Responder Multi-Sensor Inspection

Houston Public Works and Engineering
Wastewater Operations

TX Houston Large Diameter Sewer Inspection

UBU01013-UBU01012
U/S MH: UBU01013
D/S MH: UBU01012
RECORD DRAWING DIAMETER (RCD): 102 in
Job: SJ501134
Inspection Date: 8/3/2013
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1 Summary

1.1 Job

Prepared For	City of Houston
Street Location	Off Sam Houston Parkway
Deployment Location / Manhole	UBU01013
Operator	J. Williamson
Deployment Weather	Sunny (Dry)
Planned Inspection Distance	1098 ft
Actual Inspection Distance	23 ft
Inspection Direction	Downstream
Upstream Location / Manhole	UBU01013
Downstream Location / Manhole	UBU01012
Record Drawing Diameter	102 in
Record Drawing Pipe Shape	Circular
Pipe Material	Reinforced Concrete Pipe

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1.2 Results

Observations	
Number of Observations	5
Number of Grade 4 & 5 Observations	0
Number of Continuous Observations	1
Flow Height	20 %
Gas	
Inspected Distance with Average H2S Concentration Over 2 ppm	0.0 ft
% Inspected Distance with Average H2S Concentration over 2ppm	0.0 %
Average Concentration of H2S	2.0 ppm
Maximum Concentration of H2S	2 ppm
Average Temperature	83 degrees F
Maximum Temperature	83 degrees F

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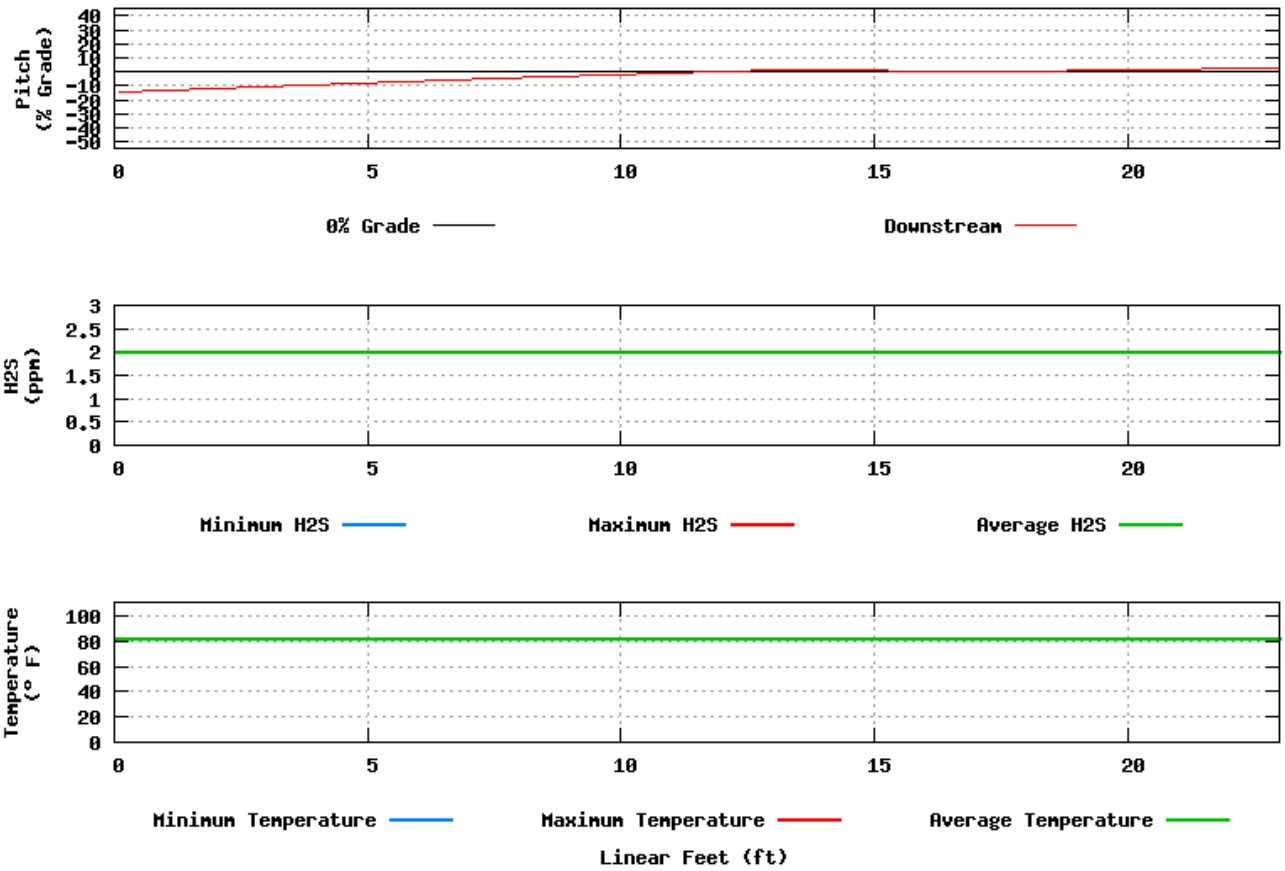
1.3 Segment Summary View

The inspected distance displayed below is the distance downstream from the UBU01013 manhole.



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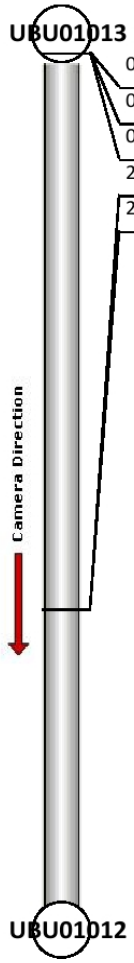
2 Observations

Profile/Photo Observation Report

Date:	**08/03/2013**	Weather:	**Dry**	Sheet #:	**0**
Pipe Length:		Owner:	**Houston, TX**	Pre Clean:	
P.O.#:		Surveyor:	**J. Williamson**	PSR:	**11997235**
Customer:	**Clean Serve**	Clean Date:		Shape:	**Circular**

Street:	**Westheimer Road**	Flow Control:	**Not Controlled**
City:	**Houston, TX**	Year Renewed:	
Location:	**Yard**	Tape/Media #:	**SD017**
Purpose:	**Maintenance Related**	Dia/Height:	**102**
Use:	**Sanitary**	Material:	**Reinforced Concrete Pipe**
Drain Area:		Lining:	**Cured in Place**
Category		Pipe Joint Length:	
Comment:			
Location Details:		Direction of Survey:	**Downstream**

US MH: **UBU01013** DS MH: **UBU01012** Total Length Surveyed: **35.3**



Position	Code	Observation	Counter	Photo	Grade
0	AMH	Manhole	0	0-AMH.jpg	-
0	MWL	Water Level	125	0-MWL.jpg	-
0	LFBK	Lining Failure Buckled	157	0-LFBK.jpg	S3
23.1	LFBK	Lining Failure Buckled	684	23.1-LFBK.jpg	S3
23.1	MSA	Abandoned Survey	690	23.1-MSA.jpg	-

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PACP Code:	**AMH**
Description:	**Manhole**
Distance (ft):	**0**
Structural Grade:	**0**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	**UBU01013**

PACP Code:	**MWL**
Description:	**Water Level**
Distance (ft):	**0**
Structural Grade:	**0**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	

PACP Code:	**LFBK**
Description:	**Lining Failure Buckled**
Distance (ft):	**0**
Structural Grade:	**3**
O&M Grade:	**0**
Clock Start/From:	**6**
Clock To:	**11**
1st Value:	
2nd Value:	
Continuous Index:	**S01**
Within 8" of Joint?:	**False**
Remarks:	**Liner is falling into the pipe and taking up part of the cross-section.**

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PACP Code:	**LFBK**
Description:	**Lining Failure Buckled**
Distance (ft):	**23.1**
Structural Grade:	**3**
O&M Grade:	**0**
Clock Start/From:	**6**
Clock To:	**11**
1st Value:	
2nd Value:	
Continuous Index:	**F01**
Within 8" of Joint?:	**False**
Remarks:	

PACP Code:	**MSA**
Description:	**Abandoned Survey**
Distance (ft):	**23.1**
Structural Grade:	**0**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	**Cannot pass buckled liner in pipe**

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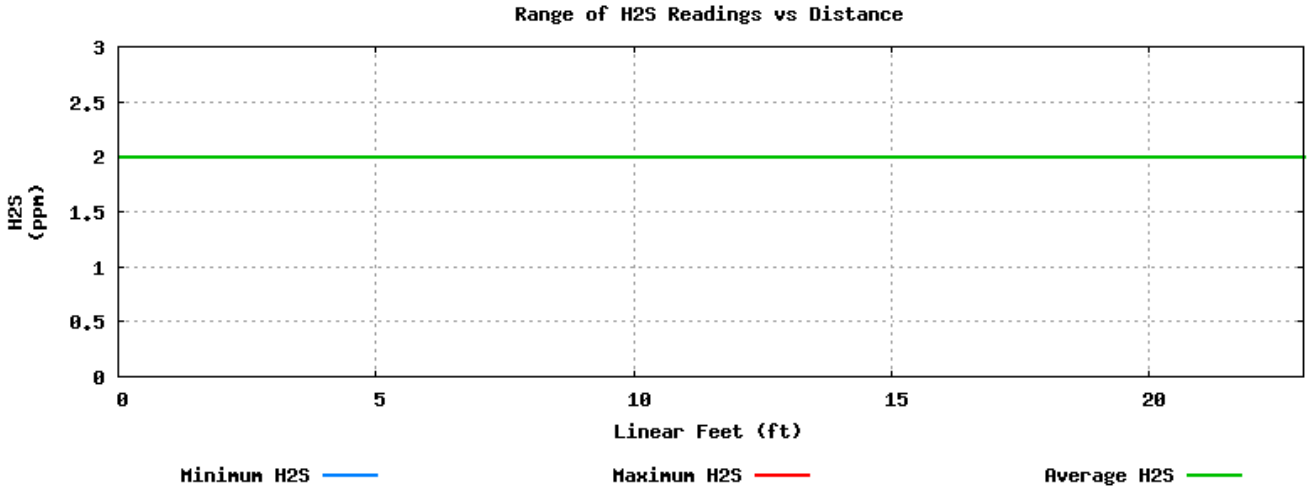
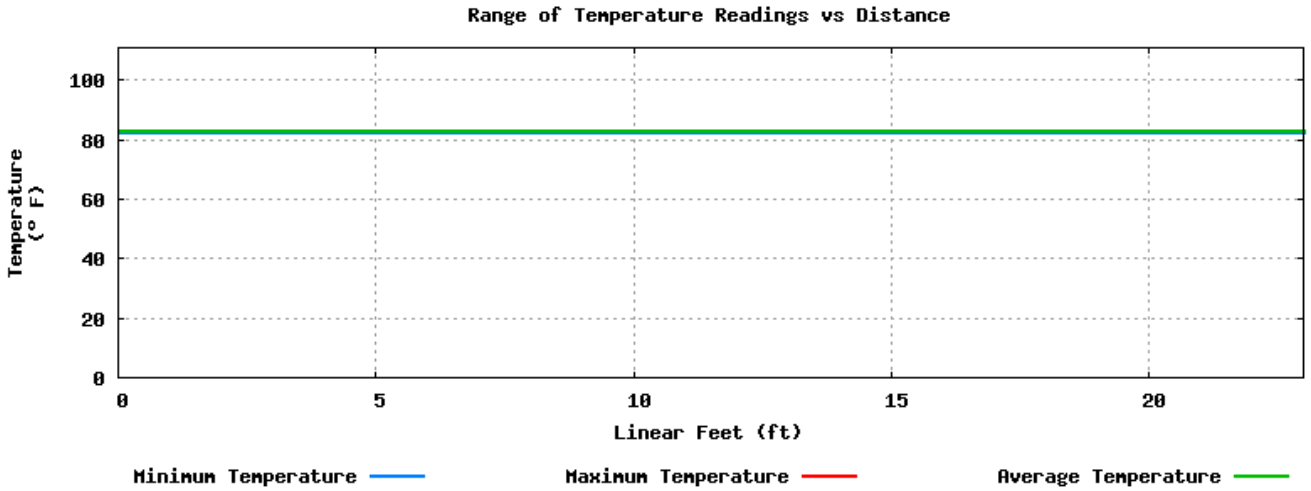
3 Gas

The inspected distance displayed below is the distance downstream from the UBU01013 manhole.





General Results	H2S Concentration	Temperature
Maximum	2 ppm	83 degrees F
Minimum	2 ppm	83 degrees F
Average	2.0 ppm	83 degrees F

H2S Concentration	Cumulative Inspected Distance	% of Inspected Distance
Maximum > 2.0 ppm	0.0 ft	0.0 %
Average > 2.0 ppm	0.0 ft	0.0 %

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TX Houston Large Diameter Sewer Inspection

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1 Summary

1.1 Job

Prepared For	City of Houston
Street Location	Off Westheimer Road
Deployment Location / Manhole	UBU01012
Operator	J. Williamson
Deployment Weather	Sunny (Dry)
Planned Inspection Distance	0 ft
Actual Inspection Distance	593 ft
Inspection Direction	Upstream
Upstream Location / Manhole	UBU01013
Downstream Location / Manhole	UBU01012
Record Drawing Diameter	102 in
Record Drawing Pipe Shape	Circular
Pipe Material	Reinforced Concrete Pipe

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1.2 Results

Observations	
Number of Observations	10
Number of Grade 4 & 5 Observations	1
Number of Continuous Observations	2
Flow Height	20 %
Ovality and Deflection	
Average ASTM Ovality	8.53 %
Minimum ASTM Ovality	3.59 %
Maximum ASTM Ovality	11.48 %
Average Deflection	14.20 %
Minimum Deflection	8.67 %
Maximum Deflection	17.79 %
Ovality Calculation Method	Half-Pipe
Sediment	
Average Sediment Depth	0.0 in
Total Sediment Volume	0.0 ft^3
% of Pipe Flow Restriction Due to Sediment	0.0 %
Gas	
Inspected Distance with Average H2S Concentration Over 2 ppm	593.0 ft
% Inspected Distance with Average H2S Concentration over 2ppm	100.0 %
Average Concentration of H2S	7.3 ppm
Maximum Concentration of H2S	9 ppm
Average Temperature	94 degrees F
Maximum Temperature	96 degrees F
Corrosion and Buildup	
Number of Precision Scans	45
Average Measured Internal Pipe Dimensions	80.14 in
Average Measured ID Change in Precision Scans (radial)	-10.93 in
Minimum Measured ID Change in Precision Scans (radial)	-33.02 in
Maximum Measured ID Change in Precision Scans (radial)	1.32 in

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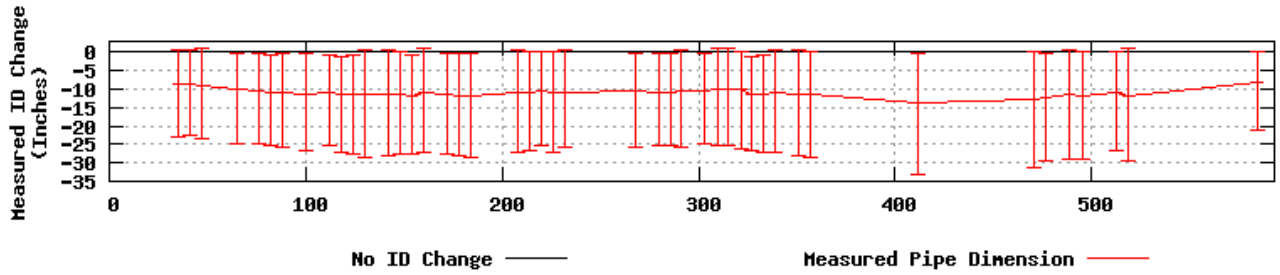
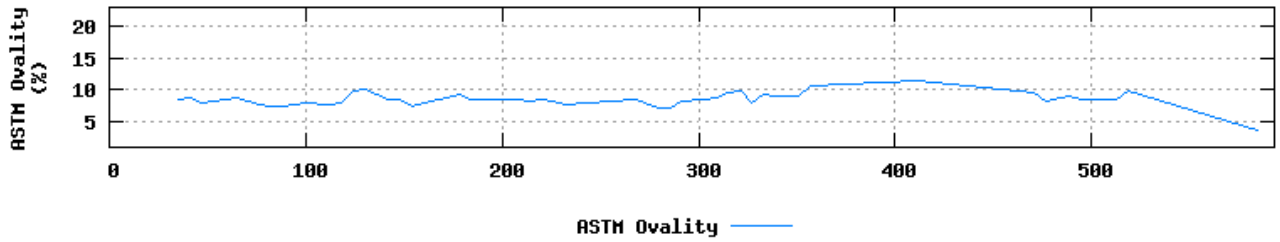
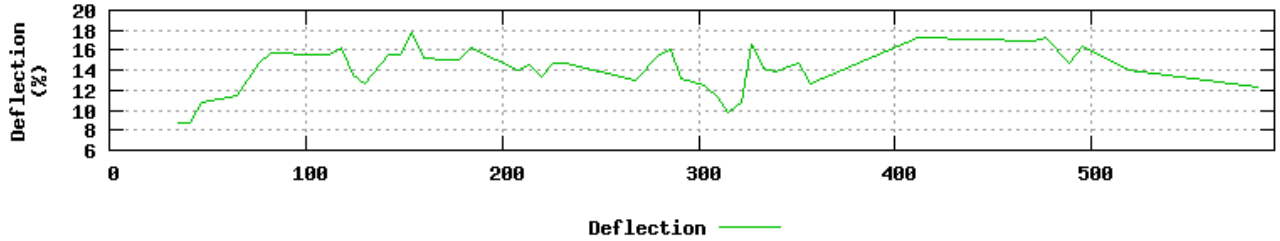
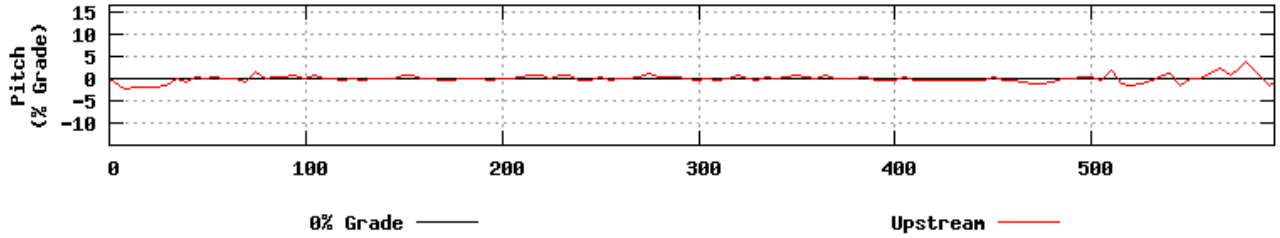
1.3 Segment Summary View

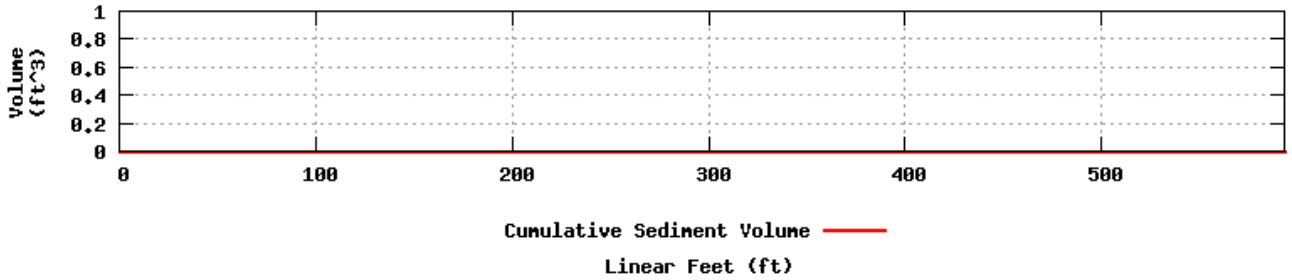
The inspected distance displayed below is the distance upstream from the UBU01012 manhole.











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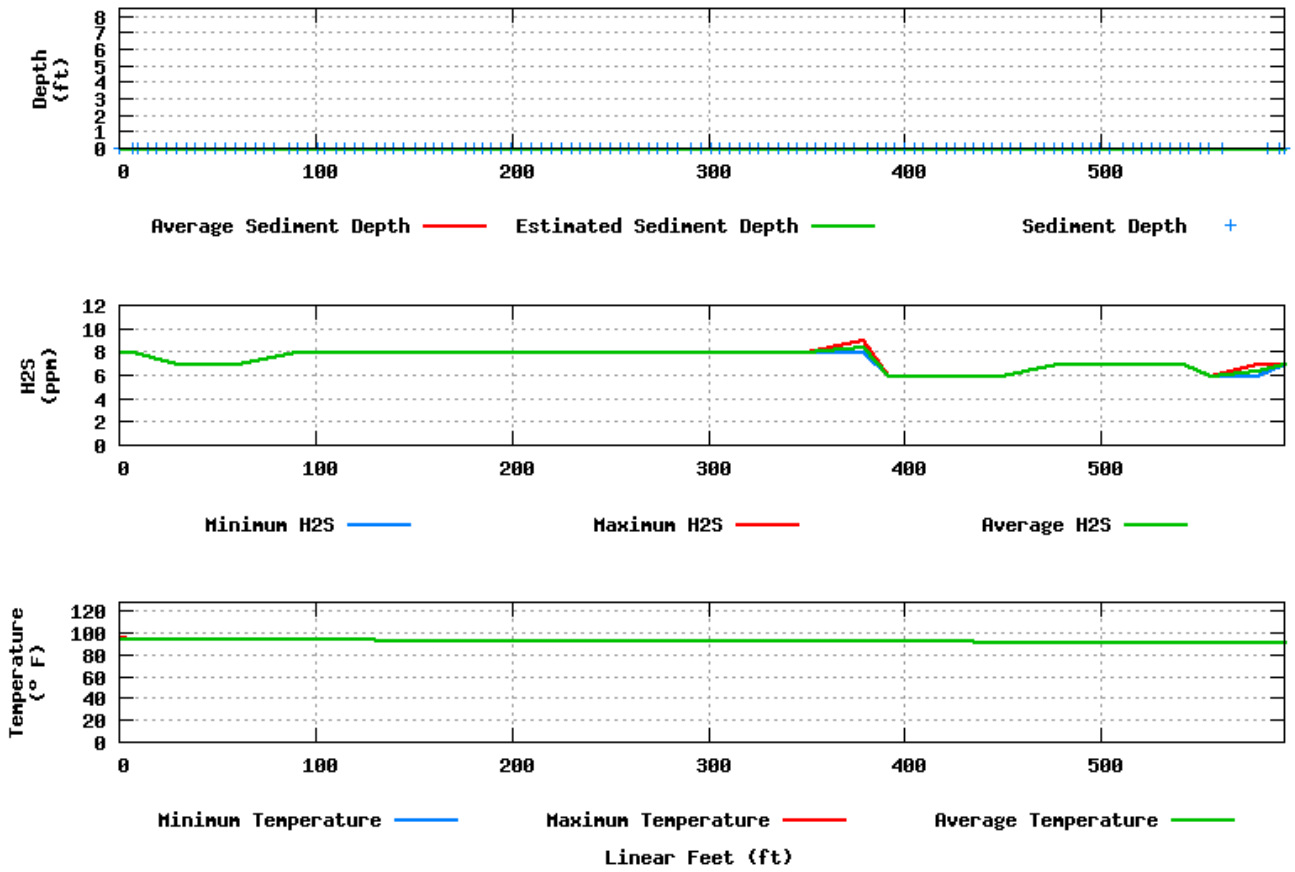
The inspected distance displayed below is the distance upstream from the UBU01012 manhole.



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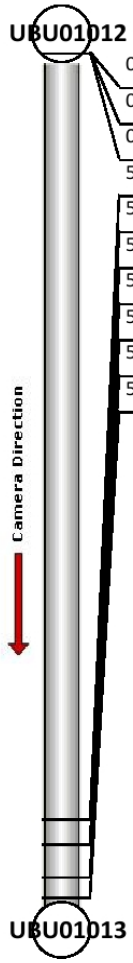
2 Observations

Profile/Photo Observation Report

Date:	**08/03/2013**	Weather:	**Dry**	Sheet #:	**0**
Pipe Length:		Owner:	**Houston, TX**	Pre Clean:	
P.O.#:		Surveyor:	**J. Williamson**	PSR:	**11997235**
Customer:	**Clean Serve**	Clean Date:		Shape:	**Circular**

Street:	**Off Westheimer Road**	Flow Control:	**Not Controlled**
City:	**Houston, TX**	Year Renewed:	
Location:	**Yard**	Tape/Media #:	**SD017**
Purpose:	**Maintenance Related**	Dia/Height:	**102**
Use:	**Sanitary**	Material:	**Reinforced Concrete Pipe**
Drain Area:		Lining:	**Cured in Place**
Category		Pipe Joint Length:	
Comment:			
Location Details:		Direction of Survey:	**Upstream**

US MH: **UBU01013** DS MH: **UBU01012** Total Length Surveyed: **596**



Position	Code	Observation	Counter	Photo	Grade
0	AMH	Manhole	0	0-AMH.jpg	-
0	MWL	Water Level	54	0-MWL.jpg	-
0	LFD	Lining Failure Detached	80	0-LFD.jpg	S3
537.2	LFW	Lining Failure Wrinkled	1494	537.2-LFW.jpg	S3
555.6	DAR	Deposits Attached Ragging	1567	555.6-DAR.jpg	M3
578.5	LFD	Lining Failure Detached	1653	578.5-LFD.jpg	S3
578.5	LFBK	Lining Failure Buckled	1660	578.5-LFBK.jpg	S3
592.9	LFBK	Lining Failure Buckled	1819	592.9-LFBK.jpg	S3
592.9	XP	Collapse Pipe Sewer	1886	592.9-XP.jpg	S5
592.9	MSA	Abandoned Survey	1967	592.9-MSA.jpg	-

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PACP Code:	**AMH**
Description:	**Manhole**
Distance (ft):	**0**
Structural Grade:	**0**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	**UBU01012**

PACP Code:	**MWL**
Description:	**Water Level**
Distance (ft):	**0**
Structural Grade:	**0**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	

PACP Code:	**LFD**
Description:	**Lining Failure Detached**
Distance (ft):	**0**
Structural Grade:	**3**
O&M Grade:	**0**
Clock Start/From:	**12**
Clock To:	**12**
1st Value:	
2nd Value:	
Continuous Index:	**S01**
Within 8" of Joint?:	**False**
Remarks:	**CIPP Liner does not fully form to existing host pipe.**

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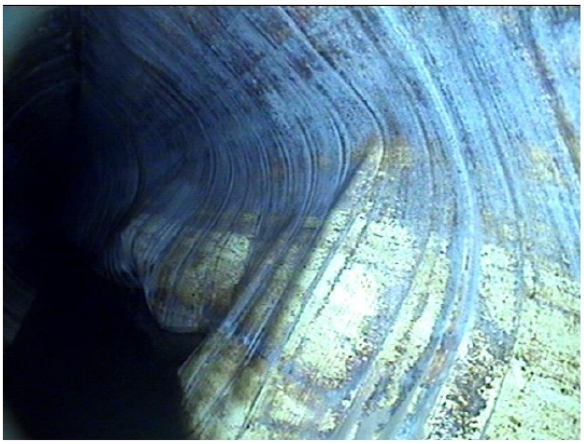
PACP Code:	**LFW**
Description:	**Lining Failure Wrinkled**
Distance (ft):	**537.2**
Structural Grade:	**3**
O&M Grade:	**0**
Clock Start/From:	**3**
Clock To:	**4**
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	

PACP Code:	**DAR**
Description:	**Deposits Attached Ragging**
Distance (ft):	**555.6**
Structural Grade:	**0**
O&M Grade:	**3**
Clock Start/From:	**6**
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	



PACP Code:	**LFD**
Description:	**Lining Failure Detached**
Distance (ft):	**578.5**
Structural Grade:	**3**
O&M Grade:	**0**
Clock Start/From:	**12**
Clock To:	**12**
1st Value:	
2nd Value:	
Continuous Index:	**F01**
Within 8" of Joint?:	**False**
Remarks:	**CIPP Liner does not fully form to existing host pipe.**

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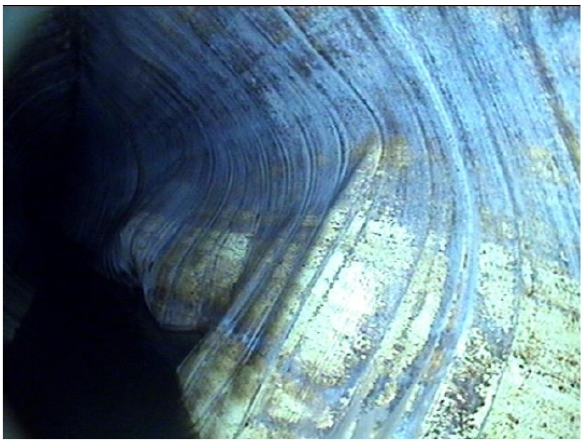
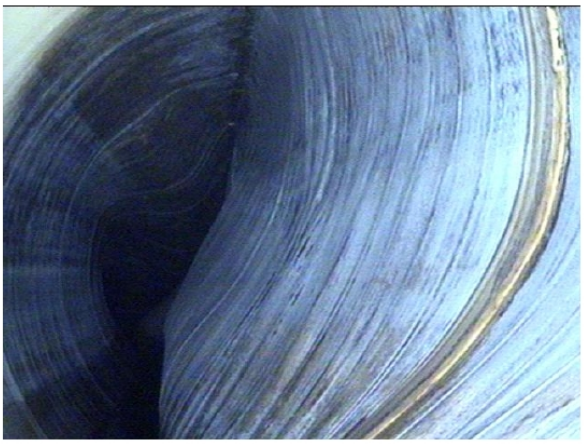


PACP Code:	**LFBK**
Description:	**Lining Failure Buckled**
Distance (ft):	**578.5**
Structural Grade:	**3**
O&M Grade:	**0**
Clock Start/From:	**2**
Clock To:	**5**
1st Value:	
2nd Value:	
Continuous Index:	**S02**
Within 8" of Joint?:	**False**
Remarks:	



PACP Code:	**LFBK**
Description:	**Lining Failure Buckled**
Distance (ft):	**592.9**
Structural Grade:	**3**
O&M Grade:	**0**
Clock Start/From:	**2**
Clock To:	**5**
1st Value:	
2nd Value:	
Continuous Index:	**F02**
Within 8" of Joint?:	**False**
Remarks:	

PACP Code:	**XP**
Description:	**Collapse Pipe Sewer**
Distance (ft):	**592.9**
Structural Grade:	**5**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	

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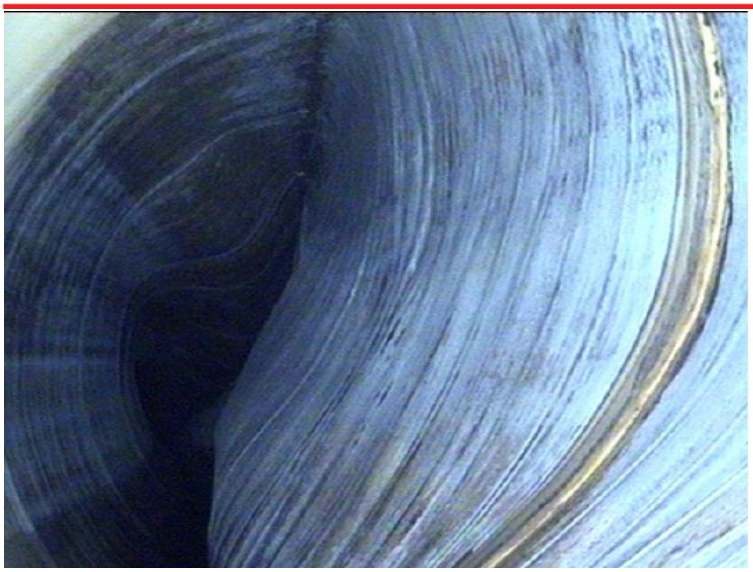

PACP Code:	**MSA**
Description:	**Abandoned Survey**
Distance (ft):	**592.9**
Structural Grade:	**0**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	**Cannot pass collapse**

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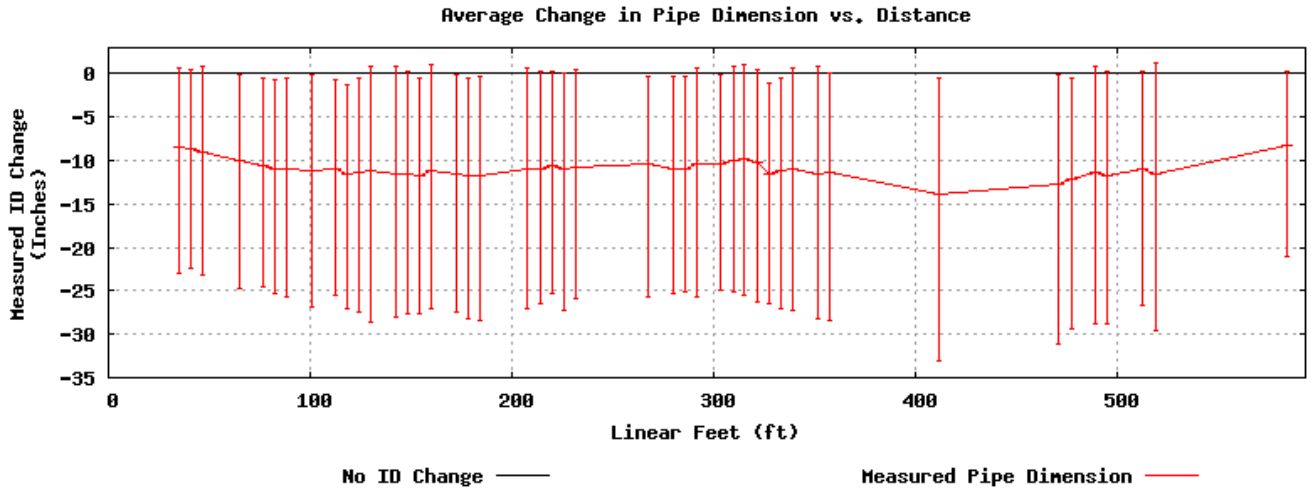
3 Ovality and Deflection

3.1 Average ID Graph

The inspected distance displayed below is the distance upstream from the UBU01012 manhole.

