STORM WATER REPORT

Cobey Creek

Mixed Use Development

Lee's Summit, MO

PREPARED FOR

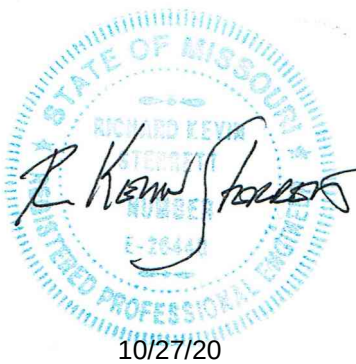
JCM DEVELOPMENT,LLC

PREPARED BY

Hg Consult, Inc

Condensed Version

October, 2020



10/27/20

Content

Report Summary

As requested by the City of Lee's Summit, this condensed report has been prepared to chronicle the changes to the storm system during construction of the first phase of the project and since the storm report was approved. As provided on the content page, 3 addendums have been prepared, based on the 3 changes to the plans. A summary of those addendums and changes are as follows:

Addendum 1

This addendum was prepared prior to construction to address City comments in regard to the north pond design. The addendum addressed the usage of the skimmer and the 40 hour release from the pond , effective height of the pond and the need to design the pond to TR-60 requirements and the energy dissipation design at the out of the discharge ping from the pond.

Addendum 2

This addendum addressed the change of the geometric shape of the south detention pond outlet structure after construction began. The approved design called for a circular structure. It was found that the circular manhole could not be cast, based on the size and a square structure was to take its place. Calculations confirmed that the geometric shape change did not impact the hydraulic design or flow of the pond.

Addendum 3

This addendum addressed the change of the geometric shape of the outlet structure for the north pond after construction began. For the same reason on the change for the south pond, circular manholes couldn't be cast and a

rectangular structure was substituted for 2 side by side manholes, with again, no impact on the pond flow or hydraulic function.

STORM WATER DRAINAGE REPORT

Cobey Creek

Mixed Use Development

Lee's Summit, MO

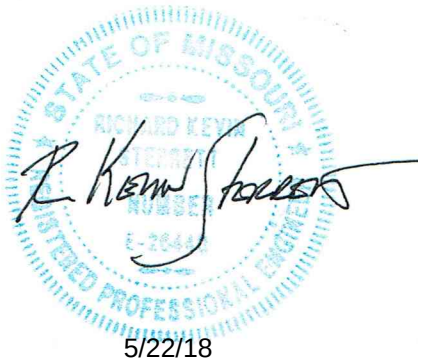
PREPARED FOR

JCM DEVELOPMENT, LLC

PREPARED BY HG

CONSULT, INC.

May 22, 2018



5/22/18

1. Project Overview

The proposed project is a mixed use development. The project will contain 12.7 acres of commercial development and 84.6 acres of mixed residential development and open space. The site is current undeveloped with a lone residential dwelling.

The topography of the site is a gentle slope south to the north, specifically to the north east corner to a creek. Some area along the highway frontage slopes to the south and drains through a culvert pipe under M-150 Highway.

2. Drainage Assessment of the Project Site

Storm drainage for the site will include a full underground system, designed for the 10-year storm event and overland routing of the higher storm events. The majority of the post development site drainage will be regulated at the north east corner of the site with a detention facility, sized for the 2-year, 10-year, and 100-year storm events with the 40-hour extended detention included.

3. 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 or creek, perimeter containment, silt fence, inlet protection, rock ditch checks will be used. The detention pond will utilized as a temporary sediment basin during construction of the early phases of the development. This will be fully addressed in the E, S&C plans with the Phase 1 construction plans. To keep construction traffic from tracking mud onto the adjacent citystreet, 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 APWA 5600.

Post-development water quality will be addressed through the use a release structure sized for the 2-year, 10-year, and 100-year storm events with the 40-hour extended detention included. The owner will need to have a routine maintenance policy for the cleaning, repair and replacement of the detention release structure.

4. Soil Classifications

NRCS Web Soil Survey categorizes the soils on the Cobey Creek site below.

Table 4.1 – Soil Classification

Symbol	Name	Slopes	HSG
10000	Arisburg silt loam	1-5%	C
10082	Sampsel silty clay loam	2-5%	C/D
10117	Sampsel silty clay loam	5-9%	C/D

For this analysis, Soil group C was considered for the Cobey Creek site. Curve Numbers were used in accordance with the APWA 5600.

5. Methodology

The method for evaluating Cobey Creek was the use of a PondPack Model. Both Pre-Development and Post-Development conditions were considered:

PondPack V8i

- TR-55 Unit Hydrograph Method
  - 2-year, 10-year and 100-year Return Frequency storms
  - AMC II Soil Moisture conditions
  - 24-Hour SCS Type II Rainfall Distribution
  - SCS Runoff Curve Numbers per APWA 5600 (Table 5602-3)
  - Time of Concentration developed per TR-55

6. Pre-Development Conditions

This section of the drainage study has been prepared to evaluate the Pre-Development Conditions related to stormwater runoff. The following tables summarize the Pre-Development Conditions Analysis. Refer to the Design Calculations for details regarding the analysis.

Table 6.1 – Pre-Development Watershed Data

Name	Area (acres)	Composite CN	Tc (hrs)
EX1	17.64	75	0.217
EX2	2.43	74	0.145
EX3	89.68	75	0.419
EX4	14.70	74	0.182

Table 6.1 – Pre-Development Discharges

Name	Q2 (cfs)	Q10 (cfs)	Q100 (cfs)
EX1	29.07	61.09	107.36
EX2	4.29	9.17	16.32
EX3	105.54	226.85	403.16
EX4	23.98	51.33	91.04

Per APWA Section 5608.4 and City of Lee's Summit criteria, the post-development discharge rates from the site shall not exceed those indicated below:

- 50% storm peak rate less than or equal to 0.5 cfs per site acre
- 10% storm peak rate less than or equal to 2.0 cfs per site acre
- 1% storm peak rate less than or equal to 3.0 cfs per site acre

APWA allowable releases were calculated for the various points of discharge. Off-site flows were allowed to bypass detention. Off-site flows were calculated using a separate PondPack model. The off-site time of concentrations used the same existing time of concentrations located in Table 6.1 and the areas can be found in Table 6.3. Where detention was not possible, areas of the site were drained to the detention in P3 to reduce the outflow from EX1, EX2, and EX4. Release rates per APWA were added to the off-site discharges to produce the allowable rates.

Table 6.3 – Pre-Development Off-site Watershed Data

Name	Total Area (acres)	On-site Area (acres)	Off-site Area (acres)
EX1	17.82	13.42	4.38
EX2	2.43	2.24	0.19
EX3	89.68	68.35	21.33
EX4	14.70	14.7	0

Table 6.4 – Off-site flow rates

Name	Q2 (cfs)	Q10 (cfs)	Q100 (cfs)
EX1	8.30	16.50	28.11
EX2	0.33	0.70	1.24
EX3	32.55	63.46	106.65
EX4	0	0	0

Table 6.5 – Allowable Peak Flow Rates

Name	Allowable Q2 (cfs)	Allowable Q10 (cfs)	Allowable Q100 (cfs)
EX1	15.01	43.34	68.37
EX2	1.49	5.32	8.17
EX3	66.73	200.16	311.70
EX4	7.35	29.40	44.10

7. Post-Development Conditions

This section of the drainage study has been prepared to evaluate the Post-Development Conditions related to stormwater runoff. The following tables summarize the Post-Development Conditions Analysis. Refer to the Design Calculations for details regarding the analysis.

Table 7.1 – Post-Development Watershed Data

Name	Area (acres)	Composite CN	Tc (hrs)
P1	10.88	84	0.153
P2	0.68	81	0.112
P3	90.04	83	0.364
P4	4.40	82	0.165

Table 7.2 – Post-Development Discharges

Name	Q2 (cfs)	Q10 (cfs)	Q100 (cfs)
P1	29.29	58.87	84.76
P2	1.73	3.27	5.40
P3	56.27	194.07	282.73
P4	10.77	20.01	32.66

All storm events for Areas P2, P3, and P4 will see a decrease in the maximum release rates from Pre-Development Conditions to Post-Development Conditions. Area P1 is does not meet the release requirements. This area will be a separate development that will require detention. The developer will be required to size this separate detention to meeting the allowable release rates located in Table 6.4.

P2 and P4 are fringe areas that do not contain any detention. The 2-year flows for P2 and P4 do not meet the allowable release rates located in Table 6.4. A waiver to the Design and Construction manual will be submitted to the City of Lee's Summit.

P5 on the proposed drainage map is a small fringe area on the backside of the detention pond. This area will be routed to a diversion ditch along the east side of the property and converge with the outlet of the detention pond at the Northeast corner of the property.

APWA 5608.4 also 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 located in the Design Calculations Section.

8. Post-Development 100-year Spillway

APWA 5600 also requires a spillway in the detention pond sized for the 100-year event, assuming 100% clogging of the primary outlet works and zero available storage in the detention pond. The 100-year water surface elevation is 976.0. The spillway was set at an elevation of 976.5 and was sized to provide 1-foot of freeboard. The spillway will be 475-feet in length and riprap will be sized and placed throughout the spillway.

9. Future Conditions

The Cobey Creek site does not have any future developments planned.

