LAWRENCEVILLE
GEORGIA

STORMWATER AUTHORITY

AGENDA

Wednesday, May 17, 2023	Third Floor GwMA Conference Room
6:00 PM	70 S. Clayton St, GA 30046

Call to Order

Review of Proposed New Projects

1. Sandalwood Stormwater Evaluation

Comments from Utility Board Staff

Final Adjournment

LAWRENCEVILLE
GEORGIA

AGENDA REPORT
MEETING: STORMWATER BOARD, MAY 17, 2023
AGENDA CATEGORY: REVIEW OF PROPOSED NEW PROJECTS

Item:	Sandalwood Stormwater Evaluation
Department:	Engineering
Date of Meeting:	Wednesday, May 17, 2023
Fiscal Impact:	N/A
Presented By:	Jim Wright, P.E., City Engineer
Action Requested:	Recommendation of Option

Summary: Sandalwood is a 22-acre townhome development that has a 4.1 acre private lake at the center. The lake was created in the 1960s by damming Shoal Creek. The drainage basin is 225 acres that drains to the lake. There are several large diameter pipes entering the lake and water leaves by crossing over the dam at a spillway. The lake was studied to determine if there would be a regional benefit by the City taking ownership of the lake and making the necessary repairs and alterations.

Attachments/Exhibits:,
Report-sandalwood dam

DAM AND CULVERT REPORT
FOR
SANDALWOOD TOWNHHOMES

SHOAL CREEK TRIBUTARY 4.1

City of Lawrenceville
Gwinnett County, Georgia

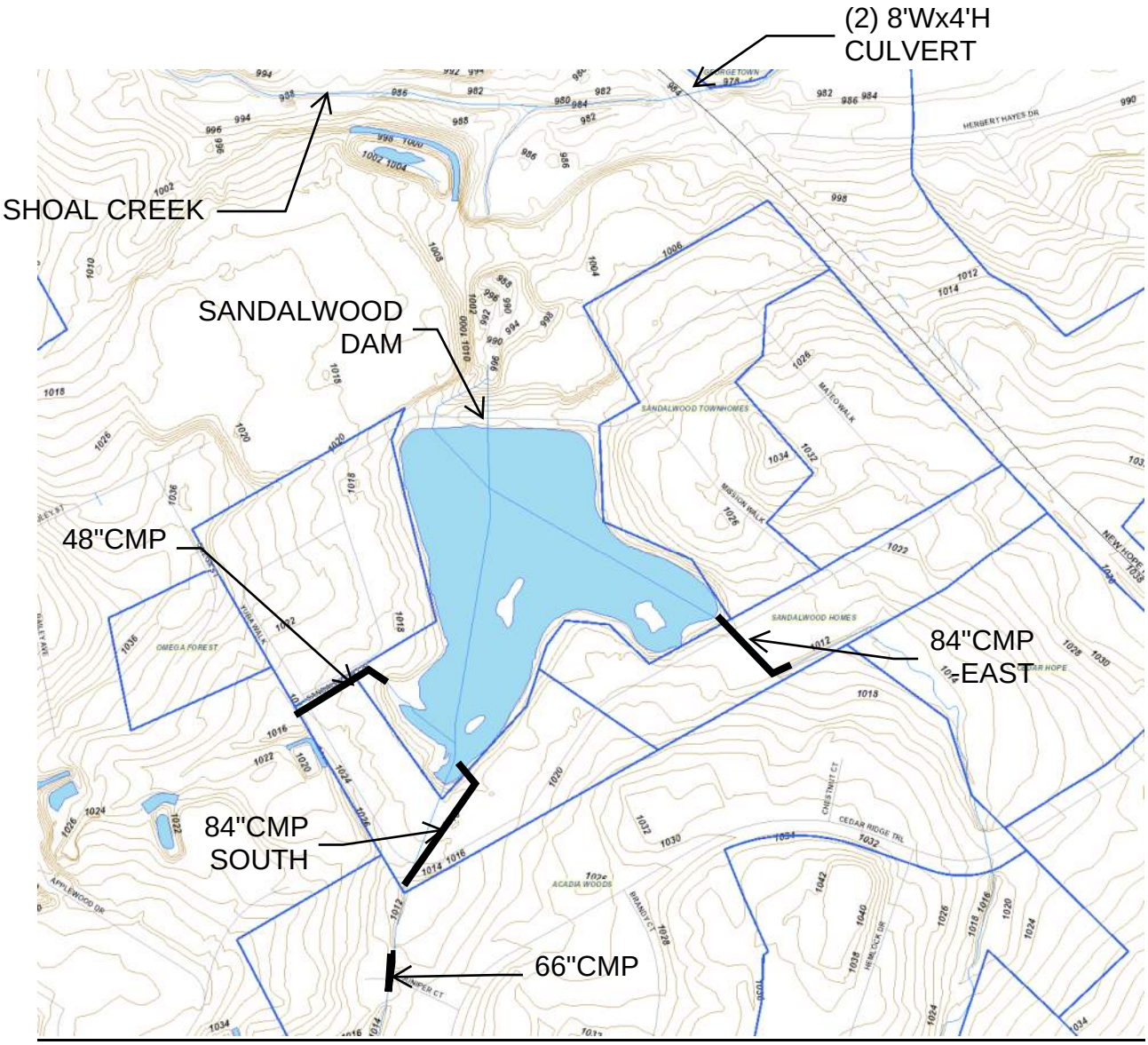
May 10, 2023

Engineer:
Hussey Gay Bell
3100 Breckinridge Blvd
Building 300
Duluth, GA 30096
770-923-1600

Proj # 23-001

Table of Contents

VICINITY MAP



PURPOSE:

The purpose of this report is to evaluate the lake and dam in the Sandalwood Development along with the three upstream pipes that deliver storm runoff to the lake. The analysis will include a visual observation of conditions and a hydrologic/hydraulic review that evaluates four (4) options for redevelopment of the lake. As part of the report, a portion of the flood study for Shoal Creek Tributary 4.1 will be rerun with findings from the hydrology study. Finally, an overall review of impacts and benefits will be provided for each option. Recommendations will be made for improvements to the lake, dam and culverts.

PROJECT DESCCRIPTION:

Sandalwood townhomes is a 22-acre townhome development located south of New Hope Road between Ezzard Street and Cedar Ridge Trail within the Lawrenceville City limits. The development was constructed in the early 1980's. Within the center of the development lies a ~4.1-acre lake. Currently there is a large concrete spillway acting as the primary and emergency discharge from the lake. Four (4) small 12" pipes are present under the spillway crest. The purpose of these pipes appears to be to carry the base flow across the dam allowing foot traffic to cross. Currently, only two of these pipes are functioning.

On the top of the dam is a ~9' paved drive with curb and gutter. This drive ends at the concrete spillway. The drive and spillway are constructed in a way that appears to provide an emergency vehicular exit from the property. There are bollards blocking access across the spillway. The spillway narrows to a concrete channel and discharges at the base of an existing concrete wall. Rip rap has been installed at the base of the wall to limit or repair erosion that was occurring. The lowest finished floor of the surrounding condominiums is 1015.98. This is sufficiently higher than the top of dam which is approximately 1011.6.

This report will also study the three main sources of inflow to the lake. A 48" CMP enters the west end of the lake. An 84" (7'Wx6.7'H) CMP enters from the south and is the primary inflow to the lake, and an 84" (84"Wx60"H) ellipse CMP enters from the Southeast. According to Gwinnett GIS these were installed in 1981. Upstream of the second culvert (7'Wx6.7'H) on the main tributary is a 66"CMP that crosses Juniper Ct. Gwinnett GIS shows this pipe as being installed in 1975. This pipe was also investigated within this report.

Finally, the report will incorporate the proposed changes to the existing Flood Study for Tributary 4.1 to demonstrate the impact of the proposed improvements on the 100-year floodplain limits and elevations.

OVERALL SUMMARY

DAM & CONCRETE SPILLWAY

Conditions

1. The road on top of the dam is in poor condition as described in Appendix A.
2. There are very large trees growing on the dam. If these trees fall, they can take a portion of the dam with them resulting in a failure.
3. Every hydrologic option for the lake recommends raising the dam to some extent.
4. The face of the dam from the water level to the top is weak and shows signs of erosion.
5. An old water line of unknown size and type is present within the dam.
6. The spillway is beginning to show signs of undermining as evident in the 12" deep collapse downstream.

Recommendations

1. Obtain a geotechnical investigation of the dam.
2. Remove the trees and roots from the dam & recompact under supervision of a geotechnical engineer.
3. Drain lake and remove sediment at the upper end.
4. Remove the road, raise the dam and rebuild the road if needed.
5. Rebuild the upstream face of the dam and install rip rap or geotechnical grid to reinforce it.
6. Excavate to the existing waterline and evaluate current condition and purpose. Depending upon evaluation, relocate, encase, or replace the waterline.
7. Rebuilding the concrete spillway is needed in Option 1 & 3. Options 2 and Option 4 allow for an earthen emergency spillway.

CONCLUSION:

Option 1, rebuilding the spillway similar to the current condition, requires the least amount of disturbance and change to the lake. There is no Outlet Control Structure to maintain, and the cost is expected to be the lowest of the four options. The disadvantages of this option appear to be that the downstream private drive will continue to overtop in the 100-year storm and that water will continuously flow down the spillway.

Option 4, detention only, is the second choice. This option provides a small micropool and enough detention so that the 84" RCP at the downstream private drive will carry the 100-year storm. The disadvantage of this option is that the property surrounding the micropool, and the micropool itself, will be difficult to maintain. It is expected that trash will accumulate, mosquitoes may breed, and plantings or grass will need attention to survive and look good. Additionally, the OCS may be large and unattractive and fencing should be installed for safety.

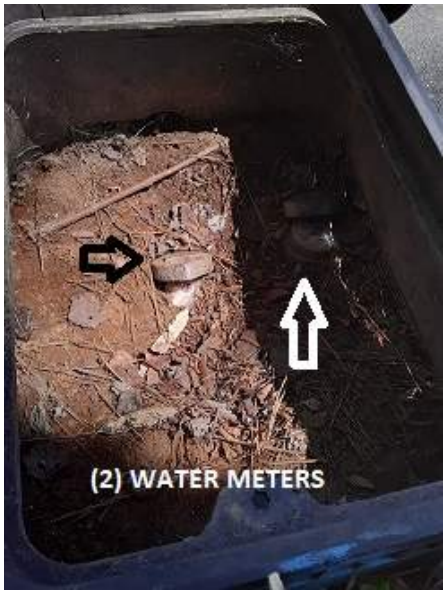
APPENDIX A
Visual Existing Condition on Dam

Access Road

The top of the dam is comprised of a 13’ back-to-back road with curb and gutter.

This road is blocked on both sides by removable bollards. It is assumed that the road is to be used in emergencies to provide access for properties on the adjacent side of the lake that would become stranded if one of the large culverts fails.

Over the years several large trees have grown up along the road causing root intrusion into the paving and buckling of curb and gutter.



The road has been patched in places for unknown reasons. A waterline is shown on Gwinnett GIS as crossing over the dam; however, utility locators were unable to locate the line.

Concrete Weir and Spillway Observations

A wide concrete weir provides the primary discharge control for the dam. It has a ~ 44’ width and flat side slopes ~8:1 that enable vehicles to pass in an emergency. The base of an old foot bridge crosses the weir.

Some damage to the weir, consisting of a small hole in the concrete and the collapsing of the grouted block section of the roadway could be observed.

At the time of observation, runoff was exiting the lake through one or two of the existing 12” pipes that convey the base flow underneath the weir. The upstream location of the pipes could not be located. Because only 2 were functioning, it is assumed that the remainder are blocked by sediment.

The weir section discharges to a wide concrete flume approximately 2’ deep. Cracking can be seen across the flume and along the edge of the flow path.

The flume is paved to the top and then proceeds to connect to a concrete flume on the adjacent property.

Near the bottom of the spillway, the flume collapsed approximately 12”.

At the bottom, there is a rip rapped basin backed up by stacked cement bags to protect the retaining wall that supports the pool.

The runoff must turn 90 degrees at the bottom to continue downstream.

Dam Observations

The face of the dam is covered with brush or small bushes. The slope is steep and weak, and erosion is present.

A tennis court, clubhouse and pool are located on the back side of the dam. There is a small area dug into the embankment that is used for garbage can storage. The remainder of the back side of the dam consists of small woody vegetation and mulch with some small to medium trees. No seepage or animal burrows were observed.

HUSSEY GAY BELL
Established 1958

DRAINAGE AREA REVIEW/SANDALWOOD CONDOMINIUMS
City of Lawrenceville
Hussey Gay Bell Project No.: 22-0006-C

Sandalwood System Assessment

Sandalwood is a condominium/townhome community located on New Hope Road just south of Georgia Highway 124. It was developed in the early 1970s.

The development has an existing ±4-acre lake which provides storm water management for the community. The contributing drainage area is approximately 237 acres.

This report provides general observations of the condition of the existing lake and dam along with a recommended program for moving forward.

Site Observations

Based on a site visit, the following observations are provided:

1. The lake and site improvements are approaching 50 years in age. This is at the end of their service life.

2. The lake is approximately 4 acres in size. The upper end is almost entirely full of sediment. In order to maintain healthy conditions in the lake, a minimum depth of water is recommended to be four feet. To meet this condition, approximately 11,500 to 14,000 cubic yards of sediment would need to be removed.

3. There are three primary pipes that carry storm water into the lake. All of those are galvanized steel pipes exhibiting various degrees of wear.

4. The dam is constructed of earth with a concrete spillway. Two low level drains exist; however, one is totally collapsed and the other does not appear to be functioning. The base flow of water is seeping underneath the initial portion of the concrete spillway. The spillway itself is in poor condition.

5. A driveway accesses the clubhouse and crosses the dam. It is in poor condition exhibited by breaks, cracking along with upheaval from tree roots. There are also large trees that are along the top of the dam.

6. Hydraulically, the spillway functions as a broad-crested weir. Storage volume is limited due to the small variance in elevation between the spillway and the top of dam, elevation of the adjacent condominiums and clubhouse and conditions upstream.

7. The lake drains into Shoal Creek. Between the lake and the creek is a newer apartment community. The runoff from Sandalwood passes through an 84" RCP under the private entrance drive to this community. This pipe is in very good condition, with Sandalwood Lake absorbing impacts from storm flows.

8. The existing pavement through much of the development is in an aged condition and is in need of maintenance/repair.

Recommended Improvements

Based on the site review, extensive maintenance and repairs are needed. The following recommendations are provided.

1. Survey of the site conditions including quantification of the amount of silt in the lake.

2. Geotechnical Engineering Study.

3. Review conditions of the incoming drainage pipes.

4. Prepare remediation plans to include:

    a) Pipe repairs
    b) Removal of sediment
    c) Repairs to dam and spillway
    d) Pavement rehabilitation from New Hope Road to the lake/dam

APPROX. BASIN TO POND

LAND USE: MOSTYLY RESIDENTIAL & SOME COMMERCIAL
BASIN AREA: ±230 AC TO POND
POND TYPE: WET

PARCEL ID: 5174 C052
OWNER: SANDALWOOD HOA

N

1000 0 500 1000 2000

(IN FEET)
1 inch = 1000 ft.

SHOAL CREEK BASIN

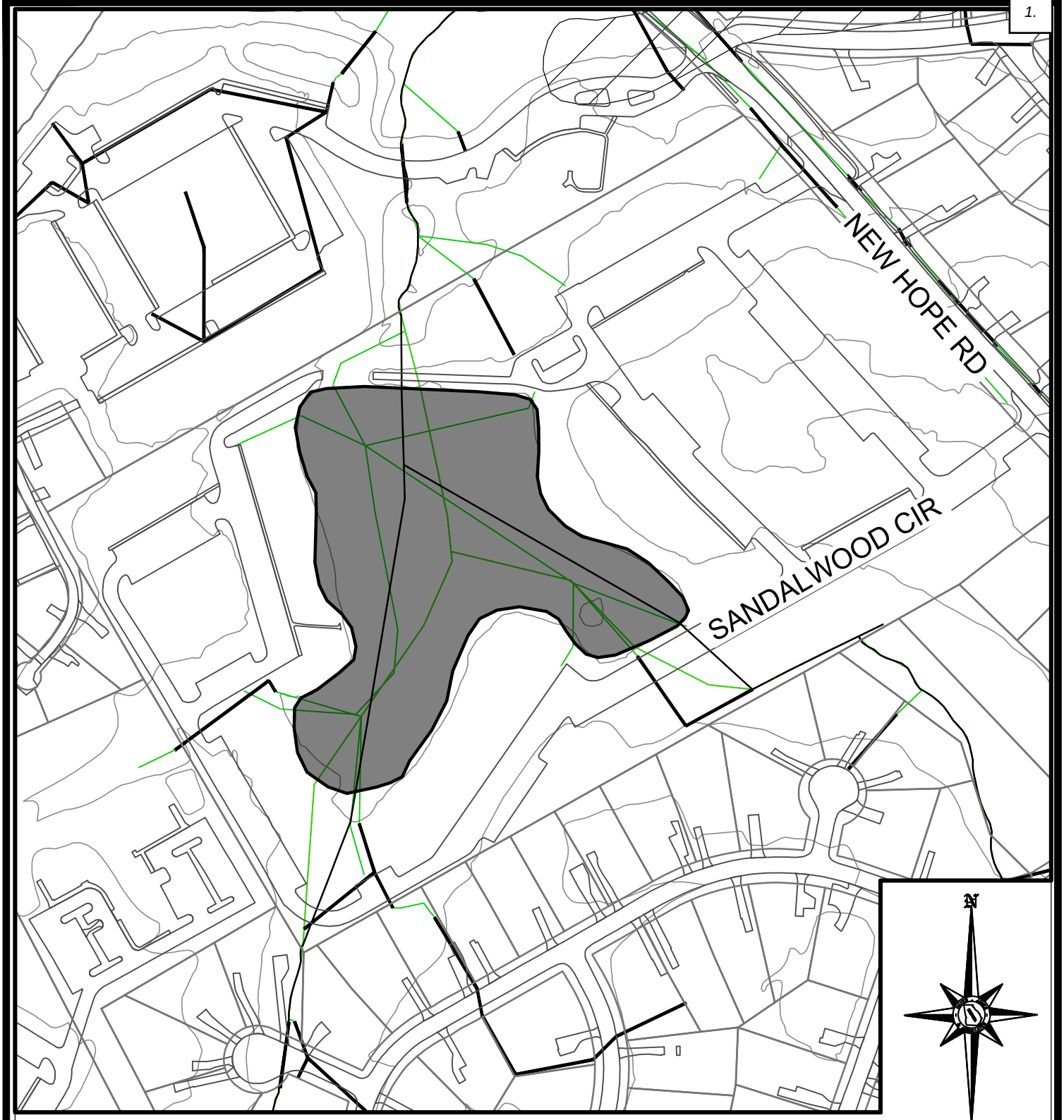
EXHIBIT
S1

PARCEL ID: 5174 C052
SANDALWOOD CIR

AUGUST 2022

POND EXHIBIT

HUSSEY GAY BELL
Established 1958
3100 Breckinridge Blvd., Bldg 300, Duluth, GA 30096 / T: 7



SHOAL CREEK BASIN

EXHIBIT

S2

PARCEL ID: 5174 C052
SANDALWOOD CIR

AUGUST 2022

POND EXHIBIT

HUSSEY GAY BELL

Established 1958

3100 BRECKINRIDGE BLVD., BLDG 300, DULUTH, GA 30096 / T: 7

APPENDIX B - HYDROLOGY

PURPOSE:

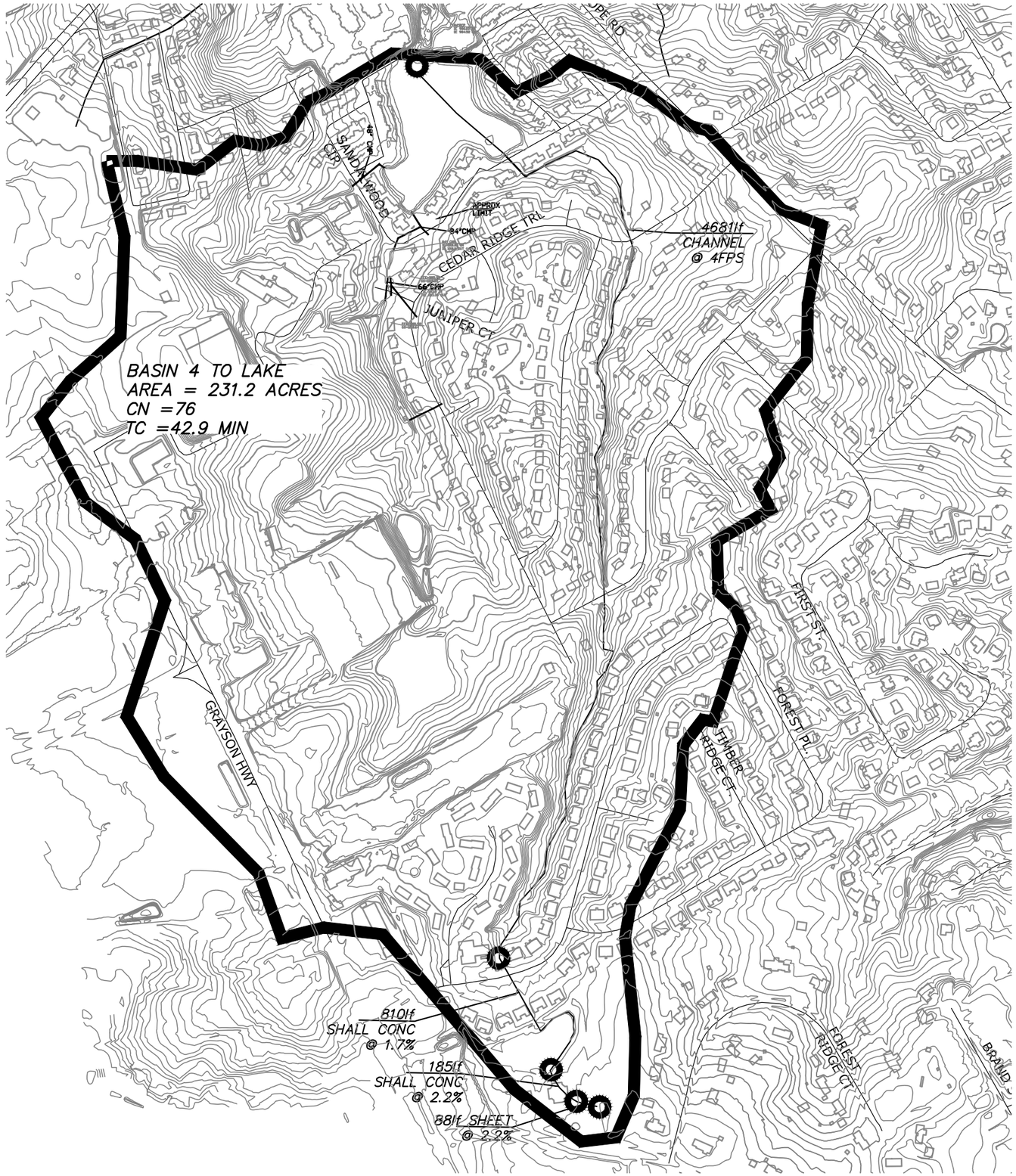
The purpose of the Hydrological analysis is to evaluate various scenarios for the lake's use. Options 1 and 2 look at leaving the lake wet and revising the outlet configuration to a concrete weir and spillway (Option 1, similar to existing) or a riser with a piped primary spillway and an earthen emergency spillway (Option 2). Option 3 and 4 evaluate transforming the lake to a regional detention facility with micropools.