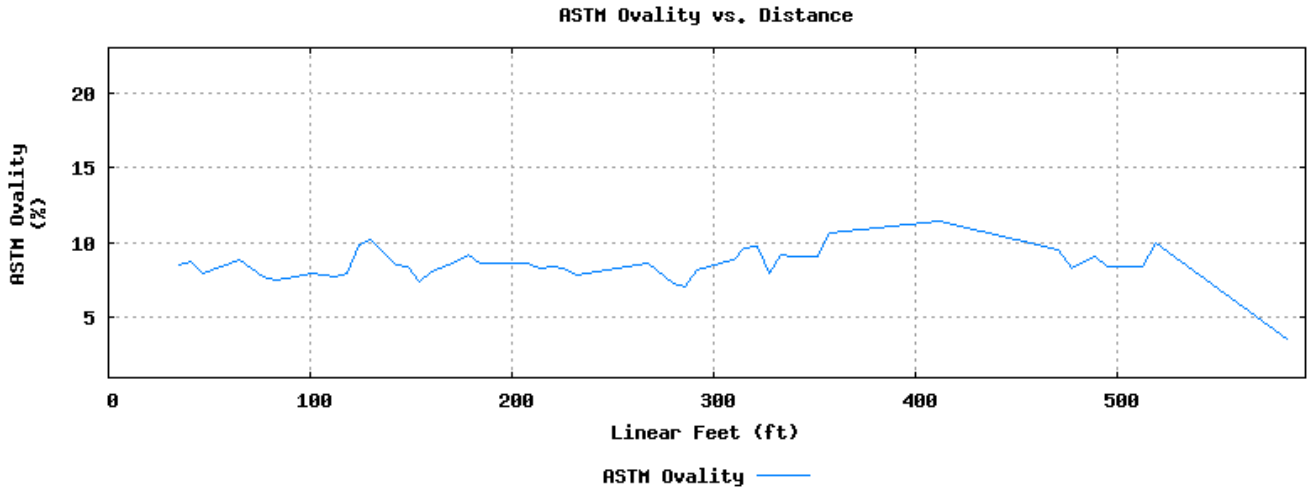


3.2 ASTM Ovality Graph (Half-Pipe)

The ASTM F1216 Ovality formula uses minimum and maximum diameters. We assume that the minimum and maximum diameters are orthogonal.

$$\text{Ovality} = (100\%)(Rh-Rv)/(Rh+Rv)$$

The inspected distance displayed below is the distance upstream from the UBU01012 manhole.



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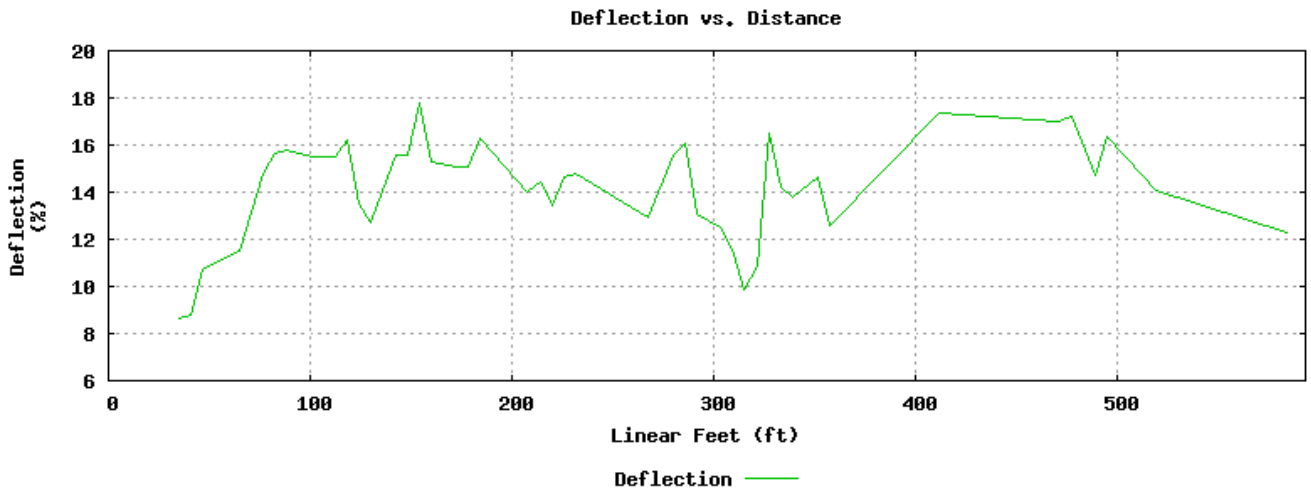
3.3 Deflection Graph (Half-Pipe)

Deflection is based on the vertical radius (half of the vertical diameter) and the RCD. For non-round pipe models, we use the record drawing model's vertical radius as the "RCD".

$$\text{Deflection} = (100\%)\ (1 - 2Rv/RCD)$$

The inspected distance displayed below is the distance upstream from the UBU01012 manhole.



3.4 Ovality Graph (Half-Pipe)

Ovality is based on the ratio of the minimum diameter (assumed to be vertical) to the maximum diameter (assumed to be horizontal). When only the top half of the pipe is visible, we double the vertical radius to get vertical diameter.

$$\text{Ovality} = (100\%)(1-Rv/Rh)$$

The inspected distance displayed below is the distance upstream from the UBU01012 manhole.

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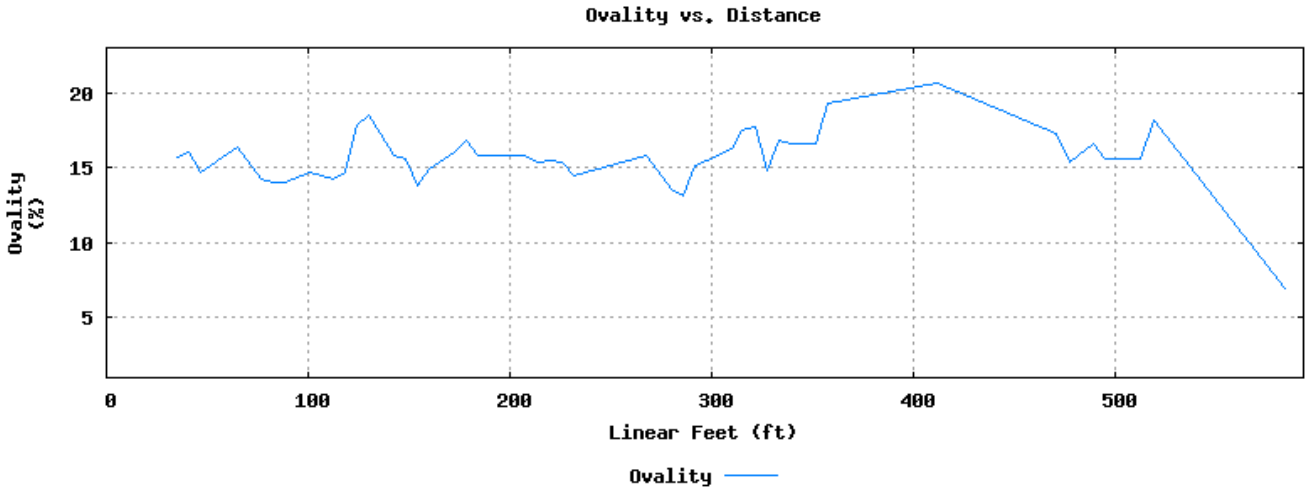

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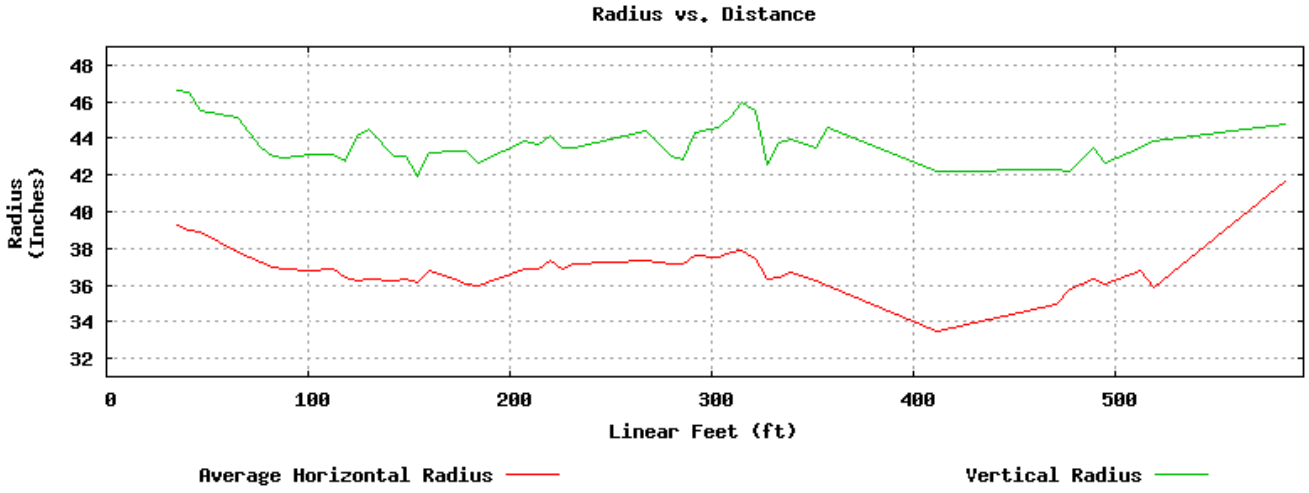
3.5 Vertical and Horizontal Radius

The inspected distance displayed below is the distance upstream from the UBU01012 manhole.



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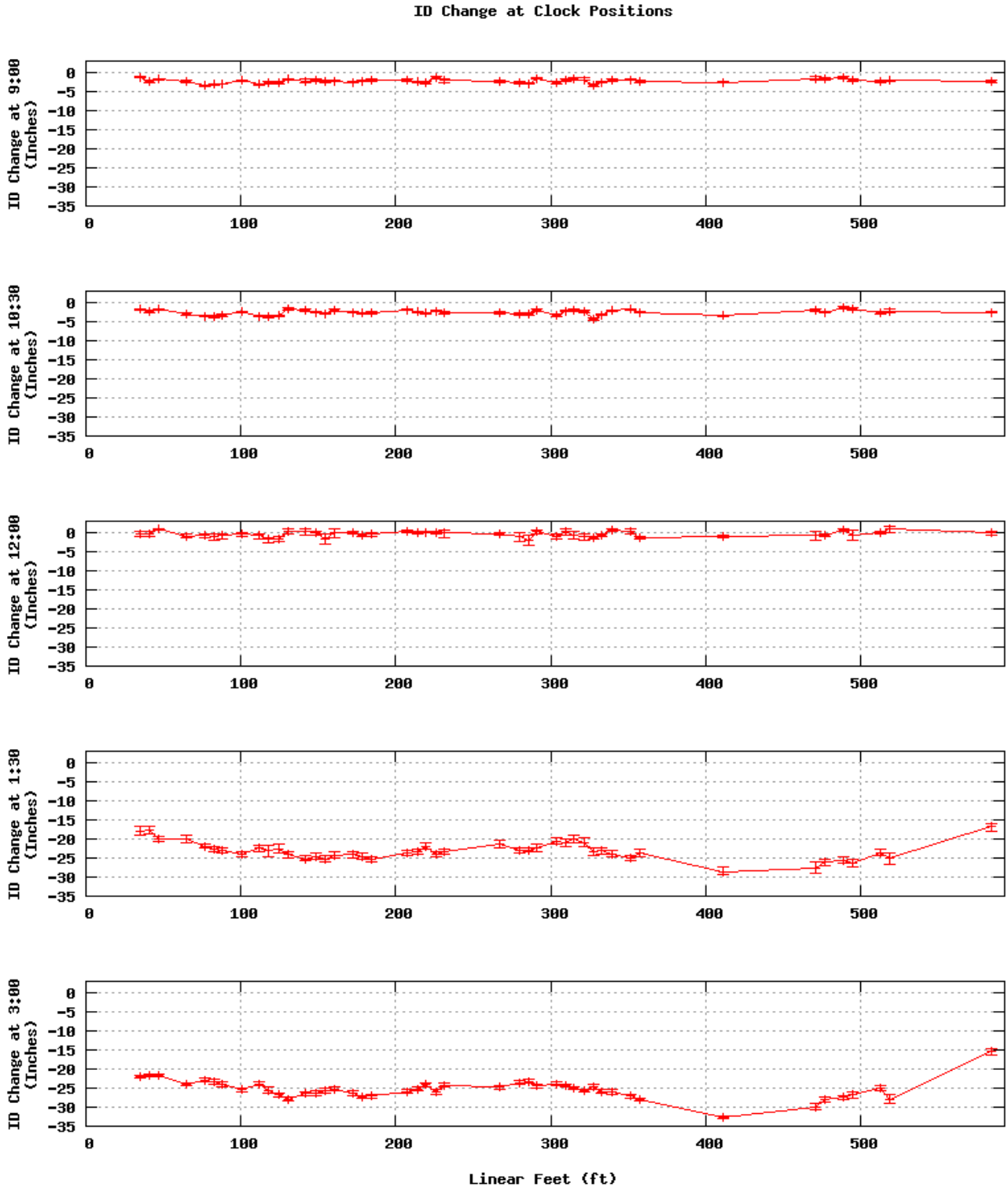
3.6 ID at Clock Positions

The inspected distance displayed below is the distance upstream from the UBU01012 manhole.



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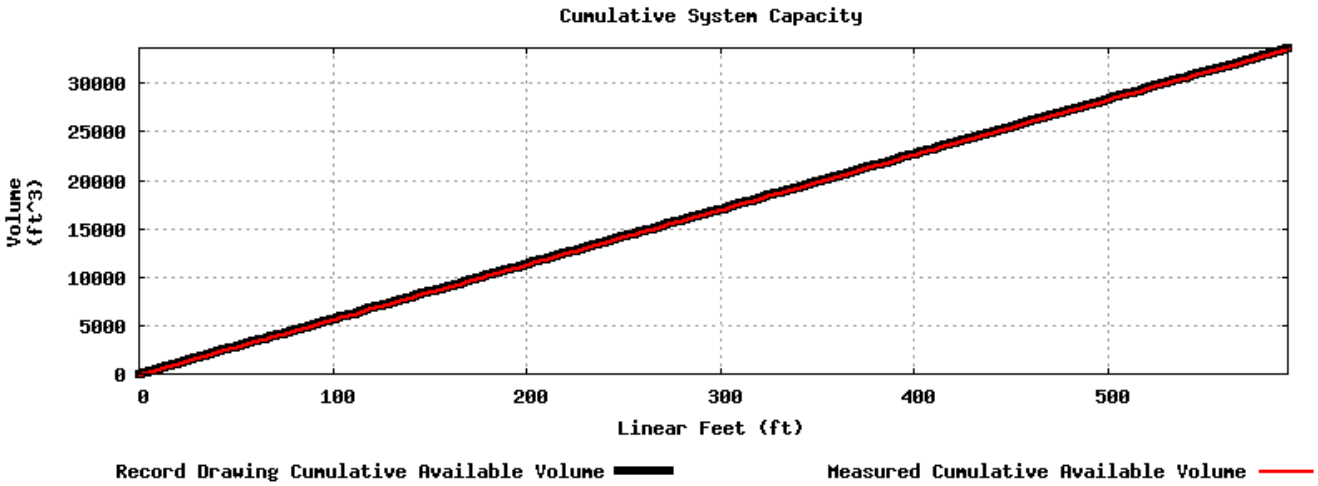
4 Sediment

4.1 Cumulative System Capacity

The inspected distance displayed below is the distance upstream from the UBU01012 manhole.



Inspection Distance	593 ft
Record Drawing Available Capacity	33649.8 ft^3
Measured Available Capacity	33649.8 ft^3
% Available Capacity	100.0 %

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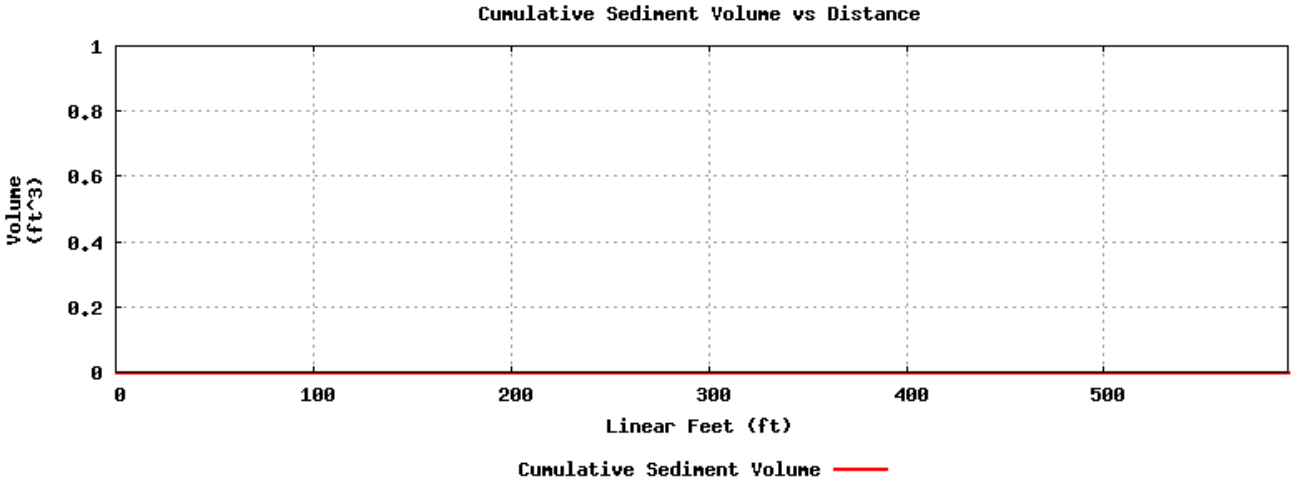
4.2 Cumulative Sediment Volume

The actual free space capacity is derived from the cross sectional sonar scans. In order to determine sediment volume, the actual free space capacity is subtracted from the total as-built capacity.

The inspected distance displayed below is the distance upstream from the UBU01012 manhole.



Inspection Distance	593 ft
Cumulative Sediment Volume	0.0 ft^3

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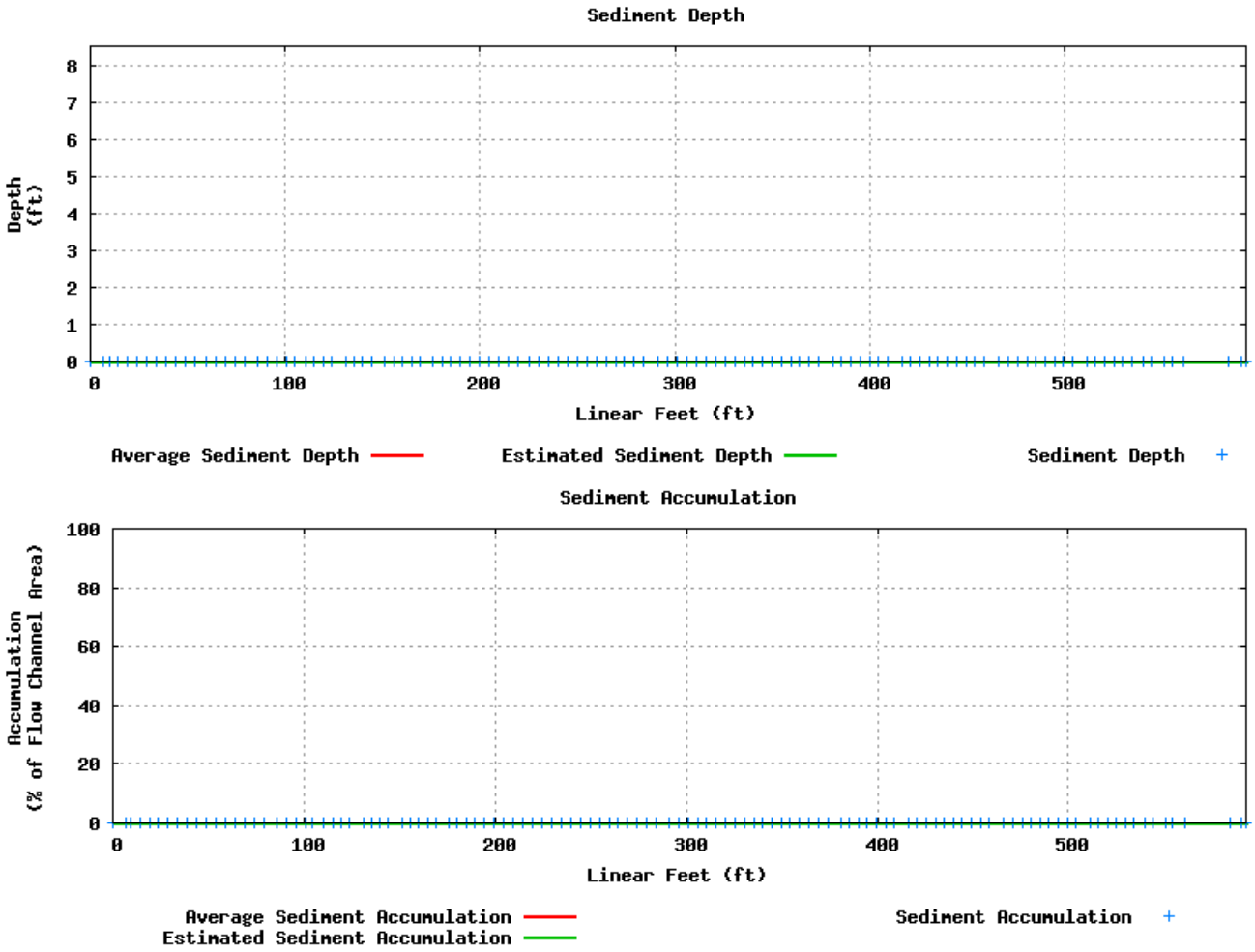
4.3 Average Sediment Depth

The standard sediment depth measurement graph represents a comprehensive summary of pipe sediment depth over distance.

The inspected distance displayed below is the distance upstream from the UBU01012 manhole.



Measure	Location	Depth	Accumulation
Maximum	0.0 ft	0.0 in	0.0 %
Minimum	0.0 ft	0.0 in	0.0 %
Average	N/A	0.0 in	0.0 %

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4.4 Cleaning Recommendations

The table below depicts the level of cleaning recommended throughout the inspected length. The recommendations are based on sediment volume, not type of material.

Recommendation	% of Capacity Lost	Distance Inspected	% of Total Length
No Cleaning	0% to 5%	593 ft	100 %
Light Cleaning	6% to 15%	0 ft	0 %
Moderate Cleaning	16% to 30%	0 ft	0 %
Heavy Cleaning	> 30%	0 ft	0 %

4.5 Cleaning Recommendations by Location

Start Location	End Location	Recommendations
0.0 ft	593.0 ft	No Cleaning

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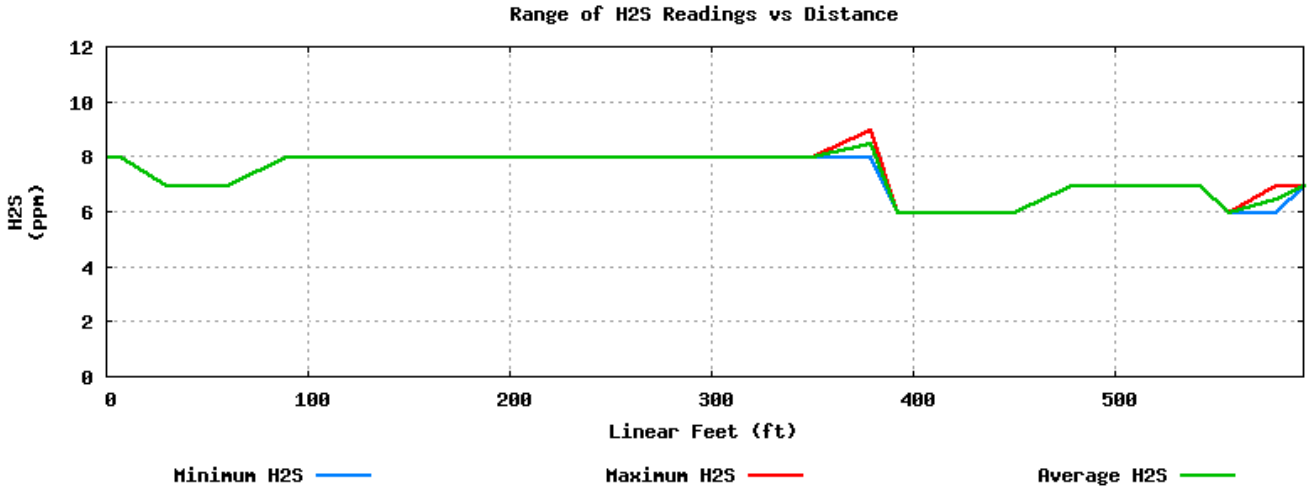
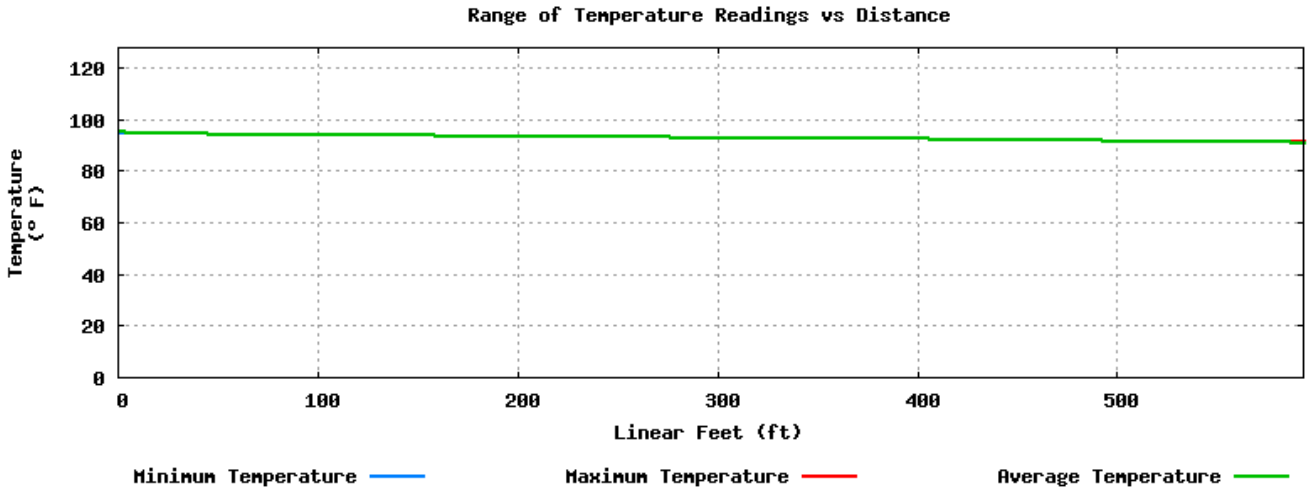
5 Gas

The inspected distance displayed below is the distance upstream from the UBU01012 manhole.





General Results	H2S Concentration	Temperature
Maximum	9 ppm	96 degrees F
Minimum	6 ppm	92 degrees F
Average	7.3 ppm	94 degrees F

H2S Concentration	Cumulative Inspected Distance	% of Inspected Distance
Maximum > 2.0 ppm	593.0 ft	100.0 %
Average > 2.0 ppm	593.0 ft	100.0 %

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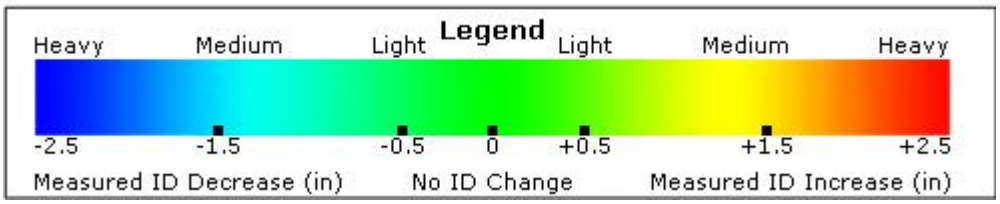
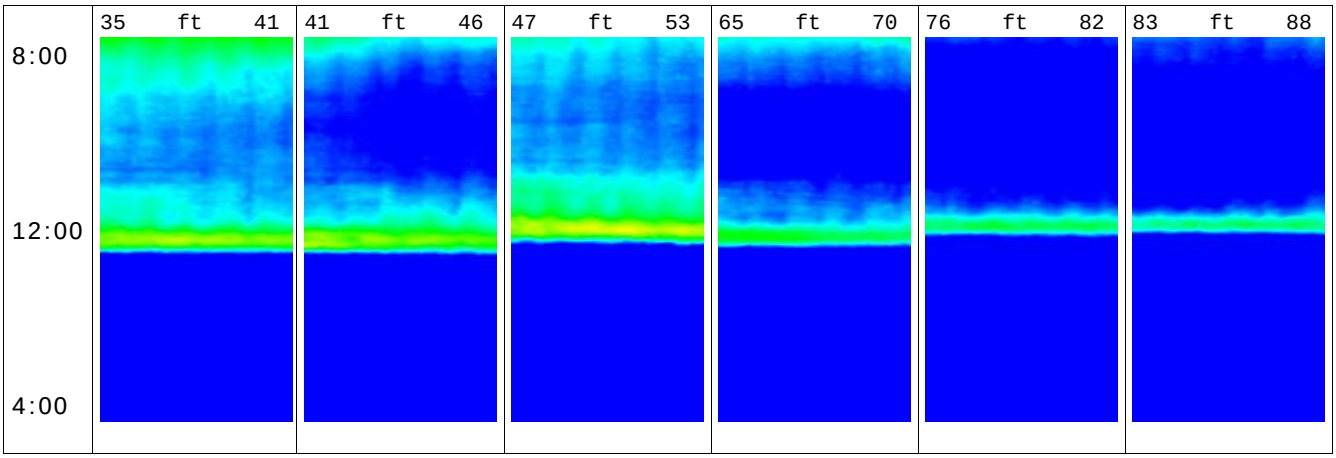
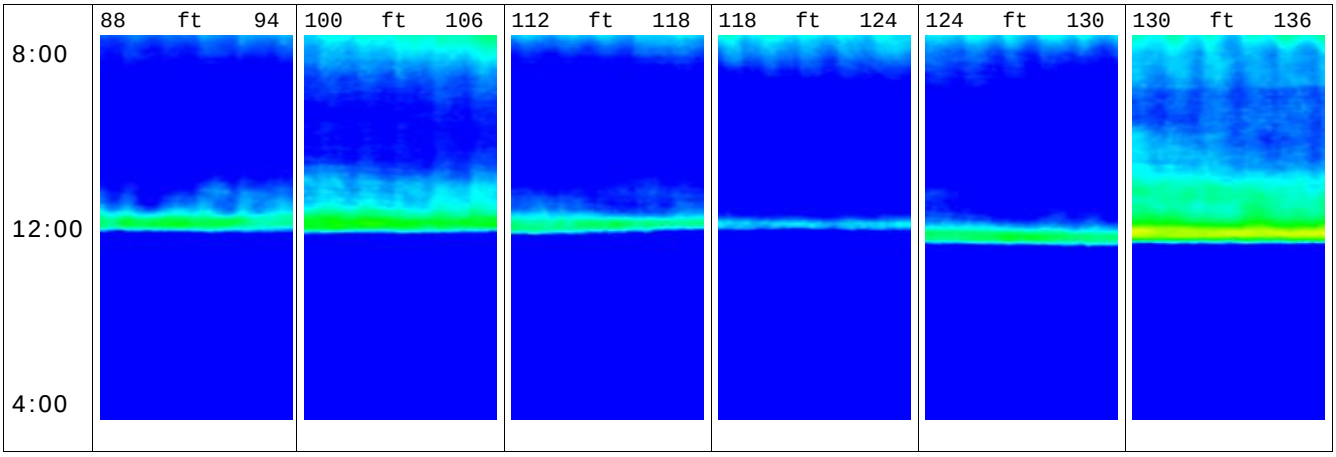
6 Corrosion and Buildup

Laser scans marked with a ✳ symbol have been identified as a pipe feature such as a tap, lateral, connection, or access shaft. In order to accurately represent the pipe's condition, the data contained in scans of pipe features is excluded from the measurements and graphs of ovality, pipe geometry, and pipe wall loss.

