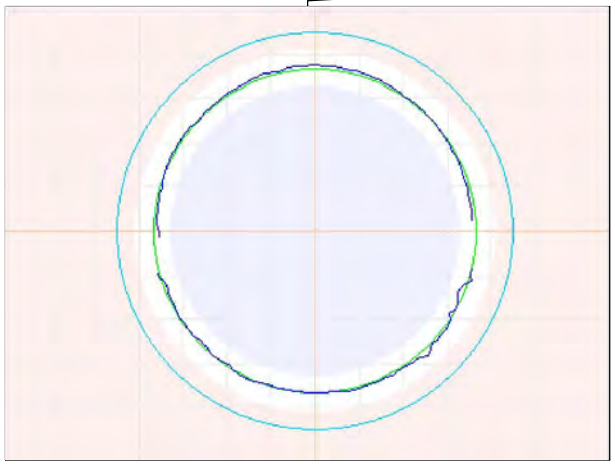
451.1ft 3D Laser Sonar Scan - Pipe Overview



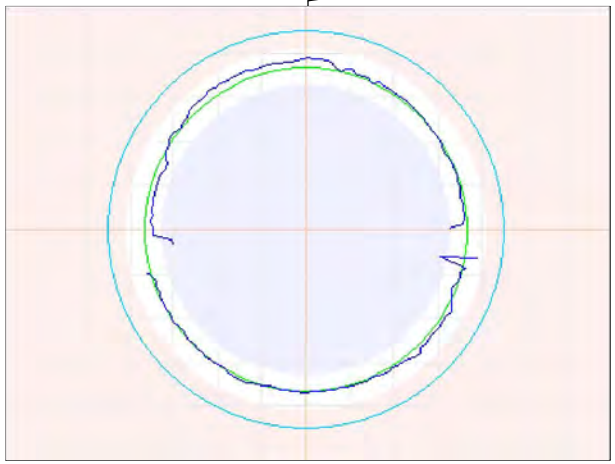
474.8ft General Observation - Corrosion to 0.7"



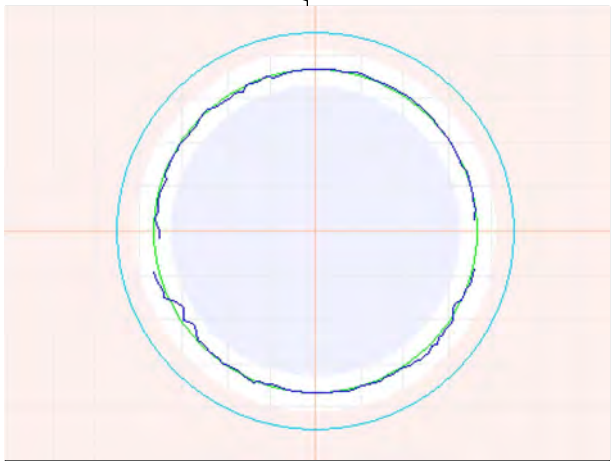




500ft General Observation - Corrosion to 0.8"



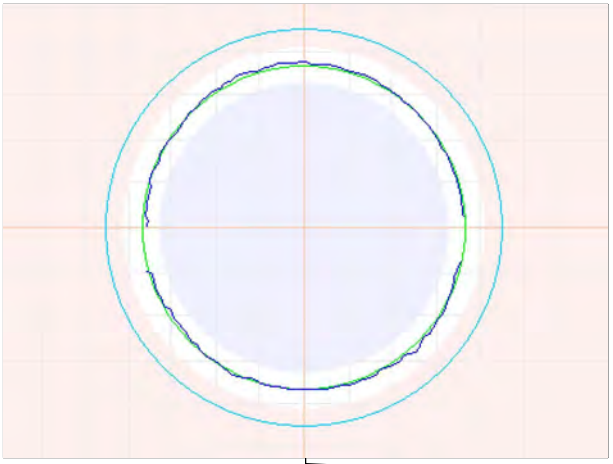
525.1ft General Observation - Corrosion to 1"



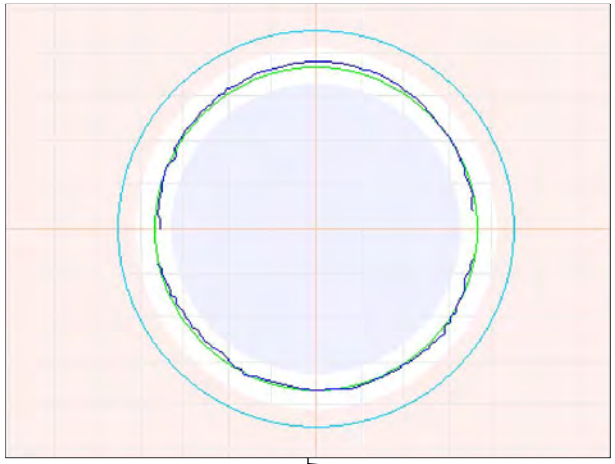
549.7ft General Observation

Observation Report

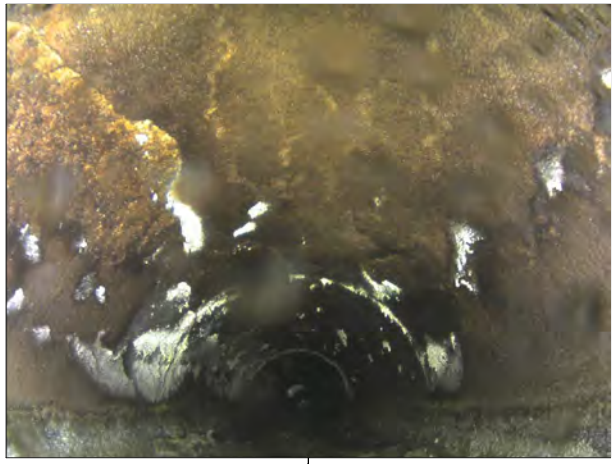
575.1ft General Observation - Corrosion to 0.4"

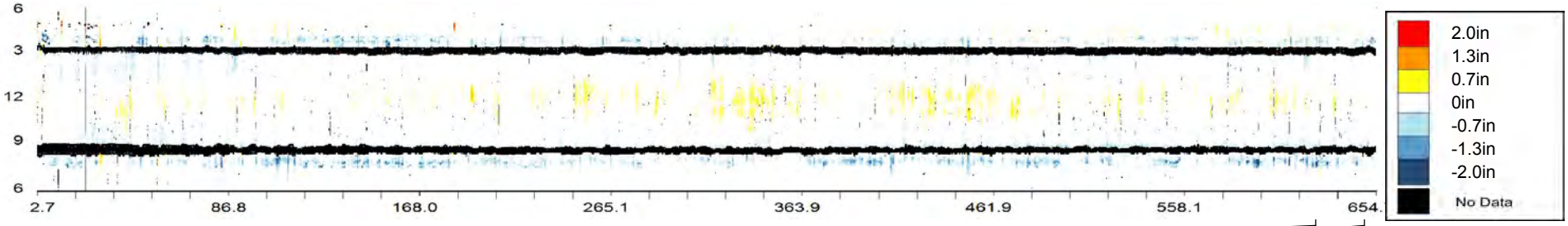


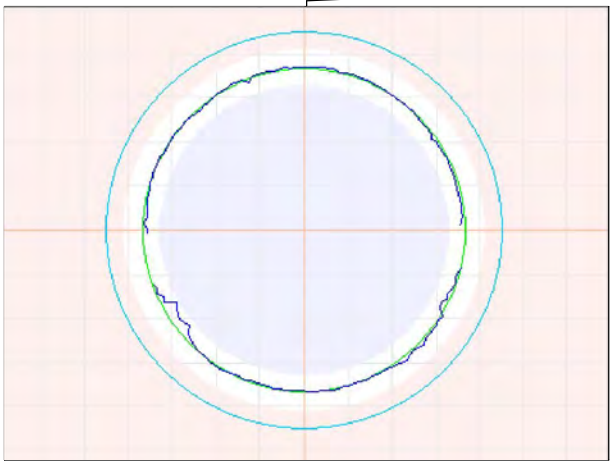
599.9ft General Observation - Corrosion to 0.6"



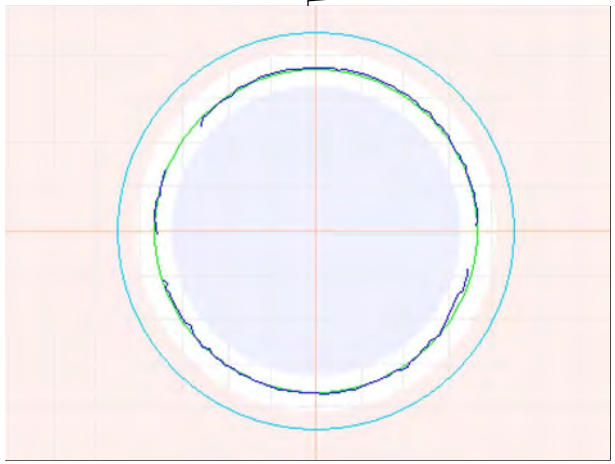
599.9ft General Observation - Corrosion to 0.6"







625.2ft General Observation - Corrosion to 0.2"



649.8ft General Observation

OVERVIEW - CMH000188 - CMH000187

Asset Number	CMH000188 - CMH000187		
Upstream MH	CMH000188	Material	Reinforced Concrete Pipe
Downstream MH	CMH000187	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	83.4 ft

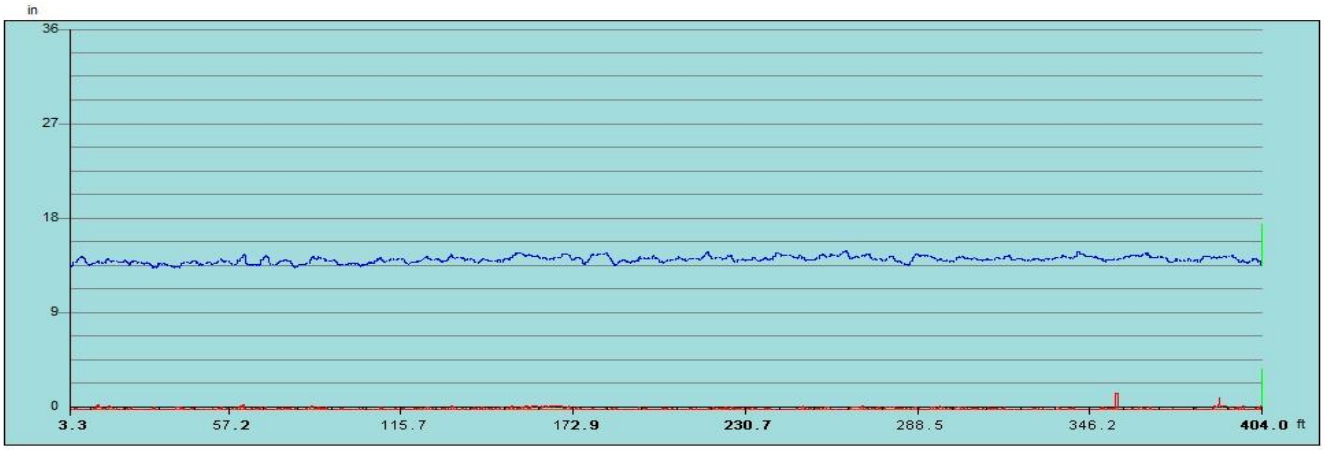
Distance	Observation	Comment
3.3 ft	**Beginning of Inspection**	**CMH000188**
3.3	General Observation	Corrosion to 0.8"
18.9	Maximum Corrosion	To 0.9"
25.6	General Observation	Corrosion to 0.4"
49.9	General Observation	Corrosion to 0.7"
75.4	General Observation	Corrosion to 0.5"
83.4	Match to Reference Shape and Size	ø36"
100.1	General Observation	Corrosion to 0.5"
125.3	General Observation	Corrosion to 0.5"
150	General Observation	Corrosion to 0.7"
174.9	General Observation	Corrosion to 0.5"
199.8	General Observation	Corrosion to 0.4"
225.3	General Observation	Corrosion to 0.6"
249.8	General Observation	Corrosion to 0.5"
275	General Observation	Corrosion to 0.5"
282.1	3D Laser Sonar Scan	Pipe Overview
299.9	General Observation	Corrosion to 0.5"
324.7	General Observation	Corrosion to 0.6"
349.8	General Observation	Corrosion to 0.6"
375.2	General Observation	Corrosion to 0.6"
399.7	General Observation	Corrosion to 0.5"
403.9 ft	**End of Inspection**	**CMH000187**

CMH000188 - CMH000187			
Asset Number	CMH000188 - CMH000187	Length	404 ft
Upstream MH	CMH000188	Diameter	36 in
Downstream MH	CMH000187	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	83.4 ft
Date Profiled	17 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	14 in
Debris Volume	0 cubic feet

Debris Graph



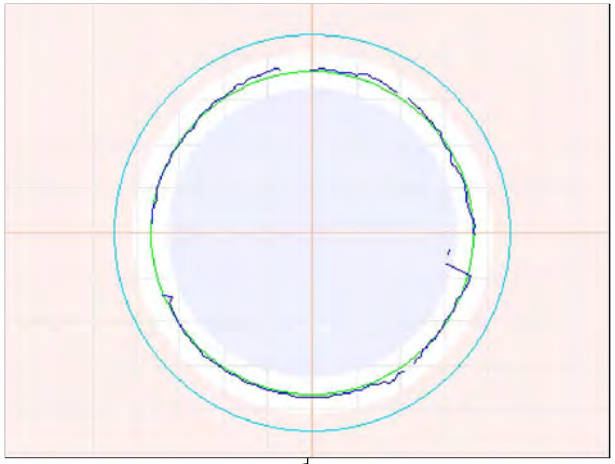
Inspection Distance (ft)

Water Level Debris Level

*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

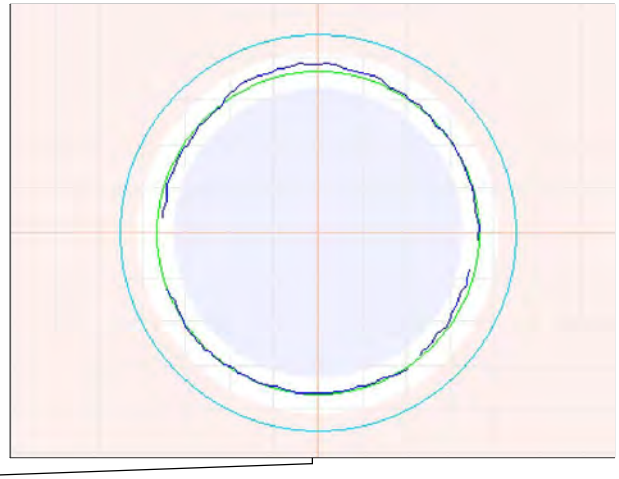
Observation Report

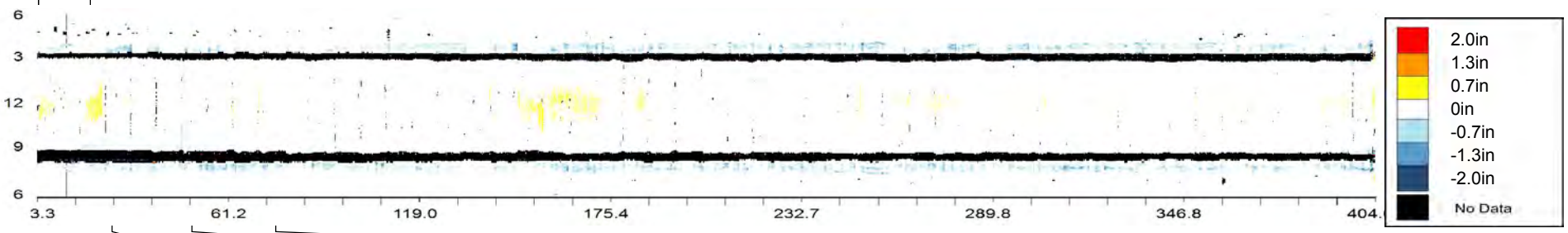
3.3ft General Observation - Corrosion to 0.8"

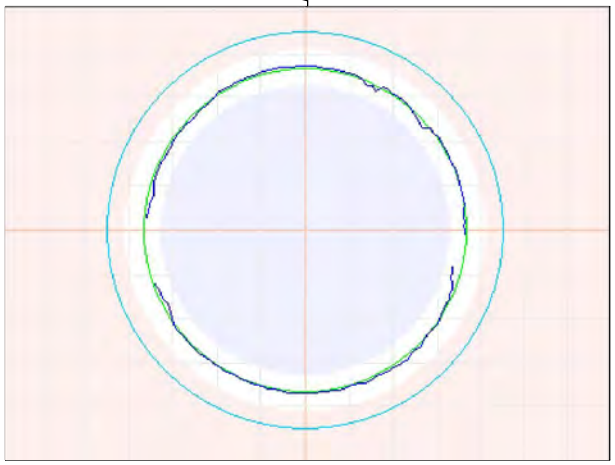


3.3ft General Observation - Corrosion to 0.8"

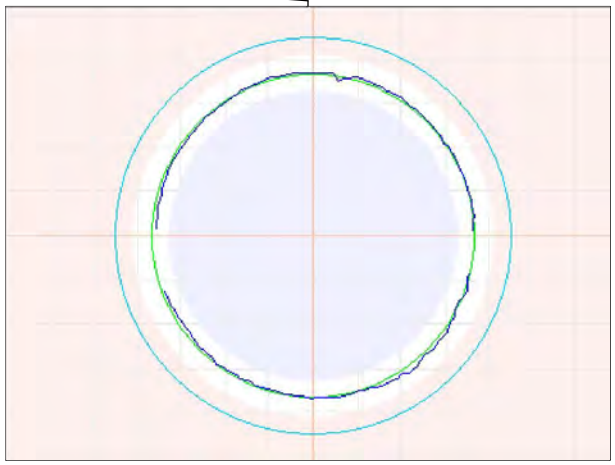
18.9ft Maximum Corrosion - To 0.9"



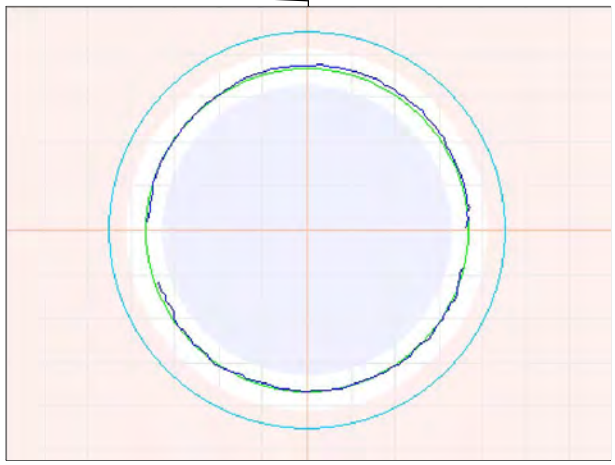




25.6ft General Observation - Corrosion to 0.4"



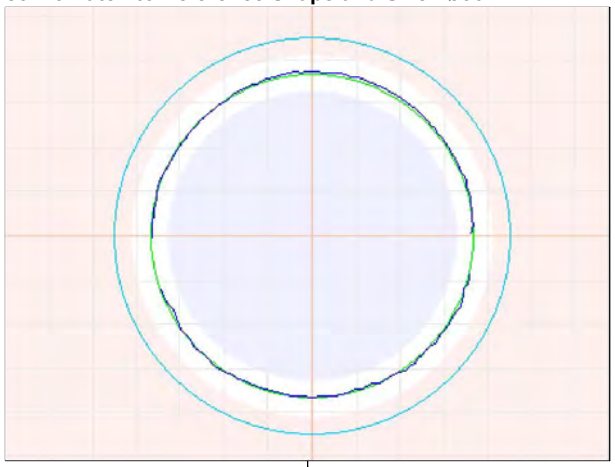
49.9ft General Observation - Corrosion to 0.7"



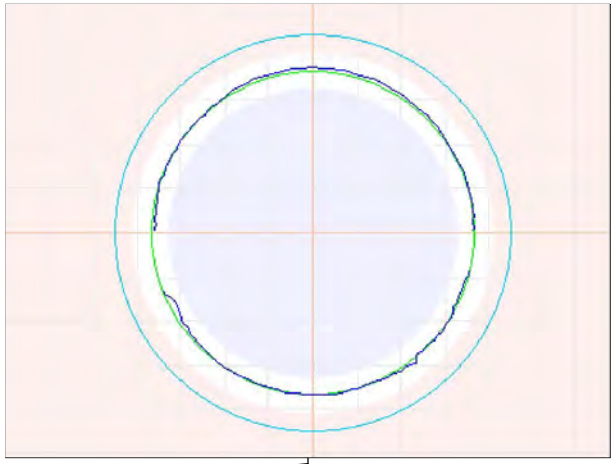
75.4ft General Observation - Corrosion to 0.5"

Observation Report

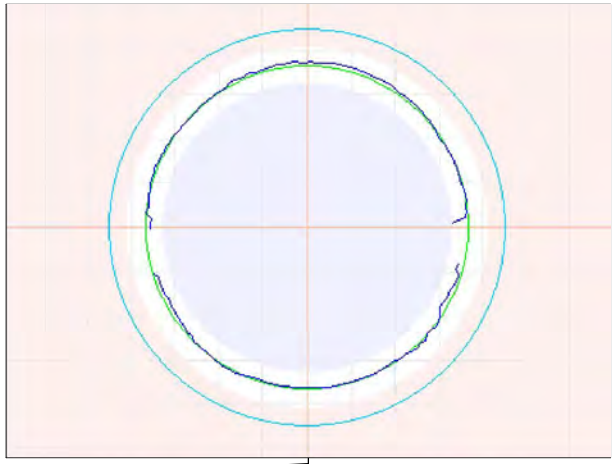
83.4ft Match to Reference Shape and Size - ø36"

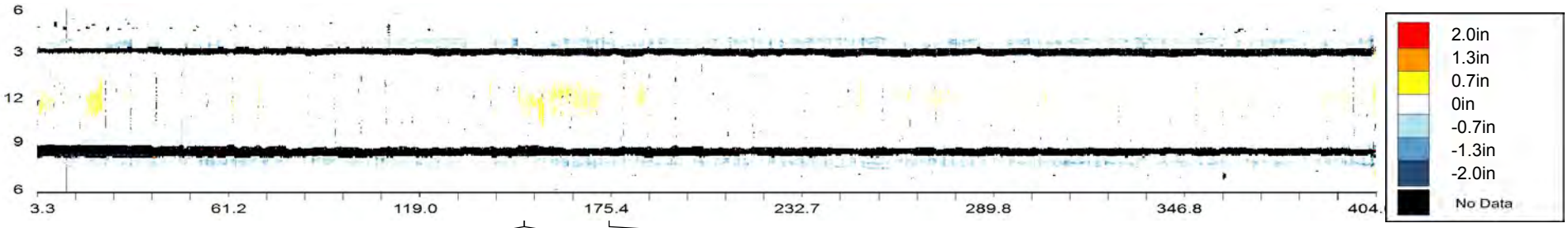


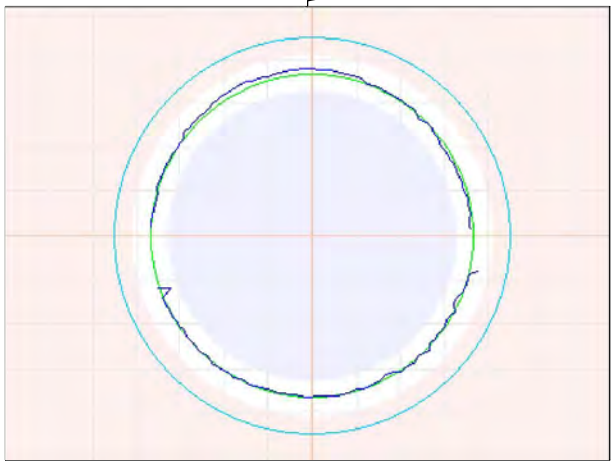
100.1ft General Observation - Corrosion to 0.5"



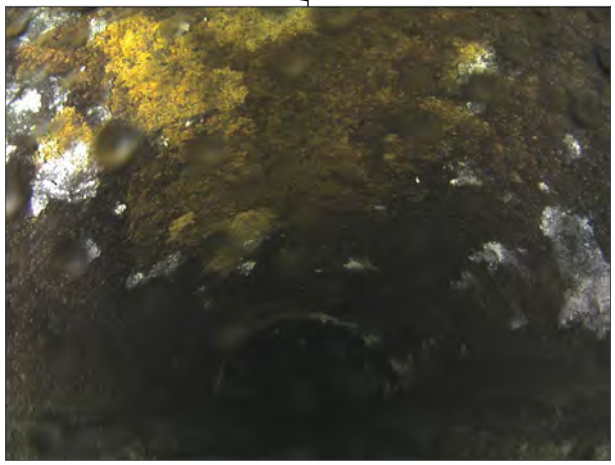
125.3ft General Observation - Corrosion to 0.5"



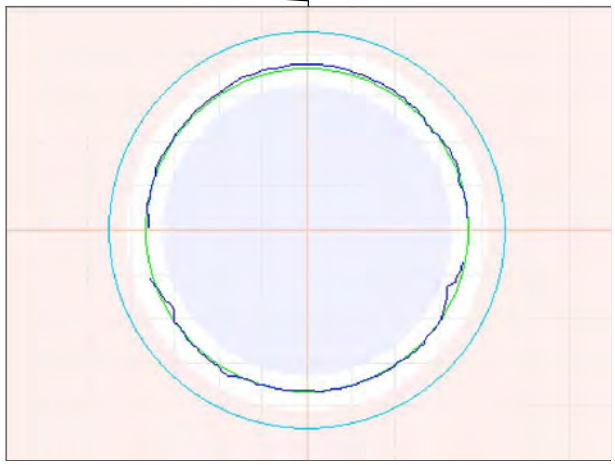




150ft General Observation - Corrosion to 0.7"



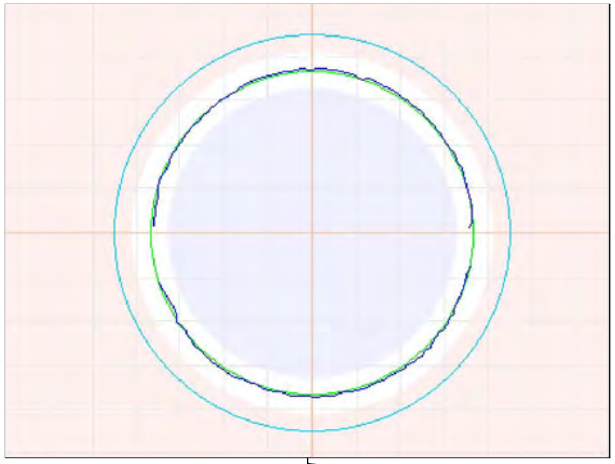
150ft General Observation - Corrosion to 0.7"



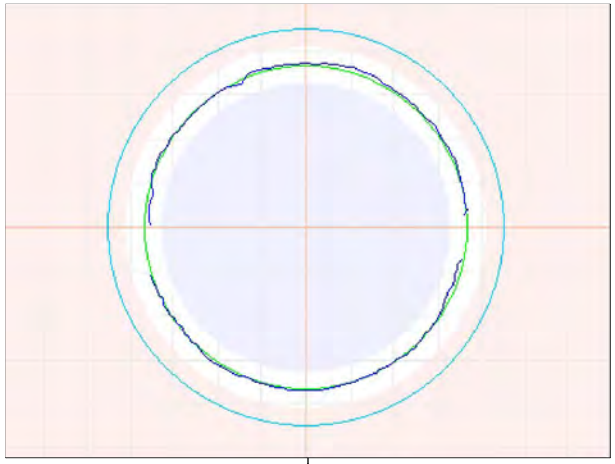
174.9ft General Observation - Corrosion to 0.5"

Observation Report

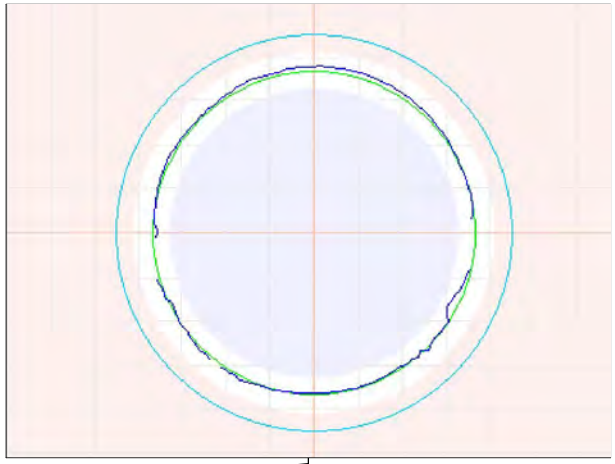
199.8ft General Observation - Corrosion to 0.4"

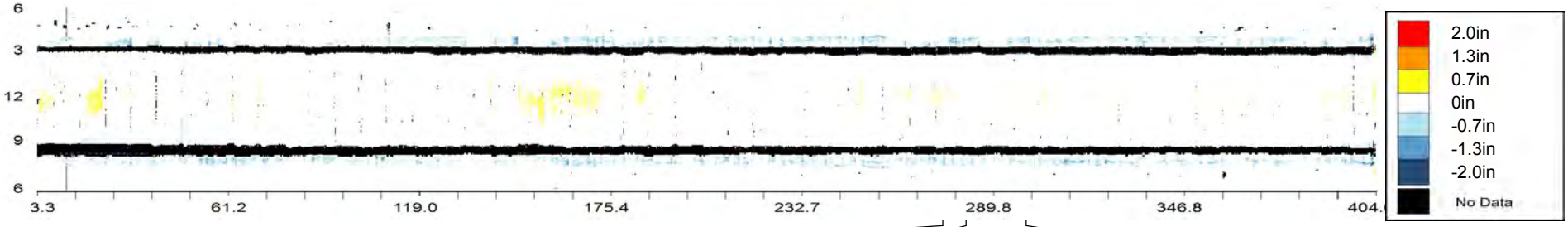


225.3ft General Observation - Corrosion to 0.6"

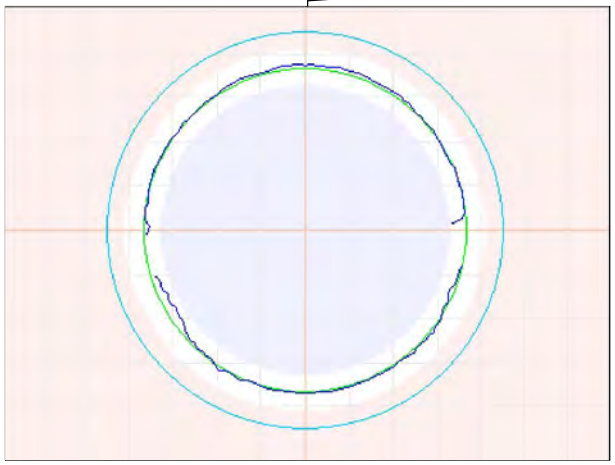


249.8ft General Observation - Corrosion to 0.5"



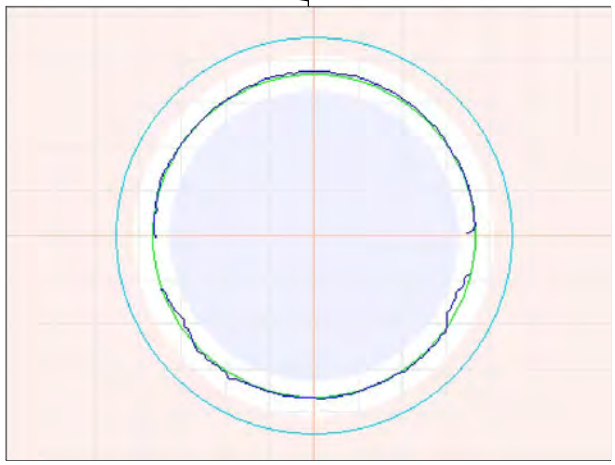


275ft General Observation - Corrosion to 0.5"



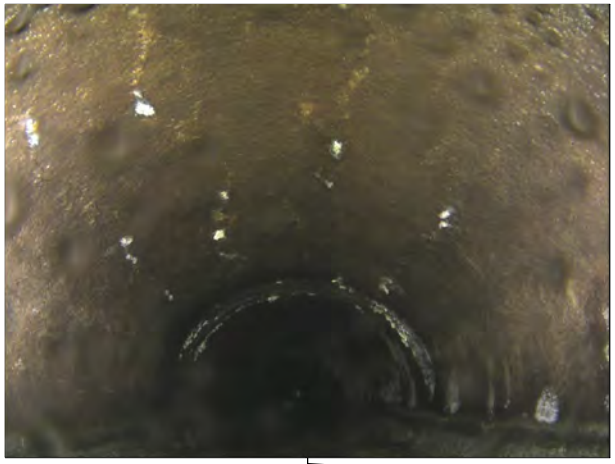
282.1ft 3D Laser Sonar Scan - Pipe Overview

299.9ft General Observation - Corrosion to 0.5"

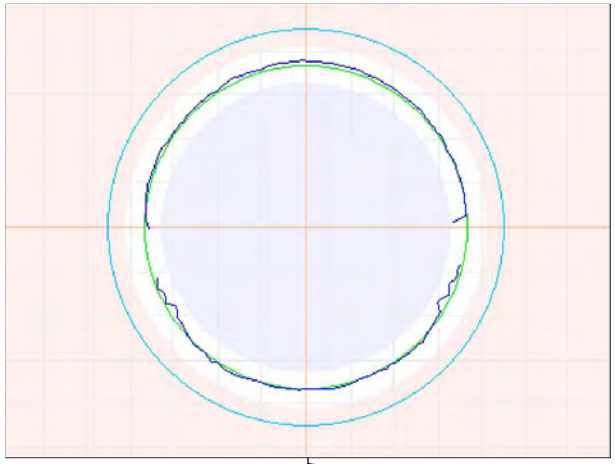


Observation Report

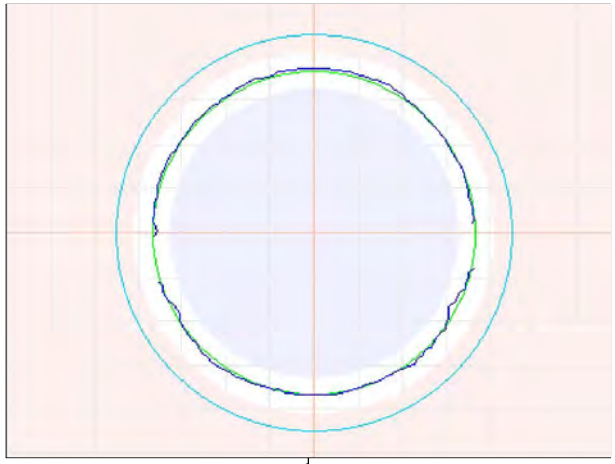
299.9ft General Observation - Corrosion to 0.5"

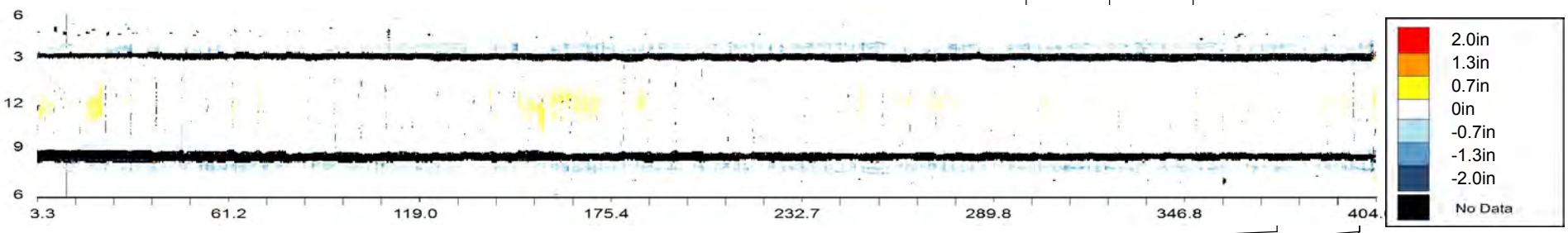


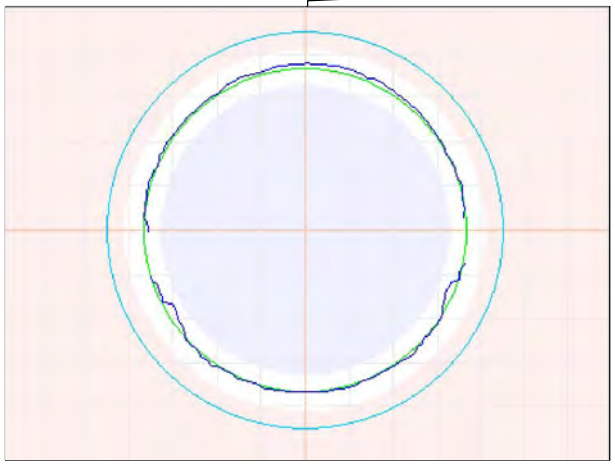
324.7ft General Observation - Corrosion to 0.6"



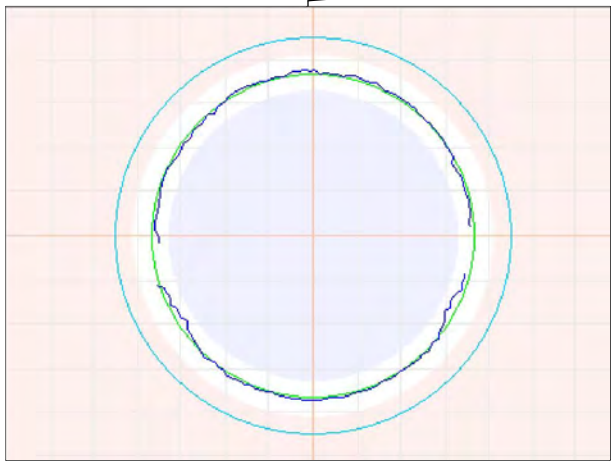
349.8ft General Observation - Corrosion to 0.6"



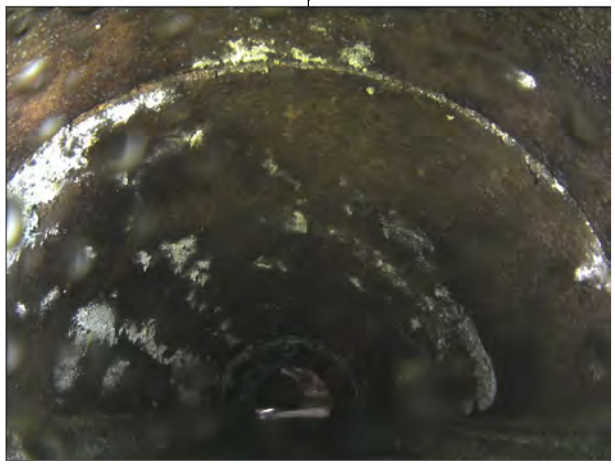




375.2ft General Observation - Corrosion to 0.6"



399.7ft General Observation - Corrosion to 0.5"



399.7ft General Observation - Corrosion to 0.5"

OVERVIEW - CMH000189 - CMH000188

Asset Number	CMH000189 - CMH000188		
Upstream MH	CMH000189	Material	Reinforced Concrete Pipe
Downstream MH	CMH000188	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	174.5 ft

Distance	Observation	Comment
2.9 ft	**Beginning of Inspection**	**CMH000189**
5	General Observation	Corrosion to 1.2"
25.8	General Observation	Corrosion to 0.8"
50.1	General Observation	Corrosion to 0.5"
57.1	Maximum Corrosion	To 1.7"
75.3	General Observation	Corrosion to 0.9"
99.8	General Observation	Corrosion to 1.3"
125.1	General Observation	Corrosion to 0.7"
150	General Observation	Corrosion to 0.6"
174.5	Match to Reference Shape and Size	ø36"
175.7	General Observation	Corrosion to 0.4"
199.9	General Observation	Corrosion to 0.4"
225.4	General Observation	Corrosion to 0.5"
249.9	General Observation	Corrosion to 0.7"
274.9	General Observation	Corrosion to 0.5"
300	General Observation	Corrosion to 0.6"
325.1	General Observation	Corrosion to 0.7"
350	General Observation	Corrosion to 0.6"
375.3	General Observation	Corrosion to 0.7"
400	General Observation	Corrosion to 0.6"
425	General Observation	Corrosion to 0.8"
449.9	General Observation	Corrosion to 0.7"
474.8	General Observation	Corrosion to 0.8"
499.8	General Observation	Corrosion to 0.5"
525	General Observation	Corrosion to 0.6"

OVERVIEW - CMH000189 - CMH000188

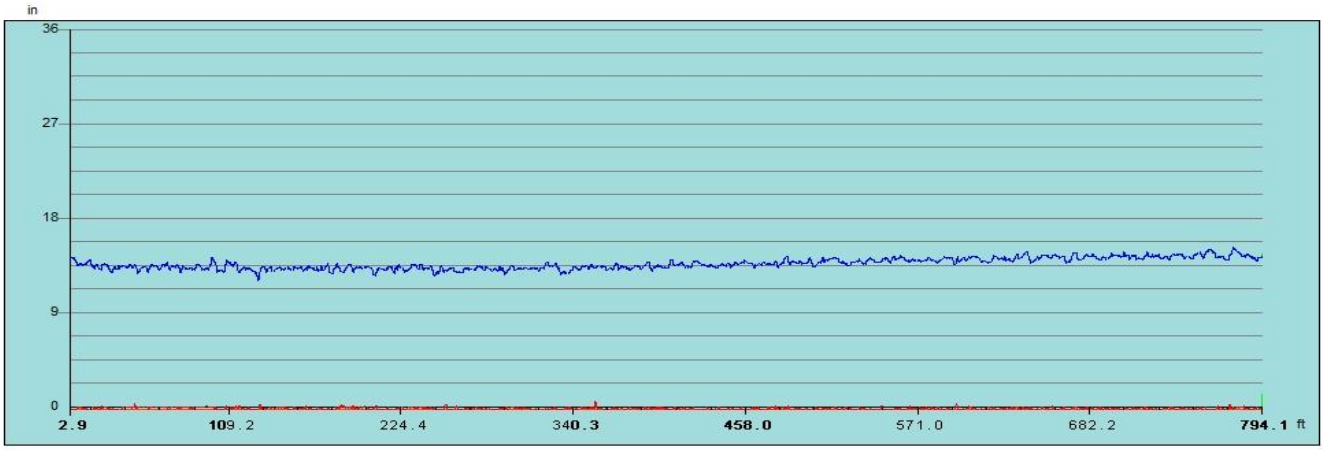
Asset Number	CMH000189 - CMH000188		
Upstream MH	CMH000189	Material	Reinforced Concrete Pipe
Downstream MH	CMH000188	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	174.5 ft

Distance	Observation	Comment
550	General Observation	Corrosion to 0.6"
574.9	General Observation	Corrosion to 0.5"
599.7	General Observation	Corrosion to 0.7"
620.3	3D Laser Sonar Scan	Pipe Overview
625	General Observation	Corrosion to 0.7"
649.8	General Observation	Corrosion to 0.7"
674.7	General Observation	Corrosion to 0.4"
699.8	General Observation	Corrosion to 1.0"
725.2	General Observation	Corrosion to 0.7"
749.6	General Observation	Corrosion to 0.5"
775.6	General Observation	Corrosion to 0.5"
793.8	General Observation	Corrosion to 0.5"
793.9 ft	**End of Inspection**	**CMH000188**

CMH000189 - CMH000188			
Asset Number	CMH000189 - CMH000188	Length	795 ft
Upstream MH	CMH000189	Diameter	36 in
Downstream MH	CMH000188	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	174.5 ft
Date Profiled	17 July 2013	Operator	

Observations	
Average Debris Depth	0 in
Average Water Level	14 in
Debris Volume	1 cubic feet

Debris Graph



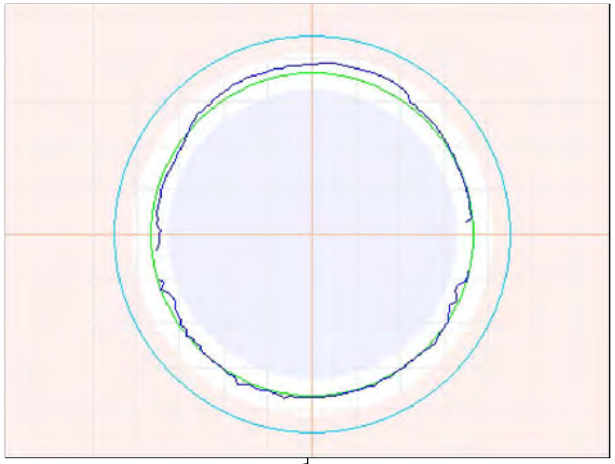
Inspection Distance (ft)

Water Level Debris Level

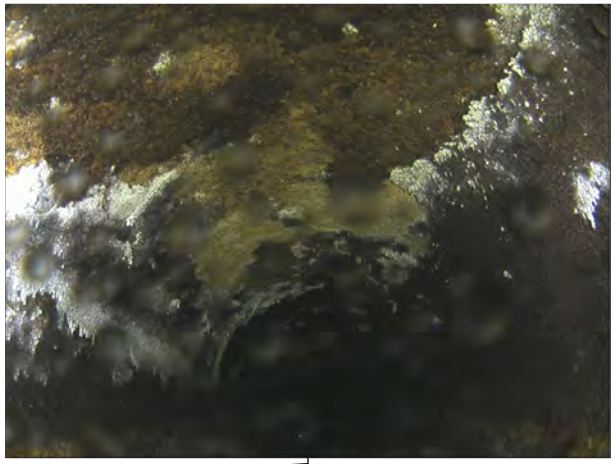
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

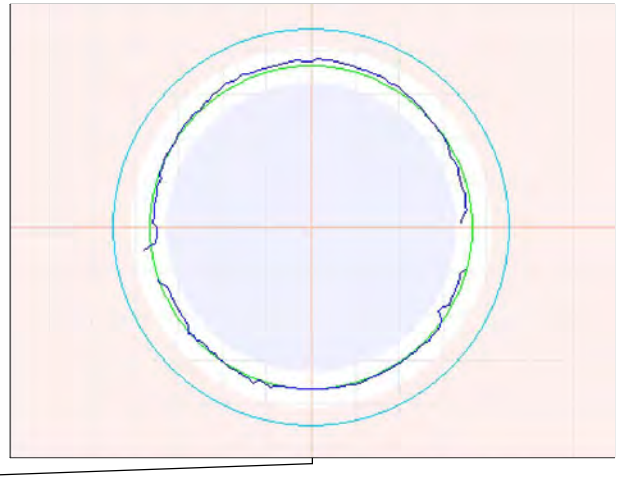
5ft General Observation - Corrosion to 1.2"

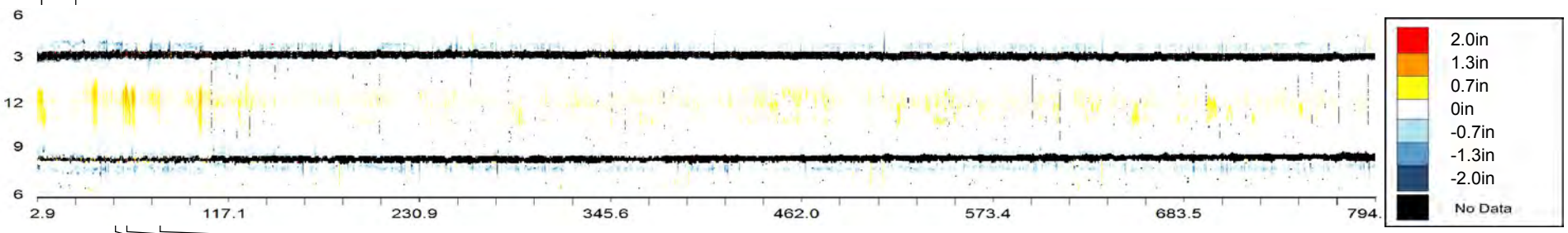


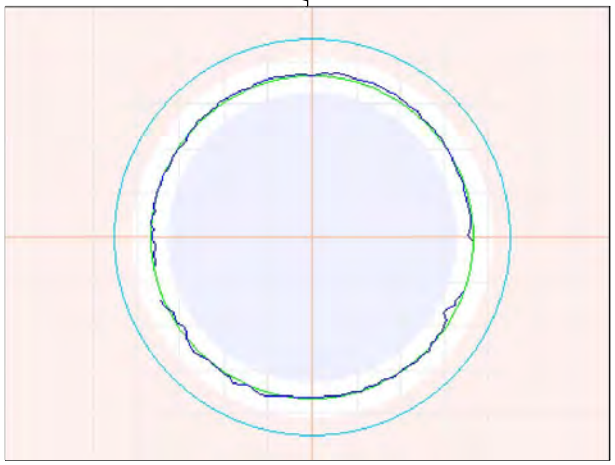
5ft General Observation - Corrosion to 1.2"



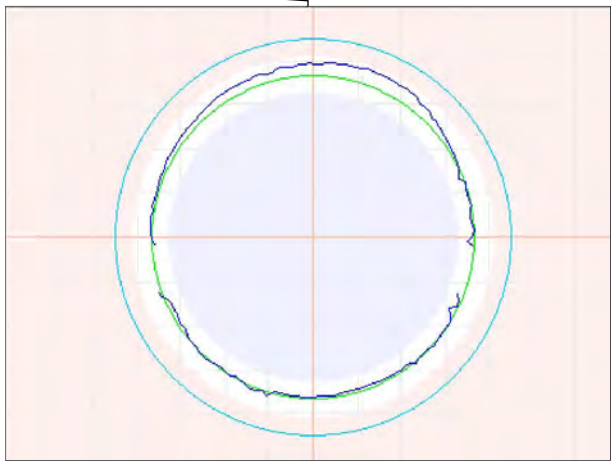
25.8ft General Observation - Corrosion to 0.8"



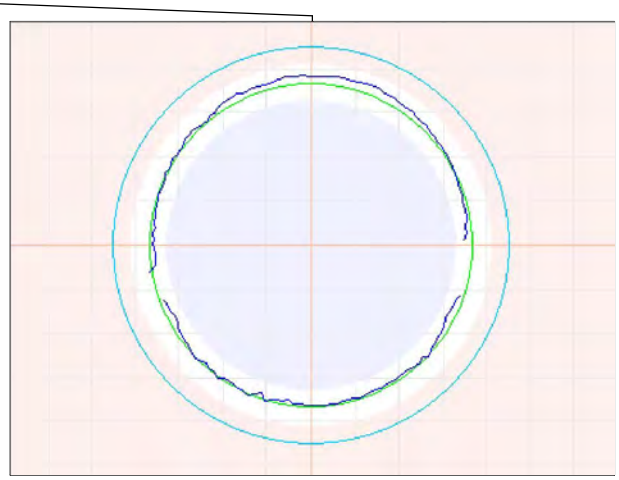




50.1ft General Observation - Corrosion to 0.5"



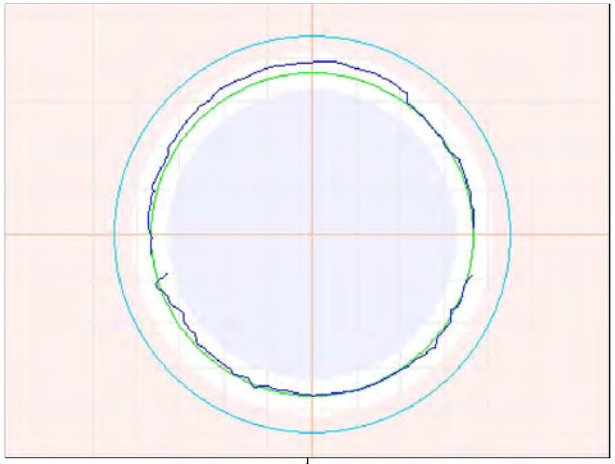
57.1ft Maximum Corrosion - To 1.7"



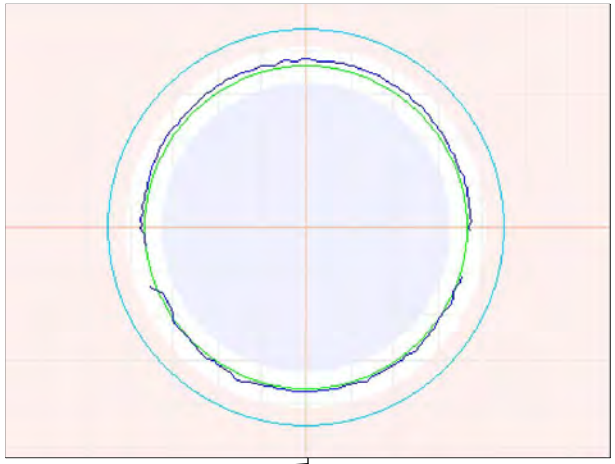
75.3ft General Observation - Corrosion to 0.9"

Observation Report

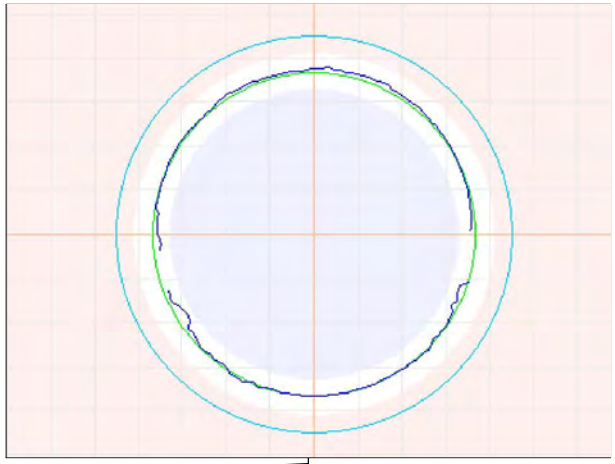
99.8ft General Observation - Corrosion to 1.3"

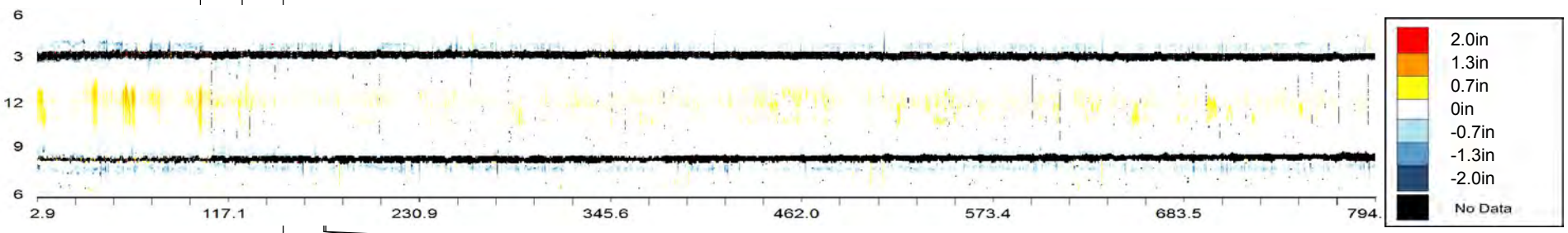


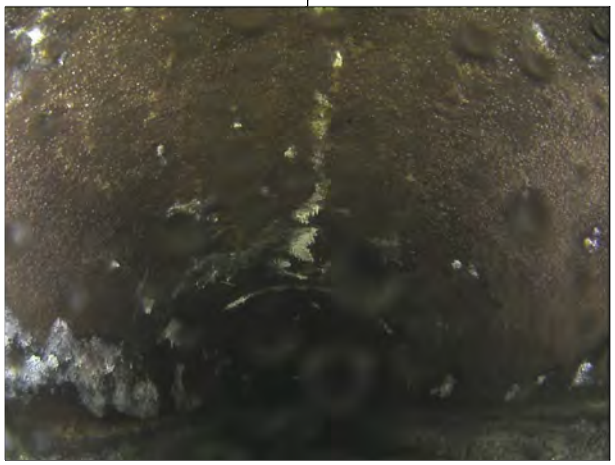
125.1ft General Observation - Corrosion to 0.7"



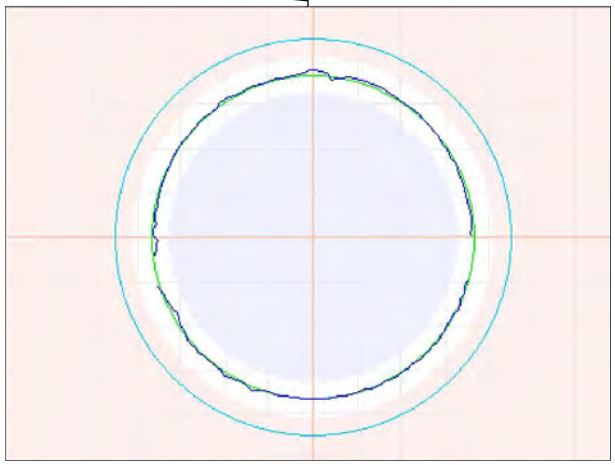
150ft General Observation - Corrosion to 0.6"



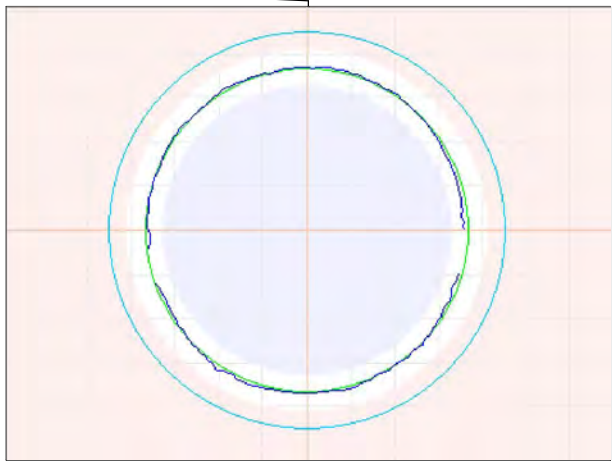




150ft General Observation - Corrosion to 0.6"



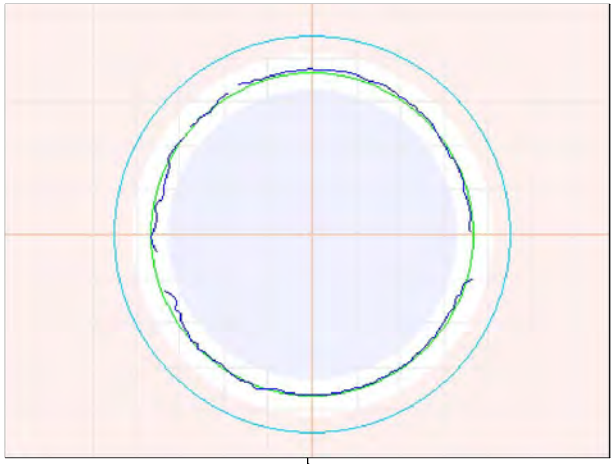
174.5ft Match to Reference Shape and Size - ø36"



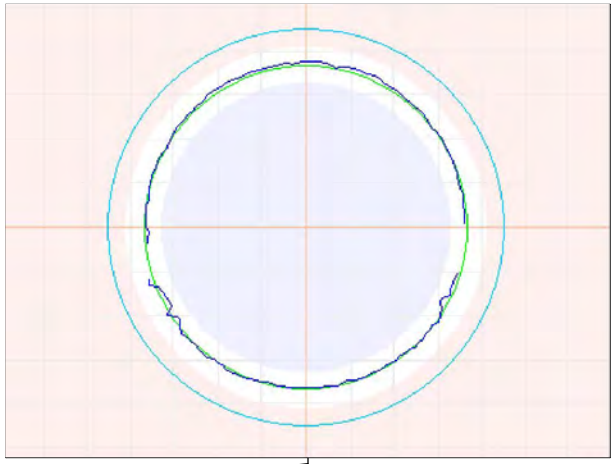
175.7ft General Observation - Corrosion to 0.4"

Observation Report

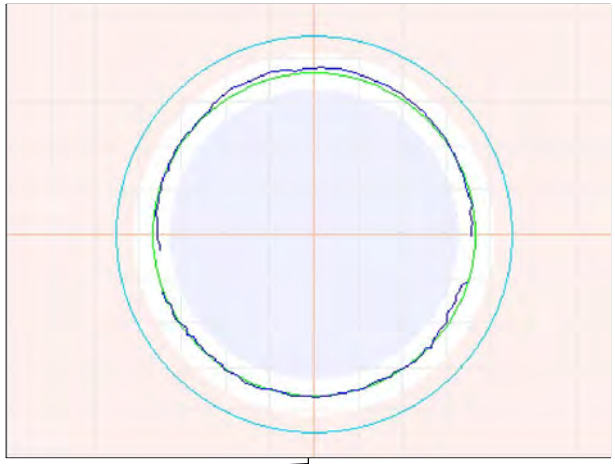
199.9ft General Observation - Corrosion to 0.4"

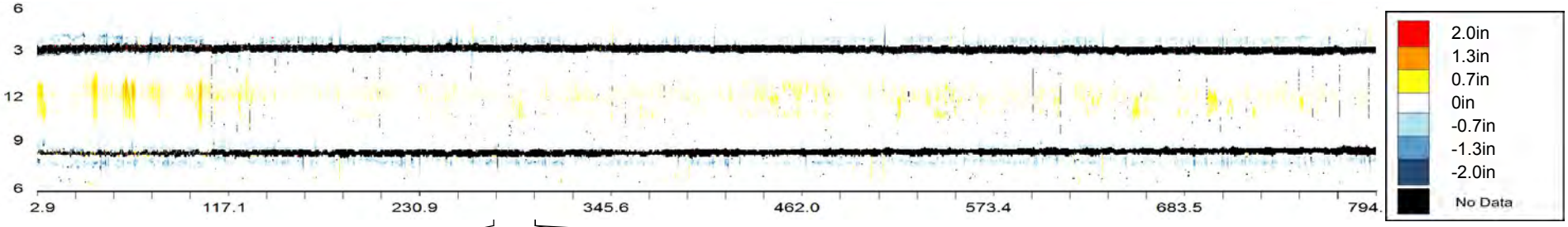


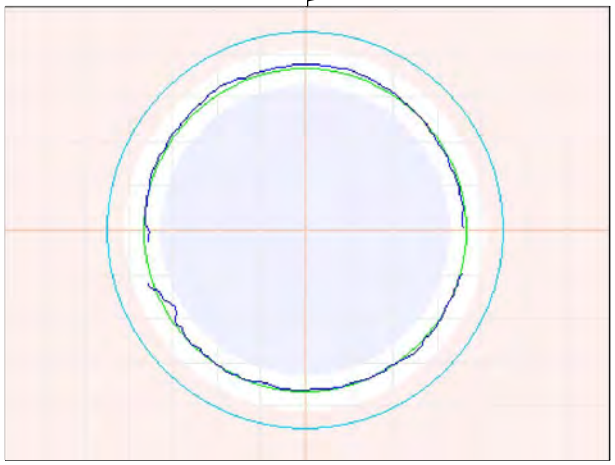
225.4ft General Observation - Corrosion to 0.5"



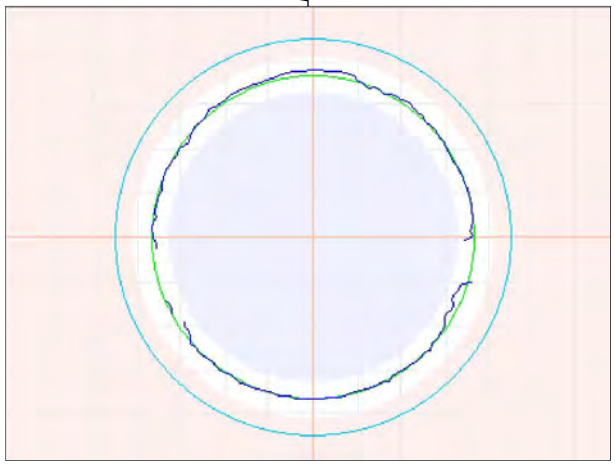
249.9ft General Observation - Corrosion to 0.7"



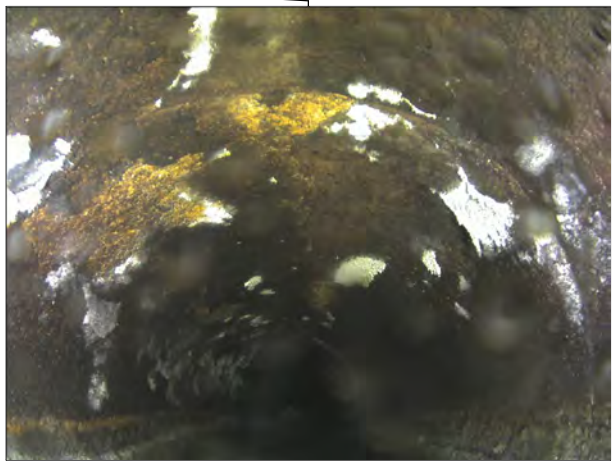




274.9ft General Observation - Corrosion to 0.5"



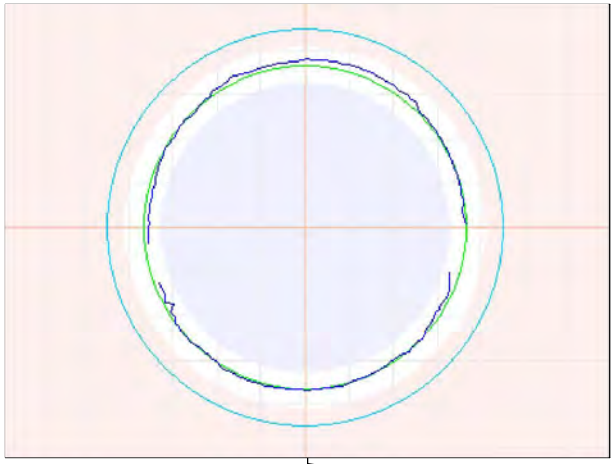
300ft General Observation - Corrosion to 0.6"



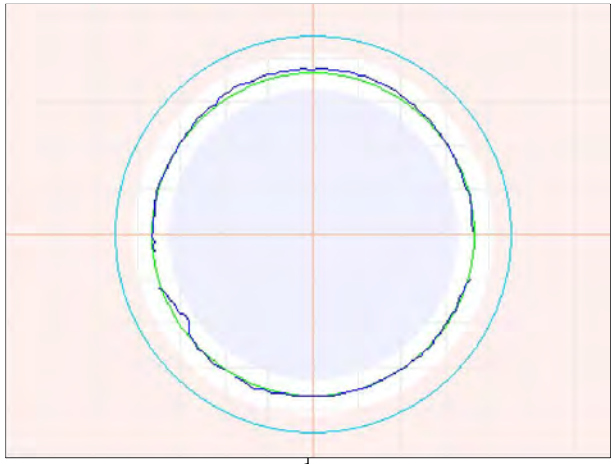
300ft General Observation - Corrosion to 0.6"

Observation Report

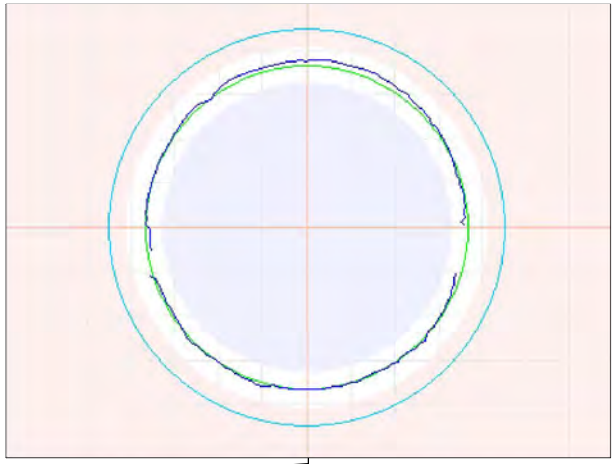
325.1ft General Observation - Corrosion to 0.7"

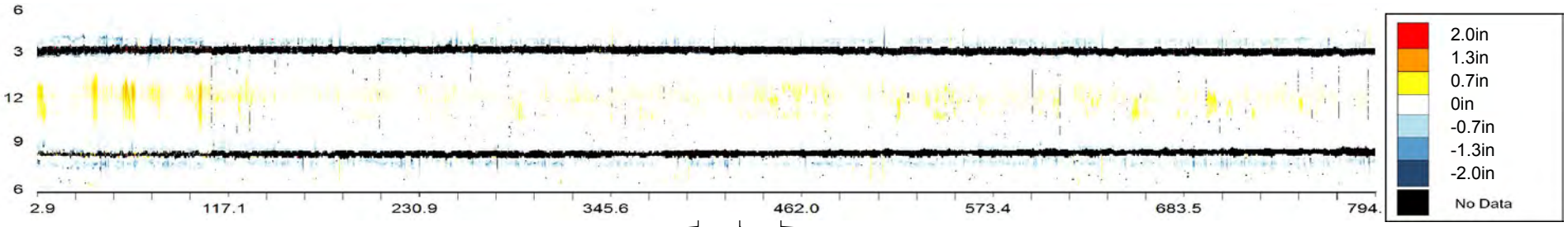


350ft General Observation - Corrosion to 0.6"

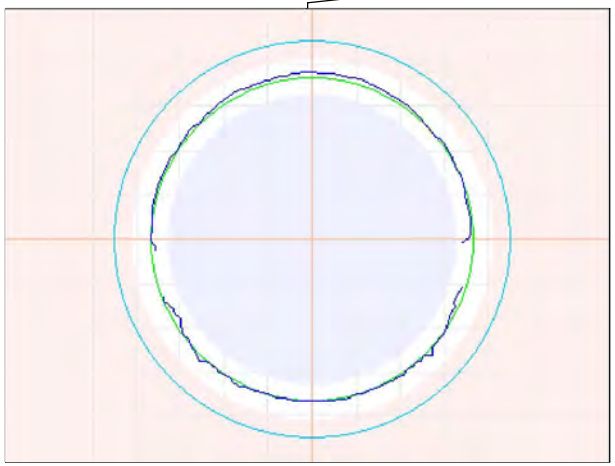


375.3ft General Observation - Corrosion to 0.7"

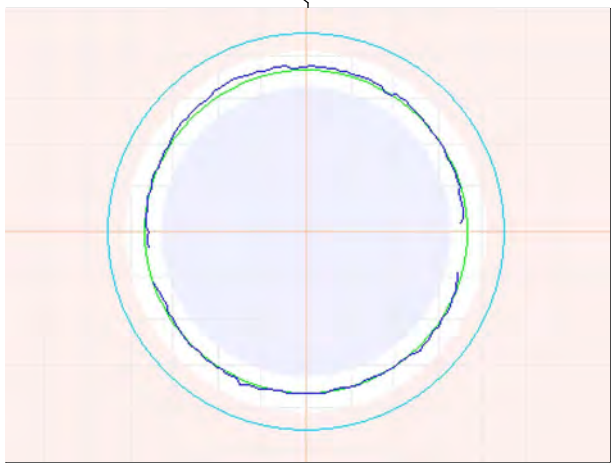




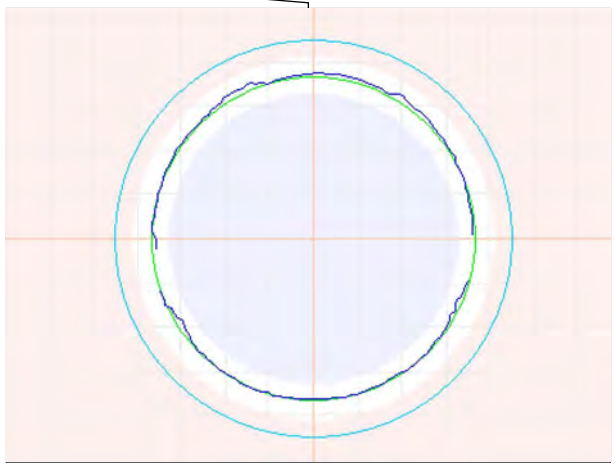
400ft General Observation - Corrosion to 0.6"



425ft General Observation - Corrosion to 0.8"

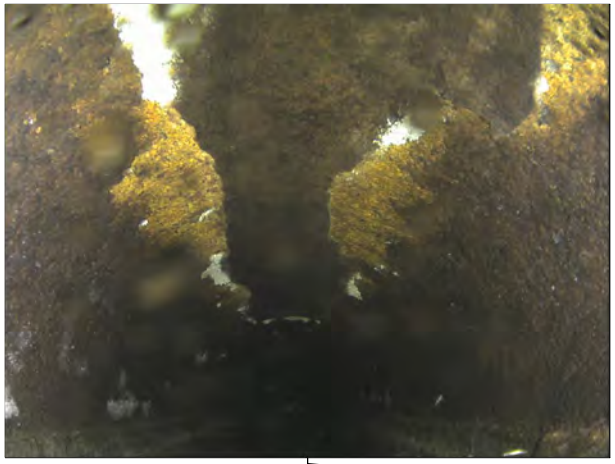


449.9ft General Observation - Corrosion to 0.7"

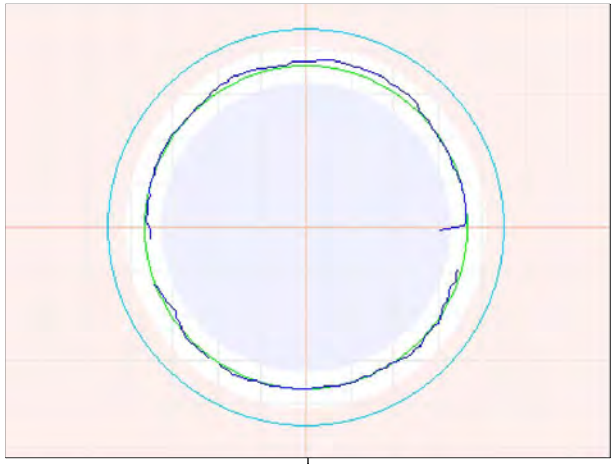


Observation Report

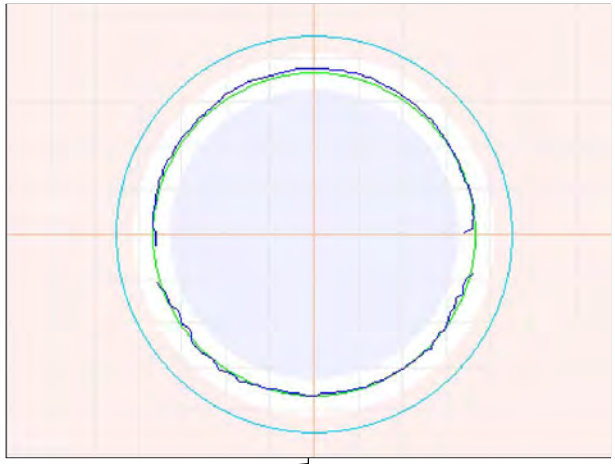
449.9ft General Observation - Corrosion to 0.7"

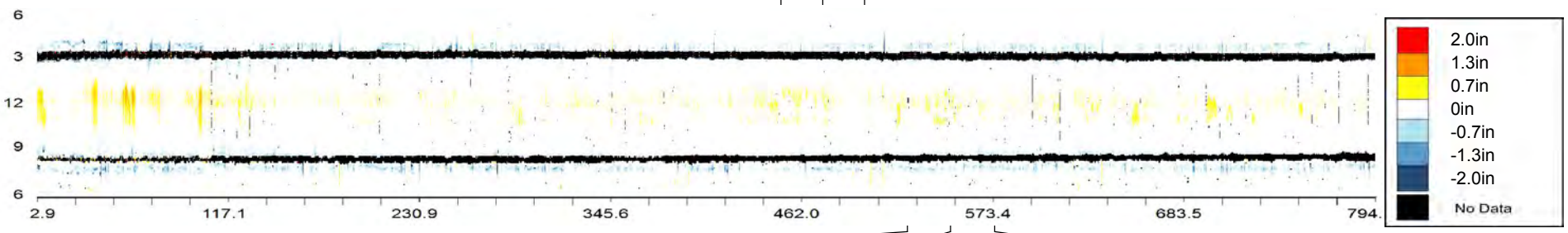


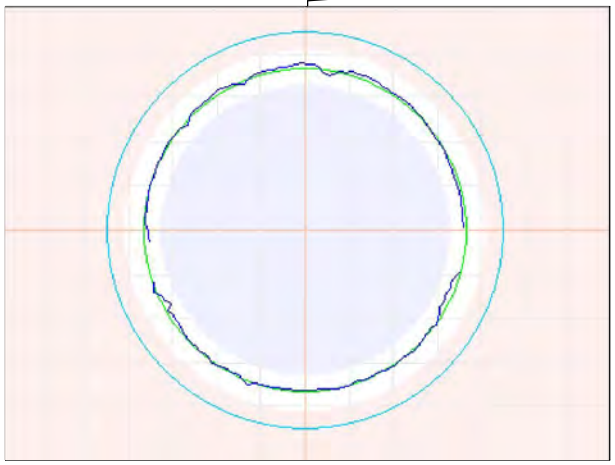
474.8ft General Observation - Corrosion to 0.8"



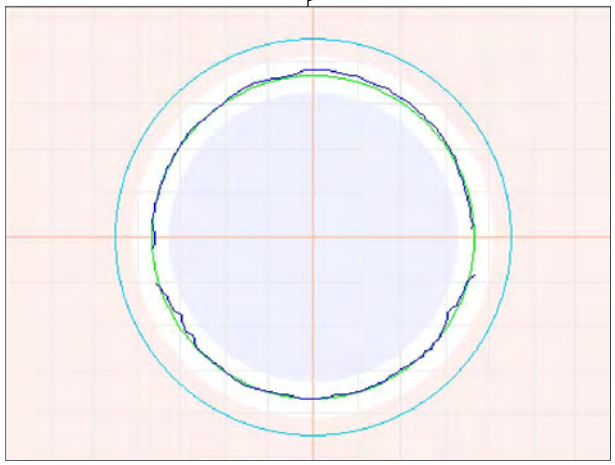
499.8ft General Observation - Corrosion to 0.5"



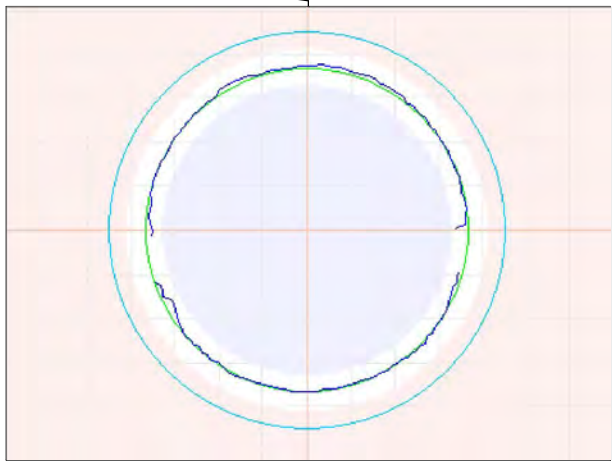




525ft General Observation - Corrosion to 0.6"



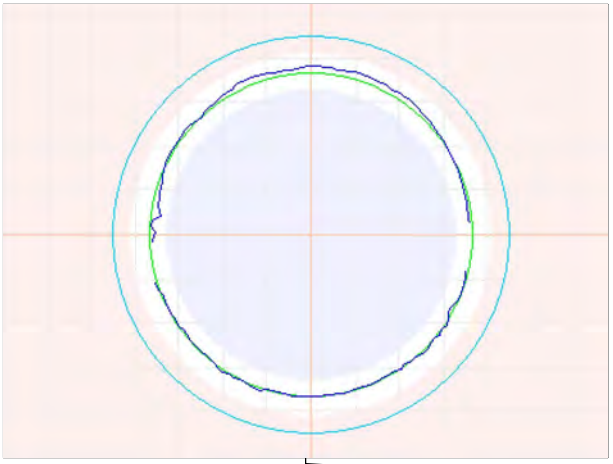
550ft General Observation - Corrosion to 0.6"



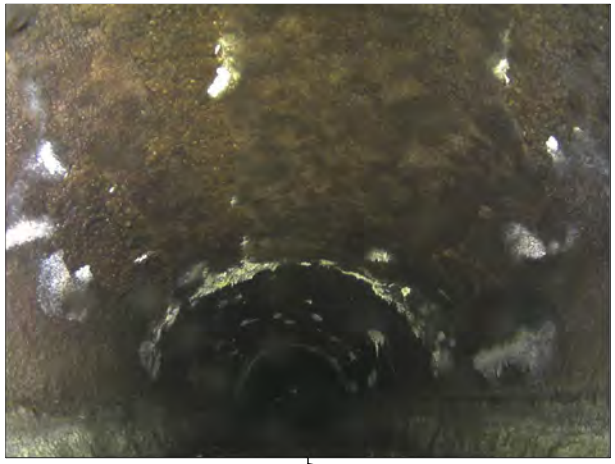
574.9ft General Observation - Corrosion to 0.5"

Observation Report

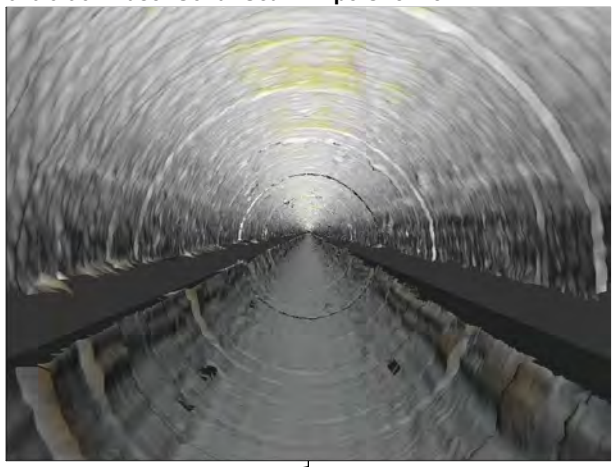
599.7ft General Observation - Corrosion to 0.7"

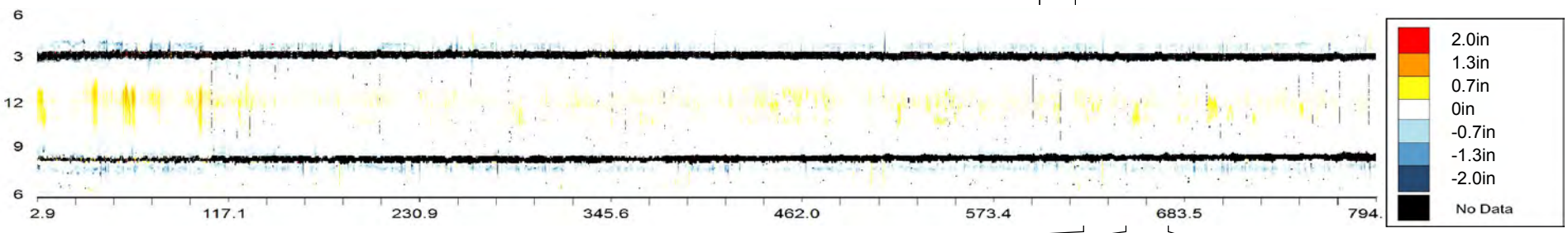


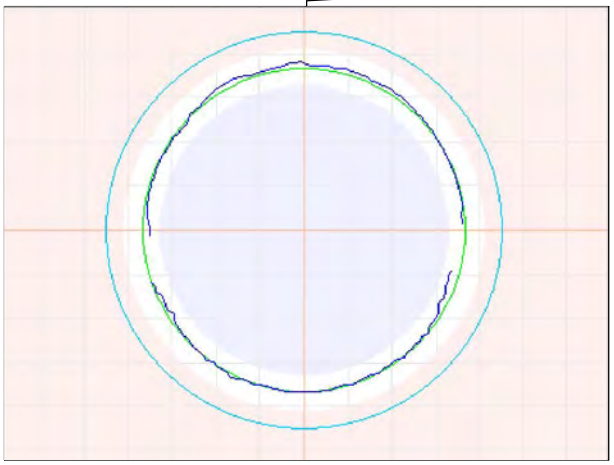
599.7ft General Observation - Corrosion to 0.7"



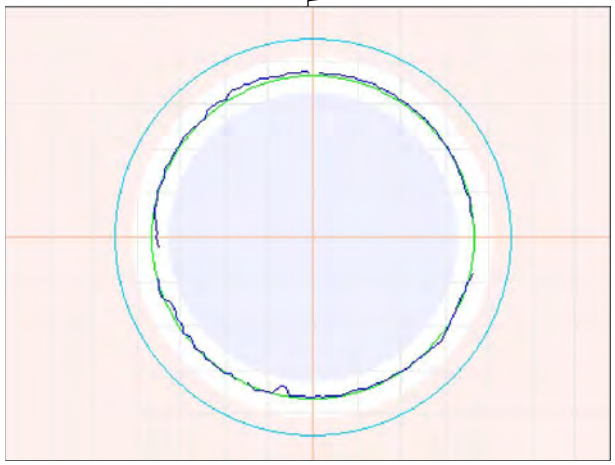
620.3ft 3D Laser Sonar Scan - Pipe Overview



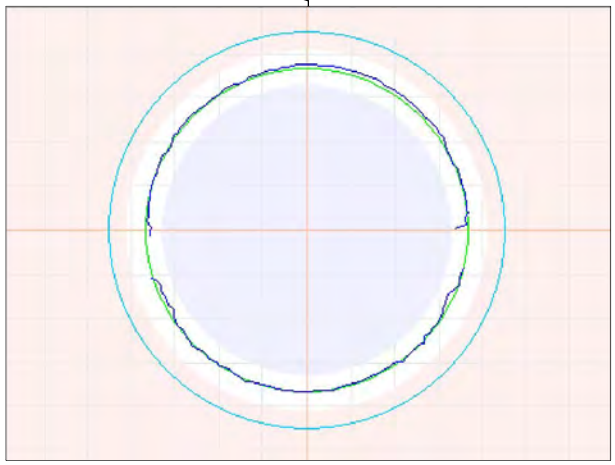




625ft General Observation - Corrosion to 0.7"



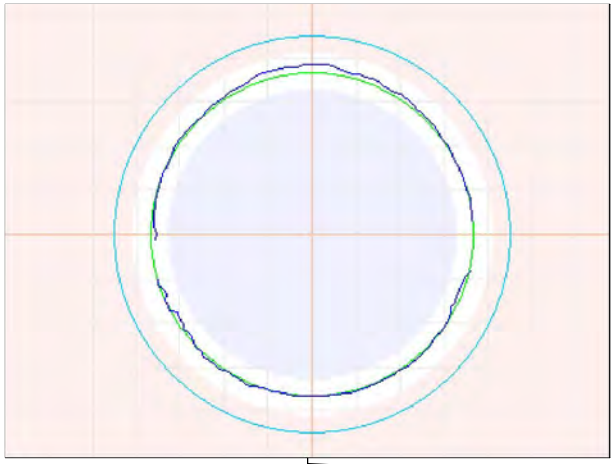
649.8ft General Observation - Corrosion to 0.7"



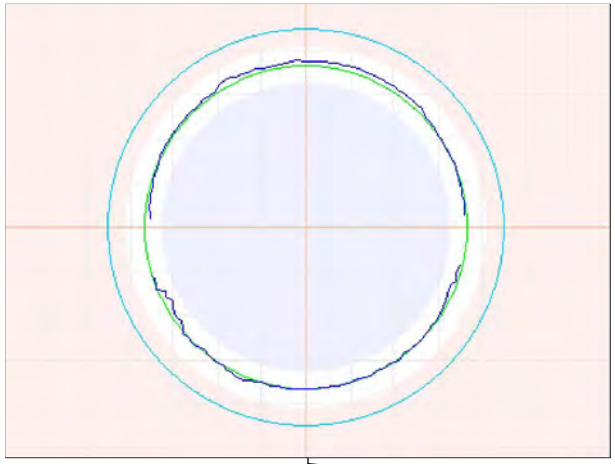
674.7ft General Observation - Corrosion to 0.4"

Observation Report

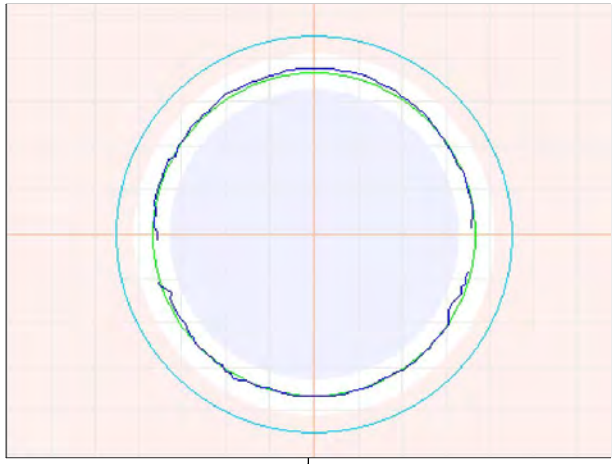
699.8ft General Observation - Corrosion to 1.0"

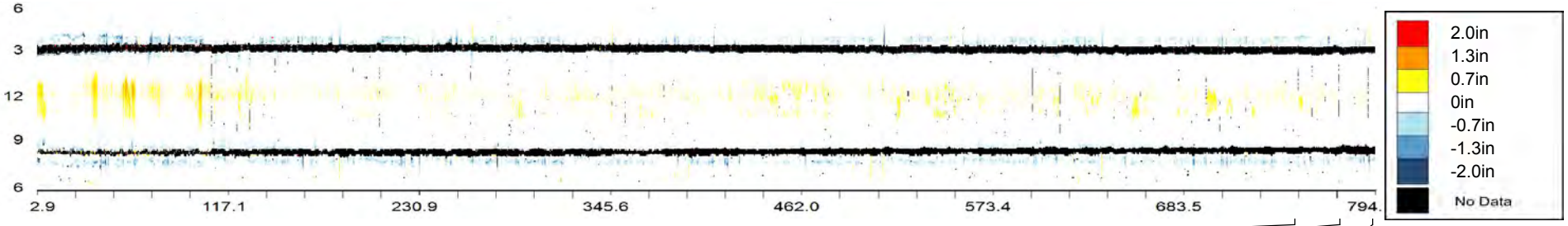


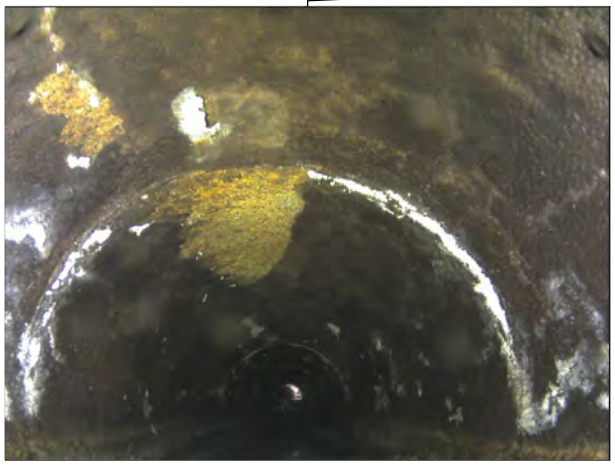
725.2ft General Observation - Corrosion to 0.7"



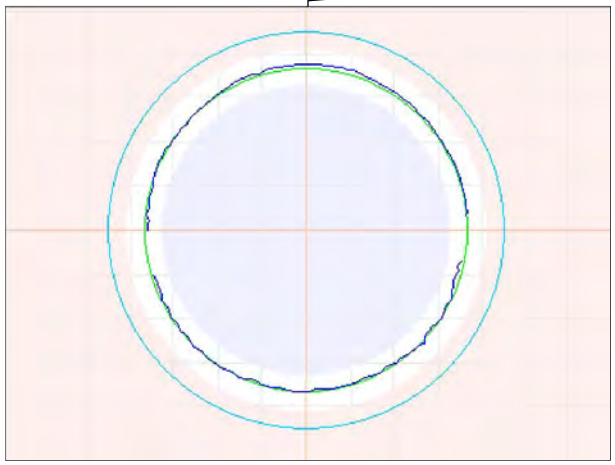
749.6ft General Observation - Corrosion to 0.5"



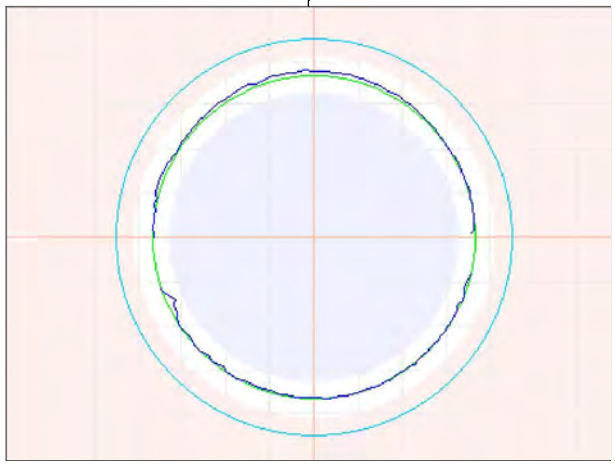




749.6ft General Observation - Corrosion to 0.5"



775.6ft General Observation - Corrosion to 0.5"



793.8ft General Observation - Corrosion to 0.5"

OVERVIEW - CMH000190 - CMH000189

Asset Number	CMH000190 - CMH000189		
Upstream MH	CMH000190	Material	Reinforced Concrete Pipe
Downstream MH	CMH000189	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	80.1 ft

Distance	Observation	Comment
4.3 ft	**Beginning of Inspection**	**CMH000190**
5	General Observation	
25.3	General Observation	Measurement inside reference to 0.6"
32.7	Maximum Corrosion	To 1.3"
49.9	General Observation	Corrosion to 0.5"
74.7	General Observation	Corrosion to 0.5"
80.1	Match to Reference Shape and Size	ø36"
99.9	General Observation	Corrosion to 0.7"
125.1	General Observation	Corrosion to 0.2"
150.1	General Observation	Corrosion to 0.5"
174.9	General Observation	Corrosion to 0.5"
199.8	General Observation	Corrosion to 0.6"
224.3	General Observation	Corrosion to 0.3"
250	General Observation	
275.1	General Observation	Corrosion to 0.4"
299.9	General Observation	Corrosion to 0.6"
325.1	General Observation	Corrosion to 0.6"
349.8	General Observation	Corrosion to 0.4"
374.8	General Observation	Corrosion to 0.4"
381.1	3D Laser Sonar Scan	Pipe Overview
399.9	General Observation	Corrosion to 0.5"
424.9	General Observation	Corrosion to 0.6"
450	General Observation	
486.8 ft	**End of Inspection**	**CMH000189**

CMH000190 - CMH000189			
Asset Number	CMH000190 - CMH000189	Length	487 ft
Upstream MH	CMH000190	Diameter	36 in
Downstream MH	CMH000189	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	80.1 ft
Date Profiled	17 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	12 in
Debris Volume	0 cubic feet

Debris Graph

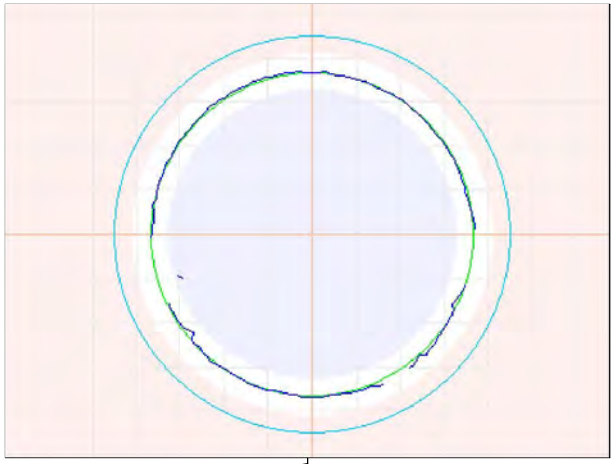
Inspection Distance (ft)

Water Level Debris Level

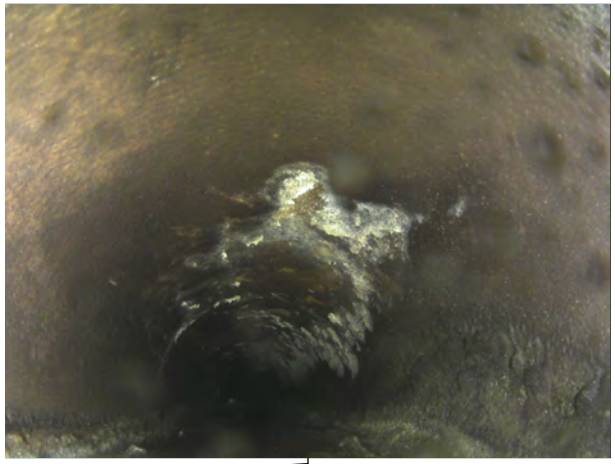
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

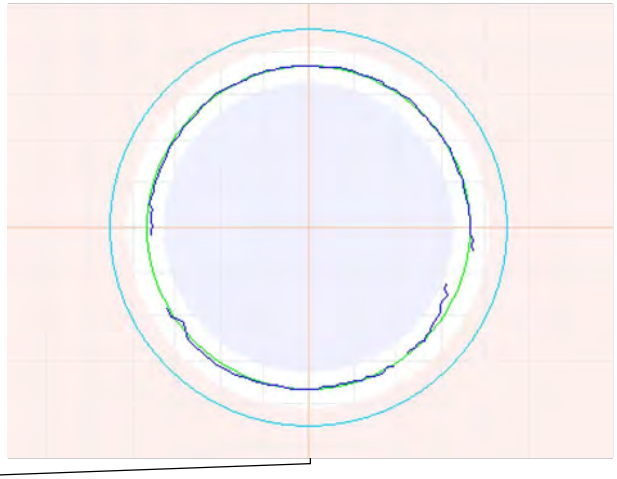
5ft General Observation

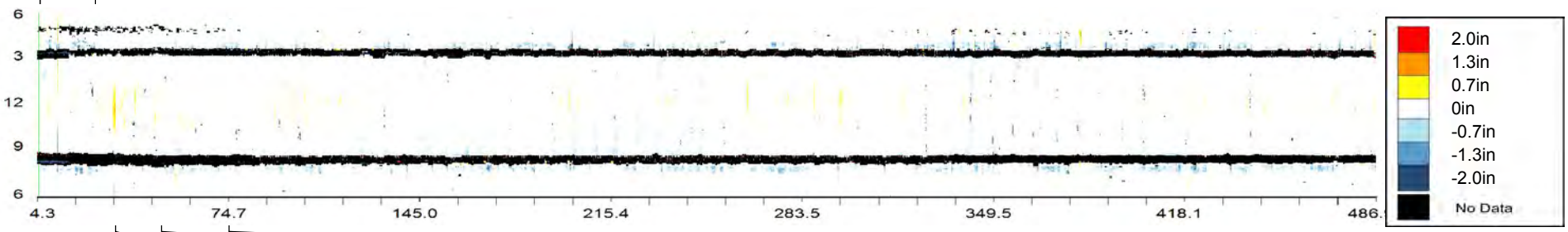


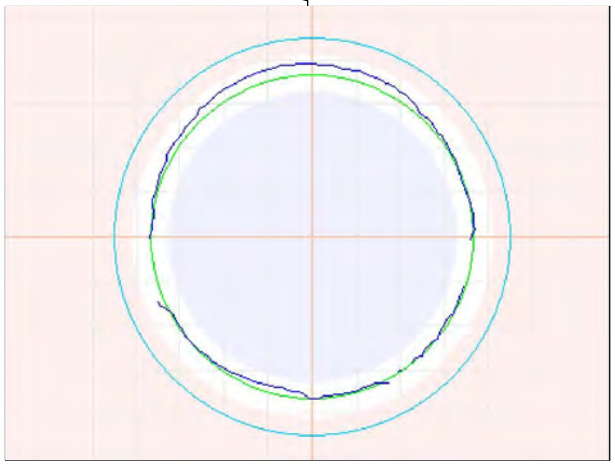
5ft General Observation



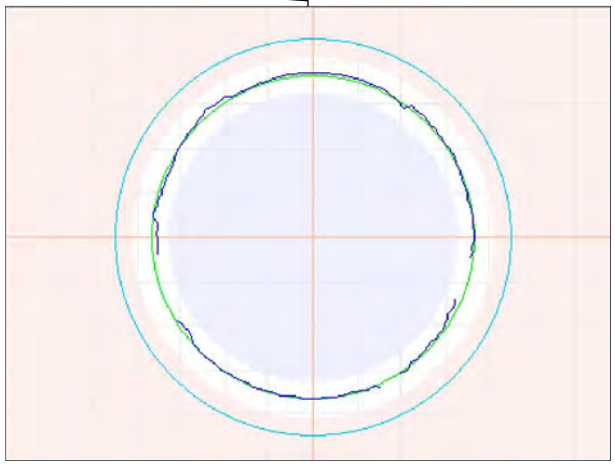
25.3ft General Observation - Measurement inside reference to 0.6"



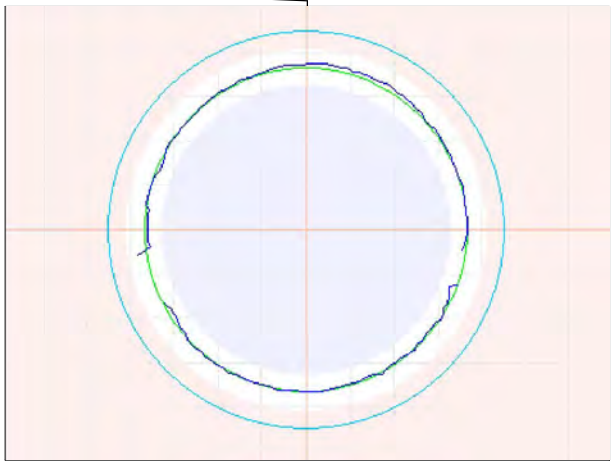




32.7ft Maximum Corrosion - To 1.3"



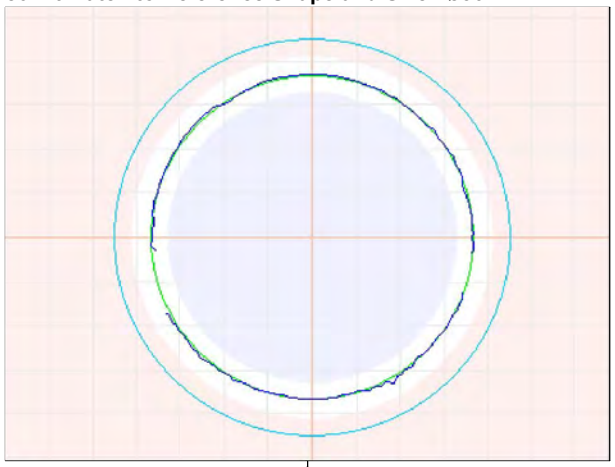
49.9ft General Observation - Corrosion to 0.5"



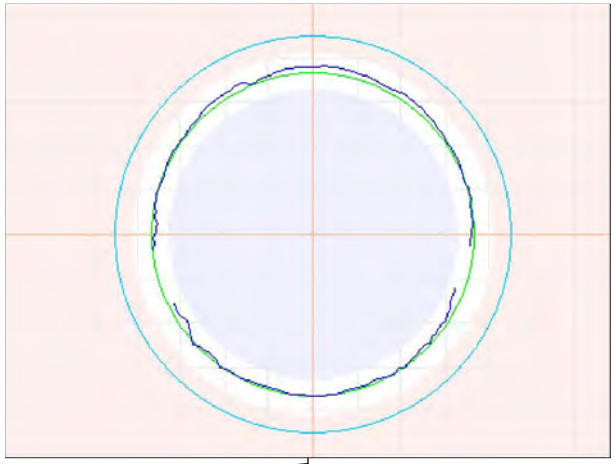
74.7ft General Observation - Corrosion to 0.5"

Observation Report

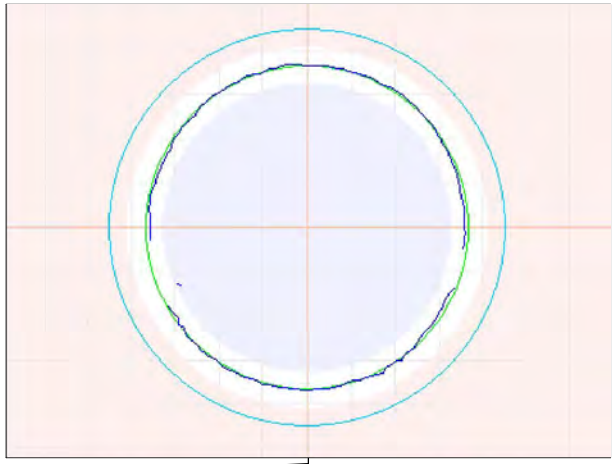
80.1ft Match to Reference Shape and Size - ø36"

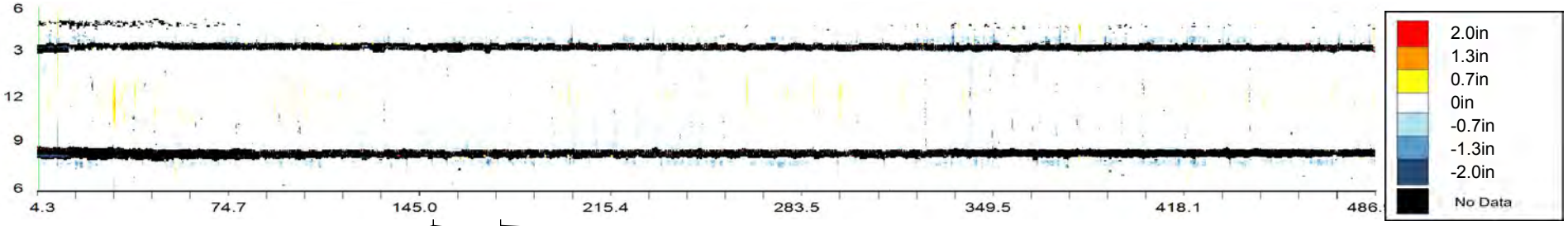


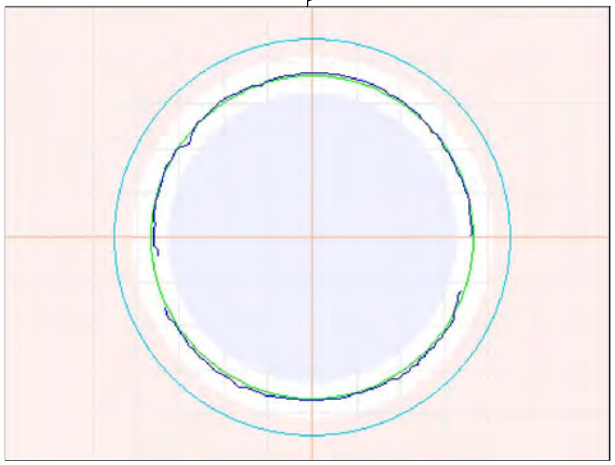
99.9ft General Observation - Corrosion to 0.7"



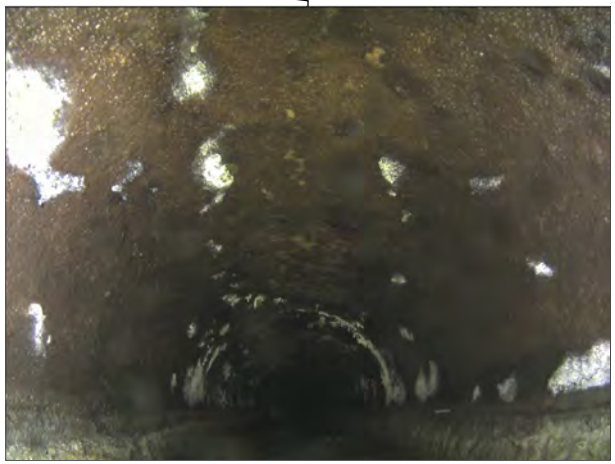
125.1ft General Observation - Corrosion to 0.2"



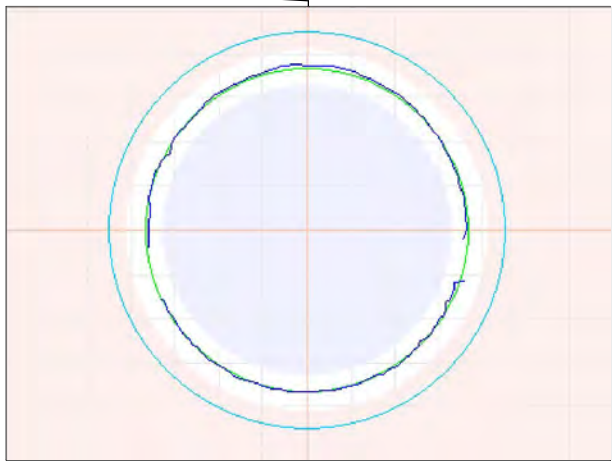




150.1ft General Observation - Corrosion to 0.5"



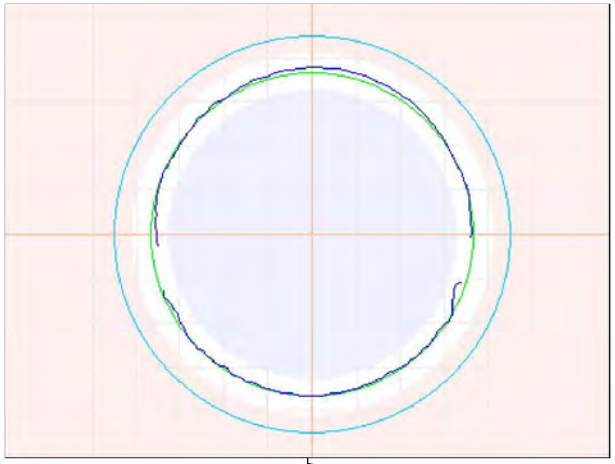
150.1ft General Observation - Corrosion to 0.5"



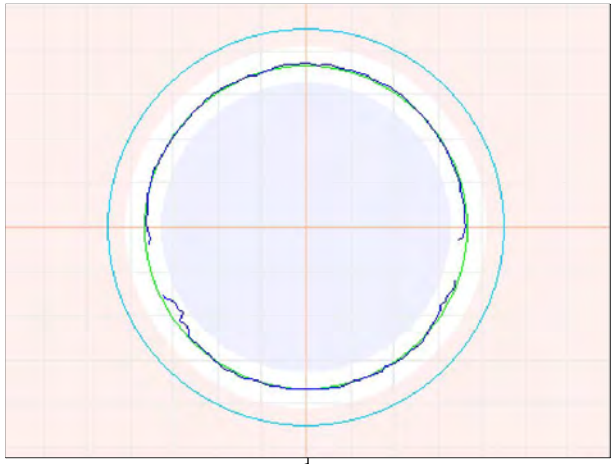
174.9ft General Observation - Corrosion to 0.5"

Observation Report

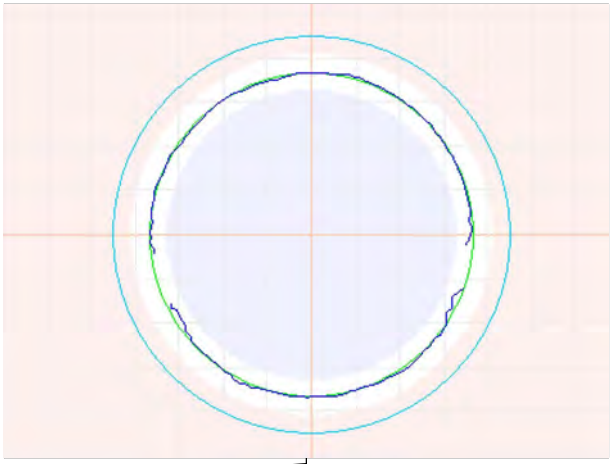
199.8ft General Observation - Corrosion to 0.6"

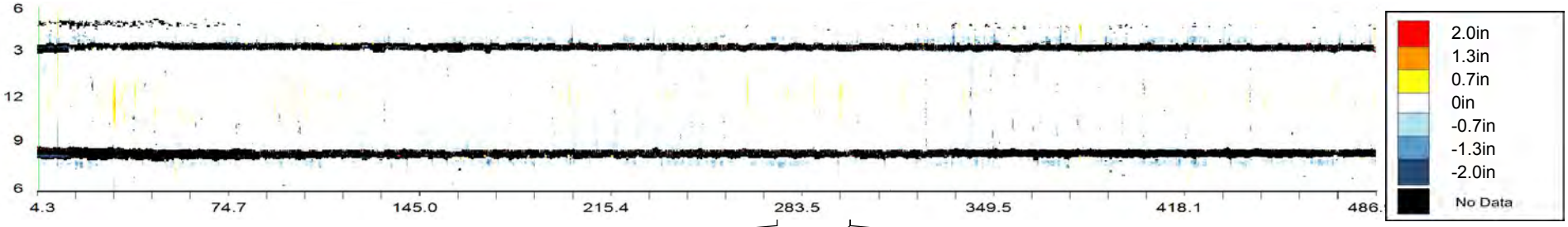


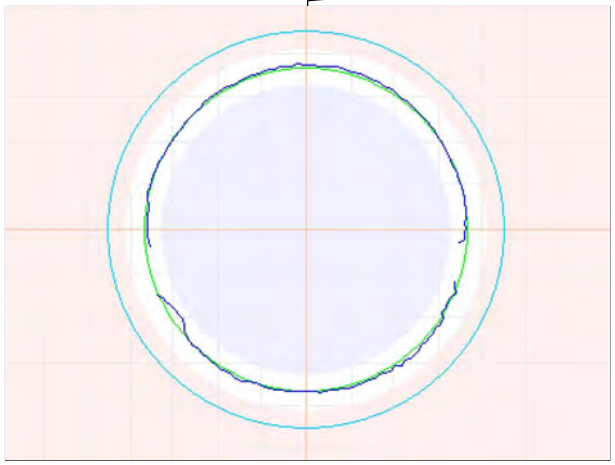
224.3ft General Observation - Corrosion to 0.3"



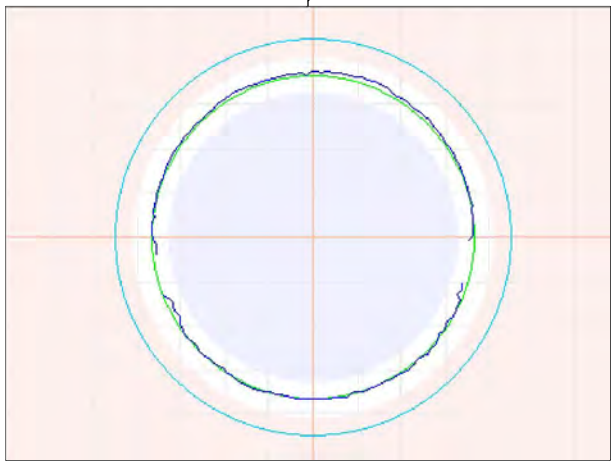
250ft General Observation







275.1ft General Observation - Corrosion to 0.4"

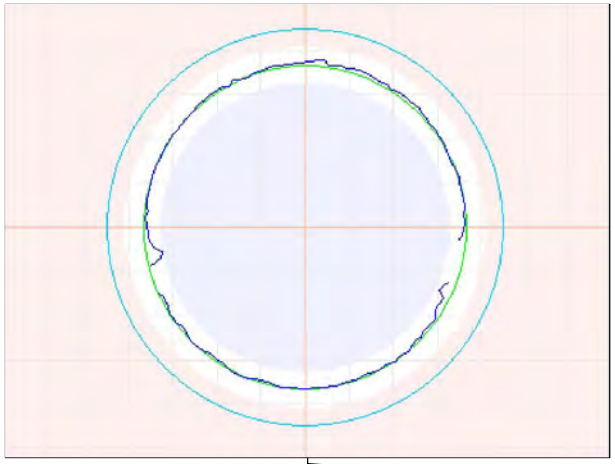


299.9ft General Observation - Corrosion to 0.6"

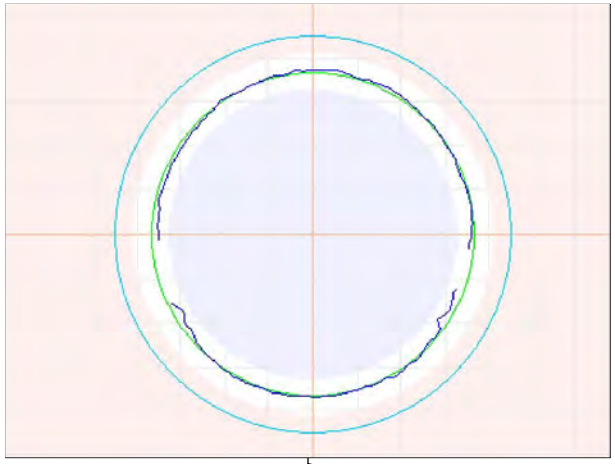
299.9ft General Observation - Corrosion to 0.6"

Observation Report

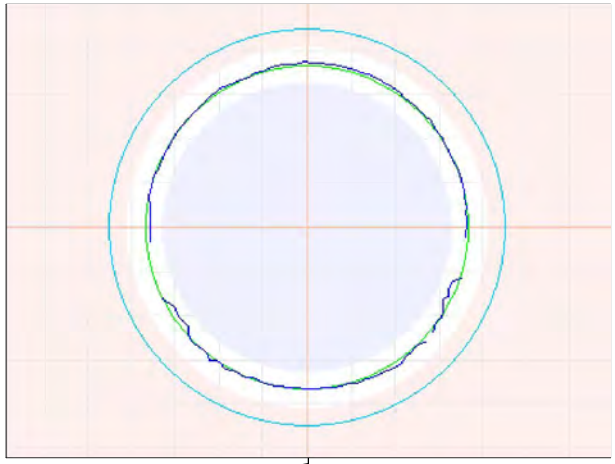
325.1ft General Observation - Corrosion to 0.6"

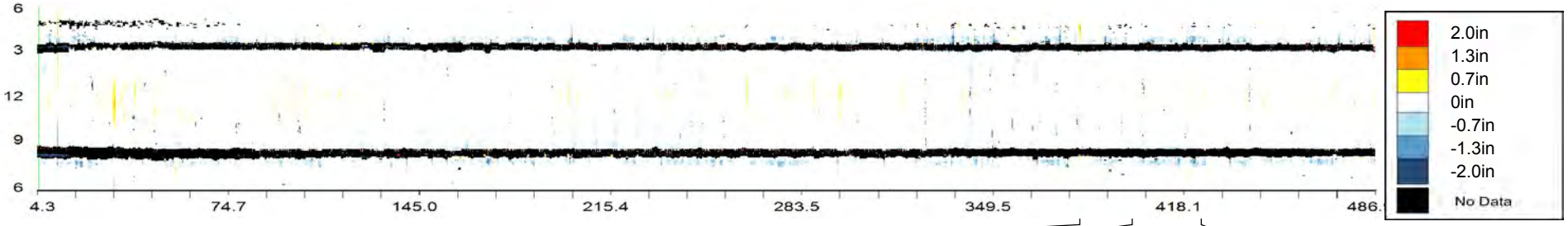


349.8ft General Observation - Corrosion to 0.4"



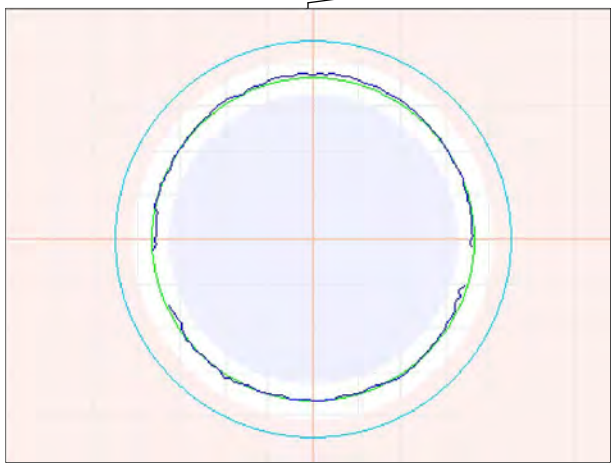
374.8ft General Observation - Corrosion to 0.4"



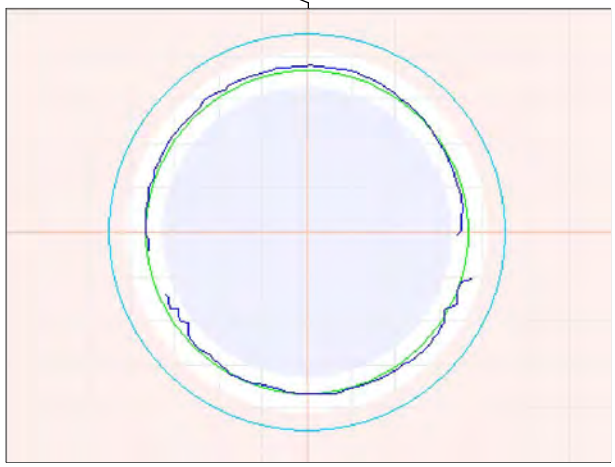


381.1ft 3D Laser Sonar Scan - Pipe Overview

399.9ft General Observation - Corrosion to 0.5"

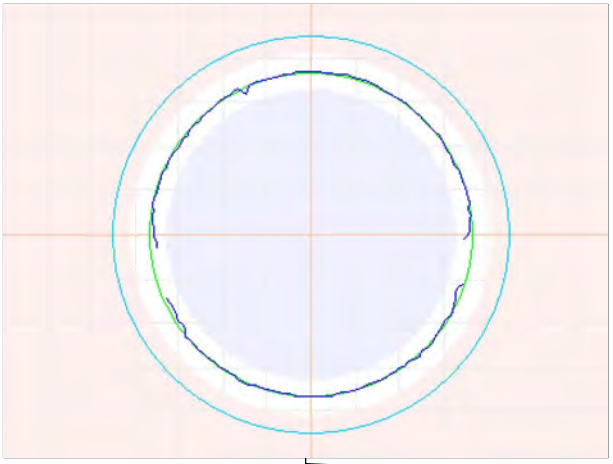


424.9ft General Observation - Corrosion to 0.6"

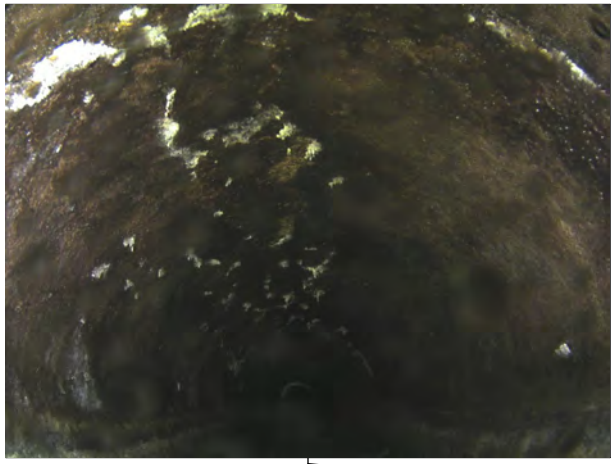


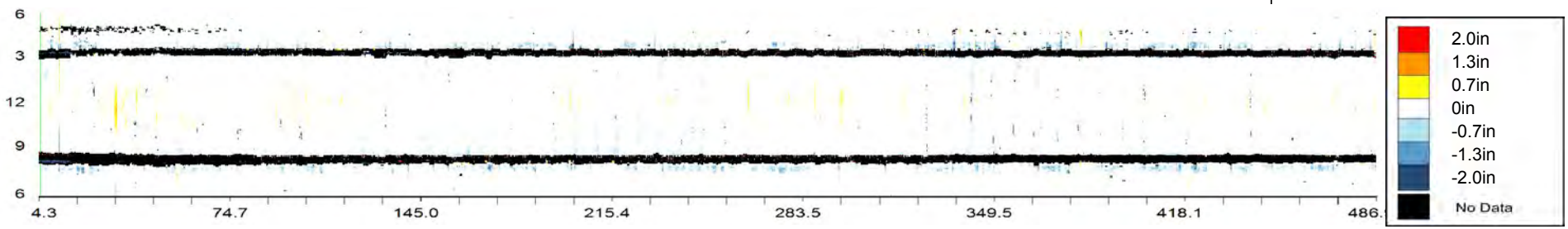
Observation Report

450ft General Observation



450ft General Observation





OVERVIEW - CMH000191 - CMH000190

Asset Number	CMH000191 - CMH000190		
Upstream MH	CMH000191	Material	Reinforced Concrete Pipe
Downstream MH	CMH000190	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	124.6 ft

Distance	Observation	Comment
6.6 ft	**Beginning of Inspection**	**CMH000191**
7.1	General Observation	Corrosion to 0.7"
25.1	General Observation	Corrosion to 0.4"
49.9	General Observation	Corrosion to 0.7"
75.2	General Observation	Corrosion to 0.6"
99.9	General Observation	Corrosion to 0.5"
124.6	Match to Reference Shape and Size	ø36"
125.3	General Observation	Corrosion to 0.4"
149.8	General Observation	Corrosion to 0.4"
161.7	Maximum Corrosion	To 1.1"
175	General Observation	Corrosion to 0.6"
199.9	General Observation	Corrosion to 0.4"
214.3	3D Laser Sonar Scan	Pipe Overview
225.1	General Observation	Corrosion to 0.8"
249.8	General Observation	Corrosion to 0.5"
264 ft	**End of Inspection**	**CMH000190**

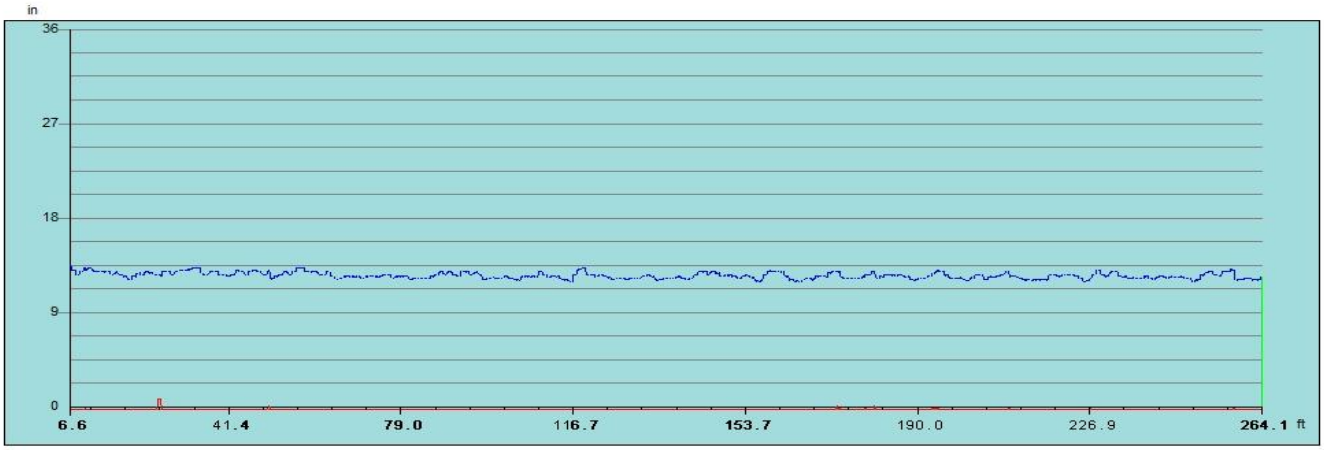
CMH000191 - CMH000190

Asset Number	CMH000191 - CMH000190	Length	264 ft
Upstream MH	CMH000191	Diameter	36 in
Downstream MH	CMH000190	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	124.6 ft
Date Profiled	17 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	13 in
Debris Volume	0 cubic feet

Debris Graph



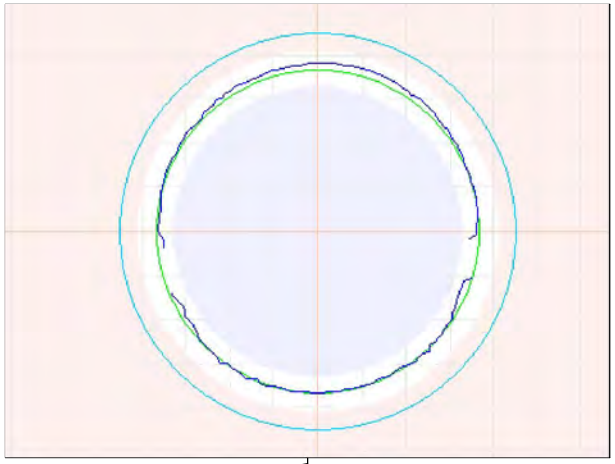
Inspection Distance (ft)

Water Level Debris Level

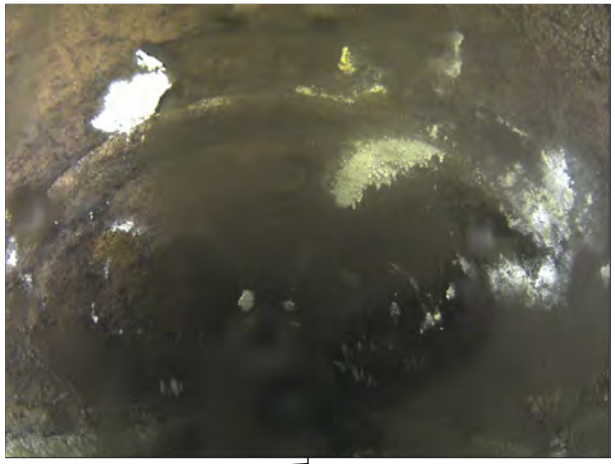
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

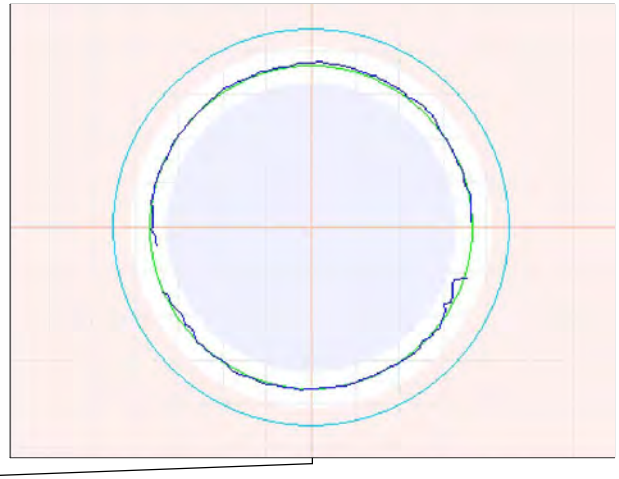
7.1ft General Observation - Corrosion to 0.7"

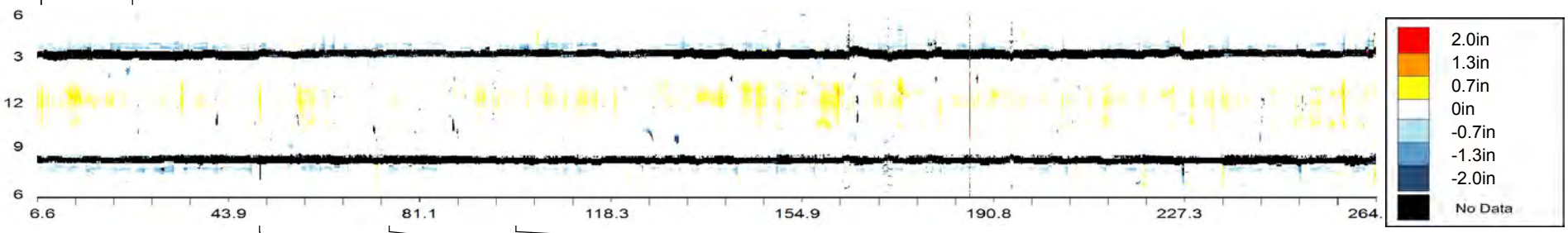


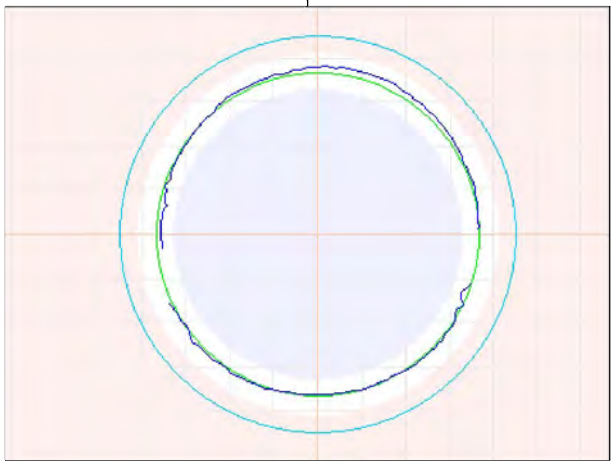
7.1ft General Observation - Corrosion to 0.7"



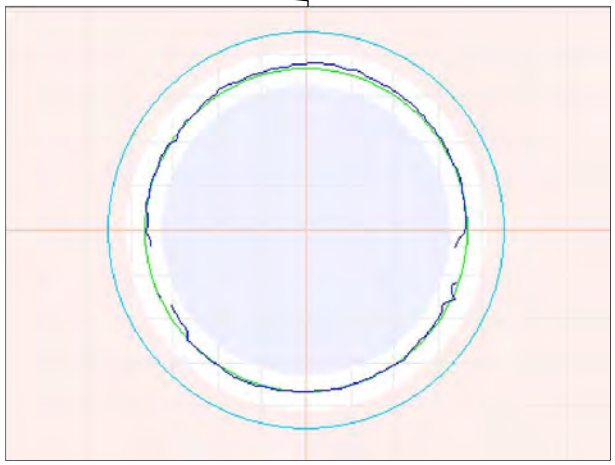
25.1ft General Observation - Corrosion to 0.4"



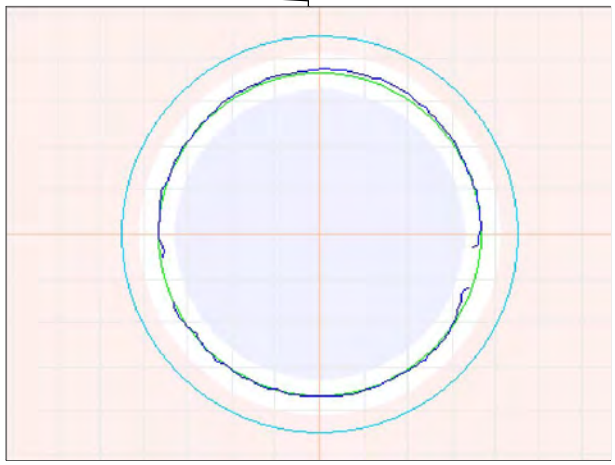




49.9ft General Observation - Corrosion to 0.7"



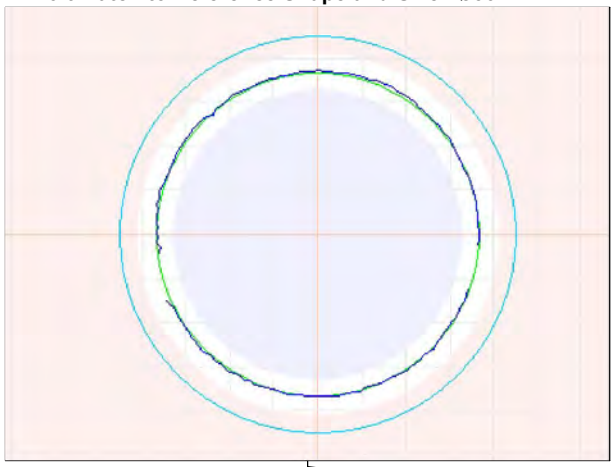
75.2ft General Observation - Corrosion to 0.6"



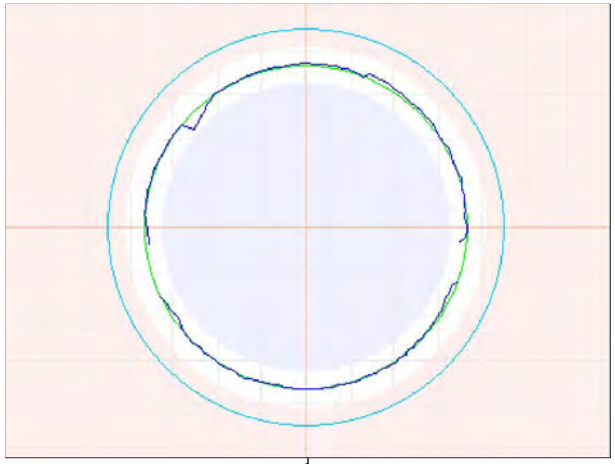
99.9ft General Observation - Corrosion to 0.5"

Observation Report

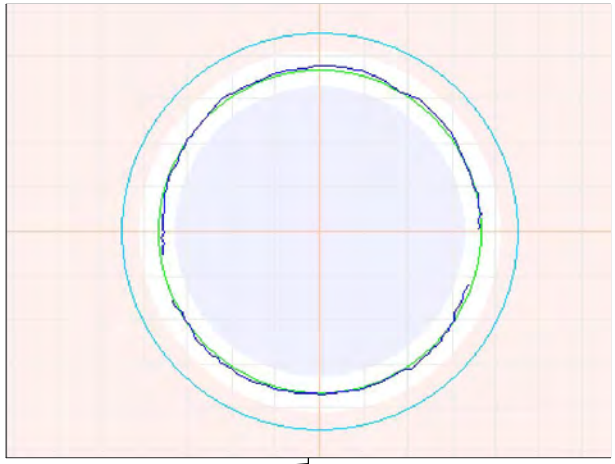
124.6ft Match to Reference Shape and Size - ø36"

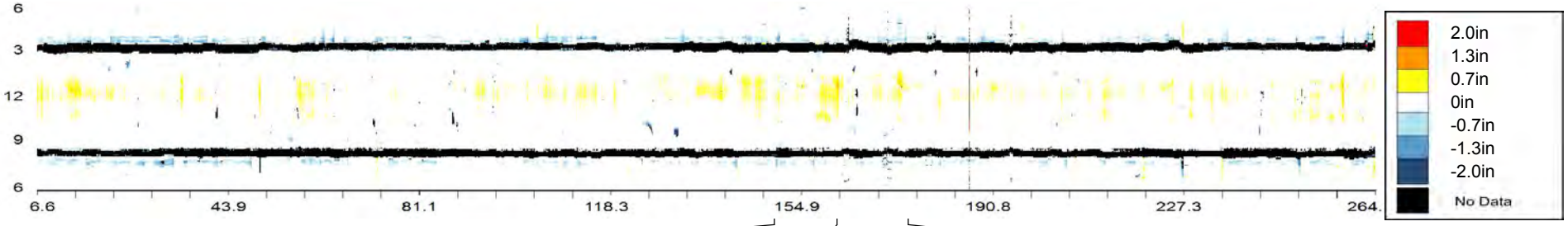


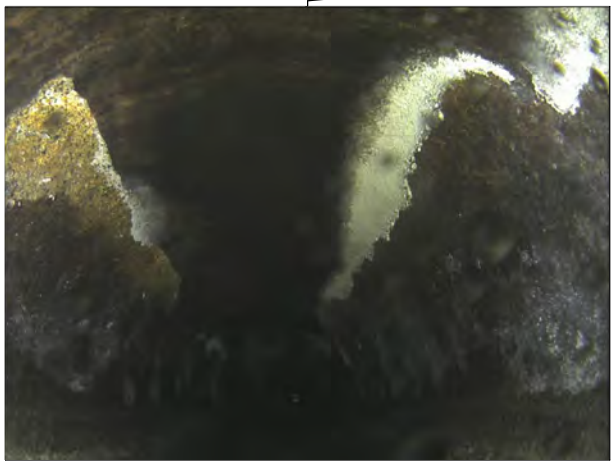
125.3ft General Observation - Corrosion to 0.4"



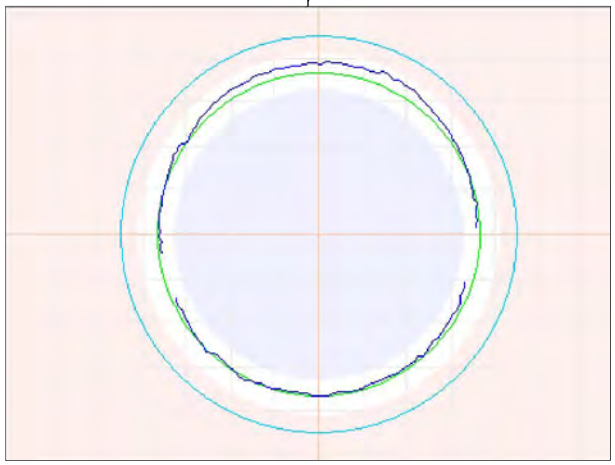
149.8ft General Observation - Corrosion to 0.4"



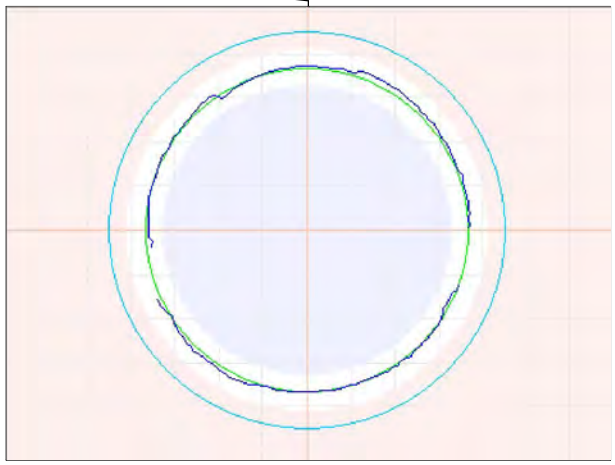




149.8ft General Observation - Corrosion to 0.4"



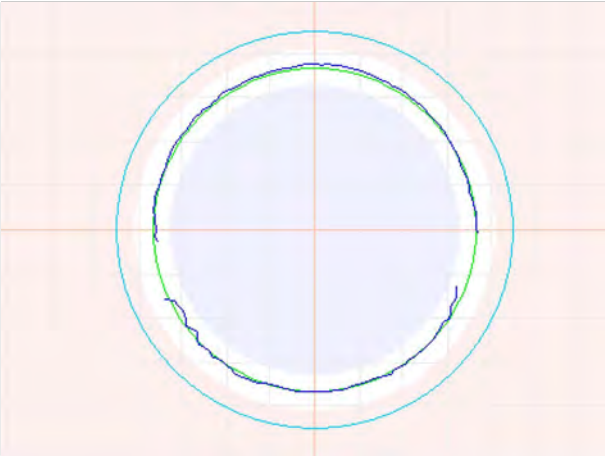
161.7ft Maximum Corrosion - To 1.1"



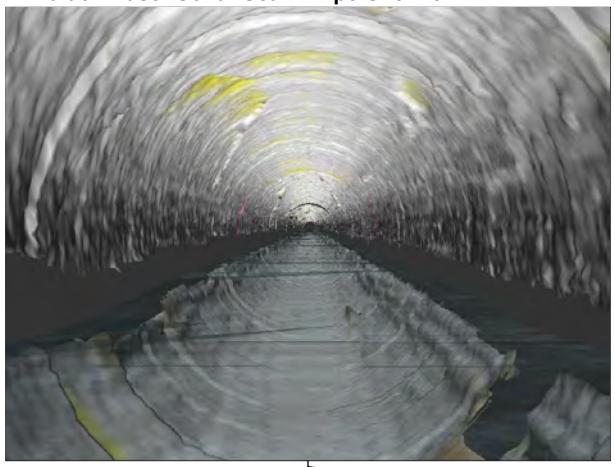
175ft General Observation - Corrosion to 0.6"

Observation Report

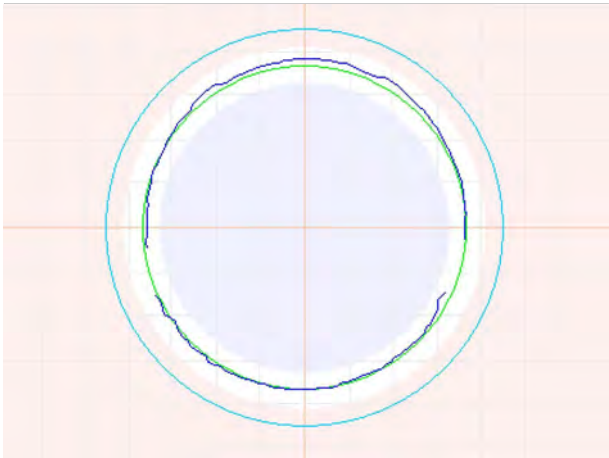
199.9ft General Observation - Corrosion to 0.4"

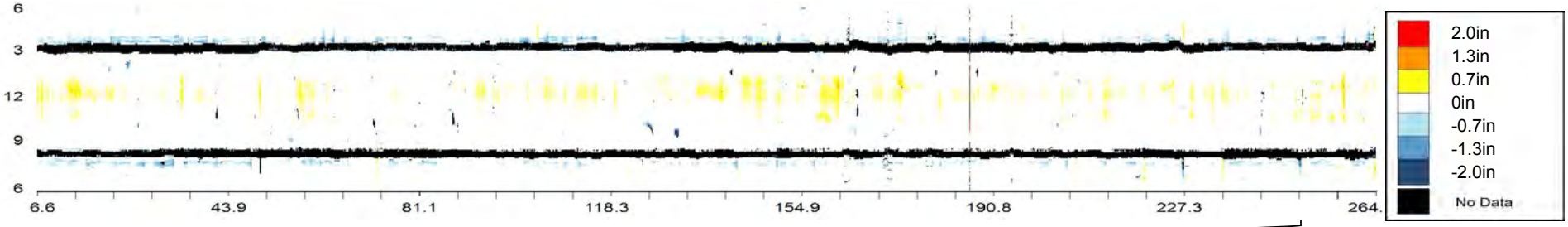


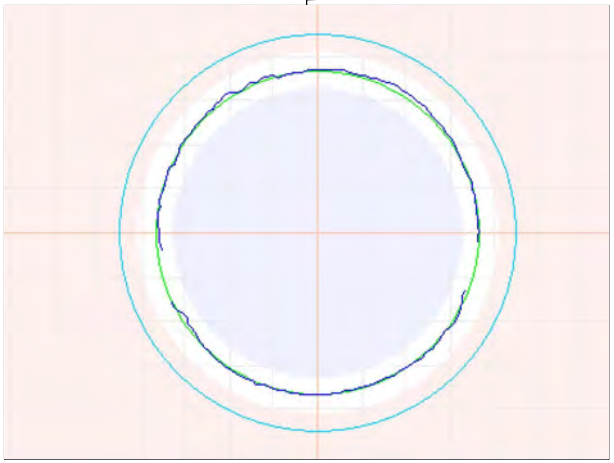
214.3ft 3D Laser Sonar Scan - Pipe Overview



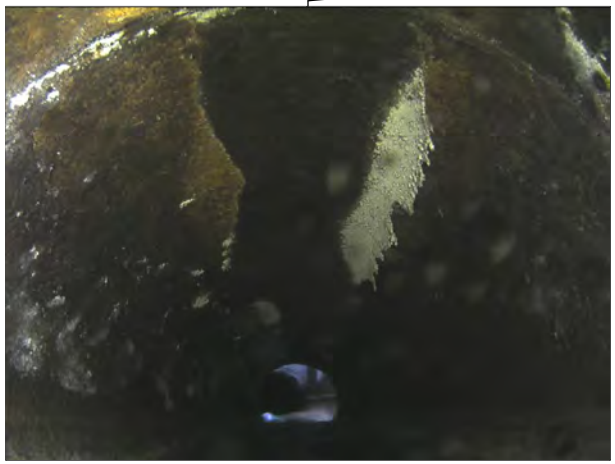
225.1ft General Observation - Corrosion to 0.8"







249.8ft General Observation - Corrosion to 0.5"



249.8ft General Observation - Corrosion to 0.5"

OVERVIEW - CMH000192 - CMH000191

Asset Number	CMH000192 - CMH000191		
Upstream MH	CMH000192	Material	Reinforced Concrete Pipe
Downstream MH	CMH000191	Size & Shape	42 in Circle
Survey Direction	Downstream	Match to Reference	239.7 ft

Distance	Observation	Comment
1.9 ft	**Beginning of Inspection**	**CMH000192**
3	General Observation	
16.5	Maximum Corrosion	To 0.8"
25	General Observation	Corrosion to 0.3"
50.1	General Observation	
74.9	General Observation	Corrosion to 0.3"
100	General Observation	
125.3	General Observation	Corrosion to 0.2"
149.9	General Observation	
175	General Observation	Corrosion to 0.2"
199.9	General Observation	
224.8	General Observation	Corrosion to 0.3"
239.7	Match to Reference Shape and Size	ø42"
249.8	General Observation	
275	General Observation	Corrosion to 0.5"
300	General Observation	
325	General Observation	Corrosion to 0.3"
349.8	General Observation	Corrosion to 0.4"
375.4	General Observation	Corrosion to 0.4"
399.9	General Observation	Corrosion to 0.5"
425.4	General Observation	Corrosion to 0.4"
449.8	General Observation	
461.2	3D Laser Sonar Scan	Pipe Overview
474.8	General Observation	Corrosion to 0.5"
500	General Observation	

OVERVIEW - CMH000192 - CMH000191

Asset Number	CMH000192 - CMH000191		
Upstream MH	CMH000192	Material	Reinforced Concrete Pipe
Downstream MH	CMH000191	Size & Shape	42 in Circle
Survey Direction	Downstream	Match to Reference	239.7 ft

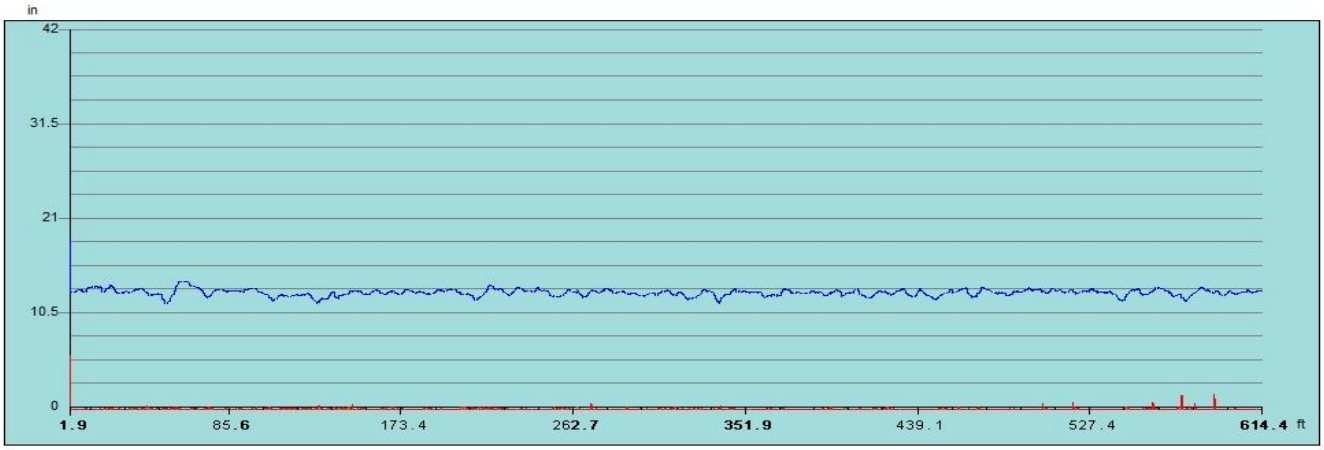
Distance	Observation	Comment
524.9	General Observation	Corrosion to 0.4"
549.9	General Observation	
574.8	General Observation	Corrosion to 0.3"
599.7	General Observation	
614.2 ft	**End of Inspection**	**CMH000191**

CMH000192 - CMH000191			
Asset Number	CMH000192 - CMH000191	Length	615 ft
Upstream MH	CMH000192	Diameter	42 in
Downstream MH	CMH000191	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	239.7 ft
Date Profiled	16 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	13 in
Debris Volume	0 cubic feet

Debris Graph



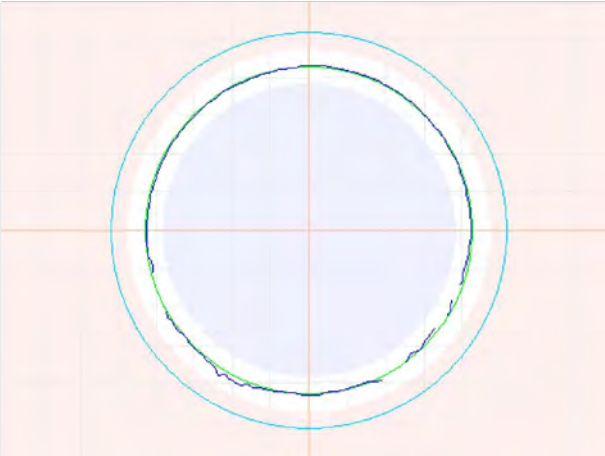
Inspection Distance (ft)

Water Level Debris Level

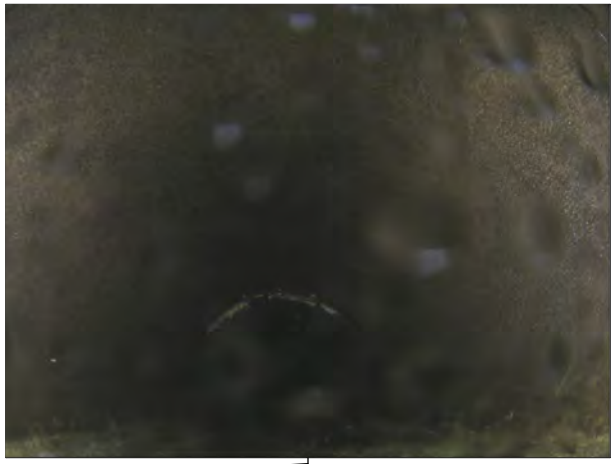
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

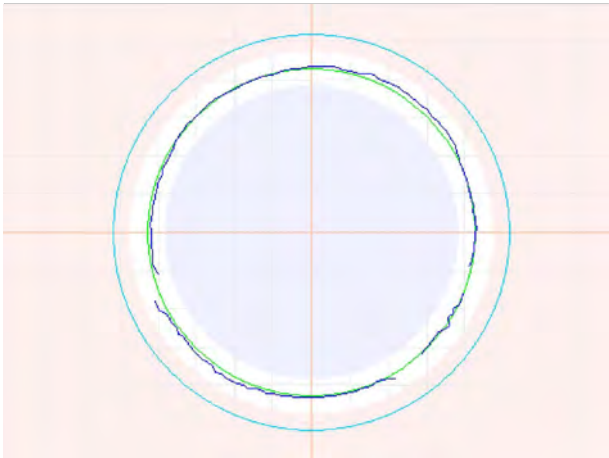
3ft General Observation

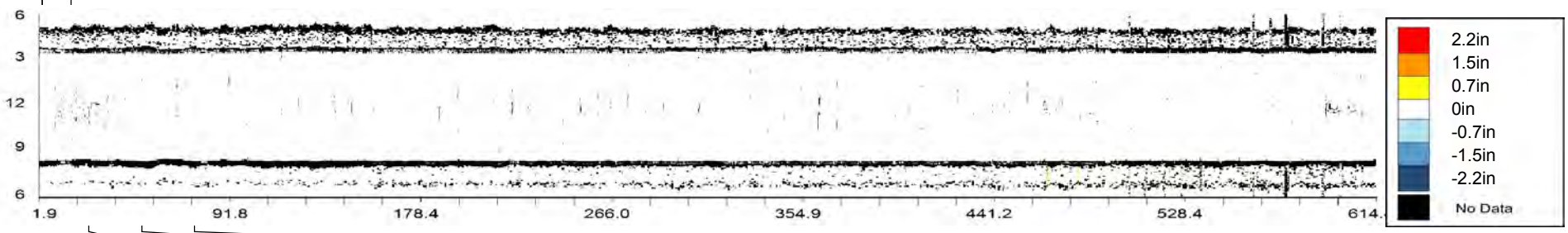


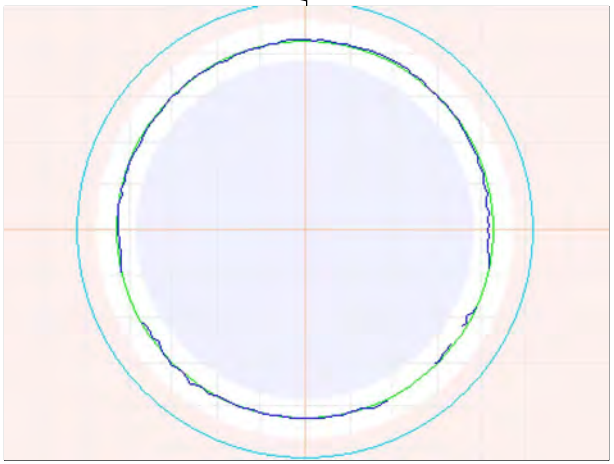
3ft General Observation



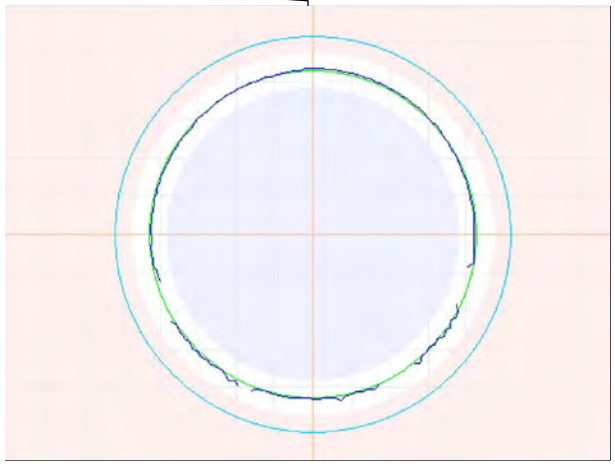
16.5ft Maximum Corrosion - To 0.8"



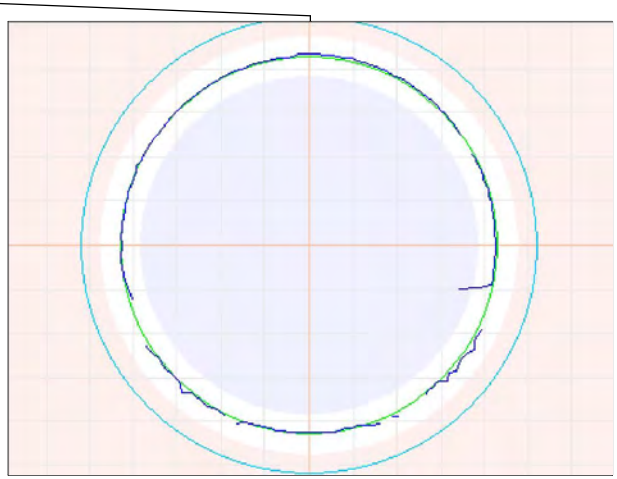




25ft General Observation - Corrosion to 0.3"



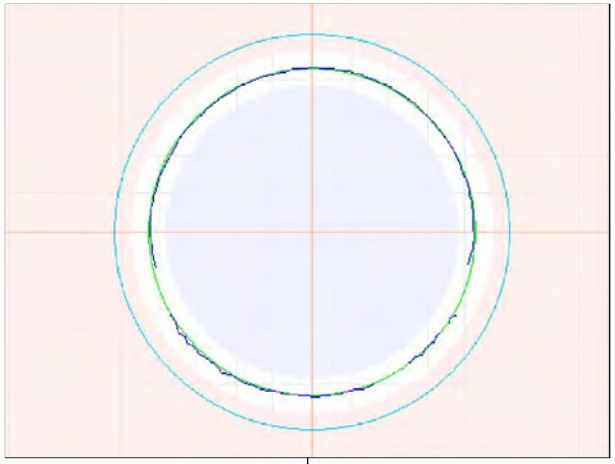
50.1ft General Observation



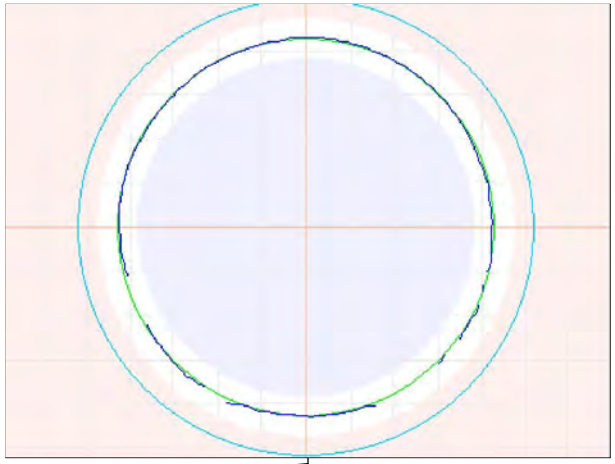
74.9ft General Observation - Corrosion to 0.3"

Observation Report

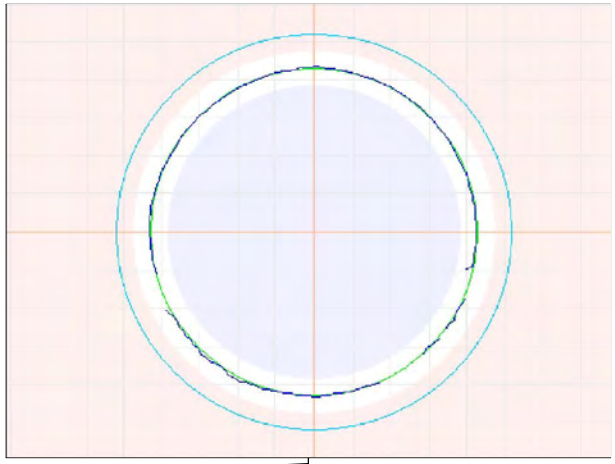
100ft General Observation

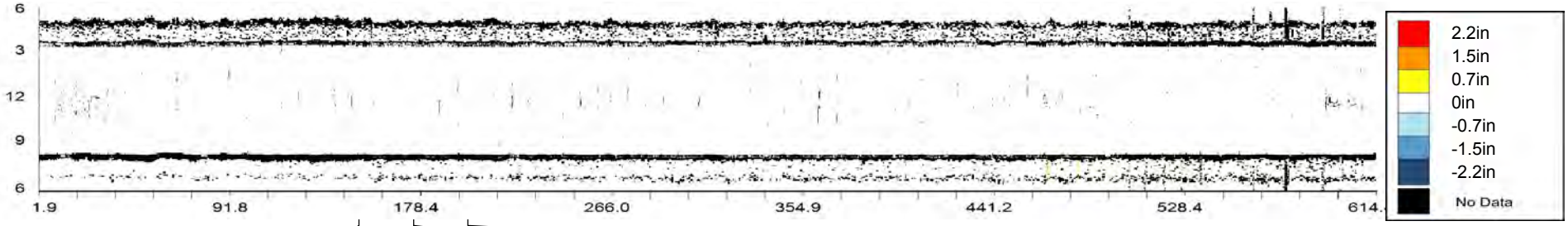


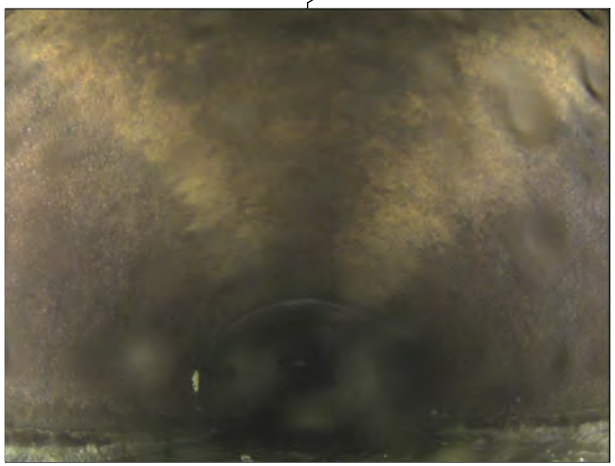
125.3ft General Observation - Corrosion to 0.2"



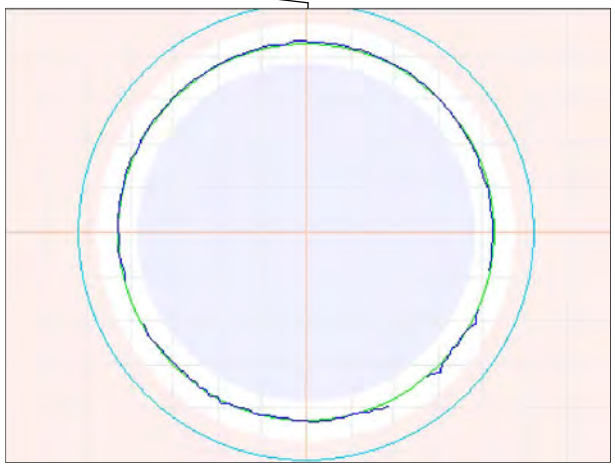
149.9ft General Observation



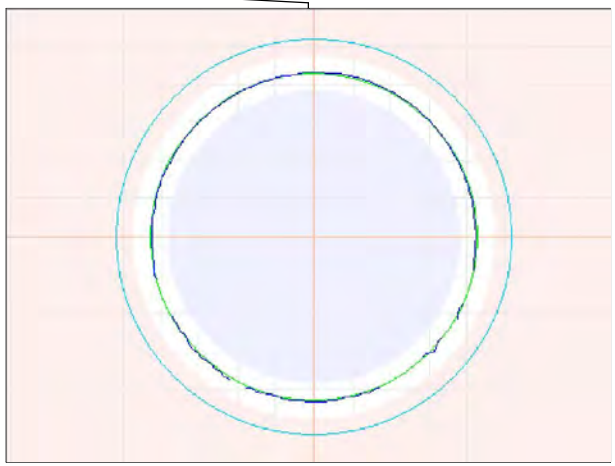




149.9ft General Observation



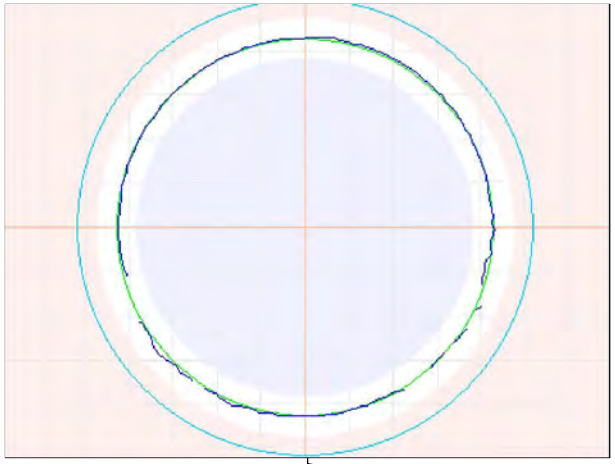
175ft General Observation - Corrosion to 0.2"



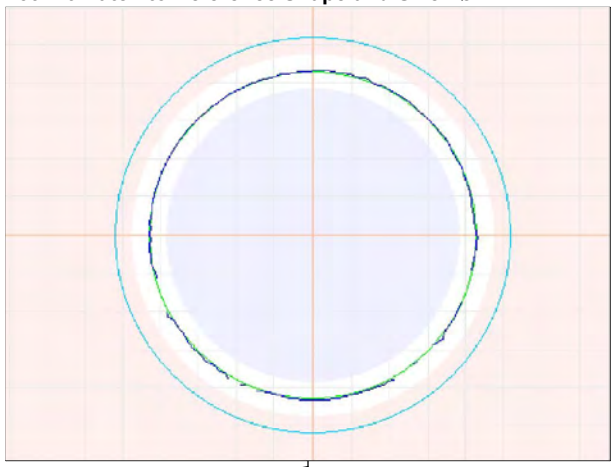
199.9ft General Observation

Observation Report

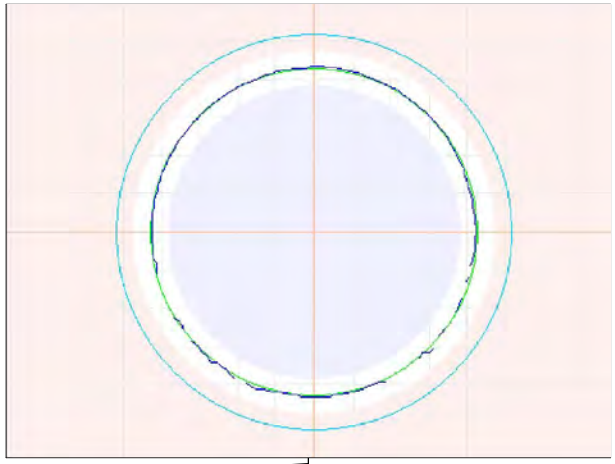
224.8ft General Observation - Corrosion to 0.3"

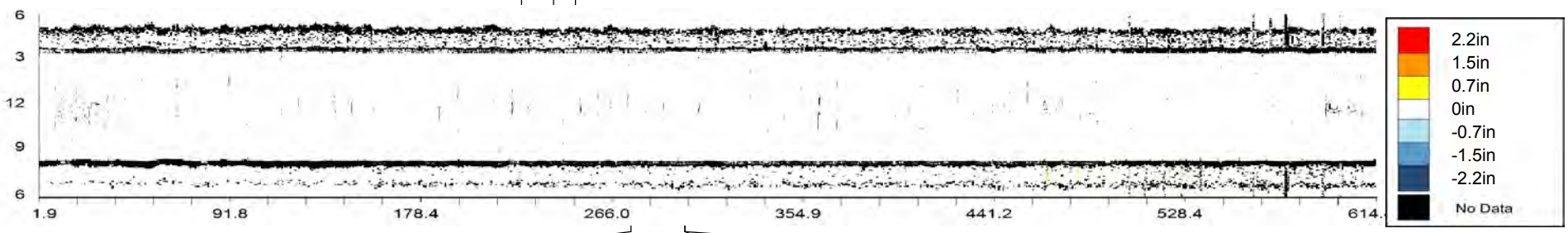


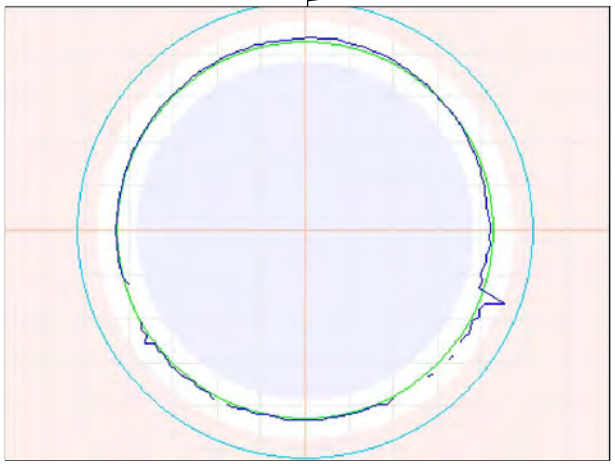
239.7ft Match to Reference Shape and Size - ø42"



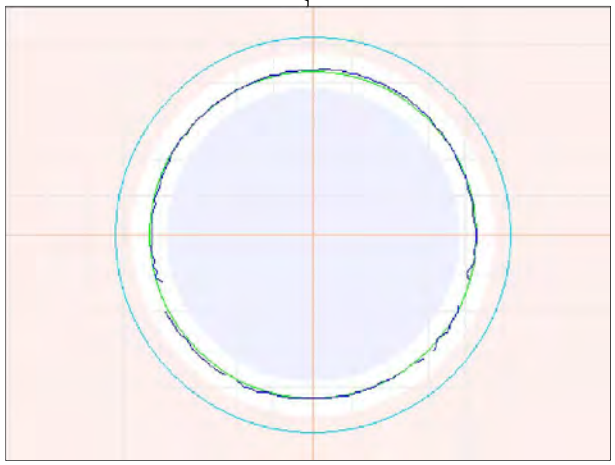
249.8ft General Observation



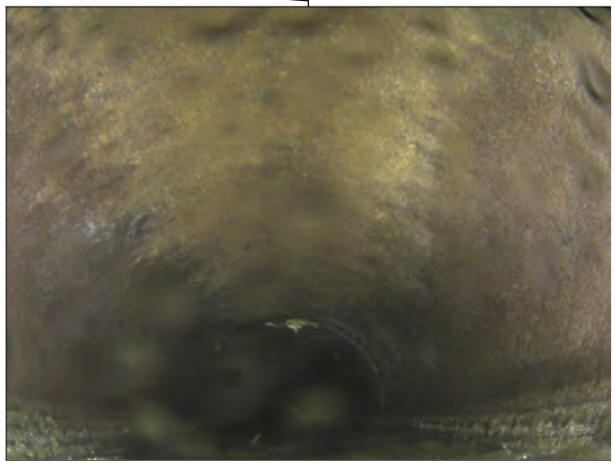




275ft General Observation - Corrosion to 0.5"



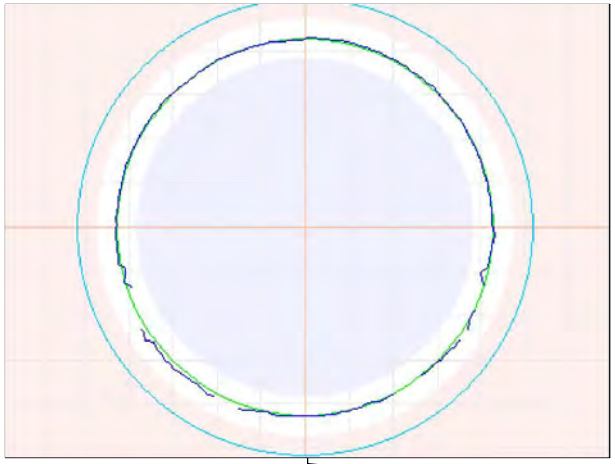
300ft General Observation



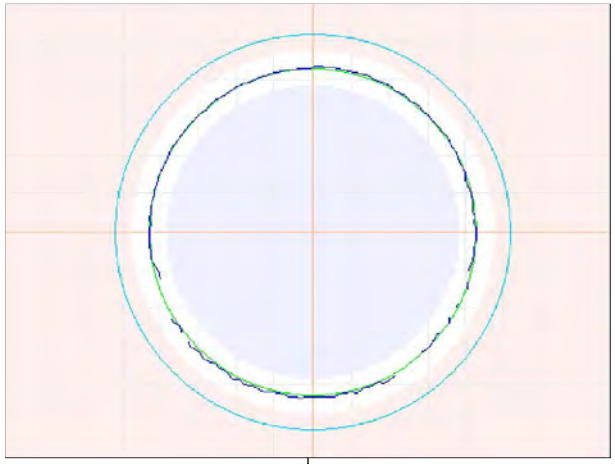
300ft General Observation

Observation Report

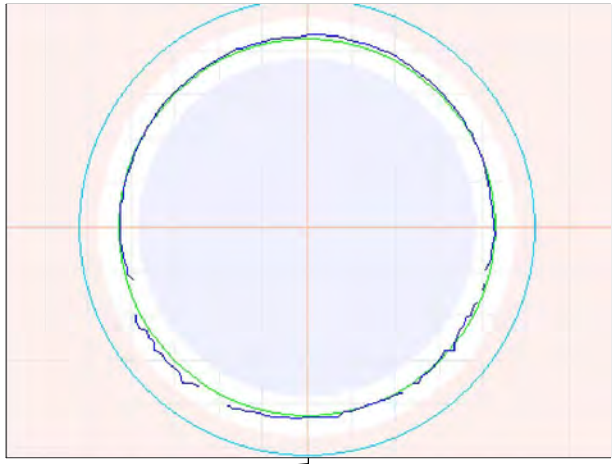
325ft General Observation - Corrosion to 0.3"

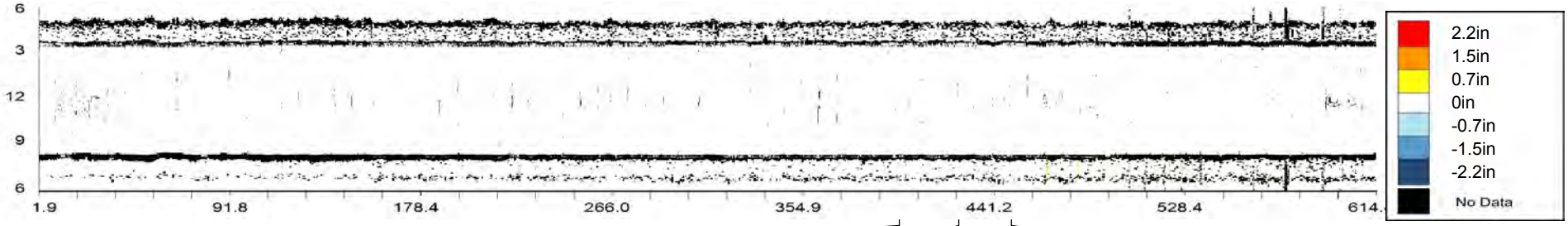


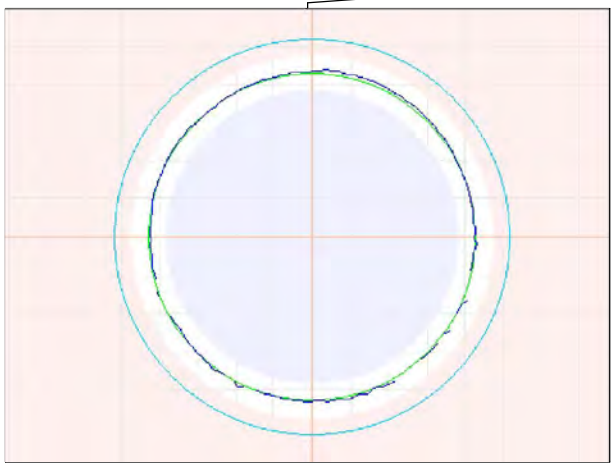
349.8ft General Observation - Corrosion to 0.4"



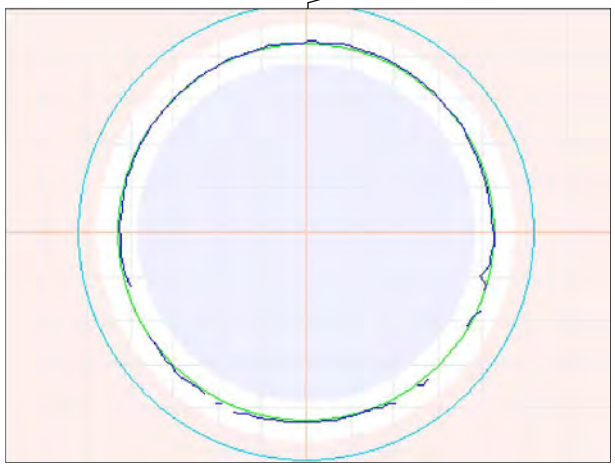
375.4ft General Observation - Corrosion to 0.4"



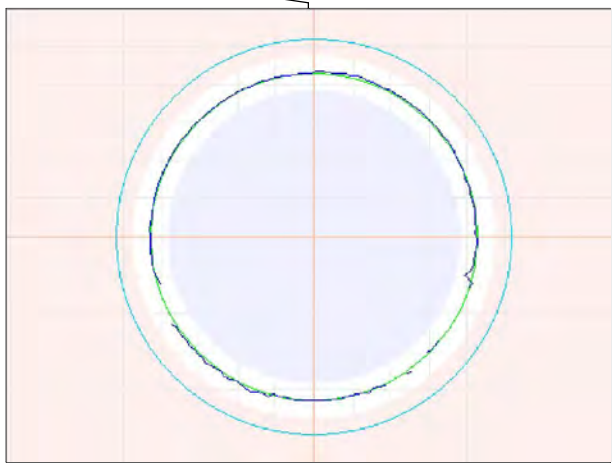




399.9ft General Observation - Corrosion to 0.5"



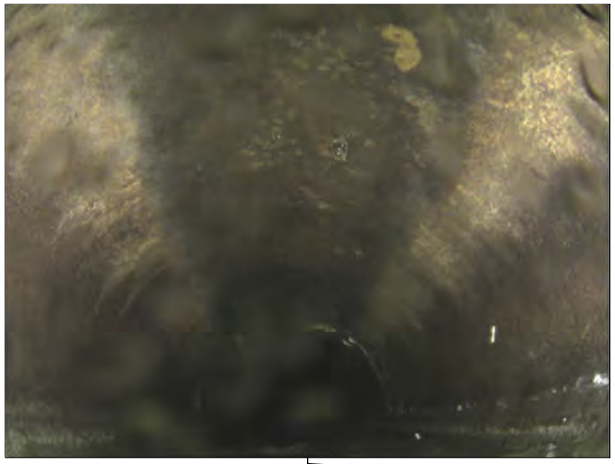
425.4ft General Observation - Corrosion to 0.4"



449.8ft General Observation

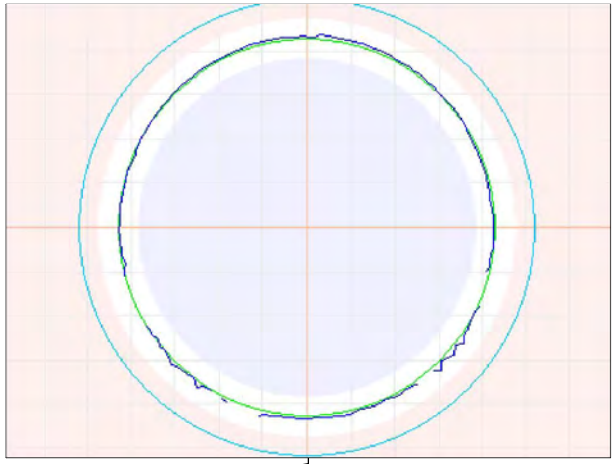
Observation Report

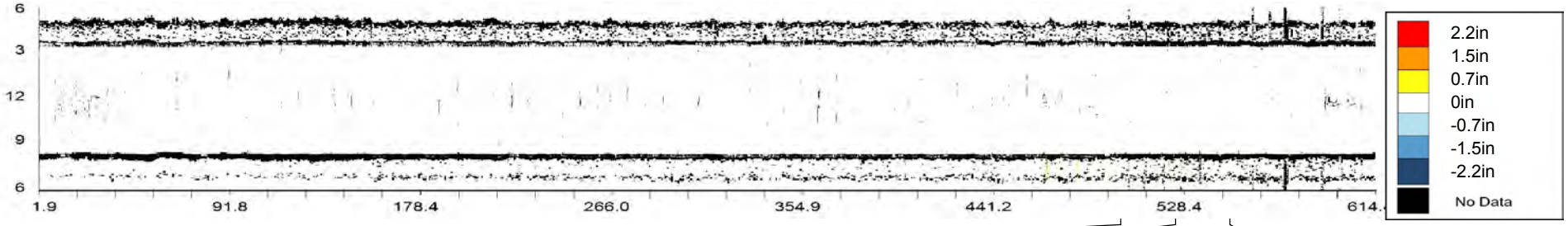
449.8ft General Observation

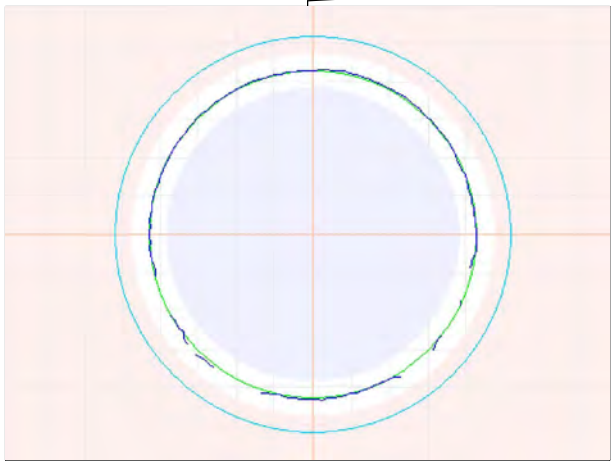


461.2ft 3D Laser Sonar Scan - Pipe Overview

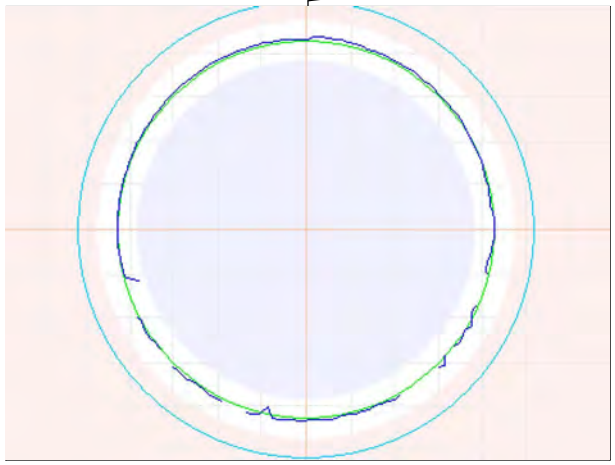
474.8ft General Observation - Corrosion to 0.5"



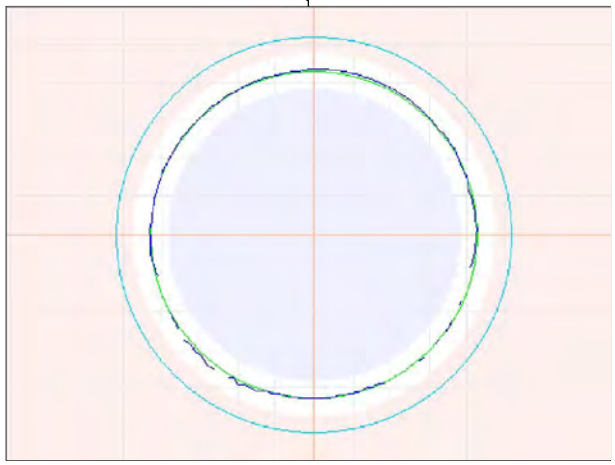




500ft General Observation



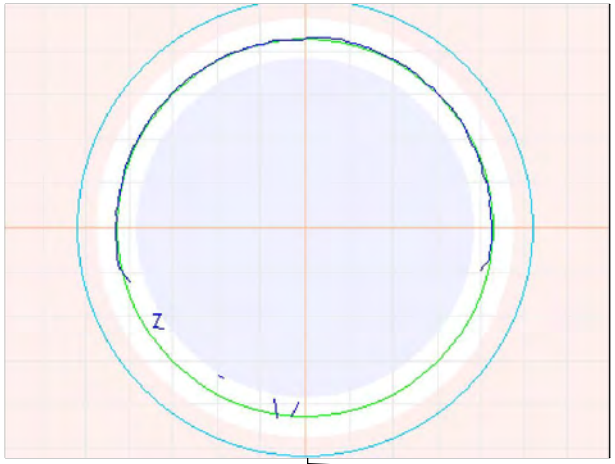
524.9ft General Observation - Corrosion to 0.4"



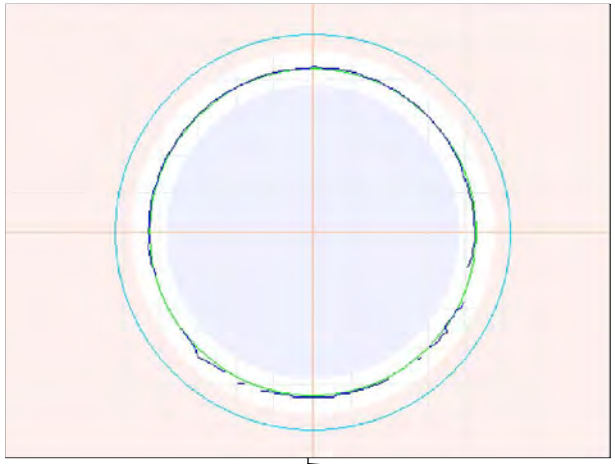
549.9ft General Observation

Observation Report

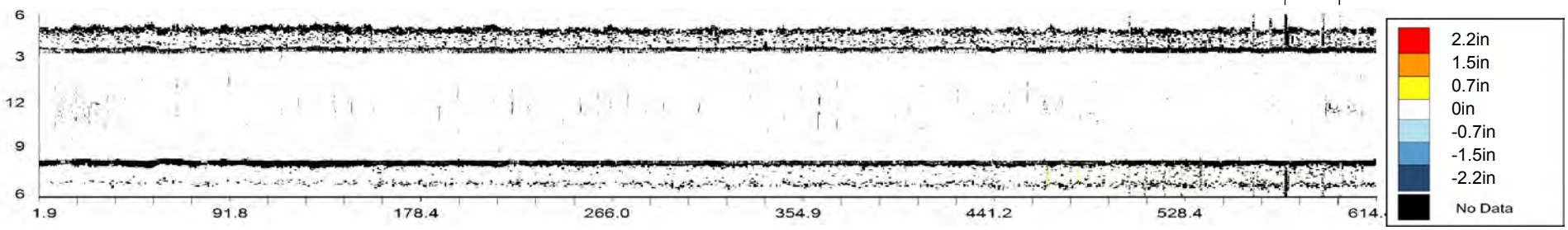
574.8ft General Observation - Corrosion to 0.3"



599.7ft General Observation



599.7ft General Observation



OVERVIEW - CMH000193 - CMH000192

Asset Number	CMH000193 - CMH000192		
Upstream MH	CMH000193	Material	Reinforced Concrete Pipe
Downstream MH	CMH000192	Size & Shape	42 in Circle
Survey Direction	Downstream	Match to Reference	114.2 ft

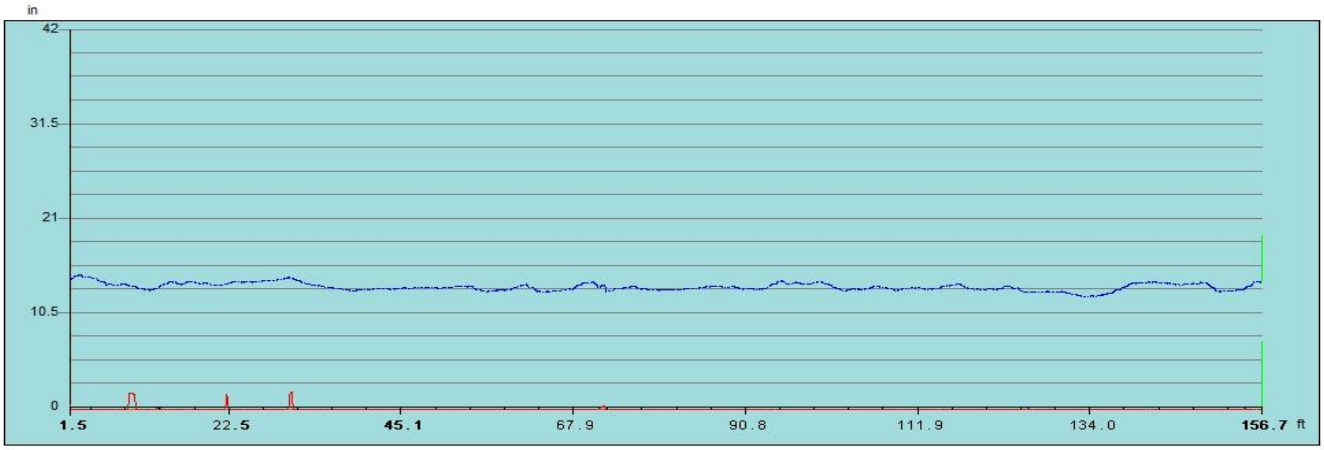
Distance	Observation	Comment
1.5 ft	**Beginning of Inspection**	**CMH000193**
2	General Observation	Corrosion to 0.5"
25	General Observation	Corrosion to 0.7"
50	General Observation	Corrosion to 0.8"
71.7	Point of Interest	Measurement inside reference in sonar to 3.3"
72.1	Maximum Corrosion	To 1.3"
75.4	General Observation	Corrosion to 0.6"
81.4	3D Laser Sonar Scan	Pipe Overview
99.9	General Observation	Corrosion to 0.5"
114.2	Match to Reference Shape and Size	ø42"
125.1	General Observation	Corrosion to 0.5"
149.8	General Observation	Corrosion to 1.0"
156.6 ft	**End of Inspection**	**CMH000192**

CMH000193 - CMH000192			
Asset Number	CMH000193 - CMH000192	Length	157 ft
Upstream MH	CMH000193	Diameter	42 in
Downstream MH	CMH000192	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	114.2 ft
Date Profiled	16 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	14 in
Debris Volume	0 cubic feet

Debris Graph



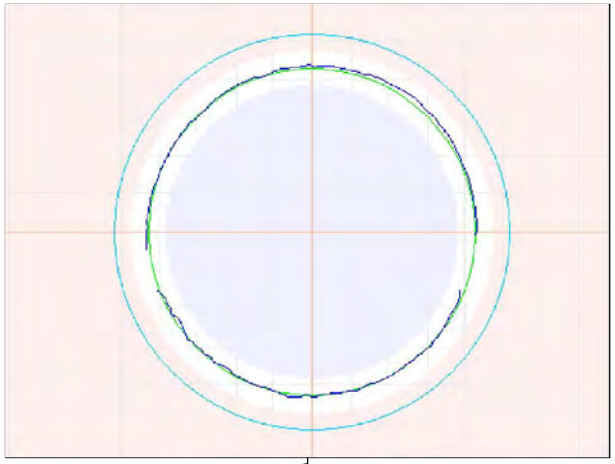
Inspection Distance (ft)

Water Level Debris Level

*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

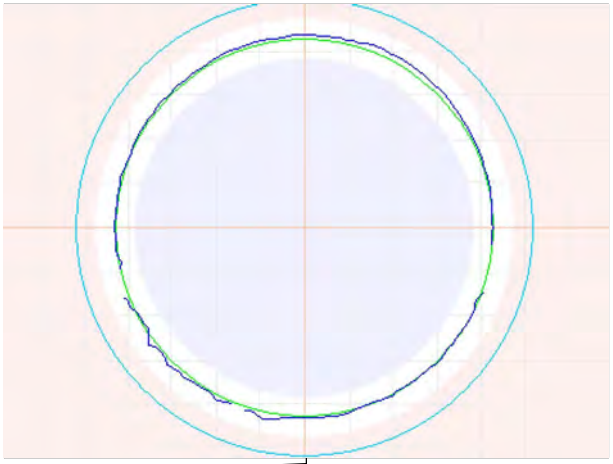
Observation Report

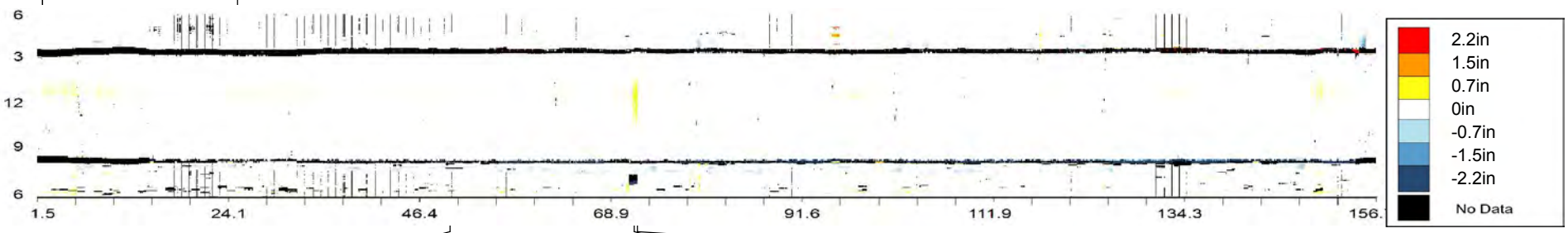
2ft General Observation - Corrosion to 0.5"

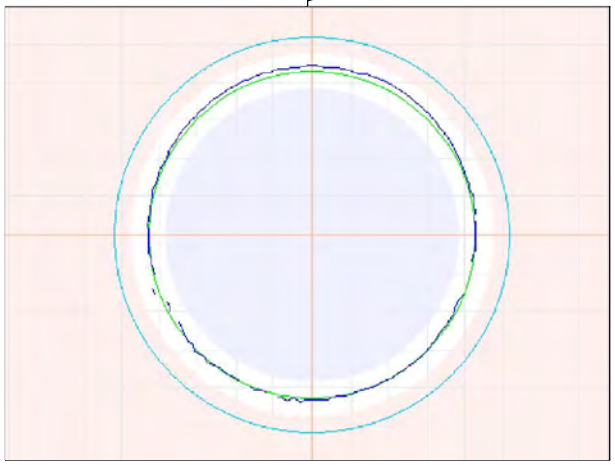


2ft General Observation - Corrosion to 0.5"

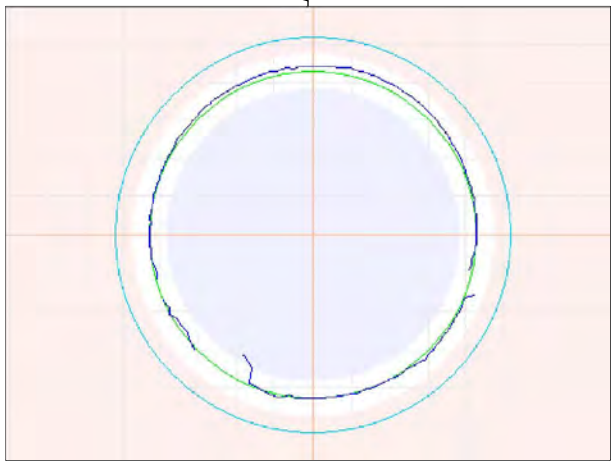
25ft General Observation - Corrosion to 0.7"



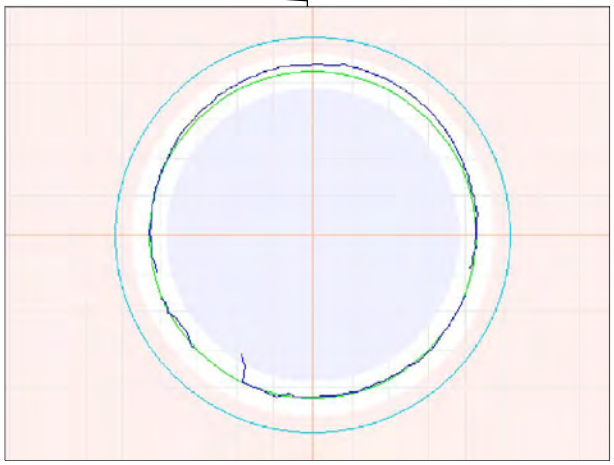




50ft General Observation - Corrosion to 0.8"



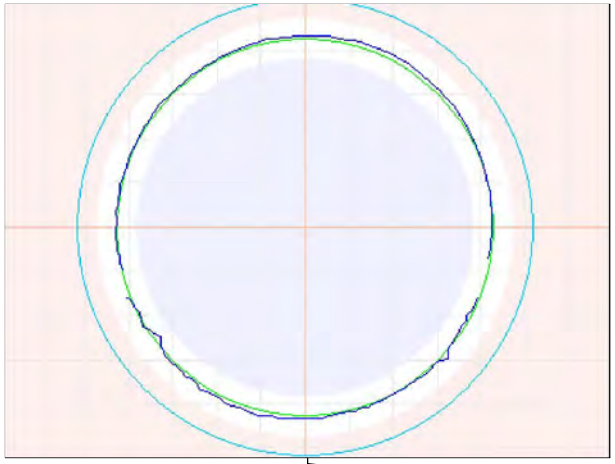
71.7ft Point of Interest - Measurement inside reference in sonar to 3.3"



72.1ft Maximum Corrosion - To 1.3"

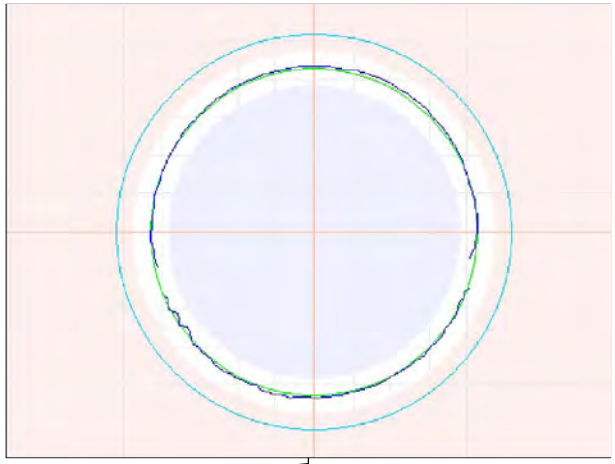
Observation Report

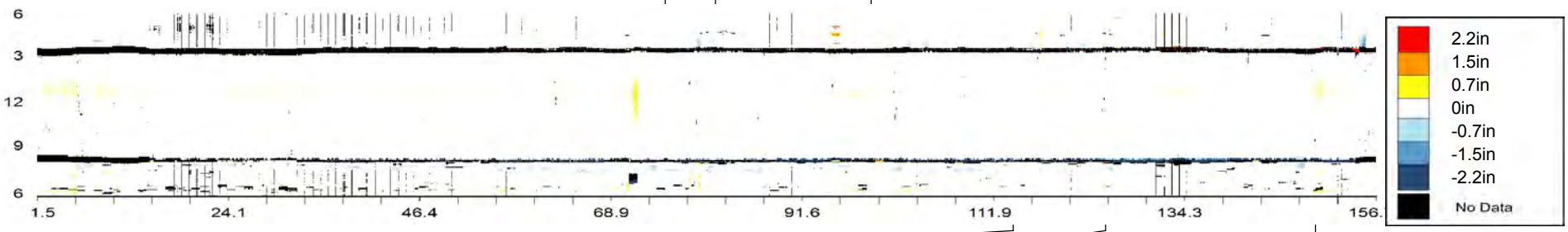
75.4ft General Observation - Corrosion to 0.6"

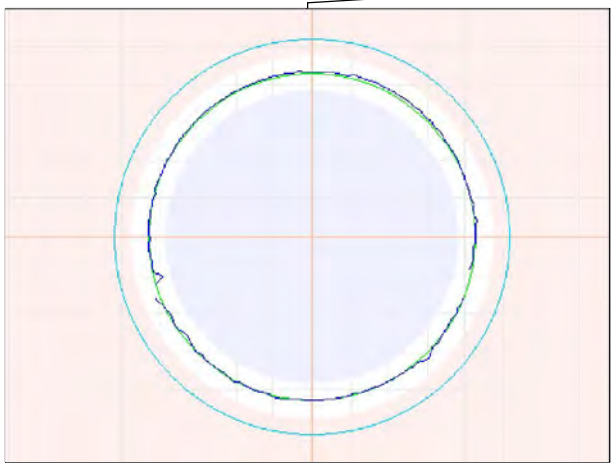


81.4ft 3D Laser Sonar Scan - Pipe Overview

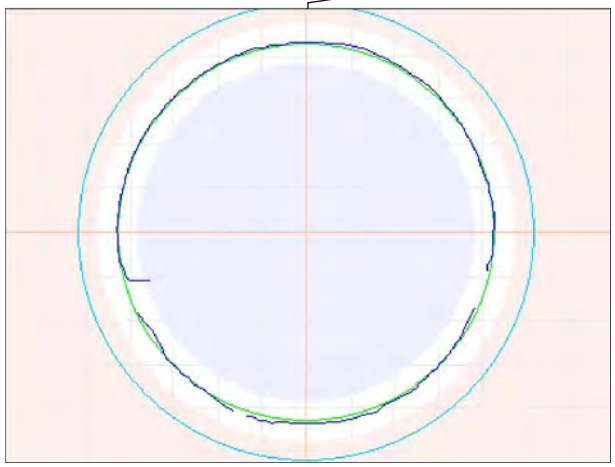
99.9ft General Observation - Corrosion to 0.5"



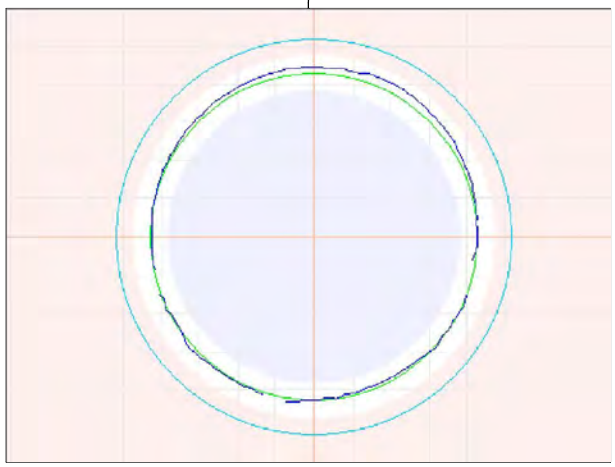




114.2ft Match to Reference Shape and Size - ø42"



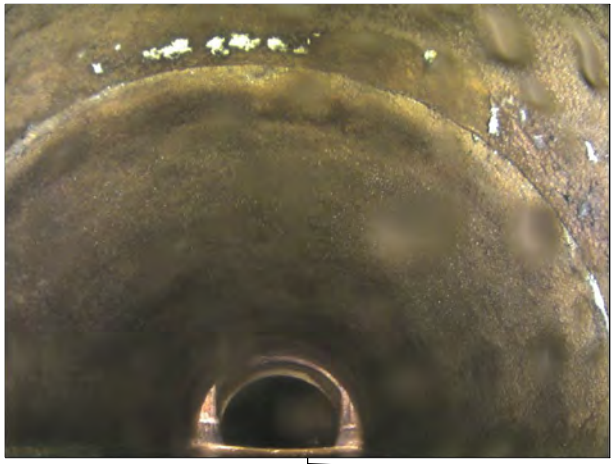
125.1ft General Observation - Corrosion to 0.5"

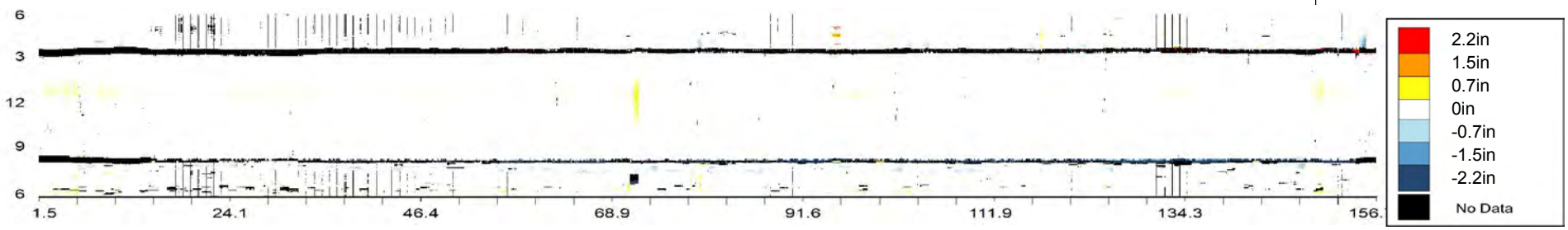


149.8ft General Observation - Corrosion to 1.0"

Observation Report

149.8ft General Observation - Corrosion to 1.0"





OVERVIEW - CMH000194 - CMH000193

Asset Number	CMH000194 - CMH000193		
Upstream MH	CMH000194	Material	Reinforced Concrete Pipe
Downstream MH	CMH000193	Size & Shape	42 in Circle
Survey Direction	Downstream	Match to Reference	100.4 ft

Distance	Observation	Comment
1.8 ft	**Beginning of Inspection**	**CMH000194**
3	General Observation	
25.4	General Observation	Corrosion to 0.2"
49.9	General Observation	Measurement inside reference to 0.5"
75	General Observation	Corrosion to 0.3"
100	General Observation	Corrosion to 0.7"
100.4	Match to Reference Shape and Size	ø42"
125.4	General Observation	Corrosion to 0.3"
149.4	Maximum Corrosion	To 0.7"
149.8	General Observation	Corrosion to 0.6"
175.3	General Observation	Corrosion to 0.2"
200.1	General Observation	
224.9	General Observation	Corrosion to 0.2"
249.9	General Observation	
274.8	General Observation	Corrosion to 0.2"
299.8	General Observation	
319.5	3D Laser Sonar Scan	Pipe Overview
325.1	General Observation	Measurement inside reference to 0.4"
350	General Observation	Corrosion to 0.6"
375	General Observation	Corrosion to 0.2"
399.9	General Observation	
425	General Observation	Corrosion to 0.4"
449.9	General Observation	
474.7	General Observation	Corrosion to 0.4"
499.7	General Observation	

