PRELIMINARY STORM WATER DRAINAGE REPORT

LOT 1B

DOUGLAS CORNERS

LEE'S SUMMIT, MISSOURI

100 NE TUDOR ROAD

PREPARED FOR

THOMPSON PROPERTIES, LLC

PREPARED BY

HG CONSULT, INC.

August 6, 2018

This section is to address the Lee's Summit checklist for inclusion. **Response will be in bold.**

1. Preliminary Development Drainage Area Map:
(including Locations of all points of discharge from each sub-drainage area)

2. Post Development Drainage Area Map:
(including Locations of all points of discharge from each sub-drainage area)

3. Undetained Areas:
(as shown on Preliminary Development Drainage Area Map and Post Development Drainage Area Map)

4. Soil analysis, showing the soil type(s) predominant on the site:
(Attached soil analysis from USDA Natural Resources Conservation Web Soil Survey)

5. Time of concentration calculations:
(Time of concentration was assumed to be 5 minutes)

6. Curve number assumptions:
(Curve number assumed to be 87 for existing condition and 89 for proposed condition)

7. Floodplain issues (if any):
No Floodplain issues are on this site.

8. Wetland and USCOE issues:
No Wetland or USCOE issues are on this site.

9. Methodology used in the preparation of this report:
General methodology of report was prepared using Bentley PondPack V8i to determine the storm events, the rainfall amounts and the detention pond requirements.

10. Existing Conditions:
The existing conditions for this site includes a 33,640 SF office building with adjacent parking and a drive aisle access to the north with the existing drive on Lot 1A and Lot 1B. The site to the south (Schlotzky's Restaurant) was previously included in site development for the sizing of the existing detention pond with a 3,330 SF building and parking lot. There was an undersized detention pond for the entire development including the partially developed Lot 1B in the existing condition drawing. Lot 1B included a parking pad and original garage area space.

11. Proposed Conditions:
The proposed condition site includes the existing condition plus the addition of a 7,972 SF office building with an additional 4,496 SF of apartments on the second floor. The proposed condition site includes the improvement of the existing detention pond to accommodate the existing office building, restaurant and all existing parking and drive aisles.

12. Future development:
No future development is planned at this time.

13. A discussion of the method used to comply with the water quality standard set forth in Section 5600 (i.e., 40 hour extended detention, or volumetric reduction credit, or combination thereof).
APWA 5608.4 requires a 40-hour extended release of the water quality storm event (1.37"/24-hour rainfall) per Section 8.10 of the BMP Manual. The detention facility will release the water quality event over a 40-hour period. The Time vs. Volume graph is attached.

14. The Time vs. Volume graph:
(See attached).

15. A discussion of all conclusions, including any waivers necessary to comply with the Design and Construction Manual.
All design is in compliance with the Design and Construction Manual. No variance requested.

16. Explanation of the accounting procedure used to calculate the allowable release rate at key points shown on the drainage maps. In essence, if off-site contributors to drainage area are present in the existing condition drainage area map, then a percentage of their existing peak flow rate can be added to the allowable peak flow rate to the various drainage points of discharge.
No off-site areas are included in this report.

17. A table showing how these drainage areas were accounted in the calculation of the allowable peak flow rate at the various drainage points of discharge.
All drainage areas discharge at the detention pond as shown and accounted for.

18. Final Report - Inflow hydrographs for the 2, 10, and 100 year storm events (please keep in mind that this information will be required to run the preliminary model, but not necessarily required in the preliminary report).
The 2, 10 and 100 year storm events are included in this report.

19. The maximum water surface elevation within the basin (normally the 100 year event).
The maximum water surface elevation within the basin are included in this report (1016.74).

20. Final Report: Stage-discharge-rating curves/data tables for each emergency spillway, primary outlet works and combined outlets and overflows.
Stage-storage rating curves included in Douglas Spillway Report.

21. Final Report: Routing curves for all design storms with time plotted as the abscissa, and the following plotted as ordinates:

a. Cumulative inflow volume
b. Cumulative discharge
c. Stage elevation
d. Cumulative storage

Routing curves to be submitted with Final Report as requested.

Project Overview

The proposed project is a speculative retail/apartment building. The building will be contained in a 7,972 square foot building footprint with retail on the bottom floor and 4,496 square foot apartments on the second floor. This project is contained on a 1.73 acre site. The site is construction ready. The storm sewer system and detention pond will need additional improvements to allow for proper drainage from site.

The topography of the site is a gentle slope north west to the east. The existing storm sewer detention system is in place on the east side of the site on the east side of NE Douglas Street and the north side of Tudor Road. The overall existing storm sewer system serves all of Douglas Corners. An additional amount of detention will be required to accommodate the entire developed area which is provided with this project.

Drainage Assessment of the Project Site

Due to the slope of the site and the need for a flat slab, the bench and fill grading method was used for the site along with the need to have positive drainage away from the building, drainage areas directing storm water into new storm sewer catchments that forces storm water into the detention pond. The remainder of the site grading directs pervious areas and impervious areas away from the building and drainage to the proposed detention pond. Design requirements call for a piping system with a minimum capacity for the 10 year event, with the 100 year storm event being routed overland in an above grade manner such as swales and gutters. To insure that higher frequency storms would not cause any ponding problems or inundation of parked vehicles, the structures and piping system have been designed to the 100 year event flows. With the relatively small drainage areas, these flows are low and pipe sizes are 18 inch draining to the detention pond and a18" discharge pipe from the detention pond to an existing catch basin off-site.

Conveyance Design

As shown on the Drainage plan for the site, all areas drain to the detention pond by sheet flow over the parking and drive aisle area and by existing piping system. This system generates a 10 year flow of 38.69 cfs and a 100 year flow of 59.35 cfs pre-developed. After development and routing through the detention pond, 10 year flows have been reduced to 11.18 cfs and 100 year flows have been reduced to 15.28 cfs. All areas within drainage area drain towards the proposed detention pond.

Temporary Erosion and Sediment Control

During construction and prior to paving, it will be necessary to control erosion and sediment from the site during storms with in the construction timeframe. To insure that sediment does not enter the existing storm system or runs off to the existing street, perimeter containment is controlled by silt fence installation, inlet protection and an engineered detention release structure. To keep construction traffic from tracking mud onto the adjacent city street, a stabilized rock construction entrance will need to be installed. These erosion control devices, and their maintenance throughout the construction timeframe, are required by ordinance and the details for them are referenced by the City's Design and Construction Manual and shown on Detail Sheets 10 thru 13.

Post development water quality will be addressed through the use a water quality detention release structure. The owner will need to have a routine maintenance policy for the cleaning, repair and replacement of the detention release structure.

Design Calculations

See the attached for drainage area calculations, flows, pipe sizing, inlet sizing and water quality calculations as requested.

AASHTO Group Index—Jackson County, Missouri
(DOUGLAS CORNERS)

Map Scale: 1:875 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 10 20 40 60

Feet: 0 40 80 160 240

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

<= 14

> 14 and <= 25

Not rated or not available

Soil Rating Lines

<= 14

> 14 and <= 25

Not rated or not available

Soil Rating Points

<= 14

> 14 and <= 25

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Jackson County, Missouri
Survey Area Data: Version 18, Sep 16, 2017

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 11, 2017—Sep 22, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

AASHTO Group Index

Map unit symbol	Map unit name	Rating (none)	Acres in AOI	Percent of AOI
10082	Arisburg-Urban land complex, 1 to 5 percent slopes	25	3.2	98.2%
10180	Udarents-Urban land-Sampsel complex, 2 to 5 percent slopes	14	0.1	1.8%
Totals for Area of Interest			**3.2**	**100.0%**

Description

The AASHTO Group Index is a refinement to the seven major groups of the AASHTO soil classification system. According to

this system, soil is classified into seven major groups: A -l through A-7. Soils classified into groups A-1, A-2. and A-3 are granular materials of which 35% or less of the particles pass through the No. 200 sieve. Soils of which more than 35% pass through the No. 200 sieve are classified into groups A-4, A-5, A-6, and A-7. These soils are mostly silt and clay-type materials.

The classifications system is based on the following criteria:

1. Grain size

a. Gravel ; fraction passing the 75-mm(3-in.) sieve and retained on the No. 10 (2-mm) U.S. sieve

b. sand: fraction passing the No. 10 (2-mm) U.S. sieve and retained on the No.200 (0.075-mm) U.S. sieve

c. Silt and clay: fraction passing the No. 200 U.S. sieve

2. Plasticity The term silty is applied when the fine fractions of the soil have a plasticity index of 10 or less. The term clayey is applied when the fine fractions have a plasticity index of 11 or more.

3. If cobbles and boulders (size larger than 75 mm) are encountered, they are excluded from the portion of the soil sample from which classification is made.

To evaluate the quality of a soil as a highway subgrade material, one must also incorporate a number called the group index (GI) with the groups and subgroups of the soil. This index is written in parentheses after the group or subgroup designation.

