Location M
(Work Zone 9)

Altair Environmental Group
710 South Milwee St.
Longwood, FL 32750
Phone: (407) 339-7134
Fax: (407) 339-6618

Observations by Inspections

SITE DATA

Mainline ID:	City:	Address:
MH-139 TO OUTFALL	CASSELBERRY	139 CARRIAGE HILL DR.

Upstream node:	Depth:	Downstream nod	Depth:	Pipe type:	Pipe shape:	Pipe height:	Pipe width:
MH-139	8.1	OUTFALL		Concrete Reinl	Circular	30	30

INSPECTION DATA

Map No:	Scheduled Date:	Start date/time:	End date/time:
	10/1/2015 3:41:32 PM	10/1/2015 3:42:23 PM	10/1/2015 4:00:01 PM

Surveyed footage:	Status:	Operator:	Work order No.:
155.0	Stopped	M. POMALES	15040

Reason:	Weather:	Condition:	Direction of Inspection
Regular	Dry	Satisfactory	Downstream

Comments

OBSERVATIONS

Footage	Length	From	To	Code	Modifiers	Comments:
0.0				START WITH FLOW		
0.0				Manhole		MH-139
0.0				Water Level		10%
49.4		7	10	Mineral Stain		AT JOINT
121.9		10	2	Root		AT JOINT
130.0				Pipe Type		PIPE CHANGE FROM RCP TO ADS
155.0				Outfall		
155.0				STOP		

Rehabilitation Table

Singhoffen & Associates, Inc.

Orlando, Florida

Job No. 15130

Line Segment Information			Distance	Observations	Clock Position	Rehabilitation Technique	Cost
From MH-139	PIPE TYPE	RCP	0'	**Manhole - #139**			
	PIPE SIZE	30"					
	PIPE LENGTH	155.0'	49.4'	Mineral Stains at Joint	7 - 10	**Chemical Grout**	
To Outfall			121.9'	Root Infiltration at Joint	10 - 2	**Remove / Chemical Grout**	
	Location M						
			155.0'	**Outfall**		Total	$2,495.00
						Grand Total	$2,495.00

Singhoffen & Associates, Inc.

Orlando, Florida

Storm Drain Rehabilitation Project
Casselberry, Florida

Plugging, Dewatering, Cleaning and Television
Inspection of Storm Water Pipelines

DVD #6 – Work Zone #2

Altair
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October 2015

Job No. 15130

Singhoffen & Associates, Inc
Orlando, Florida

Storm Drain Rehabilitation Project
Casselberry, Florida

Plugging, Dewatering, Cleaning and Television Inspection of Storm Water Pipelines

DVD # 6 - Work Zone #2

Prepared for Singhoffen & Associates, Inc.
by:

Altair Environmental Group, LLC
710 South Milwee Street
Longwood, Florida 32750
Office (407) 339 – 7134
Fax (407) 339 – 6618

E-Mail: admin@altairenvironmental.com
Website: www.altairenvironmental.com

October, 2015

Work Zone #2
(Location A)

Altair Environmental Group

Client Singhoffen & Associates, Inc.

Job No. 15130

Project Name Internal Television Inspection and Report of Findings

Drawings not to scale

Indicates Inspected Pipeline

N

Altair Environmental Group
710 South Milwee St.
Longwood, FL 32750
Phone: (407) 339-7134
Fax: (407) 339-6618

Observations by Inspections

SITE DATA

Mainline ID:	City:	Address:
329 TO 317	CASSELBERRY	KANTOR BLVD.

Upstream node:	Depth:	Downstream nod	Depth:	Pipe type:	Pipe shape:	Pipe height:	Pipe width:
329	3	317	9	Corrugated	Circular	15	15

INSPECTION DATA

Map No:	Scheduled Date:	Start date/time:	End date/time:
	5/22/2015 8:53:18 AM	5/22/2015 8:55:32 AM	8/25/2015 8:43:07 AM

Surveyed footage:	Status:	Operator:	Work order No.:
113.1	Stopped	M. POMALES	15040

Reason:	Weather:	Condition:	Direction of Inspection
Regular	Dry	Satisfactory	Downstream

Comments

OBSERVATIONS

Footage	Length	From	To	Code	Modifiers	Comments:
0.0				START WITH FLOW		
0.0				Catch Basin		317
0.1				Water Level		0%
47.3		3	8	Root		LIGHT
51.9		9	3	Root	Light	
58.5		5		Root	Medium	
112.0		1	6	General Observation		ROD INTRUDING
113.1				General Observation		TRANSPORTER CAN NOT PASS THE INTRUDING ROD. REVERSE TO FOLLOW
113.1				STOP		

OBSERVATIONS

Footage	Length	From	To	Code	Modifiers	Comments

710 S Milwee St.
Longwood, FL 32750
Phone: (407) 339-7134
Fax: (407) 339-6618
admin@altairenvironmental.com

Owner	Customer	Project	Upstream MH	Downstream MH	Date
CITY OF CASSELBERRY	CITY OF CASSELBERRY	CITY OF CASSELBERRY	S-329	S-317	11-Aug-2015

Surveyor	Street	City	Time
T. GARVEY	KANTOR BLVD	CASSELBERRY	11:32 AM

Size	Material	Sewer Use	Purpose	Length	(TV'd)	Pre-Clean	Weather
15	Corrugated Metal Pipe	Stormwater	Routine Assessment		269.4	Jetting	Dry

Comments	Direction
REVERSE SET UP	Downstream

Ftg.	Code	Description	Position	Severity	Comment
0.0	CB	Catch Basin		0	S-329
0.0	WL	Water Level		0	
8.0	R	Roots	3 to 8	3	
10.1	R	Roots	4	3	
12.0	R	Roots	12	3	
16.4	R	Roots	3	3	
21.9	R	Roots	9	3	
50.3	R	Roots	1	3	
188.2	R	Roots	1 to 6	3	
216.3	R	Roots	11	3	
231.5	GO	General Observation			PAUSE TO CHANGE CAMERAS
269.4	GO	General Observation	12		ROD PROTRUDING THROUGH PIPE
269.4	GO	General Observation			CAMERA WILL NOT PASS, END INSPECTION.

Altair Environmental Group
710 South Milwee St.
Longwood, FL 32750
Phone: (407) 339-7134
Fax: (407) 339-6618

Observations by Inspections

SITE DATA

Mainline ID:	City:	Address:
315 TO 115	CASSELBERRY	ESMT/NORTH OF STANHOPE DRIVE HOUSE # 115

Upstream node:	Depth:	Downstream nod	Depth:	Pipe type:	Pipe shape:	Pipe height:	Pipe width:
315	8.6	115	9.2	Corrugated	Circular	48	48

INSPECTION DATA

Map No:	Scheduled Date:	Start date/time:	End date/time:
	10/6/2015 9:19:03 AM	10/6/2015 9:19:29 AM	10/6/2015 9:47:56 AM

Surveyed footage:	Status:	Operator:	Work order No.:
416.6	Stopped	R Miller	15140

Reason:	Weather:	Condition:	Direction of Inspection
Regular	Dry	Satisfactory	Upstream

Comments

HEAVY CONCRETE/CEMENT THROUGHOUT PIPELINE

OBSERVATIONS

Footage	Length	From	To	Code	Modifiers	Comments:
0.0				START AGAINST FLOW		
0.0				Catch Basin		#115
0.0				Water Level		10%
5.0		5		Infiltration		LEAK WITH SAND. 5 GPM
22.3		6		Infiltration		LEAK W/ SAND 3 GPM
74.5				General Observation		HEAVY CEMENT IN PIPE
75.1				General Observation		CEMENT IN PIPE
94.4		5		General Observation		CEMENT IN PIPE
103.5		5		Infiltration		LEAK W/SAND 3 GPM

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Longwood, FL 32750
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OBSERVATIONS

Footage	Length	From	To	Code	Modifiers	Comments
162.3		7		Infiltration		LEAK W/ SAND 3 GPM
207.8		12		General Observation		NEW MANHOLE BURIED
235.8		3		Infiltration		LEAK 1 GPM
292.6		6		Infiltration		LEAK W/SAND 2 GPM
395.7		6		Infiltration		LEAK W/ SAND 2 GPM
416.6				Catch Basin		315
416.6				STOP		

Singhoffen & Associates, Inc.

Orlando, Florida

Storm Drain Rehabilitation Project
Casselberry, Florida

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DVD #7 – Work Zone #11 – Location S

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May 2016

Job No. 15130

Singhoffen & Associates, Inc
Orlando, Florida

Storm Drain Rehabilitation Project
Casselberry, Florida

Plugging, Dewatering, Cleaning and Television Inspection of Storm Water Pipelines

DVD # 7 - Work Zone #11 – Location S

Prepared for Singhoffen & Associates, Inc.
by:

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Office (407) 339 – 7134
Fax (407) 339 – 6618

E-Mail: admin@altairenvironmental.com
Website: www.altairenvironmental.com

May, 2016

Work Zone #11
(Location S)

Altair Environmental Group, LLC
710 South Milwee Street
Longwood, Florida, 32750
Phone: 407-339-7134
Fax: 407-339-6618

Observations by Inspections

SITE DATA

Mainline ID:	City:	Address:
328-295	CASSELBERRY	328 IVEY RD

Upstream node:	Depth:	Downstream nod	Depth:	Pipe type:	Pipe shape:	Pipe height:	Pipe width:
328	4	295	5	Concrete Reinl	Oval	38	60

INSPECTION DATA

Map No:	Scheduled date:	Start date/time:	End date/time:
	5/17/2016 12:09:56 PM	5/17/2016 12:10:54 PM	5/17/2016 12:31:50 PM

Surveyed footage:	Status:	Operator:	Work order no.:
170.2	Stopped	M Pomales	15040

Reason:	Weather:	Condition:	Direction of Inspection
Assessment	Dry	Satisfactory	Downstream

Comments

OBSERVATIONS

Footage	Length	From	To	Code	Modifiers	Comments:
0.0				START WITH FLOW		
0.0				Inlet		328
12.9		7		Infiltration	at Joint	
48.5		7		Infiltration	at Joint	
48.5				Access Point		BURIED MANHOLE COVER
61.9		7		Infiltration	at Joint	
85.1		7		Infiltration	at Joint	
146.2		6		Infiltration	at Joint	WATER AND SAND LEAKING
158.5		5		Infiltration	at Joint	LEAKING SAND AND WATER
170.2				Outfall		295

Altair Environmental Group, LLC
710 South Milwee Street
Longwood, Florida, 32750
Phone: 407-339-7134
Fax: 407-339-6618

OBSERVATIONS

Footage	Length	From	To	Code	Modifiers	Comments
170.2				STOP		

Appendix C

Geotechnical Investigations: Geotechnical and Environmental Consultants, Inc.

Report of Geotechnical Engineering Investigation

LOWNDES SQUARE AND APPLE HILL HOLLOW

UNDERDRAIN REPLACEMENT

Casselberry, Florida

GEC Project No. 3650G

Geotechnical and Environmental Consultants, Inc.
At the very foundation of our community

September 11, 2014

Singhofen & Associates, Inc.
11723 Orpington Street, Suite 100
Orlando, Florida 32817

Attention: Mr. Brett R. Witte, P.E.

Subject: Report of Geotechnical Engineering Investigation
LOWNDES SQUARE AND APPLE HILL HOLLOW UNDERDRAIN REPLACEMENT
Casselberry, Florida
GEC Project No. 3650G

Dear Mr. Witte:

Geotechnical and Environmental Consultants, Inc. (GEC) is pleased to present this Report of Geotechnical Engineering Investigation for the above-referenced project. This study was performed in general accordance with our Proposal No. 8002G revised on July 8, 2014. The purpose of this study was to explore soil and groundwater conditions at the subject site and to use the information obtained to develop geotechnical engineering recommendations regarding underdrain design. This report describes our exploration procedures, exhibits the data obtained and presents our conclusions and recommendations regarding the geotechnical engineering aspects of the project.

GEC appreciates the opportunity to be of service to you on this project and trusts that the information contained herein is sufficient for your current needs. Should you have any questions concerning the contents of this report, or if we may be of further assistance, please contact us.

Very truly yours,

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS, INC.
Certificate of Authorization No. 5882

9/11/14
Kevin Baboolall, E.I.
Geotechnical Engineer

9/11/14
Craig G. Ballock P.E.
Senior Geotechnical Engineer
Florida License No. 71571

GPB/CGB/cew

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OFFICES IN ORLANDO AND KISSIMMEE

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APPENDIX

Figure 1: USGS Quadrangle and NRCS Soil Survey Maps
Figure 2: Boring Location Plan
Figure 3: Boring Results
Underdrain Analysis

1.0 SITE AND PROJECT DESCRIPTION

> The project sites…include an approximately 700-foot long portion of Lowndes Square… and…an approximately 500-foot long portion of Apple Hill Hollow…

The project sites are located along Lowndes Square and Apple Hill Hollow in Casselberry, Florida. More specifically, the Lowndes Square project alignment includes an approximately 700-foot long portion of Lowndes Square starting approximately 170 feet north of the Lowndes Square and Marigold Road intersection and the Apple Hill Hollow project alignment includes an approximately 500-foot long portion of Apple Hill Hollow starting approximately 230 feet east of the Surrey Knolls intersection and proceeding north towards Carriage Hills Drive. The existing roadways are 2-lane, residential streets with miami curb and gutter and concrete sidewalks on either side of the roadway. In general, the existing pavement is in poor condition with significant surficial cracking. Land use in the project vicinity predominantly consists of residential development.

The approximate site vicinity is shown on an excerpt of the United States Geological Survey (USGS) Casselberry, Florida Quadrangle map on **Figure 1** in the **Appendix**. Based on a review of the USGS Quadrangle, the ground surface elevations along the project alignments range from approximately +58 to + 68 feet NGVD along Lowndes Square and +59 to +72 feet NGVD along Apple Hill Hollow.

> Proposed project improvements include the construction of a new underdrain system along the two project alignments…

We understand the existing underdrains installed along these two residential streets may be failing based on observed pavement conditions and information provided by the City of Casselberry. Proposed project improvements include the construction of a new underdrain system along the two project alignments to replace the existing systems.

2.0 NRCS SOIL SURVEY

The Natural Resources Conservation Service (NRCS) (formerly SCS) Soil Survey of Seminole County, Florida was reviewed for near-surface soil and groundwater information within the vicinity of the subject sites. The NRCS Soil Survey map of the site vicinity is shown on **Figure 1** in the **Appendix**. The NRCS soil near the project site is classified as Urban Land (Soil Unit No. 34). Urban Land refers to areas where most of the ground surface is covered by asphalt, concrete, buildings and other impervious surfaces that modify surface/subsurface drainage and obscure or alter the soils so that their identification is not possible.

The information obtained from the soil borings presented in this report should be considered a more current and accurate characterization of actual site soil and groundwater conditions.

3.0 SUBSURFACE EXPLORATION

In addition to consulting the sources of information previously discussed for regional and site-specific soils data, GEC conducted a subsurface exploration to evaluate soil and groundwater conditions along the project alignments. GEC explored subsurface conditions along the project alignments by performing 4 hand auger borings (AB-1 to AB-4) to a depth of 5 to 6 feet along the Apple Hill Hollow project alignment and 5 hand auger boring (AB-5 to AB-9) to a depth of 4 to 10 feet along the Lowndes Square project alignment on approximate 150 foot intervals.

The approximate locations of the borings performed for this study are shown on **Figure 2** in the **Appendix**. The boring locations were not surveyed, but established by taping distances from existing site features, therefore, they should be considered approximate. Although the boring locations are given only approximately, the methods used to locate them are, in GEC's opinion, sufficient to meet the intent of our study. If greater accuracy is desired, a registered Professional Land Surveyor should be retained to survey the boring locations.

3.1 Hand Auger Borings

Our engineering technician performed standard barrel hand auger borings in general accordance with ASTM D-4700, by manually turning a 3-inch diameter, 6-inch long sampler into the soil until it was full. He then retrieved the sampler and visually examined and classified the soil. This procedure was repeated until the desired termination depth was achieved. Our technician collected representative samples for further visual examination and classification in our laboratory.

3.2 Groundwater Measurement

A GEC engineering technician measured the depth to groundwater in the boreholes at the time of drilling and again after approximately 24 hours. Once the 24-hour groundwater measurement was recorded, the boreholes were then backfilled with soil cuttings to prevailing ground surface.

4.0 LABORATORY TESTING

Selected soil samples retrieved from the borings were tested in accordance with Florida Standard Testing Methods (FM). Florida Standard Testing Methods are adaptations of recognized standard methods, e.g., ASTM and AASHTO, which have been modified to accommodate Florida's geological

conditions. The GEC laboratory is reviewed annually by the Construction Materials Engineering Council, Inc. (CMEC) to verify compliance with FM. Our laboratory testing program is summarized on the following table:

Table 1
Summary of Laboratory Testing Program

Type of Test	Number of Tests
Percent Fines (FM 1 - T88)	5
Atterberg Limits (FM 1 - T89/90)	1
Natural Moisture Content (FM 1 - T265)	1
Constant Head Permeability (FM 1 - T215)	4

The individual results of our laboratory tests are shown adjacent to the soil profiles at the approximate depths from which the tested samples were obtained on the Boring Results sheet **Figure 3** in the **Appendix**.

4.1 Constant Head Laboratory Permeability Test Results

Tabulated below are the laboratory permeability test results from soil samples obtained at boring locations AB-1, AB-3, AB-6 and AB-8.

Table 2
Summary of Laboratory Permeability Test Results

Alignment	Boring No.	Test Depth (feet)	Run 1 – Uncompacted Sample			Run 2 – Compacted Sample			*Geometric Mean of Horizontal Permeability Rates (ft/day)
			Moisture Content (%)	Wet Density (pcf)	Horizontal Permeability Rate (ft/day)	Moisture Content (%)	Wet Density (pcf)	Horizontal Permeability Rate (ft/day)	
Apple Hill Hollow	AB-1	4 - 6	25	100.9	0.1	21	112.7	0.07	0.1
	AB-3	0 - 5	27	102.1	26.8	19	114.9	3.2	9
Lowndes Square	AB-6	0 - 4	28	102.0	12.2	21	115.6	0.4	2
	AB-8	3.5 - 6	25	91.6	7.9	22	116.0	0.2	1

*Geometric Mean = $\sqrt{Run\ 1 * Run\ 2}$

The results of our laboratory permeability tests are shown adjacent to the soil profiles at the approximate depths from which the tested samples were obtained on the Boring Results sheet **Figure 3** in the **Appendix**.

5.0 DESCRIPTION OF SUBSURFACE CONDITIONS

Detailed records of subsurface conditions encountered in our borings are shown on the Boring Results sheet in the **Appendix**. The boring logs describe the soil layers using the American Association of State Highway and Transportation Officials (AASHTO) Soil Classification System (A-3, A-2-4, etc.) and ASTM soil descriptions (e.g. sand with silt). We based our soil classifications and descriptions on visual examination and the laboratory test results shown adjacent to the boring profiles.

The boring logs and related information included in this report are indicators of subsurface conditions only at the specific boring location at the time of our field exploration.

Subsurface conditions, including groundwater levels, at other locations of the subject site may differ from conditions we encountered at the boring locations. Moreover, conditions at the boring locations can change over time. Groundwater levels fluctuate seasonally, and soil conditions can be altered by earthmoving operations.

The depths and thicknesses of the subsurface strata indicated on the boring logs were interpolated between samples obtained at different depths in the borings. The actual transition between soil layers may be different than indicated. *These stratification lines were used for our analytical purposes. Earthwork quantity estimates based on the boring results will differ from the actual quantities measured in the field during construction.*

5.1 Boring Results

…borings (AB-1 to AB-4) performed along Apple Hill Hollow typically encountered fine sand to fine sand with silt (A-3)…

In general, the auger borings (AB-1 to AB-4) performed along Apple Hill Hollow typically encountered fine sand to fine sand with silt (A-3) to the boring termination depth of 5 feet. However, at boring location AB-1 a layer of silty fine sand (A-2-4) was encountered from 4 to 6 feet.

Borings (AB-5 to AB-9) performed along Lowndes Square typically encountered fine sand to fine sand with silt (A-3)…and…a layer of silty fine sand (A-2-4)…

Borings (AB-5 to AB-9) performed along Lowndes Square typically encountered fine sand to fine sand with silt (A-3) to depths ranging from 2 to 5 feet below the ground surface. At boring locations AB-5, AB-6, and AB-8 a layer of silty fine sand (A-2-4) was encountered at depths ranging from 3.5 to 10 feet below the ground surface. In addition, a clayey fine sand layer (A-2-6) was encountered at boring location AB-5 from 3 to 4.5 feet.

Please refer to the Boring Results sheet (**Figure 3**) in the **Appendix** for specific subsurface profiles at the boring locations.

5.2 Groundwater Levels

Groundwater levels were measured at least 24 hours after completion of the borings. Groundwater levels were encountered at depths ranging from 2.1 to 3.1 feet below the existing ground surface. However, at boring location AB-2, performed on the topographically low portion of Apple Hill Hollow, the groundwater table was encountered at a depth of 0.7 feet.

Groundwater levels can vary seasonally and with changes in subsurface conditions between boring locations. Alterations in surface and/or subsurface drainage brought about by site development can also affect groundwater levels. *Therefore, groundwater depths measured at different times or at different locations on the site can be expected to vary from those measured by GEC during this investigation.*

For purposes of this report, estimated seasonal high groundwater levels are defined as groundwater levels that are anticipated at the end of the wet season during a "normal rainfall" year under pre-development site conditions. We define a "normal rainfall" year as a year in which rainfall quantity and distribution were at or near historical averages.

The estimated seasonal high groundwater level typically ranges from 1.5 to 2.5 feet below the ground surface.

GEC estimated seasonal high groundwater levels for each boring location. The estimated seasonal high groundwater level typically ranges from 1.5 to 2.5 feet below the existing surface. However, the seasonal high water table at boring location AB-2 is estimated at the existing ground surface. Encountered and estimated seasonal high groundwater levels at the boring locations are presented on the Boring Results sheet (**Figure 3**) in the **Appendix**.

6.0 ANALYSIS AND DESIGN RECOMMENDATIONS

The analyses and recommendations contained in this report are based in part on the data obtained from a limited number of soil samples and groundwater measurements obtained from widely-spaced borings. The sampling methods used indicate subsurface conditions only at the specific boring locations where samples were obtained, only at the time they were obtained, and only to the depths penetrated. Borings cannot be relied upon to accurately reflect the variations that usually exist between boring locations and these variations may not become evident until construction. If variations from the subsurface conditions described in this report do become evident during construction or if the project characteristics described in this report change, GEC should be retained to reevaluate this report's conclusions and recommendations and modify the recommendations included in this report, if needed, in light of such changes. We also recommend that GEC be allowed to review the construction plans prior to bidding so that we can verify that our recommendations were properly interpreted.

6.1 Roadway Underdrains

...it is recommended that roadway underdrains be installed along both project alignments of Lowndes Square and Apple Hill Hollow.

Roadway underdrains are typically recommended along roadway alignments where the estimated seasonal high groundwater levels are within one foot of the bottom of the base elevation. Based on our review of project topographic survey data and our boring results, there generally appears to be 1-foot or less of vertical separation between the estimated seasonal high groundwater levels at our boring locations and the existing pavement base. Therefore, it is recommended that roadway underdrains be installed along both project alignments of Lowndes Square and Apple Hill Hollow.

GEC recommends a FDOT Type 1, 6-inch underdrain be installed on both sides of the roadway… placed at least 24 inches below the bottom of the base at the edge of the existing pavement.

Roadway underdrains should be installed to protect the pavement section from groundwater inundation. GEC used the Ellipse Equation to calculate the groundwater drawdown level below the existing base. Based on the results of our calculations, GEC recommends a FDOT Type 1, 6-inch underdrain be installed on both sides of the roadway along the two project alignments. Roadway underdrains should be placed at least 24 inches below the bottom of the base at the edge of the existing pavement. This design will allow the separation between the bottom of the base and the wet season water table to be at least 1-foot for the entire width of the pavement. The underdrain should be installed in accordance with FDOT Standard Indices 286 and 500.

7.0 USE OF THIS REPORT

GEC has prepared this report for the exclusive use of our client, Singhofen & Associates, Inc., and the City of Casselberry, and for specific application to our client's project. GEC will not be held responsible for any third party's interpretation or use of this reports subsurface data or engineering analysis without our written authorization.

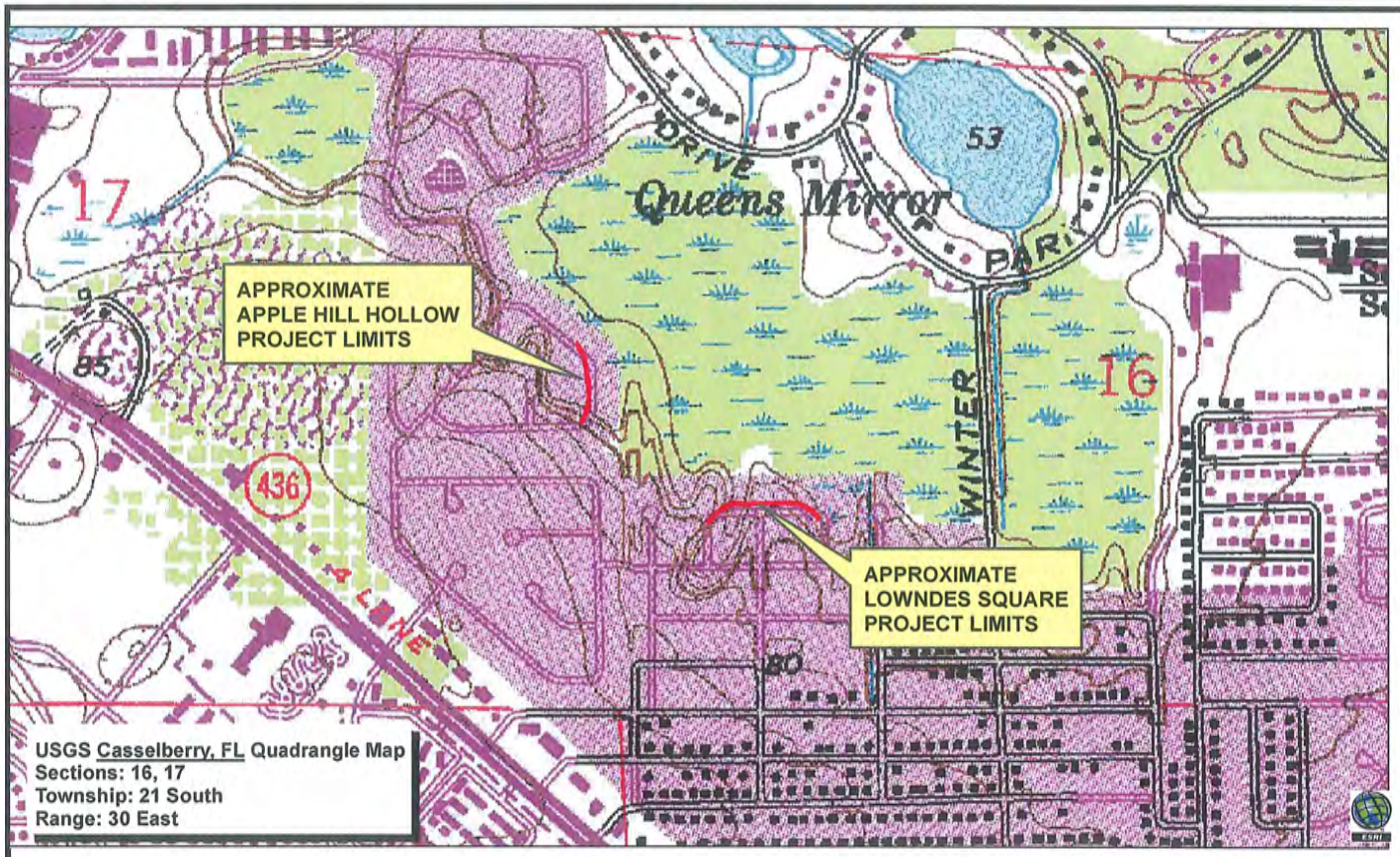
The sole purpose of the borings performed by GEC at this site was to obtain indications of subsurface conditions as part of a geotechnical exploration program. GEC has not evaluated the site for the potential presence of contaminated soil or groundwater, nor have we subjected any soil samples to analysis for contaminants.

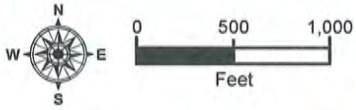
GEC has strived to provide the services described in this report in a manner consistent with that level of care and skill ordinarily exercised by members of our profession currently practicing in Central Florida. No other representation is made or implied in this document.

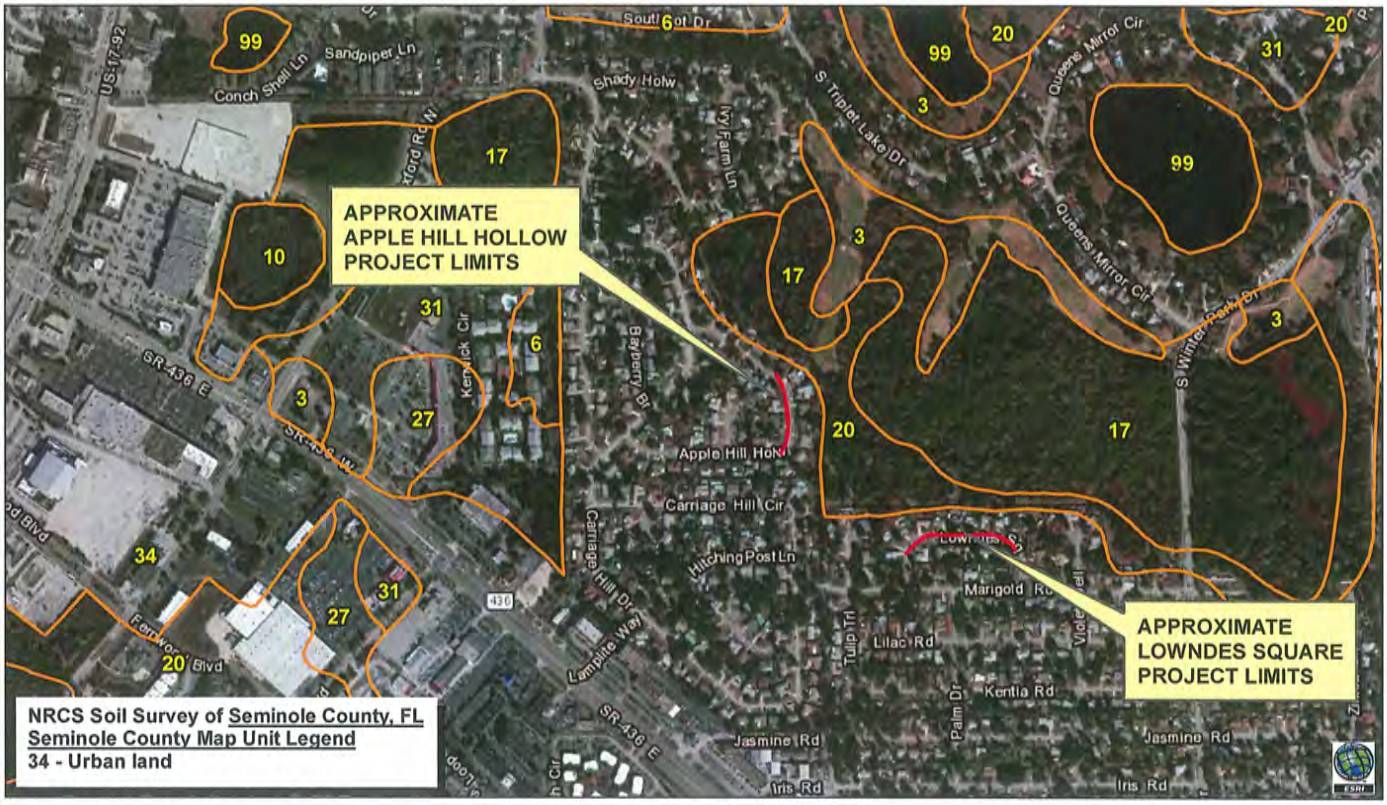
The conclusions or recommendations of this report should be disregarded if the nature, design, or location of the facilities is changed. If such changes are contemplated, GEC should be retained to review the new plans to assess the applicability of this report in light of proposed changes.

APPENDIX

USGS QUADRANGLE AND NRCS SOIL SURVEY MAPS



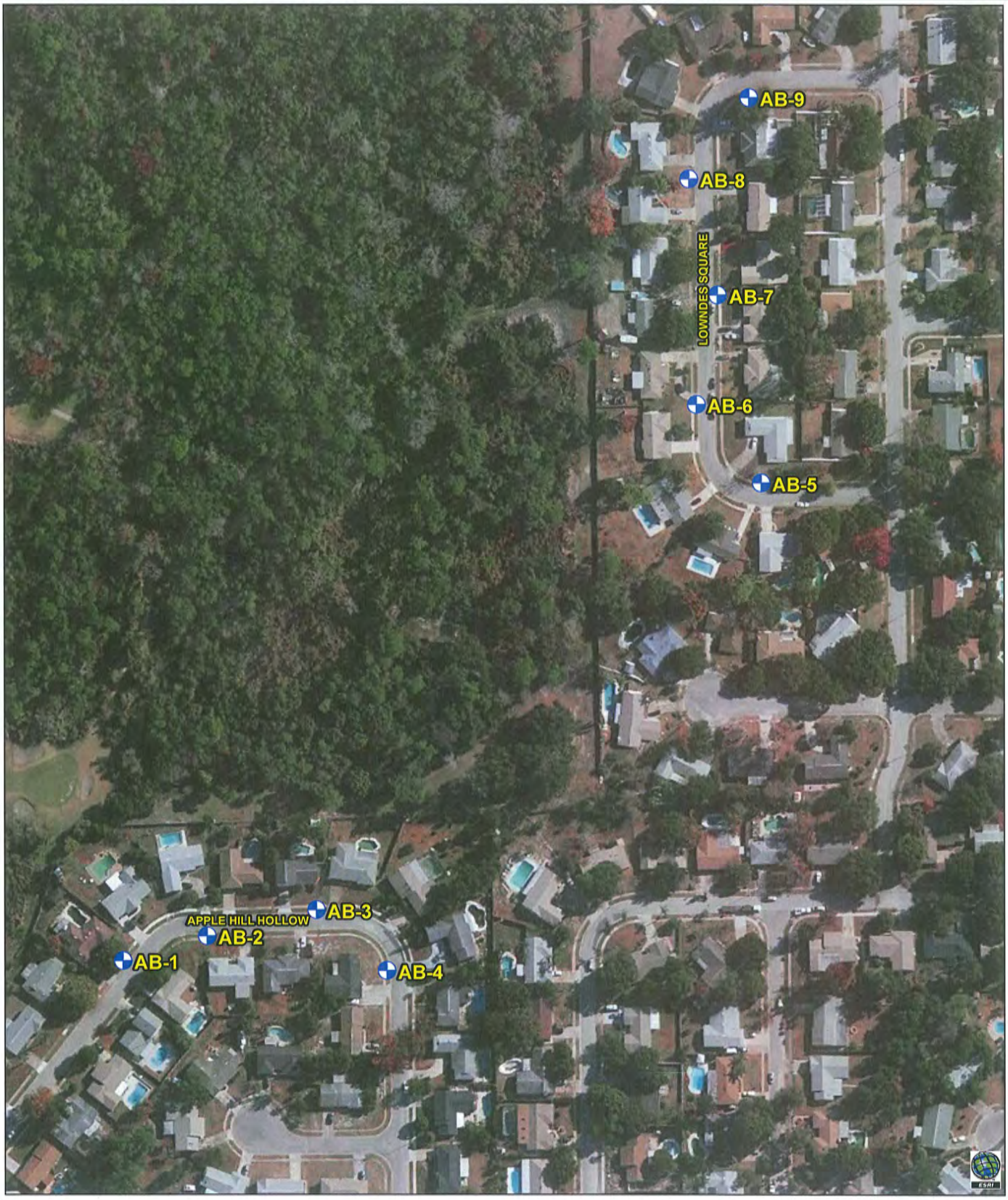




Geotechnical and Environmental Consultants, Inc. 919 Lake Baldwin Lane Orlando, FL 32814 PH (407) 898-1818 FAX (407) 898-1837 Certificate of Authorization No. 00005882 CRAIG G. BALLOCK P.E. NO. 71571	GEC	PROJECT NO. 3650G DATE 8-29-14 DRAWN BY SKR CHECKED BY GPB CHECKED BY CGB 71571	**USGS QUADRANGLE AND NRCS SOIL SURVEY MAPS** **LOWNDES SQUARE AND APPLE HILL HOLLOW UNDERDRAIN REPLACEMENT**	FIGURE NO. 1

J:\D111\3650G Apple Hill Hollow Underdrain\3650Gquad.mxd 9/8/2014

BORING LOCATION PLAN



APPROXIMATE AUGER BORING LOCATION

0 100 200
Feet

N E S W

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GEC

PROJECT NO.	3650G
DATE	8-29-14
DRAWN BY	SKR
CHECKED BY	GPB
CHECKED BY	CGB 71571

BORING LOCATION PLAN

LOWNDES SQUARE AND APPLE HILL HOLLOW UNDERDRAIN REPLACEMENT

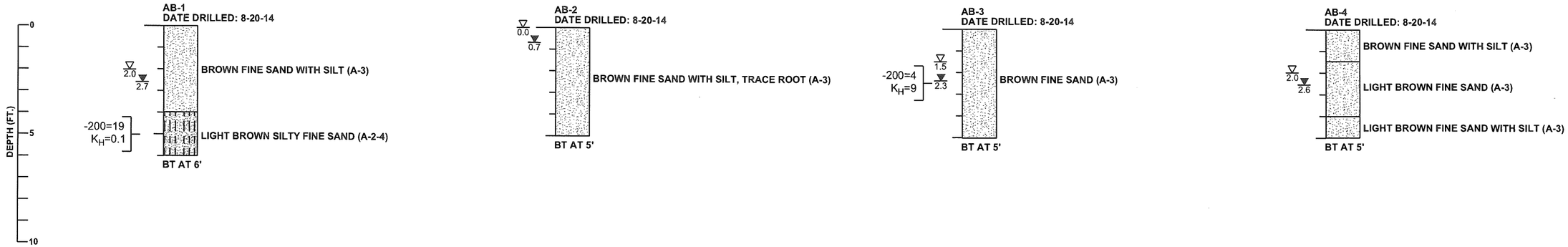
FIGURE NO.

2

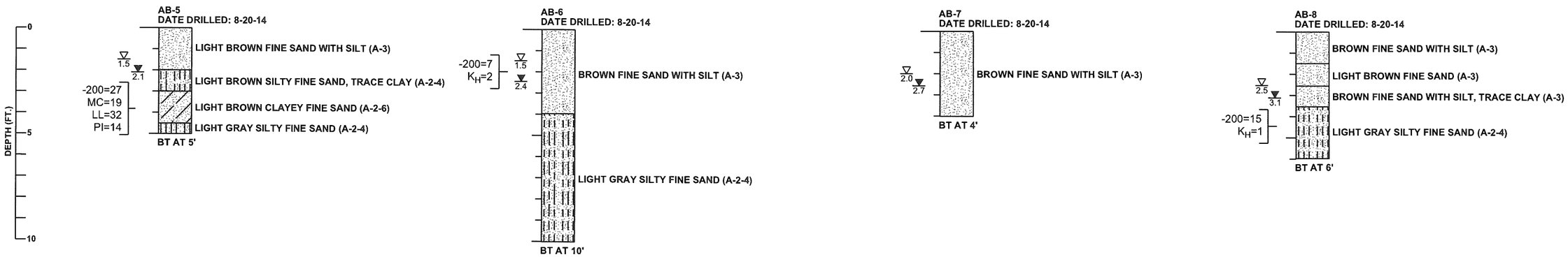
J:\D111\3650G Apple Hill Hollow Underdrain\3650G.mxd 9/8/2014

BORING RESULTS

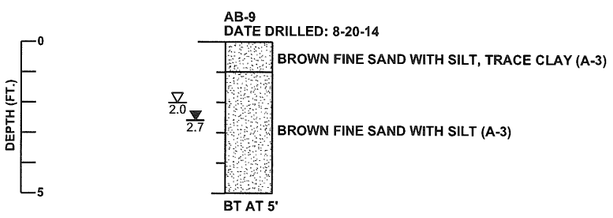
APPLE HILL HOLLOW



LOWNDES SQUARE



LOWNDES SQUARE



LEGEND

- ▽ 2.0 — ESTIMATED SEASONAL HIGH GROUNDWATER DEPTH (FT.)
- ▼ 2.7 — ENCOUNTERED GROUNDWATER DEPTH (FT.) 24 HRS. AFTER DATE DRILLED
- BT — BORING TERMINATED AT DEPTH INDICATED
- -200= — PERCENT PASSING NO. 200 U.S. STANDARD SIEVE
- MC= — PERCENT NATURAL MOISTURE CONTENT
- LL= — LIQUID LIMIT
- PI= — PLASTICITY INDEX
- K_H= — HORIZONTAL PERMEABILITY RATE (FT. / DAY)
- SAND
- SAND AND CLAY
- SAND AND SILT

GENERAL NOTES

SUBSURFACE CONDITIONS SHOWN ON THE BORINGS REPRESENT THE CONDITIONS ENCOUNTERED AT THE BORING LOCATIONS. ACTUAL CONDITIONS BETWEEN THE BORINGS MAY VARY FROM THOSE SHOWN. AASHTO SOIL CLASSIFICATIONS SHOWN ON THE BORINGS ARE BASED ON VISUAL EXAMINATION AND THE LABORATORY TESTING SHOWN.

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BORING RESULTS

LOWNDES SQUARE AND APPLE HILL HOLLOW UNDERDRAIN REPLACEMENT

FIGURE NO. 3

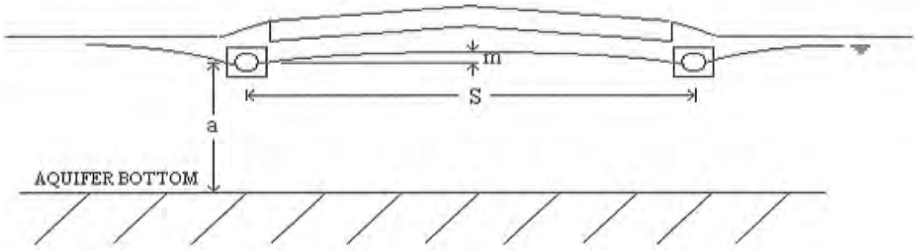
UNDERDRAIN ANALYSIS

Geotechnical and Environmental Consultants, Inc.

At the very foundation of our community

Roadway Underdrain Calculations

Lowndes Square and Apple Hill Hollow Underdrain Replacement
GEC Project No. 3650G



Known Values

$S\ (ft)$:	28	*Spacing Between Underdrains*
$c\ (in)$:	24	*Distance Between Bottom of Base and Underdrain Invert*
$a\ (ft)$:	10	*Distance Between Aquifer Bottom and Underdrain Invert*
$d\ (in)$:	6	*Underdrain Diameter*
$k\ (ft/day)$:	2	*Soil Permeability Rate*

Assumed Values

$f\ (ft)$:	3	*Fluctuation Between Wet and Dry Season Water Levels*
$D\ (days)$:	120	*Duration of Wet Season*

Calculations

$q\ (ft/day)$: 0.025 — *Recharge Rate Due to Background Flow,* $q = \frac{f}{D}$

$$S = \sqrt{\frac{4 \cdot k \cdot m^2 + 2 \cdot a \cdot m}{q}}$$

Ellipse Equation from the book "Drainage of Agricultural Land: A Practical Handbook for the Planning, Design, Construction and Maintenance of Agricultural Drainage Systems" by the Soil Conservation Service of the U.S. Department of Agriculture

$$m^2 + 2 \cdot a \cdot m - \frac{S^2 \cdot q}{4 \cdot k} = 0$$

Rearranged into a Quadratic Equation so that "m" can be evaluated

$$\begin{pmatrix} -a + \frac{1}{2} \cdot \frac{\sqrt{4 \cdot a^2 \cdot k + S^2 \cdot q}}{\sqrt{k}} \\ -a - \frac{1}{2} \cdot \frac{\sqrt{4 \cdot a^2 \cdot k + S^2 \cdot q}}{\sqrt{k}} \end{pmatrix}$$

Roots of the Quadratic Equation

Neglecting the Negative Root Results:

$$m = -a + \frac{1}{2} \cdot \frac{\sqrt{4 \cdot a^2 \cdot k + S^2 \cdot q}}{\sqrt{k}}$$

$m\ (in) =$ 1.5 — *Rise in Groundwater Level Above the Midpoint of the Underdrain Pipe*

$$r = m + \frac{d}{2}$$

$r\ (in) =$ 4.5 — *Rise in Groundwater Level Above the Invert of the Underdrain Pipe*

$$x = c - r$$

$x\ (in) =$ **19.5** — *Distance between the groundwater level and the bottom of the base*

Report of Geotechnical Engineering Investigation

CITY OF CASSELBERRY STORM DRAINREHABILITATION

Seminole County, Florida

GEC Project No. 3738G

Geotechnical and Environmental Consultants, Inc.
At the very foundation of our community

October 16, 2015

Singhofen & Associates
11723 Orpington Street, Suite 100
Orlandom Florida 32817

Attention: Mr. Robert Gaylord, P.E.

cc: Mr. Brett Witte, P.E.

Subject: Report of Geotechnical Engineering Investigation
CITY OF CASSELBERRY STORM DRAIN REHABILITATION
Seminole County, Florida
GEC Project No. 3738G

Dear Mr. Gaylord:

Geotechnical and Environmental Consultants, Inc. (GEC) is pleased to present this Report of Geotechnical Engineering Investigation for the above-referenced project. This study was performed in general accordance with our Proposal No. 8225G dated February 27, 2015. The purpose of this investigation will be to explore soil and groundwater conditions along the existing drainage elements and to use the information obtained to provide geotechnical engineering recommendations for design and construction of the proposed drainage improvements. This report describes our exploration procedures, exhibits the data obtained and presents our conclusions and recommendations regarding the geotechnical engineering aspects of the project.

GEC appreciates the opportunity to be of service to you on this project and trusts that the information contained herein is sufficient for your current needs. Should you have any questions concerning the contents of this report, or if we may be of further assistance, please contact us.

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Very truly yours,

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Not available for signing.

Kevin Baboolall, E.I.
Geotechnical Engineer

Craig Ballock, P.E.
Senior Geotechnical Engineer
Florida License No. 71571

GPB/CGB/dbj

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Figure 1: USGS Quadrangle
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Figure 5: SPT Boring Results
Figure 6: Auger Boring Results

Site Reconnaissance Photographic Logs
Pavement Core Photographic Logs
Sites J and K Ditch Stability Analysis
Sites L, O and T Underdrain Analysis

1.0 SITE AND PROJECT DESCRIPTION

This project includes eight (8) project sites located within the City of Casselberry, Florida. Land use at the project sites predominately consists of residential developments and associated roadways. The approximate site vicinities are shown on the Site Location Plan on **Figure 3** in the **Appendix**. Based on our field reconnaissance, the project sites are characterized as described below:

- **Site C (Quintuplet Drive):** Site C is located approximately 695 feet west of Lake Drive on the north side of Quintuplet Drive. The existing 500 lineal feet of 24-inch Corrugated Metal Pipe (CMP) currently lies between two residential lots and discharges into Lake Marie.
- **Site J (Cross Street):** Site J is an existing ditch crossing located approximately 150 feet west of north Winter Park Drive on both sides of Cross Street just before the City of Casselberry Water Reclamation Facility. The existing culvert is approximately 6 feet in width and the ditch is approximately 4.5 feet in depth and 8 feet in width. Erosion was observed on the southwest side of the culvert crossing at the top of the ditch in between the pavement and top of berm. Please refer to Site Recon Photos 1 and 2 in the **Appendix**.
- **Site K (Queen's Mirror Circle):** Site K is an existing canal crossing and is located along South Lake Triplet Drive and Queen's Mirror Circle. The canal connects Queens Mirror Lake and Triplet Lake. The south bank of the ditch on the west side of Queens Mirror Circle is retained by a steel sheet pile wall, however, moderate erosion was observed behind the retaining wall (Site Recon Photos 3 and 4). Side slopes on the northern ditch bank are relatively steep on both sides of Queen's Mirror Circle but are heavily vegetated. The southern ditch bank on the east side of Queen's Mirror Circle is grassed with an approximate side slope of 1V:1.5H. One area of washout was observed on the southern ditch bank. Rubble rip-rap is present beneath the Queen's Mirror Circle ditch crossing.
- **Site L (Woodstream Lane):** Site L includes Woodstream Lane, an approximately 500 foot long, 2-lane urban section roadway. At the time of GEC's site recon the pavement appeared to be recently repaved (Site Recon Photo 5) and was in good condition.
- **Site O (Secret Way):** Site O includes a 400 foot long section of Secret Way; 200 feet on each side of the existing culvert crossing, which connects Secret Lake and Lake Concord. At the time of GEC's site recon the pavement was recently repaved and was in good condition. Review of photographs of the Secret Way pavement from May 2014 revel the pavement had significant block cracking prior to resurfacing. In addition, an approximately 1-foot diameter, circular depression and distress to the existing concrete curb was observed on the west side of Secret Way near the edge of pavement across from the culvert outlet into Secret Lake. Manual probing of the depression indicated very loose soil conditions to a depth of 7.5 feet below existing ground surface, which may indicate a joint failure in the pipe near this location. Please refer to Site Recon Photo 6 in the **Appendix**.

- **Site T (Marigold Road):** Site T includes a 1,285 foot long section of Marigold Road from the intersection of Lowndes Square east towards South Winter Park Drive. At the time of GEC's site recon the pavement appeared to be recently repaved and was in good condition.
- **Site U (Sunset Drive):** Site U is located along North Sunset Drive, approximately 150 feet south of Oak Park Place, at the Lake Concord culvert crossing. The culvert is approximately 3-feet in diameter with concrete wing walls. Significant erosion was observed between Sunset Drive and the culvert wing walls (Site Recon Photos 7 and 8). At the time of GEC's site recon the pavement appeared to be recently repaved and was in good condition.
- **Site W (Turtle Mound Drive):** Site W is located between Micanopy Court and Turtle Mound Drive bordered by existing residential properties.

Based on our review of the provided project plans, the stormwater infrastructure improvement/remediation project elements associated with each project site are summarized as follows:

Table 1
Stormwater Infrastructure Improvement/Remediation

Project Site	Project Elements
Site C (Quintuplet Drive)	Pipeline Replacement
Site J (Cross Street)	Erosion of Ditch Slopes
Site K (Queens Mirror Circle)	Erosion of Ditch Slopes
Site L (Woodstream Lane)	Underdrain Replacement / Pavement Evaluation
Site O (Secret Way)	Underdrain Replacement / Pavement Evaluation *Pipe Join Replacement
Site T (Marigold Road)	Underdrain Replacement / Pavement Evaluation
Site U (Sunset Drive)	Pipe Joint Replacement / Muck Evaluation
Site W (Turtle Mound Drive)	Drainage System Replacement

* This project element was not identified in the original scope of services, however, based on site observations it may be required due to the observed depression.

> The current project plans include the rehabilitation of…existing drainage systems…

We understand the current project plans include the rehabilitation of the existing drainage systems at the 8 project sites based on the stormwater infrastructure concerns outlined above. The purpose of this investigation will be to explore soil and groundwater conditions at the various sites to use the information obtained to provide geotechnical engineering recommendations for design and construction of the proposed drainage improvements.

2.0 REVIEW OF AVAILABLE DATA

To obtain general information on soil and groundwater conditions at the project sites, GEC reviewed available data including the USGS Quadrangle map, Natural Resources Conservation Service (NRCS) Soil Survey of Seminole County and other published sources. A summary of this information is presented in the following report sections.

2.1 USGS Quadrangle Map

Based on our review of the USGS Casselberry, Florida Quadrangle map and survey data provided by Singhofen & Associates, the existing ground surface elevation at the subject sites are summarized in the following table. In addition, the following table summarizes the water elevation of lakes, if present, adjacent to each project site as documented in the USGS Quadrangle map.

Table 2
Summary of Ground Surface and Water Elevations

Project Sites	Approximate Range of Existing Ground Surface Elevation (ft. NAVD)	Surveyed Water Elevation (Date of Survey) (ft NAVD)	Lake Feature and USGS Quadrangle Water Elevation (ft NGVD)
Site C (Quintuplet Drive)	+62.0 to +53.5	+48.5 (7/2015)	Lake Marie (+54)
Site J (Cross Street)	+51.0 to +46.0	Dry (12/11/12)	---
Site K (Queen's Mirror Circle)	+56.5 to +49.0	+49.5 (5/28/15	Queens Mirror (+53) / Triplet Lake (+52)
Site L (Woodstream Lane)	+60.5 to +48.5	N/A	Lake Kathryn (+52)
Site O (Secret Way)	+55.0 to +55.5	+50.9 (12/19/12)	Secret Lake (+52)
Site T (Marigold Road)	+72.5 to +62.0	N/A	Queens Mirror (+53)
Site U (Sunset Drive)	+60.0	+55.1 (12/9/13)	Lake Concord (+59)
Site W (Turtle Mound Drive)	+56.0 to +58.5	N/A	Lake Hodge (+54)

The project sites are depicted on an excerpt of the U.S. Geological Survey (USGS) Casselberry, Florida Quadrangle Map (**Figure 1**) in the **Appendix**.

2.2 NRCS Soil Survey

The Natural Resources Conservation Service (NRCS) Soil Survey of Seminole County, Florida was reviewed for near-surface soil and groundwater information within the vicinity of the subject sites. The NRCS Soil Survey map of the site vicinity is shown on **Figure 2** in the **Appendix**. The NRCS soils near the project sites are summarized in the following table:

Table 3
Seminole County NRCS Soil Survey Classifications

Unit No.	Soil Name	Depth (inches)	Soil Description	Unified Classification Symbol	AASHTO Classification Symbol	Depth to Seasonal High Groundwater (feet)	Project Site
17	Brighton muck	0 – 8	Muck	PT	A-8	+2.0 – 0.0	O
		8 – 80	Mucky Peat	PT	A-8		
	Samsula muck	0 – 26	Muck	PT	A-8		
		26 – 30	Mucky fine sand	SP, SP-SM	A-3		
		30 – 80	Sand, fine sand, loamy fine sand	SP, SP-SM, SM	A-3, A-2-4		
	Sanibel muck	0 – 6	Muck	PT	A-8		
		6 – 8	Mucky fine sand, sand	SP, SP-SM	A-3		
		8 – 80	Sand, fine sand	SP, SP-SM	A-3		
20	Myakka fine sand	0 – 28	Fine sand, sand	SP, SP-SM	A-3	0.5 – 1.5	L
		28 – 45	Fine sand, loamy fine sand	SP-SM, SM	A-3, A-2-4		
		45 – 80	Fine sand, sand	SP,SP-SM	A-3		
	EauGallie fine sand	0 – 41	Fine sand, Sand	SP, SP-SM	A-3		
		41 – 60	Sandy clay loam, sandy loam	SM, SC-SM, SC	A-2-4, A-2-6		
		60 – 80	Loamy fine sand, sand	SP-SM, SM	A-3, A-2-4		
31	Tavares fine sand, 0 to 5 percent slopes	0 – 80	Fine sand	SP, SP-SM	A-3	3.5 – 6.0	C, L
	Millhopper fine sand, 0 to 5 percent slopes	0 – 45	Fine sand	SP-SM, SM	A-3, A-2-4		
		45 – 54	Sandy loam, loamy fine sand	SM	A-2-4		
		54 – 80	Sandy clay loam, fine sandy loam	SM, SC, SC-SM	A-2-4, A-4		
34	Urban Land	---	---	---	---	> 6	C, J, K, O, T, U, W

The NRCS soil survey map predominantly depicts Myakka, EauGallie, Tavares and Millhopper fine sands at the eight project sites. These soil types consist of nearly level to gently sloping, poorly to moderately drained soils located in broad areas of knolls and flatwoods. In addition, the NRCS predicts seasonal high groundwater levels for these soil types to generally range from 0.5 to 6.0 feet below the natural ground surface.

The Brighton, Samsula and Sanibel Muck soil unit, depicted at Site O, typically contains high organic content soils that are generally classified as PT in the Unified Soil Classification System and can have severe limitations for construction. In addition, the NRCS predicts seasonal high groundwater levels for this soil type to generally range from 2 feet above to at the natural ground surface.

Urban Land refers to areas where most of the ground surface is covered by asphalt, concrete, buildings and other impervious surfaces that modify surface/subsurface drainage and obscure or alter the soils so that their identification is not possible. The depth to seasonal high groundwater level for this soil unit is typically dependent upon the functioning of existing drainage systems.

Information contained in the NRCS Soil Survey is very general and may be outdated. Therefore, it may not be reflective of actual soil and groundwater conditions, particularly if recent development in the site vicinity has modified soil conditions or surface/subsurface drainage. The information obtained from the soil borings provides a better characterization of actual site conditions.