OVERVIEW - CMH000194 - CMH000193

Asset Number	CMH000194 - CMH000193		
Upstream MH	CMH000194	Material	Reinforced Concrete Pipe
Downstream MH	CMH000193	Size & Shape	42 in Circle
Survey Direction	Downstream	Match to Reference	100.4 ft

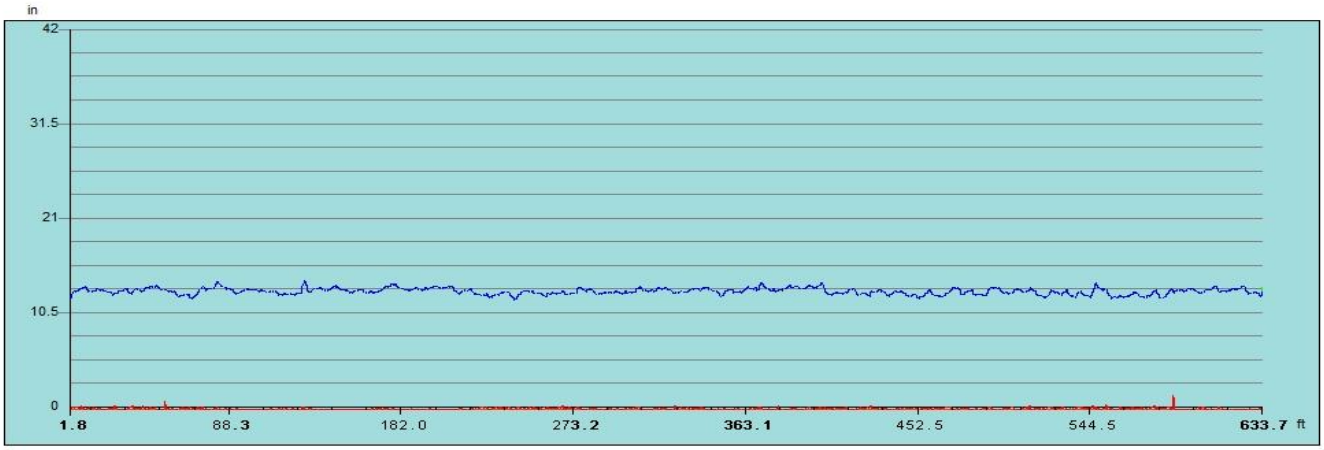
Distance	Observation	Comment
525.1	General Observation	Corrosion to 0.2"
550	General Observation	Corrosion to 0.5"
575.2	General Observation	Corrosion to 0.2"
599.9	General Observation	Corrosion to 0.5"
625	General Observation	Corrosion to 0.4"
633.5 ft	**End of Inspection**	**CMH000193**

CMH000194 - CMH000193			
Asset Number	CMH000194 - CMH000193	Length	635 ft
Upstream MH	CMH000194	Diameter	42 in
Downstream MH	CMH000193	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	100.4 ft
Date Profiled	16 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	13 in
Debris Volume	1 cubic feet

Debris Graph



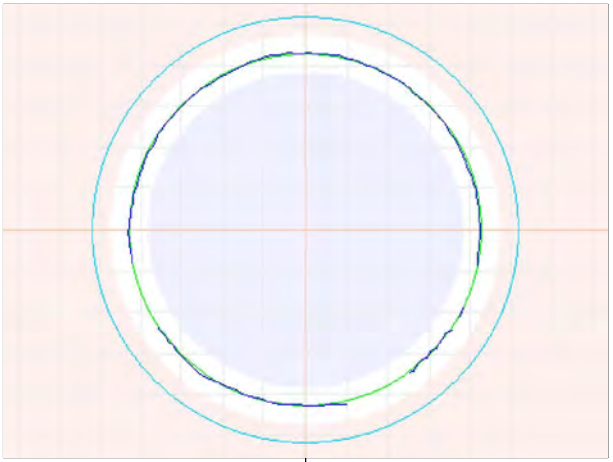
Inspection Distance (ft)

Water Level Debris Level

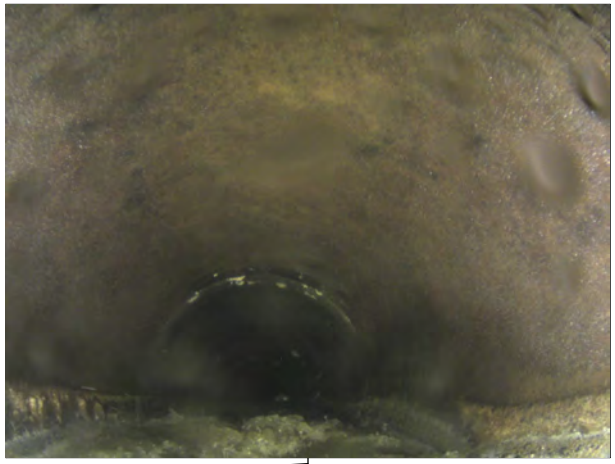
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

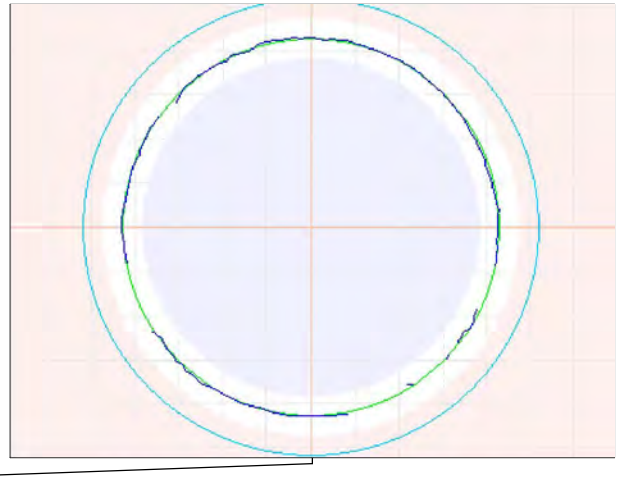
3ft General Observation

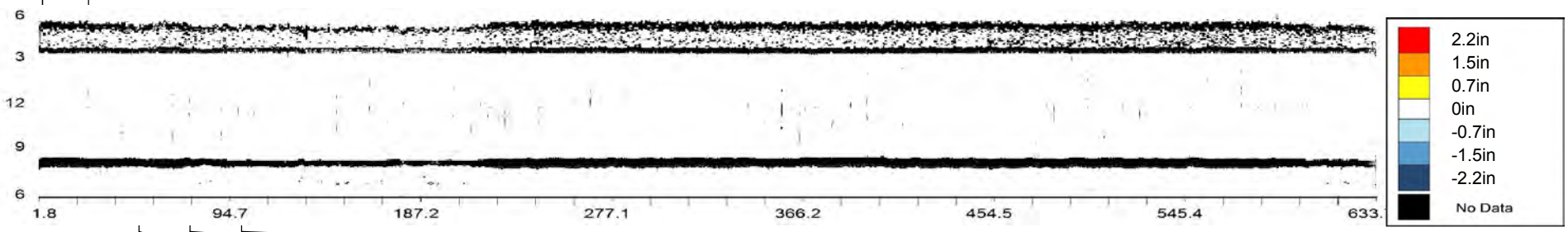


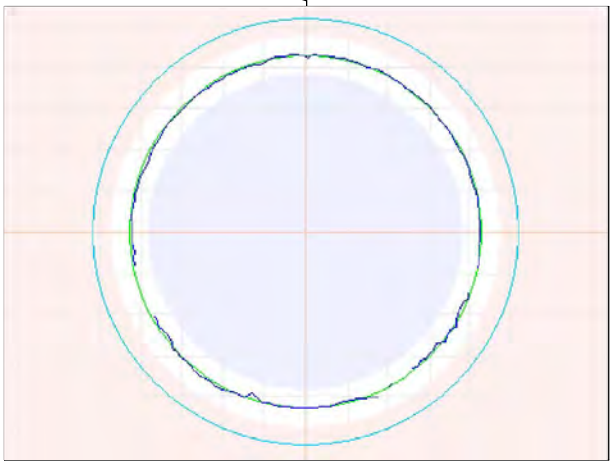
3ft General Observation



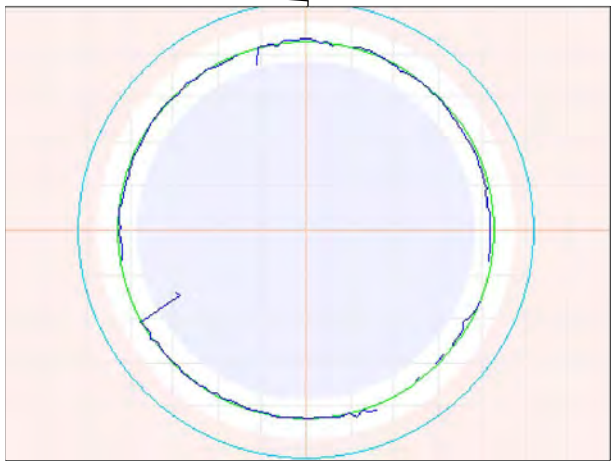
25.4ft General Observation - Corrosion to 0.2"



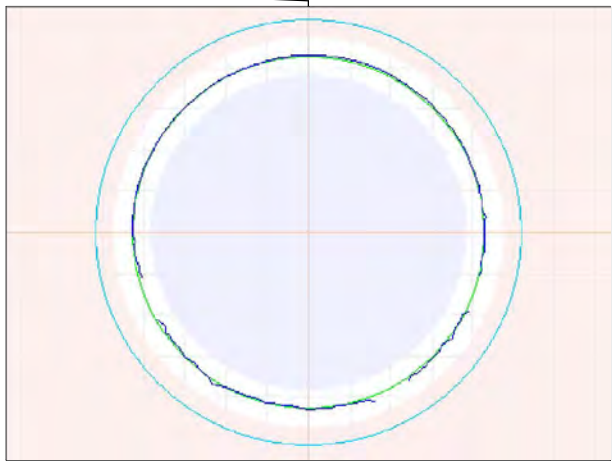




49.9ft General Observation - Measurement inside reference to 0.5"



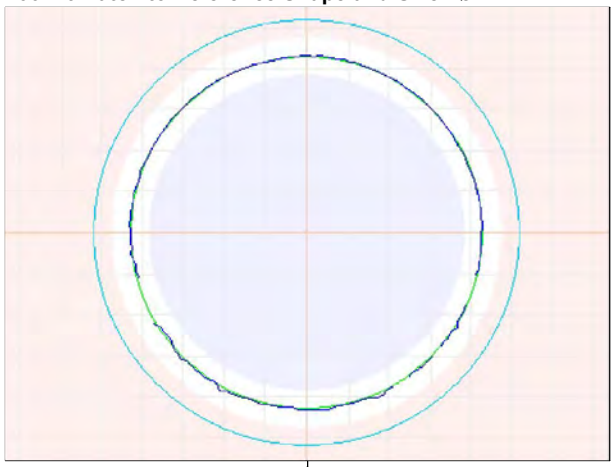
75ft General Observation - Corrosion to 0.3"



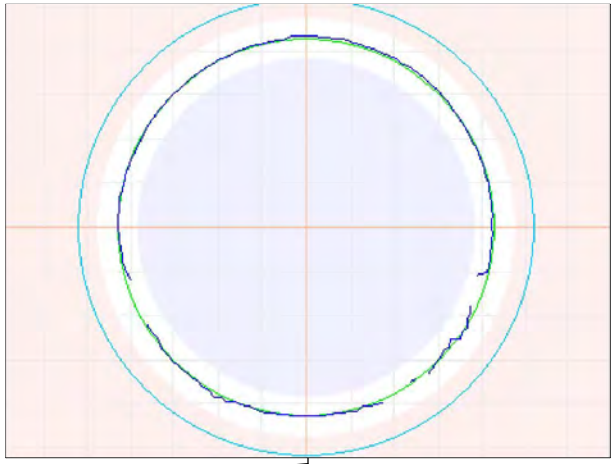
100ft General Observation - Corrosion to 0.7"

Observation Report

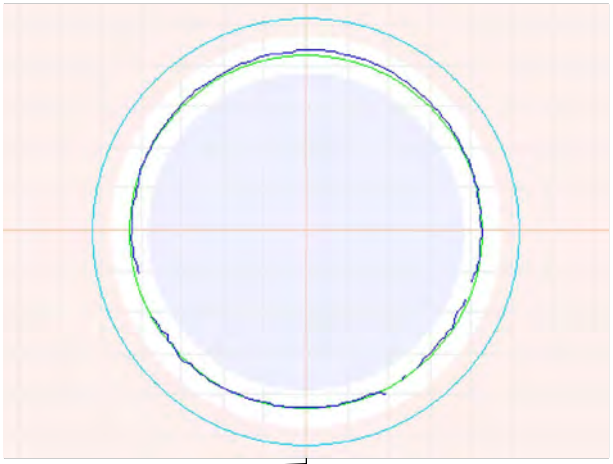
100.4ft Match to Reference Shape and Size - ø42"

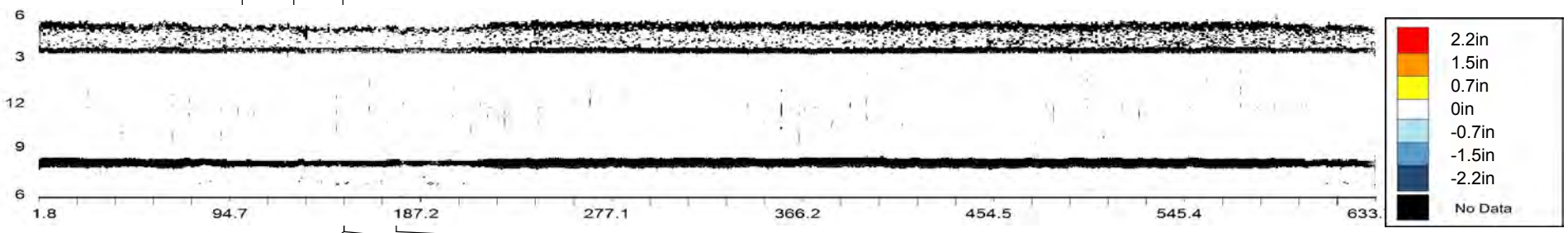


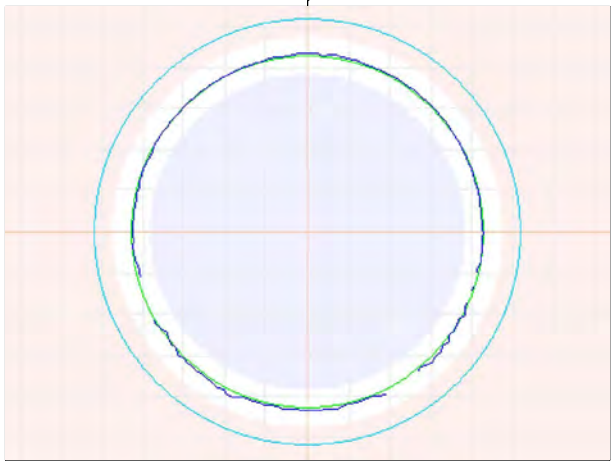
125.4ft General Observation - Corrosion to 0.3"



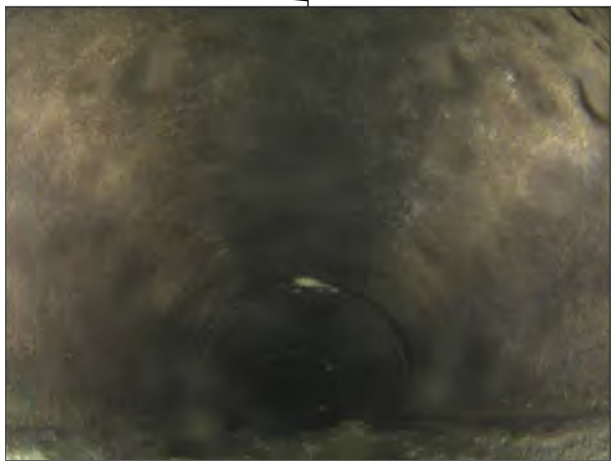
149.4ft Maximum Corrosion - To 0.7"



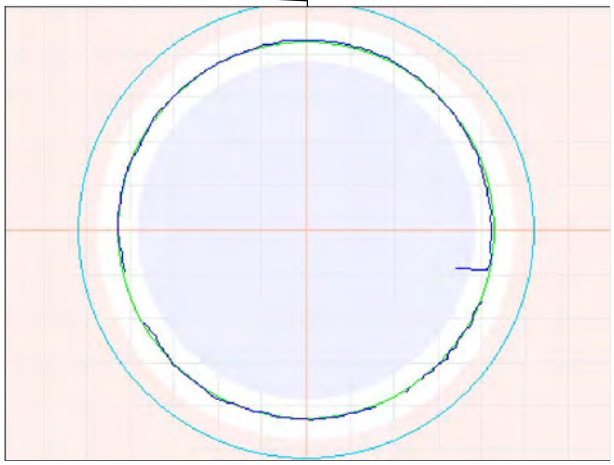




149.8ft General Observation - Corrosion to 0.6"



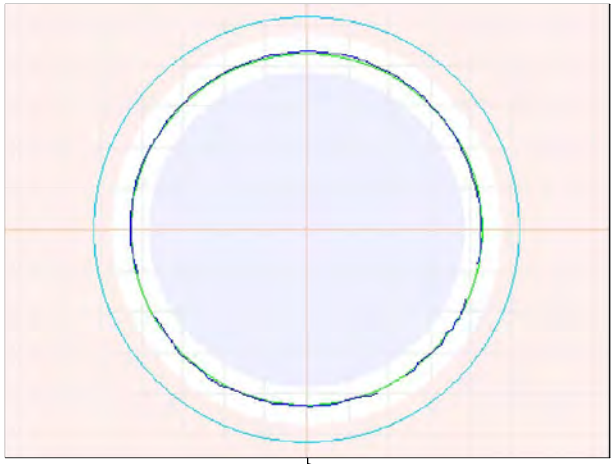
149.8ft General Observation - Corrosion to 0.6"



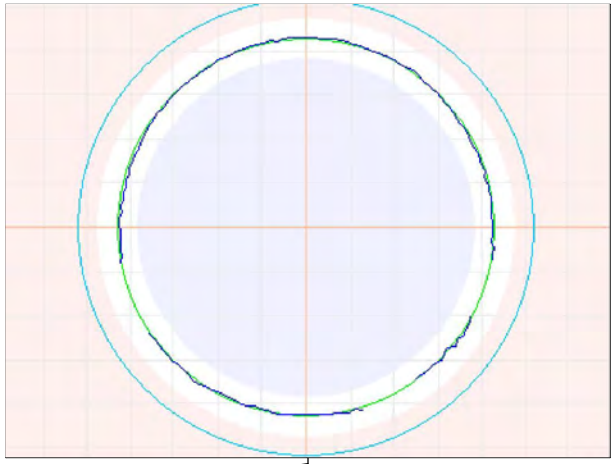
175.3ft General Observation - Corrosion to 0.2"

Observation Report

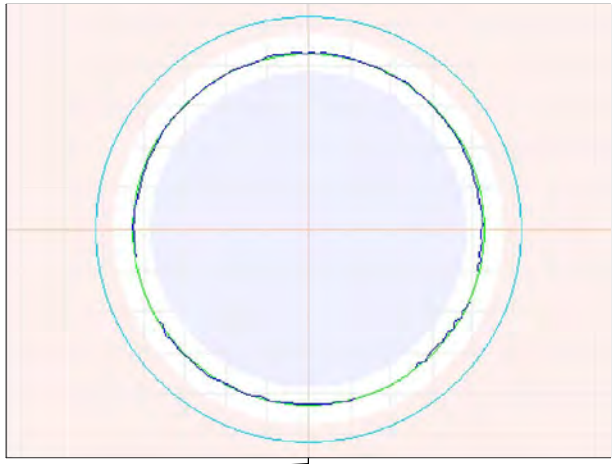
200.1ft General Observation

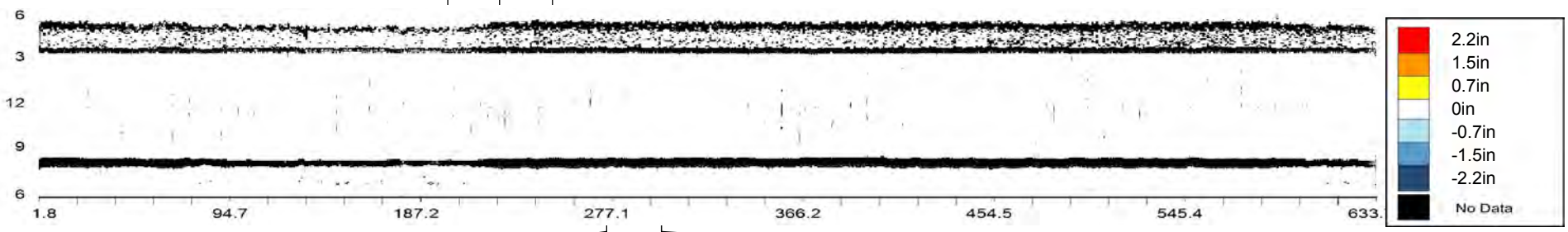


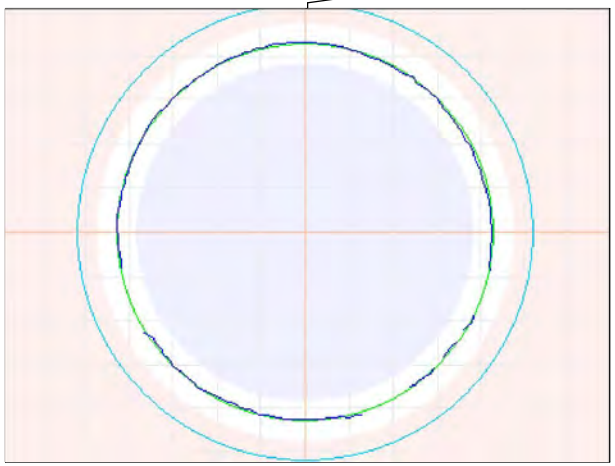
224.9ft General Observation - Corrosion to 0.2"



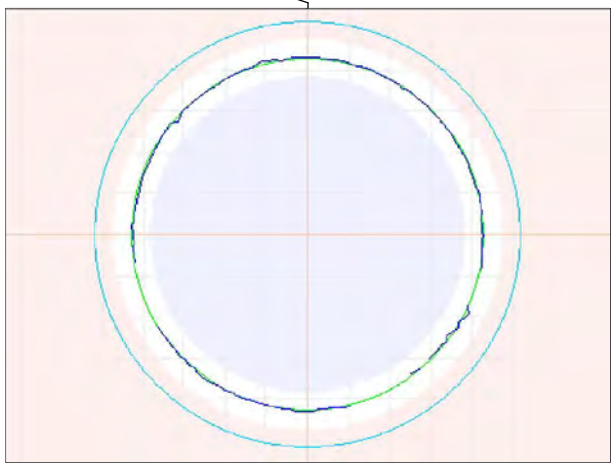
249.9ft General Observation



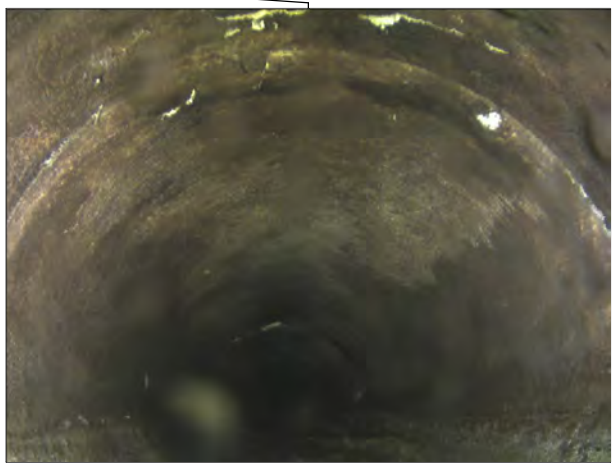




274.8ft General Observation - Corrosion to 0.2"



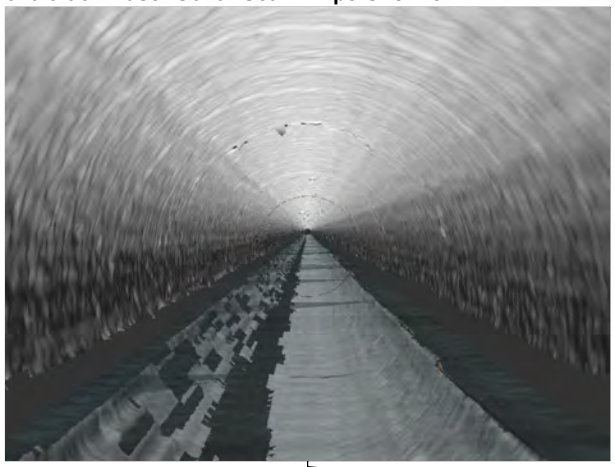
299.8ft General Observation



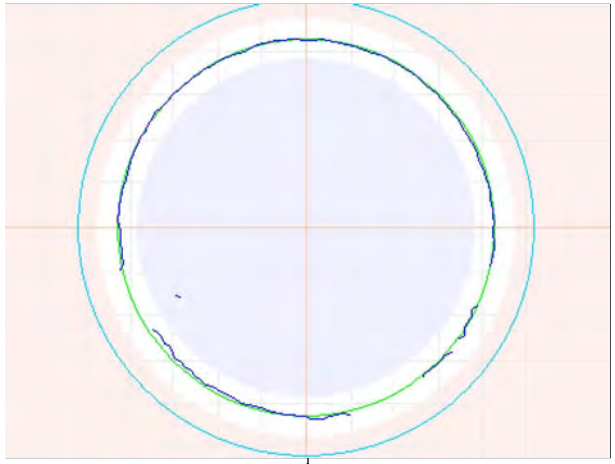
299.8ft General Observation

Observation Report

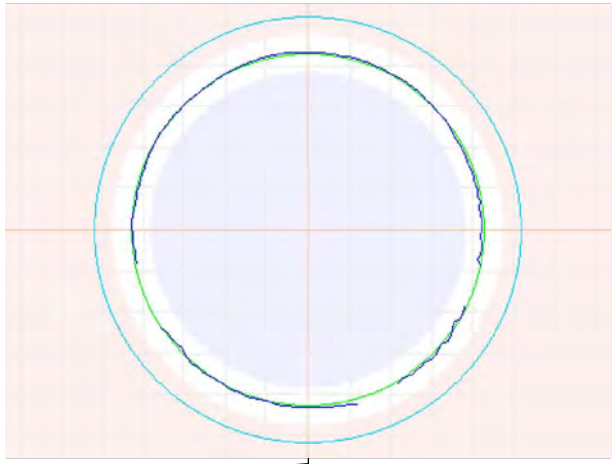
319.5ft 3D Laser Sonar Scan - Pipe Overview

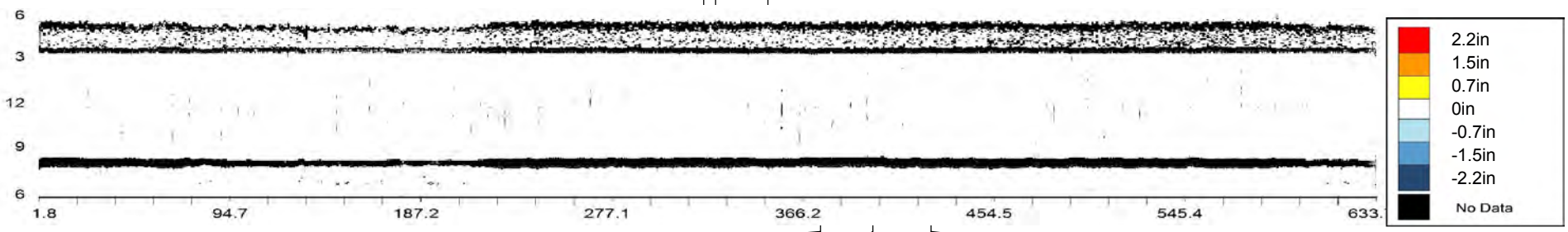


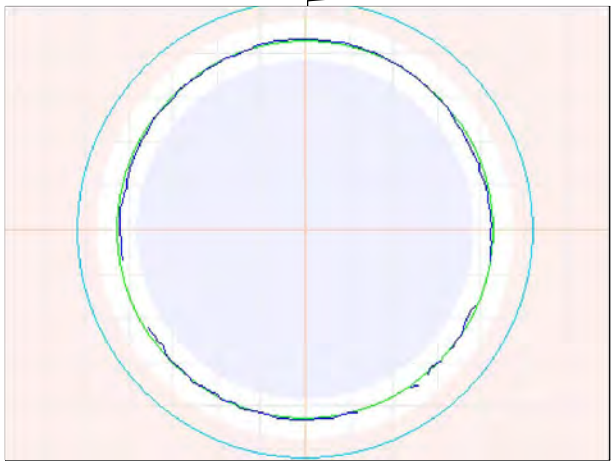
325.1ft General Observation - Measurement inside reference to 0.4"



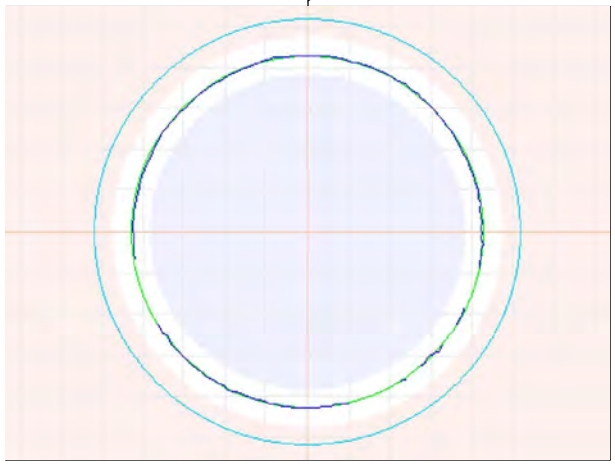
350ft General Observation - Corrosion to 0.6"



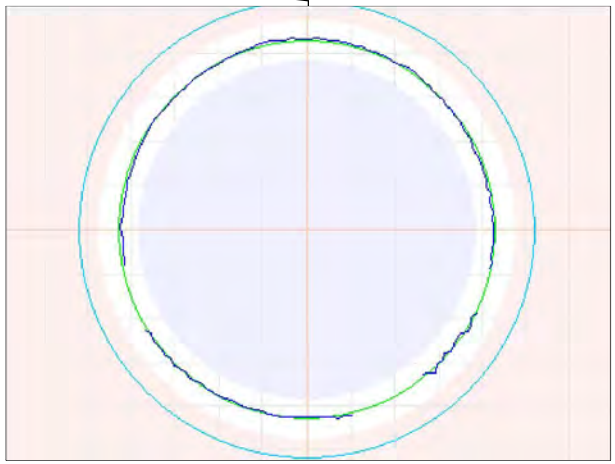




375ft General Observation - Corrosion to 0.2"



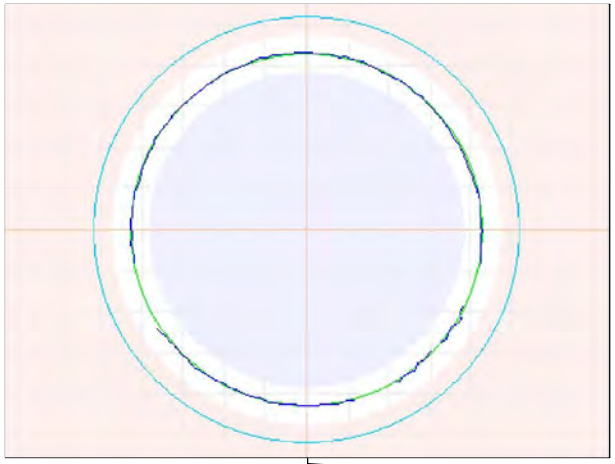
399.9ft General Observation



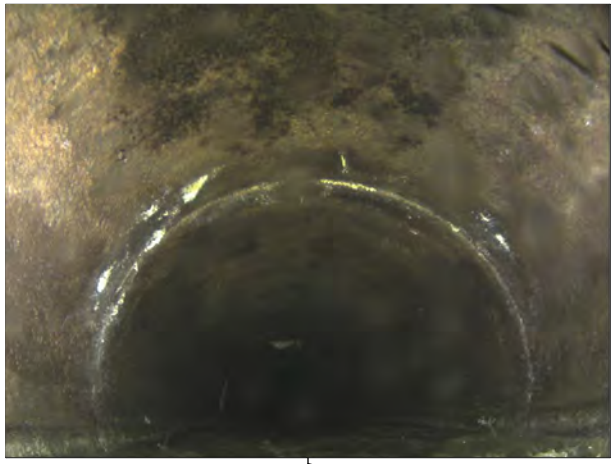
425ft General Observation - Corrosion to 0.4"

Observation Report

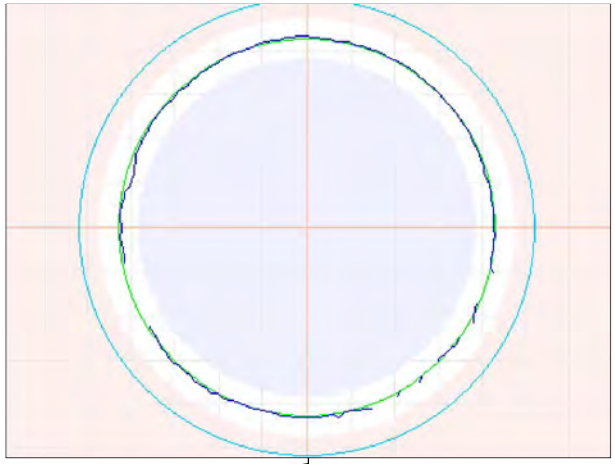
449.9ft General Observation

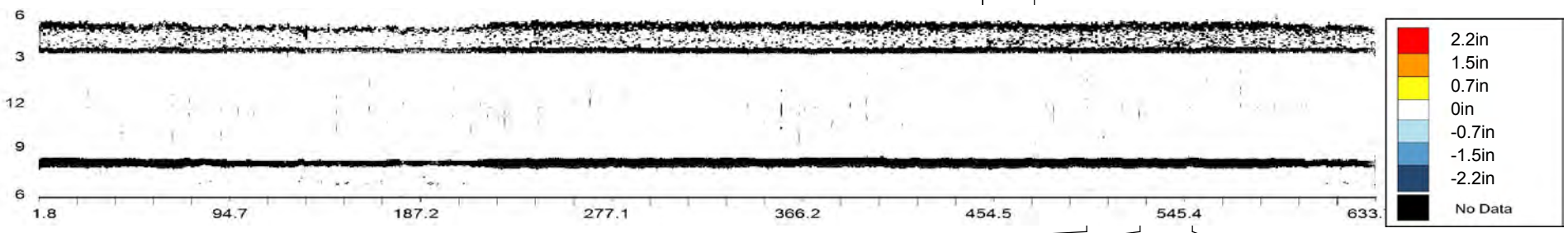


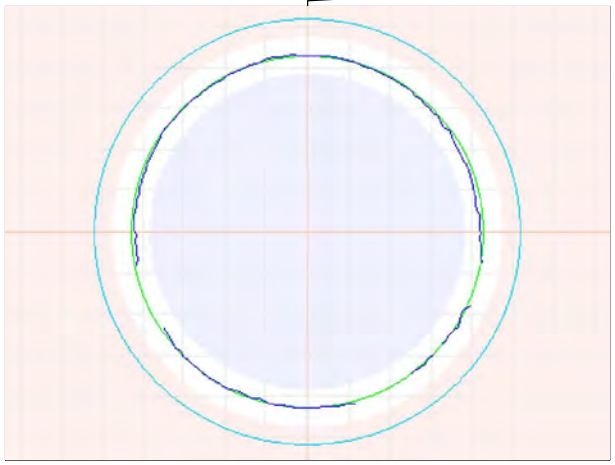
449.9ft General Observation



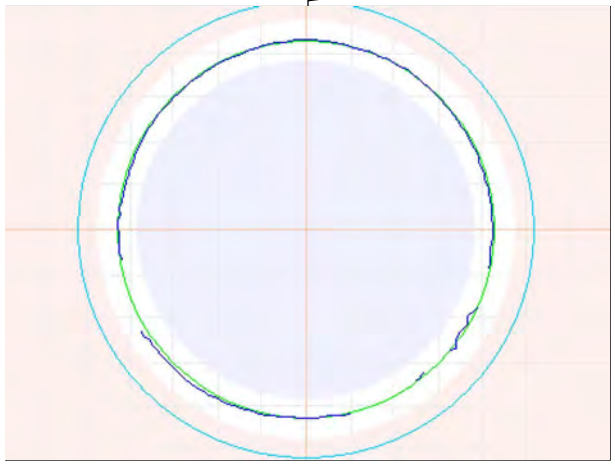
474.7ft General Observation - Corrosion to 0.4"



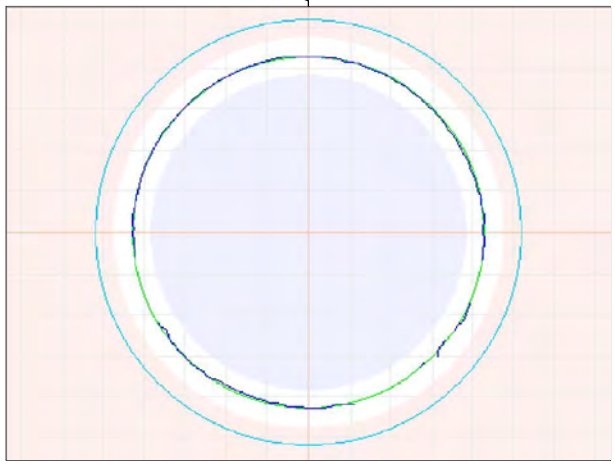




499.7ft General Observation



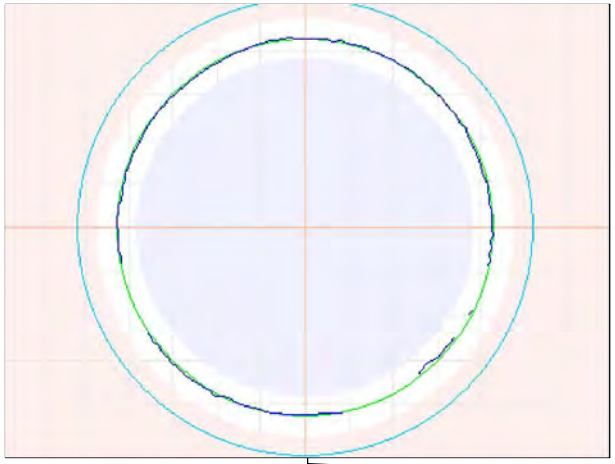
525.1ft General Observation - Corrosion to 0.2"



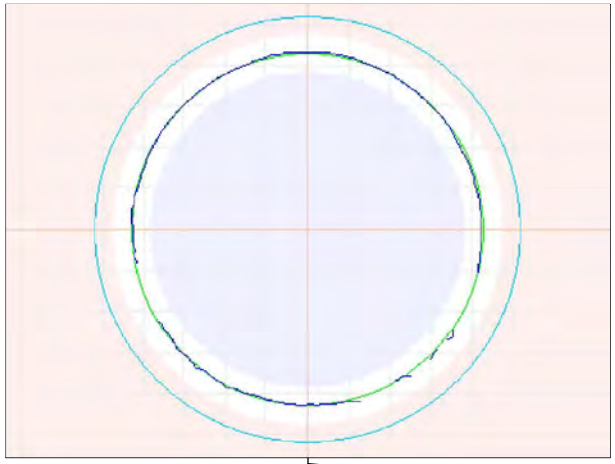
550ft General Observation - Corrosion to 0.5"

Observation Report

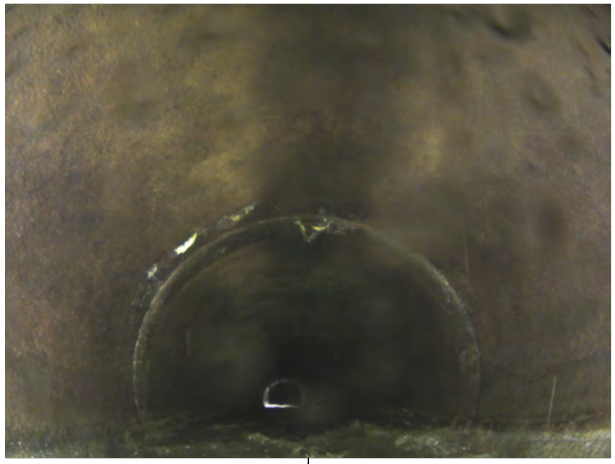
575.2ft General Observation - Corrosion to 0.2"

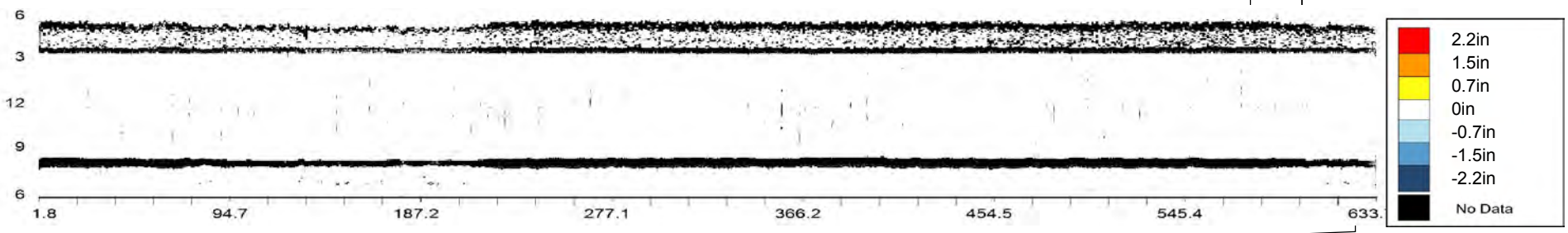


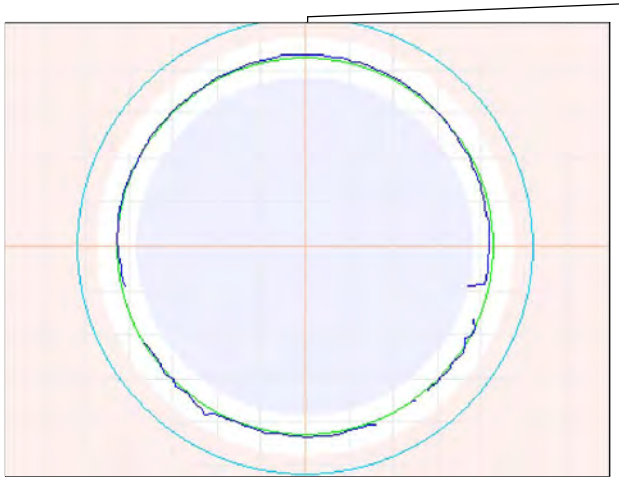
599.9ft General Observation - Corrosion to 0.5"



599.9ft General Observation - Corrosion to 0.5"







625ft General Observation - Corrosion to 0.4"

OVERVIEW - CMH000196 - CMH000194

Asset Number	CMH000196 - CMH000194		
Upstream MH	CMH000196	Material	Reinforced Concrete Pipe
Downstream MH	CMH000194	Size & Shape	42 in Circle
Survey Direction	Downstream	Match to Reference	12.9 ft

Distance	Observation	Comment
1.3 ft	**Beginning of Inspection**	**CMH000196**
2.8	General Observation	Corrosion to 0.7"
12.9	Match to Reference Shape and Size	ø42.0"
25.3	General Observation	Corrosion to 0.6"
49.9	General Observation	Corrosion to 0.7"
74.8	General Observation	Corrosion to 0.7"
100.1	General Observation	Corrosion to 0.5"
125	General Observation	Corrosion to 0.4"
149.9	General Observation	Corrosion to 0.6"
175.4	General Observation	Corrosion to 0.7"
199.9	General Observation	Corrosion to 0.6"
225.1	General Observation	Corrosion to 0.6"
249.9	General Observation	Corrosion to 0.9"
263.8	Maximum Corrosion	To 1.2"
274.7	General Observation	Corrosion to 1"
300.1	General Observation	Corrosion to 0.8"
324.9	General Observation	Corrosion to 0.7"
349.9	General Observation	Corrosion to 0.7"
375.1	General Observation	Corrosion to 0.9"
399.9	General Observation	
425	General Observation	Corrosion to 0.7"
449.8	General Observation	
475	General Observation	Corrosion to 0.8"
486.3	General Observation	Corrosion to 0.8"
488.4 ft	**End of Inspection**	**CMH000194**

CMH000196 - CMH000194			
Asset Number	CMH000196 - CMH000194	Length	488 ft
Upstream MH	CMH000196	Diameter	42 in
Downstream MH	CMH000194	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	12.9 ft
Date Profiled	16 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	15 in
Debris Volume	1 cubic feet

Debris Graph

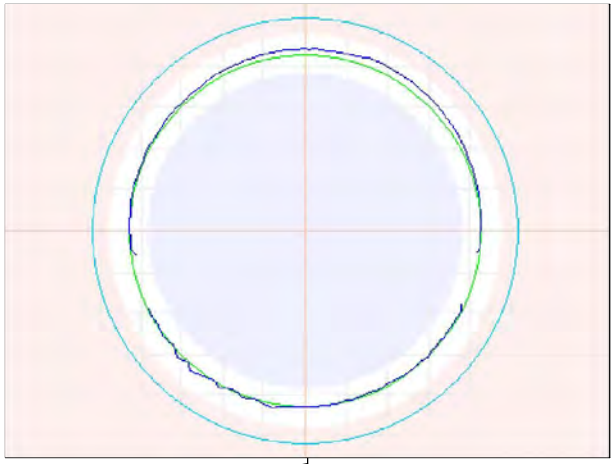
Inspection Distance (ft)

Water Level Debris Level

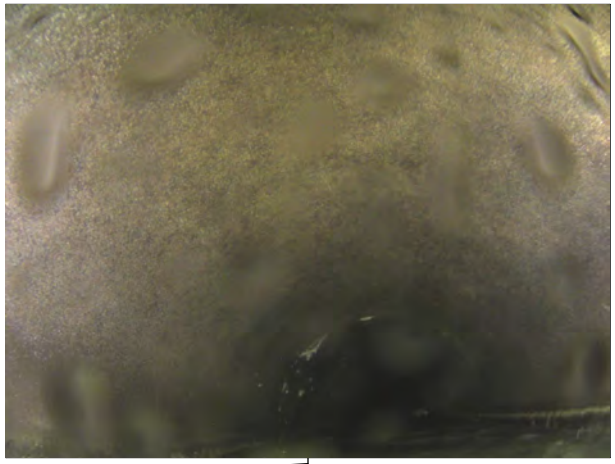
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

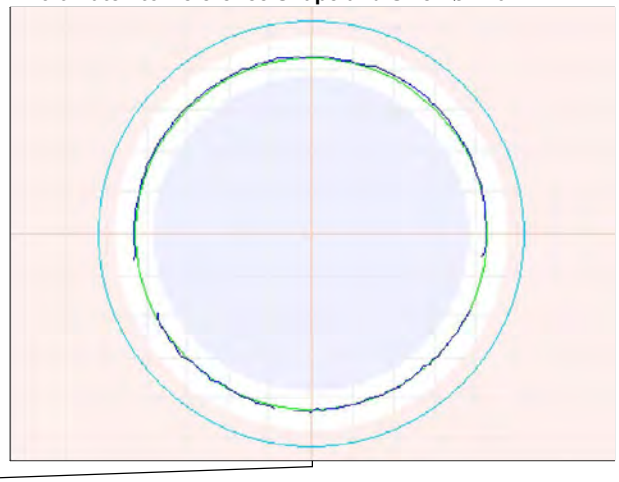
2.8ft General Observation - Corrosion to 0.7"

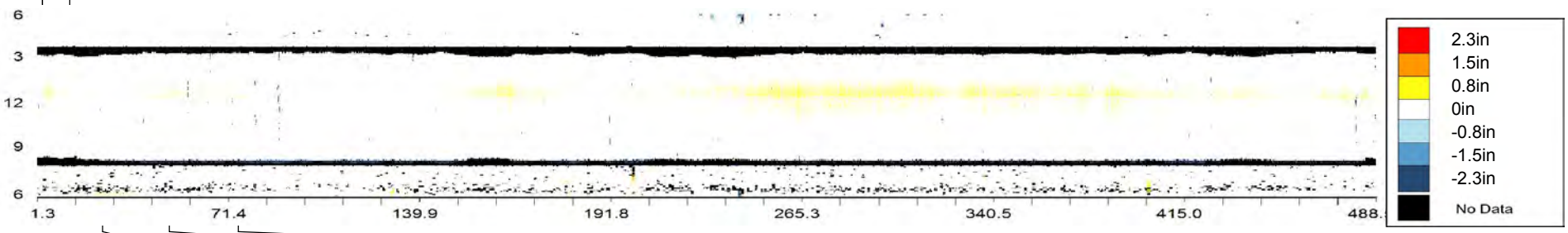


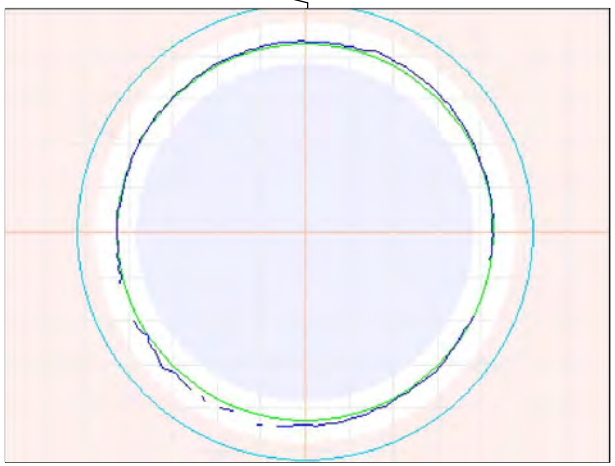
2.8ft General Observation - Corrosion to 0.7"



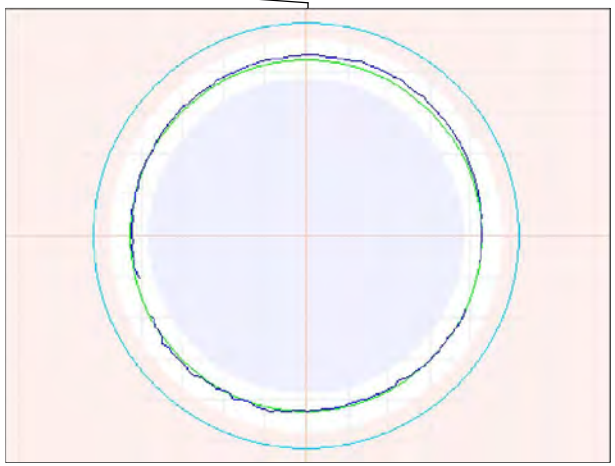
12.9ft Match to Reference Shape and Size - ø42.0"



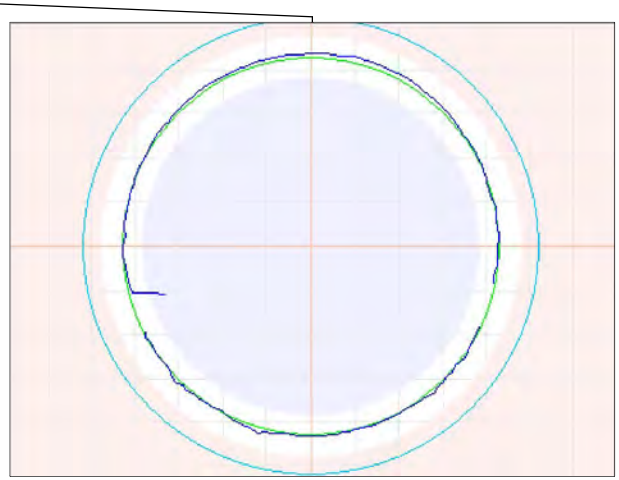




25.3ft General Observation - Corrosion to 0.6"



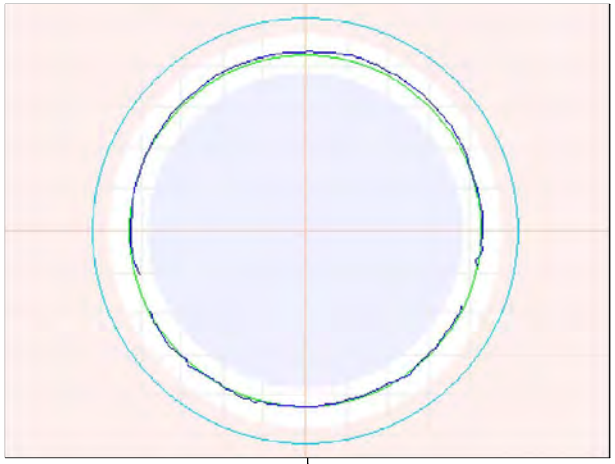
49.9ft General Observation - Corrosion to 0.7"



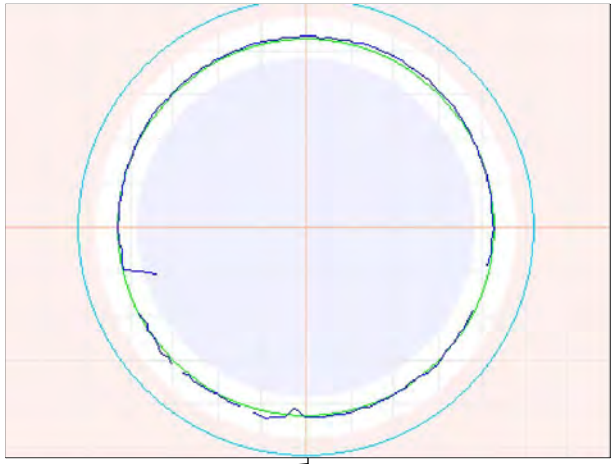
74.8ft General Observation - Corrosion to 0.7"

Observation Report

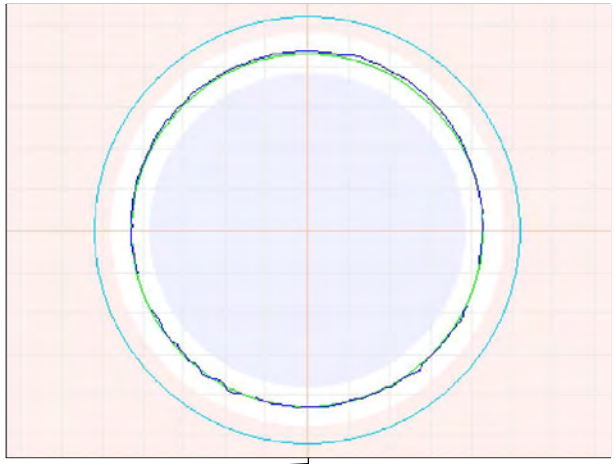
100.1ft General Observation - Corrosion to 0.5"

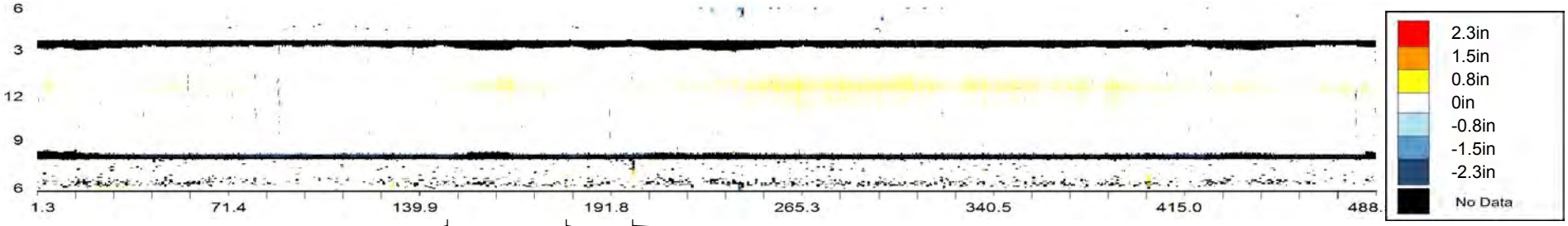


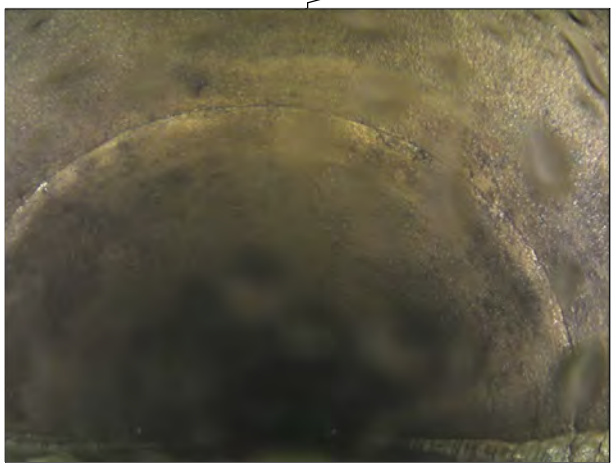
125ft General Observation - Corrosion to 0.4"



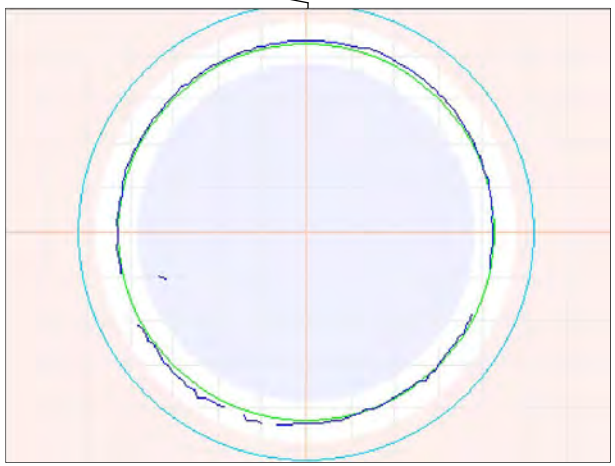
149.9ft General Observation - Corrosion to 0.6"



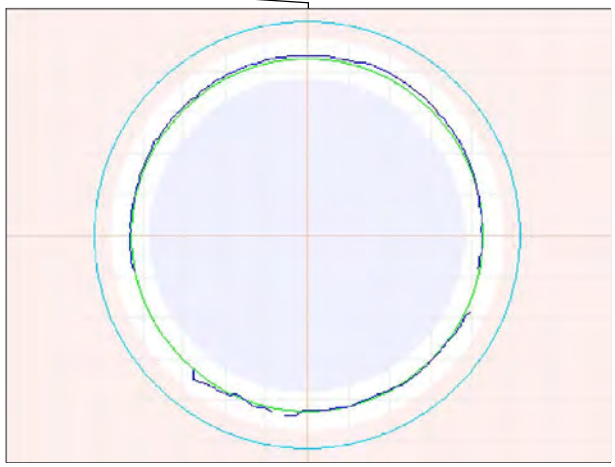




149.9ft General Observation - Corrosion to 0.6"



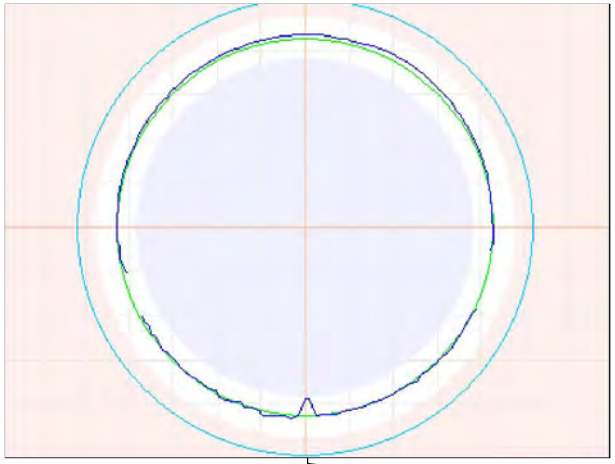
175.4ft General Observation - Corrosion to 0.7"



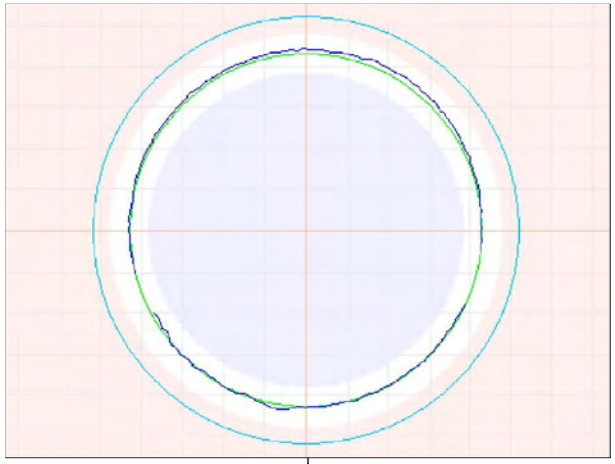
199.9ft General Observation - Corrosion to 0.6"

Observation Report

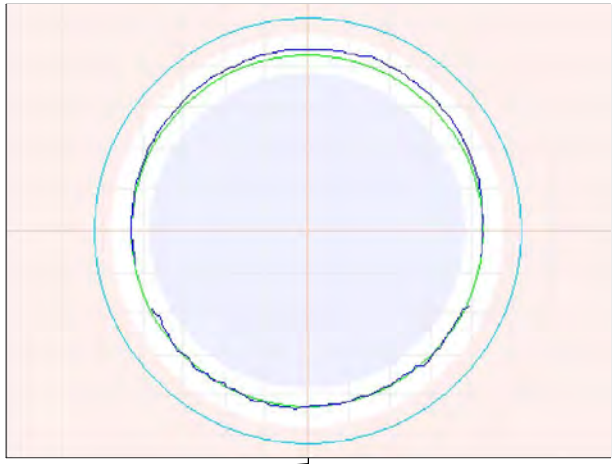
225.1ft General Observation - Corrosion to 0.6"

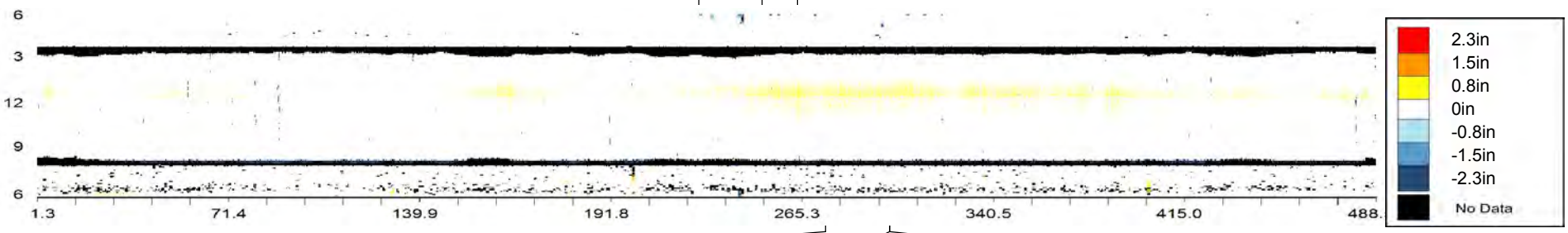


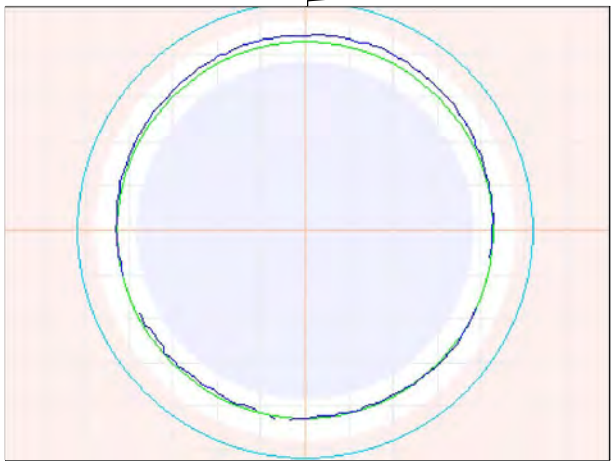
249.9ft General Observation - Corrosion to 0.9"



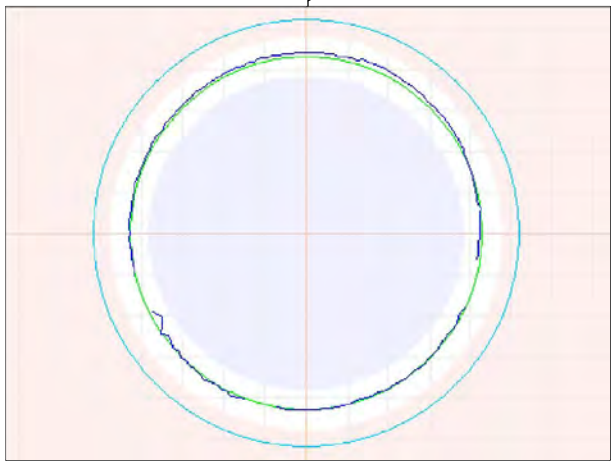
263.8ft Maximum Corrosion - To 1.2"



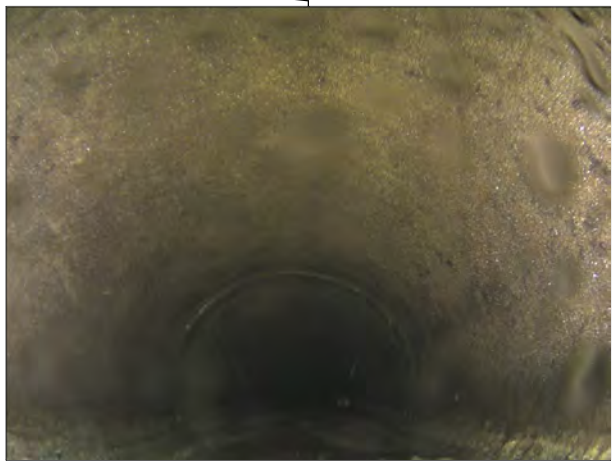




274.7ft General Observation - Corrosion to 1"



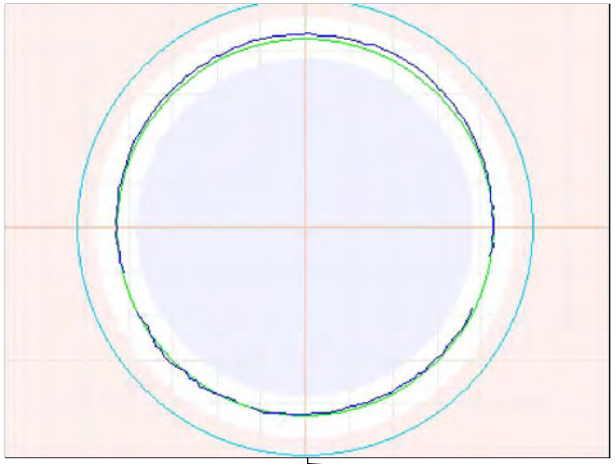
300.1ft General Observation - Corrosion to 0.8"



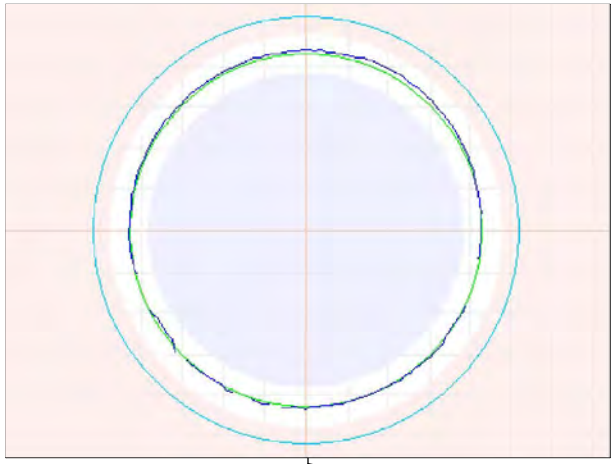
300.1ft General Observation - Corrosion to 0.8"

Observation Report

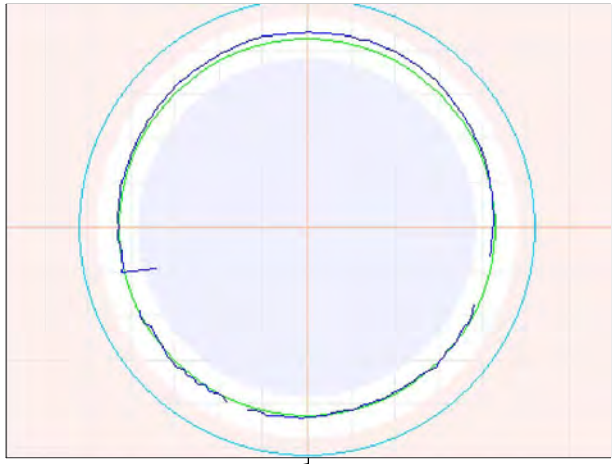
324.9ft General Observation - Corrosion to 0.7"

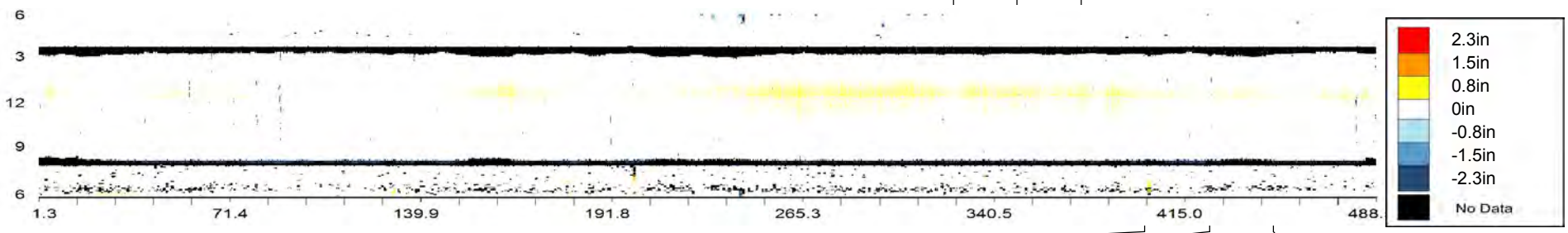


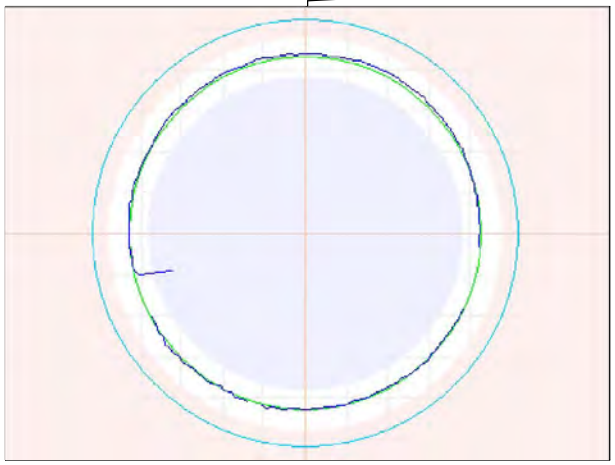
349.9ft General Observation - Corrosion to 0.7"



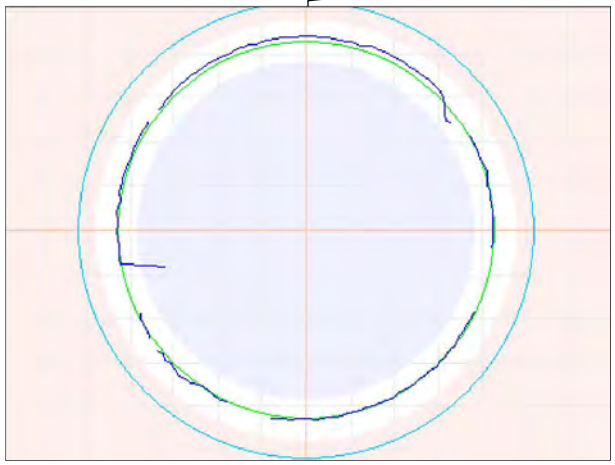
375.1ft General Observation - Corrosion to 0.9"



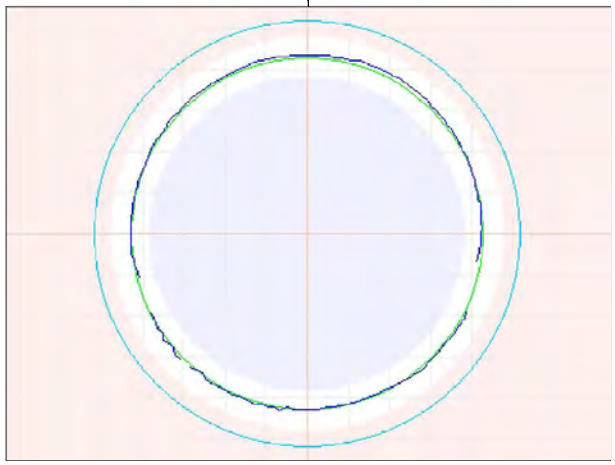




399.9ft General Observation



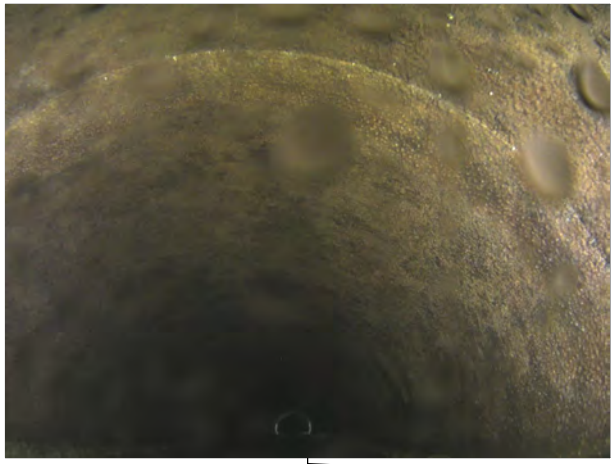
425ft General Observation - Corrosion to 0.7"



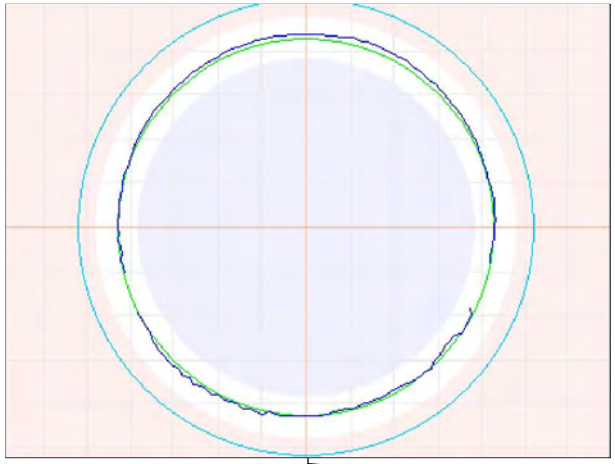
449.8ft General Observation

Observation Report

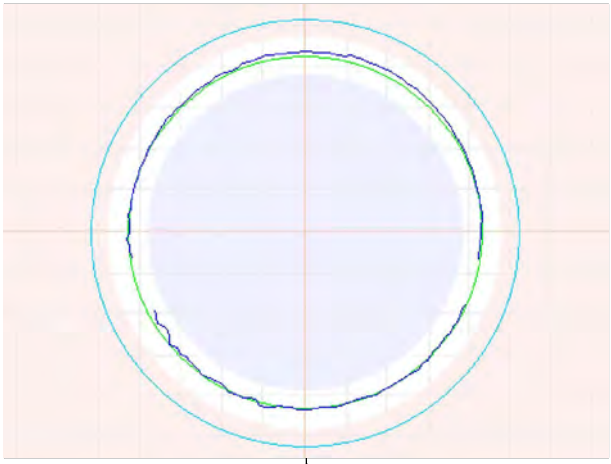
449.8ft General Observation

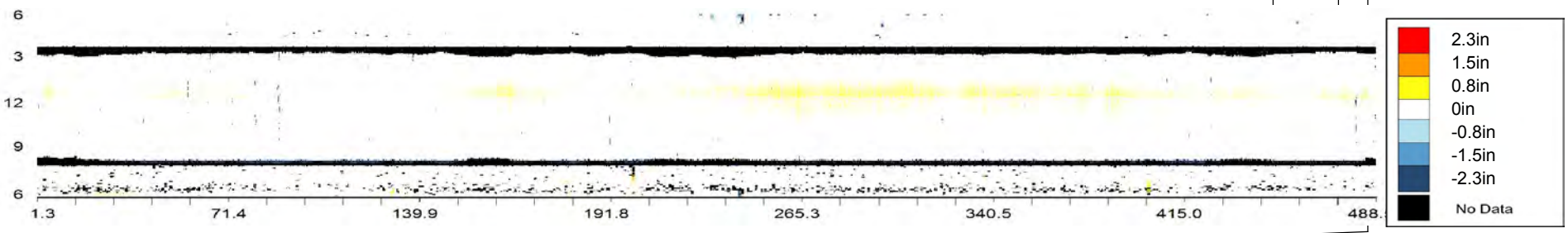


475ft General Observation - Corrosion to 0.8"



486.3ft General Observation - Corrosion to 0.8"





486.3ft General Observation - Corrosion to 0.8"

OVERVIEW - CMH000198 - CMH000196

Asset Number	CMH000198 - CMH000196		
Upstream MH	CMH000198	Material	Reinforced Concrete Pipe
Downstream MH	CMH000196	Size & Shape	42 in Circle
Survey Direction	Downstream	Match to Reference	525.8 ft

Distance	Observation	Comment
2.2 ft	**Beginning of Inspection**	**CMH000198**
4.5	General Observation	Corrosion to 0.5"
25	General Observation	Corrosion to 0.4"\Debris to 0.4"
50	General Observation	
75	General Observation	Corrosion to 0.5"\Debris to 0.2"
100.1	General Observation	Corrosion to 0.5"
125	General Observation	Corrosion to 0.4"
150.1	General Observation	Corrosion to 0.5"
175	General Observation	Corrosion to 0.4"
199.9	General Observation	
218.9	Maximum Corrosion	To 0.8"
225	General Observation	Corrosion to 0.7"
249.8	General Observation	
275	General Observation	Corrosion to 0.6"
300.1	General Observation	
311.6	3D Laser Sonar Scan	Internal pipe overview
325	General Observation	Corrosion to 0.3"
349.9	General Observation	
374.9	General Observation	Corrosion to 0.3"
400	General Observation	
424.9	General Observation	Corrosion to 0.3"
450	General Observation	
474.9	General Observation	Corrosion to 0.3"
499.7	General Observation	
524.8	General Observation	Corrosion to 0.4"
525.8	Match to Reference Shape and Size	ø42"

OVERVIEW - CMH000198 - CMH000196			
Asset Number	CMH000198 - CMH000196		
Upstream MH	CMH000198	Material	Reinforced Concrete Pipe
Downstream MH	CMH000196	Size & Shape	42 in Circle
Survey Direction	Downstream	Match to Reference	525.8 ft

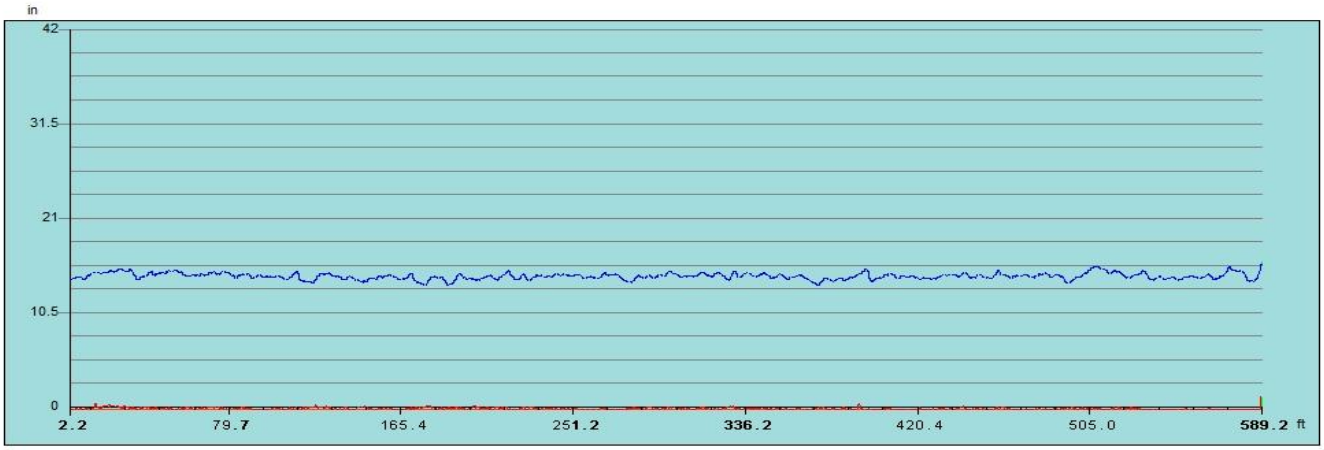
Distance	Observation	Comment
549.9	General Observation	
574.9	General Observation	Corrosion to 0.3"
587.9	General Observation	
589.1 ft	**End of Inspection**	**CMH000196**

CMH000198 - CMH000196			
Asset Number	CMH000198 - CMH000196	Length	590 ft
Upstream MH	CMH000198	Diameter	42 in
Downstream MH	CMH000196	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	525.8 ft
Date Profiled	16 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	15 in
Debris Volume	1 cubic feet

Debris Graph



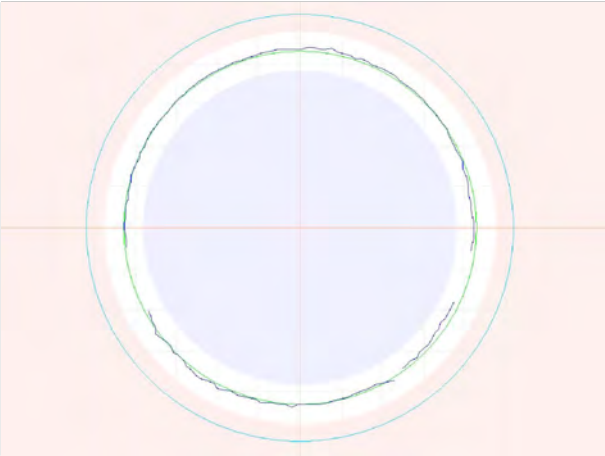
Inspection Distance (ft)

Water Level Debris Level

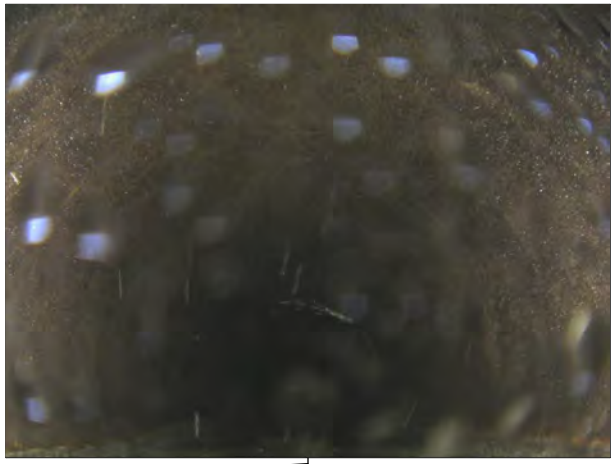
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

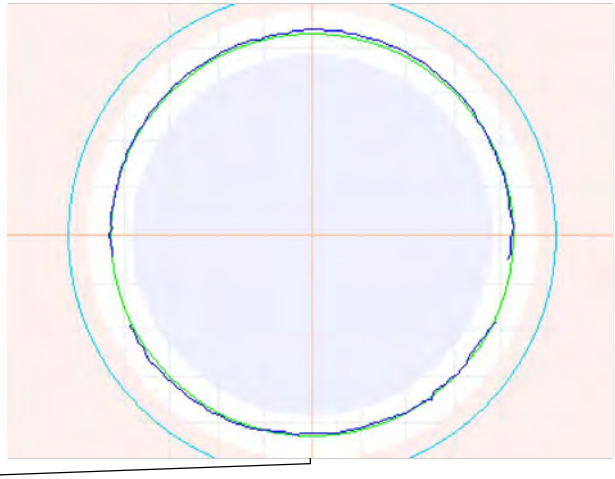
4.5ft General Observation - Corrosion to 0.5"

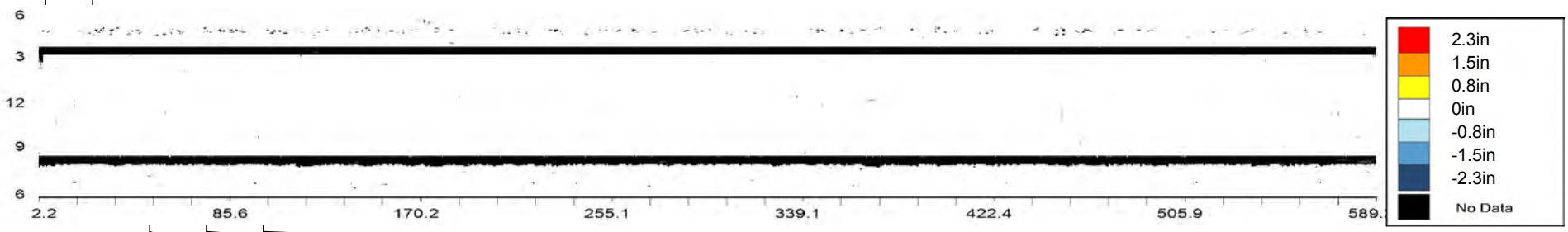


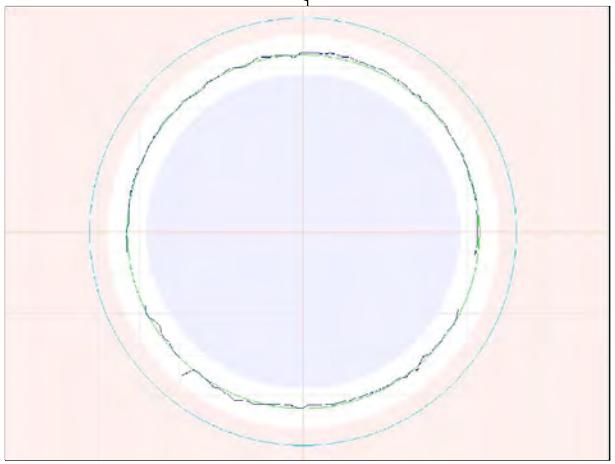
4.5ft General Observation - Corrosion to 0.5"



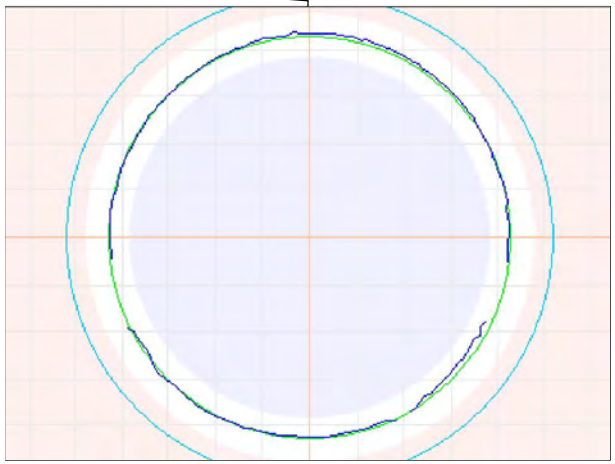
25ft General Observation - Corrosion to 0.4"\Debris to 0.4"



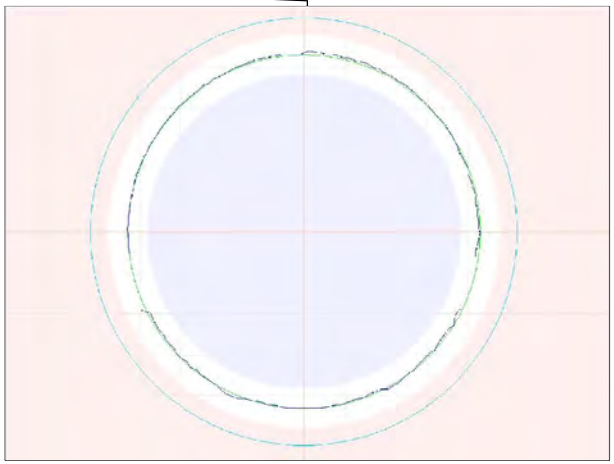




50ft General Observation



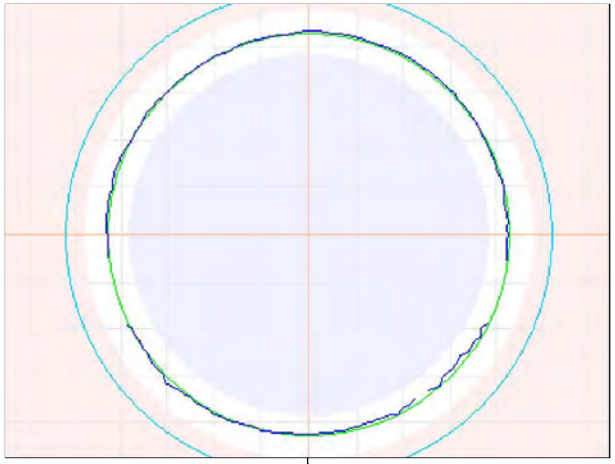
75ft General Observation - Corrosion to 0.5"\Debris to 0.2"



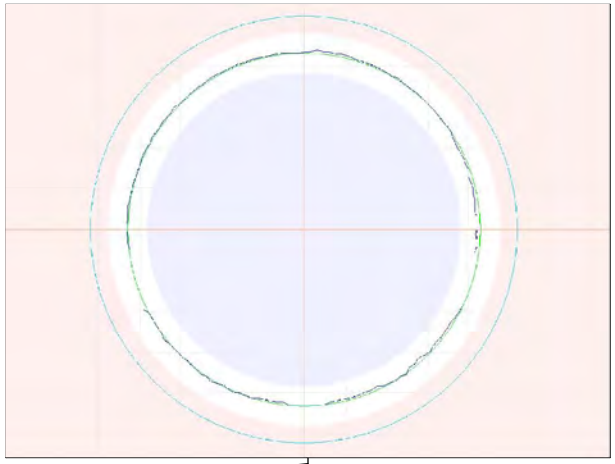
100.1ft General Observation - Corrosion to 0.5"

Observation Report

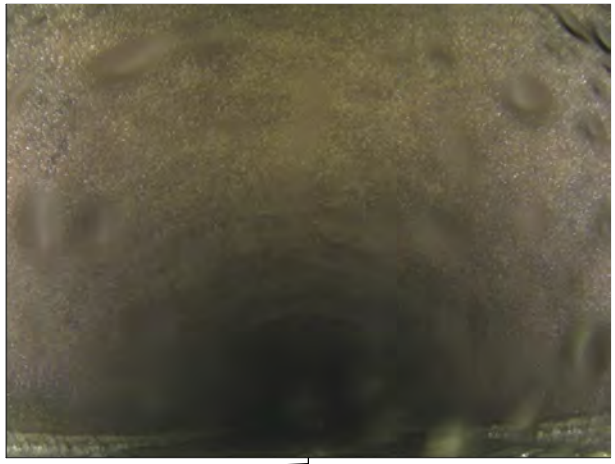
125ft General Observation - Corrosion to 0.4"

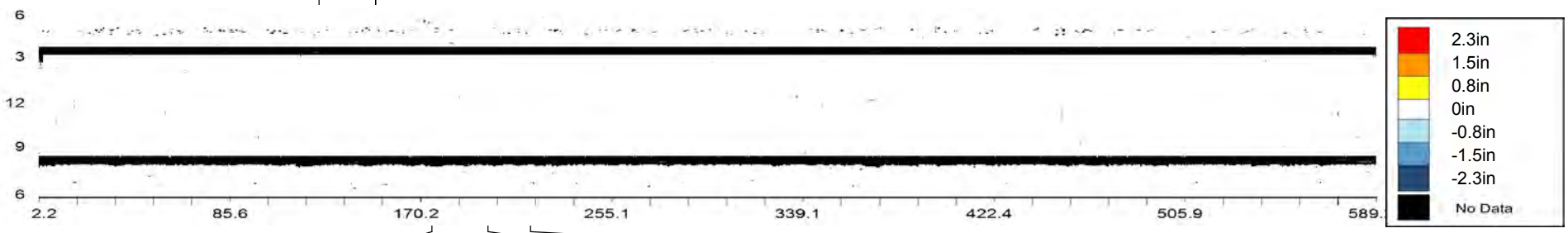


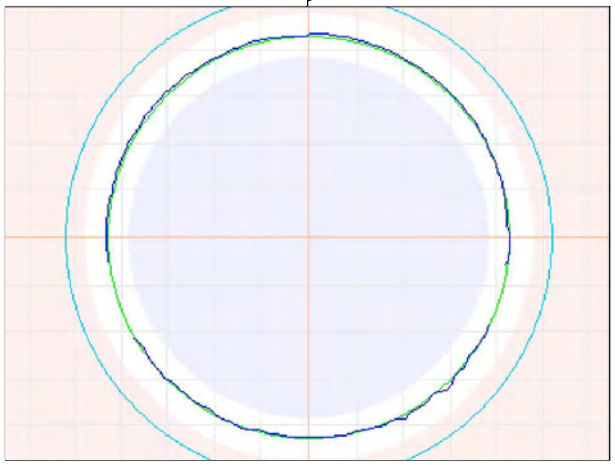
150.1ft General Observation - Corrosion to 0.5"



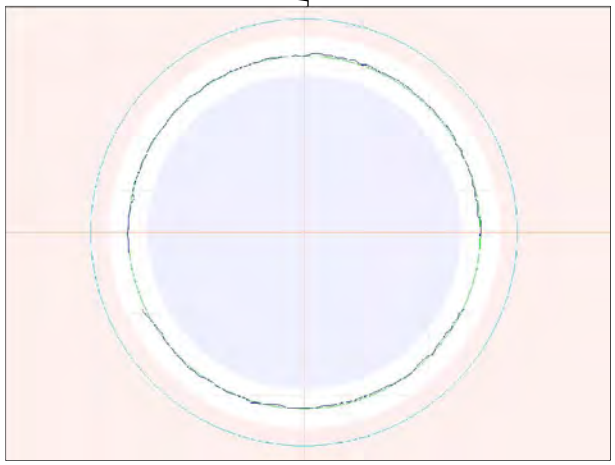
150.1ft General Observation - Corrosion to 0.5"



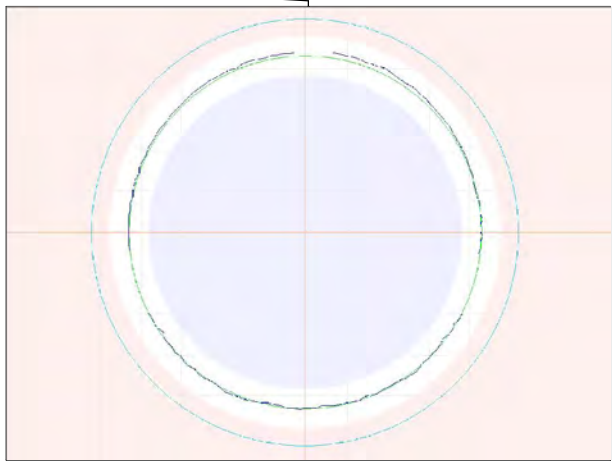




175ft General Observation - Corrosion to 0.4"



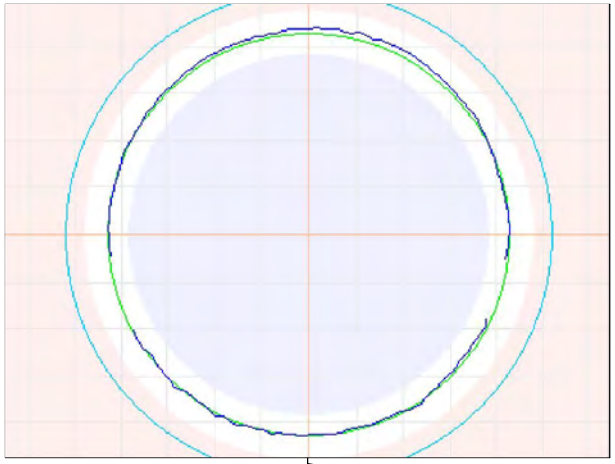
199.9ft General Observation



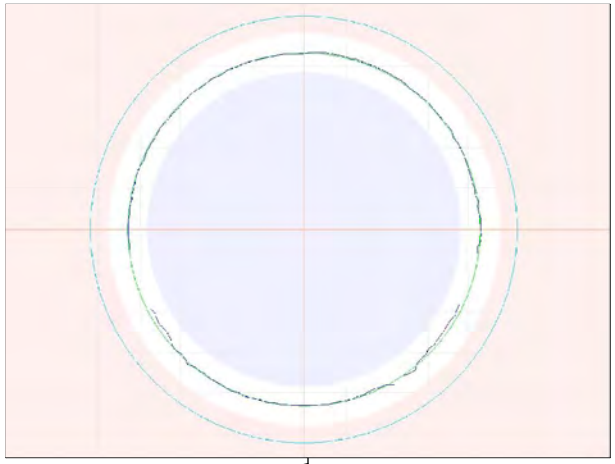
218.9ft Maximum Corrosion - To 0.8"

Observation Report

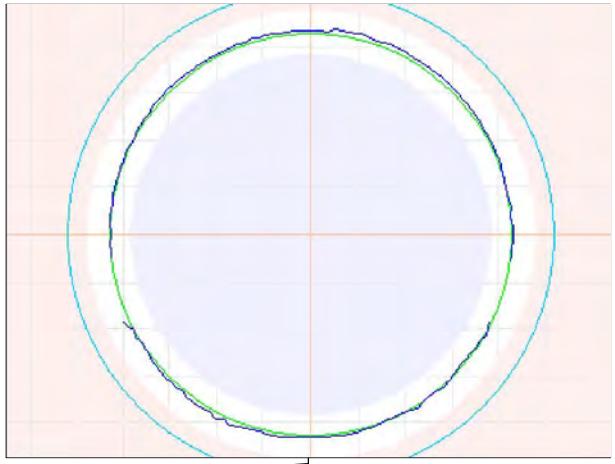
225ft General Observation - Corrosion to 0.7"

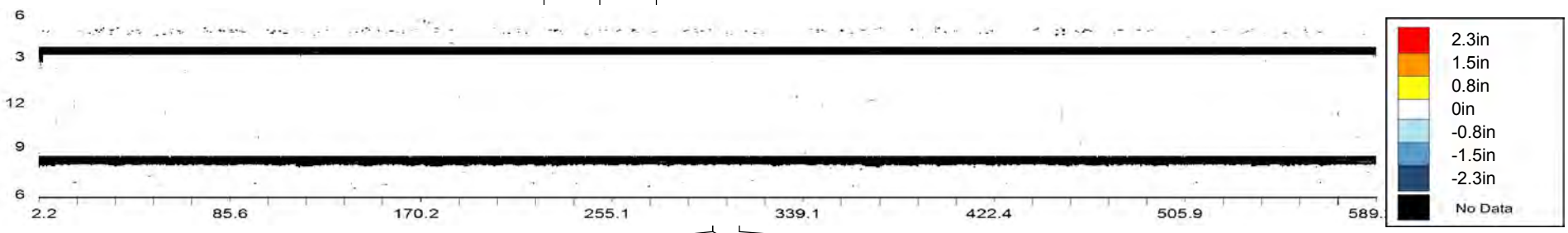


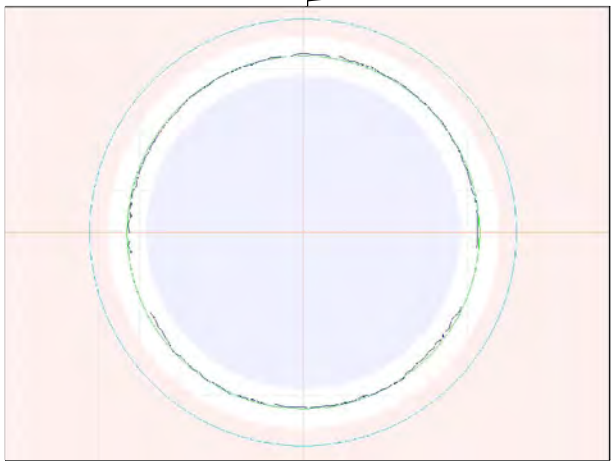
249.8ft General Observation



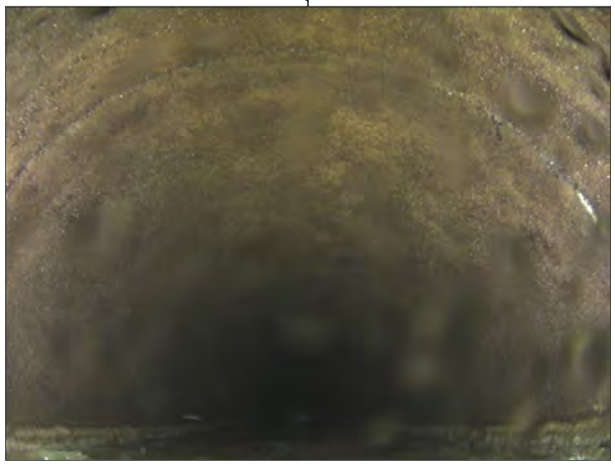
275ft General Observation - Corrosion to 0.6"







300.1ft General Observation

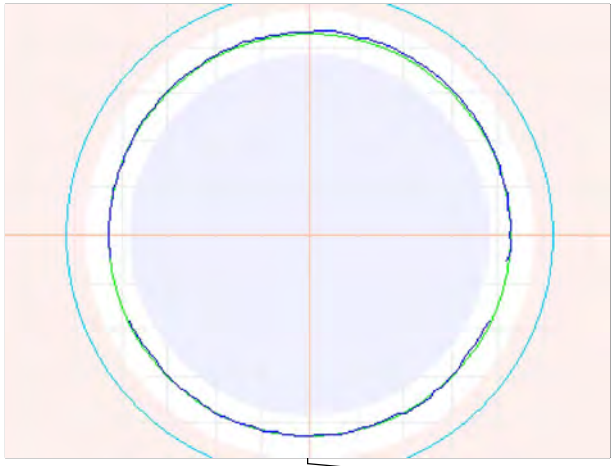


300.1ft General Observation

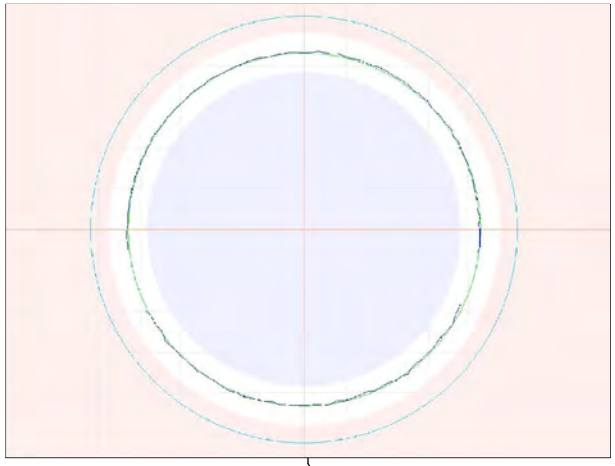
311.6ft 3D Laser Sonar Scan - Internal pipe overview

Observation Report

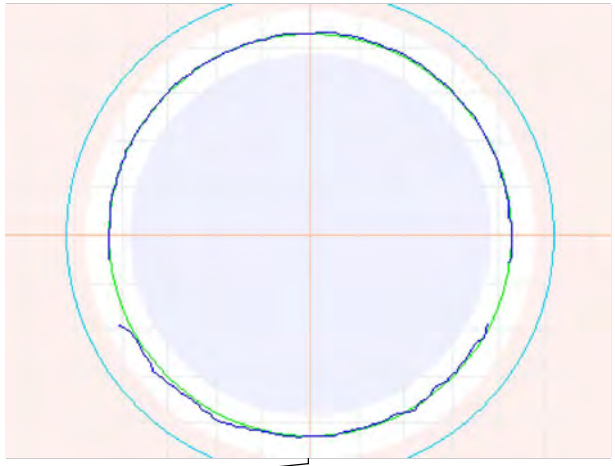
325ft General Observation - Corrosion to 0.3"

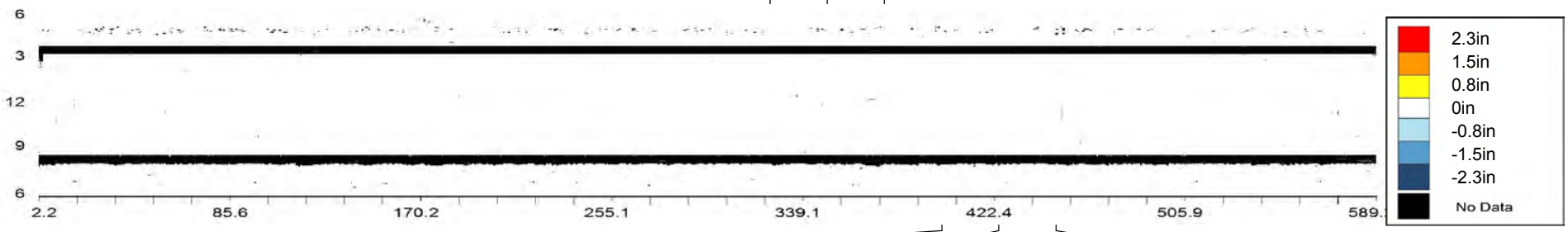


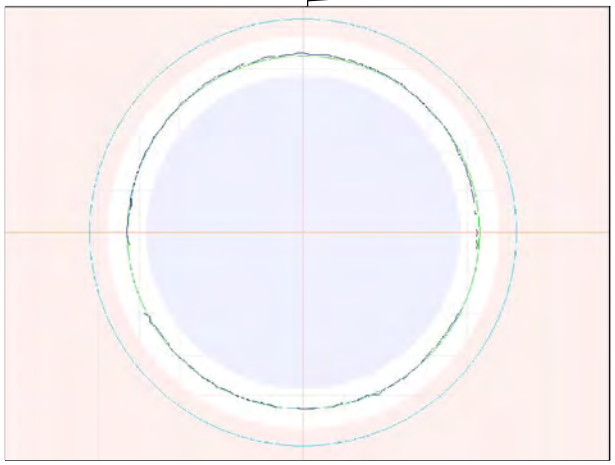
349.9ft General Observation



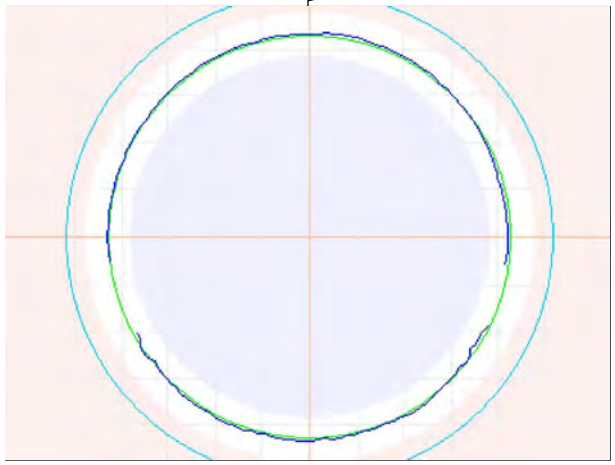
374.9ft General Observation - Corrosion to 0.3"



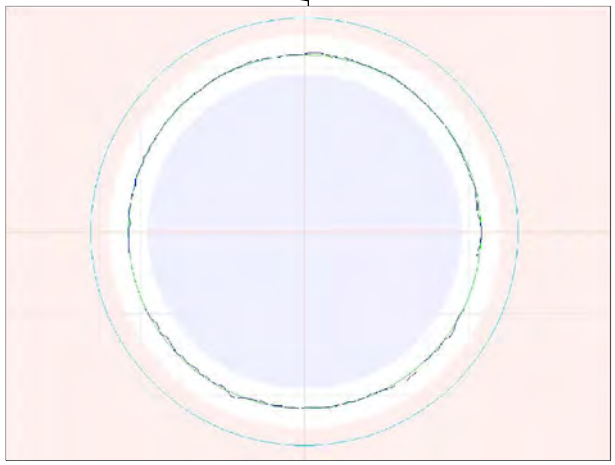




400ft General Observation



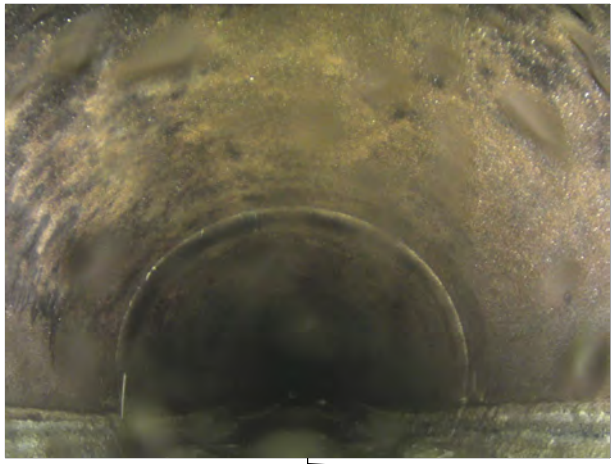
424.9ft General Observation - Corrosion to 0.3"



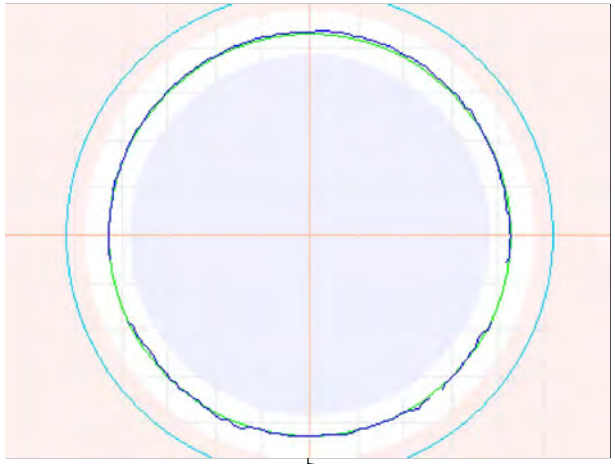
450ft General Observation

Observation Report

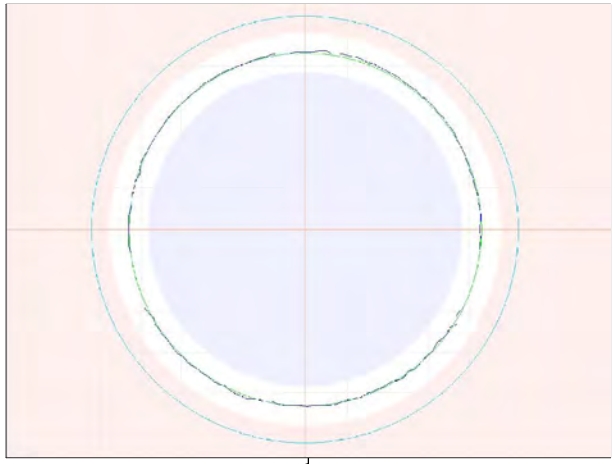
450ft General Observation

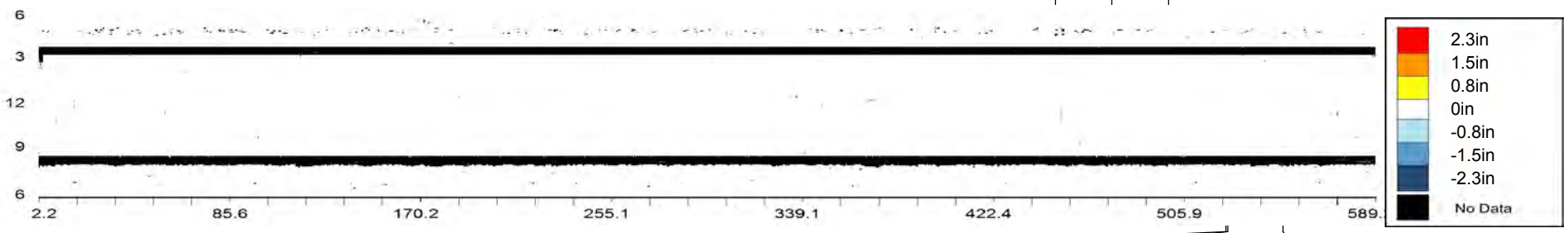


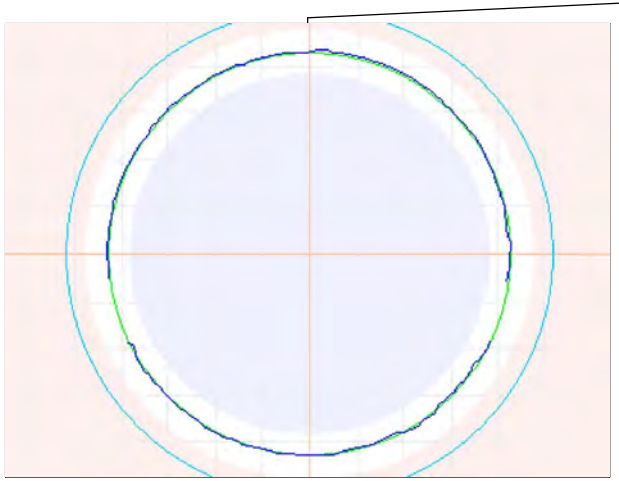
474.9ft General Observation - Corrosion to 0.3"



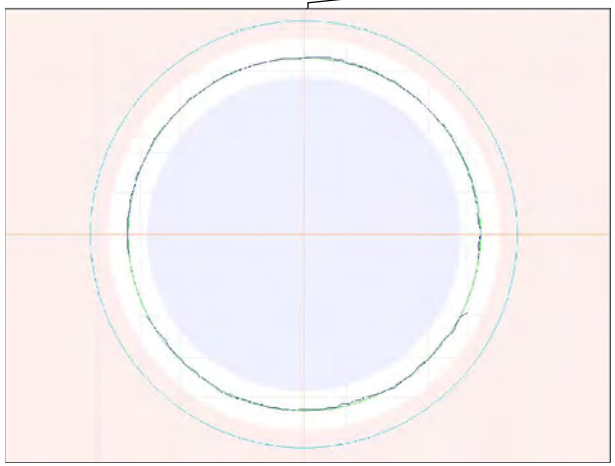
499.7ft General Observation



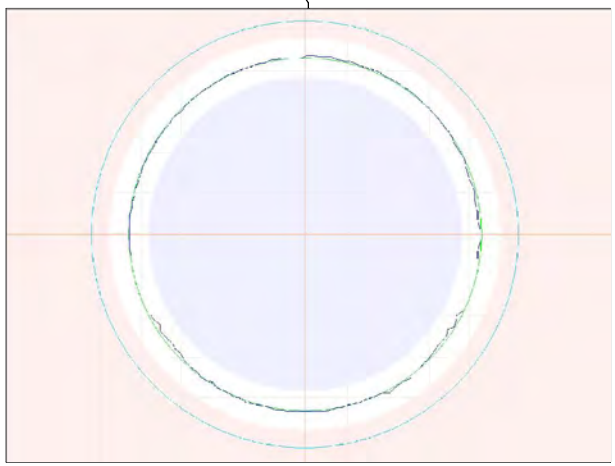




524.8ft General Observation - Corrosion to 0.4"



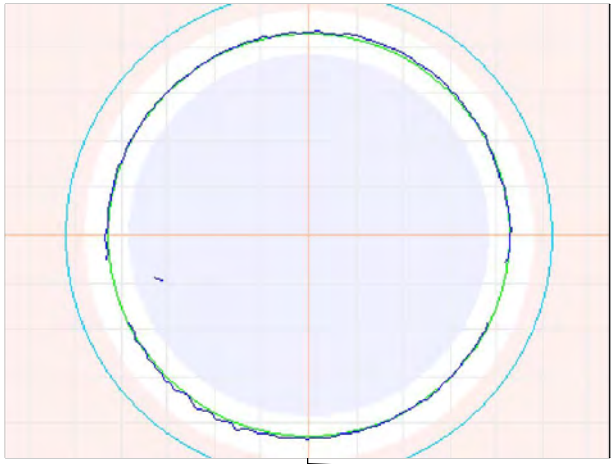
525.8ft Match to Reference Shape and Size - ø42"



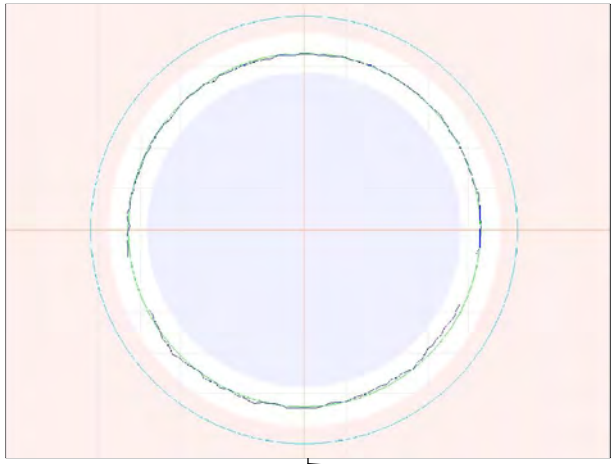
549.9ft General Observation

Observation Report

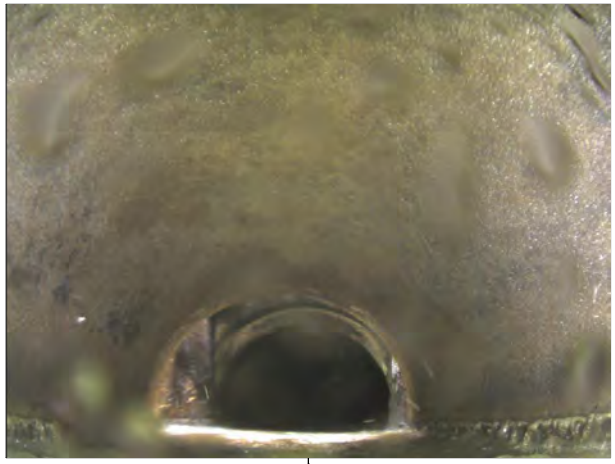
574.9ft General Observation - Corrosion to 0.3"

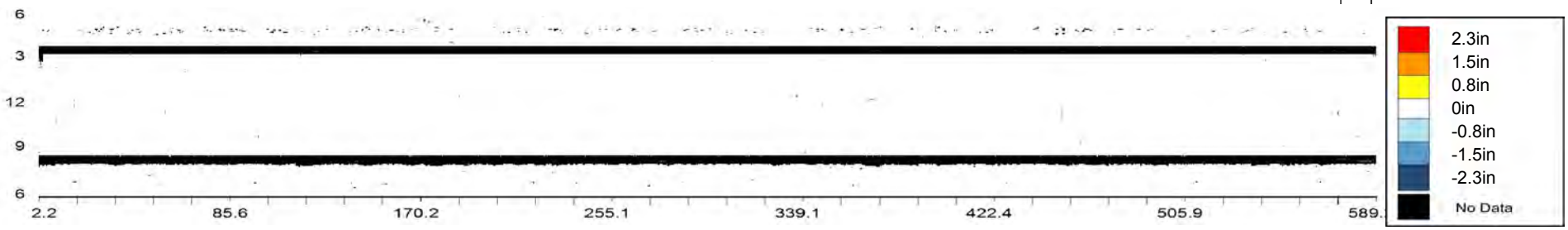


587.9ft General Observation



587.9ft General Observation





OVERVIEW - CMH000199 - CMH000198

Asset Number	CMH000199 - CMH000198		
Upstream MH	CMH000199	Material	Reinforced Concrete Pipe
Downstream MH	CMH000198	Size & Shape	42 in Circle
Survey Direction	Downstream	Match to Reference	589.5 ft

Distance	Observation	Comment
2.2 ft	**Beginning of Inspection**	**CMH000199**
3.4	General Observation	
3.4	Point of Interest	Spalling throughout
25	General Observation	Corrosion to 0.2"
49.9	General Observation	
74.9	General Observation	Corrosion to 0.4"
100	General Observation	
125	General Observation	Corrosion to 0.5"
150	General Observation	
175	General Observation	Corrosion to 0.5"
190.9	Maximum Corrosion	To 0.7"
199.8	General Observation	Corrosion to 0.6"
224.9	General Observation	Corrosion to 0.4"
250.1	General Observation	Corrosion to 0.5"
274.9	General Observation	Corrosion to 0.6"
299.8	General Observation	Corrosion to 0.5"
324.9	General Observation	Corrosion to 0.6"
349.8	General Observation	Corrosion to 0.7"
374.9	General Observation	Corrosion to 0.6"
400	General Observation	Corrosion to 0.6"
424.9	General Observation	Corrosion to 0.5"
449.9	General Observation	Corrosion to 0.5"
474.9	General Observation	Corrosion to 0.5"
499.7	General Observation	
524.8	General Observation	Corrosion to 0.4"
549.7	General Observation	

OVERVIEW - CMH000199 - CMH000198

Asset Number	CMH000199 - CMH000198		
Upstream MH	CMH000199	Material	Reinforced Concrete Pipe
Downstream MH	CMH000198	Size & Shape	42 in Circle
Survey Direction	Downstream	Match to Reference	589.5 ft

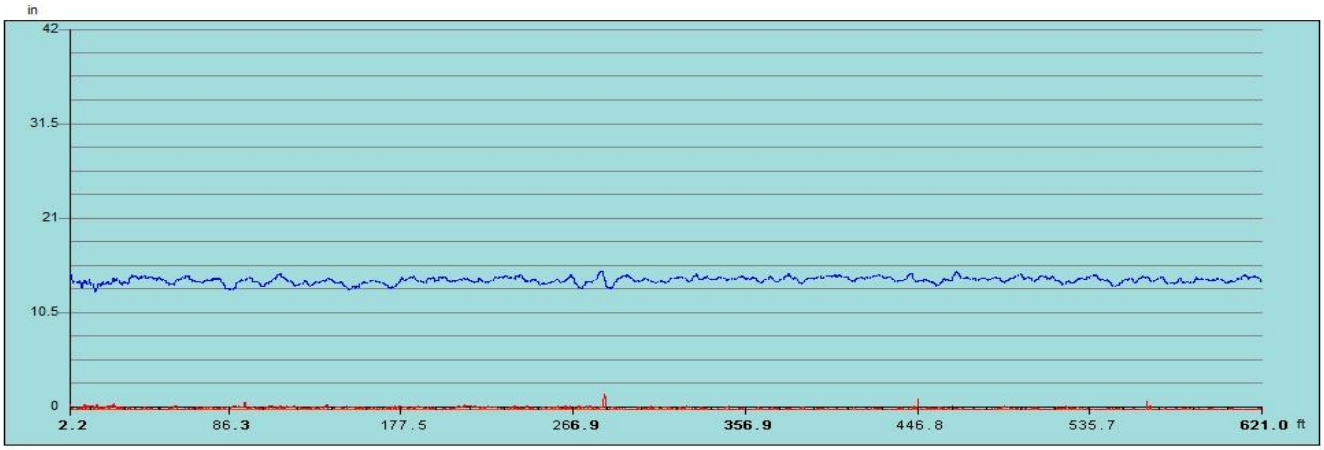
Distance	Observation	Comment
574.8	General Observation	Corrosion to 0.5"
589.5	Closest Match to Reference Size	ø42"
599.9	General Observation	
620.8 ft	**End of Inspection**	**CMH000198**

CMH000199 - CMH000198			
Asset Number	CMH000199 - CMH000198	Length	621 ft
Upstream MH	CMH000199	Diameter	42 in
Downstream MH	CMH000198	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	589.5 ft
Date Profiled	16 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	14 in
Debris Volume	1 cubic feet

Debris Graph



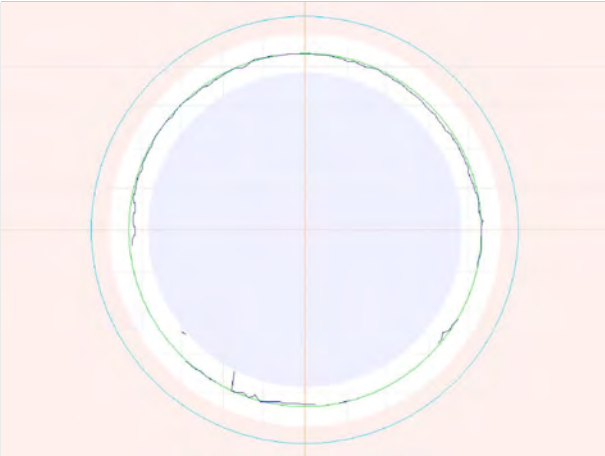
Inspection Distance (ft)

Water Level Debris Level

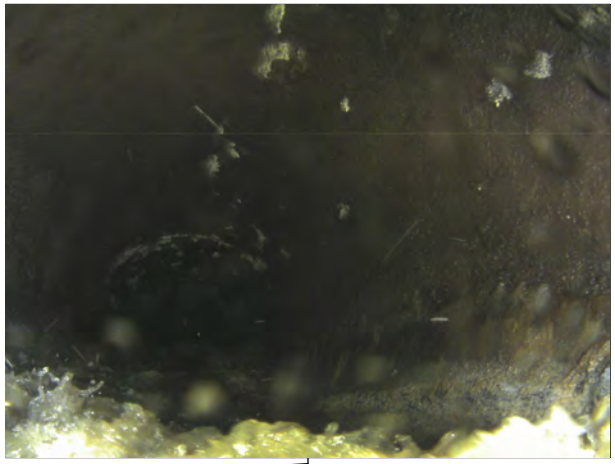
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

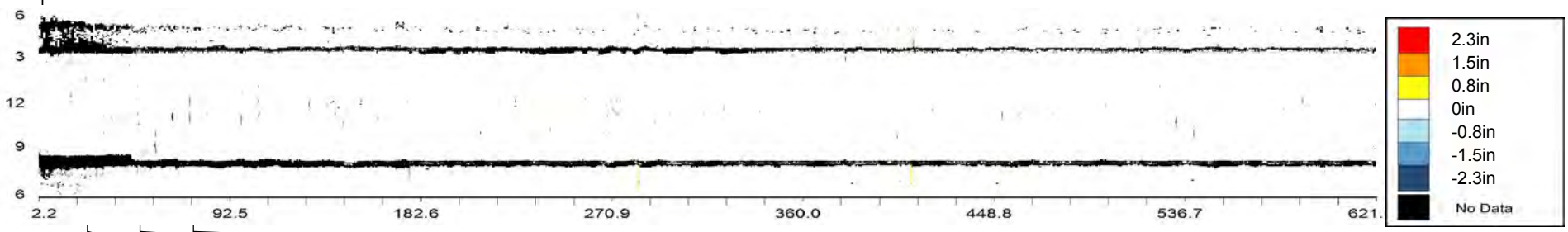
3.4ft General Observation

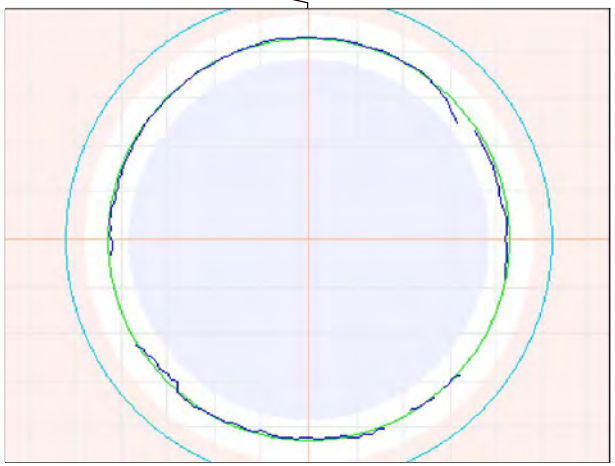


3.4ft General Observation

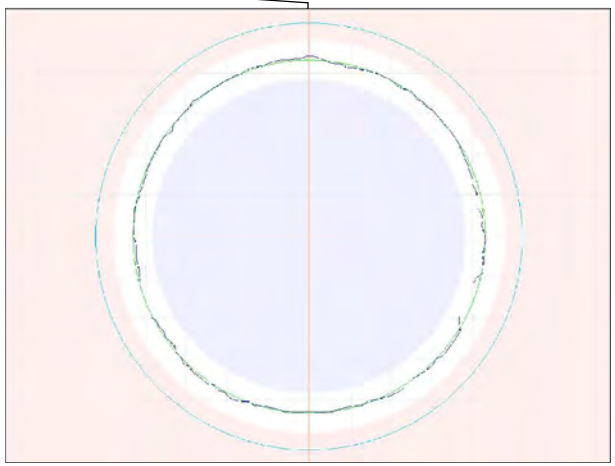


3.4ft Point of Interest - Spalling throughout

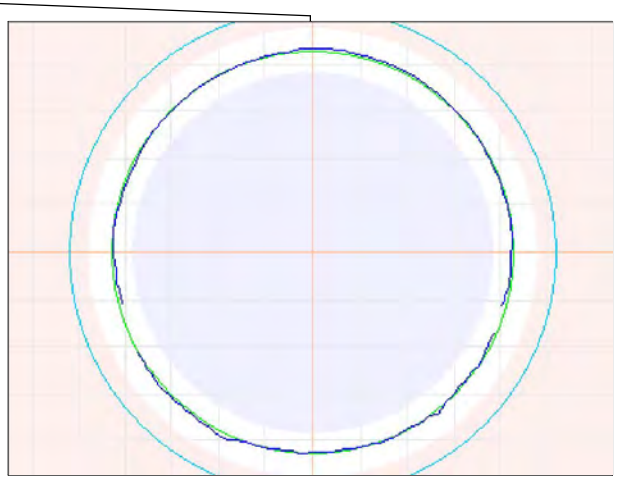




25ft General Observation - Corrosion to 0.2"



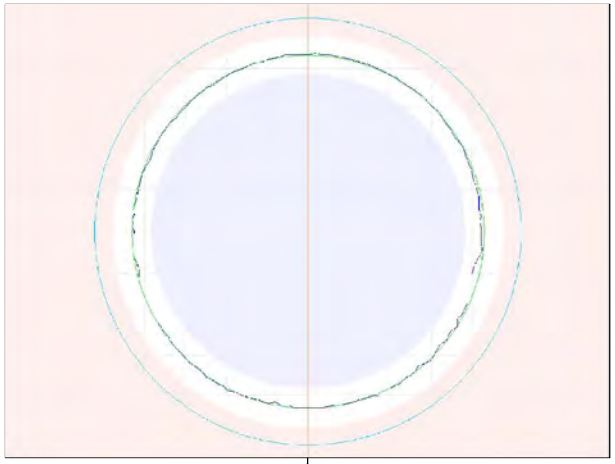
49.9ft General Observation



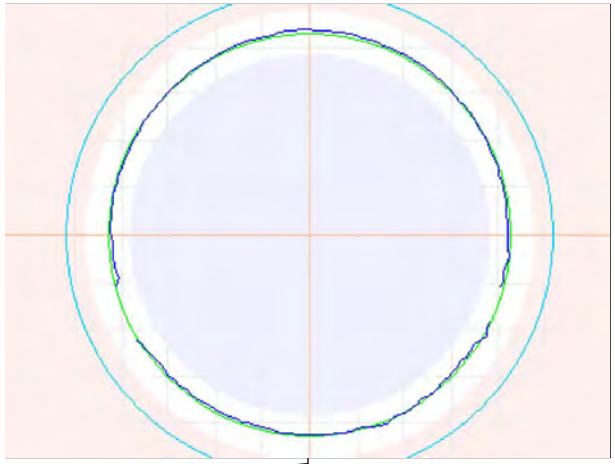
74.9ft General Observation - Corrosion to 0.4"

Observation Report

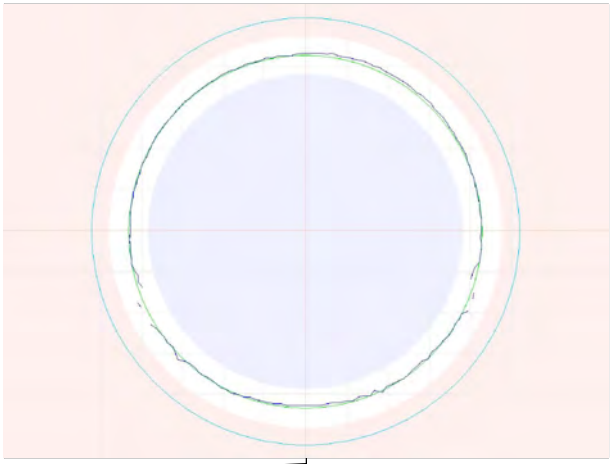
100ft General Observation

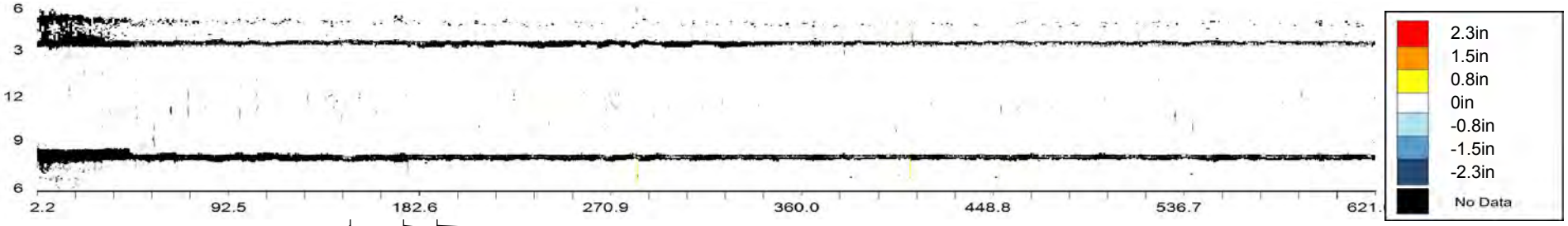


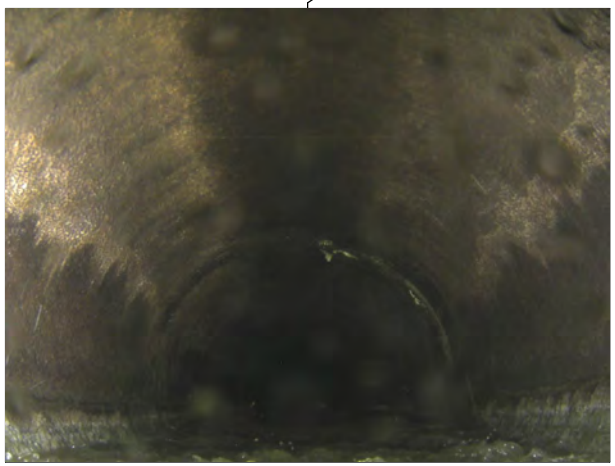
125ft General Observation - Corrosion to 0.5"



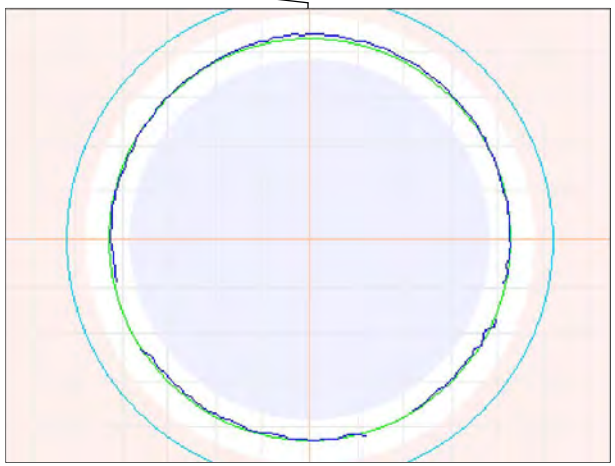
150ft General Observation



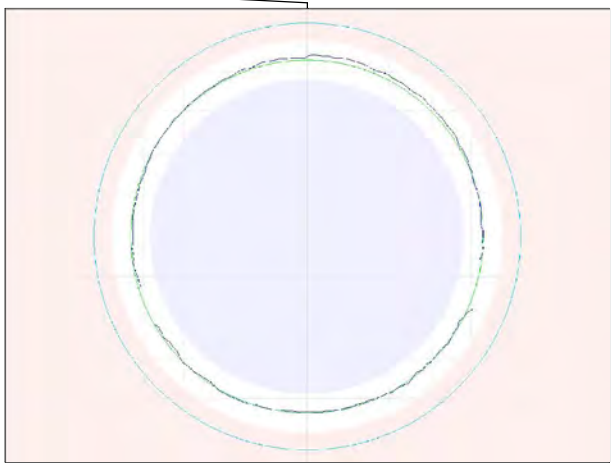




150ft General Observation



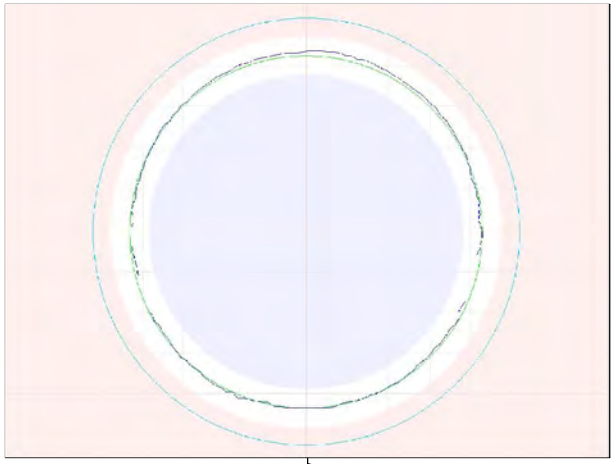
175ft General Observation - Corrosion to 0.5"



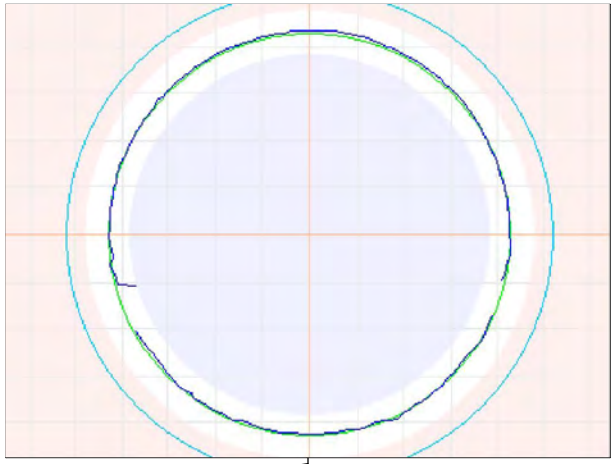
190.9ft Maximum Corrosion - To 0.7"

Observation Report

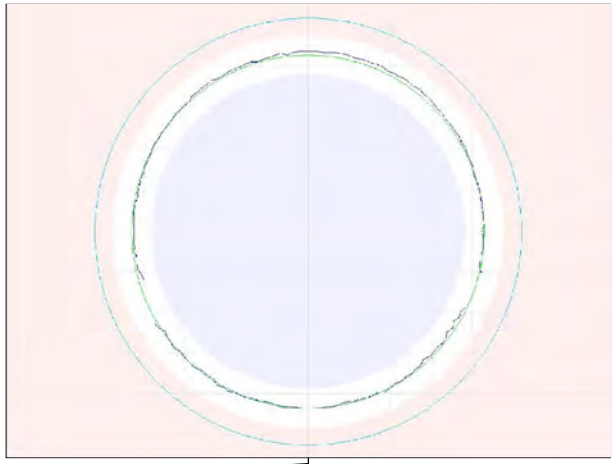
199.8ft General Observation - Corrosion to 0.6"

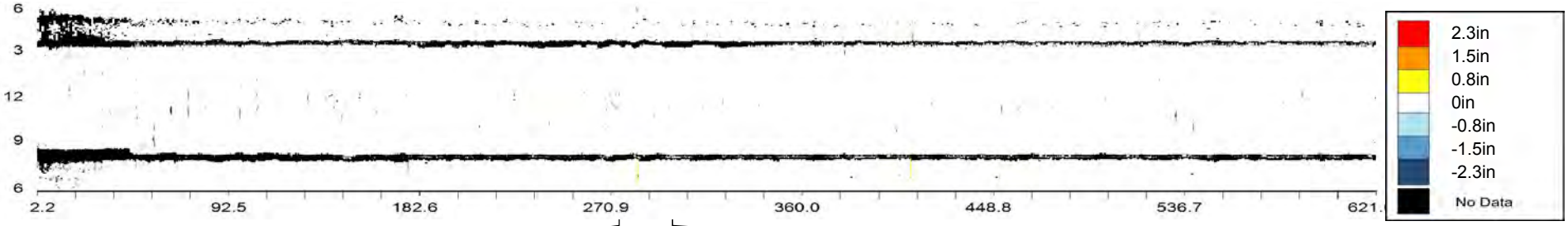


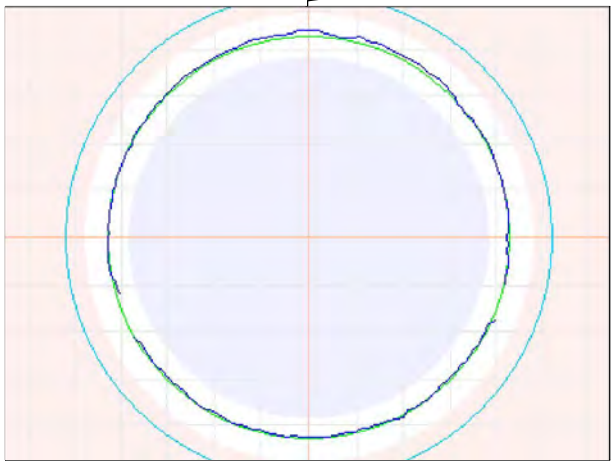
224.9ft General Observation - Corrosion to 0.4"



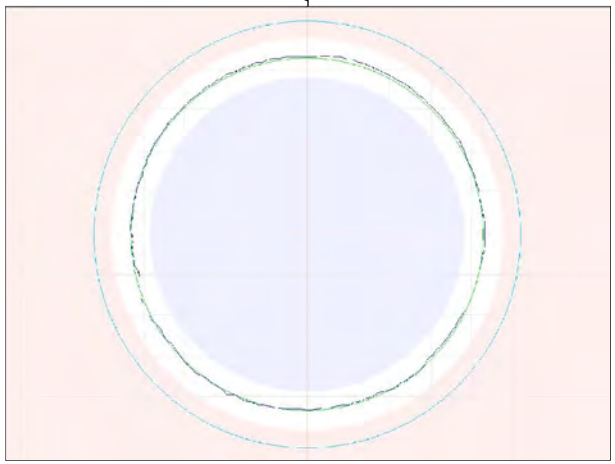
250.1ft General Observation - Corrosion to 0.5"







274.9ft General Observation - Corrosion to 0.6"

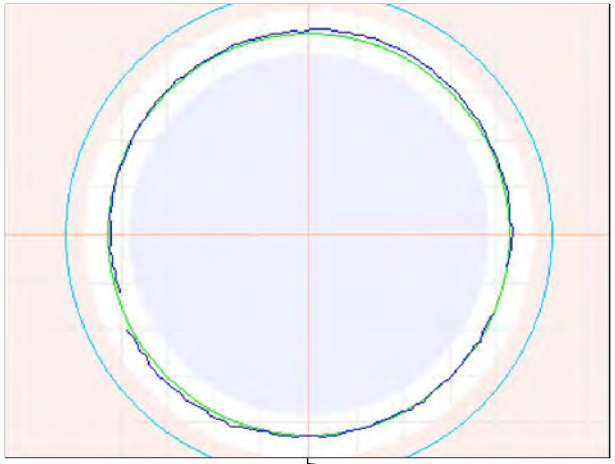


299.8ft General Observation - Corrosion to 0.5"

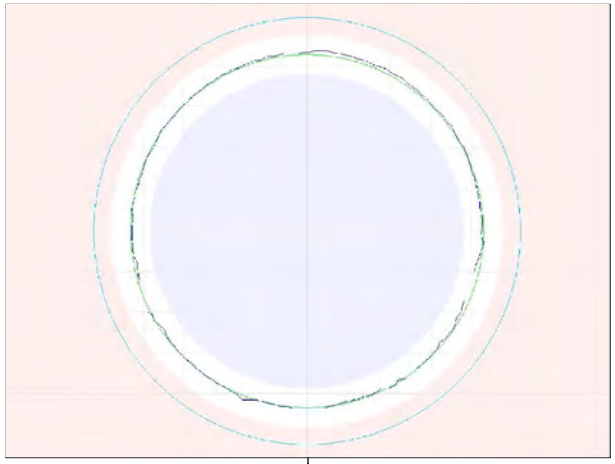
299.8ft General Observation - Corrosion to 0.5"

Observation Report

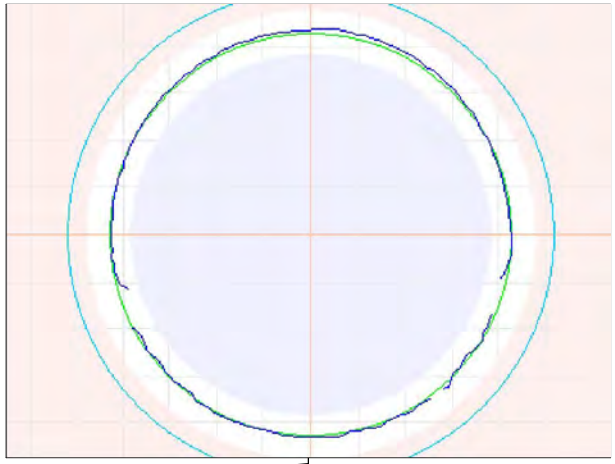
324.9ft General Observation - Corrosion to 0.6"

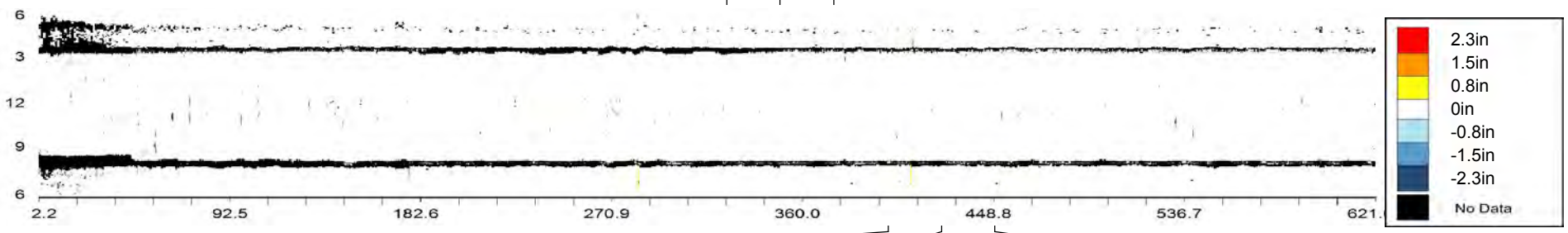


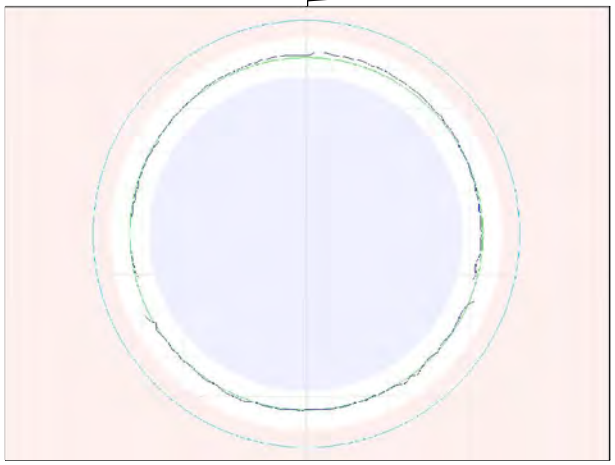
349.8ft General Observation - Corrosion to 0.7"



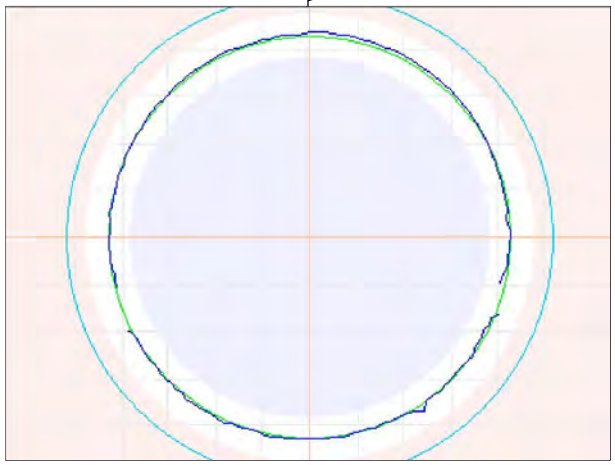
374.9ft General Observation - Corrosion to 0.6"



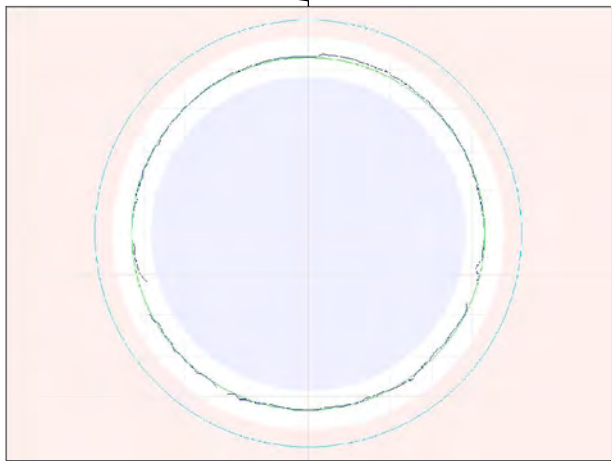




400ft General Observation - Corrosion to 0.6"



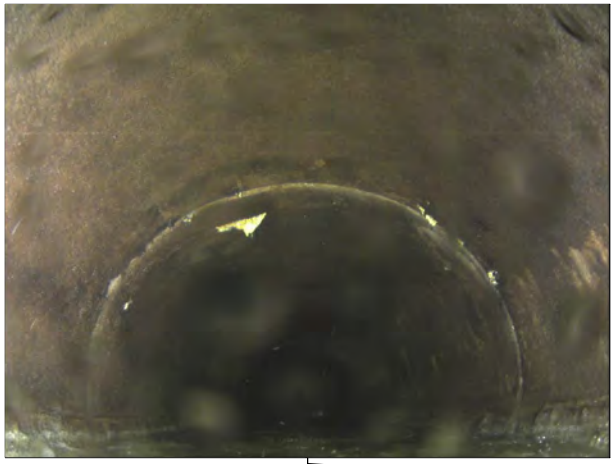
424.9ft General Observation - Corrosion to 0.5"



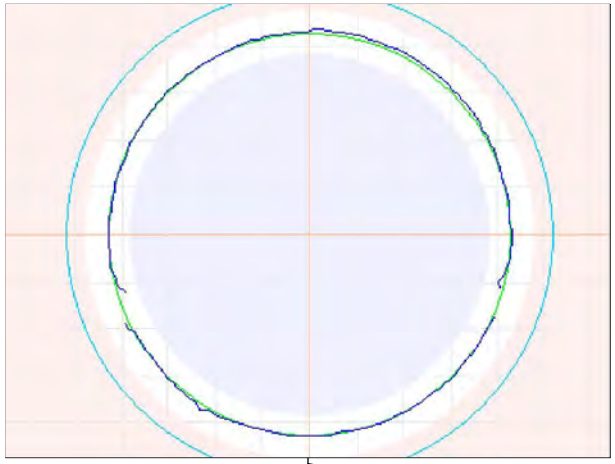
449.9ft General Observation - Corrosion to 0.5"

Observation Report

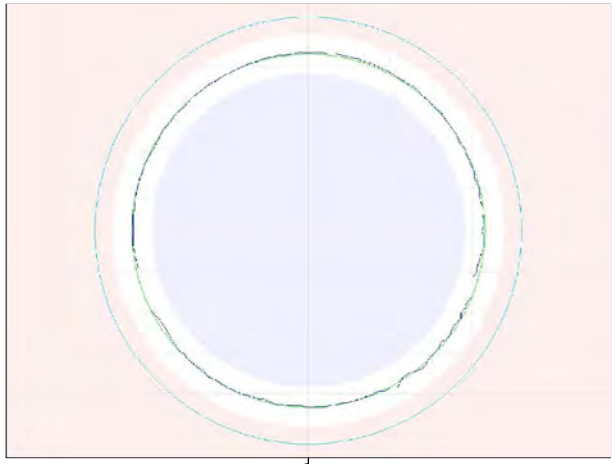
449.9ft General Observation - Corrosion to 0.5"

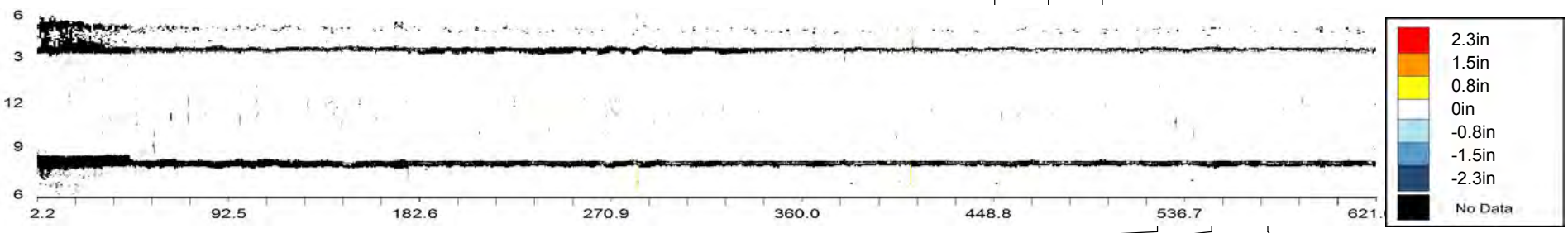


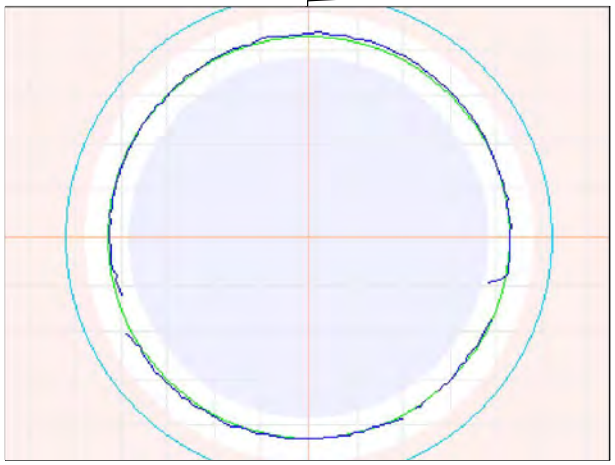
474.9ft General Observation - Corrosion to 0.5"



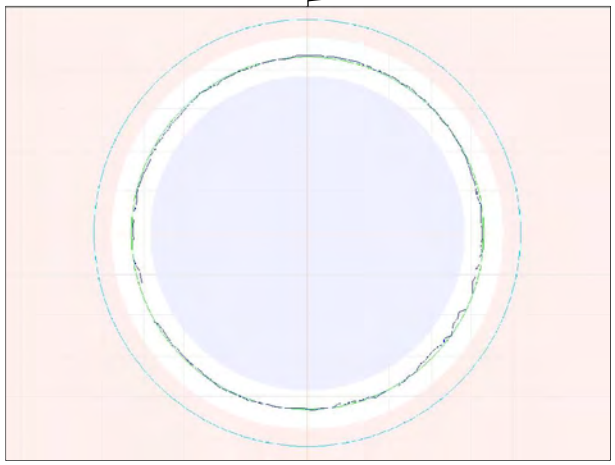
499.7ft General Observation



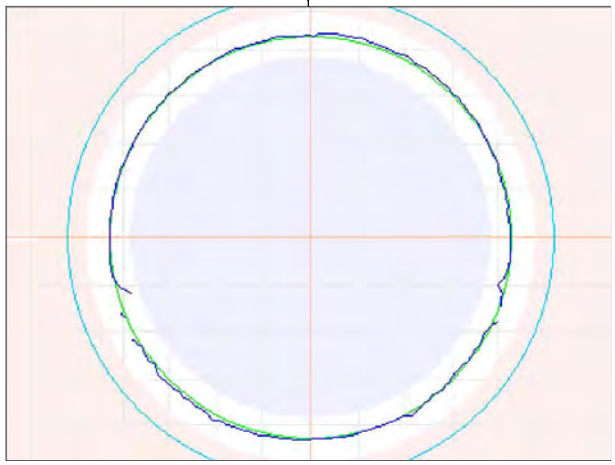




524.8ft General Observation - Corrosion to 0.4"



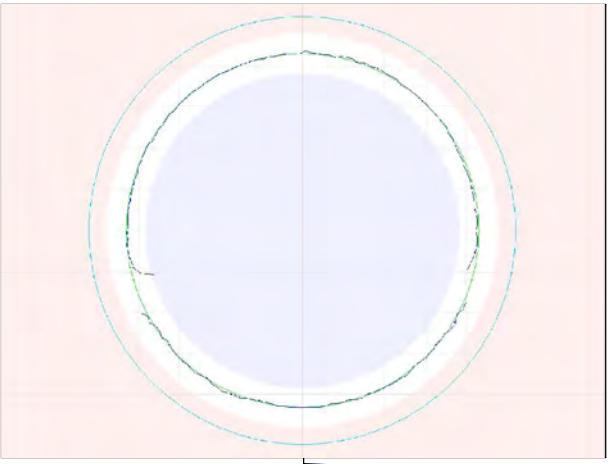
549.7ft General Observation



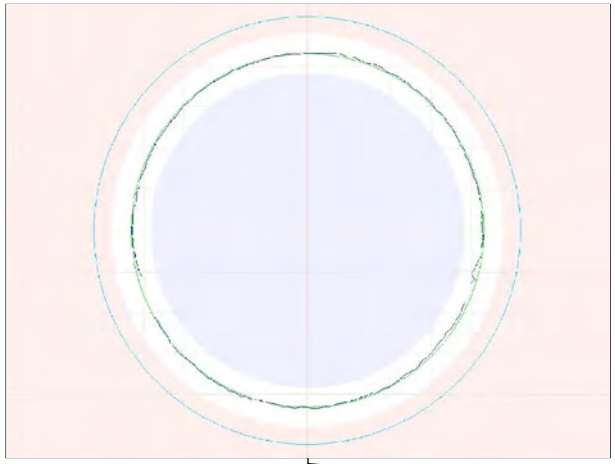
574.8ft General Observation - Corrosion to 0.5"

Observation Report

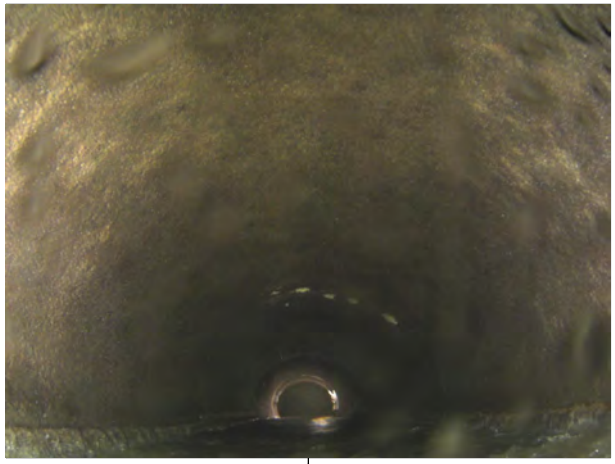
589.5ft Closest Match to Reference Size - ø42"

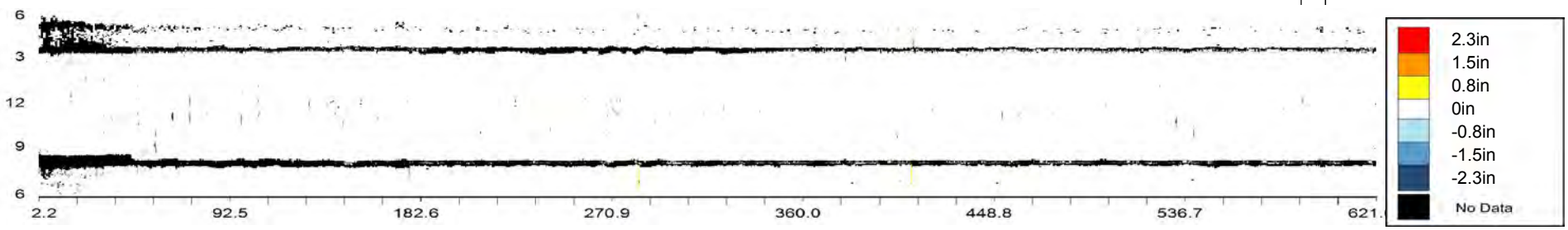


599.9ft General Observation



599.9ft General Observation





OVERVIEW - CMH000200 - CMH000199

Asset Number	CMH000200 - CMH000199		
Upstream MH	CMH000200	Material	Reinforced Concrete Pipe
Downstream MH	CMH000199	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	290.6 ft

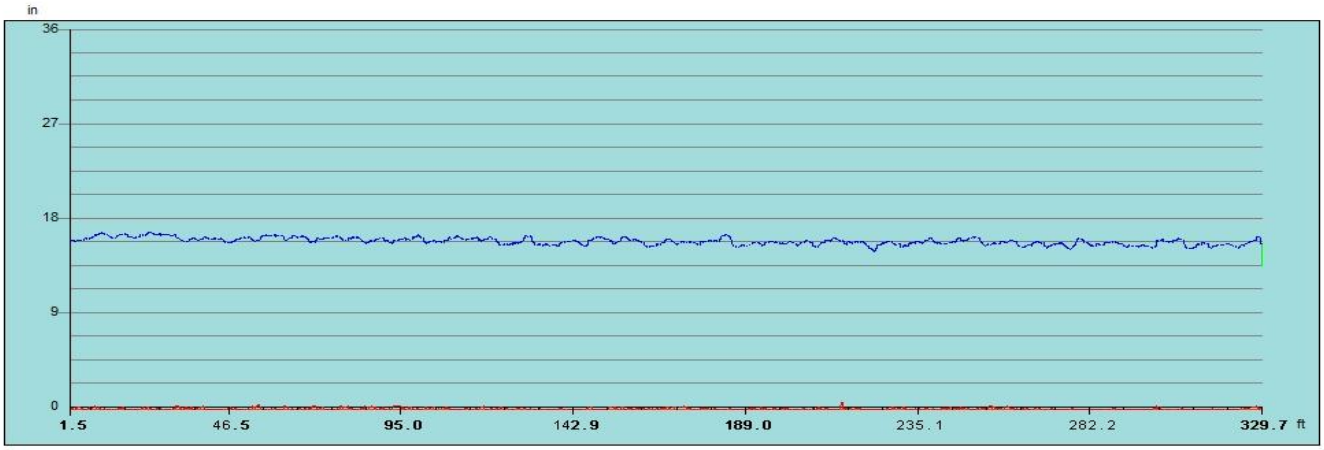
Distance	Observation	Comment
1.5 ft	**Beginning of Inspection**	**CMH000200**
2	General Observation	Corrosion to 1.4", Measurement inside reference to 0.6"
2	Point of Interest	Spalling throughout
3.1	Maximum Corrosion	To 1.5"
25	General Observation	Corrosion to 0.6"
49.9	General Observation	Corrosion to 0.5"
60.4	3D Laser Sonar Scan	Internal pipe overview
75	General Observation	Corrosion to 0.7"
99.9	General Observation	Corrosion to 0.6", Measurement inside reference to 1.0"
124.9	General Observation	Corrosion to 0.6"
149.8	General Observation	Corrosion to 0.9"
174.9	General Observation	Corrosion to 0.8"
200.1	General Observation	
225	General Observation	Corrosion to 0.6"
249.9	General Observation	Corrosion to 0.5"
274.9	General Observation	Corrosion to 0.5"
290.6	Match to Reference Shape and Size	ø36"
299.9	General Observation	Measurement inside reference to 0.7"
328.8	General Observation	Corrosion to 0.7"
329.6 ft	**End of Inspection**	**CMH000199**

CMH000200 - CMH000199			
Asset Number	CMH000200 - CMH000199	Length	330 ft
Upstream MH	CMH000200	Diameter	36 in
Downstream MH	CMH000199	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	290.6 ft
Date Profiled	16 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	16 in
Debris Volume	0 cubic feet

Debris Graph



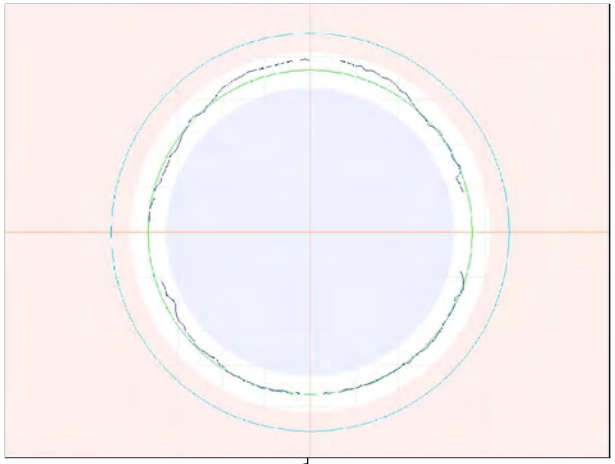
Inspection Distance (ft)

Water Level Debris Level

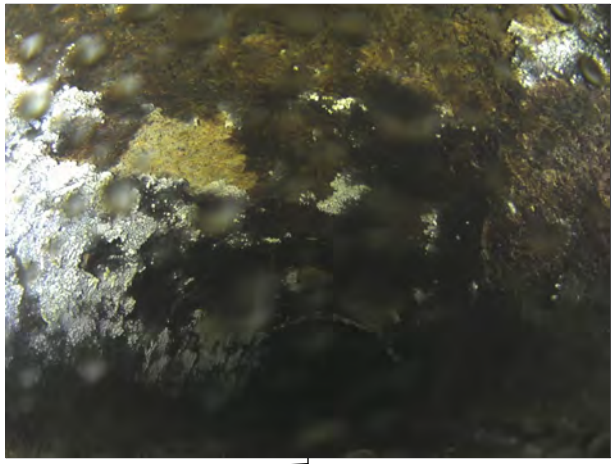
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

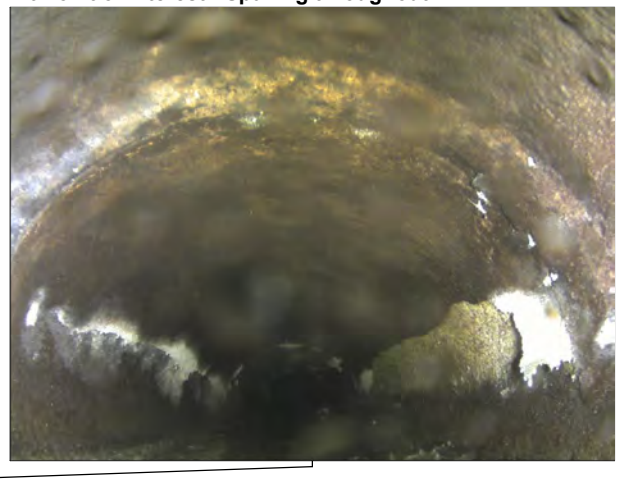
2ft General Observation - Corrosion to 1.4", Measurement inside reference to 0.6"

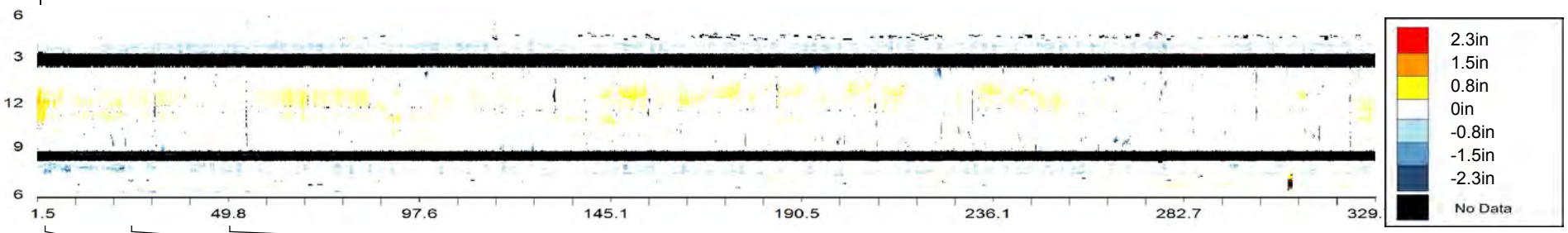


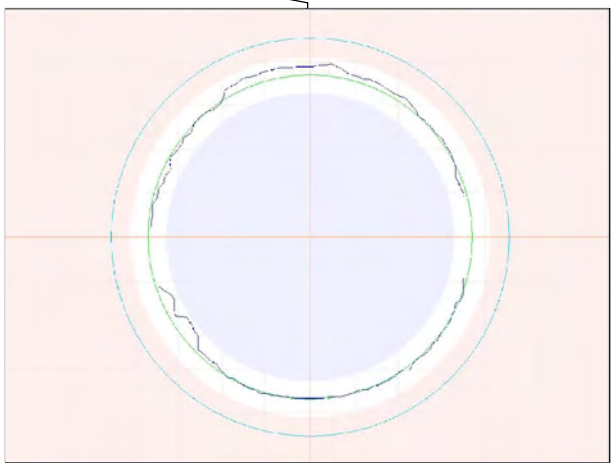
2ft General Observation - Corrosion to 1.4", Measurement inside reference to 0.6"



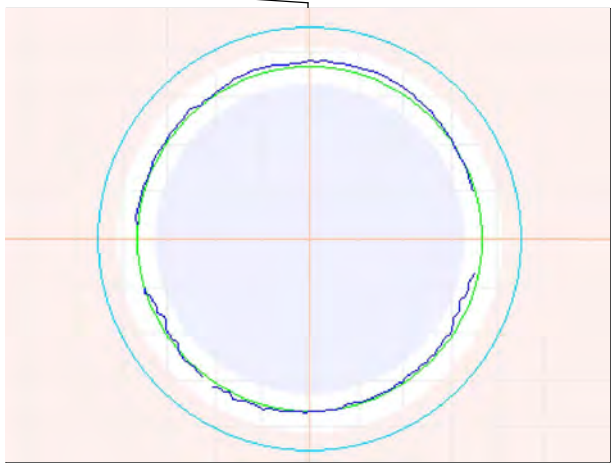
2ft Point of Interest - Spalling throughout



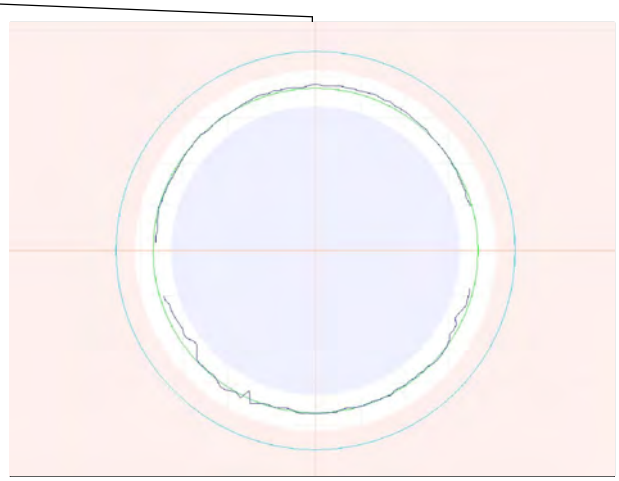




3.1ft Maximum Corrosion - To 1.5"



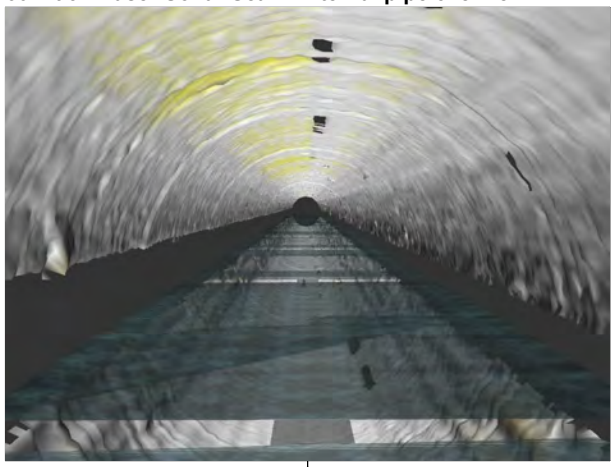
25ft General Observation - Corrosion to 0.6"



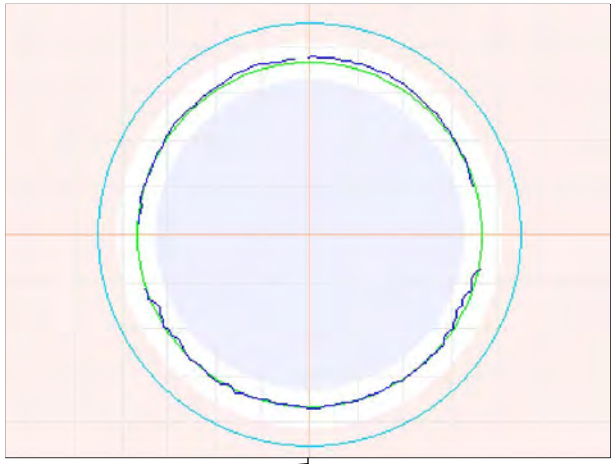
49.9ft General Observation - Corrosion to 0.5"

Observation Report

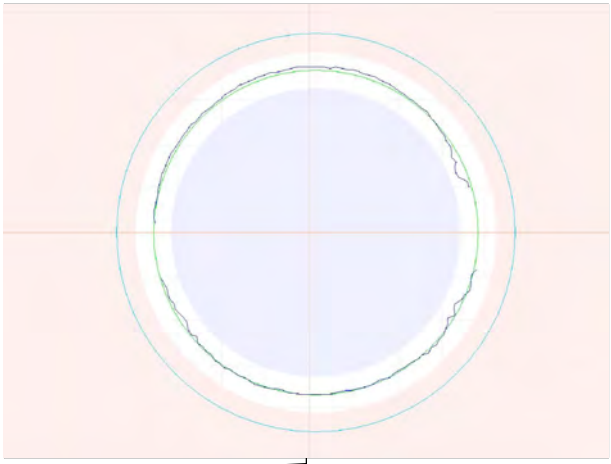
60.4ft 3D Laser Sonar Scan - Internal pipe overview

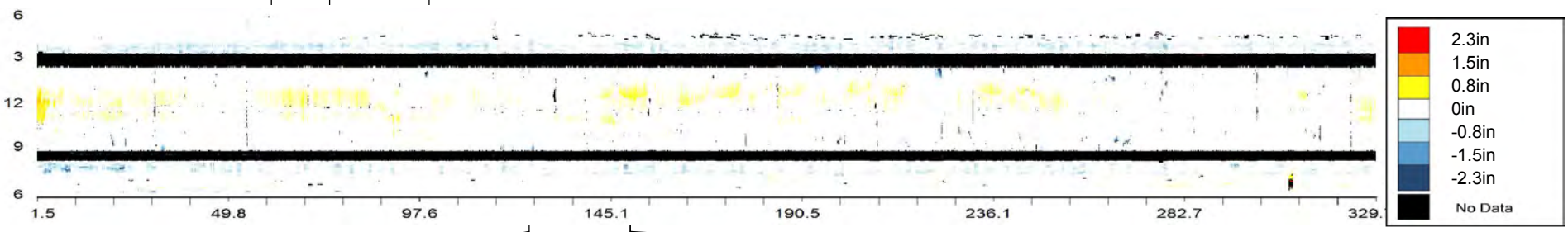


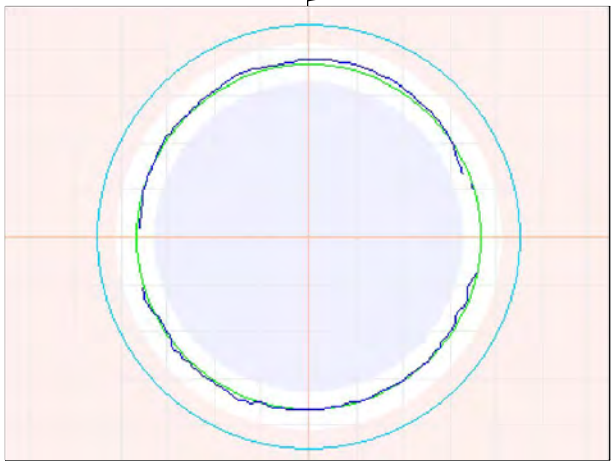
75ft General Observation - Corrosion to 0.7"



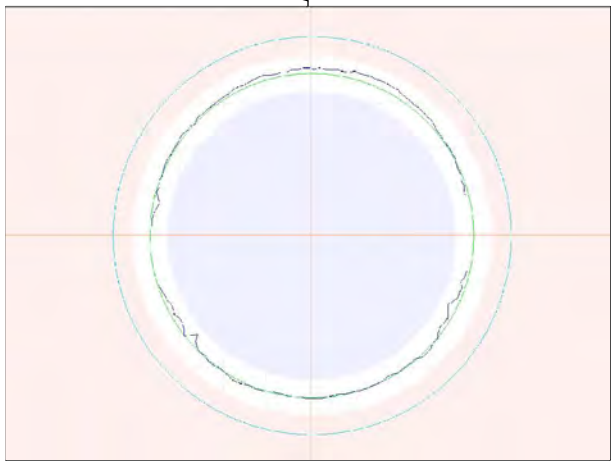
99.9ft General Observation - Corrosion to 0.6", Measurement inside reference to 1.0"



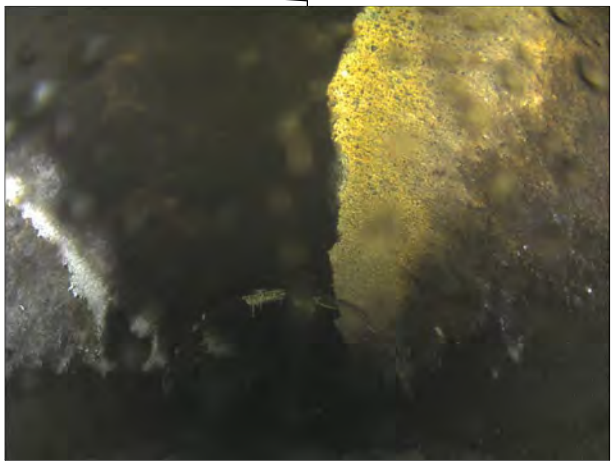




124.9ft General Observation - Corrosion to 0.6"



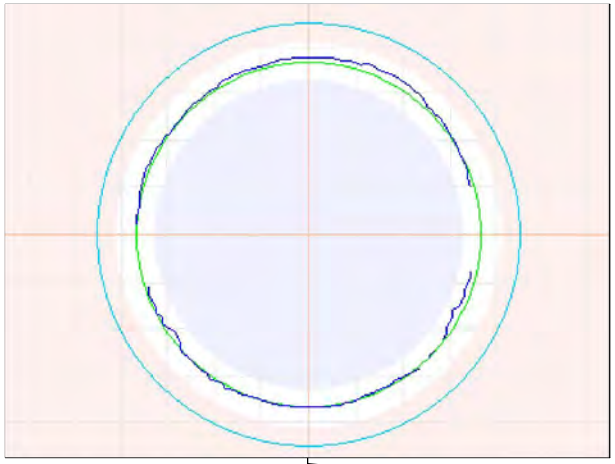
149.8ft General Observation - Corrosion to 0.9"



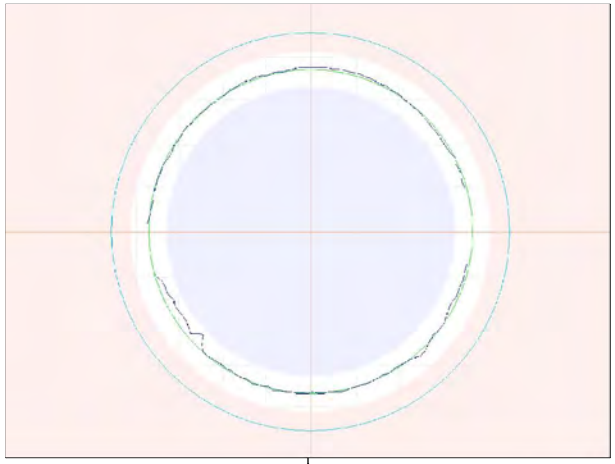
149.8ft General Observation - Corrosion to 0.9"

Observation Report

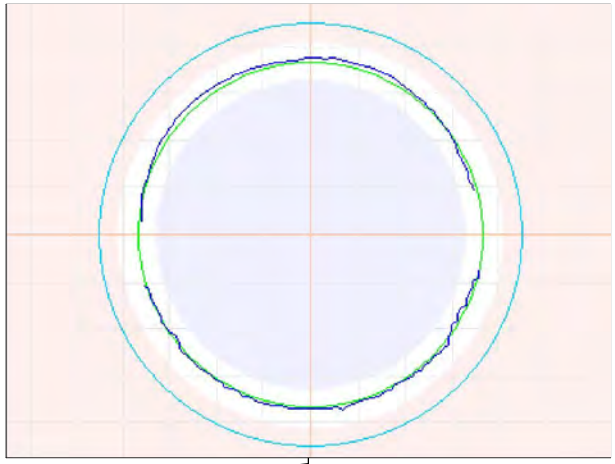
174.9ft General Observation - Corrosion to 0.8"

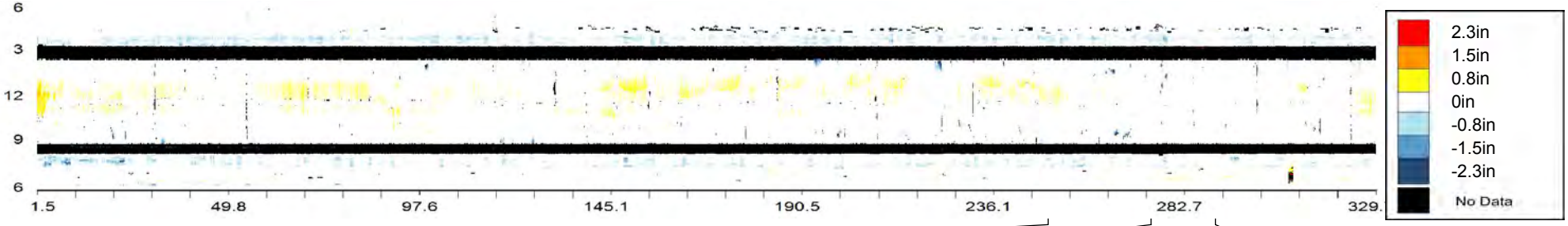


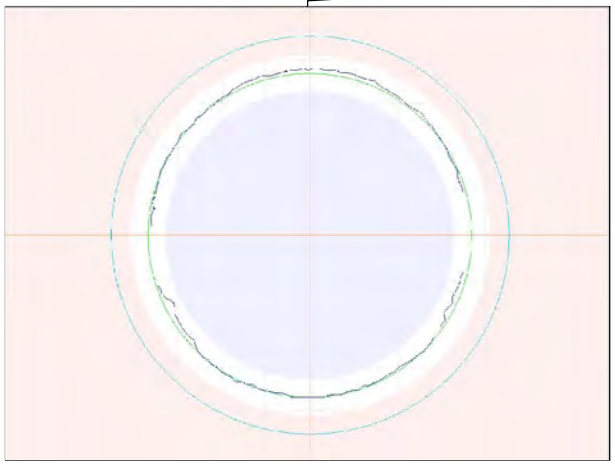
200.1ft General Observation



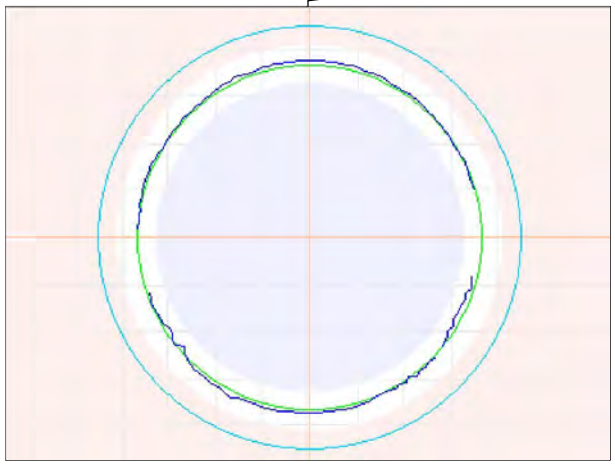
225ft General Observation - Corrosion to 0.6"



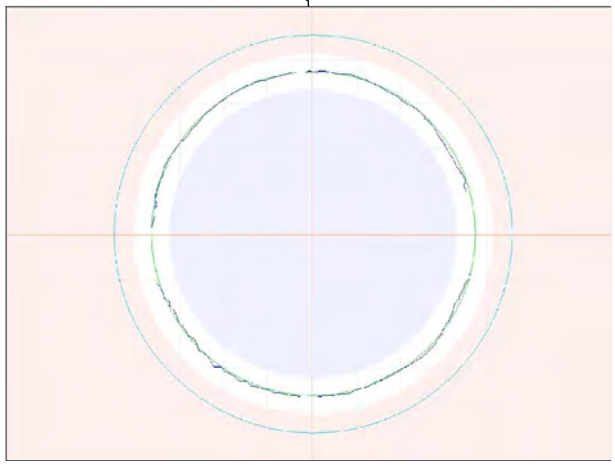




249.9ft General Observation - Corrosion to 0.5"



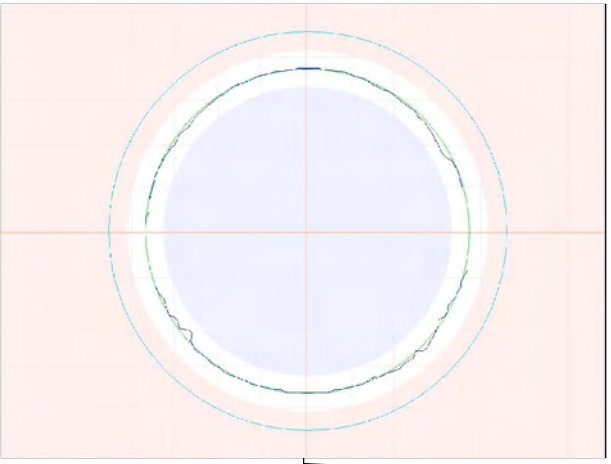
274.9ft General Observation - Corrosion to 0.5"



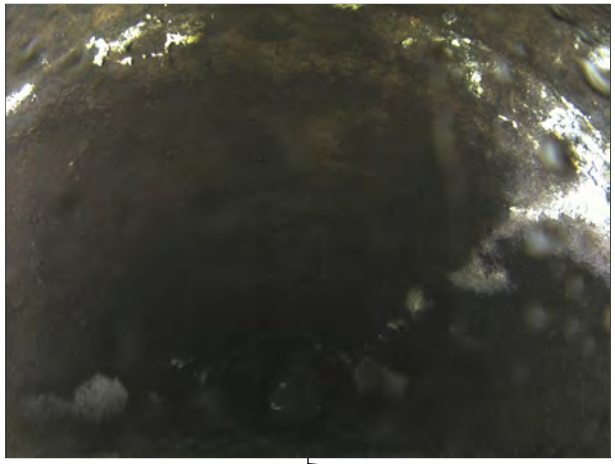
290.6ft Match to Reference Shape and Size - ø36"

Observation Report

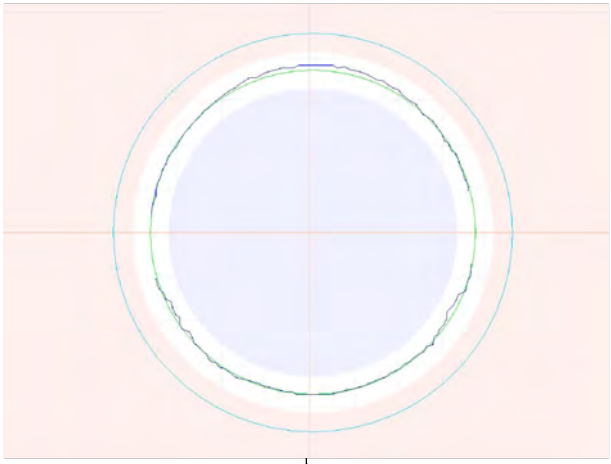
299.9ft General Observation - Measurement inside reference to 0.7"

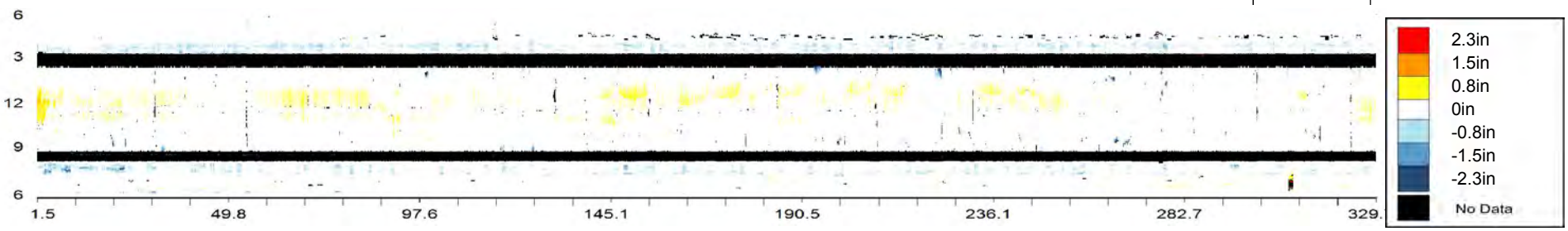


299.9ft General Observation - Measurement inside reference to 0.7"



328.8ft General Observation - Corrosion to 0.7"





OVERVIEW - CMH000201 - CMH000200

Asset Number	CMH000201 - CMH000200		
Upstream MH	CMH000201	Material	Reinforced Concrete Pipe
Downstream MH	CMH000200	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	402.6 ft

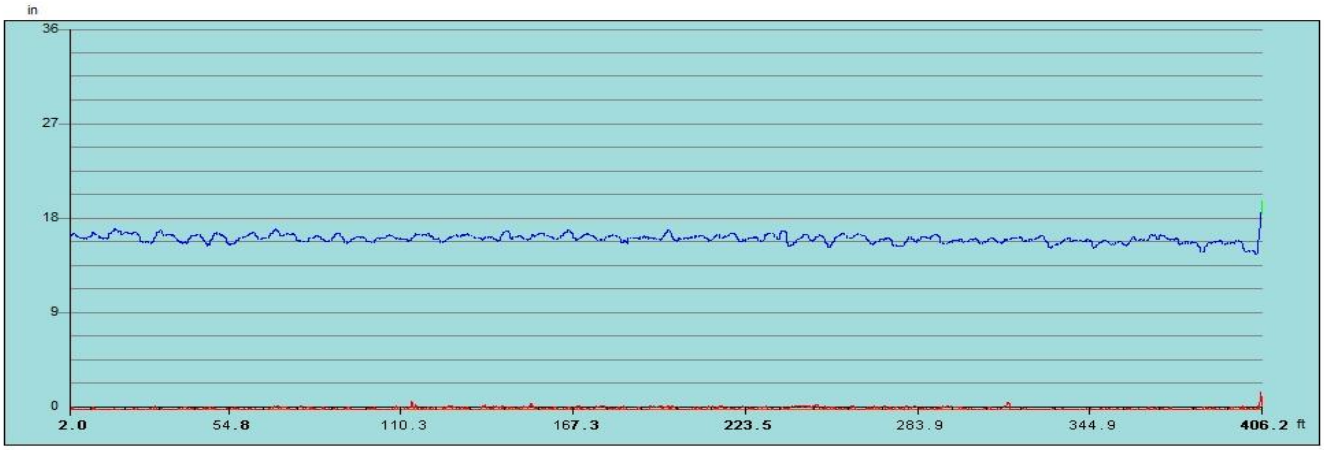
Distance	Observation	Comment
2 ft	**Beginning of Inspection**	**CMH000201**
2.3	General Observation	
25	General Observation	Corrosion to 0.5"
50.1	General Observation	Corrosion to 0.6"
75	General Observation	Corrosion to 0.8"
100.1	General Observation	Corrosion to 0.6"
125	General Observation	Corrosion to 0.6"\Debris to 0.2"
149.9	General Observation	Corrosion to 0.8"
158.3	3D Laser Sonar Scan	Corrosion
174.9	General Observation	Corrosion to 0.7"\Debris to 0.3"
200	General Observation	Corrosion to 0.8"
200.5	Maximum Corrosion	To 1.0"
224.9	General Observation	Corrosion to 0.7"\Debris to 0.2"
250.1	General Observation	Corrosion to 0.5"
274.9	General Observation	Corrosion to 0.6"
300	General Observation	Corrosion to 0.7"
324.9	General Observation	Corrosion to 0.6"
350	General Observation	Corrosion to 0.5"
368.9	Point of Interest	Spalling continues till end
374.9	General Observation	Corrosion to 0.4"
399.8	General Observation	
402.6	Match to Reference Shape and Size	ø36"
406 ft	**End of Inspection**	**CMH000200**

CMH000201 - CMH000200			
Asset Number	CMH000201 - CMH000200	Length	407 ft
Upstream MH	CMH000201	Diameter	36 in
Downstream MH	CMH000200	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	402.6 ft
Date Profiled	16 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	16 in
Debris Volume	1 cubic feet

Debris Graph



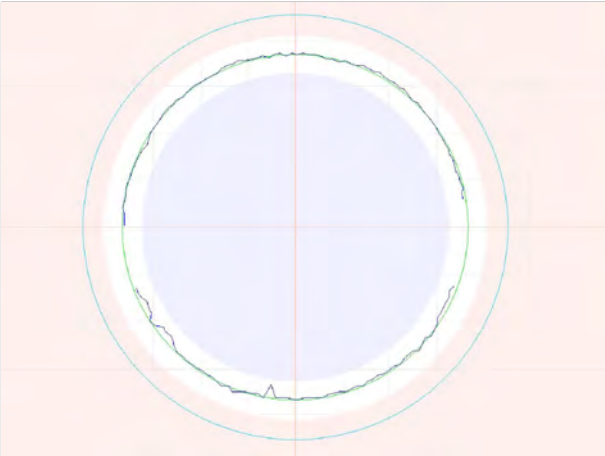
Inspection Distance (ft)

Water Level Debris Level

*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

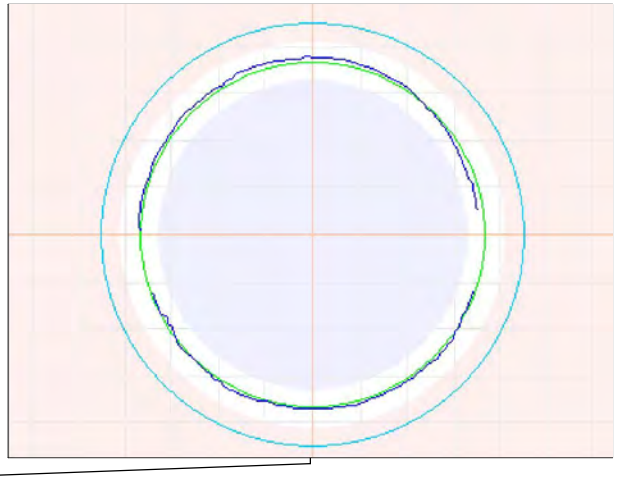
Observation Report

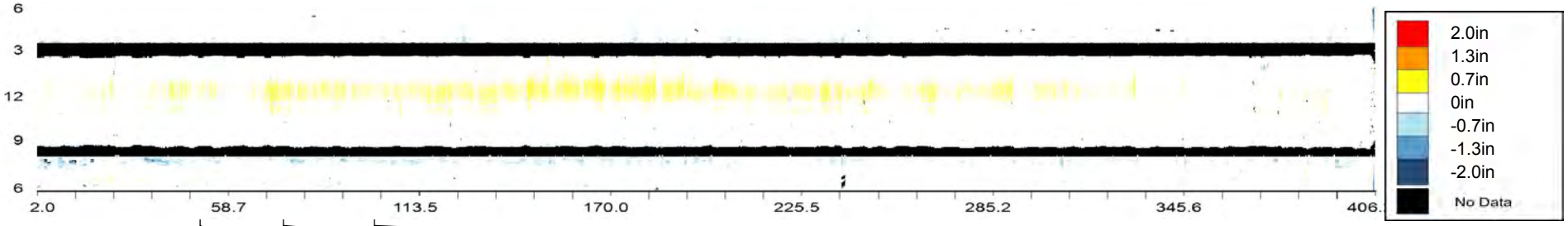
2.3ft General Observation

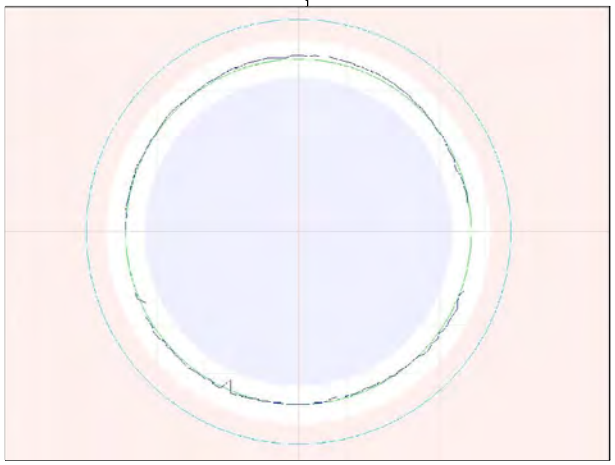


2.3ft General Observation

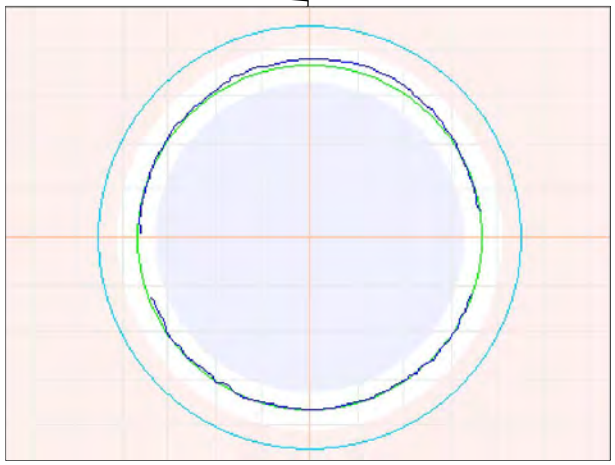
25ft General Observation - Corrosion to 0.5"



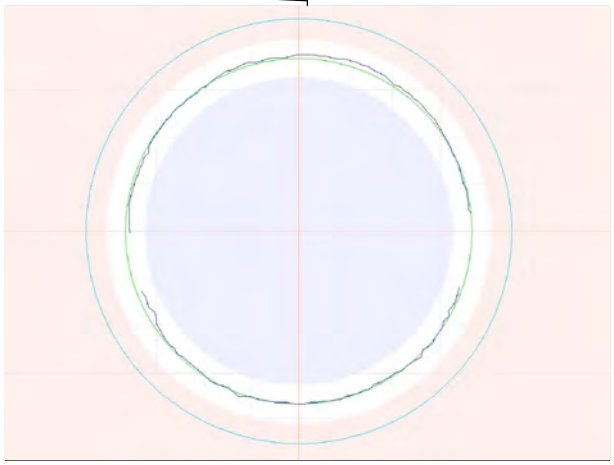




50.1ft General Observation - Corrosion to 0.6"



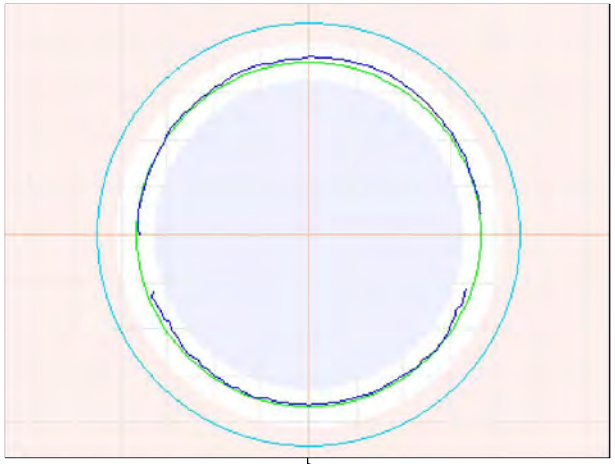
75ft General Observation - Corrosion to 0.8"



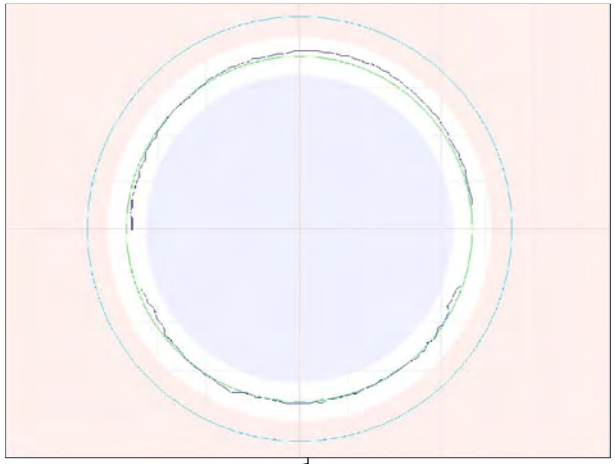
100.1ft General Observation - Corrosion to 0.6"

Observation Report

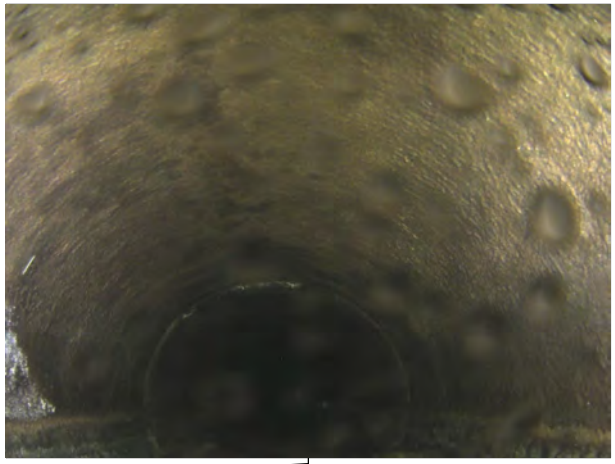
125ft General Observation - Corrosion to 0.6"\Debris to 0.2"

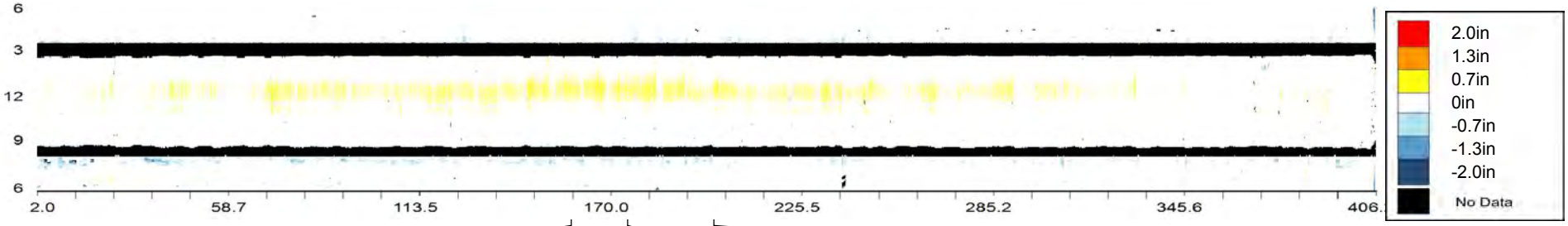


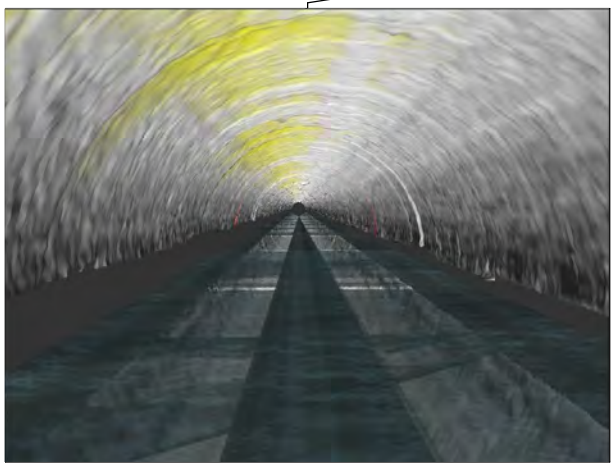
149.9ft General Observation - Corrosion to 0.8"



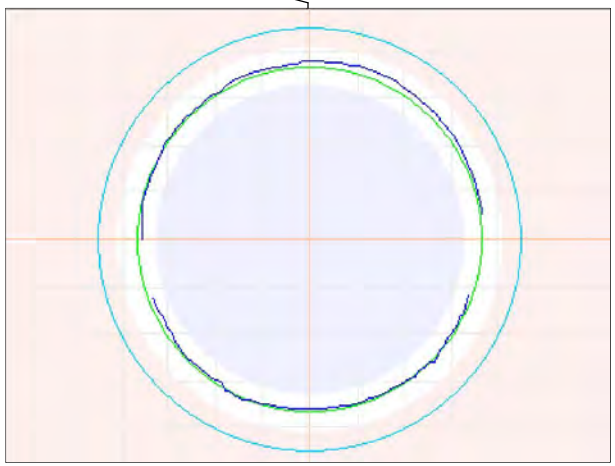
149.9ft General Observation - Corrosion to 0.8"



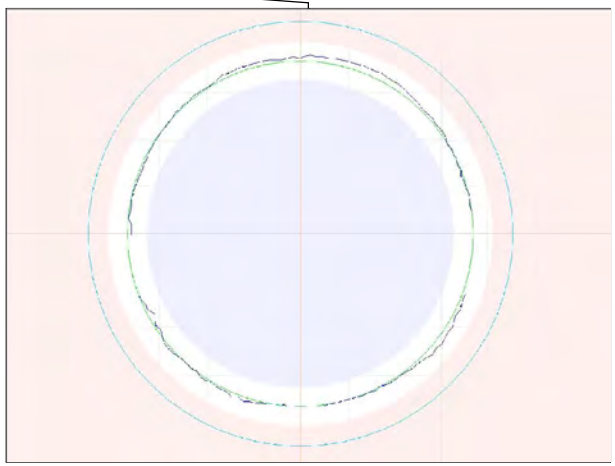




158.3ft 3D Laser Sonar Scan - Corrosion



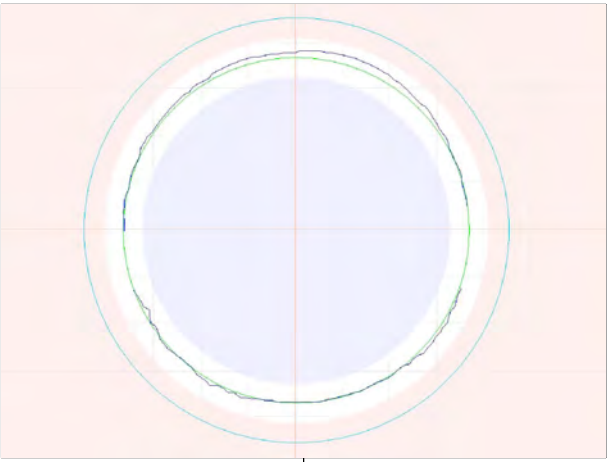
174.9ft General Observation - Corrosion to 0.7"\Debris to 0.3"