PROCEDURE:

Lake Inflow Hydrograph:

1. The Stream Stats website was used to obtain a preliminary delineation of the drainage basin. (.36 smi = 230.4 acres)
2. GIS topographic maps of Gwinnett County were used to refine the drainage basin to the dam. (.361 smi = 231.2 acres)
3. Google Earth was used to determine the current land use of the basin. CN's were assigned to the land use and a composite CN was determined. (CN = 76).
4. An overall Tc was computed for the basin.
5. Hydrographs were determined using the SCS method.

It should be noted that the following Options should be considered preliminary. Adjustments will likely be required based on the option chosen, client review and goals, community input, and engineering adjustments discovered during final design such as, adjustments to water surface elevations, top of dam elevation, forebays, allowances for base flow and traversing the weir are some considerations that are not fully addressed in this study.



GRAPHIC SCALE

500 250 0 500

1 inch = 500 ft.

B-3

1.

HUSSEY GAY BELL
Established 1958

ENGINEERS, PLANNERS & SURVEYORS

3100 BRECKINRIDGE BLVD
BUILDING 300
DULUTH, GEORGIA 30096TEL:
(770) 923-1600
FAX: (770) 923-4202

Client

CITY OF LAWRENCEVILLE
P.O. BOX 2200
Lawrenceville, GA 30046
Phone: (678) 407-6582

Contact: Jim Wright (404) 427-3017

NO.	BY	APPROVED	DATE

Project Title

SANDALWOOD DRAINAGE IMPROVEMENT PROJECT

Project Location

SHOAL CREEK TRIBUTARY #4.1
SANDALWOOD LAKE

Project No.	23-001
Drawn By:	RH
Checked By:	MB
Date:	April 15, 2023

Sheet Title

DRAINAGE BASIN MAP

Sheet Number

B-

HUSSEY GAY BELL
Established 1958

ENGINEERS, PLANNERS & SURVEYORS

3100 BRECKINRIDGE BLVD
BUILDING 300
DULUTH, GEORGIA 30096TEL:
(770) 923-1600
FAX: (770) 923-4202

Client

CITY OF LAWRENCEVILLE
P.O. BOX 2200
Lawrenceville, GA 30046
Phone: (678) 407-6582

Contact: Jim Wright (404) 427-3017

NO.	BY	APPROVED	DATE

Project Title

SANDALWOOD DRAINAGE IMPROVEMENT PROJECT

Project Location

SHOAL CREEK TRIBUTARY #4.1 SANDALWOOD LAKE

Project No.	**23-001**
Drawn By:	**RH**
Checked By:	**MB**
Date:	**April 15, 2023**

Sheet Title

LAND–USE MAP

Sheet Number

B–

BASIN DATA

Drainage area to the lake = 231.2 acres, CN = 76

Wooded = 30.4 acres,	CN = 55
Rural Residential = 3.9 acres,	CN = 66
Commercial = 55.6 acres,	CN = 92
Residential = 113.1 acres,	CN = 74
Water Surface = 8.2 acres,	CN = 98
Rural Residential = 20 acres,	CN = 68

Tc = 42.9 minutes (see next page)

TR55 Tc Worksheet

Hyd. No. 2

TO LAKE

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 88.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.72		0.00		0.00		
Land slope (%)	= 2.20		0.00		0.00		
Travel Time (min)	**= 17.31**	**+**	**0.00**	**+**	**0.00**	**=**	**17.31**
Shallow Concentrated Flow							
Flow length (ft)	= 185.00		810.00		0.00		
Watercourse slope (%)	= 2.20		1.70		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.39		2.65		0.00		
Travel Time (min)	**= 1.29**	**+**	**5.09**	**+**	**0.00**	**=**	**6.38**
Channel Flow							
X sectional flow area (sqft)	= 50.00		0.00		0.00		
Wetted perimeter (ft)	= 30.00		0.00		0.00		
Channel slope (%)	= 0.60		0.00		0.00		
Manning's n-value	= 0.040		0.015		0.015		
Velocity (ft/s)	=4.06						
			0.00				
					0.00		
Flow length (ft)	({0})4681.0		0.0		0.0		
Travel Time (min)	**= 19.20**	**+**	**0.00**	**+**	**0.00**	**=**	**19.20**

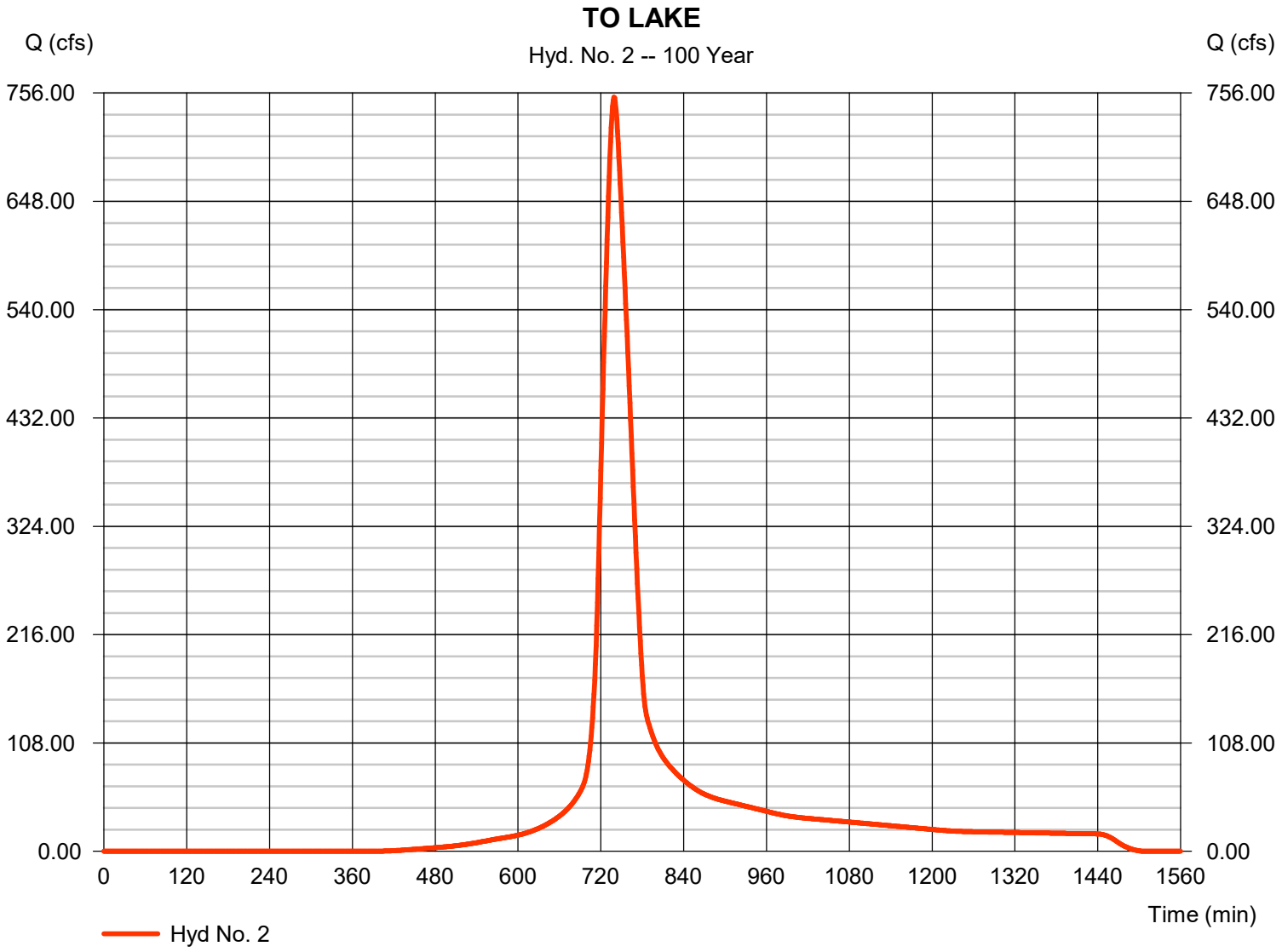
Total Travel Time, Tc ..... 42.89 min

Hyd. No. 2

TO LAKE

Hydrograph type	= SCS Runoff	Peak discharge	= 751.86 cfs
Storm frequency	= 100 yrs	Time to peak	= 739 min
Time interval	= 1 min	Hyd. volume	= 3,832,165 cuft
Drainage area	= 231.200 ac	Curve number	= 76*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 42.89 min
Total precip.	= 7.37 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(30.400 x 55) + (3.900 x 66) + (55.600 x 92) + (113.100 x 74) + (8.200 x 98) + (20.000 x 68)] / 231.200



EXISTING CONDITION

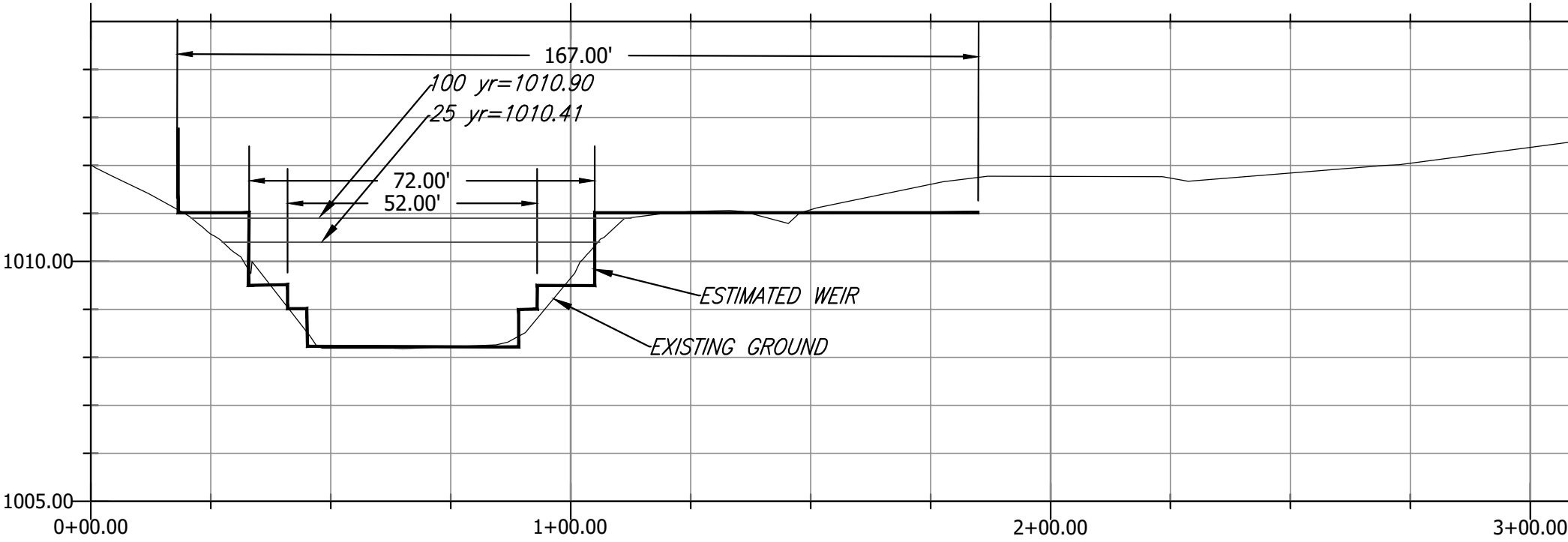
DESCRIPTION:

The top of dam is approximately 26’ wide and contains a concrete weir and a single lane paved road with curb and gutter. A concrete weir, approximately 44’ wide with 8:1 side slopes, controls the flows across the dam to the concrete spillway. Multiple broad crested weirs were used to estimate the flow through the weir described above. Refer to page B-9. Refer to Appendix A for further description of the dam and spillway.

PROCEDURE:

Current Condition

1. A field run topographic survey of the dam was completed.
2. An approximation of the weir over the dam was computed based on the dam’s profile. An approximation was made using broad crested weirs only due to program limitations.
3. A stage storage discharge curve was computed based on the pond’s contours and the approximated spillway.
4. The Inflow hydrographs (previously calculated) were routed through the existing outlet structure/weir.



Profile View of EXISTING DAM

Pond Report

Pond No. 1 - EXISTING LAKE-WS 1007.8

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 996.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	996.50	00	0	0
1.50	998.00	6,667	3,333	3,333
3.50	1000.00	19,660	25,181	28,514
5.50	1002.00	40,615	59,016	87,530
7.50	1004.00	74,294	113,216	200,746
9.50	1006.00	127,565	199,454	400,200
11.50	1008.00	177,881	304,025	704,224
13.50	1010.00	192,895	370,638	1,074,862
15.50	1012.00	213,769	406,445	1,481,307

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	12.00	0.00	0.00
Span (in)	= 0.00	12.00	0.00	0.00
No. Barrels	= 0	4	0	0
Invert El. (ft)	= 0.00	1007.81	0.00	0.00
Length (ft)	= 0.00	35.00	0.00	0.00
Slope (%)	= 0.00	4.00	0.00	n/a
N-Value	= .013	.024	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 44.00	8.00	20.00	95.00
Crest El. (ft)	= 1008.20	1009.00	1009.50	1011.00
Weir Coeff.	= 2.60	2.60	2.60	2.60
Weir Type	= Broad	Broad	Broad	Broad
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Contour)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	996.50	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
0.15	333	996.65	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
0.30	667	996.80	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
0.45	1,000	996.95	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
0.60	1,333	997.10	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
0.75	1,667	997.25	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
0.90	2,000	997.40	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
1.05	2,333	997.55	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
1.20	2,667	997.70	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
1.35	3,000	997.85	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
1.50	3,333	998.00	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
1.70	5,851	998.20	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
1.90	8,369	998.40	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
2.10	10,888	998.60	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
2.30	13,406	998.80	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
2.50	15,924	999.00	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
2.70	18,442	999.20	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
2.90	20,960	999.40	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
3.10	23,478	999.60	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
3.30	25,996	999.80	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
3.50	28,514	1000.00	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
3.70	34,416	1000.20	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
3.90	40,318	1000.40	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
4.10	46,219	1000.60	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
4.30	52,121	1000.80	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
4.50	58,022	1001.00	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
4.70	63,924	1001.20	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
4.90	69,826	1001.40	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
5.10	75,727	1001.60	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
5.30	81,629	1001.80	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
5.50	87,530	1002.00	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
5.70	98,852	1002.20	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
5.90	110,173	1002.40	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
6.10	121,495	1002.60	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	

Continues on ne

EXISTING LAKE-WS 1007.8

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
6.30	132,817	1002.80	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
6.50	144,138	1003.00	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
6.70	155,460	1003.20	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
6.90	166,781	1003.40	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
7.10	178,103	1003.60	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
7.30	189,424	1003.80	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
7.50	200,746	1004.00	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
7.70	220,691	1004.20	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
7.90	240,637	1004.40	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
8.10	260,582	1004.60	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
8.30	280,527	1004.80	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
8.50	300,473	1005.00	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
8.70	320,418	1005.20	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
8.90	340,363	1005.40	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
9.10	360,309	1005.60	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
9.30	380,254	1005.80	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
9.50	400,200	1006.00	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
9.70	430,602	1006.20	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
9.90	461,005	1006.40	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
10.10	491,407	1006.60	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
10.30	521,809	1006.80	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
10.50	552,212	1007.00	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
10.70	582,614	1007.20	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
10.90	613,017	1007.40	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
11.10	643,419	1007.60	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
11.30	673,822	1007.80	---	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
11.50	704,224	1008.00	---	0.62 ic	---	---	0.00	0.00	0.00	0.00	---	---	0.619
11.70	741,288	1008.20	---	2.41 ic	---	---	0.00	0.00	0.00	0.00	---	---	2.413
11.90	778,352	1008.40	---	5.05 ic	---	---	10.23	0.00	0.00	0.00	---	---	15.28
12.10	815,416	1008.60	---	8.06 ic	---	---	28.94	0.00	0.00	0.00	---	---	37.00
12.30	852,479	1008.80	---	10.63 ic	---	---	53.17	0.00	0.00	0.00	---	---	63.80
12.50	889,543	1009.00	---	12.56 ic	---	---	81.87	0.00	0.00	0.00	---	---	94.43
12.70	926,607	1009.20	---	14.27 ic	---	---	114.41	1.86	0.00	0.00	---	---	130.54
12.90	963,671	1009.40	---	15.60 oc	---	---	150.40	5.26	0.00	0.00	---	---	171.26
13.10	1,000,734	1009.60	---	16.37 oc	---	---	189.52	9.67	1.65	0.00	---	---	217.20
13.30	1,037,798	1009.80	---	17.10 oc	---	---	231.55	14.89	8.55	0.00	---	---	272.08
13.50	1,074,862	1010.00	---	17.80 oc	---	---	276.27	20.80	18.38	0.00	---	---	333.25
13.70	1,115,506	1010.20	---	18.47 oc	---	---	323.57	27.34	30.46	0.00	---	---	399.84
13.90	1,156,151	1010.40	---	19.12 oc	---	---	373.30	34.46	44.40	0.00	---	---	471.28
14.10	1,196,795	1010.60	---	19.75 oc	---	---	425.35	42.10	59.99	0.00	---	---	547.20
14.30	1,237,440	1010.80	---	20.36 oc	---	---	479.62	50.23	77.08	0.00	---	---	627.29
14.50	1,278,084	1011.00	---	20.95 oc	---	---	536.01	58.83	95.54	0.00	---	---	711.34
14.70	1,318,729	1011.20	---	21.53 oc	---	---	594.46	67.88	115.27	22.10	---	---	821.24
14.90	1,359,373	1011.40	---	22.09 oc	---	---	654.89	77.34	136.20	62.51	---	---	953.02
15.10	1,400,018	1011.60	---	22.64 oc	---	---	717.23	87.21	158.26	114.82	---	---	1100.16
15.30	1,440,662	1011.80	---	23.17 oc	---	---	781.44	97.46	181.40	176.78	---	---	1260.25
15.50	1,481,307	1012.00	---	23.69 oc	---	---	847.42	108.08	205.55	247.00	---	---	1431.74

...End

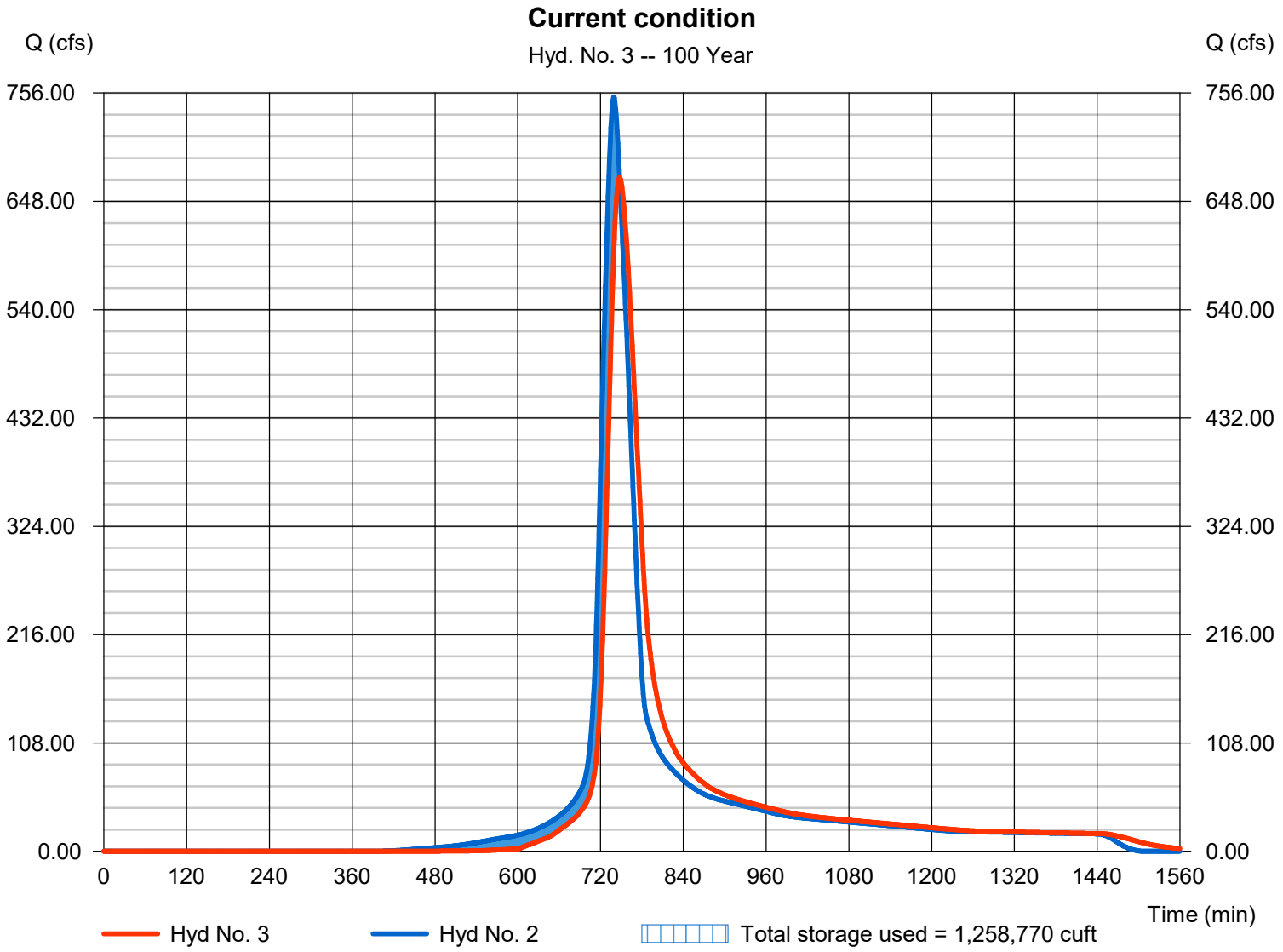
Hydrograph Report

Hyd. No. 3

Current condition

Hydrograph type	=	Reservoir	Peak discharge	=	671.37 cfs
Storm frequency	=	100 yrs	Time to peak	=	748 min
Time interval	=	1 min	Hyd. volume	=	3,821,346 cuft
Inflow hyd. No.	=	2 - TO LAKE	Max. Elevation	=	1010.91 ft
Reservoir name	=	EXISTING LAKE-WS 1007.8	Max. Storage	=	1,258,770 cuft

Storage Indication method used. Wet pond routing start elevation = 1007.80 ft.