The group index is given by the equation:

GI = (F200-35)[0.2+ 0.005(LL- 40)] + 0.01(.F200-15)(PI- 10)

where:

F200 = percentage passing through the No. 200 sieve

LL — liquid limit

PI : plasticity index

The group index is used typically to refine an AASHTO class but in the soil survey database is often used as a standalone soil attribute.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Rating Options

Units of Measure: none

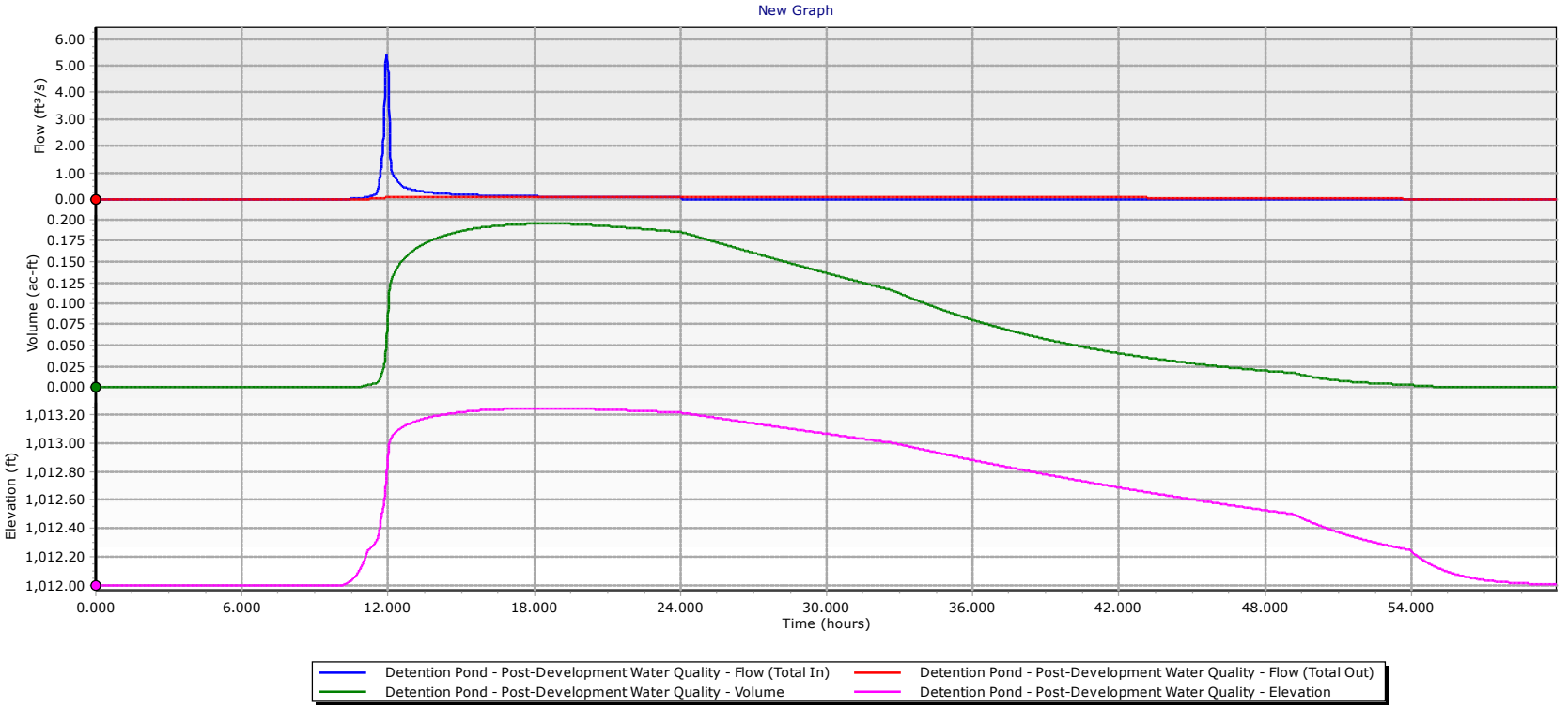
Aggregation Method: Dominant Condition

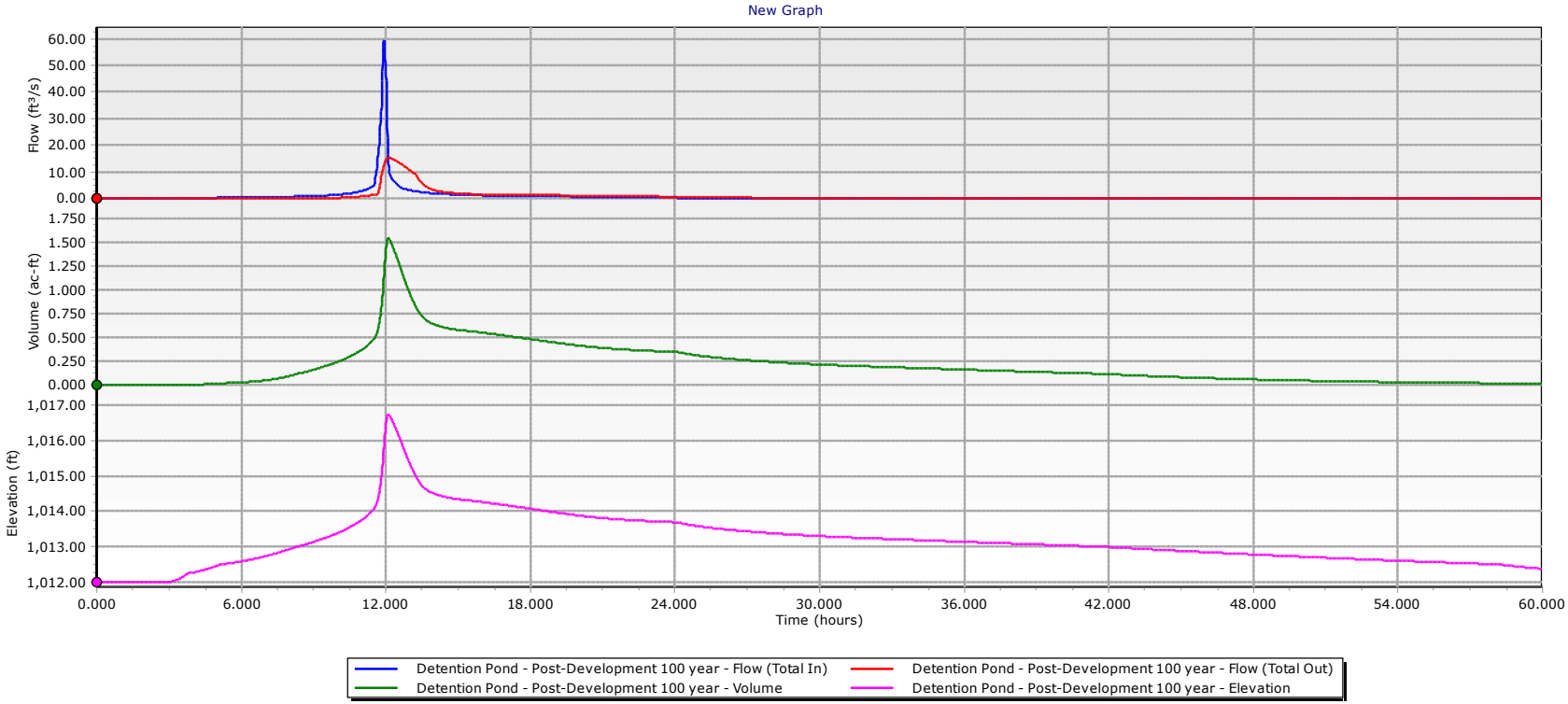
Component Percent Cutoff: None Specified

