

7-1-2008

## Evaluation of the Performance Efficiency of the New York Avenue Exfiltration Facility

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# EVALUATION OF THE PERFORMANCE EFFICIENCY OF THE NEW YORK AVENUE EXFILTRATION FACILITY

**July 2008**

*Prepared For*  
*FDEP Contract No. S0238:*



Florida Department of Environmental Protection  
Nonpoint Source Management Section  
Tallahassee, FL

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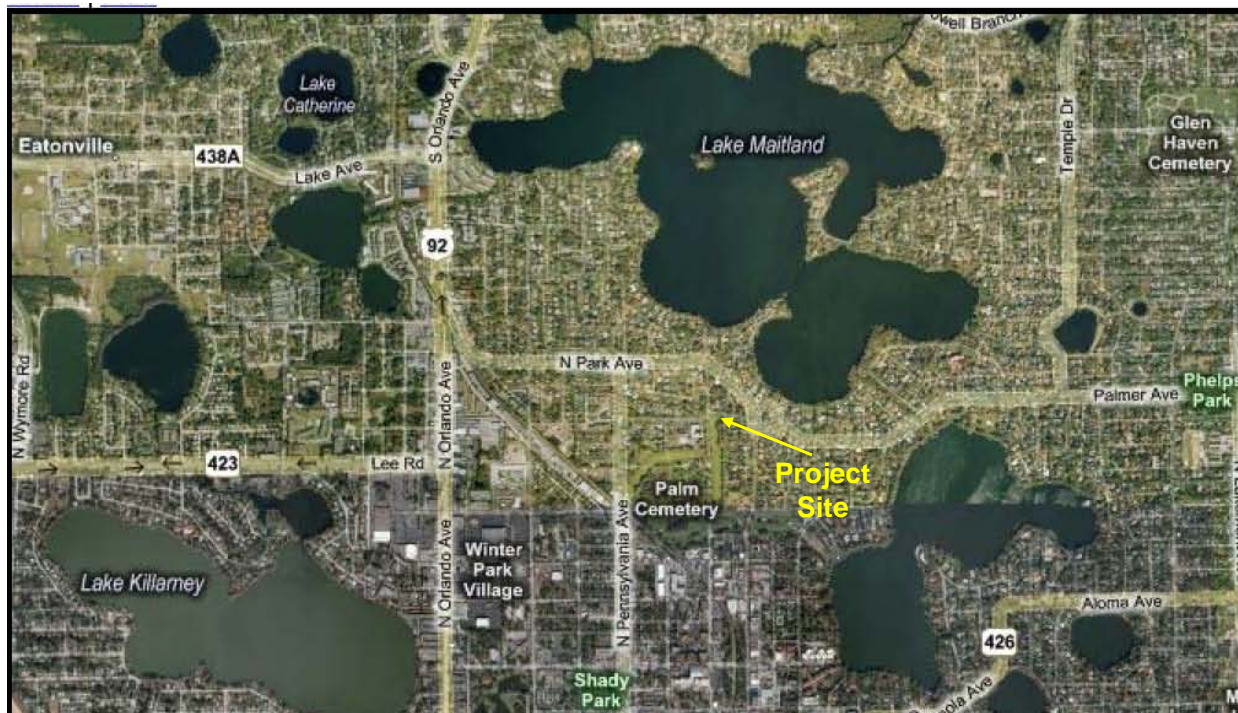
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## SECTION 1

### INTRODUCTION

This document provides a summary of work efforts conducted by the City of Winter Park (City) and its consultants, Reiss Engineering, Inc. and Environmental Research & Design, Inc. (ERD) to construct and evaluate the pollution reduction benefits of the New York Avenue Exfiltration Stormwater Treatment Facility. This project was constructed as a retrofit to reduce pollutant loadings discharging to Lake Maitland. Lake Maitland is a 470-acre lake which is the terminal waterbody in the Winter Park Chain-of-Lakes. Watershed areas surrounding Lake Maitland are highly urbanized, and much of the existing development was constructed prior to regulations requiring treatment of stormwater discharges. As a result, many watershed areas discharge untreated stormwater directly into the lake. The Winter Park Chain-of-Lakes are a significant recreational resource that provide opportunities for boating, fishing, swimming, and other aquatic activities, as well as providing scenic settings for lakeside homes and the surrounding communities. A general location map for the New York Avenue project is given on Figure 1-1.



**Figure 1-1. Location Map for the New York Avenue Project.**



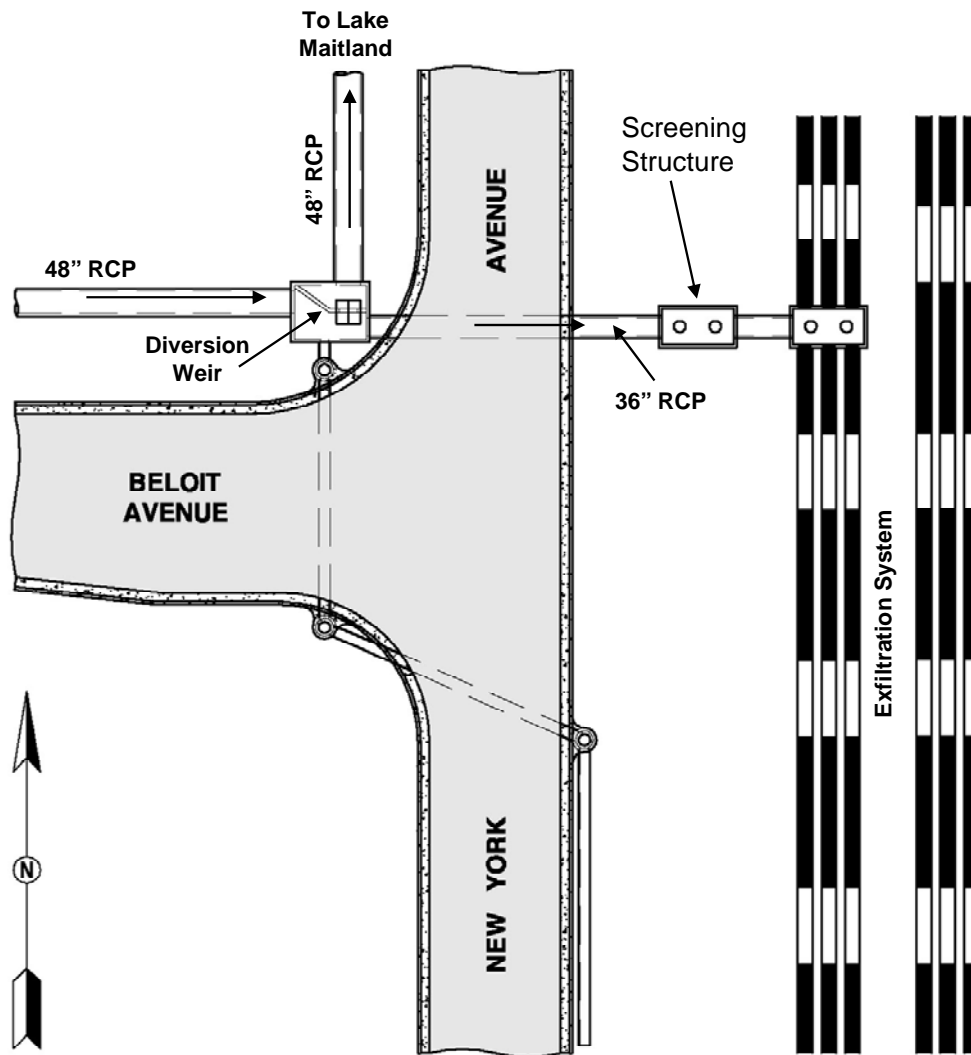
## 1.1 Project Description

The New York Avenue exfiltration facility provides dry retention treatment for 61.78 acres of a 95-acre drainage basin located adjacent to New York Avenue in the City of Winter Park. Land use in the contributing drainage basin includes open space, golf course, single-family residential, low-intensity commercial, and low-density residential uses.

The exfiltration facility is constructed on a municipal golf course which is owned by the City of Winter Park. The project site is located along New York Avenue, north of Webster Avenue and south of Lake Maitland. An overview of the project site for the New York Avenue exfiltration system is given on Figure 1-2. The exfiltration facility consists of approximately 1071 ft of three-barrel 30-inch perforated HDPE pipe inside a 6-ft thick layer of No. 4 coarse gravel. The bottom of the exfiltration pipe is located approximately 3 ft above the seasonal high groundwater level at the project site. Engineering design for the exfiltration system was performed by the City of Winter Park. A set of construction plans for the exfiltration system is given in Appendix A. A schematic of the exfiltration facility is given on Figure 1-3.



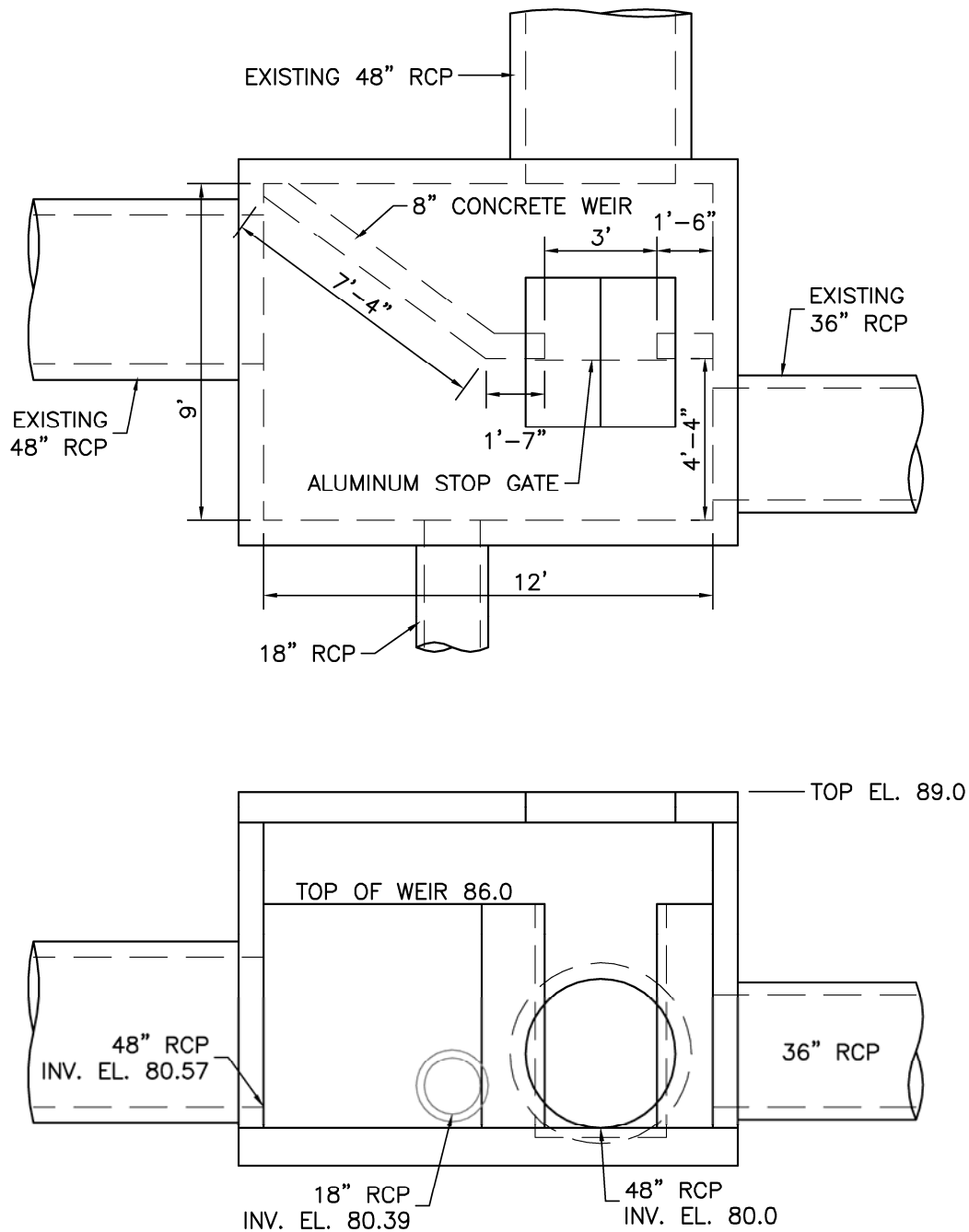
**Figure 1-2. Overview of Project Site for the New York Avenue Exfiltration System.**



**Figure 1-3. Schematic of the New York Avenue Exfiltration System.**

The exfiltration system is designed to provide dry retention treatment for 0.5-inch of runoff over the 61.78-acre contributing basin area. The treatment volume is diverted into the exfiltration system by a newly constructed weir structure. This structure diverts runoff discharging along Beloit Avenue as well as New York Avenue into the exfiltration system. When the exfiltration system becomes full, the excess water flows over the weir and into the existing downstream stormsewer system. A detailed schematic of the diversion weir structure is given on Figure 1-4. The design also incorporates a screening structure upstream from the exfiltration system to remove leaves and other debris which could potentially lead to clogging in the exfiltration system. According to calculations conducted by the City of Winter Park, it is estimated that this system will reduce existing loadings to Lake Maitland by 26.4 kg/yr for total phosphorus, 260.8 kg/yr for total nitrogen, 1008 kg/yr for BOD, and 5984 kg/yr for TSS.





**Figure 1-4. Schematic Details of the Diversion Structure.**

Construction for the exfiltration facility was completed and the system was placed in service on June 15, 2007. Restoration of the disturbed golf course areas was completed on September 15, 2007. Primary funding for construction of the New York Avenue exfiltration facility was provided by the Florida Department of Environmental Protection (FDEP) under Agreement No. S0238 in the amount of \$682,000 through a TMDL Water Quality Restoration Grant.

## **1.2 Work Efforts Performed by ERD**

A Quality Assurance Project Plan (QAPP) was developed by ERD during December 2007 which provided details concerning the proposed field monitoring and laboratory analyses. Monitoring equipment was installed at the exfiltration site by ERD during early-January 2008. Field monitoring was initiated on January 15, 2008 and was conducted over a three-month period until April 15, 2008.

This report has been divided into four separate sections for presentation of results. Section 1 contains an introduction to the report, a description of the exfiltration system, and a summary of work efforts performed by ERD. Section 2 provides a detailed discussion of the methodologies used for field and laboratory evaluations. Section 3 provides a discussion of the hydrologic and water quality results, and a summary is provided in Section 4.

## SECTION 2

### FIELD AND LABORATORY ACTIVITIES

Field and laboratory investigations were conducted by ERD from January-April 2008 to evaluate the effectiveness of the recently constructed New York Avenue exfiltration system. Performance efficiency monitoring was conducted in the field inside the diversion manhole upstream from the exfiltration unit. The field monitoring included a continuous record of inflows into the exfiltration system and overflow, as well as collection of flow-weighted composite inflow and overflow samples. Laboratory analyses were conducted on collected samples for general parameters and nutrients to assist in quantifying mass removal efficiencies. Specific details of monitoring efforts performed at the New York Avenue exfiltration system site are given in the following sections.

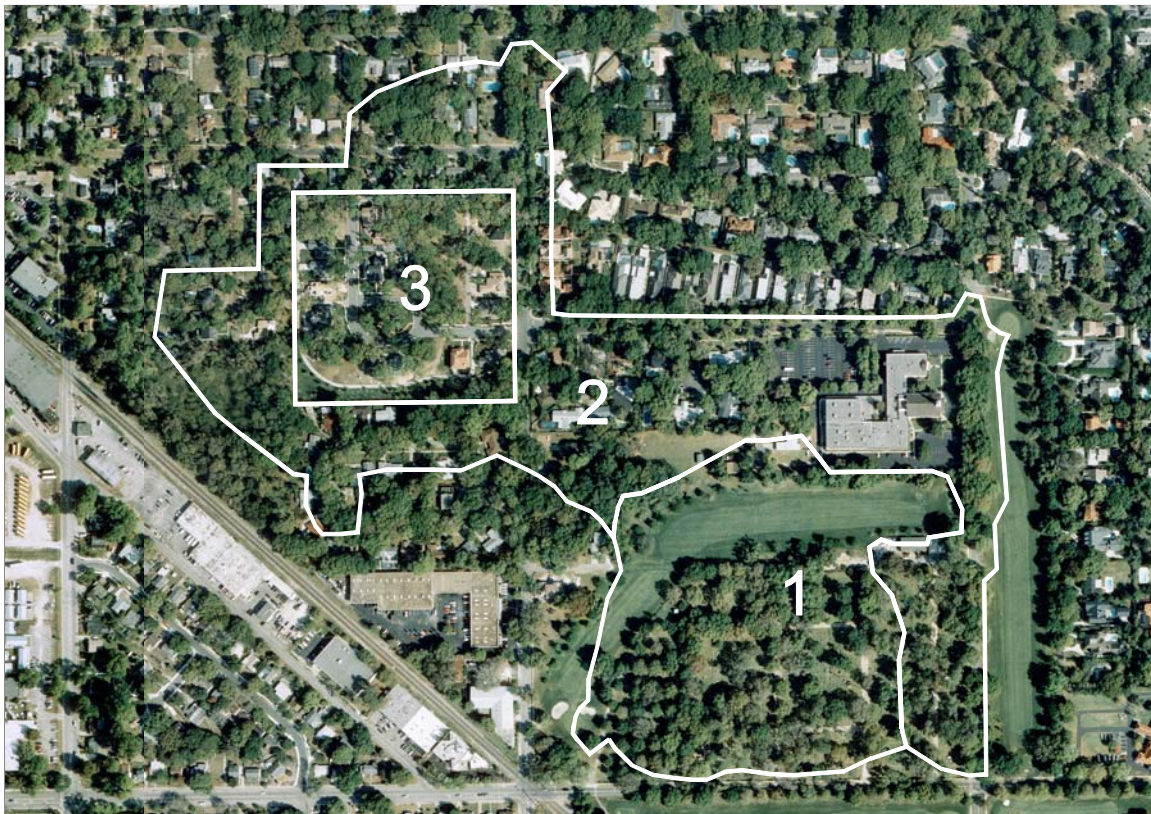
#### 2.1 Drainage Basin Characteristics

An overview of the New York Avenue exfiltration system site is given on Figure 2-1. The exfiltration system was constructed east of the intersection of New York Avenue and Beloit Avenue in Winter Park. The approximate location of the underground exfiltration system is indicated on Figure 2-1.



**Figure 2-1. Overview of the New York Avenue Exfiltration System Site.**

A delineation of the contributing watershed area for the New York Avenue exfiltration system is given on Figure 2-2. This delineation was generated by ERD based on a combination of aerial photography, 1-ft contour Lidar data, field reconnaissance, and observations of flow patterns during rain events. Based on this delineation, the overall basin area discharging to the New York Avenue exfiltration site is estimated to be approximately 61.78 acres.

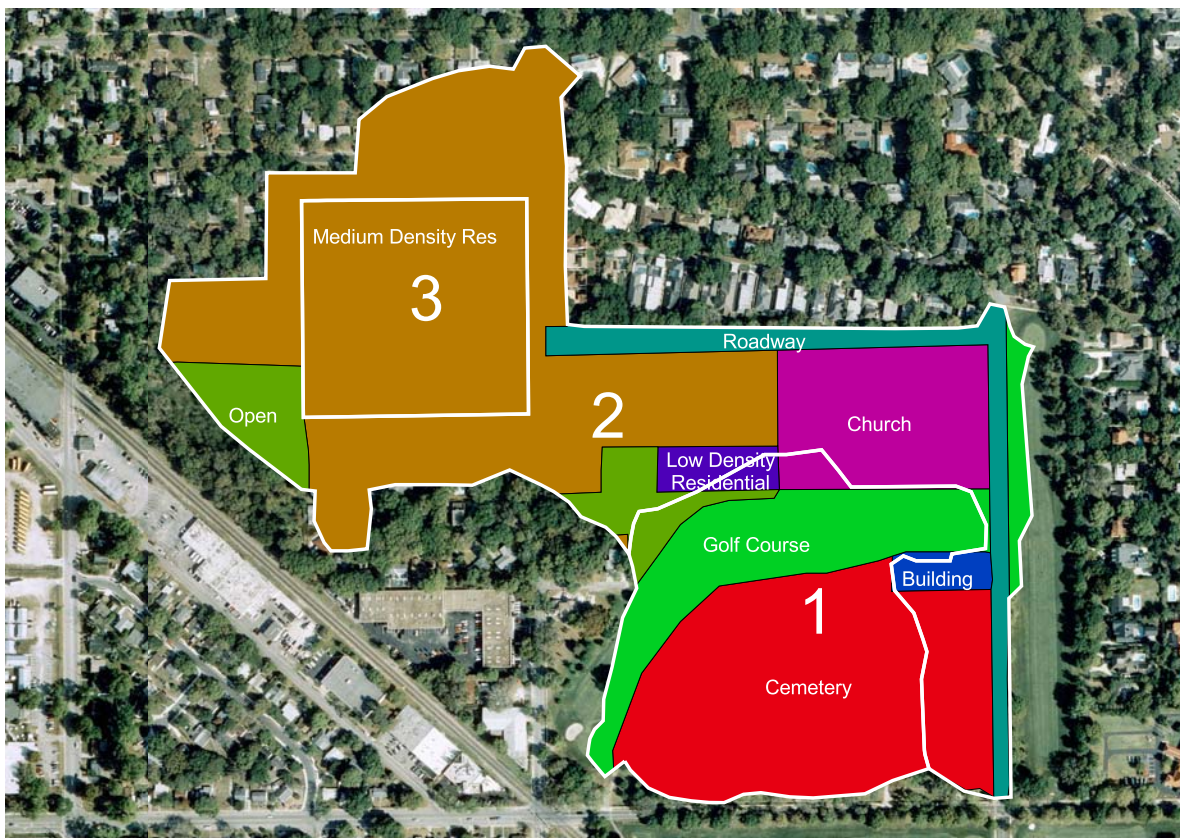


**Figure 2-2. Drainage Basin Delineation for the New York Avenue Exfiltration System.**

The drainage basin for the New York Avenue exfiltration system was divided into three sub-basin areas based upon similarities in estimated runoff generation and discharge. The area identified as Sub-basin 1 consists primarily of a cemetery and adjacent golf course. Based upon the available contour data, it appears that this area retains much of the generated runoff except during relatively large rain events. The area identified as Sub-basin 3 is a new residential area which provides stormwater treatment in an on-site dry retention facility along the southern side of the sub-basin boundary. Since much of the runoff generated in this basin is infiltrated into the ground, it is thought that this sub-basin area also discharges stormwater runoff only during significant rain events. The remaining area, identified as Sub-basin 2, is thought to contribute runoff regularly to the exfiltration site. A summary of current land use in the New York Avenue exfiltration system drainage basin is given on Figure 2-3. Land use within the basin consists of low-density residential, medium-density residential, buildings, a church site, cemetery, open space, and significant roadways.

