Evaluation of Structural Stormwater Treatment Units (SSTUs) in the Gainesville Urban Area 2012 - 2014

Alachua County Environmental Protection Department **July 2015**

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LIST OF ACRONYMS

ACEPD – Alachua County Environmental Protection Department

BMAP – Basin Management Action Plan

BMP – Best Management Practice

CDS – Continuous Deflection Separation

EPA – United States Environmental Protection Agency

ERP – Environmental Resource Permit

FDEP – Florida Department of Environmental Protection

HOG – Hogtown Creek

MST – Microbial Source Tracking

OFW – Outstanding Florida Water

TMDL – Total Maximum Daily Load

TN – Total Nitrogen

TP – Total Phosphorus

TSS – Total Suspended Solids

SSTU – Structural Stormwater Treatment Unit

SWB – Sweetwater Branch

VSS – Volatile Suspended Solids

ACKNOWLEDGEMENTS

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EXECUTIVE SUMMARY

Structural Stormwater Treatment Units (SSTUs), such as hydrodynamic separators or baffle boxes, are used to remove inorganic sediments and organic particulate matter from stormwater in urban settings where traditional stormwater treatment options, such as large stormwater ponds, are not feasible. These units are not designed specifically to remove fecal coliform bacteria; however, some bacteria attached to particulate matter may be removed. This evaluation focused on the potential for selected SSTUs to allow fecal coliform bacteria to persist and regrow within the units and degrade receiving water quality when effluent is discharged from the units. Three secondary objectives were (1) to compare the levels of fecal coliform bacteria in different types of SSTUs, (2) evaluate the concentrations of fecal coliform bacteria within different areas of the units and (3) to evaluate nutrient concentrations that pass through or are washed out of the units. Five SSTUs, sometimes referred to as structural Best Management Practices or BMPs, were evaluated in the Gainesville, Florida urban area in the Hogtown Creek and Sweetwater Branch watersheds. The five units included two Vortechs® stormwater treatment units, two Continuous Deflection Separation (CDS) systems and one baffle box. It is difficult to accurately estimate the removal efficiency of fecal coliform bacteria due to variations in antecedent conditions, rainfall frequency, intensity and duration, time of sample collection, and the limited number of samples.

The CDS system at NE 10th Avenue provides treatment solely for the main channel of Sweetwater Branch; all other units collect and treat stormwater runoff prior to discharging into the waterways. The samples collected within all the SSTUs on Sweetwater Branch were considerably higher than the samples collected within the creek. The average concentration of fecal coliform bacteria in samples collected in Hogtown Creek, downstream of the Vortechs® units, is more than double the upstream samples from the creek. The data indicate stormwater runoff and SSTU discharges may be contributing to the elevated bacteria levels commonly observed within both creeks. Results from effluent samples and samples in Hogtown Creek and Sweetwater branch main channels exceeded regulatory surface water quality standards for bacteria during several sampling events.

Due to sampling restrictions, inflow data was limited for the Vortechs® units and cannot be used to estimate treatment efficiency for the systems. Results for the two CDS units indicate 33% - 58% removal of fecal coliform bacteria. The highest bacteria levels on Sweetwater Branch were found in the baffle box and the unit does not appear to be providing treatment for urban stormwater runoff captured by the system. The results for samples collected during or following storm events were considerably higher than baseflow samples and elevated bacteria levels were found in all sediment samples. During some sampling events, the units discharged higher concentrations of bacteria and nutrients than entered the units, indicating scour or washout from the units was occurring. Bacteria may collect, persist, and multiply (regrow) within the SSTU chambers. These bacterial populations may be re-suspended from the sediments during storm events, increasing the loading on the units and decreasing the removal efficiency.

Routine inspection and maintenance of SSTUs is necessary to ensure they function as designed and remove sediments laden with fecal coliform bacteria and nutrients. Treatment effectiveness is influenced by watershed hydrology, unit scour, and environmental conditions within the units. Re-evaluating maintenance practices and increasing maintenance frequency should improve pollutant load

removal and effluent water quality. Maintenance should be scheduled based on the manufacturer's recommendations, the unit's storage capacity, contributing area size and hydrology, rainfall intensity and duration (summer rainy season and winter cold fronts), and seasonal leaf fall that can add considerable amounts of organic matter to the systems in the late fall and spring. The warm dark environment may promote persistence and regrowth of fecal coliform bacteria and release of phosphorus from organic matter and leaves. Routine maintenance removes particulate matter, reducing the potential for discharge of bacteria and nutrients. An optimized maintenance plan for each unit should be developed based on an expanded inspection and maintenance program.

1.0 BACKGROUND

Urban development throughout the country consists primarily of land use changes that increase impervious areas and stormwater runoff. Rainfall is conveyed by impervious surfaces, collecting and discharging pollutants into receiving waterbodies. Prior to environmental regulations adopted in the late 1970s, stormwater systems were designed solely to prevent flooding in urban areas. Environmental impacts, caused by directly discharging untreated stormwater runoff into natural surface waters, were not considered in design standards. These sources of non-point source pollution have contributed to the numerous waterbodies currently classified as impaired due to elevated levels of nutrients, bacteria, and other pollutants.

Historically, fecal coliform bacteria, a microbial indicator of human and warm-blooded animal fecal pollution, have exceeded state water quality standards in Gainesville's urban creeks (ACEPD, 2008). The Florida Department of Environmental Protection (FDEP) established Total Maximum Daily Loads (TMDLs) and adopted a Basin Management Action Plan (BMAP) for fecal coliform in Hogtown Creek, Sweetwater Branch, and Tumblin Creek (FDEP, 2008). In addition, Hatchet Creek, Little Hatchet Creek, and Possum Creek are designated as impaired for fecal coliform (FDEP, 2009).

Alachua County Environmental Protection Department (ACEPD) routinely monitors nutrients and fecal coliform bacteria levels in Gainesville's urban creeks. Fecal coliform concentrations vary widely in Alachua County's waters depending on hydrologic conditions, with baseflow levels typically being one or more orders of magnitude lower than samples collected under storm flow conditions (ACEPD, 2008). Results of ambient fecal coliform monitoring, microbial sources tracking (MST), and alternative bacteriological monitoring conducted to evaluate elevated fecal coliform bacteria, indicate that stormwater inputs, that can transport waste from domestic animals, humans, and wildlife, are one of the potential sources of fecal coliform bacteria found in the urban streams.

Stormwater treatment in Florida's urban areas is commonly achieved with large basins and ponds that utilize gravitational settling for removal of particulate matter and pollutants. In locations where a smaller footprint is needed, Structural Stormwater Treatment Units (SSTUs), such as hydrodynamic separators or baffle boxes, may be selected as best management practices (BMPs). The units collect sediments and organic matter found in stormwater, reducing the discharge of these materials to natural surface waters. However, they are not designed to remove fecal coliform bacteria, typically do not support removal of fine particulate matter, and also generate high flow rates through the units that can increase scour and washout (Romah, 2005; Kim and Sansalone, 2008; Berretta et al., 2011; Arias et al., 2013). The sediments in SSTUs have been found to contain bacteria and nutrients (Barbaro and Kurison, 2005; Romah, 2005; Zhang and Lulla, 2006; Berretta et al., 2011). Proper maintenance is required to remove sediments and reduce pollutant loading to creeks and other water bodies (Berretta et al., 2011).

SSTUs may partially remove fecal coliform bacteria, primarily those adsorbed to sediments, not free-floating or "planktonic" bacteria; however, elevated effluent concentrations that exceed water quality standards may be observed. Characklis et al. (2005) found that 30-50% of fecal coliform bacteria; *Escherichia coli* (*E. coli)* and enterococci were associated with particles in stormwater samples under peak flow conditions, when compared to 20-35% under baseflow conditions. Treatment efficiency is controlled by particle size distribution and flow rate; and the removal of dissolved and suspended materials can be limited (Romah, 2005; Berretta et al., 2011). In addition, concentrations within the sumps may be higher than inflow concentrations. This indicates that bacteria may be re-suspended from the sediments, increasing the loading on the units and decreasing the removal efficiency. Stormwater collection system sediments and fluvial sediments commonly harbor elevated concentrations of fecal coliform bacteria and under ambient conditions the bacteria can persist and regrow, greatly increasing their numbers (Marino and Gannon, 1991; Anderson et al., 2005; Cinotto, 2005; Characklis et al., 2005).

Stormwater runoff and secondary growth or regrowth of fecal coliform bacteria within the stormwater systems have been identified as potential sources of the elevated bacteria levels found in Gainesville's urban creeks (ACEPD, 2008). The absence of light and the high availability of nutrients present in the sediments and water column within the SSTUs can promote bacterial growth. In addition, nutrients, especially phosphorus, may be released from the sediments under anoxic conditions causing increased nutrient loading to surface waters (Kim and Sansalone, 2008; Berretta et al., 2011). The presence of fecal coliform bacteria in stormwater treatment unit sediments is a complex function of adsorption to particles, environmental conditions (within the unit), persistence, in-situ regrowth, aggregation, development of biofilms, predation (by other microorganisms), nutrient availability, and sediment particle size and composition (Marino and Gannon, 1991; Potera, 1998; Anderson et al., 2005; Cinotto, 2005; Characklis et al., 2005; Zhang and Lulla, 2006; Kim and Sansalone, 2008).

A properly designed SSTU incorporates the surrounding land use and catchment area into the selection of type and size of unit. Routine inspection and maintenance of SSTUs are required to ensure the system continues to function as designed (Berretta et al., 2011). The removal efficiency decreases as sediments are collected in the units. Maintenance schedules are site specific as sediment loads increase in the presence of unstable soils, construction activities, increased flow rates, tree canopy leaf drop, and rainfall event frequency, duration and intensity. Routine maintenance prevents the accumulation of materials within SSTU chambers and development of conditions that promote bacterial growth and phosphorus release (Kim and Sansalone, 2008). Street sweeping activities may decrease the frequency of required maintenance and is the most cost effective BMP for sediment removal (Raje et al., 2013).

2.0 OBJECTIVE

The primary goal of this study was to assess the propensity of Structural Stormwater Treatment Units (SSTUs) to collect, promote growth (regrowth), and release elevated levels of fecal coliform bacteria into the Gainesville urban creeks. This evaluation complements the work completed for the Florida Stormwater Association (Berretta et al., 2011) and provides additional information to determine the required maintenance frequency for the SSTUs included in this study. Sweetwater Branch and Hogtown Creek have fecal coliform reduction goals established as part of the Orange Creek Basin Management Action Plan (BMAP) (FDEP, 2008). Eliminating or reducing sources of fecal coliform bacteria in these watersheds is required to meet the pollutant load reduction goals based on the Total Maximum Daily Loads (TDMLs) established by Florida Department of Environmental Protection (FDEP). Secondary objectives of this study were to (1) compare fecal coliform levels in different types of SSTUs, (2) evaluate fecal coliform levels through the system (e.g., influent, sump, and effluent) to estimate fecal coliform removal or loading, and (3) evaluate the concentrations of Total Nitrogen (TN), Total Phosphorus (TP), and Total Suspended Solids (TSS) that pass through or are washed out of the units during storm events.

3.0 METHODOLOGY

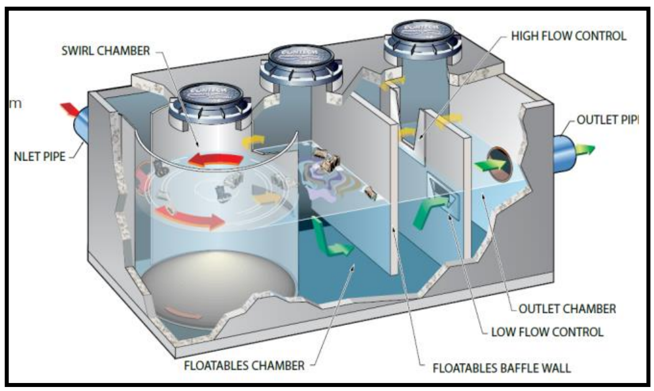
3.1 Structural Stormwater Treatment Unit (SSTU) Selection

Five SSTUs, two on Hogtown Creek and three on Sweetwater Branch, were selected for sampling as part of this investigation (Table 1, Figure 1). Three types of SSTUs were sampled as part of this project, two Vortechs® models, two Continuous Deflection Separation (CDS) systems, and one baffle box. These units were installed between 1996 and 2002. Appendix A includes photographs of the SSTUs and sample collection. The section below includes simplified basic diagrams of each type of unit in cross-section; available plan detail sheets are provided in Appendix B. A description of each sample location is included in Appendix C.

Types of SSTUs

Vortechs®

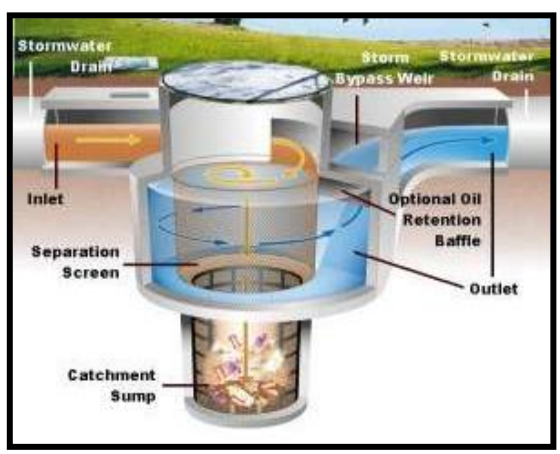
Two types of Vortechs® stormwater treatment units, 3000 and 11000 models, are located adjacent to Hogtown Creek on NW 29th Road. Vortechs® models are precast concrete structures with a swirl chamber, a floatables (oil) chamber, and a flow control chamber.



The first chamber features an angled inlet creating a circular pattern of flow (or vortex) which allows for the gravitational separation of sediments and enhances removal of very fine particulates from the water. Floatables, such as hydrocarbons and debris, are retained in a second chamber as water passes underneath a vertical wall extending from the top of the unit. Multiple flow controls reduce velocity and increase residence time and treatment efficiency.

Continuous Deflection Separation (CDS) System

Continuous Deflection Separation (CDS) systems also separate sediments by creating a circular pattern of flow (or vortex) through the center of the structure, the separation chamber. Typically stormwater enters the unit's separation chamber and is channeled through the center, the vortex directs floatables and suspended solids to the center and down, while the effluent flows through a separation screen and discharges from the structure.



Baffle Boxes

Baffle boxes are designed to impede the movement of stormwater, increasing retention time and promoting gravitational settling of sediments, before effluent is discharged. They are typically constructed in a series of consecutive chambers with vertical baffle walls and skimmers that control flow through the system, collecting both sediments and floatables prior to releasing effluent to the receiving waterbody.

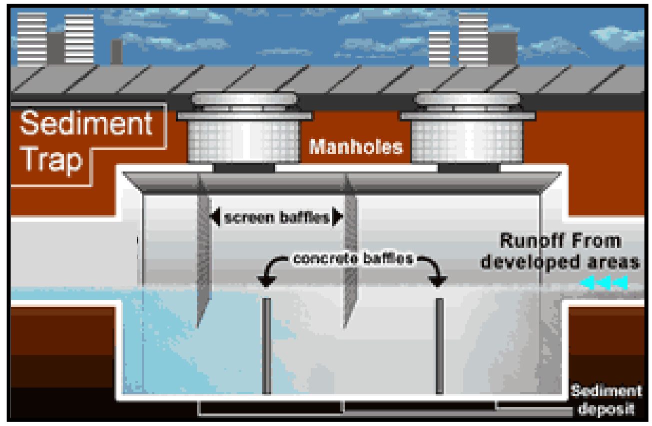


Table 1. Description of Structural Stormwater Treatment Units (SSTUs)

Site ID	SSTU Type	Location	Cell Size and Type	Contributing Source
HOG29-W	Vortechs® 11000	NW 29th Road, west of US 441 (west side of Hogtown Creek)	10' round x 7'D Swirl Chamber	Runoff
HOG29-E	Vortechs® 3000	NW 29th Road, west of US 441 (east side of Hogtown Creek)	5' round x 7'D Swirl Chamber	Runoff
SWB10	CDS PSW70_70	NE 10th Avenue, east of Main Street (north side of Sweetwater Branch)	20' W x 3'8”D Diversion Weir	Sweetwater Branch
			6' round x 13’6”'D Separation Chamber	Sweetwater Branch
SWB8	CDS PSW 50_50R	NE Boulevard & NE 8th Avenue (southwest side of Sweetwater Branch)	5' round x 10’4” D Separation Chamber	Runoff
SWB1	Three-Chamber Baffle Box	SE 1st Avenue (west side of Sweetwater Branch, east of the Public Library)	6’ W x 5'L x 8'D Individual Chambers	Runoff

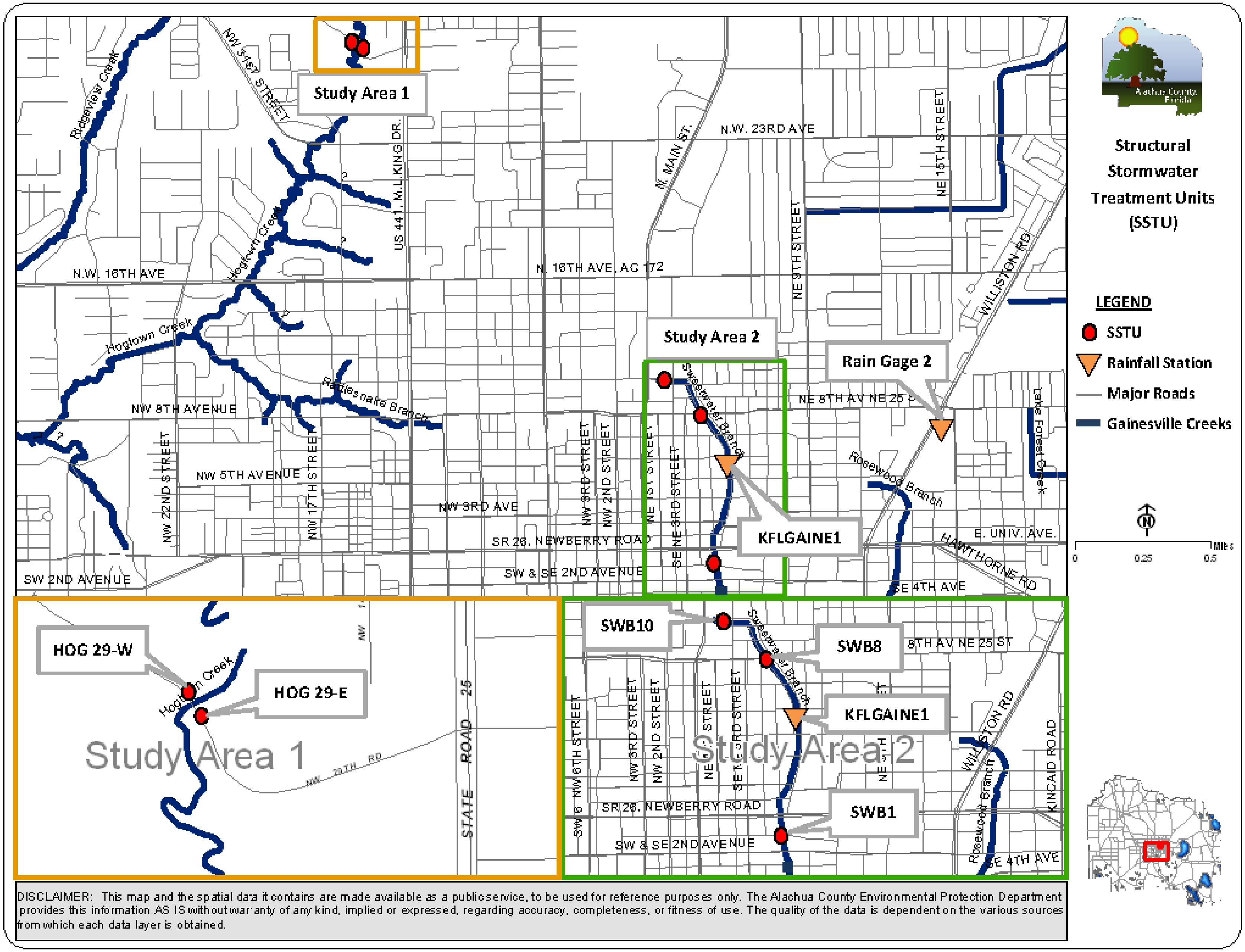


Figure 1. Location of Structural Stormwater Treatment Units (SSTUs) and Rainfall Stations

Sample Locations

Hogtown Creek Watershed

Hogtown Creek has a larger watershed and greater flow volume than Sweetwater Branch (ACEPD, 2007). It is considered to be a fluvial system with a naturally high sediment load. Additionally, relatively high relief in the watershed and the lack of upper basin storage (in terms of stormwater volume detention/retention) contribute to in-stream sediment erosion and deposition. Hogtown Creek has many tributaries and ultimately it recharges the Floridan aquifer system via Haile Sink. Two different SSTU models are installed along NW 29th Road to treat stormwater runoff prior to discharge to Hogtown Creek (Figures 2 and 3). In general, NW 29th Road is considered an east-west roadway; both SSTUs are installed on the north side of the roadway. A Vortechs® 11000 unit is installed on the west side of the creek (HOG29-W) and a Vortechs® 3000 unit is on the east side of the creek (HOG29-E).

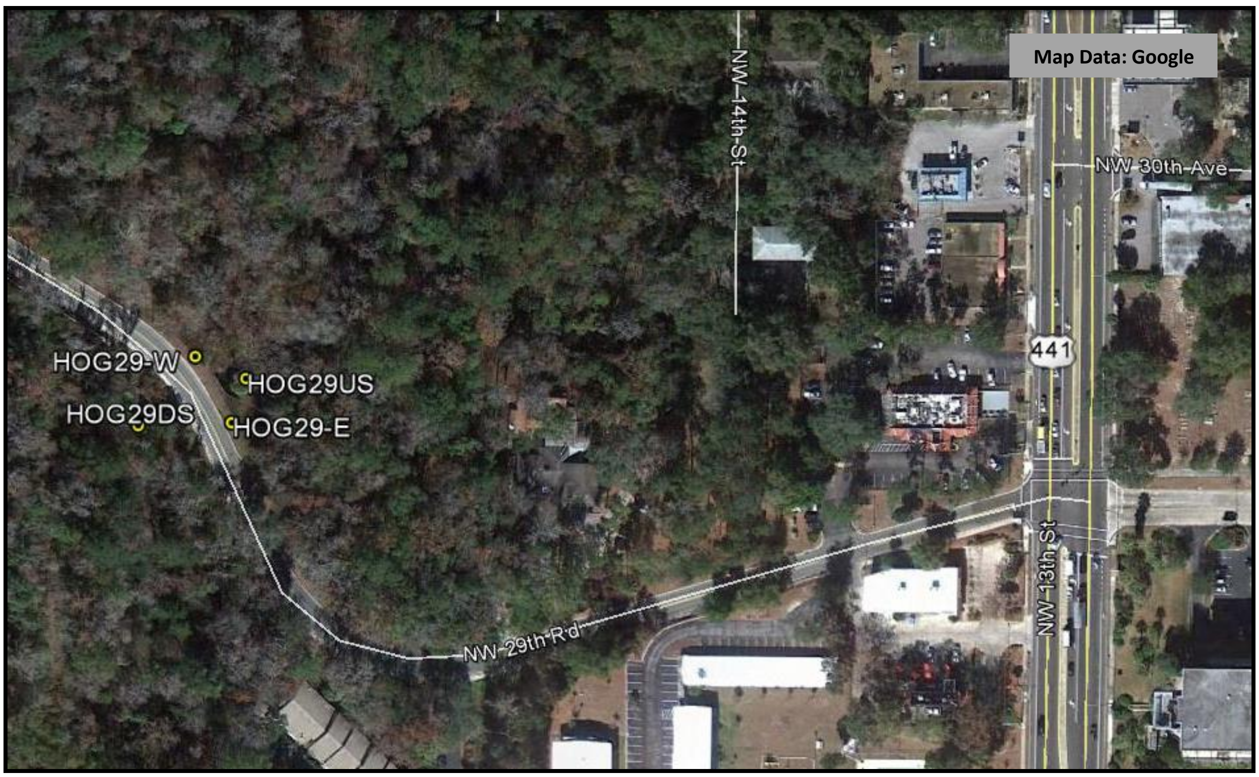


Figure 2. Location of SSTUs and surface water monitoring stations on Hogtown Creek at NW 29th Road

These Vortechs® units are not installed directly in the flow of Hogtown Creek; they are used to prevent untreated stormwater runoff from discharging into the creek directly from the roadway. Continuous inflow (likely groundwater from the surficial aquifer system) and outflow was observed at HOG29-W; however, continuous flows were not observed at HOG29-E during all sampling events. There are several blind curves along the roadway near the units making it difficult to collect influent samples, due to potential safety hazards and cars passing by.