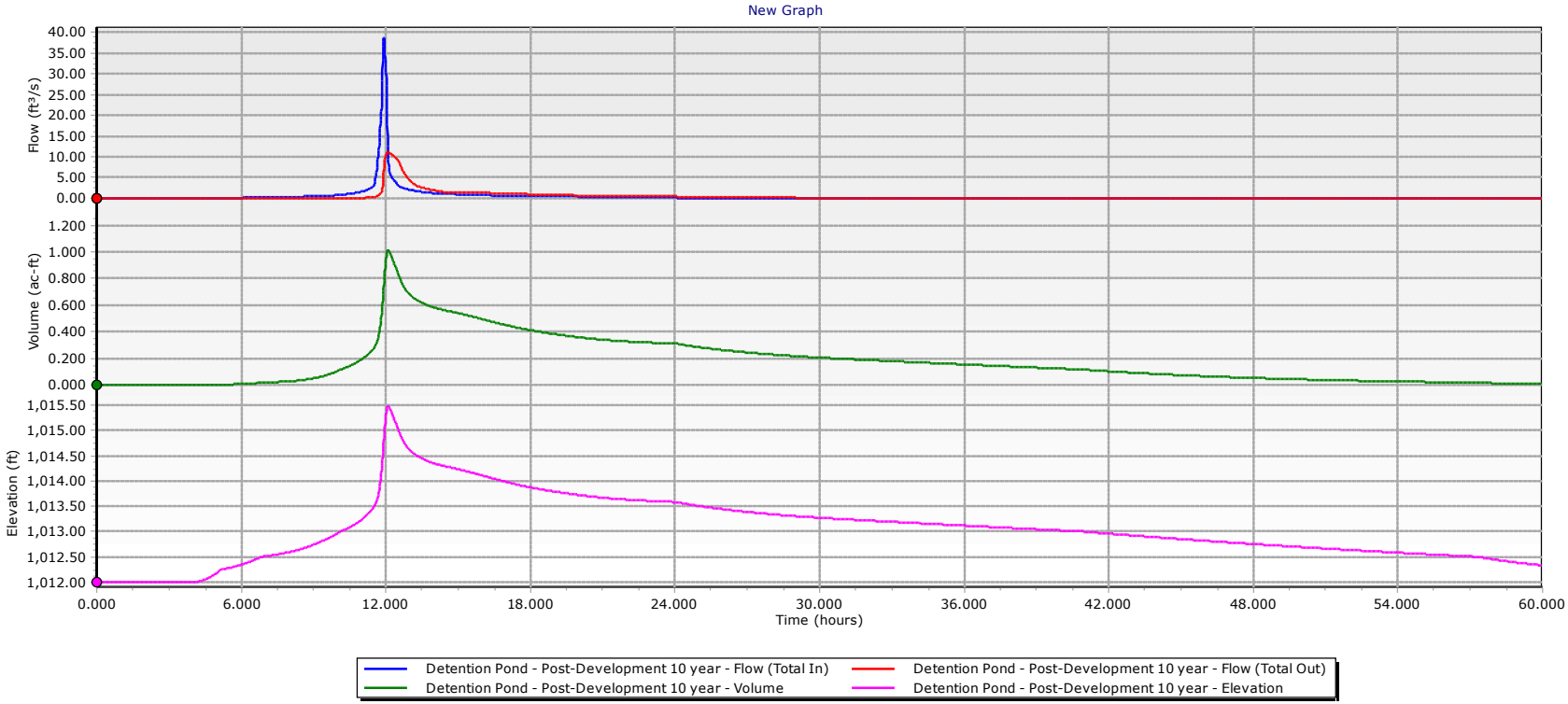
Tie-break Rule: Higher

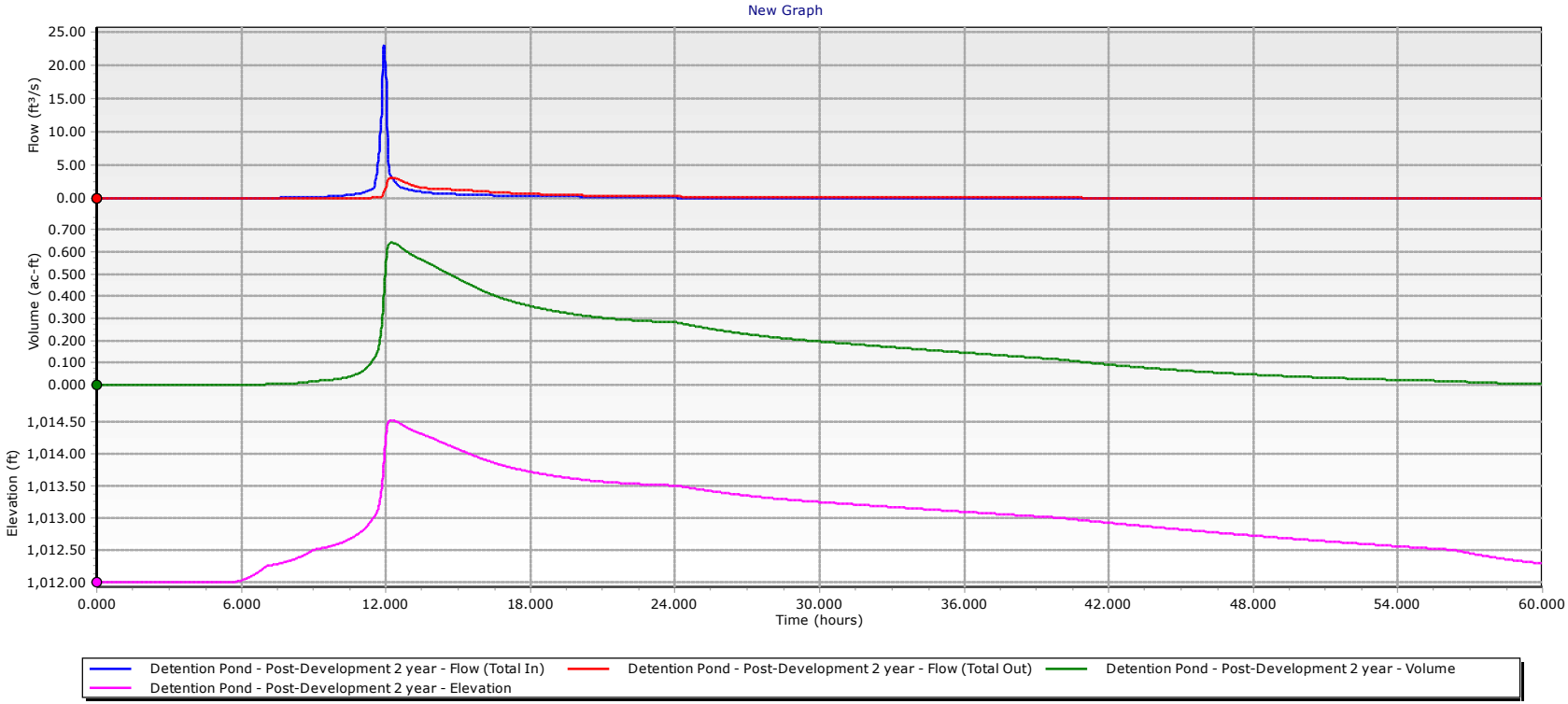
Interpret Nulls as Zero: No

Layer Options (Horizon Aggregation Method): All Layers (Weighted Average)


New Graph
Flow (ft³/s)
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Volume (ac-ft)
0.200
0.175
0.150
0.125
0.100
0.075
0.050
0.025
0.000
Elevation (ft)
1,013.20
1,013.00
1,012.80
1,012.60
1,012.40
1,012.20
1,012.00
0.000
6.000
12.000
18.000
24.000
30.000
36.000
42.000
48.000
54.000
Time (hours)
Detention Pond - Post-Development Water Quality - Flow (Total In)
Detention Pond - Post-Development Water Quality - Flow (Total Out)
Detention Pond - Post-Development Water Quality - Volume
Detention Pond - Post-Development Water Quality - Elevation


New Graph
Flow (ft³/s)
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Volume (ac-ft)
1.750
1.500
1.250
1.000
0.750
0.500
0.250
0.000
Elevation (ft)
1,017.00
1,016.00
1,015.00
1,014.00
1,013.00
1,012.00
0.000
6.000
12.000
18.000
24.000
30.000
36.000
42.000
48.000
54.000
60.000
Time (hours)
Detention Pond - Post-Development 100 year - Flow (Total In)
Detention Pond - Post-Development 100 year - Flow (Total Out)
Detention Pond - Post-Development 100 year - Volume
Detention Pond - Post-Development 100 year - Elevation


New Graph
Flow (ft³/s)
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Volume (ac-ft)
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Elevation (ft)
1,015.50
1,015.00
1,014.50
1,014.00
1,013.50
1,013.00
1,012.50
1,012.00
0.000
6.000
12.000
18.000
24.000
30.000
36.000
42.000
48.000
54.000
60.000
Time (hours)
Detention Pond - Post-Development 10 year - Flow (Total In)
Detention Pond - Post-Development 10 year - Flow (Total Out)
Detention Pond - Post-Development 10 year - Volume
Detention Pond - Post-Development 10 year - Elevation


New Graph
Flow (ft³/s)
25.00
20.00
15.00
10.00
5.00
0.00
Volume (ac-ft)
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Elevation (ft)
1,014.50
1,014.00
1,013.50
1,013.00
1,012.50
1,012.00
0.000
6.000
12.000
18.000
24.000
30.000
36.000
42.000
48.000
54.000
60.000
Time (hours)
Detention Pond - Post-Development 2 year - Flow (Total In)
Detention Pond - Post-Development 2 year - Flow (Total Out)
Detention Pond - Post-Development 2 year - Volume
Detention Pond - Post-Development 2 year - Elevation

Composite Outlet Structure Detailed Report: Primary Outlet Structure

Element Details			
Label	Primary Outlet Structure	Notes	

Headwater Range			
Headwater Type	Use Pond for Headwater Range	Maximum (Headwater)	1,018.50 ft
Pond	Detention Pond	Increment (Headwater)	0.50 ft
Minimum (Headwater)	1,012.00 ft		

SpotElevation (ft)

Tailwater Setup	
Tailwater Type	Free Outfall

Tailwater Tolerances			
Maximum Iterations	30	Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft	Flow Tolerance (Minimum)	0.001 ft³/s
Headwater Tolerance (Maximum)	0.50 ft	Flow Tolerance (Maximum)	10.000 ft³/s
Tailwater Tolerance (Minimum)	0.01 ft		

Outlet Structure			
Outlet Structure Type	Culvert	Culvert Type	Circular

Outlet Structure (IDs and Direction)			
Outlet ID	Culvert - 1	Downstream ID	Tailwater
Flow Direction	Forward Flow Only	Notes	

Outlet Structure (Advanced)			
Elevation (On)	0.00 ft	Elevation (Off)	0.00 ft

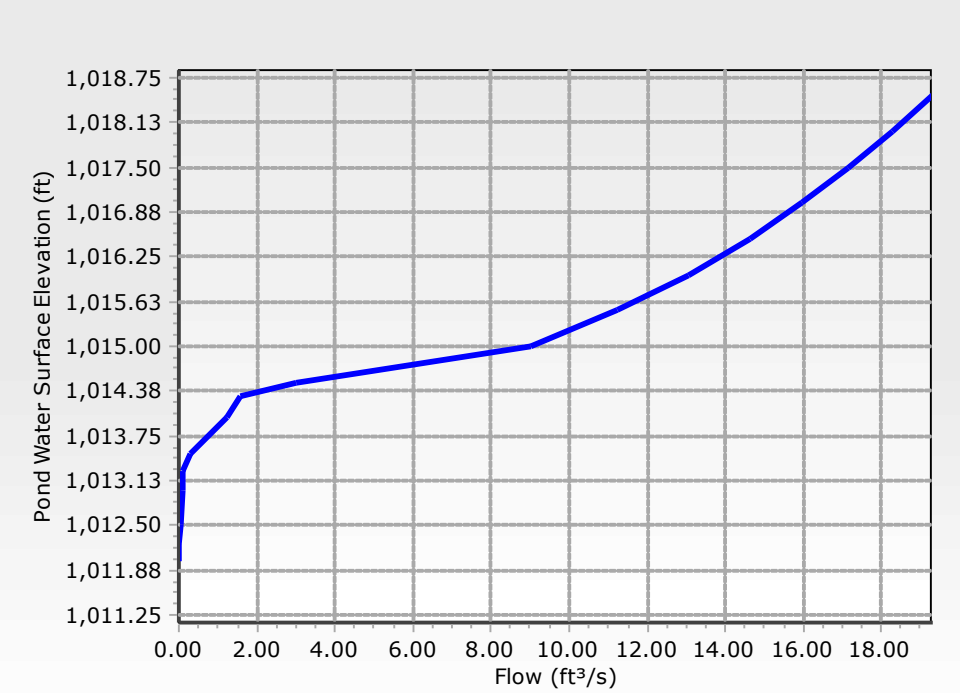
Culvert Data			
Number of Barrels	1	Downstream Invert	1,010.82 ft
Length	118.00 ft	Diameter	18.0 in
Upstream Invert	1,012.00 ft		