Soils within the drainage basin for the New York Avenue exfiltration system are well-drained sandy soils which are classified in Hydrologic Soil Group (HSG) A. Soils classified in this group have a high infiltration rate and a relatively low runoff potential for pervious areas. Wet season water table elevations in these soils are typically 6 ft or more below the ground surface.



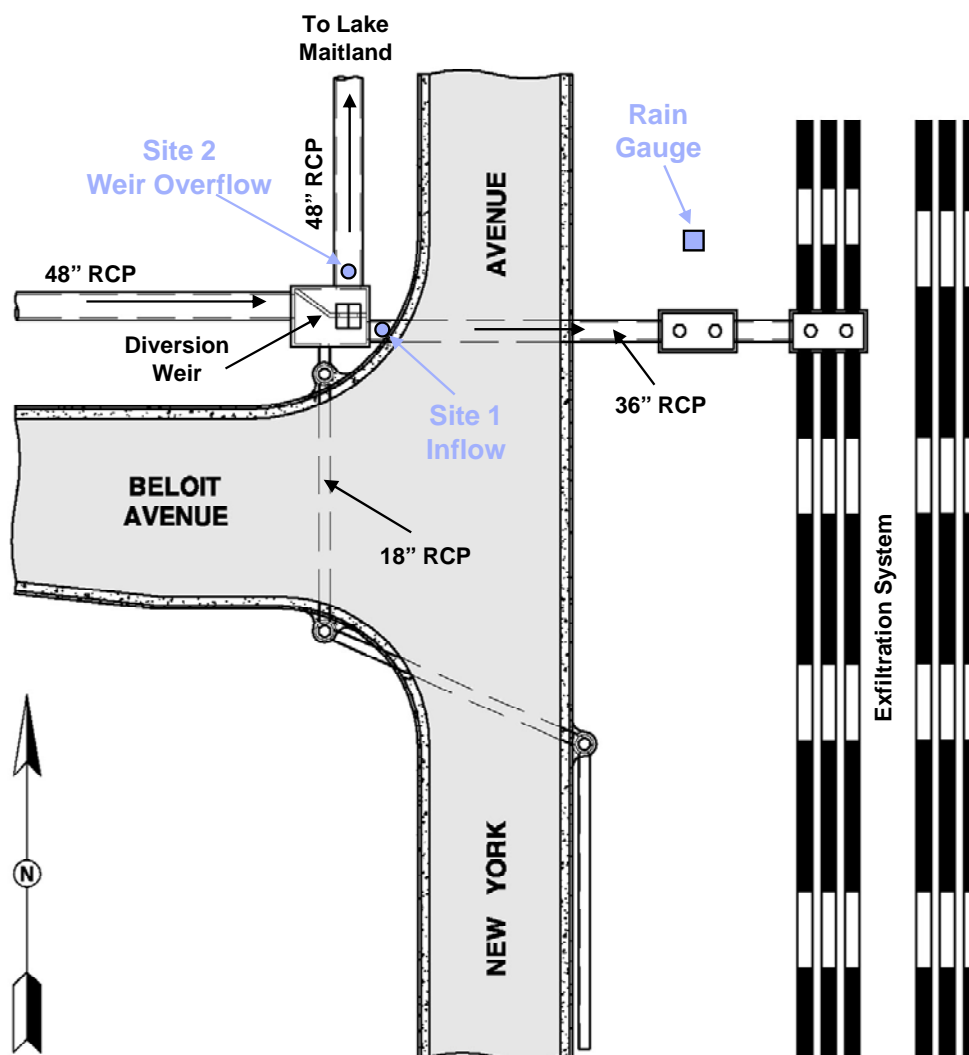


**Figure 2-3. Current Land Use in the New York Avenue Exfiltration System Drainage Basin.**

## **2.2 Field Instrumentation and Monitoring**

A schematic of the monitoring locations used to evaluate the performance efficiency of the exfiltration system is given on Figure 2-4. The incoming stormsewer lines, consisting of a 48-inch RCP and 18-inch RCP, converge into an underground concrete structure. A 6-ft tall concrete diversion weir is used to divert these incoming flows into the exfiltration system located east of the diversion structure. When the exfiltration system becomes full, excess water can discharge over the diversion weir into the existing 48-inch RCP downstream stormsewer which ultimately discharges to Lake Maitland.

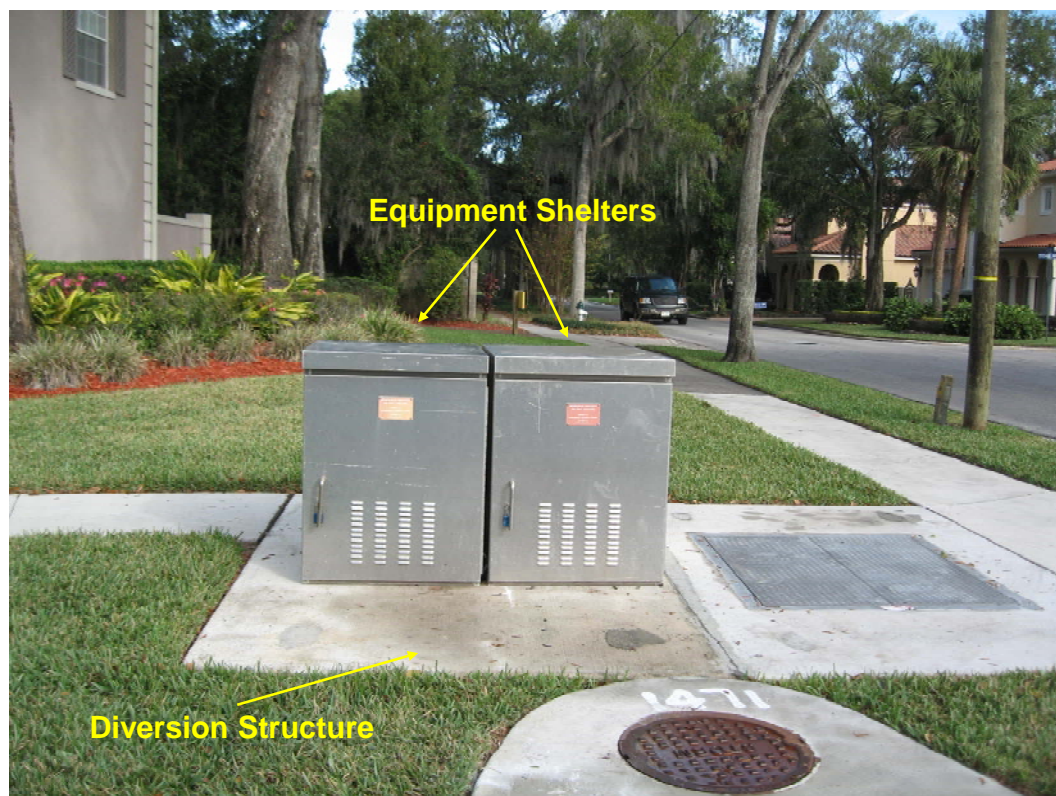
Stormwater samplers with integral flow meters were installed at each of the two monitoring sites indicated on Figure 2-4. The inflow monitoring site was located inside the 36-inch RCP which discharges from the diversion structure into the exfiltration system. This autosampler was used to provide a continuous measurement of discharges into the exfiltration system, under both storm event and baseflow conditions, as well as to collect flow-weighted samples from the inflow to the unit over a wide range of flow conditions. Monitoring Site 2 is located on the downstream site of the overflow of the diversion weir to provide a measurement of overflow which bypasses the exfiltration system. In addition, a recording rain gauge was installed adjacent to the monitoring site approximately mid-way between New York Avenue and the exfiltration system.



**Figure 2-4. Locations for Monitoring Equipment at the New York Avenue Site.**

A photograph of the automatic sampling equipment used at the New York Avenue monitoring site is given in Figure 2-5. Automatic sequential stormwater samplers with integral flow meters, manufactured by Sigma (Model 900MAX), were installed on top of the diversion structure at the corner of New York Avenue and Beloit Avenue. The automatic samplers were housed inside insulated aluminum shelters which were installed on top of a manhole cover for the underground structure. The manhole cover was removed during the monitoring program to allow access for the sample collection tubing and flow probes to the specific monitoring locations. Sensor cables and sample tubing were extended from each of the two samplers to the appropriate inflow and outflow monitoring sites. The integral flow meter was programmed to provide a continuous record of hydraulic inputs into the exfiltration system, as well as discharges over the diversion weir, with measurements stored into internal memory at 10-minute intervals.

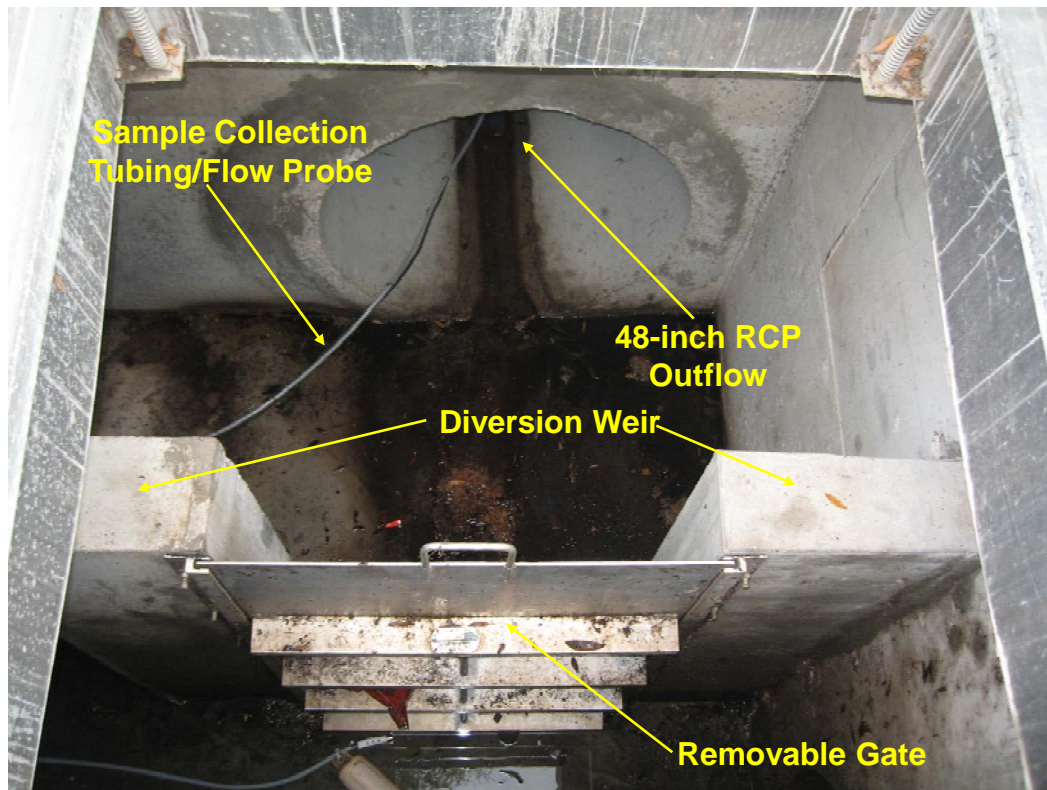




**Figure 2-5. Automatic Sampling Equipment.**

Flow measurements at the inflow monitoring site (Site 1) were performed using the area/velocity method. The flow probe utilized at this monitoring site provides simultaneous measurements of water depth and flow velocity. The depth measurements are converted into a cross-sectional area based upon the geometry of the pipe, and the velocity of flow is measured directly by the probe. Discharge is then calculated by the flow meter using the Continuity Equation ( $Q = A \times V$ ) in cubic feet per second (cfs). Flow measurements at the weir overflow monitoring site (Site 2) were performed using a pressure transducer sensor which transforms sensitive measurements of water depth into a flow rate using the Manning Equation and pipe geometry. A pressure transducer depth probe was inserted approximately 15 ft into the 48-inch RCP downstream from the diversion weir structure. This probe provided continuous measurements of water depth and converted measured water depths into an approximate flow rate.

A photograph of the interior of the diversion structure is given on Figure 2-6. The 6-ft tall concrete diversion weir is shown near the center of the picture. A removable aluminum weir plate was constructed within the weir structure to restore normal stormsewer hydraulics within the system in the event that the exfiltration system would become clogged. The sample and flow probe tubing can be seen extending downstream into the 48-inch RCP.



**Figure 2-6. Interior of Diversion Structure.**

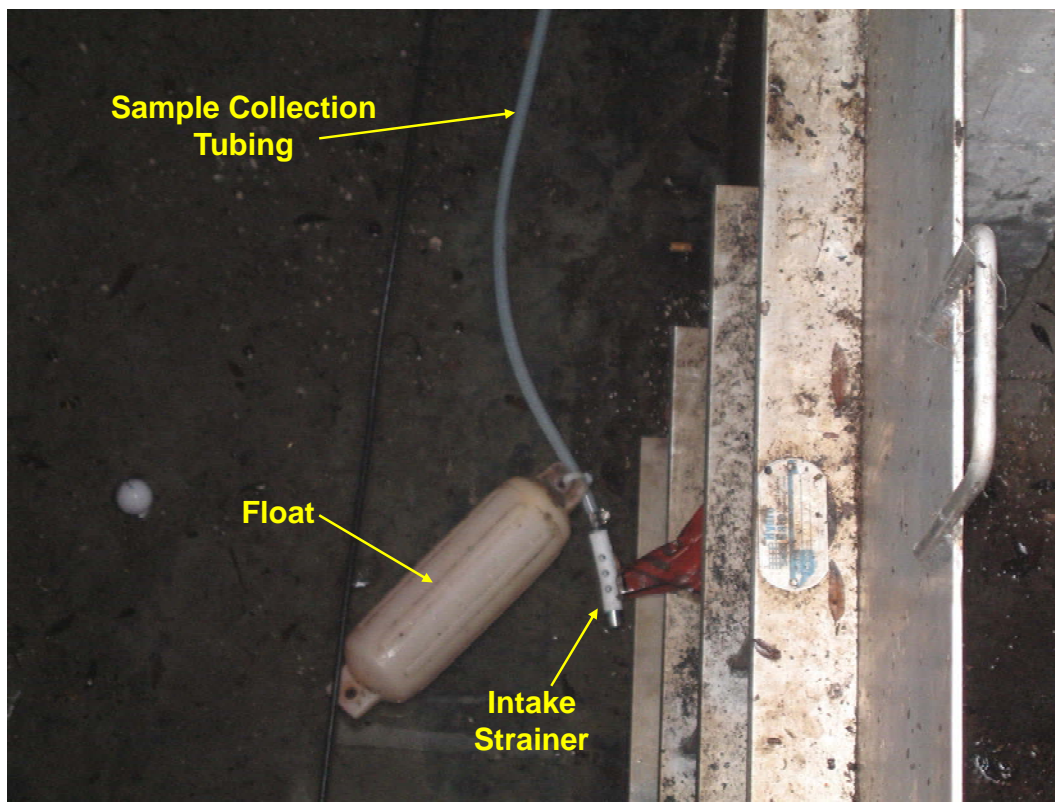


Each of the two automatic stormwater samplers contained 24 individual one-liter polyethylene bottles. The two samplers were programmed to collect samples in a flow-weighted mode, with collected samples placed into the collection bottles in a sequential order. Since 120 VAC power was not available at the site, the automatic samplers were operated on gel cell batteries which were replaced on a weekly basis. Ten separate flow-weighted composite samples of inflow were collected at the inflow site during the monitoring program. No significant overflow of the diversion weir structure occurred during the monitoring program, and as a result, no samples were collected at the downstream overflow monitoring site. All collected inflow samples were analyzed in the ERD Laboratory for general parameters, nutrients, and BOD.

The field monitoring program at the New York Avenue exfiltration site was conducted during a period of heavy leaf fall within the drainage basin. A photograph of accumulated leaves inside the diversion structure is given in Figure 2-7. Although the leaves are seen floating in this figure, much of the leaf matter would become water logged in 2-3 days and sink to the bottom of the diversion structure and 30-inch RCP inflow into the exfiltration system. Initially, the sample intake strainer for the autosampler was mounted onto the bottom at the 30-inch RCP. However, the accumulated leaves on the bottom quickly clogged the Teflon strainer, causing missed samples for several storm events. Therefore, a modification to the sampling protocol was made to minimize accumulation of leaves onto the intake strainer. A photograph of this modification is given on Figure 2-8. The intake strainer was attached to a large float so that the strainer would hang down from the float into the water column during inflow events. The float positioned the strainer near the center of the water column and prevented it from being impacted by either floating or settling leaf material. Leaf material which settled onto the probe between storm events would be washed off the strainer as the level began to rise and the strainer lifted off the bottom of the structure.



**Figure 2-7. Accumulation of Leaves Inside the Diversion Structure.**



**Figure 2-8. Modified Intake Strainer Attachment.**

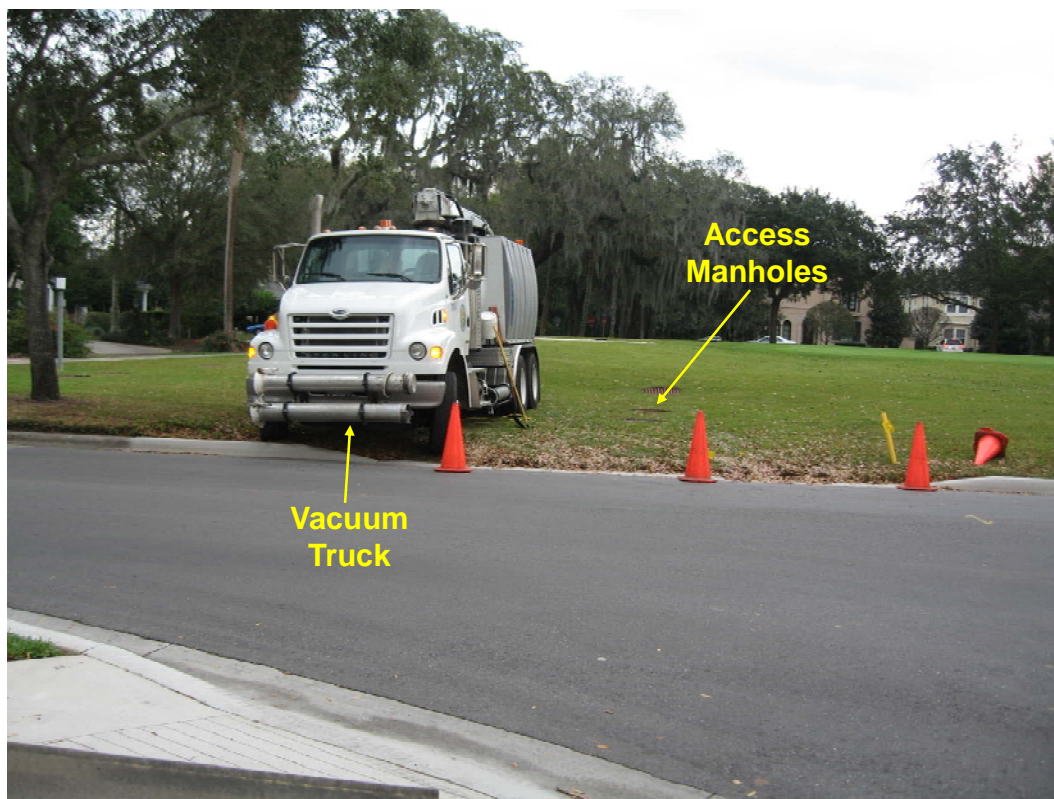
Rainfall at the monitoring site was documented using a continuous rainfall recorder attached to a 4-inch x 4-inch wooden post adjacent to the underground exfiltration pipes. The rainfall recorder (Texas Electronics Model 1014-C) produced a continuous record of all rainfall which occurred at the site. A photograph of the rainfall collector is given on Figure 2-9. The rainfall record is used to provide information on general rainfall characteristics in the vicinity of the monitoring site and to assist in evaluation of hydrologic inputs from the watershed area.

Prior to initiation of the field monitoring program, the screening structure (located between the diversion structure and exfiltration pipes) was cleaned by the City of Winter Park to remove existing debris and leaves. A photograph of cleaning operations for the screening structure is given in Figure 2-10. The cleaning process was performed using a vacuum truck which vacuumed material within the system. Cleaning operations for the screening structure were also conducted on approximately a monthly basis during the monitoring program due to the high level of leaf fall associated with the late winter and early spring months.