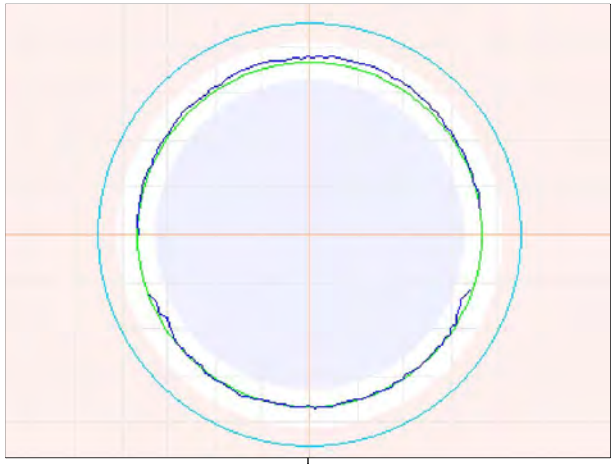
200ft General Observation - Corrosion to 0.8"

Observation Report

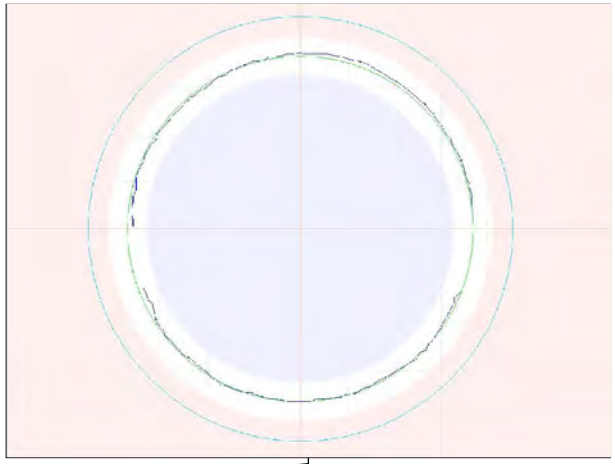
200.5ft Maximum Corrosion - To 1.0"

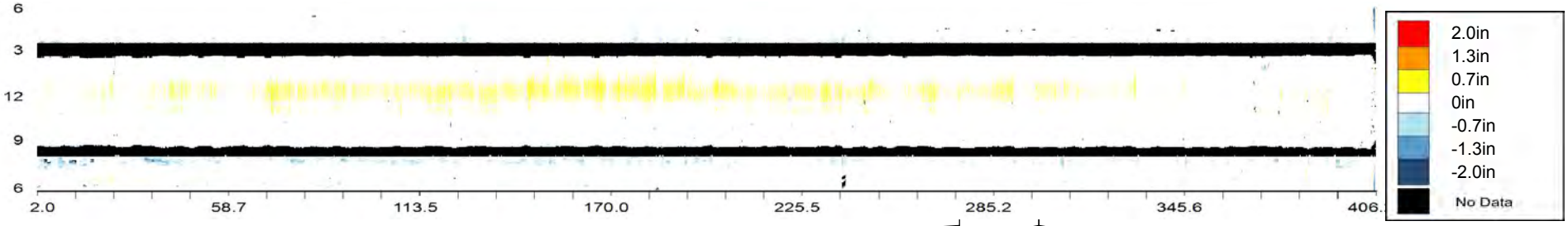


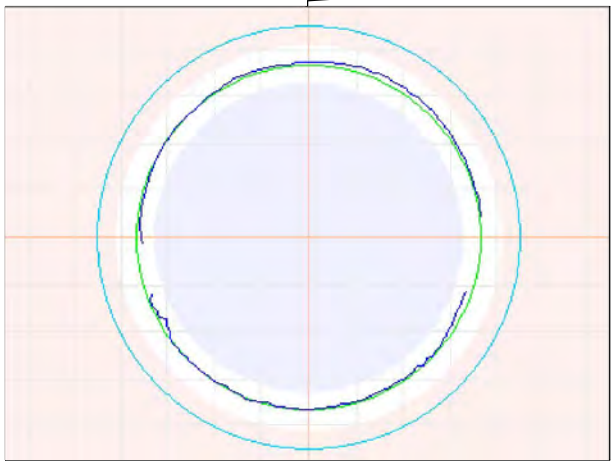
224.9ft General Observation - Corrosion to 0.7"\Debris to 0.2"



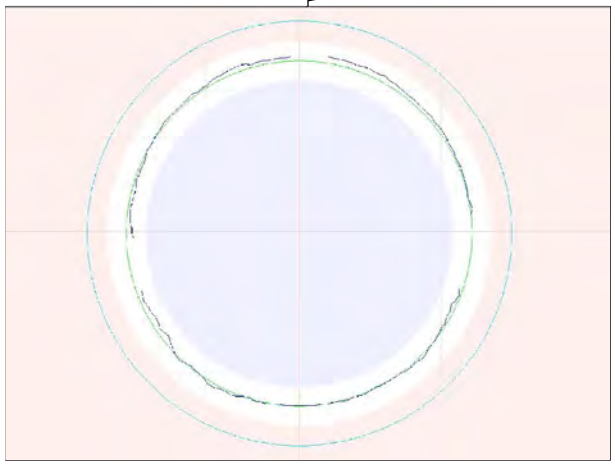
250.1ft General Observation - Corrosion to 0.5"



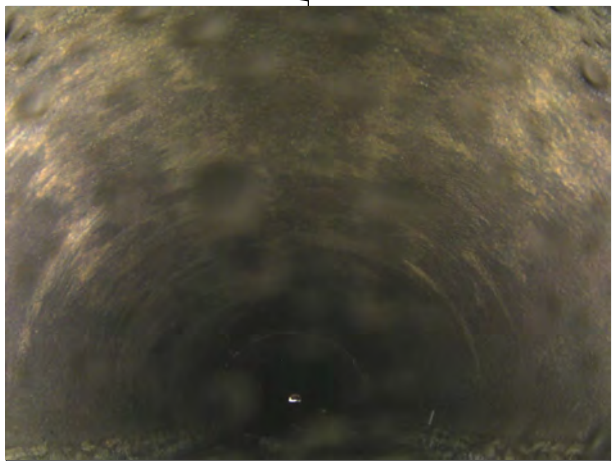




274.9ft General Observation - Corrosion to 0.6"



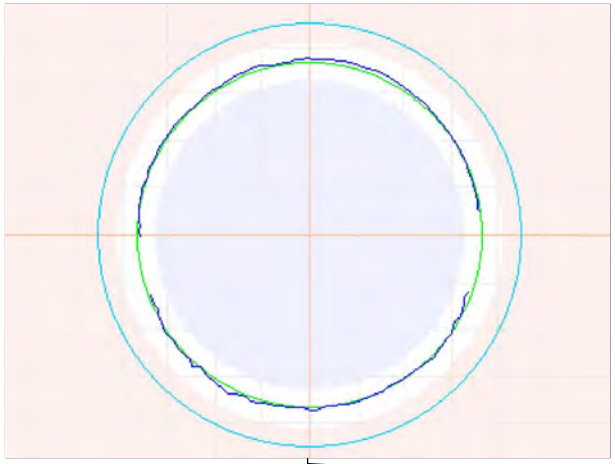
300ft General Observation - Corrosion to 0.7"



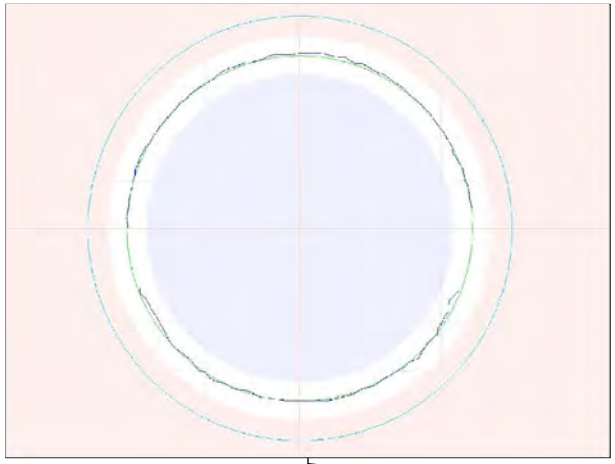
300ft General Observation - Corrosion to 0.7"

Observation Report

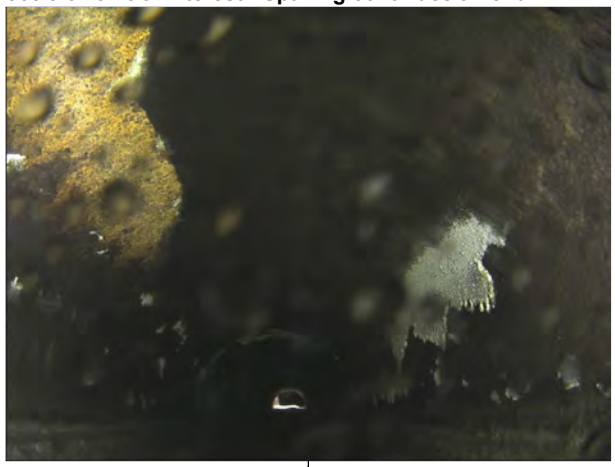
324.9ft General Observation - Corrosion to 0.6"

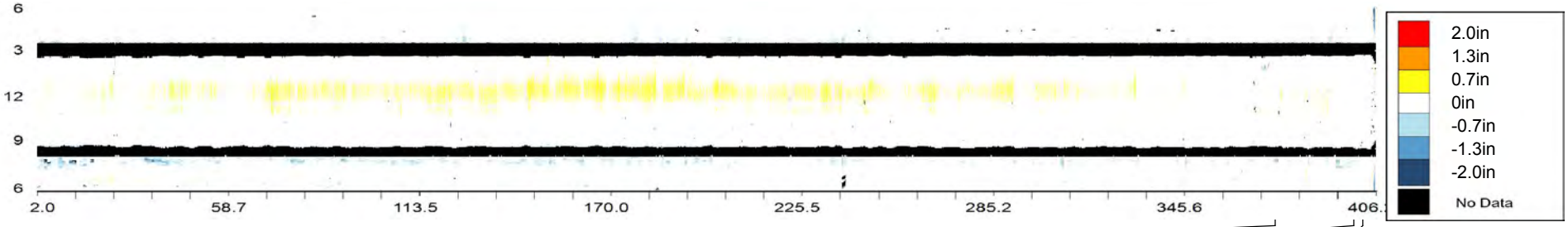


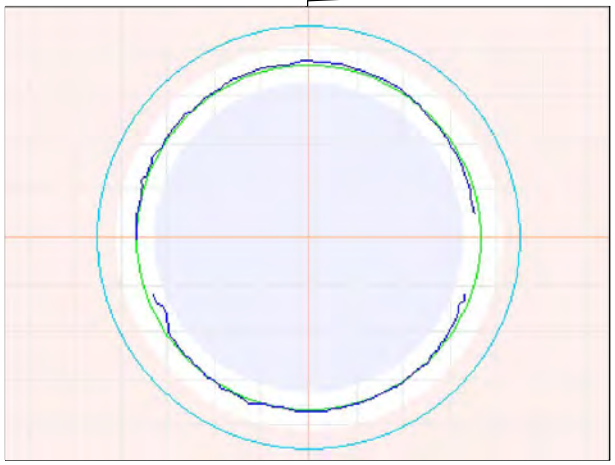
350ft General Observation - Corrosion to 0.5"



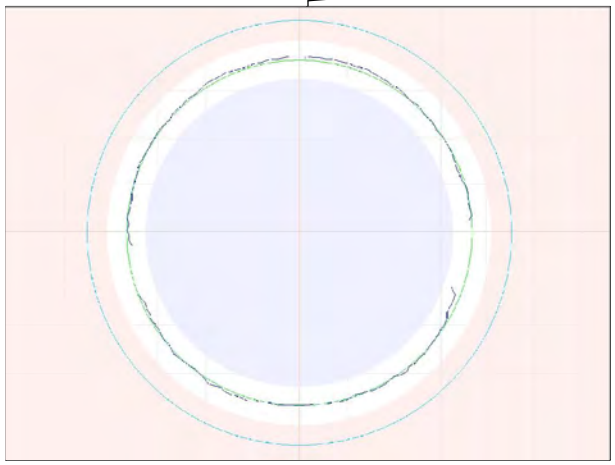
368.9ft Point of Interest - Spalling continues till end



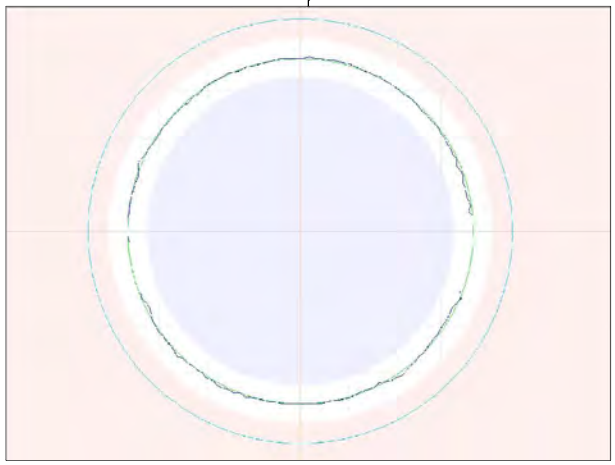




374.9ft General Observation - Corrosion to 0.4"



399.8ft General Observation



402.6ft Match to Reference Shape and Size - ø36"

OVERVIEW - CMH000203 - CMH000201

Asset Number	CMH000203 - CMH000201		
Upstream MH	CMH000203	Material	Reinforced Concrete Pipe
Downstream MH	CMH000201	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	607.6 ft

Distance	Observation	Comment
2 ft	**Beginning of Inspection**	**CMH000203**
4.2	General Observation	Corrosion to 0.7"
25	General Observation	Corrosion to 0.5"
49.9	General Observation	Corrosion to 0.6"
75	General Observation	Corrosion to 0.5"
100	General Observation	Corrosion to 0.7"
124.9	General Observation	Corrosion to 0.6"\Debris to 0.2"
150	General Observation	Corrosion to 0.8"
174.9	General Observation	Corrosion to 0.7"
199.8	General Observation	
224.9	General Observation	Corrosion to 0.4"
250	General Observation	Corrosion to 0.6"
275	General Observation	Corrosion to 0.5"\Debris to 0.1"
300.1	General Observation	
310.7	3D Laser Sonar Scan	Internal pipe overview
324.9	General Observation	Corrosion to 0.6"
350	General Observation	Corrosion to 0.5"
374.9	General Observation	Corrosion to 0.7"
399.7	General Observation	Corrosion to 0.7"
424.9	General Observation	Corrosion to 0.6"
449.8	General Observation	Corrosion to 0.8"
474.8	General Observation	Corrosion to 0.8"\Debris to 0.2"
499.9	General Observation	
524.9	General Observation	Corrosion to 0.9"\Debris to 0.3"
540.6	Maximum Corrosion	To 1.3"
549.7	General Observation	Corrosion to 0.6"

OVERVIEW - CMH000203 - CMH000201

Asset Number	CMH000203 - CMH000201		
Upstream MH	CMH000203	Material	Reinforced Concrete Pipe
Downstream MH	CMH000201	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	607.6 ft

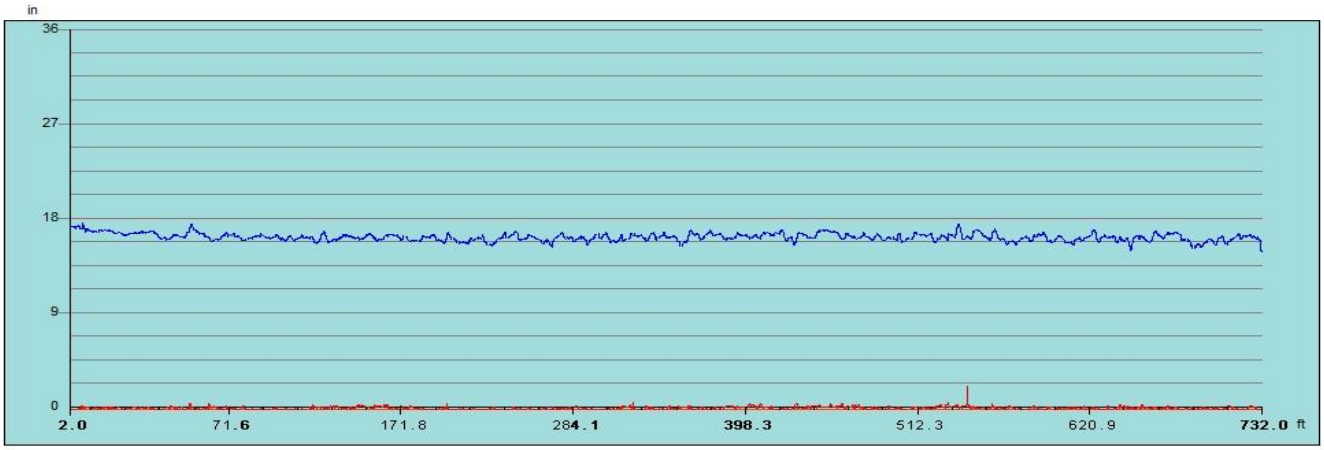
Distance	Observation	Comment
574.9	General Observation	Corrosion to 0.6"
599.8	General Observation	
607.6	Match to Reference Shape and Size	ø36"
624.8	General Observation	Corrosion to 0.6"
649.9	General Observation	Corrosion to 0.6"
674.9	General Observation	Corrosion to 0.6"\Debris to 0.1"
699.8	General Observation	Corrosion to 0.6"
729.5	General Observation	Corrosion to 0.7"
731.8 ft	**End of Inspection**	**CMH000201**

CMH000203 - CMH000201			
Asset Number	CMH000203 - CMH000201	Length	732 ft
Upstream MH	CMH000203	Diameter	36 in
Downstream MH	CMH000201	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	607.6 ft
Date Profiled	16 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	16 in
Debris Volume	1 cubic feet

Debris Graph



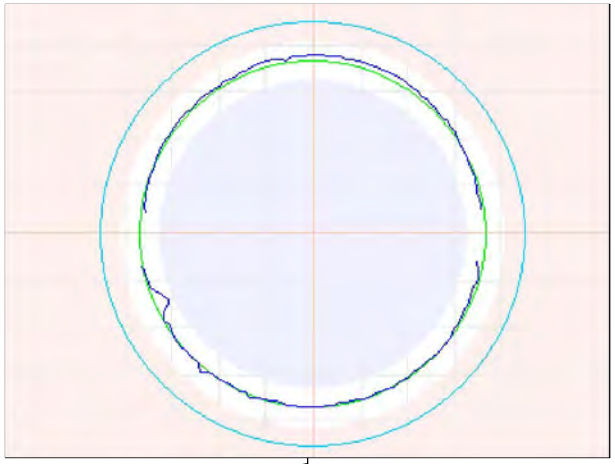
Inspection Distance (ft)

Water Level Debris Level

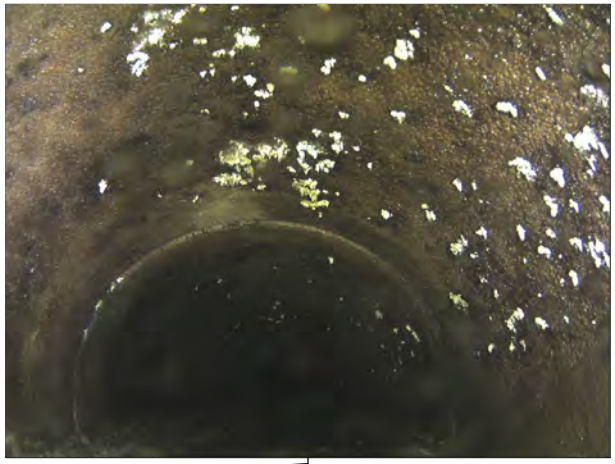
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

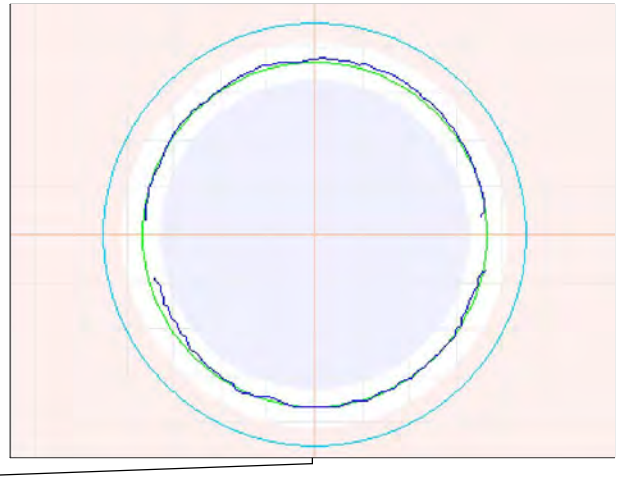
4.2ft General Observation - Corrosion to 0.7"

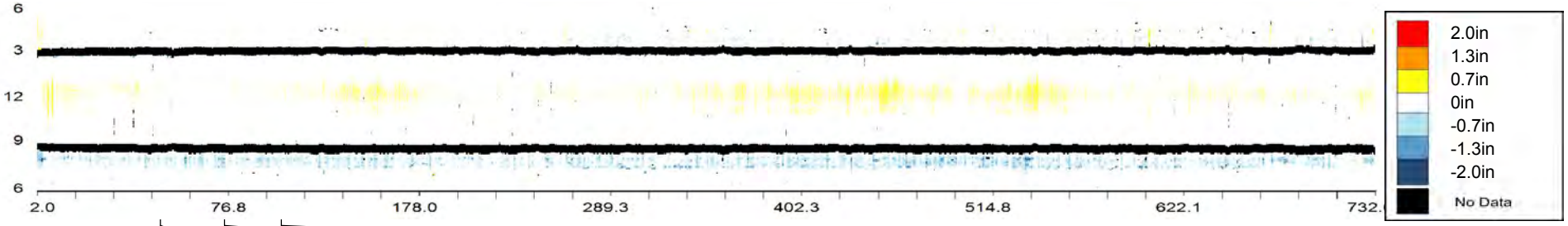


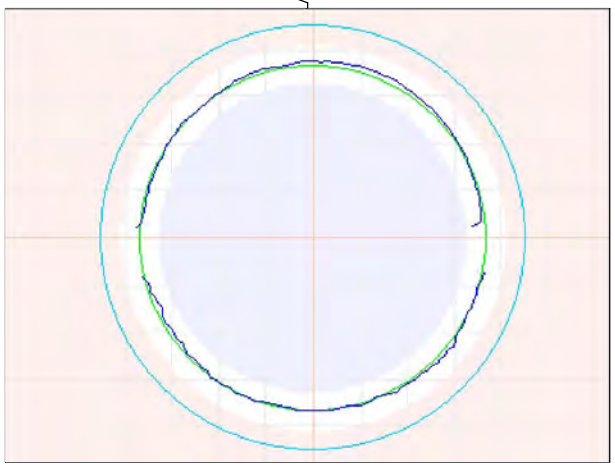
4.2ft General Observation - Corrosion to 0.7"



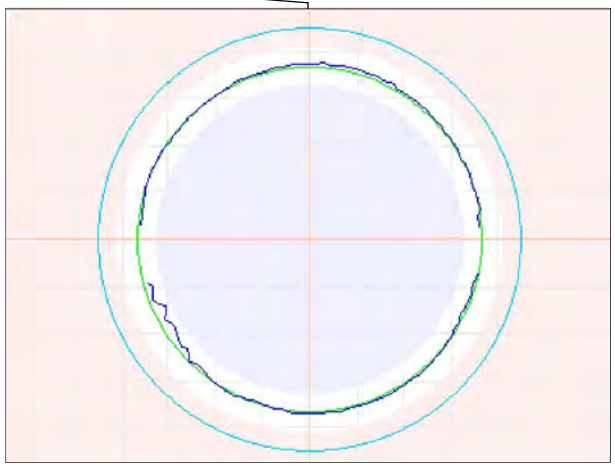
25ft General Observation - Corrosion to 0.5"



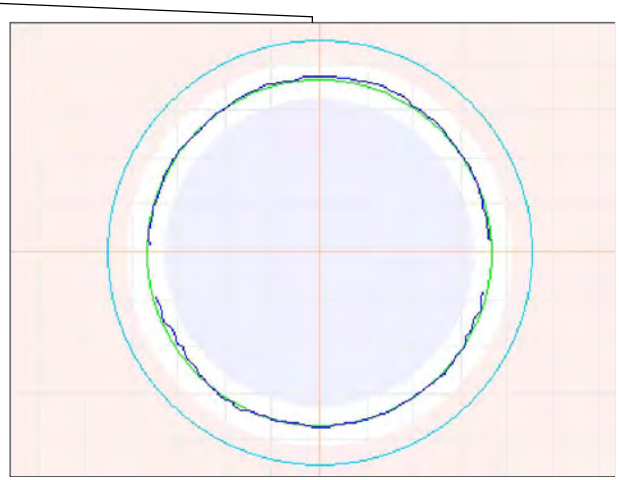




49.9ft General Observation - Corrosion to 0.6"



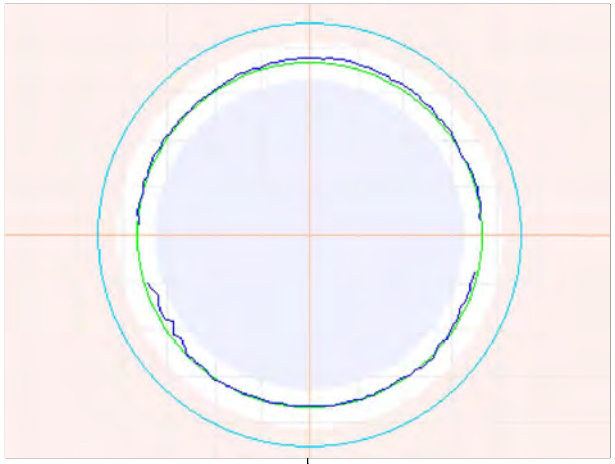
75ft General Observation - Corrosion to 0.5"



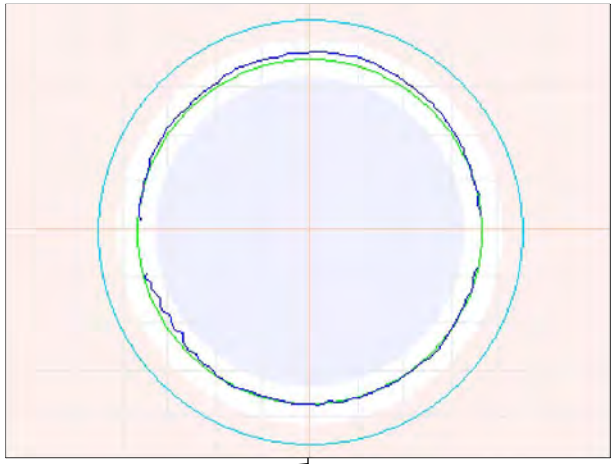
100ft General Observation - Corrosion to 0.7"

Observation Report

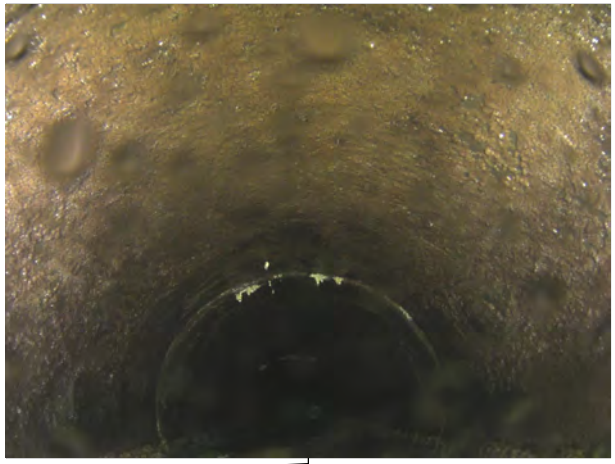
124.9ft General Observation - Corrosion to 0.6"\Debris to 0.2"

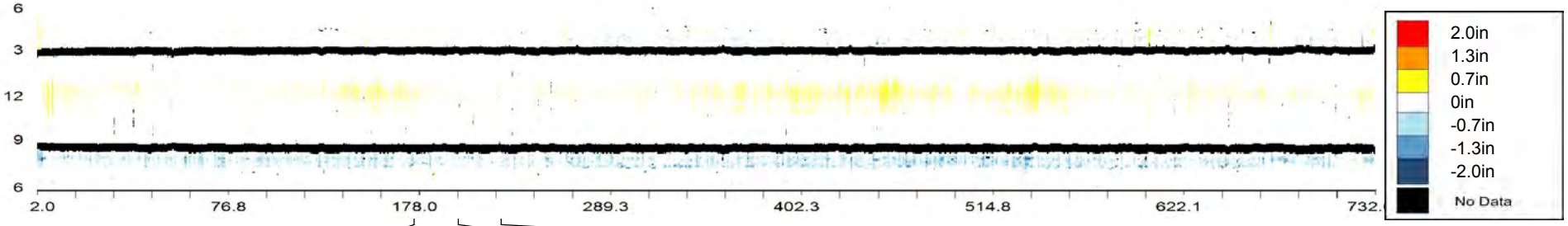


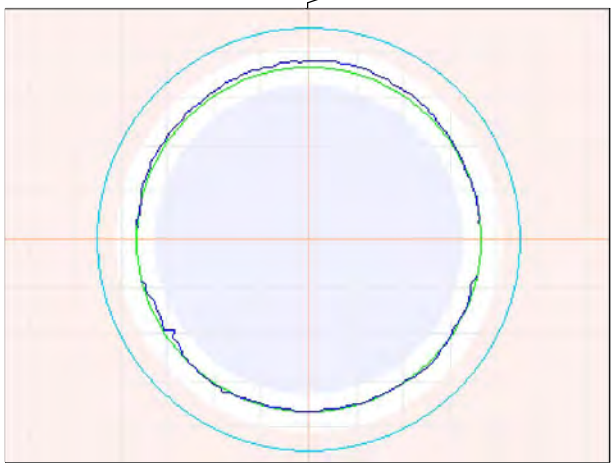
150ft General Observation - Corrosion to 0.8"



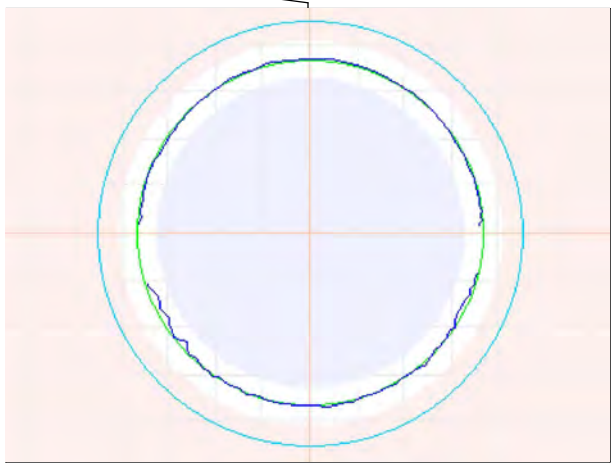
150ft General Observation - Corrosion to 0.8"



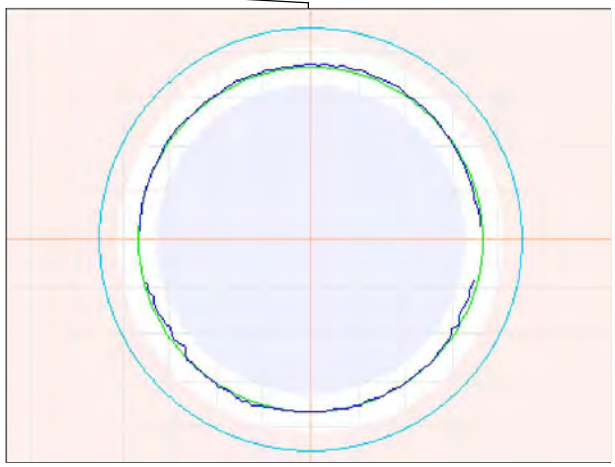




174.9ft General Observation - Corrosion to 0.7"



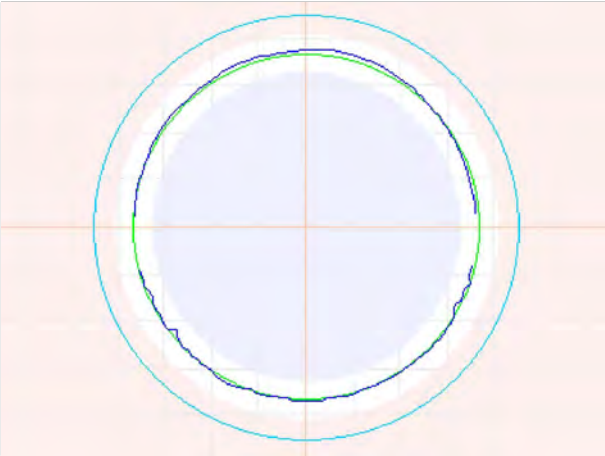
199.8ft General Observation



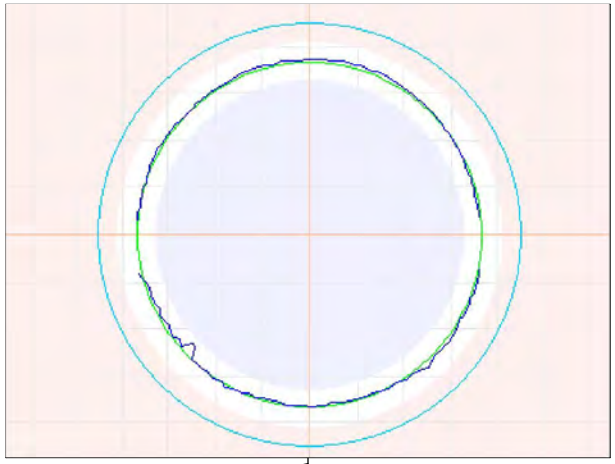
224.9ft General Observation - Corrosion to 0.4"

Observation Report

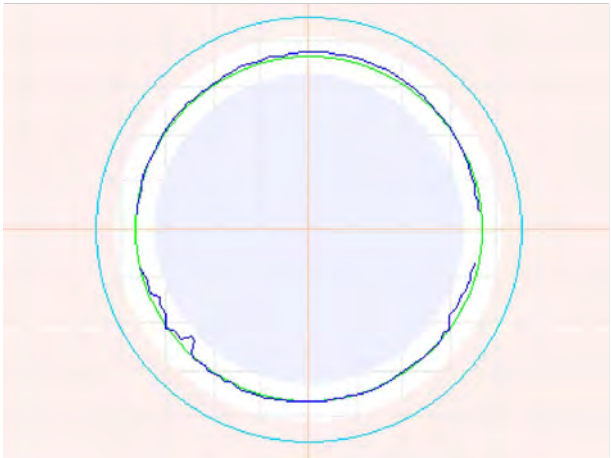
250ft General Observation - Corrosion to 0.6"

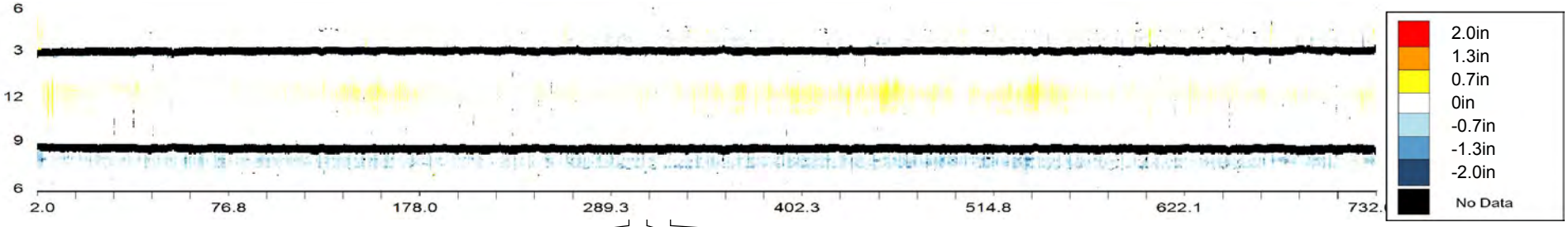


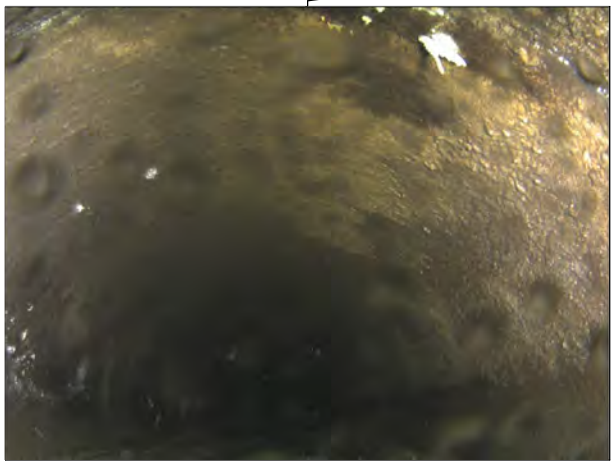
275ft General Observation - Corrosion to 0.5"\Debris to 0.1"



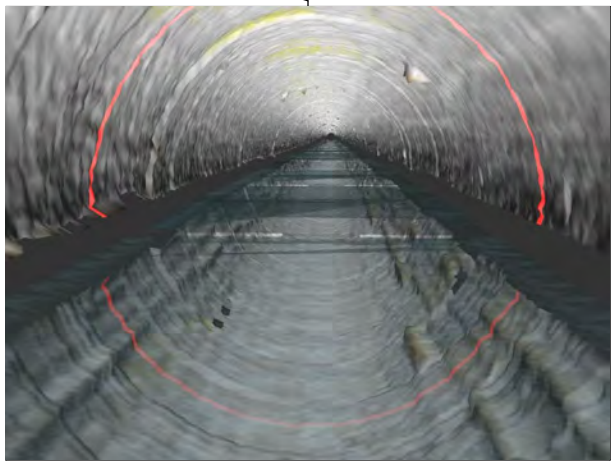
300.1ft General Observation



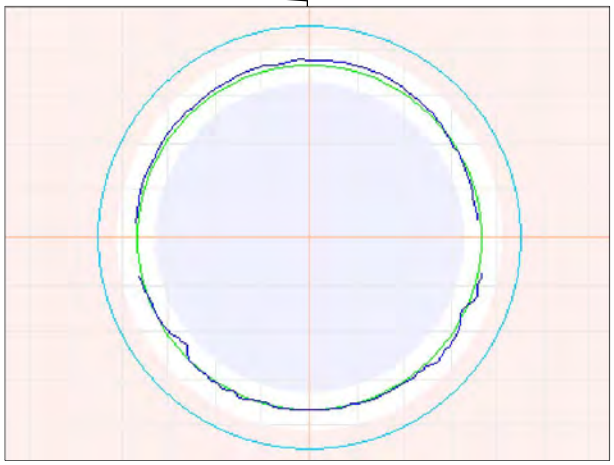




300.1ft General Observation



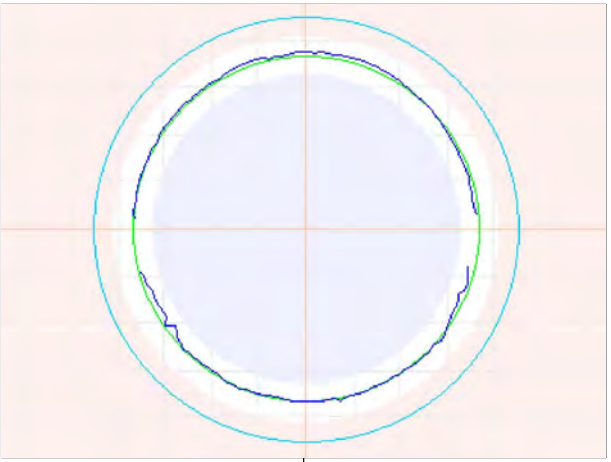
310.7ft 3D Laser Sonar Scan - Internal pipe overview



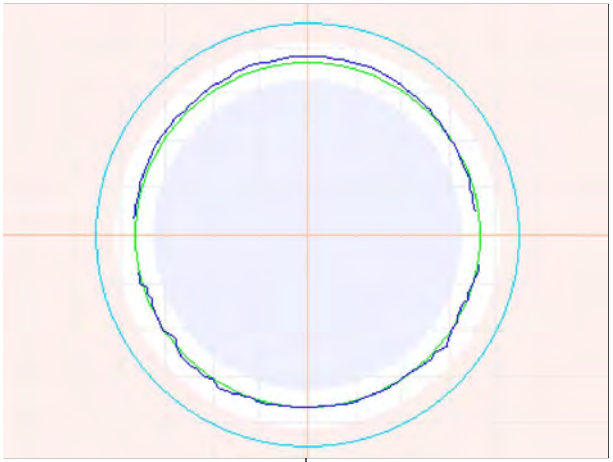
324.9ft General Observation - Corrosion to 0.6"

Observation Report

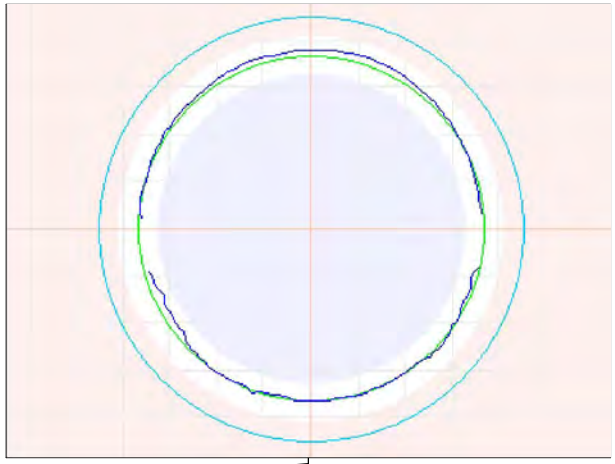
350ft General Observation - Corrosion to 0.5"

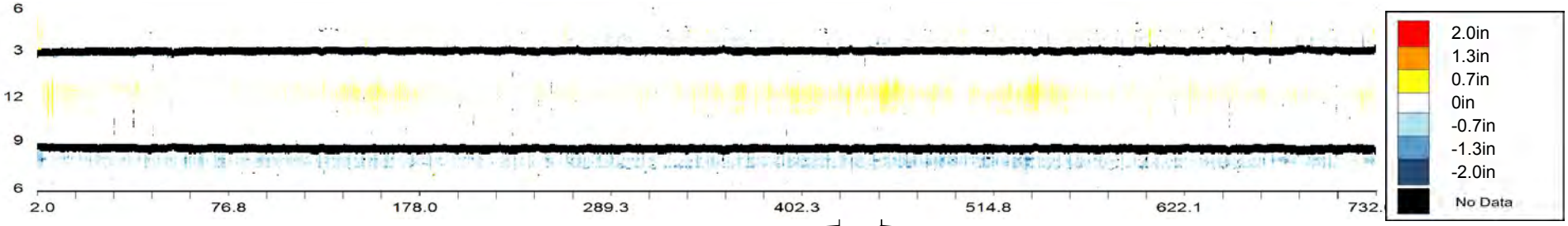


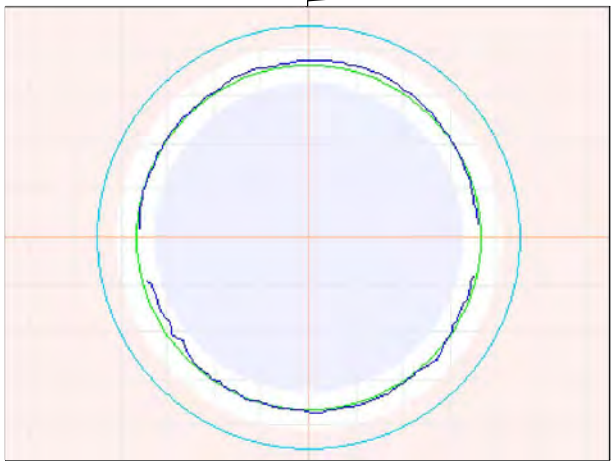
374.9ft General Observation - Corrosion to 0.7"



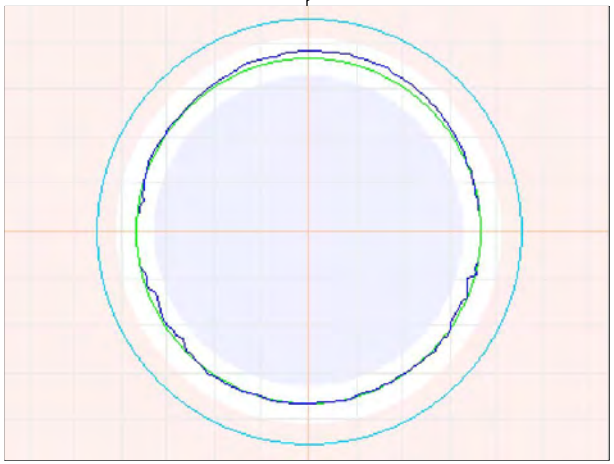
399.7ft General Observation - Corrosion to 0.7"



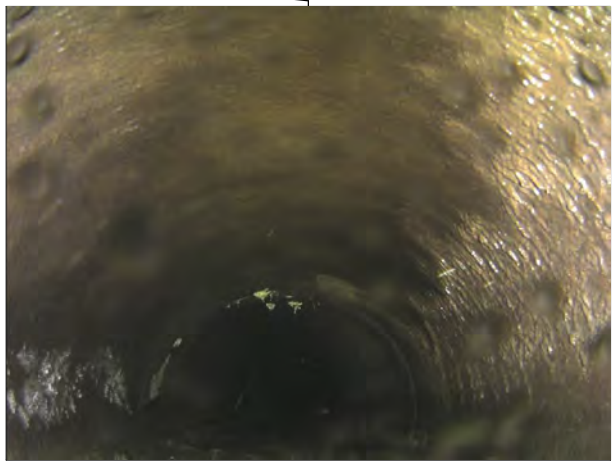




424.9ft General Observation - Corrosion to 0.6"



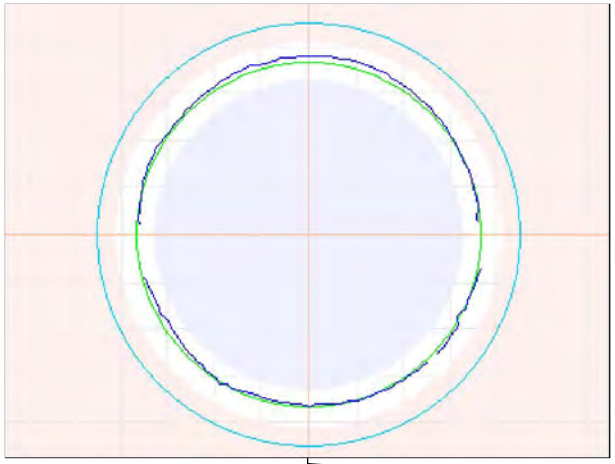
449.8ft General Observation - Corrosion to 0.8"



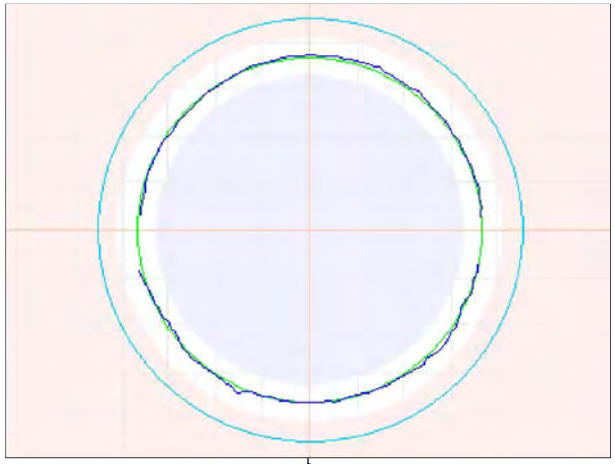
449.8ft General Observation - Corrosion to 0.8"

Observation Report

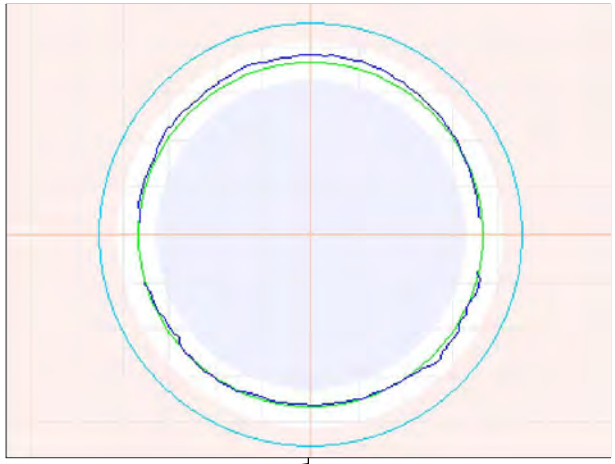
474.8ft General Observation - Corrosion to 0.8"\Debris to 0.2"

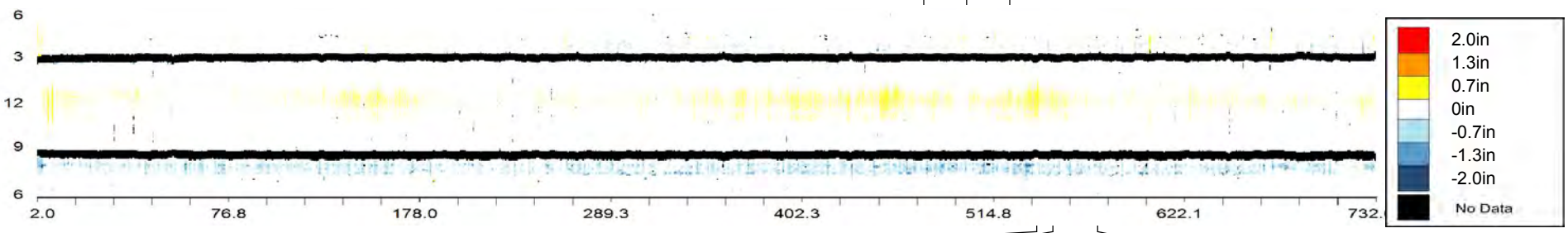


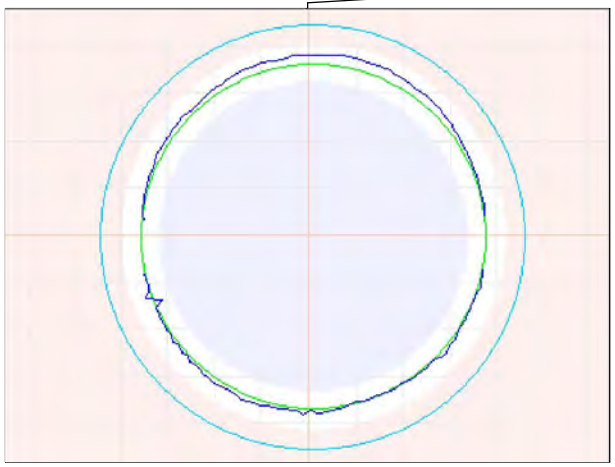
499.9ft General Observation



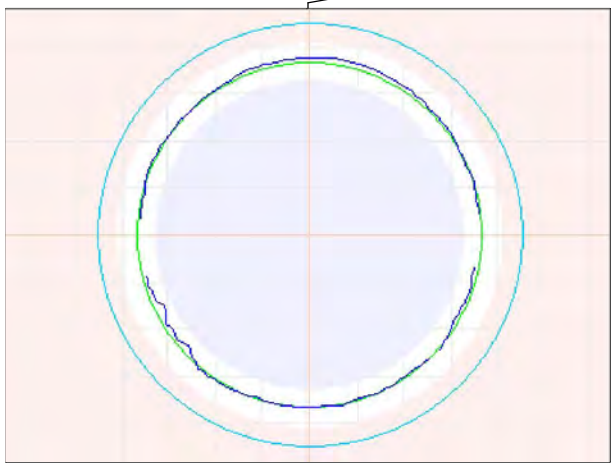
524.9ft General Observation - Corrosion to 0.9"\Debris to 0.3"



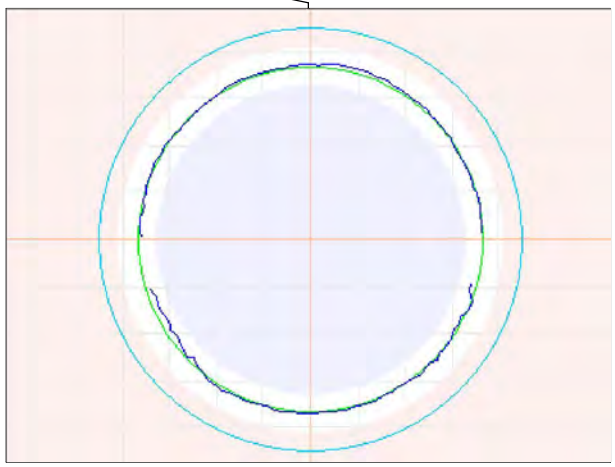




540.6ft Maximum Corrosion - To 1.3"



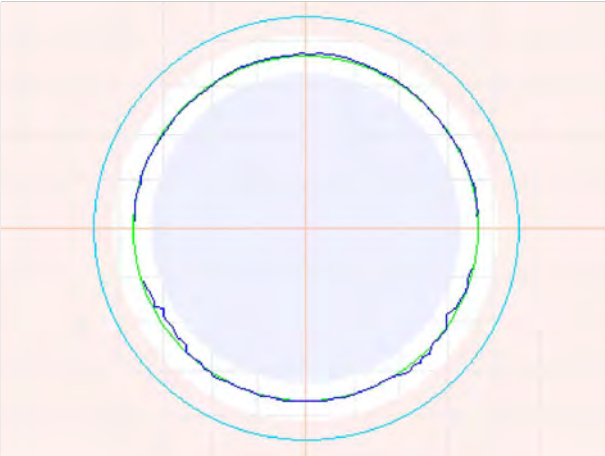
549.7ft General Observation - Corrosion to 0.6"



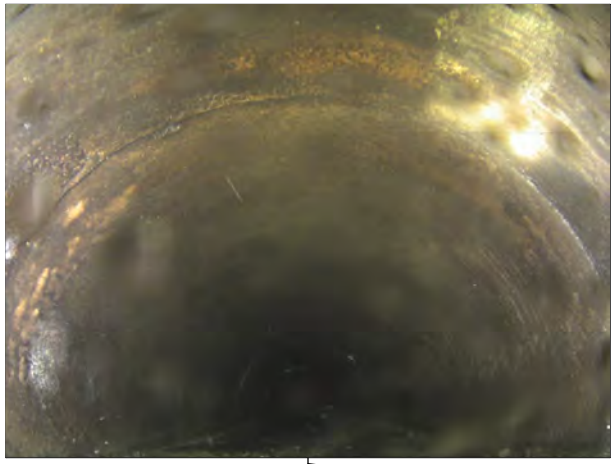
574.9ft General Observation - Corrosion to 0.6"

Observation Report

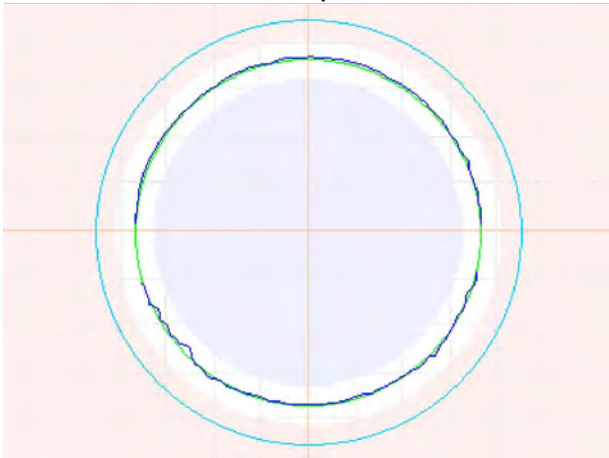
599.8ft General Observation

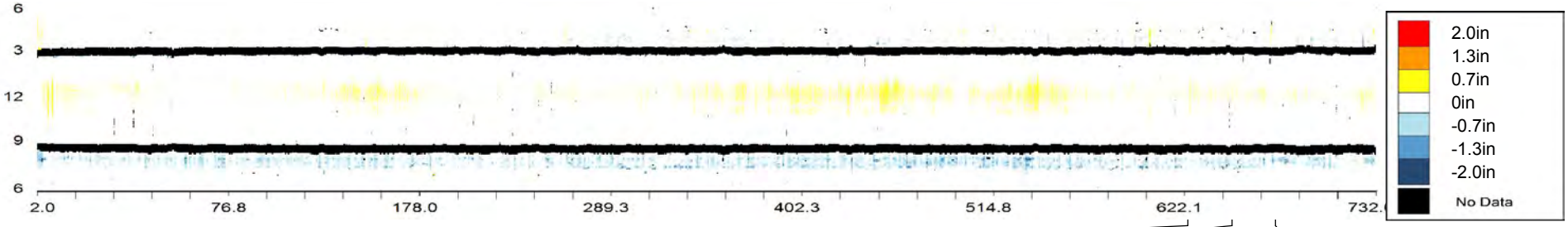


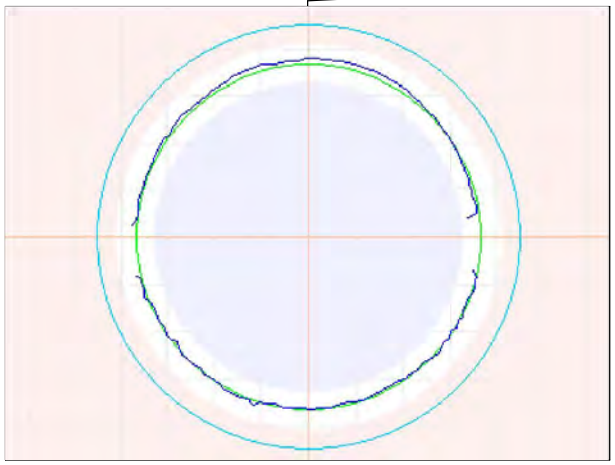
599.8ft General Observation



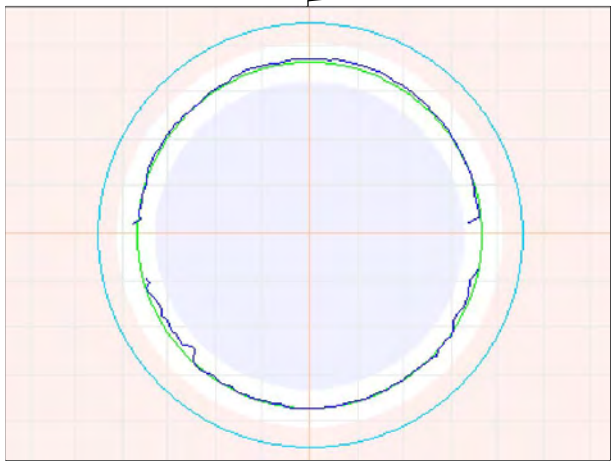
607.6ft Match to Reference Shape and Size - ø36"



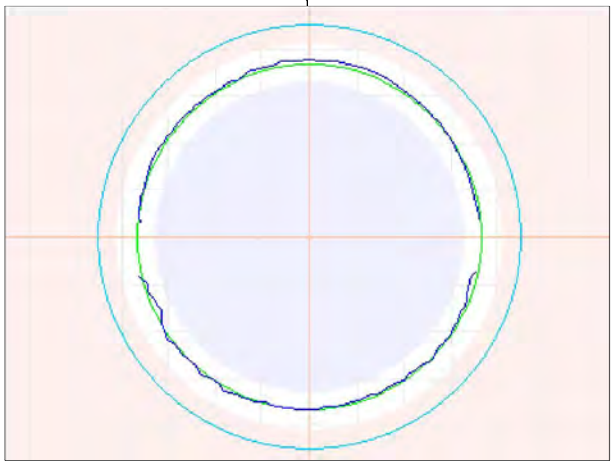




624.8ft General Observation - Corrosion to 0.6"



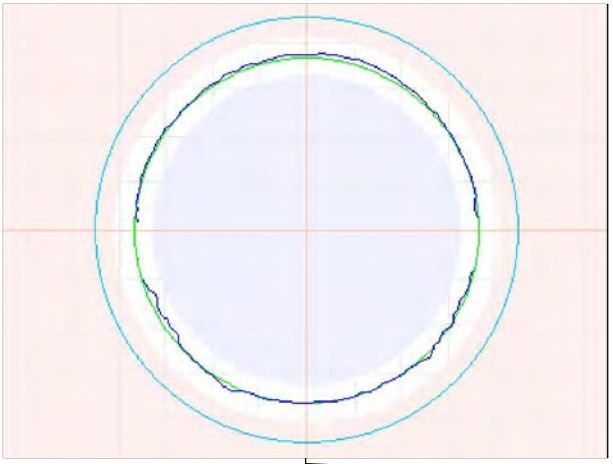
649.9ft General Observation - Corrosion to 0.6"



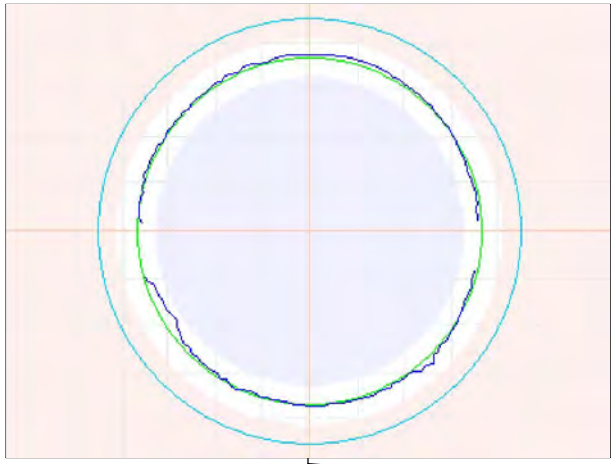
674.9ft General Observation - Corrosion to 0.6"\Debris to 0.1"

Observation Report

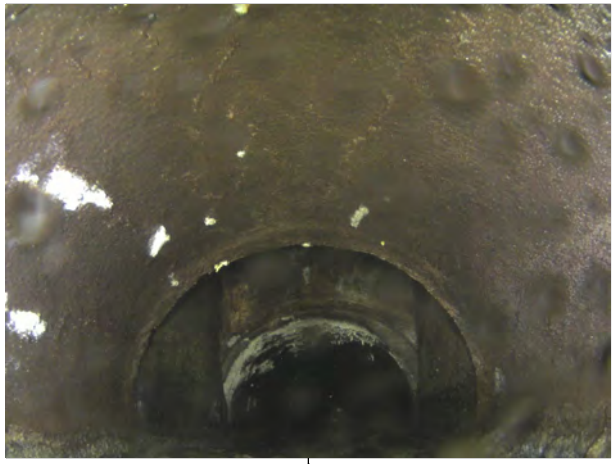
699.8ft General Observation - Corrosion to 0.6"

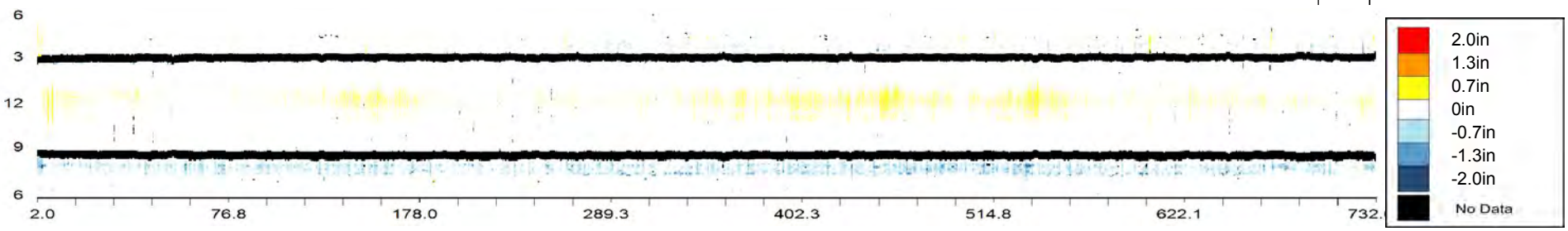


729.5ft General Observation - Corrosion to 0.7"



729.5ft General Observation - Corrosion to 0.7"





OVERVIEW - CMH000204 - CMH000203

Asset Number	CMH000204 - CMH000203		
Upstream MH	CMH000204	Material	Reinforced Concrete Pipe
Downstream MH	CMH000203	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	68.8 ft

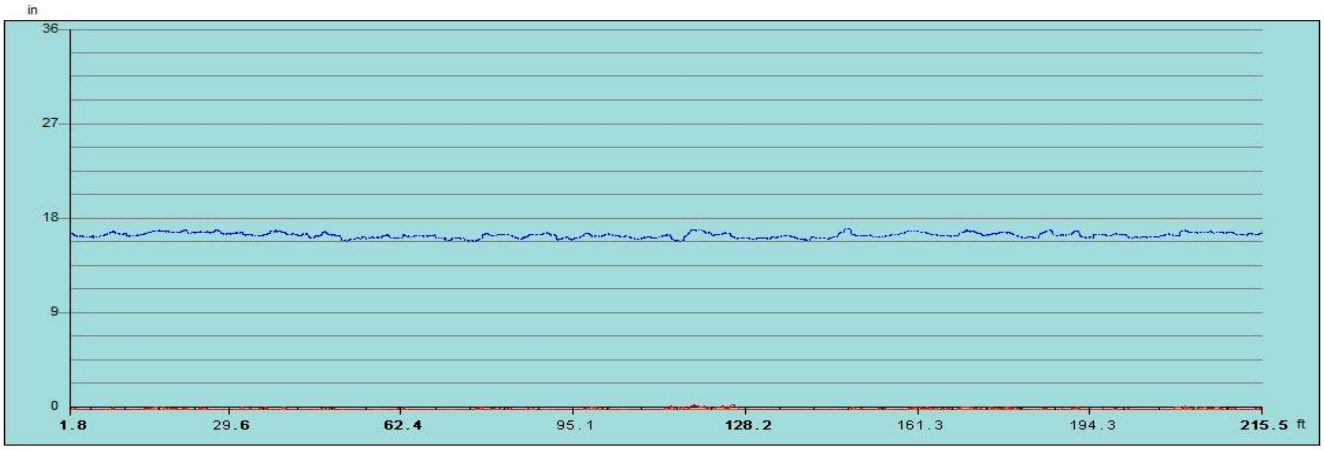
Distance	Observation	Comment
1.8 ft	**Beginning of Inspection**	**CMH000204**
1.9	General Observation	Measurement inside reference to 0.6"
25	General Observation	Corrosion to 0.4"
50.1	General Observation	Corrosion to 0.6"
68.8	Match to Reference Shape and Size	ø36"
75	General Observation	Corrosion to 0.6"\Debris to 0.2"
99.9	General Observation	
121.3	Maximum Corrosion	To 0.8"
125	General Observation	Corrosion to 0.6"
145.3	3D Laser Sonar Scan	Internal pipe overview
150	General Observation	
174.9	General Observation	Corrosion to 0.5"
199.8	General Observation	Corrosion to 0.5"
215.4 ft	**End of Inspection**	**CMH000203**

CMH000204 - CMH000203			
Asset Number	CMH000204 - CMH000203	Length	216 ft
Upstream MH	CMH000204	Diameter	36 in
Downstream MH	CMH000203	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	68.8 ft
Date Profiled	16 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	17 in
Debris Volume	0 cubic feet

Debris Graph



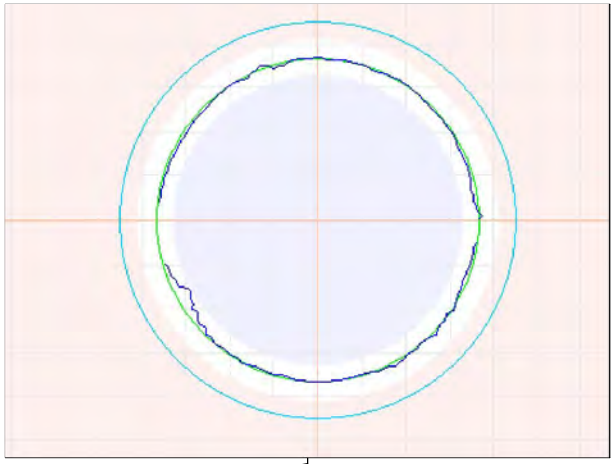
Inspection Distance (ft)

Water Level Debris Level

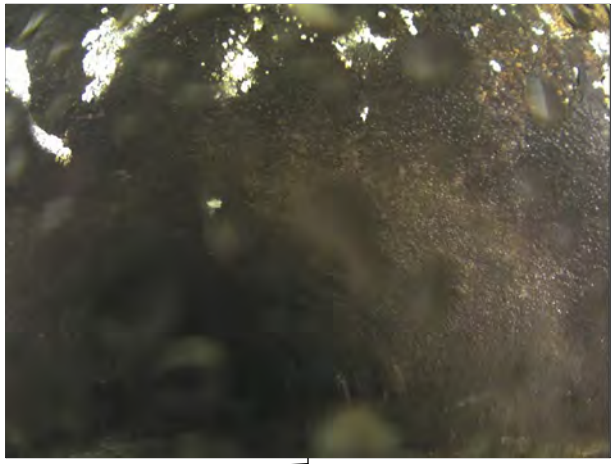
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

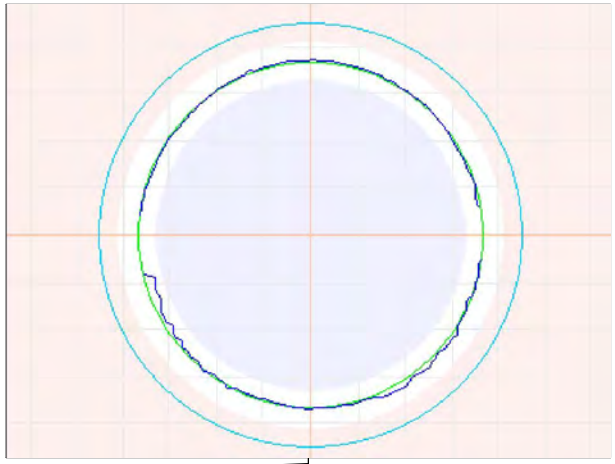
1.9ft General Observation - Measurement inside reference to 0.6"

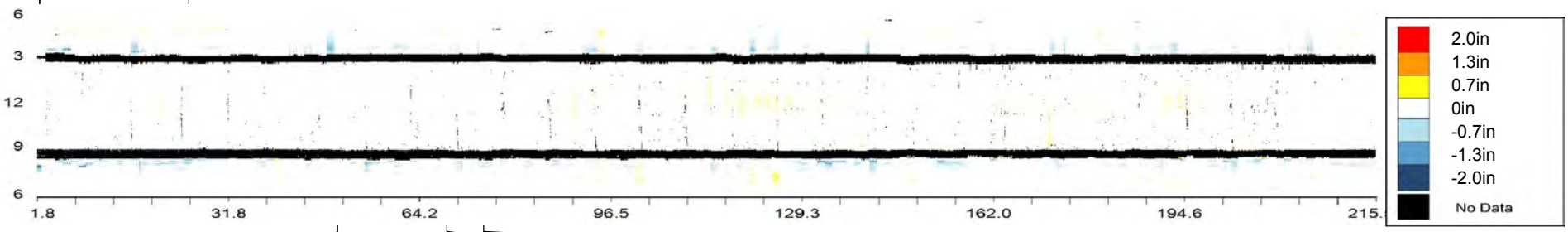


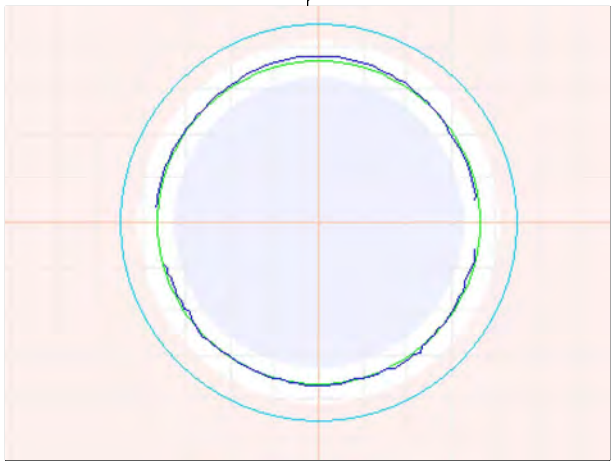
1.9ft General Observation - Measurement inside reference to 0.6"



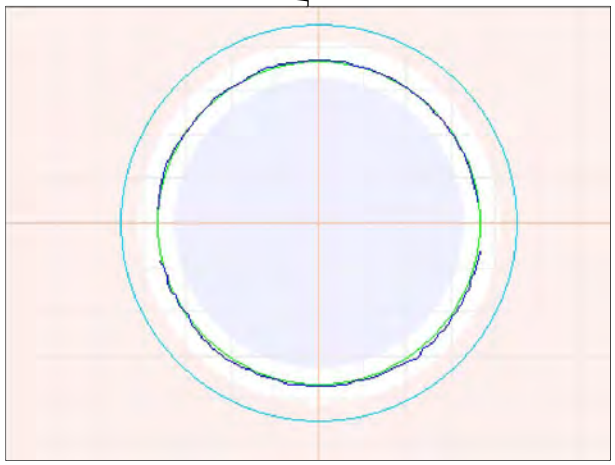
25ft General Observation - Corrosion to 0.4"



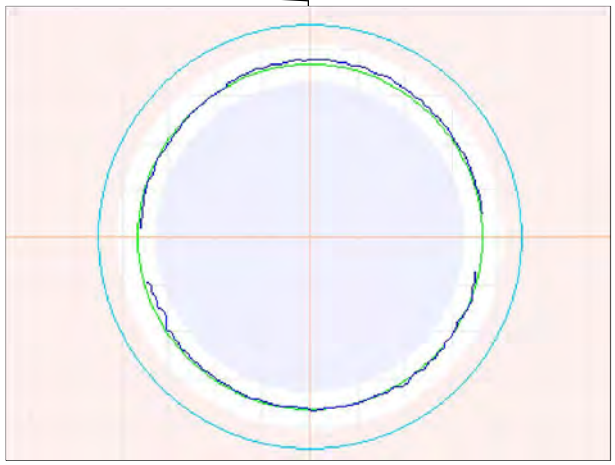




50.1ft General Observation - Corrosion to 0.6"



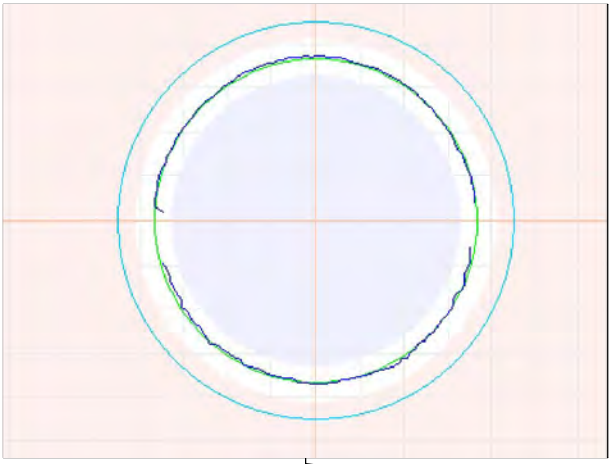
68.8ft Match to Reference Shape and Size - ø36"



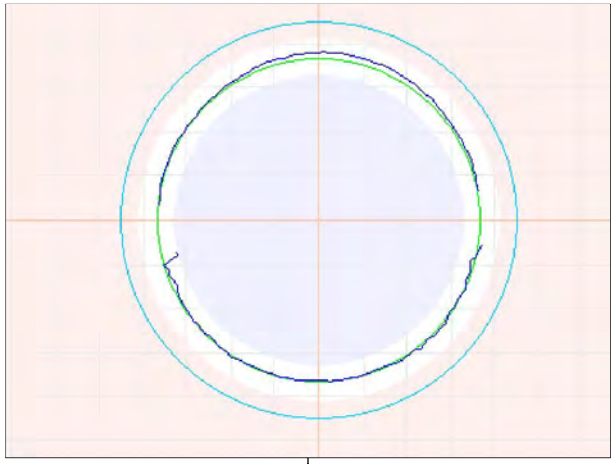
75ft General Observation - Corrosion to 0.6"\Debris to 0.2"

Observation Report

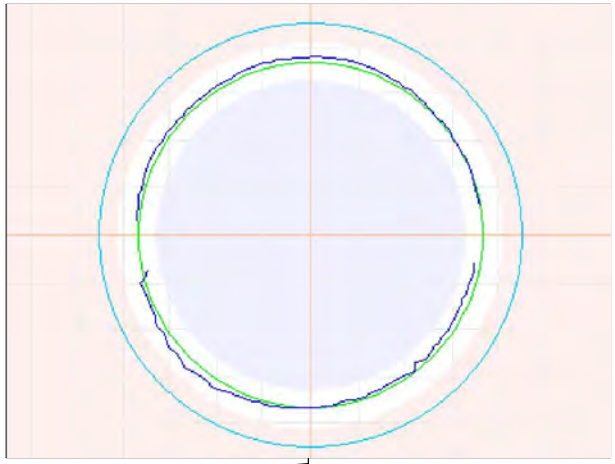
99.9ft General Observation

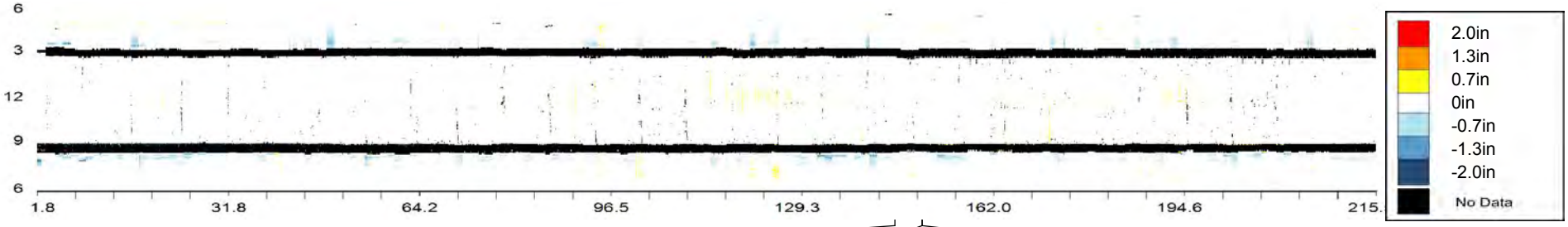


121.3ft Maximum Corrosion - To 0.8"

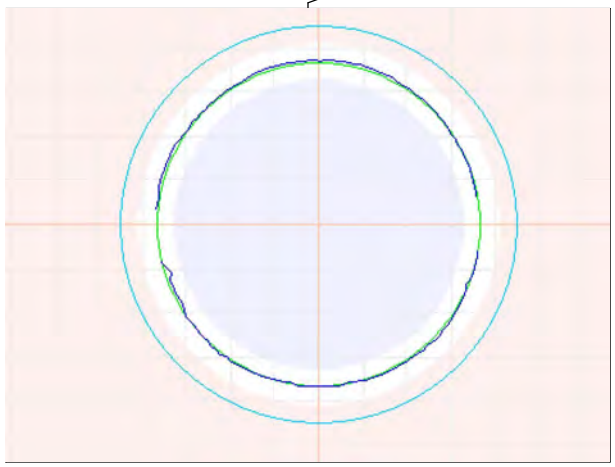


125ft General Observation - Corrosion to 0.6"

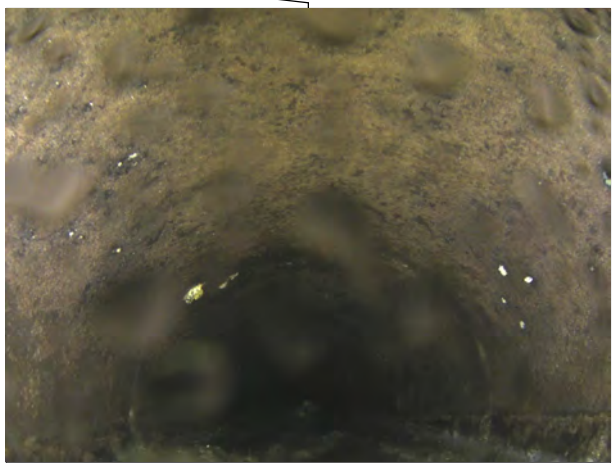




145.3ft 3D Laser Sonar Scan - Internal pipe overview



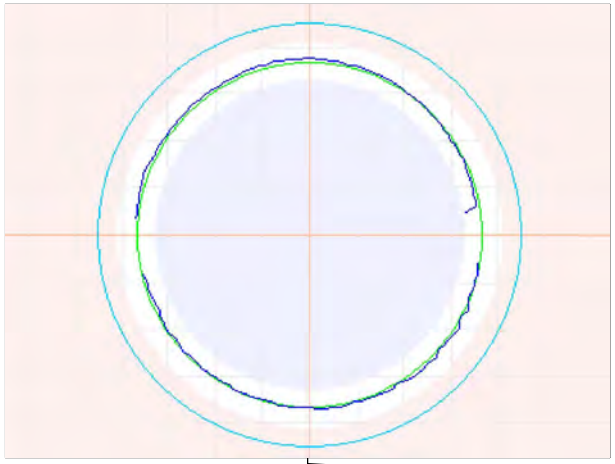
150ft General Observation



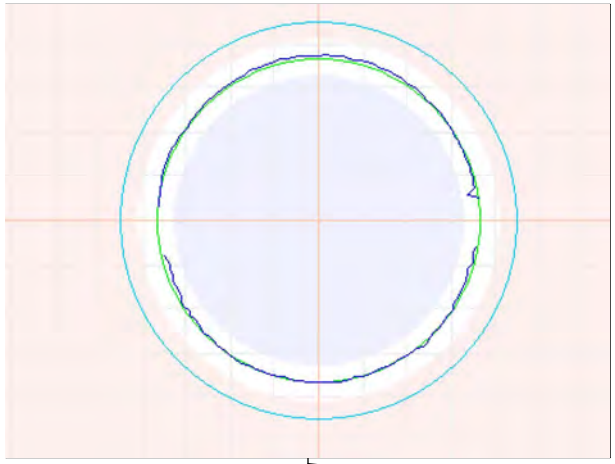
150ft General Observation

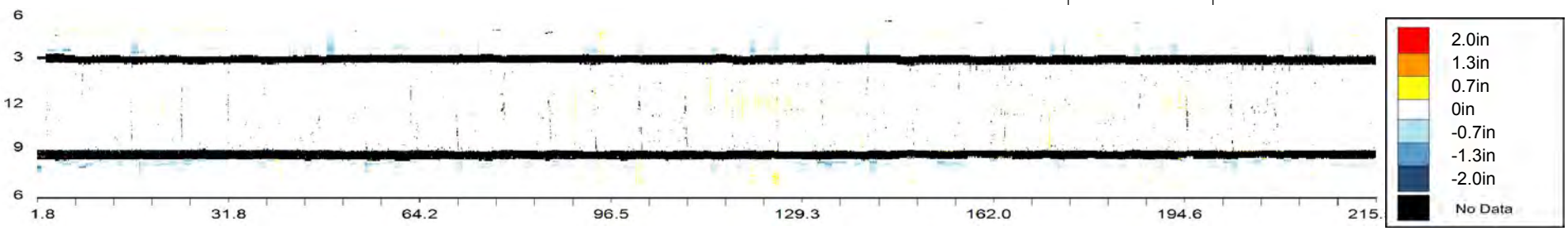
Observation Report

174.9ft General Observation - Corrosion to 0.5"



199.8ft General Observation - Corrosion to 0.5"





OVERVIEW - CMH000205 - CMH000204

Asset Number	CMH000205 - CMH000204		
Upstream MH	CMH000205	Material	Reinforced Concrete Pipe
Downstream MH	CMH000204	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	138.8 ft

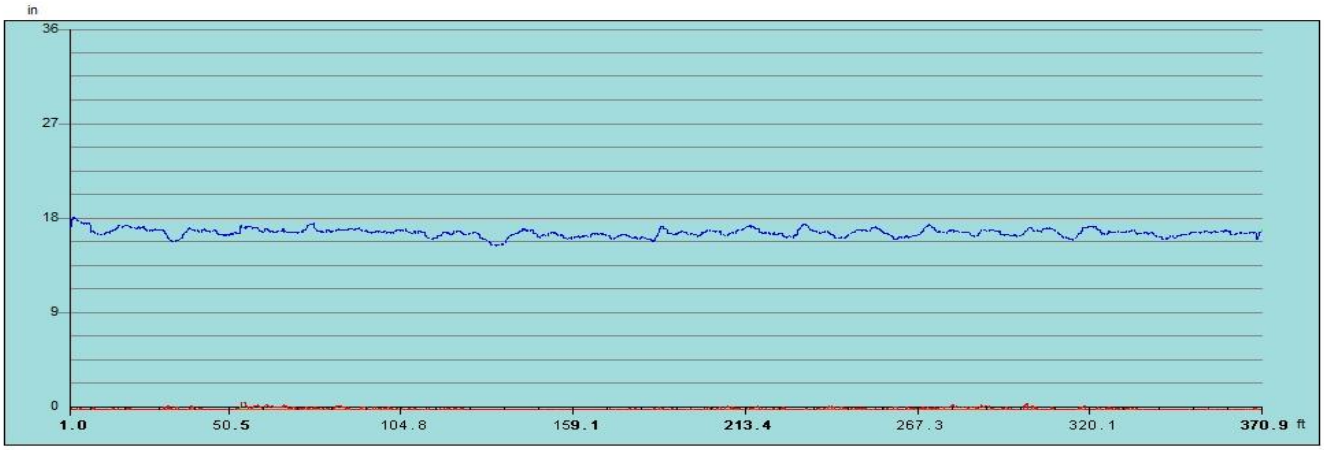
Distance	Observation	Comment
1 ft	**Beginning of Inspection**	**CMH000205**
1.1	Note	Water on lens at 12 o`clock for this asset
1.1	General Observation	
25	General Observation	Corrosion to 0.6"
50	General Observation	
75	General Observation	Corrosion to 0.6"
100.2	General Observation	Corrosion to 0.6"
125	General Observation	Corrosion to 0.5"
138.8	Closest Match to Reference Size	ø36"
150.1	General Observation	
175	General Observation	Corrosion to 1.1"
199.9	General Observation	Corrosion to 0.8"
214.3	Maximum Corrosion	To 1.1"
224.9	General Observation	Corrosion to 1.1"
249.8	General Observation	Corrosion to 0.5"
259	Point of Interest	
274.9	General Observation	Corrosion to 0.8"\Debris to 0.2"
299.8	General Observation	Corrosion to 0.6"
324.9	General Observation	Corrosion to 0.9"
350.1	General Observation	Corrosion to 0.5"
370.8 ft	**End of Inspection**	**CMH000204**

CMH000205 - CMH000204			
Asset Number	CMH000205 - CMH000204	Length	371 ft
Upstream MH	CMH000205	Diameter	36 in
Downstream MH	CMH000204	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	138.8 ft
Date Profiled	16 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	17 in
Debris Volume	0 cubic feet

Debris Graph



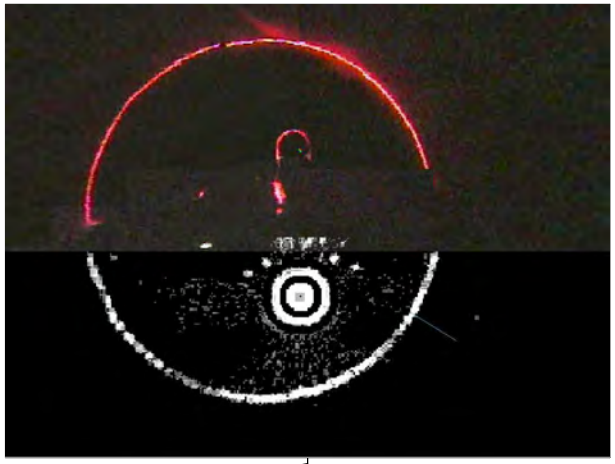
Inspection Distance (ft)

Water Level Debris Level

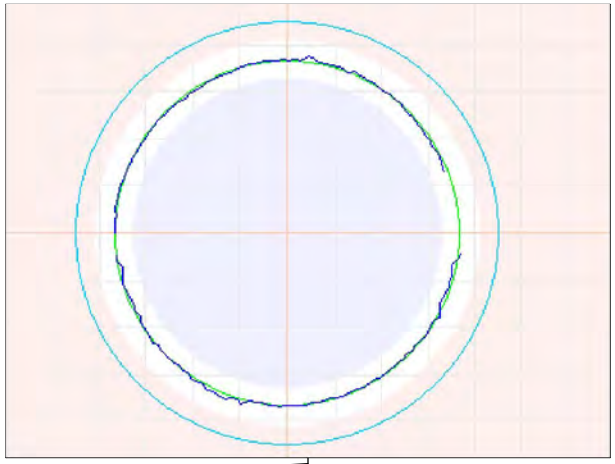
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

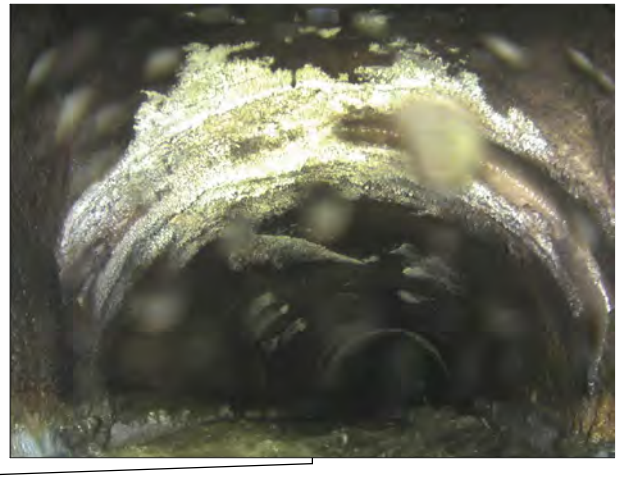
1.1ft Note - Water on lens at 12 o`clock for this asset

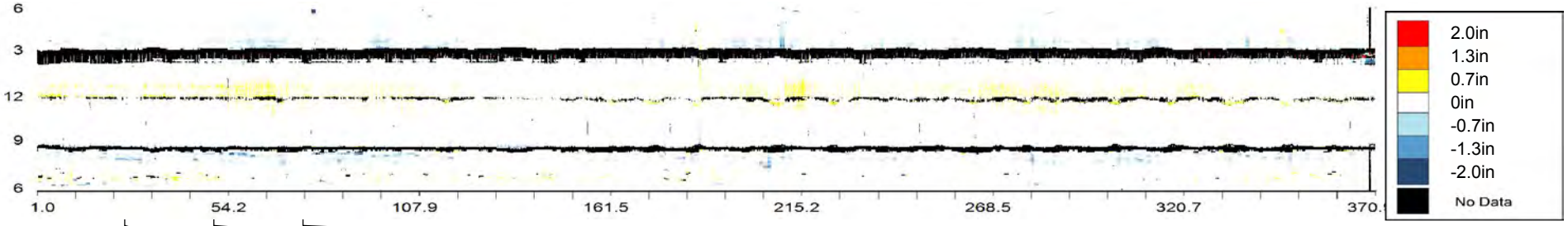


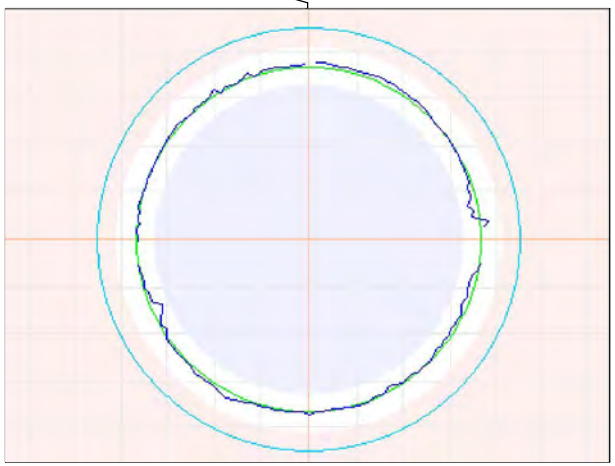
1.1ft General Observation



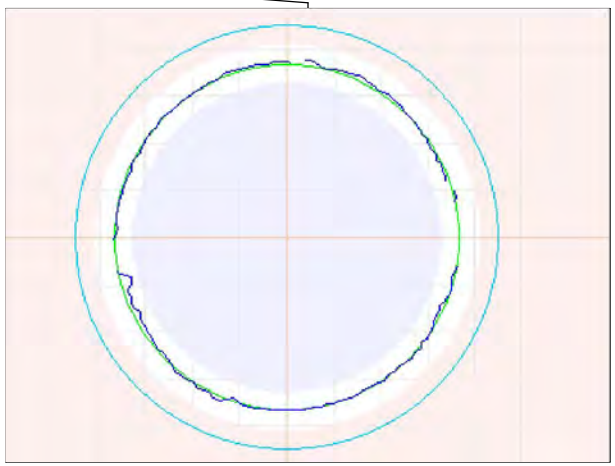
1.1ft General Observation



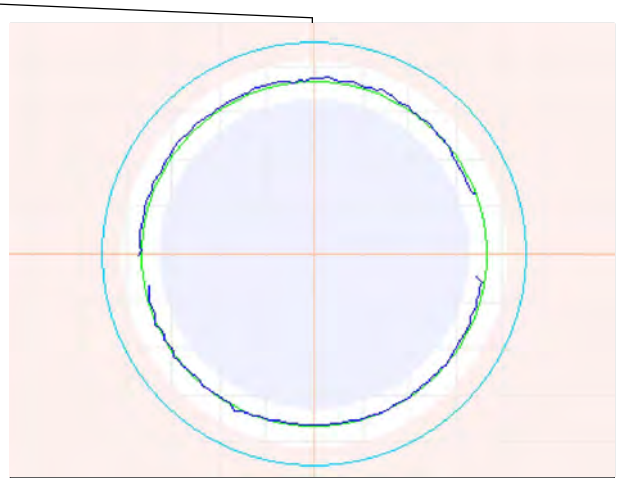




25ft General Observation - Corrosion to 0.6"



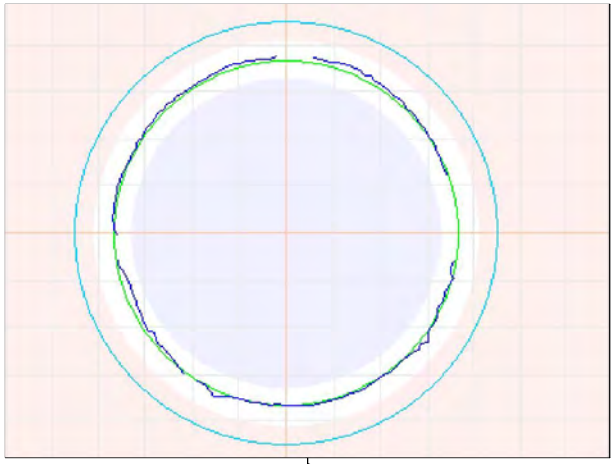
50ft General Observation



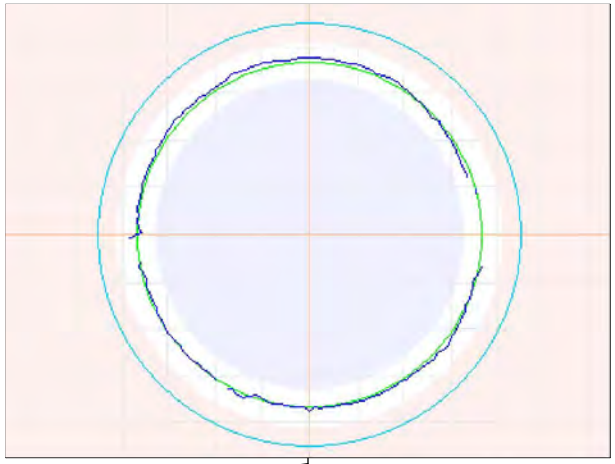
75ft General Observation - Corrosion to 0.6"

Observation Report

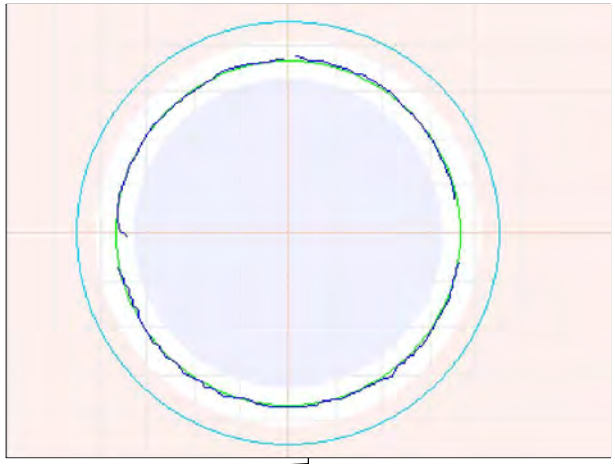
100.2ft General Observation - Corrosion to 0.6"

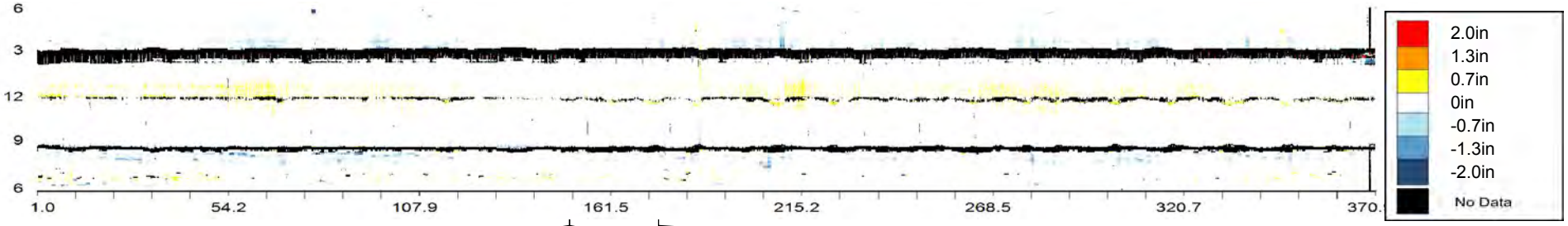


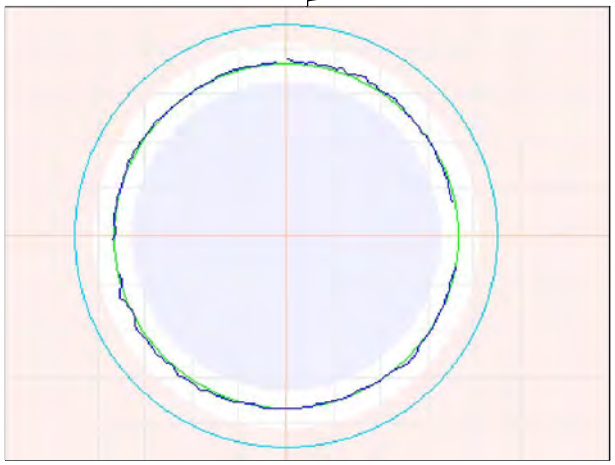
125ft General Observation - Corrosion to 0.5"



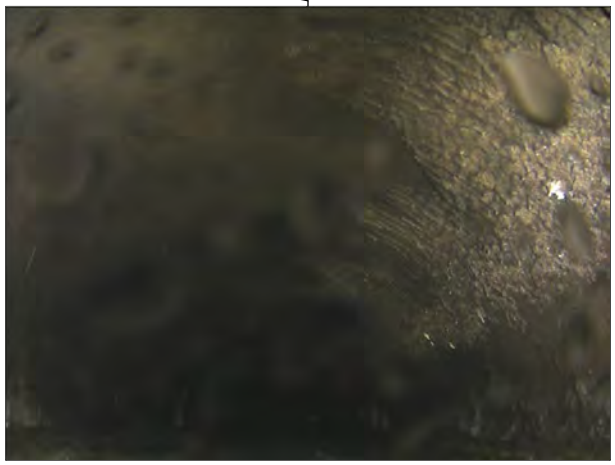
138.8ft Closest Match to Reference Size - ø36"



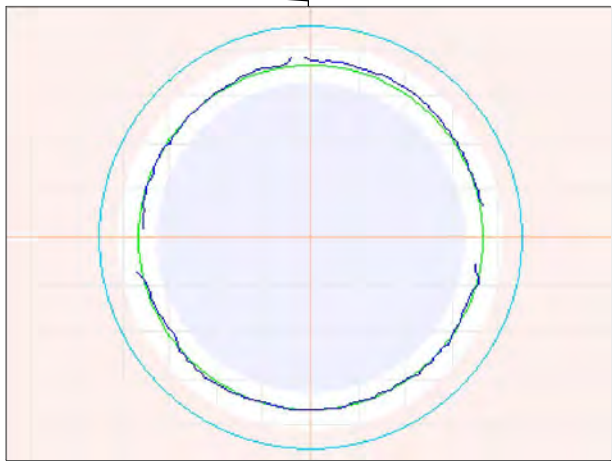




150.1ft General Observation



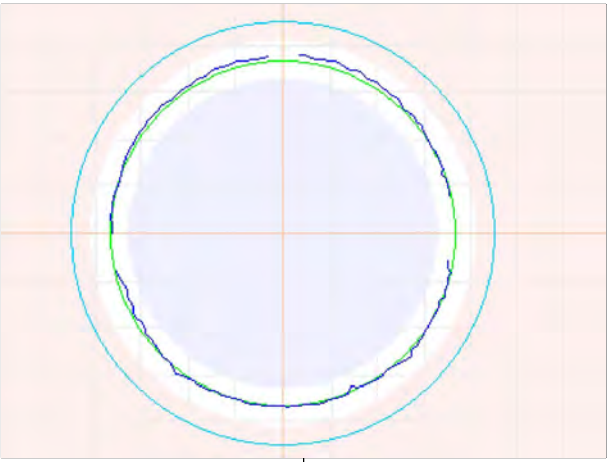
150.1ft General Observation



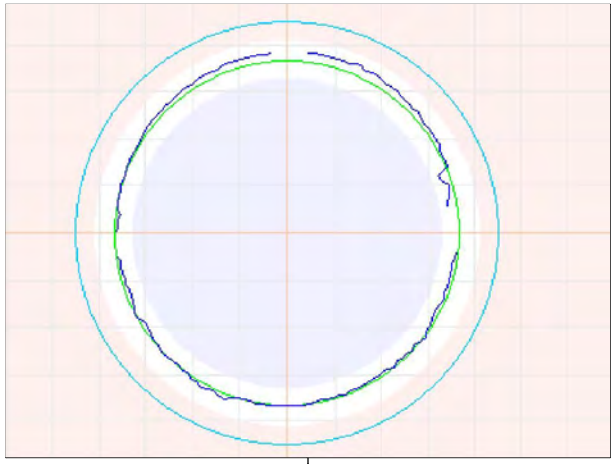
175ft General Observation - Corrosion to 1.1"

Observation Report

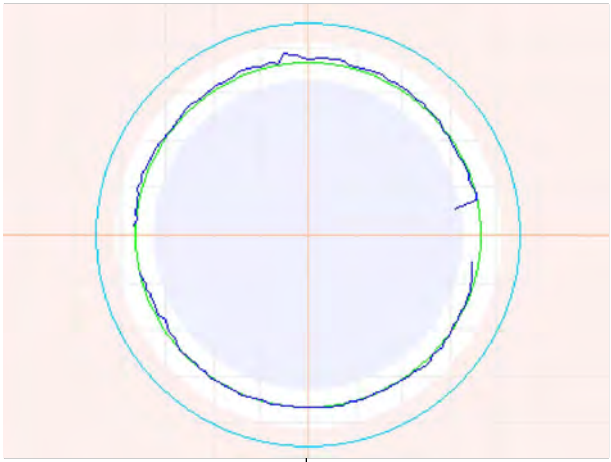
199.9ft General Observation - Corrosion to 0.8"

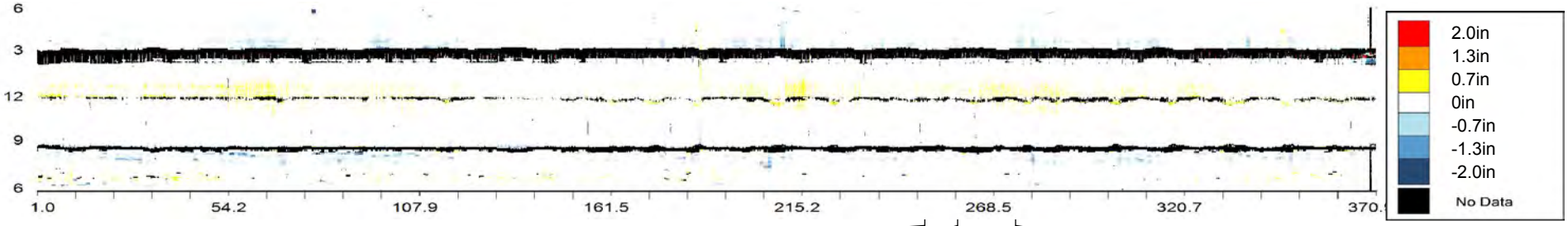


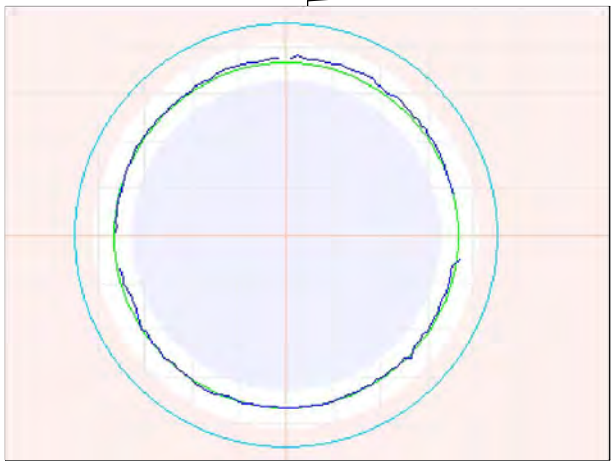
214.3ft Maximum Corrosion - To 1.1"



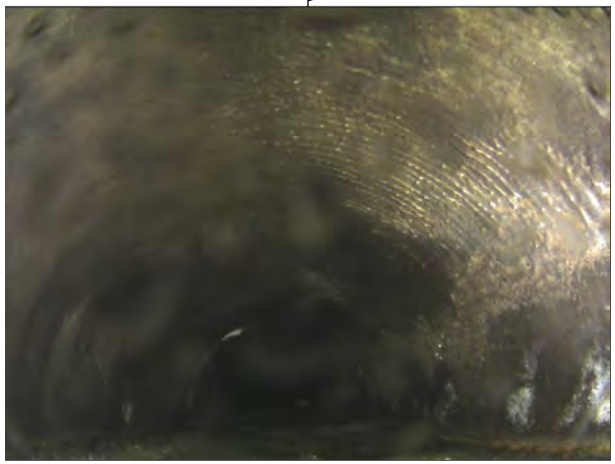
224.9ft General Observation - Corrosion to 1.1"



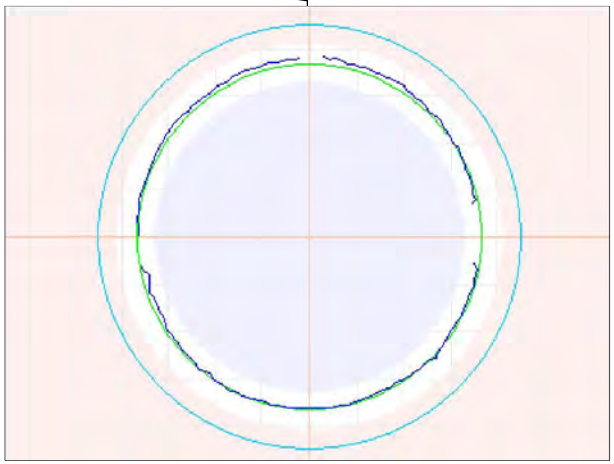




249.8ft General Observation - Corrosion to 0.5"



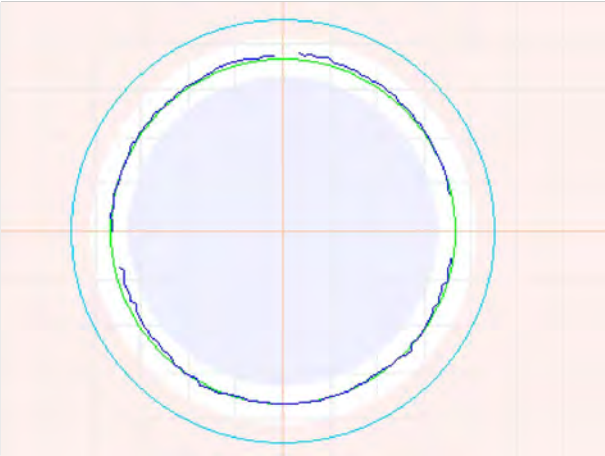
259ft Point of Interest



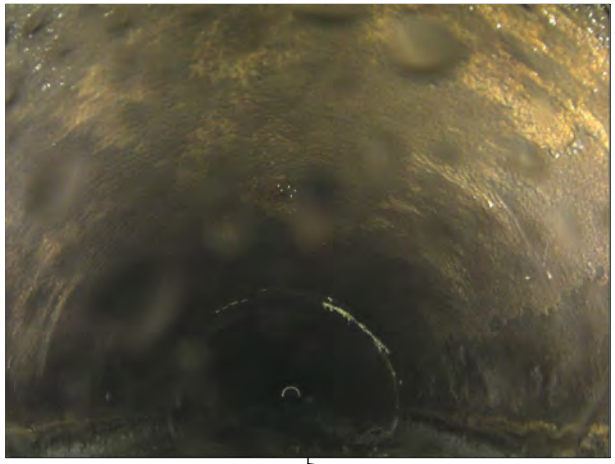
274.9ft General Observation - Corrosion to 0.8"\Debris to 0.2"

Observation Report

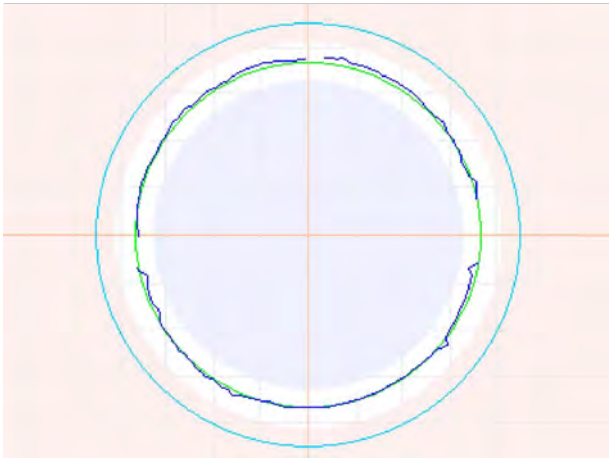
299.8ft General Observation - Corrosion to 0.6"

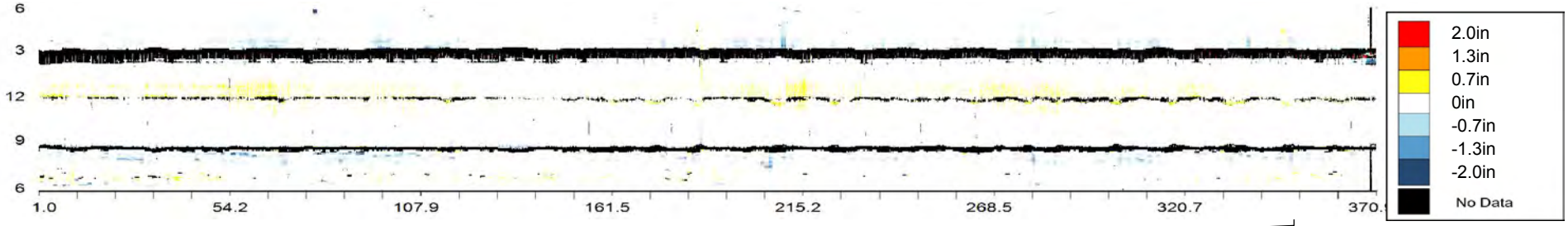


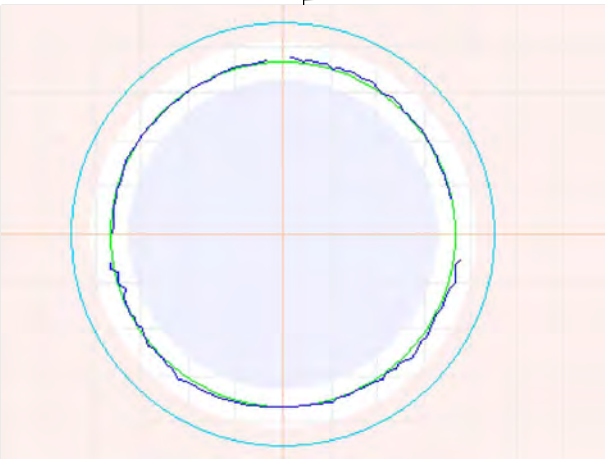
299.8ft General Observation - Corrosion to 0.6"



324.9ft General Observation - Corrosion to 0.9"







350.1ft General Observation - Corrosion to 0.5"

OVERVIEW - CMH000206 - CMH000205

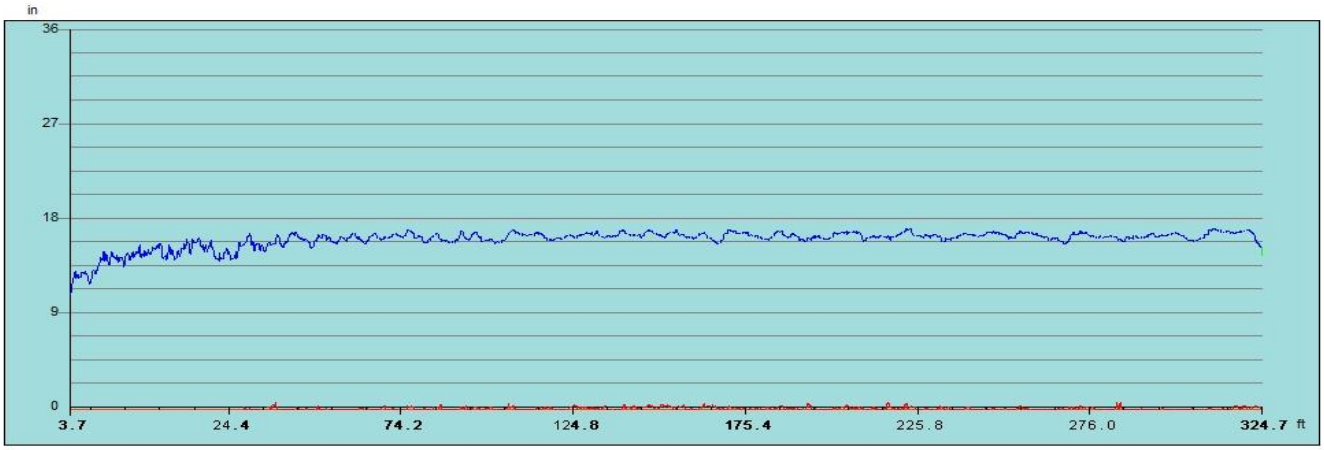
Asset Number	CMH000206 - CMH000205		
Upstream MH	CMH000206	Material	Reinforced Concrete Pipe
Downstream MH	CMH000205	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	294 ft

Distance	Observation	Comment
3.7 ft	**Beginning of Inspection**	**CMH000206**
4.7	General Observation	
25.1	General Observation	Corrosion to 0.8"
31	Maximum Corrosion	To 1.3"
50.2	General Observation	Corrosion to 0.5", Measurement inside reference to 0.8"
75	General Observation	Measurement inside reference to 0.8"
99.8	General Observation	Measurement inside reference to 0.5"
125	General Observation	Corrosion to 0.4"\Debris to 0.5"
136	3D Laser Sonar Scan	Internal pipe overview
149.8	General Observation	Corrosion to 0.6"
174.9	General Observation	Corrosion to 0.8"
200	General Observation	
225	General Observation	Corrosion to 0.6"\Debris to 0.2"
250.1	General Observation	
275	General Observation	Corrosion to 1.0"\Debris to 0.2"
294	Match to Reference Shape and Size	ø36"
300.1	General Observation	
322.2	General Observation	Corrosion to 0.6"
324.7 ft	**End of Inspection**	**CMH000205**

CMH000206 - CMH000205			
Asset Number	CMH000206 - CMH000205	Length	325 ft
Upstream MH	CMH000206	Diameter	36 in
Downstream MH	CMH000205	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	294 ft
Date Profiled	16 July 2013	Operator	

Observations	
Average Debris Depth	0 in
Average Water Level	16 in
Debris Volume	0 cubic feet

Debris Graph



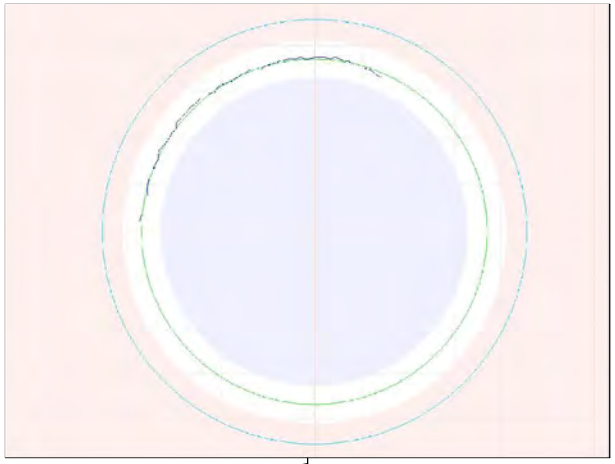
Inspection Distance (ft)

Water Level Debris Level

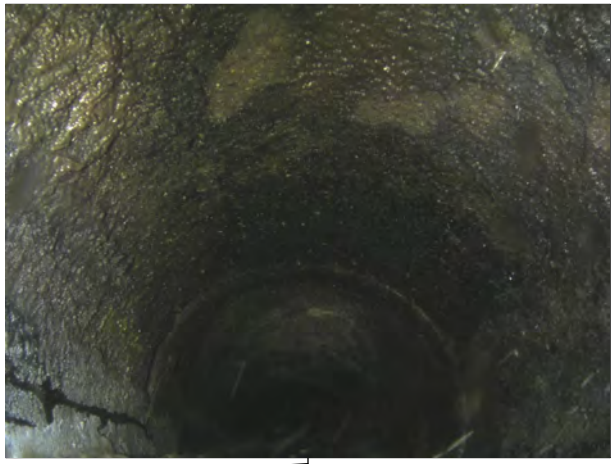
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

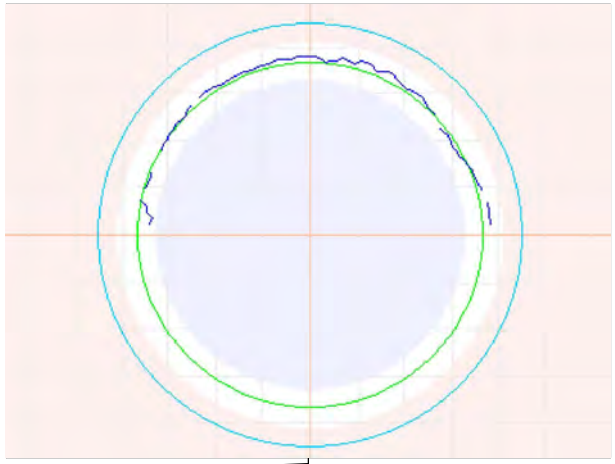
4.7ft General Observation

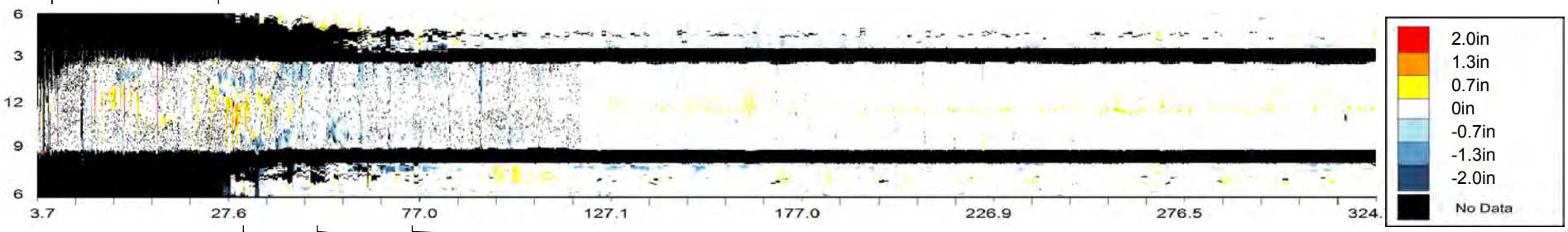


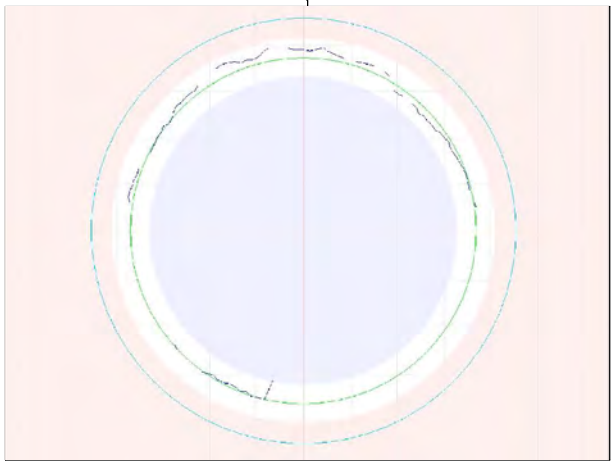
4.7ft General Observation



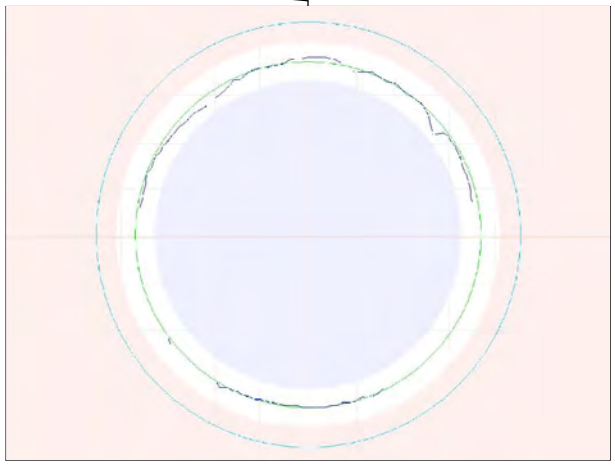
25.1ft General Observation - Corrosion to 0.8"



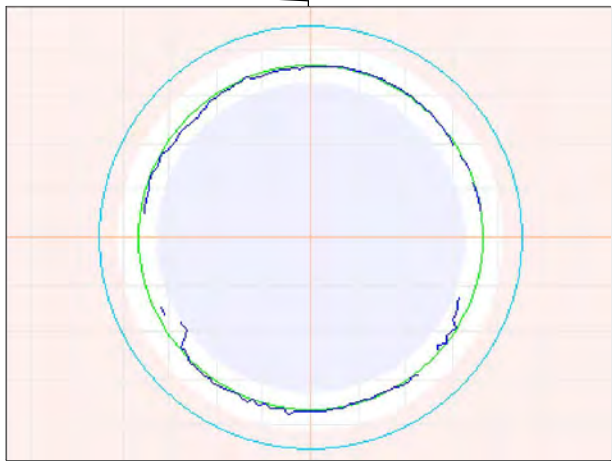




31ft Maximum Corrosion - To 1.3"



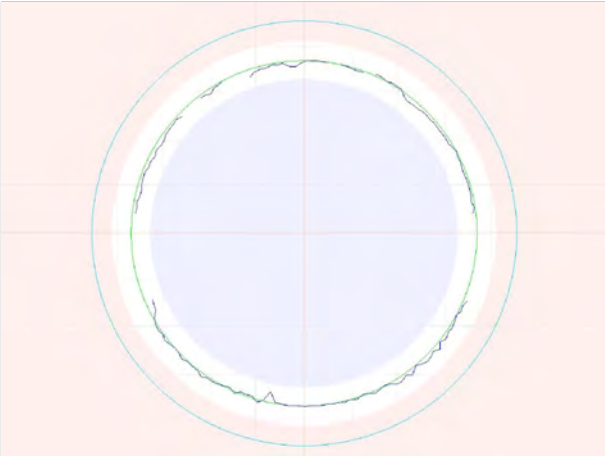
50.2ft General Observation - Corrosion to 0.5", Measurement inside reference to 0.8"



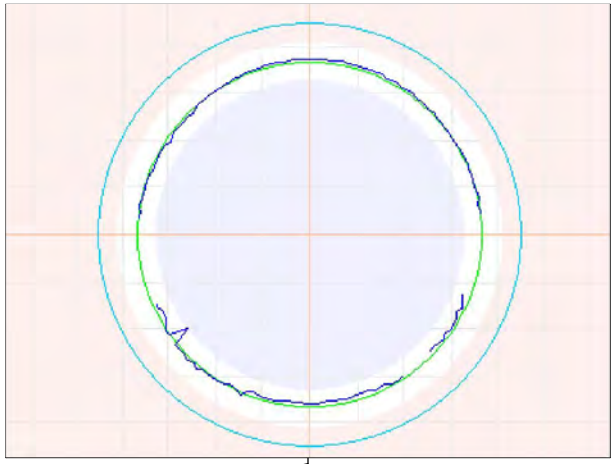
75ft General Observation - Measurement inside reference to 0.8"

Observation Report

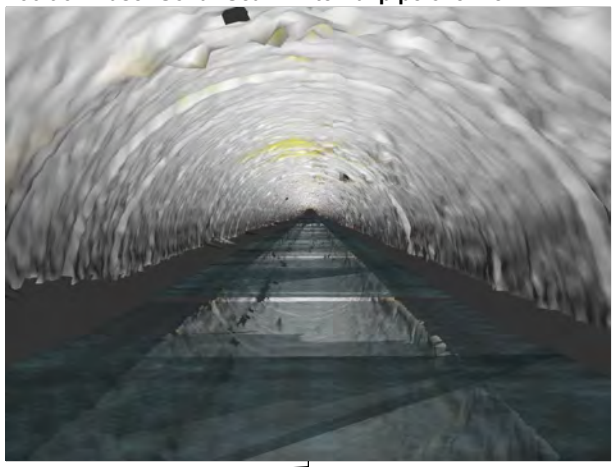
99.8ft General Observation - Measurement inside reference to 0.5"

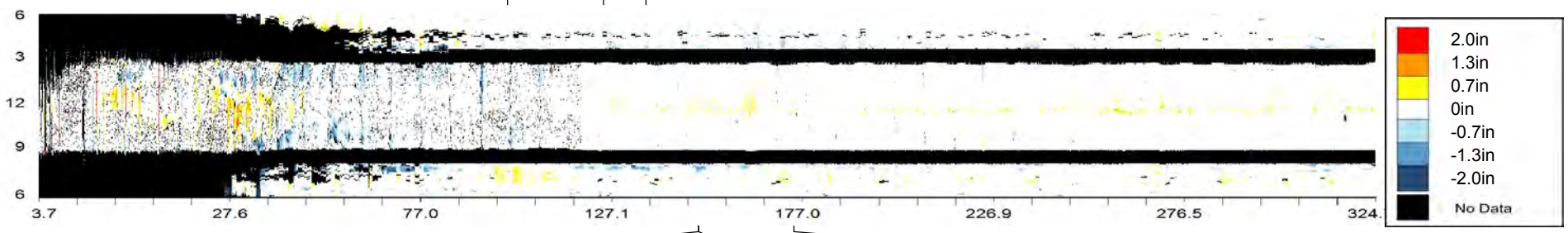


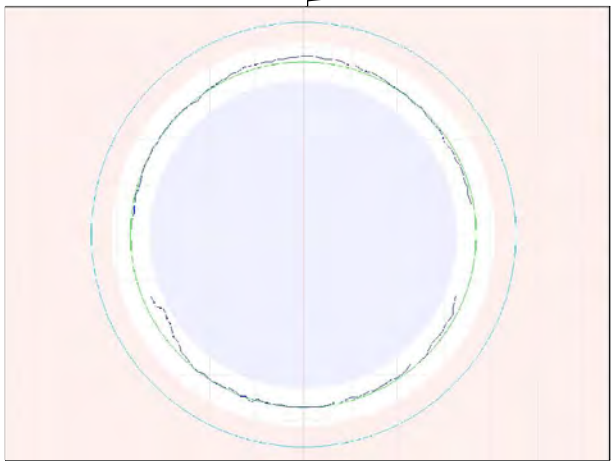
125ft General Observation - Corrosion to 0.4"\Debris to 0.5"



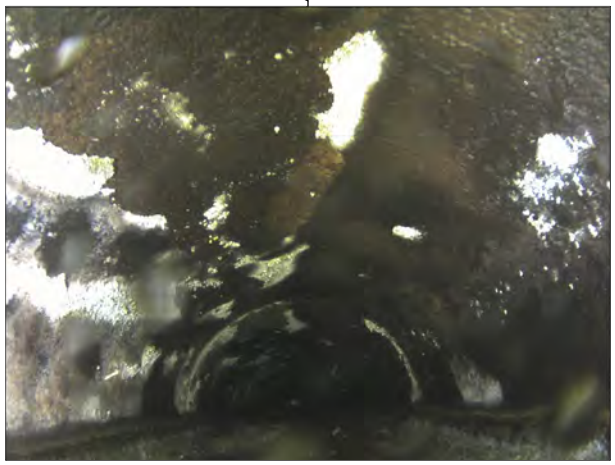
136ft 3D Laser Sonar Scan - Internal pipe overview



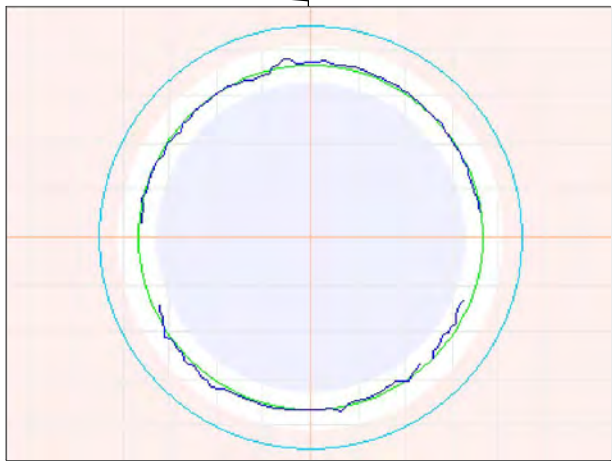




149.8ft General Observation - Corrosion to 0.6"



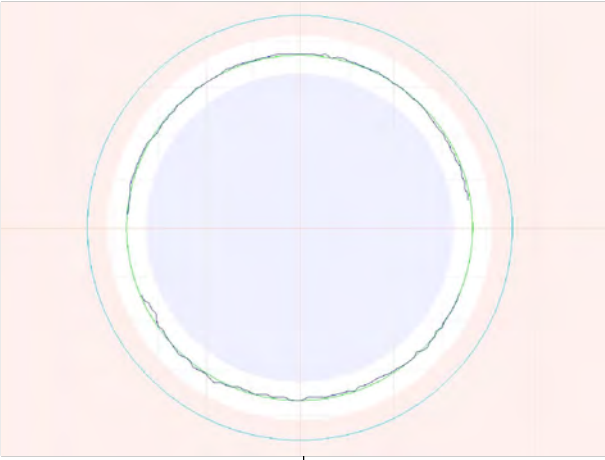
149.8ft General Observation - Corrosion to 0.6"



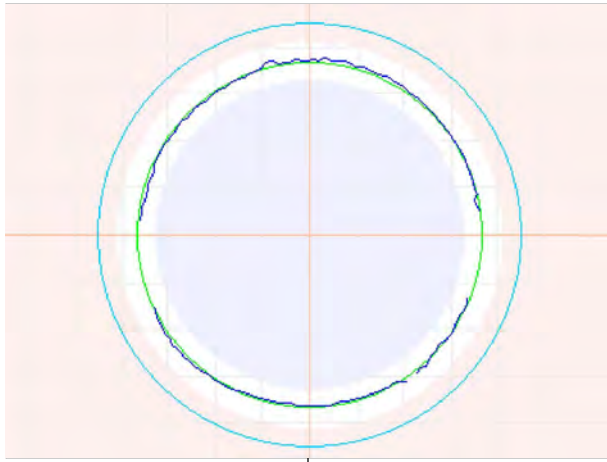
174.9ft General Observation - Corrosion to 0.8"

Observation Report

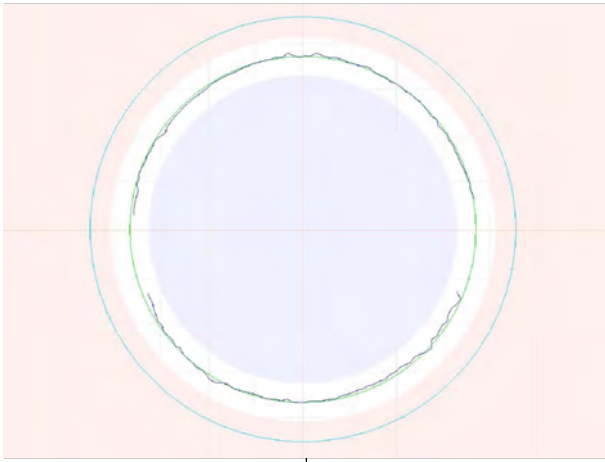
200ft General Observation

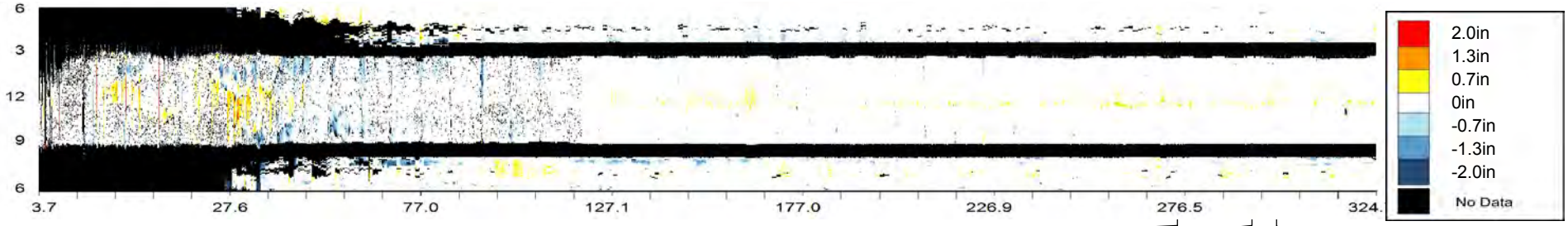


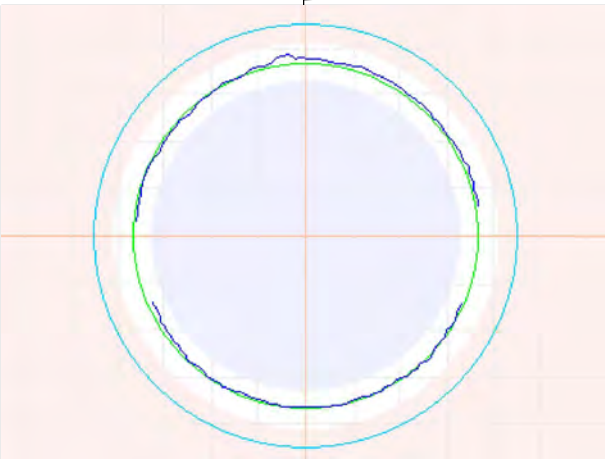
225ft General Observation - Corrosion to 0.6"\Debris to 0.2"



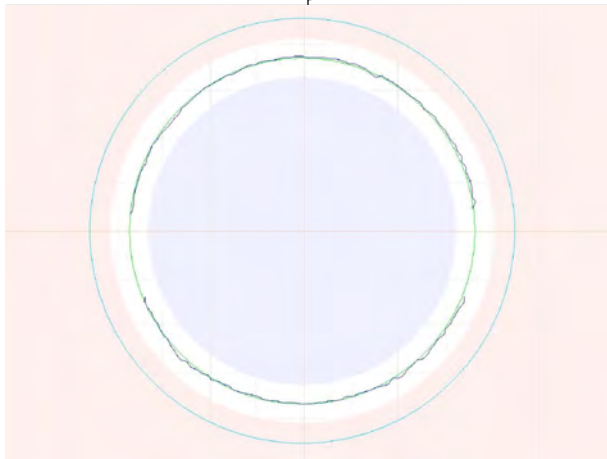
250.1ft General Observation



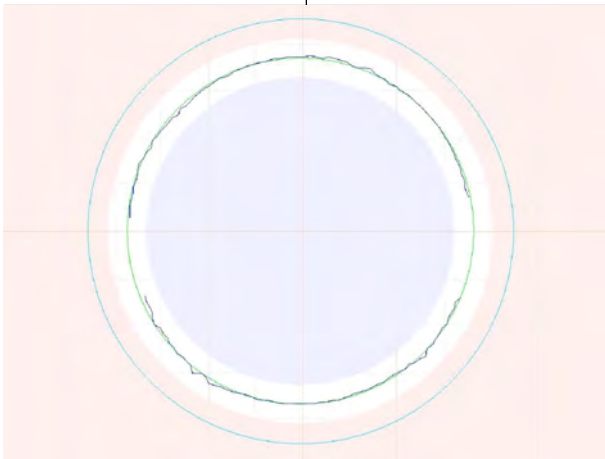




275ft General Observation - Corrosion to 1.0"\Debris to 0.2"



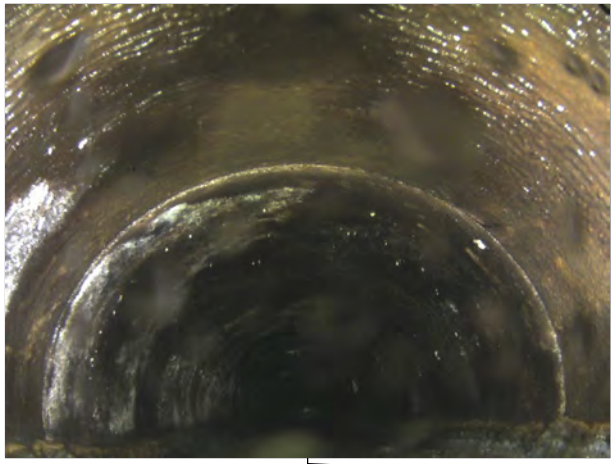
294ft Match to Reference Shape and Size - ø36"



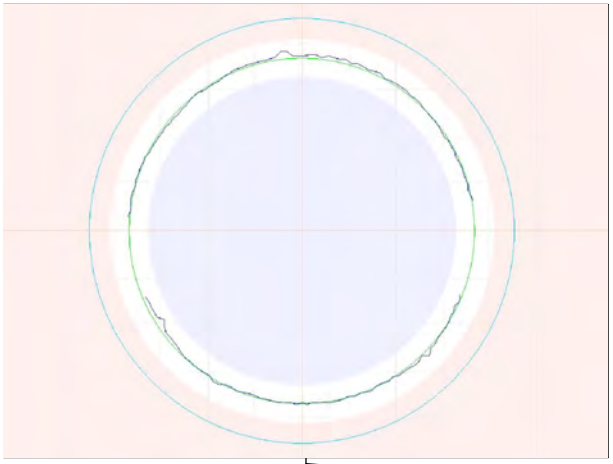
300.1ft General Observation

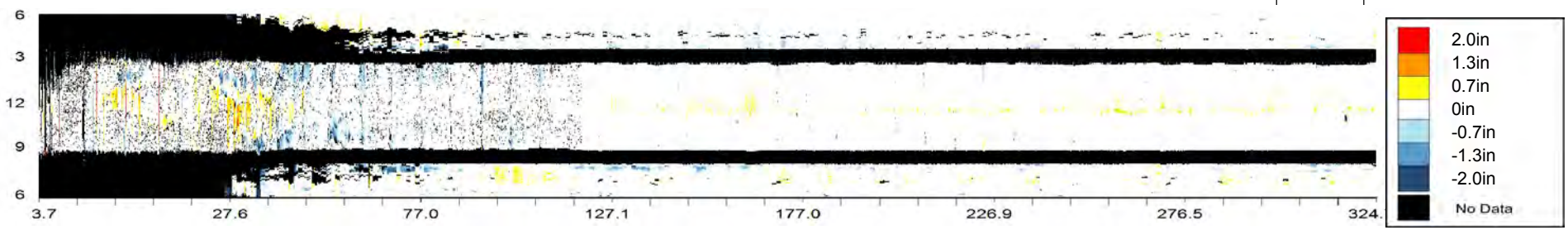
Observation Report

300.1ft General Observation



322.2ft General Observation - Corrosion to 0.6"





OVERVIEW - CMH000207 - CMH000206

Asset Number	CMH000207 - CMH000206		
Upstream MH	CMH000207	Material	Reinforced Concrete Pipe
Downstream MH	CMH000206	Size & Shape	30 in Circle
Survey Direction	Downstream	Match to Reference	376.2 ft

Distance	Observation	Comment
8 ft	**Beginning of Inspection**	**CMH000207**
8	General Observation	Measurement outside reference to 0.4"
14.1	Note	Estimated fit to reference due to no sonar data
27.1	General Observation	Corrosion to 0.4"
50.1	General Observation	Measurement inside reference to 0.4"
77	General Observation	Measurement inside reference to 0.7"
91.2	Note	Water on lens affects laser data throughout asset
99.9	General Observation	Measurement inside reference to 0.4"
125.8	General Observation	Measurement inside reference to 0.5"
149.8	General Observation	Measurement inside reference to 0.5"
175	General Observation	Corrosion to 0.5"
199.9	General Observation	Measurement inside reference to 0.9"
225	General Observation	Corrosion to 0.3"
250	General Observation	Measurement inside reference to 0.5"
274.9	General Observation	Corrosion to 0.2"
299.9	General Observation	Measurement inside reference to 0.8"
324.9	General Observation	Corrosion to 0.2"
349.8	General Observation	Measurement inside reference to 0.6"
374.9	General Observation	Corrosion to 0.6"
376.2	Closest Match to Reference Size	ø30"
399.9	General Observation	Measurement inside reference to 1.1"
424.9	General Observation	Corrosion to 0.4"
436.7	Maximum Measurement Inside Reference	To 1.9"
449.8	General Observation	Measurement inside reference to 0.4"

OVERVIEW - CMH000207 - CMH000206			
Asset Number	CMH000207 - CMH000206		
Upstream MH	CMH000207	Material	Reinforced Concrete Pipe
Downstream MH	CMH000206	Size & Shape	30 in Circle
Survey Direction	Downstream	Match to Reference	376.2 ft

Distance	Observation	Comment
449.8	General Observation	Measurement inside reference to 0.4"
464.7 ft	**End of Inspection**	**CMH000206**

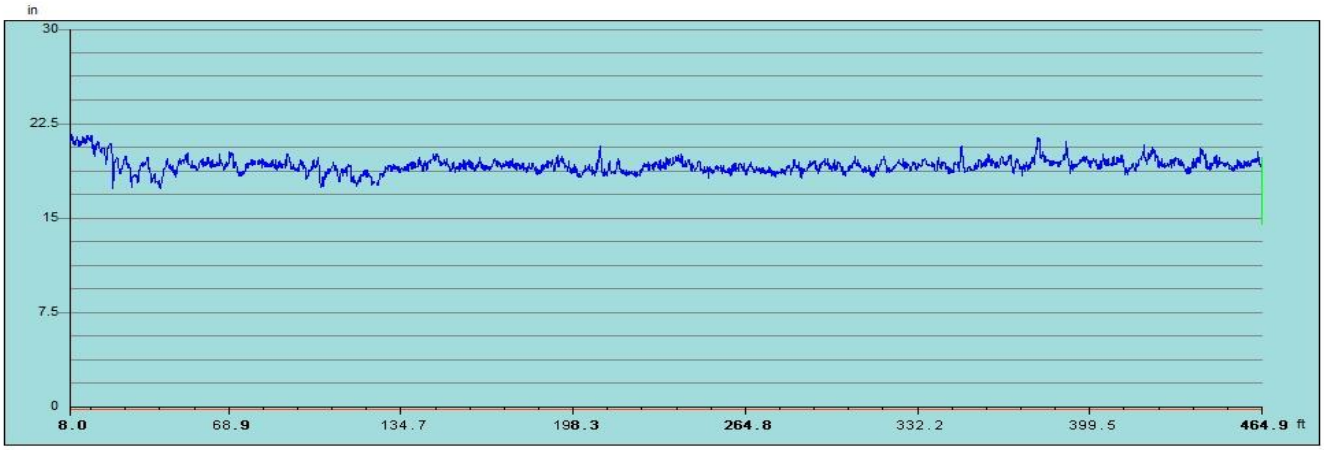
CMH000207 - CMH000206

Asset Number	CMH000207 - CMH000206	Length	465 ft
US Manhole	CMH000207	Diameter	30 in
DS Manhole	CMH000206	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	376.2 ft
Date Profiled	18 July 2013	Operator	-

Observations - (No Sonar)

Average Water Level	19 in

Waterlevel Graph



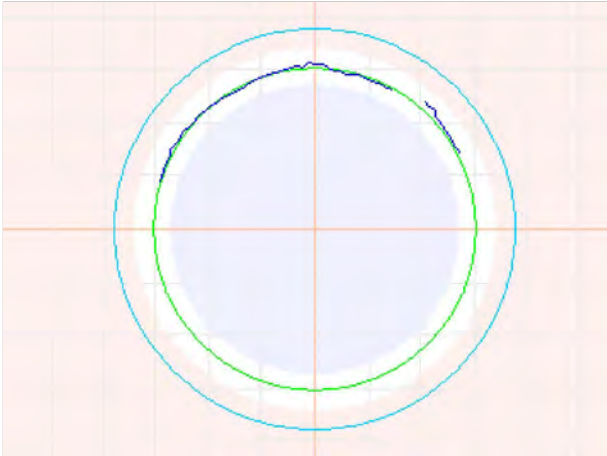
Inspection Distance (ft)

Water Level

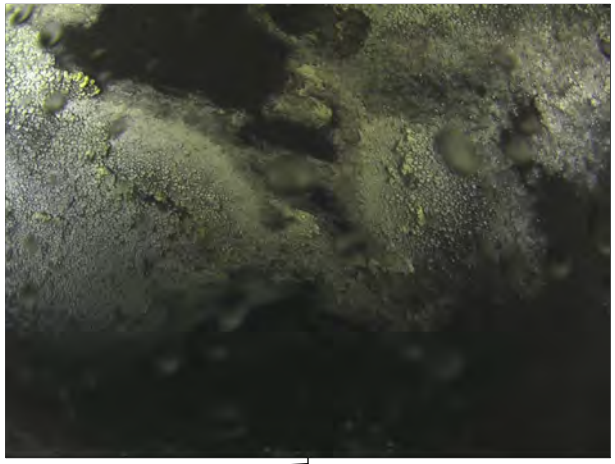
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

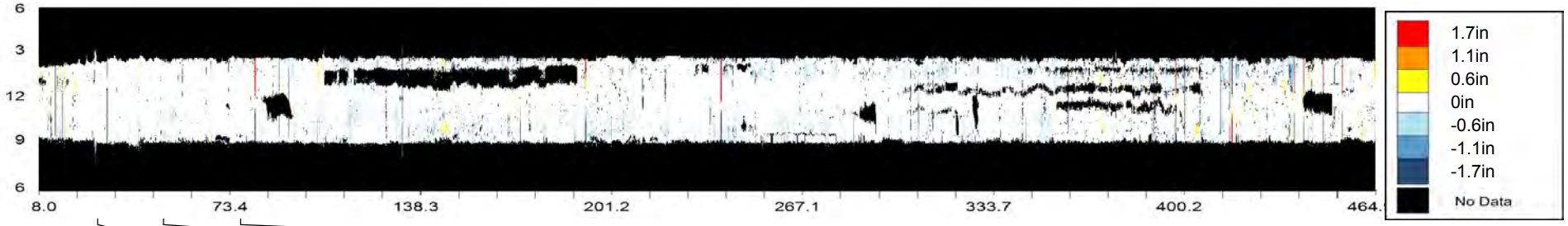
8ft General Observation - Measurement outside reference to 0.4"

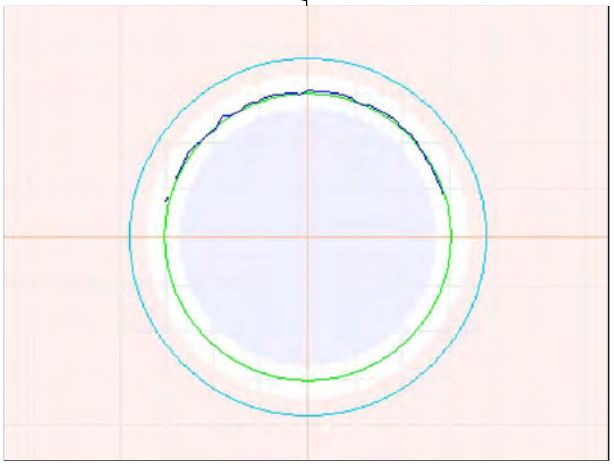


8ft General Observation - Measurement outside reference to 0.4"

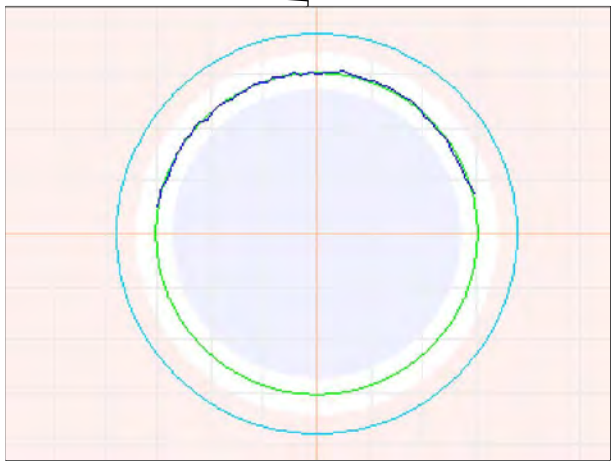


14.1ft Note - Estimated fit to reference due to no sonar data

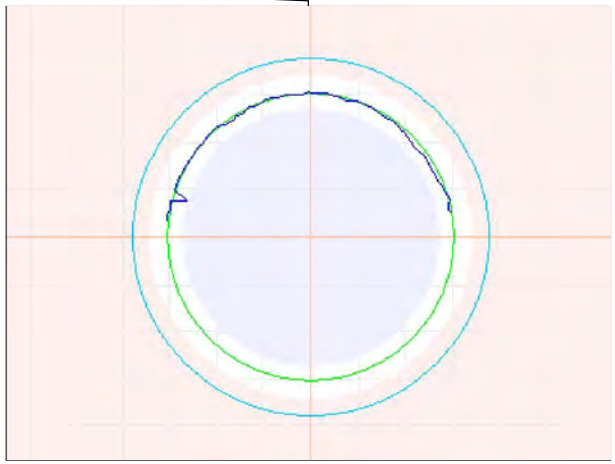




27.1ft General Observation - Corrosion to 0.4"



50.1ft General Observation - Measurement inside reference to 0.4"

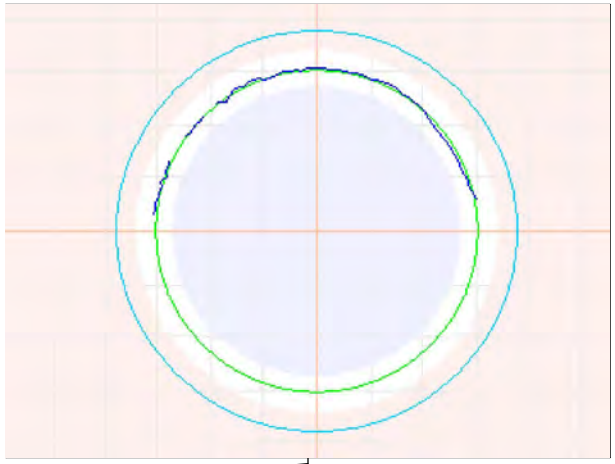


77ft General Observation - Measurement inside reference to 0.7"

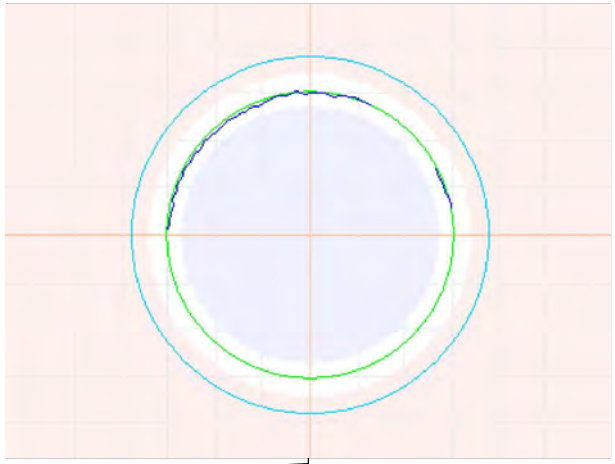
Observation Report

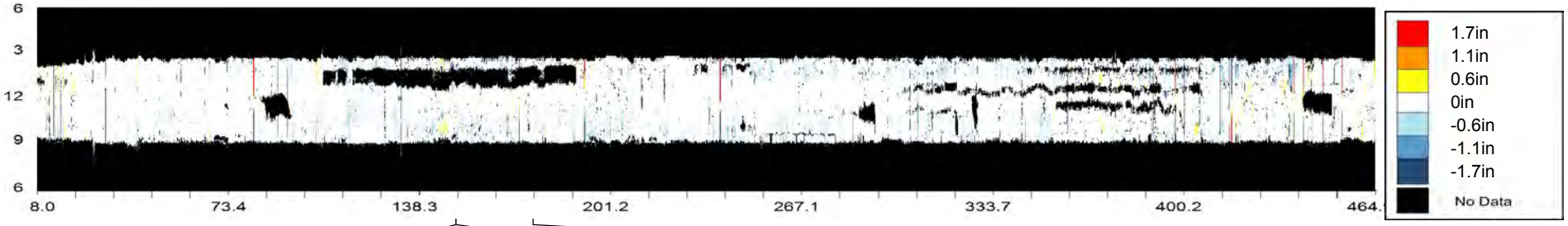
91.2ft Note - Water on lens affects laser data throughout asset

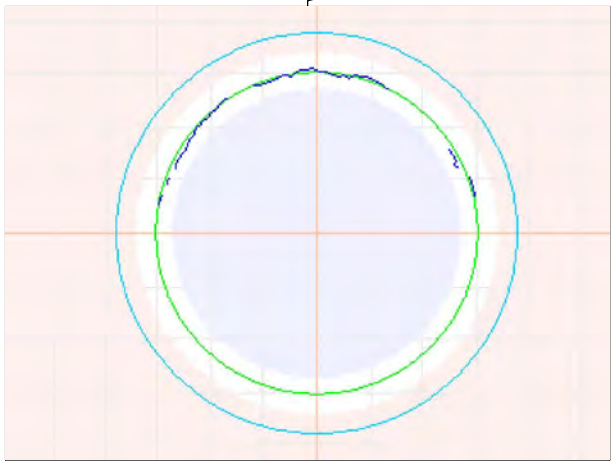
99.9ft General Observation - Measurement inside reference to 0.4"



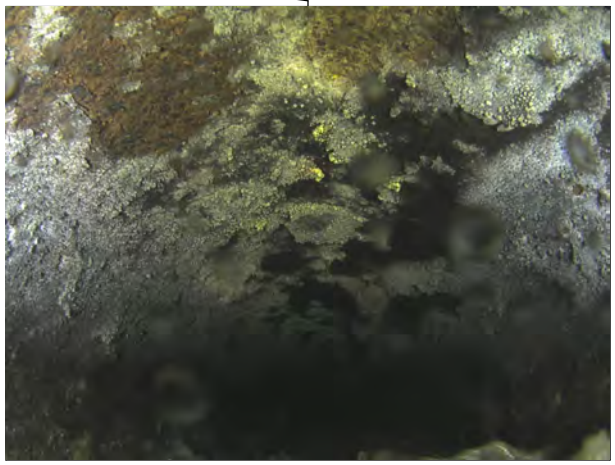
125.8ft General Observation - Measurement inside reference to 0.5"



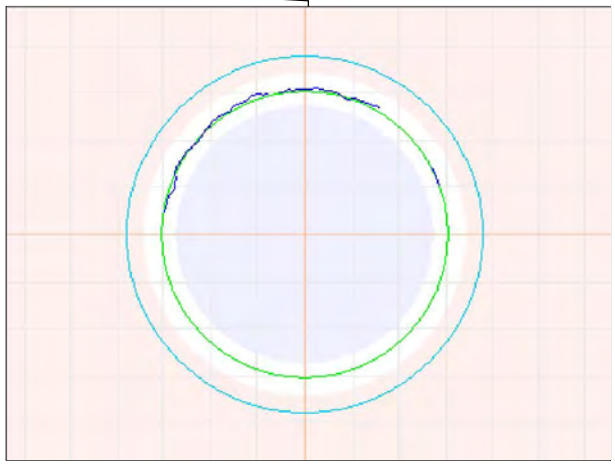




149.8ft General Observation - Measurement inside reference to 0.5"



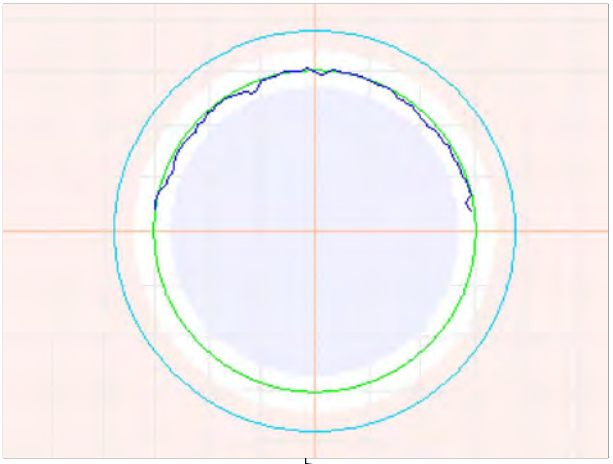
149.8ft General Observation - Measurement inside reference to 0.5"



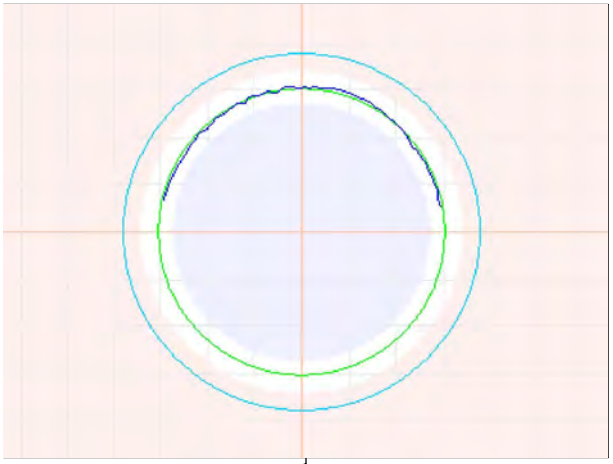
175ft General Observation - Corrosion to 0.5"

Observation Report

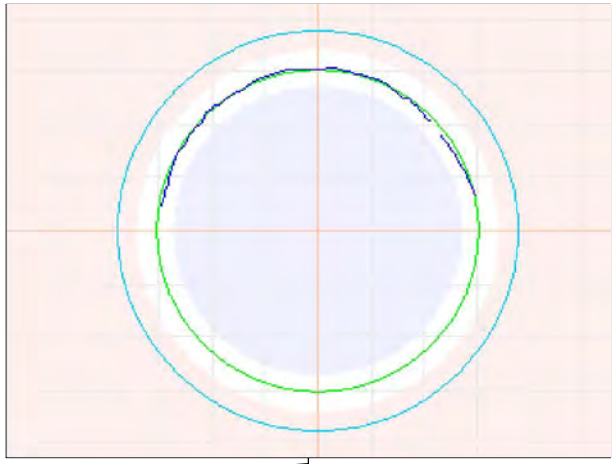
199.9ft General Observation - Measurement inside reference to 0.9"

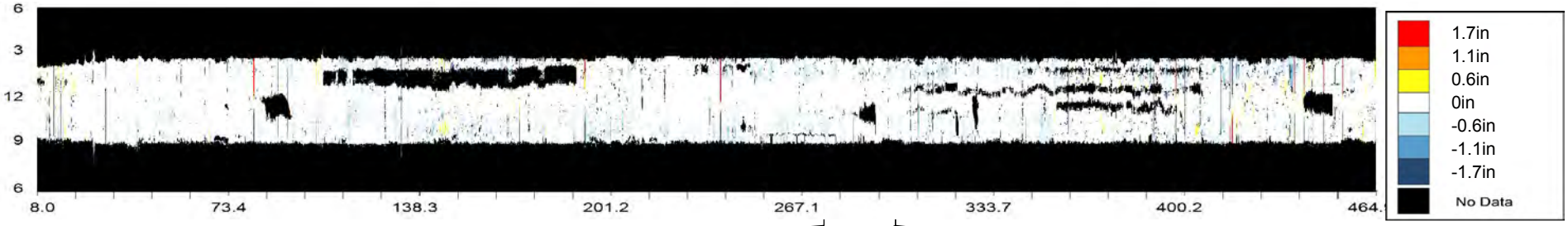


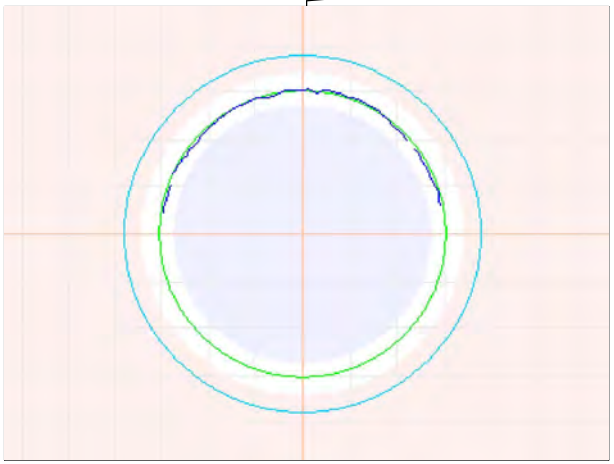
225ft General Observation - Corrosion to 0.3"



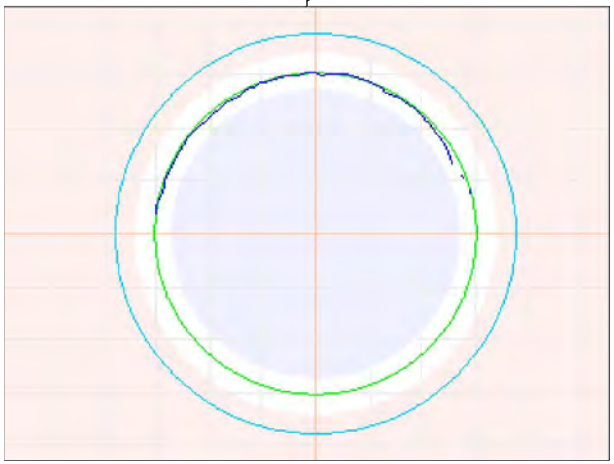
250ft General Observation - Measurement inside reference to 0.5"



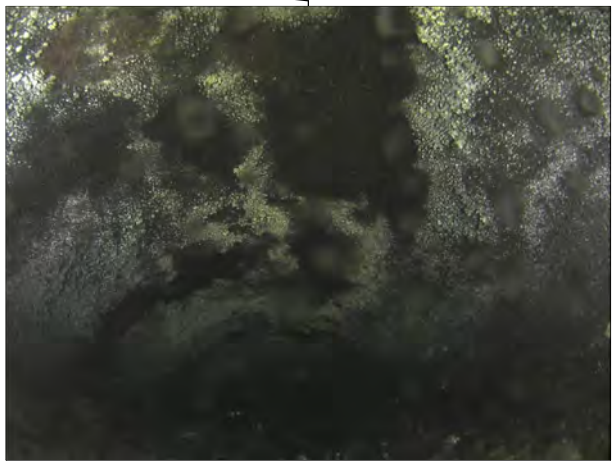




274.9ft General Observation - Corrosion to 0.2"



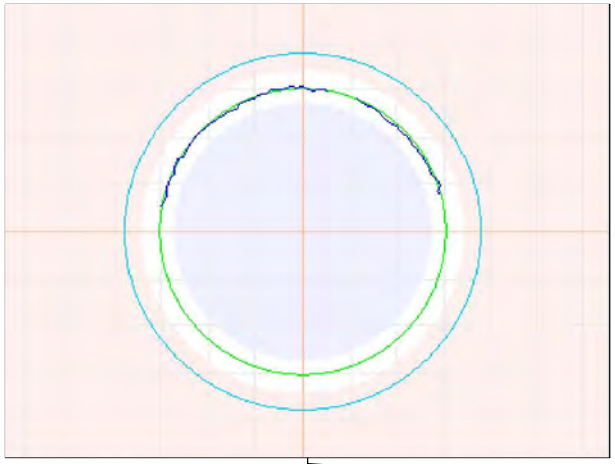
299.9ft General Observation - Measurement inside reference to 0.8"



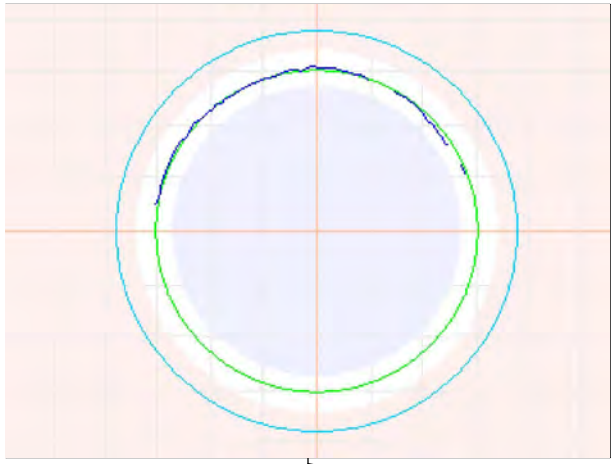
299.9ft General Observation - Measurement inside reference to 0.8"

Observation Report

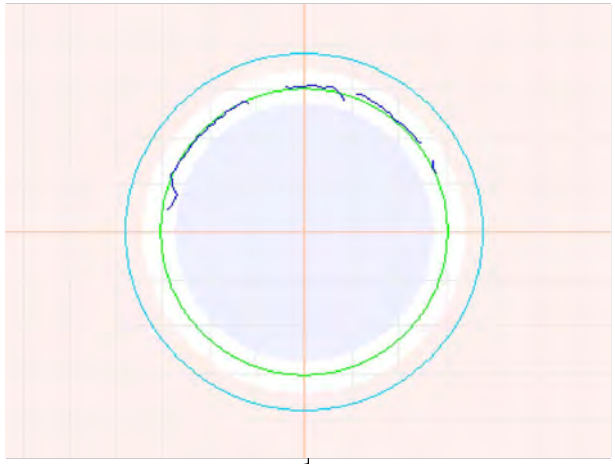
324.9ft General Observation - Corrosion to 0.2"

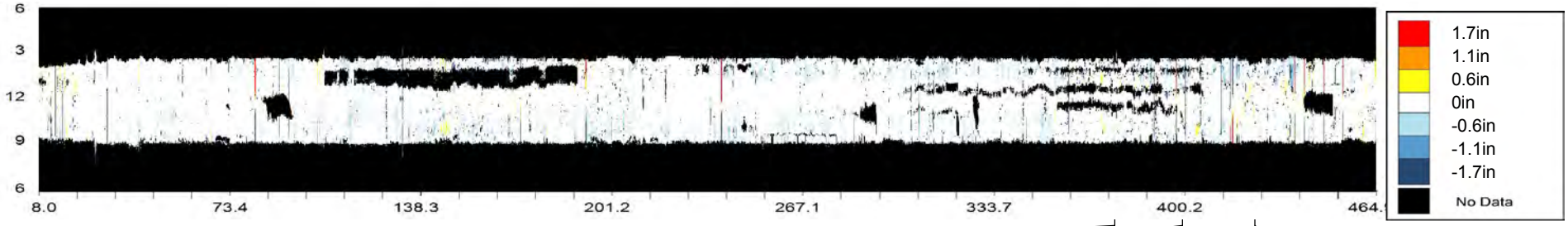


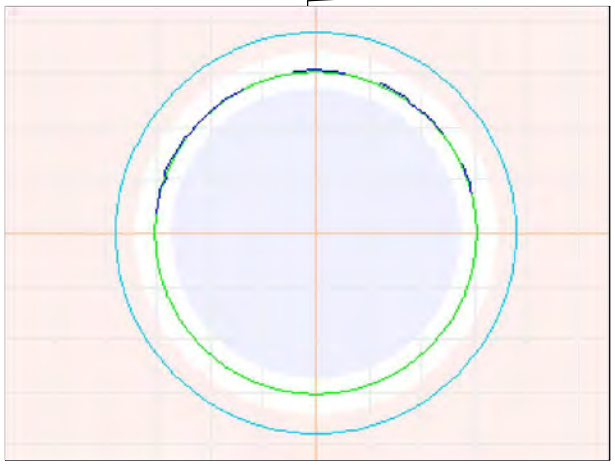
349.8ft General Observation - Measurement inside reference to 0.6"



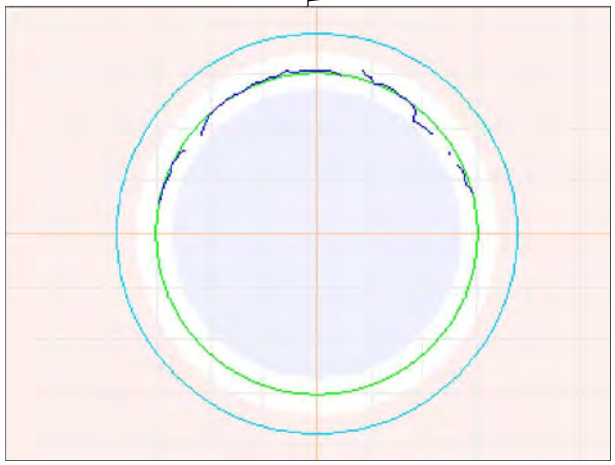
374.9ft General Observation - Corrosion to 0.6"



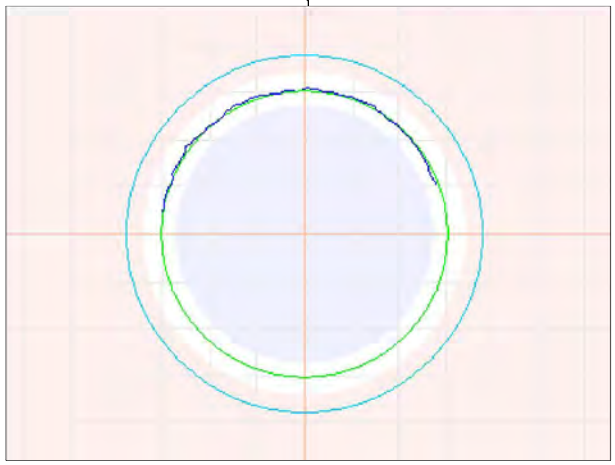




376.2ft Closest Match to Reference Size - ø30"



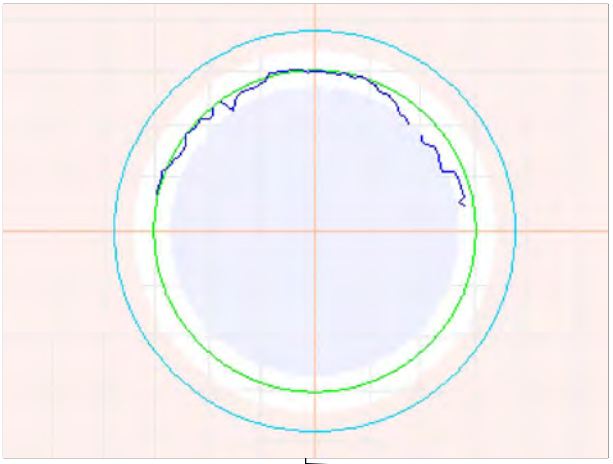
399.9ft General Observation - Measurement inside reference to 1.1"



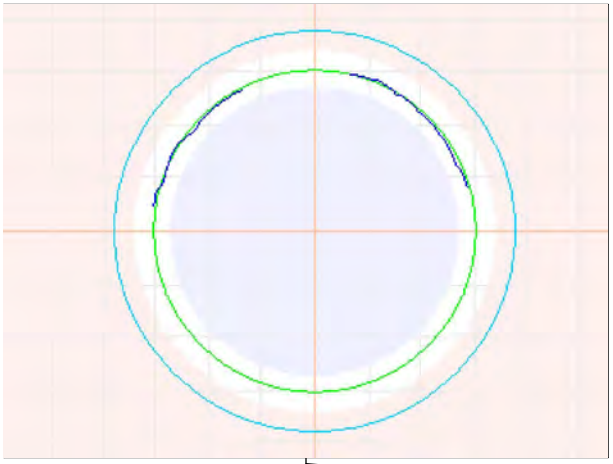
424.9ft General Observation - Corrosion to 0.4"

Observation Report

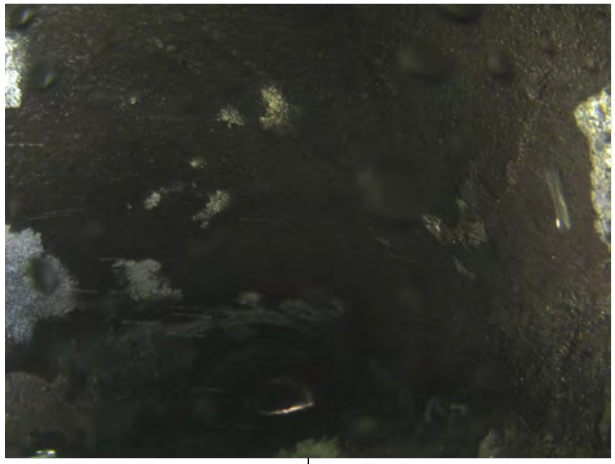
436.7ft Maximum Measurement Inside Reference - To 1.9"

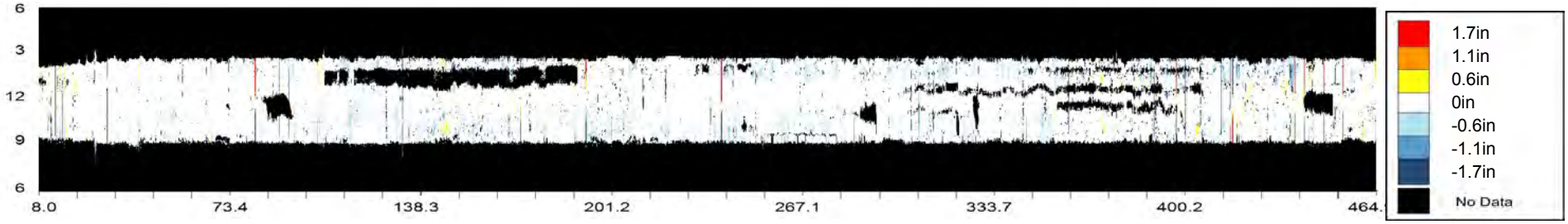


449.8ft General Observation - Measurement inside reference to 0.4"



449.8ft General Observation - Measurement inside reference to 0.4"





OVERVIEW - CMH000235 - CMH000176

Asset Number	CMH000235 - CMH000176		
Upstream MH	CMH000235	Material	Reinforced Concrete Pipe
Downstream MH	CMH000176	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	99.8 ft

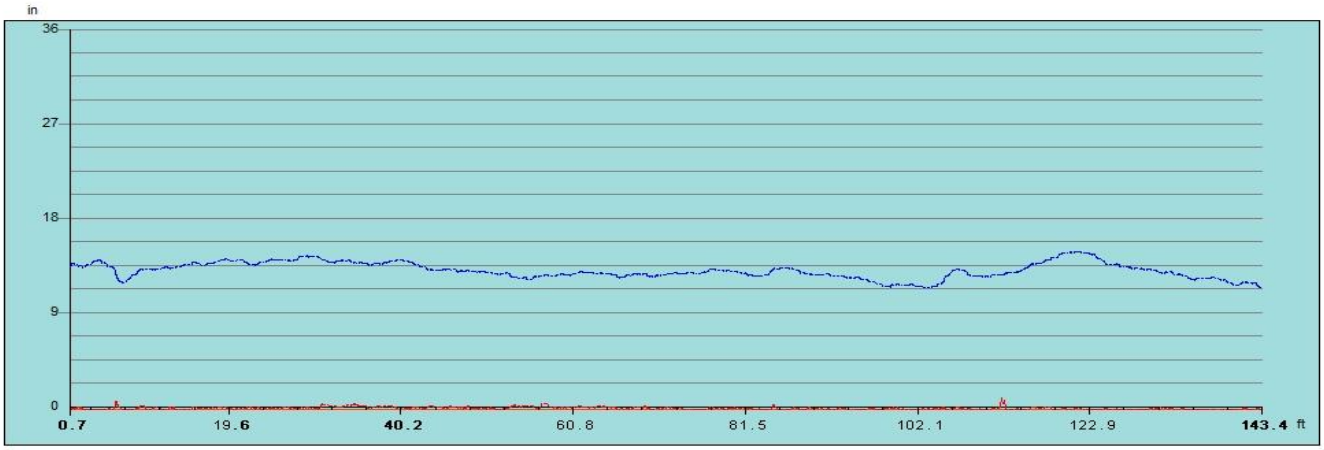
Distance	Observation	Comment
0.7 ft	**Beginning of Inspection**	**CMH000235**
0.9	Maximum Corrosion	To 0.9"
0.9	General Observation	Corrosion to 0.9"
25	General Observation	Corrosion to 0.5"
50	General Observation	
68.1	3D Laser Sonar Scan	Internal pipe overview
75	General Observation	Corrosion to 0.4"
99.8	Match to Reference Shape and Size	ø36"
100	General Observation	
125	General Observation	Corrosion to 0.5"
143.1	General Observation	
143.3 ft	**End of Inspection**	**CMH000176**

CMH000235 - CMH000176			
Asset Number	CMH000235 - CMH000176	Length	144 ft
Upstream MH	CMH000235	Diameter	36 in
Downstream MH	CMH000176	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	99.8 ft
Date Profiled	16 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	13 in
Debris Volume	0 cubic feet

Debris Graph



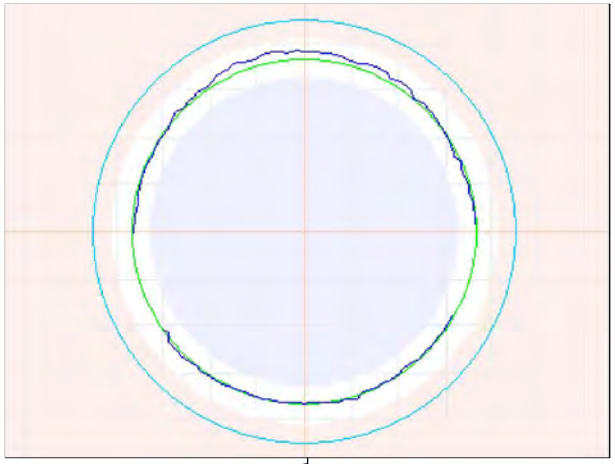
Inspection Distance (ft)

Water Level Debris Level

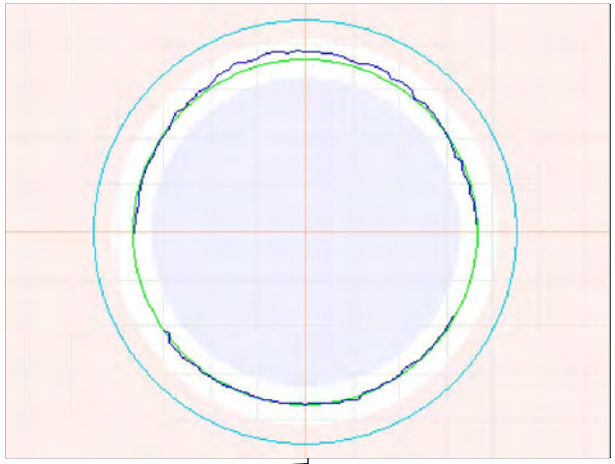
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

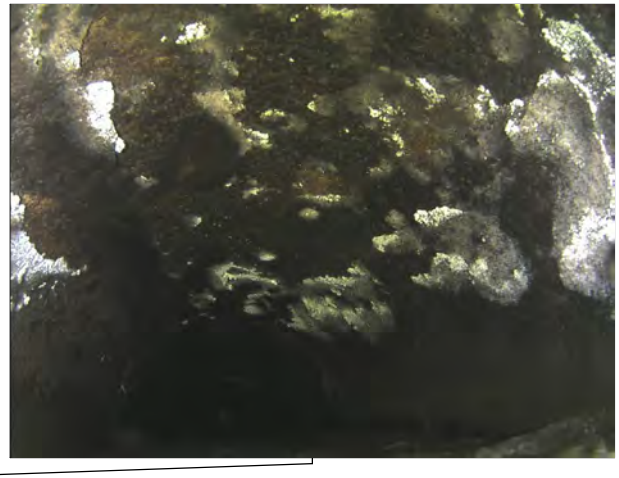
0.9ft Maximum Corrosion - To 0.9"

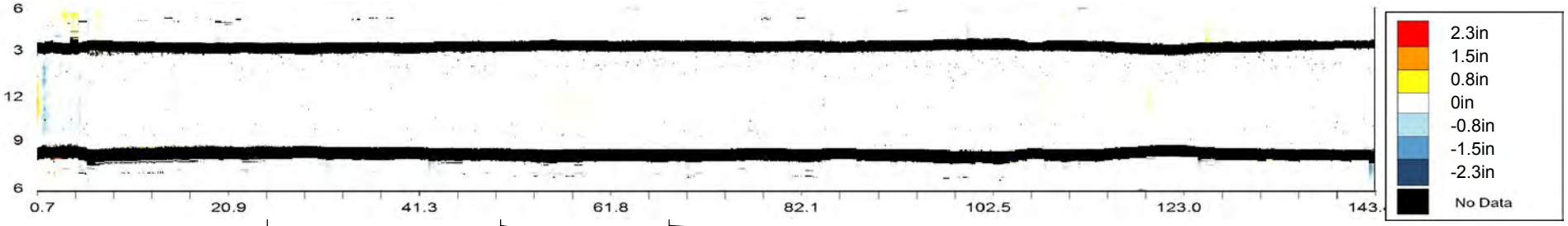


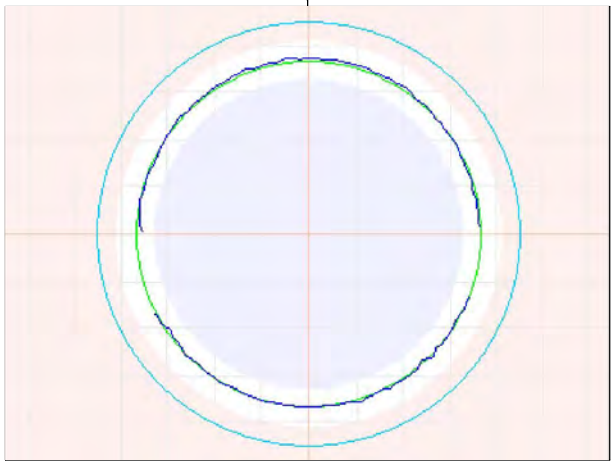
0.9ft General Observation - Corrosion to 0.9"



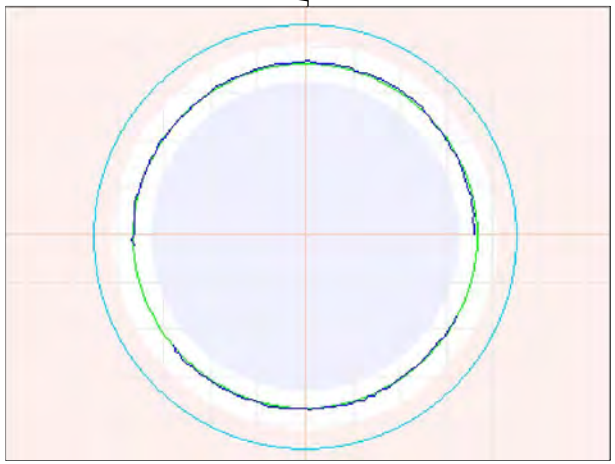
0.9ft General Observation - Corrosion to 0.9"



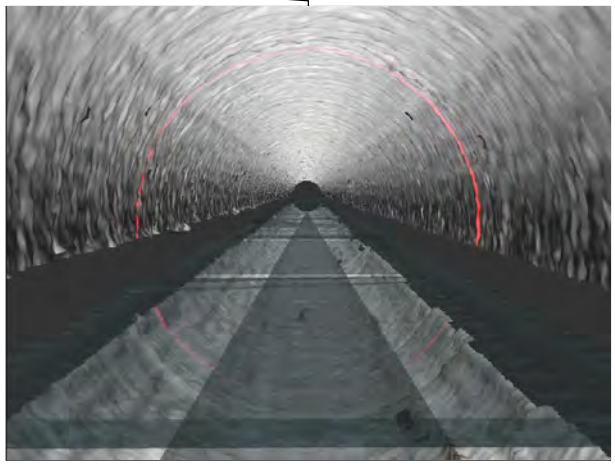




25ft General Observation - Corrosion to 0.5"



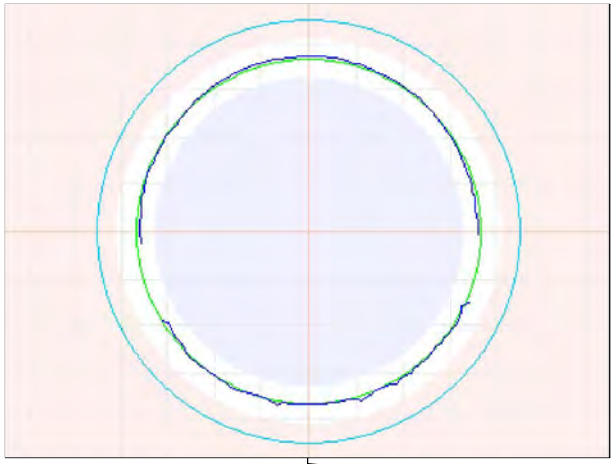
50ft General Observation



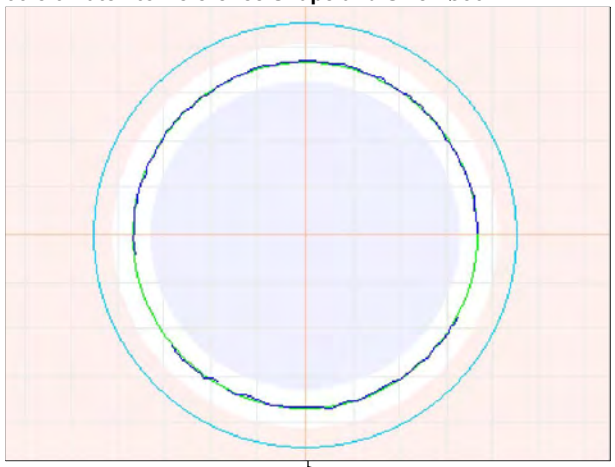
68.1ft 3D Laser Sonar Scan - Internal pipe overview

Observation Report

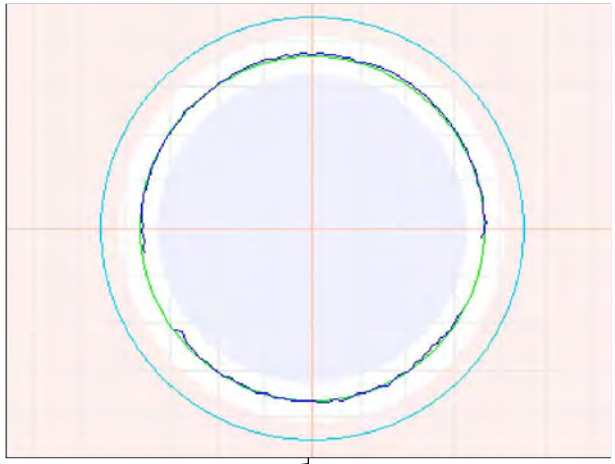
75ft General Observation - Corrosion to 0.4"

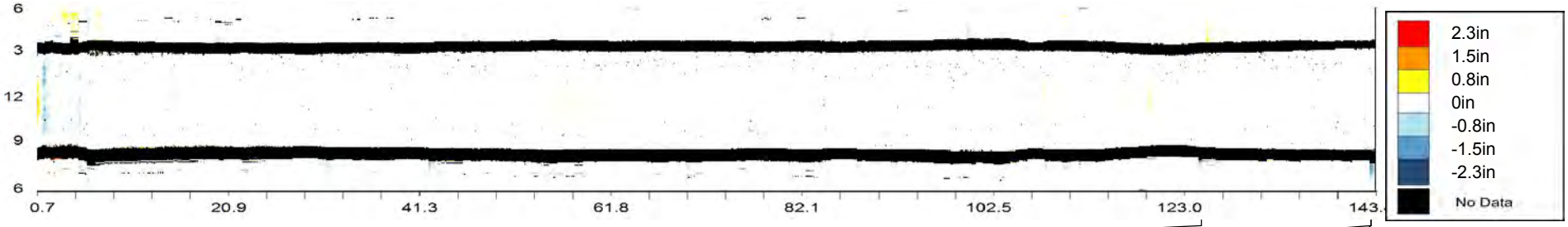


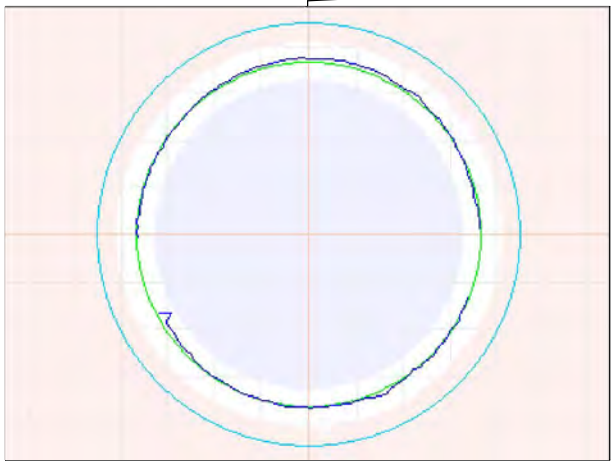
99.8ft Match to Reference Shape and Size - ø36"



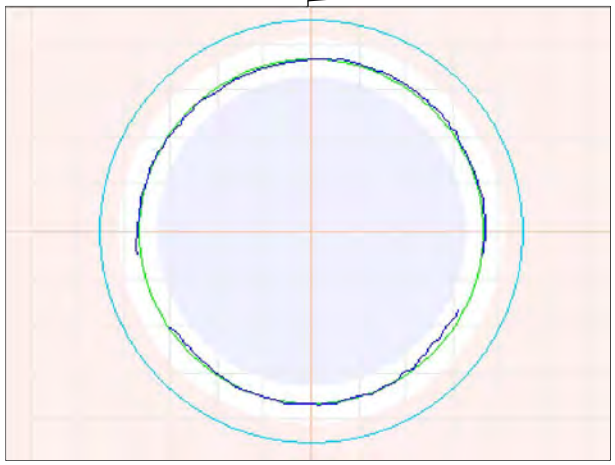
100ft General Observation







125ft General Observation - Corrosion to 0.5"



143.1ft General Observation

143.1ft General Observation

OVERVIEW - CMH000247 - CMH000235

Asset Number	CMH000247 - CMH000235		
Upstream MH	CMH000247	Material	Reinforced Concrete Pipe
Downstream MH	CMH000235	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	173.8 ft

Distance	Observation	Comment
4.7 ft	**Beginning of Inspection**	**CMH000247**
4.8	General Observation	Corrosion to 0.6"
9.7	Point of Interest	
12.1	Maximum Corrosion	To 0.8"
25	General Observation	Corrosion to 0.3"
50	General Observation	Measurement inside reference to 0.5"
75	General Observation	Corrosion to 0.4"
100.1	General Observation	
124.9	General Observation	Corrosion to 0.4"\Debris to 0.2"
130.3	3D Laser Sonar Scan	Internal pipe overview
149.9	General Observation	Corrosion to 0.5"
173.8	Match to Reference Shape and Size	ø36"
174.8	General Observation	Corrosion to 0.2"
199.9	General Observation	
207.3 ft	**End of Inspection**	**CMH000235**

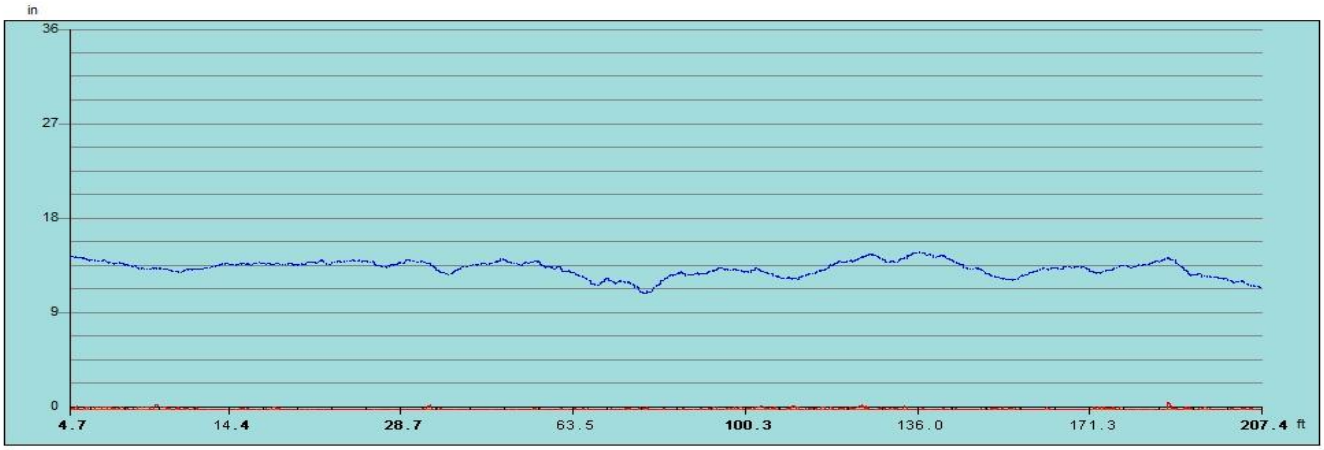
CMH000247 - CMH000235

Asset Number	CMH000247 - CMH000235	Length	208 ft
Upstream MH	CMH000247	Diameter	36 in
Downstream MH	CMH000235	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	173.8 ft
Date Profiled	16 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	13 in
Debris Volume	0 cubic feet

Debris Graph



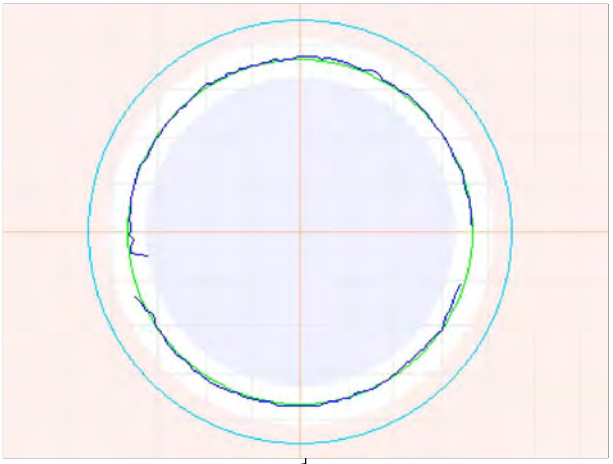
Inspection Distance (ft)

Water Level Debris Level

*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

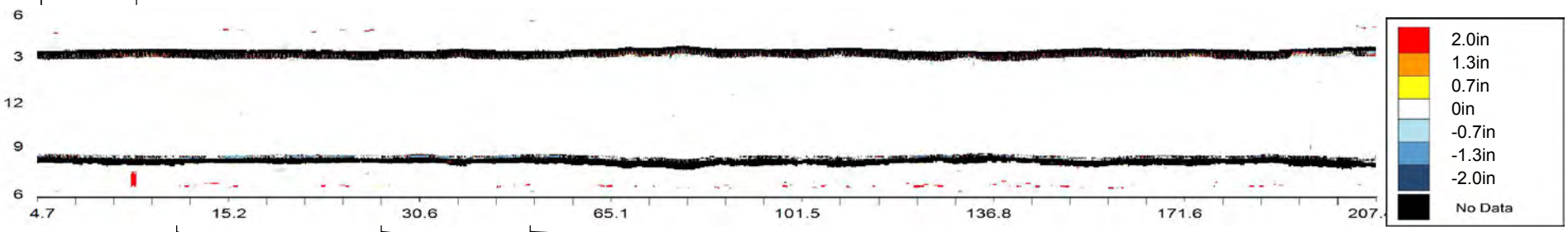
Observation Report

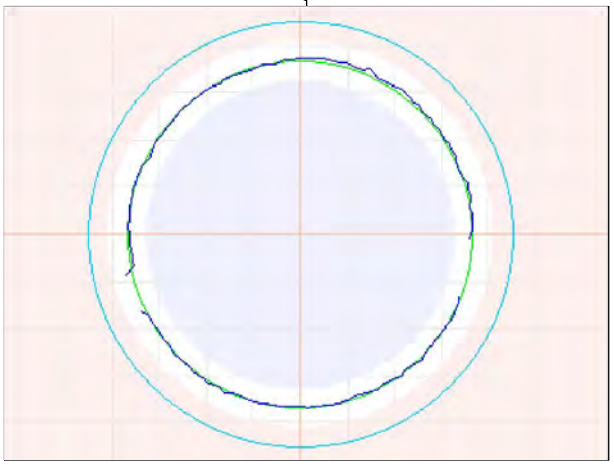
4.8ft General Observation - Corrosion to 0.6"



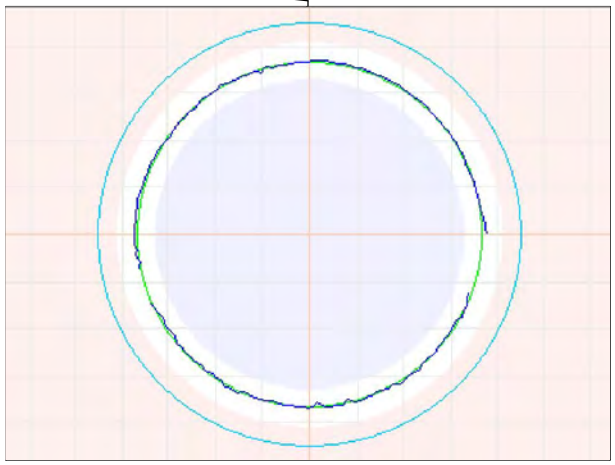
4.8ft General Observation - Corrosion to 0.6"

9.7ft Point of Interest

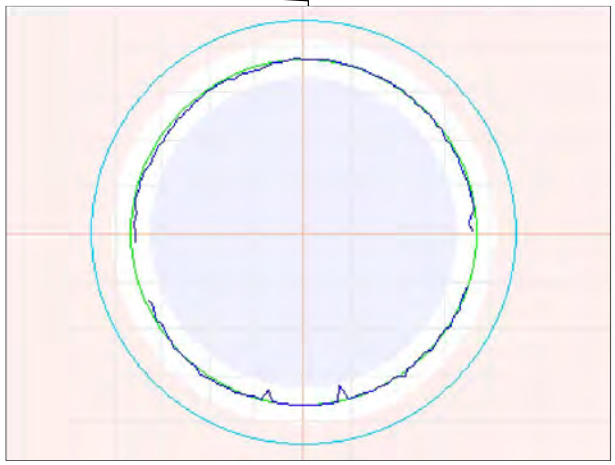




12.1ft Maximum Corrosion - To 0.8"



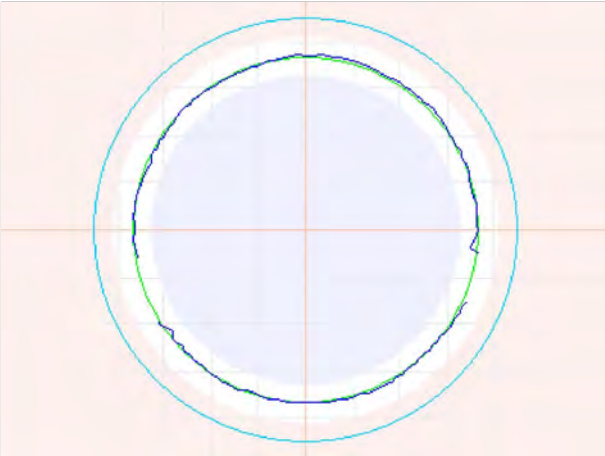
25ft General Observation - Corrosion to 0.3"



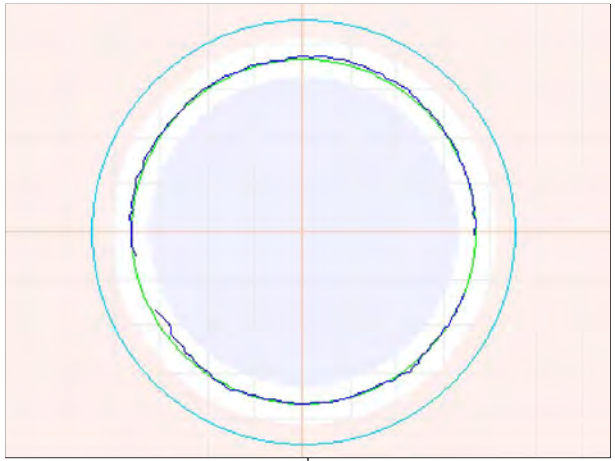
50ft General Observation - Measurement inside reference to 0.5"

Observation Report

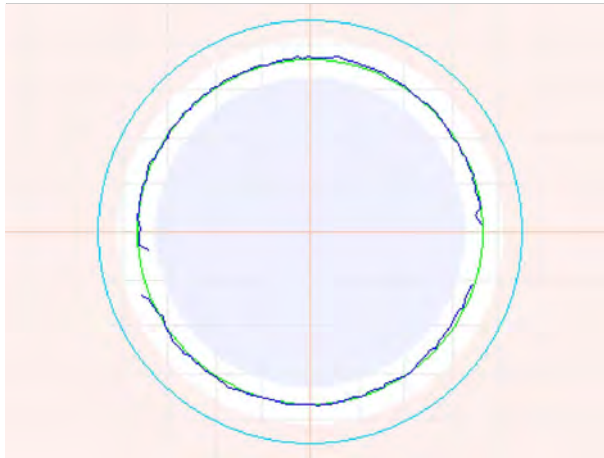
75ft General Observation - Corrosion to 0.4"

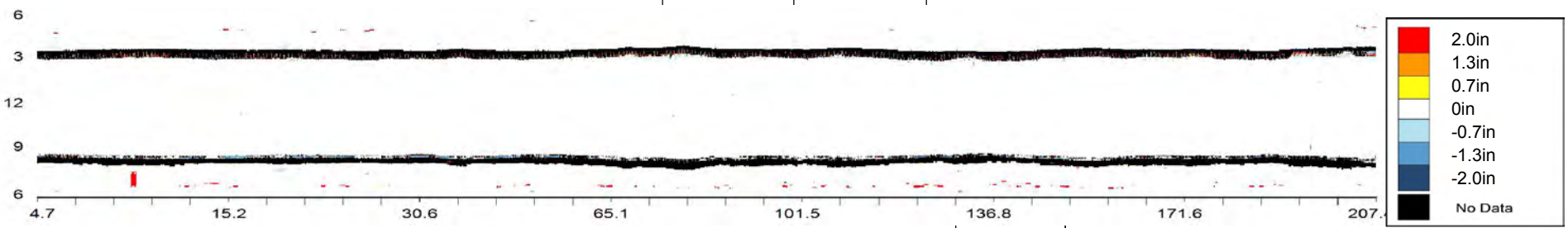


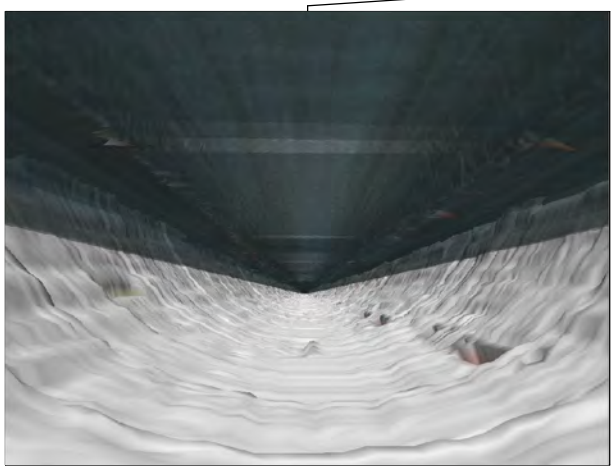
100.1ft General Observation



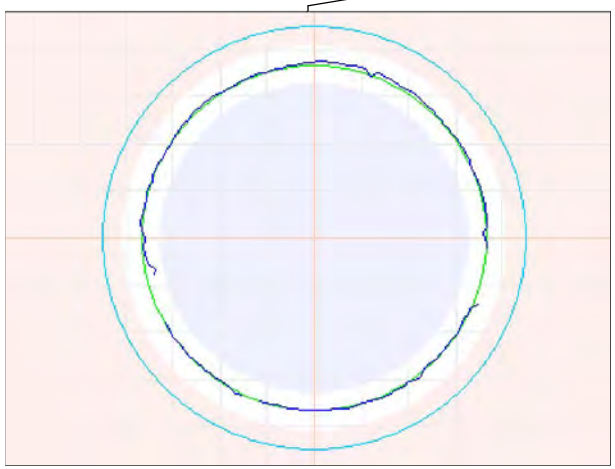
124.9ft General Observation - Corrosion to 0.4"\Debris to 0.2"



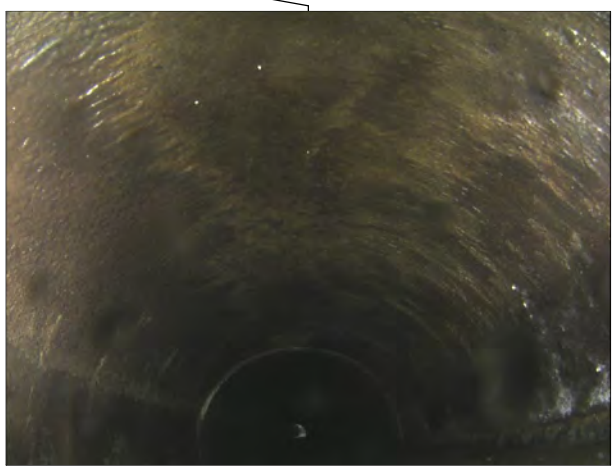




130.3ft 3D Laser Sonar Scan - Internal pipe overview



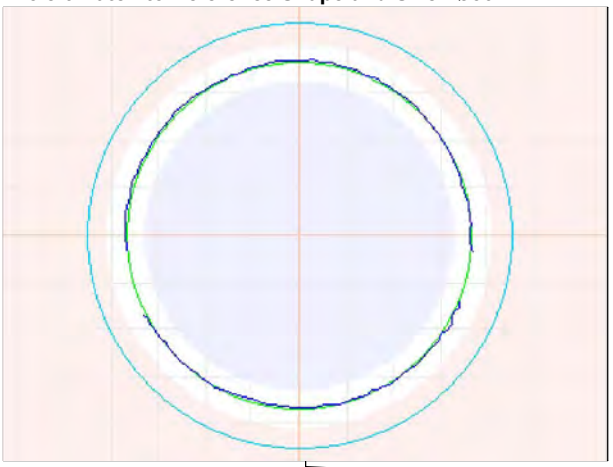
149.9ft General Observation - Corrosion to 0.5"