10. Conclusions

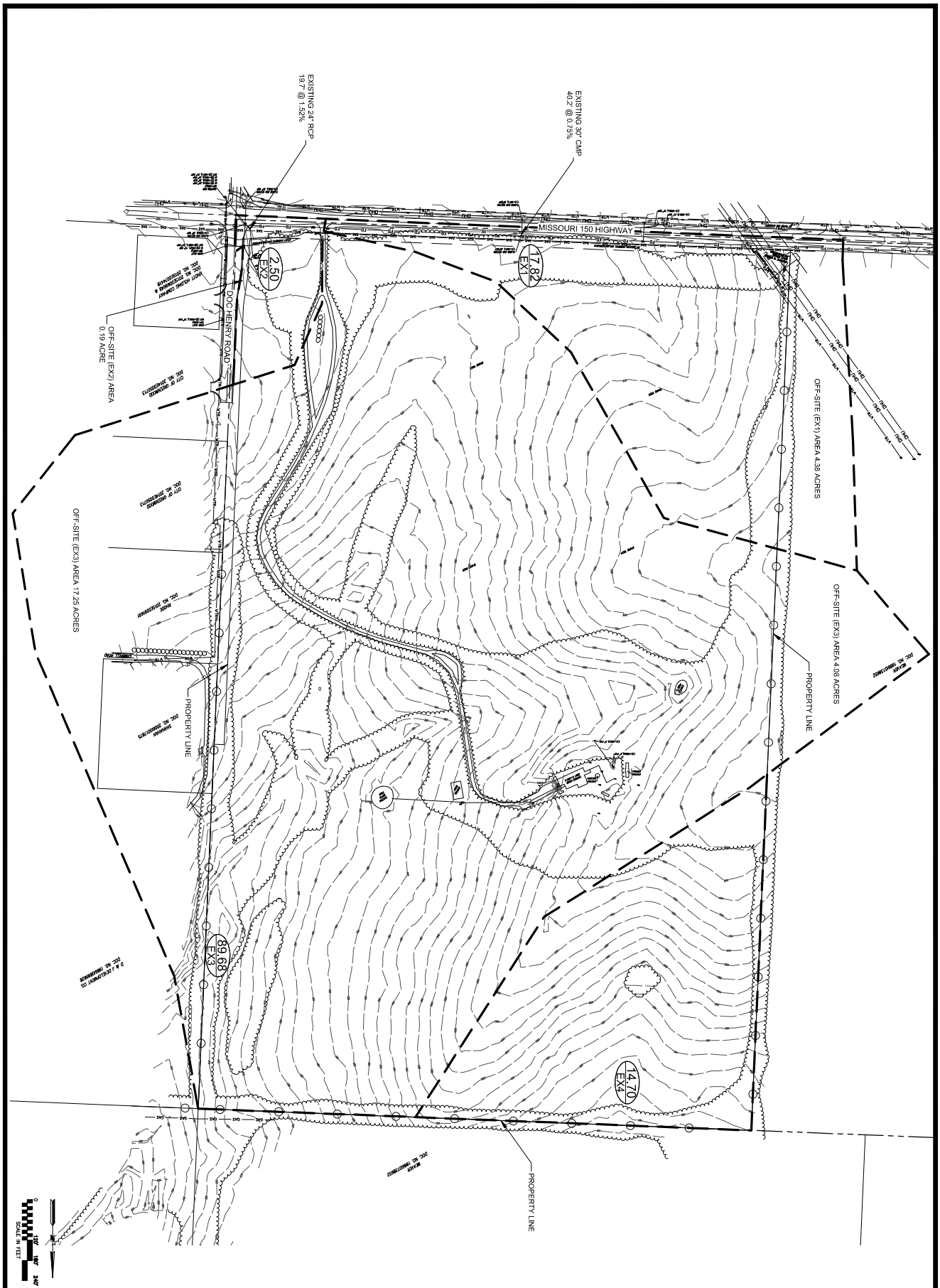
The Cobey Creek project is a mixed use development 186 single family lots, 44 multi-family lots, and 4 commercial lots. The project will contain 12.7 acres of commercial development and 84.6 acres of mixed residential development and open space. The report has been prepared to evaluate the stormwater discharge at the site to ensure the requirements of APWA 5600 are met. The detention pond and release structure was designed to not increase peak discharges from existing conditions as well as meeting the maximum releases from APWA 5600. It is not anticipated that the Cobey Creek Development will have any downstream impacts.

The 2-year flows for P2 and P4 do not meet the allowable release rates located in Table 6.4. A waiver to the Design and Construction manual will be submitted to the City of Lee's Summit.

11. Design Calculations

See the attached for drainage area maps and stormwater calculations.

DRAINAGE AREA MAPS



STORM DRAINAGE REPORT
EXISTING CONDITIONS

COBEY CREEK

CITY OF LEE'S SUMMIT, JACKSON COUNTY, MISSOURI

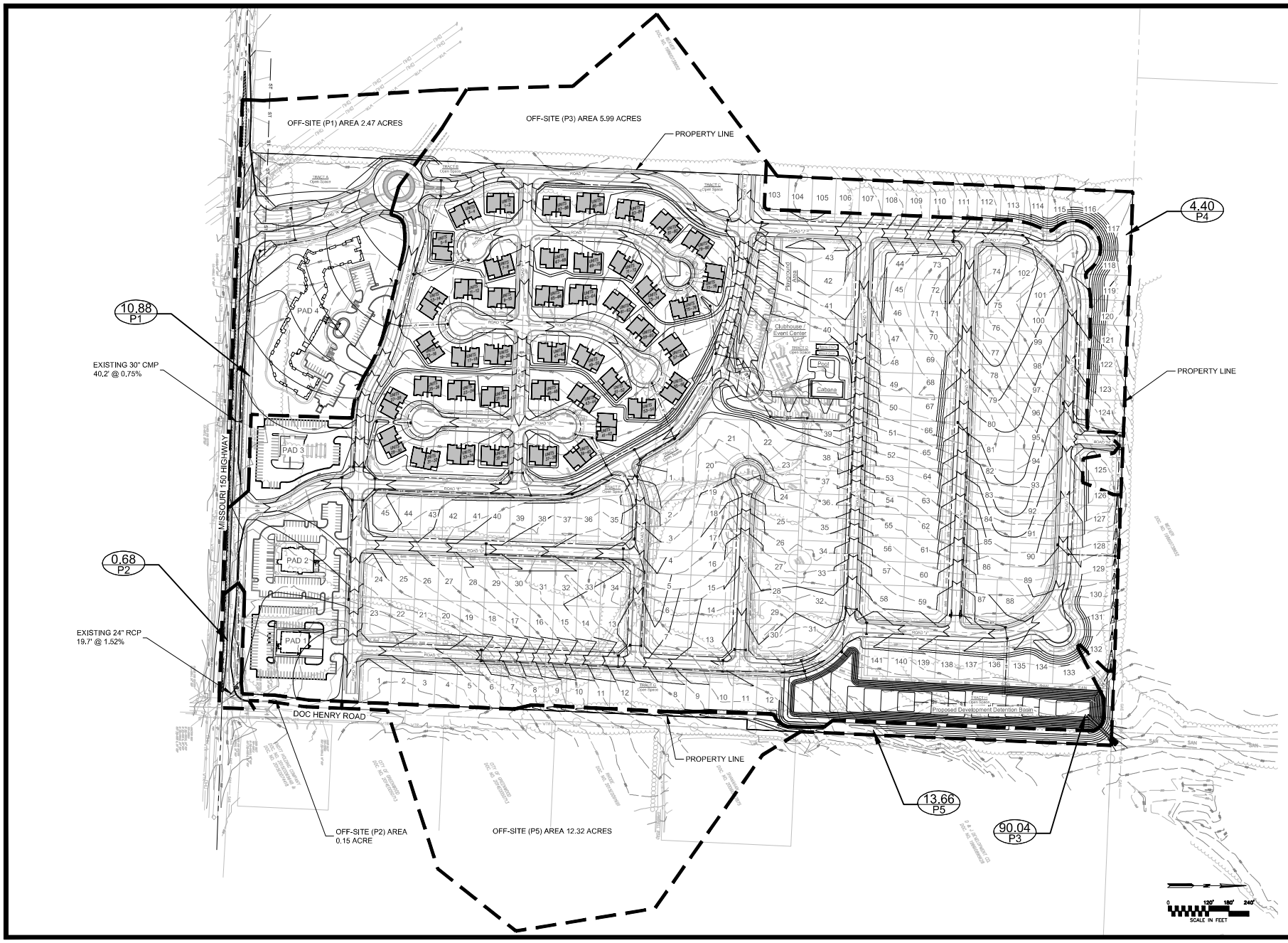
Consult Inc engineers planners
11010 Haskell Street, Suite 210, Kansas City, Kansas 66109
CORPORATE LICENSE No. E20100573 (MO.) / E-1736 (KS.)

R. KEVIN STERRETT, KS E-21889
MO E-26440
Jul 11, 2017

DATE	REVISION	NO.	BY	CK/APP

SHEET NO.	SHEET TITLE
1	16-009 BASE
2	16-009 EXISTING EXHIBIT

DATE: May 5, 2016
PROJECT NO.: 16-009



NO.	BY	DRAWN
DATE	REVISION	

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R. KEVIN STERRETT - KS E-21889 MO E-26440
Jul 11, 2017

Consult Inc engineers planners
11010 Haskell Street, Suite 210, Kansas City, Kansas 66109
CORPORATE LICENSE No. E2010095T3 (MO) / E-2796 (KS)

STORM DRAINAGE REPORT
DEVELOPED CONDITIONS

COBEY CREEK

CITY OF LEE'S SUMMIT, JACKSON COUNTY, MISSOURI

X-REF NO.	16-059 BASE
DRAWING NO.	16-059 PDPs
DATE	May 8, 2018
JOB NO.	16-059
SHEET OF	2 OF 2

SOIL CLASSIFICATIONS

Hydrologic Soil Group—Jackson County, Missouri

Map Scale: 1:4,680 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

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
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- 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: Oct 14, 2014—Oct 10, 2016

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
10000	Arisburg silt loam, 1 to 5 percent slopes	C	60.8	66.3%
10116	Sampsel silty clay loam, 2 to 5 percent slopes	C/D	9.0	9.8%
10117	Sampsel silty clay loam, 5 to 9 percent slopes	C/D	21.9	23.8%
Totals for Area of Interest			**91.7**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

TIME OF CONCENTRATION CALCULATIONS

EX1

	Area	CN	Composite CN
Row Crop	4.4	78	19
Undeveloped	13.4	74	56
Total	**17.8**		**75**

P1

	Area	CN	Composite CN
Row Crop	2.5	78	18
Undeveloped	1.0	74	7
Mixed Use	7.4	88	60
Total	**10.9**		**84**

EX2

	Area	CN	Composite CN
Undeveloped	0.2	74	6
Undeveloped	2.3	74	68
Total	**2.5**		**74**

P2

	Area	CN	Composite CN
Undeveloped	0.2	74	16
Undeveloped	0.2	74	23
Mixed Use	0.3	88	41
Total	**0.7**		**81**

EX3

	Area	CN	Composite CN
Row Crop	4.1	78	4
Residential/Undeveloped	17.3	80	15
Undeveloped	68.4	74	56
Total	**89.7**		**75**

P3

	Area	CN	Composite CN
Row Crop	6.0	78	5
Undeveloped	3.3	74	3
Multi Family	25.8	88	25
Residential	55.0	82	50
Total	**90.0**		**83**