3.0 SUBSURFACE EXPLORATION

In addition to consulting the sources of information previously discussed for regional and site-specific soils data, GEC conducted a subsurface exploration to evaluate soil and groundwater conditions as detailed in the following table:

Table 4
Field Investigation Program

Project Area	* Boring Type	Boring No.	Depth (ft.)	Additional Investigation
Site C (Quintuplet Drive)	DCP	DCP-1	8	**
Site J (Cross Street)	SPT	SPT-J-1	15	Muck probes on a linear 5 foot grid pattern within the existing stormwater canal
Site K (Queen's Mirror Circle)	SPT	SPT-K-1	15	Muck probes on a linear 10 foot grid pattern within the existing stormwater canal
Site L (Woodstream Lane)	HA	HA-L-1 to HA-L-3	5 to 15	2 Pavement Cores (C-L-1 to C-L-2)
Site O (Secret Way)	HA	HA-O-1 to HA-O-3	6 to 7	2 Pavement Cores (C-O-1 to C-O-2)
Site T (Marigold Road)	HA	HA-T-1 to HA-T-8	5 to 7	3 Pavement Cores (C-T-1 to C-T-3)
Site U (Sunset Drive)	SPT	SPT-U-1 to SPT-U-2	15	Muck probes on a linear 10 foot grid pattern within the existing stormwater canal
Site W (Turtle Mound Drive)	DCP	DCP-W-1	8	---

* DCP – Dynamic Cone Penetrometer Test Boring; HA – Hand Auger Boring; SPT -Standard Penetration Test Boring
** Unable to access back of property due to homeowner restrictions.

The boring, probe and pavement core locations were established in the field using project plans provided by Singhofen & Associates and a sub-meter accuracy GPS unit (Trimble Geo XH) and were later surveyed for horizontal and vertical control by Southeastern Surveying and Mapping Corp., a

registered Professional Land Surveyor. However, Site U (Sunset Drive) was not surveyed during this study. In addition, manual muck probe locations were not surveyed. The locations of the borings for this study are shown on the Boring, Muck Probe, and Coring Location Plan sheets (**Figures 4A** through **4H**) in the **Appendix**.

3.1 SPT Borings

SPT borings were drilled in general accordance with ASTM Procedure D-1586. The boreholes were advanced by the rotary wash method with bentonite-based mud used as the circulating fluid to stabilize the borehole. Casing was used as necessary to stabilize the borehole and prevent loose surficial sands from raveling into the lower more stable portions of the borehole. GEC's field crew obtained SPT samples continuously in the borings to a depth of 10 feet and at 5-foot depth intervals thereafter. However, some boring locations were hand augered to a depth of 6 feet to avoid damage to underground utilities. A GEC engineering technician monitored the drilling operation, and collected, examined and visually classified each sample. He then packaged representative portions of each sample for transport to our laboratory for further examination and laboratory testing.

3.2 Manual Hand Auger Borings

Our engineering technician performed standard barrel manual hand auger borings in general accordance with ASTM D-4700, by manually turning a 3-inch diameter, 6-inch long sampler into the soil until it was full. He then retrieved the sampler and visually examined and classified the soil. This procedure was repeated until the desired termination depth was achieved. Our technician collected representative samples for further visual examination and classification in our laboratory.

3.3 Dynamic Cone Penetrometer

The Dynamic Cone Penetrometer (DCP) tests were performed in hand auger borings in general accordance with "Dynamic Cone for Shallow In-Situ Penetration Testing," *Vane Shear and Cone Penetration Testing of In-Situ Soils, ASTM STP 399*, 1966. The DCP tests were performed on 1-foot intervals until the boring termination depth was reached. Our technician collected representative samples for further visual examination and classification in our laboratory.

3.4 Manual Muck Probes

Manual muck probes were performed by pushing a slender metal rod into the surficial soil and evaluating the relative resistance of the soil to manual penetration. Highly organic soils, such as

muck and/or peat, are characteristically very soft and will easily yield to the manual probe. Manual probes, however, cannot detect peat or muck layers which are present beneath layers of sand or dense soils which cannot be penetrated by the probe. The probes can also penetrate to some extent in very loose sands which may be present beneath peat or muck layers. No soil samples are obtained for visual examination or laboratory testing when using this exploratory technique. The soil type being penetrated is inferred solely by evaluating the relative resistance of the soil to penetration. These limitations can lead to some under-estimation or over-estimation of peat or muck layer thicknesses. The probe data presented in this report should be evaluated with these limitations in mind.

3.5 *Pavement Cores*

Pavement cores were conducted using a 6-inch diameter core barrel and were cored through the pavement to the bottom of the base material. After the pavement cores were completed, the hole was backfilled with cold patch asphalt to the pavement surface.

3.6 Groundwater Measurement

A GEC engineering technician measured the depth to groundwater in the boreholes at the time of drilling and again after approximately 24 hours. Once the 24-hour groundwater measurement was recorded, the boreholes were then backfilled with soil cuttings to prevailing ground surface.

4.0 LABORATORY TESTING

Selected soil samples retrieved from the borings were tested in accordance with Florida Standard Testing Methods (FM). Florida Standard Testing Methods are adaptations of recognized standard methods, e.g., ASTM and AASHTO, which have been modified to accommodate Florida's geological conditions. The GEC laboratory is reviewed annually by the Construction Materials Engineering Council, Inc. (CMEC) to verify compliance with FM. Our laboratory testing program is summarized in the following table:

Table 5
Summary of Laboratory Testing Program

Type of Test	Number of Tests
Percent Fines (FM 1 - T88)	19
Atterberg Limits (FM 1 - T89/90)	4
Organic Content (FM 1 - T267)	4

Type of Test	Number of Tests
Natural Moisture Content (FM 1 - T265)	8
Laboratory Permeability (Constant Head) (FM 1 - T215)	7

The individual results of our laboratory tests are shown adjacent to the soil profiles at the approximate depths from which the tested samples were obtained on the SPT and Auger Boring Results sheets **Figures 5** to **6** in the **Appendix**.

4.1 Constant Head Laboratory Permeability Test Results

Tabulated below are the laboratory permeability test results from soil samples obtained at boring locations HA-L-1, HA-L-2, HA-T-3, HA-T-6, HA-T-7, HA-O-1 and HA-O-2.

Table 6
Summary of Laboratory Permeability Test Results

Site	Boring No.	Test Depth (feet)	Soil Type	Run 1 – Uncompacted Sample			Run 2 – Compacted Sample			Geometric Mean of Hydraulic Conductivity (ft./day)
				Moisture Content (%)	Wet Density (pcf)	Hydraulic Conductivity (ft./day)	Moisture Content (%)	Wet Density (pcf)	Hydraulic Conductivity (ft./day)	
L	HA-L-1	2 - 5	A-3	24	109.7	26.9	22	116.9	13.6	19.1
	HA-L-2	4 - 6								
	HA-L-2	0 - 4	A-3	25	111.0	15.1	20	117.5	3.3	7.1
	HA-L-1	0 - 2								
O	HA-O-1	0 - 4	A-3	31	107.4	15.7	22	116.0	3.0	6.9
	HA-O-2	0 - 4.5								
	HA-O-2	5 - 7	A-2-4	25	94.2	0.6	21	113.9	0.01	0.1
	HA-O-3	4.5 - 6								
T	HA-T-3	0 - 4	A-3	19	109.1	16.8	20	117.0	10.9	13.5
	HA-T-4	0 - 3.5								
	HA-T-6	0 - 4.5	A-3	26	107.8	15.7	18	115.0	2.0	5.6
	HA-T-5	0 - 4								
	HA-T-7	0 - 4	A-3	25	107.1	23.9	22	112.4	12.5	17.3
	HA-T-8	2.5 5								

The results of our laboratory permeability tests are shown adjacent to the soil profiles at the approximate depths from which the tested samples were obtained on the Auger Boring Results sheet **Figure 6** in the **Appendix**.

5.0 DESCRIPTION OF SUBSURFACE CONDITIONS

Detailed records of subsurface conditions encountered in our borings and muck probes are shown on the Boring and Muck Probe Results sheet in the **Appendix**. The boring logs describe the soil layers using the Unified Soil Classification System (USCS) symbol (e.g., SP-SM) and American Association of State Highway and Transportation Officials (AASHTO) with ASTM soil descriptions (e.g., sand with silt). We based our soil classifications and descriptions on visual examination and the laboratory test results shown adjacent to the boring profiles.

The boring and muck probe logs and related information included in this report are indicators of subsurface conditions only at the specific boring, muck probe, and coring locations at the time of our field exploration. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ from conditions we encountered at the boring, muck probe, and coring locations. Moreover, conditions at these locations can change over time. Groundwater levels fluctuate seasonally, and soil conditions can be altered by earthmoving operations.

The depths and thicknesses of the subsurface strata indicated on the boring logs were interpolated between samples obtained at different depths in the borings. The actual transition between soil layers may be different than indicated. *These stratification lines were used for our analytical purposes. Earthwork quantity estimates based on the boring results will differ from the actual quantities measured in the field during construction.*

5.1 Soil Boring Results

In general, the soil borings performed for the eight project sites encountered the following subsurface conditions:

- **Site C (Quintuplet Drive):** The Dynamic Cone Penetrometer boring (DCP-C-1) performed at this site encountered loose fine sand (SP) to 2 feet below existing grade underlain by medium dense fine sand with silt (SP-SM) to the boring termination depth of 8 feet below the existing ground surface. However, a very dense layer of fine sand with silt (SP-SM) was encountered from 4 to 5 feet below the ground surface.
- **Site J (Cross Street):** Boring location (SPT-J-1) encountered loose fine sand with silt (SP-SM) to 6 feet below the existing grade underlain by a layer of loose silty fine sand (SM) to the boring termination depth of 15 feet. However, a layer of loose clayey fine sand (SC) was encountered from 6 to 8 feet below the existing ground surface.
- **Site K (Queen's Mirror Circle):** Boring location (SPT-K-1) encountered loose to medium dense fine sand with silt (SP-SM) to silty fine sand (SM) to 8 feet below the existing grade

underlain by a layer of layer of loose clayey fine sand (SC) from 8 to 13 feet and a layer of loose fine sand (SP) to the boring termination depth of 15 feet.

- **Site L (Woodstream Lane):** The hand auger borings (HA-L-1 to HA-L-3) performed at this site typically encountered fine sands with variable silt content (A-3, A-2-4) to boring termination depths ranging from 5 to 15 feet below the existing ground surface.
- **Site O (Secret Way):** The hand auger borings (HA-O-1 to HA-O-3) performed along Secret Way typically encountered fine sands with variable silt content (A-3, A-2-4) to boring termination depths ranging from 6 to 7 feet below the existing ground surface. However, a layer of mucky fine sand (A-8) (Organic Content = 15%) was encountered from 2 to 3 feet below the existing ground surface.
- **Site T (Marigold Road):** The hand auger borings (HA-T-1 to HA-T-8) performed along Marigold Road typically encountered fine sands with variable silt content (A-3, A-2-4). However, a 0.5-foot layer of clayey fine sand (A-2-6) was encountered at boring location HA-T-2 from 2 to 2.5 feet below the existing ground surface. Near-surface organic soils (A-8) were also encountered along Marigold Road at boring locations HA-T-1 and HA-T-8 from the ground surface to depths extending to 2.5 feet below existing grade. The measured organic content of the mucky fine sand to sandy muck soils ranged from 8 to 35 percent.
- **Site U (Sunset Drive):** The SPT borings (SPT-U-1 and SPT-U-2) performed on both sides of Sunset Drive generally encountered loose to medium dense fine sand with silt (SP-SM) to silty fine sand (SM) to the boring termination depth of 15 feet below the existing ground surface. However, a layer of mucky fine sand (PT) (Organic Content = 8%) was encountered at boring location SPT-U-2 from 2 to 4 feet below the existing ground surface.
- **Site W (Turtle Mound Drive):** The Dynamic Cone Penetrometer boring (DCP-W-1) performed at site near the existing drainage structure typically encountered loose to medium dense fine sand (SP) and fine sand with silt (SP-SM) to the boring termination depth of 8 feet below the existing surface.

Please refer to the SPT and Auger Boring Results sheets (**Figures 5** to **6**) in the **Appendix** for specific subsurface profiles at the boring locations.

5.2 Pavement Cores

GEC visually surveyed the condition of the existing pavement surface and obtained pavement cores at locations representative of the existing pavement conditions to aid in the evaluation of the existing pavement section. Pictures of the pavement cores and individual core data are included in the **Appendix**.

Asphalt pavement cores were performed to obtain pavement thickness and base course thickness as well as base type. The measured pavement and base course thicknesses are noted in the following table.

Table 7
Summary of Pavement Component Thicknesses

Site	Core No.	* Lane	Distance from Edge of Pavement (ft.)	Pavement Condition	Asphalt Thickness (in)	Base Thickness (in)	Base Course Type	Subgrade Description
L	C-L-1	WB	3.5	Good	1 ¾	6 ¾	Limerock	Brown fine sand with silt (A-3)
	C-L-2	EB	4.5	Good	1 ½	8	Limerock	Brown fine sand with silt (A-3)
O	C-O-1	SB	4.5	Good	2 $^{5}/_{8}$	5 ½	Soil Cement	Dark brown fine sand with silt, trace organic material (A-2-4)
	C-O-2	NB	3	Good	1 $^{7}/_{8}$	6 ½	Soil Cement	Dark brown silty fine sand, trace organic material (A-2-4)
T	C-T-1	WB	3	Good	1 $^{7}/_{8}$	9	Soil Cement	Light brown clayey fine sand (A-2-6)
	C-T-2	EB	4.5	Good	3 ¼	12 ¾	Soil Cement	Brown fine sand with silt (A-3)
	C-T-3	WB	2	Good	2 $^{1}/_{8}$	14	Soil Cement	Light brown fine sand with silt (A-3)

*WB: Westbound; EB: Eastbound; NB: Northbound; SB: Southbound.

5.3 Manual Muck Probe Results

Manual muck probes were performed within the channel bottoms of ditches and canals located on Sites J, K and U. In addition, a manual probe was performed within a circular depression identified adjacent to an existing manhole structure located at Site O. A summary of the manual muck probe results is included in the following table:

Table 8
Summary of Manual Muck Probes Results

Project Site	*Range of Standing Water Depth (ft.)	Range of Estimated Surficial Organic Soil Thickness (ft.)
Site J (Cross Street)	0.0	0.0 - 1.0

Project Site	*Range of Standing Water Depth (ft.)	Range of Estimated Surficial Organic Soil Thickness (ft.)
Site K (Queen's Mirror Circle)	0.5 - 1.5	0.0
Site O (Secret Way)	0.0	**7.5
Site U (Sunset Drive)	0.5 - 1.0	0.0

* Standing water depths measured between April 1st and 2nd.

** Listed value represents push through void/very loose sands not a surficial muck thickness.

Specific muck probe results at individual probe locations are presented on the respective Boring and Muck Probe Location Plan with Probe Results Sheets presented on **Figures 4A** through **4H** in the **Appendix**.

5.4 Groundwater Levels

Groundwater levels were measured at least 24 hours after completion of the borings. Groundwater levels encountered at each project site are summarized in the following table:

Table 9
Encountered Groundwater Levels

Project Site	Encountered Groundwater Depth (feet)	Encountered Groundwater Elevation (ft NAVD)
Site C (Quintuplet Drive)	7.9	+55.1
*Site J (Cross Street)	5.1	+45.0
*Site K (Queen's Mirror Circle)	6.3	+50.2
Site L (Woodstream Lane)	2.7 to 10.3	+50.2 to +47.3
*Site O (Secret Way)	4.0 to 4.1	+51.1 to +51.2
Site T (Marigold Road)	1.8 to 3.7	+72.2 to +59.4
*Site U (Sunset Drive)	3.5 to 6.4	---
Site W (Turtle Mound Drive)	7.7	+50.5

*Nearby drainage feature (ditch/canal) present at boring location will impact groundwater levels at this site.

Groundwater levels can vary seasonally and with changes in subsurface conditions between boring locations. Alterations in surface and/or subsurface drainage brought about by site development can also affect groundwater levels. *Therefore, groundwater depths measured at different times or at different locations on the site can be expected to vary from those measured by GEC during this investigation.*

For purposes of this report, estimated seasonal high groundwater levels are defined as groundwater levels that are anticipated at the end of the wet season during a "normal rainfall" year under pre-development site conditions. We define a "normal rainfall" year as a year in which rainfall quantity and distribution were at or near historical averages.

GEC's estimated seasonal high groundwater levels for each of the project sites are summarized in the following table:

Table 10
Estimated Seasonal High Groundwater Levels

Project Site	Estimated Seasonal High Groundwater Depth (feet)	Estimated Seasonal High Groundwater Elevation (ft NAVD)
Site C (Quintuplet Drive)	4.9	+58.1
*Site J (Cross Street)	2.0	+48.1
*Site K (Queen's Mirror Circle)	4.5	+52.0
Site L (Woodstream Lane)	1.0 to 8.0	+52.5 to +49.0
*Site O (Secret Way)	2.0	+53.1 to +53.3
Site T (Marigold Road)	1.0 to 2.0	+72.5 to +60.8
*Site U (Sunset Drive)	2.5 to 3.0	---
Site W (Turtle Mound Drive)	4.7	+53.5

*Seasonal high groundwater levels are directly dependent on the function of the existing canal/ditch and may differ from our estimates during extreme storm conditions.

Encountered and estimated seasonal high groundwater levels at the individual boring locations are presented on the SPT and Auger Boring Results sheets (**Figures 5** to **6**) in the **Appendix**.

6.0 GEOTECHNICAL ANALYSES AND RECOMMENDATIONS

The conclusions and recommendations contained in this report are based in part on the data obtained from a limited number of soil samples and the groundwater measurements obtained from widely-spaced borings. The sampling methods used indicate subsurface conditions only at the specific boring locations where samples were obtained, only at the time they were obtained, and only to the depths penetrated. *Borings cannot be relied upon to accurately reflect the variations that usually exist between boring locations and these variations may not become evident until construction.*

If variations from the subsurface conditions described in this report do become evident during construction or if the project characteristics described in this report change, GEC should be retained to reevaluate this report's conclusions and recommendations in light of such changes.

Below are our general conclusions and recommendations for each project site based on the data obtained from this study. Details regarding site specific recommendations are included in the subsequent sections of this report.

- **Site C (Quintuplet Drive):** Due to site access limitations from the homeowners, GEC was only able to perform soil borings in the front of the subject property. In general, the soils encountered at the Dynamic Cone Penetrometer boring location (DCP-1) are suitable for use as pipe bedding and backfill soil. Based on our review of survey information provided for Site C, if excavations are required to rehabilitate the existing CMP, we anticipate that sheeting and bracing or properly designed trench shields will be required to support the sides of excavations in the area of the existing residence on the east side of the CMP alignment. In addition, dewatering may be required to facilitate excavation and placement of future stormwater pipe. It should be noted that organic soils (A-8) may be present at the outfall pipe location. GEC has provided recommendations for temporary excavations, dewatering and pipe bedding, backfill and compaction in the following report sections.
- **Site J (Cross Street):** Moderate erosion was observed on the southwest side of the culvert crossing at the top of the ditch in between the pavement and top of berm. Slope stability analyses indicate the ditch side slopes are stable, however, to mitigate the existing erosion and future erosion at the site GEC has provided several remediation alternatives for protection of the existing ditch side slopes in the following report sections.
- **Site K (Queen's Mirror Circle):** Moderate to severe erosion was observed behind the existing retaining wall located on the south ditch bank on the west side of Queen's Mirror Circle. In addition, low to moderate erosion was observed on the other ditch side slopes to the east and west of Queen's Mirror Circle. Existing vegetation on the ditch side slopes is currently providing some level of erosion protection, however, slope stability analyses indicate the ditch side slopes currently exhibit a factor of safety less than the recommended 1.3 for earthen berms. We recommend that the existing erosion behind the existing retaining wall be repaired through the use of excavable flowable fill and that erosion protection be applied to the remaining un-retained side slopes with slopes greater than 1H:2V. GEC has provided several remediation alternatives for protection of the existing ditch side slopes in the following report sections.

- **Site L (Woodstream Lane):** The existing pavement at the project site appeared to be in relatively good condition, with pavement thicknesses ranging from 1.25 to 1.5 inches and a limerock base material with thicknesses ranging from 6.75 to 8 inches. Estimated seasonal high groundwater elevations are estimated to range from +52.5 to +49.0, west to east along the project alignment. If less than 1-foot of vertical separation between the estimated seasonal high groundwater levels and the existing pavement base is present then roadway underdrains are recommended to provide groundwater separation. GEC has provided recommendations for underdrain design in the following report sections.
- **Site O (Secret Way):** The existing pavement at the project site appeared to be in relatively good condition, with pavement thicknesses ranging from 1.875 to 2.625 inches and a soil cement base material with thicknesses ranging from 5.5 to 6.5 inches. Estimated seasonal high groundwater elevations are estimated to range from +53.1 to +53.3, north to south along the project alignment. If less than 1-foot of vertical separation between the estimated seasonal high groundwater levels and the existing pavement base is present then roadway underdrains are recommended to provide groundwater separation. GEC has provided recommendations for underdrain design in the following report sections. In addition, an approximately 1-foot diameter, circular depression and distress to the existing concrete curb was observed on the west side of Secret Way near the edge of pavement across from the culvert outlet into Secret Lake. Manual probing of the depression indicated very loose soil conditions to a depth of 7.5 feet below existing ground surface, which may indicate a joint failure in the pipe near this location that is resulting in washout of the surrounding soils. We recommend excavation of the surrounding soils and repair of the existing pipe to mitigate the depression in this area.
- **Site T (Marigold Road):** The existing pavement at the project site appeared to be in relatively good condition, with pavement thicknesses ranging from 1.875 to 3.25 inches and a soil cement base material with thicknesses ranging from 9 to 14 inches. Estimated seasonal high groundwater elevations are estimated to range from +72.5 to +60.8, west to east along the project alignment. If less than 1-foot of vertical separation between the estimated seasonal high groundwater levels and the existing pavement base is present then roadway underdrains are recommended to provide groundwater separation. GEC has provided recommendations for underdrain design in the following report sections.
- **Site U (Sunset Drive):** The existing pavement at the project site appeared to be in relatively good condition and no noticeable signs of pavement distress or pipe joint failure were observed during GEC's reconnaissance of this site. Organic soils (8% organic content) were encountered at a depth of 2 to 4 feet at boring location SPT-U-2, however, the organic content was relatively low and no noticeable signs of settlement due to organic soils were observed on site. However, moderate to severe erosion was observed behind

the existing culvert headwall and wing walls. To mitigate the existing erosion and future erosion at the site GEC has provided several remediation alternatives for protection of the existing ditch side slopes in the following report sections.

- **Site W (Turtle Mound Drive):** The soils encountered at boring location DCP-W-1 predominantly consists of loose to medium dense fine sand and fine sand with silt (SP, SP-SM) to a boring termination depth of 8 feet below the existing ground surface, which appear suitable for support of the future stormwater structure replacement at this site. GEC has provided recommendations for temporary excavations and pipe bedding, backfill and compaction in the following report sections.

6.1 Pipe Bedding, Backfill and Compaction

In general, the soils encountered at the respective boring locations performed for Sites C and W are suitable for use as pipe bedding soil and backfill soil. All fill soils should be selected in accordance with Index 505 of the FDOT Design Standards.

The near-surface soils encountered in our borings classified as fine sand, fine sand with silt (A-3, A-2-4) and silty fine sand (A-2-4) should be treated as Select (S) material. However, the A-2-4 material may retain excess moisture and may be difficult to dry and compact. Therefore, the contractor should be prepared to manipulate the moisture content of unstable subgrade soils as necessary to achieve stability and compaction requirements.

Ideally, pipe bedding and backfill soils should consist of non-plastic sands with less than about 12% fines content and should not contain any significant amount of organic substances (less than 3% by weight) or other deleterious materials. The contractor should adhere to the following recommendations for bedding fill placement and compaction.

- Remove any soft, loose sands/sediments, organic soils and clayey sands, from below the pipe invert elevation, for the full width of the trench and to the depth required to reach suitable bedding soil as described above.

- Compact pipe bedding soil and trench backfill soil to a minimum of 95% of the soil's Modified Proctor maximum dry density to a minimum depth of 6 inches below the bottom of pipe.

- Excavate and shape bedding soils to accommodate pipe "bells," valves, and fittings to completely support each pipe section and help to eliminate point loading conditions.

- Place fill in level lifts no thicker than 12 inches.

- Compact each backfill lift to a minimum of 95% of the soil's modified Proctor maximum dry density as determined by AASHTO T-180 for each lift of fill placed.

- Compaction tests should be performed for each run of pipe between manholes or at least one test per 300 lineal feet, with at least one test at an elevation of 1 foot above the top of pipe. In addition, one test should be run for every foot of backfill from 1 foot above the top of pipe to finished grade elevation.

- Allow an Engineering Technician, working under the direction of a registered Geotechnical Engineer, to perform in-place density tests to verify that the recommended degree of compaction has been achieved.

Install sheeting and bracing… if required, to support the sides of excavations during utility installation.

- Install sheeting and bracing or properly designed trench shields, if required, to support the sides of excavations during utility installation.

- All excavations including utility trenches, should comply with the recommendations included in the **Temporary Excavations** section of this report.

- Where utility lines will traverse roadways and/or other permanent structures, such as sidewalks, the backfill should be compacted to 98% of the soil's Modified Proctor maximum dry density for a depth of 2 feet below ground surface.

6.2 Earth Pressure on Shoring and Bracing

If temporary shoring and bracing is required for any excavations at the project sites, the system should be designed to resist lateral earth pressure. The design earth pressure will be a function of the flexibility of the shoring and bracing system. For a flexible system restrained laterally by braces placed as the excavation proceeds, the design earth pressure for shoring and bracing can be computed using a uniform earth pressure distribution with depth. It is recommended that well points or other appropriate methods be used to dewater around the excavations. For such dewatered excavations, we recommend using the following uniform pressure distribution over the full braced height as follows:

Uniform Soil Pressure Distribution, $p = 0.65\ K_a \gamma_s H$

Where: p = uniform pressure distribution for design of braced excavation
K_a = coefficient of active earth pressure = 0.33
γ_s = unit weight of saturated soils = 115 pcf
H = depth of excavation

An appropriate factor of safety should be applied for the design of the braced excavations.

Lateral pressure distributions determined in accordance with the above do not take hydrostatic pressures or surcharge loads into account. To the extent that such pressures and forces may act on the walls, they should be included in the design.

Construction equipment and excavated fill should be kept a minimum distance of 5 feet from the edge of the braced or shored excavation. Backfill material placed adjacent to (5 feet away from) the braced or shored excavation should have a minimum slope of 2H:1V.

6.3 Roadway Underdrains

...we recommend our seasonal high groundwater levels be reviewed with respect to the surveyed pavement grades to evaluate if roadway underdrains are required for project sites L, O and T.

Roadway underdrains are typically recommended along roadway alignments where the estimated seasonal high groundwater levels are within one foot of the bottom of the base elevation. Therefore, we recommend our seasonal high groundwater levels be reviewed with respect to the surveyed pavement grades to evaluate if roadway underdrains are required for project sites L, O and T.

GEC recommends FDOT Type 1, 6-inch underdrains be utilized on both sides of the roadway… where groundwater levels are within one foot of the bottom of the base elevation. Roadway underdrains should be placed at least 24 inches below the bottom of the base…

If less than one foot of vertical clearance is present between the existing roadway base and the seasonal high groundwater levels then roadway underdrains should be installed to protect the pavement section from groundwater inundation. To provide a recommended underdrain section and minimum invert embedment depth GEC used the Ellipse Equation and the subsurface data gathered during our subsurface investigation to calculate groundwater drawdown. Based on the results of our calculations, GEC recommends FDOT Type 1, 6-inch underdrains be utilized on both sides of the roadway along the project alignments where groundwater levels are within one foot of the bottom of the base elevation. Roadway underdrains should be placed at

least 24 inches below the bottom of the base at the edge of the existing pavement. This design will allow the separation between the bottom of the base and the wet season water table to be at least 1-foot for the entire width of the pavement. The underdrain should be installed in accordance with FDOT Standard Indices 286 and 500.

6.4 Ditch Slope Stability

GEC performed a global slope stability analysis, using the computer model STEDwin 2.86, for the existing ditch/canal side slopes at Sites J and K, using soil parameters developed from our borings (SPT-J-1 and SPT-K-1) and the ditch geometry depicted from survey data.

We recommend regarding side slopes at Site K to a maximum slope of 1H:2V and the application of an erosion protection system as detailed in the following report section.

The results of our analysis indicate the existing ditch slopes at Site J achieve a factor of safety greater than 1.3 for overall stability, which is appropriate for this earthen slope. However, our analyses for Site K indicate a factor of safety of 1.2 for earthen side slopes along the ditch alignment with side slopes greater than 1H:2V. We recommend regarding side slopes at Site K to a maximum slope of 1H:2V and the application of an erosion protection system as detailed in the following report section. Depending on site right-of-way limits a retaining wall system may be required to facilitate stable side slopes.

Results of our stability analysis for the existing ditch slopes are included in the **Appendix.**

6.5 Erosion Protection

The need for erosion protection is typically seen in areas with conditions of exposed soils and sloped topography such as earthen slopes, channels, creeks and canals. The migration of soil particles away from such facilities are typically attributed to loose soils and the flow of water from surface runoff and/or a sheet flow condition in a drainage system. In order, to maintain the integrity and performance of a facility with erosional concerns, appropriate mitigation techniques are required. The following erosion mitigation alternatives are typical for Florida's soil conditions:

- **Option A - Rip Rap/Rock Armor:** Use of a concrete rubble, limerock or granite matrix, fabric formed concrete or concrete articulating block mats along the existing ditch side slopes. The rip rap/rock armor option will absorb and deflect the energy imparted by debris and the flow of water along the channel slopes as well as protect soil from erosion in areas of concentrated runoff. Depending on the anticipated channel flow speeds and aesthetic requirements for the project site, several rip rap/rock armor mitigation alternatives are available. Typically this mitigation alternative has lower maintenance

requirements as it is not reliant on vegetation to function but may be considered aesthetically appropriate for use in residential areas. In addition, with a rubble, limerock or granite matrix rip rap, localized, smaller erosion paths may still be present on the upslope of channel banks depending on the placement of the rip rap material.

- **Option B - High Performance Turf Reinforcement Mat System (HPTRM):** For this alternative ditch side slopes are re-graded, filled and compacted prior to placement of the High Performance Turf Reinforcement Mat System. Earth anchors are nailed into a deep competent soil stratum along the side slopes of the ditch to keep the blanket in place. Vegetation can be added by seeding under the HPTRM or sodding above the system for added rigidity and appearance. Typically a minimum side slope of 1H:2V is recommended for this mitigation alternative. This mitigation alternative provides good side slope protection but may not be appropriate for high channel flow conditions. In addition, this vegetated mitigation alternative is typically more aesthetically appropriate for residential areas.
- **Option C - Perforated Geoweb System:** This alternative consists of a flexible, three-dimensional cellular confinement system of HDPE material in a honeycomb panel. This system would be placed along the ditch slopes and filled with free draining soils. The outer cells of the Geoweb system is typically vegetated above the mean high water level and filled with concrete or gravel down below the mean high water level. The use of this system provides improved benefits of lateral drainage and adaptability in areas with limited space. Selection of this option will have aesthetic qualities; however, it will be more costly than Option B.
- **Option D – Vegetated Bag / Geotextile Reinforced Stacked Slope / Gabion Baskets:** Appropriate for areas where limited right-of-way require more vertical side slopes these alternatives provided erosion protection for side slopes as steep as 1H:1V. Alternatives are available for both vegetated and hard surfaces depending on site requirements. Due to the steeper side slopes additional slope stability analyses are typically required for design of these systems.
- **Option E – Flowable Fill:** Where erosion damage has occurred in areas of limited access (i.e. behind retaining walls or around pipes) flowable fill facilities filling the voids that may otherwise be difficult to backfill. Typically, the remaining overlying soils at the subsurface cavity/void feature are removed to fully expose the cavity and allow visual observation of the feature and adequate access for placement of material to fill the remaining void. Excavatable flowable fill in accordance with FDOT Section 121 Standard Specifications for Road and Bridge Construction is recommended to fill the remaining cavity left by site erosion. Flowable fill is a cement product and will therefore be more resilient to future surface runoff in the area than site soils.

Based on our site observations and the results of our subsurface investigation the following erosion mitigation measures are recommended for consideration at the reference project sites:

Table 11
Summary of Erosion Mitigation Recommendations

Project Site	Observed Erosion Issue	*Recommended Erosion Mitigation
Site J (Cross Street)	Washout on southwest side of the culvert crossing at the top of the ditch in between the pavement and top of berm	A / B
Site K (Queen's Mirror Circle)	Moderate to severe erosion behind the existing retaining wall	E
	Un-retained, vegetated side slopes with slopes greater than 1H:2V and low to moderate erosion	A / B / C / D
Site O (Secret Way)	An approximately 1-foot diameter, circular depression and distress to the existing concrete curb on the west side of Secret Way near the edge of pavement across from the culvert outlet into Secret Lake. Manual probing of the depression indicated very loose soil conditions to a depth of 7.5 feet below existing ground surface, which may indicate a joint failure in the pipe near this location that is resulting in washout of the surrounding soils.	**
Site U (Sunset Drive)	Moderate to severe erosion behind the existing culvert headwall and wing walls	A / E

* Refer to erosion mitigation alternative descriptions above for addition details regarding each alternative.

** We recommend further investigation of the existing pipeline at this location to confirm if the soil subsidence is caused by a leak in the storm pipe in this area. Repair of the pipeline and backfill of the depression with compacted fill is our recommended remediation if the pipeline is leaking.

GEC would also be pleased to discuss these alternatives with Singhofen & Associates and the City to help determine the best option considering the City's budget and expectations. In addition, selection of an appropriate erosion mitigation alternative is dependent on channel/surface runoff flow and should be coordinated with the project Drainage Engineer to evaluate water flow conditions on site.

7.0 CONSTRUCTION ISSUES

The following sections of this report include comments on issues related to the geotechnical aspects of the proposed construction. *These recommendations are not intended to dictate construction methods or sequences.* Instead, they are furnished as an aid to design professionals and to identify important construction issues related to foundation and earthwork plans and specifications. These recommendations may also be useful to personnel who observe construction activity.

Prospective contractors for this project should evaluate potential construction problems on the basis of their review of the contract documents, their own knowledge and experience in the local area, and on the basis of similar projects in other localities, taking into account their own proposed means and methods.

7.1 Temporary Dewatering

Depending on groundwater levels at the time of construction, excavation depths and final design grades, temporary dewatering may be required to facilitate stable excavations and placement and compaction of fill. The contractor should be required to provide a dewatering system which maintains groundwater levels at least 2 feet below compaction surfaces, including the bottom of all excavations. A system of ditches and sumps may be sufficient in some instances to achieve adequate dewatering, but the contractor should be prepared to install wellpoint dewatering systems as necessary.

Additionally, the contractor must provide positive site drainage during the site preparation and fill placement. Surface runoff should not be allowed to accumulate. Temporary rim ditches may be required to facilitate site preparation.

7.2 Temporary Excavations

The owner and the contractor should be familiar with local, state and federal safety regulations, including current Occupational Safety and Health Administration (OSHA) excavation and trench safety standards. Construction site safety is the responsibility of the contractor. The contractor should also be responsible for the means, methods, techniques, sequences, and operations of the construction.

The contractor should be aware that slope height, slope inclination, and excavation depths (including utility trench excavations) should not exceed those specified in local, state, or federal safety regulations; e.g., OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926. *OSHA*

regulations are strictly enforced and, if not followed, the owner, contractor, earthwork subcontractor or utility subcontractor could be liable for substantial penalties.

The soil encountered in the borings performed by GEC at this site is primarily sand with varying amounts of silt. We anticipate that OSHA will classify these materials as Type C. OSHA recommends a maximum temporary slope inclination of 1.5 horizontal to 1 vertical for this soil type. Soils encountered in the construction excavations may vary significantly across the site. Our soil classifications are based on the materials encountered in widely-spaced borings. The contractor should verify that similar conditions exist throughout the proposed excavation area. If different subsurface conditions are encountered at the time of construction, GEC should be contacted immediately to evaluate the conditions encountered.

Since excavations will be required in the vicinity of existing facilities, the contractor should be required to provide temporary support…

Since excavations will be required in the vicinity of existing facilities, the contractor should be required to provide temporary support of pavements, underground utilities and structures adjacent to excavations. A facility condition survey should be performed prior to construction and movements or vibrations should be monitored in nearby structures during construction activities. This survey should document the nature and existing condition of the existing buildings and roadways adjacent to the site that could potentially be impacted by the proposed construction. Prior to performing the work, the contractor should provide a plan to the Engineer of Record for temporary support of existing facilities and for condition monitoring during construction.

8.0 USE OF THIS REPORT

GEC has prepared this report for the exclusive use of our client, Singhofen & Associates, and for specific application to our client's project. GEC will not be held responsible for any third party's interpretation or use of this report's subsurface data or engineering analysis without our written authorization.

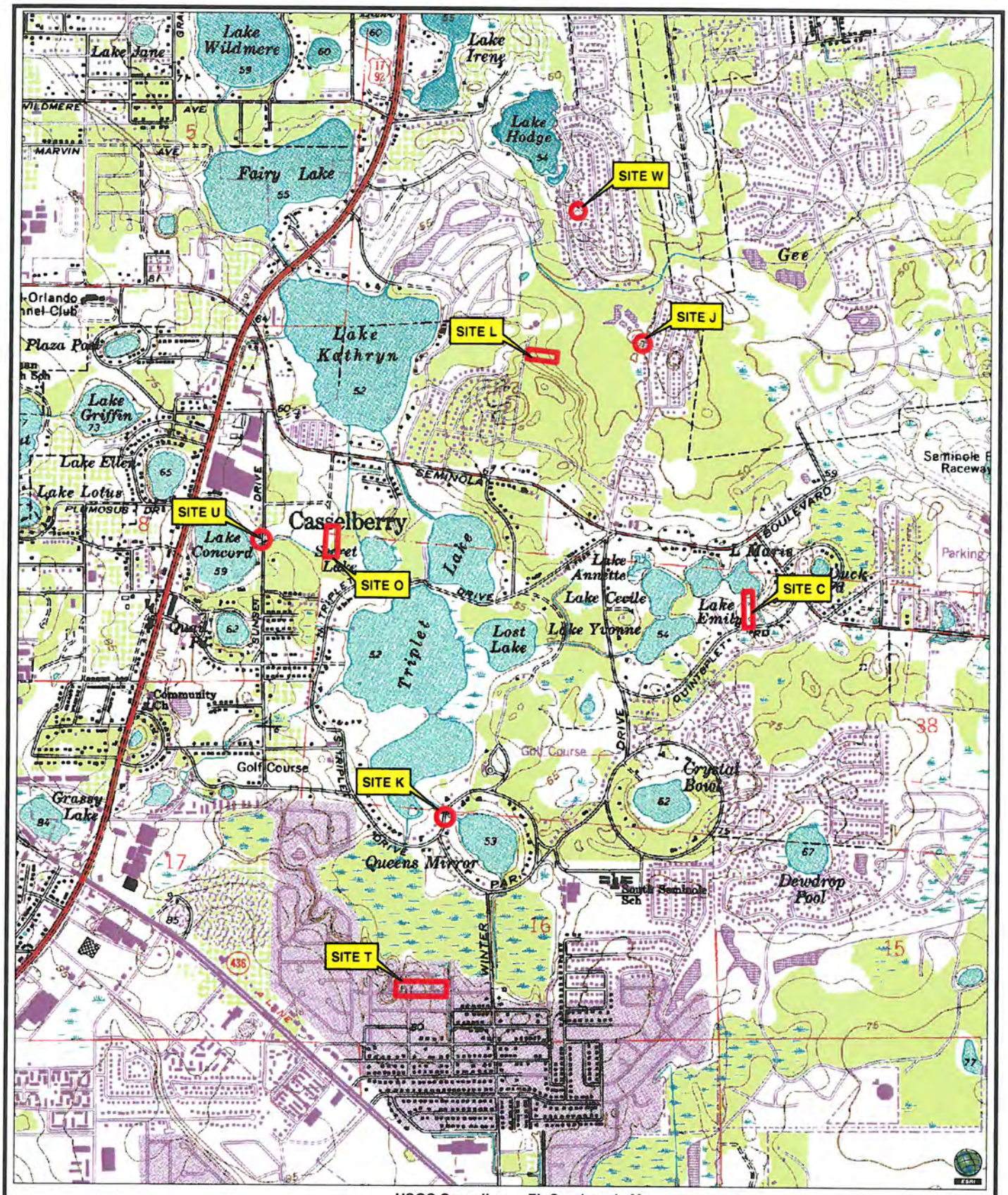
The sole purpose of the borings performed by GEC at this site was to obtain indications of subsurface conditions as part of a geotechnical exploration program. GEC has not evaluated the site for the potential presence of contaminated soil or groundwater, nor have we subjected any soil samples to analysis for contaminants.

GEC has strived to provide the services described in this report in a manner consistent with that level of care and skill ordinarily exercised by members of our profession currently practicing in Central Florida. No other representation is made or implied in this document.

The conclusions or recommendations of this report should be disregarded if the nature, design, or location of the facilities is changed. If such changes are contemplated, GEC should be retained to review the new plans to assess the applicability of this report in light of proposed changes.

APPENDIX

USGS QUADRANGLE MAP



USGS Casselberry, FL Quadrangle Map

SECTIONS: 4 (W) / 8 (O, U) / 9 (J, L) / 10 (C) / 16 (K, T)
TOWNSHIP: 21 SOUTH
RANGE: 30 EAST

0 1,000 2,000
Feet

N W E S

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GEC

PROJECT NO.	3738G
DATE	10/16/2015
DRAWN BY	SKR
CHECKED BY	CGB 71571
CHECKED BY	CGB 71571

USGS QUADRANGLE MAP

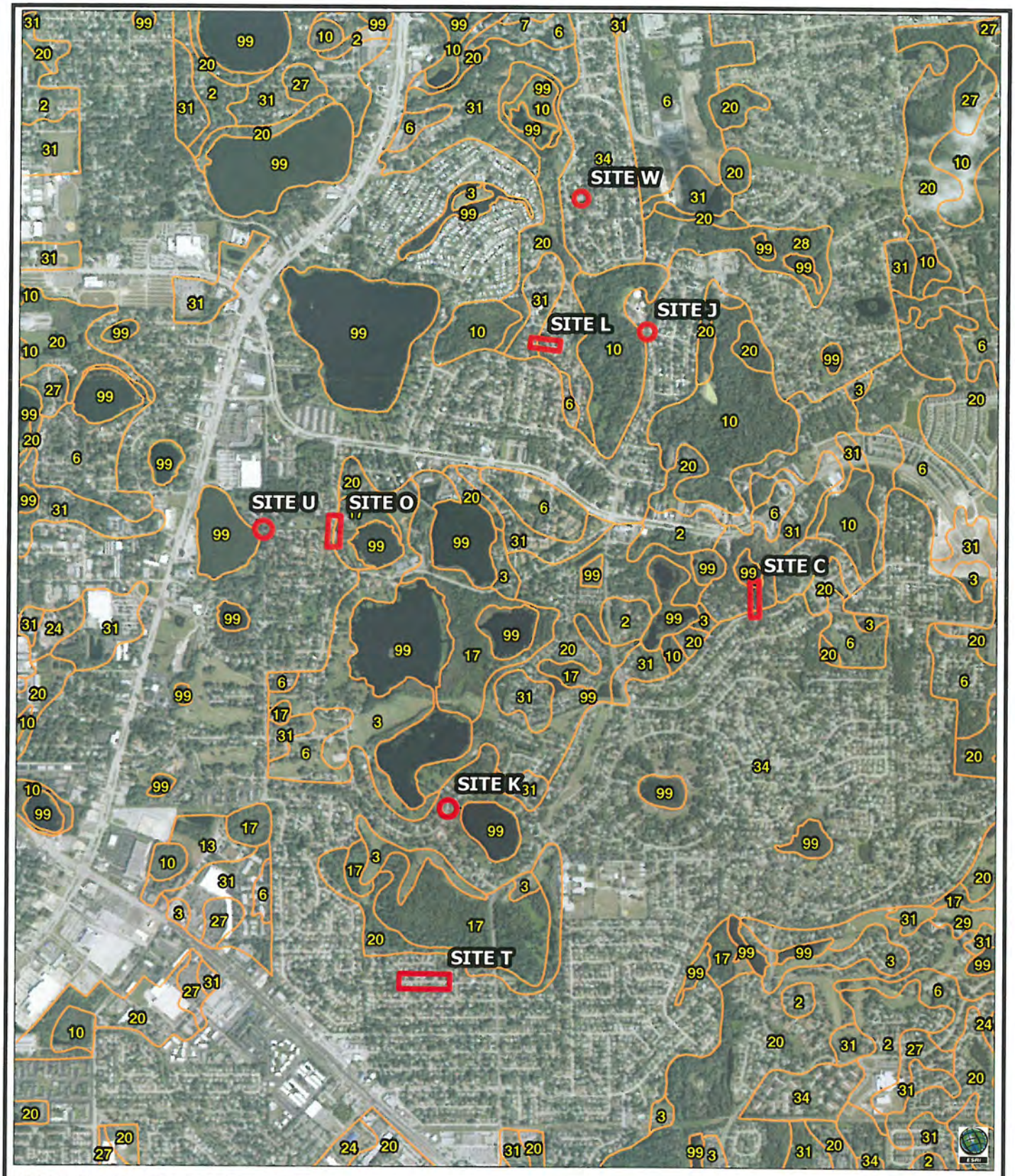
CITY OF CASSELBERRY
STORM DRAIN REHABILITATION

FIGURE NO.

1

J:\D114\3738G Casselberry Storm Drain Rehab\3738G quad.mxd 10/16/2015

NRCS SOIL SURVEY MAP



NRCS Soil Survey of Seminole County, FL
Seminole County Map Unit Legend
17 - Brighton, Samsula, and Sanibel mucks
20 - Myakka and EauGallie fine sands
31 - Tavares-Millhopper fine sands, 0 to 5 percent slopes
34 - Urban land

0 1,000 2,000
Feet

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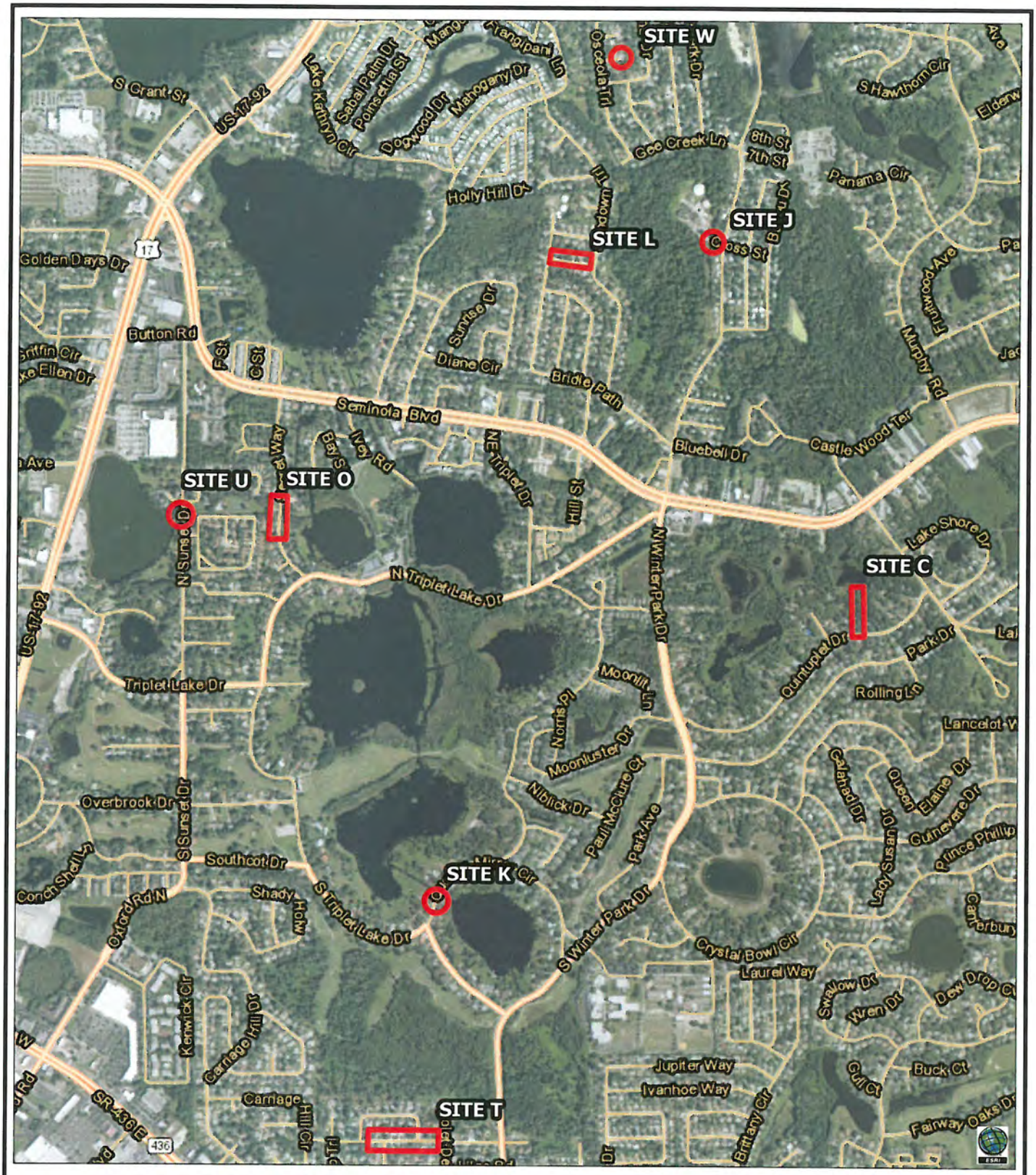
NRCS SOIL SURVEY MAP

CITY OF CASSELBERRY
STORM DRAIN REHABILITATION

FIGURE NO.
2

J:\D114\3738G Casselberry Storm Drain Rehab\3738G soils.mxd 10/16/2015

SITE LOCATION PLAN



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SITE LOCATION PLAN

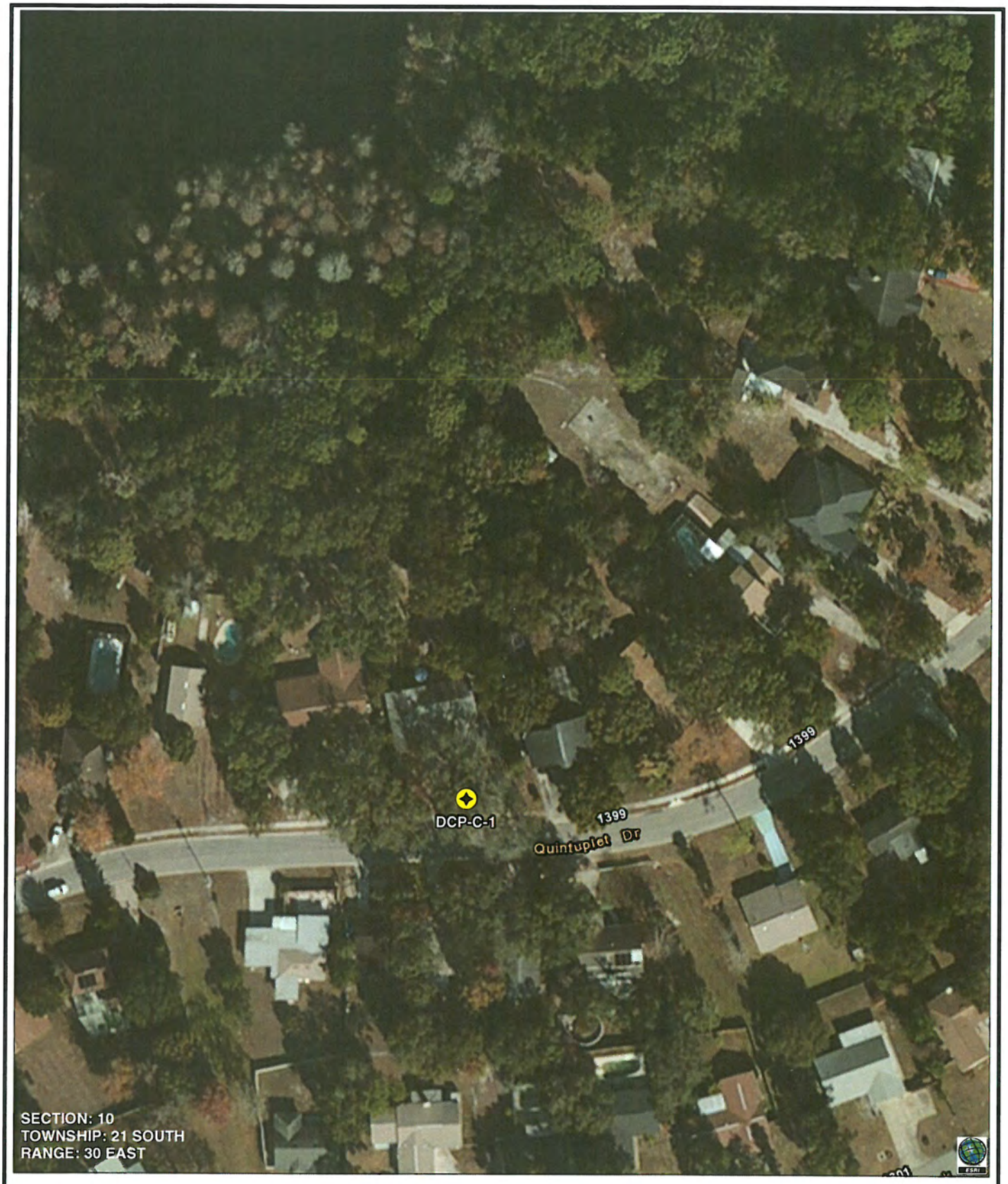
CITY OF CASSELBERRY
STORM DRAIN REHABILITATION

FIGURE NO.

3

J:\D114\3738G Casselberry Storm Drain Rehab\3738G Locations.mxd 10/16/2015

BORING, CORING AND MUCK PROBE LOCATION PLANS



APPROXIMATE DYNAMIC CONE PENETROMETER LOCATION

0 50 100
Feet

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SITE C BORING LOCATION PLAN
CITY OF CASSELBERRY
STORM DRAIN REHABILITATION
QUINTUPLET DRIVE

FIGURE NO.
4A

J:\D114\3738G Casselberry Storm Drain Rehab\3738G SITE C.mxd 10/6/2015

STANDING WATER DEPTH (FT.)

(0.0 | 0.5)

SURFICIAL MUCK THICKNESS (FT.)

APPROXIMATE SPT BORING LOCATION

APPROXIMATE MUCK PROBE LOCATION (PERFORMED ON (4-1-15)

0 30 60
Feet

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PROJECT NO.	3738G
DATE	10/6/2015
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SITE J BORING AND MUCK PROBE LOCATION PLAN WITH PROBE RESULTS

CITY OF CASSELBERRY
STORM DRAIN REHABILITATION
CROSS STREET

FIGURE NO.

4B

J:\D114\3738G Casselberry Storm Drain Rehab\3738G SITE J.mxd 10/6/2015

STANDING WATER DEPTH (FT.)

APPROXIMATE SPT BORING LOCATION

(0.0 | 0.5) APPROXIMATE MUCK PROBE LOCATION (PERFORMED ON (4-1-15)

SURFICIAL MUCK THICKNESS (FT.)