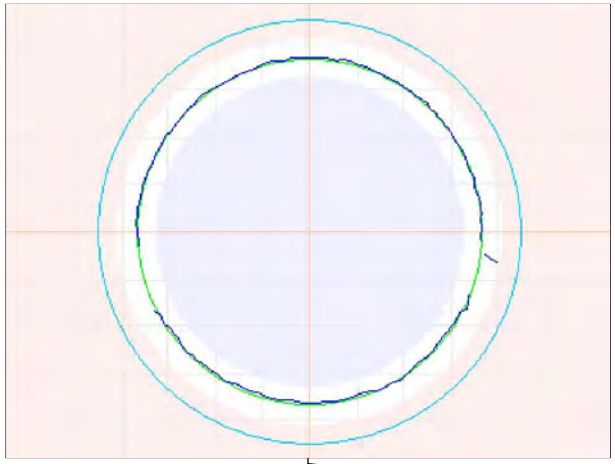
149.9ft General Observation - Corrosion to 0.5"

Observation Report

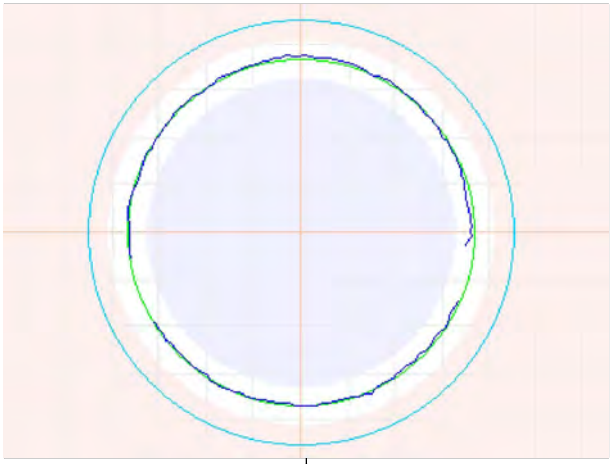
173.8ft Match to Reference Shape and Size - ø36"

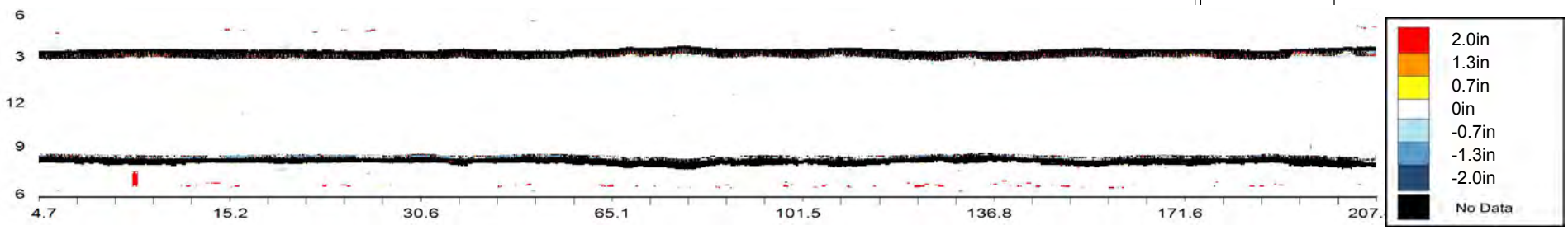


174.8ft General Observation - Corrosion to 0.2"



199.9ft General Observation





OVERVIEW - CMH000255 - CMH000255A

Asset Number	CMH000255 - CMH000255A		
Upstream MH	CMH000255	Material	Reinforced Concrete Pipe
Downstream MH	CMH000255A	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	2.8 ft

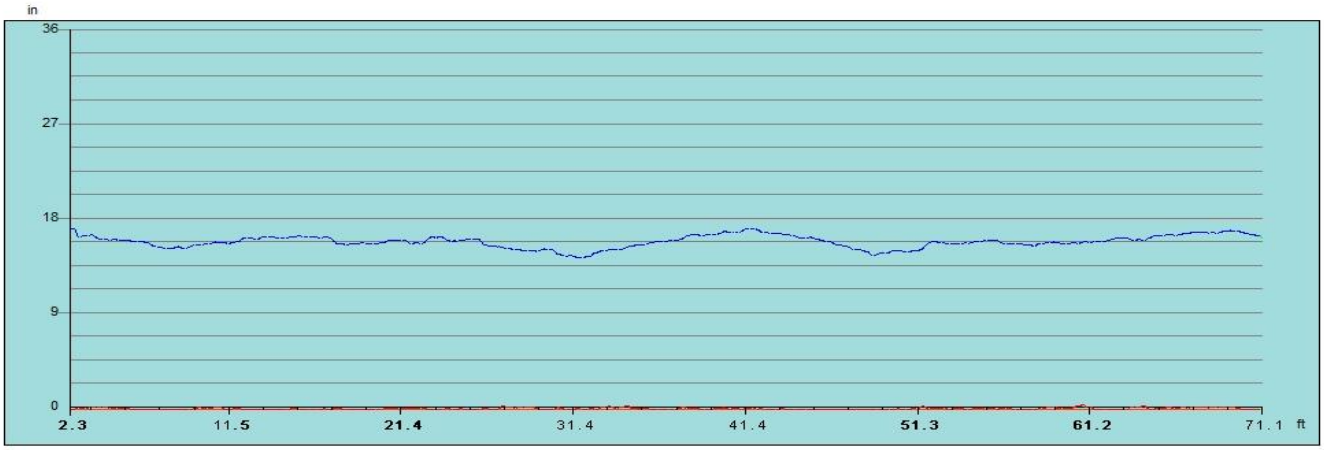
Distance	Observation	Comment
2.3 ft	**Beginning of Inspection**	**CMH000255**
2.5	General Observation	Corrosion to 0.4"
2.8	Match to Reference Shape and Size	ø36"
25	General Observation	Corrosion to 0.7"
30.3	Maximum Corrosion	To 0.9"
50.1	General Observation	Corrosion to 0.6"
55.4	3D Laser Sonar Scan	Pipe Overview
59	Point of Interest	
70	General Observation	Corrosion to 0.4"
71 ft	**End of Inspection**	**CMH000255A**

CMH000255 - CMH000255A			
Asset Number	CMH000255 - CMH000255A	Length	72 ft
Upstream MH	CMH000255	Diameter	36 in
Downstream MH	CMH000255A	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	2.8 ft
Date Profiled	15 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	16 in
Debris Volume	0 cubic feet

Debris Graph



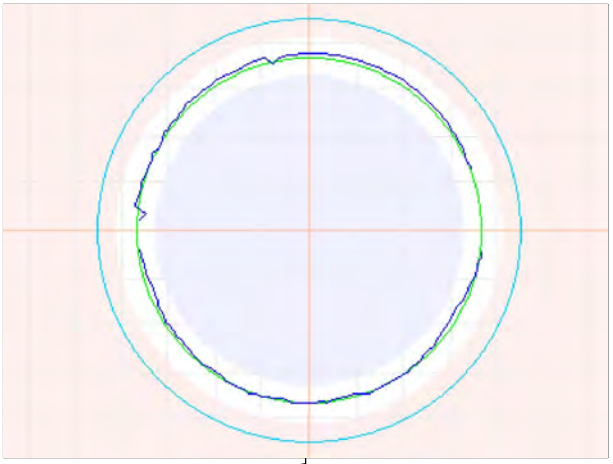
Inspection Distance (ft)

Water Level Debris Level

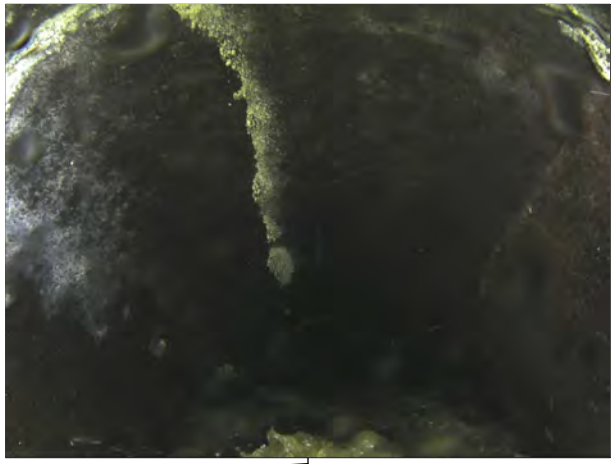
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

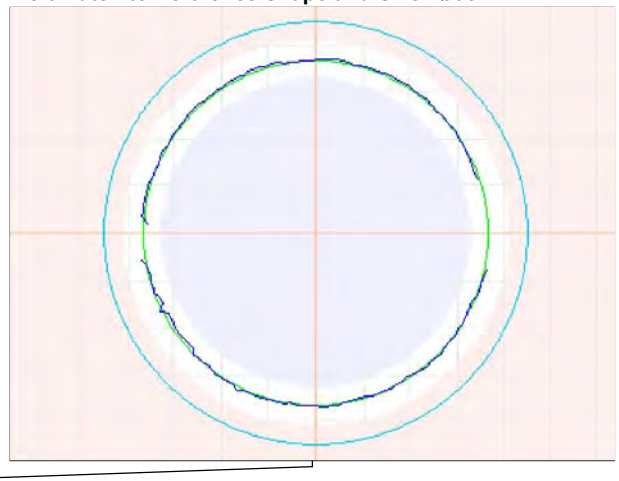
2.5ft General Observation - Corrosion to 0.4"

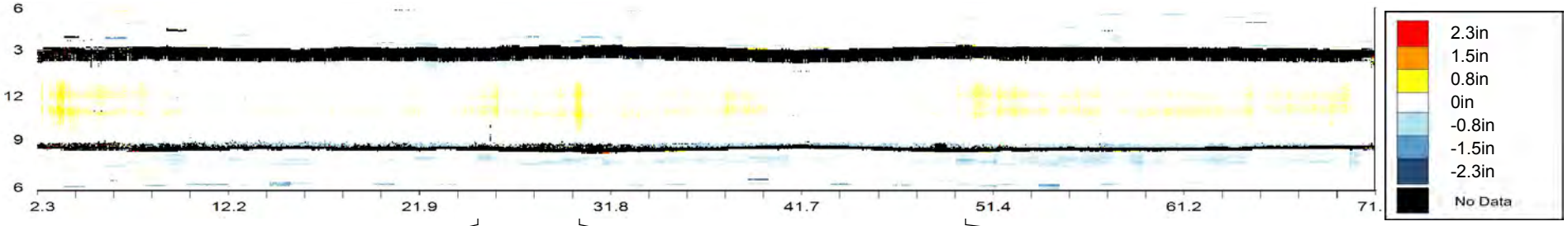


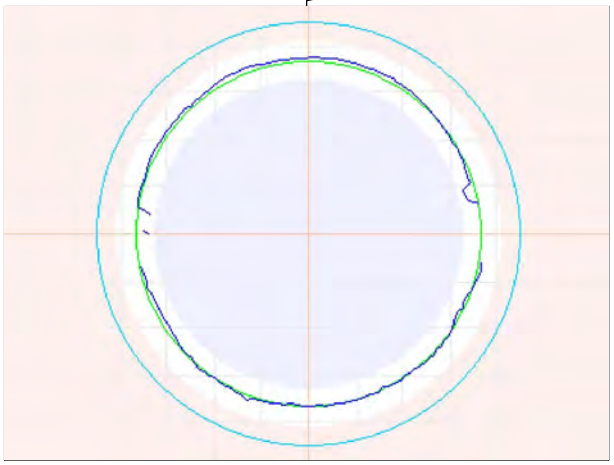
2.5ft General Observation - Corrosion to 0.4"



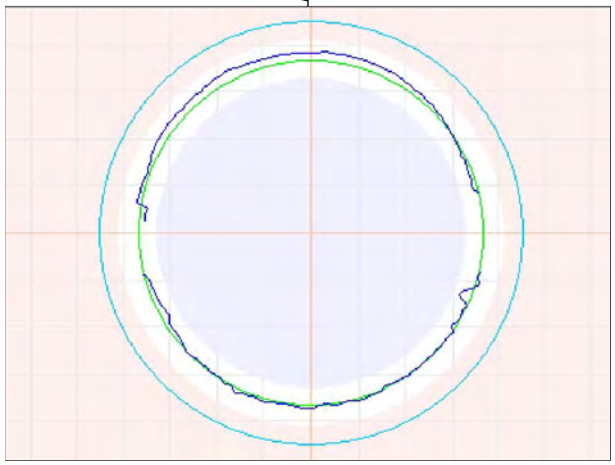
2.8ft Match to Reference Shape and Size - ø36"



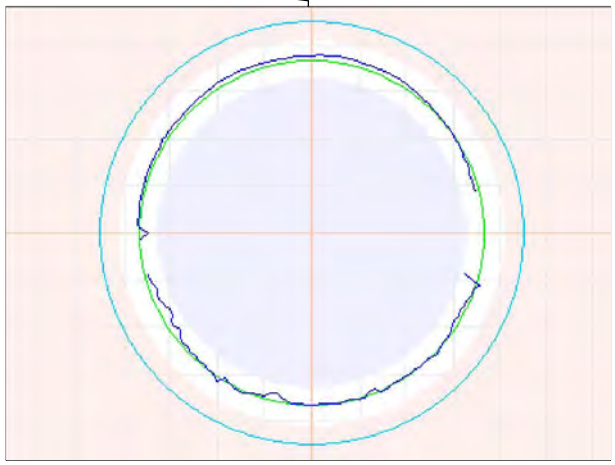




25ft General Observation - Corrosion to 0.7"



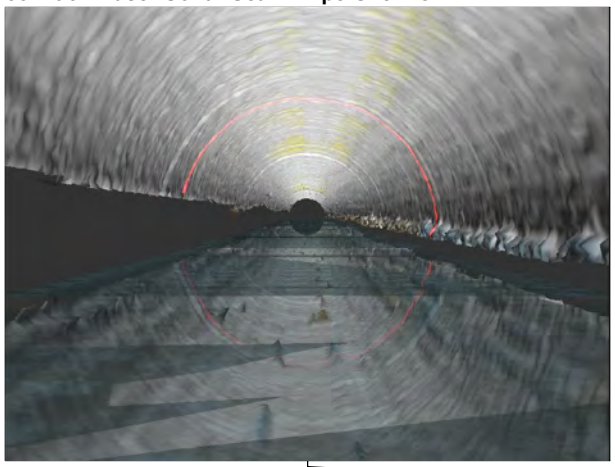
30.3ft Maximum Corrosion - To 0.9"



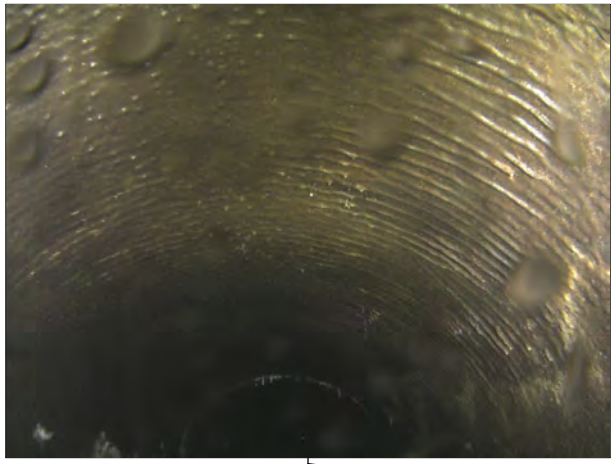
50.1ft General Observation - Corrosion to 0.6"

Observation Report

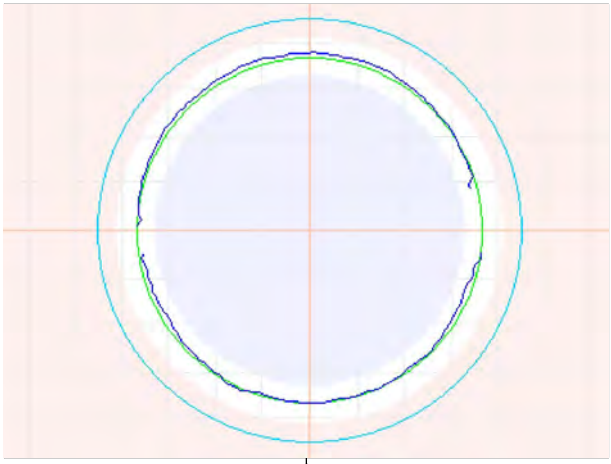
55.4ft 3D Laser Sonar Scan - Pipe Overview

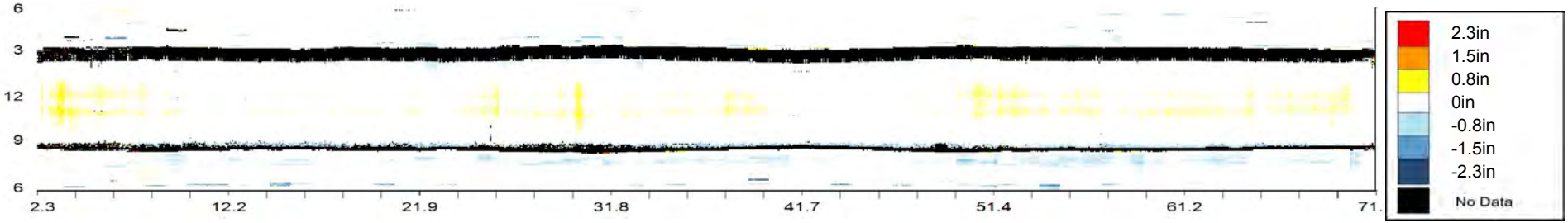


59ft Point of Interest



70ft General Observation - Corrosion to 0.4"





OVERVIEW - CMH000255A - CMH000247

Asset Number	CMH000255A - CMH000247		
Upstream MH	CMH000255A	Material	Reinforced Concrete Pipe
Downstream MH	CMH000247	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	145.6 ft

Distance	Observation	Comment
2.2 ft	**Beginning of Inspection**	**CMH000255A**
3	General Observation	Corrosion to 0.5"
25	General Observation	Corrosion to 0.7"
44.7	Maximum Corrosion	To 0.9"
49.9	General Observation	Corrosion to 0.6"
75	General Observation	Corrosion to 0.4"
100.1	General Observation	Corrosion to 0.5"
125	General Observation	Corrosion to 0.7"
145.6	Match to Reference Shape and Size	ø36"
150.1	General Observation	Corrosion to 0.6"
175	General Observation	Corrosion to 0.7"
200.1	General Observation	Corrosion to 0.3"
222.2	3D Laser Sonar Scan	Pipe Overview
225	General Observation	Corrosion to 0.5"
250.1	General Observation	Corrosion to 0.3"
275	General Observation	Corrosion to 0.6"
299.8	General Observation	
318.4 ft	**End of Inspection**	**CMH000247**

CMH000255A - CMH000247			
Asset Number	CMH000255A - CMH000247	Length	319 ft
Upstream MH	CMH000255A	Diameter	36 in
Downstream MH	CMH000247	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	145.6 ft
Date Profiled	15 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	16 in
Debris Volume	0 cubic feet

Debris Graph

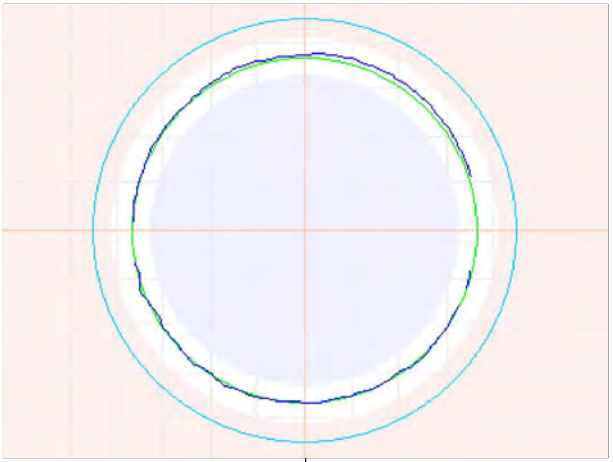
Inspection Distance (ft)

Water Level Debris Level

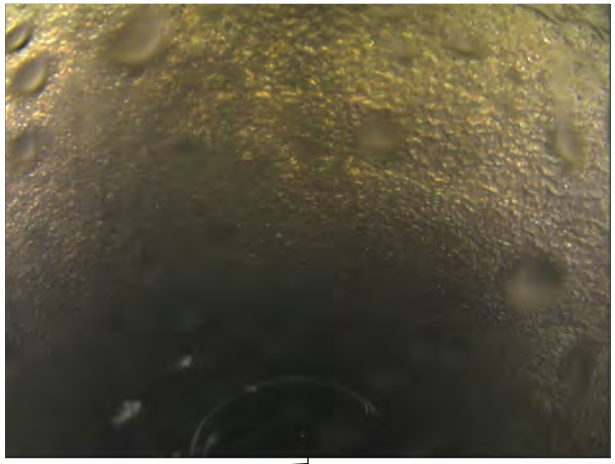
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

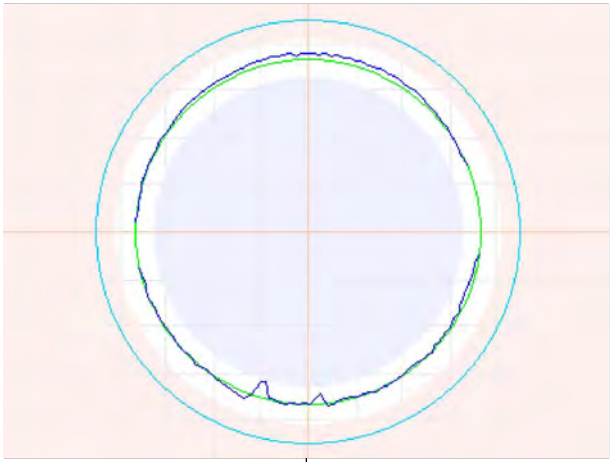
3ft General Observation - Corrosion to 0.5"

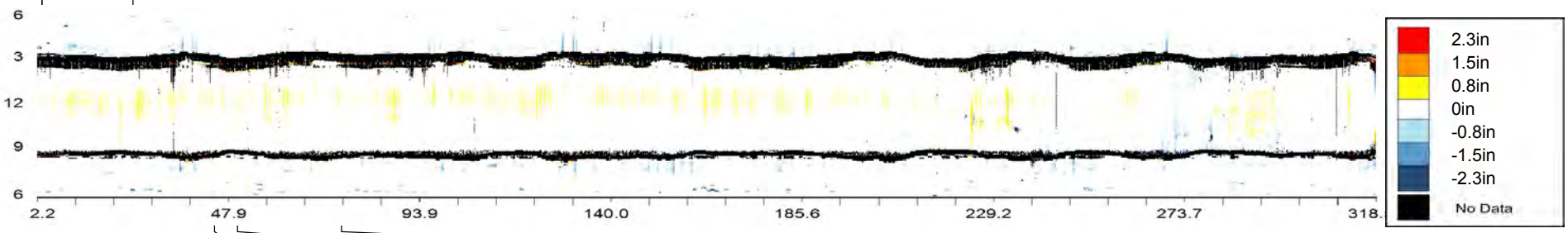


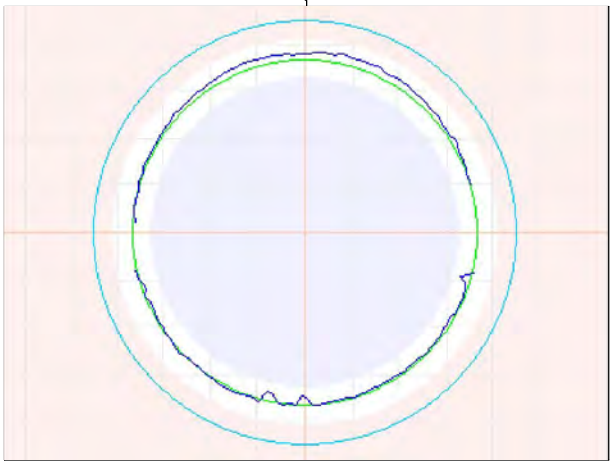
3ft General Observation - Corrosion to 0.5"



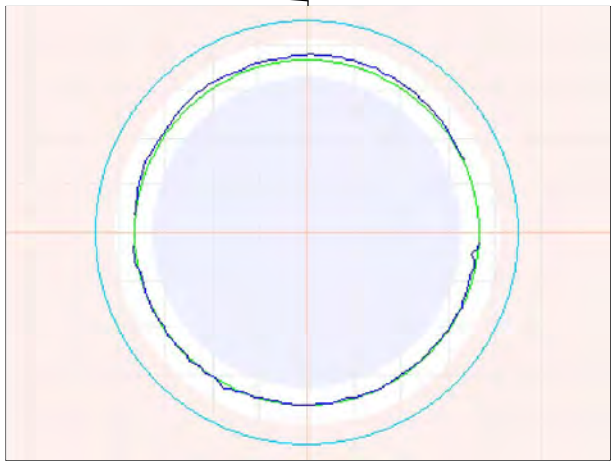
25ft General Observation - Corrosion to 0.7"



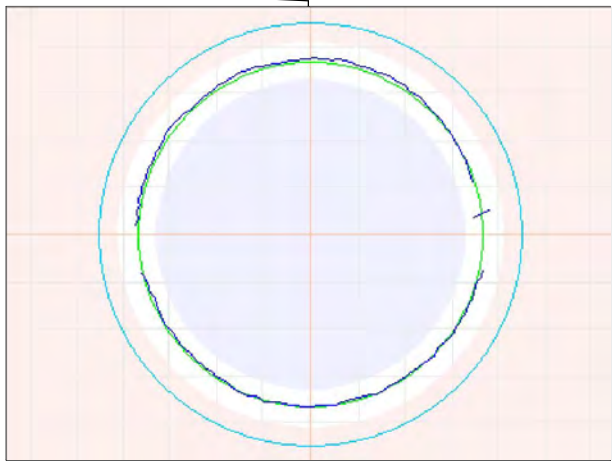




44.7ft Maximum Corrosion - To 0.9"



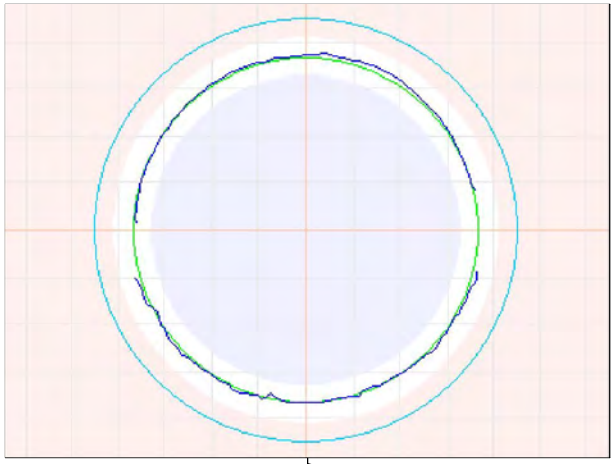
49.9ft General Observation - Corrosion to 0.6"



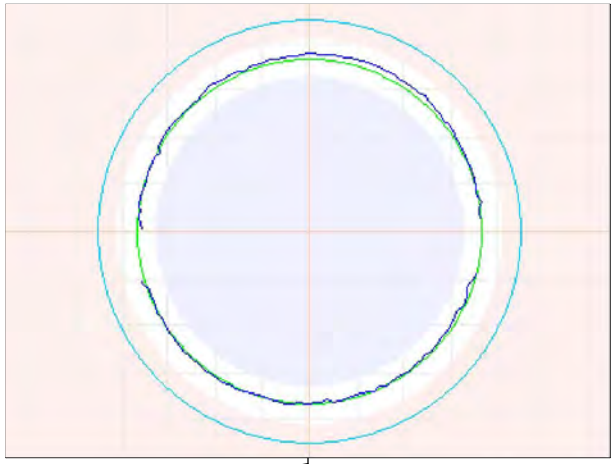
75ft General Observation - Corrosion to 0.4"

Observation Report

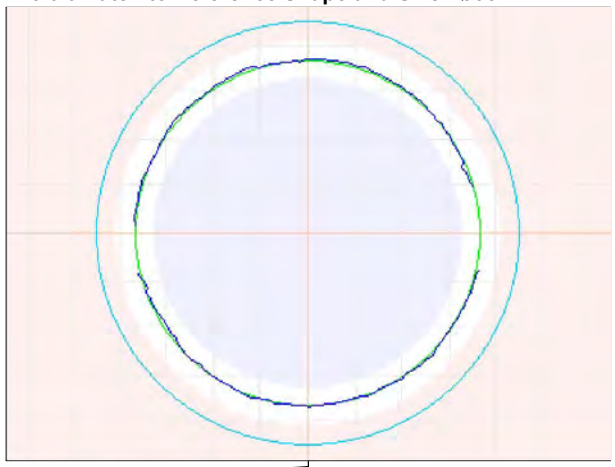
100.1ft General Observation - Corrosion to 0.5"

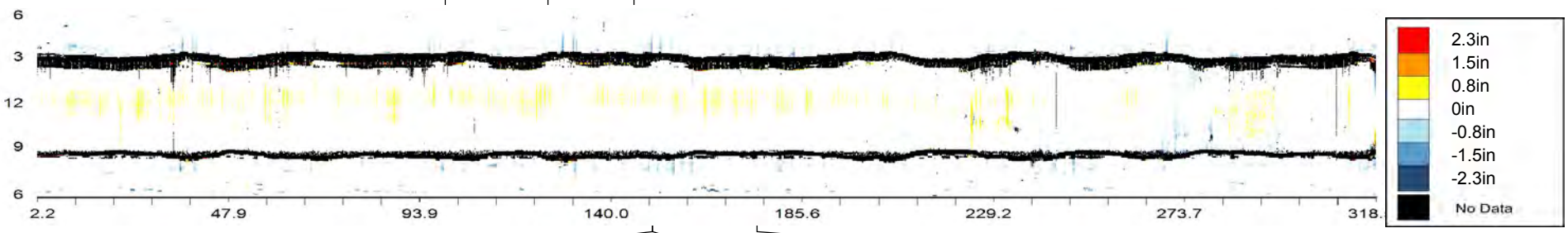


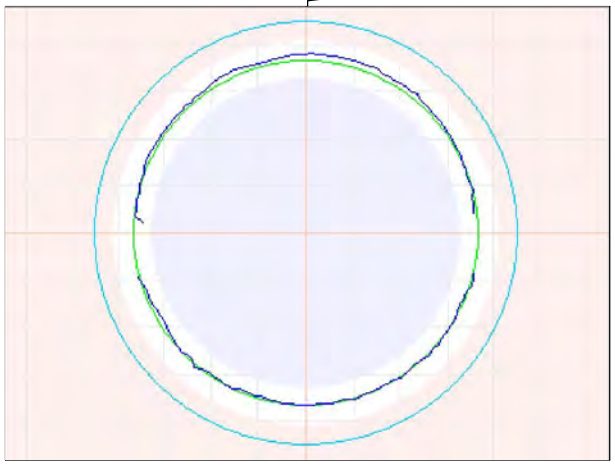
125ft General Observation - Corrosion to 0.7"



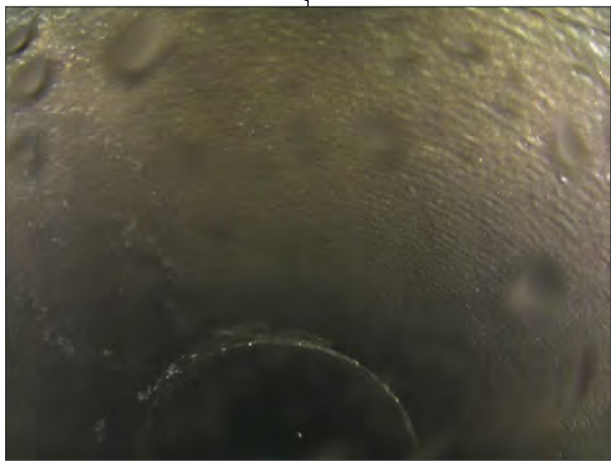
145.6ft Match to Reference Shape and Size - ø36"



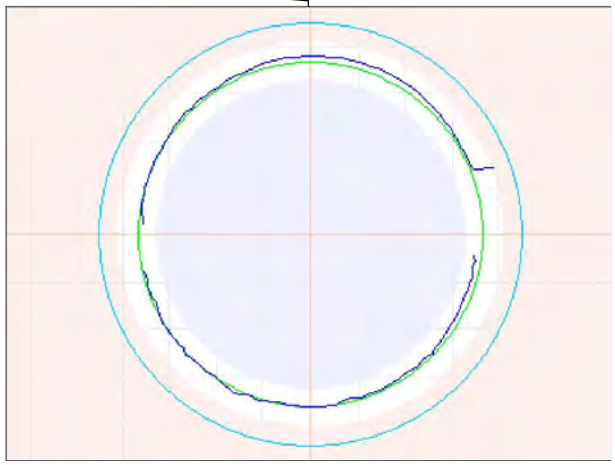




150.1ft General Observation - Corrosion to 0.6"



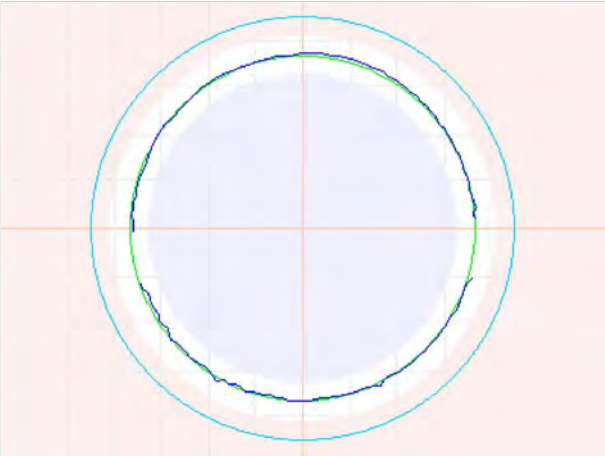
150.1ft General Observation - Corrosion to 0.6"



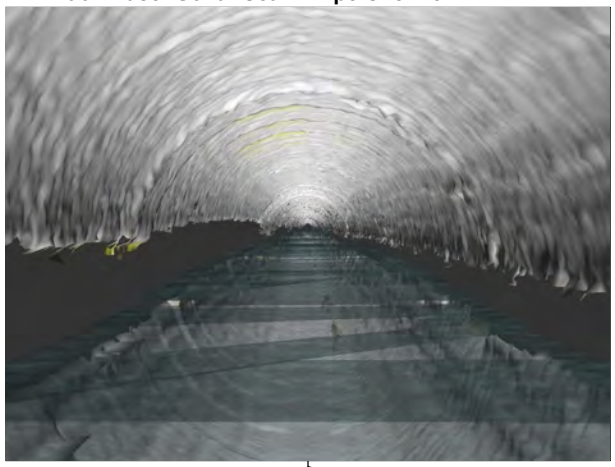
175ft General Observation - Corrosion to 0.7"

Observation Report

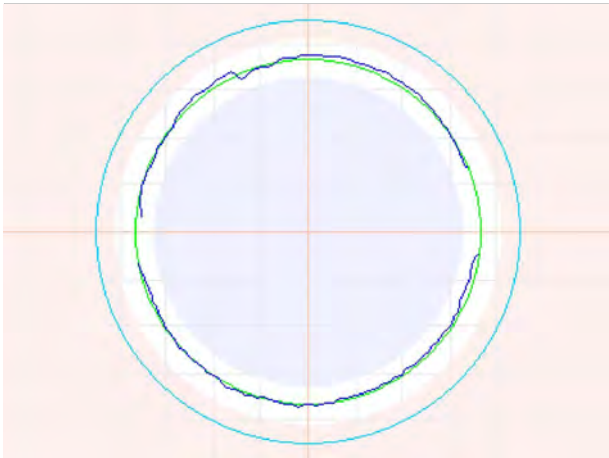
200.1ft General Observation - Corrosion to 0.3"

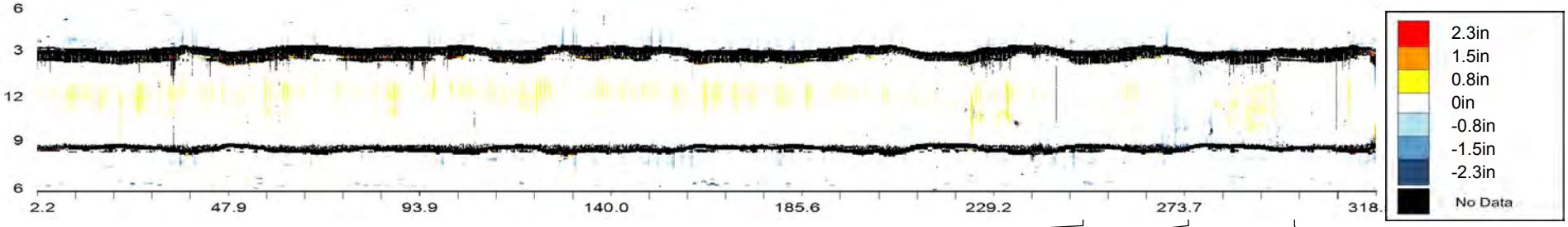


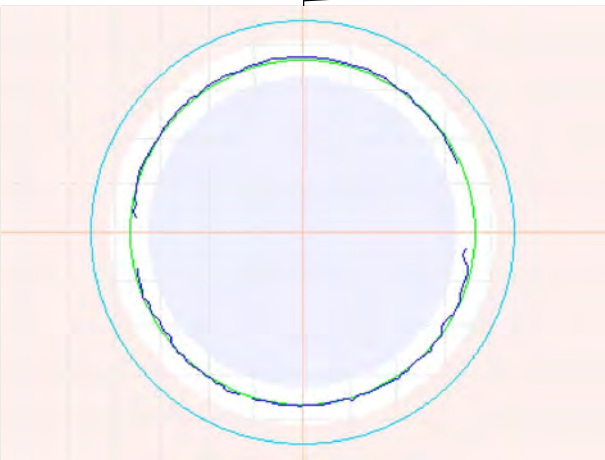
222.2ft 3D Laser Sonar Scan - Pipe Overview



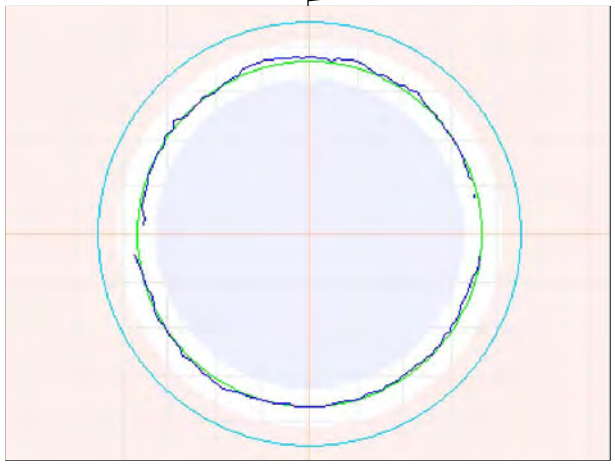
225ft General Observation - Corrosion to 0.5"



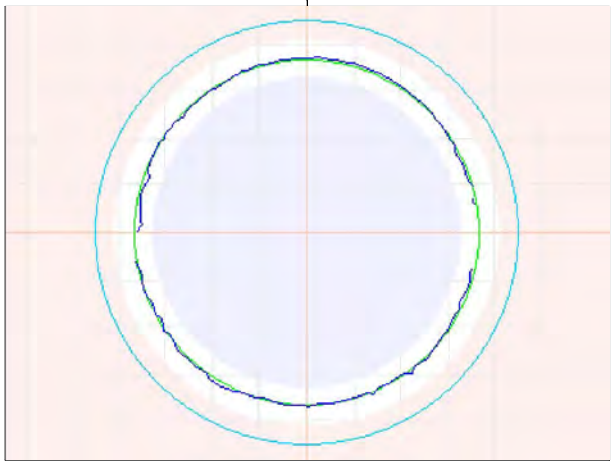




250.1ft General Observation - Corrosion to 0.3"



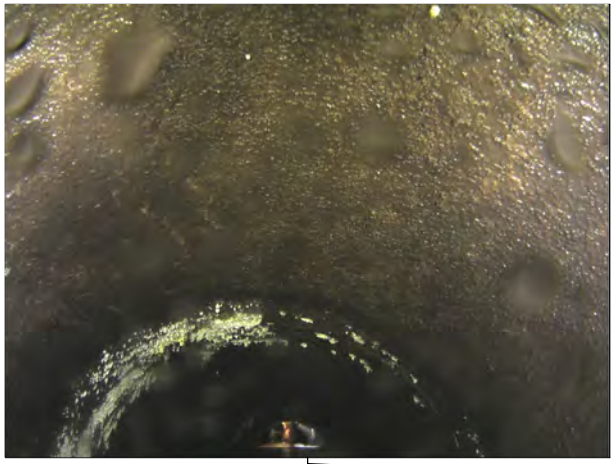
275ft General Observation - Corrosion to 0.6"

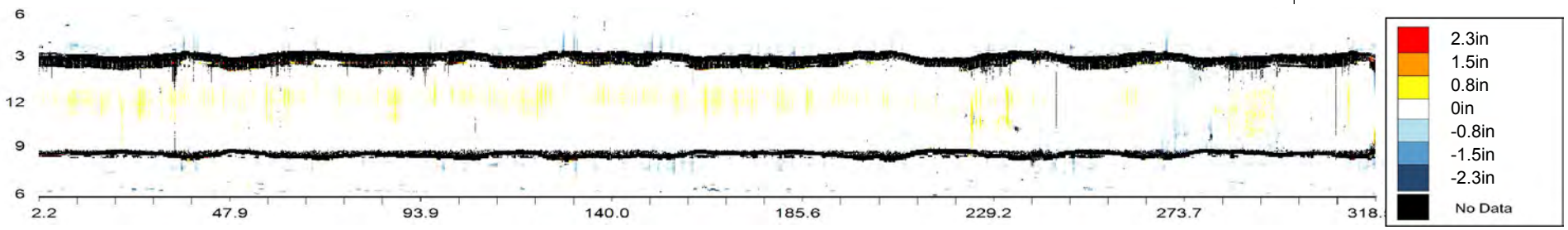


299.8ft General Observation

Observation Report

299.8ft General Observation





OVERVIEW - CMH000262 - CMH000255

Asset Number	CMH000262 - CMH000255		
Upstream MH	CMH000262	Material	Reinforced Concrete Pipe
Downstream MH	CMH000255	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	191.7 ft

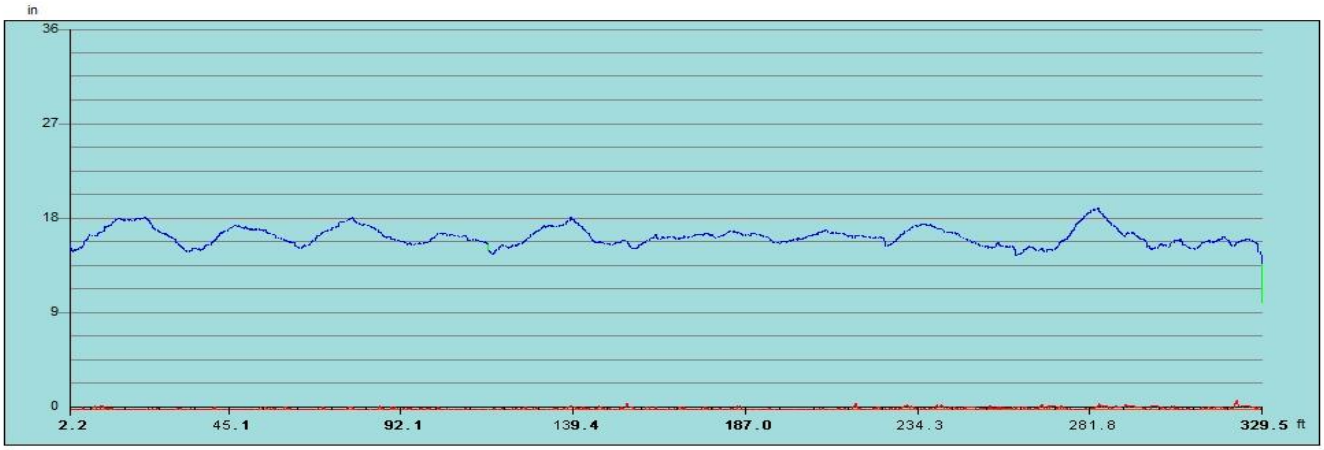
Distance	Observation	Comment
2.2 ft	**Beginning of Inspection**	**CMH000262**
5.3	General Observation	Corrosion to 0.7"
5.3	Point of Interest	Spalling throughout
25	General Observation	Corrosion to 0.6"
50	General Observation	Corrosion to 0.7"
75	General Observation	Corrosion to 0.9"
100	General Observation	Corrosion to 0.6"
124.9	General Observation	Corrosion to 0.6"
150	General Observation	Corrosion to 0.7"
175	General Observation	Corrosion to 0.8"
191.7	Match to Reference Shape and Size	ø36"
200	General Observation	Corrosion to 0.5"
224.9	General Observation	Corrosion to 1.0"
249.8	General Observation	Corrosion to 0.9"
274.9	General Observation	Corrosion to 0.6"\Debris to 0.1"
290.8	Maximum Corrosion	To 1.2"
299.9	General Observation	
328.1	General Observation	Corrosion to 1.0"
329.5 ft	**End of Inspection**	**CMH000255**

CMH000262 - CMH000255			
Asset Number	CMH000262 - CMH000255	Length	330 ft
Upstream MH	CMH000262	Diameter	36 in
Downstream MH	CMH000255	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	191.7 ft
Date Profiled	15 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	16 in
Debris Volume	0 cubic feet

Debris Graph



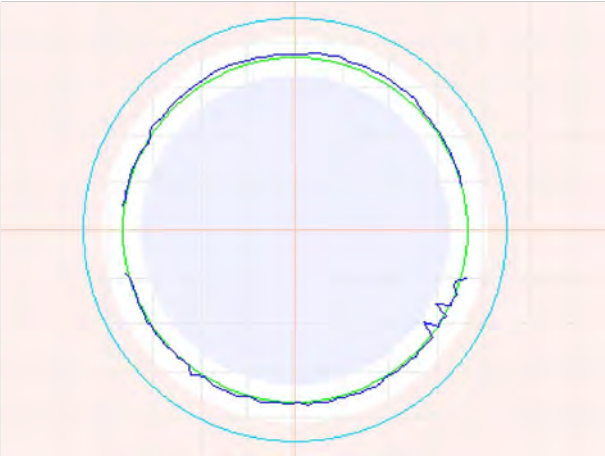
Inspection Distance (ft)

Water Level Debris Level

*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

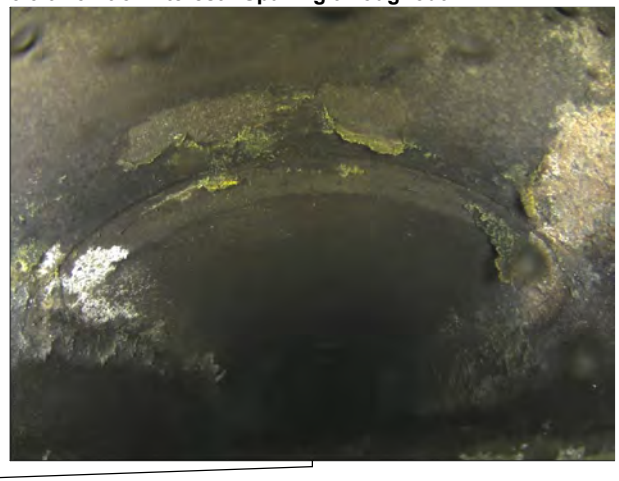
Observation Report

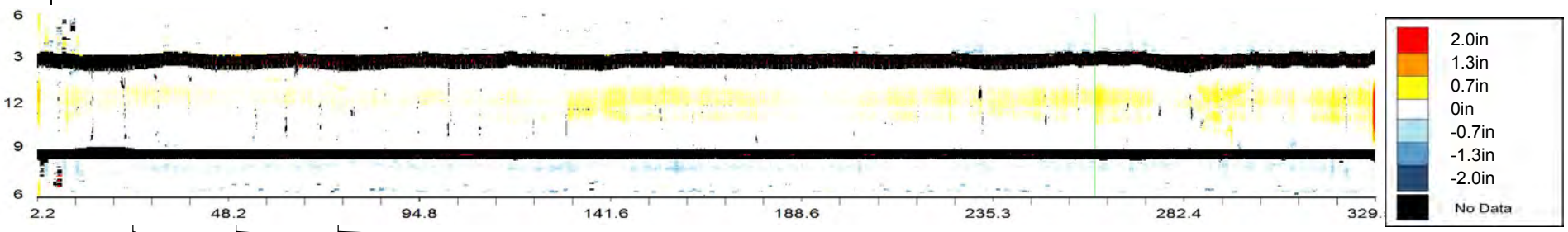
5.3ft General Observation - Corrosion to 0.7"

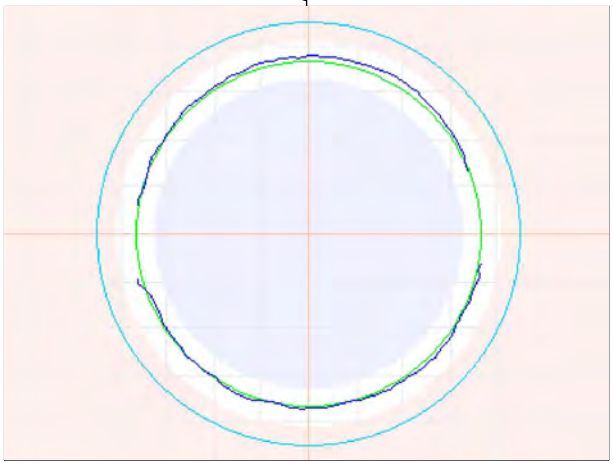


5.3ft General Observation - Corrosion to 0.7"

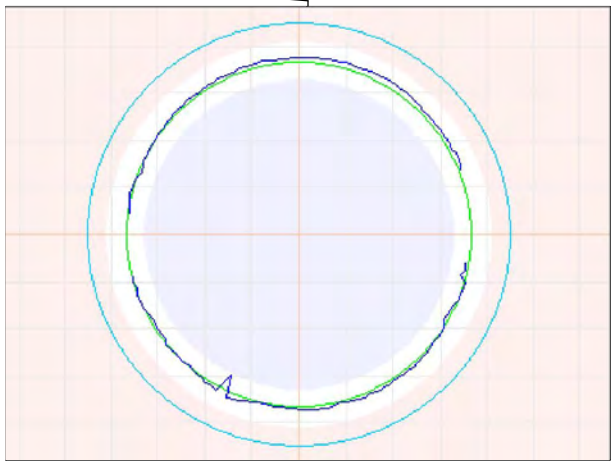
5.3ft Point of Interest - Spalling throughout



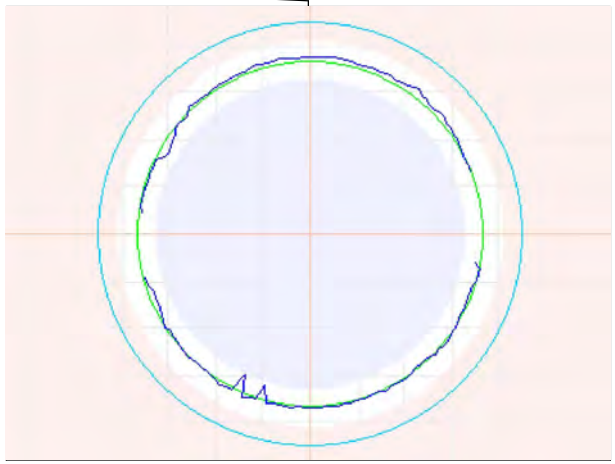




25ft General Observation - Corrosion to 0.6"



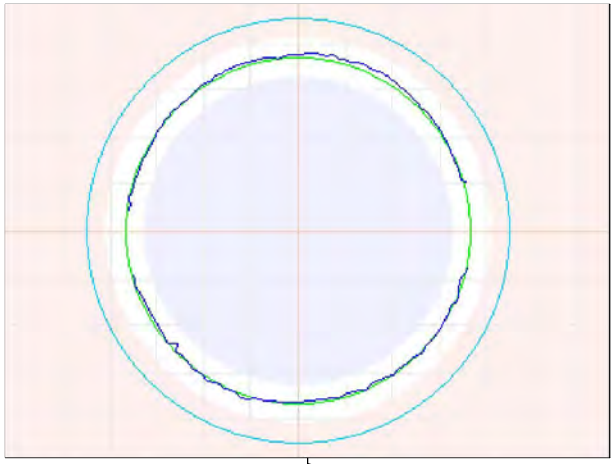
50ft General Observation - Corrosion to 0.7"



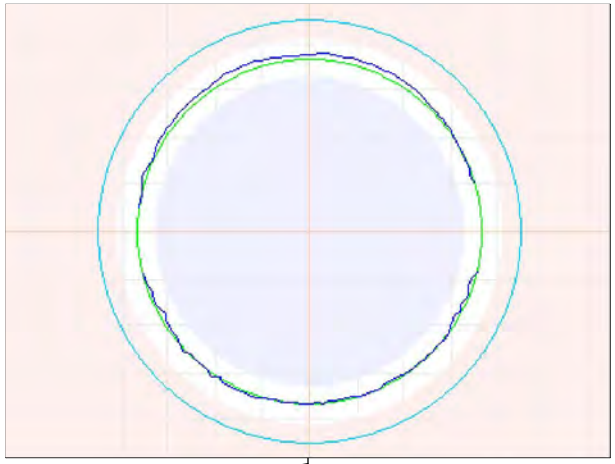
75ft General Observation - Corrosion to 0.9"

Observation Report

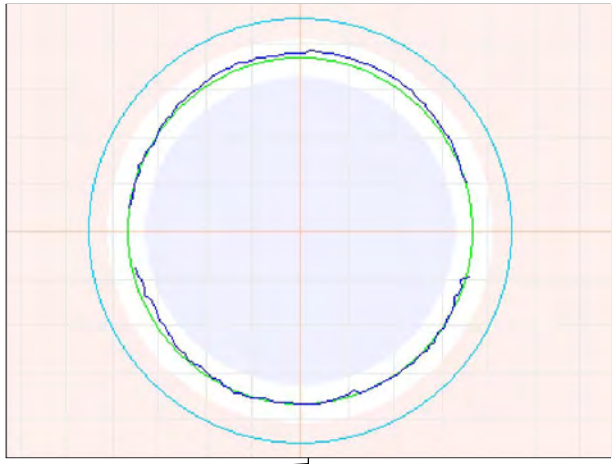
100ft General Observation - Corrosion to 0.6"

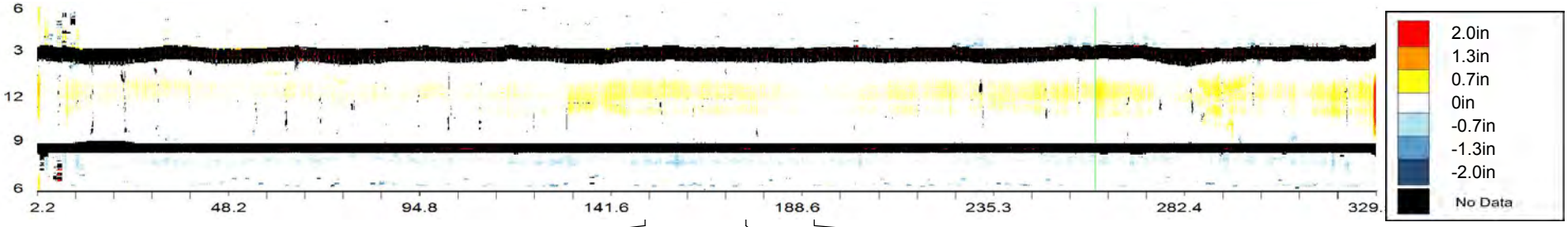


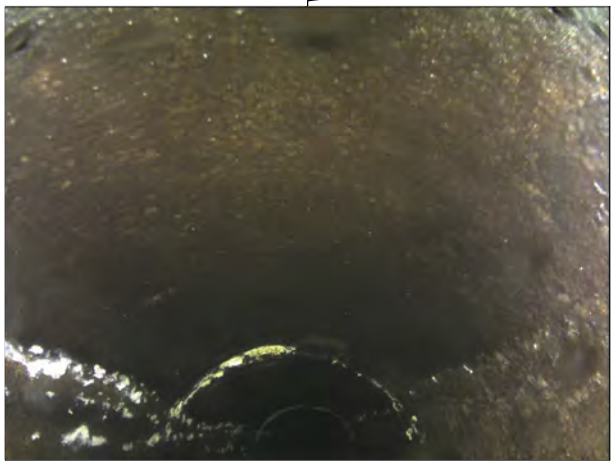
124.9ft General Observation - Corrosion to 0.6"



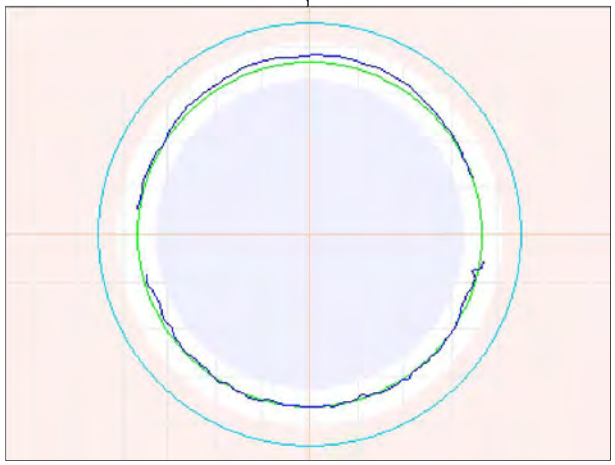
150ft General Observation - Corrosion to 0.7"



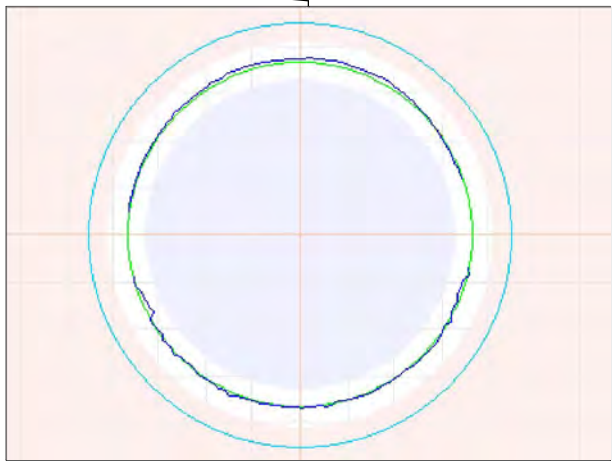




150ft General Observation - Corrosion to 0.7"



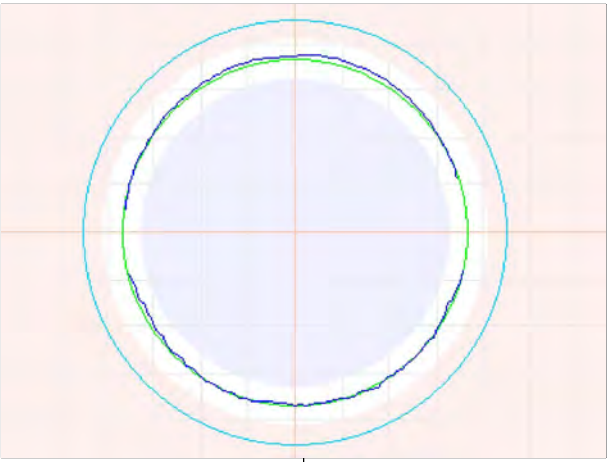
175ft General Observation - Corrosion to 0.8"



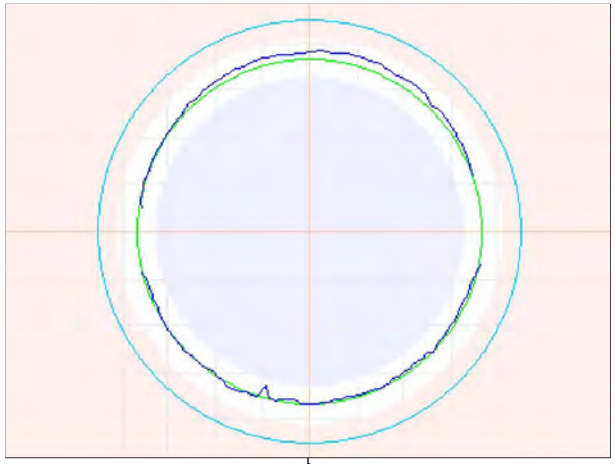
191.7ft Match to Reference Shape and Size - ø36"

Observation Report

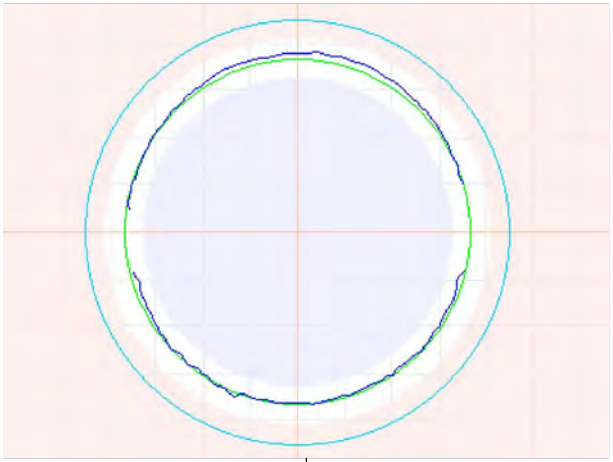
200ft General Observation - Corrosion to 0.5"

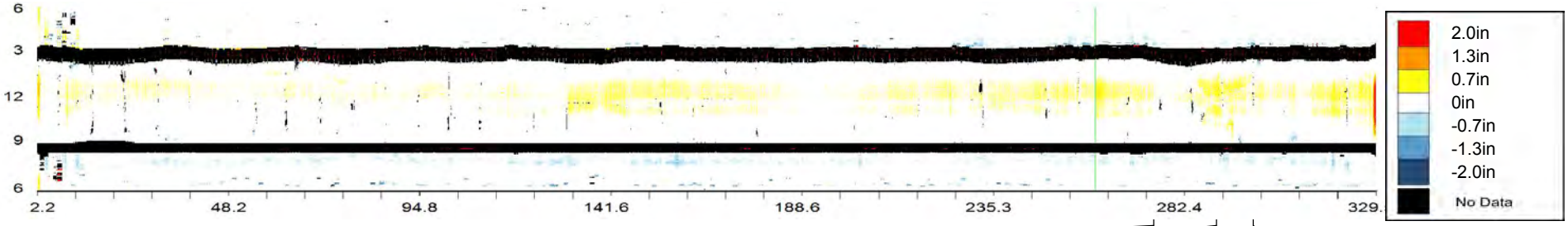


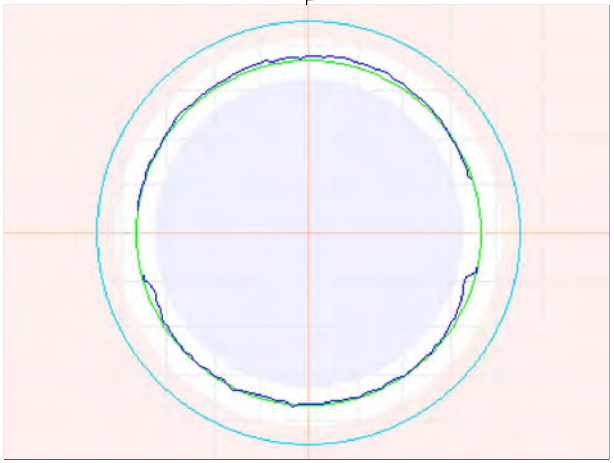
224.9ft General Observation - Corrosion to 1.0"



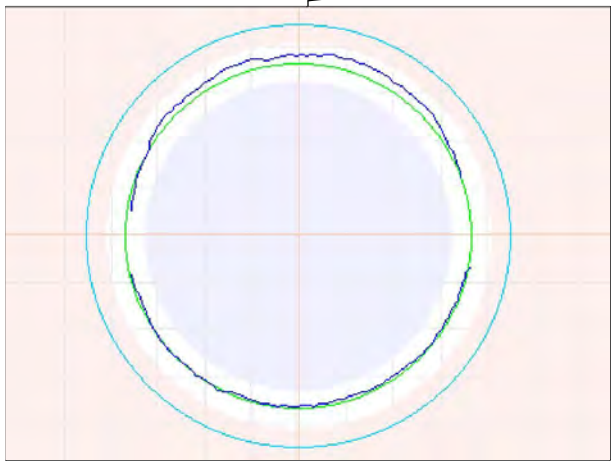
249.8ft General Observation - Corrosion to 0.9"



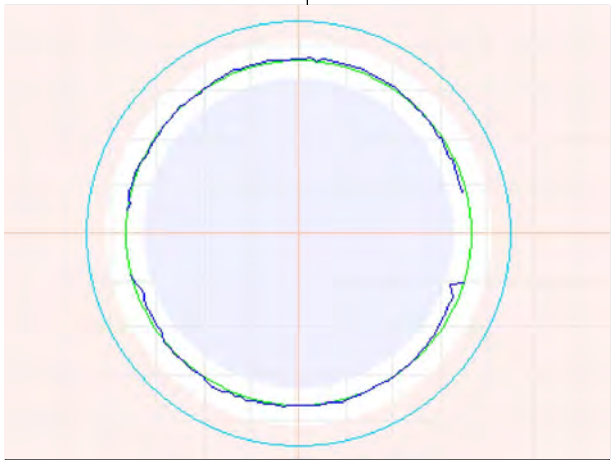




274.9ft General Observation - Corrosion to 0.6"\Debris to 0.1"



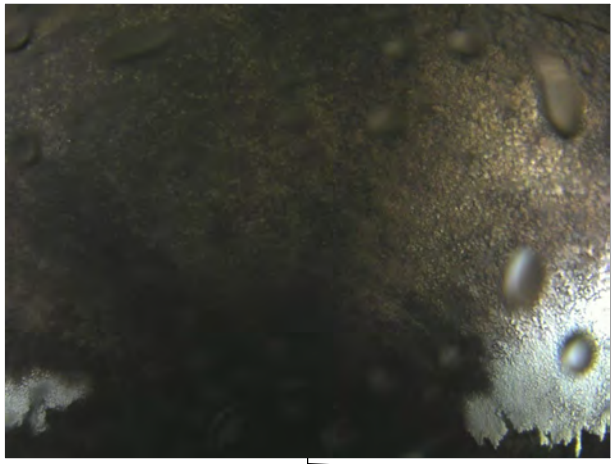
290.8ft Maximum Corrosion - To 1.2"



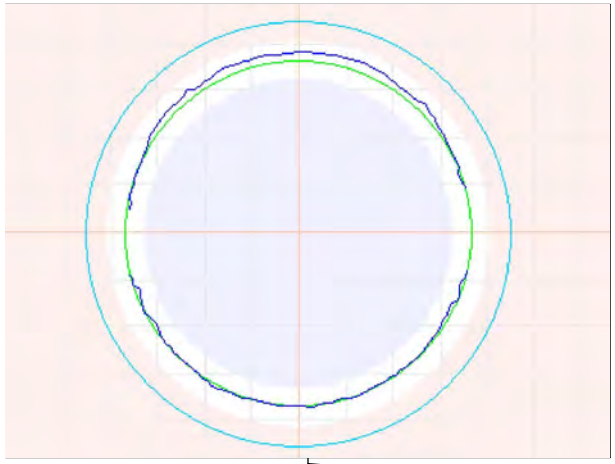
299.9ft General Observation

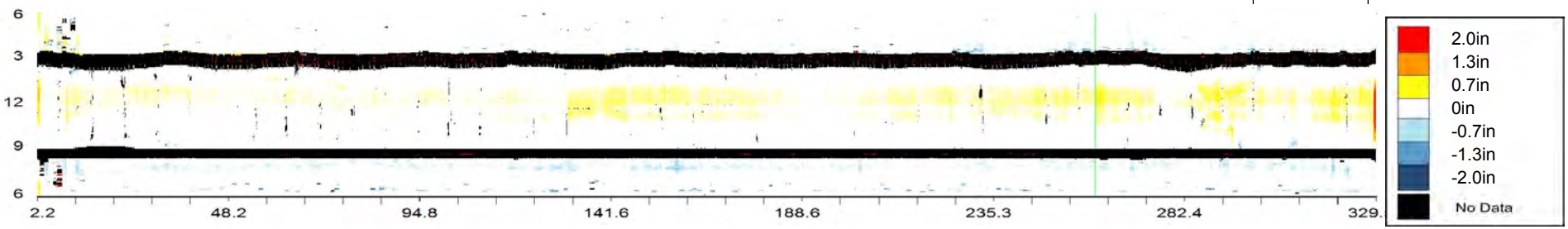
Observation Report

299.9ft General Observation



328.1ft General Observation - Corrosion to 1.0"





OVERVIEW - CMH000269 - CMH000262

Asset Number	CMH000269 - CMH000262		
Upstream MH	CMH000269	Material	Reinforced Concrete Pipe
Downstream MH	CMH000262	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	153.9 ft

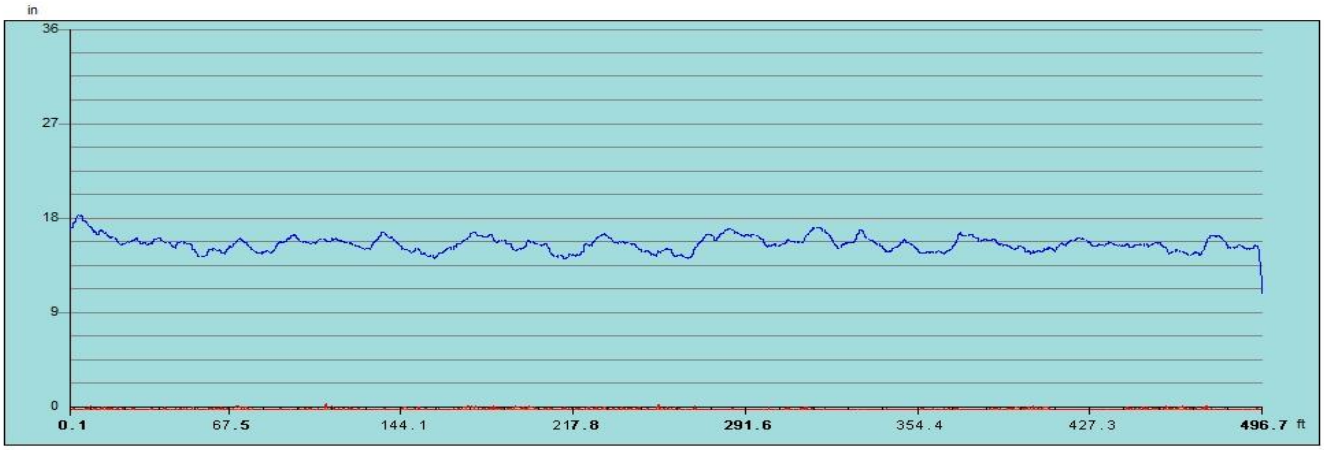
Distance	Observation	Comment
0.1 ft	**Beginning of Inspection**	**CMH000269**
1.4	General Observation	Corrosion to 0.5"
1.4	Point of Interest	Spalling throughout
25	General Observation	Corrosion to 0.6"
49.9	General Observation	Measurement inside reference to 0.6"
75	General Observation	Corrosion to 1.0"\Debris to 0.2"
100.1	General Observation	Corrosion to 0.5", Measurement inside reference to 0.6"
125	General Observation	Corrosion to 0.3"
149.8	General Observation	Measurement inside reference to 0.6"
153.9	Closest Match to Reference Size	ø36"
174.9	General Observation	Corrosion to 0.9"\Debris to 0.1"
200	General Observation	Measurement inside reference to 0.7"
225	General Observation	Corrosion to 0.3"
250.1	General Observation	Corrosion to 0.6"
274.9	General Observation	Corrosion to 0.4"
299.9	General Observation	Corrosion to 0.7"
324.9	General Observation	Corrosion to 0.7"
349.8	General Observation	Corrosion to 0.5"
374.9	General Observation	Corrosion to 0.5"
399.8	General Observation	Corrosion to 0.9"
424.9	General Observation	Corrosion to 0.5"
449.9	General Observation	Corrosion to 0.8"
474.8	General Observation	Corrosion to 0.7"
492.9	Maximum Corrosion	To 1.1"
494.7	General Observation	Corrosion to 0.9"
496.6 ft	**End of Inspection**	**CMH000262**

CMH000269 - CMH000262			
Asset Number	CMH000269 - CMH000262	Length	497 ft
Upstream MH	CMH000269	Diameter	36 in
Downstream MH	CMH000262	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	153.9 ft
Date Profiled	15 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	16 in
Debris Volume	0 cubic feet

Debris Graph



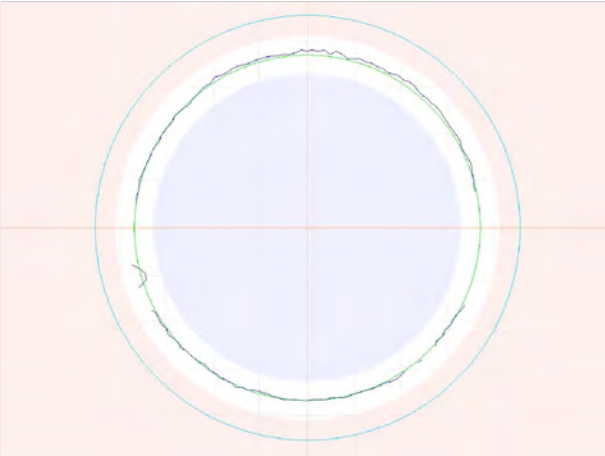
Inspection Distance (ft)

Water Level Debris Level

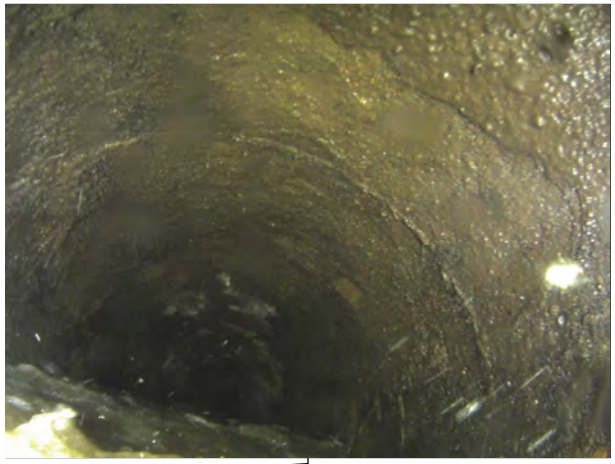
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

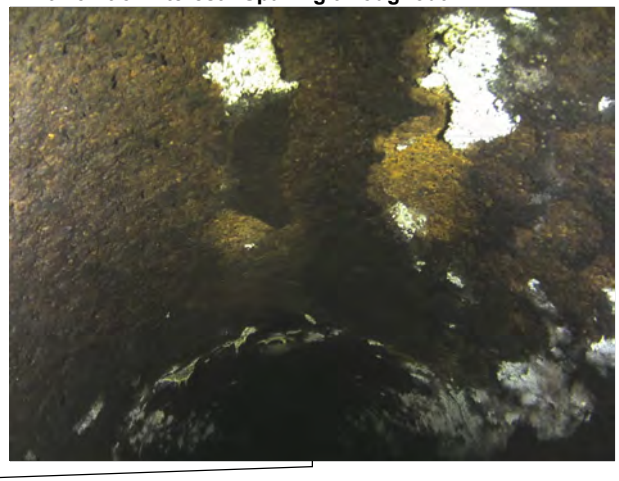
1.4ft General Observation - Corrosion to 0.5"

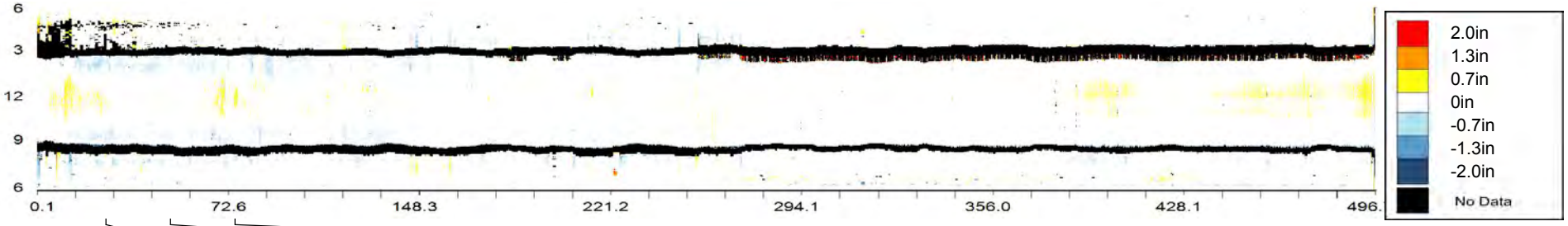


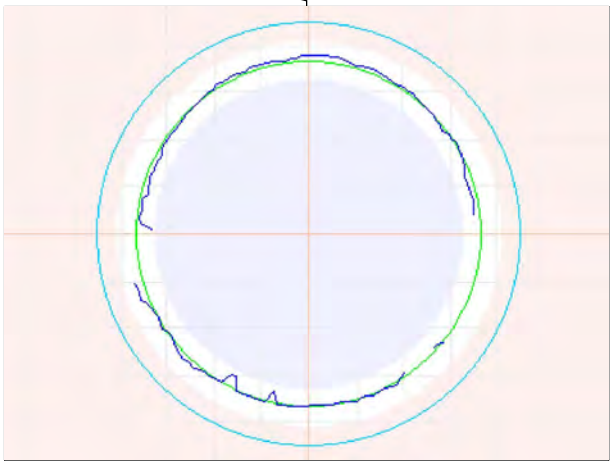
1.4ft General Observation - Corrosion to 0.5"



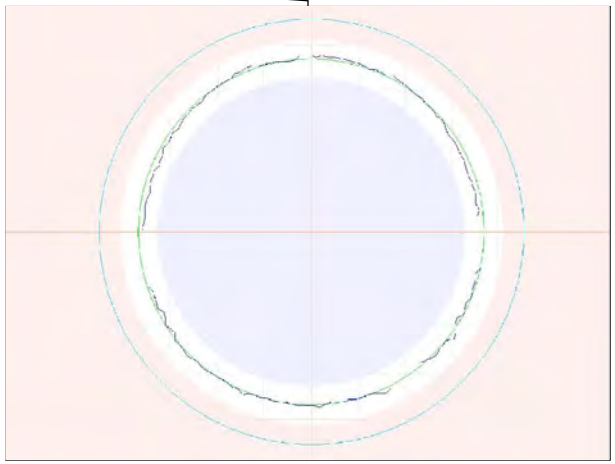
1.4ft Point of Interest - Spalling throughout



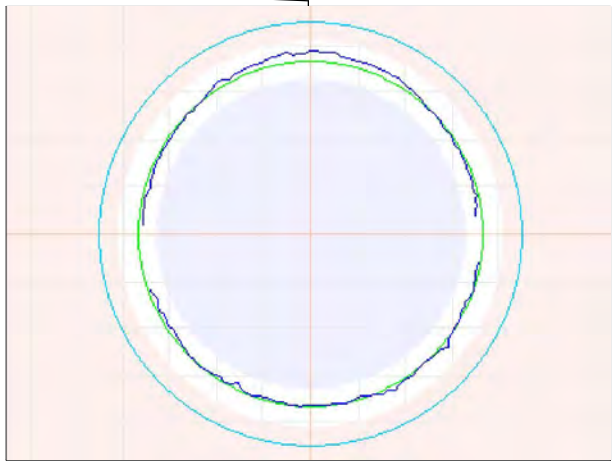




25ft General Observation - Corrosion to 0.6"



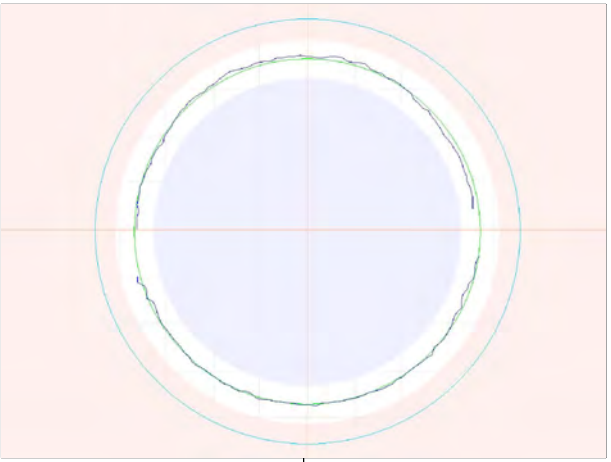
49.9ft General Observation - Measurement inside reference to 0.6"



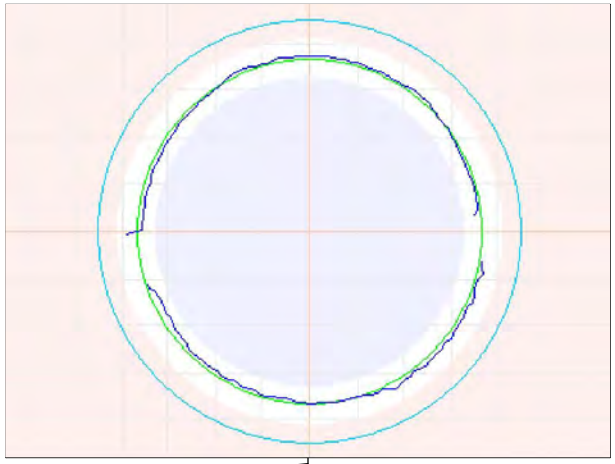
75ft General Observation - Corrosion to 1.0"\Debris to 0.2"

Observation Report

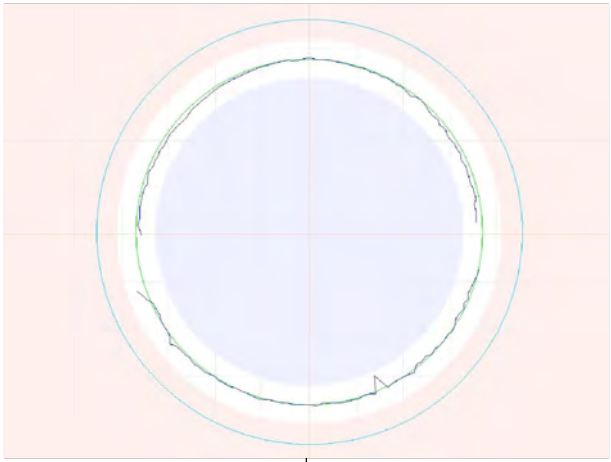
100.1ft General Observation - Corrosion to 0.5", Measurement inside reference to 0.6"

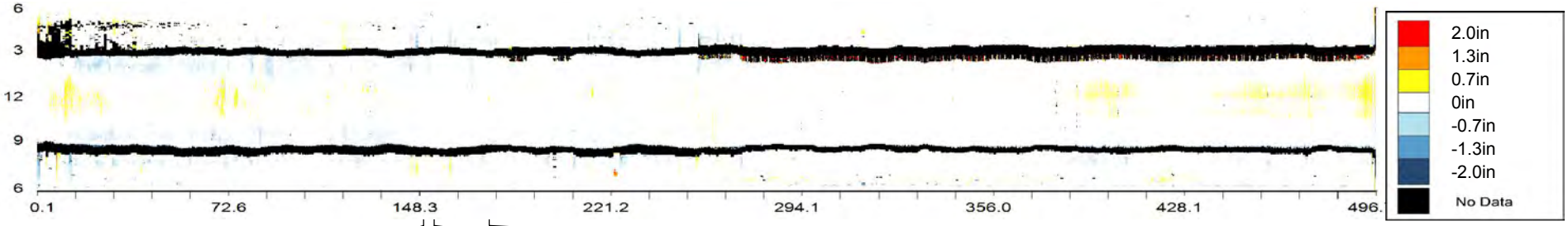


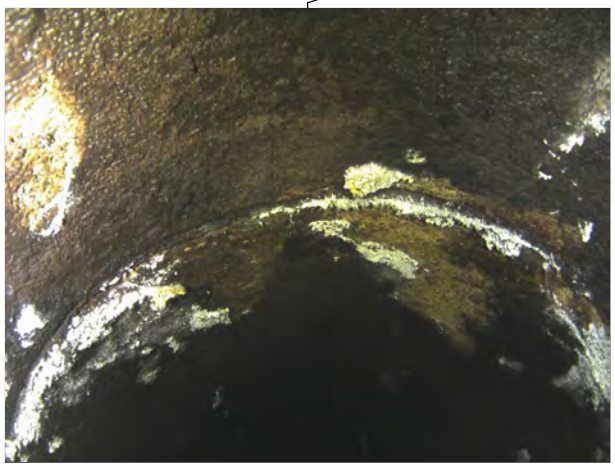
125ft General Observation - Corrosion to 0.3"



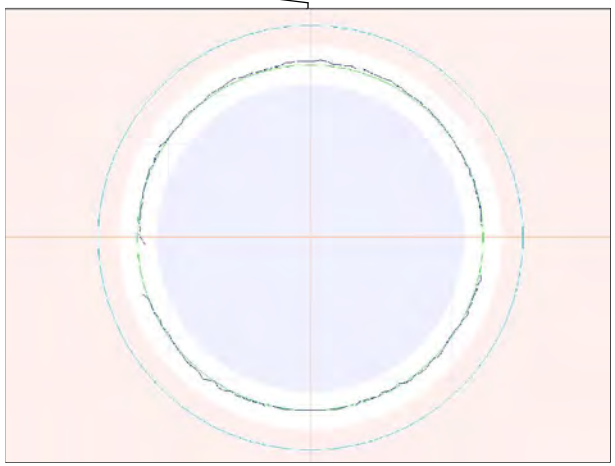
149.8ft General Observation - Measurement inside reference to 0.6"



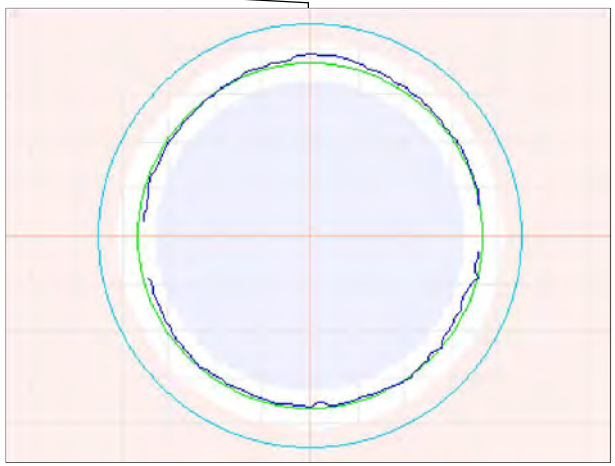




149.8ft General Observation - Measurement inside reference to 0.6"



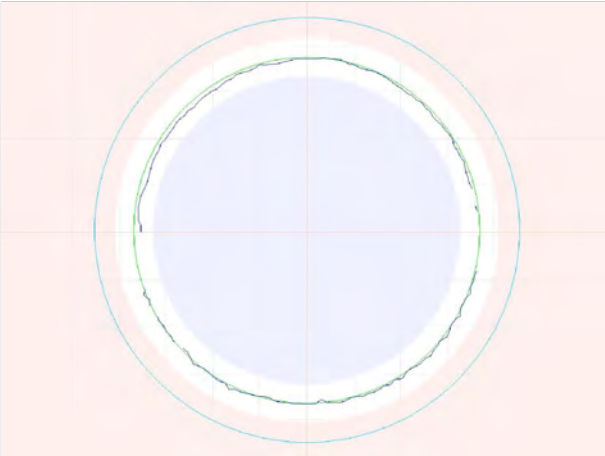
153.9ft Closest Match to Reference Size - ø36"



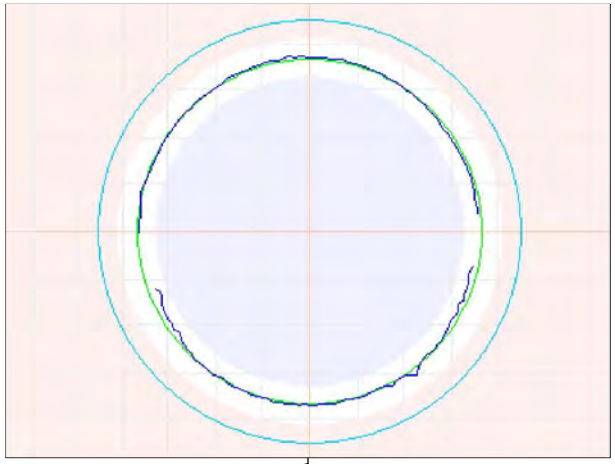
174.9ft General Observation - Corrosion to 0.9"\Debris to 0.1"

Observation Report

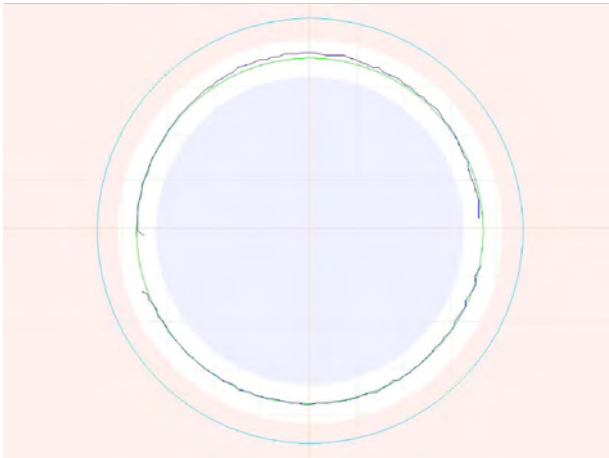
200ft General Observation - Measurement inside reference to 0.7"

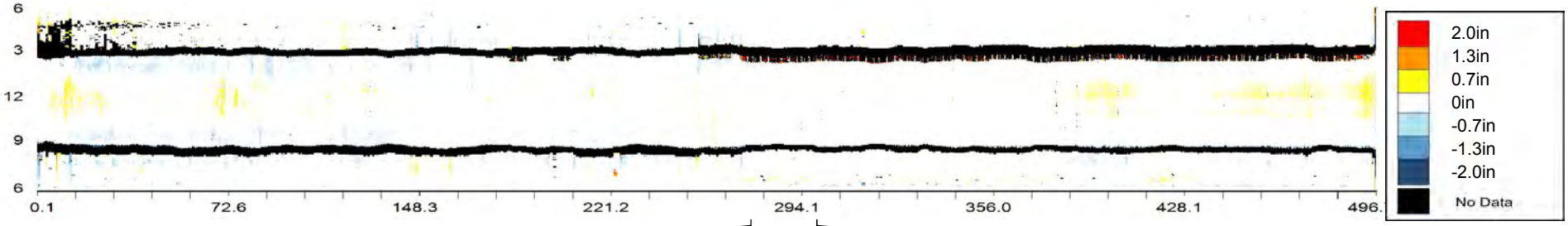


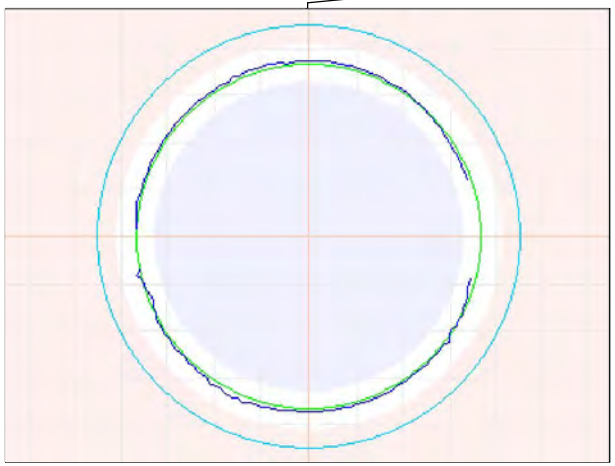
225ft General Observation - Corrosion to 0.3"



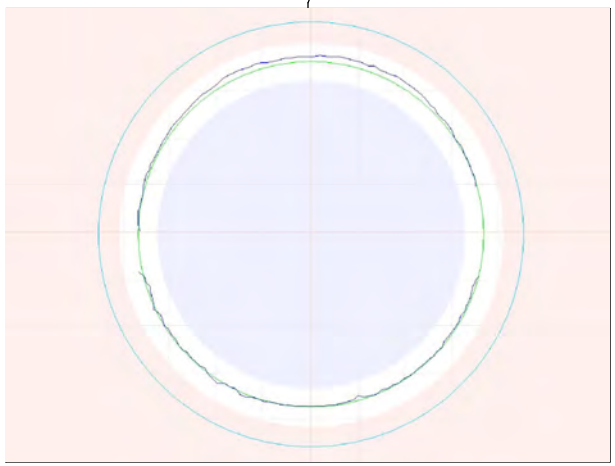
250.1ft General Observation - Corrosion to 0.6"



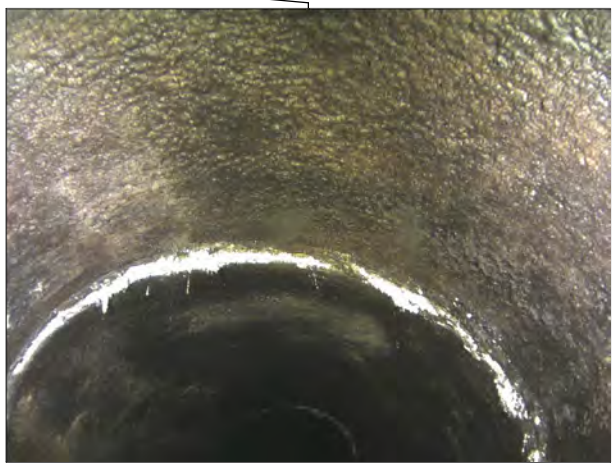




274.9ft General Observation - Corrosion to 0.4"



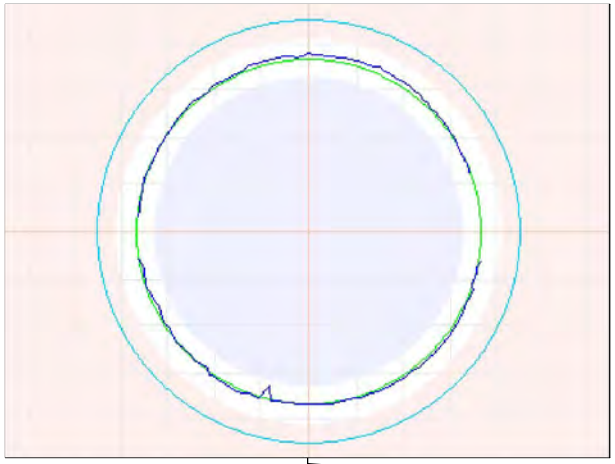
299.9ft General Observation - Corrosion to 0.7"



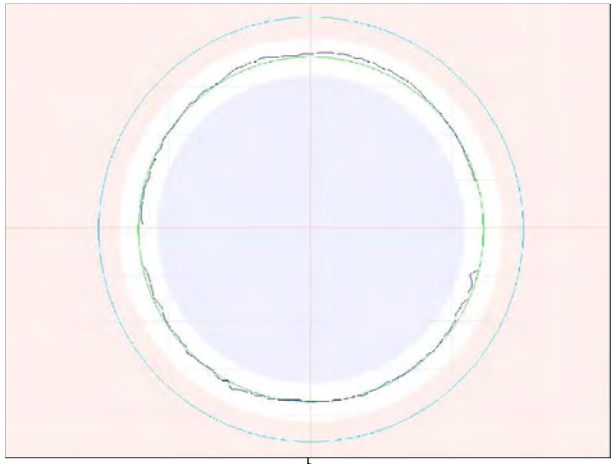
299.9ft General Observation - Corrosion to 0.7"

Observation Report

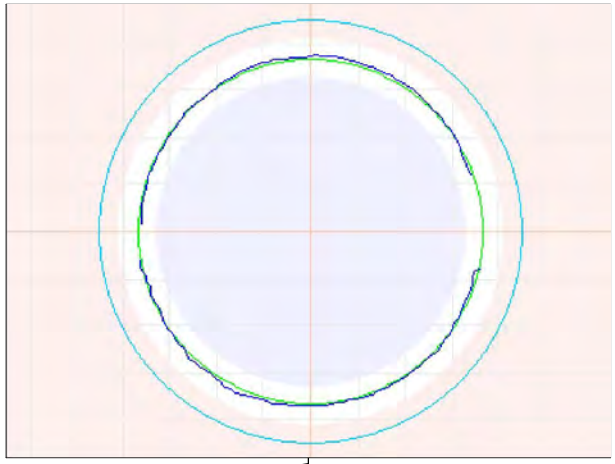
324.9ft General Observation - Corrosion to 0.7"

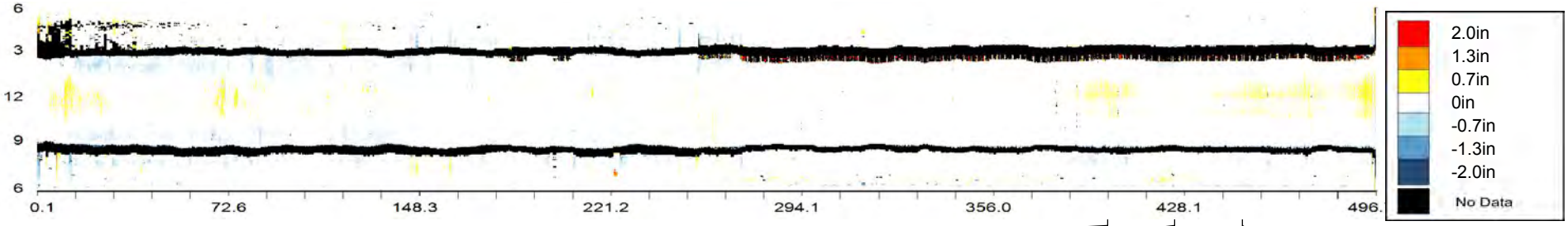


349.8ft General Observation - Corrosion to 0.5"

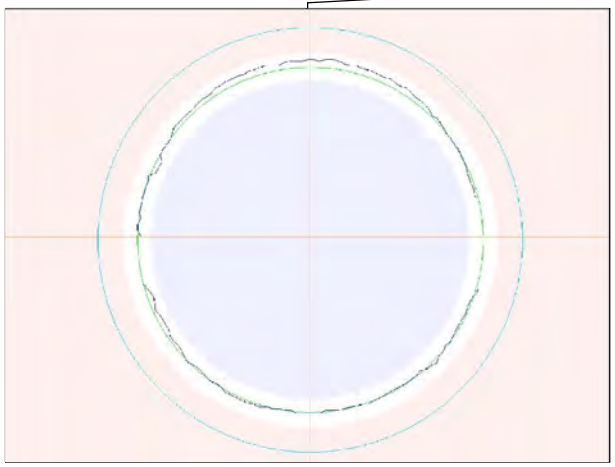


374.9ft General Observation - Corrosion to 0.5"

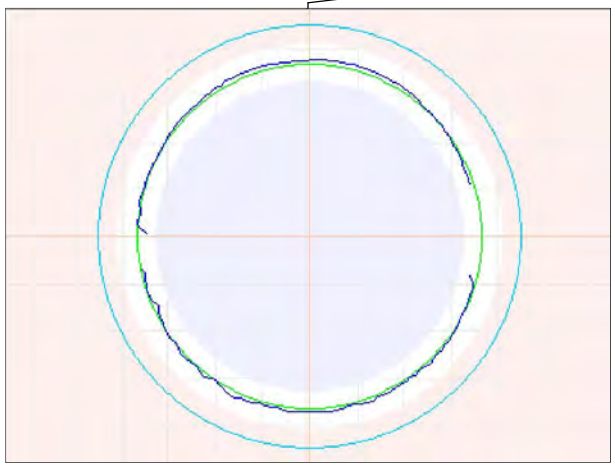




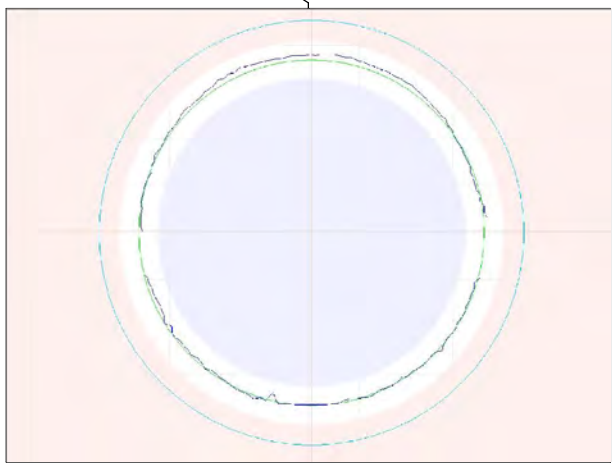
399.8ft General Observation - Corrosion to 0.9"



424.9ft General Observation - Corrosion to 0.5"

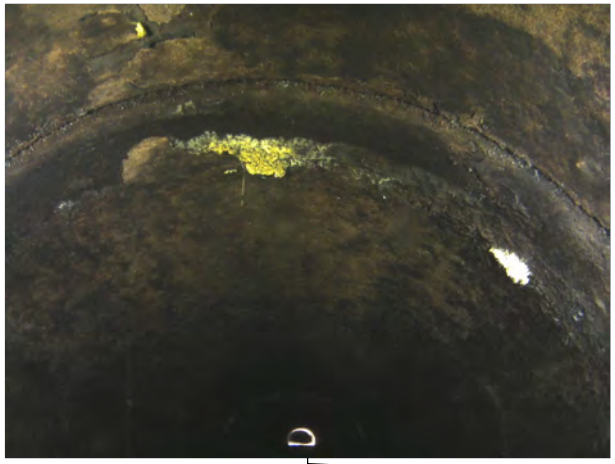


449.9ft General Observation - Corrosion to 0.8"

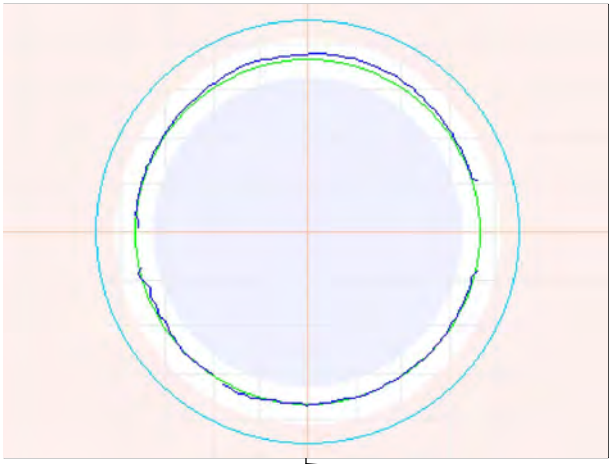


Observation Report

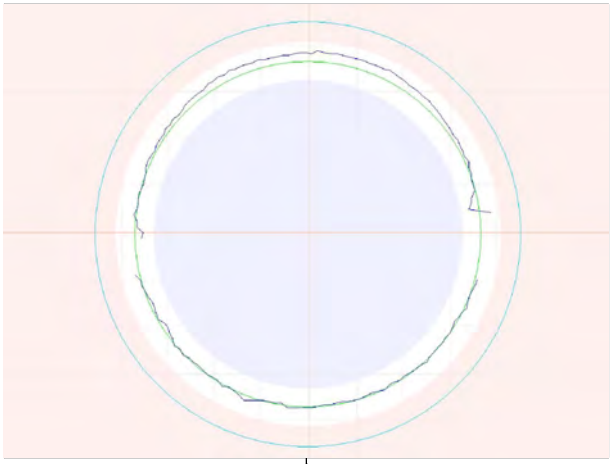
449.9ft General Observation - Corrosion to 0.8"

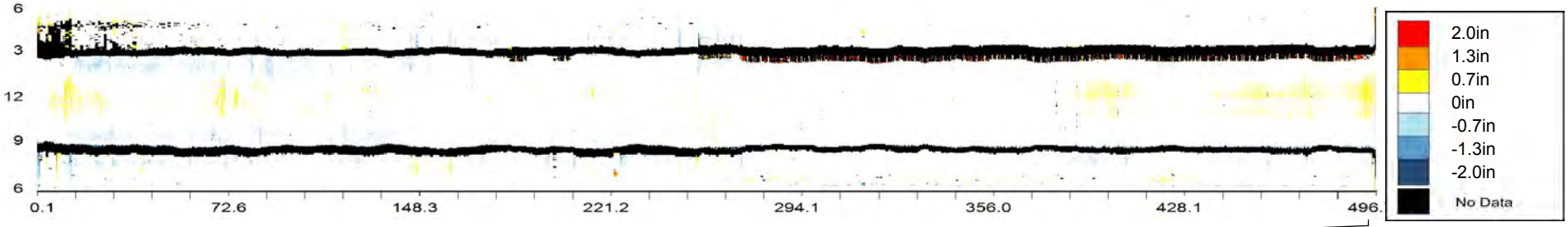


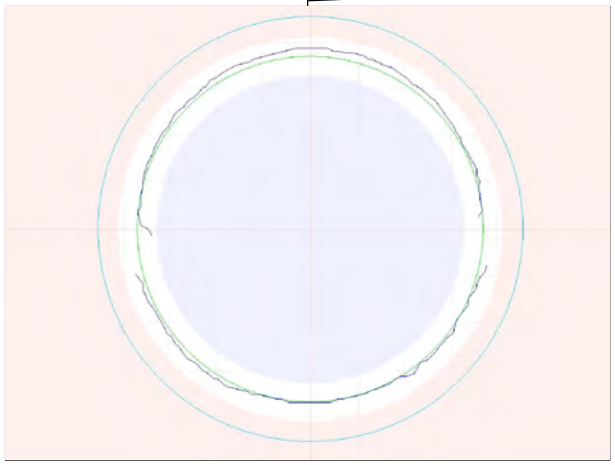
474.8ft General Observation - Corrosion to 0.7"



492.9ft Maximum Corrosion - To 1.1"







494.7ft General Observation - Corrosion to 0.9"

OVERVIEW - CMH000276 - CMH000269

Asset Number	CMH000276 - CMH000269		
Upstream MH	CMH000276	Material	Reinforced Concrete Pipe
Downstream MH	CMH000269	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	335.5 ft

Distance	Observation	Comment
1.6 ft	**Beginning of Inspection**	**CMH000276**
3	General Observation	Corrosion to 0.6"
3	Point of Interest	Encrustation throughout
25	General Observation	Corrosion to 0.6"
49.9	General Observation	Corrosion to 0.6"
75	General Observation	Corrosion to 0.6"\Debris to 0.2"
100	General Observation	Corrosion to 0.6"
125	General Observation	Corrosion to 0.6"
149.9	General Observation	Corrosion to 0.5"
175	General Observation	Corrosion to 0.9"\Debris to 0.3"
181.9	Maximum Corrosion	To 1.2"
199.8	General Observation	Corrosion to 0.7"
225	General Observation	Corrosion to 0.4"
249.9	General Observation	Corrosion to 0.5"
274.9	General Observation	Corrosion to 0.4"\Debris to 0.2"
299.9	General Observation	
324.9	General Observation	Corrosion to 0.4"
335.5	Match to Reference Shape and Size	ø36"
349.9	General Observation	
374.9	General Observation	Corrosion to 0.7"
400.1	General Observation	
424.9	General Observation	Corrosion to 0.4"\Debris to 0.2"
450.1	General Observation	Corrosion to 0.5"
474.9	General Observation	Corrosion to 0.7"
499.8	General Observation	Corrosion to 0.5"

OVERVIEW - CMH000276 - CMH000269

Asset Number	CMH000276 - CMH000269		
Upstream MH	CMH000276	Material	Reinforced Concrete Pipe
Downstream MH	CMH000269	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	335.5 ft

Distance	Observation	Comment
524.8	General Observation	Corrosion to 0.3"\Debris to 0.2"
536	Point of Interest	Spalling
549.8	General Observation	Corrosion to 0.5"
577.3	General Observation	Corrosion to 0.8"
577.5 ft	**End of Inspection**	**CMH000269**

CMH000276 - CMH000269			
Asset Number	CMH000276 - CMH000269	Length	579 ft
Upstream MH	CMH000276	Diameter	36 in
Downstream MH	CMH000269	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	335.5 ft
Date Profiled	15 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	16 in
Debris Volume	1 cubic feet

Debris Graph

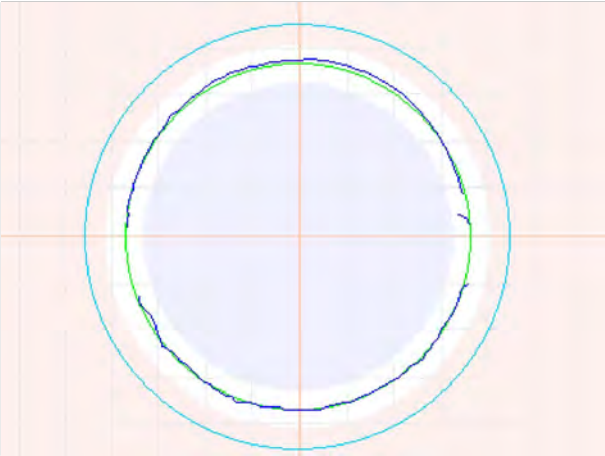
Inspection Distance (ft)

Water Level Debris Level

*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

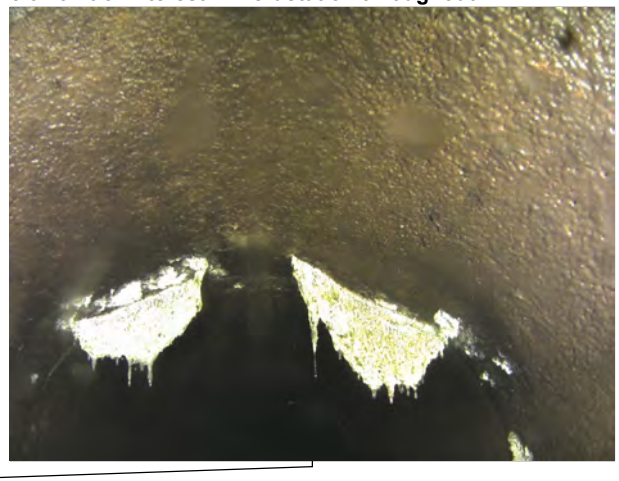
Observation Report

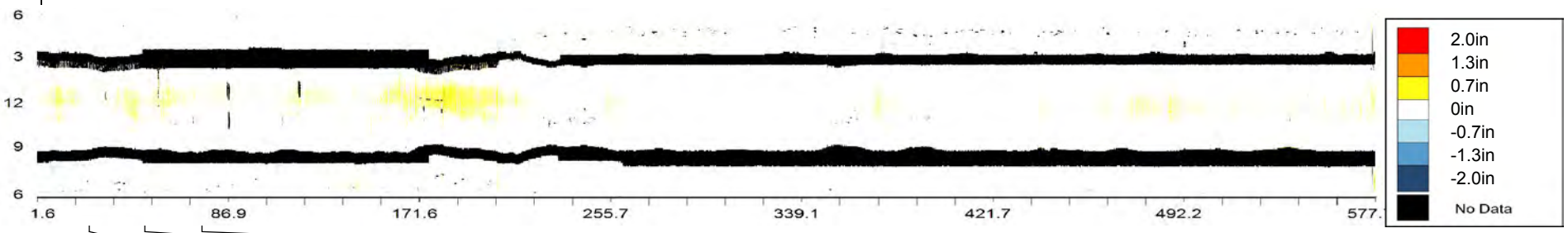
3ft General Observation - Corrosion to 0.6"

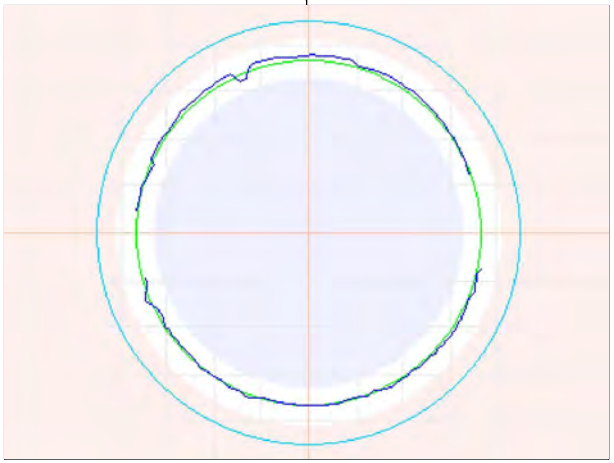


3ft General Observation - Corrosion to 0.6"

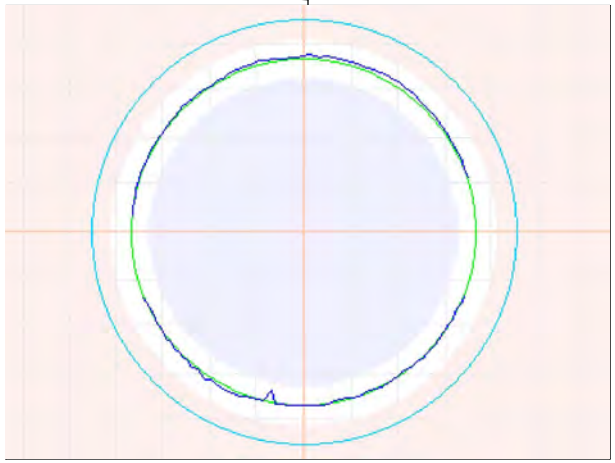
3ft Point of Interest - Encrustation throughout



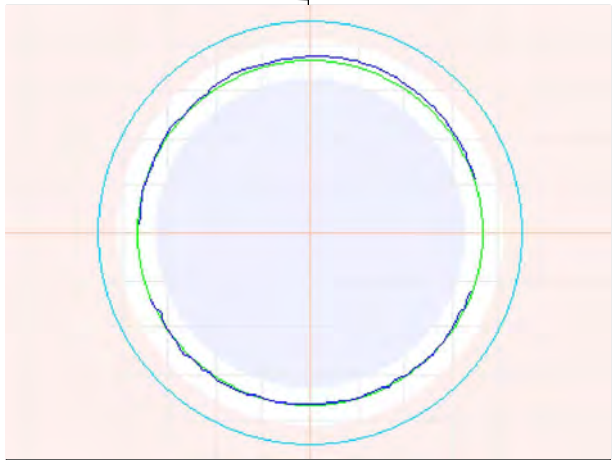




25ft General Observation - Corrosion to 0.6"



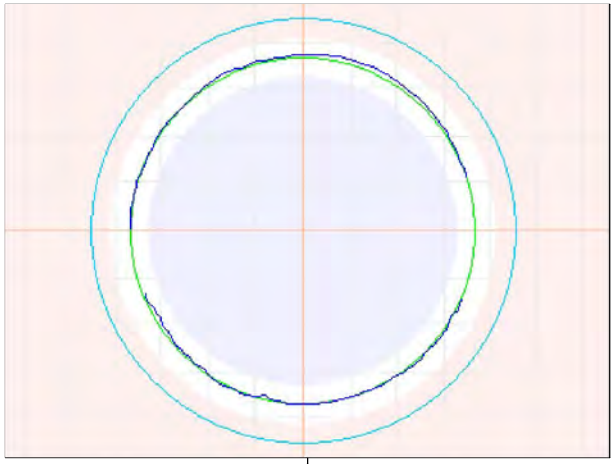
49.9ft General Observation - Corrosion to 0.6"



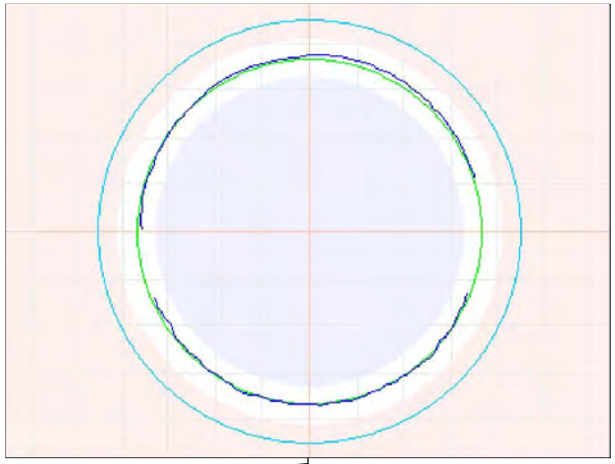
75ft General Observation - Corrosion to 0.6"\Debris to 0.2"

Observation Report

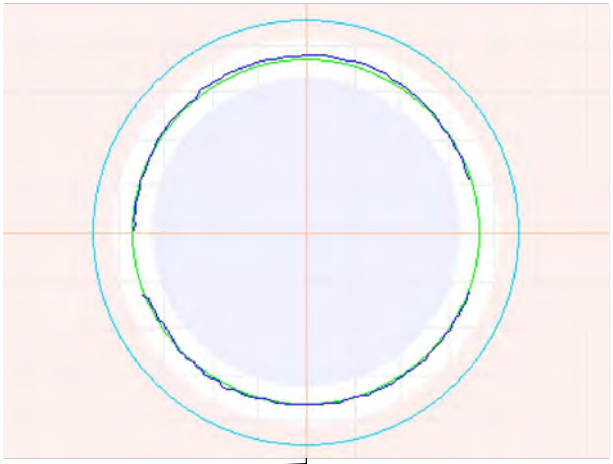
100ft General Observation - Corrosion to 0.6"

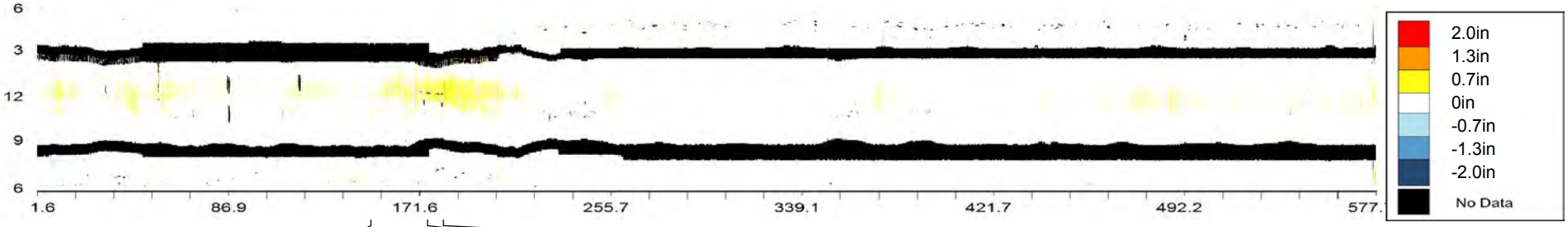


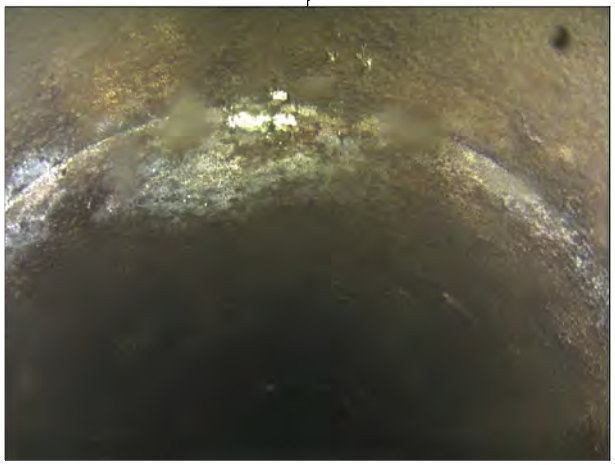
125ft General Observation - Corrosion to 0.6"



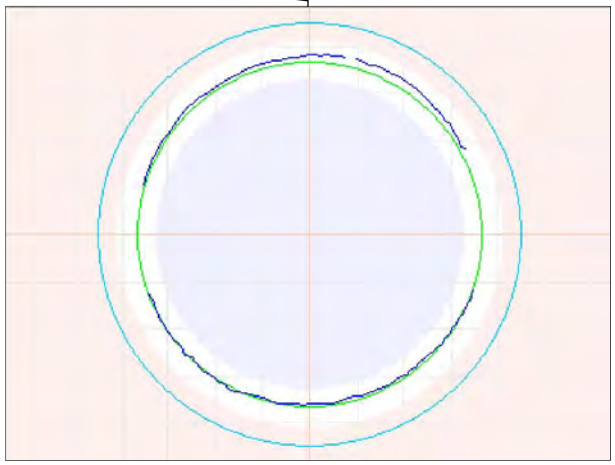
149.9ft General Observation - Corrosion to 0.5"



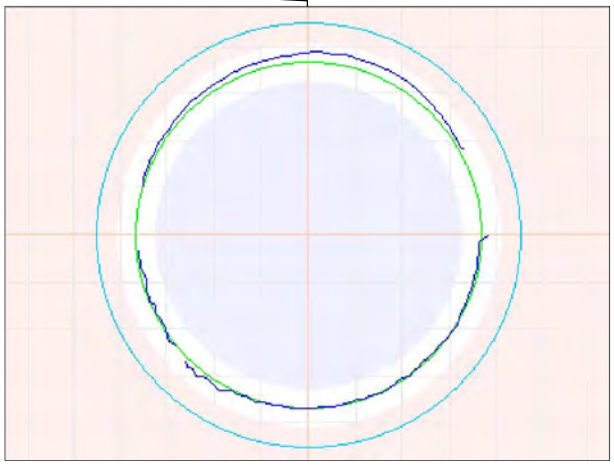




149.9ft General Observation - Corrosion to 0.5"



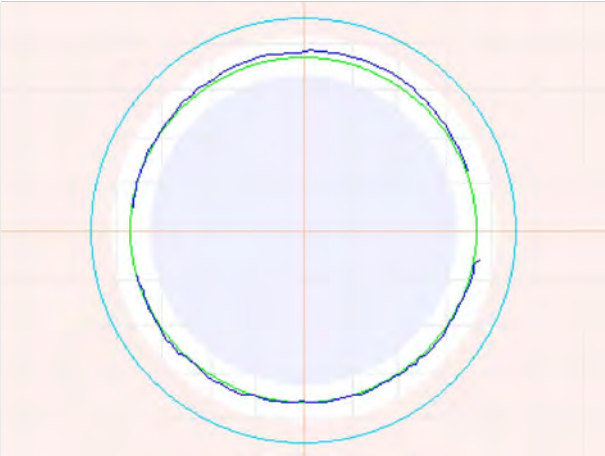
175ft General Observation - Corrosion to 0.9"\Debris to 0.3"



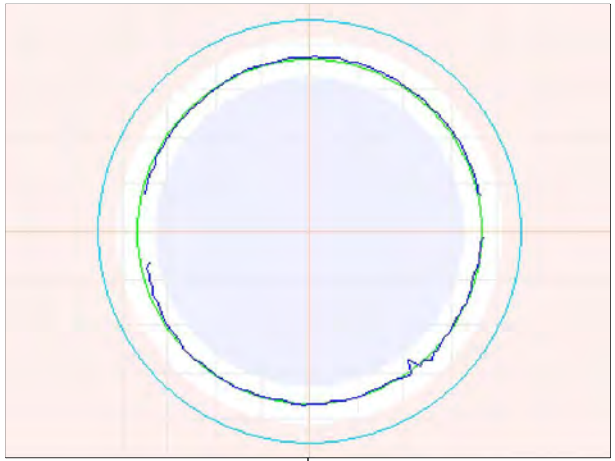
181.9ft Maximum Corrosion - To 1.2"

Observation Report

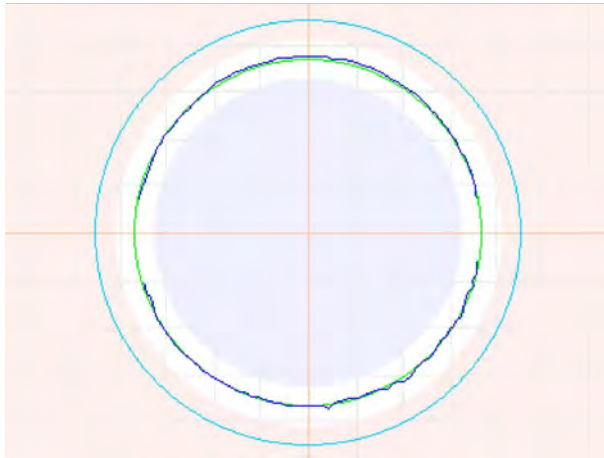
199.8ft General Observation - Corrosion to 0.7"

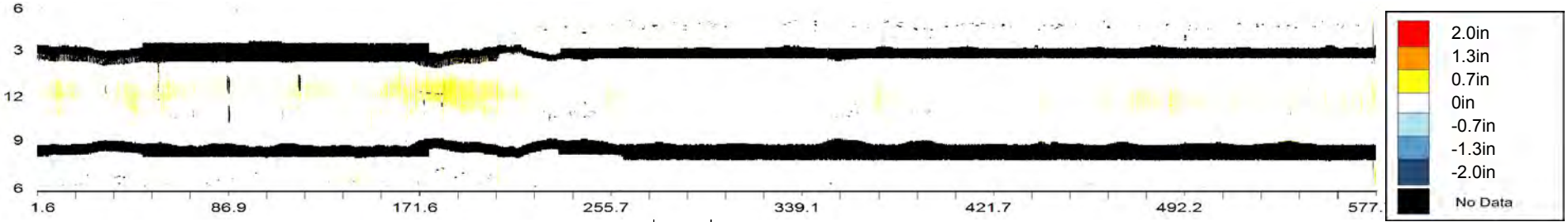


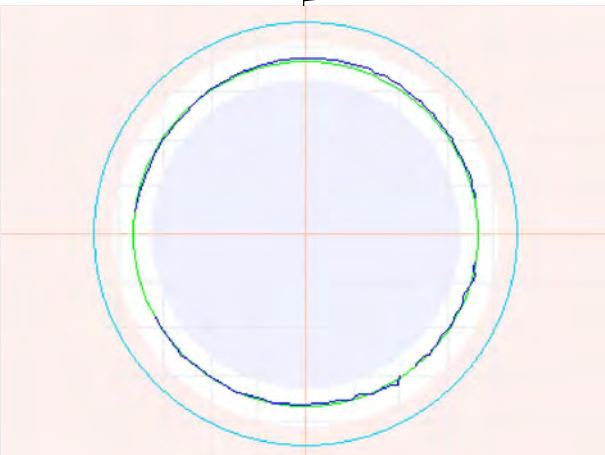
225ft General Observation - Corrosion to 0.4"



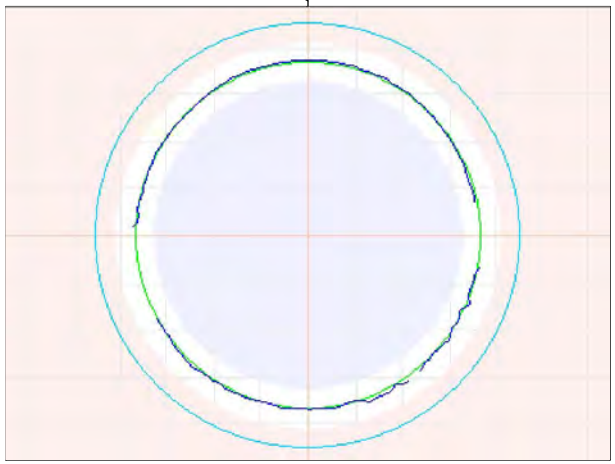
249.9ft General Observation - Corrosion to 0.5"



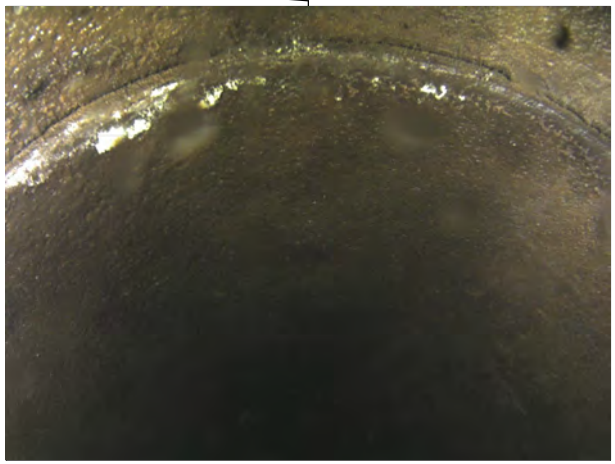




274.9ft General Observation - Corrosion to 0.4"\Debris to 0.2"



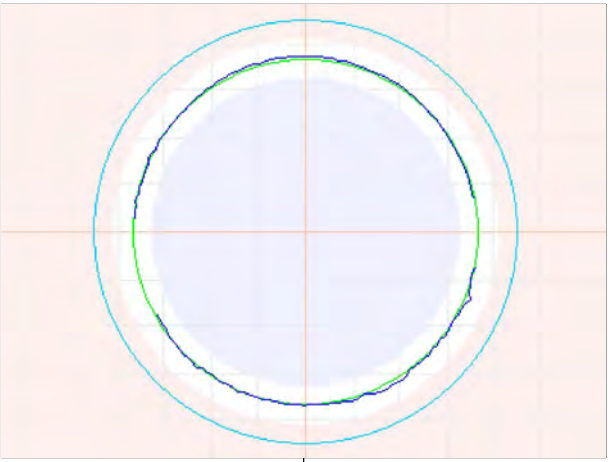
299.9ft General Observation



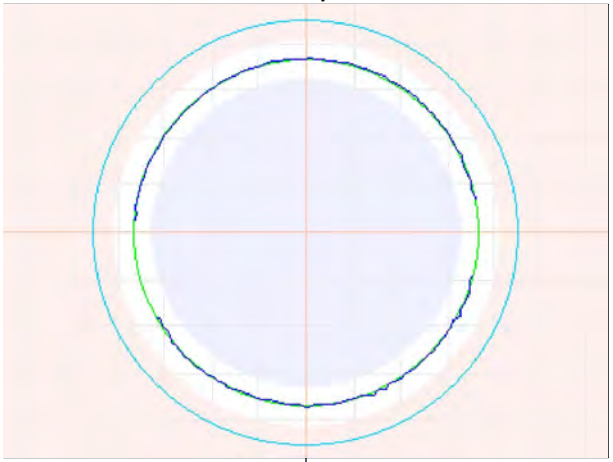
299.9ft General Observation

Observation Report

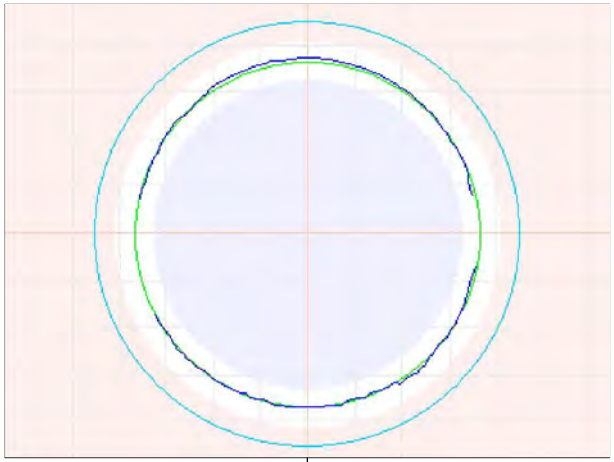
324.9ft General Observation - Corrosion to 0.4"

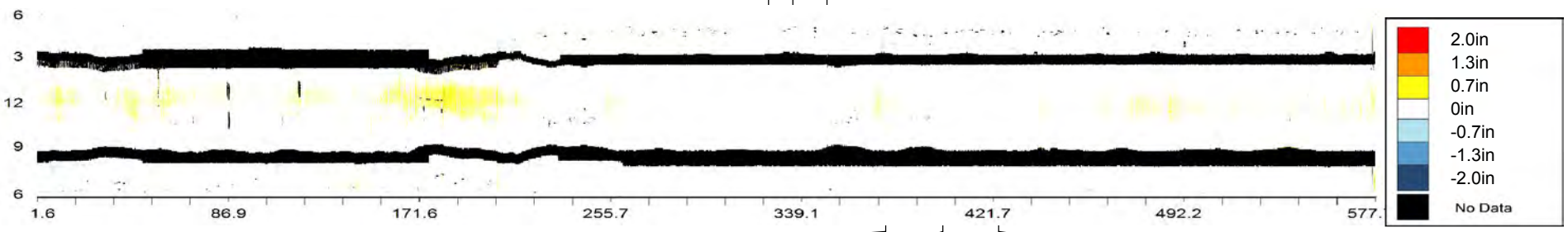


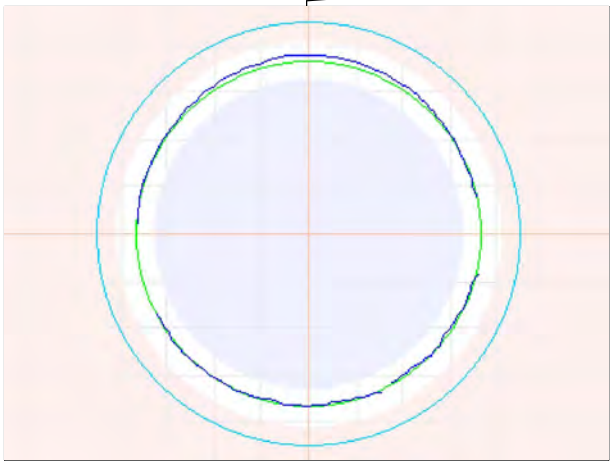
335.5ft Match to Reference Shape and Size - ø36"



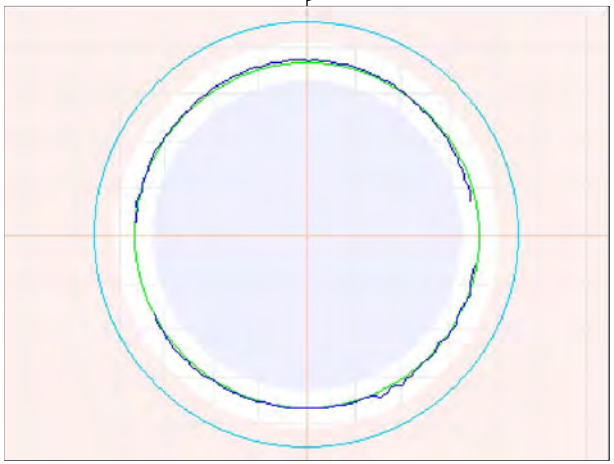
349.9ft General Observation



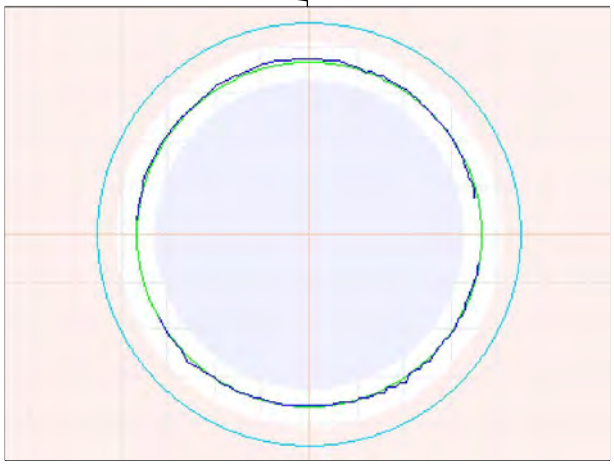




374.9ft General Observation - Corrosion to 0.7"



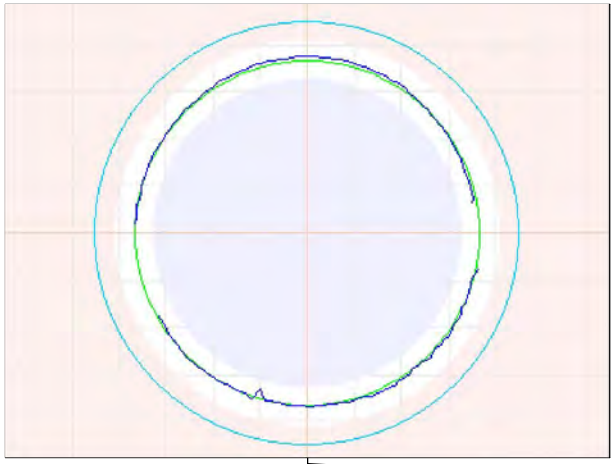
400.1ft General Observation



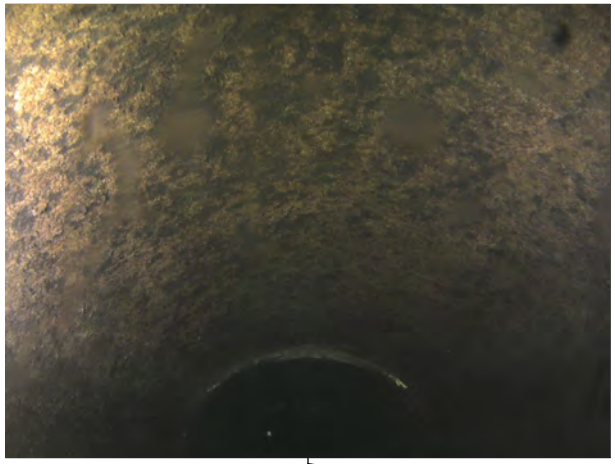
424.9ft General Observation - Corrosion to 0.4"\Debris to 0.2"

Observation Report

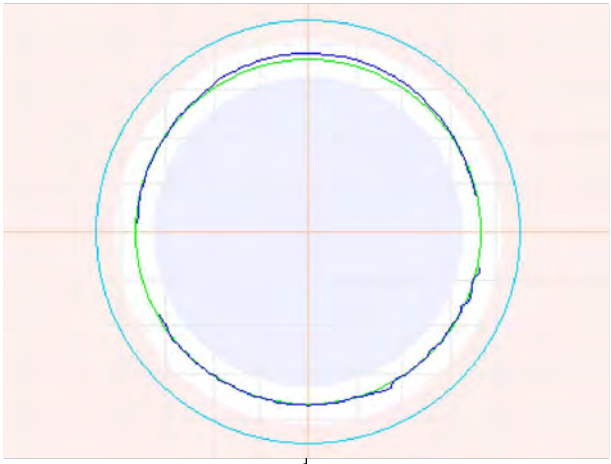
450.1ft General Observation - Corrosion to 0.5"

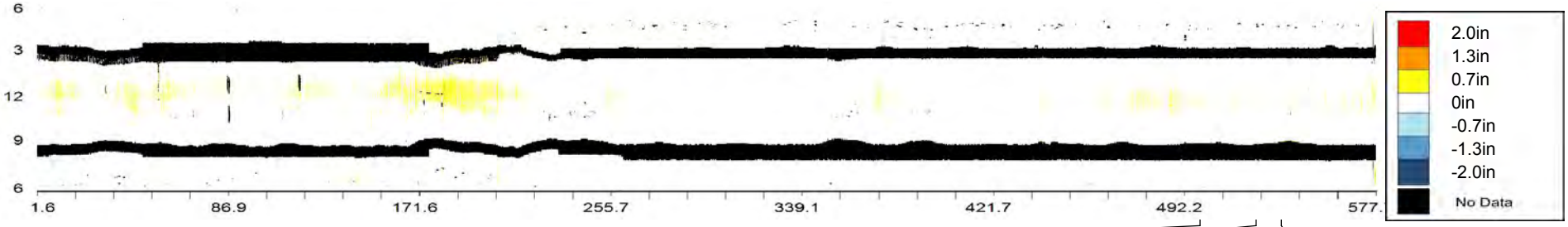


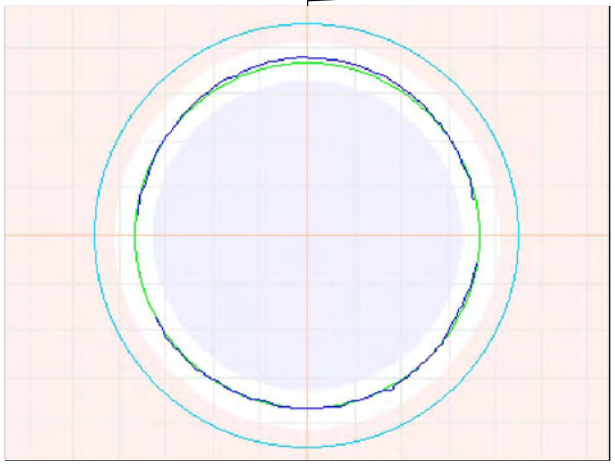
450.1ft General Observation - Corrosion to 0.5"



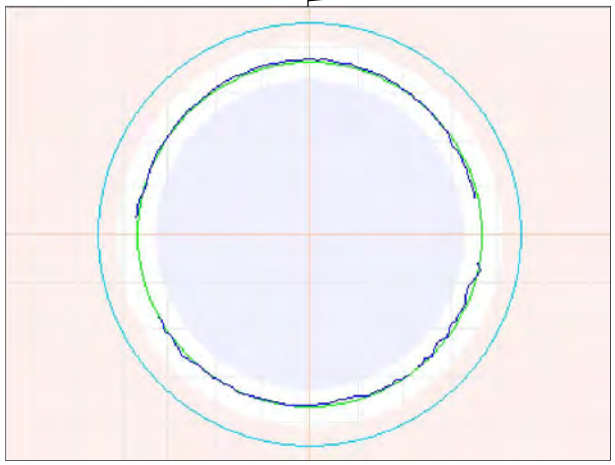
474.9ft General Observation - Corrosion to 0.7"







499.8ft General Observation - Corrosion to 0.5"

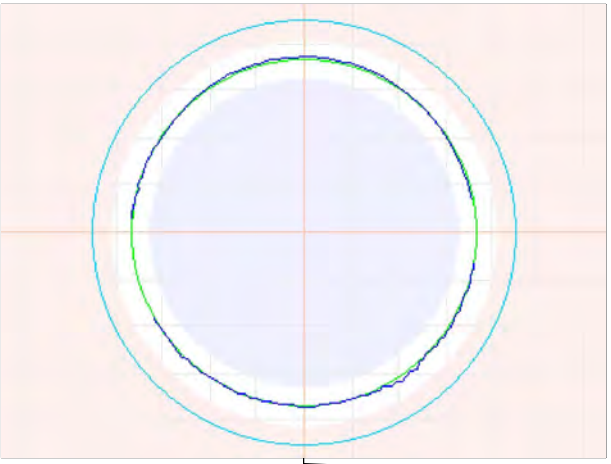


524.8ft General Observation - Corrosion to 0.3"\Debris to 0.2"

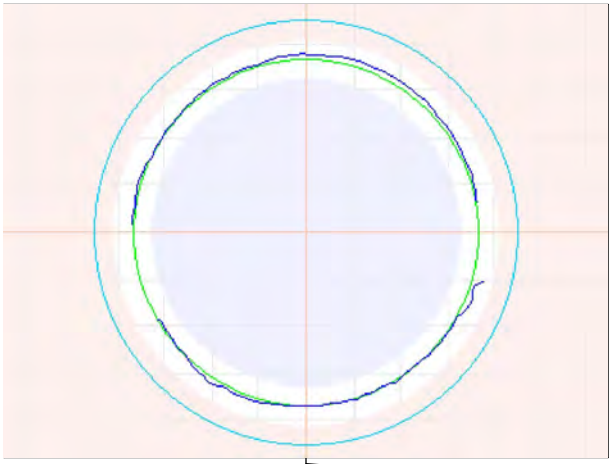
536ft Point of Interest - Spalling

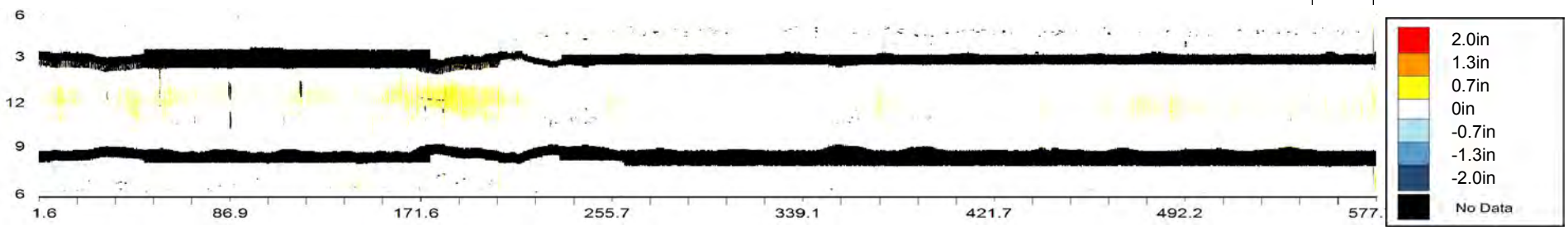
Observation Report

549.8ft General Observation - Corrosion to 0.5"



577.3ft General Observation - Corrosion to 0.8"





OVERVIEW - CMH000281 - CMH000276

Asset Number	CMH000281 - CMH000276		
Upstream MH	CMH000281	Material	Reinforced Concrete Pipe
Downstream MH	CMH000276	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	339.2 ft

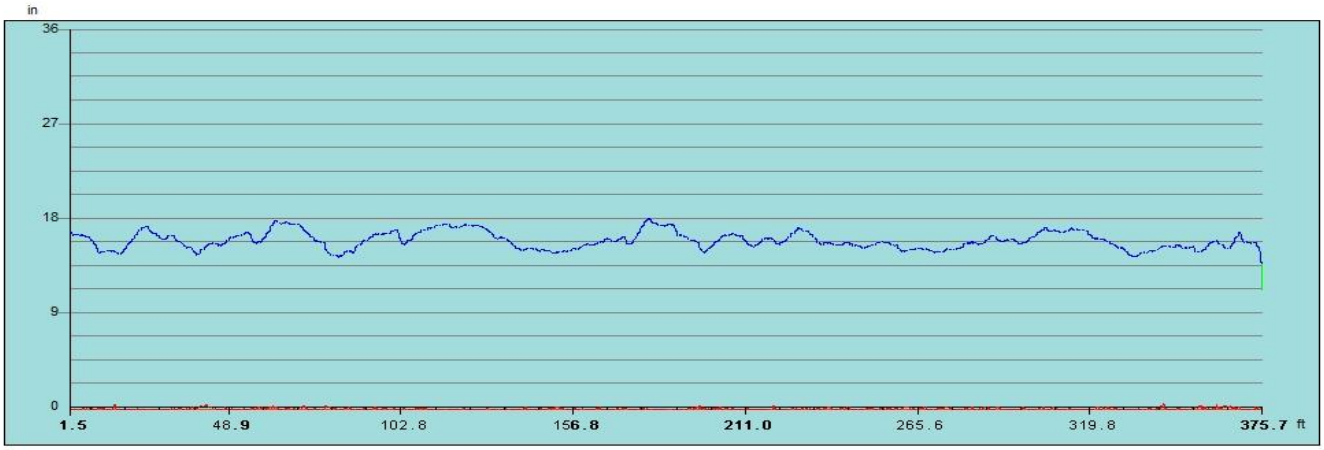
Distance	Observation	Comment
1.5 ft	**Beginning of Inspection**	**CMH000281**
1.9	General Observation	Corrosion to 0.5"
25	General Observation	Corrosion to 0.6"
38.9	Maximum Corrosion	To 1.2"
50	General Observation	Corrosion to 0.6"
75	General Observation	Corrosion to 0.8"
99.8	General Observation	Corrosion to 0.7"
124.9	General Observation	Corrosion to 0.7"
150.1	General Observation	Corrosion to 0.6"
174.9	General Observation	Corrosion to 0.7"
199.9	General Observation	Corrosion to 0.8", Debris to 0.7"
225	General Observation	Corrosion to 0.7"
249.8	General Observation	Corrosion to 0.7"
275	General Observation	Corrosion to 0.8"\Debris to 0.2"
300	General Observation	Corrosion to 0.6"
324.8	3D Laser Sonar Scan	Pipe overview
324.9	General Observation	Corrosion to 0.7"\Debris to 0.1"
339.2	Match to Reference Shape and Size	ø36"
350	General Observation	Corrosion to 0.7"
374.9	General Observation	Corrosion to 0.8"
375.2	General Observation	Corrosion to 1.1"
375.6 ft	**End of Inspection**	**CMH000276**

CMH000281 - CMH000276			
Asset Number	CMH000281 - CMH000276	Length	376 ft
Upstream MH	CMH000281	Diameter	36 in
Downstream MH	CMH000276	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	339.2 ft
Date Profiled	15 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	16 in
Debris Volume	0 cubic feet

Debris Graph



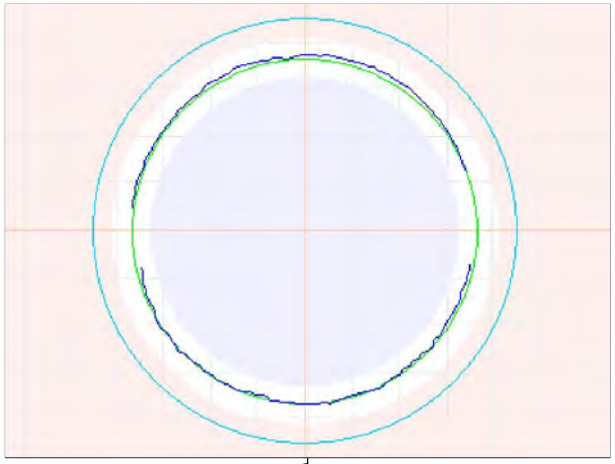
Inspection Distance (ft)

Water Level Debris Level

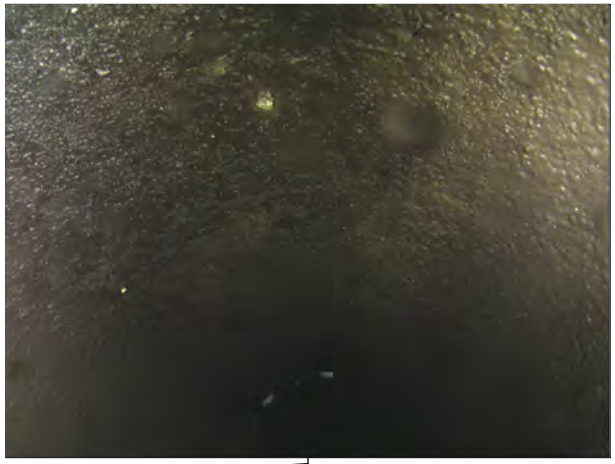
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

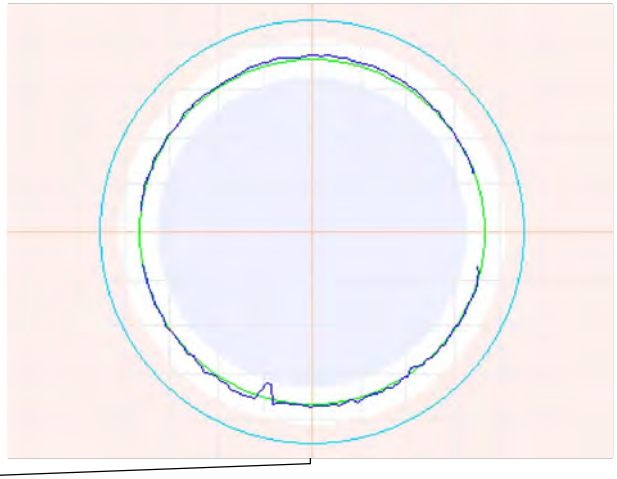
1.9ft General Observation - Corrosion to 0.5"

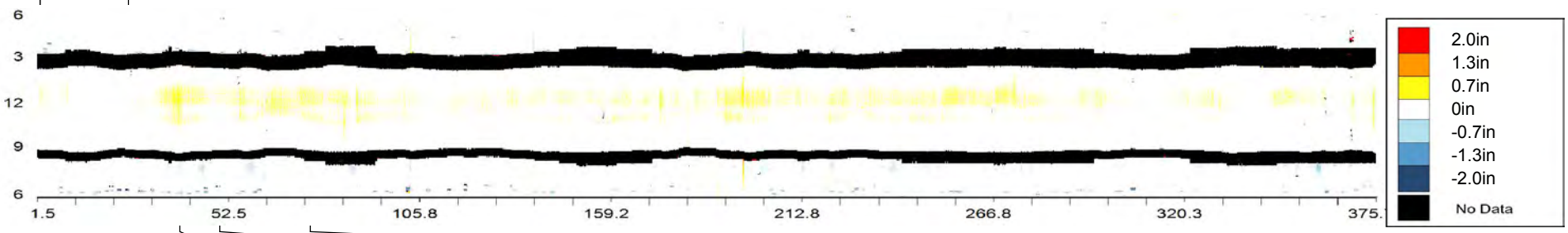


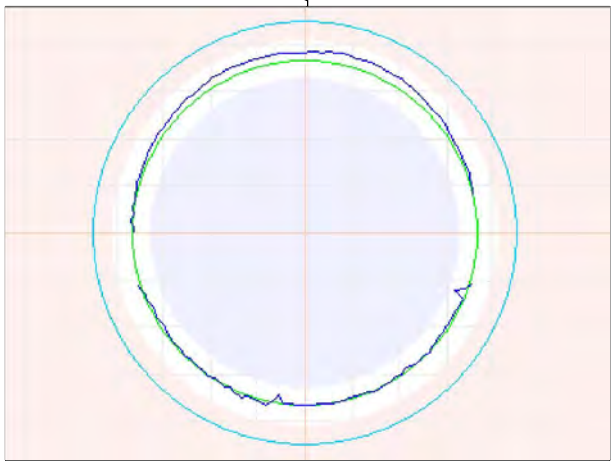
1.9ft General Observation - Corrosion to 0.5"



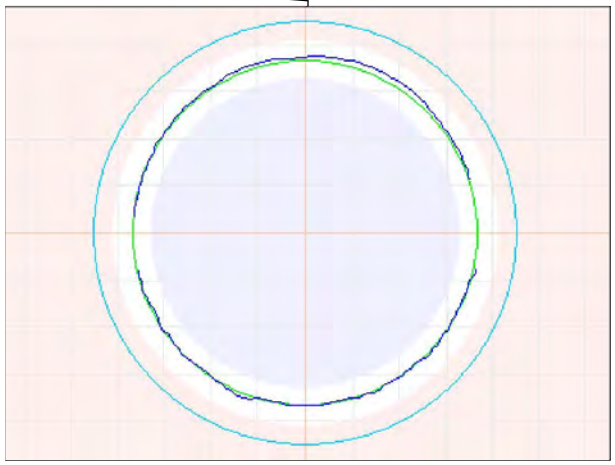
25ft General Observation - Corrosion to 0.6"



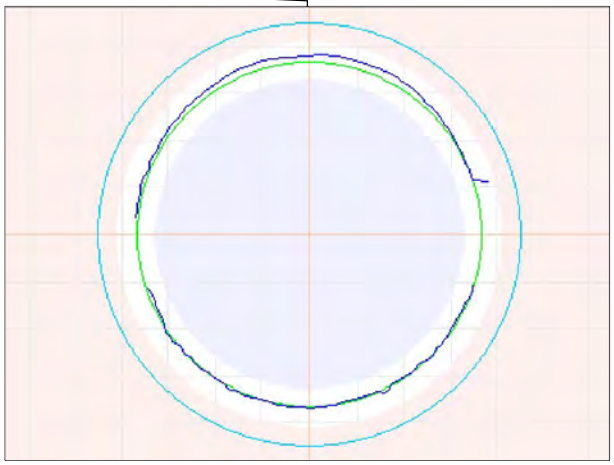




38.9ft Maximum Corrosion - To 1.2"



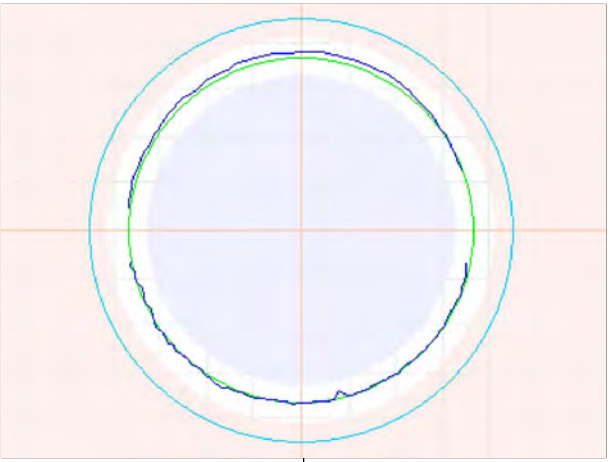
50ft General Observation - Corrosion to 0.6"



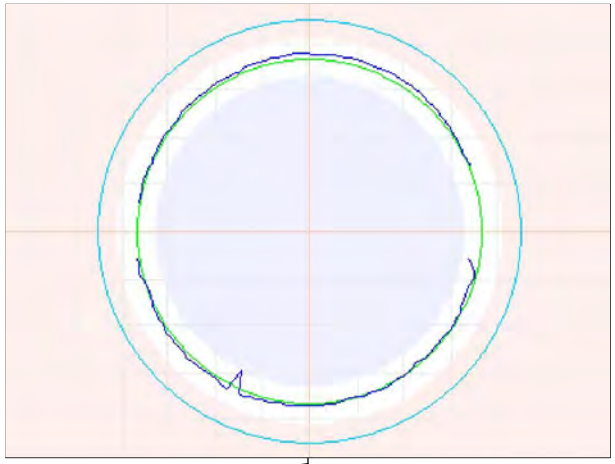
75ft General Observation - Corrosion to 0.8"

Observation Report

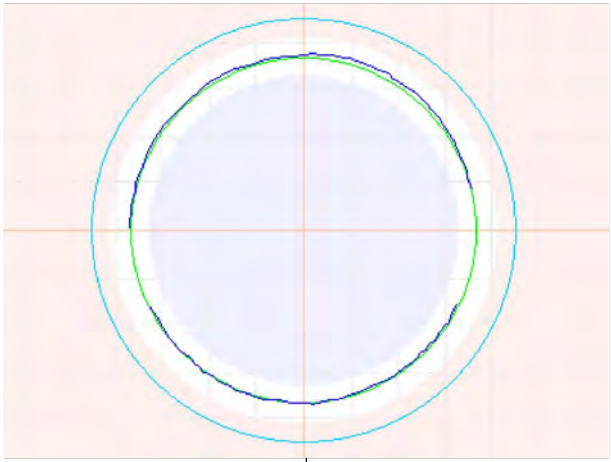
99.8ft General Observation - Corrosion to 0.7"

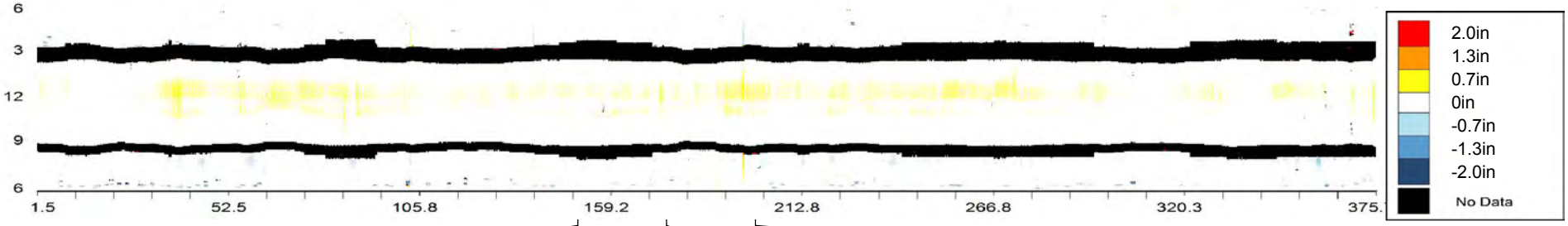


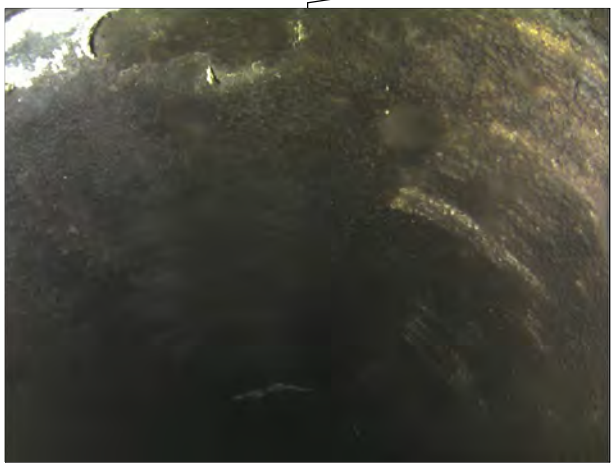
124.9ft General Observation - Corrosion to 0.7"



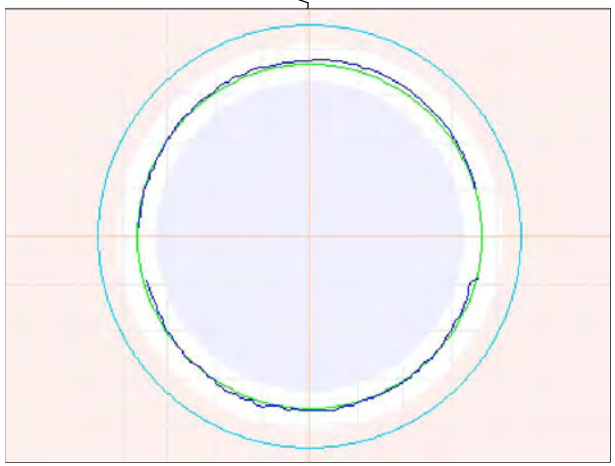
150.1ft General Observation - Corrosion to 0.6"



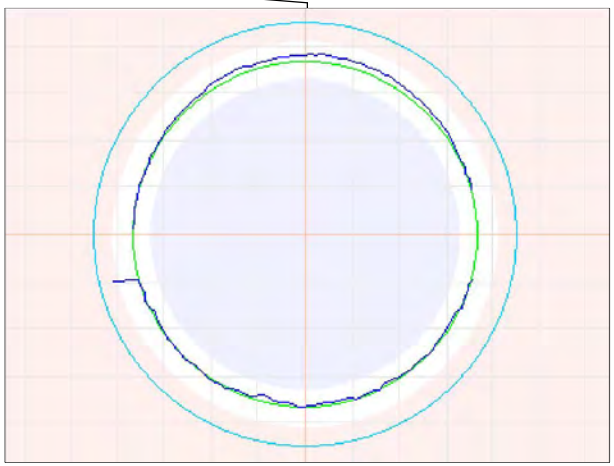




150.1ft General Observation - Corrosion to 0.6"



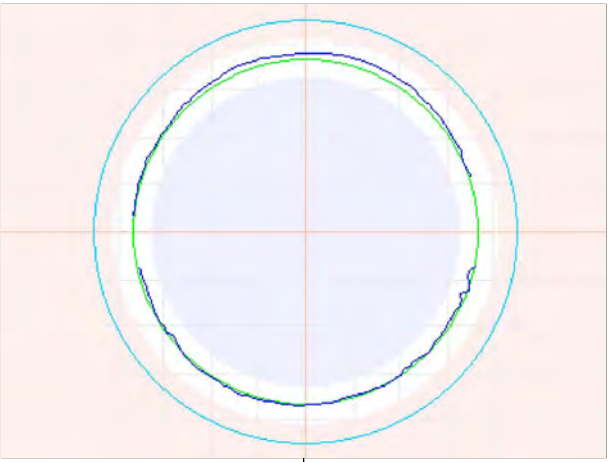
174.9ft General Observation - Corrosion to 0.7"



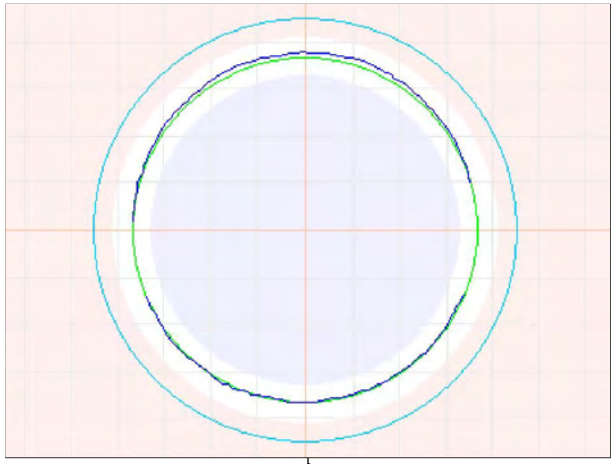
199.9ft General Observation - Corrosion to 0.8", Debris to 0.7"

Observation Report

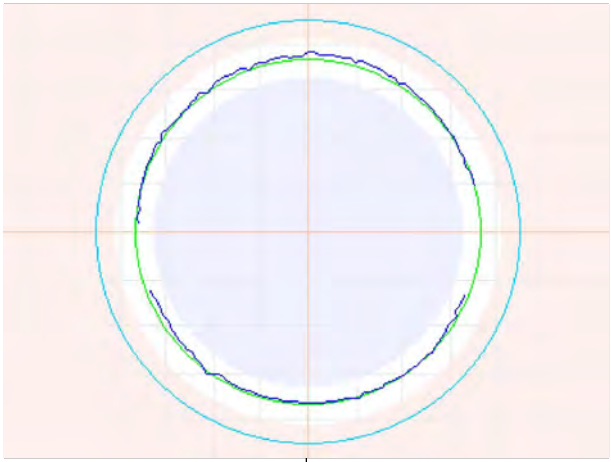
225ft General Observation - Corrosion to 0.7"

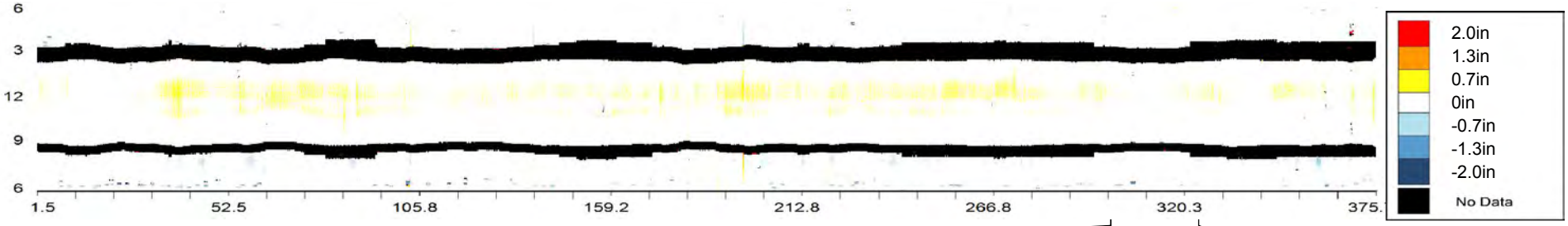


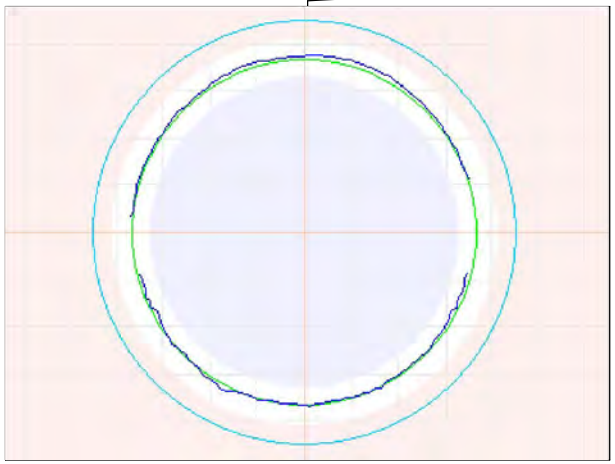
249.8ft General Observation - Corrosion to 0.7"



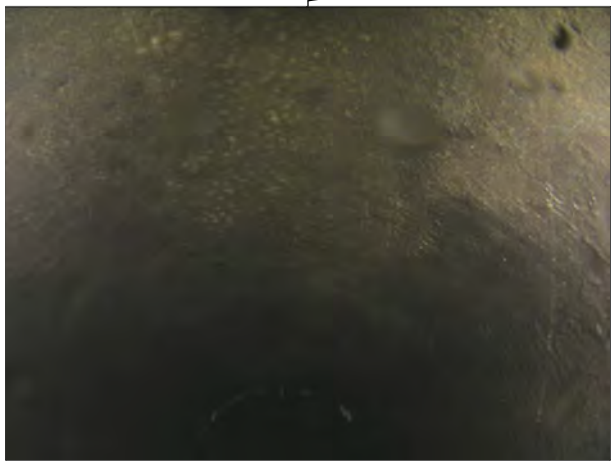
275ft General Observation - Corrosion to 0.8"\Debris to 0.2"







300ft General Observation - Corrosion to 0.6"

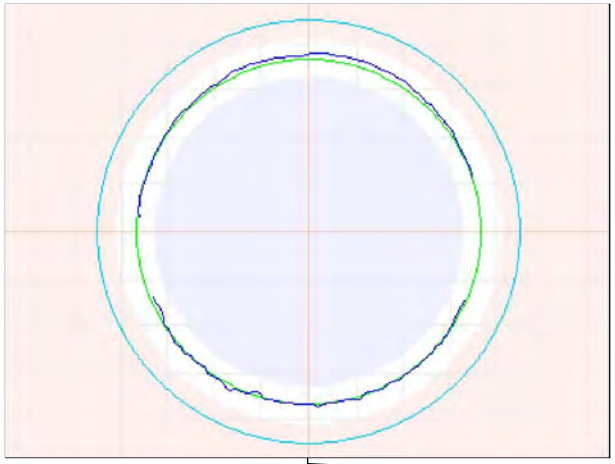


300ft General Observation - Corrosion to 0.6"

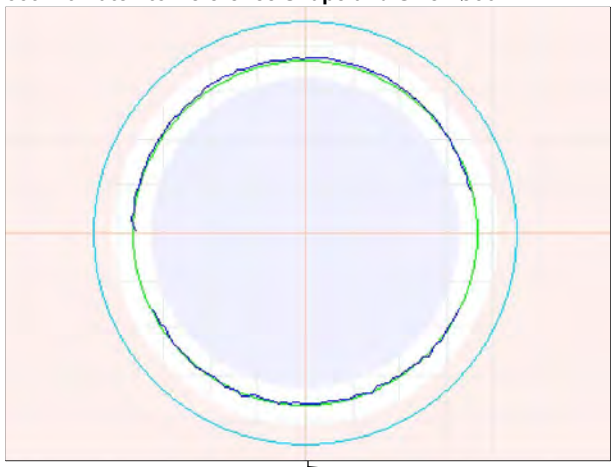
324.8ft 3D Laser Sonar Scan - Pipe overview

Observation Report

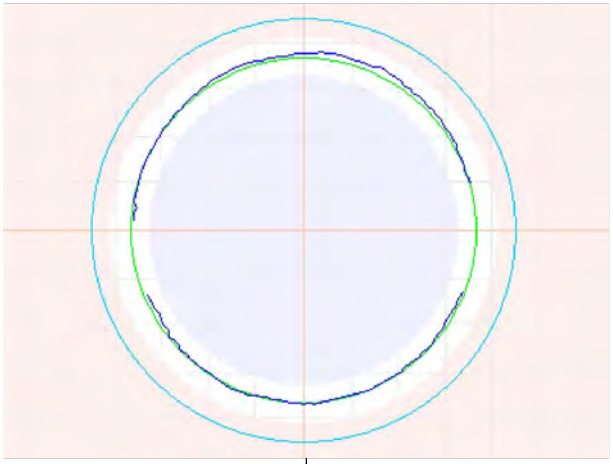
324.9ft General Observation - Corrosion to 0.7"\Debris to 0.1"

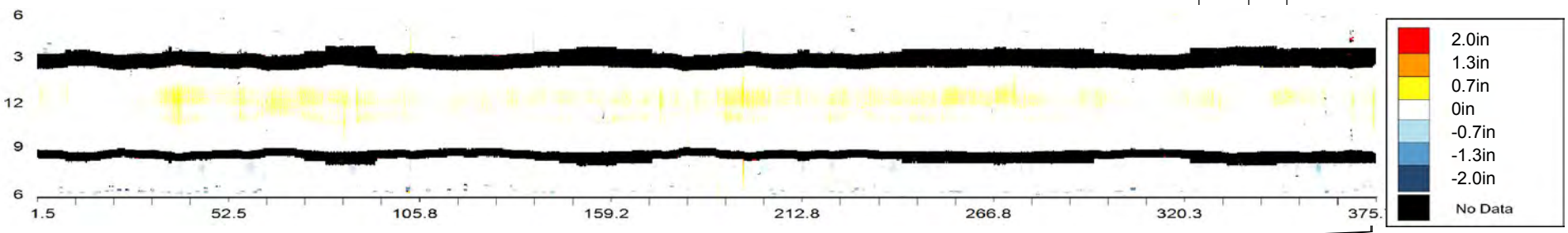


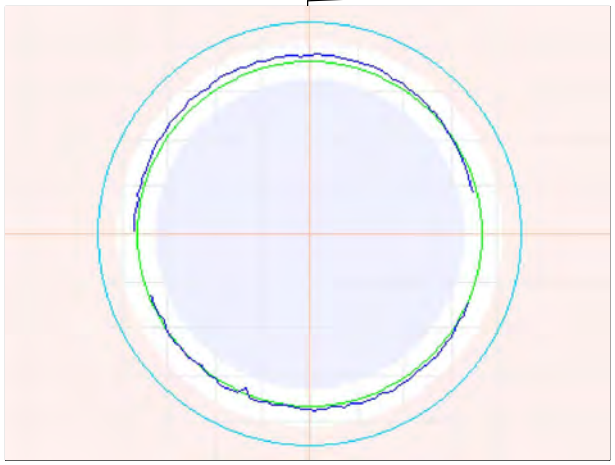
339.2ft Match to Reference Shape and Size - ø36"



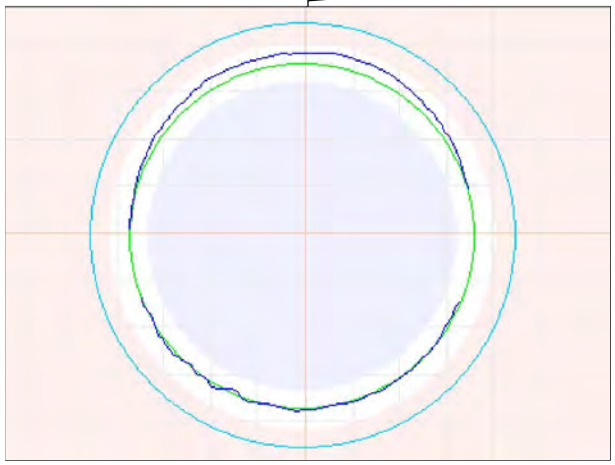
350ft General Observation - Corrosion to 0.7"







374.9ft General Observation - Corrosion to 0.8"



375.2ft General Observation - Corrosion to 1.1"

OVERVIEW - CMH000286 - CMH000281

Asset Number	CMH000286 - CMH000281		
Upstream MH	CMH000286	Material	Reinforced Concrete Pipe
Downstream MH	CMH000281	Size & Shape	42 in Circle
Survey Direction	Downstream	Match to Reference	146.8 ft

Distance	Observation	Comment
2.5 ft	**Beginning of Inspection**	**CMH000286**
2.5	General Observation	
25	General Observation	Corrosion to 0.4"\Debris to 0.1"
49.9	General Observation	
75	General Observation	Corrosion to 0.4"
100.1	General Observation	
124.9	General Observation	Corrosion to 0.6"
146.8	Match to Reference Shape and Size	ø42"
149.8	General Observation	Corrosion to 0.5"
175	General Observation	Corrosion to 0.6"
200.1	General Observation	Corrosion to 0.5"
225	General Observation	Corrosion to 0.6"
250.1	General Observation	
274.9	General Observation	Corrosion to 0.5"
300.1	General Observation	Corrosion to 0.5"
324.9	General Observation	Corrosion to 0.7"
350.1	General Observation	Corrosion to 0.7"
374.9	General Observation	Corrosion to 0.5"
399.7	General Observation	Corrosion to 0.5"
424.9	General Observation	Corrosion to 0.4"
449.8	General Observation	
474.9	General Observation	Corrosion to 0.5"
500	General Observation	Corrosion to 0.6"
524.9	General Observation	Corrosion to 0.7"
550	General Observation	Corrosion to 0.6"

OVERVIEW - CMH000286 - CMH000281

Asset Number	CMH000286 - CMH000281		
Upstream MH	CMH000286	Material	Reinforced Concrete Pipe
Downstream MH	CMH000281	Size & Shape	42 in Circle
Survey Direction	Downstream	Match to Reference	146.8 ft

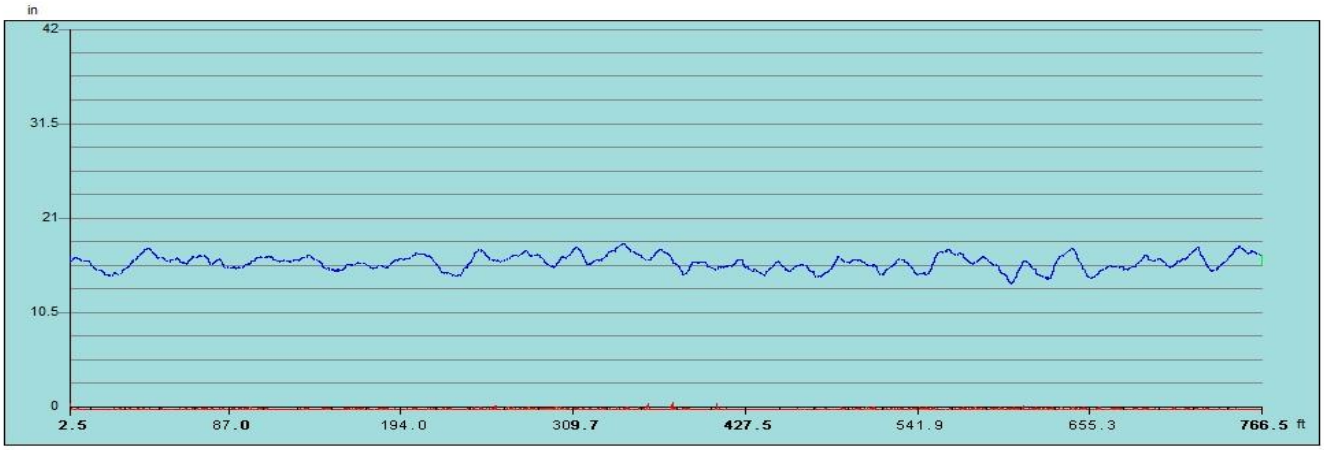
Distance	Observation	Comment
574.9	General Observation	Corrosion to 0.9"
599.7	Maximum Corrosion	To 0.9"
599.9	General Observation	Corrosion to 0.7"
624.9	General Observation	Corrosion to 0.7"\Debris to 0.3"
649.7	General Observation	Corrosion to 0.7"
674.8	General Observation	Corrosion to 0.7"
699.7	General Observation	Corrosion to 0.6"
724.8	General Observation	Corrosion to 0.6"
749.7	General Observation	Corrosion to 0.8"
766.3 ft	**End of Inspection**	**CMH000281**

CMH000286 - CMH000281			
Asset Number	CMH000286 - CMH000281	Length	767 ft
Upstream MH	CMH000286	Diameter	42 in
Downstream MH	CMH000281	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	146.8 ft
Date Profiled	15 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	16 in
Debris Volume	0 cubic feet

Debris Graph



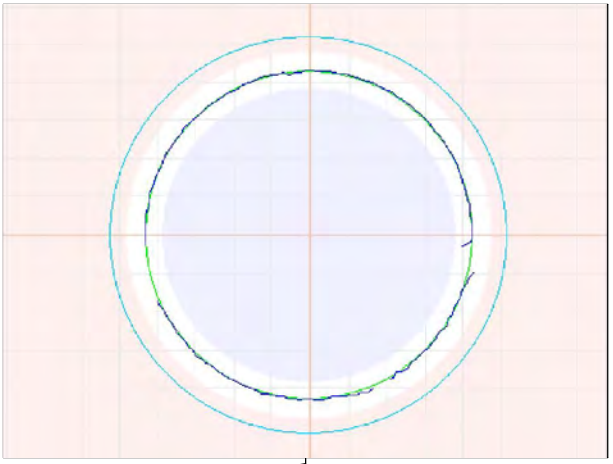
Inspection Distance (ft)

Water Level Debris Level

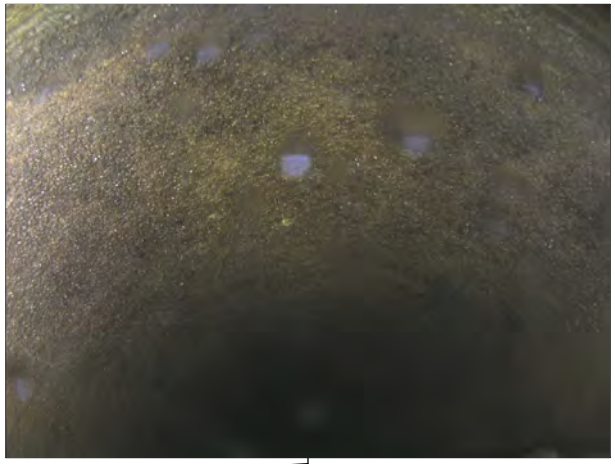
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

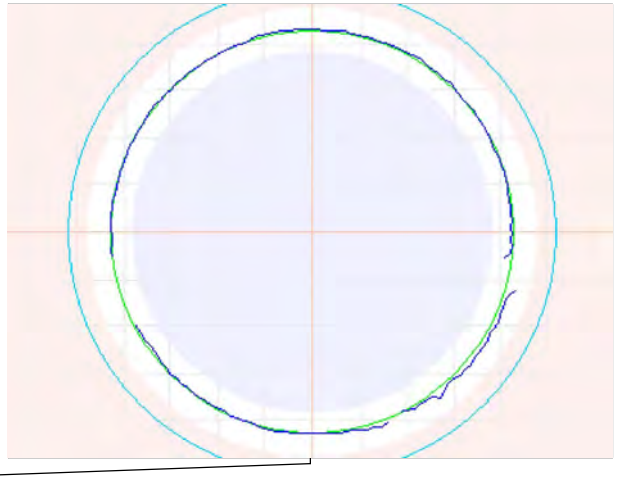
2.5ft General Observation

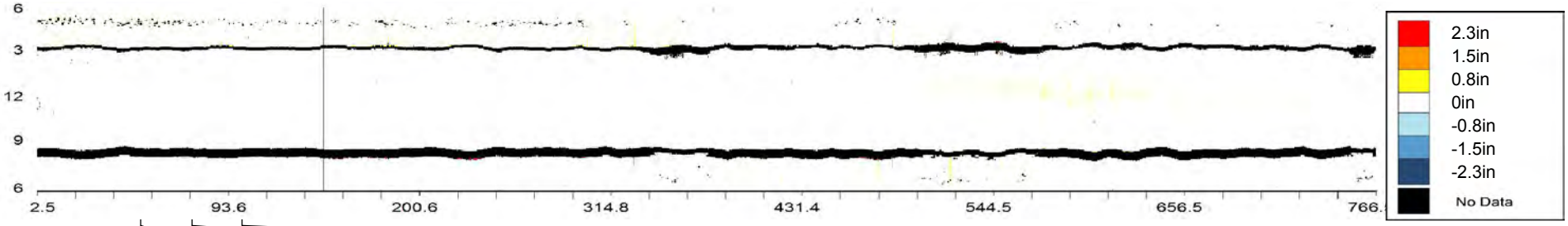


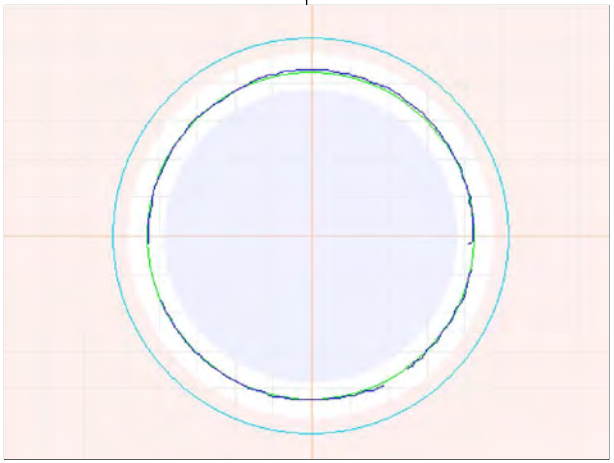
2.5ft General Observation



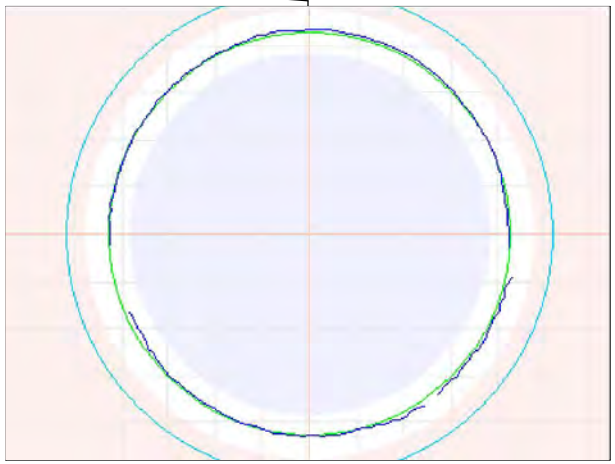
25ft General Observation - Corrosion to 0.4"\Debris to 0.1"



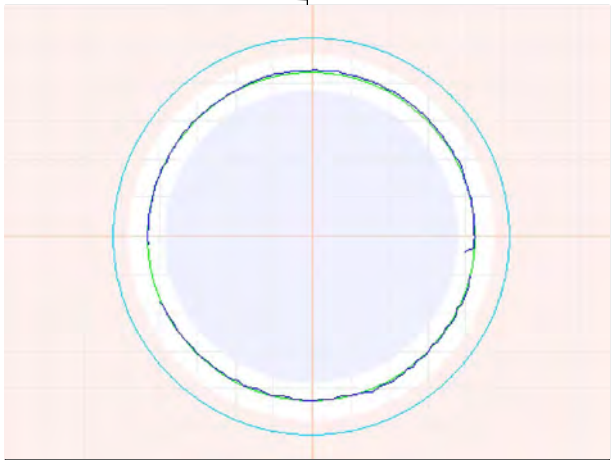




49.9ft General Observation



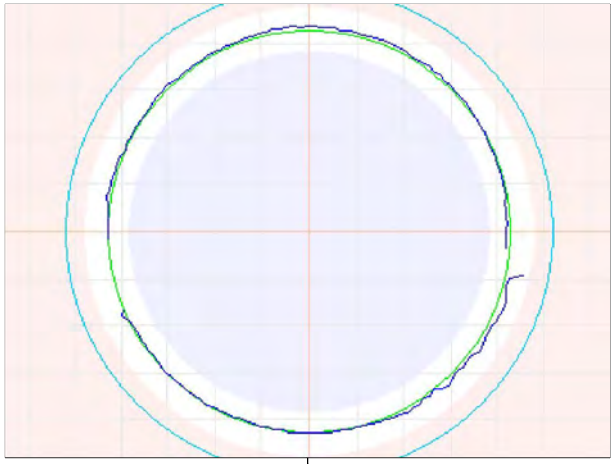
75ft General Observation - Corrosion to 0.4"



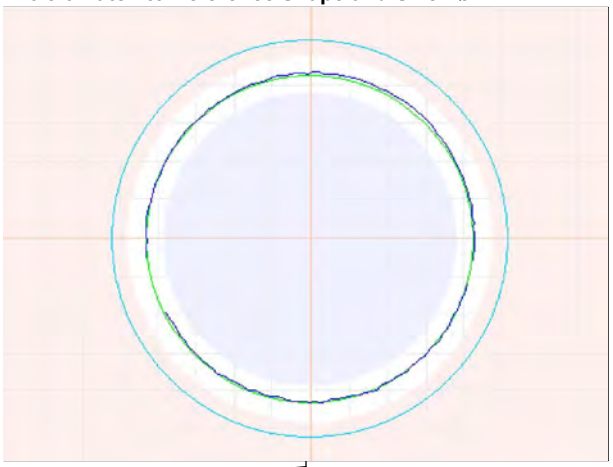
100.1ft General Observation

Observation Report

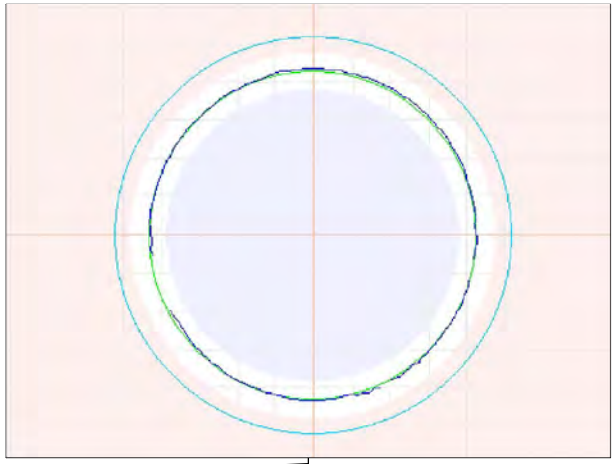
124.9ft General Observation - Corrosion to 0.6"

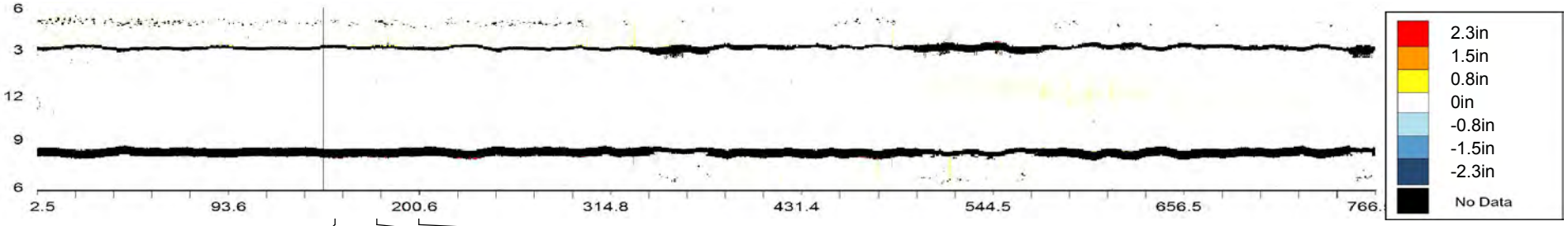


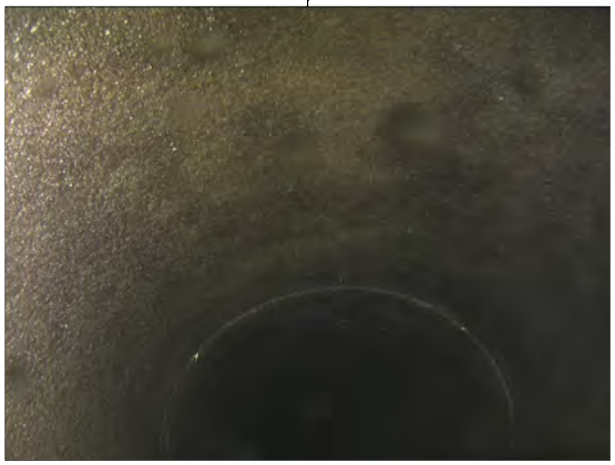
146.8ft Match to Reference Shape and Size - ø42"



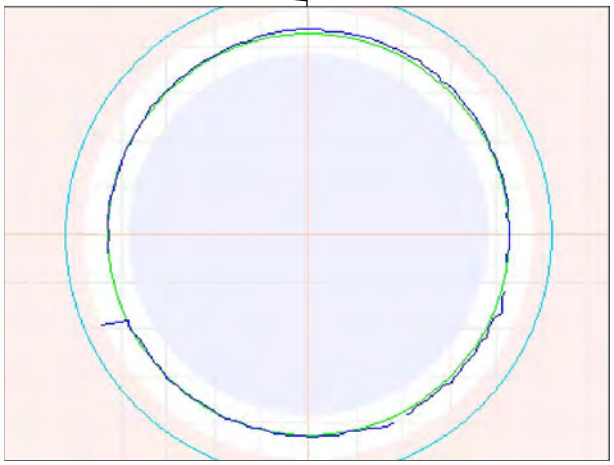
149.8ft General Observation - Corrosion to 0.5"



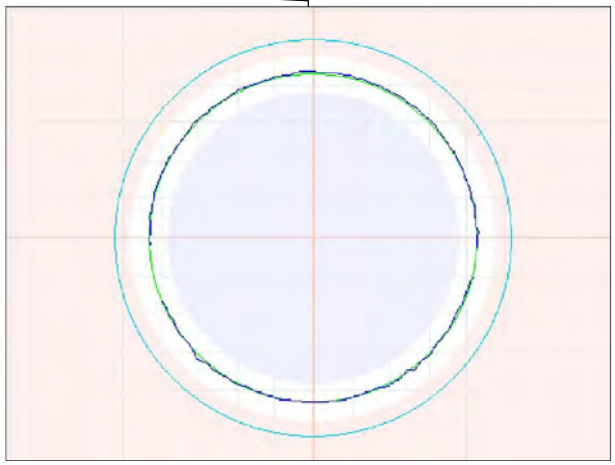




149.8ft General Observation - Corrosion to 0.5"



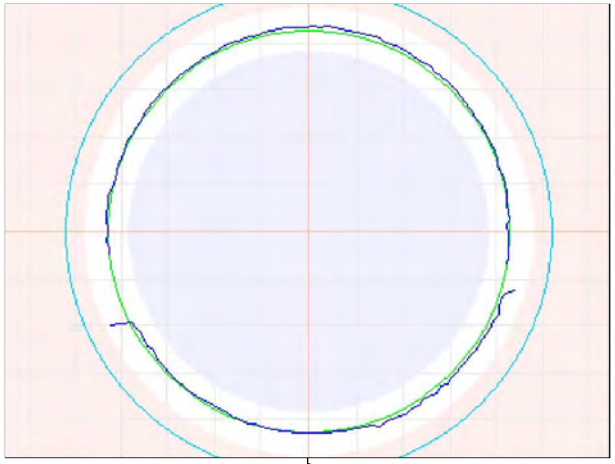
175ft General Observation - Corrosion to 0.6"



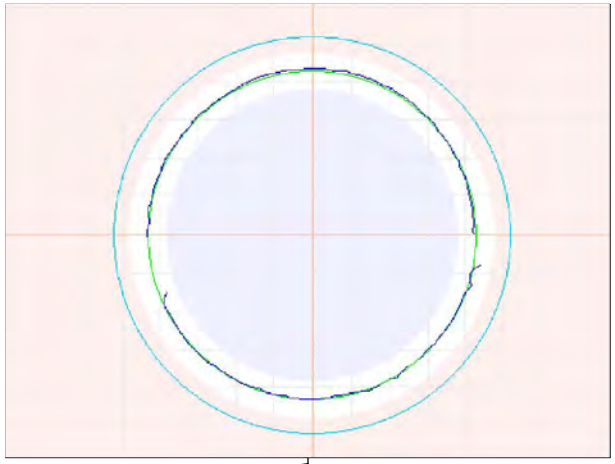
200.1ft General Observation - Corrosion to 0.5"

Observation Report

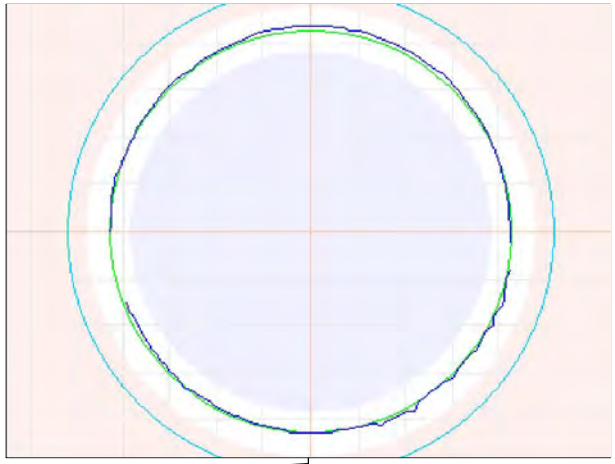
225ft General Observation - Corrosion to 0.6"

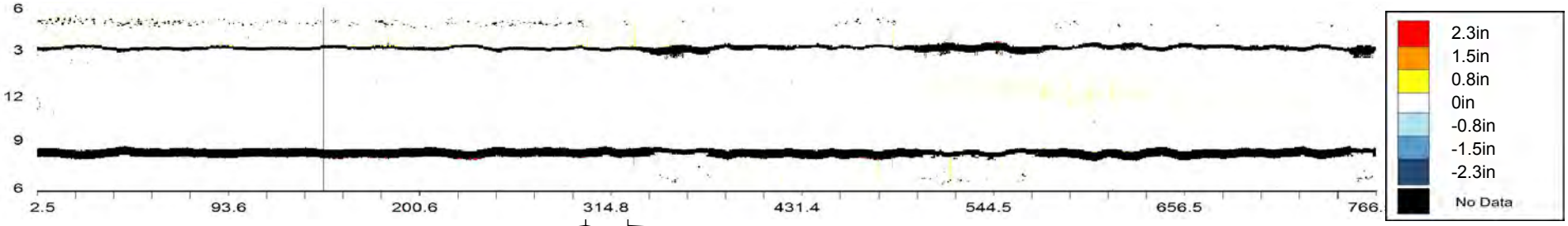


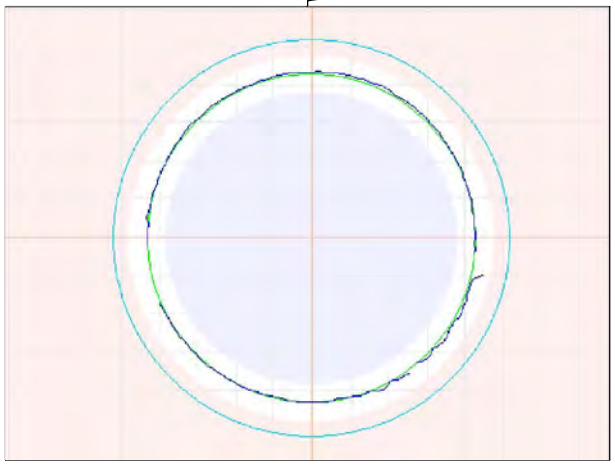
250.1ft General Observation



274.9ft General Observation - Corrosion to 0.5"

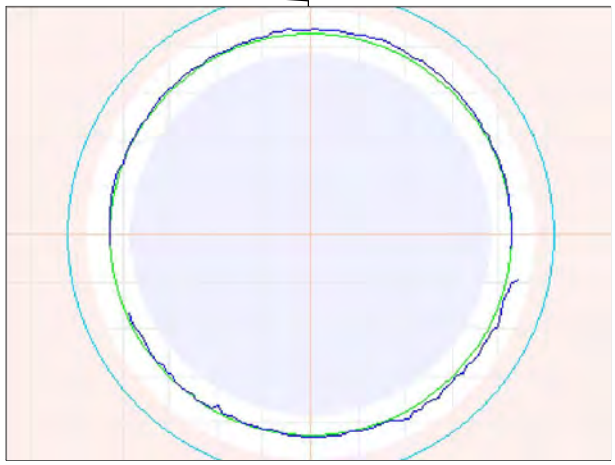






300.1ft General Observation - Corrosion to 0.5"

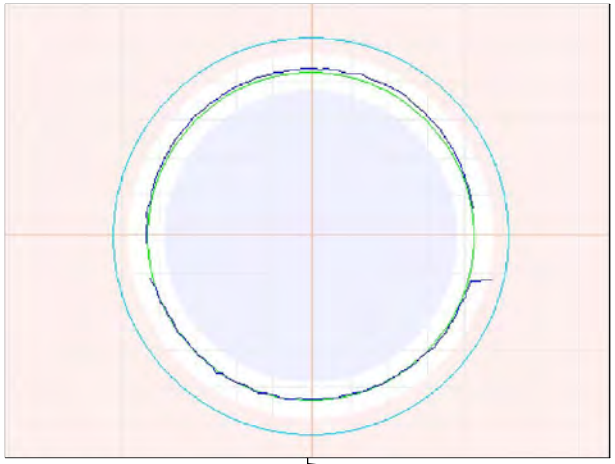
300.1ft General Observation - Corrosion to 0.5"



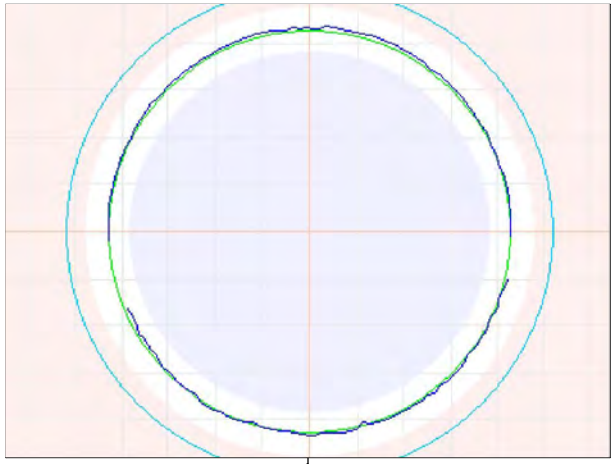
324.9ft General Observation - Corrosion to 0.7"

Observation Report

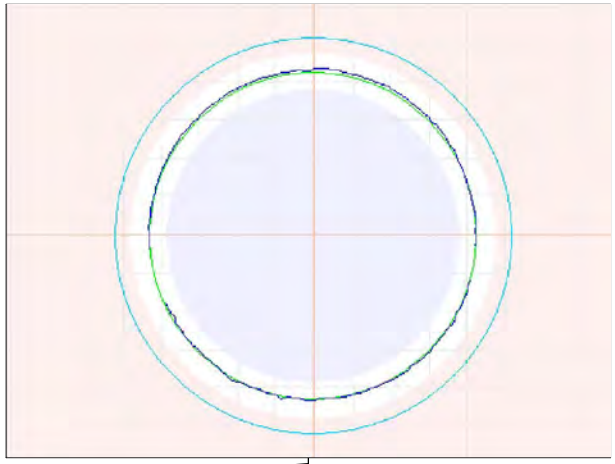
350.1ft General Observation - Corrosion to 0.7"

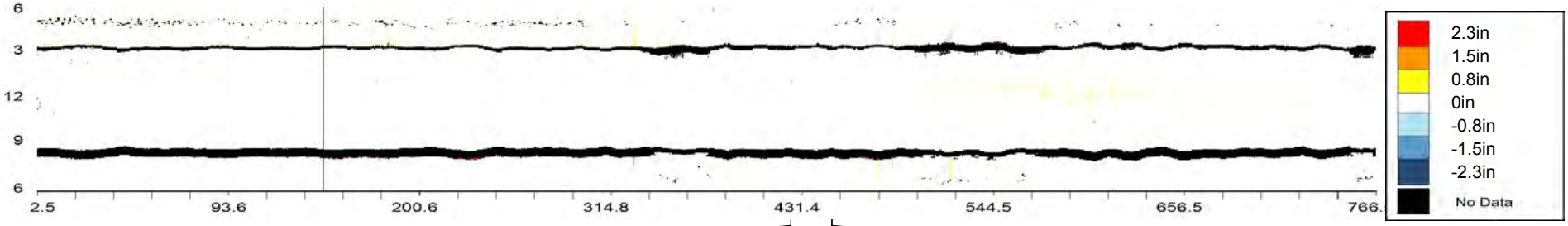


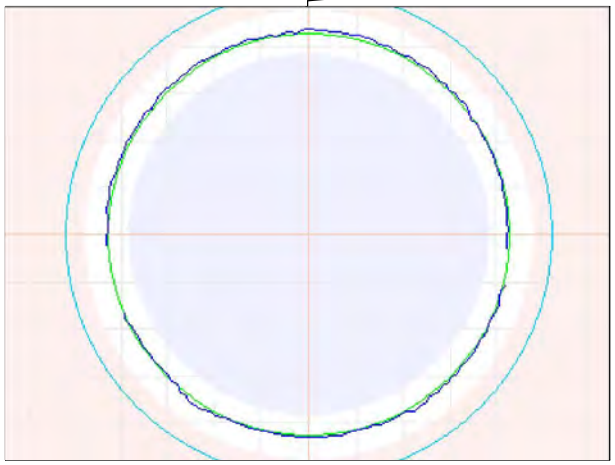
374.9ft General Observation - Corrosion to 0.5"



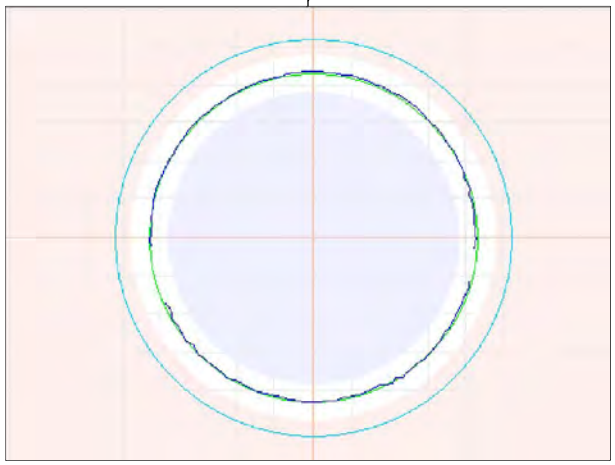
399.7ft General Observation - Corrosion to 0.5"



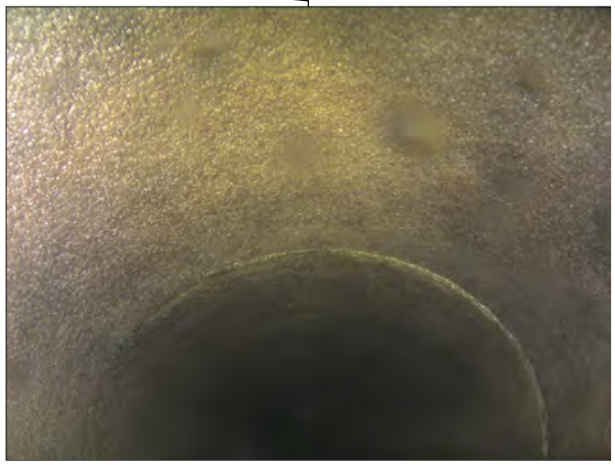




424.9ft General Observation - Corrosion to 0.4"