RESULTS:

	Current Condition		
Frequency (year)	Inflow (cfs)	Outflow (cfs)	Elevation
2	242.64	180.16	1009.44
5	337.89	272.66	1009.80
10	422.36	355.90	1010.07
25	546.03	473.60	1010.41
50	646.80	570.45	1010.66
100	751.85	671.37	1010.91

The top of the existing dam varies in elevation from 1011.08 to 1012.52 with most of the dam at ~ 1011.6. The results above show that the 100-year elevation within the lake only has .7' of freeboard. Downstream of the dam is an existing 84" RCP under a private drive. Analysis of the downstream pipe shows that the current 100-year storm will flow over the drive.

OPTION 1 – WET LAKE W/ CONCRETE SPILLWAY

Description

Procedure

Current Top of Dam Profile & Estimated Spillway

Stage Storage Discharge Data

Routed Hydrograph

Results

Advantages & Disadvantages

Exhibit 1 – Shoal Creek Tributary 4.1 Downstream Option 1

Cost Estimate

OPTION 1: WET LAKE WITH CONCRETE SPILLWAY

DESCRIPTION:

The first option was to repair the spillway as needed in the current configuration. Because the routing showed a lack of freeboard for the 100-year elevation, Hussey Gay Bell does not recommend “repair as needed”. An alternative was analyzed where the spillway was lowered 1’ to allow for 1.5’ of freeboard. It should be noted that during the design phase, the base flow should be addressed.

PROCEDURE:

Wet Pond- Concrete Spillway

1. Currently the dam does not have an appropriate amount of freeboard.
2. To obtain 1.5’ of freeboard the water surface was lowered 1.0’ to 1006.8 and the top of the dam was raised slightly.
3. Various broad crested weirs were utilized to obtain the optimal configuration.
4. The existing stage-storage data was used for the proposed condition. This assumes no changes to the grades above the 1006.8 contour. The stage-storage discharge curve was computed.
5. The hydrographs were routed through the proposed outlet configuration to verify freeboard and reduction in peak flows.
6. For construction purposes, a 14:1 side slope was used to approximate the broad crested weir configuration.
7. The 100-year maximum elevation in this configuration is 1010.34. Adding 1.5’ for freeboard sets the new top of dam elevation at 1011.84. Based on the existing topographic map, there should be no issues adjusting the entire top of dam to this elevation.

Pond Report

Pond No. 3 - PROP POND-WS 1006.8 SPILL

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 996.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	996.50	00	0	0
1.50	998.00	6,667	3,333	3,333
3.50	1000.00	19,660	25,181	28,514
5.50	1002.00	40,615	59,016	87,530
7.50	1004.00	74,294	113,216	200,746
9.50	1006.00	127,565	199,454	400,200
11.50	1008.00	177,881	304,025	704,224
13.50	1010.00	192,895	370,638	1,074,862
15.50	1012.00	213,769	406,445	1,481,307

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	Inactive	Inactive	Inactive	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	1	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 20.00	22.00	24.00	24.00
Crest El. (ft)	= 1006.81	1007.80	1009.40	1009.70
Weir Coeff.	= 2.60	2.60	2.60	2.60
Weir Type	= Broad	Broad	Broad	Broad
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Contour)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	996.50	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
0.15	333	996.65	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
0.30	667	996.80	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
0.45	1,000	996.95	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
0.60	1,333	997.10	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
0.75	1,667	997.25	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
0.90	2,000	997.40	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
1.05	2,333	997.55	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
1.20	2,667	997.70	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
1.35	3,000	997.85	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
1.50	3,333	998.00	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
1.70	5,851	998.20	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
1.90	8,369	998.40	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
2.10	10,888	998.60	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
2.30	13,406	998.80	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
2.50	15,924	999.00	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
2.70	18,442	999.20	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
2.90	20,960	999.40	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
3.10	23,478	999.60	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
3.30	25,996	999.80	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
3.50	28,514	1000.00	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
3.70	34,416	1000.20	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
3.90	40,318	1000.40	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
4.10	46,219	1000.60	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
4.30	52,121	1000.80	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
4.50	58,022	1001.00	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
4.70	63,924	1001.20	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
4.90	69,826	1001.40	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
5.10	75,727	1001.60	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
5.30	81,629	1001.80	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
5.50	87,530	1002.00	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
5.70	98,852	1002.20	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
5.90	110,173	1002.40	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
6.10	121,495	1002.60	---	---	---	---	0.00	0.00	0.00	0.00	---	---	---

Continues on ne

PROP POND-WS 1006.8 SPILL

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
6.30	132,817	1002.80	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
6.50	144,138	1003.00	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
6.70	155,460	1003.20	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
6.90	166,781	1003.40	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
7.10	178,103	1003.60	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
7.30	189,424	1003.80	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
7.50	200,746	1004.00	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
7.70	220,691	1004.20	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
7.90	240,637	1004.40	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
8.10	260,582	1004.60	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
8.30	280,527	1004.80	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
8.50	300,473	1005.00	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
8.70	320,418	1005.20	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
8.90	340,364	1005.40	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
9.10	360,309	1005.60	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
9.30	380,254	1005.80	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
9.50	400,200	1006.00	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
9.70	430,602	1006.20	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
9.90	461,005	1006.40	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
10.10	491,407	1006.60	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
10.30	521,809	1006.80	---	---	---	---	0.00	0.00	0.00	0.00	---	---	0.000
10.50	552,212	1007.00	---	---	---	---	4.31	0.00	0.00	0.00	---	---	4.307
10.70	582,614	1007.20	---	---	---	---	12.67	0.00	0.00	0.00	---	---	12.67
10.90	613,017	1007.40	---	---	---	---	23.57	0.00	0.00	0.00	---	---	23.57
11.10	643,419	1007.60	---	---	---	---	36.51	0.00	0.00	0.00	---	---	36.51
11.30	673,822	1007.80	---	---	---	---	51.22	0.00	0.00	0.00	---	---	51.22
11.50	704,224	1008.00	---	---	---	---	67.50	5.12	0.00	0.00	---	---	72.62
11.70	741,288	1008.20	---	---	---	---	85.22	14.47	0.00	0.00	---	---	99.69
11.90	778,352	1008.40	---	---	---	---	104.26	26.59	0.00	0.00	---	---	130.84
12.10	815,416	1008.60	---	---	---	---	124.53	40.93	0.00	0.00	---	---	165.46
12.30	852,479	1008.80	---	---	---	---	145.98	57.20	0.00	0.00	---	---	203.18
12.50	889,543	1009.00	---	---	---	---	168.53	75.19	0.00	0.00	---	---	243.72
12.70	926,607	1009.20	---	---	---	---	192.13	94.75	0.00	0.00	---	---	286.89
12.90	963,671	1009.40	---	---	---	---	216.75	115.77	0.00	0.00	---	---	332.52
13.10	1,000,734	1009.60	---	---	---	---	242.33	138.13	5.58	0.00	---	---	386.04
13.30	1,037,798	1009.80	---	---	---	---	268.85	161.79	15.78	1.97	---	---	448.39
13.50	1,074,862	1010.00	---	---	---	---	296.27	186.65	29.00	10.25	---	---	522.18
13.70	1,115,506	1010.20	---	---	---	---	324.57	212.68	44.65	22.06	---	---	603.96
13.90	1,156,151	1010.40	---	---	---	---	353.71	239.81	62.40	36.55	---	---	692.47
14.10	1,196,795	1010.60	---	---	---	---	383.67	268.00	82.02	53.27	---	---	786.96
14.30	1,237,440	1010.80	---	---	---	---	414.44	297.22	103.36	71.99	---	---	887.01
14.50	1,278,084	1011.00	---	---	---	---	445.99	327.43	126.29	92.49	---	---	992.20
14.70	1,318,729	1011.20	---	---	---	---	478.30	358.61	150.69	114.64	---	---	1102.24
14.90	1,359,373	1011.40	---	---	---	---	511.36	390.71	176.49	138.31	---	---	1216.88
15.10	1,400,018	1011.60	---	---	---	---	545.13	423.71	203.61	163.42	---	---	1335.88
15.30	1,440,662	1011.80	---	---	---	---	579.63	457.60	232.00	189.89	---	---	1459.13
15.50	1,481,307	1012.00	---	---	---	---	614.83	492.35	261.60	217.66	---	---	1586.44

...End

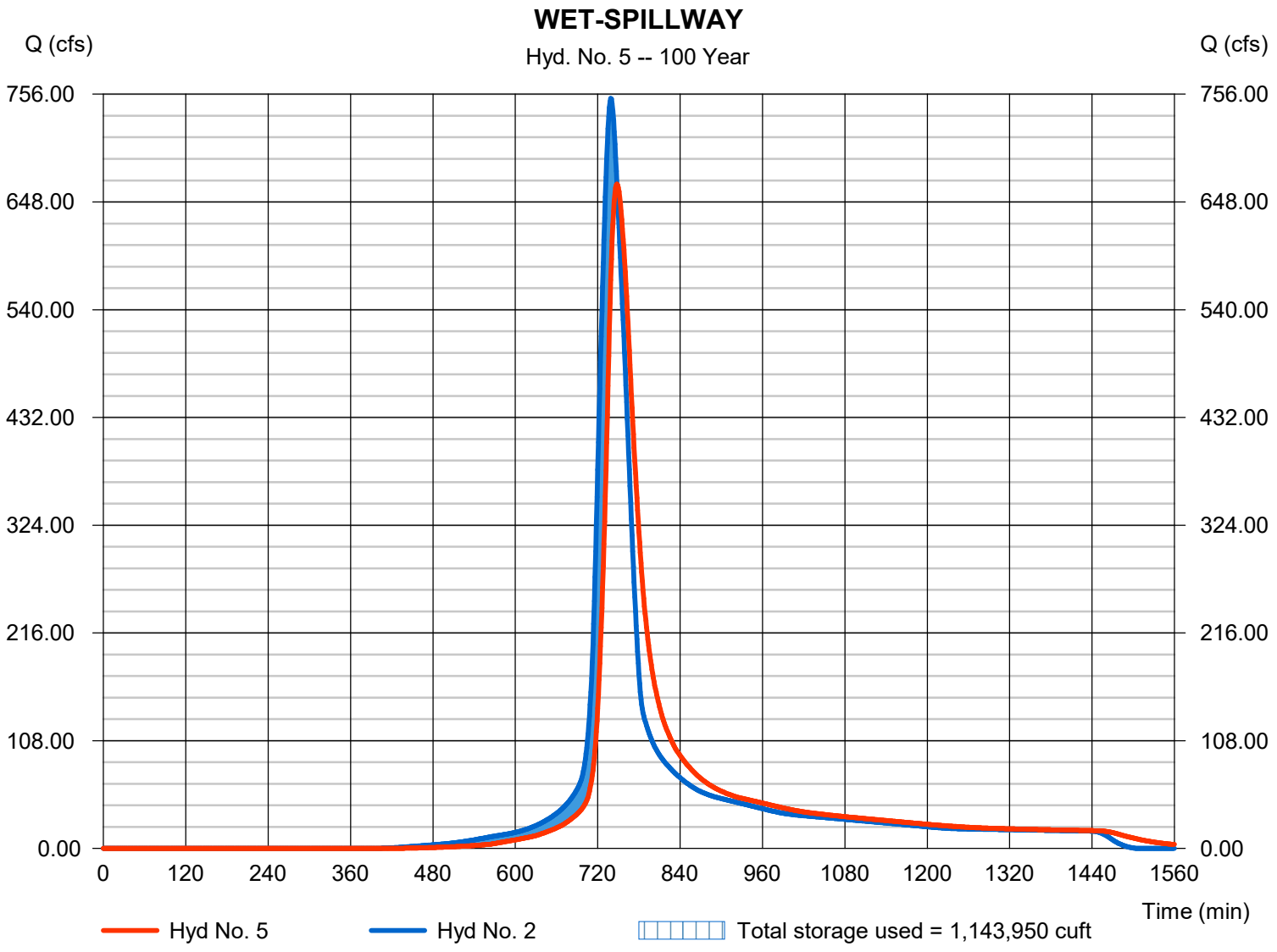
Hydrograph Report

Hyd. No. 5

WET-SPILLWAY

Hydrograph type	= Reservoir	Peak discharge	= 665.90 cfs
Storm frequency	= 100 yrs	Time to peak	= 748 min
Time interval	= 1 min	Hyd. volume	= 3,832,151 cuft
Inflow hyd. No.	= 2 - TO LAKE	Max. Elevation	= 1010.34 ft
Reservoir name	= PROP POND-WS 1006.8 SPIL	Max. Storage	= 1,143,950 cuft

Storage Indication method used. Wet pond routing start elevation = 1006.80 ft.



RESULTS:

Wet Pond with adjusted concrete emergency spillway.

20’ weir @ 1006.8

14:1 side slopes beginning at 1007.8

	Current Condition			Proposed Condition			
Frequency	Inflow	Outflow	Elevation	Inflow	Outflow	Elevation	NET Q
(year)	(cfs)	(cfs)		(cfs)	(cfs)		(cfs)
2	242.64	180.16	1009.44	242.64	171.13	1008.63	-9.03
5	337.89	272.66	1009.80	337.89	255.75	1009.06	-16.91
10	422.36	355.90	1010.07	422.36	332.14	1009.40	-23.76
25	546.03	473.60	1010.41	546.03	456.14	1009.82	-17.46
50	646.80	570.45	1010.66	646.80	560.22	1010.09	-10.23
100	751.85	671.37	1010.90	751.85	665.90	1010.34	-5.47

The normal pool of the lake was reduced from 1007.8 to 1006.8 (-1’). The 2-, 5-, 10-, 25- , 50- & 100-year peak flows were reduced. The 100-year elevation within the lake is reduced from 1010.90 to 1010.34 (-.56’).

Advantages

1. The water surface of the lake remains close to the existing condition.
2. Only a portion of the top of dam would need to be disturbed.
3. Appears to be the least expensive option.
4. Low maintenance.

Disadvantages

1. Spillway flows constantly.
2. If dam is needed for emergency exit from subdivision, water depth may become an issue.
3. Foot Bridge will be required to cross spillway if access is desired.
4. Limited reduction in downstream flows.
5. Excavation and haul off of approximately 15,000 cy of lake sediment (to obtain a 5’ depth in lake).

RECOMMENDATION:

This option is recommended because it requires the least amount of disturbance. The primary expenses are the concrete spillway and the haul off. Haul off volumes may be reduced by refining the proposed water surface elevation and top of dam elevations during design. Future maintenance would be easily visible and would include repairs to the spillway and removal of accumulated silt in the upstream areas.

(2) 8'Wx4'H CONC BOX
IE 977.3 IN
IE 976.9 OUT
SILTED

HERBERT HAYES

PRIVATE DRIVE

NEW HOPE RD

84"RCP
IE 986.03 IN
IE 984.52 OUT

NEW CONCRETE SPILLWAY & RENOVATED DAM

NEW 1 LANE ROAD FOR EMERGENCY ACCESS

LAKE
WS ~ 1' LOWER THAN EXISTING

N

GRAPHIC SCALE
100 50 0 100
1 inch = 100 ft.

HUSSEY GAY BELL
Established 1958

ENGINEERS, PLANNERS & SURVEYORS

3100 BRECKINRIDGE BLVD
BUILDING 300
DULUTH, GEORGIA 30096TEL:
(770) 923-1600
FAX: (770) 923-4202

Client

CITY OF LAWRENCEVILLE
P.O. BOX 2200
Lawrenceville, GA 30046
Phone: (678) 407-6582

Contact: Jim Wright (404) 427-3017

NO.	BY	APPROVED	DATE

Project Title

SANDALWOOD DRAINAGE IMPROVEMENT PROJECT

Project Location

SANDALWOOD TOWNHOMES

Project No.	23-001
Drawn By:	RH
Checked By:	MB
Date:	April 15, 2023

Sheet Title

SHOAL CREEK TRIBUTARY 4.1 DOWNSTREAM OPTION 1

Sheet Number

EXHIBIT

SANDALWOOD DAM
CITY OF LAWRENCEVILLE
HIGH LEVEL ESTIMATE- OPTION 1 CONCRETE SPILLWAY WITH LAKE
5/10/2023

DEMOLITION

ITEM	UNITS	QUANTITY	ENGINEERS ESTIMATE UNIT COST	TOTAL
Pavement Removal	SFT	4,530	$ 2.00	$ 9,060.00
Curb & Gutter Removal	LF	560	$ 3.00	$ 1,680.00
Clearing	AC	1	$ 3,000.00	$ 3,000.00
Concrete Spillway Removal	SFT	7,265	$ 5.00	$ 36,325.00
Drain Lake	LS	1	$ 20,000.00	$ 20,000.00
			SUBTOTAL	**$ 70,065.00**

DRIVE ON DAM

ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
Light Duty Paving (Inc. 6"GAB)	SY	360	$ 26.00	$ 9,360.00
24" Curb & Gutter	LF	500	$ 25.00	$ 12,500.00
Bollards (4)	EA	4	$ 500.00	$ 2,000.00
			SUB TOTAL	**$ 23,860.00**

DAM

ITEM	UNITS	QUANTITY	ENGINEERS ESTIMATE UNIT COST	TOTAL
Spillway Excavation	LS	1	$ 10,000.00	$ 10,000.00
Remove & reinstall 5' deep on dam face	CY	2,000	$ 30.00	$ 60,000.00
Sediment Removal from Lake	CY	16,000	$ 15.00	$ 240,000.00
Concrete Weir	SY	345	$ 300.00	$ 103,500.00
Concrete Spillway	SY	151	$ 1,000.00	$ 151,000.00
Spillway Drains	LS	1	$ 30,000.00	$ 30,000.00
6" Toe Drains	LF	130	$ 300.00	$ 39,000.00
Foot Bridge	LS	1	$ 15,000.00	$ 15,000.00
Geotechnical Engineer	LS	1	$ 18,000.00	$ 18,000.00
			SUB TOTAL	**$ 666,500.00**

EROSION CONTROL

ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
Silt fence	LF	400	$ 5.00	$ 2,000.00
Temporary Seeding	AC	1	$ 1,500.00	$ 1,500.00
Construction Exit	EA	1	$ 3,500.00	$ 3,500.00
Rock Dam	CY	30	$ 60.00	$ 1,800.00
Temporary coffer dam, siphon water control	LS	1	$ 75,000.00	$ 75,000.00
Rip Rap	CY	83	$ 120.00	$ 9,960.00
			SUB TOTAL	**$ 93,760.00**

			SUBTOTAL	**$ 854,185.00**
Design Fees 10%			10%	$ 85,418.50
Contingency 25%			25%	$ 213,546.25
			TOTAL	**$ 1,153,149.75**

OPTION 2 – WET LAKE W/ RISER ONLY

Description

Procedure

Stage Storage Discharge Data

Routed Hydrograph

Results

Advantages & Disadvantages

OPTION 2: WET POND- RISER & EARTHEN EMERGENCY SPILLWAY

DESCRIPTION:

A riser and primary spillway (pipe) through the dam were evaluated in lieu of a concrete weir and spillway. In this option all flows (1-year through the 100-year frequency) will pass through the riser. The emergency spillway is anticipated to be earthen with geotechnical reinforcement such as vegetated *Geoweb* soil confinement system.

PROCEDURE:

1. The normal pool of the lake was dropped 0.6’ from 1007.8 to 1007.2.
2. To maintain peak flows at current levels and to remain below the current 100-year elevation, a 10x10 riser was required. This riser has a 2’ weir cut into it at an elevation of 1007.2 to handle the lower year storm frequencies. In the final design, an earthen emergency spillway is required to convey emergency discharges larger than the 100-year flow.
3. An 84”, (7’) diameter, Class V reinforced concrete pipe is required to carry the 100-year storm event. This pipe would require a concrete cradle to prevent uneven settling.
4. The inflow hydrographs to the lake were routed through the proposed riser.
5. The 100-year elevation of the lake was determined to be 1010.88. This is 0.02’ below the current 100-year elevation. The top of the dam would need to be raised to 1012.38 to provide 1.5’ of freeboard.
6. All peak discharges were reduced when compared to the existing condition.
7. Conveyance of base flows will be addressed in the final design but it is anticipated to go through the riser and discharge pipe.