0 25 50
Feet

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PROJECT NO.	3738G
DATE	10/16/2015
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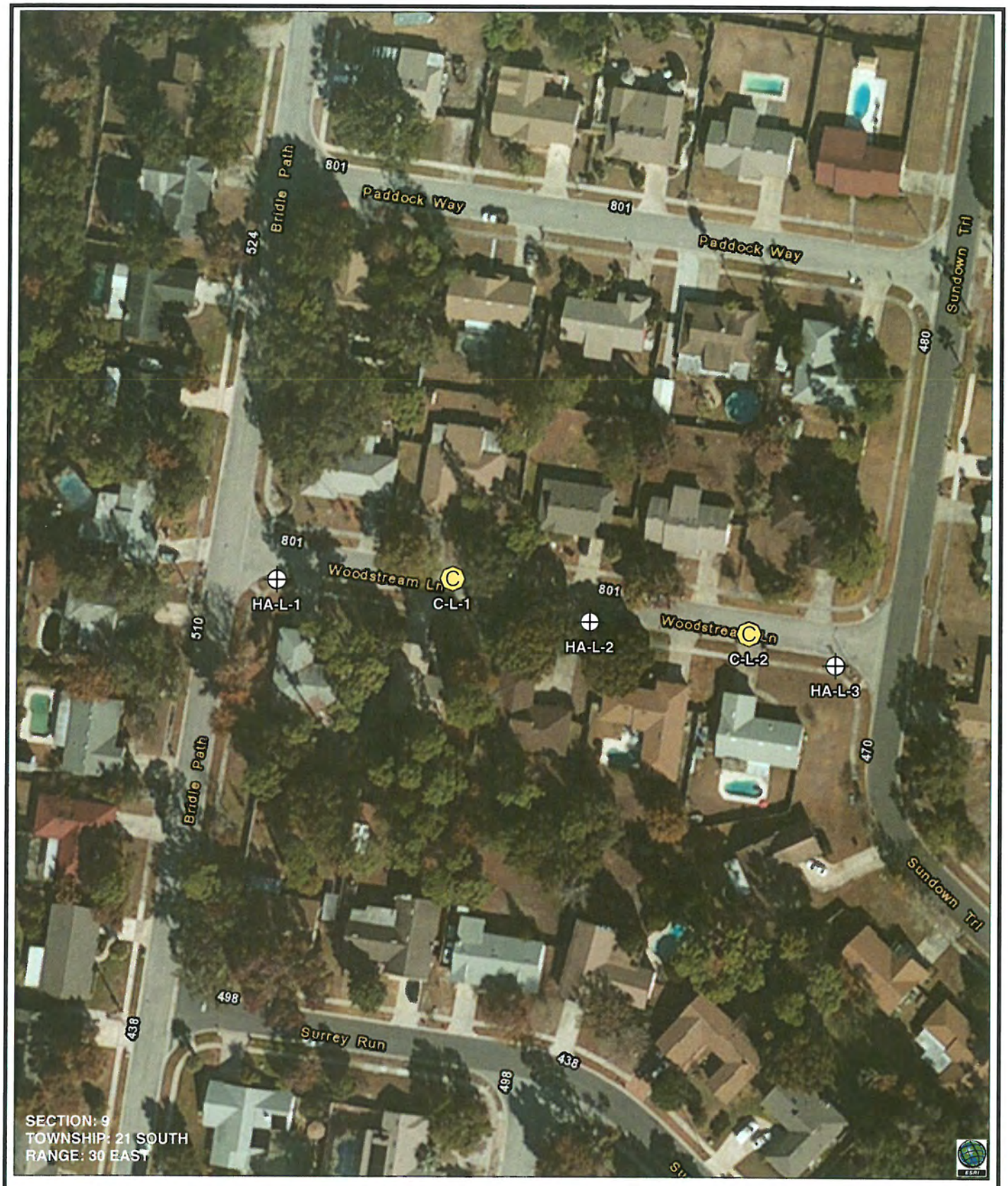
SITE K BORING AND MUCK PROBE LOCATION PLAN WITH PROBE RESULTS
CITY OF CASSELBERRY
STORM DRAIN REHABILITATION
QUEEN'S MIRROR CIRCLE

FIGURE NO.
4C

J:\D114\3738G Casselberry Storm Drain Rehab\3738G SITE K.mxd 10/16/2015



APPROXIMATE HAND AUGER BORING LOCATION

APPROXIMATE PAVEMENT CORE LOCATION

0 50 100
Feet

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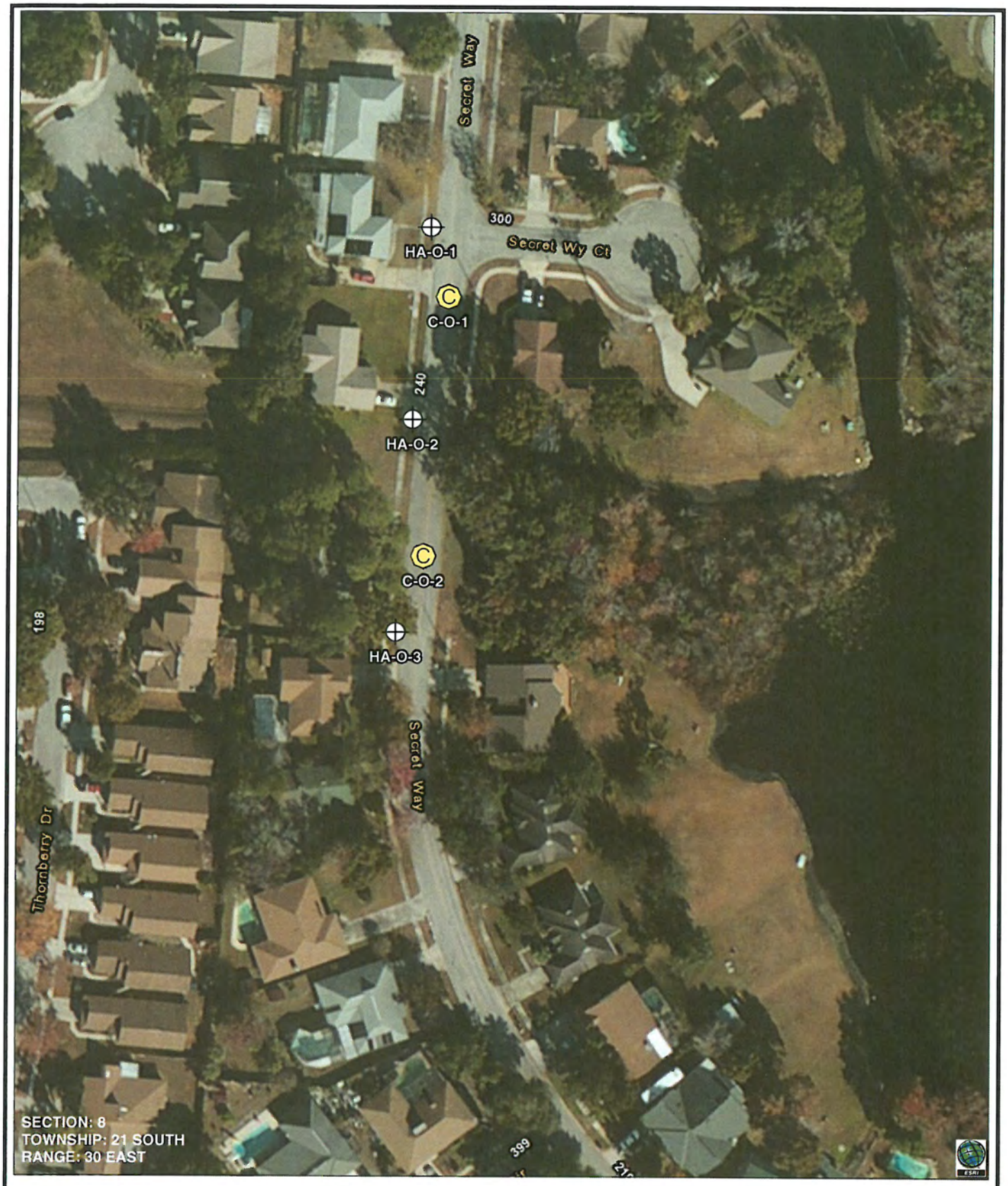
SITE L BORING AND CORING LOCATION PLAN
CITY OF CASSELBERRY
STORM DRAIN REHABILITATION
WOODSTREAM LANE

FIGURE NO.
4D

J:\D114\3738G Casselberry Storm Drain Rehab\3738G SITE L.mxd 10/6/2015



APPROXIMATE HAND AUGER BORING LOCATION

APPROXIMATE PAVEMENT CORE LOCATION

0 50 100
Feet

N W E S

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PROJECT NO.	3738G
DATE	10/6/2015
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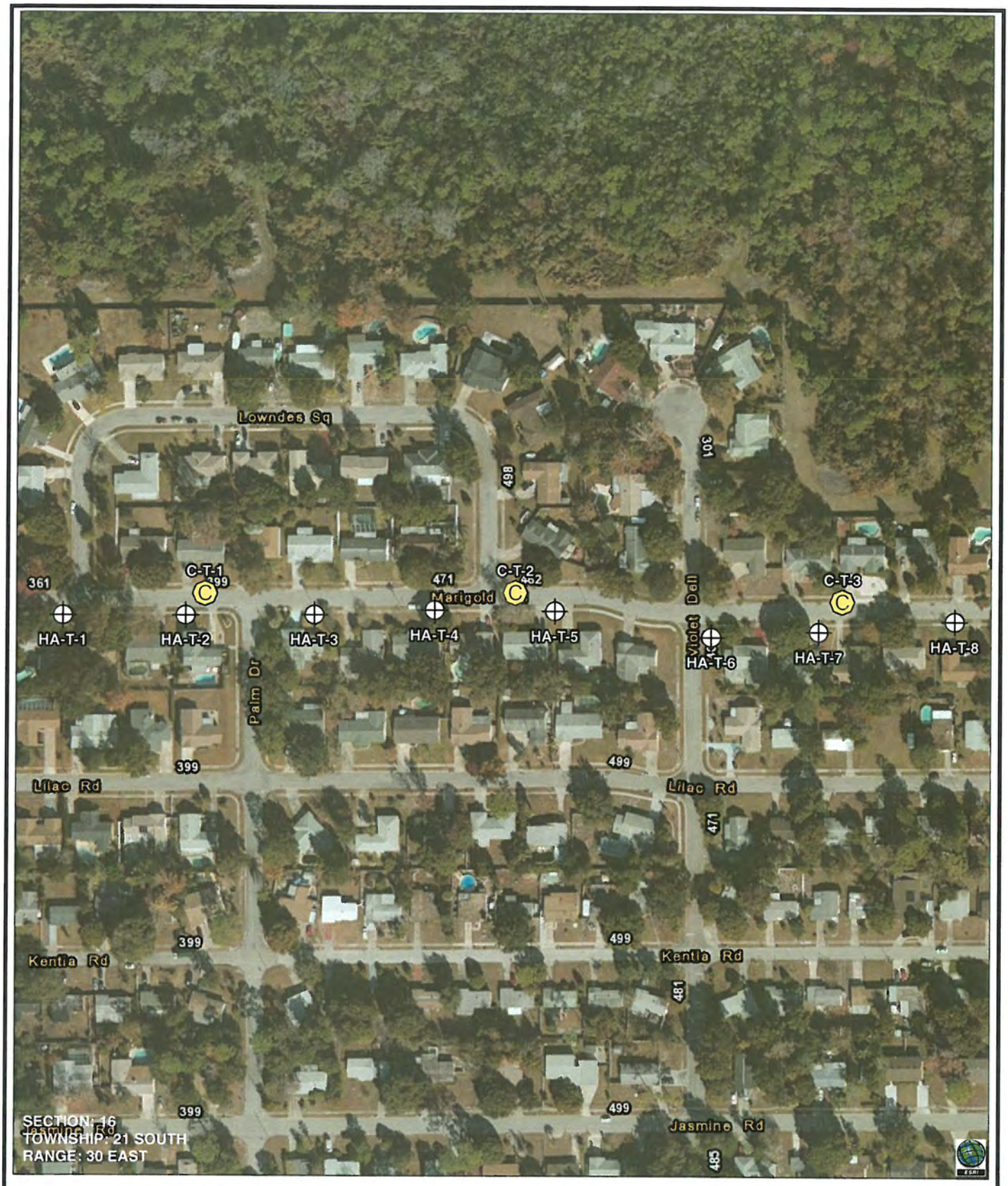
SITE O BORING AND CORING LOCATION PLAN
CITY OF CASSELBERRY
STORM DRAIN REHABILITATION
SECRET WAY

FIGURE NO.
4E

J:\D114\3738G Casselberry Storm Drain Rehab\3738G SITE O.mxd 10/6/2015



APPROXIMATE HAND AUGER BORING LOCATION

APPROXIMATE PAVEMENT CORE LOCATION

0 100 200
Feet

N W E S

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SITE T BORING AND CORING LOCATION PLAN
CITY OF CASSELBERRY
STORM DRAIN REHABILITATION
MARIGOLD ROAD

FIGURE NO.
4F

J:\D114\3738G Casselberry Storm Drain Rehab\3738G SITE T.mxd 10/6/2015

STANDING WATER DEPTH (FT.)

(0.0 | 0.5)

SURFICIAL MUCK THICKNESS (FT.)

APPROXIMATE SPT BORING LOCATION

APPROXIMATE MUCK PROBE LOCATION (PERFORMED ON (4-1-15)

0 25 50
Feet

N W E S

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PROJECT NO.	3738G
DATE	10/16/2015
DRAWN BY	SKR
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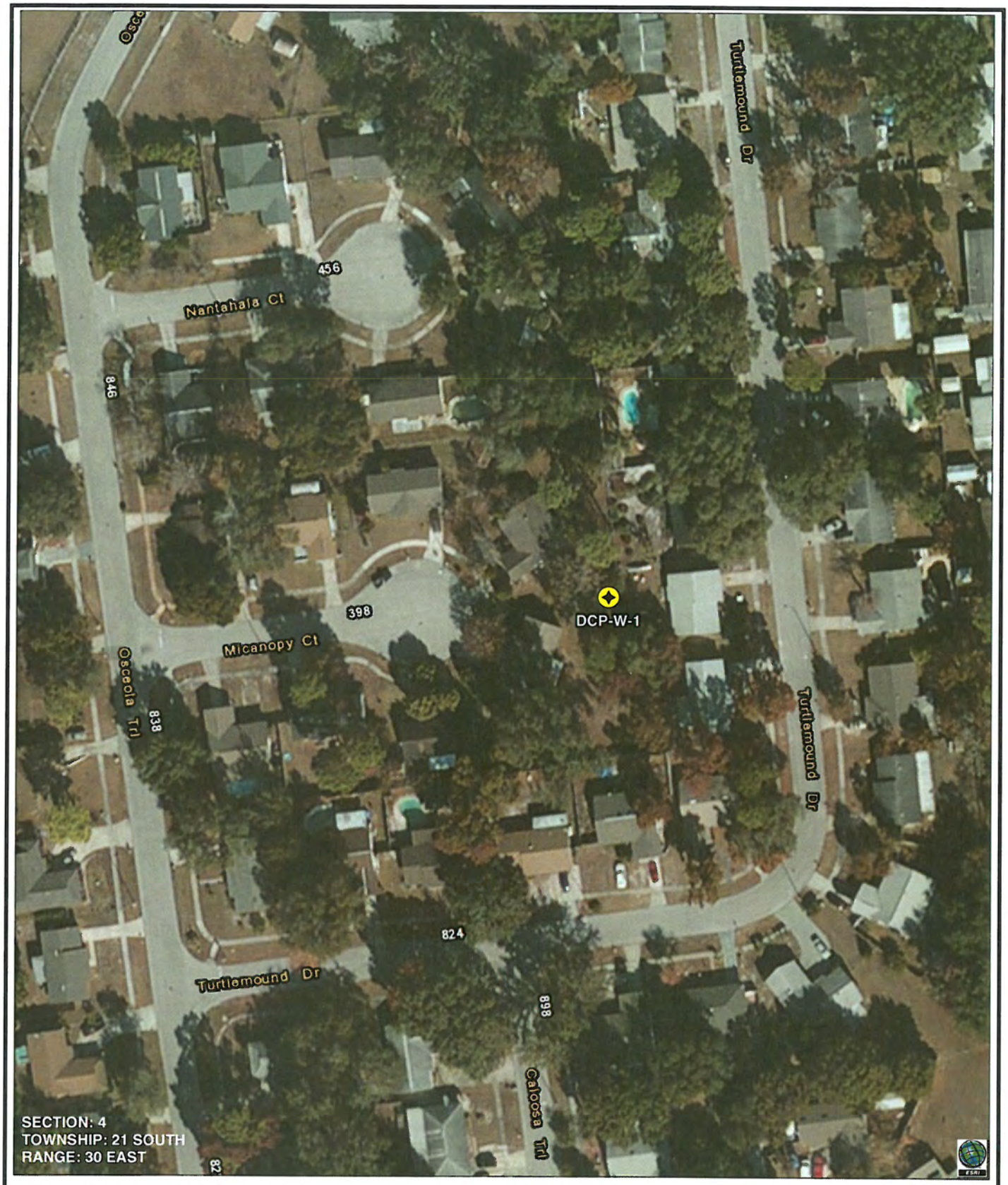
SITE U BORING AND MUCK PROBE LOCATION PLAN WITH PROBE RESULTS

CITY OF CASSELBERRY
STORM DRAIN REHABILITATION
SUNSET DRIVE

FIGURE NO.

4G

J:\D114\3738G Casselberry Storm Drain Rehab\3738G SITE U.mxd 10/16/2015



APPROXIMATE DYNAMIC CONE PENETROMETER LOCATION

0 50 100
Feet

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DATE	10/6/2015
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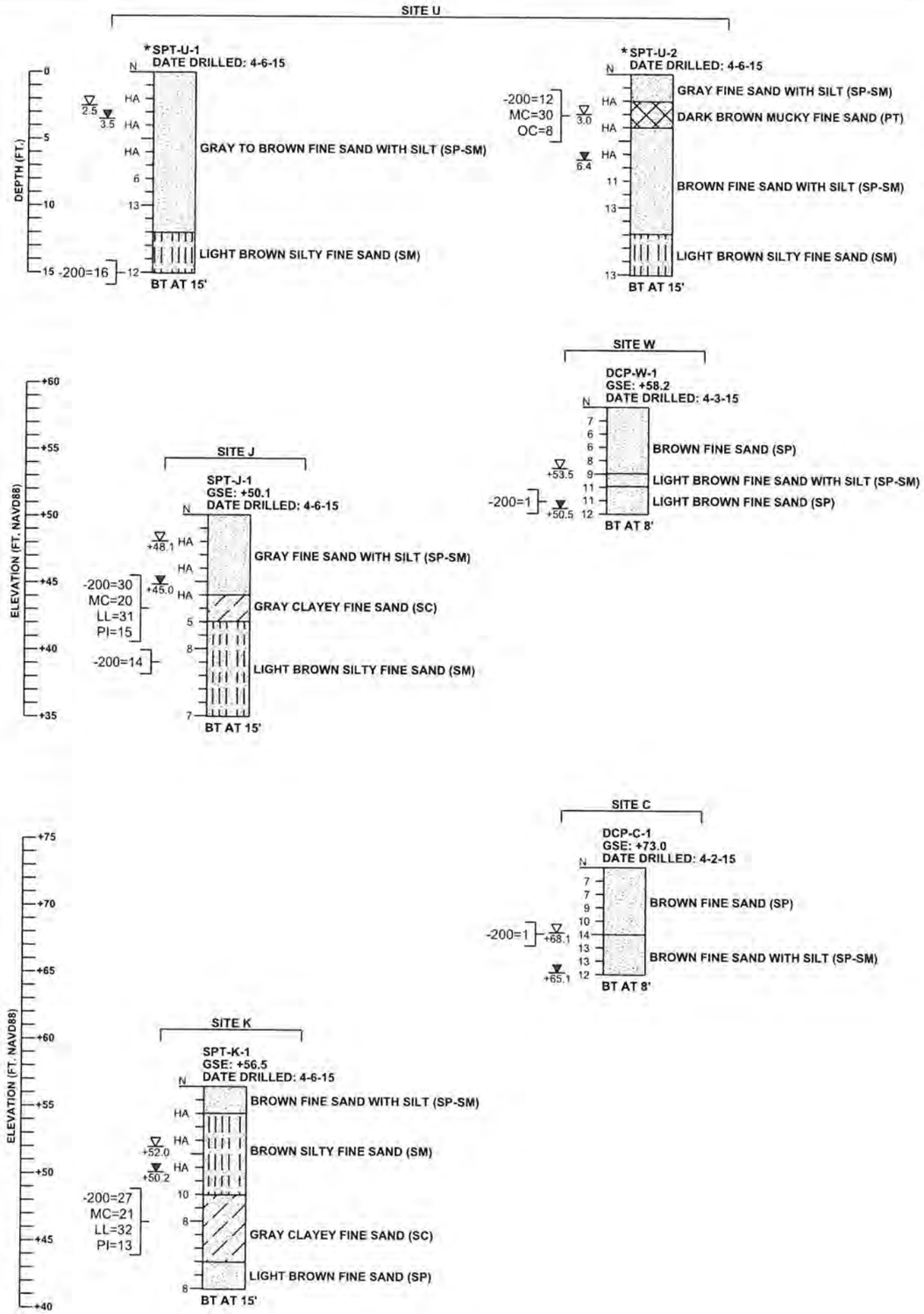
SITE W BORING LOCATION PLAN
CITY OF CASSELBERRY
STORM DRAIN REHABILITATION
TURTLE MOUND DRIVE

FIGURE NO.
4H

J:\D114\3738G Casselberry Storm Drain Rehab\3738G SITE W.mxd 10/6/2015

BORING RESULTS



LEGEND

GSE	GROUND SURFACE ELEVATION (FT. NAVD88)
+48.1	ESTIMATED SEASONAL HIGH GROUNDWATER ELEVATION (FT. NAVD88)
+45.0	ENCOUNTERED GROUNDWATER ELEVATION (FT. NAVD88) 24 HRS. AFTER DATE DRILLED
2.5	ESTIMATED SEASONAL HIGH GROUNDWATER DEPTH (FT.)
3.5	ENCOUNTERED GROUNDWATER DEPTH (FT.) 24 HRS. AFTER DATE DRILLED
N	STANDARD PENETRATION RESISTANCE, BLOWS PER FOOT
HA	HAND AUGERED FOR UTILITY CLEARANCE
BT	BORING TERMINATED AT DEPTH INDICATED
-200=	PERCENT PASSING NO. 200 U.S. STANDARD SIEVE
MC=	PERCENT NATURAL MOISTURE CONTENT
LL=	LIQUID LIMIT
PI=	PLASTICITY INDEX
OC=	PERCENT ORGANIC CONTENT

SAND — SAND AND CLAY — SAND AND SILT — SAND AND MUCK

GENERAL NOTES

SUBSURFACE CONDITIONS SHOWN ON THE BORINGS REPRESENT THE CONDITIONS ENCOUNTERED AT THE BORING LOCATIONS. ACTUAL CONDITIONS BETWEEN THE BORINGS MAY VARY FROM THOSE SHOWN. UNIFIED SOIL CLASSIFICATIONS SHOWN ON THE BORINGS ARE BASED ON VISUAL EXAMINATION AND THE LABORATORY TESTING SHOWN.

STANDARD PENETRATION TEST BORINGS WERE PERFORMED IN ACCORDANCE WITH ASTM D-1586. STANDARD PENETRATION RESISTANCES ARE SHOWN ON THE BORINGS AT THE TEST DEPTHS IN IN BLOWS PER FOOT UNLESS OTHERWISE NOTED.

THE BORING LOCATIONS WERE ESTABLISHED IN THE FIELD USING PROJECT PLANS AND A HANDHELD, SUBMETER ACCURACY, GPS UNIT (TRIMBLE GEOXH) AND WERE LATER SURVEYED FOR HORIZONTAL AND VERTICAL CONTROL BY SOUTHEASTERN SURVEYING & MAPPING CORPORATION.

* THE BORING LOCATIONS FOR SITE U WERE NOT SURVEYED.

THE DYNAMIC CONE PENETROMETER (DCP) TEST BORINGS DCP-1 AND DCP-2 WERE PERFORMED IN GENERAL ACCORDANCE WITH "DYMNAMIC CONE FOR SHALLOW IN-SITU PENETRATION TESTING, VANE SHEAR AND CONE PENETRATION TESTING OF IN-SITU SOILS", ASTM STP 377, 1966.

THE "N" VALUES SHOWN FOR THE DCP TEST BORINGS REPRESENT APPROXIMATE STANDARD PENETRATION RESISTANCE, BLOWS PER FOOT CORRELATED FROM MEASURED DCP RESISTANCE, BLOWS PER 1.75 INCHES OF PENETRATION. THE CORRELATION OF DCP TO SPT "N" VALUES IS BASED ON THE CALIBRATION CURVE FOR COASTAL PLAINS SOILS, ASTM SPT 399, 1966.

SPLIT SPOON SAMPLER:
INSIDE DIAMETER: 1.375 IN.
OUTSIDE DIAMETER: 2.0 IN.
AVERAGE HAMMER DROP: 30 IN.
HAMMER WEIGHT: 140 LBS.
HAMMER TYPE: AUTOMATIC

CORRELATION OF STANDARD PENETRATION RESISTANCE WITH RELATIVE DENSITY AND CONSISTENCY OF SOIL

GRANULAR SOILS	SPT AUTOMATIC HAMMER N VALUE (blows per foot)	DCP CORRELATED N VALUE (blows per foot)	RELATIVE DENSITY
SANDS	0-3	0-4	VERY LOOSE
	3-8	4-10	LOOSE
	8-24	10-30	MEDIUM DENSE
	24-40	30-50	DENSE
	OVER 40	OVER 50	VERY DENSE

NON-GRANULAR SOILS	SPT AUTOMATIC HAMMER N VALUE (blows per foot)	DCP CORRELATED N VALUE (blows per foot)	CONSISTENCY
SILTS, CLAYS, MUCK, PEAT	0-1	0-2	VERY SOFT
	1-3	2-4	SOFT
	3-6	4-8	FIRM
	6-12	8-15	STIFF
	12-24	15-30	VERY STIFF
	OVER 24	OVER 30	HARD

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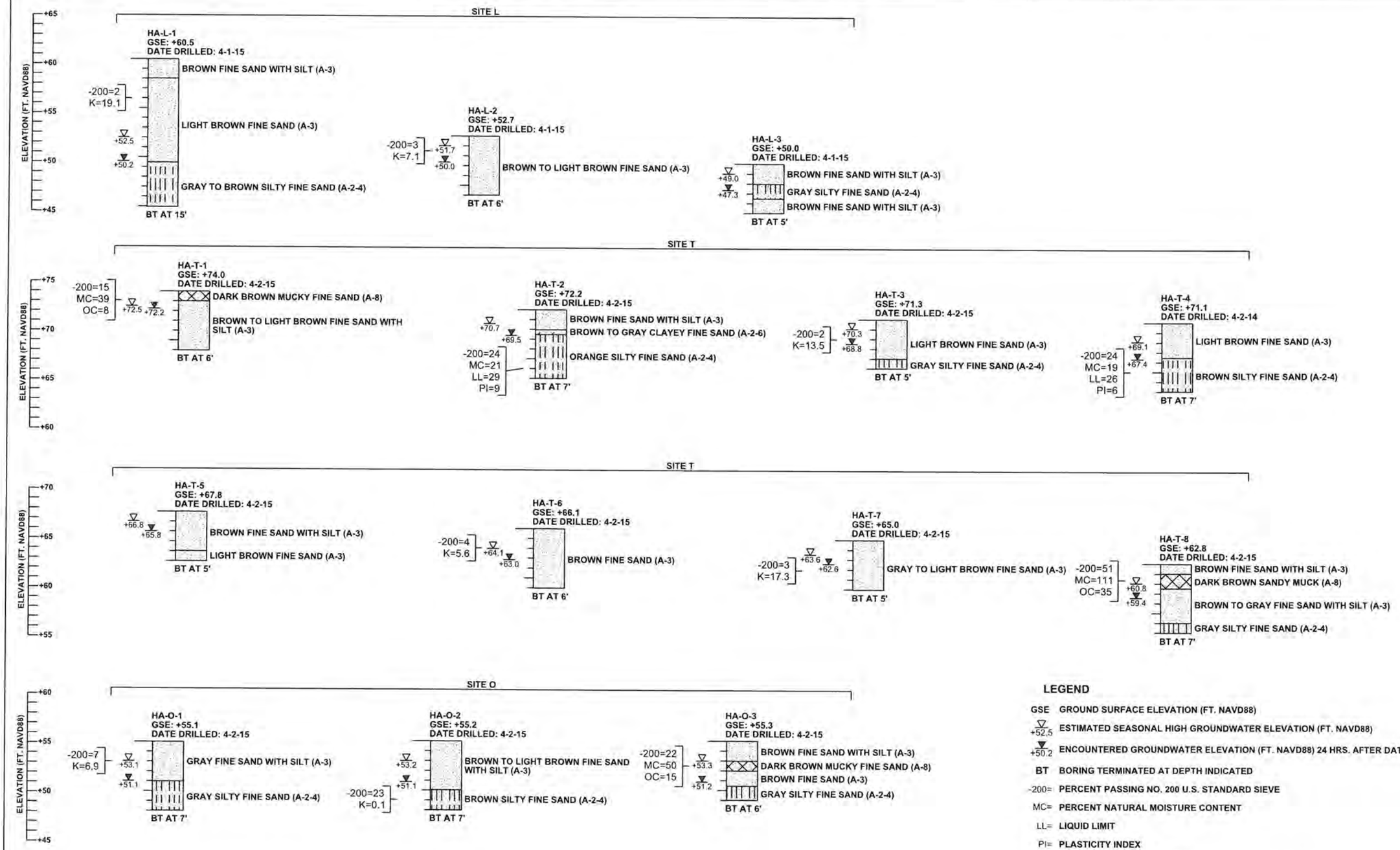
SPT BORING RESULTS

CITY OF CASSELBERRY STORM DRAIN REHABILITATION

FIGURE NO. 5



LEGEND

GSE	GROUND SURFACE ELEVATION (FT. NAVD88)
▽ +52.5	ESTIMATED SEASONAL HIGH GROUNDWATER ELEVATION (FT. NAVD88)
▼ +50.2	ENCOUNTERED GROUNDWATER ELEVATION (FT. NAVD88) 24 HRS. AFTER DATE DRILLED
BT	BORING TERMINATED AT DEPTH INDICATED
-200=	PERCENT PASSING NO. 200 U.S. STANDARD SIEVE
MC=	PERCENT NATURAL MOISTURE CONTENT
LL=	LIQUID LIMIT
PI=	PLASTICITY INDEX
OC=	PERCENT ORGANIC CONTENT
K=	LABORATORY HYDRAULIC CONDUCTIVITY RATE (FT./DAY)

SAND | SAND AND CLAY | SAND AND SILT | SAND AND MUCK

GENERAL NOTES

SUBSURFACE CONDITIONS SHOWN ON THE BORINGS REPRESENT THE CONDITIONS ENCOUNTERED AT THE BORING LOCATIONS. ACTUAL CONDITIONS BETWEEN THE BORINGS MAY VARY FROM THOSE SHOWN. AASHTO SOIL CLASSIFICATIONS SHOWN ON THE BORINGS ARE BASED ON VISUAL EXAMINATION AND THE LABORATORY TESTING SHOWN.

THE BORING LOCATIONS WERE ESTABLISHED IN THE FIELD USING PROJECT PLANS AND A HANDHELD, SUBMETER ACCURACY, GPS UNIT (TRIMBLE GEOXH) AND WERE LATER SURVEYED FOR HORIZONTAL AND VERTICAL CONTROL BY SOUTHEASTERN SURVEYING & MAPPING CORPORATION.

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AUGER BORING RESULTS

CITY OF CASSELBERRY STORM DRAIN REHABILITATION

FIGURE NO. 6

SITE RECONNAISSANCEPHOTOGRAPHIC LOGS

Geotechnical and Environmental Consultants, Inc.

At the very foundation of our community

Photographic Log

Client Name:	Project Name:	Project Location:	GEC Project No.:
Singhofen & Associates, Inc.	City of Casselberry Storm Drain Rehabilitation	Casselberry, Florida	3738G

Photo:	Date:
1	4-2-15

Description:

Site J (Cross Street)

Looking: North

Photo showing current ditch side slopes south of Cross Street, near the City of Casselberry Water Reclamation Facility.

Photo:	Date:
2	4-2-15

Description:

Site J (Cross Street)

Looking: North

Photo illustrates erosion occurrence at the top of ditch in between the pavement and top of berm.

Geotechnical and Environmental Consultants, Inc.

At the very foundation of our community

Photographic Log

Client Name:	Project Name:	Project Location:	GEC Project No.:
Singhofen & Associates, Inc.	City of Casselberry Storm Drain Rehabilitation	Casselberry, Florida	3738G

Photo:	Date:
3	4-2-15

Description:

Site K

(Queen's Mirror Cir.)

Looking: West

Sheet pile seawall located on west side of Queen's Mirror Circle. This drainage canal connects to Triplet Lake.

Photo:	Date:
4	4-2-15

Description:

Site K

(Queen's Mirror Cir.)

Looking: East

Erosion occurrence of soil behind the sheet pile seawall.

Geotechnical and Environmental Consultants, Inc.

At the very foundation of our community

Photographic Log

Client Name:	Project Name:	Project Location:	GEC Project No.:
Singhofen & Associates, Inc.	City of Casselberry Storm Drain Rehabilitation	Casselberry, Florida	3738G

Photo:	Date:
5	4-2-15

Description:

Site L

(Woodstream Lane)

Looking: West

Photo illustrates the repaved asphalt condition along the roadway from Sundown Trail to Bridal Path.

Photo:	Date:
6	4-2-15

Description:

Site O (Secret Way)

Looking: Northeast

Ground subsidence observed on the west side of Secret Way within the right-of-way, in between the drainage canal system on both sides of Secret Way. Pavement and gutter distress is also illustrated in the photo.

Geotechnical and Environmental Consultants, Inc.

At the very foundation of our community

Photographic Log

Client Name:	Project Name:	Project Location:	GEC Project No.:
Singhofen & Associates, Inc.	City of Casselberry Storm Drain Rehabilitation	Casselberry, Florida	3738G

Photo:	Date:
7	4-2-15

Description:

Site U (Sunset Drive)

Looking: East

Photo showing erosion occurrence around the culvert system of surrounding soils.

Photo:	Date:
8	4-2-15

Description:

Site U (Sunset Drive)

Looking: North

Detailed view of erosional impact in between the roadway guardrail and back of culvert.

PAVEMENT CORE PHOTOGRAPHIC LOGS

Geotechnical and Environmental Consultants, Inc.

At the very foundation of our community

Photographic Log

Client Name:	Project Name:	Project Location:	GEC Project No.:
Singhofen & Associates, Inc.	City of Casselberry Storm Drain Rehabilitation	Casselberry, Florida	3738G

Photo:	Date:
1	4-6-15

Description:

Site L

Core location C-L-1

Looking: East

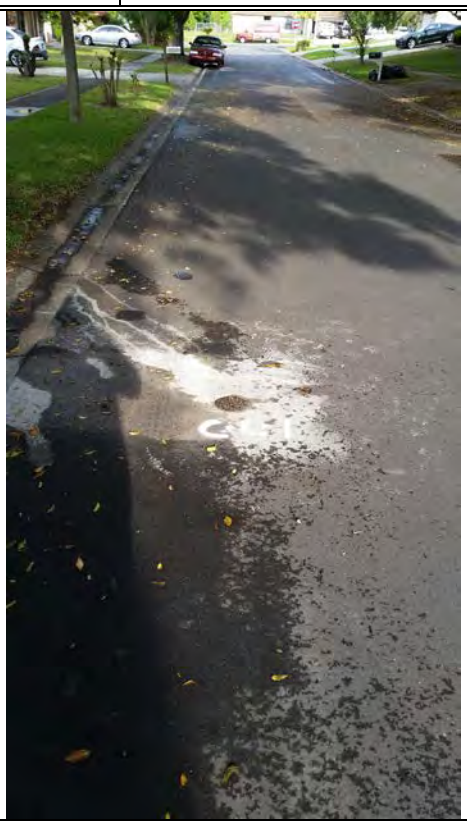

Photo:	Date:
2	4-6-15

Description:

Asphalt Thickness: 1.75”

Base Thickness: 6.75”

Base Type: Limerock

Geotechnical and Environmental Consultants, Inc.

At the very foundation of our community

Photographic Log

Client Name:	Project Name:	Project Location:	GEC Project No.:
Singhofen & Associates, Inc.	City of Casselberry Storm Drain Rehabilitation	Casselberry, Florida	3738G

Photo:	Date:
3	4-6-15

Description:

Site L

Core location C-L-2

Looking: East

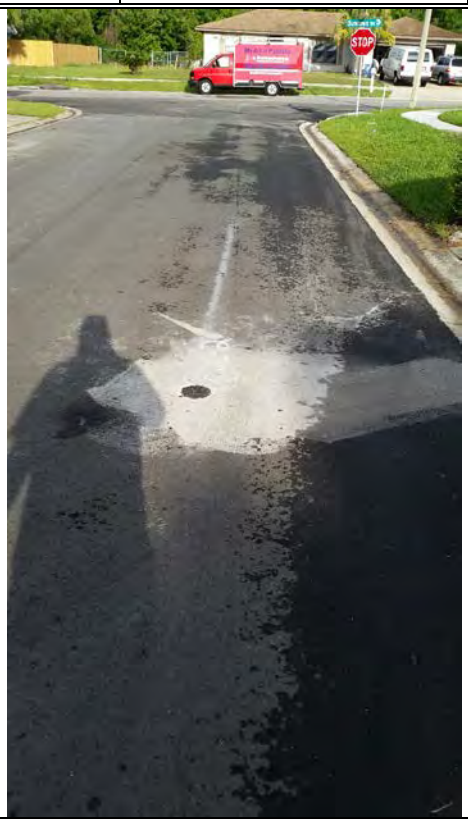

Photo:	Date:
4	4-6-15

Description:

Asphalt Thickness: 1.25”

Base Thickness: 8”

Base Type: Limerock

Geotechnical and Environmental Consultants, Inc.

At the very foundation of our community

Photographic Log

Client Name:	Project Name:	Project Location:	GEC Project No.:
Singhofen & Associates, Inc.	City of Casselberry Storm Drain Rehabilitation	Casselberry, Florida	3738G

Photo:	Date:
5	4-6-15

Description:

Site O

Core location C-O-1

Looking: North

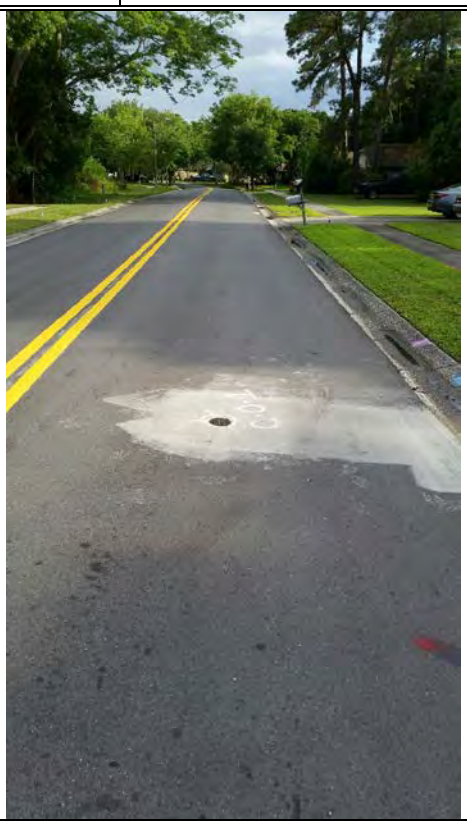

Photo:	Date:
6	4-6-15

Description:

Asphalt Thickness: 2.62”

Base Thickness: 5.5”

Base Type: Soil cement

Geotechnical and Environmental Consultants, Inc.

At the very foundation of our community

Photographic Log

Client Name:	Project Name:	Project Location:	GEC Project No.:
Singhofen & Associates, Inc.	City of Casselberry Storm Drain Rehabilitation	Casselberry, Florida	3738G

Photo:	Date:
7	4-6-15

Description:

Site O

Core location C-O-2

Looking: North

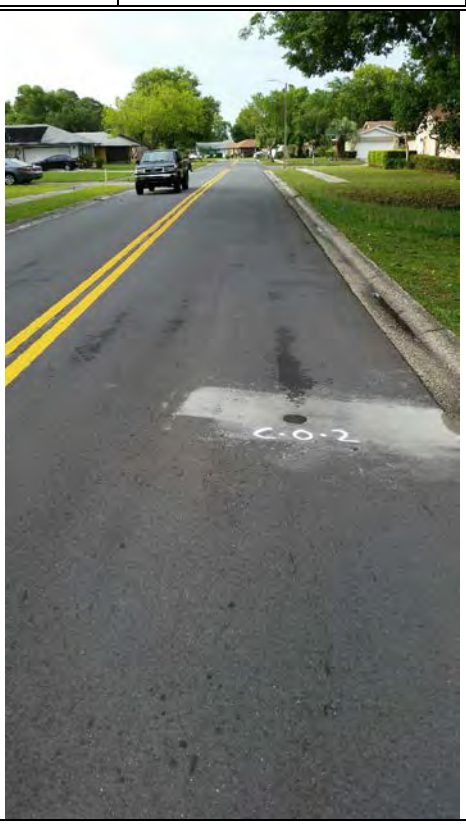

Photo:	Date:
8	4-6-15

Description:

Asphalt Thickness: 1.87”

Base Thickness: 6.5”

Base Type: Soil Cement

Geotechnical and Environmental Consultants, Inc.

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Photographic Log

Client Name:	Project Name:	Project Location:	GEC Project No.:
Singhofen & Associates, Inc.	City of Casselberry Storm Drain Rehabilitation	Casselberry, Florida	3738G

Photo:	Date:
9	4-6-15

Description:

Site T

Core location C-T-1

Looking: East

Photo:	Date:
10	4-6-15

Description:

Asphalt Thickness: 1.87”

Base Thickness: 9”

Base Type: Soil Cement

Geotechnical and Environmental Consultants, Inc.

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Photographic Log

Client Name:	Project Name:	Project Location:	GEC Project No.:
Singhofen & Associates, Inc.	City of Casselberry Storm Drain Rehabilitation	Casselberry, Florida	3738G

Photo:	Date:
11	4-6-15

Description:

Site T

Core location C-T-2

Looking: East

Photo:	Date:
12	4-6-15

Description:

Asphalt Thickness: 3.25”

Base Thickness: 12.75”

Base Type: Soil Cement

Geotechnical and Environmental Consultants, Inc.

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Photographic Log

Client Name:	Project Name:	Project Location:	GEC Project No.:
Singhofen & Associates, Inc.	City of Casselberry Storm Drain Rehabilitation	Casselberry, Florida	3738G

Photo:	Date:
13	4-6-15

Description:

Site T

Core location C-T-3

Looking: East

Photo:	Date:
14	4-6-15

Description:

Asphalt Thickness: 2.12”

Base Thickness: 14”

Base Type: Soil Cement

SITES L, O AND T UNDERDRAIN ANALYSIS

Geotechnical and Environmental Consultants, Inc.

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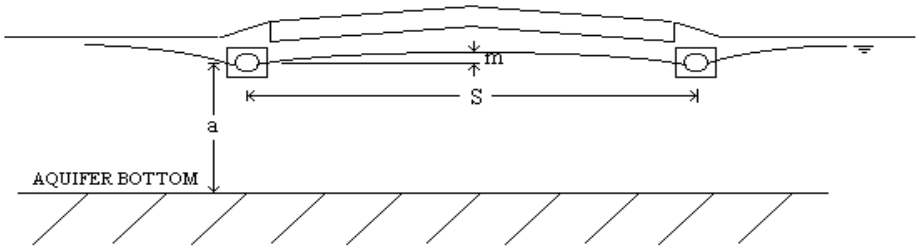
Roadway Underdrain Calculations

City of Casselberry Storm Drain Rehabilitation
Site L (Woodstream Lane)
GEC Project No. 3738G



Known Values

$S\ (ft)$:	26	*Spacing Between Underdrains*
$c\ (in)$:	24	*Distance Between Bottom of Base and Underdrain Invert*
$a\ (ft)$:	20	*Distance Between Aquifer Bottom and Underdrain Invert*
$d\ (in)$:	6	*Underdrain Diameter*
$k\ (ft/day)$:	13.1	*Soil Permeability Rate*

Assumed Values

$f\ (ft)$:	3	*Fluctuation Between Wet and Dry Season Water Levels*
$D\ (days)$:	120	*Duration of Wet Season*

Calculations

$q\ (ft/day)$: **0.025** — *Recharge Rate Due to Background Flow,* $q = \frac{f}{D}$

$$S = \sqrt{\frac{4 \cdot k \cdot m^2 + 2 \cdot a \cdot m}{q}}$$

Ellipse Equation from the book "Drainage of Agricultural Land: A Practical Handbook for the Planning, Design, Construction and Maintenance of Agricultural Drainage Systems" by the Soil Conservation Service of the U.S. Department of Agriculture

$$m^2 + 2 \cdot a \cdot m - \frac{S^2 \cdot q}{4 \cdot k} = 0$$

Rearranged into a Quadratic Equation so that "m" can be evaluated

$$\begin{pmatrix} -a + \frac{1}{2} \cdot \frac{\sqrt{4 \cdot a^2 \cdot k + S^2 \cdot q}}{\sqrt{k}} \\ -a - \frac{1}{2} \cdot \frac{\sqrt{4 \cdot a^2 \cdot k + S^2 \cdot q}}{\sqrt{k}} \end{pmatrix}$$

Roots of the Quadratic Equation

Neglecting the Negative Root Results:

$$m = -a + \frac{1}{2} \cdot \frac{\sqrt{4 \cdot a^2 \cdot k + S^2 \cdot q}}{\sqrt{k}}$$

$m\ (in) =$ **0.1** — *Rise in Groundwater Level Above the Midpoint of the Underdrain Pipe*

$$r = m + \frac{d}{2}$$

$r\ (in) =$ **3.1** — *Rise in Groundwater Level Above the Invert of the Underdrain Pipe*

$x = c - r$

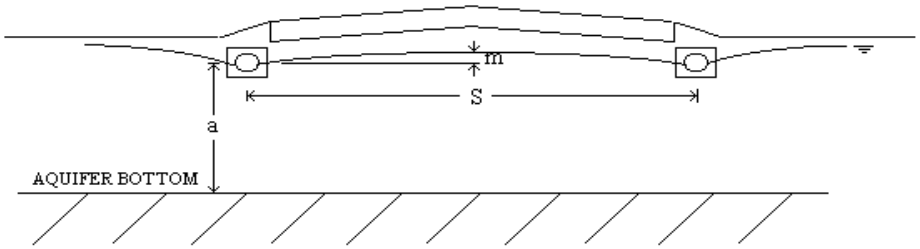
$x\ (in) =$ **20.9** — *Distance between the groundwater level and the bottom of the base*

Geotechnical and Environmental Consultants, Inc.

At the very foundation of our community

Roadway Underdrain Calculations

City of Casselberry Storm Drain Rehabilitation
Site O (Secret Way)
GEC Project No. 3738G



Known Values

$S\ (ft)$:	26	*Spacing Between Underdrains*
$c\ (in)$:	24	*Distance Between Bottom of Base and Underdrain Invert*
$a\ (ft)$:	20	*Distance Between Aquifer Bottom and Underdrain Invert*
$d\ (in)$:	6	*Underdrain Diameter*
$k\ (ft/day)$:	3.5	*Soil Permeability Rate*

Assumed Values

$f\ (ft)$:	3	*Fluctuation Between Wet and Dry Season Water Levels*
$D\ (days)$:	120	*Duration of Wet Season*

Calculations

$q\ (ft/day)$: 0.025 — *Recharge Rate Due to Background Flow,* $q = \frac{f}{D}$

$$S = \sqrt{\frac{4 \cdot k \cdot m^2 + 2 \cdot a \cdot m}{q}}$$

Ellipse Equation from the book "Drainage of Agricultural Land: A Practical Handbook for the Planning, Design, Construction and Maintenance of Agricultural Drainage Systems" by the Soil Conservation Service of the U.S. Department of Agriculture

$$m^2 + 2 \cdot a \cdot m - \frac{S^2 \cdot q}{4 \cdot k} = 0$$

Rearranged into a Quadratic Equation so that "m" can be evaluated

$$\begin{pmatrix} -a + \frac{1}{2} \cdot \frac{\sqrt{4 \cdot a^2 \cdot k + S^2 \cdot q}}{\sqrt{k}} \\ -a - \frac{1}{2} \cdot \frac{\sqrt{4 \cdot a^2 \cdot k + S^2 \cdot q}}{\sqrt{k}} \end{pmatrix}$$

Roots of the Quadratic Equation

Neglecting the Negative Root Results:

$$m = -a + \frac{1}{2} \cdot \frac{\sqrt{4 \cdot a^2 \cdot k + S^2 \cdot q}}{\sqrt{k}}$$

$m\ (in) =$ 0.4 — *Rise in Groundwater Level Above the Midpoint of the Underdrain Pipe*

$$r = m + \frac{d}{2}$$

$r\ (in) =$ 3.4 — *Rise in Groundwater Level Above the Invert of the Underdrain Pipe*

$x = c - r$

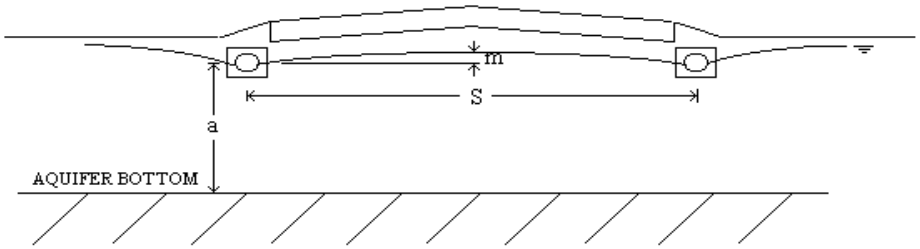
$x\ (in) =$ 20.6 — *Distance between the groundwater level and the bottom of the base*

Geotechnical and Environmental Consultants, Inc.

At the very foundation of our community

Roadway Underdrain Calculations

City of Casselberry Storm Drain Rehabilitation
Site T (Marigold Road)
GEC Project No. 3738G



Known Values

$S\ (ft)$:	26	*Spacing Between Underdrains*
$c\ (in)$:	24	*Distance Between Bottom of Base and Underdrain Invert*
$a\ (ft)$:	20	*Distance Between Aquifer Bottom and Underdrain Invert*
$d\ (in)$:	6	*Underdrain Diameter*
$k\ (ft/day)$:	12.1	*Soil Permeability Rate*

Assumed Values

$f\ (ft)$:	3	*Fluctuation Between Wet and Dry Season Water Levels*
$D\ (days)$:	120	*Duration of Wet Season*

Calculations

$q\ (ft/day)$: 0.025 — *Recharge Rate Due to Background Flow,* $q = \frac{f}{D}$

$$S = \sqrt{\frac{4 \cdot k \cdot m^2 + 2 \cdot a \cdot m}{q}}$$

Ellipse Equation from the book "Drainage of Agricultural Land: A Practical Handbook for the Planning, Design, Construction and Maintenance of Agricultural Drainage Systems" by the Soil Conservation Service of the U.S. Department of Agriculture

$$m^2 + 2 \cdot a \cdot m - \frac{S^2 \cdot q}{4 \cdot k} = 0$$

Rearranged into a Quadratic Equation so that "m" can be evaluated

$$\begin{pmatrix} -a + \frac{1}{2} \cdot \frac{\sqrt{4 \cdot a^2 \cdot k + S^2 \cdot q}}{\sqrt{k}} \\ -a - \frac{1}{2} \cdot \frac{\sqrt{4 \cdot a^2 \cdot k + S^2 \cdot q}}{\sqrt{k}} \end{pmatrix}$$

Roots of the Quadratic Equation

Neglecting the Negative Root Results:

$$m = -a + \frac{1}{2} \cdot \frac{\sqrt{4 \cdot a^2 \cdot k + S^2 \cdot q}}{\sqrt{k}}$$

$m\ (in) =$ 0.1 — *Rise in Groundwater Level Above the Midpoint of the Underdrain Pipe*

$$r = m + \frac{d}{2}$$

$r\ (in) =$ 3.1 — *Rise in Groundwater Level Above the Invert of the Underdrain Pipe*

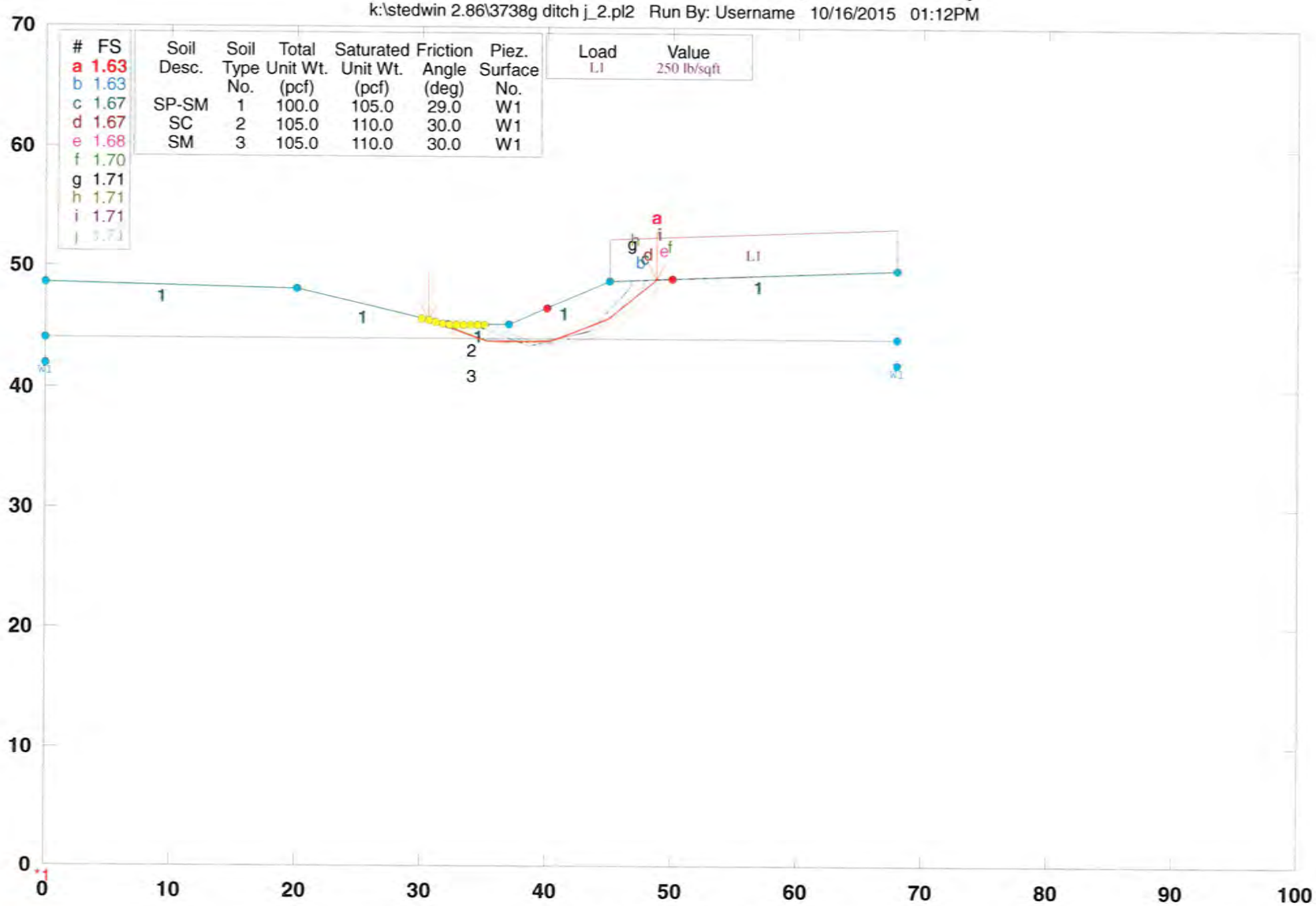
$x = c - r$

$x\ (in) =$ 20.9 — *Distance between the groundwater level and the bottom of the base*

SITES J AND K DITCH STABLITY ANALYSIS

City of Casselberry Site J Ditch (Cross Street)

k:\stedwin 2.86\3738g ditch j_2.pl2 Run By: Username 10/16/2015 01:12PM



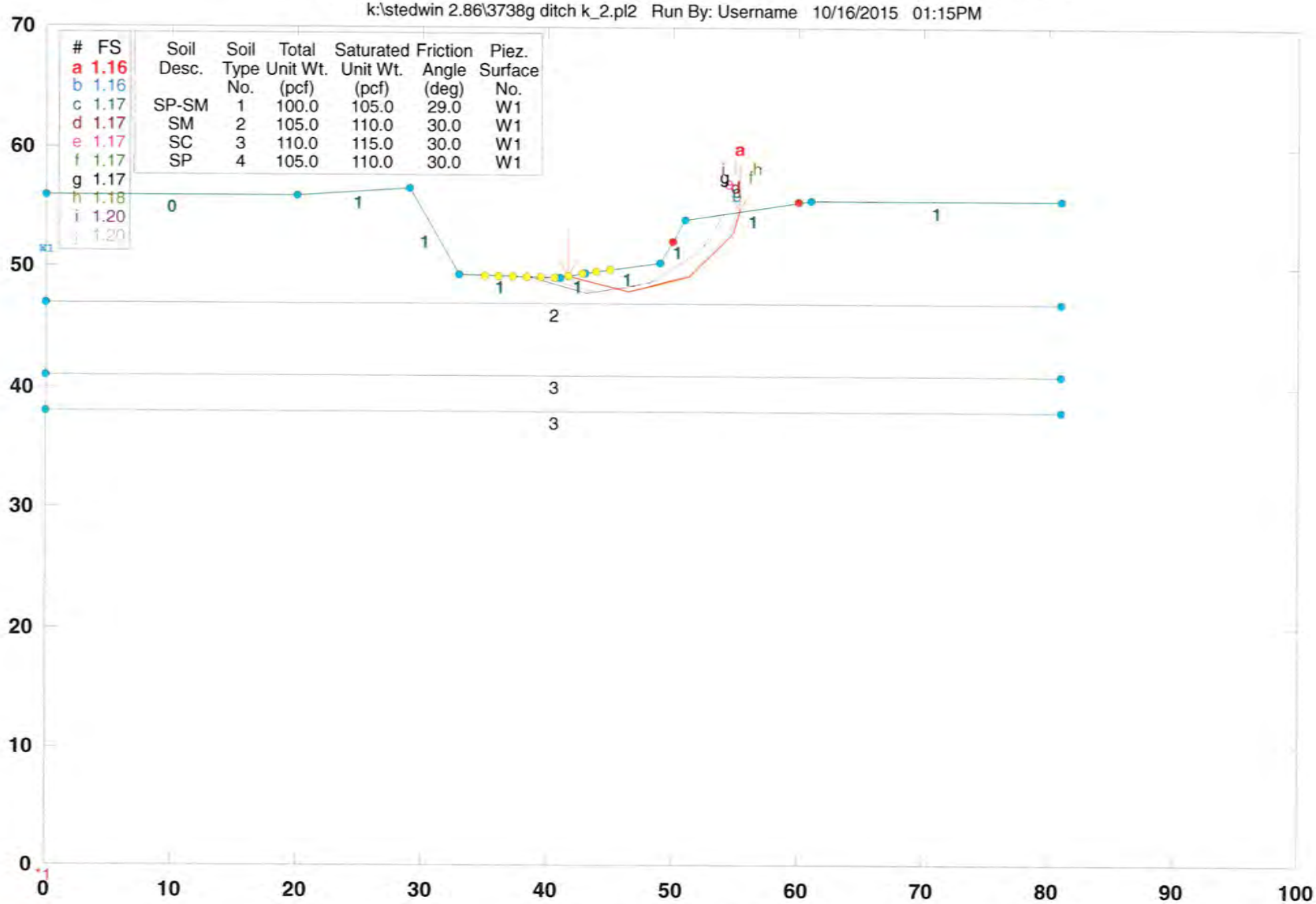
STABL6H FSmin=1.63

Safety Factors Are Calculated By The Modified Bishop Method

STED

City of Casselberry Site K (Queen's Mirror Circle) West Side

k:\stedwin 2.86\3738g ditch k_2.pl2 Run By: Username 10/16/2015 01:15PM



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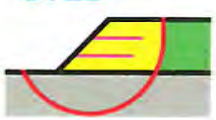
Safety Factors Are Calculated By The Modified Bishop Method

STED

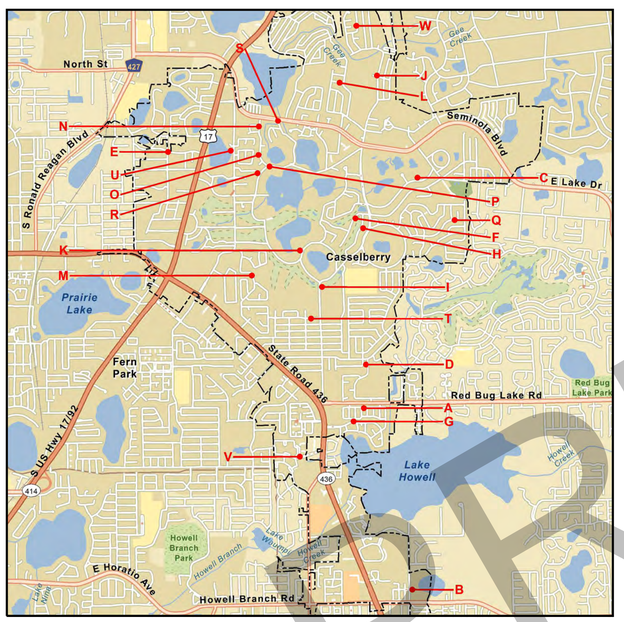


Appendix D
Preliminary Construction Plans

CITY OF CASSELBERRY
PUBLIC WORKS DEPARTMENT

STORM DRAIN
REHABILITATION PROJECT

PROJECT NO. PW 1501



PROJECT SITE LOCATION

MAYOR/COMMISSIONER
CHARLENE GLANCY

VICE MAYOR/COMMISSIONER
COLLEEN HUFFORD

COMMISSIONER
SANDRA SOLOMON

COMMISSIONER
ANDREW MEADOWS

COMMISSIONER
ANTHONY ARAMENDIA

PREPARED FOR:
PUBLIC WORKS
PUBLIC WORKS DIRECTOR, MARK D. GISCLAR, MPA
ASST. PUBLIC WORKS DIRECTOR/CITY ENGINEER, KELLY HANS BROCK, PH.D., P.E., CFM

PREPARED BY:
SINGHOFEN & ASSOCITES, INC.
11723 Orpington Street, Suite 100
Orlando, Florida 32817
Phone: 407-679-3001 Fax: 407-679-2691

INDEX OF PLANS

SHEET NO.	SHEET DESCRIPTION
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3	Typical Sections & Details
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18	Area Location Map
19	Area Location Map
20	Area Location Map
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22	Quintuplet Drive (Area C1)
23	Quintuplet Drive (Area C2)
24	Easement to Lake Marie (Area C3)
25	Quintuplet Drive (Area C4)
26	Quintuplet Drive (Area C5)
27	Gregory Drive (Area D)
28	Concord Drive (Area E)
29	Paul McClure Court (Area F)
30	Stanhope Drive (Area G1)
31	Stanhope Drive (Area G2)
32	Paul McClure Court & Park Ave. (Area H1)
33	Park Ave. (Area H2)
34	Park Ave. (Area H3)
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37	Queens Mirror Circle (Area K)
38	Woodstream Lane (Area L)
39	Easement from Carriage Hill Drive (Area M)
40	277/285 Secret Way (Area N)
41	224/228 Secret Way (Area O)
42	Intersection of Secret Way & N Triplet Lake Dr. (Area P)
43	Intersection of Guinevere Drive & Excalibur Drive (Area Q)
44	Intersection N Triplet Lake Dr. & Oakwood Dr. (Area R)
45	Ivey Road (Area S)
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53	Apple Hill Hollow
54	Apple Hill Hollow
55	Lowndes Square
56	Cross Sections
57	Cross Sections

PRELIMINARY
(signed & sealed plan supercedes this sheet)

GENERAL NOTES:

1. All construction shall be in accordance with and conform to the most stringent requirement of the project specifications, the Florida Department of Transportation Standard Specifications for Road and Bridge Construction (2015), and supplements thereto.