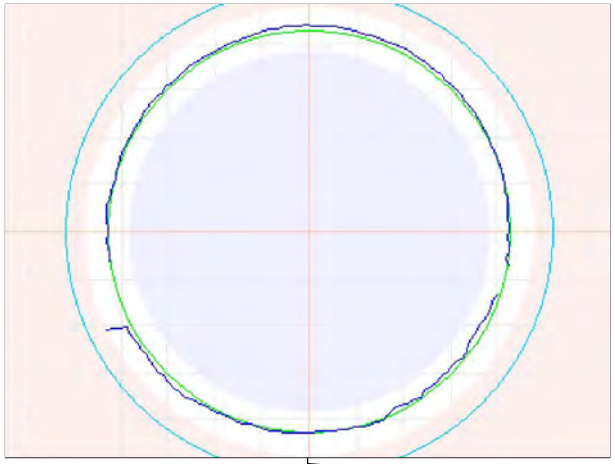
449.8ft General Observation



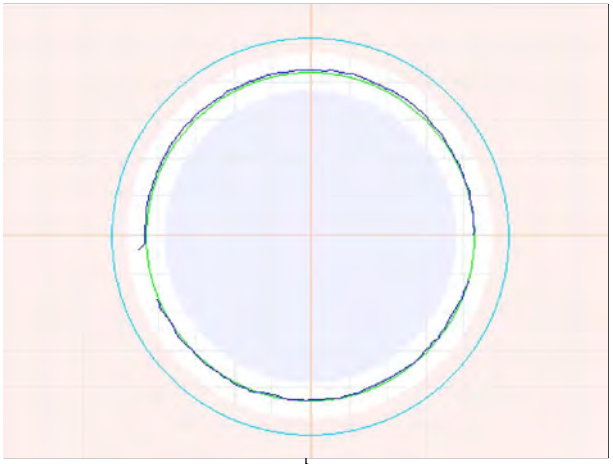
449.8ft General Observation

Observation Report

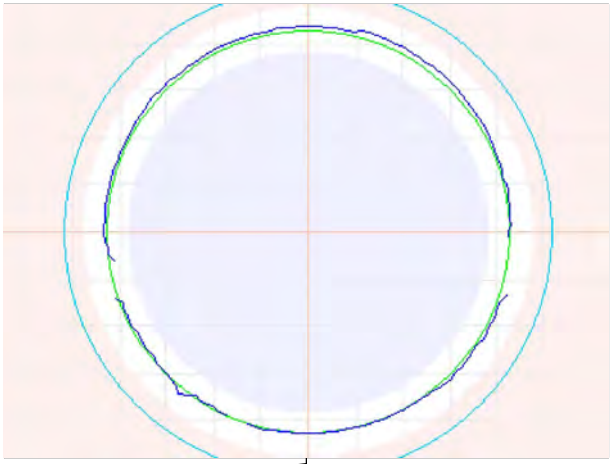
474.9ft General Observation - Corrosion to 0.5"

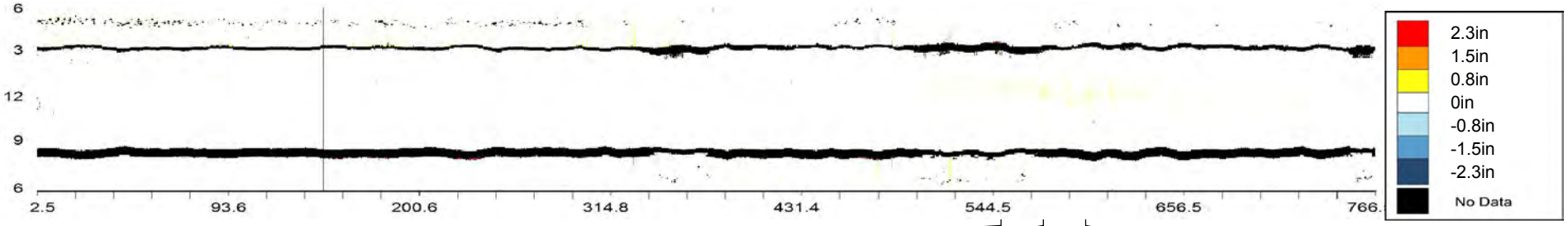


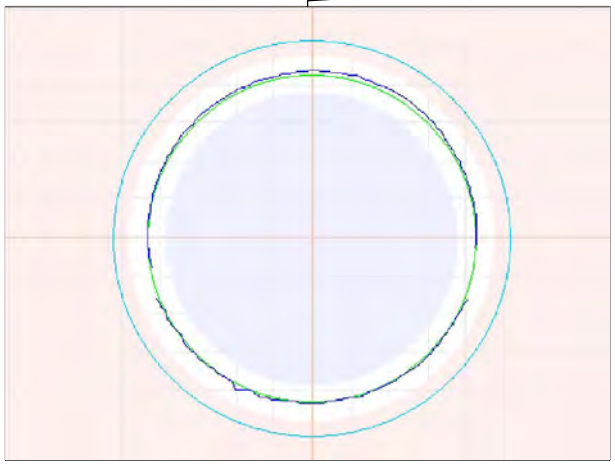
500ft General Observation - Corrosion to 0.6"



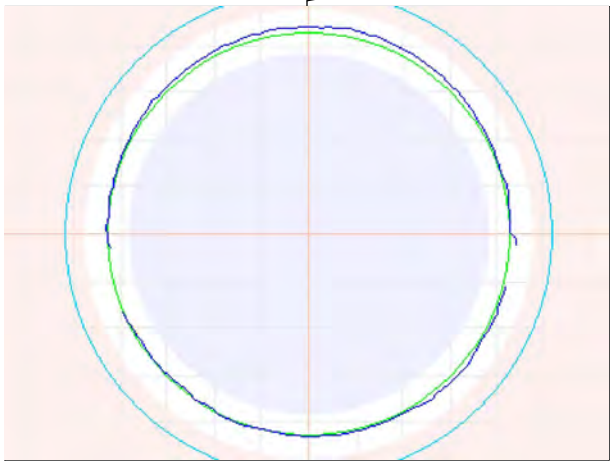
524.9ft General Observation - Corrosion to 0.7"



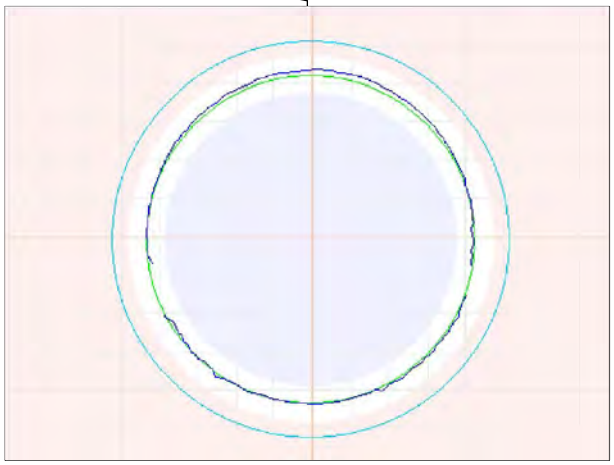




550ft General Observation - Corrosion to 0.6"



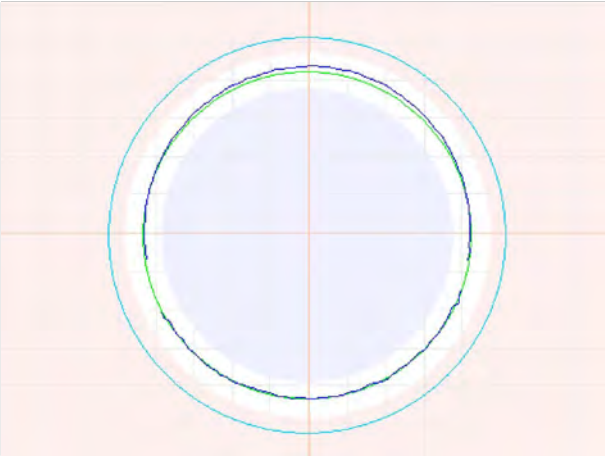
574.9ft General Observation - Corrosion to 0.9"



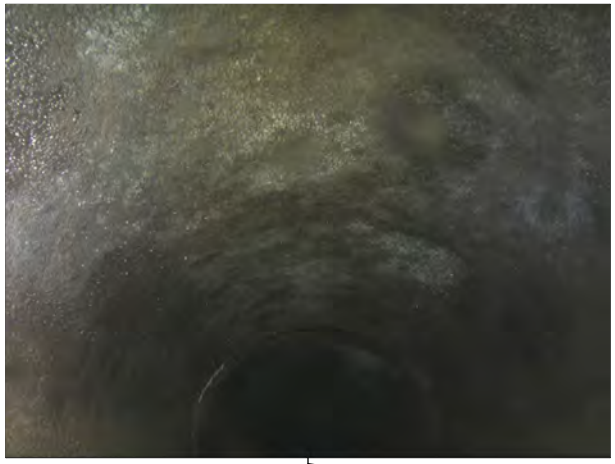
599.7ft Maximum Corrosion - To 0.9"

Observation Report

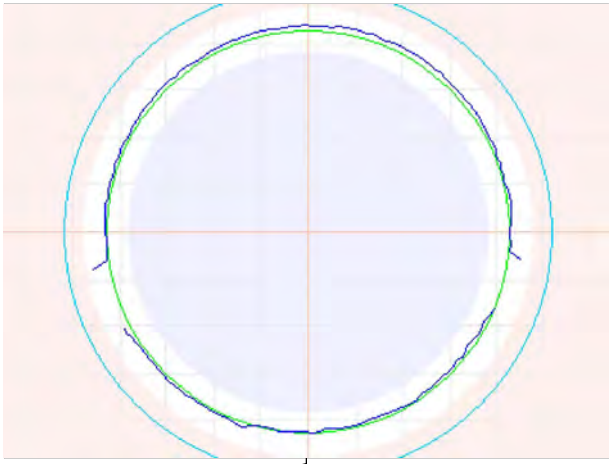
599.9ft General Observation - Corrosion to 0.7"

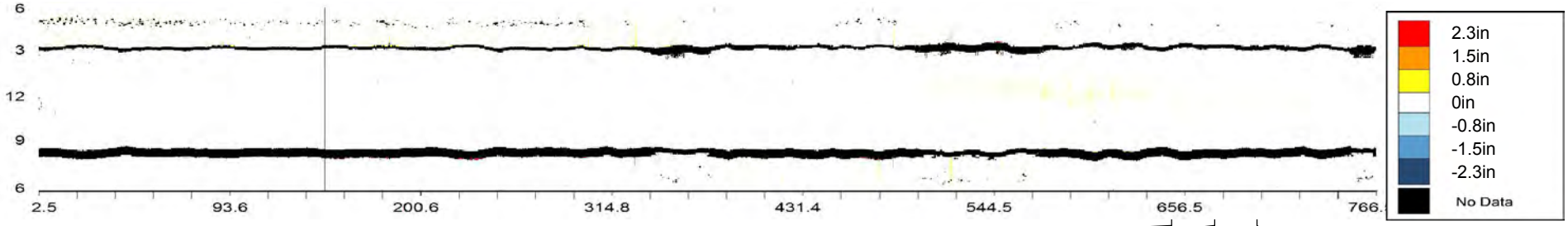


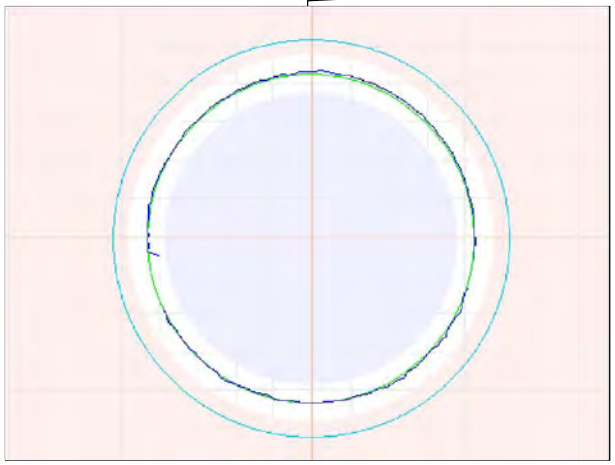
599.9ft General Observation - Corrosion to 0.7"



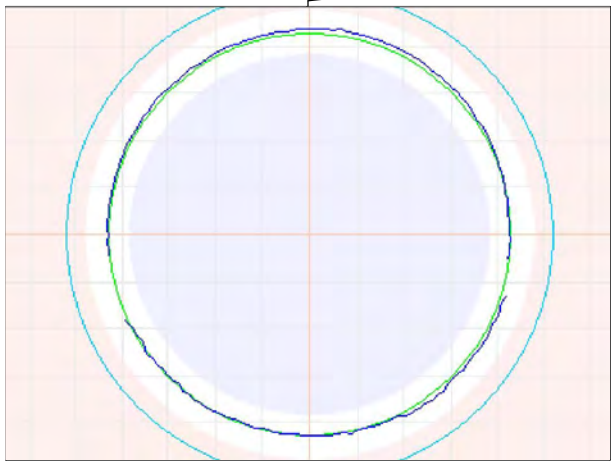
624.9ft General Observation - Corrosion to 0.7"\Debris to 0.3"



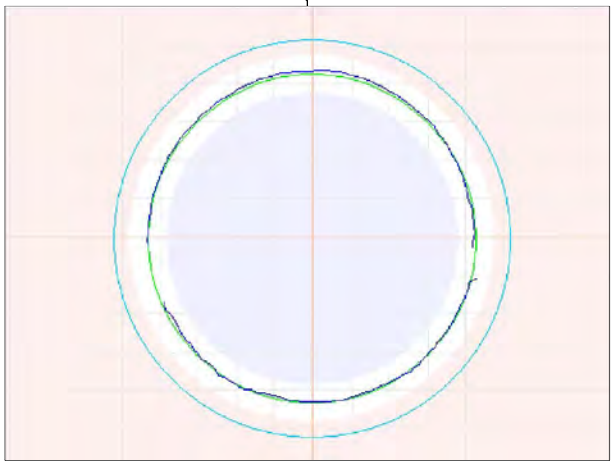




649.7ft General Observation - Corrosion to 0.7"



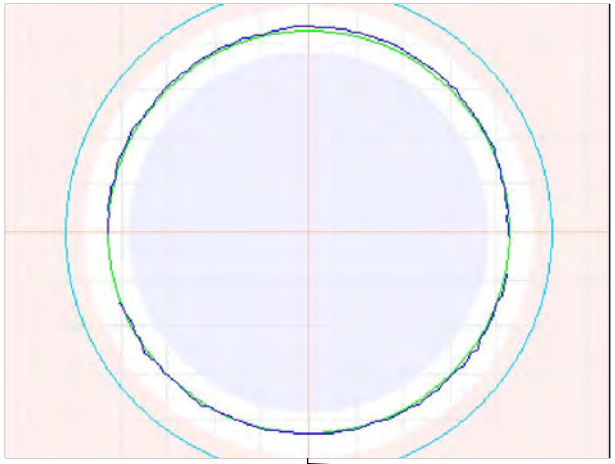
674.8ft General Observation - Corrosion to 0.7"



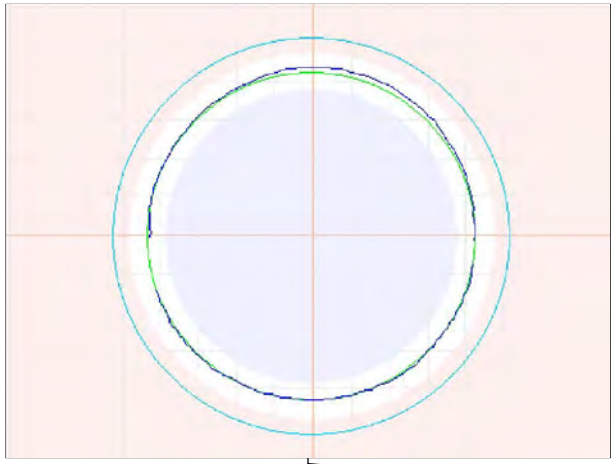
699.7ft General Observation - Corrosion to 0.6"

Observation Report

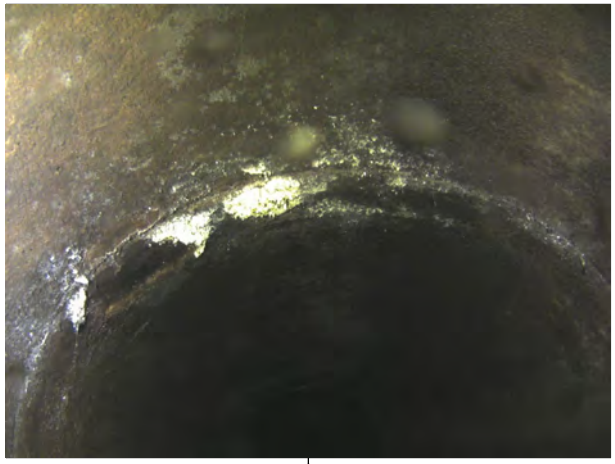
724.8ft General Observation - Corrosion to 0.6"

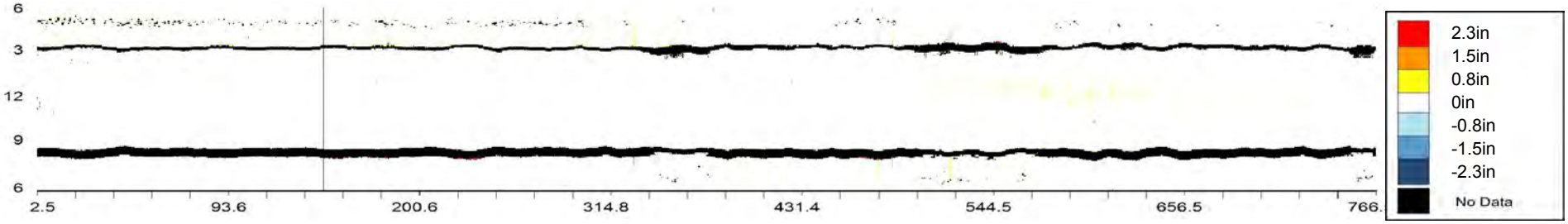


749.7ft General Observation - Corrosion to 0.8"



749.7ft General Observation - Corrosion to 0.8"





OVERVIEW - CMH000290 - CMH000286

Asset Number	CMH000290 - CMH000286		
Upstream MH	CMH000290	Material	Reinforced Concrete Pipe
Downstream MH	CMH000286	Size & Shape	42 in Circle
Survey Direction	Downstream	Match to Reference	159.7 ft

Distance	Observation	Comment
4.7 ft	**Beginning of Inspection**	**CMH000290**
6.1	General Observation	Corrosion to 0.6", Debris to 1.2"
25	General Observation	Corrosion to 0.4"
50.1	General Observation	Corrosion to 0.7"
75	General Observation	Corrosion to 0.4"
100.1	General Observation	Corrosion to 0.5"
125	General Observation	Corrosion to 0.8"
125.5	Point of Interest	Lateral
149.8	General Observation	Debris to 1.0"
159.7	Match to Reference Shape and Size	ø42"
174.9	General Observation	Corrosion to 0.3"
199.8	General Observation	Corrosion to 0.8"
224.9	General Observation	Corrosion to 0.6"
249.9	General Observation	Corrosion to 0.6"
274.9	General Observation	Corrosion to 0.4"
300	General Observation	Corrosion to 0.6"
324.9	General Observation	Corrosion to 0.3"
350	General Observation	Corrosion to 0.6"
374.9	General Observation	Corrosion to 0.4"
377.1	3D Laser Sonar Scan	Internal pipe overview
399.8	General Observation	
424.9	General Observation	Corrosion to 0.5"
443.3	Maximum Debris	To 2.5"
449.8	General Observation	Corrosion to 0.6"
462.1	Maximum Corrosion	To 0.9"

OVERVIEW - CMH000290 - CMH000286

Asset Number	CMH000290 - CMH000286		
Upstream MH	CMH000290	Material	Reinforced Concrete Pipe
Downstream MH	CMH000286	Size & Shape	42 in Circle
Survey Direction	Downstream	Match to Reference	159.7 ft

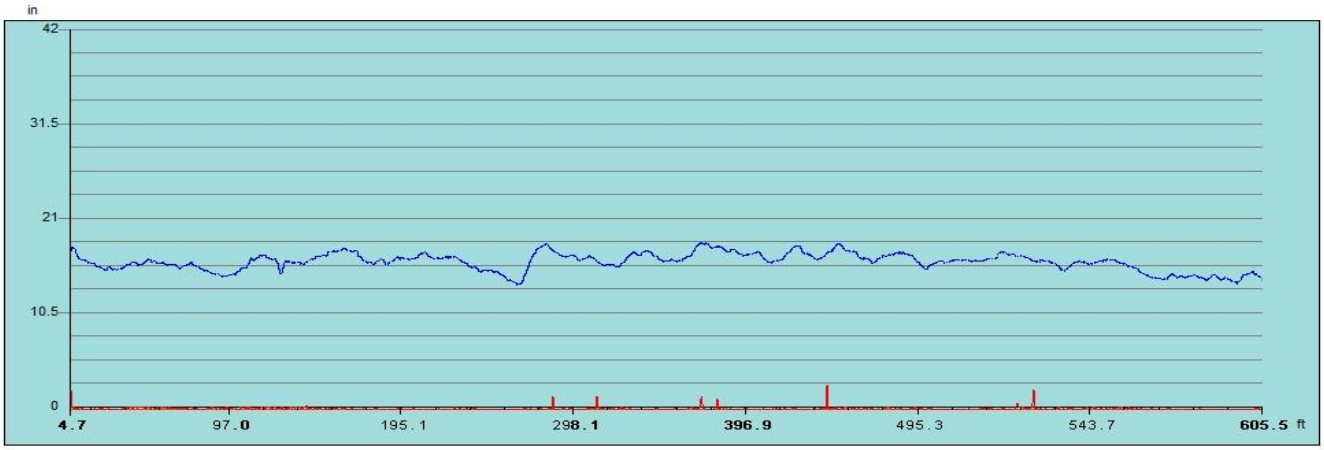
Distance	Observation	Comment
474.9	General Observation	Corrosion to 0.6"
499.9	General Observation	Corrosion to 0.5"
524.9	General Observation	Corrosion to 0.5"
549.8	General Observation	
574.8	General Observation	Corrosion to 0.5"
599.7	General Observation	Corrosion to 0.5"
605.3 ft	**End of Inspection**	**CMH000286**

CMH000290 - CMH000286			
Asset Number	CMH000290 - CMH000286	Length	606 ft
Upstream MH	CMH000290	Diameter	42 in
Downstream MH	CMH000286	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	159.7 ft
Date Profiled	15 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	16 in
Debris Volume	1 cubic feet

Debris Graph



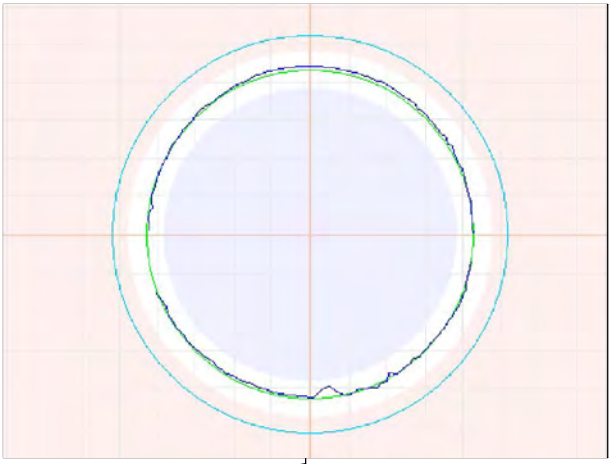
Inspection Distance (ft)

Water Level Debris Level

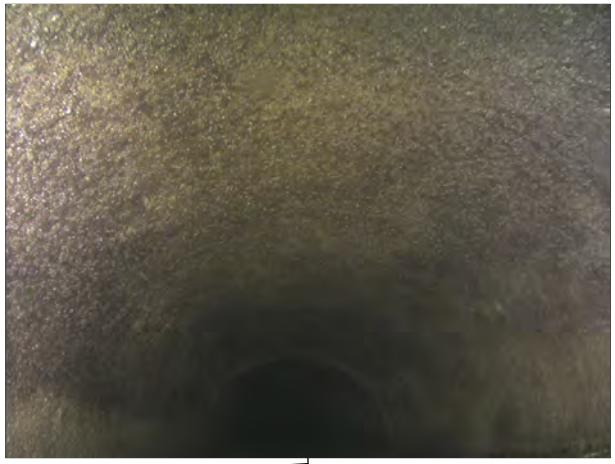
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

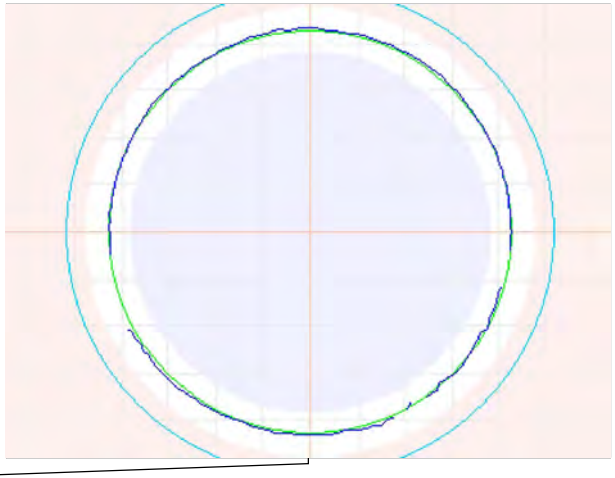
6.1ft General Observation - Corrosion to 0.6", Debris to 1.2"

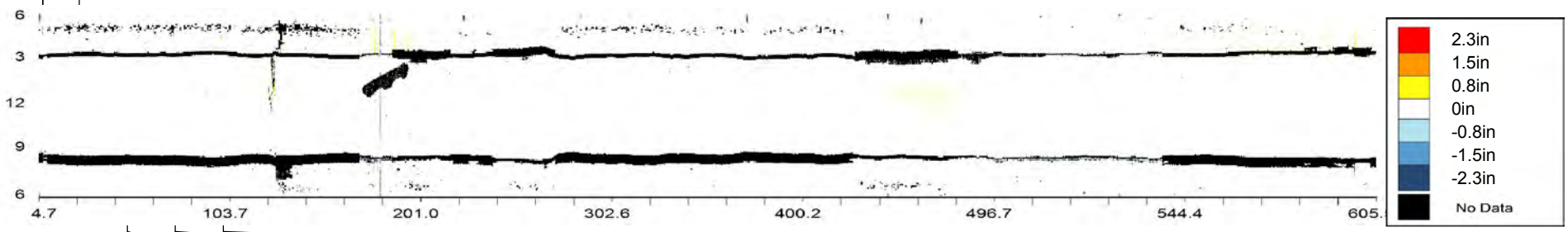


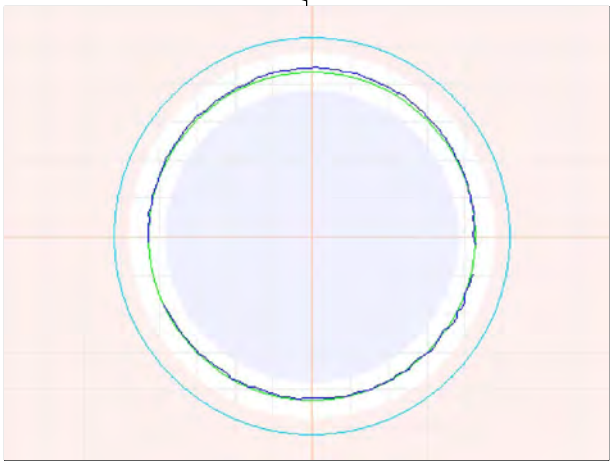
6.1ft General Observation - Corrosion to 0.6", Debris to 1.2"



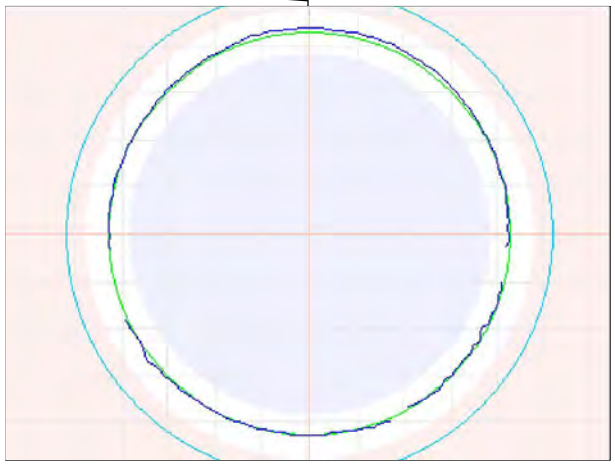
25ft General Observation - Corrosion to 0.4"



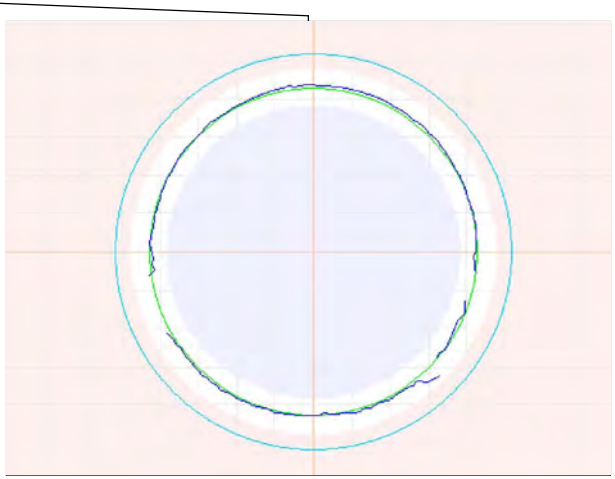




50.1ft General Observation - Corrosion to 0.7"



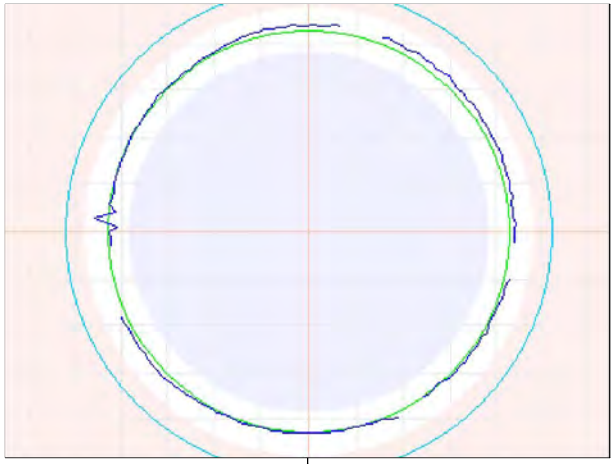
75ft General Observation - Corrosion to 0.4"



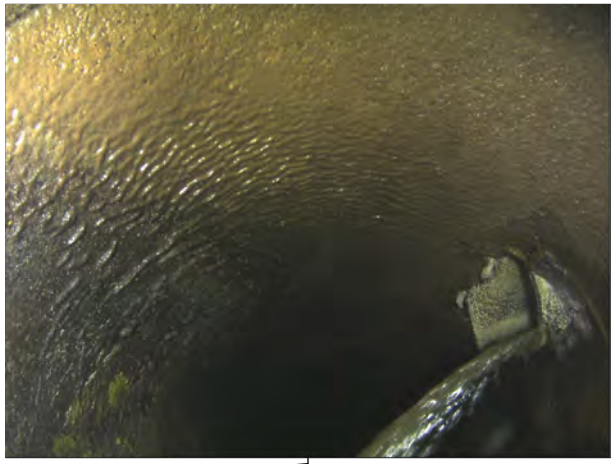
100.1ft General Observation - Corrosion to 0.5"

Observation Report

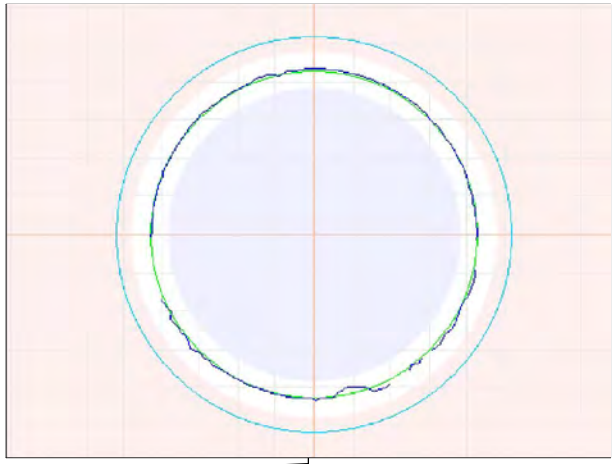
125ft General Observation - Corrosion to 0.8"

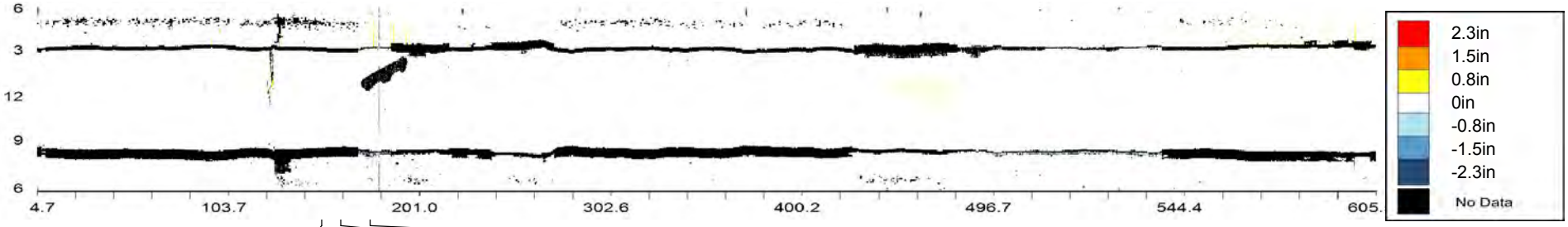


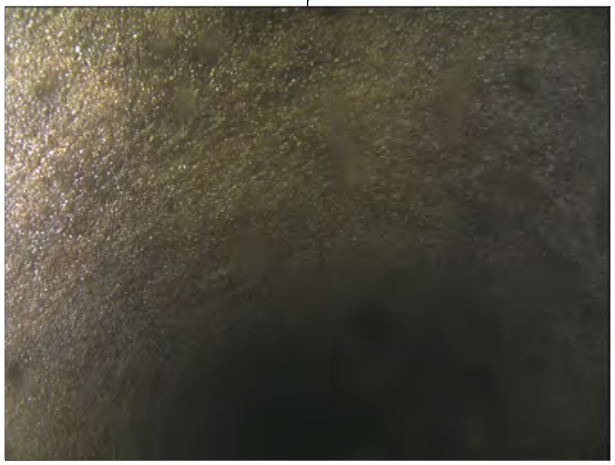
125.5ft Point of Interest - Lateral



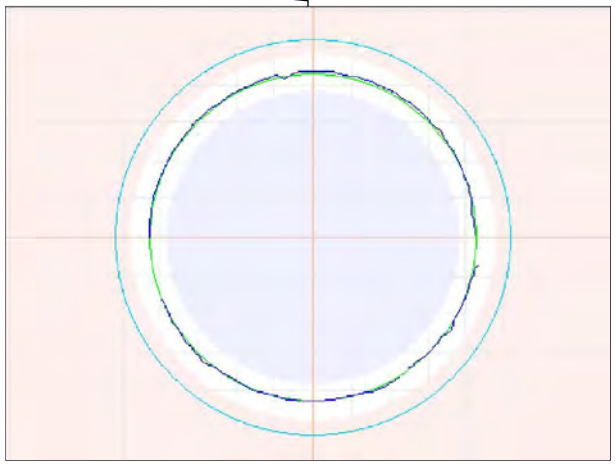
149.8ft General Observation - Debris to 1.0"



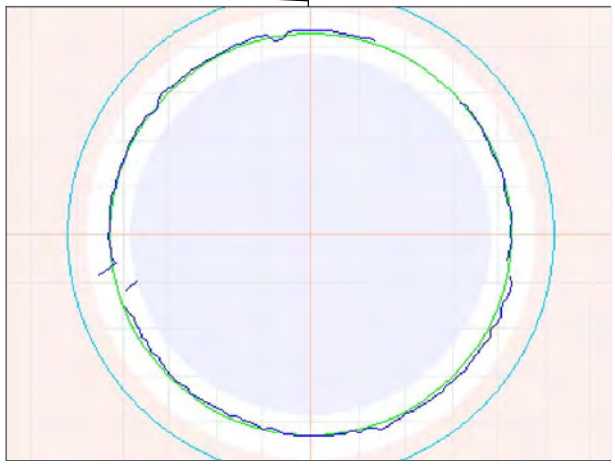




149.8ft General Observation - Debris to 1.0"



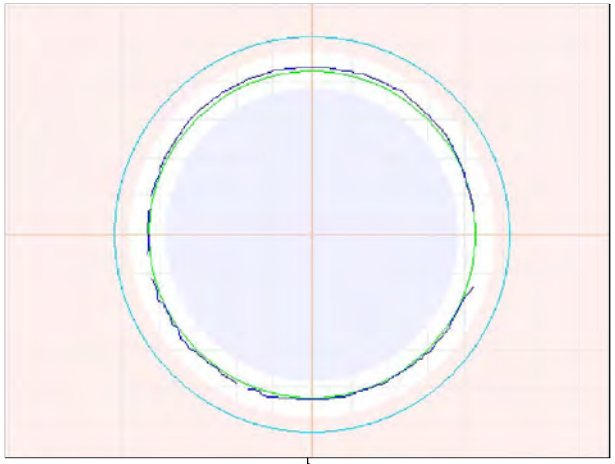
159.7ft Match to Reference Shape and Size - ø42"



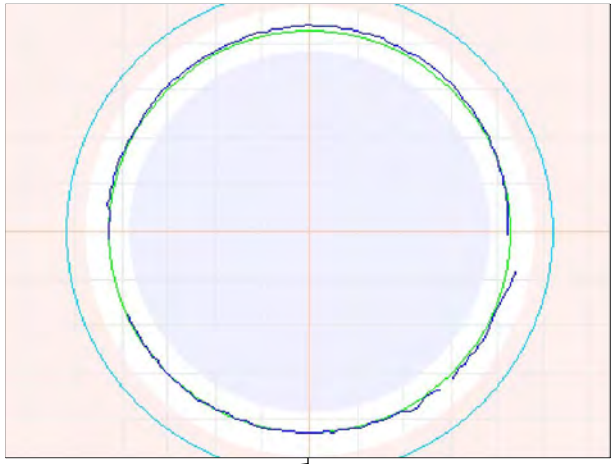
174.9ft General Observation - Corrosion to 0.3"

Observation Report

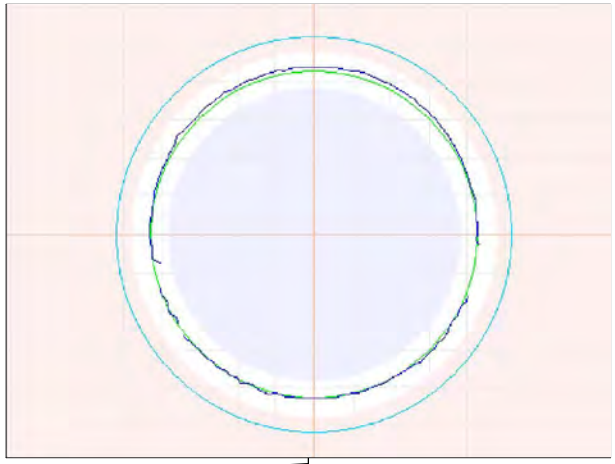
199.8ft General Observation - Corrosion to 0.8"

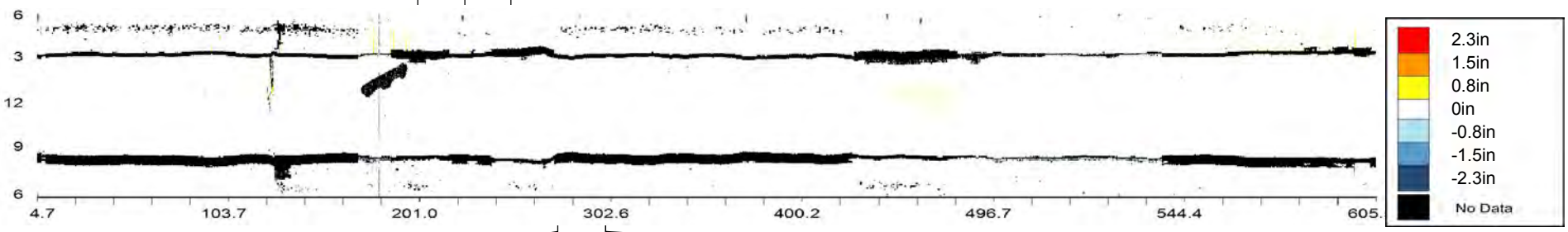


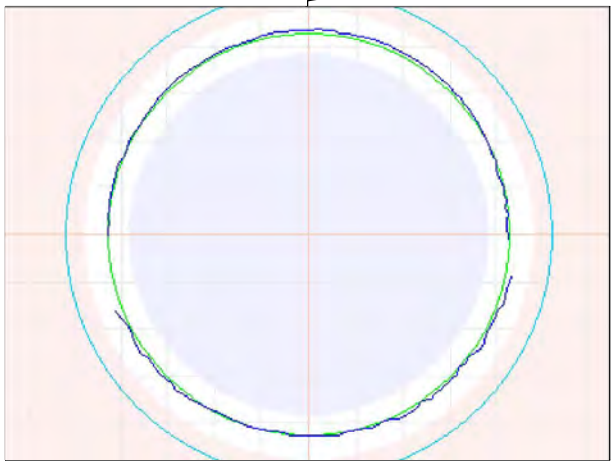
224.9ft General Observation - Corrosion to 0.6"



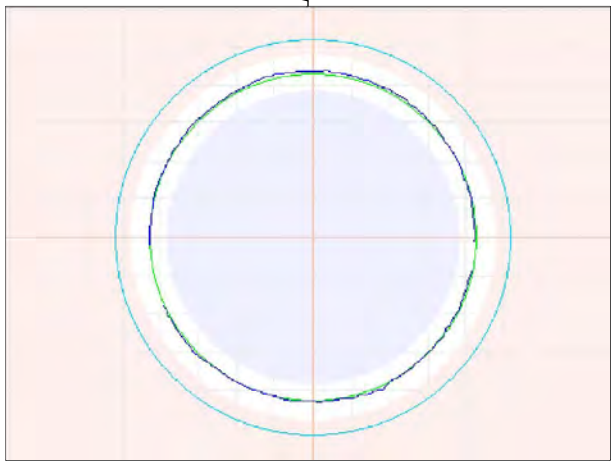
249.9ft General Observation - Corrosion to 0.6"







274.9ft General Observation - Corrosion to 0.4"

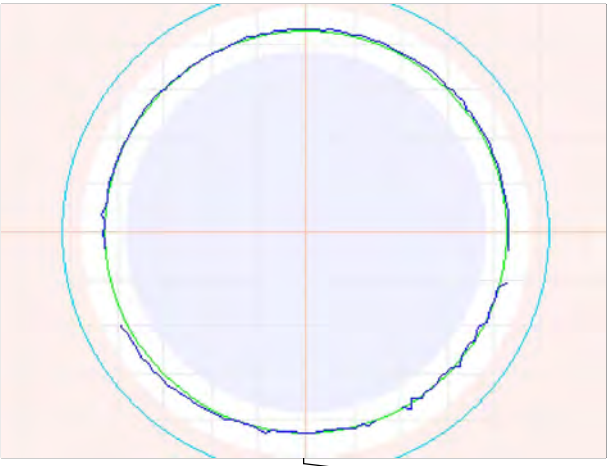


300ft General Observation - Corrosion to 0.6"

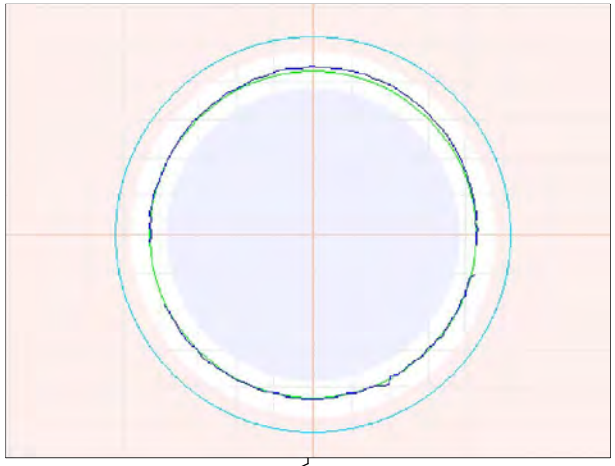
300ft General Observation - Corrosion to 0.6"

Observation Report

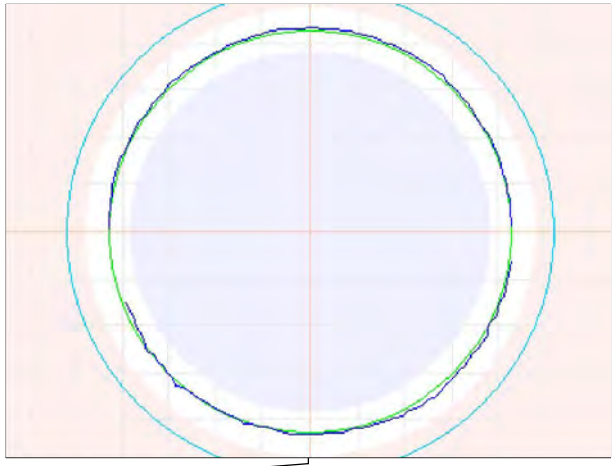
324.9ft General Observation - Corrosion to 0.3"

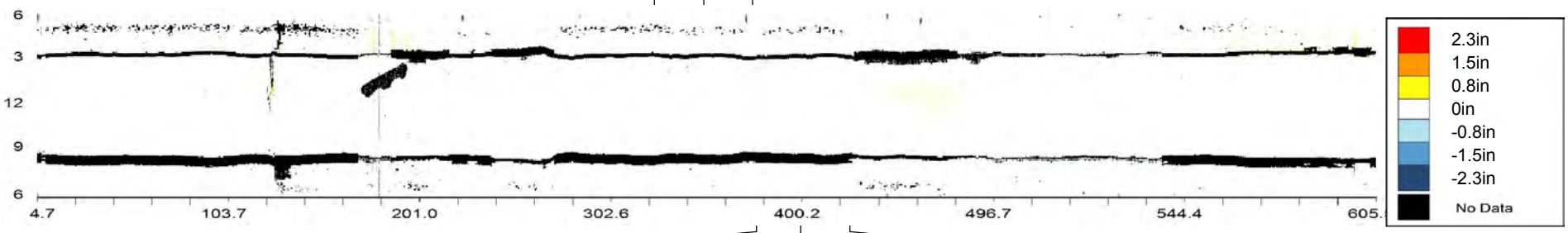


350ft General Observation - Corrosion to 0.6"

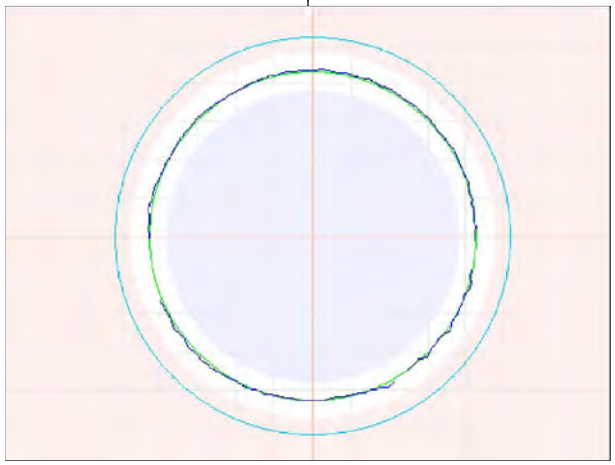


374.9ft General Observation - Corrosion to 0.4"

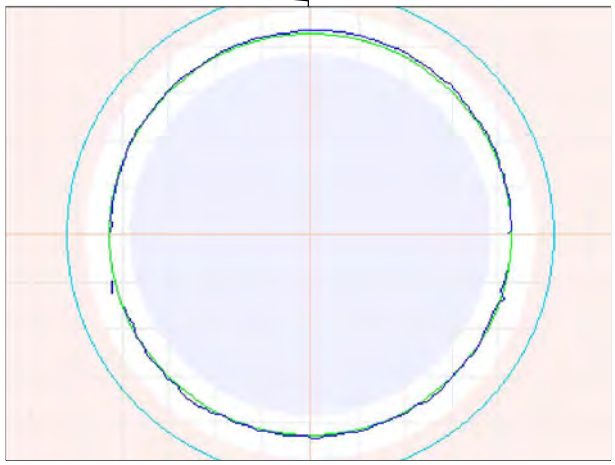




377.1ft 3D Laser Sonar Scan - Internal pipe overview



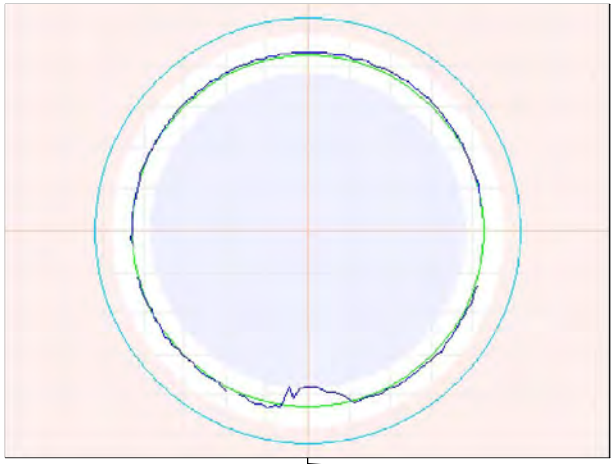
399.8ft General Observation



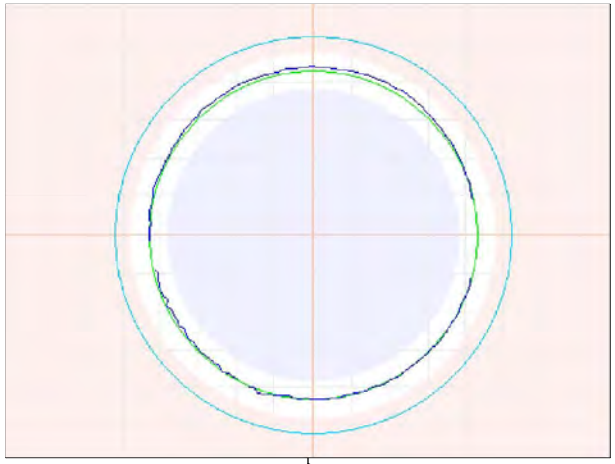
424.9ft General Observation - Corrosion to 0.5"

Observation Report

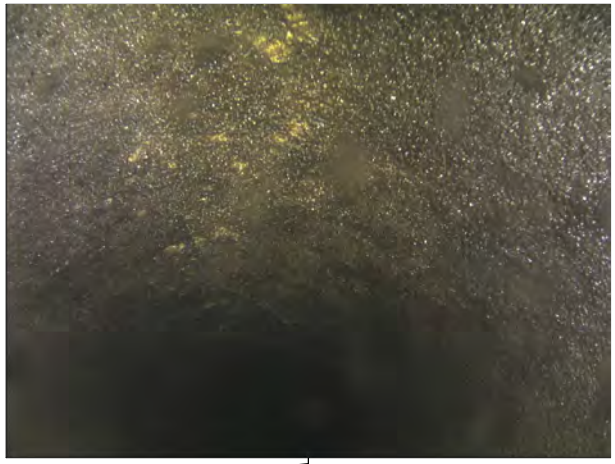
443.3ft Maximum Debris - To 2.5"

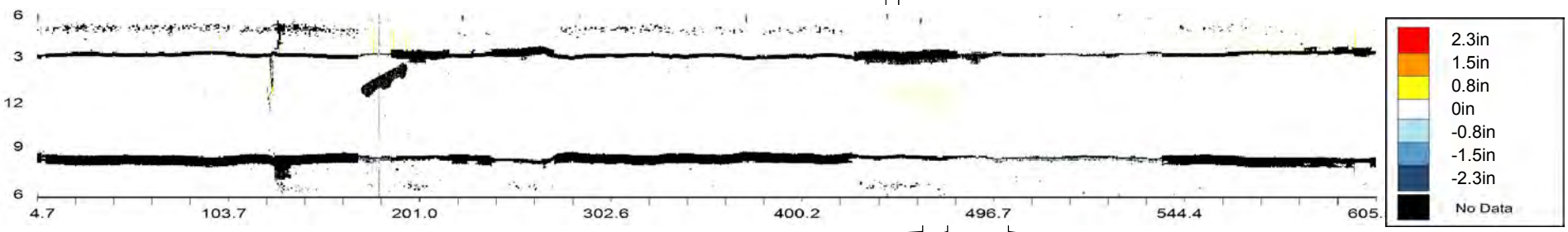


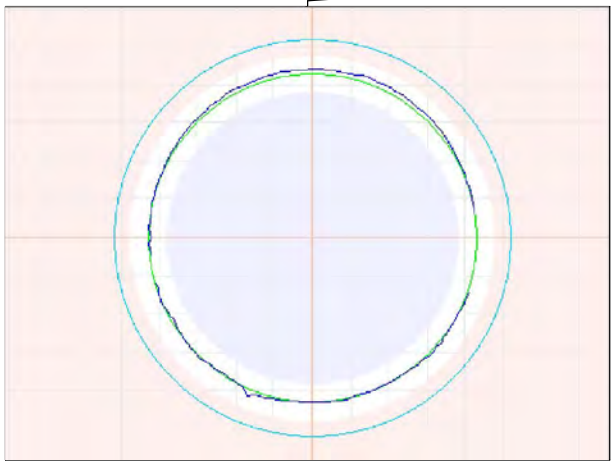
449.8ft General Observation - Corrosion to 0.6"



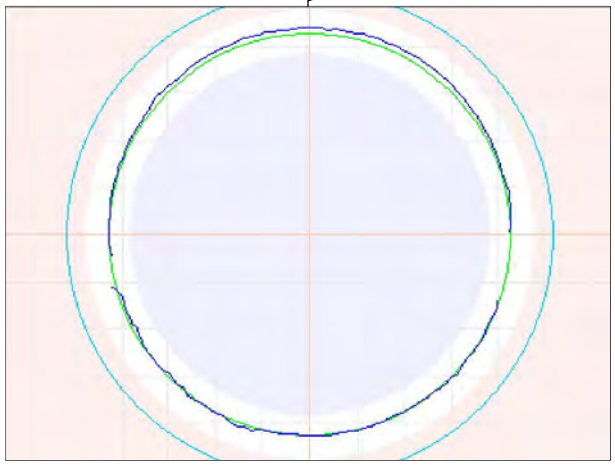
449.8ft General Observation - Corrosion to 0.6"



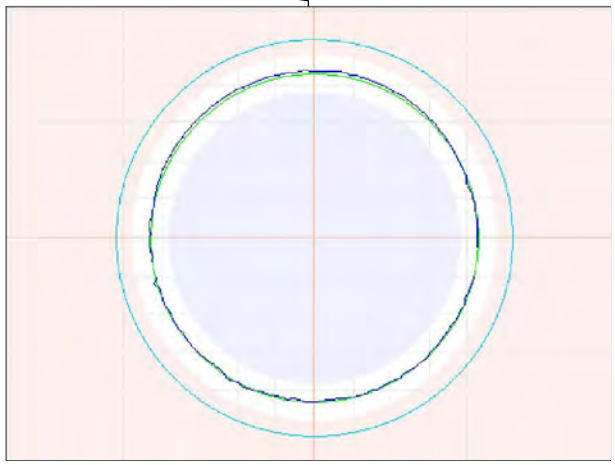




462.1ft Maximum Corrosion - To 0.9"



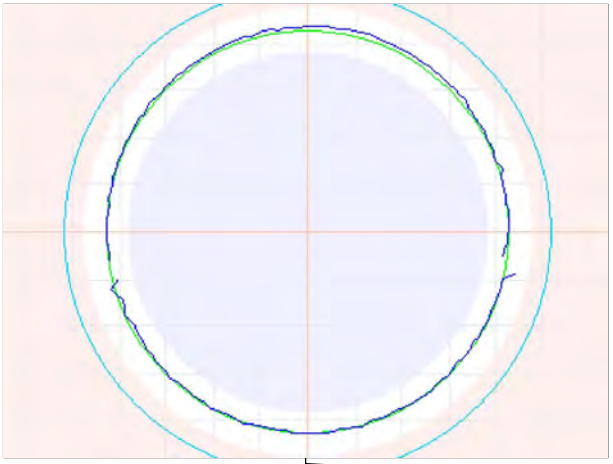
474.9ft General Observation - Corrosion to 0.6"



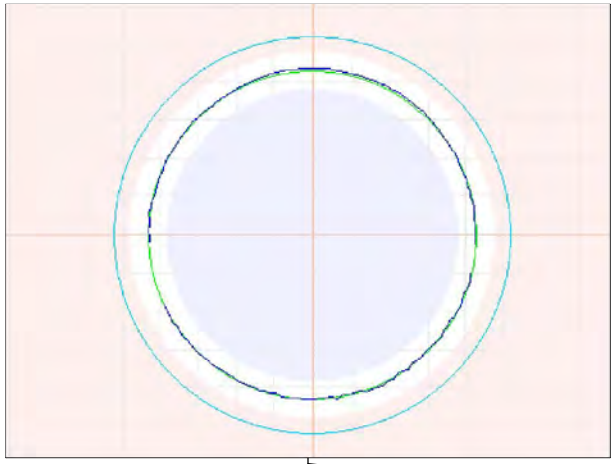
499.9ft General Observation - Corrosion to 0.5"

Observation Report

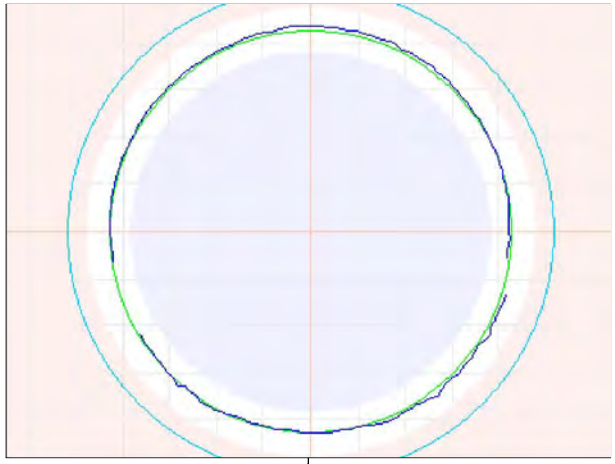
524.9ft General Observation - Corrosion to 0.5"

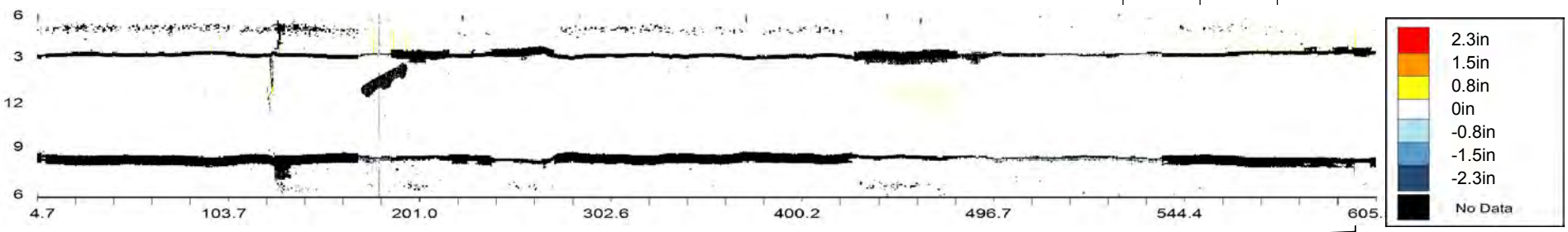


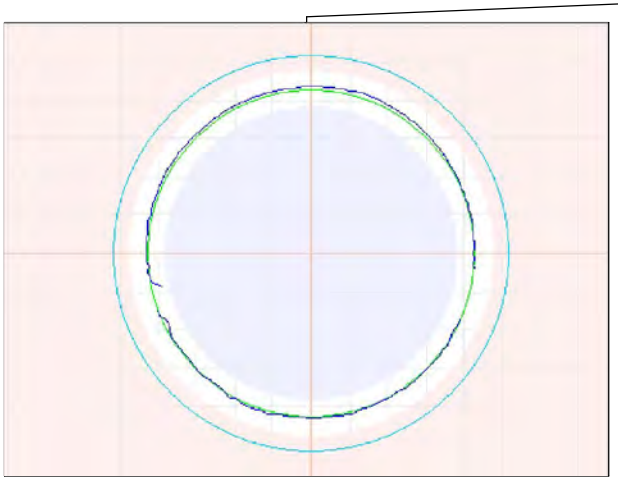
549.8ft General Observation



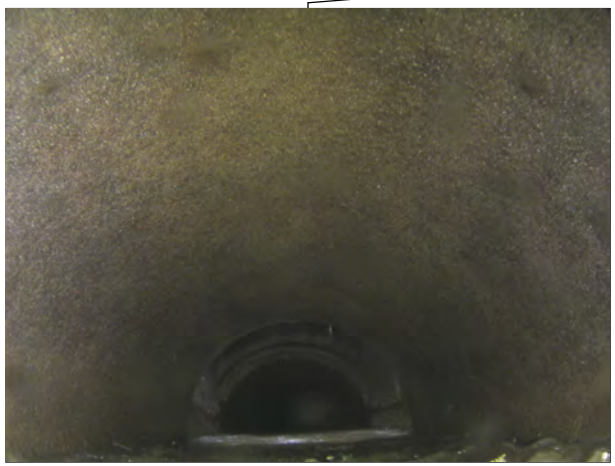
574.8ft General Observation - Corrosion to 0.5"







599.7ft General Observation - Corrosion to 0.5"



599.7ft General Observation - Corrosion to 0.5"

OVERVIEW - CMH000294 - CMH000290

Asset Number	CMH000294 - CMH000290		
Upstream MH	CMH000294	Material	Reinforced Concrete Pipe
Downstream MH	CMH000290	Size & Shape	42 in Circle
Survey Direction	Downstream	Match to Reference	358.4 ft

Distance	Observation	Comment
4.1 ft	**Beginning of Inspection**	**CMH000294**
7.5	General Observation	Corrosion to 1.2", Debris to 1.0"
7.7	Maximum Corrosion	To 1.7"
25	General Observation	Corrosion to 0.4"\Debris to 0.9"
50.1	General Observation	Corrosion to 0.8", Debris to 0.6"
75	General Observation	Corrosion to 0.6"\Debris to 0.3"
100	General Observation	
125.1	General Observation	Corrosion to 0.4"\Debris to 0.4"
149.9	General Observation	
175	General Observation	Corrosion to 0.5"\Debris to 0.2"
200.1	General Observation	Corrosion to 0.6"
225	General Observation	Corrosion to 0.4"\Debris to 0.5"
250	General Observation	Corrosion to 0.5", Debris to 0.7"
274.9	General Observation	Corrosion to 0.4"\Debris to 1.0"
300	General Observation	Corrosion to 0.5"
325	General Observation	Corrosion to 0.4"\Debris to 0.4"
342.8	Maximum Debris	To 2.8"
349.9	General Observation	Debris to 2.2"
350.5	3D Laser Scan	Internal pipe overview
350.5	3D Laser Sonar Scan	Debris
358.4	Match to Reference Shape and Size	ø42"
374.9	General Observation	Corrosion to 0.6"
400	General Observation	Corrosion to 0.5"
424.9	General Observation	Corrosion to 0.5"
449.7	General Observation	Corrosion to 0.5"

OVERVIEW - CMH000294 - CMH000290

Asset Number	CMH000294 - CMH000290		
Upstream MH	CMH000294	Material	Reinforced Concrete Pipe
Downstream MH	CMH000290	Size & Shape	42 in Circle
Survey Direction	Downstream	Match to Reference	358.4 ft

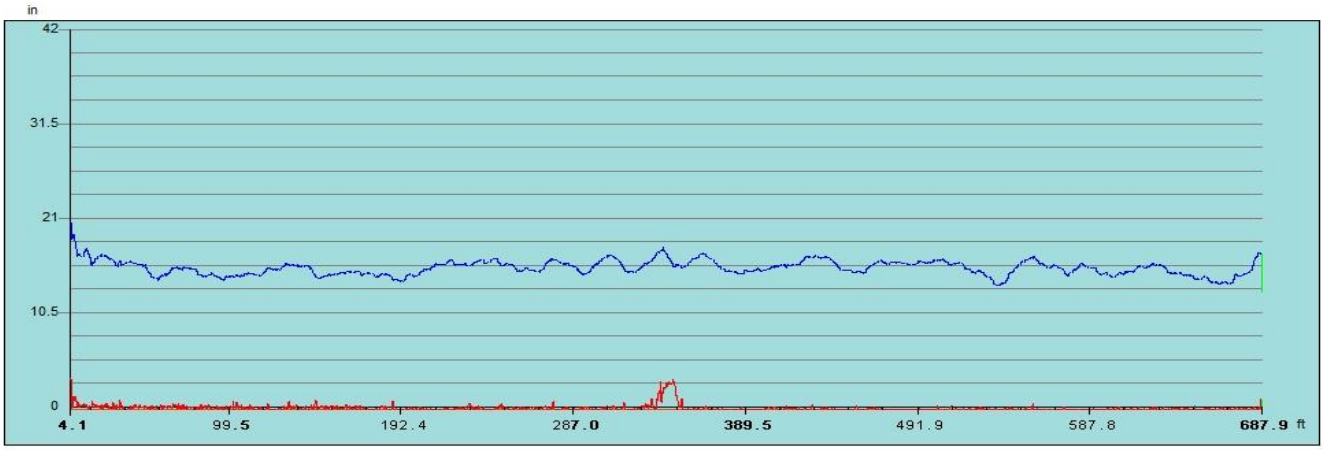
Distance	Observation	Comment
449.7	General Observation	Corrosion to 0.5"
474.9	General Observation	Corrosion to 0.7"
499.8	General Observation	Corrosion to 0.5"
524.9	General Observation	Corrosion to 0.3"\Debris to 0.7"
549.7	General Observation	
574.9	General Observation	Corrosion to 0.6"
599.9	General Observation	Corrosion to 0.5"
624.8	General Observation	Corrosion to 0.4"
649.9	General Observation	
674.9	General Observation	Corrosion to 0.3"
686.8	General Observation	
687.7 ft	**End of Inspection**	**CMH000290**

CMH000294 - CMH000290			
Asset Number	CMH000294 - CMH000290	Length	688 ft
Upstream MH	CMH000294	Diameter	42 in
Downstream MH	CMH000290	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	358.4 ft
Date Profiled	15 July 2013	Operator	

Observations

Average Debris Depth	0 in
Average Water Level	16 in
Debris Volume	2 cubic feet

Debris Graph



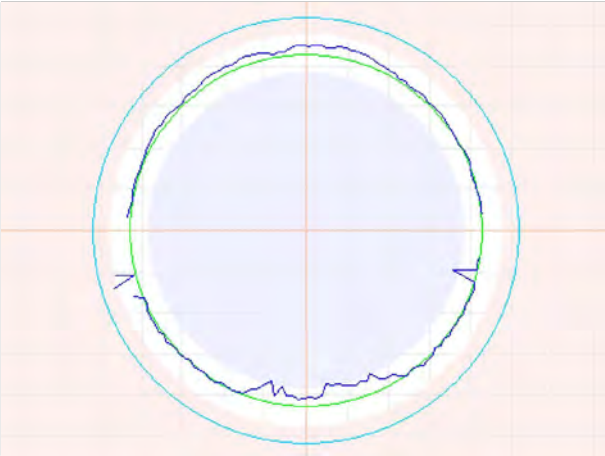
Inspection Distance (ft)

Water Level — Debris Level

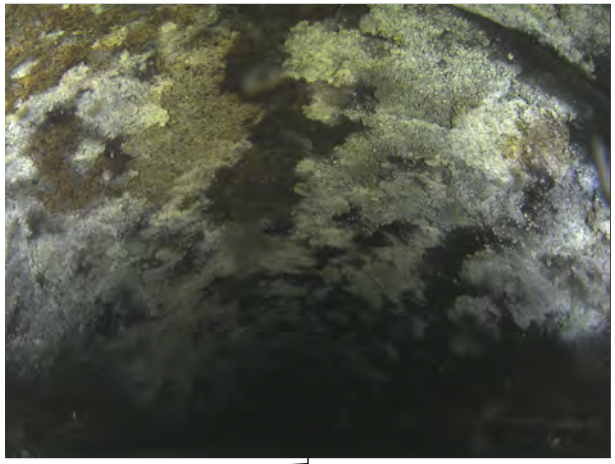
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

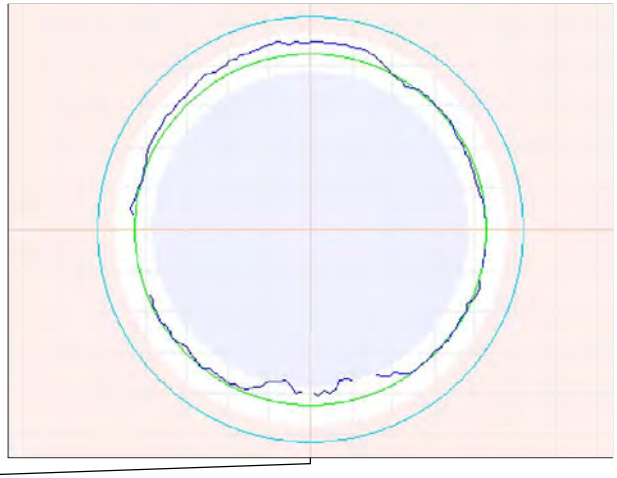
7.5ft General Observation - Corrosion to 1.2", Debris to 1.0"

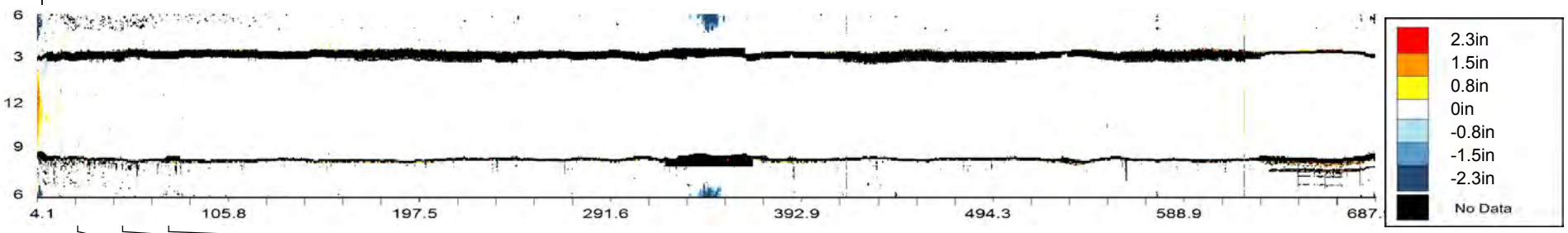


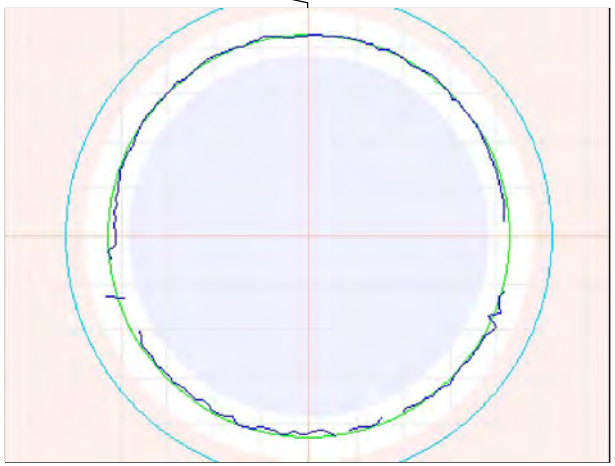
7.5ft General Observation - Corrosion to 1.2", Debris to 1.0"



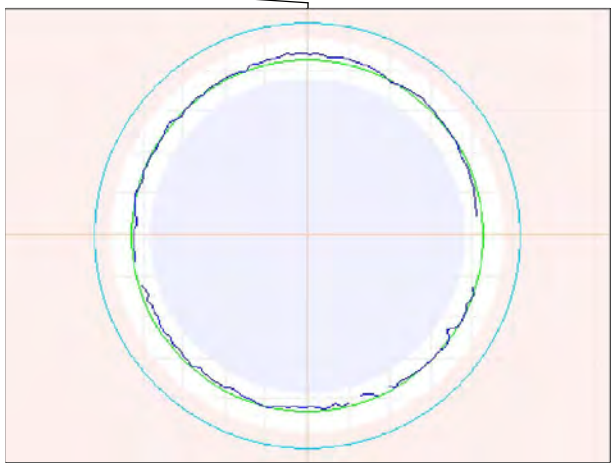
7.7ft Maximum Corrosion - To 1.7"



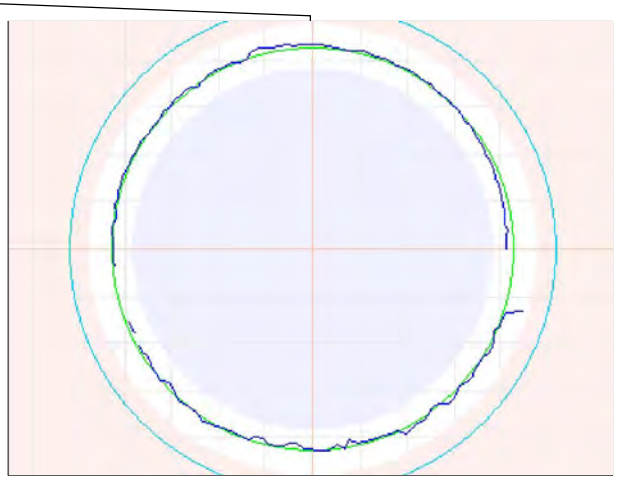




25ft General Observation - Corrosion to 0.4"\Debris to 0.9"



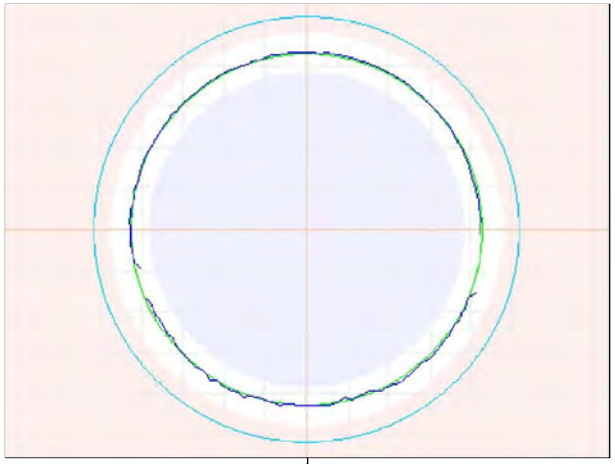
50.1ft General Observation - Corrosion to 0.8", Debris to 0.6"



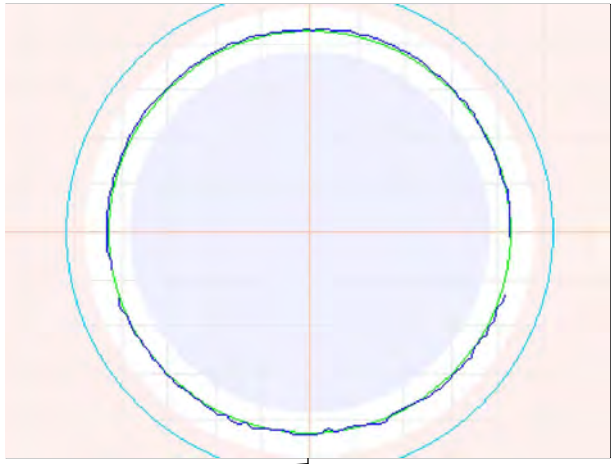
75ft General Observation - Corrosion to 0.6"\Debris to 0.3"

Observation Report

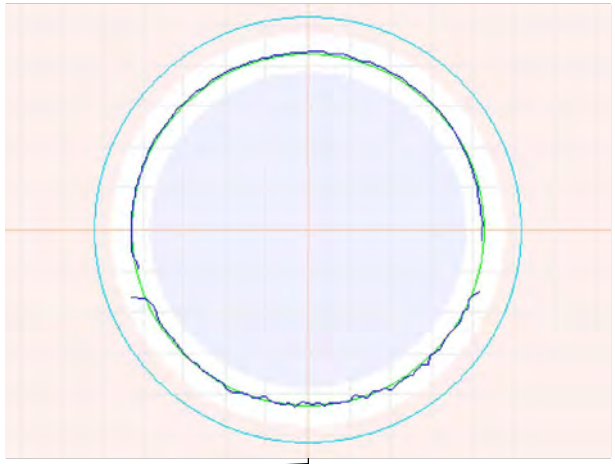
100ft General Observation

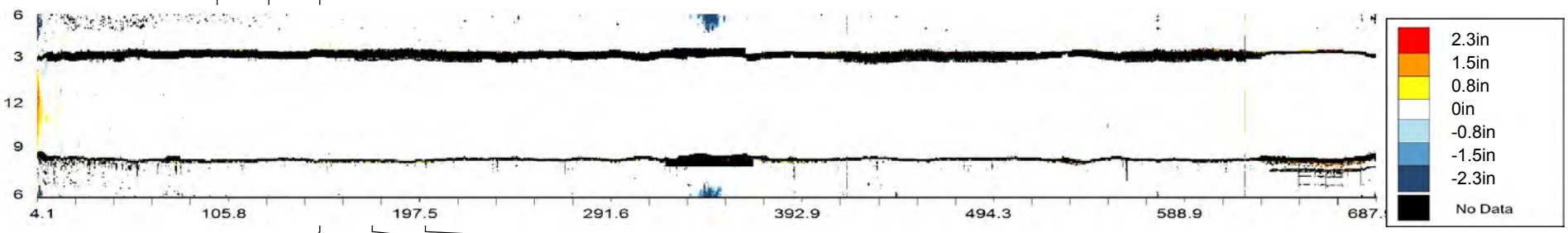


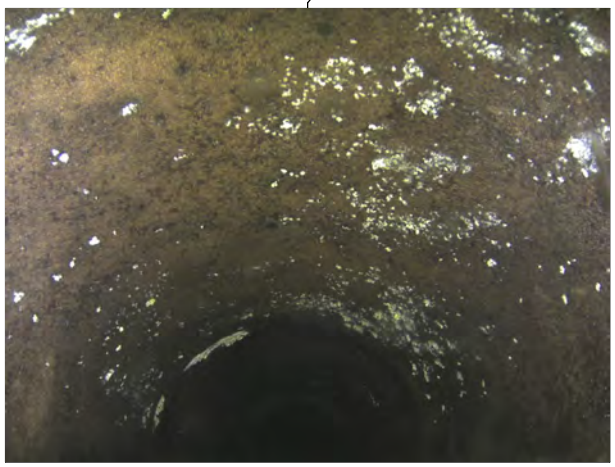
125.1ft General Observation - Corrosion to 0.4"\Debris to 0.4"



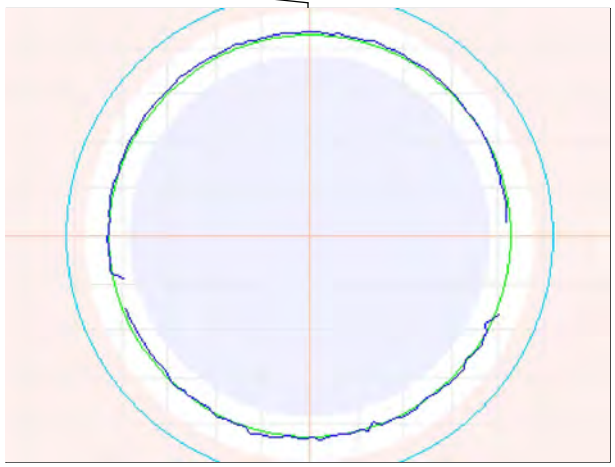
149.9ft General Observation



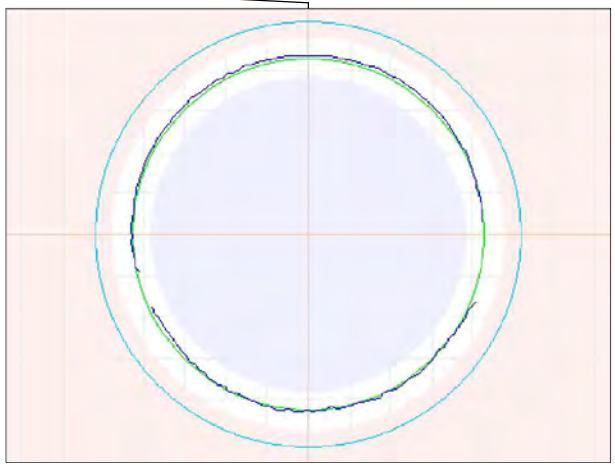




149.9ft General Observation



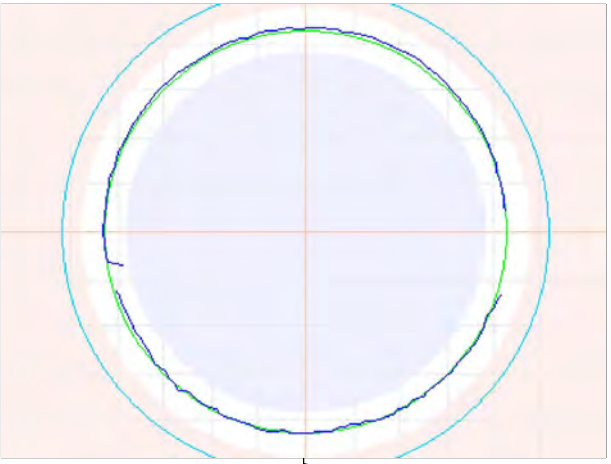
175ft General Observation - Corrosion to 0.5"\Debris to 0.2"



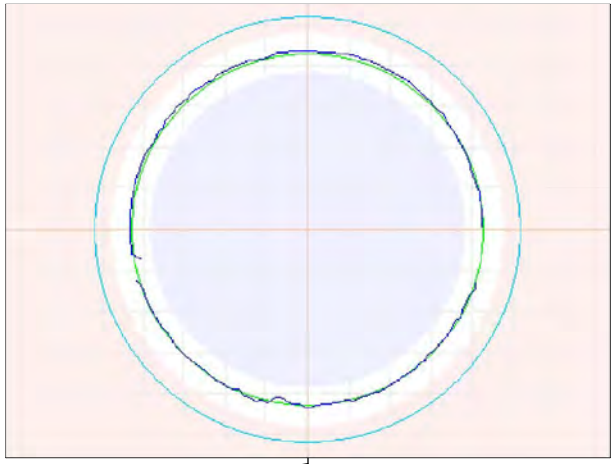
200.1ft General Observation - Corrosion to 0.6"

Observation Report

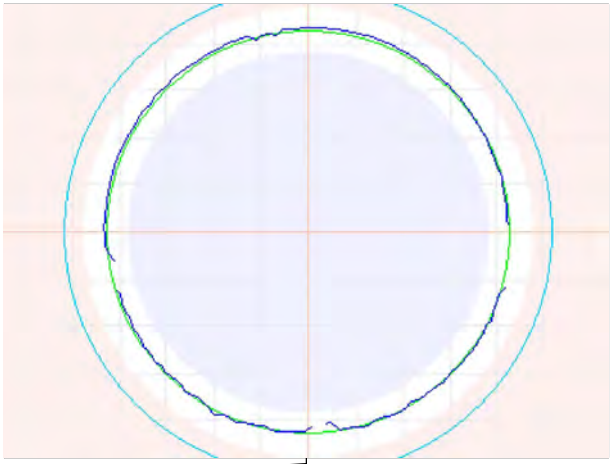
225ft General Observation - Corrosion to 0.4"\Debris to 0.5"

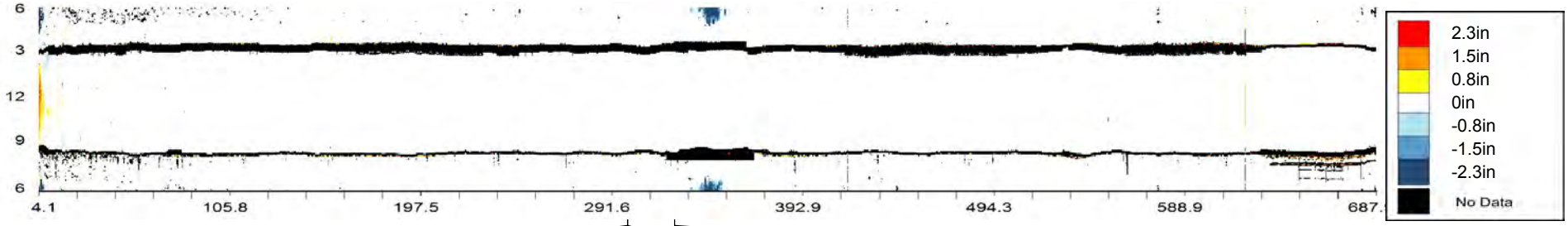


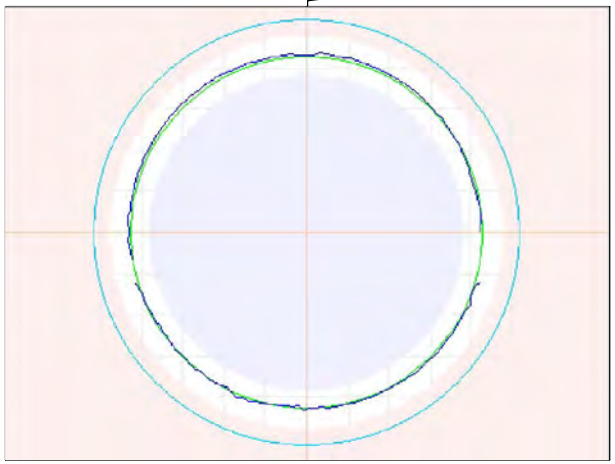
250ft General Observation - Corrosion to 0.5", Debris to 0.7"



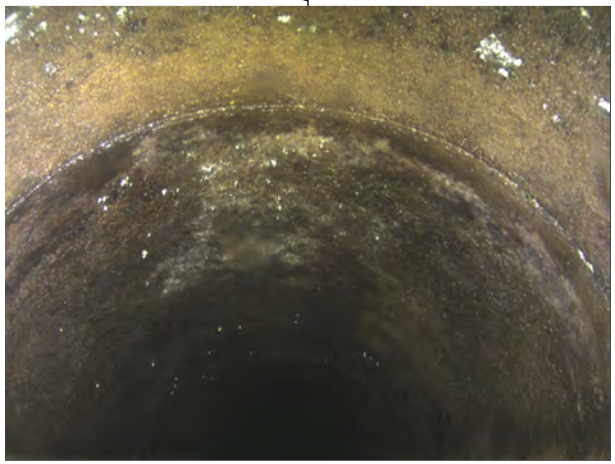
274.9ft General Observation - Corrosion to 0.4"\Debris to 1.0"



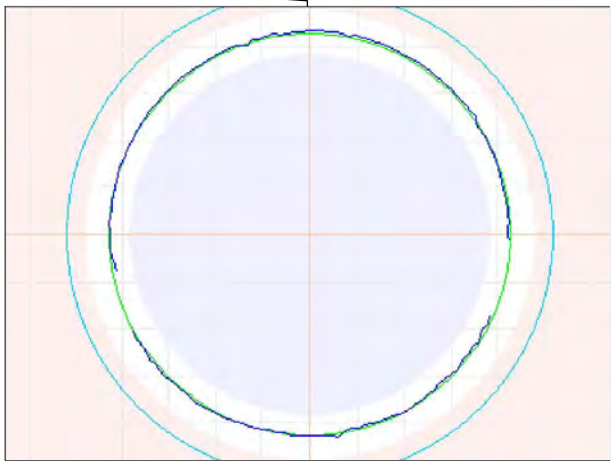




300ft General Observation - Corrosion to 0.5"



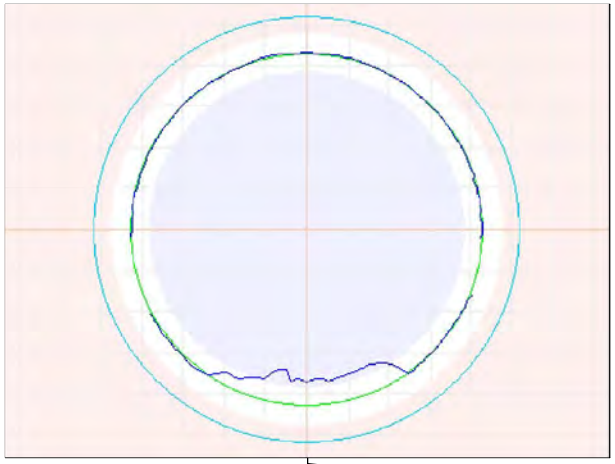
300ft General Observation - Corrosion to 0.5"



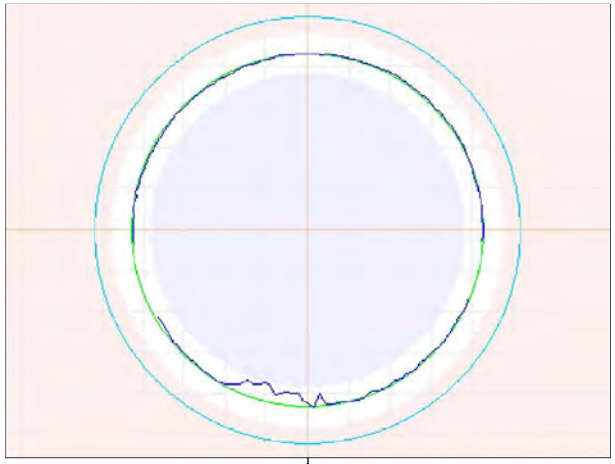
325ft General Observation - Corrosion to 0.4"\Debris to 0.4"

Observation Report

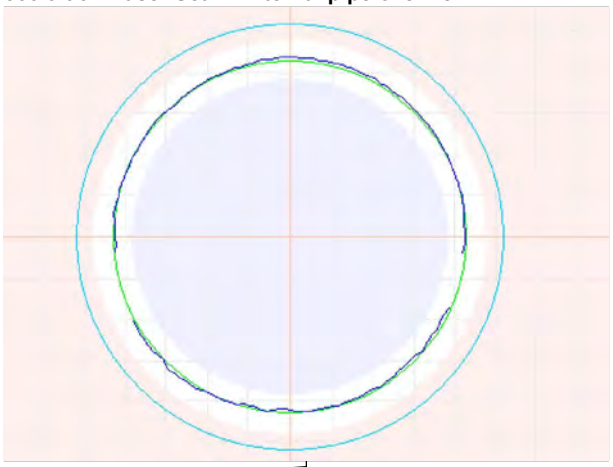
342.8ft Maximum Debris - To 2.8"

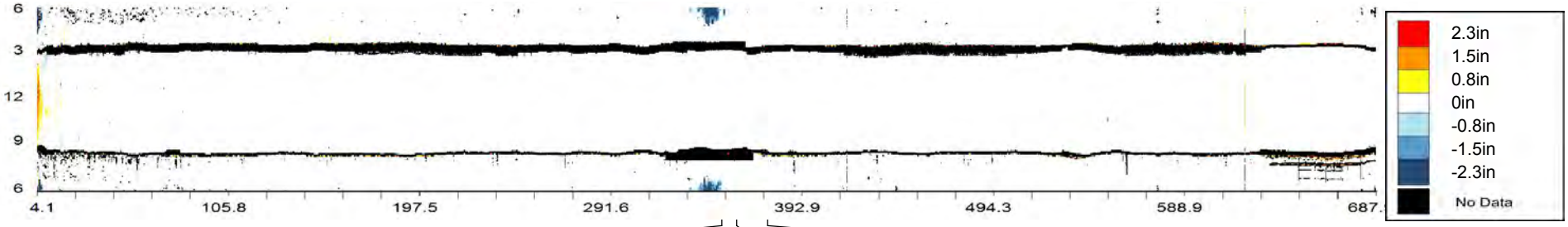


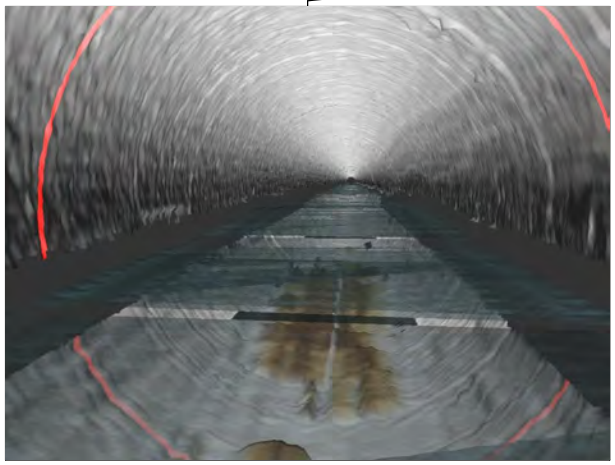
349.9ft General Observation - Debris to 2.2"



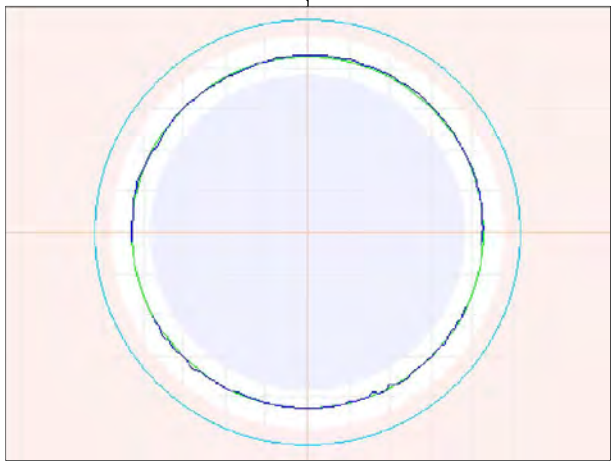
350.5ft 3D Laser Scan - Internal pipe overview



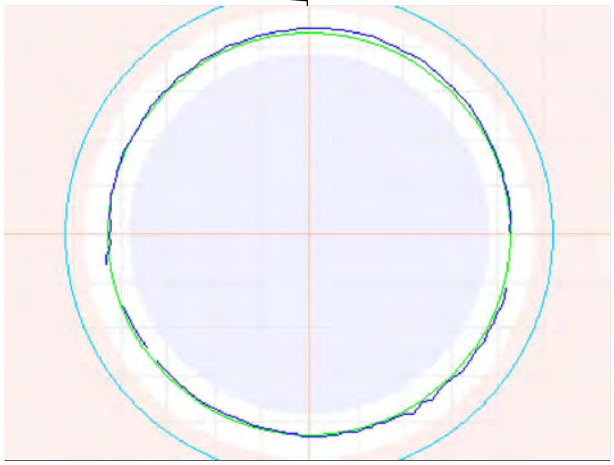




350.5ft 3D Laser Sonar Scan - Debris



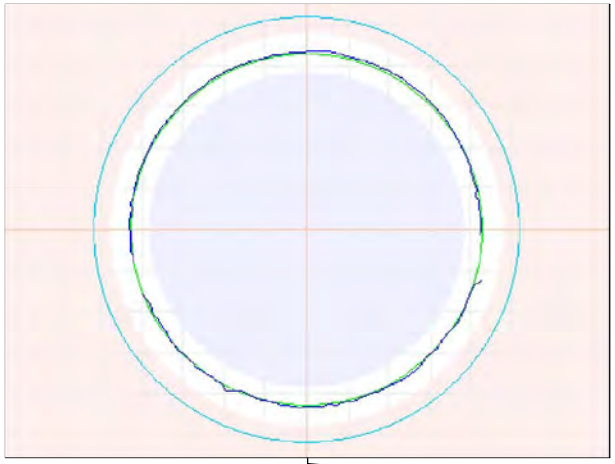
358.4ft Match to Reference Shape and Size - ø42"



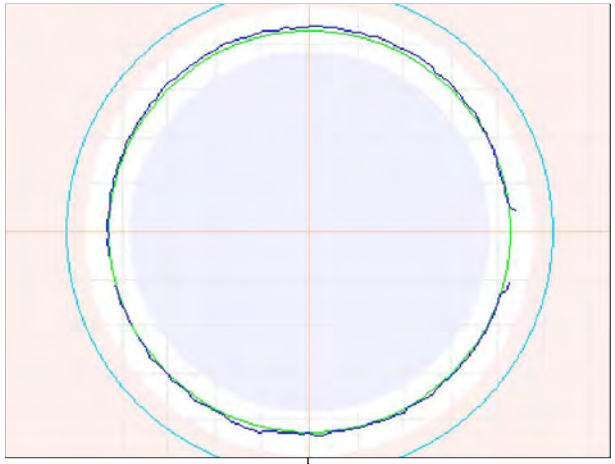
374.9ft General Observation - Corrosion to 0.6"

Observation Report

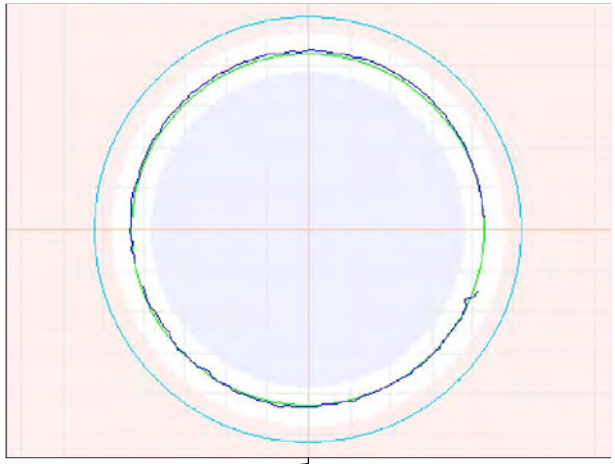
400ft General Observation - Corrosion to 0.5"

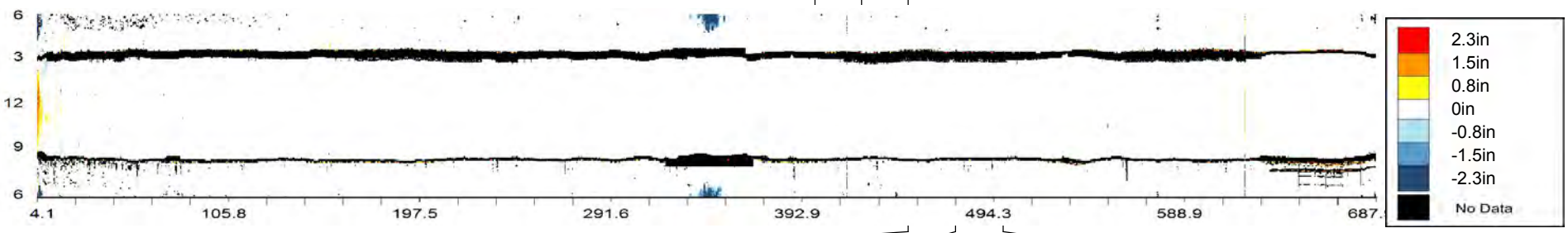


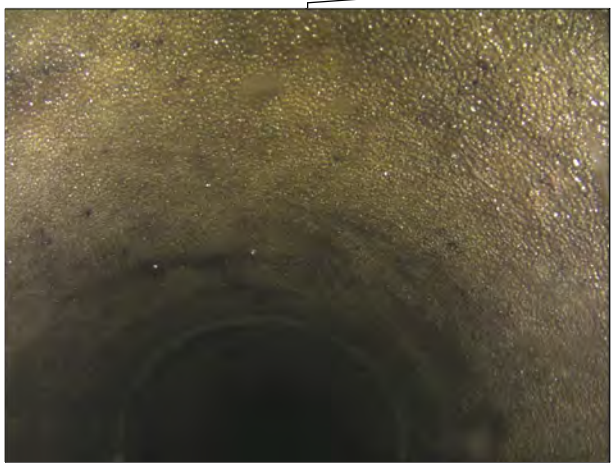
424.9ft General Observation - Corrosion to 0.5"



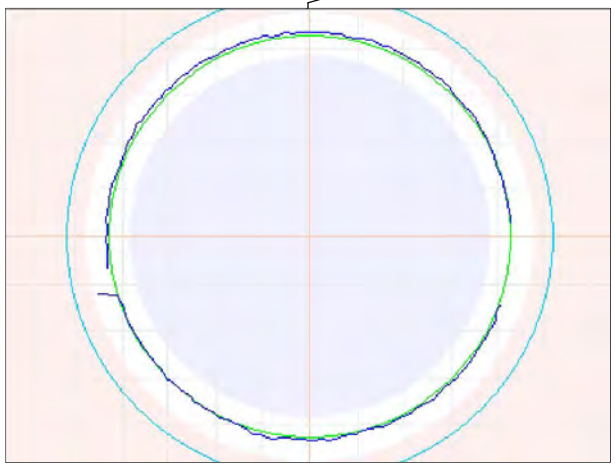
449.7ft General Observation - Corrosion to 0.5"



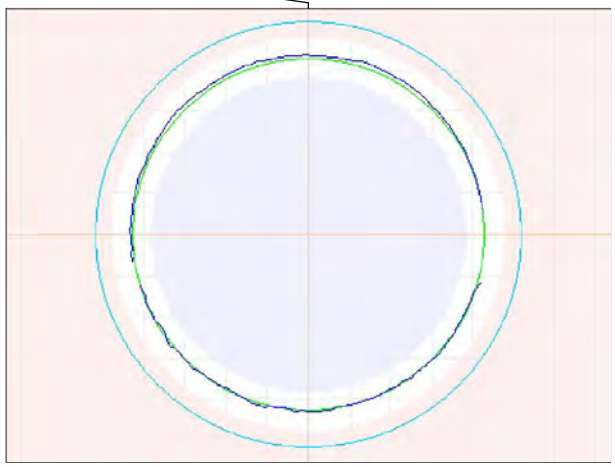




449.7ft General Observation - Corrosion to 0.5"



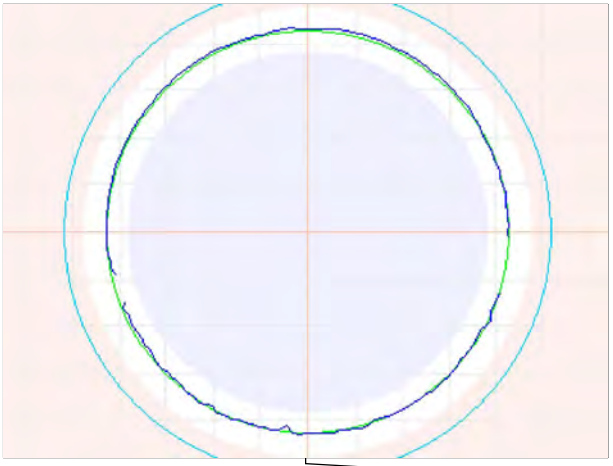
474.9ft General Observation - Corrosion to 0.7"



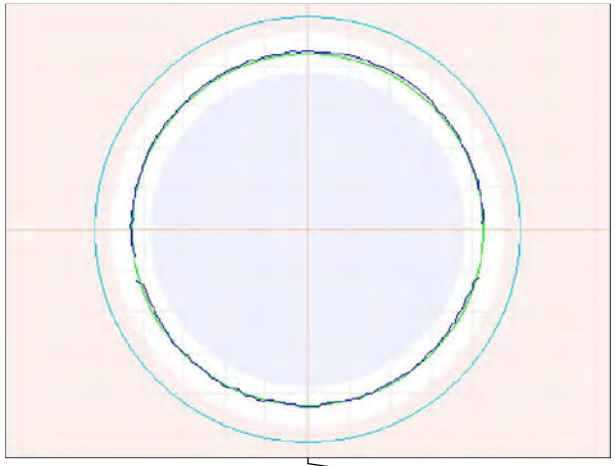
499.8ft General Observation - Corrosion to 0.5"

Observation Report

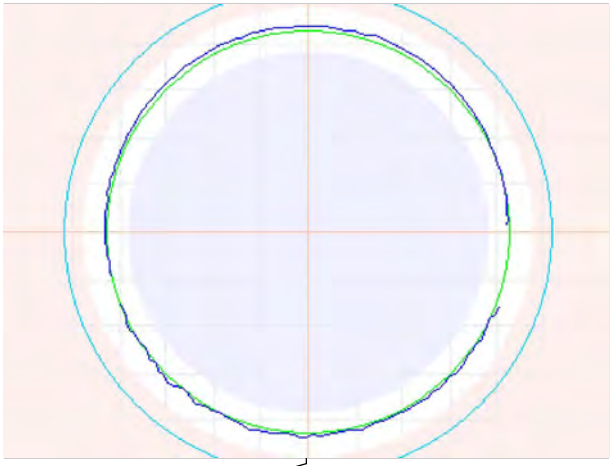
524.9ft General Observation - Corrosion to 0.3"\Debris to 0.7"

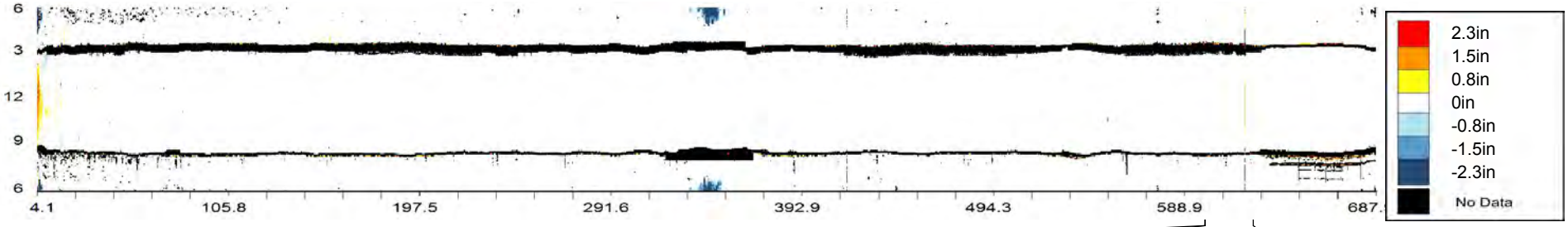


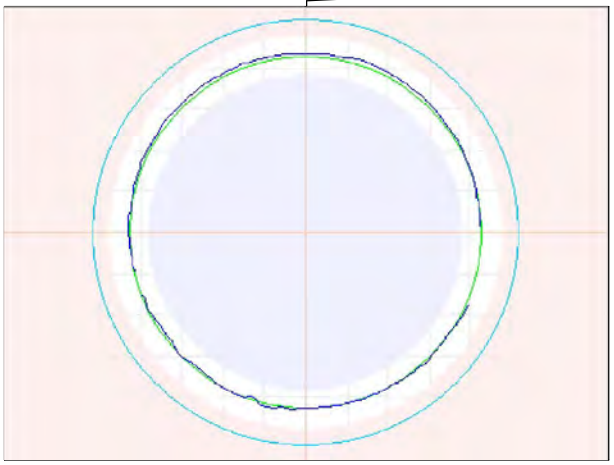
549.7ft General Observation



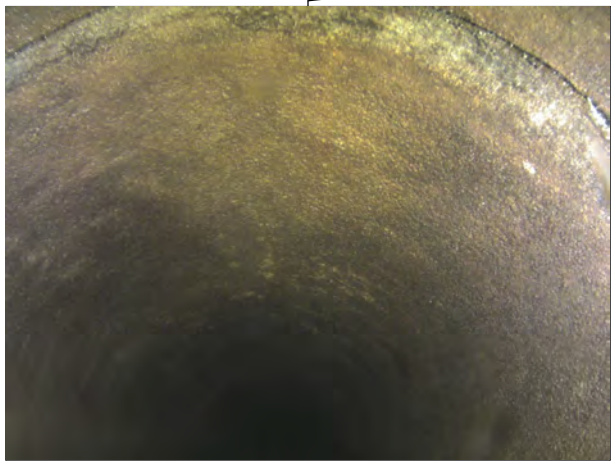
574.9ft General Observation - Corrosion to 0.6"



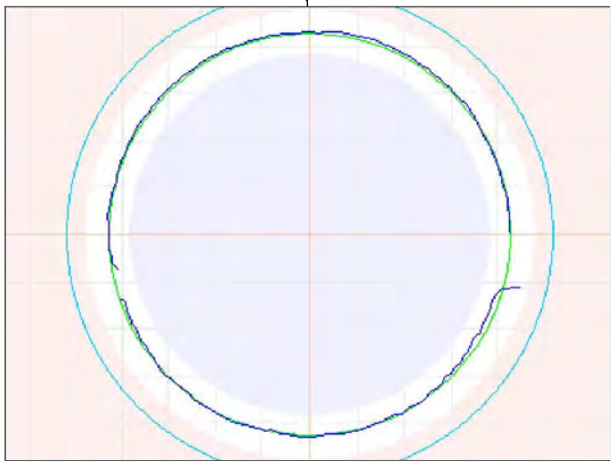




599.9ft General Observation - Corrosion to 0.5"



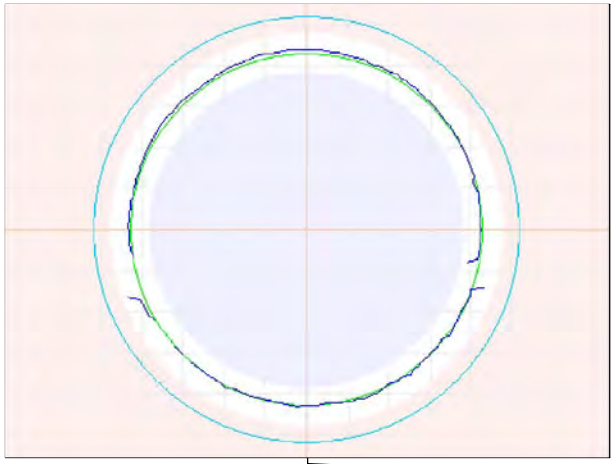
599.9ft General Observation - Corrosion to 0.5"



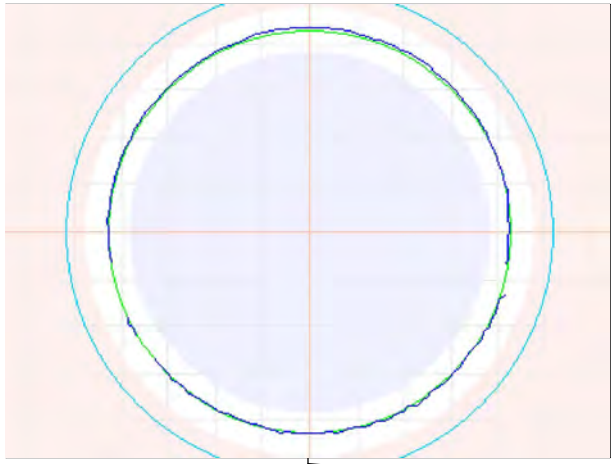
624.8ft General Observation - Corrosion to 0.4"

Observation Report

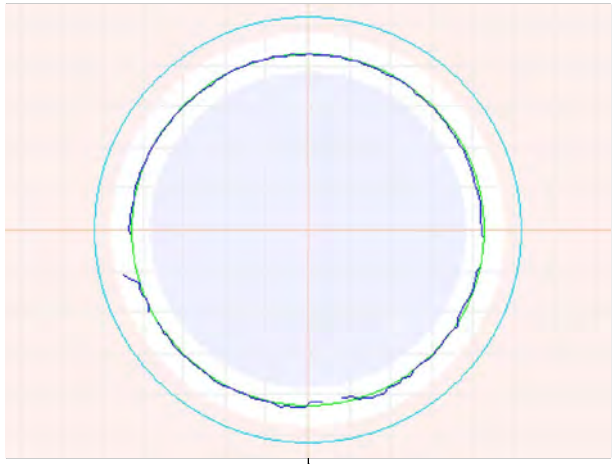
649.9ft General Observation

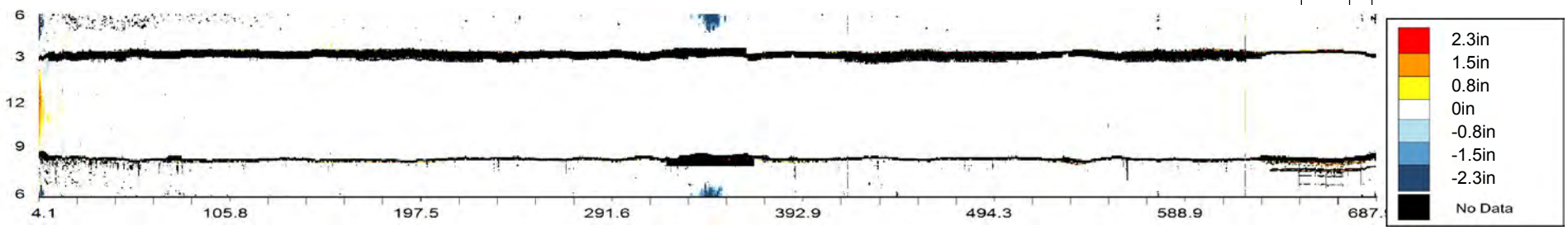


674.9ft General Observation - Corrosion to 0.3"



686.8ft General Observation





OVERVIEW - CSS000001-WRFIntertie36in

Asset Number	CSS000001-WRFIntertie36in		
Upstream MH	CSS000001	Material	Reinforced Concrete Pipe
Downstream MH	WRF Intertie Box	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	1988 ft

Distance	Observation	Comment
0 ft	**Beginning of Inspection**	**CSS000001**
11.5	General Observation	
49.6	General Observation	
100.5	General Observation	
149.5	General Observation	
200.2	General Observation	
249.7	General Observation	
299.7	General Observation	
351.5	General Observation	
397.2	General Observation	
446.2	General Observation	
503.3	General Observation	Debris to 12.4"
510.3	Maximum Debris	To 14.1"
546.1	General Observation	Debris to 5.1"
602	General Observation	Debris to 2.4"
648.9	General Observation	Debris to 5.8"
699.3	General Observation	Debris to
752.4	General Observation	Debris to 9.6"
796	General Observation	Debris to 9.0"
846	General Observation	Debris to 6.6"
897	General Observation	Debris to 3.4"
952.2	General Observation	Debris to 8.0"
999.4	General Observation	Debris to 5.5"
1047.2	General Observation	Debris to 7.2"
1097.3	General Observation	Debris to 3.5"
1148.7	General Observation	Debris to 6.6"

OVERVIEW - CSS000001-WRFIntertie36in

Asset Number	CSS000001-WRFIntertie36in		
Upstream MH	CSS000001	Material	Reinforced Concrete Pipe
Downstream MH	WRF Intertie Box	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	1988 ft

Distance	Observation	Comment
1198.6	General Observation	Debris to 7.6"
1246.6	General Observation	Debris to 5.4"
1301.1	General Observation	Debris to 4.2"
1346.3	General Observation	Debris to 4.9"
1397.3	General Observation	Debris to 8.9"
1452.8	General Observation	Debris to 4.9"
1497.8	General Observation	Debris to 5.9"
1550.7	General Observation	Debris to 6.9"
1602.4	General Observation	Debris to 6.3"
1653.8	General Observation	Debris to 7.8"
1696	General Observation	Debris to 5.3"
1748	General Observation	Debris to 5.8"
1795.1	General Observation	Debris to 7.6"
1846.1	General Observation	Debris to 7.9"
1898.8	General Observation	Debris to 6.9"
1946.6	General Observation	Debris to 6.5"
1988	Closest Match to Reference Size	Ã¸36"
1998.4	General Observation	Debris to 3.1"
2051.4	General Observation	Debris to 5.0"
2098.2	General Observation	Debris to 5.5"
2150.6	General Observation	Debris to 6.2"
2196.6	General Observation	Debris to 5.2"
2251.8	General Observation	Debris to 3.2"
2296.5	General Observation	Debris to 5.0"
2353.2	General Observation	Debris to 4.6"
2396.2	General Observation	Debris to 3.2"

OVERVIEW - CSS000001-WRFIntertie36in

Asset Number	CSS000001-WRFIntertie36in		
Upstream MH	CSS000001	Material	Reinforced Concrete Pipe
Downstream MH	WRF Intertie Box	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	1988 ft

Distance	Observation	Comment
2453.1	General Observation	Debris to 3.5"
2495.8	General Observation	Debris to 3.2"
2550.3	General Observation	Debris to 4.8"
2597.1	General Observation	Debris to 4.3"
2647.7	General Observation	Debris to 2.5"
2695.5	General Observation	Debris to 4.7"
2746.4	General Observation	Debris to 4.1"
2802.5	General Observation	Debris to 1.7"
2851.2	General Observation	Debris to 2.1"
2900.2	General Observation	Debris to 3.1"
2949.4	General Observation	Debris to 3.8"
3002.4	General Observation	Debris to 2.4"
3052.9	General Observation	Debris to 1.7"
3097.9	General Observation	Debris to 1.9"
3145.9	General Observation	Debris to 3.4"
3197	General Observation	Debris to 2.3"
3249.2	General Observation	Debris to 2.8"
3301.1	General Observation	Debris to 2.3"
3352.6	General Observation	Debris to 2.4"
3398.7	General Observation	Debris to 2.0"
3446.3	General Observation	Debris to 2.2"
3495.3	General Observation	Debris to 2.8"
3550.8	General Observation	Debris to 2.4"
3602.5	General Observation	
3649.2	General Observation	
3701.5	General Observation	

OVERVIEW - CSS000001-WRFIntertie36in

Asset Number	CSS000001-WRFIntertie36in		
Upstream MH	CSS000001	Material	Reinforced Concrete Pipe
Downstream MH	WRF Intertie Box	Size & Shape	36 in Circle
Survey Direction	Downstream	Match to Reference	1988 ft

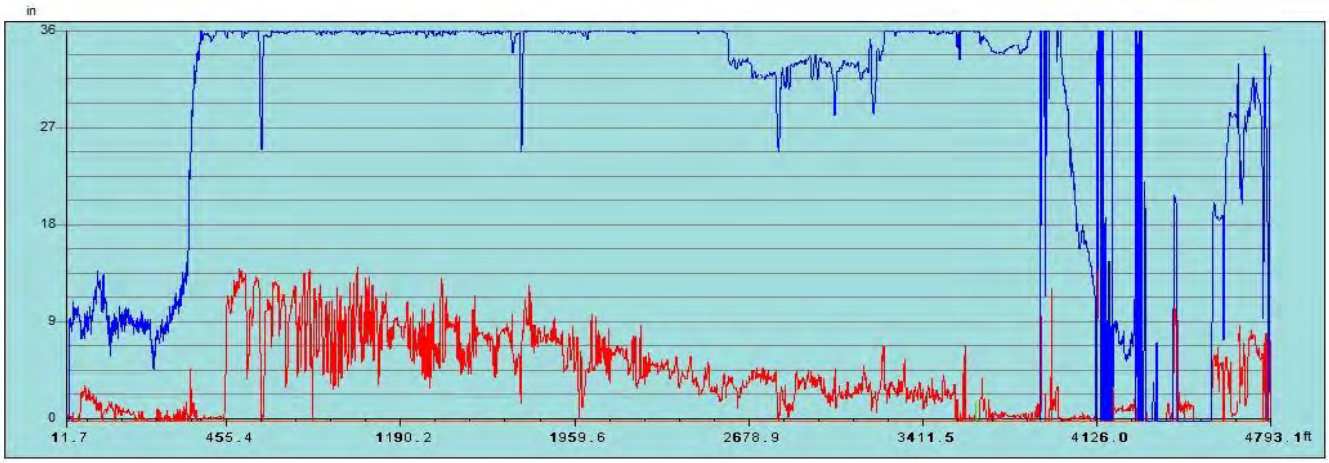
Distance	Observation	Comment
3752.1	General Observation	
3796.3	General Observation	
3846	General Observation	
3898.6	General Observation	
3948.6	General Observation	
3996.1	General Observation	
4050.6	General Observation	
4099.3	General Observation	
4140.9	Point of Interest	Low level sonar return until 4720ft
4149.8	General Observation	Limited Sonar Return
4200.9	General Observation	
4249.5	General Observation	
4299.4	General Observation	Limited Sonar Return
4349.9	General Observation	Limited Sonar Return
4399	General Observation	Limited Sonar Return
4450.1	General Observation	
4501.2	General Observation	Limited Sonar Return
4549.3	General Observation	Limited Sonar Return
4600.7	General Observation	
4650.3	General Observation	
4698.5	General Observation	
4749.4	General Observation	Debris to 8.5"
15698.1 ft	**End of Inspection**	**WRF Intertie Box**

CSS000001-WRFIntertie36in			
Asset Number	CSS000001-WRFIntertie36in	Length	4786 ft
Upstream MH	CSS000001	Diameter	36 in
Downstream MH	WRF Intertie Box	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	1988 ft
Date Profiled	25 July 2013	Operator	

Observations

Average Debris Depth	4 in
Average Water Level	27 in
Debris Volume	2120 cubic feet

Debris Graph



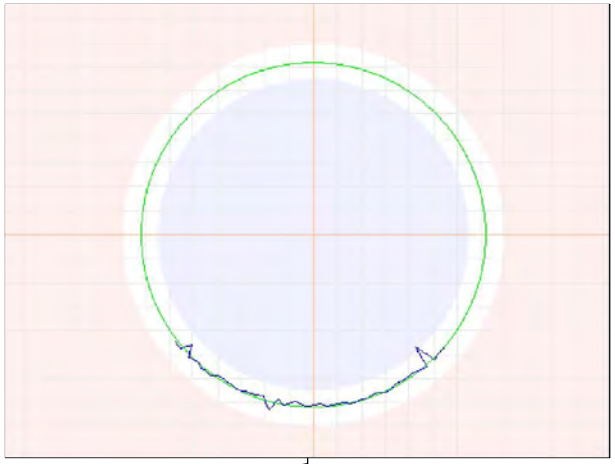
Inspection Distance (ft)

Water Level — Debris Level

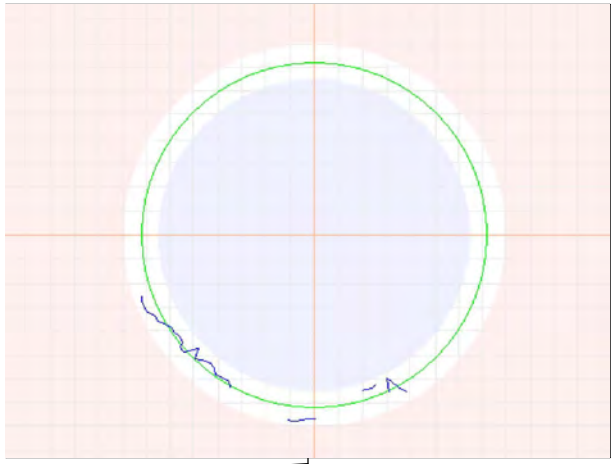
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

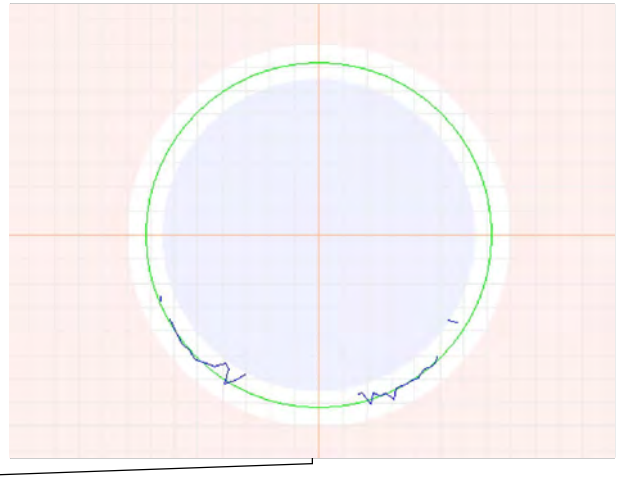
11.5ft General Observation

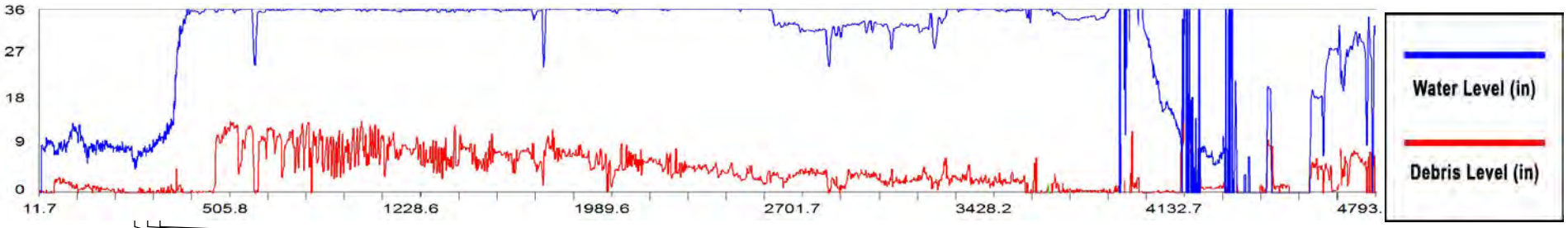


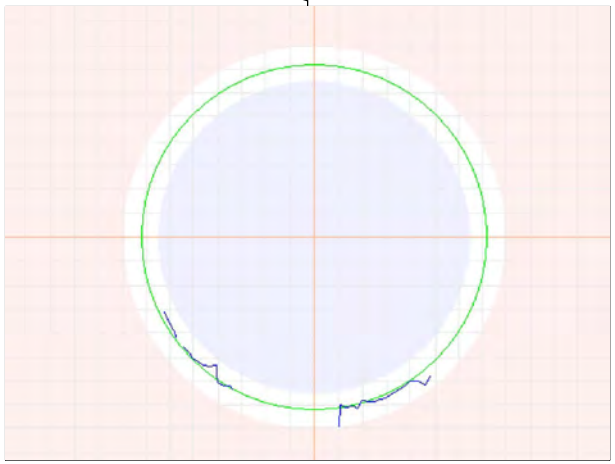
49.6ft General Observation



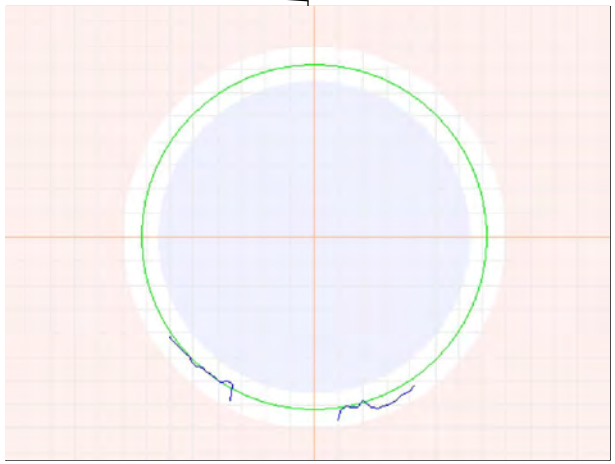
100.5ft General Observation



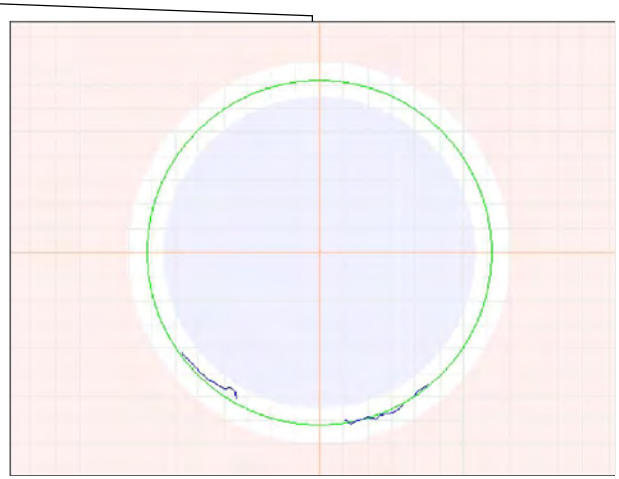




149.5ft General Observation



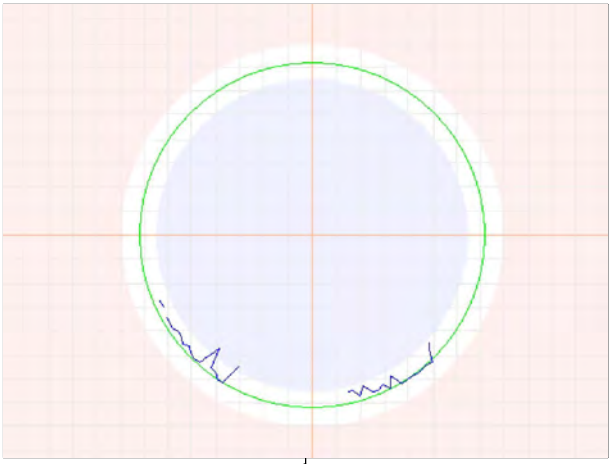
200.2ft General Observation



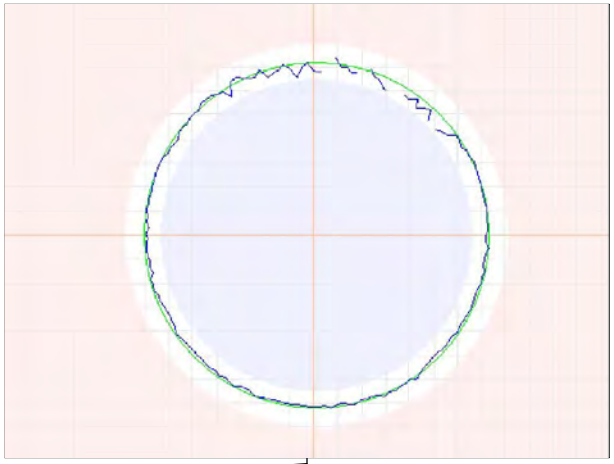
249.7ft General Observation

Observation Report

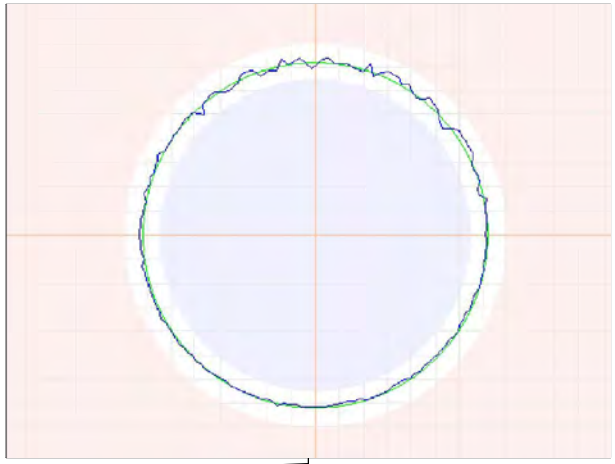
299.7ft General Observation

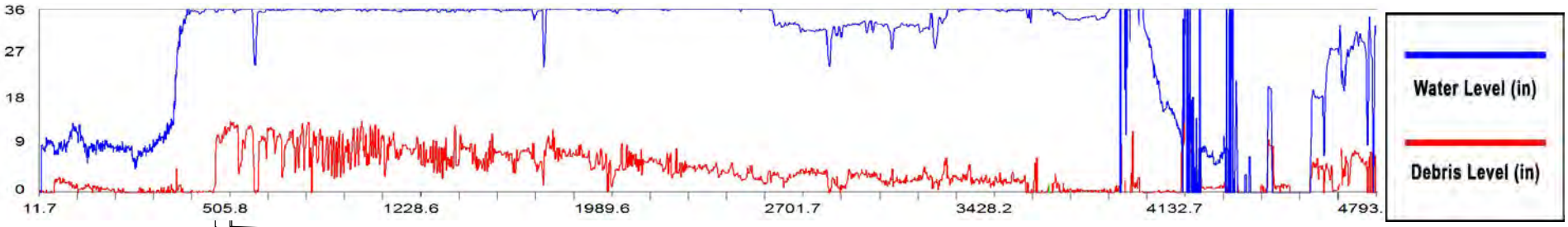


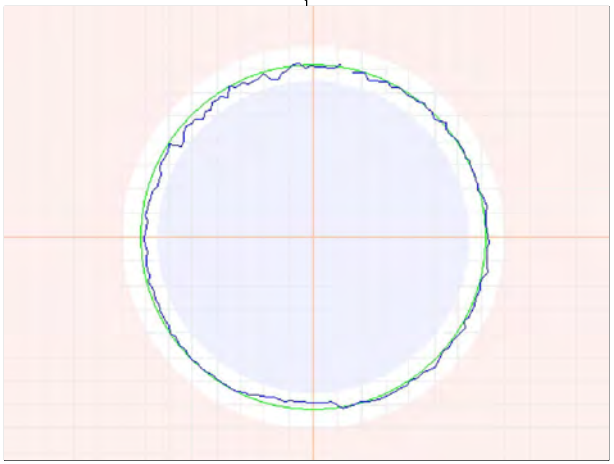
351.5ft General Observation



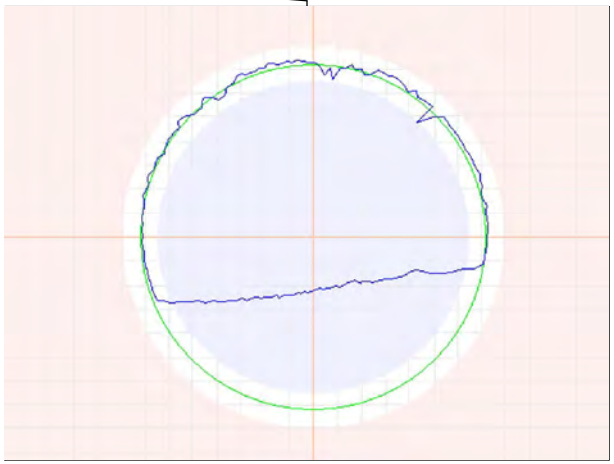
397.2ft General Observation



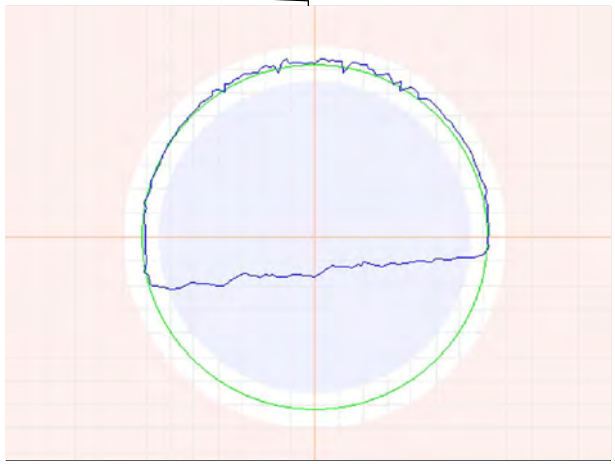




446.2ft General Observation



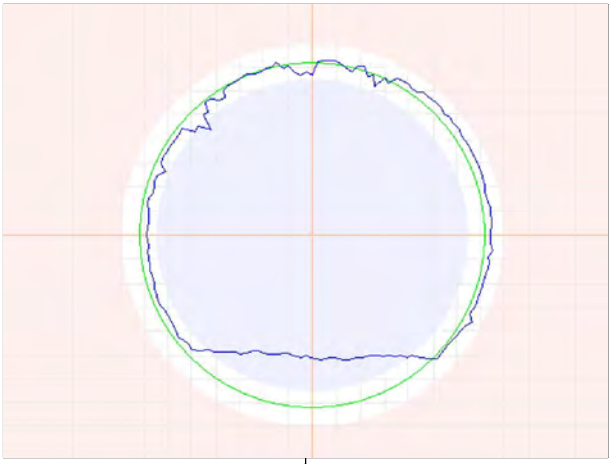
503.3ft General Observation - Debris to 12.4"



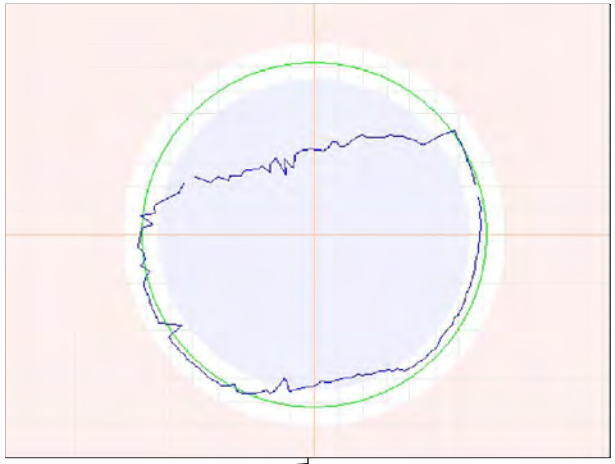
510.3ft Maximum Debris - To 14.1"

Observation Report

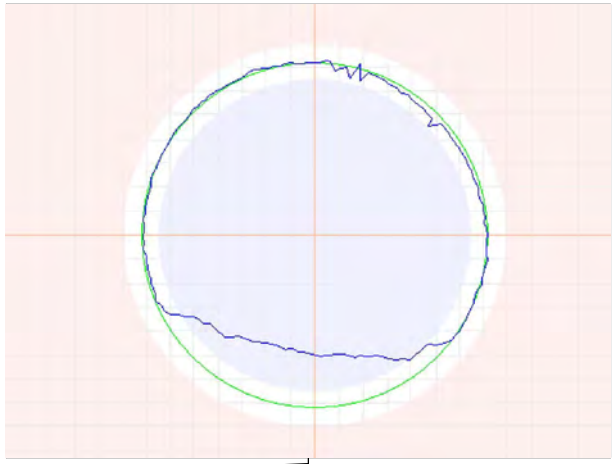
546.1ft General Observation - Debris to 5.1"

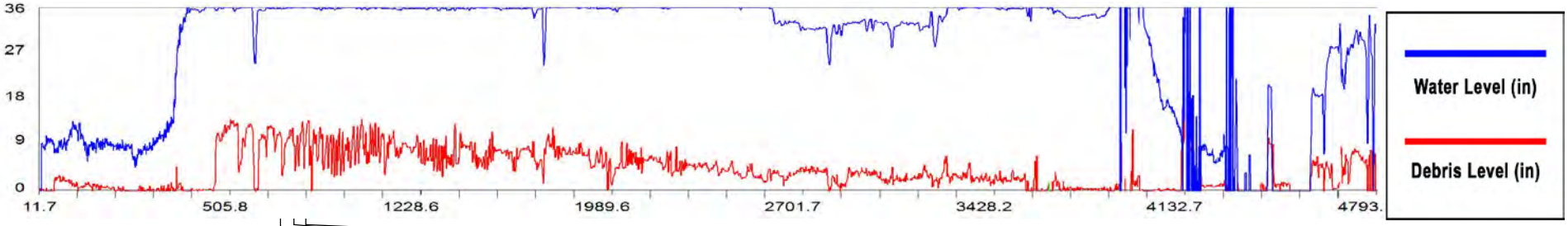


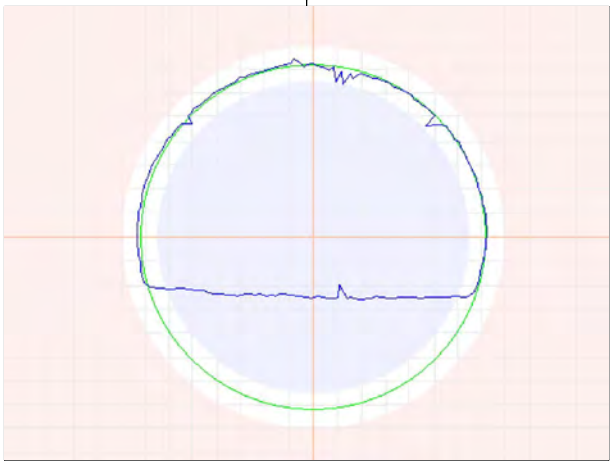
602ft General Observation - Debris to 2.4"



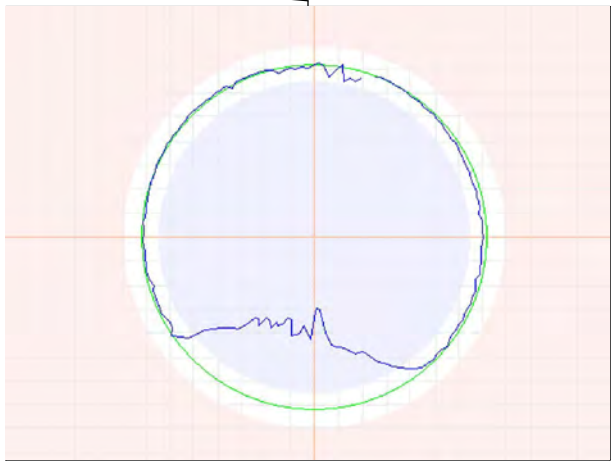
648.9ft General Observation - Debris to 5.8"



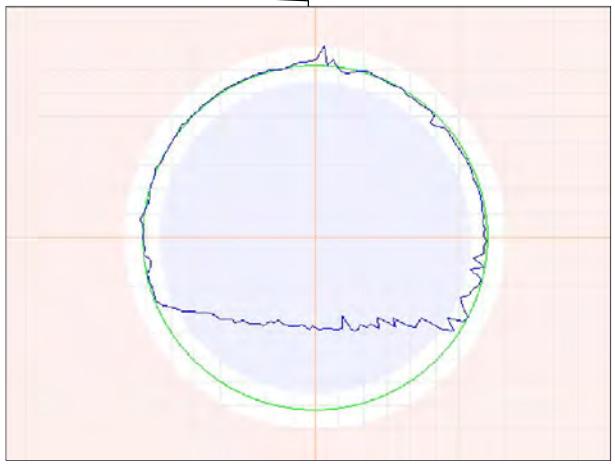




699.3ft General Observation - Debris to



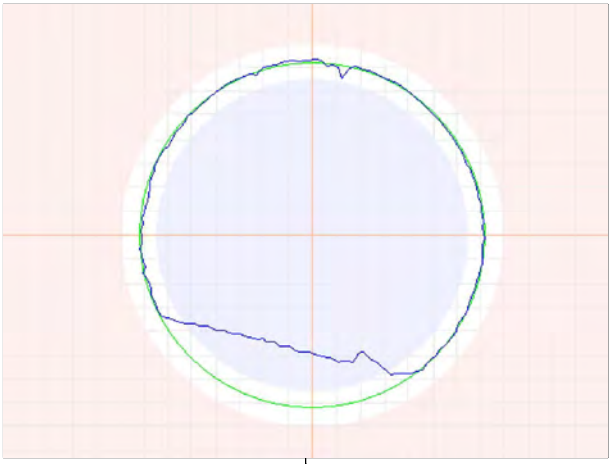
752.4ft General Observation - Debris to 9.6"



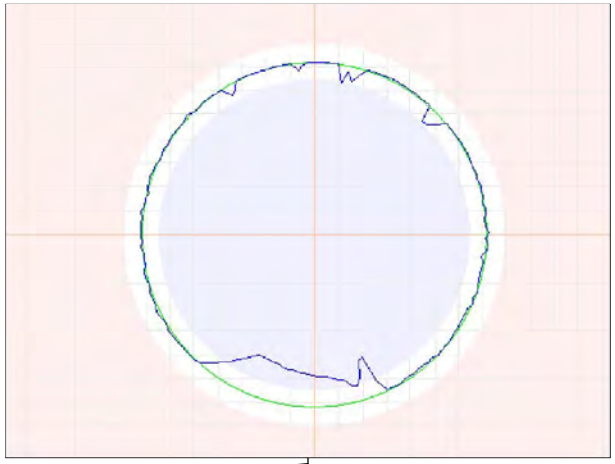
796ft General Observation - Debris to 9.0"

Observation Report

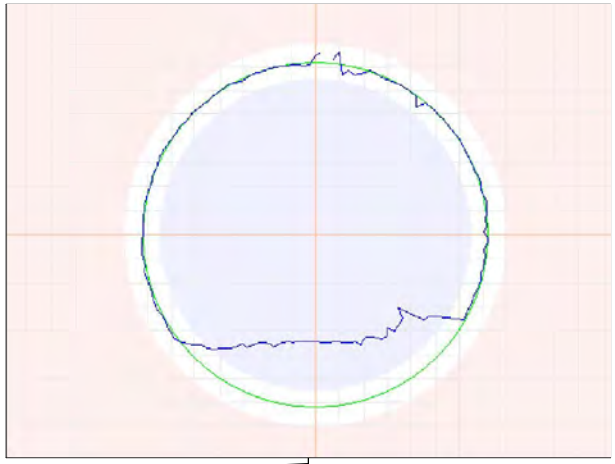
846ft General Observation - Debris to 6.6"

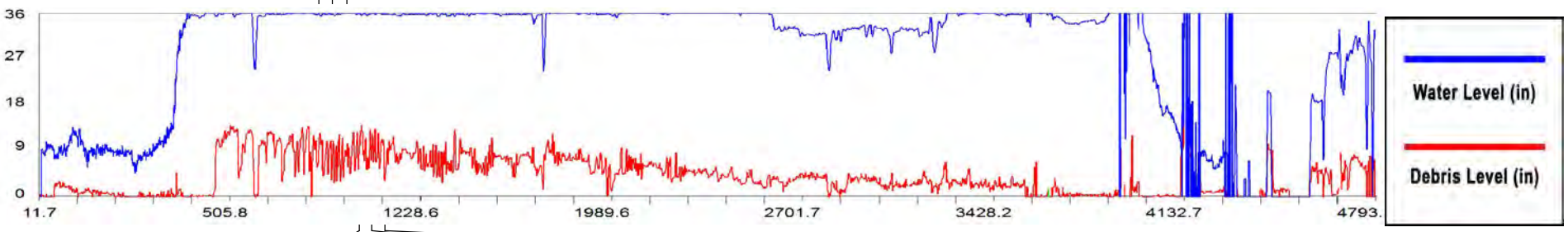


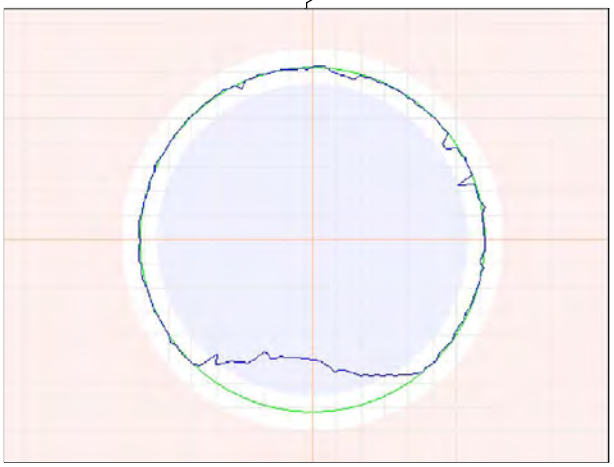
897ft General Observation - Debris to 3.4"



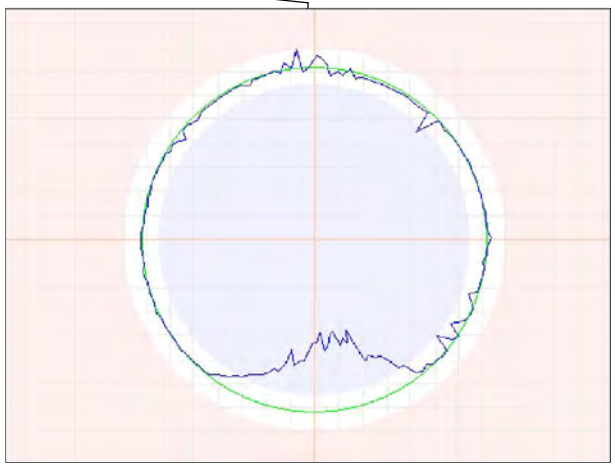
952.2ft General Observation - Debris to 8.0"



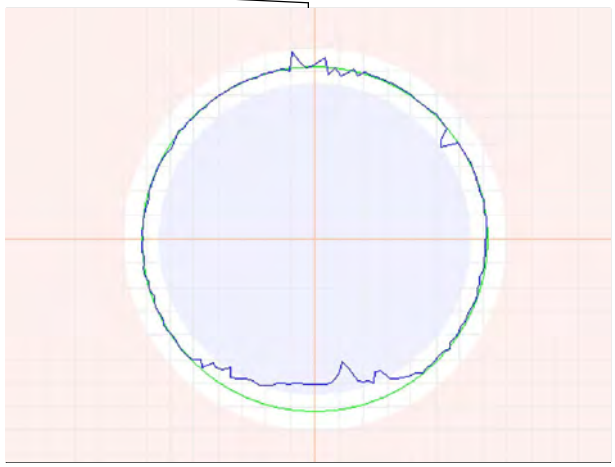




999.4ft General Observation - Debris to 5.5"



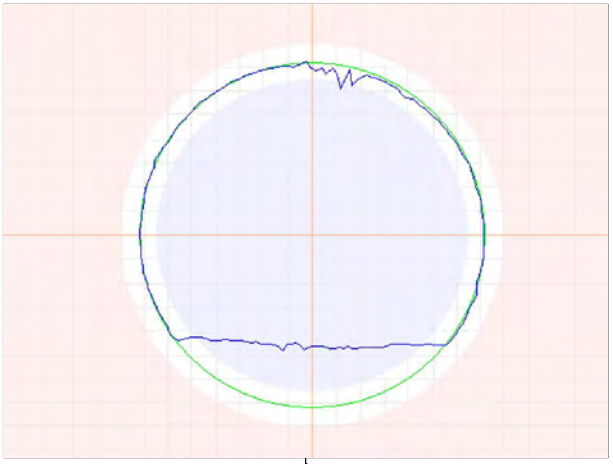
1047.2ft General Observation - Debris to 7.2"



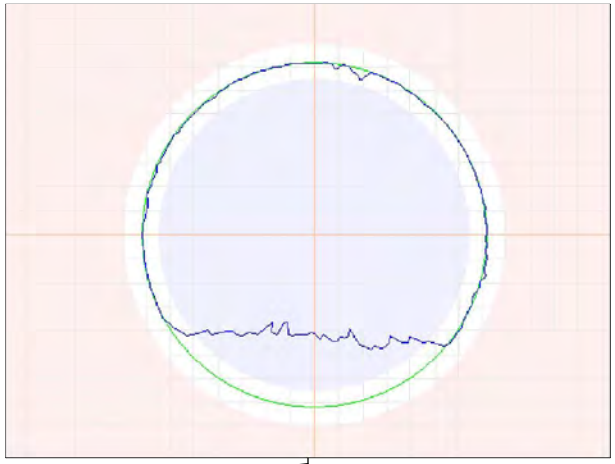
1097.3ft General Observation - Debris to 3.5"

Observation Report

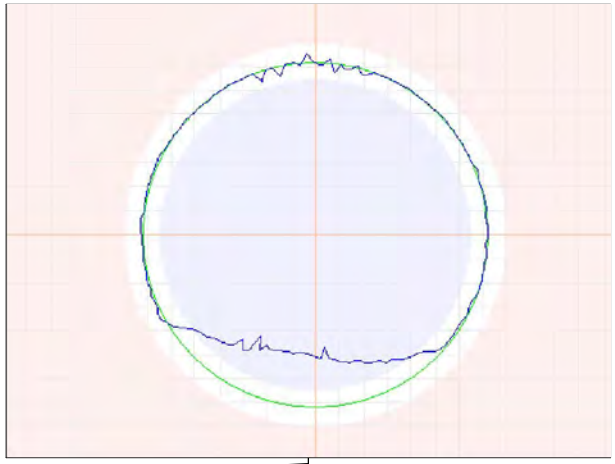
1148.7ft General Observation - Debris to 6.6"

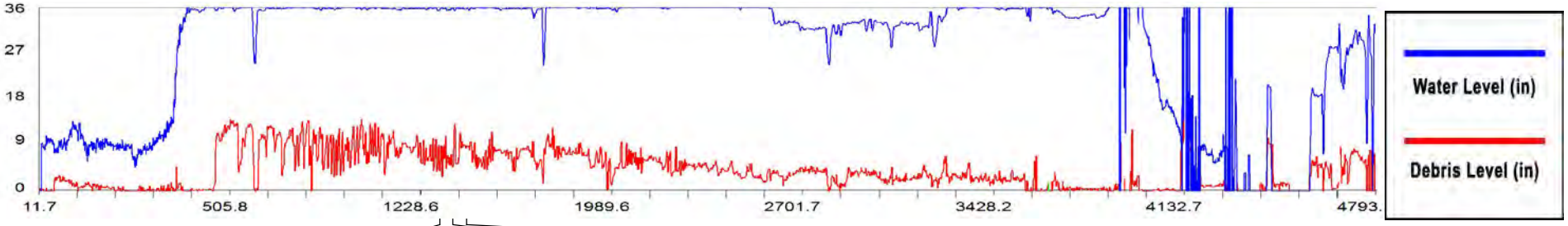


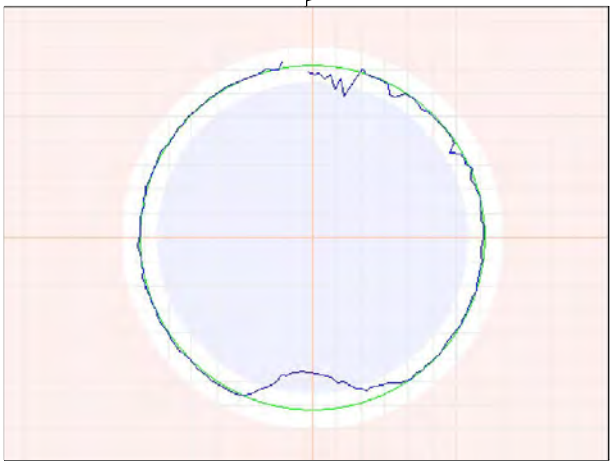
1198.6ft General Observation - Debris to 7.6"



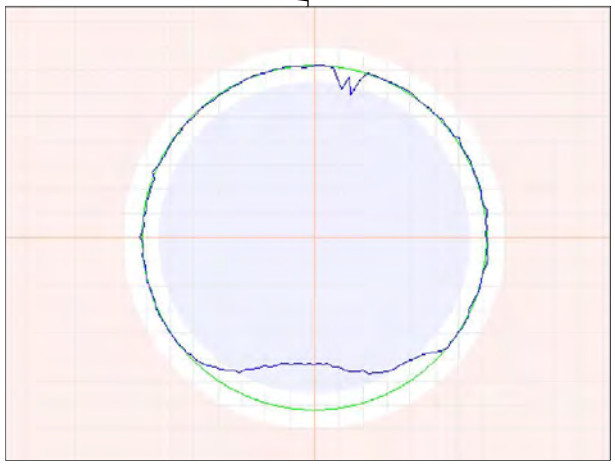
1246.6ft General Observation - Debris to 5.4"



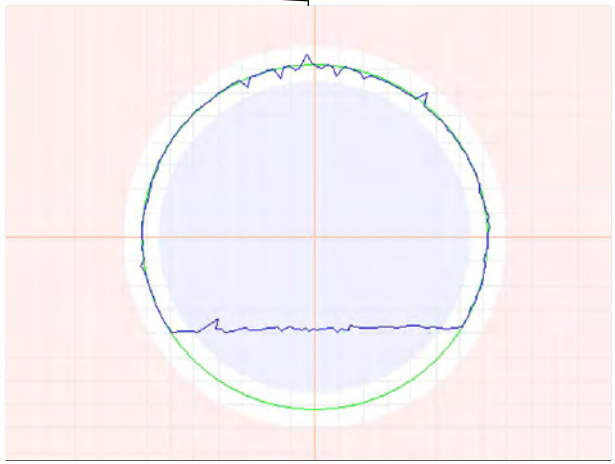




1301.1ft General Observation - Debris to 4.2"



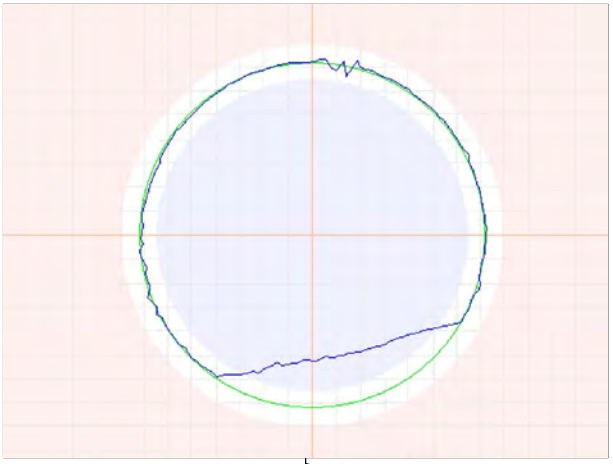
1346.3ft General Observation - Debris to 4.9"



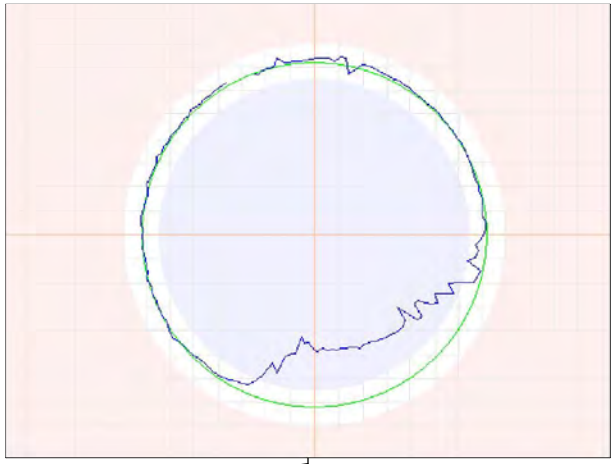
1397.3ft General Observation - Debris to 8.9"

Observation Report

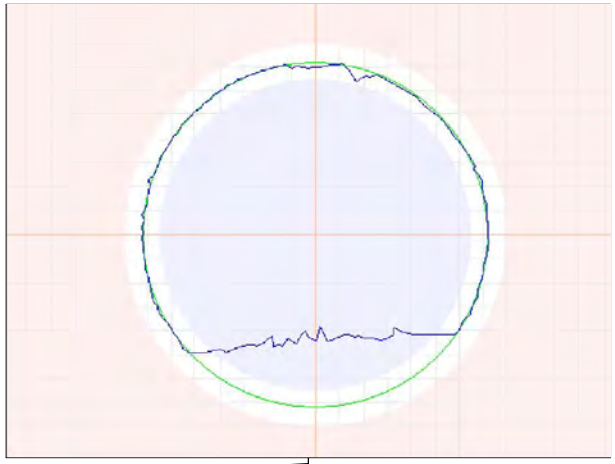
1452.8ft General Observation - Debris to 4.9"

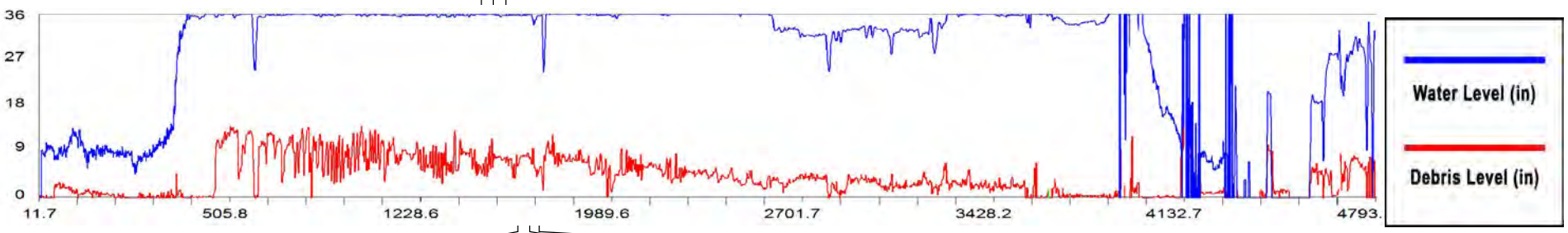


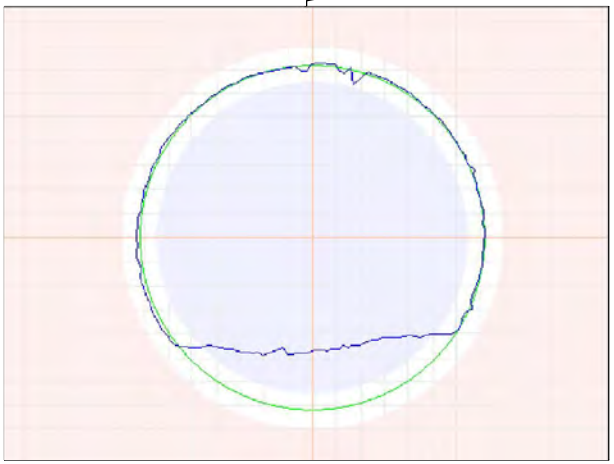
1497.8ft General Observation - Debris to 5.9"



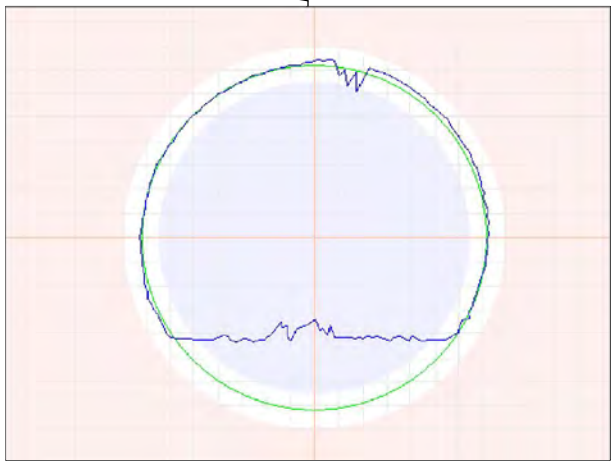
1550.7ft General Observation - Debris to 6.9"



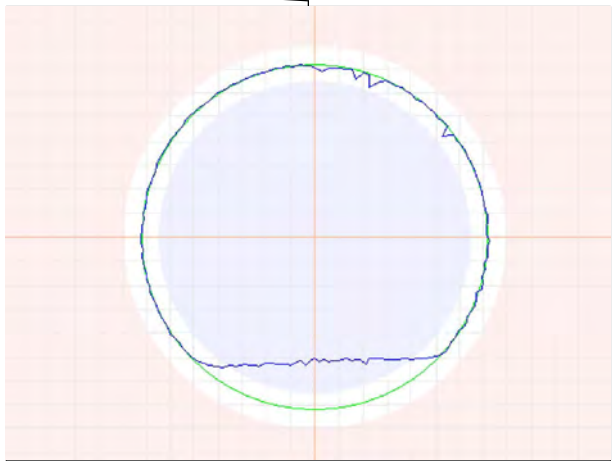




1602.4ft General Observation - Debris to 6.3"



1653.8ft General Observation - Debris to 7.8"

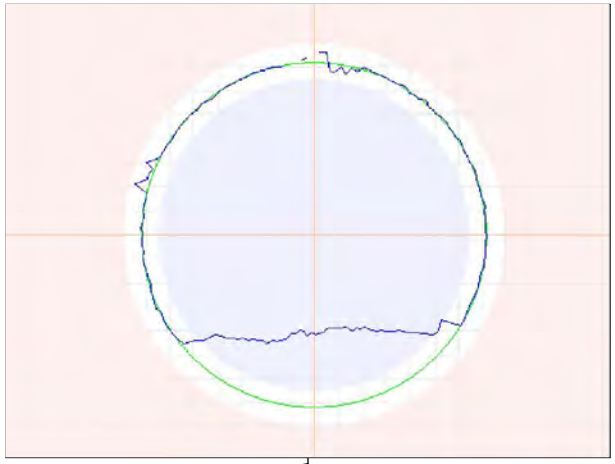


1696ft General Observation - Debris to 5.3"

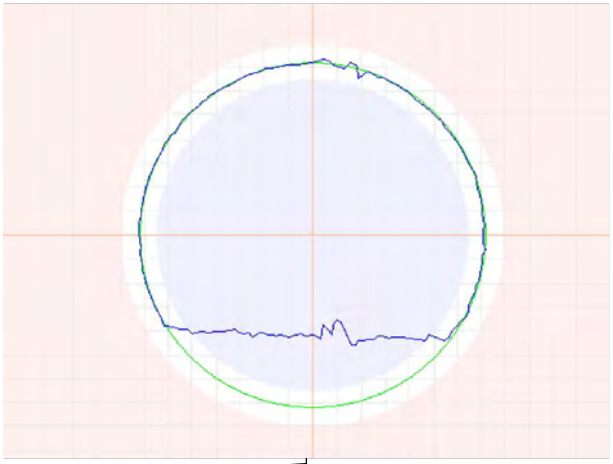
Observation Report

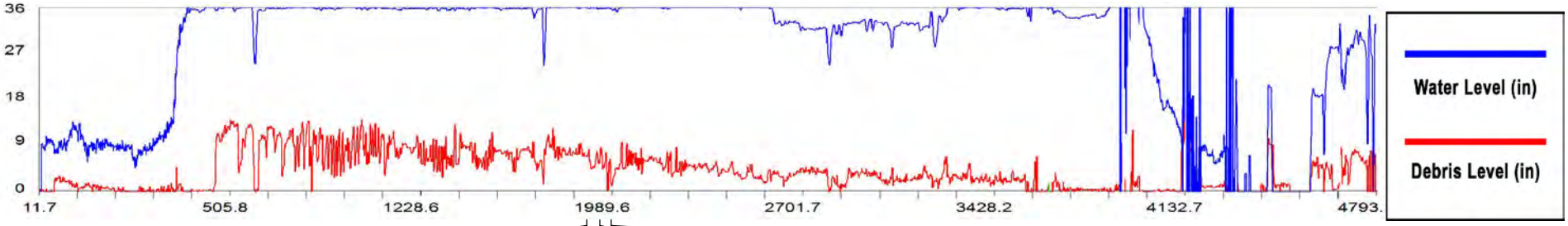
1748ft General Observation - Debris to 5.8"

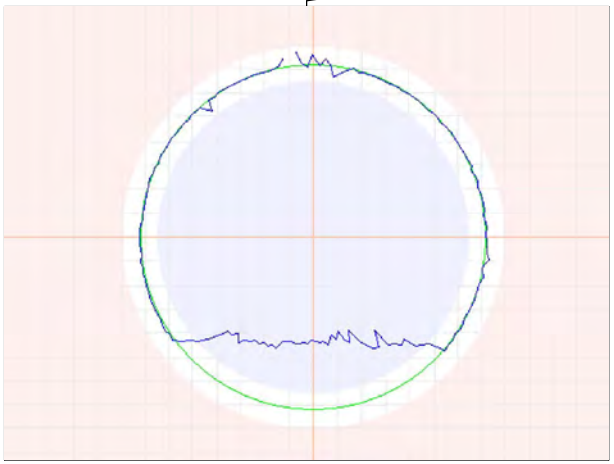
1795.1ft General Observation - Debris to 7.6"



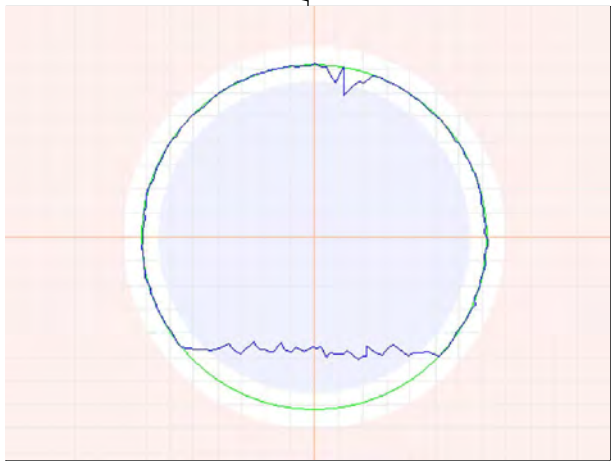
1846.1ft General Observation - Debris to 7.9"



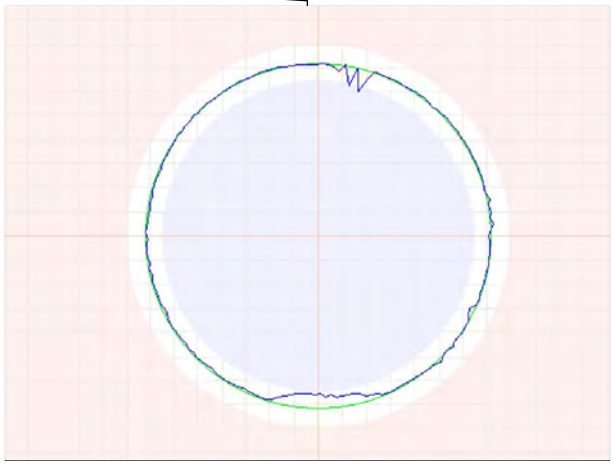




1898.8ft General Observation - Debris to 6.9"



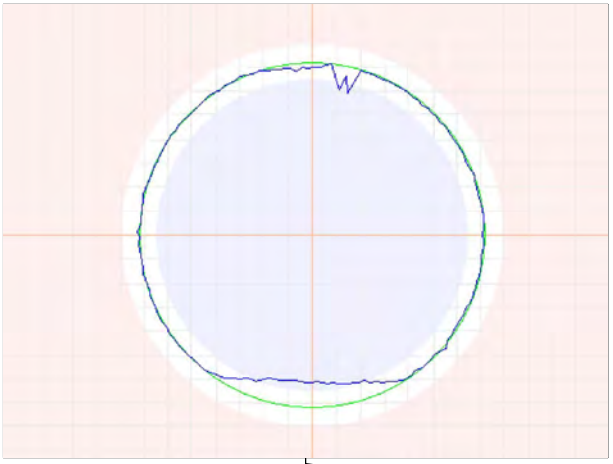
1946.6ft General Observation - Debris to 6.5"



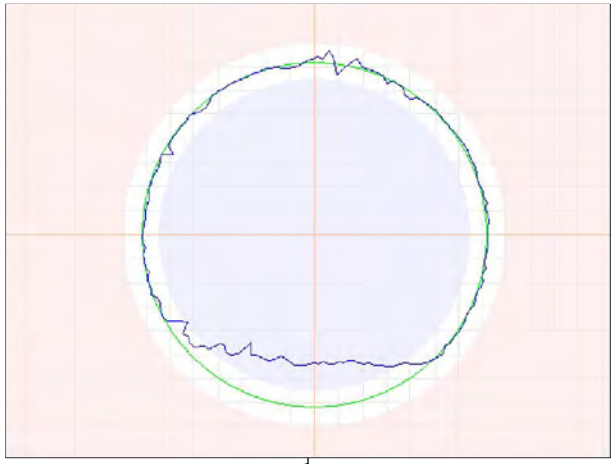
1988ft Closest Match to Reference Size - Ã¸36"

Observation Report

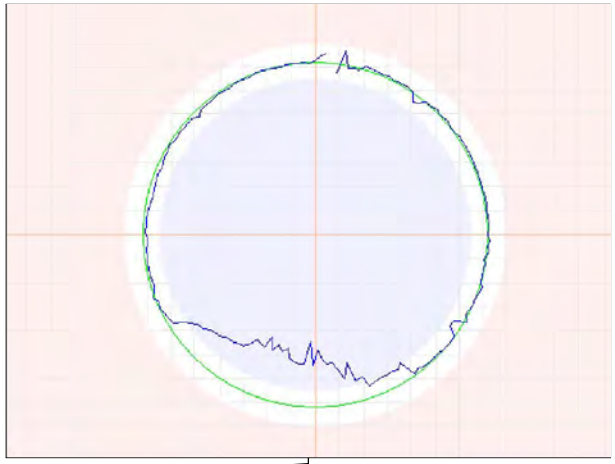
1998.4ft General Observation - Debris to 3.1"

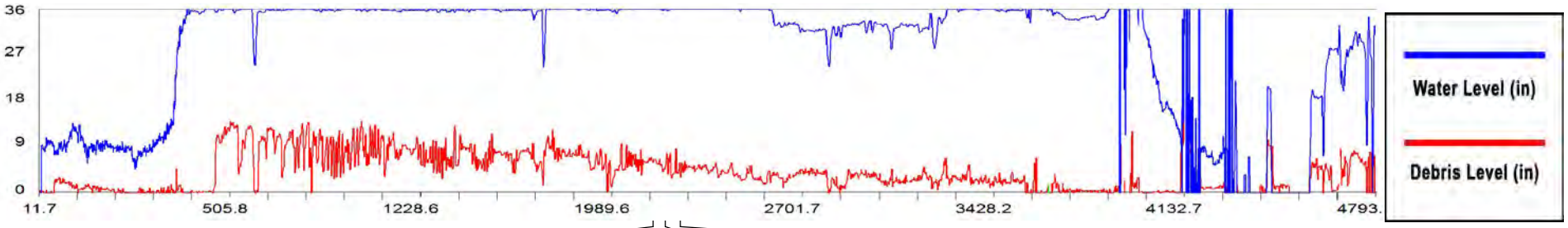


2051.4ft General Observation - Debris to 5.0"

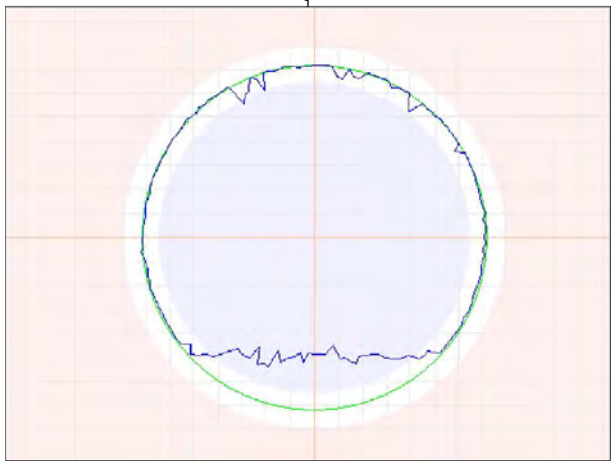


2098.2ft General Observation - Debris to 5.5"

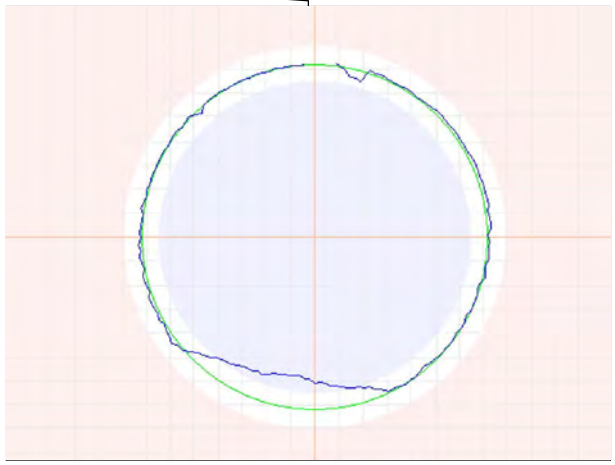




2150.6ft General Observation - Debris to 6.2"



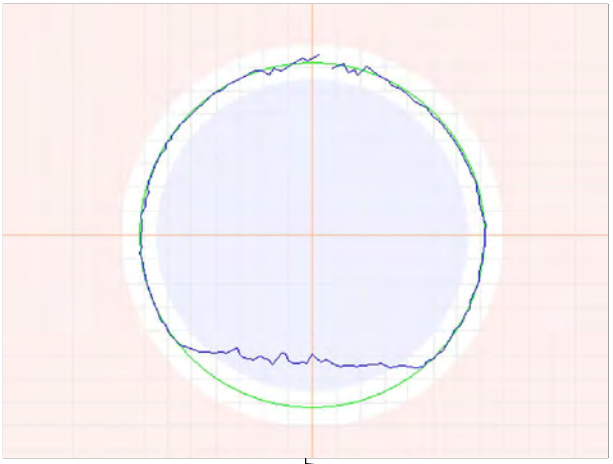
2196.6ft General Observation - Debris to 5.2"



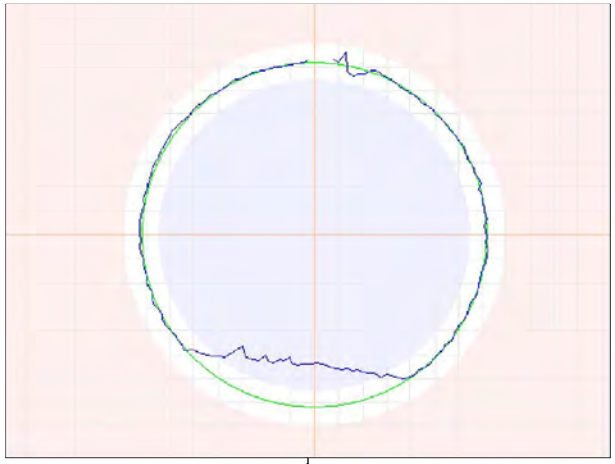
2251.8ft General Observation - Debris to 3.2"

Observation Report

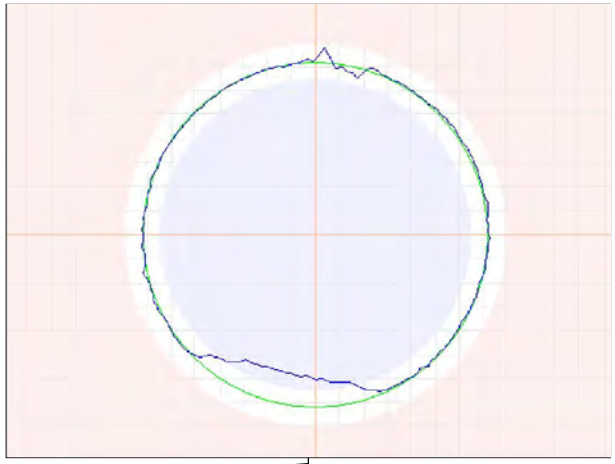
2296.5ft General Observation - Debris to 5.0"

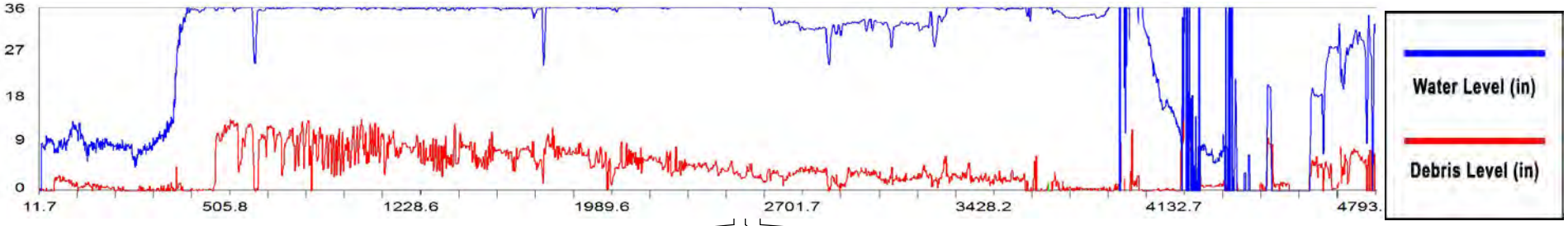


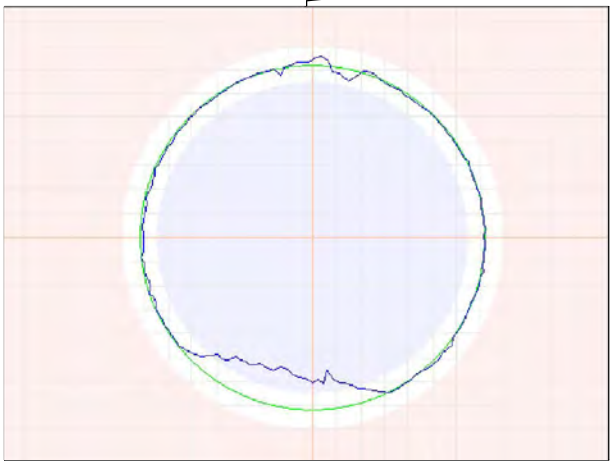
2353.2ft General Observation - Debris to 4.6"



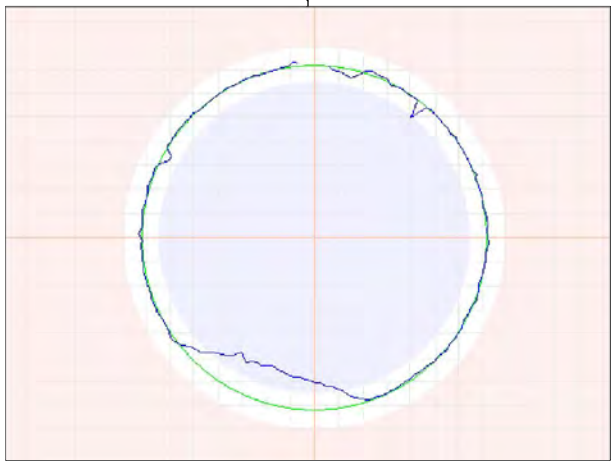
2396.2ft General Observation - Debris to 3.2"



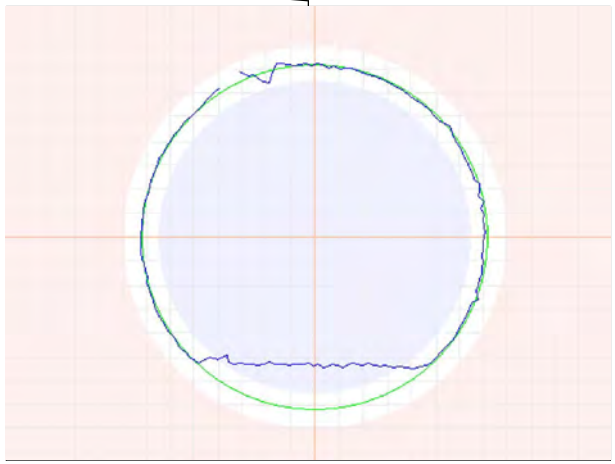




2453.1ft General Observation - Debris to 3.5"



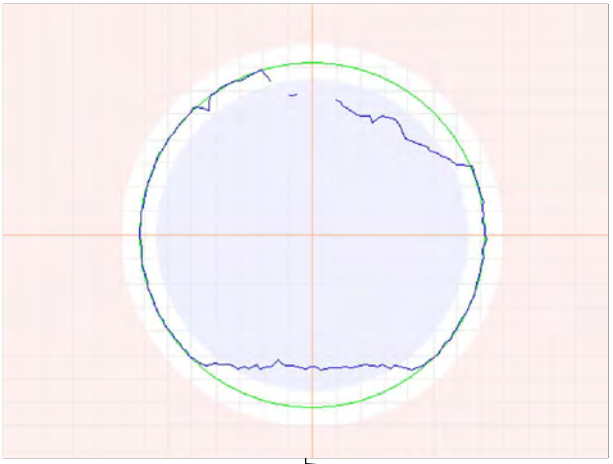
2495.8ft General Observation - Debris to 3.2"



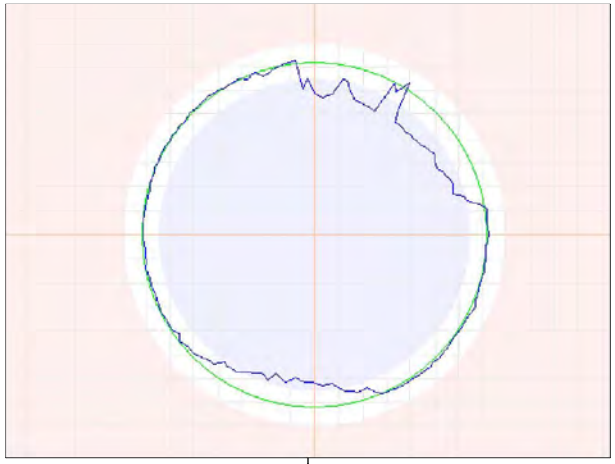
2550.3ft General Observation - Debris to 4.8"

Observation Report

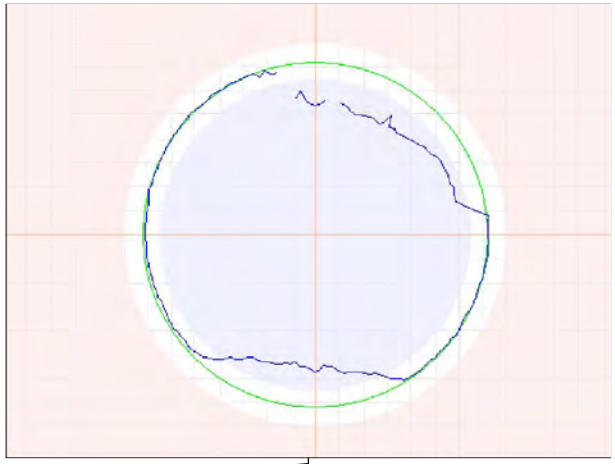
2597.1ft General Observation - Debris to 4.3"

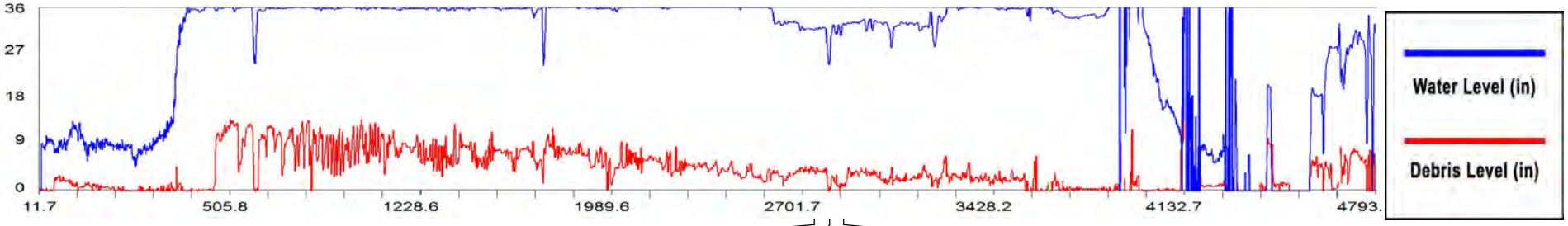


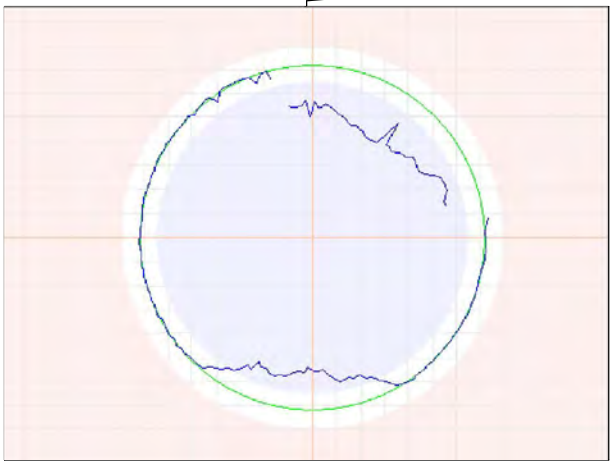
2647.7ft General Observation - Debris to 2.5"



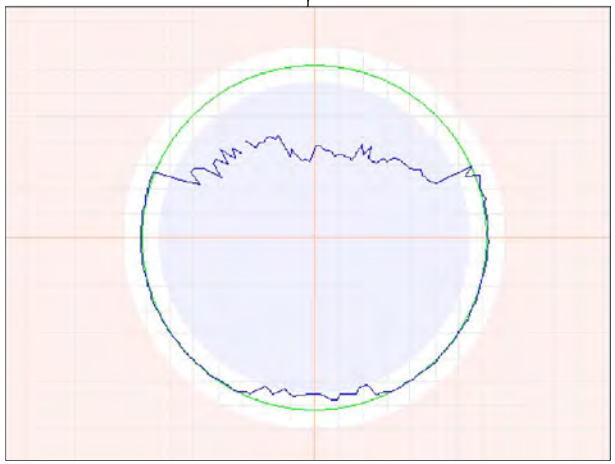
2695.5ft General Observation - Debris to 4.7"



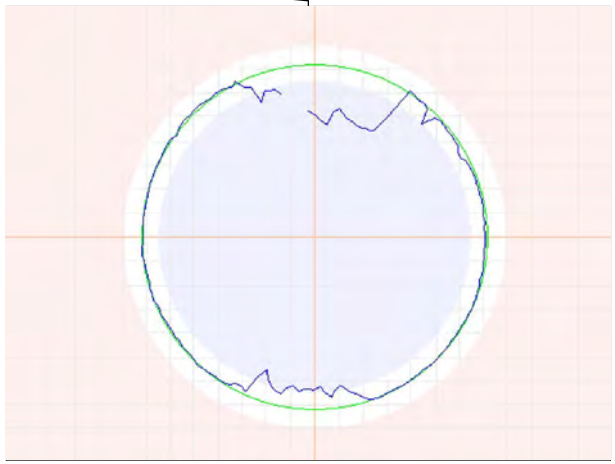




2746.4ft General Observation - Debris to 4.1"



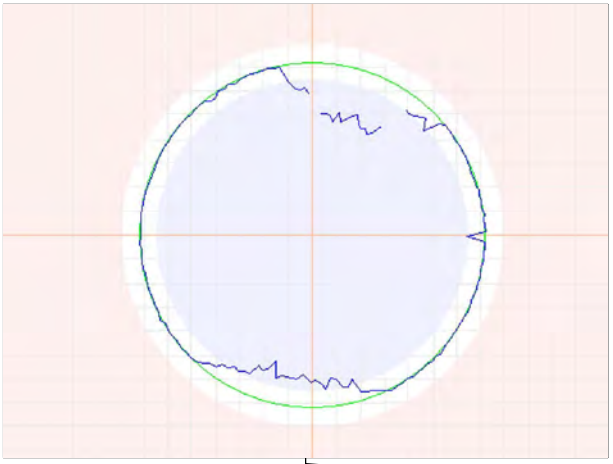
2802.5ft General Observation - Debris to 1.7"



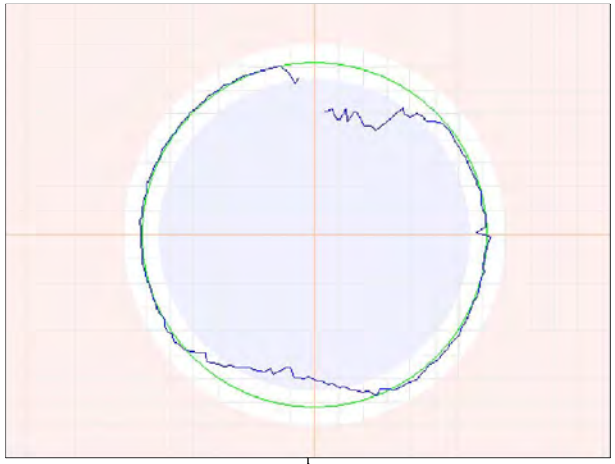
2851.2ft General Observation - Debris to 2.1"

Observation Report

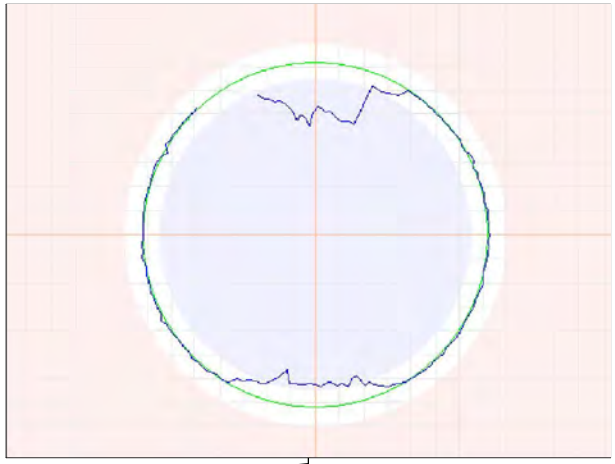
2900.2ft General Observation - Debris to 3.1"

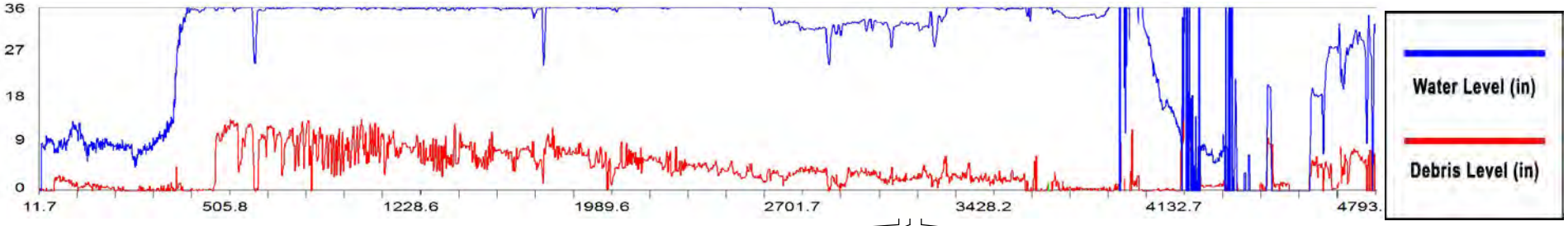


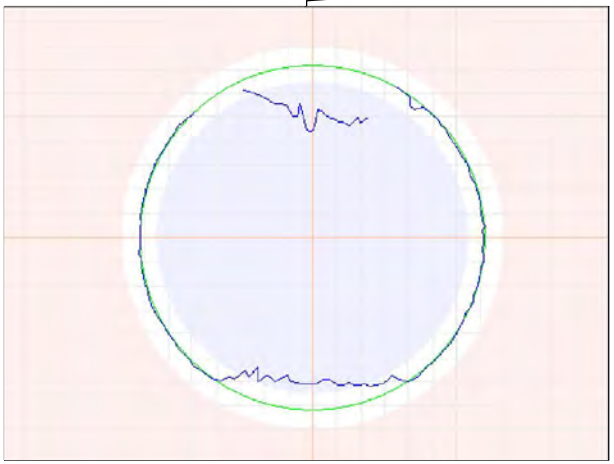
2949.4ft General Observation - Debris to 3.8"



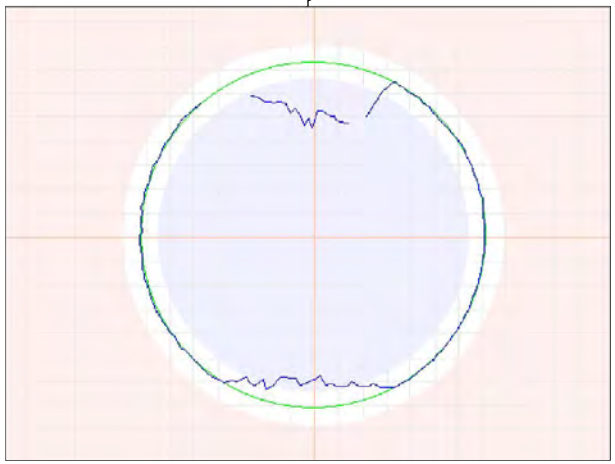
3002.4ft General Observation - Debris to 2.4"



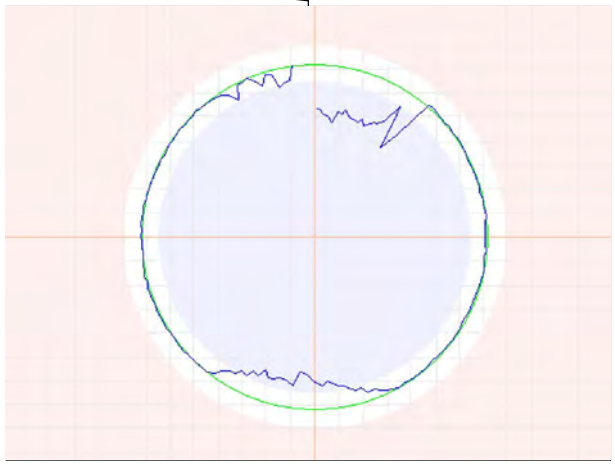




3052.9ft General Observation - Debris to 1.7"



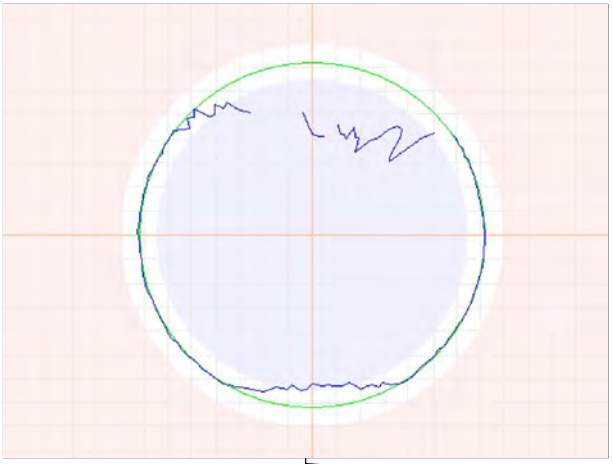
3097.9ft General Observation - Debris to 1.9"



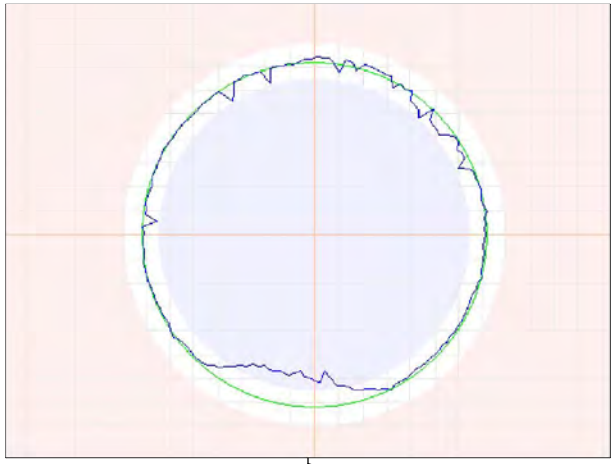
3145.9ft General Observation - Debris to 3.4"

Observation Report

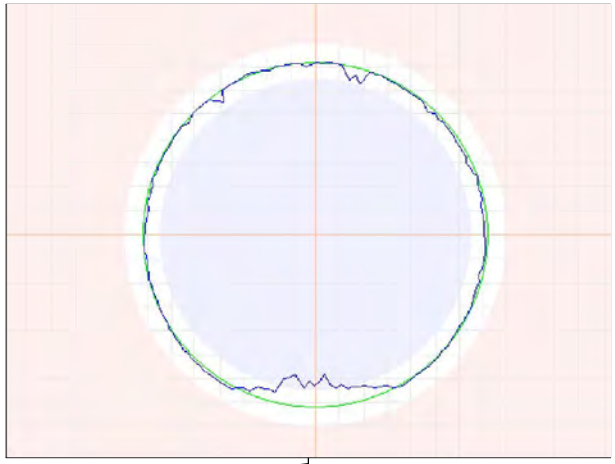
3197ft General Observation - Debris to 2.3"

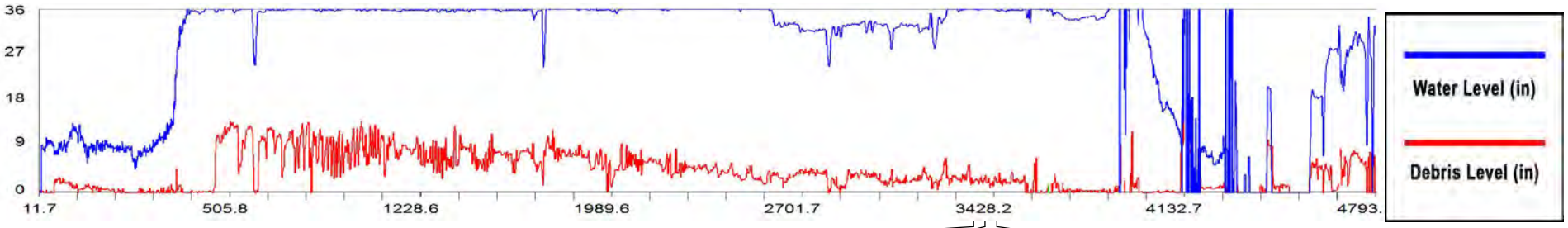


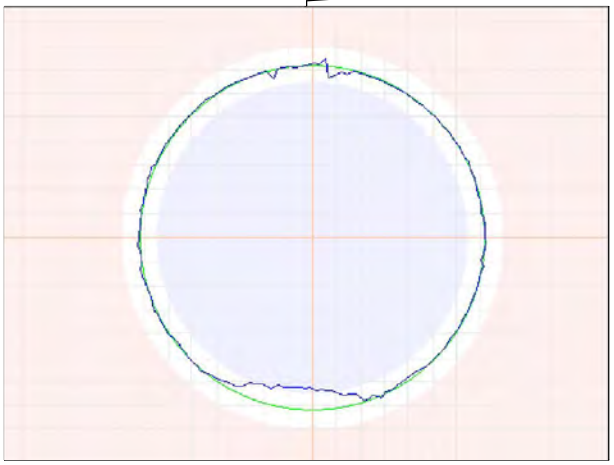
3249.2ft General Observation - Debris to 2.8"



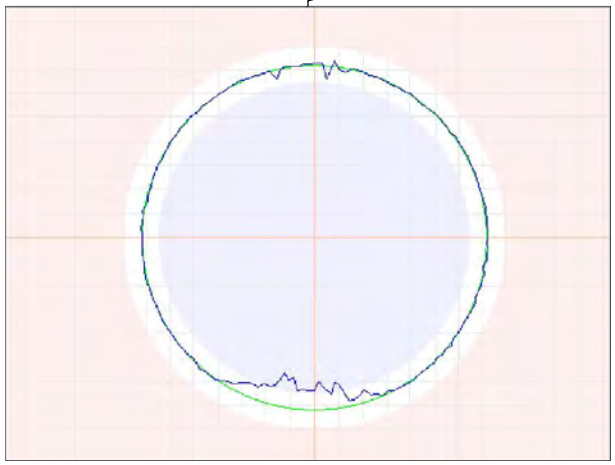
3301.1ft General Observation - Debris to 2.3"



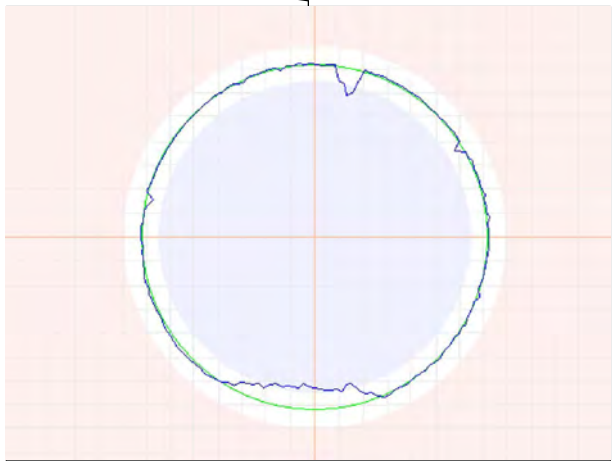




3352.6ft General Observation - Debris to 2.4"



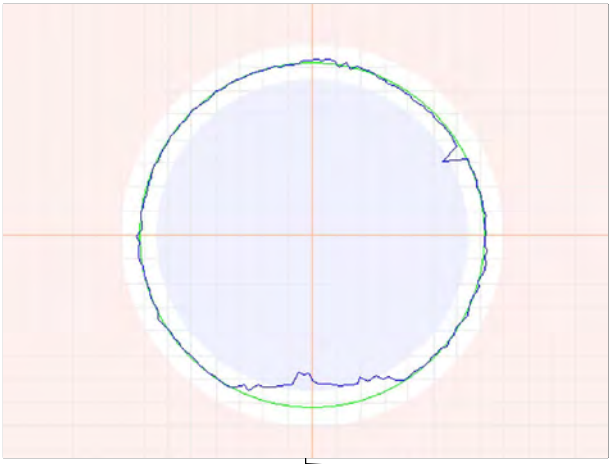
3398.7ft General Observation - Debris to 2.0"



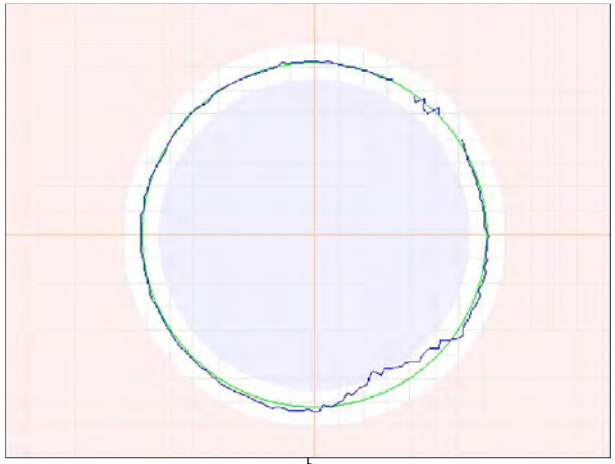
3446.3ft General Observation - Debris to 2.2"

Observation Report

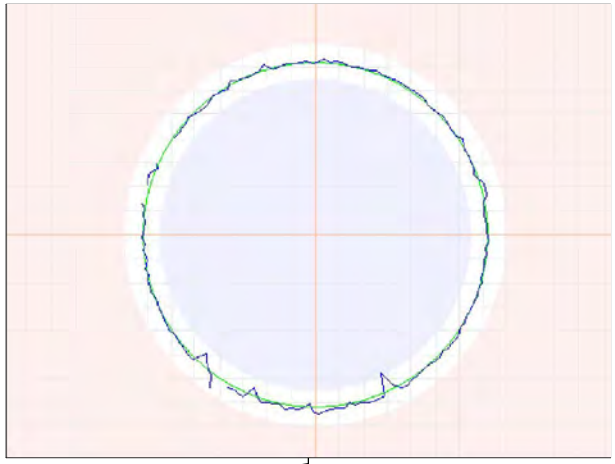
3495.3ft General Observation - Debris to 2.8"

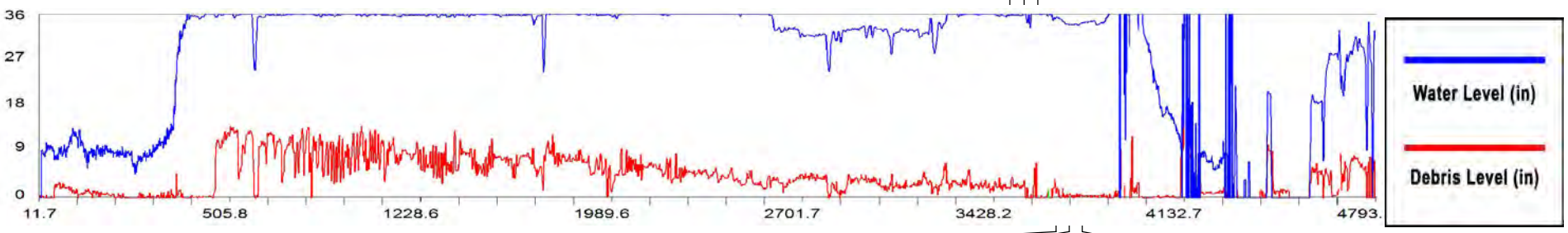


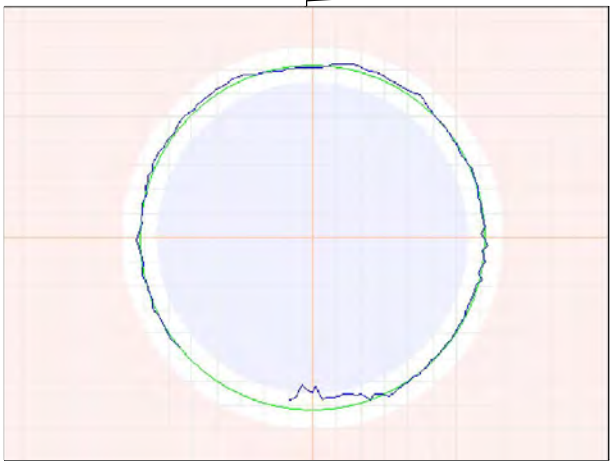
3550.8ft General Observation - Debris to 2.4"