EX4

	Area	CN	Composite CN
Undeveloped	14.7	74	**74**
Total	**14.7**		

P4

	Area	CN	Composite CN
Residential	4.4	82	**82**
Total	**4.4**		

Cobey Creek
Existing
Jackson County, Missouri

Sub-Area Time of Concentration Details

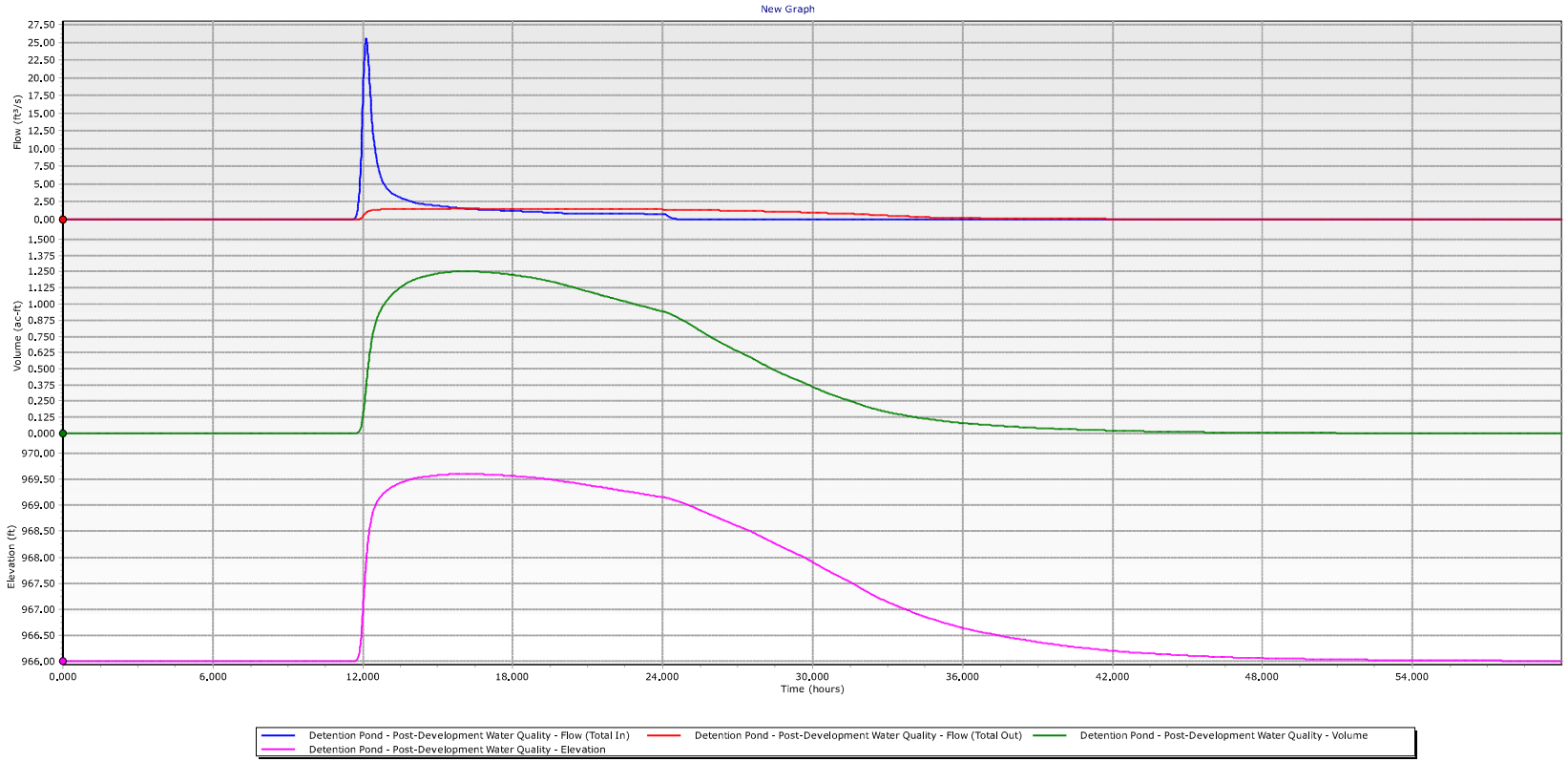
Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
EX3							
SHEET	100	0.0100	0.170				0.228
SHALLOW	1400	0.0330	0.050				0.133
CHANNEL	1520	0.0160	0.030	22.00	17.60	7.280	0.058
					Time of Concentration		.419
EX1							
SHEET	50	0.0140	0.170				0.114
SHALLOW	500	0.0200	0.050				0.061
CHANNEL	910	0.0200	0.030	8.00	10.00	6.019	0.042
					Time of Concentration		.217
EX2							
SHEET	50	0.0150	0.150				0.101
SHALLOW	100	0.0220	0.050				0.012
CHANNEL	350	0.0220	0.050	4.50	8.00	3.038	0.032
					Time of Concentration		.145
EX4							
SHEET	50	0.0120	0.150				0.110
SHALLOW	340	0.0300	0.050				0.034
CHANNEL	730	0.0300	0.050	16.00	15.00	5.336	0.038
					Time of Concentration		.182

Cobey Creek
Proposed
Jackson County, Missouri

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)
P3							
SHEET	100	0.0100	0.170				0.228
SHALLOW	600	0.0160	0.050				0.082
CHANNEL	2950	0.0175	0.013	12.60	12.60	15.175	0.054
					Time of Concentration		.364
P1							
SHEET	50	0.0140	0.170				0.114
SHALLOW	200	0.0200	0.025				0.019
CHANNEL	1000	0.0200	0.013	8.00	10.00	13.889	0.020
					Time of Concentration		.153
P2							
SHEET	50	0.0150	0.150				0.101
SHALLOW	50	0.0220	0.025				0.005
CHANNEL	250	0.0220	0.013	4.50	8.00	11.574	0.006
					Time of Concentration		.112
P4							
SHEET	50	0.0120	0.150				0.110
SHALLOW	100	0.0300	0.050				0.010
CHANNEL	1460	0.0300	0.030	16.00	15.00	9.012	0.045
					Time of Concentration		.165

WATER QUALITY EVENT EXTENDED RELEASE


New Graph
Flow (ft³/s)
27.50
25.00
22.50
20.00
17.50
15.00
12.50
10.00
7.50
5.00
2.50
0.00
Volume (ac-ft)
1.500
1.375
1.250
1.125
1.000
0.875
0.750
0.625
0.500
0.375
0.250
0.125
0.000
Elevation (ft)
970.00
969.50
969.00
968.50
968.00
967.50
967.00
966.50
966.00
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

PONDPACK OUTPUT

COBEY CREEK

Project Summary	
Title	COBEY CREEK
Engineer	Kellen Huffman
Company	Hg Consult, Inc
Date	5/22/2018

Notes

COBEY CREEK

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
P3	Pre-Development Water Quality	1	0.988	12.240	5.37
P3	Post-Development Water Quality	1	2.422	12.130	25.54
P3	Pre-Development 2 year	2	9.729	12.130	105.54
P3	Post-Development 2 year	2	13.945	12.090	169.63
P3	Pre-Development 10 year	10	20.139	12.130	226.85
P3	Post-Development 10 year	10	25.862	12.090	314.25
P3	Pre-Development 100 year	100	35.662	12.120	403.16
P3	Post-Development 100 year	100	42.704	12.090	511.44
P1	Pre-Development Water Quality	1	0.196	12.090	1.62
P1	Post-Development Water Quality	1	0.322	12.010	5.06
P1	Pre-Development 2 year	2	1.933	12.040	29.07
P1	Post-Development 2 year	2	1.756	11.980	29.29
P1	Pre-Development 10 year	10	4.002	12.030	61.09
P1	Post-Development 10 year	10	3.215	11.970	52.87
P1	Pre-Development 100 year	100	7.086	12.010	107.36
P1	Post-Development 100 year	100	5.265	11.970	84.76
P2	Pre-Development Water Quality	1	0.024	12.050	0.21
P2	Post-Development Water Quality	1	0.015	12.010	0.23
P2	Pre-Development 2 year	2	0.258	11.990	4.29
P2	Post-Development 2 year	2	0.097	11.950	1.73
P2	Pre-Development 10 year	10	0.543	11.970	9.17
P2	Post-Development 10 year	10	0.184	11.940	3.27
P2	Pre-Development 100 year	100	0.970	11.970	16.32

COBEY CREEK

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
P2	Post-Development 100 year	100	0.309	11.940	5.40
P4	Pre-Development Water Quality	1	0.141	12.080	1.11
P4	Post-Development Water Quality	1	0.107	12.030	1.58
P4	Pre-Development 2 year	2	1.519	12.010	23.98
P4	Post-Development 2 year	2	0.654	11.990	10.77
P4	Pre-Development 10 year	10	3.192	12.010	51.33
P4	Post-Development 10 year	10	1.228	11.990	20.01
P4	Pre-Development 100 year	100	5.706	11.990	91.04
P4	Post-Development 100 year	100	2.044	11.970	32.66

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
O-3	Pre-Development Water Quality	1	0.988	12.240	5.37
O-3	Post-Development Water Quality	1	2.421	16.040	1.53
O-3	Pre-Development 2 year	2	9.729	12.130	105.54
O-3	Post-Development 2 year	2	13.944	12.470	56.27
O-3	Pre-Development 10 year	10	20.139	12.130	226.85
O-3	Post-Development 10 year	10	25.861	12.290	194.07
O-3	Pre-Development 100 year	100	35.662	12.120	403.16
O-3	Post-Development 100 year	100	42.703	12.310	282.73
O-1	Pre-Development Water Quality	1	0.196	12.090	1.62
O-1	Post-Development Water Quality	1	0.322	12.010	5.06
O-1	Pre-Development 2 year	2	1.933	12.040	29.07

COBEY CREEK

Subsection: Master Network Summary

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
O-1	Post-Development 2 year	2	1.756	11.980	29.29
O-1	Pre-Development 10 year	10	4.002	12.030	61.09
O-1	Post-Development 10 year	10	3.215	11.970	52.87
O-1	Pre-Development 100 year	100	7.086	12.010	107.36
O-1	Post-Development 100 year	100	5.265	11.970	84.76
O-2	Pre-Development Water Quality	1	0.024	12.050	0.21
O-2	Post-Development Water Quality	1	0.015	12.010	0.23
O-2	Pre-Development 2 year	2	0.258	11.990	4.29
O-2	Post-Development 2 year	2	0.097	11.950	1.73
O-2	Pre-Development 10 year	10	0.543	11.970	9.17
O-2	Post-Development 10 year	10	0.184	11.940	3.27
O-2	Pre-Development 100 year	100	0.970	11.970	16.32
O-2	Post-Development 100 year	100	0.309	11.940	5.40
O-4	Pre-Development Water Quality	1	0.141	12.080	1.11
O-4	Post-Development Water Quality	1	0.107	12.030	1.58
O-4	Pre-Development 2 year	2	1.519	12.010	23.98
O-4	Post-Development 2 year	2	0.654	11.990	10.77
O-4	Pre-Development 10 year	10	3.192	12.010	51.33
O-4	Post-Development 10 year	10	1.228	11.990	20.01
O-4	Pre-Development 100 year	100	5.706	11.990	91.04
O-4	Post-Development 100 year	100	2.044	11.970	32.66