Unsubmerged->Submerged			
Specify Transitions	False	Compute Inlet Control Only	False

Composite Outlet Structure Detailed Report: Primary Outlet Structure

Culvert Coefficients			
Inlet Description	Concrete - Groove end projecting	C	0.0317
Chart	Chart 1	Y	0.6900
Nomograph	Nomograph 3	Manning's n	0.011
Equation Form	Form 1	Ke	0.200
K	0.0045	Kr	0.000
M	2.0000	Slope Correction Factor	-0.500

Culvert (Advanced)			
Convergence Tolerance	0.00 ft	Specify Number of Backwater Sections	False



RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Culvert - 1 (Culvert-Circular)

Mannings open channel maximum capacity: 13.35 ft³/s
Upstream ID = Orifice - 2, Orifice - 3, Riser - 1, Orifice - 1
Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Device Flow (ft³/s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)
1,012.00	0.00	0.00	0.00	Free Outfall
1,012.25	0.02	1,012.07	Free Outfall	Free Outfall

Composite Outlet Structure Detailed Report: Primary Outlet Structure

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Culvert - 1 (Culvert-Circular)

Mannings open channel maximum capacity: 13.35 ft³/s
Upstream ID = Orifice - 2, Orifice - 3, Riser - 1, Orifice - 1
Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Device Flow (ft³/s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)
1,012.50	0.06	1,012.12	Free Outfall	Free Outfall
1,013.00	0.09	1,012.16	Free Outfall	Free Outfall
1,013.25	0.11	1,012.17	Free Outfall	Free Outfall
1,013.50	0.28	1,012.27	Free Outfall	Free Outfall
1,014.00	1.21	1,012.59	Free Outfall	Free Outfall
1,014.30	1.55	1,012.67	Free Outfall	Free Outfall
1,014.50	3.00	1,012.96	Free Outfall	Free Outfall
1,015.00	9.01	1,013.86	Free Outfall	Free Outfall
1,015.50	11.25	1,014.31	Free Outfall	Free Outfall
1,016.00	13.07	1,014.76	Free Outfall	Free Outfall
1,016.50	14.64	1,015.20	Free Outfall	Free Outfall
1,017.00	15.96	1,015.76	Free Outfall	Free Outfall
1,017.50	17.15	1,016.31	Free Outfall	Free Outfall
1,018.00	18.27	1,016.85	Free Outfall	Free Outfall
1,018.50	19.31	1,017.39	Free Outfall	Free Outfall

Downstream Hydraulic Grade Line Error (ft)	Convergence Error (ft³/s)	Downstream Channel Tailwater (ft)	Tailwater Error (ft)
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.01	(N/A)	0.00
0.00	0.01	(N/A)	0.00
0.00	0.01	(N/A)	0.00
0.00	0.01	(N/A)	0.00
0.00	0.01	(N/A)	0.00
0.00	0.01	(N/A)	0.00
0.00	0.01	(N/A)	0.00
0.00	0.01	(N/A)	0.00

Message
WS below an invert; no flow. CRIT.DEPTH CONTROL Vh= .018ft Dcr= .053ft CRIT.DEPTH Hev= .00ft

Composite Outlet Structure Detailed Report: Primary Outlet Structure

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Culvert - 1 (Culvert-Circular)

Mannings open channel maximum capacity: 13.35 ft³/s
Upstream ID = Orifice - 2, Orifice - 3, Riser - 1, Orifice - 1
Downstream ID = Tailwater (Pond Outfall)

Message
CRIT.DEPTH CONTROL Vh= .029ft Dcr= .086ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .038ft Dcr= .111ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .040ft Dcr= .119ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .067ft Dcr= .194ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .147ft Dcr= .411ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .169ft Dcr= .468ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .251ft Dcr= .658ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .586ft Dcr= 1.162ft CRIT.DEPTH Hev= .00ft
INLET CONTROL... Submerged: HW =2.31
INLET CONTROL... Submerged: HW =2.76
INLET CONTROL... Submerged: HW =3.20
FULL FLOW...Lfull=112.82ft Vh=1.267ft HL=3.384ft Hev= .00ft
FULL FLOW...Lfull=115.54ft Vh=1.464ft HL=3.963ft Hev= .00ft
FULL FLOW...Lfull=116.79ft Vh=1.660ft HL=4.521ft Hev= .00ft
FULL FLOW...Lfull=117.01ft Vh=1.855ft HL=5.057ft Hev= .00ft

Outlet Structure	
Outlet Structure Type	Riser

Outlet Structure (IDs and Direction)			
Outlet ID	Riser - 1	Downstream ID	Culvert - 1
Flow Direction	Forward Flow Only	Notes	

Outlet Structure (Advanced)			
Elevation (On)	0.00 ft	Elevation (Off)	0.00 ft

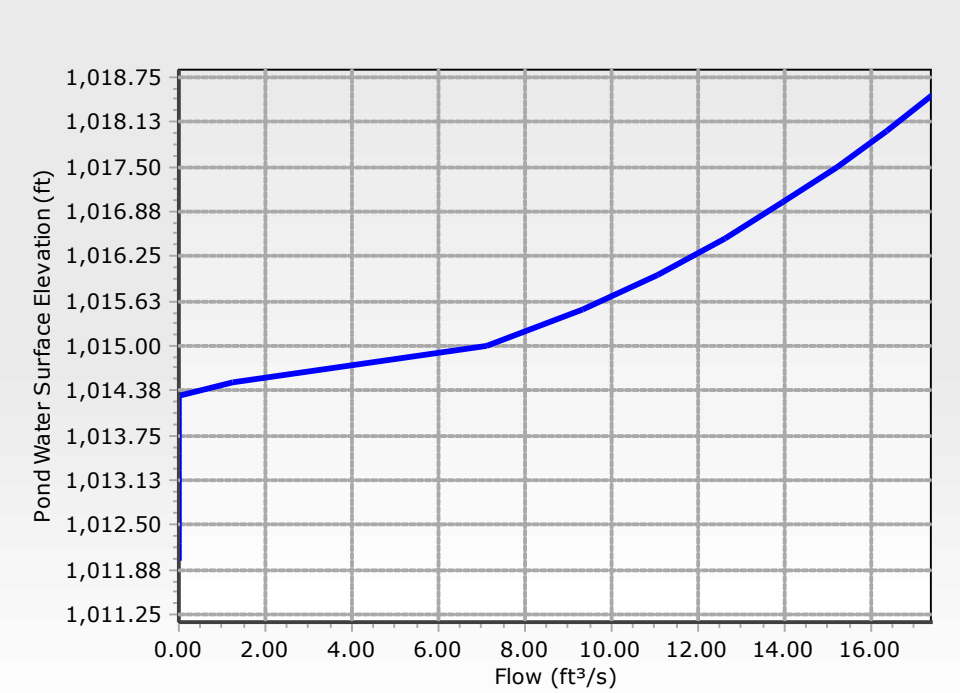
Outlet Structure (Riser)

Composite Outlet Structure Detailed Report: Primary Outlet Structure

Outlet Structure (Riser)			
Riser	Stand Pipe	Transition Elevation	0.00 ft
Diameter	18.0 in	Transition Height	0.00 ft
Weir Coefficient	3.00 (ft^0.5)/s	K Reverse	1.000
Orifice Coefficient	0.600		

Outlet Structure (Common)	
Elevation	1,014.30 ft

Outlet Structure (Riser, Advanced)			
Use Orifice Depth to Crest?	True	Use Submerged Weir Equation?	False



RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Riser - 1 (Stand Pipe)

Upstream ID = (Pond Water Surface)
Downstream ID = Culvert - 1 (Culvert-Circular)

Water Surface Elevation (ft)	Device Flow (ft³/s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)
1,012.00	0.00	0.00	0.00	0.00
1,012.25	0.00	0.00	0.00	1,012.07
1,012.50	0.00	0.00	0.00	1,012.12

Composite Outlet Structure Detailed Report: Primary Outlet Structure

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Riser - 1 (Stand Pipe)

Upstream ID = (Pond Water Surface)
Downstream ID = Culvert - 1 (Culvert-Circular)

Water Surface Elevation (ft)	Device Flow (ft^3/s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)
1,013.00	0.00	0.00	0.00	1,012.16
1,013.25	0.00	0.00	0.00	1,012.17
1,013.50	0.00	0.00	0.00	1,012.27
1,014.00	0.00	0.00	0.00	1,012.59
1,014.30	0.00	0.00	0.00	1,012.67
1,014.50	1.26	1,014.50	Free Outfall	1,012.96
1,015.00	7.12	1,015.00	Free Outfall	1,013.86
1,015.50	9.32	1,015.50	1,014.31	1,014.31
1,016.00	11.09	1,016.00	1,014.76	1,014.76
1,016.50	12.62	1,016.50	1,015.20	1,015.20
1,017.00	13.98	1,017.00	1,015.76	1,015.76
1,017.50	15.21	1,017.50	1,016.31	1,016.31
1,018.00	16.36	1,018.00	1,016.85	1,016.85
1,018.50	17.43	1,018.50	1,017.39	1,017.39