Pond Report

Pond No. 10 - PROP POND-WS RISER

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 996.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	996.50	00	0	0
1.50	998.00	6,667	3,333	3,333
3.50	1000.00	19,660	25,181	28,514
5.50	1002.00	40,615	59,016	87,530
7.50	1004.00	74,294	113,216	200,746
9.50	1006.00	127,565	199,454	400,200
11.50	1008.00	177,881	304,025	704,224
13.50	1010.00	192,895	370,638	1,074,862
14.50	1011.00	202,022	197,421	1,272,283
15.50	1012.00	213,769	207,847	1,480,130

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 84.00	Inactive	0.00	0.00
Span (in)	= 84.00	0.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 995.00	0.00	0.00	0.00
Length (ft)	= 104.00	0.00	0.00	0.00
Slope (%)	= 1.90	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 38.00	2.00	Inactive	Inactive
Crest El. (ft)	= 1007.90	1007.21	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	2.60
Weir Type	= 1	Rect	Broad	Broad
Multi-Stage	= Yes	Yes	No	No
Exfil.(in/hr)	= 0.000 (by Contour)			
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	996.50	0.00	---	---	---	0.00	0.00	---	---	---	---	0.000
0.15	333	996.65	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
0.30	667	996.80	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
0.45	1,000	996.95	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
0.60	1,333	997.10	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
0.75	1,667	997.25	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
0.90	2,000	997.40	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
1.05	2,333	997.55	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
1.20	2,667	997.70	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
1.35	3,000	997.85	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
1.50	3,333	998.00	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
1.70	5,851	998.20	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
1.90	8,369	998.40	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
2.10	10,888	998.60	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
2.30	13,406	998.80	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
2.50	15,924	999.00	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
2.70	18,442	999.20	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
2.90	20,960	999.40	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
3.10	23,478	999.60	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
3.30	25,996	999.80	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
3.50	28,514	1000.00	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
3.70	34,416	1000.20	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
3.90	40,318	1000.40	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
4.10	46,219	1000.60	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
4.30	52,121	1000.80	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
4.50	58,022	1001.00	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
4.70	63,924	1001.20	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
4.90	69,826	1001.40	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
5.10	75,727	1001.60	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
5.30	81,629	1001.80	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
5.50	87,530	1002.00	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
5.70	98,852	1002.20	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
5.90	110,173	1002.40	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	

Continues on ne

PROP POND-WS RISER

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
6.10	121,495	1002.60	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
6.30	132,817	1002.80	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
6.50	144,138	1003.00	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
6.70	155,460	1003.20	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
6.90	166,781	1003.40	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
7.10	178,103	1003.60	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
7.30	189,424	1003.80	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
7.50	200,746	1004.00	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
7.70	220,691	1004.20	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
7.90	240,637	1004.40	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
8.10	260,582	1004.60	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
8.30	280,527	1004.80	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
8.50	300,473	1005.00	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
8.70	320,418	1005.20	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
8.90	340,364	1005.40	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
9.10	360,309	1005.60	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
9.30	380,254	1005.80	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
9.50	400,200	1006.00	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
9.70	430,602	1006.20	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
9.90	461,005	1006.40	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
10.10	491,407	1006.60	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
10.30	521,809	1006.80	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
10.50	552,212	1007.00	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
10.70	582,614	1007.20	26.00 ic	---	---	---	0.00	0.00	---	---	---	---	0.000
10.90	613,017	1007.40	26.00 ic	---	---	---	0.00	0.55	---	---	---	---	0.552
11.10	643,419	1007.60	26.00 ic	---	---	---	0.00	1.62	---	---	---	---	1.623
11.30	673,822	1007.80	26.00 ic	---	---	---	0.00	3.02	---	---	---	---	3.019
11.50	704,224	1008.00	26.00 ic	---	---	---	4.00	4.68	---	---	---	---	8.676
11.70	741,288	1008.20	27.40 ic	---	---	---	20.79	6.56	---	---	---	---	27.35
11.90	778,352	1008.40	54.51 ic	---	---	---	44.74	8.65	---	---	---	---	53.38
12.10	815,416	1008.60	86.42 ic	---	---	---	74.11	10.91	---	---	---	---	85.03
12.30	852,479	1008.80	121.60 ic	---	---	---	108.05	13.35	---	---	---	---	121.40
12.50	889,543	1009.00	164.16 ic	---	---	---	146.00	15.95	---	---	---	---	161.95
12.70	926,607	1009.20	207.89 ic	---	---	---	187.57	18.70	---	---	---	---	206.27
12.90	963,671	1009.40	255.66 ic	---	---	---	232.48	21.59	---	---	---	---	254.07
13.10	1,000,734	1009.60	305.11 ic	---	---	---	280.50	24.61	---	---	---	---	305.11
13.30	1,037,798	1009.80	359.19 oc	---	---	---	331.43	27.76	---	---	---	---	359.19
13.50	1,074,862	1010.00	416.12 ic	---	---	---	385.08	31.04	---	---	---	---	416.12
13.60	1,094,604	1010.10	445.62 ic	---	---	---	412.90	32.72	---	---	---	---	445.62
13.70	1,114,346	1010.20	475.80 ic	---	---	---	441.37	34.43	---	---	---	---	475.80
13.80	1,134,088	1010.30	506.63 ic	---	---	---	470.46	36.17	---	---	---	---	506.63
13.90	1,153,830	1010.40	538.10 ic	---	---	---	500.16	37.94	---	---	---	---	538.10
14.00	1,173,572	1010.50	568.53 ic	---	---	---	530.36 s	38.17 s	---	---	---	---	568.53
14.10	1,193,315	1010.60	582.54 ic	---	---	---	544.47 s	38.07 s	---	---	---	---	582.53
14.20	1,213,057	1010.70	592.46 ic	---	---	---	554.33 s	38.14 s	---	---	---	---	592.46
14.30	1,232,799	1010.80	600.82 ic	---	---	---	562.59 s	38.22 s	---	---	---	---	600.81
14.40	1,252,541	1010.90	608.17 ic	---	---	---	569.85 s	38.31 s	---	---	---	---	608.16
14.50	1,272,283	1011.00	614.82 ic	---	---	---	576.42 s	38.39 s	---	---	---	---	614.81
14.60	1,293,068	1011.10	620.89 ic	---	---	---	582.40 s	38.47 s	---	---	---	---	620.88
14.70	1,313,853	1011.20	626.52 ic	---	---	---	587.95 s	38.55 s	---	---	---	---	626.50
14.80	1,334,637	1011.30	631.77 ic	---	---	---	593.13 s	38.63 s	---	---	---	---	631.76
14.90	1,355,422	1011.40	636.71 ic	---	---	---	598.00 s	38.70 s	---	---	---	---	636.70
15.00	1,376,207	1011.50	641.39 ic	---	---	---	602.61 s	38.77 s	---	---	---	---	641.38
15.10	1,396,992	1011.60	645.84 ic	---	---	---	607.00 s	38.83 s	---	---	---	---	645.84
15.20	1,417,776	1011.70	650.10 ic	---	---	---	611.18 s	38.90 s	---	---	---	---	650.08
15.30	1,438,561	1011.80	654.18 ic	---	---	---	615.20 s	38.96 s	---	---	---	---	654.17
15.40	1,459,346	1011.90	658.11 ic	---	---	---	619.06 s	39.03 s	---	---	---	---	658.09
15.50	1,480,130	1012.00	661.91 ic	---	---	---	622.80 s	39.09 s	---	---	---	---	661.90

...End

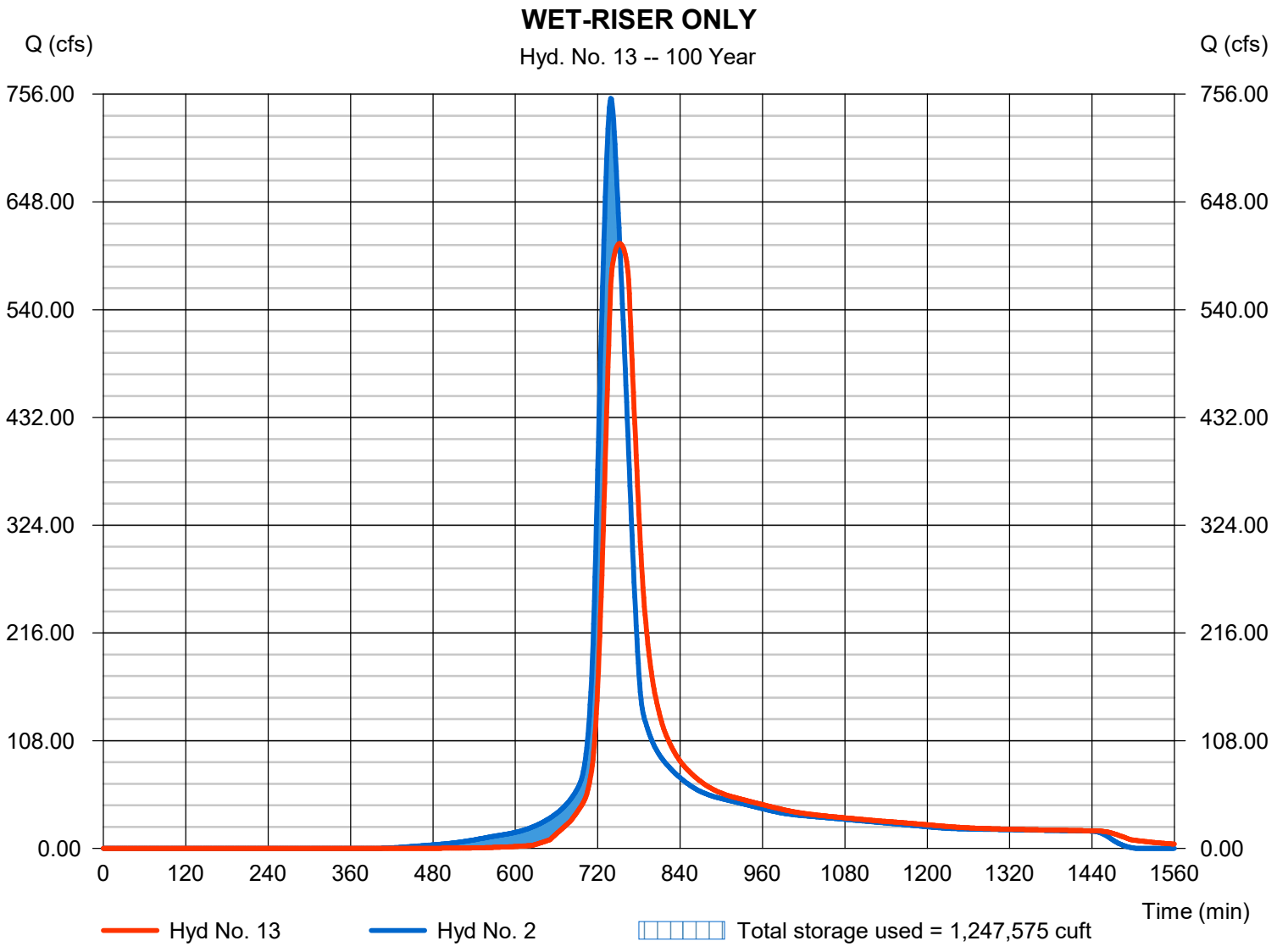
Hydrograph Report

Hyd. No. 13

WET-RISER ONLY

Hydrograph type	=	Reservoir	Peak discharge	=	606.31 cfs
Storm frequency	=	100 yrs	Time to peak	=	752 min
Time interval	=	1 min	Hyd. volume	=	3,815,520 cuft
Inflow hyd. No.	=	2 - TO LAKE	Max. Elevation	=	1010.88 ft
Reservoir name	=	PROP POND-WS RISER	Max. Storage	=	1,247,575 cuft

Storage Indication method used. Wet pond routing start elevation = 1007.20 ft.



RESULTS:

OPTION 2-Wet Pond- Riser & Earthen Emergency Spillway

OCS: (assumed 10'x10' square riser w/ peaked trash rack & 84" RCP outlet)
WSE = 1007.2
Earthen emergency spillway

	Current Condition			Proposed Condition			
Frequency	Inflow	Outflow	Elevation	Inflow	Outflow	Elevation	NET Q
(year)	(cfs)	(cfs)		(cfs)	(cfs)		(cfs)
2	242.64	180.16	1009.44	242.64	176.70	1009.07	-3.46
5	337.89	272.66	1009.80	337.89	266.83	1009.45	-5.83
10	422.36	355.90	1010.07	422.36	347.38	1009.76	-8.52
25	546.03	473.60	1010.41	546.03	462.99	1010.16	-10.61
50	646.80	570.45	1010.66	646.80	555.15	1010.46	-15.30
100	751.85	671.37	1010.90	751.85	606.31	1010.88	-65.06

Advantages

1. The water surface of the lake remains close to the existing condition.
2. Lower frequency storms would not flow over the spillway. An earthen spillway could be used for storms exceeding the 100 - year event.

Disadvantages

1. High cost
2. Large unattractive OCS
3. The entire dam would be significantly disturbed/rebuilt.
4. The adjacent pool and wall may be affected.
5. Excavation and haul-off of approximately 16,000 cy to get 5' depth in lake.

RECOMMENDATION:

This option is not recommended due to the cost. The primary contributor to the cost is the size of the outlet control structure and discharging pipe as well as the complete renovation of the dam. A 10'x10' OCS was used to control flows. If the structure is designed as a D-3D riser (to prevent vortexes), the equivalent structure becomes a 21' x 7' riser based on the flows and outlet pipe size (7'diameter). The 84" RCP Class V would require a concrete cradle that also adds to the cost. In addition, the dam would require complete renovation due to the excavation required for the pipe. A total renovation of the dam may result in the replacement of the adjacent wall, pool, and clubhouse.

Option 3 – Micropool w/ Water Quality

Description

Procedure

Stage Storage Discharge Data

Routed Hydrograph

Results

Advantages & Disadvantages

OPTION 3: DRY POND WITH MICROPOOL & WATER QUALITY STORAGE

DESCRIPTION:

The third option was to convert the lake to a dry pond and provide some regional detention & water quality. Due to the drainage area being more than 75 acres, a small pool of water (approximately 5’ deep, elevation = 1001.5) will remain within the pond to prevent clogging and resuspension of settled sediments. A ~ 10-inch discharge pipe or orifice will be installed to discharge the WQV for the Basin over 24 hours.

“Dry Pond”-

OCS: (assumed 8’x8’ square riser @ 1006.25 w/ peaked trash rack & 66” RCP outlet)
10” discharge pipe pipe/orifice for WQ flow control @ 1001.5.
Concrete Emergency Spillway: 6’ wide w/ 4:1 side slopes @ elevation 1008.0.
Base flow outlet – Future design

PROCEDURE:

1. A small pool of water (approximately 5’ deep, elevation = 1001.5) was included to prevent clogging.
2. The required WQv for the basin was computed (417,462 cft @ 1006.11) and the overflow was placed above this elevation (1006.25). A 10” outlet was sized to drain the water quality volume over 24 hours.
3. An outlet control structure and primary spillway was sized to detain as much as possible while maintaining 1.5’ freeboard. (100-year elevation ~ 1010.34) The top of dam was adjusted to 1011.84.
4. A 6’ wide concrete emergency spillway was required to pass the 10-year and larger storm events to maintain freeboard on the dam.

Pond No. 5 - MICRO-WS 1001.5

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 996.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	996.50	00	0	0
1.50	998.00	6,667	3,333	3,333
3.50	1000.00	19,660	25,181	28,514
5.50	1002.00	40,615	59,016	87,530
7.50	1004.00	74,294	113,216	200,746
9.50	1006.00	127,565	199,454	400,200
11.50	1008.00	177,881	304,025	704,224
13.50	1010.00	192,895	370,638	1,074,862
15.50	1012.00	213,769	406,445	1,481,307

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 66.00	10.00	0.00	0.00
Span (in)	= 66.00	10.00	0.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 995.00	1001.50	0.00	0.00
Length (ft)	= 104.00	0.00	0.00	0.00
Slope (%)	= 0.96	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 32.00	6.00	8.00	8.00
Crest El. (ft)	= 1006.25	1008.00	1009.00	1010.00
Weir Coeff.	= 3.33	2.60	2.60	2.60
Weir Type	= 1	Broad	Broad	Broad
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Contour)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	996.50	0.00	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
0.15	333	996.65	21.92 ic	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
0.30	667	996.80	21.92 ic	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
0.45	1,000	996.95	21.92 ic	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
0.60	1,333	997.10	21.92 ic	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
0.75	1,667	997.25	21.92 ic	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
0.90	2,000	997.40	21.92 ic	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
1.05	2,333	997.55	21.92 ic	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
1.20	2,667	997.70	21.92 ic	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
1.35	3,000	997.85	21.92 ic	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
1.50	3,333	998.00	21.92 ic	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
1.70	5,851	998.20	21.92 ic	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
1.90	8,369	998.40	21.92 ic	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
2.10	10,888	998.60	21.92 ic	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
2.30	13,406	998.80	21.92 ic	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
2.50	15,924	999.00	21.92 ic	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
2.70	18,442	999.20	21.92 ic	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
2.90	20,960	999.40	21.92 ic	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
3.10	23,478	999.60	21.92 ic	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
3.30	25,996	999.80	21.92 ic	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
3.50	28,514	1000.00	21.92 ic	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
3.70	34,416	1000.20	21.92 ic	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
3.90	40,318	1000.40	21.92 ic	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
4.10	46,219	1000.60	21.92 ic	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
4.30	52,121	1000.80	21.92 ic	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
4.50	58,022	1001.00	21.92 ic	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
4.70	63,924	1001.20	21.92 ic	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
4.90	69,826	1001.40	21.92 ic	0.00	---	---	0.00	0.00	0.00	0.00	---	---	0.000
5.10	75,727	1001.60	21.92 ic	0.04 ic	---	---	0.00	0.00	0.00	0.00	---	---	0.042
5.30	81,629	1001.80	21.92 ic	0.33 ic	---	---	0.00	0.00	0.00	0.00	---	---	0.330
5.50	87,530	1002.00	21.92 ic	0.82 ic	---	---	0.00	0.00	0.00	0.00	---	---	0.825
5.70	98,852	1002.20	21.92 ic	1.40 ic	---	---	0.00	0.00	0.00	0.00	---	---	1.397
5.90	110,173	1002.40	21.92 ic	1.83 ic	---	---	0.00	0.00	0.00	0.00	---	---	1.826
6.10	121,495	1002.60	21.92 ic	2.17 ic	---	---	0.00	0.00	0.00	0.00	---	---	

Continues on ne

MICRO-WS 1001.5

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
6.30	132,817	1002.80	21.92 ic	2.47 ic	---	---	0.00	0.00	0.00	0.00	---	---	2.468
6.50	144,138	1003.00	21.92 ic	2.73 ic	---	---	0.00	0.00	0.00	0.00	---	---	2.733
6.70	155,460	1003.20	21.92 ic	2.97 ic	---	---	0.00	0.00	0.00	0.00	---	---	2.975
6.90	166,781	1003.40	21.92 ic	3.20 ic	---	---	0.00	0.00	0.00	0.00	---	---	3.198
7.10	178,103	1003.60	21.92 ic	3.41 ic	---	---	0.00	0.00	0.00	0.00	---	---	3.407
7.30	189,424	1003.80	21.92 ic	3.60 ic	---	---	0.00	0.00	0.00	0.00	---	---	3.604
7.50	200,746	1004.00	21.92 ic	3.79 ic	---	---	0.00	0.00	0.00	0.00	---	---	3.790
7.70	220,691	1004.20	21.92 ic	3.97 ic	---	---	0.00	0.00	0.00	0.00	---	---	3.968
7.90	240,637	1004.40	21.92 ic	4.14 ic	---	---	0.00	0.00	0.00	0.00	---	---	4.138
8.10	260,582	1004.60	21.92 ic	4.30 ic	---	---	0.00	0.00	0.00	0.00	---	---	4.301
8.30	280,527	1004.80	21.92 ic	4.46 ic	---	---	0.00	0.00	0.00	0.00	---	---	4.459
8.50	300,473	1005.00	21.92 ic	4.61 ic	---	---	0.00	0.00	0.00	0.00	---	---	4.611
8.70	320,418	1005.20	21.92 ic	4.76 ic	---	---	0.00	0.00	0.00	0.00	---	---	4.758
8.90	340,364	1005.40	21.92 ic	4.90 ic	---	---	0.00	0.00	0.00	0.00	---	---	4.901
9.10	360,309	1005.60	21.92 ic	5.04 ic	---	---	0.00	0.00	0.00	0.00	---	---	5.039
9.30	380,254	1005.80	21.92 ic	5.17 ic	---	---	0.00	0.00	0.00	0.00	---	---	5.175
9.50	400,200	1006.00	21.92 ic	5.31 ic	---	---	0.00	0.00	0.00	0.00	---	---	5.306
9.70	430,602	1006.20	21.92 ic	5.43 ic	---	---	0.00	0.00	0.00	0.00	---	---	5.434
9.90	461,005	1006.40	21.92 ic	5.56 ic	---	---	6.19	0.00	0.00	0.00	---	---	11.75
10.10	491,407	1006.60	28.57 ic	5.68 ic	---	---	22.06	0.00	0.00	0.00	---	---	27.74
10.30	521,809	1006.80	49.27 ic	5.80 ic	---	---	43.46	0.00	0.00	0.00	---	---	49.27
10.50	552,212	1007.00	76.04 ic	5.92 ic	---	---	69.21	0.00	0.00	0.00	---	---	75.13
10.70	582,614	1007.20	105.68 oc	6.04 ic	---	---	98.67	0.00	0.00	0.00	---	---	104.71
10.90	613,017	1007.40	137.70 oc	6.15 ic	---	---	131.42	0.00	0.00	0.00	---	---	137.57
11.10	643,419	1007.60	173.41 oc	6.26 ic	---	---	167.14	0.00	0.00	0.00	---	---	173.40
11.30	673,822	1007.80	212.00 oc	6.37 ic	---	---	205.63	0.00	0.00	0.00	---	---	212.00
11.50	704,224	1008.00	252.72 oc	6.03 ic	---	---	246.69	0.00	0.00	0.00	---	---	252.72
11.70	741,288	1008.20	295.28 ic	5.11 ic	---	---	290.17	1.40	0.00	0.00	---	---	296.67
11.90	778,352	1008.40	336.77 ic	3.70 ic	---	---	333.07 s	3.95	0.00	0.00	---	---	340.72
12.10	815,416	1008.60	350.35 ic	3.18 ic	---	---	347.16 s	7.25	0.00	0.00	---	---	357.59
12.30	852,479	1008.80	359.56 ic	2.84 ic	---	---	356.71 s	11.16	0.00	0.00	---	---	370.71
12.50	889,543	1009.00	366.97 ic	2.57 ic	---	---	364.40 s	15.60	0.00	0.00	---	---	382.56
12.70	926,607	1009.20	373.30 ic	2.35 ic	---	---	370.95 s	20.51	1.86	0.00	---	---	395.67
12.90	963,671	1009.40	378.91 ic	2.16 ic	---	---	376.73 s	25.84	5.26	0.00	---	---	409.99
13.10	1,000,734	1009.60	383.99 ic	2.00 ic	---	---	381.98 s	31.57	9.67	0.00	---	---	425.22
13.30	1,037,798	1009.80	388.69 ic	1.86 ic	---	---	386.82 s	37.67	14.88	0.00	---	---	441.24
13.50	1,074,862	1010.00	393.10 ic	1.74 ic	---	---	391.33 s	44.12	20.80	0.00	---	---	457.99
13.70	1,115,506	1010.20	397.28 ic	1.63 ic	---	---	395.63 s	50.91	27.34	1.86	---	---	477.37
13.90	1,156,151	1010.40	401.28 ic	1.54 ic	---	---	399.71 s	58.00	34.46	5.26	---	---	498.97
14.10	1,196,795	1010.60	405.12 ic	1.45 ic	---	---	403.62 s	65.40	42.10	9.67	---	---	522.23
14.30	1,237,440	1010.80	408.84 ic	1.37 ic	---	---	407.44 s	73.09	50.23	14.88	---	---	547.02
14.50	1,278,084	1011.00	412.45 ic	1.31 ic	---	---	411.14 s	81.06	58.83	20.80	---	---	573.14
14.70	1,318,729	1011.20	415.98 ic	1.24 ic	---	---	414.71 s	89.30	67.87	27.34	---	---	600.47
14.90	1,359,373	1011.40	419.43 ic	1.19 ic	---	---	418.23 s	97.80	77.34	34.46	---	---	629.01
15.10	1,400,018	1011.60	422.81 ic	1.13 ic	---	---	421.66 s	106.56	87.20	42.10	---	---	658.65
15.30	1,440,662	1011.80	426.13 ic	1.08 ic	---	---	425.00 s	115.56	97.45	50.23	---	---	689.32
15.50	1,481,307	1012.00	429.39 ic	1.04 ic	---	---	428.34 s	124.80	108.08	58.83	---	---	721.10

...End

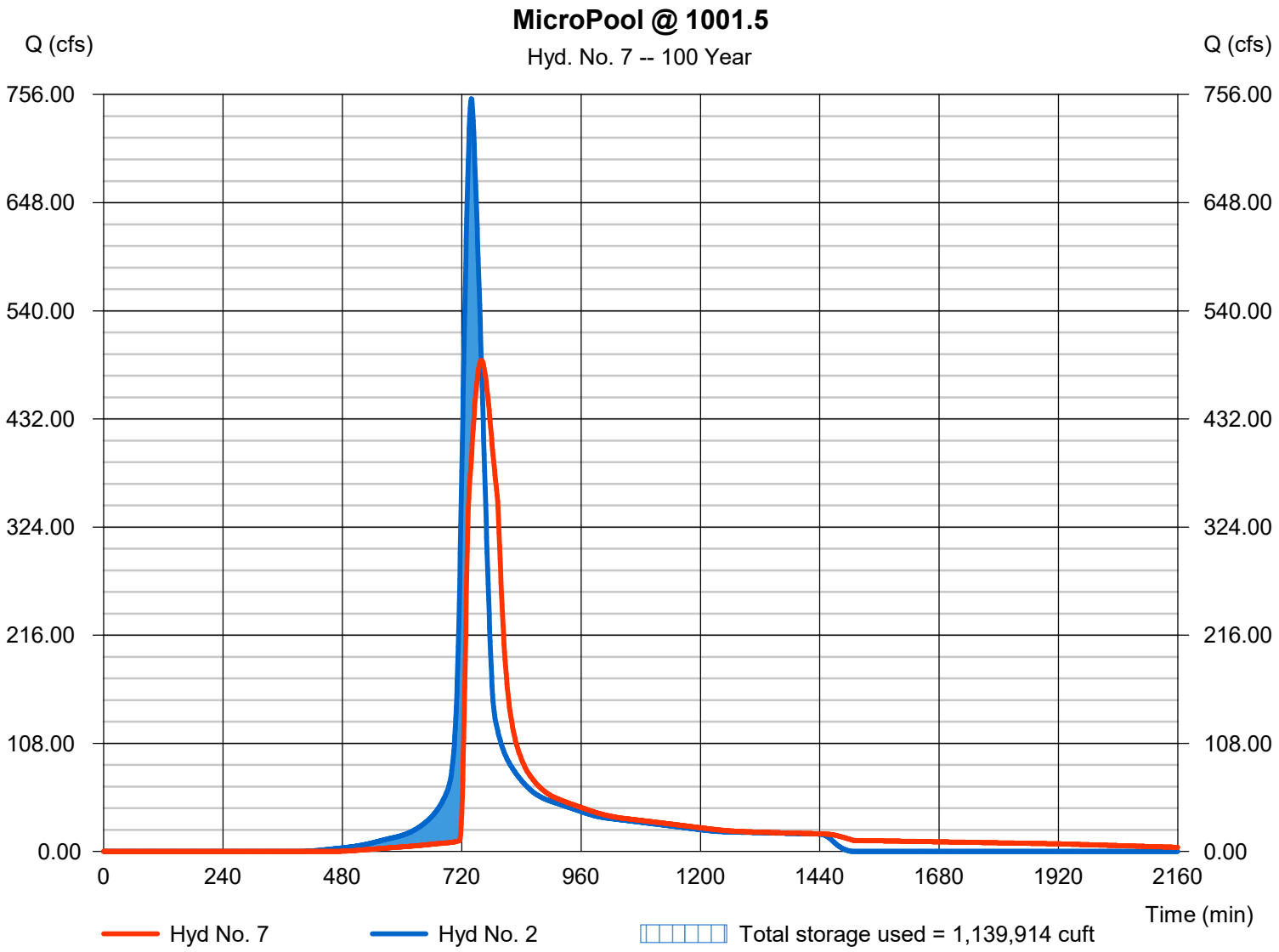
Hydrograph Report

Hyd. No. 7

MicroPool @ 1001.5

Hydrograph type	=	Reservoir	Peak discharge	=	490.40 cfs
Storm frequency	=	100 yrs	Time to peak	=	759 min
Time interval	=	1 min	Hyd. volume	=	3,826,758 cuft
Inflow hyd. No.	=	2 - TO LAKE	Max. Elevation	=	1010.32 ft
Reservoir name	=	MICRO-WS 1001.5	Max. Storage	=	1,139,914 cuft

Storage Indication method used. Wet pond routing start elevation = 1001.40 ft.