Pond Summary

COBEY CREEK

Subsection: Master Network Summary

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
Detention Pond (IN)	Post-Development Water Quality	1	2.422	12.130	25.54	(N/A)	(N/A)
Detention Pond (OUT)	Post-Development Water Quality	1	2.421	16.040	1.53	969.60	1.254
Detention Pond (IN)	Post-Development 2 year	2	13.945	12.090	169.63	(N/A)	(N/A)
Detention Pond (OUT)	Post-Development 2 year	2	13.944	12.470	56.27	972.74	5.248
Detention Pond (IN)	Post-Development 10 year	10	25.862	12.090	314.25	(N/A)	(N/A)
Detention Pond (OUT)	Post-Development 10 year	10	25.861	12.290	194.07	974.17	7.988
Detention Pond (IN)	Post-Development 100 year	100	42.704	12.090	511.44	(N/A)	(N/A)
Detention Pond (OUT)	Post-Development 100 year	100	42.703	12.310	282.73	976.00	12.018

PONDPACK SPILLWAY OUTPUT

COBEY CREEK-SPILLWAY

Project Summary	
Title	COBEY CREEK-SPILLWAY
Engineer	Kellen Huffman
Company	Hg Consult, Inc
Date	5/22/2018

Notes

COBEY CREEK-SPILLWAY

Subsection: Master Network Summary

Catchments Summary

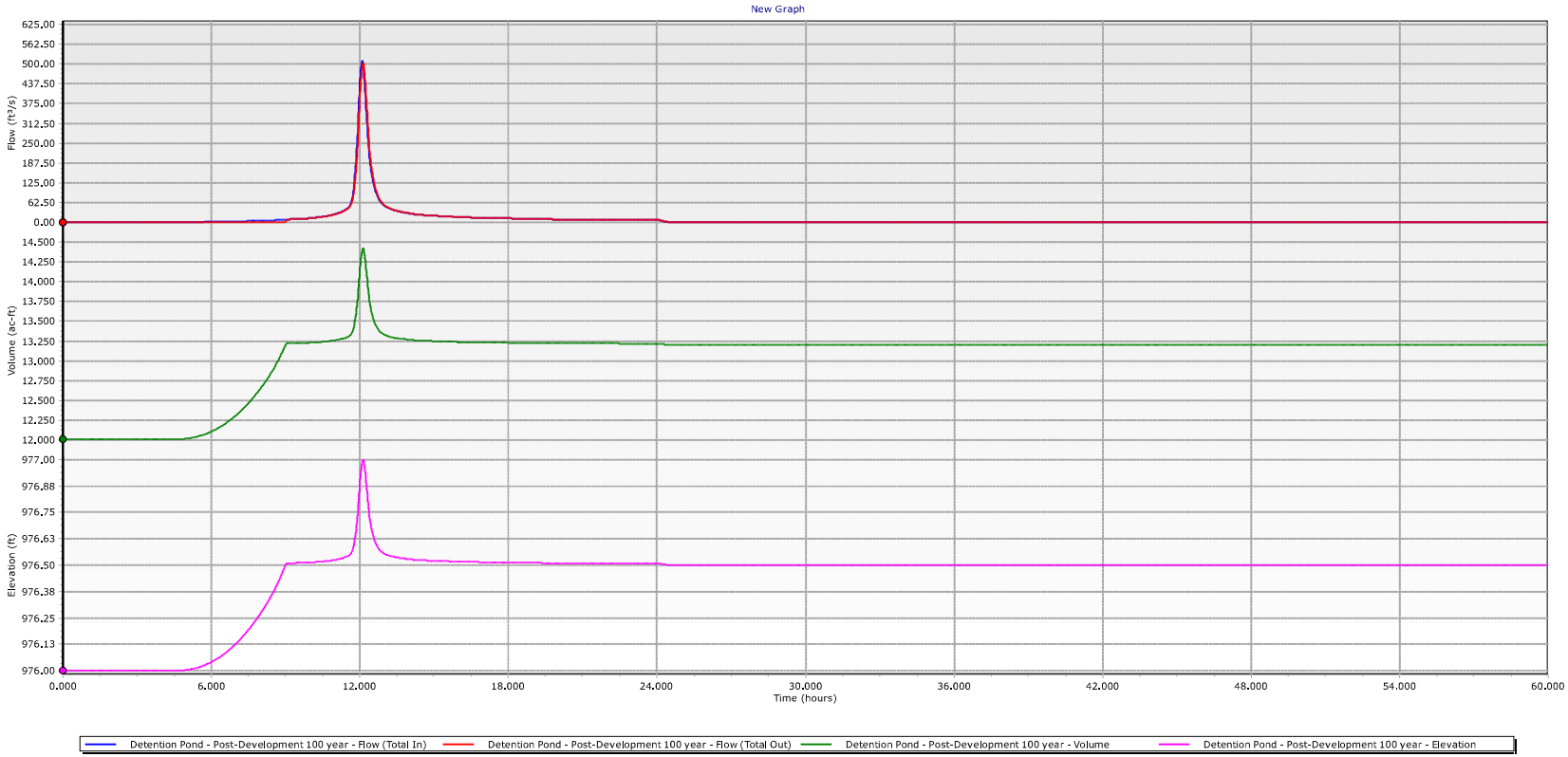
Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
P3	Post-Development 100 year	100	42.704	12.090	511.44

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
O-3	Post-Development 100 year	100	41.518	12.130	502.73

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
Detention Pond (IN)	Post-Development 100 year	100	42.704	12.090	511.44	(N/A)	(N/A)
Detention Pond (OUT)	Post-Development 100 year	100	41.518	12.130	502.73	977.00	14.420


New Graph
Flow (ft³/s)
625.00
562.50
500.00
437.50
375.00
312.50
250.00
187.50
125.00
62.50
0.00
Volume (ac-ft)
14.500
14.250
14.000
13.750
13.500
13.250
13.000
12.750
12.500
12.250
12.000
Elevation (ft)
977.00
976.88
976.75
976.63
976.50
976.38
976.25
976.13
976.00
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

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

Element Details			
Label	Composite Outlet Structure - 1	Notes	

Headwater Range			
Headwater Type	Use Pond for Headwater Range	Maximum (Headwater)	979.00 ft
Pond	Detention Pond	Increment (Headwater)	0.50 ft
Minimum (Headwater)	964.70 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

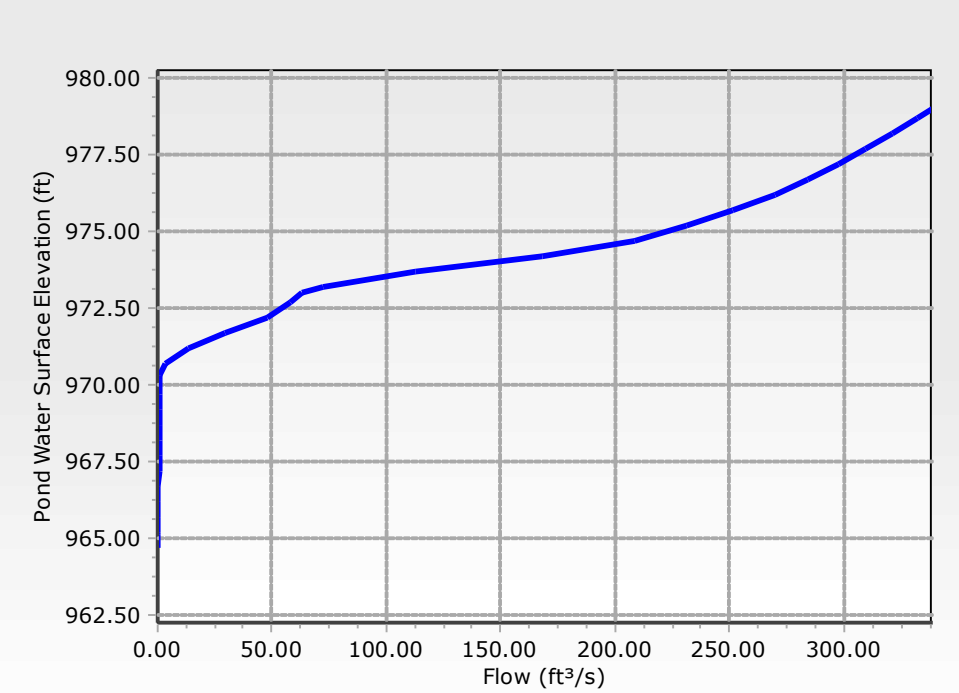
Culvert Data			
Number of Barrels	2	Downstream Invert	964.20 ft
Length	102.32 ft	Diameter	48.0 in
Upstream Invert	964.70 ft		

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

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

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: 127.65 ft³/s
Upstream ID = Orifice - 3, Riser - 2, Orifice - 1, Riser - 1, Orifice - 2
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)

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

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

Mannings open channel maximum capacity: 127.65 ft³/s
Upstream ID = Orifice - 3, Riser - 2, Orifice - 1, Riser - 1, Orifice - 2
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)
964.70	0.00	0.00	0.00	Free Outfall
965.10	0.12	964.80	Free Outfall	Free Outfall
965.20	0.16	964.81	Free Outfall	Free Outfall
965.70	0.30	964.85	Free Outfall	Free Outfall
966.20	0.35	964.87	Free Outfall	Free Outfall
966.70	0.41	964.88	Free Outfall	Free Outfall
967.20	0.49	964.90	Free Outfall	Free Outfall
967.70	0.52	964.90	Free Outfall	Free Outfall
968.20	0.56	964.92	Free Outfall	Free Outfall
968.70	0.62	964.92	Free Outfall	Free Outfall
969.20	0.66	964.93	Free Outfall	Free Outfall
969.70	0.68	964.93	Free Outfall	Free Outfall
970.20	0.72	964.94	Free Outfall	Free Outfall
970.30	0.72	964.94	Free Outfall	Free Outfall
970.70	3.53	965.24	Free Outfall	Free Outfall
971.20	13.78	965.78	Free Outfall	Free Outfall
971.70	29.56	966.31	Free Outfall	Free Outfall
972.20	47.61	966.78	Free Outfall	Free Outfall
972.70	57.94	967.01	Free Outfall	Free Outfall
973.00	63.26	967.13	Free Outfall	Free Outfall
973.20	72.53	967.32	Free Outfall	Free Outfall
973.70	112.93	968.07	Free Outfall	Free Outfall
974.20	167.95	969.00	Free Outfall	Free Outfall
974.70	208.39	969.66	Free Outfall	Free Outfall
975.20	230.98	970.13	Free Outfall	Free Outfall
975.70	251.77	970.63	Free Outfall	Free Outfall
976.20	270.41	971.12	Free Outfall	Free Outfall
976.70	284.48	971.51	Free Outfall	Free Outfall
977.20	297.36	971.89	Free Outfall	Free Outfall
977.70	309.66	972.26	Free Outfall	Free Outfall
978.20	321.29	972.63	Free Outfall	Free Outfall
978.70	332.45	973.00	Free Outfall	Free Outfall
979.00	338.98	973.22	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