2. The Contractor will have all required permits in-hand prior to beginning construction and shall perform all work in accordance with the requirements of the permits obtained by the City and those permits obtained by the Contractor.

3. The Contractor shall verify all dimensions, quantities, and details shown on the Plans, Specifications, Special Provisions, or other data received from the Engineer, and shall notify the Engineer of all errors, omissions, conflicts, or discrepancies found therein. Failure to discover or correct errors, conflicts, or discrepancies shall not relieve the Contractor of full responsibilities for unsatisfactory work, faulty construction, improper operation resulting therefrom, nor from rectifying such conditions at his own expense. He shall not take advantage of any errors or omissions.

4. At least three (3) calendar days prior to the Preconstruction Conference, the Contractor shall submit a tentative base Construction Schedule, Traffic Control Plan, Dewatering Plan, Preconstruction Survey, and Erosion Control Plan to the Engineer for approval. No work will begin prior to approval of the Construction Schedule, Traffic Control Plan, Dewatering Plan, Erosion Control Plan, and the Preconstruction Survey.

5. The Construction Progress Schedule shall utilize the critical path method (CPM) format to describe in detail how the construction is to be phased, establish start and finish dates for all significant construction activities, and identify all controlling items of work. The schedule is to be approved by the Engineer and will be updated on a monthly basis to reflect actual work progress. Payment for preparing, updating and submitting the schedule will be included in the pay item for "Mobilization".

6. Temporary drainage shall be provided during construction to eliminate any flooding of private or public property. Any drainage problem existing before and during construction should be brought to the attention of the Engineer.

7. The Preconstruction Survey will verify the Control Points and Benchmark elevations provided by the Engineer and will also establish the location and description of all additional reference points and the locations, descriptions, and elevations of all additional benchmarks to be used in constructing the project. The survey will be signed and sealed by a Professional Surveyor and Mapper registered in the State of Florida. Significant inconsistencies between the field notes and the Control Points and Benchmark elevations provided by the Engineer will immediately be brought to the attention of the Engineer for resolution prior to beginning construction. Payment will be included in the pay item for "Mobilization".

8. Unless noted on the plan sheets, Southeastern Surveying and Mapping, Corp. (407) 292-8580, provided the topography, benchmarks, rights-of-ways, and utility location information shown on the construction drawings. Elevations are based on North American Vertical Datum of 1988 (NAVD 1988).

9. The Contractor is responsible for preserving all property corners and monuments shown on the plans or found during construction. If a property corner or monument is destroyed or disturbed, the Contractor will have it replaced and certified by a Professional Surveyor and Mapper registered in the State of Florida. All costs for preserving, replacing and certifying property corners and monuments will be included in the pay item for "Mobilization".

10. Any National Geodetic Survey Monument within the limits of construction must be protected. If in danger of damage, the Contractor will immediately notify the Engineer and:

    FLDEP, Bureau of Surveying and Mapping, MS 105
    3900 Commonwealth Blvd.
    Tallahassee, Florida 32399
    (850) 245-2606 (Office)
    (850) 245-2645 (Fax)

11. Unless as noted on the plan sheets, the information shown on these drawings concerning type and location of underground and other utilities is based on surveyed field information. The information may not reflect actual conditions or be all inclusive regarding all utilities in the area, either in service or abandoned, or that the utilities are in the horizontal or vertical locations shown. The Contractor will make his own determination as to the type and location of utilities as necessary to establish their locations and avoid damage. Damage to existing utilities as a result of Contractor's work or his subcontractors shall be the sole responsibility of the Contractor to repair, pay all fines, pay all fees, and all other cost associated with restoring the utility.

12. The following utility representatives should be contracted for information concerning type and location of their facilities. The list may not include all utilities in the area.

Sunshine State One-Call of Florida	800-432-4770 (5 days notification prior to construction)
City of Casselberry	407-262-7725 ext. 1236
Brighthouse Networks	407-532-8509
Duke Energy	800-700-8744
Teco Peoples Gas	407-420-2678
Centurylink	407-830-3458

13. Prior to any scheduled interruption of utility service, the Contractor will coordinate such interruption with the utility provider and will provide a minimum 24-hour notice to the affected parties. In the case of a water main shut down, a minimum 24-hour notice will also be provided to the fire department. The Contractor will notify the electric utility a minimum of two weeks prior to construction in the vicinity of their facilities.

14. The Contractor is required to coordinate closely with the utility companies when connecting to or working around existing facilities. Protect any utilities encountered. If an existing utility must be relocated due to a conflict, notify utility company and Engineer. All coordination and scheduling of utility crossings and relocations shall be the responsibility of the Contractor.

15. The limits of construction are defined as roadway rights-of-way, drainage rights-of-way, permanent drainage easements, and temporary construction easements.

16. The Contractor shall be entirely responsible and liable for all damage or injury as a result of his operations to all other adjacent public and private property, landscaping, trees, fences, utilities, structures of any kind and appurtenances during the progress of the Work.

17. All areas where sod has been removed or disturbed by Contractor's operations shall be sodded of like kind. Payment included in unit price for Performance Turf (Sod).

18. All existing drainage structures and pipes, pavement, sidewalks, curbs, etc. within the limits of construction shall remain, unless otherwise noted on the drawings or directed by the Engineer. All drainage structures, pipes, pavement, sidewalks, curbs, etc., that are damaged during construction are the responsibility of the Contractor and shall be repaired or replaced with the same type and material at no additional cost to the Owner or Engineer.

19. Existing pavement, driveways, and sidewalks shall be saw-cut as required for construction.

20. The disposal of excess earthwork materials shall be the responsibility of the Contractor. All excess material is the property of the Contractor.

21. No trenches shall be allowed to remain open overnight.

22. No burning shall be done except upon approval by the Jurisdictional Municipality.

23. Disturbed areas shall be compacted (as a minimum) equal to adjacent undisturbed ground except when otherwise specified for bedding, backfill, or roadway embankment. All disturbed areas are to be sodded except for areas that are landscaped or paved.

24. All joints of concrete pipe culverts and storm sewers shall have a filter fabric jacket as detailed in Standard Index 280.

25. All existing trees located within right-of-way shall be protected. If impacts to existing trees are unavoidable, Contractor shall relocate or replace existing trees as directed by City representative.

26. All existing fences that are removed are to be replaced or relocated. All fences damaged by construction activities are to be replaced of the same type and material.

27. All utilities are to be adjusted or relocated by others, unless noted otherwise on the drawings or directed by the Engineer.

28. Contractor shall verify all pipe diameters designated for CIPP prior to shop drawing submittals.

29. Locations that did not include surveyed information are based off aerials and GIS information. Actual field locations, dimensions, and pipe sizes and materials may not be accurately reflected in the drawings and it is the responsibility of the Contractor to verify field conditions prior to beginning any work.

GENERAL PAY ITEM NOTES:

1. No separate payment will be made for dewatering. The costs for dewatering are included in the unit prices for pipe and concrete.

2. No separate payment will be made for geotextile fabric or filter fabric. The costs for these items shall be included in the unit prices for pipe.

3. The Contractor's bid shall be comprehensive and include all labor, materials and equipment including items not found in the summary of pay items but necessary to complete the project.

STORMWATER PAY ITEM NOTES:

101-1: MOBILIZATION
The lump sum price also shall include costs for preparation of an approved Construction Progress Schedule, Erosion Control Plan, Dewatering Plan, Preconstruction Survey, and As-Built drawings. Also includes costs for coordination with utility companies on conflict adjustments.

102-1: MAINTENANCE OF TRAFFIC
The lump sum price constitutes full compensation for all labor and materials required to implement the approved Traffic Control Plan to safely maintain traffic through and around the work zones for the duration of the project, including warning and regulatory signs, drums, barricades, warning lights, flaggers, and for the maintenance of existing driveways, temporary pavement, and removal and reinstallation of existing signs in conflict with construction as directed by the Engineer. No adjustments will be made to the contract price for increases in contract time.

104: PREVENTION, CONTROL, AND ABATEMENT OF EROSION AND WATER POLLUTION
The lump sum price shall include all costs for furnishing, installing, and maintaining synthetic baled hay, staked silt fence, barricade fences, soil tracking devices, sedimentation barriers, and street cleaning. Also, includes costs for removal and disposal of captured sediment, removal and disposal sediment off-site upon completion of construction (including any necessary permits and fees for disposal).

110-1-1: CLEARING AND GRUBBING
The lump sum price includes removal and disposal of drainage structures, pipes, curbs, fences, and other obstructions necessary to be removed and for which other items of the contract do not specify the removal thereof. Partial payments shall be based upon the estimated total value of clearing and grubbing work completed to the date of the estimate as determined by the Engineer. All partial estimates and payments shall be subject to correction in subsequent estimates and payment.

110-15-2: TREE PRESERVATION & REPLACEMENT
The lump sum price shall include all costs associated with protecting existing trees and landscaping. Also includes costs for relocating and/or replacing trees as required for construction operations or as directed by Engineer.

120-14: EXCAVATION, EMBANKMENT & GRADING
Payment shall constitute full compensation for grading of shoulders, slopes, compaction, final dressing, excavation, and all earthworks necessary to complete the project to the lines and grades shown on the plans.

121-70: FLOWABLE FILL
The unit price shall constitute full compensation for all labor and materials necessary for placement of flowable fill as shown in the plans.

160-4, 285-708, & 334-1-13: TYPE B STABILIZATION, OPTIONAL BASE GROUP, AND SUPERPAVE ASPHALTIC CONCRETE
The unit price shall constitute full compensation for labor and materials of furnishing, grading, stabilization of soils, and the installation of stabilized subgrade, limerock base, and superpave asphalt pavement.

400-2-1 & 400-4-2: CONCRETE
The unit price shall constitute full compensation for all work and materials necessary for placement of concrete to repair culverts and structures as shown in the plans. Payment includes concrete, forms, joints, cleaning, finishing, and curing.

425-1-541 THRU 425-5-1: INLETS AND MANHOLES
The unit price shall constitute full compensation for all work and materials necessary for the installation of the inlets and manholes. Payment includes all materials, foundation preparation, grates, covers, chains, locks, bolts, connecting existing pipes, and modification of existing inlets and manholes.

430-175-115 THRU 430-175-224: CONCRETE PIPE CULVERT
The unit price includes payment for furnishing and installing pipe, furnishing and placing select bedding and backfill, placing regular backfill, final grading, wrapping of pipe joints with filter fabric, shoring & bracing, concrete pipe collar and jacket, matching of existing inverts, and modification of existing inlets and manholes.

430-982-129 & 430-982-629: MITERED END SECTION
The unit price shall constitute full compensation for all work and materials necessary for the installation of mitered end sections. Payment includes all materials, foundation preparation, reinforcing steel, joint forming, placing, finishing, and curing.

430-94-1 & 430-94-3: DESILTING PIPE
The unit price includes payment for desilting pipe, furnishing all equipment, tools and labor, disposal of silt and debris, and all incidentals necessary to satisfactorily perform the work. Also includes breaking apart and removal of bricks and concrete debris piles.

431-1-1 THRU 431-1-4: PIPE LINER
The unit price shall constitute full compensation for all labor and materials, equipment, and incidentals required to install and test cured-in-place (CIPP) lining and appurtenances complete as shown in the plans. Also includes removal of roots and other intrusions prior to placement of CIPP.

432-3-1 THRU 433-1: CHEMICAL GROUT REPAIR
The unit price constitutes full compensation for all labor and materials necessary for the injection of non-shrink grout into all voids and joints to the limits shown in the plans. Also includes removal of roots and other intrusions prior to injection of grout.

440-1-10: UNDERDRAIN, TYPE I
The unit price shall constitute full compensation for furnishing and installing pipe, filter fabric, aggregate, sand, fittings, cleanouts, connecting to existing drainage structures, trench excavation, select bedding and backfill, and final grading. Unit price shall also include all costs to replace or repair pavement and curbs & gutters as shown in the plans and as required because of construction operations.

520-1-8: CONCRETE CURB & GUTTER (MIAMI)
The unit price constitutes full compensation for all labor and materials necessary for placement of Miami Curb & Gutter to the locations shown on the plans. Also, includes saw-cutting existing curb & gutter, transitions to existing curb & gutter, joints, placing, finishing, and curing.

520-3: VALLEY GUTTER
The unit price constitutes full compensation for all labor and materials necessary for placement of valley gutter to the locations shown on the plans. Also, includes saw-cutting existing curb & gutter, transitions to existing curb & gutter, joints, placing, finishing, and curing.

522-1 & 522-2: CONCRETE SIDEWALK AND DRIVEWAYS
The unit price shall constitute full compensation for all labor and materials necessary for the installation of concrete sidewalk and driveways. Payment includes all materials, foundation preparation, reinforcing steel, transitions, joint forming (or sawing), placing, finishing, and curing. Also includes all cost for construction of curb ramps per FDOT Standard Index 304.

530-3-3 & 530-3-4: RUBBLE RIPRAP
The unit price constitutes full compensation for all labor and materials required to construct rubble riprap, including all materials, foundation preparation, hauling, excavation, bedding stone, geotextile fabric, and backfill to the lines and grades shown on the plans.

550-10-918: FENCING, SPECIAL, RESET EXISTING
The unit price constitutes full compensation for removing and resetting existing fencing including furnishing new fencing material of the same type that was removed or reusing undamaged fencing material that was removed.

570-1-2: PERFORMANCE TURF (SODDING) (MATCH EXISTING)
The unit price shall constitute full compensation for furnishing, delivering, protecting, and installing sod, including site preparation, removal of undesirable plant species, soil amendment, application of fertilizer, planting, and watering.

700-1: SIGNAGE & MARKING
The lump sum price shall include full compensation for replacement of all pavement striping, marking, signs, and reflective pavement markers that are in conflict with construction operations and/or as required by the City.

1050-11-224:UTILITY PIPE, PVC
The unit price includes payment for furnishing and installing pipe, furnishing and placing select bedding and backfill, placing regular backfill, final grading, wrapping of pipe joints with filter fabric, shoring & bracing, and matching of existing inverts.

SUMMARY OF QUANTITIES

ITEM NO.	DESCRIPTION	UNIT	QUANTITIES PLAN	QUANTITIES FINAL
101-1	MOBILIZATION (5% OF BASE BID)	LS	1	
102-1	MAINTENANCE OF TRAFFIC	LS	1	
104	PREVENTION, CONTROL, AND ABATEMENT OF EROSION AND WATER POLLUTION	LS	1	
110-1-1	CLEARING & GRUBBING	LS	1	
110-15-2	TREE PRESERVATION & REPLACEMENT	LS	1	
120-14	EXCAVATION, EMBANKMENT, & GRADING	LS	1	
121-70	FLOWABLE FILL	CY	3	
160-4	TYPE B STABILIZATION	SY	1242	
285-708	OPTIONAL BASE, BASE GROUP 08	SY	1242	
334-1-13	SUPERPAVE ASPHALTIC CONC, TRAFFIC C	TN	102	
400-2-1	CONC CLASS II, CULVERTS	CY	1	
400-4-2	CONC CLASS IV, ENDWALLS	CY	1	
425-1-541	INLETS, DT BOT, TYPE D, <10'	EA	2	
425-1-545	INLETS, DT BOT,TYPE D, PARTIAL	EA	1	
425-2-61	MANHOLES, P-8, <10'	EA	1	
425-5-1	MANHOLE, ADJUST, UTILITIES	EA	1	
430-175-115	PIPE CULV, OPT MATL, ROUND, 15"S/CD	LF	88	
430-175-118	PIPE CULV, OPT MATL, ROUND, 18"S/CD	LF	385	
430-175-124	PIPE CULV, OPT MATL, ROUND, 24"S/CD	LF	284	
430-175-224	PIPE CULV, OPT MATL, OTHER, 19"x30" S/CD	LF	19	
430-982-129	MITERED END SECT, OPTIONAL RD, 24" CD	EA	2	
430-982-629	MITERED END SECT, OPT - OTHER, 19"x30" CD	EA	1	
430-94-1	DESILTING PIPE, 0 - 24"	LF	200	
430-94-3	DESILTING PIPE, 37 - 48"	LF	417	
431-1-1	PIPE LINER, OPTIONAL MATERIAL, 0-24"	LF	1085	
431-1-3	PIPE LINER, OPTIONAL MATERIAL, 37-48"	LF	417	
431-1-4	PIPE LINER, OPTIONAL MATERIAL, 49-60"	LF	384	
432-3-1	CHEM GROUT REPAIR, PIPE,NON-TEST,15"	EA	8	
432-3-2	CHEM GROUT REPAIR, PIPE,NON-TEST,18"	EA	3	
432-3-4	CHEM GROUT REPAIR, PIPE,NON-TEST,24"	EA	2	
432-3-5	CHEM GROUT REPAIR, PIPE,NON-TEST,30"	EA	2	
432-3-6	CHEM GROUT REPAIR, PIPE,NON-TEST,36"	EA	7	
432-3-8	CHEM GROUT REPAIR, PIPE,NON-TEST,48"	EA	11	
433-1	CHEM GROUT REPAIR, MANHOLE / INLET	EA	4	
440-1-10	UNDERDRAIN, TYPE I	LF	7128	
520-1-8	CONCRETE CURB & GUTTER, MIAMI	LF	677	
520-3	VALLEY GUTTER- CONCRETE	LF	92	
522-1	CONCRETE SIDEWALK AND DRIVEWAYS, 4"	SY	218	
522-2	CONCRETE SIDEWALK AND DRIVEWAYS, 6"	SY	1309	
530-3-3	RIPRAP, RUBBLE, BANK AND SHORE	TN	437	
530-3-4	RIPRAP, RUBBLE, F&I, DITCH LINING	TN	46	
550-10-918	FENCING,SPECIAL TYP, 0.0-5.0', RESET EXISTING	LF	50	
570-1-2	PERFORMANCE TURF, SOD	SY	5157	
700-1	SIGNAGE & MARKINGS	LS	1	
1050-11-224	UTILITY PIPE, F&I,PVC,WATER/SEWER,8-19.9	LF	6	

PRELIMINARY
(signed & sealed plan supercedes this sheet)

Revision	Date	Approved
PER CITY	4/29/16	BRW

Designed by: BRW
Drawn by: BJG/ADB
Checked by: RBG
Approved by: BRW
Vertical Datum: NAVD 1988

SINGHOFEN & ASSOCIATES, INC.
STORMWATER MANAGEMENT AND CIVIL ENGINEERING
11723 Orpington Street, Suite 100
Orlando, Florida 32817
Ph: (407) 679-3001
Fax: (407) 679-2691
DBPR No. 5112

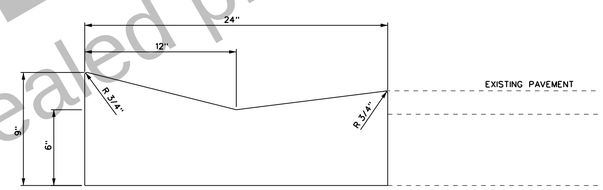
CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

GENERAL NOTES & PAY ITEM NOTES

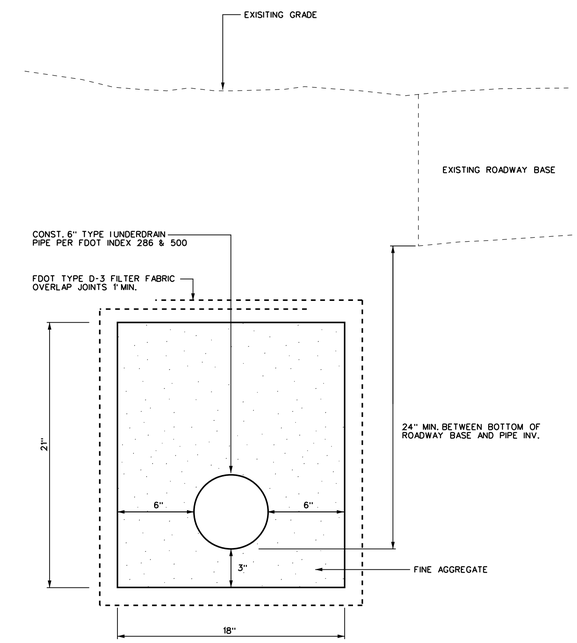
SHEET
2
SAI
Project No.
2015-006.10

PRELIMINARY
(signed & sealed plan supercedes this sheet)



MIAMI CURB DETAIL

SCALE 1"=2'



UNDERDRAIN TYPICAL DETAIL

SCALE 1"=2'

Revision	Date	Approved
PER CITY	4/29/16	BRW

Designed by: BRW
Drawn by: BJG/ADB
Checked by: RBG
Approved by: BRW
Vertical Datum: NAVD 1988

SINGHOFEN & ASSOCIATES, INC.
STORMWATER MANAGEMENT AND CIVIL ENGINEERING
SAI
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Orlando, Florida 32817
Ph: (407) 679-3001
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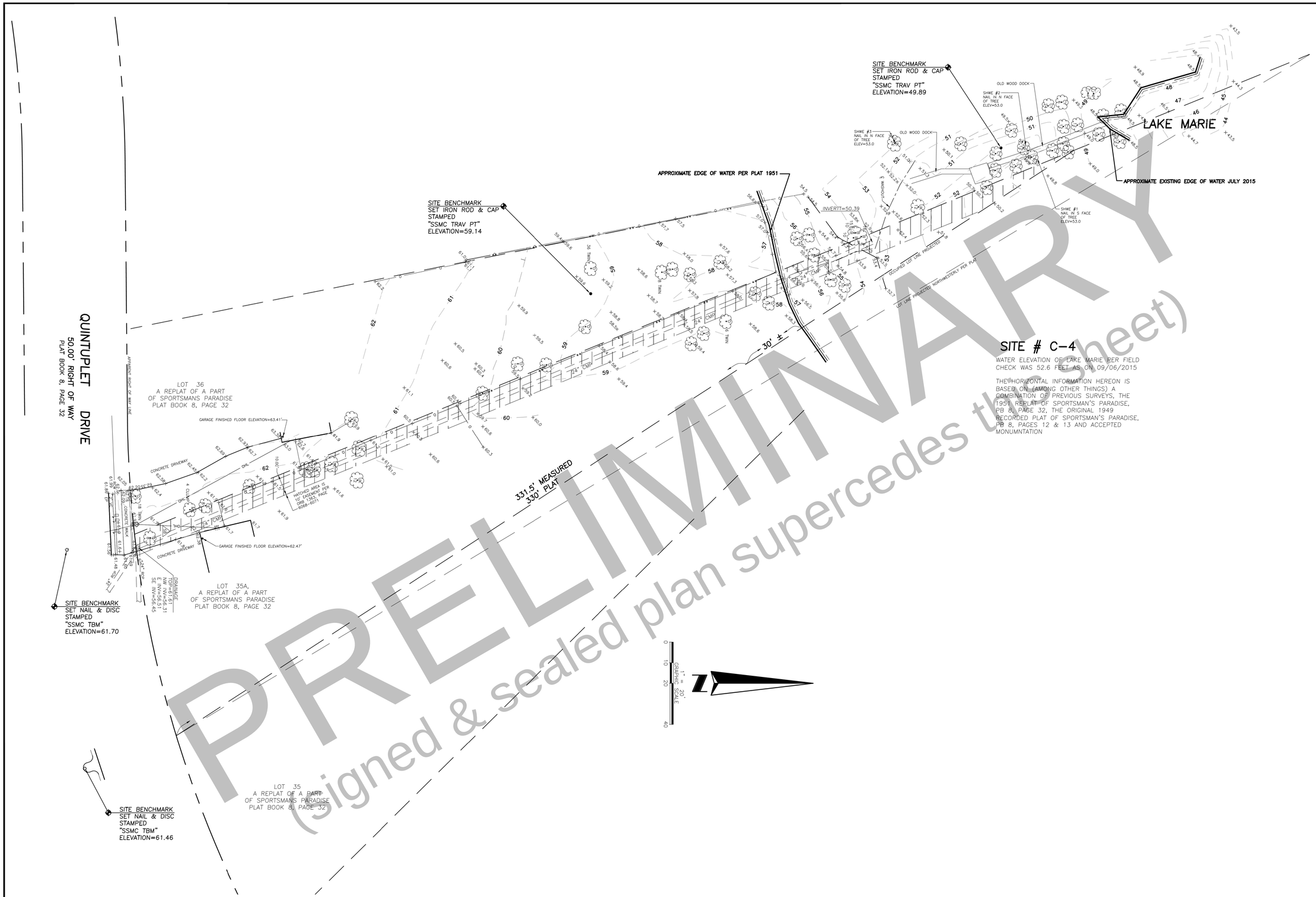
DBPR No. 5112

CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

TYPICAL SECTIONS & DETAILS

SHEET
3
SAI
Project No.
2015-006.10



SITE # C-4

WATER ELEVATION OF LAKE MARIE PER FIELD CHECK WAS 52.6 FEET AS ON 09/06/2015

THE HORIZONTAL INFORMATION HEREON IS BASED ON (AMONG OTHER THINGS) A COMBINATION OF PREVIOUS SURVEYS, THE 1951 REPLAT OF SPORTSMAN'S PARADISE, PB 8, PAGE 32, THE ORIGINAL 1949 RECORDED PLAT OF SPORTSMAN'S PARADISE, PB 8, PAGES 12 & 13 AND ACCEPTED MONUMNTATION

PRELIMINARY
(signed & sealed plan supercedes this sheet)

REVISION DATE	REVISION	BY

SHEET NUMBER 2 OF 11
NOT VALID WITHOUT SHEETS 1 & 3-11

SOUTHEASTERN SURVEYING AND MAPPING CORPORATION
6500 All American Boulevard
Orlando, Florida 32810-4350
(407) 295-9000 Certificate of Authorization LB2108
e-mail info@southeasternsurveying.com

Topographic Survey
City of Casselberry
Storm Drain Rehabilitation Project (PW 1501)

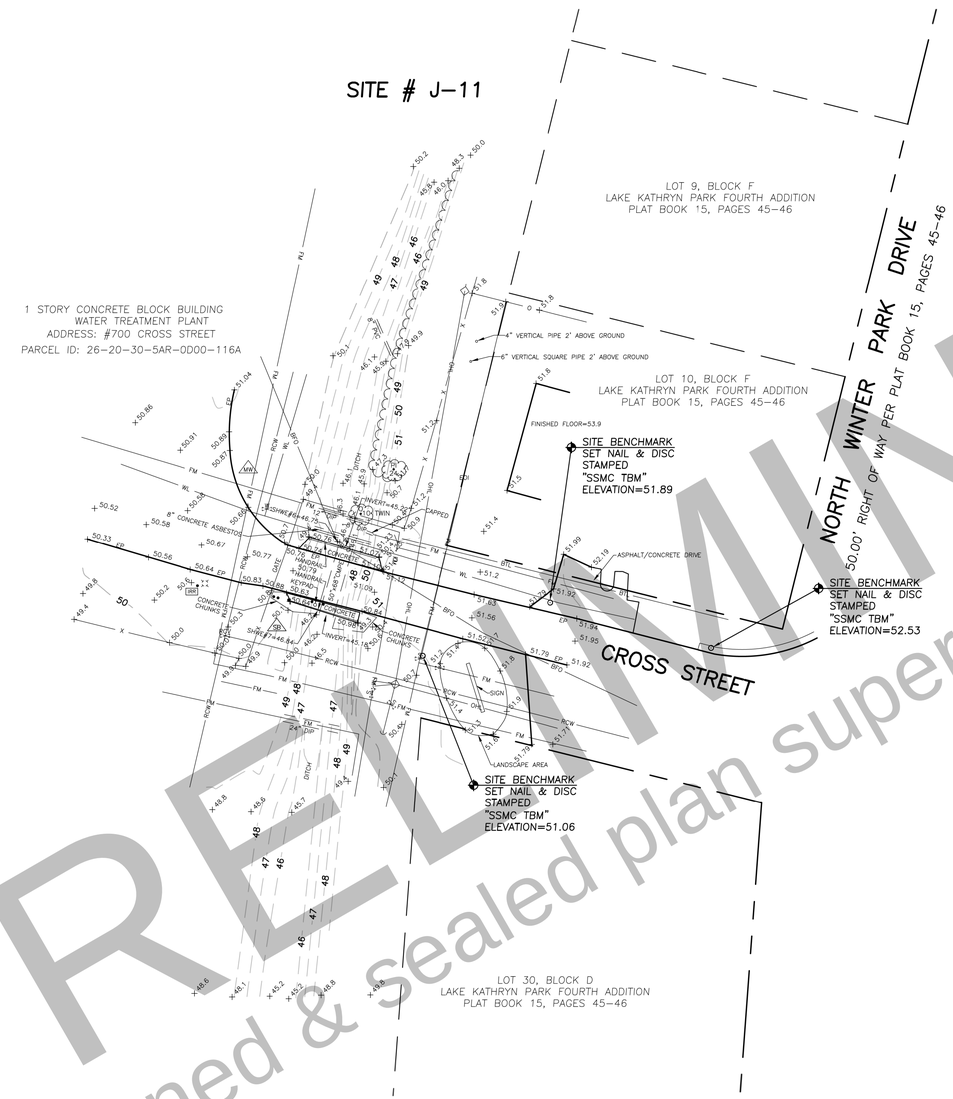
Project:
Field Date: 8/06/2015
Drawn By: JLG
Scale: 1"=20'

SEE SHEET 1 FOR NOTES, LEGEND AND DESCRIPTION.

DRAWING NUMBER
59295001

SHEET 4

A:\Casselberry\StormDrainRehab\DGN\SDR-Survey_Sheet1.dgn
6/9/2016



1" = 20'
GRAPHIC SCALE
0 10 20 40

PRELIMINARY
(signed & sealed plan supercedes this sheet)

REVISION DATE	REVISION	BY

SHEET NUMBER 3 OF 11
NOT VALID WITHOUT SHEETS 1-2 & 4-11

SOUTHEASTERN SURVEYING AND MAPPING CORPORATION
6500 All American Boulevard
Orlando, Florida 32810-4350
(407) 292-8580 Certificate of Authorization LB2108
e-mail info@southeasternsurveying.com

Topographic Survey

Project:
City of Casselberry
Storm Drain Rehabilitation Project (PW 1501)

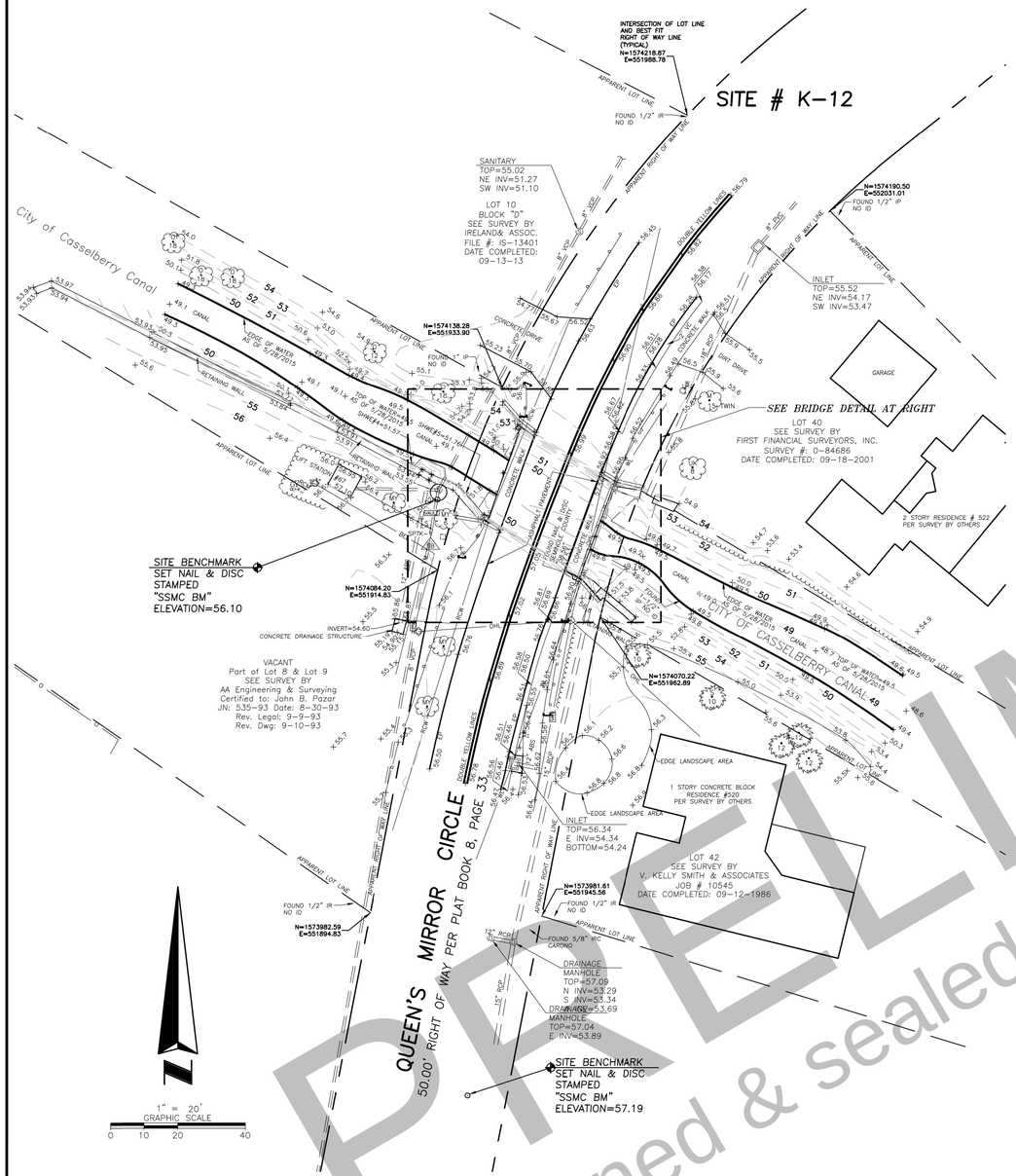
Field Date: 8/06/215
Drawn By: JLG
Scale: 1"=20'

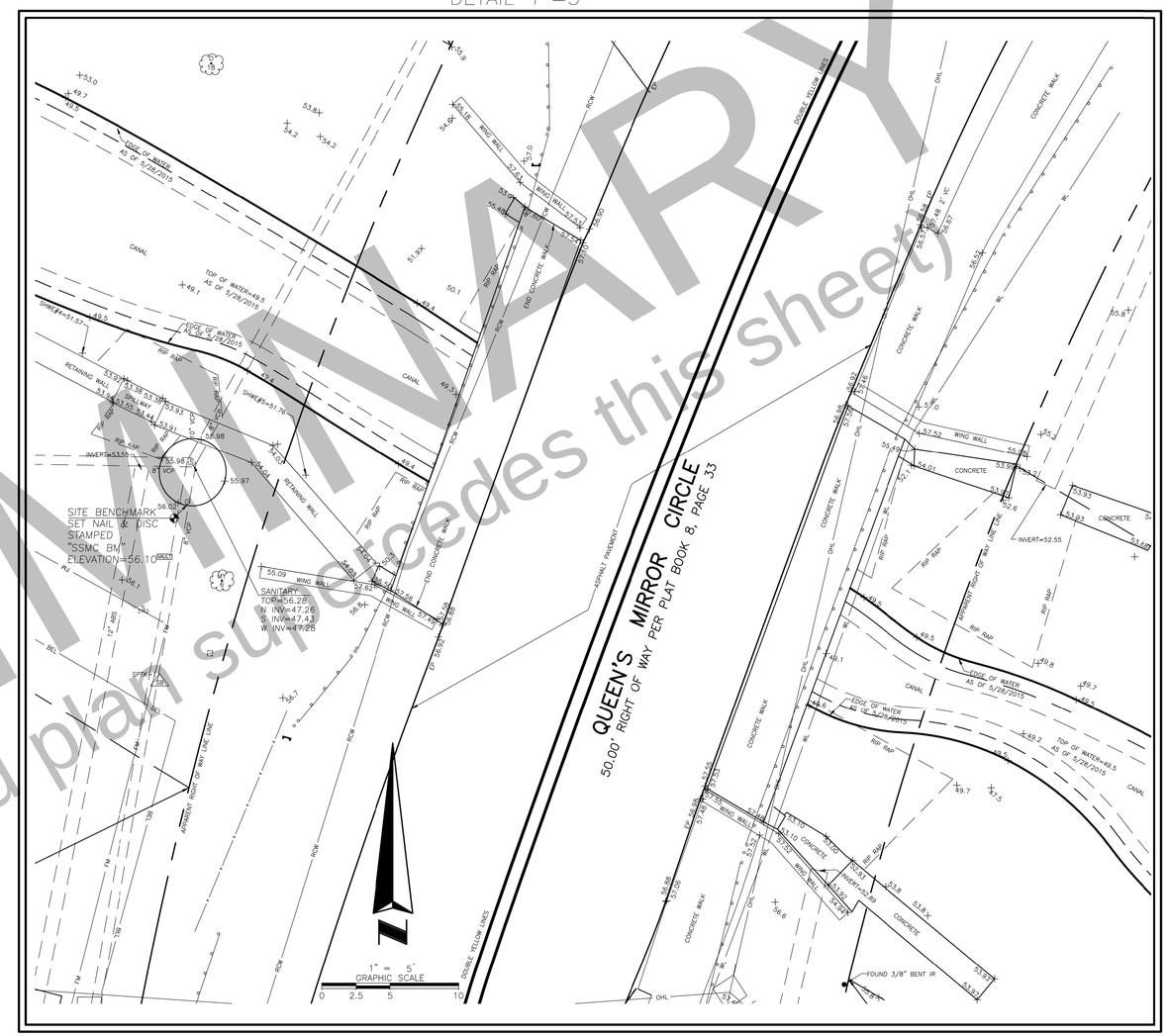
SEE SHEET 1 FOR NOTES, LEGEND AND DESCRIPTION.

DRAWING NUMBER
59295001

SHEET 5

R:\Casselberry\StormDrainRehab\DGN\SDR-Survey_Sheet2.dgn
6/9/2016





PRELIMINARY
(signed & sealed plan supercedes this sheet)

Site K-12
Missing and ambiguous record plat data resulted over the years, in various interpretations of the lot lines and right of way lines. As a result of these inconsistencies the lot lines & right of way lines depicted hereon were derived from the individual residents' surveys performed by others and supplied to this surveyor by the residents and shown as a graphic possibility of their locations. In order to resolve any inconsistencies that could exist and in keeping in harmony with the neighboring residents, a "boundary survey" to determine the true lot line and right of way line locations would be strongly advised especially if any improvements were to be performed in the proximity of these lot lines.

REVISION DATE	REVISION	BY

SHEET NUMBER 4 OF 9
NOT VALID WITHOUT SHEETS 1-3 & 7-11

SOUTHEASTERN SURVEYING AND MAPPING CORPORATION
6500 All American Boulevard
Orlando, Florida 32810-4350
(407) 292-8580 Fax: (407) 292-8583 LB2108
e-mail info@southeasternsurveying.com

Project: Topographic Survey
City of Casselberry
Storm Drain Rehabilitation Project (PW 1501)

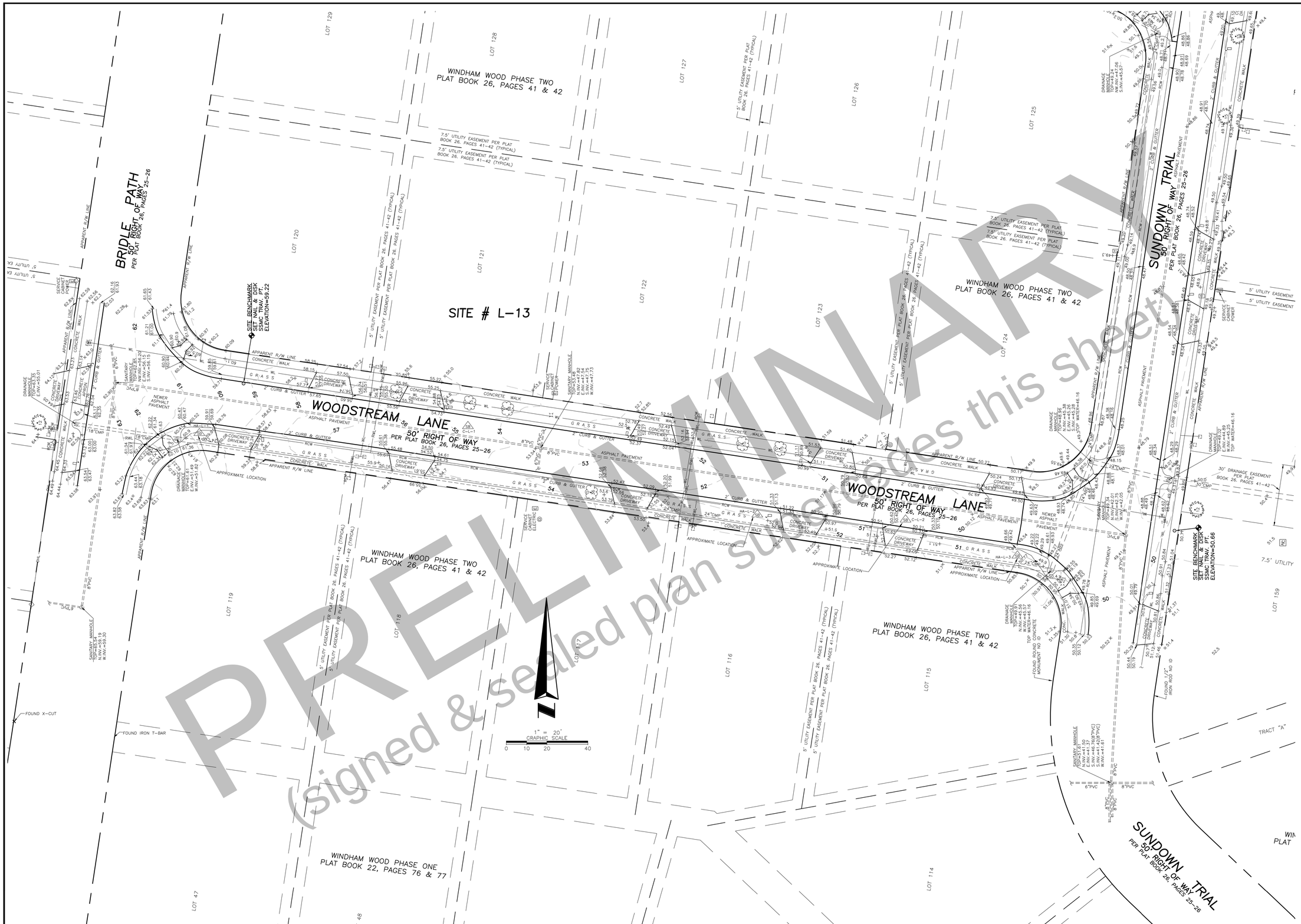
Field Date: 8/06/2015 | Drawn By: JLG | Scale: 1"=20'

SEE SHEET 1 FOR NOTES, LEGEND AND DESCRIPTION.

DRAWING NUMBER
59295001

SHEET 6

R:\Casselberry\StormDrainRehab\DGN\SDR-Survey_Sheet3.dgn
6/9/2016



PRELIMINARY
(signed & sealed plan supersedes this sheet)

REVISION DATE	REVISION	BY

SHEET NUMBER 10 OF 11

NOT VALID WITHOUT SHEETS 1-9 & 11

Southeastern Surveying

SOUTHEASTERN SURVEYING
AND MAPPING CORPORATION
6500 All American Boulevard
Orlando, Florida 32810-4350
(407) 292-8580 Fax: (407) 292-8575 Www.southeasternsurveying.com
e-mail info@southeasternsurveying.com

Topographuc Survey

Project: City of Casselberry
Storm Drain Rehabilitation Project (PW 1501)

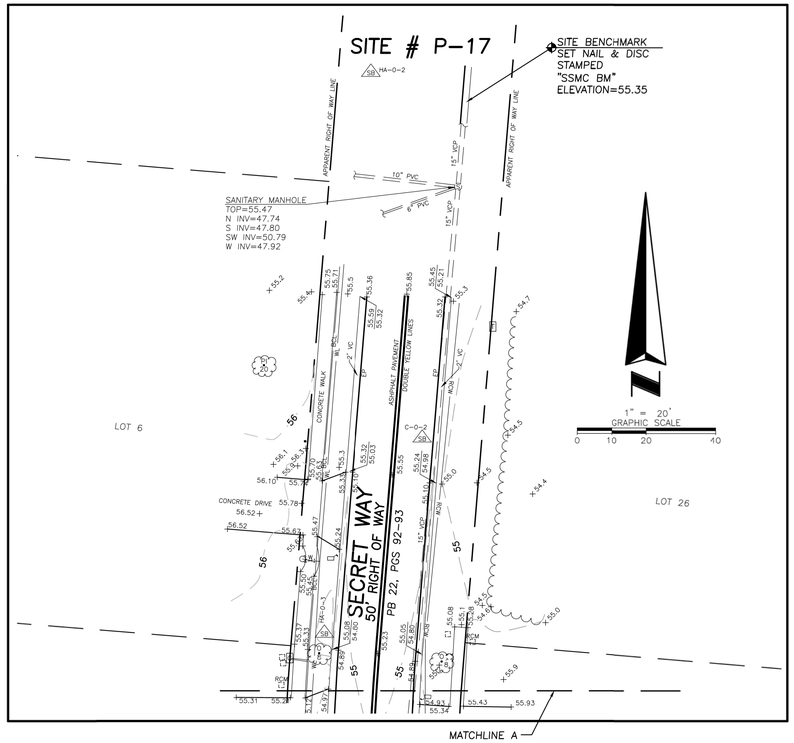
Field Date: 8/05/2015 | Drawn By: JLG | Scale: 1"=20'

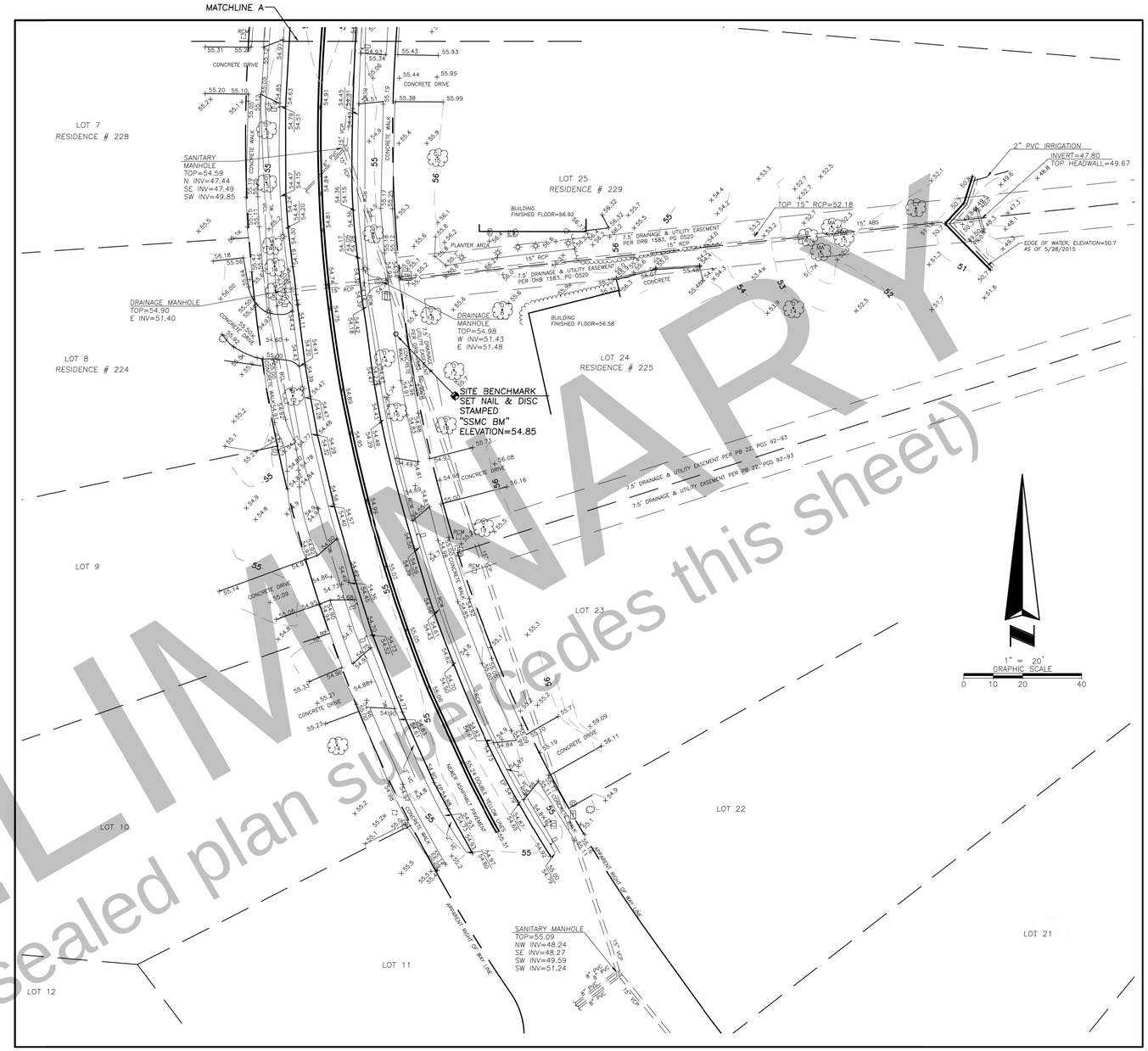
SEE SHEET 1 FOR NOTES, LEGEND AND DESCRIPTION.