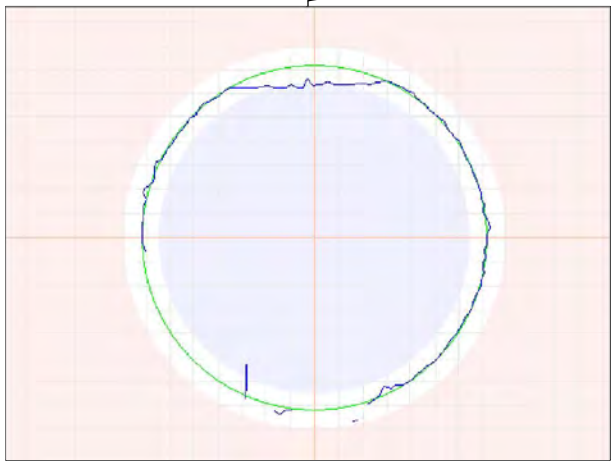
3602.5ft General Observation



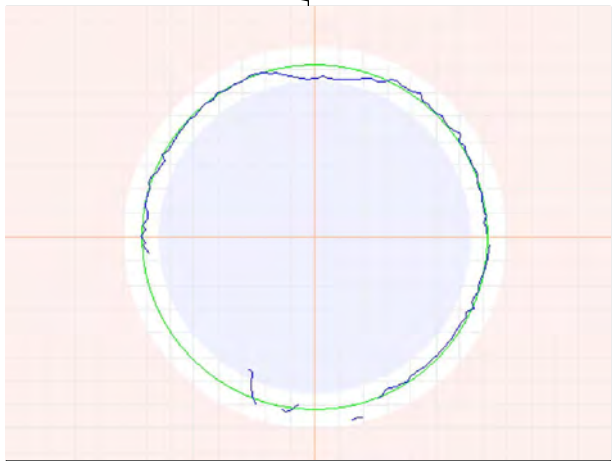




3649.2ft General Observation



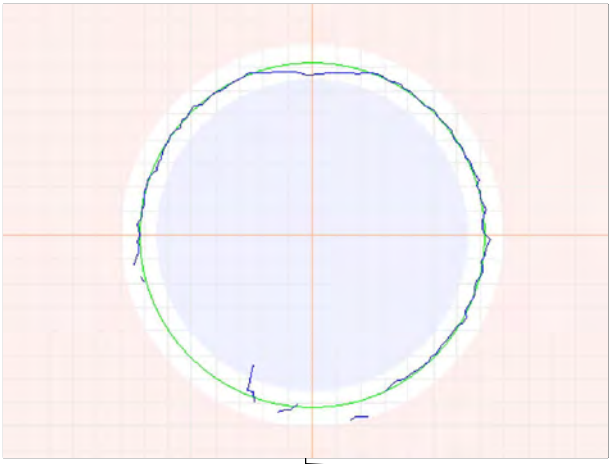
3701.5ft General Observation



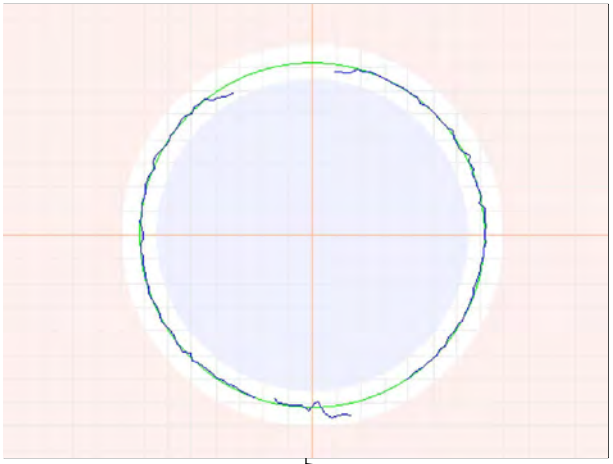
3752.1ft General Observation

Observation Report

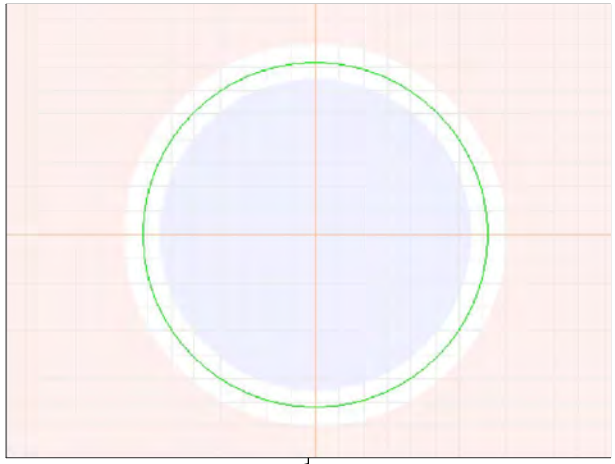
3796.3ft General Observation

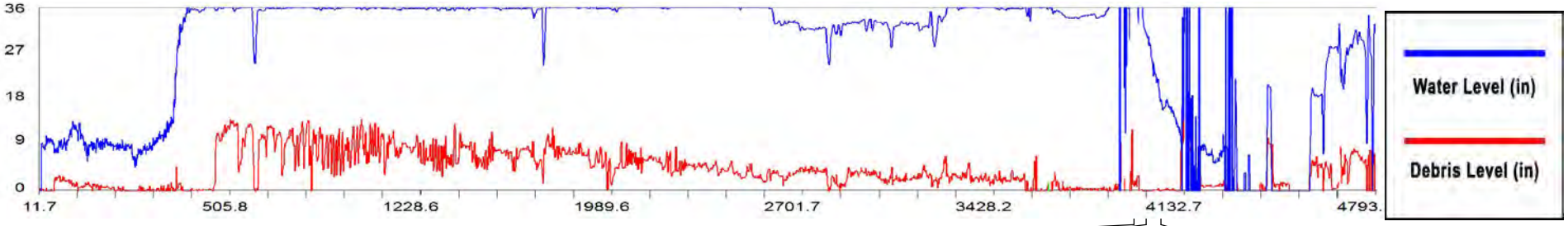


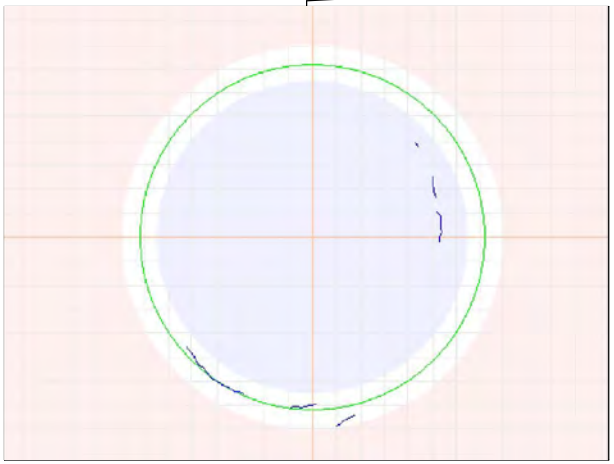
3846ft General Observation



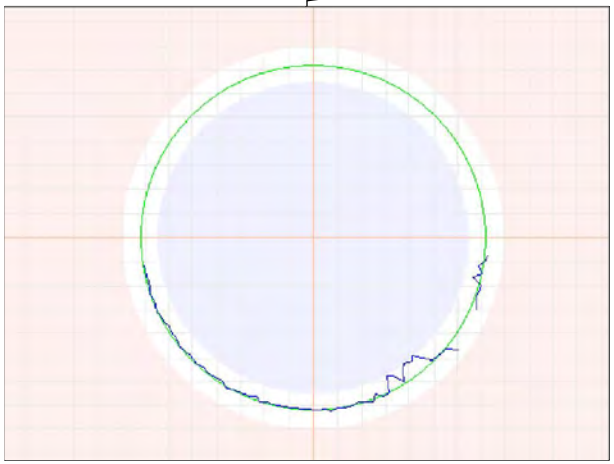
3898.6ft General Observation



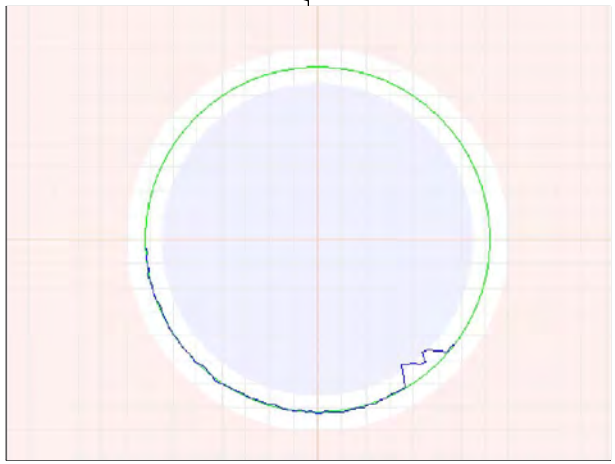




3948.6ft General Observation



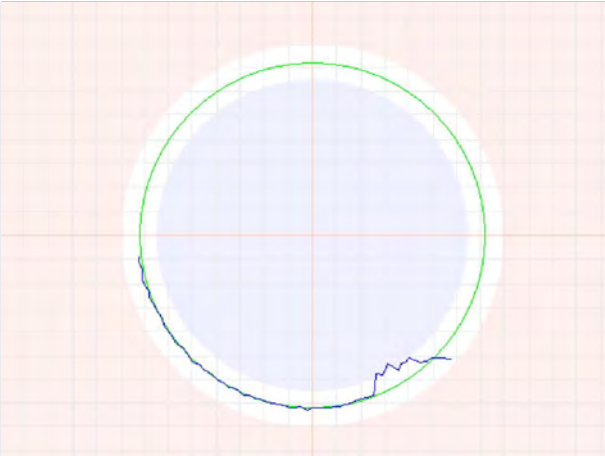
3996.1ft General Observation



4050.6ft General Observation

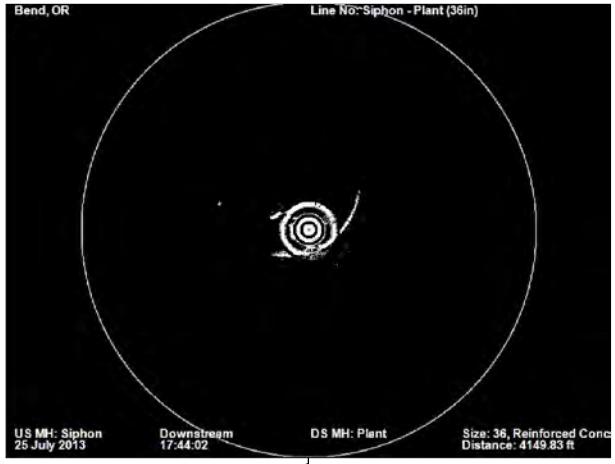
Observation Report

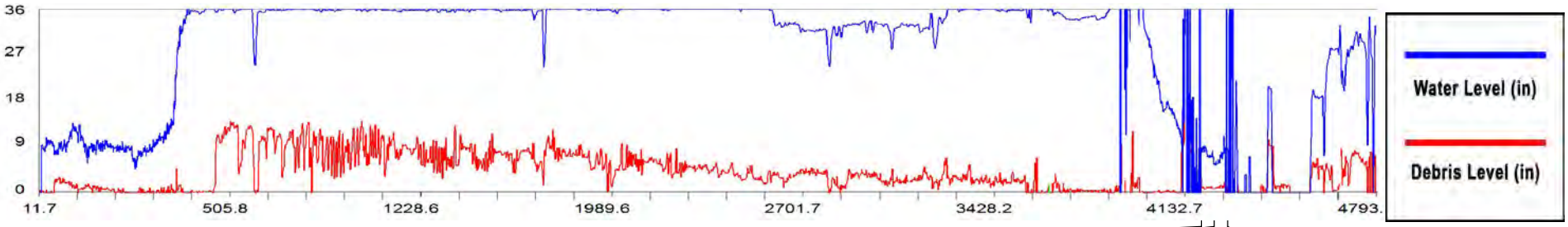
4099.3ft General Observation

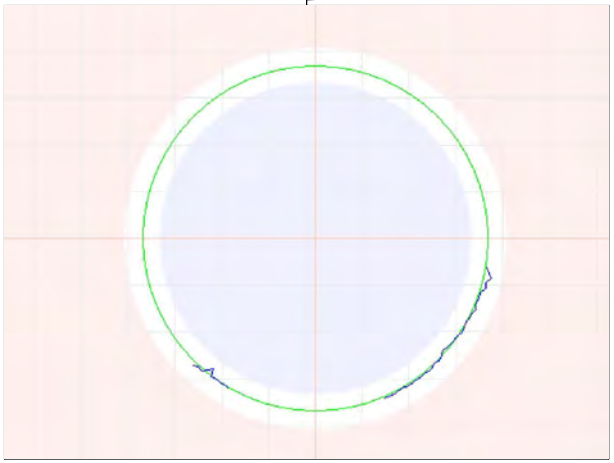


4140.9ft Point of Interest - Low level sonar return until 4720ft

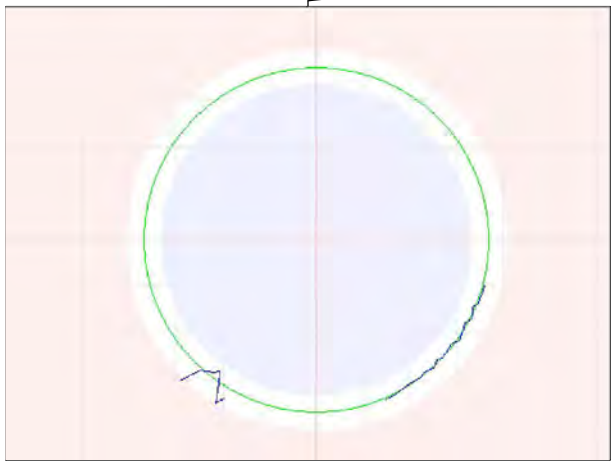
4149.8ft General Observation - Limited Sonar Return



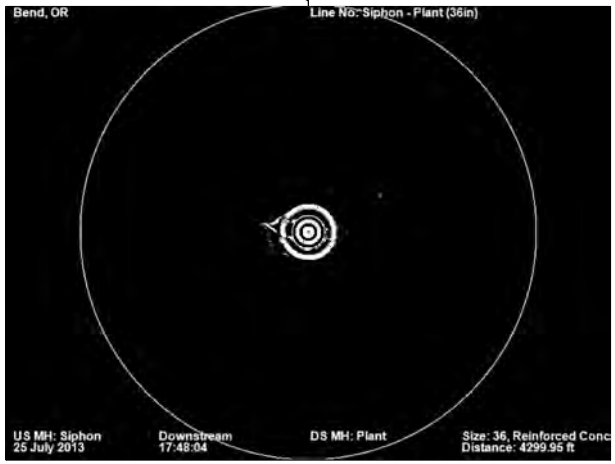




4200.9ft General Observation



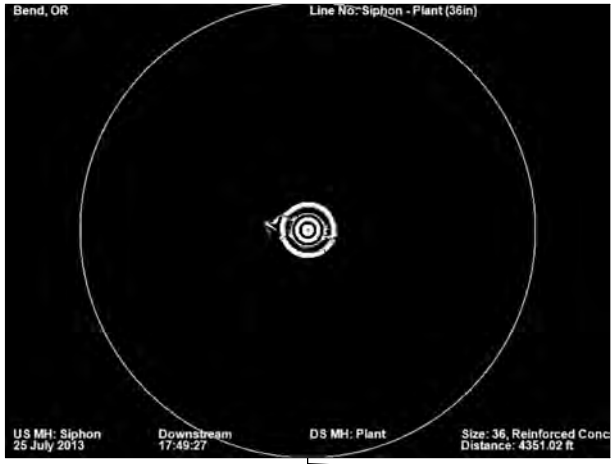
4249.5ft General Observation



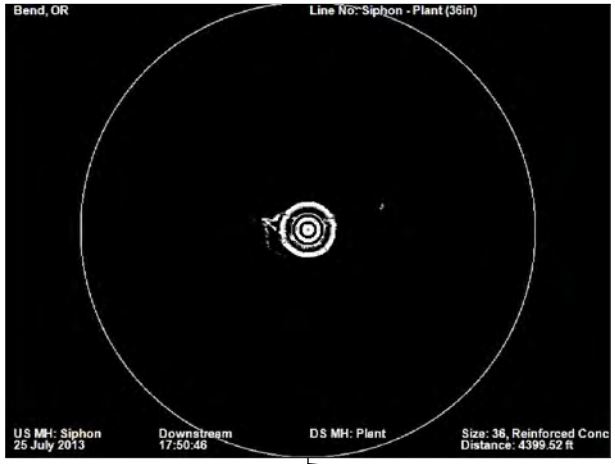
4299.4ft General Observation - Limited Sonar Return

Observation Report

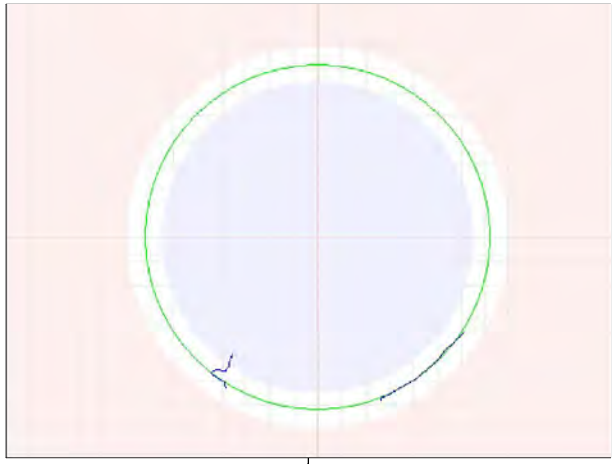
4349.9ft General Observation - Limited Sonar Return

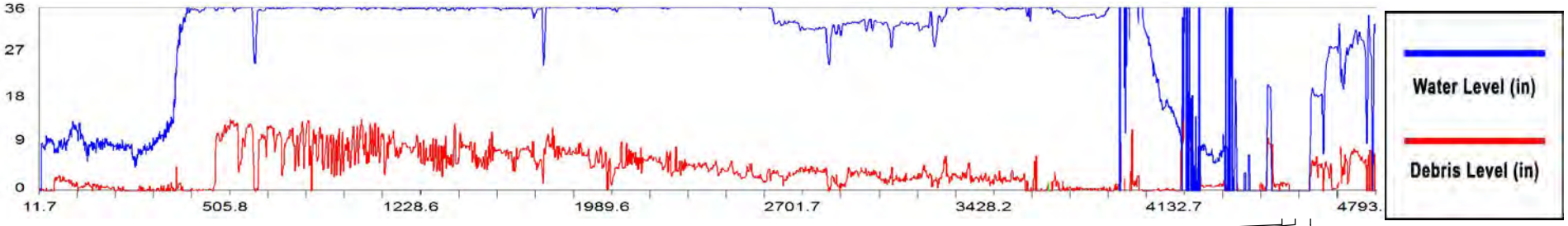


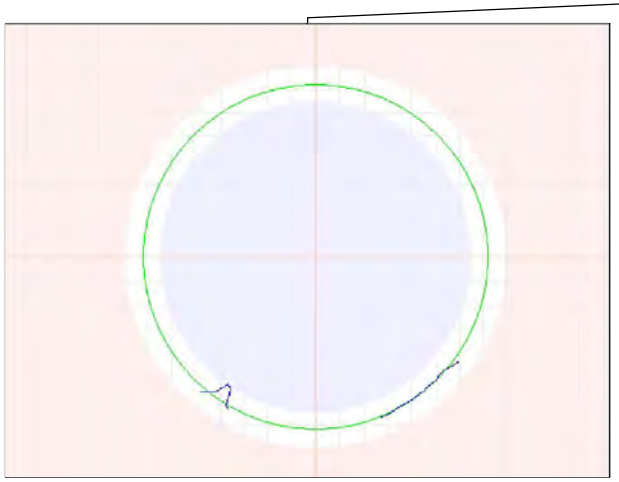
4399ft General Observation - Limited Sonar Return



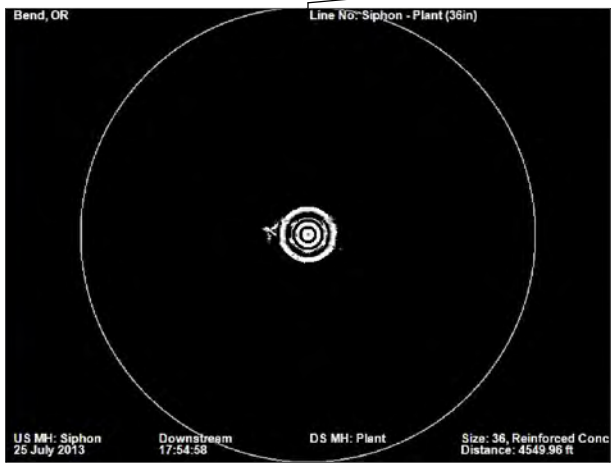
4450.1ft General Observation



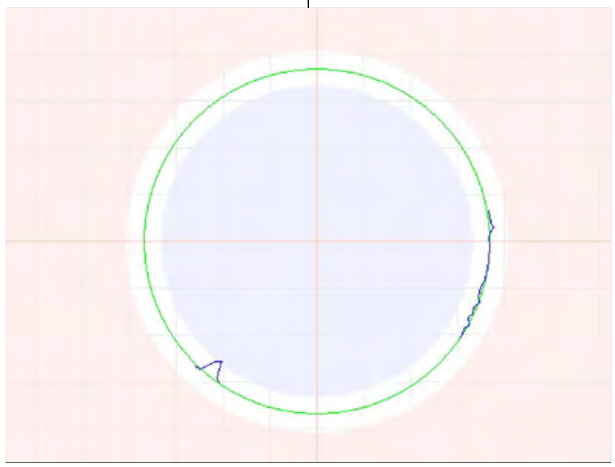




4501.2ft General Observation - Limited Sonar Return



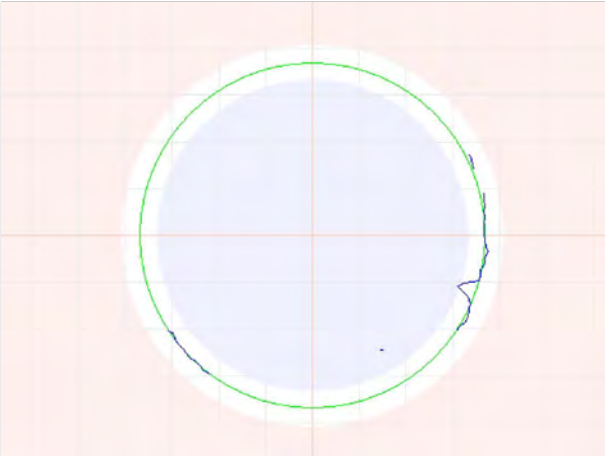
4549.3ft General Observation - Limited Sonar Return



4600.7ft General Observation

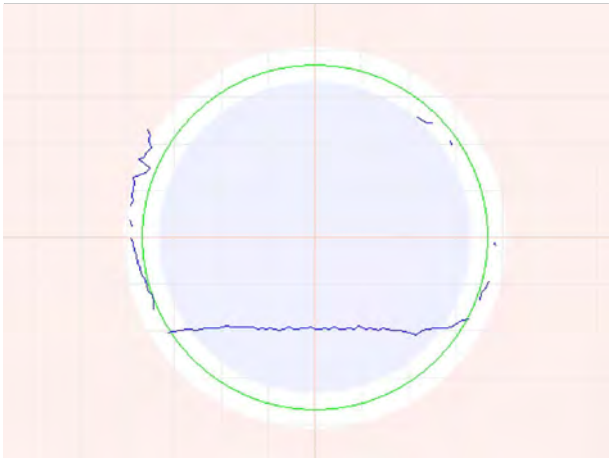
Observation Report

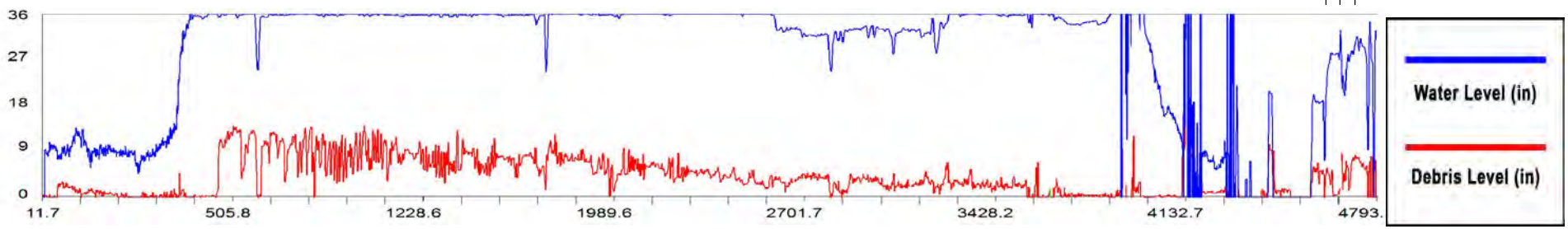
4650.3ft General Observation



4698.5ft General Observation

4749.4ft General Observation - Debris to 8.5"





OVERVIEW - CSS000001-WRFIntertie21in

Asset Number	CSS000001-WRFIntertie21in		
Upstream MH	CSS000001	Material	Reinforced Concrete Pipe
Downstream MH	WRF Intertie Box	Size & Shape	21 in Circle
Survey Direction	Downstream	Match to Reference	1149.6 ft

Distance	Observation	Comment
0 ft	**Beginning of Inspection**	**CSS000001**
10.2	General Observation	
50.2	General Observation	
100.7	General Observation	
150.6	General Observation	
200.1	General Observation	
250.2	General Observation	
300.2	General Observation	
350	General Observation	
400	General Observation	
450	General Observation	
500.4	General Observation	
550.2	General Observation	
599.8	General Observation	Debris to 2.5"
649.9	General Observation	
700.5	General Observation	
750.3	General Observation	
790.6	General Observation	
849.3	General Observation	
899.4	General Observation	
951.4	General Observation	
1000.4	General Observation	
1051	General Observation	
1099.1	General Observation	
1149.6	Match to Reference Shape and Size	Ã¸21"

OVERVIEW - CSS000001-WRFIntertie21in

Asset Number	CSS000001-WRFIntertie21in		
Upstream MH	CSS000001	Material	Reinforced Concrete Pipe
Downstream MH	WRF Intertie Box	Size & Shape	21 in Circle
Survey Direction	Downstream	Match to Reference	1149.6 ft

Distance	Observation	Comment
1149.6	General Observation	
1198.4	General Observation	Debris to 0.3"
1248.2	General Observation	
1299.7	General Observation	Debris to 1.1"
1346.8	General Observation	Debris to 1.0"
1399.1	General Observation	Debris to 0.9"
1447.3	General Observation	Debris to 0.4"
1500.4	General Observation	
1547.2	General Observation	
1599.1	General Observation	
1651.2	General Observation	Debris to 0.3"
1701.1	General Observation	Debris to 0.7"
1749.1	General Observation	
1798.8	General Observation	
1851.7	General Observation	
1896.7	General Observation	Debris to 0.5"
1948.6	General Observation	
2001.7	General Observation	Debris to 0.4"
2052.2	General Observation	Debris to 0.4"
2096.7	General Observation	Debris to 0.6"
2147.3	General Observation	Debris to 0.8"
2200	General Observation	Debris to 0.8"
2207.5	Maximum Debris	To 5.6"
2251.3	General Observation	Debris to 0.6"
2299.3	General Observation	Debris to 0.4"
2348	General Observation	Debris to 0.7"

OVERVIEW - CSS000001-WRFIntertie21in

Asset Number	CSS000001-WRFIntertie21in		
Upstream MH	CSS000001	Material	Reinforced Concrete Pipe
Downstream MH	WRF Intertie Box	Size & Shape	21 in Circle
Survey Direction	Downstream	Match to Reference	1149.6 ft

Distance	Observation	Comment
2396.5	General Observation	Debris to 0.5"
2450.3	General Observation	Debris to 0.6"
2498.2	General Observation	
2547.3	General Observation	Debris to 0.2"
2598.1	General Observation	
2651.2	General Observation	Debris to 0.6"
2698.3	General Observation	Debris to 0.3"
2749.8	General Observation	
2797.1	General Observation	Debris to 0.2"
2851.5	General Observation	Debris to 0.5"
2900.6	General Observation	Debris to 0.3"
2950	General Observation	Debris to 0.7"
3000.3	General Observation	Debris to 1.0"
3051.1	General Observation	Debris to 0.5"
3098.8	General Observation	
3151.8	General Observation	
3196.6	General Observation	Debris to 0.8"
3251.8	General Observation	Debris to 0.7"
3297	General Observation	Debris to 0.7"
3347.7	General Observation	Debris to 0.6"
3398.9	General Observation	Debris to 0.6"
3450.9	General Observation	Debris to 0.9"
3501.5	General Observation	Debris to 0.8"
3548.8	General Observation	
3601.5	General Observation	
3647.8	General Observation	Debris to 0.6"

OVERVIEW - CSS000001-WRFIntertie21in

Asset Number	CSS000001-WRFIntertie21in		
Upstream MH	CSS000001	Material	Reinforced Concrete Pipe
Downstream MH	WRF Intertie Box	Size & Shape	21 in Circle
Survey Direction	Downstream	Match to Reference	1149.6 ft

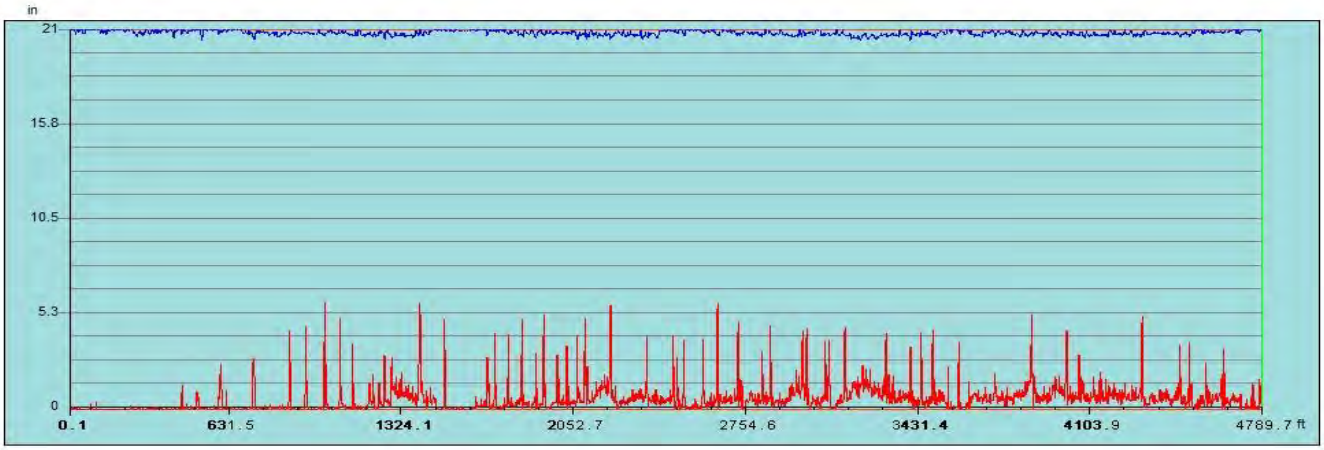
Distance	Observation	Comment
3701.8	General Observation	Debris to 0.8"
3749	General Observation	Debris to 0.6"
3799.6	General Observation	Debris to 0.7"
3847.1	General Observation	Debris to 0.9"
3898.5	General Observation	Debris to 0.3"
3948.5	General Observation	Debris to 0.4"
3997.7	General Observation	Debris to 1.0"
4049.6	General Observation	Debris to 1.2"
4099.7	General Observation	Debris to 1.6"
4149.2	General Observation	Debris to 1.8"
4199.2	General Observation	Debris to 1.4"
4248.9	General Observation	Debris to 0.8"
4299.3	General Observation	Debris to 1.1"
4349.7	General Observation	Debris to 0.8"
4399.6	General Observation	Debris to 1.1"
4449.6	General Observation	Debris to 1.4"
4499.4	General Observation	Debris to 2.2"
4549.4	General Observation	Debris to 0.4"
4599.2	General Observation	Debris to 0.6"
4649.4	General Observation	Debris to 0.6"
4699.9	General Observation	Debris to 0.9"
4749.6	General Observation	
4783.7	General Observation	
15711.2 ft	**End of Inspection**	**WRF Intertie Box**

CSS000001-WRFIntertie21in			
Asset Number	CSS000001-WRFIntertie21in	Length	4790 ft
Upstream MH	CSS000001	Diameter	21 in
Downstream MH	WRF Intertie Box	Material	Reinforced Concrete Pipe
Survey Direction	Downstream	Shape	Circle
Date Installed		Match to Reference *	1149.6 ft
Date Profiled	24 July 2013	Operator	

Observations

Average Debris Depth	1 in
Average Water Level	21 in
Debris Volume	83 cubic feet

Debris Graph



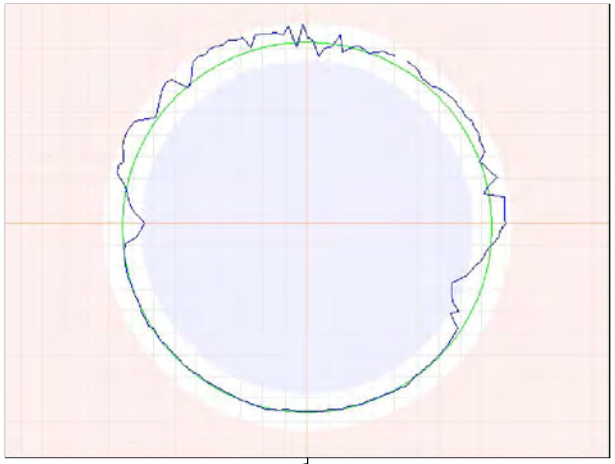
Inspection Distance (ft)

Water Level Debris Level

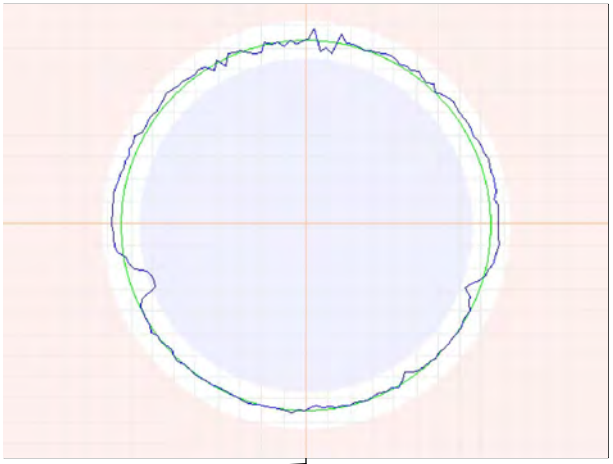
*** The match to reference is the point that best indicates the shape and size of the original condition of the pipe.**

Observation Report

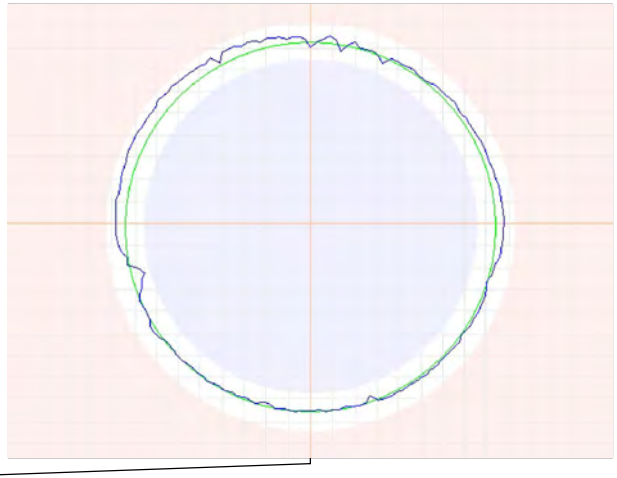
10.2ft General Observation

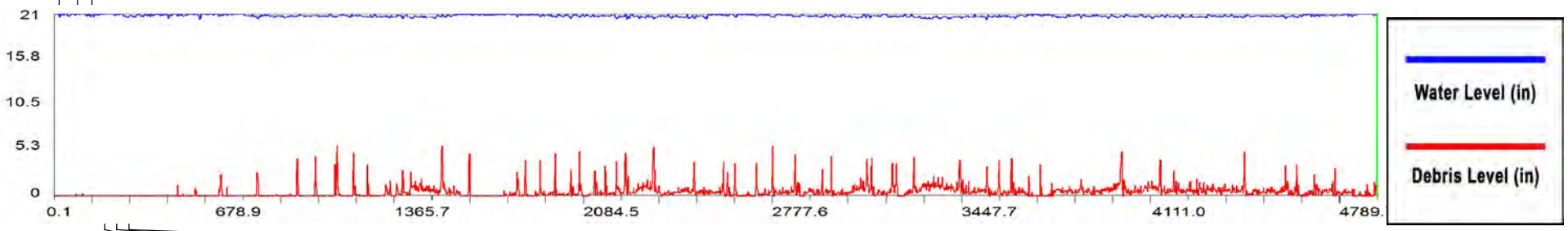


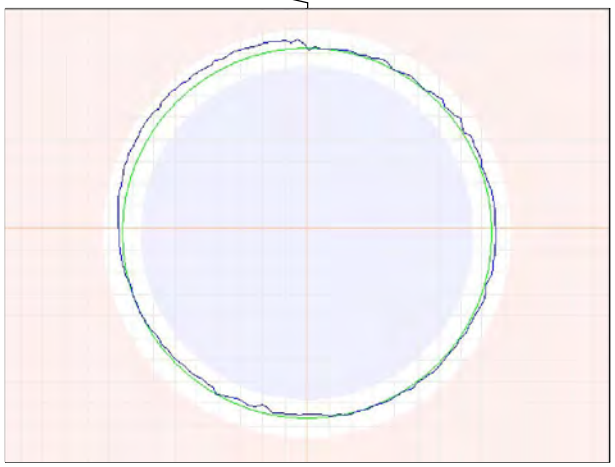
50.2ft General Observation



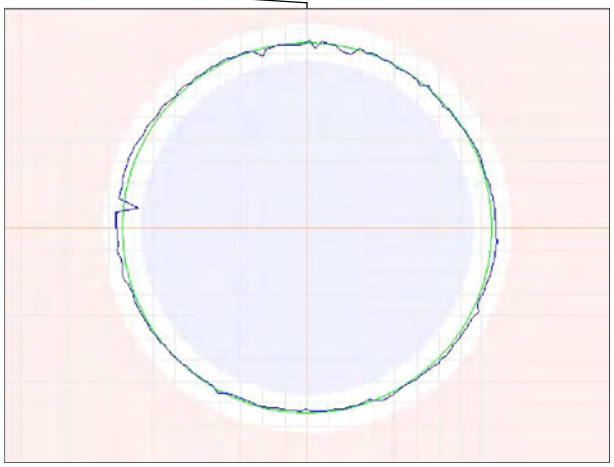
100.7ft General Observation



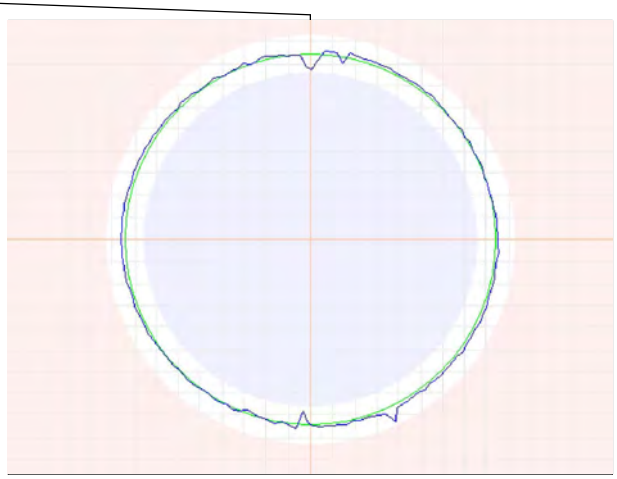




150.6ft General Observation



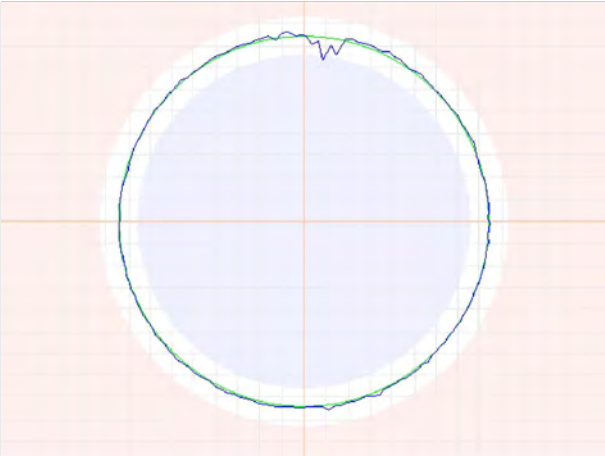
200.1ft General Observation



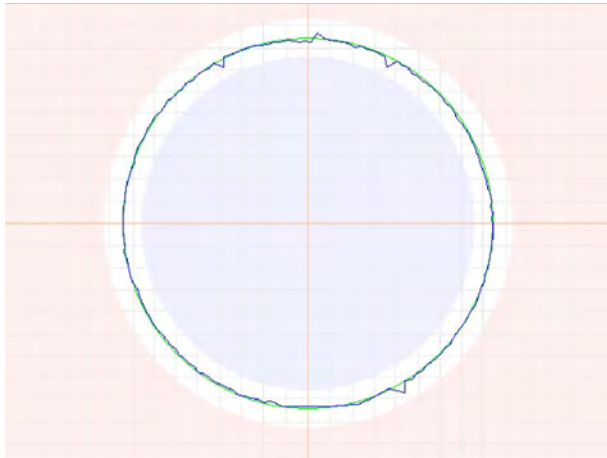
250.2ft General Observation

Observation Report

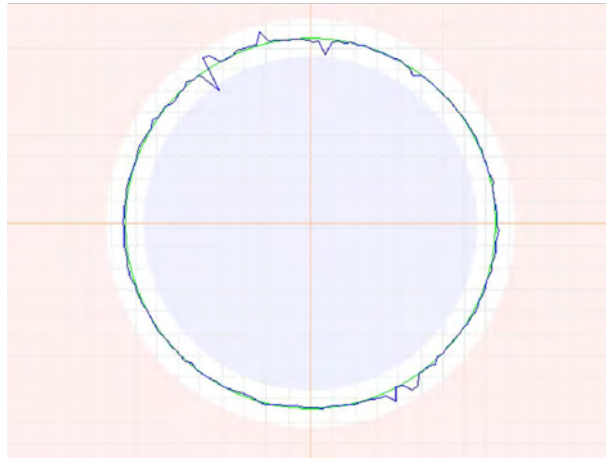
300.2ft General Observation

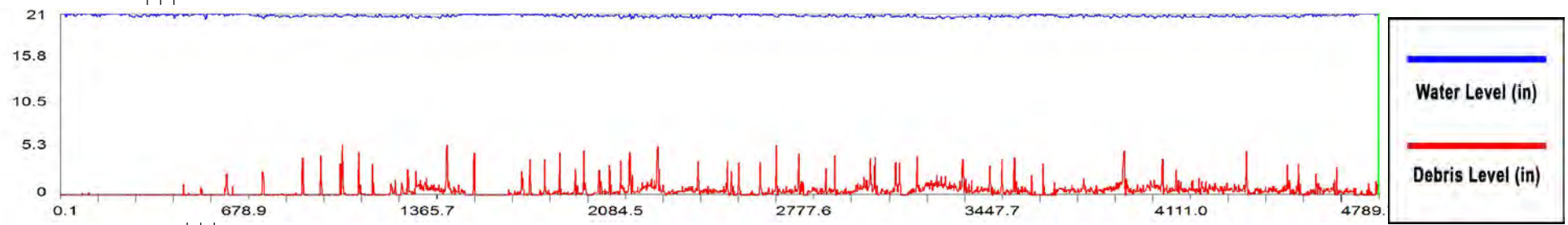


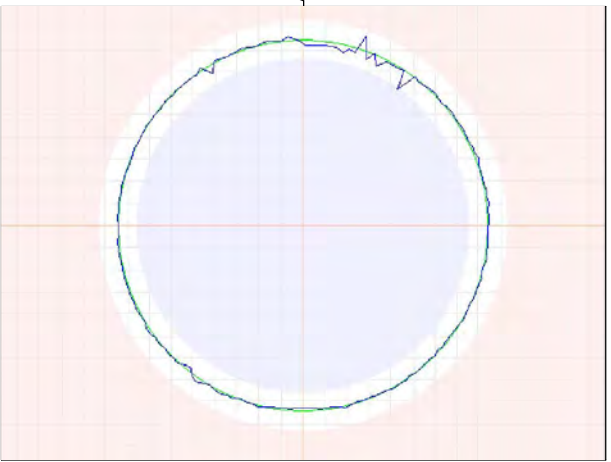
350ft General Observation



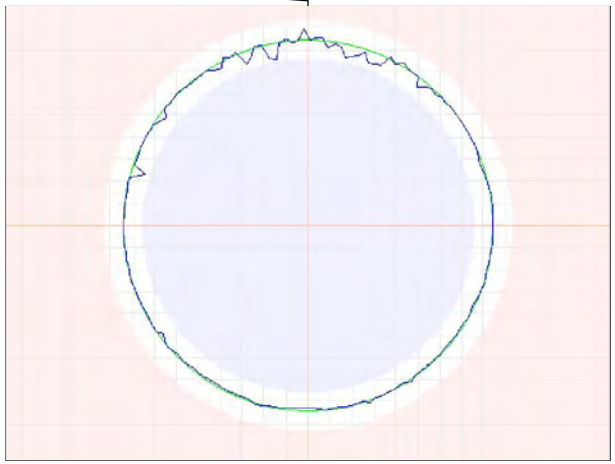
400ft General Observation



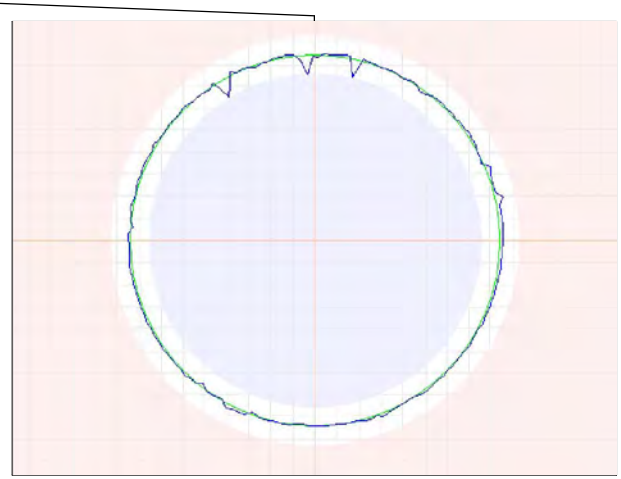




450ft General Observation



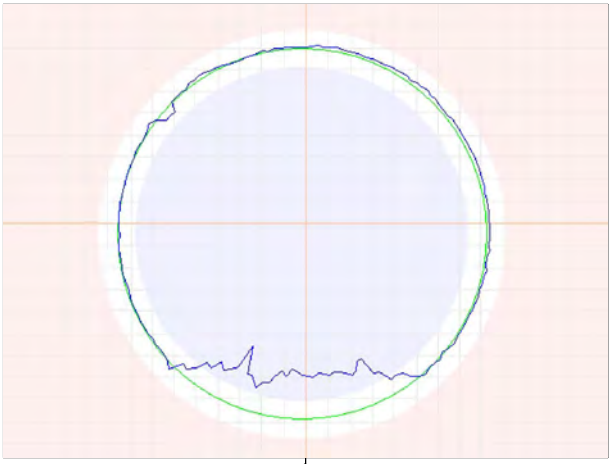
500.4ft General Observation



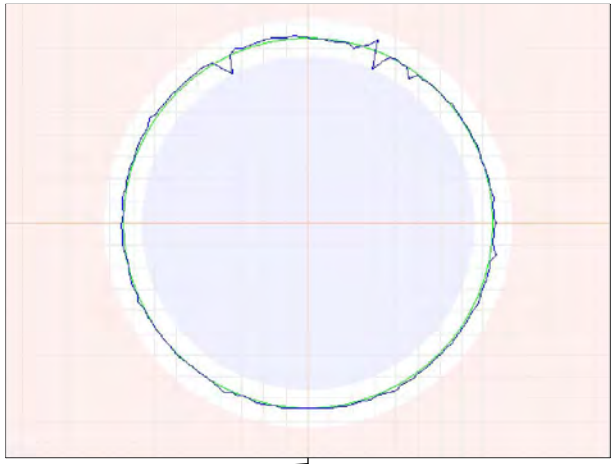
550.2ft General Observation

Observation Report

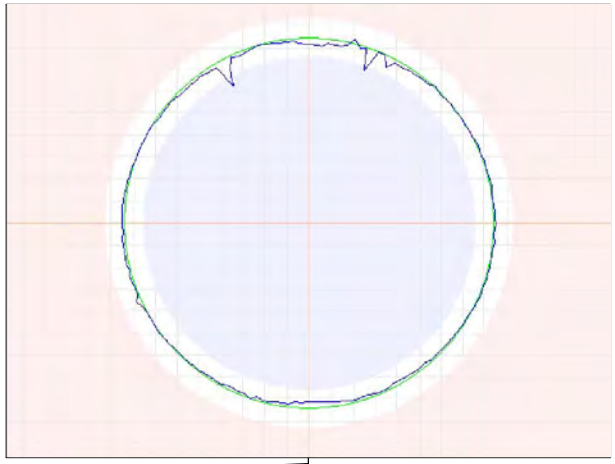
599.8ft General Observation - Debris to 2.5"

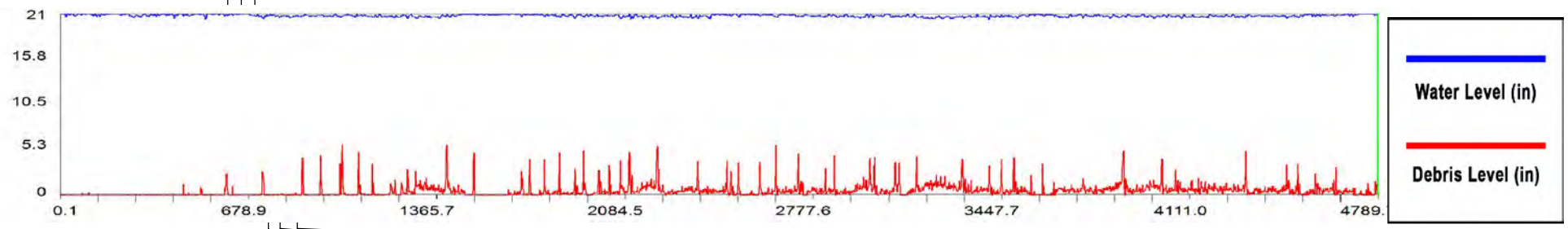


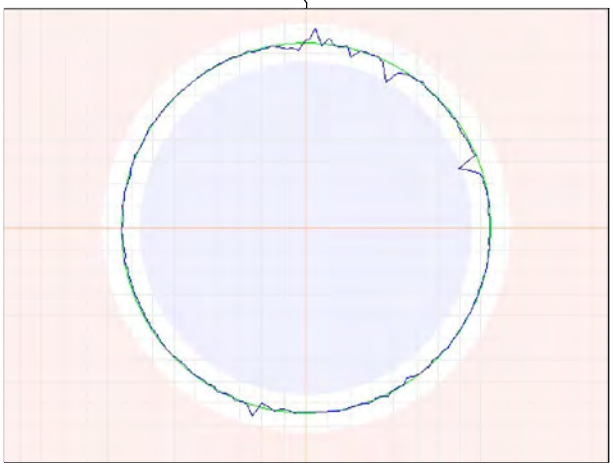
649.9ft General Observation



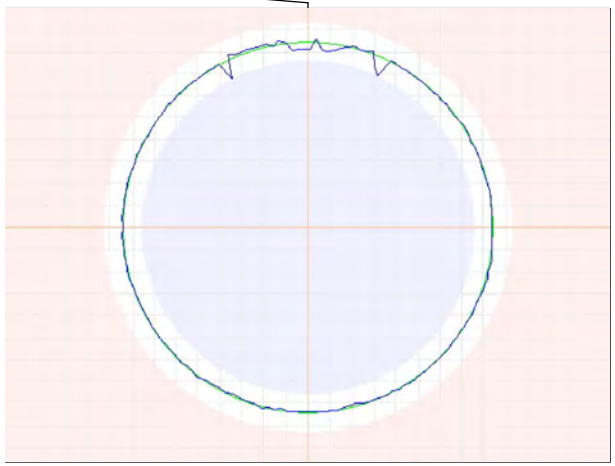
700.5ft General Observation



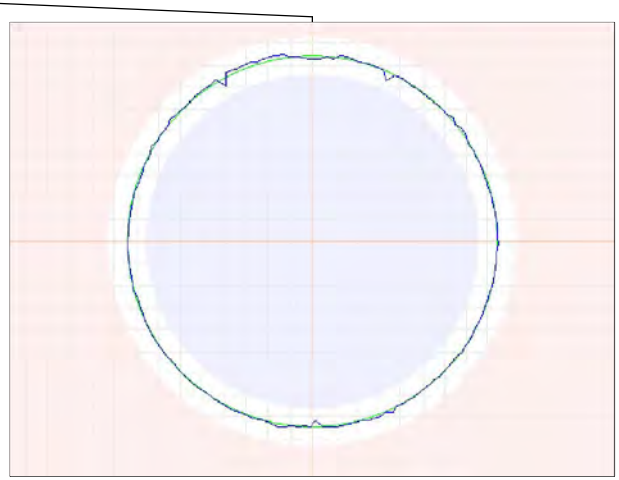




750.3ft General Observation



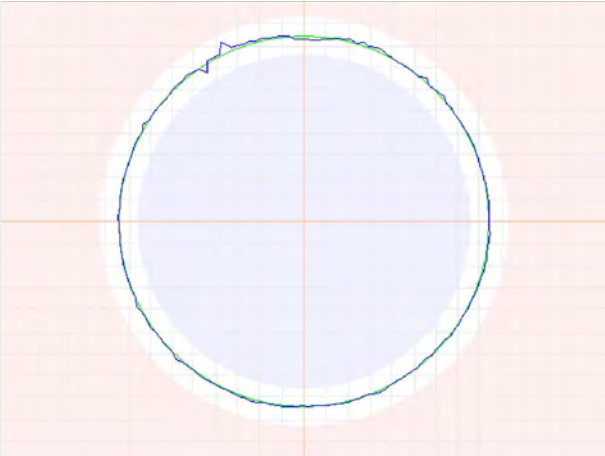
790.6ft General Observation



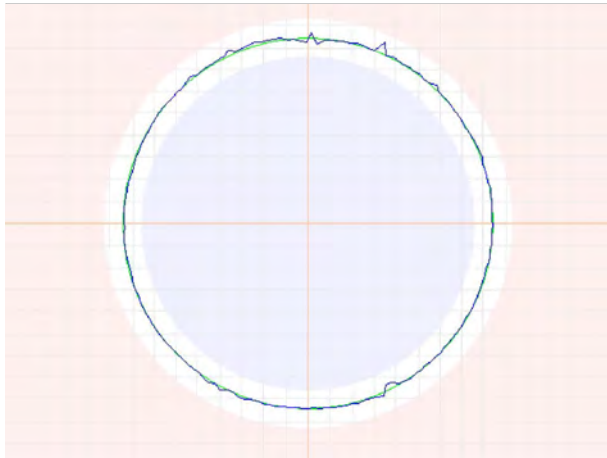
849.3ft General Observation

Observation Report

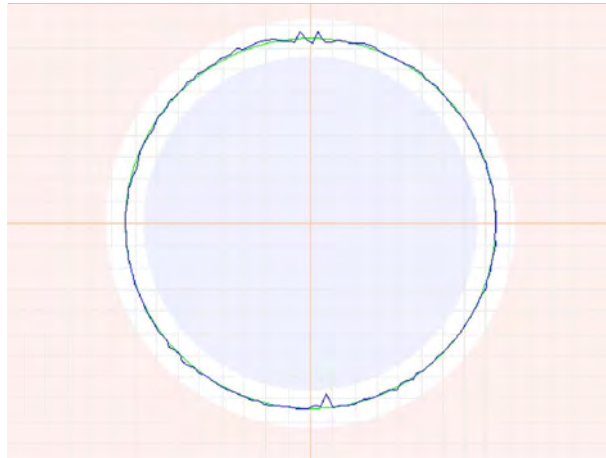
899.4ft General Observation

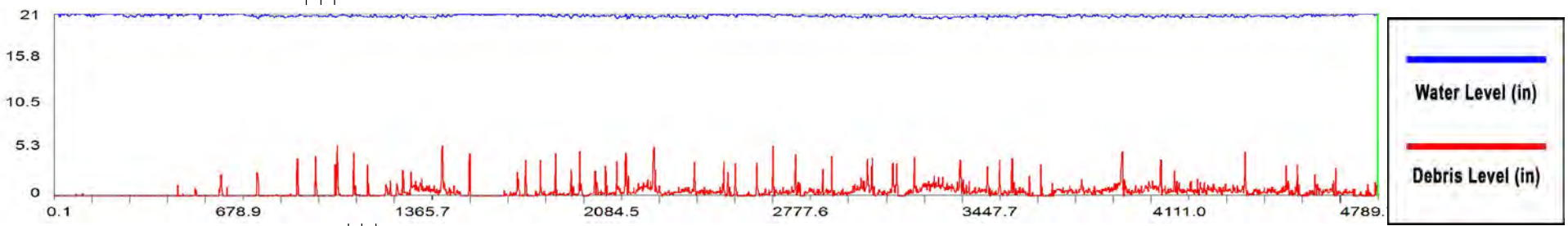


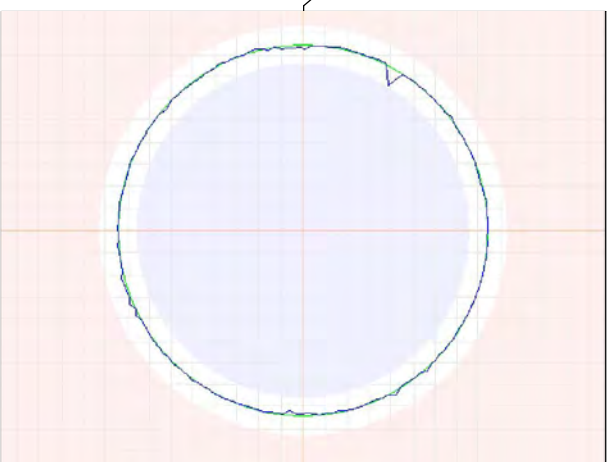
951.4ft General Observation



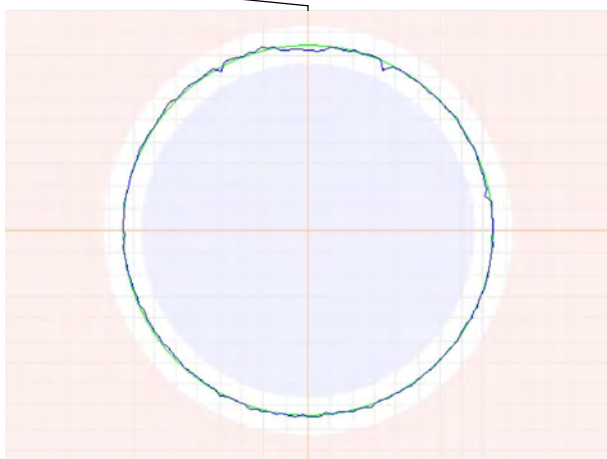
1000.4ft General Observation



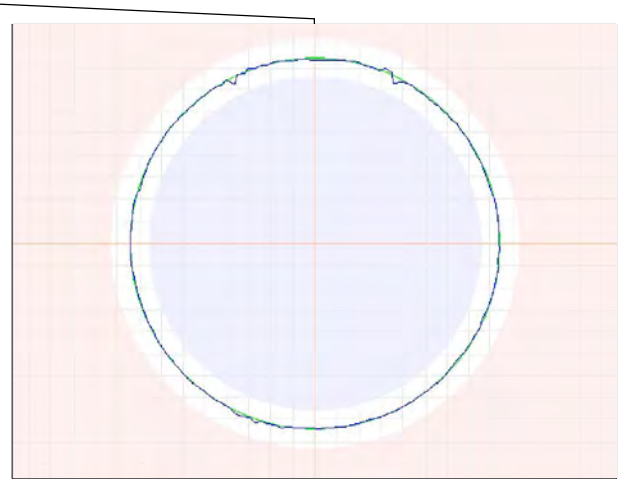




1051ft General Observation



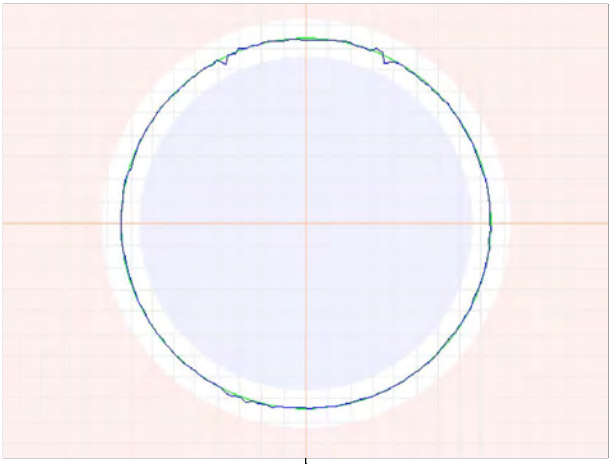
1099.1ft General Observation



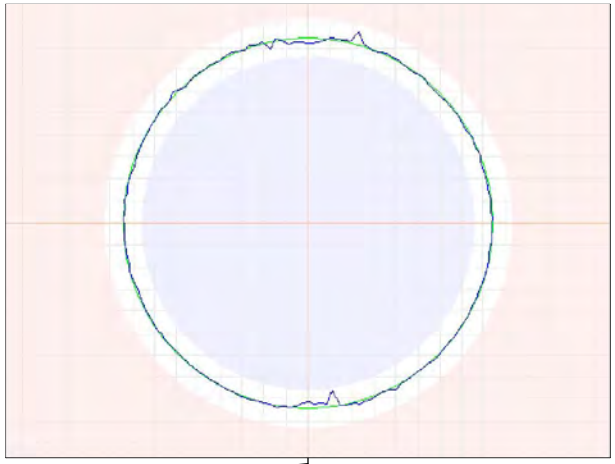
1149.6ft Match to Reference Shape and Size - Ã¸21"

Observation Report

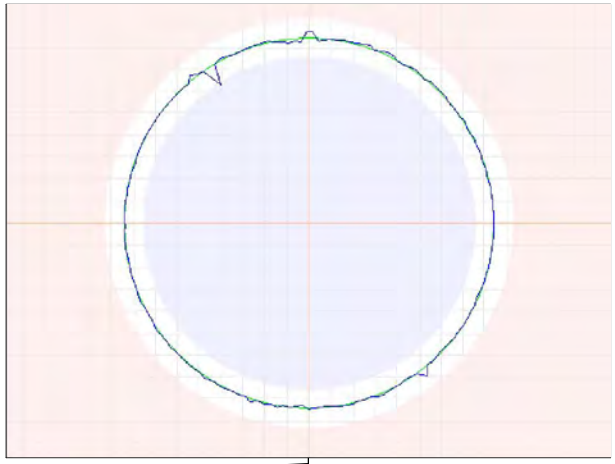
1149.6ft General Observation

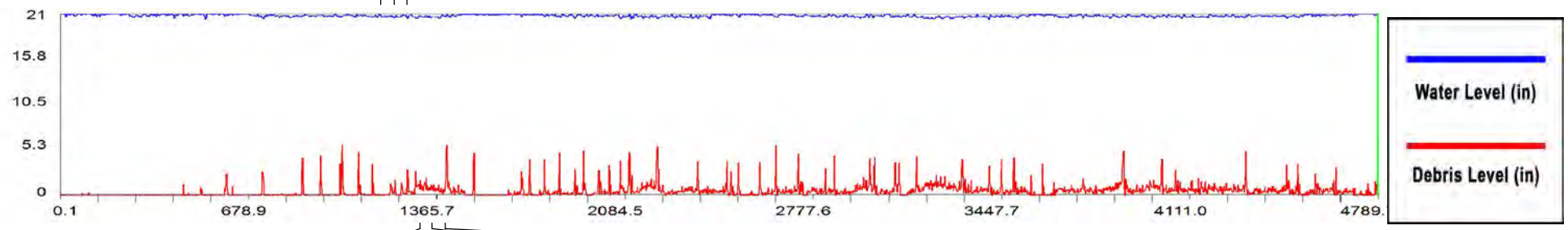


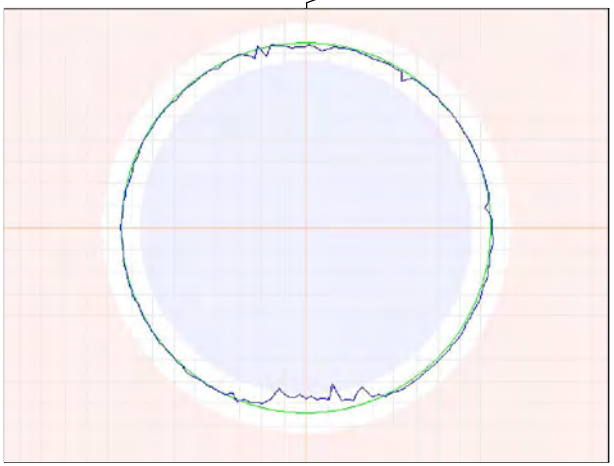
1198.4ft General Observation - Debris to 0.3"



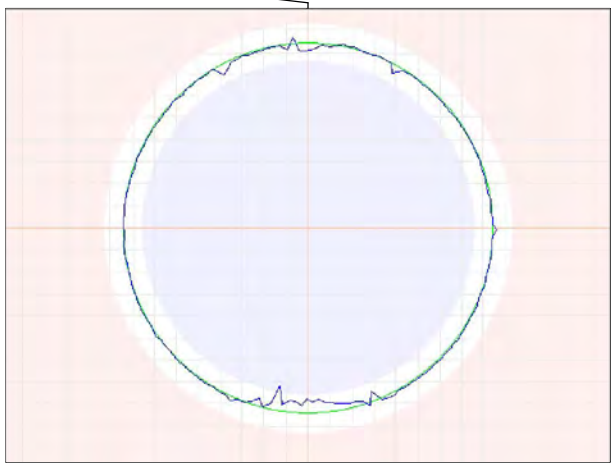
1248.2ft General Observation



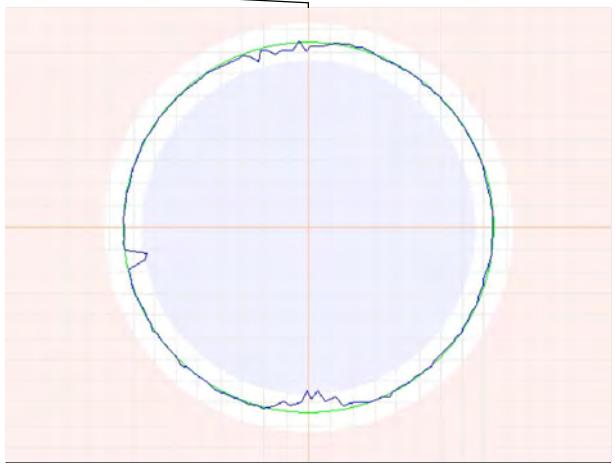




1299.7ft General Observation - Debris to 1.1"



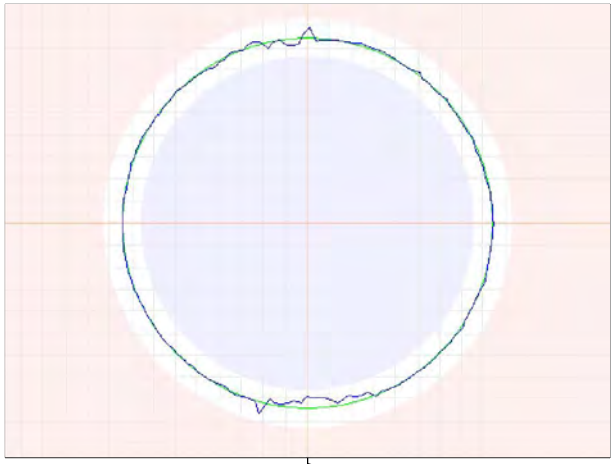
1346.8ft General Observation - Debris to 1.0"



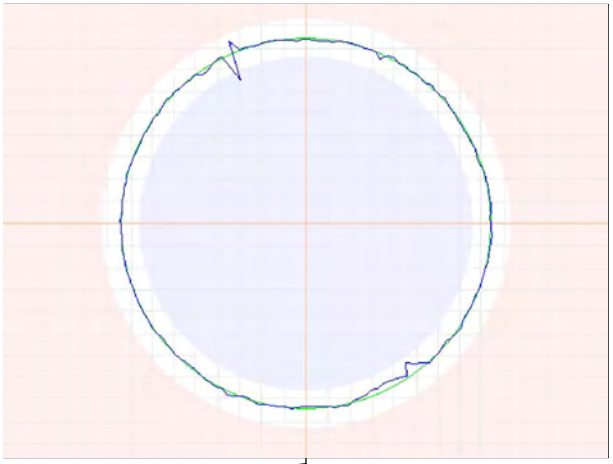
1399.1ft General Observation - Debris to 0.9"

Observation Report

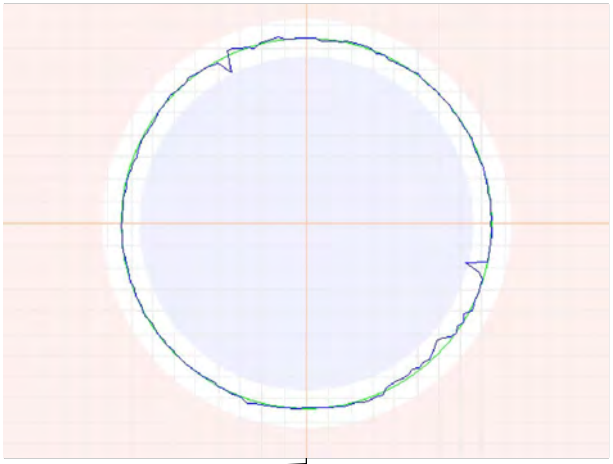
1447.3ft General Observation - Debris to 0.4"

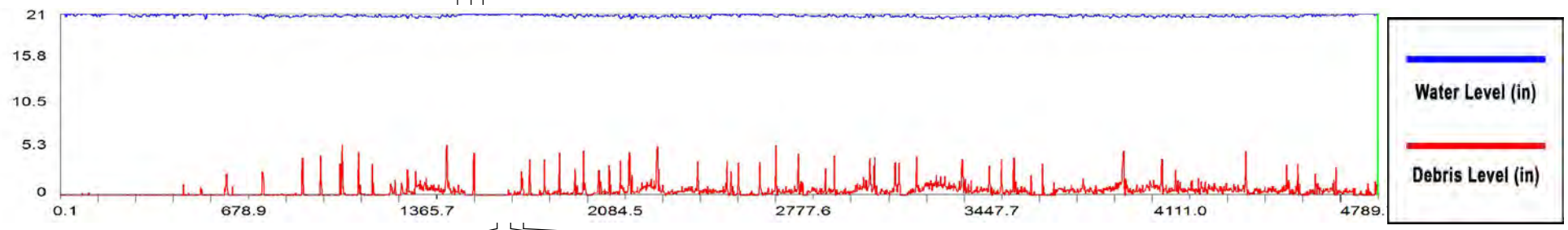


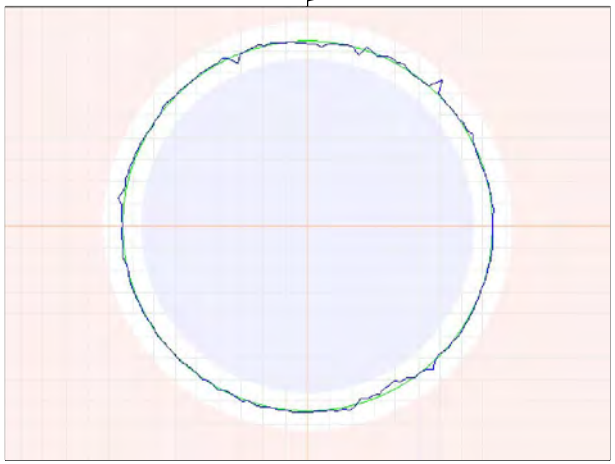
1500.4ft General Observation



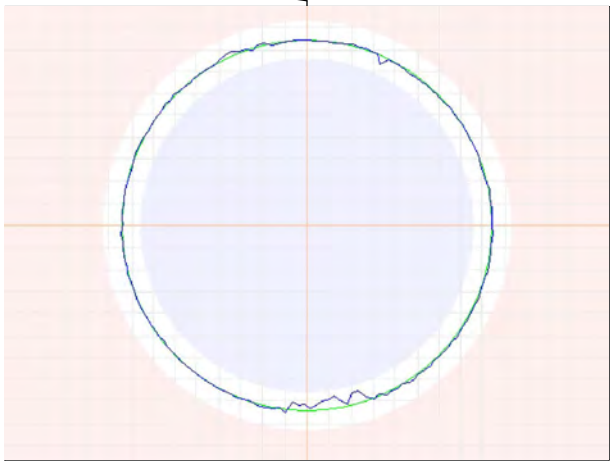
1547.2ft General Observation



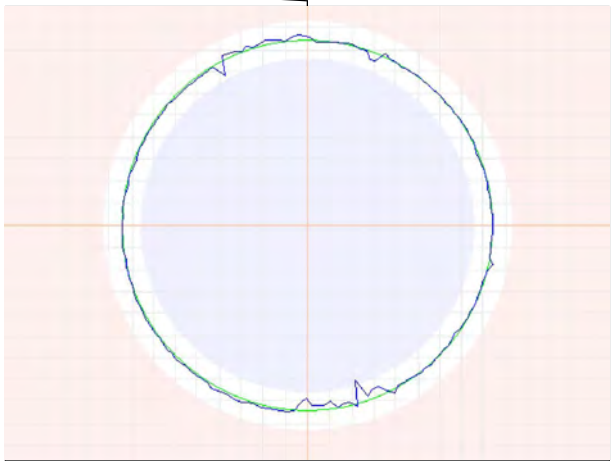




1599.1ft General Observation



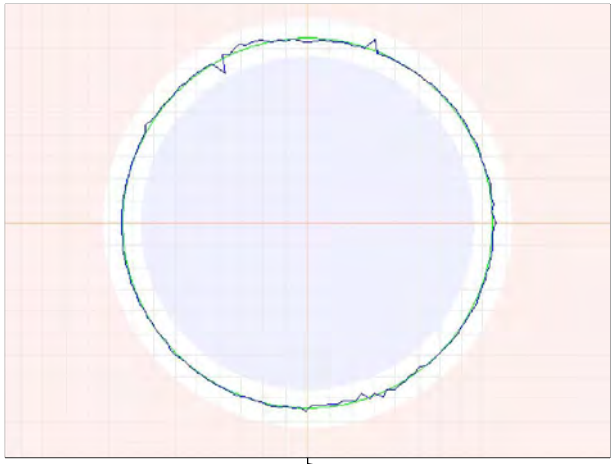
1651.2ft General Observation - Debris to 0.3"



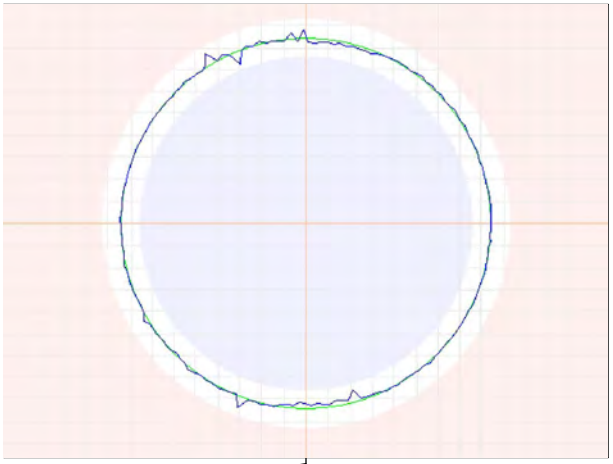
1701.1ft General Observation - Debris to 0.7"

Observation Report

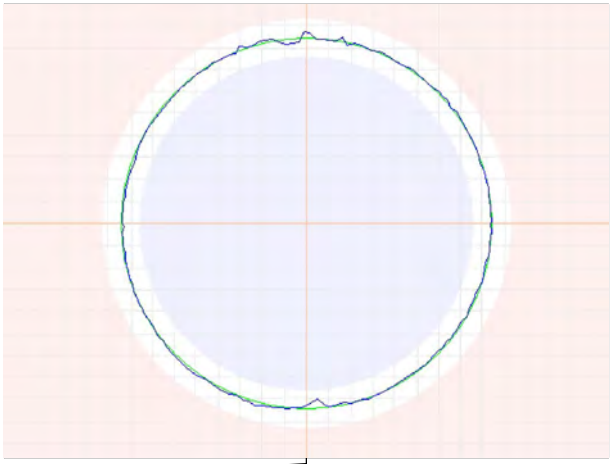
1749.1ft General Observation

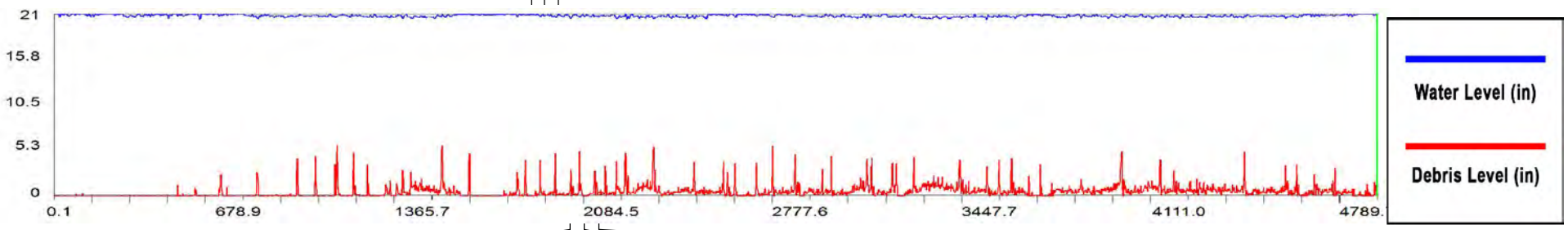


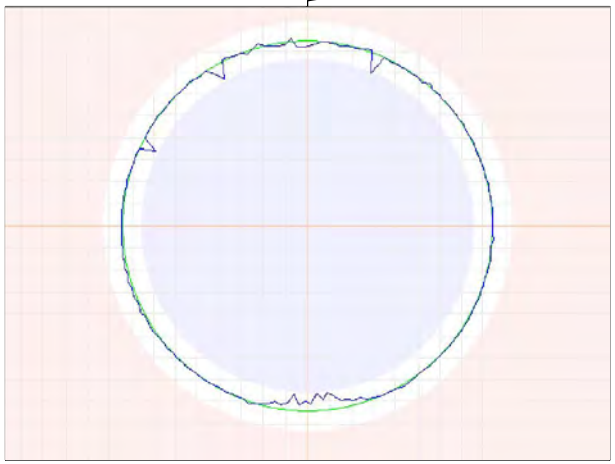
1798.8ft General Observation



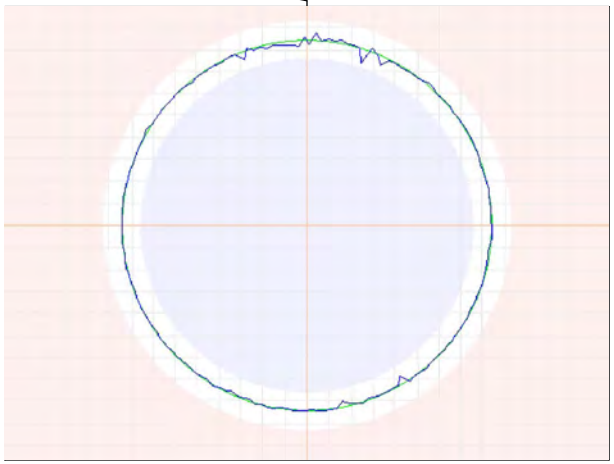
1851.7ft General Observation



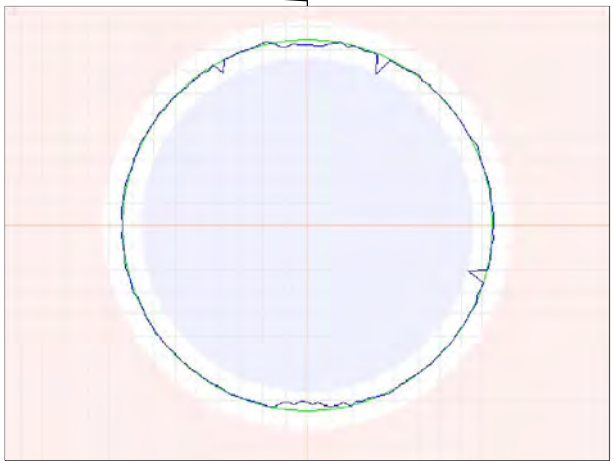




1896.7ft General Observation - Debris to 0.5"



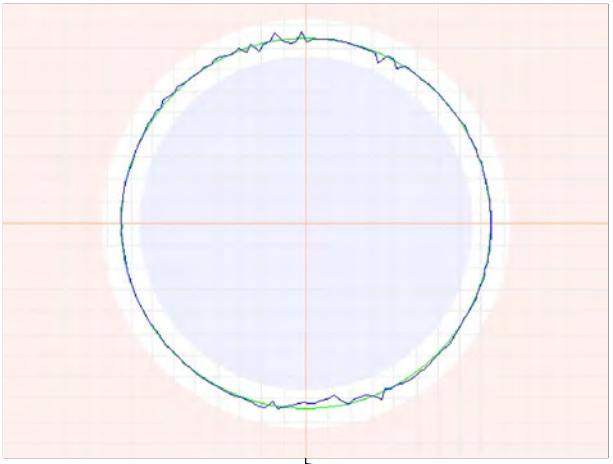
1948.6ft General Observation



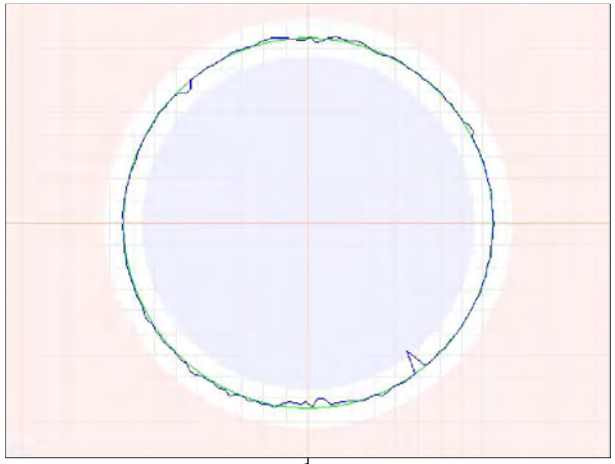
2001.7ft General Observation - Debris to 0.4"

Observation Report

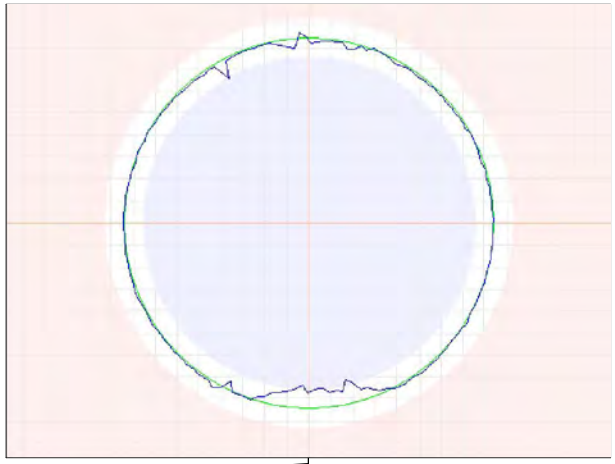
2052.2ft General Observation - Debris to 0.4"

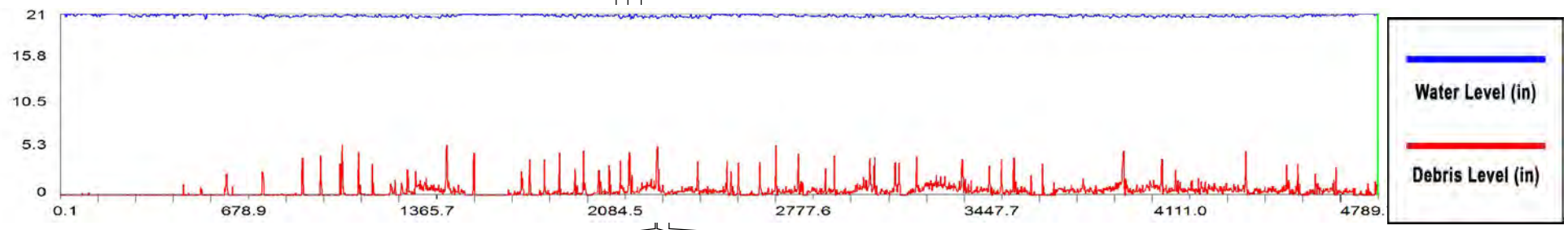


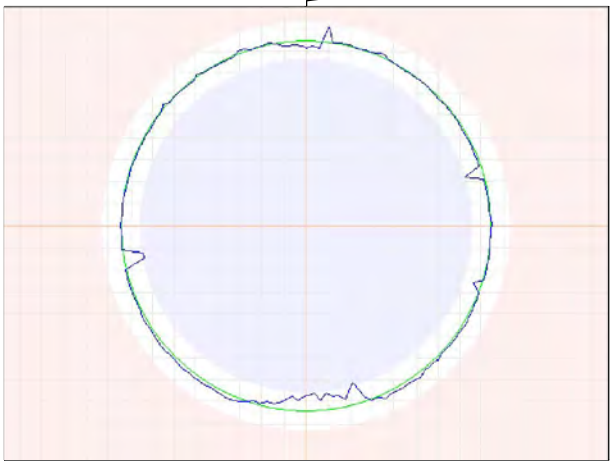
2096.7ft General Observation - Debris to 0.6"



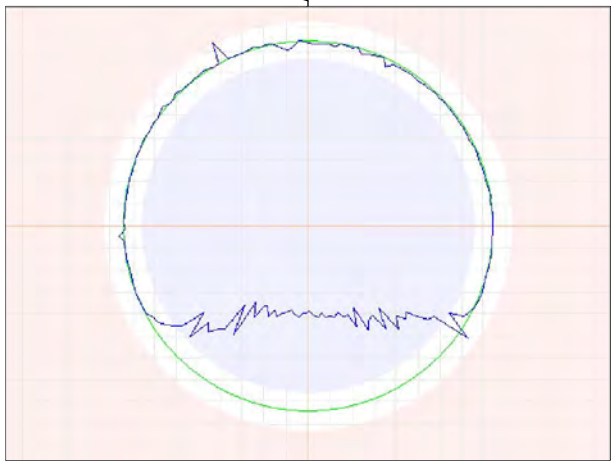
2147.3ft General Observation - Debris to 0.8"



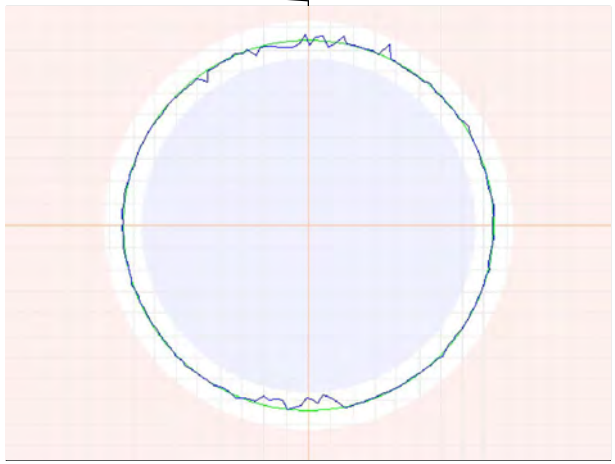




2200ft General Observation - Debris to 0.8"



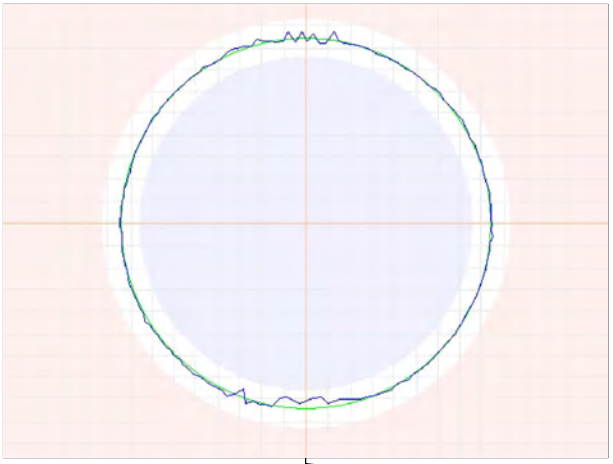
2207.5ft Maximum Debris - To 5.6"



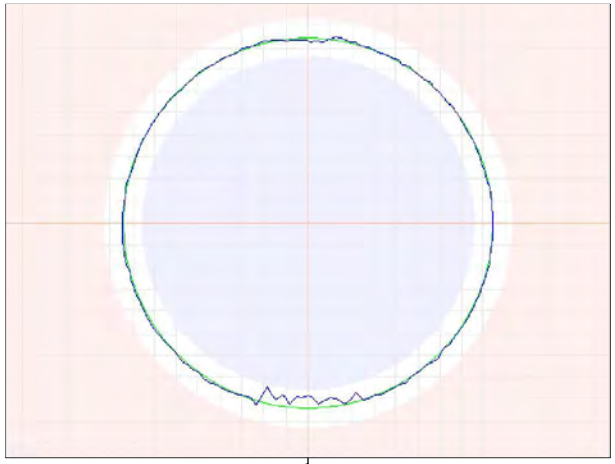
2251.3ft General Observation - Debris to 0.6"

Observation Report

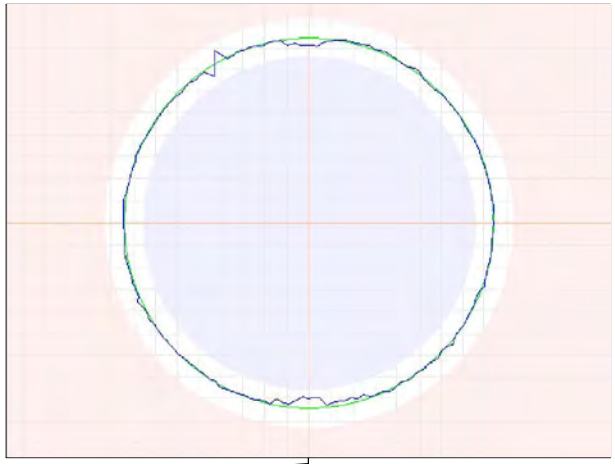
2299.3ft General Observation - Debris to 0.4"

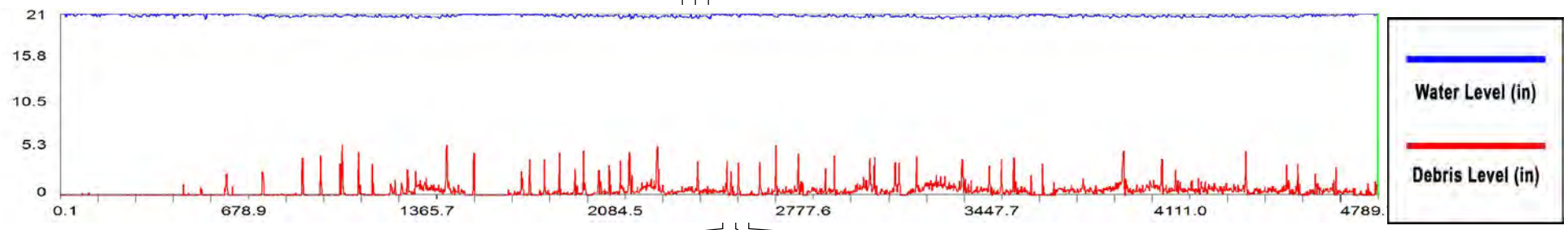


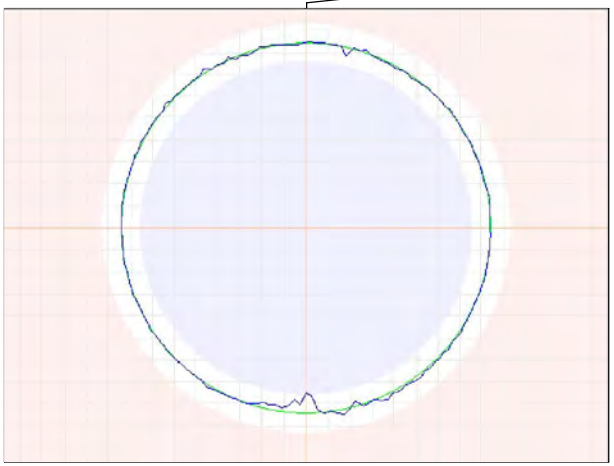
2348ft General Observation - Debris to 0.7"



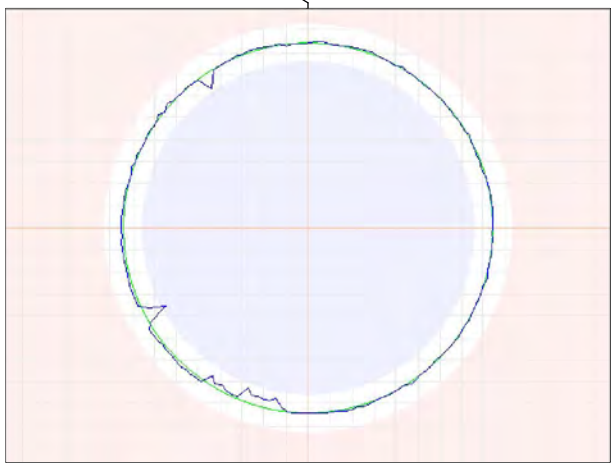
2396.5ft General Observation - Debris to 0.5"



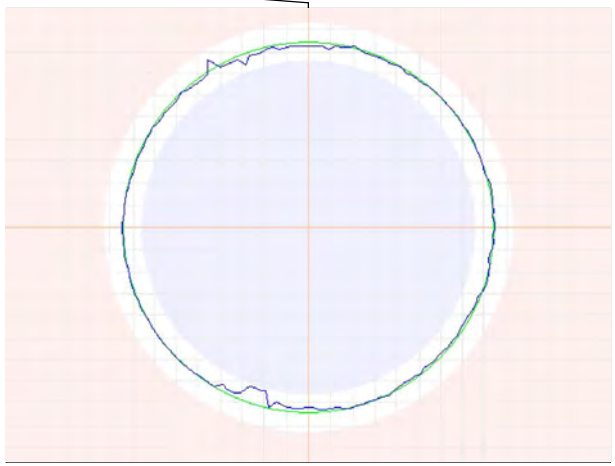




2450.3ft General Observation - Debris to 0.6"



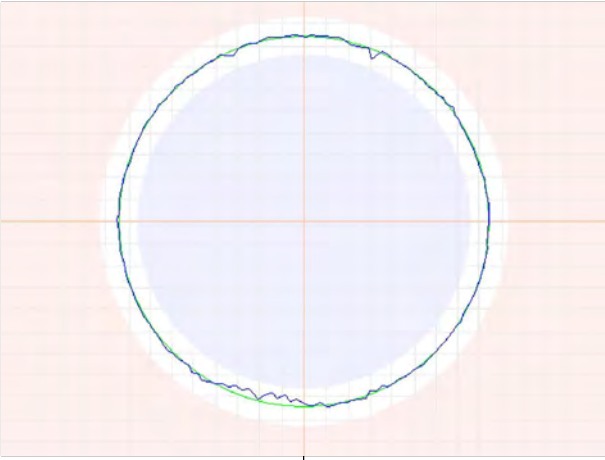
2498.2ft General Observation



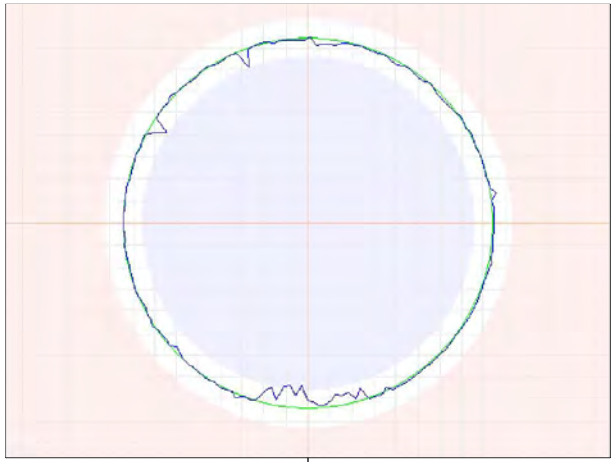
2547.3ft General Observation - Debris to 0.2"

Observation Report

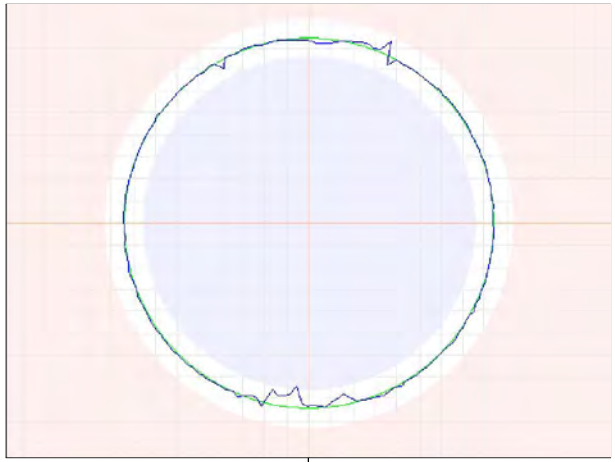
2598.1ft General Observation

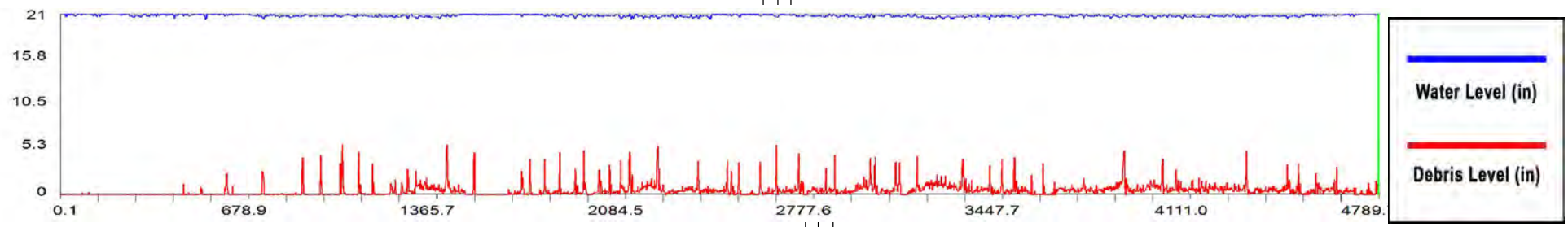


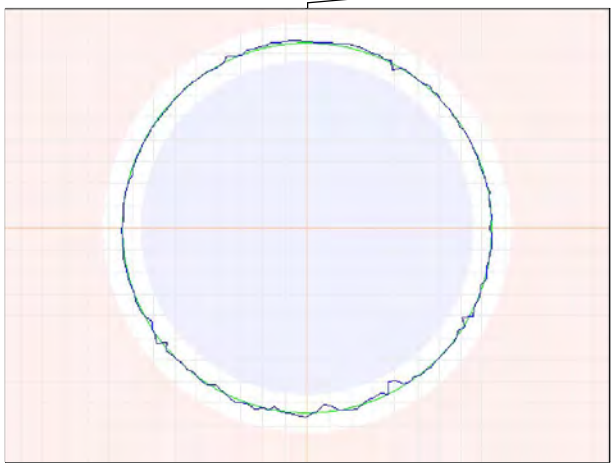
2651.2ft General Observation - Debris to 0.6"



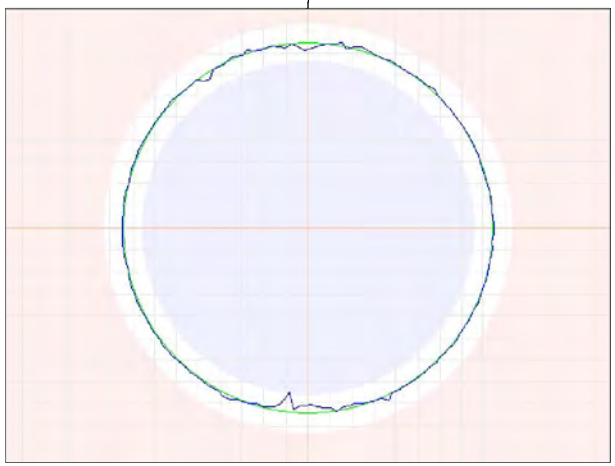
2698.3ft General Observation - Debris to 0.3"



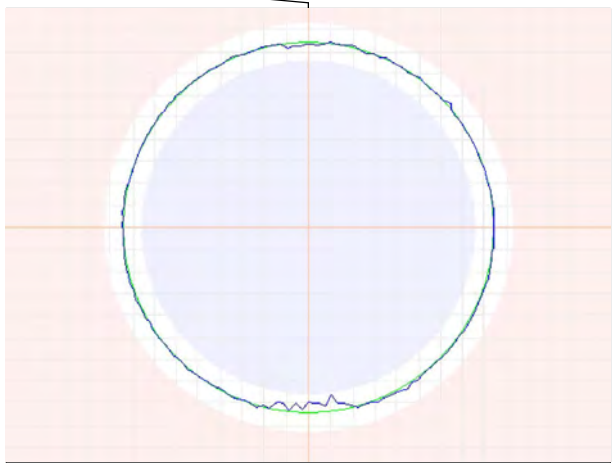




2749.8ft General Observation



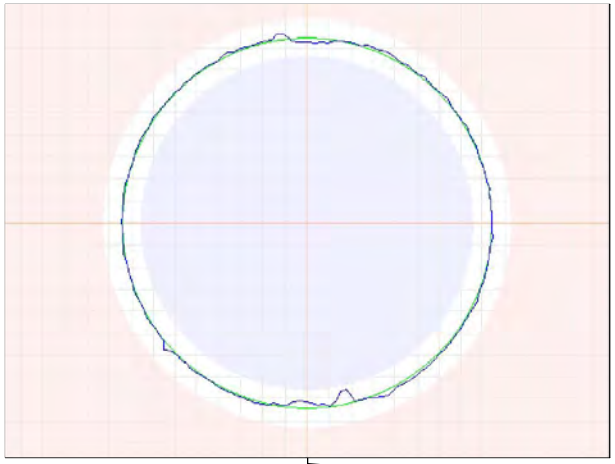
2797.1ft General Observation - Debris to 0.2"



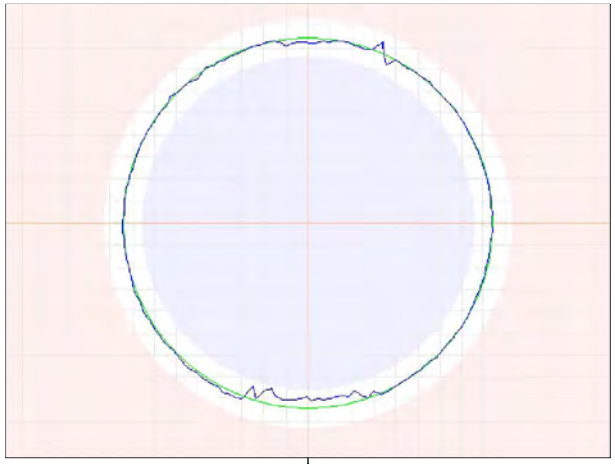
2851.5ft General Observation - Debris to 0.5"

Observation Report

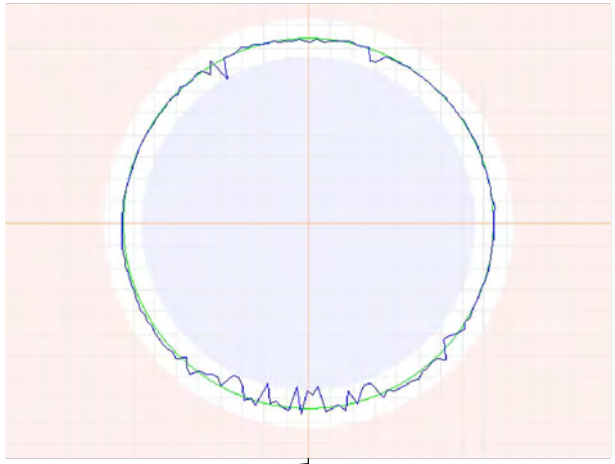
2900.6ft General Observation - Debris to 0.3"

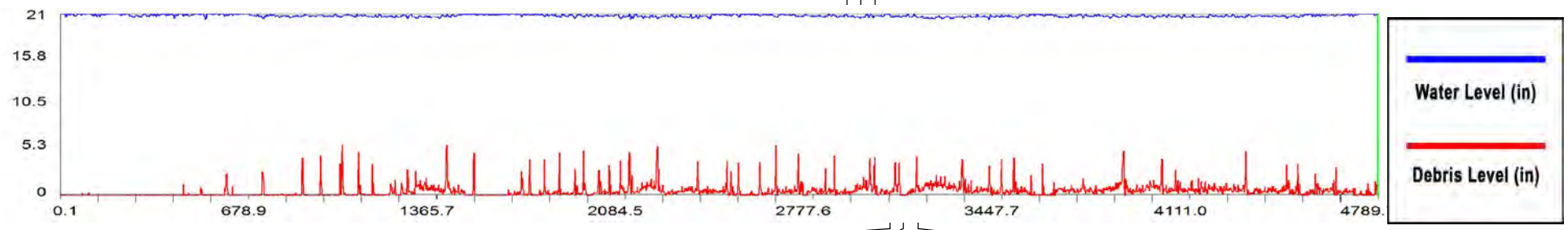


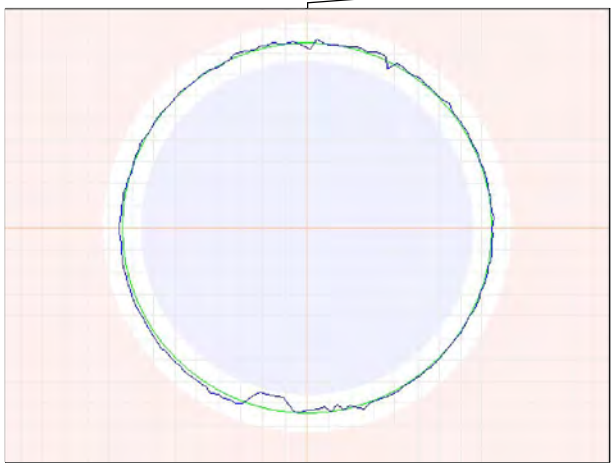
2950ft General Observation - Debris to 0.7"



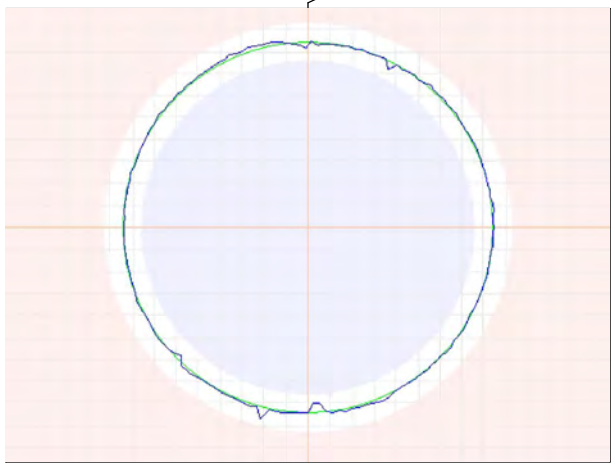
3000.3ft General Observation - Debris to 1.0"



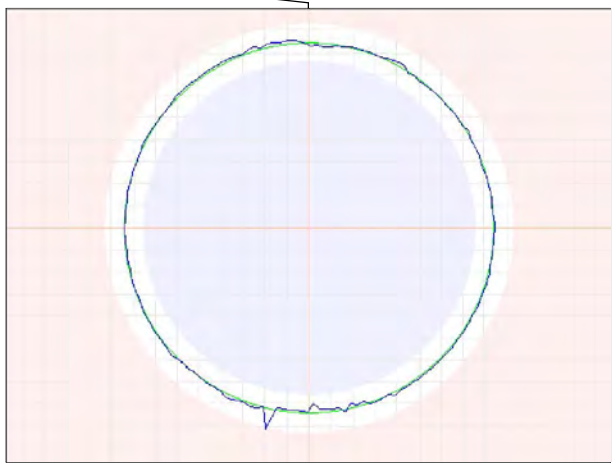




3051.1ft General Observation - Debris to 0.5"



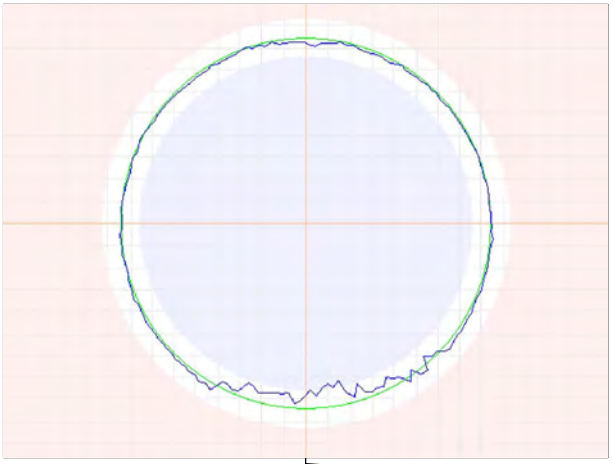
3098.8ft General Observation



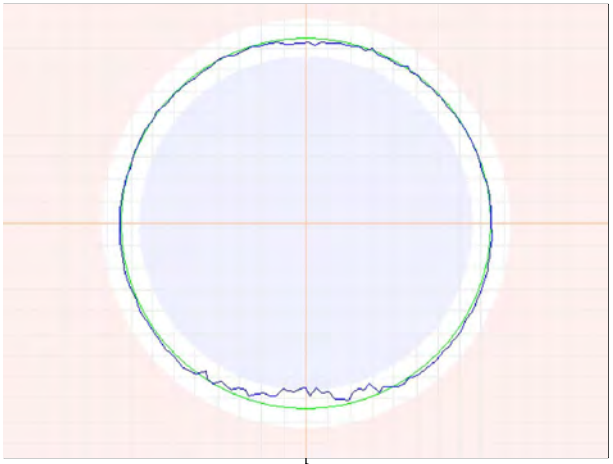
3151.8ft General Observation

Observation Report

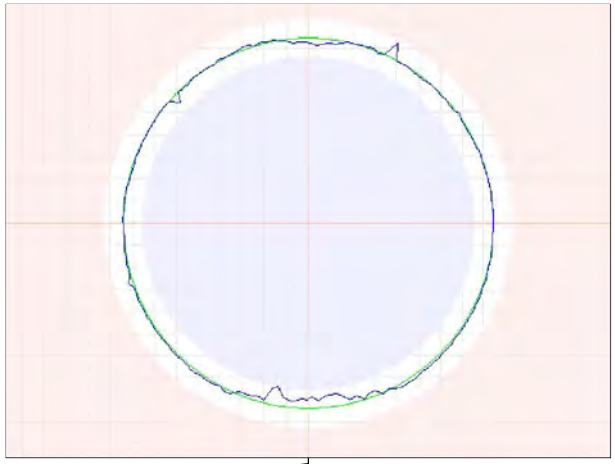
3196.6ft General Observation - Debris to 0.8"

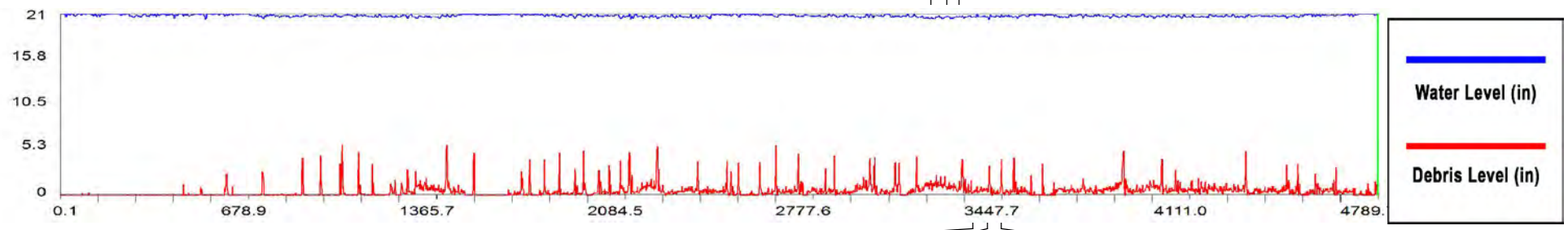


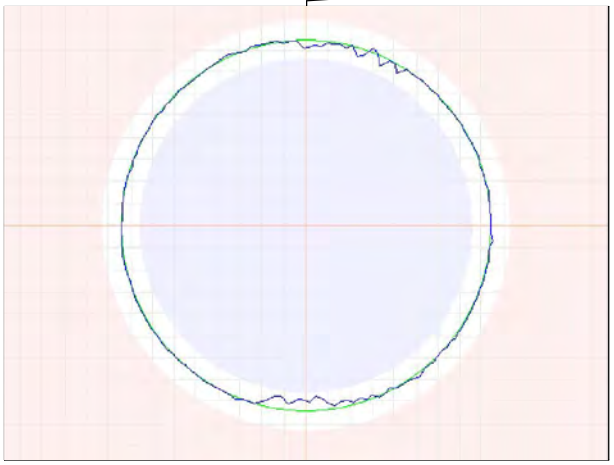
3251.8ft General Observation - Debris to 0.7"



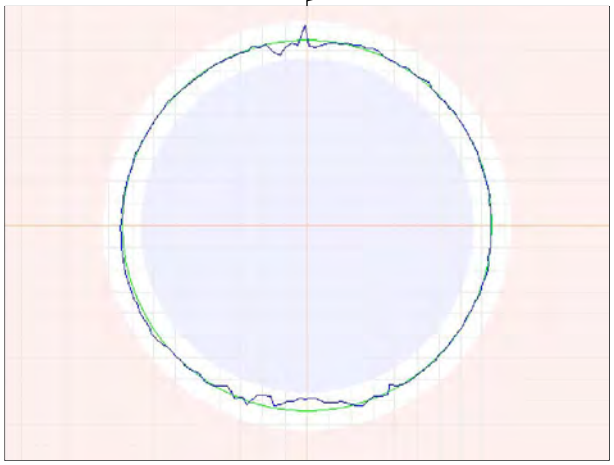
3297ft General Observation - Debris to 0.7"



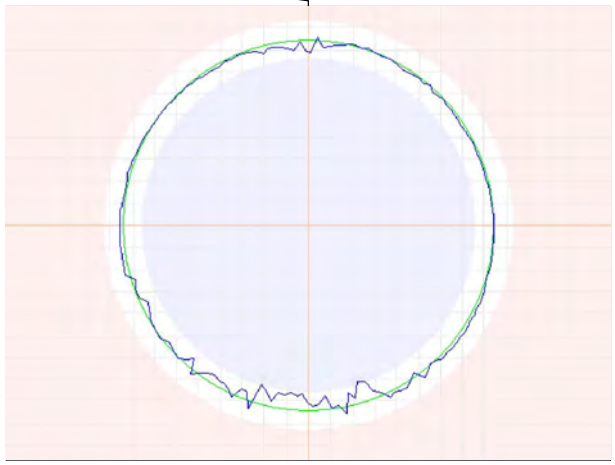




3347.7ft General Observation - Debris to 0.6"



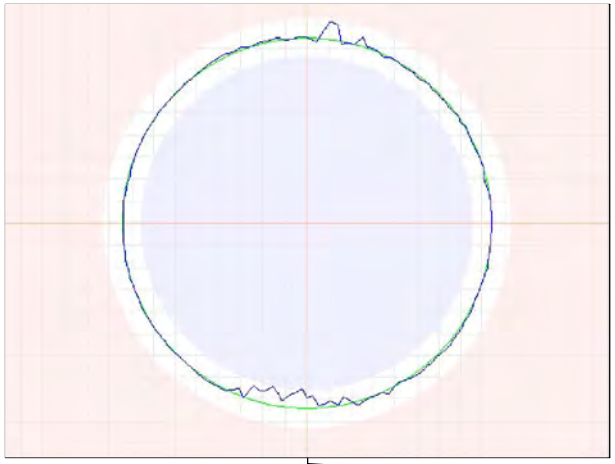
3398.9ft General Observation - Debris to 0.6"



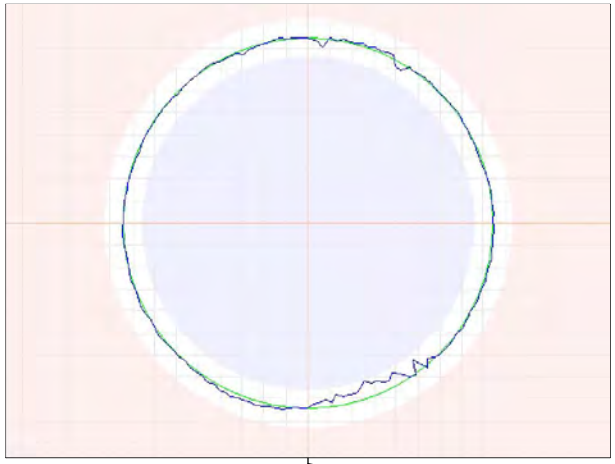
3450.9ft General Observation - Debris to 0.9"

Observation Report

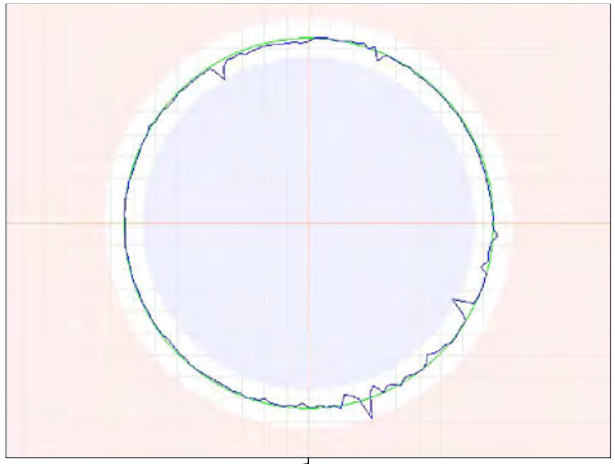
3501.5ft General Observation - Debris to 0.8"

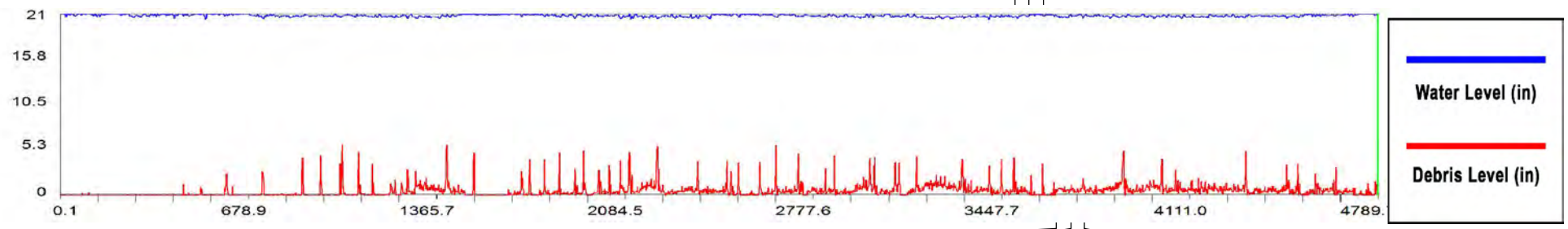


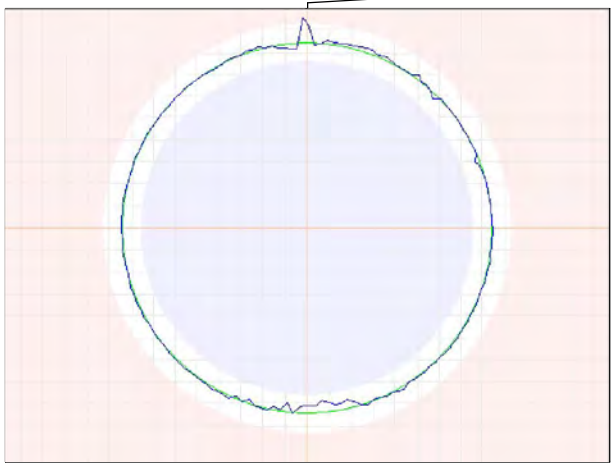
3548.8ft General Observation



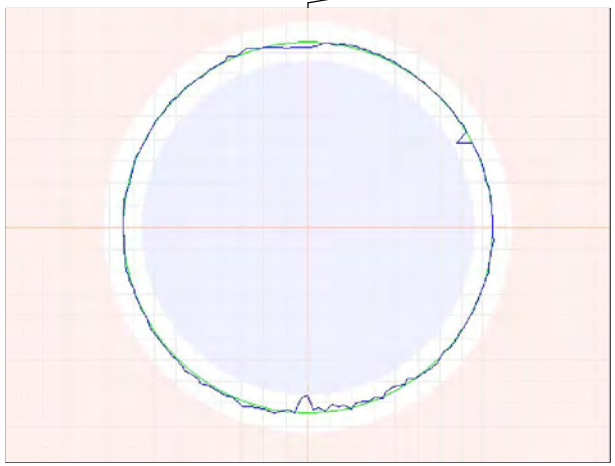
3601.5ft General Observation



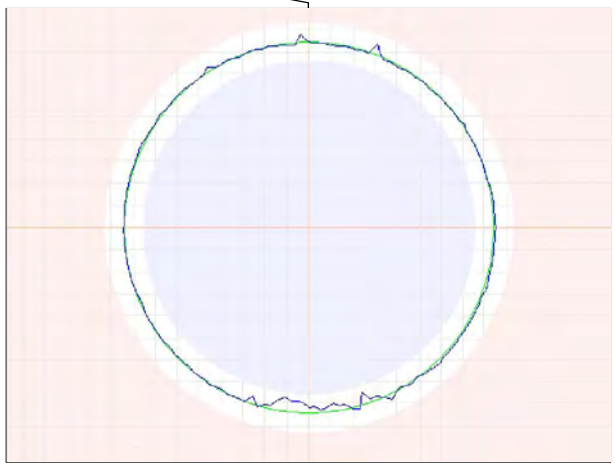




3647.8ft General Observation - Debris to 0.6"



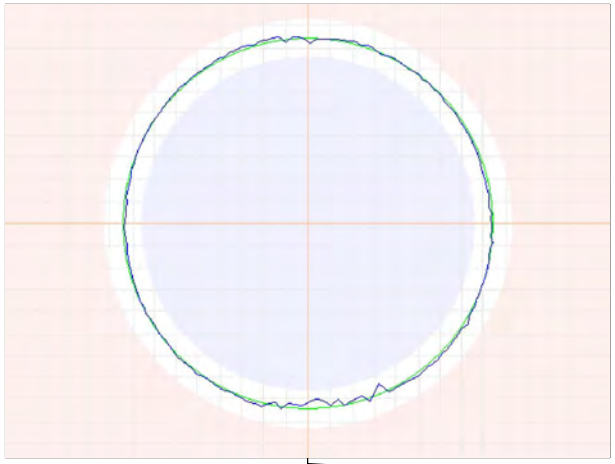
3701.8ft General Observation - Debris to 0.8"



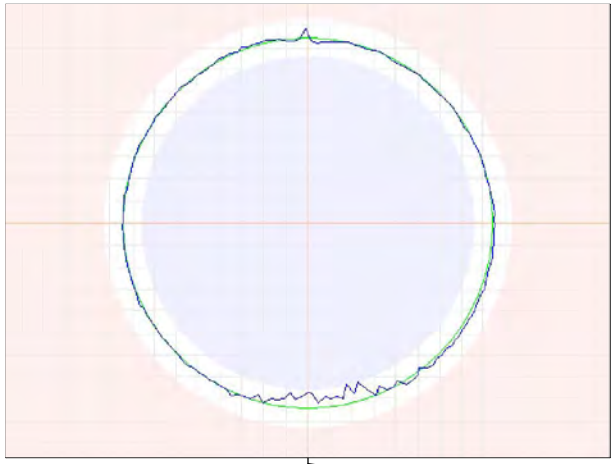
3749ft General Observation - Debris to 0.6"

Observation Report

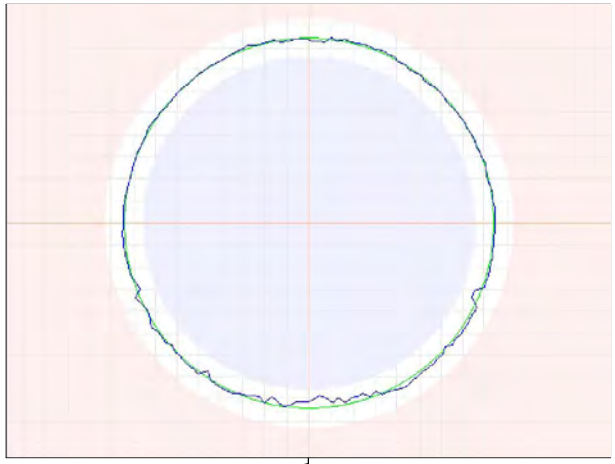
3799.6ft General Observation - Debris to 0.7"

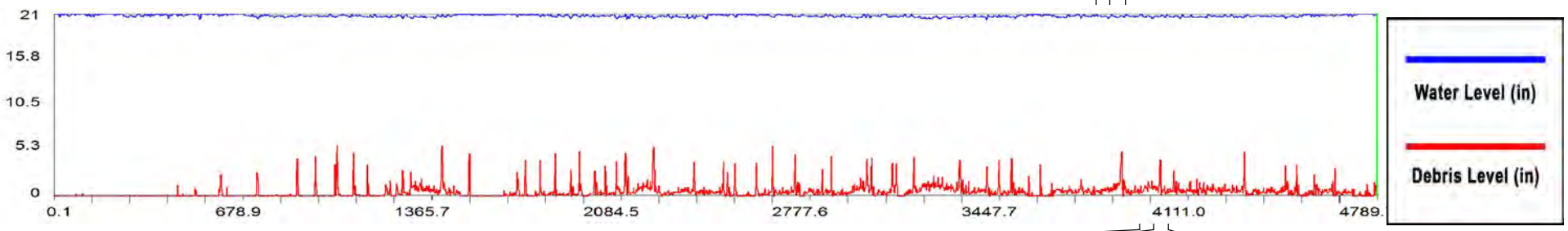


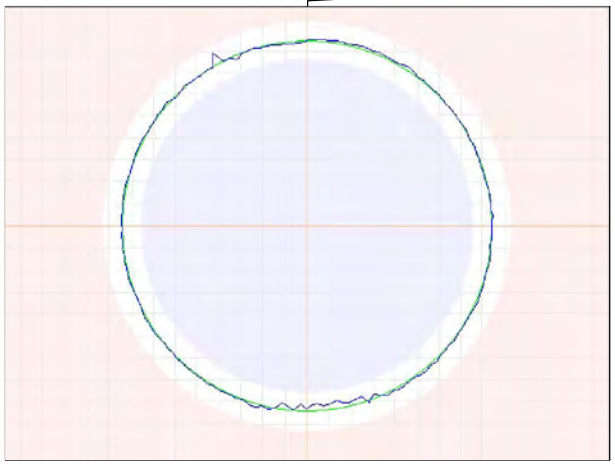
3847.1ft General Observation - Debris to 0.9"



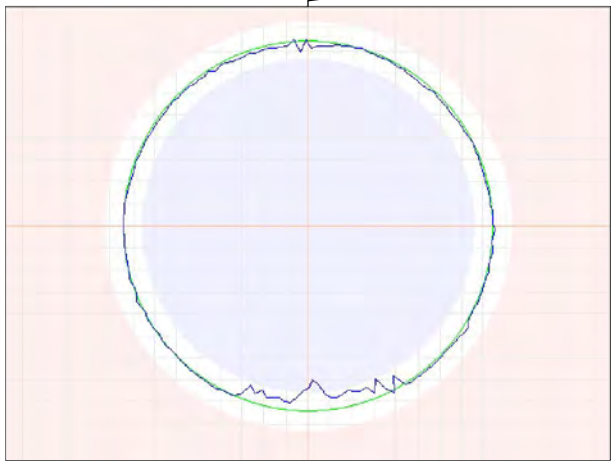
3898.5ft General Observation - Debris to 0.3"



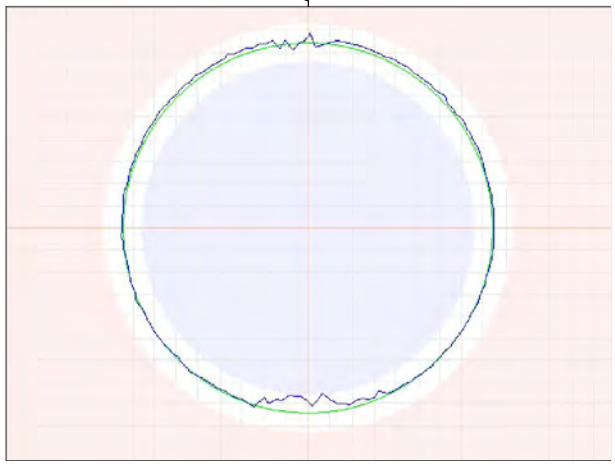




3948.5ft General Observation - Debris to 0.4"



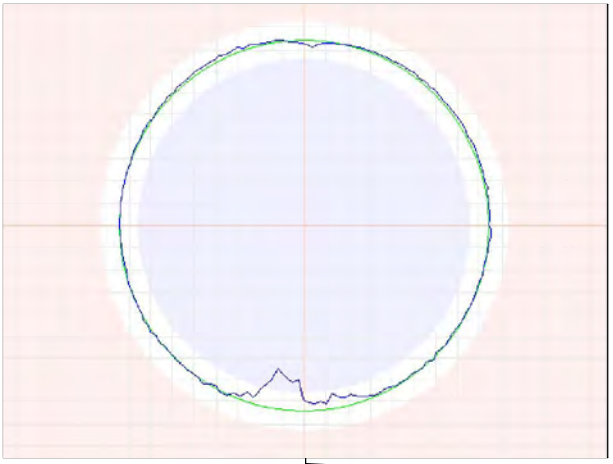
3997.7ft General Observation - Debris to 1.0"



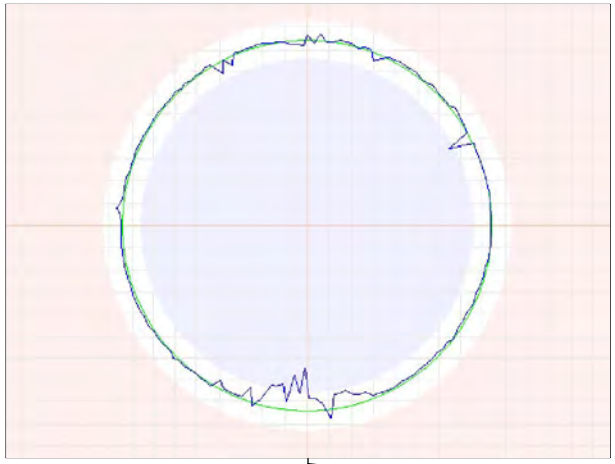
4049.6ft General Observation - Debris to 1.2"

Observation Report

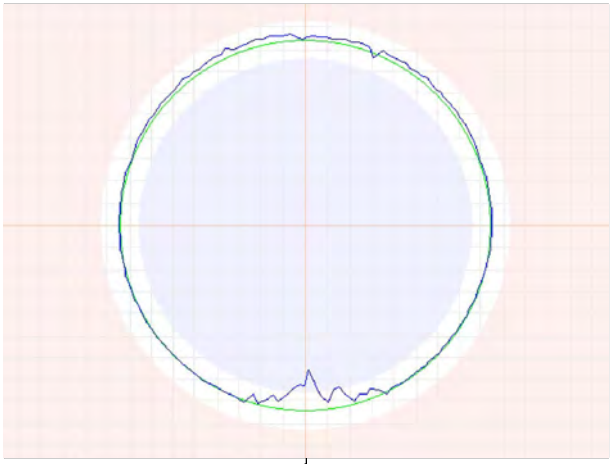
4099.7ft General Observation - Debris to 1.6"

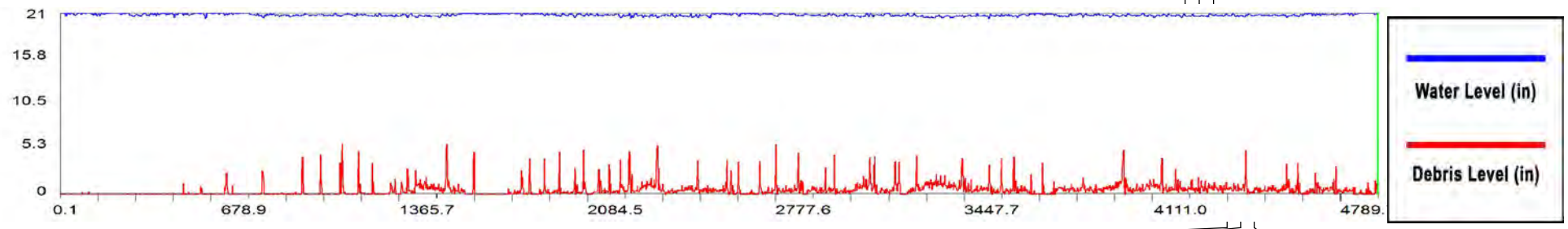


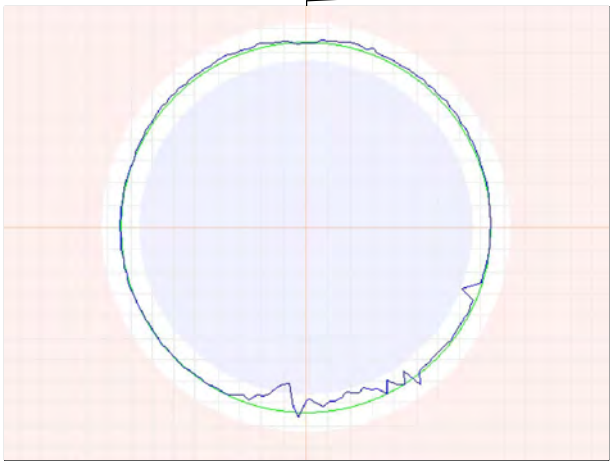
4149.2ft General Observation - Debris to 1.8"



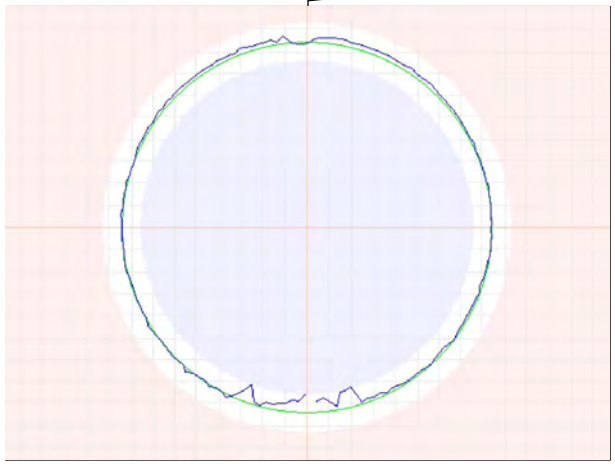
4199.2ft General Observation - Debris to 1.4"



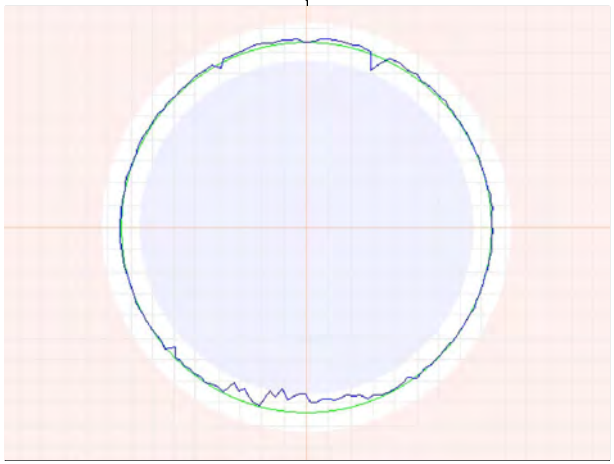




4248.9ft General Observation - Debris to 0.8"



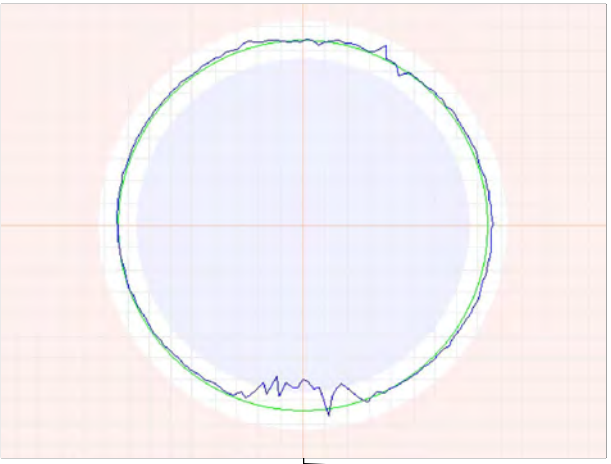
4299.3ft General Observation - Debris to 1.1"



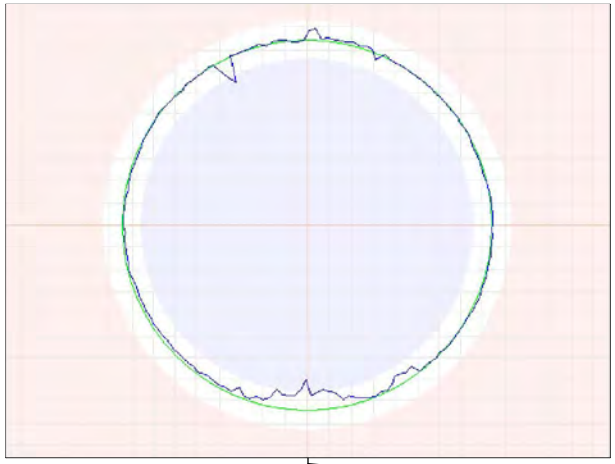
4349.7ft General Observation - Debris to 0.8"

Observation Report

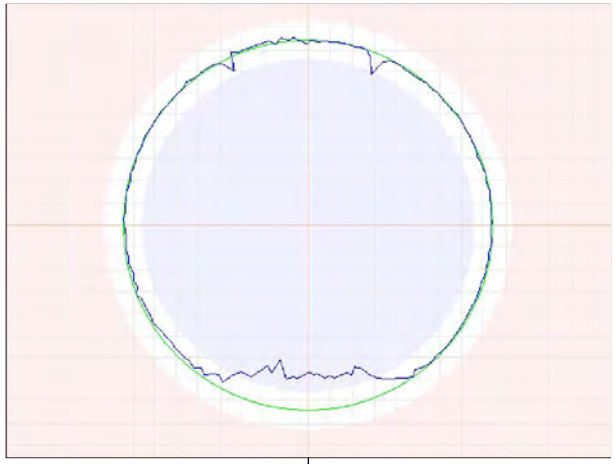
4399.6ft General Observation - Debris to 1.1"

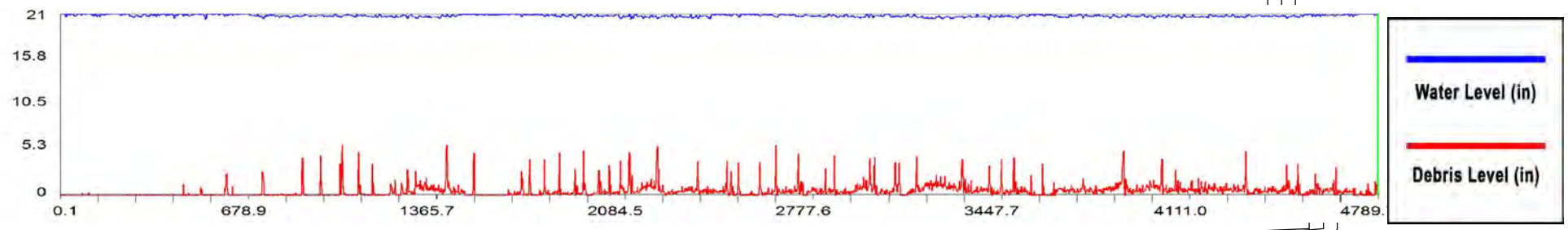


4449.6ft General Observation - Debris to 1.4"

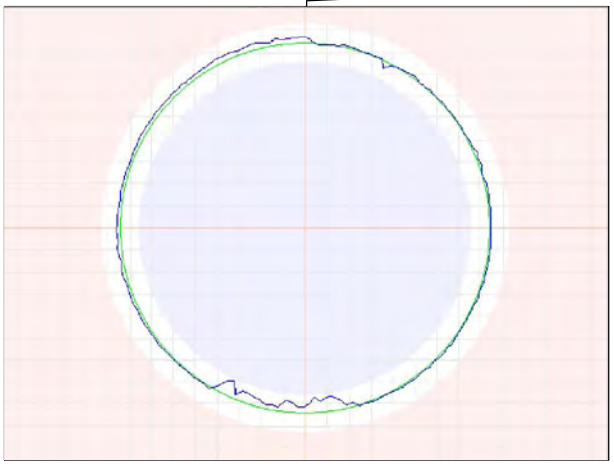


4499.4ft General Observation - Debris to 2.2"

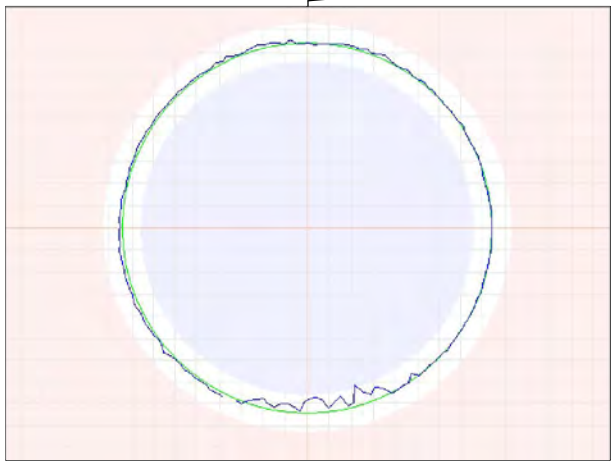




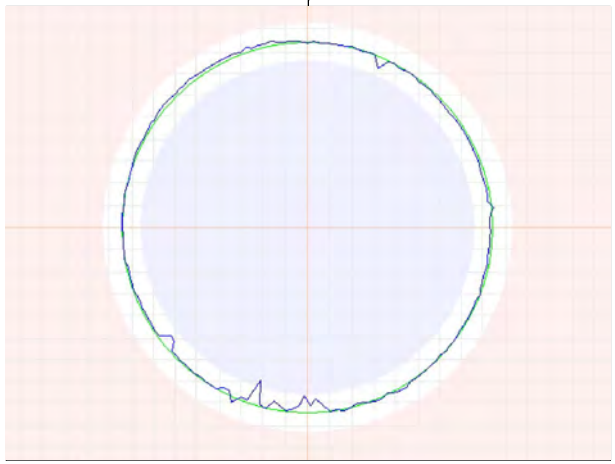
4549.4ft General Observation - Debris to 0.4"



4599.2ft General Observation - Debris to 0.6"

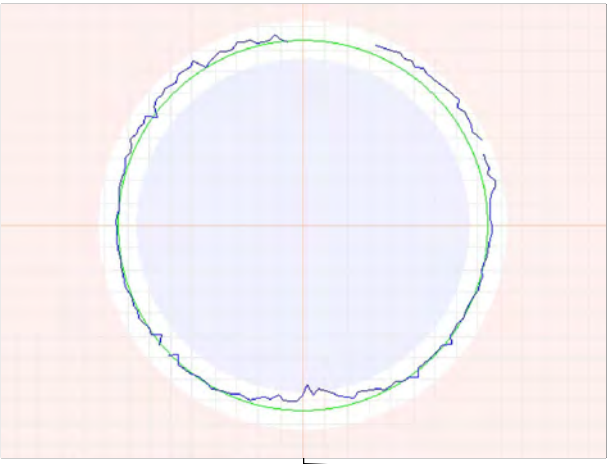


4649.4ft General Observation - Debris to 0.6"

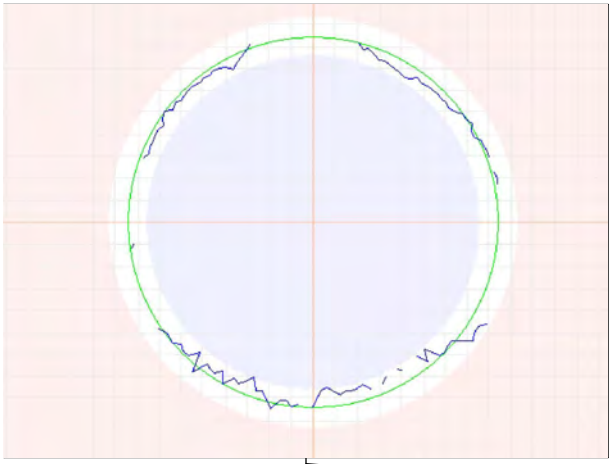


Observation Report

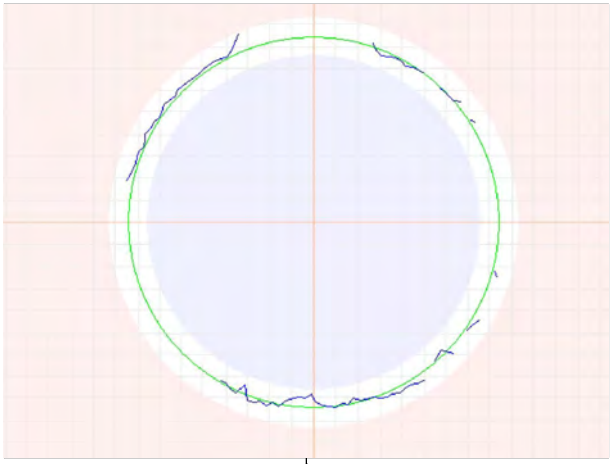
4699.9ft General Observation - Debris to 0.9"

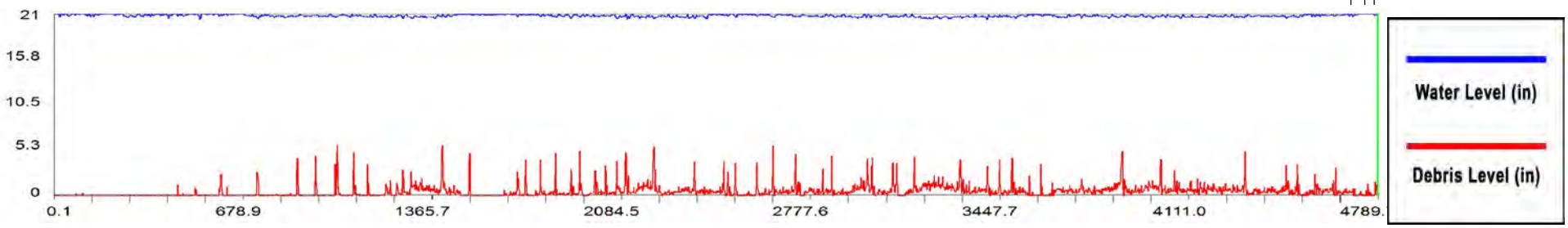


4749.6ft General Observation



4783.7ft General Observation





CONTACT DETAILS

King County

Michelle Beason, P.E
Director of Client Services
mbeason@redzone.com

2410 Camino Ramon, Suite 128
San Ramon
CA
94583
925 262 7366

RedZone® ROBOTICS

13 Tarndale Grove
Albany
North Shore
Auckland
New Zealand

PO Box 305056
Triton Plaza
North Shore
Auckland
New Zealand
Ph + 64 9 47 999 01

The information contained in this Report is provided for interpretation by suitably qualified civil engineering professionals engaged by the Client. This Report is not intended and must not be taken to be professional civil engineering advice, nor shall it be relied upon as a substitute for professional civil engineering advice.

Interpretation of this Report, evaluation of the pipelines, and any rehabilitation, investigative, cleaning or other decisions are the sole responsibility of the Client.

Certain information contained in this report such as distances and dimensions may incorporate information provided by others. This information may not always be accurate and complete. The Engineer should make their own assessments with regards to such information.

©2013

Appendix F: Manhole Inspection Reports

Data Collection Requirements (Check off when complete)

Manhole 294 Date 10-8-13

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #: _____
- ☐ Manhole frame and cover (closed) ..... Photo #: _____
- ☐ Underside of flattop (roof) or cone ..... Photo #: _____
- ☐ Walls (representative), ladder and steps ..... Photo #: _____
- ☐ Walls (representative), ladder and steps ..... Photo #: _____
- ☐ Walls (representative), ladder and steps ..... Photo #: _____
- ☐ Bench ..... Photo #: _____
- ☐ Flow channel ..... Photo #: _____
- ☐ Main influent pipe(s) ..... Photo #: _____
- ☐ Main effluent pipe ..... Photo #: _____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #: _____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock	29	10 o'clock		___ o'clock	
2 o'clock	34	2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S _____

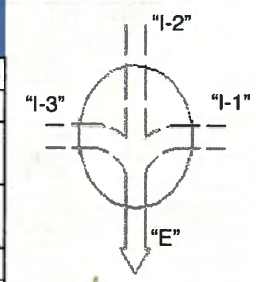
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	3/4	6 o'clock	3/4	6 o'clock	3/4"	Influent Pipe	
10 o'clock	1/2	10 o'clock	1/2	10 o'clock	3/4"	Influent Pipe	
2 o'clock	1/8	2 o'clock	1/2	2 o'clock	1"	Effluent Pipe	

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
294	10-8-13	8:45	J. Barth	PC		
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
9' 6"	6"	1'	3'	3'	N/A	0
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)					
Pipe Material					
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)					



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:	None	
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole 2 Date 10-18-13

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #: _____
- ☐ Manhole frame and cover (closed) ..... Photo #: _____
- ☐ Underside of flattop (roof) or cone ..... Photo #: _____
- ☐ Walls (representative), ladder and steps ..... Photo #: _____
- ☐ Walls (representative), ladder and steps ..... Photo #: _____
- ☐ Walls (representative), ladder and steps ..... Photo #: _____
- ☐ Bench ..... Photo #: _____
- ☐ Flow channel ..... Photo #: _____
- ☐ Main influent pipe(s) ..... Photo #: _____
- ☐ Main effluent pipe ..... Photo #: _____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #: _____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S _____

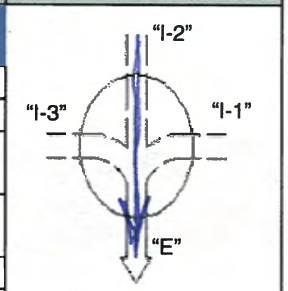
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	0	6 o'clock	0	6 o'clock	1/8	Influent Pipe	
10 o'clock	0	10 o'clock	0	10 o'clock	1/8	Influent Pipe	
2 o'clock	0	2 o'clock	0	2 o'clock	1/8	Effluent Pipe	

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
290	10-8-13	10:30	J. Booth	P.C.		
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
6' 4"	—	12 0"	4'	1'	—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)	36"		36"		
Pipe Material	concrete		concrete		
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)	6'-4"		6'-4"		
Channelized?	yes		yes		
Drop (In/Out)	No		No		



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole 2416 Date 10-8-13

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #: _____
- ☐ Manhole frame and cover (closed) ..... Photo #: _____
- ☐ Underside of flattop (roof) or cone ..... Photo #: _____
- ☐ Walls (representative), ladder and steps ..... Photo #: _____
- ☐ Walls (representative), ladder and steps ..... Photo #: _____
- ☐ Walls (representative), ladder and steps ..... Photo #: _____
- ☐ Bench ..... Photo #: _____
- ☐ Flow channel ..... Photo #: _____
- ☐ Main influent pipe(s) ..... Photo #: _____
- ☐ Main effluent pipe ..... Photo #: _____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #: _____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock	50	6 o'clock	45	6 o'clock	~~0~~
10 o'clock	63	10 o'clock	38	10 o'clock	~~0~~
2 o'clock	34	2 o'clock	42	2 o'clock	0

H2S readings (peak H2S from gas meter)

- ☐ H2S 0

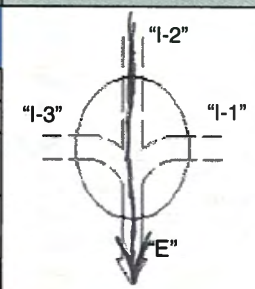
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	0	6 o'clock	0	6 o'clock	0	Influent Pipe	0
10 o'clock	0	10 o'clock	0	10 o'clock	0	Influent Pipe	
2 o'clock	0	2 o'clock	0	2 o'clock	0	Effluent Pipe	0

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
286	10-8-13	11:20	J. Both	C		
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
7' 9	6"	15'6'	—	5'6"	none	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)	42"		42"		
Pipe Material	concrete		concrete		
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?	Y		Y		
Drop (In/Out)	N		N		



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole 281 Date 10-8-13

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #: _____
- ☐ Manhole frame and cover (closed) ..... Photo #: _____
- ☐ Underside of flattop (roof) or cone ..... Photo #: _____
- ☐ Walls (representative), ladder and steps ..... Photo #: _____
- ☐ Walls (representative), ladder and steps ..... Photo #: _____
- ☐ Walls (representative), ladder and steps ..... Photo #: _____
- ☐ Bench ..... Photo #: _____
- ☐ Flow channel ..... Photo #: _____
- ☐ Main influent pipe(s) ..... Photo #: _____
- ☐ Main effluent pipe ..... Photo #: _____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #: _____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S 0

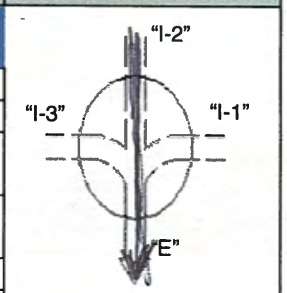
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	0	6 o'clock	X	6 o'clock	1/2	Influent Pipe	1/8
10 o'clock	0	10 o'clock		10 o'clock	0	Influent Pipe	
2 o'clock	0	2 o'clock		2 o'clock	1/8	Effluent Pipe	1/8

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
281	10-8-13	12:00	J. Booth	C		
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
4'-6"	—	1'	—	28"	—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)	42"		36" ?		
Pipe Material	concrete		concrete		
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)	4'-6"				
Channelized?	yes		yes		
Drop (In/Out)	N		N		



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole 276 Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock	48	6 o'clock	38	6 o'clock	
10 o'clock	51	10 o'clock	42	___ o'clock	
2 o'clock	54	2 o'clock	50	___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S 0

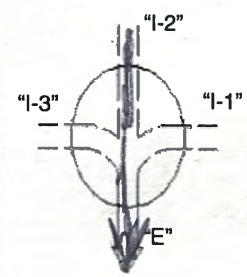
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	0	6 o'clock	0	6 o'clock	0	Influent Pipe	0
10 o'clock	0	10 o'clock	0	10 o'clock	0	Influent Pipe	
2 o'clock	0	2 o'clock	0	2 o'clock	1/8	Effluent Pipe	1/8

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
276	10.8.13	12:25	J. Booth	C		
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
8'	6"	1'	3'	4'	—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)	36"		36"		
Pipe Material	con		con		
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?	y		y		
Drop (In/Out)	N		N		



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole 269 Date 10-8-13

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #: _____
- ☐ Manhole frame and cover (closed) ..... Photo #: _____
- ☐ Underside of flattop (roof) or cone ..... Photo #: _____
- ☐ Walls (representative), ladder and steps ..... Photo #: _____
- ☐ Walls (representative), ladder and steps ..... Photo #: _____
- ☐ Walls (representative), ladder and steps ..... Photo #: _____
- ☐ Bench ..... Photo #: _____
- ☐ Flow channel ..... Photo #: _____
- ☐ Main influent pipe(s) ..... Photo #: _____
- ☐ Main effluent pipe ..... Photo #: _____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #: _____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock	48	6 o'clock	32	6 o'clock	
10 o'clock	53	10 o'clock	43	___ o'clock	
2 o'clock	58	2 o'clock	51	___ o'clock	

H2S readings (peak H2S from gas meter)

☐ H2S 3

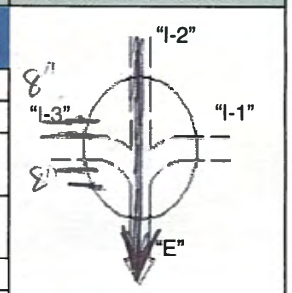
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	0	6 o'clock	0	6 o'clock	X	Influent Pipe	
10 o'clock	0	10 o'clock	0	10 o'clock		Influent Pipe	
2 o'clock	0	2 o'clock	0	2 o'clock		Effluent Pipe	

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
269	10-8-13	2:15	J. Booth	C		
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
4' 6"	6"	1	3'		—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)	36"		36"		
Pipe Material	Con		Con	2 - 8"	
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?	Y		Y		
Drop (In/Out)	N		N		



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole 247 Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock	39	6 o'clock		6 o'clock	28
10 o'clock	43	10 o'clock		___ o'clock	40
2 o'clock	46	2 o'clock		___ o'clock	31

H2S readings (peak H2S from gas meter)

☐ H2S 2

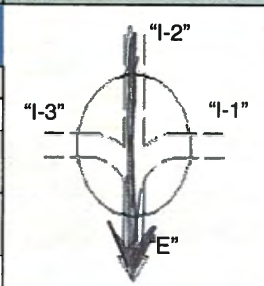
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	0	6 o'clock		6 o'clock	1/4	Influent Pipe	
10 o'clock	0	10 o'clock	X	10 o'clock	0	Influent Pipe	
2 o'clock	0	2 o'clock		2 o'clock	1/8	Effluent Pipe	

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
247	10-8-13	2:40	J. Booth	C		
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
5' 4"	—	1' 4"		8 41	—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)	36"		36"		
Pipe Material	Con		Con		
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)					



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock	28	6 o'clock		6 o'clock	
10 o'clock	37	10 o'clock		___ o'clock	
2 o'clock	41	2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S_____

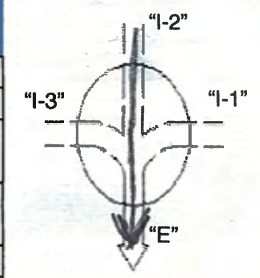
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	1/8	6 o'clock	X	6 o'clock	1/8	Influent Pipe	
10 o'clock	0	10 o'clock		10 o'clock	1/8	Influent Pipe	
2 o'clock	0	2 o'clock		2 o'clock	1/8	Effluent Pipe	

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
235	10-8-13	2:00	J. Booth	R		
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
4'		1'		32'	—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)	36"		36"		
Pipe Material					
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)					



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole 176

Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (~~no photos necessary if scrape tests performed prior to MH digital scanning~~) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S_____

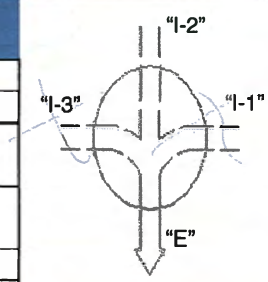
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	1/8	6 o'clock		6 o'clock		Influent Pipe	
10 o'clock	1/8	10 o'clock	X	10 o'clock	X	Influent Pipe	
2 o'clock	0	2 o'clock		2 o'clock		Effluent Pipe	

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
176	10-8-13	3:15	J. Booth	R		
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
3'	—	1'		2'		
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)	36"		36"		
Pipe Material	Con		Con		
Clock Position ("Effluent" = 6:00)	6:00				
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)			Flume		



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:	None	
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S 26

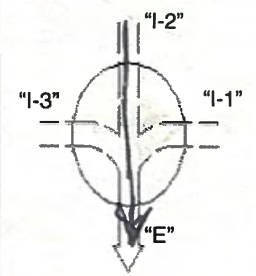
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	1/4	6 o'clock		6 o'clock		Influent Pipe	1/8
10 o'clock	1/8	10 o'clock		10 o'clock		Influent Pipe	
2 o'clock	1/8	2 o'clock		2 o'clock		Effluent Pipe	1/8

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
207	10-8-13	4:00	J. Booth	R	—	—
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
3' 8"		1"		2' 8"	—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)	36"		36"		
Pipe Material	con		con		
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?	Y		Y		
Drop (In/Out)	N		N		



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S_____

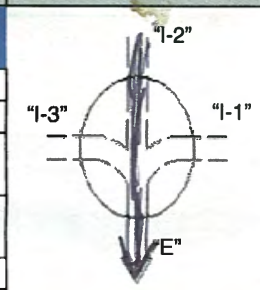
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	1/8	6 o'clock	0 1/4	6 o'clock	1/4	Influent Pipe	1/8
10 o'clock	0	10 o'clock	0	10 o'clock	1/8	Influent Pipe	
2 o'clock	1/8	2 o'clock	0	2 o'clock	1/8	Effluent Pipe	1/4

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
206	10-8-13	4:20	J. Booth	R	—	—
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
5'6"		1'	3'	1'6"	—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)	36"		36"		
Pipe Material	con		con		
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?	yes		yes		
Drop (In/Out)	N		yes		



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock	38	6 o'clock		6 o'clock	
10 o'clock	46	10 o'clock		___ o'clock	
2 o'clock	51	2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S_____

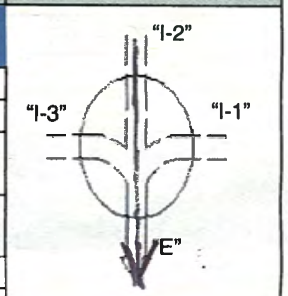
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	0	6 o'clock		6 o'clock		Influent Pipe	0
10 o'clock	0	10 o'clock	X	10 o'clock	X	Influent Pipe	
2 o'clock	0	2 o'clock		2 o'clock		Effluent Pipe	0

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
205	10-8-13	4:45	J. Booth	R	—	—
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
3'	—	1'		2'	—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)	36"		36"		
Pipe Material	con		con		
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?	yes		yes		
Drop (In/Out)					



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S_____

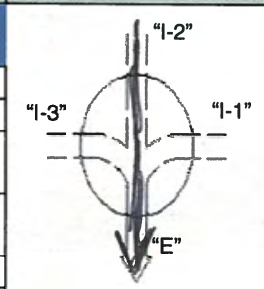
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	0	6 o'clock		6 o'clock	0	Influent Pipe	0
10 o'clock	0	10 o'clock	X	10 o'clock	0	Influent Pipe	
2 o'clock	1/8	2 o'clock		2 o'clock	1/8	Effluent Pipe	0

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
204	10-8-13	5:10	J. Booth	R	—	—
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
3'	6"	1'		2'	—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)	36"		36"		
Pipe Material	Con		Con		
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)					

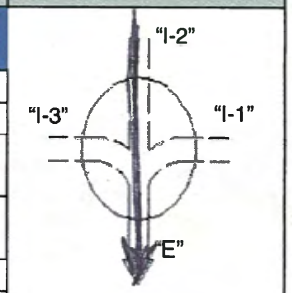


Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
203	10-9-13	9:15	J. Booth	C		
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
6'	—	1'	3'	2'		
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)	36"		36"		
Pipe Material	CON		CON		
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)					



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S_____

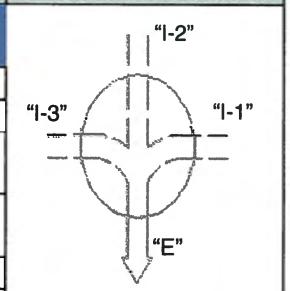
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	1/8	6 o'clock	0	6 o'clock	1/8	Influent Pipe	1/8
10 o'clock	1/8	10 o'clock	0	10 o'clock	1/8	Influent Pipe	
2 o'clock	1/8	2 o'clock	1/8	2 o'clock	1/8	Effluent Pipe	1/8

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
Syphon out 36"	10-10-13	11:30	J. Booth	S	—	—
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
8.5'	3'				—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)					
Pipe Material					
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)					



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S_____

Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

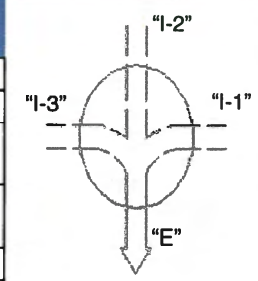
Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	1/8"	6 o'clock		6 o'clock		Influent Pipe	
12 o'clock	1/8"	10 o'clock		10 o'clock		Influent Pipe	
2 o'clock		2 o'clock		2 o'clock		Effluent Pipe	

about 2'
from Rim

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
Syphon out 2pt	10-10-13	11:15	J. Booth	S	—	—
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
9'	3'				—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)					
Pipe Material					
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)					



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S_____

Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

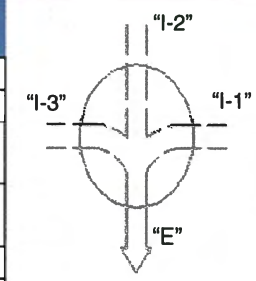
Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	1/4"	6 o'clock		6 o'clock		Influent Pipe	
12 o'clock	1/4	10 o'clock		10 o'clock		Influent Pipe	
2 o'clock		2 o'clock		2 o'clock		Effluent Pipe	

about 2' from Rim

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
Syphon IV	10-10-13	11:00	J. Booth	S	—	—
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
8'	3'				—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)					
Pipe Material					
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)					



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch	S/S	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S_____

Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

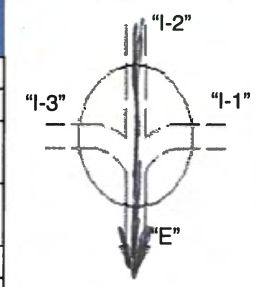
Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
12 o'clock	1/4"	6 o'clock		6 o'clock		Influent Pipe	
9 o'clock	1/8	10 o'clock		10 o'clock		Influent Pipe	
2 o'clock		2 o'clock		2 o'clock		Effluent Pipe	

Scrape aprox 2' from top

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
175	10-9-13	5:45	J. Booth	C	—	—
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
4'	1'	1'		3'	—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)					
Pipe Material					
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)					



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S 4

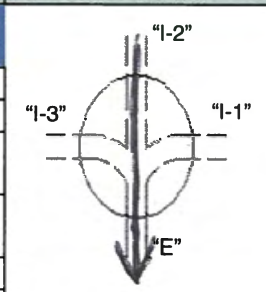
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	1/8	6 o'clock	X	6 o'clock	X	Influent Pipe	0
10 o'clock	1/8	10 o'clock		10 o'clock		Influent Pipe	
2 o'clock	0	2 o'clock		2 o'clock		Effluent Pipe	1/8

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
177	10-9-13		J Booth	C	—	—
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
4'	1'	1'		3'	—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)					
Pipe Material					
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)					



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S 6.8

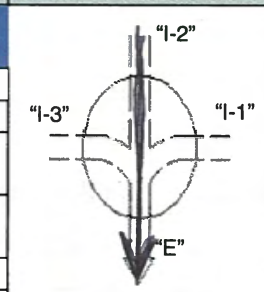
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	1/4	6 o'clock	X	6 o'clock	0	Influent Pipe	0
10 o'clock	1/8	10 o'clock		10 o'clock	0	Influent Pipe	
2 o'clock	1/8	2 o'clock		2 o'clock	1/8	Effluent Pipe	0

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
178	10-9-13	5:30	J. Booth	C	—	—
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
4'	1'	1'		3'	—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)					
Pipe Material					
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)					



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S 4.5

Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

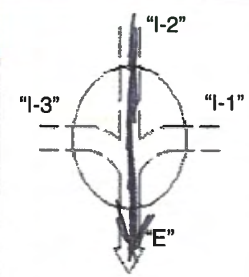
Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	1/8	6 o'clock		6 o'clock	1/8	Influent Pipe	
10 o'clock	1/8	10 o'clock		10 o'clock	1/8	Influent Pipe	
2 o'clock	1/8	2 o'clock		2 o'clock	1/8	Effluent Pipe	

Flow monitors in manhole unable to scrape
check fresh drill holes

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
179	10-9-13	5:10	J. Booth	C	—	—
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
7'	1'	1'	—	6'	—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)					
Pipe Material					
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)					



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S 3.8

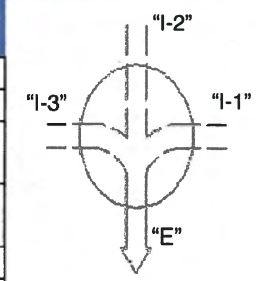
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	1/8	6 o'clock	1/8	6 o'clock	0	Influent Pipe	0
10 o'clock	1/8	10 o'clock	0	10 o'clock	0	Influent Pipe	
2 o'clock	1/8	2 o'clock	0	2 o'clock	0	Effluent Pipe	

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
180	10-9-13	4:45	J. Booth	C	—	—
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
4'	1'	1'		3'	—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)					
Pipe Material					
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)					



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S_____

Between 3 and 5 in flow line
severe deterioration

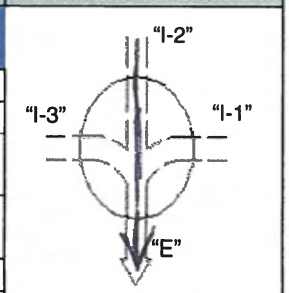
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	1/4	6 o'clock	X	6 o'clock	1/8	Influent Pipe	1/8
10 o'clock	1/4	10 o'clock		10 o'clock	1/8	Influent Pipe	
2 o'clock	1/4	2 o'clock		2 o'clock	1/8	Effluent Pipe	1/8

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
181	10-9-13	4:15	J. Booth	C	—	—
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
3'	1'	1'	—	2'	—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)					
Pipe Material					
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)					



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S 3.8

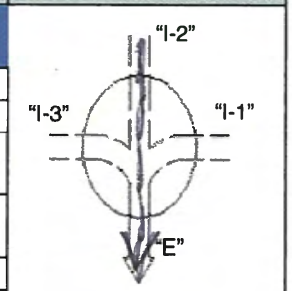
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	1/4	6 o'clock		6 o'clock	1/8	Influent Pipe	1/8
10 o'clock	1/8	10 o'clock	X	10 o'clock	1/8	Influent Pipe	
2 o'clock	1/8	2 o'clock		2 o'clock	1/4	Effluent Pipe	1/8

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
183	10-9-13	3:55	J. Booth	C	—	—
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
5'	1'	1'		4'	—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)					
Pipe Material					
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)					



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

`Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S 3.9

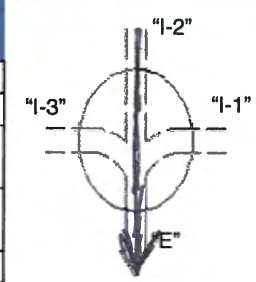
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	1/8	6 o'clock	X	6 o'clock	0	Influent Pipe	0
10 o'clock	0	10 o'clock		10 o'clock	0	Influent Pipe	
2 o'clock	0	2 o'clock		2 o'clock	0	Effluent Pipe	0

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
184	10-9-13	3:30	J. Booth	C	—	—
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
4'	1'	1'		3'		
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)					
Pipe Material					
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)					



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S 3.9

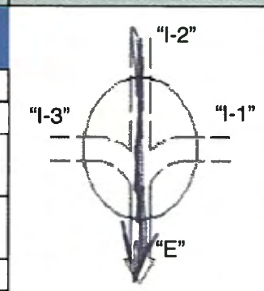
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	1/8	6 o'clock		6 o'clock	1/8	Influent Pipe	1/8
10 o'clock	1/8	10 o'clock	X	10 o'clock	0	Influent Pipe	
2 o'clock	1/8	2 o'clock		2 o'clock	1/8	Effluent Pipe	1/8

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
185	10-9-13	3:10	J. Booth	C	—	—
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
4'	1'	1'		3'	—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)					
Pipe Material					
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)					



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S 5.1

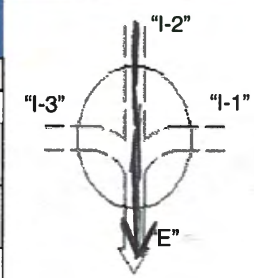
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	1/8	6 o'clock	X	6 o'clock	1/8	Influent Pipe	0
10 o'clock	1/8	10 o'clock		10 o'clock	1/8	Influent Pipe	
2 o'clock	1/8	2 o'clock		2 o'clock	0	Effluent Pipe	0

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
186	10-9-13	2:45	J. Both	C	—	—
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
8'	1'	1'		7'	—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)					
Pipe Material					
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)					



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S 4.8

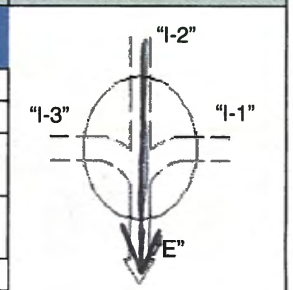
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	1/8	6 o'clock	1/8	6 o'clock	0	Influent Pipe	0
10 o'clock	1/8	10 o'clock	1/8	10 o'clock	1/8	Influent Pipe	
2 o'clock	1/8	2 o'clock	1/8	2 o'clock	1/8	Effluent Pipe	0

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
147	2:25	2:25	J. Booth	C	—	—
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
7'	1'	1'		6'	—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)					
Pipe Material					
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)					



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

☐ H2S 4

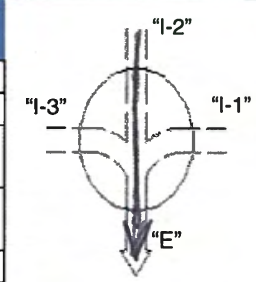
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	1/8	6 o'clock	1/8	6 o'clock	1/8	Influent Pipe	1/8
10 o'clock	1/8	10 o'clock	1/8	10 o'clock	1/8	Influent Pipe	
2 o'clock	1/8	2 o'clock	1/8	2 o'clock	1/8	Effluent Pipe	1/8

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
188	10-9-13	1:40	J. Booth	C	—	—
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
4'	1'	1'		3'	—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)					
Pipe Material					
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)					



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S_____

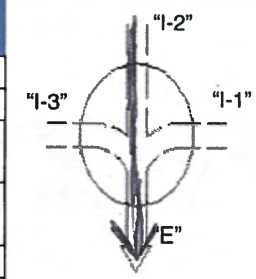
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	1/8	6 o'clock	X	6 o'clock	0	Influent Pipe	0
10 o'clock	1/8	10 o'clock		10 o'clock	0	Influent Pipe	
2 o'clock	1/8	2 o'clock		2 o'clock	0	Effluent Pipe	0

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
189	10-9-13	1:35	J. Booth	C	—	—
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
8.0	1'	1'	—	7'	—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)					
Pipe Material					
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)					



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S_____

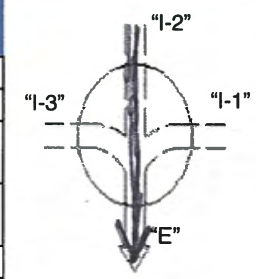
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	1/8	6 o'clock	1/8	6 o'clock	0	Influent Pipe	0
10 o'clock	0	10 o'clock	0	10 o'clock	0	Influent Pipe	
2 o'clock	0	2 o'clock	0	2 o'clock	0	Effluent Pipe	0

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
190	10-9-13	1:20	J. Booth	C	—	—
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
4'	1'	1'		3'	—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)					
Pipe Material					
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)					



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S_____

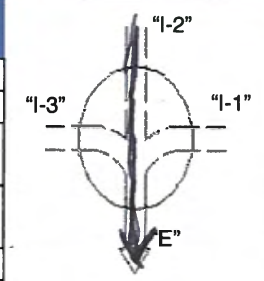
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	1/8	6 o'clock		6 o'clock	1/8	Influent Pipe	1/8
10 o'clock	1/8	10 o'clock	X	10 o'clock	1/8	Influent Pipe	
2 o'clock	1/8	2 o'clock		2 o'clock	1/8	Effluent Pipe	1/8

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
191	10-9-13	1:00	J. Booth	C	—	—
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
4'	6"	1'	3'		—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)					
Pipe Material					
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)					



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S_____ 3.1

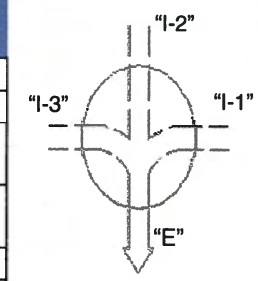
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	1/8	6 o'clock		6 o'clock	0	Influent Pipe	0
10 o'clock	1/8	10 o'clock	X	10 o'clock	0	Influent Pipe	
2 o'clock	0	2 o'clock		2 o'clock	0	Effluent Pipe	0

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
192	10-9-13	12:40	J. Booth	C	—	—
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
6		1'		5'	—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)					
Pipe Material					
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)					



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S 3.8

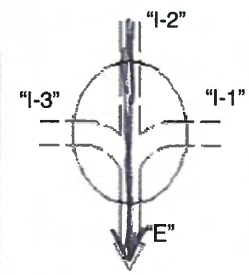
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	0	6 o'clock	0	6 o'clock		Influent Pipe	0
10 o'clock	0	10 o'clock	0	10 o'clock	X	Influent Pipe	
2 o'clock	0	2 o'clock	0	2 o'clock		Effluent Pipe	0

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
193	10-9-13	12:15	J. Booth			
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
4	—	1'	3'	1'	—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)					
Pipe Material					
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)					



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S_____

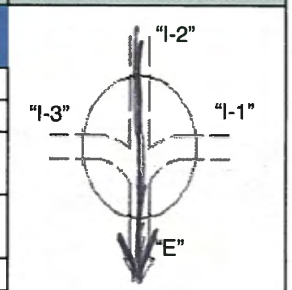
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	1/8	6 o'clock	X	6 o'clock	0	Influent Pipe	1/8
10 o'clock	1/8	10 o'clock		10 o'clock	1/8	Influent Pipe	
2 o'clock	1/8	2 o'clock		2 o'clock	1/8	Effluent Pipe	0

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
19[illegible]4	10-9-13	11:20	J. Booth	C	—	—
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
5'		1'	2'	2[illegible]'	—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)					
Pipe Material					
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)					



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S 2.4

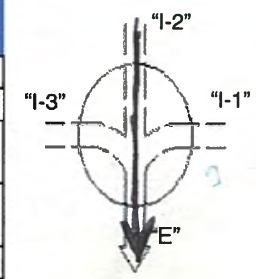
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	1/8	6 o'clock	X	6 o'clock	0	Influent Pipe	0
10 o'clock	1/8	10 o'clock		10 o'clock	0	Influent Pipe	
2 o'clock	1/8	2 o'clock		2 o'clock	0	Effluent Pipe	0

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
1986	10-9-13		J. Booth	C	—	—
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
6'	—	1' 9		5'		
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)					
Pipe Material					
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)					



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S_____

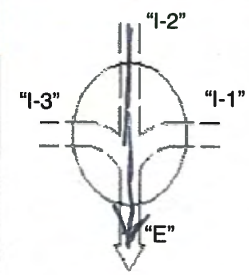
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	0 1/8	6 o'clock	1/8	6 o'clock	0	Influent Pipe	1/8
10 o'clock	1/8	10 o'clock	1/8	10 o'clock	1/8	Influent Pipe	
2 o'clock	1/8	2 o'clock	1/8	2 o'clock	1/8	Effluent Pipe	0

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
198	10-9-13	10:40	J. Booth	C	—	—
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
5'		1'		4'	—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)					
Pipe Material					
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)					



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S_____

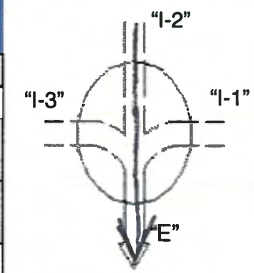
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	0	6 o'clock	1/8	6 o'clock		Influent Pipe	0
10 o'clock	0	10 o'clock	1/8	10 o'clock		Influent Pipe	
2 o'clock	0	2 o'clock	0	2 o'clock		Effluent Pipe	0

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
~~200~~ 199	10-9-13	10:25	J. Booth	C		
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
2'-6"	—	1'		1'6"	—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)					
Pipe Material					
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)					



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S 4.5

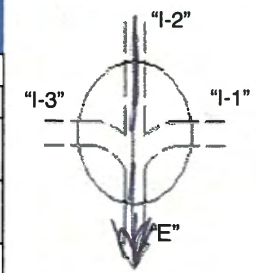
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	0	6 o'clock		6 o'clock		Influent Pipe	0
10 o'clock	0	10 o'clock	X	10 o'clock	X	Influent Pipe	
2 o'clock	0	2 o'clock		2 o'clock		Effluent Pipe	0

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
200	10-9-13	10:00	J. Barth	C		
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
3' 6"		6"	3'	—	—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)					
Pipe Material					
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)					



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S_____

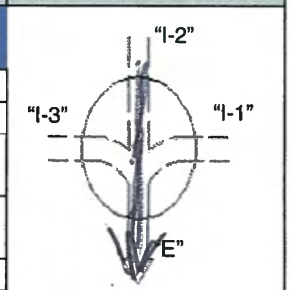
Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	1/8	6 o'clock	X	6 o'clock	0	Influent Pipe	0
10 o'clock	1/8	10 o'clock		10 o'clock	1/8	Influent Pipe	
2 o'clock	1/8	2 o'clock		2 o'clock	1/8	Effluent Pipe	0

City of Bend, Existing Plant Interceptor Condition Assessment
Manhole Inspection Form

Manhole Number	Date	Time	Inspector	Weather (S, C, R)	Northing	Easting
201	10-9-13	6:30	J. Book	C	—	—
Rim to Effluent Invert (nearest 0.5 foot)	**Rim to Grade (N/A if rim is flush with ground)**	**Chimney Height (in)**	**Cone Height (in)**	**Barrel Height (feet)**	**Rung Type (Ladder, Plastic, Metal)**	**# of Steps**
3	—	1'		2'	—	—
Surface Condition (circle one)	Easement	Asphalt	Sidewalk/ROW	Other:		
Traffic Volume (circle one)	None	Residential	City/County	Highway	Other:	
Inflow Potential (circle one)	None	Low	Med	High	Within Stream Banks	Within Floodplain

Pipes	Pipe "E"	Pipe "I-1"	Pipe "I-2"	Pipe "I-3"	Notes
Size (in)					
Pipe Material					
Clock Position ("Effluent" = 6:00)					
Depth from Rim to Invert (feet)					
Channelized?					
Drop (In/Out)					



Frame and Cover (Size:)						
-Type (circle one)	Solid	Vented/Slots	Gasketed	Bolted	Insert	Locking
-Material (circle one)	Cast Iron	Ductile Iron	Aluminum	Hatch		
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt(s) Missing
Grade Rings						
-Type (circle one)	None	Concrete	Cast-in-Place	Brick	HDPE	Other:
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	
Barrel/Wall						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Cracked	Broken	Missing	Corroded/Pitted	Bolt Missing
Bench/Channel						
-Type (circle one)	Concrete	Cast-in-Place	Brick	HDPE/Fiberglass	Other:	
-Condition (circle one)	Sound	Corroded	Mortar Missing	Displaced Brick	Infiltration	Debris
Structural/O&M Condition						
-Rungs (circle one)	SCM: only oval barrel section	Missing	Offset	Other:		
-Conc. Corrosion (circle one)	None	SRI	SAV	SAP	SRV	Location (GR, B/W, B/C):
-Evidence of I/I (circle one)	None	Pipe Penetrations	Bench	Barrel / Joints	Chimney	Other:
-Evidence of Surcharge (circle one)	None	Bench	Above Crown	Rungs	Other:	

Data Collection Requirements (Check off when complete)

Manhole _____ Date_____

Photos (10 minimum, label each photo)

- ☐ Photo of manhole taken along pipe alignment (facing downstream) ..... Photo #:_____
- ☐ Manhole frame and cover (closed) ..... Photo #:_____
- ☐ Underside of flattop (roof) or cone ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Walls (representative), ladder and steps ..... Photo #:_____
- ☐ Bench ..... Photo #:_____
- ☐ Flow channel ..... Photo #:_____
- ☐ Main influent pipe(s) ..... Photo #:_____
- ☐ Main effluent pipe ..... Photo #:_____
- ☐ Scrape Tests (no photos necessary if scrape tests performed prior to MH digital scanning) ..... Photo #:_____

Hardness readings (3 measurements circumferentially with hardness durometer)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)	
Clock position	Hardness	Clock position	Hardness	Clock position	Hardness
6 o'clock		6 o'clock		6 o'clock	
10 o'clock		10 o'clock		___ o'clock	
2 o'clock		2 o'clock		___ o'clock	

H2S readings (peak H2S from gas meter)

- ☐ H2S_____

Scrape test (rough depth in 1/8" increments of concrete that spalls off and photo each scrape)

Top (first couple feet from grade)		Middle (approx. halfway down)		Bottom (just above pipe penetrations)		Pipe Penetrations (crown of pipe)	
Clock position	Depth	Clock position	Depth	Clock position	Depth	Location	Depth
6 o'clock	0	6 o'clock		6 o'clock		Influent Pipe	0
10 o'clock	0	10 o'clock	X	10 o'clock	X	Influent Pipe	
2 o'clock	0	2 o'clock		2 o'clock		Effluent Pipe	0

Appendix G: 2007 Yeoman Interceptor CCTV Report

Final Report

City of Bend, Oregon
Yeoman Interceptor
CCTV Review

Prepared for

City of Bend, Oregon

December 2007

CH2MHILL
Corvallis, Oregon

Contents

Section **Page**

I. Executive Summary **1**
A. General 1
B. Findings 1
C. Recommendations 2

II. Introduction and Project Background **5**
A. History 5
B. Goals of Study 5

III. Field Data Analysis **7**
A. Objective 7
B. General CCTV Observations 7

IV. Recommendations **9**
A. Introduction 9
B. Annual Pipeline Maintenance—Part A 9
C. Immediate Pipeline Maintenance—Part B 10
D. Pipeline Rehabilitation—Parts C-E 10
E. Rehabilitation Implementation Plan 11

Summary **13**

Appendixes

A CCTV Review Yeoman Interceptor
B Rehabilitation Recommendations
C Key Map
D NASSCO's Pipeline Assessment Defect Coding
E CCTV Logs From PSC
F CCTV Logs From CH2M HILL
G CCTV DVDs

Tables **Page**

1 Priority Designation 2
2 System Improvement Cost Summary 3
3 Suggested Implementation Plan 12

SECTION I

Executive Summary

A. General

This executive summary is a general overview of the consultant's findings, conclusions, and recommendations of the City of Bend, closed circuit television (CCTV) review. The primary purpose of this investigation was to review CCTV documents and prepare a condition assessment based on these documents. The study has also provided improvement recommendations for extending the life of the Yeoman Interceptor.

Major project goals were as follows:

- Analyze interceptor pipeline defects in the sanitary sewer system that may affect long-term performance.
- Provide specific short-term and projected long-term recommendations for improvements to the sanitary sewer interceptor.

B. Findings

- The City operates and maintains an extensive wastewater management system that includes one wastewater treatment facility, 360 miles of sanitary sewer, and 86 wastewater pumping stations (*Collection System Master Plan TM 3.6 Cost Criteria, MWH, April 2007*).
- The City of Bend is concerned about the condition and long-term viability of the sanitary sewer interceptors. This CCTV review includes work performed in January of 2005. The reviews were conducted in November of 2007.
- The Yeoman Interceptor was constructed in the early 1970s. We observed that the pipeline is, in general, in fair to good condition. The observed condition is relatively consistent throughout the length of the investigation. The CCTV DVDs and logs reviewed included approximately 19,500 linear feet of 30- to 42-inch reinforced concrete pipe (RCP).
- There were discrepancies between the Record Drawings supplied and the CCTV logs and DVD recordings. Thirteen lines called out as 42-inch on the CCTV logs were shown as 36-inch on the Record Drawings, one line called out as 42-inch on the CCTV logs was shown as 32-inch on the Record Drawings, and three lines called out as 42-inch on the CCTV logs were shown as 36-inch on the Record Drawings.
- The most reliable and accurate method of identifying and assessing the specific location of defects to the sanitary sewer interceptor is through the use of CCTV inspection. This is not specific to this project or to Bend, Oregon. CCTV pipeline evaluation is used effectively throughout the industry.

- There were no major pipe failures identified in this data review. The pipe was found to be in a relatively consistent condition throughout. Defects identified were attached debris, such as grease or other deposits, general pipeline surface degradation, minor concrete spalling at many joints, very minor fine root intrusion, and minor cracks.
- Based on the results of the CCTV inspection work, it was determined that in order to assure long-term viability of the Yeoman Interceptor, pipe rehabilitation through lining would provide a cost-effective protective system. Various lining systems have been suggested with Cured-In-Place-Pipe (CIPP) being a preferred method.
- Cost for relining the entire 19,500 linear foot interceptor would be approximately $9.2 million including engineering, administration and legal, and a 30 percent contingency for unexpected or presently unidentified construction issues. This cost is based on renewing the interceptor with a lining pipe that is adequate to carry all dead and live loads, a Fully Deteriorated host pipe.

C. Recommendations

- The RCP degrading is relatively uniform throughout this interceptor. The lower portions of the interceptor (Manhole A2-1 through A2-15) were found to have somewhat greater surface deterioration than upper reaches (Manhole A2-27 through A2-34). Apparently, no testing was performed to evaluate the pipe structural loss. Visual observation of the supplied CCTV data indicates that approximately 25 percent to 50 percent of the structural life of the interceptor remains.

TABLE 1
Priority Designation

Priority	Priority Condition Description
1	Frequent and more severe cracking, extensive surface deterioration, roots at joints, failing joint seals
2	Less frequent cracking, extensive surface deterioration, minor roots at joints
3	Surface deterioration, debris attached to pipe wall

- None of the line segments were in need of immediate repair or rehabilitation. However, one location will require heavy cleaning to remove accumulated debris that blocked the CCTV camera, which is considered a maintenance effort. Another location was originally thought by the City to be an illicit connection, but it was determined that this is legitimately providing service to the City's service area within the Urban Growth Boundary. The intrusion could be cut back to wall of the pipe or, preferably, a manhole structure could be constructed at the site.
- The recommendations identified three general priorities for pipeline rehabilitation. The separation between the three priority levels is relatively minor. Our overall recommendation would be for the City to begin planning and budgeting for an interceptor rehabilitation program that would install a CIPP liner for the entire length of this major sewer line.

- Timing for implementing the sewer interceptor improvement work may be delayed safely for several years. A prudent rehabilitation program to renew this interceptor should be planned and budgeted for a startup within approximately ten years.
- Until the pipeline rehabilitation program can be implemented, we recommend that the City also conduct a regular program of cleaning and debris removal. A thoroughly clean pipe will deteriorate at a somewhat slower rate than one burdened with debris and corrosive deposits. A well planned and implemented maintenance play may extend the life of this system.

Table 2 summarizes the overall recommended system improvement costs and includes costs for both Fully Deteriorated and Partially Deteriorated host pipe conditions.

TABLE 2
System Improvement Cost Summary
(All costs are in November 2007 dollars. November 2007 ENR 20 City Average is 8092)

Part	Description of Improvements	Fully Deteriorated Cost Estimate ($)*	Partially Deteriorated Cost Estimate ($)*
A	Annual Cleaning and Maintenance Program	$98,000	$98,000
Total	**Annual Maintenance**	**$98,000**	**$98,000**
B	Immediate Maintenance	$30,000	$30,000
C	Pipeline Rehabilitation/Renewal for Priority 1 Work	$2,323,000	$1,917,000
D	Pipeline Rehabilitation/Renewal for Priority 2 Work	$2,403,000	$1,870,000
E	Pipeline Rehabilitation/Renewal for Priority 3 Work	$896,000	$704,000
Subtotal		**$5,652,000**	**$4,521,000**
	Engineering (10%)	$848,000	$678,000
	City Administration and Legal (15%)	$565,000	$452,000
Subtotal		**$7,065,000**	**$5,651,000**
	Contingency (30%)	$2,120,000	$1,695,000
Total	**Excluding Part A—Annual Maintenance**	**$9,185,000**	**$7,346,000**

*Current year costs, no allowance for inflation and the time value of money.

SECTION II

Introduction and Project Background

A. History

The City of Bend, Oregon, operates and maintains an extensive wastewater management system that includes approximately 360 miles of sanitary sewer, 86 wastewater pumping stations, and one wastewater treatment facility. The City currently provides service to a population of approximately 6,600 with a service area of approximately 29,953 acres (over 46 square miles). (*Collection System Master Plan TM 3.6 Cost Criteria, MWH, April 2007*).

The oldest parts of the City's wastewater system were constructed during the early 1900s and have been expanded over the years to accommodate residential, commercial, and industrial growth. Recent interceptors have been constructed using Reinforced Concrete Pipe (RCP).

B. Goals of Study

In an effort to evaluate the current condition of the Yeoman Interceptor, PSC Industrial Outsourcing Group, Benicia, CA, was retained to provide comprehensive CCTV inspection of the entire 19,500 linear foot interceptor. The CCTV work was completed in January 2005. The CCTV documents, including DVD recordings and logs were reviewed for this report in November 2007.

SECTION III

Field Data Analysis

A. Objective

The evaluation of the system's ability to safely transport wastewater flows to the City's wastewater treatment plant (WWTF), the life expectancy, and recommendations for ensuring a long, useful life were the general purposes of this sanitary sewer CCTV review.

By definition, the sanitary sewer infrastructure is the network of gravity sewer pipes and manhole structures including pumping stations, force mains, and control structures. In principle, sanitary sewer systems are designed to transport domestic, commercial, and industrial wastes to the treatment facility. The city has recently completed a Collection System Master Plan that identifies the need to provide additional conveyance capacity for the Plant Interceptor (Yeoman Interceptor), ultimately providing an additional parallel Plant Interceptor pipeline. This report does not address the Yeoman Interceptor's current capacity, flows, or effects of potential future flows. The City will need to evaluate timing of repairs discussed in this report along with proposed additional conveyance improvements in the reach of the Plant Interceptor.

The purpose of this review is to qualify defects in the interceptor and prepare recommendations for system improvements. The review and subsequent analysis gives relatively accurate cost information based on conferences with local contractors experienced in the methods recommended for system renewal. The cost basis provided is at budgetary level and is not intended as the final engineering cost estimates.

B. General CCTV Observations

The findings of the CCTV review are that the Yeoman Interceptor generally is in good to fair condition. Defects identified are minor in nature. No major defects or pipeline failures were found.

The CCTV camera, supplied by and used by PSC, was mounted on a float and cabled upstream and downstream. The rate of travel was about 30 to 60 feet per minute. When appropriate, the camera operator stopped the device to pan or tilt for defect observation. Direction of travel was upstream to downstream throughout the CCTV work. The supplied logs indicate that the interceptor was not cleaned prior to the CCTV work.

Typical minor defects include:

- Debris
- Deposits attached to the pipeline walls–grease or light floating sludge
- Minor cracking or spalling at joints
- Very fine roots at many joints
- Many joints also had material exposed at joints, probably dried sludge or grease
- Little or no inflow and infiltration (I/I) was observed

There were no major defects identified. However, some serious considerations were identified:

- The CCTV coverage had to be abandoned between manhole A2-20 and A2-19 because debris under the water surface blocked the camera. This debris blockage should be corrected with heavy, mechanical cleaning with debris removal.
- An intruding tap (approximately 12-inch diameter) should be removed in the segment between A2-38 and A2-37. There was no manhole or junction structure at the location where the intruding tap was identified.
- Surface deterioration of the concrete pipe is causing increased roughness throughout (PACP coded SRI, see Appendix D—PACP Coding Charts). SRI, defined as Surface Damage Roughness Increased, is due to exposure to the corrosive nature of the sewer environment.

There were significant differences between the Record Drawings that were supplied and the CCTV logs and DVD recordings. Of the 39 line segments actually CCTV inspected and reviewed, 13 lines that were called out as 42-inch on the CCTV logs were shown as 36-inch on the Record Drawings, one line called out as 42-inch on the CCTV logs was shown as 32-inch on the Record Drawings, and three lines called out as 42-inch on the CCTV logs were shown as 36-inch on the Record Drawings. It is unknown why there is a difference between the CCTV logs and the Record Drawings.

SECTION IV

Recommendations

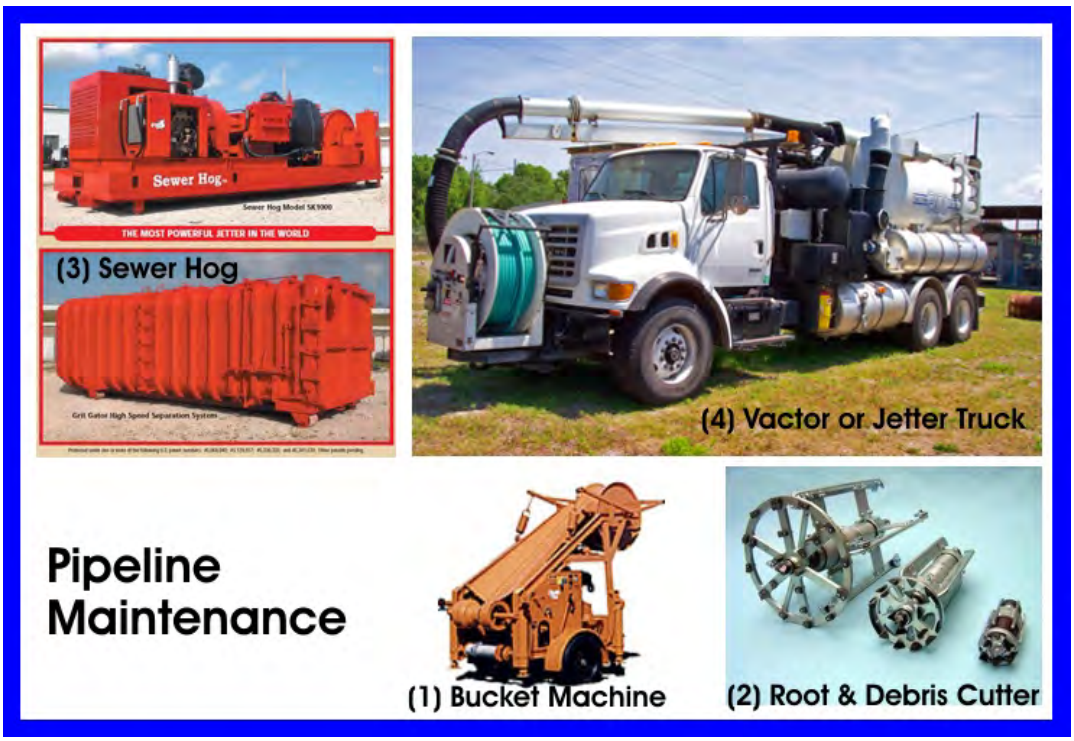
A. Introduction

The recommended improvement plan has been identified to restore the wastewater Yeoman Interceptor infrastructure and to preserve and extend the useful life of the interceptor. The plan includes immediate maintenance, periodic ongoing maintenance, and long-term rehabilitation.

B. Annual Pipeline Maintenance—Part A

The Yeoman Interceptor is exhibiting surface deterioration due to continual contact with the corrosive atmosphere and attached debris present in sanitary sewers. The surface deterioration may be reduced by maintaining cleaner pipe surfaces. The recommendation for ongoing maintenance for this interceptor is to have the pipe cleaned and debris removed on a relatively frequent basis. The first cleaning would take the greatest effort, however, subsequent maintenance cleanings would be much faster, require less effort, and would be less costly.

An annual budget is proposed that would cover light to moderate cleaning with limited heavy cleaning. The budget of $98,000 per year would provide approximately $5 per linear foot for various cleaning activities, debris removal and disposal, traffic control, and other related tasks. The first cleaning of the interceptor may require mechanical tools, such as a bucket machine (1) or a cutting head (2) to breakup and loosen solidified deposits. The Sewer Hog system (3) is also a heavy cleaning mechanical system which does not require dewatering, operates on a vacuum system utilizing water in the system, and delivers a waste that is dry enough for solid waste disposal may be recommended. After the initial



heavy cleaning, normal cleaning with multiple jetter passes should provide adequate pipeline maintenance using a vactor or jetter truck (4).

C. Immediate Pipeline Maintenance—Part B

Based on the review of the CCTV inspection videos, one segment requires immediate heavy cleaning attention. The inspection between manhole A2-20 and A2-19 was abandoned at 490 feet from the upstream manhole (A2-20) due to debris restricting the flow. Another issue with this reach is that manhole A2-20 is buried. This access manhole should be raised to grade to assure a convenient point-of-entry for cleaning tools and, when contracted, for inserting lining materials and equipment, and bypass equipment. The budget of $30,000 includes up to $35 per foot for heavy cleaning, debris removal and disposal, $15 per foot for CCTV services, and $5,000 for adjusting the manhole to grade. Bypass pumping is not anticipated or budgeted for this blockage removal.

These unit costs are high because of the specialized equipment necessary for the cleaning activities and the very small quantities involved. Light to moderate cleaning and CCTV work with greater quantities will significantly reduce the unit costs.

D. Pipeline Rehabilitation—Parts C-E

The recommendation to line the Yeoman Interceptor using Cured-In-Place-Pipe (CIPP) is based on several criteria. First of all, CIPP has a long track record of successful installations on small- to large-diameter pipelines. CIPP can be designed for host pipes that are fully deteriorated, thus utilizing a thicker, fully structural wall thickness, or partially deteriorated using a thinner, less expensive liner. Once cured, the resin impregnated felt tubing provides a very low flow resistant surface, that has proven longevity, corrosion, and abrasion resistance.

The CIPP design for a fully deteriorated host pipe will provide a full strength pipe replacement. If the host pipe were to completely fail, the CIPP liner would be able to carry all designed dead and live loads. The partially deteriorated design adds structural strength to the host pipe but is intended as a protective measure to extend the life of the host pipe. Table 1 provides costs for both Fully Deteriorated and Partially Deteriorated host pipe conditions.

The reinforced concrete pipe (RCP) host pipe in the Yeoman Interceptor is in good to fair condition. At no point in the CCTV review was pipe reinforcing exposed. There were no severe fractures, extended cracks, deformation, holes, or other failure indicators. This host pipe may be a candidate for having a partially deteriorated lining.

However, a strong case can be made for utilizing a fully deteriorated design. This design is more expensive both to manufacture and to deliver and install. But the cost increase is incremental. The added cost for utilizing a fully deteriorated design, as opposed to the partially deteriorated design, is between 10 percent and 50 percent, depending on the pipe diameter, length of shot, and other considerations.

The costs recommended are for fully deteriorated host pipes for average length shots. The budget level cost estimate for lining the Yeoman Interceptor is about $9,185,000. This cost includes all the preparation work, bypass pumping, lining design and delivery, installation, and curing; and the engineering, City administrative and legal work, plus 30 percent for contingencies. The estimate also includes $5,000 to remove an intruding tap. The interceptor should be re-televised after lining to assure proper installation and cure.

Timing for implementing the sewer interceptor improvement work may be safely delayed for several years. An effective rehabilitation program to rehabilitate the Yeoman Interceptor could be scheduled and budgeted for a startup within ten years.

The hydraulic capacity of a CIPP lined pipe is generally less than the original pipe due to the loss of inside diameter. Assuming a full strength CIPP lining, the wall thickness for 42-inch is 30.5 mm (1.2 inches), and peak hydraulic capacity of the Yeoman Interceptor is not expected to be substantially affected. The is due to the reduced friction of the smooth wall glass-fiber liner from the roughened, deteriorated surface of the RCP. The lower roughness coefficient is expected to have similar affect on increasing pipe capacity as the diameter loss has on reducing capacity.

Rehabilitation of existing manholes is also recommended when CIPP rehabilitation is performed. For purposes of cost estimating, 60-inch manholes are assumed, with an average depth of 15 feet. Manhole rehabilitation would involve pressure washing and application of a polymer modified cementitious mortar or a high build epoxy such as Raven 400 series to the manholes, assuming that the structural condition of the manhole is found to be acceptable. A planning level cost estimate for this work (assuming manhole work is part of a larger CIPP project and not a standalone project, which would increase these cost estimates as a result of mobilization and overhead costs, is between $100 to $120 per vertical foot. For 36 manholes this is approximately $83,000.

E. Rehabilitation Implementation Plan

Table 3 provides a possible implementation plan for sewer interceptor improvements. A budget may be allocated for performing the work at the time suggested.

TABLE 3
Suggested Implementation Plan (assuming fully-deteriorated pipe costs)
(All costs are in November 2007 dollars. November 2007 ENR 20 City Average is 8092)

Part	Description of Improvements	Year 1	Year 2-7 Average	Year 8	Year 9	Year 10
A	Annual Cleaning & Maint. Program	$98,000	$98,000	$98,000	$60,000	$30,000
B	Immediate Maintenance	$30,000				
C	Pipeline Rehabilitation Priority 1 Work			$3,775,000		
D	Pipeline Rehabilitation Priority 2 Work				$3,905,000	
E	Pipeline Rehabilitation Priority 3 Work					$1,456,000

Includes Engineering, City Administration and Legal, and Contingency markups consistent with *Collection System Master Plan TM 3.6 Cost Criteria, MWH, April 2007* (10%, 15%, with 30% contingency applied to that subtotal)

Summary

- The Yeoman Interceptor RCP is deteriorating throughout the length inspected. The lower reaches of the interceptor were found to be more deteriorated than the upper reaches. None of the line segments were in need of immediate repair or rehabilitation. One location will require heavy cleaning to remove accumulated debris that blocked the CCTV camera and another location had an intruding tap that should be removed.
- The pipeline rehabilitation recommendations identified three general priorities. The overall recommendation would be for the City to begin planning and budgeting for an interceptor rehabilitation program that would install a CIPP liner for the entire length of this major sewer line.
- Until the rehabilitation program can be implemented, it is also recommended that a regular program of cleaning and debris removal be scheduled.