6.1 Precision Scans







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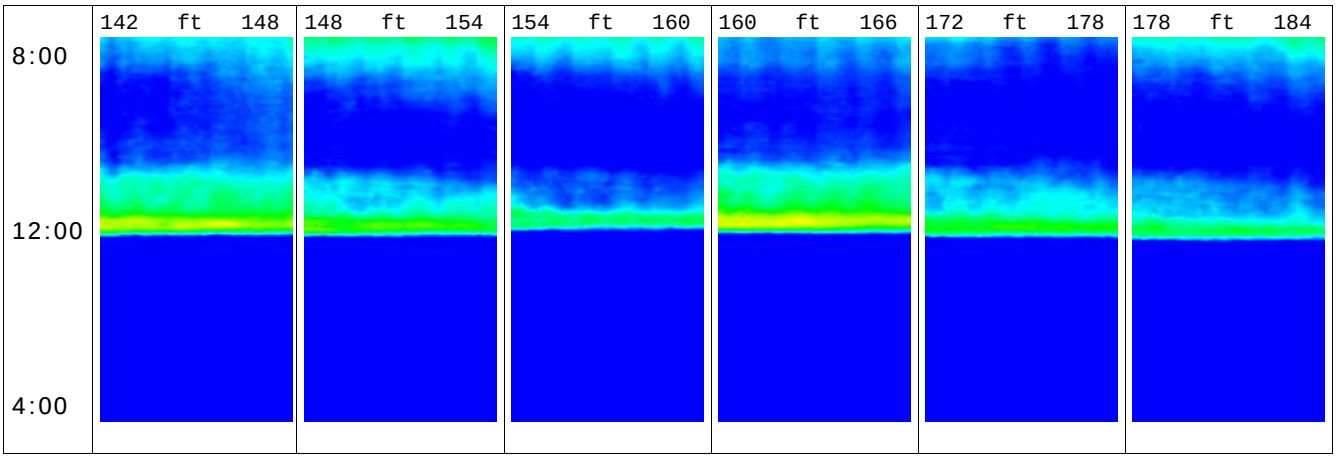

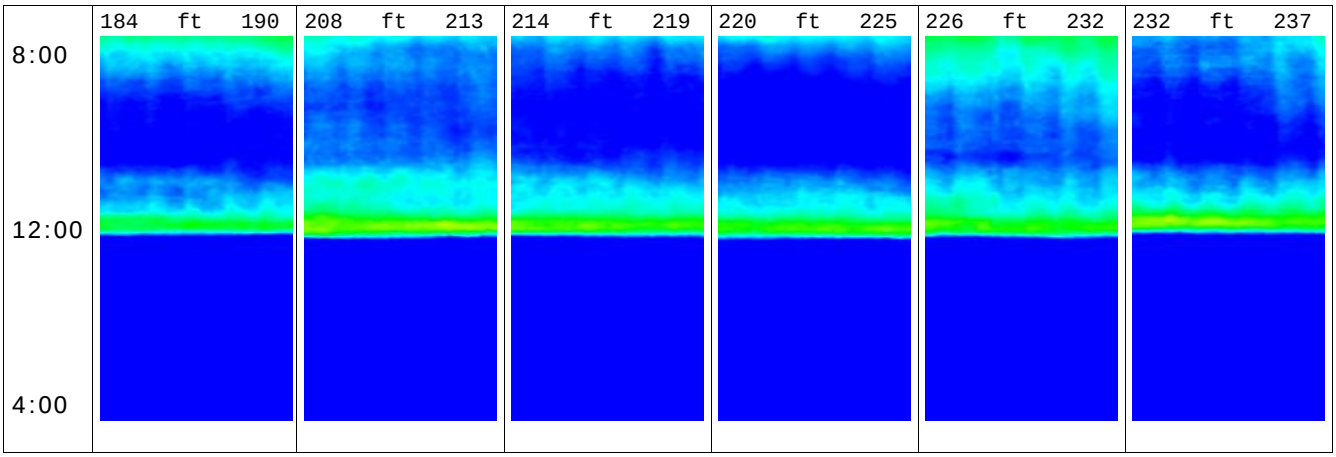

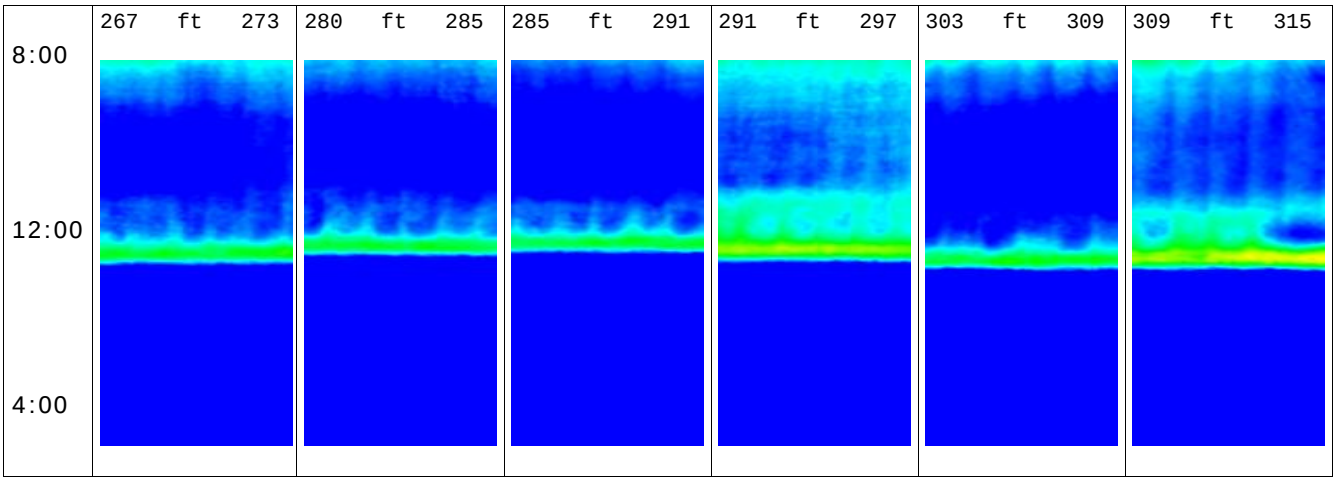

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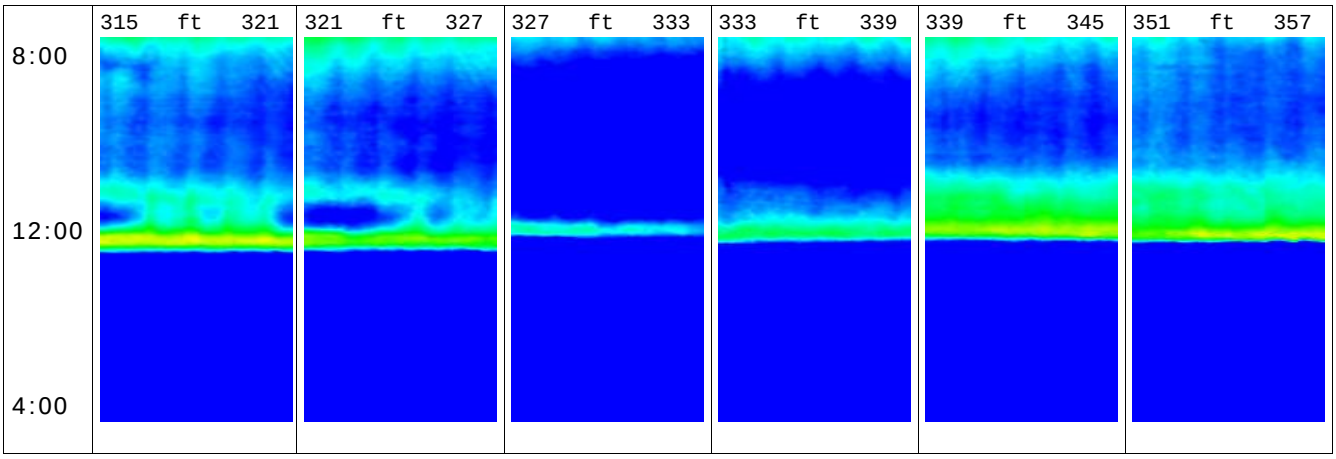

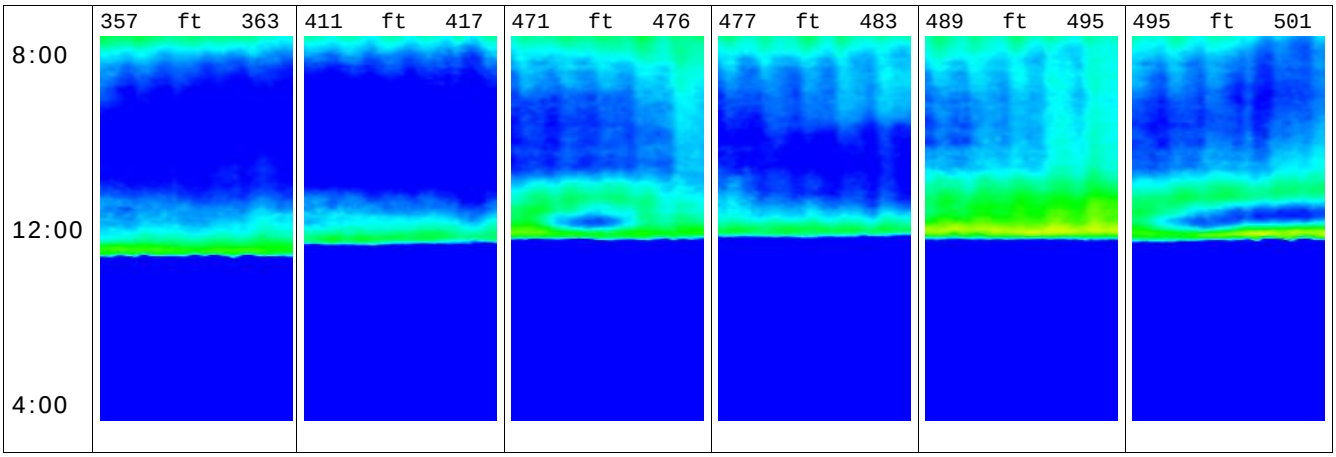

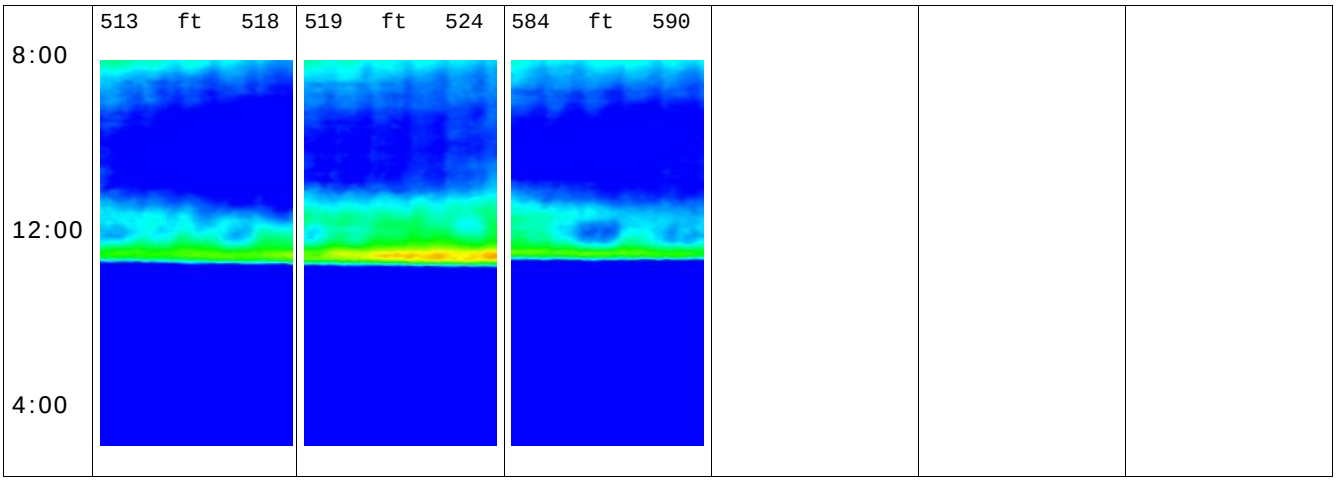

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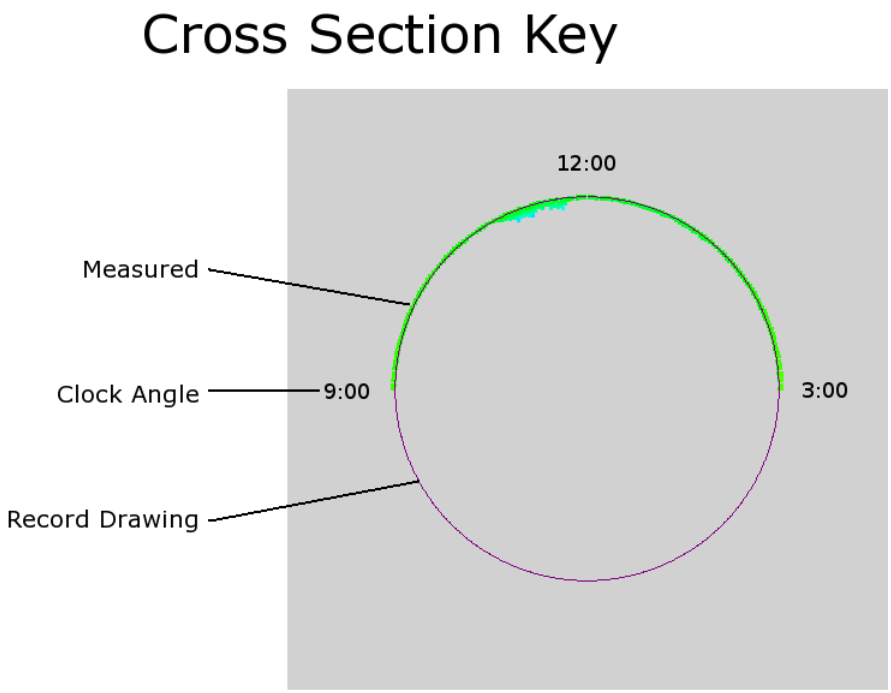
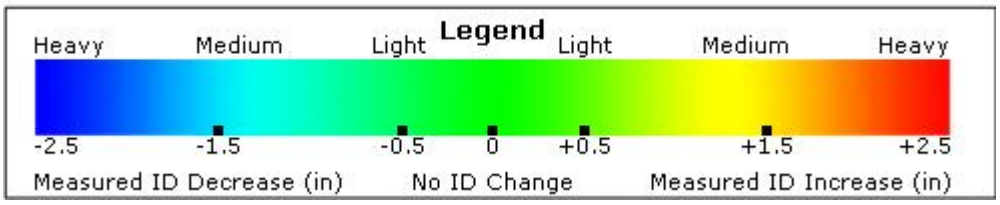
6.2 Cross Sections





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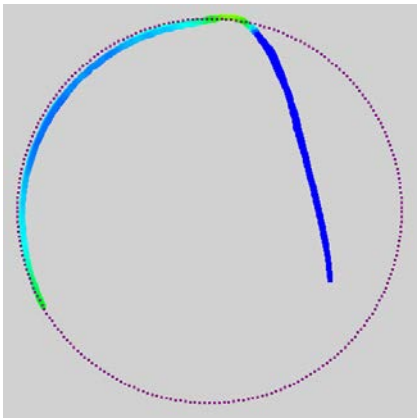	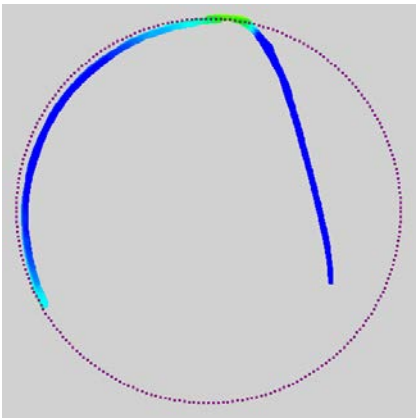	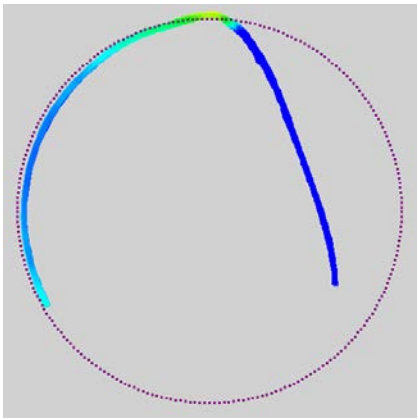

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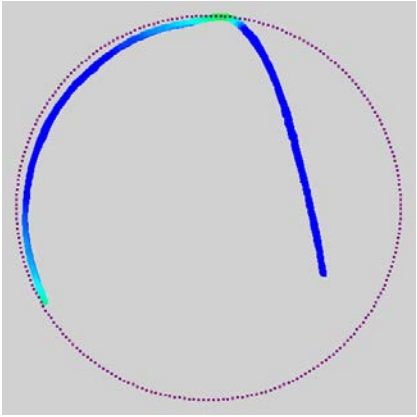
65ft



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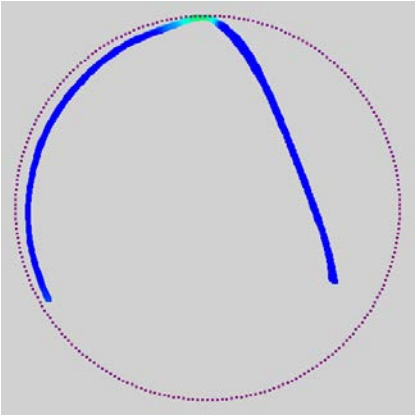

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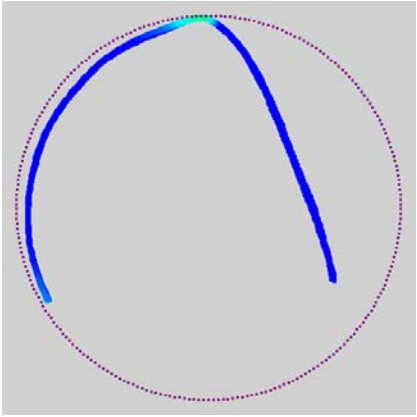

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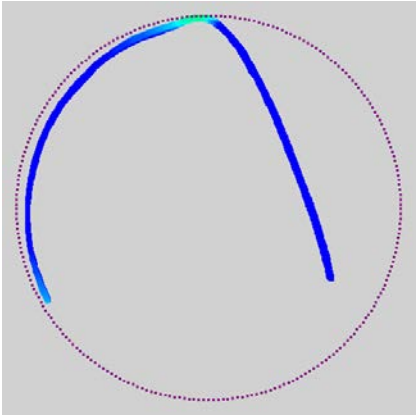

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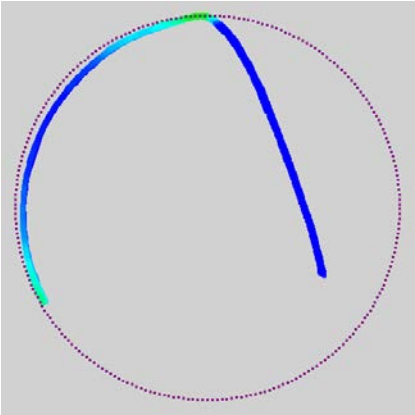

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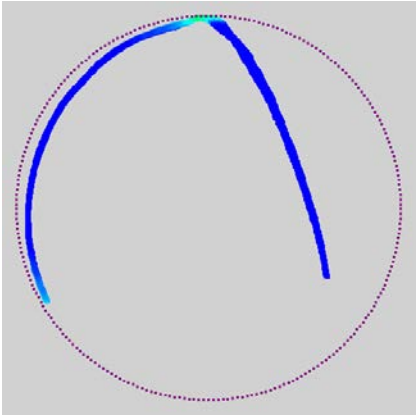

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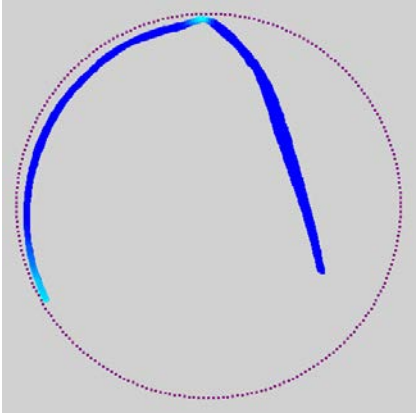

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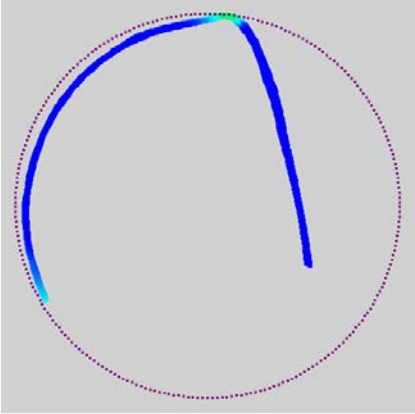

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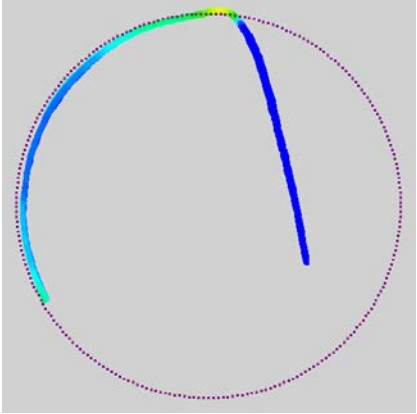

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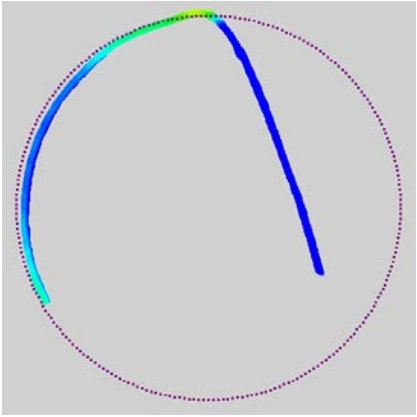

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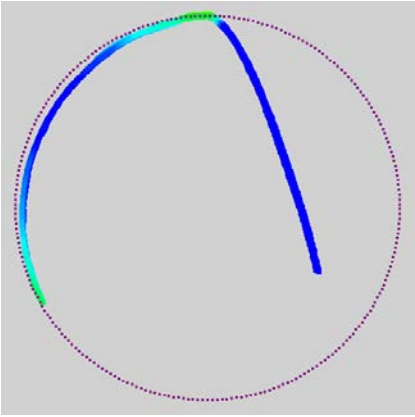

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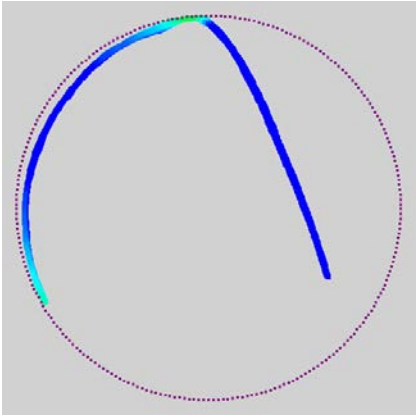

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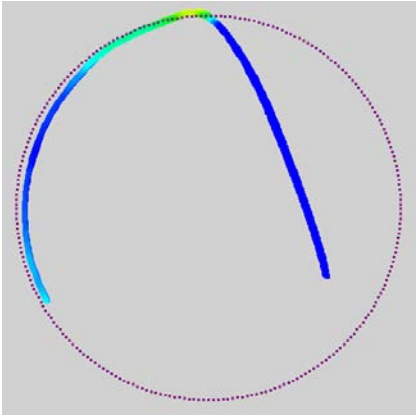

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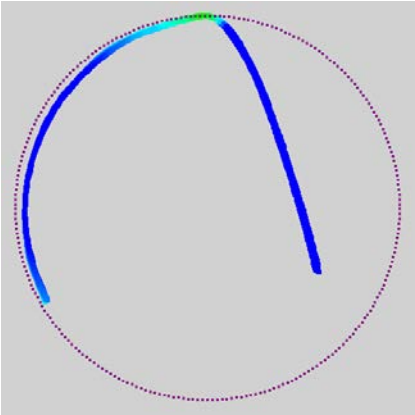

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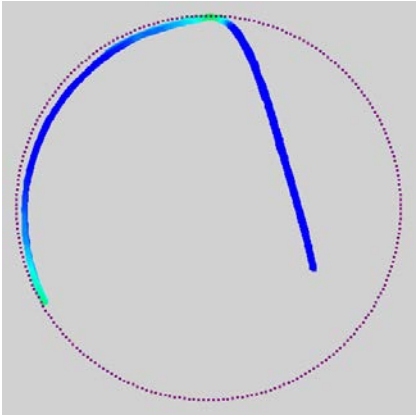

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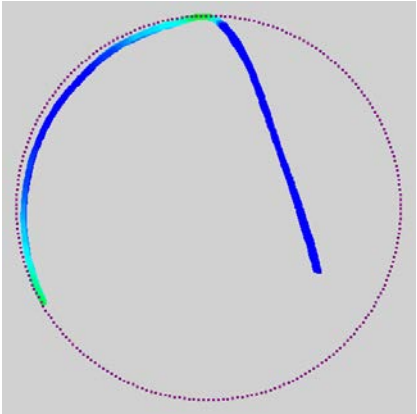

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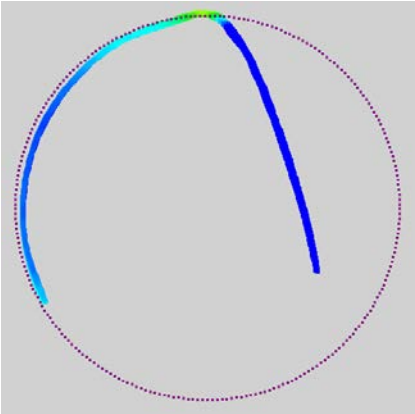

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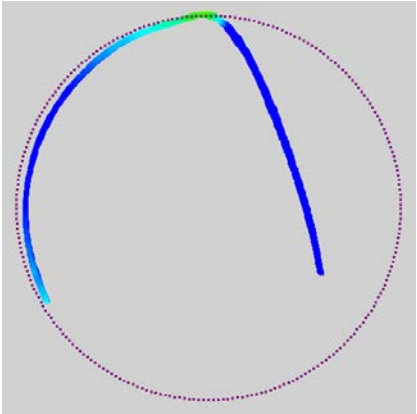

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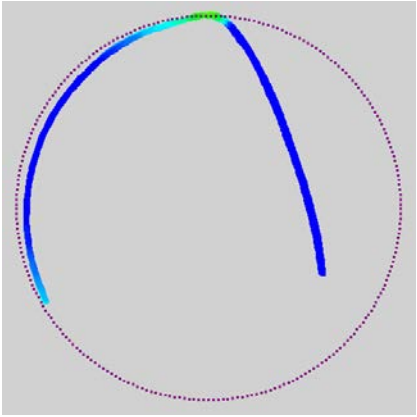
220ft



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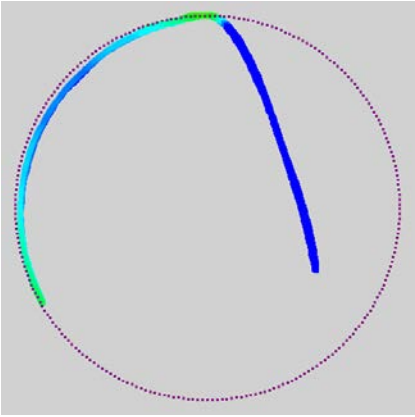

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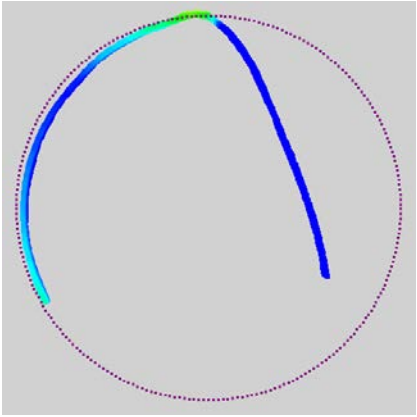

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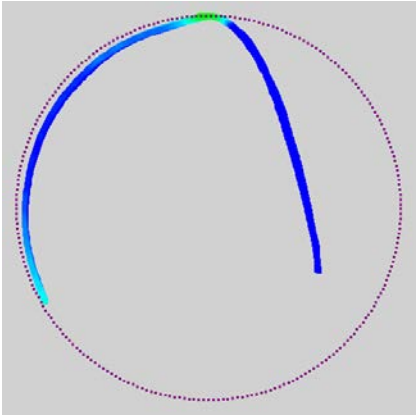

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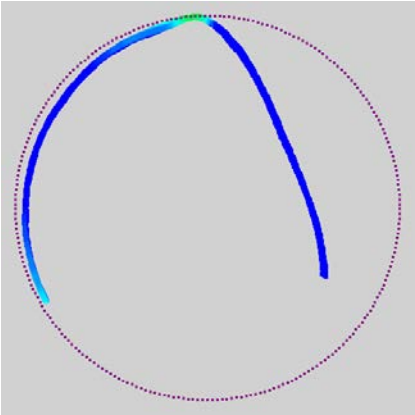

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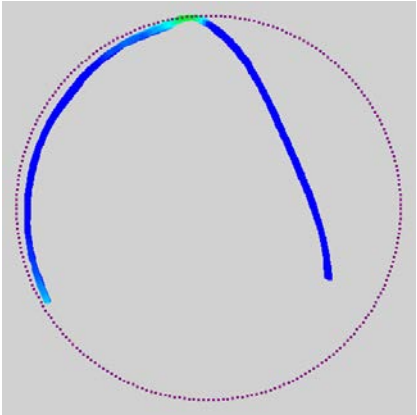

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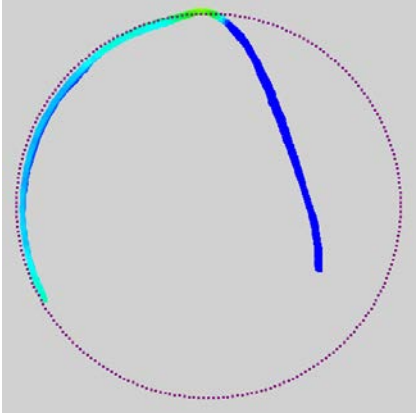

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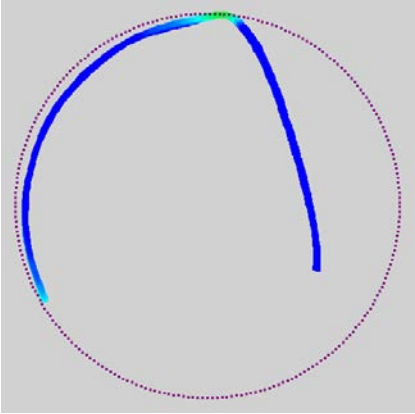

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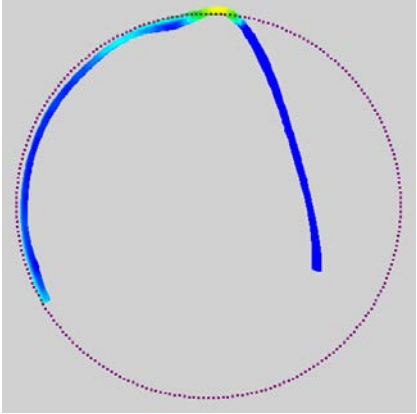

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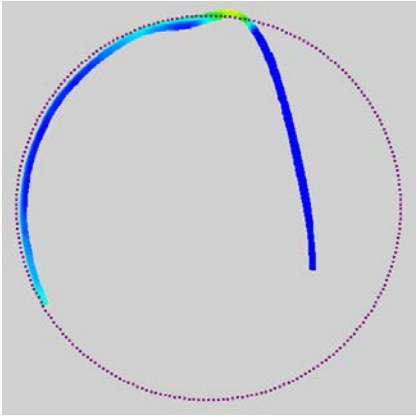
315ft



