

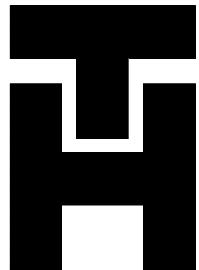
**STORMWATER MANAGEMENT REPORT  
FOR:**

**KROGER & MIXED USE  
AT  
BUCKWALTER PLACE  
BLUFFTON, SC**

**PREPARED FOR:  
BC BUCKWALTER, LLC**

**J-25125.0004  
FEBRUARY 2016**

PREPARED BY:



**THOMAS & HUTTON**

[www.thomasandhutton.com](http://www.thomasandhutton.com)

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## **EXHIBITS**

- Pre-Developed Drainage Exhibit
- Post-Development Drainage Exhibit
- Reuse Irrigation Exhibit

**SUMMARY OF RESULTS**

**Kroger & Mixed Use at Buckwalter Place**

**Runoff Rate Summary:**

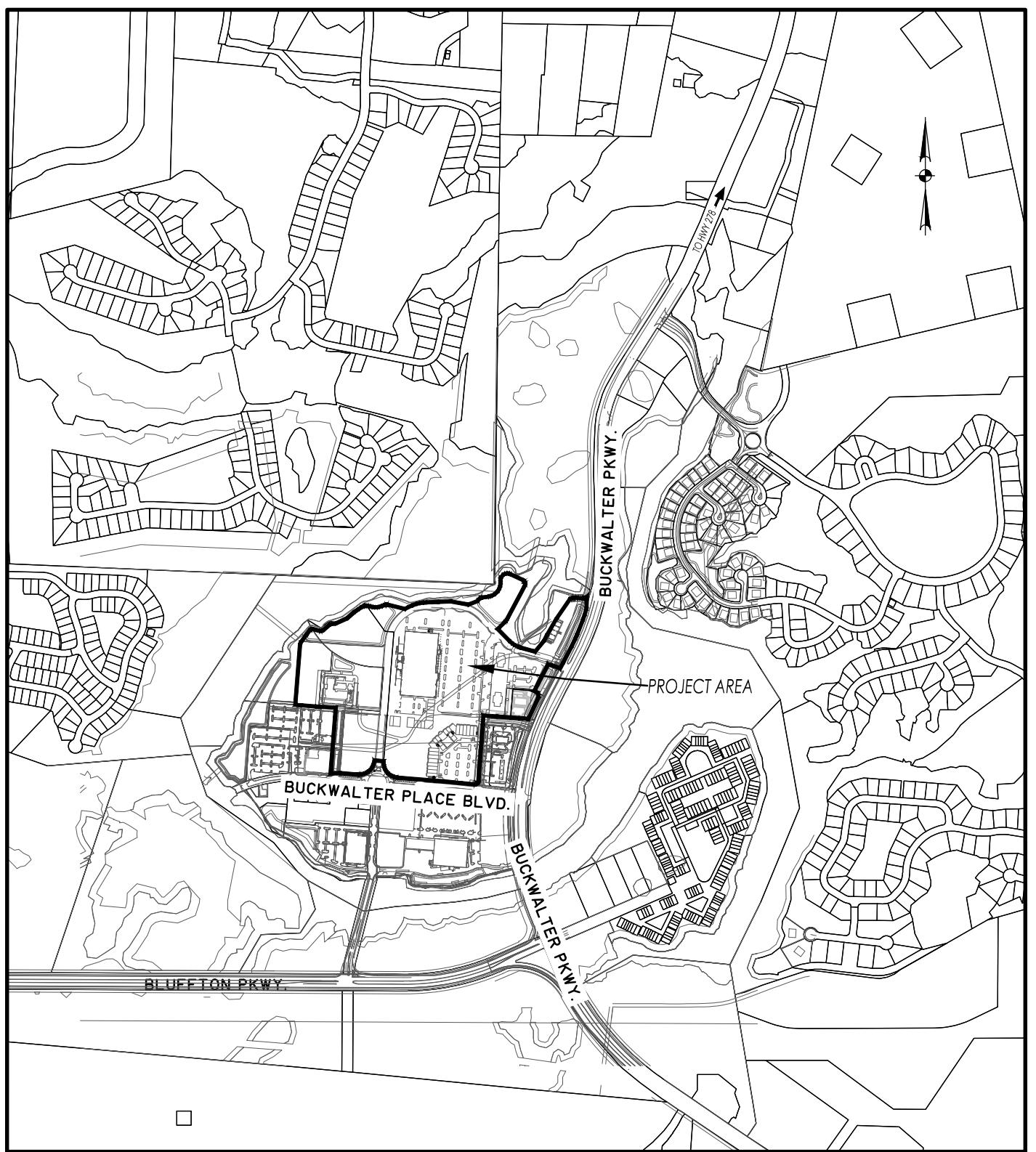
	OW-T1-86&74		OW-T1-111		OW_T1-139	
Storm Frequency	Pre	Post	Pre	Post	Pre	Post
2	32.6	19.0	16.0	7.4	26.8	22.1
10	59.6	39.9	29.2	14.7	44.8	37.0
25	76.8	58.1	37.6	22.5	56.0	45.7
100	106.6	100.5	52.0	38.9	75.2	59.6

\*All flows are reported in cfs.

**Maximum Pond Stages (NGVD 1929):**

Storm Frequency	Town Pond	Pond 1	Pond 2	Pond 3
2	15.5	16.3	16.6	17.9
10	16.2	17.1	17.4	19.3
25	16.5	17.5	17.7	19.6
100	16.9	18.0	18.1	20.2

In summary, the proposed development, as modeled at build out conditions, does not appear to adversely affect the pre-development flow rates or raise the stages within the system above acceptable limits.



## KROGER AND MIXED USE

PROPOSED ACTIVITY:

VICINITY MAP

CLIENT:

BC Buckwalter, LLC

LOCATION: BUCKWALTER PLACE BLUFFTON, SC

DATE: SEPTEMBER 24, 2015

JOB NUMBER: J - 25125.0004

SHEET: 1 OF 1

SCALE: 1" = 1000'

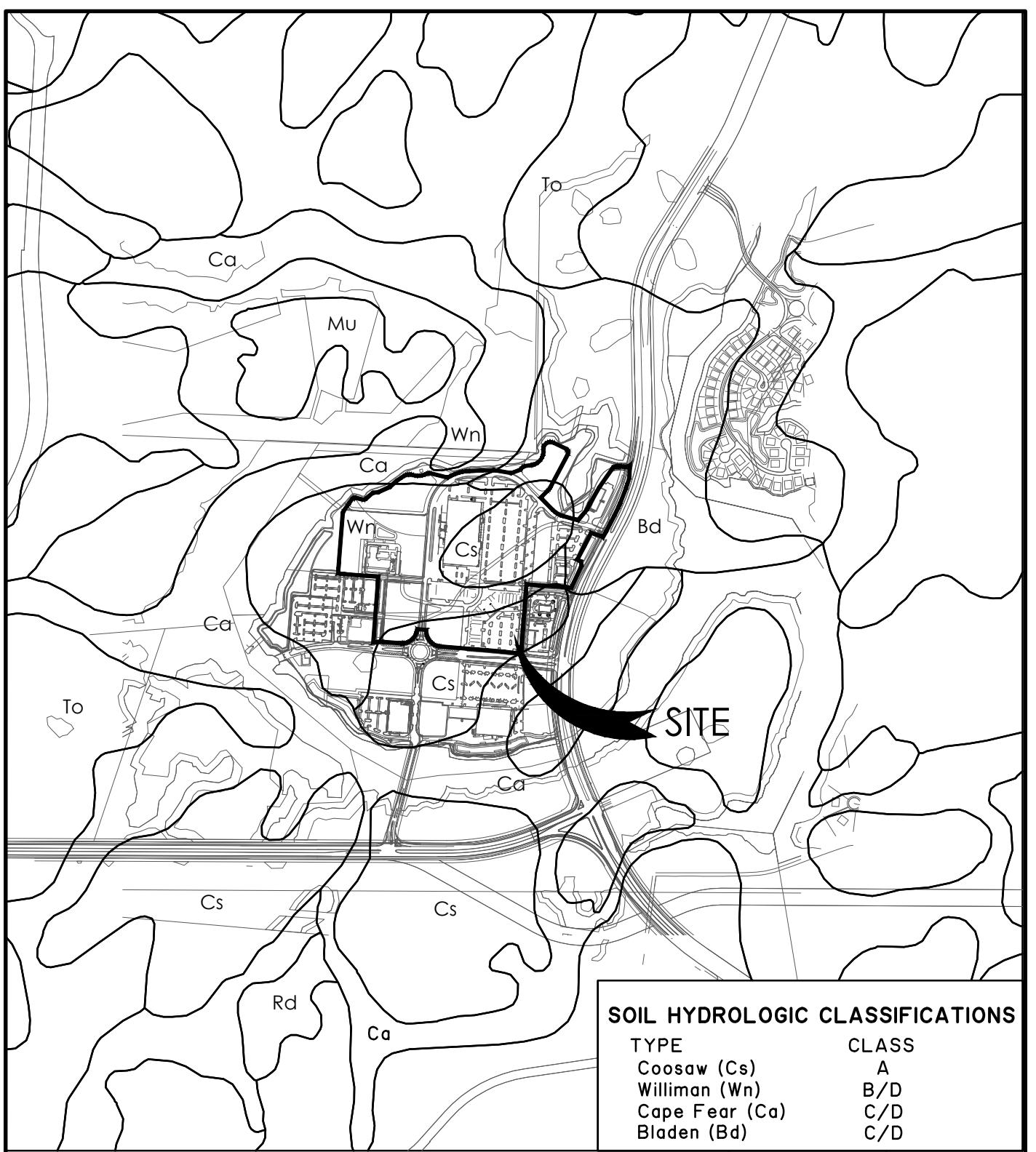


**THOMAS & HUTTON**  
Engineering | Surveying | Planning | GIS | Consulting

50 Park of Commerce Way • PO Box 2727  
Savannah, GA 31402-2727 • 912.234.5300

[www.thomasandhutton.com](http://www.thomasandhutton.com)

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## KROGER AND MIXED USE

PROPOSED ACTIVITY:

SOILS MAP

CLIENT:

BC Buckwalter, LLC

LOCATION: BUCKWALTER PLACE, BLUFFTON, SC

DATE: SEPTEMBER 22, 2012

JOB NUMBER: J - 25125.0004

SHEET: EXHIBIT  
SCALE: 1" = 1000'



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50 Park of Commerce Way • PO Box 2727  
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## **PROJECT NARRATIVE**

Buckwalter Place is a 94-acre community located within the Buckwalter Tract in the Town of Bluffton, SC. Existing developments within Buckwalter Place include the Law Enforcement Center, CareCore National, Exxon Gas, McDonald's, St. Joe's Immediate Care, Station 300, Ace Hardware, Southern Barrel Brewing Company, Buckwalter Dental/State Farm Insurance and Publix. BC Buckwalter, LLC proposes developing the remaining +/-38 acres of undeveloped land within Buckwalter Place. The proposed development will consist of a Kroger and mixed use area. The site will be developed in two phases.

The initial phase will consist of earthwork management including pond excavation and placement of preliminary fill for building pads, parking lots and roadways. This analysis is anticipated to be modified as required for subsequent permit applications in the future to reflect any design changes that may be warranted. This stormwater analysis uses hydrological parameters representative of build-out conditions (final state) in an effort to design the permanent stormwater wet ponds during this stage of construction.

## **PURPOSE**

The purposes of this report are:

- To define the existing basins and sub basins for the project.
- To determine the Pre Development runoff rates.
- To determine and document compliance with the State of South Carolina Stormwater Management regulations.
- To document that major drainage infrastructure such as road crossings, drainage connectors, ponds, and outfalls are adequate for all existing and proposed development within the drainage basin.
- Estimate water elevations for all existing and proposed impoundments and ponds.
- Provide design elevations for establishing internal roads and other improvements.

## **REGULATORY REQUIREMENTS**

**State of South Carolina.** Land disturbing activities (including the construction of roads, residential neighborhoods, commercial areas, etc.) are required to apply for and receive a NPDES Construction General Permit (CGP). These permits address water quality and quantity using thresholds based on the project's land disturbance footprint, distance to receiving water, and proximity to sensitive areas. A SC DHEC OCRM technical review is required if a land disturbing project is:

- $\geq 1$  acre and not within  $\frac{1}{2}$  mile of a receiving water or
- if a project is  $> \frac{1}{2}$  acre and within  $\frac{1}{2}$  mile of a receiving water.

However, a technical review could be required even if the project is less than one-half acres and within one-half mile of a receiving water if it meets defined criteria that are outlined in the regulations. Also, projects within or part of a larger common plan (LCP) that will disturb more than one acre are subject to the NDPEs requirement. Development associated with this project is

subject to these regulations as they will be part of the LCP and disturb areas greater than the thresholds listed above.

For nearly all acreages of disturbance, the regulations require that post-development peak discharge rates from the basins be at or below pre-development rates for the 2-year and 10-year 24-hour storm events.

The regulations also require a "water quality volume" be detained to improve water quality from the site. The thresholds of the "water quality volume" are related to the projects relative location to a receiving water body. Projects that are not within  $\frac{1}{2}$  mile of a receiving waterbody are required to capture and detain onsite the first  $\frac{1}{2}$  inch of runoff and release that quantity over a 24-hour period. Projects within  $\frac{1}{2}$  mile of a receiving waterbody are required to capture and detain onsite:

- the first  $\frac{1}{2}$  inch of runoff from the site, or
- the first 1 inch of runoff from the built upon area, whichever is greater.

The project is located within a  $\frac{1}{2}$  mile of a receiving water body. Therefore, the project is required to store and release the first  $\frac{1}{2}$  inch of runoff from the entire site or first 1 inch of runoff from the built upon area, whichever is greater, in a time period greater than or equal to 24 hours. Results can be found in Appendix G.

In addition to the above water quality regulations for the permanent stormwater management system, the NPDES Construction General Permit (CGP) also requires that various construction site stormwater best management practices (BMPs) be implemented during construction to address sediment and erosion control (and other water quality parameters). The current NPDES CGP requires that a stormwater pollution prevention plan (SWPPP) be developed for the project site. The overall design consideration for the SWPPP is that it must provide for 80% total suspended solids (TSS) removal efficiency from the construction site under disturbed soil conditions.

## **PRE DEVELOPMENT DRAINAGE SYSTEM**

Elevations within the project area range from elevation 21 adjacent to Buckwalter Parkway to elevation 16 adjacent to the wetlands (NGVD 1929 Datum). A portion of the site presently drains east to a linear wet detention pond running northward along the Buckwalter Parkway. This stormwater runoff passes beneath Buckwalter Parkway by means of two (2) 36-inch reinforced concrete pipes into a wetland system, which ultimately discharges into the Okatie River. The remaining portions of the property drain to the north and west into existing storm ponds or the adjacent wetland systems. The stormwater collection and treatment system has been master planned for the site. The soils on the site consist of hydrologic soil groups A, B/D and C/D which are shown on the attached soils map. The majority of the proposed site area is presently cleared and stabilized with grassing.

## **POST DEVELOPMENT DRAINAGE SYSTEM**

The ultimate stormwater collection and treatment system consists of grassed swales and pipes routed to stormwater ponds for treatment prior to release from the site. A total of three (3) detention ponds will be constructed to attenuate stormwater runoff from the proposed Kroger and mixed use area. Runoff shall be directed to vegetated swales, pipe conveyance systems

and directly to the stormwater detention facility where possible. The detention ponds will be used to provide water quality treatment and water quantity attenuation as required by SCDHEC OCRM. On site BMPs will be used throughout construction to prevent sediment transport from the site.

## **METHODOLOGY**

The pre-development and post-development conditions were analyzed using the Advanced Interconnected Channel and Pond Routing (ICPR) computer program developed by Streamline Technologies. The program is used to model rainfall and stormwater runoff and to perform hydraulic routing through the storm drainage system. The ICPR program is a FEMA-approved model that has undergone extensive testing and application. ICPR has the ability to analyze complex interconnected drainage systems dynamically over extended time periods.

The hydrologic input data consists of information for each drainage basin, or sub-basin, within the project. Input variables include runoff curve number, rainfall distribution pattern, hydrograph peaking factor, area of each drainage basin, and time of concentration. The ICPR program generates runoff hydrographs for each sub-basin based on the user-specified variables. Hydrographs are generated by ICPR using the SCS Unit Hydrograph Method.

The model hydraulic input data consists of a system of nodes and links. Nodes represent locations where flows enter or exit the system, pipe or channel characteristics change, or where stage/storage/time relationships are provided. Links represent traditional types of hydraulic conveyance such as pipes, channels, drop structures, weirs, etc. The sizes, invert, lengths, and Manning's "n" values for all pipes connecting the ponds are input into the model. In addition to pipe information, all pond, lake, and detention area stage-area information and the respective outfall structure information is input into the model. The node and link conditions are analyzed within the model for a given storm, and flow conditions are determined.

Hydrographs for each drainage area are merged within the ICPR program, and the hydrologic results are then combined with the hydraulic information to model the hydraulic interactions of the entire drainage system. The results include pond area and discharge rates and stage/storage information during the design storm.

For the design of the storm drainage system, a warning stage elevation is set for each pond and node location to check for flooding during the various storm events.

## **HYDROLOGY**

The following hydrologic parameters have been used as input to the ICPR models:

1. The SCS Unit Hydrograph Method is used.
2. The depth of rainfall for each storm frequency was obtained from the *South Carolina Stormwater DHEC Storm Water Management BMP Handbook* (July, 2005) – Appendix F, South Carolina Rainfall Data for Beaufort County. The following rainfall depths were used in the model simulations:
  - a. 2-year, 24-hour Design Storm = 4.5 inches
  - b. 10-year, 24-hour Design Storm = 6.9 inches
  - c. 25-year, 24-hour Design Storm = 8.4 inches
  - d. 100-year, 24-hour Design Storm = 11.0 inches

3. The SCS Type III Statistical Rainfall Distribution is used. This distribution pattern is determined by the Soil Conservation Service comparing regional rain gauge data.
4. A 323 Hydrograph Peaking Factor was used.
5. Curve Numbers:

**TABLE 1  
Land Use Curve Numbers**

<b>Land Use / Land Cover</b>	<b>Hydrologic Soils Group (HSG)</b>				
	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>Water</b>
Woods - Grass Combination	57	70	82	86	100
Paved Streets; open ditches (w/ROW)	83	89	92	93	100
Commercial	95	95	95	95	100

## **TAILWATER**

For the pre- and post-development models, there are four (4) major outfalls. These outfalls correlate to particular nodes defined within the Beaufort County Stormwater Management Plan, prepared by Thomas & Hutton and Camp Dresser McKee, Inc. Tailwater conditions for each of the outfalls were defined by the time versus stage elevation data for that particular node, extracted from the Beaufort County Stormwater Management Plan. These values were obtained for each of the four (4) design storm events (2-yr, 10-yr, 25-yr and 100-yr). Tailwater information can be found in Appendix E. The location of the corresponding nodes from the Beaufort County Stormwater Management Plan are shown on the Pre- and Post-development Drainage Area Exhibits.

## **RUNOFF CALCULATIONS**

Basin specific peak flow rates were calculated for each design storm using ICPR. The pre- and post-development drainage basins are shown in exhibits that follow this report.

### Curve Numbers

Curve numbers were generated according to procedures set forth in SCS Technical Release 55. The composite curve numbers for each drainage basin were calculated using an area-weighted average of curve numbers for unique land use/hydrologic soil group (HSG) combinations. Aerial photography and proposed site layout plans were used to determine a comprehensive pre- and post-development land use for each basin/sub-basin. Soil information was obtained from the Soil Survey of Beaufort County, South Carolina provided by The United States Department of Agriculture Soil Conservation Service.

The land uses included woods, paved streets, and commercial. Using the land uses, hydrologic soil groups and land area within each parameter, weighted curve numbers were generated using the Win TR-55 program. See Appendix A and B for the composite curve number values for each sub-basin.

Time of Concentration

Times of concentration were calculated according to procedures set forth in SCS Technical Release (TR) 55. The travel times ( $t_1$ ) for overland flow, shallow concentrated flow, channel and pipe flow are added together for the drainage basin to get the time of concentration  $T_c$ . Basin information for the area of interest was collected for use in the ICPR models. Basins were drawn and the longest flow paths were found. The times of concentration were calculated based on the NRCS, three part travel time method documented in TR-55. The three equations used are summarized below:

Sheet Flow: (hr)

$$t_1 = \frac{0.007(nL)^{0.8}}{P_2^{0.05} \times S^{0.4}}$$

Symbol	Dimension	Units
n	Manning's n	—
L	Length of flow	ft
P <sub>2</sub>	2 yr event rainfall	in
S	Slope	ft/ft

Shallow Concentrated Flow: (hr)

$$t_2 = \frac{L}{3600 \times V}$$

Symbol	Dimension	Units
L	Length of flow	ft
V*	Velocity	ft/s

Pipe and Channel Flow: (hr)

$$t_3 = \frac{L}{3600 \times V}$$

Symbol	Dimension	Units
L	Length of flow	ft
V*	Velocity	ft/s

\*Assumed to be 2 ft/s

Time of Concentration: (hr)

$$t_c = t_1 + t_2 + t_3$$

See Appendix A and B for time of concentration calculations for each sub-basin.

The pre-development drainage basins were obtained from the Buckwalter Place Master Plan report documents. Curve numbers and time of concentrations were calculated and compared to previously calculated values from the Buckwalter Place Master Plan report. A hydrologic model was then created to obtain pre-development flows. The results can be found in Appendix D.

The post-development sub-basins were delineated using the Thomas & Hutton survey along with proposed pipe networks and site grading for the proposed project. Portions of the area being modeled have already been constructed. Therefore, the post-developed sub-basin delineations and associated hydrologic and hydraulic parameters for these areas were obtained from the stormwater reports and as-built information for each individual existing development. A post-development model was developed for the proposed development. Results can be found in Appendix F.

The proposed detention ponds were designed to meet criteria found in the SCDHEC stormwater management requirements. Table 2 summarizes the proposed ponds input data. See Appendix F for the resulting peak water surface elevations for each pond within the conceptual layout. All elevations are based on NGVD29 datum.

**TABLE 2  
Post-Development Pond Input**

	Normal Water		Top of Bank	
	Elev. (ft.)	Area (ac.)	Elev. (ft.)	Area (ac.)
Town Pond	13.65	1.53	18	2.20
1	14	1.73	18	2.13
2	15	1.2	19	1.5
3	16.4	0.13	21	0.39

For the sake of comparing the Pre/Post-Development conditions, flows are summarized in Table 3 below, for the major outfall locations. As required, post-development peak flow rates at these outfall locations are less than pre-development conditions for the 2-year, 10-year, and 25-year storm events. See Appendices C through F for pre-development and post-development ICPR model input and results. Pre- and post-development basin exhibits are located at the end of the report.

**TABLE 3  
Pre-Development vs. Post-Development Discharge Rates at Outfall**

Storm Frequency	OW-T1-86&74		OW-T1-111		OW_T1-139	
	Pre	Post	Pre	Post	Pre	Post
2	32.6	19.0	16.0	7.4	26.8	22.1
10	59.6	39.9	29.2	14.7	44.8	37.0
25	76.8	58.1	37.6	22.5	56.0	45.7
100	106.6	100.5	52.0	38.9	75.2	59.6

## **OCRM WATER QUALITY**

The South Carolina Department of Health and Environmental Control (DHEC) maintains a network of water quality monitoring stations throughout the state. There are no stations in the immediate vicinity of the project site. The closest station, 18-08, is approximately 3.5 miles downstream of the project site where the wetland system ties into the Okatie River. This monitoring station is not listed on the current (2014) 303(d) list of impaired waters.

The development exceeds DHEC requirements to capture the first ½ inch of runoff from the entire contributing area. Appendix G shows the water quality volume required and the volume that is provided for each proposed pond.

## **SEDIMENTOLOGY**

During on-site construction, sediment control is to be attained through the use of Best Management Practices (BMP's) such as grassing, silt fence, riprap at pipe outfalls, construction entrances/exits, inlet protection, and the proposed (permanent) wet detention basins. A Stormwater Pollution Prevention Plan was developed and is included in the construction drawings along with a sequence of construction. Also included is a three (3) phase erosion control plan which includes gravel construction entrances, silt fence, & matting.

The proposed detention ponds will be utilized as sediment basins throughout the construction of the project. Sedimentology calculations were performed using SEDCAD. The sedimentology calculations assumed all areas for all phases will be active at one time. The SEDCAD calculations, included in Appendix H, show that the removal efficiency of all ponds exceed the required 80%.

## **TOWN OF BLUFFTON WATER QUALITY**

The Town of Bluffton stormwater volume requirements will be accommodated through irrigation reuse on site. This method was selected due to the poorly drained soils on the site which are not suitable for infiltration practices. The Town of Bluffton guidelines require the 95th percentile storm event volume to be detained and/or reused on site. The proposed outfall elevation is 14.00 feet. The pond elevation will be drawn down to elevation 12.77 feet with irrigation reuse. See the irrigation re-use exhibit attached exhibit at the end of this report for irrigation areas. The calculations for this requirement can be found in Appendix I of this report.

The Town of Bluffton requires all projects to utilize three BMPs in series. The Stormwater Design Manual requires the stormwater management system to contain at a minimum one wet detention BMP, one vegetative BMP, and one filter or infiltration based BMP. The design of the Kroger and Mixed Use site has a sediment forebay (sediment removal BMP) that will overflow onto a vegetative filter strip (vegetative BMP) that leads to a wet detention pond. The wet detention pond outfalls to a drainage conveyance, that discharges into the adjacent wetland system. Water Quality treatment for the project is provided by each of these components working in conjunction.

## **POLLUTANT LOADING**

In order to quantify the impact of stormwater pollution for the site, calculations were performed to determine the removal efficiency of targeted pollutants. Targeted pollutants include total suspended solids, nitrogen, phosphorous, and bacteria.

The site was evaluated in pre-development conditions to determine a baseline of pollutants anticipated for the project. The BMPs incorporated into the post-development stormwater system were then examined, in series, to determine the overall removal efficiency of each pollutant as it is routed through the system. By comparing the pre and post-development conditions we are able to prove pollutants will be removed by the BMPs proposed for the site. The Pollutant Loading Calculations can be found in Appendix I of this report.