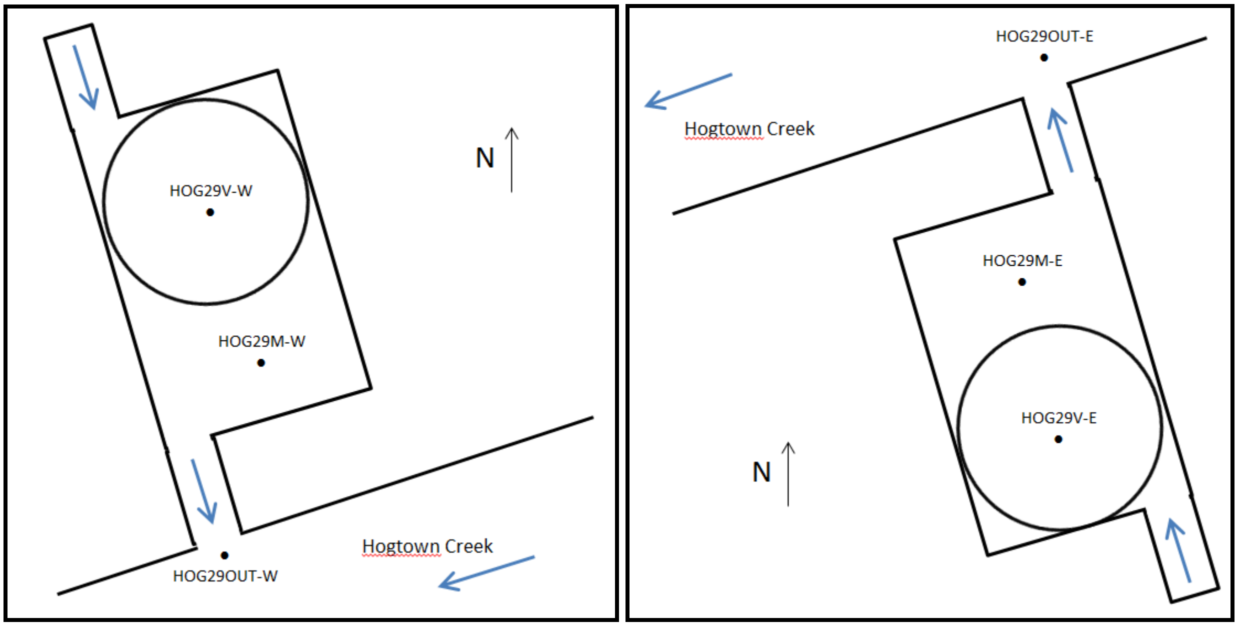


Figure 3. Diagram of Sampling Locations for the Vortechs® 11000 unit installed at HOG29-W and the Vortechs® 3000 unit installed at HOG29-E on Hogtown Creek at NW 29th Road

Sweetwater Branch Watershed

Sweetwater Branch is small and the upper watershed is a low flow system during baseflow conditions. Three SSTUs were evaluated in the Sweetwater Branch watershed (Figure 1). The headwaters of Sweetwater Branch include ditched tributaries and underground culverts north of NW 16th Avenue (ACEPD, 2007). Downstream of NW 16th Avenue, the creek is piped underground to the south until it resurfaces at NE 10th Avenue through a diversion weir box into a Continuous Deflection Separation (CDS) system (Figures 4 and 5). Sweetwater Branch continues to flow through the historic Duckpond area where a CDS system, at NE 8th Avenue and NE Boulevard, treats stormwater runoff from a small residential area (Figures 6 and 7). Downstream, the creek passes through downtown Gainesville; east of the Alachua County Public Library near SE 1st Avenue, stormwater from a small section of the nearby urban area is routed through a three-chamber baffle box prior to discharge into the creek (Figures 8 and 9). During the time of sample collection, Sweetwater Branch ultimately recharged the Floridan aquifer system via Alachua Sink, after flowing through Paynes Prairie Preserve State Park, an Outstanding Florida Water (OFW). Currently Sweetwater Branch flows south passing under SR331 (Williston Road) to a recently constructed wetland and sheetflow restoration area in Paynes Prairie Preserve State Park; a direct connection to the Floridan aquifer system no longer exists.

Figure 4. Location of CDS Unit and surface water monitoring stations on Sweetwater Branch at NE 10th Avenue

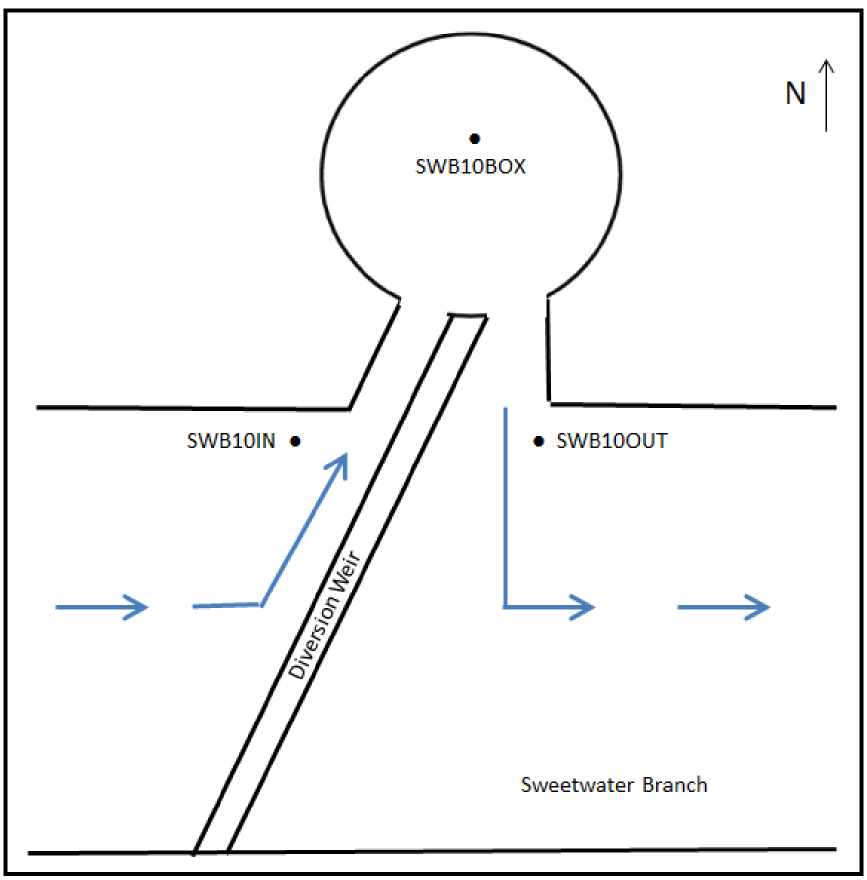


Figure 5. Diagram of Sampling Locations for the CDS Unit installed on Sweetwater Branch at NE 10th Avenue

Figure 6. Location of CDS Unit and surface water monitoring site on Sweetwater Branch at NE 8th Avenue

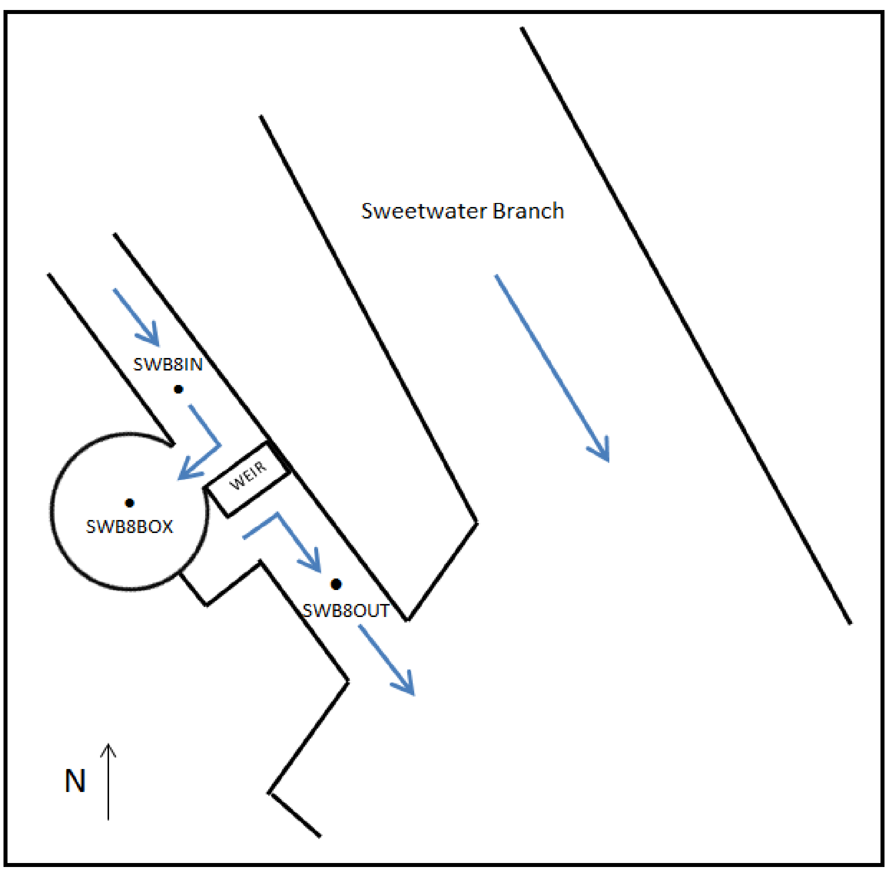


Figure 7. Diagram of Sampling Locations for the CDS Unit installed on Sweetwater Branch at NE 8th Avenue

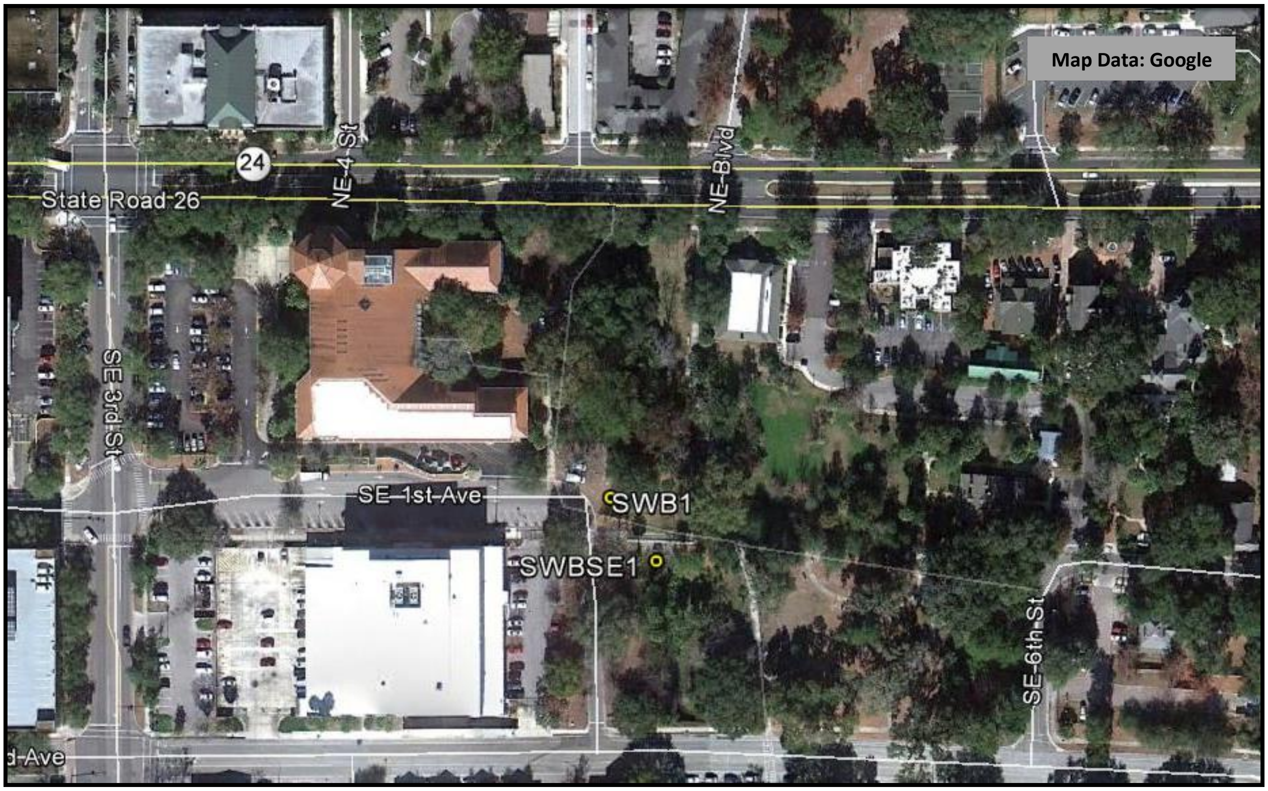


Figure 8. Location of Baffle Box and surface water monitoring site on Sweetwater Branch at SE 1st Avenue

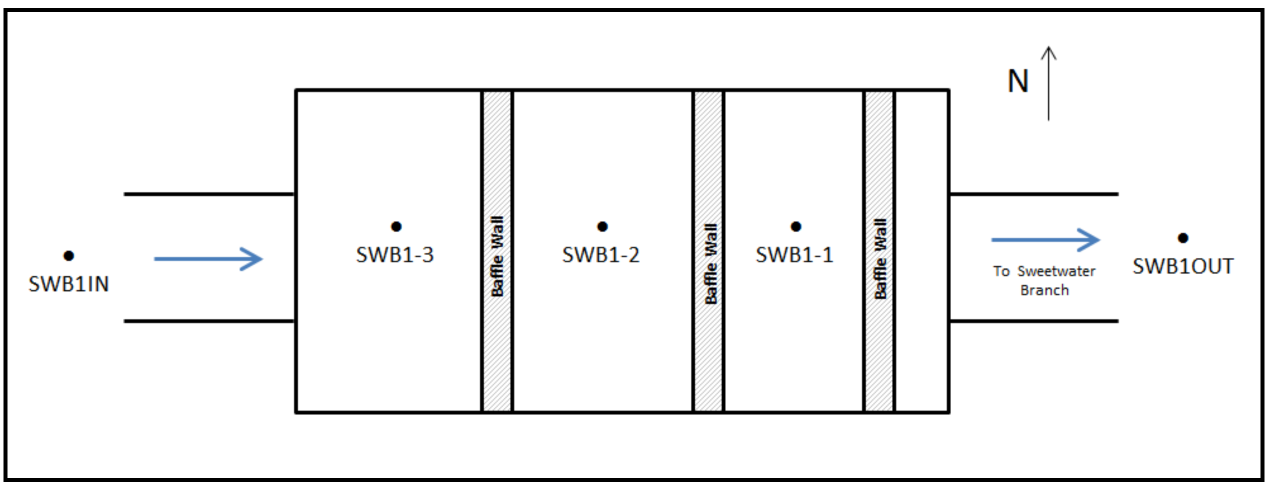


Figure 9. Diagram of Sampling Locations for the Baffle Box installed on Sweetwater Branch at SE 1st Avenue

3.2 Sampling Methods and Constituents

Water quality samples were collected from each chamber of the selected SSTUs, as conditions allowed, and analyzed for fecal coliform bacteria. Selected sampling events included analysis of nutrients and inorganic indicators, in addition to fecal coliform bacteria. Sampling locations are shown in Figures 2 through 9 and described in Appendix C. When feasible, sampling included influent and effluent grab samples at each SSTU and samples collected in the receiving waterbody upstream and downstream of the SSTU discharge. Influent and effluent sample collection was not always possible under baseflow conditions. A grab pole was used to collect water samples as needed. Where a grab pole was used for water sampling, an intermediate container (the container for the unpreserved sample fraction) was used as a transfer device for filling the remaining sample containers, except those for fecal coliform analyses. Fecal coliform samples were collected directly, with or without a grab pole into Whirl-paks® or other sterile containers. Sediment samples were collected near the surface of the sediment layer using a Petite Ponar grab sampler and analyzed for fecal coliform bacteria. These results may not be representative of the entire thickness when the sediment is greater than one foot in depth. Weather conditions and flow observations were recorded during sample collection. Samples were immediately placed on wet ice after collection and hand delivered for laboratory analyses. All laboratory analyses were performed by Advanced Environmental Laboratories, Inc. (AEL) in Gainesville, Florida (Table 2). Maintenance data was obtained from the City of Gainesville Public Works Department.

Table 2. Summary of Analytical Methods and Method Detection Limits

Constituent	Analytical Method	Sample Matrix	Method Description	Method Detection Limit (MDL)*
Fecal Coliform	SM 9222D	Water	Membrane Filtration	10 CFU/100mL
Fecal Coliform	SM 9222D	Sediment	Membrane Filtration	160 Col/dry g
Total Nitrogen	Calculation	Water	TN = TKN +NO3 +NO2	0.004 mg/L
Total Kjeldahl Nitrogen	EPA 351.2	Water	Colorimetric Method	0.050 mg/L
Nitrate + Nitrite	SM 4500NO3-F	Water	Colorimetric Method	0.004 mg/L
Ammonia Nitrogen	EPA 350.1	Water	Colorimetric Method	0.01 mg/L
Total Phosphorus	EPA 365.3	Water	Colorimetric Method	0.002 mg/L
Potassium	SW-846 610	Water	Inductively Coupled Plasma	0.015 mg/L
Total Suspended Solids (TSS)	SM 2540D	Water	Filtration	2.0 mg/L
Volatile Suspended Solids (VSS)	SM 2540E	Water	Filtration	2.0 mg/L

*Method detection limits (MDL) are adjusted when dilutions are made; AEL reports MDLs with every analysis.

4.0 RESULTS AND DISCUSSION

4.1 Climate Conditions and Sampling Events

Fifteen water quality sampling events were conducted at the selected Structural Stormwater Treatment Unit (SSTU) sites along Hogtown Creek and Sweetwater Branch between June 2012 and October 2013 (Appendix D). Several preliminary samples were analyzed to provide an overview of fecal coliform bacteria levels within the systems. Comprehensive sampling events were utilized to further evaluate the SSTUs, including storm event sampling, analyses for nitrogen, phosphorus, and inorganic indicators, and collecting pre-storm event sediment samples for fecal coliform bacteria analysis (Table 3).

Table 3. Description of Selected Sampling Events

Sample Date	Sample Type	Rainfall on Sample Date[1] (in.)	Antecedent Rainfall[2] (in.)	SSTUs Sampled		Water Quality Analyses Conducted
12/10/12	Storm Event	0.63/0.66	0.63/0.66	HOG29-W HOG29-E	---	Nutrients, Potassium, TSS, VSS, Fecal Coliform
12/12/12	Storm Event	1.01/1.84	3.95/6.90	HOG29-W HOG29-E	---	Nutrients, Potassium, TSS, VSS, Fecal Coliform
6/4/13	Storm Event	0.01/0.25	0.48/1.14	---	SWB1	Nutrients, TSS, VSS, Fecal Coliform
6/5/13[3]	Storm Event	0.02/0.39	0.52/2.12	---	SWB8 SWB1	Nutrients, TSS, VSS, Fecal Coliform
8/5/13[3]	Wet Season Baseflow	0.01/0.00	2.92/4.68	HOG29-W HOG29-E	SWB10 SWB8 SWB1	Fecal Coliform
8/16/13	Storm Event	0.85/0.77	0.85/1.05	---	SWB1	Nutrients, TSS, VSS, Fecal Coliform
10/22/13	Storm Event	0.08/0.11	0.09/0.11	---	SWB8	Nutrients, TSS, VSS, Fecal Coliform

1. Rainfall reported for two stations: Hydrologic Data Collection, Inc. Station (Rain Gage 2)/ Weather Underground Station at the Duckpond (KFLGAINE1). Does not include rainfall recorded after sample collection.
2. Total rainfall recorded 7 days prior to sample collection. See Appendix E for Total Daily Rainfall Values.
3. Sediment samples collected for fecal coliform analysis; see Section 4.2 for details.

Rainfall can vary significantly with geographic location within a watershed as shown in Table 3. The primary source of rainfall data was ACEPD Rain Gage 2, located in the eastern part of the Sweetwater Branch watershed at NE 8th Avenue and Waldo Road (Figure 1). This station is located approximately 1.0 mile from the SSTUs on Sweetwater Branch and 2.0 miles from the units on Hogtown Creek. Additional rainfall data from a weather station located in the Duckpond Neighborhood is also included and appears to more accurately represent the storm events sampled on June 4 and 5, 2013.

4.2 Sediment Depth Measurements and Sediment Quality

Sediment samples were collected near the surface of the sediment layer using a Petite Ponar sampler and analyzed for fecal coliform bacteria (Appendix A, Figure A-5). Elevated levels of fecal coliform bacteria were found in sediment samples collected from several of the SSTU chambers (Table 4). Sediment accumulation and composition varied among the units and within the individual chambers of each unit. These results may not be representative of the entire thickness when the sediment is greater than one foot in depth. The chambers generally had trash (floating debris) on top of the sediments making sample collection, sediment thickness measurements, and successful recovery of the samples difficult. Most of the sediment sampled in the units was organic particulate matter or detritus. In Table 4, the term gravel includes granular materials consisting of coarse sand and small pieces of asphalt or concrete, likely from construction activities or roadwork within the watersheds, and the term organics refers to particulate matter comprised of decaying leaves and other vegetative detritus. The availability of nitrogen, phosphorus, and carbon combined with the warm dark moist environment likely promotes and sustains bacterial growth in the sediments within the SSTU chambers (Marino and Gannon, 1991). Pre-storm event samples were collected in 2013 and pre-maintenance samples were collected in 2014. The sediment data is only representative of the conditions present at the time of sampling; however, there were no indications during field sample collection that these results are atypical.

Table 4. Fecal Coliform Bacteria Results for Sediment Samples

Sample ID	Location	Date	Sediment Thickness (ft)	Sediment Description	Fecal Coliform (Col/dry g)
HOG29V-W	Vortex Chamber	8/5/13	1.0	Organics, gravel	21,000
		6/25/14	> 1.0	Leaf pack	111,000 **B,I**
HOG29V-E	Vortex Chamber	8/5/13	<1.0	Organics, gravel	1,300
		6/25/14	> 2.5	Organics	6,150
SWB10BOX	CDS Chamber	8/5/13	4.9	Organic leaf pack	637
		6/25/14	> 3.0	Organics	42,100
SWB8BOX	CDS Chamber	6/5/13	3.0	Mostly leaf pack	36,000
		8/5/13	>10	Leafy organics	1,000
		6/25/14	> 3.0	Mostly leaf pack	13,200
SWB1-3	First Chamber	8/5/13	0.2	Organics, gravel	270
		6/25/14	0.4	Leaf pack, some gravel/sand	6,890
SWB1-2	Second Chamber	6/5/13	0.2	Mostly leaf pack	17,100
		6/25/14	0.04	Leaf pack, organics	7,600
SWB1-1	Third Chamber	6/5/13	0.7	Sand/gravel with leaves	7,610

Gravel includes granular materials (coarse sand and small pieces of asphalt/concrete).

Organics refers to particulate matter comprised of decaying leaves and other vegetative detritus.

B = Results based upon colony counts outside the acceptable range.

I = The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.

4.3 Fecal Coliform Bacteria Results and Discussion

Under storm flow conditions, fecal coliform levels can be several orders of magnitude higher than those found under baseflow conditions. The geometric mean is frequently used to compare and analyze data that varies over several orders of magnitude; it is a better measure of central tendency because, unlike the arithmetic mean, the effects of very high or low values are reduced. In most instances, the concentration of fecal coliform bacteria in samples collected at each location within the systems exceeded regulatory standards. See Appendix F for detailed fecal coliform bacteria results.

Hogtown Creek Watershed

Water samples were collected from each chamber of the Vortechs® units, as conditions allowed, and analyzed for fecal coliform bacteria (Table 5 and Figure 10). When feasible, influent and effluent samples were collected for each unit, and upstream and downstream samples were collected from Hogtown Creek. Influent sample collection was limited by weather conditions and potential safety hazards, due to vehicle traffic and several blind curves along the roadway near the SSTU inlets. Accumulation of sediment, debris, and trash inhibited collection of samples from HOG29V-E on December 12, 2012. Continuous outflow was not observed at HOG29-E during baseflow sampling.

Table 5. Summary of Fecal Coliform Bacteria Results for Hogtown Creek

Sample Site	Location	Fecal Coliform (CFU/100mL)			
		Count	Minimum	Maximum	Geometric Mean
HOG29US	Hogtown Creek Upstream	6	50 **U**	15,400	1,224
HOG29V-W	Vortex Chamber	8	108	25,000	1,811
HOG29M-W	Main Chamber	7	200	32,000	2,055
HOG29OUT-W	Unit Effluent	8	38	28,400	1,453
HOG29V-E	Vortex Chamber	7	702	60,000 **Z**	10,891
HOG29M-E	Main Chamber	7	200	60,000 **Z**	5,206
HOG29OUT-E	Unit Effluent	4	4,000	40,000	11,870
HOG29DS	Hogtown Creek Downstream	4	1,070	15,000	3,125

U = The compound was analyzed for but not detected.

Z = Confluent growth/Too numerous to count.