Appendix A

CCTV Review Table

APPENDIX A: CCTV REVIEW Yeoman Interceptor

City of Bend, OR

Upstream Manhole	Downstream Manhole	Pipe Length (ft.)	Feet Televised	Pipe Diameter (in.)	Pipe Type	Crew #:	Date Televised	Tape No:	Observations:	Notes
A2-39	A2-38	706	706	42	RCP	JC	1/24/2005	1	SRI, DAGS, SSS (79'), CC (538')	
A2-38	A2-37	621	621	42	RCP	JC	1/24/2005	1	TBI (129'), SRI, DAGS	
A2-37	A2-36	781	781	42	RCP	JC	1/24/2005	1	SRI, DAE (182', 549'), SSS (763')	
A2-36	A2-35	384	384	42	RCP	JC	1/24/2005	1	SRI, SSS (24')	**As-Built Drawings indicate 36" pipe**
A2-35	A2-34	591	591	42	RCP	JC	1/24/2005	1	SRI, SSS (33'), DAGS, DAE (231')	**As-Built Drawings indicate 30" pipe**
A2-34	A2-33	505	505	42	RCP	JC	1/25/2005	1	DAGS, SRI	**Limited visablily due to steam As-Built Drawings indicate 36" pipe**
A2-33	A2-32	338	338	42	RCP	JC	1/25/2005	1	SRI, DAGS	**Limited visablily due to steam As-Built Drawings indicate 36" pipe**
A2-32	A2-31	399	399	42	RCP	JC	1/25/2005	1	SRI, DAGS	**As-Built Drawings indicate 36" pipe**
A2-31	A2-30	217	217	42	RCP	JC	1/25/2005	1	SRI, DAGS	**As-Built Drawings indicate 36" pipe**
A2-30	A2-29	150	150	42	RCP	JC	1/25/2005	1	SRI, DAGS	**As-Built Drawings indicate 36" pipe**
A2-29	A2-28	589	589	42	RCP	JC	1/25/2005	2	SRI, DAGS	**As-Built Drawings indicate 30" pipe**
A2-28	A2-27	480	480	42	RCP	JC	1/25/2005	2	SRI, DAGS	**As-Built Drawings indicate 30" pipe**
A2-27	A2-26	330	330	42	RCP	JC	1/25/2005	2	SRI, DAGS	**As-Built Drawings indicate 32" pipe**
A2-26	A2-25	377	377	42	RCP	JC	1/25/2005	2	SRI, OBJ (53', 258', 306')	**As-Built Drawings indicate 36" pipe**
A2-25	A2-24	225	225	42	RCP	JC	1/25/2005	2	OBJ (Repeated from 103'-214'), SRI	**As-Built Drawings indicate 36" pipe**
A2-24	A2-23	759	759	42	RCP	JC	1/25/2005	2	SRI, RFL, RFB, OBJ (Repeated from 126' - 741')	**As-Built Drawings indicate 36" pipe**
A2-23	A2-22	420	420	42	RCP	JC	1/25/2005	2	SRI, RFL, RFB, DAE (308', 378'), DAGS, OBJ (385')	**As-Built Drawings indicate 36" pipe**
A2-22	A2-21	342	342	42	RCP	JC	1/26/2005	2	SRI, RFL, CL (87'-95'), DAGS	**As-Built Drawings indicate 36" pipe**
A2-21	A2-20	618	618	42	RCP	JC	1/26/2005	2	CL (32'-47'), DAGS, SRI	**Limited visablily due to steam**
A2-20	A2-19	N/A	491	42	RCP	JC	1/26/2005	3	OBJ (106'), MSA	**Survey Abandoned at 490'09" due to debris under water line**
A2-19	A2-18	506	506	42	RCP	JC	1/26/2005	3		
A2-18	A2-17	656	656	42	RCP	JC	1/26/2005	3	DAGS, RFL	
A2-17	A2-16	168	168	42	RCP	JC	1/26/2005	3		
A2-16	A2-15	638	638	42	RCP	JC	1/26/2005	3	SRI, DAGS, RFL	
A2-15	A2-14	275	275	42	RCP	JC	1/26/2005	3	DAGS, CM (123'-272')	**As-Built Drawings indicate 36" pipe**
A2-14	A2-13	496	496	36	RCP	JC	1/26/2005	3	CM (11'-150'), DAGS, CL (209'-218')	
A2-13	A2-12	811	811	36	RCP	JC	1/26/2005	3	SRI, DAGS, RFL, OBJ (620')	
A2-12	A2-11	413	413	36	RCP	JC	1/26/2005	3	CL (26', 39'-43', 131'-158', 184'), OBJ (86', 258'), DAGS, SRI	
A2-11	A2-10	668	668	36	RCP	JC	1/26/2005	3	SRI, CL (15', 104'), DAGS, OBJ (98', 546'), RFL	
A2-10	A2-9	751	751	36	RCP	JC	1/27/2005	4	SRI, DAGS, CL (580'-741')	
A2-9	A2-8	500	500	36	RCP	JC	1/27/2005	4	CL (8'-29', 54'-62'), DAGS	**As-Built Drawings indicate 42" pipe**
A2-8	A2-7	750	750	42	RCP	JC	1/27/2005	4	CL (145'-155', 510'-518'), OBJ (691'), DAGS	
A2-7	A2-6	636	636	42	RCP	JC	1/27/2005	4	OBJ (80', 96'), DAGS	
A2-6	A2-5	694	694	42	RCP	JC	1/27/2005	4	DAGS, CL (39'-48'), OBJ (215', 674', 683')	

APPENDIX A: CCTV REVIEW Yeoman Interceptor

City of Bend, OR

Upstream Manhole	Downstream Manhole	Pipe Length (ft.)	Feet Televised	Pipe Diameter (in.)	Pipe Type	Crew #:	Date Televised	Tape No:	Observations:	Notes
A2-5	A2-4	505	505	42	RCP	JC	1/27/2005	4	DAGS, CL (25'-78', 177'-206', 255'-448')	
A2-4	A2-3	689	689	42	RCP	JC	1/27/2005	4	OBJ (149', 272'), RFL, DAGS	
A2-3	A2-2	606	606	36	RCP	JC	1/27/2005	4	CL (23'-30'), CM (44'-230', 251'-285', 293'-558'), DAGS, SRI	
A2-2	A2-1	430	430	36	RCP	JC	1/27/2005	4	CM (0'-430'), DAGS	
	Total:	19,024	19,515							

PACP Codes	
UMH: Upstream Manhole	RFB: Roots Fine Barrel
DMH: Downstream Manhole	SRI: Surface Roughness Increased
CC: Circular Crack	SSS: Surface Spalling
CL: Longitudinal Crack	DEA: Deposits Attached Encrustation
CM: Crack Multiple	DAGS: Deposits Attached Grease
OBJ: Object wedged in joint	TBI: Break In/Hammer Intruding
RFL: Roots Fine Lateral	MSA: Survey Abandoned

Note: Manhole 20 is buried.

All OBJ observations are minor debris in joint.

There is some uncertainty in pipe diameters between the videos and as-builts.

Appendix B

Rehabilitation Recommendations

APPENDIX B: REHABILITATION RECOMMENDATIONS FOR YEOMAN INTERCEPTOR

City of Bend, OR

Upstream Manhole	Downstream Manhole	Pipe Length (ft.)	Feet Televised	Pipe Diameter (in.) (1)	Pipe Type	Crew #:	Date Televised	Tape No:	Comments:	Observations:	Recommendation	Priority Repair	Estimated Rehab Cost (2)
ANNUAL MAINTENANCE PROGRAM RECOMMENDATIONS													
A2-1	A2-39	19,515		30 - 42	RCP						Normal & Heavy Cleaning	0	$98,000
ANNUAL MAINTENANCE PROGRAM TOTAL													**$98,000**
MAINTENANCE RECOMMENDATIONS													
A2-17	A2-16	168	168	42	RCP	JC	1/26/2005	3			Do Nothing	0	$0
A2-19	A2-18	506	506	42	RCP	JC	1/26/2005	3			Do Nothing	0	$0
A2-20	A2-19	N/A	491	42	RCP	JC	1/26/2005	3	Survey Abandoned at 490'09" due to debris under water line	OBJ (106'), MSA	Heavy Cleaning, ReCCTV, Raise MH A2-20 to grade	0	$30,000
MAINTENANCE TOTAL			**1,165**									**3**	**$30,000**
PRIORITY 1 RECOMMENDATIONS													
A2-2	A2-1	430	430	36	RCP	JC	1/27/2005	4		CM (0'-430'), DAGS	CIPP	1	$97,000
A2-3	A2-2	606	606	36	RCP	JC	1/27/2005	4		CL (23'-30'), CM (44'-230', 251'-285', 293'-558'), DAGS, SRI	CIPP	1	$136,000
A2-4	A2-3	689	689	42	RCP	JC	1/27/2005	4		OBJ (149', 272'), RFL, DAGS	CIPP	2	$224,000
A2-5	A2-4	505	505	42	RCP	JC	1/27/2005	4		DAGS, CL (25'-78', 177'-206', 255'-448')	CIPP	1	$164,000
A2-6	A2-5	694	694	42	RCP	JC	1/27/2005	4		DAGS, CL (39'-48'), OBJ (215', 674', 683')	CIPP	1	$226,000
A2-7	A2-6	636	636	42	RCP	JC	1/27/2005	4		OBJ (80', 96'), DAGS	CIPP	3	$207,000
A2-8	A2-7	750	750	42	RCP	JC	1/27/2005	4		CL (145'-155', 510'-518'), OBJ (691'), DAGS	CIPP	1	$244,000
A2-9	A2-8	500	500	36	RCP	JC	1/27/2005	4	As-Built Drawings indicate 42" pipe	CL (8'-29', 54'-62'), DAGS	CIPP	1	$113,000
A2-10	A2-9	751	751	36	RCP	JC	1/27/2005	4		SRI, DAGS, CL (580'-741')	CIPP	1	$169,000
A2-11	A2-10	668	668	36	RCP	JC	1/26/2005	3		SRI, CL (15', 104'), DAGS, OBJ (98', 546'), RFL	CIPP	1	$150,000
A2-12	A2-11	413	413	36	RCP	JC	1/26/2005	3		CL (26', 39'-43', 131'-158', 184'), OBJ (86', 258'), DAGS, SRI	CIPP	1	$93,000
A2-13	A2-12	811	811	36	RCP	JC	1/26/2005	3		SRI, DAGS, RFL, OBJ (620')	CIPP	2	$182,000
A2-14	A2-13	496	496	36	RCP	JC	1/26/2005	3		CM (11'-150'), DAGS, CL (209'-218')	CIPP	1	$112,000
A2-15	A2-14	275	275	42	RCP	JC	1/26/2005	3	As-Built Drawings indicate 36" pipe	DAGS, CM (123'-272')	CIPP	1	$89,000
PRIORITY 1 BYPASS PUMPING													$82,000
PRIORITY 1 SUBTOTAL			**8,224**									**14**	**$2,288,000**
PRIORITY 2 RECOMMENDATIONS													
A2-16	A2-15	638	638	42	RCP	JC	1/26/2005	3		SRI, DAGS, RFL	CIPP	2	$207,000
A2-18	A2-17	656	656	42	RCP	JC	1/26/2005	3		DAGS, RFL	CIPP	3	$213,000
A2-21	A2-20	618	618	42	RCP	JC	1/26/2005	2	Limited visablily due to steam	CL (32'-47'), DAGS, SRI	CIPP	1	$201,000
A2-22	A2-21	342	342	42	RCP	JC	1/26/2005	2	As-Built Drawings indicate 36" pipe	SRI, RFL, CL (87'-95'), DAGS	CIPP	1	$111,000
A2-23	A2-22	420	420	42	RCP	JC	1/25/2005	2	As-Built Drawings indicate 36" pipe	SRI, RFL, RFB, DAE (308', 378'), DAGS, OBJ (385')	CIPP	2	$137,000

APPENDIX B: REHABILITATION RECOMMENDATIONS FOR YEOMAN INTERCEPTOR

City of Bend, OR

Upstream Manhole	Downstream Manhole	Pipe Length (ft.)	Feet Televised	Pipe Diameter (in.) (1)	Pipe Type	Crew #:	Date Televised	Tape No:	Comments:	Observations:	Recommendation	Priority Repair	Estimated Rehab Cost (2)
A2-24	A2-23	759	759	42	RCP	JC	1/25/2005	2	As-Built Drawings indicate 36" pipe	SRI, RFL, RFB, OBJ (Repeated from 126' - 741')	CIPP	2	$247,000
A2-25	A2-24	225	225	42	RCP	JC	1/25/2005	2	As-Built Drawings indicate 36" pipe	OBJ (Repeated from 103'-214'), SRI	CIPP	2	$73,000
A2-26	A2-25	377	377	42	RCP	JC	1/25/2005	2	As-Built Drawings indicate 36" pipe	SRI, OBJ (53', 258', 306')	CIPP	2	$123,000
A2-35	A2-34	591	591	42	RCP	JC	1/24/2005	1	As-Built Drawings indicate 30" pipe	SRI, SSS (33'), DAGS, DAE (231')	CIPP	2	$192,000
A2-36	A2-35	384	384	42	RCP	JC	1/24/2005	1	As-Built Drawings indicate 36" pipe	SRI, SSS (24')	CIPP	2	$125,000
A2-37	A2-36	781	781	42	RCP	JC	1/24/2005	1		SRI, DAE (182', 549'), SSS (763')	CIPP	2	$254,000
A2-38	A2-37	621	621	42	RCP	JC	1/24/2005	1		TBI (129'), SRI, DAGS	CIPP, Remove Intruding Tap	2	$202,000
A2-39	A2-38	706	706	42	RCP	JC	1/24/2005	1		SRI, DAGS, SSS (79'), CC (538')	CIPP	2	$229,000
PRIORITY 2 BYPASS PUMPING													$71,000
PRIORITY 2 SUBTOTAL			**7,118**									**13**	**$2,385,000**
PRIORITY 3 RECOMMENDATIONS													
A2-27	A2-26	330	330	42	RCP	JC	1/25/2005	2	As-Built Drawings indicate 32" pipe	SRI, DAGS	CIPP	3	$107,000
A2-28	A2-27	480	480	42	RCP	JC	1/25/2005	2	As-Built Drawings indicate 30" pipe	SRI, DAGS	CIPP	3	$156,000
A2-29	A2-28	589	589	42	RCP	JC	1/25/2005	2	As-Built Drawings indicate 30" pipe	SRI, DAGS	CIPP	3	$49,000
A2-30	A2-29	150	150	42	RCP	JC	1/25/2005	1	As-Built Drawings indicate 36" pipe	SRI, DAGS	CIPP	3	$49,000
A2-31	A2-30	217	217	42	RCP	JC	1/25/2005	1	As-Built Drawings indicate 36" pipe	SRI, DAGS	CIPP	3	$71,000
A2-32	A2-31	399	399	42	RCP	JC	1/25/2005	1	As-Built Drawings indicate 36" pipe	SRI, DAGS	CIPP	3	$130,000
A2-33	A2-32	338	338	42	RCP	JC	1/25/2005	1	Limited visablily due to steam As-Built Drawings indicate 36" pipe	SRI, DAGS	CIPP	3	$110,000
A2-34	A2-33	505	505	42	RCP	JC	1/25/2005	1	Limited visablily due to steam As-Built Drawings indicate 36" pipe	DAGS, SRI	CIPP	3	$164,000
PRIORITY 3 BYPASS PUMPING													$30,000
PRIORITY 3 SUBTOTAL			**3,008**									**8**	**$866,000**
			19,515										

TOTALS (3)	**$5,569,000**
ENGINEERING (15%)	**$835,000**
CITY ADMINISTRATION AND LEGAL (10%)	**$557,000**
SUBTOTAL	**$6,961,000**
CONTINGENCY (30%)	**$2,088,000**
TOTAL REHABILITATION BUDGET COST (3)	**$9,049,000**

(1) Pipe diameters from CCTV DVD's and logs (there is

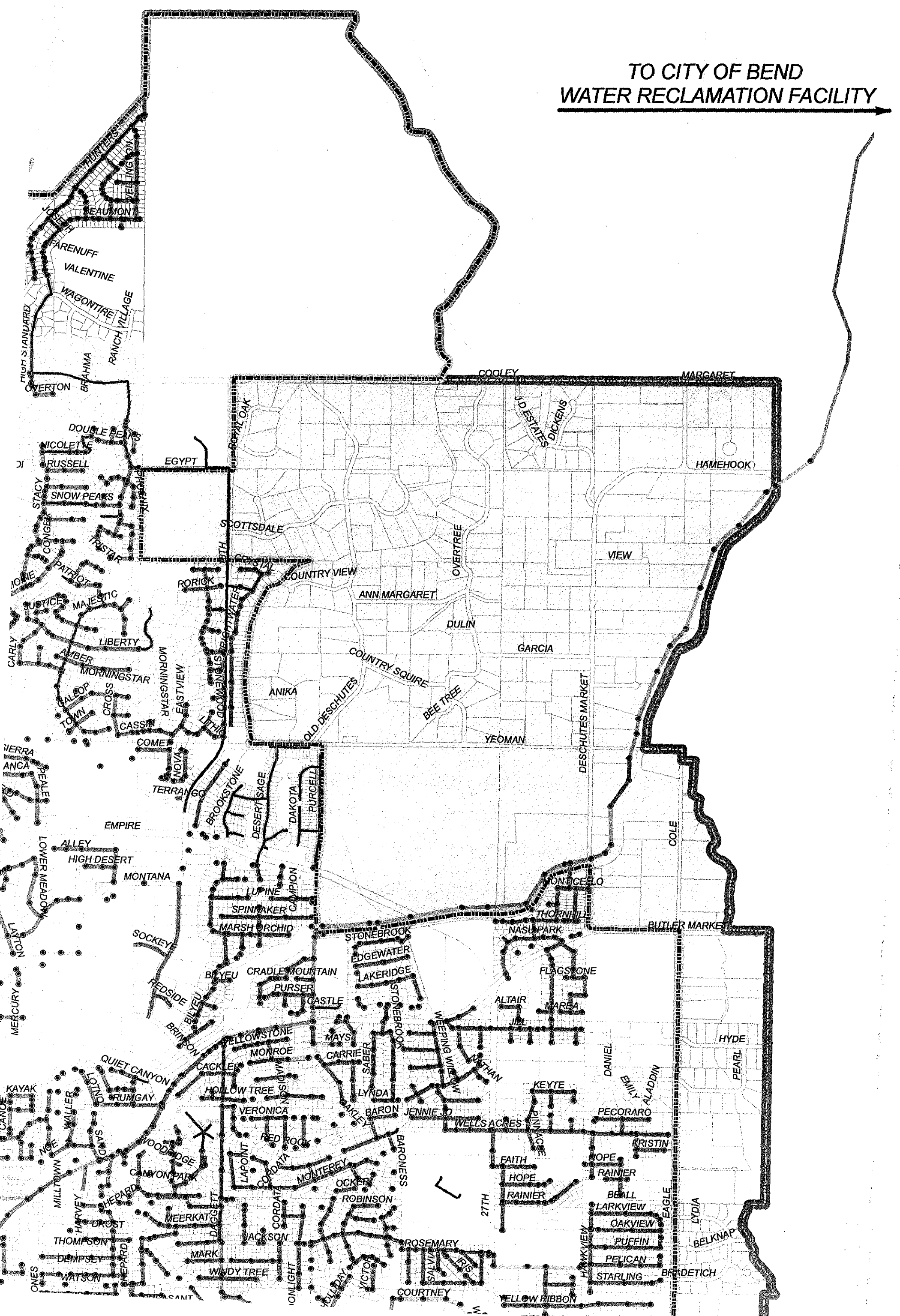
(2) Rounded to nearest $100

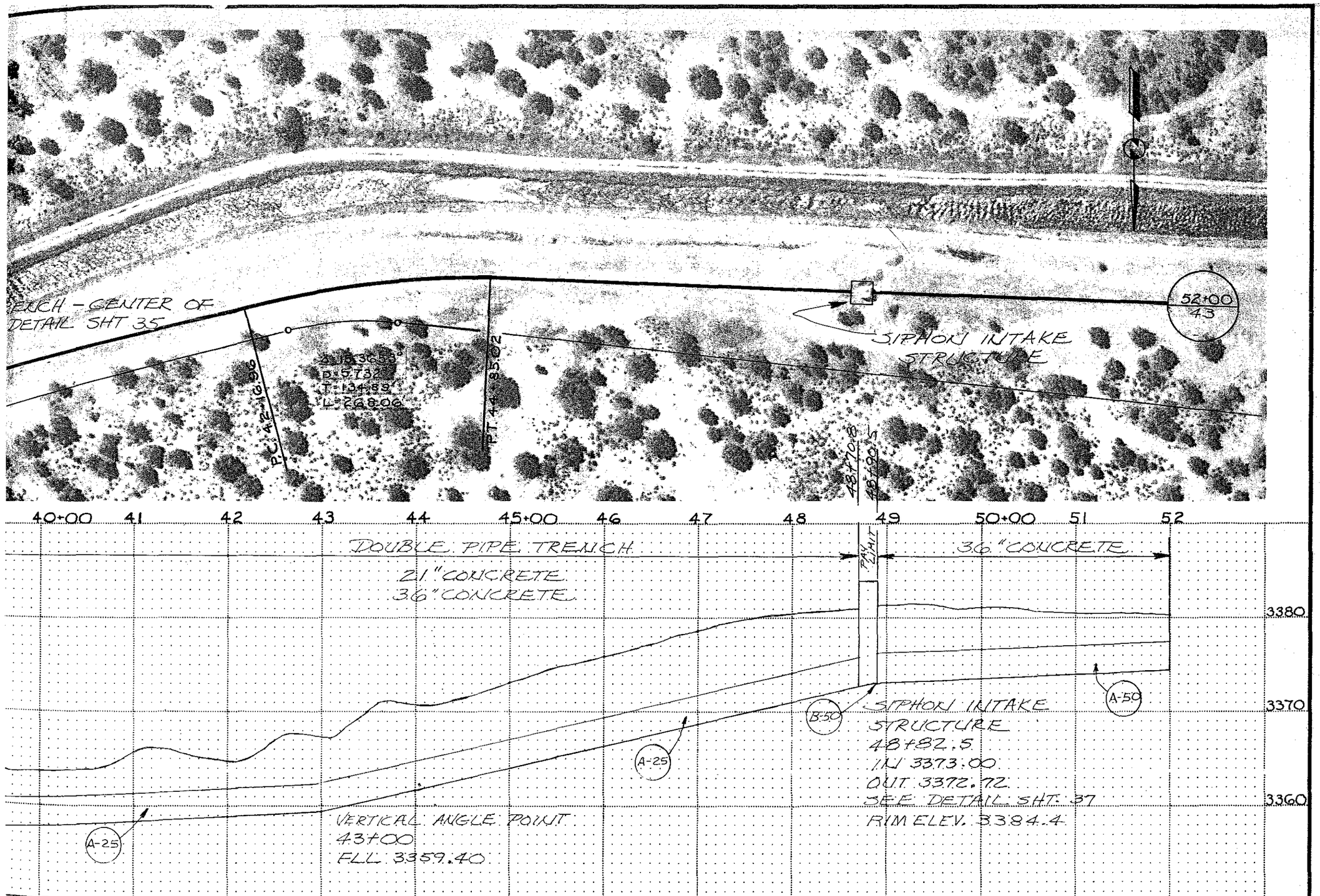
(3) Does not include Annual Maintenance Program

PACP Codes Used in CCTV Review	
UMH: Upstream Manhole	RFB: Roots Fine Barrel
DMH: Downstream Manhole	SRI: Surface Roughness Increased
CC: Circular Crack	SSS: Surface Spalling
CL: Longitudinal Crack	DEA: Deposits Attached Encrustation
CM: Crack Multiple	DAGS: Deposits Attached Grease
OBJ: Object wedged in joint	TBI: Break In/Hammer Intruding
RFL: Roots Fine Lateral	MSA: Survey Abandoned

Appendix C

Key Map


TO CITY OF BEND
WATER RECLAMATION FACILITY
HUNTERS
WELLINGTON
BEAUMONT
FARENUFF
VALENTINE
WAGONTIRE
RANCH VILLAGE
BRAHMA
OVERTON
COOLEY
MARGARET
ROYAL OAK
J D ESTATES
DICKENS
DOUBLE PEAKS
NICOLETTE
RUSSELL
EGYPT
HAMEHOOK
SNOW PEAKS
STACY
PHOENIX
SCOTTSDALE
TRISTAR
PATRIOT
CRYSTAL
COUNTRY VIEW
OVERTREE
VIEW
RORICK
ANN MARGARET
MAJESTIC
DULIN
LIBERTY
GARCIA
AMBER
MORNINGSTAR
COUNTRY SQUIRE
EASTVIEW
ANIKA
BEE TREE
GALLOP
CROSS
TOWN
CASSIN
OLD DESCHUTES
YEOMAN
DESCHUTES MARKET
COMET
NOVA
TERRANGO
BROOKSTONE
DESERT SAGE
DAKOTA
PURCELL
PEALE
EMPIRE
COLE
ALLEY
HIGH DESERT
LOWER MEADOW
MONTANA
LUPINE
CAMPION
SPINNAKER
MARSH ORCHID
MONTICELLO
THORNHILL
BUTLER MARKET
NASU PARK
STONEBROOK
SOCKEYE
EDGEWATER
LAKERIDGE
FLAGSTONE
BIJYEU
CRADLE MOUNTAIN
PURSER
REDSIDE
CASTLE
ALTAIR
MAREA
JILL
MERCURY
BRINSON
YELLOWSTONE
MAYS
HYDE
MONROE
CARRIER
SABER
WEEPING WILLOW
NATHAN
PEARL
QUIET CANYON
CACKLER
DANIEL
EMILY
ALADDIN
KAYAK
HOLLOW TREE
LYNDA
KEYTE
RUMGAY
VERONICA
BARON
JENNIE JO
PECORARO
WELLS ACRES
PINNACLE
KRISTIN
RED ROCK
WOODRIDGE
FAITH
HOPE
CANYON PARK
MONTEREY
HOPE
RAINIER
OCKER
RAINIER
BEALL
ROBINSON
LARKVIEW
EAGLE
LYDIA
MEERKAT
OAKVIEW
DROST
JACKSON
PUFFIN
BELKNAP
THOMPSON
ROSEMARY
PELICAN
DEMPSEY
MARK
STARLING
BRADETICH
WATSON
WINDY TREE
COURTNEY
YELLOW RIBBON



S. Recorded	ML		DSGN.	DRWN.	CHKD.
			MAL	SLP	BMG
REVISION	BY	APD	October 1978		

BECON

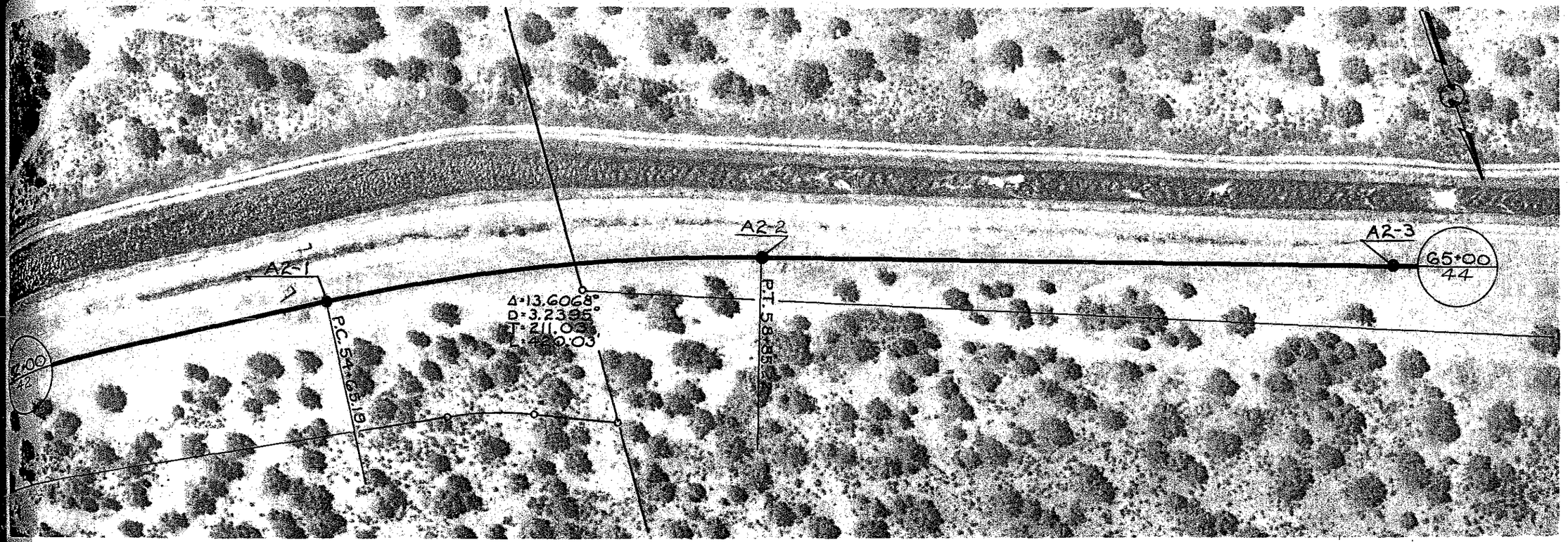
BEND ENGINEERING CONSULTANTS
A JOINT VENTURE
CENTURY WEST ENGINEERING CORPORATION
JOHN CAROLLO ENGINEERS
CH2M HILL

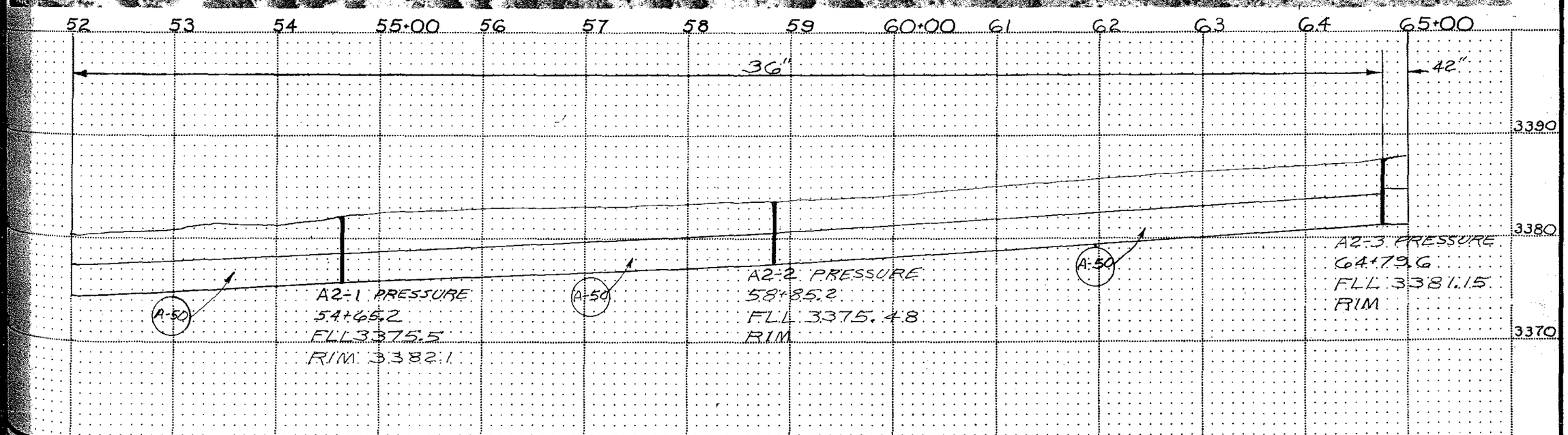
CITY OF BEND, OREGON
SEWAGE COLLECTION SYSTEM

INT A2 STA. 39+00 TO STA. 52+00

DWG. NO.

SHEET NO. 42 OF 78 3/3





NO.	DATE	REVISION	BY	APD
	3-16-81	As Recorded	ML	

DSGN.	DRWN.	CHKD.
MAL	SLP	BMG

October 1978

BECON

BEND ENGINEERING CONSULTANTS
A JOINT VENTURE
CENTURY WEST ENGINEERING CORPORATION
JOHN CAROLLO ENGINEERS
CH2M HILL

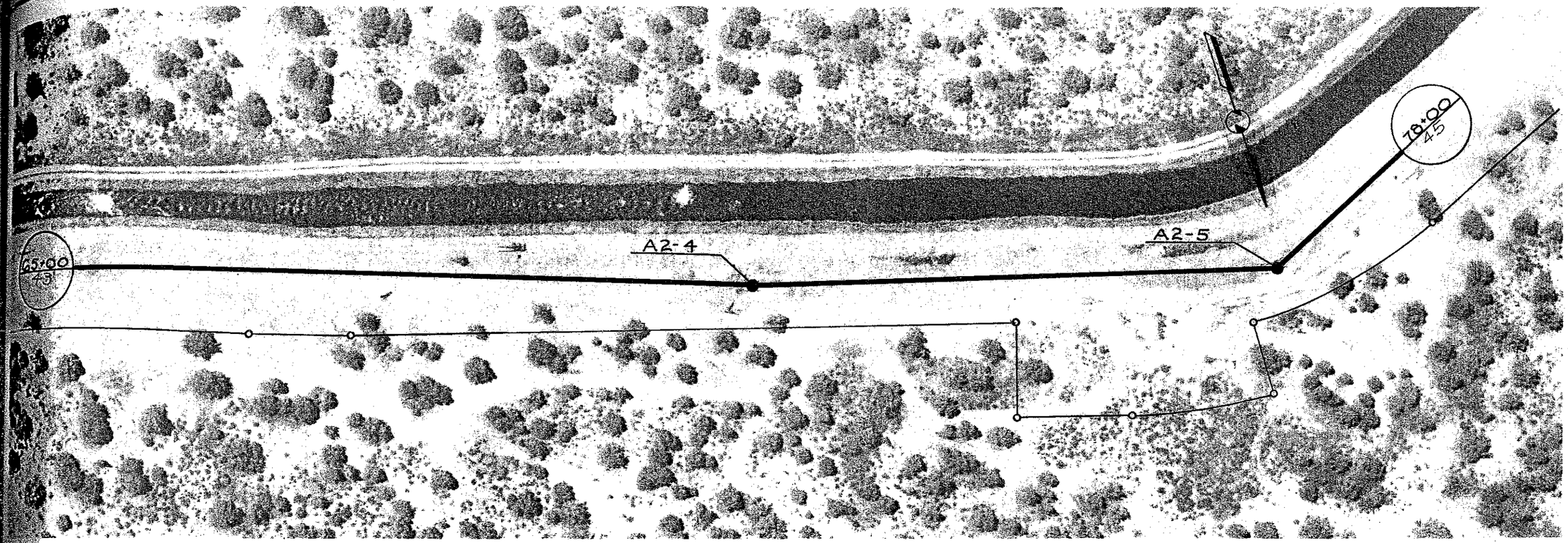
CITY OF BEND, OREGON
SEWAGE COLLECTION SYSTEM

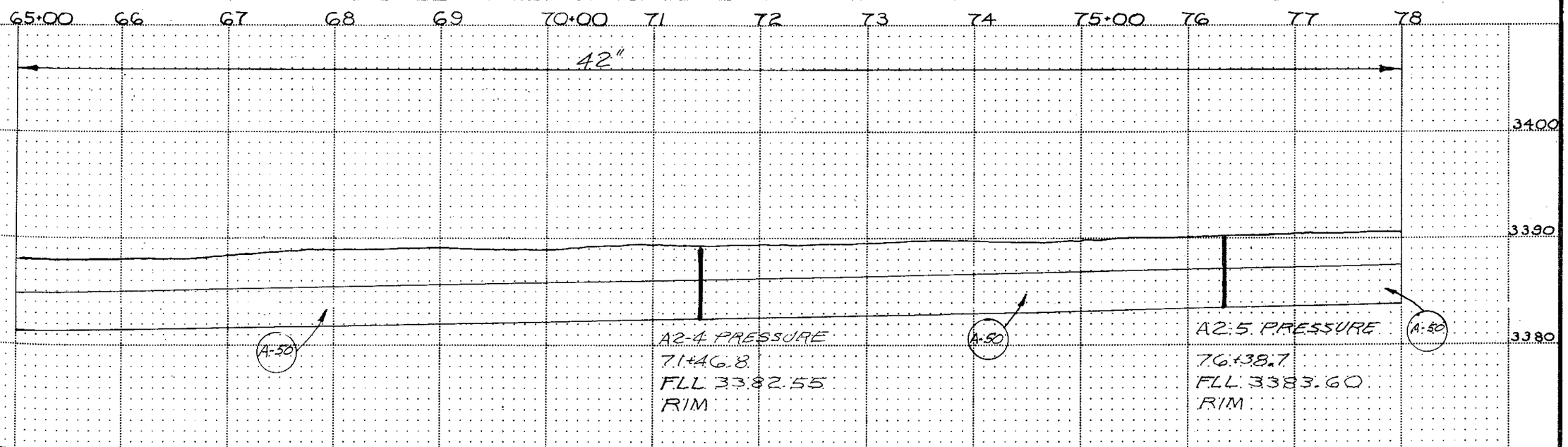
INT. A2 STA. 52+00 TO 65+00

DWG. NO.

SHEET NO. 43 OF 78

314





NO.	DATE	REVISION	BY	APD
	3-16-81	As-Recorded	ML	

DSGN.	DRWN.	CHKD.
MAL	SLP	BMG

October 1978

BECON

BEND ENGINEERING CONSULTANTS
A JOINT VENTURE
CENTURY WEST ENGINEERING CORPORATION
JOHN CAROLLO ENGINEERS
CH2M HILL

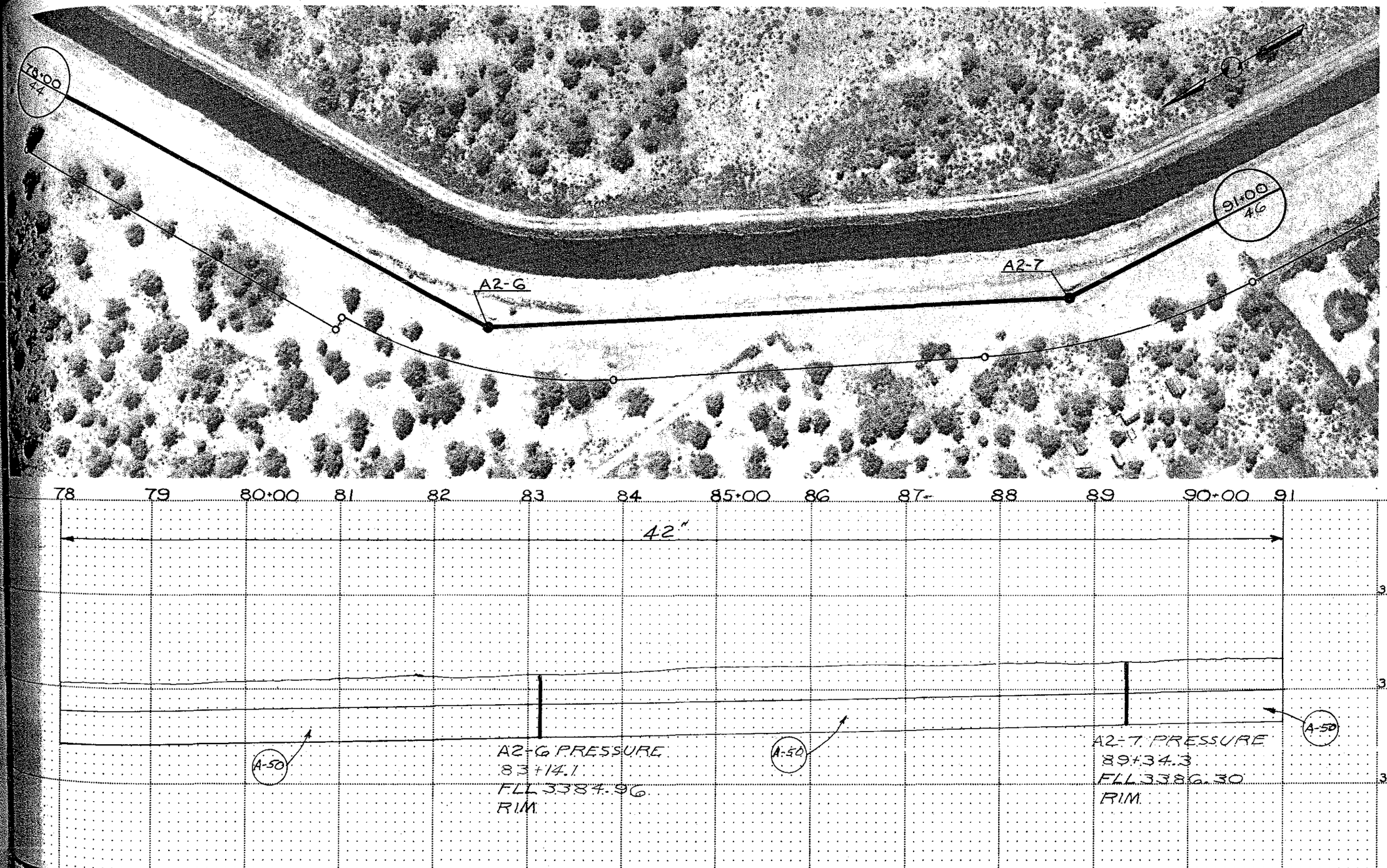
CITY OF BEND, OREGON
SEWAGE COLLECTION SYSTEM

INT. A2 STA. 65+00 TO 78+00

DWG. NO.

SHEET NO. 44 OF 78

315



NO.	DATE	REVISION	BY	APD
	3-16-81	As-Recorded	ML	

DSGN.	DRWN.	CHKD.
MAL	SLP	BMG

October 1978

BECON

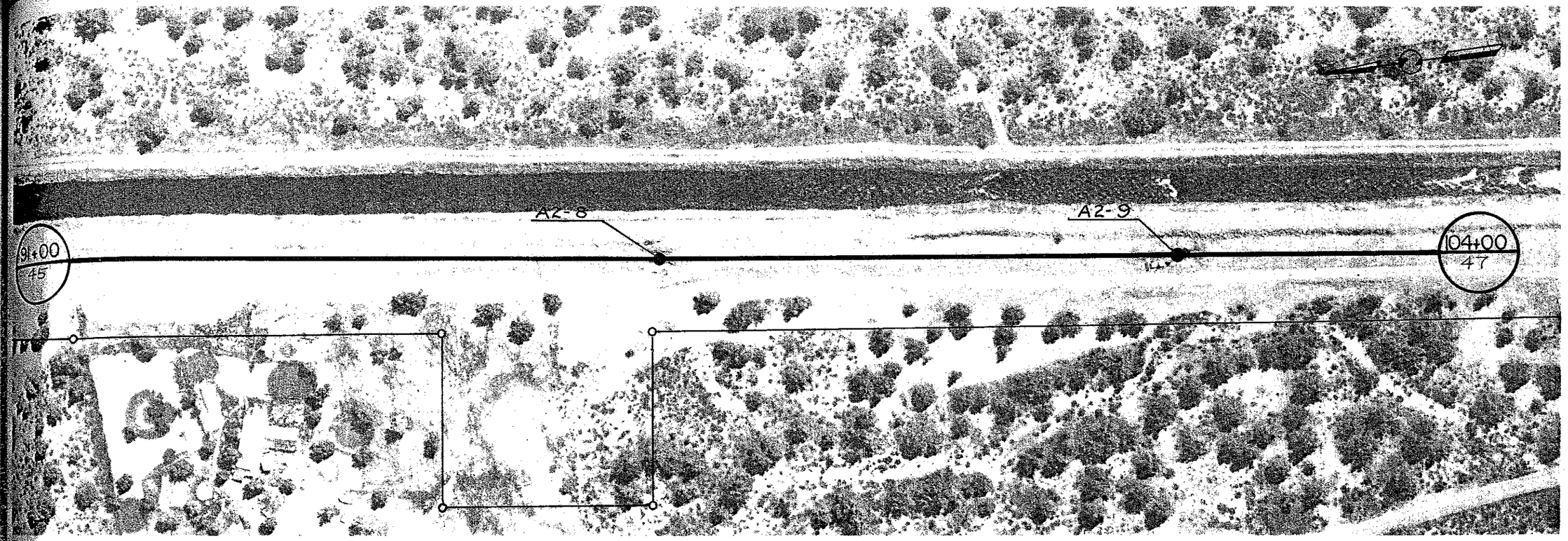
BEND ENGINEERING CONSULTANTS
A JOINT VENTURE
CENTURY WEST ENGINEERING CORPORATION
JOHN CAROLLO ENGINEERS
CH2M HILL

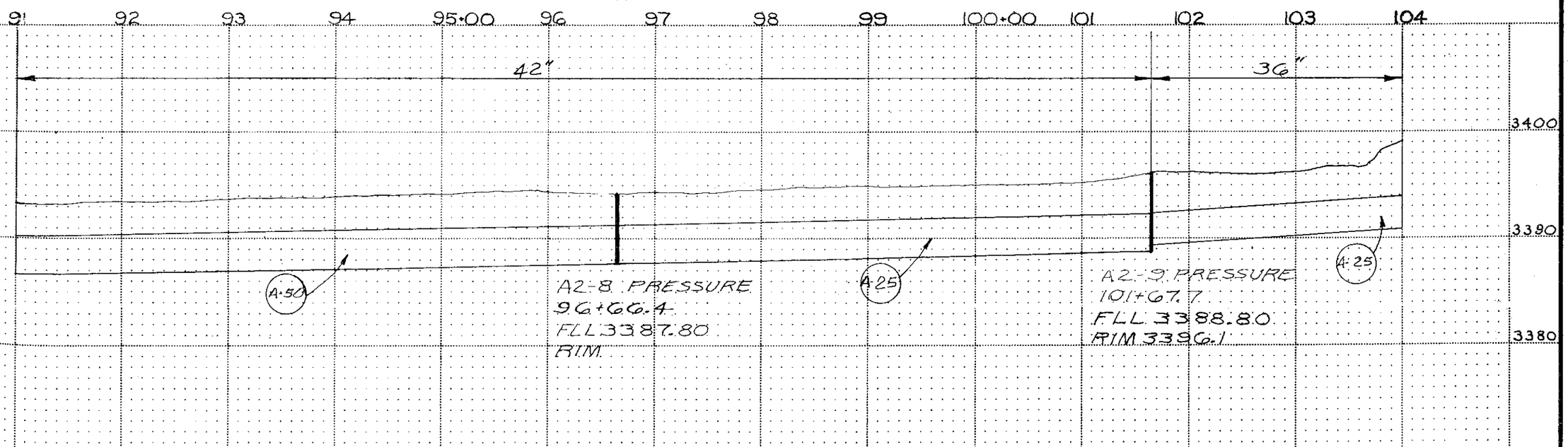
CITY OF BEND, OREGON
SEWAGE COLLECTION SYSTEM

INT. A2 STA. 78+00 TO 91+00

DWG. NO.

SHEET NO. 45 316 OF 78





NO.	DATE	REVISION	BY	APD
	3-16-81	As-Recorded	ML	

DSGN.	DRWN.	CHKD.
MAL	SLP	BMG

October 1978

BECON

BEND ENGINEERING CONSULTANTS
A JOINT VENTURE
CENTURY WEST ENGINEERING CORPORATION
JOHN CAROLLO ENGINEERS
CH2M HILL

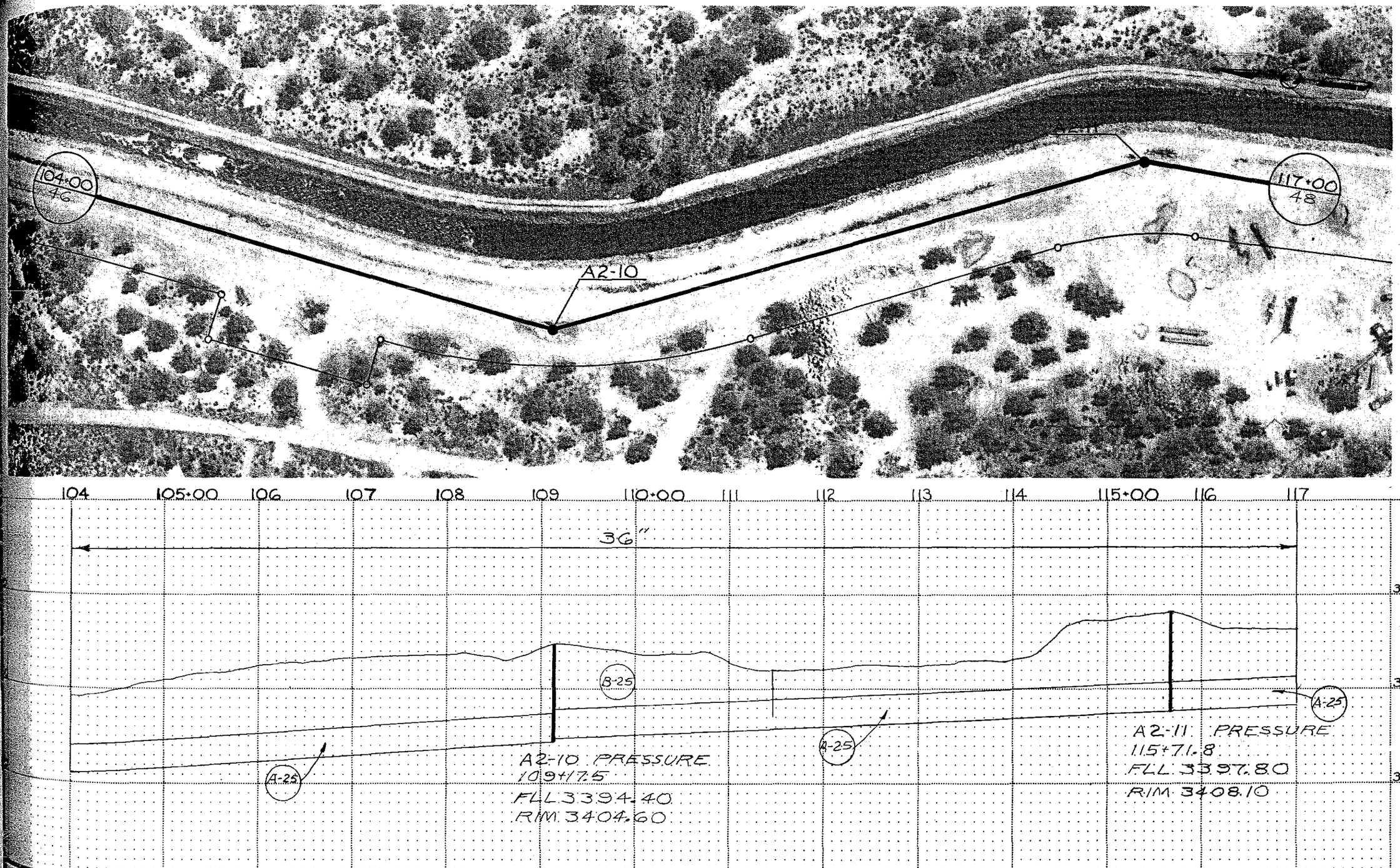
CITY OF BEND, OREGON
SEWAGE COLLECTION SYSTEM

INT. A2 STA. 91+00 TO 104+00

DWG. NO.

SHEET NO. 46 OF 78

317



NO.	DATE	REVISION	BY	APD
	3-16-81	AS-Recorded	ML	

DSGN.	DRWN.	CHKD.
MAL	SLP	BMG

October 1978

BECON

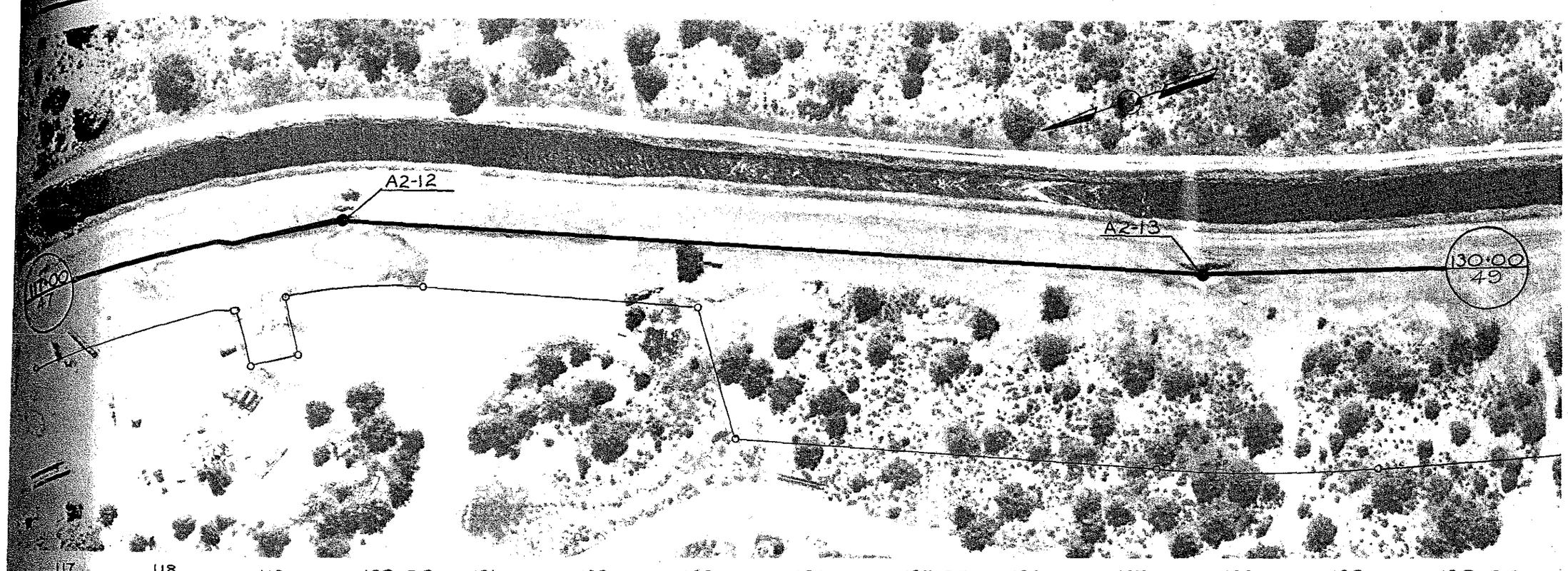
BEND ENGINEERING CONSULTANTS
A JOINT VENTURE
CENTURY WEST ENGINEERING CORPORATION
JOHN CAROLLO ENGINEERS
CH2M HILL

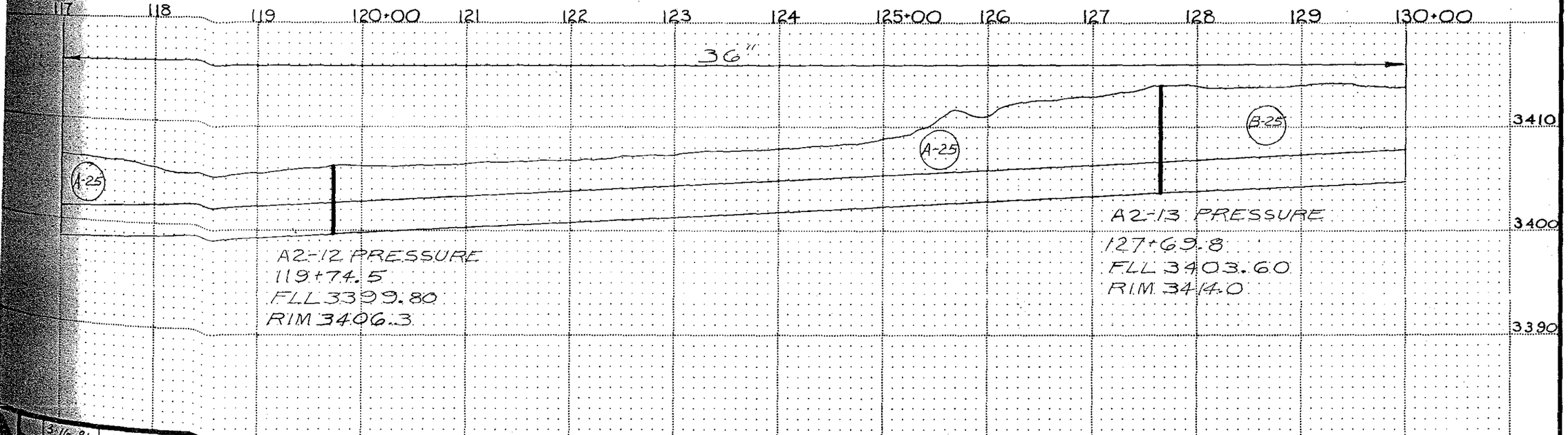
CITY OF BEND, OREGON
SEWAGE COLLECTION SYSTEM

INT. A2 STA. 104+00 TO 117+00

DWG. NO.

SHEET NO. 47 318 OF 78





NO.	DATE	REVISION	BY	APD
	3-16-81	As - Recorded	ML	

DSGN.	DRWN.	CHKD.
MAL	SLP	BMG

October 1978

BECON

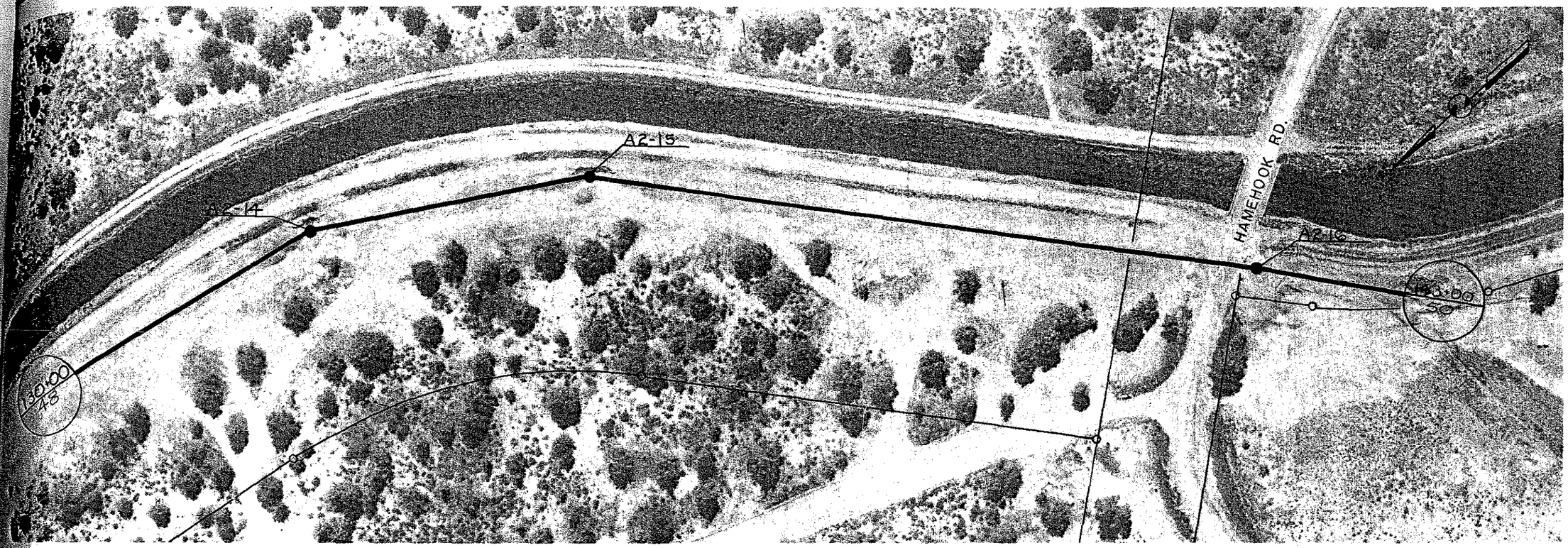
BEND ENGINEERING CONSULTANTS
A JOINT VENTURE
CENTURY WEST ENGINEERING CORPORATION
JOHN CAROLLO ENGINEERS
CH2M HILL

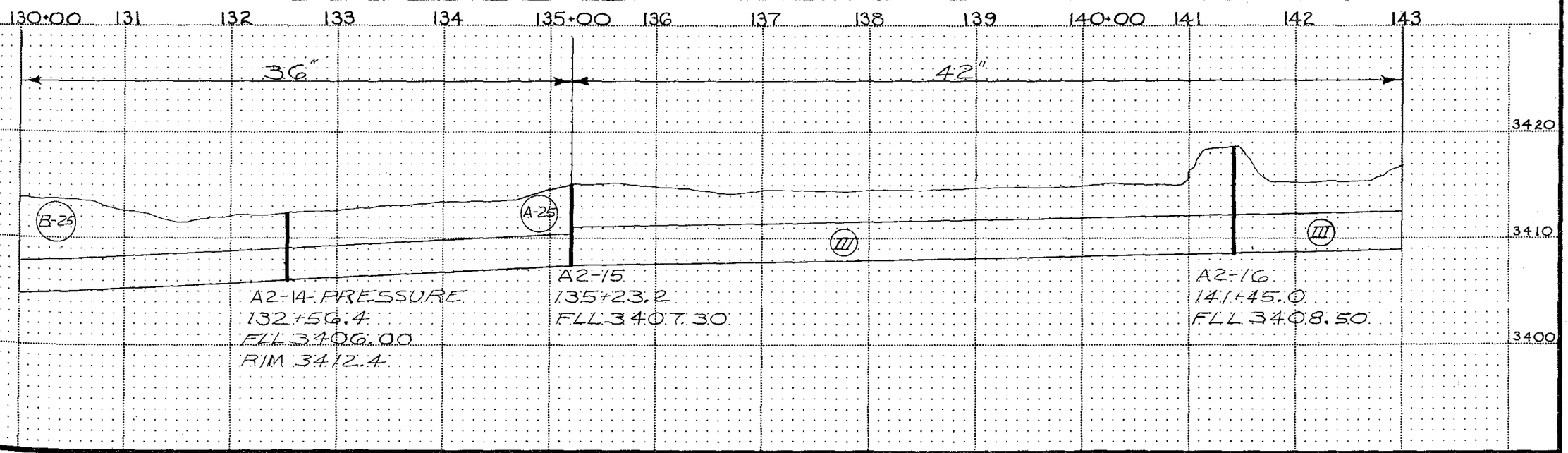
CITY OF BEND, OREGON
SEWAGE COLLECTION SYSTEM

INT. A2 STA. 117+00 TO 130+00

DWG. NO.

SHEET NO. 48 319 OF 78





NO.	DATE	REVISION	BY	APD
	3-16-81	As-Recorded	ML	

DSGN.	DRWN.	CHKD.
MAL	SLP	BMG

October 1978

BECON

BEND ENGINEERING CONSULTANTS
A JOINT VENTURE
CENTURY WEST ENGINEERING CORPORATION
JOHN CAROLLO ENGINEERS
CH2M HILL

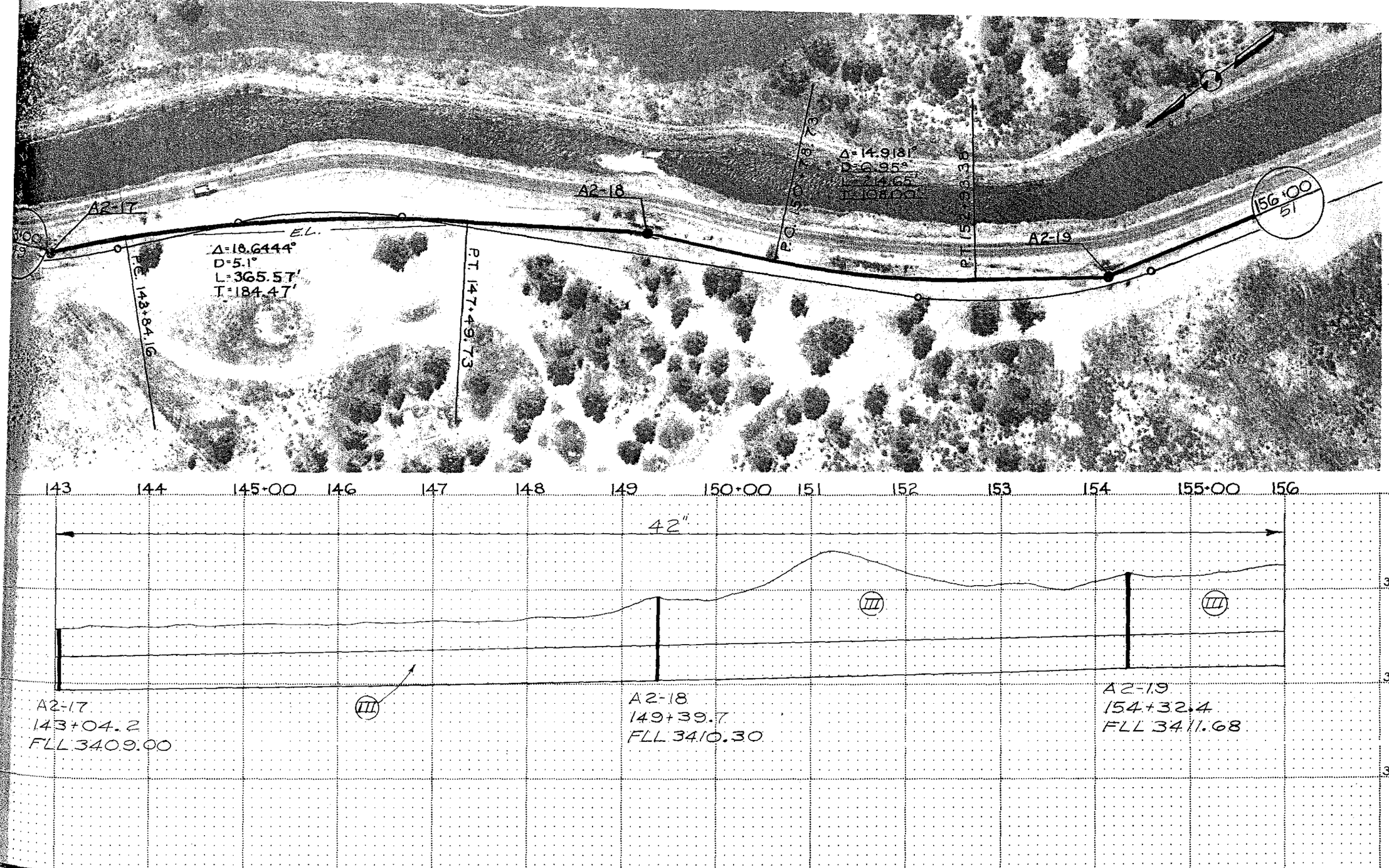
CITY OF BEND, OREGON
SEWAGE COLLECTION SYSTEM

INT. A2 STA. 130+00 TO 143+00

DWG. NO.

SHEET NO. 49 OF 78

320



NO.	DATE	REVISION	BY	APD
	3-16-81	As-Recorded	ML	

DSGN.	DRWN.	CHKD.
MAL	SLP	BMG

October 1978

BECON

BEND ENGINEERING CONSULTANTS
A JOINT VENTURE
CENTURY WEST ENGINEERING CORPORATION
JOHN CAROLLO ENGINEERS
CH2M HILL

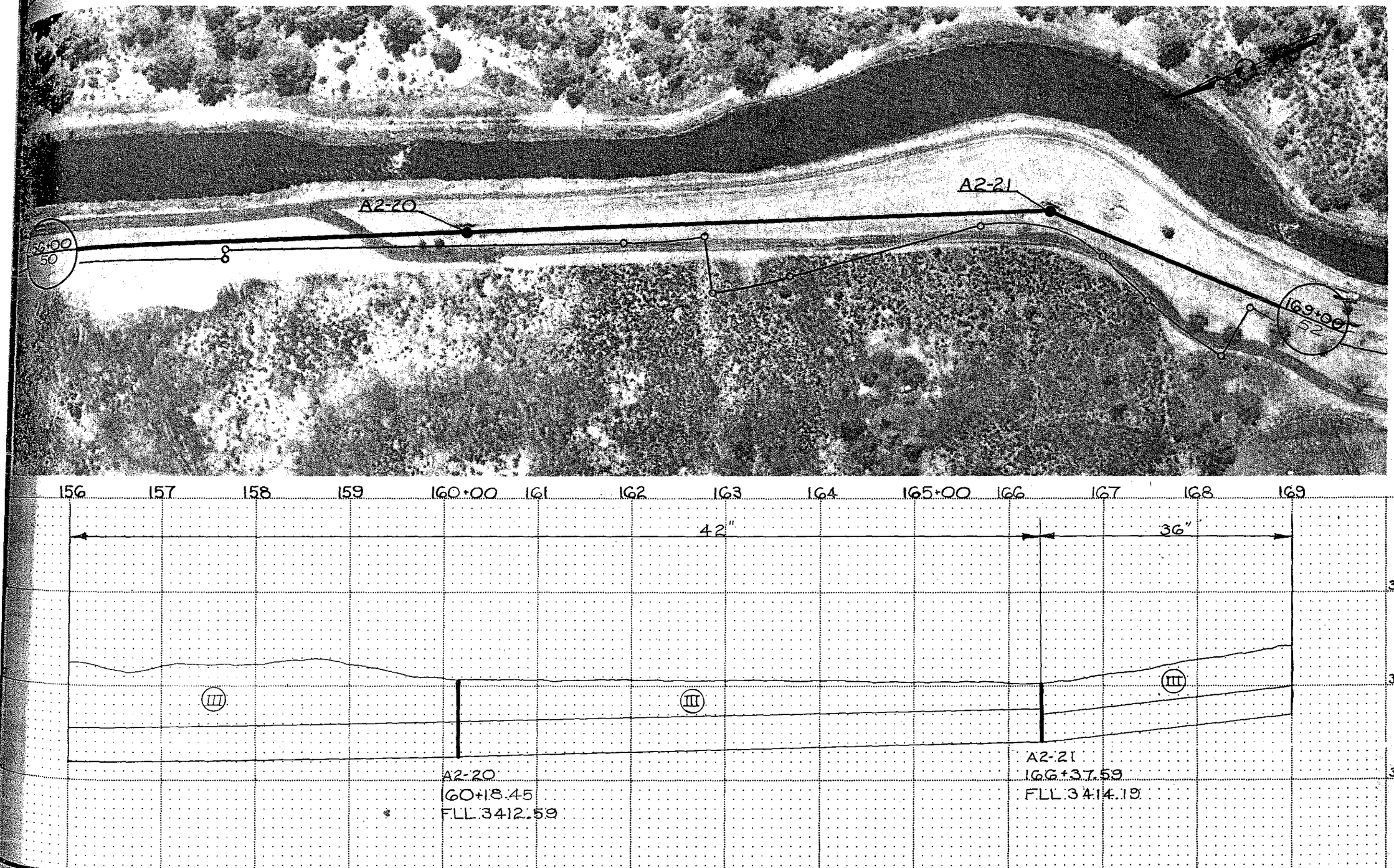
CITY OF BEND, OREGON
SEWAGE COLLECTION SYSTEM

INT. A2 STA 143+00 TO 156+00

DWG. NO.

SHEET NO. 50 OF 78

321



NO.	DATE	REVISION	BY	APD
	3-16-81	As-Recorded	ML	

DSGN.	DRWN.	CHKD.
MAL	SLP	BMG

October 1978

BECON

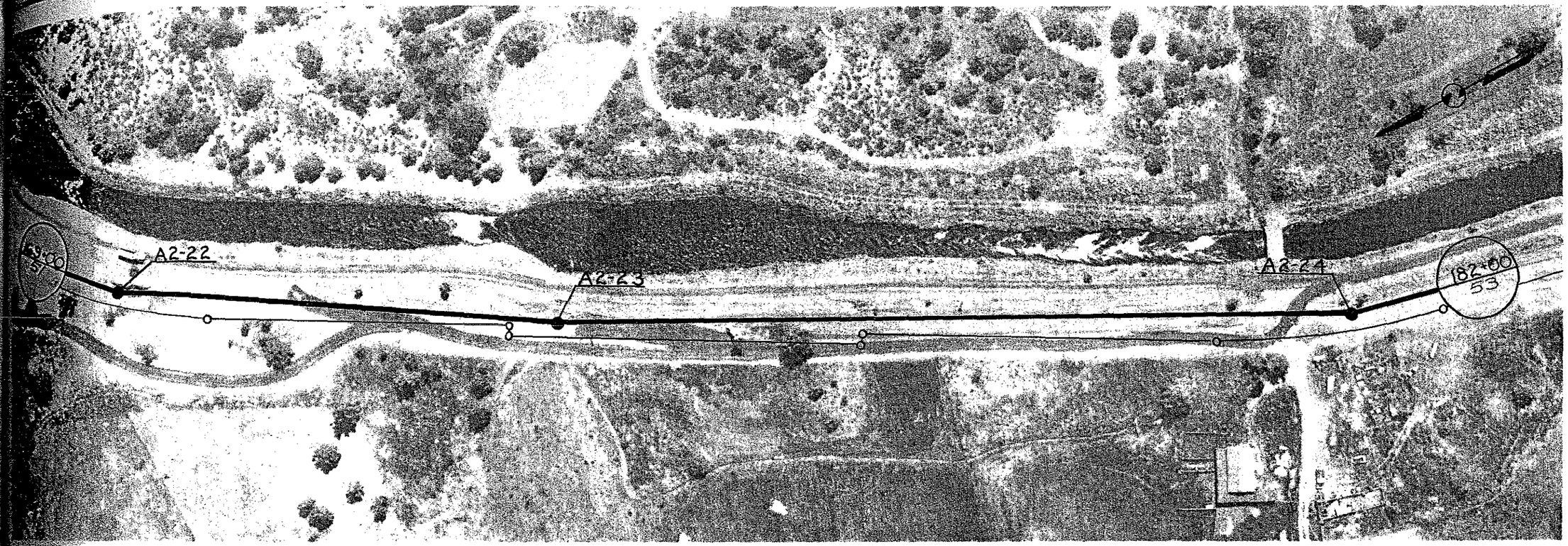
BEND ENGINEERING CONSULTANTS
A JOINT VENTURE
CENTURY WEST ENGINEERING CORPORATION
JOHN CAROLLO ENGINEERS
CH2M HILL

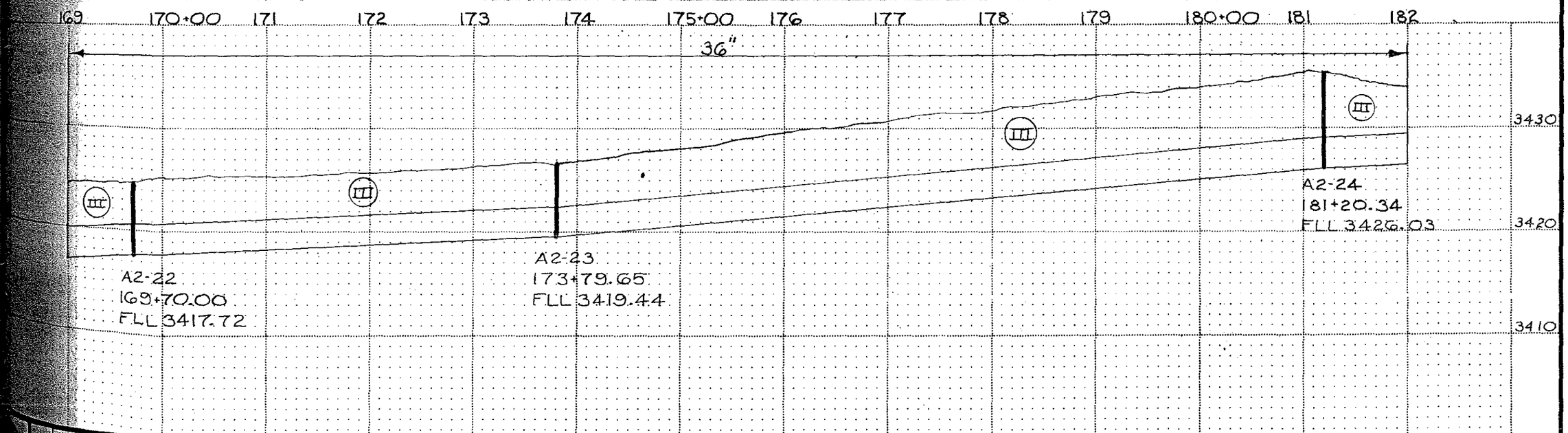
CITY OF BEND, OREGON
SEWAGE COLLECTION SYSTEM

INT. A2 STA. 156+00 TO 169+00

DWG. NO.

SHEET NO. 51 322 OF 78





NO.	DATE	REVISION	BY	APD
	3-16-81	As-Recorded	ML	

DSGN.	DRWN.	CHKD.
MAL	SLP	BMG

October 1978

BECON

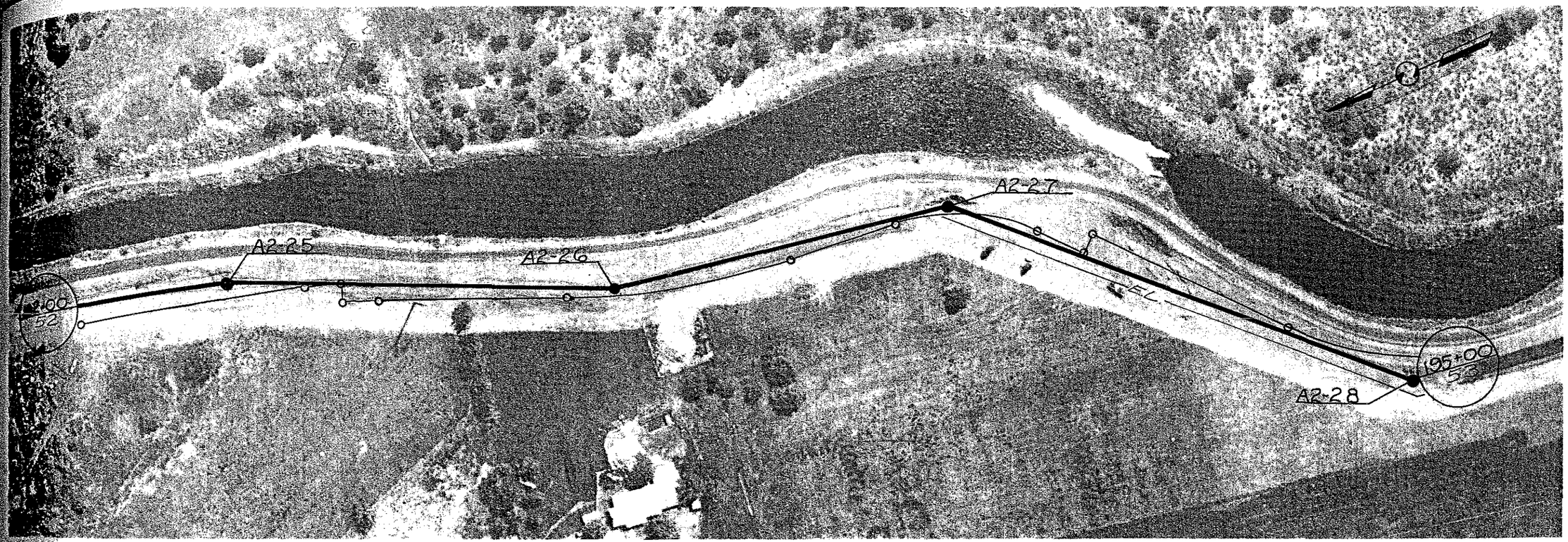
BEND ENGINEERING CONSULTANTS
A JOINT VENTURE
CENTURY WEST ENGINEERING CORPORATION
JOHN CAROLLO ENGINEERS
CH2M HILL

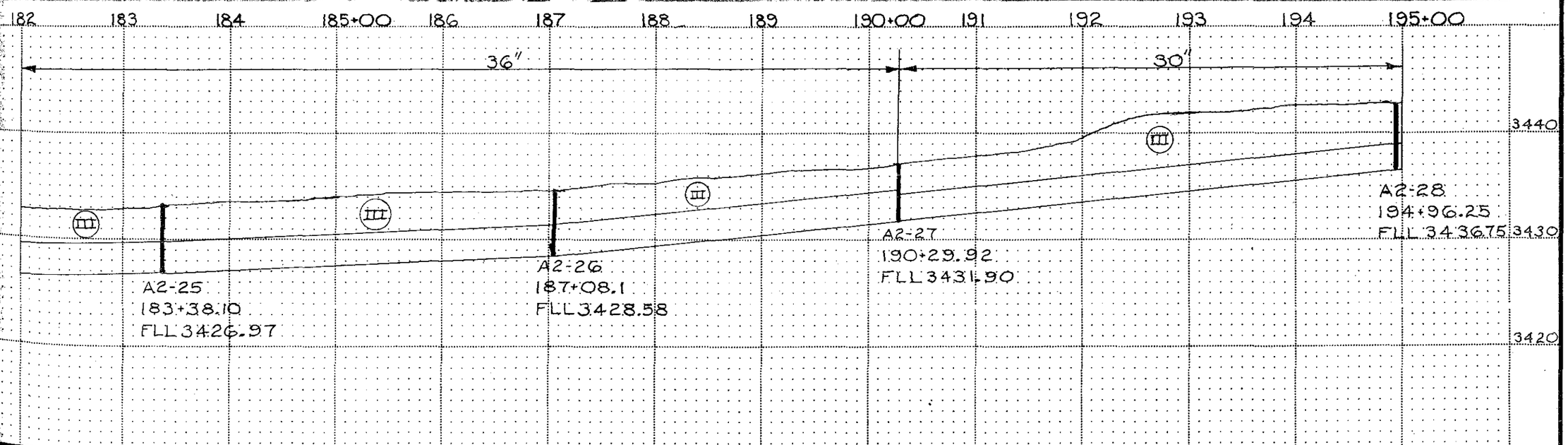
CITY OF BEND, OREGON
SEWAGE COLLECTION SYSTEM

INT. A2 STA. 169+00 TO 182+00

DWG. NO.

SHEET NO. 52 323 OF 78





NO.	DATE	REVISION	BY	APD
	3-16-81	As Recorded	ML	

DSGN.	DRWN.	CHKD.
MAL	SLP	BMG

October 1978

BECON

BEND ENGINEERING CONSULTANTS
A JOINT VENTURE
CENTURY WEST ENGINEERING CORPORATION
JOHN CAROLLO ENGINEERS
CH2M HILL

CITY OF BEND, OREGON
SEWAGE COLLECTION SYSTEM

INT. A2 STA. 182+00 TO 195+00

DWG. NO.

SHEET NO. 53 OF 78

324

Appendix D

NASSCO's Pipeline Assessment Defect Coding

NASSCO'S PIPELINE ASSESSMENT & CERTIFICATION PROGRAM (PACP)©

Section 4—Continuous Defect Coding

"TRULY" 4-1

"Truly" continuous defects run along the sewer without any interruption for more than 3 feet.

Examples:
- Longitudinal Fractures
- Cracks

"REPEATED" 4-1

"Repeated" continuous defects occur at regular intervals along the sewer. These occur at pipe joints and include:
- Encrustation
- Open Joints
- Circumferential Fractures

Section 5—Structural Defect Coding (Module 6A)

C CRACK 5-1
- CL Longitudinal 5-2
- CC Circumferential 5-2
- CM Multiple 5-2
- CS Spiral 5-2

F FRACTURE 5-7
- FL Longitudinal 5-7
- FC Circumferential 5-7
- FM Multiple 5-7
- FS Spiral 5-7

B BROKEN 5-14
- BSV -Soil Visible Beyond Defect 5-14
- BV V -Void Visible Beyond Defect 5-14

H HOLE 5-16
- HSV -Soil Visible Beyond Defect 5-16
- HV V -Void Visible Beyond Defect 5-16

D DEFORMED 5-18
- DV Deformed Vertically (brick) 5-18
- DH Deformed Horizontally (brick) 5-18

X COLLAPSE 5-22
- XP Pipe Collapse 5-22
- XB Brick Collapse 5-22

J JOINT 5-25
- JO Joint Offset (Displaced) 5-25
- JS Joint Separated (Open) 5-25
- JA Joint Angular 5-25

S SURFACE DAMAGE 5-30
- SRI Roughness Increased 5-30
  - SRIM -Mechanical 5-31
  - SRIC -Chemical Attack 5-31
  - SRIZ -Not Evident 5-31

S SURFACE DAMAGE 5-30
- SAV Aggregate Visible 5-30
  - SAVM -Mechanical 5-31
  - SAVC -Chemical Attack 5-31
  - SAVZ -Not Evident 5-31

S SURFACE DAMAGE 5-30
- SAP Aggregate Projecting 5-30
  - SAPM -Mechanical 5-31
  - SAPC -Chemical Attack 5-31
  - SAPZ -Not Evident 5-31

S SURFACE DAMAGE 5-30
- SAM Aggregate Missing 5-30
  - SAMM -Mechanical 5-31
  - SAMC -Chemical Attack 5-31
  - SAMZ -Not Evident 5-31

S SURFACE DAMAGE 5-30
- SRV Reinforcement Visible 5-30
  - SRVM -Mechanical 5-31
  - SRVC -Chemical Attack 5-31
  - SRVZ -Not Evident 5-31

S SURFACE DAMAGE 5-30
- SRP Reinforcement Projecting 5-30
  - SRPM -Mechanical 5-31
  - SRPC -Chemical Attack 5-31
  - SRPZ -Not Evident 5-31

S SURFACE DAMAGE 5-30
- SRC Reinforcement Corroded 5-31
  - SRCM -Mechanical 5-31
  - SRCC -Chemical Attack 5-31
  - SRCZ -Not Evident 5-31

S SURFACE DAMAGE 5-30
- SMW Missing Wall 5-31
  - SMWM -Mechanical 5-31
  - SMWC -Chemical Attack 5-31
  - SMWZ -Not Evident 5-31

S SURFACE DAMAGE 5-30
- SSS Surface Spalling 5-31
  - SSSM -Mechanical 5-31
  - SSSC -Chemical Attack 5-31
  - SSSZ -Not Evident 5-31

S SURFACE DAMAGE 5-30
- SZ Other 5-31
  - SZM -Mechanical 5-31
  - SZC -Chemical Attack 5-31
  - SZZ -Not Evident 5-31

S SURFACE DAMAGE 5-30
- SCP Corrosion (metal pipe) 5-31

LF LINING FAILURE 5-44
- LFD Detached Lining 5-44
- LFDE Defective End 5-44
- LFB Blistered Lining 5-44
- LFCS Service Cut Shifted 5-44
- LFAC Abandoned Connection 5-44

LF LINING FAILURE 5-44 (continued)
- LFOC Overcut Service 5-44
- LFUC Undercut Service 5-44
- LFBK Buckled Lining 5-44
- LFW Wrinkled Lining 5-44
- LFZ Other 5-44

WF WELD FAILURE 5-56
- WFL Longitudinal 5-56
- WFC Circumferential 5-56
- WFM Multiple 5-56
- WFS Spiral 5-56
- WFZ Unidentified 5-56

RP POINT REPAIR 5-62
- RPR Pipe Replaced 5-62
  - RPRD -Defective 5-62
- RPP Patch Repair 5-62
  - RPPD -Defective 5-62

RP POINT (cont) **REPAIR 5-62**
- RPL Localized Lining 5-62
  - RPLD -Defective 5-62
- RPZ Other 5-62
  - RPZD -Defective 5-62

BRICKWORK 5-68
- DB Displaced 5-68
- MB Missing 5-68
- DI Dropped Invert 5-68

BRICKWORK 5-68 (continued)
- MM Missing Mortar 5-68
  - S -Small 5-68
  - M -Medium 5-68
  - L -Large 5-69

Updated June 2005

NASSCO'S PIPELINE ASSESSMENT & CERTIFICATION PROGRAM (PACP)©

Section 6—Operational and Maintenance (Module 6B)

D	**DEPOSITS**	**6-1**
DA	**Attached**	**6-1**
DAE	-Encrustation	6-2
DAGS	-Grease	6-2
DAR	-Ragging	6-2
DAZ	-Other	6-2

D	**DEPOSITS** (continued)	**6-1**
DS	**Settled**	**6-1**
DSF	-Fine	6-2
DSGV	-Gravel	6-2
DSC	-Hard/Compacted	6-2
DSZ	-Other	6-2

D	**DEPOSITS** (continued)	**6-1**
DN	**Ingress**	**6-1**
DNF	-Fine Material (silt & sand)	6-3
DNGV	-Gravel	6-3
DNZ	-Other	6-3

R	**ROOTS**	**6-7**
RF	**Fine**	**6-7**
RFB	-Barrel	6-7
RFL	-Lateral	6-7
RFC	-Connection	6-7

R	**ROOTS** (continued)	**6-7**
RM	**Medium**	**6-7**
RMB	-Barrel	6-7
RML	-Lateral	6-7
RMC	-Connection	6-7

R	**ROOTS** (continued)	**6-7**
RB	**Ball**	**6-7**
RBB	-Barrel	6-7
RBL	-Lateral	6-7
RBC	-Connection	6-7

R	**ROOTS** (continued)	**6-7**
RT	**Tap**	**6-7**
RTB	-Barrel	6-7
RTL	-Lateral	6-7
RTC	-Connection	6-7

I	**INFILTRATION**	**6-13**
IW	**Weeper**	**6-13**
ID	**Dripper**	**6-13**
IR	**Runner**	**6-13**
IG	**Gusher**	**6-13**

OB	**OBSTACLES/** Obstructions	**6-19**
OBB	**Brick or Masonry**	**6-19**
OBM	**Pipe Material in Invert**	**6-19**

OB	**OBSTACLES/** Obstructions (cont)	**6-19**
OBI	**Object protruding through wall**	**6-19**
OBJ	**Object wedged in joint**	**6-19**

OB	**OBSTACLES/** Obstructions (cont)	**6-19**
OBC	**Object through connection/junction**	**6-19**
OBP	**External Pipe Cable**	**6-19**

OB	**OBSTACLES/** Obstructions (cont)	**6-19**
OBS	**Built into structure**	**6-20**
OBN	**Construction Debris**	**6-20**
OBR	**Rocks**	**6-20**
OBZ	**Other**	**6-20**

V	**VERMIN**	**6-31**
VR	**Rat**	**6-31**
VC	**Cockroach**	**6-31**
VZ	**Other**	**6-31**

Section 7—Construction Features Coding (Module 6C)

T	**TAP**	**7-1**
TF	**Factory Made (junction)**	**7-1**
TFA	-Active	7-2
TFB	- Abandoned	7-2
TFC	-Capped	7-2
TFD	-Defective	7-2

T	**TAP** (continued)	**7-1**
TB	**Break In/Hammer (connection)**	**7-2**
TBI	-Intruding	7-2
TBA	-Active	7-2
TBB	-Abandoned	7-2
TBC	-Capped	7-2
TBD	-Defective	7-2

T	**TAP** (continued)	**7-1**
TS	**Saddle (connection)**	**7-2**
TSI	-Intruding	7-2
TSA	-Active	7-2
TSB	- Abandoned	7-2
TSC	-Capped	7-2
TSD	-Defective	7-2

IS	**INTRUDING SEAL MATERIAL**	**7-8**
ISSR	**Sealing Ring**	**7-8**
ISSRH	-Hanging	7-8
ISSRB	-Broken	7-8

IS	**INTRUDING SEAL MATERIAL** (continued)	**7-8**
ISGT	**Grout**	**7-8**
ISZ	**Other**	**7-8**

L	**LINE** (of sewer)	**7-11**
LL	**Left**	**7-11**
LLU	**Left & Up**	**7-11**
LLD	**Left & Down**	**7-11**
LR	**Right**	**7-11**

L	**LINE** (of sewer) (continued)	**7-11**
LRU	**Right & Up**	**7-11**
LRD	**Right & Down**	**7-11**
LU	**UP**	**7-11**
LD	**Down**	**7-11**

A	**ACCESS POINT**	**7-13**
AMH	**Manhole**	**7-13**
AWA	**Wastewater Access**	**7-13**
ADP	**Discharge Point**	**7-13**
ATC	**Tee Connection**	**7-13**

A	**ACCESS POINT** (continued)	**7-13**
AOC	**Other Special Chamber**	**7-14**
AM	**Meter**	**7-14**
AWW	**Wet Well**	**7-14**
AJB	**Junction Box**	**7-14**

A	**ACCESS POINT** (continued)	**7-13**
ACO	**Clean Out**	**7-14**
ACOM	-Machine	7-14
ACOP	-Property	7-14
ACOH	-House	7-14

A	**ACCESS POINT** (continued)	**7-13**
ACB	**Catch Basin**	**7-14**
AEP	**End of Pipe**	**7-14**

Section 8—Miscellaneous Features Coding (Module 6D)

M	**MISC. FEATURES**	**8-1**
MCU	**Camera Underwater**	**8-1**
MGO	**General Observation**	**8-1**
MGP	**General Photograph**	**8-1**

M	**MISC. FEATURES** (cont)	**8-1**
MSC	**Shape/Size Change (Sewer Dims/ Vertical/ Horizontal)**	**8-1**
MJL	**Joint Length Change**	**8-1**

M	**MISC. FEATURES** (cont)	**8-1**
MLC	**Lining Change**	**8-1**
MMC	**Material Change**	**8-2**
MSA	**Survey Abandoned**	**8-2**
MWL	**Water Level**	**8-2**
MWLS	-sag	8-2

M	**MISC. FEATURES** (cont)	**8-1**
MWM	**Water Mark**	**8-2**
MY	**Dye Test**	**8-2**
MYV	-Dye Visible	8-2
MYN	-Not Visible	8-2

Updated June 2005

Appendix E

CCTV Logs from PSC

Yeoman Interceptor Study

City of Bend
Bend, Oregon

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

PROJ INFO

PROJ NAME:	PROJECT NUM:	RESPONSIBLE:	DATE:
Yeoman Interceptor Study		Dan O'Malley	01/24/2005

CLIENT	City Of Bend
RESPONSIBLE:	Bob Griffith
DEPARTMENT:	City of Bend Public Works
PO BOX:	
STREET:	757 NE 15TH Street
CITY, ST ZIP:	Bend, Oregon 97701
TELEPHONE:	541-385-6677
FAX:	
MOBILE:	
E-MAIL:	bgriffith@ci.bend.or.us

PROJ MGR	
RESPONSIBLE:	
DEPARTMENT:	
PO BOX:	
STREET:	
CITY, ST ZIP:	
TELEPHONE:	
FAX:	
MOBILE:	
E-MAIL:	

CONTRACTOR	PSC Industrial Outsourcing Group
RESPONSIBLE:	Bernd Green
DEPARTMENT:	Municipal Services
PO BOX:	
STREET:	395 W. Channel Rd
CITY, ST ZIP:	Benicia CA 94510
TELEPHONE:	707-746-8287
FAX:	707-746-8297
MOBILE:	707-333-0097
E-MAIL:	ehalden@contactpsc.com

	SECTION #	STREET	FROM MANHOLE	TO MANHOLE	SECTION LENGTH	FLOW	TAPE #	START TIME
1	1	Easement	A2-39	A2-38	706.32	D/S	1	
2	2	Easement	A2-38	A2-37	621.69	D/S	1	10:40
3	3	Easement	A2-37	A2-36	780.91	D/S	1	11:35
4	4	Easement	A2-36	A2-35	384.73	D/S	1	14:22
5	5	Easement	A2-35	A2-34	590.78	D/S	1	14:38
6	6	Easement	A2-34	A2-33	505.64	D/S	1	07:18
7	7	Easement	A2-33	A2-32	338.11	D/S	1	07:38
8	8	Easement	A2-32	A2-31	398.82	D/S	1	07:50
9	9	Easement	A2-31	A2-30	217.6	D/S	1	08:17
10	10	Easement	A2-30	A2-29	150.51	D/S	1	08:26
11	11	Easement	A2-29	A2-28	579.02	D/S	2	09:24
12	12	Easement	A2-28	A2-27	480.41	D/S	2	09:41
13	13	Easement	A2-27	A2-26	330	D/S	2	13:10
14	14	Easement	A2-26	A2-25	377.23	D/S	2	13:18
15	15	Easement	A2-25	A2-24	224.8	D/S	2	14:01
16	16	Easement	A2-24	A2-23	759.12	D/S	2	14:07
17	17	Easement	A2-23	A2-22	420.1	D/S	2	14:23
18	18	Easement	A2-22	A2-21	342.67	D/S	2	07:25
19	19	Easement	A2-21	A2-20	617.74	D/S	2	07:49
20	20	Easement	A2-20	A2-19	490.74	D/S	3	09:08
21	21	Easement	A2-19	A2-18	505.95	D/S	3	10:39
22	22	Easement	A2-18	A2-17	655.64	D/S	3	10:57
23	23	Easement	A2-17	A2-16	164.6	D/S	3	11:26
24	24	Easement	A2-16	A2-15	638.41	D/S	3	12:05
25	25	Easement	A2-15	A2-14	275.37	D/S	3	12:20
26	26	Easement	A2-14	A2-13	496.22	D/S	3	12:27
27	27	Easement	A2-13	A2-12	810.81	D/S	3	13:23
28	28	Easement	A2-12	A2-11	413.01	D/S	3	13:37
29	29	Easement	A2-11	A2-10	668.11	D/S	3	14:28
30	30	Easement	A2-10	A2-9	751.22	D/S	4	07:54
31	31	Easement	A2-9	A2-8	499.77	D/S	4	08:26
32	32	Easement	A2-8	A2-7	750	D/S	4	08:52
33	33	Easement	A2-7	A2-6	635.78	D/S	4	09:44
34	34	Easement	A2-6	A2-5	694.06	D/S	4	10:08
35	35	Easement	A2-5	A2-4	504.93	D/S	4	11:07
36	36	Easement	A2-4	A2-3	689.29	D/S	4	11:35
37	37	Easement	A2-3	A2-2	606.39	D/S	4	11:51
38	38	Easement	A2-2	A2-1	430.24	D/S	4	12:13
					19506.74 FT			

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

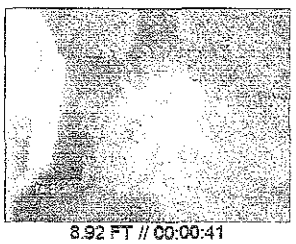
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/24/2005	510572	Clear / Cool	Jim Constable	1	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-0001	CEIIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-39
CITY:	Bend, Or.	MAP #2:		MH:	A2-38
LOCALE:	Easement	TAPE #:	1	TV'D LGTH:	706.32 ft

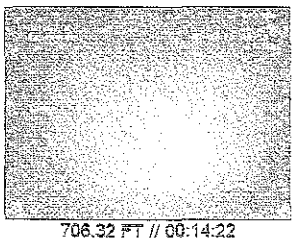
INSPECT REASON:	General Condition	PIPE SIZE:	42"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRV'D:	

REMARK:

1:500	DIST	OBSERVATION
A2-39	8.92	Inspection begins at upstream manhole



8.92 FT // 00:00:41



706.32 FT // 00:14:22

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/24/2005	510572	Clear / Cool	Jim Constable	1	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-0001	OEIIII		No	0

1:500 DIST OBSERVATION

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/24/2005	510572	Clear / Cool	Jim Constable	1	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-0001	OEIII		No	0

1:500	DIST	OBSERVATION
A2-38	706.32	Inspection ends at downstream manhole

PSC Industrial Outsourcing Group
385 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8297, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	Easement	01/24/2005	1	

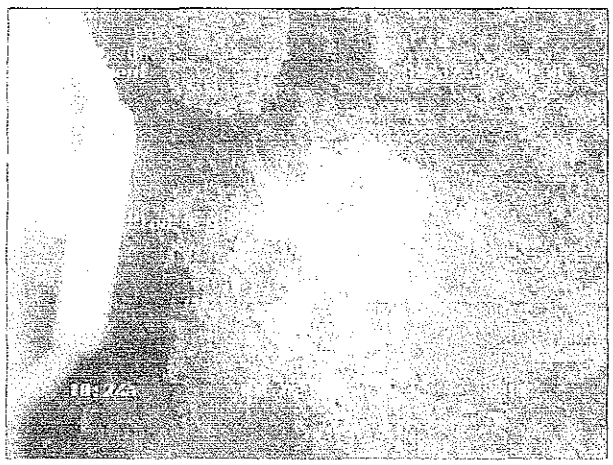


IMAGE: 1a, TAPE #: 1, 00:00:41
8.92FT, inspection begins at upstream manhole

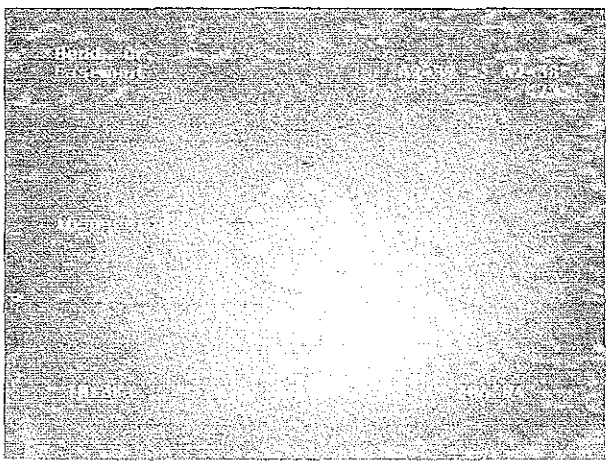


IMAGE: 2a, TAPE #: 1, 00:14:22
706.32FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

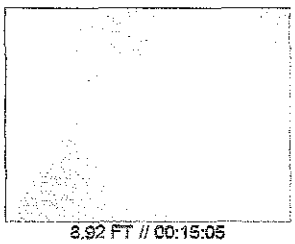
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/24/2005	510572	Clear / Cool	Jim Constable	2	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	250

STREET:	Easement	MAP #1:	22-11	MH:	A2-38
CITY:	Bend, Or.	MAP #2:		MH:	A2-37
LOCALE:	Easement	TAPE #:	1	TVD LGTH:	621.69 ft

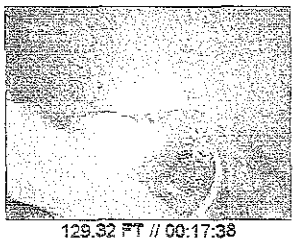
INSPECT REASON:	General Condition	PIPE SIZE:	42"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

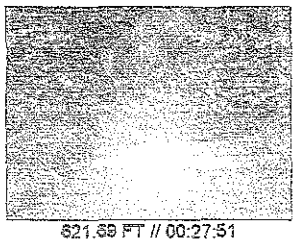
1:600	DIST	OBSERVATION
A2-38	8.92	Inspection begins at upstream manhole
	129.32	Including break-in connection at Cl of street



8.92 FT // 00:15:05



129.32 FT // 00:17:38



621.69 FT // 00:27:51

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/24/2005	510572	Clear / Cool	Jim Constable	2	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-0001	CEIIII		No	250

1:500	DIST	OBSERVATION

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/24/2005	510572	Clear / Cool	Jim Constable	2	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	250

1:500	DIST	OBSERVATION
A2-37	621.69	inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	Easement	01/24/2005	2	

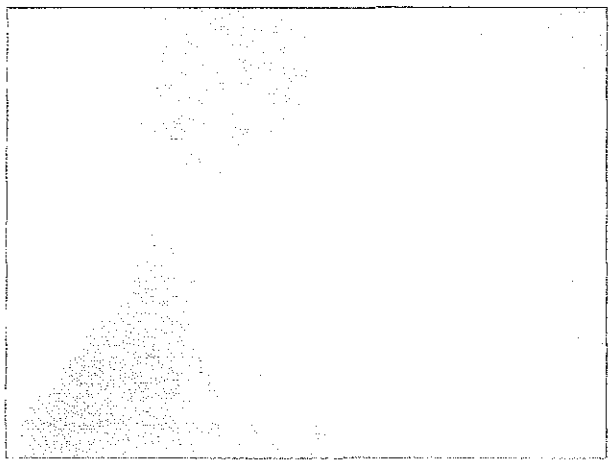


IMAGE: 3a, TAPE #: 1, 00:15:05
8.92FT, inspection begins at upstream manhole

IMAGE: 4a, TAPE #: 1, 00:17:38
129.32FT, intruding break-in-connection, at 01 o´clock

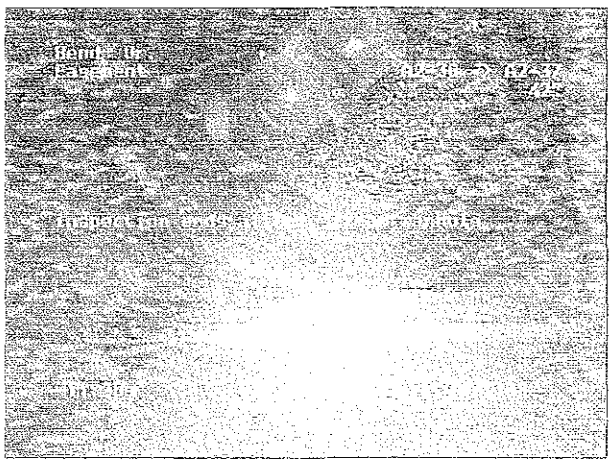


IMAGE: 5a, TAPE #: 1, 00:27:51
621.69FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

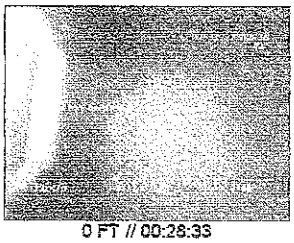
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/24/2005	510572	Clear / Cool	Jim Constable	3	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-37
CITY:	Bend, Or.	MAP #2:		MH:	A2-38
LOCALE:	Easement	TAPE #:	1	TV'D LGTH:	780.91 ft

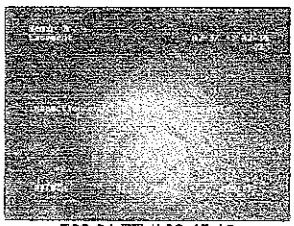
INSPECT REASON:	General Condition	PIPE SIZE:	42"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:500	DIST	OBSERVATION
A2-37	0.00	inspection begins at upstream manhole



0 FT // 00:28:33



780.91 FT // 00:45:16

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/24/2005	510572	Clear / Cool	Jim Constable	3	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-0001	CEIII		No	0

1:500 DIST OBSERVATION

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/24/2005	510572	Clear / Cool	Jim Constable	3	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

1:500	DIST	OBSERVATION
A2-36	780.91	inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	Easement	01/24/2005	3	

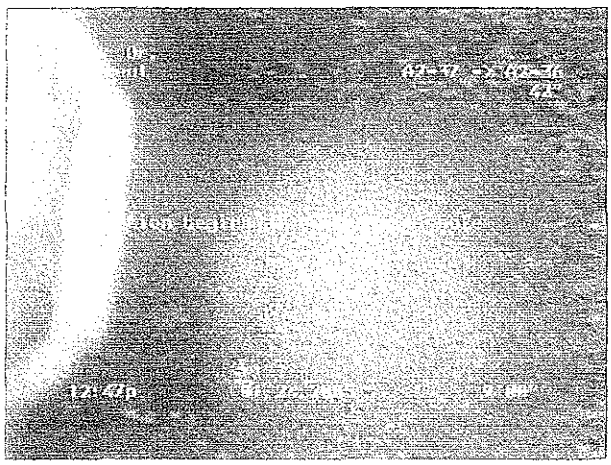


IMAGE: 6a, TAPE #: 1, 00:28:33
0FT, inspection begins at upstream manhole

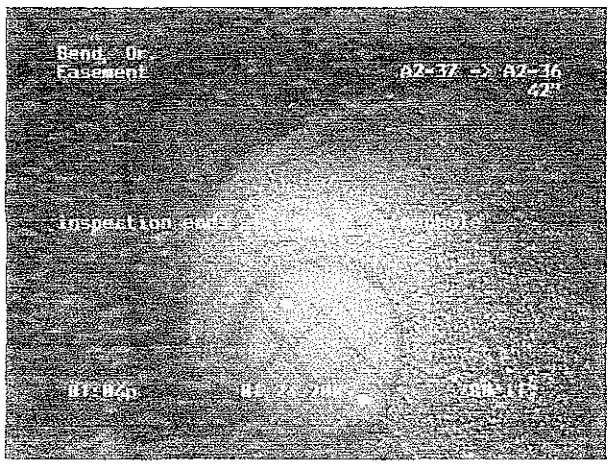


IMAGE: 9a, TAPE #: 1, 00:45:16
780.91FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

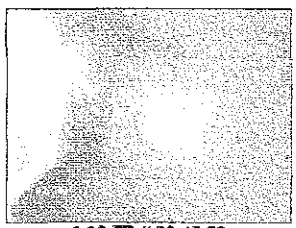
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/24/2005	510572	Clear / Cool	Jim Constable	4	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-S001	OEIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-36
CITY:	Bend, Or.	MAP #2:		MH:	A2-35
LOCALE:	Easement	TAPE #:	1	TVD LGTH:	384.73 ft

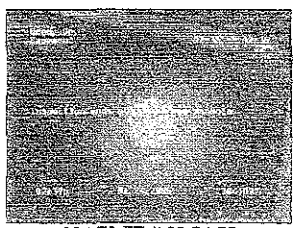
INSPECT REASON:	General Condition	PIPE SIZE:	42"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:500	DIST	OBSERVATION
A2-36	8.92	Inspection begins at upstream manhole



8.92 FT // 00:45:59



384.73 FT // 00:54:55

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/24/2005	510572	Clear / Cool	Jim Constable	4	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-0001	OEIIII		No	0

1:500	DIST	OBSERVATION
A2-35	384.73	Inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	Easement	01/24/2005	4	

IMAGE: 10a, TAPE #: 1, 00:45:59
8.92FT, inspection begins at upstream manhole

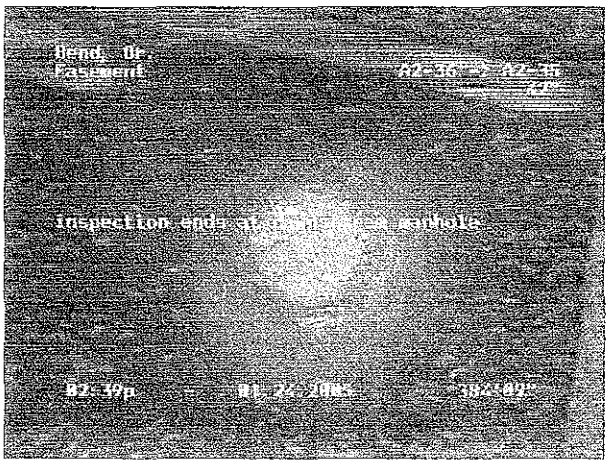


IMAGE: 11a, TAPE #: 1, 00:54:55
384.73FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

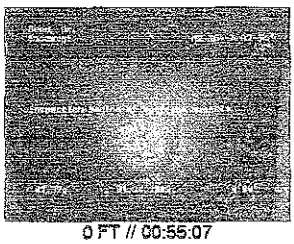
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/24/2005	510572	Clear / Cool	Jim Constable	5	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIII		No	500

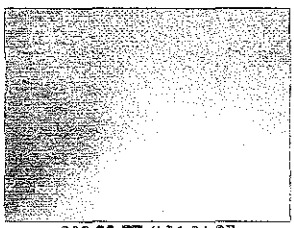
STREET:	Easement	MAP #1:	22-11	MH:	A2-35
CITY:	Bend, Or.	MAP #2:		MH:	A2-34
LOCALE:	Easement	TAPE #:	1	TVD LGTH:	590.78 ft

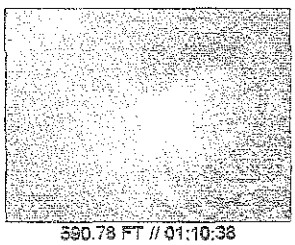
INSPECT REASON:	General Condition	PIPE SIZE:	42"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:500	DIST	OBSERVATION
A2-35	0.00	inspection begins at upstream manhole


0 FT // 00:55:07


230.98 FT // 01:01:27

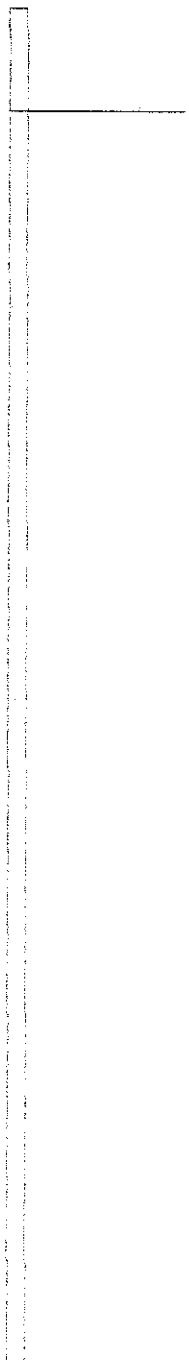

590.78 FT // 01:10:38

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/24/2006	510572	Clear / Cool	Jim Constable	5	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-0001	OEIIII		No	500

1:500 DIST OBSERVATION



PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/24/2005	510572	Clear / Cool	Jim Constable	5	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIII		No	500

1:500	DIST	OBSERVATION
A2-34	590.78	inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	Easement	01/24/2005	5	

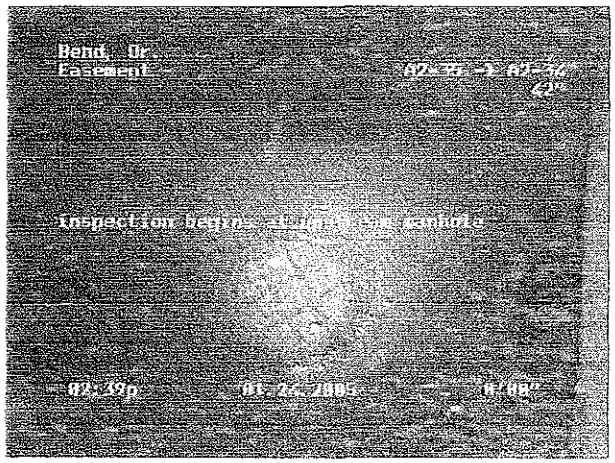


IMAGE: 12a, TAPE #: 1, 00:55:07
0FT, inspection begins at upstream manhole

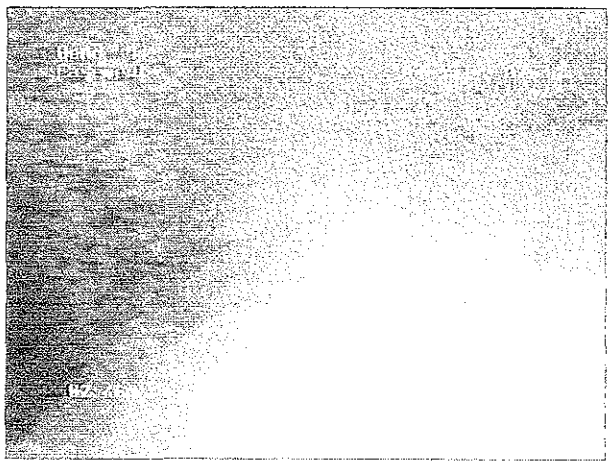


IMAGE: 13a, TAPE #: 1, 01:01:27
230.98FT, obstruction

IMAGE: 14a, TAPE #: 1, 01:10:38
590.78FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

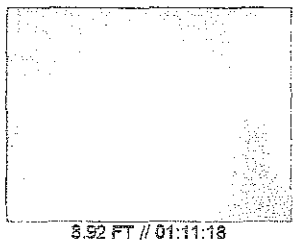
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/25/2005	510572	Clear / Cool	Jim Constable	6	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OSIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-34
CITY:	Bend, Or.	MAP #2:		MH:	A2-33
LOCALE:	Easement	TAPE #:	1	TVD LGTH:	505.64 ft

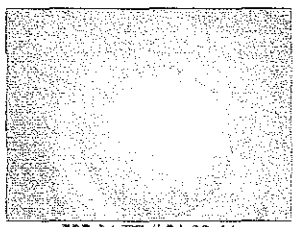
INSPECT REASON:	General Condition	PIPE SIZE:	42"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:500	DIST	OBSERVATION
A2-34	8.92	Inspection begins at upstream manhole



8.92 FT // 01:11:18



505.64 FT // 01:20:44

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/25/2005	510572	Clear / Cool	Jim Constable	6	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIIi		No	0

1:500	DIST	OBSERVATION

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/25/2005	510572	Clear / Cool	Jim Constable	6	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-0001	OEIIII		No	0

1:500	DIST	OBSERVATION
A2-33	505.64	inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	Easement	01/26/2005	6	

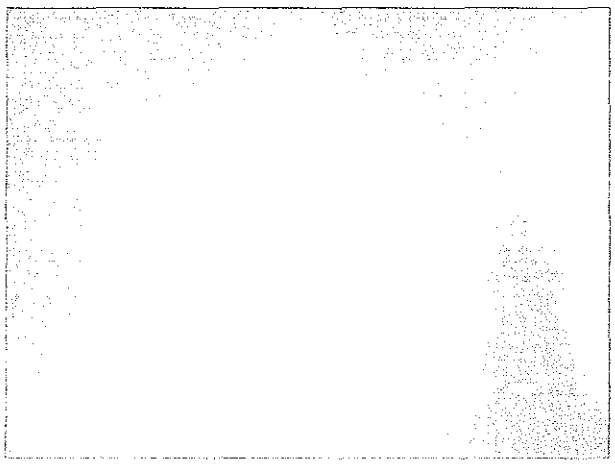


IMAGE: 15a, TAPE #: 1, 01:11:18
8.92FT, inspection begins at upstream manhole

IMAGE: 17a, TAPE #: 1, 01:20:44
505.84FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

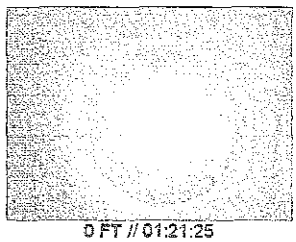
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/25/2005	510572	Clear / Cool	Jim Constable	7	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-33
CITY:	Bend, Or.	MAP #2:		MH:	A2-32
LOCALE:	Easement	TAPE #:	1	TVD LGTH:	338.11 ft

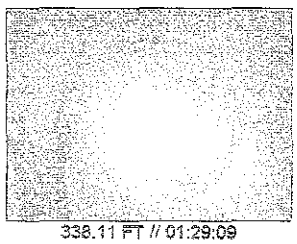
INSPECT REASON:	General Condition	PIPE SIZE:	42"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:500	DIST	OBSERVATION
A2-33	0.00	inspection begins at upstream manhole



0 FT // 01:21:25



338.11 FT // 01:29:09

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/25/2005	510572	Clear / Cool	Jim Constable	7	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-0001	OEIIII		No	0

1:500	DIST	OBSERVATION
A2-32	338.11	inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	Easement	01/25/2005	7	

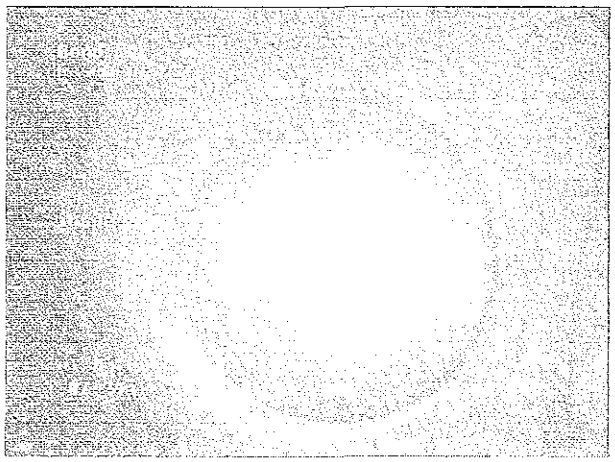


IMAGE: 18a, TAPE #: 1, 01:21:25
0FT, inspection begins at upstream manhole

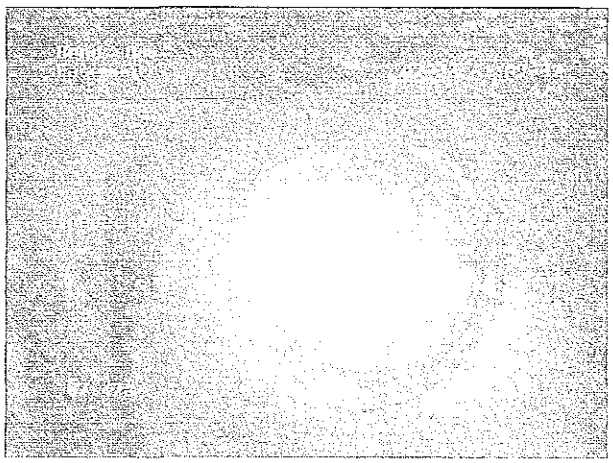


IMAGE: 19a, TAPE #: 1, 01:29:09
338.11FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

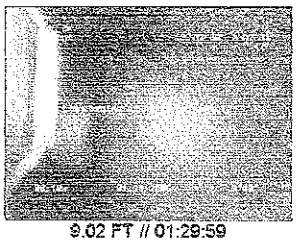
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/25/2005	510572	Clear / Cool	Jim Constable	8	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-32
CITY:	Bend, Or.	MAP #2:		MH:	A2-31
LOCALE:	Easement	TAPE #:	1	TVD LGTH:	398.82 ft

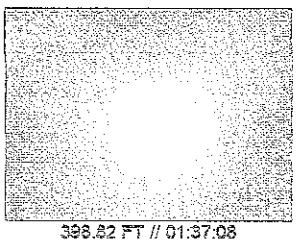
INSPECT REASON:	General Condition	PIPE SIZE:	42"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:500	DIST	OBSERVATION
A2-32	9.02	Inspection begins at upstream manhole



9.02 FT // 01:29:59



398.82 FT // 01:37:08

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/25/2005	510572	Clear / Cool	Jim Constable	8	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

1:500	DIST	OBSERVATION
A2-31	398.82	Inspection ends at downstream manhole

PSC Industrial Outsourcing Group
385 W. Channel Rd
Benicia CA 94510
Tel: 707-746-5287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	Easement	01/25/2008	3	

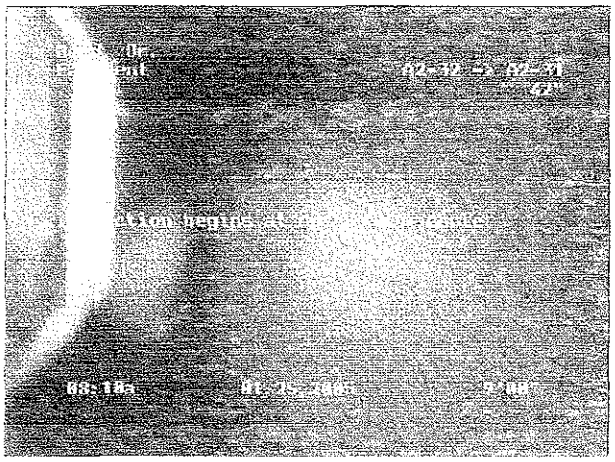


IMAGE: 20a, TAPE #: 1, 01:29:59
9.02FT, inspection begins at upstream manhole

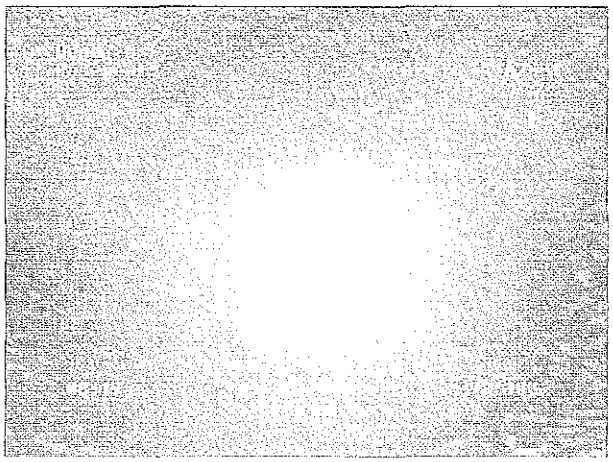


IMAGE: 21a, TAPE #: 1, 01:37:08
398.82FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

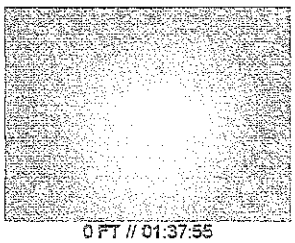
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/25/2005	510572	Clear / Cool	Jim Constable	9	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-8001	OEIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-31
CITY:	Bend, Or.	MAP #2:		MH:	A2-30
LOCALE:	Easement	TAPE #:	1	TVD LGTH:	217.8 ft

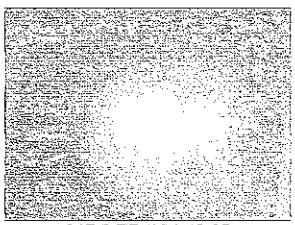
INSPECT REASON:	General Condition	PIPE SIZE:	42"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:500	DIST	OBSERVATION
A2-31	0.00	Inspection begins at upstream manhole



0 FT // 01:37:55



217.5 FT // 01:43:05

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-6287, Fax: 707-746-6297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/25/2005	510572	Clear / Cool	Jim Constable	9	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

1:500	DIST	OBSERVATION
A2-30	217.8D	inspection ends at downstream manhole

PSC Industrial Outsourcing Group
355 W. Channel Rd
Benicia CA 94510
Tel. 707-746-8267, Fax. 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	Easement	01/25/2005	9	

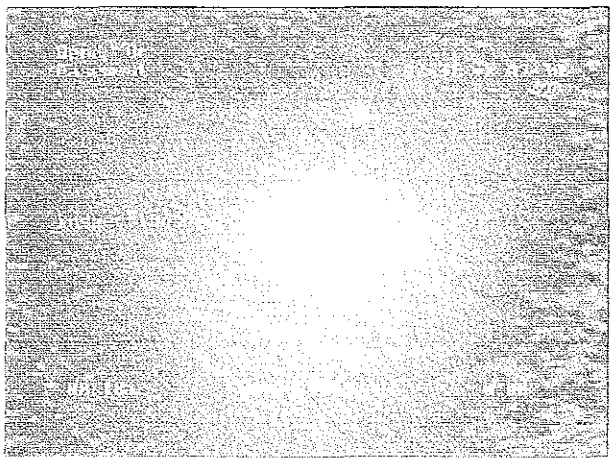


IMAGE: 22a, TAPE #: 1, 01:37:55
0FT, inspection begins at upstream manhole

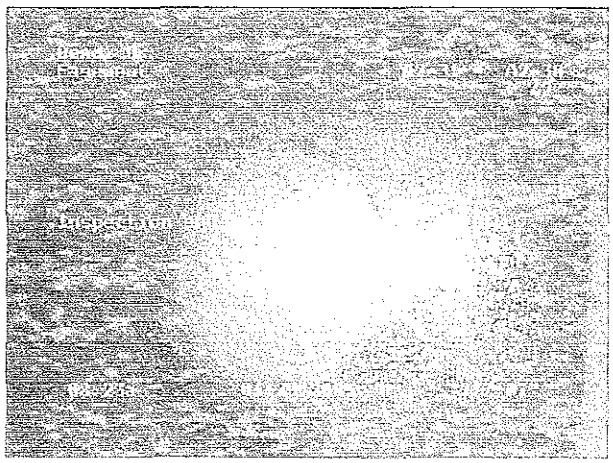


IMAGE: 23a, TAPE #: 1, 01:43:05
217.6FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

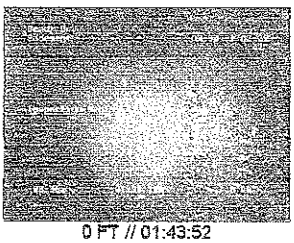
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/25/2005	510572	Clear / Cool	Jim Constable	10	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-30
CITY:	Bend, Or.	MAP #2:		MH:	A2-29
LOCALE:	Easement	TAPE #:	1	TVD LGTH:	150.51 ft

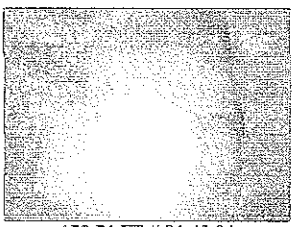
INSPECT REASON:	General Condition	PIPE SIZE:	42"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:600	DIST	OBSERVATION
A2-30	0.00	inspection begins at upstream manhole
A2-29	150.51	inspection ends at downstream manhole



0 FT // 01:43:52



150.51 FT // 01:48:01

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	Easement	01/25/2005	10	

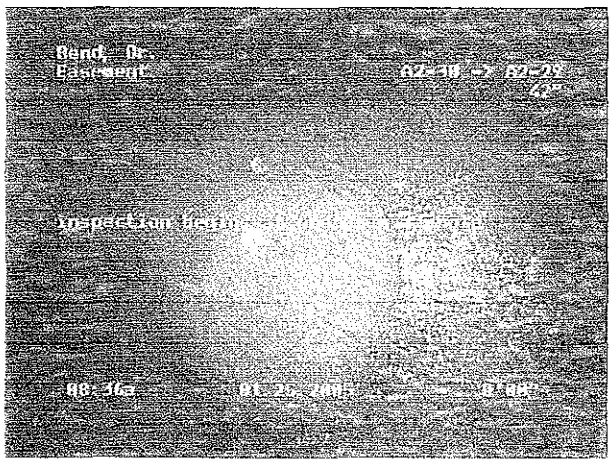


IMAGE: 24a, TAPE #: 1, 01:43:52
0FT, inspection begins at upstream manhole

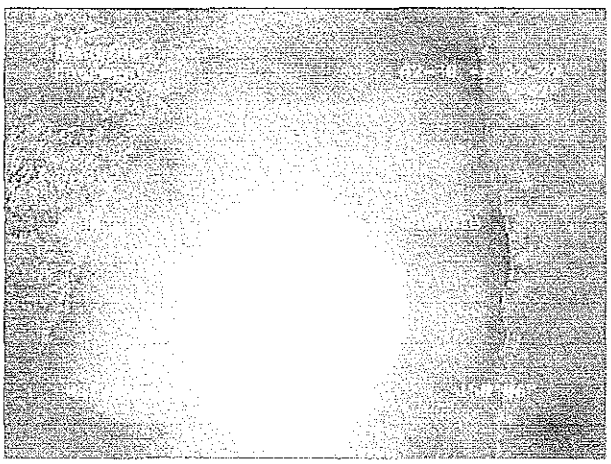


IMAGE: 25a, TAPE #: 1, 01:48:01
150.51FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

PROJ INFO

PROJ NAME:	PROJECT NUM:	RESPONSIBLE:	DATE:
Yeoman Interceptor Study		Dan O'Malley	01/24/2005

CLIENT	City Of Bend
RESPONSIBLE:	Bob Griffith
DEPARTMENT:	City of Bend Public Works
PO BOX:	
STREET:	757 NE 15TH Street
CITY, ST ZIP:	Bend, Oregon 97701
TELEPHONE:	541-385-6677
FAX:	
MOBILE:	
E-MAIL:	bgriffith@ci.bend.or.us

PROJ MGR	
RESPONSIBLE:	
DEPARTMENT:	
PO BOX:	
STREET:	
CITY, ST ZIP:	
TELEPHONE:	
FAX:	
MOBILE:	
E-MAIL:	

CONTRACTOR	PSC Industrial Outsourcing Group
RESPONSIBLE:	Bernd Green
DEPARTMENT:	Municipal Services
PO BOX:	
STREET:	395 W. Channel Rd
CITY, ST ZIP:	Benicia CA 94510
TELEPHONE:	707-746-8287
FAX:	707-746-8297
MOBILE:	707-333-0097
E-MAIL:	ehalden@contactpsc.com

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

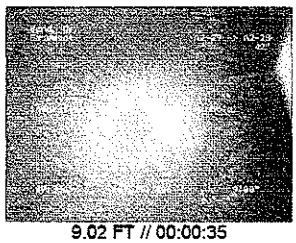
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/25/2005	510572	Clear / Cool	Jim Constable	11	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIIi		No	0

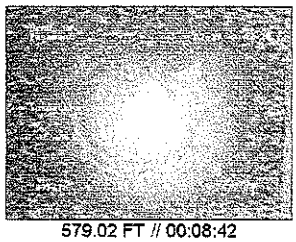
STREET:	Easement	MAP #1:	22-11	MH:	A2-29
CITY:	Bend, Or.	MAP #2:		MH:	A2-28
LOCALE:	Easement	TAPE #:	2	TV'D LGTH:	579.02 ft

INSPECT REASON:	General Condition	PIPE SIZE:	42"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:500	DIST	OBSERVATION
A2-29	9.02	inspection begins at upstream manhole


9.02 FT // 00:00:35


579.02 FT // 00:08:42

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/25/2005	**510572**	**Clear / Cool**	**Jim Constable**	**11**	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	**OEIIII**		**No**	**0**

1:500 DIST OBSERVATION

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/25/2005	**510572**	**Clear / Cool**	**Jim Constable**	**11**	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	**OEIIII**		**No**	**0**

1:500	DIST	OBSERVATION
A2-28	579.02	inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	**Easement**	**01/25/2005**	**11**	

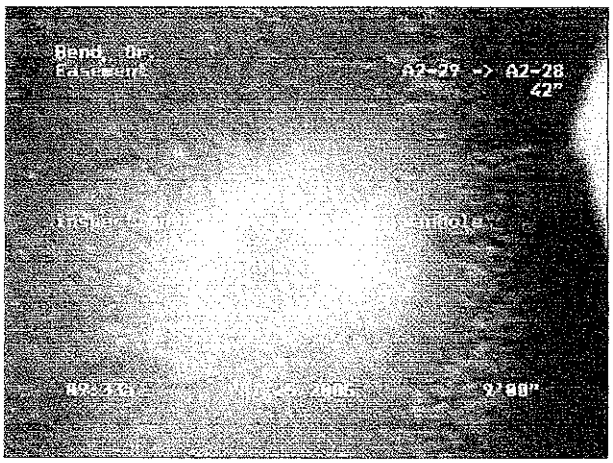


IMAGE: 26a, TAPE #: 2, 00:00:35
9.02FT, inspection begins at upstream manhole

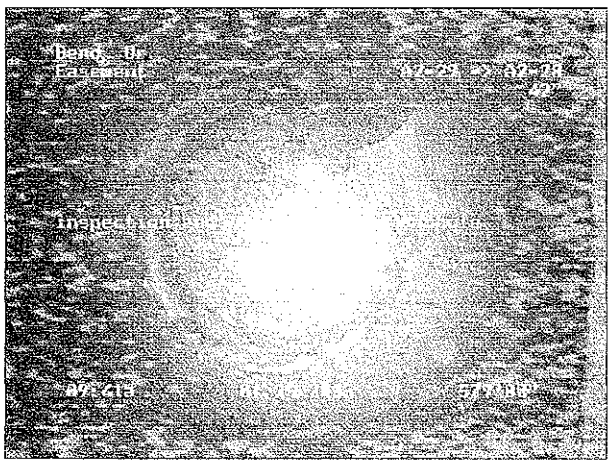


IMAGE: 27a, TAPE #: 2, 00:08:42
579.02FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/25/2005	510572	Clear / Cool	Jim Constable	12	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-28
CITY:	Bend, Or.	MAP #2:		MH:	A2-27
LOCALE:	Easement	TAPE #:	2	TV'D LGTH:	480.41 ft

INSPECT REASON:	General Condition	PIPE SIZE:	42"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:500	DIST	OBSERVATION
A2-28	9.00	inspection begins at upstream manhole

9 FT // 00:09:27

480.41 FT // 00:17:11

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/25/2005	**510572**	**Clear / Cool**	**Jim Constable**	**12**	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	**OEIIII**		**No**	**0**

1:500	DIST	OBSERVATION
A2-27	480.41	inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	**Easement**	**01/25/2005**	**12**	

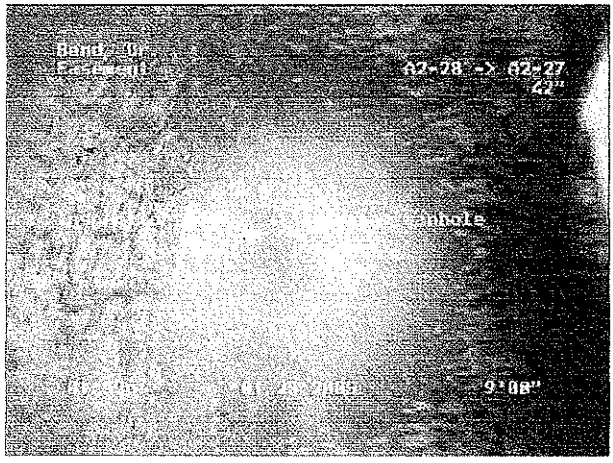


IMAGE: 28a, TAPE #: 2, 00:09:27
9FT, inspection begins at upstream manhole

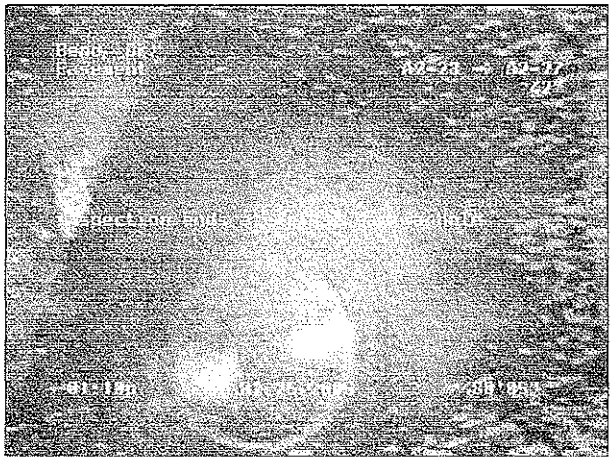


IMAGE: 29a, TAPE #: 2, 00:17:11
480.41FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

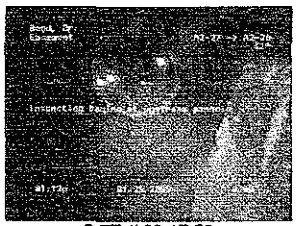
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/25/2005	510572	Clear / Cool	Jim Constable	13	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-27
CITY:	Bend, Or.	MAP #2:		MH:	A2-26
LOCALE:	Easement	TAPE #:	2	TV'D LGTH:	330 ft

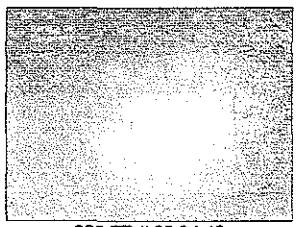
INSPECT REASON:	General Condition	PIPE SIZE:	42"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:500	DIST	OBSERVATION
A2-27	0.00	inspection begins at upstream manhole



0 FT // 00:17:59



330 FT // 00:24:40

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/25/2005	**510572**	**Clear / Cool**	**Jim Constable**	**13**	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	**OEIIII**		**No**	**0**

1:500	DIST	OBSERVATION
A2-26	330.00	inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	**Easement**	**01/25/2005**	**13**	

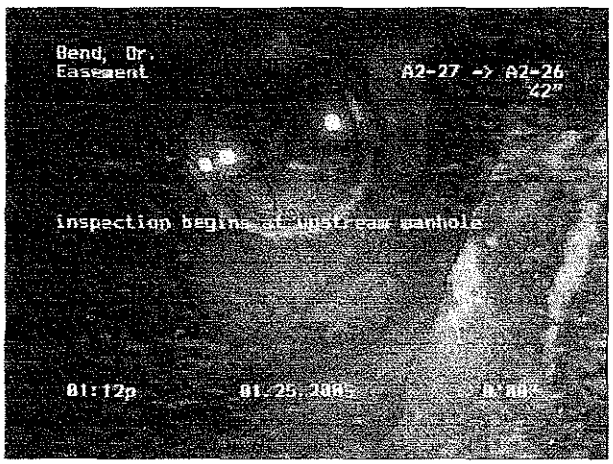


IMAGE: 30a, TAPE #: 2, 00:17:59
0FT, inspection begins at upstream manhole

IMAGE: 31a, TAPE #: 2, 00:24:40
330FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

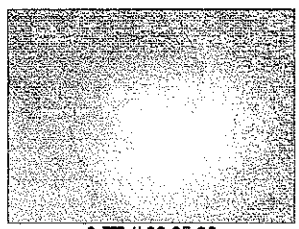
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/25/2005	510572	Clear / Cool	Jim Constable	14	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-26
CITY:	Bend, Or.	MAP #2:		MH:	A2-25
LOCALE:	Easement	TAPE #:	2	TV'D LGTH:	377.23 ft

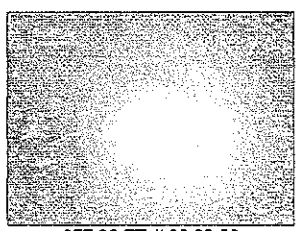
INSPECT REASON:	General Condition	PIPE SIZE:	42"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:500	DIST	OBSERVATION
A2-26	0.00	inspection begins at upstream manhole



0 FT // 00:25:20



377.23 FT // 00:33:08

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/25/2005	**510572**	**Clear / Cool**	**Jim Constable**	**14**	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	**OEIIII**		**No**	**0**

1:500	DIST	OBSERVATION
A2-25	377.23	inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	**Easement**	**01/25/2005**	**14**	

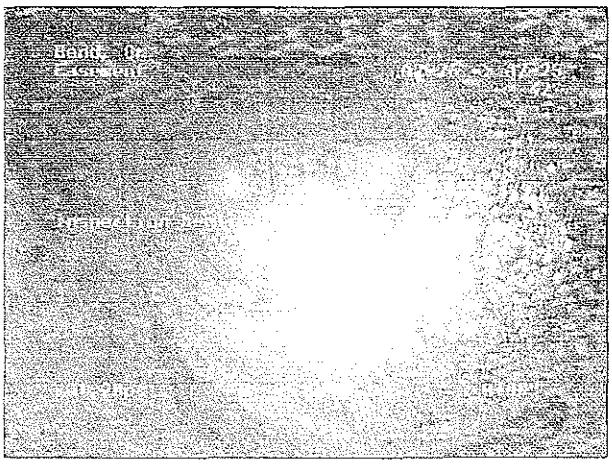


IMAGE: 32a, TAPE #: 2, 00:25:20
0FT, inspection begins at upstream manhole

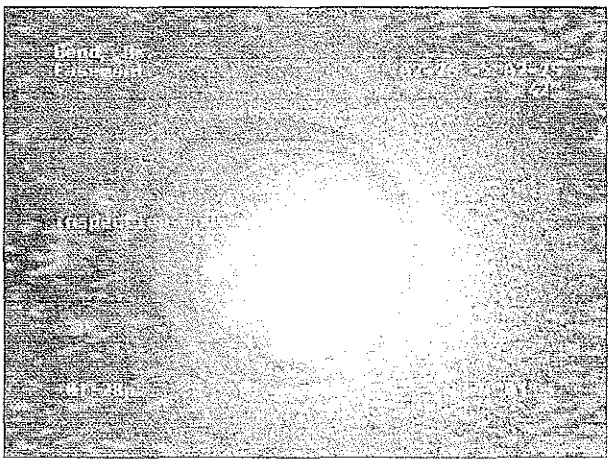


IMAGE: 33a, TAPE #: 2, 00:33:08
377.23FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

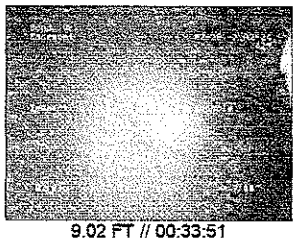
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/25/2005	510572	Clear / Cool	Jim Constable	15	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-25
CITY:	Bend, Or.	MAP #2:		MH:	A2-24
LOCALE:	Easement	TAPE #:	2	TV'D LGTH:	224.8 ft

INSPECT REASON:	General Condition	PIPE SIZE:	42"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:500	DIST	OBSERVATION
A2-25	9.02	inspection begins at upstream manhole



9.02 FT // 00:33:51

224.8 FT // 00:37:38

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8297, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/25/2005	**510572**	**Clear / Cool**	**Jim Constable**	**15**	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	**OEIIII**		**No**	**0**

1:500	DIST	OBSERVATION
A2-24	224.80	inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	**Easement**	**01/25/2005**	**15**	

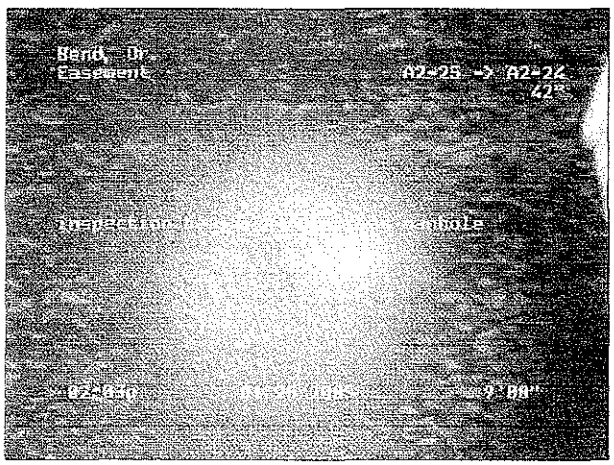


IMAGE: 34a, TAPE #: 2, 00:33:51
9.02FT, inspection begins at upstream manhole

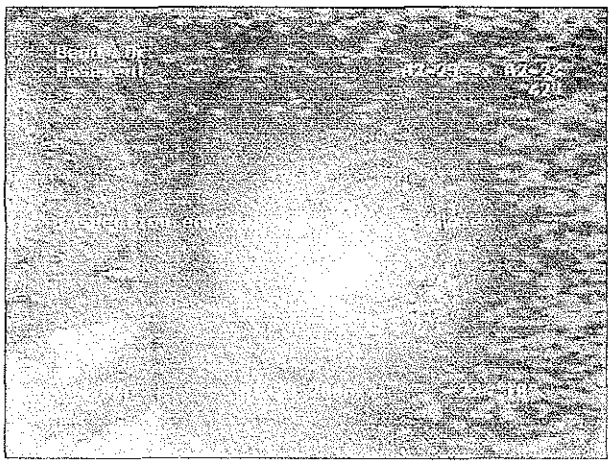


IMAGE: 35a, TAPE #: 2, 00:37:38
224.8FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

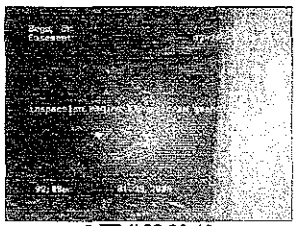
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/25/2005	510572	Clear / Cool	Jim Constable	16	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-24
CITY:	Bend, Or.	MAP #2:		MH:	A2-23
LOCALE:	Easement	TAPE #:	2	TV'D LGTH:	759.12 ft

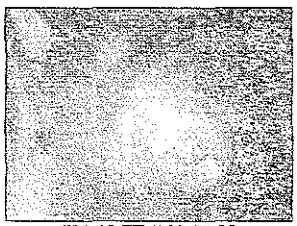
INSPECT REASON:	General Condition	PIPE SIZE:	42"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:500	DIST	OBSERVATION
A2-24	0.00	inspection begins at upstream manhole



0 FT // 00:38:18



759.12 FT // 00:52:22

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/25/2005	**510572**	**Clear / Cool**	**Jim Constable**	**16**	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	**OEIIII**		**No**	**0**

1:500 DIST OBSERVATION

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/25/2005	**510572**	**Clear / Cool**	**Jim Constable**	**16**	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	**OEIIII**		**No**	**0**

1:500	DIST	OBSERVATION
A2-23	759.12	inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	**Easement**	**01/25/2005**	**16**	

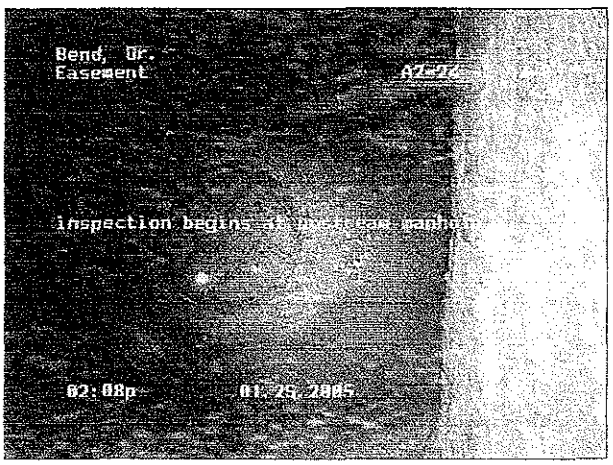


IMAGE: 36a, TAPE #: 2, 00:38:18
0FT, inspection begins at upstream manhole

IMAGE: 37a, TAPE #: 2, 00:52:22
759.12FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

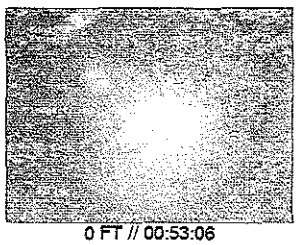
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/25/2005	510572	Clear / Cool	Jim Constable	17	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-23
CITY:	Bend, Or.	MAP #2:		MH:	A2-22
LOCALE:	Easement	TAPE #:	2	TV'D LGTH:	420.1 ft

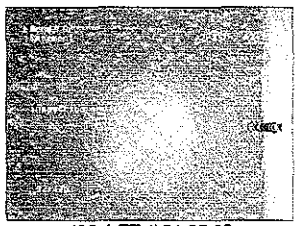
INSPECT REASON:	General Condition	PIPE SIZE:	42"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:500	DIST	OBSERVATION
A2-23	0.00	inspection begins at upstream manhole



0 FT // 00:53:06



420.1 FT // 01:05:03

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/25/2005	**510572**	**Clear / Cool**	**Jim Constable**	**17**	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	**OEIIII**		**No**	**0**

1:500	DIST	OBSERVATION
A2-22	420.10	inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	**Easement**	**01/25/2005**	**17**	

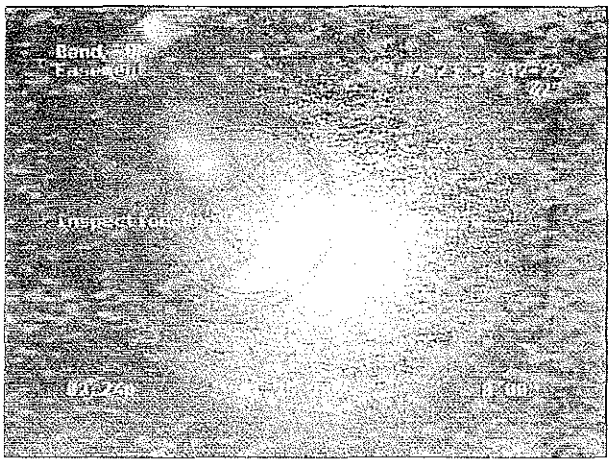


IMAGE: 38a, TAPE #: 2, 00:53:06
0FT, inspection begins at upstream manhole

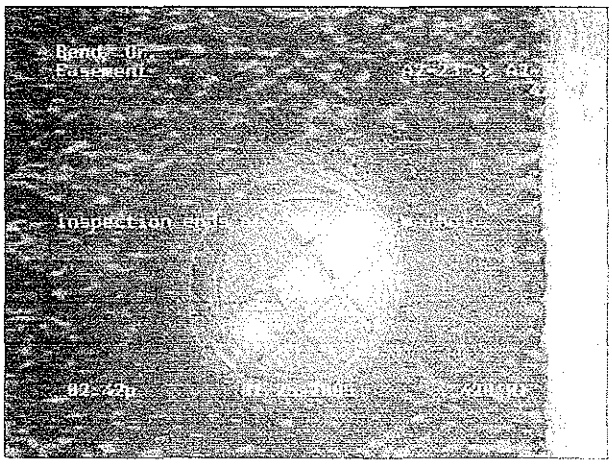


IMAGE: 39a, TAPE #: 2, 01:05:03
420.1FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

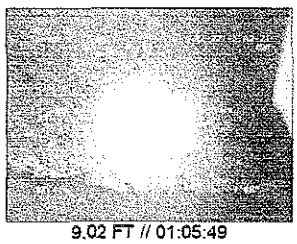
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/26/2005	510572	Clear / Cool	Jim Constable	18	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

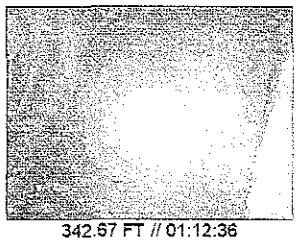
STREET:	Easement	MAP #1:	22-11	MH:	A2-22
CITY:	Bend, Or.	MAP #2:		MH:	A2-21
LOCALE:	Easement	TAPE #:	2	TV'D LGTH:	342.67 ft

INSPECT REASON:	General Condition	PIPE SIZE:	42"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:500	DIST	OBSERVATION
A2-22		
	9.02	inspection begins at upstream manhole


9.02 FT // 01:05:49


342.67 FT // 01:12:36

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/26/2005	**510572**	**Clear / Cool**	**Jim Constable**	**18**	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	**OEIIII**		**No**	**0**

1:500	DIST	OBSERVATION
A2-21	342.67	inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	**Easement**	**01/26/2005**	**18**	

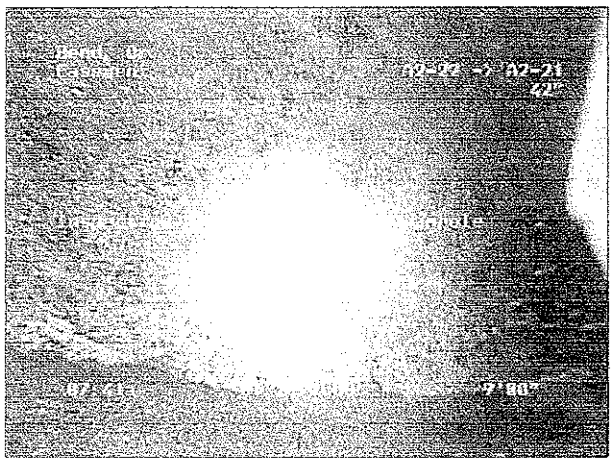


IMAGE: 40a, TAPE #: 2, 01:05:49
9.02FT, inspection begins at upstream manhole

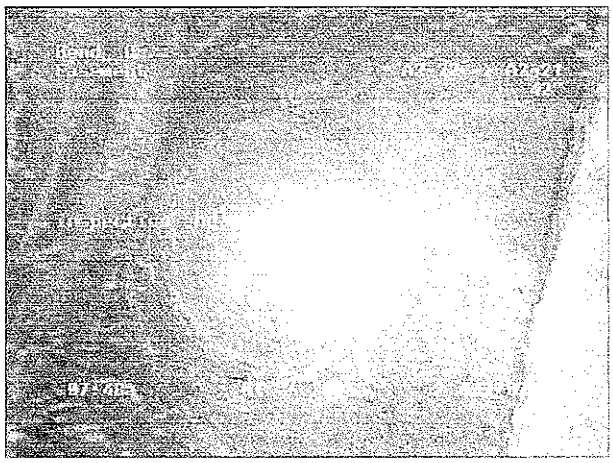


IMAGE: 41a, TAPE #: 2, 01:12:36
342.67FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

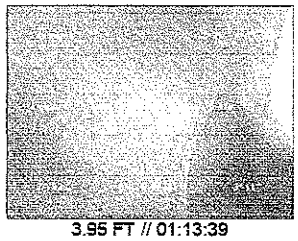
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/26/2005	510572	Clear / Cool	Jim Constable	19	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

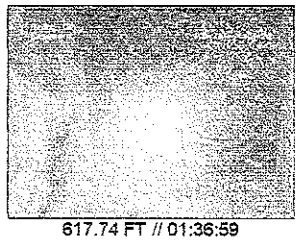
STREET:	Easement	MAP #1:	22-11	MH:	A2-21
CITY:	Bend, Or.	MAP #2:		MH:	A2-20
LOCALE:	Easement	TAPE #:	2	TV'D LGTH:	617.74 ft

INSPECT REASON:	General Condition	PIPE SIZE:	42"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:500	DIST	OBSERVATION
A2-21	3.95	inspection begins at upstream manhole


3.95 FT // 01:13:39


617.74 FT // 01:36:59

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/26/2005	**510572**	**Clear / Cool**	**Jim Constable**	**19**	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	**OEIIII**		**No**	**0**

1:500 DIST OBSERVATION

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/26/2005	**510572**	**Clear / Cool**	**Jim Constable**	**19**	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	**OEIIII**		**No**	**0**

1:500	DIST	OBSERVATION
A2-20	617.74	inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	Easement	01/26/2005	19	

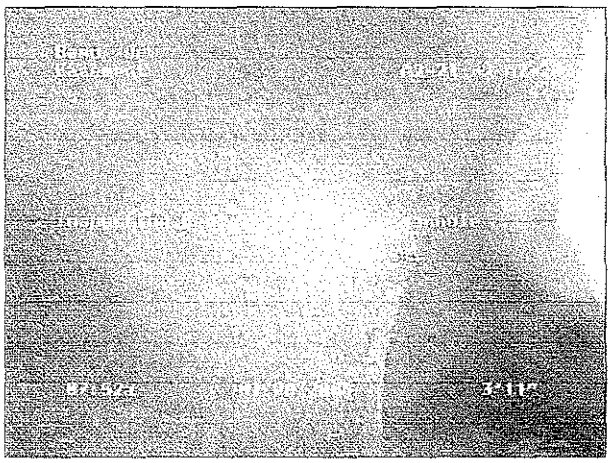


IMAGE: 42a, TAPE #: 2, 01:13:39
3.95FT, inspection begins at upstream manhole

IMAGE: 43a, TAPE #: 2, 01:36:59
617.74FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

PROJ INFO

PROJ NAME:	PROJECT NUM:	RESPONSIBLE:	DATE:
Yeoman Interceptor Study		Dan O'Malley	01/24/2005

CLIENT	City Of Bend
RESPONSIBLE:	Bob Griffith
DEPARTMENT:	City of Bend Public Works
PO BOX:	
STREET:	757 NE 15TH Street
CITY, ST ZIP:	Bend, Oregon 97701
TELEPHONE:	541-385-6677
FAX:	
MOBILE:	
E-MAIL:	bgriffith@ci.bend.or.us

PROJ MGR	
RESPONSIBLE:	
DEPARTMENT:	
PO BOX:	
STREET:	
CITY, ST ZIP:	
TELEPHONE:	
FAX:	
MOBILE:	
E-MAIL:	

CONTRACTOR	PSC Industrial Outsourcing Group
RESPONSIBLE:	Bernd Green
DEPARTMENT:	Municipal Services
PO BOX:	
STREET:	395 W. Channel Rd
CITY, ST ZIP:	Benicia CA 94510
TELEPHONE:	707-746-8287
FAX:	707-746-8297
MOBILE:	707-333-0097
E-MAIL:	ehalden@contactpsc.com

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

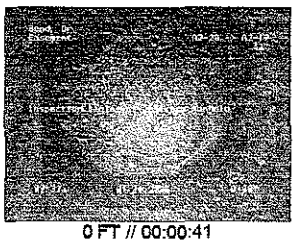
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/26/2005	510572	Clear / Cool	Jim Constable	20	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-20
CITY:	Bend, Or.	MAP #2:		MH:	A2-19
LOCALE:	Easement	TAPE #:	3	TV'D LGTH:	490.74 ft

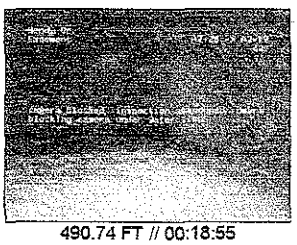
INSPECT REASON:	General Condition	PIPE SIZE:	42"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:500	DIST	OBSERVATION
A2-20	0.00	inspection begins at upstream manhole



0 FT // 00:00:41



490.74 FT // 00:18:55

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/26/2005	**510572**	**Clear / Cool**	**Jim Constable**	**20**	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	**OEIIII**		**No**	**0**

1:500	DIST	OBSERVATION
	490.74	camera blocked, inspection abandoned, debri blocking camera under water line

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	Easement	01/26/2005	20	

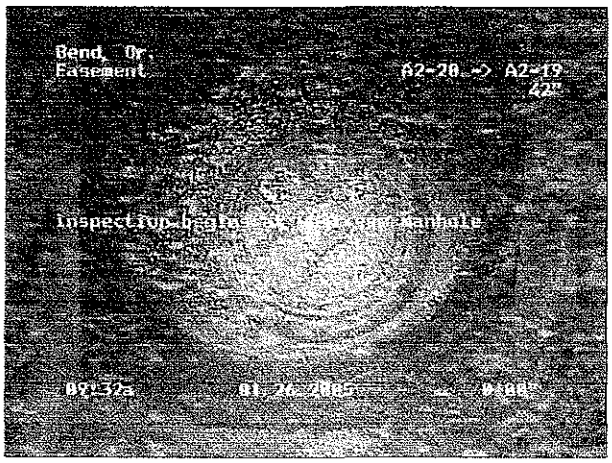


IMAGE: 44a, TAPE #: 3, 00:00:41
0FT, inspection begins at upstream manhole

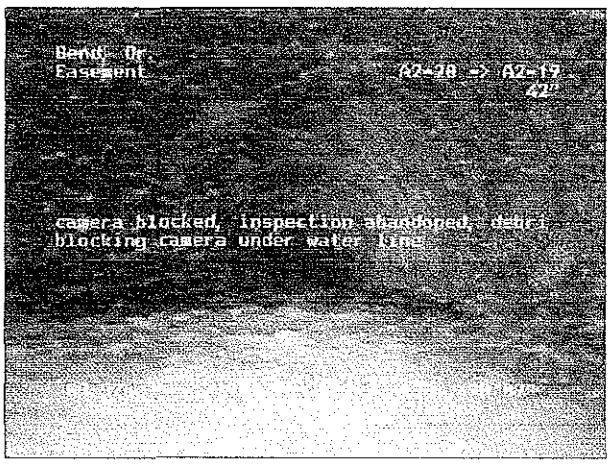


IMAGE: 45a, TAPE #: 3, 00:18:55
490.74FT, camera blocked, inspection abandoned, debri blocking camera under water line

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

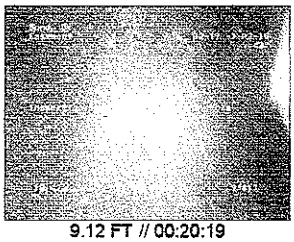
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/26/2005	510572	Clear / Cool	Jim Constable	21	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-19
CITY:	Bend, Or.	MAP #2:		MH:	A2-18
LOCALE:	Easement	TAPE #:	3	TV'D LGTH:	505.95 ft

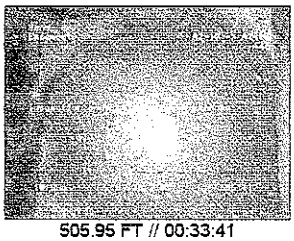
INSPECT REASON:	General Condition	PIPE SIZE:	42"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:500	DIST	OBSERVATION
A2-19	9.12	inspection begins at upstream manhole



9.12 FT // 00:20:19



505.95 FT // 00:33:41

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8297, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/26/2005	**510572**	**Clear / Cool**	**Jim Constable**	**21**	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	**OEIIII**		**No**	**0**

1:500 DIST OBSERVATION

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/26/2005	**510572**	**Clear / Cool**	**Jim Constable**	**21**	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	**OEIIII**		**No**	**0**

1:500	DIST	OBSERVATION
A2-18	505.95	inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	**Easement**	**01/26/2005**	**21**	

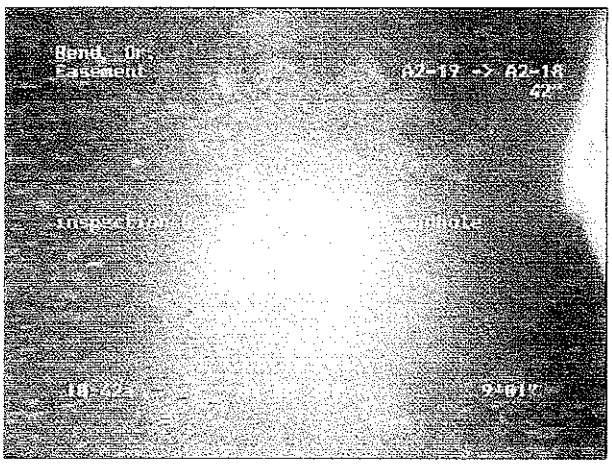


IMAGE: 46a, TAPE #: 3, 00:20:19
9.12FT, inspection begins at upstream manhole

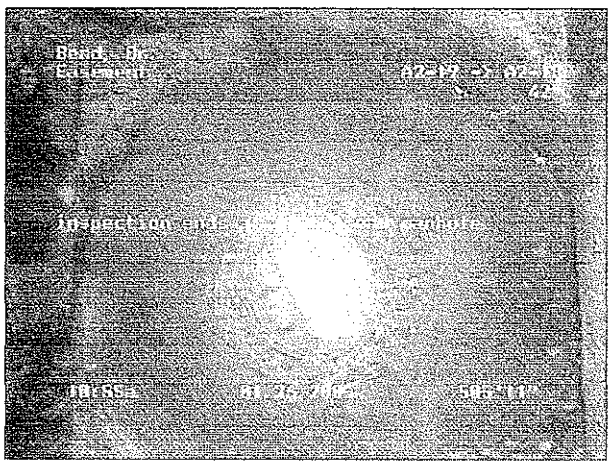


IMAGE: 47a, TAPE #: 3, 00:33:41
505.95FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

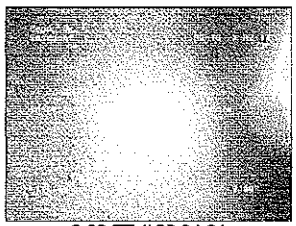
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/26/2005	510572	Clear / Cool	Jim Constable	22	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-18
CITY:	Bend, Or.	MAP #2:		MH:	A2-17
LOCALE:	Easement	TAPE #:	3	TV'D LGTH:	655.64 ft

INSPECT REASON:	General Condition	PIPE SIZE:	42"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:500	DIST	OBSERVATION
A2-18	9.02	inspection begins at upstream manhole



9.02 FT // 00:34:31

655.64 FT // 00:45:41

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/26/2005	**510572**	**Clear / Cool**	**Jim Constable**	**22**	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	**OEIIII**		**No**	**0**

1:500 DIST OBSERVATION

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/26/2005	**510572**	**Clear / Cool**	**Jim Constable**	**22**	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	**OEIIII**		**No**	**0**

1:500	DIST	OBSERVATION
A2-17	655.64	inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	**Easement**	**01/26/2005**	**22**	

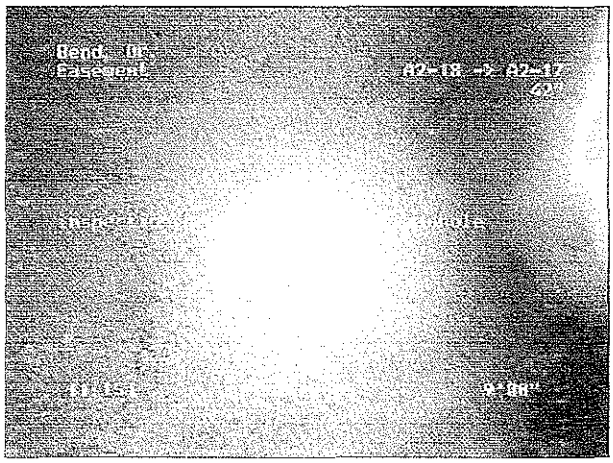


IMAGE: 48a, TAPE #: 3, 00:34:31
9.02FT, inspection begins at upstream manhole

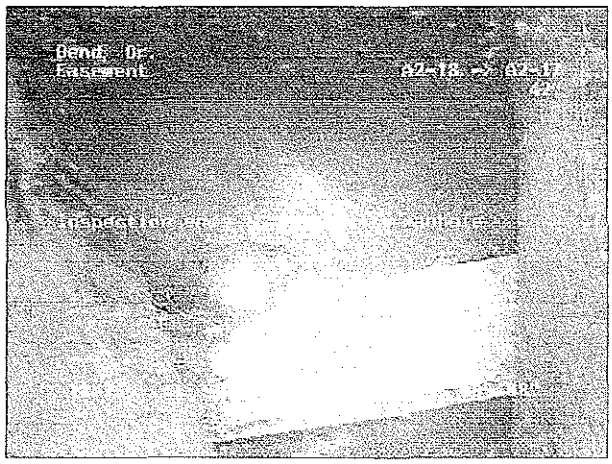


IMAGE: 49a, TAPE #: 3, 00:45:41
655.64FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

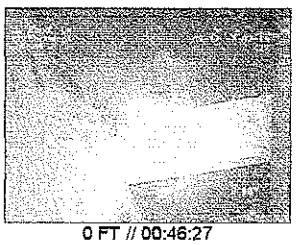
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/26/2005	510572	Clear / Cool	Jim Constable	23	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-17
CITY:	Bend, Or.	MAP #2:		MH:	A2-16
LOCALE:	Easement	TAPE #:	3	TV'D LGTH:	164.6 ft

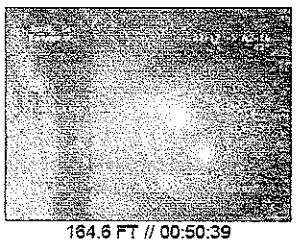
INSPECT REASON:	General Condition	PIPE SIZE:	42"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:500	DIST	OBSERVATION
A2-17	0.00	inspection begins at upstream manhole
A2-16	164.60	inspection ends at downstream manhole



0 FT // 00:46:27



164.6 FT // 00:50:39

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	**Easement**	**01/26/2005**	**23**	

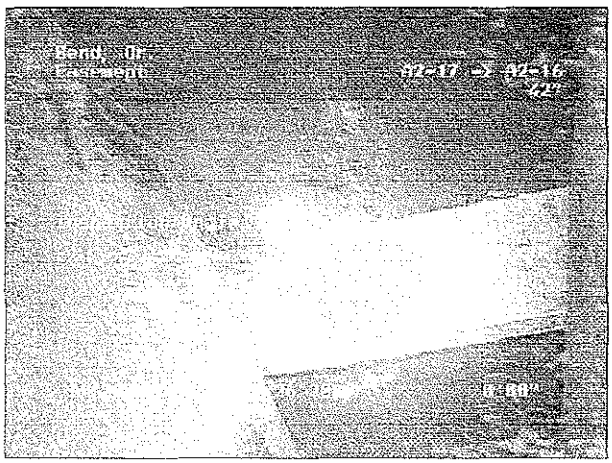


IMAGE: 50a, TAPE #: 3, 00:46:27
0FT, inspection begins at upstream manhole

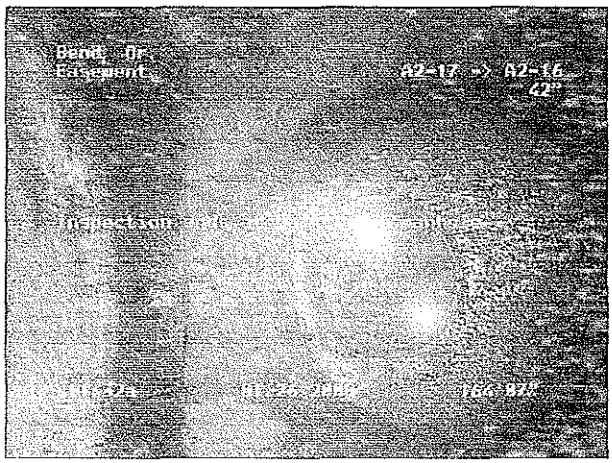


IMAGE: 51a, TAPE #: 3, 00:50:39
164.6FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

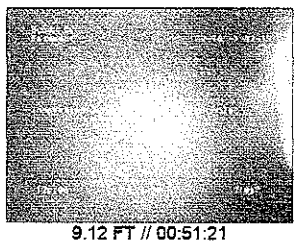
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/26/2005	510572	Clear / Cool	Jim Constable	24	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-16
CITY:	Bend, Or.	MAP #2:		MH:	A2-15
LOCALE:	Easement	TAPE #:	3	TV'D LGTH:	638.41 ft

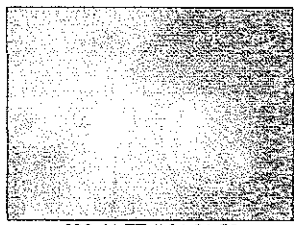
INSPECT REASON:	General Condition	PIPE SIZE:	48"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:500	DIST	OBSERVATION
A2-16	9.12	inspection begins at upstream manhole



9.12 FT // 00:51:21



638.41 FT // 01:01:56

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/26/2005	**510572**	**Clear / Cool**	**Jim Constable**	**24**	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	**OEIIII**		**No**	**0**

1:500 DIST OBSERVATION

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/26/2005	**510572**	**Clear / Cool**	**Jim Constable**	**24**	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	**OEIIII**		**No**	**0**

1:500	DIST	OBSERVATION
A2-15	638.41	inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	**Easement**	**01/26/2005**	**24**	

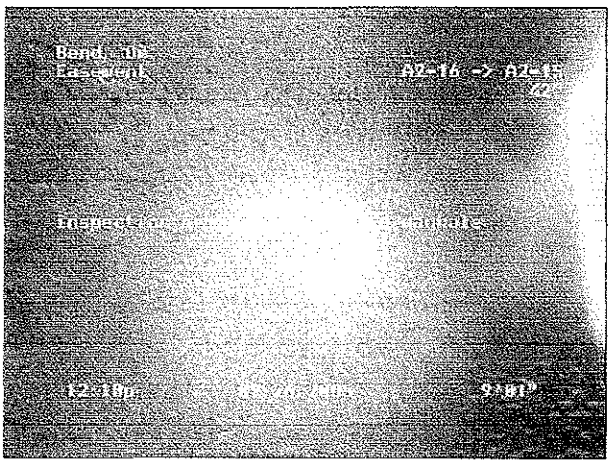


IMAGE: 52a, TAPE #: 3, 00:51:21
9.12FT, inspection begins at upstream manhole

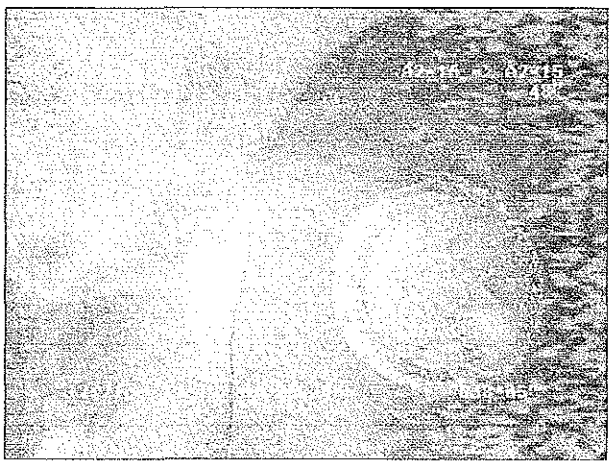


IMAGE: 53a, TAPE #: 3, 01:01:56
638.41FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

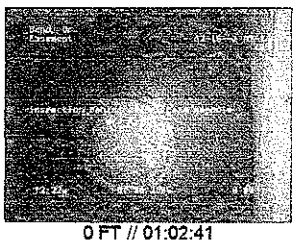
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/26/2005	510572	Clear / Cool	Jim Constable	25	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-15
CITY:	Bend, Or.	MAP #2:		MH:	A2-14
LOCALE:	Easement	TAPE #:	3	TV'D LGTH:	275.37 ft

INSPECT REASON:	General Condition	PIPE SIZE:	48"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:500	DIST	OBSERVATION
A2-15	0.00	inspection begins at upstream manhole



0 FT // 01:02:41

275.37 FT // 01:07:07

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/26/2005	**510572**	**Clear / Cool**	**Jim Constable**	**25**	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	**OEIIII**		**No**	**0**

1:500	DIST	OBSERVATION
A2-14	275.37	inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	**Easement**	**01/26/2005**	**25**	

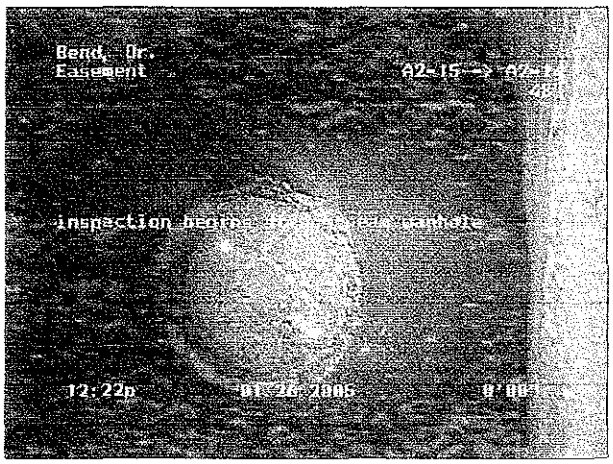


IMAGE: 54a, TAPE #: 3, 01:02:41
0FT, inspection begins at upstream manhole

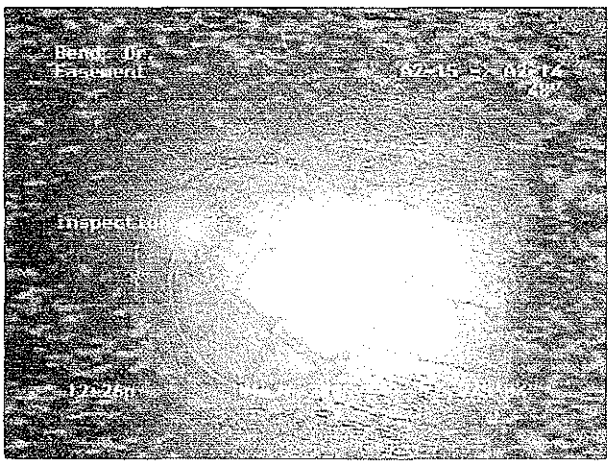


IMAGE: 55a, TAPE #: 3, 01:07:07
275.37FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

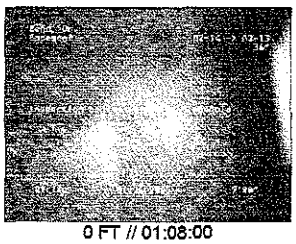
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/26/2005	510572	Clear / Cool	Jim Constable	26	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-14
CITY:	Bend, Or.	MAP #2:		MH:	A2-13
LOCALE:	Easement	TAPE #:	3	TV'D LGTH:	496.22 ft

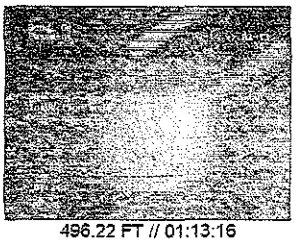
INSPECT REASON:	General Condition	PIPE SIZE:	36"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:500	DIST	OBSERVATION
A2-14	0.00	inspection begins at upstream manhole



0 FT // 01:08:00



496.22 FT // 01:13:16

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/26/2005	**510572**	**Clear / Cool**	**Jim Constable**	**26**	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	**OEIIII**		**No**	**0**

1:500	DIST	OBSERVATION
A2-13	496.22	inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	**Easement**	**01/26/2005**	**26**	

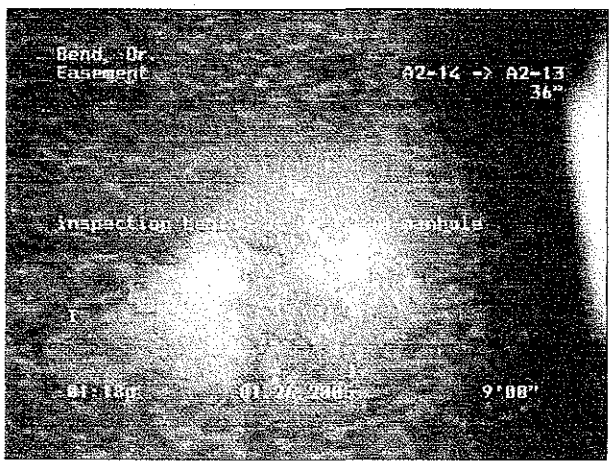


IMAGE: 56a, TAPE #: 3, 01:08:00
0FT, inspection begins at upstream manhole

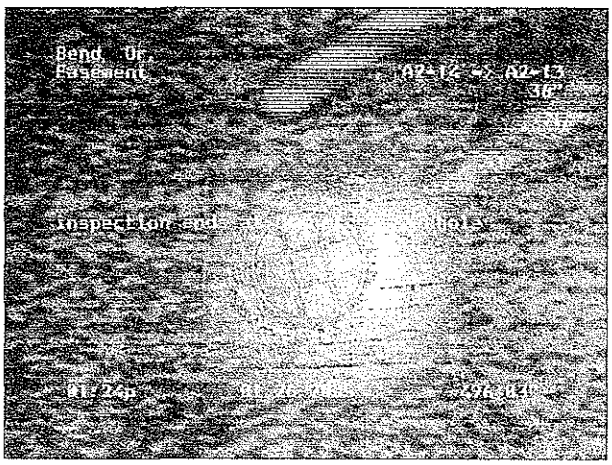


IMAGE: 57a, TAPE #: 3, 01:13:16
496.22FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

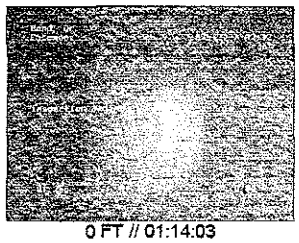
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/26/2005	510572	Clear / Cool	Jim Constable	27	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-13
CITY:	Bend, Or.	MAP #2:		MH:	A2-12
LOCALE:	Easement	TAPE #:	3	TV'D LGTH:	810.81 ft

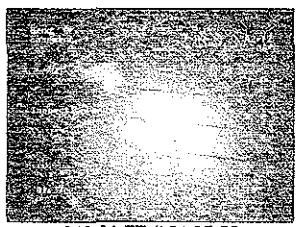
INSPECT REASON:	General Condition	PIPE SIZE:	36"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:500	DIST	OBSERVATION
A2-13	0.00	inspection begins at upstream manhole



0 FT // 01:14:03



810.81 FT // 01:25:50

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/26/2005	**510572**	**Clear / Cool**	**Jim Constable**	**27**	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	**OEIIII**		**No**	**0**

1:500 DIST OBSERVATION

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/26/2005	**510572**	**Clear / Cool**	**Jim Constable**	**27**	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	**OEIIII**		**No**	**0**

1:500 DIST OBSERVATION

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/26/2005	**510572**	**Clear / Cool**	**Jim Constable**	**27**	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	**OEIIII**		**No**	**0**

1:500	DIST	OBSERVATION
A2-12	810.81	inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	**Easement**	**01/26/2005**	**27**	

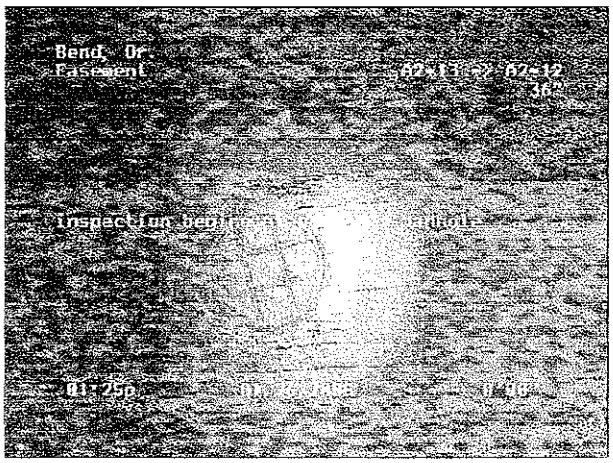


IMAGE: 58a, TAPE #: 3, 01:14:03
0FT, inspection begins at upstream manhole

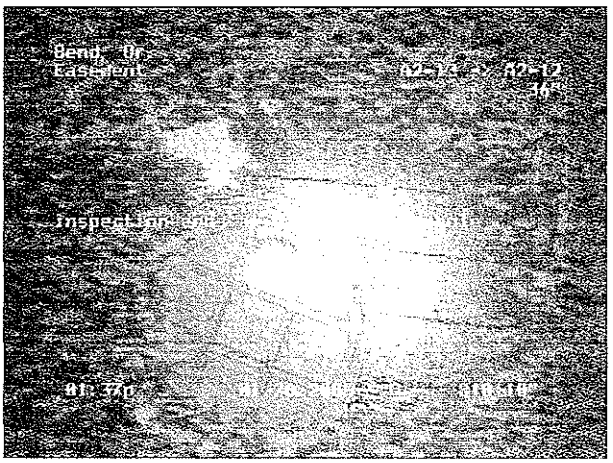


IMAGE: 59a, TAPE #: 3, 01:25:50
810.81FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

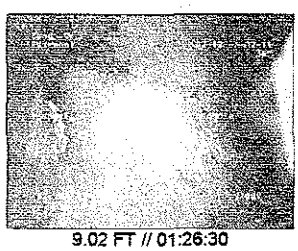
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/26/2005	510572	Clear / Cool	Jim Constable	28	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-12
CITY:	Bend, Or.	MAP #2:		MH:	A2-11
LOCALE:	Easement	TAPE #:	3	TV'D LGTH:	413.01 ft

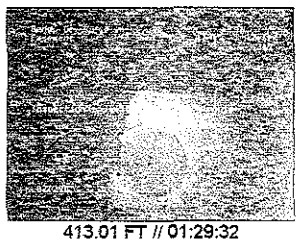
INSPECT REASON:	General Condition	PIPE SIZE:	36"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:500	DIST	OBSERVATION
A2-12	9.02	inspection begins at upstream manhole



9.02 FT // 01:26:30



413.01 FT // 01:29:32

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/26/2005	**510572**	**Clear / Cool**	**Jim Constable**	**28**	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	**OEIIII**		**No**	**0**

1:500	DIST	OBSERVATION
A2-11	413.0'	inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	**Easement**	**01/26/2005**	**28**	

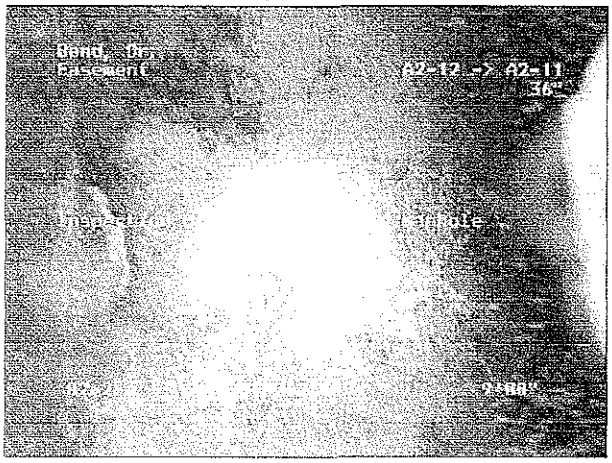


IMAGE: 60a, TAPE #: 3, 01:26:30
9.02FT, inspection begins at upstream manhole

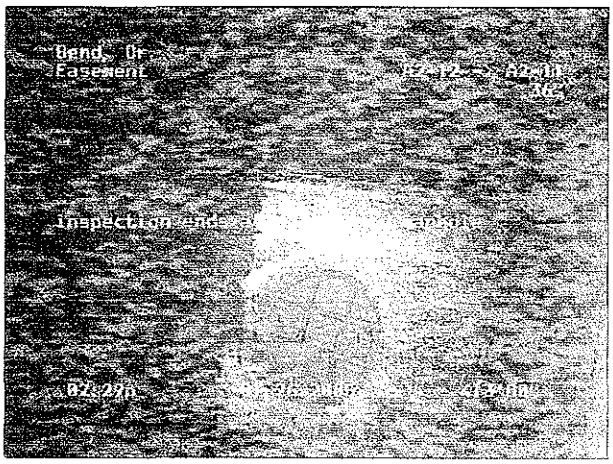


IMAGE: 61a, TAPE #: 3, 01:29:32
413.01FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

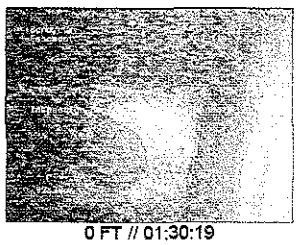
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/26/2005	510572	Clear / Cool	Jim Constable	29	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

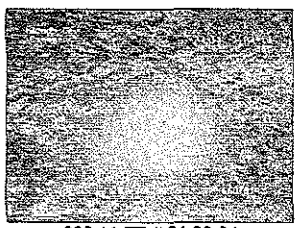
STREET:	Easement	MAP #1:	22-11	MH:	A2-11
CITY:	Bend, Or.	MAP #2:		MH:	A2-10
LOCALE:	Easement	TAPE #:	3	TV'D LGTH:	668.11 ft

INSPECT REASON:	General Condition	PIPE SIZE:	36"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:500	DIST	OBSERVATION
A2-11	0.00	inspection begins at upstream manhole


0 FT // 01:30:19

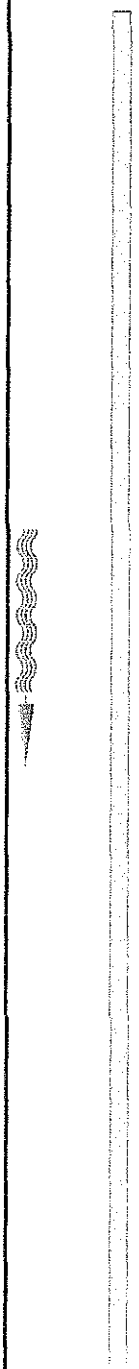

668.11 FT // 01:39:04

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/26/2005	**510572**	**Clear / Cool**	**Jim Constable**	**29**	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	**OEIIII**		**No**	**0**

1:500 DIST OBSERVATION

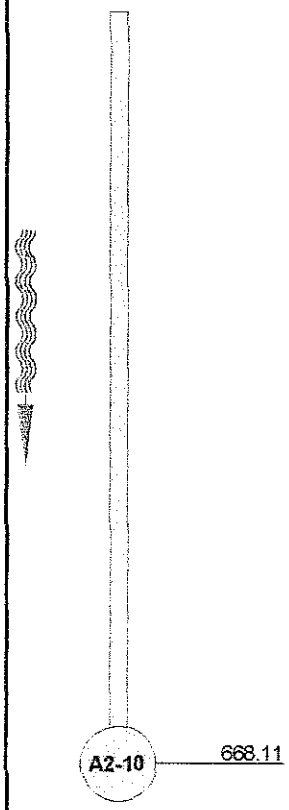


PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/26/2005	**510572**	**Clear / Cool**	**Jim Constable**	**29**	
PRESENT:	VEHICLE: **TV-1-9001**	CAMERA: **OEIIII**	PRESET:	CLEANED: **No**	RATE: **0**

1:500 DIST OBSERVATION



inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	**Easement**	**01/26/2005**	**29**	

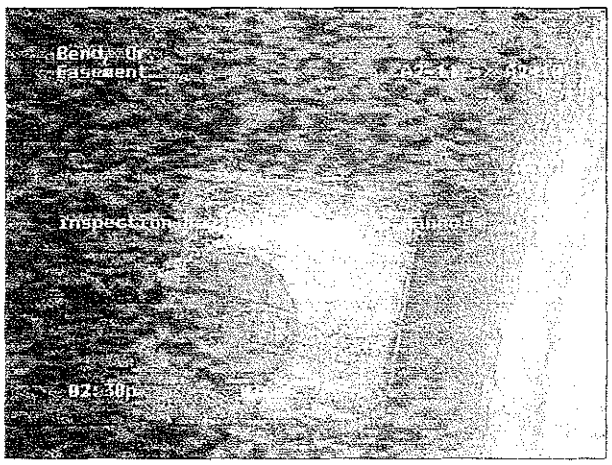


IMAGE: 62a, TAPE #: 3, 01:30:19
0FT, inspection begins at upstream manhole

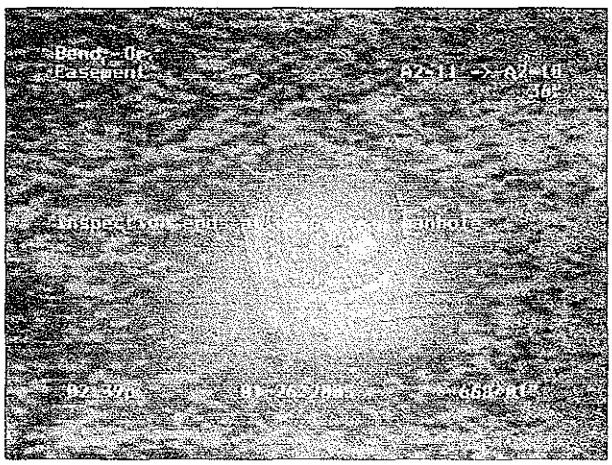


IMAGE: 63a, TAPE #: 3, 01:39:04
668.11FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

PROJ INFO

PROJ NAME:	PROJECT NUM:	RESPONSIBLE:	DATE:
Yeoman Interceptor Study		Dan O'Malley	01/24/2005

CLIENT	**City Of Bend**
RESPONSIBLE:	**Bob Griffith**
DEPARTMENT:	**City of Bend Public Works**
PO BOX:	
STREET:	**757 NE 15TH Street**
CITY, ST ZIP:	**Bend, Oregon 97701**
TELEPHONE:	**541-385-6677**
FAX:	
MOBILE:	
E-MAIL:	**bgriffith@ci.bend.or.us**

PROJ MGR	
RESPONSIBLE:	
DEPARTMENT:	
PO BOX:	
STREET:	
CITY, ST ZIP:	
TELEPHONE:	
FAX:	
MOBILE:	
E-MAIL:	

CONTRACTOR	**PSC Industrial Outsourcing Group**
RESPONSIBLE:	**Bernd Green**
DEPARTMENT:	**Municipal Services**
PO BOX:	
STREET:	**395 W. Channel Rd**
CITY, ST ZIP:	**Benicia CA 94510**
TELEPHONE:	**707-746-8287**
FAX:	**707-746-8297**
MOBILE:	**707-333-0097**
E-MAIL:	**ehalden@contactpsc.com**

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

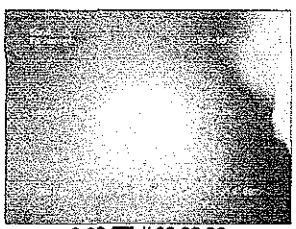
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/27/2005	510572	Clear / Cool	Jim Constable	30	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-10
CITY:	Bend, Or.	MAP #2:		MH:	A2-9
LOCALE:	Easement	TAPE #:	4	TV'D LGTH:	751.22 ft

INSPECT REASON:	General Condition	PIPE SIZE:	36"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:1525	DIST	OBSERVATION
A2-10	9.02	inspection begins at upstream manhole



9.02 FT // 00:00:30

751.22 FT // 00:12:26

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/27/2005	**510572**	**Clear / Cool**	**Jim Constable**	**30**	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	**OEIIII**		**No**	**0**

1:1525	DIST	OBSERVATION
A2-9	751.22	inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	**Easement**	**01/27/2005**	**30**	

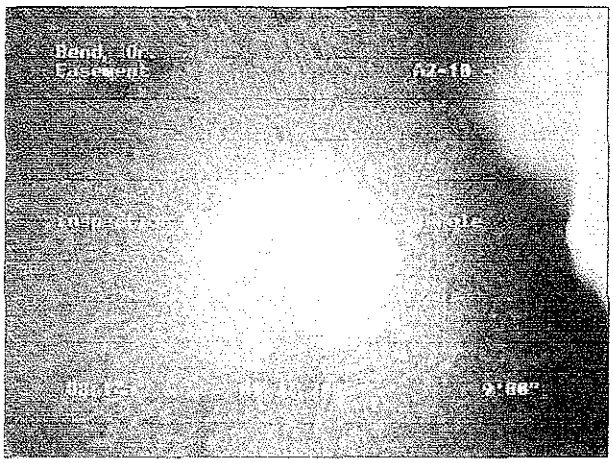


IMAGE: 65a, TAPE #: 4, 00:00:30
9.02FT, inspection begins at upstream manhole

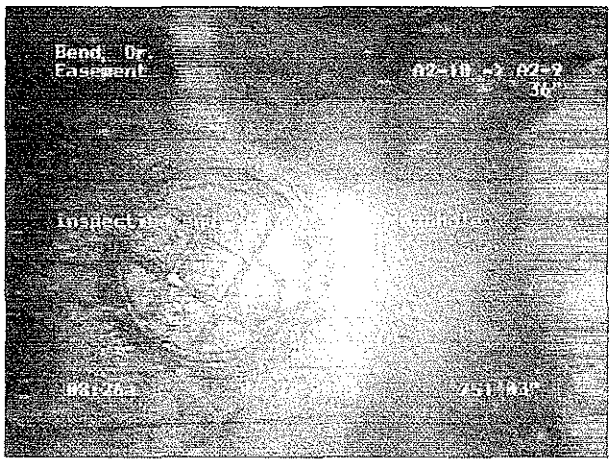


IMAGE: 66a, TAPE #: 4, 00:12:26
751.22FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

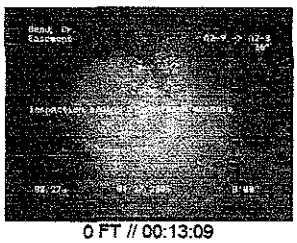
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/27/2005	510572	Clear / Cool	Jim Constable	31	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-9
CITY:	Bend, Or.	MAP #2:		MH:	A2-8
LOCALE:	Easement	TAPE #:	4	TV'D LGTH:	499.77 ft

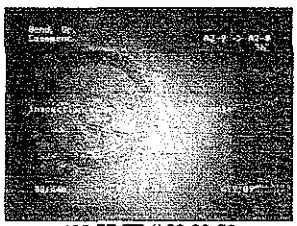
INSPECT REASON:	General Condition	PIPE SIZE:	36"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:1225	DIST	OBSERVATION
A2-9	0.00	inspection begins at upstream manhole
A2-8	499.77	inspection ends at downstream manhole



0 FT // 00:13:09



499.77 FT // 00:29:59

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	Easement	01/27/2005	31	

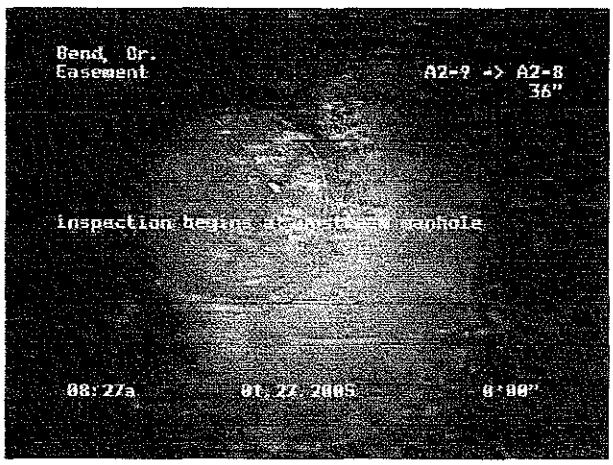


IMAGE: 67a, TAPE #: 4, 00:13:09
0FT, inspection begins at upstream manhole

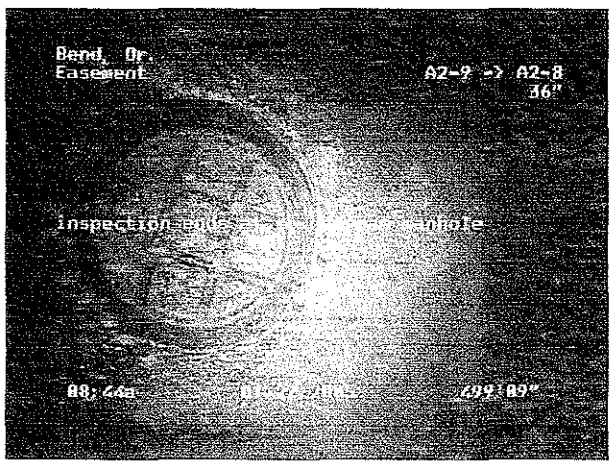


IMAGE: 68a, TAPE #: 4, 00:29:59
499.77FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

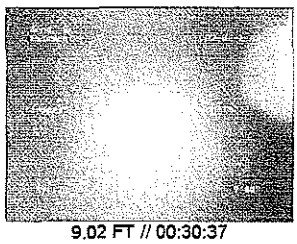
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/27/2005	510572	Clear / Cool	Jim Constable	32	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-8
CITY:	Bend, Or.	MAP #2:		MH:	A2-7
LOCALE:	Easement	TAPE #:	4	TV'D LGTH:	750 ft

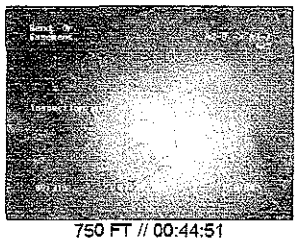
INSPECT REASON:	General Condition	PIPE SIZE:	42"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:1525	DIST	OBSERVATION
A2-8	9.02	inspection begins at upstream manhole



9.02 FT // 00:30:37



750 FT // 00:44:51

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/27/2005	**510572**	**Clear / Cool**	**Jim Constable**	**32**	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	**OEIIII**		**No**	**0**

1:1525	DIST	OBSERVATION
A2-7	750.00	inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	**Easement**	**01/27/2005**	**32**	

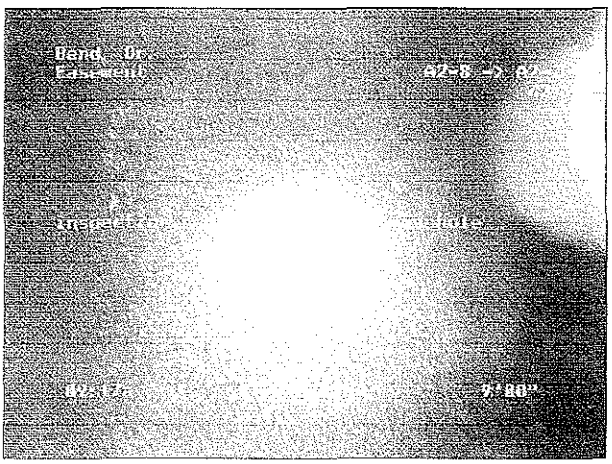


IMAGE: 69a, TAPE #: 4, 00:30:37
9.02FT, inspection begins at upstream manhole

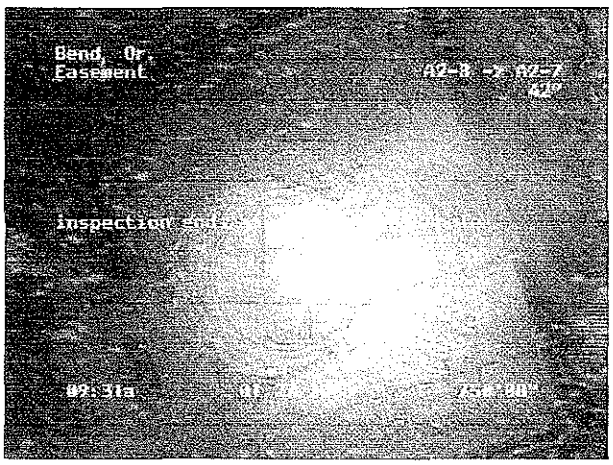


IMAGE: 70a, TAPE #: 4, 00:44:51
750FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

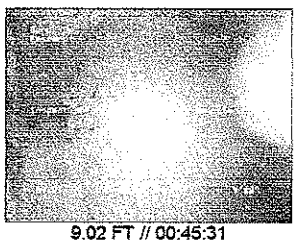
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/27/2005	510572	Clear / Cool	Jim Constable	33	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-7
CITY:	Bend, Or.	MAP #2:		MH:	A2-6
LOCALE:	Easement	TAPE #:	4	TV'D LGTH:	635.78 ft

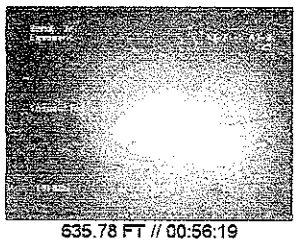
INSPECT REASON:	General Condition	PIPE SIZE:	42"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:1525	DIST	OBSERVATION
A2-7	9.02	inspection begins at upstream manhole



9.02 FT // 00:45:31



635.78 FT // 00:56:19

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/27/2005	**510572**	**Clear / Cool**	**Jim Constable**	**33**	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	**OEIIII**		**No**	**0**

1:1525	DIST	OBSERVATION
A2-6	635.78	inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	**Easement**	**01/27/2005**	**33**	

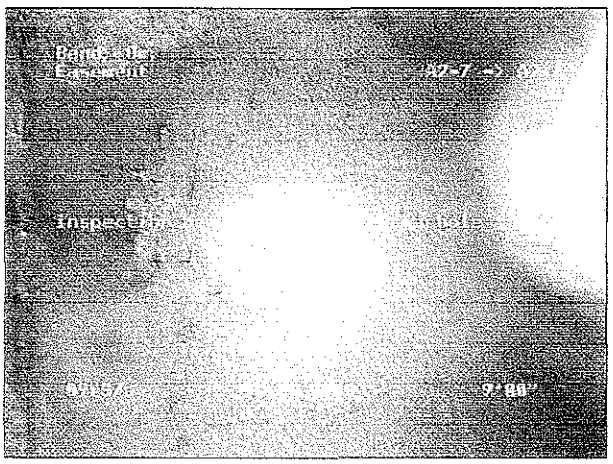


IMAGE: 71a, TAPE #: 4, 00:45:31
9.02FT, inspection begins at upstream manhole

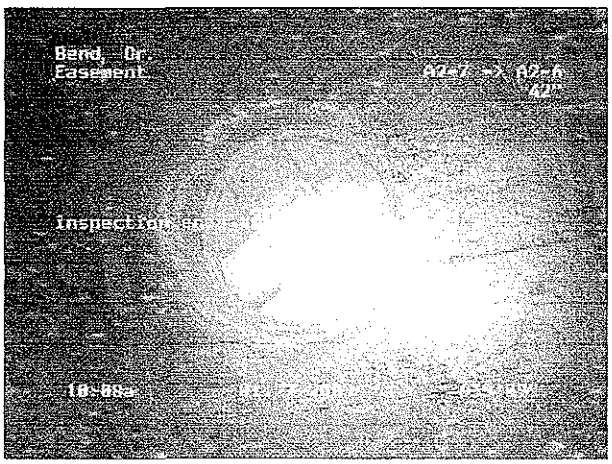


IMAGE: 72a, TAPE #: 4, 00:56:19
635.78FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

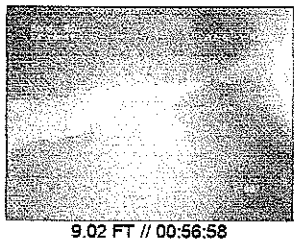
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/27/2005	510572	Clear / Cool	Jim Constable	34	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-6
CITY:	Bend, Or.	MAP #2:		MH:	A2-5
LOCALE:	Easement	TAPE #:	4	TV'D LGTH:	694.06 ft

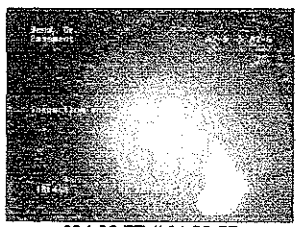
INSPECT REASON:	General Condition	PIPE SIZE:	42"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:1525	DIST	OBSERVATION
A2-6	9.02	inspection begins at upstream manhole



9.02 FT // 00:56:58



694.06 FT // 01:08:57

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/27/2005	**510572**	**Clear / Cool**	**Jim Constable**	**34**	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	**OEIIII**		**No**	**0**

1:1525	DIST	OBSERVATION
A2-5	694.06	inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	Easement	01/27/2005	34	

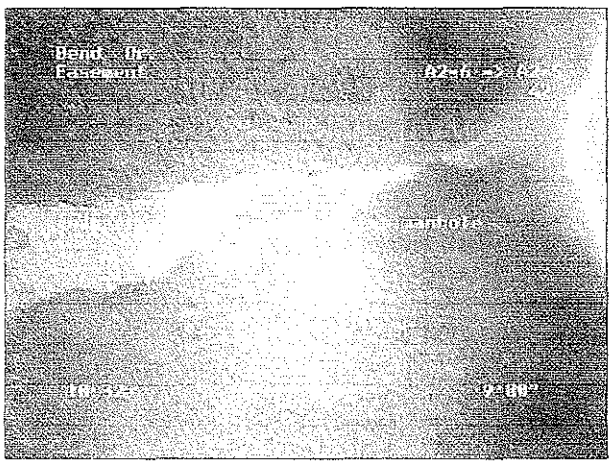


IMAGE: 73a, TAPE #: 4, 00:56:58
9.02FT, inspection begins at upstream manhole

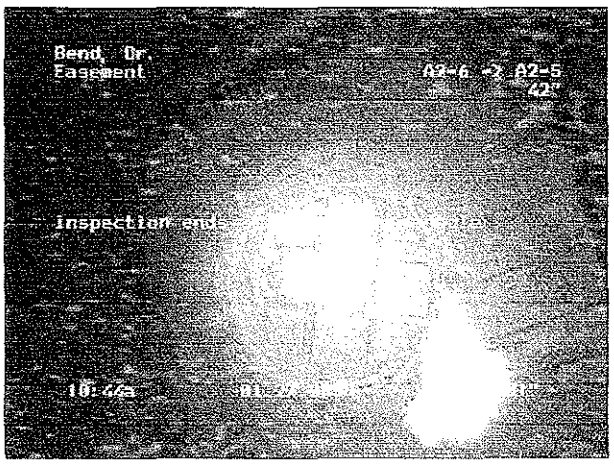


IMAGE: 74a, TAPE #: 4, 01:08:57
694.06FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

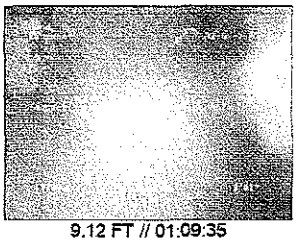
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/27/2005	510572	Clear / Cool	Jim Constable	35	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-5
CITY:	Bend, Or.	MAP #2:		MH:	A2-4
LOCALE:	Easement	TAPE #:	4	TV'D LGTH:	504.93 ft

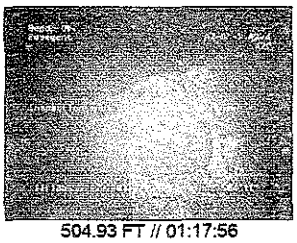
INSPECT REASON:	General Condition	PIPE SIZE:	42"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:1250	DIST	OBSERVATION
A2-5	9.12	Inspection begins at upstream manhole
A2-4	504.93	inspection ends at downstream manhole



9.12 FT // 01:09:35



504.93 FT // 01:17:56

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	**Easement**	**01/27/2005**	**35**	

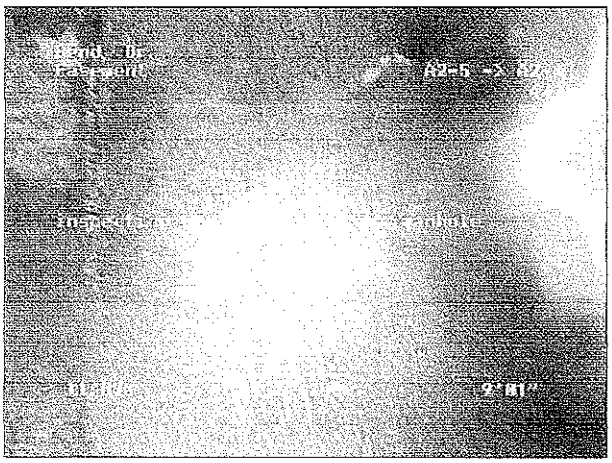


IMAGE: 75a, TAPE #: 4, 01:09:35
9.12FT, inspection begins at upstream manhole

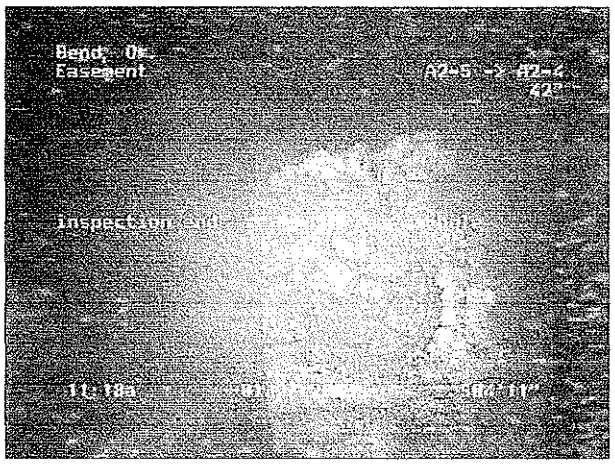


IMAGE: 76a, TAPE #: 4, 01:17:56
504.93FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

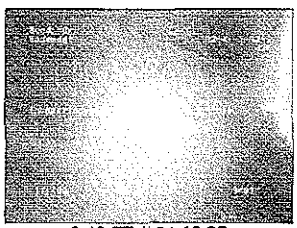
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/27/2005	510572	Clear / Cool	Jim Constable	36	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-4
CITY:	Bend, Or.	MAP #2:		MH:	A2-3
LOCALE:	Easement	TAPE #:	4	TV'D LGTH:	689.29 ft

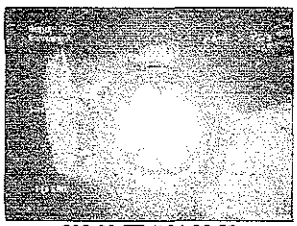
INSPECT REASON:	General Condition	PIPE SIZE:	42"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:1525	DIST	OBSERVATION
A2-4	9.12	inspection begins at upstream manhole



9.12 FT // 01:18:35



689.29 FT // 01:28:32

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/27/2005	**510572**	**Clear / Cool**	**Jim Constable**	**36**	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	**OEIIII**		**No**	**0**

1:1525	DIST	OBSERVATION
A2-3	689.29	inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	Easement	01/27/2005	36	

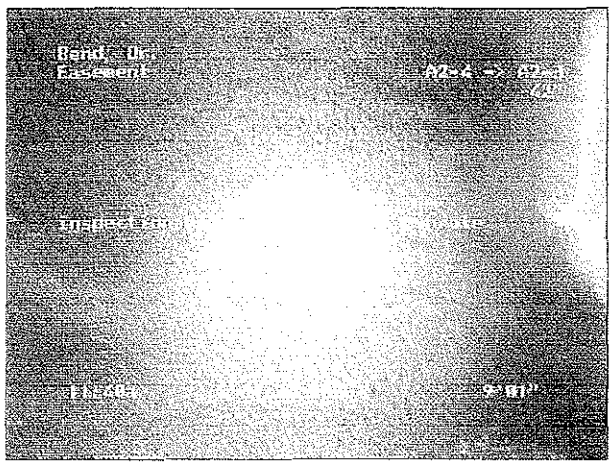


IMAGE: 77a, TAPE #: 4, 01:18:35
9.12FT, inspection begins at upstream manhole

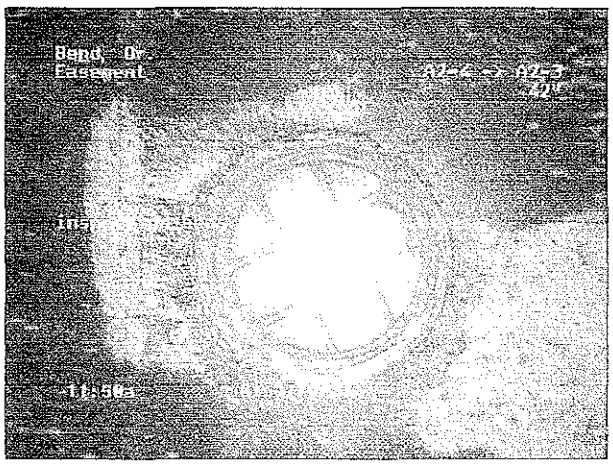


IMAGE: 78a, TAPE #: 4, 01:28:32
689.29FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

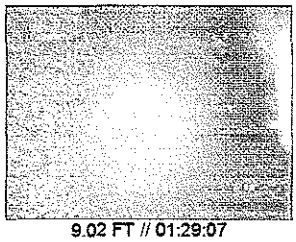
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/27/2005	510572	Clear / Cool	Jim Constable	37	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-3
CITY:	Bend, Or.	MAP #2:		MH:	A2-2
LOCALE:	Easement	TAPE #:	4	TV'D LGTH:	606.39 ft

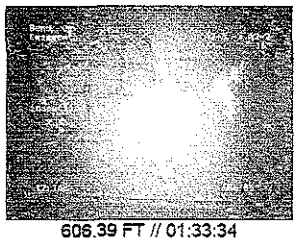
INSPECT REASON:	General Condition	PIPE SIZE:	36"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:1500	DIST	OBSERVATION
A2-3	9.02	inspection begins at upstream manhole
A2-2	606.39	inspection ends at downstream manhole



9.02 FT // 01:29:07



606.39 FT // 01:33:34

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	Easement	01/27/2005	37	

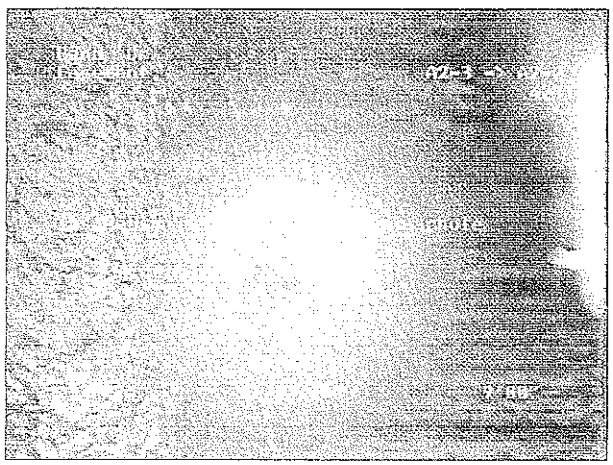


IMAGE: 79a, TAPE #: 4, 01:29:07
9.02FT, inspection begins at upstream manhole

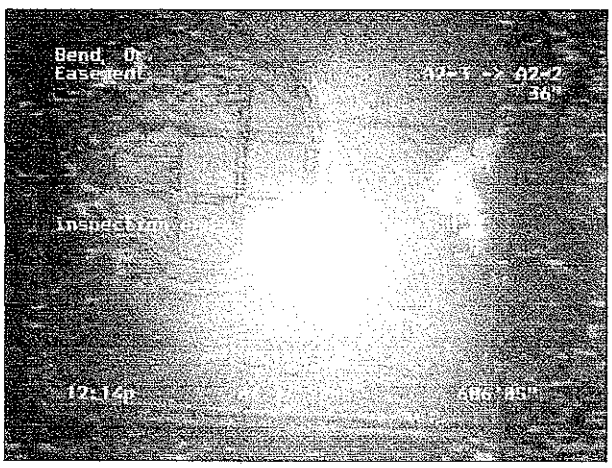


IMAGE: 80a, TAPE #: 4, 01:33:34
606.39FT, inspection ends at downstream manhole

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION REPORT

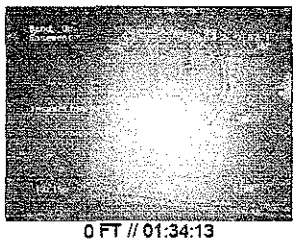
DATE:	WORK ORDER:	WEATHER:	OPERATOR:	SECTION NR:	SECTION NAME:
01/27/2005	510572	Clear / Cool	Jim Constable	38	
PRESENT:	VEHICLE:	CAMERA:	PRESET:	CLEANED:	RATE:
	TV-1-9001	OEIIII		No	0

STREET:	Easement	MAP #1:	22-11	MH:	A2-2
CITY:	Bend, Or.	MAP #2:		MH:	A2-1
LOCALE:	Easement	TAPE #:	4	TV'D LGTH:	430.24 ft

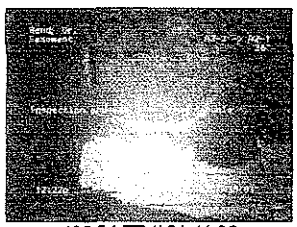
INSPECT REASON:	General Condition	PIPE SIZE:	36"
SECTION TYPE:	Sanitary Sewer	MATERIAL:	Cement JT LGTH:
AREA:		LINING:	Not Lined
		RSRVD:	

REMARK:

1:1050	DIST	OBSERVATION
A2-2	0.00	inspection begins at upstream manhole
	c	
A2-1	430.24	inspection ends at downstream manhole



0 FT // 01:34:13



430.24 FT // 01:41:06

PSC Industrial Outsourcing Group
395 W. Channel Rd
Benicia CA 94510
Tel: 707-746-8287, Fax: 707-746-8297

INSPECTION IMAGES

CITY:	STREET:	DATE:	SECTION NR:	SECTION NAME:
Bend, Or.	Easement	01/27/2005	38	

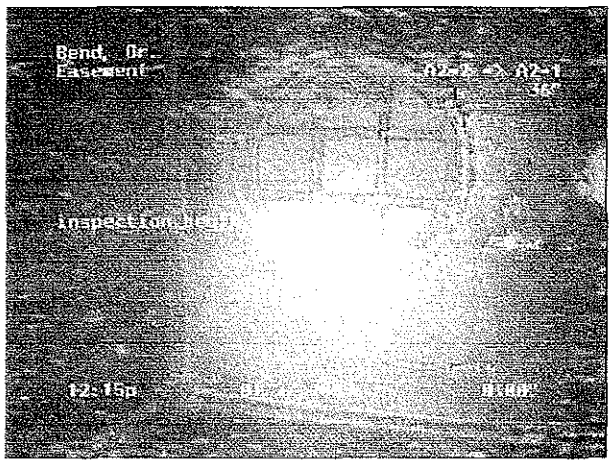


IMAGE: 81a, TAPE #: 4, 01:34:13
0FT, inspection begins at upstream manhole

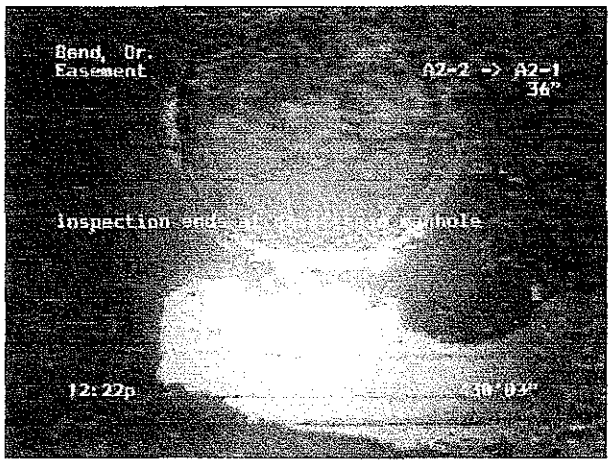


IMAGE: 82a, TAPE #: 4, 01:41:06
430.24FT, inspection ends at downstream manhole

Appendix F

CCTV Logs from CH2M HILL

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 39 (Upstream) **To** ( ) 38 (Downstream)

Date Televised: 1 / 24 / 05 **Pipe Diameter:** 42" **TV Tape No:** 1

Date Reviewed: 11 / 14 / 07 **Invert Depth:** **Counter Start:**

Crew: ____, ____, ____, ____ **Pipe Material:** 4 (1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other) **Counter Stop:**

Location: EASEMENT **Total Footage:** 706

Surface Condition: ____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other ____

Measurement: ____
1=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: ____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other ____

Frequency: ____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)
1 2 3 4 5

OBSERVATIONS: DIRECTIONS: FROM USMH → DSMH.