**STORMWATER MANAGEMENT REPORT**

**KROGER & MIXED USE AT BUCKWALTER PLACE**

**APPENDIX A**

PRE-DEVELOPMENT CN AND TC CALCULATIONS

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Beaufort NOAA-14 County, South Carolina

Sub-Area Summary Table

Sub-Area Identifier	Drainage Area (ac)	Time of Concentration (hr)	Curve Number	Receiving Reach	Sub-Area Description
<hr/>					
DA1	36.90	1.017	82		
DA2	19.20	0.684	89		
Town	14.00	0.669	82		
Total Area:	70.10 (ac)				

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Beaufort NOAA-14 County, South Carolina

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Mannings's Slope (ft/ft)	n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
<hr/>							
DA1							
SHEET	100	0.0040	0.400				0.609
SHALLOW	1500	0.0040	0.050				0.408
Time of Concentration						1.017	<hr/>
<hr/>							
DA2							
SHEET	75	0.0080	0.410				0.374
SHALLOW	300	0.0100	0.050				0.052
CHANNEL	1860					2.000	0.258
Time of Concentration						.684	<hr/>
<hr/>							
Town							
SHEET	100	0.0050	0.400				0.557
SHALLOW	460	0.0050	0.050				0.112
Time of Concentration						.669	<hr/>
<hr/>							

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Beaufort NOAA-14 County, South Carolina

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
-----				
DA1	Woods - grass combination	(poor)	A	4.9 57
	Woods - grass combination	(poor)	D	32 86
	Total Area / Weighted Curve Number		36.9	82
			=====	==
DA2	Paved; open ditches (w/right-of-way)		D	7 93
	Woods - grass combination	(poor)	D	12.2 86
	Total Area / Weighted Curve Number		19.2	89
			=====	==
Town	Woods - grass combination	(poor)	A	2 57
	Woods - grass combination	(poor)	D	12 86
	Total Area / Weighted Curve Number		14	82
			==	==

## Beaufort NOAA-14 County, South Carolina

## Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
DA1	User defined urban (Click button or User defined urban (Click button or User defined urban (Click button or Newly graded area (pervious only)	A B D B	2.2 9.8 2 2.38	95 95 95 86
	Total Area / Weighted Curve Number		16.38 =====	94 ==
DA2	Newly graded area (pervious only) Newly graded area (pervious only) Newly graded area (pervious only)	A B D	3.8 15 1.5	77 86 94
	Total Area / Weighted Curve Number		20.3 =====	85 ==
DA3	Newly graded area (pervious only) Newly graded area (pervious only) Newly graded area (pervious only)	A B D	9.1 2.8 3.6	77 86 94
	Total Area / Weighted Curve Number		15.5 =====	83 ==
DA4	User defined urban (Click button or User defined urban (Click button or User defined urban (Click button or	A B D	4 .5 1.1	95 95 95
	Total Area / Weighted Curve Number		5.6 ====	95 ==
DA5	User defined urban (Click button or User defined urban (Click button or User defined urban (Click button or	A B D	1.1 1 2.4	95 95 95
	Total Area / Weighted Curve Number		4.5 ====	95 ==
DA6	User defined urban (Click button or Newly graded area (pervious only) Newly graded area (pervious only)	C A C	5.3 .1 2.5	95 77 91
	Total Area / Weighted Curve Number		7.9 ====	94 ==

**STORMWATER MANAGEMENT REPORT**

**KROGER & MIXED USE AT BUCKWALTER PLACE**

**APPENDIX B**

POST-DEVELOPMENT CN AND TC CALCULATIONS

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Beaufort NOAA-14 County, South Carolina

Sub-Area Summary Table

Sub-Area Identifier	Drainage Area (ac)	Time of Concentration (hr)	Curve Number	Receiving Reach	Sub-Area Description
<hr/>					
DA1	16.40	0.585	96		
DA2	20.30	0.483	95		
DA3	15.50	0.508	95		
DA4	5.60	0.245	93		
DA5	4.50	0.336	95		
DA6	7.90	0.684	95		

Total Area: 70.20 (ac)

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## Beaufort NOAA-14 County, South Carolina

## Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
<hr/>							
DA1							
SHEET	55	0.0030	0.410				0.432
SHALLOW	335	0.0050	0.025				0.065
CHANNEL	1610	0.0050	0.013	3.14	6.28	5.082	0.088
				Time of Concentration			.585
							<hr/>
DA2							
SHEET	100	0.0100	0.410				0.431
SHALLOW	150	0.0150	0.025				0.017
CHANNEL	750	0.0050	0.013	4.91	7.85	5.952	0.035
				Time of Concentration			.483
							<hr/>
DA3							
SHEET	100	0.0100	0.410				0.431
SHALLOW	145	0.0150	0.025				0.016
CHANNEL	1300	0.0050	0.013	4.91	7.85	5.920	0.061
				Time of Concentration			.508
							<hr/>
DA4							
SHEET	25	0.0035	0.410				0.216
SHALLOW	45	0.0150	0.025				0.005
CHANNEL	435	0.0050	0.013	3.14	6.28	5.035	0.024
				Time of Concentration			.245
							<hr/>
DA5							
SHEET	58	0.0080	0.410				0.305
SHALLOW	160	0.0150	0.025				0.018
CHANNEL	240	0.0050	0.013	3.14	6.28	5.128	0.013
				Time of Concentration			.336
							<hr/>
DA6							
SHEET	75	0.0080	0.410				0.374
SHALLOW	300	0.0100	0.050				0.052
CHANNEL	1860				2.000		0.258
				Time of Concentration			.684
							<hr/>

JAR

Beaufort NOAA-14 County, South Carolina

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
DA1	CN directly entered by user	-	16.4	96
	Total Area / Weighted Curve Number		16.4 =====	96 ==
DA2	CN directly entered by user	-	20.3	95
	Total Area / Weighted Curve Number		20.3 =====	95 ==
DA3	CN directly entered by user	-	15.5	95
	Total Area / Weighted Curve Number		15.5 =====	95 ==
DA4	CN directly entered by user	-	5.6	93
	Total Area / Weighted Curve Number		5.6 ====	93 ==
DA5	CN directly entered by user	-	4.5	95
	Total Area / Weighted Curve Number		4.5 ====	95 ==
DA6	CN directly entered by user	-	7.9	95
	Total Area / Weighted Curve Number		7.9 ====	95 ==

**STORMWATER MANAGEMENT REPORT**

**KROGER & MIXED USE AT BUCKWALTER PLACE**

**APPENDIX C**

PRE-DEVELOPMENT ICPR MODEL INPUT

25125.0004

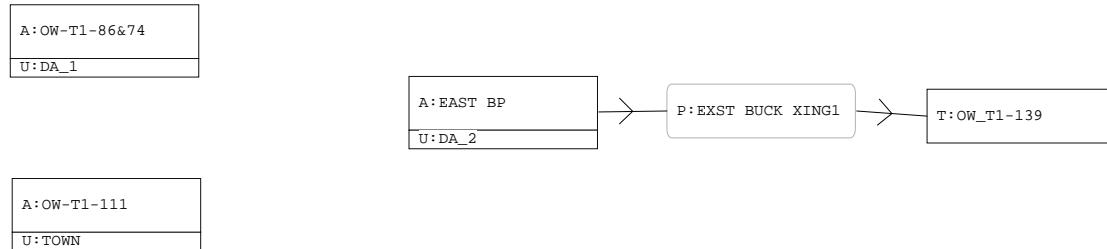


KROGER & MIXED USE AT BUCKWALTER PLACE  
PRE-DEVELOPED CONDITIONS  
NODE NETWORK

Nodes  
A Stage/Area  
V Stage/Volume  
T Time/Stage  
M Manhole

Basins  
O Overland Flow  
U SCS Unit CN  
S SBUH CN  
Y SCS Unit GA  
Z SBUH GA

Links  
P Pipe  
W Weir  
C Channel  
D Drop Structure  
B Bridge  
R Rating Curve  
H Breach  
E Percolation  
F Filter  
X Exfil Trench



KROGER & MIXED USE AT BUCKWALTER PLACE  
PRE-DEVELOPED CONDITIONS  
INPUT REPORT

---

=====  
==== Basins =====  
=====

Name: DA_1	Node: OW-T1-86&74	Status: Onsite
Group: BASE	Type: SCS Unit Hydrograph CN	
Unit Hydrograph: Uh323	Peaking Factor: 323.0	
Rainfall File: Scsiii	Storm Duration(hrs): 0.00	
Rainfall Amount(in): 0.000	Time of Conc(min): 60.00	
Area(ac): 36.900	Time Shift(hrs): 0.00	
Curve Number: 82.00	Max Allowable Q(cfs): 999999.000	
DCIA(%): 0.00		

Name: DA_2	Node: East BP	Status: Onsite
Group: BASE	Type: SCS Unit Hydrograph CN	
Unit Hydrograph: Uh323	Peaking Factor: 323.0	
Rainfall File:	Storm Duration(hrs): 0.00	
Rainfall Amount(in): 0.000	Time of Conc(min): 41.00	
Area(ac): 19.200	Time Shift(hrs): 0.00	
Curve Number: 89.00	Max Allowable Q(cfs): 999999.000	
DCIA(%): 0.00		

Name: TOWN	Node: OW-T1-111	Status: Onsite
Group: BASE	Type: SCS Unit Hydrograph CN	
Unit Hydrograph: Uh323	Peaking Factor: 323.0	
Rainfall File: Scsiii	Storm Duration(hrs): 0.00	
Rainfall Amount(in): 0.000	Time of Conc(min): 40.00	
Area(ac): 14.000	Time Shift(hrs): 0.00	
Curve Number: 82.00	Max Allowable Q(cfs): 999999.000	
DCIA(%): 0.00		

=====  
==== Nodes =====  
=====

Name: EAST BP	Base Flow(cfs): 0.000	Init Stage(ft): 16.400
Group: BASE		Warn Stage(ft): 20.000
Type: Stage/Area		

Stage(ft)            Area(ac)

---

Name: OW-T1-111	Base Flow(cfs): 0.000	Init Stage(ft): 0.000
Group: BASE		Warn Stage(ft): 0.000
Type: Stage/Area		

Stage(ft)            Area(ac)

---

Name: OW-T1-86&74	Base Flow(cfs): 0.000	Init Stage(ft): 0.000
Group: BASE		Warn Stage(ft): 0.000
Type: Stage/Area		

KROGER & MIXED USE AT BUCKWALTER PLACE  
PRE-DEVELOPED CONDITIONS  
INPUT REPORT

---

Stage(ft)	Area(ac)
-----	-----
Name: OW_T1-139	Base Flow(cfs): 0.000
Group: BASE	Init Stage(ft): 16.300
Type: Time/Stage	Warn Stage(ft): 19.000
Time(hrs)	Stage(ft)
-----	-----
0.00	16.300
999.00	16.300

---

=====  
==== Pipes =====  
=====

Name: EXST BUCK XING1	From Node: East BP	Length(ft): 151.00
Group: BASE	To Node: OW_T1-139	Count: 2
UPSTREAM	DOWNSTREAM	Friction Equation: Automatic
Geometry: Circular	Circular	Solution Algorithm: Most Restrictive
Span(in): 36.00	36.00	Flow: Both
Rise(in): 36.00	36.00	Entrance Loss Coef: 0.20
Invert(ft): 16.400	16.300	Exit Loss Coef: 0.20
Manning's N: 0.013000	0.013000	Bend Loss Coef: 0.00
Top Clip(in): 0.000	0.000	Outlet Ctrl Spec: Use dc or tw
Bot Clip(in): 0.000	0.000	Inlet Ctrl Spec: Use dc
		Stabilizer Option: None

Upstream FHWA Inlet Edge Description:  
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:  
Circular Concrete: Square edge w/ headwall

Inverts based on Alta survey (NGVD29 confirmed by Roby Morgan)  
Pipe sizes set at 36" - Alta says 30" but KMS said pipes are silted in and are actually 36"

=====  
==== Hydrology Simulations =====  
=====

Name: 002-YR  
Filename: Z:\25125\25125.0004\Engineering\Calculations\Storm Water\ICPR\Pre\002-YR.R32

Override Defaults: Yes  
Storm Duration(hrs): 24.00  
Rainfall File: Scsiii  
Rainfall Amount(in): 4.50

Time(hrs) Print Inc(min)  
-----  
24.000 5.00

-----  
Name: 010-YR  
Filename: Z:\25125\25125.0004\Engineering\Calculations\Storm Water\ICPR\Pre\010-YR.R32

Override Defaults: Yes  
Storm Duration(hrs): 24.00  
Rainfall File: Scsiii  
Rainfall Amount(in): 6.90

Time(hrs) Print Inc(min)  
-----  
24.000 5.00

-----  
Name: 025-YR

---

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9/24/2015

KROGER & MIXED USE AT BUCKWALTER PLACE  
PRE-DEVELOPED CONDITIONS  
INPUT REPORT

---

Filename: Z:\25125\25125.0004\Engineering\Calculations\Storm Water\ICPR\Pre\025-YR.R32

Override Defaults: Yes  
Storm Duration(hrs): 24.00  
Rainfall File: Scsiii  
Rainfall Amount(in): 8.40

Time(hrs) Print Inc(min)  
-----  
24.000 5.00

Name: 100-YR  
Filename: Z:\25125\25125.0004\Engineering\Calculations\Storm Water\ICPR\Pre\100-YR.R32

Override Defaults: Yes  
Storm Duration(hrs): 24.00  
Rainfall File: Scsiii  
Rainfall Amount(in): 11.00

Time(hrs) Print Inc(min)  
-----  
24.000 5.00

=====  
==== Routing Simulations =====  
=====

Name: 002-YR Hydrology Sim: 002-YR  
Filename: Z:\25125\25125.0004\Engineering\Calculations\Storm Water\ICPR\Pre\002-YR.I32

Execute: Yes Restart: No Patch: No  
Alternative: No

Max Delta Z(ft): 0.05 Delta Z Factor: 0.00500  
Time Step Optimizer: 0.000  
Start Time(hrs): 0.000 End Time(hrs): 30.00  
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000  
Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)  
-----  
30.000 15.000

Group Run  
-----  
BASE Yes

Name: 010-YR Hydrology Sim: 010-YR  
Filename: Z:\25125\25125.0004\Engineering\Calculations\Storm Water\ICPR\Pre\010-YR.I32

Execute: Yes Restart: No Patch: No  
Alternative: No

Max Delta Z(ft): 0.05 Delta Z Factor: 0.00500  
Time Step Optimizer: 0.000  
Start Time(hrs): 0.000 End Time(hrs): 30.00  
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000  
Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)  
-----  
30.000 15.000

Group Run  
-----  
BASE Yes

---

Z:\25125\25125.0004\Engineering\Calculations\Storm Water\ICPR\Pre\25125.0004-Pre.ICP  
9/24/2015

KROGER & MIXED USE AT BUCKWALTER PLACE  
PRE-DEVELOPED CONDITIONS  
INPUT REPORT

---

Name: 025-YR Hydrology Sim: 025-YR  
Filename: Z:\25125\25125.0004\Engineering\Calculations\Storm Water\ICPR\Pre\025-YR.I32

Execute: Yes      Restart: No      Patch: No  
Alternative: No

Max Delta Z(ft): 0.05      Delta Z Factor: 0.00500  
Time Step Optimizer: 0.000  
Start Time(hrs): 0.000  
Min Calc Time(sec): 0.5000  
Boundary Stages:  
End Time(hrs): 30.00  
Max Calc Time(sec): 60.0000  
Boundary Flows:

Time(hrs)      Print Inc(min)  
-----  
30.000      15.000

Group      Run  
-----  
BASE      Yes

Name: 100-YR      Hydrology Sim: 100-YR  
Filename: Z:\25125\25125.0004\Engineering\Calculations\Storm Water\ICPR\Pre\100-YR.I32

Execute: Yes      Restart: No      Patch: No  
Alternative: No

Max Delta Z(ft): 0.05      Delta Z Factor: 0.00500  
Time Step Optimizer: 0.000  
Start Time(hrs): 0.000  
Min Calc Time(sec): 0.5000  
Boundary Stages:  
End Time(hrs): 30.00  
Max Calc Time(sec): 60.0000  
Boundary Flows:

Time(hrs)      Print Inc(min)  
-----  
30.000      15.000

Group      Run  
-----  
BASE      Yes

**STORMWATER MANAGEMENT REPORT**  
**KROGER & MIXED USE AT BUCKWALTER PLACE**

**APPENDIX D**

PRE-DEVELOPMENT ICPR MODEL OUTPUT

25125.0004



KROGER & MIXED USE AT BUCKWALTER PLACE  
PRE-DEVELOPED CONDITIONS  
NODE MAX REPORT

Name	Group	Simulation	Max Time Stage hrs	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Time Inflow hrs	Max Inflow cfs	Max Time Outflow hrs	Max Outflow cfs
EAST BP	BASE	002-YR	12.50	18.108	20.000	-0.0010	560	12.50	26.861	12.50	26.827
EAST BP	BASE	010-YR	12.50	18.663	20.000	-0.0015	519	12.50	44.879	12.50	44.836
EAST BP	BASE	025-YR	12.50	18.984	20.000	-0.0018	460	12.50	56.053	12.50	56.008
EAST BP	BASE	100-YR	12.50	19.599	20.000	-0.0023	237	12.50	75.267	12.50	75.232
OW-T1-111	BASE	002-YR	24.00	1108.146	0.000	*****	113	12.50	16.037	0.00	0.000
OW-T1-111	BASE	010-YR	24.00	1701.174	0.000	*****	113	12.50	29.223	0.00	0.000
OW-T1-111	BASE	025-YR	24.00	2020.220	0.000	*****	113	12.50	37.561	0.00	0.000
OW-T1-111	BASE	100-YR	24.00	2527.026	0.000	*****	113	12.50	51.990	0.00	0.000
OW-T1-86&74	BASE	002-YR	24.00	2244.518	0.000	*****	113	12.75	32.600	0.00	0.000
OW-T1-86&74	BASE	010-YR	24.00	3152.493	0.000	*****	113	12.75	59.636	0.00	0.000
OW-T1-86&74	BASE	025-YR	24.00	3636.050	0.000	*****	113	12.75	76.772	0.00	0.000
OW-T1-86&74	BASE	100-YR	24.00	4355.854	0.000	*****	113	12.67	106.575	0.00	0.000
OW_T1-139	BASE	002-YR	0.00	16.300	19.000	0.0000	23	12.50	26.827	0.00	0.000
OW_T1-139	BASE	010-YR	0.00	16.300	19.000	0.0000	23	12.50	44.836	0.00	0.000
OW_T1-139	BASE	025-YR	0.00	16.300	19.000	0.0000	23	12.50	56.008	0.00	0.000
OW_T1-139	BASE	100-YR	0.00	16.300	19.000	0.0000	23	12.50	75.232	0.00	0.000

Z:\25125\25125.0004\Engineering\Calculations\Storm Water\ICPR\Pre\25125.0004-Pre.ICP  
9/24/2015

**STORMWATER MANAGEMENT REPORT**

**KROGER & MIXED USE AT BUCKWALTER PLACE**

**APPENDIX E**

Post-Development ICPR Model Input

25125.0004

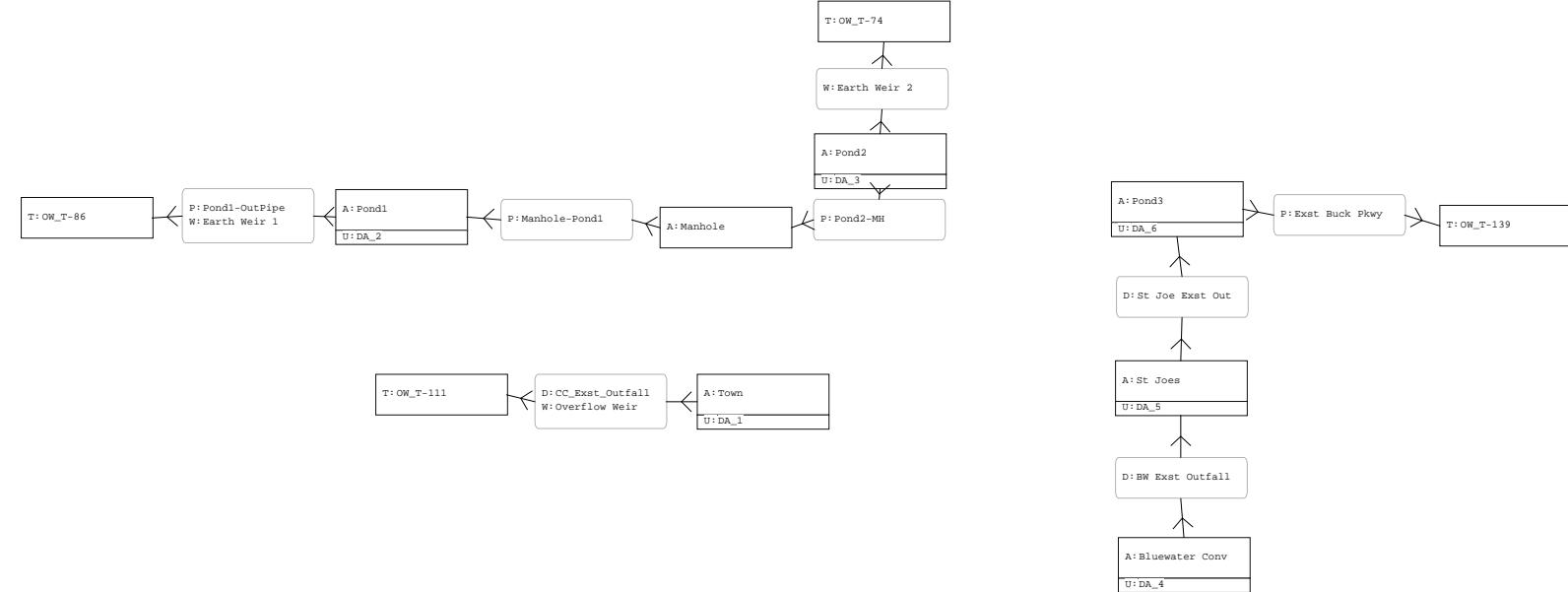
**T** THOMAS & HUTTON

KROGER & MIXED USE AT BUCKWALTER PLACE  
POST-DEVELOPED CONDITIONS  
NODE NETWORK

Nodes  
 A Stage/Area  
 V Stage/Volume  
 T Time/Stage  
 M Manhole

Basins  
 O Overland Flow  
 U SCS Unit CN  
 S SBUH CN  
 Y SCS Unit GA  
 Z SBUH GA

Links  
 P Pipe  
 W Weir  
 C Channel  
 D Drop Structure  
 B Bridge  
 R Rating Curve  
 H Breach  
 E Percolation  
 F Filter  
 X Exfil Trench



KROGER & MIXED USE AT BUCKWALTER PLACE  
POST-DEVELOPED CONDITIONS  
INPUT REPORT

=====  
==== Basins =====  
=====

Name: DA\_1 Node: Town Status: Onsite  
Group: BASE Type: SCS Unit Hydrograph CN  
  
Unit Hydrograph: Uh323 Peaking Factor: 323.0  
Rainfall File: Storm Duration(hrs): 0.00  
Rainfall Amount(in): 0.000 Time of Conc(min): 35.00  
Area(ac): 16.400 Time Shift(hrs): 0.00  
Curve Number: 96.00 Max Allowable Q(cfs): 999999.000  
DCIA(%): 0.00

Name: DA\_2 Node: Pond1 Status: Onsite  
Group: BASE Type: SCS Unit Hydrograph CN  
  
Unit Hydrograph: Uh323 Peaking Factor: 323.0  
Rainfall File: Storm Duration(hrs): 0.00  
Rainfall Amount(in): 0.000 Time of Conc(min): 29.00  
Area(ac): 20.300 Time Shift(hrs): 0.00  
Curve Number: 95.00 Max Allowable Q(cfs): 999999.000  
DCIA(%): 0.00

Name: DA\_3 Node: Pond2 Status: Onsite  
Group: BASE Type: SCS Unit Hydrograph CN  
  
Unit Hydrograph: Uh323 Peaking Factor: 323.0  
Rainfall File: Storm Duration(hrs): 0.00  
Rainfall Amount(in): 0.000 Time of Conc(min): 30.00  
Area(ac): 15.500 Time Shift(hrs): 0.00  
Curve Number: 95.00 Max Allowable Q(cfs): 999999.000  
DCIA(%): 0.00

Name: DA\_4 Node: Bluewater Conv Status: Onsite  
Group: BASE Type: SCS Unit Hydrograph CN  
  
Unit Hydrograph: Uh323 Peaking Factor: 323.0  
Rainfall File: Storm Duration(hrs): 0.00  
Rainfall Amount(in): 0.000 Time of Conc(min): 15.00  
Area(ac): 5.600 Time Shift(hrs): 0.00  
Curve Number: 93.00 Max Allowable Q(cfs): 999999.000  
DCIA(%): 0.00

Name: DA\_5 Node: St Joes Status: Onsite  
Group: BASE Type: SCS Unit Hydrograph CN  
  
Unit Hydrograph: Uh323 Peaking Factor: 323.0  
Rainfall File: Storm Duration(hrs): 0.00  
Rainfall Amount(in): 0.000 Time of Conc(min): 20.00  
Area(ac): 4.500 Time Shift(hrs): 0.00  
Curve Number: 95.00 Max Allowable Q(cfs): 999999.000  
DCIA(%): 0.00

Name: DA\_6 Node: Pond3 Status: Onsite  
Group: BASE Type: SCS Unit Hydrograph CN  
  
Unit Hydrograph: Uh323 Peaking Factor: 323.0  
Rainfall File: Storm Duration(hrs): 0.00  
Rainfall Amount(in): 0.000 Time of Conc(min): 41.00  
Area(ac): 7.900 Time Shift(hrs): 0.00  
Curve Number: 95.00 Max Allowable Q(cfs): 999999.000  
DCIA(%): 0.00

=====  
==== Nodes =====  
=====

KROGER & MIXED USE AT BUCKWALTER PLACE  
POST-DEVELOPED CONDITIONS  
INPUT REPORT

stage/area from record dwgs (NGVD29 Datum)

Stage(ft)	Area(ac)
17.000	0.1400
21.000	0.3900

Name: Manhole              Base Flow(cfs): 0.000              Init Stage(ft): 14.000  
Group: BASE    Warn Stage(ft): 18.390  
Type: Stage/Area

Stage(ft)	Area(ac)
-----------	----------

Name: OW\_T-111 Base Flow(cfs): 0.000 Init Stage(ft): 13.300  
Group: BASE Warn Stage(ft): 20.000  
Type: Time/Stage

Time (hrs)	Stage (ft)
0.00	13.300
30.00	13.300

Name: OW\_T-139 Base Flow(cfs): 0.000 Init Stage(ft): 16.320  
Group: BASE Warn Stage(ft): 22.000  
Type: Time/Stage

Time (hrs)	Stage (ft)
0.00	16.320
36.00	16.320

Name: OW\_T-74 Base Flow(cfs): 0.000 Init Stage(ft): 11.700  
Group: BASE Warn Stage(ft): 20.000  
Type: Time/Stage

Time (hrs)	Stage (ft)
0.00	11.700
30.00	11.700

Name: OW\_T-86 Base Flow(cfs): 0.000 Init Stage(ft): 12.500  
Group: BASE Warn Stage(ft): 20.000  
Type: Time/Stage

Time (hrs)	Stage (ft)
0.00	12.500
30.00	12.500

Name: Pond1 Base Flow(cfs): 0.000 Init Stage(ft): 14.000  
Group: BASE Warn Stage(ft): 18.000  
Type: Stage/Area

Stage(ft)	Area(ac)
14.000	1.7300
18.000	2.1300

Name: Pond2 Base Flow(cfs): 0.000 Init Stage(ft): 15.000  
Group: BASE Warn Stage(ft): 19.000

KROGER & MIXED USE AT BUCKWALTER PLACE  
POST-DEVELOPED CONDITIONS  
INPUT REPORT

---

Type: Stage/Area

Stage(ft)	Area(ac)		
15.000	1.2000		
19.000	1.5000		
Name: Pond3	Base Flow(cfs): 0.000	Init Stage(ft): 16.400	
Group: BASE		Warn Stage(ft): 21.000	
Type: Stage/Area			
Stage(ft)	Area(ac)		
16.400	0.1300		
21.000	0.3900		
Name: St Joes	Base Flow(cfs): 0.000	Init Stage(ft): 16.400	
Group: BASE		Warn Stage(ft): 21.000	
Type: Stage/Area			

stage/area from record dwgs (NGVD29 Datum)

Stage(ft)	Area(ac)		
16.300	0.2600		
21.000	0.5000		
Name: Town	Base Flow(cfs): 0.000	Init Stage(ft): 13.650	
Group: BASE		Warn Stage(ft): 18.000	
Type: Stage/Area			
Stage(ft)	Area(ac)		
13.650	1.5300		
18.000	2.2000		

---

===== Pipes =====

Name: Exst Buck Pkwy	From Node: Pond3	Length(ft): 151.00
Group: BASE	To Node: OW_T-139	Count: 2
UPSTREAM	DOWNSTREAM	Friction Equation: Automatic
Geometry: Circular	Circular	Solution Algorithm: Most Restrictive
Span(in): 36.00	36.00	Flow: Both
Rise(in): 36.00	36.00	Entrance Loss Coef: 0.20
Invert(ft): 16.400	16.300	Exit Loss Coef: 0.20
Manning's N: 0.013000	0.013000	Bend Loss Coef: 0.00
Top Clip(in): 0.000	0.000	Outlet Ctrl Spec: Use dc or tw
Bot Clip(in): 0.000	0.000	Inlet Ctrl Spec: Use dc
		Stabilizer Option: None

Upstream FHWA Inlet Edge Description:  
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:  
Circular Concrete: Square edge w/ headwall

Inverts based on Alta survey (NGVD29 confirmed by Roby Morgan)  
Pipe sizes set at 36" - Alta says 30" but KMS said pipes are silted in and are actually 36"

Name: Manhole-Pond1	From Node: Manhole	Length(ft): 191.00
Group: BASE	To Node: Pond1	Count: 1
UPSTREAM	DOWNSTREAM	Friction Equation: Automatic
Geometry: Circular	Circular	Solution Algorithm: Most Restrictive
Span(in): 36.00	36.00	Flow: Both
Rise(in): 36.00	36.00	Entrance Loss Coef: 0.20
Invert(ft): 13.590	8.000	Exit Loss Coef: 1.00
Manning's N: 0.013000	0.013000	Bend Loss Coef: 0.00
Top Clip(in): 0.000	0.000	Outlet Ctrl Spec: Use dc or tw
Bot Clip(in): 0.000	0.000	Inlet Ctrl Spec: Use dc
		Stabilizer Option: None