**Figure 2-9. Recording Rainfall Collector.**



**Figure 2-10. Cleaning Operations for the Screening Structure.**

## 2.3 Laboratory Analyses

A summary of laboratory methods and MDLs for analyses conducted on water samples collected during this project is given in Table 2-1. All laboratory analyses were conducted in the ERD Laboratory. The ERD Laboratory is NELAC-certified (No. 1031026). Details on field operations, laboratory procedures, and quality assurance methodologies are provided in the FDEP-approved Comprehensive Quality Assurance Plan No. 870322G for Environmental Research & Design, Inc. In addition, a Quality Assurance Project Plan (QAPP), outlining the specific field and laboratory procedures to be conducted for this project, was submitted to and approved by FDEP prior to initiation of any field and laboratory activities.

**TABLE 2-1**  
**ANALYTICAL METHODS AND DETECTION**  
**LIMITS FOR LABORATORY ANALYSES**

PARAMETER	METHOD OF ANALYSIS	METHOD DETECTION LIMITS (MDLs) <sup>1</sup>
pH	EPA-83, Sec. 150.1 <sup>2</sup>	N/A
Conductivity	EPA-83, Sec. 120.1 <sup>2</sup>	0.3 µmho/cm
Alkalinity	EPA-83, Sec. 310.1 <sup>2</sup>	0.5 mg/l
Ammonia	EPA-83, Sec. 350.1 <sup>2</sup>	0.005 mg/l
NO <sub>x</sub>	EPA-83, Sec. 353.2 <sup>2</sup>	0.005 mg/l
TKN	Alkaline Persulfate Digestion <sup>3</sup>	0.01 mg/l
Ortho-P	EPA-83, Sec. 365.1 <sup>2</sup>	0.001 mg/l
Total Phosphorus	Alkaline Persulfate Digestion <sup>3</sup>	0.001 mg/l
Turbidity	EPA-83, Sec. 180.1 <sup>2</sup>	0.1 NTU
Color	EPA-83, Sec. 110.3 <sup>2</sup>	1 Pt-Co Unit
TSS	EPA-83, Sec. 160.2 <sup>2</sup>	0.7 mg/l
BOD	SM-19, Sec. 5210B <sup>4</sup>	2 mg/l

1. MDLs are calculated based on the EPA method of determining detection limits
2. Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020, Revised March 1983.
3. FDEP-approved alternate method
4. Standard Methods for the Examination of Water and Wastewater, 19th Ed., 1995.



## SECTION 3

### RESULTS

Field monitoring, sample collection, and laboratory analyses were conducted by ERD from January 15-April 15, 2008 to evaluate the hydraulic and pollutant removal efficiencies of the New York Avenue exfiltration system in the City of Winter Park. A discussion of the results of these efforts is given in the following sections.

#### 3.1 Site Hydrology

##### 3.1.1 Rainfall Characteristics

A continuous record of rainfall characteristics was collected at the exfiltration system monitoring site from January 15-April 15, 2008 using a tipping bucket rainfall collector with a resolution of 0.01 inch and a digital data logging recorder. However, due to an initial programming error, information on the starting and ending time for rain events was not collected during the initial four weeks of the monitoring program, although total rainfall depth was still recorded for individual rain events. Beginning on February 15, 2008, the programming was modified to log all available data.

The characteristics of individual rain events measured at the New York Avenue exfiltration system site from January 15-April 15, 2008 are given in Table 3-1. During the initial four weeks of the monitoring program, information is provided only for total rainfall associated with each rain event. However, beginning on February 13<sup>th</sup>, information is also provided on event start time, event end time, event duration, average rainfall intensity, and antecedent dry period for each individual rain event measured at the monitoring site. For purposes of this analysis, average rainfall intensity is calculated as the total rainfall divided by the total event duration.

A total of 12.95 inches of rainfall fell in the vicinity of the exfiltration system over the 91-day monitoring period from a total of 43 separate storm events. A summary of rainfall event characteristics measured at the exfiltration system rain gauge site from January 15-April 15, 2008 is given in Table 3-2. Individual rainfall amounts measured at the exfiltration system site range from 0.01-2.11 inches, with an average of 0.30 inches/event. Durations for events measured at the site range from 0.01-12.8 hours, with antecedent dry periods ranging from 0.13-9.96 days.

A comparison of measured and typical “average” rainfall in the vicinity of the New York Avenue exfiltration system is given in Figure 3-1. Measured rainfall presented in this figure is based upon the field-measured rain events at the exfiltration system monitoring site presented in Table 3-1, summarized on a monthly basis. “Average” rainfall conditions are based upon historical monthly rainfall averages recorded at the Orlando International Airport (OIA) over the 64-year period from 1942-2005. Comparisons between measured and average rainfall are provided for the months of January-April 2008 even though measurements performed at the exfiltration system site during January and April 2008 represent only partial months. Historical average rainfall during the months of January-April in Central Florida is approximately 11.04 inches.

TABLE 3-1

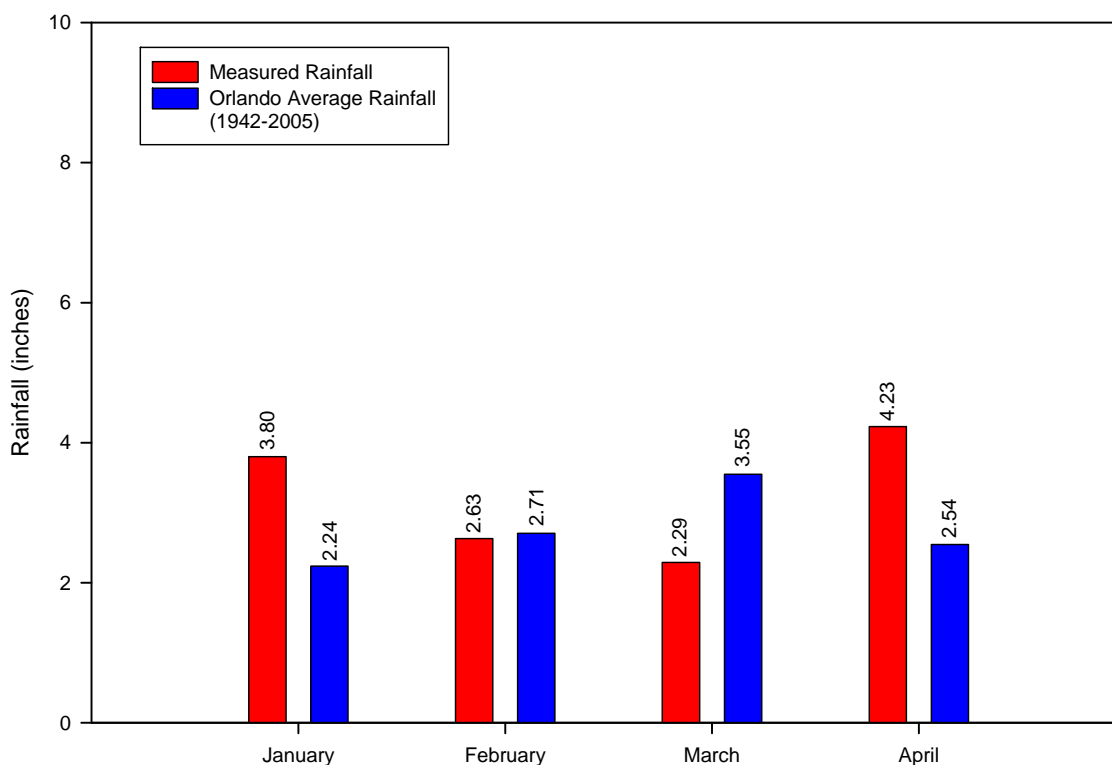
**SUMMARY OF RAINFALL MEASURED AT  
THE NEW YORK AVENUE MONITORING SITE  
FROM JANUARY 15-APRIL 15, 2008**

EVENT START		EVENT END		TOTAL RAINFALL (inches)	DURATION (hours)	ANTECEDENT DRY PERIOD (days)	AVERAGE INTENSITY (inches/hour)
DATE	TIME	DATE	TIME				
1/16/08	--	--	--	0.01	--	--	--
1/17/08	--	--	--	1.03	--	--	--
1/18/08	--	--	--	0.01	--	--	--
1/19/08	--	--	--	0.94	--	--	--
1/22/08	--	--	--	0.10	--	--	--
1/23/08	--	--	--	1.43	--	--	--
1/26/08	--	--	--	0.14	--	--	--
1/27/08	--	--	--	0.14	--	--	--
2/6/08	--	--	--	0.01	--	--	--
2/7/08	--	--	--	0.40	--	--	--
2/8/08	--	--	--	0.01	--	--	--
2/12/08	--	--	--	0.39	--	--	--
2/13/08	14:47	2/13/08	14:47	0.01	--	--	--
2/18/08	14:46	2/18/08	14:46	0.03	0.01	5.0	2.35
2/19/08	9:53	2/19/08	10:01	0.11	0.14	0.8	0.81
2/21/08	8:46	2/21/08	10:03	0.12	1.30	1.9	0.09
2/21/08	17:17	2/21/08	18:00	0.30	0.72	0.3	0.42
2/23/08	10:45	2/23/08	12:38	0.43	1.88	1.7	0.23
2/26/08	18:09	2/26/08	20:13	0.26	2.07	3.2	0.13
2/26/08	23:25	2/27/08	4:59	0.55	5.56	0.1	0.10
2/29/08	7:35	2/29/08	7:35	0.01	--	2.1	--
3/4/08	16:53	3/4/08	16:54	0.02	0.02	4.4	1.20
3/5/08	6:01	3/5/08	6:01	0.01	--	0.5	--
3/6/08	16:38	3/7/08	4:02	1.17	11.40	1.4	0.10
3/7/08	15:15	3/7/08	15:15	0.01	--	0.5	--
3/7/08	20:22	3/8/08	2:59	0.21	6.62	0.2	0.03
3/13/08	11:27	3/13/08	11:28	0.02	0.02	5.4	1.20
3/14/08	18:02	3/14/08	20:30	0.07	2.46	1.3	0.03
3/17/08	10:02	3/17/08	10:02	0.01	--	2.6	--
3/20/08	6:08	3/20/08	7:31	0.25	1.38	2.8	0.18
3/30/08	6:39	3/30/08	7:08	0.28	0.49	10.0	0.57
3/31/08	6:57	3/31/08	7:22	0.23	0.41	1.0	0.57
3/31/08	16:33	3/31/08	16:33	0.01	--	0.4	--
4/1/08	16:21	4/1/08	17:41	0.86	1.33	1.0	0.64
4/1/08	22:11	4/1/08	22:11	0.01	--	0.2	--
4/2/08	13:06	4/2/08	13:07	0.02	0.02	0.6	1.18
4/2/08	17:37	4/2/08	18:08	0.07	0.51	0.2	0.14
4/3/08	7:26	4/3/08	7:26	0.01	--	0.6	--
4/3/08	17:05	4/3/08	17:05	0.01	--	0.4	--
4/4/08	19:27	4/4/08	19:27	0.01	--	1.1	--
4/5/08	14:47	4/6/08	3:35	2.11	12.79	0.8	0.16
4/6/08	13:01	4/7/08	0:23	1.05	11.36	0.4	0.09
4/13/08	12:48	4/13/08	15:19	0.08	2.53	6.5	0.03
<b>TOTAL:</b>				<b>12.95</b>			

TABLE 3-2

**SUMMARY OF RAINFALL CHARACTERISTICS IN  
THE VICINITY OF THE NEW YORK AVENUE EXFILTRATION  
SYSTEM FROM JANUARY – APRIL 2008**

PARAMETER	UNITS	MINIMUM VALUE	MAXIMUM VALUE	MEAN EVENT VALUE
Event Rainfall	inches	0.01	2.11	0.30
Event Duration	hours	0.01	12.8	3.00
Average Intensity	inches/hour	0.03	2.35	0.49
Antecedent Dry Period	days	0.13	9.96	1.91



**Figure 3-1. Comparison of Average and Measured Rainfall in the Vicinity of the New York Avenue Exfiltration System Site.**

As seen in Figure 3-1, measured rainfall in the vicinity of the exfiltration system site was greater than “normal” during January and April, even though the field monitored rainfall included only half of each month. Measured rainfall during February and March was slightly less than “normal”. Overall, the field measured rainfall of 12.95 inches from January-April 2008 is approximately 17% greater than the “average” rainfall of 11.04 inches which typically occurs during the period from January-April in the Central Florida area.

### 3.1.2 Hydrologic Inputs

The autosampler installed by ERD at the inflow to the exfiltration system contained an internal flow meter which provided measurements of stormwater discharge based upon water depth, geometric characteristics of the stormsewer, and measured water velocity. However, as discussed in Section 2, leaves and other debris frequently accumulated within the diversion structure, interfering with the accuracy of the velocity measurements. Although the operation of the flow sensor was sufficient to pace the autosampler for collection of stormwater inflow, the measured discharge rates are not considered to be accurate enough to provide estimates of hydrologic inputs associated with monitored storm events. Therefore, it was decided to hydrologically model the estimated runoff volume associated with each of the individual monitored rainfall events summarized in Table 3-1. The results of this modeling exercise would then be used to represent the total runoff volume which discharged into the exfiltration system during the monitoring program.

The SCS curve number methodology was used to generate estimates of the runoff volumes produced within the drainage sub-basin area for each of the monitored rainfall events listed in Table 3-1. The SCS methodology utilizes the hydrologic characteristics of the drainage basin, including impervious area, directly connected impervious area (DCIA), and soil curve numbers to estimate runoff volumes for modeled storm events. Hydrologic characteristics were developed by ERD for each of the three sub-basin areas, identified in Figure 2-2, which discharge to the exfiltration system. Individual hydrologic characteristics were developed for each land use category within each of the three sub-basins for use in hydrologic modeling. A summary of this information is provided in Appendix B. Hydrologic characteristics of the sub-basin areas were determined by ERD based upon a review of available aerial photography and a field reconnaissance of the sub-basin areas.

A summary of general hydrologic characteristics for each of the three sub-basin areas is given in Table 3-3. The total basin area discharging to the exfiltration system is approximately 61.78 acres which includes 27.5 acres of impervious area. Approximately 14.89 acres of the impervious area are considered to be DCIA for modeling purposes. As discussed previously, soils within the drainage basin are well-drained and are classified in HSG A which is reflected in the selected pervious CN values listed in Table 3-3.

**TABLE 3-3**  
**CHARACTERISTICS OF THE NEW YORK AVENUE**  
**EXFILTRATION SYSTEM DRAINAGE BASIN AREA**

PARAMETER	SUB-BASIN 1	SUB-BASIN 2	SUB-BASIN 3	TOTALS
Total Area (acres)	18.47	34.14	9.17	61.78
Impervious Area (acres)	0.27	23.11	4.13	27.51
DCIA (acres)	0.00	12.87	2.02	14.89
DCIA (%)	0.00	37.7	22.0	24.1
Pervious CN	39	39	39	39
Non-DCIA CN	39.9	67.4	56.4	54.9
S (inches)	15.1	6.74	7.73	9.39

After estimating the hydrologic characteristics of the basin area, the runoff volume for each rainfall event is calculated by adding the rainfall excess from the non-directly connected impervious area (non-DCIA) portion to the rainfall excess created from the DCIA portion for the basin. Rainfall excess from the non-DCIA areas is calculated using the following set of equations:

$$\text{Soil Storage, } S = \left( \frac{1000}{nDCIA \text{ CN}} - 10 \right)$$

$$nDCIA \text{ CN} = \frac{[CN * (100 - IMP)] + [98 (IMP - DCIA)]}{(100 - DCIA)}$$

$$Q_{nDCIA_i} = \frac{(P_i - 0.2S)^2}{(P_i + 0.8S)}$$

where:

CN	=	curve number for pervious area
IMP	=	percent impervious area
DCIA	=	percent directly connected impervious area
nDCIA CN	=	curve number for non-DCIA area
P <sub>i</sub>	=	rainfall event depth (inches)
Q <sub>nDCIAi</sub>	=	rainfall excess for non-DCIA for rainfall event (inches)

For the DCIA portion, rainfall excess is calculated using the following equation:

$$Q_{DCIA_i} = (P_i - 0.1)$$

When P<sub>i</sub> is less than 0.1, Q<sub>DCIAi</sub> is equal to zero. This methodology was used to estimate the generated runoff volume within each of the delineated sub-basin areas for each of the rainfall events listed in Table 3-1.

The methodology outlined above provides an estimate of the “generated” runoff volume for each sub-basin area. However, significant portions of the generated runoff volume may be attenuated during migration through stormwater management systems or in depressional areas within individual sub-basin areas. If the stormwater management system provides dry retention treatment, a large portion of the runoff volume may be infiltrating into the ground and not reach the receiving water as a surface flow. If the area contains depressional areas, then much of the generated runoff volume may simply infiltrate into the ground or evaporate, and relatively large rain events may be required to actually result in transport of runoff from the sub-basin area. The watershed model used for estimation of runoff volumes includes estimates of the types of stormwater management systems utilized within each sub-basin area, the amount of developed area treated by each stormwater management type, and volume reductions for depressional areas. Estimates of the amount of generated runoff volume which is attenuated in stormwater management systems or in depressional areas are included in the model, and the attenuated volume is subtracted from the generated volume within each sub-basin. The result is an estimate of the runoff volume which actually discharges into the stormsewer system from each sub-basin area as a surface inflow.

A summary of estimated volumetric removal efficiencies for stormwater management systems and depressional areas in the exfiltration system drainage basin is given in Table 3-4. These volumetric removals are based on previous research performed by ERD on the performance efficiencies of stormwater management systems used in the State of Florida. Developed areas treated by dry retention are assumed to have a volumetric loss of approximately 80% for runoff inputs due to infiltration and evaporation within the pond. The information summarized in Table 3-4 is used to assist in calculation of estimated runoff inflow from sub-basin areas into the exfiltration system.

**TABLE 3-4**

**ESTIMATED VOLUMETRIC REMOVAL EFFICIENCIES FOR  
STORMWATER MANAGEMENT SYSTEMS AND DEPRESSIONAL  
AREAS IN THE EXFILTRATION SYSTEM DRAINAGE BASIN**

SUB-BASIN	SYSTEM TYPE	VOLUME REDUCTION (%)
1	Depressional Area	95
3	Dry Retention	80

The 9.17-acre medium-density residential area which forms Sub-basin 3 discharges to a dry retention facility. A volumetric loss of 80% is assumed for this sub-basin. No significant stormwater treatment for depressional areas are thought to exist in Sub-basin 2, and no volumetric reductions are assumed for this sub-basin. Sub-basin 1 appears to consist of a relatively low-lying area which must accumulate standing water before significant discharges can occur into downstream portions of the drainage basin. It is thought that this sub-basin contributes stormwater runoff into the stormsewer system only during significant rain events. As a result, a volumetric removal efficiency of approximately 95% is assumed for runoff generated within this sub-basin. However, due to the lack of impervious areas in this sub-basin, the predicted runoff generation rate is low, even if the depressional attenuation is not considered. Additional details concerning hydrologic modeling for estimation of runoff volumes discharging to the New York Avenue exfiltration system is given in Appendix B.



A summary of modeled runoff inputs to the New York Avenue exfiltration system from January 15-April 15, 2008 is given in Table 3-5 using the methodology outlined previously. Due to the anticipated depressional storage and dry retention stormwater treatment system, little generated runoff is predicted to occur in Sub-basins 1 or 3. A substantially larger runoff volume is predicted for Sub-basin 2 which has no significant stormwater treatment or depressional storage attenuation mechanisms.

**TABLE 3-5**  
**MODELED RUNOFF INPUTS TO THE**  
**NEW YORK AVENUE EXFILTRATION SYSTEM**  
**FROM JANUARY 15-APRIL 15, 2008**

PARAMETER	SUB-BASIN			TOTALS
	1	2	3	
Area (acres)	18.47	34.14	9.17	61.78
Runoff Volume (ac-ft)	0.00	13.37	0.35	13.72
Runoff C Value	0.000	0.363	0.035	0.240

Based upon the hydrologic modeling, the runoff volume reaching the exfiltration system during the period from January 15-April 15, 2008 is approximately 13.72 ac-ft. Using the recorded rainfall depth of 12.95 inches during this period, the calculated watershed runoff coefficient for the 61.78-acre drainage basin area is approximately 0.240. This value suggests that approximately 24.0% of the rainfall volume within the drainage basin becomes stormwater runoff.

As discussed in Section 2, flow monitoring was also conducted in the 48-inch RCP located downstream from the diversion weir structure to document the quantity of runoff discharges which discharge over the diversion weir and bypass the exfiltration system. No significant flows were recorded through the downstream 48-inch RCP during the 91-day monitoring program. However, water levels ranging from 0.02-0.42 inches were recorded in the 48-inch RCP following several significant storm events. These flows are thought to be insignificant with respect to the overall runoff volume and appear to reflect low level water leakage through the aluminum gate installed in the diversion weir structure. Therefore, for purposes of this analysis, the overflow volume for stormwater runoff is assumed to be zero.

### 3.2 Chemical Characteristics of Monitoring Inflow and Outflow

ERD collected ten flow-weighted composite inflow samples to the New York Avenue exfiltration system during the period from January 15-April 15, 2008. Each inflow sample was collected as a flow-weighted composite between the beginning and ending period for each rain event. A complete listing of the chemical characteristics of individual composite inflow samples collected during the monitoring program is given in Table 3-6. Monitored rain events range from 0.21-2.11 inches, with an overall mean of 0.86 inches per monitored event.