RESULTS:

OPTION 3-WQV Option - "Dry Pond" with OCS & adjusted Concrete Emergency Spillway.

"Dry Pond"-

OCS: (assumed 8'x8' square riser @ 1006.25 w/ peaked trash rack & 66" RCP outlet)
10" discharge pipe pipe/orifice for WQ flow control @ 1001.5.
Concrete Emergency Spillway: 6' wide w/ 4:1 side slopes @ elevation 1008.0.
Base flow outlet – Future design

	Current Condition			Proposed Condition			
Frequency	Inflow	Outflow	Elevation	Inflow	Outflow	Elevation	NET Q
(year)	(cfs)	(cfs)		(cfs)	(cfs)		(cfs)
2	242.64	180.16	1009.44	242.64	112.82	1007.25	-67.34
5	337.89	272.66	1009.80	337.89	214.00	1007.81	-58.66
10	422.36	355.90	1010.07	422.36	298.98	1008.18	-56.92
25	546.03	473.60	1010.41	546.03	376.21	1008.89	-97.39
50	646.80	570.45	1010.66	646.80	427.66	1009.47	-142.79
100	751.85	671.37	1010.90	751.85	494.40	1010.36	-176.97

Advantages

1. Water Quality would be provided to a certain degree for the basin.
2. Peak flows for all storm frequencies are reduced.
3. Base flows would pass through the riser; therefore, a footbridge for crossing would not be required.
4. The accumulated sediment could be left in place or regraded if desired.

Disadvantages

1. A Concrete Spillway would still be required.
2. The low-level orifice would be likely to clog frequently requiring substantial maintenance.
3. Water quality is technically not permitted on flowing streams.
4. Grading and substantial planting around the lake with water friendly plants will be needed to improve aesthetics.
5. Cost

RECOMMENDATION:

This option is not recommended due to the need for a low-level orifice. Historically, these smaller orifices clog and the water surface rises to the weir, significantly reducing the detention capacity. In addition, water quality on live streams is not permitted within the Georgia Stormwater Management Manual.

Option 4 – Micropool w/ Detention Only

Description

Procedure

Stage Storage Discharge Data

Routed Hydrograph

Results

Advantages & Disadvantages

Exhibit 2 – Shoal Creek Tributary 4.1 Downstream Option 4

Cost Estimate

OPTION 4 - DETENTION ONLY OPTION

DESCRIPTION:

The normal pool of the lake was reduced from 1007.8 to 1001.5 (-6.3'). This reduction provides a +- 5' deep micro pool that will aid in preventing low level orifices from clogging. This pond does not provide water quality or channel protection. To evaluate the level of detention provided, this option was compared to the existing storm flows through the lake.

"Dry Pond"

OCS: (assumed 10'x10' square riser w/ peaked trash rack & 84" RCP outlet)
(2) 26" diameter orifices installed in the OCS @ 1001.5
(2) 3' weirs @ 1006.0
Top of riser = 1008.5 (1008.5-995=13.5'H
WSE = 1001.5 (Micropool)
Base flow outlet – Future design

PROCEDURE:

Detention Only Option

1. A detention only option was attempted.
2. For comparison purposes flows, hydrographs were generated to the downstream study point based on current conditions.
3. The current inflow hydrographs to the lake were routed through the OCS.
4. All flows passed through the riser and principal spillway.

Pond No. 7 - OPTION 4-RISER-DETENT ONLY

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 996.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	996.50	00	0	0
1.50	998.00	6,667	3,333	3,333
3.50	1000.00	19,660	25,181	28,514
5.50	1002.00	40,615	59,016	87,530
7.50	1004.00	74,294	113,216	200,746
9.50	1006.00	127,565	199,454	400,200
11.50	1008.00	177,881	304,025	704,224
13.50	1010.00	192,895	370,638	1,074,862
15.50	1012.00	213,769	406,445	1,481,307

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 84.00	26.00	0.00	0.00
Span (in)	= 84.00	26.00	0.00	0.00
No. Barrels	= 1	2	1	0
Invert El. (ft)	= 995.00	1001.50	0.00	0.00
Length (ft)	= 104.00	0.00	0.00	0.00
Slope (%)	= 0.96	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 34.00	6.00	Inactive	Inactive
Crest El. (ft)	= 1008.50	1006.00	0.00	0.00
Weir Coeff.	= 3.33	2.60	2.60	2.60
Weir Type	= 1	Broad	Broad	Broad
Multi-Stage	= Yes	Yes	No	No

Exfil.(in/hr) = 0.000 (by Contour)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	996.50	0.00	0.00	---	---	0.00	0.00	---	---	---	---	0.000
0.15	333	996.65	26.00 ic	0.00	---	---	0.00	0.00	---	---	---	---	0.000
0.30	667	996.80	26.00 ic	0.00	---	---	0.00	0.00	---	---	---	---	0.000
0.45	1,000	996.95	26.00 ic	0.00	---	---	0.00	0.00	---	---	---	---	0.000
0.60	1,333	997.10	26.00 ic	0.00	---	---	0.00	0.00	---	---	---	---	0.000
0.75	1,667	997.25	26.00 ic	0.00	---	---	0.00	0.00	---	---	---	---	0.000
0.90	2,000	997.40	26.00 ic	0.00	---	---	0.00	0.00	---	---	---	---	0.000
1.05	2,333	997.55	26.00 ic	0.00	---	---	0.00	0.00	---	---	---	---	0.000
1.20	2,667	997.70	26.00 ic	0.00	---	---	0.00	0.00	---	---	---	---	0.000
1.35	3,000	997.85	26.00 ic	0.00	---	---	0.00	0.00	---	---	---	---	0.000
1.50	3,333	998.00	26.00 ic	0.00	---	---	0.00	0.00	---	---	---	---	0.000
1.70	5,851	998.20	26.00 ic	0.00	---	---	0.00	0.00	---	---	---	---	0.000
1.90	8,369	998.40	26.00 ic	0.00	---	---	0.00	0.00	---	---	---	---	0.000
2.10	10,888	998.60	26.00 ic	0.00	---	---	0.00	0.00	---	---	---	---	0.000
2.30	13,406	998.80	26.00 ic	0.00	---	---	0.00	0.00	---	---	---	---	0.000
2.50	15,924	999.00	26.00 ic	0.00	---	---	0.00	0.00	---	---	---	---	0.000
2.70	18,442	999.20	26.00 ic	0.00	---	---	0.00	0.00	---	---	---	---	0.000
2.90	20,960	999.40	26.00 ic	0.00	---	---	0.00	0.00	---	---	---	---	0.000
3.10	23,478	999.60	26.00 ic	0.00	---	---	0.00	0.00	---	---	---	---	0.000
3.30	25,996	999.80	26.00 ic	0.00	---	---	0.00	0.00	---	---	---	---	0.000
3.50	28,514	1000.00	26.00 ic	0.00	---	---	0.00	0.00	---	---	---	---	0.000
3.70	34,416	1000.20	26.00 ic	0.00	---	---	0.00	0.00	---	---	---	---	0.000
3.90	40,318	1000.40	26.00 ic	0.00	---	---	0.00	0.00	---	---	---	---	0.000
4.10	46,219	1000.60	26.00 ic	0.00	---	---	0.00	0.00	---	---	---	---	0.000
4.30	52,121	1000.80	26.00 ic	0.00	---	---	0.00	0.00	---	---	---	---	0.000
4.50	58,022	1001.00	26.00 ic	0.00	---	---	0.00	0.00	---	---	---	---	0.000
4.70	63,924	1001.20	26.00 ic	0.00	---	---	0.00	0.00	---	---	---	---	0.000
4.90	69,826	1001.40	26.00 ic	0.00	---	---	0.00	0.00	---	---	---	---	0.000
5.10	75,727	1001.60	26.00 ic	0.14 ic	---	---	0.00	0.00	---	---	---	---	0.138
5.30	81,629	1001.80	26.00 ic	1.18 ic	---	---	0.00	0.00	---	---	---	---	1.182
5.50	87,530	1002.00	26.00 ic	3.12 ic	---	---	0.00	0.00	---	---	---	---	3.124
5.70	98,852	1002.20	26.00 ic	5.88 ic	---	---	0.00	0.00	---	---	---	---	5.876
5.90	110,173	1002.40	26.00 ic	9.55 ic	---	---	0.00	0.00	---	---	---	---	9.547
6.10	121,495	1002.60	26.00 ic	13.43 ic	---	---	0.00	0.00	---	---	---	---	

Continues on ne

OPTION 4-RISER-DETENT ONLY

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
6.30	132,817	1002.80	26.00 ic	17.98 ic	---	---	0.00	0.00	---	---	---	---	17.98
6.50	144,138	1003.00	26.00 ic	22.94 ic	---	---	0.00	0.00	---	---	---	---	22.94
6.70	155,460	1003.20	27.65 ic	27.65 ic	---	---	0.00	0.00	---	---	---	---	27.65
6.90	166,781	1003.40	32.27 ic	32.26 ic	---	---	0.00	0.00	---	---	---	---	32.26
7.10	178,103	1003.60	36.07 ic	36.07 ic	---	---	0.00	0.00	---	---	---	---	36.07
7.30	189,424	1003.80	39.56 ic	39.16 ic	---	---	0.00	0.00	---	---	---	---	39.16
7.50	200,746	1004.00	43.55 ic	42.25 ic	---	---	0.00	0.00	---	---	---	---	42.25
7.70	220,691	1004.20	45.62 ic	45.14 ic	---	---	0.00	0.00	---	---	---	---	45.14
7.90	240,637	1004.40	47.85 ic	47.85 ic	---	---	0.00	0.00	---	---	---	---	47.85
8.10	260,582	1004.60	50.42 ic	50.42 ic	---	---	0.00	0.00	---	---	---	---	50.42
8.30	280,527	1004.80	54.51 ic	52.86 ic	---	---	0.00	0.00	---	---	---	---	52.86
8.50	300,473	1005.00	56.87 ic	55.19 ic	---	---	0.00	0.00	---	---	---	---	55.19
8.70	320,418	1005.20	57.43 ic	57.43 ic	---	---	0.00	0.00	---	---	---	---	57.43
8.90	340,363	1005.40	59.58 ic	59.58 ic	---	---	0.00	0.00	---	---	---	---	59.58
9.10	360,309	1005.60	61.77 ic	61.66 ic	---	---	0.00	0.00	---	---	---	---	61.66
9.30	380,254	1005.80	64.30 ic	63.67 ic	---	---	0.00	0.00	---	---	---	---	63.67
9.50	400,200	1006.00	66.88 ic	65.62 ic	---	---	0.00	0.00	---	---	---	---	65.62
9.70	430,602	1006.20	69.52 ic	67.51 ic	---	---	0.00	1.40	---	---	---	---	68.91
9.90	461,005	1006.40	74.95 ic	69.36 ic	---	---	0.00	3.95	---	---	---	---	73.30
10.10	491,407	1006.60	78.40 ic	71.15 ic	---	---	0.00	7.25	---	---	---	---	78.40
10.30	521,809	1006.80	84.06 ic	72.90 ic	---	---	0.00	11.16	---	---	---	---	84.06
10.50	552,212	1007.00	90.21 ic	74.61 ic	---	---	0.00	15.60	---	---	---	---	90.21
10.70	582,614	1007.20	98.65 ic	76.28 ic	---	---	0.00	20.51	---	---	---	---	96.79
10.90	613,017	1007.40	104.69 oc	77.92 ic	---	---	0.00	25.84	---	---	---	---	103.76
11.10	643,419	1007.60	112.01 oc	79.52 ic	---	---	0.00	31.58	---	---	---	---	111.09
11.30	673,822	1007.80	119.34 oc	81.09 ic	---	---	0.00	37.68	---	---	---	---	118.76
11.50	704,224	1008.00	129.10 oc	82.62 ic	---	---	0.00	44.12	---	---	---	---	126.75
11.70	741,288	1008.20	136.36 oc	84.14 ic	---	---	0.00	50.91	---	---	---	---	135.04
11.90	778,352	1008.40	145.89 oc	85.62 ic	---	---	0.00	58.00	---	---	---	---	143.62
12.10	815,416	1008.60	157.46 oc	87.08 ic	---	---	3.58	65.40	---	---	---	---	156.07
12.30	852,479	1008.80	180.94 oc	88.52 ic	---	---	18.61	73.09	---	---	---	---	180.22
12.50	889,543	1009.00	212.29 oc	89.93 ic	---	---	40.04	81.06	---	---	---	---	211.03
12.70	926,607	1009.20	246.95 oc	91.32 ic	---	---	66.32	89.30	---	---	---	---	246.94
12.90	963,671	1009.40	287.18 oc	92.69 ic	---	---	96.68	97.80	---	---	---	---	287.18
13.10	1,000,734	1009.60	328.58 oc	91.38 ic	---	---	130.64	106.56	---	---	---	---	328.58
13.30	1,037,798	1009.80	372.27 oc	88.87 ic	---	---	167.84	115.56	---	---	---	---	372.27
13.50	1,074,862	1010.00	418.31 oc	85.51 ic	---	---	208.00	124.80	---	---	---	---	418.31
13.70	1,115,506	1010.20	466.39 oc	81.14 ic	---	---	250.96	134.28	---	---	---	---	466.38
13.90	1,156,151	1010.40	513.11 ic	73.02 ic	---	---	296.53	143.56 s	---	---	---	---	513.11
14.10	1,196,795	1010.60	551.99 ic	63.75 ic	---	---	344.56	143.68 s	---	---	---	---	551.99
14.30	1,237,440	1010.80	585.76 ic	53.90 ic	---	---	394.94	136.92 s	---	---	---	---	585.76
14.50	1,278,084	1011.00	604.86 ic	48.19 ic	---	---	423.28 s	133.38 s	---	---	---	---	604.85
14.70	1,318,729	1011.20	618.70 ic	44.19 ic	---	---	443.05 s	131.45 s	---	---	---	---	618.69
14.90	1,359,373	1011.40	630.31 ic	40.89 ic	---	---	459.47 s	129.94 s	---	---	---	---	630.30
15.10	1,400,018	1011.60	640.47 ic	38.08 ic	---	---	473.72 s	128.66 s	---	---	---	---	640.46
15.30	1,440,662	1011.80	649.61 ic	35.63 ic	---	---	486.41 s	127.55 s	---	---	---	---	649.59
15.50	1,481,307	1012.00	657.97 ic	33.47 ic	---	---	497.90 s	126.58 s	---	---	---	---	657.95

...End

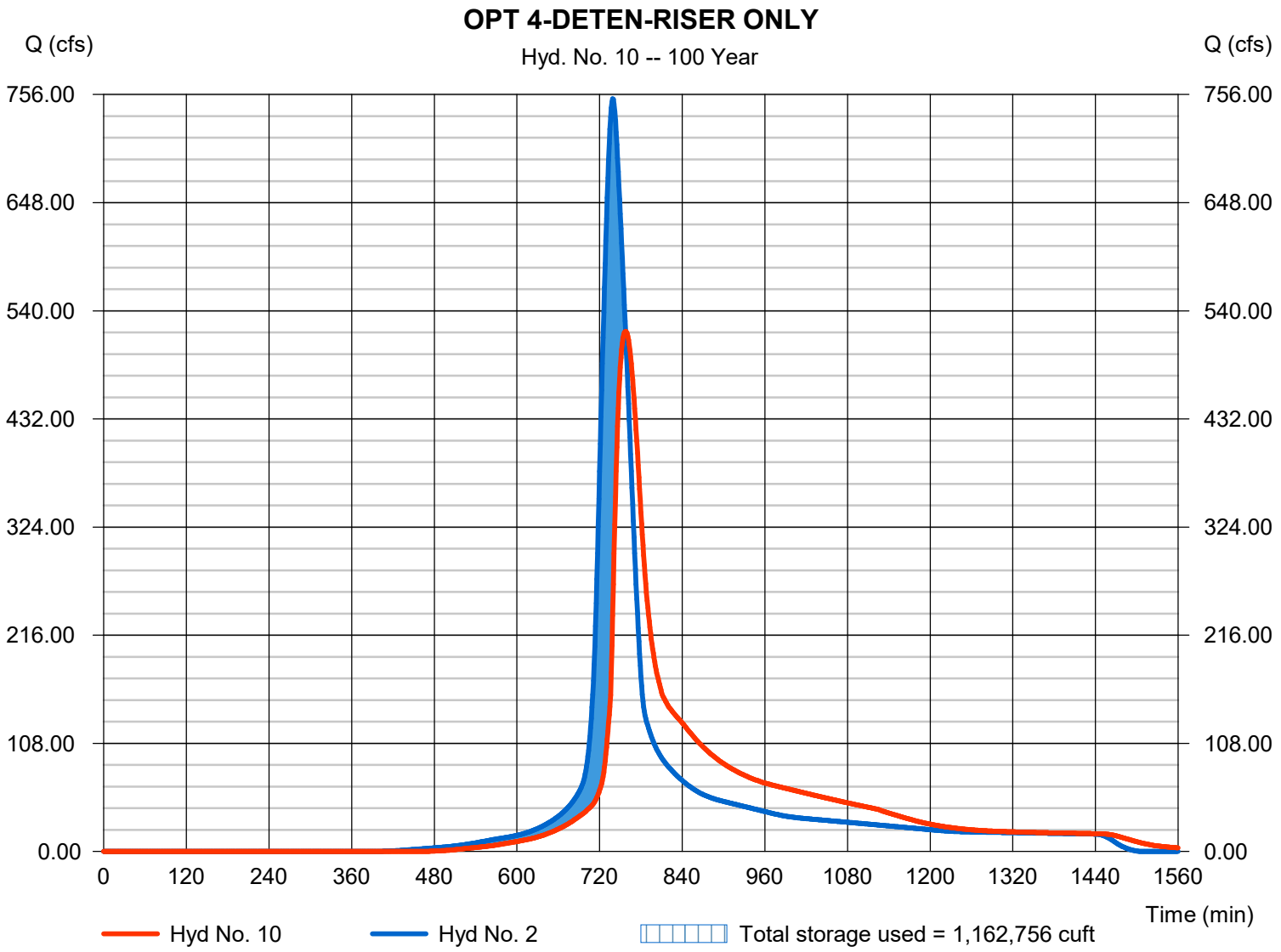
Hydrograph Report

Hyd. No. 10

OPT 4-DETEN-RISER ONLY

Hydrograph type	=	Reservoir	Peak discharge	=	519.43 cfs
Storm frequency	=	100 yrs	Time to peak	=	758 min
Time interval	=	1 min	Hyd. volume	=	3,830,831 cuft
Inflow hyd. No.	=	2 - TO LAKE	Max. Elevation	=	1010.43 ft
Reservoir name	=	OPTION 4-RISER-DETENT ONLY	Max. Storage	=	1,162,756 cuft

Storage Indication method used. Wet pond routing start elevation = 1001.40 ft.



RESULTS:

Detention Only Option

OCS: (assumed 10'x10' square riser w/ peaked trash rack & 84" RCP outlet)
(2) 26" diameter orifices installed in the OCS @ 1001.5
(2) 3' weirs @ 1006.0
Rim of riser = 1008.5 (1008.5-995=13.5'H)
WSE = 1001.5 (Micropool)
Base flow outlet – Future design

	Current Condition			Detention Only			
Frequency	Inflow	Outflow	Elevation	Inflow	Outflow	Elevation	NET Q
(years)	(cfs)	(cfs)		(cfs)	(cfs)		(cfs)
2	242.64	180.16	1009.44	242.64	84.10	1006.80	-96.06
5	337.89	272.66	1009.80	337.89	126.95	1008.00	-145.71
10	422.36	355.90	1010.07	422.36	180.10	1008.80	-174.90
25	546.03	473.60	1010.41	546.03	314.25	1009.53	-159.35
50	646.80	570.45	1010.66	646.80	419.43	1010.00	-151.02
100	751.85	671.37	1010.90	751.85	519.43	1010.43	-151.94

All peak discharges are less than the current condition.