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

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

Mannings open channel maximum capacity: 127.65 ft³/s
Upstream ID = Orifice - 3, Riser - 2, Orifice - 1, Riser - 1, Orifice - 2
Downstream ID = Tailwater (Pond 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	0.00	(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	0.00	(N/A)	0.00
0.00	0.06	(N/A)	0.00
0.00	0.04	(N/A)	0.00
0.00	0.02	(N/A)	0.00
0.00	0.01	(N/A)	0.00
0.00	0.01	(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.
CRIT.DEPTH CONTROL Vh= .023ft Dcr= .068ft H.JUMP IN PIPE Hev= .00ft
CRIT.DEPTH CONTROL Vh= .026ft Dcr= .079ft CRIT.DEPTH Hev= .00ft

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

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

Mannings open channel maximum capacity: 127.65 ft³/s
Upstream ID = Orifice - 3, Riser - 2, Orifice - 1, Riser - 1, Orifice - 2
Downstream ID = Tailwater (Pond Outfall)

Message
CRIT.DEPTH CONTROL Vh= .037ft Dcr= .109ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .040ft Dcr= .119ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .044ft Dcr= .130ft CRIT.DEPTH Hev= .00ft
FLOW PRECEDENCE SET TO UPSTREAM CONTROLLING STRUCTURE
FLOW PRECEDENCE SET TO UPSTREAM CONTROLLING STRUCTURE
CRIT.DEPTH CONTROL Vh= .051ft Dcr= .151ft CRIT.DEPTH Hev= .00ft
FLOW PRECEDENCE SET TO UPSTREAM CONTROLLING STRUCTURE
FLOW PRECEDENCE SET TO UPSTREAM CONTROLLING STRUCTURE
FLOW PRECEDENCE SET TO UPSTREAM CONTROLLING STRUCTURE
FLOW PRECEDENCE SET TO UPSTREAM CONTROLLING STRUCTURE
CRIT.DEPTH CONTROL Vh= .058ft Dcr= .172ft CRIT.DEPTH Hev= .00ft
FLOW PRECEDENCE SET TO UPSTREAM CONTROLLING STRUCTURE
FLOW PRECEDENCE SET TO UPSTREAM CONTROLLING STRUCTURE
FLOW PRECEDENCE SET TO UPSTREAM CONTROLLING STRUCTURE
CRIT.DEPTH CONTROL Vh= .530ft Dcr= 1.440ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .597ft Dcr= 1.595ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .630ft Dcr= 1.670ft CRIT.DEPTH Hev= .00ft

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

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

Mannings open channel maximum capacity: 127.65 ft³/s
Upstream ID = Orifice - 3, Riser - 2, Orifice - 1, Riser - 1, Orifice - 2
Downstream ID = Tailwater (Pond Outfall)

Message
CRIT.DEPTH CONTROL Vh= .686ft Dcr= 1.793ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .924ft Dcr= 2.261ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= 1.264ft Dcr= 2.778ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= 1.554ft Dcr= 3.091ft CRIT.DEPTH Hev= .00ft
INLET CONTROL... Submerged: HW =5.43
INLET CONTROL... Submerged: HW =5.93
INLET CONTROL... Submerged: HW =6.42
INLET CONTROL... Submerged: HW =6.81
INLET CONTROL... Submerged: HW =7.19
INLET CONTROL... Submerged: HW =7.56
INLET CONTROL... Submerged: HW =7.93
INLET CONTROL... Submerged: HW =8.30
INLET CONTROL... Submerged: HW =8.52

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	

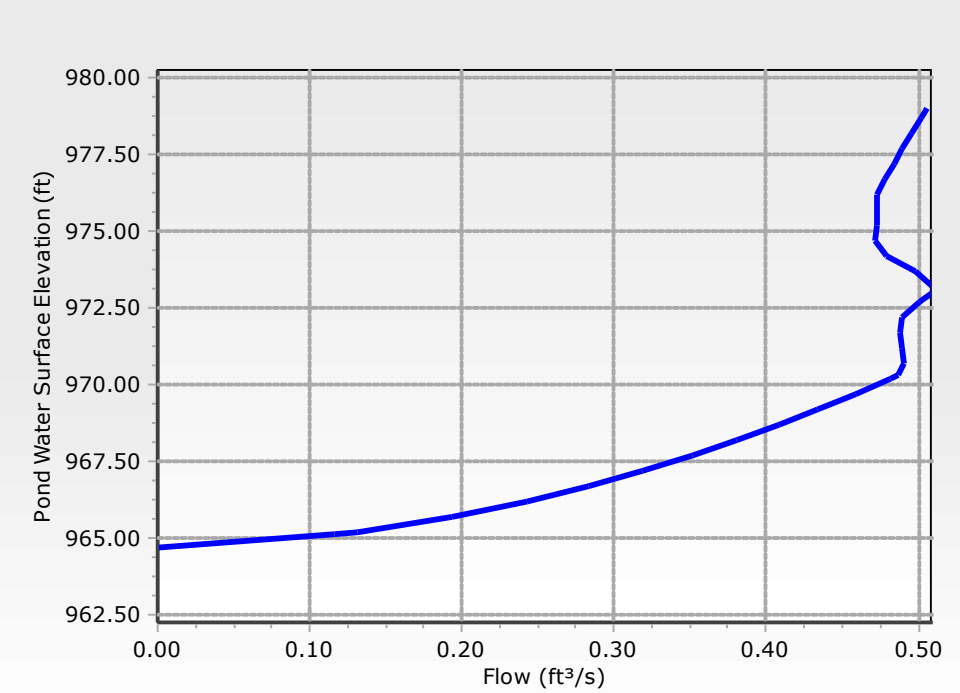
Outlet Structure (Advanced)			
Elevation (On)	0.00 ft	Elevation (Off)	0.00 ft

Outlet Structure (Orifice)			
Orifice	Circular Orifice	Orifice Coefficient	0.600

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

Outlet Structure (Orifice)			
Number of Openings	2	Orifice Diameter	2.0 in

Outlet Structure (Common)	
Elevation	964.70 ft



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)
964.70	0.00	0.00	0.00	0.00
965.10	0.12	965.10	964.80	964.80
965.20	0.13	965.20	964.81	964.81
965.70	0.19	965.70	964.85	964.85
966.20	0.24	966.20	964.87	964.87
966.70	0.28	966.70	964.88	964.88
967.20	0.32	967.20	964.90	964.90
967.70	0.35	967.70	964.90	964.90
968.20	0.38	968.20	964.91	964.92

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

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 (ft^3/s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)
968.70	0.41	968.70	964.92	964.92
969.20	0.43	969.20	964.93	964.93
969.70	0.46	969.70	964.93	964.93
970.20	0.48	970.20	964.94	964.94
970.30	0.49	970.30	964.94	964.94
970.70	0.49	970.70	965.24	965.24
971.20	0.49	971.20	965.78	965.78
971.70	0.49	971.70	966.31	966.31
972.20	0.49	972.20	966.78	966.78
972.70	0.50	972.70	967.01	967.01
973.00	0.51	973.00	967.13	967.13
973.20	0.51	973.20	967.32	967.32
973.70	0.50	973.70	968.07	968.07
974.20	0.48	974.20	968.99	969.00
974.70	0.47	974.70	969.66	969.66
975.20	0.47	975.20	970.13	970.13
975.70	0.47	975.70	970.63	970.63
976.20	0.47	976.20	971.12	971.12
976.70	0.48	976.70	971.51	971.51
977.20	0.48	977.20	971.89	971.89
977.70	0.49	977.70	972.26	972.26
978.20	0.50	978.20	972.63	972.63
978.70	0.50	978.70	973.00	973.00
979.00	0.51	979.00	973.22	973.22

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

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

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
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 =.30
H =.39
H =.85
H =1.33
H =1.82
H =2.30
H =2.80
H =3.29
H =3.78
H =4.27
H =4.77
H =5.26
H =5.36
H =5.46
H =5.42
H =5.39

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

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

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

Message
H =5.42
H =5.69
H =5.87
H =5.88
H =5.63
H =5.21
H =5.04
H =5.07
H =5.07
H =5.08
H =5.19
H =5.31
H =5.44
H =5.57
H =5.70
H =5.78

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

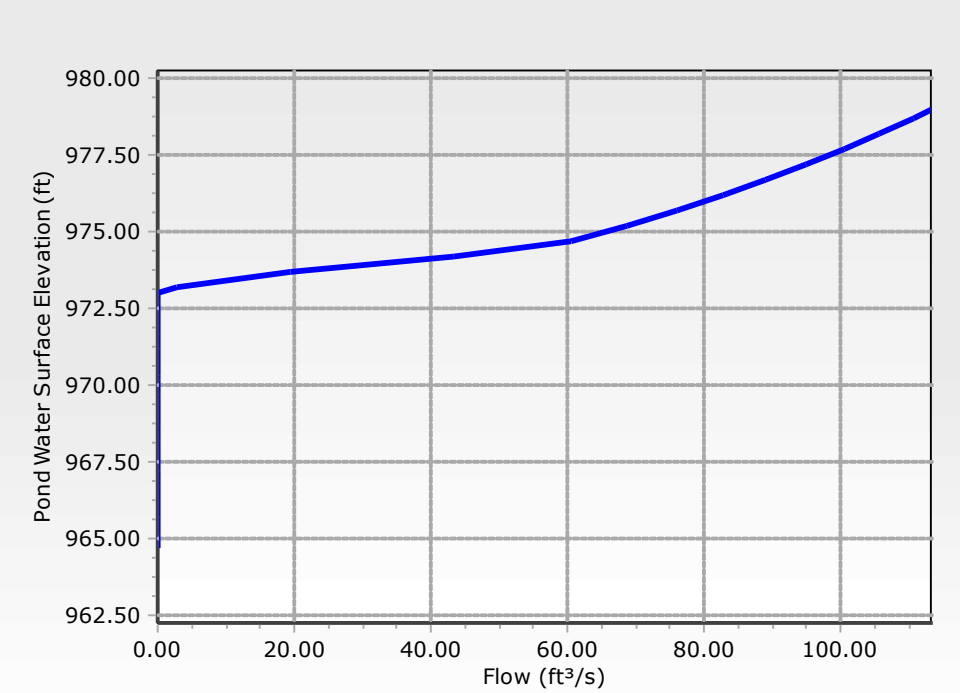
Outlet Structure (Riser)			
Riser	Stand Pipe	Transition Elevation	0.00 ft
Diameter	42.0 in	Transition Height	0.00 ft
Weir Coefficient	3.00 (ft^0.5)/s	K Reverse	1.000
Orifice Coefficient	0.600		

Outlet Structure (Common)	
Elevation	973.00 ft

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

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

Outlet Structure (Riser, Advanced)



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)
964.70	0.00	0.00	0.00	0.00
965.10	0.00	0.00	0.00	964.80
965.20	0.00	0.00	0.00	964.81
965.70	0.00	0.00	0.00	964.85
966.20	0.00	0.00	0.00	964.87
966.70	0.00	0.00	0.00	964.88
967.20	0.00	0.00	0.00	964.90
967.70	0.00	0.00	0.00	964.90
968.20	0.00	0.00	0.00	964.92
968.70	0.00	0.00	0.00	964.92
969.20	0.00	0.00	0.00	964.93
969.70	0.00	0.00	0.00	964.93
970.20	0.00	0.00	0.00	964.94