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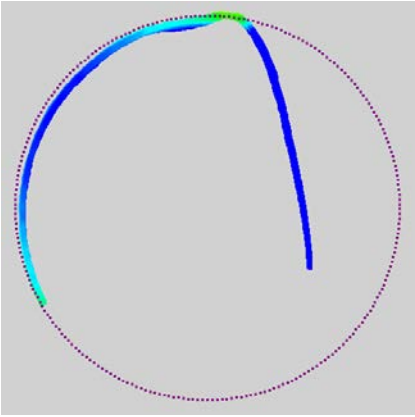

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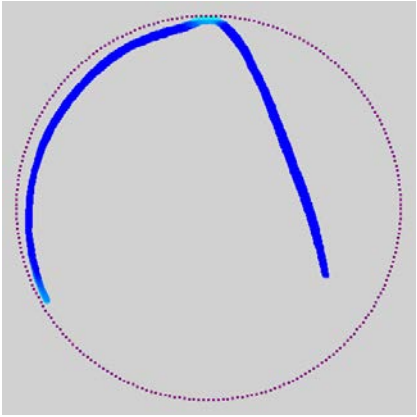

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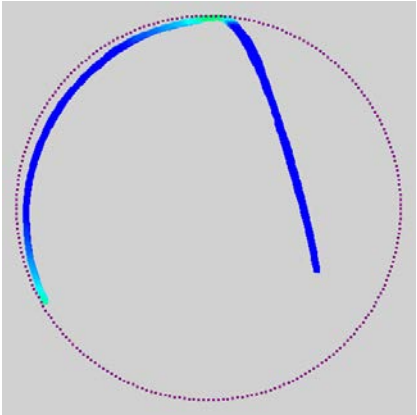

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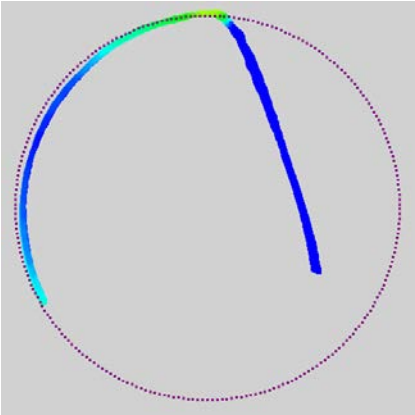

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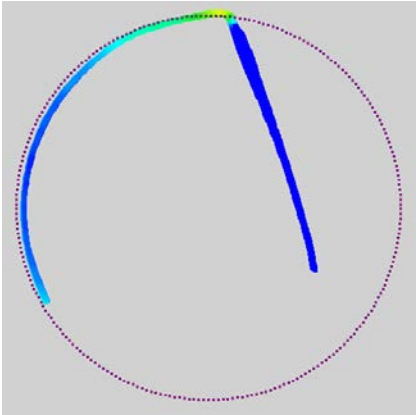

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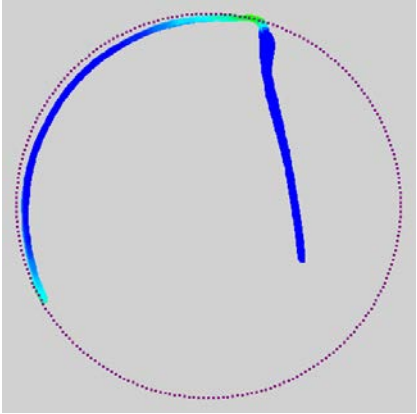

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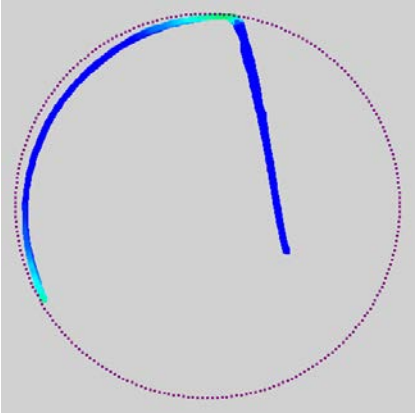
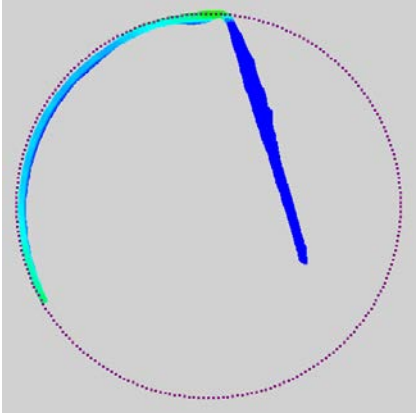


471ft



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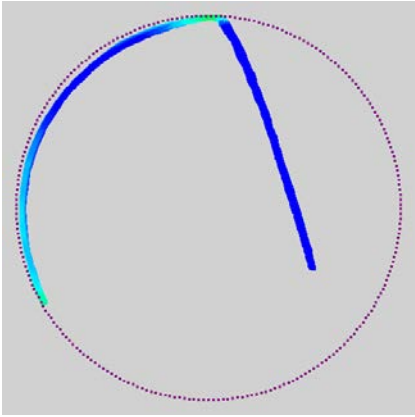
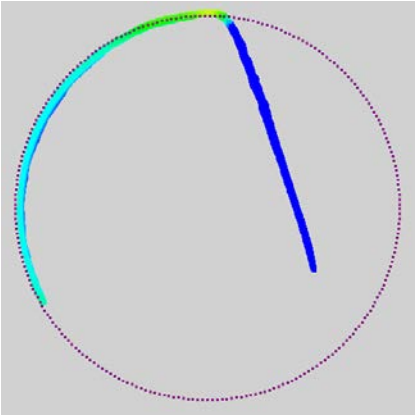
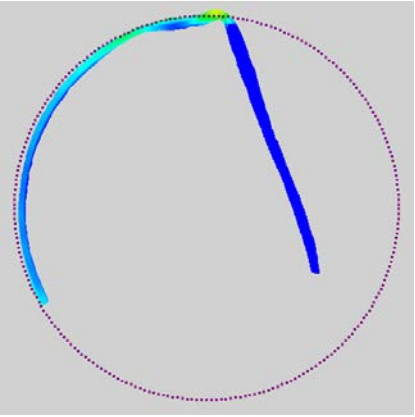
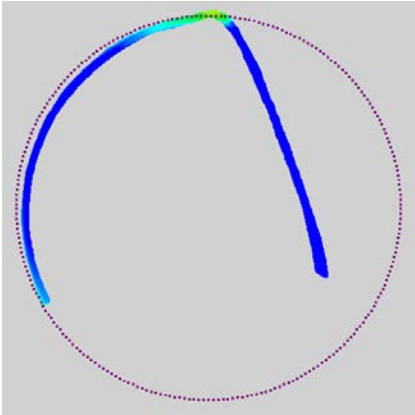
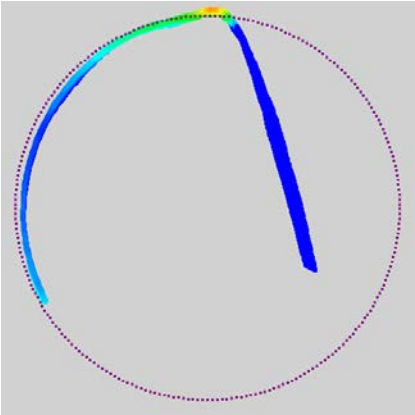
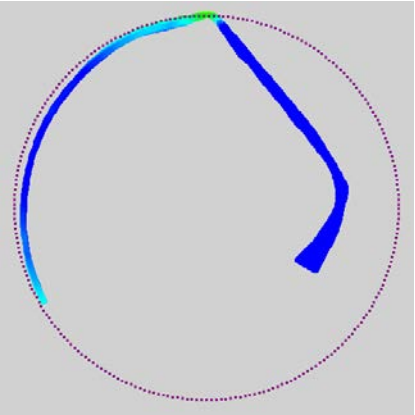
477ft	489ft	495ft
		

513ft	519ft	584ft
		

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Responder Multi-Sensor Inspection

Houston Public Works and Engineering
Wastewater Operations

TX Houston Large Diameter Sewer Inspection

UBU01011-UBU01010
U/S MH: UBU01011
D/S MH: UBU01010
RECORD DRAWING DIAMETER (RCD): 108 in
Job: SJ501134
Inspection Date: 8/13/2013
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1 Summary

1.1 Job

Prepared For	City of Houston
Street Location	Off Westheimer Road
Deployment Location / Manhole	UBU01011
Operator	J. Williamson
Deployment Weather	Sunny (Dry)
Planned Inspection Distance	1564 ft
Actual Inspection Distance	33 ft
Inspection Direction	Downstream
Upstream Location / Manhole	UBU01011
Downstream Location / Manhole	UBU01010
Record Drawing Diameter	108 in
Record Drawing Pipe Shape	Circular
Pipe Material	Reinforced Concrete Pipe

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1.2 Results

Observations	
Number of Observations	6
Number of Grade 4 & 5 Observations	1
Number of Continuous Observations	0
Flow Height	20 %
Sediment	
Average Sediment Depth	1.5 in
Total Sediment Volume	5.8 ft^3
% of Pipe Flow Restriction Due to Sediment	0.3 %
Gas	
Inspected Distance with Average H2S Concentration Over 2 ppm	33.0 ft
% Inspected Distance with Average H2S Concentration over 2ppm	100.0 %
Average Concentration of H2S	7.4 ppm
Maximum Concentration of H2S	8 ppm
Average Temperature	88 degrees F
Maximum Temperature	88 degrees F

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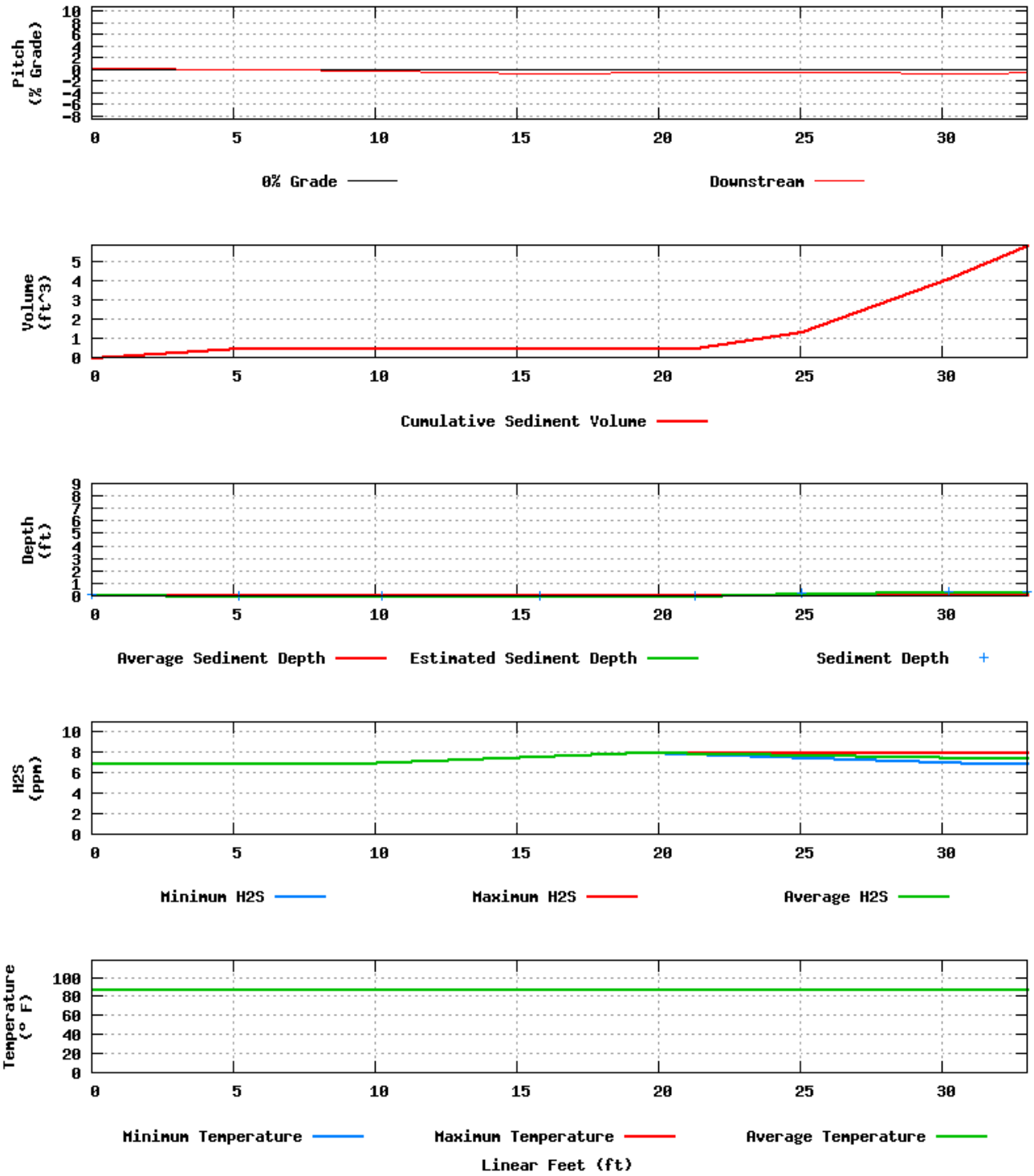
1.3 Segment Summary View

The inspected distance displayed below is the distance downstream from the UBU01011 manhole.



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2 Observations

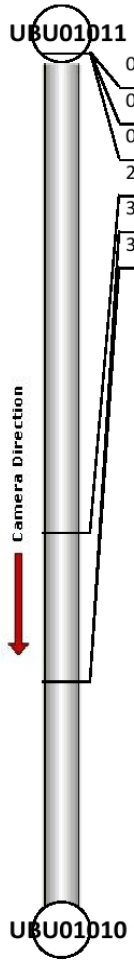
Profile/Photo Observation Report

Date:	**08/13/2013**	Weather:	**Dry**	Sheet #:	**0**
Pipe Length:		Owner:	**Houston, TX**	Pre Clean:	
P.O.#:		Surveyor:	**J. Williamson**	PSR:	**11997233**
Customer:	**Clean Serve**	Clean Date:		Shape:	**Circular**

Street:	**Westheimer Road**	Flow Control:	**Not Controlled**
City:	**Houston, TX**	Year Renewed:	
Location:	**Yard**	Tape/Media #:	**SD018**
Purpose:	**Pre-Rehabilitation Survey**	Dia/Height:	**102**
Use:	**Sanitary**	Material:	**Reinforced Concrete Pipe**
Drain Area:		Lining:	**Cured in Place**
Category		Pipe Joint Length:	
Comment:			
Location Details:		Direction of Survey:	**Downstream**

US MH: **UBU01011** DS MH: **UBU01010** Total Length Surveyed: **44.3**

Position	Code	Observation	Counter	Photo	Grade
0	AMH	Manhole	0	0-AMH.jpg	-
0	MWL	Water Level	65	0-MWL.jpg	-
0	LFD	Lining Failure Detached	94	0-LFD.jpg	S3
25	LFW	Lining Failure Wrinkled	222	25-LFW.jpg	S3
32.8	XP	Collapse Pipe Sewer	588	32.8-XP.jpg	S5
32.8	MSA	Abandoned Survey	641	32.8-MSA.jpg	-



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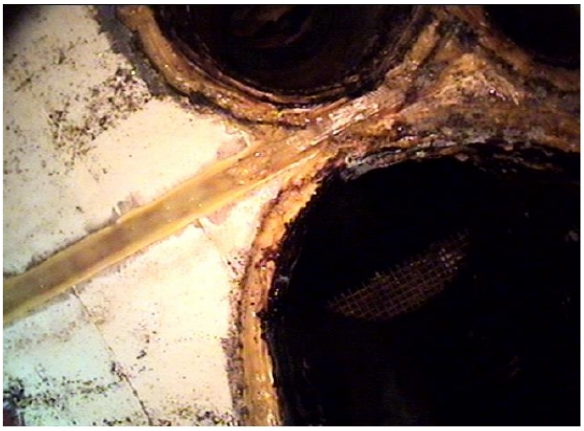

PACP Code:	**AMH**
Description:	**Manhole**
Distance (ft):	**0**
Structural Grade:	**0**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	**UBU01011**

PACP Code:	**MWL**
Description:	**Water Level**
Distance (ft):	**0**
Structural Grade:	**0**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	

PACP Code:	**LFD**
Description:	**Lining Failure Detached**
Distance (ft):	**0**
Structural Grade:	**3**
O&M Grade:	**0**
Clock Start/From:	**11**
Clock To:	**1**
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	

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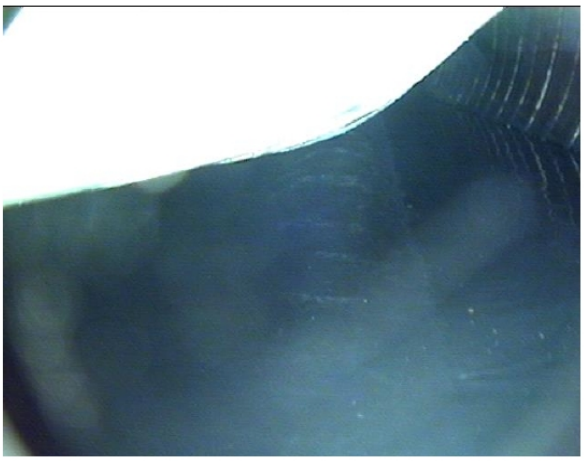
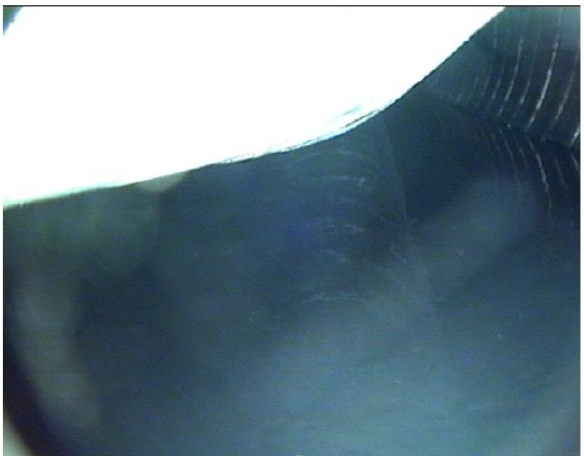
PACP Code:	**LFW**
Description:	**Lining Failure Wrinkled**
Distance (ft):	**25**
Structural Grade:	**3**
O&M Grade:	**0**
Clock Start/From:	**12**
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	



PACP Code:	**XP**
Description:	**Collapse Pipe Sewer**
Distance (ft):	**32.8**
Structural Grade:	**5**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	



PACP Code:	**MSA**
Description:	**Abandoned Survey**
Distance (ft):	**32.8**
Structural Grade:	**0**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	**Cannot pass collapse sewer pipe.**

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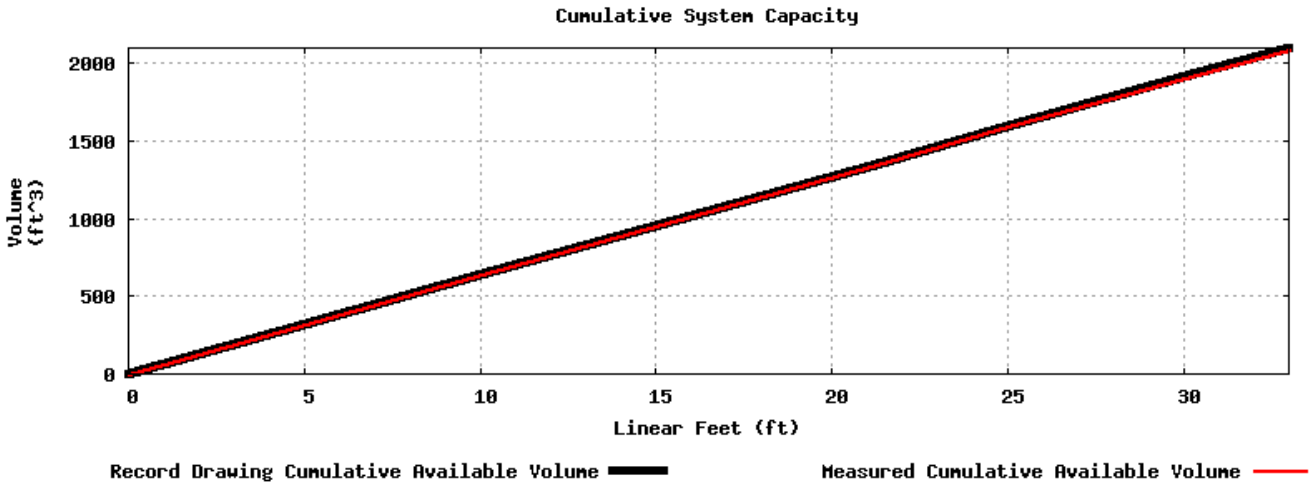
3 Sediment

3.1 Cumulative System Capacity

The inspected distance displayed below is the distance downstream from the UBU01011 manhole.



Inspection Distance	33 ft
Record Drawing Available Capacity	2099.4 ft^3
Measured Available Capacity	2093.5 ft^3
% Available Capacity	99.7 %

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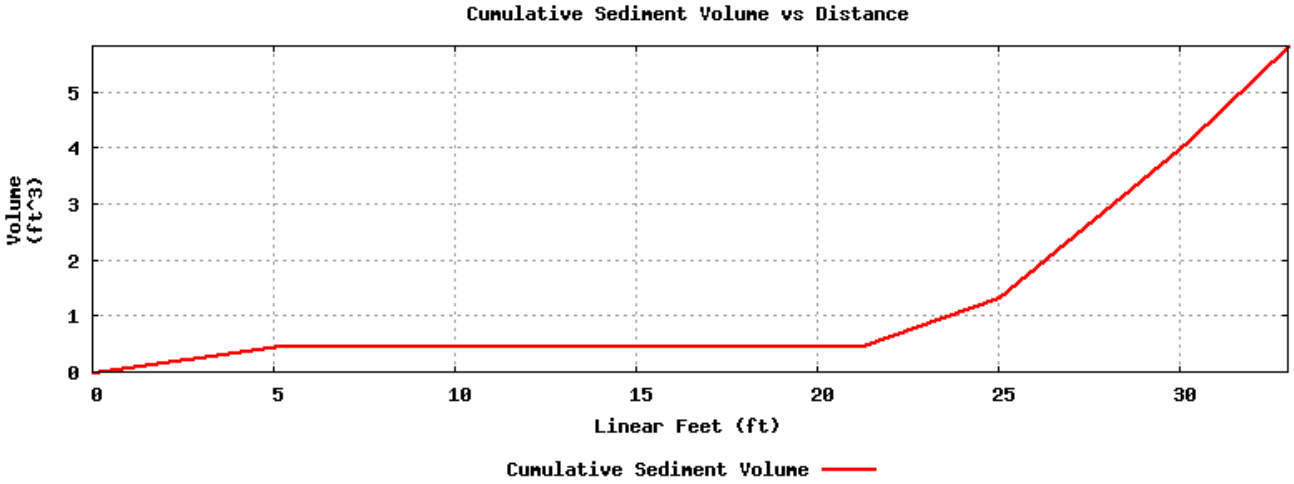
3.2 Cumulative Sediment Volume

The actual free space capacity is derived from the cross sectional sonar scans. In order to determine sediment volume, the actual free space capacity is subtracted from the total as-built capacity.

The inspected distance displayed below is the distance downstream from the UBU01011 manhole.



Inspection Distance	33 ft
Cumulative Sediment Volume	5.8 ft^3

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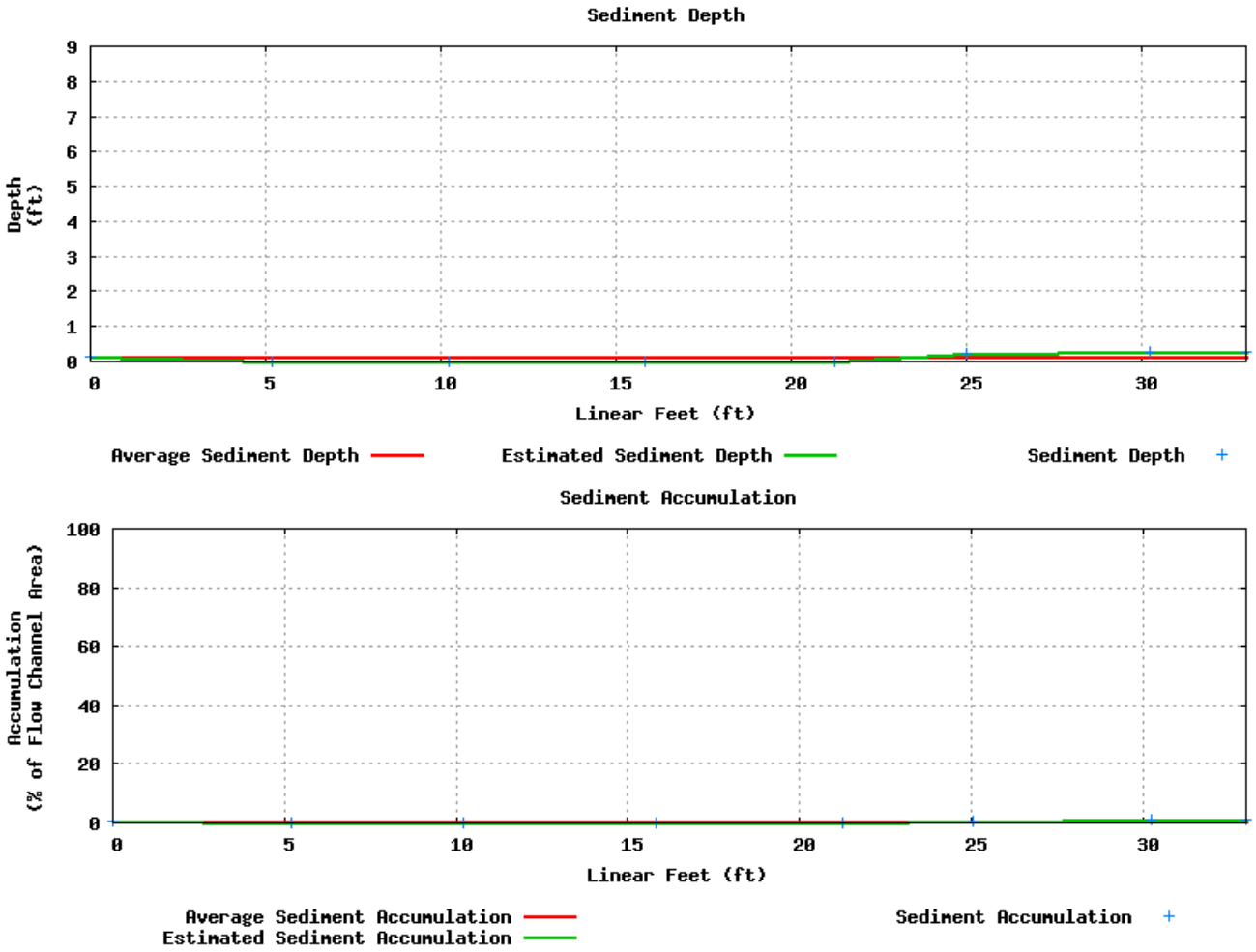
3.3 Average Sediment Depth

The standard sediment depth measurement graph represents a comprehensive summary of pipe sediment depth over distance.

The inspected distance displayed below is the distance downstream from the UBU01011 manhole.



Measure	Location	Depth	Accumulation
Maximum	30.2 ft	3.5 in	1.0 %
Minimum	5.2 ft	0.0 in	0.0 %
Average	N/A	1.5 in	0.3 %

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3.4 Cleaning Recommendations

The table below depicts the level of cleaning recommended throughout the inspected length. The recommendations are based on sediment volume, not type of material.

Recommendation	% of Capacity Lost	Distance Inspected	% of Total Length
No Cleaning	0% to 5%	33 ft	100 %
Light Cleaning	6% to 15%	0 ft	0 %
Moderate Cleaning	16% to 30%	0 ft	0 %
Heavy Cleaning	> 30%	0 ft	0 %

3.5 Cleaning Recommendations by Location

Start Location	End Location	Recommendations
0.0 ft	33.0 ft	No Cleaning

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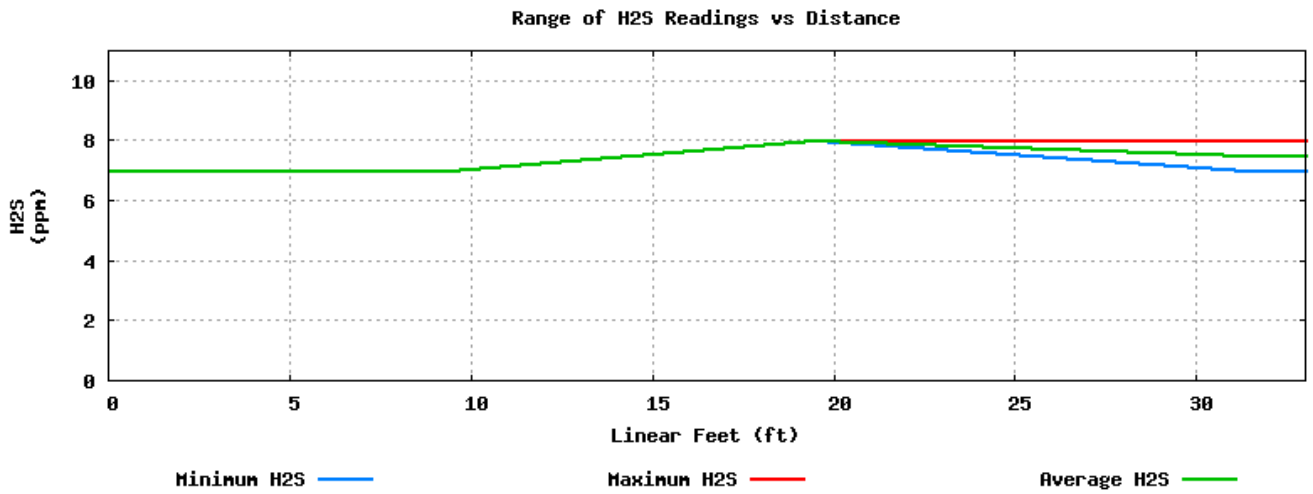
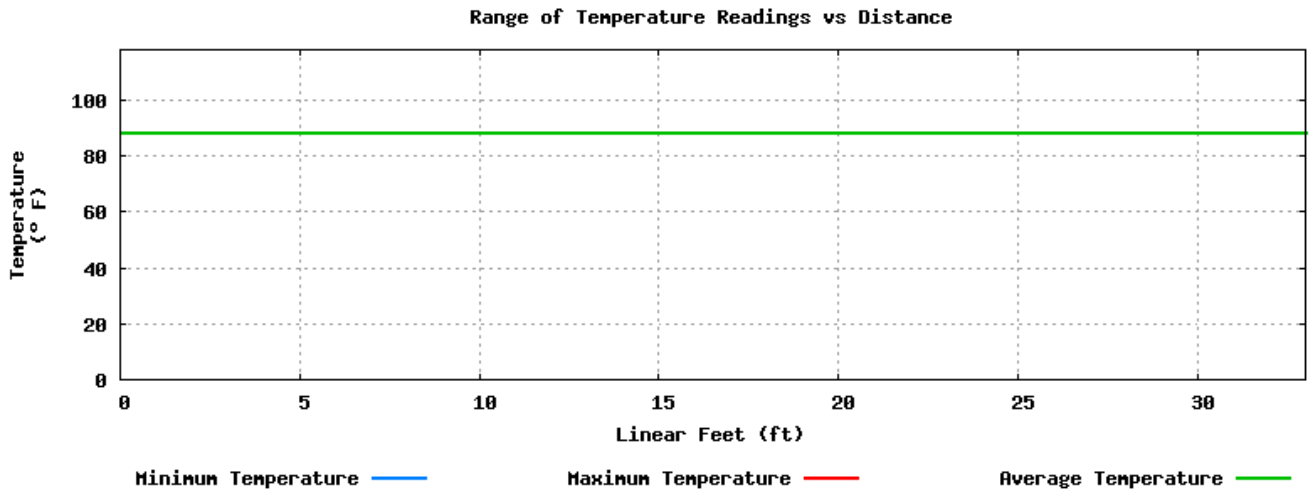
4 Gas

The inspected distance displayed below is the distance downstream from the UBU01011 manhole.