DRAWING NUMBER
59295001

SHEET 7

A:\Casselberry\StormDrainRehab\DGN\SDR-Survey_Sheet4.dgn
6/9/2016





PRELIMINARY
(signed & sealed plan supersedes this sheet)

REVISION DATE	REVISION	BY

SHEET NUMBER 6 OF 11

NOT VALID WITHOUT SHEETS 1-5 & 7-11

SOUTHEASTERN SURVEYING AND MAPPING CORPORATION
6500 All American Boulevard
Orlando, Florida 32810-4350
(407) 297-1900 Certificate of Authorization LB2108
e-mail info@southeasternsurveying.com

Project: **Topographic Survey**
City of Casselberry
Storm Drain Rehabilitation Project (PW 1501)

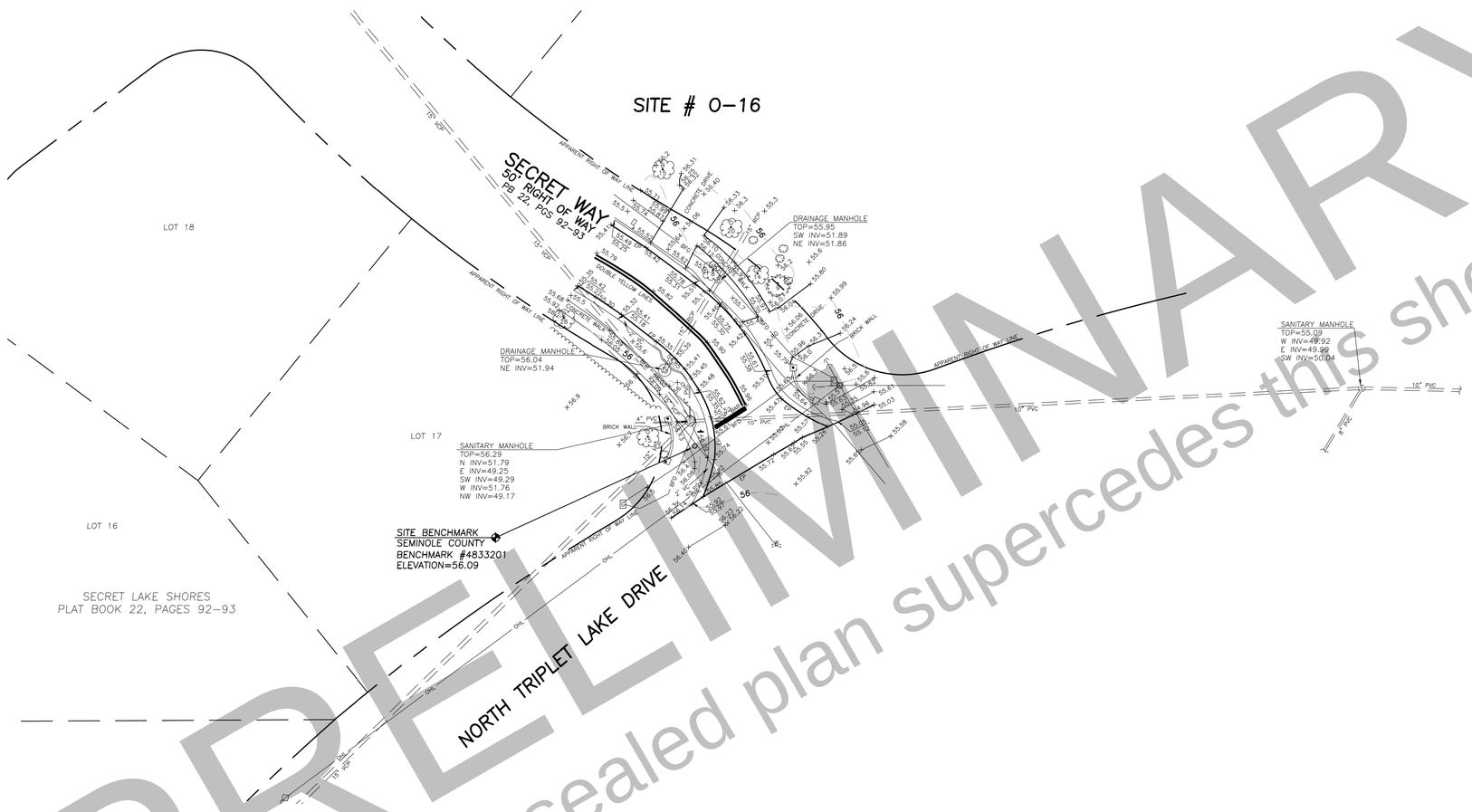
Field Date: 8/06/2015 | Drawn By: JLG | Scale: 1" = 20'

SEE SHEET 1 FOR NOTES, LEGEND AND DESCRIPTION.

DRAWING NUMBER
59295001

SHEET 8

N:\Casselberry\StormDrainRehab\DGN\SDR-Survey_Sheet5.dgn
8/8/2016



1" = 20'
GRAPHIC SCALE
0 10 20 40

PRELIMINARY
(signed & sealed plan supercedes this sheet)

REVISION DATE	REVISION	BY

SHEET NUMBER 5 OF 11
NOT VALID WITHOUT SHEETS 1-4 & 8-11

SOUTHEASTERN SURVEYING AND MAPPING CORPORATION
6500 All American Boulevard
Orlando, Florida 32810-4350
(407) 292-8580 Certificate of Authorization LB2108
e-mail info@southeasternsurveying.com

Topographic Survey

Project:
City of Casselberry
Storm Drain Rehabilitation Project (PW 1501)

Field Date: 8/05/2015 | Drawn By: JLG | Scale: 1"=20'

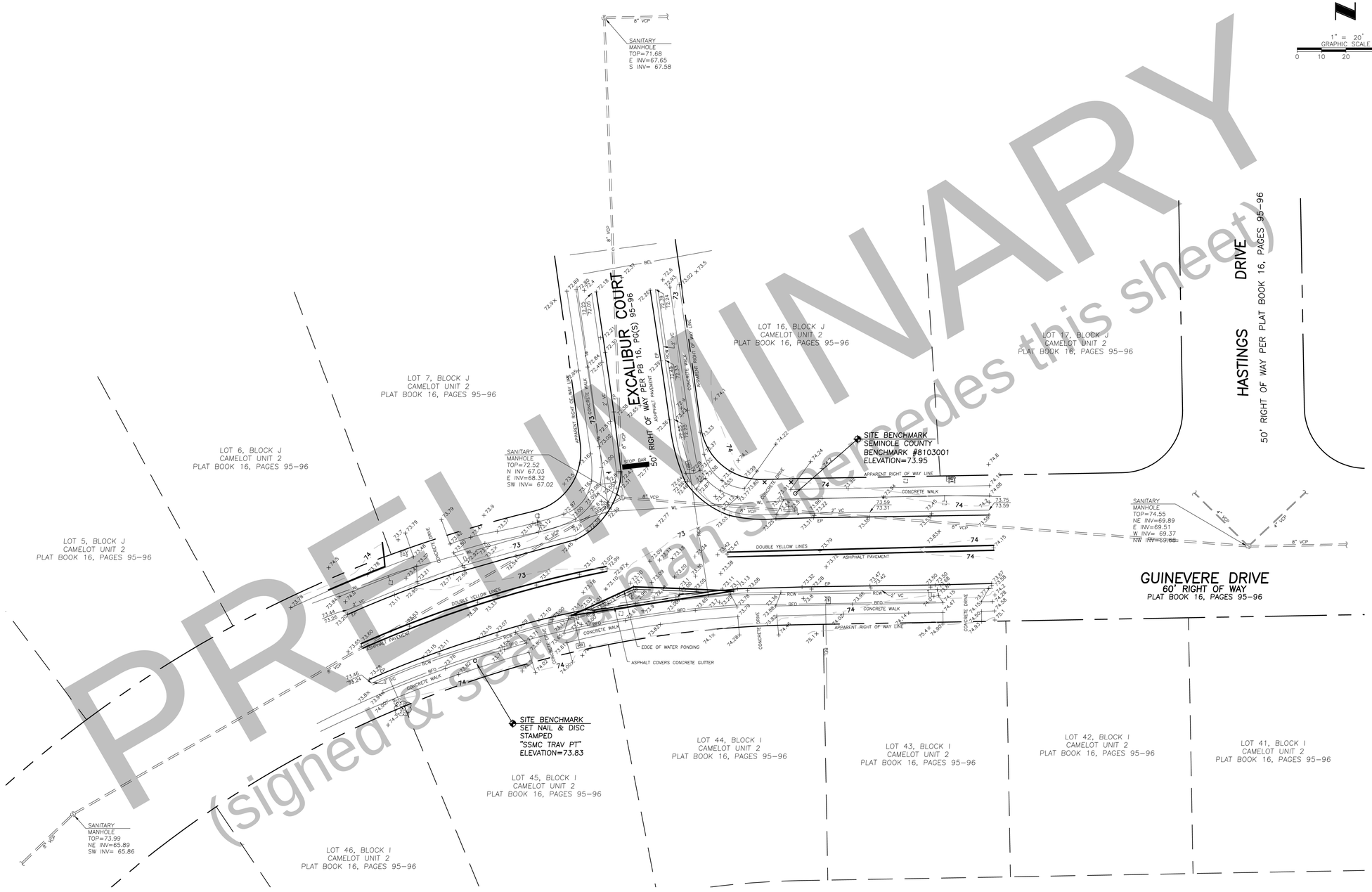
SEE SHEET 1 FOR NOTES, LEGEND AND DESCRIPTION.

DRAWING NUMBER
59295001

SHEET 9

R:\Casselberry\StormDrainRehab\DGN\SDR-Survey_Sheet6.dgn
6/9/2016

SITE # Q-18



PRELIMINARY
(signed & sealed plan supersedes this sheet)

REVISION DATE	REVISION	BY

SHEET NUMBER 7 OF 11
NOT VALID WITHOUT SHEETS 1-6 & 8-11

SOUTHEASTERN SURVEYING AND MAPPING CORPORATION
6500 All American Boulevard
Orlando, Florida 32810-4350
(407) 292-8580 Certificate of Authorization No. LB2108
e-mail info@southeasternsurveying.com

Topographic Survey
City of Casselberry
Storm Drain Rehabilitation Project (PW 1501)

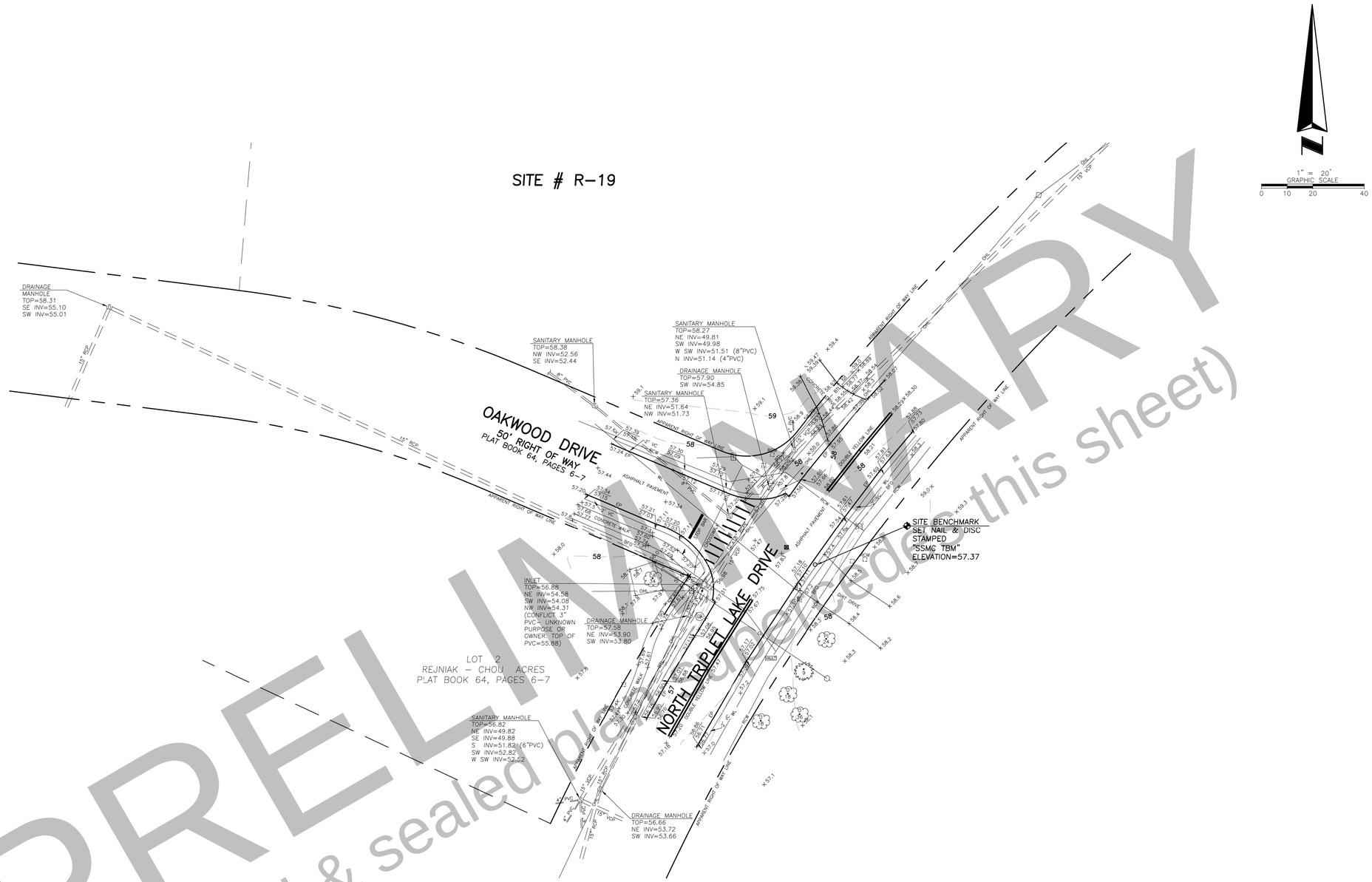
Project:
Field Date: 8/26/2015
Drawn By: JLG
Scale: 1"=20'

SEE SHEET 1 FOR NOTES, LEGEND AND DESCRIPTION.

DRAWING NUMBER
59295001

SHEET 10

N:\Casselberry\StormDrainRehab\DGN\SDR-Survey_Sheet7.dgn
6/9/2016



PRELIMINARY
(signed & sealed plans supersedes this sheet)

REVISION DATE	REVISION	BY

SHEET NUMBER 8 OF 11
NOT VALID WITHOUT SHEETS 1-7 & 9-11

SOUTHEASTERN SURVEYING AND MAPPING CORPORATION
6500 All American Boulevard
Orlando, Florida 32810-4350
(407) 292-8580 Certificate of Authorization LB2108
e-mail info@southeasternsurveying.com

Topographic Survey

Project: **City of Casselberry**
Storm Drain Rehabilitation Project (PW 1501)

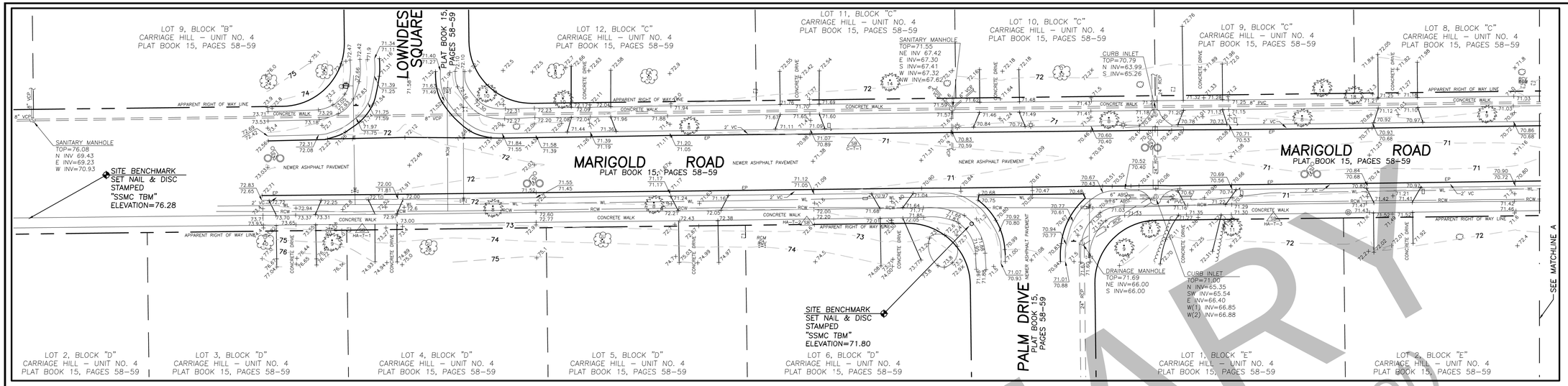
Field Date: 8/06/2015 | Drawn By: JLG | Scale: 1"=20'

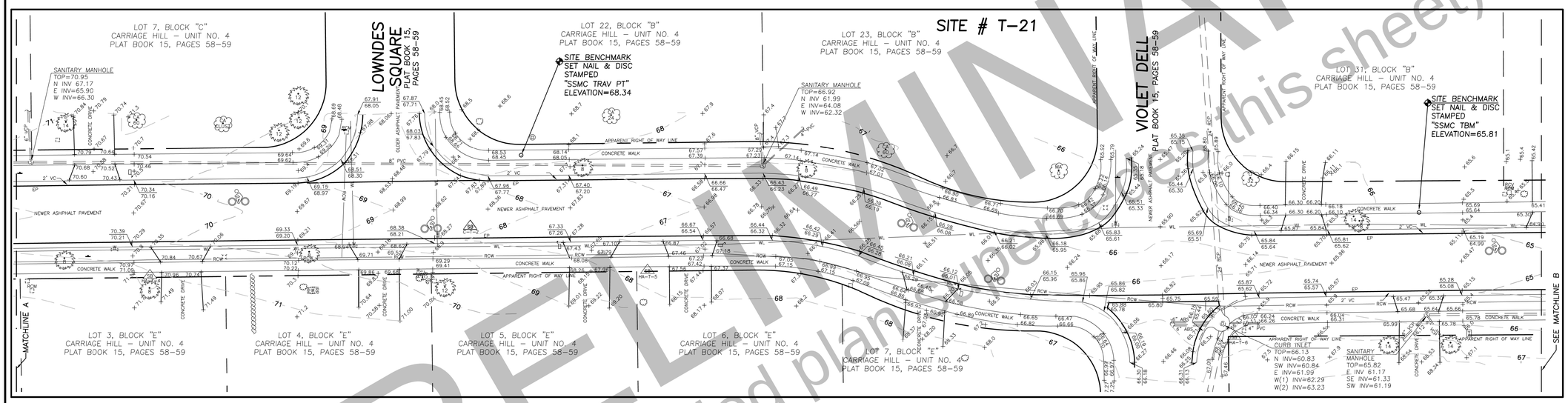
SEE SHEET 1 FOR NOTES, LEGEND AND DESCRIPTION.

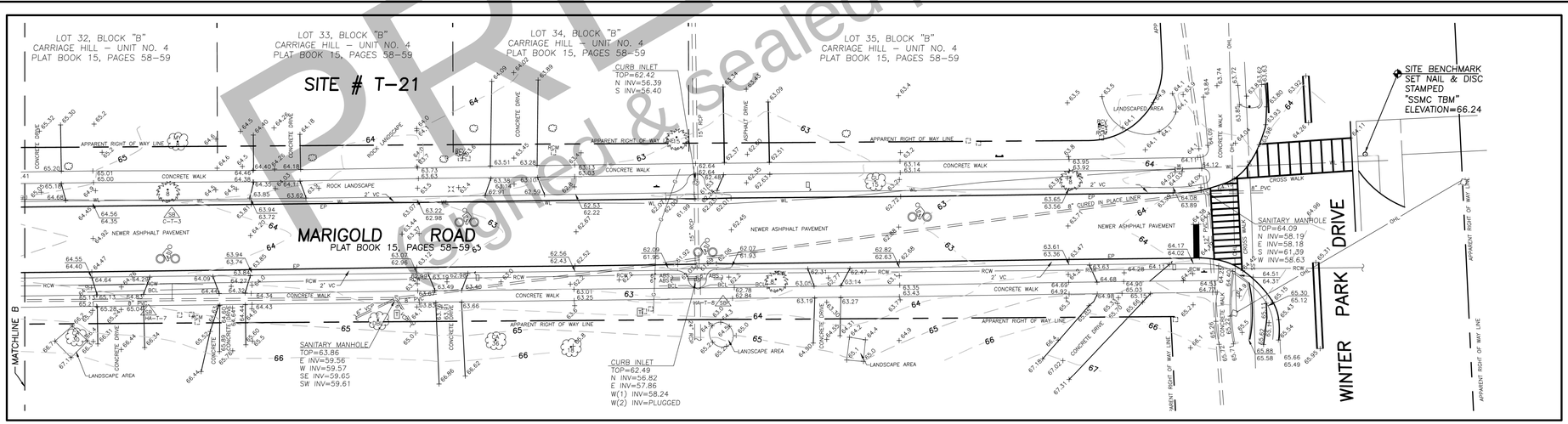
DRAWING NUMBER
59295001

SHEET 11

N:\Casselberry\StormDrainRehab\DGN\SDR-Survey_Sheet8.dgn
6/9/2016







1" = 20'
GRAPHIC SCALE
0 10 20 40

PRELIMINARY
Not signed & sealed plans supercedes this sheet

REVISION DATE	REVISION	BY

SHEET NUMBER 9 OF 11
NOT VALID WITHOUT SHEETS 1–8 & 10–11

Southeastern Surveying
SOUTHEASTERN SURVEYING AND MAPPING CORPORATION
6500 All American Boulevard
Orlando, Florida 32810–4350
(407) 292–8580 Fax (407) 292–8582 LB2108
e–mail info@southeasternsurveying.com

Project:
Topographic Survey
City of Casselberry
Storm Drain Rehabilitation Project (PW 1501)

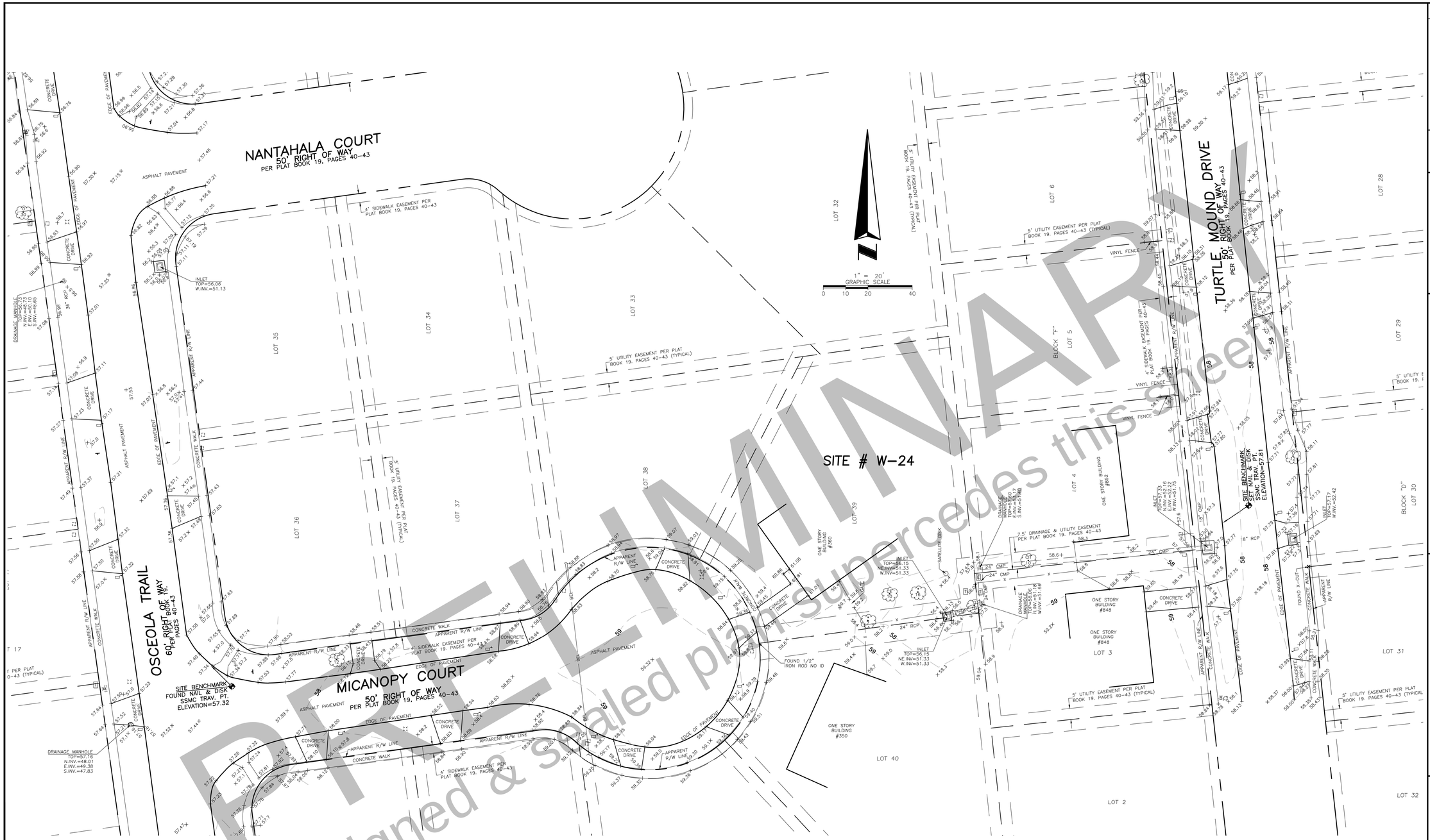
Field Date: 8/06/2015
Drawn By: JLC
Scale: 1"=20'

SEE SHEET 1 FOR NOTES, LEGEND AND DESCRIPTION.

DRAWING NUMBER
59295001

SHEET 12

N:\Casselberry\StormDrainRehab\DGN\SDR-Survey_Sheet9.dgn
6/9/2016



PRELIMINARY
(signed & sealed plans supercedes this sheet)

REVISION DATE	REVISION	BY

SHEET NUMBER 11 OF 11
NOT VALID WITHOUT SHEETS 1-10

SOUTHEASTERN SURVEYING AND MAPPING CORPORATION
6500 All American Boulevard
Orlando, Florida 32810-4350
(407) 292-8580 Fax (407) 292-8583 Certificate of Authorization No. LB2108
e-mail info@southeasternsurveying.com

Topographic Survey
City of Casselberry
Project: Storm Drain Rehabilitation Project (PW 1501)

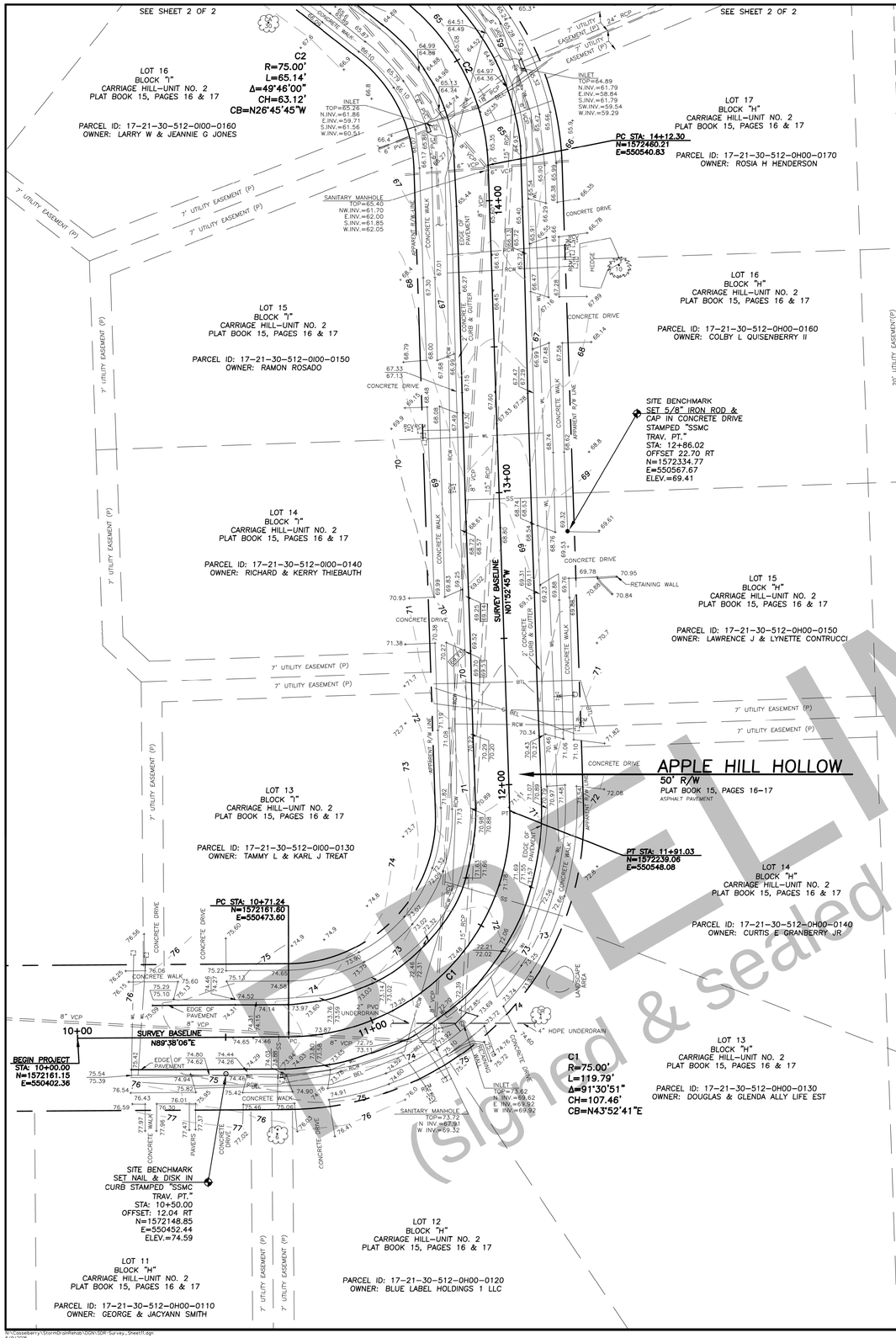
Field Date: 8/26/2015 | Drawn By: JLG | Scale: 1"=20'

SEE SHEET 1 FOR NOTES, LEGEND AND DESCRIPTION.

DRAWING NUMBER
59295001

SHEET 13

N:\Casselberry\StormDrainRehab\DGN\SDR-Survey_Sheet10.dgn
6/9/2016



1" = 20' GRAPHIC SCALE
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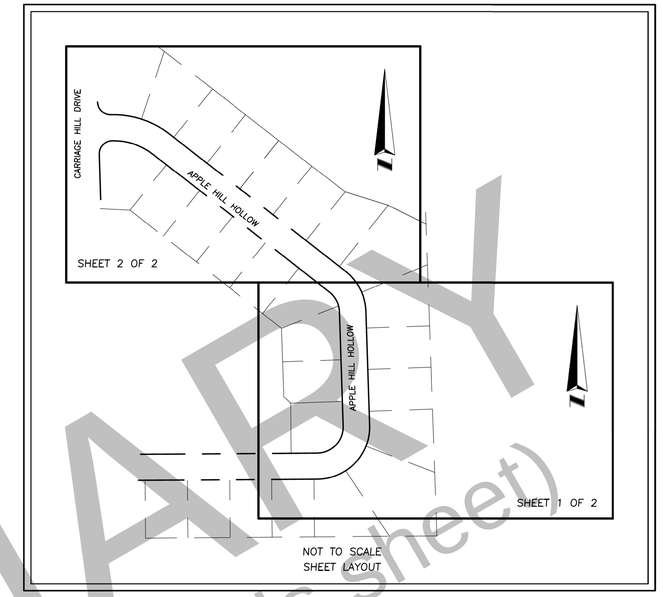


LEGEND AND ABBREVIATIONS:

	= DRAINAGE MANHOLE	–BEL–	= BURIED ELECTRIC LINE
	= FIRE HYDRANT	–BTL–	= BURIED TELEPHONE LINE
	= WATER SPIGOT	–G–	= GAS LINE
	= IRON ROD	–RWL–	= RECLAIMED WATER LINE
	= LIGHT POLE	–WL–	= WATER LINE
	= NAIL W/DISC	–SS–	= SANITARY SEWER LINE
RCM	= RECLAIMED WATER METER	TRAV.PT.	= TRAVERSE POINT
	= RECLAIMED WATER VALVE	SSMC	= SOUTHEASTERN SURVEYING & MAPPING CORPORATION
	= SANITARY MANHOLE	PT	= POINT OF TANGENCY
	= TRAFFIC SIGN	PC	= POINT OF CURVATURE
	= WATER METER	STA:	= STATION
	= WATER VALVE		
ELEV.	= ELEVATION		
ID	= IDENTIFICATION		
LB	= LICENSED BUSINESS		
PVC	= POLYVINYL CHLORIDE PIPE		
RCP	= REINFORCED CONCRETE PIPE		
VCP	= VITRIFIED CLAY PIPE		
HDPE	= HIGH DENSITY POLYETHYLENE PIPE		
C1	= CURVE NUMBER		
R	= RADIUS		
L	= LENGTH		
Δ	= CENTRAL ANGLE		
CH	= CHORD		
CB	= CHORD BEARING		

SIZE SHOWN IS TRUNK DIAMETER IN INCHES MEASURED AT CHEST HEIGHT

= PALM

= TREE

CA	= CAMPHOR		
MA	= MAGNOLIA		
S	= SYCAMORE		
OR	= ORANGE		
*	= BOUGAINVILLEA		

DESCRIPTION:

A portion of Apple Hill Hollow as shown on Carriage Hill – Unit No. 2, according to the plat thereof as recorded in Plat Book 15, Pages 16 and 17, Public Records of Seminole County, Florida.

SURVEYOR'S REPORT:

1. Utility locations if shown hereon are based on field location of markings by utility company representatives, surface features and construction plans furnished to the surveyor. Additional sub–surface utilities may exist that have not been field located.
2. Easements or rights of way that appear on recorded plans or that have been furnished to the surveyor by others have been incorporated into this drawing with appropriate notation. Other easements may be discovered by a search of the Public Records.
3. Minimum Horizontal Accuracy for this survey is in accordance with the STANDARDS OF PRACTICE set forth by the Board of Professional Surveyors and Mappers in Chapter 5J–17 requirements of Florida Administration Code. The map and measurement methods used for this survey meet or exceed this requirement. The dimensions shown hereon are in United States standard survey feet and decimals thereof.
4. This survey does not determine ownership of the lands shown hereon.
5. Underground foundations have not been located.
6. Survey map and report or the copies thereof are not valid without the signature and the original raised seal of a Florida Licensed Surveyor and Mapper.
7. Features shown by symbol as indicated in the legend are not to scale.
8. Additions or deletions to survey maps or reports by other than the signing party or parties is prohibited without written consent of the signing party or parties.
9. Vertical information shown hereon refers to Seminole County GPS point 0181/CORAL as being a 4" x 4" concrete monument with brass disk stamped GPS 0181/CORAL, Elevation=81.797 North American Vertical Datum 1988 (NAVD88).
10. Horizontal positions for all features shown on the map are relative to North American Datum of 1983 (NAD83), 1990 adjustment, State Plane Coordinate System, Florida East Zone. Control points used for this survey are Seminole County GPS point #0181/CORAL and point #497A/HEART; distances shown are GRID distances.
11. Bearings shown hereon are based on the Survey Baseline from Station 10+00 to PC Station 10+50.00 being N 89°38'06" E. Bearings shown hereon are measured unless otherwise noted.
12. This Survey was performed without benefit of an abstract, title search, title opinion or title commitment. A title search may reveal additional information affecting the parcel as shown.
13. Improvements & Topographic features shown hereon are limited to areas per specific instructions of the client.
14. Right of Way information shown hereon was determined by found monumentation, recorded plats, and information obtained on the Seminole County Property Appraisers web site.

NOTICE OF LIABILITY:

This survey is certified to those individuals shown on the face thereof. Any other use, benefit or reliance by any other party is strictly prohibited and restricted. Surveyor is responsible only to those certified and hereby disclaims any other liability and hereby restricts the rights of any other individual or firm to use this survey, without express written consent of the surveyor.

PRELIMINARY
(signed & sealed plan supercedes this sheet)

Jason Peterson
Professional Surveyor
and Mapper
Number 4791

Southeastern Surveying

SOUTHEASTERN SURVEYING
AND MAPPING CORPORATION
6500 All American Boulevard
Orlando, Florida 32810–4350
(407) 292–8580 Fax (407) 292–0141
e–mail: info@southeasternsurveying.com
Certification Number LB2108

REVISION	BY

REVISION DATE	

SHEET NUMBER 1 OF 2
NOT VALID WITHOUT SHEET 2 OF 2

Topographic Survey
Apple Hill Hollow
Storm Drain Rehabilitation

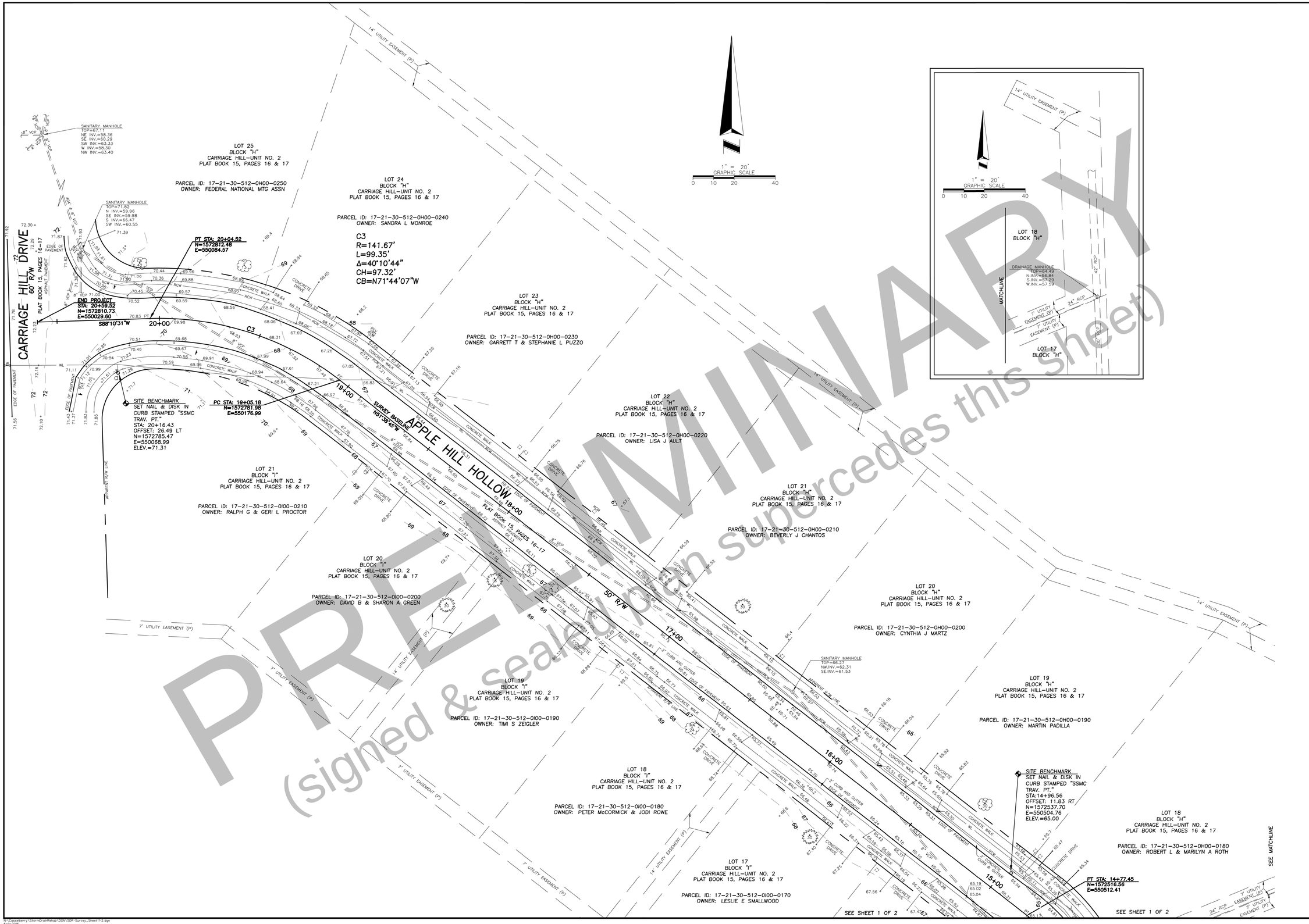
Project:

Field Date: 3/17/2016 | Drawn By: DM | Scale: 1"=20'

Certified to: Singhofen & Associates, Inc.

DRAWING NUMBER
55323003
SHEET NUMBER
SHEET 14

N:\Casselberry\StormDrainRehab\DGN\SDR-Survey_Sheet11.dgn
6/9/2016



SHEET NUMBER 2 OF 2
NOT VALID WITHOUT SHEET 1 OF 2

SOUTHEASTERN SURVEYING AND MAPPING CORPORATION
6500 All American Boulevard
Orlando, Florida 32810-4350
(407) 292-8580 Fax (407) 292-0141
e-mail: info@southeasternsurveying.com
Certification Number LB2108

REVISION	REVISION DATE	BY

Topographic Survey
Apple Hill Hollow
Storm Drain Rehabilitation

Project:
Field Date: 3/17/2016
Drawn By: DM
Scale: 1"=20'

SEE SHEET 1 FOR NOTES, LEGEND AND DESCRIPTION.

DRAWING NUMBER
55323003
SHEET NUMBER
SHEET 15

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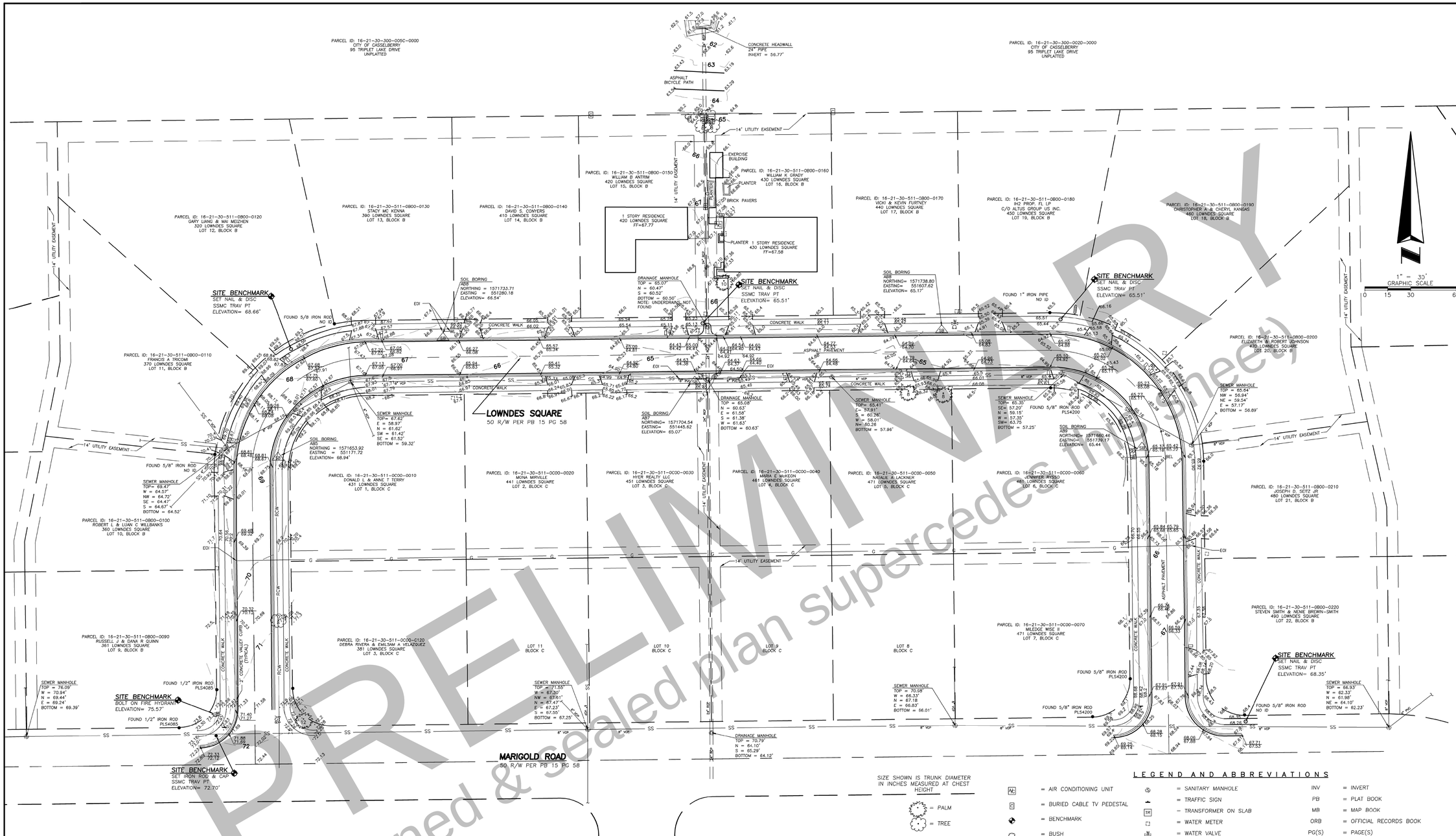
6/9/2016



SIZE SHOWN IS TRUNK DIAMETER IN INCHES MEASURED AT CHEST HEIGHT

= PALM

= TREE

DESCRIPTION:
A portion of Carriage Hill–Unit #4, Plat Book 15, Pages 58–59 per records of Seminole County, Florida.

SURVEYOR'S REPORT:

1. Utility locations if shown hereon are based on field location of markings by Utility Company representatives, surface features and construction plans furnished to the surveyor. Additional sub–surface utilities may exist that have not been field located. sunshine 811 has ceased responding to design tickets and mark buried utilities only for actual construction.
2. Easements or rights of way that appear on recorded plans or that have been furnished to the surveyor by others have been incorporated into this drawing with appropriate notation. Other easements may be discovered by a search of the Public Records.
3. Measurement methods used for this survey meet STANDARDS OF PRACTICE FOR LAND SURVEYING Chapter 5J–17.050–.052 requirements.
4. Underground foundations have not been located.
5. Bearings and distances shown hereon are measured unless otherwise noted.
6. The survey map and report or the copies thereof are not valid without the signature and the original raised seal of a Florida Licensed Surveyor and Mapper.
7. Features shown by symbol as indicated in the legend are not to scale.
8. Bearings shown hereon are based on PLAT of Carriage Hill–Unit #4, as recorded in Plat Book 15, pages 58–59, Seminole Florida .
9. Vertical information shown hereon refers to Seminole County GPS point 0181/CORAL as being a 4"x4" concrete monument with brass disk stamped GPS 0181/CORAL, Elevation=81.797 North American Vertical Datum 1988; NAVD88.
10. Based on the Federal Emergency Management Agency Flood Insurance Rate Map (FIRM)number 12117C0165F, dated 09/28/2007, the above described property is within Zone "X"
11. The horizontal positions for all features shown on the map are relative to North American Datum, NAD 1983, 2007 adjustment, State Plane Coordinate System, Florida East Zone. Control points used for this survey are Seminole County GPS point 0321/JADE, Designation Number 515120321 and Seminole County GPS point 0497/GIS–497, Designation Number 409750497; distances shown are GRID distances.
12. This Survey was performed without benefit of an abstract, title search, title opinion or title commitment. A title search may reveal additional information affecting the parcel as shown.
13. Unless shown, only those visible features found within the boundaries of this survey or in the immediate vicinity of the above described parcel boundary have been located.
14. Dimensions are shown in United States standard survey feet and decimals thereof.
15. Positional accuracy meets National Geodetic Survey, NGS Third Order, Class One, specifically 1:10,000, verified by redundant measurements.
16. Additions or deletions to survey maps or reports by other than the signing party or parties is prohibited without written consent of the signing party or parties.
17. Right of Way information shown hereon was determined by found monumentation, recorded plats, and information obtained on the Seminole County Property Appraisers web site. No Right of Way documentation was provided by client.
18. Improvements & Topographic features shown hereon are limited to areas per specific instructions of the client.

NOTICE OF LIABILITY:
This survey is certified to those individuals shown on the face thereof. Any other use, benefit or reliance by any other party is strictly prohibited and restricted. Surveyor is responsible only to those certified and hereby disclaims any other liability and hereby restricts the rights of any other individual or firm to use this survey, without express written consent of the surveyor.

LEGEND AND ABBREVIATIONS

AC	= AIR CONDITIONING UNIT		= SANITARY MANHOLE	INV	= INVERT
C	= BURIED CABLE TV PEDESTAL		= TRAFFIC SIGN	PB	= PLAT BOOK
	= BENCHMARK	TR	= TRANSFORMER ON SLAB	MB	= MAP BOOK
	= BUSH		= WATER METER	ORB	= OFFICIAL RECORDS BOOK
T	= BURIED TELEPHONE PEDESTAL		= WATER VALVE	PG(S)	= PAGE(S)
	= DRAINAGE MANHOLE	–X–	= CHAINLINK FENCE	LB	= LICENSED BUSINESS
E	= ELECTRIC FIXTURE	–O–	= WOOD FENCE	LS	= LICENSED SURVEYOR
	= ELECTRIC SERVICE METER	–BEL–	= BURIED ELECTRIC LINE	RLS	= REGISTERED LAND SURVEYOR
	= FIRE HYDRANT	–BTL–	= BURIED TELEPHONE LINE	PSM	= PROFESSIONAL SURVEYOR AND MAPPER
	= IRON ROD	–G–	= GAS LINE	PCP	= PERMANENT CONTROL POINT
	= LIGHT POLE	–OHL–	= OVERHEAD UTILITY LINE	PRM	= PERMANENT REFERENCE MONUMENT
	= MAILBOX	–WL–	= WATER LINE	ID	= IDENTIFICATION
	= NAIL W/DISC	–RWL–	= RECLAIM WATER LINE	R/W	= RIGHT OF WAY
P	= PUMP	–SS–	= SANITARY SEWER	FF	= FINISH FLOOR ELEVATION
RW	= RECLAIMED WATER VALVE		= TREE/HEDGE LINE	EOI	= END OF INFORMATION
		–FM–	= FORCE MAIN	NAD	= NORTH AMERICAN DATUM
SB	= SOIL BORING	–OTC–	= OVERHEAD TRAFFIC LINE	NAVD	= NORTH AMERICAN VERTICAL DATUM
		ABS	= ACRYLONITRILE BUTADIENE STYRENE PIPE	TRAV.PT.	= TRAVERSE POINT
		PVC	= POLYVINYL CHLORIDE PIPE	SSMC	= SOUTHEASTERN SURVEYING & MAPPING CORPORATION
		RCP	= REINFORCED CONCRETE PIPE		
		VCP	= VITRIFIED CLAY PIPE		

REVISION DATE	REVISION	BY

SHEET NUMBER 1 OF 1

JAMES L. PETERSEN
Professional Surveyor & Mapper
Number 4791

SOUTHEASTERN SURVEYING AND MAPPING CORPORATION
6600 All American Blvd.
Orlando, Florida 32810–5350
(407) 292–8580 Certification Number LB2108
e–mail: info@southeasternsurveying.com

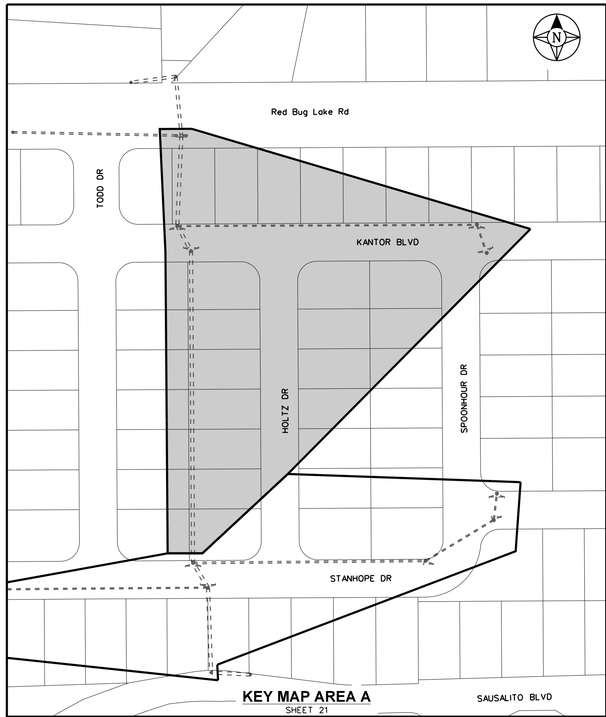
Topographic Survey
City of Casselberry
Project: Lowndes Square Drainage Improvements

Scale: 1" = 30'
Drawn By: JWG
Field Date: 9–4–2014

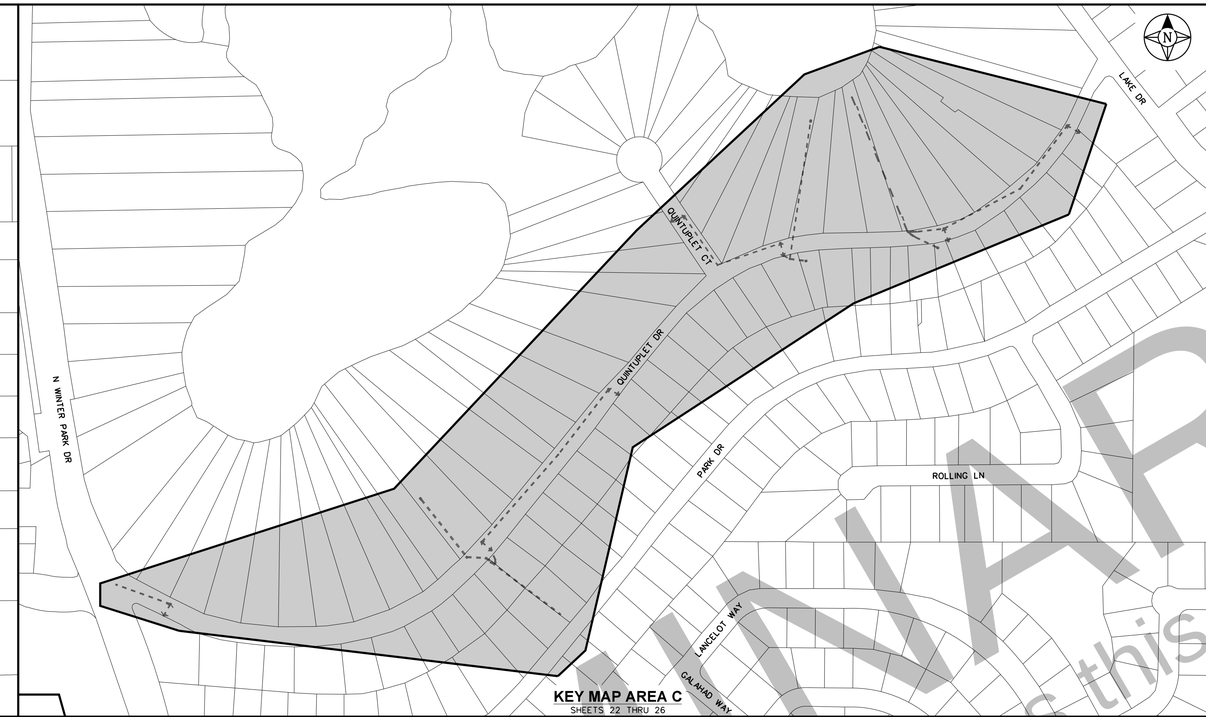
Certified to: City of Casselberry
Singhofen & Associates, Inc

DRAWING NUMBER
55323002C
SHEET NUMBER
SHEET 16

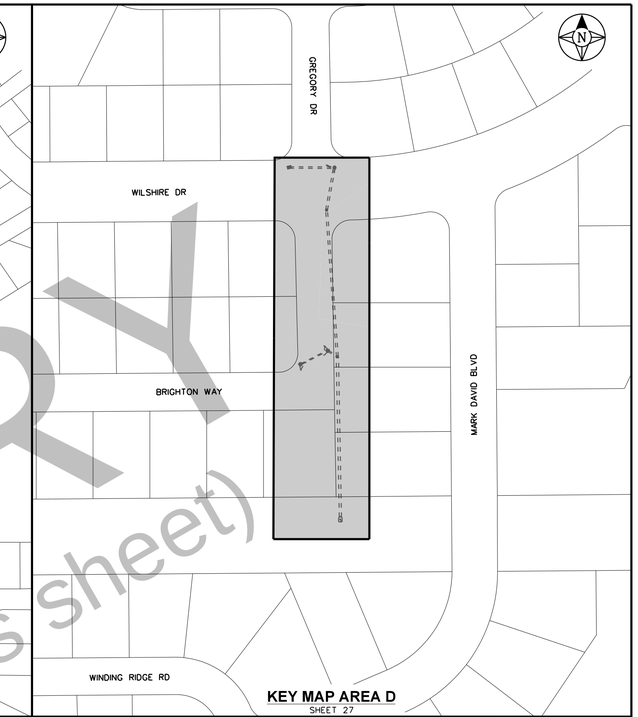
N:\Casselberry\StormDrainRehab\DGN\SDR-Survey_Sheet12.dgn
6/9/2016