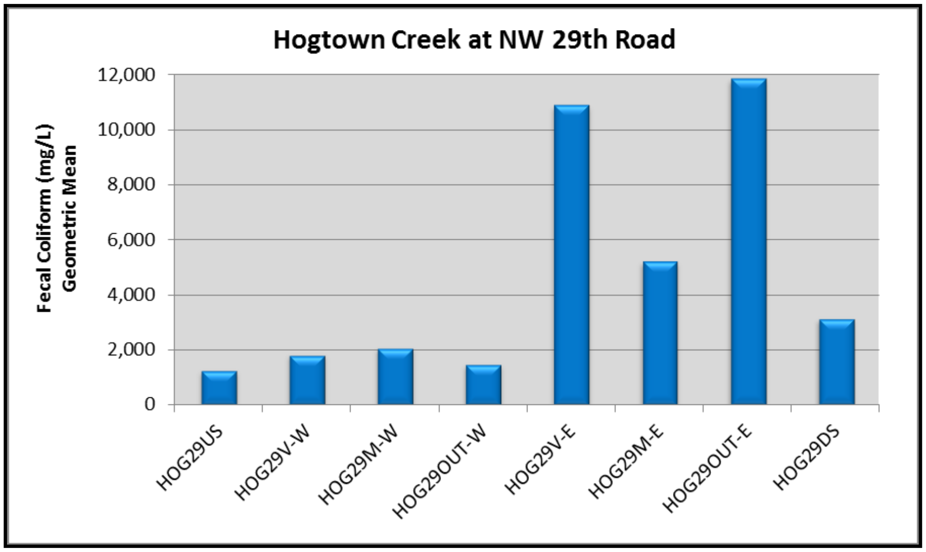


Figure 10. Geometric Mean Values for Fecal Coliform Bacteria Results for Hogtown Creek at NW 29th Road

The geometric mean of fecal coliform bacteria samples collected in Hogtown Creek, downstream of the discharges from the Vortechs® units, is more than double the results for upstream samples, indicating stormwater runoff and SSTU discharges may be contributing to the elevated bacteria levels within Hogtown Creek. The water samples collected from the Vortex and Main chambers resulted in many of the highest bacteria levels found in the Vortechs® systems. One influent sample was collected from HOG29-W on December 12, 2012. The influent sample result was a considerably low value of 95 CFU/100mL, possibly diluted by heavy rainfall that occurred on December 10, 2012; the corresponding results from the unit chambers and effluent ranged from 2,800 to 5,200 CFU/100mL. In addition, the sediment sample results from the Vortex chambers were elevated, ranging between 1,300 and 111,000Col/dry g. This indicates that bacteria may be collected, persist, and regrow within the chambers and possibly re-suspended from the sediments, increasing the loading on the units and decreasing the removal efficiency (Marino and Gannon, 1991; Anderson et al., 2005).

Specific rain events were not selected for storm event monitoring on Hogtown Creek; however, samples collected during or following rain events generally resulted in higher bacteria levels than samples collected during baseflow conditions. Due to variations in antecedent conditions, rainfall quantity, intensity and duration, and timing of sample collection it is difficult to determine if the Vortechs® units provide effective treatment and bacteria removal during high flow events. Bacteria not adsorbed to heavier particulates have a slower settling rate than gravel, sand, or silt and can be more easily transported through the units with water flow (Romah, 2005). Bacteria may also be re-suspended from the sediments, increasing the loading on the units and decreasing the removal efficiency (Zhang and Lulla, 2006). In addition, without proper maintenance high flow events may increase scour and washout the unit resulting in increased pollutant loading to Hogtown Creek during storm events (Berretta et al., 2011).

Sweetwater Branch Watershed

Water samples were collected from the inflow, separation chamber, and outflow of the Continuous Deflection Separation (CDS) systems, as conditions allowed, and analyzed for fecal coliform bacteria (Table 6, Figures 11 and 12). Samples were also collected from the inflow, each of the three chambers, and outflow of the baffle box. When feasible, upstream or downstream samples were collected from Sweetwater Branch. Accumulation of sediment, debris, and trash occasionally inhibited collection of samples from the separation chambers. Under baseflow conditions, continuous outflow from all units was not observed. The geometric means of samples collected within the SSTUs are considerably higher than geometric means of the fecal coliform bacteria samples collected within Sweetwater Branch, indicating stormwater runoff and SSTU discharges may be contributing to the elevated bacteria levels commonly observed within the creek. The geometric mean of the outflow samples was lower than the inflow samples for the two CDS units, indicating partial removal of fecal coliform bacteria at these locations (Figure 11 and 12). However, the effluent bacteria results from several events continued to exceed regulatory surface water quality standards (FDEP, 2010).

Table 6. Summary of Fecal Coliform Bacteria Results for Sweetwater Branch

Sample Site	Location	Fecal Coliform (CFU/100mL)			
		Count	Minimum	Maximum	Geometric Mean
SWB10IN	Unit Influent	7	380	37,800 **J4**	2,339
SW10BOX	CDS Chamber	7	380	12,000 **Z**	2,749
SWB10OUT	Unit Effluent	7	240	5,000	1,567
SWBNE10	Sweetwater Branch Downstream	2	76	1,550	522
SWBNE8	Sweetwater Branch Upstream	2	144	2,000	537
SWB8IN	Unit Influent	10	320	56,000	8,425
SWB8BOX	CDS Chamber	8	1,120 **J4**	60,800 **J4**	5,475
SWB8OUT	Unit Effluent	10	120 **Z**	19,000	3,682
SWB1IN	Unit Influent	7	2,500	60,000 **Z**	10,312
SWB1-3	First Chamber	4	60	18,000	1,411
SWB1-2	Second Chamber	10	108	60,000 **Z**	4,426
SWB1-1	Third Chamber	4	10 **U**	90,000	1,579
SWB1OUT	Unit Effluent	6	608	73,000	11,789
SWBSE1	Sweetwater Branch Downstream	3	390	4,600	1,713

U = The compound was analyzed for but not detected

Z = Confluent growth/Too numerous to count

J4 = Estimated Result.

The fecal coliform bacteria concentration was elevated in the diversion weir box prior to entering the CDS system at NE 10th Avenue. However, the highest bacteria levels were found in samples collected from the separation chamber, with a geometric mean of 2,749 CFU/100mL, indicating that fecal coliform bacteria present in Sweetwater Branch may be collected within this unit (Figure 11). The bacteria results for sediment samples collected from the separation chamber were 637 and 42,100 Col/dry g. The average fecal coliform bacteria removal rate for this unit was 33% based on the samples collected.

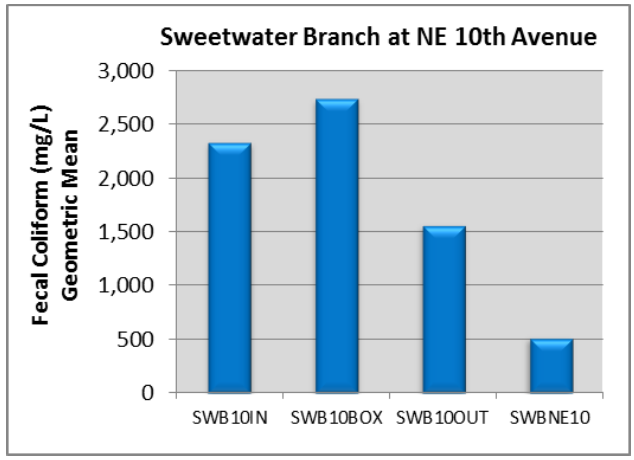


Figure 11. Geometric Mean Values for Fecal Coliform Bacteria Results for Sweetwater Branch at NE 10th Avenue

Sample results for the CDS unit at NE 8th Avenue showed the highest level of fecal coliform bacterial treatment observed for Sweetwater Branch (Figure 12). The geometric mean of baseflow samples collected from the unit's inflow and outflow at NE 8th Avenue were 8,425 and 3,682 CFU/100mL, approximately 55% removal rate. The elevated bacteria levels found in this system are likely from stormwater runoff from the residential area captured by this unit, and persistence and regrowth within the unit. The bacteria results for sediment samples collected from the separation chamber were between 1,000 and 36,000 Col/dry g.

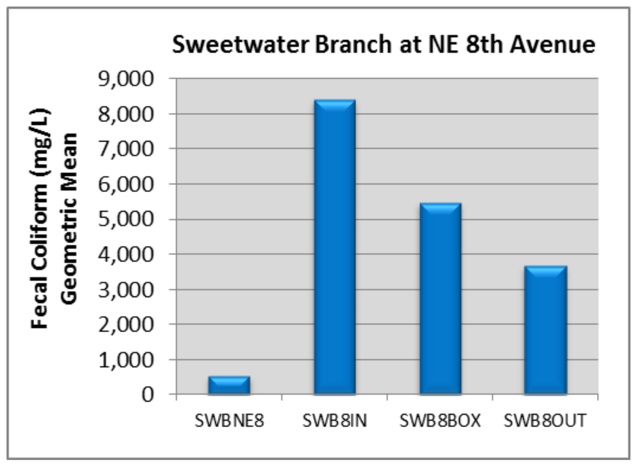


Figure 12. Geometric Mean Values for Fecal Coliform Bacteria Results for Sweetwater Branch at NE 8th Avenue

The highest results for fecal coliform bacteria samples collected from the Sweetwater Branch units were found in the baffle box at SE 1st Avenue. The geometric mean of the effluent samples, with a value of 11,789 CFU/100mL, was higher than the influent sample results, indicating this system is not providing effective stormwater treatment (Figure 13). The bacteria results for sediment samples collected from all three chambers were between 270 and 17,100 Col/dry g, with the highest values in the middle chamber. The elevated bacteria levels found in this system are likely from the urban stormwater runoff captured by the unit, in addition to persistence and regrowth within the unit.

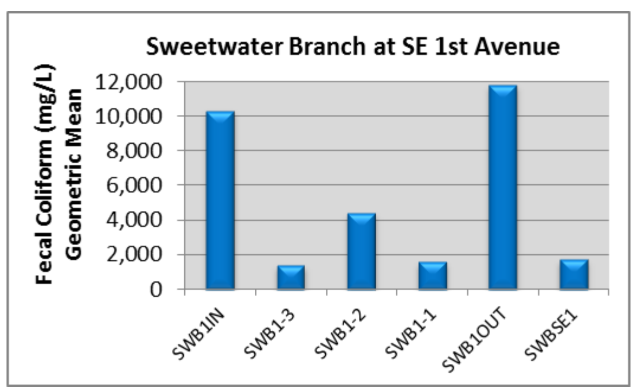


Figure 13. Geometric Mean Values for Fecal Coliform Bacteria Results for Sweetwater Branch at SE 1st Avenue

Levels of fecal coliform bacteria in stormwater runoff, in particular under first flush conditions, may be several orders of magnitude greater than baseflow conditions (ACEPD, 2008). Storm event samples were not collected for the unit at NE 10th Avenue; they were collected from the unit at NE 8th Avenue during two storm events. Due to variations in antecedent conditions, rainfall quantity, intensity, and duration, and timing of sample collection it is difficult to determine if the CDS units provide effective treatment and bacteria removal during high flow events. The data indicates that bacteria is likely collected within the separation chambers; and may be re-suspended from the sediments increasing the loading on the units and decreasing the removal efficiency (Zhang and Lulla, 2006). Without proper maintenance, a high flow event may increase scour and washout the units resulting in increased pollutant loading to Sweetwater Branch during storm events (Berretta et al., 2011).

One of the highest results in this study was found in a sample collected from the effluent of the baffle box, after rainfall ceased for the storm event and flow decreased within the unit (Figure 14). The data suggests that bacteria likely passes through this system under most conditions and may also be re-suspended from the sediments, increasing the loading on the unit and decreasing the removal efficiency (Zhang and Lulla, 2006). Without proper maintenance, high flow events appear to increase scour and washout the unit resulting in increased bacteria levels and pollutant loading discharging to Sweetwater Branch under storm flow conditions (Berretta et al., 2011).

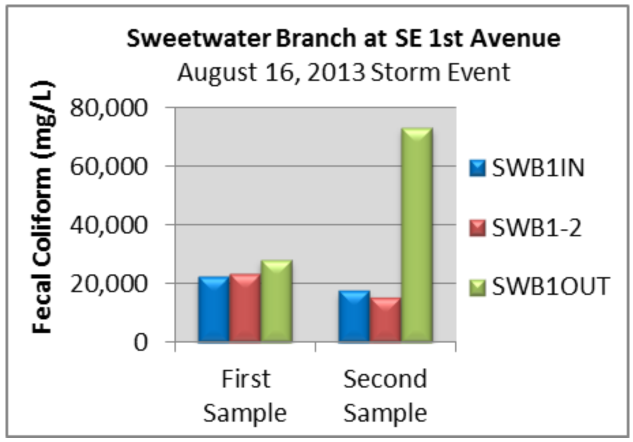


Figure 14. Storm Event Fecal Coliform Bacteria Results for Sweetwater Branch at SE 1st Avenue

The geometric mean of bacteria samples collected within the CDS unit at NE 8th Avenue and the baffle box at SE 1st Avenue are considerably higher than the samples collected within the unit at NE 10th Avenue. The units with the higher bacteria levels receive only stormwater runoff; the unit at NE 10th Avenue provides treatment solely for the main channel of Sweetwater Branch. These results suggest stormwater runoff and SSTU discharges are likely a source of elevated bacteria levels commonly found within Sweetwater Branch.

4.4 Nutrients and Inorganic Indicators

Water quality samples were collected during selected sampling events to evaluate the concentrations of Total Nitrogen (TN), Total Phosphorus (TP), and Total Suspended Solids (TSS) that pass through or are washed out of the units during sampling events (Appendix G). Effluent samples were collected from the Vortechs® units on Hogtown Creek during a rain event on December 10, 2012 (Table 7). Additional samples were collected from locations within the units and upstream within Hogtown Creek after the rainfall ceased on December 12, 2012; more than four inches of cumulative rainfall occurred between the two sampling events.

Table 7. Summary of Water Quality Samples Collected for Hogtown Creek

Sample ID	Date	TN (mg/L)	TP (mg/L)	TSS (mg/L)	Fecal Coliform (CFU/100mL)
HOG29-US	12/12/2012	0.26	0.993	4,600	3,200
HOG29M-W	12/12/2012	0.3	0.993	2 **U**	5,200
HOG29OUT-W	12/12/2012	0.47	1.39	2 **U**	3,400
HOG29OUT-W	12/10/2012	2.8	1.88	75	28,400
HOG29M-E	12/12/2012	0.048	0.834	13	200
HOG29OUT-E	12/12/2012	0.034	1.03	2.6	9,400
HOG29OUT-E	12/10/2012	1.1	1.03	160	13,200

= Sample collected during rain event.

U = The compound was analyzed for but not detected.

Due to variations in antecedent conditions, rainfall quantity and duration, and timing of sample collection, the limited number of samples collected, and the lack of inflow data, it is difficult to determine if the Vortechs® units provide effective removal of nutrients and TSS during baseflow or storm flow conditions. However, the effluent concentration of Total Nitrogen was considerably higher in the samples collected during the storm event (Figure 15), suggesting the units may be considered sources of nitrogen during storm events. Phosphorus was found to be elevated in all samples, ranging from 0.834 to 1.88 mg/L; however, these concentrations were similar to those reported for an evaluation of a SSTU in southwest Gainesville (Arias et al., 2013).

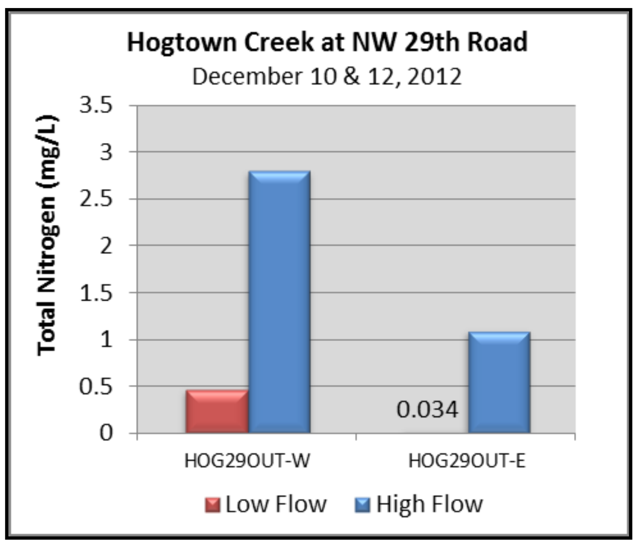


Figure 15. Total Nitrogen Results for Effluent Samples Collected from SSTUs on Hogtown Creek at NW 29th Road

Phosphorus occurs naturally in soils and geological formations (e.g., Hawthorn Group) in the Gainesville urban area and erosion and transport of these sediments may increase phosphorus levels in-stream and in stormwater runoff (ACEPD, 2007). Organic matter from the breakdown of leaves and other plant materials can be a source of both nitrogen and phosphorus (Romah, 2005; Berretta et al., 2011; Arias et al., 2013). Hogtown Creek is considered to be a fluvial system with a naturally high sediment load; therefore, the level of Total Suspended Solids discharged from the units is negligible compared to the levels found in the main channel of the creek.

Water quality samples were collected for nutrients and inorganic indicators during five sampling events on Sweetwater Branch. Preliminary samples were collected from the unit at NE 10th Avenue and two storm events were monitored for each unit located at NE 8th Avenue and SE 1st Avenue. Influent and effluent concentrations were used to estimate the pollutant removal efficiency or treatment effectiveness during the sampling events (Table 8). Due to the limited number of samples collected, the pollutant removal estimates should not be considered accurate for all conditions. The removal of Total Nitrogen and Total Suspended Solids in the CDS systems (39% to 51%) is consistent with results found in similar studies (Kim and Sansalone, 2008; Raje et al., 2013). The baffle box at SE 1st Avenue does not appear to provide stormwater treatment under the current conditions. This unit is likely a source of sediment, nutrients, and bacteria in Sweetwater Branch; pollutant removal efficiency may be improved with increased system maintenance.

Table 8. Average Removal Efficiency of SSTUs on Sweetwater Branch

Site ID	Average Removal Efficiency			
	TN	TP	TSS	Fecal Coliform
SWB10	39 %	-11 %	50 %	33 %
SWB8	40 %	22 %	51%	56 %
SWB1	-20 %	-21%	-123 %	-14 %

* Negative value indicates effluent sample results were higher than influent sample results.

During the storm event monitoring, concentrations of Total Nitrogen in the effluent at NE 8th Avenue and SE 1st Avenue were observed to be elevated in the samples collected during the higher flows (Figure 16 and 17). In addition, the pollutant removal efficiency within the system decreased, indicating the units may be considered sources of Total Nitrogen and Total Suspended Solids during storm events.

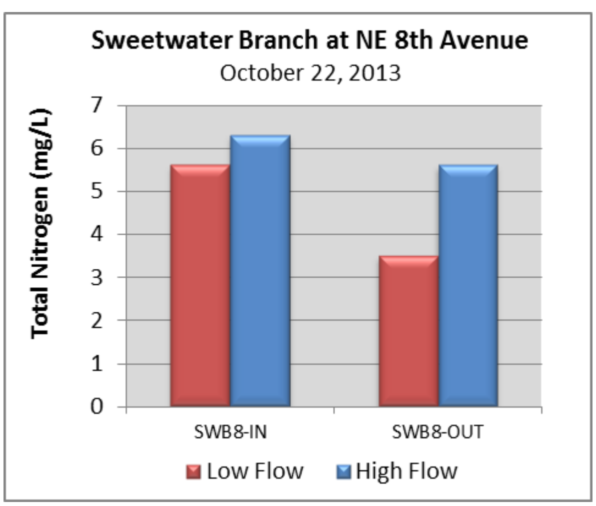


Figure 16. Total Nitrogen Results for Influent and Effluent Samples from Sweetwater Branch at NE 8th Avenue

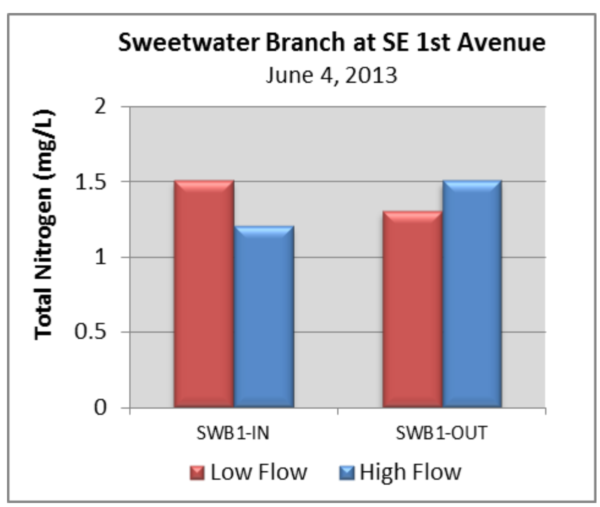


Figure 17. Total Nitrogen Results for Influent and Effluent Samples from Sweetwater Branch at SE 1st Avenue

4.5 SSTU Maintenance Practices

Routine inspection and maintenance of SSTUs is required to ensure the systems function as designed (Berretta et al., 2011). The pollutant removal efficiency typically decreases as sediments accumulate within the units. In addition, bacteria concentrations within the sumps may be higher than inflow concentrations. This indicates that bacteria may be re-suspended from the sediments, increasing the loading on the units and decreasing the removal efficiency (Zhang and Lulla, 2006). Without proper maintenance, high flow events may increase scour and washout the unit resulting in increased pollutant loading to Sweetwater Branch under storm flow conditions (Berretta et al., 2011).

Maintenance schedules are site-specific as sediment loads increase in the presence of unstable soils, construction activities, leaf drop, increased flow rates, and rainfall event frequency and intensity. Street sweeping actives may decrease the frequency of required maintenance. Environmental Resource Permit (ERP) conditions typically include quarterly inspection requirements for the first year of operation. The inspection and maintenance schedule for subsequent years is determined by the results of the quarterly inspections. Minimum maintenance requirements for an ERP are typically once per year, independent of site-specific conditions. Infrequent maintenance may allow sediment to accumulate outside the swirl chamber, requiring additional maintenance throughout the stormwater system. During stormwater sample collection, trash and debris and/or sediment accumulation within the chambers appeared to hinder the function of the units.

The five SSTUs evaluated are reportedly inspected and maintained a minimum of once per year by the City of Gainesville. The combination of the volume in the overflow cell (diversion box) and a relatively deep CDS allowed for removal of 23 yd^3 of sediment in March 2012 from SWB10. The CDS unit at SWB8 is also relatively deep and a total of 31 yd^3 was removed from this unit in 2012. Maintenance was not reported for the SWB1 baffle box or the HOG29 units in 2012. A total of 13 yd^3 of sediment was removed from the five units in 2014. Scour and wash out can occur if flow rates exceed design standards for the unit and lack of maintenance allows excessive sediment accumulation within the units. In addition, accumulated sediments will release phosphorus under anoxic conditions. Routine maintenance schedules should be established for the SSTUs to provide effective stormwater treatment and improve effluent water quality. In addition, the quantity of sediment removed from the systems must be documented to estimate the pollutant load removed the system and verify credits received toward pollutant load reduction goals established by the Florida Department of Environmental Protection. An example inspection and maintenance log is provided in Appendix H. Use of this maintenance log or similar form will help quantify the amounts of materials and pollutants removed from the units and provide documentation to verify inspection and maintenance activities.

5.0 SUMMARY AND RECOMMENDATIONS

Fecal coliform bacteria levels were elevated in water and sediment samples collected within the SSTUs and samples collected in the streams under baseflow and storm flow conditions. Water samples collected within the units were typically higher than samples collected from the receiving waterbodies. Also, samples collected from the separation and/or main chambers of the units typically had the highest levels of bacteria, indicating the sediments within the units are a source of bacteria. Removal efficiencies in the SSTUs evaluated on Sweetwater Branch ranged from -14% to 56% for fecal coliform bacteria. Sample results for the baffle box indicated the lowest removal efficiency; in fact it appears to be a source of fecal coliform bacteria to Sweetwater Branch. The results are based on a limited number of samples and are only representative of the conditions at the time. Collection of samples before and after future maintenance activities can provide more information for site-specific inspection and maintenance programs.

Average calculated removal efficiencies for Total Suspended Solids were approximately 50% for the CDS units on Sweetwater Branch; nitrogen removal was approximately 40% and phosphorus removal was 22% for the unit at SWB8 and -11% for the unit at SWB10. SWB10 and SWB1 both released higher concentrations of Total Phosphorus than was observed entering the units; however, phosphorus naturally occurs in soils and geological formations (e.g., Hawthorn Group) in the Gainesville urban area and the breakdown of organic detritus can be a source of both nitrogen and phosphorus. The baffle box effluent concentrations of Total Nitrogen, Total Phosphorus, Total Suspended Solids, and fecal coliform bacteria were higher than influent concentrations, indicating this unit is discharging these constituents to Sweetwater Branch during rainfall events.

Gainesville has an extensive tree canopy with 51% tree cover and 16% shrub cover (Escobedo et al., 2012). Leaf drop and organic matter (e.g., catkins and mast) production primarily occur during two periods in north Florida, fall leaf and mast (fruit) drop in late November and leaf drop of tardily deciduous trees (e.g., Florida Maple, Live Oak, Laurel Oak and Water Oak) in March and Magnolias in May. Pines generally lose their needles in the fall; however drought stress can cause the needles to fall as early as July. Storms with heavy rain and wind can also precipitate premature needle drop. Unlike areas in the northern United States, where sand from winter road treatment is a primary sediment source in SSTUs; in the Gainesville area the primary source of sediments are organic detritus and leaves.

In order to effectively remove fecal coliform bacteria and nutrients from Structural Stormwater Treatment Units (SSTUs), routine inspection and maintenance must be conducted. Maintenance frequency strongly impacts the quality of effluent discharging from the units. A buildup of organic particulate matter or detritus (leaves, flowers, and mast) provides a medium for bacteria growth and is also a source of nutrients. The main contributions of sediment in the SSTUs are leaves and organic detritus; however, inorganic sediments (e.g., gravel or sand) were also observed. The majority of organic detritus enters the units during fall and spring leaf drop.

Inspection and maintenance activities are recommended to coincide with the seasonal inputs. Early winter maintenance in December (after seasonal leaf and mast drop in the late fall) is recommended to clean out the units before the winter storm fronts arrive in January and February. Maintenance of the units in the April (after spring leaf and flower drop) will ensure the units are sediment free prior to the summer rainy season that typically begins in June. Since Gainesville's tree canopy is primarily made up of pines or tardily deciduous oaks, inspection and maintenance activities may be needed more than once in the spring (Escobedo et al., 2012). Additional inspections and/or maintenance may also be needed after extreme weather events (e.g., hurricanes or extended droughts) and during the summer rainy season, June through September. Approximately half of the annual average rainfall can be expected during these four summer months.