General Results	H2S Concentration	Temperature
Maximum	8 ppm	88 degrees F
Minimum	7 ppm	88 degrees F
Average	7.4 ppm	88 degrees F

H2S Concentration	Cumulative Inspected Distance	% of Inspected Distance
Maximum > 2.0 ppm	33.0 ft	100.0 %
Average > 2.0 ppm	33.0 ft	100.0 %

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Responder Multi-Sensor Inspection

Houston Public Works and Engineering
Wastewater Operations

TX Houston Large Diameter Sewer Inspection

UBU01012-UBU01011
U/S MH: UBU01012
D/S MH: UBU01011
RECORD DRAWING DIAMETER (RCD): 102 in
Job: SJ501134
Inspection Date: 8/13/2013
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1 Summary

1.1 Job

Prepared For	City of Houston
Street Location	Off Westheimer Road
Deployment Location / Manhole	UBU01012
Operator	J. Williamson
Deployment Weather	Sunny (Dry)
Planned Inspection Distance	1735 ft
Actual Inspection Distance	1759 ft
Inspection Direction	Downstream
Upstream Location / Manhole	UBU01012
Downstream Location / Manhole	UBU01011
Record Drawing Diameter	102 in
Record Drawing Pipe Shape	Circular
Pipe Material	Reinforced Concrete Pipe

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1.2 Results

Observations	
Number of Observations	13
Number of Grade 4 & 5 Observations	0
Number of Continuous Observations	4
Flow Height	20 %
Average ASTM Ovality	9.19 %
Minimum ASTM Ovality	0.19 %
Maximum ASTM Ovality	30.20 %
Average Deflection	14.82 %
Minimum Deflection	7.28 %
Maximum Deflection	44.77 %
Ovality Calculation Method	Full-Pipe
Sediment	
Average Sediment Depth	3.4 in
Total Sediment Volume	1041.9 ft^3
% of Pipe Flow Restriction Due to Sediment	0.9 %
Gas	
Inspected Distance with Average H2S Concentration Over 2 ppm	1759.0 ft
% Inspected Distance with Average H2S Concentration over 2ppm	100.0 %
Average Concentration of H2S	6.4 ppm
Maximum Concentration of H2S	8 ppm
Average Temperature	88 degrees F
Maximum Temperature	90 degrees F
Number of Precision Scans	225
Average Measured Internal Pipe Dimensions	87.22 in
Average Measured ID Change in Precision Scans (radial)	-10.39 in
Minimum Measured ID Change in Precision Scans (radial)	-40.59 in
Maximum Measured ID Change in Precision Scans (radial)	76.07 in

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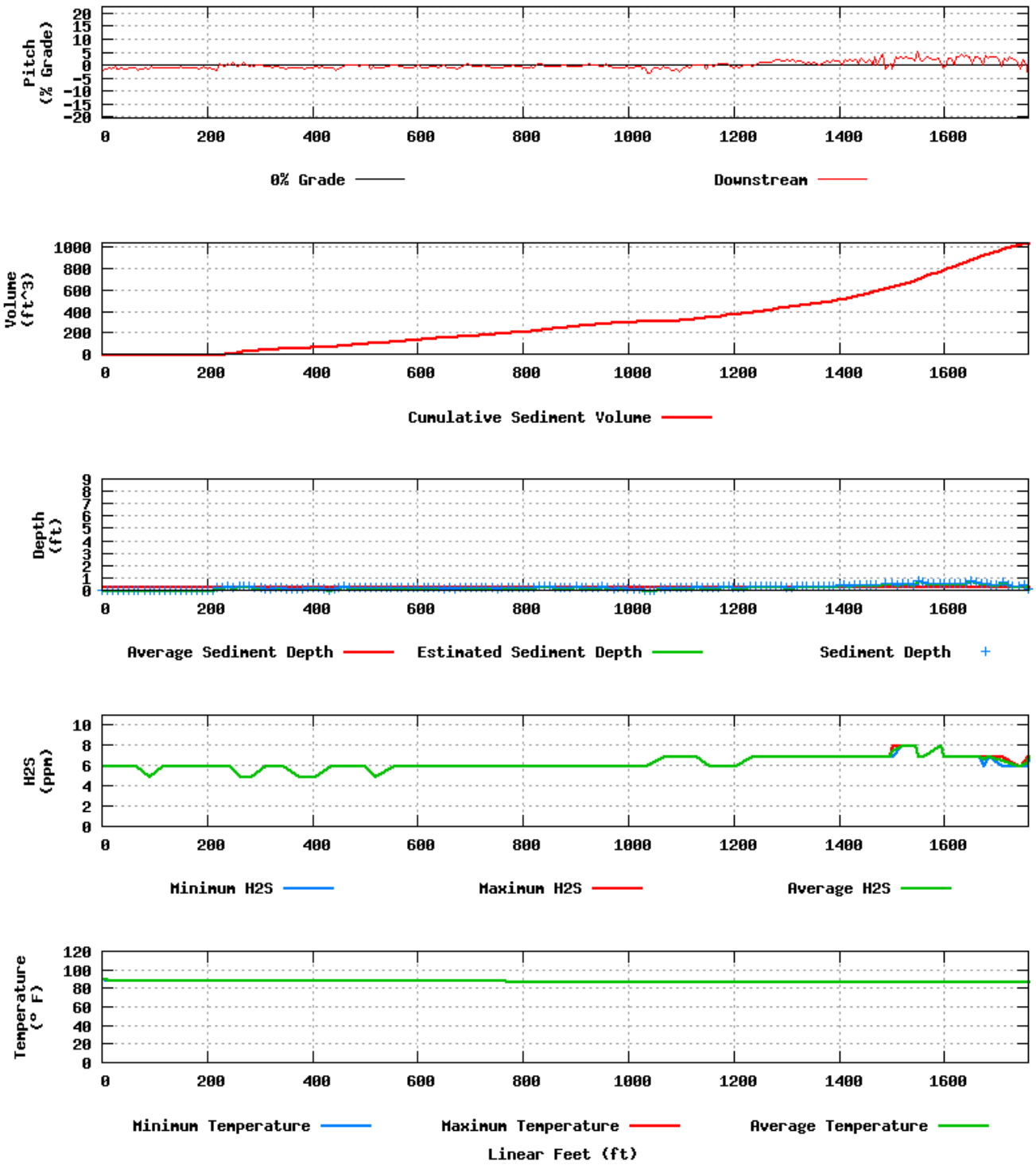
1.3 Segment Summary View

The inspected distance displayed below is the distance downstream from the UBU01012 manhole.



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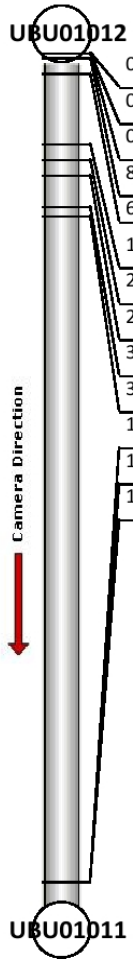
2 Observations

Profile/Photo Observation Report

Date:	**08/13/2013**	Weather:	**Dry**	Sheet #:	**0**
Pipe Length:		Owner:	**Houston, TX**	Pre Clean:	
P.O.#:		Surveyor:	**J. Williamson**	PSR:	**11997234**
Customer:	**Clean Serve**	Clean Date:		Shape:	**Circular**

Street:	**Westheimer Road**	Flow Control:	**Not Controlled**
City:	**Houston, TX**	Year Renewed:	
Location:	**Yard**	Tape/Media #:	**SD018**
Purpose:	**Pre-Rehabilitation Survey**	Dia/Height:	**102**
Use:	**Sanitary**	Material:	**Reinforced Concrete Pipe**
Drain Area:		Lining:	**Cured in Place**
Category		Pipe Joint Length:	
Comment:			
Location Details:		Direction of Survey:	**Downstream**

US MH: **UBU01012** DS MH: **UBU01011** Total Length Surveyed: **1800.3**



Position	Code	Observation	Counter	Photo	Grade
0	AMH	Manhole	0	0-AMH.jpg	-
0	MWL	Water Level	51	0-MWL.jpg	-
0	LFD	Lining Failure Detached	67	0-LFD.jpg	S3
8.5	LFBK	Lining Failure Buckled	352	8.5-LFBK.jpg	S3
64.2	LFBK	Lining Failure Buckled	1063	64.2-LFBK.jpg	S3
192.9	LL	Alignment Left	1560	192.9-LL.jpg	M2
227.5	LFD	Lining Failure Detached	1641	227.5-LFD.jpg	S3
260.3	LFW	Lining Failure Wrinkled	1706	260.3-LFW.jpg	S3
325.1	LFW	Lining Failure Wrinkled	1877	325.1-LFW.jpg	S3
344	LFD	Lining Failure Detached	1910	344-LFD.jpg	S3
1758.6	LL	Alignment Left	7616	1758.6-LL.jpg	M2
1758.6	AMH	Manhole	7654	1758.6-AMH.jpg	-
1758.6	LFD	Lining Failure Detached	7681	1758.6-LFD.jpg	S3

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PACP Code:	**AMH**
Description:	**Manhole**
Distance (ft):	**0**
Structural Grade:	**0**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	**UBU01012**

PACP Code:	**MWL**
Description:	**Water Level**
Distance (ft):	**0**
Structural Grade:	**0**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	

PACP Code:	**LFD**
Description:	**Lining Failure Detached**
Distance (ft):	**0**
Structural Grade:	**3**
O&M Grade:	**0**
Clock Start/From:	**8**
Clock To:	**12**
1st Value:	
2nd Value:	
Continuous Index:	**S01**
Within 8" of Joint?:	**False**
Remarks:	

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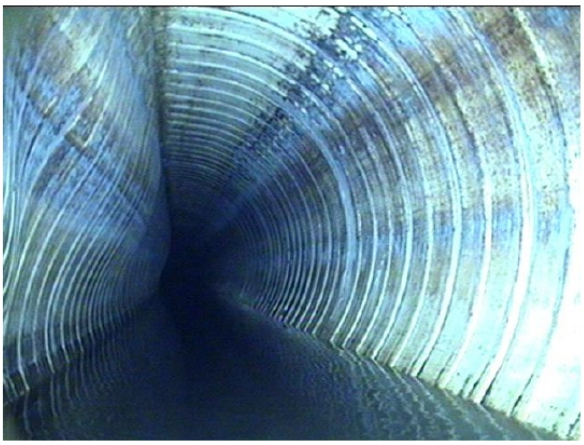
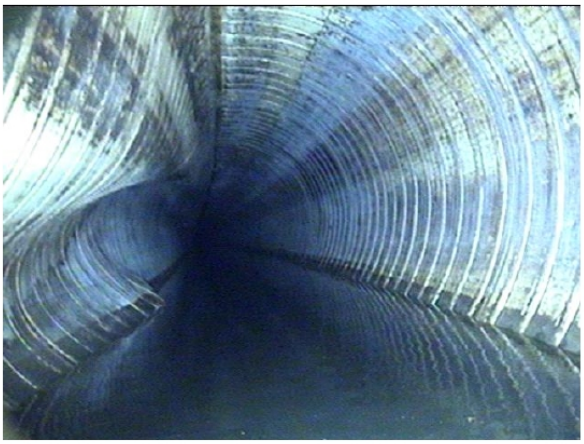
PACP Code:	**LFBK**
Description:	**Lining Failure Buckled**
Distance (ft):	**8.5**
Structural Grade:	**3**
O&M Grade:	**0**
Clock Start/From:	**10**
Clock To:	**12**
1st Value:	
2nd Value:	
Continuous Index:	**S02**
Within 8" of Joint?:	**False**
Remarks:	



PACP Code:	**LFBK**
Description:	**Lining Failure Buckled**
Distance (ft):	**64.2**
Structural Grade:	**3**
O&M Grade:	**0**
Clock Start/From:	**10**
Clock To:	**12**
1st Value:	
2nd Value:	
Continuous Index:	**F02**
Within 8" of Joint?:	**False**
Remarks:	



PACP Code:	**LL**
Description:	**Alignment Left**
Distance (ft):	**192.9**
Structural Grade:	**0**
O&M Grade:	**2**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	

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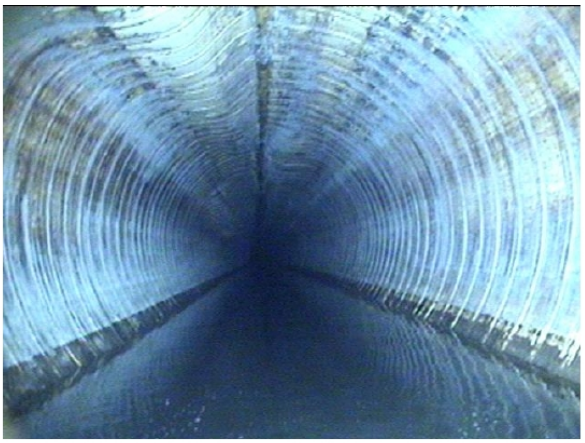
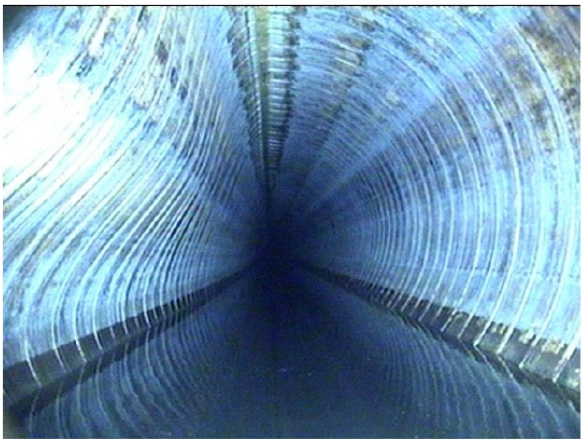


PACP Code:	**LFD**
Description:	**Lining Failure Detached**
Distance (ft):	**227.5**
Structural Grade:	**3**
O&M Grade:	**0**
Clock Start/From:	**8**
Clock To:	**12**
1st Value:	
2nd Value:	
Continuous Index:	**F01**
Within 8" of Joint?:	**False**
Remarks:	

PACP Code:	**LFW**
Description:	**Lining Failure Wrinkled**
Distance (ft):	**260.3**
Structural Grade:	**3**
O&M Grade:	**0**
Clock Start/From:	**10**
Clock To:	**11**
1st Value:	
2nd Value:	
Continuous Index:	**S03**
Within 8" of Joint?:	**False**
Remarks:	



PACP Code:	**LFW**
Description:	**Lining Failure Wrinkled**
Distance (ft):	**325.1**
Structural Grade:	**3**
O&M Grade:	**0**
Clock Start/From:	**10**
Clock To:	**11**
1st Value:	
2nd Value:	
Continuous Index:	**F03**
Within 8" of Joint?:	**False**
Remarks:	

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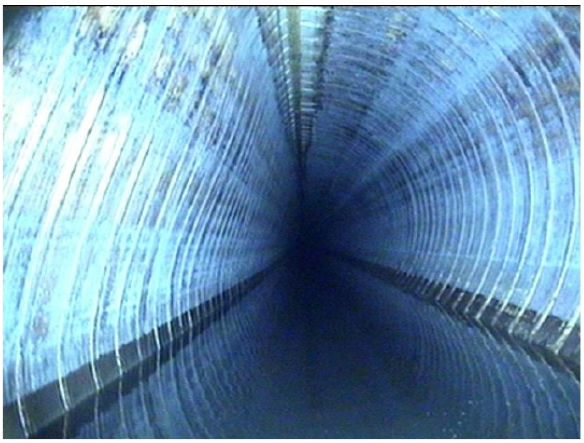
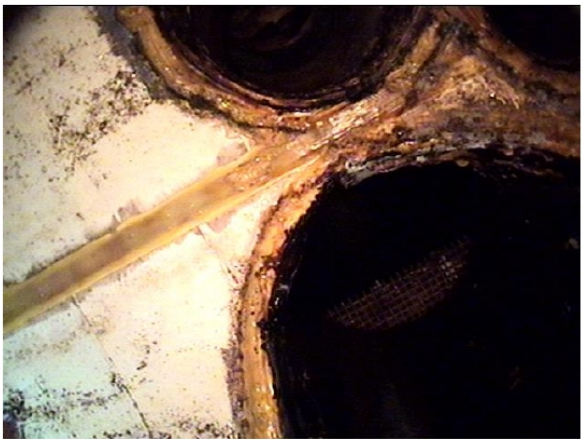


PACP Code:	**LFD**
Description:	**Lining Failure Detached**
Distance (ft):	**344**
Structural Grade:	**3**
O&M Grade:	**0**
Clock Start/From:	**7**
Clock To:	**12**
1st Value:	
2nd Value:	
Continuous Index:	**S04**
Within 8" of Joint?:	**False**
Remarks:	

PACP Code:	**LL**
Description:	**Alignment Left**
Distance (ft):	**1758.6**
Structural Grade:	**0**
O&M Grade:	**2**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	



PACP Code:	**AMH**
Description:	**Manhole**
Distance (ft):	**1758.6**
Structural Grade:	**0**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	**UBU01011**

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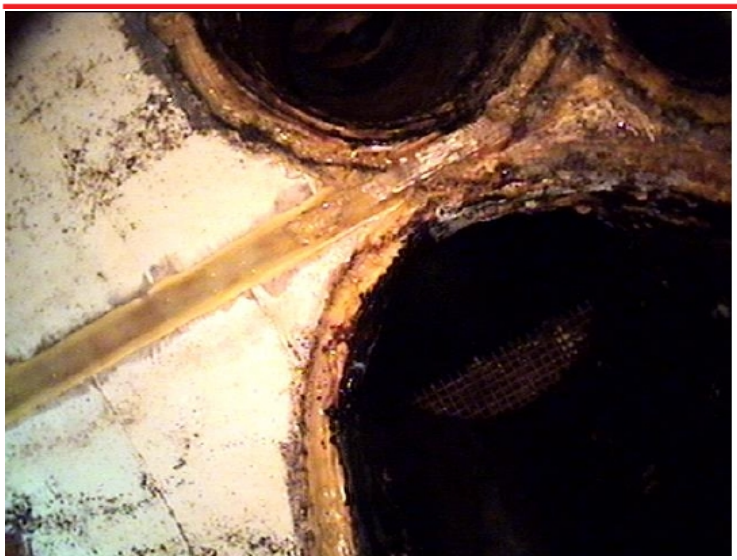

PACP Code:	**LFD**
Description:	**Lining Failure Detached**
Distance (ft):	**1758.6**
Structural Grade:	**3**
O&M Grade:	**0**
Clock Start/From:	**7**
Clock To:	**12**
1st Value:	
2nd Value:	
Continuous Index:	**F04**
Within 8" of Joint?:	**False**
Remarks:	

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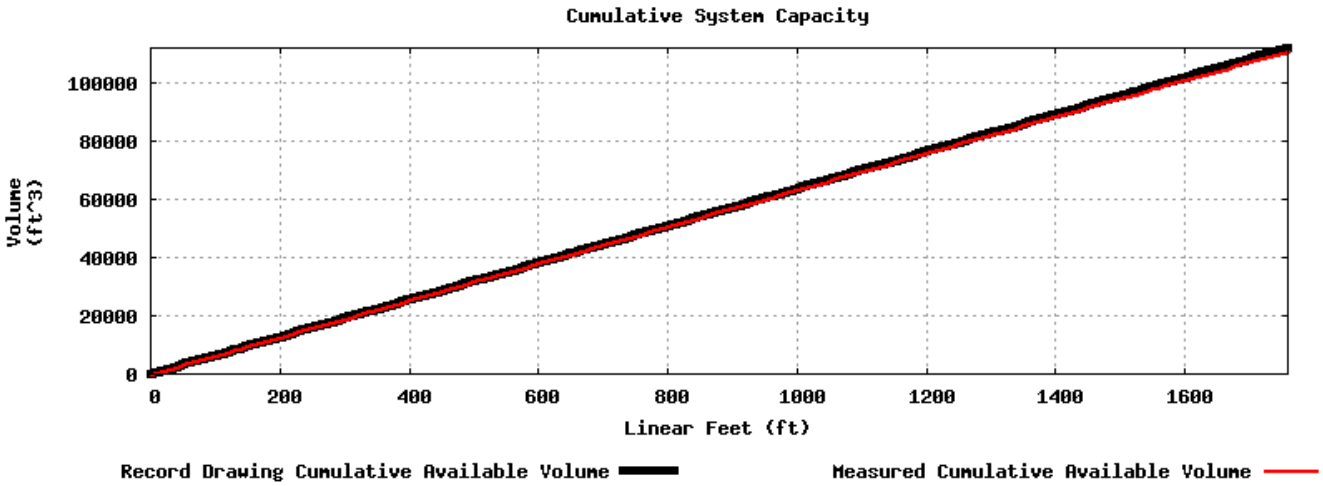
3 Sediment

3.1 Cumulative System Capacity

The inspected distance displayed below is the distance downstream from the UBU01012 manhole.



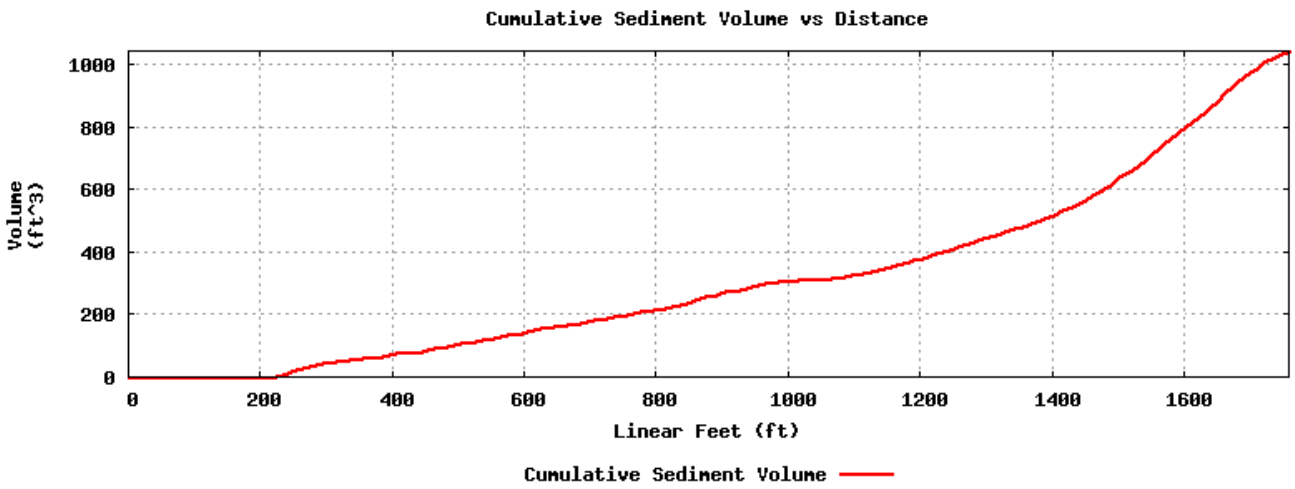
Inspection Distance	1759 ft
Record Drawing Available Capacity	111902.7 ft^3
Measured Available Capacity	110860.8 ft^3
% Available Capacity	99.1 %

Copyright 2013

3.2 Cumulative Sediment Volume

The actual free space capacity is derived from the cross sectional sonar scans. In order to determine sediment volume, the actual free space capacity is subtracted from the total as-built capacity.

The inspected distance displayed below is the distance downstream from the UBU01012 manhole.



Inspection Distance	1759 ft
Cumulative Sediment Volume	1041.9 ft^3

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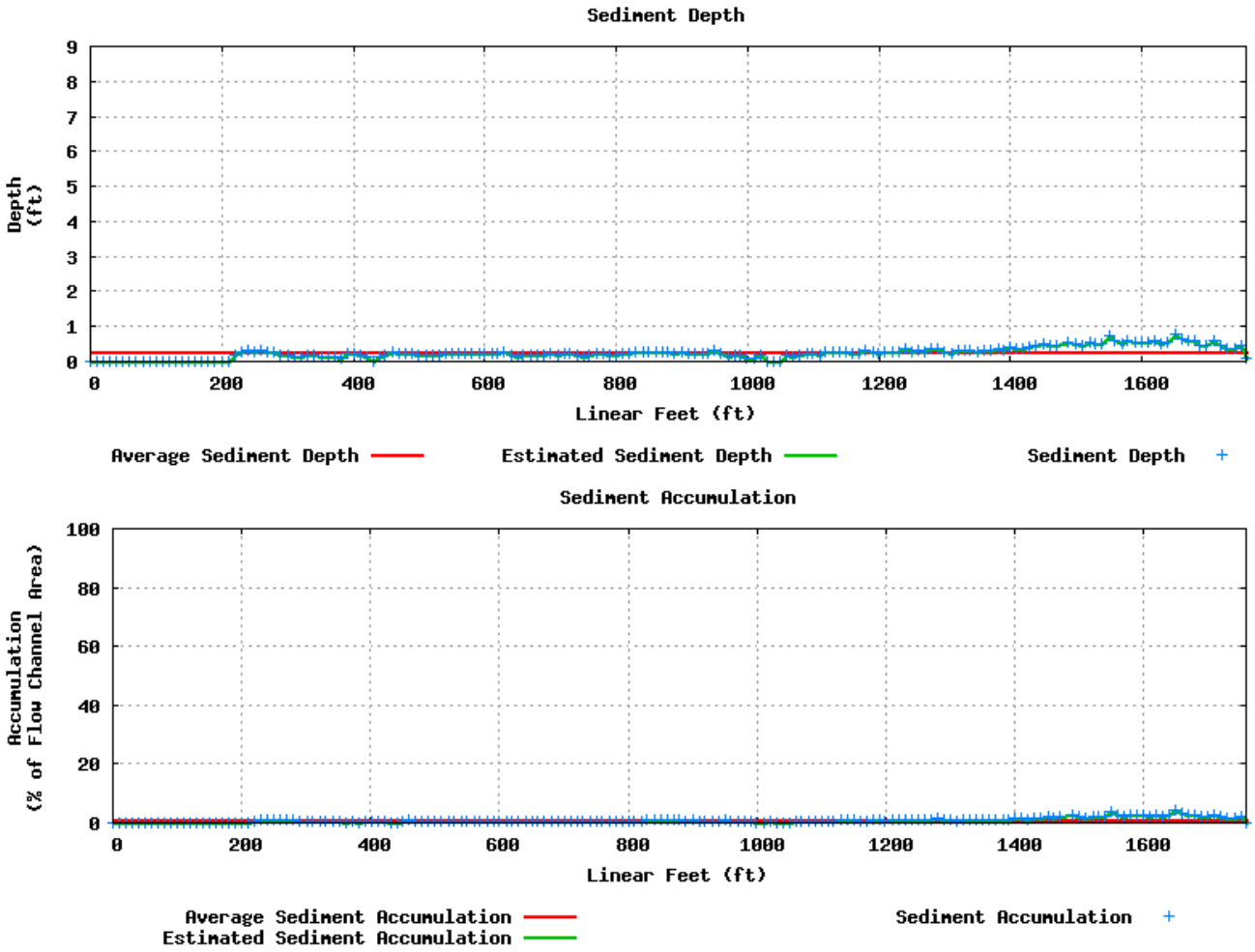
3.3 Average Sediment Depth

The standard sediment depth measurement graph represents a comprehensive summary of pipe sediment depth over distance.

The inspected distance displayed below is the distance downstream from the UBU01012 manhole.



Measure	Location	Depth	Accumulation
Maximum	1650.5 ft	9.3 in	4.1 %
Minimum	0.0 ft	0.0 in	0.0 %
Average	N/A	3.4 in	0.9 %

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3.4 Cleaning Recommendations

The table below depicts the level of cleaning recommended throughout the inspected length. The recommendations are based on sediment volume, not type of material.

Recommendation	% of Capacity Lost	Distance Inspected	% of Total Length
No Cleaning	0% to 5%	1759 ft	100 %
Light Cleaning	6% to 15%	0 ft	0 %
Moderate Cleaning	16% to 30%	0 ft	0 %
Heavy Cleaning	> 30%	0 ft	0 %

3.5 Cleaning Recommendations by Location

Start Location	End Location	Recommendations
0.0 ft	1759.0 ft	No Cleaning

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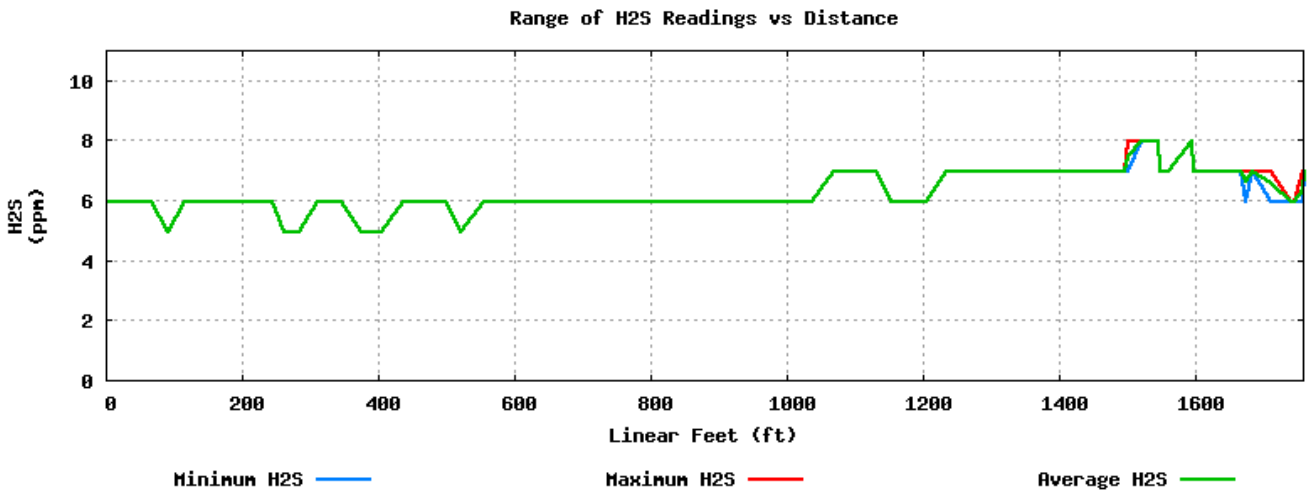
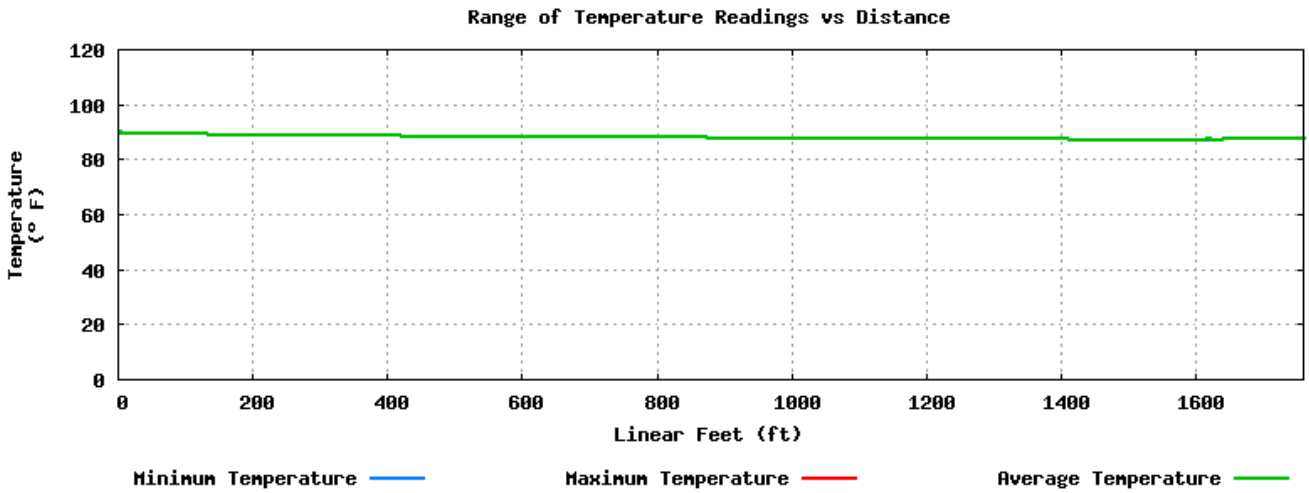
4 Gas

The inspected distance displayed below is the distance downstream from the UBU01012 manhole.