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

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)
970.30	0.00	0.00	0.00	964.94
970.70	0.00	0.00	0.00	965.24
971.20	0.00	0.00	0.00	965.78
971.70	0.00	0.00	0.00	966.31
972.20	0.00	0.00	0.00	966.78
972.70	0.00	0.00	0.00	967.01
973.00	0.00	0.00	0.00	967.13
973.20	2.95	973.20	Free Outfall	967.32
973.70	19.32	973.70	Free Outfall	968.07
974.20	43.36	974.20	Free Outfall	969.00
974.70	60.38	974.70	Free Outfall	969.66
975.20	68.68	975.20	Free Outfall	970.13
975.70	76.09	975.70	Free Outfall	970.63
976.20	82.84	976.20	Free Outfall	971.12
976.70	89.07	976.70	Free Outfall	971.51
977.20	94.90	977.20	Free Outfall	971.89
977.70	100.39	977.70	Free Outfall	972.26
978.20	105.60	978.20	Free Outfall	972.63
978.70	110.56	978.70	Free Outfall	973.00
979.00	113.43	979.00	973.22	973.22

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	0.00	(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: Composite Outlet Structure - 1

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

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)	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	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	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	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	Weir: H =0.2ft

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

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

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

Message
Weir: H =0.7ft
Weir: H =1.2ft
Orifice: H =1.70; Riser orifice equation controlling.
Orifice: H =2.20; Riser orifice equation controlling.
Orifice: H =2.70; Riser orifice equation controlling.
Orifice: H =3.20; Riser orifice equation controlling.
Orifice: H =3.70; Riser orifice equation controlling.
Orifice: H =4.20; Riser orifice equation controlling.
Orifice: H =4.70; Riser orifice equation controlling.
Orifice: H =5.20; Riser orifice equation controlling.
Orifice: H =5.70; Riser orifice equation controlling.
FULLY CHARGED RISER: Orifice Equation Control to Crest; H=6.00

Outlet Structure	
Outlet Structure Type	Riser

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

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

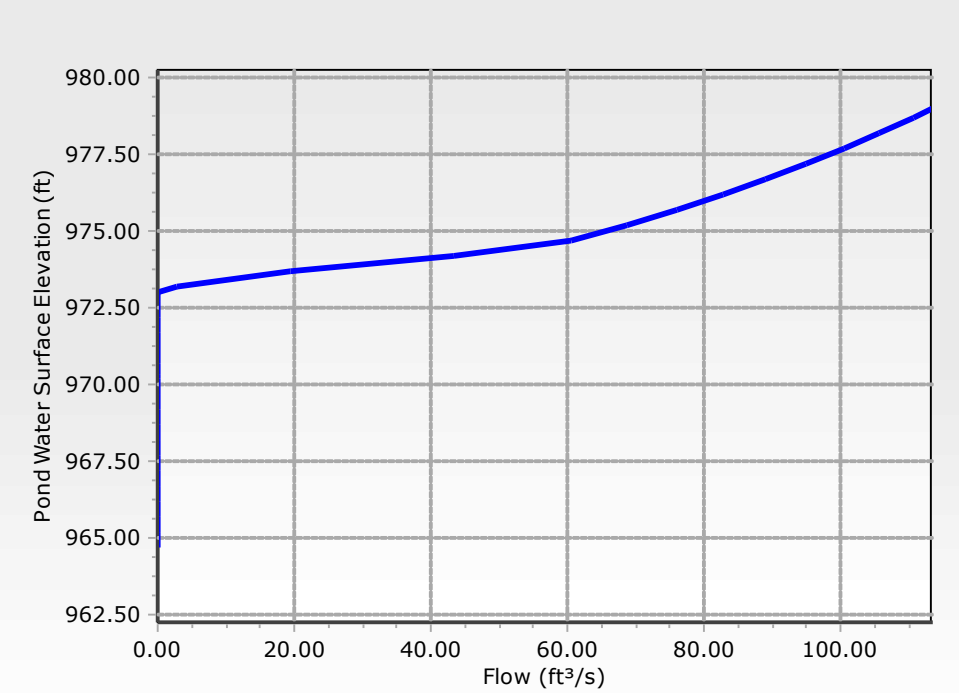
Outlet Structure (Riser)			
Riser	Stand Pipe	Transition Elevation	0.00 ft
Diameter	42.0 in	Transition Height	0.00 ft
Weir Coefficient	3.00 (ft^0.5)/s	K Reverse	1.000
Orifice Coefficient	0.600		

Outlet Structure (Common)

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

Outlet Structure (Common)			
Elevation	973.00 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 - 2 (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)
964.70	0.00	0.00	0.00	0.00
965.10	0.00	0.00	0.00	964.80
965.20	0.00	0.00	0.00	964.81
965.70	0.00	0.00	0.00	964.85
966.20	0.00	0.00	0.00	964.87
966.70	0.00	0.00	0.00	964.88
967.20	0.00	0.00	0.00	964.90
967.70	0.00	0.00	0.00	964.90

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Riser - 2 (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)
968.20	0.00	0.00	0.00	964.92
968.70	0.00	0.00	0.00	964.92
969.20	0.00	0.00	0.00	964.93
969.70	0.00	0.00	0.00	964.93
970.20	0.00	0.00	0.00	964.94
970.30	0.00	0.00	0.00	964.94
970.70	0.00	0.00	0.00	965.24
971.20	0.00	0.00	0.00	965.78
971.70	0.00	0.00	0.00	966.31
972.20	0.00	0.00	0.00	966.78
972.70	0.00	0.00	0.00	967.01
973.00	0.00	0.00	0.00	967.13
973.20	2.95	973.20	Free Outfall	967.32
973.70	19.32	973.70	Free Outfall	968.07
974.20	43.36	974.20	Free Outfall	969.00
974.70	60.38	974.70	Free Outfall	969.66
975.20	68.68	975.20	Free Outfall	970.13
975.70	76.09	975.70	Free Outfall	970.63
976.20	82.84	976.20	Free Outfall	971.12
976.70	89.07	976.70	Free Outfall	971.51
977.20	94.90	977.20	Free Outfall	971.89
977.70	100.39	977.70	Free Outfall	972.26
978.20	105.60	978.20	Free Outfall	972.63
978.70	110.56	978.70	Free Outfall	973.00
979.00	113.43	979.00	973.22	973.22

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	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Riser - 2 (Stand Pipe)

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
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.
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.
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.
WS below an invert; no flow.

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Riser - 2 (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.
WS below an invert; no flow.
Weir: H =0.2ft
Weir: H =0.7ft
Weir: H =1.2ft
Orifice: H =1.70; Riser orifice equation controlling.
Orifice: H =2.20; Riser orifice equation controlling.
Orifice: H =2.70; Riser orifice equation controlling.
Orifice: H =3.20; Riser orifice equation controlling.
Orifice: H =3.70; Riser orifice equation controlling.
Orifice: H =4.20; Riser orifice equation controlling.
Orifice: H =4.70; Riser orifice equation controlling.
Orifice: H =5.20; Riser orifice equation controlling.
Orifice: H =5.70; Riser orifice equation controlling.
FULLY CHARGED RISER: Orifice Equation Control to Crest; H=6.00

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	

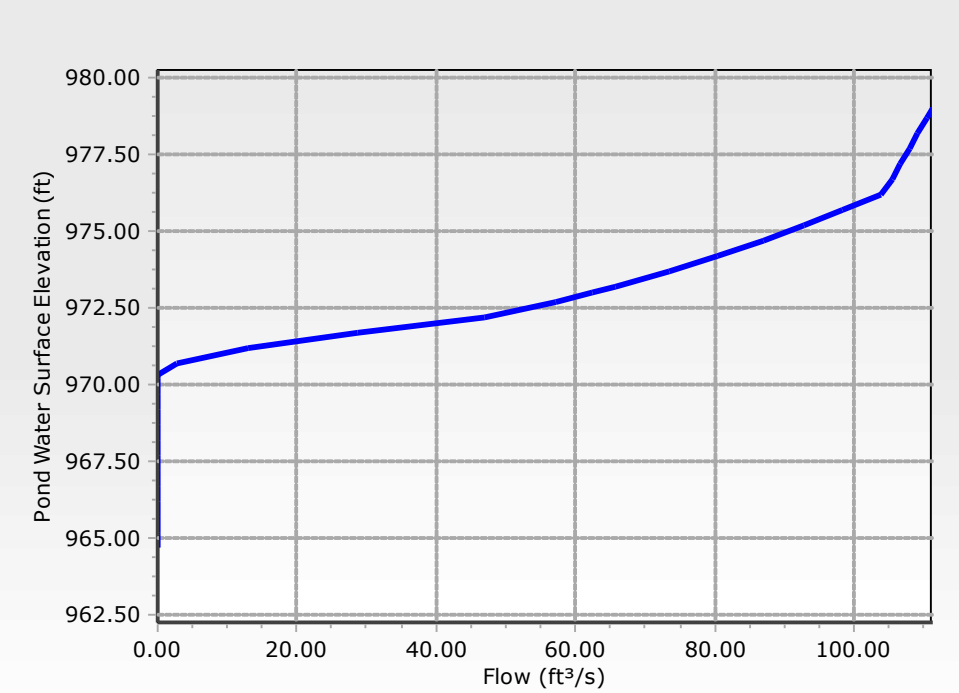
Outlet Structure (Advanced)			
Elevation (On)	0.00 ft	Elevation (Off)	0.00 ft

Outlet Structure (Orifice)			
Orifice	Circular Orifice	Orifice Coefficient	0.600

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

Outlet Structure (Orifice)			
Number of Openings	4	Orifice Diameter	21.0 in

Outlet Structure (Common)	
Elevation	970.30 ft



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)
964.70	0.00	0.00	0.00	0.00
965.10	0.00	0.00	0.00	964.80
965.20	0.00	0.00	0.00	964.81
965.70	0.00	0.00	0.00	964.85
966.20	0.00	0.00	0.00	964.87
966.70	0.00	0.00	0.00	964.88
967.20	0.00	0.00	0.00	964.90
967.70	0.00	0.00	0.00	964.90
968.20	0.00	0.00	0.00	964.92