KEY MAP AREA A
SHEET 21



KEY MAP AREA C
SHEETS 22 THRU 26



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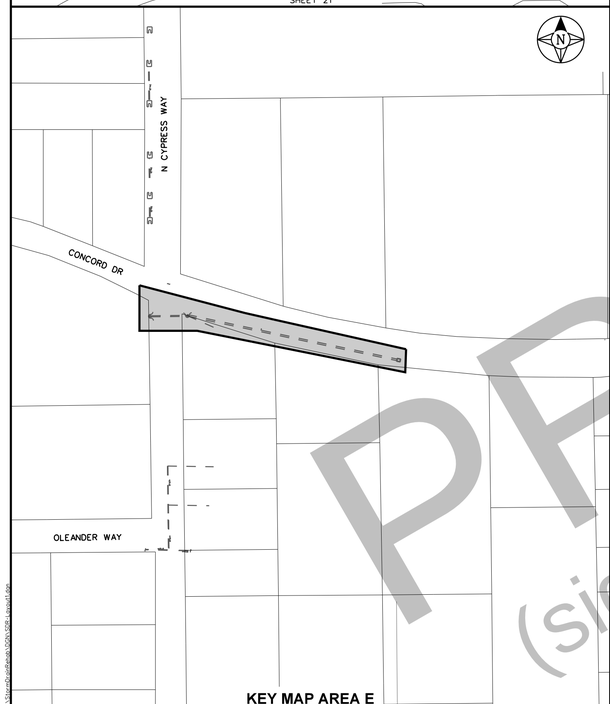
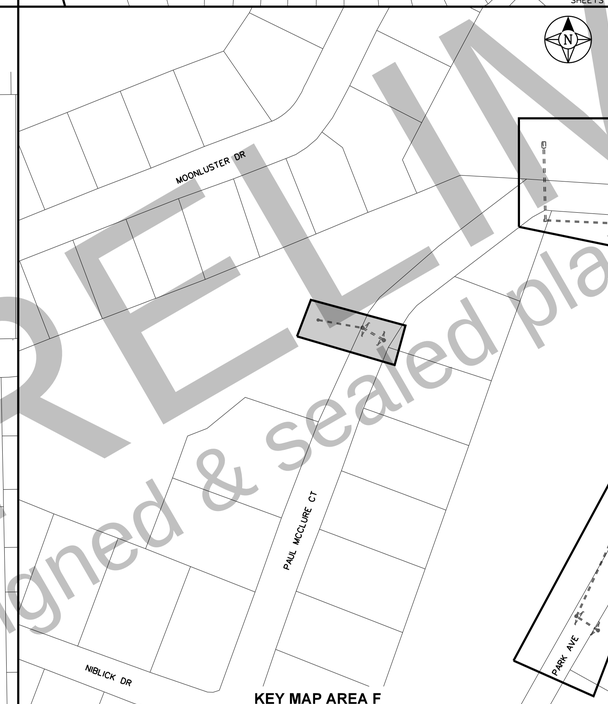
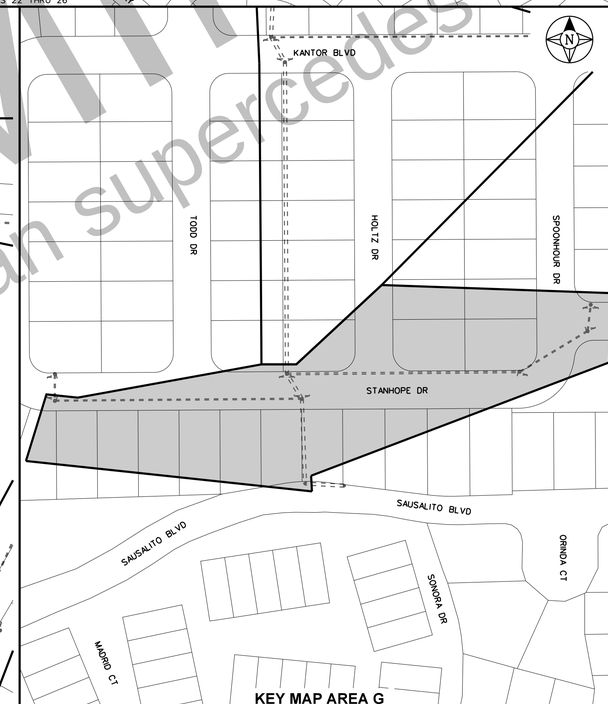


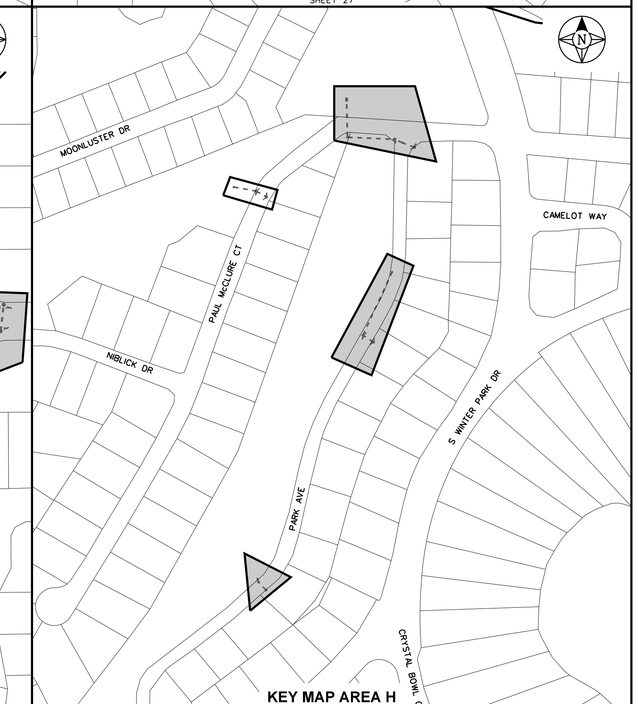
KEY MAP AREA E
SHEET 28



KEY MAP AREA F
SHEET 29



KEY MAP AREA G
SHEETS 30 & 31



KEY MAP AREA H
SHEETS 32 THRU 34

PRELIMINARY
(signed & sealed plan supercedes this sheet)

Revision	Date	Approved
PER CITY	4/29/16	BRW

Designed by: BRW
Drawn by: BJG/ADB
Checked by: RBG
Approved by: BRW
Vertical Datum: NAVD 1988

SINGHOFEN & ASSOCIATES, INC.
STORMWATER MANAGEMENT AND CIVIL ENGINEERING
11723 Orpington Street, Suite 100
Orlando, Florida 32817
Ph: (407) 679-3001
Fax: (407) 679-2691
DBPR No. 5112

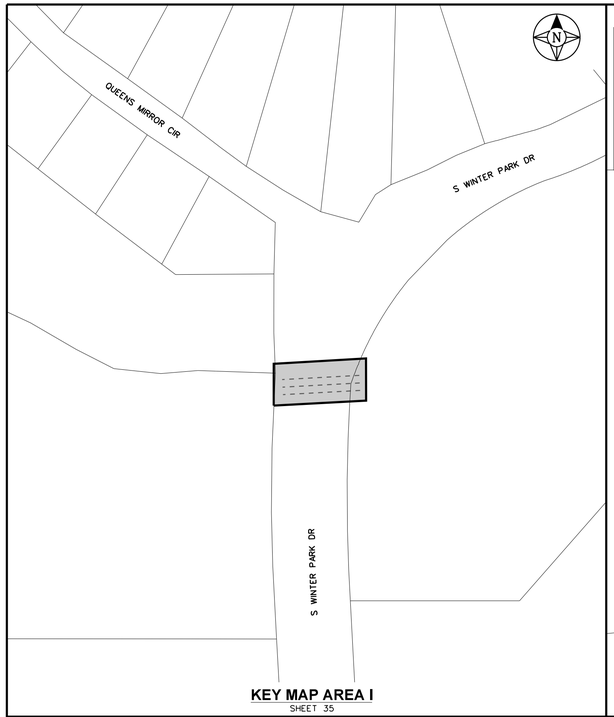
CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

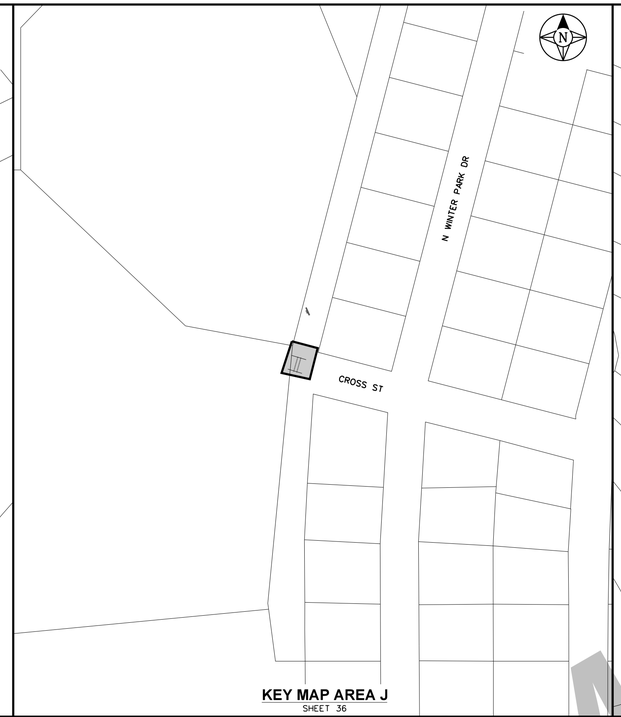
AREA LOCATION MAP

SHEET
17

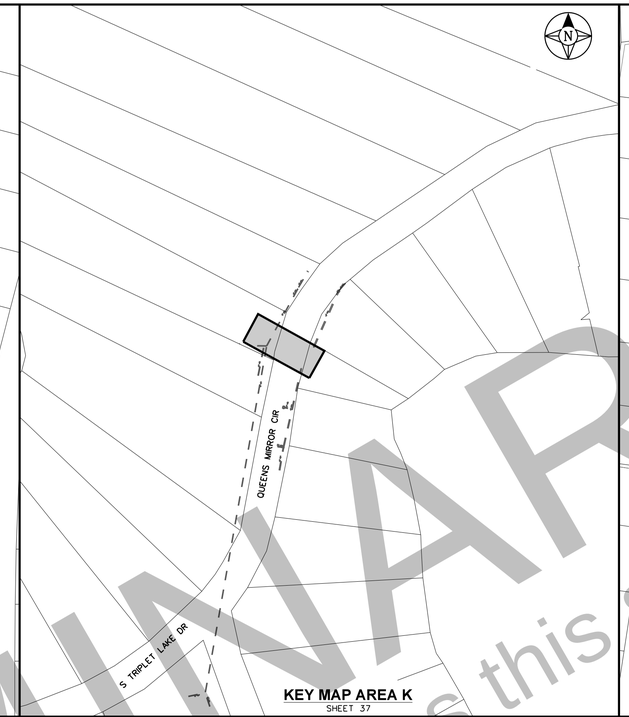
SAI
Project No.
2015-006.10



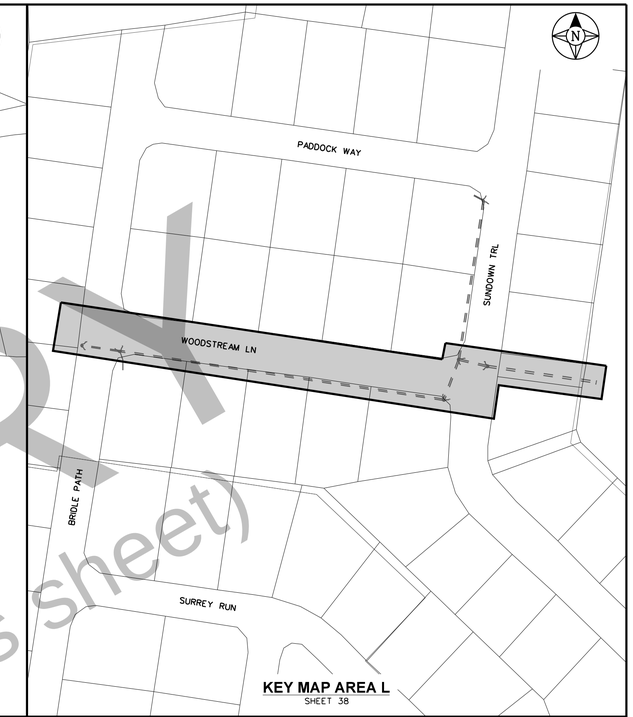
KEY MAP AREA I
SHEET 35



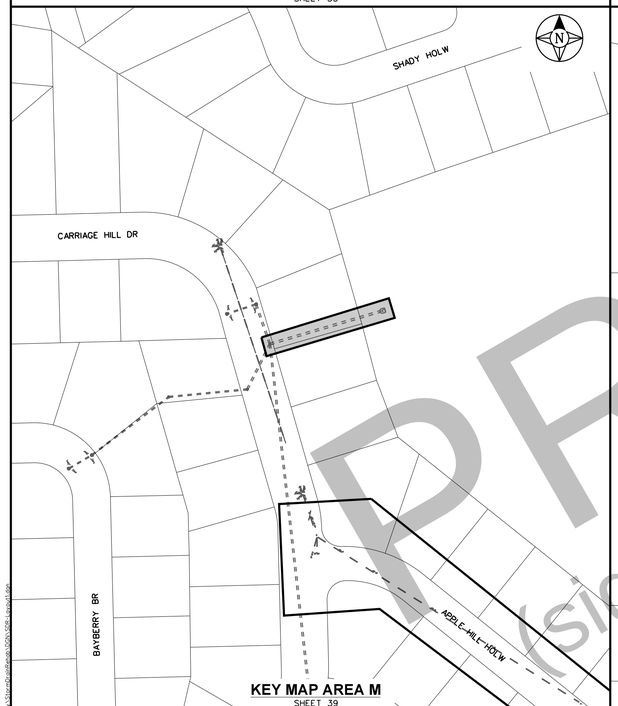
KEY MAP AREA J
SHEET 36



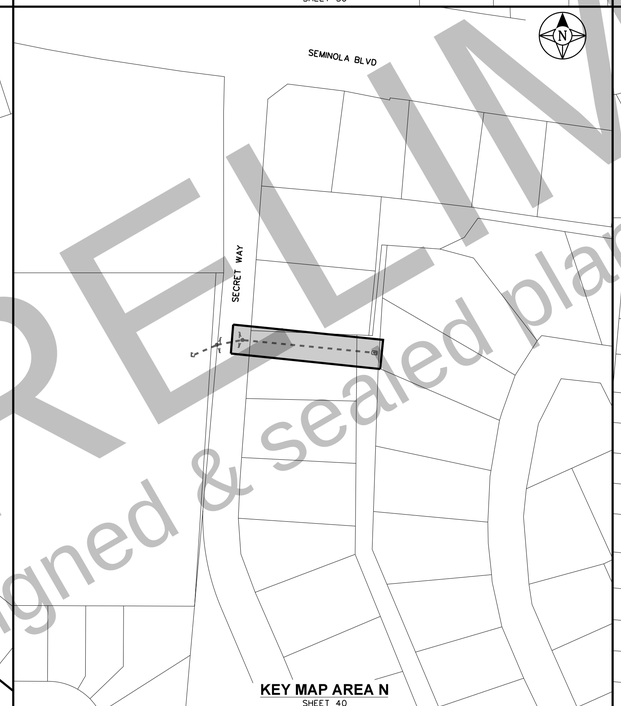
KEY MAP AREA K
SHEET 37



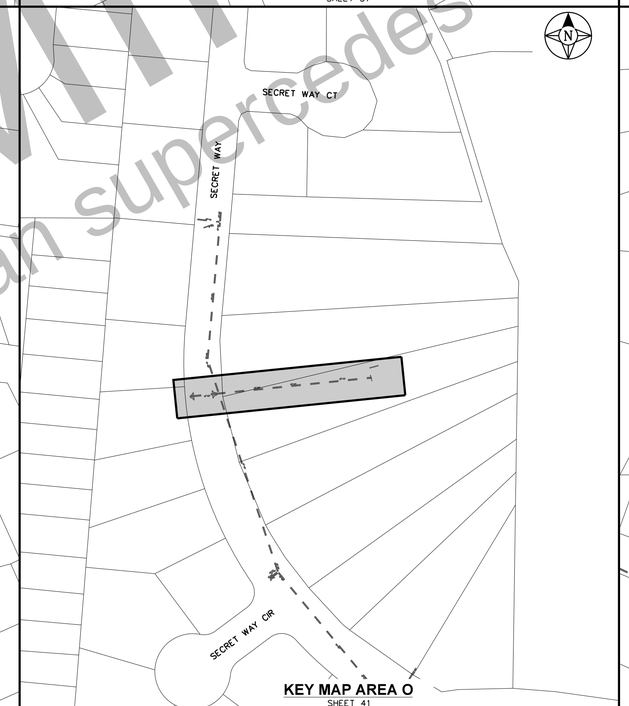
KEY MAP AREA L
SHEET 38



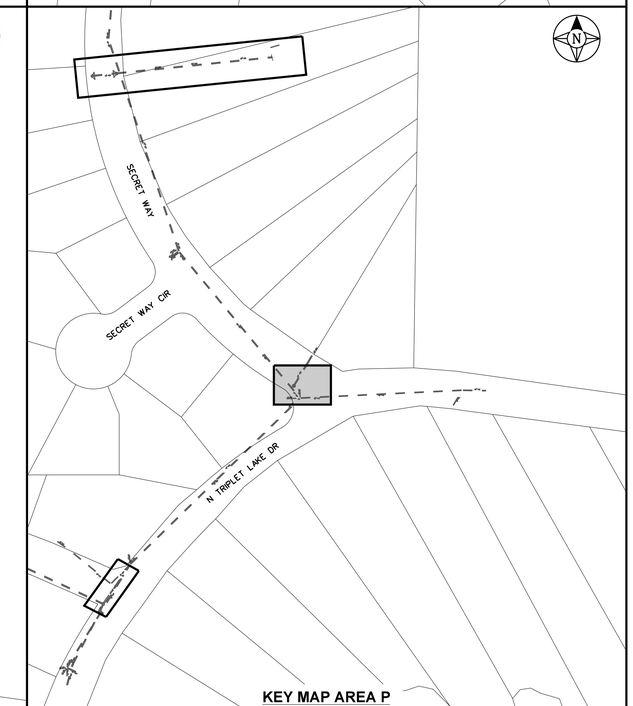
KEY MAP AREA M
SHEET 39



KEY MAP AREA N
SHEET 40



KEY MAP AREA O
SHEET 41



KEY MAP AREA P
SHEET 42

PRELIMINARY
(signed & sealed plan supercedes this sheet)

Revision	Date	Approved
PER CITY	4/29/16	BRW

Designed by: BRW
Drawn by: BJG/ADB
Checked by: RBG
Approved by: BRW
Vertical Datum: NAVD 1988

SINGHOFEN & ASSOCIATES, INC.
STORMWATER MANAGEMENT AND CIVIL ENGINEERING
SAI
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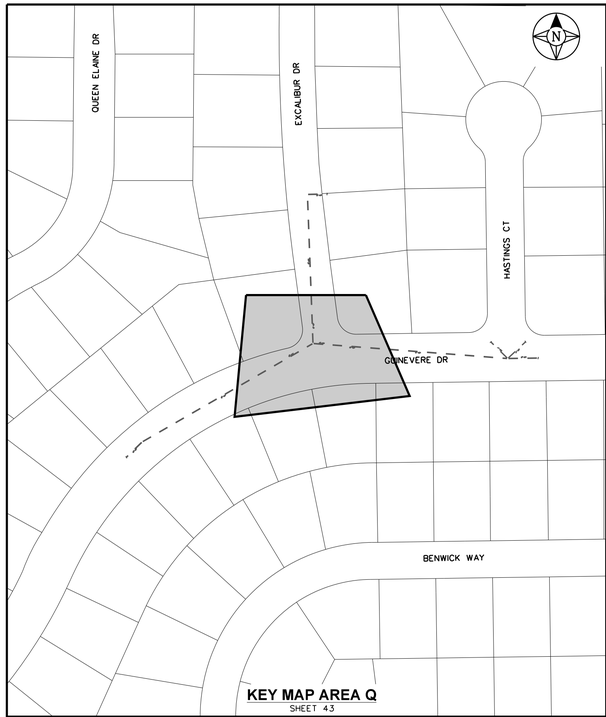
Ph: (407) 679-3001
Fax: (407) 679-2691
DBPR No. 5112

CITY OF CASSELBERRY
FLORIDA

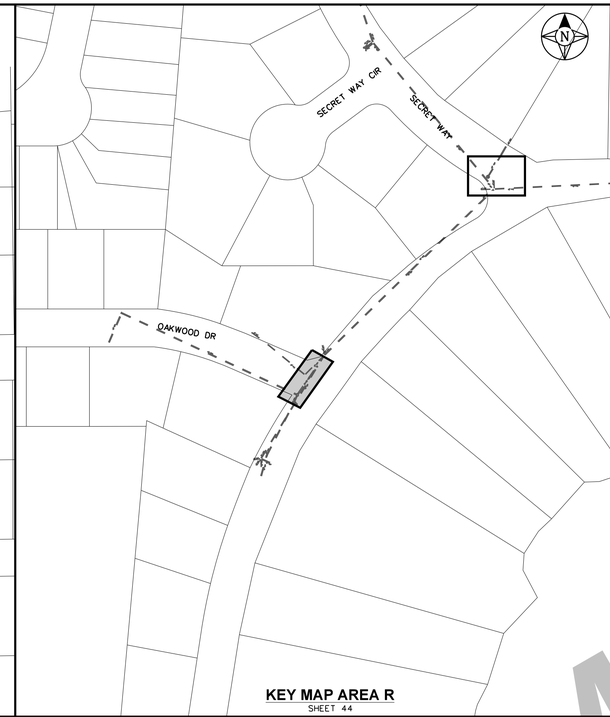
STORM DRAIN
REHABILITATION PROJECT

AREA LOCATION MAP

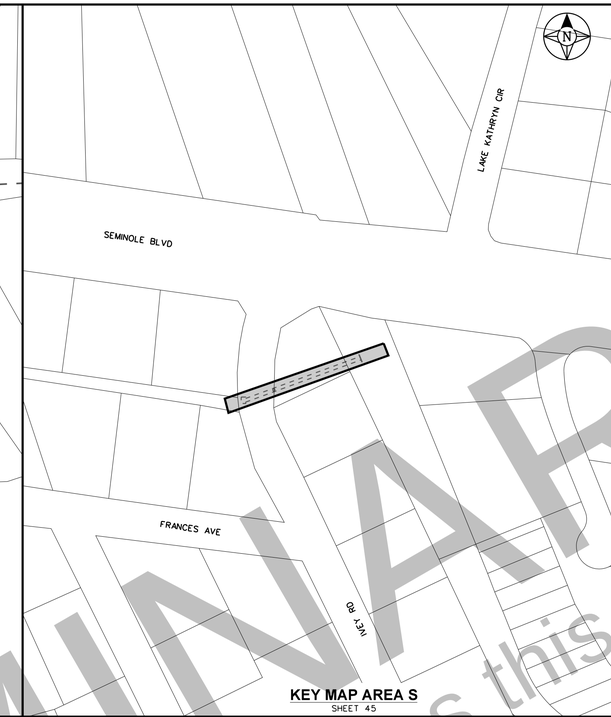
SHEET
18
SAI
Project No.
2015-006.10



KEY MAP AREA Q
SHEET 43

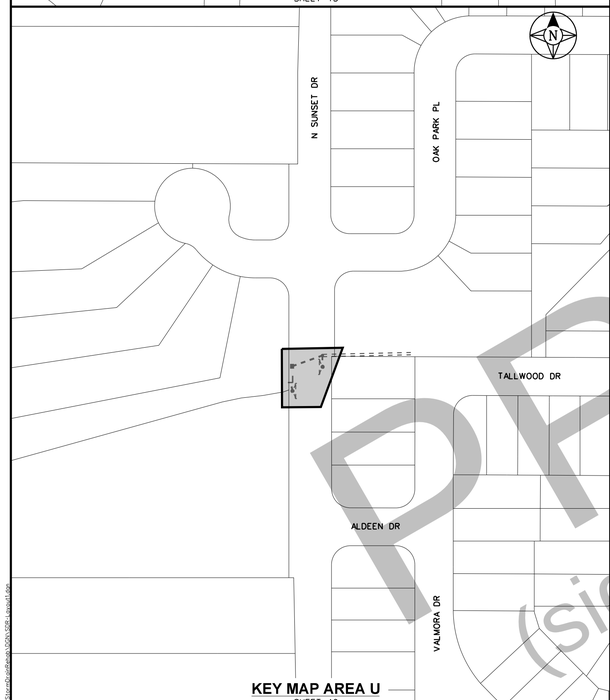


KEY MAP AREA R
SHEET 44

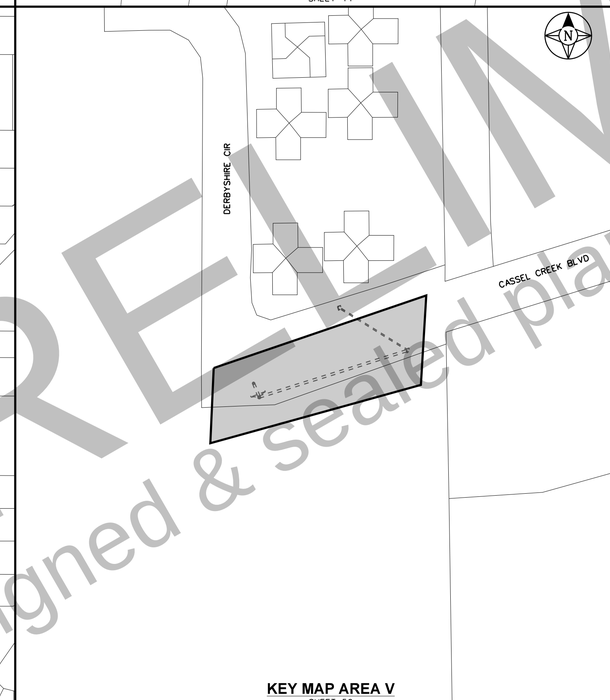


KEY MAP AREA S
SHEET 45

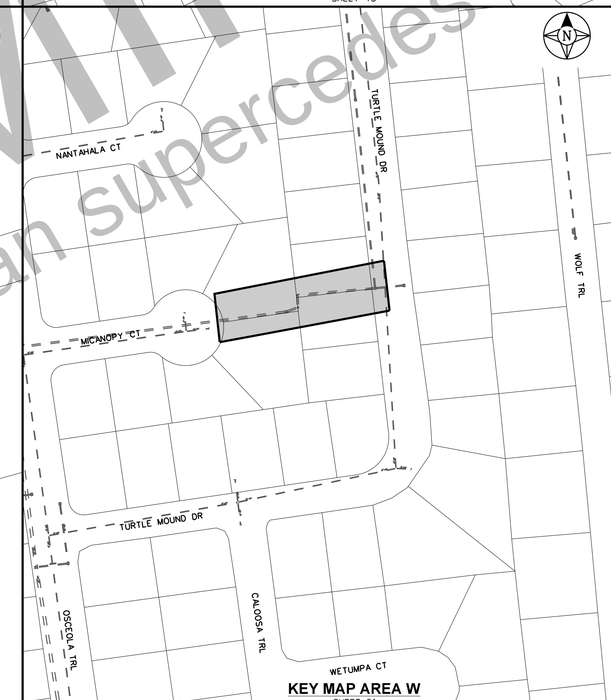
KEY MAP AREA T
SHEETS 46 THRU 48



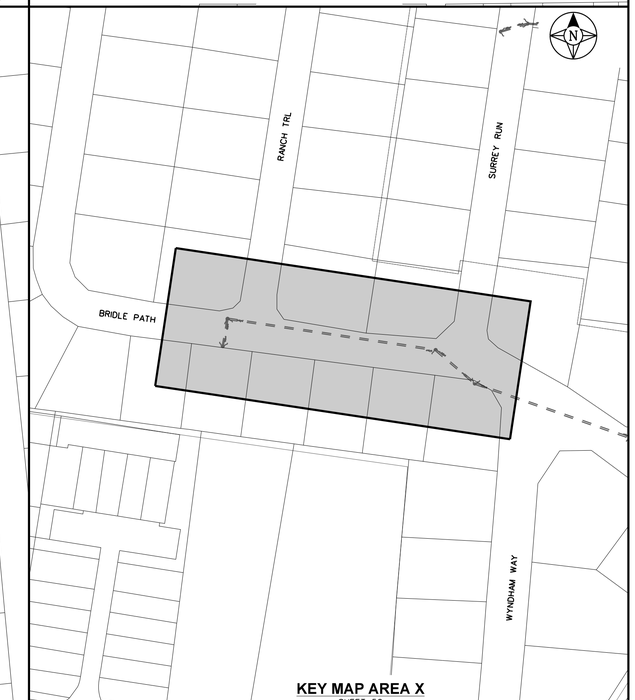
KEY MAP AREA U
SHEET 49



KEY MAP AREA V
SHEET 50



KEY MAP AREA W
SHEET 51



KEY MAP AREA X
SHEET 52

PRELIMINARY
(signed & sealed plan supercedes this sheet)

Revision	Date	Approved
PER CITY	4/29/16	BRW

Designed by: BRW
Drawn by: BJG/ADB
Checked by: RBG
Approved by: BRW
Vertical Datum: NAVD 1988

SINGHOFEN & ASSOCIATES, INC.
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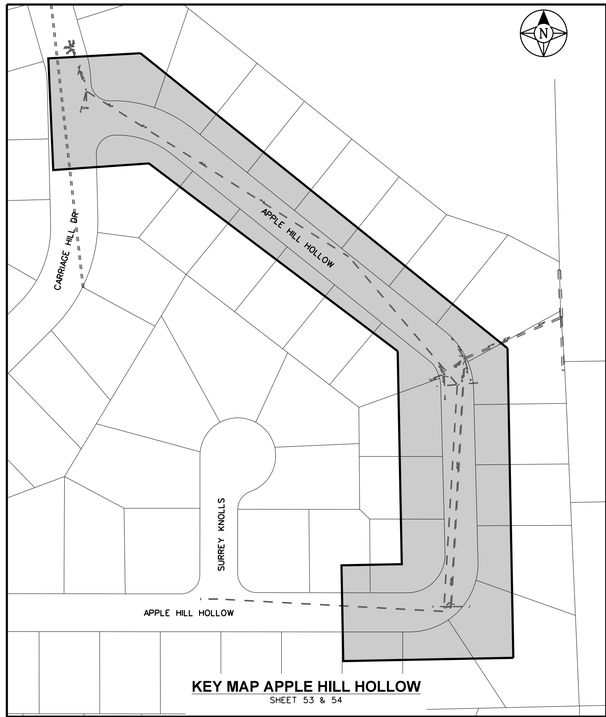
DBPR No. 5112

CITY OF CASSELBERRY
FLORIDA

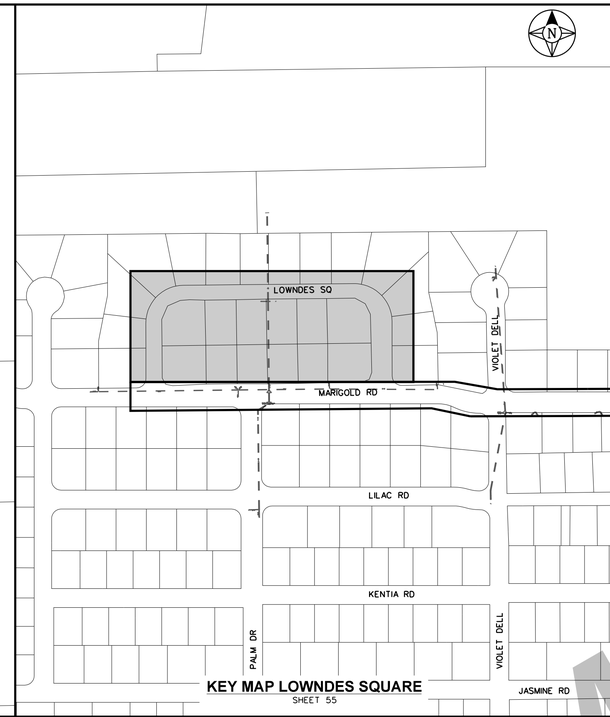
STORM DRAIN
REHABILITATION PROJECT

AREA LOCATION MAP

SHEET
19
SAI
Project No.
2015-006.10



KEY MAP APPLE HILL HOLLOW
SHEET 53 & 54



KEY MAP LOWNDES SQUARE
SHEET 55

PRELIMINARY
(signed & sealed plan supercedes this sheet)

Revision	Date	Approved
PER CITY	4/29/16	BRW

Designed by: BRW
Drawn by: BJG/ADB
Checked by: RBG
Approved by: BRW
Vertical Datum: NAVD 1988

SINGHOFEN & ASSOCIATES, INC.
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DBPR No. 5112

CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

AREA LOCATION MAP

SHEET
20
SAI
Project No.
2015-006.10

NOTE:
THE LOCATIONS OF EXISTING STORMWATER STRUCTURES & CULVERTS SHOWN ON THIS SHEET WERE NOT SURVEYED AND ARE CONSIDERED APPROXIMATE.

Rehabilitation Table - Area A

From Structure: 317
To Structure: 317N

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Catch Basin - #317		
11.1'	Mineral Stains at Joint	12 - 12	Chemical Grout
68.7'	Mineral Deposits at Joint	6 - 9	Chemical Grout
117.5'	Catch Basin - #317N		

From Structure: 317
To Structure: 329

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Catch Basin - #317		
47.3'	Root	3 - 8	CIPP
51.9'	Root	9 - 3	CIPP
58.5'	Root	5	CIPP
112.0'	Rod Intruding	1 - 6	Chemical Grout
113.1'	Transporter Can Not Pass		

From Structure: 329
To Structure: 317

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Catch Basin - #329		
8.0'	Roots	3 - 8	CIPP
10.1'	Roots	4	CIPP
12.0'	Roots	12	CIPP
16.4'	Roots	3	CIPP
21.9'	Roots	9	CIPP
43.3'	Roots	10	CIPP
50.3'	Roots	1	CIPP
188.2'	Roots	1 - 6	CIPP
216.3'	Roots	11	CIPP
269.4'	Rod Protruding	12	
269.4	Transporter Can Not Pass		

From Structure: 115
To Structure: 315

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Catch Basin - #115		
5.0'	Infiltration	5	CIPP
22.3'	Infiltration	6	CIPP
74.5'	Heavy Cement in Pipe		Remove Cement
75.1'	Cement in Pipe		Remove Cement
94.4'	Cement in Pipe	5	Remove Cement
103.5'	Infiltration	5	CIPP
162.3'	Infiltration	7	CIPP
207.8'	Buried Manhole	12	
235.8'	Infiltration	3	CIPP
292.6'	Infiltration	6	CIPP
395.7'	Infiltration	6	CIPP
416.6'	Catch Basin - #315		

Note: "From" and "To" structure designation does not necessarily indicate direction of flow.

Revision	Date	Approved
PER CITY	4/29/16	BRW

Designed by: BRW
Drawn by: BJG/ADB
Checked by: RBG
Approved by: BRW
Vertical Datum: NAVD 1988

SINGHOFEN & ASSOCIATES, INC.
STORMWATER MANAGEMENT AND CIVIL ENGINEERING
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CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

KANTOR BLVD.
(AREA A)

SHEET
21
SAI
Project No.
2015-006.10

NOTE:
THE LOCATIONS OF EXISTING STORMWATER STRUCTURES, CULVERTS, & EASEMENTS SHOWN ON THIS SHEET WERE NOT SURVEYED AND ARE CONSIDERED APPROXIMATE.

Rehabilitation Table - Area C1

From Structure: 1189
To Structure: 1161

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Catch Basin - #1189		
222.4'	Light Roots at Joint	3	CIPP
248.7'	5.7' Longitudinal Crack		CIPP
271.3'	Manhole - #1161		

From Structure: 1147
To Structure: 1161

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Catch Basin - #1147		
91.9'	Roots	7	Chemical Grout
99.7'	Roots	5	Chemical Grout
256.3'	Manhole - #1161		

From Structure: 1147
To Structure: 1148

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Catch Basin - #1147		
21.7'	Joint Offset - Medium		CIPP
30.1'	Catch Basin - #1148		

Note: "From" and "To" structure designation does not necessarily indicate direction of flow.

Revision	Date	Approved
PER CITY	4/29/16	BRW

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CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

QUINTUPLET DRIVE
AREA C1

SHEET
22
SAI
Project No.
2015-006.10

NOTE:
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Rehabilitation Table - Area C2

From Structure: 1280
To Structure: MES

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Manhole - #1280		
39.8'	Roots	8	Chemical Grout
48.8'	Roots	7	Chemical Grout
120.8'	Roots	5	Chemical Grout
169.0'	Joint Offset	5 - 7	25' CIPP
196.8'	Joint Offset	5 - 7	25' CIPP
250.0'	Roots	8	Chemical Grout
266.5'	Roots	6	Chemical Grout
275.5'	Sag	6	15' CIPP
290.8'	Joint Separated	12 - 12	15' CIPP
299.5'	Roots	8	Chemical Grout
315.4'	Roots	9	Chemical Grout
339.3'	Roots	5	Chemical Grout
346.6'	Joint Offset	5 - 7	Replace Pipe
355.0'	Joint Separated	12 - 12	Replace Pipe
365.1'	MES		

From Structure: 1261
To Structure: 1210

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Catch Basin - #1261		
10.2'	Roots at Joint	5	Chemical Grout
34.0'	Roots at Joint	5	Chemical Grout
41.9'	Roots at Joint	5	Chemical Grout
70.1'	Roots at Joint	5	Chemical Grout
102.7'	Hole w/ Visible Soil	7	Chemical Grout
126.8'	Hole w/ Visible Soil	5	Chemical Grout
170.6'	Manhole - #1210		

From Structure: 1261
To Structure: 1280W

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Catch Basin - #1261		
14.6'	Pipe Broken at Joint - Soil Visible	12 - 12	CIPP
14.6'	Medium Roots at Joint	5 - 6	Root Removal
32.1'	Catch Basin - #1280W		

Note: "From" and "To" structure designation does not necessarily indicate direction of flow.

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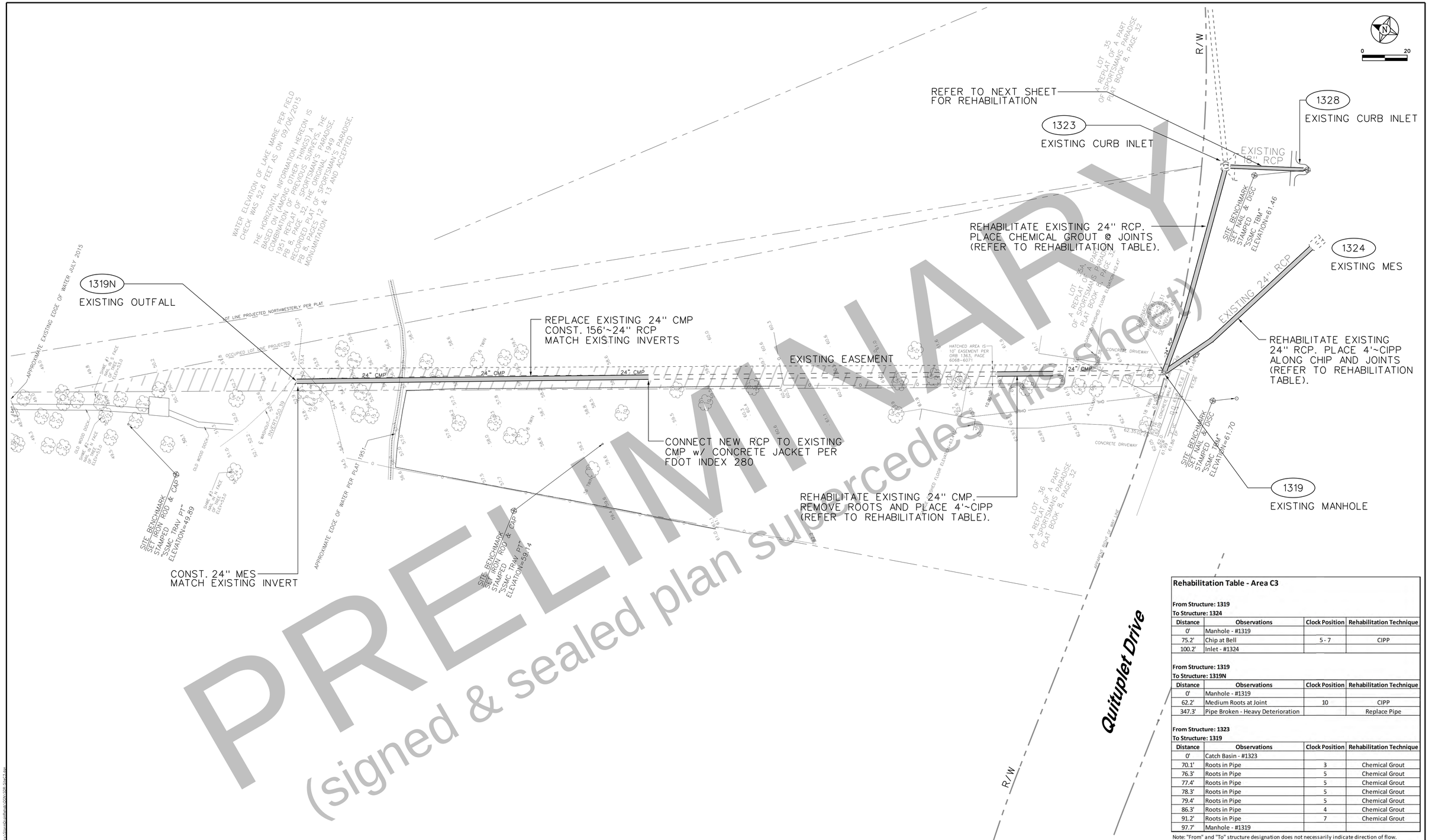
CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

QUINTUPLET DRIVE
AREA C2

SHEET
23
SAI
Project No.
2015-006.10



PRELIMINARY
(signed & sealed plan supercedes this sheet)

Rehabilitation Table - Area C3

From Structure: 1319
To Structure: 1324

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Manhole - #1319		
75.2'	Chip at Bell	5 - 7	CIPP
100.2'	Inlet - #1324		

From Structure: 1319
To Structure: 1319N

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Manhole - #1319		
62.2'	Medium Roots at Joint	10	CIPP
347.3'	Pipe Broken - Heavy Deterioration		Replace Pipe

From Structure: 1323
To Structure: 1319

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Catch Basin - #1323		
70.1'	Roots in Pipe	3	Chemical Grout
76.3'	Roots in Pipe	5	Chemical Grout
77.4'	Roots in Pipe	5	Chemical Grout
78.3'	Roots in Pipe	5	Chemical Grout
79.4'	Roots in Pipe	5	Chemical Grout
86.3'	Roots in Pipe	4	Chemical Grout
91.2'	Roots in Pipe	7	Chemical Grout
97.7'	Manhole - #1319		

Note: "From" and "To" structure designation does not necessarily indicate direction of flow.

Revision	Date	Approved
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CITY OF CASSELBERRY FLORIDA

STORM DRAIN REHABILITATION PROJECT

EASEMENT TO LAKE MARIE AREA C3

SHEET **24**

SAI Project No. 2015-006.10

NOTE:
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Rehabilitation Table - Area C4

From Structure: 1350
To Structure: 1355

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Catch Basin - #1350		
17.3'	Joint Bell Broken - Gasket Exposed		CIPP
17.3'	Joint Separated - Void Visible		CIPP
29.2'	Cement Repair Protruding 1"	11 - 3	CIPP
30.9'	Catch Basin - #1355		

From Structure: 1355
To Structure: 1327

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Catch Basin - #1355		
41.0'	Circular Crack with Mineral Stains	1 - 4	Chemical Grout
204.9'	Manhole - #1327		

From Structure: 1323
To Structure: 1328

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Catch Basin - #1323		
25.1'	Roots at Joint	5	CIPP
25.1'	Crack at Joint	6 - 12	CIPP
30.9'	Catch Basin - #1328		

Note: "From" and "To" structure designation does not necessarily indicate direction of flow.

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CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

QUINTUPLET DRIVE
AREA C4

SHEET
25
SAI
Project No.
2015-006.10

PRELIMINARY
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Rehabilitation Table - Area C5

From Structure: 1109
To Structure: 1107

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Catch Basin - #1109		
95.3'	1 Inch of Dirt and Bricks		Remove Debris
152.5'	Catch Basin - #1107		

Note: "From" and "To" structure designation does not necessarily indicate direction of flow.

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CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

QUINTUPLET DRIVE
AREA C5

SHEET
26
SAI
Project No.
2015-006.10

PRELIMINARY
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Rehabilitation Table - Area D

From Structure: 704
To Structure: 703

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Catch Basin - #704		
38.1'	Broken Pipe	6	CIPP
55.2'	Catch Basin - #703		

Note: "From" and "To" structure designation does not necessarily indicate direction of flow.

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CITY OF CASSELBERRY
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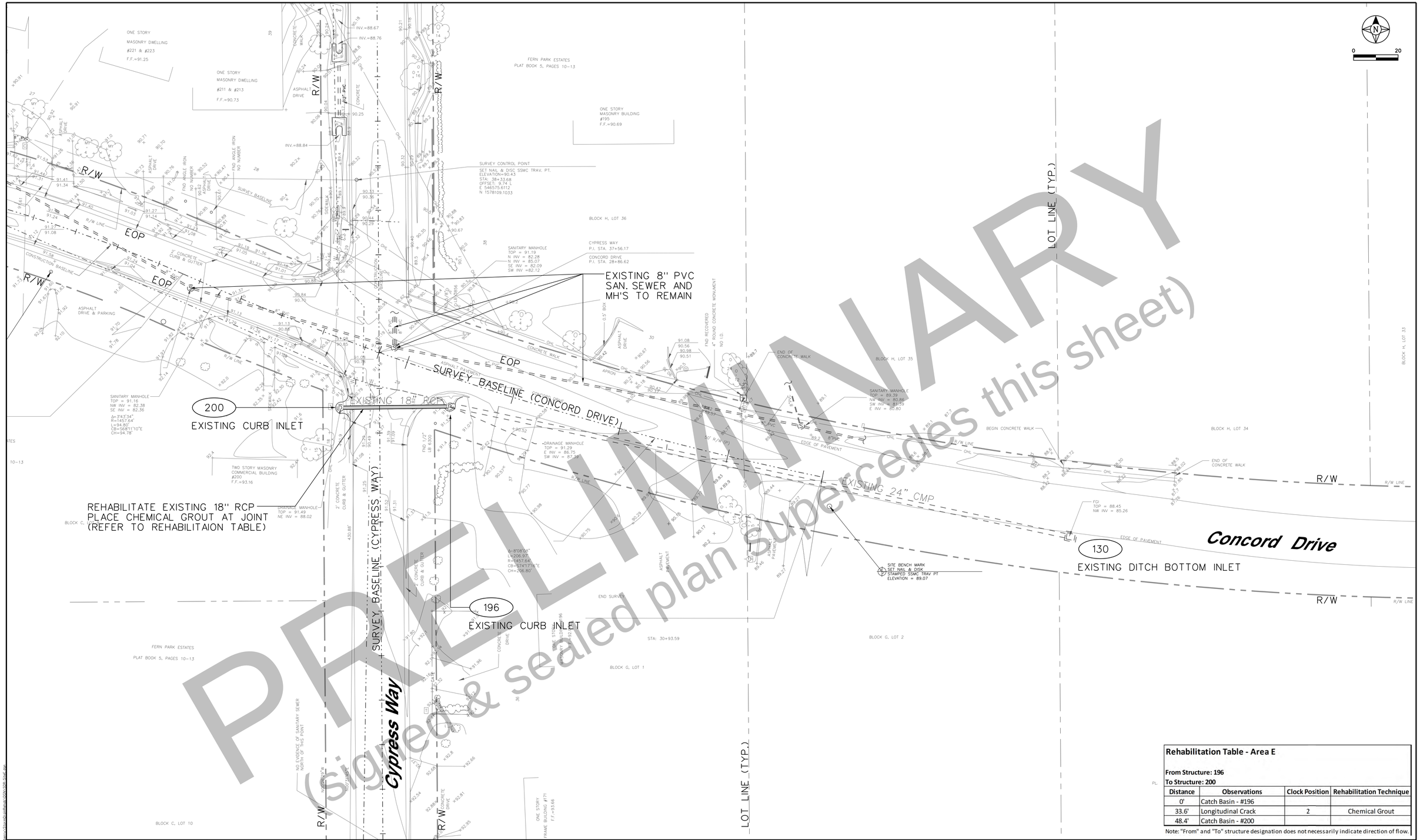
STORM DRAIN
REHABILITATION PROJECT

GREGORY DRIVE
(AREA D)

SHEET
27
SAI
Project No.
2015-006.10



Rehabilitation Table - Area E

From Structure: 196
To Structure: 200

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Catch Basin - #196		
33.6'	Longitudinal Crack	2	Chemical Grout
48.4'	Catch Basin - #200		

Note: "From" and "To" structure designation does not necessarily indicate direction of flow.

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CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

CONCORD DRIVE
(AREA E)

SHEET
28
SAI Project No.
2015-006.10

NOTE:
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Rehabilitation Table - Area F

From Structure: 163A
To Structure: 163B

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Catch Basin - #163A		
17.7'	Root Infiltration	5 - 7	Replace Pipe
35.8'	Headwall - 163B		

Note: "From" and "To" structure designation does not necessarily indicate direction of flow.

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CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

Paul McClure Court
(Area F)

SHEET
29
SAI
Project No.
2015-006.10

NOTE:
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Rehabilitation Table - Area G1

From Structure: 638
To Structure: 115

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Catch Basin - #638		
26.4'	Mineral Stains	4 - 7	Chemical Grout
37.4'	Catch Basin - #115		

From Structure: 638
To Structure: 638S

Distance	Observations	Clock Position	Rehabilitation Technique
0	Catch Basin - #638		
0.0'	Mineral Stains	3	Chemical Grout
63.4'	Mineral Stains	12 - 12	Chemical Grout
90.7'	Manhole - #638S		

From Structure: 624
To Structure: 635

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Catch Basin - #624		
166.5'	0.9' Longitudinal Crack - Soil Visible		Replace Pipe
322.5'	Infiltration at #635 Structure Walls		Chemical Grout
322.5'	Catch Basin - #635		

Note: "From" and "To" structure designation does not necessarily indicate direction of flow.

Revision	Date	Approved
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CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

STANHOPE DRIVE
(AREA G1)

SHEET
30
SAI
Project No.
2015-006.10

PRELIMINARY
(signed & sealed plan supercedes this sheet)

NOTE:
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Rehabilitation Table - Area G2

From Structure: 648
To Structure: 149

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Catch Basin - #648		
16.1'	Mineral Stains	7 - 10	CIPP
30.3'	Circular Crack	7 - 4	CIPP
32.6'	Catch Basin - #149		

Note: "From" and "To" structure designation does not necessarily indicate direction of flow.

Revision	Date	Approved
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CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

STANHOPE DRIVE
(AREA G2)

SHEET
31
SAI
Project No.
2015-006.10

PRELIMINARY
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NOTE:
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Rehabilitation Table - Area H1

From Structure: 148D
To Structure: 148E

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Catch Basin - #148D		
33.5'	Hole in Pipe - Deterioration - Soil Visible		Replace Pipe
96.2'	Outfall - #148E		

Note: "From" and "To" structure designation does not necessarily indicate direction of flow.

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CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

PAUL McCLURE CT & PARK AVE
AREA H1

SHEET
32
SAI
Project No.
2015-006.10

NOTE:
THE LOCATIONS OF EXISTING STORMWATER STRUCTURES & CULVERTS SHOWN ON THIS SHEET WERE NOT SURVEYED AND ARE CONSIDERED APPROXIMATE.

NO IMPROVEMENTS NEEDED

Revision	Date	Approved
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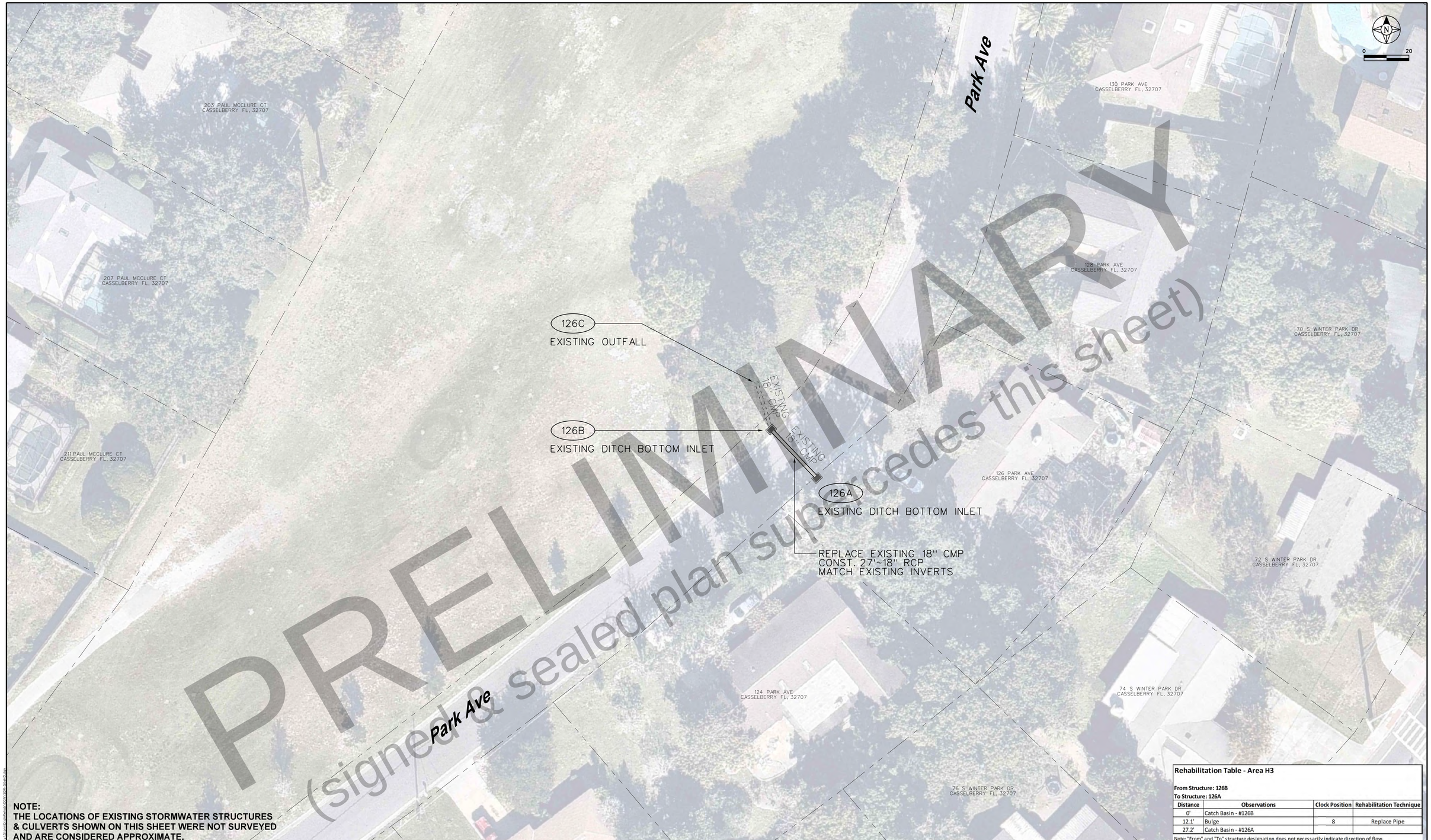
CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

PARK AVE
AREA H2

SHEET
33
SAI
Project No.
2015-006.10



NOTE:
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Rehabilitation Table - Area H3

From Structure: 126B
To Structure: 126A

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Catch Basin - #126B		
12.1'	Bulge	8	Replace Pipe
27.2'	Catch Basin - #126A		

Note: "From" and "To" structure designation does not necessarily indicate direction of flow.