In general, runoff collected at the inflow monitoring site was found to be approximately neutral in pH, with measured pH values ranging from 6.32-7.40. The runoff inflow was found to be poorly to moderately buffered, with alkalinity values ranging from 17.4-83.0 mg/l. The runoff samples were characterized by relatively low conductivity levels, with measured values ranging from 43-183  $\mu\text{mho/cm}$ . The observed conductivity values at this site are somewhat less than values commonly observed in urban runoff.

In general, a relatively high degree of variability was observed in measured concentrations for the evaluated nitrogen species. Variability in measured nitrogen concentrations is common in urban runoff samples. Measured concentrations for the individual nitrogen species are typical of values commonly observed in urban runoff. The average total nitrogen concentration measured at the site is 1386  $\mu\text{g/l}$ . Approximately 61% of the total nitrogen measured at the inflow monitoring site was contributed by particulate nitrogen, with 22% by dissolved organic nitrogen, 11% by ammonia, and 6% by  $\text{NO}_x$ .

Relatively elevated concentrations of phosphorus species were observed at the inflow monitoring site, with measured total phosphorus concentrations ranging from 113-1136  $\mu\text{g/l}$ , with an overall mean of 356  $\mu\text{g/l}$ . This mean total phosphorus value is somewhat higher than concentrations commonly observed in urban runoff. A relatively wide range of concentrations was observed for soluble reactive phosphorus (SRP), dissolved organic phosphorus, and particulate phosphorus measured at the site. Of the total phosphorus measured at the inflow monitoring site, approximately 47% is contributed by particulate phosphorus, 44% by SRP, and 9% by dissolved organic phosphorus. Relatively elevated levels of SRP, with concentrations in excess of 150  $\mu\text{g/l}$ , were observed during four of the 10 monitoring events at this site.

Stormwater runoff collected at the inflow monitoring site was found to have highly variable concentrations for both turbidity and TSS, with approximately a 25-fold difference between minimum and maximum values measured for each of these parameters. Highly variable values of BOD were also observed at the monitoring site, with measured concentrations ranging from 2.3-17.9 mg/l. However, measured BOD concentrations at the inflow monitoring site are typical of values commonly observed in urban runoff.

A graphical statistical comparison of the chemical characteristics of inflow samples collected at the exfiltration monitoring site was developed for general parameters, nitrogen species, and phosphorus species. A graphical summary of data for each parameter is presented in the form of Tukey box plots, also often called "box and whisker plots". The bottom line of the box portion of each plot represents the lower quartile, with 25% of the data points lying below this value. The upper line of the box represents the 75% upper quartile, with 25% of the data lying above this value. The **blue** horizontal line within the box represents the median value, with 50% of the data lying both above and below this value. The **red** horizontal line within the box represents the mean of the data points. The vertical lines, also known as "whiskers", represent the 5 and 95 percentiles for the data sets. Individual values which lie outside of the 5-95 percentile range, sometimes referred to as "outliers", are indicated as **red dots**.

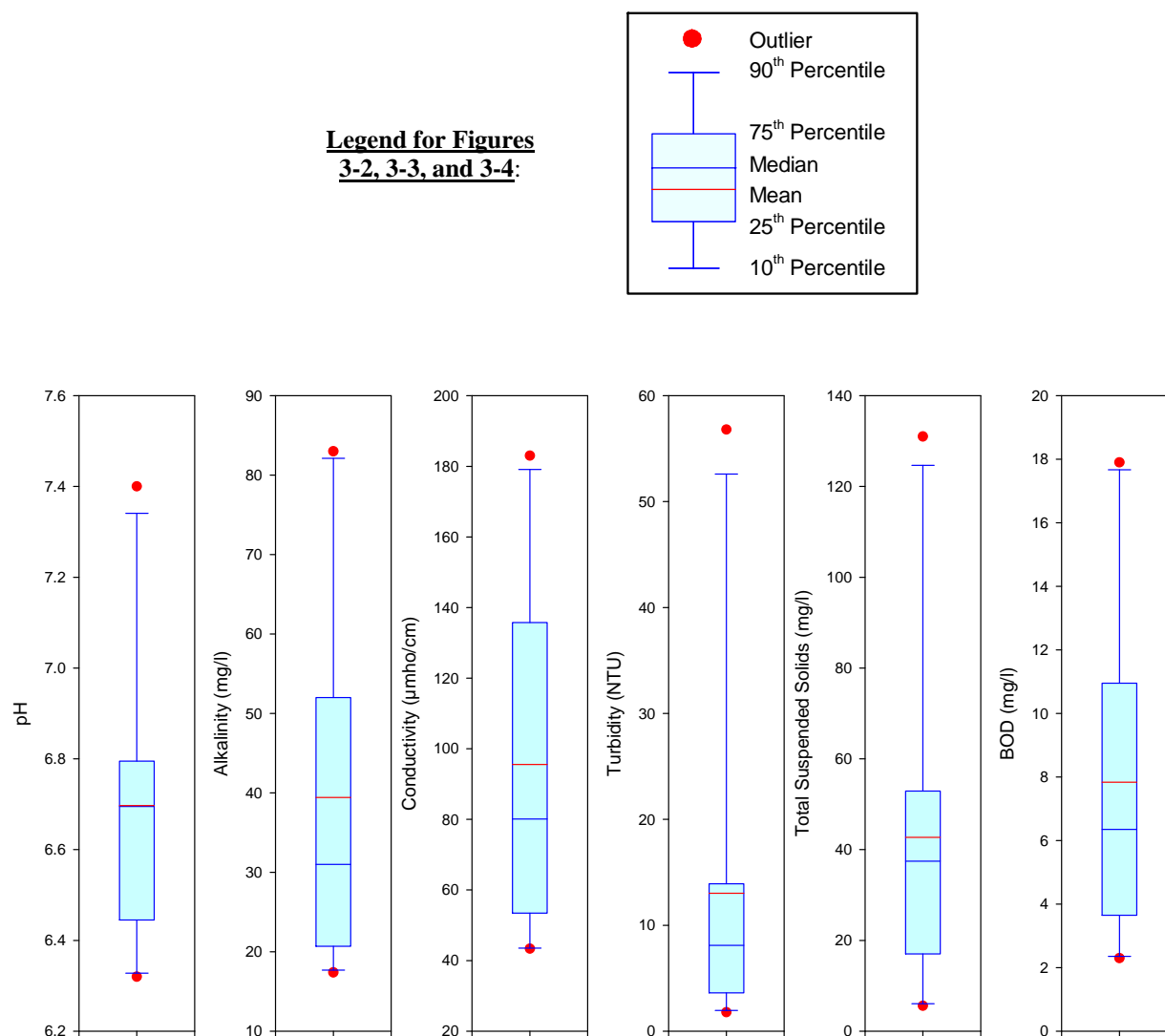
TABLE 3-6

**CHEMICAL CHARACTERISTICS OF RUNOFF SAMPLES  
COLLECTED AT THE INFLOW TO THE NEW YORK AVENUE  
EXFILTRATION SYSTEM FROM JANUARY 15-APRIL 15, 2008**

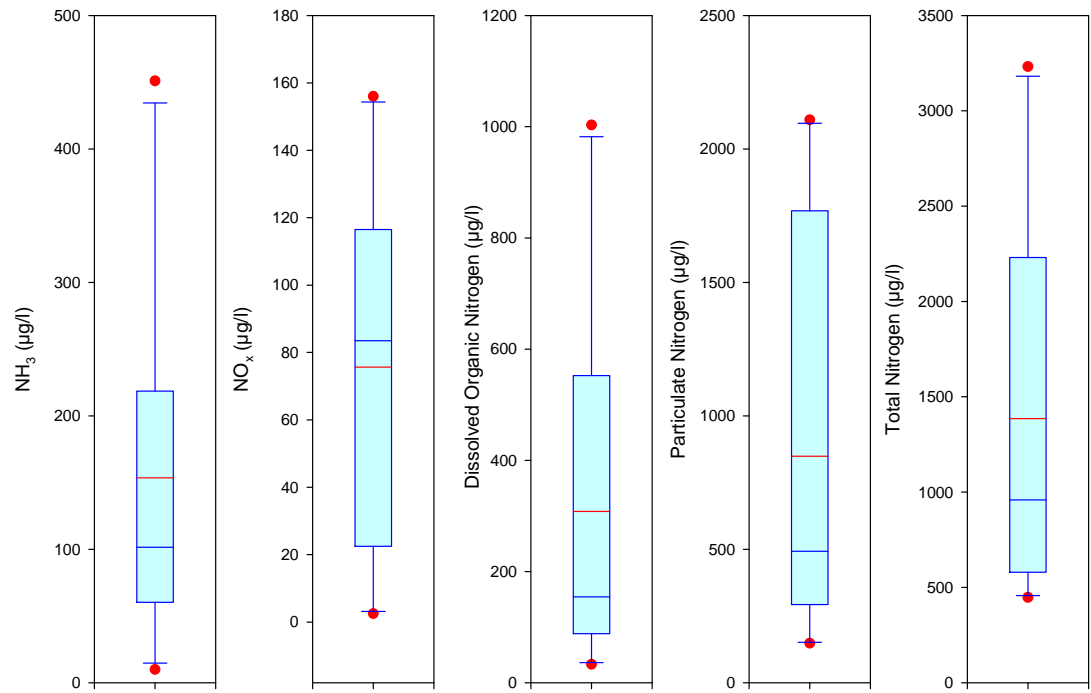
DATE	PARAMETER														RAINFALL (inches)	
	pH (s.u.)	Alk. (mg/l)	Cond. (µmho/cm)	NH <sub>3</sub> (µg/l)	NO <sub>x</sub> (µg/l)	Diss. Org. N (µg/l)	Part. N (µg/l)	Total N (µg/l)	SRP (µg/l)	Diss. Org. P (µg/l)	Part. P (µg/l)	Total P (µg/l)	Turb. (NTU)	TSS (mg/l)		BOD (mg/l)
1/23/08	6.75	20.4	43	10	27	128	429	594	31	14	71	116	8.6	41.5	7.0	1.43
2/21/08	6.81	83.0	183	86	109	1003	329	1527	183	45	89	317	3.4	19.4	9.4	0.30
2/23/08	6.69	29.8	84	102	86	180	1698	2066	49	4	280	333	13.6	67.6	5.7	0.43
2/26/08	6.79	44.6	144	61	83	472	2109	2725	57	30	421	508	56.8	131	17.9	0.81
3/6/08	6.65	32.2	69	58	84	158	148	448	78	7	28	113	3.7	10.0	8.1	1.17
3/7/08	6.46	20.8	56	196	61	151	451	859	57	5	93	155	12.4	33.4	3.9	0.21
3/20/08	6.70	44.2	122	451	9	793	1979	3232	630	114	392	1136	14.9	43.5	15.6	0.25
4/1/08	6.40	27.6	76	185	156	96	623	1060	219	54	164	437	7.6	48.0	5.6	0.86
4/5/08	6.32	17.4	45	101	139	33	534	807	54	19	84	157	7.5	27.0	2.9	2.11
4/6/08	7.40	74.2	133	286	<5	65	185	539	229	14	49	292	1.8	5.6	2.3	1.05
Average	6.70	39.4	96	154	84	308	849	1386	159	31	167	356	13.0	42.7	7.8	0.86
Minimum	6.32	17.4	43	10	9	33	148	448	31	4	28	113	1.8	5.6	2.3	0.21
Maximum	7.40	83.0	183	451	156	1003	2109	3232	630	114	421	1136	56.8	131.0	17.9	2.11

A summary of statistical variability in general parameters measured at the inflow monitoring site is given on Figure 3-2. A relatively low degree of variability was observed in measured pH values at the inflow monitoring site. However, a substantially larger degree of variability was observed in measured concentrations for the remaining parameters. Each of the remaining parameters had at least one “outlier” value which lies outside of the 95 percentile “whisker”. A comparison of variability in measured nitrogen species at the inflow monitoring site is given on Figure 3-3. A relatively high degree of variability was observed for each of the measured nitrogen species, although variability in nitrogen species is commonly observed in urban runoff.

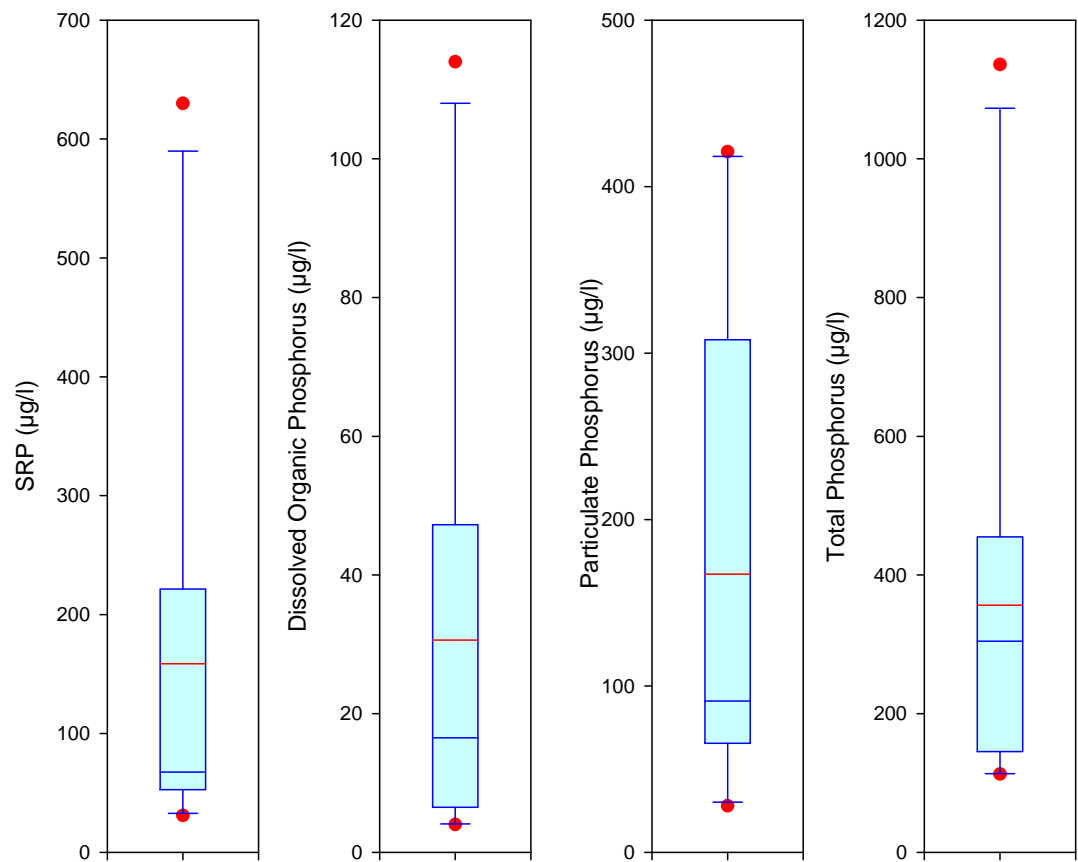
A comparison of variability in measured concentrations for phosphorus species is given on Figure 3-4. A particularly large range of degree of variability was observed for measured concentrations of SRP, dissolved organic phosphorus, and total phosphorus. The variability observed for the measured phosphorus species appears to be well outside of the range of variability commonly observed for phosphorus species in urban runoff.



**Figure 3-2. Summary of Statistical Variability in General Parameters Measured at the New York Avenue Exfiltration System Inflow Monitoring Site.**



**Figure 3-3. Summary of Statistical Variability in Nitrogen Species Measured at the New York Avenue Exfiltration System Inflow Monitoring Site.**



**Figure 3-4. Summary of Statistical Variability in Phosphorus Species Measured at the New York Avenue Exfiltration System Inflow Monitoring Site.**

### **3.3 Estimated System Removal Efficiency**

The primary objective of the monitoring efforts discussed in this report is to estimate the mass removal efficiency of the exfiltration system by comparing calculated mass loadings in the inflow and outflow to the unit over the 91-day monitoring period. However, as discussed in Section 2, no significant discharge was observed over the diversion weir structure during the monitoring program, indicating that virtually all generated runoff within the drainage basin entered the exfiltration system. This implies a removal efficiency of 100% since none of the generated runoff volume was discharged to the downstream waterbody. The field monitoring program included rain events as large as 2.11 inches which did not result in discharges over the diversion weir. This finding is significant since rain events in excess of 2.1 inches rarely occur during an annual rainfall cycle.

Although an apparent removal efficiency of 100% was observed during the monitoring program, it is unlikely that the system would achieve a removal efficiency of 100% on an annual basis. Based upon the design retention volume of 0.5-inch of runoff over the watershed area and the modeled drainage basin runoff coefficient of 0.240, the theoretical capacity of the exfiltration system is equal to approximately 2.08 inches of rainfall (0.5 inches divided by 0.240). However, there are several factors which suggest that the observed removal efficiency of 100% is not likely to be achieved over an annual cycle. First, rain events in excess of approximately 2.1 inches, although rare, will cause over-topping of the diversion weir structure and discharges to the downstream conveyance system. In addition, most of the observed significant rain events during the monitoring program were separated by several or more days of either low or no measured rainfall. This allowed the exfiltration system to recover virtually completely between the observed significant events. However, complete recovery of the exfiltration system may not be possible during the summer months when rainfall events may be more frequent.

An evaluation of estimated mean annual mass removal efficiencies for dry retention systems was conducted by ERD (2007) as part of an evaluation for the Florida Department of Environmental Protection. This evaluation was summarized in a document titled "Evaluation of Current Stormwater Design Criteria within the State of Florida – Final Report". Appendix D of this document titled "Calculated Performance Efficiency of Dry Retention as a Function of DCIA and Non-DCIA Curve Number" contains a series of tables for five meteorological zones within the State of Florida for retention depths ranging from 0.25-4.00 inches in 0.25-inch increments. These tables reflect a continuous simulation of the performance of a dry retention system over a period of record of more than 50 years.

A summary of the estimated performance efficiency for the New York Avenue exfiltration system is given in Table 3-7. Central Florida is located in meteorological zone 2 based upon the 2007 ERD report. As indicated in Table 3-2, the drainage basin area for the New York Avenue exfiltration system has a DCIA percentage of 24.1% and a non-DCIA curve number of 54.9. When these input data are iterated in the tables provided in Appendix D of the ERD report, the estimated annual performance efficiency is approximately 83%. This value indicates that approximately 83% of the annual runoff volume will be removed by the dry retention system as a result of infiltration into the soil. Therefore, for purposes of this analysis, it is assumed that the New York Avenue exfiltration system will have an annual removal efficiency of approximately 83%.



**TABLE 3-7**

**ESTIMATED PERFORMANCE EFFICIENCY FOR  
THE NEW YORK AVENUE EXFILTRATION SYSTEM**

<b>PARAMETER</b>	<b>VALUE</b>
Meteorological Zone	2
Percent DCIA (%)	24.1
Non-DCIA CN	54.9
Retention Depth (inches)	0.5
Annual Removal (%)	83.0

A summary of calculated annual mass removals for the New York Avenue exfiltration system is given in Table 3-8. The generated runoff volume is calculated based upon a watershed area of 61.78 acres, an annual C value of 0.240, and annual rainfall of 50 inches for the Central Florida area. Based upon these assumptions, the generated annual runoff volume within the drainage basin area is approximately 61.75 ac-ft. It is assumed that 83% of this volume will be removed by the exfiltration system, with the remaining volume (approximately 10.50 ac-ft) discharging to Lake Maitland. Estimates of annual mass loadings for total nitrogen, total phosphorus, TSS, and BOD were calculated by multiplying the mean runoff concentrations summarized in Table 3-6 times the generated runoff volume of 61.75 ac-ft/yr. These values are summarized in Table 3-8 as the generated pollutant mass for each parameter. The annual mass loading removed by the exfiltration system is calculated assuming that approximately 83% of the mass loading will be retained within the system, with 17% of the mass loading discharging to downstream waterbodies. Based upon this analysis, the New York Avenue exfiltration system is expected to remove approximately 87.6 kg/yr of total nitrogen, 22.5 kg/yr of total phosphorus, 2699 kg/yr of TSS, and 493 kg/yr of BOD.

**TABLE 3-8**

**SUMMARY OF ANNUAL MASS REMOVALS FOR  
THE NEW YORK AVENUE EXFILTRATION SYSTEM**

<b>PARAMETER</b>	<b>UNITS</b>	<b>GENERATED VOLUME/MASS</b>	<b>REMOVED IN EXFILTRATION SYSTEM</b>	<b>DISCHARGE TO LAKE MAITLAND</b>
Runoff Volume	ac-ft/yr	61.75	51.25	10.50
Total Nitrogen Load	kg/yr	105.5	87.6	17.9
Total Phosphorus Load	kg/yr	27.1	22.5	4.6
TSS Load	kg/yr	3252	2699	553
BOD Load	kg/yr	594	493	101

An evaluation of estimated present worth costs for the New York Avenue exfiltration system is given in Table 3-9. This analysis assumes a construction cost of \$1,154,441.32 and an annual maintenance cost of approximately \$20,000 per year for 20 years. This equates to an estimated present worth cost of approximately \$1,554,441.32.