KROGER & MIXED USE AT BUCKWALTER PLACE  
POST-DEVELOPED CONDITIONS  
INPUT REPORT

---

Upstream FHWA Inlet Edge Description:  
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:  
Circular Concrete: Square edge w/ headwall

Name: Pond1-OutPipe	From Node: Pond1	Length(ft): 98.00
Group: BASE	To Node: OW_T-86	Count: 1
UPSTREAM		Friction Equation: Automatic
Geometry: Circular	DOWNSTREAM	Solution Algorithm: Most Restrictive
Span(in): 42.00	Circular	Flow: Both
Rise(in): 42.00	42.00	Entrance Loss Coef: 0.00
Invert(ft): 14.000	42.00	Exit Loss Coef: 1.00
Manning's N: 0.013000	14.000	Bend Loss Coef: 0.00
Top Clip(in): 0.000	0.000	Outlet Ctrl Spec: Use dc or tw
Bot Clip(in): 0.000	0.000	Inlet Ctrl Spec: Use dc
		Stabilizer Option: None

Upstream FHWA Inlet Edge Description:  
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:  
Circular Concrete: Square edge w/ headwall

Name: Pond2-MH	From Node: Pond2	Length(ft): 469.00
Group: BASE	To Node: Manhole	Count: 1
UPSTREAM		Friction Equation: Automatic
Geometry: Circular	DOWNSTREAM	Solution Algorithm: Most Restrictive
Span(in): 36.00	Circular	Flow: Both
Rise(in): 36.00	36.00	Entrance Loss Coef: 0.30
Invert(ft): 15.000	36.00	Exit Loss Coef: 0.50
Manning's N: 0.013000	13.590	Bend Loss Coef: 0.00
Top Clip(in): 0.000	0.000	Outlet Ctrl Spec: Use dc or tw
Bot Clip(in): 0.000	0.000	Inlet Ctrl Spec: Use dc
		Stabilizer Option: None

Upstream FHWA Inlet Edge Description:  
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:  
Circular Concrete: Square edge w/ headwall

=====  
==== Drop Structures =====  
=====

Name: BW Exst Outfall	From Node: Bluewater Conv	Length(ft): 146.00
Group: BASE	To Node: St Joes	Count: 1
UPSTREAM		Friction Equation: Automatic
Geometry: Circular	DOWNSTREAM	Solution Algorithm: Most Restrictive
Span(in): 30.00	Circular	Flow: Both
Rise(in): 30.00	30.00	Entrance Loss Coef: 0.200
Invert(ft): 17.000	30.00	Exit Loss Coef: 0.200
Manning's N: 0.013000	16.570	Outlet Ctrl Spec: Use dc or tw
Top Clip(in): 0.000	0.013000	Inlet Ctrl Spec: Use dc
Bot Clip(in): 0.000	0.000	Solution Incs: 10

Upstream FHWA Inlet Edge Description:  
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:  
Circular Concrete: Square edge w/ headwall

data from record dwgs (NGVD29 Datum)

\*\*\* Weir 1 of 4 for Drop Structure BW Exst Outfall \*\*\*

Count: 1	Bottom Clip(in): 0.000
Type: Horizontal	Top Clip(in): 0.000
Flow: Both	Weir Disc Coef: 3.200

TABLE

Z:\25125\25125.0004\Engineering\Calculations\Storm Water\ICPR\Post\25125.0004-Post.ICP  
1/6/2016

KROGER & MIXED USE AT BUCKWALTER PLACE  
POST-DEVELOPED CONDITIONS  
INPUT REPORT

Geometry: Rectangular	Orifice Disc Coef: 0.600
Span(in): 48.00	Invert(ft): 21.170
Rise(in): 48.00	Control Elev(ft): 21.170

\*\*\* Weir 2 of 4 for Drop Structure BW Exst Outfall \*\*\*

TABLE

Count: 1	Bottom Clip(in): 0.000
Type: Vertical: Mavis	Top Clip(in): 0.000
Flow: Both	Weir Disc Coef: 3.200
Geometry: Rectangular	Orifice Disc Coef: 0.600
Span(in): 6.00	Invert(ft): 17.000
Rise(in): 12.00	Control Elev(ft): 17.000

\*\*\* Weir 3 of 4 for Drop Structure BW Exst Outfall \*\*\*

TABLE

Count: 1	Bottom Clip(in): 0.000
Type: Vertical: Mavis	Top Clip(in): 0.000
Flow: Both	Weir Disc Coef: 3.200
Geometry: Rectangular	Orifice Disc Coef: 0.600
Span(in): 36.00	Invert(ft): 18.000
Rise(in): 18.00	Control Elev(ft): 18.000

\*\*\* Weir 4 of 4 for Drop Structure BW Exst Outfall \*\*\*

TABLE

Count: 1	Bottom Clip(in): 0.000
Type: Vertical: Mavis	Top Clip(in): 0.000
Flow: Both	Weir Disc Coef: 3.200
Geometry: Rectangular	Orifice Disc Coef: 0.600
Span(in): 144.00	Invert(ft): 19.500
Rise(in): 12.00	Control Elev(ft): 19.500

---

Name: CC_Exst_Outfall	From Node: Town	Length(ft): 115.00
Group: BASE	To Node: OW_T-111	Count: 1
UPSTREAM	DOWNTSTREAM	Friction Equation: Automatic
Geometry: Circular	Circular	Solution Algorithm: Most Restrictive
Span(in): 30.00	30.00	Flow: Both
Rise(in): 30.00	30.00	Entrance Loss Coef: 0.000
Invert(ft): 13.650	13.650	Exit Loss Coef: 1.000
Manning's N: 0.013000	0.013000	Outlet Ctrl Spec: Use dc or tw
Top Clip(in): 0.000	0.000	Inlet Ctrl Spec: Use dc
Bot Clip(in): 0.000	0.000	Solution Incs: 10

Upstream FHWA Inlet Edge Description:  
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:  
Circular Concrete: Square edge w/ headwall

data from record dwgs (NGVD29 Datum)

\*\*\* Weir 1 of 4 for Drop Structure CC\_Exst\_Outfall \*\*\*

TABLE

Count: 1	Bottom Clip(in): 0.000
Type: Horizontal	Top Clip(in): 0.000
Flow: Both	Weir Disc Coef: 3.200
Geometry: Rectangular	Orifice Disc Coef: 0.600
Span(in): 48.00	Invert(ft): 17.530
Rise(in): 48.00	Control Elev(ft): 17.530

\*\*\* Weir 2 of 4 for Drop Structure CC\_Exst\_Outfall \*\*\*

TABLE

Count: 1	Bottom Clip(in): 0.000
Type: Vertical: Mavis	Top Clip(in): 0.000
Flow: Both	Weir Disc Coef: 3.200
Geometry: Rectangular	Orifice Disc Coef: 0.600
Span(in): 12.00	Invert(ft): 13.300
Rise(in): 4.20	Control Elev(ft): 13.300

\*\*\* Weir 3 of 4 for Drop Structure CC\_Exst\_Outfall \*\*\*

TABLE

Count: 1	Bottom Clip(in): 0.000
Type: Vertical: Mavis	Top Clip(in): 0.000
Flow: Both	Weir Disc Coef: 3.200
Geometry: Rectangular	Orifice Disc Coef: 0.600
Span(in): 24.00	Invert(ft): 13.650

KROGER & MIXED USE AT BUCKWALTER PLACE  
POST-DEVELOPED CONDITIONS  
INPUT REPORT

Rise(in): 32.64 Control Elev(ft): 13.650

\*\*\* Weir 4 of 4 for Drop Structure CC\_Exst\_Outfall \*\*\*

Count: 1	Bottom Clip(in): 0.000
Type: Vertical: Mavis	Top Clip(in): 0.000
Flow: Both	Weir Disc Coef: 3.200
Geometry: Rectangular	Orifice Disc Coef: 0.600
Span(in): 36.00	Invert(ft): 16.370
Rise(in): 13.92	Control Elev(ft): 16.370

TABLE

Name: St Joe Exst Out	From Node: St Joes	Length(ft): 140.00
Group: BASE	To Node: Pond3	Count: 1
UPSTREAM	DOWNTSTREAM	Friction Equation: Automatic
Geometry: Circular	Circular	Solution Algorithm: Most Restrictive
Span(in): 36.00	36.00	Flow: Both
Rise(in): 36.00	36.00	Entrance Loss Coef: 0.200
Invert(ft): 15.880	16.170	Exit Loss Coef: 0.200
Manning's N: 0.013000	0.013000	Outlet Ctrl Spec: Use dc or tw
Top Clip(in): 0.000	0.000	Inlet Ctrl Spec: Use dc
Bot Clip(in): 0.000	0.000	Solution Incs: 10

Upstream FHWA Inlet Edge Description:  
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:  
Circular Concrete: Square edge w/ headwall

data from record dwgs (NGVD29 Datum)

\*\*\* Weir 1 of 4 for Drop Structure St Joe Exst Out \*\*\*

Count: 1	Bottom Clip(in): 0.000
Type: Horizontal	Top Clip(in): 0.000
Flow: Both	Weir Disc Coef: 3.200
Geometry: Rectangular	Orifice Disc Coef: 0.600
Span(in): 48.00	Invert(ft): 20.520
Rise(in): 48.00	Control Elev(ft): 20.520

TABLE

\*\*\* Weir 2 of 4 for Drop Structure St Joe Exst Out \*\*\*

Count: 1	Bottom Clip(in): 0.000
Type: Vertical: Mavis	Top Clip(in): 0.000
Flow: Both	Weir Disc Coef: 3.200
Geometry: Rectangular	Orifice Disc Coef: 0.600
Span(in): 6.60	Invert(ft): 16.300
Rise(in): 6.60	Control Elev(ft): 16.300

TABLE

\*\*\* Weir 3 of 4 for Drop Structure St Joe Exst Out \*\*\*

Count: 1	Bottom Clip(in): 0.000
Type: Vertical: Mavis	Top Clip(in): 0.000
Flow: Both	Weir Disc Coef: 3.200
Geometry: Rectangular	Orifice Disc Coef: 0.600
Span(in): 12.00	Invert(ft): 16.850
Rise(in): 17.40	Control Elev(ft): 16.850

TABLE

\*\*\* Weir 4 of 4 for Drop Structure St Joe Exst Out \*\*\*

Count: 1	Bottom Clip(in): 0.000
Type: Vertical: Mavis	Top Clip(in): 0.000
Flow: Both	Weir Disc Coef: 3.200
Geometry: Rectangular	Orifice Disc Coef: 0.600
Span(in): 27.00	Invert(ft): 18.300
Rise(in): 20.00	Control Elev(ft): 18.300

TABLE

---

=====  
==== Weirs =====  
=====

Name: Earth Weir 1	From Node: Pond1
Group: BASE	To Node: OW_T-86
Flow: Both	Count: 1
Type: Vertical: Mavis	Geometry: Trapezoidal
Bottom Width(ft): 10.00	

KROGER & MIXED USE AT BUCKWALTER PLACE  
POST-DEVELOPED CONDITIONS  
INPUT REPORT

Left Side Slope(h/v): 3.00  
Right Side Slope(h/v): 3.00  
Invert(ft): 17.500  
Control Elevation(ft): 17.500  
Struct Opening Dim(ft): 9999.00

TABLE

Bottom Clip(ft): 0.000  
Top Clip(ft): 0.000  
Weir Discharge Coef: 3.200  
Orifice Discharge Coef: 0.600

Name: Earth Weir 2 From Node: Pond2  
Group: BASE To Node: OW\_T-74  
Flow: Both Count: 1  
Type: Vertical: Mavis Geometry: Trapezoidal

Bottom Width(ft): 10.00  
Left Side Slope(h/v): 3.00  
Right Side Slope(h/v): 3.00  
Invert(ft): 17.000  
Control Elevation(ft): 17.000  
Struct Opening Dim(ft): 9999.00

TABLE

Bottom Clip(ft): 0.000  
Top Clip(ft): 0.000  
Weir Discharge Coef: 3.200  
Orifice Discharge Coef: 0.600

Name: Overflow Weir From Node: Town  
Group: BASE To Node: OW\_T-111  
Flow: Both Count: 1  
Type: Vertical: Mavis Geometry: Trapezoidal

Bottom Width(ft): 5.00  
Left Side Slope(h/v): 3.00  
Right Side Slope(h/v): 3.00  
Invert(ft): 16.000  
Control Elevation(ft): 16.000  
Struct Opening Dim(ft): 9999.00

TABLE

Bottom Clip(ft): 0.000  
Top Clip(ft): 0.000  
Weir Discharge Coef: 3.200  
Orifice Discharge Coef: 0.600

data from record dwgs (NGVD29 Datum)

=====  
==== Hydrology Simulations =====  
=====

Name: 002-YR  
Filename: Z:\25125\25125.0004\Engineering\Calculations\Storm Water\ICPR\Post\002-YR.R32

Override Defaults: Yes  
Storm Duration(hrs): 24.00  
Rainfall File: SCSII  
Rainfall Amount(in): 4.50

Time(hrs) Print Inc(min)  
-----  
24.000 5.00

Name: 010-YR  
Filename: Z:\25125\25125.0004\Engineering\Calculations\Storm Water\ICPR\Post\010-YR.R32

Override Defaults: Yes  
Storm Duration(hrs): 24.00  
Rainfall File: SCSII  
Rainfall Amount(in): 6.90

Time(hrs) Print Inc(min)  
-----  
24.000 5.00

Name: 025-YR  
Filename: Z:\25125\25125.0004\Engineering\Calculations\Storm Water\ICPR\Post\025-YR.R32

Z:\25125\25125.0004\Engineering\Calculations\Storm Water\ICPR\Post\25125.0004-Post.ICP  
1/6/2016

KROGER & MIXED USE AT BUCKWALTER PLACE  
POST-DEVELOPED CONDITIONS  
INPUT REPORT

Override Defaults: Yes  
Storm Duration(hrs): 24.00  
Rainfall File: Scsiii  
Rainfall Amount(in): 8.40

Time(hrs) Print Inc(min)  
-----  
24.000 5.00

Name: 100-YR  
Filename: Z:\25125\25125.0004\Engineering\Calculations\Storm Water\ICPR\Post\100-YR.R32

Override Defaults: Yes  
Storm Duration(hrs): 24.00  
Rainfall File: Scsiii  
Rainfall Amount(in): 11.00

Time(hrs) Print Inc(min)  
-----  
24.000 5.00

===== Routing Simulations =====

Name: 002-YR Hydrology Sim: 002-YR  
Filename: Z:\25125\25125.0004\Engineering\Calculations\Storm Water\ICPR\Post\002-YR.I32

Execute: Yes Restart: No Patch: No  
Alternative: No

Max Delta Z(ft): 0.05 Delta Z Factor: 0.00500  
Time Step Optimizer: 0.000 End Time(hrs): 30.00  
Start Time(hrs): 0.000 Max Calc Time(sec): 60.0000  
Min Calc Time(sec): 0.5000 Boundary Stages: 2 yr  
Boundary Flows:

Time(hrs) Print Inc(min)  
-----  
30.000 15.000

Group Run  
-----  
BASE Yes

Name: 010-YR Hydrology Sim: 010-YR  
Filename: Z:\25125\25125.0004\Engineering\Calculations\Storm Water\ICPR\Post\010-YR.I32

Execute: Yes Restart: No Patch: No  
Alternative: No

Max Delta Z(ft): 0.05 Delta Z Factor: 0.00500  
Time Step Optimizer: 0.000 End Time(hrs): 30.00  
Start Time(hrs): 0.000 Max Calc Time(sec): 60.0000  
Min Calc Time(sec): 0.5000 Boundary Stages: 10 yr  
Boundary Flows:

Time(hrs) Print Inc(min)  
-----  
30.000 15.000

Group Run  
-----  
BASE Yes

Name: 025-YR Hydrology Sim: 025-YR  
Filename: Z:\25125\25125.0004\Engineering\Calculations\Storm Water\ICPR\Post\025-YR.I32

Execute: Yes Restart: No Patch: No  
Alternative: No

Max Delta Z(ft): 0.05 Delta Z Factor: 0.00500  
Time Step Optimizer: 0.000 End Time(hrs): 30.00  
Start Time(hrs): 0.000 Max Calc Time(sec): 60.0000  
Min Calc Time(sec): 0.5000

KROGER & MIXED USE AT BUCKWALTER PLACE  
POST-DEVELOPED CONDITIONS  
INPUT REPORT

Boundary Stages: 25 yr

Boundary Flows:

Time(hrs)	Print Inc(min)
30.000	15.000

Group Run  
----  
BASE Yes

Name: 100-YR Hydrology Sim: 100-YR  
Filename: Z:\25125\25125.0004\Engineering\Calculations\Storm Water\ICPR\Post\100-YR.I32

Execute: Yes      Restart: No      Patch: No  
Alternative: No  
  
Max Delta Z(ft): 0.05      Delta Z Factor: 0.00500  
Time Step Optimizer: 0.000      End Time(hrs): 30.00  
Start Time(hrs): 0.000      Max Calc Time(sec): 60.0000  
Min Calc Time(sec): 0.5000      Boundary Flows:  
Boundary Stages: 100 yr

Time(hrs)	Print Inc(min)
30.000	15.000

Group Run  
----  
BASE Yes

=====  
==== Boundary Conditions =====  
=====

Name: 2 yr      Node: OW\_T-139      Type: Stage  
  
Time(hrs)      Stage(ft)  
-----  
0.000      16.300  
8.000      16.300  
20.000      17.800  
30.000      17.800

Name: 2 yr      Node: OW\_T-111      Type: Stage  
  
Time(hrs)      Stage(ft)  
-----  
0.000      13.300  
8.000      13.300  
20.000      15.300  
30.000      15.300

Name: 2 yr      Node: OW\_T-86      Type: Stage  
  
Time(hrs)      Stage(ft)  
-----  
0.000      12.500  
8.000      12.500  
20.000      14.800  
30.000      14.800

Name: 2 yr      Node: OW\_T-74      Type: Stage  
  
Time(hrs)      Stage(ft)  
-----  
0.000      11.700  
8.000      11.700  
20.000      13.900  
30.000      13.900

Name: 10 yr      Node: OW\_T-139      Type: Stage  
  
Time(hrs)      Stage(ft)  
-----

KROGER & MIXED USE AT BUCKWALTER PLACE  
POST-DEVELOPED CONDITIONS  
INPUT REPORT

0.000	16.300
8.000	16.300
20.000	19.300
30.000	19.300

Name: 10 yr Node: OW\_T-111 Type: Stage

Time(hrs)	Stage(ft)
0.000	13.300
8.000	13.300
20.000	16.200
30.000	16.200

Name: 10 yr Node: OW\_T-86 Type: Stage

Time(hrs)	Stage(ft)
0.000	12.500
8.000	12.500
20.000	15.400
30.000	15.400

Name: 10 yr Node: OW\_T-74 Type: Stage

Time(hrs)	Stage(ft)
0.000	11.700
8.000	11.700
20.000	14.500
30.000	14.500

Name: 25 yr Node: OW\_T-139 Type: Stage

Time(hrs)	Stage(ft)
0.000	16.300
8.000	16.300
20.000	19.600
30.000	19.600

Name: 25 yr Node: OW\_T-111 Type: Stage

Time(hrs)	Stage(ft)
0.000	13.300
8.000	13.300
20.000	16.400
30.000	16.400

Name: 25 yr Node: OW\_T-86 Type: Stage

Time(hrs)	Stage(ft)
0.000	12.500
8.000	12.500
20.000	15.600
30.000	15.600

Name: 25 yr Node: OW\_T-74 Type: Stage

Time(hrs)	Stage(ft)
0.000	11.700
8.000	11.700
20.000	14.800
30.000	14.800

Name: 100 yr Node: OW\_T-139 Type: Stage

Time(hrs)	Stage(ft)
0.000	16.300
8.000	16.300
20.000	20.200
30.000	20.200

KROGER & MIXED USE AT BUCKWALTER PLACE  
POST-DEVELOPED CONDITIONS  
INPUT REPORT

Name: 100 yr Node: OW\_T-111 Type: Stage

Time(hrs)	Stage(ft)
0.000	13.300
8.000	13.300
20.000	16.600
30.000	16.600

Name: 100 yr Node: OW\_T-86 Type: Stage

Time(hrs)	Stage(ft)
0.000	12.500
8.000	12.500
20.000	16.100
30.000	16.100

Name: 100 yr Node: OW\_T-74 Type: Stage

Time(hrs)	Stage(ft)
0.000	11.700
8.000	11.700
20.000	15.300
30.000	15.300

**STORMWATER MANAGEMENT REPORT**

**KROGER & MIXED USE AT BUCKWALTER PLACE**

**APPENDIX F**

POST-DEVELOPMENT ICPR MODEL OUTPUT

25125.0004

**T** THOMAS & HUTTON

KROGER & MIXED USE AT BUCKWALTER PLACE  
POST-DEVELOPED CONDITIONS  
NODE NETWORK

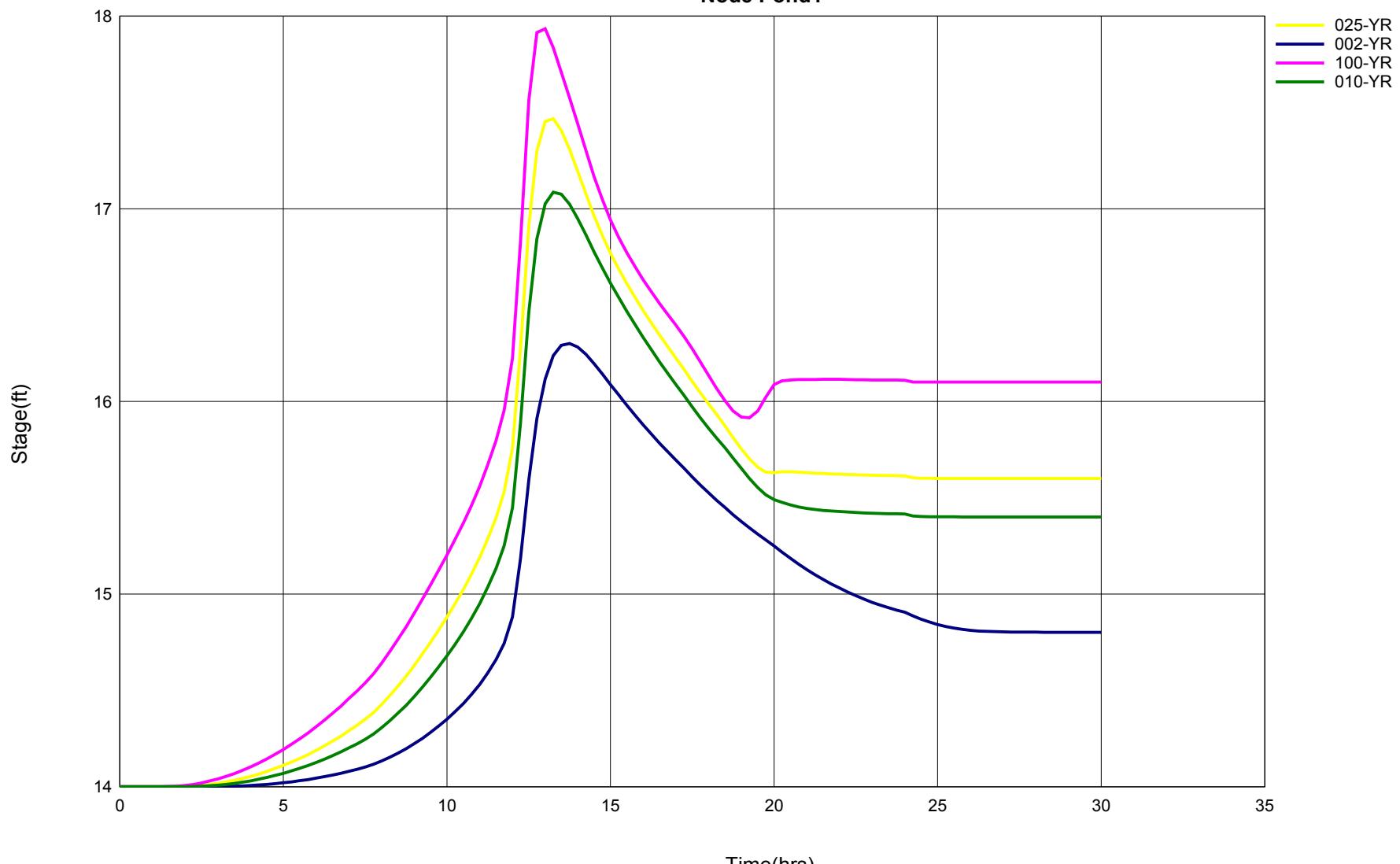
Name	Group	Simulation	Max Stage hrs	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft <sup>2</sup>	Max Inflow hrs	Max Inflow cfs	Max Outflow hrs	Max Outflow cfs
Bluewater Conv	BASE	002-YR	12.60	19.085	21.000	0.0003	11774	12.25	13.498	12.37	8.758
Bluewater Conv	BASE	010-YR	12.62	19.879	21.000	0.0004	13937	12.25	21.503	12.36	12.721
Bluewater Conv	BASE	025-YR	12.62	20.343	21.000	0.0005	15199	12.25	26.457	12.35	14.667
Bluewater Conv	BASE	100-YR	12.64	21.122	21.000	0.0006	17321	12.25	34.994	12.40	17.807
Manhole	BASE	002-YR	13.60	16.374	18.390	0.0003	676	13.04	12.769	13.04	12.614
Manhole	BASE	010-YR	13.27	17.192	18.390	0.0005	298	12.44	14.152	12.46	13.808
Manhole	BASE	025-YR	13.10	17.535	18.390	0.0005	269	12.48	13.438	12.50	13.248
Manhole	BASE	100-YR	12.86	17.972	18.390	-0.0009	163	12.34	12.363	12.35	12.113
OW_T-111	BASE	002-YR	20.00	15.300	20.000	0.0003	0	13.93	7.423	0.00	0.000
OW_T-111	BASE	010-YR	20.00	16.200	20.000	0.0003	0	13.61	14.699	0.00	0.000
OW_T-111	BASE	025-YR	20.00	16.400	20.000	0.0002	0	13.35	22.455	0.00	0.000
OW_T-111	BASE	100-YR	20.00	16.600	20.000	0.0002	0	13.06	38.873	0.00	0.000
OW_T-139	BASE	002-YR	20.00	17.800	22.000	-0.0200	453	12.70	22.130	0.00	0.000
OW_T-139	BASE	010-YR	20.00	19.300	22.000	-0.0200	58	12.66	37.045	0.00	0.000
OW_T-139	BASE	025-YR	20.00	19.600	22.000	-0.0200	23	12.66	45.748	0.00	0.000
OW_T-139	BASE	100-YR	20.00	20.200	22.000	-0.0200	23	12.66	59.612	0.00	0.000
OW_T-74	BASE	002-YR	20.00	13.900	20.000	0.0003	0	0.00	0.000	0.00	0.000
OW_T-74	BASE	010-YR	20.00	14.500	20.000	0.0003	0	13.15	7.589	0.00	0.000
OW_T-74	BASE	025-YR	20.00	14.800	20.000	0.0002	0	12.98	18.990	0.00	0.000
OW_T-74	BASE	100-YR	20.00	15.300	20.000	0.0002	0	12.80	40.983	0.00	0.000
OW_T-86	BASE	002-YR	20.00	14.800	20.000	0.0003	149	13.69	19.009	0.00	0.000
OW_T-86	BASE	010-YR	20.00	15.400	20.000	0.0003	168	13.32	32.293	0.00	0.000
OW_T-86	BASE	025-YR	20.00	15.600	20.000	0.0002	171	13.16	39.102	0.00	0.000
OW_T-86	BASE	100-YR	20.00	16.100	20.000	0.0002	168	12.89	59.512	0.00	0.000
Pond1	BASE	002-YR	13.69	16.302	18.000	0.0002	85598	12.42	45.946	13.69	19.009
Pond1	BASE	010-YR	13.32	17.089	18.000	0.0003	88955	12.42	74.441	13.32	32.293
Pond1	BASE	025-YR	13.16	17.474	18.000	0.0004	90567	12.42	87.496	13.16	39.102
Pond1	BASE	100-YR	12.89	17.950	18.000	0.0004	92626	12.42	109.873	12.89	59.512
Pond2	BASE	002-YR	13.22	16.592	19.000	0.0002	58097	12.42	29.064	13.04	12.769
Pond2	BASE	010-YR	13.15	17.363	19.000	0.0003	60431	12.42	45.618	13.04	19.689
Pond2	BASE	025-YR	12.98	17.642	19.000	0.0004	61255	12.42	55.888	12.87	29.367
Pond2	BASE	100-YR	12.80	18.020	19.000	0.0004	62174	12.42	73.617	12.74	47.485
Pond3	BASE	002-YR	12.70	17.946	21.000	0.0002	9916	12.58	22.772	12.70	22.130
Pond3	BASE	010-YR	20.60	19.300	21.000	0.0003	12931	12.56	37.901	12.66	37.045
Pond3	BASE	025-YR	20.56	19.601	21.000	0.0004	13566	12.57	46.724	12.66	45.748
Pond3	BASE	100-YR	20.23	20.201	21.000	0.0004	15044	12.58	60.813	12.66	59.612
St Joes	BASE	002-YR	12.75	18.900	21.000	0.0004	17109	12.33	18.784	12.76	10.988
St Joes	BASE	010-YR	12.69	19.643	21.000	0.0005	18761	12.33	28.423	12.70	18.884
St Joes	BASE	025-YR	12.68	20.030	21.000	0.0005	19623	12.33	34.066	12.68	23.403
St Joes	BASE	100-YR	12.68	20.634	21.000	0.0006	20966	12.33	43.180	12.70	30.352
Town	BASE	002-YR	13.92	15.460	18.000	0.0002	78788	12.42	28.828	13.93	7.423
Town	BASE	010-YR	21.54	16.212	18.000	0.0002	83837	12.42	44.964	13.61	14.699
Town	BASE	025-YR	13.36	16.499	18.000	0.0003	85761	12.42	54.989	13.35	22.455
Town	BASE	100-YR	13.06	16.891	18.000	0.0004	88391	12.42	72.312	13.06	38.873