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CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

PARK AVE
AREA H3

SHEET
34
SAI
Project No.
2015-006.10

NOTE:
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CITY OF CASSELBERRY
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STORM DRAIN
REHABILITATION PROJECT

S WINTER PARK DRIVE
(AREA I)

SHEET
35
SAI
Project No.
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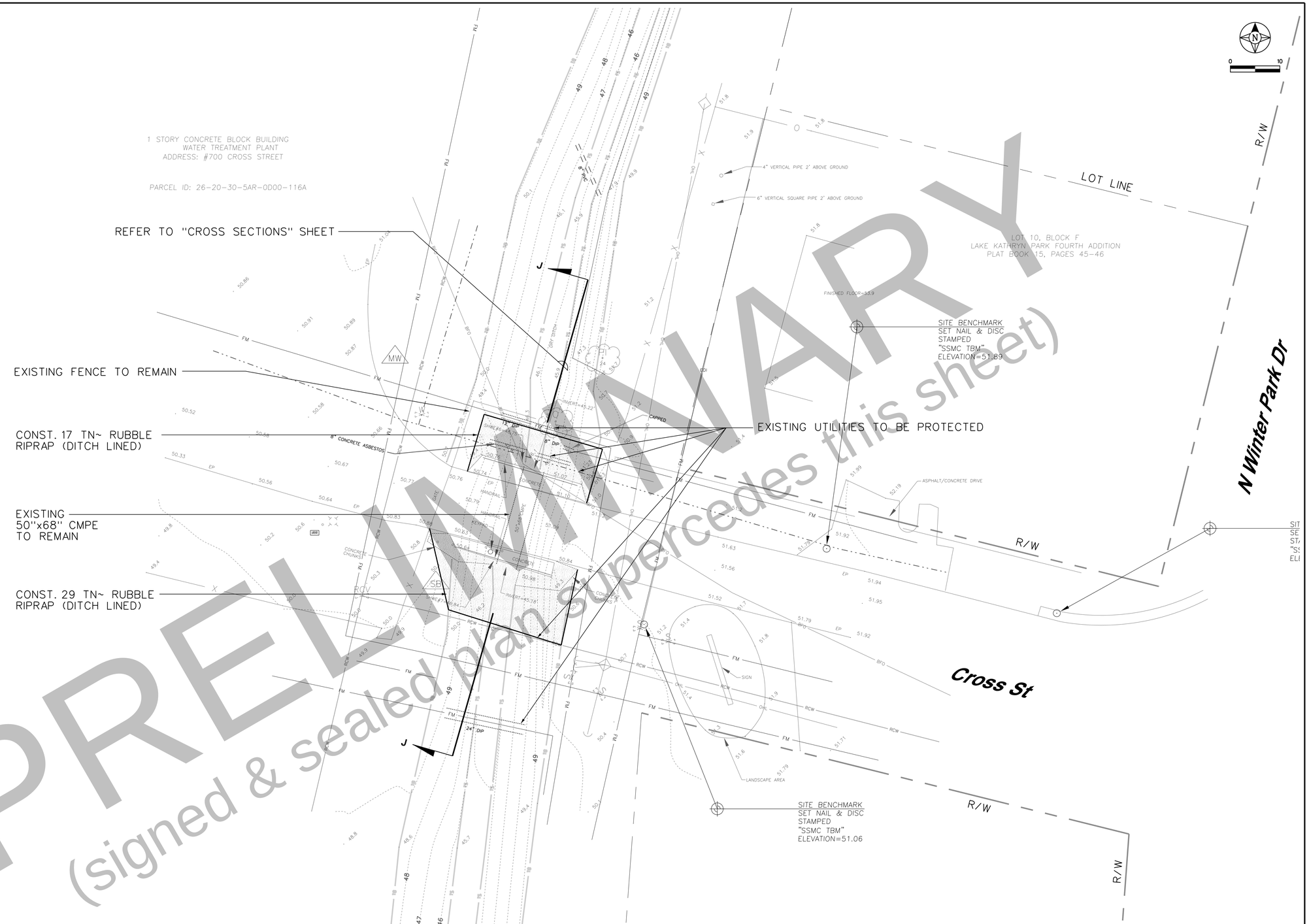

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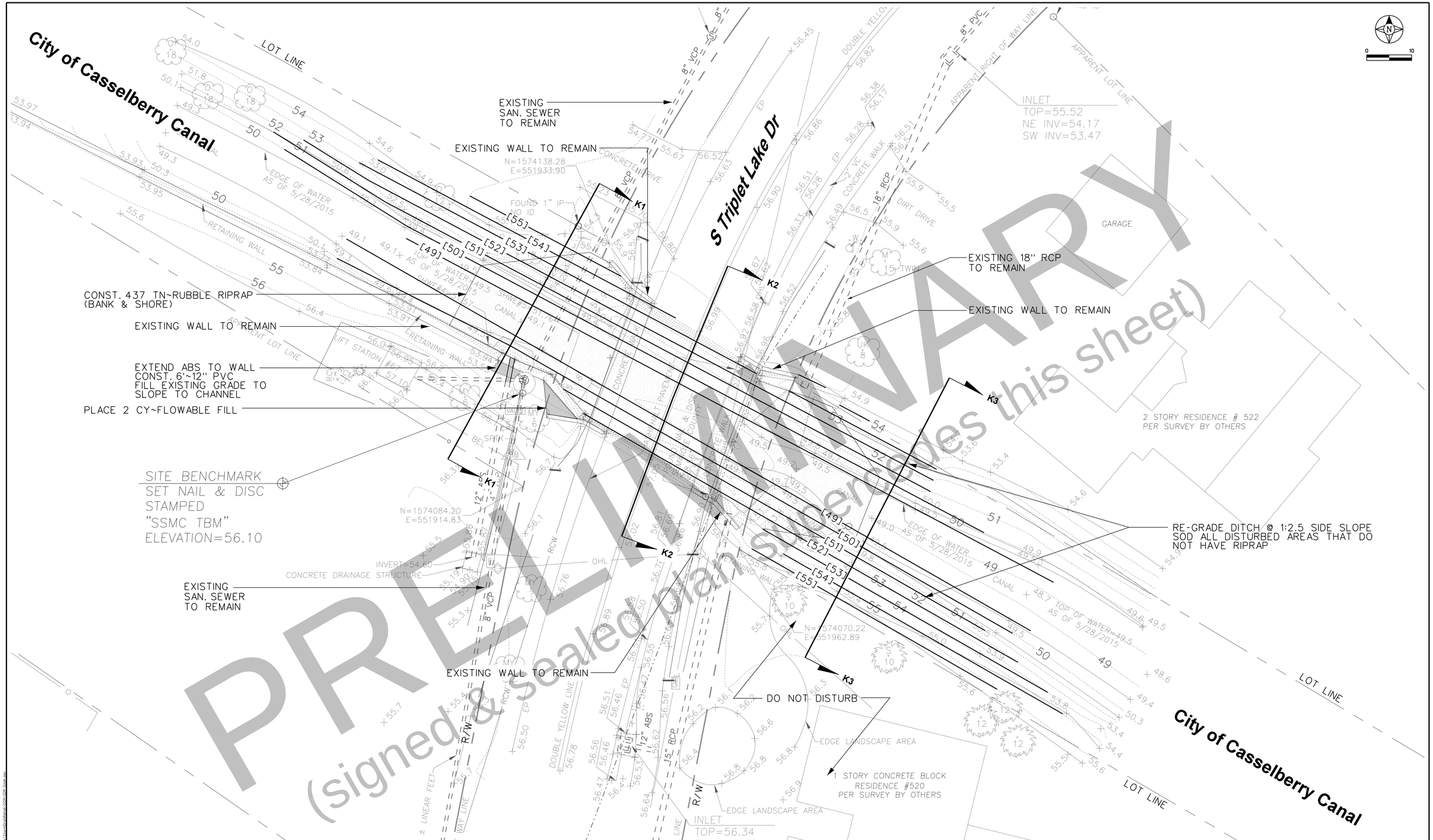
CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

CROSS STREET
(AREA J)

SHEET
36
SAI
Project No.
2015-006.10



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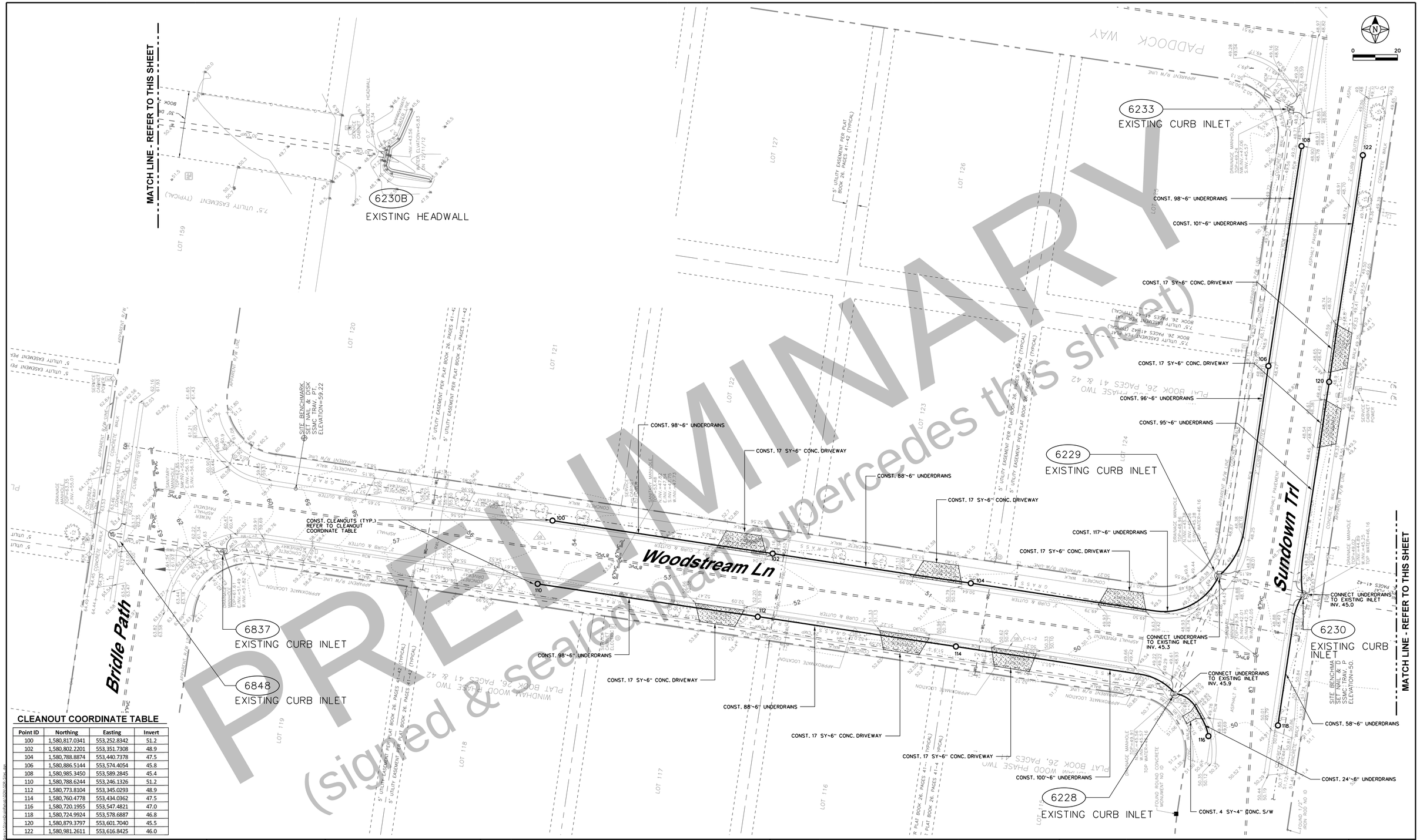
CITY OF CASSELBERRY FLORIDA

STORM DRAIN REHABILITATION PROJECT

QUEENS MIRROR CIRCLE (AREA K)

SHEET 37

SAI Project No. 2015-006.10



CLEANOUT COORDINATE TABLE

Point ID	Northing	Easting	Invert
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102	1,580,802.2201	553,351.7308	48.9
104	1,580,788.8874	553,440.7378	47.5
106	1,580,886.5144	553,574.4054	45.8
108	1,580,985.3450	553,589.2845	45.4
110	1,580,788.6244	553,246.1326	51.2
112	1,580,773.8104	553,345.0293	48.9
114	1,580,760.4778	553,434.0362	47.5
116	1,580,720.1955	553,547.4821	47.0
118	1,580,724.9924	553,578.6887	46.8
120	1,580,879.3797	553,601.7040	45.5
122	1,580,981.2611	553,616.8425	46.0

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DBPR No. 5112

CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

WOODSTREAM LANE
(AREA L)

SHEET
38
SAI
Project No.
2015-006.10

NOTE:
THE LOCATIONS OF EXISTING STORMWATER STRUCTURES, CULVERTS, & EASEMENTS SHOWN ON THIS SHEET WERE NOT SURVEYED AND ARE CONSIDERED APPROXIMATE.

Rehabilitation Table - Area M

From Structure: 139
To Structure: OUTFALL

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Manhole - #139		
49.4'	Mineral Stains at Joint	7 - 10	Chemical Grout
121.9'	Root Infiltration at Joint	10 - 2	Chemical Grout
130.0'	Material Change - RCP to ADS		
155.0'	Outfall		

Note: "From" and "To" structure designation does not necessarily indicate direction of flow.

Revision	Date	Approved
PER CITY	4/29/16	BRW

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CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

EASEMENT FROM CARRIAGE HILL DRIVE
(AREA M)

SHEET
39
SAI
Project No.
2015-006.10

PRELIMINARY
(signed & sealed plan supercedes this sheet)

NOTE:
THE LOCATIONS OF EXISTING STORMWATER STRUCTURES, CULVERTS, & EASEMENTS SHOWN ON THIS SHEET WERE NOT SURVEYED AND ARE CONSIDERED APPROXIMATE.

Rehabilitation Table - Area N

From Structure: 277F
To Structure: 277B

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Catch Basin - #277F		
130.8'	Material Change - RCP to HDPE		
130.8'	Infiltration at Material Change	9	Chemical Grout
132.8'	Offset Joint - Camera unable to pass	12 - 12	Chemical Grout

Note: "From" and "To" structure designation does not necessarily indicate direction of flow.

Revision	Date	Approved
PER CITY	4/29/16	BRW

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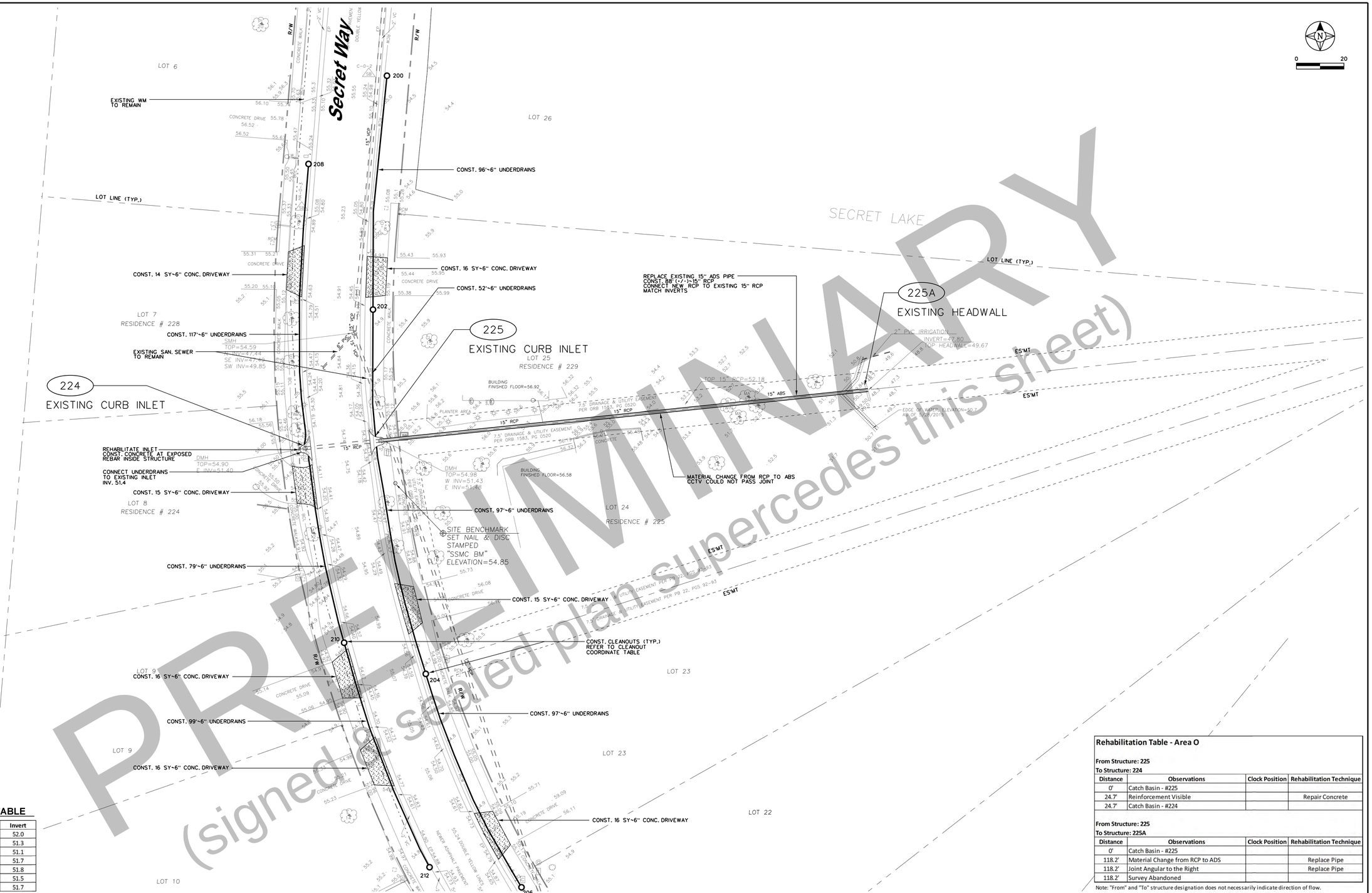
CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

277/285 SECRET WAY
(AREA N)

SHEET
40
SAI
Project No.
2015-006.10



CLEANOUT COORDINATE TABLE

Point ID	Northing	Easting	Invert
200	1,578,011.2648	550,271.6426	52.0
202	1,577,912.8147	550,265.7470	51.3
204	1,577,759.4631	550,287.9943	51.1
206	1,577,669.6218	550,328.3115	51.7
208	1,577,974.1139	550,238.6045	51.8
210	1,577,772.5773	550,253.5881	51.5
212	1,577,678.0821	550,289.5759	51.7

Rehabilitation Table - Area O

From Structure: 225
To Structure: 224

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Catch Basin - #225		
24.7'	Reinforcement Visible		Repair Concrete
24.7'	Catch Basin - #224		

From Structure: 225
To Structure: 225A

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Catch Basin - #225		
118.2'	Material Change from RCP to ADS		Replace Pipe
118.2'	Joint Angular to the Right		Replace Pipe
118.2'	Survey Abandoned		

Note: "From" and "To" structure designation does not necessarily indicate direction of flow.

Revision	Date	Approved
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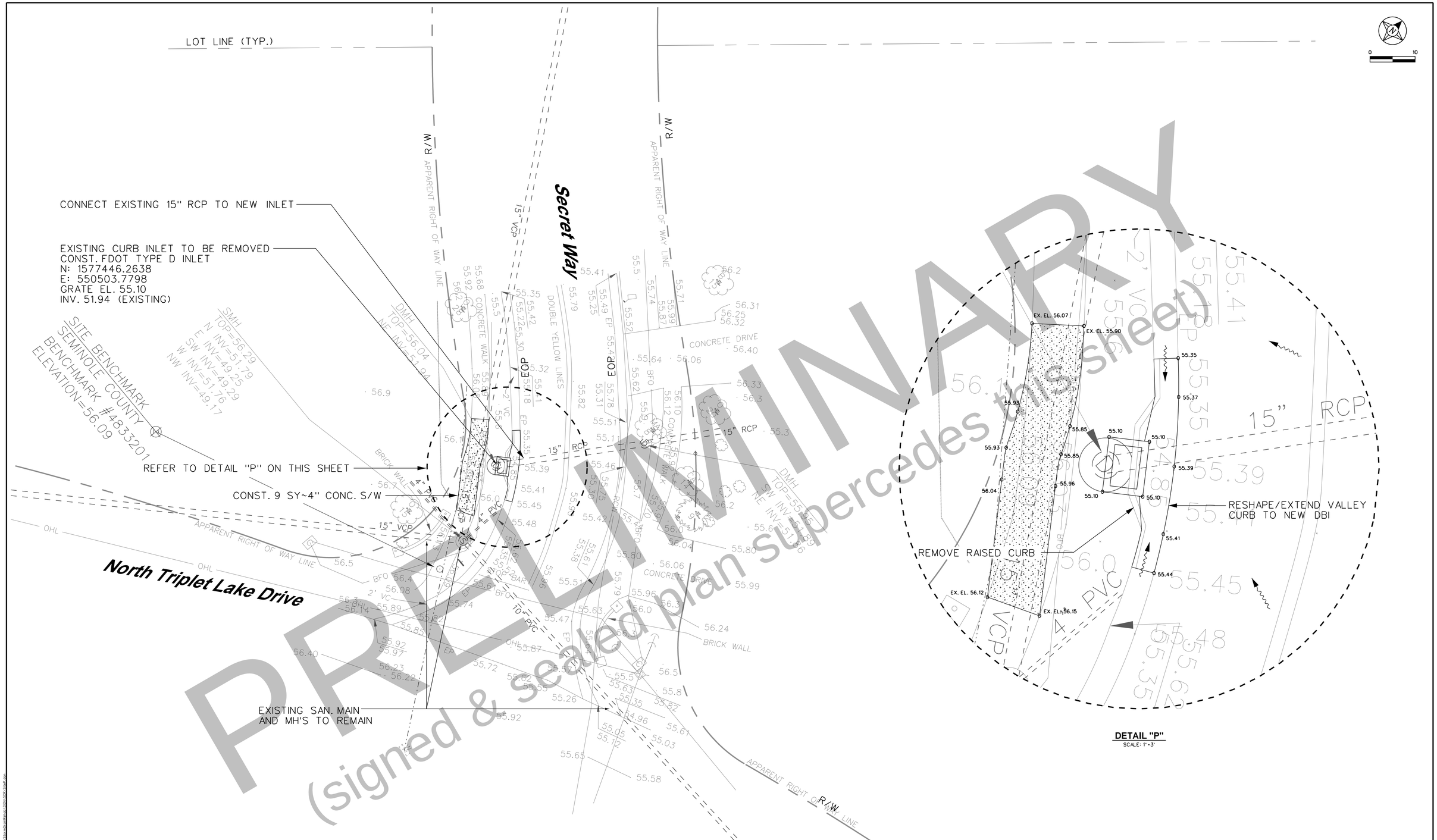
CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

224/228 SECRET WAY
(AREA O)

SHEET
41
SAI
Project No.
2015-006.10



Revision	Date	Approved
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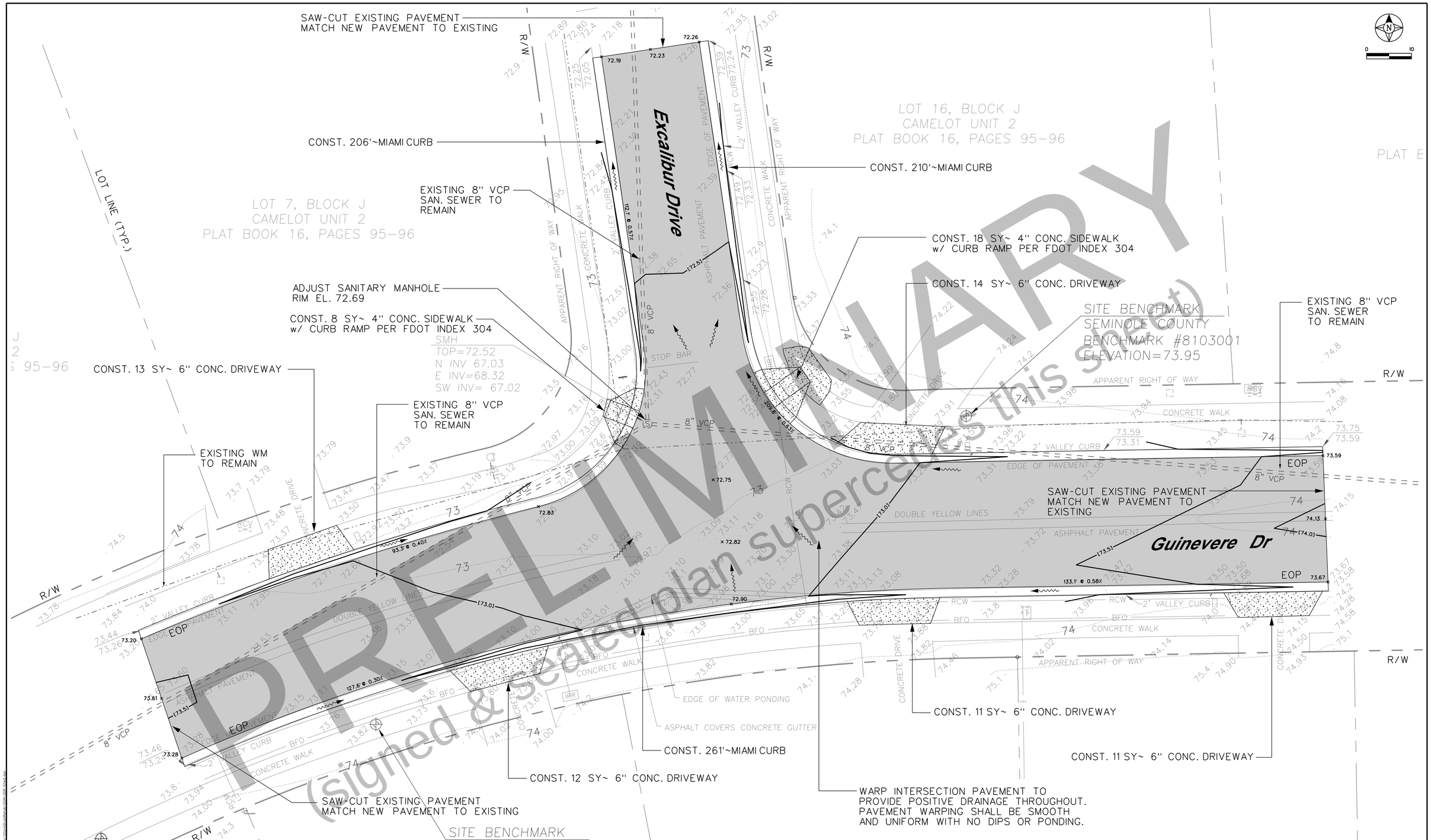
CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

INTERSECTION OF
SECRET WAY & N TRIPLET LAKE DR.
(AREA P)

SHEET
42
SAI
Project No.
2015-006.10



PRELIMINARY
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Revision	Date	Approved
PER CITY	4/29/16	BRW

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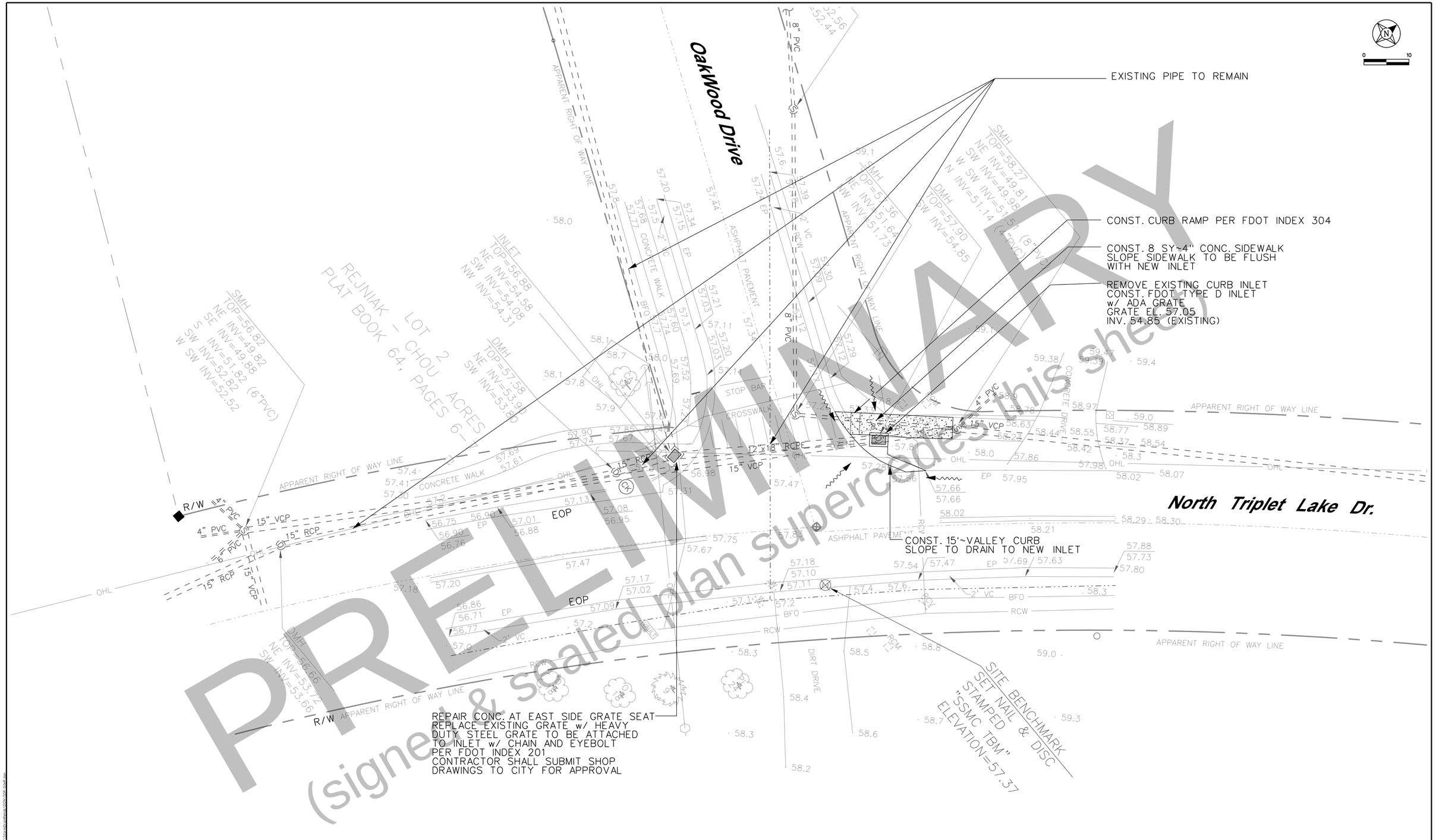
CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

INTERSECTION OF GUINEVERE DRIVE AND EXCALIBUR DRIVE (AREA Q)

SHEET
43
SAI Project No.
2015-006.10



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PER CITY	4/29/16	BRW

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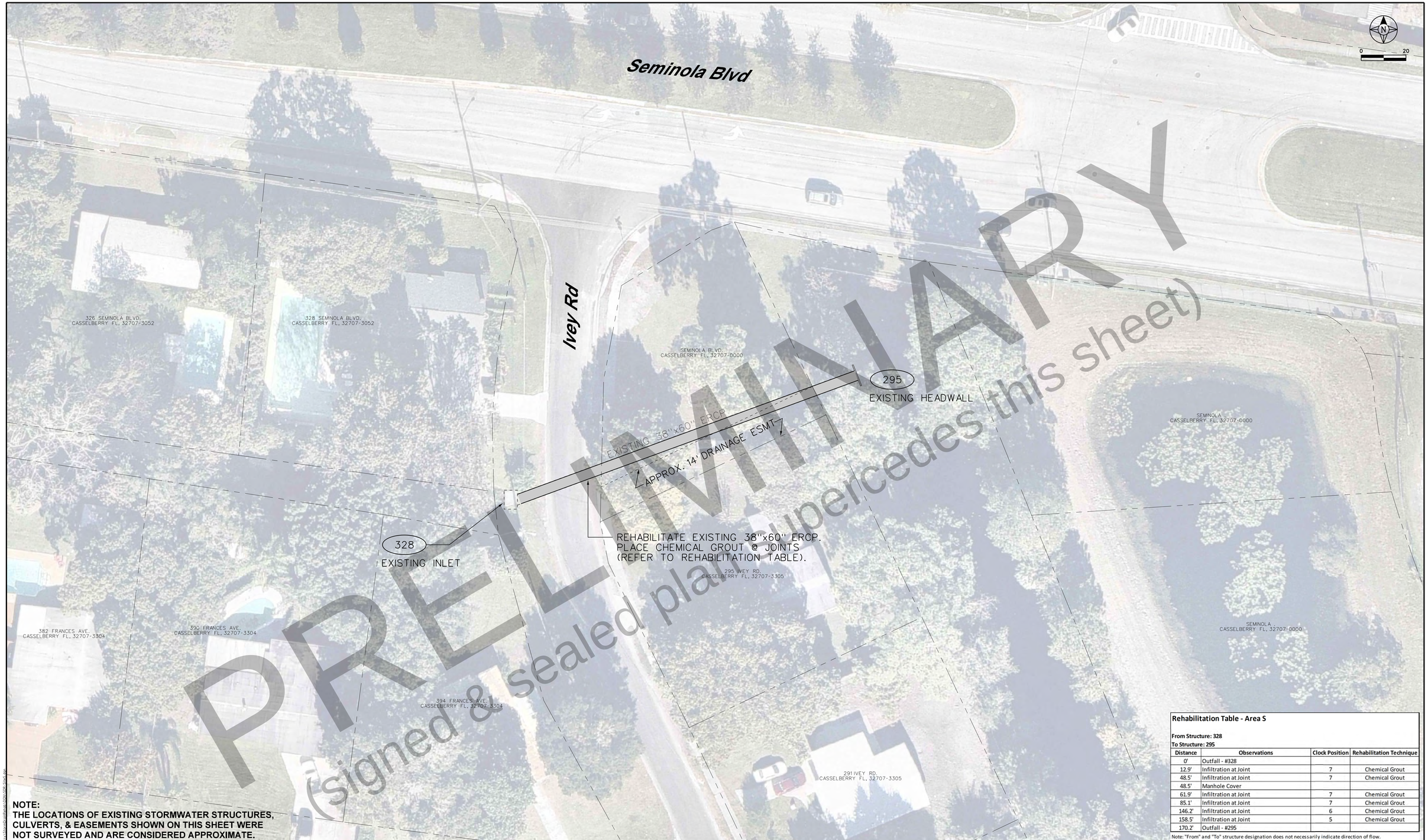
CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

INTERSECTION N TRIPLET LAKE DR.
& OAKWOOD DR.
(AREA R)

SHEET
44
SAI
Project No.
2015-006.10



PRELIMINARY
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NOTE:
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Rehabilitation Table - Area S

From Structure: 328
To Structure: 295

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Outfall - #328		
12.9'	Infiltration at Joint	7	Chemical Grout
48.5'	Infiltration at Joint	7	Chemical Grout
48.5'	Manhole Cover		
61.9'	Infiltration at Joint	7	Chemical Grout
85.1'	Infiltration at Joint	7	Chemical Grout
146.2'	Infiltration at Joint	6	Chemical Grout
158.5'	Infiltration at Joint	5	Chemical Grout
170.2'	Outfall - #295		

Note: "From" and "To" structure designation does not necessarily indicate direction of flow.

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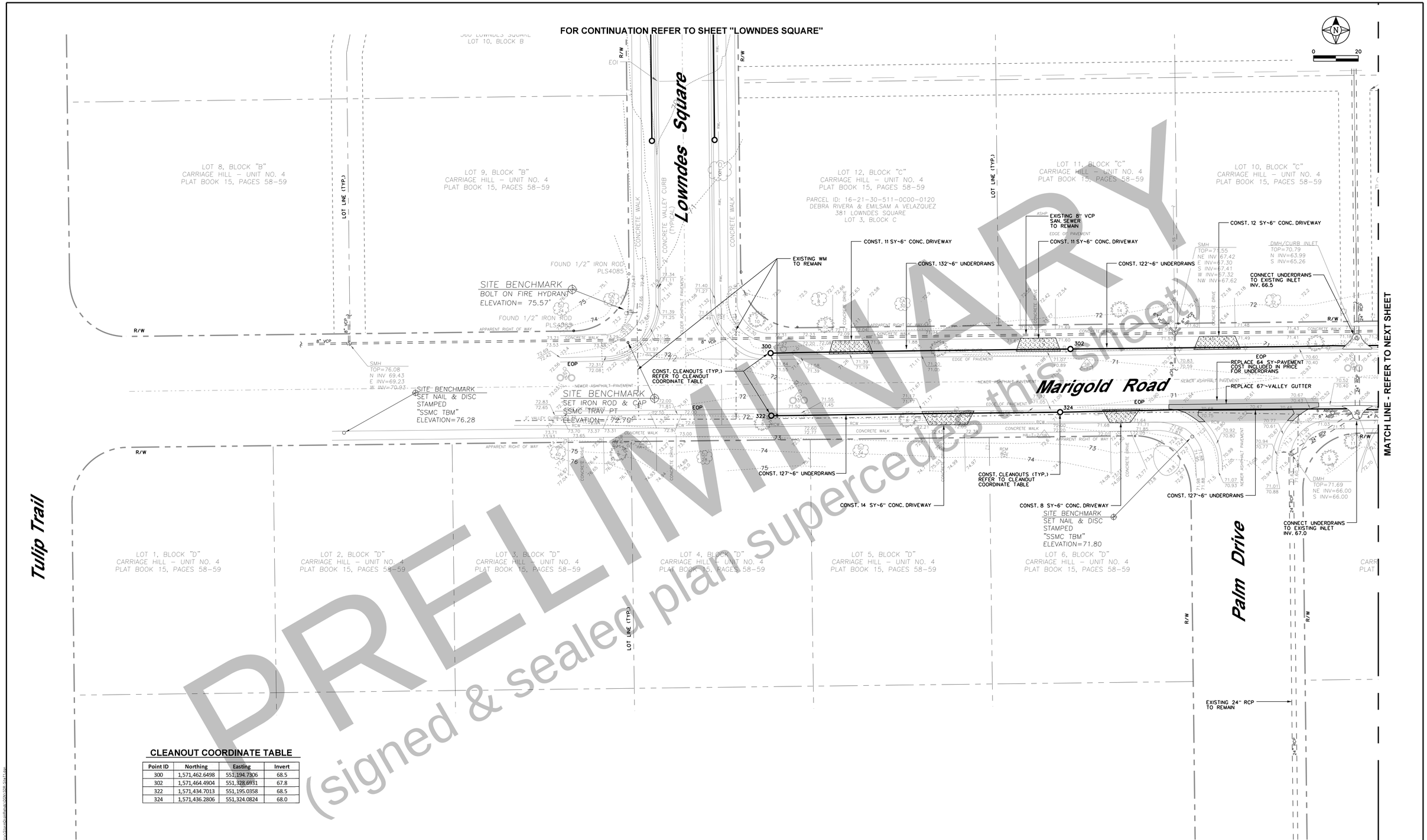
CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

IVEY ROAD
(AREA S)

SHEET
45
SAI
Project No.
2015-006.10



PRELIMINARY
(signed & sealed plans supercedes this sheet)

CLEANOUT COORDINATE TABLE

Point ID	Northing	Easting	Invert
300	1,571,462.6498	551,194.7306	68.5
302	1,571,464.4904	551,328.6931	67.8
322	1,571,434.7013	551,195.0358	68.5
324	1,571,436.2806	551,324.0824	68.0

Revision	Date	Approved
PER CITY	4/29/16	BRW

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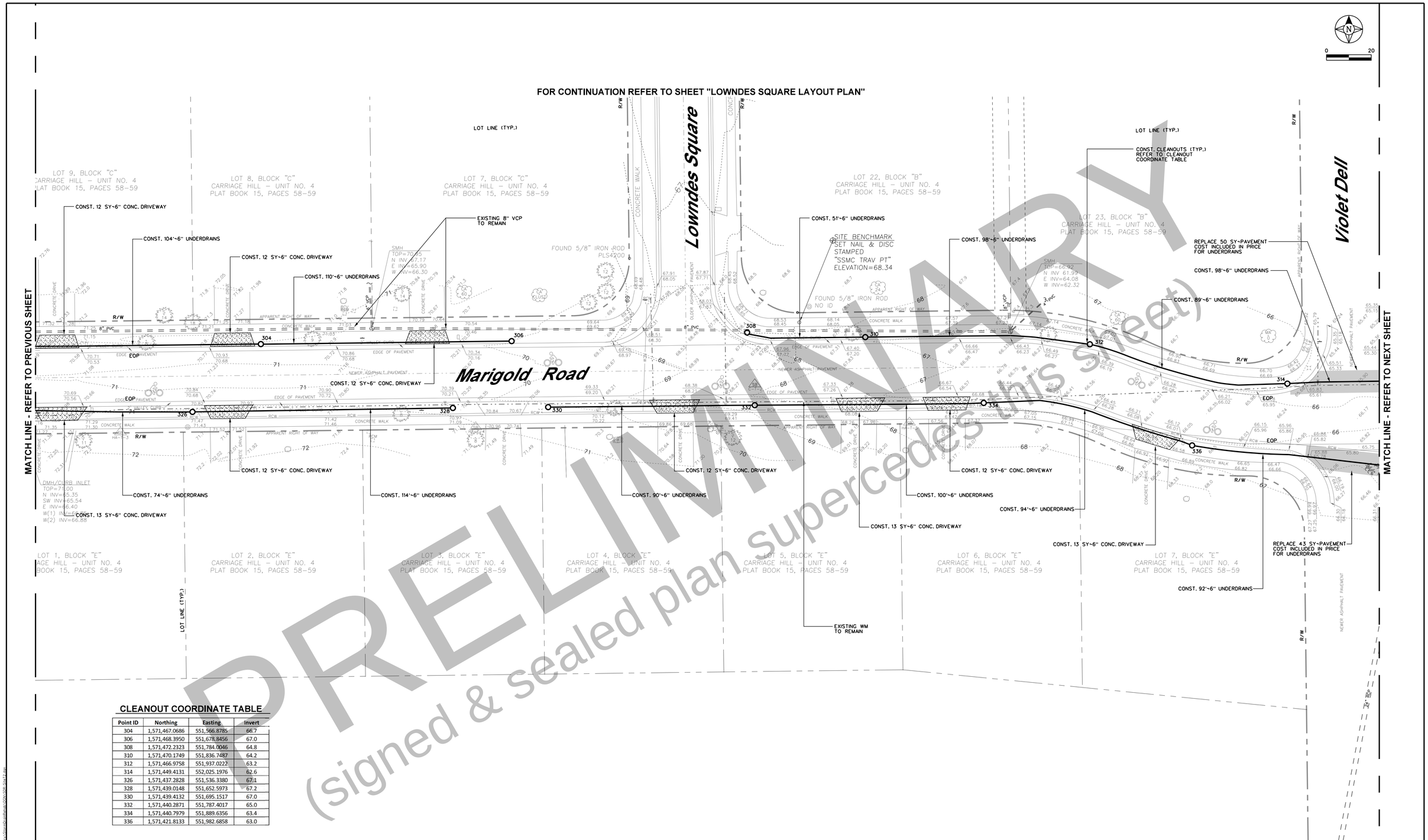
CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

MARIGOLD ROAD
(SITE T)

SAI
Project No.
2015-006.10



PRELIMINARY
(signed & sealed plan supercedes this sheet)

CLEANOUT COORDINATE TABLE

Point ID	Northing	Easting	Invert
304	1,571,467.0686	551,566.8785	66.7
306	1,571,468.3950	551,678.8456	67.0
308	1,571,472.2323	551,784.0046	64.8
310	1,571,470.1749	551,836.7487	64.2
312	1,571,466.9758	551,937.0222	63.2
314	1,571,449.4131	552,025.1976	62.6
326	1,571,437.2828	551,536.3380	67.1
328	1,571,439.0148	551,652.5973	67.2
330	1,571,439.4132	551,695.1517	67.0
332	1,571,440.2871	551,787.4017	65.0
334	1,571,440.7979	551,889.6356	63.4
336	1,571,421.8133	551,982.6858	63.0

Revision	Date	Approved
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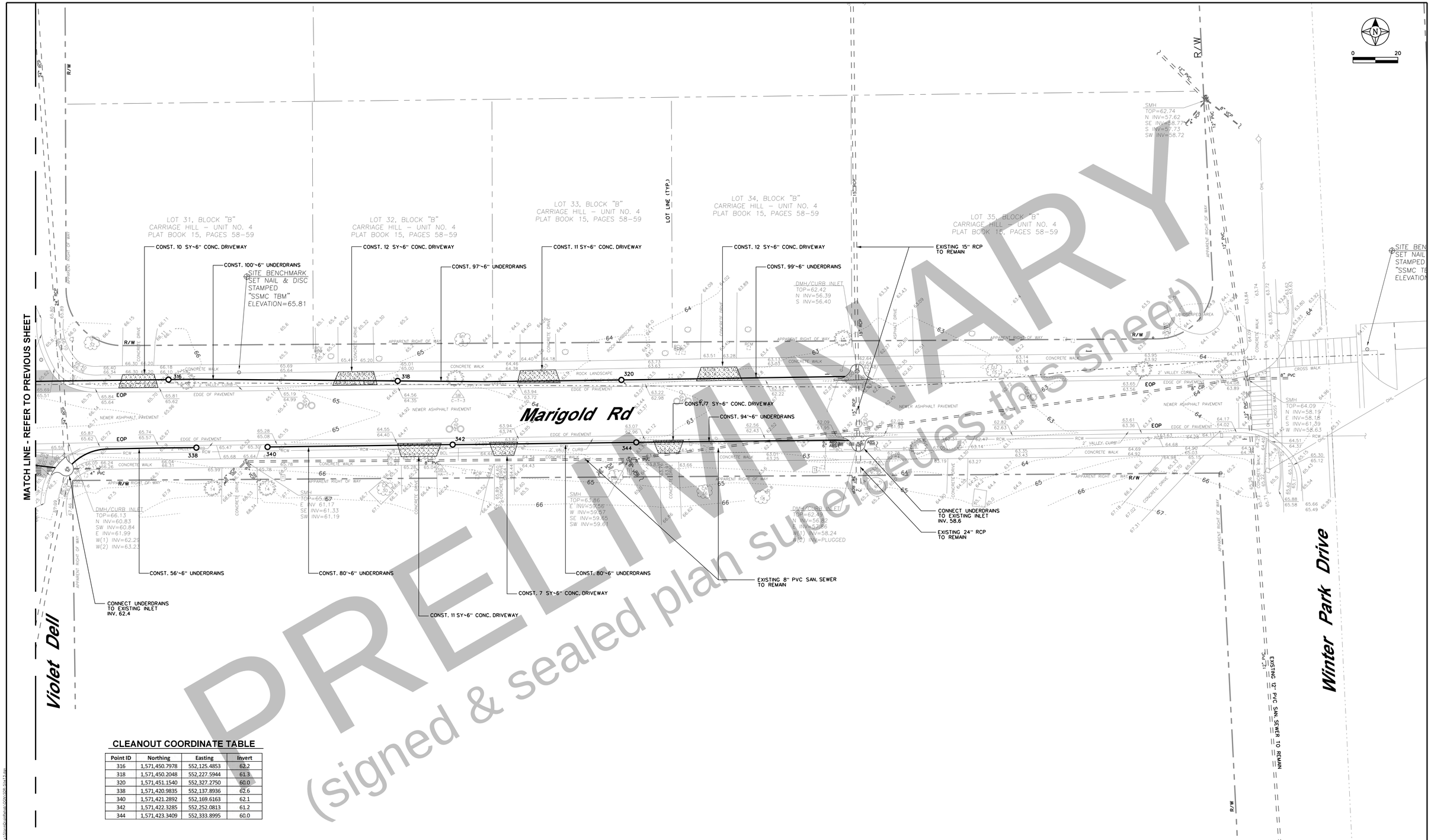
CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

MARIGOLD ROAD
(SITE T)

SHEET
47
SAI Project No. 2015-006.10



PRELIMINARY
(signed & sealed plan supersedes this sheet)

CLEANOUT COORDINATE TABLE

Point ID	Northing	Easting	Invert
316	1,571,450.7978	552,125.4853	62.2
318	1,571,450.2048	552,227.5944	61.3
320	1,571,451.1540	552,327.2750	60.0
338	1,571,420.9835	552,137.8936	62.6
340	1,571,421.2892	552,169.6163	62.1
342	1,571,422.3285	552,252.0813	61.2
344	1,571,423.3409	552,333.8995	60.0

Revision	Date	Approved
PER CITY	4/29/16	BRW

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CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

MARIGOLD ROAD
(SITE T)

SHEET
48
SAI
Project No.
2015-006.10

Rehabilitation Table - Area U

From Structure: MH-1
To Structure: 1A

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Catch Basin - MH-1		
10.1'	Joint Offset	5 - 7	Chemical Grout
12.0'	End of Pipe - 1A		

Note: "From" and "To" structure designation does not necessarily indicate direction of flow.

NOTE:
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Revision	Date	Approved
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CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

N SUNSET DRIVE
(AREA U)

SHEET
49
SAI Project No. 2015-006.10

PRELIMINARY
(signed & sealed plan supercedes this sheet)

NOTE:
THE LOCATIONS OF EXISTING STORMWATER STRUCTURES & CULVERTS SHOWN ON THIS SHEET WERE NOT SURVEYED AND ARE CONSIDERED APPROXIMATE.

Rehabilitation Table - Area V

From Structure: 1166
To Structure: 1166A

Distance	Observations	Clock Position	Rehabilitation Technique
0'	Catch Basin - #1166		
105.0'	Mineral Stains at Joint	2 - 10	Chemical Grout
129.0'	Mineral Stains at Joint	2 - 5	Chemical Grout
154.9'	Mineral Stains at Joint	3 - 9	Chemical Grout
163.0'	Mineral Stains at Joint	12 - 12	Chemical Grout
171.2'	Mineral Stains at Joint	3 - 6	Chemical Grout
195.4'	Mineral Stains at Joint	7	Chemical Grout
203.2'	Mineral Stains at Joint	2 - 9	Chemical Grout
207.9'	Manhole - #1166A		

Note: "From" and "To" structure designation does not necessarily indicate direction of flow.