The two Vortechs® units at NW 29th Road and Hogtown Creek have a relatively small contributing area and are slow to fill with sediment. The units should be inspected at a minimum twice a year, early winter and late spring (as described above). Although sediment accumulation in the units may not be a maintenance concern, inspection during the summer is important to address problems with unit function and to identify obstructions, trash accumulation, or structural defects.

The CDS units on Sweetwater Branch at NE 10th Avenue and at NE 8th Avenue are deep and relatively large volumes (17 to 24 yd^3) of sediment were removed from the units when they were maintained in 2012. These units were found to have the greatest amounts of trash based on visual inspection during field sampling activities. During some of the storm events the amount of sediment and trash in the units appeared to inhibit the separation chamber function. Additional inspection and maintenance is needed for the baffle box to improve treatment effectiveness, as this unit appears to provide little stormwater treatment under current conditions and is likely subject to scour and washout during high flow events.

Evaluation of maintenance requirements based on seasonal leaf drop and rainfall events should be conducted. This will help optimize the maintenance activities for the units. The following outlines a recommended inspection and maintenance program for SSTUs:

- Semi-annual inspections (early winter and late spring) after seasonal leaf drop,
- A second spring inspection for the units on Sweetwater Branch,
- Monthly inspections for the units on Sweetwater Branch in summer (June through September),
- Inspections after extremely heavy rainfall following a long antecedent dry period, including winter fronts with heavy rainfall,
- Inspections after extreme weather events (e.g., hurricanes or extended droughts).
- Maintenance records should be kept for all inspection and maintenance activities (Appendix H).

Inspections are essential to functionality and maintenance is the key to effective removal efficiency. Manufacturers recommend developing a unit specific maintenance schedule by evaluating the units seasonally and after heavy rain or other conditions, such as leaf drop or winter road sanding (in northern climates), that could reduce unit function and/or contribute to unit scour. The inspections should include measuring the depth of sediment to evaluate the need for maintenance. This will allow development of a proactive inspection and maintenance program for each of the individual units based on seasonal, local conditions relating to the contributing area and rainfall. The recommended inspection and maintenance program should be applied to all SSTUs in the Gainesville urban area to optimize performance and reduce pollutant loading to surface waters. In addition, street sweeping activities are a low cost proactive supplement to SSTU maintenance and should be considered, especially at times of seasonal leaf drop.

Alachua County Environmental Protection Department (ACEPD) routinely monitors nutrients and fecal coliform bacteria levels in Gainesville's urban creeks. Fecal coliform concentrations vary widely in Alachua County's waters depending on hydrologic conditions, with baseflow levels typically being one or more orders of magnitude lower than samples collected under storm flow conditions (ACEPD, 2008). Results of ambient fecal coliform monitoring, microbial sources tracking (MST), and alternative bacteriological monitoring conducted to evaluate elevated fecal coliform bacteria, indicate that stormwater inputs, that can transport waste from domestic animals, humans, and wildlife, are one of the potential sources of fecal coliform bacteria found in the urban streams.

Previous work (ACEPD, 2008) documents the persistence and possible regrowth of fecal coliform bacteria in Gainesville urban creek fluvial sediment. ACEPD continues to monitor fecal coliform bacteria, investigates illicit discharges and sanitary sewer overflows (SSOs) that impact the creeks, and implements education and outreach programs to improve water quality. In 2014 ACEPD began partnering with the FDEP on a pilot project to conduct additional microbial source tracking (MST) from human sources in the urban creeks using human specific indicators including HF183 human marker, acetaminophen (Tylenol), and sucralose (Splenda), as well as fecal coliform and *Escherichia coli* (*E. coli*). This pilot study is anticipated to be completed in 2016. ACEPD continues to monitor the urban creeks for fecal coliform and *E. coli* to establish trends and identify potential illicit discharges and water quality impacts.

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APPENDICES

APPENDIX A

Photographs of SSTUs and Sample Collection

Appendix A

Photographs of SSTUs and Sample Collection

Figure A-1. From top left to bottom right, HOG29-W Vortex and Main Chambers, HOG29-E Vortex and Main Chambers, the HOG29-W outfall pipe, and the HOG29DS downstream sample location.
June 19, 2012

Figure A-2. Overflow weir on Sweetwater Branch at SWB10 (left) and SWB10BOX (right).
December 12, 2012

Figure A-3. Outfall pipe from SWB8 and Sweetwater Branch culvert (left) and SWB8BOX (right).
December 12, 2012 and June 19, 2012

Figure A-4. Sample collection from the baffle box chambers, SWB1, (left) and the outfall pipe, SWB1OUT, under the pedestrian bridge in Sweetwater Branch Park (right).
August 27, 2012

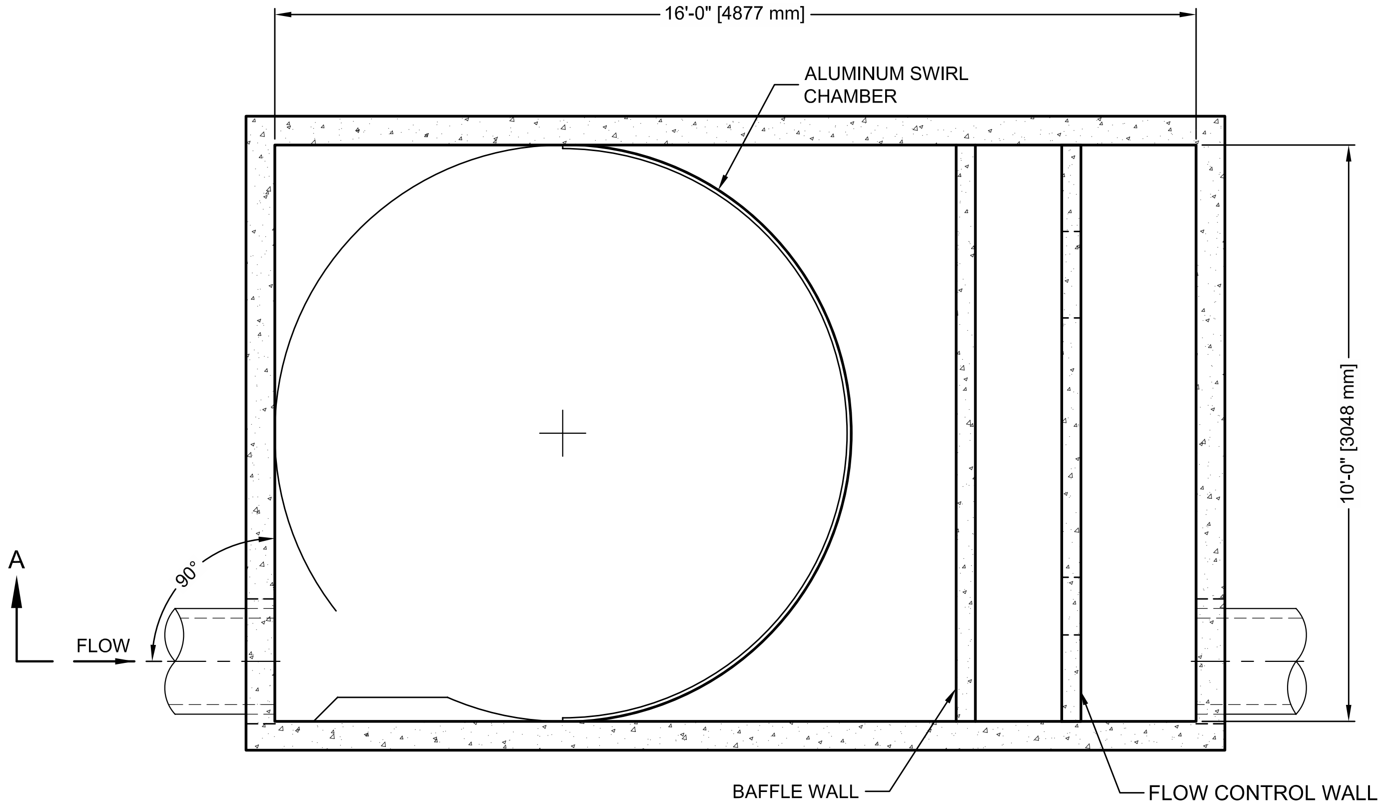
Figure A-5. Sediment sample collection from the baffle box chambers, SWB1 (left) and the Petite Ponar sampler with sample collected from the CDS unit at SWB8 (right).
June 4, 2013 and August 5, 2013

APPENDIX B
Available Plan Sheets

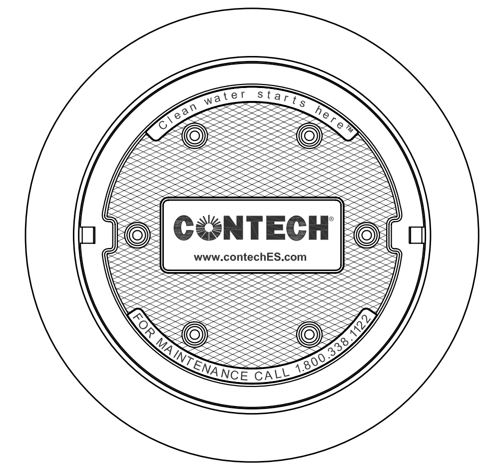
APPENDIX B-1

HOG29-W

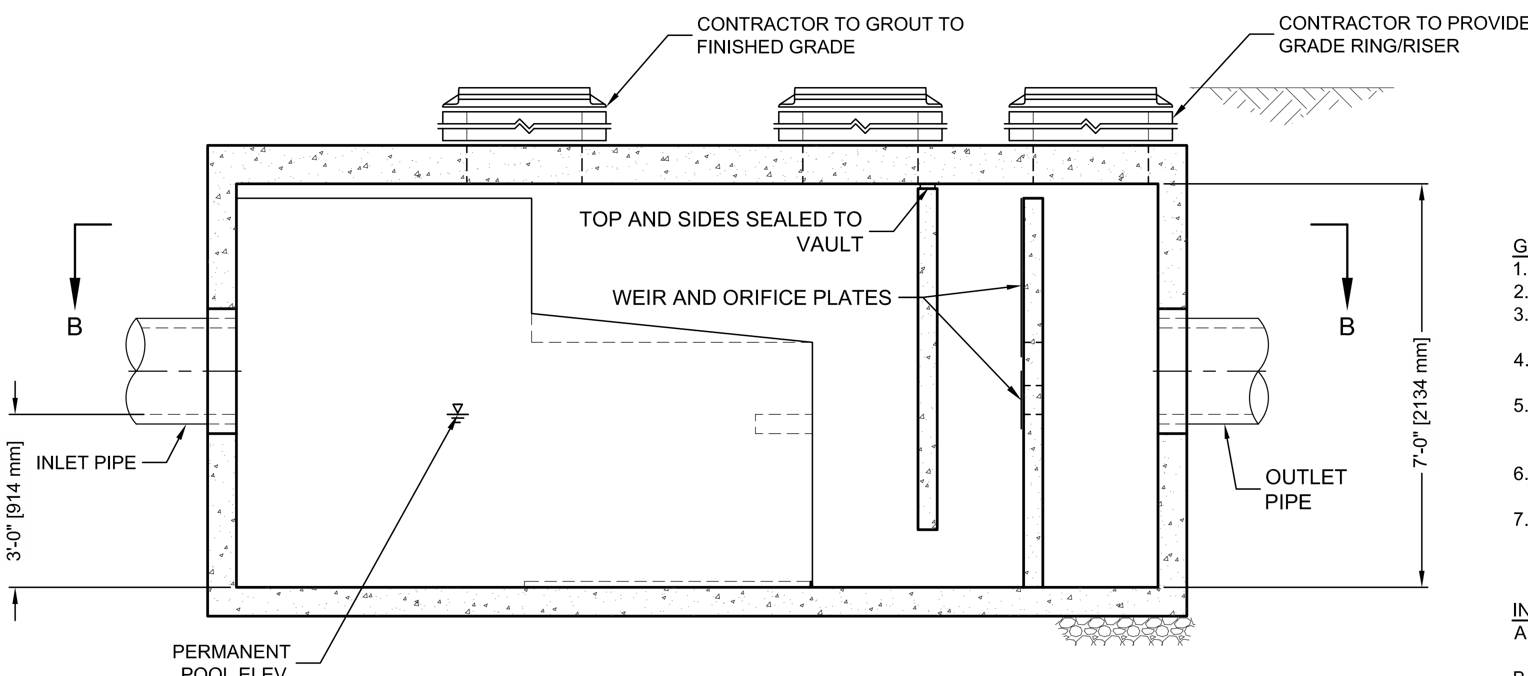
(Vortechs® 11000 Standard Detail Sheet)



SECTION B-B



FRAME AND COVER
(DIAMETER VARIES)
N.T.S.



SECTION A-A

VORTECHS 11000 DESIGN NOTES

VORTECHS 11000 RATED TREATMENT CAPACITY IS 17.5 CFS, OR PER LOCAL REGULATIONS. IF THE SITE CONDITIONS EXCEED RATED TREATMENT CAPACITY, AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.

THE STANDARD INLET/OUTLET CONFIGURATION IS SHOWN. FOR OTHER CONFIGURATION OPTIONS , PLEASE CONTACT YOUR CONTECH CONSTRUCTION PRODUCTS REPRESENTATIVE. www.contech-cpi.com

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID			*
WATER QUALITY FLOW RATE (CFS)			*
PEAK FLOW RATE (CFS)			*
RETURN PERIOD OF PEAK FLOW (YRS)			*
PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*
RIM ELEVATION			*
ANTI-FLOTATION BALLAST		WIDTH	HEIGHT
		*	*
NOTES/SPECIAL REQUIREMENTS:			
* PER ENGINEER OF RECORD			

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.contechES.com
4. VORTECHS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 AND CASTINGS SHALL MEET AASHTO M306 LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.
6. INLET PIPE(S) MUST BE PERPEDICULAR TO THE VAULT AND AT THE CORNER TO INTRODUCE THE FLOW TANGENTIALLY TO THE SWIRL CHAMBER. DUAL INLETS NOT TO HAVE OPPOSING TANGENTIAL FLOW DIRECTIONS.
7. OUTLET PIPE(S) MUST BE DOWN STREAM OF THE FLOW CONTROL BAFFLE AND MAY BE LOCATED ON THE SIDE OR END OF THE VAULT. THE FLOW CONTROL WALL MAY BE TURNED TO ACCOMODATE OUTLET PIPE KNOCKOUTS ON THE SIDE OF THE VAULT.

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE VORTSENTRY HS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

Vortechs®
THIS PRODUCT MAY BE PROTECTED BY THE FOLLOWING U.S. PATENT: 5,759,415; RELATED FOREIGN PATENTS.

CONTECH®
ENGINEERED SOLUTIONS LLC
www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

VORTECHS 11000
STANDARD DETAIL

APPENDIX B-2

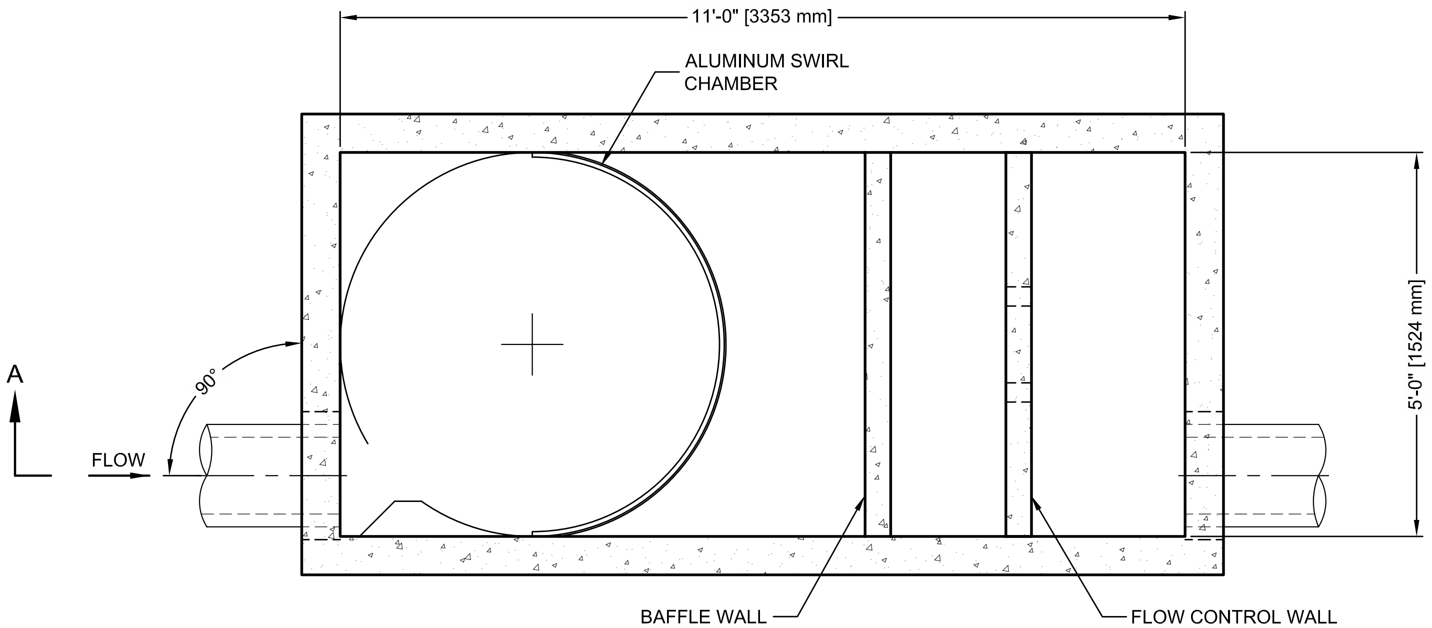
HOG29-E

(Vortechs® 3000 Standard Detail Sheet)

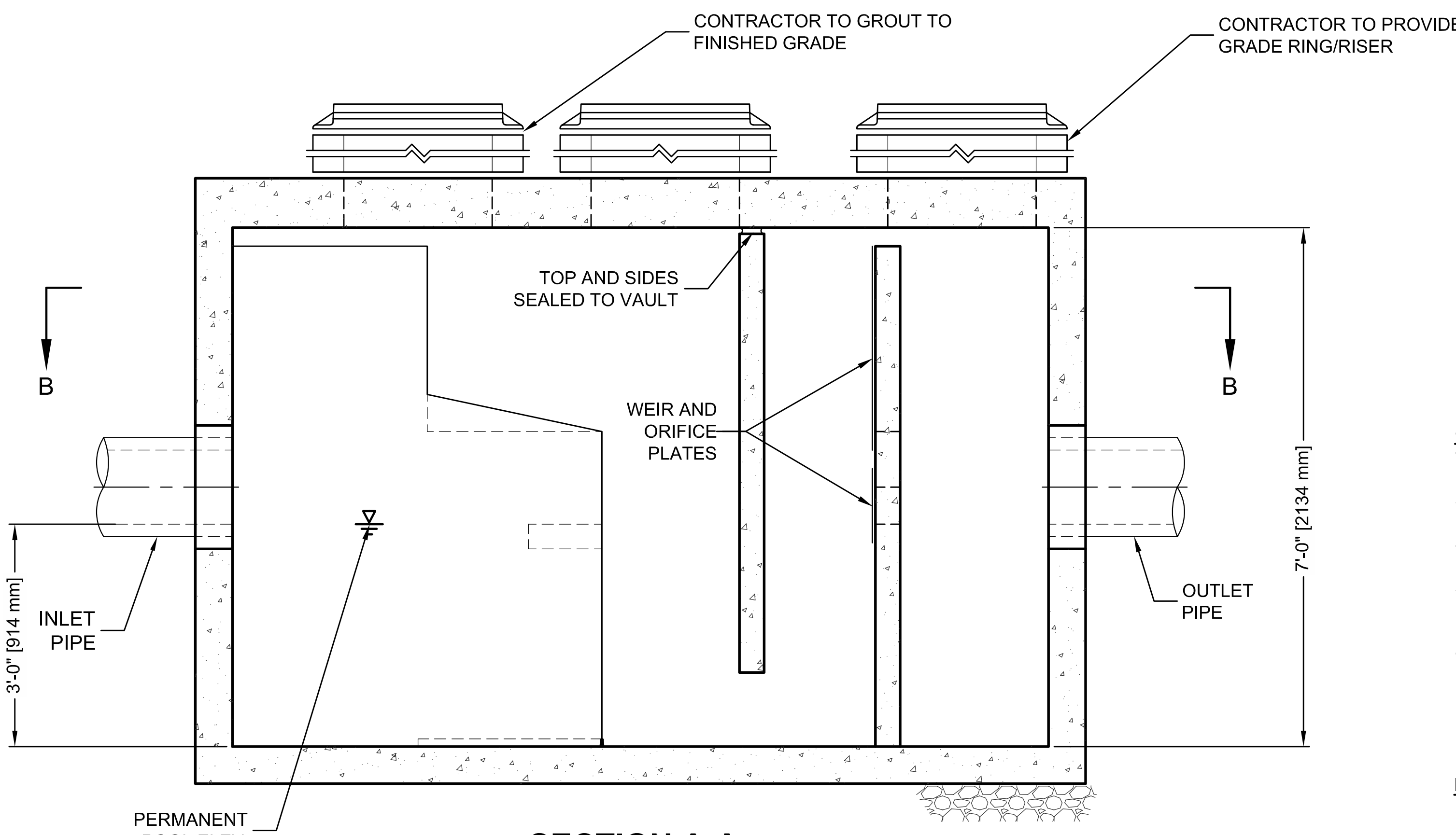
VORTECHS 3000 DESIGN NOTES

VORTECHS 3000 RATED TREATMENT CAPACITY IS 4.5 CFS, OR PER LOCAL REGULATIONS. IF THE SITE CONDITIONS EXCEED RATED TREATMENT CAPACITY, AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.

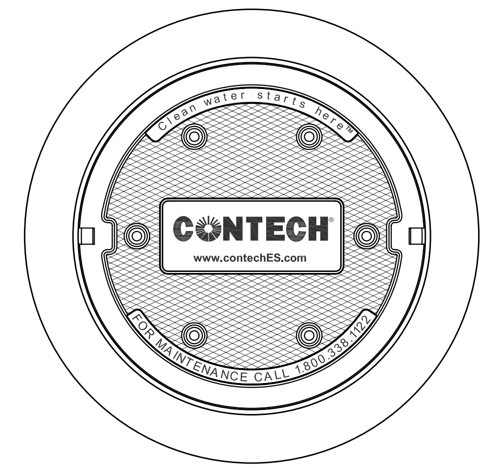
THE STANDARD INLET/OUTLET CONFIGURATION IS SHOWN. FOR OTHER CONFIGURATION OPTIONS , PLEASE CONTACT YOUR CONTECH REPRESENTATIVE. www.contechES.com



SECTION B-B



SECTION A-A



FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	*
WATER QUALITY FLOW RATE (CFS)	*
PEAK FLOW RATE (CFS)	*
RETURN PERIOD OF PEAK FLOW (YRS)	*

PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*

RIM ELEVATION	*

ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
	*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

GENERAL NOTES

1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH REPRESENTATIVE. www.contechES.com
4. VORTECHS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 AND CASTINGS SHALL MEET AASHTO M306 LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.
6. INLET PIPE(S) MUST BE PERPEDICULAR TO THE VAULT AND AT THE CORNER TO INTRODUCE THE FLOW TANGENTIALLY TO THE SWIRL CHAMBER. DUAL INLETS NOT TO HAVE OPPOSING TANGENTIAL FLOW DIRECTIONS.
7. OUTLET PIPE(S) MUST BE DOWN STREAM OF THE FLOW CONTROL BAFFLE AND MAY BE LOCATED ON THE SIDE OR END OF THE VAULT. THE FLOW CONTROL WALL MAY BE TURNED TO ACCOMODATE OUTLET PIPE KNOCKOUTS ON THE SIDE OF THE VAULT.