General Results	H2S Concentration	Temperature
Maximum	8 ppm	90 degrees F
Minimum	5 ppm	88 degrees F
Average	6.4 ppm	88 degrees F

H2S Concentration	Cumulative Inspected Distance	% of Inspected Distance
Maximum > 2.0 ppm	1759.0 ft	100.0 %
Average > 2.0 ppm	1759.0 ft	100.0 %

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Responder Multi-Sensor Inspection

Houston Public Works and Engineering
Wastewater Operations

TX Houston Large Diameter Sewer Inspection

UBU01010-UBU01009
U/S MH: UBU01010
D/S MH: UBU01009
RECORD DRAWING DIAMETER (RCD): 108 in
Job: SJ501134
Inspection Date: 8/14/2013
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1 Summary

1.1 Job

Prepared For	City of Houston
Street Location	Westheimer Road
Deployment Location / Manhole	UBU01009
Operator	J. Williamson
Deployment Weather	Sunny (Dry)
Planned Inspection Distance	1312 ft
Actual Inspection Distance	1315 ft
Inspection Direction	Upstream
Upstream Location / Manhole	UBU01010
Downstream Location / Manhole	UBU01009
Record Drawing Diameter	108 in
Record Drawing Pipe Shape	Circular
Pipe Material	Reinforced Concrete Pipe

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1.2 Results

Observations	
Number of Observations	10
Number of Grade 4 & 5 Observations	2
Number of Continuous Observations	3
Flow Height	30 %
Sediment	
Average Sediment Depth	1.9 in
Total Sediment Volume	331.5 ft^3
% of Pipe Flow Restriction Due to Sediment	0.4 %

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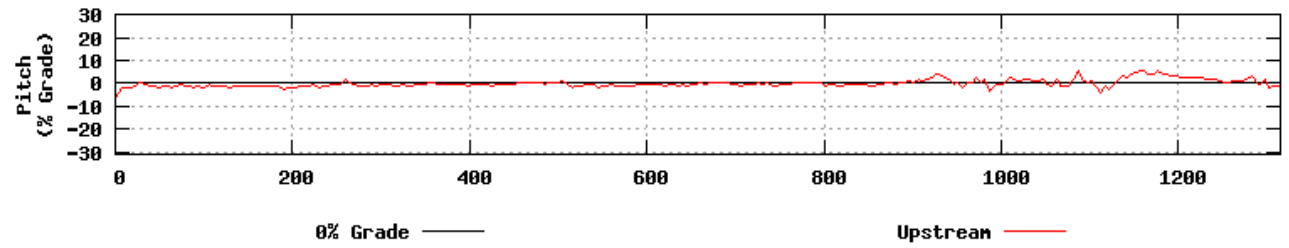
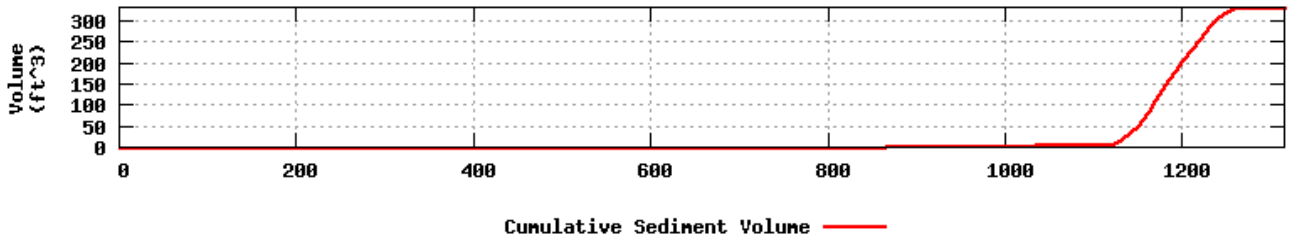
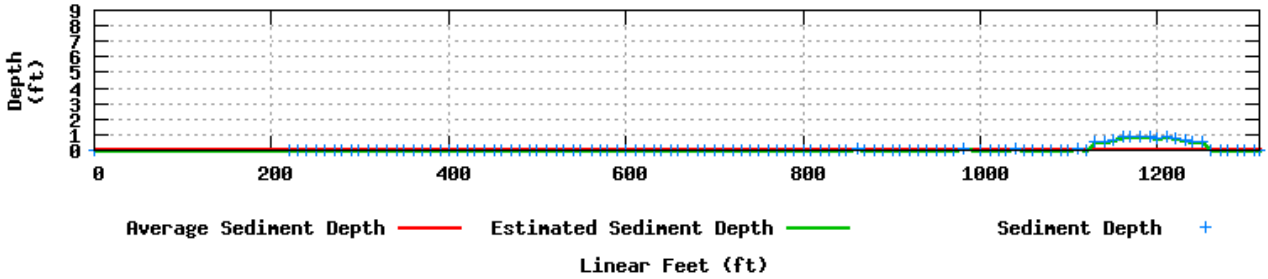
1.3 Segment Summary View

The inspected distance displayed below is the distance upstream from the UBU01009 manhole.







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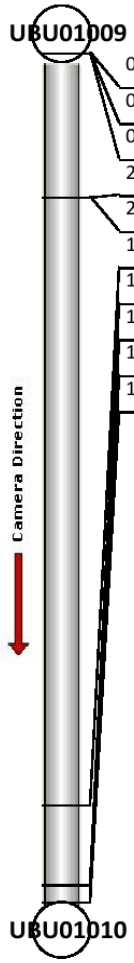
2 Observations

Profile/Photo Observation Report

Date:	**08/14/2013**	Weather:	**Dry**	Sheet #:	**0**
Pipe Length:		Owner:	**Houston, TX**	Pre Clean:	
P.O.#:		Surveyor:	**J. Williamson**	PSR:	**1642877**
Customer:	**Clean Serve**	Clean Date:		Shape:	**Circular**

Street:	**Westheimer Road**	Flow Control:	**Not Controlled**
City:	**Houston, TX**	Year Renewed:	
Location:	**Parking Lot**	Tape/Media #:	**SD018**
Purpose:	**Pre-Rehabilitation Survey**	Dia/Height:	**108**
Use:	**Sanitary**	Material:	**Reinforced Concrete Pipe**
Drain Area:		Lining:	**Cured in Place**
Category		Pipe Joint Length:	
Comment:			
Location Details:	**@ Hayes Rd. Intersection**	Direction of Survey:	**Upstream**

US MH: **UBU01010** DS MH: **UBU01009** Total Length Surveyed: **1315**



Position	Code	Observation	Counter	Photo	Grade
0	AMH	Manhole	0	0-AMH.jpg	-
0	MWL	Water Level	105	0-MWL.jpg	-
0	LFD	Lining Failure Detached	138	0-LFD.jpg	S3
223.6	LFD	Lining Failure Detached	1571	223.6-LFD.jpg	S3
223.6	LFD	Lining Failure Detached	1594	223.6-LFD_2.jpg	S3
1164.8	D	Deformed	3898	1164.8000488281	S4
1289.4	D	Deformed	4164	1289.4-D.jpg	S4
1315	TF	Tap Factory	4238	1315-TF.jpg	-
1315	AMH	Manhole	4292	1315-AMH.jpg	-
1315	LFD	Lining Failure Detached	4308	1315-LFD.jpg	S3

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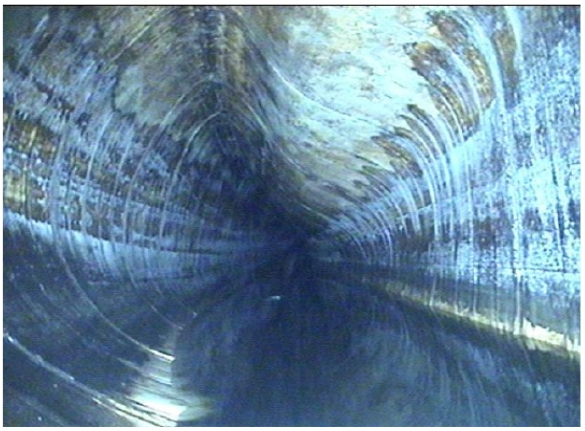
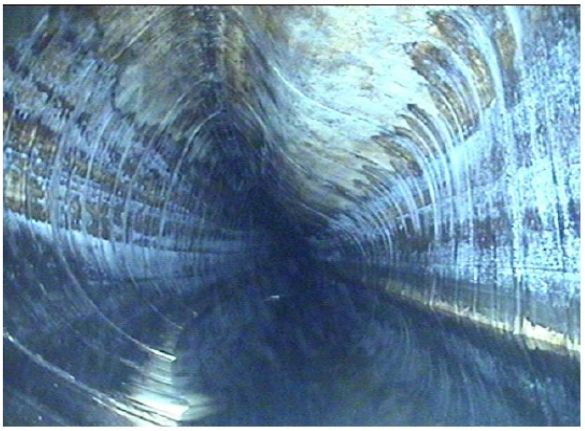
PACP Code:	**AMH**
Description:	**Manhole**
Distance (ft):	**0**
Structural Grade:	**0**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	**UBU01009**



PACP Code:	**MWL**
Description:	**Water Level**
Distance (ft):	**0**
Structural Grade:	**0**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	



PACP Code:	**LFD**
Description:	**Lining Failure Detached**
Distance (ft):	**0**
Structural Grade:	**3**
O&M Grade:	**0**
Clock Start/From:	**11**
Clock To:	**5**
1st Value:	
2nd Value:	
Continuous Index:	**S01**
Within 8" of Joint?:	**False**
Remarks:	

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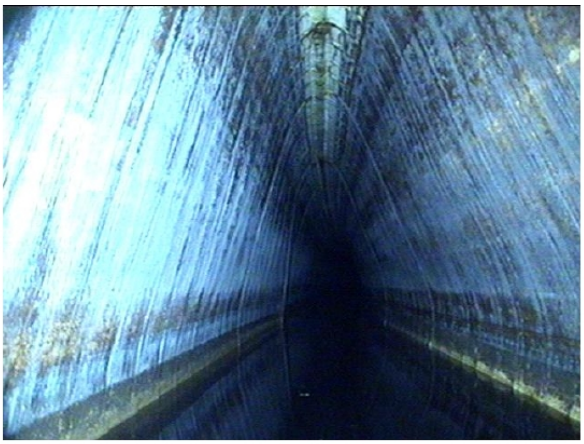
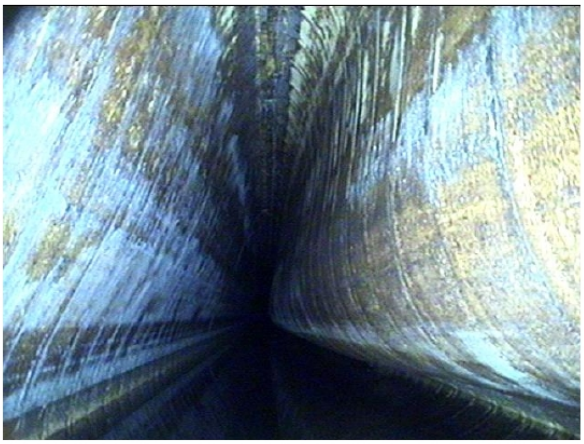


PACP Code:	**LFD**
Description:	**Lining Failure Detached**
Distance (ft):	**223.6**
Structural Grade:	**3**
O&M Grade:	**0**
Clock Start/From:	**11**
Clock To:	**5**
1st Value:	
2nd Value:	
Continuous Index:	**F01**
Within 8" of Joint?:	**False**
Remarks:	

PACP Code:	**LFD**
Description:	**Lining Failure Detached**
Distance (ft):	**223.6**
Structural Grade:	**3**
O&M Grade:	**0**
Clock Start/From:	**8**
Clock To:	**4**
1st Value:	
2nd Value:	
Continuous Index:	**S02**
Within 8" of Joint?:	**False**
Remarks:	



PACP Code:	**D**
Description:	**Deformed**
Distance (ft):	**1164.8**
Structural Grade:	**4**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	**S03**
Within 8" of Joint?:	**False**
Remarks:	

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PACP Code:	**D**
Description:	**Deformed**
Distance (ft):	**1289.4**
Structural Grade:	**4**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	**F03**
Within 8" of Joint?:	**False**
Remarks:	

PACP Code:	**TF**
Description:	**Tap Factory**
Distance (ft):	**1315**
Structural Grade:	**0**
O&M Grade:	**0**
Clock Start/From:	**1**
Clock To:	
1st Value:	**18**
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	

PACP Code:	**AMH**
Description:	**Manhole**
Distance (ft):	**1315**
Structural Grade:	**0**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	**UBU01010**

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PACP Code:	**LFD**
Description:	**Lining Failure Detached**
Distance (ft):	**1315**
Structural Grade:	**3**
O&M Grade:	**0**
Clock Start/From:	**8**
Clock To:	**4**
1st Value:	
2nd Value:	
Continuous Index:	**F02**
Within 8" of Joint?:	**False**
Remarks:	

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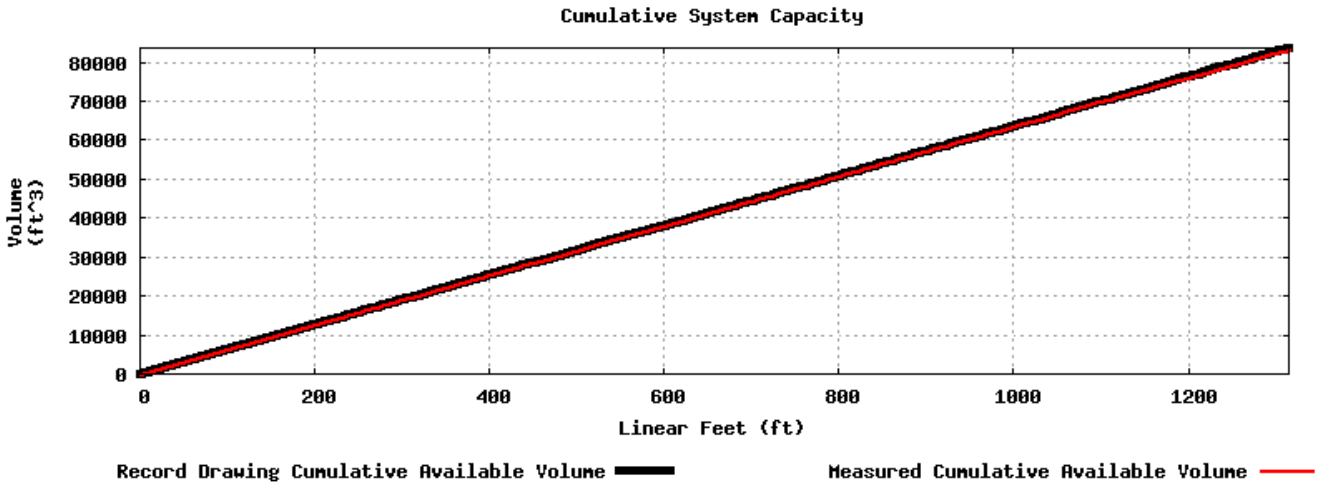
3 Sediment

3.1 Cumulative System Capacity

The inspected distance displayed below is the distance upstream from the UBU01009 manhole.



Inspection Distance	1315 ft
Record Drawing Available Capacity	83656.7 ft^3
Measured Available Capacity	83325.2 ft^3
% Available Capacity	99.6 %

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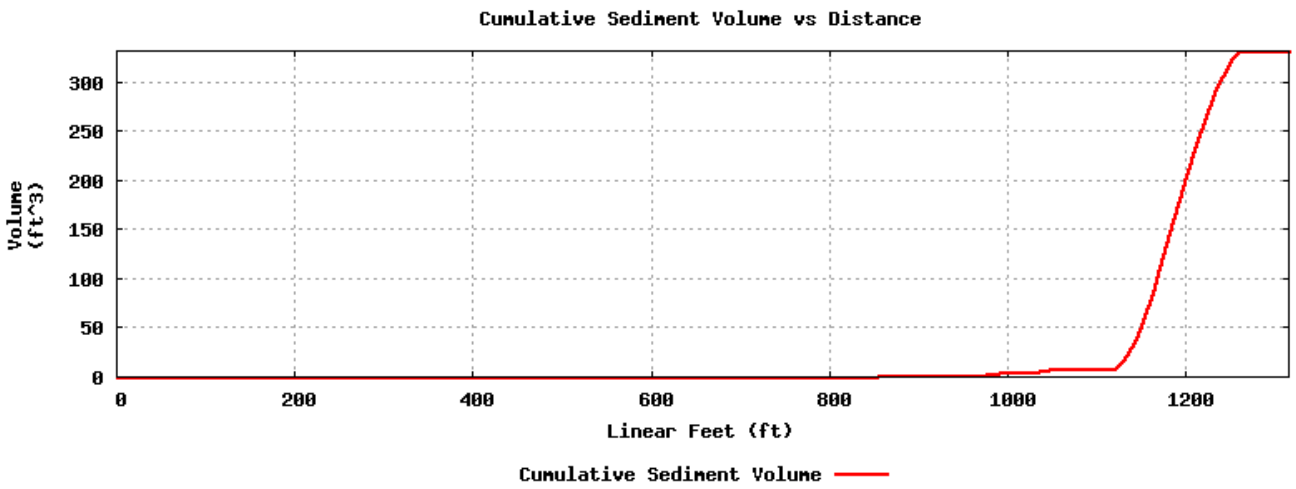
3.2 Cumulative Sediment Volume

The actual free space capacity is derived from the cross sectional sonar scans. In order to determine sediment volume, the actual free space capacity is subtracted from the total as-built capacity.

The inspected distance displayed below is the distance upstream from the UBU01009 manhole.



Inspection Distance	1315 ft
Cumulative Sediment Volume	331.5 ft^3

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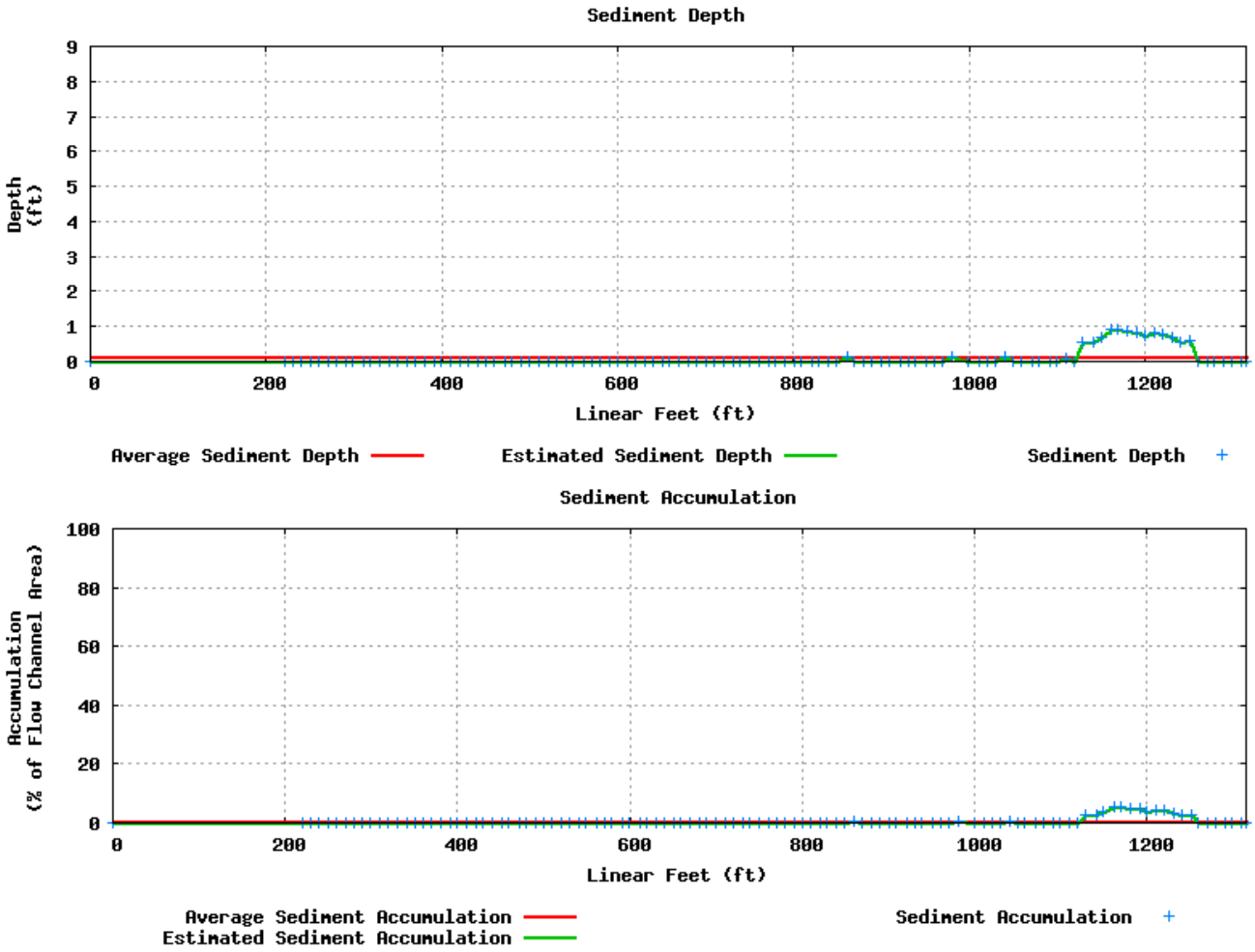
3.3 Average Sediment Depth

The standard sediment depth measurement graph represents a comprehensive summary of pipe sediment depth over distance.

The inspected distance displayed below is the distance upstream from the UBU01009 manhole.



Measure	Location	Depth	Accumulation
Maximum	1161.5 ft	11.1 in	5.4 %
Minimum	0.0 ft	0.0 in	0.0 %
Average	N/A	1.9 in	0.4 %

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3.4 Cleaning Recommendations

The table below depicts the level of cleaning recommended throughout the inspected length. The recommendations are based on sediment volume, not type of material.

Recommendation	% of Capacity Lost	Distance Inspected	% of Total Length
No Cleaning	0% to 5%	1296.7 ft	99 %
Light Cleaning	6% to 15%	18.3 ft	1 %
Moderate Cleaning	16% to 30%	0 ft	0 %
Heavy Cleaning	> 30%	0 ft	0 %

3.5 Cleaning Recommendations by Location

Start Location	End Location	Recommendations
0.0 ft	1161.5 ft	No Cleaning
1161.5 ft	1179.8 ft	Light Cleaning
1179.8 ft	1315.0 ft	No Cleaning

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Responder Multi-Sensor Inspection

Houston Public Works and Engineering
Wastewater Operations

TX Houston Large Diameter Sewer Inspection

UBU01011-UBU01010
U/S MH: UBU01011
D/S MH: UBU01010
RECORD DRAWING DIAMETER (RCD): 108 in
Job: SJ501134
Inspection Date: 8/14/2013
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1 Summary

1.1 Job

Prepared For	City of Houston
Street Location	Westheimer Road
Deployment Location / Manhole	UBU01010
Operator	J. Williamson
Deployment Weather	Sunny (Dry)
Planned Inspection Distance	1564 ft
Actual Inspection Distance	432 ft
Inspection Direction	Upstream
Upstream Location / Manhole	UBU01011
Downstream Location / Manhole	UBU01010
Record Drawing Diameter	108 in
Record Drawing Pipe Shape	Circular
Pipe Material	Reinforced Concrete Pipe

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1.2 Results

Observations	
Number of Observations	9
Number of Grade 4 & 5 Observations	2
Number of Continuous Observations	2
Flow Height	30 %
Sediment	
Average Sediment Depth	3.2 in
Total Sediment Volume	234.1 ft^3
% of Pipe Flow Restriction Due to Sediment	0.9 %

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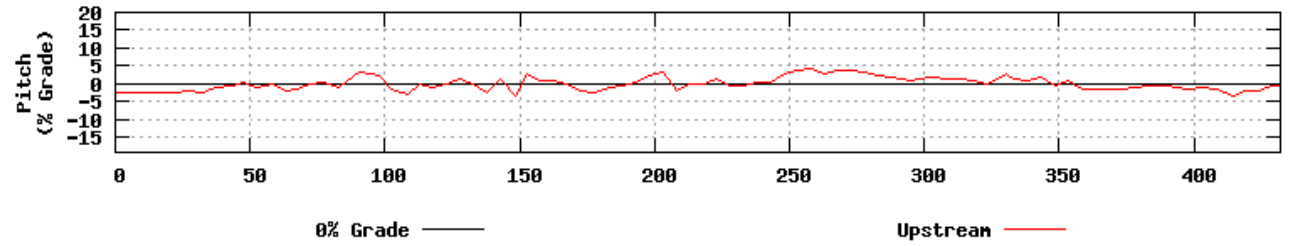
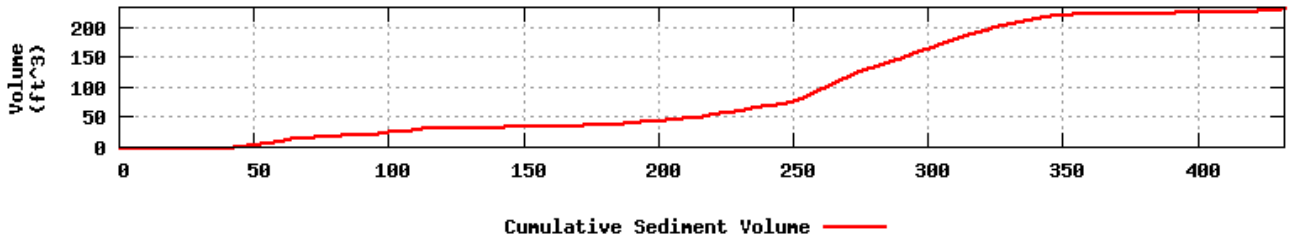
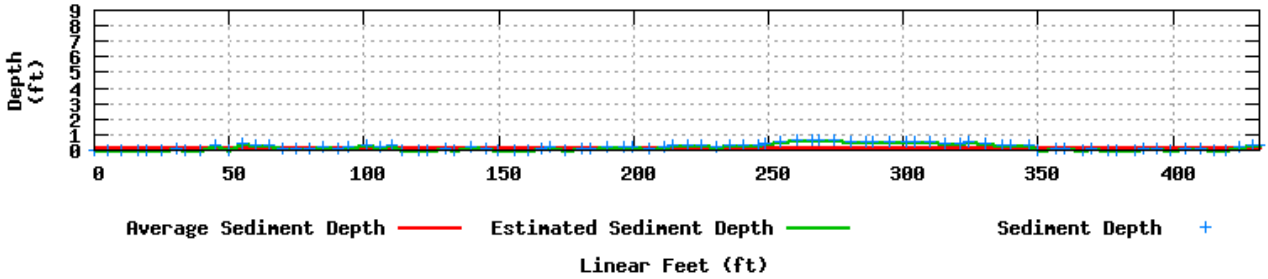
1.3 Segment Summary View

The inspected distance displayed below is the distance upstream from the UBU01010 manhole.







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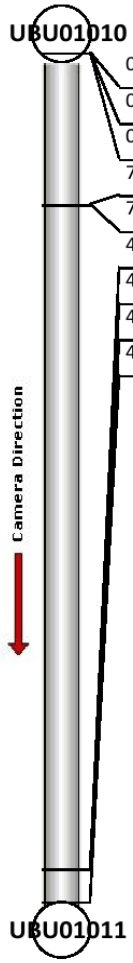
2 Observations

Profile/Photo Observation Report

Date:	**08/14/2013**	Weather:	**Dry**	Sheet #:	**0**
Pipe Length:		Owner:	**Houston, TX**	Pre Clean:	
P.O.#:		Surveyor:	**J. Williamson**	PSR:	**11997233**
Customer:	**Clean Serve**	Clean Date:		Shape:	**Circular**

Street:	**Westheimer Road**	Flow Control:	**Not Controlled**
City:	**Houston, TX**	Year Renewed:	
Location:	**Parking Lot**	Tape/Media #:	**SD018**
Purpose:	**Pre-Rehabilitation Survey**	Dia/Height:	**108**
Use:	**Sanitary**	Material:	**Reinforced Concrete Pipe**
Drain Area:		Lining:	**Cured in Place**
Category		Pipe Joint Length:	
Comment:			
Location Details:	**@ Walnut Bend Ln.**	Direction of Survey:	**Upstream**

US MH: **UBU01011** DS MH: **UBU01010** Total Length Surveyed: **431.9**



Position	Code	Observation	Counter	Photo	Grade
0	AMH	Manhole	0	0-AMH.jpg	-
0	MWL	Water Level	64	0-MWL.jpg	-
0	LFD	Lining Failure Detached	83	0-LFD.jpg	S3
77.6	LFD	Lining Failure Detached	879	77.6-LFD.jpg	S3
77.6	LFD	Lining Failure Detached	884	77.6-LFD_2.jpg	S3
415.2	D	Deformed	4467	415.2-D.jpg	S4
431.9	LFD	Lining Failure Detached	4571	431.9-LFD.jpg	S3
431.9	XP	Collapse Pipe Sewer	4602	431.9-XP.jpg	S5
431.9	MSA	Abandoned Survey	4618	431.9-MSA.jpg	-

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PACP Code:	**AMH**
Description:	**Manhole**
Distance (ft):	**0**
Structural Grade:	**0**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	**UBU01010**

PACP Code:	**MWL**
Description:	**Water Level**
Distance (ft):	**0**
Structural Grade:	**0**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	

PACP Code:	**LFD**
Description:	**Lining Failure Detached**
Distance (ft):	**0**
Structural Grade:	**3**
O&M Grade:	**0**
Clock Start/From:	**12**
Clock To:	**5**
1st Value:	
2nd Value:	
Continuous Index:	**S01**
Within 8" of Joint?:	**False**
Remarks:	

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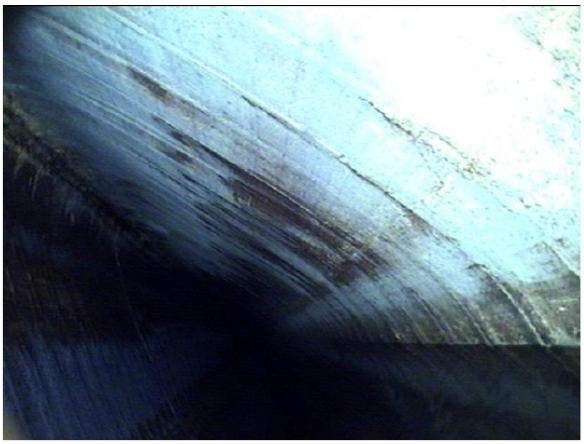

PACP Code:	**LFD**
Description:	**Lining Failure Detached**
Distance (ft):	**77.6**
Structural Grade:	**3**
O&M Grade:	**0**
Clock Start/From:	**12**
Clock To:	**5**
1st Value:	
2nd Value:	
Continuous Index:	**F01**
Within 8" of Joint?:	**False**
Remarks:	

PACP Code:	**LFD**
Description:	**Lining Failure Detached**
Distance (ft):	**77.6**
Structural Grade:	**3**
O&M Grade:	**0**
Clock Start/From:	**8**
Clock To:	**4**
1st Value:	
2nd Value:	
Continuous Index:	**S02**
Within 8" of Joint?:	**False**
Remarks:	

PACP Code:	**D**
Description:	**Deformed**
Distance (ft):	**415.2**
Structural Grade:	**4**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	

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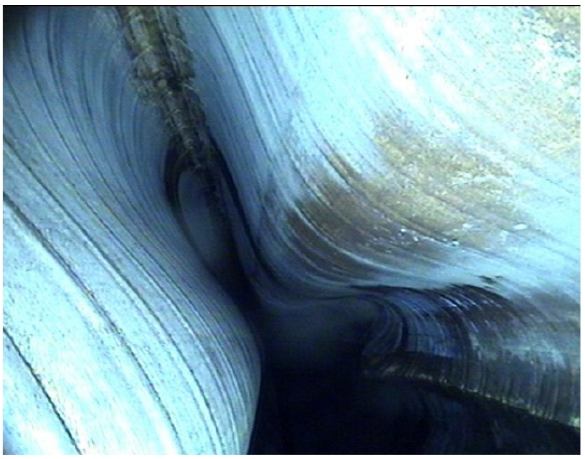
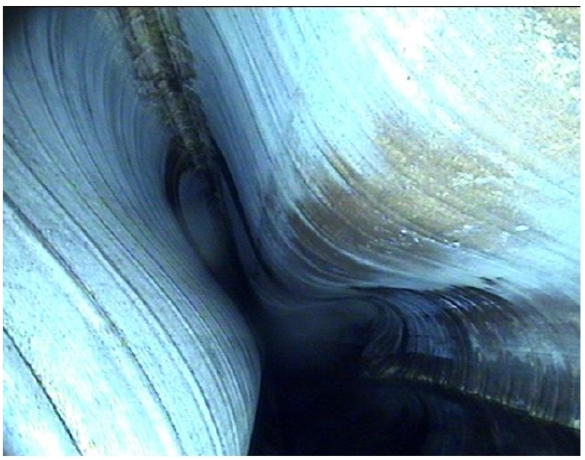
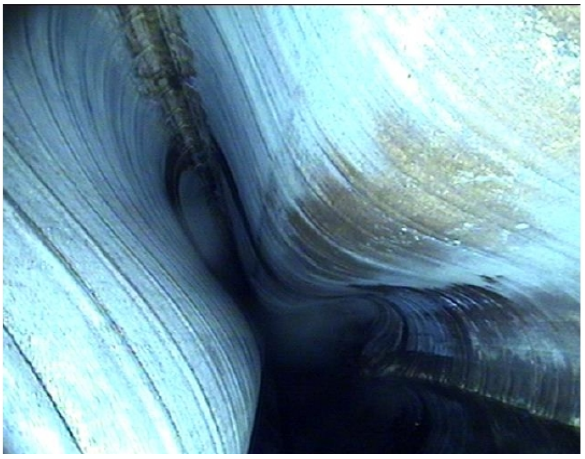


PACP Code:	**LFD**
Description:	**Lining Failure Detached**
Distance (ft):	**431.9**
Structural Grade:	**3**
O&M Grade:	**0**
Clock Start/From:	**8**
Clock To:	**4**
1st Value:	
2nd Value:	
Continuous Index:	**F02**
Within 8" of Joint?:	**False**
Remarks:	



PACP Code:	**XP**
Description:	**Collapse Pipe Sewer**
Distance (ft):	**431.9**
Structural Grade:	**5**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	



PACP Code:	**MSA**
Description:	**Abandoned Survey**
Distance (ft):	**431.9**
Structural Grade:	**0**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	**Cannot pass collapse.**

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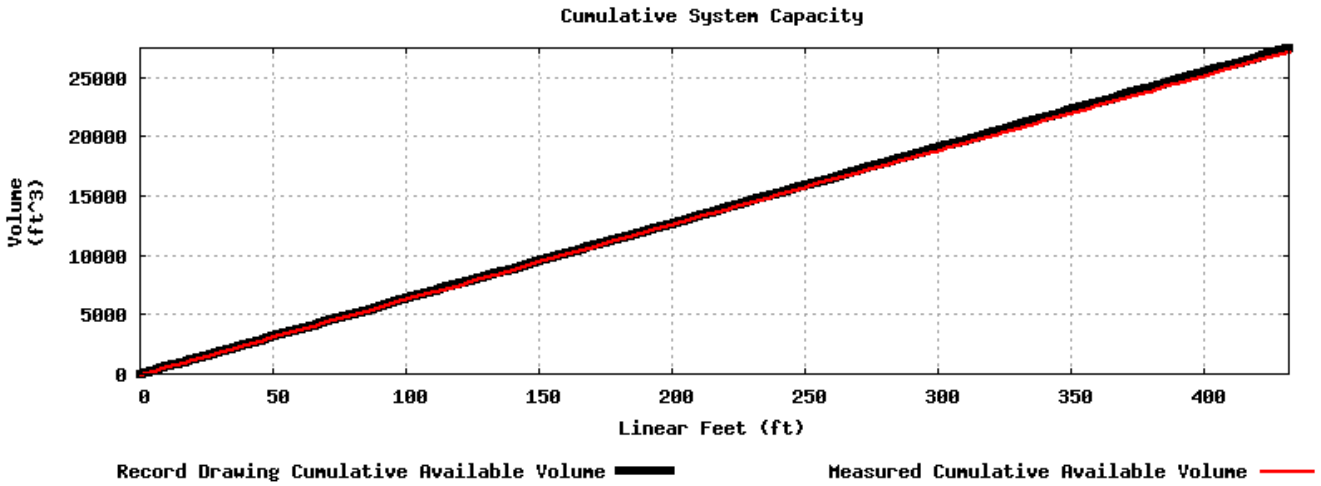
3 Sediment

3.1 Cumulative System Capacity

The inspected distance displayed below is the distance upstream from the UBU01010 manhole.