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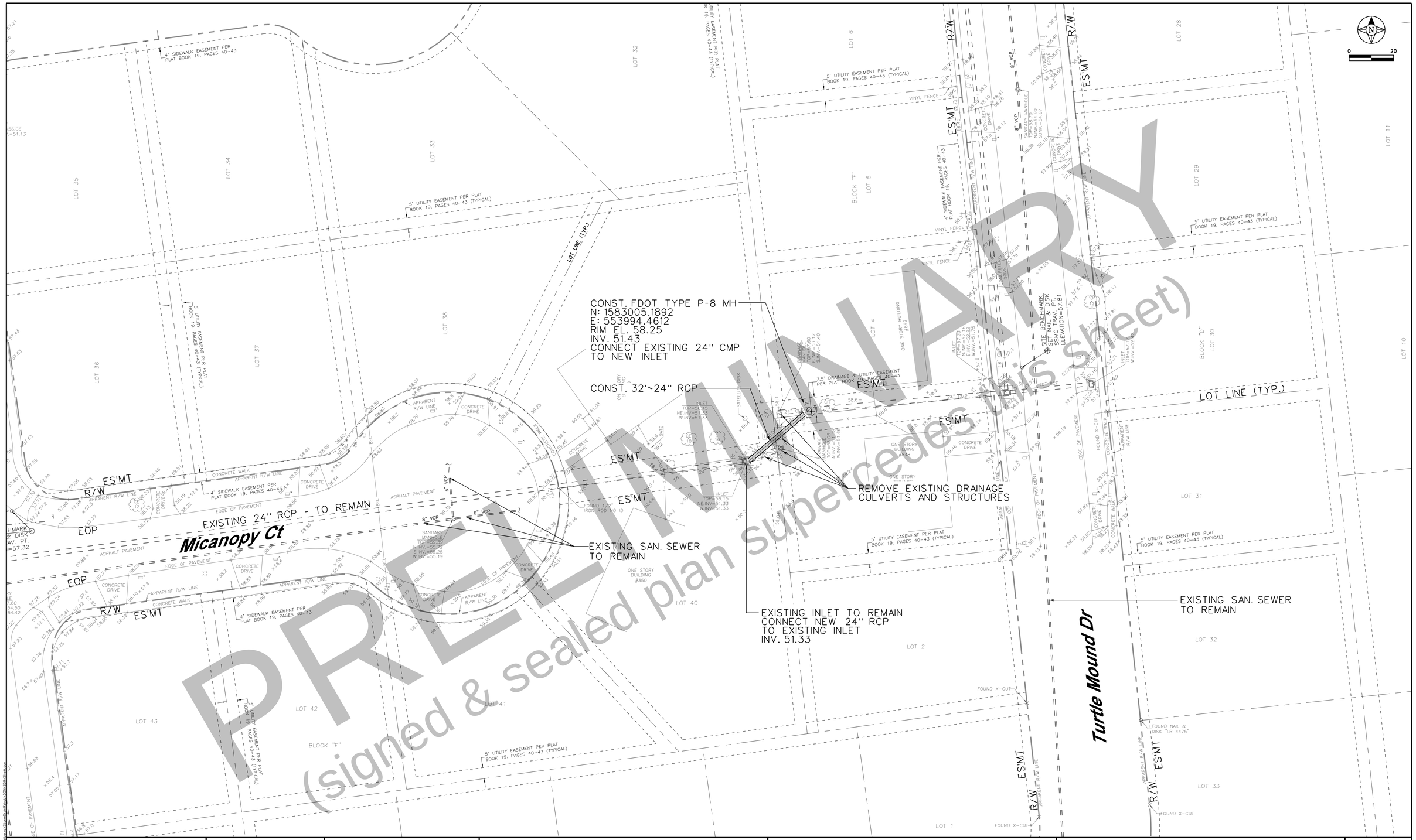
CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

CASSEL CREEK BLVD.
(AREA V)

SHEET
50
SAI
Project No.
2015-006.10



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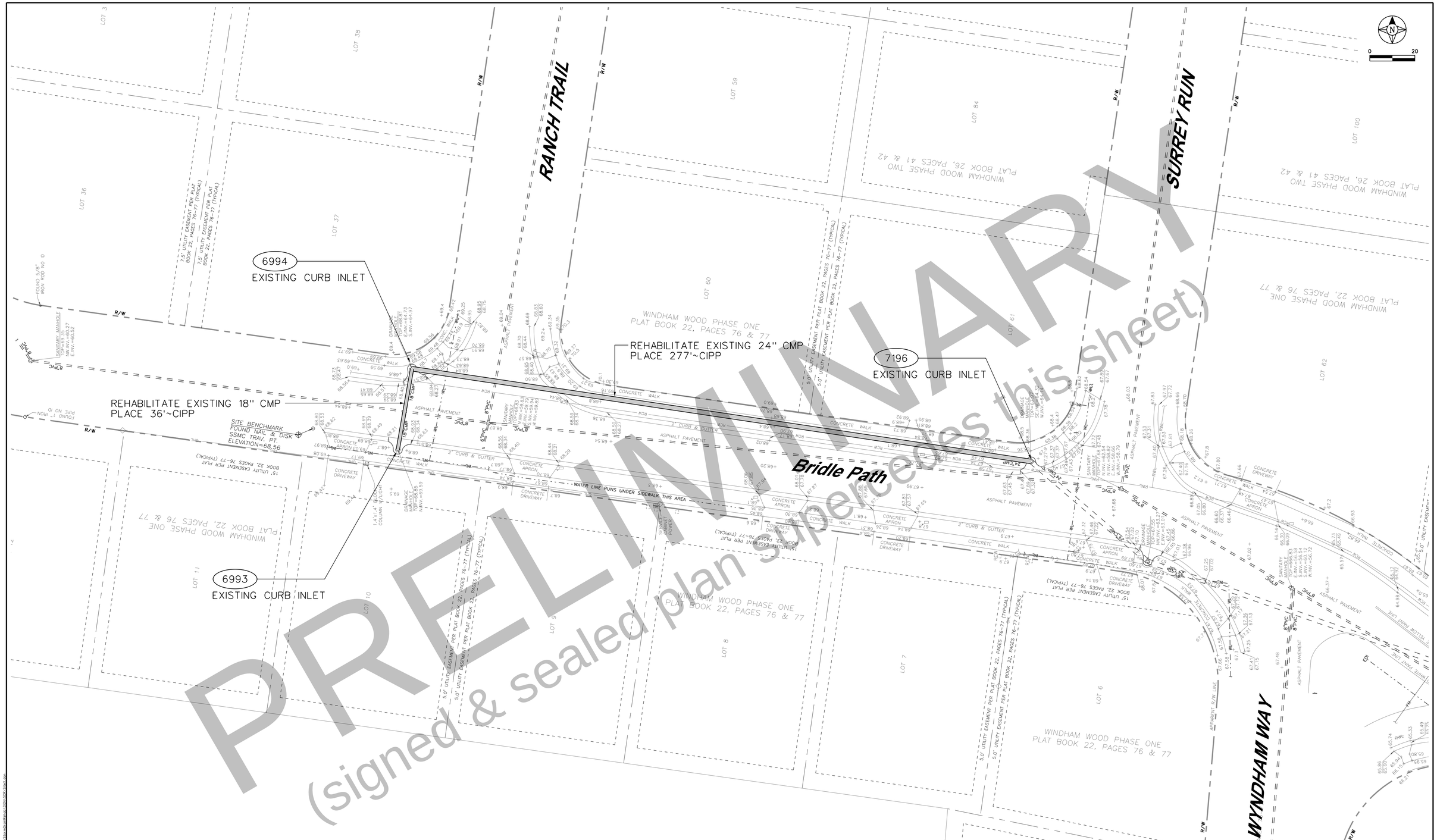
CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

MICANOPY CT. EASEMENT
(AREA W)

SHEET
51
SAI
Project No.
2015-006.10



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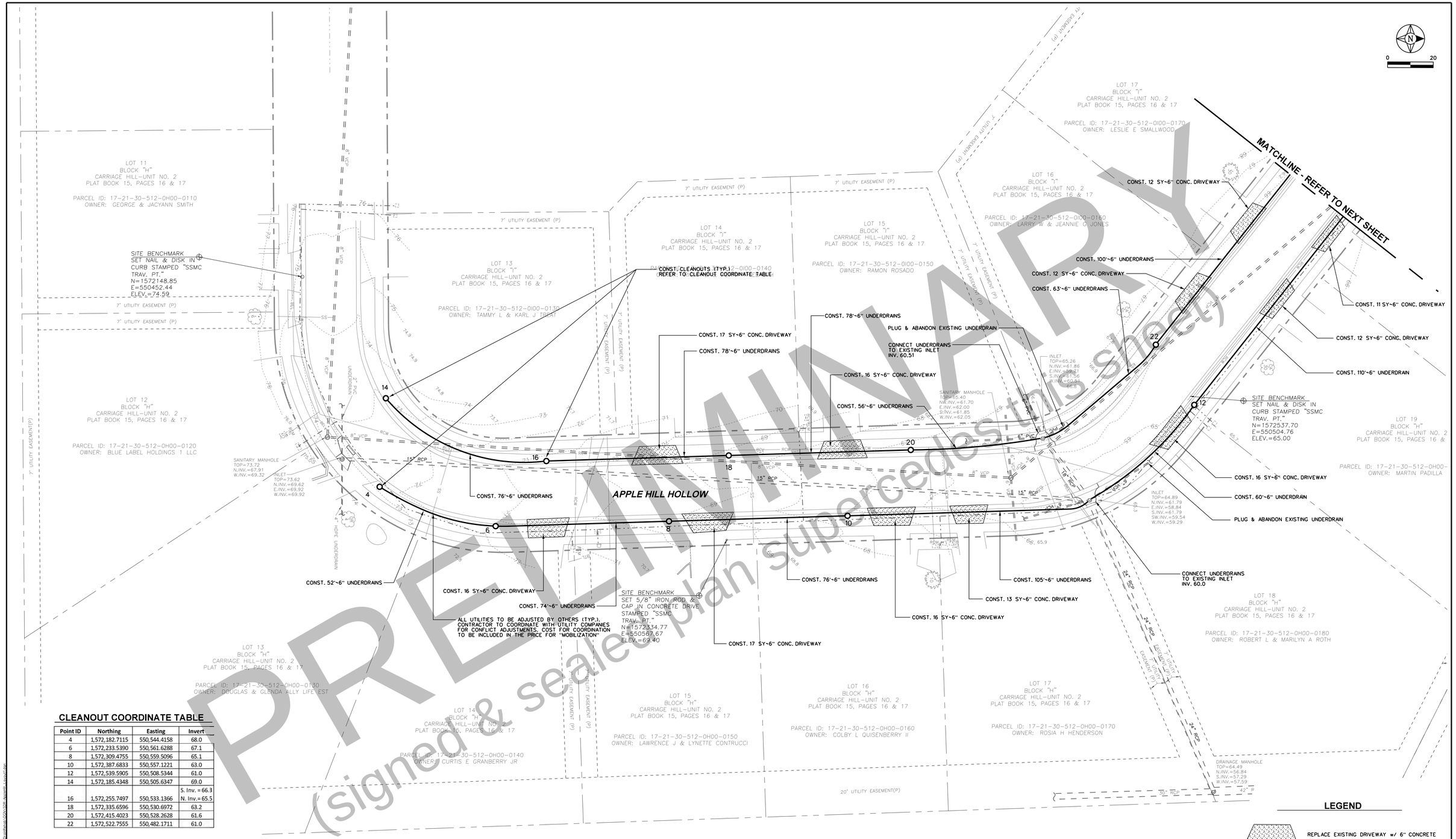
CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

BRIDLE PATH
(AREA X)

SHEET
52
SAI
Project No.
2015-006.10



PRELIMINARY
(signed & sealed plan supercedes this sheet)

CLEANOUT COORDINATE TABLE

Point ID	Northing	Easting	Invert
4	1,572,182.7115	550,544.4158	68.0
6	1,572,233.5390	550,561.6288	67.1
8	1,572,309.4755	550,559.5096	65.1
10	1,572,387.6833	550,557.1221	63.0
12	1,572,539.5905	550,508.5344	61.0
14	1,572,185.4348	550,505.6347	69.0
16	1,572,255.7497	550,533.1366	S. Inv. = 66.3 N. Inv.= 65.5
18	1,572,335.6596	550,530.6972	63.2
20	1,572,415.4023	550,528.2628	61.6
22	1,572,522.7555	550,482.1711	61.0

LEGEND

REPLACE EXISTING DRIVEWAY w/ 6" CONCRETE

Revision	Date	Approved
PER CITY	4/29/16	BRW

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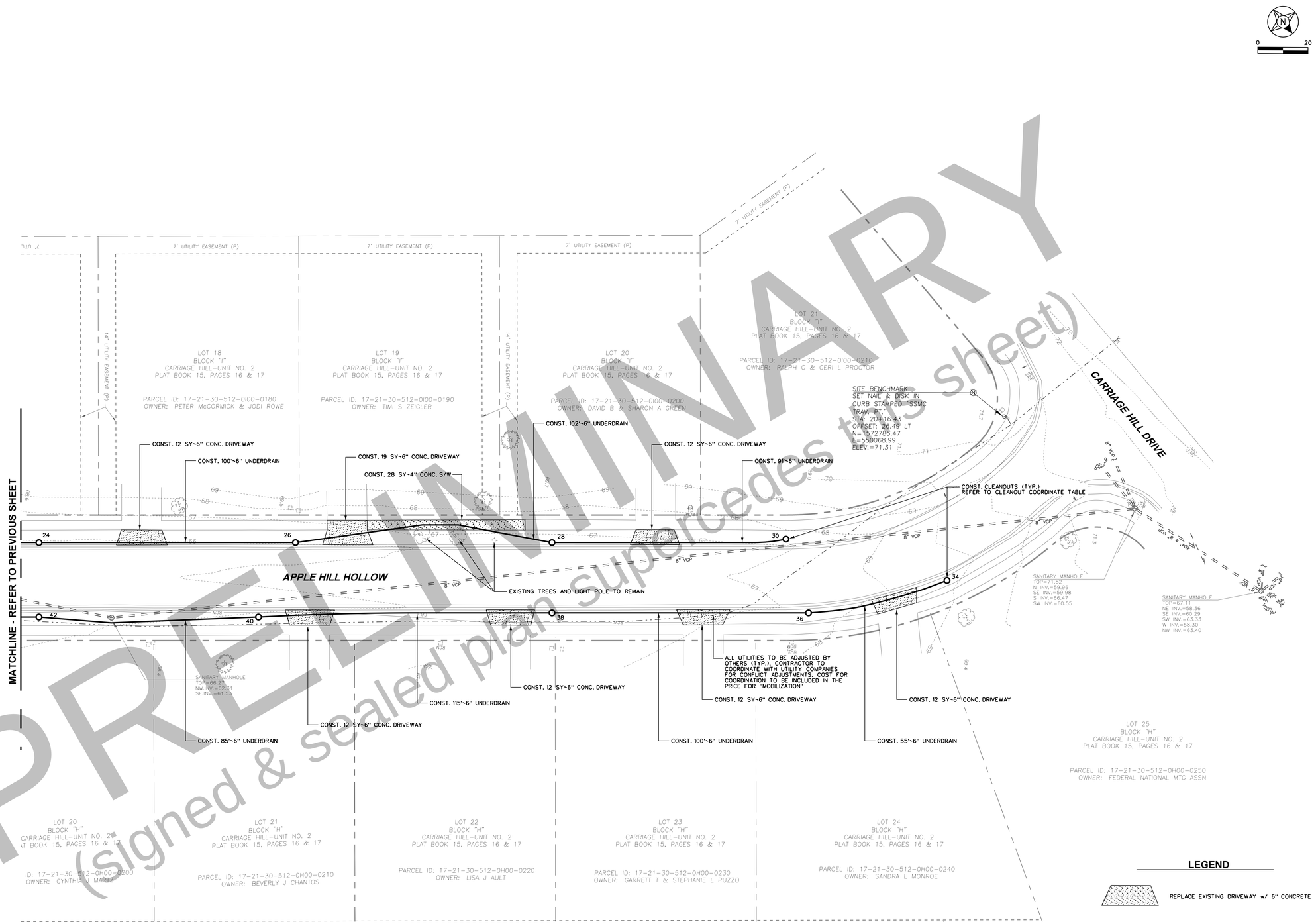
CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

APPLE HILL HOLLOW
LAYOUT PLAN

SHEET
53
SAI Project No.
2015-006.10



PRELIMINARY
(signed & sealed plan supercedes this sheet)

CLEANOUT COORDINATE TABLE

Point ID	Northing	Easting	Invert
24	1,572,586.1283	550,401.9329	61.9
26	1,572,649.5766	550,321.7495	62.1
28	1,572,713.0249	550,241.5661	62.3
30	1,572,769.7878	550,167.5645	63.5
34	1,572,822.5082	550,127.4083	64.7
36	1,572,798.4305	550,178.7573	63.5
38	1,572,734.9822	550,258.9407	62.3
40	1,572,663.6947	550,351.6965	62.0
42	1,572,609.3827	550,420.3339	61.6

LEGEND

REPLACE EXISTING DRIVEWAY w/ 6" CONCRETE

Revision	Date	Approved
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CITY OF CASSELBERRY
FLORIDA

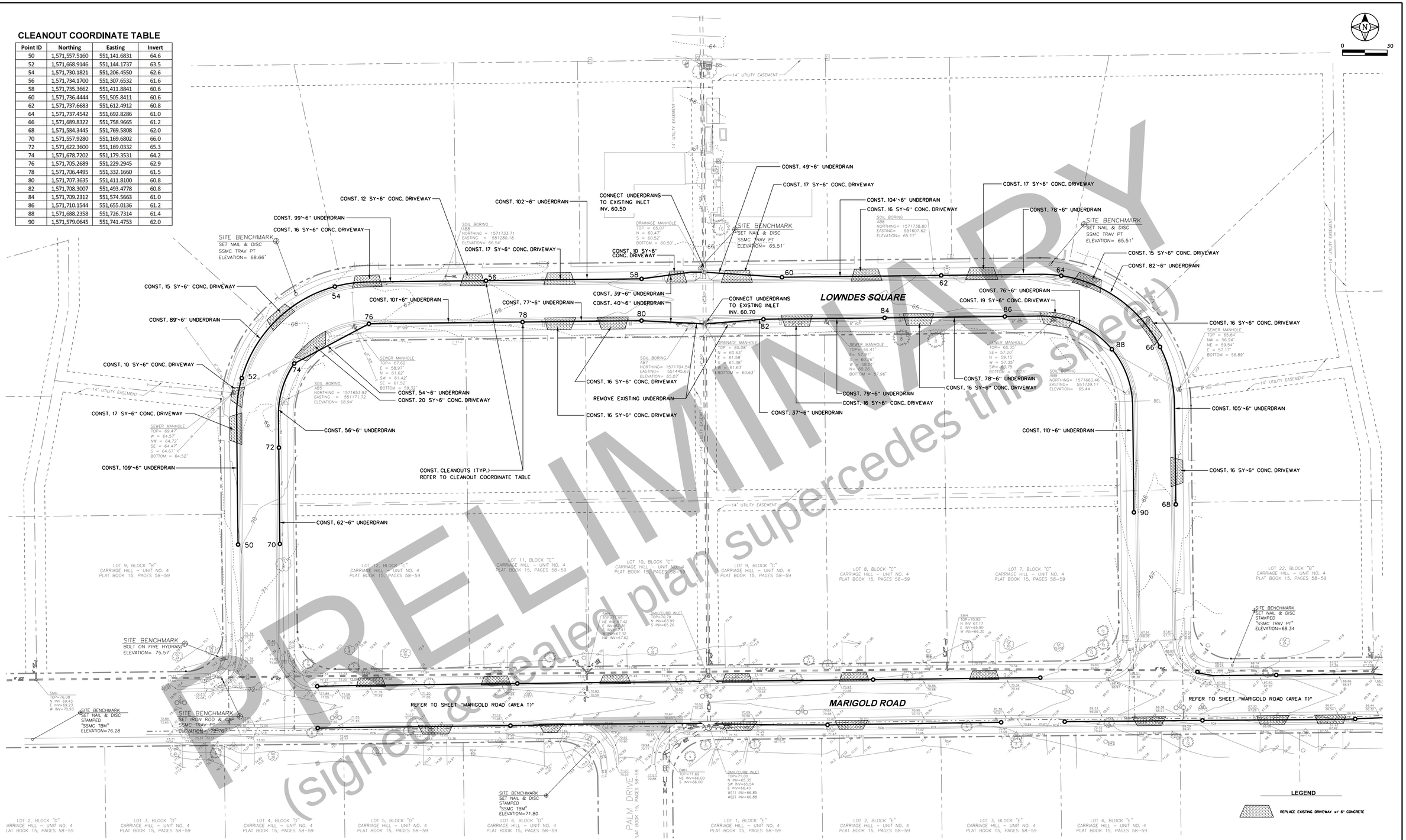
STORM DRAIN
REHABILITATION PROJECT

APPLE HILL HOLLOW
LAYOUT PLAN

SHEET
54
SAI
Project No.
2015-006.10

CLEANOUT COORDINATE TABLE

Point ID	Northing	Easting	Invert
50	1,571,557.5160	551,141.6831	64.6
52	1,571,668.9146	551,144.1737	63.5
54	1,571,730.1821	551,206.4550	62.6
56	1,571,734.1700	551,307.6532	61.6
58	1,571,735.3662	551,411.8841	60.6
60	1,571,736.4444	551,505.8411	60.6
62	1,571,737.6683	551,612.4912	60.8
64	1,571,737.4542	551,692.8286	61.0
66	1,571,689.8322	551,758.9665	61.2
68	1,571,584.3445	551,769.5808	62.0
70	1,571,557.9280	551,169.6802	66.0
72	1,571,622.3600	551,169.0332	65.3
74	1,571,678.7202	551,179.3531	64.2
76	1,571,705.2689	551,229.2945	62.9
78	1,571,706.4495	551,332.1660	61.5
80	1,571,707.3635	551,411.8100	60.8
82	1,571,708.3007	551,493.4778	60.8
84	1,571,709.2312	551,574.5663	61.0
86	1,571,710.1544	551,655.0136	61.2
88	1,571,688.2358	551,726.7314	61.4
90	1,571,579.0645	551,741.4753	62.0



PRELIMINARY
(signed & sealed plan supercedes this sheet)

Revision	Date	Approved
PER CITY	4/29/16	BRW

Designed by: BRW
Drawn by: BJG/ADB
Checked by: RBG
Approved by: BRW
Vertical Datum: NAVD 1988

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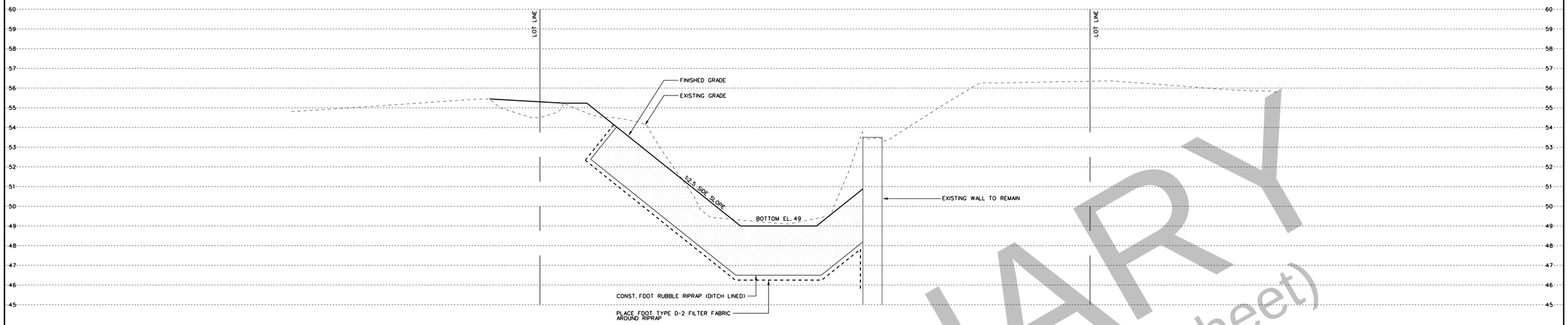
CITY OF CASSELBERRY
FLORIDA

STORM DRAIN
REHABILITATION PROJECT

LOWNDES SQUARE
LAYOUT PLAN

SHEET
55
SAI Project No. 2015-006.10



SECTION K1-K1

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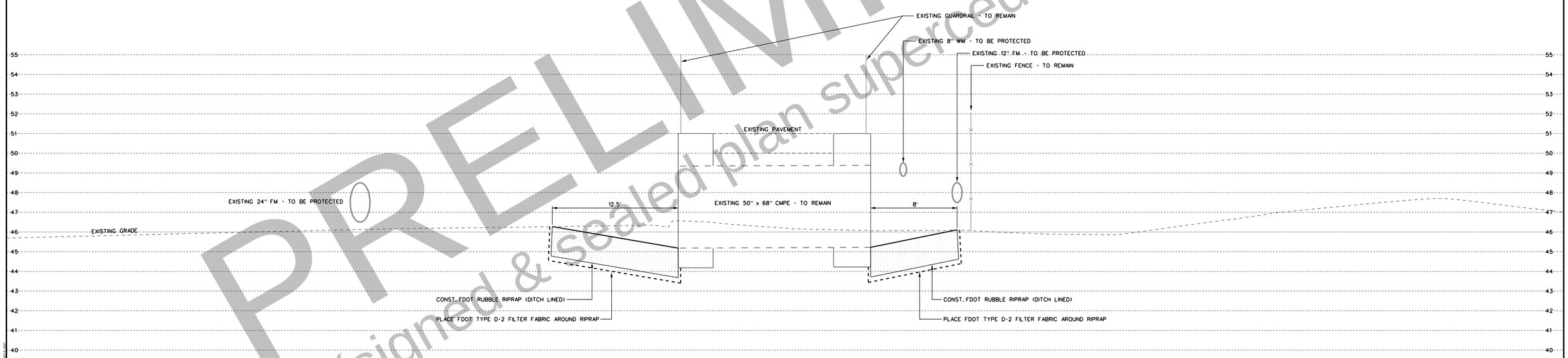
VSCALE 1"=5'



SECTION J-J

HSCALE 1"=10'
VSCALE 1"=5'

PRELIMINARY
(signed & sealed plan supercedes this sheet)

Revision	Date	Approved
PER CITY	4/29/16	BRW

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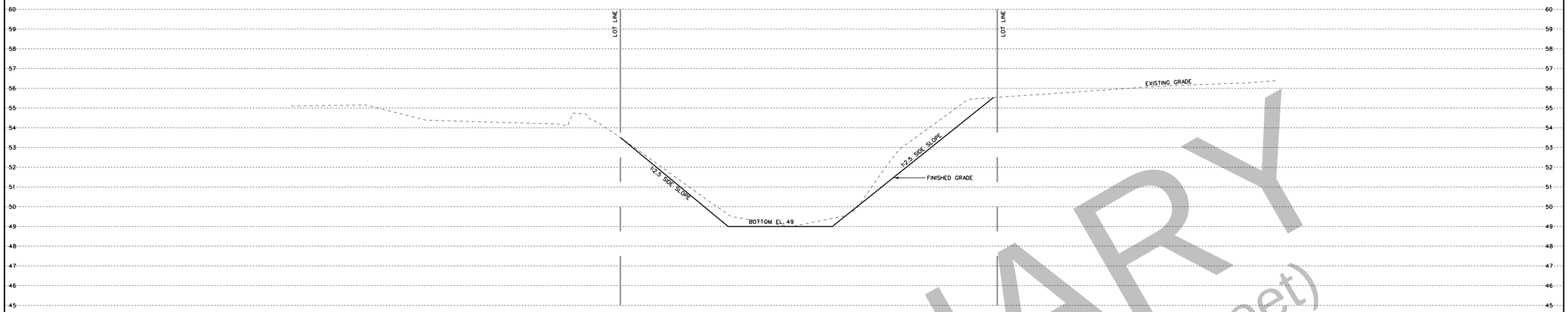
STORM DRAIN
REHABILITATION PROJECT

CROSS SECTIONS

SHEET
56
SAI
Project No.
2015-006.10



SECTION K3-K3

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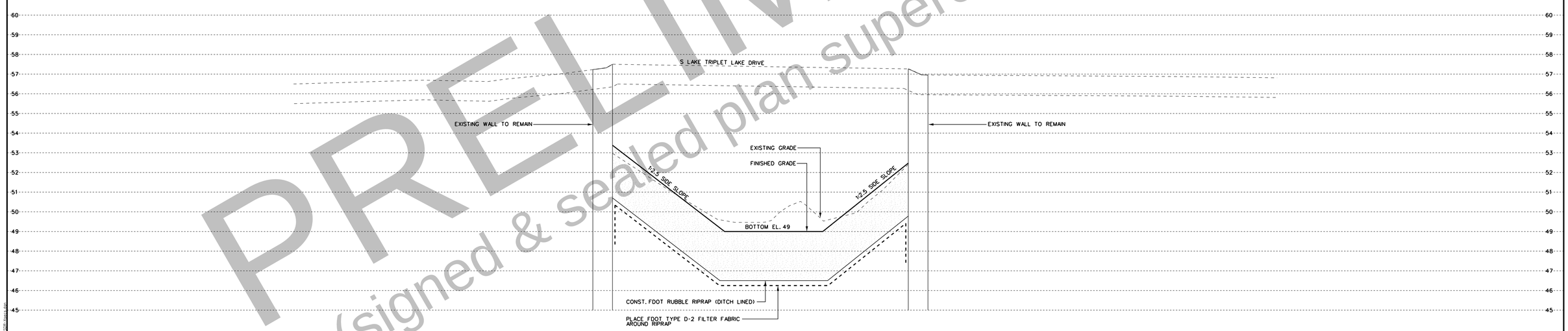
VSCALE 1"=5'



SECTION K2-K2

HSCALE 1"=10'
VSCALE 1"=5'

PRELIMINARY
(signed & sealed plan supercedes this sheet)

Revision	Date	Approved
PER CITY	4/29/16	BRW

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Checked by: RBG
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FLORIDA

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REHABILITATION PROJECT

CROSS SECTIONS

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57
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Project No.
2015-006.10

Appendix E
CCTV Inspection Results Summary

Table E.1 - CCTV Inspection Results Summary

Project Area	Area ID	Video ID	Pipe (Beg. Str.)	Pipe (End Str.)	Size (in)	Length Surveyed (ft)	Pipe Length (ft)	Pipe Material	Pipe Structural or O&M Issues and Observations	Distance (ft)	Clock Position	Pipe Rehabilitation Technique				Additional Comments
												Point Repair(s)/Pipe Replacement	Repair/ Replacement Length	CIPP Recommend	CIPP Length	
Kantor Blvd to Stanhope Drive	A	3	141	329	18	33.9	33.9	RCP	None	-	-	No	0	No	0	
Kantor Blvd	A	4	317	317N	48	117.5	117.5	RCP	Mineral Stains at Joint	11.1	12 - 12	Chemical Grout	1	No	0	
									Mineral Deposits at Joint	68.7	6 - 9	Chemical Grout	1	No	0	
Kantor Blvd	A	5	317	103	48	33.5	33.5	RCP	None	-	-	No	0	No	0	
Kantor Blvd to Stanhope Drive	A	65	317	329	15	113.1	382.5	CMP	Roots	47.3	3 - 8	No	0	Yes	113	
									Roots	51.9	9 - 3	No	0	Yes		
									Roots	58.5	5	No	0	Yes		
									Rod Protruding Through Pipe	112.0	1 - 6	Chemical Grout	1	No	0	CCTV Could Not Pass Rod
		66	329	317	15	269.4	382.5	CMP	Roots	8.0	3 - 8	No	0	Yes	260	Reverse Camera Setup
									Roots	10.1	4	No	0	Yes		
									Roots	12.0	12	No	0	Yes		
									Roots	16.4	3	No	0	Yes		
									Roots	21.9	9	No	0	Yes		
									Roots	43.3	10	No	0	Yes		
									Roots	50.3	1	No	0	Yes		
									Roots	188.2	1 - 6	No	0	Yes		
									Roots	216.3	11	No	0	Yes		
									Rod Protruding Through Pipe	269.4	12	-	-	-	-	
Kantor Blvd to Stanhope Drive	A	67	115	315	48	416.6	416.6	CMP	Infiltration	5.0	5	No	0	Yes	417	
									Infiltration	22.3	6	No	0			
									Heavy Cement in Pipe	74.5	-	No	0			Remove Cement
									Cement in Pipe	75.1	-	No	0			Remove Cement
									Cement in Pipe	94.4	5	No	0			Remove Cement
									Infiltration	103.5	5	No	0			
									Infiltration	162.3	7	No	0			
									Buried Manhole	207.8	12	No	0			
									Infiltration	235.8	3	No	0			
									Infiltration	292.6	6	No	0			
									Infiltration	395.7	6	No	0			
Quintuplet Drive System	C	6	1350	1355	18	30.9	30.9	RCP	Joint Bell Broken - Gasket Exposed	17.3	-	No	0	Yes	31	
									Joint Seperated - Void Visible	17.3	-	No	0	Yes		
									Cement Repair Protruding 1"	29.2	11 - 3	No	0	Yes		
Quintuplet Drive System	C	7	1355	1327	24	204.9	204.9	RCP	Circular Crack with Mineral Stains	41	1 - 4	Chemical Grout	1	No	0	
Quintuplet Drive System	C	8	1323	1327	24	225.9	225.9	RCP	None	-	-	No	0	No	0	
Quintuplet Drive System	C	9	1323	1328	18	30.9	30.9	RCP	Roots at Joint	25.1	5	No	0	Yes	31	
									Crack at Joint	25.1	6 - 12	No	0	Yes		
Quintuplet Drive System	C	10	1323	1319	24	97.7	97.7	RCP	Roots in Pipe	70.1	3	Chemical Grout	1	No	0	
									Roots in Pipe	76.3	5	Chemical Grout	1	No	0	
									Roots in Pipe	77.4	5	Chemical Grout	1	No	0	
									Roots in Pipe	78.3	5	Chemical Grout	1	No	0	Perforated Pipe
									Roots in Pipe	79.4	5	Chemical Grout	1	No	0	
									Roots in Pipe	86.3	4	Chemical Grout	1	No	0	
									Roots in Pipe	91.2	7	Chemical Grout	1	No	0	
Quintuplet Drive System	C	11	1319	1324	24	100.2	100.2	RCP	Chip at Bell	75.2	5 - 7	No	0	Yes	4	
Quintuplet Drive System	C	12 / 12A	1319	1319N	24	350.6	507	CMP/HDPE	Medium Roots at Joint	62.2	10	No	0	Yes	4	
									Material Change to HDPE	230.5	-	No	0	No	0	
									Material Change to CMP	274.0	-	No	0	No	0	
									Pipe Broken - Heavy Deterioration	347.3	-	Replace Pipe	156	No	0	
									Heavy Debris	350.6	-	No	0	No	0	CCTV Could Not Continue
Quintuplet Drive System	C	13	1245	1207	15	31.1	31.1	RCP	None	-	-	No	0	No	0	
Quintuplet Drive System	C	14	1245	1210	15	166.0	166.0	RCP	None	-	-	No	0	No	0	

Table E.1 - CCTV Inspection Results Summary

Project Area	Area ID	Video ID	Pipe (Beg. Str.)	Pipe (End Str.)	Size (in)	Length Surveyed (ft)	Pipe Length (ft)	Pipe Material	Pipe Structural or O&M Issues and Observations	Distance (ft)	Clock Position	Pipe Rehabilitation Technique				Additional Comments
												Point Repair(s)/Pipe Replacement	Repair/ Replacement Length	CIPP Recommend	CIPP Length	
Quintuplet Drive System	C	15	1261	1210	15	170.6	170.6	RCP	Roots at Joint	10.2	5	Chemical Grout	1	No	0	
									Roots at Joint	34.0	5	Chemical Grout	1	No	0	
									Roots at Joint	41.9	5	Chemical Grout	1	No	0	
									Lift Hole w/ Visible Soil	70.1	5	Chemical Grout	1	No	0	
									Lift Hole w/ Visible Soil	102.7	7	Chemical Grout	1	No	0	
									Lift Hole w/ Visible Soil	126.8	5	Chemical Grout	1	No	0	
									Lift Hole w/ Extended Cement	143.1	5 , 12	No	0	No	0	Cement Extends 1" Into Pipe
									Lift Hole w/ Extended Cement	151.1	1	No	0	No	0	Cement Extends 1" Into Pipe
Quintuplet Drive System	C	16	1261	1280W	18	32.1	32.1	RCP	Pipe Broken at Joint - Soil Visible	14.6	12 - 12	No	0	Yes	32	
									Roots at Joint	14.6	5 - 6					
Quintuplet Drive System	C	17	1280W	1280	18	16.6	16.6	RCP	None	-	-	No	0	No	0	
Quintuplet Drive System	C	18	1280	1280E	18x30	44.8	44.8	ERCP	None	-	-	No	0	No	0	
Quintuplet Drive System	C	19	1189	1176	18	30.8	30.8	RCP	None	-	-	No	0	No	0	
Quintuplet Drive System	C	20	1189	1161	24	271.3	271.3	RCP	Begin Sediment in Pipe	60.0	-	No	0	Yes	271	Clean Sediment Prior to CIPP
									End Sediment in Pipe	166.5	-					
									Roots at Joint	222.4	3					
									5.7' Longitudinal Crack	248.7	-					
Quintuplet Drive System	C	21	1147	1161	24	256.3	256.3	RCP	Roots in Pipe	91.9	7 , 9	Chemical Grout	1	No	0	Perforated Pipe
									Roots in Pipe	99.7	5	Chemical Grout	1	No	0	
Quintuplet Drive System	C	22	1147	1148	24	30.1	30.1	RCP	Joint Offset - Medium	21.7	-	No	0	Yes	30	
Quintuplet Drive System	C	23	1148	1148S	24	26.7	26.7	RCP	None	-	-	No	0	No	0	
Quintuplet Drive System	C	24	1143	1143N	36	203.0	203.0	RCP	None	-	-	No	0	No	0	
Quintuplet Drive System	C	25	1143	1148N	36	52.9	52.9	RCP	None	-	-	No	0	No	0	
Quintuplet Drive System	C	26	1148N	1148E	30	21.6	21.6	RCP	None	-	-	No	0	No	0	
Quintuplet Drive System	C	27	1148E	1021	30	230.9	230.9	RCP	None	-	-	No	0	No	0	Junction Box #1021 buried
Quintuplet Drive System	C	28	1148SS	1148S	18	18.0	18.0	RCP	None	-	-	No	0	No	0	
Quintuplet Drive System	C	29	1109	1	18	29.2	29.2	RCP	None	-	-	No	0	No	0	
Quintuplet Drive System	C	30	1109	1107	24	152.5	152.5	RCP	Heavy Debris	95.3	-	Clean Pipe	0	No	0	Debris/Bricks in Pipe
Quintuplet Drive System	C	37	1280	MES	18x30	365.1	365.1	ERCP	Sanitary Pipe Through MH 1280	0	-	No	0	No	0	
									Roots at Joint	39.8	8	Chemical Grout	1	No	0	
									Roots at Joint	48.8	7	Chemical Grout	1	No	0	
									Roots at Joint	120.8	5	Chemical Grout	1	No	0	
									Joint Offset - Small	169.0	5 - 7	No	0	Yes	25	
									Joint Offset - Small	193.8	5 - 7	No	0	Yes	25	
									Roots at Joint	250.0	8	Chemical Grout	1	No	0	
									Roots at Joint	266.5	6	Chemical Grout	1	No	0	
									Sag in Pipe	275.5	-	No	0	Yes	15	
									Joint Seperated With Roots	290.8	12 - 12	No	0	Yes	15	
									Roots at Joint	299.5	8	Chemical Grout	1	No	0	
									Roots at Joint	315.4	9	Chemical Grout	1	No	0	
									Roots at Joint	339.3	5	Chemical Grout	1	No	0	
									Joint Offset - Small	346.6	5 - 7	Replace Pipe	9	No	0	
									Joint Separation w/ Broken Conc.	355.0	12 - 12	Replace Pipe	10	No	0	
Gregory Drive	D	58	704	703	24	55.2	55.2	RCP	Pipe Broken	38.1	10	No	0	Yes	55	Second Pipe Visible Crossing Storm Pipe
Gregory Drive	D	59	704	704A	30	50.4	50.4	RCP	None	-	-	No	0	No	0	
Gregory Drive	D	60	704A	704B	30	182.7	182.7	RCP	None	-	-	No	0	No	0	
Gregory Drive	D	61	803A	803	18	32.1	32.1	RCP	None	-	-	No	0	No	0	Sanitary Pipe Crossing Through Storm Pipe
Gregory Drive	D	62	803A	803B	24	8.0	8.0	RCP	None	-	-	No	0	No	0	
Gregory Drive	D	63	OUTFALL	803B	36	218.1	218.1	RCP	None	-	-	No	0	No	0	
Concord Drive	E	51	196	200	18	48.4	48.4	RCP	Crack along Pipe	33.6	2	Chemical Grout	1	No	0	

Table E.1 - CCTV Inspection Results Summary

Project Area	Area ID	Video ID	Pipe (Beg. Str.)	Pipe (End Str.)	Size (in)	Length Surveyed (ft)	Pipe Length (ft)	Pipe Material	Pipe Structural or O&M Issues and Observations	Distance (ft)	Clock Position	Pipe Rehabilitation Technique				Additional Comments
												Point Repair(s)/Pipe Replacement	Repair/ Replacement Length	CIPP Recommend	CIPP Length	
Concord Drive	E	52	196	130	24	260.3	260.3	CMP	Roots in Pipe	33.1	4	Replace Pipe	260	No	0	
									Roots in Pipe	35.1	8					
									Roots in Pipe	52.1	5 - 7					Perforated Pipe
									Crack in Pipe	91.5	10					Non-Perforated Pipe
									Roots in Pipe	100.4	7					
									Crack in Pipe	110.4	3 - 9					
									Roots in Pipe	111.7	7					
									Roots in Pipe	132.3	5					
									Roots in Pipe	141.2	5					
									Roots in Pipe	160.8	5					
									Visible Filter Fabric	167.8	8 - 4					
									Visible Filter Fabric	187.5	9 - 3					
									Visible Filter Fabric	244.8	12 - 12					
Paul McClure Court	F	38	163A	163	15	25.1	25.1	CMP	None	-	-	No	0	No	0	
Paul McClure Court	F	39	163A	163B	18	35.8	35.8	CMP	Broken Pipe	17.7	5	Replace Pipe	36	No	0	
									Roots in Pipe	17.7	5 - 7					
Stanhope Drive	G	31	152	115	24	298.1	298.1	CMP	Sediment/Debris in Pipe	152.5	-	Clean Pipe	0	No	0	
Stanhope Drive	G	32	638	115	48	37.4	37.4	RCP	Mineral Stain	26.4	4 - 7	Chemical Grout	1	No	0	
Stanhope Drive	G	33	638	638S	48	90.7	90.7	RCP	Mineral Stain	0	3	Chemical Grout	1	No	0	
									Mineral Stain	63.4	12 - 12	Chemical Grout	1	No	0	
Stanhope Drive	G	34	624	635	18	322.5	322.5	CMP	Crack in Pipe	166.5	0.9 - 1	Replace Pipe	322	No	0	
									Plastic Board Across Pipe	321.5	5 - 7	Clean Pipe	0	No	0	
									Leaking at Walls of Inlet	322.5	-	Chemical Grout	1	No	0	
Stanhope Drive	G	35	648	149	15	32.6	32.6	RCP	Mineral Stains	16.1	10 - 7	No	0	Yes	33	
									Crack in Pipe	30.3	7 - 4	No	0	Yes		
Spoonhour Drive	G	36	648	152	18	104.2	104.2	CMP	None	-	-	No	0	No	0	
Park Avenue	H	40	138A	138	18	24.1	24.1	CMP	None	-	-	No	0	No	0	
Park Avenue	H	41	138A	144	18	160	160	CMP	None	-	-	No	0	No	0	
Park Avenue	H	42	126B	126A	18	27.1	27.1	CMP	Heavy Concrete in Inlet #126B	0	-	Clean Structure	0	No	0	
									Bulgle and Crack in Pipe	12.1	8	Replace Pipe	27	No	0	
Park Avenue	H	43	126B	126C	18	11.9	11.9	CMP	None	-	-	No	0	No	0	
Park Avenue	H	44	148B	148A	18	31.6	31.6	CMP	None	-	-	No	0	No	0	
Park Avenue	H	45	148C	148B	18	24.4	24.4	CMP	None	-	-	No	0	No	0	
Paul McClure Court	H	46	148D	148C	18	115.4	115.4	CMP	None	-	-	No	0	No	0	
Paul McClure Court	H	47	148D	148E	24	96.2	96.2	CMP/HDPE	Hole/Deterioration	33.5	9	Replace Pipe	96	No	0	
									Material Changes to HDPE	80.3	-					
Winter Park Drive	I	48 / 48A	HW-2	HW-1	36"x72"	127.9	127.9	ERCP	New Junction Box Located	57.7	-	Chemical Grout	1	Yes	128	
Winter Park Drive	I	49	HW-2A	HW-1A	36"x72"	126.9	126.9	ERCP	New Junction Box Located	56.2	-	Chemical Grout	1	Yes	128	New Manhole (Buried)
Winter Park Drive	I	50	HW-2B	HW-1B	36"x72"	129.1	129.1	ERCP	New Junction Box Located	60.4	-	Chemical Grout	1	Yes	128	
Easment from Carriage Hill Drive	M	64	139	OUTFALL	30	155.0	155.0	RCP/ADS	Mineral Stains at Joint	49.4	7 - 10	Chemical Grout	1	No	0	
									Roots at Joint	121.9	10 - 2	Chemical Grout	1	No	0	
									Material Change to ADS	130.0	-	No	0	No	0	
Secret Way	N	57	277F	277B	18	133.8	169.0	RCP	Leaking at Joint	130.8	9	Chemical Grout	1	No	0	
									Joint Offset	132.8	12 - 12	Chemical Grout	1	No	0	
									Material Change to HDPE	133.8	-	No	0	No	0	CCTV Could Not Continue
Secret Way	O	53	225	224	15	24.7	24.7	RCP	Exposed Rebar At Inlet #224	24.7	-	Repair Concrete	1	No	0	
Secret Way	O	54	225	225A	15	118.2	206	RCP/ADS	Material Change to ADS	118.2	-	No	0	Yes	88	
									Joint Angles to the Right	118.2	-					CCTV Could Not Continue
Ivey Road	S	68	328	295	38"x60"	170.2	170.2	RCP	Infiltration	12.9	7	Chemical Grout	1	No	0	
									Infiltration	48.5	7	Chemical Grout	1	No	0	
									Manhole Cover	48.5	-	No	0	No	0	Manhole Lid Only at Culvert Bend, No Structure Box
									Infiltration	61.9	7	Chemical Grout	1	No	0	
									Infiltration	85.1	7	Chemical Grout	1	No	0	
									Leaking Water and Sand	146.2	6	Chemical Grout	1	No	0	
									Leaking Water and Sand	158.5	5	Chemical Grout	1	No	0	
Sunset Drive	U	55	MH-1	1A	15	12.0	12.0	RCP	Joint Offset	10.1	5 - 7	Chemical Grout	1	No	0	

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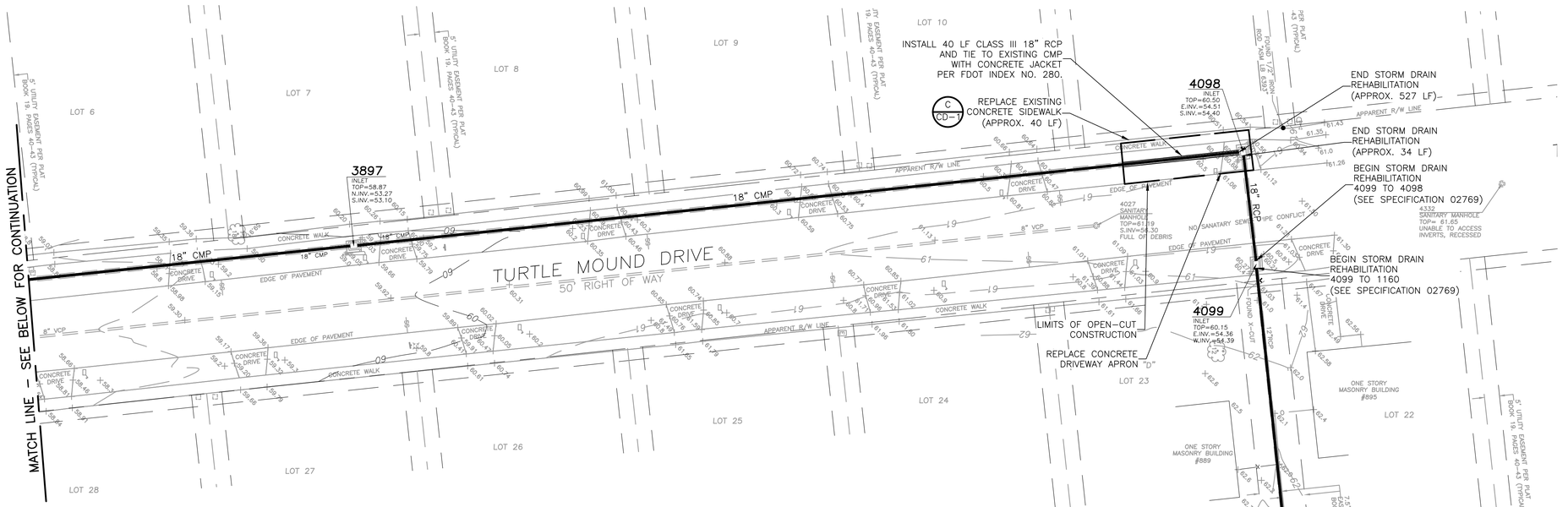
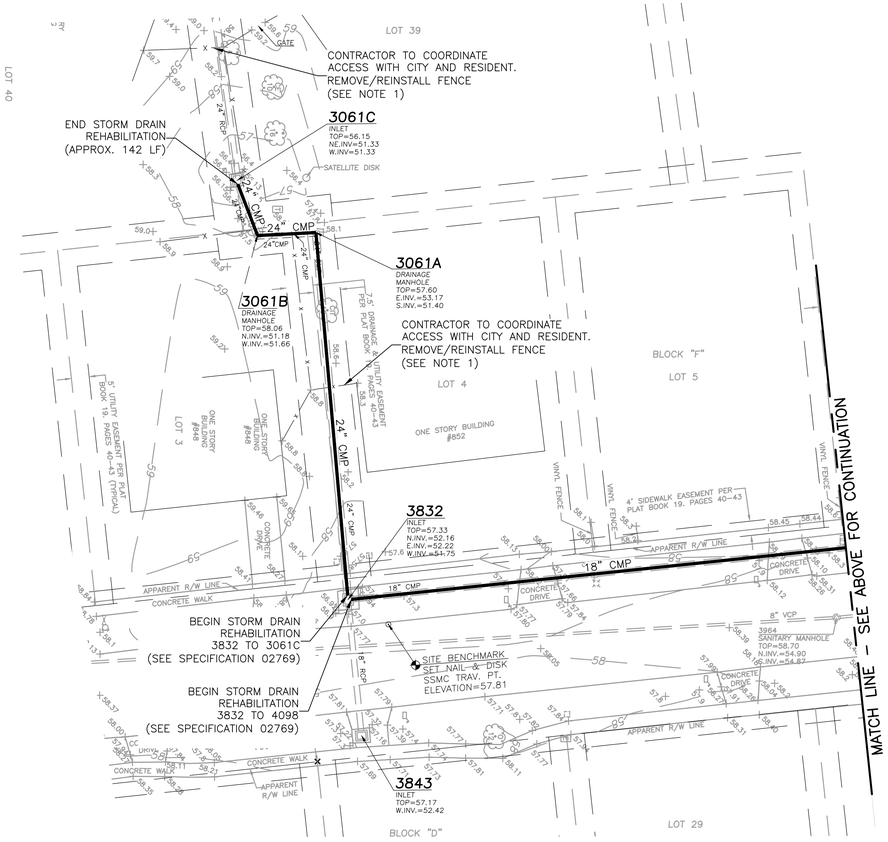
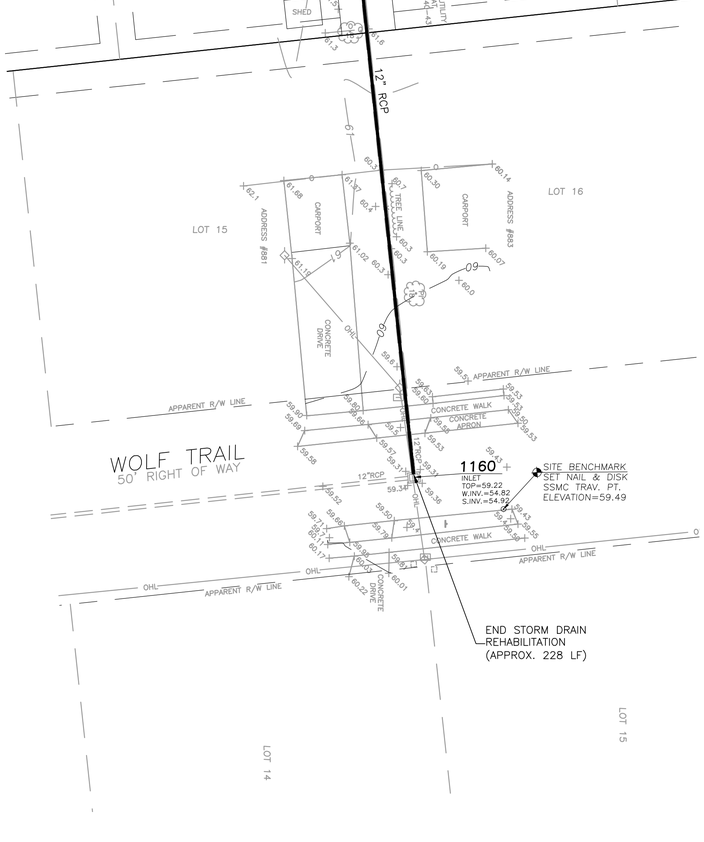
Project Area	Area ID	Video ID	Pipe (Beg. Str.)	Pipe (End Str.)	Size (in)	Length Surveyed (ft)	Pipe Length (ft)	Pipe Material	Pipe Structural or O&M Issues and Observations	Distance (ft)	Clock Position	Pipe Rehabilitation Technique				Additional Comments
												Point Repair(s)/Pipe Replacement	Repair/ Replacement Length	CIPP Recommend	CIPP Length	
Sunset Drive	U	56	2	2A	15	35.7	35.7	RCP	None	-	-	No	0	No	0	
Cassel Creek Blvd near Creek Crossing/ Newport Colony	V	1	1166B	1166	18	116.0	116.0	RCP	None	-	-	No	0	No	0	
Cassel Creek Blvd near Creek Crossing/ Newport Colony	V	2	1166	1166A	36	207.9	207.9	RCP	Mineral Staining at Joint	105.0' 129.0' 154.9' 163.0' 171.2' 195.4' 203.2'	2 - 10 2 - 5 3 - 9 12 - 12 3 - 6 7 2 - 9	Chemical Grout Chemical Grout Chemical Grout Chemical Grout Chemical Grout Chemical Grout Chemical Grout	1 1 1 1 1 1 1	No	0	

Appendix F
CDM Inspection Results and Design for Area W







NOTES:

1. CONTRACTOR SHALL RESTORE WORK AREA TO SIMILAR OR BETTER CONDITION.
2. CONNECTION TO DISSIMILAR PIPE SHALL BE IN ACCORDANCE WITH FDOT INDEX. NO. 280.
3. CONTRACTOR SHALL SOD ALL DISTURBED AREAS PER SPECIFICATION 02822.
4. CONTRACTOR SHALL VERIFY PIPE DIAMETERS DESIGNATED FOR LINING PRIOR TO SHOP DRAWING SUBMITTALS.

DATE:
WILLIAM J. CRAVEN, P.E.
P.E. NO. 59294

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: W. CRAVEN
DRAWN BY: D. BUCKLAND
SHEET CHK'D BY: W. CRAVEN
CROSS CHK'D BY: D. PRAH
APPROVED BY: W. CRAVEN
DATE: FEBRUARY 2014

CDM Smith
2301 Maitland Center Parkway, Suite 300
Maitland, FL 32751
Tel: (407) 660-2552
FL COA No. EB-0000020

CITY OF CASSELBERRY

STORM DRAIN REHABILITATION PROJECT

TURTLE MOUND DRIVE PLANS

PROJECT NO. 61762-94623
FILE NAME: C003STPL.DWG
SHEET NO.
C-3

ISSUED FOR BID

XREFs: [CDMS_2436, 57014001_PRELIMINARY FEB 26 2013,] Images: []
Last saved by: CARRIONYL, Time: 2/10/2014 12:09:15 PM
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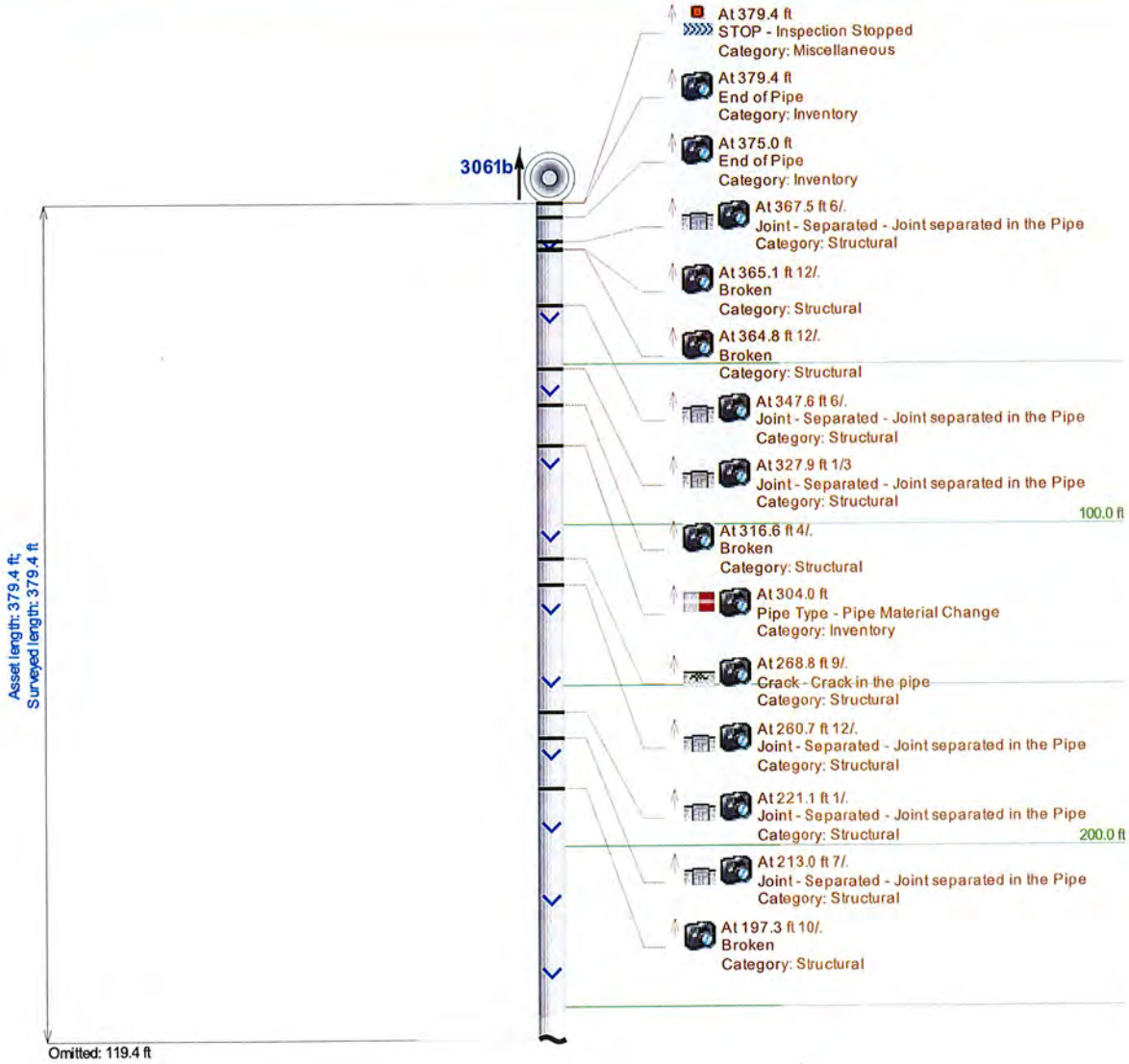
CUES, Inc.
3600 Rio Vista Avenue
Orlando, FL 32805
Phone: 407-849-0190
Fax: 407-425-1569

Main Inspection with Pipe-Run Graph

Project Name:	Mainline ID:	City:	Address:
CoC-SW/Storm Drain Rehab 12 sites	CoC 3061 3061b	Casselberry	Osceola Trl

Start date/time:	Pipe width:	Pipe height:	Pipe type:	Surface condition:
12/13/2012	24	24	Concrete	Asphalt

Direction:	Surveyed footage:	Weather:	Tape/Media number:
UPSTREAM	379.4	Dry	



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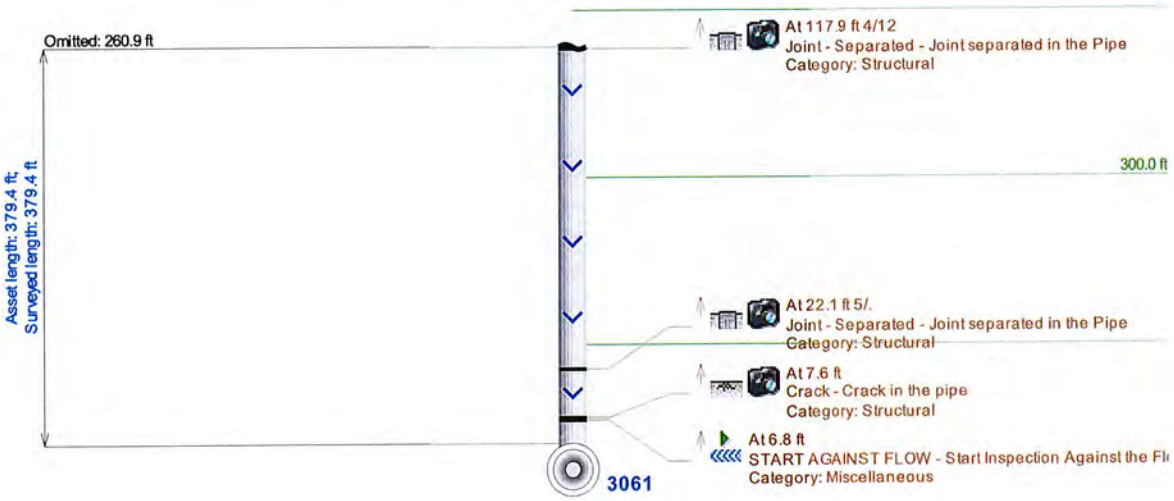

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Observation Report with Still Images

Mainline ID:	Project Name:	Start date/time:	Weather:	Operator:
CoC 3061 3061b	CoC-SW/Storm Drain Rehab 12 sites	12/13/2012 7:46:29 AM	Dry	Kevin Calhoun

Upstream node:	Depth US:	Downstream node:	Depth DS:	Asset length:	Extra:
3061b		3061		379.4	

Comments

Observations

Distance	Length	Code	Reversed	Clock Pos.	Severity	Comment
6.8		START AGAINST FLOW	Yes	/		
7.6		Crack	Yes	/	Longitudinal - Narrow	

22.1		Joint - Separated	Yes	5 /	Small	

117.9		Joint -	Yes	4 / 12	Large

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Observations

Distance	Length	Code	Reversed	Clock Pos.	Severity	Comment
[illegible]		Joint - Separated	[illegible]	[illegible]	Large	

197.3	Broken	Yes	10 /	Hole	

213.0	Joint - Separated	Yes	7 /	Large	

221.1	Joint - Separated	Yes	1 /	Medium	

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Observations

Distance	Length	Code	Reversed	Clock Pos.	Severity	Comment
260.7		Joint - Separated	Yes	12 /	Small	
268.8		Crack	Yes	9 /		
304.0		Pipe Type	Yes	/		transitions from RCP to Corrugated metal pipe

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Observations

Distance	Length	Code	Reversed	Clock Pos.	Severity	Comment
316.6		Broken	Yes	4 /	Hole	repeated perforation
327.9		Joint - Separated	Yes	1 / 3	Medium	
347.6		Joint - Separated	Yes	6 /	Large	

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Observations

Distance	Length	Code	Reversed	Clock Pos.	Severity	Comment
364.8		Broken	Yes	12 /	Hole	STRUCTURE 3061C
365.1		Broken	Yes	12 /	Hole	FGI for Structure 3061c
367.5		Joint - Separated	Yes	6 /	Medium	

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Observations

Distance	Length	Code	Reversed	Clock Pos.	Severity	Comment
375.0		End of Pipe	Yes	/		traversing towards unknow structure
379.4		End of Pipe	Yes	/		
379.4		STOP	Yes	/		