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

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)
968.70	0.00	0.00	0.00	964.92
969.20	0.00	0.00	0.00	964.93
969.70	0.00	0.00	0.00	964.93
970.20	0.00	0.00	0.00	964.94
970.30	0.00	0.00	0.00	964.94
970.70	2.79	970.70	Free Outfall	965.24
971.20	13.03	971.20	Free Outfall	965.78
971.70	28.85	971.70	Free Outfall	966.31
972.20	46.88	972.20	Free Outfall	966.78
972.70	57.18	972.70	Free Outfall	967.01
973.00	62.56	973.00	Free Outfall	967.13
973.20	65.90	973.20	Free Outfall	967.32
973.70	73.58	973.70	Free Outfall	968.07
974.20	80.54	974.20	Free Outfall	969.00
974.70	86.94	974.70	Free Outfall	969.66
975.20	92.90	975.20	Free Outfall	970.13
975.70	98.50	975.70	970.63	970.63
976.20	103.80	976.20	971.12	971.12
976.70	105.48	976.70	971.51	971.51
977.20	106.72	977.20	971.89	971.89
977.70	107.99	977.70	972.26	972.26
978.20	109.27	978.20	972.63	972.63
978.70	110.59	978.70	973.00	973.00
979.00	111.36	979.00	973.22	973.22

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	0.00	(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: Composite Outlet Structure - 1

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
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.
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.
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= .103ft
Dcr= .297ft CRIT.DEPTH Hev= .00ft

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

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

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

Message
CRIT.DEPTH CONTROL Vh= .243ft Dcr= .656ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .407ft Dcr= .994ft CRIT.DEPTH Hev= .00ft
H =1.03
H =1.53
H =1.83
H =2.03
H =2.53
H =3.03
H =3.53
H =4.03
H =4.53
H =5.03
H =5.19
H =5.31
H =5.44
H =5.57
H =5.70
H =5.78

Outlet Structure			
Outlet Structure Type	Orifice		

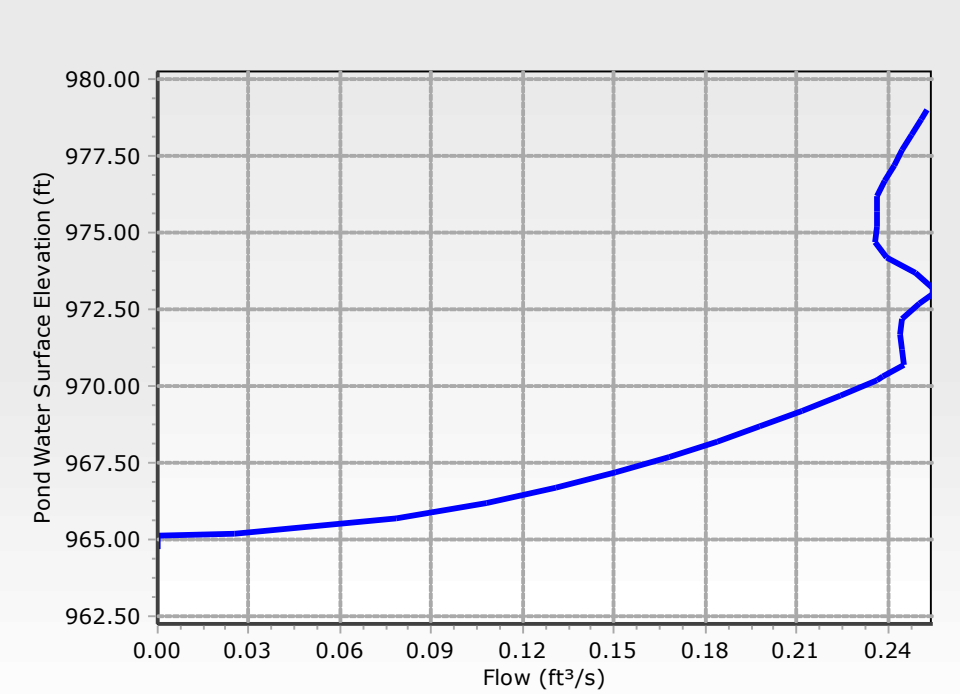
Outlet Structure (IDs and Direction)			
Outlet ID	Orifice - 2	Downstream ID	Culvert - 1
Flow Direction	Forward Flow Only	Notes	

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	4	Orifice Diameter	1.0 in

Outlet Structure (Common)	
Elevation	965.10 ft

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1



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)
964.70	0.00	0.00	0.00	0.00
965.10	0.00	0.00	0.00	964.80
965.20	0.03	965.20	Free Outfall	964.81
965.70	0.08	965.70	Free Outfall	964.85
966.20	0.11	966.20	Free Outfall	964.87
966.70	0.13	966.70	Free Outfall	964.88
967.20	0.15	967.20	Free Outfall	964.90
967.70	0.17	967.70	Free Outfall	964.90
968.20	0.18	968.20	Free Outfall	964.92
968.70	0.20	968.70	Free Outfall	964.92
969.20	0.21	969.20	Free Outfall	964.93
969.70	0.22	969.70	Free Outfall	964.93
970.20	0.24	970.20	Free Outfall	964.94
970.30	0.24	970.30	Free Outfall	964.94
970.70	0.25	970.70	965.24	965.24
971.20	0.24	971.20	965.78	965.78

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

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)
971.70	0.24	971.70	966.31	966.31
972.20	0.24	972.20	966.78	966.78
972.70	0.25	972.70	967.01	967.01
973.00	0.25	973.00	967.13	967.13
973.20	0.25	973.20	967.32	967.32
973.70	0.25	973.70	968.07	968.07
974.20	0.24	974.20	968.99	969.00
974.70	0.24	974.70	969.66	969.66
975.20	0.24	975.20	970.13	970.13
975.70	0.24	975.70	970.63	970.63
976.20	0.24	976.20	971.12	971.12
976.70	0.24	976.70	971.51	971.51
977.20	0.24	977.20	971.89	971.89
977.70	0.24	977.70	972.26	972.26
978.20	0.25	978.20	972.63	972.63
978.70	0.25	978.70	973.00	973.00
979.00	0.25	979.00	973.22	973.22

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	0.00	(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: Composite Outlet Structure - 1

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Orifice - 2 (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)	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	H =.06
0.00	0.00	(N/A)	0.00	H =.56
0.00	0.00	(N/A)	0.00	H =1.06
0.00	0.00	(N/A)	0.00	H =1.56
0.00	0.00	(N/A)	0.00	H =2.06
0.00	0.00	(N/A)	0.00	H =2.56
0.00	0.00	(N/A)	0.00	H =3.06
0.00	0.00	(N/A)	0.00	H =3.56
0.00	0.00	(N/A)	0.00	H =4.06
0.00	0.00	(N/A)	0.00	H =4.56
0.00	0.00	(N/A)	0.00	H =5.06
0.00	0.00	(N/A)	0.00	H =5.16
0.00	0.00	(N/A)	0.00	H =5.46
0.00	0.00	(N/A)	0.00	H =5.42
0.00	0.00	(N/A)	0.00	H =5.39
0.00	0.00	(N/A)	0.00	H =5.42
0.00	0.00	(N/A)	0.00	H =5.69
0.00	0.00	(N/A)	0.00	H =5.87
0.00	0.00	(N/A)	0.00	H =5.88
0.00	0.00	(N/A)	0.00	H =5.63
0.00	0.00	(N/A)	0.00	H =5.21
0.00	0.00	(N/A)	0.00	H =5.04

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

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 =5.07
H =5.07
H =5.08
H =5.19
H =5.31
H =5.44
H =5.57
H =5.70
H =5.78

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

Composite Rating Table
Tailwater Elevation = Free Outfall (Composite Outlet Structure - 1)

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
964.70	0.00	(N/A)	0.00
965.10	0.12	(N/A)	0.00
965.20	0.16	(N/A)	0.00
965.70	0.27	(N/A)	0.00
966.20	0.35	(N/A)	0.00
966.70	0.41	(N/A)	0.00
967.20	0.47	(N/A)	0.00
967.70	0.52	(N/A)	0.00
968.20	0.56	(N/A)	0.00
968.70	0.61	(N/A)	0.00
969.20	0.65	(N/A)	0.00
969.70	0.68	(N/A)	0.00
970.20	0.72	(N/A)	0.00
970.30	0.72	(N/A)	0.00
970.70	3.53	(N/A)	0.00
971.20	13.76	(N/A)	0.00
971.70	29.58	(N/A)	0.00
972.20	47.61	(N/A)	0.00
972.70	57.94	(N/A)	0.00
973.00	63.26	(N/A)	0.00
973.20	72.53	(N/A)	0.00
973.70	112.95	(N/A)	0.00
974.20	167.97	(N/A)	0.00
974.70	208.40	(N/A)	0.00
975.20	230.98	(N/A)	0.00
975.70	251.39	(N/A)	0.00
976.20	270.19	(N/A)	0.00
976.70	284.34	(N/A)	0.00
977.20	297.25	(N/A)	0.00
977.70	309.51	(N/A)	0.00
978.20	321.21	(N/A)	0.00
978.70	332.45	(N/A)	0.00
979.00	338.97	(N/A)	0.00

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

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

Composite Rating Table
Tailwater Elevation = Free Outfall (Composite Outlet Structure - 1)

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

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

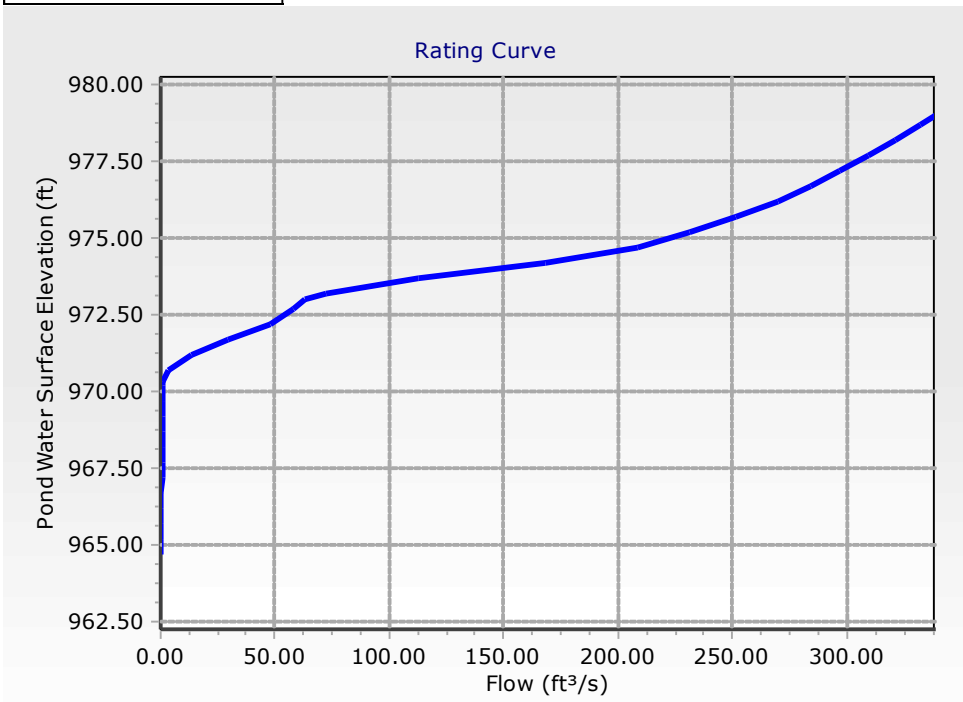
Composite Rating Table
Tailwater Elevation = Free Outfall (Composite Outlet Structure - 1)

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

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

Composite Rating Table
Tailwater Elevation = Free Outfall (Composite Outlet Structure - 1)

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



FINAL STORM REPORT

ADDENDUM 1

Cobey Creek, Phase 1

Mixed Use Development

Lee's Summit, MO

PREPARED FOR

JCM DEVELOPMENT, LLC

PREPARED BY

HG CONSULT, INC.