**TABLE 3-9**  
**EVALUATION OF PRESENT WORTH COST FOR**  
**THE NEW YORK AVENUE EXFILTRATION SYSTEM**

PARAMETER	VALUE
Basin Area (acres)	61.78
Design Retention Treatment Provided (inches)	0.5
BMP Construction Costs (\$) (Land: \$0 + Construction: \$1,154,441.32)	\$1,154,441.32
Annual Maintenance Cost (\$)	20,000
Present Worth Cost (20-year) (\$)	\$1,554,441.32

An evaluation of load reduction costs for the New York Avenue exfiltration system is given in Table 3-10. The estimated annual mass removal for total nitrogen, total phosphorus, TSS, and BOD is divided by the 20-year present worth cost of \$1,554,441.32. The resulting present worth costs per kg of pollutant removed are summarized in the last row of Table 3-10.

**TABLE 3-10**  
**EVALUATION OF LOAD REDUCTION COSTS FOR**  
**THE NEW YORK AVENUE EXFILTRATION SYSTEM**

PARAMETER	TOTAL NITROGEN	TOTAL PHOSPHORUS	TSS	BOD
Annual Mass Removed (kg/yr)	87.6	22.5	2699	493
Present Worth Cost per kg Removed (\$)	887	3454	28.8	158

### **3.4 Quality Assurance**

Supplemental samples were collected during the field monitoring program for quality assurance purposes. These supplemental samples include equipment blanks and duplicate samples, along with supplemental laboratory analyses to evaluate precision and accuracy of the collected data. A summary of QA data collected as part of this project is given in Appendix C.

## SECTION 4

### SUMMARY

A field monitoring program was conducted by ERD from January-April 2008 to evaluate the performance efficiency of the New York Avenue exfiltration system. The exfiltration system is designed to provide dry retention treatment for 0.5-inch of runoff for 61.78 acres of a 95-acre contributing basin area. Automatic samplers with integral flow meters were used to provide a continuous record of hydrologic discharges through the basin area, as well as collect runoff samples on a flow-weighted basis. A recording rain gauge was also installed adjacent to the monitoring site.

Composite runoff samples were collected during a total of 10 storm events at the monitoring site. The collected runoff samples were found to be highly variable with respect to chemical characteristics, with relatively elevated concentrations for most phosphorus species. No significant discharges were observed over the diversion weir structure during the 91-day monitoring program, which included measured rain events as great as 2.11 inches, suggesting that virtually 100% of the generated runoff volume was retained by the exfiltration system.

A supplemental analysis was conducted which estimated that the long-term annual removal efficiency of the exfiltration system will be approximately 83%. Based upon this estimated performance efficiency and the chemical characteristics of runoff collected at the site, it is estimated that the New York Avenue exfiltration system will provide removal for approximately 87.6 kg/yr of total nitrogen, 22.5 kg/yr of total phosphorus, 26.99 kg/yr of TSS, and 493 kg/yr of BOD.

A summary of total project costs is given in Table 4-1. FDEP and the City of Winter Park each contributed 50% (\$ 609,434.15) of the total project cost.

**TABLE 4-1**  
**SUMMARY OF TOTAL**  
**PROJECT COSTS AND FUNDING SOURCES**

<b>PROJECT FUNDING ACTIVITY</b>	<b>TOTAL PROJECT COSTS (\$)</b>	<b>DEP GRANT FUNDS (\$)</b>	<b>CITY OF WINTER PARK FUNDS (\$)</b>
Staff	32,033.08	--	32,033.08
Travel	--	--	--
Equipment	--	--	--
Supplies	--	--	--
Contractual	--	--	--
BMP Implementation	1,154,441.32	609,434.15	545,007.17
Monitoring	32,393.90	--	32,393.90
Public Education	--	--	--
Other	--	--	--
<b>TOTAL:</b>	<b>\$ 1,218,868.30</b>	<b>\$ 609,434.15</b>	<b>\$ 609,434.15</b>
<b>PERCENTAGE MATCH:</b>		<b>50</b>	<b>50</b>

## **APPENDICES**

**APPENDIX A**

**CONSTRUCTION PLANS FOR THE  
NEW YORK AVENUE EXFILTRATION SYSTEM**

CONSTRUCTION PLANS  
FOR  
NEW YORK AVE EXFILTRATION SYSTEM  
FLORIDA FOREVER AND THE CITY OF WINTER PARK

City Of Winter Park

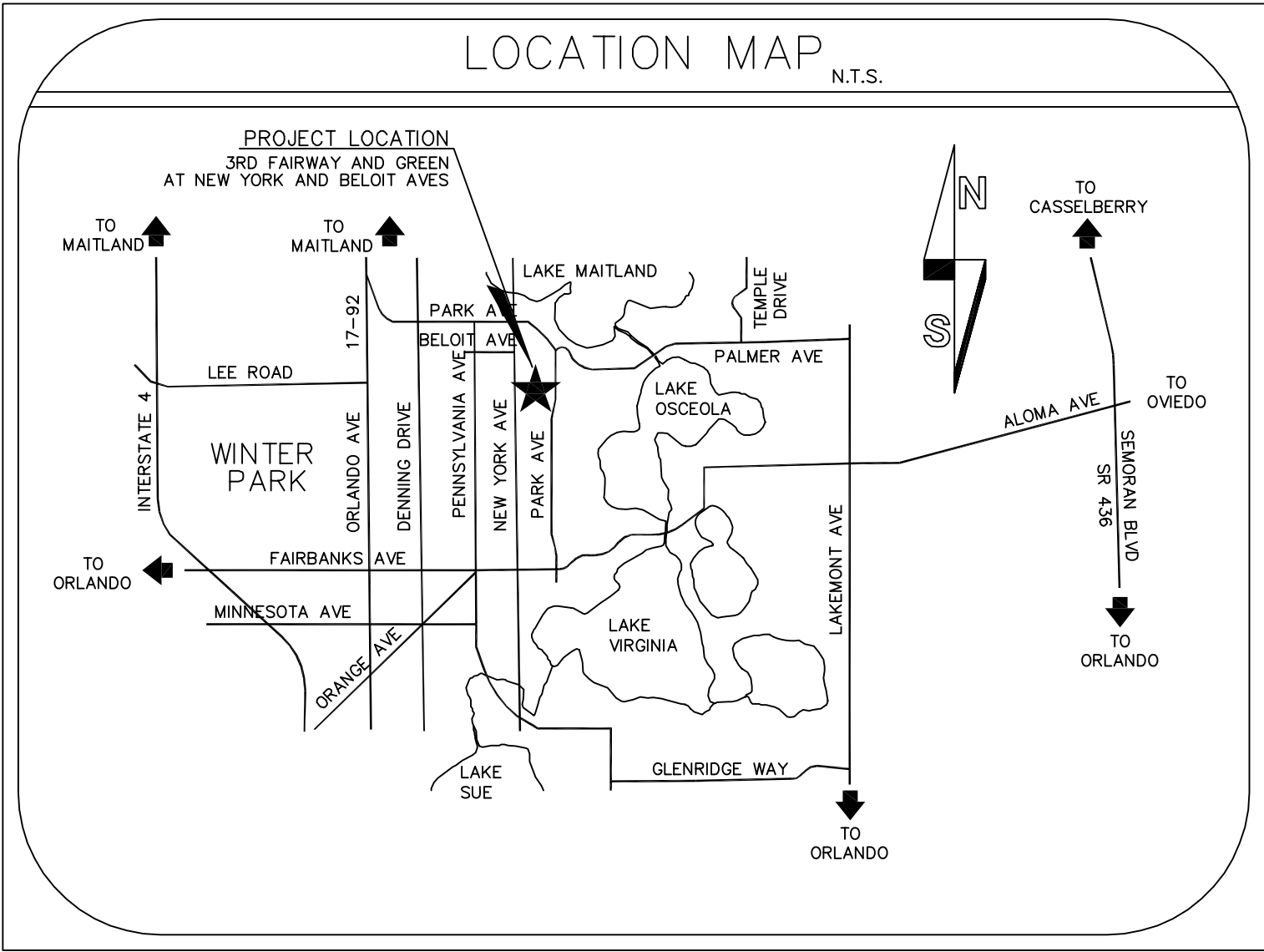


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JAMES S. WILLIAMS, P.E.  
CITY MANAGER  
TROY R. ATTAWAY, P.E.  
DIRECTOR of PUBLIC WORKS  
DONALD J. MARCOTTE, P.E.  
CITY ENGINEER, ASSISTANT PW DIRECTOR  
JOSEPH SERRANO  
PROJECT MANAGER, ASSISTANT PW DIRECTOR

UTILITIES ENCOUNTERED
CALL SUNSHINE 48 HOURS BEFORE YOU DIG 1-800-432-4770
TECO PEOPLES GAS 407-420-2678
CITY OF WINTER PARK WATER AND WASTEWATER 407-599-3458
BRIGHTHOUSE NETWORKS 407-532-8520
CITY OF WINTER PARK STREETS AND DRAINAGE 407-599-3233
SPRINT (TELEPHONE) 407-830-3428
CITY OF WINTER PARK (ELECTRIC) 407-599-3491

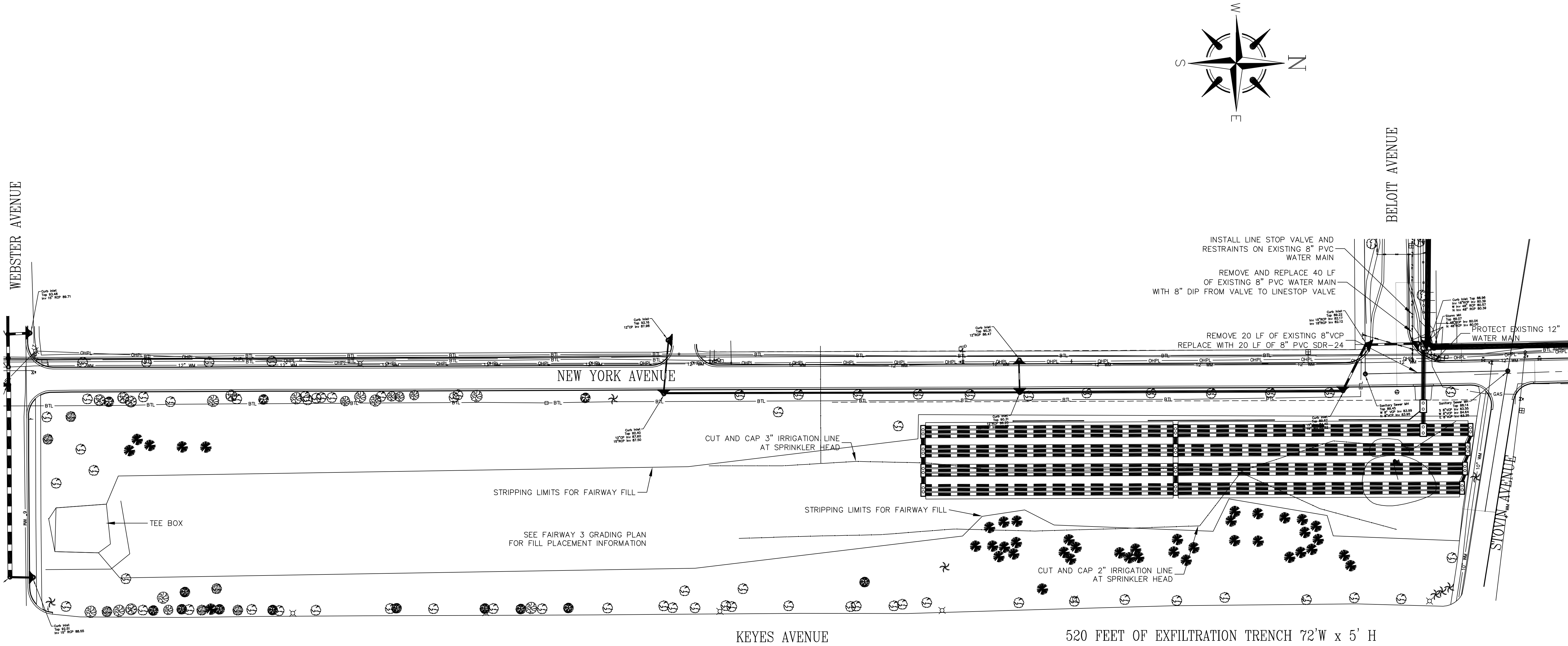


WINTER PARK  
LOCATION MAP  
N.T.S.

INDEX OF SHEETS	
SHEET	DESCRIPTION
1	KEY SHEET
2	GENERAL NOTES
3	OVERALL SITE PLAN
4	STRUCTURES AND CROSS SECTIONS
5	PLAN VIEW AND PROFILE
6	EXFILTRATION DETAILS
7	IRRIGATION LAYOUT

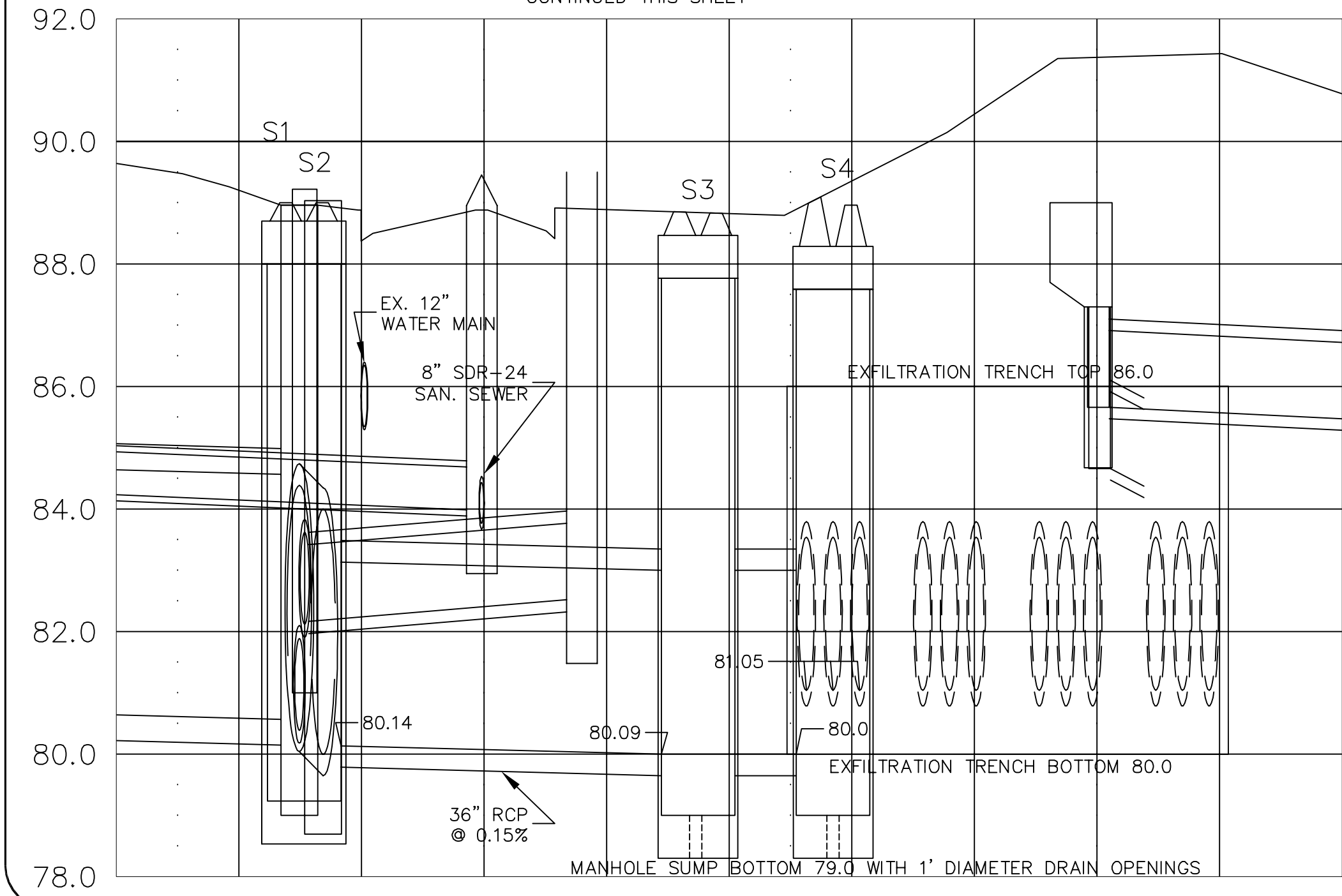
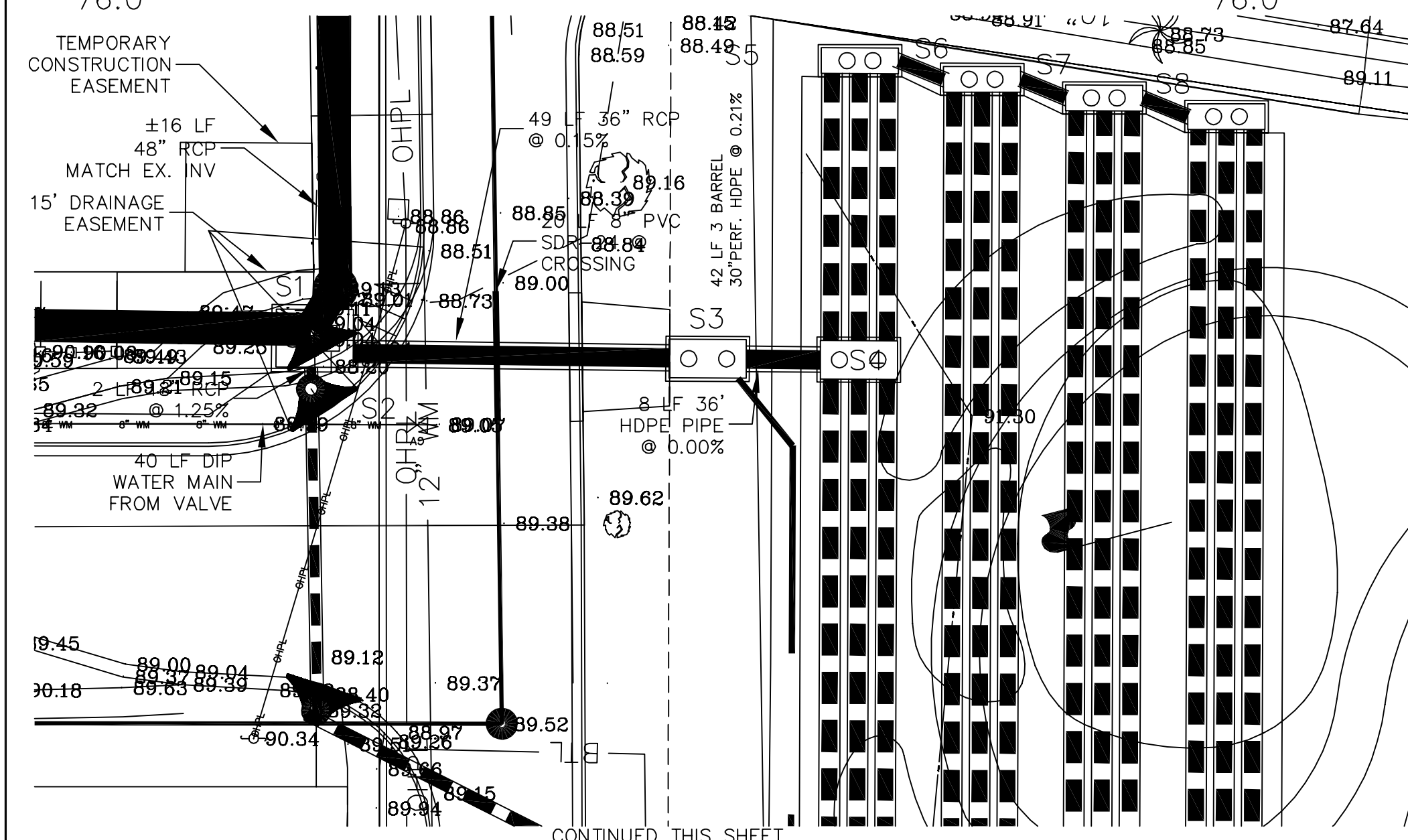
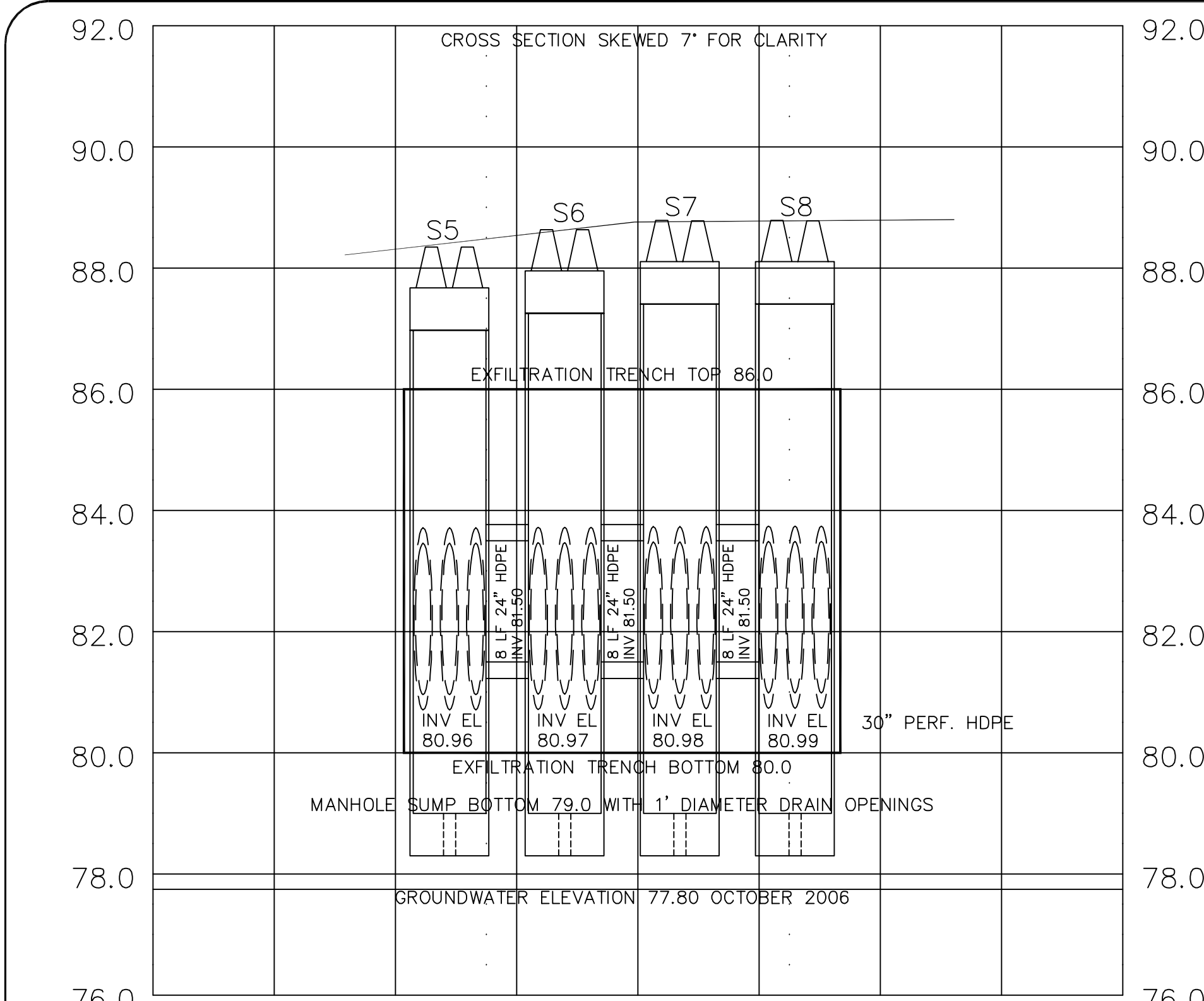
GRAPHIC SYMBOLOGY LEGEND		
SECTION LINE		HEDGE
CITY LINE		TREES
BASE OR SURVEY LINE		EDGE OF WOODED AREA
RIGHT OF WAY		CONCRETE
LIMITED ACCESS LINE		RATE OF SUPERELEVATION
FENCE LINE		POWER POLE
BOX CULVERT		OVERHEAD POWER CABLE
BRIDGE		TELEPHONE POLE
STORM SEWER INLET		OVERHEAD TELEPHONE POLE
MANHOLE		GUY WIRE AND ANCHOR PIN
SURVEY REFERENCE POINT		BURIED POWER CABLE
BENCH MARK		ELECTRIC DUCT
POINT OF INTERSECTION		BURIED TELEPHONE CABLE
NORTH POINT		TELEPHONE DUCT
BASE LINE		LIGHT POLE
CENTERLINE		GAS MAIN
PROPERTY LINE		WATER MAIN
DELTA ANGLE		SANITARY SEWER
APPROXIMATE		MANHOLE
ROUND		VALVE
CURB		FIRE HYDRANT
CURB AND GUTTER		UNDERGROUND CABLE TELEVISION
		OVERHEAD CABLE TELEVISION