KROGER & MIXED USE AT BUCKWALTER PLACE  
POST-DEVELOPED CONDITIONS  
LINK NETWORK

Name	Group	Simulation	Max Time hrs	Max Flow cfs	Max Delta Q cfs	Max US Stage ft	Max US Stage hrs	Max DS Stage hrs	Max DS Stage ft
BW_Exst_Outfall	BASE	002-YR	12.37	8.758	-0.037	12.60	19.085	12.75	18.900
CC_Exst_Outfall	BASE	002-YR	13.93	7.423	-0.022	13.92	15.460	20.00	15.300
Earth Weir 1	BASE	002-YR	0.00	0.000	0.000	13.69	16.302	20.00	14.800
Earth Weir 2	BASE	002-YR	0.00	0.000	0.000	13.22	16.592	20.00	13.900
Exst_Buck_Pkwy	BASE	002-YR	12.70	22.130	-0.358	12.70	17.946	2.28	19.300
Manhole-Pond1	BASE	002-YR	13.04	12.614	0.564	13.60	16.374	13.69	16.302
Overflow Weir	BASE	002-YR	0.00	0.000	0.000	13.92	15.460	20.00	15.300
Pond1-OutPipe	BASE	002-YR	13.69	19.009	0.011	13.69	16.302	13.69	15.333
Pond2-MH	BASE	002-YR	13.04	12.769	0.004	13.22	16.592	2.28	16.590
St_Joe_Exst_Out	BASE	002-YR	12.76	10.988	0.015	12.75	18.900	12.70	17.946
BW_Exst_Outfall	BASE	010-YR	12.36	12.721	-0.745	12.62	19.879	12.69	19.643
CC_Exst_Outfall	BASE	010-YR	13.61	13.221	0.023	21.54	16.212	20.00	16.200
Earth Weir 1	BASE	010-YR	0.00	0.000	0.000	13.32	17.089	20.00	15.400
Earth Weir 2	BASE	010-YR	13.15	7.589	0.003	13.15	17.363	20.00	14.500
Exst_Buck_Pkwy	BASE	010-YR	12.66	37.045	-1.110	20.60	19.300	1.52	19.300
Manhole-Pond1	BASE	010-YR	12.46	13.808	0.538	13.27	17.192	13.32	17.089
Overflow Weir	BASE	010-YR	13.62	1.479	0.006	21.54	16.212	20.00	16.200
Pond1-OutPipe	BASE	010-YR	13.32	32.293	0.075	13.32	17.089	13.32	15.759
Pond2-MH	BASE	010-YR	12.44	14.152	-0.027	13.15	17.363	13.27	17.192
St_Joe_Exst_Out	BASE	010-YR	12.70	18.884	0.497	12.69	19.643	20.60	19.300
BW_Exst_Outfall	BASE	025-YR	12.35	14.667	-0.758	12.62	20.343	12.68	20.030
CC_Exst_Outfall	BASE	025-YR	13.29	15.486	-2.089	13.36	16.499	20.00	16.400
Earth Weir 1	BASE	025-YR	0.00	0.000	0.000	13.16	17.474	20.00	15.600
Earth Weir 2	BASE	025-YR	12.98	18.990	0.008	12.98	17.642	20.00	14.800
Exst_Buck_Pkwy	BASE	025-YR	12.66	45.748	-0.709	20.56	19.601	20.00	19.600
Manhole-Pond1	BASE	025-YR	12.50	13.248	-0.423	13.10	17.535	13.16	17.474
Overflow Weir	BASE	025-YR	13.36	6.979	0.011	13.36	16.499	20.00	16.400
Pond1-OutPipe	BASE	025-YR	13.16	39.102	0.089	13.16	17.474	13.07	15.944
Pond2-MH	BASE	025-YR	12.48	13.438	-0.017	12.98	17.642	13.10	17.535
St_Joe_Exst_Out	BASE	025-YR	12.68	23.403	0.412	12.68	20.030	20.56	19.601
BW_Exst_Outfall	BASE	100-YR	12.40	17.807	-0.751	12.64	21.122	12.68	20.634
CC_Exst_Outfall	BASE	100-YR	13.05	19.714	-2.188	13.06	16.891	20.00	16.600
Earth Weir 1	BASE	100-YR	12.89	10.682	0.006	12.89	17.950	20.00	16.100
Earth Weir 2	BASE	100-YR	12.80	40.983	0.017	12.80	18.020	20.00	15.300
Exst_Buck_Pkwy	BASE	100-YR	12.66	59.612	-0.720	20.23	20.201	20.00	20.200
Manhole-Pond1	BASE	100-YR	12.35	12.113	0.650	12.86	17.972	12.89	17.950
Overflow Weir	BASE	100-YR	13.06	19.160	0.014	13.06	16.891	20.00	16.600
Pond1-OutPipe	BASE	100-YR	12.89	48.830	0.392	12.89	17.950	12.86	16.184
Pond2-MH	BASE	100-YR	12.34	12.363	-0.400	12.80	18.020	12.86	17.972
St_Joe_Exst_Out	BASE	100-YR	12.70	30.352	-1.159	12.68	20.634	20.23	20.201

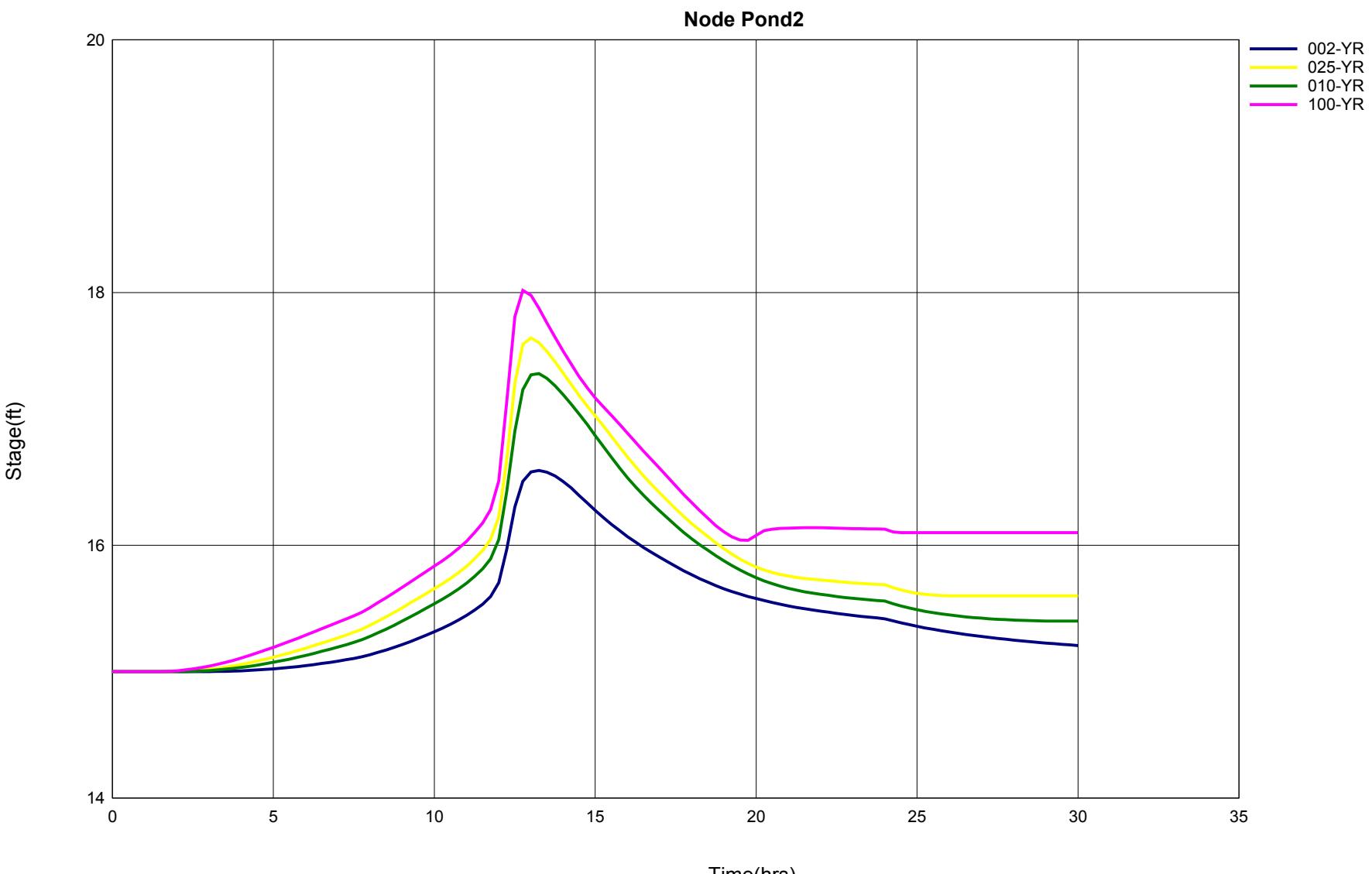
KROGER & MIXED USE AT BUCKWALTER PLACE  
POST-DEVELOPED CONDITIONS  
POND 1 TIME VS STAGE

Node Pond1



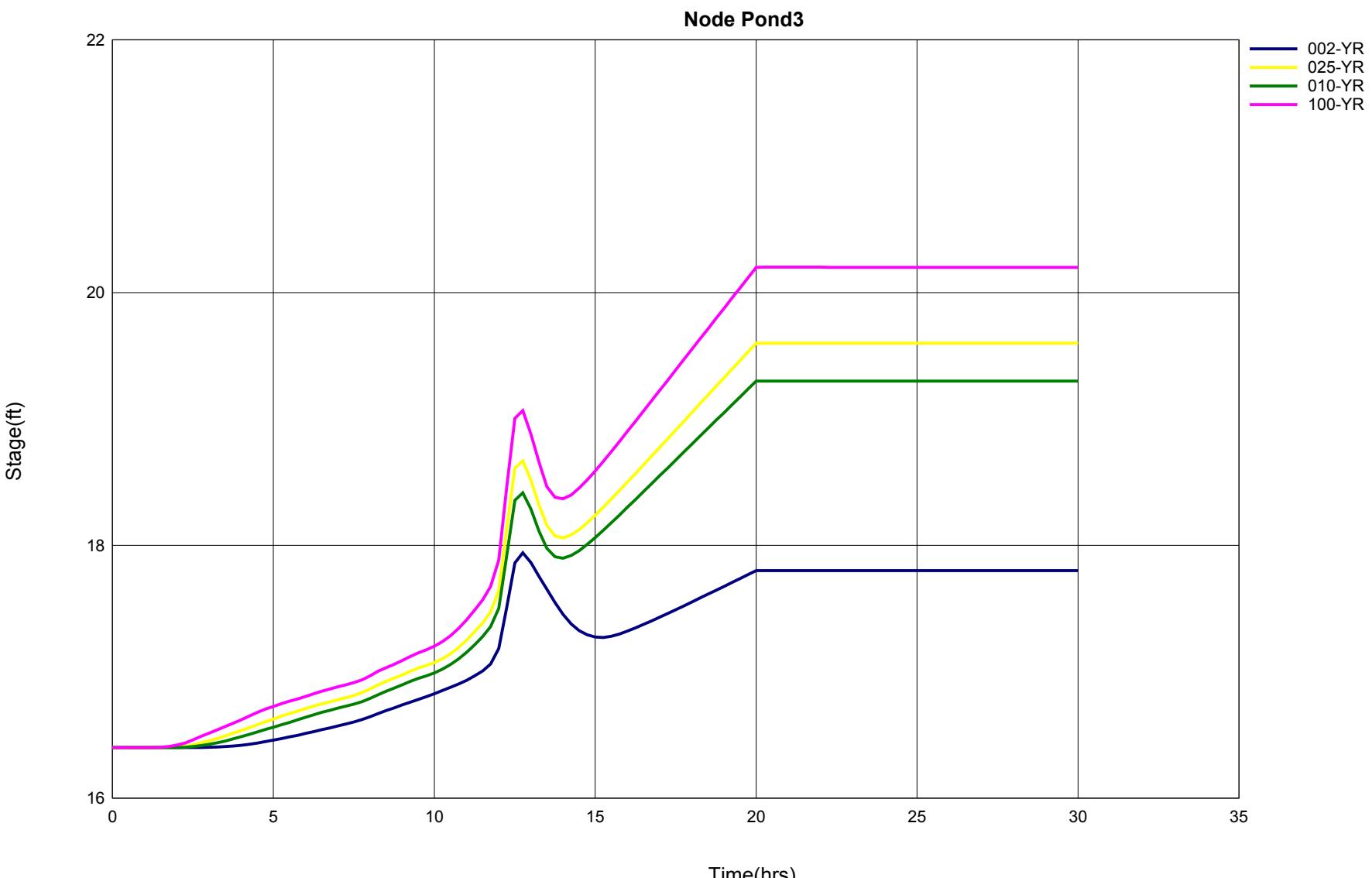
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1/6/2016

KROGER & MIXED USE AT BUCKWALTER PLACE  
POST-DEVELOPED CONDITIONS  
POND 2 TIME VS STAGE



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1/6/2016

KROGER & MIXED USE AT BUCKWALTER PLACE  
POST-DEVELOPED CONDITIONS  
POND 3 TIME VS STAGE



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**STORMWATER MANAGEMENT REPORT**

**KROGER & MIXED USE AT BUCKWALTER PLACE**

**APPENDIX G**

PROPOSED PONDS/WATER QUALITY CALCULATIONS

25125.0004

**T** THOMAS & HUTTON

## Water Quality Design Considerations

### Pond 1

#### DETERMINE STORAGE VOLUME REQUIRED

First half-inch of runoff from the entire site

20.30 ac = Drainage Basin Area

0.5 in = Volume of runoff over site to place in water quality pond

**0.85** ac-ft = Volume of runoff to place in water quality pond

First one inch of runoff from the built-upon portion of the property

20.30 ac = Drainage Basin Area

95 % = percent impervious (future)

19.29 ac = Built upon portion

1 in = Volume of runoff over site to place in water quality pond

**1.61** ac-ft = Volume of runoff to place in water quality pond

#### DETERMINE INITIAL STAGE OF WATER QUALITY POND

If the volume of water calculated above (whichever is greater) is placed in the water quality pond, the initial stage of the pond can be calculated as follows:

Given the following stage-area-storage relationship for Pond 1:

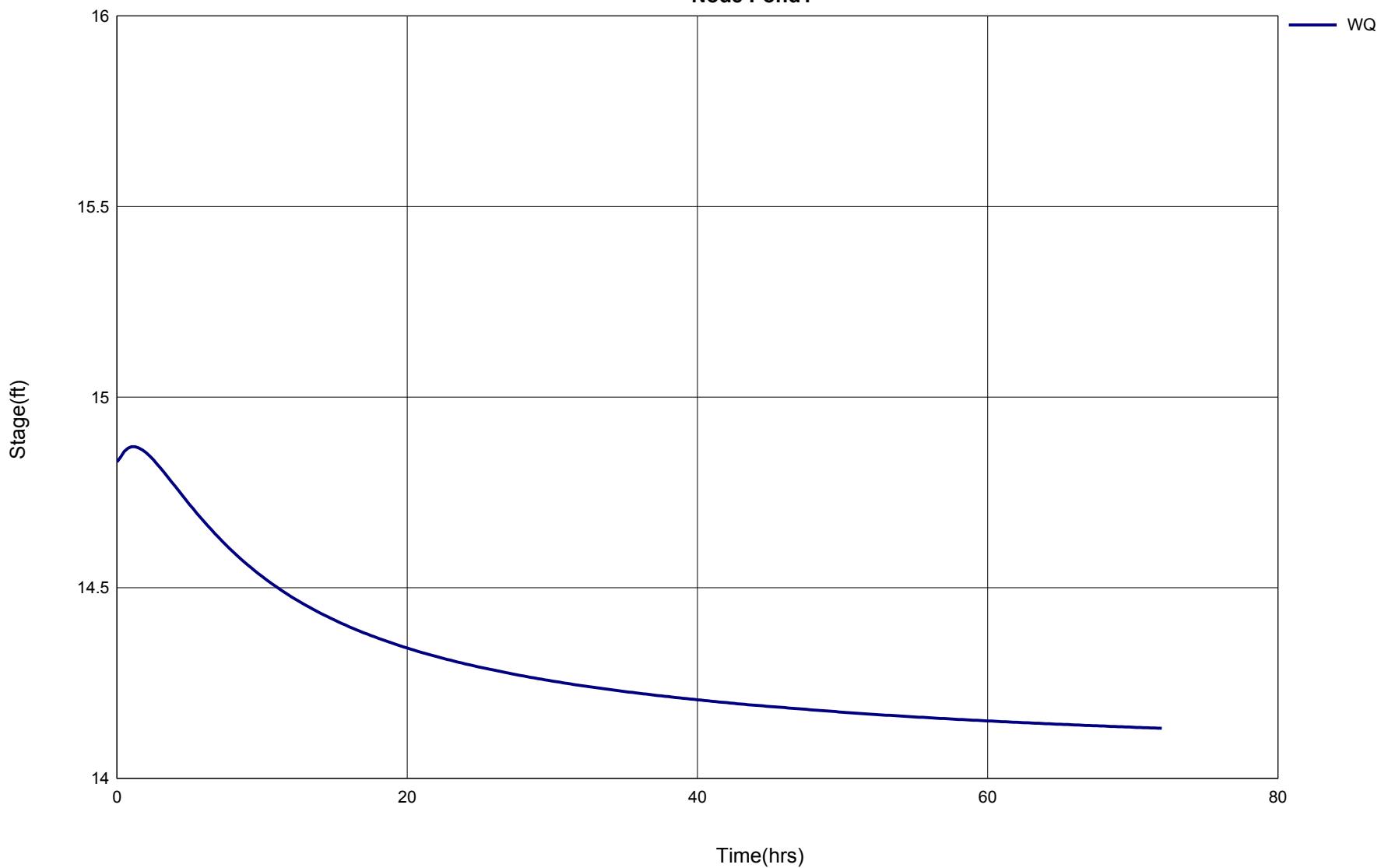
Elev. (ft)	Surface Area (ac)	Total Storage (ac-ft)
14	1.73	0.00
18	2.13	7.72

Interpolation yields an initial stage of:

Elevation (ft)	Pond Depth (ft)	Total Storage (ac-ft)
14	0	0.00
<b>14.83</b>	0.8	<b>1.61</b>
18	4	7.72

KROGER & MIXED USE AT BUCKWALTER PLACE  
POST-DEVELOPED CONDITIONS  
POND 1 DRAWDOWN

**Node Pond1**



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11/12/2015

## Water Quality Design Considerations

### Pond 2

#### DETERMINE STORAGE VOLUME REQUIRED

First half-inch of runoff from the entire site

15.50 ac = Drainage Basin Area

0.5 in = Volume of runoff over site to place in water quality pond

**0.65** ac-ft = Volume of runoff to place in water quality pond

First one inch of runoff from the built-upon portion of the property

15.50 ac = Drainage Basin Area

95 % = percent impervious (future)

14.73 ac = Built upon portion

1 in = Volume of runoff over site to place in water quality pond

**1.23** ac-ft = Volume of runoff to place in water quality pond

#### DETERMINE INITIAL STAGE OF WATER QUALITY POND

If the volume of water calculated above (whichever is greater) is placed in the water quality pond, the initial stage of the pond can be calculated as follows:

Given the following stage-area-storage relationship for Pond 1:

Elev. (ft)	Surface Area (ac)	Total Storage (ac-ft)
15	1.2	0.00
19	1.5	5.40

Interpolation yields an initial stage of:

Elevation (ft)	Pond Depth (ft)	Total Storage (ac-ft)
15	0	0.00
<b>15.91</b>	0.9	<b>1.23</b>
19	4	5.40

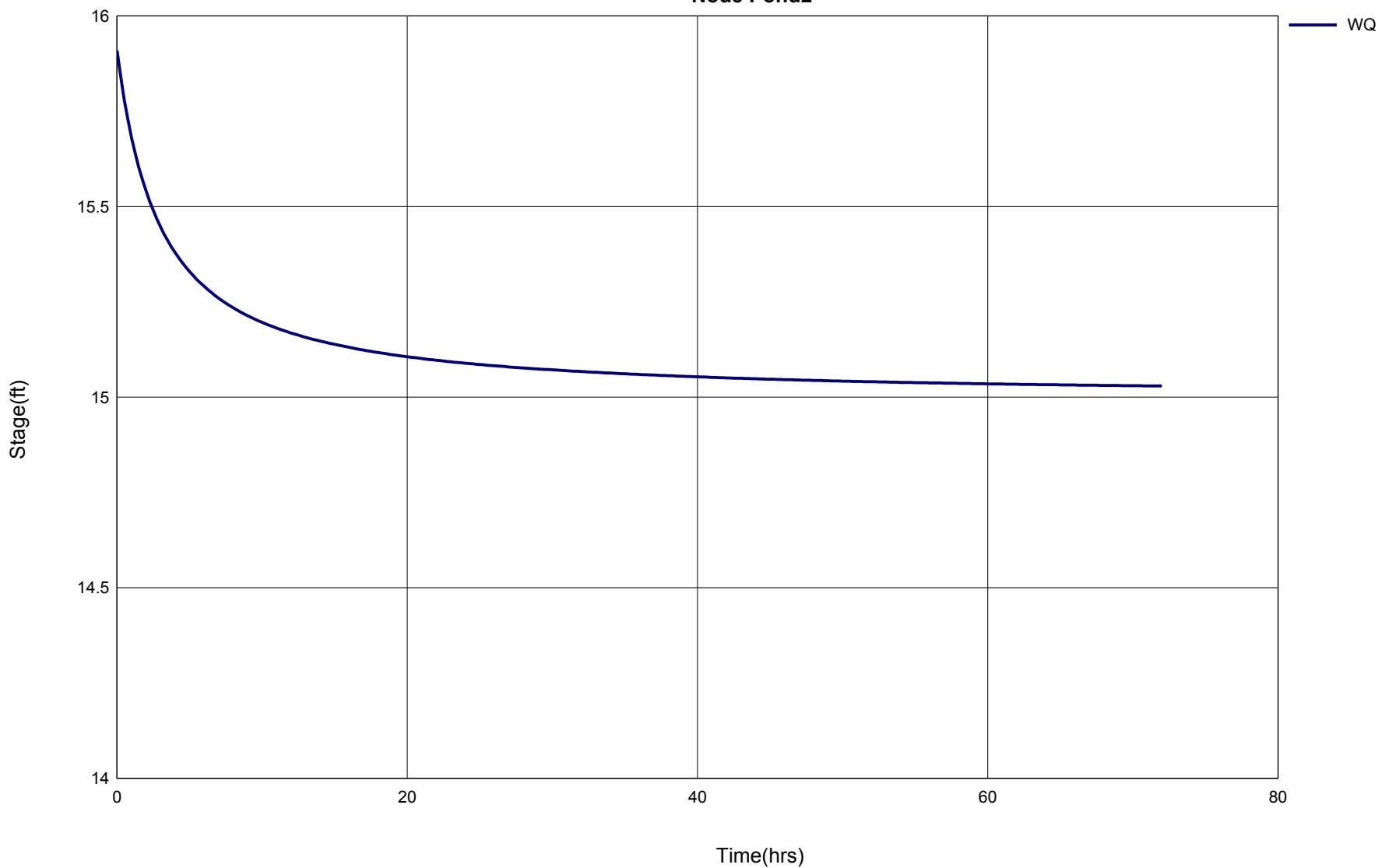
## **Pond 3 Silt Fence**

***Silt fence will be placed along the top of bank during construction to treat sediment runoff before entering pond 3. All disturbed area within DA#6 will pass through silt fence.***

Brian Blake, EIT

KROGER & MIXED USE AT BUCKWALTER PLACE  
POST-DEVELOPED CONDITIONS  
POND 2 DRAWDOWN

Node Pond2



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10/28/2015

## Water Quality Design Considerations

### Pond 3

#### DETERMINE STORAGE VOLUME REQUIRED

First half-inch of runoff from the entire site

7.90 ac = Drainage Basin Area

0.5 in = Volume of runoff over site to place in water quality pond

**0.33** ac-ft = Volume of runoff to place in water quality pond

First one inch of runoff from the built-upon portion of the property

7.90 ac = Drainage Basin Area

95 % = percent impervious (future)

7.51 ac = Built upon portion

1 in = Volume of runoff over site to place in water quality pond

**0.63** ac-ft = Volume of runoff to place in water quality pond

#### DETERMINE INITIAL STAGE OF WATER QUALITY POND

If the volume of water calculated above (whichever is greater) is placed in the water quality pond, the initial stage of the pond can be calculated as follows:

Given the following stage-area-storage relationship for Pond 1:

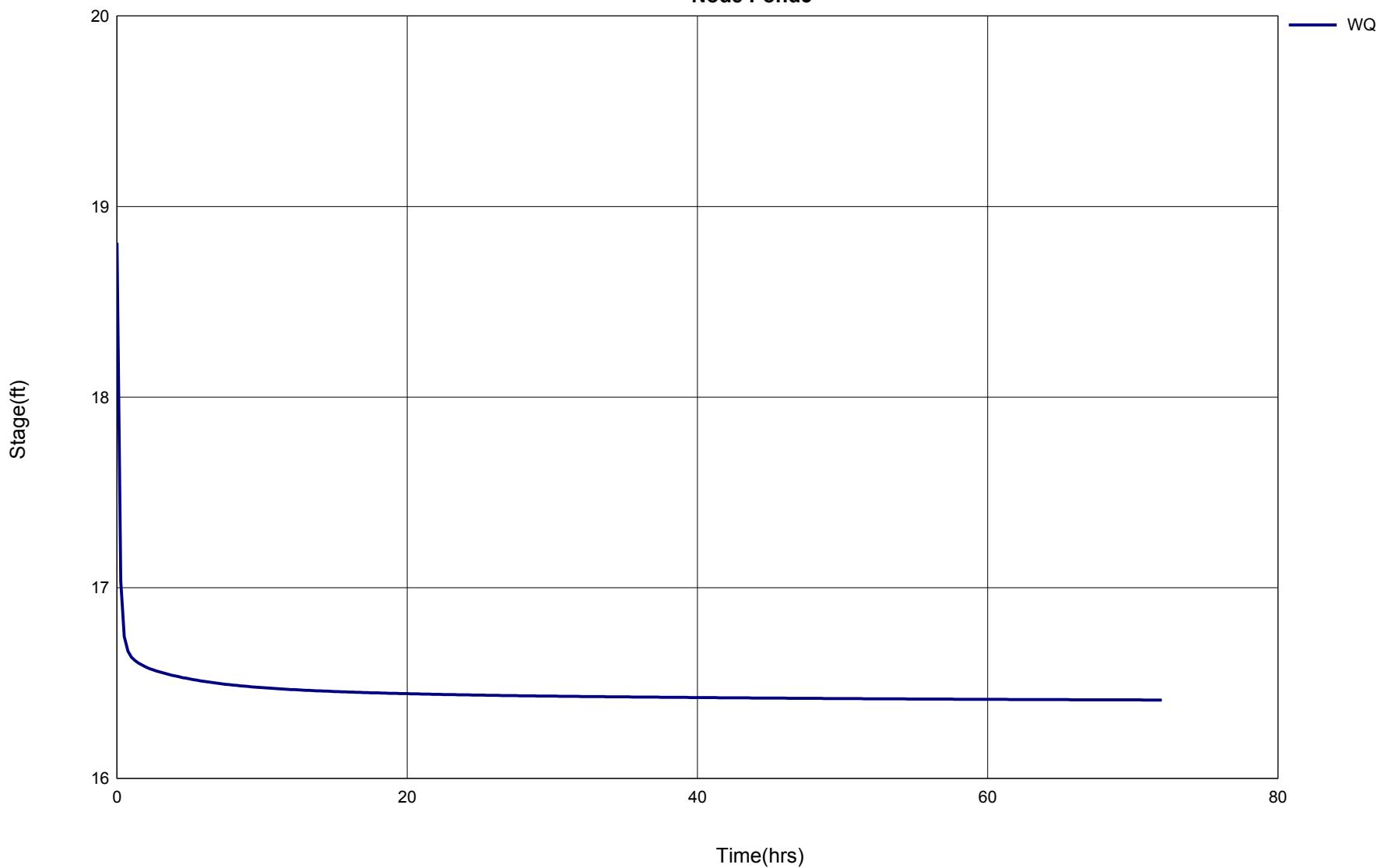
Elev. (ft)	Surface Area (ac)	Total Storage (ac-ft)
16.4	0.13	0.00
21	0.39	1.20

Interpolation yields an initial stage of:

Elevation (ft)	Pond Depth (ft)	Total Storage (ac-ft)
16.4	0	0.00
<b>18.81</b>	2.4	<b>0.63</b>
21	4.6	1.20

KROGER & MIXED USE AT BUCKWALTER PLACE  
POST-DEVELOPED CONDITIONS  
POND 3 DRAWDOWN

**Node Pond3**



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10/28/2015

## Water Quality Design Considerations

### Existing Town Pond

#### DETERMINE STORAGE VOLUME REQUIRED

##### First half-inch of runoff from the entire site

16.40 ac = Drainage Basin Area

0.5 in = Volume of runoff over site to place in water quality pond

**0.68** ac-ft = Volume of runoff to place in water quality pond

##### First one inch of runoff from the built-upon portion of the property

16.40 ac = Drainage Basin Area

95 % = percent impervious (future)

15.58 ac = Built upon portion

1 in = Volume of runoff over site to place in water quality pond

**1.30** ac-ft = Volume of runoff to place in water quality pond

#### DETERMINE INITIAL STAGE OF WATER QUALITY POND

If the volume of water calculated above (whichever is greater) is placed in the water quality pond, the initial stage of the pond can be calculated as follows:

Given the following stage-area-storage relationship for Pond 1:

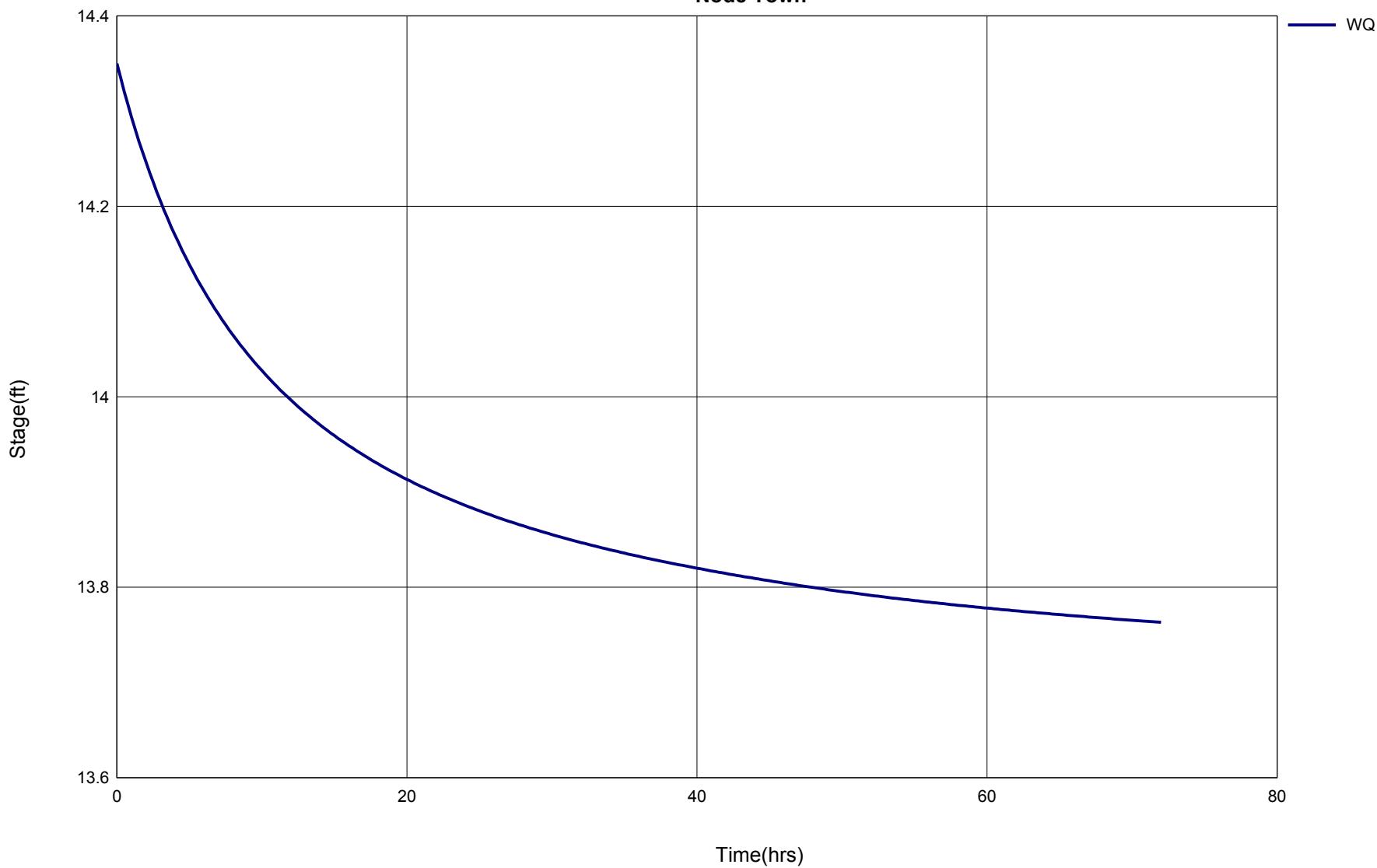
Elev. (ft)	Surface Area (ac)	Total Storage (ac-ft)
13.65	1.53	0.00
18	2.2	8.11

Interpolation yields an initial stage of:

Elevation (ft)	Pond Depth (ft)	Total Storage (ac-ft)
13.65	0	0.00
<b>14.35</b>	0.7	<b>1.30</b>
18	4.35	8.11

KROGER & MIXED USE AT BUCKWALTER PLACE  
POST-DEVELOPED CONDITIONS  
TOWN POND DRAWDOWN

Node Town



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10/28/2015

**STORMWATER MANAGEMENT REPORT**

**KROGER & MIXED USE AT BUCKWALTER PLACE**

**APPENDIX H**

SEDIMENTOLOGY CALCULATIONS

25125.0004

**T** THOMAS & HUTTON

## **Pond 1**

***DA#2 on Post-Development Basin Exhibit, outfalls to OW\_T1-86.***

Brian Blake, EIT

***General Information******Storm Information:***

Storm Type:	NRCS Type III
Design Storm:	10 yr - 24 hr
Rainfall Depth:	6.900 inches

***Particle Size Distribution:***

Size (mm)	Williman
1.4000	100.000%
1.0000	80.200%
0.0630	35.000%
0.0440	25.300%
0.0380	25.300%
0.0040	8.300%
0.0030	5.800%
0.0010	0.000%

***Structure Networking:***

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	Pond 1 Pond 1

#1  
*Pond*

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## Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	In Out	20.300	20.300	63.78 20.50	8.22 8.22	33.8 3.0	5,643 335	3.55 0.00	1.90 0.00

***Particle Size Distribution(s) at Each Structure******Structure #1:***

Size (mm)	In	Out
1.4000	100.000%	100.000%
1.0000	100.000%	100.000%
0.0630	46.376%	100.000%
0.0440	33.523%	100.000%
0.0380	33.523%	100.000%
0.0040	10.998%	100.000%
0.0030	7.685%	87.475%
0.0010	0.000%	0.000%

***Structure Detail:******Structure #1 (Pond)****Pond 1**Pond 1*

Pond Inputs:

Initial Pool Elev:	14.00 ft
Initial Pool:	6.10 ac-ft
*Sediment Storage:	0.00 ac-ft
Dead Space:	20.00 %

*\*Sediment capacity calculated from 0.000 times total contributing area***Straight Pipe**

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
42.00	98.00	0.00	0.0130	14.00	0.20	0.00

**Emergency Spillway**

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
17.50	11.50	3.00:1	3.00:1	10.00

Pond Results:

Peak Elevation:	15.89 ft
H'graph Detention Time:	2.67 hrs
Pond Model:	CSTRS
Dewater Time:	1.43 days
Trap Efficiency:	91.21 %

*Dewatering time is calculated from peak stage to lowest spillway***Elevation-Capacity-Discharge Table**

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
10.00	1.330	0.000	0.000	Top of Sed. Storage
10.50	1.377	0.677	0.000	
11.00	1.425	1.377	0.000	
11.50	1.474	2.102	0.000	
12.00	1.523	2.851	0.000	

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Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
12.50	1.574	3.626	0.000	
13.00	1.625	4.425	0.000	
13.50	1.677	5.251	0.000	
14.00	1.730	6.102	0.000	Spillway #1
14.50	1.778	6.979	2.724	27.25
15.00	1.826	7.880	8.979	4.25
15.50	1.875	8.806	15.695	1.65
15.89	1.914	9.550	20.503	1.15 Peak Stage
16.00	1.925	9.756	21.829	
16.50	1.975	10.731	28.744	
17.00	2.026	11.731	38.607	
17.50	2.078	12.757	49.557	Spillway #2
18.00	2.130	13.809	62.614	

Detailed Discharge Table

Elevation (ft)	Straight Pipe (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
10.00	0.000	0.000	0.000
10.50	0.000	0.000	0.000
11.00	0.000	0.000	0.000
11.50	0.000	0.000	0.000
12.00	0.000	0.000	0.000
12.50	0.000	0.000	0.000
13.00	0.000	0.000	0.000
13.50	0.000	0.000	0.000
14.00	0.000	0.000	0.000
14.50	(1)>2.724	0.000	2.724
15.00	(1)>8.979	0.000	8.979
15.50	(1)>15.695	0.000	15.695
16.00	(1)>21.829	0.000	21.829
16.50	(1)>28.744	0.000	28.744
17.00	(1)>38.607	0.000	38.607
17.50	(1)>49.557	0.000	49.557
18.00	(1)>60.547	2.067	62.614

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## ***Subwatershed Hydrology Detail:***

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	20.300	0.483	0.000	0.000	85.000	F	63.78	8.218
<b>Σ</b>		<b>20.300</b>						<b>63.78</b>	<b>8.218</b>

## ***Subwatershed Sedimentology Detail:***

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.170	995.00	0.01	1.0000	1.0000	1	33.8	5,643	3.55	1.90
<b>Σ</b>								<b>33.8</b>	<b>5,643</b>	<b>3.55</b>	<b>1.90</b>

## **Pond 2**

***DA#3 on Post-Development Basin Exhibit, outfalls to Pond 1 and  
OW\_T1-74.***

Brian Blake, EIT

***General Information******Storm Information:***

Storm Type:	NRCS Type III
Design Storm:	10 yr - 24 hr
Rainfall Depth:	6.900 inches

***Particle Size Distribution:***

Size (mm)	Coosaw
1.4000	100.000%
1.0000	79.400%
0.0630	32.300%
0.0440	17.900%
0.0380	17.900%
0.0040	7.200%
0.0030	5.200%
0.0010	0.000%

***Structure Networking:***

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	Pond 2

*#1  
Pond*

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## Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	In Out	15.500	15.500	54.72 40.88	7.68 7.68	30.2 1.8	5,566 278	3.73 0.00	1.93 0.00

***Particle Size Distribution(s) at Each Structure******Structure #1:***

Size (mm)	In	Out
1.4000	100.000%	100.000%
1.0000	100.000%	100.000%
0.0630	42.468%	100.000%
0.0440	23.535%	100.000%
0.0380	23.535%	100.000%
0.0040	9.467%	100.000%
0.0030	6.837%	100.000%
0.0010	0.000%	0.000%

***Structure Detail:******Structure #1 (Pond)****Pond 2*

Pond Inputs:

Initial Pool Elev:	17.00 ft
Initial Pool:	6.98 ac-ft
*Sediment Storage:	0.00 ac-ft
Dead Space:	20.00 %

*\*No sediment capacity defined***Sharp-crested Weir**

Weir Width (ft)	Spillway Elev (ft)
10.00	17.00

**V-notch Weir**

Notch Angle (deg)	Spillway Elev (ft)
143.00	17.00

**Straight Pipe**

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
36.00	660.00	0.30	0.0130	15.00	0.20	14.00

Pond Results:

Peak Elevation:	18.00 ft
H'graph Detention Time:	0.56 hrs
Pond Model:	CSTRS
Dewater Time:	0.63 days
Trap Efficiency:	93.94 %

*Dewatering time is calculated from peak stage to lowest spillway***Elevation-Capacity-Discharge Table**

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Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
11.00	1.020	0.000	0.000	Top of Sed. Storage
11.01	1.020	0.010	0.000	
11.50	1.042	0.515	0.000	
12.00	1.064	1.042	0.000	
12.50	1.086	1.579	0.000	
13.00	1.108	2.128	0.000	
13.50	1.131	2.687	0.000	
14.00	1.154	3.258	0.000	
14.50	1.177	3.841	0.000	
15.00	1.200	4.435	0.000	Spillway #3
15.50	1.236	5.044	0.000	
16.00	1.272	5.671	0.000	
16.50	1.309	6.316	0.000	
17.00	1.346	6.980	0.000	Spillway #1 Spillway #2
17.50	1.384	7.662	13.000	14.25
18.00	1.422	8.363	40.838	
18.00	1.422	8.364	40.878	0.95 Peak Stage
18.50	1.461	9.084	82.500	
19.00	1.500	9.824	138.527	

## Detailed Discharge Table

Elevation (ft)	Sharp- crested Weir(cfs)	V-notch Weir (cfs)	Straight Pipe (cfs)	Combined Total Discharge (cfs)
11.00	0.000	0.000	0.000	0.000
11.01	0.000	0.000	0.000	0.000
11.50	0.000	0.000	0.000	0.000
12.00	0.000	0.000	0.000	0.000
12.50	0.000	0.000	0.000	0.000
13.00	0.000	0.000	0.000	0.000
13.50	0.000	0.000	0.000	0.000
14.00	0.000	0.000	0.000	0.000
14.50	0.000	0.000	0.000	0.000
15.00	0.000	0.000	0.000	0.000
15.50	0.000	0.000	0.000	0.000
16.00	0.000	0.000	0.000	0.000
16.50	0.000	0.000	0.000	0.000
17.00	0.000	0.000	0.000	0.000
17.50	11.679	1.321	0.000	13.000
18.00	33.367	7.472	0.000	40.838

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Elevation (ft)	Sharp- crested Weir(cfs)	V-notch Weir (cfs)	Straight Pipe (cfs)	Combined Total Discharge (cfs)
18.50	61.911	20.590	0.000	82.500
19.00	96.261	42.266	0.000	138.527

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## ***Subwatershed Hydrology Detail:***

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	15.500	0.500	0.000	0.000	95.000	F	54.72	7.677
<b>Σ</b>		<b>15.500</b>						<b>54.72</b>	<b>7.677</b>

## ***Subwatershed Sedimentology Detail:***

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.170	995.00	0.01	1.0000	1.0000	1	30.2	5,566	3.73	1.93
<b>Σ</b>								<b>30.2</b>	<b>5,566</b>	<b>3.73</b>	<b>1.93</b>

***General Information******Storm Information:***

Storm Type:	NRCS Type III
Design Storm:	10 yr - 24 hr
Rainfall Depth:	6.900 inches

***Particle Size Distribution:***

Size (mm)	Bladen
1.4000	100.000%
1.0000	89.200%
0.0630	64.500%
0.0440	51.500%
0.0380	50.300%
0.0040	6.600%
0.0030	4.100%
0.0010	0.000%

***Structure Networking:***

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Silt Fence	#1	==>	End	0.000	0.000	0 Pond 1

*#1  
Silt  
Fence*

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## Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)	
#1	In Out		2.800	2.800	14.75 8.22	1.23 1.23	12.1 0.7	15,144 4,134	9.11 0.00	4.32 0.00

***Particle Size Distribution(s) at Each Structure******Structure #1:***

Size (mm)	In	Out
1.4000	100.000%	100.000%
1.0000	89.200%	100.000%
0.0630	64.500%	100.000%
0.0440	51.500%	100.000%
0.0380	50.300%	100.000%
0.0040	6.600%	100.000%
0.0030	4.100%	70.078%
0.0010	0.000%	0.000%

***Structure Detail:******Structure #1 (Silt Fence)***

0

**Pond 1****Silt Fence Inputs:**

Fence Flow Rate (gpm/sq ft)	Width along contour (ft)	Height (ft)	Land Slope (%)	Tie-back distance (ft)
15.0	150.0	3.0	0.50	600.0

*\*Sediment Storage: 0.00 ac-ft**\*No sediment capacity defined***Silt Fence Results:**

Peak Fence Stage:	0.80 ft
Peak Water Stage:	0.80 ft
Dewater Time:	0.50 days
Trap Efficiency:	94.15 %

*Dewatering time is calculated from peak stage to lowest spillway***Stage-Capacity-Discharge Table**

Fence Stage (ft)	Water Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
0.00	0.00	0.000	0.000	0.000	Top of Sediment
0.10	0.10	0.069	0.003	0.568	8.35
0.20	0.20	0.138	0.013	1.270	2.20
0.30	0.30	0.207	0.030	2.106	0.45
0.40	0.40	0.275	0.054	3.075	0.25
0.50	0.50	0.344	0.085	4.178	0.15
0.60	0.60	0.413	0.123	5.414	0.20
0.70	0.70	0.482	0.167	6.785	0.15
0.80	0.80	0.548	0.216	8.216	0.07 Peak Stage
0.80	0.80	0.551	0.219	8.289	
0.90	0.90	0.620	0.277	9.926	
1.00	1.00	0.689	0.343	11.698	
1.10	1.10	0.758	0.415	13.603	
1.20	1.20	0.826	0.494	15.642	
1.30	1.30	0.895	0.580	17.814	
1.40	1.40	0.964	0.673	20.120	

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Fence Stage (ft)	Water Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
1.50	1.50	1.033	0.773	22.560	
1.60	1.60	1.102	0.880	25.134	
1.70	1.70	1.171	0.993	27.841	
1.80	1.80	1.240	1.114	30.682	
1.90	1.90	1.309	1.241	33.656	
2.00	2.00	1.377	1.376	36.765	
2.10	2.10	1.446	1.517	40.007	
2.20	2.20	1.515	1.665	43.382	
2.30	2.30	1.584	1.820	46.892	
2.40	2.40	1.653	1.982	50.535	
2.50	2.50	1.722	2.150	54.311	
2.60	2.60	1.791	2.326	58.222	
2.70	2.70	1.860	2.508	62.266	
2.80	2.80	1.928	2.698	66.444	
2.90	2.90	1.997	2.894	70.755	
3.00	3.00	2.066	3.097	75.201	

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## ***Subwatershed Hydrology Detail:***

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	2.800	0.100	0.000	0.000	86.000	F	14.75	1.229
<b>Σ</b>		<b>2.800</b>						<b>14.75</b>	<b>1.229</b>

## ***Subwatershed Sedimentology Detail:***

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.240	200.00	0.50	1.0000	1.0000	1	12.1	15,144	9.11	4.32
<b>Σ</b>								<b>12.1</b>	<b>15,144</b>	<b>9.11</b>	<b>4.32</b>

# **Town Pond**

Brian Blake, EIT

## ***General Information***

### ***Storm Information:***

Storm Type:	NRCS Type III
Design Storm:	10 yr - 24 hr
Rainfall Depth:	6.900 inches

### ***Particle Size Distribution:***

Size (mm)	Williman
1.4000	100.000%
1.0000	80.200%
0.0630	35.000%
0.0440	25.300%
0.0380	25.300%
0.0040	8.300%
0.0030	5.800%
0.0010	0.000%

***Structure Networking:***

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	Town Pond

*#1  
Pond*

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## Structure Summary:

Immediate Contributing Area		Total Contributing Area	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	In	16.830	50.51	8.28	11.3	5,938	3.94	0.66
	Out		18.67	8.27	1.0	116	0.00	0.00

***Particle Size Distribution(s) at Each Structure******Structure #1:***

Size (mm)	In	Out
1.4000	100.000%	100.000%
1.0000	82.524%	100.000%
0.0630	36.488%	100.000%
0.0440	26.376%	100.000%
0.0380	26.376%	100.000%
0.0040	8.653%	100.000%
0.0030	6.047%	70.979%
0.0010	0.000%	0.000%

## Structure Detail:

### Structure #1 (Pond)

Town Pond

Pond Inputs:

Initial Pool Elev:	13.65 ft
Initial Pool:	4.79 ac-ft
*Sediment Storage:	0.00 ac-ft
Dead Space:	20.00 %

*\*No sediment capacity defined*

### Side-contracting Weir

Weir Width (ft)	Spillway Elev (ft)
5.00	16.00

### V-notch Weir

Notch Angle (deg)	Spillway Elev (ft)
143.00	16.00

### Side-contracting Weir

Weir Width (ft)	Spillway Elev (ft)
2.00	13.65

### Side-contracting Weir

Weir Width (ft)	Spillway Elev (ft)
1.00	16.37

Pond Results:

Peak Elevation:	15.74 ft
H'graph Detention Time:	3.09 hrs
Pond Model:	CSTRS
Dewater Time:	0.69 days
Trap Efficiency:	91.48 %

*Dewatering time is calculated from peak stage to lowest spillway*

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## Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
9.00	0.600	0.000	0.000		Top of Sed. Storage
9.01	0.602	0.006	0.000		
9.50	0.680	0.320	0.000		
10.00	0.764	0.681	0.000		
10.50	0.854	1.085	0.000		
11.00	0.948	1.535	0.000		
11.50	1.047	2.034	0.000		
12.00	1.152	2.583	0.000		
12.50	1.261	3.186	0.000		
13.00	1.375	3.845	0.000		
13.30	1.446	4.268	0.000		
13.50	1.494	4.562	0.000		
13.65	1.530	4.789	0.000		Spillway #3
14.00	1.579	5.333	1.343	4.90*	
14.50	1.651	6.141	4.951	6.90	
15.00	1.725	6.985	9.772	2.45	
15.50	1.800	7.866	15.529	1.50	
15.74	1.838	8.307	18.673	0.85	Peak Stage
16.00	1.877	8.785	22.074		Spillway #1
					Spillway #2
16.37	1.935	9.490	31.701		Spillway #4
16.50	1.955	9.743	36.565		
17.00	2.035	10.741	62.224		
17.50	2.117	11.779	98.959		
18.00	2.200	12.858	147.541		

\*Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.

## Detailed Discharge Table

Elevation (ft)	Side- contracted Weir (cfs)	V-notch Weir (cfs)	Side- contracted Weir (cfs)	Side- contracted Weir (cfs)	Combined Total Discharge (cfs)
9.00	0.000	0.000	0.000	0.000	0.000
9.01	0.000	0.000	0.000	0.000	0.000
9.50	0.000	0.000	0.000	0.000	0.000
10.00	0.000	0.000	0.000	0.000	0.000
10.50	0.000	0.000	0.000	0.000	0.000
11.00	0.000	0.000	0.000	0.000	0.000

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Elevation (ft)	Side- contracted Weir (cfs)	V-notch Weir (cfs)	Side- contracted Weir (cfs)	Side- contracted Weir (cfs)	Combined Total Discharge (cfs)
11.50	0.000	0.000	0.000	0.000	0.000
12.00	0.000	0.000	0.000	0.000	0.000
12.50	0.000	0.000	0.000	0.000	0.000
13.00	0.000	0.000	0.000	0.000	0.000
13.30	0.000	0.000	0.000	0.000	0.000
13.50	0.000	0.000	0.000	0.000	0.000
13.65	0.000	0.000	0.000	0.000	0.000
14.00	0.000	0.000	1.343	0.000	1.343
14.50	0.000	0.000	4.951	0.000	4.951
15.00	0.000	0.000	9.772	0.000	9.772
15.50	0.000	0.000	15.529	0.000	15.529
16.00	0.000	0.000	22.074	0.000	22.074
16.37	3.712	0.622	27.367	0.000	31.701
16.50	5.778	1.321	29.311	0.154	36.565
17.00	16.007	7.472	37.173	1.572	62.224
17.50	29.051	20.590	45.608	3.710	98.959
18.00	44.343	42.266	54.575	6.357	147.541

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## ***Subwatershed Hydrology Detail:***

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	14.000	0.585	0.000	0.000	95.000	F	46.39	6.926
	2	2.830	0.100	0.000	0.000	90.000	F	15.64	1.349
<b>Σ</b>		<b>16.830</b>						<b>50.51</b>	<b>8.275</b>

## ***Subwatershed Sedimentology Detail:***

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Peak Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.170	2,000.00	0.50	0.0150	1.0000	1	1.3	266	0.17	0.09
	2	0.170	250.00	0.50	1.0000	1.0000	1	9.9	11,480	7.68	3.62
<b>Σ</b>								<b>11.3</b>	<b>5,938</b>	<b>3.94</b>	<b>0.66</b>

**STORMWATER MANAGEMENT REPORT**

**KROGER & MIXED USE AT BUCKWALTER PLACE**

**APPENDIX I**

TOWN OF BLUFFTON WATER QUALITY

25125.0004

**T** THOMAS & HUTTON

**Buckwalter Place - Kroger and Mixed Use  
Innovation Drive, Bluffton South Carolina  
95th Percentile Storm Volume Retention**

<b>Pre-Development Conditions</b>		1.95 inches	=P
95th Percentile Storm (Savannah Area)			
PreDeveloped CN	82 ; S =	2.20 inches	

<b>Bluffton Law Enforcement Center (BLEC)</b>			
Site Acreage	2.5 Acres		
Post Development CN	93 ; S =	0.75 inches	
Qpre =	0.62 inches		
Qpost =	1.27 inches		
Change in Q =	0.65 inches		
Available Irrigation Area	0.5 Acres		

<b>Kroger and Mixed Use</b>			
Site Acreage	38 Acres		
Post Development CN	95 ; S =	0.53 inches	
Qpre =	0.62 inches		
Qpost =	1.44 inches		
Change in Q =	0.82 inches		
Available Irrigation Area	7.20 Acres		

<b>Future Development</b>			
Site Acreage	3.5 Acres		
Post Development CN	95 ; S =	0.53 inches	
Qpre =	0.62 inches		
Qpost =	1.44 inches		
Change in Q =	0.82 inches		
Available Irrigation Area	1.2 Acres		

	BLEC	Kroger and		Total	cubic feet
		Mixed Use	Future Development		
95th Percentile Storage Volume:	5924	113004	10408	129336	
	0.14	2.59	0.24	3.0	Acre-Feet

Given the following stage-area-storage relationship for the Pond 1 and Pond 2:

Stage	Surface Area (ft)	Incremental Storage (ft <sup>3</sup> )	Incremental Storage (ac-ft)	Total Storage (ft <sup>3</sup> )
14	123909.00	0.00	0	0
8	85693.00	628806.00	14.4354	628,806

We can see that the drawdown needed lies between the NWL = 14 and elevation 8  
Interpolation to find the elevation where of the 95th % drawdown volume is yields:

Elevation: **12.77**

The pond provides sufficient storage needed to irrigate the proposed area. The pond elevation will be drawn down to elevation 12.77 with irrigating. This will allow storage, prior to discharge, of the 95% storm event.