Downstream Hydraulic Grade Line Error (ft)	Convergence Error (ft^3/s)	Downstream Channel Tailwater (ft)	Tailwater Error (ft)	Message
0.00	0.00	(N/A)	0.00	WS below an invert; no flow.
0.00	0.00	(N/A)	0.00	WS below an invert; no flow.
0.00	0.00	(N/A)	0.00	WS below an invert; no flow.
0.00	0.00	(N/A)	0.00	WS below an invert; no flow.
0.00	0.00	(N/A)	0.00	WS below an invert; no flow.
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	

Composite Outlet Structure Detailed Report: Primary Outlet Structure

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Riser - 1 (Stand Pipe)

Upstream ID = (Pond Water Surface)
Downstream ID = Culvert - 1 (Culvert-Circular)

Message
WS below an invert; no flow.
WS below an invert; no flow.
WS below an invert; no flow.
Weir: H =0.2ft
Orifice: H =.70; Riser orifice equation controlling.
FULLY CHARGED RISER: Orifice Equation Control to Crest; H=1.20
FULLY CHARGED RISER: Orifice Equation Control to Crest; H=1.70
FULLY CHARGED RISER: Orifice Equation Control to Crest; H=2.20
FULLY CHARGED RISER: Orifice Equation Control to Crest; H=2.70
FULLY CHARGED RISER: Orifice Equation Control to Crest; H=3.20
FULLY CHARGED RISER: Orifice Equation Control to Crest; H=3.70
FULLY CHARGED RISER: Orifice Equation Control to Crest; H=4.20

Outlet Structure	
Outlet Structure Type	Orifice

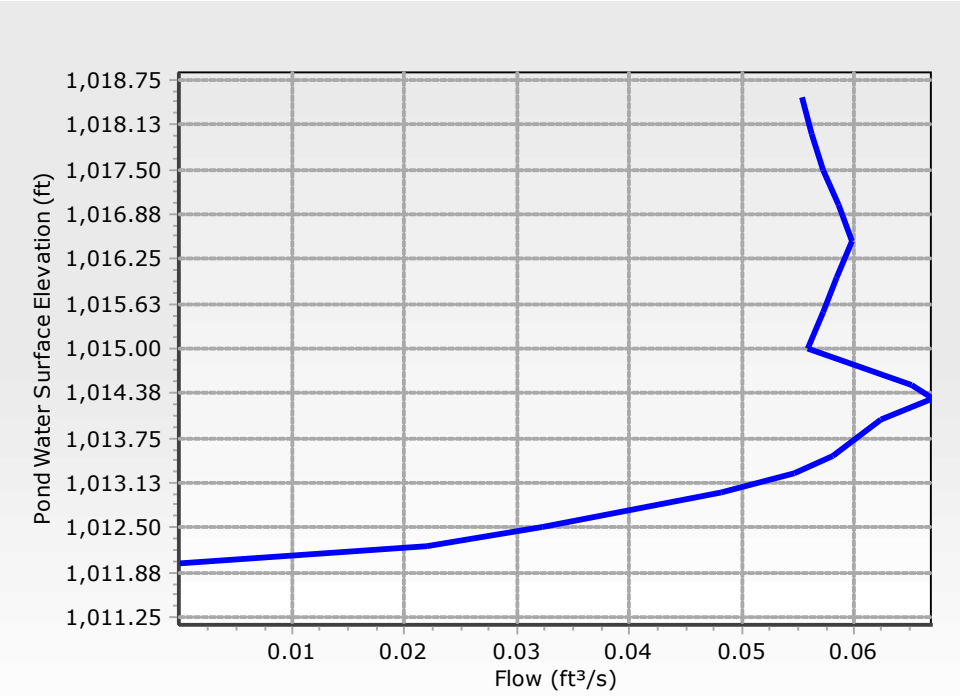
Outlet Structure (IDs and Direction)			
Outlet ID	Orifice - 1	Downstream ID	Culvert - 1
Flow Direction	Forward Flow Only	Notes	

Outlet Structure (Advanced)			
Elevation (On)	0.00 ft	Elevation (Off)	0.00 ft

Outlet Structure (Orifice)			
Orifice	Circular Orifice	Orifice Coefficient	0.600
Number of Openings	2	Orifice Diameter	1.0 in

Outlet Structure (Common)	
Elevation	1,012.00 ft

Composite Outlet Structure Detailed Report: Primary Outlet Structure



RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Orifice - 1 (Orifice-Circular)

Upstream ID = (Pond Water Surface)
Downstream ID = Culvert - 1 (Culvert-Circular)

Water Surface Elevation (ft)	Device Flow (ft³/s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)
1,012.00	0.00	0.00	0.00	0.00
1,012.25	0.02	1,012.25	1,012.07	1,012.07
1,012.50	0.03	1,012.50	1,012.12	1,012.12
1,013.00	0.05	1,013.00	1,012.16	1,012.16
1,013.25	0.05	1,013.25	1,012.17	1,012.17
1,013.50	0.06	1,013.50	1,012.27	1,012.27
1,014.00	0.06	1,014.00	1,012.59	1,012.59
1,014.30	0.07	1,014.30	1,012.67	1,012.67
1,014.50	0.07	1,014.50	1,012.96	1,012.96
1,015.00	0.06	1,015.00	1,013.86	1,013.86
1,015.50	0.06	1,015.50	1,014.31	1,014.31
1,016.00	0.06	1,016.00	1,014.76	1,014.76
1,016.50	0.06	1,016.50	1,015.20	1,015.20
1,017.00	0.06	1,017.00	1,015.76	1,015.76
1,017.50	0.06	1,017.50	1,016.31	1,016.31
1,018.00	0.06	1,018.00	1,016.85	1,016.85
1,018.50	0.06	1,018.50	1,017.39	1,017.39

Composite Outlet Structure Detailed Report: Primary Outlet Structure

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Orifice - 1 (Orifice-Circular)

Upstream ID = (Pond Water Surface)
Downstream ID = Culvert - 1 (Culvert-Circular)

Downstream Hydraulic Grade Line Error (ft)	Convergence Error (ft^3/s)	Downstream Channel Tailwater (ft)	Tailwater Error (ft)
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00

Message
WS below an invert; no flow.
H =.18
H =.38
H =.84
H =1.08
H =1.23
H =1.41
H =1.63
H =1.54
H =1.14
H =1.19
H =1.24
H =1.30
H =1.24
H =1.19
H =1.15
H =1.11

Outlet Structure	
Outlet Structure Type	Orifice

Outlet Structure (IDs and Direction)

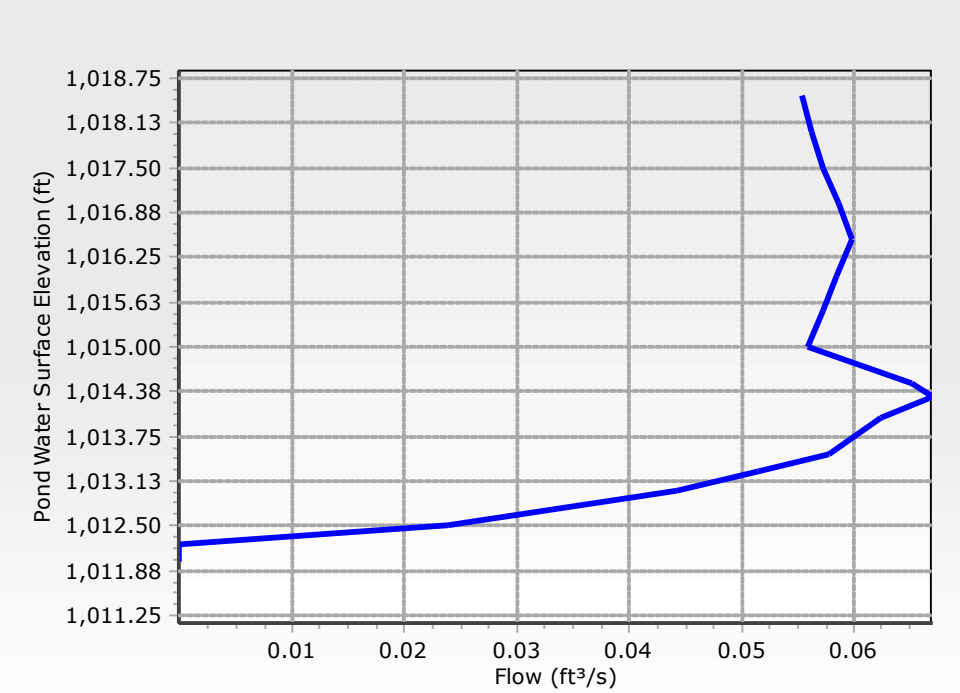
Composite Outlet Structure Detailed Report: Primary Outlet Structure

Outlet Structure (IDs and Direction)			
Outlet ID	Orifice - 2	Downstream ID	Culvert - 1
Flow Direction	Forward Flow Only	Notes	

Outlet Structure (Advanced)			
Elevation (On)	0.00 ft	Elevation (Off)	0.00 ft

Outlet Structure (Orifice)			
Orifice	Circular Orifice	Orifice Coefficient	0.600
Number of Openings	2	Orifice Diameter	1.0 in

Outlet Structure (Common)	
Elevation	1,012.25 ft



RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Orifice - 2 (Orifice-Circular)

Upstream ID = (Pond Water Surface)
Downstream ID = Culvert - 1 (Culvert-Circular)

Water Surface Elevation (ft)	Device Flow (ft³/s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)

Composite Outlet Structure Detailed Report: Primary Outlet Structure

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Orifice - 2 (Orifice-Circular)

Upstream ID = (Pond Water Surface)
Downstream ID = Culvert - 1 (Culvert-Circular)

Water Surface Elevation (ft)	Device Flow (ft^3/s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)
1,012.00	0.00	0.00	0.00	0.00
1,012.25	0.00	0.00	0.00	1,012.07
1,012.50	0.02	1,012.50	Free Outfall	1,012.12
1,013.00	0.04	1,013.00	Free Outfall	1,012.16
1,013.25	0.05	1,013.25	Free Outfall	1,012.17
1,013.50	0.06	1,013.50	1,012.27	1,012.27
1,014.00	0.06	1,014.00	1,012.59	1,012.59
1,014.30	0.07	1,014.30	1,012.67	1,012.67
1,014.50	0.07	1,014.50	1,012.96	1,012.96
1,015.00	0.06	1,015.00	1,013.86	1,013.86
1,015.50	0.06	1,015.50	1,014.31	1,014.31
1,016.00	0.06	1,016.00	1,014.76	1,014.76
1,016.50	0.06	1,016.50	1,015.20	1,015.20
1,017.00	0.06	1,017.00	1,015.76	1,015.76
1,017.50	0.06	1,017.50	1,016.31	1,016.31
1,018.00	0.06	1,018.00	1,016.85	1,016.85
1,018.50	0.06	1,018.50	1,017.39	1,017.39

Downstream Hydraulic Grade Line Error (ft)	Convergence Error (ft^3/s)	Downstream Channel Tailwater (ft)	Tailwater Error (ft)
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00

Message
WS below an invert; no flow.
WS below an invert; no flow.