FILE NAME	LANDER.DWG
PLOT CODE	BEL.PLT



FILE NAME FILE.DWG	PLOT CODE FILE.CTB	DATE	REVISIONS	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	NEW YORK AVENUE EXFILTRATION SYSTEM		
								PROJECT NUMBER	DATE	06/15/06
City of Winter Park								NEW YORK AVENUE AND BELOIT AVENUE		
401 Park Avenue South Winter Park, Florida 32789 Telephone (407) 623-3242								City of Winter Park		
								Winter Park, Florida		
								SHEET NO. 3 OF 7		

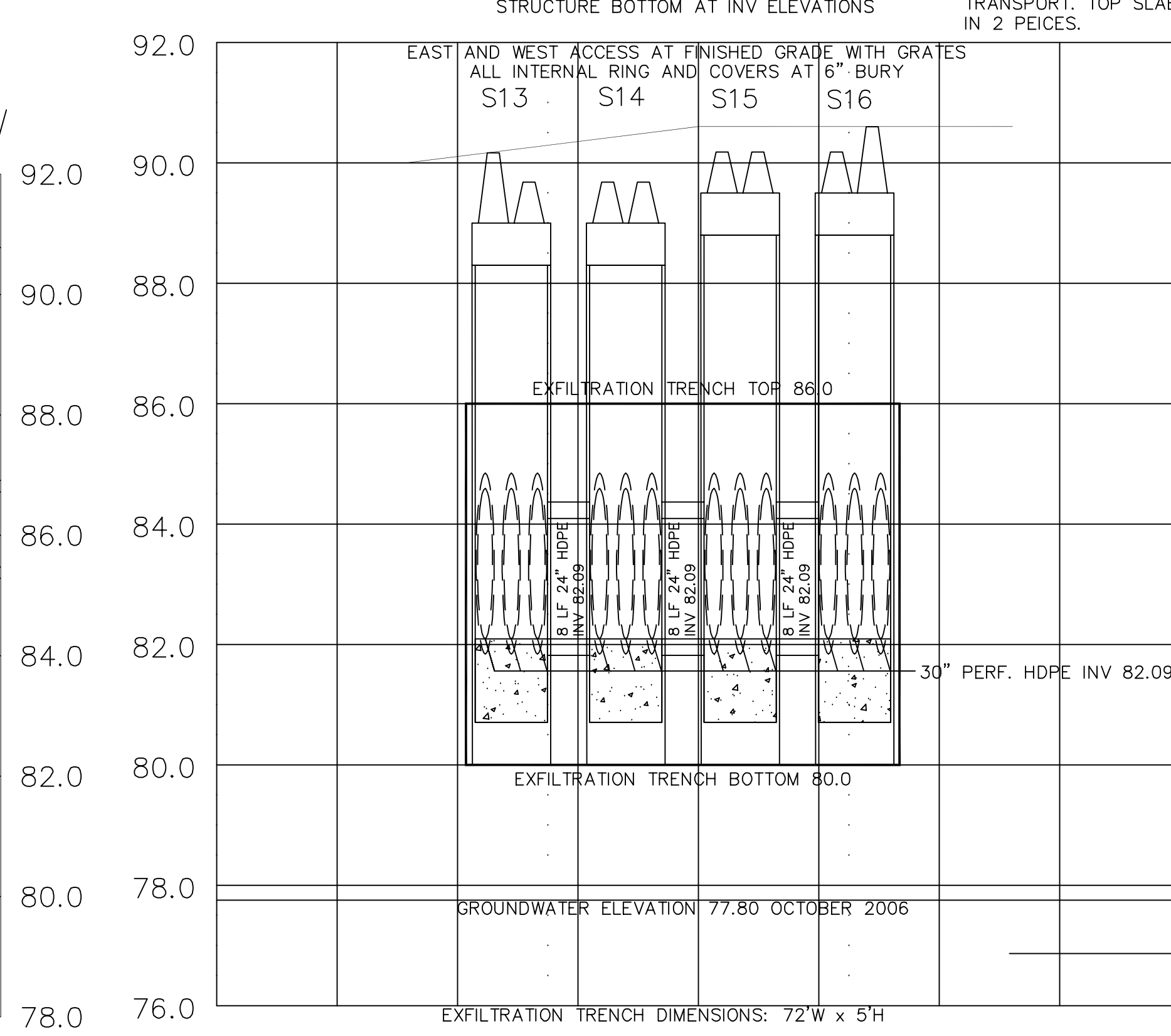




S1  
9' x 12' (INTERNAL DIMENSIONS)  
DIVERSION STRUCTURE WITH 12' WEIR  
TOP EL 89.0  
W 48" RCP INV 80.57 (EXISTING)  
S 18" RCP INV 80.39  
E 36" RCP INV 80.14  
N 48" RCP INV 80.00  
12.7' L' WEIR EL 86.0  
(SEE DETAIL SHEET 6)

S2  
P-4 INLET  
TOP EL 89.0  
N 18" RCP INV 80.60  
S 18" RCP INV 80.70 (EXISTING)

S3  
5' x 12' (INTERNAL DIMENSIONS)  
DEBRIS SCREEN STRUCTURE  
TOP EL 88.75  
W 36" RCP INV 80.09  
E 36" HDPE INV 80.00  
SCREEN TOP EL 84.0  
S 12" UNDERDRAIN INV EL 80.15  
(SEE DETAIL SHEET 6)



S4  
5' x 12' (INTERNAL DIMENSIONS)  
JUNCTION MH W/ SECONDARY SCREEN  
TOP EL 88.70  
W 36" HDPE INV 80.00  
S 3 ~30" HDPE PERF. PIPE INV 81.05  
N 3 ~30" HDPE PERF. PIPE INV 81.05  
(SEE DETAIL SHEET 6)

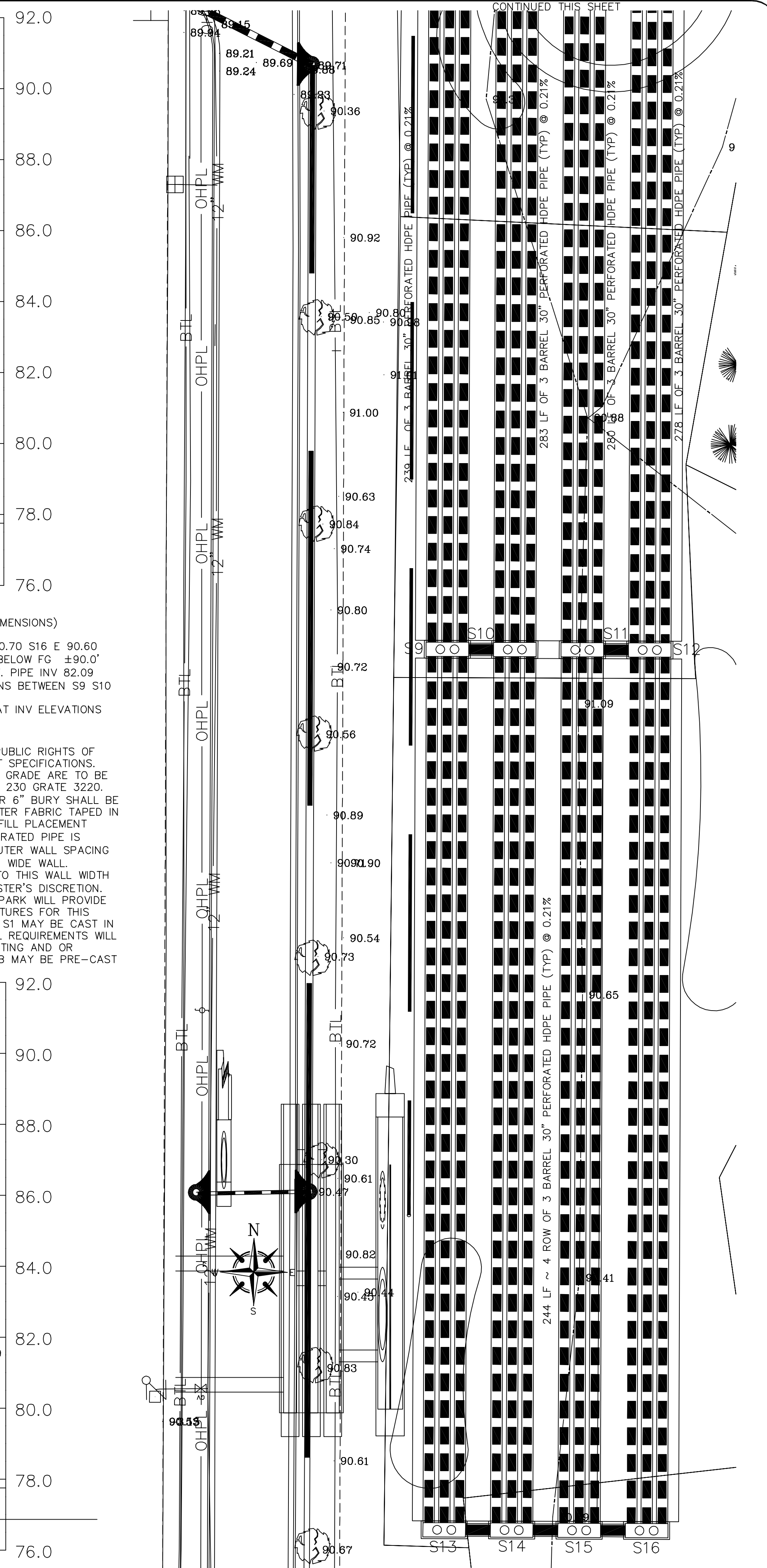
S5, S6, S7, S8,  
4' x 12' (INTERNAL DIMENSIONS)  
JUNCTION MANHOLE  
TOPS AT FG S5 88.70, S6 89.0, S7 89.2,  
S8 89.2  
S 3 ~30" HDPE PERF. PIPE INV ±81.00  
SUMP BOTTOM EL 79.0  
24" HDPE CONNECTIONS BETWEEN S5 S6  
S7 S8 INV 81.00

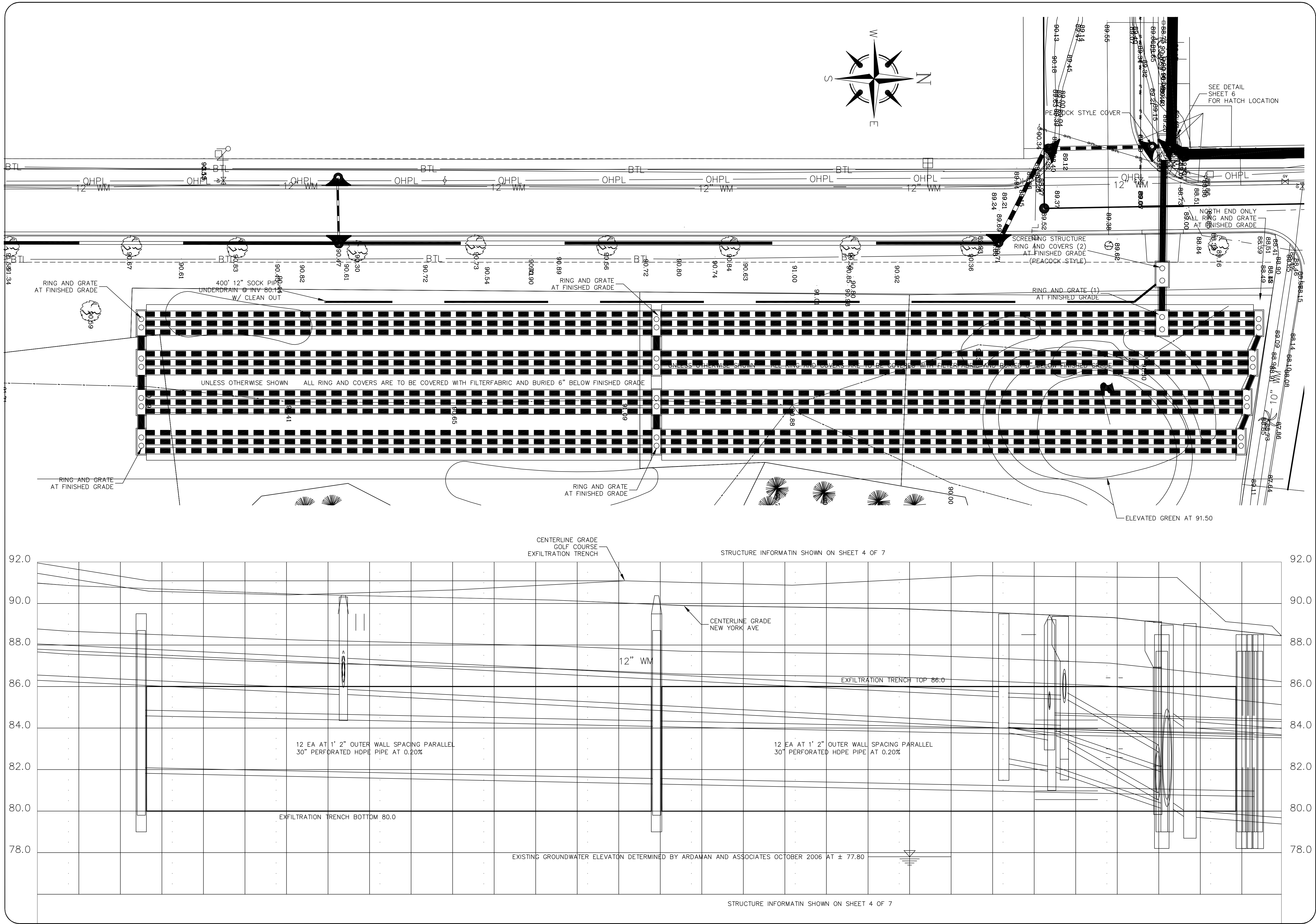
S9, S10, S11, S12,  
4' x 12' (INTERNAL DIMENSIONS)  
JUNCTION MANHOLE  
TOPS AT FG S9 W 90.70 S12 E 90.60  
ALL OTHER TOPS 6" BELOW FG ±90.0'  
N 3 ~30" HDPE PERF. PIPE INV 81.57  
S 3 ~30" HDPE PERF. PIPE INV 81.58  
24" HDPE CONNECTIONS BETWEEN S9 S10  
AND S11 S12 INV 81.54  
STRUCTURE BOTTOM AT INV ELEVATIONS

S13, S14, S15, S16,  
4' x 12' (INTERNAL DIMENSIONS)  
JUNCTION MANHOLE  
TOPS AT FG S13 W 90.70 S16 E 90.60  
ALL OTHER TOPS 6" BELOW FG ±90.0'  
N 3 ~30" HDPE PERF. PIPE INV 82.09  
24" HDPE CONNECTIONS BETWEEN S9 S10  
S11 S12 INV 82.09  
STRUCTURE BOTTOM AT INV ELEVATIONS

STRUCTURE NOTES:  
STRUCTURES WITHIN PUBLIC RIGHTS OF  
WAY MUST MEET FDOT SPECIFICATIONS.  
RING AND COVERS AT GRADE ARE TO BE  
TRAFFIC BEARING USF 230 GRATE 3220.  
RING AND COVERS FOR 6" BURY SHALL BE  
USF 230 AA WITH FILTER FABRIC TAPED IN  
PLACE PRIOR TO BACKFILL PLACEMENT  
3 ~ 30" HDPE PERFORATED PIPE IS  
DESIGNED AT 1' 2" OUTER WALL SPACING  
TO FIT THE INSIDE 12' WIDE WALL.  
ADJUSTMENTS MADE TO THIS WALL WIDTH  
ARE AT THE PRE-CASTER'S DISCRETION.  
THE CITY OF WINTER PARK WILL PROVIDE  
ALL PRE CAST STRUCTURES FOR THIS  
PROJECT. STRUCTURE S1 MAY BE CAST IN  
PLACE IF STRUCTURAL REQUIREMENTS WILL  
NOT PERMIT PRE-CASTING AND OR  
TRANSPORT. TOP SLAB MAY BE PRE-CAST  
IN 2 PEICES.