**Growing Season - 1" / week Irrigation Rate**

Available Irrigation Area	<b>8.9</b> acres	=	387,684 square feet
Disposal Calc:	1 inch/week/	12 in/ft	7 days/week = 0.0119 ft/day/unit area
Disposal Rate	0.0119 ft/day per unit area (1" per week )		
1.95 in. Storage Volume:	<b>129,336</b> cubic feet		
	=	Volume / (Irr. Area (SF) x Disposal Rate)	
Time to Dispose of Required Volume	=	<b>28.0</b>	days
Maximum Allowable Days to Irrigate	=	<b>28.0</b>	days

**Dormant Season - 0.85" / week Irrigation Rate**

Available Irrigation Area	<b>8.9</b> acres	=	387,684 square feet
Disposal Calc:	0.85 inch/week	12 in/ft	7 days/week = 0.0101 ft/day/unit area
Disposal Rate	0.0101 ft/day per unit area (0.85" per week )		
1.95 in. Storage Volume:	<b>129,336</b> cubic feet		
	=	Volume / (Irr. Area (SF) x Disposal Rate)	
Time to Dispose of Required Volume	=	<b>33.0</b>	days
Additional Storage Needed (If Needed)	=	<b>19,492.0</b>	cubic feet

**Conclusion**

1.95" of built-upon portion of the property is retained and dispensed through infiltration practices and on site irrigation reuse.  
The Town of Bluffton requirement has been satisfied

## Pollutant Loading Calculations - Town of Bluffton Requirement

**Kroger and Mixed Use Pre-Development Conditions**  
**Site Loading**

**OCRM Method for Estimating Loading Functions, Trapping Efficiencies, and Downstream Loading**  
 Based on OCRM Method (*Post Development BMP Design Aid Manual*, June 15, 2002)

### Event Mean Concentrations (EMCs)

**Land Use:** Silviculture - Site area

Variable	Value	Unit	Description
EMC <sub>TSS</sub>	<b>26.00</b>	mg/l	Event mean concentration of total suspended solids
EMC <sub>N</sub>	<b>1.69</b>	mg/l	Event mean concentration of nitrogen
EMC <sub>P</sub>	<b>0.10</b>	mg/l	Event mean concentration of phosphorus
EMC <sub>BI</sub>	<b>4800</b>	MPN/100ml	Event mean concentration of bacterial indicator

### Runoff Parameters

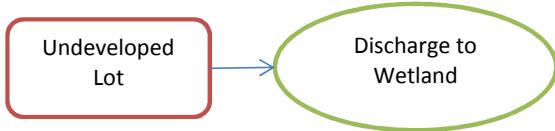
**Area:** Pre  
 A (acre) **38**  
 CN **82.0**  
 S 2.20  
 Ia (in.) 0.44

### Rainfall/Runoff

**Area:** Predevelopment - Site acreage

Avg Prec for Bin	Beaufort Rainfall Frequency		
	Prob (%)	Depth (in.)	Q (out)
12.5	0.00	0.00	0.000
11.5	0.00	0.00	0.000
10.5	0.01	0.31	0.247
9.5	0.00	0.00	0.000
8.5	0.00	0.00	0.000
7.5	0.00	0.11	0.080
6.5	0.01	0.29	0.199
5.5	0.04	0.74	0.475
4.5	0.06	1.01	0.591
3.5	0.20	2.56	1.305
2.5	0.70	6.39	2.549
1.5	2.93	16.04	3.697
0.75	4.81	12.48	0.642
0.25	19.83	11.50	0.000
0	71.41	0.00	0.000
Yearly	100.0	51.4	9.78

### Load to Wetland



**Area:** Pre - Site Area

Variable	Value	Unit	Description
L <sub>TSS</sub> =	2195	pounds	TSS export during time interval for impervious areas based on input EMC
L <sub>N</sub> =	142.6	pounds	Nitrogen export during time interval based on input EMC
L <sub>P</sub> =	8.4	pounds	Phosphorus export during time interval based on input EMC
L <sub>BI</sub> =	4.05E+05	MPN	Bacteria Indicator export during time interval based on input EMC

## Pollutant Loading Calculations - Town of Bluffton Requirement

**Kroger and Mixed Use Post-Development Conditions**  
**Site Loading**

**OCRM Method for Estimating Loading Functions, Trapping Efficiencies, and Downstream Loading**  
 Based on OCRM Method (*Post Development BMP Design Aid Manual*, June 15, 2002)

### Event Mean Concentrations (EMCs)

**Land Use:** Commercial

Variable	Value	Unit	Description
EMC <sub>TSS</sub>	116.00	mg/l	Event mean concentration of total suspended solids
EMC <sub>N</sub>	1.90	mg/l	Event mean concentration of nitrogen
EMC <sub>P</sub>	0.23	mg/l	Event mean concentration of phosphorus
EMC <sub>BI</sub>	2700	MPN/100ml	Event mean concentration of bacterial indicator

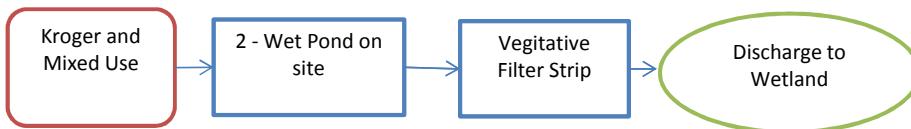
### Runoff Parameters

**Area:** Total Project  
 A (acre) 38  
 CN 95.0  
 S 0.53  
 Ia (in.) 0.11

### Rainfall/Runoff

**Area:** DA1

Avg Prec for Bin	Beaufort Rainfall Frequency		Retention Reduction		
	Prob (%)	Depth (in.)	Q (in)	Q(retain)	Q(out)
12.5	0.00	0.00	0.000	0.00	0.00
11.5	0.00	0.00	0.000	0.00	0.00
10.5	0.01	0.31	0.296	0.00	0.30
9.5	0.00	0.00	0.000	0.00	0.00
8.5	0.00	0.00	0.000	0.00	0.00
7.5	0.00	0.11	0.103	0.00	0.10
6.5	0.01	0.29	0.265	0.00	0.26
5.5	0.04	0.74	0.661	0.00	0.66
4.5	0.06	1.01	0.879	0.00	0.88
3.5	0.20	2.56	2.151	0.01	2.14
2.5	0.70	6.39	5.015	0.04	4.97
1.5	2.93	16.04	10.830	0.18	10.65
0.75	4.81	12.48	5.906	5.91	0.00
0.25	19.83	11.50	1.435	1.44	0.00
0	71.41	0.00	0.000	0.00	0.00
Yearly	100.0	51.4	27.54	7.58	19.96



### Loading to Water Quality Basin

Variable	Value	Unit	Description
L <sub>TSSI</sub> =	27,557	pounds	TSS export during time interval for impervious areas based on input EMC
L <sub>N</sub> =	451.4	pounds	Nitrogen export during time interval based on input EMC
L <sub>P</sub> =	54.64	pounds	Phosphorus export during time interval based on input EMC
L <sub>BI</sub> =	641,423	MPN	Bacteria Indicator export during time interval based on input EMC

### Vegetative Filter Strip Effeciency

Variable	Value	Unit	Description
TE <sub>TSS</sub> =	50	%	Trapping efficiency for TSS within selected structure
TE <sub>N</sub> =	30	%	Trapping efficiency for Nitrogen within selected structure
TE <sub>P</sub> =	20	%	Trapping efficiency for Phosphorus within selected structure
TE <sub>BI</sub> =	50	%	Trapping efficiency for Bacteria Indicator within selected structure

### Load Removed by Vegetative Filter Strip

Variable	Value	Unit	Description
D <sub>TSSI</sub> =	13779	pounds	TSS trapped in BMP during time interval for impervious areas based on input EMC
D <sub>N</sub> =	135.4	pounds	Nitrogen trapped in BMP during time interval based on input EMC
D <sub>P</sub> =	10.93	pounds	Phosphorus to receiving waters during time interval based on input EMC
D <sub>BI</sub> =	320,712	MPN	Bacteria Indicator trapped in BMP during time interval based on input EMC

### Load Remaining

Variable	Value	Unit	Description
Q <sub>TSSI</sub> =	13779	pounds	TSS to receiving waters during time interval for impervious areas based on input EMC
Q <sub>N</sub> =	315.96	pounds	Nitrogen to receiving waters during time interval based on input EMC
Q <sub>P</sub> =	43.71	pounds	Phosphorus to receiving waters during time interval based on input EMC
Q <sub>BI</sub> =	320,712	MPN	Bacteria Indicator to receiving waters during time interval based on input EMC

### Wet Pond On Site Effeciency

Variable	Value	Unit	Description
TE <sub>TSS</sub> =	75	%	Trapping efficiency for TSS within selected structure
TE <sub>N</sub> =	40	%	Trapping efficiency for Nitrogen within selected structure
TE <sub>P</sub> =	50	%	Trapping efficiency for Phosphorus within selected structure
TE <sub>BI</sub> =	45	%	Trapping efficiency for Bacteria Indicator within selected structure

### Load Removed by 2 - Wet Pond On Site

Variable	Value	Unit	Description
D <sub>TSSI</sub> =	20668.08	pounds	TSS trapped in BMP during time interval for impervious areas based on input EMC
D <sub>N</sub> =	252.77	pounds	Nitrogen trapped in BMP during time interval based on input EMC
D <sub>P</sub> =	43.71	pounds	Phosphorus to receiving waters during time interval based on input EMC
D <sub>BI</sub> =	288640.37	MPN	Bacteria Indicator trapped in BMP during time interval based on input EMC

### Loading Remaining

Variable	Value	Unit	Description
Q <sub>TSSI</sub> =	-6889	pounds	TSS to receiving waters during time interval for impervious areas based on input EMC
Q <sub>N</sub> =	63.19	pounds	Nitrogen to receiving waters during time interval based on input EMC
Q <sub>P</sub> =	0.00	pounds	Phosphorus to receiving waters during time interval based on input EMC
Q <sub>BI</sub> =	32071	MPN	Bacteria Indicator to receiving waters during time interval based on input EMC

**Kroger and Mixed Use**  
**Summary of Results**

**OCRM Method for Estimating Loading Functions, Trapping Efficiencies, and Downstream Loading**  
 Based on OCRM Method (*Post Development BMP Design Aid Manual*, June 15, 2002)

Total Annual Pollutant Contribution to Receiving Waters

Pollutant	Unit	Pre Development Loading		
Area	acre	<b>38.00</b>		
Total Suspended Solids	pounds	<b>2195</b>		
Nitrogen	pounds	<b>143</b>		
Phosphorous	pounds	<b>8.44</b>		
Bacteria	MPN	<b>405144</b>		
Pollutant	Unit	Post Development Loadings		
		Before BMP's	After BMP's	% Change
Area	acre	5.85	5.85	-84.61%
Total Suspended Solids	pounds	27557	-6889	-413.93%
Nitrogen	pounds	451.4	63.2	-55.70%
Phosphorous	pounds	54.6	0.00	-100.00%
Bacteria	MPN	641,423	32,071	-92.08%

**STORMWATER MANAGEMENT REPORT**

**KROGER & MIXED USE AT BUCKWALTER PLACE**

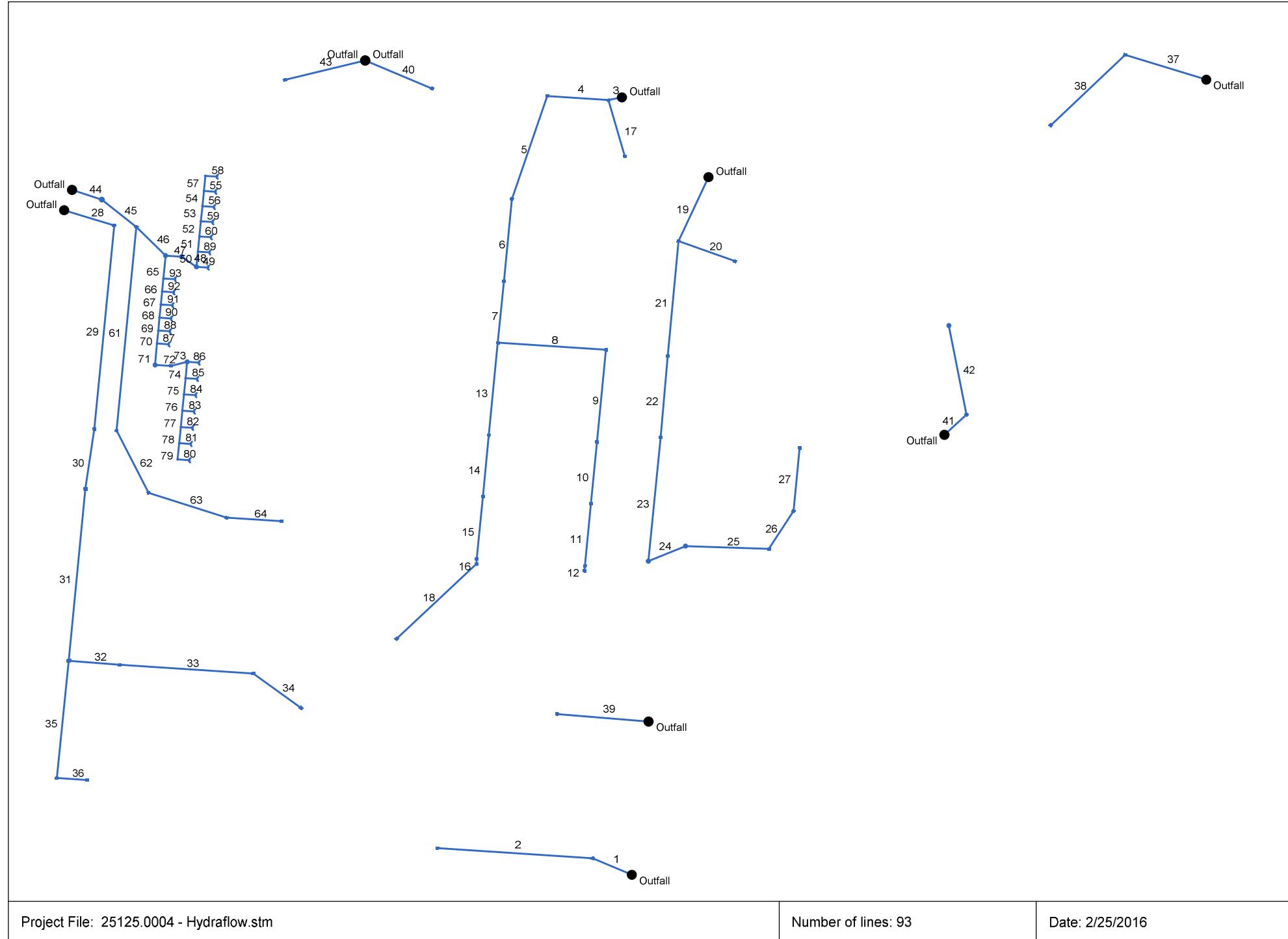
**APPENDIX J**

HYDRAFLOW REPORT (PIPE SIZING CALCULATIONS)

25125.0004

**T** THOMAS & HUTTON

# Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Project File: 25125.0004 - Hydraflow.stm

Number of lines: 93

Date: 2/25/2016

# Storm Sewer Inventory Report

Page 1

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert EI Dn (ft)	Line Slope (%)	Invert EI Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/Rim EI (ft)	
1	End	55.344	-152.676	DrGrt	0.00	0.59	0.85	6.0	17.30	0.30	17.47	18	Cir	0.012	0.66	20.35	240
2	1	195.835	-22.813	DrGrt	0.00	0.53	0.85	6.0	17.47	0.30	18.05	15	Cir	0.012	1.00	20.95	241
3	End	17.522	166.154	Comb	0.00	0.31	0.75	6.0	14.33	0.32	14.39	42	Cir	0.012	1.50	20.00	100 (27)
4	3	77.010	18.421	Comb	0.00	0.49	0.85	6.0	14.39	0.30	14.62	36	Cir	0.012	1.48	20.31	201
5	4	164.274	-78.859	DrGrt	0.00	0.50	0.95	6.0	14.62	0.30	15.11	36	Cir	0.012	0.50	21.24	202
6	5	126.000	-11.141	DrGrt	0.00	0.27	0.85	6.0	15.11	0.30	15.49	36	Cir	0.012	0.50	21.90	203
7	6	94.500	0.000	DrGrt	0.00	0.58	0.85	6.0	15.49	0.30	15.77	36	Cir	0.012	1.50	21.40	204
8	7	136.089	-90.000	DrGrt	0.00	0.20	0.85	6.0	15.77	0.30	16.18	30	Cir	0.012	1.50	21.38	210
9	8	142.000	90.000	DrGrt	0.00	0.19	0.85	6.0	16.18	0.30	16.61	24	Cir	0.012	0.50	21.33	211
10	9	94.500	0.000	DrGrt	0.00	0.19	0.85	6.0	16.61	0.30	16.89	24	Cir	0.012	0.50	20.90	212
11	10	96.000	0.000	Comb	0.00	0.16	0.95	6.0	16.89	0.30	17.18	18	Cir	0.012	0.50	20.93	213
12	11	7.461	0.000	Comb	0.00	0.39	0.85	6.0	17.18	0.30	17.20	18	Cir	0.012	1.00	20.93	214
13	7	142.000	0.000	DrGrt	0.00	0.44	0.85	6.0	16.02	0.30	16.45	24	Cir	0.012	0.50	21.33	205
14	13	94.500	0.000	DrGrt	0.00	0.33	0.85	6.0	16.45	0.30	16.73	24	Cir	0.012	0.50	21.04	206
15	14	96.000	0.000	Comb	0.00	0.30	0.85	6.0	16.73	0.30	17.02	24	Cir	0.012	0.50	21.21	207
16	15	7.598	-3.189	Comb	0.00	0.33	0.95	6.0	17.02	0.30	17.04	18	Cir	0.012	1.03	21.23	208
17	3	88.637	-89.545	Comb	0.00	0.18	0.95	6.0	17.13	0.30	17.40	15	Cir	0.012	1.00	20.90	215
18	16	152.606	39.804	Comb	0.00	0.28	0.95	6.0	17.04	0.30	17.50	15	Cir	0.012	1.00	21.94	209
19	End	104.831	110.956	DrGrt	0.00	0.83	0.80	6.0	13.95	0.30	14.26	30	Cir	0.012	1.69	19.86	216
20	19	77.213	-87.412	Comb	0.00	0.46	0.70	6.0	16.90	0.30	17.13	15	Cir	0.012	1.00	21.71	223
21	19	176.941	-16.503	DrGrt	0.00	0.53	0.95	6.0	14.26	0.30	14.79	30	Cir	0.012	0.50	20.51	217
22	21	124.935	-0.364	DrGrt	0.00	0.59	0.95	6.0	14.79	0.30	15.17	24	Cir	0.012	0.50	19.67	218
23	22	190.210	0.506	DrGrt	0.00	0.26	0.95	6.0	15.17	0.30	15.74	24	Cir	0.013	1.50	19.49	219

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# Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert EI Dn (ft)	Line Slope (%)	Invert EI Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/Rim EI (ft)	
24	23	52.044	-120.898	Comb	0.00	0.11	0.95	6.0	15.74	0.30	15.90	18	Cir	0.013	0.80	20.92	220
25	24	104.633	28.635	Comb	0.00	0.19	0.95	6.0	15.90	0.30	16.21	18	Cir	0.012	1.38	21.37	242
26	25	65.702	-64.184	Comb	0.00	0.05	0.95	6.0	16.21	0.30	16.41	15	Cir	0.012	0.69	22.06	243
27	26	96.990	-23.703	Comb	0.00	0.37	0.95	6.0	16.41	0.30	16.70	15	Cir	0.012	1.00	22.15	244
28	End	66.910	20.406	DrGrt	0.00	0.08	0.95	6.0	9.00	0.30	9.20	36	Cir	0.013	1.45	21.51	224
29	28	313.000	74.169	DrGrt	0.00	0.12	0.95	6.0	9.20	0.30	10.14	36	Cir	0.013	0.50	20.89	225
30	29	92.275	2.417	MH	0.00	0.00	0.00	0.0	10.14	0.30	10.42	36	Cir	0.013	0.15	21.75	226
31	30	264.437	-2.471	MH	0.00	0.00	0.00	0.0	10.42	0.30	11.21	30	Cir	0.013	1.00	22.43	227
32	31	64.479	-88.987	Comb	0.00	0.74	0.63	6.0	16.06	0.30	16.26	18	Cir	0.013	0.50	20.74	237
33	32	168.055	-0.959	Comb	0.00	0.54	0.56	6.0	16.26	0.30	16.76	18	Cir	0.013	0.98	21.61	238
34	33	79.728	36.837	Comb	0.00	0.54	0.95	6.0	16.76	0.30	17.00	15	Cir	0.013	1.00	21.27	239
35	31	180.372	0.239	DrGrt	0.00	0.28	0.95	6.0	11.21	0.30	11.75	24	Cir	0.013	1.50	18.98	228
36	35	37.996	-90.225	DrGrt	0.00	1.24	0.42	6.0	11.75	0.30	11.86	24	Cir	0.013	1.00	18.96	229
37	End	108.562	-159.430	Comb	0.00	0.11	0.95	6.0	16.00	0.50	16.54	15	Cir	0.012	1.42	20.58	247
38	37	142.864	-69.707	Comb	0.00	0.22	0.95	6.0	16.54	0.30	16.97	15	Cir	0.012	1.00	20.50	248
39	End	115.533	-174.286	DrGrt	0.00	1.30	0.85	6.0	16.30	0.30	16.65	18	Cir	0.012	1.00	21.40	100 (52)
40	End	94.357	27.134	Comb	0.00	0.56	0.80	6.0	15.92	0.30	16.20	15	Cir	0.013	1.00	20.67	221
41	End	41.527	-48.281	DrGrt	0.00	0.85	0.80	6.0	15.78	0.29	15.90	18	Cir	0.012	1.22	19.68	245
42	41	138.249	-50.923	DrGrt	0.00	0.48	0.85	6.0	15.90	0.30	16.31	15	Cir	0.012	1.00	21.13	246
43	End	104.912	163.515	Comb	0.00	0.34	0.80	6.0	15.69	0.30	16.00	15	Cir	0.012	1.00	20.50	222
44	End	40.262	21.784	MH	0.00	0.00	0.00	0.0	9.00	0.30	9.12	42	Cir	0.013	0.43	18.21	100 (59)
45	44	60.222	22.147	DrGrt	0.00	0.46	0.95	6.0	9.12	0.30	9.30	42	Cir	0.013	1.21	21.51	251
46	45	57.264	6.334	MH	0.00	0.00	0.00	0.0	9.30	0.30	9.47	36	Cir	0.013	0.76	22.21	443

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	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/Rim El (ft)	
47	46	20.332	-45.690	Comb	0.00	0.11	0.95	6.0	9.47	0.30	9.53	24	Cir	0.012	0.95	23.50	231
48	47	24.142	35.444	MH	0.00	0.00	0.00	0.0	9.53	0.30	9.61	18	Cir	0.013	1.00	19.08	426
49	48	14.667	-35.444	Hdwl	0.00	0.12	0.95	6.0	13.55	0.50	13.62	9	Cir	0.013	1.00	14.81	407
50	48	23.333	-125.444	MH	0.00	0.00	0.00	0.0	9.61	0.30	9.68	18	Cir	0.013	1.00	18.95	425
51	50	23.333	0.000	MH	0.00	0.00	0.00	0.0	12.68	0.30	12.75	18	Cir	0.013	1.00	19.18	424
52	51	23.333	0.000	MH	0.00	0.00	0.00	0.0	12.75	0.30	12.82	18	Cir	0.013	1.00	20.12	423
53	52	23.166	0.000	MH	0.00	0.00	0.00	0.0	12.82	0.30	12.89	18	Cir	0.013	1.00	21.44	422
54	53	23.500	0.000	MH	0.00	0.00	0.00	0.0	12.89	0.30	12.96	12	Cir	0.013	1.00	22.27	441
55	54	14.667	90.000	Hdwl	0.00	0.13	0.95	6.0	13.24	0.50	13.31	9	Cir	0.013	1.00	14.51	402
56	53	14.667	90.073	Hdwl	0.00	0.13	0.95	6.0	13.12	0.50	13.19	9	Cir	0.013	1.00	14.39	403
57	54	23.148	0.000	MH	0.00	0.00	0.00	0.0	12.96	0.30	13.03	9	Cir	0.013	1.00	22.63	442
58	57	14.667	90.000	Hdwl	0.00	0.12	0.95	6.0	13.03	0.30	13.07	9	Cir	0.013	1.00	14.26	401
59	52	14.667	90.000	Hdwl	0.00	0.12	0.95	6.0	13.00	0.50	13.08	9	Cir	0.013	1.00	14.27	404
60	51	14.667	90.000	Hdwl	0.00	0.15	0.95	6.0	12.89	0.50	12.96	9	Cir	0.013	1.00	14.16	405
61	45	313.000	50.643	DrGrt	0.00	0.49	0.95	6.0	9.30	0.30	10.24	30	Cir	0.013	0.77	20.89	249
62	61	103.772	-27.350	DrGrt	0.00	0.45	0.95	6.0	10.24	0.30	10.55	24	Cir	0.013	1.14	21.04	234
63	62	105.234	-46.086	DrGrt	0.00	0.40	0.95	6.0	10.55	0.30	10.87	24	Cir	0.013	0.50	21.16	235
64	63	68.916	-16.564	DrGrt	0.00	0.73	0.95	6.0	10.87	0.30	11.07	18	Cir	0.013	1.00	21.42	236
65	46	35.167	44.310	MH	0.00	0.00	0.00	0.0	9.47	0.30	9.58	30	Cir	0.013	1.00	22.38	427
66	65	20.000	0.000	MH	0.00	0.00	0.00	0.0	9.58	0.30	9.64	30	Cir	0.013	1.00	22.48	428
67	66	20.000	0.000	MH	0.00	0.00	0.00	0.0	9.64	0.30	9.70	30	Cir	0.013	1.00	22.58	429
68	67	20.186	0.000	MH	0.00	0.00	0.00	0.0	9.70	0.30	9.76	24	Cir	0.013	1.00	22.68	430
69	68	19.814	0.000	MH	0.00	0.00	0.00	0.0	9.76	0.30	9.82	24	Cir	0.013	1.00	22.78	431