July 1, 2019

7/1/19

Contents

This addendum to the final storm report for Cobey Creek, Phase 1, is prepared to address comments from the City of Lee's Summit staff from a letter dated May 25th, 2019 in regard to specific stormwater issues. The three sections are intended to provide additional information to the first three comments of said letter.

1. 40 Hour Extended Detention

The 8" skimmer used for erosion control will be permanent and the coupling will be capped. After final construction, if it is determined the North Detention Pond does not drain in 48 hours; the cap will be removed to drain the detention pond.

2. Effective Height

TR-60 states the following for the effective height of the dam.

"Effective height of dam. The difference in elevation in feet between the lowest open channel auxiliary spillway crest and the lowest point in the original cross section on the centerline of the dam. If there is no open channel auxiliary spillway, the top of the dam becomes the upper limit."

The top of the auxiliary spillway is at El. 977.0. The lowest point in the original cross section on the centerline of the dam is El. 968.0. Therefore, TR-60 does not apply to this detention pond.

3. Energy Dissipation

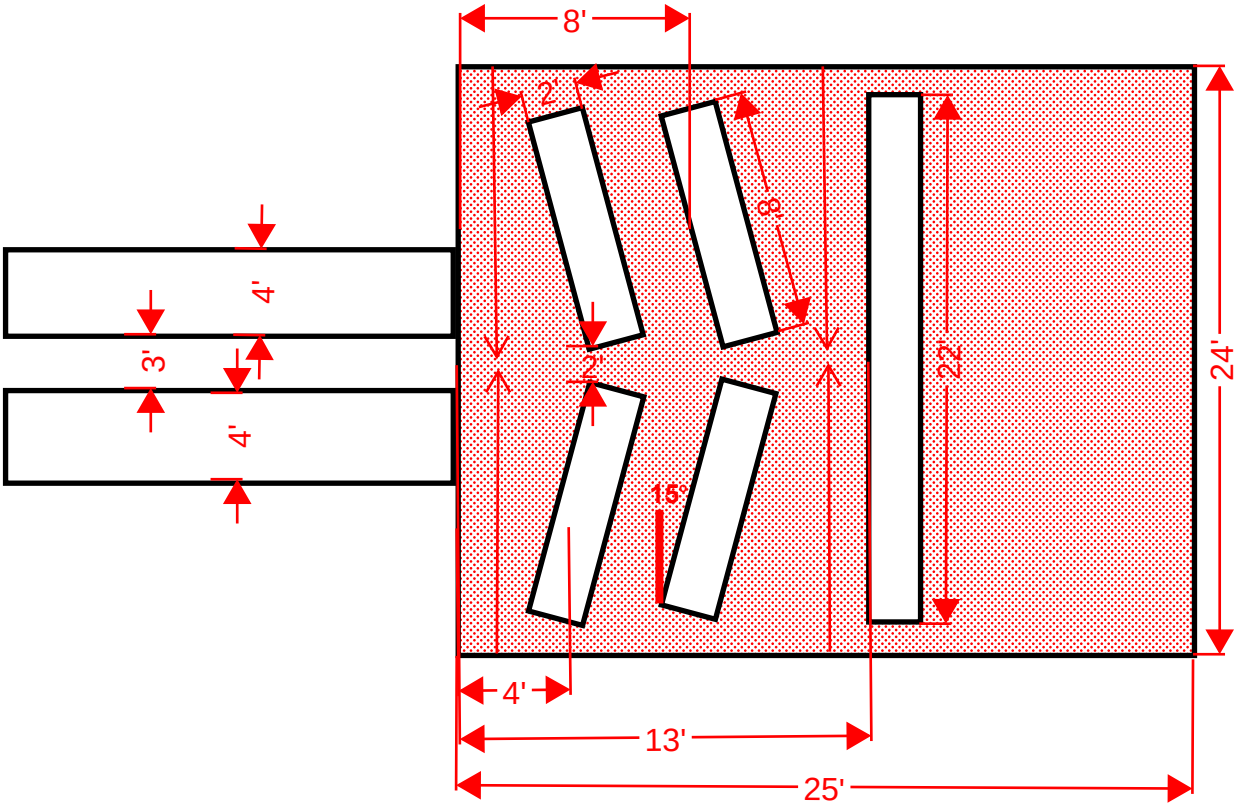
Additional energy dissipation has been added to the outlet structure at the request of the City of Lee's Summit. The outlet rip rap pad is fitted with a Contra Costa Design from HEC 14. The design details are included in the plans. The original 100-year outlet velocity is ~12.0 ft/s and the proposed 100-year outlet velocity is expected to be ~8.7 ft/s. Calculations are included in this Addendum.

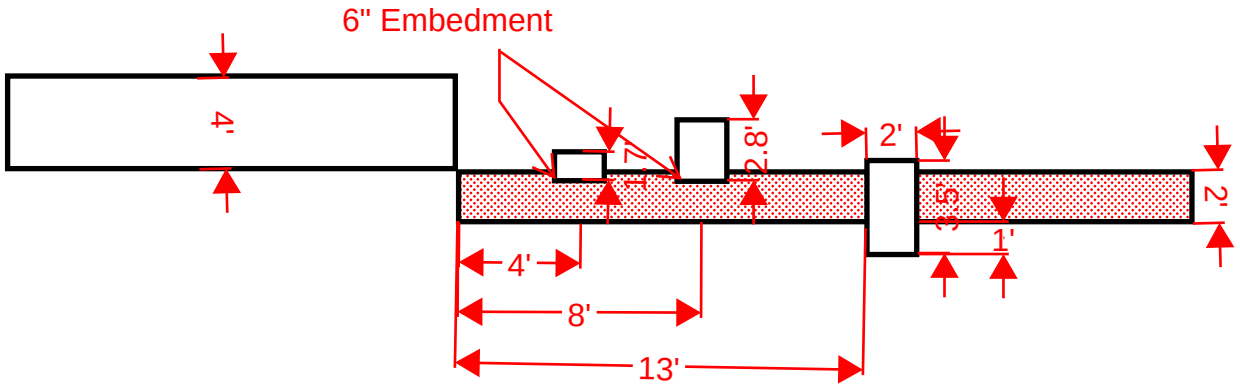
HY-8 Energy Dissipation Report

External Energy Dissipator

Parameter	Value	Units
Select Culvert and Flow		
Crossing	Crossing 1	
Culvert	Culvert 1	
Flow	280.00	cfs
Culvert Data		
Culvert Width (including multiple barrels)	8.0	ft
Culvert Height	4.0	ft
Outlet Depth	3.51	ft
Outlet Velocity	11.98	ft/s
Froude Number	1.13	
Tailwater Depth	0.00	ft
Tailwater Velocity	0.00	ft/s
Tailwater Slope (SO)	0.0049	
External Dissipator Data		
External Dissipator Category	Streambed Level Structures	
External Dissipator Type	Contra Costa	
Restrictions		
Froude Number	<3	
TailWater	<.5D	
Input Data		
Baffle Block Height Ratio		
Note:	2.5 < Baffle Block Height Ratio < 7	
Note:	Optimum Baffle Block Height Ratio = 3.5	
Ratio of Baffle Block Height to Block Distance from the Culvert	3.500	
End Sill Height to Maximum Depth Ratio		
Note:	Maximum Depth in the Dissipator is 4.794 feet	
Note:	0.06 < End Sill Height to Max Depth Ratio < 0.1	
Note:	0.1 is Recommended for End Sill Height to Max Depth Ratio	
Ratio to Determine End Sill Height from Maximum Depth	0.100	
Basin Width		
Note:	Channel Width is 8.000 feet	ft
Note:	4.000 < Basin Width < 12.000	ft
Note:	Channel Width is Recommended for Basin Width	
Basin Width	8.000	ft
Results		
Basin Depth (Y2)	4.794	ft
Basin Length (LB)	21.373	ft
Basin Width (WB)	8.000	ft
Exit Width (W3)	8.000	ft
Exit Depth (YC)	2.954	ft

Exit Velocity (VB=VC)	8.653	ft/s
First Baffle		
Height (H1)	1.174	ft
Width (WB)	8.000	ft
Space (L1)	4.111	ft
Second Baffle		
Height (H2)	2.349	ft
Width (WB)	8.000	ft
Space (L2)	8.221	ft
End Sill		
Height (H3)	0.479	ft
Top Width (W3)	8.000	ft
Location (L3)	13.152	ft


8'
2'
8'
4'
3'
4'
2'
15°
22'
24'
4'
13'
25'


6" Embedment
4'
1'
2.8'
2'
1.5'
2'
1'
4'
8'
13'

STORM WATER REPORT

Addendum 2

Cobey Creek

Mixed Use Development

Lee's Summit, MO

PREPARED FOR

JCM DEVELOPMENT,LLC

PREPARED BY

Hg Consult, Inc

August 3, 2020

This addendum to the final storm report for Cobey Creek, Phase 1, is prepared to address the updating of the Pond Pack information for the south pond outlet structure. The attached Pondpack print out addresses the flow characteristics associated with six- 12inch diameter holes shown on the new square outlet structure detail, also attached.

The structure was changed to square from a circular manhole due to the unavailability of the manhole in a 6 foot diameter, as designed and approved in the original plans. The Pond pack information is provided as confirmation that original release orifices (12” holes) on the circuler manhole when placed on the square version, shows no changes to the hydraulic function of the outlet structure within the pond.

STORM WATER REPORT

Addendum 3

Cobey Creek

Mixed Use Development

Lee's Summit, MO

PREPARED FOR

JCM DEVELOPMENT,LLC

PREPARED BY

Hg Consult, Inc

October 8, 2020

This addendum to the Final Storm Report for Cobey Creek, Phase 1 is prepared for addressing the change to the geometric shape of the outlet structure in the north pond from circular to rectangular, due to the unavailability of a six foot diameter manhole.

This change is the same as the change at the south pond, except that the north pond design called for 2 circular manholes side by side. The shape of the outlet structure has been redesigned to incorporate the 2 manholes into one larger and rectangular structure. All orifices that were shown for the manholes have been incorporated into the rectangular structure at the same elevations to provide the same hydraulic flows at the various storm events as originally designed. Details of the new and approved structure are attached.