Inspection Distance	432 ft
Record Drawing Available Capacity	27482.7 ft^3
Measured Available Capacity	27248.5 ft^3
% Available Capacity	99.1 %

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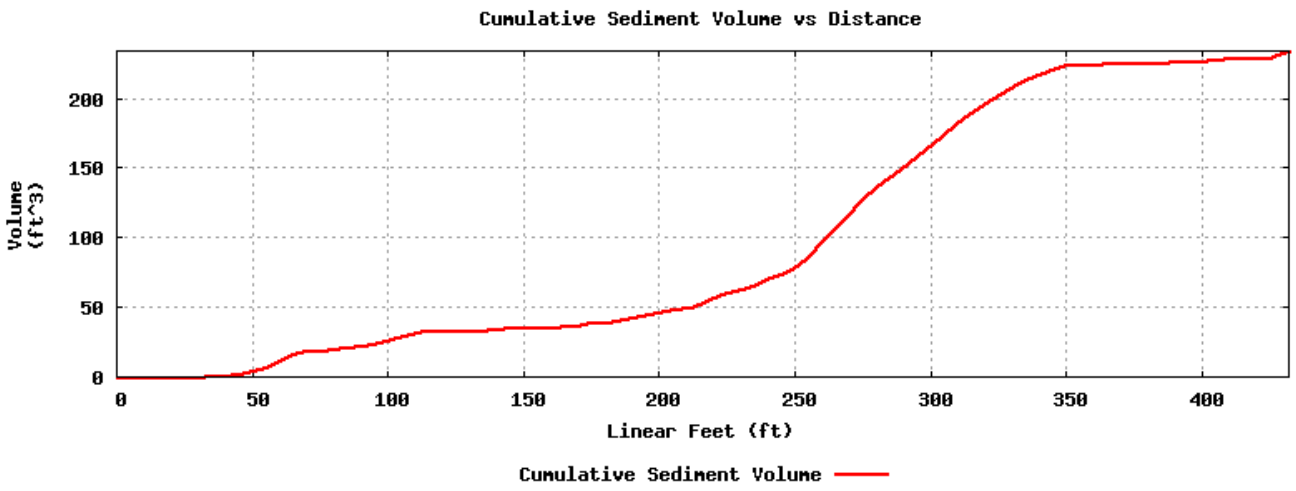
3.2 Cumulative Sediment Volume

The actual free space capacity is derived from the cross sectional sonar scans. In order to determine sediment volume, the actual free space capacity is subtracted from the total as-built capacity.

The inspected distance displayed below is the distance upstream from the UBU01010 manhole.



Inspection Distance	432 ft
Cumulative Sediment Volume	234.1 ft^3

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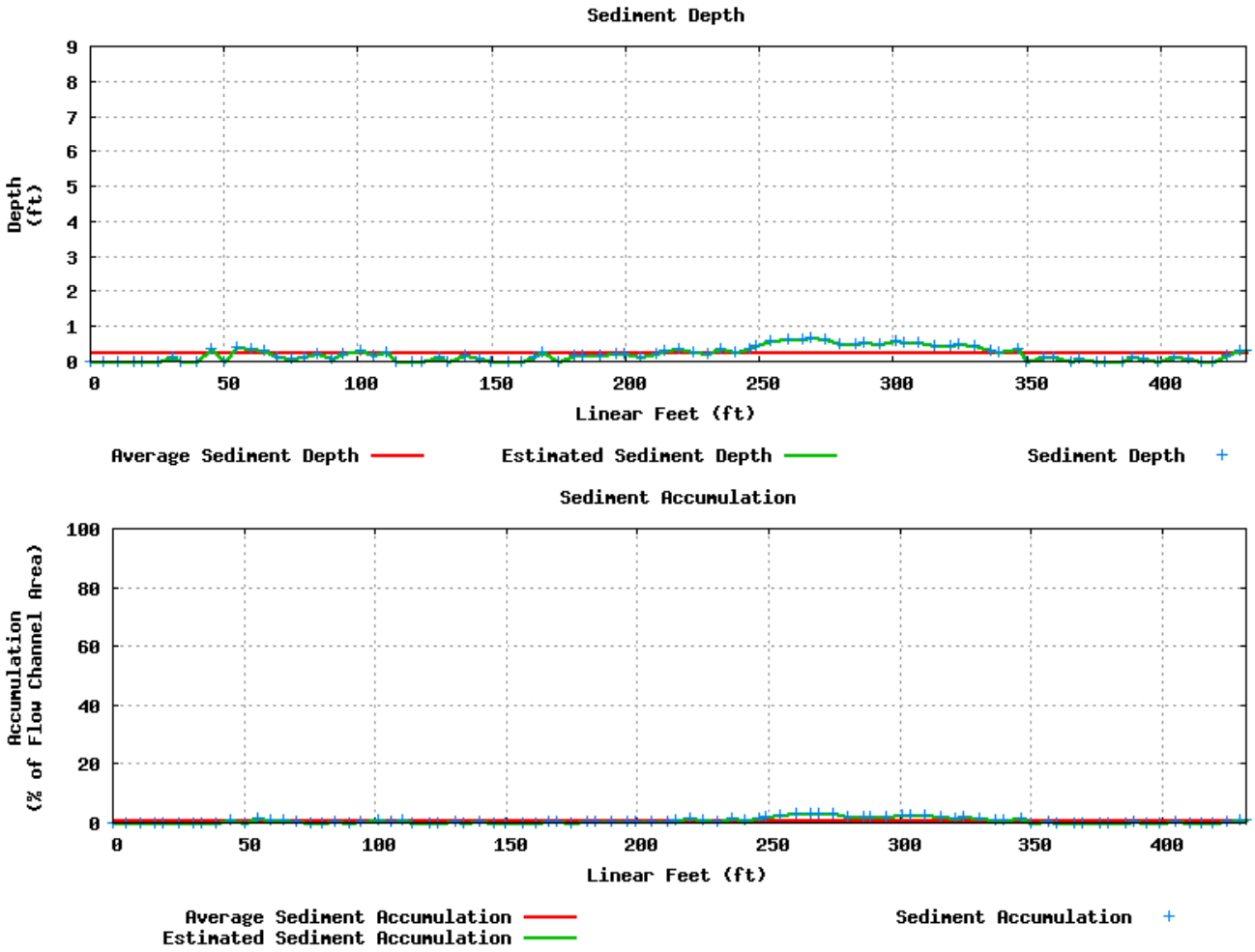
3.3 Average Sediment Depth

The standard sediment depth measurement graph represents a comprehensive summary of pipe sediment depth over distance.

The inspected distance displayed below is the distance upstream from the UBU01010 manhole.



Measure	Location	Depth	Accumulation
Maximum	269.0 ft	8.2 in	3.4 %
Minimum	0.0 ft	0.0 in	0.0 %
Average	N/A	3.2 in	0.9 %

Copyright 2013

3.4 Cleaning Recommendations

The table below depicts the level of cleaning recommended throughout the inspected length. The recommendations are based on sediment volume, not type of material.

Recommendation	% of Capacity Lost	Distance Inspected	% of Total Length
No Cleaning	0% to 5%	432 ft	100 %
Light Cleaning	6% to 15%	0 ft	0 %
Moderate Cleaning	16% to 30%	0 ft	0 %
Heavy Cleaning	> 30%	0 ft	0 %

3.5 Cleaning Recommendations by Location

Start Location	End Location	Recommendations
0.0 ft	432.0 ft	No Cleaning

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Responder Multi-Sensor Inspection

Houston Public Works and Engineering
Wastewater Operations

TX Houston Large Diameter Sewer Inspection

UBU01007-UBU01006
U/S MH: UBU01007
D/S MH: UBU01006
RECORD DRAWING DIAMETER (RCD): 108 in
Job: SJ501134
Inspection Date: 8/15/2013
Copyright 2013

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3.5 Cleaning Recommendations by Location 11

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1 Summary

1.1 Job

Prepared For	City of Houston
Street Location	Westheimer Road
Deployment Location / Manhole	UBU01007
Operator	J. Williamson
Deployment Weather	Sunny (Wet)
Planned Inspection Distance	997 ft
Actual Inspection Distance	365 ft
Inspection Direction	Downstream
Upstream Location / Manhole	UBU01007
Downstream Location / Manhole	UBU01006
Record Drawing Diameter	108 in
Record Drawing Pipe Shape	Circular
Pipe Material	Reinforced Concrete Pipe

Copyright 2013

1.2 Results

Observations	
Number of Observations	3
Number of Grade 4 & 5 Observations	0
Number of Continuous Observations	0
Flow Height	30 %
Sediment	
Average Sediment Depth	14.1 in
Total Sediment Volume	1776.8 ft^3
% of Pipe Flow Restriction Due to Sediment	7.7 %

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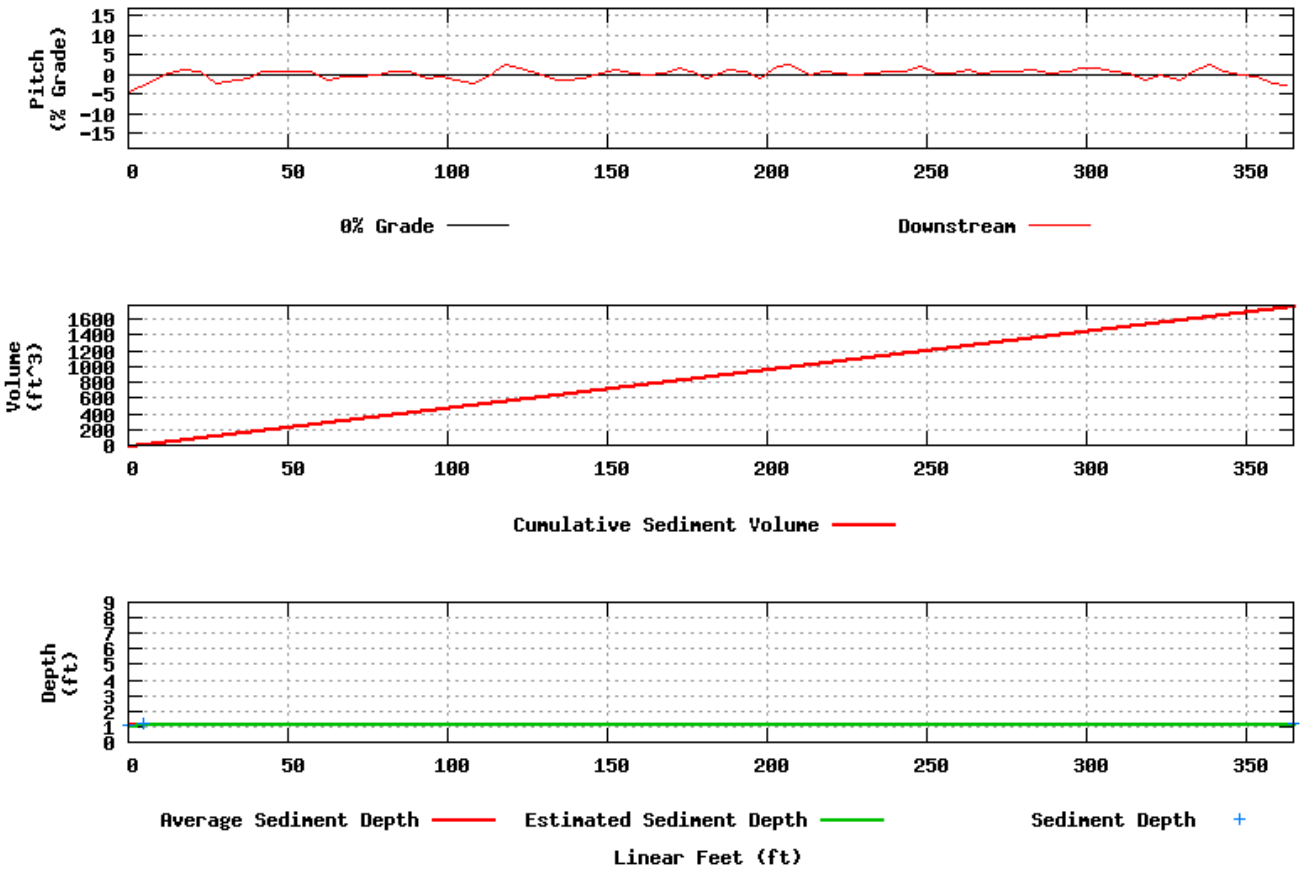
1.3 Segment Summary View

The inspected distance displayed below is the distance downstream from the UBU01007 manhole.



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2 Observations

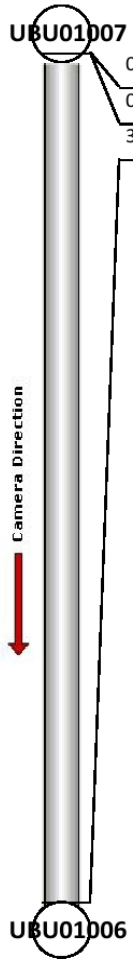
Profile/Photo Observation Report

Date:	**08/15/2013**	Weather:	**Dry**	Sheet #:	**0**
Pipe Length:		Owner:	**Houston, TX**	Pre Clean:	
P.O.#:		Surveyor:	**J. Williamson**	PSR:	**11998436**
Customer:	**Clean Serve**	Clean Date:		Shape:	**Circular**

Street:	**Westheimer Road**	Flow Control:	**Not Controlled**
City:	**Houston, TX**	Year Renewed:	
Location:	**Parking Lot**	Tape/Media #:	**SD018**
Purpose:	**Not Known**	Dia/Height:	**108**
Use:	**Sanitary**	Material:	**Reinforced Concrete Pipe**
Drain Area:		Lining:	**Cured in Place**
Category		Pipe Joint Length:	
Comment:			
Location Details:		Direction of Survey:	**Downstream**

US MH: **UBU01007** DS MH: **UBU01006** Total Length Surveyed: **365**

Position	Code	Observation	Counter	Photo	Grade
0	AMH	Manhole	0	0-AMH.jpg	-
0	MWL	Water Level	64	0-MWL.jpg	-
365	MSA	Abandoned Survey	1255	365-MSA.jpg	-



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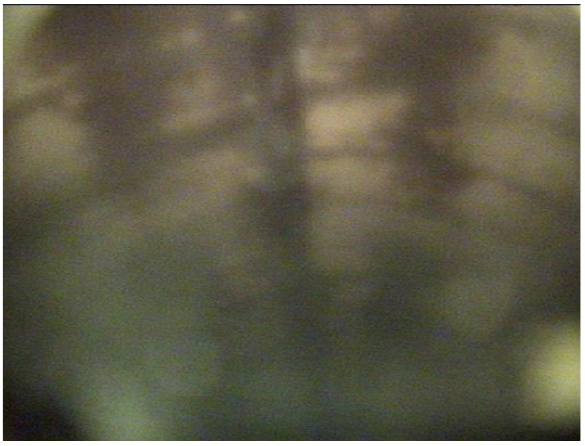
PACP Code:	**AMH**
Description:	**Manhole**
Distance (ft):	**0**
Structural Grade:	**0**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	**UBU01007**

PACP Code:	**MWL**
Description:	**Water Level**
Distance (ft):	**0**
Structural Grade:	**0**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	



PACP Code:	**MSA**
Description:	**Abandoned Survey**
Distance (ft):	**365**
Structural Grade:	**0**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	**Camera underwater.**

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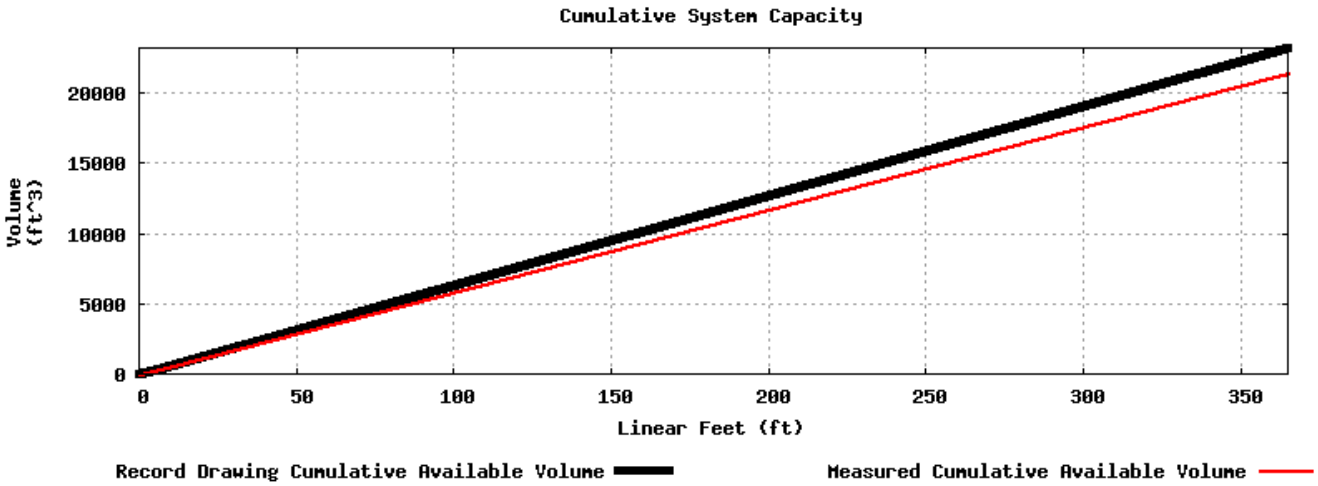
3 Sediment

3.1 Cumulative System Capacity

The inspected distance displayed below is the distance downstream from the UBU01007 manhole.



Inspection Distance	365 ft
Record Drawing Available Capacity	23220.3 ft^3
Measured Available Capacity	21443.5 ft^3
% Available Capacity	92.3 %

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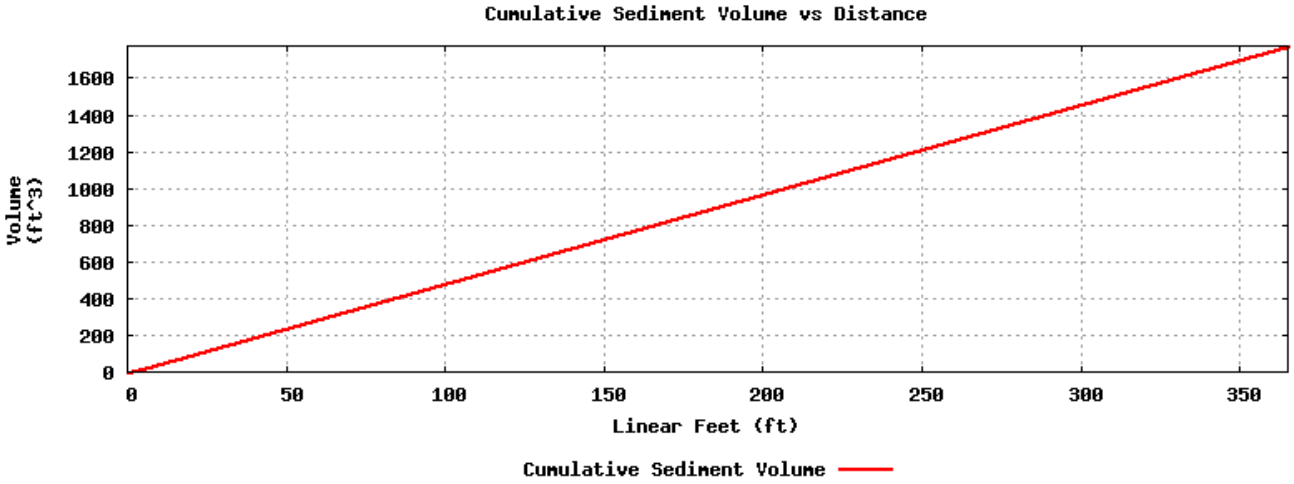
3.2 Cumulative Sediment Volume

The actual free space capacity is derived from the cross sectional sonar scans. In order to determine sediment volume, the actual free space capacity is subtracted from the total as-built capacity.

The inspected distance displayed below is the distance downstream from the UBU01007 manhole.



Inspection Distance	365 ft
Cumulative Sediment Volume	1776.8 ft^3

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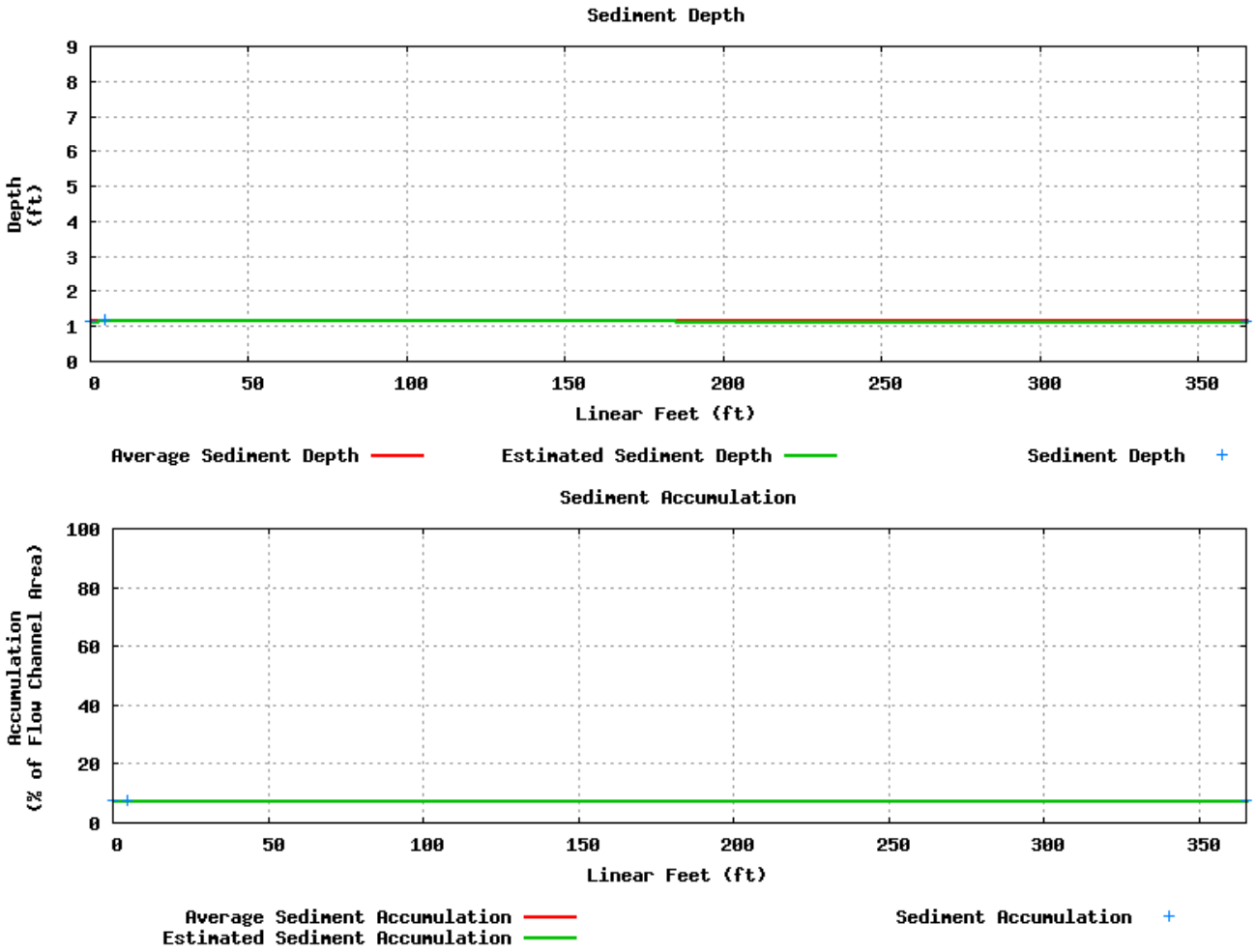
3.3 Average Sediment Depth

The standard sediment depth measurement graph represents a comprehensive summary of pipe sediment depth over distance.

The inspected distance displayed below is the distance downstream from the UBU01007 manhole.



Measure	Location	Depth	Accumulation
Maximum	4.6 ft	14.2 in	7.7 %
Minimum	0.0 ft	13.7 in	7.4 %
Average	N/A	14.1 in	7.7 %

Copyright 2013

3.4 Cleaning Recommendations

The table below depicts the level of cleaning recommended throughout the inspected length. The recommendations are based on sediment volume, not type of material.

Recommendation	% of Capacity Lost	Distance Inspected	% of Total Length
No Cleaning	0% to 5%	0 ft	0 %
Light Cleaning	6% to 15%	365 ft	100 %
Moderate Cleaning	16% to 30%	0 ft	0 %
Heavy Cleaning	> 30%	0 ft	0 %

3.5 Cleaning Recommendations by Location

Start Location	End Location	Recommendations
0.0 ft	365.0 ft	Light Cleaning

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Responder Multi-Sensor Inspection

Houston Public Works and Engineering
Wastewater Operations

TX Houston Large Diameter Sewer Inspection

UBU01008-UBU01007
U/S MH: UBU01008
D/S MH: UBU01007
RECORD DRAWING DIAMETER (RCD): 108 in
Job: SJ501134
Inspection Date: 8/15/2013
Copyright 2013

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1 Summary

1.1 Job

Prepared For	City of Houston
Street Location	Westheimer Road
Deployment Location / Manhole	UBU01008
Operator	J. Williamson
Deployment Weather	Sunny (Wet)
Planned Inspection Distance	1225 ft
Actual Inspection Distance	1245 ft
Inspection Direction	Downstream
Upstream Location / Manhole	UBU01008
Downstream Location / Manhole	UBU01007
Record Drawing Diameter	108 in
Record Drawing Pipe Shape	Circular
Pipe Material	Reinforced Concrete Pipe

Copyright 2013

1.2 Results

Observations	
Number of Observations	5
Number of Grade 4 & 5 Observations	0
Number of Continuous Observations	1
Flow Height	30 %
Sediment	
Average Sediment Depth	4.2 in
Total Sediment Volume	1024.7 ft^3
% of Pipe Flow Restriction Due to Sediment	1.3 %

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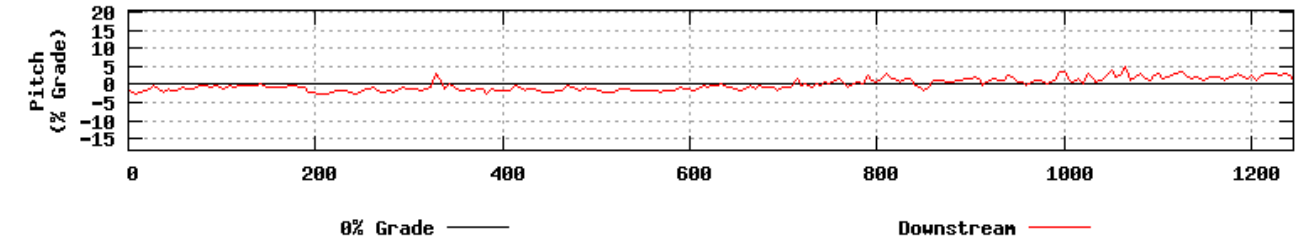
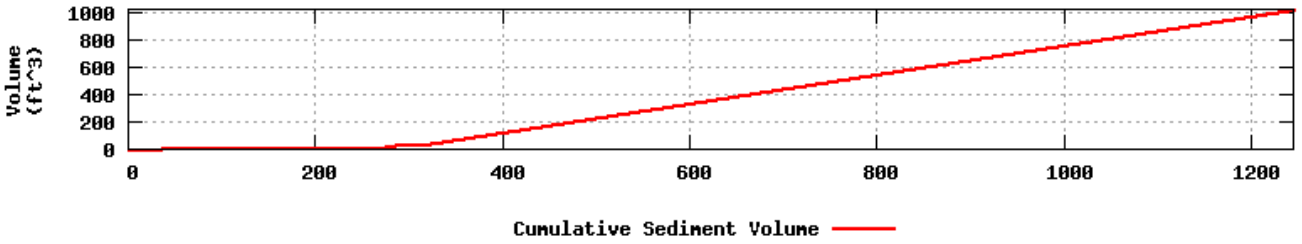
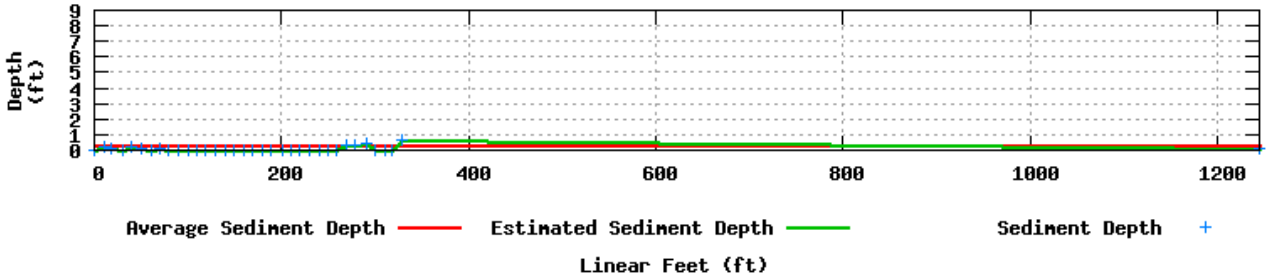
1.3 Segment Summary View

The inspected distance displayed below is the distance downstream from the UBU01008 manhole.