Composite Outlet Structure Detailed Report: Primary Outlet Structure

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Orifice - 2 (Orifice-Circular)

Upstream ID = (Pond Water Surface)
Downstream ID = Culvert - 1 (Culvert-Circular)

Message
H =.21
H =.71
H =.96
H =1.21
H =1.41
H =1.63
H =1.54
H =1.14
H =1.19
H =1.24
H =1.30
H =1.24
H =1.19
H =1.15
H =1.11

Outlet Structure			
Outlet Structure Type	Orifice		

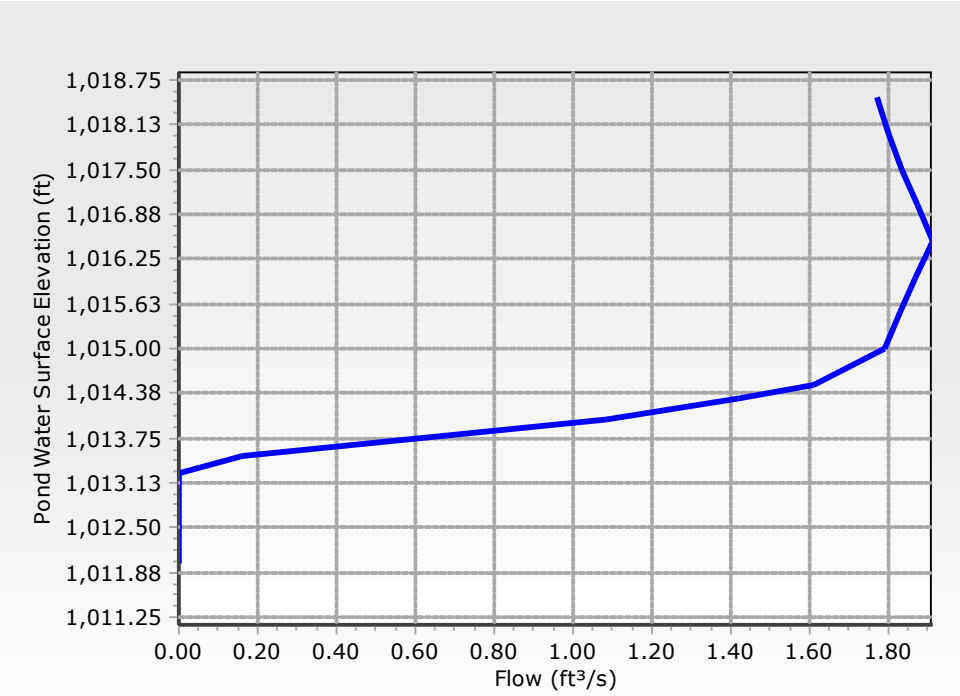
Outlet Structure (IDs and Direction)			
Outlet ID	Orifice - 3	Downstream ID	Culvert - 1
Flow Direction	Forward Flow Only	Notes	

Outlet Structure (Advanced)			
Elevation (On)	0.00 ft	Elevation (Off)	0.00 ft

Outlet Structure (Orifice)			
Orifice	Circular Orifice	Orifice Coefficient	0.600
Number of Openings	1	Orifice Diameter	8.0 in

Outlet Structure (Common)	
Elevation	1,013.25 ft

Composite Outlet Structure Detailed Report: Primary Outlet Structure



RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Orifice - 3 (Orifice-Circular)

Upstream ID = (Pond Water Surface)
Downstream ID = Culvert - 1 (Culvert-Circular)

Water Surface Elevation (ft)	Device Flow (ft³/s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)
1,012.00	0.00	0.00	0.00	0.00
1,012.25	0.00	0.00	0.00	1,012.07
1,012.50	0.00	0.00	0.00	1,012.12
1,013.00	0.00	0.00	0.00	1,012.16
1,013.25	0.00	0.00	0.00	1,012.17
1,013.50	0.16	1,013.50	Free Outfall	1,012.27
1,014.00	1.08	1,014.00	Free Outfall	1,012.59
1,014.30	1.42	1,014.30	Free Outfall	1,012.67
1,014.50	1.61	1,014.50	Free Outfall	1,012.96
1,015.00	1.79	1,015.00	1,013.86	1,013.86
1,015.50	1.83	1,015.50	1,014.31	1,014.31
1,016.00	1.87	1,016.00	1,014.76	1,014.76
1,016.50	1.91	1,016.50	1,015.20	1,015.20
1,017.00	1.87	1,017.00	1,015.76	1,015.76
1,017.50	1.83	1,017.50	1,016.31	1,016.31
1,018.00	1.80	1,018.00	1,016.85	1,016.85
1,018.50	1.77	1,018.50	1,017.39	1,017.39

Composite Outlet Structure Detailed Report: Primary Outlet Structure

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Orifice - 3 (Orifice-Circular)

Upstream ID = (Pond Water Surface)
Downstream ID = Culvert - 1 (Culvert-Circular)

Downstream Hydraulic Grade Line Error (ft)	Convergence Error (ft^3/s)	Downstream Channel Tailwater (ft)	Tailwater Error (ft)
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00

Message
WS below an invert; no flow.
WS below an invert; no flow.
WS below an invert; no flow.
WS below an invert; no flow.
WS below an invert; no flow.
CRIT.DEPTH CONTROL Vh= .066ft Dcr= .184ft CRIT.DEPTH Hev= .00ft
H =.42
H =.72
H =.92
H =1.14
H =1.19
H =1.24
H =1.30
H =1.24
H =1.19
H =1.15
H =1.11

Composite Outlet Structure Detailed Report: Primary Outlet Structure

Composite Rating Table
Tailwater Elevation = Free Outfall (Primary Outlet Structure)

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
1,012.00	0.00	(N/A)	0.00
1,012.25	0.02	(N/A)	0.00
1,012.50	0.06	(N/A)	0.00
1,013.00	0.09	(N/A)	0.00
1,013.25	0.11	(N/A)	0.00
1,013.50	0.28	(N/A)	0.00
1,014.00	1.21	(N/A)	0.00
1,014.30	1.55	(N/A)	0.00
1,014.50	3.00	(N/A)	0.00
1,015.00	9.01	(N/A)	0.00
1,015.50	11.25	(N/A)	0.00
1,016.00	13.07	(N/A)	0.00
1,016.50	14.64	(N/A)	0.00
1,017.00	15.96	(N/A)	0.00
1,017.50	17.15	(N/A)	0.00
1,018.00	18.27	(N/A)	0.00
1,018.50	19.31	(N/A)	0.00

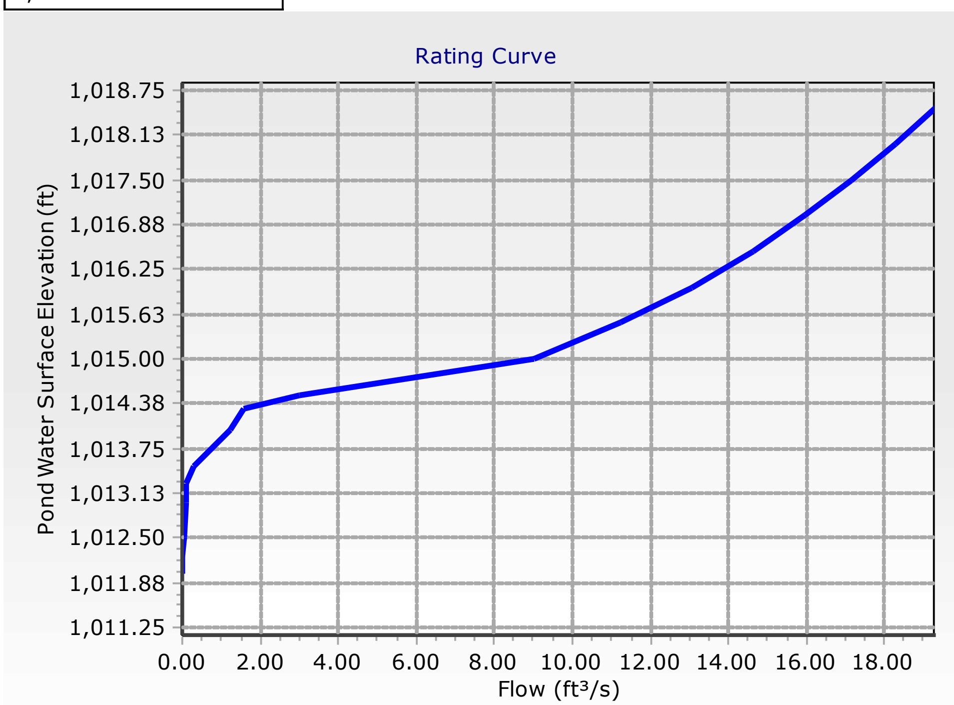
Contributing Structures
(no Q: Orifice - 2,Orifice - 3,Riser - 1,Orifice - 1,Culvert - 1)
Orifice - 1,Culvert - 1 (no Q: Orifice - 2,Orifice - 3,Riser - 1)
Orifice - 2,Orifice - 1,Culvert - 1 (no Q: Orifice - 3,Riser - 1)
Orifice - 2,Orifice - 1,Culvert - 1 (no Q: Orifice - 3,Riser - 1)
Orifice - 2,Orifice - 1,Culvert - 1 (no Q: Orifice - 3,Riser - 1)
Orifice - 2,Orifice - 3,Orifice - 1,Culvert - 1 (no Q: Riser - 1)
Orifice - 2,Orifice - 3,Orifice - 1,Culvert - 1 (no Q: Riser - 1)
Orifice - 2,Orifice - 3,Orifice - 1,Culvert - 1 (no Q: Riser - 1)
Orifice - 2,Orifice - 3,Riser - 1,Orifice - 1,Culvert - 1
Orifice - 2,Orifice - 3,Riser - 1,Orifice - 1,Culvert - 1