INSTALLATION NOTES

A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE VORTECHS STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

Vortechs®

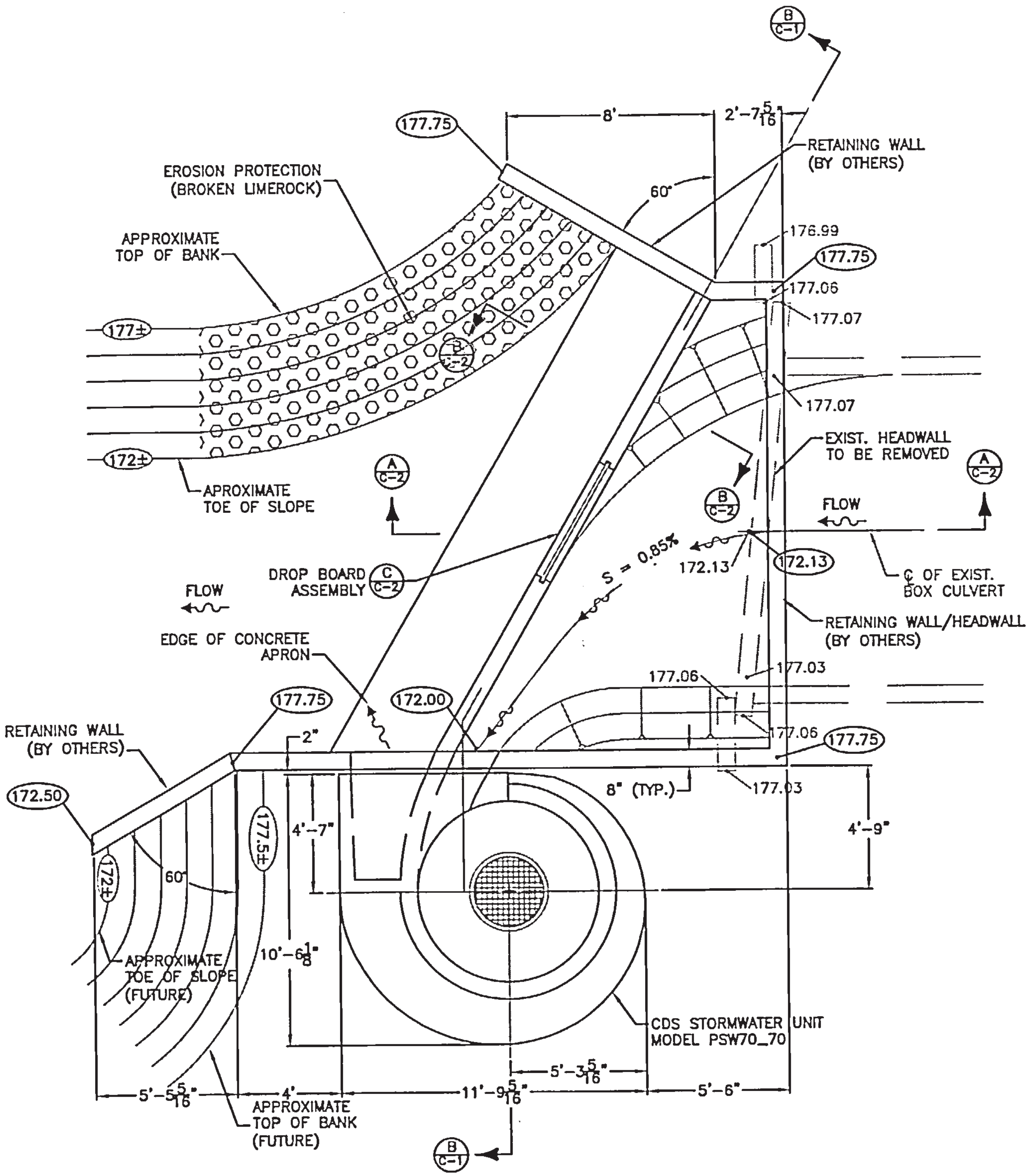
CONTECH®
ENGINEERED SOLUTIONS LLC
www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

VORTECHS 3000
STANDARD DETAIL

C:\USERS\FISHERS\DESKTOP\LOGO UPDATE\VORTECHS DIM UPDATE\VX-3000-DTL.DWG 8/28/2012 11:11 AM

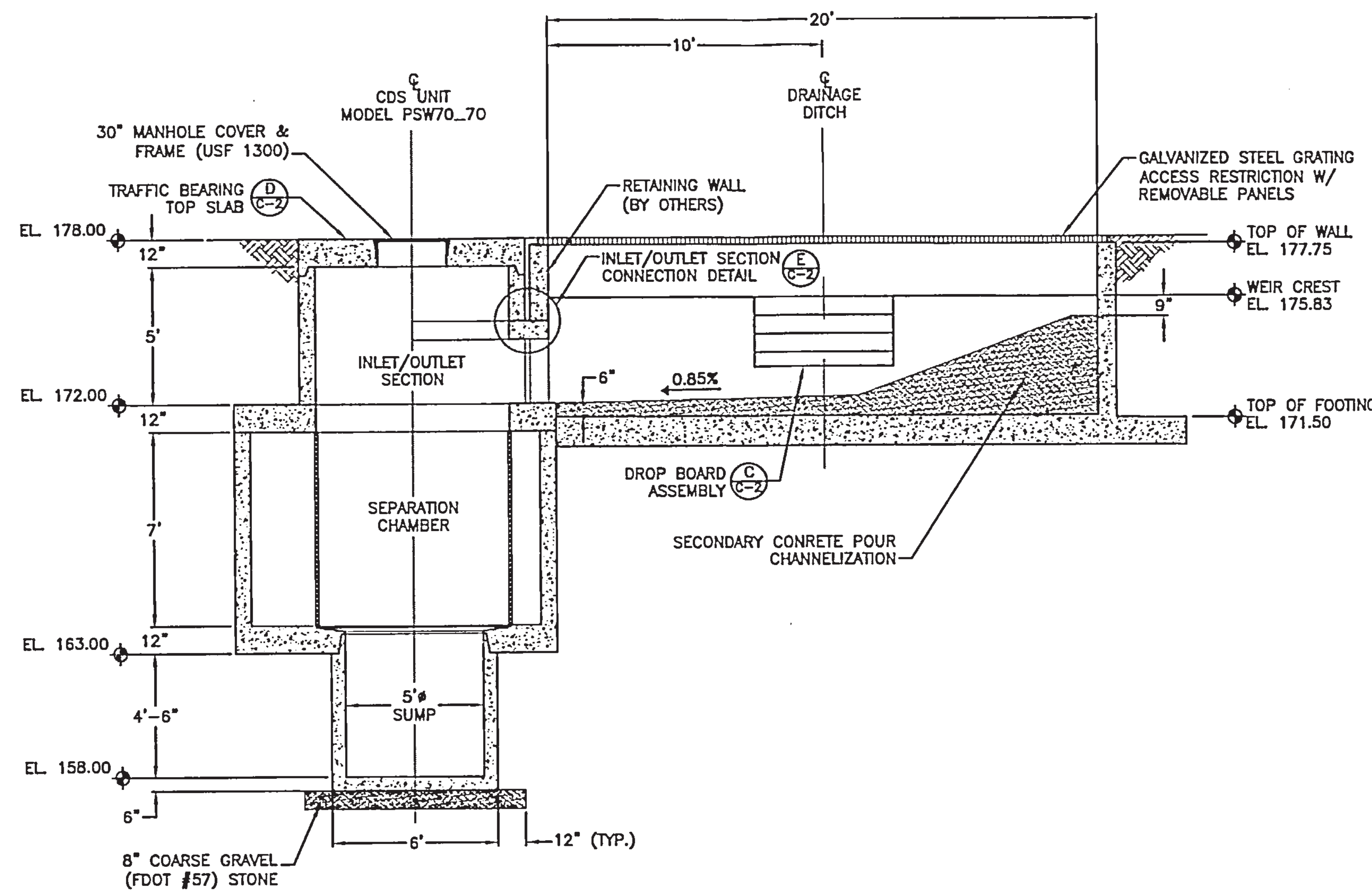
APPENDIX B-3

SWB10
(Permitted Plans)



PLAN VIEW (A)

SCALE: 1"=6'



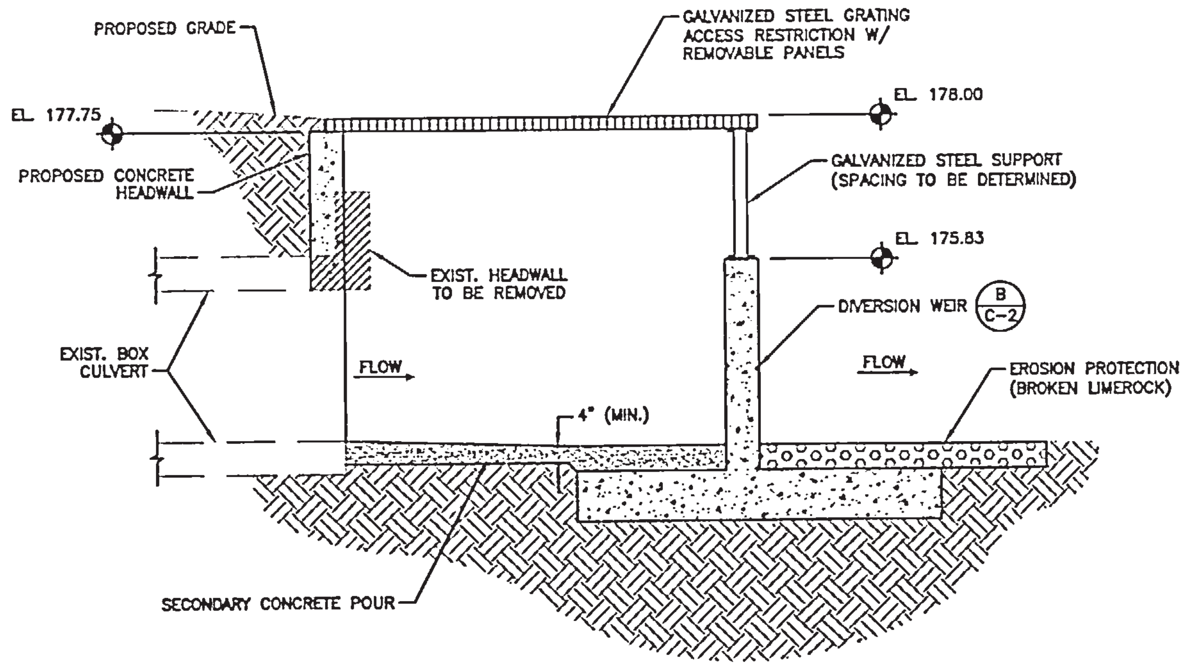
SECTION VIEW (B)

SCALE: 1"=6'

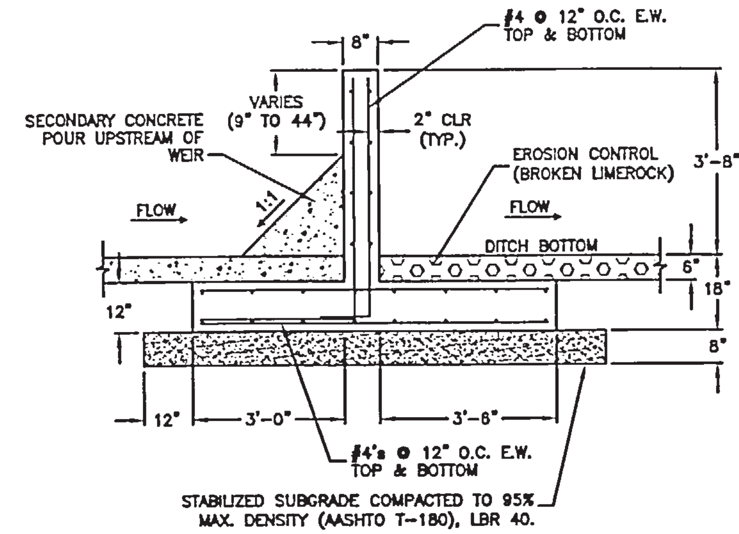
8/17/01

REV	DESCRIPTION	DATE	APPR	REFERENCE INFORMATION AND NOTES
				FL-98-021

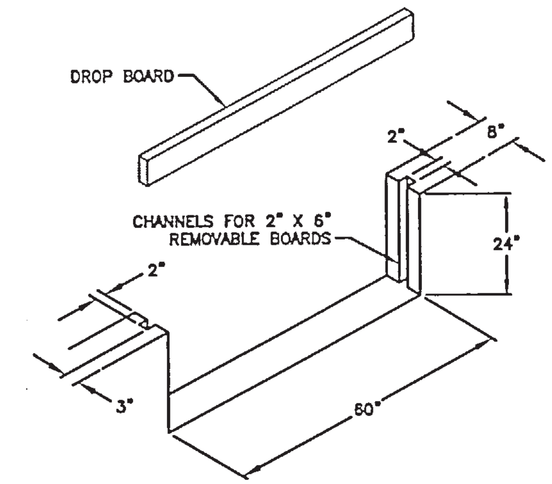
DATE	CDS TECHNOLOGIES, INC.		TITLE	SCALE
08-08-00			NE 10TH AVENUE DRAINAGE RETROFIT PROJECT	AS SHOWN
DRAWN	CHECKED	APPROVED FOR CONSTRUCTION:	GAINESVILLE, FLORIDA	SHEET
D. ZIEGLER			FL-98-021A	C-1



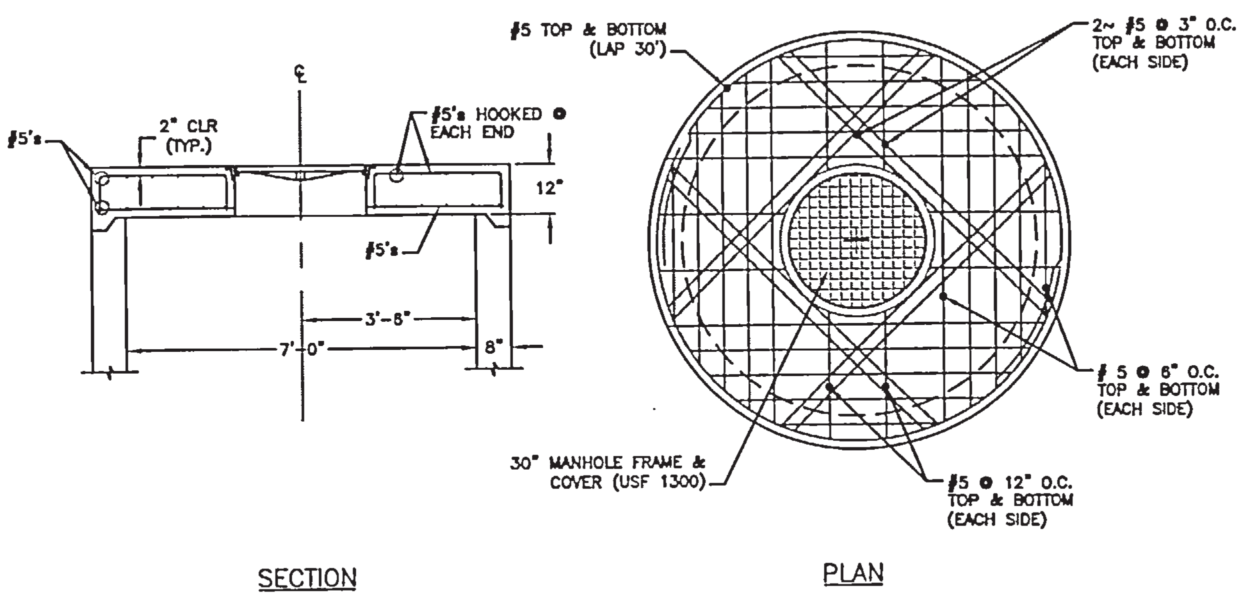
DIVERSION WEIR CHAMBER SECTION VIEW (A/–)
SCALE: N.T.S.



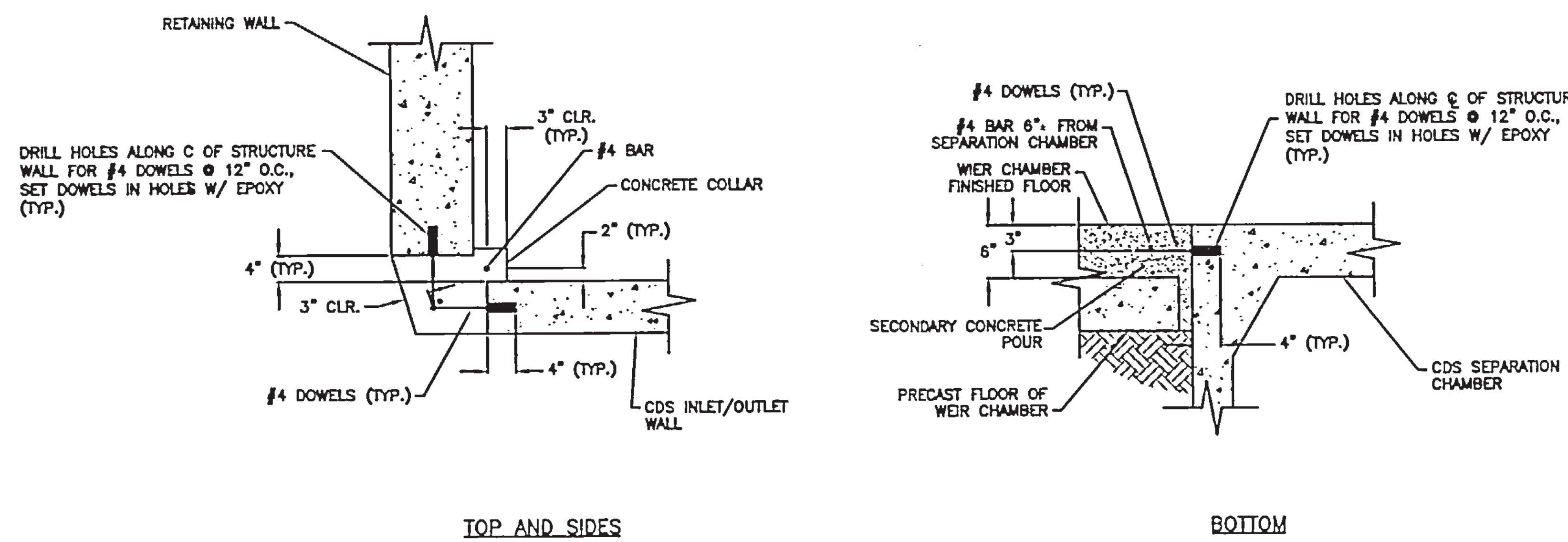
DIVERSION WEIR DETAIL (B/–)
SCALE: N.T.S.



DROP BOARD ASSEMBLY DETAIL (C/–)
SCALE: N.T.S.



TRAFFIC BEARING TOP SLAB DETAIL (D/–)
SCALE: N.T.S.



INLET/OUTLET SECTION CONNECTION DETAIL (E/–)
SCALE: N.T.S

D. Z. 5/17/01

REV	DESCRIPTION	DATE	APPR	REFERENCE INFORMATION AND NOTES
				FL-98-021

DATE: 08-08-00
DRAWN: D. ZIEGLER
CHECKED:

CDS PATENTED TECHNOLOGIES, INC.

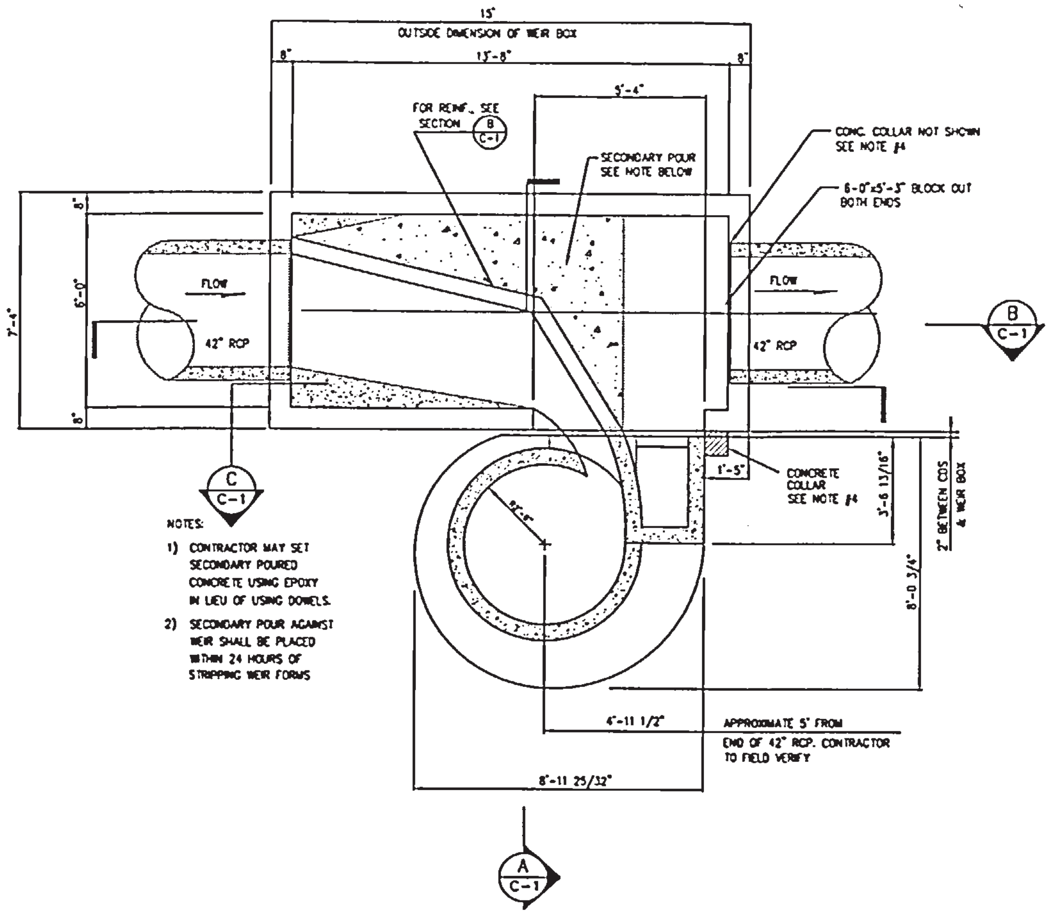
APPROVED FOR CONSTRUCTION:

TITLE: N.E. 10TH AVE UE DRAINAGE RETROFIT PROJECT
GAINESVILLE, FLORIDA
FL-98-021B

SCALE: AS SHOWN
SHEET: C-2

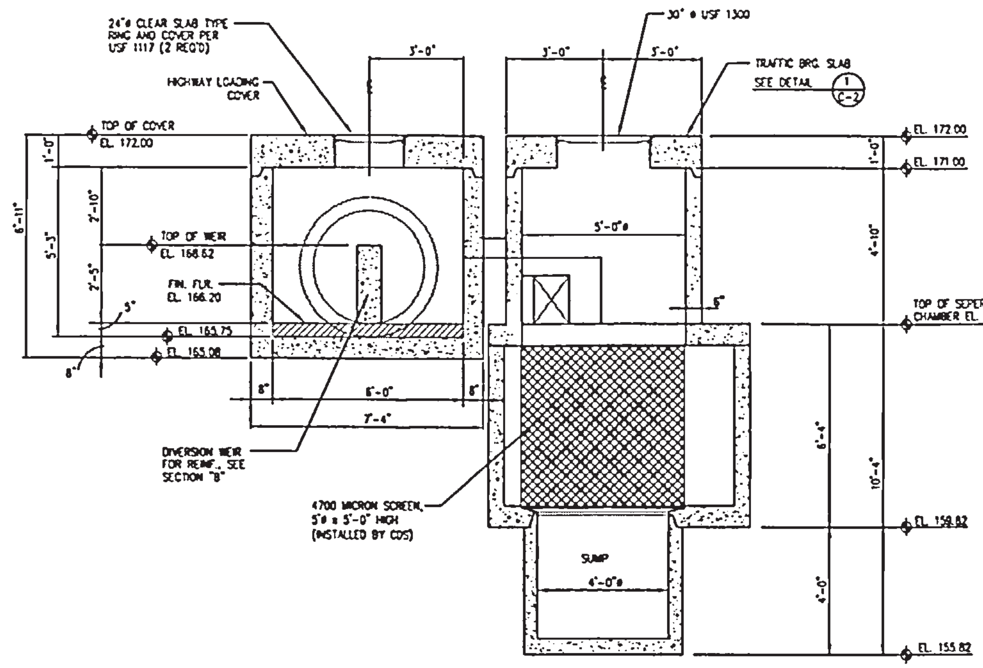
APPENDIX B-4

SWB8
(Permitted Plans)



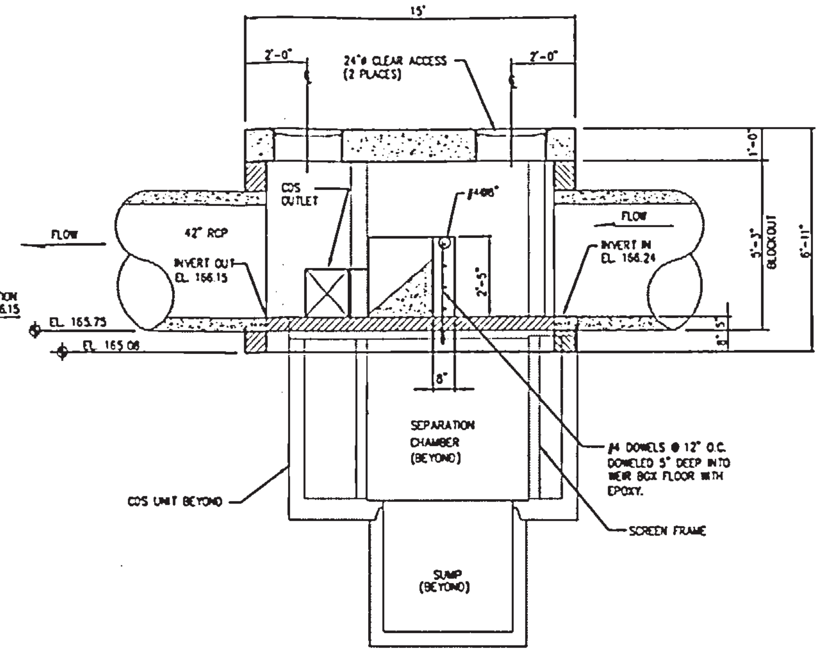
CDS – PSW50_50R UNIT PLAN

SCALE: 1" = 6'-0"



SECTION A C-1

SCALE: 1" = 6'-0"



SECTION B C-1

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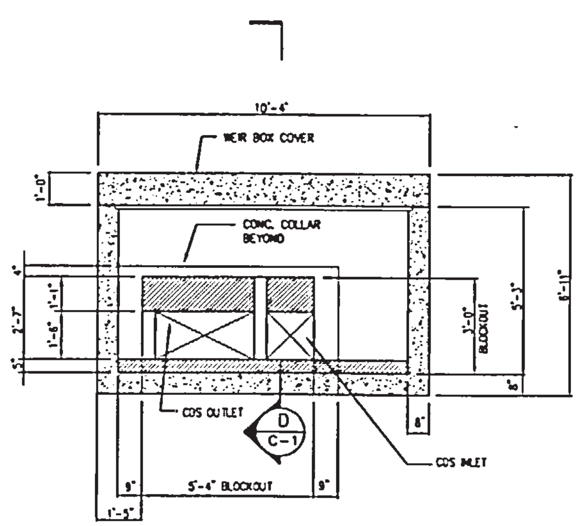