Advantages

1. The peak flows downstream of the lake will be significantly reduced. Runoff would not flow over the downstream private drive.
2. Footbridge for crossing would not be required.
3. The accumulated sediment could be left in place or regraded if desired.

Disadvantages

1. Aesthetically, a large OCS may not be very attractive.
2. Grading and substantial planting around the lake with water friendly plants required to improve aesthetics.
3. Increased maintenance over Option 1 less than Option 2 or 3.
4. Cost

RECOMMENDATION:

This option is the second choice. It has the advantage of piping the lower frequency storms through the dam so that the spillway is not functioning constantly. It also provides significant reduction in peak flows to downstream areas prior to New Hope Road. *Flows from the junction above New Hope Road and downstream are not expected to change significantly.*

HUSSEY GAY BELL
Established 1958

ENGINEERS, PLANNERS & SURVEYORS

3100 BRECKINRIDGE BLVD
BUILDING 300
DULUTH, GEORGIA 30096TEL:
(770) 923-1600
FAX: (770) 923-4202

Client

CITY OF LAWRENCEVILLE
P.O. BOX 2200
Lawrenceville, GA 30046
Phone: (678) 407-6582

Contact: Jim Wright (404) 427-3017

NO.	BY	APPROVED	DATE

Project Title

SANDALWOOD DRAINAGE IMPROVEMENT PROJECT

Project Location

SANDALWOOD TOWNHOMES

Project No.	23-001
Drawn By:	RH
Checked By:	MB
Date:	April 15, 2023

Sheet Title

SHOAL CREEK TRIBUTARY 4.1 DOWNSTREAM OPTION 4

Sheet Number

EXHIBIT

HERBERT HAYES DR

(2) 8'Wx4'H CONC BOX
IE 977.3 IN
IE 976.9 OUT
SILTED

PRIVATE DRIVE

NEW HOPE RD

DOWNSTREAM PIPE PASSES 100-YEAR FLOW

NEW 84" CLASS V RCP

84"RCP
IE 986.03 IN
IE 984.52 OUT

NEW 1 LANE ROAD FOR EMERGENCY ACCESS

OUTLET CONTROL STRUCTURE

MICROPOOL

FENCED NATURAL AREA

N

GRAPHIC SCALE
100 50 0 100
1 inch = 100 ft.

i: \projeng\2023\23001 - sandalwood\dwg\production\sandalwood report-1.dwg
5/1/2008 8:31:59 AM
ruth hansen

SANDALWOOD DAM
CITY OF LAWRENCEVILLE
HIGH LEVEL ESTIMATE- OPTION 4 RISER & EARTHEN EMERGENCY SPILLWAY
5/10/2023

DEMOLITION

ITEM	UNITS	QUANTITY	ENGINEERS ESTIMATE UNIT COST	TOTAL
Pavement Removal	SFT	4,530	$ 2.00	$ 9,060.00
Curb & Gutter Removal	LF	560	$ 3.00	$ 1,680.00
Clearing	AC	1	$ 3,000.00	$ 3,000.00
Concrete Spillway Removal	SFT	7,265	$ 5.00	$ 36,325.00
Drain Lake	LS	1	$ 20,000.00	$ 20,000.00
			SUBTOTAL	**$ 70,065.00**

DRIVE ON DAM

ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
Light Duty Paving (Inc. 6"GAB)	SY	360	$ 26.00	$ 9,360.00
24" Curb & Gutter	LF	500	$ 25.00	$ 12,500.00
Bollards (4)	EA	4	$ 500.00	$ 2,000.00
			SUB TOTAL	**$ 23,860.00**

DAM/ MICROPOOL

ITEM	UNITS	QUANTITY	ENGINEERS ESTIMATE UNIT COST	TOTAL
Excavation & Storage for Primary Spillway	CY	1,250	$ 30.00	$ 37,500.00
Remove & reinstall 5' deep on dam faces	CY	2,000	$ 30.00	$ 60,000.00
Earthwork (Reshape Lake Bottom)	CY	16,000	$ 8.00	$ 128,000.00
OCS (10'x10' Riser & Foundation)	VF	15	$ 12,000.00	$ 180,000.00
84"Class V RCP	LF	100	$ 1,200.00	$ 120,000.00
Concrete Cradle	CY	2,100	$ 150.00	$ 315,000.00
Trash Rack	EA	1	$ 5,000.00	$ 5,000.00
Fencing	LF	2,300	$ 40.00	$ 92,000.00
6" Toe Drains	LF	130	$ 300.00	$ 39,000.00
Geotechnical Engineer	LS	1	$ 18,000.00	$ 18,000.00
			SUB TOTAL	**$ 994,500.00**

EROSION CONTROL

ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
Silt fence	LF	400	$ 5.00	$ 2,000.00
Temporary Seeding	AC	1	$ 1,500.00	$ 1,500.00
Construction Exit	EA	1	$ 3,500.00	$ 3,500.00
Rock Dam	CY	30	$ 60.00	$ 1,800.00
Temporary coffer dam, siphon water control	LS	1	$ 75,000.00	$ 75,000.00
Permanent Vegetation	AC	5	$ 10,000.00	$ 45,000.00
Forebays	EA	3	$ 6,000.00	$ 18,000.00
Rip Rap	CY	83	$ 200.00	$ 16,600.00
			SUB TOTAL	**$ 163,400.00**

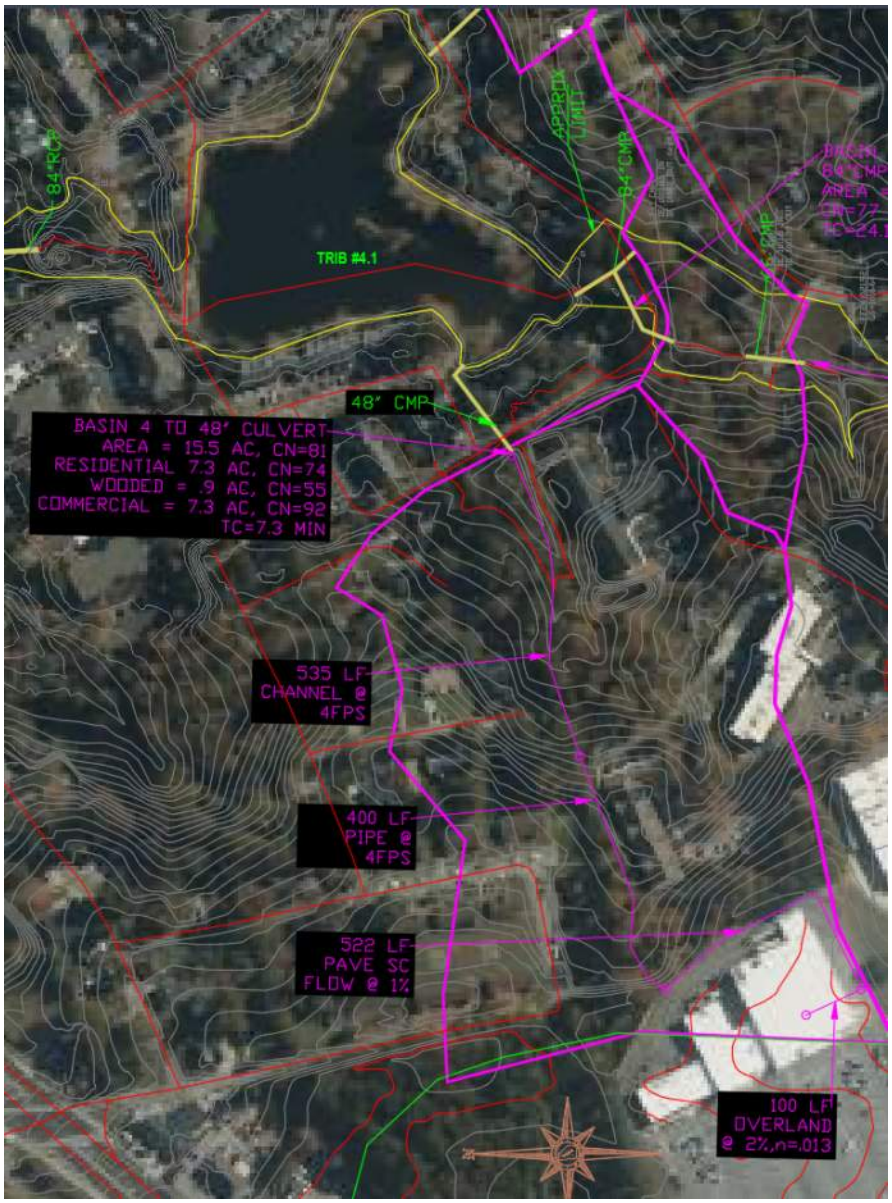
		SUB TOTAL	**$ 1,251,825.00**
Design Fees 10%		10%	$ 125,182.50
Contingency 25%		25%	$ 312,956.25
		TOTAL	**$ 1,689,963.75**

APPENDIX C - UPSTREAM CULVERTS

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	117.89	148.29	-------	202.33	250.00	319.27	375.23	432.48	TO 66IN CMP
2	SCS Runoff	------	127.73	161.85	-------	222.68	276.62	355.28	418.98	484.26	TO 84IN CMP
3	SCS Runoff	------	39.99	48.93	-------	64.55	78.06	97.43	112.91	128.64	48IN CMP
4	SCS Runoff	------	61.94	81.43	-------	116.92	148.78	195.90	234.51	274.49	84INCH EAST

48” CMP SANDALWOOD-WEST



Basin limits are approximate.

Drainage area = 15.5 acres, CN = 81

Residential = 7.3 acres, CN = 74
Wooded = .9 acres, CN = 55
Commercial = 7.3acres, CN = 92

Tc = 7.3 minutes (see next sheet)

TR55 Tc Worksheet

Hyd. No. 3

48IN CMP

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.013		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.72		0.00		0.00		
Land slope (%)	= 2.00		0.00		0.00		
Travel Time (min)	**= 1.28**	**+**	**0.00**	**+**	**0.00**	**=**	**1.28**
Shallow Concentrated Flow							
Flow length (ft)	= 522.00		0.00		0.00		
Watercourse slope (%)	= 1.00		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	=2.03		0.00		0.00		
Travel Time (min)	**= 4.28**	**+**	**0.00**	**+**	**0.00**	**=**	**4.28**
Channel Flow							
X sectional flow area (sqft)	= 7.06		15.00		0.00		
Wetted perimeter (ft)	= 9.42		11.00		0.00		
Channel slope (%)	= 5.00		4.00		0.00		
Manning's n-value	= 0.025		0.045		0.015		
Velocity (ft/s)	=10.99						
			8.15				
					0.00		
Flow length (ft)	({0})400.0		535.0		0.0		
Travel Time (min)	**= 0.61**	**+**	**1.09**	**+**	**0.00**	**=**	**1.70**

Total Travel Time, Tc ..... 7.26 min

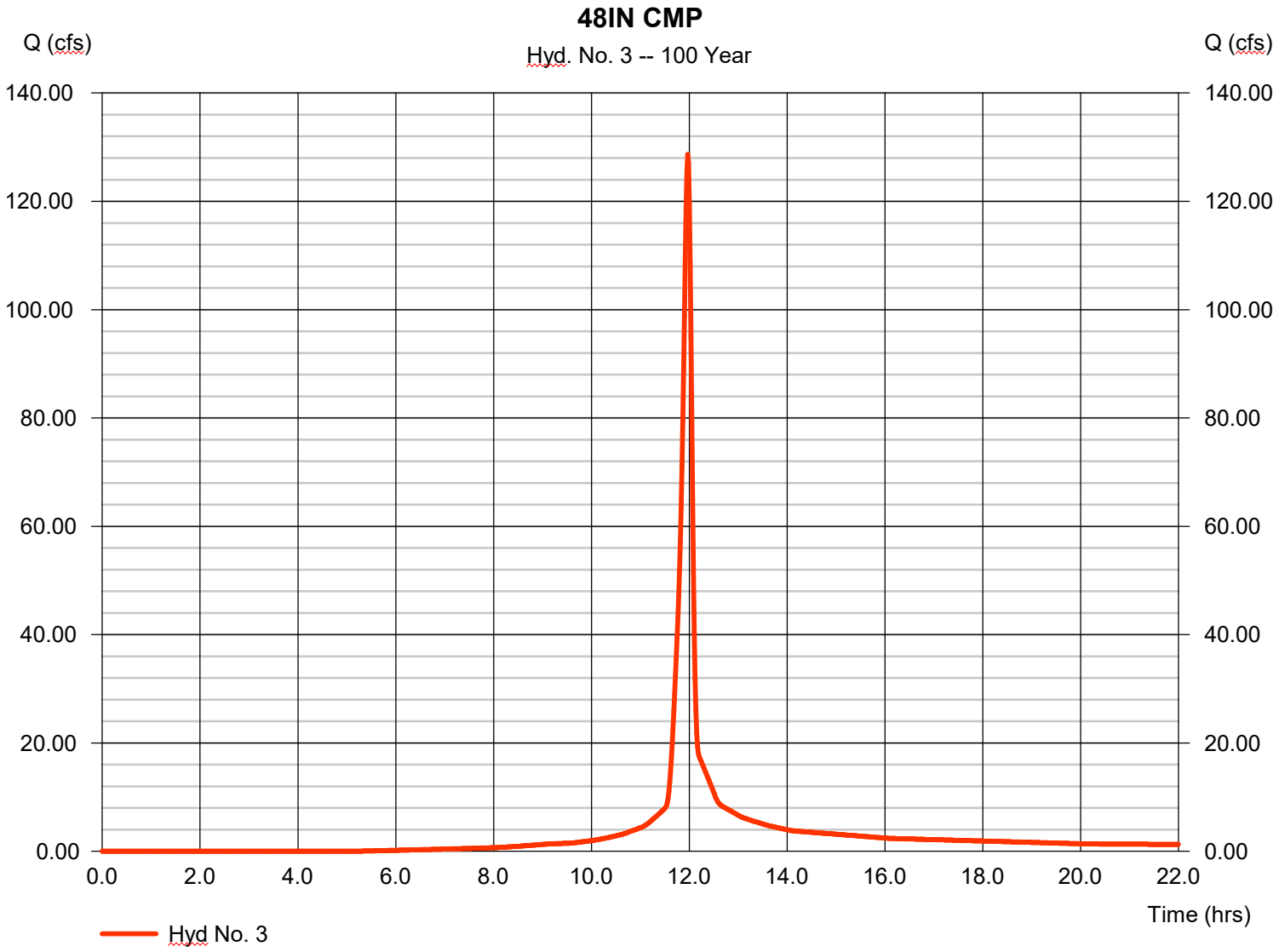
Hydrograph Report

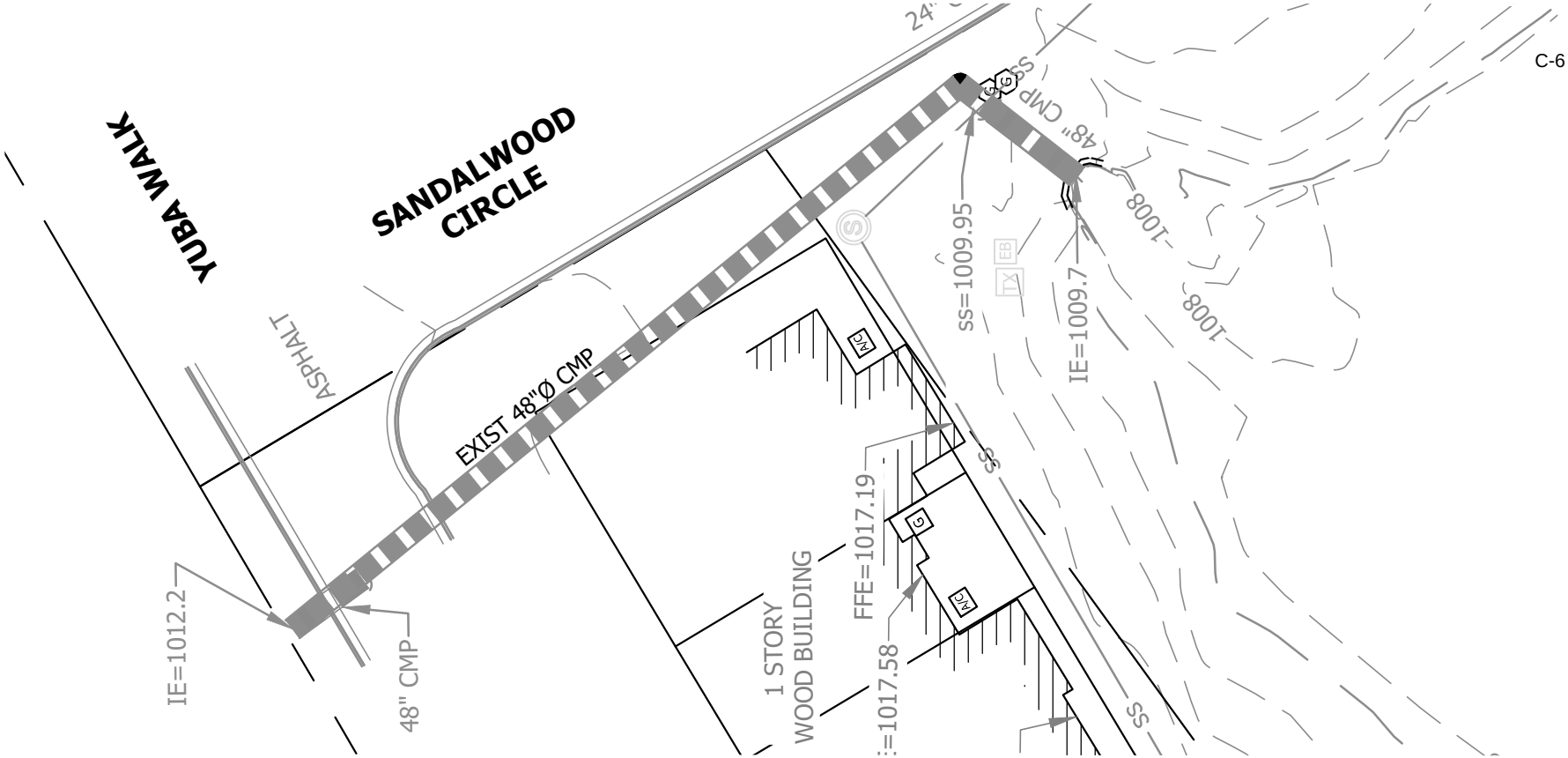
Hyd. No. 3

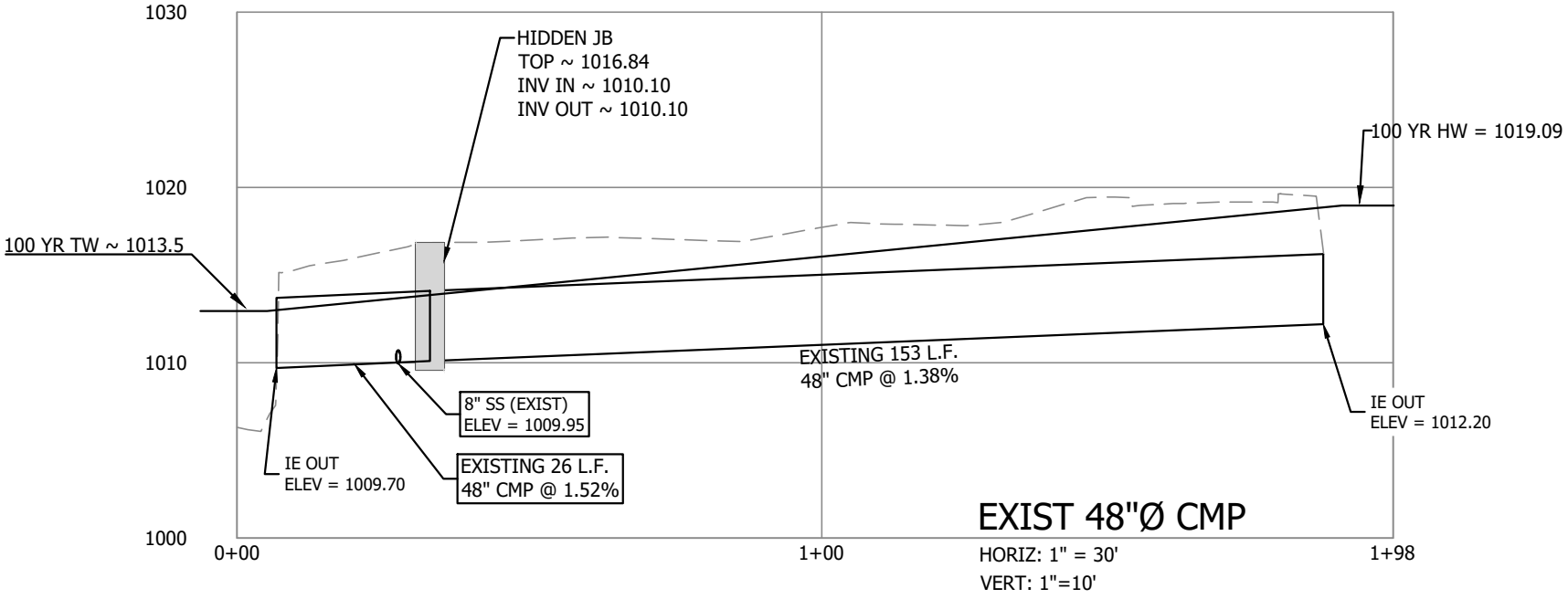
48IN CMP

Hydrograph type	= SCS Runoff	Peak discharge	= 128.64 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.97 hrs
Time interval	= 1 min	Hyd. volume	= 282,021 cuft
Drainage area	= 15.500 ac	Curve number	= 81*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 7.26 min
Total precip.	= 7.36 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(7.300 x 92) + (0.900 x 55) + (7.300 x 74)] / 15.500




YUBA WALK
SANDALWOOD CIRCLE
ASPHALT
EXIST 48"Ø CMP
IE=1012.2
48" CMP
1 STORY WOOD BUILDING
FFE=1017.19
=1017.58
SS
SS
SS
48" CMP
IE=1009.95
IE=1009.7
1008
1008
AC
G
AC
G
TX
EB


1030
1020
1010
1000
HIDDEN JB
TOP ~ 1016.84
INV IN ~ 1010.10
INV OUT ~ 1010.10
100 YR HW = 1019.09
100 YR TW ~ 1013.5
EXISTING 153 L.F.
48" CMP @ 1.38%
8" SS (EXIST)
ELEV = 1009.95
IE OUT
ELEV = 1012.20
IE OUT
ELEV = 1009.70
EXISTING 26 L.F.
48" CMP @ 1.52%
0+00
1+00
1+98
EXIST 48"Ø CMP
HORIZ: 1" = 30'
VERT: 1"=10'

48IN CMP CULVERT

Invert Elev Dn (ft)	=	1009.91
Pipe Length (ft)	=	186.00
Slope (%)	=	1.33
Invert Elev Up (ft)	=	1012.39
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	1
n-Value	=	0.023
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Headwall
Coeff. K,M,c,Y,k	=	0.0078, 2, 0.0379, 0.69, 0.5

Embankment

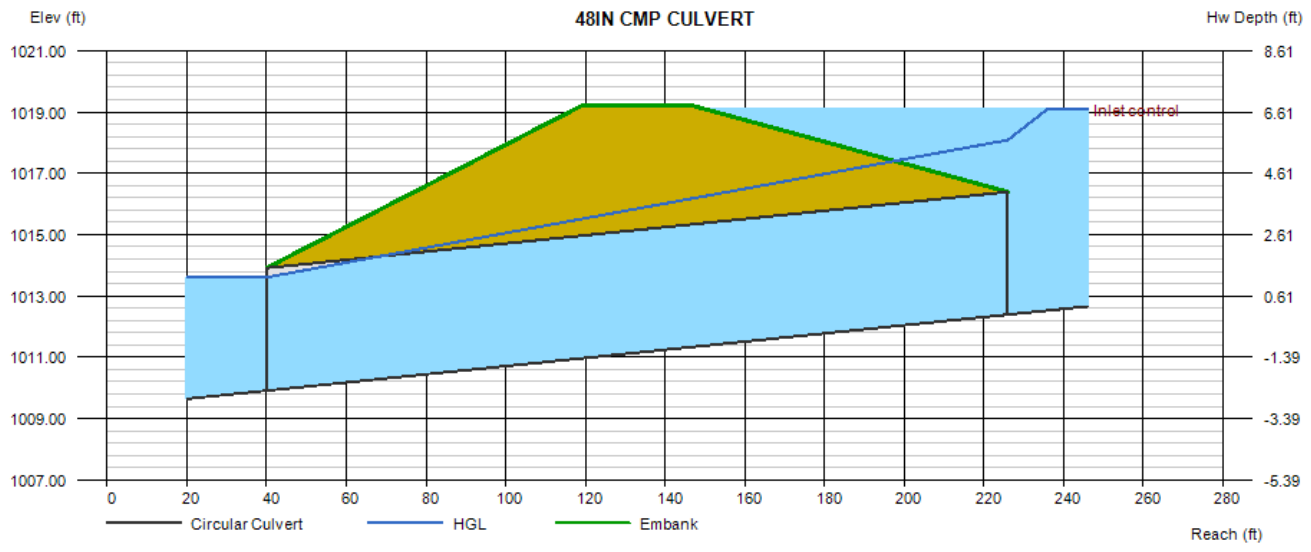
Top Elevation (ft)	=	1019.20
Top Width (ft)	=	28.00
Crest Width (ft)	=	91.00

Calculations

Qmin (cfs)	=	128.63
Qmax (cfs)	=	128.63
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	128.63
Qpipe (cfs)	=	128.63
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	10.60
Veloc Up (ft/s)	=	10.24
HGL Dn (ft)	=	1013.61
HGL Up (ft)	=	1018.08
Hw Elev (ft)	=	1019.09
Hw/D (ft)	=	1.68
Flow Regime	=	Inlet Control



SUMMARY - 48" CMP SANDALWOOD – WEST

An existing 48" pipe runs under Sandalwood Circle carrying runoff from the Senior Housing development to the lake. The drainage area to the pipe was computed from GIS topographic information. CN's were computed based on current land use obtained from aerial photography provided by Microsoft. Although there appears to be at least two detention facilities within the basin, detention was not accounted for within this analysis. The time of concentration was estimated, and the 100-year flow was calculated using the SCS method. An analysis was performed on the pipe (See page C-7). According to the analysis, the pipe appears capable of conveying the 100-year storm frequency; however, there is no freeboard on the 100-year storm elevation.