Composite Outlet Structure Detailed Report: Primary Outlet Structure

Composite Rating Table

Tailwater Elevation = Free Outfall (Primary Outlet Structure)

Contributing Structures
Orifice - 2,Orifice - 3,Riser - 1,Orifice - 1,Culvert - 1
Orifice - 2,Orifice - 3,Riser - 1,Orifice - 1,Culvert - 1
Orifice - 2,Orifice - 3,Riser - 1,Orifice - 1,Culvert - 1
Orifice - 2,Orifice - 3,Riser - 1,Orifice - 1,Culvert - 1
Orifice - 2,Orifice - 3,Riser - 1,Orifice - 1,Culvert - 1
Orifice - 2,Orifice - 3,Riser - 1,Orifice - 1,Culvert - 1
Orifice - 2,Orifice - 3,Riser - 1,Orifice - 1,Culvert - 1



Composite Outlet Structure Detailed Report: Emergency Spillway

Element Details			
Label	Emergency Spillway	Notes	

Headwater Range			
Headwater Type	Use Pond for Headwater Range	Maximum (Headwater)	1,018.50 ft
Pond	Detention Pond	Increment (Headwater)	0.50 ft
Minimum (Headwater)	1,012.00 ft		

SpotElevation (ft)

Tailwater Setup	
Tailwater Type	Free Outfall

Tailwater Tolerances			
Maximum Iterations	30	Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft	Flow Tolerance (Minimum)	0.001 ft³/s
Headwater Tolerance (Maximum)	0.50 ft	Flow Tolerance (Maximum)	10.000 ft³/s
Tailwater Tolerance (Minimum)	0.01 ft		

Outlet Structure	
Outlet Structure Type	Weir

Outlet Structure (IDs and Direction)			
Outlet ID	Weir	Downstream ID	Tailwater
Flow Direction	Forward Flow Only	Notes	

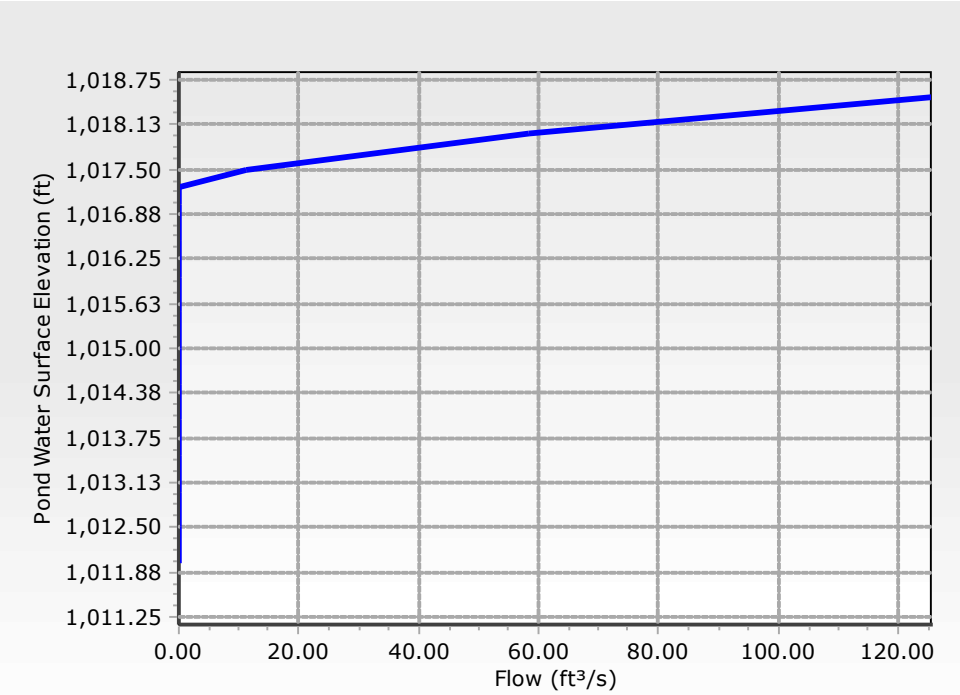
Outlet Structure (Advanced)			
Elevation (On)	0.00 ft	Elevation (Off)	0.00 ft

Outlet Structure (Weir)			
Weir	Rectangular Weir	Rectangular Weir	Suppressed
Vary Coefficient with Depth	False	Weir Length	30.00 ft
Weir Coefficient	3.00 (ft^0.5)/s		

Outlet Structure (Common)	
Elevation	1,017.25 ft

Composite Outlet Structure Detailed Report: Emergency Spillway

Outlet Structure (Weir, Advanced)	
User Defined Table	False



RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Weir - 1 (Rectangular Weir)

Upstream ID = (Pond Water Surface)
Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)
1,012.00	0.00	(N/A)	0.00
1,012.50	0.00	(N/A)	0.00
1,013.00	0.00	(N/A)	0.00
1,013.50	0.00	(N/A)	0.00
1,014.00	0.00	(N/A)	0.00
1,014.50	0.00	(N/A)	0.00
1,015.00	0.00	(N/A)	0.00
1,015.50	0.00	(N/A)	0.00
1,016.00	0.00	(N/A)	0.00
1,016.50	0.00	(N/A)	0.00
1,017.00	0.00	(N/A)	0.00
1,017.25	0.00	(N/A)	0.00
1,017.50	11.25	(N/A)	0.00
1,018.00	58.46	(N/A)	0.00

Composite Outlet Structure Detailed Report: Emergency Spillway

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Weir - 1 (Rectangular Weir)

Upstream ID = (Pond Water Surface)
Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
1,018.50	125.78	(N/A)	0.00

Computation Messages
HW & TW below Inv.El.=1017.250
HW & TW below Inv.El.=1017.250
HW & TW below Inv.El.=1017.250
HW & TW below Inv.El.=1017.250
HW & TW below Inv.El.=1017.250
HW & TW below Inv.El.=1017.250
HW & TW below Inv.El.=1017.250
HW & TW below Inv.El.=1017.250
HW & TW below Inv.El.=1017.250
HW & TW below Inv.El.=1017.250
HW & TW below Inv.El.=1017.250
H=.00; Htw=.00; Qfree=.00;
H=.25; Htw=.00; Qfree=11.25;
H=.75; Htw=.00; Qfree=58.46;
H=1.25; Htw=.00; Qfree=125.78;

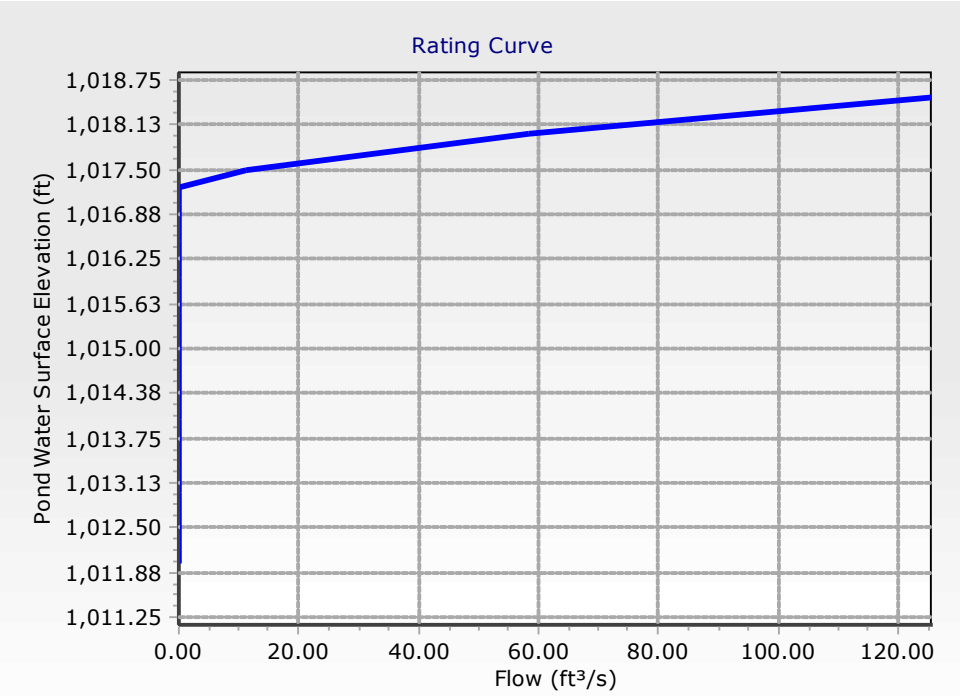
Composite Outlet Structure Detailed Report: Emergency Spillway