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
0		MWL				16"
0'-706'		SRIC				MINOR SURFACE DEGRADATION
0'-706'		DAGS				INTERMITTENT LIGHT GREASE
79'		SSSJ				MINOR SPALL @ JT.
538'		CCJ				
706'		AMH				A2-38 → A2-37

DEPTH OF FLOW ≅ 16"

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 38 (Upstream) **To** (A2) 37 (Downstream)

Date Televised: 1 / 24 / 05 **Pipe Diameter:** 42 **TV Tape No:** 1

Date Reviewed: 11 / 14 / 07 **Invert Depth:** _____ **Counter Start:** _____

Crew: _____, _____, _____, _____ **Pipe Material:** 4 **Counter Stop:** _____
1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: BASEMENT **Total Footage:** 621'

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
1=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)

1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
0-621'		MWL				16"
0		AMH				MH 38
129'		TRI				12"-DIP PROTUDING 3"
						PIPE JUNCTION - NO STRUCTURE
						@ 1:00
404'-407'						TAPE SKIPS
621'		AMH				MH # 37
0-621'		SRIC				MINOR SURFACE DETERIORATION
						ENTIRE LENGTH
0-621'		DAGS				TREEMENT LEAVE GRASS

DIRECTION USMH → DSMH

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 37 (Upstream) **To** (A2) 36 (Downstream)

Date Televised: 1 / 24 / 05 **Pipe Diameter:** 42" **TV Tape No:** 1

Date Reviewed: 11 / 14 / 07 **Invert Depth:** _____ **Counter Start:** _____

Crew: _____, _____, _____, _____ **Pipe Material:** 4 **Counter Stop:** _____

1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: EASEMENT **Total Footage:** 781

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
1=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)

1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
0		AMH				MH # 37
0-781		MWL				≈ 16"
0-781		SR1C				Minor Surface Deterioration
—	—	—	—	—	—	Entering Prop Line
182'		DAET				Minor Mineral Staining.
549'		DAET				" " "
763'		SSSJ				Minor Surface Spall @ Jt.
—	—	—	—	—	—	@ 12:00
781'		AMH				MH # 36

Possible Spray Liner.

Direction USMH → DSMH

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 36 (Upstream) **To** (A2) 35 (Downstream)

Date Televised: 1 / 24 / 05 **Pipe Diameter:** 42" **TV Tape No:** 1

Date Reviewed: 11 / 14 / 07 **Invert Depth:** _____ **Counter Start:** _____

Crew: _____, _____, _____, _____ **Pipe Material:** 4 **Counter Stop:** _____

1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: Easement **Total Footage:** _____

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
.=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)

1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
0-384		MWL				16"
0		AMH				MH # 36
0-384		SRIC				Minor Surface Deterioration
						Entire Length
24		SSSS				Minor Surface Spall @
						2:40
384		AMH				MH # 35

Direction USMH → DSMH

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 35 (Upstream) **To** (A2) 34 (Downstream)

Date Televised: 01 / 24 / 05 **Pipe Diameter:** 42" **TV Tape No:** _____

Date Reviewed: 11 / 14 / 07 **Invert Depth:** _____ **Counter Start:** _____

Crew: _____, _____, _____, _____ **Pipe Material:** 4 **Counter Stop:** _____
1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: BASEMENT **Total Footage:** 591

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
1=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)

1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
0-591		MWL				21½"
0-591		SBSL				Minor Surface Deterioration / Broken Lenth.
0		AMH				MH #35
33		SSSS				Minor Surface Crack @ 12:00
0-591		DAGS				Intermittent Light Grease
231		DAFT				@ 4:00 Mineral Deposit @ Waterline.
591		AMH				MH #34
						2 - 8"-10" Pipes Connect @ 2:00 Dir
						3 45° Bend In Pipe @ MH.

Direction USMH → DSMH

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 34 (Upstream) **To** (A2) 33 (Downstream)

Date Televised: 1 / 25 / 07 **Pipe Diameter:** 42 **TV Tape No:** 1

Date Reviewed: 11 / 14 / 07 **Invert Depth:** _____ **Counter Start:** _____

Crew: _____, _____, _____, _____ **Pipe Material:** 4 **Counter Stop:** _____

1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: EASEMENT **Total Footage:** 505

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
1=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)
1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
0-505		WWL				≈ 10-12"
0		AMH				MH # 34
0-120'		DAGS				GREASE DEPOSITS - MODERATE 8:00
						PEELING AWAY IN PLACES 4:00
120'-505'		DAGS				INTERMITTENT GREASE
						DEPOSITS
505'		AMH				MH # 33
0-505						VISABILITY IMPAIRED BY
						STEAM
0-505'		SREC				MINOR SURFACE DETERIORATION
						"TRULY" CONTINUOUS

DIRECTION: USMH --> DSMH

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 33 (Upstream) **To** (A2) 32 (Downstream)

Date Televised: 1/25/05 **Pipe Diameter:** 42 **TV Tape No:** 1

Date Reviewed: 11/15/07 **Invert Depth:** _____ **Counter Start:** _____

Crew: _____, _____, _____, _____ **Pipe Material:** 4 (1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other) **Counter Stop:** _____

Location: BASEMENT **Total Footage:** 338

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
1=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)
1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
0'		AMH				MH # 33
0-338		MWL				10"-12"
0-338		SRIC				MINOR SURFACE DETERIORATION
						TOTALLY CONTINUOUS
0-300'		DAGS				MODERATE, CONTINUOUS
						8:00-1000 & 2:00-400
0-338						VISIBILITY IMPAIRED BY
						STEAM
338'		AMH				MH # 32

DIRECTION USMH → DSMH

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 32 (Upstream) **To** (A2) 31 (Downstream)

Date Televised: 1/25/05 **Pipe Diameter:** 42 **TV Tape No:** 1

Date Reviewed: 11/15/07 **Invert Depth:** _____ **Counter Start:** _____

Crew: _____, _____, _____, _____ **Pipe Material:** 4 (1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other) **Counter Stop:** _____

Location: EASEMENT **Total Footage:** 399

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
_=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)
1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
0		AMH				MH #32
0-399		SRCL				MINOR SURFACE DETERIORATION
						"TRUSS" CONTINUOUS.
0-399		MWL				16"
0-302		DAGS				LIGHT ITERMITTANT
						GREASE DEPOSITS.
302-312		DAGS				MODERATE, PERSISTANT 8:00-10:00
361-322		DAGS				MODERATE ITERMITTENT
399		AMH				MH #31 END OF SURVEY.

DIRECTION USMH → DSMH

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 31 (Upstream) **To** (A2) 30 (Downstream)

Date Televised: 1 / 25 / 05 **Pipe Diameter:** 42 **TV Tape No:** 1

Date Reviewed: 11 / 15 / 07 **Invert Depth:** _____ **Counter Start:** _____

Crew: _____, _____, _____, _____ **Pipe Material:** 4 **Counter Stop:** _____
1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: EASEMENT **Total Footage:** _____

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)

1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
0		AMH				MH # 31 Begin Survey
0-217		SRIC				Minor Surface Deterioration
						"Tenty" Continuous,
0-217		MWL				16"
0-217		MGS				Light Treatment Grease
						Buildup.

DIRECTION: USMH → DSMH.

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 30 (Upstream) **To** (A2) 29 (Downstream)

Date Televised: 1 / 25 / 05 **Pipe Diameter:** 12 **TV ~~Tape~~ DVD No:** 1

Date Reviewed: 11 / 15 / 07 **Invert Depth:** _____ **Counter Start:** _____

Crew: _____, _____, _____, _____ **Pipe Material:** 4 **Counter Stop:** _____

1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: EASEMENT **Total Footage:** 150

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)

1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
0		AMH				USMH # 30 START SURVEY
0-150		MWL				18"
0-150		SRIC				MINOR SURFACE DETERIORATION
						TRULY CONT.
0-150		DAGS				LIGHT INTERMITTENT GREASE
150		MH2				MH # 29 END SURVEY

SURVEY DIRECTION: USMH → DSMH.

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 29 (Upstream) **To** (A2) 28 (Downstream)

Date Televised: 1 / 25 / 05 **Pipe Diameter:** 42 **TV DVD No:** 2

Date Reviewed: 11 / 15 / 07 **Invert Depth:** _____ **Counter Start:** _____

Crew/Reviewer: JC / MAW **Pipe Material:** 4 **Counter Stop:** _____

1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: EASEMENT **Total Footage:** 579

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
1=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)

1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
0		MH				USMH # 29 START SURVEY
0-589		SRIC				MINOR, "TRULY" CONT.
0-589		DAGS				LIGHT ITERMITTENT
0-589		MWL				16"
589		MH				DSMH # 28 END SURVEY

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 28 (Upstream) **To** (A2) 27 (Downstream)

Date Televised: 1/25/05 **Pipe Diameter:** 42" **TV DVD No:** 2

Date Reviewed: 11/15/07 **Invert Depth:** **Counter Start:**

Crew/Reviewer: IC / MAW, **Pipe Material:** 4 **Counter Stop:**
1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: BASEMENT **Total Footage:**

Surface Condition:
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other

Measurement:
Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required:
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other

Frequency:
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)
1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
0		AMH				USMH # 28
0-480		SRIC				LIGHT, TRULY CONT.
0-480		MWL				21"
0-480		DMGS				INTERMITTENT, LIGHT.
480		AMH				DSMH # 27

Survey Direction: USMH → DSMH.

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 27 (Upstream) **To** (A2) 26 (Downstream)

Date Televised: 1 / 25 / 05 **Pipe Diameter:** 42 **TV DVD No:** 2

Date Reviewed: 11 / 15 / 07 **Invert Depth:** _____ **Counter Start:** _____

Crew/Reviewer: JC / MW **Pipe Material:** 4 **Counter Stop:** _____

1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: EASEMENT **Total Footage:** 330

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
1=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: ____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)

1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
0		AMH				USMH # 27 Street Surface
0-330		CRC				Missing "Tainy" Cover
0-330		MWL				18"
0-330		MGI				Light, Infiltration
330						DSMH # 26 End Survey

Survey Direction: USMH → DSMH.

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 26 (Upstream) **To** (A2) 25 (Downstream)

Date Televised: 1 / 25 / 05 **Pipe Diameter:** 42" **TV Tape No:** 2

Date Reviewed: 11 / 16 / 07 **Invert Depth:** _____ **Counter Start:** _____

Crew: JC, _____, _____, _____ **Pipe Material:** 4 **Counter Stop:** _____

1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: Easement **Total Footage:** 377' 03"

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)

1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
0		AMH				USMH # 26 Start survey
0 - 377		SRTC				Minor, "Truly"
52'08"		OBJ				Minor
257'06"		OBJ				Minor
305'08"		OBJ				Minor
0 - 377		MWL				Slightly less than 1/2 full
377'03"		AMH				DSMH # 25, End Survey

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 25 (Upstream) **To** (A2) 24 (Downstream)

Date Televised: 1 / 25 / 05 **Pipe Diameter:** 42" **TV Tape No:** 2

Date Reviewed: 11 / 16 / 07 **Invert Depth:** _____ **Counter Start:** _____

Crew: JC, _____, _____, _____ **Pipe Material:** 4 (1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other) **Counter Stop:** _____

Location: Easement **Total Footage:** 224' 10"

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)
1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
0		AMH				USMH #25 Start Survey
103		OBJ				Minor
111		OBJ				Minor
151		OBJ				Minor
190		OBJ				Minor
206		OBJ				Minor
214		OBJ				Minor
0-224		SRIC				Light, "Truly"
224'10"		AMH				DSMH #24 - End Survey
0-224		MWL				Less than 1/2 full

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 24 (Upstream) **To** (A2) 23 (Downstream)

Date Televised: 1 / 25 / 05 **Pipe Diameter:** 42 **TV Tape No:** _____

Date Reviewed: 11 / 16 / 07 **Invert Depth:** _____ **Counter Start:** _____

Crew: JC, _____, _____, _____ **Pipe Material:** 4 **Counter Stop:** _____

1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: Easement **Total Footage:** 759' 0"

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)

1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
0		AMH				USMH #24 - Start Survey
0-759		SRIC				Light - Truly
126		OBJ				Minor
140		OBJ				Minor - Could be a hole - could not
						tell from angle
157		OBJ				Minor
166		RFL				Light roots
181		OBJ				minor
189		RFL				Fine Roots
245		OBJ				Minor
261		OBJ				minor
276		OBJ				Minor
394		RFL				
426		RFB				
473		RFB				
481		RFB				
512		RFL				
567		OBJ				Minor
638		RFB				
741		OBJ				Minor
759' 0"		AMH				DSMH #23 - End Survey
0-759		MWL				less than 1/2 full

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 23 (Upstream) **To** (A2) 22 (Downstream)

Date Televised: 1 / 25 / 05 **Pipe Diameter:** 42" **TV Tape No:** 2

Date Reviewed: 11 / 16 / 07 **Invert Depth:** **Counter Start:**

Crew: JC, , , BLA **Pipe Material:** 4 (1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other) **Counter Stop:**

Location: Easement **Total Footage:** 420'01"

Surface Condition:
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other

Measurement:
Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required:
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other

Frequency:
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)
1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
0		AMH				USMH # 23 - Start Survey
0 - 420		SRIC				Light - Truby
32		RFL				
40		RFL				
119		RFB				
174		RFL				
253		RFL				
301		RFL				
308		DAE				or Roots?
378		DAE				or Roots?
385		OBJ				Minor
398-420		DAGS				minor
0 - 420		MWL				Less than 1/2 Full
420'01"		AMH				DSMH # 22 - End Survey

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 22 (Upstream) **To** (A2) 21 (Downstream)

Date Televised: 1 / 26 / 05 **Pipe Diameter:** 42" **TV Tape No:** 2

Date Reviewed: 11 / 16 / 07 **Invert Depth:** _____ **Counter Start:** _____

Crew: JC, _____, _____, BLA **Pipe Material:** 4 **Counter Stop:** _____

1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: Easement **Total Footage:** _____

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)

1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
0		AMH				USMH # 22 - Start Survey
9-17		CL				
0-342		SRIC				Truly - Minor
71		RFL				
87		RFL				
87-95		CL				
125-342		RFL				at most joints - light
125-342		DAGS				Deposits at Joints - Light
342		AMH				DSMH # 21 End Survey
0-342		MWL				Less than 1/2 full

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 21 (Upstream) **To** (A2) 20 (Downstream)

Date Televised: 1 / 26 / 05 **Pipe Diameter:** 12" **TV Tape No:** 2

Date Reviewed: 11 / 16 / 07 **Invert Depth:** _____ **Counter Start:** _____

Crew: JC, _____, _____, BLA **Pipe Material:** 4 **Counter Stop:** _____

1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: Easement **Total Footage:** 617' 08"

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
1=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)

1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
≈4'		AMH				USMH #21 - Start Survey
						visability is poor- foggy
32-47		CL				
4 - 618		MWL				≈ 1/4 full
108		MGO				visability is slightly better
153		DAGS				Moderate - at Joint
286		MGO				visability back to normal
286		DAGS				Minor- at joint
286-618		SRIG				minor - truly
617' 08"		AMH				DSMH #20 - End survey

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 20 (Buried) Upstream **To** (A2) 19 Downstream

Date Televised: 1 / 26 / 05 **Pipe Diameter:** 42" **TV Tape No:** 3

Date Reviewed: 11 / 16 / 07 **Invert Depth:** _____ **Counter Start:** _____

Crew: JC, _____, _____, BLA **Pipe Material:** 4 **Counter Stop:** _____

1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: Easement **Total Footage:** 490'09"

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)

1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
0		AMH				USMH #20 - Start Survey
0-		MWL				level 1/4 full
1016		OBJ				minor
490'09"		MSA				Abandoned due to debris
						under water line

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 19 (Upstream) **To** (A2) 18 (Downstream)

Date Televised: 1/26/05 **Pipe Diameter:** 42 **TV Tape No:** 3

Date Reviewed: 11/16/07 **Invert Depth:** _____ **Counter Start:** _____

Crew: JC, _____, _____, BLA **Pipe Material:** 4 **Counter Stop:** _____

1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: Easement **Total Footage:** 505' 11"

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
1=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)

1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
0		AMH				US MH # 19 - Start Survey
0 - 506		MWL				43 full
505'11"		AMH				DS MH # 18 - End Survey

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 18 (Upstream) **To** (A2) 17 (Downstream)

Date Televised: 1 / 26 / 05 **Pipe Diameter:** 42 **TV Tape No:** 3

Date Reviewed: 11 / 16 / 07 **Invert Depth:** _____ **Counter Start:** _____

Crew: JC, _____, _____, BLA **Pipe Material:** 4 **Counter Stop:** _____

1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: Easement **Total Footage:** 655' 08"

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
1=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)

1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
9		AMH				USMH #18 - Start @ ~9'
40-655		DAGS				minor - truly
480		RFL				
655' 08"		AMH				DSMH #17 - End Survey
9-655		MWL				less than 1/2 full

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 17 (Upstream) **To** (A2) 16 (Downstream)

Date Televised: 1 / 26 / 05 **Pipe Diameter:** 42 **TV Tape No:** 3

Date Reviewed: 11 / 10 / 07 **Invert Depth:** _____ **Counter Start:** _____

Crew: JC, _____, _____, BLA **Pipe Material:** 4 **Counter Stop:** _____

1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: Easement **Total Footage:** 168

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)
1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
0		AMH				USMH #17 - Start Survey
0		MWL				less than 1/2 full
167'08"		AMH				

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 16 (Upstream) **To** (A2) 15 (Downstream)

Date Televised: 1 / 26 / 05 **Pipe Diameter:** 42" **TV Tape No:** 3

Date Reviewed: 11 / 16 / 07 **Invert Depth:** **Counter Start:**

Crew: JC, , , BLA **Pipe Material:** 4 **Counter Stop:**
1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: Easement **Total Footage:**

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

RIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)

1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
0		AMH				USMH # 16 - Start Survey
0-40		SRCC				
0 - 40		DAGS				
95		RFL				
125-638		DAGS				Light
224		RFL				
231		RFL				
250-638		MWL				1/4 full
535		RFL				
638'05"		AMH				DSMH #15 - End Survey

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 15 (Upstream) **To** (A2) 14 (Downstream)

Date Televised: 1 / 26 / 05 **Pipe Diameter:** 48" **TV Tape No:** 3

Date Reviewed: 11 / 16 / 07 **Invert Depth:** _____ **Counter Start:** _____

Crew: JC, _____, _____, BLA **Pipe Material:** 4 **Counter Stop:** _____

1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: Easement **Total Footage:** 275'04"

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)

1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
0		AMH				USMH #15 - Start Survey
0		MWL				1/3 full
13-275		DPGS				
123-202		CL				Right side (3' o'clock)
123-272		CL				9 o'clock
230-230		CL				3 o'clock
275'04"		AMH				DSMH #14 - End Survey

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 14 (Upstream) **To** (A2) 13 (Downstream)

Date Televised: 1 / 26 / 05 **Pipe Diameter:** 36" **TV Tape No:** 3

Date Reviewed: 11 / 16 / 07 **Invert Depth:** **Counter Start:**

Crew: JC, , , BLA **Pipe Material:** 4 **Counter Stop:**
1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: Easement **Total Footage:** 496'03"

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)
1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
0		AMH				USMH #14 - Start Survey
6		MWL				1/2 full
11-150		CM				
11-150		DAGS				Truly - light - in cracks
209-218		CL				
335		RFL				
445-496		SRIC				minor
496'03"		AMH				DSMH #13 - End Survey

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 13 (Upstream) **To** (A2) 12 (Downstream)

Date Televised: 1 / 26 / 05 **Pipe Diameter:** 36" **TV Tape No:** 3

Date Reviewed: 11 / 19 / 07 **Invert Depth:** **Counter Start:**

Crew: JC, , , BLA **Pipe Material:** 4 **Counter Stop:**
1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: Easement **Total Footage:** 810' 09"

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)
1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
0		AMH				USMH # 13 - Start Survey
122-130		SRIC				minor
194-209		SRIC				minor
230-496		SRIC				
254-496		DAGS				
383		RFL				
509		RFL				
516-752		DAGS				
516-697		SRIC				
650		OBJ				minor
810' 09"		AMH				DSMH # 12 - End Survey

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 12 (Upstream) **To** (A2) 11 (Downstream)

Date Televised: 1 / 26 / 05 **Pipe Diameter:** 36" **TV Tape No:** 3

Date Reviewed: 11 / 19 / 07 **Invert Depth:** **Counter Start:**

Crew: JC, , , BLD **Pipe Material:** 4 **Counter Stop:**
1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: Easement **Total Footage:** 413' 00"

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)
1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
9		AMH				USMH # 12 - Start Survey
26		CL				
39-43		CL				
56		OBS				minor
121-158		CL				
131-158		DAGS				~~Mi~~ Light
158-170		SRIC				minor
184		CL				
258		OBS				minor
356-370		SRIC				minor
413'						DSMH # 11 - End Survey

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 11 (Upstream) **To** (A2) 10 (Downstream)

Date Televised: 1 / 26 / 05 **Pipe Diameter:** 36" **TV Tape No:** 3

Date Reviewed: 11 / 19 / 07 **Invert Depth:** _____ **Counter Start:** _____

Crew: JC, _____, _____, BLA **Pipe Material:** 4 **Counter Stop:** _____

1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: Easement **Total Footage:** 668' 01"

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)

1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
0		AMH				USMH #11 - Start Survey
0-668		SRIC				
15		CL				
0-668		DAGS				
98		OBJ	RFL			
104		CL				
546		OBJ				miter
668' 01"		AMH				DSMH #10 - End Survey

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 10 (Upstream) **To** (A2) 9 (Downstream)

Date Televised: 1/27/05 **Pipe Diameter:** 36" **TV Tape No:** 4

Date Reviewed: 11/19/07 **Invert Depth:** **Counter Start:**

Crew: JC, , , BLA **Pipe Material:** 4 **Counter Stop:**
1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: Easement **Total Footage:** 751' 03"

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
1=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)
1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
9		AMH				USMH #110 - start survey
9-198		SRIC				
9-198		DAGS				
580-741		CL				cannot read footage on screen
751' 03"						

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 9 (Upstream) **To** (A2) 8 (Downstream)

Date Televised: 1 / 27 / 05 **Pipe Diameter:** 36" **TV Tape No:** 4"

Date Reviewed: 11 / 19 / ____ **Invert Depth:** ____ **Counter Start:** ____

Crew: JC, ____, ____, BLA **Pipe Material:** 4 **Counter Stop:** ____

1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: Eas **Total Footage:** 499' 09"

Surface Condition: ____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other ____

Measurement: ____
=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: ____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other ____

Frequency: ____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)

1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
0		AMH				USMH #9 - Start Survey
4-29		CL				
54-62		CL				
517-519		DAGS				
534-543		DAGS				
499'09"		AMH				DSMH #8 - End Survey

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 8 (Upstream) **To** (A2) 7 (Downstream)

Date Televised: 1 / 27 / 05 **Pipe Diameter:** 42" **TV Tape No:** 4

Date Reviewed: 11 / 19 / 07 **Invert Depth:** **Counter Start:**

Crew: JC, , , BLA **Pipe Material:** 4 **Counter Stop:**
1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: Easement **Total Footage:** 750' 00"

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)

1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
9		AMH				USMH#8 - Start Survey
145-155		CL	DAGS			
171-176		DAGS				
198-218		DAGS				
510-518		CL				
691		OBJ				Minor
750'00"		AMH				DSMH #7 - End Survey

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 7 (Upstream) **To** (A2) 6 (Downstream)

Date Televised: 1 / 27 / 05 **Pipe Diameter:** 42" **TV Tape No:** 4

Date Reviewed: 11 / 19 / 07 **Invert Depth:** _____ **Counter Start:** _____

Crew: JC, _____, _____, BLA **Pipe Material:** 4 **Counter Stop:** _____

1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: Easement **Total Footage:** 635'09"

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
1=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)

1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
9		AMH				USMH #7 - Start Survey
80		OBJ				
96		OBJ				
446-453		DAGS				
635'09"		AMH				DSMH #6 - End Survey

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 6 (Upstream) **To** (A2) 5 (Downstream)

Date Televised: 1 / 27 / 05 **Pipe Diameter:** 42" **TV Tape No:** 4

Date Reviewed: 11 / 19 / 07 **Invert Depth:** _____ **Counter Start:** _____

Crew: JC, ____, ____, BLD **Pipe Material:** 4 **Counter Stop:** _____

1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: Easement **Total Footage:** 694' 01"

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
1=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)

1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
9		AMH				USMH #6 - Start Survey
11-14		DAGS				
39-48		CL				
215		OBJ				
265-275		DAGS				
674		OBJ				
683		OBJ				
685-693		DAGS				
694'01"		AMH				DSMH #5 - End Survey

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 5 (Upstream) **To** (A2) 4 (Downstream)

Date Televised: 1 / 27 / 05 **Pipe Diameter:** 42" **TV Tape No:** 4

Date Reviewed: 11 / 19 / 07 **Invert Depth:** **Counter Start:**

Crew: JC, , , BLA **Pipe Material:** 4 **Counter Stop:**
1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: Easement **Total Footage:** 504' 11"

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)
1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
9		AMH				USMH #5 - Start Survey
25-78		CL	DAGS			
177-206		CL	DAGS			
255-448		CL	DAGS			
504' 11"		AMH				DSMH #4 End Survey

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 4 (Upstream) **To** (A2) 3 (Downstream)

Date Televised: 1 / 27 / 05 **Pipe Diameter:** 42" **TV Tape No:** 4

Date Reviewed: 11 / 19 / 07 **Invert Depth:** _____ **Counter Start:** _____

Crew: JC, ____, ____, BIA **Pipe Material:** 4 **Counter Stop:** _____

1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: Easement **Total Footage:** 1689' 04"

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)

1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
9		AMH				USMH #4 - Start Survey
149		OBJ				minor
272		OBJ				Minor
411		RFL				
428		RFL				
550-582		DAGS				Light
1689' 04"		AMH				DSMH #3 End survey

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 3 (Upstream) **To** (A2) 2 (Downstream)

Date Televised: 1 / 27 / 05 **Pipe Diameter:** 36" **TV Tape No:** 4

Date Reviewed: 11 / 19 / 07 **Invert Depth:** _____ **Counter Start:** _____

Crew: JC, _____, _____, BCD **Pipe Material:** 4 **Counter Stop:** _____

1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: Easement **Total Footage:** 606' 05"

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)

1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
9		AMH				USMH #3 - Start Survey
23-30		CL				
44-230		CM	DAGS	CL		
251-285		CM	CL	DAGS		
285-466		SRIC				minor
293-558		CM	CL	DAGS		
606'05"		AMH				DSMH #2 = End Survey

1999 © Wade & Associates, Inc.

TELEVISION INSPECTION

City of Bend, OR

Line Segment: (A2) 2 (Upstream) **To** (A2) 1 (Downstream)

Date Televised: 1 / 27 / 05 **Pipe Diameter:** 36" **TV Tape No:** 4

Date Reviewed: 1 / 19 / 07 **Invert Depth:** _____ **Counter Start:** _____

Crew: JC, ____, ____, BLA **Pipe Material:** 4 **Counter Stop:** _____

1=vcp, 2=pvc, 3=dip, 4=rcp, 5=cmp, 6=CIP, 7=Obg, 8=Other

Location: Easement **Total Footage:** 430' 03"

Surface Condition: _____
1=Open Field
2=Street (Paved)
3=Street (Unpaved)
4=Sidewalk
5=Front Yard
6=Back Yard
7=Side Yard
8=Building, Structure
9=Street ROW
10=Other _____

Measurement: _____
=Estimated
2=Scaled From Map
3=Tape Measure
4=Surveyed
5=Walking Wheel

Maintenance Required: _____
1=Flush
2=Jet Flush
3=Power Rod
4=Root Cutter
5=Vapor Rooter
6=Bucket
7=Vacuum
8=Other _____

Frequency: _____
1=Monthly
2=Quarterly
3=Semi-Annual
4=Annual
5=Every Two Years
6=Every Five Years
7=Once Only

PRIORITY LEVEL:
(Circle One; 1=Highest, 5=Lowest)
1 2 3 4 5

OBSERVATIONS:

Footage:	Measurement from Up/Down: (U/D)	Observation Code: 1	2	3	4	Comments:
0		AMH				USMH #2 - Start Survey
0-430		CL	DAGS	CM		Light deposit - Truck
430' 03"		AMH				DSMH #1 - End Survey

1999 © Wade & Associates, Inc.

Appendix G

CCTV DVDs

Table I-1

Recommended System Improvement Cost Summary
Fully Deteriorated Host Pipe

Part	Description of Improvements	Fully Deteriorated Cost Estimate ($)	Partially Deteriorated Cost Estimate ($)
A	Annual Cleaning and Maintenance Program	$98,000	$98,000
Total	**Annual Maintenance**	**$98,000**	**$98,000**
B	Immediate Maintenance	$30,000	$30,000
C	Pipeline Rehabilitation/Renewal for Priority 1 Work	$2,288,000	$1,882,000
D	Pipeline Rehabilitation/Renewal for Priority 2 Work	$2,385,000	$1,852,000
E	Pipeline Rehabilitation/Renewal for Priority 3 Work	$866,000	$674,000
Subtotal		**$5,569,000**	**$4,438,000**
	Engineering (15%)	$835,000	$666,000
	City Administration & Legal (10%)	$557,000	$444,000
Subtotal		**$6,961,000**	**$5,548,000**
	Contingency (30%)	$2,088,000	$1,664,000
Total	**Excluding Part A - Annual Maintenance**	**$9,049,000**	**$7,212,000**

Table I-2

Recommended System Improvement Cost Summary
Partially Deteriorated Host Pipe

Part	Description of Improvements	Partially Deteriorated Cost Estimate ($)	Partially Deteriorated Cost Estimate ($)
A	Annual Cleaning and Maintenance Program	$98,000	$98,000
Total	**Annual Maintenance**	**$98,000**	**$98,000**
B	Immediate Maintenance	$30,000	$30,000
C	Pipeline Rehabilitation/Renewal for Priority 1 Work	$1,882,000	$1,882,000
D	Pipeline Rehabilitation/Renewal for Priority 2 Work	$1,852,000	$1,852,000
E	Pipeline Rehabilitation/Renewal for Priority 3 Work	$674,000	$674,000
Subtotal		**$4,438,000**	**$4,438,000**
	Engineering (15%)	$666,000	$666,000
	City Administration & Legal (10%)	$444,000	$444,000
Subtotal		**$5,548,000**	**$5,548,000**
	Contingency (30%)	$1,664,000	$1,664,000
Total	**Excluding Part A - Annual Maintenance**	**$7,212,000**	**$7,212,000**

Table IV-1

Recommended Impelmentation Plan

Part	Description of Improvements	Year 1	Year 2 - 7, Average $	Year 8	Year 9	Year 10
A	Annual Cleaning & Maint. Program	$98,000	$109,000	$124,000	$78,000	$40,000
B	Immediate Maintenance	$30,000				
C	Pipeline Rehabilitation Priority 1 Work			$2,898,000		
D	Pipeline Rehabilitation Priority 2 Work				$3,112,000	
E	Pipeline Rehabilitation Priority 3 Work					$1,164,000

City of Bend, OR

Basin Up	Up Manhole	Basin Dn	Down Manhole	Preliminary Review (Y/N)	Redo Request Date	Redo Reason	Notes
A2	39	A2	38				
A2	38	A2	37				
A2	37	A2	36				
A2	36	A2	35				
A2	35	A2	34				
A2	34	A2	33				
A2	33	A2	32				
A2	32	A2	31				
A2	31	A2	30				
A2	30	A2	29				
A2	29	A2	28				
A2	28	A2	27				
A2	27	A2	26				
A2	26	A2	25				
A2	25	A2	24				
A2	24	A2	23				
A2	23	A2	22				
A2	22	A2	21				
A2	21	A2	20				
A2	20	A2	19				
A2	19	A2	18				
A2	18	A2	17				
A2	17	A2	16				
A2	16	A2	15				
A2	15	A2	14				
A2	14	A2	13				
A2	13	A2	12				
A2	12	A2	11				
A2	11	A2	10				
A2	10	A2	9				
A2	9	A2	8				
A2	8	A2	7				
A2	7	A2	6				
A2	6	A2	5				
A2	5	A2	4				
A2	4	A2	3				
A2	3	A2	2				
A2	2	A2	1				

APPENDIX A: CCTV REVIEW Yeoman Interceptor

City of Bend, OR

Upstream Manhole	Downstream Manhole	Pipe Length (ft.)	Feet Televised	Pipe Diameter (in.)	Pipe Type	Crew #:	Date Televised	Tape No:	Observations:	Notes
A2-39	A2-38	706	706	42	RCP	JC	1/24/2005	1	SRI, DAGS, SSS (79'), CC (538')	
A2-38	A2-37	621	621	42	RCP	JC	1/24/2005	1	TBI (129'), SRI, DAGS	
A2-37	A2-36	781	781	42	RCP	JC	1/24/2005	1	SRI, DAE (182', 549'), SSS (763')	
A2-36	A2-35	384	384	42	RCP	JC	1/24/2005	1	SRI, SSS (24')	**As-Built Drawings indicate 36" pipe**
A2-35	A2-34	591	591	42	RCP	JC	1/24/2005	1	SRI, SSS (33'), DAGS, DAE (231')	**As-Built Drawings indicate 30" pipe**
A2-34	A2-33	505	505	42	RCP	JC	1/25/2005	1	DAGS, SRI	**Limited visablily due to steam As-Built Drawings indicate 36" pipe**
A2-33	A2-32	338	338	42	RCP	JC	1/25/2005	1	SRI, DAGS	**Limited visablily due to steam As-Built Drawings indicate 36" pipe**
A2-32	A2-31	399	399	42	RCP	JC	1/25/2005	1	SRI, DAGS	**As-Built Drawings indicate 36" pipe**
A2-31	A2-30	217	217	42	RCP	JC	1/25/2005	1	SRI, DAGS	**As-Built Drawings indicate 36" pipe**
A2-30	A2-29	150	150	42	RCP	JC	1/25/2005	1	SRI, DAGS	**As-Built Drawings indicate 36" pipe**
A2-29	A2-28	589	589	42	RCP	JC	1/25/2005	2	SRI, DAGS	**As-Built Drawings indicate 30" pipe**
A2-28	A2-27	480	480	42	RCP	JC	1/25/2005	2	SRI, DAGS	**As-Built Drawings indicate 30" pipe**
A2-27	A2-26	330	330	42	RCP	JC	1/25/2005	2	SRI, DAGS	**As-Built Drawings indicate 32" pipe**
A2-26	A2-25	377	377	42	RCP	JC	1/25/2005	2	SRI, OBJ (53', 258', 306')	**As-Built Drawings indicate 36" pipe**
A2-25	A2-24	225	225	42	RCP	JC	1/25/2005	2	OBJ (Repeated from 103'-214'), SRI	**As-Built Drawings indicate 36" pipe**
A2-24	A2-23	759	759	42	RCP	JC	1/25/2005	2	SRI, RFL, RFB, OBJ (Repeated from 126' - 741')	**As-Built Drawings indicate 36" pipe**
A2-23	A2-22	420	420	42	RCP	JC	1/25/2005	2	SRI, RFL, RFB, DAE (308', 378'), DAGS, OBJ (385')	**As-Built Drawings indicate 36" pipe**
A2-22	A2-21	342	342	42	RCP	JC	1/26/2005	2	SRI, RFL, CL (87'-95'), DAGS	**As-Built Drawings indicate 36" pipe**
A2-21	A2-20	618	618	42	RCP	JC	1/26/2005	2	CL (32'-47'), DAGS, SRI	**Limited visablily due to steam**
A2-20	A2-19	N/A	491	42	RCP	JC	1/26/2005	3	OBJ (106'), MSA	**Survey Abandoned at 490'09" due to debris under water line**
A2-19	A2-18	506	506	42	RCP	JC	1/26/2005	3		
A2-18	A2-17	656	656	42	RCP	JC	1/26/2005	3	DAGS, RFL	
A2-17	A2-16	168	168	42	RCP	JC	1/26/2005	3		
A2-16	A2-15	638	638	42	RCP	JC	1/26/2005	3	SRI, DAGS, RFL	
A2-15	A2-14	275	275	42	RCP	JC	1/26/2005	3	DAGS, CM (123'-272')	**As-Built Drawings indicate 36" pipe**
A2-14	A2-13	496	496	36	RCP	JC	1/26/2005	3	CM (11'-150'), DAGS, CL (209'-218')	
A2-13	A2-12	811	811	36	RCP	JC	1/26/2005	3	SRI, DAGS, RFL, OBJ (620')	
A2-12	A2-11	413	413	36	RCP	JC	1/26/2005	3	CL (26', 39'-43', 131'-158', 184'), OBJ (86', 258'), DAGS, SRI	
A2-11	A2-10	668	668	36	RCP	JC	1/26/2005	3	SRI, CL (15', 104'), DAGS, OBJ (98', 546'), RFL	
A2-10	A2-9	751	751	36	RCP	JC	1/27/2005	4	SRI, DAGS, CL (580'-741')	
A2-9	A2-8	500	500	36	RCP	JC	1/27/2005	4	CL (8'-29', 54'-62'), DAGS	**As-Built Drawings indicate 42" pipe**
A2-8	A2-7	750	750	42	RCP	JC	1/27/2005	4	CL (145'-155', 510'-518'), OBJ (691'), DAGS	
A2-7	A2-6	636	636	42	RCP	JC	1/27/2005	4	OBJ (80', 96'), DAGS	
A2-6	A2-5	694	694	42	RCP	JC	1/27/2005	4	DAGS, CL (39'-48'), OBJ (215', 674', 683')	
A2-5	A2-4	505	505	42	RCP	JC	1/27/2005	4	DAGS, CL (25'-78', 177'-206', 255'-448')	

APPENDIX A: CCTV REVIEW Yeoman Interceptor

City of Bend, OR

Upstream Manhole	Downstream Manhole	Pipe Length (ft.)	Feet Televised	Pipe Diameter (in.)	Pipe Type	Crew #:	Date Televised	Tape No:	Observations:	Notes
A2-4	A2-3	689	689	42	RCP	JC	1/27/2005	4	OBJ (149', 272'), RFL, DAGS	
A2-3	A2-2	606	606	36	RCP	JC	1/27/2005	4	CL (23'-30'), CM (44'-230', 251'-285', 293'-558'), DAGS, SRI	
A2-2	A2-1	430	430	36	RCP	JC	1/27/2005	4	CM (0'-430'), DAGS	
	Total:	19,024	19,515							

PACP Codes	
UMH: Upstream Manhole	RFB: Roots Fine Barrel
DMH: Downstream Manhole	SRI: Surface Roughness Increased
CC: Circular Crack	SSS: Surface Spalling
CL: Longitudinal Crack	DEA: Deposits Attached Encrustation
CM: Crack Multiple	DAGS: Deposits Attached Grease
OBJ: Object wedged in joint	TBI: Break In/Hammer Intruding
RFL: Roots Fine Lateral	MSA: Survey Abandoned

Note: Manhole 20 is buried.

All OBJ observations are minor debris in joint.

There is some uncertainty in pipe diameters between the videos and as-builts.

Do Nothing
Replace
Point Repair
CIPP

City of Bend, OR

Basin Up	Up Manhole	Basin Dn	Down Manhole	Diameter	Length	LineID	Pipe Length (ft.)	Feet Televised	Pipe Diameter (in.)	Pipe Type	Crew #:	Date Televised	Tape No:	Comments:	Observations:	Recommendation	Priority Repair
A2	39	A2	38				706	706	42	RCP	JC	1/24/2005	1		SRI, DAGS, SSS (79'), CC (538')	CIPP	2
A2	38	A2	37				621	621	42	RCP	JC	1/24/2005	1		TBI (129'), SRI, DAGS	CIPP, Point Repair (129')	2
A2	37	A2	36				781	781	42	RCP	JC	1/24/2005	1		SRI, DAE (182', 549'), SSS (763')	CIPP	2
A2	36	A2	35				384	384	42	RCP	JC	1/24/2005	1	**As-Built Drawings indicate 36" pipe**	SRI, SSS (24')	CIPP	2
A2	35	A2	34				591	591	42	RCP	JC	1/24/2005	1	**As-Built Drawings indicate 30" pipe**	SRI, SSS (33'), DAGS, DAE (231')	CIPP	2
A2	34	A2	33				505	505	42	RCP	JC	1/25/2005	1	**Limited visablily due to steam As-Built Drawings indicate 36" pipe**	DAGS, SRI	CIPP	3
A2	33	A2	32				338	338	42	RCP	JC	1/25/2005	1	**Limited visablily due to steam As-Built Drawings indicate 36" pipe**	SRI, DAGS	CIPP	3
A2	32	A2	31				399	399	42	RCP	JC	1/25/2005	1	**As-Built Drawings indicate 36" pipe**	SRI, DAGS	CIPP	3
A2	31	A2	30				217	217	42	RCP	JC	1/25/2005	1	**As-Built Drawings indicate 36" pipe**	SRI, DAGS	CIPP	3
A2	30	A2	29				150	150	42	RCP	JC	1/25/2005	1	**As-Built Drawings indicate 36" pipe**	SRI, DAGS	CIPP	3
A2	29	A2	28				589	589	42	RCP	JC	1/25/2005	2	**As-Built Drawings indicate 30" pipe**	SRI, DAGS	CIPP	3
A2	28	A2	27				480	480	42	RCP	JC	1/25/2005	2	**As-Built Drawings indicate 30" pipe**	SRI, DAGS	CIPP	3
A2	27	A2	26				330	330	42	RCP	JC	1/25/2005	2	**As-Built Drawings indicate 32" pipe**	SRI, DAGS	CIPP	3
A2	26	A2	25				377	377	42	RCP	JC	1/25/2005	2	**As-Built Drawings indicate 36" pipe**	SRI, OBJ (53', 258', 306')	CIPP	2
A2	25	A2	24				225	225	42	RCP	JC	1/25/2005	2	**As-Built Drawings indicate 36" pipe**	OBJ (Repeated from 103'-214'), SRI	CIPP	2
A2	24	A2	23				759	759	42	RCP	JC	1/25/2005	2	**As-Built Drawings indicate 36" pipe**	SRI, RFL, RFB, OBJ (Repeated from 126' - 741')	CIPP	2
A2	23	A2	22				420	420	42	RCP	JC	1/25/2005	2	**As-Built Drawings indicate 36" pipe**	SRI, RFL, RFB, DAE (308', 378'), DAGS, OBJ (385')	CIPP	2
A2	22	A2	21				342	342	42	RCP	JC	1/26/2005	2	**As-Built Drawings indicate 36" pipe**	SRI, RFL, CL (87'-95'), DAGS	CIPP	1
A2	21	A2	20				618	618	42	RCP	JC	1/26/2005	2	**Limited visablily due to steam**	CL (32'-47'), DAGS, SRI	CIPP	1
A2	20	A2	19				N/A	491	42	RCP	JC	1/26/2005	3	**Survey Abandoned at 490'09" due to debris under water line**	OBJ (106'), MSA	Heavy Cleaning, ReCCTV	0
A2	19	A2	18				506	506	42	RCP	JC	1/26/2005	3			Do Nothing	0
A2	18	A2	17				656	656	42	RCP	JC	1/26/2005	3		DAGS, RFL	CIPP	3
A2	17	A2	16				168	168	42	RCP	JC	1/26/2005	3			Do Nothing	0
A2	16	A2	15				638	638	42	RCP	JC	1/26/2005	3		SRI, DAGS, RFL	CIPP	2
A2	15	A2	14				275	275	42	RCP	JC	1/26/2005	3	**As-Built Drawings indicate 36" pipe**	DAGS, CM (123'-272')	CIPP	1
A2	14	A2	13				496	496	36	RCP	JC	1/26/2005	3		CM (11'-150'), DAGS, CL (209'-218')	CIPP	1
A2	13	A2	12				811	811	36	RCP	JC	1/26/2005	3		SRI, DAGS, RFL, OBJ (620')	CIPP	2
A2	12	A2	11				413	413	36	RCP	JC	1/26/2005	3		CL (26', 39'-43', 131'-158', 184'), OBJ (86', 258'), DAGS, SRI	CIPP	1
A2	11	A2	10				668	668	36	RCP	JC	1/26/2005	3		SRI, CL (15', 104'), DAGS, OBJ (98', 546'), RFL	CIPP	1
A2	10	A2	9				751	751	36	RCP	JC	1/27/2005	4		SRI, DAGS, CL (580'-741')	CIPP	1
A2	9	A2	8				500	500	36	RCP	JC	1/27/2005	4	**As-Built Drawings indicate 42" pipe**	CL (8'-29', 54'-62'), DAGS	CIPP	1
A2	8	A2	7				750	750	42	RCP	JC	1/27/2005	4		CL (145'-155', 510'-518'), OBJ (691'), DAGS	CIPP	1
A2	7	A2	6				636	636	42	RCP	JC	1/27/2005	4		OBJ (80', 96'), DAGS	CIPP	3
A2	6	A2	5				694	694	42	RCP	JC	1/27/2005	4		DAGS, CL (39'-48'), OBJ (215', 674', 683')	CIPP	1
A2	5	A2	4				505	505	42	RCP	JC	1/27/2005	4		DAGS, CL (25'-78', 177'-206', 255'-448')	CIPP	1
A2	4	A2	3				689	689	42	RCP	JC	1/27/2005	4		OBJ (149', 272'), RFL, DAGS	CIPP	2
A2	3	A2	2				606	606	36	RCP	JC	1/27/2005	4		CL (23'-30'), CM (44'-230', 251'-285', 293'-558'), DAGS, SRI	CIPP	1
A2	2	A2	1				430	430	36	RCP	JC	1/27/2005	4		CM (0'-430'), DAGS	CIPP	1

APPENDIX B: REHABILITATION RECOMMENDATIONS FOR YEOMAN INTERCEPTOR

City of Bend, OR

Upstream Manhole	Downstream Manhole	Pipe Length (ft.)	Feet Televised	Pipe Diameter (in.) (1)	Pipe Type	Crew #:	Date Televised	Tape No:	Comments:	Observations:	Recommendation	Priority Repair	Estimated Rehab Cost (2)
ANNUAL MAINTENANCE PROGRAM RECOMMENDATIONS													
A2-1	A2-39	19,515		30 - 42	RCP						Normal & Heavy Cleaning	0	$98,000
ANNUAL MAINTENANCE PROGRAM TOTAL													**$98,000**
MAINTENANCE RECOMMENDATIONS													
A2-17	A2-16	168	168	42	RCP	JC	1/26/2005	3			Do Nothing	0	$0
A2-19	A2-18	506	506	42	RCP	JC	1/26/2005	3			Do Nothing	0	$0
A2-20	A2-19	N/A	491	42	RCP	JC	1/26/2005	3	Survey Abandoned at 490'09" due to debris under water line	OBJ (106'), MSA	Heavy Cleaning, ReCCTV, Raise MH A2-20 to grade	0	$30,000
MAINTENANCE TOTAL			**1,165**									**3**	**$30,000**
PRIORITY 1 RECOMMENDATIONS													
A2-2	A2-1	430	430	36	RCP	JC	1/27/2005	4		CM (0'-430'), DAGS	CIPP	1	$97,000
A2-3	A2-2	606	606	36	RCP	JC	1/27/2005	4		CL (23'-30'), CM (44'-230', 251'-285', 293'-558'), DAGS, SRI	CIPP	1	$136,000
A2-4	A2-3	689	689	42	RCP	JC	1/27/2005	4		OBJ (149', 272'), RFL, DAGS	CIPP	2	$224,000
A2-5	A2-4	505	505	42	RCP	JC	1/27/2005	4		DAGS, CL (25'-78', 177'-206', 255'-448')	CIPP	1	$164,000
A2-6	A2-5	694	694	42	RCP	JC	1/27/2005	4		DAGS, CL (39'-48'), OBJ (215', 674', 683')	CIPP	1	$226,000
A2-7	A2-6	636	636	42	RCP	JC	1/27/2005	4		OBJ (80', 96'), DAGS	CIPP	3	$207,000
A2-8	A2-7	750	750	42	RCP	JC	1/27/2005	4		CL (145'-155', 510'-518'), OBJ (691'), DAGS	CIPP	1	$244,000
A2-9	A2-8	500	500	36	RCP	JC	1/27/2005	4	As-Built Drawings indicate 42" pipe	CL (8'-29', 54'-62'), DAGS	CIPP	1	$113,000
A2-10	A2-9	751	751	36	RCP	JC	1/27/2005	4		SRI, DAGS, CL (580'-741')	CIPP	1	$169,000
A2-11	A2-10	668	668	36	RCP	JC	1/26/2005	3		SRI, CL (15', 104'), DAGS, OBJ (98', 546'), RFL	CIPP	1	$150,000
A2-12	A2-11	413	413	36	RCP	JC	1/26/2005	3		CL (26', 39'-43', 131'-158', 184'), OBJ (86', 258'), DAGS, SRI	CIPP	1	$93,000
A2-13	A2-12	811	811	36	RCP	JC	1/26/2005	3		SRI, DAGS, RFL, OBJ (620')	CIPP	2	$182,000
A2-14	A2-13	496	496	36	RCP	JC	1/26/2005	3		CM (11'-150'), DAGS, CL (209'-218')	CIPP	1	$112,000
A2-15	A2-14	275	275	42	RCP	JC	1/26/2005	3	As-Built Drawings indicate 36" pipe	DAGS, CM (123'-272')	CIPP	1	$89,000
PRIORITY 1 BYPASS PUMPING													$82,000
PRIORITY 1 SUBTOTAL			**8,224**									**14**	**$2,288,000**
PRIORITY 2 RECOMMENDATIONS													
A2-16	A2-15	638	638	42	RCP	JC	1/26/2005	3		SRI, DAGS, RFL	CIPP	2	$207,000
A2-18	A2-17	656	656	42	RCP	JC	1/26/2005	3		DAGS, RFL	CIPP	3	$213,000
A2-21	A2-20	618	618	42	RCP	JC	1/26/2005	2	Limited visablily due to steam	CL (32'-47'), DAGS, SRI	CIPP	1	$201,000
A2-22	A2-21	342	342	42	RCP	JC	1/26/2005	2	As-Built Drawings indicate 36" pipe	SRI, RFL, CL (87'-95'), DAGS	CIPP	1	$111,000
A2-23	A2-22	420	420	42	RCP	JC	1/25/2005	2	As-Built Drawings indicate 36" pipe	SRI, RFL, RFB, DAE (308', 378'), DAGS, OBJ (385')	CIPP	2	$137,000

APPENDIX B: REHABILITATION RECOMMENDATIONS FOR YEOMAN INTERCEPTOR

City of Bend, OR

Upstream Manhole	Downstream Manhole	Pipe Length (ft.)	Feet Televised	Pipe Diameter (in.) (1)	Pipe Type	Crew #:	Date Televised	Tape No:	Comments:	Observations:	Recommendation	Priority Repair	Estimated Rehab Cost (2)
A2-24	A2-23	759	759	42	RCP	JC	1/25/2005	2	As-Built Drawings indicate 36" pipe	SRI, RFL, RFB, OBJ (Repeated from 126' - 741')	CIPP	2	$247,000
A2-25	A2-24	225	225	42	RCP	JC	1/25/2005	2	As-Built Drawings indicate 36" pipe	OBJ (Repeated from 103'-214'), SRI	CIPP	2	$73,000
A2-26	A2-25	377	377	42	RCP	JC	1/25/2005	2	As-Built Drawings indicate 36" pipe	SRI, OBJ (53', 258', 306')	CIPP	2	$123,000
A2-35	A2-34	591	591	42	RCP	JC	1/24/2005	1	As-Built Drawings indicate 30" pipe	SRI, SSS (33'), DAGS, DAE (231')	CIPP	2	$192,000
A2-36	A2-35	384	384	42	RCP	JC	1/24/2005	1	As-Built Drawings indicate 36" pipe	SRI, SSS (24')	CIPP	2	$125,000
A2-37	A2-36	781	781	42	RCP	JC	1/24/2005	1		SRI, DAE (182', 549'), SSS (763')	CIPP	2	$254,000
A2-38	A2-37	621	621	42	RCP	JC	1/24/2005	1		TBI (129'), SRI, DAGS	CIPP, Remove Intruding Tap	2	$202,000
A2-39	A2-38	706	706	42	RCP	JC	1/24/2005	1		SRI, DAGS, SSS (79'), CC (538')	CIPP	2	$229,000
PRIORITY 2 BYPASS PUMPING													$71,000
PRIORITY 2 SUBTOTAL			**7,118**									**13**	**$2,385,000**
PRIORITY 3 RECOMMENDATIONS													
A2-27	A2-26	330	330	42	RCP	JC	1/25/2005	2	As-Built Drawings indicate 32" pipe	SRI, DAGS	CIPP	3	$107,000
A2-28	A2-27	480	480	42	RCP	JC	1/25/2005	2	As-Built Drawings indicate 30" pipe	SRI, DAGS	CIPP	3	$156,000
A2-29	A2-28	589	589	42	RCP	JC	1/25/2005	2	As-Built Drawings indicate 30" pipe	SRI, DAGS	CIPP	3	$49,000
A2-30	A2-29	150	150	42	RCP	JC	1/25/2005	1	As-Built Drawings indicate 36" pipe	SRI, DAGS	CIPP	3	$49,000
A2-31	A2-30	217	217	42	RCP	JC	1/25/2005	1	As-Built Drawings indicate 36" pipe	SRI, DAGS	CIPP	3	$71,000
A2-32	A2-31	399	399	42	RCP	JC	1/25/2005	1	As-Built Drawings indicate 36" pipe	SRI, DAGS	CIPP	3	$130,000
A2-33	A2-32	338	338	42	RCP	JC	1/25/2005	1	Limited visablily due to steam As-Built Drawings indicate 36" pipe	SRI, DAGS	CIPP	3	$110,000
A2-34	A2-33	505	505	42	RCP	JC	1/25/2005	1	Limited visablily due to steam As-Built Drawings indicate 36" pipe	DAGS, SRI	CIPP	3	$164,000
PRIORITY 3 BYPASS PUMPING													$30,000
PRIORITY 3 SUBTOTAL			**3,008**									**8**	**$866,000**
			19,515										

TOTALS (3)	**$5,569,000**
ENGINEERING (15%)	**$835,000**
CITY ADMINISTRATION AND LEGAL (10%)	**$557,000**
SUBTOTAL	**$6,961,000**
CONTINGENCY (30%)	**$2,088,000**
TOTAL REHABILITATION BUDGET COST (3)	**$9,049,000**

(1) Pipe diameters from CCTV DVD's and logs (there is

(2) Rounded to nearest $100

(3) Does not include Annual Maintenance Program

PACP Codes Used in CCTV Review	
UMH: Upstream Manhole	RFB: Roots Fine Barrel
DMH: Downstream Manhole	SRI: Surface Roughness Increased
CC: Circular Crack	SSS: Surface Spalling
CL: Longitudinal Crack	DEA: Deposits Attached Encrustation
CM: Crack Multiple	DAGS: Deposits Attached Grease
OBJ: Object wedged in joint	TBI: Break In/Hammer Intruding
RFL: Roots Fine Lateral	MSA: Survey Abandoned

APPENDIX B
CITY OF ARCADIA, FLORIDA
SANITARY SEWER CCTV PROGRAM

US MH	DS MH	Feet Televised	Pipe Dia (in.)	Pipe Type	Voids	Circular Cracks	Broken Fracture Pipe	Long Cracks	Sag	Exposed Aggregate Spalling	Off Set Joint	Roots	Obst.	Comments:	Condition	Recommendation	Repair Priority	Pipe Replacement Unit Replace Cost	Pipe Replacement Total Replace Cost	Number of Point Repairs
39	**38**	706	42	RCP												CIPP	2			
38	37	621	42	RCP												CIPP, Cut Intruding Tap	2			
37	**36**	781	42	RCP												CIPP	2			
36	35	384	42	RCP												CIPP	2			
35	**34**	591	42	RCP												CIPP	2			
34	33	505	42	RCP												CIPP	3			
33	**32**	338	42	RCP												CIPP	3			
32	31	399	42	RCP												CIPP	3			
31	**30**	217	42	RCP												CIPP	3			
30	29	150	42	RCP												CIPP	3			
29	**28**	589	42	RCP												CIPP	3			
28	27	480	42	RCP												CIPP	3			
27	**26**	330	42	RCP												CIPP	3			
26	25	377	42	RCP												CIPP	2			
25	**24**	225	42	RCP												CIPP	2			
24	23	759	42	RCP												CIPP	2			
23	**22**	420	42	RCP												CIPP	2			
22	21	342	42	RCP												CIPP	2			
21	**20**	618	42	RCP												CIPP	2			
20	19	491	42	RCP												Heavy Cleaning, ReCCTV	0			
19	**18**	506	42	RCP												Do Nothing	0			
18	17	656	42	RCP												CIPP	2			
17	**16**	168	42	RCP												Do Nothing	0			
16	15	638	42	RCP												CIPP	2			
15	**14**	275	42	RCP												CIPP	1			
14	13	496	36	RCP												CIPP	1			
13	**12**	811	36	RCP												CIPP	1			
12	11	413	36	RCP												CIPP	1			
11	**10**	668	36	RCP												CIPP	1			
10	9	751	36	RCP												CIPP	1			
9	**8**	500	36	RCP												CIPP	1			
8	7	750	42	RCP												CIPP	1			
7	**6**	636	42	RCP												CIPP	1			
6	5	694	42	RCP												CIPP	1			
5	**4**	505	42	RCP												CIPP	1			
4	3	689	42	RCP												CIPP	1			
3	**2**	606	36	RCP												CIPP	1			
2	1	430	36	RCP												CIPP	1			
		19,515																		**0**

ADMIN., ENGINEERING, CONTINGENCY (30%)

TOTAL

(1) Rounded to nearest $100

APPENDIX B
CITY OF ARCADIA, FLORIDA
SANITARY SEWER CCTV PROGRAM

Point Repairs		Maintenance						Pipe Liner		
Unit Cost	Total Point Repair Cost	Pipe Cleaning	CCTV	Root Removal	Obs. Removal	Cut Intrude Taps	Raise MH to Grade	Unit Repair Cost	Line Repair Cost	Total Estimated Repair
								$325	$229,450	$229,000
						$5,000		$325	$201,825	$202,000
								$325	$253,825	$254,000
								$325	$124,800	$125,000
								$325	$192,075	$192,000
								$325	$164,125	$164,000
								$325	$109,850	$110,000
								$325	$129,675	$130,000
								$325	$70,525	$71,000
								$325	$48,750	$49,000
								$325	$191,425	$191,000
								$325	$156,000	$156,000
								$325	$107,250	$107,000
								$325	$122,525	$123,000
								$325	$73,125	$73,000
								$325	$246,675	$247,000
								$325	$136,500	$137,000
								$325	$111,150	$111,000
								$325	$200,850	$201,000
		$17,185	$7,365				$5,000	$0	$0	$30,000
								$0	$0	$0
								$325	$213,200	$213,000
								$0	$0	$0
								$325	$207,350	$207,000
								$325	$89,375	$89,000
								$225	$111,600	$112,000
								$225	$182,475	$182,000
								$225	$92,925	$93,000
								$225	$150,300	$150,000
								$225	$168,975	$169,000
								$225	$112,500	$113,000
								$325	$243,750	$244,000
								$325	$206,700	$207,000
								$325	$225,550	$226,000
								$325	$164,125	$164,000
								$325	$223,925	$224,000
								$225	$136,350	$136,000
								$225	$96,750	$97,000
	$0	**$17,185**	**$7,365**	**$0**	**$0**	**$5,000**	**$5,000**		**$5,496,250**	**$5,528,000**
										$1,658,000
										$7,186,000

Appendix H: Brenford Siphon Cleaning Quotation

October 23, 2013 ***Confidential***

Bend, OR Siphons

Brown and Caldwell
Attn: Dana Devin-Clarke
503.820.5644
ddclarke@brwncald.com

Subject: Budgetary Proposal for Pipe Line Cleaning Services in Bend, OR

Thank you for the opportunity to provide our proposal for the above referenced project.

We appreciate the opportunity to submit this Budgetary Quote.
We look forward to working with you.
Please let us know if you have any questions.

Sincerely,

_____

David Davis
Brenford Environmental Systems LP
Project Manager
Office - 281-992-4333
ddavis@brenford.com

For Budgetary Purposes Only

With attachments

Exhibit A
Exhibit B

Exhibit A

Below is a list of equipment and personnel that Brenford Environmental Systems (Brenford) will provide and the associated cost, subject to the terms and conditions contained within the Brenford Services Agreement to provide services to satisfy the scope of work.

Scope of Work

Brenford will provide cleaning services of the large diameter pipe to the extent that the pipe capacity is restored to the contract specifications. Brenford is not responsible for the integrity of the pipe wall or any damage resulting in failure of the pipe wall. Brenford's base cleaning service is a service to remove sand, grit and gravel from a large diameter pipeline collection system. In the event that there is

www.brenford.com

8411-A Industrial Drive
Pearland, TX 77584
Office: (281) 992-4333
Fax: (281) 992-4334

tuberculation, root intrusion, objects that are 6 inches in diameter or greater, large diameter rock/tile and/or a buildup of chemical material and any other items that are foreign to the collection system on the interior of the pipeline that require removal to industry standards, such removal of material is NOT included in the service cost unless specifically included in the proposal as noted below. This service does NOT include the removal of fixed debris or materials, like cement or concrete, from the pipeline. **This service does NOT include removal of protruding laterals. This service does NOT include removal of additional debris caused by a collapse in the pipe.**
This service does NOT include removal of hazardous material.

Brenford relied on the following information provided by the customer in the preparation of this proposal:

- Pipeline details:

Diameter (inches)	Length (feet)	Percent material	Cubic Yards
~24"	~4,900LF	~10% to 75%	~217
~36"	~4,900LF	~10% to 75%	~487

Source of pipeline details: Customer
The equipment and personnel provided by Brenford for this service

("Two Sewer Hog Packages") include the following:

Equipment
- Two (2) Sewer Hog SK1000 Units
- Four (4) Grit Gators
- Four (4) 6" down hole Hydraulic Submersible Pumps
- One (1) Roll-Off Truck

Personnel
- Two (2) Equipment Operators
- One (1) Roll-Off Truck Driver
- One (1) Field Technician

Miscellaneous Equipment
- Fire hose (400 ft)
- Decant hose (200 ft)
- Various Cleaning Nozzles

For Budgetary Purposes Only

Prices for standard cleaning (removal of sand, grit and gravel) as described below. Price does NOT include removal of protruding laterals. **Price does NOT include the removal of hazardous waste.**

_____ / _____
Brenford / Customer

Diameter (inches)	Length (ft)	Standard Lease Monthly Rate	Quantity	Total
~24" to 36"	~9,800LF	$260,809.36/Month	2 months	$521,618.72
		Mobilization	1	$28,390.00
		Total		$550,008.72

Budgetary price is based on debris being accepted for disposal at Negus Landfill located at 2400 NE Maple Ave, Redmond, OR.

Rates are subject to change during site walk and/or additional information.

This Service rate is valid if the material removed does not exceed 1,127 tons for the Project (Total Estimated Tonnage). The Customer will incur $454.36 per ton for each ton of additional material removed above the Total Estimated Tonnage amount.

Key contract provisions assumed in this quote

This proposal is assembled with certain assumptions about terms and conditions and any material changes to key contract provisions described below will change the proposal pricing

- Industry standard force majeure and mutual indemnity
- Satisfaction of credit requirements and minimum insurance
- Brenford services billed monthly
- Payment in US funds net 30 days with customary default provisions for non-payment
- No warranty provided on cleaning services
- No consequential or related damages or responsibility for loss or damage
- The terms of this proposal are made part of the contract with the customer.
- Only covers debris removal and disposal of material acceptable in a Type IV landfill. Customer responsible for removal, transportation, disposal and decontamination of Brenford equipment to industry standards if exposed to material not acceptable in a Type IV landfill

_____ / _____
Brenford / Customer

Exhibit B

Equipment And Personnel Provided by Customer

The Customer understands that in order for this project to be a success, the following must be provided by Customer at no cost to Brenford in a timely manner as not to delay the work of Brenford:

- A site supervisor or equivalent to observe activity and confirm daily reports at the completion of each shift period and to provide timely inspection for acceptance of the work by Customer upon completion of each segment of work. If the Customer fails to make an individual available to confirm the daily reports, then the daily reports will be deemed to be correct and accepted by the customer.
- Water (350 GPM per Sewer Hog), Hydrant Meter, Backflow Preventer and Hose Protection Ramps (as required). Will be charged at the City Rate
- CCTV/Sonar (as required).
  Customer will provide closed circuit television and/or sonar services to confirm acceptance of the cleaning immediately upon completion of a pipeline segment with notice by Brenford. This will typically be coordinated to ensure that the inspection is completed on a prompt basis after the final cleaning pass is completed of a pipeline segment and prior to the relocation of the Sewer Hog equipment to the next work location. In the event that specialized cleaning is required, Customer will make this equipment available throughout the period of the specialized cleaning to support the cleaning process and confirmation.
- Ingress and egress access to manholes and the site work area(s) adequate for the delivery, set-up, operation, maintenance and removal of Brenford's equipment and related site restoration, if any.

_____ / _____
Brenford / Customer

Appendix I: Influent Fan Testing Results and Recommendations Report

DRAFT

Influent Fan Testing Results and Recommendations

Prepared for
City of Bend, Oregon

December 12, 2014

6500 SW Macadam Avenue, Suite 200
Portland, OR 97239
Phone: 503.244.7005
Fax: 503.244.909

Table of Contents

1. Introduction 1-1
2. Headspace Ventilation Sampling 2-1
   2.1 Sampling Locations 2-1
      2.1.1 Baseline Sampling 2-1
      2.1.2 Fan Testing and Sampling 2-2
   2.2 Sampling Methods 2-3
      2.2.1 Differential Air Pressure 2-3
      2.2.2 Installing ACR Air Pressure Data Loggers 2-3
3. Results of Field Investigation 3-1
   3.1 Baseline Differential Air Pressure Data 3-1
   3.2 Fan Test Differential Air Pressure Data 3-3
      3.2.1 Grab Sample Locations 3-5
      3.2.2 Zones of Influence Due to Air Withdrawal 3-8
4. Conclusions 4-1
   5.1 Vapor-Phase Treatment Alternatives Analysis 5-1
      5.1.1 Biological Odor Control 5-1
      5.1.2 Activated Carbon Adsorbers 5-2
      5.1.3 Summary of Advantages and Disadvantages 5-3
   5.2 Direct Discharge Ventilation Alternative 5-3
   5.3 Siting Alternatives 5-4
   5.4 Cost Comparisons 5-4
5. Recommendations 6-1
6. Conceptual Layouts 7-1
7. Limitations 8-1

Appendix A: Baseline Differential Air Pressure Data Charts A-1

Appendix B: Fan Test (at 1,000 cfm) Differential Air Pressure Data Charts B-1

List of Figures

Figure 1-1. Plant interceptor size and material 1-1
Figure 2-1. Fan setup example at CMH000175 2-2
Figure 2-2. PI sampling and venting locations 2-2
Figure 2-3. ACR Smart Reader used to measure and record differential air pressure 2-3
Figure 2-4. Differential air pressure instrument in waterproof case 2-3
Figure 3-1. Baseline pressure data: CMH000184 3-1
Figure 3-2. Baseline pressure data: CMH000269 3-2
Figure 3-3. Baseline differential air pressure results 3-3
Figure 3-4. Fan test headspace air pressure at CMH000184 3-3
Figure 3-5. Fan test headspace air pressure at CMH000269 3-3
Figure 3-6. Day 1 fan test data summary: 9/15/2014 3-4
Figure 3-7. Day 2 fan test data summary: 9/16/2014 3-4
Figure 3-8. Locations of air pressure grab sampling 3-7
Figure 3-9. Fan testing zones of influence 3-8
Figure 5-1. Biological odor control system examples 5-1
Figure 5-2. Schematic of an activated carbon system and photo 5-2
Figure 7-1. Biotrickling filter odor control conceptual layout 7-1
Figure 7-2. Direct discharge system conceptual layout 7-2

List of Tables

Table 2-1. Mechanical Venting Locations 2-2
Table 3-1. Baseline Differential Air Pressure Monitoring Data (in. WC) 3-2
Table 3-2. Fan Test Data Summary 3-4
Table 3-3. Fan Test Grab Sample Data 3-5
Table 3-4. Fan Test Grab Sample Data 3-6
Table 3-5. Current and Projected 2024 Airflow and Flow Depth Conditions 3-9
Table 5-2. Summary of Biological and Carbon Adsorption Vapor-Phase Odor Control Technologies 5-3
Table 5-3. Advantages and Disadvantages of Direct Discharge to Atmosphere 5-4
Table 5-4. Forced Air Ventilation Facility Siting Options 5-4
Table 5-5. Biological Odor Control Systems Costs 5-5
Table 5-6. Carbon Media Odor Control Systems Costs 5-5
Table 5-7. Direct Discharge Ventilation 5-5

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.
Draft Fan Test Report 121214.docx

Section 1

Introduction

The City of Bend (City) retained Brown and Caldwell (BC) to inspect the plant interceptor (PI) in 2013. The gravity portion of the PI is approximately 5 miles long and is the primary means of sanitary sewer conveyance from the city to the Water Reclamation Facility (WRF).

The inspection results indicated that select portions of the PI exhibit advanced corrosion. The corroded areas exhibited extensive defects requiring immediate attention such as visible surface reinforcement (see Plant Interceptor Condition Assessment Report, 2013).

As part of the condition assessment effort completed in 2013, BC recommended to the City the need to address corrosion. The City amended BC's scope to include further investigation of the gravity section of the PI to investigate the feasibility of implementing a forced-air ventilation corrosion control solution.

Plant Interceptor

The PI, constructed in 1978, measures approximately 25,300 feet. Figure 1-1 illustrates the PI configuration and material. The PI varies in diameter with larger sewer diameters discharging into smaller sewer pipe. The gravity sections were the subject of the corrosion control investigation.

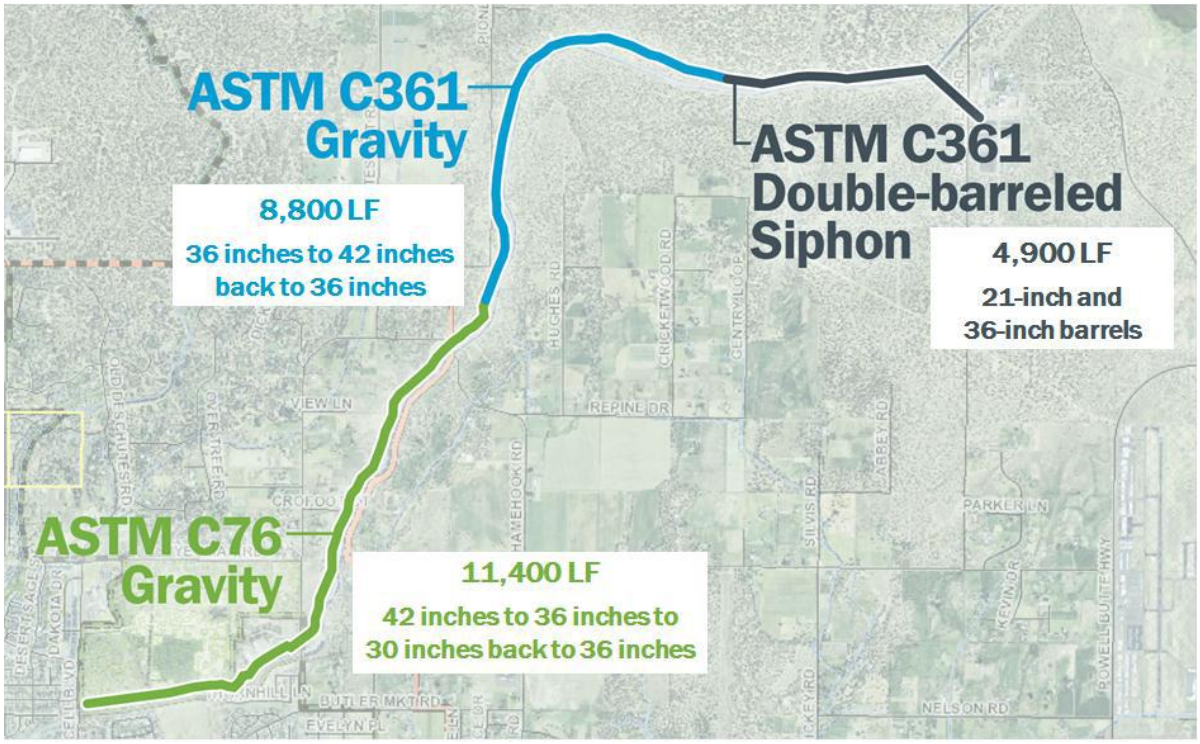


Figure 1-1. Plant interceptor size and material

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

Section 2

Headspace Ventilation Sampling

The headspace ventilation sampling effort was conducted in the gravity section of the PI over the course of one and a half week. It consisted of a differential air pressure baseline sampling effort and a subsequent full-scale fan test. The baseline sampling effort was conducted on August 13 through 19, 2014. The physical characteristics of the interceptor in the study area were analyzed prior to field sampling in order to determine airflow rates and probable headspace constriction points within the sewer. Pipe characteristic data were used to construct a computer model to estimate the amount of air dragged through the interceptors within the study area. This provided the basis for sizing both the fan used during the field fan test and the recommended air treatment systems. This analysis also determined the locations along the alignments where sampling efforts would be focused. Sampling locations were chosen based on the following general parameters:

- predetermined locations to collect data for air drag analysis to further calibrate the computer model
- key nodes in the interceptor such as connection maintenance manholes, severe changes in pipelines' horizontal alignment, or vertical slope
- safe access to maintenance manholes and holes in the manhole covers

The field fan test was conducted on September 15 and 16, 2014. The purpose of the field fan test was to determine whether sufficient air could be forcibly moved through the open headspace of the pipe in order to reduce the rate of corrosion in exposed concrete surfaces. Differential air pressure data loggers were reinstalled in the same manholes in which baseline sampling had occurred. Air was withdrawn from two locations along the PI while air pressure data were continuously monitored by the data loggers.

2.1 Sampling Locations

This sampling effort for the headspace ventilation study consisted of the following two phases:

- continuous differential air pressure measurement, and grab sample air pressure sampling in an initial, "baseline" phase
- continuous differential air pressure measurement, and grab sample pressure sampling during a "fan test" phase

2.1.1 Baseline Sampling

Headspace air pressure data were recorded at eight manholes along the gravity section of the PI during the "baseline" phase of sampling. The same eight locations were also used during the "fan testing" phase. Sampling locations were chosen based on the contributing factors previously discussed in Section 2. Differential pressure and temperature data loggers were installed at each location to sample and record differential pressure at 2-minute intervals. The instruments were installed for approximately one week to capture the diurnal flow pattern influences of headspace differential air pressure. Additionally, spot or "snapshot" pressure readings were taken using a handheld manometer to ensure consistency in the data. The baseline differential air pressure data were analyzed in order to gain a better understanding of how the interceptors naturally ventilate air as a result of their physical characteristics and diurnal wastewater flow characteristics.

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

The baseline sampling locations are listed below.

- CMH000179
- CMH000184
- CMH000187
- CMH000191
- CMH000200
- CMH000204
- CMH000269
- CMH000294

2.1.2 Fan Testing and Sampling

The results of the baseline sampling were used to develop and execute a forced-air ventilation "fan test," which used a 1,000-cubic-foot per minute (cfm) fan to mechanically ventilate the sewers at two separate locations. The purpose of the fan test was to determine whether sufficient air could be forcibly moved through the open headspace of the pipe in order to reduce the rate of corrosion in exposed concrete surfaces. The pressure sensors simultaneously recorded the differential air pressure response within the sewer as a result of the air extraction by the fan. During fan testing, spot pressure readings were also taken using a handheld manometer and were compared against pressure trends recorded by the loggers installed in the manhole covers during the baseline phase of sampling. The manometer readings provided real-time insight into the effect of the fan on the interceptor at various locations along the alignment. The fan test differential pressure data and manometer readings were analyzed and used to develop minimum "zones of influence" along the gravity section of the PI as well as assess the overall air pressure reduction as a result of mechanical air extraction. The sampling locations were the same as the "baseline" locations shown in the list above. Table 2-2 provides the mechanical venting locations. Figure 2-1 shows an example of the fan testing equipment setup at CMH000175. A map showing the baseline and fan test sampling locations is presented in Figure 2-2.

Table 2-1. Mechanical Venting Locations

Unique manhole ID	Handheld manometer readings	Time of fan testing
CMH000175	❖	Day 1 (9/19/2014)
CMH000194	❖	Day 2 (9/20/2014)

Figure 2-1. Fan setup example at CMH000175

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

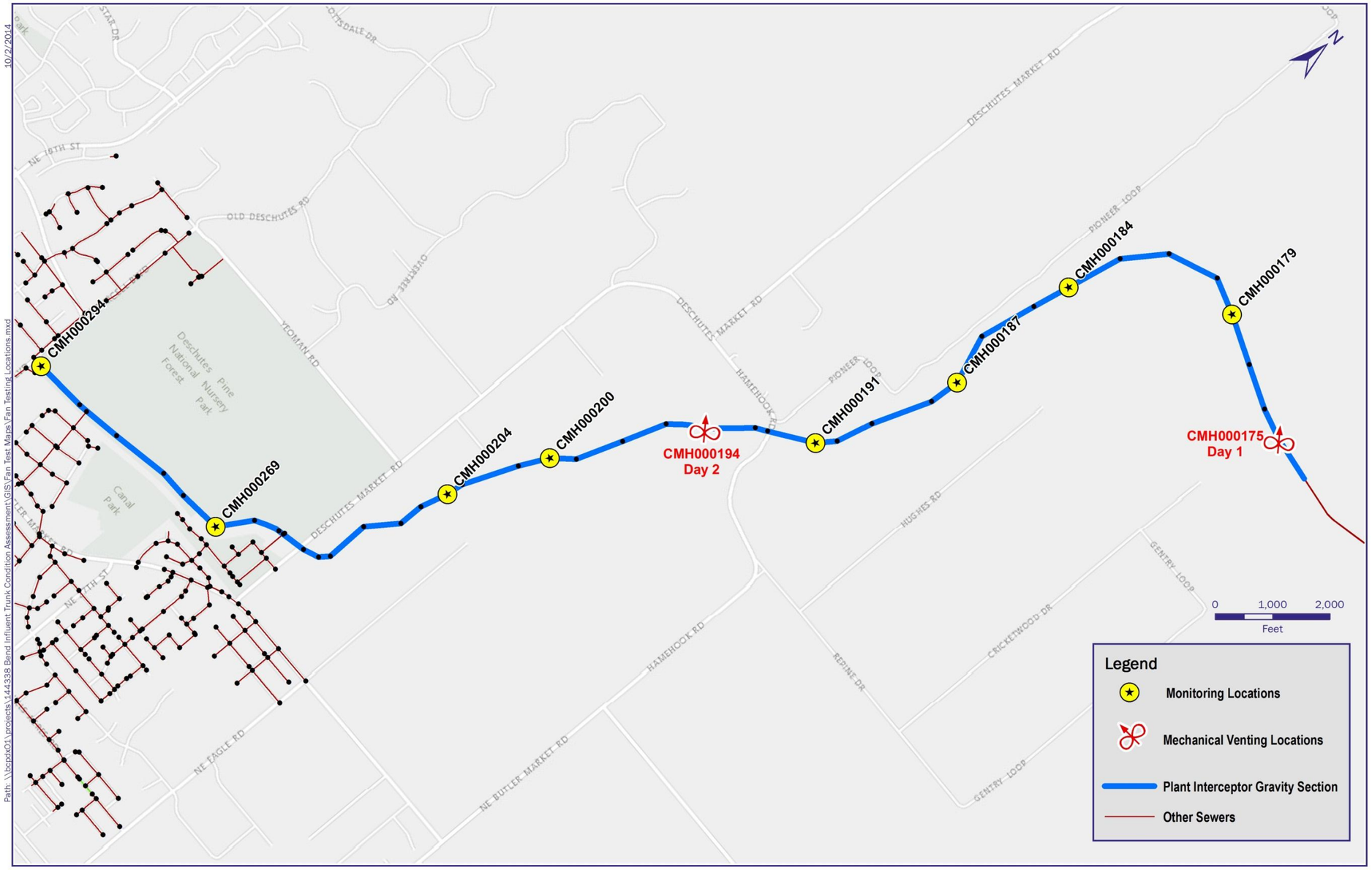


Figure 2-2. PI sampling and venting locations

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

2.2 Sampling Methods

The following sections explain the types of sampling performed in the interceptors, including a description of the data instruments and installation techniques.

2.2.1 Differential Air Pressure

Differential pressure data were recorded using an ACR Smart Reader data logging instrument, as shown in Figure 2-3. The instrument is sensitive to small changes in differential pressure. The ACR Smart Reader instrument is not intended for damp and corrosive environments, so a Pelican case was used to house the instrument during deployment. Two flexible plastic hoses were connected to the instrument, with one routed into the maintenance hole and the other routed through the casting in order to record background atmospheric pressure. Differential pressure data provide insight into how, and under what influences, air moves in the headspace of a partially full gravity-fed pipe. The range of this device was -2.0 to 2.0 inches of water column.

Figure 2-3. ACR Smart Reader used to measure and record differential air pressure

2.2.2 Installing ACR Air Pressure Data Loggers

The ACR Smart Reader was installed using either a brass tee fitting or 1/4-inch bolt to penetrate the maintenance hole lid to ensure exposure to atmospheric pressure while allowing the instrument to collect data inside the maintenance hole. A P-trap drain was used to provide drainage away from the instrument in case of precipitation while also providing a seal from the atmosphere inside the fitting. This installation method was necessary because the ACR instrument records pressure in both atmospheres simultaneously and returns the difference between the two (i.e., differential pressure) as data output. A typical installation of the differential pressure instrument is shown in Figure 2-4.

Figure 2-4. Differential air pressure instrument in waterproof case

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

Section 3

Results of Field Investigation

Summaries and discussions of the baseline and fan test data collected during the field investigation are presented in this section.

3.1 Baseline Differential Air Pressure Data

Examples of baseline-phase pressure data charts are presented in Figures 3-1 and 3-2. Charts of all continuous differential air pressure recorded are presented in Appendix A.

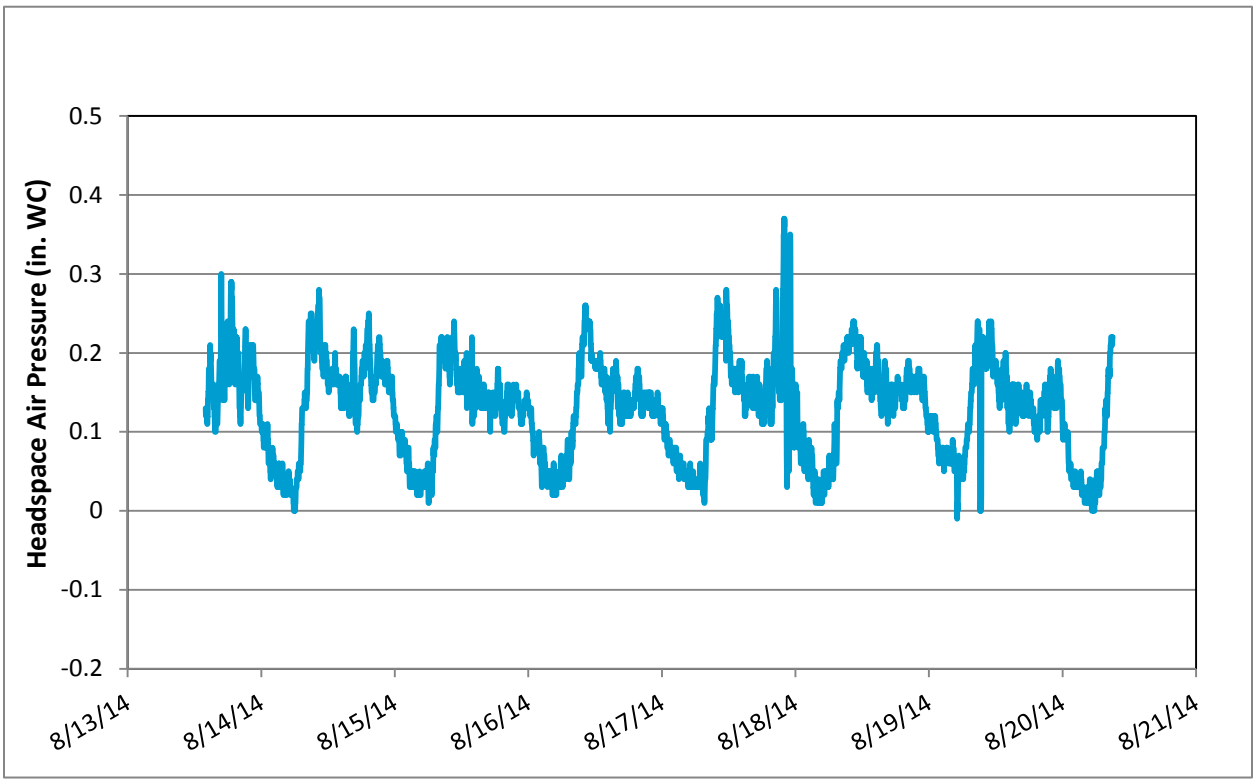


Figure 3-1. Baseline pressure data: CMH000184

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

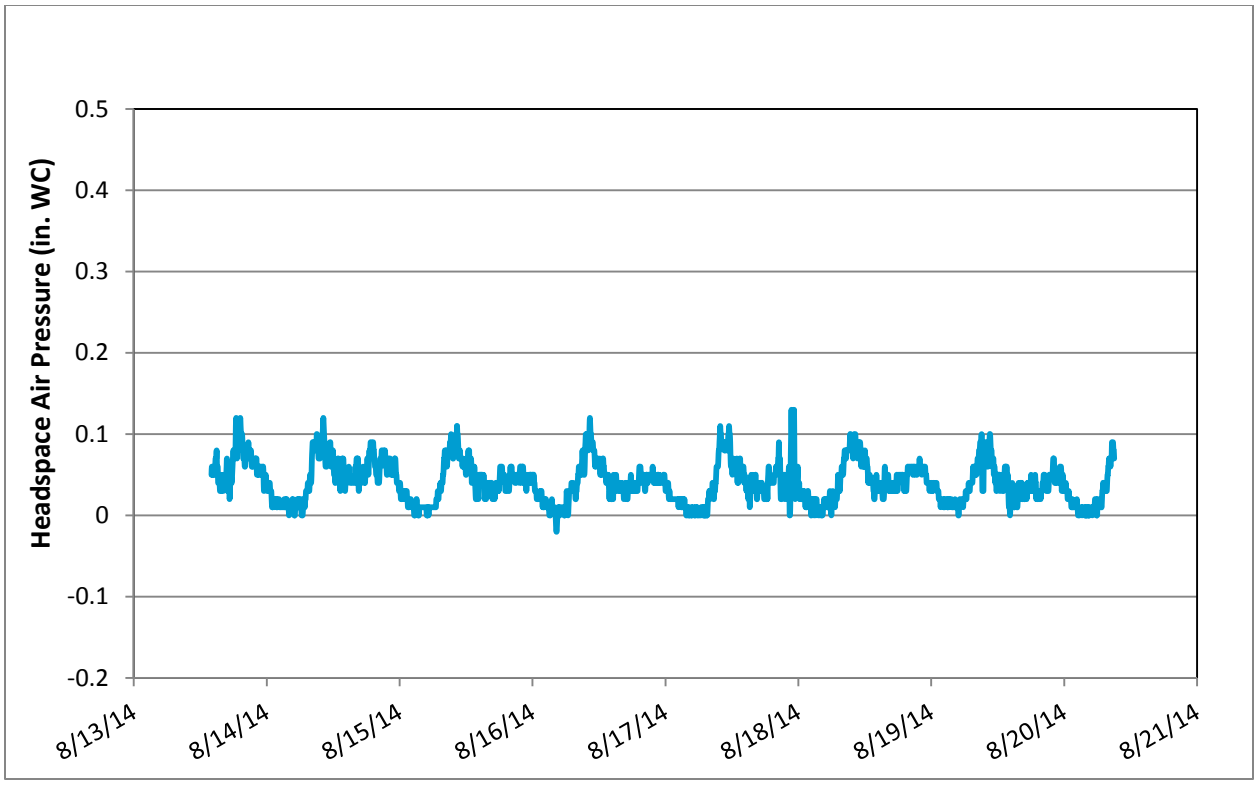


Figure 3-2. Baseline pressure data: CMH000269

A summary of the baseline differential air pressure data recorded during the sampling effort is listed in Table 3-1 and presented graphically in Figure 3-3. Red shading indicates that air pressures in the PI are well above atmospheric pressure; yellow shading indicates that air pressures in the PI are slightly above atmospheric pressure.

Table 3-1. Baseline Differential Air Pressure Monitoring Data (in. WC)

Unique MH ID	Maximum	Minimum	Average*	Standard deviation
CMH000179	0.43	0.01	0.15	0.06
CMH000184	0.37	-0.01	0.13	0.06
CMH000187	0.43	-0.13	0.18	0.12
CMH000191	0.33	0.02	0.13	0.06
CMH000200	0.23	0.01	0.10	0.04
CMH000204	0.25	-0.04	0.08	0.04
CMH000269	0.13	-0.02	0.04	0.03
CMH000294	0.10	-0.02	0.03	0.02

**Shaded color to correspond with Figure 3-3.*

Brown AND Caldwell

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

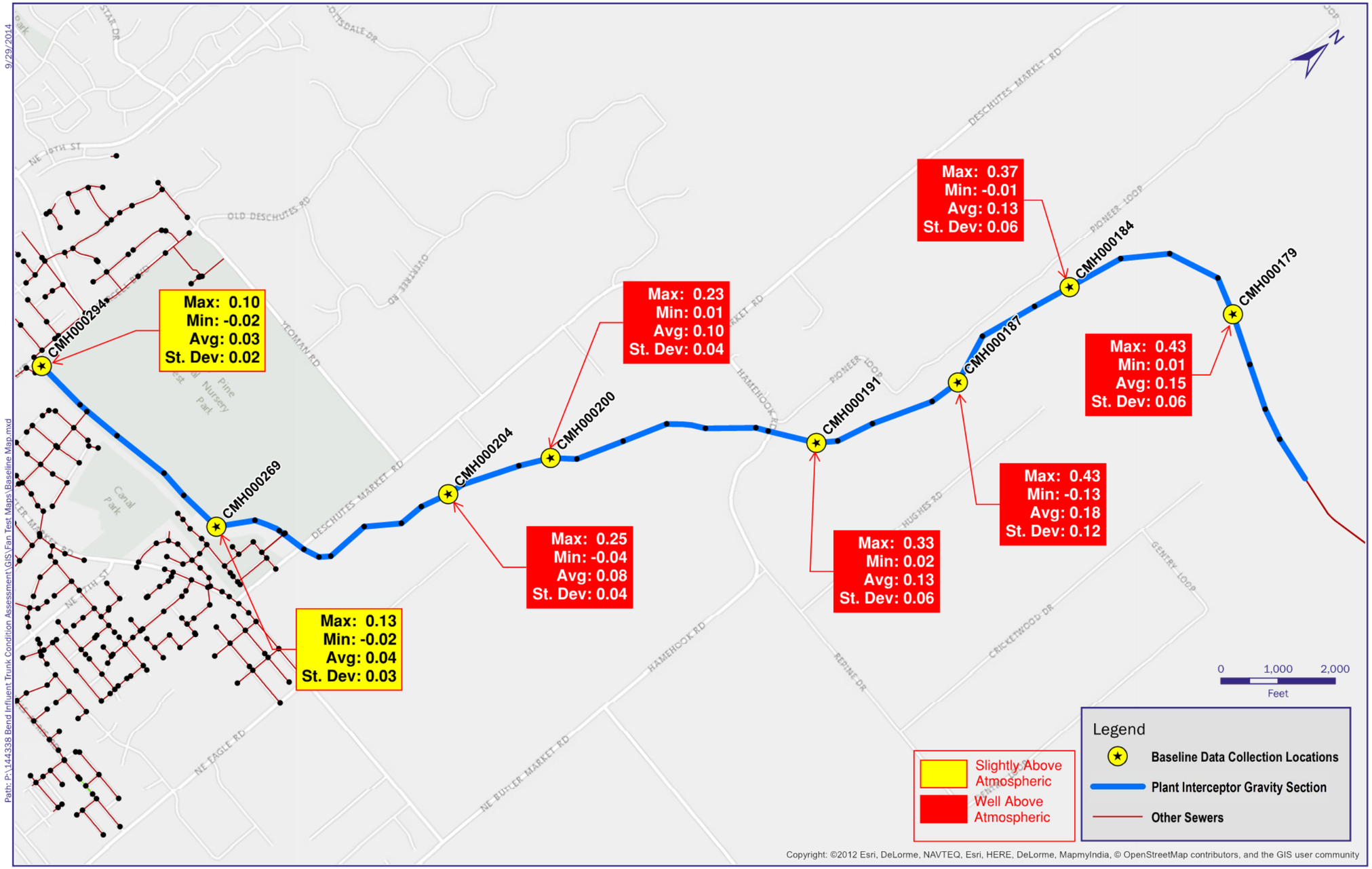


Figure 3-3. Baseline differential air pressure results

As these figures indicate, the headspace differential air pressure in the PI is practically always continuously positive. This is due primarily to the presence of the siphon that carries flow under the Main Canal to the WRF; positive pressures generally decrease as a function of distance from the siphon. The maximum pressure measured in the PI was measured at manholes CMH000179 and CMH000187. Significantly lower pressures, on the order of 0.1 inch of water column, were measured on the upstream end of the PI at manholes CMH000269 and CMH000294.

3.2 Fan Test Differential Air Pressure Data

As discussed in Section 2 of this report, the locations and durations for air withdrawal during the fan test were determined from analysis of the baseline air pressure data. Examples of fan test phase pressure data charts are presented in Figures 3-4 and 3-5. Charts of all recorded differential air pressure data are included in Appendix B.

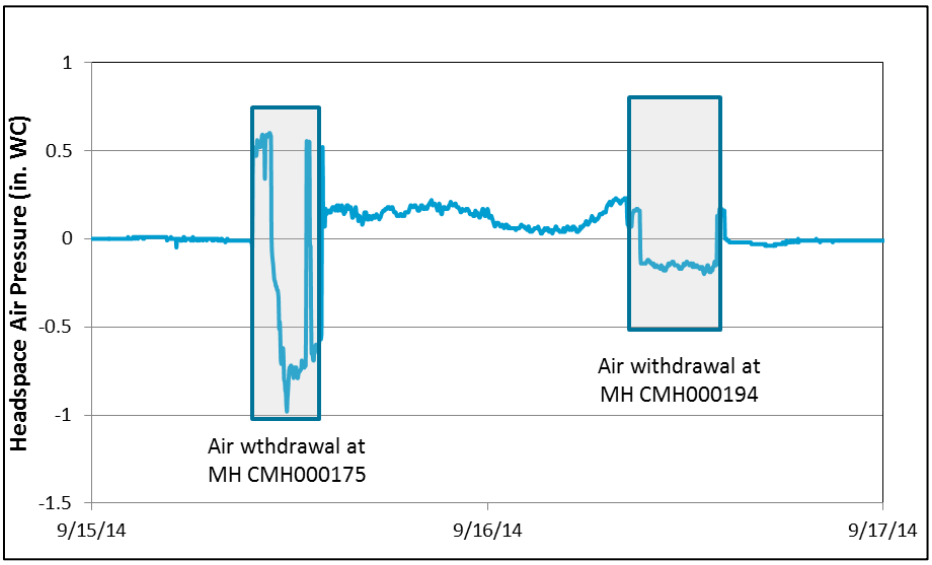


Figure 3-4. Fan test headspace air pressure at CMH000184

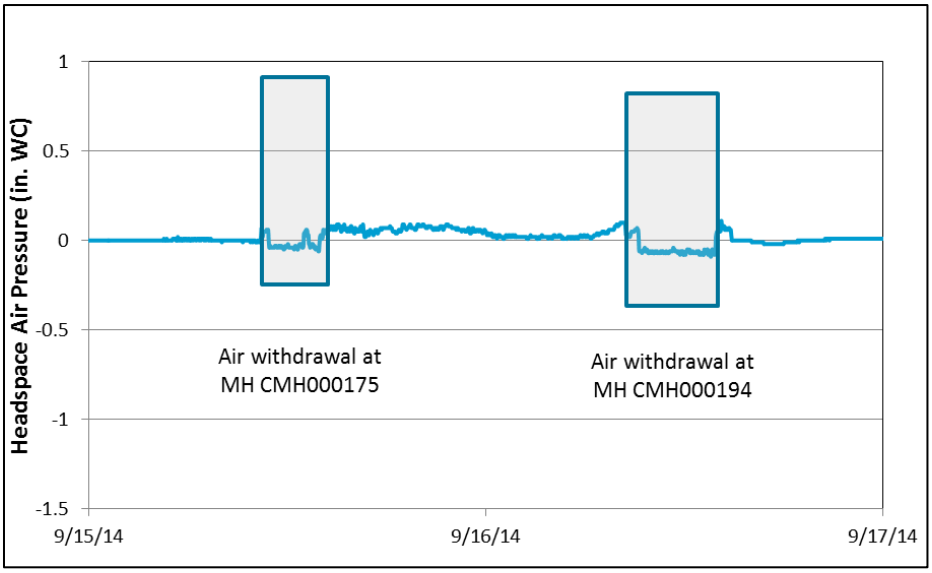


Figure 3-5. Fan test headspace air pressure at CMH000269

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

A summary of the continuous differential air pressure data recorded during the fan test is listed in Table 3-2 and presented graphically in Figures 3-6 and 3-7. The dark green indicates that air pressure in the PI is well below atmospheric pressure during the fan test, while the light green indicates that air pressure in the PI is slightly below atmospheric pressure during the fan test.

Table 3-2. Fan Test Data Summary

Test location	Date	Fan test headspace air pressure (in. WC)					
		Maximum	Δ Maximum*	Minimum	Average**	Δ Average*	Standard deviation
CMH000179	9/15/2014	-0.14	-0.57	-0.80	-0.48	-0.63	0.15
	9/16/2014	-0.11	-0.54	-0.20	-0.15	-0.30	0.02
CMH000184	9/15/2014	-0.42	-0.79	-0.98	-0.70	-0.83	0.10
	9/16/2014	-0.12	-0.49	-0.20	-0.15	-0.28	0.02
CMH000187	9/15/2014	-0.22	-0.65	-0.35	-0.31	-0.49	0.04
	9/16/2014	-0.14	-0.57	-0.22	-0.19	-0.37	0.02
CMH000191	9/15/2014	-0.20	-0.53	-0.44	-0.34	-0.47	0.05
	9/16/2014	-0.41	-0.74	-0.52	-0.48	-0.61	0.02
CMH000200	9/15/2014	-0.27	-0.50	-0.50	-0.41	-0.51	0.04
	9/16/2014	-0.22	-0.45	-0.91	-0.62	-0.72	0.23
CMH000204	9/15/2014	-0.31	-0.56	-0.67	-0.49	-0.57	0.10
	9/16/2014	-0.34	-0.59	-1.09	-0.64	-0.72	0.18
CMH000269	9/15/2014	-0.02	-0.15	-0.06	-0.04	-0.08	0.01
	9/16/2014	-0.04	-0.17	-0.09	-0.06	-0.10	0.01
CMH000294	9/15/2014	-0.01	-0.11	-0.05	-0.03	-0.06	0.01
	9/16/2014	-0.02	-0.12	-0.05	-0.04	-0.07	0.01

**Baseline headspace air pressure testing completed prior to fan testing.*

***Shaded color corresponds with Figures 3-6 and 3-7.*

Brown AND Caldwell

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

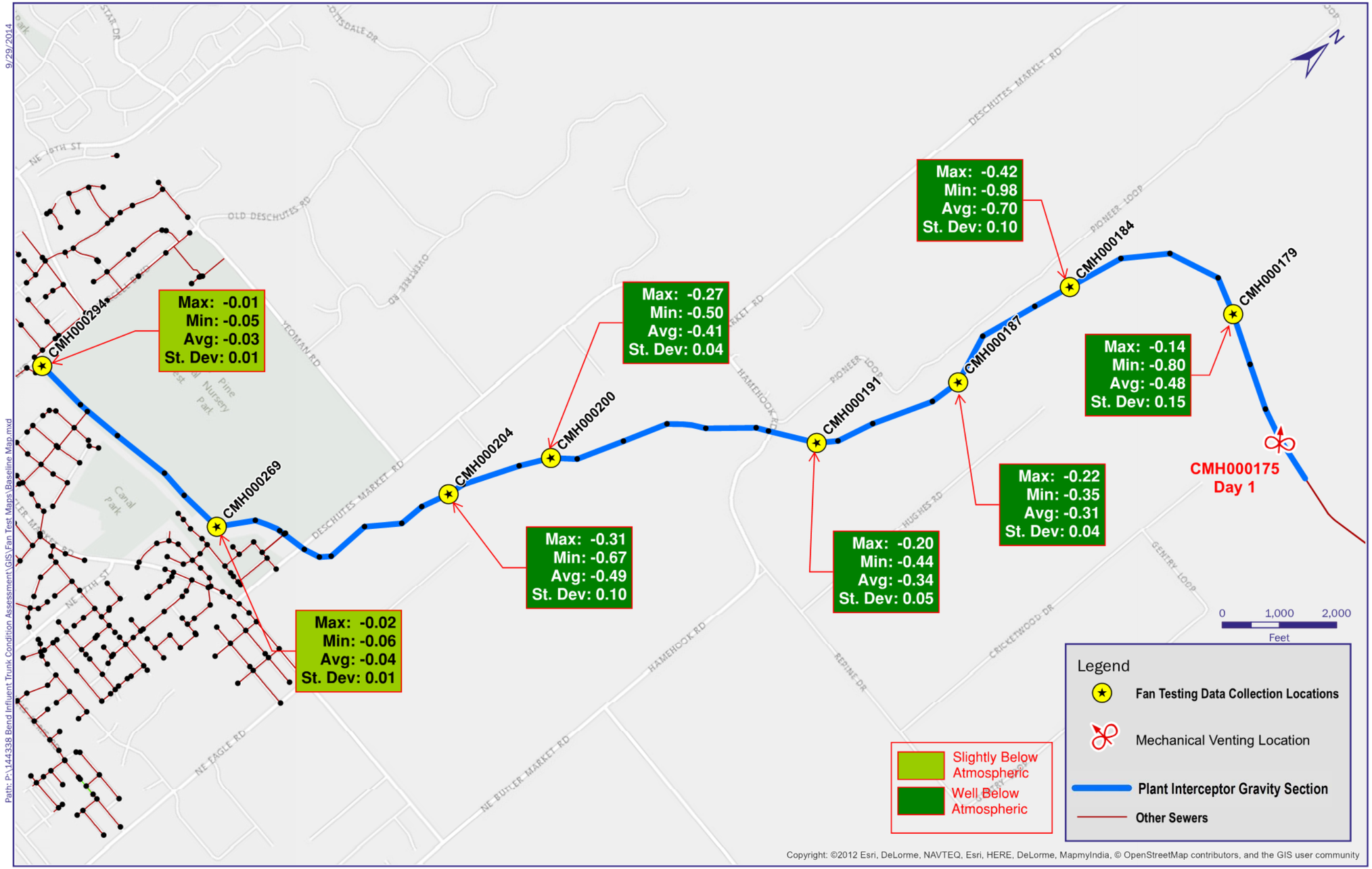


Figure 3-6. Day 1 fan test data summary: 9/15/2014

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

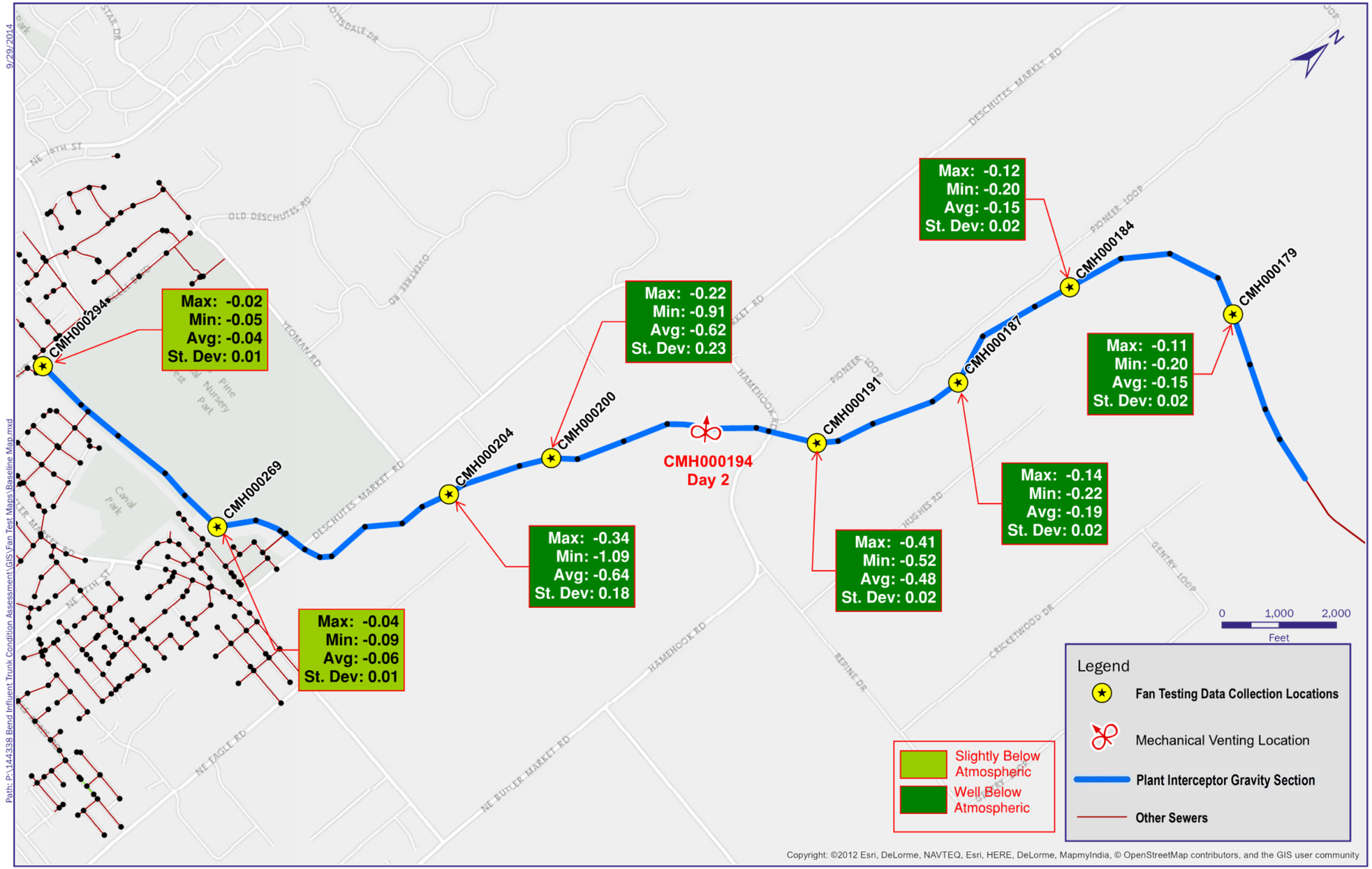


Figure 3-7. Day 2 fan test data summary: 9/16/2014

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

As can be seen in Table 3-2 and Figures 3-4 through 3-7, 1,000 cfm air extraction at both of the tested air withdrawal locations had a very significant pressure reduction effect along the entire alignment of the PI. Average pressures along the entire alignment were maintained at levels well below atmospheric for the duration of each fan test. These results indicate that the air pulled from the 1,000 cfm fan was being dragged through the open headspace of the PI. At a half-full pipe condition at this air withdrawal rate the air in the headspace would be expected to be traveling at approximately 600 feet per minute, which is approximately 6 times the velocity that the air would move along the headspace solely under the drag-induced influence of the flowing wastewater in the pipe. Note that the negative pressures induced in the two upstream-most manholes, CMH000294 and CMH000269, were not as great as those induced throughout the rest of the PI. This could be due to the pressure losses incurred along the reach between CMH000204 and CMH000269, where several horizontal bends, changes in slope, and sections of 30-inch-diameter pipe exist.

3.2.1 Grab Sample Locations

In addition to continuous differential air pressure data monitoring, differential air pressure data grab samples were taken using a handheld manometer at numerous locations throughout the interceptor system. The grab samples were collected at the manholes where the fans were located and at the following three other locations at a nearby neighborhood:

- Location 1: Corner of NE Studio Road and NE Majesty Lane
- Location 2: Near corner of NE Butler Market Road and NE Studio Road (in grass area)
- Location 3: NE Studio Road south of Location 1 (in middle of street next to apartment complex)

A summary of the grab sample results is presented in Tables 3-3 and 3-4. Figure 3-8 is a map showing these three locations.

Table 3-3. Fan Test Grab Sample Data

Location	Time	Headspace pressure (in. WC)	Testing fan on	Testing fan off
Day 1 (9/15/2014)				
At fan	10:50 a.m.	-1.15	❖	
	12:15 p.m.	-1.15	❖	
	1:17 p.m.	-1.30	❖	
	1:55 p.m.	-1.14	❖	
Location 1	11:25 a.m.	0.02	❖	
	12:42 p.m.	0.04	❖	
	1:35 p.m.	0.06	❖	
	2:19 p.m.	0.03		❖
Location 2	11:29 a.m.	0.02	❖	
	12:40 p.m.	0.03	❖	
	1:33 p.m.	0.04	❖	
	2:16 p.m.	0.02		❖
Location 3	11:35 a.m.	0.03	❖	
	12:44 p.m.	0.03	❖	
	1:38 p.m.	0.06	❖	
	2:16 p.m.	0.02		❖

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

Table 3-4. Fan Test Grab Sample Data

Location	Time	Headspace pressure (in. WC)	Testing fan on	Testing fan off
Day 2 (9/16/2014)				
At fan	9:17 a.m.	-1.20	❖	
	9:50 a.m.	-1.25	❖	
	10:25 a.m.	-1.20	❖	
	10:55 a.m.	-1.35	❖	
	11:25 a.m.	-1.30	❖	
	1:10 p.m.	-1.45	❖	
	1:32 p.m.	-1.30	❖	
Location 1	8:54 a.m.	0.01		❖
	9:35 a.m.	0.02	❖	
	10:10 a.m.	0.03	❖	
	11:13 a.m.	0.02	❖	
	12:55 p.m.	0.01	❖	
Location 2	8:52 a.m.	0.02		❖
	9:33 a.m.	0.01	❖	
	10:08 a.m.	0.02	❖	
	11:10 a.m.	0.02	❖	
	12:56 p.m.	0.01	❖	
Location 3	8:56 a.m.	0.01		❖
	9:38 a.m.	0.02	❖	
	10:12 a.m.	0.03	❖	
	11:14 a.m.	0.03	❖	
	12:53 p.m.	0.03	❖	

Brown AND Caldwell

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

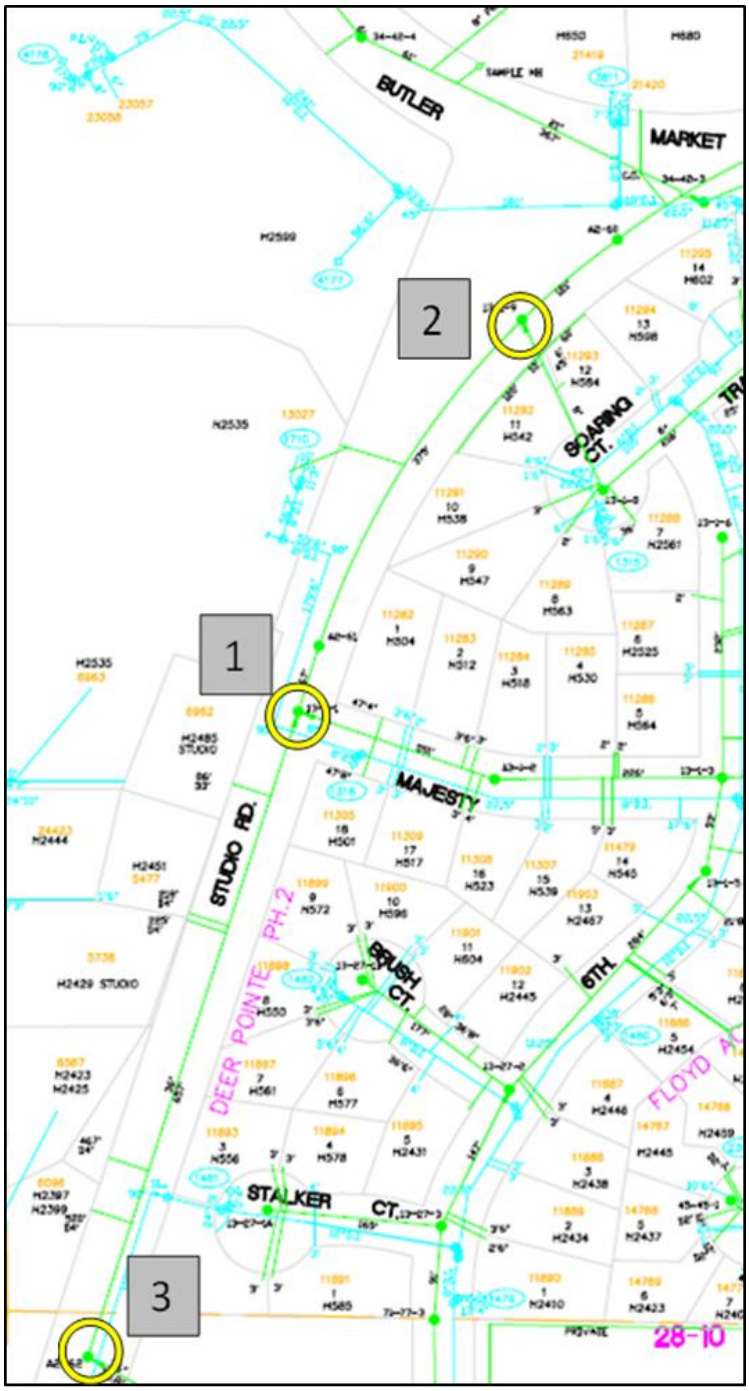


Figure 3-8. Locations of air pressure grab sampling

The air pressure grab sampling results presented in Table 3-3 indicates that the withdrawal of 1,000 cfm of air from both manholes along the PI had very little air pressure reduction effect in the three listed manholes.

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

3.2.2 Zones of Influence Due to Air Withdrawal

Given the results presented in this section, it is possible to establish zones of influence for each of the air withdrawal locations along the gravity section of the PI. A map showing these zones of influence is presented in Figure 3-9. These zones of influence were determined based on discernible fan-induced differential air pressure reductions at each of the eight manholes where pressures were continuously monitored.

Brown AND Caldwell

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

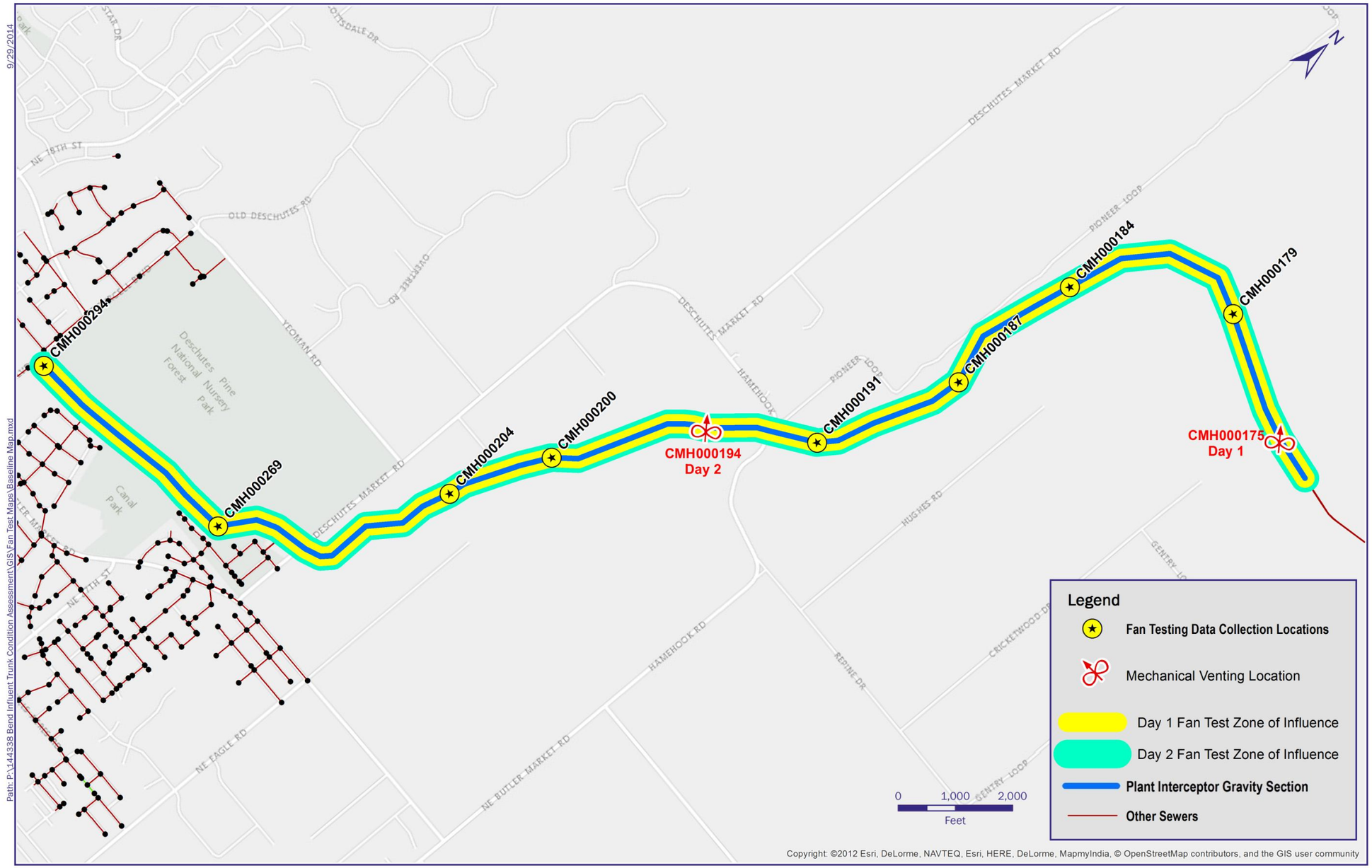


Figure 3-9. Fan testing zones of influence

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

As can be seen in Figure 3-9, each of the two air withdrawal locations resulted in a zone of influence that extended along the entire reach of the PI.

Following the conclusion of the fan test study, an analysis was performed on the projected, future free headspace conditions in the PI. Flow data provided in the 2014 Draft Sanitary Sewer Master Plan were input into the sewer headspace airflow model in order to ascertain the availability of free headspace in the pipe under flow conditions projected out to 2024. The results of this analysis are presented in Table 3-4. Note that in Table 3-4 "headspace airflow capacity" refers to the amount of air that would be dragged by the flowing wastewater in the open headspace above it without the aid of forced-air ventilation.

Table 3-5. Current and Projected 2024 Airflow and Flow Depth Conditions

Time frame	Dry weather flow conditions						Wet weather flow conditions		
	Average (mgd)	Avg. pipeline d/D	Headspace airflow capacity (cfm)	Daily max peak (mgd)	Avg. pipeline d/D	Headspace airflow capacity (cfm)	Peak WW flow (mgd)	Avg. pipeline d/D	Headspace airflow capacity (cfm)
Existing	6.2	0.33	540	11.3	0.43	550	20.2	0.63	600
2024	8.8	0.37	545	16.5	0.56	700	27.1	0.79	250

As can be seen in Table 3-4, it appears that the PI will have sufficient headspace to accommodate forced-air ventilation. The exception to this could be under 2024 peak wet weather flow conditions where the average depth ratio (d/D) in the PI is expected to be approximately 0.79. This flow condition could temporarily reduce the zone of influence of a fan before flow levels in the pipe subside following the effects of wet weather flow transmission. Once this condition subsides, the fan would be able to effectively ventilate the sewer in the intended fashion.

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

Section 4

Conclusions

The following conclusions are drawn from the fan test results presented in this report:

- 1,000 cfm air withdrawal efforts from manholes CMH000175 and CMH000194 resulted in significant air pressure reductions along the entire length of the PI. These air pressure reductions were more pronounced between the location of the siphon and manhole CMH000204. The less significant pressure reductions that were recorded in the two tested manholes upstream of CMH000204 were likely a result of numerous physical changes in the interceptor upstream of manhole CMH000204, such as changes in horizontal alignment, changes in slope, and a reduction in pipe diameter for one pipe segment.
- The withdrawal of air at manhole CMH000175 had a much greater overall pressure reduction effect along the alignment than the air withdrawal at manhole CMH000194. At CMH000194 the fan was pulling against the momentum of the flowing wastewater in the downstream direction, in addition to pulling air from the upstream reaches of the pipe. This resulted in less significant pressure reduction in the downstream reaches of the sewer. At manhole CMH000175 all of the air withdrawn by the fan was drawn from the upstream reaches of the sewer, resulting in lower overall negative pressures.
- Given the pressure reduction effects measured during the fan test, it is surmised that the maximum air velocity in the open headspace of the PI was increased by a factor of 6, up to approximately 600 feet per minute. This represents an approximately six-fold increase in the air velocity in the sewer headspace from what would normally be expected to be induced by the drag effect of the flowing wastewater under a half-full flow condition. Experience has shown that forcibly moving air at such velocities through the open headspace of a sewer such as the PI will be effective at controlling and reducing the rate of corrosion in the exposed concrete surfaces of the pipe wall.

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

Section 5

Technology Alternatives Analysis

Given the results of the fan testing, the relative remoteness of the interceptor location, and the history of odor complaints recorded along the interceptor alignment, the City of Bend appears to have the option of simply withdrawing air from the PI with a dedicated blower and directing it straight to atmosphere in order to move air through the pipe headspace and keep the pipe walls dry or, to take it a step further, designing and building a dedicated odor control system for this same application. The following provides a brief description of the systems envisioned for both of these types of application and their relative costs.

5.1 Vapor-Phase Treatment Alternatives Analysis

The principal vapor-phase technologies typically used to treat odorous air emanating from collection systems carrying raw municipal wastewater include biological treatment systems and activated-carbon (AC) adsorbers. Due to concerns about hazardous chemicals and the greater need for frequent operations and maintenance (O&M)-related service, wet chemical scrubbers are normally not considered for collection system applications and will not be analyzed further for this application. The following sections provide a summary of these technologies.

5.1.1 Biological Odor Control

Most biological odor control systems remove odors by capturing the odor-causing compounds in a media bed, where they can be oxidized by naturally occurring microorganisms such as bacteria, actinomycetes, or fungi. As odorous gases move through the packing media, two processes occur simultaneously: the compounds adhere to the media through either absorption or adsorption and bioconversion. Moisture content and temperature are important environmental conditions that must be maintained to optimize microorganism activity and thereby optimize odor removal.

Several biological odor control systems are currently in use in modern wastewater treatment and collection system facilities. These include in-ground biofilters, aboveground packaged biofilters, and biotrickling filters (also referred to as bioscrubbers). Examples of two of these systems (a biotrickling filter schematic and in-ground biofilter) are shown in Figure 5-1.

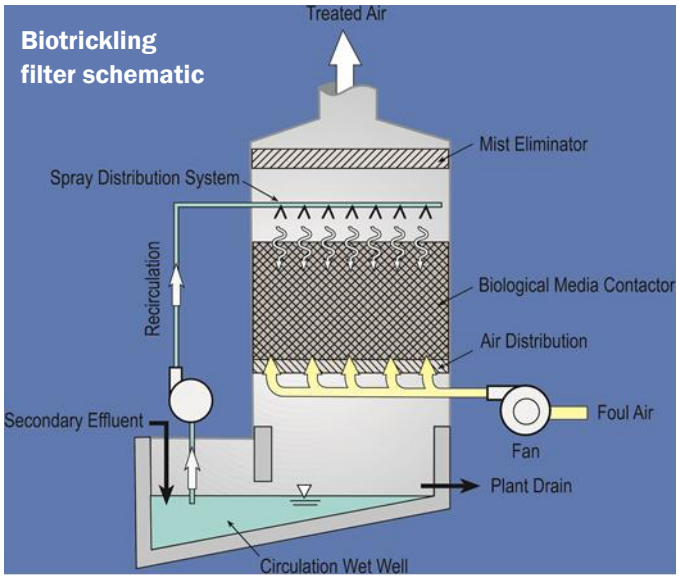


Figure 5-1. Biological odor control system examples

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

Of the vapor-phase odor control technologies typically used in municipal wastewater applications, biological systems are considered to be very environmentally sustainable. This is primarily due to the lack of chemicals used in the odor removal process and the infrequent media replacement requirements. In general, biological odor control systems become competitively cost-effective when average hydrogen sulfide (H_2S) concentrations are expected to be at a minimum of 20 to 25 parts per million by volume (ppmv). This is because comparable chemical scrubbing systems at these concentrations begin to require high chemical consumption and associated high costs.

In addition, the effectiveness of biological systems at consistent odor removal is contingent on passing a constant stream of odorous air through the media. If the active bacteria on the media are starved of odorous compounds due to infrequent use of the system, the colonies will fail to thrive, thus impeding optimal odor removal performance. This would likely not be an issue for a potential PI application.

5.1.2 Activated Carbon Adsorbers

Standard AC works by capturing H_2S and various organic molecules such as volatile organic compounds by adsorbing or binding the odorous compounds to binding sites on the surface of the carbon. AC particles have a large surface area relative to their weight, providing “sites” for the entrapment of odor molecules. With the exception of ammonia, AC adsorption technology is well suited to removing a wide variety of odorous compounds at low influent concentrations that are typically encountered in wastewater treatment and collection applications. One example of this type of odor control system is shown in Figure 5-2.

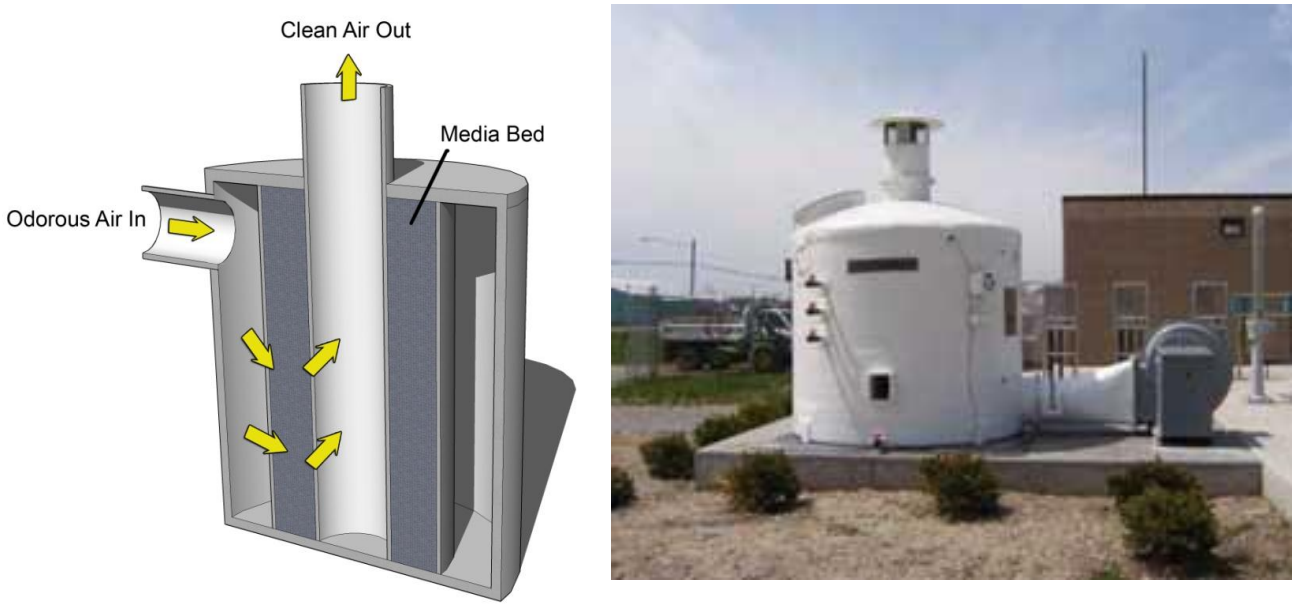


Figure 5-2. Schematic of an activated carbon system and photo

Deep-bed carbon units are sized for face velocities of 50 to 60 feet per minute and typically use a media depth of 3 feet. The lower face velocity of carbon units means that, for the same airflow rate, the carbon adsorbers require larger vessels than wet scrubbers. However, carbon units do not have chemical storage tanks and area requirements can be further reduced by using dual-stage units with stacked beds. The net result is that the carbon systems may not take up any more space than a chemical scrubber sized to treat a similar amount of foul air.

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

The life of a carbon bed is limited by the number of binding sites within the media, and once most of the sites are full the carbon must be either regenerated or replaced. AC is an extremely effective adsorbent because it possesses a high surface area per unit weight. Bituminous coal and coconut shell are the most widely used sources for manufacturing virgin AC.

Carbon systems are also often used as a second stage or polishing step in conjunction with a biological odor control system. O&M requirements are fairly low in comparison to other technologies. These efforts are focused primarily on routine fan maintenance and occasional odor removal performance tests. Depending on the concentration of the H_2S in the foul air stream, frequent media replacement could be necessary.

5.1.3 Summary of Advantages and Disadvantages

A summary of the advantages and disadvantages of biological and carbon adsorption vapor-phase odor control technologies is presented in Table 5-2.

Table 5-2. Summary of Biological and Carbon Adsorption Vapor-Phase Odor Control Technologies

Technology	Advantages	Disadvantages
Biological	• Simple to operate • Can treat very high H_2S concentrations • Low O&M costs • Considered a "green" technology • Engineered media can last 10 to 20 years	• More effective for H_2S at consistently high concentrations • Bacteria can fail to thrive when concentrations are too low • High relative capital cost • Can require large footprint relative to other technologies
Carbon adsorption	• Simple to operate • Can treat a wide variety of odorous compounds • No additives required for operation • Lower relative capital cost • Can require smaller footprint relative to other technologies	• High odor concentrations can lead to high O&M costs due to frequent media replacement • Media must be checked periodically for odor breakthrough • Spent media will result in immediate release of untreated odors

5.2 Direct Discharge Ventilation Alternative

The idea behind this alternative would be to simply forcibly ventilate 1,000 cfm of air from the PI and discharge it untreated, directly to atmosphere. While this would certainly represent the most cost-effective alternative, it carries with it the possibility of eliciting further odor complaints along the alignment. It is envisioned that this system would consist of a 1,000 cfm fan whose intake duct is connected directly to a manhole along the PI, most likely near the upstream end of the double-barrel siphon. The fan would discharge air directly to atmosphere via an approximately 10-foot-long, 10-inch-diameter inert plastic duct. A tall stack would allow wind dispersion to reduce the concentration of odorous gases as a function of horizontal distance from the stack; however, depending on meteorological conditions, this would certainly not always be the case and could lead to further odor complaints. Such a system would be expected to have fewer O&M requirements than a full odor control system. Routine fan maintenance would be the primary O&M necessity. A summary of the pros and cons of such a system are summarized in Table 5-3.

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

Table 5-3. Advantages and Disadvantages of Direct Discharge to Atmosphere

Technology	Advantages	Disadvantages
1,000 cfm blower discharging directly to atmosphere	• Simple to operate • Very low capital cost • Very low O&M costs	• Proper dispersion dependent upon atmospheric conditions • Could elicit further odor complaints

5.3 Siting Alternatives

Two options were considered in terms of siting a forced-air ventilation facility; both options would involve withdrawing the air from MH CMH000175. One option is to construct it on the upstream end of the siphon. The other option is to construct it on the downstream end of the siphon and pull the air from the CMH000175 via an approximately 5,000-linear-foot, 12-inch-diameter high-density polyethylene (HDPE) duct, which would be held aloft via supports as it crossed the canal. The idea behind considering these options was to compare the cost of pulling air from a 5,000-foot distance versus the cost of bringing electrical service to the location on the upstream end of the siphon. Following conversations with the Central Electric Cooperative it was determined that 3-phase electrical service would need to be brought from approximately 2,000 feet away to the upstream siphon location at a unit cost of $40 per foot. This translates into a cost for the establishment of electrical service of approximately $80,000. By comparison, using the 2012 RS Means Guide as a reference, 12-inch-diameter HDPE air duct carries an average material unit cost of $31 per linear foot. At a total length of 5,000 feet this would translate into a material cost of $155,000. Assuming a shallow burial is allowed, the construction cost would be approximately $350,000, which does not include construction or permitting of a pipe bridge needed to cross the canal. Therefore, siting the CMH000175 air withdrawal unit on the upstream end of the siphon appears to be the more economically viable alternative. Table 5-4 summarizes the comparison between the two options.

Table 5-4. Forced-Air Ventilation Facility Siting Options

Option	Cost
Electrical service canal crossing	$80,000
Airflow duct to WRF	$350,000

5.4 Cost Comparisons

Tables 5-5 through 5-7 summarize the various costs associated with each of the options discussed in Sections 5.1 and 5.2. Present-worth costs were calculated based on a 25-year life cycle and a 3 percent annual interest rate. Note all capital cost figures include an estimated $80,000 for electrical service to the location in the vicinity of MH CMH000175 described in Section 5.3.

Brown AND Caldwell

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

Table 5-5. Biological Odor Control Systems Costs	
Parameter	Cost, $
Option 1: 1,000 cfm biotrickling filter	
Capital cost	150, 000
Construction/engineering	15,000
Construction management	15,000
Misc. costs	8,000
Total capital improvement program (CIP) cost	188,000
Annual routine O&M cost	8,500
25-year present worth	330,000
Option 2: 1,000 cfm package biofilter	
Capital cost	510,000
Construction/engineering	51,000
Construction management	51,000
Misc. costs	25,000
Total CIP cost	637,000
Annual routine O&M cost	19,000
25-year present worth	960,000

Table 5-6. Carbon Media Odor Control Systems Costs	
Parameter	Cost, $
Option 3: 1,000 cfm carbon adsorption system	
Capital cost	130,000
Construction/engineering	26,000
Construction management	26,000
Misc. costs	7,000
Total CIP cost	189,000
Annual routine O&M cost	16,000
25-year present worth	470,000

Table 5-7. Direct Discharge Ventilation	
Parameter	Cost, $
Option 4: 1,000 cfm buried fan, discharge stack	
Capital cost	130,000
Construction/engineering	26,000
Construction management	26,000
Misc. costs	7,000
Total CIP cost	189,000
Annual routine O&M cost	1,000
25-year present worth	210,000

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

According to the information presented in Tables 5-4 through 5-6, the lowest present-worth cost alternative would be the option whereby odorous air is discharged directly to atmosphere; however, this low-cost option must be weighed against the possibility that this will elicit further odor complaints along the PI alignment. The most cost-effective odor control solution appears to be the 1,000 cfm biotrickling filter option.

Brown AND Caldwell

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

Section 6

Recommendations

The following recommendations are put forth based on the conclusions drawn in this report:

- Design and build a 1,000 cfm forced-air withdrawal facility to withdraw air from manhole CMH000175 and to be sited on the upstream end of the double-barrel siphon. At a minimum, the purpose of this facility would be to move sufficient amounts of air to dry the exposed concrete pipe walls along the PI; however, this facility could also be designed and built as a dedicated odor control facility to help reduce historical odor complaints that have been recorded along the alignment of the PI. If an odor control facility is desired, it is recommended that a biotrickling filter be designed and built; however, before proceeding with the design of any odor control facility along the PI, a routine H_2S data logging exercise, involving recording continuously monitored H_2S data at MH CMH000175, should be conducted to further understand the concentrations of H_2S that are stripped from solution along the PI alignment.
- Design and build a 1,000 cfm forced-air withdrawal facility to withdraw air from manhole CMH000269. As with the recommended facility at manhole CMH000175, the primary purpose of this facility would be to move sufficient amounts of air to dry the exposed concrete pipe walls along the PI; however, the secondary purpose for this facility would be to maintain dry pipe wall conditions along the reach of the PI between manholes CMH000269 and CMH000294. As with the facility recommended at CMH000175, this facility could be designed and built as a dedicated odor control facility to help reduce historical odor complaints that have been recorded along the alignment of the PI. Furthermore, as with the facility at CMH000175, a routine H_2S data logging exercise, involving recording continuously monitored H_2S data at MH CMH000269, should be conducted.

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

Section 7

Conceptual Layouts

A conceptual layout for a 1,000 cfm biotrickling filter odor control system is presented in Figure 7-1.

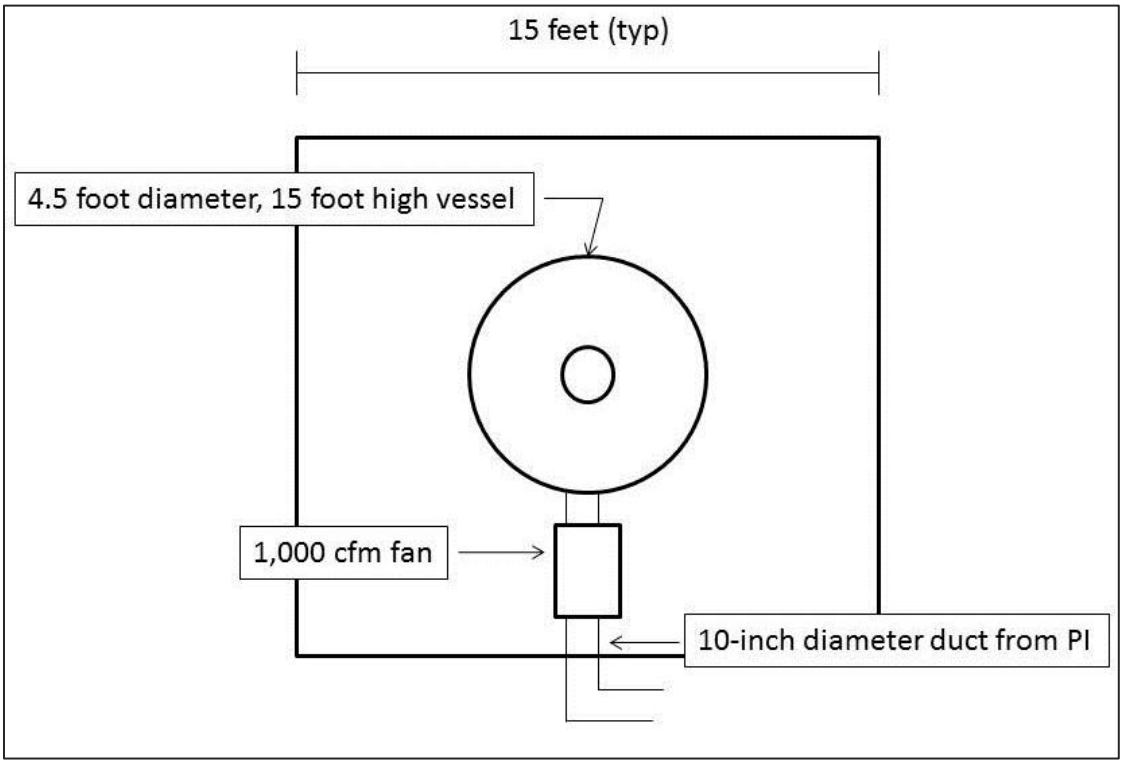


Figure 7-1. Biotrickling filter odor control conceptual layout

The footprint for a 1,000 cfm biotricking filter for this application would have an approximate area of 225 square feet. Major components would consist of the 225-square-foot concrete pad; a 1,000 cfm backward-curved centrifugal fan; miscellaneous nutrient recirculation piping and pump; a run of 10-inch-diameter intake ductwork, and an approximately 5-foot-high, 10-inch-diameter discharge stack.

A conceptual layout for a 1,000 cfm direct-discharge ventilation system is illustrated in Figure 7-2.

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

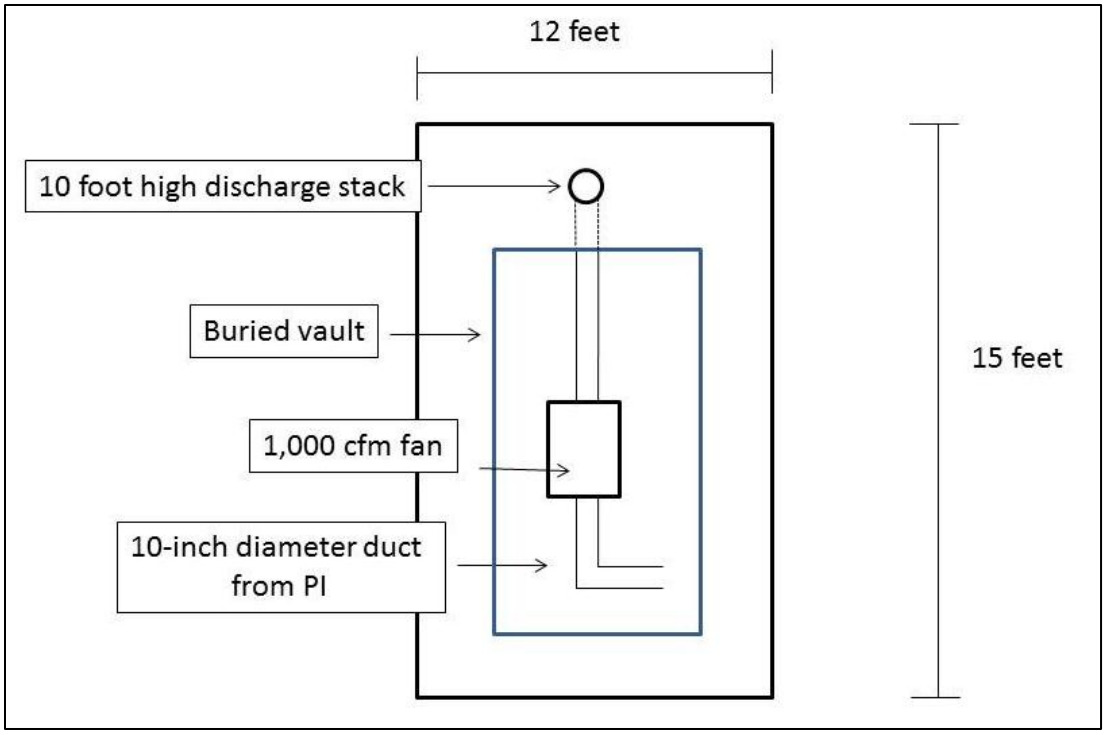


Figure 7-2. Direct-discharge system conceptual layout

A buried 1,000 cfm discharge fan, used for direct discharge of foul air to atmosphere, is envisioned to be housed in an approximately 10-foot-long by 8-foot-wide buried vault, whose total footprint is envisioned to be approximately 15 feet long by 12 feet wide. The 10-inch-diameter, approximately 10-foot-high discharge stack would be supported on the concrete pad surrounding the buried vault.

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

Section 8

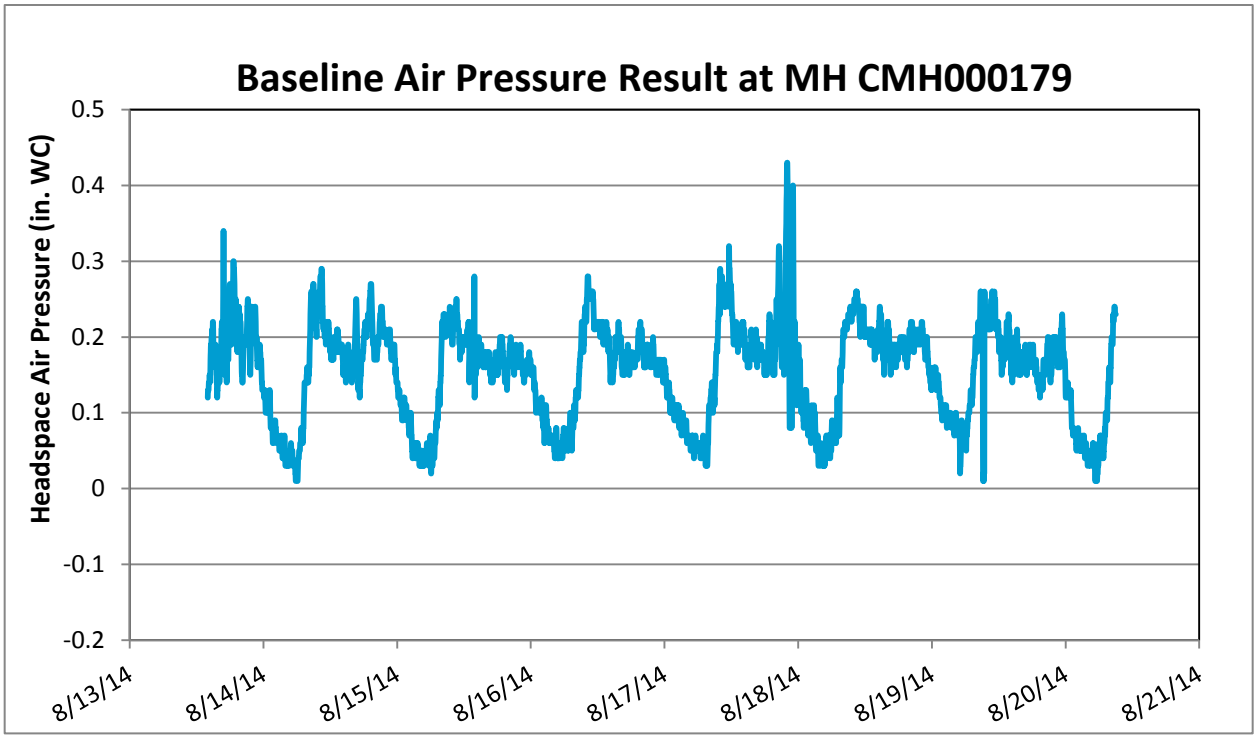
Limitations

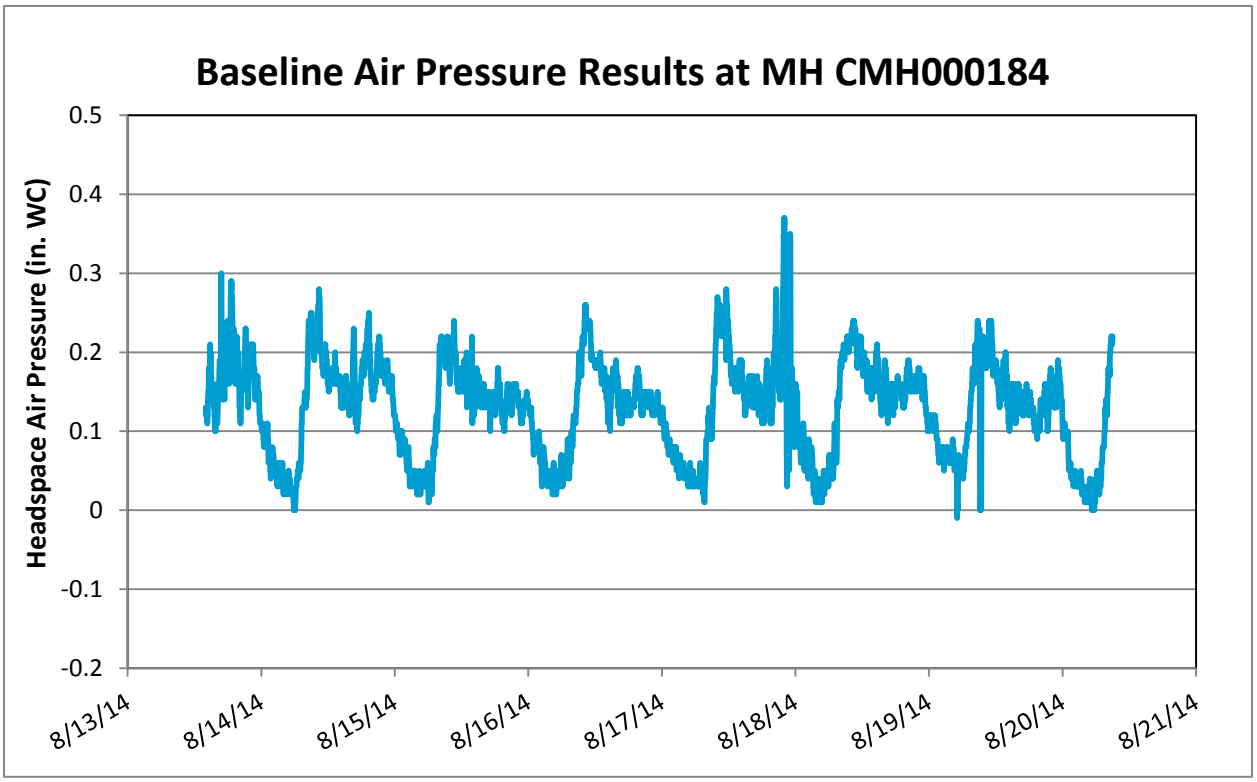
This document was prepared solely for the City of Bend (City) in accordance with professional standards at the time the services were performed and in accordance with the contract between the City and Brown and Caldwell dated October 31, 2013. This document is governed by the specific scope of work authorized by the City; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by the City and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

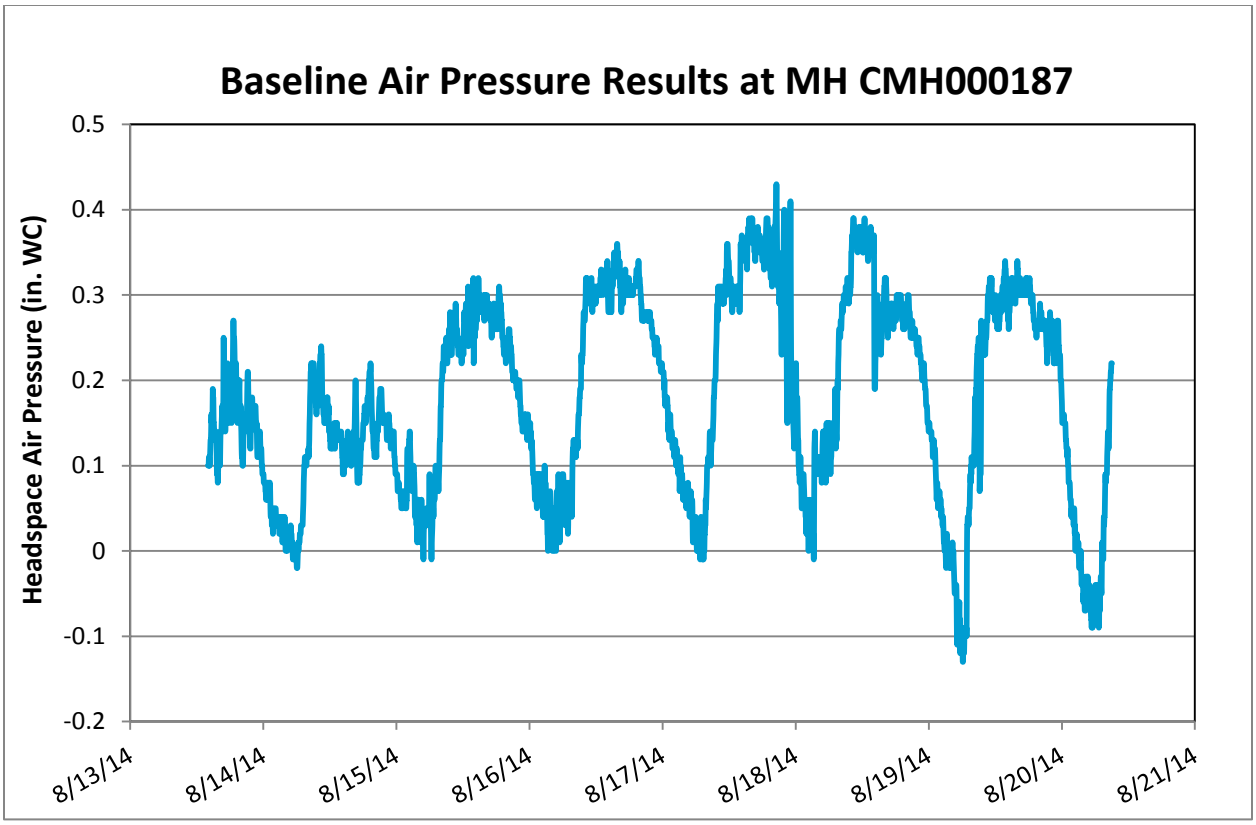
Appendix A: Baseline Differential Air Pressure Data Charts

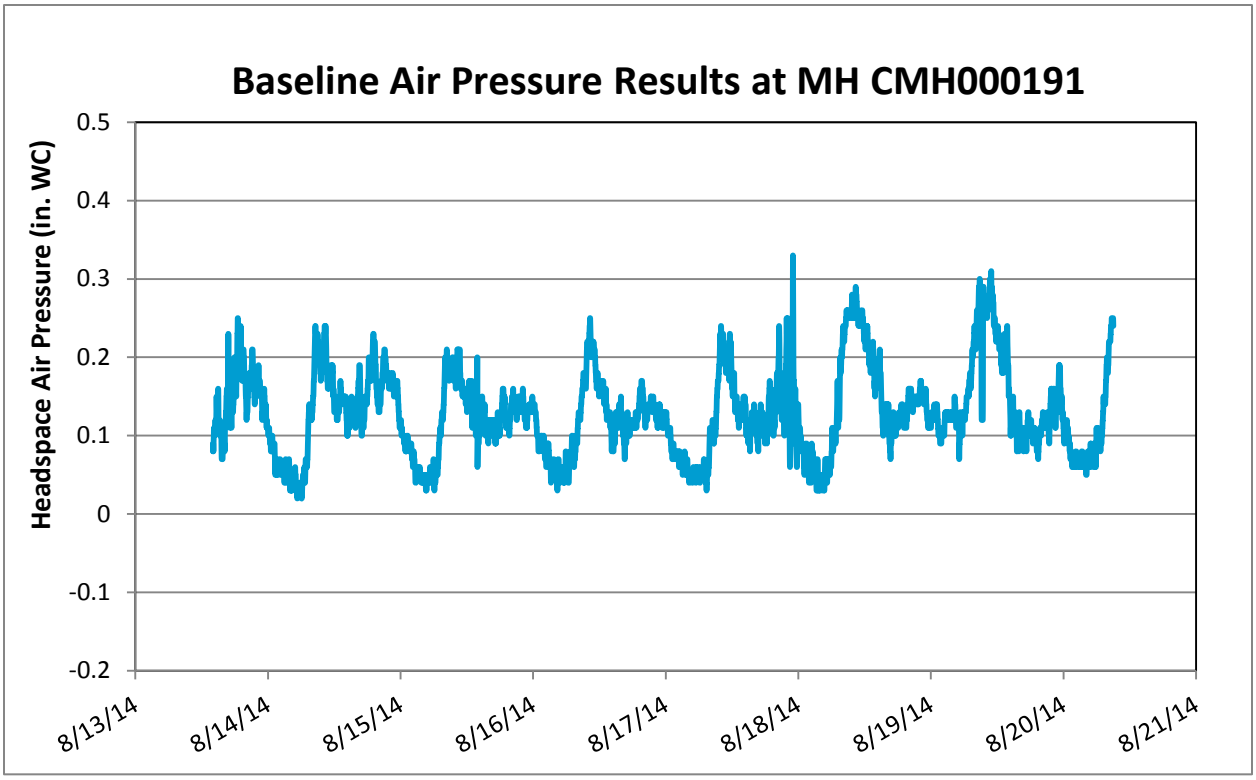
DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.





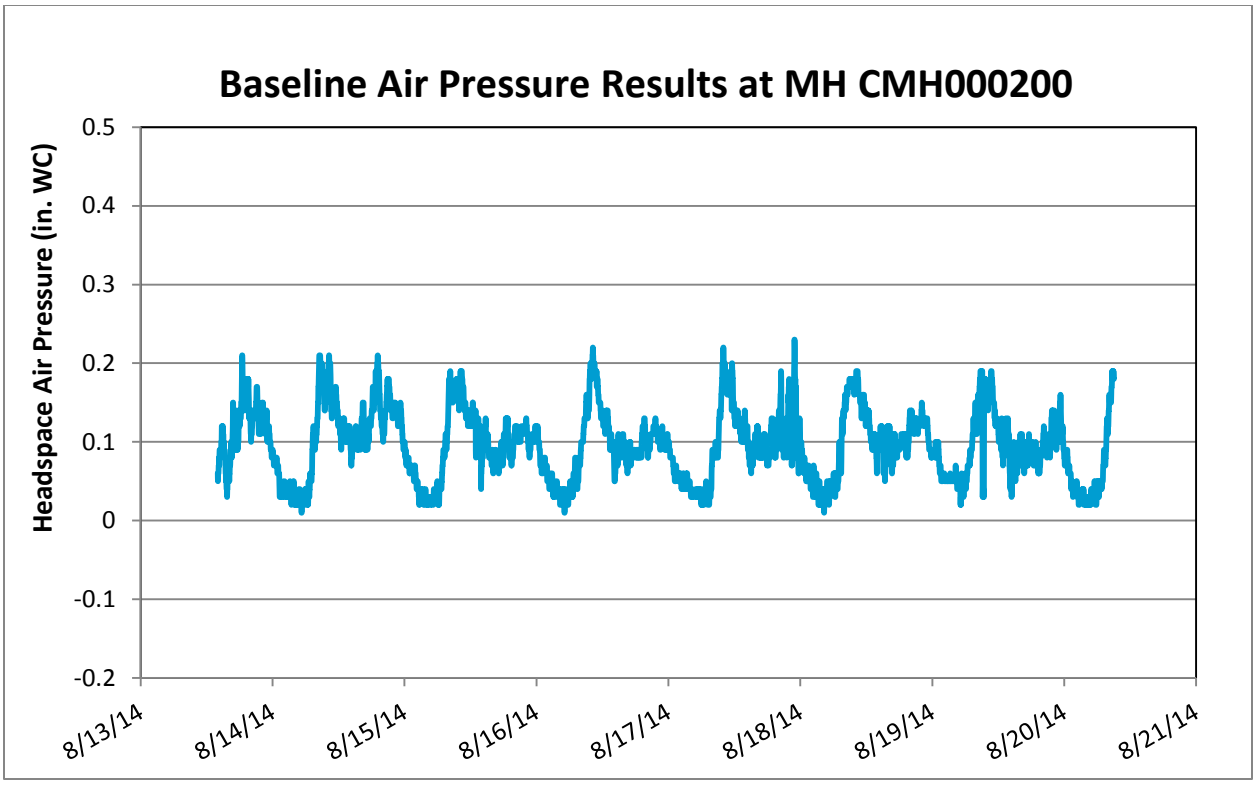
DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

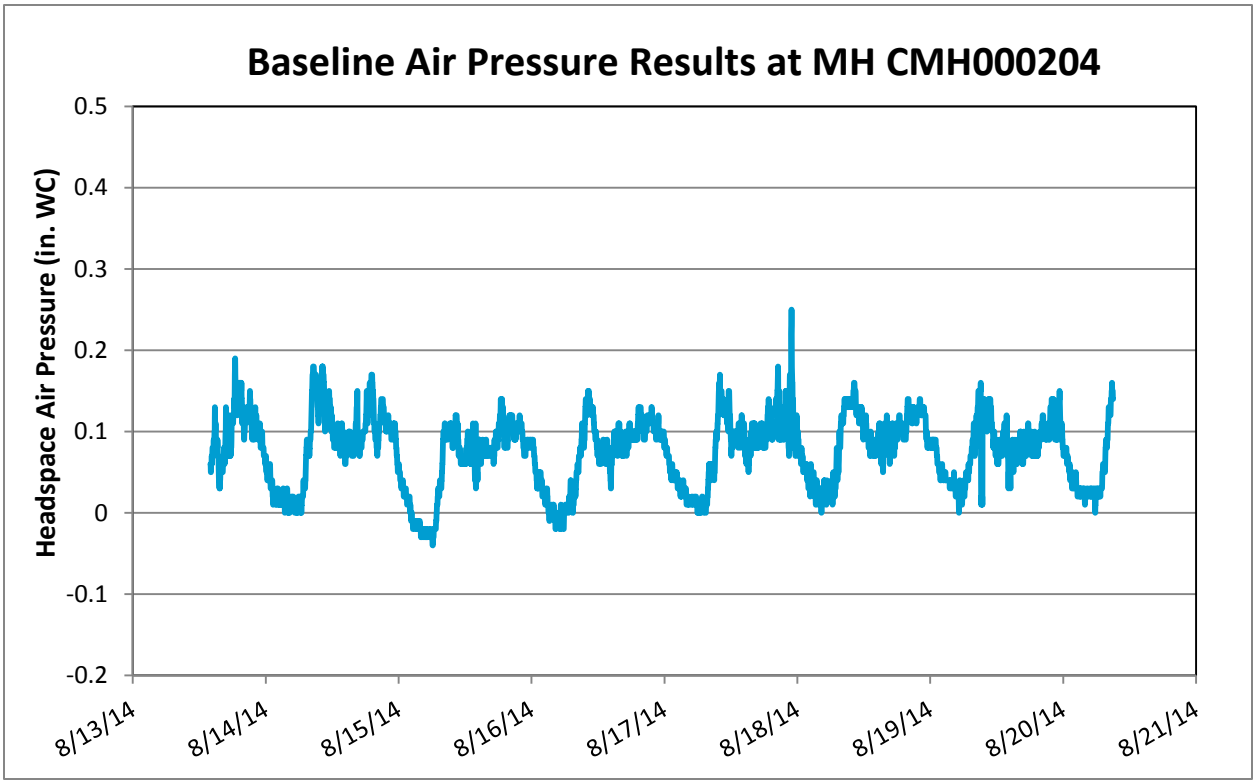




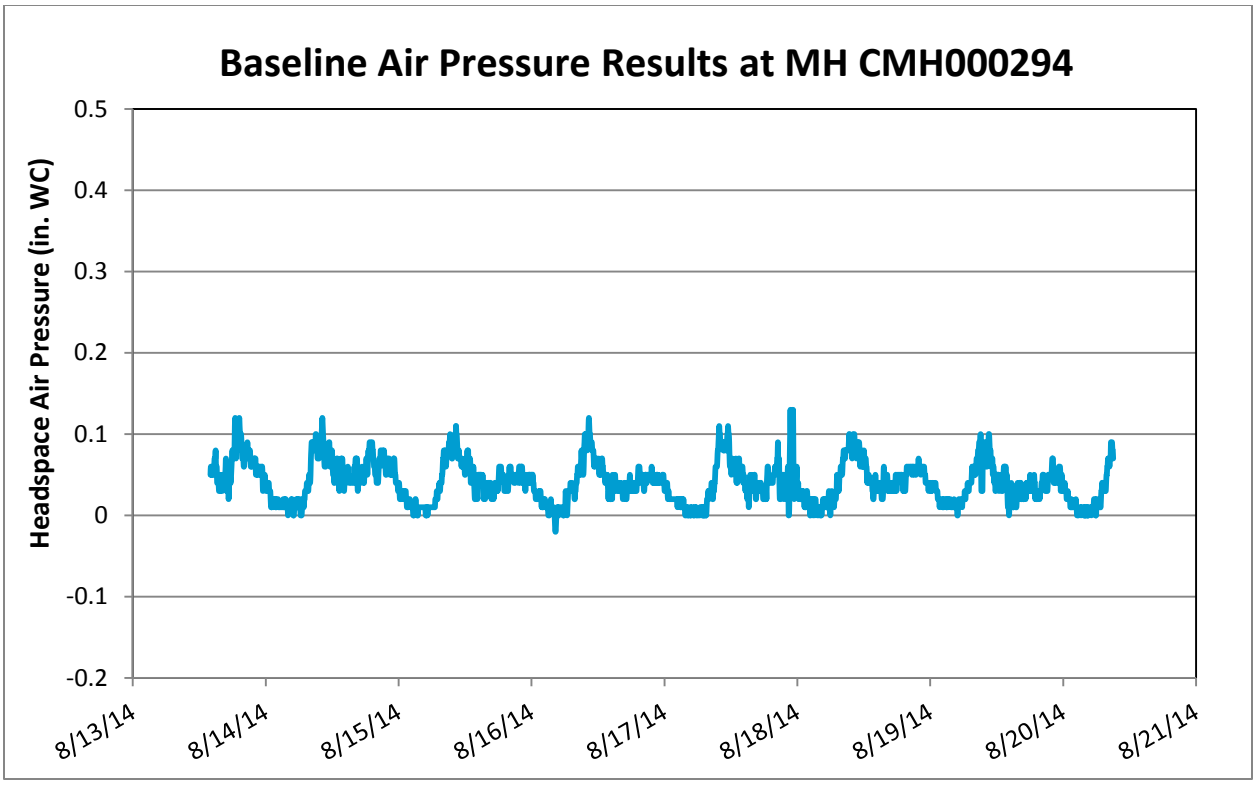
Brown AND Caldwell

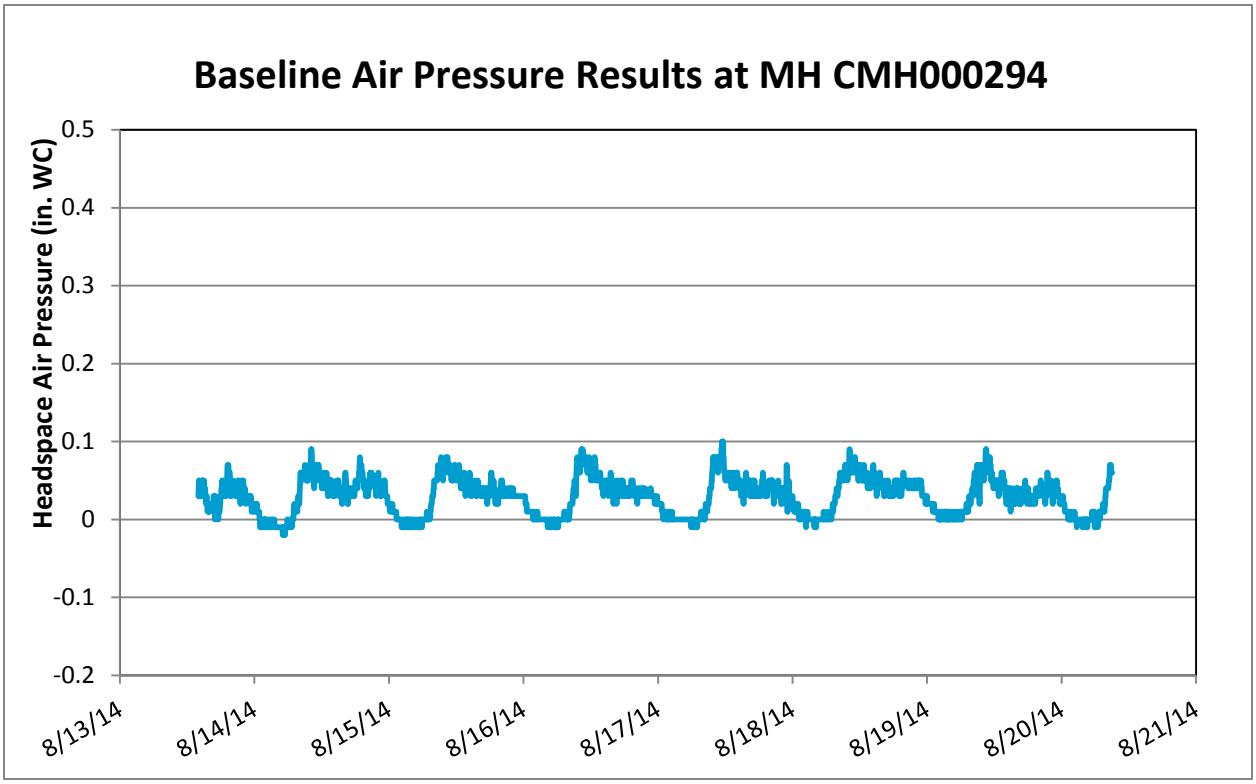
DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.





DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.



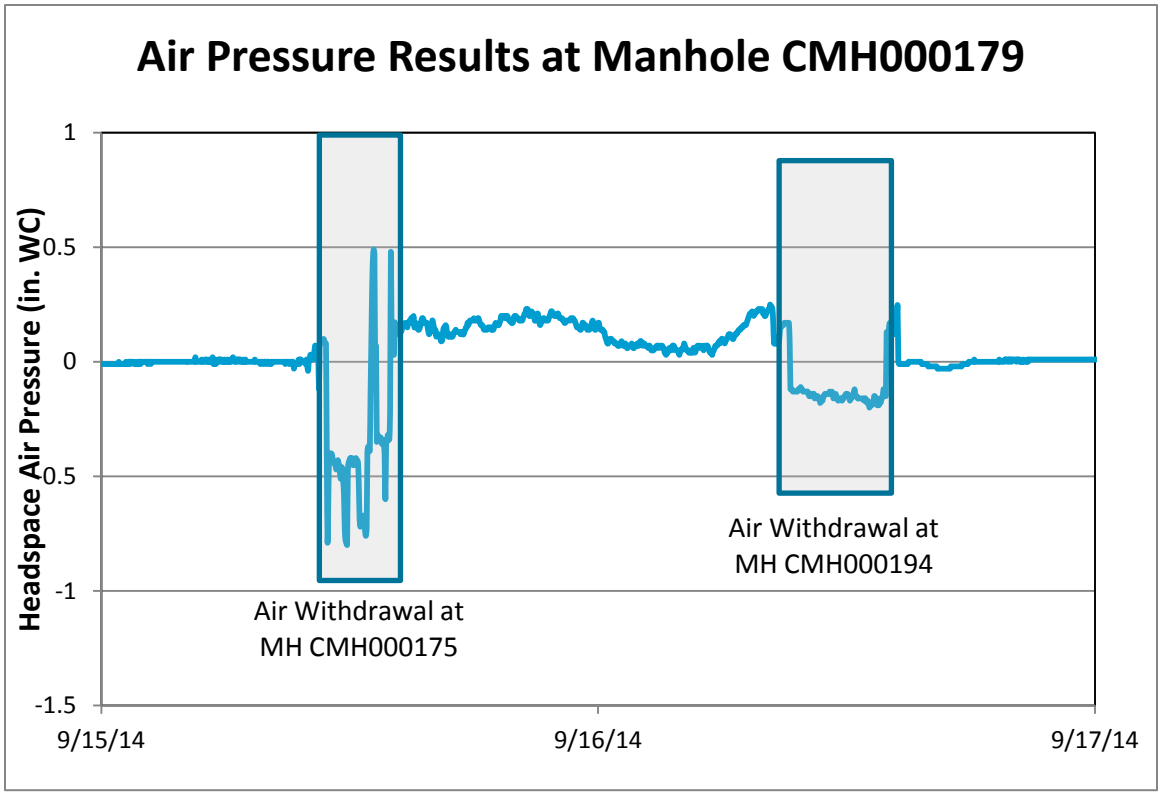


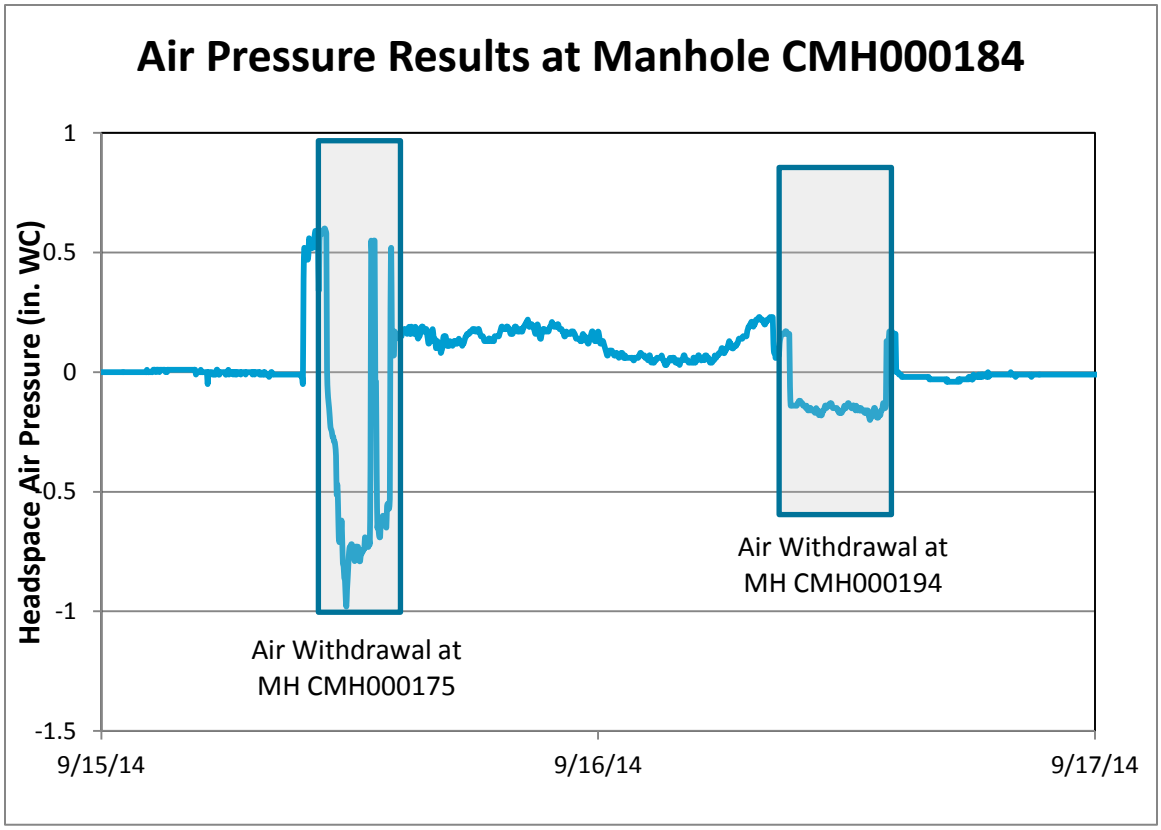
Brown AND Caldwell

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

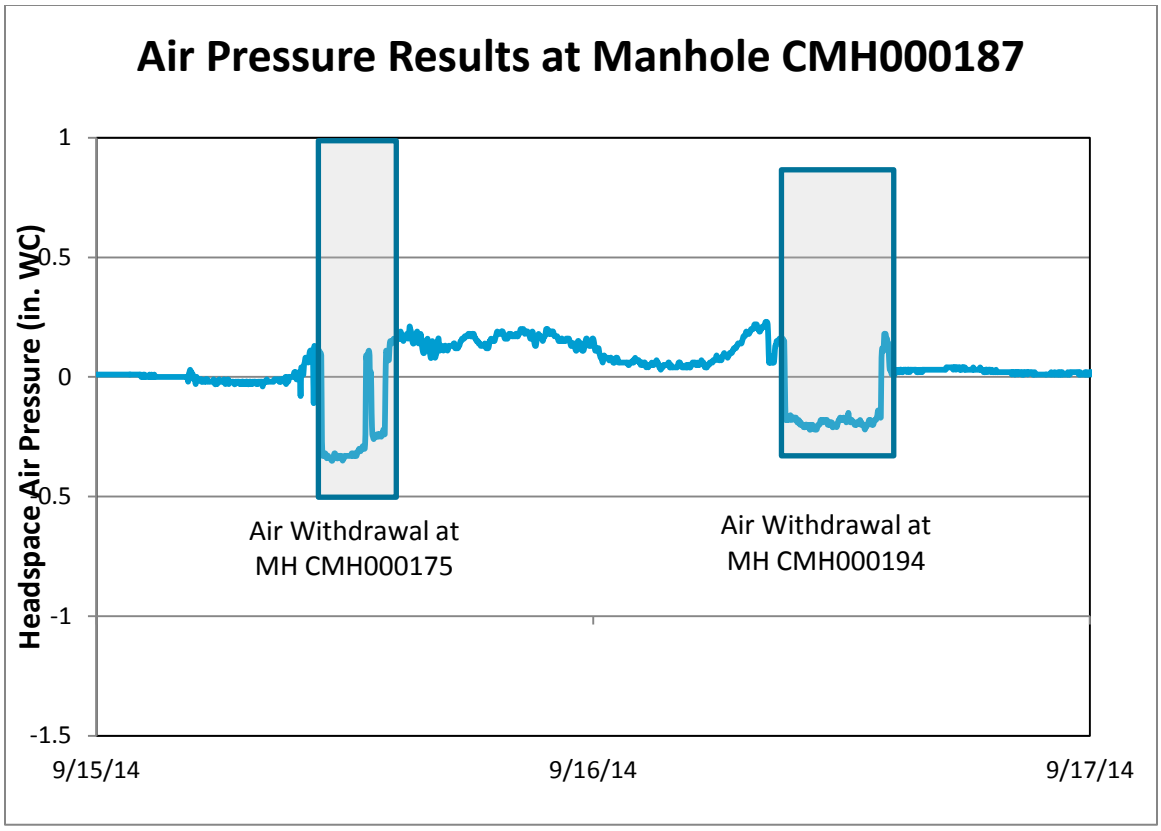
Appendix B: Fan Test (at 1,000 cfm) Differential Air Pressure Data Charts

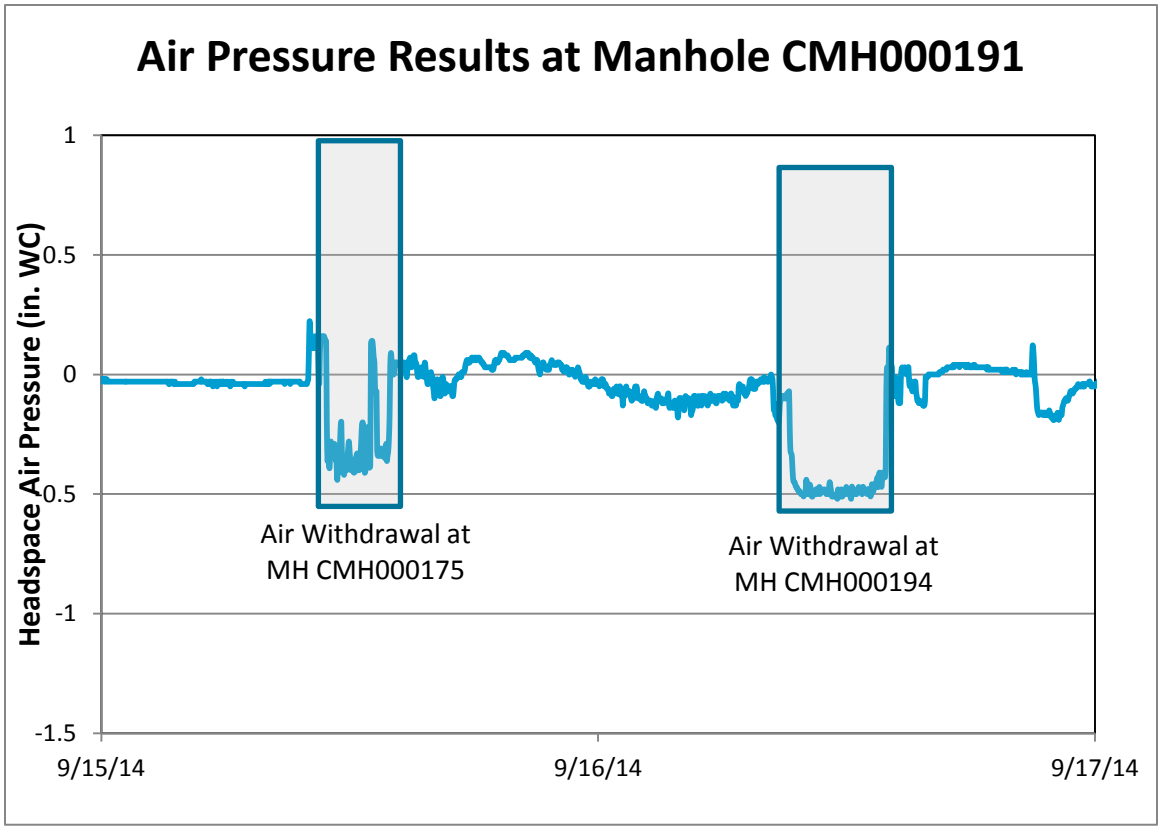
DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.





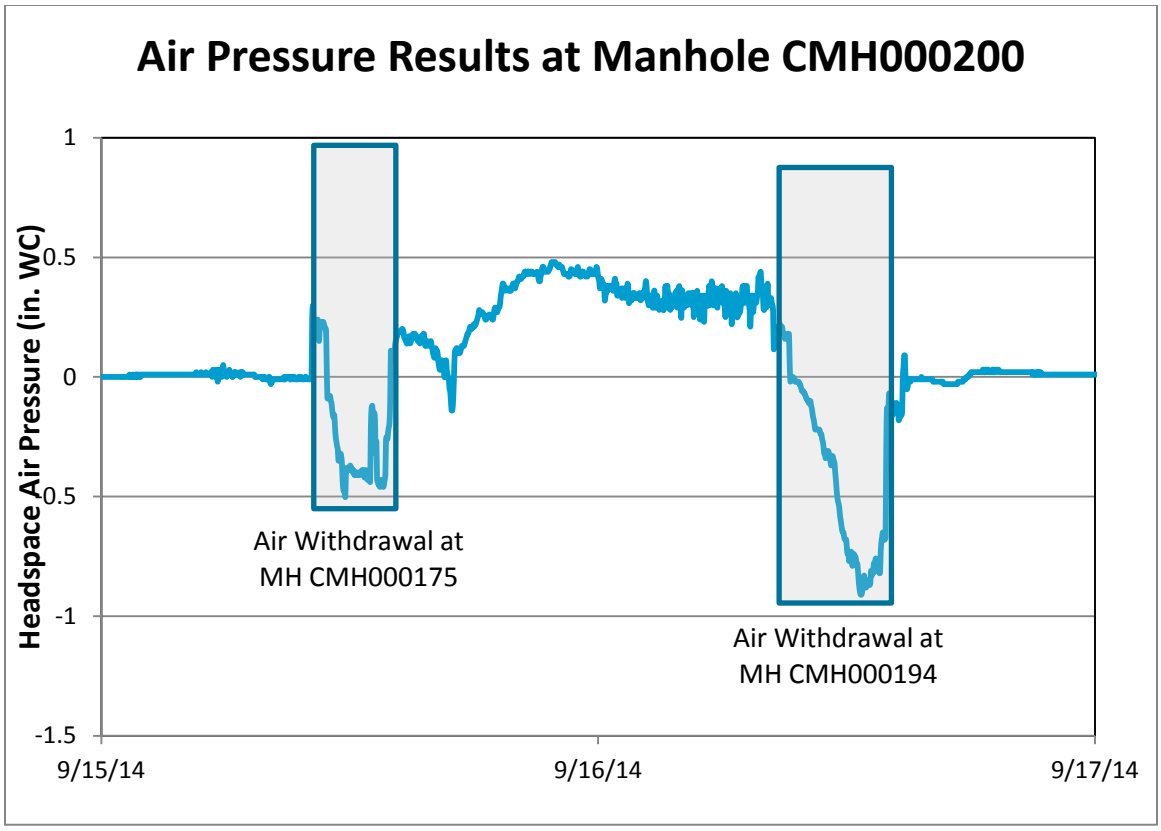
DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.

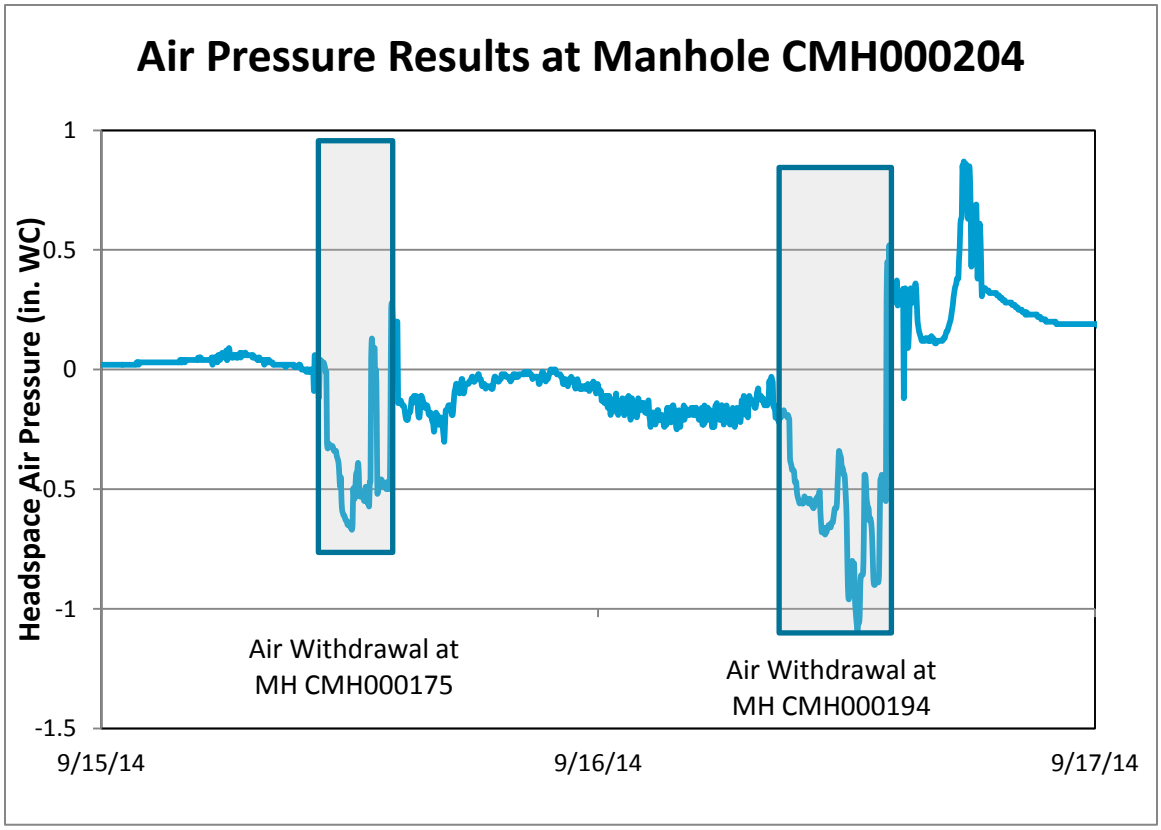




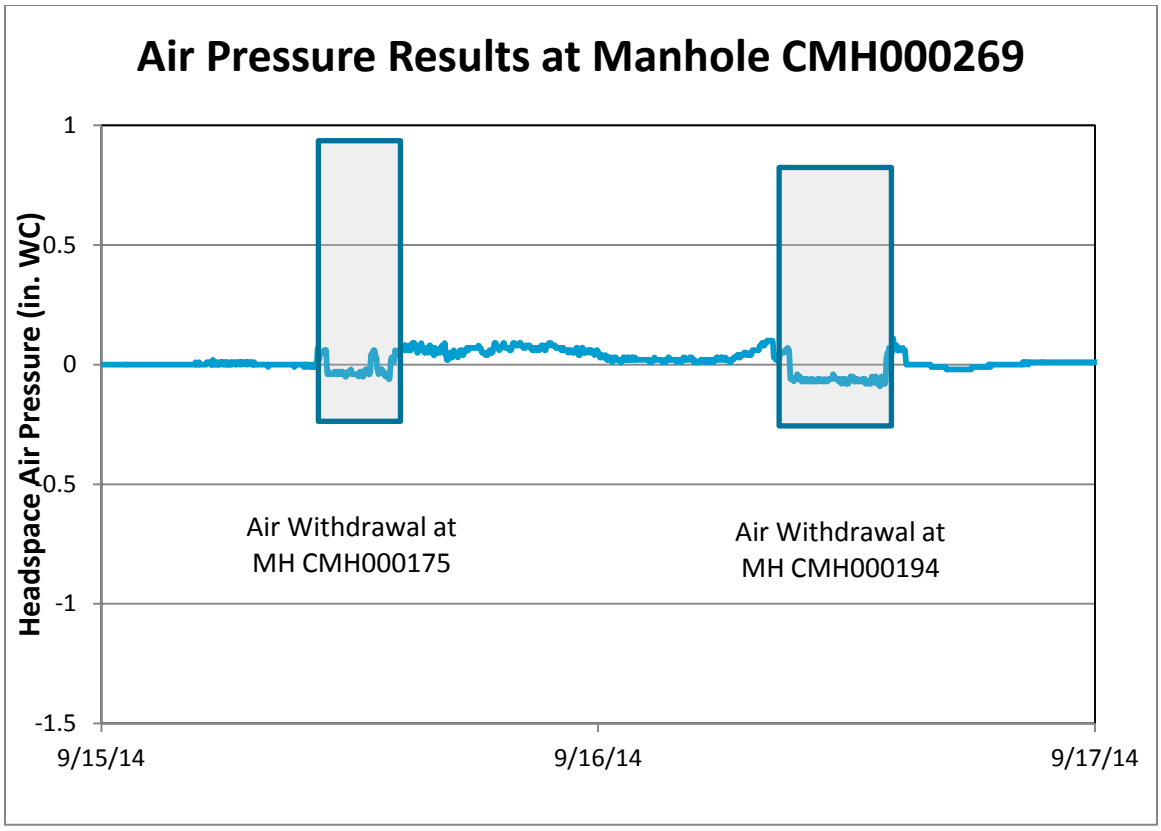
Brown AND Caldwell

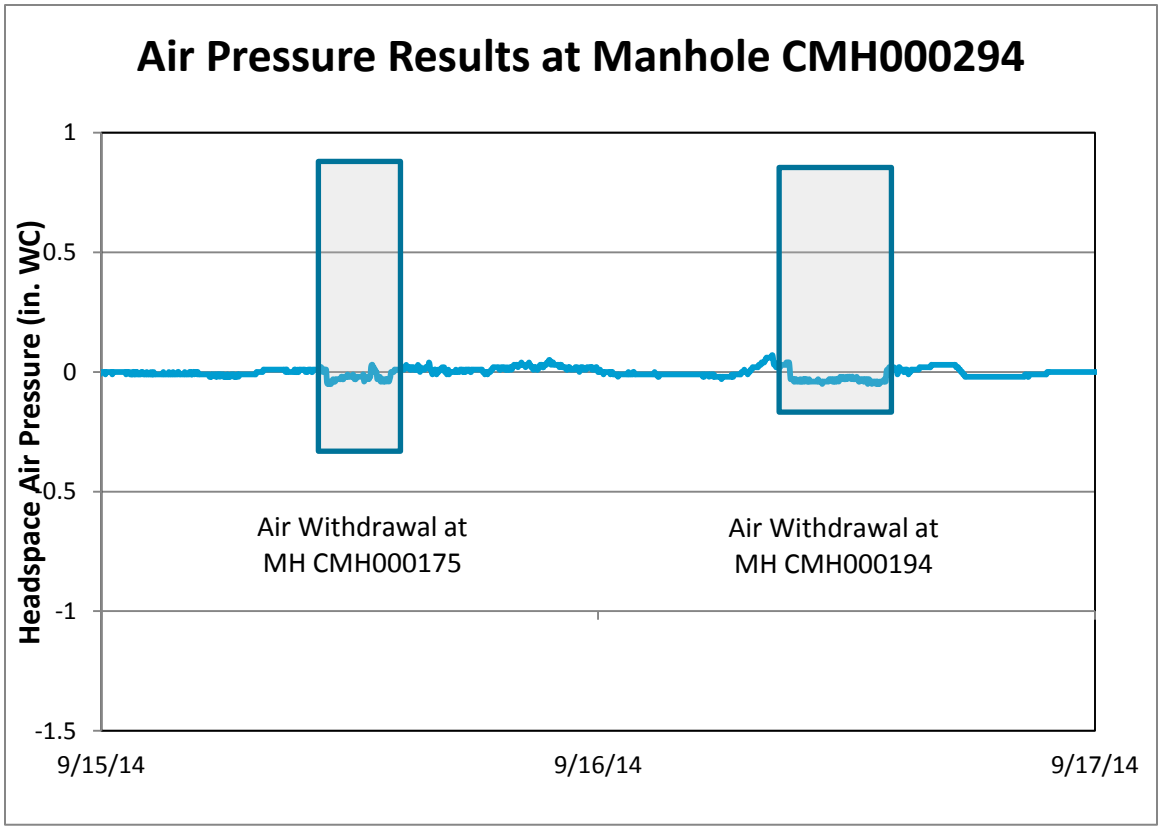
DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.





DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.





Brown AND Caldwell

DRAFT for review purposes only. Use of contents on this sheet is subject to the limitations specified at the end of this document.