EXFILTRATION TRENCH DIMENSIONS: 72'W x 5'H





FILE NAME  
FILE.DWG

PLOT CODE  
FILE.CTB

DATE

REVISIONS

DESIGNED BY:

CHECKED BY:

DRAWN BY:

APPROVED BY:

City of Winter Park

401 Park Avenue South  
Winter Park, Florida 32789  
Telephone (407) 623-3242

PROJECT NUMBER  
06-22-06

DATE  
06-22-06

NEW YORK AVENUE EXFILTRATION SYSTEM

NEW YORK AVENUE @ BELOIT AVENUE

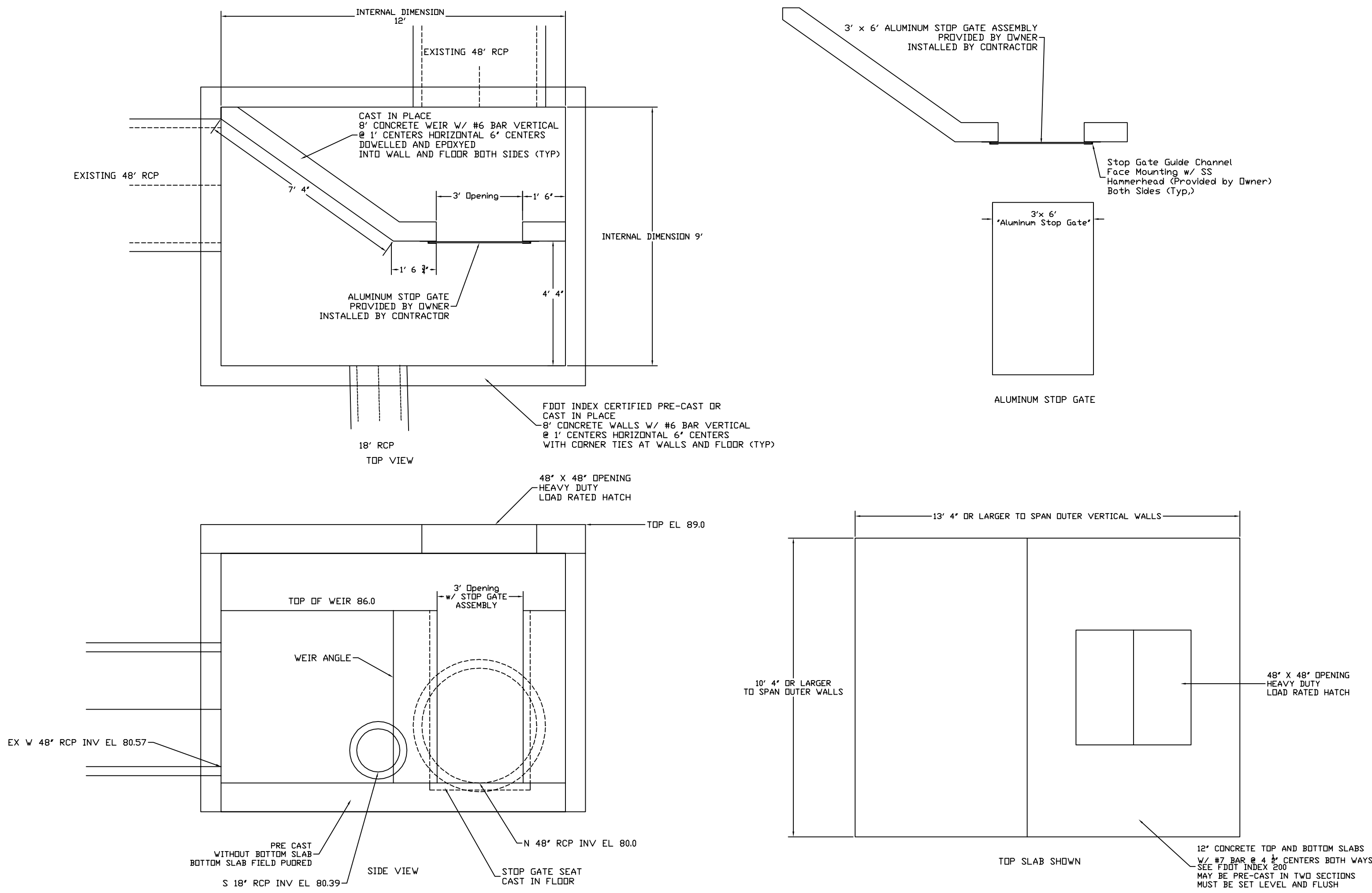
City of Winter Park

Winter Park, Florida

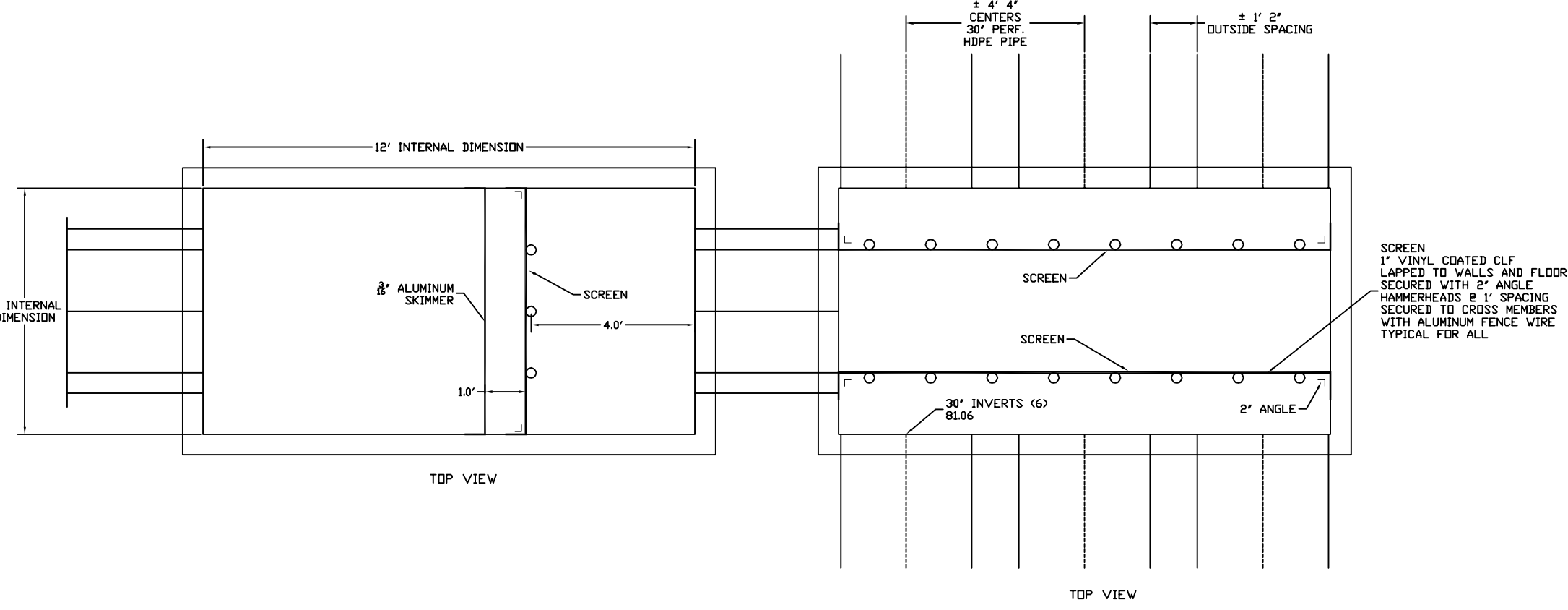
1" = 20'

SHEET NO. 5 OF 7

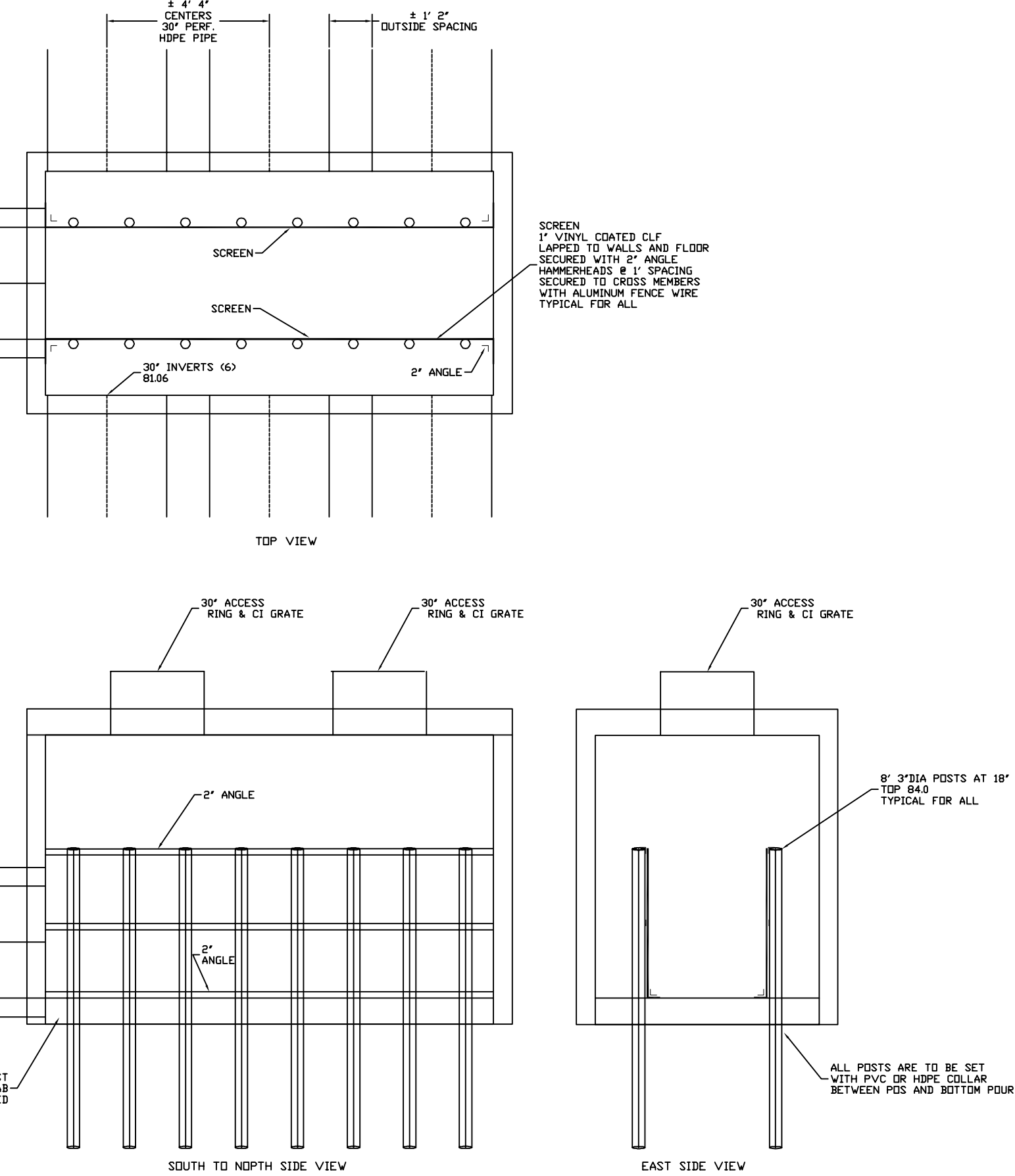




S1 DIVERSION STRUCTURE DETAIL



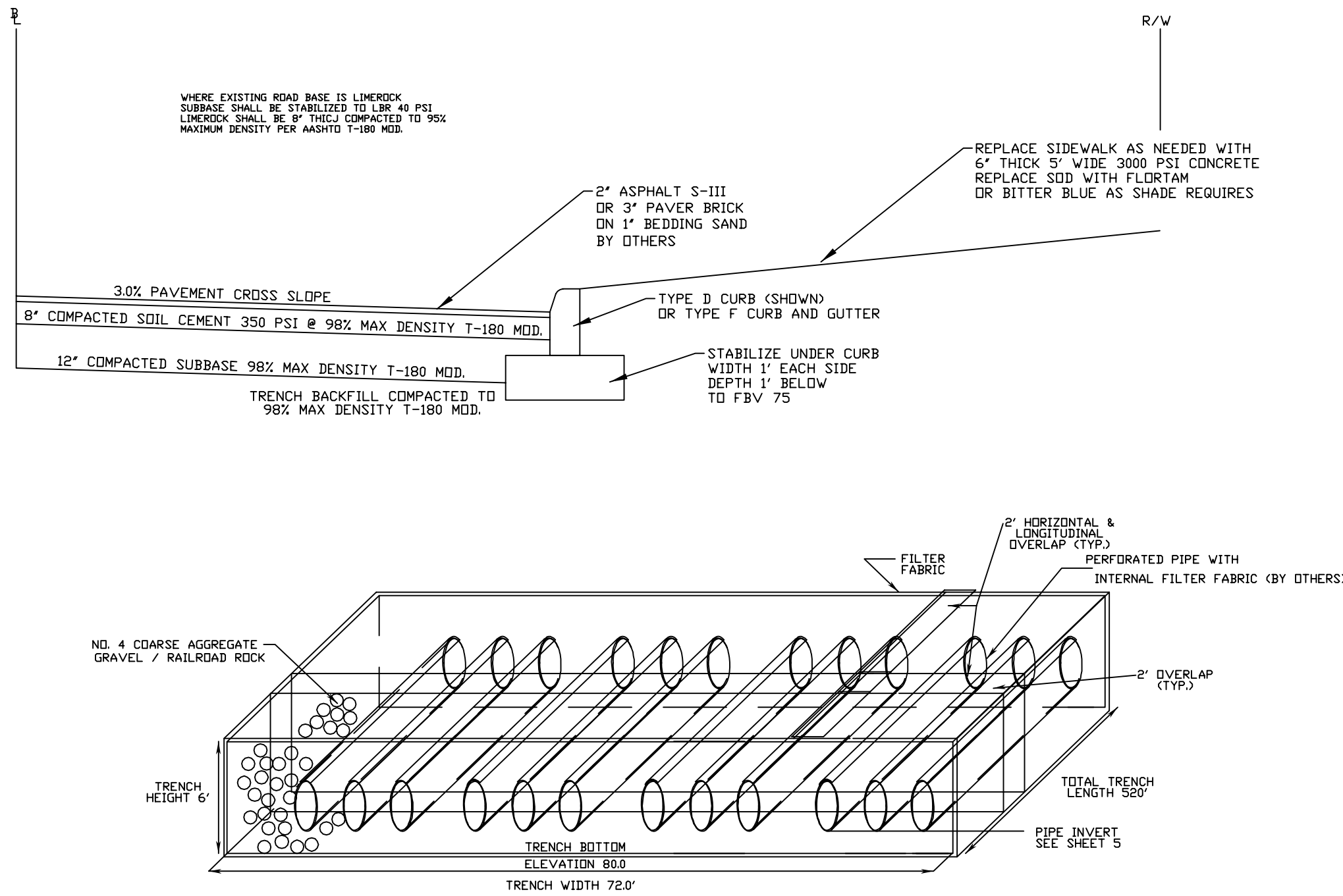
S3 DEBRIS SCREEN  
STRUCTURE DETAIL  
NTS



S4 JUNCTION MANHOLE  
SECONDARY SCREEN DETAIL  
NTS

GENERAL NOTES  
1. CONSTRUCTION WILL BE CONDUCTED IN TWO PHASES WITH THE FIRST PHASE COMPLETED PRIOR TO DEMOLITION OR CONSTRUCTION ACTIVITIES WITHIN THE CITY OF WINTER PARK RIGHT OF WAY. THE FIRST PHASE INCLUDES ALL PROPOSED IMPROVEMENTS BENEATH THE THIRD FAIRWAY OF THE MUNICIPAL GOLF COURSE, INCLUDING AND UP TO THE SEPARATOR SCREEN. THE GOLF COURSE FAIRWAY SHALL BE COMPACTED AND GRADED BACK TO THE ORIGINAL ELEVATIONS PRIOR TO CONSTRUCTION. IRRIGATION SYSTEM SHALL BE RESTORED AND TESTED. UTILITY COORDINATION FOR PHASE TWO CONSTRUCTION MAY BE ADDRESSED DURING PHASE ONE ACTIVITIES, PROVIDED ROAD CLOSURES ARE NOT REQUIRED. ALL NECESSARY UTILITY COORDINATION BETWEEN THE CONTRACTOR AND SERVISING UTILITY WILL BE THE RESPONSIBILITY OF THE CONTRACTOR. CITY OF WINTER PARK ELECTRIC, WATER AND SEWER, TCCO GAS, AND EMBARC COMMUNICATIONS ALL HAVE FACILITIES WITHIN THE CONSTRUCTION LIMITS. THESE COMPANIES HAVE BEEN NOTIFIED OF PROPOSED ACTIVITIES BY THE CITY OF WINTER PARK, BUT IT IS THE CONTRACTORS RESPONSIBILITY TO COORDINATE NECESSARY ACTIVITIES FOR AND DURING CONSTRUCTION.  
2. PHASE TWO SHALL INCLUDE ALL PHYSICAL UTILITY RELOCATION, PROTECTION, AND COORDINATION. TOP SOIL, TURF AND SURFACE STRIPPINGS ARE TO BE STOCKPILED SEPARATELY FROM SUITABLE GRANULAR BACKFILL. PRIOR TO STRIPPING ACTIVITIES EXISTING SURFACE IRRIGATION HEADS, CONTROLLERS AND PEDASTALS WITHIN CONSTRUCTION AND STAGING AREAS ARE EITHER REMOVED AND STORED OR REPLACED AT THE CONTRACTORS EXPENSE. EXISTING IRRIGATION MAINS ARE TO BE CAPPED AT LOCATIONS SHOWN IN THESE DRAWINGS. IRRIGATION SYSTEM VALVES ARE TO BE OPERATED TO ISOLATE THE THIRD FAIRWAY AND GREEN FROM THE REMAINDER OF THE GOLF COURSE IRRIGATION SYSTEM.  
3. A 20 FOOT SEPARATION FROM THE EXISTING TREE TRUNKS TO THE EDGE OF THE PROPOSED EXFILTRATION SYSTEM IS REQUIRED. THE TOP OF EXCAVATED SIDE SLOPES MUST MAINTAIN A 10 SEPARATION FROM EXISTING TREE TRUNKS. ALL APPLICABLE TRENCH SAFETY REQUIREMENTS APPLY.  
4. THE EXFILTRATION SYSTEM SHALL BE CONSTRUCTED IN CONFORMANCE WITH THE LINE AND GRADES SHOWN ON THE PLAN. CONNECTIONS TO ALL STRUCTURES ARE TO BE ACCOMPLISHED BY MEANS OF CONSTRUCTION BRICK AND NON-SHRINK GROUT. ALL SURFACES ARE TO BE SMOOTH TROWEL FINISHED WITH A SMOOTH APPEARANCE, BOTH INSIDE AND OUTSIDE OF THE PRECAST TO PIPE CONNECTION. ALL STRUCTURES ARE TO BE SET UPON COMPACTED, OR UNEXCAVATED SOIL WITH 12\"/>

5. ALL INLETS, STRUCTURES, PIPES, CURBS, GRATES, AND COVERS SHOWN ON THESE PLANS FOR CONSTRUCTION WITHIN THE PUBLIC RIGHT OF WAY ARE IN ACCORDANCE WITH CURRENT FDOT ROADWAY AND TRAFFIC DESIGN STANDARDS. ALL CONSTRUCTION WILL BE IN ACCORDANCE WITH THESE SPECIFICATIONS UNLESS OTHERWISE DIRECTED BY THE CITY ENGINEER, OR HIS DESIGNATED REPRESENTATIVE, IN WRITING.  
6. CONTRACTOR WILL BE RESPONSIBLE FOR TREE PROTECTION, NOISE, DUST AND EROSION CONTROL RELATED TO SITE WORK BEING PERFORMED.  
7. CONTRACTOR WILL BE RESPONSIBLE FOR MAINTAINING A CLEAN, SAFE SITE. CONTRACTOR IS RESPONSIBLE FOR PEDESTRIAN SAFETY WITHIN THE WORK AREA AND WILL PROVIDE REASONABLE WARNING AND OR BARRICADE PLACEMENT. CONTRACTOR WILL POLICE ALL LOOSE DEBRIS, AND ARRANGE MATERIALS IN A NEAT AND ORDERLY FASHION PRIOR TO LEAVING THE WORK SITE EACH WORK DAY.  
8. CONTRACTOR WILL BE RESPONSIBLE FOR MAINTAINING EROSION CONTROL. CONTRACTOR WILL BE RESPONSIBLE FOR KEEPING SEDIMENT OUT OF NEW AND EXISTING STORMWATER SYSTEMS BY MAINTAINING SILT BARRIERS AND PROTECTION MEASURES AT ENTRY POINTS ALONG, AND OR INSIDE SYSTEMS FOR THE DURATION OF THE OF THE WORK DESCRIBED IN THIS SCOPE. SEDIMENT BUILDUP WHICH OCCURS AS A RESULT OF CONTRACTORS FAILURE TO PROVIDE AND MAINTAIN ADEQUATE EROSION AND SEDIMENT CONTROL WILL BE REMOVED BY THE CONTRACTOR, OR REMOVED BY CITY AND BACKCHARGED TO CONTRACTOR. FAILURE TO PROTECT NEW EXFILTRATION TRENCH INSTALLATION FROM SEDIMENT INTRUSION WILL RESULT IN NON-PAYMENT FOR AFFECTED LENGTHS. FILTER FABRIC SECURED TO THE INSIDE OF THE PROPOSED PERFORATED PIPE IS RECOMMENDED, AND MAY BE LEFT IN PLACE FOLLOWING CONSTRUCTION IF DETERMINED TO BE SUFFICIENTLY CLEAN AND SECURED.  
9. THE CONTRACTOR WILL PROVIDE ON-SITE RESTROOM FACILITIES, ON SITE ROLL OFF WASTE RECEPTACLE, MAINTENANCE OF TRAFFIC SET UP, CAST IN PLACE ASSOCIATED MATERIALS, AND CONSTRUCTION LAY-DUT SERVICES. CITY PROVIDED SERVICES WILL INCLUDE TREE TRIMMING/REMOVAL, GEOTECHNICAL TESTING, PERMITS, MATERIAL ACQUISITION (AS DESCRIBED), GREENSCAPE RESTORATION, AND INSPECTION.  
10. A SUBSURFACE SOIL EXPLORATION HAS BEEN PERFORMED BY ARDAMAN AND ASSOCIATES, INC. FOR THIS PROJECT AND IS AVAILABLE UPON REQUEST. CONTACT CHARLES H. CUNNINGHAM PE. AT 407-855-3860 FILE NO. 06-6444 PROPOSED EXFILTRATION SITE WINTER PARK, ORANGE COUNTY, FLORIDA, JUNE 16, 2006, AND SUBSEQUENT REVISIONS.



EXFILTRATION TRENCH DETAIL VIEW  
NTS.

NOTE:  
ALL MATERIALS DESCRIBED IN THIS DETAIL WILL BE PROVIDED BY THE CITY OF WINTER PARK. FILTER FABRIC SHALL BE NON-WEAVING, NON-TEAR, OR APPROVED EQUAL. CRUSHED CONCRETE AND LIMEROCK ARE NOT SUITABLE COARSE AGGREGATE METHODS.  
EXTERNAL FILTER FABRIC SHALL BE DOUBLED @ ENDS PROTECTING SOIL TIGHT PERIMETER ON ALL SIDES OF THE TRENCH AND AROUND STRUCTURES AND PIPES. CONTRACTOR MAY, AT HIS DISCRETION, WRAP STRUCTURES AND DRAINFIELD TOGETHER PROVIDED CLOTH CONTOURS TO THE TOP AND SIDES OF STRUCTURES.

TYPICAL EXFILTRATION TRENCH DETAIL  
NTS.