Composite Rating Table
Tailwater Elevation = Free Outfall (Emergency Spillway)

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
1,012.00	0.00	(N/A)	0.00
1,012.50	0.00	(N/A)	0.00
1,013.00	0.00	(N/A)	0.00
1,013.50	0.00	(N/A)	0.00
1,014.00	0.00	(N/A)	0.00
1,014.50	0.00	(N/A)	0.00
1,015.00	0.00	(N/A)	0.00
1,015.50	0.00	(N/A)	0.00
1,016.00	0.00	(N/A)	0.00
1,016.50	0.00	(N/A)	0.00
1,017.00	0.00	(N/A)	0.00
1,017.25	0.00	(N/A)	0.00
1,017.50	11.25	(N/A)	0.00
1,018.00	58.46	(N/A)	0.00
1,018.50	125.78	(N/A)	0.00

Contributing Structures
None Contributing
None Contributing
None Contributing
None Contributing
None Contributing
None Contributing
None Contributing
None Contributing
None Contributing
None Contributing
None Contributing
Weir - 1
Weir - 1
Weir - 1
Weir - 1

Composite Outlet Structure Detailed Report: Emergency Spillway



STORM SEWER NOTES:
1. All construction shall be in accordance with the latest edition of the City of Lee's Summit "DESIGN AND CONSTRUCTION MANUAL".
2. All pipe to be HDPE with smooth interior with a minimum "n" value of 0.011
3. Contractor shall verify the exact location and depth of all existing utilities prior to construction.
4. Elevations are called out to top of curb, top of pavement, or top of structure, unless otherwise noted.
5. See Storm Water Report for pipe sizing.
6. Parking lot grading shall be performed to route storm water as directed to the storm collection system.

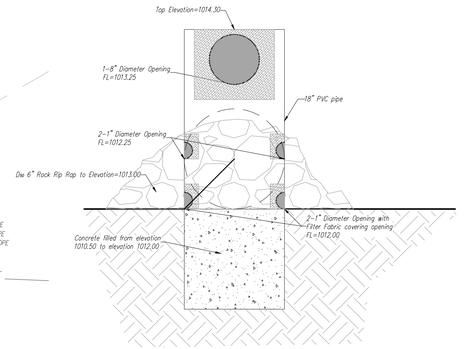
Detention Pond Details:

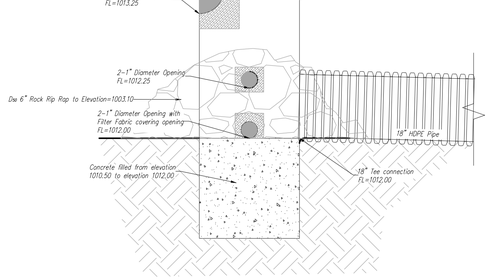
Elevation (feet)	Surf.Area (sq-ft)	Cum.Store (cubic-feet)
1012	52	0
1013	14,200	7,127
1014	15,477	21,965
1015	16,796	38,102
1016	18,158	55,580
1016.74	19,193	69,731 (100 year storage)
1017	19,577	74,448

Detention release was sized by Bentley PondPACK V8i and is sized to release the 100-year storm event over the proposed rip rap lined channel.

The APWA 5600 allowable minimum releases for 6.3 acres are:

2 year - 3.15 cfs
10 year - 12.60 cfs
100 year - 18.90 cfs





Detention Release Structure
NTS

Contractor to verify all invert elevations for existing sewer connections. Contact civil engineer if conflict arises.

PROJECT BENCHMARK:

#1 Iron bar at north west corner of property.
N 1006947.3760
E 2823375.6230
TOP ELEV. 1021.42

Know what's below.
Call before you dig.

KEY

PROPOSED		EXISTING
979	Grades	960
	100 Year Overflow	
	Drainage Area	

SCALE IN FEET: 0, 30', 45', 60'

Contractor to verify all invert elevations for existing sewer connections. Contact civil engineer if conflict arises.

NO.	REVISION	DATE	BY	CK/APP

STATE OF MISSOURI
R. KEVIN STERRETT
NUMBER 2006026873
LICENSED PROFESSIONAL ENGINEER
8/06/18

R. KEVIN STERRETT, MO E-26440

Consult Inc engineers planners
CORPORATE LICENSE No. E2010005873

PRELIMINARY DEVELOPMENT DRAINAGE AREA MAP

DOUGLAS CORNERS BUILDING
LEE'S SUMMIT - JACKSON COUNTY - MISSOURI

X-REF NO.	18109B
DRAWING NO.	18007
DATE	JUNE 12, 2018
JOB NO.	18007
SHEET OF	6 OF 13

STORM SEWER NOTES:
1. All construction shall be in accordance with the latest edition of the City of Lee's Summit "DESIGN AND CONSTRUCTION MANUAL".
2. All pipe to be HDPE with smooth interior with a minimum "n" value of 0.011
3. Contractor shall verify the exact location and depth of all existing utilities prior to construction.
4. Elevations are called out to top of curb, top of pavement, or top of structure, unless otherwise noted.
5. See Storm Water Report for pipe sizing.
6. Parking lot grading shall be performed to route storm water as directed to the storm collection system.

Detention Pond Details:

Elevation (feet)	Surf.Area (sq-ft)	Cum.Store (cubic-feet)
1012	52	0
1013	14,200	7,127
1014	15,477	21,965
1015	16,796	38,102
1016	18,158	55,580
1016.74	19,193	69,731 (100 year storage)
1017	19,577	74,448

Detention release was sized by Bentley PondPACK V8i and is sized to release the 100-year storm event over the proposed rip rap lined channel.

The APWA 5600 allowable minimum releases for 6.3 acres are:

2 year - 3.15 cfs
10 year - 12.60 cfs
100 year - 18.90 cfs

EXISTING MANHOLE TOP=1023.4 IN (S)=1016.4, 6" PVC OUT (W)=1016.2, 8" PVC

EXISTING CLEAN OUT PER OWNER, POSSIBLE CONNECTION POINT FOR SERVICE LINE FROM GRINDER PUMP ON LOT 2

Project Benchmark Elev=1021.42

720 SF undetained

15' SANITARY SEWER EASEMENT

28' ACCESS EASEMENT

S. LINE 100' MISSOURI PUBLIC SERVICE EASEMENT

TRSH ENCL

Area 1

EXISTING CONCRETE

EXISTING BUILDING

EXISTING SIDEWALK

10' SEWER EASEMENT

Elevation (100 year flood)=1016.74

Outlet Release Structure See Detail on this sheet. FL=1012.00

Top of Overflow FG=1017.25

30' X 20' X 6" Dso Rip Rap

CURB INLET TOP=1014.2 IN (W)=1011.4, 18" HDPE IN (S)=1007.4, 36" HDPE OUT (E)=1007.1, 36" HDPE

12855 SF undetained

END OF PIPE F.A.=1014.3, 15" HDPE

CURB INLET TOP=1018.1 OUT (N)=1015.8, 15" HDPE

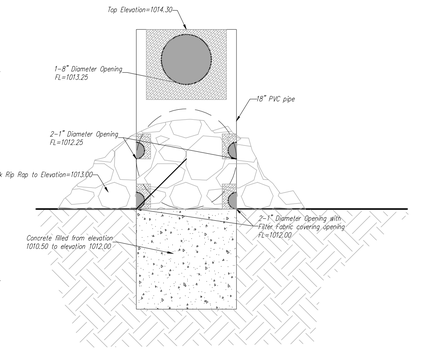
GREASE TRAP

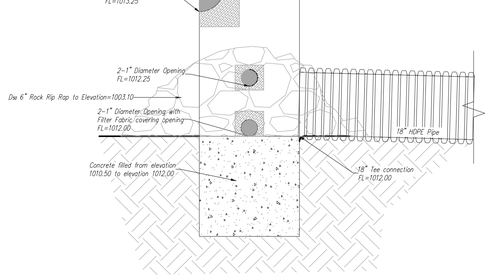
GRINDER PUMP MANHOLE

7.5' U/E

10' SEWER EASEMENT

12''W





Detention Release Structure
NTS

0 30' 45' 60'
SCALE IN FEET

Know what's below.
Call before you dig.

Contractor to verify all invert elevations for existing sewer connections. Contact civil engineer if conflict arises.

PROJECT BENCHMARK:

#1 Iron bar at north west corner of property.
N 1006947.3760
E 2823375.6230
TOP ELEV. 1021.42

KEY

PROPOSED		EXISTING
979	Grades	960
	100 Year Overflow	
	Drainage Area	

Contractor to verify all invert elevations for existing sewer connections. Contact civil engineer if conflict arises.

NO.	REVISION	DATE	BY	CK/APP

© THIS IS NOT A BUILDING SEAL AND THE SIGNATURE IN BLUE INK ON THE PLAN IS A COPY AND MAY CONTAIN UNAUTHORIZED ALTERATIONS. THE CERTIFICATION CONTAINED ON THIS DOCUMENT SHALL NOT APPLY TO ANY COPIES

STATE OF MISSOURI
R. KEVIN STERRETT
NUMBER 2006
LICENSED PROFESSIONAL ENGINEER
8/06/18
R. KEVIN STERRETT | NO. E-26440

Consult Inc engineers planners
CORPORATE LICENSE No. E2010005873

POST DEVELOPMENT DRAINAGE AREA MAP

DOUGLAS CORNERS BUILDING
LEE'S SUMMIT - JACKSON COUNTY - MISSOURI

X-REF NO. 18109B
DRAWING NO. 18007
DATE JUNE 12, 2018
JOB NO. 18007
SHEET 7 OF 13