According to Gwinnett County GIS, the existing pipe was installed in 1981. The 48" culvert crosses the Sandalwood, runs approximately 10 feet northwest of the existing building, parallels an existing sewer pipe (~6.5 center to center), turns 90 degrees in a junction box crosses the existing sewer pipe (that appears to be intersecting the storm pipe) and discharges into the lake. It should be noted that if this pipe were to fail, approximately 32 units would appear to be stranded. Additionally, a failed pipe would most likely damage the adjacent condominium to the south. A site visit was made by Hussey Gay Bell in April 2023. (See Page C-40 TO 43) for photographs.

FREQUENCY	INFLOW	HW	COMMENTS
2	40.0	1015.06	~4.14' freeboard
5	48.9	1015.41	~3.79' freeboard
10	78.1	1016.53	~2.67' freeboard
25	97.4	1017.40	~1.80' freeboard
100	128.6	1019.09	~.11' freeboard

**TW = (dc+D)/2 was used instead of the 100-year elevation of the lake because it is more conservative.*

The upstream headwall is in good condition. Some of the grout between the pipe and the headwall has been washed away near the bottom of the pipe. There are a couple of trees that will endanger the integrity of the headwall as they grow. The bottom of the pipe appeared solid throughout. There was 1-3" of sediment throughout the pipe. Approximately 10' from the upstream end there is a damaged section of the pipe. (See Photo 3 Page C-40) This damage appears to have been repaired with uncoated steel around the damaged section; however, sediment was evident. Joints along the pipes had gaps, but no sediment was evident. Near the downstream end a gas line passes through the pipe at a skew. Sediment is visible at the pipe wall penetrations. At the downstream headwall there is a 1.5' to 2' drop off. (See Photo 14 Page C-43) It appears that water is beginning to undermine the pipe. Grout has fallen out between some of the rocks and the pipe.

Attempts were made to locate the junction box found during the site visit; however, no access was provided to the surface. The road surface adjacent to the pipe has large bubbles (possibly tree roots) and potholes. It is unknown whether the pipe is contributing to these issues or not.

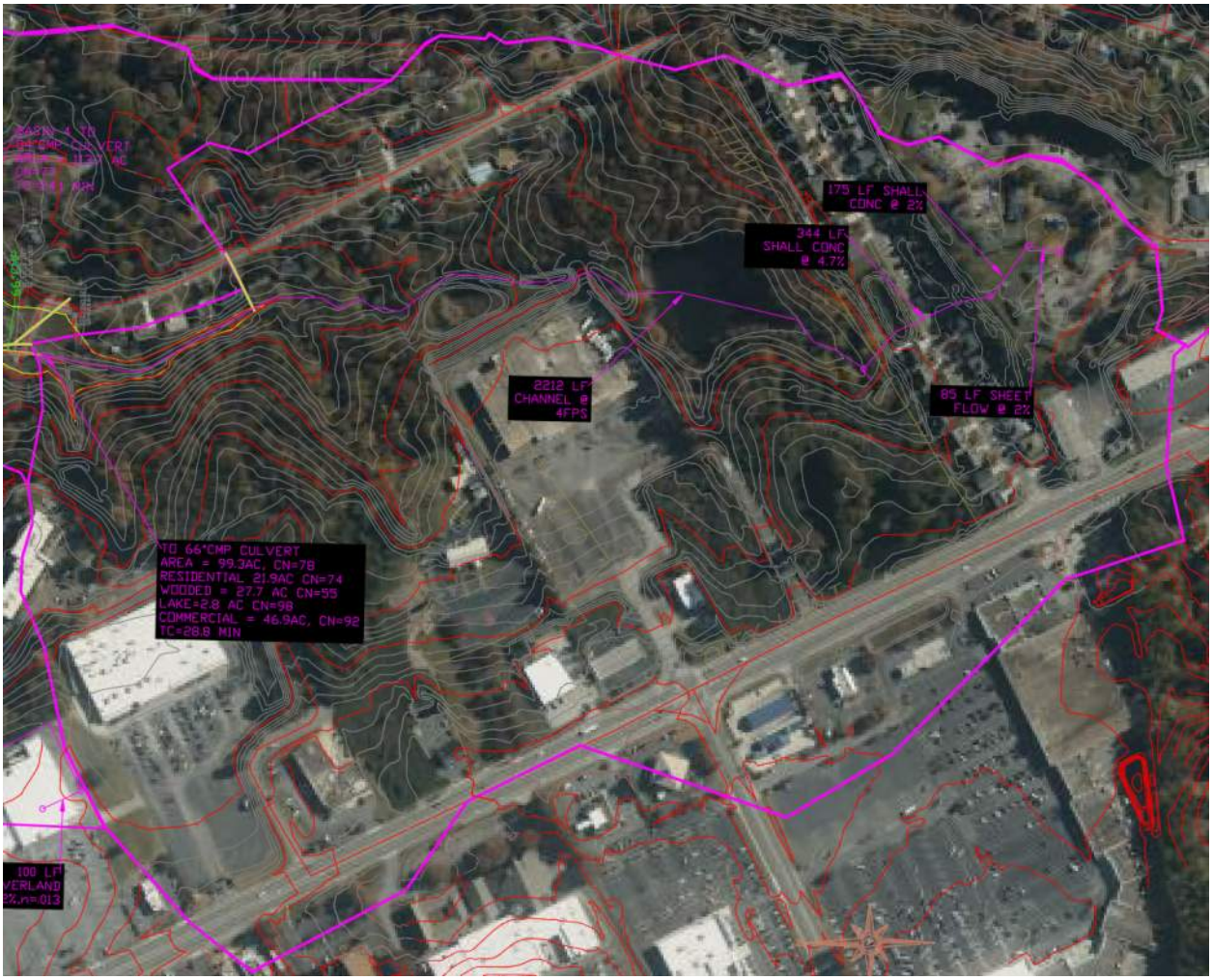
If the pipe is installed between the curb and the condo units corresponding to the GIS, there are at least 5 large pine trees and a Cedar tree located above the pipe. (See Photo below)

Looking downstream

RECOMMENDATIONS:

Generally, the 42-year-old 48” diameter corrugated metal pipe appears to be in good condition; however, corrosion is beginning to form at the flow line throughout the pipe and lining or reapplying a protective coating should be planned. The undermining of the outlet headwall should be repaired, possibly by hand placed, grouted rip rap similar to the downstream headwall of the southern 84” CMP (See Photo 1 Page C-33). Additional rip rap should be placed beyond the repair. Trees should be removed from the proximity of the upstream headwall and grout reinstalled around the pipes. It is also recommended that the gas pipe penetrations and the damaged section be repaired so that sediment cannot escape into the pipe.

66” CMP JUNIPER COURT



Basin limits are approximate.

Drainage area = 99.3 acres, CN = 78

Residential = 21.9 acres, CN = 74
Wooded = 27.7 acres, CN = 55
Commercial = 46.9 acres, CN = 92
Lake = 2.8 acres, CN =98

Tc = 28.8minutes (see next sheet)

TR55 Tc Worksheet

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

Hyd. No. 1

TO 66IN CMP

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.400	0.011	0.011	
Flow length (ft)	= 81.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.72	0.00	0.00	
Land slope (%)	= 2.00	0.00	0.00	
Travel Time (min)	**= 16.83 +**	**0.00 +**	**0.00 =**	**16.83**
Shallow Concentrated Flow				
Flow length (ft)	= 175.00	344.00	0.00	
Watercourse slope (%)	= 2.00	4.70	0.00	
Surface description	= Unpaved	Unpaved	Paved	
Average velocity (ft/s)	=2.28	3.50	0.00	
Travel Time (min)	**= 1.28 +**	**1.64 +**	**0.00 =**	**2.92**
Channel Flow				
X sectional flow area (sqft)	= 20.00	0.00	0.00	
Wetted perimeter (ft)	= 40.00	0.00	0.00	
Channel slope (%)	= 1.70	0.00	0.00	
Manning's n-value	= 0.030	0.015	0.015	
Velocity (ft/s)	=4.07			
		0.00		
			0.00	
Flow length (ft)	({0})2212.0	0.0	0.0	
Travel Time (min)	**= 9.06 +**	**0.00 +**	**0.00 =**	**9.06**

Total Travel Time, Tc ..... 28.80 min

Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

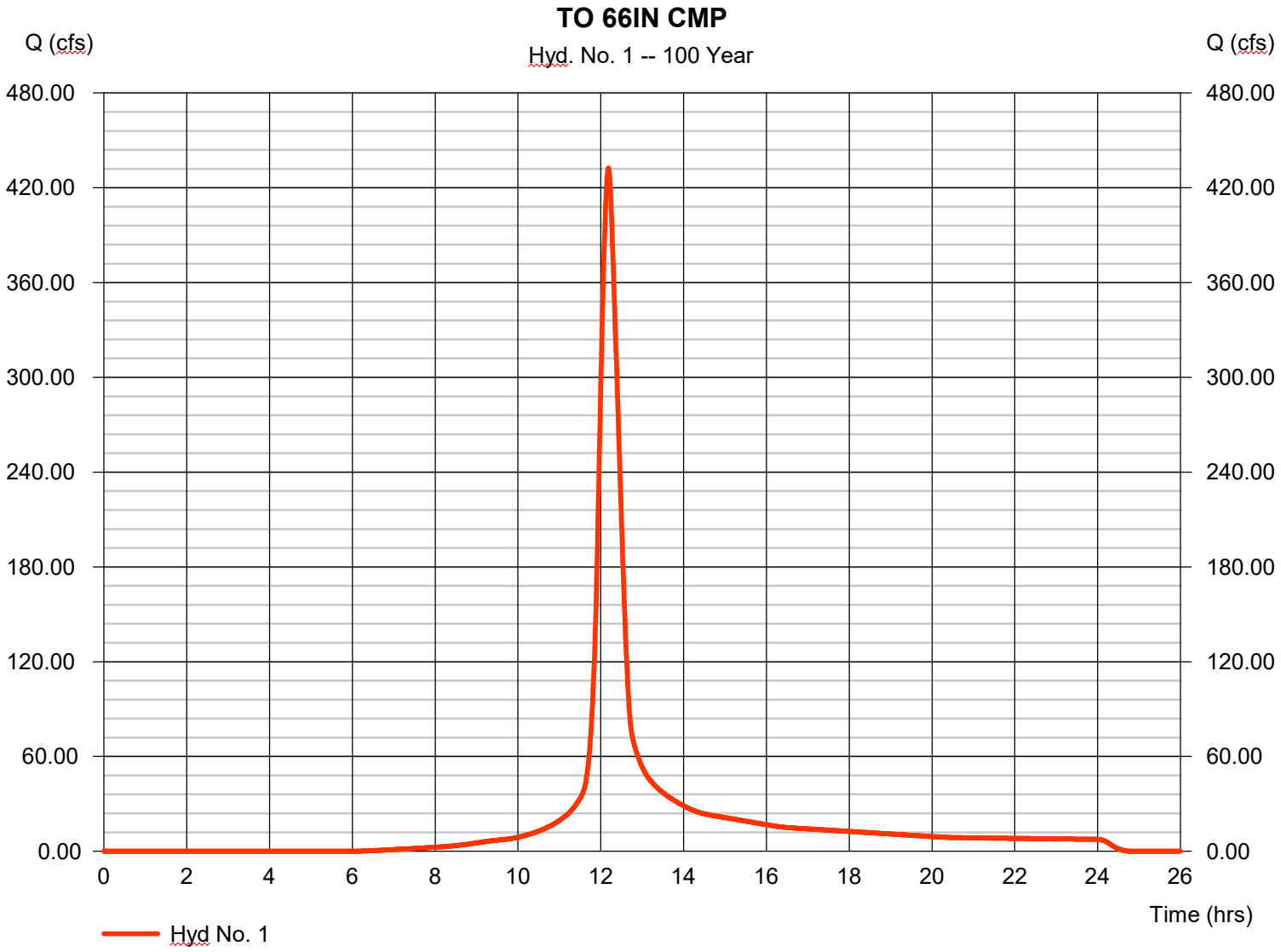
Friday, 04 / 7 / 2023

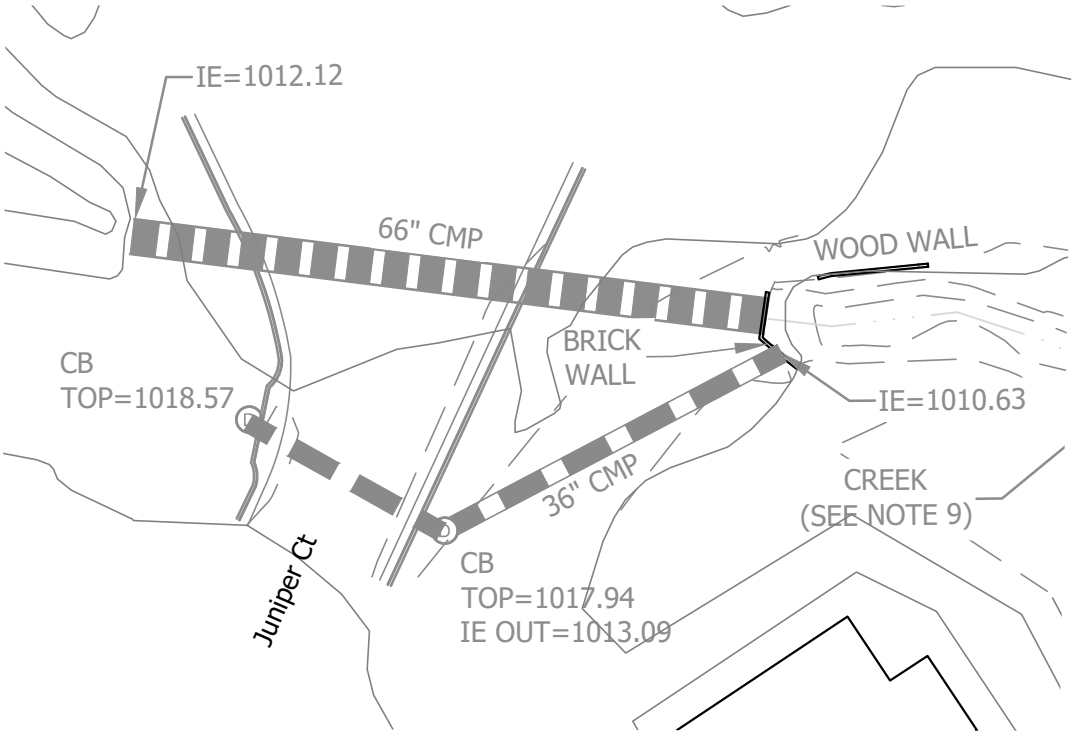
Hyd. No. 1

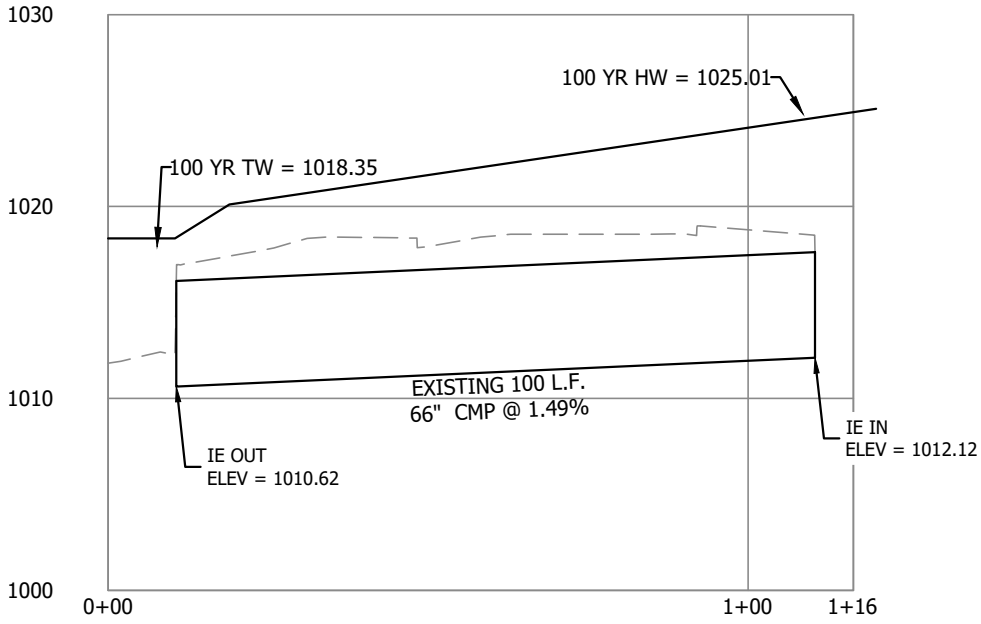
TO 66IN CMP

Hydrograph type	= SCS Runoff	Peak discharge	= 432.48 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.18 hrs
Time interval	= 1 min	Hyd. volume	= 1,731,158 cuft
Drainage area	= 99.300 ac	Curve number	= 78*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 28.80 min
Total precip.	= 7.36 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(21.900 x 74) + (27.700 x 55) + (2.800 x 98) + (46.900 x 92)] / 99.300







PROFILE OF STORM LINE 'JUNIPER'
VERT. SCALE 1"=10'
HORZ. SCALE 1"=30'

66 INCH JUNIPER CT.

Invert Elev Dn (ft)	=	1010.63
Pipe Length (ft)	=	99.77
Slope (%)	=	1.49
Invert Elev Up (ft)	=	1012.12
Rise (in)	=	66.0
Shape	=	Circular
Span (in)	=	66.0
No. Barrels	=	1
n-Value	=	0.023
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Headwall
Coeff. K,M,c,Y,k	=	0.0078, 2, 0.0379, 0.69, 0.5

Embankment

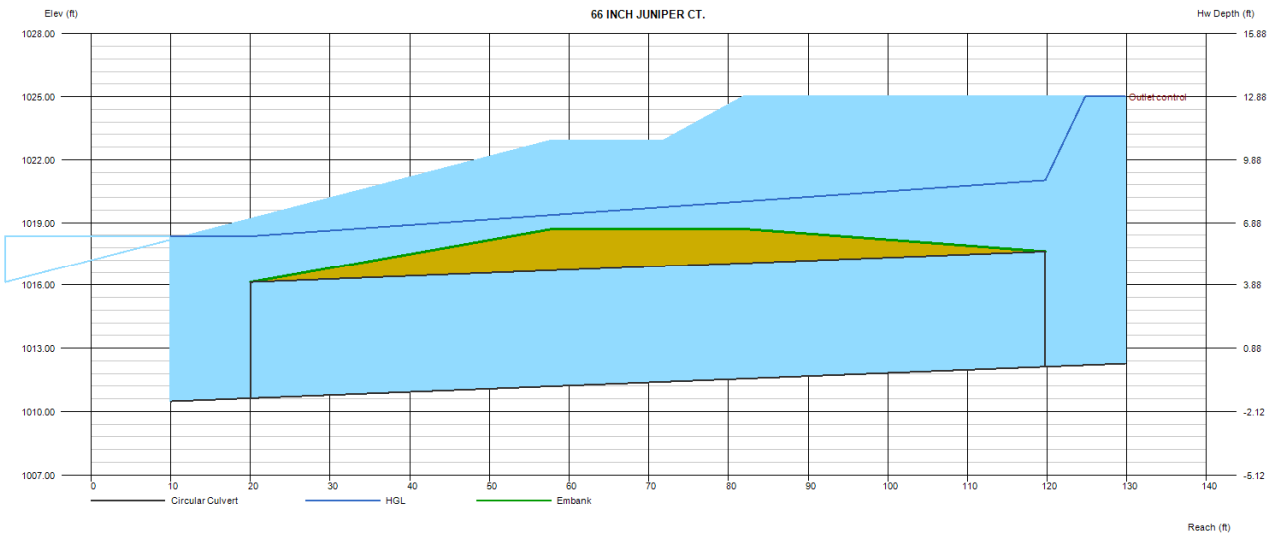
Top Elevation (ft)	=	1018.70
Top Width (ft)	=	24.00
Crest Width (ft)	=	42.00

Calculations

Qmin (cfs)	=	432.50
Qmax (cfs)	=	432.50
Tailwater Elev (ft)	=	1018.35

Highlighted

Qtotal (cfs)	=	432.50
Qpipe (cfs)	=	310.58
Qovertop (cfs)	=	121.92
Veloc Dn (ft/s)	=	13.07
Veloc Up (ft/s)	=	13.07
HGL Dn (ft)	=	1018.35
HGL Up (ft)	=	1021.02
Hw Elev (ft)	=	1025.01
Hw/D (ft)	=	2.34
Flow Regime	=	Outlet Control



SUMMARY - 66” CMP JUNIPER COURT

An existing 66” corrugated metal pipe crosses Juniper Court carrying runoff from the upstream basin. According to Gwinnett County GIS the existing pipe was installed in 1975. The drainage area to the pipe was computed from GIS topographic information. CN’s were computed based on current land use obtained from aerial photography provided by Microsoft. Although there appears to be at least two detention facilities and one lake within the upstream basin, detention was not accounted for within this analysis. The time of concentration was estimated, and the 100-year flow was calculated using the SCS Method. An analysis was performed on the pipe (see Page C-14). According to the analysis, the pipe can convey the 2-year storm frequency. HEC-RAS will be used to determine the 100-year elevation at this crossing.