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2 Observations

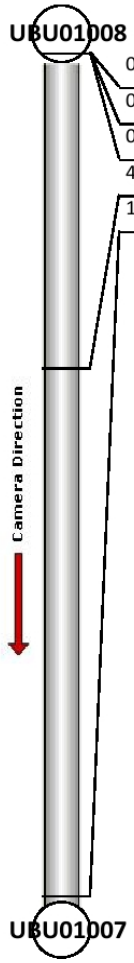
Profile/Photo Observation Report

Date:	**08/15/2013**	Weather:	**Dry**	Sheet #:	**0**
Pipe Length:		Owner:	**Houston, TX**	Pre Clean:	
P.O.#:		Surveyor:	**J. Williamson**	PSR:	**11998433**
Customer:	**Clean Serve**	Clean Date:		Shape:	**Circular**

Street:	**Westheimer Road**	Flow Control:	**Not Controlled**
City:	**Houston, TX**	Year Renewed:	
Location:	**Parking Lot**	Tape/Media #:	**SD018**
Purpose:	**Pre-Rehabilitation Survey**	Dia/Height:	**108**
Use:	**Sanitary**	Material:	**Reinforced Concrete Pipe**
Drain Area:		Lining:	**Cured in Place**
Category		Pipe Joint Length:	
Comment:			
Location Details:	**Intersection of Woodland Park Dr.**	Direction of Survey:	**Downstream**

US MH: **UBU01008** DS MH: **UBU01007** Total Length Surveyed: **1253.9**

Position	Code	Observation	Counter	Photo	Grade
0	AMH	Manhole	0	0-AMH.jpg	-
0	MWL	Water Level	69	0-MWL.jpg	-
0	LFD	Lining Failure Detached	90	0-LFD.jpg	S3
465.3	LFD	Lining Failure Detached	2113	465.3-LFD.jpg	S3
1245	AMH	Manhole	6620	1245-AMH.jpg	-



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PACP Code:	**AMH**
Description:	**Manhole**
Distance (ft):	**0**
Structural Grade:	**0**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	**UBU01008**

PACP Code:	**MWL**
Description:	**Water Level**
Distance (ft):	**0**
Structural Grade:	**0**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	

PACP Code:	**LFD**
Description:	**Lining Failure Detached**
Distance (ft):	**0**
Structural Grade:	**3**
O&M Grade:	**0**
Clock Start/From:	**8**
Clock To:	**12**
1st Value:	
2nd Value:	
Continuous Index:	**S01**
Within 8" of Joint?:	**False**
Remarks:	

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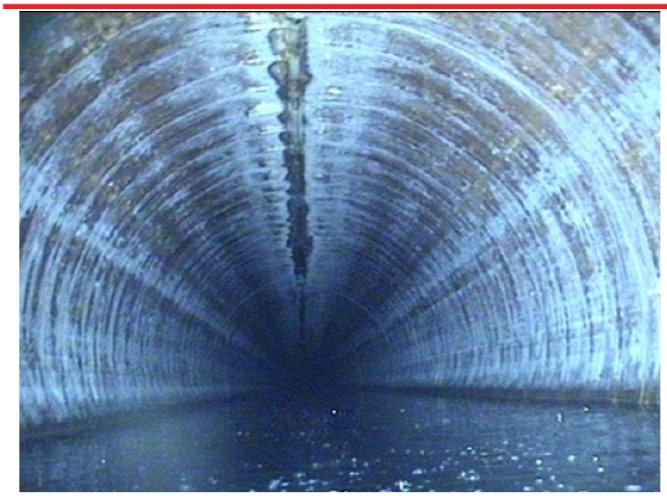
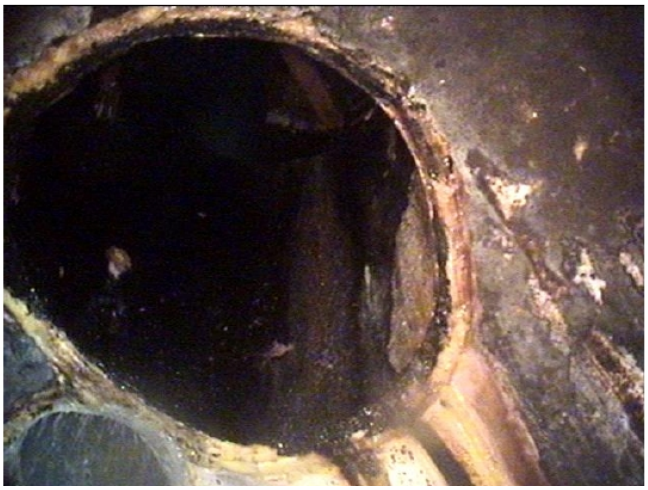


PACP Code:	**LFD**
Description:	**Lining Failure Detached**
Distance (ft):	**465.3**
Structural Grade:	**3**
O&M Grade:	**0**
Clock Start/From:	**8**
Clock To:	**12**
1st Value:	
2nd Value:	
Continuous Index:	**F01**
Within 8" of Joint?:	**False**
Remarks:	



PACP Code:	**AMH**
Description:	**Manhole**
Distance (ft):	**1245**
Structural Grade:	**0**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	**UBU01007**

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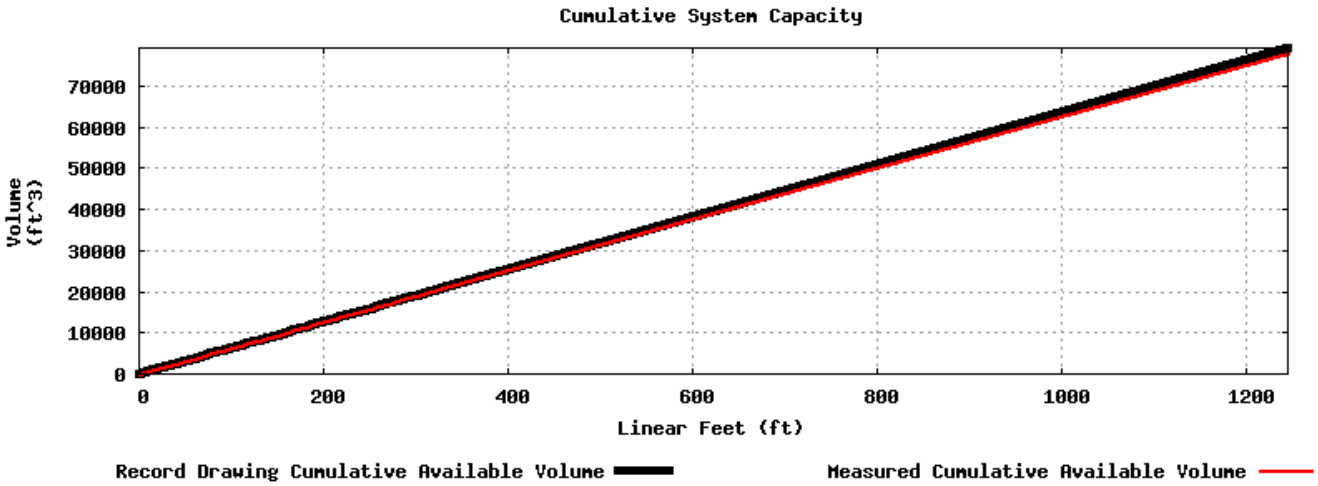
3 Sediment

3.1 Cumulative System Capacity

The inspected distance displayed below is the distance downstream from the UBU01008 manhole.



Inspection Distance	1245 ft
Record Drawing Available Capacity	79203.5 ft^3
Measured Available Capacity	78178.8 ft^3
% Available Capacity	98.7 %

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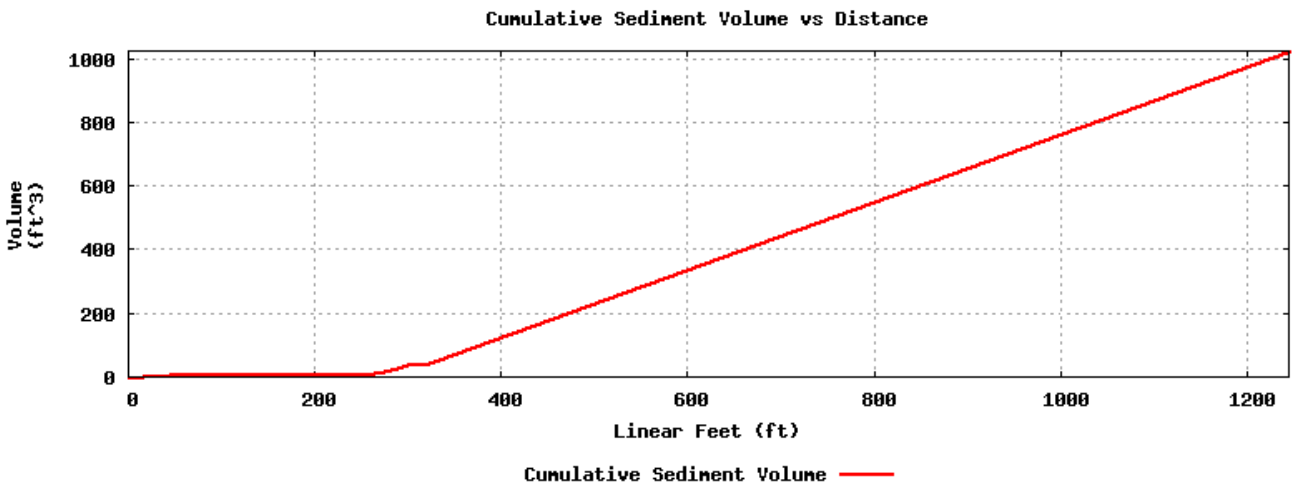
3.2 Cumulative Sediment Volume

The actual free space capacity is derived from the cross sectional sonar scans. In order to determine sediment volume, the actual free space capacity is subtracted from the total as-built capacity.

The inspected distance displayed below is the distance downstream from the UBU01008 manhole.



Inspection Distance	1245 ft
Cumulative Sediment Volume	1024.7 ft^3

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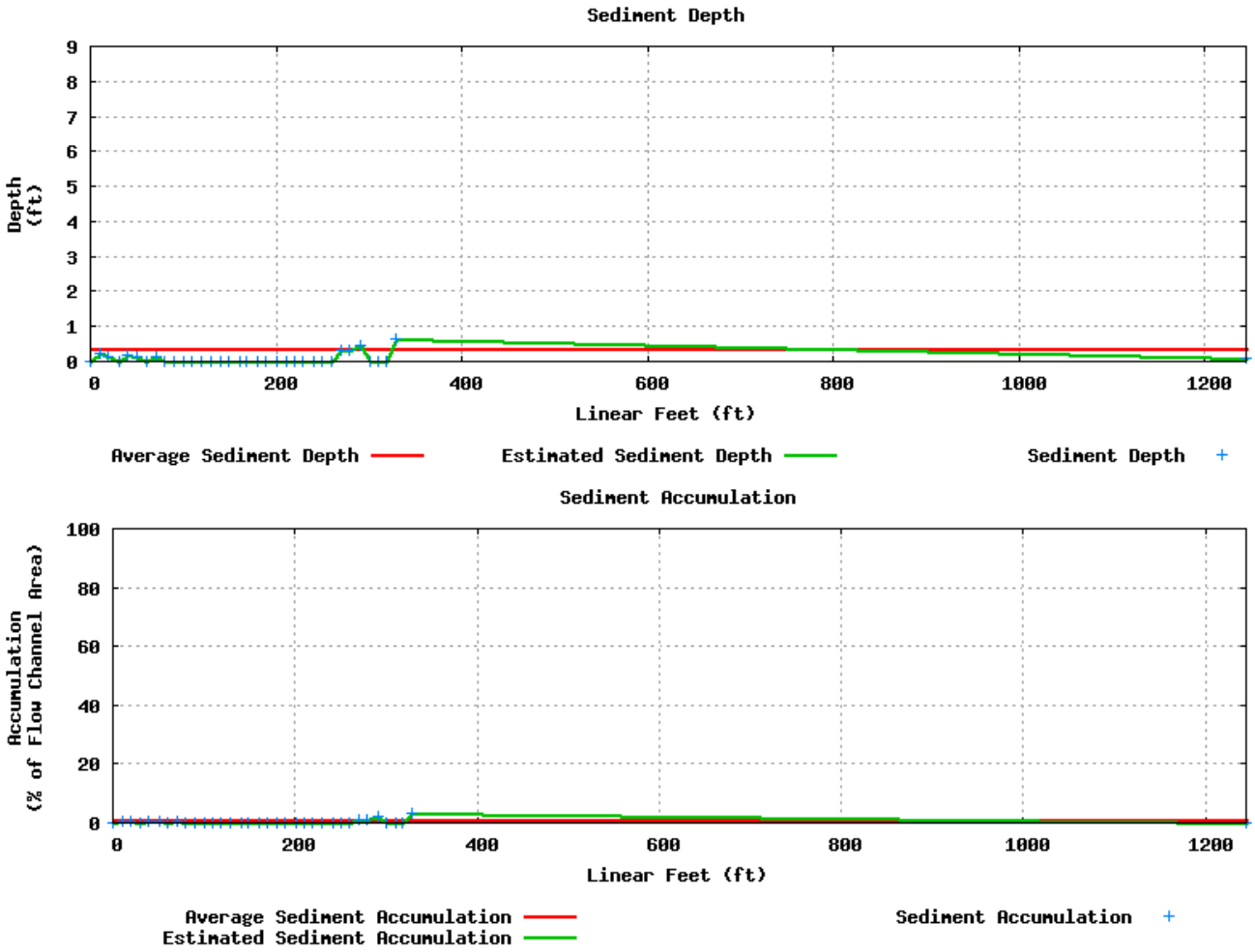
3.3 Average Sediment Depth

The standard sediment depth measurement graph represents a comprehensive summary of pipe sediment depth over distance.

The inspected distance displayed below is the distance downstream from the UBU01008 manhole.



Measure	Location	Depth	Accumulation
Maximum	329.3 ft	7.6 in	3.1 %
Minimum	0.0 ft	0.0 in	0.0 %
Average	N/A	4.2 in	1.3 %

Copyright 2013

3.4 Cleaning Recommendations

The table below depicts the level of cleaning recommended throughout the inspected length. The recommendations are based on sediment volume, not type of material.

Recommendation	% of Capacity Lost	Distance Inspected	% of Total Length
No Cleaning	0% to 5%	1245 ft	100 %
Light Cleaning	6% to 15%	0 ft	0 %
Moderate Cleaning	16% to 30%	0 ft	0 %
Heavy Cleaning	> 30%	0 ft	0 %

3.5 Cleaning Recommendations by Location

Start Location	End Location	Recommendations
0.0 ft	1245.0 ft	No Cleaning

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Responder Multi-Sensor Inspection

Houston Public Works and Engineering
Wastewater Operations

TX Houston Large Diameter Sewer Inspection

UBU01009-UBU01008
U/S MH: UBU01009
D/S MH: UBU01008
RECORD DRAWING DIAMETER (RCD): 108 in
Job: SJ501134
Inspection Date: 8/15/2013
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3.5 Cleaning Recommendations by Location 13

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1 Summary

1.1 Job

Prepared For	City of Houston
Street Location	Westheimer Road
Deployment Location / Manhole	UBU01009
Operator	J. Williamson
Deployment Weather	Sunny (Wet)
Planned Inspection Distance	1685 ft
Actual Inspection Distance	1760 ft
Inspection Direction	Downstream
Upstream Location / Manhole	UBU01009
Downstream Location / Manhole	UBU01008
Record Drawing Diameter	108 in
Record Drawing Pipe Shape	Circular
Pipe Material	Reinforced Concrete pipe

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1.2 Results

Observations	
Number of Observations	9
Number of Grade 4 & 5 Observations	1
Number of Continuous Observations	1
Flow Height	30 %
Sediment	
Average Sediment Depth	1.3 in
Total Sediment Volume	251.7 ft^3
% of Pipe Flow Restriction Due to Sediment	0.2 %

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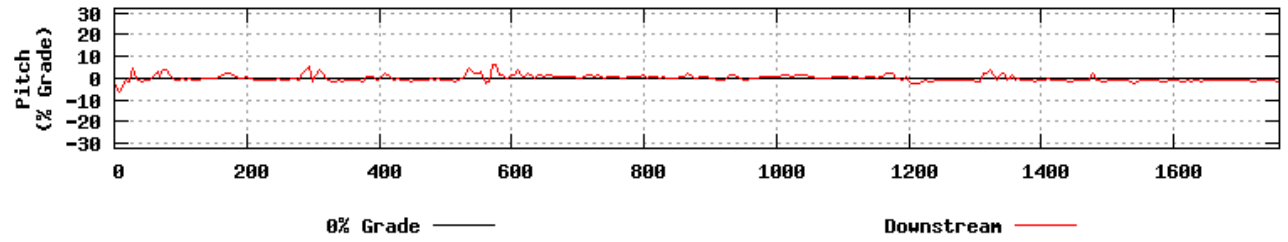
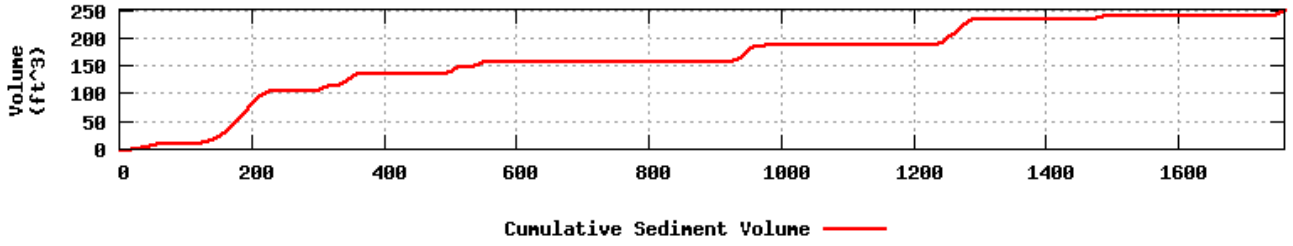
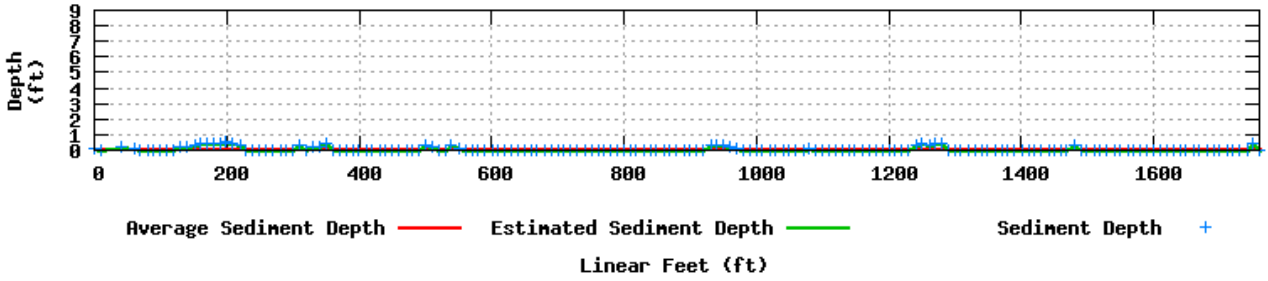
1.3 Segment Summary View

The inspected distance displayed below is the distance downstream from the UBU01009 manhole.







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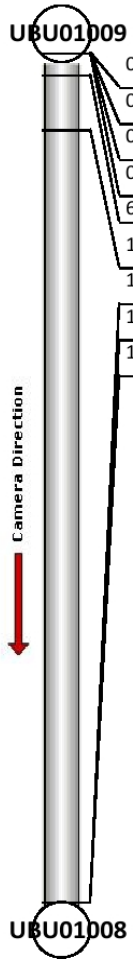
2 Observations

Profile/Photo Observation Report

Date:	**08/15/2013**	Weather:	**Dry**	Sheet #:	**0**
Pipe Length:		Owner:	**Houston, TX**	Pre Clean:	
P.O.#:		Surveyor:	**J. Williamson**	PSR:	**11998430**
Customer:	**Clean Serve**	Clean Date:		Shape:	**Circular**

Street:	**Westheimer Road**	Flow Control:	**Not Controlled**
City:	**Houston, TX**	Year Renewed:	
Location:	**Parking Lot**	Tape/Media #:	**SD018**
Purpose:	**Pre-Rehabilitation Survey**	Dia/Height:	**108**
Use:	**Sanitary**	Material:	**Reinforced Concrete Pipe**
Drain Area:		Lining:	**Cured in Place**
Category		Pipe Joint Length:	
Comment:			
Location Details:	**@ Hayes Rd. Intersection**	Direction of Survey:	**Downstream**

US MH: **UBU01009** DS MH: **UBU01008** Total Length Surveyed: **1759.6**



Position	Code	Observation	Counter	Photo	Grade
0	AMH	Manhole	0	0-AMH.jpg	-
0	MWL	Water Level	96	0-MWL.jpg	-
0	LFD	Lining Failure Detached	122	0-LFD.jpg	S3
0	TBA	Tap Break-in Active	156	0-TBA.jpg	-
64.9	D	Deformed	1001	64.9-D.jpg	S4
157.7	LR	Alignment Right	1314	157.7-LR.jpg	M2
1759.6	LFD	Lining Failure Detached	5996	1759.6-LFD.jpg	S3
1759.6	TBA	Tap Break-in Active	6004	1759.6-TBA.jpg	-
1759.6	AMH	Manhole	6036	1759.6-AMH.jpg	-

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PACP Code:	**AMH**
Description:	**Manhole**
Distance (ft):	**0**
Structural Grade:	**0**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	**UBU01009**

PACP Code:	**MWL**
Description:	**Water Level**
Distance (ft):	**0**
Structural Grade:	**0**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	

PACP Code:	**LFD**
Description:	**Lining Failure Detached**
Distance (ft):	**0**
Structural Grade:	**3**
O&M Grade:	**0**
Clock Start/From:	**8**
Clock To:	**4**
1st Value:	
2nd Value:	
Continuous Index:	**S01**
Within 8" of Joint?:	**False**
Remarks:	

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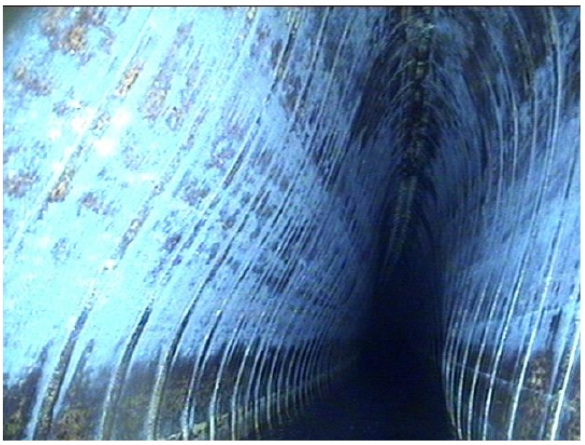
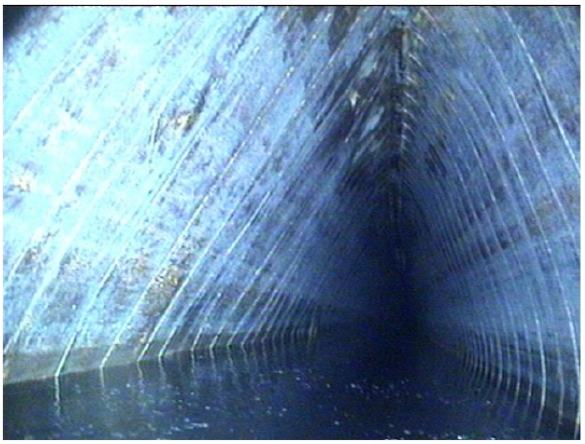
PACP Code:	**TBA**
Description:	**Tap Break-in Active**
Distance (ft):	**0**
Structural Grade:	**0**
O&M Grade:	**0**
Clock Start/From:	**12**
Clock To:	
1st Value:	**18**
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	



PACP Code:	**D**
Description:	**Deformed**
Distance (ft):	**64.9**
Structural Grade:	**4**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	



PACP Code:	**LR**
Description:	**Alignment Right**
Distance (ft):	**157.7**
Structural Grade:	**0**
O&M Grade:	**2**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	

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PACP Code:	**LFD**
Description:	**Lining Failure Detached**
Distance (ft):	**1759.6**
Structural Grade:	**3**
O&M Grade:	**0**
Clock Start/From:	**8**
Clock To:	**4**
1st Value:	
2nd Value:	
Continuous Index:	**F01**
Within 8" of Joint?:	**False**
Remarks:	

PACP Code:	**TBA**
Description:	**Tap Break-in Active**
Distance (ft):	**1759.6**
Structural Grade:	**0**
O&M Grade:	**0**
Clock Start/From:	**12**
Clock To:	
1st Value:	**18**
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	

PACP Code:	**AMH**
Description:	**Manhole**
Distance (ft):	**1759.6**
Structural Grade:	**0**
O&M Grade:	**0**
Clock Start/From:	
Clock To:	
1st Value:	
2nd Value:	
Continuous Index:	
Within 8" of Joint?:	**False**
Remarks:	**UBU01008**

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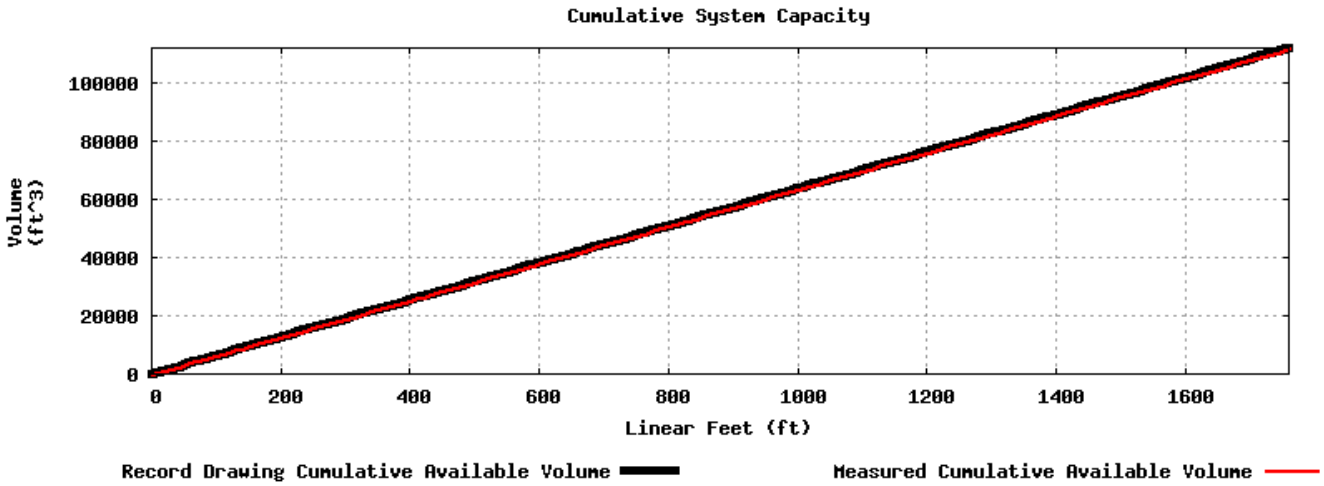
3 Sediment

3.1 Cumulative System Capacity

The inspected distance displayed below is the distance downstream from the UBU01009 manhole.



Inspection Distance	1760 ft
Record Drawing Available Capacity	111966.4 ft^3
Measured Available Capacity	111714.7 ft^3
% Available Capacity	99.8 %

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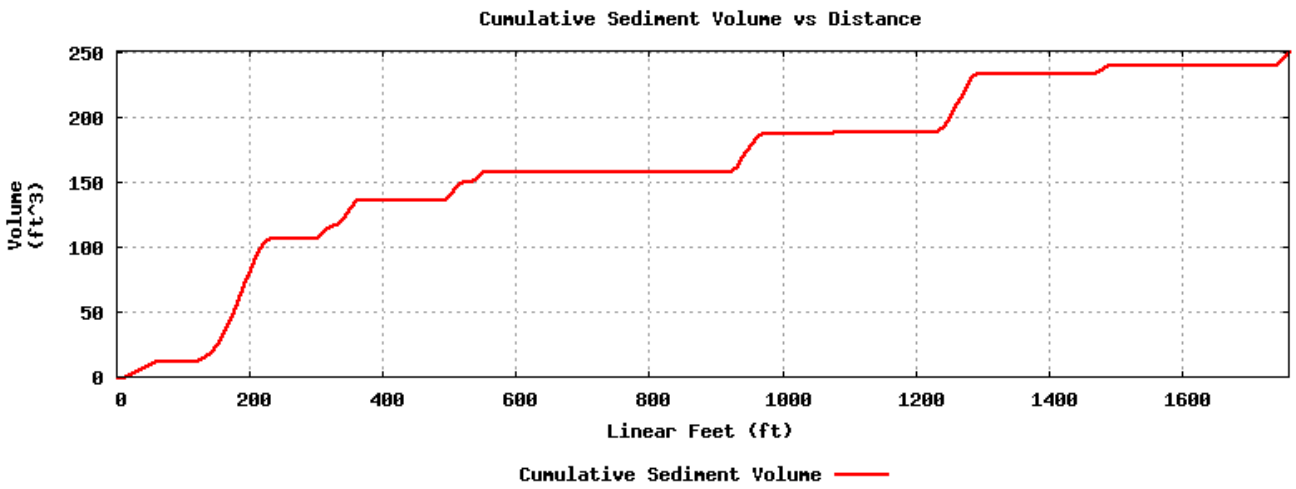
3.2 Cumulative Sediment Volume

The actual free space capacity is derived from the cross sectional sonar scans. In order to determine sediment volume, the actual free space capacity is subtracted from the total as-built capacity.

The inspected distance displayed below is the distance downstream from the UBU01009 manhole.



Inspection Distance	1760 ft
Cumulative Sediment Volume	251.7 ft^3

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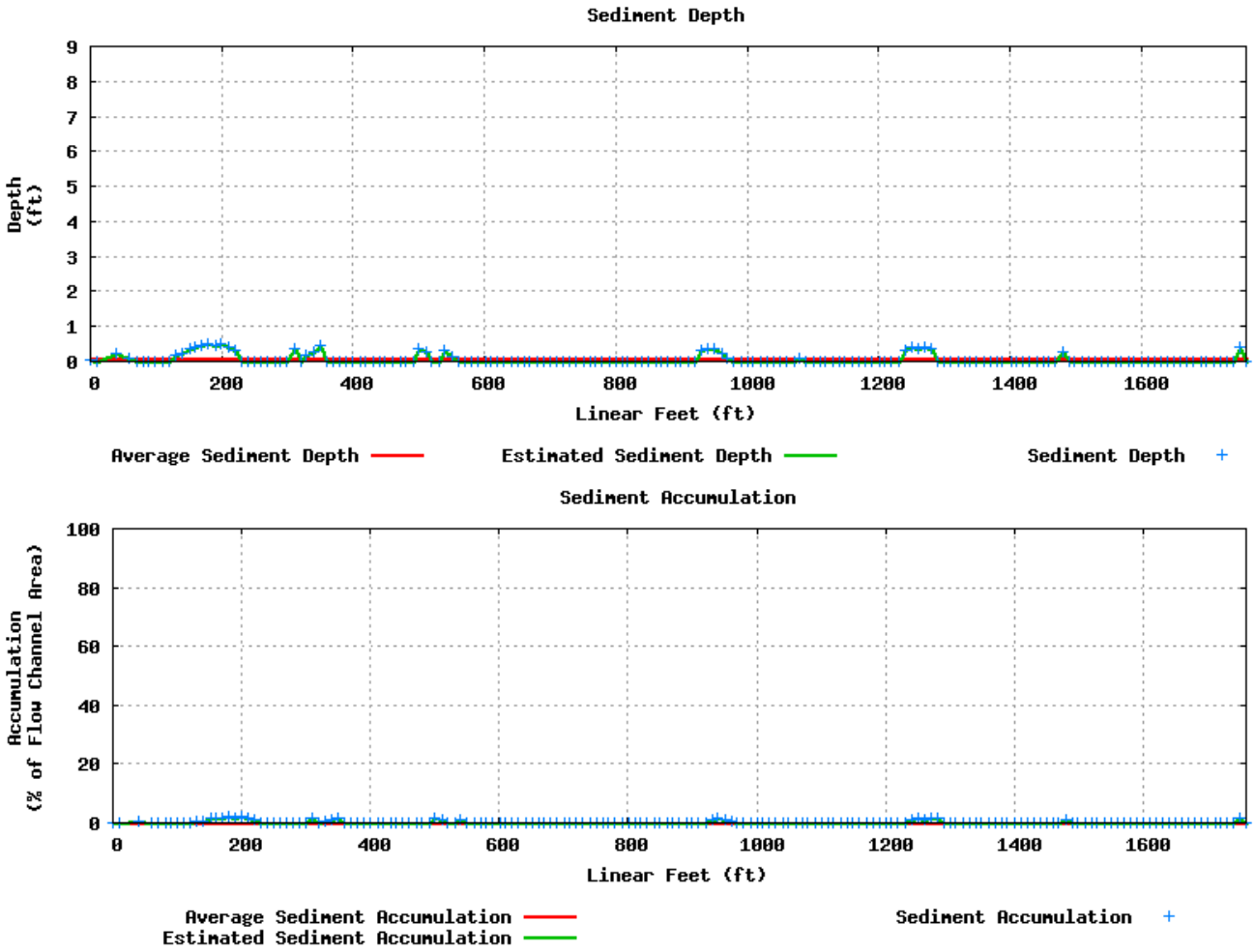
3.3 Average Sediment Depth

The standard sediment depth measurement graph represents a comprehensive summary of pipe sediment depth over distance.

The inspected distance displayed below is the distance downstream from the UBU01009 manhole.



Measure	Location	Depth	Accumulation
Maximum	198.9 ft	6.2 in	2.3 %
Minimum	10.2 ft	0.0 in	0.0 %
Average	N/A	1.3 in	0.2 %

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3.4 Cleaning Recommendations

The table below depicts the level of cleaning recommended throughout the inspected length. The recommendations are based on sediment volume, not type of material.

Recommendation	% of Capacity Lost	Distance Inspected	% of Total Length
No Cleaning	0% to 5%	1760 ft	100 %
Light Cleaning	6% to 15%	0 ft	0 %
Moderate Cleaning	16% to 30%	0 ft	0 %
Heavy Cleaning	> 30%	0 ft	0 %

3.5 Cleaning Recommendations by Location

Start Location	End Location	Recommendations
0.0 ft	1760.0 ft	No Cleaning

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