SECTION C C-1

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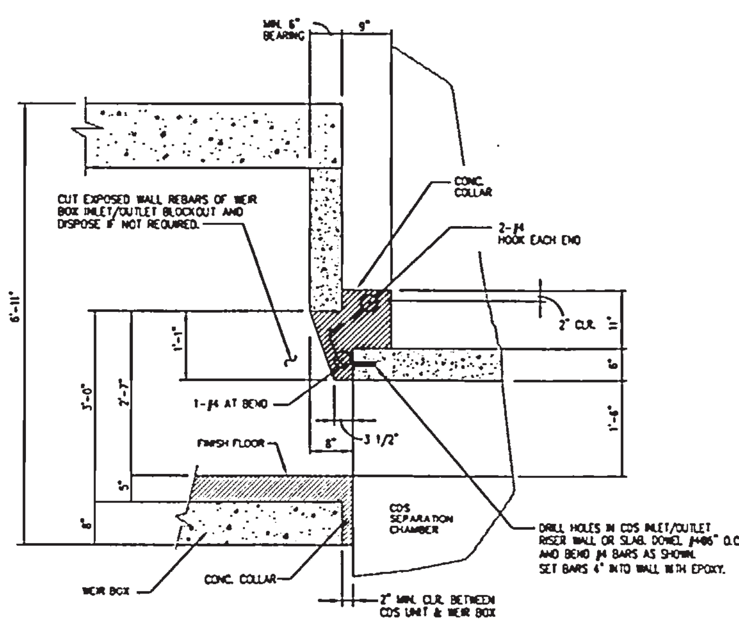
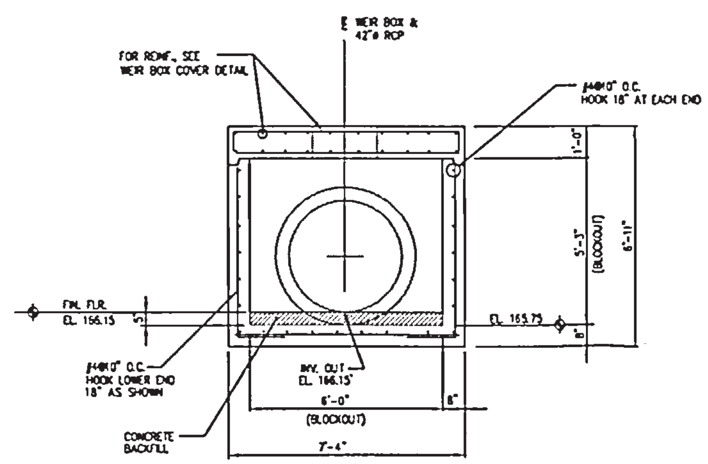


SECTION D C-1

SCALE: 1"=3'



WEIR BOX OUTLET DETAIL 1 C-1

SCALE: 1" = 6'-0"

NOTES:

1. CDS TECHNOLOGIES PROVIDES CDS UNIT CONSISTING OF SUMP, SEPERATION CHAMBER AND 4'-10" RISER WITH INLET/OUTLET STRUCTURE
2. CONTRACTOR TO PROVIDE BALANCE OF MATERIAL REQUIRED TO COMPLETE INSTALLATION INCLUDING, BUT NOT LIMITED TO CONCRETE DIVERSION WEIR AND ASSOCIATED CONCRETE WORK REQUIRED TO ENSURE FLOW INTO AND OUT OF CDS UNIT
3. CONTRACTOR TO VERIFY IN FIELD FINAL GRADE OF EXISTING ROADWAY AND SET ACCESS COVERS TO MEET FINAL GRADE
4. FOR CONNECTING PIPE AND CDS UNIT TO WEIR BOX
   a. CONCRETE POUR IN FIELD TO CONNECT PIPE TO WEIR BOX
   b. CONCRETE POUR IN FEILD TO CONNECT CDS UNIT TO TO WEIR BOX
   c. LAYOUT DIMENSIONS PROVIDE 2" GAP BETWEEN CDS UNIT AND WEIR BOX
5. BLOCKOUTS
   a. 6'-0"x5'-3" BLOCKOUT FOR EACH PIPE
   b. 5'-4"x3'-0" BLOCKOUT FOR CDS UNIT

5/17/01
DAVID B. ZIEGLER, P.E.
FL REG No. 54757

REV	DESCRIPTION	DATE	APPR	REFERENCE INFORMATION AND NOTES

DATE	CDS TECHNOLOGIES, INC. (PATENTED)	TITLE	SCALE
08/01/00		NE 8TH AVENUE GAINESVILLE, FL FL-98-021B	AS SHOWN
DRAWN	CHECKED / APPROVED FOR CONSTRUCTION:		SHEET
JBH			C-1

APPENDIX B-5

SWB1
(Construction Drawings)

BAFFLING STRUCTURE

SPECIFICATIONS:

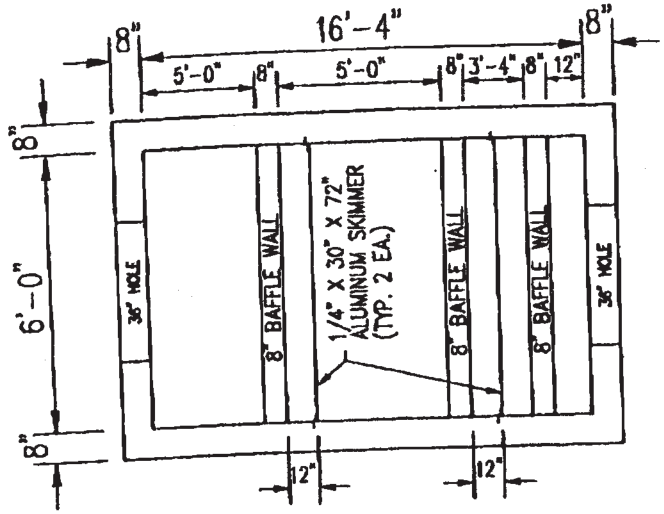
1. Steel: Base Slab – #6 @ 6" O.C.E.W. w/ straight end embedment reinf.

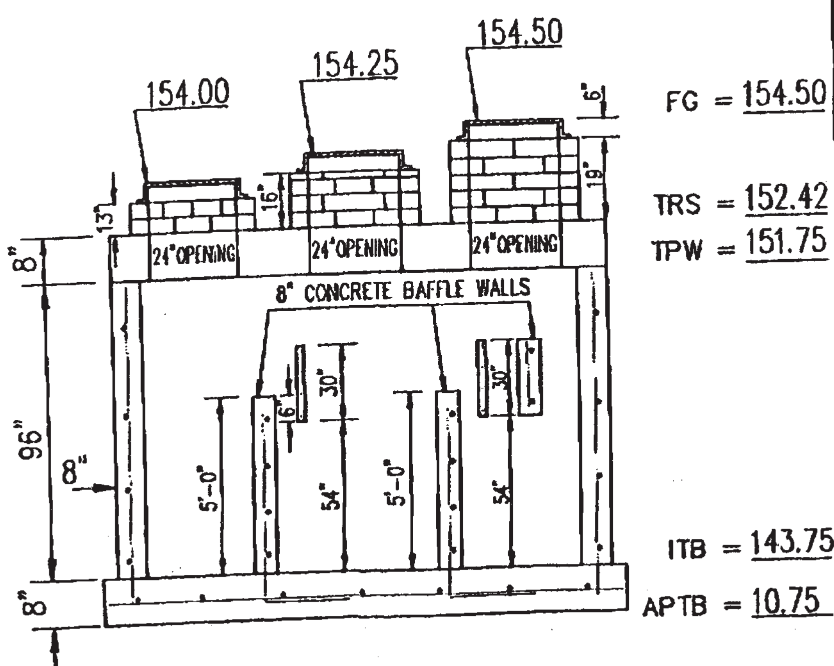
   Walls – #4 @ 12" O.C. VERT., #6 @ 6" O.C. HORIZ. or equiv. WWF. w/ 3 #4 bars ea. side & top of holes.

   Top Slab – #6 @ 6" O.C.E.W. + 2 #5 hoop bars & #8 around opening.

2. 4000 PSI Concrete. Type II Cement.

SPECIAL NOTES: SEE FOLLOWING TOP SLAB DETAIL





PRODUCT CODE	PC #	PC DESCRIPTION	DATE POURED	SHIP DATE
		(3 EA.) USF# 170-E "STORM" R/C		
12056 #	#2	8" (88" X 212")(24") TOP SLAB		
59420 #	#1	96" BASE UNIT		

DIRECTION	PIPE SIZE	PIPE INVERT	HOLE SIZE	HOLE INVERT	ITB ELEV	RAISE HOLE ABOVE ITB
WEST	24" Rcp	148.10	36"	147.60	143.75	48"
EAST	24" Rcp	148.75	36"	148.25		54"

SHOP DRAWING REVIEW

CITY OF GAINESVILLE PUBLIC WORKS DEPT.

P.O. Box 490 Mail Station
Gainesville, FL 32602 334-2051

☑ No Exceptions Taken
☐ Modify as noted
☐ Revise and Resubmit
☐ Rejected ☐ Reviewed

By: [signature] Date 9.18.96

Review is for general conformance with the design concept. Markings and comments shall not relieve the contractor from compliance with the intent of the project drawings, specifications and contract documents. Contractor is responsible for confirming and correlating all quantities and dimensions, fabrication processes and techniques of construction, coordination of the work with other trades, and the satisfactory performance of his work.

CITY OF GAINESVILLE
S.E. 1st AVE. CRIC PROJECT

DRAWING SCALE : 1/4"=1'-0"

TAYLOR PRECAST, INC.
CONCRETE SANITARY & DRAINAGE STRUCTURES

SEIST.DWG

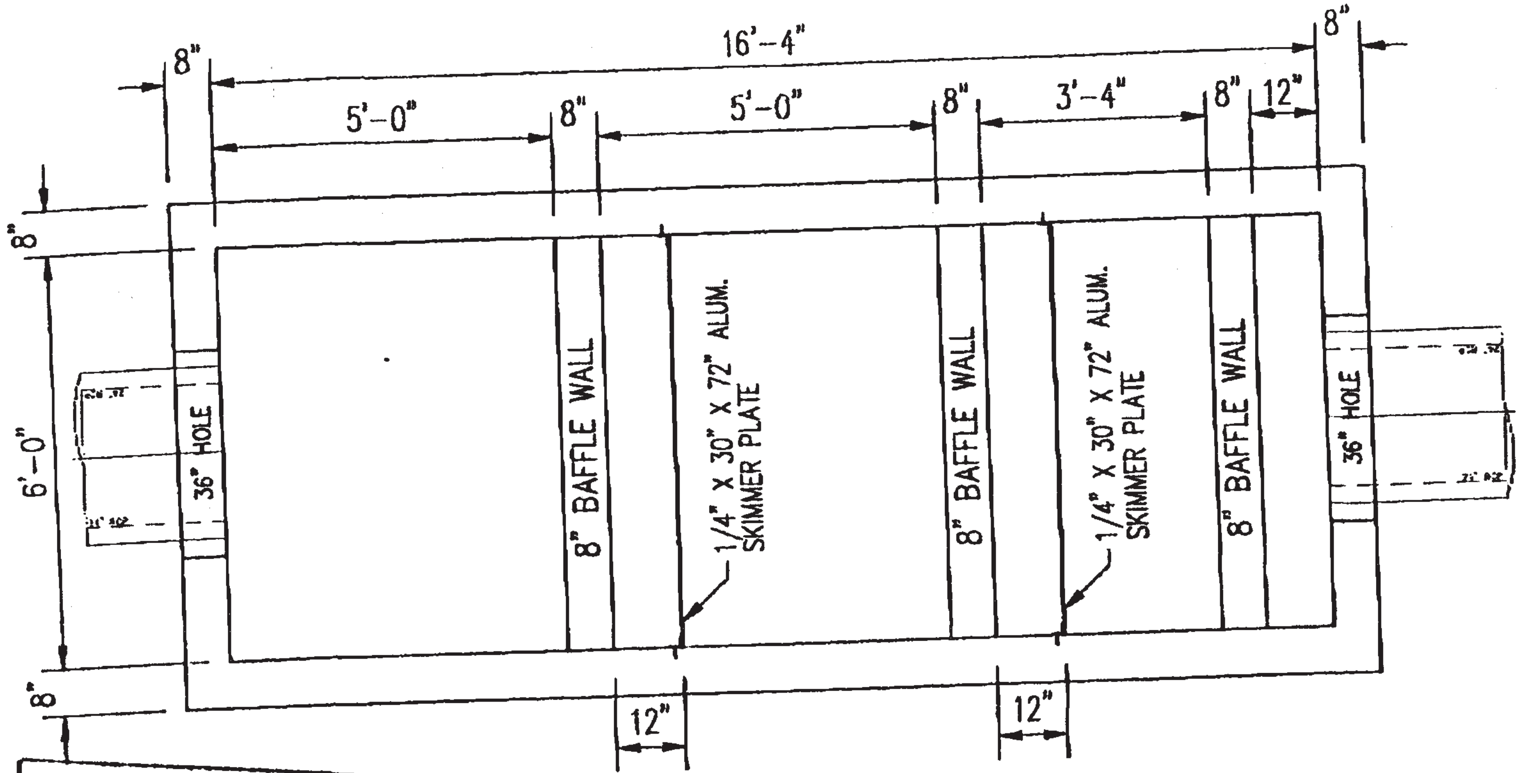
Date: 9/18/1996

TITLE-B

GRSTRP1.DWG

SEP-18-96 WED 02:10 PM TAYLOR PRECAST

BAFFLING STRUCTURE LAYOUT



PLAN VIEW LAYOUT

SHOP DRAWING REVIEW

CITY OF GAINESVILLE
PUBLIC WORKS DEPT.
P.O. Box 490, Mail Station 58
Gainesville, FL 32602 334-2051

- ☑ No Exceptions Taken
- ☐ Modify as Noted
- ☐ Revise and Resubmit
- ☐ Rejected ☐ Reviewed

By: JMJ

Date: 9·18·96

Review is for general conformance with the design concept. Markings and comments shall not relieve the contractor from compliance with the intent of the project drawings, specifications and contract documents. Contractor is responsible for confirming and correlating all quantities and dimensions; fabrication processes and techniques of construction; coordination of the work with other trades; and the satisfactory performance of his work.

CITY OF GAINESVILLE P/W S.E. 1st AVE. CRIC PROJECT	DRAWN BY: M. BAIN DRAWING SCALE : 3/8"=1'-0"

Taylor

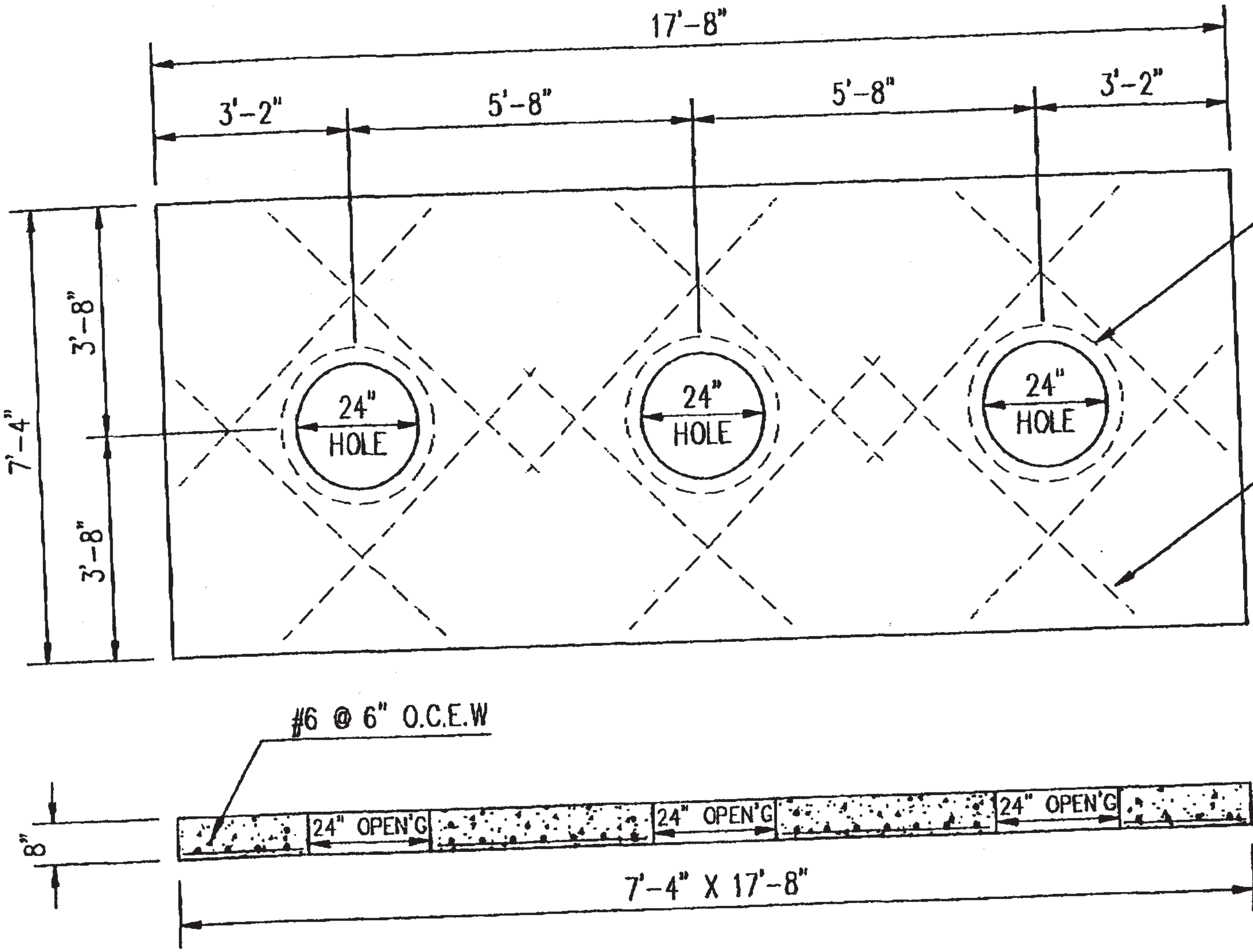
TAYLOR PRECAST, INC.
CONCRETE SANITARY & DRAINAGE STRUCTURES

Date: 9/18/1996

...1ST.DWG

SEP-18-96 WED 02:11 PM TAYLOR PRECAST P. 07/07

BAFFLING STRUCTURE TOP SLAB DETAIL



SHOP DRAWING REVIEW

CITY OF GAINESVILLE PUBLIC WORKS DEPT.
P.O. Box 490, Mail Station 58
Gainesville, FL 32602 334-2051

- No Exceptions Taken
- Modify as Noted
- Revise and Resubmit
- Rejected
- Reviewed

Date 9.18.96

By

Review is for general conformance with the design concept and comments shall not relieve the contractor from compliance with the intent of the project drawings, specifications and contract documents. Contractor is responsible for confirming and correlating all quantities and dimensions; fabrication processes and techniques of construction; coordination of the work with other trades; and the satisfactory performance of his work.

SPECIFICATIONS:
1. STEEL: #6 @ 6" O.C.E.W WITH ADDITIONAL REINFORCING AS SHOWN.
2. 4,000 P.S.I. CONCRETE. TYPE II CEMENT.
3. APPROX. WGHT. = 12056#

CITY OF GAINESVILLE P/W S.E. 1st AVE. CRIC PROJECT	DRAWN BY: M. BAIN DRAWING SCALE: 3/8"=1'-0"

TAYLOR PRECAST, INC.
CONCRETE SANITARY & DRAINAGE STRUCTURES

APPENDIX C
SSTU Sample Location Descriptions

Appendix C

Structural Stormwater Treatment Unit Sample Location Descriptions

Sample ID	Sample Site	Site Description
Hogtown Creek at NW 29th Road		
HOG29US	Upstream	Main channel of Hogtown Creek, upstream of the box culvert under NW 29th Road (upstream of the SSTUs)
HOG29V-W	Vortech 11000 Vortex Chamber	Large swirl chamber (separation chamber) in the SSTU for particulate removal
HOG29M-W	Vortech 11000 Main Chamber	Main chamber (adjacent to the separation or swirl chamber) of the SSTU after the vortex chamber, prior to the discharge from the unit
HOG29OUT-W	Vortech 11000 Effluent	Effluent from the SSTU, collected at the outfall pipe in the box culvert under NW 29th Road
HOG29V-E	Vortech 3000 Vortex Chamber	Large swirl chamber (separation chamber) in the SSTU for particulate removal
HOG29M-E	Vortech 3000 Main Chamber	Main chamber (adjacent to the separation or swirl chamber) of the SSTU after the vortex chamber, prior to the discharge from the unit
HOG29OUT-E	Vortech 3000 Effluent	Effluent from the SSTU, collected at the outfall pipe in the box culvert under NW 29th Road
HOG29DS	Downstream	Main channel of Hogtown Creek, downstream of the box culvert under NW 29th Road (downstream of the SSTUs)
Sweetwater Branch at NE 10th Avenue		
SWB10IN	Influent	Main channel of Sweetwater Branch on the north side of the channel, prior to entering the SSTU
SWB10BOX	CDS Chamber	Inside the continuous deflection separation (CDS) swirl chamber (separation chamber)
SWB10OUT	Effluent	Main channel of Sweetwater Branch on the north side of the channel, at the discharge pipe from the SSTU
SWBNE10	Downstream	Main channel of Sweetwater Branch, downstream of the SSTU discharge
Sweetwater Branch at NE 8th Avenue		
SWBNE8	Upstream	Main channel of Sweetwater Brach, approximately 30 feet upstream from the CDS intake
SWB8IN	Influent	Upstream of the baffle wall before the flow enters the vortex box
SWB8BOX	CDS Chamber	Large swirl chamber (separation chamber) for particulate removal (manhole for access to sample is located on the edge of the street)
SWB8OUT	Effluent	Downstream of the baffle wall as the flow exits the vortex box
Sweetwater Branch at SE 1st Avenue		
SWB1IN	Influent	Inflow to the baffle box
SWB1-3	Baffle Box	First chamber stormwater enters in the baffle box
SWB1-2	Baffle Box	Second chamber of the baffle box
SWB1-1	Baffle Box	Third chamber of the baffle box
SWB1OUT	Effluent	Outfall pipe from the baffle box to Sweetwater Branch, located under the pedestrian bridge in Sweetwater Branch Park
SWBSE1	Downstream	Main channel of Sweetwater Branch, downstream of the discharge from the baffle box

APPENDIX D
Summary of Sampling Events

Appendix D
Summary of Sampling Events

Sample Date	Sample Type	Rainfall on Sample Date (in.)	Antecedent Rainfall[1] (in.)	SSTUs Sampled	Analyses Conducted
6/19/12	Preliminary	0.00	0.79	HOG29-W SWB10 HOG29-E SWB8	Fecal Coliform
6/28/12	Preliminary	0.00	12.19	HOG29-W SWB10 HOG29-E SWB8 SWB1	Fecal Coliform
7/5/12	Preliminary	0.00	0.0	HOG29-W SWB10 HOG29-E SWB8 SWB1	Fecal Coliform
7/18/12	Preliminary	0.00	0.80	HOG29-W SWB10 HOG29-E SWB8	Fecal Coliform
8/21/12	Storm Event	2.00	6.06	HOG29-W HOG29-E	Fecal Coliform
8/23/12	Preliminary	0.04	6.07	SWB10 SWB8 SWB1	Fecal Coliform
8/27/12	Preliminary	0.82	4.28	HOG29-W SWB8 HOG29-E SWB1	Fecal Coliform
12/10/12	Storm Event	2.65	0.00	HOG29-W HOG29-E	Nutrients, Potassium, TSS, VSS, Fecal Coliform
12/12/12	Preliminary	1.13	2.94	HOG29-W HOG29-E	Nutrients, Potassium, TSS, VSS, Fecal Coliform
2/26/13	Preliminary	0.61	0.71	SWB10	Nutrients, Potassium, TSS, VSS, Fecal Coliform[3]
6/4/13	Storm Event	0.03	0.47	SWB1	Nutrients, TSS, VSS, Fecal Coliform
6/5/13[2]	Storm Event	0.04	0.5	SWB8 SWB1	Nutrients, TSS, VSS, Fecal Coliform
8/5/13[2]	Wet Season Base Flow	0.01	2.91	HOG29-W SWB10 HOG29-E SWB8 SWB1	Fecal Coliform
8/16/13	Storm Event	0.86	0.00	SWB1	Nutrients, TSS, VSS, Fecal Coliform
10/22/13	Storm Event	0.10	0.01	SWB8	Nutrients, TSS, VSS, Fecal Coliform

1. Total rainfall recorded 7 days prior to sample date. See Appendix E for Total Daily Rainfall Values.
2. Sediment samples collected for fecal coliform analysis; see Section 4.2 for details.
3. See Appendix G for additional analyses conducted.