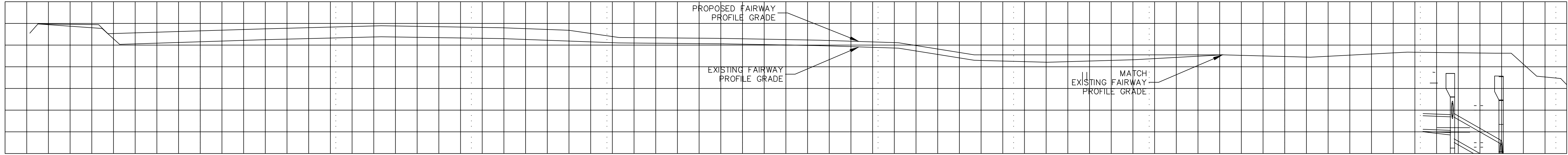
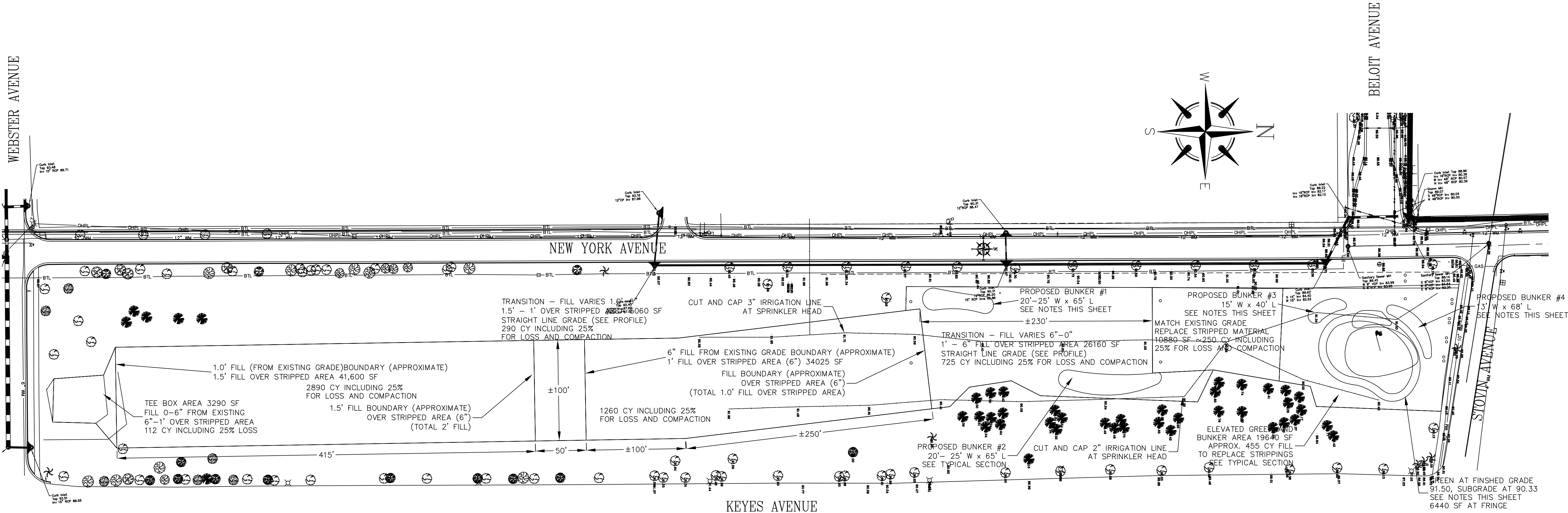
PROJECT NUMBER	DATE	12-12-06
FILE NAME	PLOT CODE	N.T.S.
DESIGNED BY	CHECKED BY	SHEET NO. 6 OF 7


GENERAL NOTES AND DETAILS	NEW YORK AVENUE EXFILTRATION SYSTEM
CITY OF WINTER PARK	Winter Park, Florida

DESIGNED BY	CHECKED BY	APPROVED BY
BEL	BEL	---
REVISIONS	REVIEWED BY	DATE

FILE NAME	PLOT CODE
NPARKBRK.DWG	BEL.PLT

GRADING PLAN NOTES:  
THE INFORMATION CONTAINED ON THIS PLAN SHEET IS INTENDED TO BALANCE 6300 CY OF CLEAN FILL DISPLACED BY THE EXFILTRATION CONSTRUCTION AND REMOVAL OF 2100 CY OF TOPSOIL STRIPPINGS. A 25% LOSS FACTOR IS EMPLOYED IN THESE CALCULATIONS, ACTUAL LOSSES WILL VARY.  
THE FILL ZONES ARE TO BE SLOPED FROM THE LIMITS SHOWN AT NO GREATER THAN A 10:1 SLOPE TO MATCH THE EXISTING GROUND. BUNKER LOCATIONS SHOWN ARE TO BE CUT 1' DEEP FROM FINISHED GRADED AREAS READY FOR PLACEMENT OF 12" OF BUNKER SAND. FOR FAIRWAY BUNKERS #1 AND #2, THE REMOVED MATERIAL IS TO BE DEPOSITED AT THE BUNKER EDGE FARTHEST AWAY FROM THE FAIRWAY TAPERING FLUSH TO THE FAIRWAY WHERE ADJACENT. THE RAISED PORTION OF THE FAIRWAY BUNKERS ARE TO BE SHAPED TO A HEIGHT OF 1.0' AND SLOPED TO MATCH EXISTING GRADE AT A SLOPE NO GREATER THAN 8'H TO 1'V.  
GREEN BUNKERS ARE TO BE CUT 1' FROM FINISHED GRADING, READY FOR FILL WITH 12" OF BUNKER SAND. REMOVED MATERIAL FROM THESE BUNKERS WILL BE SPREAD ALONG DESIGNATED AREAS ALONG THE PERIMETER OF THE GREEN.  
THE GREEN WILL BE GRADED TO SUB GRADE FOR GREEN CONSTRUCTION. SUBGRADE IS 14" BELOW FINISHED GRADE.  
CONTRACTOR WILL BE RESPONSIBLE FOR VERIFYING SITE BALANCE OR TRANSPORT OF ADDITIONAL CLEAN FILL TO AN APPROVED LOCATION WITHIN THE CITY. ALL PLACED FILL SHALL BE COMPACTED TO 95% MAX. DENSITY PER AASHTO T-180 MODIFIED.



FILE NAME FILE.DWG	PLOT CODE FILE.CTB	DATE	REVISIONS	DRAWN BY: CHECKED BY: APPROVED BY:	 City of Winter Park 401 Park Avenue South Winter Park, Florida 32789 Telephone (407) 623-3242	PROJECT NUMBER DATE 06/15/06	HOLE 3 GRADING NEW YORK AVENUE AND BELOIT AVENUE City of Winter Park Winter Park, Florida

## **APPENDIX B**

### **HYDROLOGIC MODELING FOR ESTIMATION OF RUNOFF VOLUMES DISCHARGING TO THE NEW YORK AVENUE EXFILTRATION SYSTEM**

**New York Avenue  
Appendix B**

Parameter	Basin 1					
	Building	Cemetery	Church	Golf Course	Low Density Res	Open
Total Area (ac)	0.107	11.029	0.472	5.863	0.316	0.684
DCIA (%)	0.0	0.0	0.0	0.0	0.0	0.0
non DCIA CN	65.6	40.2	39.0	39.0	39.0	39.0
S (in)	5.26	14.89	15.64	15.64	15.64	15.64

Rainfall Event Range (in)	Mean Rainfall Depth (in)	Basin 1					
		Building	Cemetery	Church	Golf Course	Low Density Res	Open
1/16/08 0:00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
1/17/08 0:00	1.03	0.00	0.00	0.00	0.00	0.00	0.00
1/18/08 0:00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
1/19/08 0:00	0.94	0.00	0.00	0.00	0.00	0.00	0.00
1/22/08 0:00	0.1	0.00	0.00	0.00	0.00	0.00	0.00
1/23/08 0:00	1.43	0.00	0.00	0.00	0.00	0.00	0.00
1/26/08 0:00	0.14	0.00	0.00	0.00	0.00	0.00	0.00
1/27/08 0:00	0.14	0.00	0.00	0.00	0.00	0.00	0.00
2/6/08 0:00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
2/7/08 0:00	0.4	0.00	0.00	0.00	0.00	0.00	0.00
2/8/08 0:00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
2/12/08 0:00	0.39	0.00	0.00	0.00	0.00	0.00	0.00
2/13/08 14:47	0.01	0.00	0.00	0.00	0.00	0.00	0.00
2/18/08 14:46	0.03	0.00	0.00	0.00	0.00	0.00	0.00
2/19/08 9:53	0.11	0.00	0.00	0.00	0.00	0.00	0.00
2/21/08 8:46	0.12	0.00	0.00	0.00	0.00	0.00	0.00
2/21/08 17:17	0.3	0.00	0.00	0.00	0.00	0.00	0.00
2/23/08 10:45	0.43	0.00	0.00	0.00	0.00	0.00	0.00
2/26/08 18:09	0.26	0.00	0.00	0.00	0.00	0.00	0.00
2/26/08 23:25	0.55	0.00	0.00	0.00	0.00	0.00	0.00
2/29/08 7:35	0.01	0.00	0.00	0.00	0.00	0.00	0.00
3/4/08 16:53	0.02	0.00	0.00	0.00	0.00	0.00	0.00
3/5/08 6:01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
3/6/08 16:38	1.17	0.00	0.00	0.00	0.00	0.00	0.00
3/7/08 15:15	0.01	0.00	0.00	0.00	0.00	0.00	0.00
3/7/08 20:22	0.21	0.00	0.00	0.00	0.00	0.00	0.00
3/13/08 11:27	0.02	0.00	0.00	0.00	0.00	0.00	0.00
3/14/08 18:02	0.07	0.00	0.00	0.00	0.00	0.00	0.00
3/17/08 10:02	0.01	0.00	0.00	0.00	0.00	0.00	0.00
3/20/08 6:08	0.25	0.00	0.00	0.00	0.00	0.00	0.00
3/30/08 6:39	0.28	0.00	0.00	0.00	0.00	0.00	0.00
3/31/08 6:57	0.23	0.00	0.00	0.00	0.00	0.00	0.00
3/31/08 16:33	0.01	0.00	0.00	0.00	0.00	0.00	0.00
4/1/08 16:21	0.86	0.00	0.00	0.00	0.00	0.00	0.00
4/1/08 22:11	0.01	0.00	0.00	0.00	0.00	0.00	0.00
4/2/08 13:06	0.02	0.00	0.00	0.00	0.00	0.00	0.00
4/2/08 17:37	0.07	0.00	0.00	0.00	0.00	0.00	0.00
4/3/08 7:26	0.01	0.00	0.00	0.00	0.00	0.00	0.00
4/3/08 17:05	0.01	0.00	0.00	0.00	0.00	0.00	0.00
4/4/08 19:27	0.01	0.00	0.00	0.00	0.00	0.00	0.00
4/5/08 14:47	2.11	0.00	0.00	0.00	0.00	0.00	0.00
4/6/08 13:01	1.05	0.00	0.00	0.00	0.00	0.00	0.00
4/13/08 12:48	0.08	0.00	0.00	0.00	0.00	0.00	0.00

Generated Volume (ac-ft/yr)	0.00	0.00	0.00	0.00	0.00	0.00
Weighted Basin "C" Value	0.016	0.000	0.000	0.000	0.000	0.000

Dry	0.107	11.029	0.472	5.863	0.316	0.684
Percent Removal	0.95	0.95	0.95	0.95	0.95	0.95
Weighted Percent Removal	0.95	0.95	0.95	0.95	0.95	0.95
Volume Removed	0.00	0.00	0.00	0.00	0.00	0.00
Wet	0	0	0	0	0	0
Percent Removal	0.2	0.2	0.2	0.2	0.2	0.2
Weighted Percent Removal	0.0	0.0	0.0	0.0	0.0	0.0
Volume Removed	0.00	0.00	0.00	0.00	0.00	0.00

0.00	0.00	0.00	0.00	0.00	0.00
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**New York Avenue  
Appendix B**

Parameter	Basin 2								Basin 3
	Building	Cemetery	Church	Golf Course	Low Density Res	Medium Density Res	Open	Road	Medium Density Res
Total Area (ac)	0.615	2.709	5.175	0.976	0.703	17.600	2.850	3.511	9.171
DCIA (%)	32.0	0.0	62.0	0.0	0.0	44.0	0.0	49.0	22.0
non DCIA CN	52.0	40.2	57.6	39.0	44.3	87.5	39.0	40.2	56.4
S (in)	9.23	14.89	7.35	15.64	12.57	1.43	15.64	14.90	7.73

Rainfall Event Range (in)	Mean Rainfall Depth (in)	Basin 2								Basin 3
		Building	Cemetery	Church	Golf Course	Low Density Res	Medium Density Res	Open	Road	Medium Density Res
1/16/08 0:00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/17/08 0:00	1.03	0.02	0.00	0.25	0.00	0.00	0.81	0.00	0.13	0.16
1/18/08 0:00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/19/08 0:00	0.94	0.01	0.00	0.22	0.00	0.00	0.71	0.00	0.12	0.14
1/22/08 0:00	0.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/23/08 0:00	1.43	0.02	0.00	0.36	0.00	0.00	1.28	0.00	0.19	0.22
1/26/08 0:00	0.14	0.00	0.00	0.01	0.00	0.00	0.03	0.00	0.01	0.01
1/27/08 0:00	0.14	0.00	0.00	0.01	0.00	0.00	0.03	0.00	0.01	0.01
2/6/08 0:00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2/7/08 0:00	0.4	0.00	0.00	0.08	0.00	0.00	0.20	0.00	0.04	0.05
2/8/08 0:00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2/12/08 0:00	0.39	0.00	0.00	0.08	0.00	0.00	0.19	0.00	0.04	0.05
2/13/08 14:47	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2/18/08 14:46	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2/19/08 9:53	0.11	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
2/21/08 8:46	0.12	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00
2/21/08 17:17	0.3	0.00	0.00	0.05	0.00	0.00	0.13	0.00	0.03	0.03
2/23/08 10:45	0.43	0.01	0.00	0.09	0.00	0.00	0.22	0.00	0.05	0.06
2/26/08 18:09	0.26	0.00	0.00	0.04	0.00	0.00	0.10	0.00	0.02	0.03
2/26/08 23:25	0.55	0.01	0.00	0.12	0.00	0.00	0.32	0.00	0.06	0.08
2/29/08 7:35	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/4/08 16:53	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/5/08 6:01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/6/08 16:38	1.17	0.02	0.00	0.29	0.00	0.00	0.97	0.00	0.15	0.18
3/7/08 15:15	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/7/08 20:22	0.21	0.00	0.00	0.03	0.00	0.00	0.07	0.00	0.02	0.02
3/13/08 11:27	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/14/08 18:02	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/17/08 10:02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/20/08 6:08	0.25	0.00	0.00	0.04	0.00	0.00	0.10	0.00	0.02	0.03
3/30/08 6:39	0.28	0.00	0.00	0.05	0.00	0.00	0.12	0.00	0.03	0.03
3/31/08 6:57	0.23	0.00	0.00	0.03	0.00	0.00	0.08	0.00	0.02	0.02
3/31/08 16:33	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4/1/08 16:21	0.86	0.01	0.00	0.20	0.00	0.00	0.63	0.00	0.11	0.13
4/1/08 22:11	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4/2/08 13:06	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4/2/08 17:37	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4/3/08 7:26	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4/3/08 17:05	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4/4/08 19:27	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4/5/08 14:47	2.11	0.03	0.00	0.55	0.00	0.00	2.14	0.00	0.29	0.36
4/6/08 13:01	1.05	0.02	0.00	0.25	0.00	0.00	0.83	0.00	0.14	0.16
4/13/08 12:48	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Generated Volume (ac-ft/yr)	0.17	0.00	2.76	0.00	0.00	8.96	0.00	1.48	1.75
Weighted Basin "C" Value	0.255	0.000	0.495	0.000	0.000	0.472	0.000	0.390	0.177

Dry	0	0	0	0	0	0	0	0	9.171
Percent Removal	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Weighted Percent Removal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.80
Volume Removed	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.40
Wet	0	0	0	0	0	0	0	0	0
Percent Removal	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Weighted Percent Removal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Volume Removed	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

0.17	0.00	2.76	0.00	0.00	8.96	0.00	1.48	0.35
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Total	13.72
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Area (ac)	61.781
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## **APPENDIX C**

### **QA DATA**

### SAMPLE DUPLICATE RECOVERY (5% of all samples)

PARAMETERS	UNITS	SAMPLE ID	DATE ANALYZED	REPEAT 1	REPEAT 2	MEAN	s	% RELATIVE STD. DEVIATION (RSD)	RELATIVE % DEVIATION (RPD)	ACCEPTANCE RANGE (% RSD)	FLAG
pH	s.u.	08-0372	02/28/08	6.79	6.82	6.81	0.021	0.312	0.441	0-2	
pH	s.u.	08-0732	04/16/08	7.4	7.41	7.41	0.007	0.095	0.135	0-2	
Alkalinity	mg/l	08-0732	04/16/08	74.2	73.8	74.0	0.283	0.382	0.541	0-4	
Alkalinity	mg/l	08-0372	02/28/08	44.6	45	44.8	0.283	0.631	0.893	0-4	
Specific Conductivity	µmho/cm	08-0539	03/25/08	122	123	123	0.707	0.577	0.816	0-8	
Turbidity	mg/l	08-0372	02/28/08	56.8	56.4	56.6	0.283	0.500	0.707	0-2	
Turbidity	mg/l	08-0732	04/16/08	1.8	1.8	1.80	0.00	0.00	0.00	0-2	
TSS	mg/l	08-0372	02/28/08	131	133	132	1.41	1.07	1.52	0-5	
BOD <sub>5</sub>	mg/l	08-0458	03/13/08	0	0	0.00	0.00	0.00	0.00	0-20	
SRP	µg/l	08-0458	03/11/08	0	0	0	0.00	0.00	0.00	0-5	
NOX-N	µg/l	08-0458	03/11/08	0	0	0	0.00	0.00	0.00	0-4	
Ammonia	µg/l	08-0185	02/10/08	0	0	0	0.00	0.00	0.00	0-10	
Total N	µg/l	08-0658	04/14/08	807	804	806	2.12	0.263	0.372	0-10	
Total P	µg/l	08-0658	04/14/08	157	155	156	1.41	0.907	1.28	0-5	

### BLANK SPIKE RECOVERY STUDY (5% of all samples)

PARAMETERS	UNITS	DATE ANALYZED	INITIAL CONC.	INITIAL VOLUME (ml)	SPIKE CONC.	SPIKE VOLUME ADDED (ml)	FINAL CONC.	MEASURED CONC.	PERCENT RECOVERY	ACCEPTANCE RANGE	FLAG
TSS	mg/l	02/25/08	0	500	28.7	500	28.7	29.6	103%	91-105	
BOD <sub>5</sub>	mg/l	01/24/08	0.2	300	10000	6	200	198	98.9%	85-115	
SRP	µg/l	02/22/08	0	10	10000	0.250	250	248	99.2%	90-110	
NOX-N	µg/l	02/22/08	0	10	10000	0.250	250	260	104%	95-105	
Ammonia	µg/l	02/10/08	0	10	10000	0.400	400	438	110%	80-120	
Total N	µg/l	04/14/08	0	5	22600	0.500	2260	2277	101%	90-110	
Total P	µg/l	04/14/08	0	5	10000	0.500	1000	1005	101%	94-106	

**MATRIX SPIKE RECOVERY STUDY**  
(5% of all Samples)

PARAMETERS	UNITS	SAMPLE ID	DATE ANALYZED	INITIAL CONC.	INITIAL VOLUME (ml)	SPIKE CONC.	SPIKE VOLUME ADDED (ml)	FINAL CONC.	MEASURED CONC.	PERCENT RECOVERY	ACCEPTANCE RANGE	FLAG
TSS	mg/l	08-0359	02/25/08	19.4	500	28.7	500	48.1	48.7	101%	91-105	
BOD <sub>5</sub>	mg/l	08-0185	01/24/08	7.0	300	10000	6	207	203	98.1%	85-115	
SRP	µg/l	08-0359	02/22/08	183	10	10000	0.150	333	330	99.1%	90-110	
NOX-N	µg/l	08-0359	02/22/08	109	10	100000	0.150	1609	1600	99.4%	95-105	
Ammonia	µg/l	08-0185	02/10/08	10	10	100000	0.200	2010	2030	101%	80-120	
Total N	µg/l	08-0658	04/14/08	807	5	100000	0.200	4807	4554	94.7%	90-110	
Total P	µg/l	08-0658	04/14/08	157	5	10000	0.200	557	560	101%	94-106	

**RESULTS OF LABORATORY TESTS CONDUCTED  
ON FIELD CLEANED EQUIPMENT BLANKS  
COLLECTED FROM NEW YORK AVE**

Sample ID Number	Sample Description	Matrix	Site Location	Date Collected	Date Received	pH	s.u.	Alkalinity mg/l	Conductivity mmho/cm	BOD <sub>5</sub> mg/l	Turbidity NTU	TSS mg/L	NOX-N µg/l	SRP µg/l	Ammonia mg/l	Total N mg/l	Total P mg/l
184	New York Ave	BF	Inflow PCEB	01/23/08	01/23/08	5.71		1.0	2.1	<2.0	<0.1	<0.7	<5	<1	<5	<25	<1
458	New York Ave	BF	PCEB	03/10/08	03/10/08	5.15		0.6	2.1	<2.0	<0.1	<0.7	<5	<1	<5	<25	<1
657	New York Ave	BF	Site 1 PCEB	04/03/08	04/07/08	5.25		0.6	2.0	<2.0	<0.1	<0.7	<5	<1	<5	<25	<1