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70	69	20.000	0.000	MH	0.00	0.00	0.00	0.0	9.82	0.30	9.88	24	Cir	0.013	1.00	22.71	432
71	70	32.979	-0.413	MH	0.00	0.00	0.00	0.0	9.88	0.30	9.98	24	Cir	0.013	1.00	22.52	433
72	71	20.095	-90.000	Comb	0.00	0.11	0.95	6.0	9.98	0.30	10.04	24	Cir	0.013	0.63	23.50	233
73	72	21.170	-21.303	MH	0.00	0.00	0.00	0.0	10.04	0.30	10.10	24	Cir	0.013	1.00	19.00	434
74	73	25.000	111.716	MH	0.00	0.00	0.00	0.0	10.10	0.30	10.18	24	Cir	0.013	1.00	19.06	435
75	74	25.000	0.000	MH	0.00	0.00	0.00	0.0	10.18	0.30	10.25	18	Cir	0.013	1.00	19.35	436
76	75	25.000	0.000	MH	0.00	0.00	0.00	0.0	10.25	0.30	10.33	18	Cir	0.013	1.00	20.97	437
77	76	25.186	0.000	MH	0.00	0.00	0.00	0.0	10.33	0.30	10.40	15	Cir	0.013	1.00	22.60	438
78	77	24.814	0.000	MH	0.00	0.00	0.00	0.0	10.40	0.30	10.48	15	Cir	0.013	1.00	22.45	439
79	78	25.000	0.000	MH	0.00	0.00	0.00	0.0	10.48	0.30	10.55	12	Cir	0.013	1.00	22.33	440
80	79	14.667	-90.000	Hdwl	0.00	0.15	0.95	6.0	10.55	0.30	10.60	12	Cir	0.013	1.00	11.79	420
81	78	14.667	-90.000	Hdwl	0.00	0.15	0.95	6.0	10.53	0.50	10.60	9	Cir	0.013	1.00	11.79	419
82	77	14.667	-90.000	Hdwl	0.00	0.15	0.95	6.0	10.40	0.50	10.48	9	Cir	0.013	1.00	11.67	418
83	76	14.667	-90.000	Hdwl	0.00	0.15	0.95	6.0	10.33	0.30	10.37	9	Cir	0.013	1.00	11.56	417
84	75	14.667	-90.000	Hdwl	0.00	0.15	0.95	6.0	10.25	0.50	10.32	9	Cir	0.013	1.00	11.52	416
85	74	14.667	-90.000	Hdwl	0.00	0.15	0.95	6.0	10.18	0.30	10.22	9	Cir	0.013	1.00	11.41	415
86	73	14.667	21.716	Hdwl	0.00	0.15	0.95	6.0	10.10	0.50	10.17	9	Cir	0.013	1.00	11.37	414
87	70	14.667	-90.000	Hdwl	0.00	0.14	0.95	6.0	9.88	0.50	9.95	9	Cir	0.013	1.00	11.15	413
88	69	14.667	-90.000	Hdwl	0.00	0.13	0.95	6.0	9.82	0.50	9.89	9	Cir	0.013	1.00	11.09	412
89	50	14.667	90.000	Hdwl	0.00	0.14	0.95	6.0	9.77	0.50	9.84	9	Cir	0.013	1.00	11.04	406
90	68	14.667	-90.000	Hdwl	0.00	0.13	0.95	6.0	9.76	0.50	9.83	9	Cir	0.013	1.00	11.03	411
91	67	14.667	-90.000	Hdwl	0.00	0.13	0.95	6.0	9.70	0.50	9.77	9	Cir	0.013	1.00	10.97	410
92	66	14.667	-90.000	Hdwl	0.00	0.13	0.95	6.0	9.64	0.50	9.71	9	Cir	0.013	1.00	10.91	409

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# Storm Sewer Inventory Report

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Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/Rim El (ft)	
93	65	14.667	-90.000	HdwL	0.00	0.14	0.95	6.0	9.58	0.50	9.65	9	Cir	0.013	1.00	10.85	408
Project File: 25125.0004 - Hydraflow.stm												Number of lines: 93				Date: 2/25/2016	

# Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	141	DropGrate	20.35	Rect	4.00	4.00	18	Cir	17.47	15	Cir	17.47
2	142	DropGrate	20.95	Rect	4.00	4.00	15	Cir	18.05			
3	101	Combination	20.00	Rect	4.00	4.00	42	Cir	14.39	36	Cir	14.39
4	102	Combination	20.31	Rect	4.00	4.00	36	Cir	14.62	36	Cir	14.62
5	103	DropGrate	21.24	Rect	4.00	4.00	36	Cir	15.11	36	Cir	15.11
6	104	DropGrate	21.90	Rect	4.00	4.00	36	Cir	15.49	36	Cir	15.49
7	105	DropGrate	21.40	Rect	4.00	4.00	36	Cir	15.77	30	Cir	15.77
										24	Cir	16.02
8	111	DropGrate	21.38	Rect	4.00	4.00	30	Cir	16.18	24	Cir	16.18
9	112	DropGrate	21.33	Rect	4.00	4.00	24	Cir	16.61	24	Cir	16.61
10	113	DropGrate	20.90	Rect	4.00	4.00	24	Cir	16.89	18	Cir	16.89
11	114	Combination	20.93	Rect	4.00	4.00	18	Cir	17.18	18	Cir	17.18
12	115	Combination	20.93	Rect	4.00	4.00	18	Cir	17.20			
13	106	DropGrate	21.33	Rect	4.00	4.00	24	Cir	16.45	24	Cir	16.45
14	107	DropGrate	21.04	Rect	4.00	4.00	24	Cir	16.73	24	Cir	16.73
15	108	Combination	21.21	Rect	4.00	4.00	24	Cir	17.02	18	Cir	17.02
16	109	Combination	21.23	Rect	4.00	4.00	18	Cir	17.04	15	Cir	17.04
17	116	Combination	20.90	Rect	4.00	4.00	15	Cir	17.40			
18	110	Combination	21.94	Rect	4.00	4.00	15	Cir	17.50			
19	117	DropGrate	19.86	Rect	4.00	4.00	30	Cir	14.26	15	Cir	16.90
										30	Cir	14.26
20	124	Combination	21.71	Rect	4.00	4.00	15	Cir	17.13			
21	118	DropGrate	20.51	Rect	4.00	4.00	30	Cir	14.79	24	Cir	14.79

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Number of Structures: 93

Run Date: 2/25/2016

# Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
22	119	DropGrate	19.67	Rect	4.00	4.00	24	Cir	15.17	24	Cir	15.17
23	120	DropGrate	19.49	Cir	4.00	4.00	24	Cir	15.74	18	Cir	15.74
24	121	Combination	20.92	Cir	4.00	4.00	18	Cir	15.90	18	Cir	15.90
25	144	Combination	21.37	Rect	4.00	4.00	18	Cir	16.21	15	Cir	16.21
26	145	Combination	22.06	Rect	4.00	4.00	15	Cir	16.41	15	Cir	16.41
27	146	Combination	22.15	Rect	4.00	4.00	15	Cir	16.70			
28	125	DropGrate	21.51	Rect	4.00	4.00	36	Cir	9.20	36	Cir	9.20
29	126	DropGrate	20.89	Rect	4.00	4.00	36	Cir	10.14	36	Cir	10.14
30	127	Manhole	21.75	Rect	5.00	5.00	36	Cir	10.42	30	Cir	10.42
31	128	Manhole	22.43	Rect	5.00	5.00	30	Cir	11.21	18 24	Cir Cir	16.06 11.21
32	138	Combination	20.74	Rect	4.00	4.00	18	Cir	16.26	18	Cir	16.26
33	139	Combination	21.61	Rect	4.00	4.00	18	Cir	16.76	15	Cir	16.76
34	140	Combination	21.27	Rect	4.00	4.00	15	Cir	17.00			
35	129	DropGrate	18.98	Rect	4.00	4.00	24	Cir	11.75	24	Cir	11.75
36	130	DropGrate	18.96	Rect	4.00	4.00	24	Cir	11.86			
37	149	Combination	20.58	Rect	4.00	4.00	15	Cir	16.54	15	Cir	16.54
38	150	Combination	20.50	Rect	4.00	4.00	15	Cir	16.97			
39	143	DropGrate	21.40	Rect	4.00	4.00	18	Cir	16.65			
40	122	Combination	20.67	Rect	4.00	4.00	15	Cir	16.20			
41	147	DropGrate	19.68	Rect	4.00	4.00	18	Cir	15.90	15	Cir	15.90
42	148	DropGrate	21.13	Cir	4.00	4.00	15	Cir	16.31			
43	123	Combination	20.50	Rect	4.00	4.00	15	Cir	16.00			

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Run Date: 2/25/2016

# Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
44	162	Manhole	18.21	Cir	5.00	5.00	42	Cir	9.12	42	Cir	9.12
45	131	DropGrate	21.51	Rect	4.00	4.00	42	Cir	9.30	36 30	Cir Cir	9.30 9.30
46	344	Manhole	22.21	Cir	4.00	4.00	36	Cir	9.47	24 30	Cir Cir	9.47 9.47
47	132	Combination	23.50	Cir	4.00	4.00	24	Cir	9.53	18	Cir	9.53
48	326	Manhole	19.08	Cir	4.00	4.00	18	Cir	9.61	9 18	Cir Cir	13.55 9.61
49	307	OpenHeadwall	14.81	n/a	n/a	n/a	9	Cir	13.62			
50	325	Manhole	18.95	Cir	0.67	0.67	18	Cir	9.68	18 9	Cir Cir	12.68 9.77
51	324	Manhole	19.18	Cir	0.67	0.67	18	Cir	12.75	18 9	Cir Cir	12.75 12.89
52	323	Manhole	20.12	Cir	0.67	0.67	18	Cir	12.82	18 9	Cir Cir	12.82 13.00
53	322	Manhole	21.44	Cir	0.67	0.67	18	Cir	12.89	12 9	Cir Cir	12.89 13.12
54	342	Manhole	22.27	Cir	0.67	0.67	12	Cir	12.96	9 9	Cir Cir	13.24 12.96
55	302	OpenHeadwall	14.51	n/a	n/a	n/a	9	Cir	13.31			
56	303	OpenHeadwall	14.39	n/a	n/a	n/a	9	Cir	13.19			
57	343	Manhole	22.63	Cir	0.67	0.67	9	Cir	13.03	9	Cir	13.03
58	301	OpenHeadwall	14.26	n/a	n/a	n/a	9	Cir	13.07			
59	304	OpenHeadwall	14.27	n/a	n/a	n/a	9	Cir	13.08			
60	305	OpenHeadwall	14.16	n/a	n/a	n/a	9	Cir	12.96			
61	133	DropGrate	20.89	Rect	4.00	4.00	30	Cir	10.24	24	Cir	10.24
62	135	DropGrate	21.04	Rect	4.00	4.00	24	Cir	10.55	24	Cir	10.55

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Run Date: 2/25/2016

# Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
63	136	DropGrate	21.16	Rect	4.00	4.00	24	Cir	10.87	18	Cir	10.87
64	137	DropGrate	21.42	Rect	4.00	4.00	18	Cir	11.07			
65	328	Manhole	22.38	Cir	0.67	0.67	30	Cir	9.58	30	Cir	9.58
66	329	Manhole	22.48	Cir	0.67	0.67	30	Cir	9.64	30	Cir	9.64
67	330	Manhole	22.58	Cir	0.67	0.67	30	Cir	9.70	24	Cir	9.70
68	331	Manhole	22.68	Cir	0.67	0.67	24	Cir	9.76	24	Cir	9.76
69	332	Manhole	22.78	Cir	0.67	0.67	24	Cir	9.82	24	Cir	9.82
70	333	Manhole	22.71	Cir	0.67	0.67	24	Cir	9.88	24	Cir	9.88
71	334	Manhole	22.52	Cir	4.00	4.00	24	Cir	9.98	24	Cir	9.98
72	134	Combination	23.50	Rect	4.00	4.00	24	Cir	10.04	24	Cir	10.04
73	335	Manhole	19.00	Cir	4.00	4.00	24	Cir	10.10	24	Cir	10.10
74	336	Manhole	19.06	Cir	0.67	0.67	24	Cir	10.18	18	Cir	10.18
75	337	Manhole	19.35	Cir	0.67	0.67	18	Cir	10.25	18	Cir	10.25
76	338	Manhole	20.97	Cir	0.67	0.67	18	Cir	10.33	15	Cir	10.33
77	339	Manhole	22.60	Cir	0.67	0.67	15	Cir	10.40	15	Cir	10.40
78	340	Manhole	22.45	Cir	0.67	0.67	15	Cir	10.48	12	Cir	10.48
79	341	Manhole	22.33	Cir	0.67	0.67	12	Cir	10.55	12	Cir	10.55

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# Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
80	320	OpenHeadwall	11.79	n/a	n/a	n/a	12	Cir	10.60			
81	319	OpenHeadwall	11.79	n/a	n/a	n/a	9	Cir	10.60			
82	318	OpenHeadwall	11.67	n/a	n/a	n/a	9	Cir	10.48			
83	317	OpenHeadwall	11.56	n/a	n/a	n/a	9	Cir	10.37			
84	316	OpenHeadwall	11.52	n/a	n/a	n/a	9	Cir	10.32			
85	315	OpenHeadwall	11.41	n/a	n/a	n/a	9	Cir	10.22			
86	314	OpenHeadwall	11.37	n/a	n/a	n/a	9	Cir	10.17			
87	313	OpenHeadwall	11.15	n/a	n/a	n/a	9	Cir	9.95			
88	312	OpenHeadwall	11.09	n/a	n/a	n/a	9	Cir	9.89			
89	306	OpenHeadwall	11.04	n/a	n/a	n/a	9	Cir	9.84			
90	311	OpenHeadwall	11.03	n/a	n/a	n/a	9	Cir	9.83			
91	310	OpenHeadwall	10.97	n/a	n/a	n/a	9	Cir	9.77			
92	309	OpenHeadwall	10.91	n/a	n/a	n/a	9	Cir	9.71			
93	308	OpenHeadwall	10.85	n/a	n/a	n/a	9	Cir	9.65			

# Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	240	7.66	18	Cir	55.344	17.30	17.47	0.300	18.37	18.83	0.21	19.04	End	DropGrate
2	241	3.74	15	Cir	195.835	17.47	18.05	0.300	19.04*	19.60*	0.14	19.75	1	DropGrate
3	100 (27)	31.59	42	Cir	17.522	14.33	14.39	0.322	17.70	17.71	0.26	17.97	End	Combination
4	201	28.90	36	Cir	77.010	14.39	14.62	0.300	17.97*	18.09*	0.38	18.48	3	Combination
5	202	26.40	36	Cir	164.274	14.62	15.11	0.300	18.48*	18.70*	0.11	18.81	4	DropGrate
6	203	23.30	36	Cir	126.000	15.11	15.49	0.300	18.81*	18.94*	0.08	19.02	5	DropGrate
7	204	21.91	36	Cir	94.500	15.49	15.77	0.300	19.02*	19.11*	0.22	19.33	6	DropGrate
8	210	7.54	30	Cir	136.089	15.77	16.18	0.300	19.33*	19.37*	0.06	19.43	7	DropGrate
9	211	6.40	24	Cir	142.000	16.18	16.61	0.300	19.43*	19.52*	0.03	19.56	8	DropGrate
10	212	5.25	24	Cir	94.500	16.61	16.89	0.300	19.56*	19.60*	0.02	19.62	9	DropGrate
11	213	3.99	18	Cir	96.000	16.89	17.18	0.300	19.62*	19.74*	0.04	19.78	10	Combination
12	214	2.77	18	Cir	7.461	17.18	17.20	0.300	19.78*	19.78*	0.04	19.82	11	Combination
13	205	11.45	24	Cir	142.000	16.02	16.45	0.300	19.33*	19.64*	0.10	19.75	7	DropGrate
14	206	8.71	24	Cir	94.500	16.45	16.73	0.300	19.75*	19.87*	0.06	19.93	13	DropGrate
15	207	6.67	24	Cir	96.000	16.73	17.02	0.300	19.93*	20.00*	0.04	20.03	14	Combination
16	208	4.63	18	Cir	7.598	17.02	17.04	0.300	20.03*	20.05*	0.11	20.16	15	Combination
17	215	1.46	15	Cir	88.637	17.13	17.40	0.300	17.97	18.04	0.08	18.12	3	Combination
18	209	2.23	15	Cir	152.606	17.04	17.50	0.300	20.16*	20.31*	0.05	20.36	16	Combination
19	216	21.83	30	Cir	104.831	13.95	14.26	0.299	17.70*	17.95*	0.52	18.47	End	DropGrate
20	223	2.67	15	Cir	77.213	16.90	17.13	0.300	18.47*	18.59*	0.07	18.66	19	Combination
21	217	14.98	30	Cir	176.941	14.26	14.79	0.300	18.47*	18.67*	0.07	18.75	19	DropGrate
22	218	11.39	24	Cir	124.935	14.79	15.17	0.300	18.75*	19.02*	0.10	19.12	21	DropGrate
23	219	7.35	24	Cir	190.210	15.17	15.74	0.300	19.12*	19.32*	0.13	19.45	22	DropGrate
24	220	5.43	18	Cir	52.044	15.74	15.90	0.300	19.45*	19.59*	0.12	19.70	23	Combination
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NOTES: Return period = 25 Yrs. ; *Surcharged (HGL above crown).														

# Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
25	242	4.71	18	Cir	104.633	15.90	16.21	0.300	19.70*	19.88*	0.15	20.04	24	Combination
26	243	3.29	15	Cir	65.702	16.21	16.41	0.300	20.04*	20.18*	0.08	20.26	25	Combination
27	244	2.93	15	Cir	96.990	16.41	16.70	0.300	20.26*	20.43*	0.09	20.52	26	Combination
28	224	15.96	36	Cir	66.910	9.00	9.20	0.300	17.50*	17.54*	0.11	17.65	End	DropGrate
29	225	16.32	36	Cir	313.000	9.20	10.14	0.300	17.65*	17.84*	0.04	17.88	28	DropGrate
30	226	15.72	36	Cir	92.275	10.14	10.42	0.300	17.88*	17.93*	0.01	17.94	29	Manhole
31	227	16.27	30	Cir	264.437	10.42	11.21	0.300	17.94*	18.36*	0.17	18.53	30	Manhole
32	237	10.28	18	Cir	64.479	16.06	16.26	0.300	18.53*	19.15*	0.26	19.41	31	Combination
33	238	6.67	18	Cir	168.055	16.26	16.76	0.300	19.41*	20.09*	0.22	20.31	32	Combination
34	239	4.24	15	Cir	79.728	16.76	17.00	0.300	20.31*	20.65*	0.19	20.84	33	Combination
35	228	6.46	24	Cir	180.372	11.21	11.75	0.300	18.53*	18.68*	0.10	18.78	31	DropGrate
36	229	4.33	24	Cir	37.996	11.75	11.86	0.300	18.78*	18.79*	0.03	18.82	35	DropGrate
37	247	2.47	15	Cir	108.562	16.00	16.54	0.496	19.60*	19.73*	0.09	19.82	End	Combination
38	248	1.70	15	Cir	142.864	16.54	16.97	0.300	19.82*	19.91*	0.03	19.94	37	Combination
39	100 (52)	9.17	18	Cir	115.533	16.30	16.65	0.300	17.47*	18.44*	0.42	18.86	End	DropGrate
40	221	3.72	15	Cir	94.357	15.92	16.20	0.297	17.50*	17.81*	0.14	17.96	End	Combination
41	245	8.88	18	Cir	41.527	15.78	15.90	0.289	17.50*	17.75*	0.48	18.23	End	DropGrate
42	246	3.41	15	Cir	138.249	15.90	16.31	0.300	18.23*	18.56*	0.12	18.68	41	DropGrate
43	222	2.25	15	Cir	104.912	15.69	16.00	0.295	17.86*	17.97*	0.05	18.02	End	Combination
44	100 (59)	39.72	42	Cir	40.262	9.00	9.12	0.300	17.50*	17.56*	0.11	17.68	End	Manhole
45	251	39.97	42	Cir	60.222	9.12	9.30	0.300	17.68*	17.77*	0.32	18.10	44	DropGrate
46	443	21.89	36	Cir	57.264	9.30	9.47	0.300	18.10*	18.16*	0.11	18.27	45	Manhole
47	231	7.79	24	Cir	20.332	9.47	9.53	0.300	18.27*	18.29*	0.09	18.38	46	Combination
48	426	7.00	18	Cir	24.142	9.53	9.61	0.300	18.38*	18.49*	0.24	18.73	47	Manhole

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NOTES: Return period = 25 Yrs. ; \*Surcharged (HGL above crown).

# Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
49	407	0.98	9	Cir	14.667	13.55	13.62	0.500	18.73*	18.79*	0.08	18.86	48	OpenHeadwall
50	425	6.06	18	Cir	23.333	9.61	9.68	0.300	18.73*	18.81*	0.18	19.00	48	Manhole
51	424	5.01	18	Cir	23.333	12.68	12.75	0.300	19.00*	19.05*	0.12	19.17	50	Manhole
52	423	3.90	18	Cir	23.333	12.75	12.82	0.300	19.17*	19.21*	0.08	19.28	51	Manhole
53	422	2.96	18	Cir	23.166	12.82	12.89	0.300	19.28*	19.30*	0.04	19.34	52	Manhole
54	441	1.96	12	Cir	23.500	12.89	12.96	0.300	19.34*	19.42*	0.10	19.51	53	Manhole
55	402	1.02	9	Cir	14.667	13.24	13.31	0.500	19.51*	19.57*	0.08	19.65	54	OpenHeadwall
56	403	1.02	9	Cir	14.667	13.12	13.19	0.500	19.34*	19.40*	0.08	19.48	53	OpenHeadwall
57	442	0.95	9	Cir	23.148	12.96	13.03	0.300	19.51*	19.59*	0.07	19.66	54	Manhole
58	401	0.95	9	Cir	14.667	13.03	13.07	0.300	19.66*	19.71*	0.07	19.78	57	OpenHeadwall
59	404	0.98	9	Cir	14.667	13.00	13.08	0.500	19.28*	19.33*	0.08	19.41	52	OpenHeadwall
60	405	1.15	9	Cir	14.667	12.89	12.96	0.500	19.17*	19.24*	0.11	19.35	51	OpenHeadwall
61	249	15.73	30	Cir	313.000	9.30	10.24	0.300	18.10*	18.56*	0.12	18.68	45	DropGrate
62	234	12.17	24	Cir	103.772	10.24	10.55	0.300	18.68*	18.98*	0.27	19.25	61	DropGrate
63	235	8.87	24	Cir	105.234	10.55	10.87	0.300	19.25*	19.41*	0.06	19.47	62	DropGrate
64	236	5.77	18	Cir	68.916	10.87	11.07	0.300	19.47*	19.68*	0.17	19.84	63	DropGrate
65	427	14.43	30	Cir	35.167	9.47	9.58	0.300	18.27*	18.32*	0.13	18.45	46	Manhole
66	428	13.46	30	Cir	20.000	9.58	9.64	0.300	18.45*	18.47*	0.12	18.59	65	Manhole
67	429	12.54	30	Cir	20.000	9.64	9.70	0.300	18.59*	18.61*	0.10	18.71	66	Manhole
68	430	11.60	24	Cir	20.186	9.70	9.76	0.300	18.71*	18.76*	0.21	18.97	67	Manhole
69	431	10.65	24	Cir	19.814	9.76	9.82	0.300	18.97*	19.02*	0.18	19.20	68	Manhole
70	432	9.71	24	Cir	20.000	9.82	9.88	0.300	19.20*	19.23*	0.15	19.38	69	Manhole
71	433	8.68	24	Cir	32.979	9.88	9.98	0.300	19.38*	19.43*	0.12	19.55	70	Manhole
72	233	8.71	24	Cir	20.095	9.98	10.04	0.300	19.55*	19.58*	0.08	19.65	71	Combination
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NOTES: Return period = 25 Yrs. ; *Surcharged (HGL above crown).														

# Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
73	434	7.93	24	Cir	21.170	10.04	10.10	0.300	19.65*	19.68*	0.10	19.78	72	Manhole
74	435	6.83	24	Cir	25.000	10.10	10.18	0.300	19.78*	19.80*	0.07	19.88	73	Manhole
75	436	5.70	18	Cir	25.000	10.18	10.25	0.300	19.88*	19.95*	0.16	20.11	74	Manhole
76	437	4.59	18	Cir	25.000	10.25	10.33	0.300	20.11*	20.16*	0.11	20.26	75	Manhole
77	438	3.47	15	Cir	25.186	10.33	10.40	0.300	20.26*	20.34*	0.12	20.46	76	Manhole
78	439	2.35	15	Cir	24.814	10.40	10.48	0.300	20.46*	20.49*	0.06	20.55	77	Manhole
79	440	1.22	12	Cir	25.000	10.48	10.55	0.300	20.55*	20.58*	0.04	20.62	78	Manhole
80	420	1.22	12	Cir	14.667	10.55	10.60	0.300	20.62*	20.63*	0.04	20.67	79	OpenHeadwall
81	419	1.15	9	Cir	14.667	10.53	10.60	0.500	20.55*	20.62*	0.11	20.73	78	OpenHeadwall
82	418	1.16	9	Cir	14.667	10.40	10.48	0.500	20.46*	20.53*	0.11	20.64	77	OpenHeadwall
83	417	1.16	9	Cir	14.667	10.33	10.37	0.300	20.26*	20.34*	0.11	20.44	76	OpenHeadwall
84	416	1.16	9	Cir	14.667	10.25	10.32	0.500	20.11*	20.18*	0.11	20.29	75	OpenHeadwall
85	415	1.18	9	Cir	14.667	10.18	10.22	0.300	19.88*	19.95*	0.11	20.06	74	OpenHeadwall
86	414	1.18	9	Cir	14.667	10.10	10.17	0.500	19.78*	19.85*	0.11	19.97	73	OpenHeadwall
87	413	1.13	9	Cir	14.667	9.88	9.95	0.500	19.38*	19.45*	0.10	19.55	70	OpenHeadwall
88	412	1.02	9	Cir	14.667	9.82	9.89	0.500	19.20*	19.25*	0.08	19.33	69	OpenHeadwall
89	406	1.10	9	Cir	14.667	9.77	9.84	0.500	19.00*	19.06*	0.10	19.16	50	OpenHeadwall
90	411	1.02	9	Cir	14.667	9.76	9.83	0.500	18.97*	19.03*	0.08	19.11	68	OpenHeadwall
91	410	1.03	9	Cir	14.667	9.70	9.77	0.500	18.71*	18.76*	0.08	18.85	67	OpenHeadwall
92	409	1.02	9	Cir	14.667	9.64	9.71	0.500	18.59*	18.64*	0.08	18.73	66	OpenHeadwall
93	408	1.08	9	Cir	14.667	9.58	9.65	0.500	18.45*	18.51*	0.09	18.61	65	OpenHeadwall
Project File: 25125.0004 - Hydraflow.stm									Number of lines: 93			Run Date: 2/25/2016		
NOTES: Return period = 25 Yrs. ; *Surcharged (HGL above crown).														

# Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	141	4.14	0.00	4.14	0.00	DrGrt	0.0	0.00	3.35	2.13	3.13	Sag	1.50	0.020	0.020	0.000	0.26	28.94	0.26	28.94	0.0	Off
2	142	3.74	0.00	3.74	0.00	DrGrt	0.0	0.00	3.35	2.13	3.13	Sag	1.50	0.020	0.020	0.000	0.24	27.26	0.24	27.26	0.0	Off
3	101	1.96	0.00	1.96	0.00	Comb	6.0	3.04	1.52	3.04	2.61	Sag	1.50	0.050	0.020	0.000	0.25	10.26	0.25	10.26	0.0	Off
4	102	3.46	0.00	3.46	0.00	Comb	6.0	3.04	1.52	3.04	2.61	Sag	1.50	0.050	0.020	0.000	0.33	14.46	0.33	14.46	0.0	Off
5	103	3.97	0.00	3.97	0.00	DrGrt	0.0	0.00	3.35	2.13	3.13	Sag	1.50	0.020	0.020	0.000	0.25	28.22	0.25	28.22	0.0	Off
6	104	1.88	0.00	1.88	0.00	DrGrt	0.0	0.00	3.35	2.13	3.13	Sag	1.50	0.020	0.020	0.000	0.15	18.39	0.15	18.39	0.0	Off
7	105	4.08	0.00	4.08	0.00	DrGrt	0.0	0.00	3.35	2.13	3.13	Sag	1.50	0.020	0.020	0.000	0.26	28.67	0.26	28.67	0.0	Off
8	111	1.44	0.00	1.44	0.00	DrGrt	0.0	0.00	3.35	2.13	3.13	Sag	1.50	0.020	0.020	0.000	0.13	15.86	0.13	15.86	0.0	Off
9	112	1.34	0.00	1.34	0.00	DrGrt	0.0	0.00	3.35	2.13	3.13	Sag	1.50	0.020	0.020	0.000	0.12	15.31	0.12	15.31	0.0	Off
10	113	1.37	0.00	1.37	0.00	DrGrt	0.0	0.00	3.35	2.13	3.13	Sag	1.50	0.020	0.020	0.000	0.12	15.45	0.12	15.45	0.0	Off
11	114	1.23	0.00	1.23	0.00	Comb	6.0	3.04	1.52	3.04	2.61	Sag	1.50	0.050	0.020	0.000	0.20	7.76	0.20	7.76	0.0	Off
12	115	2.77	0.00	2.77	0.00	Comb	6.0	3.04	1.52	3.04	2.61	Sag	1.50	0.050	0.020	0.000	0.30	12.66	0.30	12.66	0.0	Off
13	106	3.08	0.00	3.08	0.00	DrGrt	0.0	0.00	3.35	2.13	3.13	Sag	1.50	0.020	0.020	0.000	0.21	24.31	0.21	24.31	0.0	Off
14	107	2.30	0.00	2.30	0.00	DrGrt	0.0	0.00	3.35	2.13	3.13	Sag	1.50	0.020	0.020	0.000	0.17	20.59	0.17	20.59	0.0	Off
15	108	2.13	0.00	2.13	0.00	Comb	6.0	3.04	1.52	3.04	2.61	Sag	1.50	0.050	0.020	0.000	0.26	10.76	0.26	10.76	0.0	Off
16	109	2.59	0.00	2.59	0.00	Comb	6.0	3.04	1.52	3.04	2.61	Sag	1.50	0.050	0.020	0.000	0.29	12.11	0.29	12.11	0.0	Off
17	116	1.46	0.00	1.46	0.00	Comb	6.0	3.04	1.52	3.04	2.61	Sag	1.50	0.050	0.020	0.000	0.22	8.61	0.22	8.61	0.0	Off
18	110	2.23	0.00	2.23	0.00	Comb	6.0	3.04	1.52	3.04	2.61	Sag	1.50	0.050	0.020	0.000	0.27	11.06	0.27	11.06	0.0	Off
19	117	5.53	0.00	5.53	0.00	DrGrt	0.0	0.00	3.35	2.13	3.13	Sag	1.50	0.020	0.020	0.000	0.31	34.41	0.31	34.41	0.0	Off
20	124	2.67	0.00	2.67	0.00	Comb	6.0	3.04	1.52	3.04	2.61	Sag	1.50	0.050	0.020	0.000	0.29	12.36	0.29	12.36	0.0	Off
21	118	4.17	0.00	4.17	0.00	DrGrt	0.0	0.00	3.35	2.13	3.13	Sag	1.50	0.020	0.020	0.000	0.26	29.06	0.26	29.06	0.0	Off
22	119	4.69	0.00	4.69	0.00	DrGrt	0.0	0.00	3.35	2.13	3.13	Sag	1.50	0.020	0.020	0.000	0.28	31.18	0.28	31.18	0.0	Off
23	120	2.08	0.00	2.08	0.00	DrGrt	0.0	0.00	3.35	2.13	3.13	Sag	1.50	0.020	0.020	0.000	0.16	19.41	0.16	19.41	0.0	Off

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Number of lines: 93

Run Date: 2/25/2016

NOTES: Inlet N-Values = 0.016; Intensity = 282.30 / (Inlet time + 29.20) ^ 0.99; Return period = 25 Yrs.; \* Indicates Known Q added. All curb inlets are Horiz throat.

# Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
24	121	0.84	0.00	0.84	0.00	Comb	6.0	3.04	1.52	3.04	2.61	Sag	1.50	0.050	0.020	0.000	0.17	6.26	0.17	6.26	0.0	Off
25	144	1.50	0.00	1.50	0.00	Comb	6.0	3.04	1.52	3.04	2.61	Sag	1.50	0.050	0.020	0.000	0.22	8.76	0.22	8.76	0.0	Off
26	145	0.42	0.00	0.42	0.00	Comb	6.0	3.04	1.52	3.04	2.61	Sag	1.50	0.050	0.020	0.000	0.13	4.31	0.13	4.31	0.0	Off
27	146	2.93	0.00	2.93	0.00	Comb	6.0	3.04	1.52	3.04	2.61	Sag	1.50	0.050	0.020	0.000	0.31	13.11	0.31	13.11	0.0	Off
28	125	0.61	0.00	0.61	0.00	DrGrt	0.0	0.00	5.43	1.74	3.13	Sag	1.50	0.020	0.020	0.000	0.08	10.71	0.08	10.71	0.0	Off
29	126	0.97	0.00	0.97	0.00	DrGrt	0.0	0.00	5.43	1.74	3.13	Sag	1.50	0.020	0.020	0.000	0.10	13.44	0.10	13.44	0.0	Off
30	127	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
31	128	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
32	138	3.87	0.00	3.87	0.00	Comb	6.0	3.04	1.52	3.04	2.61	Sag	1.50	0.050	0.020	0.000	0.36	15.51	0.36	15.51	0.0	Off
33	139	2.50	0.00	2.50	0.00	Comb	6.0	3.04	1.52	3.04	2.61	Sag	1.50	0.050	0.020	0.000	0.28	11.86	0.28	11.86	0.0	Off
34	140	4.24	0.00	4.24	0.00	Comb	4.0	3.04	7.93	3.04	2.61	Sag	2.00	0.050	0.020	0.000	0.37	15.71	0.37	15.71	0.0	Off
35	129	2.21	0.00	2.21	0.00	DrGrt	0.0	0.00	5.43	1.74	3.13	Sag	1.50	0.020	0.020	0.000	0.18	21.02	0.18	21.02	0.0	Off
36	130	4.33	0.00	4.33	0.00	DrGrt	0.0	0.00	5.43	1.74	3.13	Sag	1.50	0.020	0.020	0.000	0.28	31.13	0.28	31.13	0.0	Off
37	149	0.89	0.00	0.89	0.00	Comb	6.0	3.04	1.52	3.04	2.61	Sag	1.50	0.050	0.020	0.000	0.17	6.46	0.17	6.46	0.0	Off
38	150	1.70	0.00	1.70	0.00	Comb	6.0	3.04	1.52	3.04	2.61	Sag	1.50	0.050	0.020	0.000	0.23	9.41	0.23	9.41	0.0	Off
39	143	9.17	0.00	9.17	0.00	DrGrt	0.0	0.00	3.35	2.13	3.13	Sag	1.50	0.020	0.020	0.000	0.44	46.99	0.44	46.99	0.0	Off
40	122	3.72	0.00	3.72	0.00	Comb	6.0	3.04	1.52	3.04	2.61	Sag	1.50	0.050	0.020	0.000	0.35	15.16	0.35	15.16	0.0	Off
41	147	5.68	0.00	5.68	0.00	DrGrt	0.0	0.00	3.35	1.74	3.13	Sag	1.50	0.020	0.020	0.000	0.34	36.68	0.34	36.68	0.0	Off
42	148	3.41	0.00	3.41	0.00	DrGrt	0.0	0.00	3.35	2.13	3.13	Sag	1.50	0.020	0.020	0.000	0.23	25.80	0.23	25.80	0.0	Off
43	123	2.25	0.00	2.25	0.00	Comb	6.0	3.04	1.52	3.04	2.61	Sag	1.50	0.050	0.020	0.000	0.27	11.11	0.27	11.11	0.0	Off
44	162	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
45	131	3.65	0.00	3.65	0.00	DrGrt	0.0	0.00	5.43	1.74	3.13	Sag	2.00	0.020	0.020	0.000	0.25	28.10	0.25	28.10	0.0	Off
46	344	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off

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Number of lines: 93

Run Date: 2/25/2016

NOTES: Inlet N-Values = 0.016; Intensity = 282.30 / (Inlet time + 29.20) ^ 0.99; Return period = 25 Yrs.; \* Indicates Known Q added. All curb inlets are Horiz throat.

# Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
47	132	0.84	0.00	0.84	0.00	Comb	6.0	3.04	1.52	3.04	2.61	Sag	1.50	0.050	0.020	0.000	0.17	6.26	0.17	6.26	0.0	Off
48	326	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
49	307	0.98	0.00	0.98	0.00	Hdwl	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
50	325	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
51	324	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
52	323	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
53	322	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
54	342	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
55	302	1.02	0.00	1.02	0.00	Hdwl	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
56	303	1.02	0.00	1.02	0.00	Hdwl	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
57	343	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
58	301	0.95	0.00	0.95	0.00	Hdwl	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
59	304	0.98	0.00	0.98	0.00	Hdwl	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
60	305	1.15	0.00	1.15	0.00	Hdwl	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
61	133	3.85	0.00	3.85	0.00	DrGrt	0.0	0.00	5.43	1.74	3.13	Sag	2.00	0.020	0.020	0.000	0.26	29.03	0.26	29.03	0.0	Off
62	135	3.55	0.00	3.55	0.00	DrGrt	0.0	0.00	3.35	2.13	3.13	Sag	1.50	0.020	0.020	0.000	0.23	26.43	0.23	26.43	0.0	Off
63	136	3.19	0.00	3.19	0.00	DrGrt	0.0	0.00	3.35	2.13	3.13	Sag	1.50	0.020	0.020	0.000	0.22	24.80	0.22	24.80	0.0	Off
64	137	5.77	0.00	5.77	0.00	DrGrt	0.0	0.00	3.35	2.13	3.13	Sag	1.50	0.020	0.020	0.000	0.32	35.31	0.32	35.31	0.0	Off
65	328	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
66	329	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
67	330	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
68	331	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
69	332	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off

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Number of lines: 93

Run Date: 2/25/2016

NOTES: Inlet N-Values = 0.016; Intensity = 282.30 / (Inlet time + 29.20) ^ 0.99; Return period = 25 Yrs.; \* Indicates Known Q added. All curb inlets are Horiz throat.

# Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
70	333	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
71	334	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
72	134	0.84	0.00	0.84	0.00	Comb	6.0	3.04	1.52	3.04	2.61	Sag	1.50	0.050	0.020	0.000	0.17	6.26	0.17	6.26	0.0	Off
73	335	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
74	336	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
75	337	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
76	338	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
77	339	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
78	340	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
79	341	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
80	320	1.22	0.00	1.22	0.00	Hdwl	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
81	319	1.15	0.00	1.15	0.00	Hdwl	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
82	318	1.16	0.00	1.16	0.00	Hdwl	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
83	317	1.16	0.00	1.16	0.00	Hdwl	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
84	316	1.16	0.00	1.16	0.00	Hdwl	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
85	315	1.18	0.00	1.18	0.00	Hdwl	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
86	314	1.18	0.00	1.18	0.00	Hdwl	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
87	313	1.13	0.00	1.13	0.00	Hdwl	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
88	312	1.02	0.00	1.02	0.00	Hdwl	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
89	306	1.10	0.00	1.10	0.00	Hdwl	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
90	311	1.02	0.00	1.02	0.00	Hdwl	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
91	310	1.03	0.00	1.03	0.00	Hdwl	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
92	309	1.02	0.00	1.02	0.00	Hdwl	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off

Project File: 25125.0004 - Hydraflow.stm

Number of lines: 93

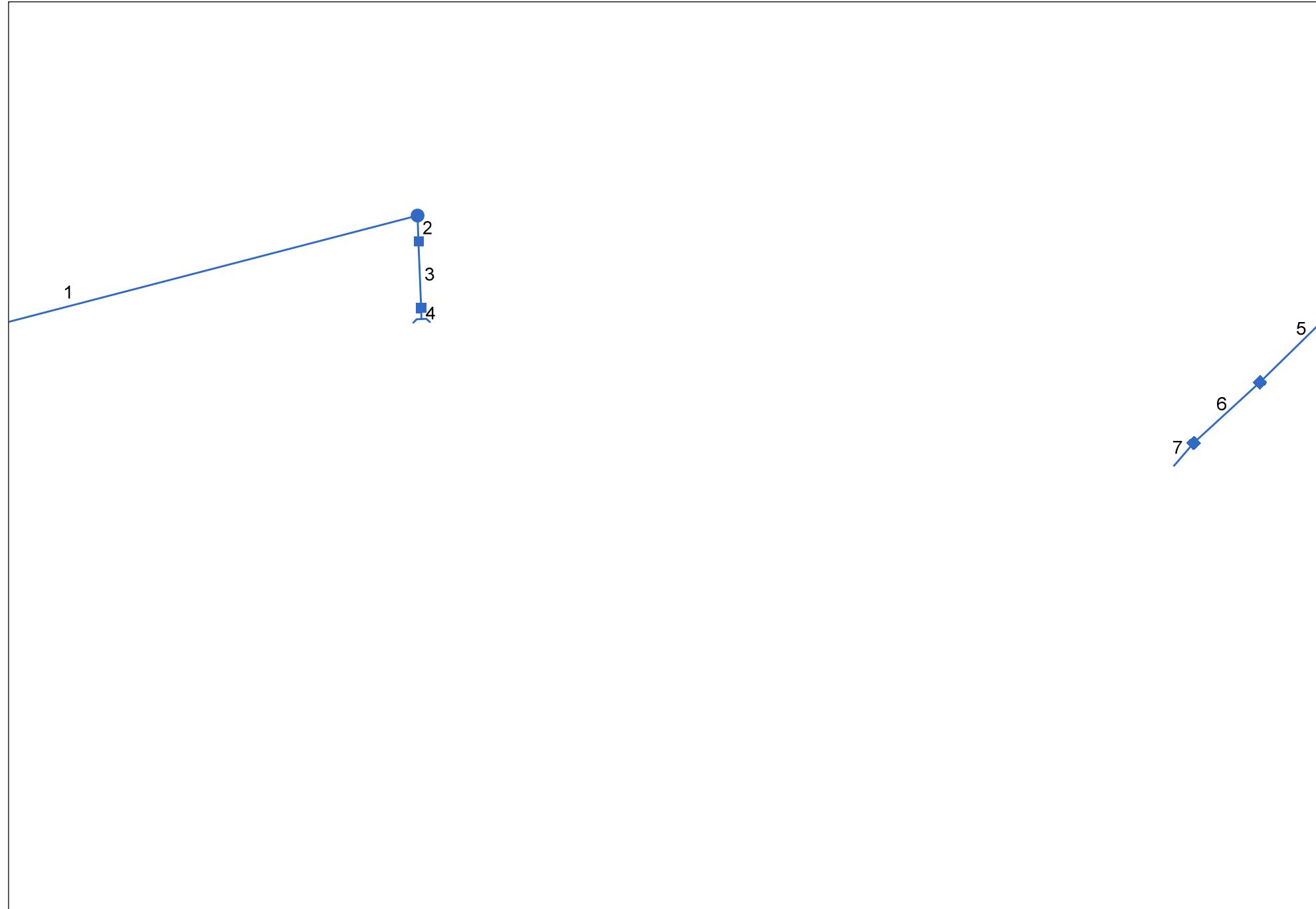
Run Date: 2/25/2016

NOTES: Inlet N-Values = 0.016; Intensity = 282.30 / (Inlet time + 29.20) ^ 0.99; Return period = 25 Yrs.; \* Indicates Known Q added. All curb inlets are Horiz throat.

# Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
93	308	1.08	0.00	1.08	0.00	Hdwl	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
Project File: 25125.0004 - Hydraflow.stm										Number of lines: 93										Run Date: 2/25/2016		
NOTES: Inlet N-Values = 0.016; Intensity = 282.30 / (Inlet time + 29.20) ^ 0.99; Return period = 25 Yrs. ; * Indicates Known Q added. All curb inlets are Horiz throat.																					Storm Sewers v10.40	

# Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Project File: 25125.0004 - Mass Grading - Hydraflow.stm

Number of lines: 8

Date: 2/25/2016

# Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/Rim El (ft)	
1	End	302.459	-14.638	MH	0.00	0.00	0.00	0.0	9.00	0.00	9.00	36	Cir	0.013	1.00	18.79	107
2	1	10.788	102.581	Curb	0.00	0.21	0.95	6.0	9.00	0.28	9.03	18	Cir	0.013	0.50	39.64	111
3	2	28.000	0.000	Curb	0.00	0.55	0.95	6.0	9.03	0.32	9.12	18	Cir	0.013	0.50	39.64	110
4	3	4.588	0.000	Hdwl	5.97	0.00	0.00	0.0	9.12	0.22	9.13	18	Cir	0.013	1.00	11.34	102
5	End	54.774	135.461	Curb	0.00	0.19	0.95	6.0	9.00	0.29	9.16	42	Cir	0.013	0.50	21.00	108
6	5	37.538	1.952	Curb	0.00	0.07	0.95	6.0	9.16	0.32	9.28	42	Cir	0.013	0.50	21.00	109
7	6	12.492	-6.777	None	31.59	0.00	0.00	0.0	9.28	0.24	9.31	42	Cir	0.013	1.00	11.12	100
8	End	106.460	118.056	DrGrt	21.83	0.33	0.75	6.0	9.00	2.00	11.13	30	Cir	0.013	1.00	22.48	101

Project File: 25125.0004 - Mass Grading - Hydraflow.stm

Number of lines: 8

Date: 2/25/2016

# Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	2	Manhole	18.79	Cir	5.00	5.00	36	Cir	9.00	18	Cir	9.00
2	22	Curb-Horiz	39.64	Rect	4.00	4.00	18	Cir	9.03	18	Cir	9.03
3	21	Curb-Horiz	39.64	Rect	4.00	4.00	18	Cir	9.12	18	Cir	9.12
4	7	OpenHeadwall	11.34	n/a	n/a	n/a	18	Cir	9.13			
5	18	Curb-Horiz	21.00	Rect	4.00	4.00	42	Cir	9.16	42	Cir	9.16
6	17	Curb-Horiz	21.00	Rect	4.00	4.00	42	Cir	9.28	42	Cir	9.28
7	19	None	11.12	n/a	n/a	n/a	42	Cir	9.31			
8	5	DropGrate	22.48	Rect	4.00	4.00	30	Cir	11.13			

# Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	107	11.95	36	Cir	302.459	9.00	9.00	0.000	17.50*	17.60*	0.04	17.64	End	Manhole
2	111	11.96	18	Cir	10.788	9.00	9.03	0.278	17.64*	17.78*	0.36	18.14	1	Curb-Horiz
3	110	10.31	18	Cir	28.000	9.03	9.12	0.321	18.14*	18.41*	0.26	18.67	2	Curb-Horiz
4	102	5.97	18	Cir	4.588	9.12	9.13	0.218	18.67*	18.69*	0.18	18.87	3	OpenHeadwall
5	108	33.63	42	Cir	54.774	9.00	9.16	0.292	17.70*	17.76*	0.09	17.86	End	Curb-Horiz
6	109	32.14	42	Cir	37.538	9.16	9.28	0.320	17.86*	17.89*	0.09	17.98	5	Curb-Horiz
7	100	31.59	42	Cir	12.492	9.28	9.31	0.240	17.98*	17.99*	0.17	18.16	6	None
8	101	23.89	30	Cir	106.460	9.00	11.13	2.001	17.70*	18.06*	0.37	18.43	End	DropGrate
Project File: 25125.0004 - Mass Grading - Hydraflow.stm									Number of lines: 8			Run Date: 2/25/2016		
NOTES: Return period = 25 Yrs. ; *Surcharged (HGL above crown).														

# Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	2	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
2	22	1.66	0.00	1.66	0.00	Curb	6.0	4.13	0.00	0.00	0.00	Sag	2.00	0.050	0.020	0.000	0.21	7.27	0.24	7.27	0.4	Off
3	21	4.34	0.00	4.34	0.00	Curb	6.0	4.13	0.00	0.00	0.00	Sag	2.00	0.050	0.020	0.000	0.39	16.53	0.42	16.53	0.4	Off
4	7	5.97*	0.00	5.97	0.00	Hdwl	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
5	18	1.50	0.00	1.50	0.00	Curb	6.0	4.13	0.00	0.00	0.00	Sag	2.00	0.050	0.020	0.000	0.19	6.61	0.22	6.61	0.4	Off
6	17	0.55	0.00	0.55	0.00	Curb	6.0	4.13	0.00	0.00	0.00	Sag	2.00	0.050	0.020	0.000	0.10	1.97	0.13	1.97	0.4	Off
7	19	31.59*	0.00	0.00	31.59	None	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
8	5	23.89*	0.00	23.89	0.00	DrGrt	0.0	0.00	4.42	1.98	2.23	Sag	2.00	0.020	0.020	0.000	1.01	103.59	1.01	103.59	0.0	Off
Project File: 25125.0004 - Mass Grading - Hydraflow.stm													Number of lines: 8				Run Date: 2/25/2016					
NOTES: Inlet N-Values = 0.016; Intensity = 282.30 / (Inlet time + 29.20) ^ 0.99; Return period = 25 Yrs. ; * Indicates Known Q added. All curb inlets are Horiz throat.																					Storm Sewers v10.40	

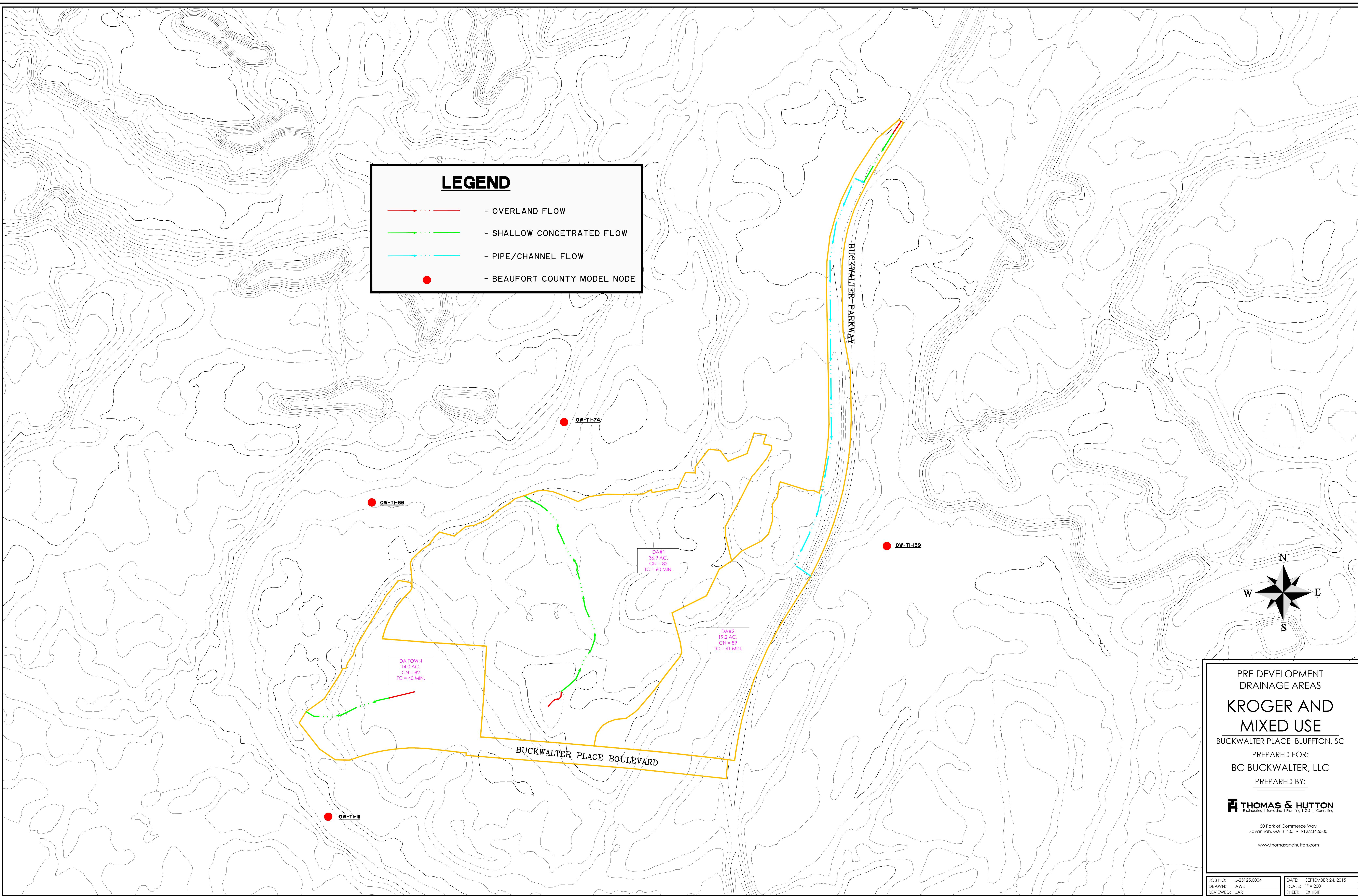
**STORMWATER MANAGEMENT REPORT**

**KROGER & MIXED USE AT BUCKWALTER PLACE**

**REPORT EXHIBITS**

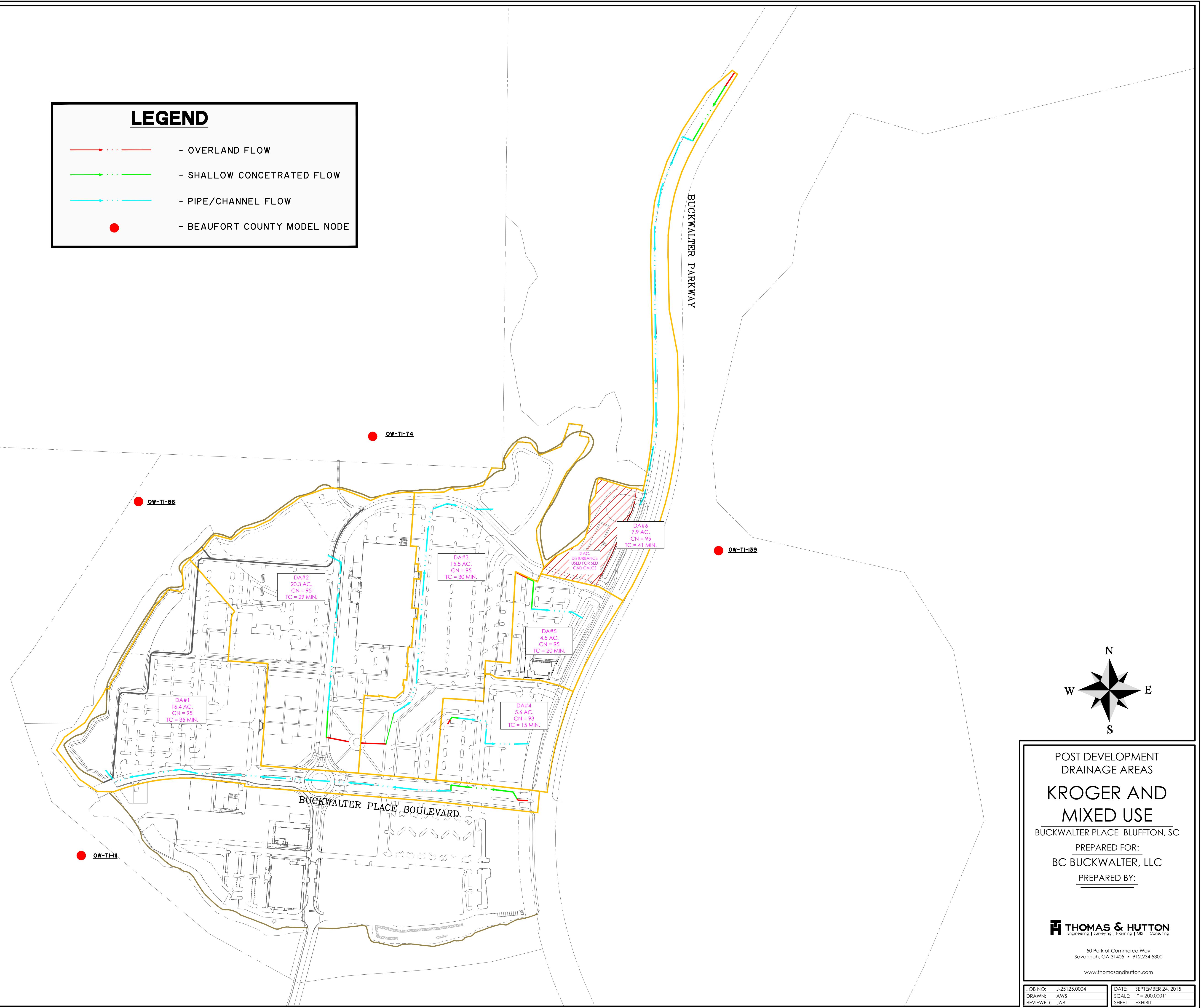
25125.0004

**T** THOMAS & HUTTON



## LEGEND

- OVERLAND FLOW
- SHALLOW CONCENTRATED FLOW
- PIPE/CHANNEL FLOW
- BEAUFORT COUNTY MODEL NODE



POST DEVELOPMENT  
DRAINAGE AREAS

### KROGER AND MIXED USE

BUCKWALTER PLACE BLUFFTON, SC

PREPARED FOR:

BC BUCKWALTER, LLC

PREPARED BY:

**THOMAS & HUTTON**  
Engineering | Surveying | GIS | Consulting

50 Park of Commerce Way  
Savannah, GA 31405 • 912.234.5300

[www.thomasandhutton.com](http://www.thomasandhutton.com)

JOB NO: J25125.0004	DATE: SEPTEMBER 24, 2015
DRAWN: AWS	SCALE: 1" = 200.000'
REVIEWED: JAR	SHEET: EXHIBIT