APPENDIX E
Rainfall Data – Total Daily Values

Appendix E-1

2012 Rainfall Data - Total Daily Values (in.)

Sweetwater Branch Watershed, Gainesville Florida

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.00	0.00	0.00	0.17	0.00	0.02	0.00	0.43	0.00	0.60	0.00	0.00
2	0.03	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.11	0.08	0.00	0.00
3	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.48	0.00	0.00
4	0.00	0.00	0.28	0.01	0.00	0.00	0.00	1.00	0.00	0.03	0.00	0.00
5	0.00	0.01	0.01	0.00	0.00	0.04	0.19	1.27	0.00	0.13	0.00	0.00
6	0.00	0.06	0.00	0.00	0.00	0.08	0.05	0.10	0.00	0.01	0.03	0.00
7	0.00	0.00	0.00	0.00	0.21	0.64	0.00	0.00	0.32	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.13	0.05	0.00	0.05	0.02	0.00	0.00
9	0.00	0.00	0.00	0.00	0.11	1.06	0.00	0.00	0.84	0.00	0.00	0.00
10	0.00	0.05	0.00	0.00	0.01	0.66	0.55	0.00	0.00	0.00	0.00	2.65
11	0.02	0.04	0.00	0.00	0.00	0.00	0.17	0.04	0.00	0.00	0.00	0.29
12	0.00	0.00	0.00	0.00	0.00	0.02	0.11	0.15	0.00	0.00	0.00	1.13
13	0.00	0.00	0.00	0.00	0.02	0.00	0.35	0.00	0.00	0.00	0.01	0.00
14	0.00	0.00	0.37	0.00	0.00	0.76	0.00	0.00	0.00	0.00	0.01	0.00
15	0.00	0.03	0.09	0.00	0.85	0.01	0.03	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.19	0.00	0.14	0.04	0.23	0.00	0.00	0.00
17	0.00	0.01	0.20	0.00	0.27	0.00	0.00	0.42	0.02	0.00	0.00	0.00
18	0.61	0.00	0.01	0.03	0.02	0.00	0.00	0.05	1.81	0.00	0.00	0.00
19	0.00	0.00	0.00	0.19	0.00	0.00	0.10	1.42	0.02	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.13	1.39	0.00	0.00	0.70
21	0.00	0.00	0.00	0.21	0.00	0.09	0.00	2.00	0.01	0.00	0.00	0.00
22	0.00	0.24	0.00	0.84	0.00	0.09	0.00	0.01	0.00	0.00	0.00	0.00
23	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00
24	0.00	0.02	0.15	0.00	0.00	6.51	0.09	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	2.89	0.06	0.00	0.00	0.00	0.00	0.00
26	0.00	0.23	0.00	0.00	0.00	2.61	0.00	0.10	0.00	0.00	0.00	0.69
27	0.26	0.37	0.00	0.00	0.22	0.00	0.00	0.82	0.25	0.00	0.00	0.00
28	0.00	0.02	0.00	0.00	3.24	0.00	0.00	0.47	0.00	0.00	0.00	0.00
29	0.00	0.00	0.00	0.00	1.77	0.00	0.25	0.33	0.00	0.00	0.00	1.19
30	0.00		0.00	0.00	0.08	0.00	0.85	0.35	0.00	0.00	0.00	0.00
31	0.00		0.54		0.05		0.10	0.00		0.00		0.00
Total	0.92	1.08	1.76	1.52	7.04	15.61	3.09	11.17	5.05	1.35	0.05	6.65

2012 Total = 55.29

= SSTU Sample Collected

Data collected and processed by Hydrologic Data Collection, Inc. at Rain Gage 2.

Located at NE 8th Ave. and Waldo Rd in Gainesville, FL.

Rainfall data recorded at 15-minute intervals through Sept 2013. As of Oct 1, 2013 data is recorded at 5-minute intervals.

Appendix E-2

2013 Rainfall Data - Total Daily Values (in.)

Sweetwater Branch Watershed, Gainesville Florida

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.00	0.00	0.00	0.01	0.03	0.00	1.76	0.40	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.50	0.19	0.96	0.15	0.00	0.00	1.12	0.00
3	0.17	0.00	0.00	0.56	1.20	0.21	0.13	0.06	0.45	0.00	0.00	0.00
4	0.01	0.00	0.00	0.15	0.26	0.03	0.55	0.01	0.96	0.00	0.00	0.00
5	0.00	0.00	0.00	0.01	0.07	0.04	0.38	0.01	0.00	0.00	0.00	0.00
6	0.04	0.03	0.01	0.02	0.00	0.33	0.01	0.00	0.78	0.00	0.00	0.00
7	0.00	0.29	0.00	0.00	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.35
11	0.00	0.00	0.00	0.08	0.24	0.08	0.00	0.00	0.15	0.00	0.00	0.00
12	0.00	0.00	0.27	0.00	0.01	0.03	0.28	0.00	0.00	0.00	0.00	0.00
13	0.00	0.06	0.00	0.00	0.00	0.00	1.23	0.00	0.00	0.00	0.00	0.00
14	0.00	0.12	0.00	0.50	0.00	0.48	0.03	0.00	0.00	0.00	0.00	1.64
15	0.00	0.00	0.00	0.12	0.00	0.00	0.02	0.00	0.02	0.01	0.15	0.86
16	0.00	0.00	0.00	0.05	0.00	0.20	0.04	0.86	0.00	0.00	0.01	0.00
17	0.04	0.00	0.06	0.04	0.00	0.00	0.03	0.27	0.00	0.00	0.18	0.00
18	0.00	0.00	0.04	0.02	0.02	0.00	0.02	0.62	0.00	0.00	0.00	0.00
19	0.00	0.00	0.07	0.07	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	0.16	0.03	0.56	0.00	0.36	0.21	0.00	0.00	0.02	0.00
21	0.00	0.00	0.00	0.02	0.20	0.29	0.07	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.03	0.00	0.01	1.35	0.47	0.32	0.10	0.09	0.00
23	0.00	0.13	0.07	0.02	0.00	0.00	0.26	0.52	0.61	0.00	0.00	0.00
24	0.00	0.05	0.42	0.04	0.00	0.00	0.15	0.00	0.75	0.00	0.00	0.00
25	0.00	0.53	0.00	0.02	0.00	0.00	0.12	0.11	0.44	0.00	0.00	0.00
26	0.00	0.61	0.00	0.00	0.00	1.03	0.07	0.00	0.00	0.00	1.74	0.00
27	0.00	0.00	0.00	0.00	0.00	0.06	0.02	0.00	0.00	0.00	0.07	0.01
28	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.10	0.00	0.00	0.00
29	0.00		0.00	0.63	0.06	0.25	0.05	0.00	0.00	0.00	0.00	1.34
30	0.13		0.00	0.01	0.00	0.59	0.03	0.00	0.06	0.00	0.00	0.00
31	0.04		0.00		0.01		2.21	0.00		0.00		0.00
Total	0.43	1.82	1.10	2.43	3.16	4.29	10.27	3.69	4.64	0.11	3.38	4.20

2013 Total = 39.52

[shaded] = SSTU Sample Collected

Data collected and processed by Hydrologic Data Collection, Inc. at Rain Gage 2.

Located at NE 8th Ave. and Waldo Rd in Gainesville, FL.

Rainfall data recorded at 15-minute intervals through Sept 2013. As of Oct 1, 2013 data is recorded at 5-minute intervals.

APPENDIX F

Water Quality Data - Fecal Coliform Bacteria

Appendix F
Water Quality Data - Fecal Coliform Bacteria

Sample ID	Sample Date	Sample Time	Compound Name	Units	Result	Data Qualifier
Hogtown Creek at NW 29th Road						
HOG29US	6/19/2012	11:35	Fecal Coliform	Col/100mL MF	50	U
HOG29US	7/5/2012	14:20	Fecal Coliform	Col/100mL MF	874	
HOG29US	7/18/2012	14:35	Fecal Coliform	Col/100mL MF	2,090	
HOG29US	8/21/2012	13:45	Fecal Coliform	Col/100mL MF	15,400	
HOG29US	12/12/2012	10:10	Fecal Coliform	Col/100mL MF	3,200	
HOG29US	8/5/2013	10:45	Fecal Coliform	Col/100mL MF	747	
HOG29IN-W	12/12/2012	9:40	Fecal Coliform	Col/100mL MF	95	
HOG29V-W	6/19/2012	11:20	Fecal Coliform	Col/100mL MF	408	
HOG29V-W	6/28/2012	13:17	Fecal Coliform	Col/100mL MF	12,000	Z
HOG29V-W	7/5/2012	14:20	Fecal Coliform	Col/100mL MF	2,340	
HOG29V-W	7/18/2012	14:15	Fecal Coliform	Col/100mL MF	668	
HOG29V-W	8/21/2012	13:40	Fecal Coliform	Col/100mL MF	2,000	
HOG29V-W	8/27/2012	10:00	Fecal Coliform	Col/100mL MF	25,000	
HOG29V-W	12/12/2012	9:38	Fecal Coliform	Col/100mL MF	2,800	
HOG29V-W	8/5/2013	10:50	Fecal Coliform	Col/100mL MF	108	
HOG29M-W	6/19/2012	11:25	Fecal Coliform	Col/100mL MF	600	
HOG29M-W	6/28/2012	13:19	Fecal Coliform	Col/100mL MF	12,000	Z
HOG29M-W	7/5/2012	14:20	Fecal Coliform	Col/100mL MF	646	
HOG29M-W	7/18/2012	14:10	Fecal Coliform	Col/100mL MF	200	
HOG29M-W	8/21/2012	13:40	Fecal Coliform	Col/100mL MF	1,000	
HOG29M-W	8/27/2012	9:59	Fecal Coliform	Col/100mL MF	32,000	
HOG29M-W	12/12/2012	9:35	Fecal Coliform	Col/100mL MF	5,200	
HOG29OUT-W	6/19/2012	11:35	Fecal Coliform	Col/100mL MF	1,400	
HOG29OUT-W	6/28/2012	13:25	Fecal Coliform	Col/100mL MF	760	
HOG29OUT-W	7/5/2012	14:20	Fecal Coliform	Col/100mL MF	722	
HOG29OUT-W	7/18/2012	14:15	Fecal Coliform	Col/100mL MF	38	
HOG29OUT-W	8/21/2012	13:40	Fecal Coliform	Col/100mL MF	960	
HOG29OUT-W	8/27/2012	9:57	Fecal Coliform	Col/100mL MF	7,330	
HOG29OUT-W	12/10/2012	15:10	Fecal Coliform	Col/100mL MF	28,400	
HOG29OUT-W	12/12/2012	9:30	Fecal Coliform	Col/100mL MF	3,400	
HOG29V-E	6/19/2012	11:15	Fecal Coliform	Col/100mL MF	3,600	
HOG29V-E	6/28/2012	13:09	Fecal Coliform	Col/100mL MF	12,000	Z
HOG29V-E	7/5/2012	14:20	Fecal Coliform	Col/100mL MF	60,000	Z
HOG29V-E	7/18/2012	14:00	Fecal Coliform	Col/100mL MF	33,300	
HOG29V-E	8/21/2012	13:30	Fecal Coliform	Col/100mL MF	6,000	
HOG29V-E	8/27/2012	10:03	Fecal Coliform	Col/100mL MF	50,000	
HOG29V-E	8/5/2013	10:55	Fecal Coliform	Col/100mL MF	702	
HOG29M-E	6/19/2012	11:20	Fecal Coliform	Col/100mL MF	7,800	
HOG29M-E	6/28/2012	13:08	Fecal Coliform	Col/100mL MF	2,880	
HOG29M-E	7/5/2012	14:20	Fecal Coliform	Col/100mL MF	60,000	Z

Appendix F
Water Quality Data - Fecal Coliform Bacteria

Sample ID	Sample Date	Sample Time	Compound Name	Units	Result	Data Qualifier
HOG29M-E	7/18/2012	13:55	Fecal Coliform	Col/100mL MF	4,000	
HOG29M-E	8/21/2012	13:30	Fecal Coliform	Col/100mL MF	2,670	
HOG29M-E	8/27/2012	10:02	Fecal Coliform	Col/100mL MF	36,000	
HOG29M-E	12/12/2012	9:50	Fecal Coliform	Col/100mL MF	200	
HOG29OUT-E	8/21/2012	13:30	Fecal Coliform	Col/100mL MF	4,000	
HOG29OUT-E	8/27/2012	9:58	Fecal Coliform	Col/100mL MF	40,000	
HOG29OUT-E	12/10/2012	15:05	Fecal Coliform	Col/100mL MF	13,200	
HOG29OUT-E	12/12/2012	9:45	Fecal Coliform	Col/100mL MF	9,400	
HOG29DS	6/19/2012	11:30	Fecal Coliform	Col/100mL MF	1,350	
HOG29DS	7/5/2012	14:20	Fecal Coliform	Col/100mL MF	1,070	
HOG29DS	7/18/2012	14:30	Fecal Coliform	Col/100mL MF	4,400	
HOG29DS	8/21/2012	13:45	Fecal Coliform	Col/100mL MF	15,000	
Sweetwater Branch at NE 10th Avenue						
SWB10IN	6/19/2012	13:13	Fecal Coliform	Col/100mL MF	380	
SWB10IN	6/28/2012	11:38	Fecal Coliform	Col/100mL MF	2,150	
SWB10IN	7/5/2012	13:56	Fecal Coliform	Col/100mL MF	37,800	J4
SWB10IN	7/18/2012	9:05	Fecal Coliform	Col/100mL MF	3,400	
SWB10IN	8/23/2012	13:30	Fecal Coliform	Col/100mL MF	3,010	
SWB10IN	2/26/2013	11:05	Fecal Coliform	Col/100mL MF	1,200	Z
SWB10IN	8/5/2013	10:10	Fecal Coliform	Col/100mL MF	1,010	
SWB10BOX	6/19/2012	13:10	Fecal Coliform	Col/100mL MF	380	
SWB10BOX	6/28/2012	11:37	Fecal Coliform	Col/100mL MF	12,000	Z
SWB10BOX	7/5/2012	13:56	Fecal Coliform	Col/100mL MF	6,400	
SWB10BOX	7/18/2012	9:00	Fecal Coliform	Col/100mL MF	5,000	
SWB10BOX	8/23/2012	13:30	Fecal Coliform	Col/100mL MF	8,000	
SWB10BOX	2/26/2013	11:10	Fecal Coliform	Col/100mL MF	1,200	Z
SWB10BOX	8/5/2013	10:05	Fecal Coliform	Col/100mL MF	846	
SWB10OUT	6/19/2012	13:15	Fecal Coliform	Col/100mL MF	240	
SWB10OUT	6/28/2012	11:39	Fecal Coliform	Col/100mL MF	2,960	
SWB10OUT	7/5/2012	13:56	Fecal Coliform	Col/100mL MF	5,000	
SWB10OUT	7/18/2012	9:10	Fecal Coliform	Col/100mL MF	2,800	
SWB10OUT	8/23/2012	13:30	Fecal Coliform	Col/100mL MF	1,950	
SWB10OUT	2/26/2013	11:15	Fecal Coliform	Col/100mL MF	1,200	Z
SWB10OUT	8/5/2013	10:00	Fecal Coliform	Col/100mL MF	999	
SWBNE10	6/19/2012	13:20	Fecal Coliform	Col/100mL MF	176	
SWBNE10	7/18/2012	8:48	Fecal Coliform	Col/100mL MF	1,550	
Sweetwater Branch at NE 8th Avenue						
SWBNE8	6/5/2013	8:33	Fecal Coliform	Col/100mL MF	2,000	
SWBNE8	8/5/2013	9:35	Fecal Coliform	Col/100mL MF	144	
SWB8IN	6/19/2012	13:05	Fecal Coliform	Col/100mL MF	320	

Appendix F
Water Quality Data - Fecal Coliform Bacteria

Sample ID	Sample Date	Sample Time	Compound Name	Units	Result	Data Qualifier
SWB8IN	6/28/2012	11:10	Fecal Coliform	Col/100mL MF	520	
SWB8IN	7/5/2012	13:40	Fecal Coliform	Col/100mL MF	53,600	J4
SWB8IN	7/18/2012	10:05	Fecal Coliform	Col/100mL MF	11,000	
SWB8IN	8/23/2012	13:15	Fecal Coliform	Col/100mL MF	3,010	
SWB8IN	8/27/2012	9:23	Fecal Coliform	Col/100mL MF	36,000	
SWB8IN	6/5/2013	12:40	Fecal Coliform	Col/100mL MF	44,000	
SWB8IN	6/5/2013	13:35	Fecal Coliform	Col/100mL MF	56,000	
SWB8IN	10/22/2013	15:45	Fecal Coliform	Col/100mL MF	9,000	
SWB8IN	10/22/2013	15:55	Fecal Coliform	Col/100mL MF	7,640	
SWB8BOX	6/19/2012	13:00	Fecal Coliform	Col/100mL MF	3,080	
SWB8BOX	6/28/2012	11:13	Fecal Coliform	Col/100mL MF	1,600	
SWB8BOX	7/5/2012	13:40	Fecal Coliform	Col/100mL MF	60,800	J4
SWB8BOX	7/18/2012	10:10	Fecal Coliform	Col/100mL MF	2,000	
SWB8BOX	8/23/2012	13:15	Fecal Coliform	Col/100mL MF	4,010	
SWB8BOX	8/27/2012	9:22	Fecal Coliform	Col/100mL MF	60,000	Z
SWB8BOX	6/5/2013	8:45	Fecal Coliform	Col/100mL MF	5,000	
SWB8BOX	8/5/2013	9:40	Fecal Coliform	Col/100mL MF	1,120	J4
SWB8OUT	6/19/2012	13:06	Fecal Coliform	Col/100mL MF	5,800	
SWB8OUT	6/28/2012	11:17	Fecal Coliform	Col/100mL MF	1,150	
SWB8OUT	7/5/2012	13:40	Fecal Coliform	Col/100mL MF	5,600	
SWB8OUT	7/18/2012	10:08	Fecal Coliform	Col/100mL MF	2,340	
SWB8OUT	8/23/2012	13:15	Fecal Coliform	Col/100mL MF	4,600	
SWB8OUT	8/27/2012	9:21	Fecal Coliform	Col/100mL MF	19,000	
SWB8OUT	6/5/2013	12:45	Fecal Coliform	Col/100mL MF	120	Z
SWB8OUT	6/5/2013	13:40	Fecal Coliform	Col/100mL MF	10,000	
SWB8OUT	10/22/2013	15:48	Fecal Coliform	Col/100mL MF	10,000	
SWB8OUT	10/22/2013	15:58	Fecal Coliform	Col/100mL MF	5,000	
Sweetwater Branch at SE 1st Avenue						
SWB1IN	8/23/2012	12:40	Fecal Coliform	Col/100mL MF	2,500	
SWB1IN	8/27/2012	9:02	Fecal Coliform	Col/100mL MF	60,000	Z
SWB1IN	6/4/2013	8:40	Fecal Coliform	Col/100mL MF	6,000	Z
SWB1IN	6/4/2013	13:09	Fecal Coliform	Col/100mL MF	6,000	Z
SWB1IN	6/4/2013	13:33	Fecal Coliform	Col/100mL MF	6,000	Z
SWB1IN	8/16/2013	9:00	Fecal Coliform	Col/100mL MF	22,000	
SWB1IN	8/16/2013	9:35	Fecal Coliform	Col/100mL MF	17,400	
SWB1-3	6/28/2012	10:58	Fecal Coliform	Col/100mL MF	1,100	
SWB1-3	7/5/2012	13:20	Fecal Coliform	Col/100mL MF	60	
SWB1-3	8/23/2012	12:40	Fecal Coliform	Col/100mL MF	3,340	
SWB1-3	8/27/2012	9:01	Fecal Coliform	Col/100mL MF	18,000	
SWB1-2	6/28/2012	10:56	Fecal Coliform	Col/100mL MF	1,000	
SWB1-2	7/5/2012	13:21	Fecal Coliform	Col/100mL MF	108	

Appendix F
Water Quality Data - Fecal Coliform Bacteria

Sample ID	Sample Date	Sample Time	Compound Name	Units	Result	Data Qualifier
SWB1-2	8/23/2012	12:40	Fecal Coliform	Col/100mL MF	1,340	
SWB1-2	8/27/2012	9:00	Fecal Coliform	Col/100mL MF	60,000	Z
SWB1-2	6/4/2013	8:45	Fecal Coliform	Col/100mL MF	6,000	Z
SWB1-2	6/4/2013	13:11	Fecal Coliform	Col/100mL MF	6,000	Z
SWB1-2	6/4/2013	13:35	Fecal Coliform	Col/100mL MF	6,000	Z
SWB1-2	8/16/2013	9:05	Fecal Coliform	Col/100mL MF	23,000	
SWB1-2	8/16/2013	9:30	Fecal Coliform	Col/100mL MF	15,100	
SWB1-1	6/28/2012	10:54	Fecal Coliform	Col/100mL MF	4,600	
SWB1-1	7/5/2012	13:23	Fecal Coliform	Col/100mL MF	10	U
SWB1-1	8/23/2012	12:40	Fecal Coliform	Col/100mL MF	1,500	
SWB1-1	8/27/2012	8:59	Fecal Coliform	Col/100mL MF	90,000	
SWB1OUT	8/23/2012	12:40	Fecal Coliform	Col/100mL MF	608	
SWB1OUT	8/27/2012	8:58	Fecal Coliform	Col/100mL MF	60,000	Z
SWB1OUT	6/4/2013	13:07	Fecal Coliform	Col/100mL MF	6,000	Z
SWB1OUT	6/4/2013	13:31	Fecal Coliform	Col/100mL MF	6,000	Z
SWB1OUT	8/16/2013	8:55	Fecal Coliform	Col/100mL MF	28,000	J4
SWB1OUT	8/16/2013	9:25	Fecal Coliform	Col/100mL MF	73,000	
SWBSE1	7/18/2012	11:35	Fecal Coliform	Col/100mL MF	4,600	
SWBSE1	6/4/2013	8:50	Fecal Coliform	Col/100mL MF	2,800	
SWBSE1	8/5/2013	8:50	Fecal Coliform	Col/100mL MF	390	

U = The compound was analyzed for but not detected
Z = Confluent growth/Too numerous to count
J4 = Estimated Result

APPENDIX G

Water Quality Data - Nutrients and Inorganic Indicators

Appendix G
Water Quality Data - Nutrients and Inorganic Indicators

Sample ID	Sample Date	Sample Time	Compound Name	Units	Result	Data Qualifier
Hogtown Creek at NW 29th Road						
HOG29OUT-W	12/10/2012	15:10	Nitrate + Nitrite	mg/L	0.25	
HOG29US	12/12/2012	10:10	Nitrate + Nitrite	mg/L	0.07	
HOG29US	12/12/2012	10:10	Potassium	mg/L	1.5	
HOG29US	12/12/2012	10:10	Total Kjeldahl Nitrogen	mg/L	0.19	
HOG29US	12/12/2012	10:10	Total Nitrogen	mg/L	0.26	
HOG29US	12/12/2012	10:10	Total Phosphorus (as P)	mg/L	0.993	
HOG29US	12/12/2012	10:10	Total Suspended Solids	mg/L	4600	
HOG29US	12/12/2012	10:10	Volatile Suspended Solids	mg/L	7	
HOG29IN-W	12/12/2012	9:40	Nitrate + Nitrite	mg/L	0.31	
HOG29IN-W	12/12/2012	9:40	Potassium	mg/L	3.6	
HOG29IN-W	12/12/2012	9:40	Total Kjeldahl Nitrogen	mg/L	0.1	
HOG29IN-W	12/12/2012	9:40	Total Nitrogen	mg/L	0.41	
HOG29IN-W	12/12/2012	9:40	Total Phosphorus (as P)	mg/L	1.35	
HOG29IN-W	12/12/2012	9:40	Total Suspended Solids	mg/L	2	U
HOG29IN-W	12/12/2012	9:40	Volatile Suspended Solids	mg/L	2	U
HOG29V-W	12/12/2012	9:38	Nitrate + Nitrite	mg/L	0.29	
HOG29V-W	12/12/2012	9:38	Potassium	mg/L	3.8	
HOG29V-W	12/12/2012	9:38	Total Kjeldahl Nitrogen	mg/L	0.081	
HOG29V-W	12/12/2012	9:38	Total Nitrogen	mg/L	0.37	
HOG29V-W	12/12/2012	9:38	Total Phosphorus (as P)	mg/L	1.47	
HOG29V-W	12/12/2012	9:38	Total Suspended Solids	mg/L	2	U
HOG29V-W	12/12/2012	9:38	Volatile Suspended Solids	mg/L	2	U
HOG29M-W	12/12/2012	9:35	Nitrate + Nitrite	mg/L	0.3	
HOG29M-W	12/12/2012	9:35	Potassium	mg/L	3.8	
HOG29M-W	12/12/2012	9:35	Total Kjeldahl Nitrogen	mg/L	0.071	U
HOG29M-W	12/12/2012	9:35	Total Nitrogen	mg/L	0.3	
HOG29M-W	12/12/2012	9:35	Total Phosphorus (as P)	mg/L	0.993	
HOG29M-W	12/12/2012	9:35	Total Suspended Solids	mg/L	2	U
HOG29M-W	12/12/2012	9:35	Volatile Suspended Solids	mg/L	2	U
HOG29OUT-W	12/10/2012	15:10	Potassium	mg/L	9.9	
HOG29OUT-W	12/10/2012	15:10	Total Kjeldahl Nitrogen	mg/L	2.6	
HOG29OUT-W	12/10/2012	15:10	Total Nitrogen	mg/L	2.8	
HOG29OUT-W	12/10/2012	15:10	Total Phosphorus (as P)	mg/L	1.88	
HOG29OUT-W	12/10/2012	15:10	Total Suspended Solids	mg/L	75	
HOG29OUT-W	12/10/2012	15:10	Volatile Suspended Solids	mg/L	13	
HOG29OUT-W	12/12/2012	9:30	Nitrate + Nitrite	mg/L	0.3	
HOG29OUT-W	12/12/2012	9:30	Potassium	mg/L	3.8	
HOG29OUT-W	12/12/2012	9:30	Total Kjeldahl Nitrogen	mg/L	0.17	
HOG29OUT-W	12/12/2012	9:30	Total Nitrogen	mg/L	0.47	
HOG29OUT-W	12/12/2012	9:30	Total Phosphorus (as P)	mg/L	1.39	
HOG29OUT-W	12/12/2012	9:30	Total Suspended Solids	mg/L	2	U

Appendix G
Water Quality Data - Nutrients and Inorganic Indicators

Sample ID	Sample Date	Sample Time	Compound Name	Units	Result	Data Qualifier
HOG29OUT-W	12/12/2012	9:30	Volatile Suspended Solids	mg/L	2	U
HOG29M-E	12/12/2012	9:50	Nitrate + Nitrite	mg/L	0.048	
HOG29M-E	12/12/2012	9:50	Potassium	mg/L	2.7	
HOG29M-E	12/12/2012	9:50	Total Kjeldahl Nitrogen	mg/L	0.071	U
HOG29M-E	12/12/2012	9:50	Total Nitrogen	mg/L	0.048	
HOG29M-E	12/12/2012	9:50	Total Phosphorus (as P)	mg/L	0.834	
HOG29M-E	12/12/2012	9:50	Total Suspended Solids	mg/L	13	
HOG29M-E	12/12/2012	9:50	Volatile Suspended Solids	mg/L	2	
HOG29OUT-E	12/10/2012	15:05	Nitrate + Nitrite	mg/L	0.18	
HOG29OUT-E	12/10/2012	15:05	Potassium	mg/L	3.7	
HOG29OUT-E	12/10/2012	15:05	Total Kjeldahl Nitrogen	mg/L	0.94	
HOG29OUT-E	12/10/2012	15:05	Total Nitrogen	mg/L	1.1	
HOG29OUT-E	12/10/2012	15:05	Total Phosphorus (as P)	mg/L	1.03	
HOG29OUT-E	12/10/2012	15:05	Total Suspended Solids	mg/L	160	
HOG29OUT-E	12/10/2012	15:05	Volatile Suspended Solids	mg/L	62	
HOG29OUT-E	12/12/2012	9:45	Nitrate + Nitrite	mg/L	0.034	
HOG29OUT-E	12/12/2012	9:45	Potassium	mg/L	2.5	
HOG29OUT-E	12/12/2012	9:45	Total Kjeldahl Nitrogen	mg/L	0.071	U
HOG29OUT-E	12/12/2012	9:45	Total Nitrogen	mg/L	0.034	
HOG29OUT-E	12/12/2012	9:45	Total Phosphorus (as P)	mg/L	1.03	
HOG29OUT-E	12/12/2012	9:45	Total Suspended Solids	mg/L	2.6	
HOG29OUT-E	12/12/2012	9:45	Volatile Suspended Solids	mg/L	2	
Sweetwater Branch at NE 10th Avenue						
SWB10IN	2/26/2013	11:05	Alkalinity, Total	mg/L	28	
SWB10IN	2/26/2013	11:05	Ammonia (N)	mg/L	0.064	
SWB10IN	2/26/2013	11:05	Boron	mg/L	0.01	
SWB10IN	2/26/2013	11:05	Cadmium	mg/L	0.0002	U
SWB10IN	2/26/2013	11:05	Calcium	mg/L	8.6	
SWB10IN	2/26/2013	11:05	Chloride	mg/L	1.2	
SWB10IN	2/26/2013	11:05	Chromium	mg/L	0.00083	
SWB10IN	2/26/2013	11:05	Color	Color Units	30	
SWB10IN	2/26/2013	11:05	Copper	mg/L	0.0036	
SWB10IN	2/26/2013	11:05	Iron	mg/L	0.12	
SWB10IN	2/26/2013	11:05	Lead	mg/L	0.0034	
SWB10IN	2/26/2013	11:05	Magnesium	mg/L	1.2	
SWB10IN	2/26/2013	11:05	Manganese	mg/L	0.0054	
SWB10IN	2/26/2013	11:05	Nickel	mg/L	0.0011	U
SWB10IN	2/26/2013	11:05	Nitrate + Nitrite	mg/L	0.052	
SWB10IN	2/26/2013	11:05	Orthophosphate	mg/L	0.081	
SWB10IN	2/26/2013	11:05	Potassium	mg/L	1.2	
SWB10IN	2/26/2013	11:05	Sulfate	mg/L	1.4	
SWB10IN	2/26/2013	11:05	Total Dissolved Solids	mg/L	22	

Appendix G
Water Quality Data - Nutrients and Inorganic Indicators

Sample ID	Sample Date	Sample Time	Compound Name	Units	Result	Data Qualifier
SWB10IN	2/26/2013	11:05	Total Hardness (as CaCO3)	mg/L	26	
SWB10IN	2/26/2013	11:05	Total Kjeldahl Nitrogen	mg/L	0.28	
SWB10IN	2/26/2013	11:05	Total Nitrogen	mg/L	0.33	
SWB10IN	2/26/2013	11:05	Total Organic Carbon	mg/L	6.8	
SWB10IN	2/26/2013	11:05	Total Phosphorus (as P)	mg/L	0.166	
SWB10IN	2/26/2013	11:05	Total Suspended Solids	mg/L	12	
SWB10IN	2/26/2013	11:05	Zinc	mg/L	0.038	
SWB10BOX	2/26/2013	11:10	Alkalinity, Total	mg/L	28	
SWB10BOX	2/26/2013	11:10	Ammonia (N)	mg/L	0.029	
SWB10BOX	2/26/2013	11:10	Boron	mg/L	0.01	
SWB10BOX	2/26/2013	11:10	Cadmium	mg/L	0.0002	U
SWB10BOX	2/26/2013	11:10	Calcium	mg/L	8.4	
SWB10BOX	2/26/2013	11:10	Chloride	mg/L	1.2	
SWB10BOX	2/26/2013	11:10	Chromium	mg/L	0.00074	
SWB10BOX	2/26/2013	11:10	Color	Color Units	20	
SWB10BOX	2/26/2013	11:10	Copper	mg/L	0.0024	
SWB10BOX	2/26/2013	11:10	Iron	mg/L	0.14	
SWB10BOX	2/26/2013	11:10	Lead	mg/L	0.004	
SWB10BOX	2/26/2013	11:10	Magnesium	mg/L	1.2	
SWB10BOX	2/26/2013	11:10	Manganese	mg/L	0.0051	
SWB10BOX	2/26/2013	11:10	Nickel	mg/L	0.0011	U
SWB10BOX	2/26/2013	11:10	Nitrate + Nitrite	mg/L	0.05	
SWB10BOX	2/26/2013	11:10	Orthophosphate	mg/L	0.083	
SWB10BOX	2/26/2013	11:10	Potassium	mg/L	1.2	
SWB10BOX	2/26/2013	11:10	Sulfate	mg/L	1.4	
SWB10BOX	2/26/2013	11:10	Total Dissolved Solids	mg/L	33	
SWB10BOX	2/26/2013	11:10	Total Hardness (as CaCO3)	mg/L	26	
SWB10BOX	2/26/2013	11:10	Total Kjeldahl Nitrogen	mg/L	0.27	
SWB10BOX	2/26/2013	11:10	Total Nitrogen	mg/L	0.32	
SWB10BOX	2/26/2013	11:10	Total Organic Carbon	mg/L	6.9	
SWB10BOX	2/26/2013	11:10	Total Phosphorus (as P)	mg/L	0.0972	
SWB10BOX	2/26/2013	11:10	Total Suspended Solids	mg/L	8	
SWB10BOX	2/26/2013	11:10	Zinc	mg/L	0.037	
SWB10OUT	2/26/2013	11:15	Alkalinity, Total	mg/L	32	
SWB10OUT	2/26/2013	11:15	Ammonia (N)	mg/L	0.019	
SWB10OUT	2/26/2013	11:15	Boron	mg/L	0.011	
SWB10OUT	2/26/2013	11:15	Cadmium	mg/L	0.0002	U
SWB10OUT	2/26/2013	11:15	Calcium	mg/L	8.9	
SWB10OUT	2/26/2013	11:15	Chloride	mg/L	1.3	
SWB10OUT	2/26/2013	11:15	Chromium	mg/L	0.00084	
SWB10OUT	2/26/2013	11:15	Color	Color Units	30	
SWB10OUT	2/26/2013	11:15	Copper	mg/L	0.0026	
SWB10OUT	2/26/2013	11:15	Iron	mg/L	0.11	

Appendix G
Water Quality Data - Nutrients and Inorganic Indicators

Sample ID	Sample Date	Sample Time	Compound Name	Units	Result	Data Qualifier
SWB10OUT	2/26/2013	11:15	Lead	mg/L	0.0041	
SWB10OUT	2/26/2013	11:15	Magnesium	mg/L	1.2	
SWB10OUT	2/26/2013	11:15	Manganese	mg/L	0.0054	
SWB10OUT	2/26/2013	11:15	Nickel	mg/L	0.0011	U
SWB10OUT	2/26/2013	11:15	Nitrate + Nitrite	mg/L	0.041	
SWB10OUT	2/26/2013	11:15	Orthophosphate	mg/L	0.078	
SWB10OUT	2/26/2013	11:15	Potassium	mg/L	1.3	
SWB10OUT	2/26/2013	11:15	Sulfate	mg/L	1.6	
SWB10OUT	2/26/2013	11:15	Total Dissolved Solids	mg/L	10	U
SWB10OUT	2/26/2013	11:15	Total Hardness (as CaCO3)	mg/L	27	
SWB10OUT	2/26/2013	11:15	Total Kjeldahl Nitrogen	mg/L	0.16	
SWB10OUT	2/26/2013	11:15	Total Nitrogen	mg/L	0.2	
SWB10OUT	2/26/2013	11:15	Total Organic Carbon	mg/L	7.2	
SWB10OUT	2/26/2013	11:15	Total Phosphorus (as P)	mg/L	0.185	
SWB10OUT	2/26/2013	11:15	Total Suspended Solids	mg/L	6	
SWB10OUT	2/26/2013	11:15	Zinc	mg/L	0.035	
Sweetwater Branch at NE 8th Avenue						
SWBNE8	6/5/2013	8:33	Nitrate + Nitrite	mg/L	0.022	
SWBNE8	6/5/2013	8:33	Total Kjeldahl Nitrogen	mg/L	0.4	
SWBNE8	6/5/2013	8:33	Total Nitrogen	mg/L	0.42	
SWBNE8	6/5/2013	8:33	Total Phosphorus (as P)	mg/L	0.189	
SWBNE8	6/5/2013	8:33	Total Suspended Solids	mg/L	12	
SWBNE8	6/5/2013	8:33	Volatile Suspended Solids	mg/L	8	
SWB8IN	6/5/2013	12:40	Nitrate + Nitrite	mg/L	0.16	
SWB8IN	6/5/2013	12:40	Total Kjeldahl Nitrogen	mg/L	2.3	
SWB8IN	6/5/2013	12:40	Total Nitrogen	mg/L	2.5	
SWB8IN	6/5/2013	12:40	Total Phosphorus (as P)	mg/L	0.973	
SWB8IN	6/5/2013	12:40	Total Suspended Solids	mg/L	140	
SWB8IN	6/5/2013	12:40	Volatile Suspended Solids	mg/L	84	
SWB8IN	6/5/2013	13:35	Nitrate + Nitrite	mg/L	0.086	
SWB8IN	6/5/2013	13:35	Total Kjeldahl Nitrogen	mg/L	0.43	
SWB8IN	6/5/2013	13:35	Total Nitrogen	mg/L	0.52	
SWB8IN	6/5/2013	13:35	Total Phosphorus (as P)	mg/L	0.288	
SWB8IN	6/5/2013	13:35	Total Suspended Solids	mg/L	38	
SWB8IN	6/5/2013	13:35	Volatile Suspended Solids	mg/L	9	
SWB8IN	10/22/2013	15:45	Nitrate + Nitrite	mg/L	0.77	
SWB8IN	10/22/2013	15:45	Total Kjeldahl Nitrogen	mg/L	4.8	
SWB8IN	10/22/2013	15:45	Total Nitrogen	mg/L	5.6	
SWB8IN	10/22/2013	15:45	Total Phosphorus (as P)	mg/L	0.753	
SWB8IN	10/22/2013	15:45	Total Suspended Solids	mg/L	56	
SWB8IN	10/22/2013	15:45	Volatile Suspended Solids	mg/L	43	
SWB8IN	10/22/2013	15:55	Nitrate + Nitrite	mg/L	1.4	

Appendix G
Water Quality Data - Nutrients and Inorganic Indicators

Sample ID	Sample Date	Sample Time	Compound Name	Units	Result	Data Qualifier
SWB8IN	10/22/2013	15:55	Total Kjeldahl Nitrogen	mg/L	4.9	
SWB8IN	10/22/2013	15:55	Total Nitrogen	mg/L	6.3	
SWB8IN	10/22/2013	15:55	Total Phosphorus (as P)	mg/L	0.74	
SWB8IN	10/22/2013	15:55	Total Suspended Solids	mg/L	98	
SWB8IN	10/22/2013	15:55	Volatile Suspended Solids	mg/L	49	
SWB8BOX	6/5/2013	8:45	Nitrate + Nitrite	mg/L	0.12	
SWB8BOX	6/5/2013	8:45	Total Kjeldahl Nitrogen	mg/L	0.68	
SWB8BOX	6/5/2013	8:45	Total Nitrogen	mg/L	0.8	
SWB8BOX	6/5/2013	8:45	Total Phosphorus (as P)	mg/L	0.356	
SWB8BOX	6/5/2013	8:45	Total Suspended Solids	mg/L	29	
SWB8BOX	6/5/2013	8:45	Volatile Suspended Solids	mg/L	8	
SWB8OUT	6/5/2013	12:45	Nitrate + Nitrite	mg/L	0.078	
SWB8OUT	6/5/2013	12:45	Total Kjeldahl Nitrogen	mg/L	0.82	
SWB8OUT	6/5/2013	12:45	Total Nitrogen	mg/L	0.9	
SWB8OUT	6/5/2013	12:45	Total Phosphorus (as P)	mg/L	0.958	
SWB8OUT	6/5/2013	12:45	Total Suspended Solids	mg/L	53	
SWB8OUT	6/5/2013	12:45	Volatile Suspended Solids	mg/L	25	
SWB8OUT	6/5/2013	13:40	Nitrate + Nitrite	mg/L	0.063	
SWB8OUT	6/5/2013	13:40	Total Kjeldahl Nitrogen	mg/L	0.34	
SWB8OUT	6/5/2013	13:40	Total Nitrogen	mg/L	0.4	
SWB8OUT	6/5/2013	13:40	Total Phosphorus (as P)	mg/L	0.225	
SWB8OUT	6/5/2013	13:40	Total Suspended Solids	mg/L	7.6	
SWB8OUT	6/5/2013	13:40	Volatile Suspended Solids	mg/L	3	
SWB8OUT	10/22/2013	15:48	Nitrate + Nitrite	mg/L	0.96	
SWB8OUT	10/22/2013	15:48	Total Kjeldahl Nitrogen	mg/L	2.5	
SWB8OUT	10/22/2013	15:48	Total Nitrogen	mg/L	3.5	
SWB8OUT	10/22/2013	15:48	Total Phosphorus (as P)	mg/L	0.409	
SWB8OUT	10/22/2013	15:48	Total Suspended Solids	mg/L	40	
SWB8OUT	10/22/2013	15:48	Volatile Suspended Solids	mg/L	21	
SWB8OUT	10/22/2013	15:58	Nitrate + Nitrite	mg/L	1	
SWB8OUT	10/22/2013	15:58	Total Kjeldahl Nitrogen	mg/L	4.6	
SWB8OUT	10/22/2013	15:58	Total Nitrogen	mg/L	5.6	
SWB8OUT	10/22/2013	15:58	Total Phosphorus (as P)	mg/L	0.616	
SWB8OUT	10/22/2013	15:58	Total Suspended Solids	mg/L	64	
SWB8OUT	10/22/2013	15:58	Volatile Suspended Solids	mg/L	34	
Sweetwater Branch at SE 1st Avenue						
SWB1IN	6/4/2013	13:09	Nitrate + Nitrite	mg/L	0.29	
SWB1IN	6/4/2013	13:09	Total Kjeldahl Nitrogen	mg/L	1.2	
SWB1IN	6/4/2013	13:09	Total Nitrogen	mg/L	1.5	
SWB1IN	6/4/2013	13:09	Total Phosphorus (as P)	mg/L	0.461	
SWB1IN	6/4/2013	13:09	Total Suspended Solids	mg/L	74	
SWB1IN	6/4/2013	13:09	Volatile Suspended Solids	mg/L	22	

Appendix G
Water Quality Data - Nutrients and Inorganic Indicators

Sample ID	Sample Date	Sample Time	Compound Name	Units	Result	Data Qualifier
SWB1IN	6/4/2013	13:33	Nitrate + Nitrite	mg/L	0.19	
SWB1IN	6/4/2013	13:33	Total Kjeldahl Nitrogen	mg/L	0.96	
SWB1IN	6/4/2013	13:33	Total Nitrogen	mg/L	1.2	
SWB1IN	6/4/2013	13:33	Total Phosphorus (as P)	mg/L	0.382	
SWB1IN	6/4/2013	13:33	Total Suspended Solids	mg/L	52	
SWB1IN	6/4/2013	13:33	Volatile Suspended Solids	mg/L	10	
SWB1IN	8/16/2013	9:00	Nitrate + Nitrite	mg/L	0.06	
SWB1IN	8/16/2013	9:00	Total Kjeldahl Nitrogen	mg/L	0.74	
SWB1IN	8/16/2013	9:00	Total Nitrogen	mg/L	0.8	
SWB1IN	8/16/2013	9:00	Total Phosphorus (as P)	mg/L	0.293	
SWB1IN	8/16/2013	9:00	Total Suspended Solids	mg/L	72	
SWB1IN	8/16/2013	9:00	Volatile Suspended Solids	mg/L	40	
SWB1IN	8/16/2013	9:35	Nitrate + Nitrite	mg/L	0.072	
SWB1IN	8/16/2013	9:35	Total Kjeldahl Nitrogen	mg/L	0.18	
SWB1IN	8/16/2013	9:35	Total Nitrogen	mg/L	0.25	
SWB1IN	8/16/2013	9:35	Total Phosphorus (as P)	mg/L	0.106	
SWB1IN	8/16/2013	9:35	Total Suspended Solids	mg/L	3.4	
SWB1IN	8/16/2013	9:35	Volatile Suspended Solids	mg/L	2	
SWB1-2	6/4/2013	8:45	Nitrate + Nitrite	mg/L	0.04	
SWB1-2	6/4/2013	8:45	Total Kjeldahl Nitrogen	mg/L	1.1	
SWB1-2	6/4/2013	8:45	Total Nitrogen	mg/L	1.1	
SWB1-2	6/4/2013	8:45	Total Phosphorus (as P)	mg/L	0.382	
SWB1-2	6/4/2013	8:45	Total Suspended Solids	mg/L	29	
SWB1-2	6/4/2013	8:45	Volatile Suspended Solids	mg/L	7	
SWB1-2	6/4/2013	13:11	Nitrate + Nitrite	mg/L	0.12	
SWB1-2	6/4/2013	13:11	Total Kjeldahl Nitrogen	mg/L	1.1	
SWB1-2	6/4/2013	13:11	Total Nitrogen	mg/L	1.2	
SWB1-2	6/4/2013	13:11	Total Phosphorus (as P)	mg/L	0.832	
SWB1-2	6/4/2013	13:11	Total Suspended Solids	mg/L	160	
SWB1-2	6/4/2013	13:11	Volatile Suspended Solids	mg/L	29	
SWB1-2	6/4/2013	13:35	Nitrate + Nitrite	mg/L	0.2	
SWB1-2	6/4/2013	13:35	Total Kjeldahl Nitrogen	mg/L	1.1	
SWB1-2	6/4/2013	13:35	Total Nitrogen	mg/L	1.3	
SWB1-2	6/4/2013	13:35	Total Phosphorus (as P)	mg/L	0.45	
SWB1-2	6/4/2013	13:35	Total Suspended Solids	mg/L	59	
SWB1-2	6/4/2013	13:35	Volatile Suspended Solids	mg/L	16	
SWB1-2	8/16/2013	9:05	Nitrate + Nitrite	mg/L	0.059	
SWB1-2	8/16/2013	9:05	Total Kjeldahl Nitrogen	mg/L	0.45	
SWB1-2	8/16/2013	9:05	Total Nitrogen	mg/L	0.51	
SWB1-2	8/16/2013	9:05	Total Phosphorus (as P)	mg/L	0.186	
SWB1-2	8/16/2013	9:05	Total Suspended Solids	mg/L	41	
SWB1-2	8/16/2013	9:05	Volatile Suspended Solids	mg/L	24	
SWB1-2	8/16/2013	9:30	Nitrate + Nitrite	mg/L	0.058	

Appendix G
Water Quality Data - Nutrients and Inorganic Indicators

Sample ID	Sample Date	Sample Time	Compound Name	Units	Result	Data Qualifier
SWB1-2	8/16/2013	9:30	Total Kjeldahl Nitrogen	mg/L	0.27	
SWB1-2	8/16/2013	9:30	Total Nitrogen	mg/L	0.33	
SWB1-2	8/16/2013	9:30	Total Phosphorus (as P)	mg/L	0.124	
SWB1-2	8/16/2013	9:30	Total Suspended Solids	mg/L	8.4	
SWB1-2	8/16/2013	9:30	Volatile Suspended Solids	mg/L	6	
SWB1OUT	6/4/2013	13:07	Nitrate + Nitrite	mg/L	0.051	
SWB1OUT	6/4/2013	13:07	Total Kjeldahl Nitrogen	mg/L	1.2	
SWB1OUT	6/4/2013	13:07	Total Nitrogen	mg/L	1.3	
SWB1OUT	6/4/2013	13:07	Total Phosphorus (as P)	mg/L	0.466	
SWB1OUT	6/4/2013	13:07	Total Suspended Solids	mg/L	84	
SWB1OUT	6/4/2013	13:07	Volatile Suspended Solids	mg/L	17	
SWB1OUT	6/4/2013	13:31	Nitrate + Nitrite	mg/L	0.18	
SWB1OUT	6/4/2013	13:31	Total Kjeldahl Nitrogen	mg/L	1.3	
SWB1OUT	6/4/2013	13:31	Total Nitrogen	mg/L	1.5	
SWB1OUT	6/4/2013	13:31	Total Phosphorus (as P)	mg/L	0.628	
SWB1OUT	6/4/2013	13:31	Total Suspended Solids	mg/L	160	
SWB1OUT	6/4/2013	13:31	Volatile Suspended Solids	mg/L	25	
SWB1OUT	8/16/2013	8:55	Nitrate + Nitrite	mg/L	0.12	
SWB1OUT	8/16/2013	8:55	Total Kjeldahl Nitrogen	mg/L	0.96	
SWB1OUT	8/16/2013	8:55	Total Nitrogen	mg/L	1.1	
SWB1OUT	8/16/2013	8:55	Total Phosphorus (as P)	mg/L	0.298	
SWB1OUT	8/16/2013	8:55	Total Suspended Solids	mg/L	130	
SWB1OUT	8/16/2013	8:55	Volatile Suspended Solids	mg/L	50	
SWB1OUT	8/16/2013	9:25	Nitrate + Nitrite	mg/L	0.073	
SWB1OUT	8/16/2013	9:25	Total Kjeldahl Nitrogen	mg/L	0.26	
SWB1OUT	8/16/2013	9:25	Total Nitrogen	mg/L	0.33	
SWB1OUT	8/16/2013	9:25	Total Phosphorus (as P)	mg/L	0.124	
SWB1OUT	8/16/2013	9:25	Total Suspended Solids	mg/L	9.8	
SWB1OUT	8/16/2013	9:25	Volatile Suspended Solids	mg/L	6	
SWBSE1	6/4/2013	8:50	Nitrate + Nitrite	mg/L	0.084	
SWBSE1	6/4/2013	8:50	Total Kjeldahl Nitrogen	mg/L	0.49	
SWBSE1	6/4/2013	8:50	Total Nitrogen	mg/L	0.57	
SWBSE1	6/4/2013	8:50	Total Phosphorus (as P)	mg/L	0.184	
SWBSE1	6/4/2013	8:50	Total Suspended Solids	mg/L	4	U
SWBSE1	6/4/2013	8:50	Volatile Suspended Solids	mg/L	1	

U = The compound was analyzed for but not detected

APPENDIX H

Sediment Data – Fecal Coliform Bacteria and Nutrients

Appendix H
Sediment Data – Fecal Coliform Bacteria and Nutrients

Sample ID	Sample Date	Sample Time	Compound Name	Units	Result
SWB1-2	6/25/2014	9:45	Fecal Coliform	Col/dry g MF	7,600
SWB1-3	6/25/2014	10:00	Fecal Coliform	Col/dry g MF	6,890
SWB8-BOX	6/25/2014	10:10	Fecal Coliform	Col/dry g MF	13,200
SWB10-BOX	6/25/2014	10:25	Fecal Coliform	Col/dry g MF	42,100
HOG29V-E	6/25/2014	11:00	Fecal Coliform	Col/dry g MF	6,150
HOG29V-W	6/25/2014	11:25	Fecal Coliform	Col/dry g MF	111,000

APPENDIX I

Example Inspection & Maintenance Log

Structural Stormwater Treatment Unit
Inspection & Maintenance Log

Location: ______________________ **Unit Type:** ______________________

Date	Structural Defects	Sediment Depth	Maintenance Performed	Sediment Removed (yd^3)	Disposal Location	Maintenance Personnel	Comments