FREQUENCY	INFLOW	TW	HW	COMMENTS
2	148.3	1015.83 (downstream HW)	1017.22	~1.48’ freeboard
5	202.3	1016.93 (downstream HW)	1019.06	~.36’ over road
10	250.0	1017.97 (downstream HW)	1019.54	~.84’ over road
25	319.3	1018.13 (1018.66 used)	1024.20	*~5.5’ over road
100	432.5	1018.35(1018.66 used)	*1025.01	* ~6.31 over road

**100-year to be determined from HEC-RAS study. Beyond accuracy of this analysis. Road Elev ~ 1018.7*

A site visit was made by Hussey Gay Bell in April 2023. Refer to Page C-44 for photographs.

The upstream headwall is in good condition. There are a couple of trees growing on top of the headwall that are causing cracking above the pipe. The bottom of the pipe appeared solid throughout. There was 6-12” of sediment throughout the pipe. Approximately halfway through the pipe there is a bulge in the top of the pipe and in the right wall. (See Photos 3&4 Page C-44) Closer to the downstream headwall, near the water line, a 2” gap is present. At the downstream headwall there is significant backwater and accumulated silt resulting from a blockage in front of the 84” downstream pipe. (See Photo 8 Page C-45) A large tree is growing above the headwall but does not appear to be damaging it. The road surface above the pipe has accumulated sediment and debris indicating possible overtopping of the road.

RECOMMENDATIONS:

The invert of the 66” pipe appears sound; however, sediment 6”-18” deep is present throughout the pipe due to the backwater from the downstream 84” culvert. The silt within the 66” pipe, downstream blockages within the creek, and the sediment and debris within the downstream 84” pipe, must be removed to maintain the flood carrying capacity of the pipes and creek. Bulges in the top and side of the pipe are concerning; however, there is no corresponding settlement or deformities present in the road. This leads to the assumption that these bulges have been present since the installation; however, they should be monitored to ensure that failure is not occurring.

84” CMP SANDALWOOD - SOUTH (Downstream of Juniper)

Basin limits are approximate.

Drainage area = 113.7 acres, CN = 77

Residential = 36.3 acres, CN = 74
Wooded = 27.7 acres, CN = 55
Commercial = 46.9 acres, CN = 92
Lake = 2.8 acres, CN =98

Tc = 29.7 minutes (see next sheet)

TR55 Tc Worksheet

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

Hyd. No. 2

TO 84IN CMP

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 81.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.72		0.00		0.00		
Land slope (%)	= 2.00		0.00		0.00		
Travel Time (min)	**= 16.83**	**+**	**0.00**	**+**	**0.00**	**=**	**16.83**
Shallow Concentrated Flow							
Flow length (ft)	= 175.00		344.00		0.00		
Watercourse slope (%)	= 2.00		4.70		0.00		
Surface description	= Unpaved		Unpaved		Paved		
Average velocity (ft/s)	=2.28		3.50		0.00		
Travel Time (min)	**= 1.28**	**+**	**1.64**	**+**	**0.00**	**=**	**2.92**
Channel Flow							
X sectional flow area (sqft)	= 20.00		20.00		0.00		
Wetted perimeter (ft)	= 40.00		40.00		0.00		
Channel slope (%)	= 1.70		1.70		0.00		
Manning's n-value	= 0.030		0.030		0.015		
Velocity (ft/s)	=4.07						
			4.07				
					0.00		
Flow length (ft)	({0})2212.0		227.0		0.0		
Travel Time (min)	**= 9.06**	**+**	**0.93**	**+**	**0.00**	**=**	**9.99**

Total Travel Time, Tc ..... 29.73 min

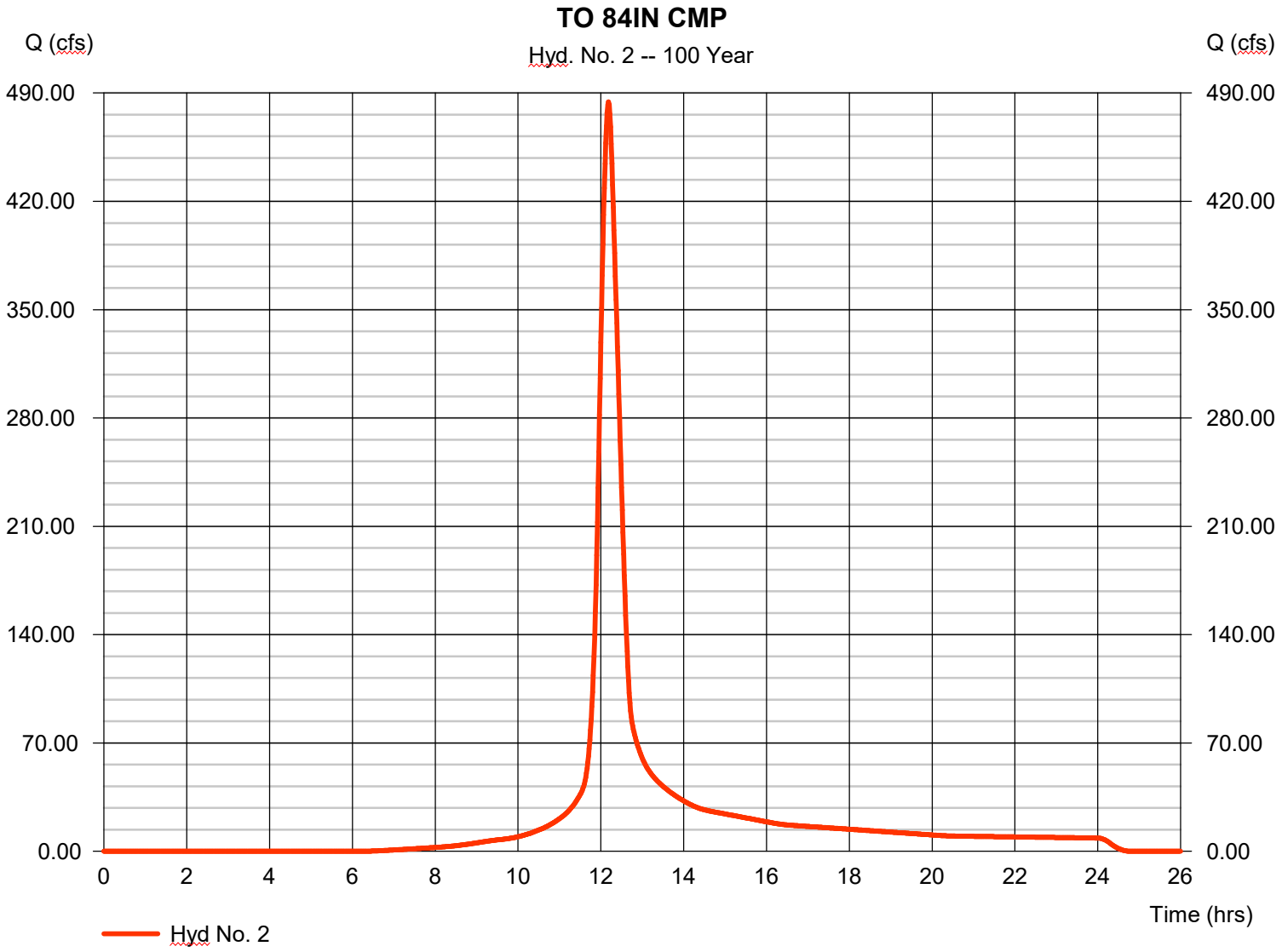
Hydrograph Report

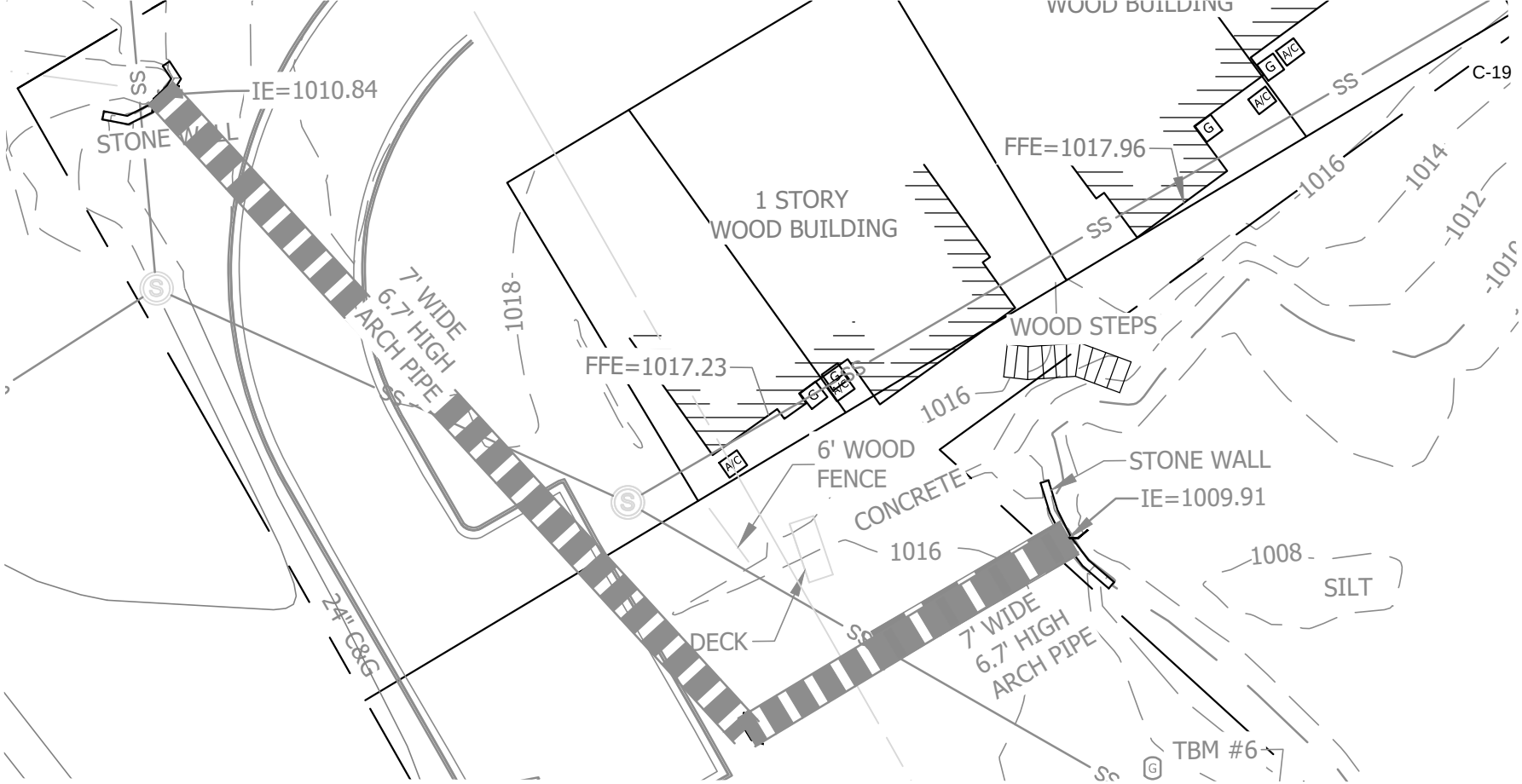
Hyd. No. 2

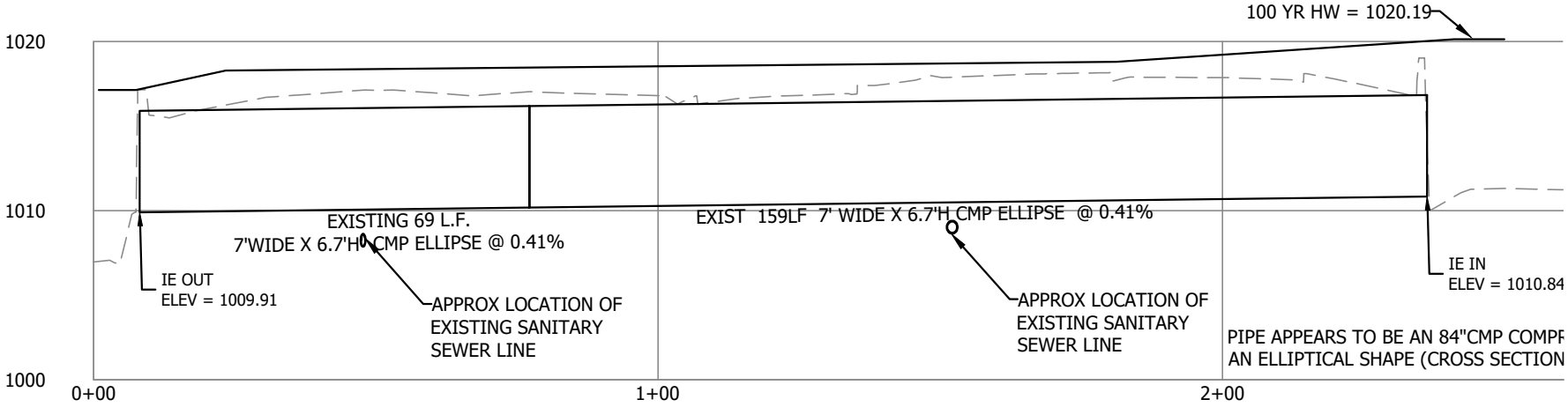
TO 84IN CMP

Hydrograph type	= SCS Runoff	Peak discharge	= 484.26 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.18 hrs
Time interval	= 1 min	Hyd. volume	= 1,936,006 cuft
Drainage area	= 113.700 ac	Curve number	= 77*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 29.73 min
Total precip.	= 7.36 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(33.500 x 74) + (27.700 x 55) + (2.800 x 98) + (46.900 x 92) + (2.800 x 74)] / 113.700







PROFILE OF STORM LINE '84 INCH SANDALWOOD'
VERT. SCALE 1"=10'
HORZ. SCALE 1"=30'

84IN SANDALWOOD

Invert Elev Dn (ft)	=	1009.91
Pipe Length (ft)	=	245.00
Slope (%)	=	0.38
Invert Elev Up (ft)	=	1010.84
Rise (in)	=	80.4
Shape	=	Elliptical
Span (in)	=	84.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Elliptical Inlet Face (E)
Culvert Entrance	=	Tapered inlet-beveled edges (E)
Coeff. K,M,c,Y,k	=	0.536, 0.622, 0.0368, 0.83, 0.2

Embankment

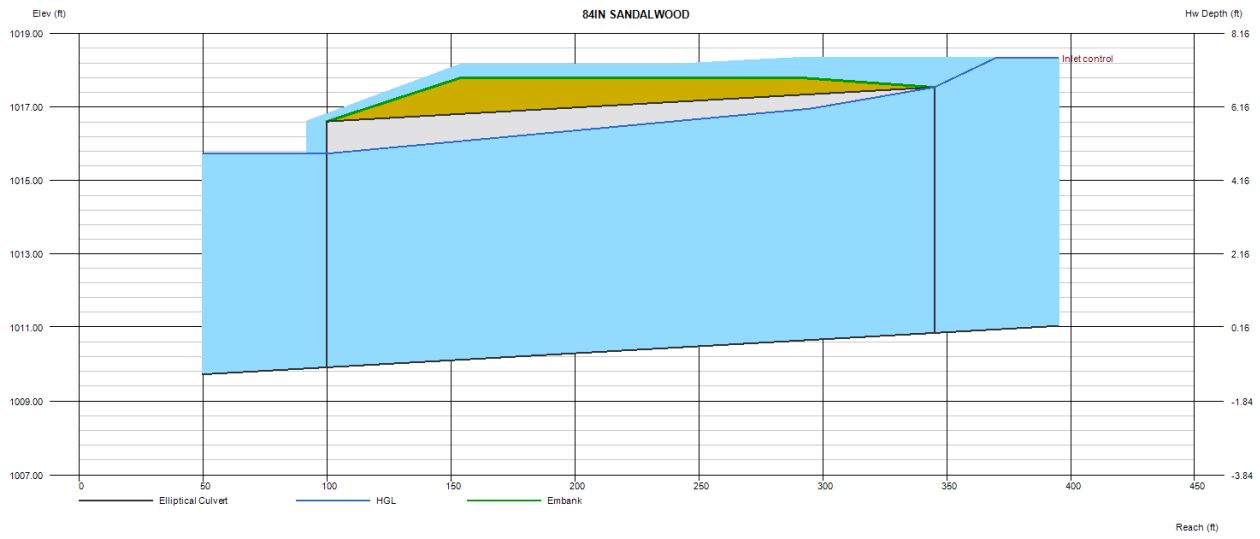
Top Elevation (ft)	=	1017.80
Top Width (ft)	=	137.00
Crest Width (ft)	=	178.00

Calculations

Qmin (cfs)	=	484.30
Qmax (cfs)	=	484.30
Tailwater Elev (ft)	=	1010.34

Highlighted

Qtotal (cfs)	=	484.30
Qpipe (cfs)	=	268.58
Qovertop (cfs)	=	215.72
Veloc Dn (ft/s)	=	7.80
Veloc Up (ft/s)	=	7.40
HGL Dn (ft)	=	1015.74
HGL Up (ft)	=	1017.27
Hw Elev (ft)	=	1018.35
Hw/D (ft)	=	1.12
Flow Regime	=	Inlet Control



SUMMARY- 84" CMP SANDALWOOD - SOUTH

An existing 80.4" H x 84"W corrugated metal pipe crosses Sandalwood carrying runoff from the 66"CMP under Juniper Ct and an additional 14.4 acres of upstream residential area. According to Gwinnett County GIS the existing pipe was installed in 1981. Beginning at the upstream side of Sandalwood, the pipe crosses Sandalwood connects to a junction box where it is turned and discharges into the headwater of the lake. The drainage area to the pipe was computed from GIS topographic information. CN's were obtained from aerial photography provided by Microsoft. Although there appears to be at least two detention facilities and one lake within the upstream basin, detention was not accounted for within this analysis. The time of concentration was estimated, and the 100-year flow was calculated using the SCS method and checked using the Regression Equation. An analysis was performed on the pipe (see page C-20). According to the analysis, the pipe can convey the 5-year storm frequency. It does not appear that the backwater from the downstream lake is a factor in the carrying capacity of the pipe. Due to the limitations of the "Hydraflow Express" program, HEC-RAS will be used to determine the 100-year elevation at this crossing.

FREQUENCY	INFLOW cfs	TW	HW	COMMENTS
2	161.9	1010.34 (100 YR LAKE)	1015.83	~1.7' freeboard
5	222.7	1010.34 (100 YR LAKE)	1016.93	~.09' freeboard
10	276.6	1010.34 (100 YR LAKE)	1017.97	~.07' over road
25	355.3	1010.34 (100 YR LAKE)	1018.13	~1.58 over road
100	484.3	1010.34 (100 YR LAKE)	1018.35	~3.11' over road

**100-year to be determined from HEC-RAS study. Beyond accuracy of this analysis*

REGRESSION EQUATION (Region 2)

Q100 = 644a^.7tia^.17 A = 113.7 ac = .177 smi TIA ~ 43% Q100 = 644(.177)^.7(43)^.17 =315.6(1.77)= 363 cfs, SCS = 484 cfs

The downstream headwall appears stable, the pipe discharges approximately 2' above the normal pool. A rock wall below the pipe prevents scour from undermining the headwall. Approximately 5' into the pipe, a gas line traverses the pipe. There is a 5"-6" bulge into the pipe. The invert appears solid with very little siltation. Approximately 25' into the pipe there is a gap at the joint. No sediment is present. A custom junction box constructed of granite block turns the pipe. Minor gaps appear below the pipe in the junction box where the grouting has been eroded. There is what appears to be a round opening in the top of the pipe that has been grouted (possibly from a former repair). Approximately 30' downstream of the upstream headwall, a waterline traverses through the pipe. Grout is present on both sides of the pipe wall. Sediment is not observed; however, some leakage is visible. At the upstream headwall there is approximately 1.5' to 2' of sediment. Refer to page C-34 to C-39 for photographs.

RECOMMENDATIONS:

Generally, the 42-year-old, 84" diameter corrugated metal pipe appears to be in good condition; however, corrosion is beginning to form at the flow line throughout the pipe and lining or reapplying protective coating should be planned. The removal of the blockage at the upstream end of the pipe is critical to the flood carrying capacity of upstream systems.

84” CMP SANDALWOOD EAST

Basin limits are approximate.

Drainage area = 86.2 acres, CN = 73

Residential = 66.2 acres, CN = 74
Residential = 20 acres, CN = 68

Tc = 40.1 minutes (see next sheet)

TR55 Tc Worksheet

Hyd. No. 4

84INCH EAST

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.400	0.011	0.011	
Flow length (ft)	= 88.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.72	0.00	0.00	
Land slope (%)	= 2.20	0.00	0.00	
Travel Time (min)	**= 17.31 +**	**0.00 +**	**0.00 =**	**17.31**
Shallow Concentrated Flow				
Flow length (ft)	= 185.00	810.00	0.00	
Watercourse slope (%)	= 2.20	1.70	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=2.39	2.65	0.00	
Travel Time (min)	**= 1.29 +**	**5.09 +**	**0.00 =**	**6.38**
Channel Flow				
X sectional flow area (sqft)	= 50.00	0.00	0.00	
Wetted perimeter (ft)	= 30.00	0.00	0.00	
Channel slope (%)	= 0.60	0.00	0.00	
Manning's n-value	= 0.040	0.015	0.015	
Velocity (ft/s)	=4.06			
		0.00		
			0.00	
Flow length (ft)	({0})4006.0	0.0	0.0	
Travel Time (min)	**= 16.43 +**	**0.00 +**	**0.00 =**	**16.43**

Total Travel Time, Tc ..... 40.12 min

Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

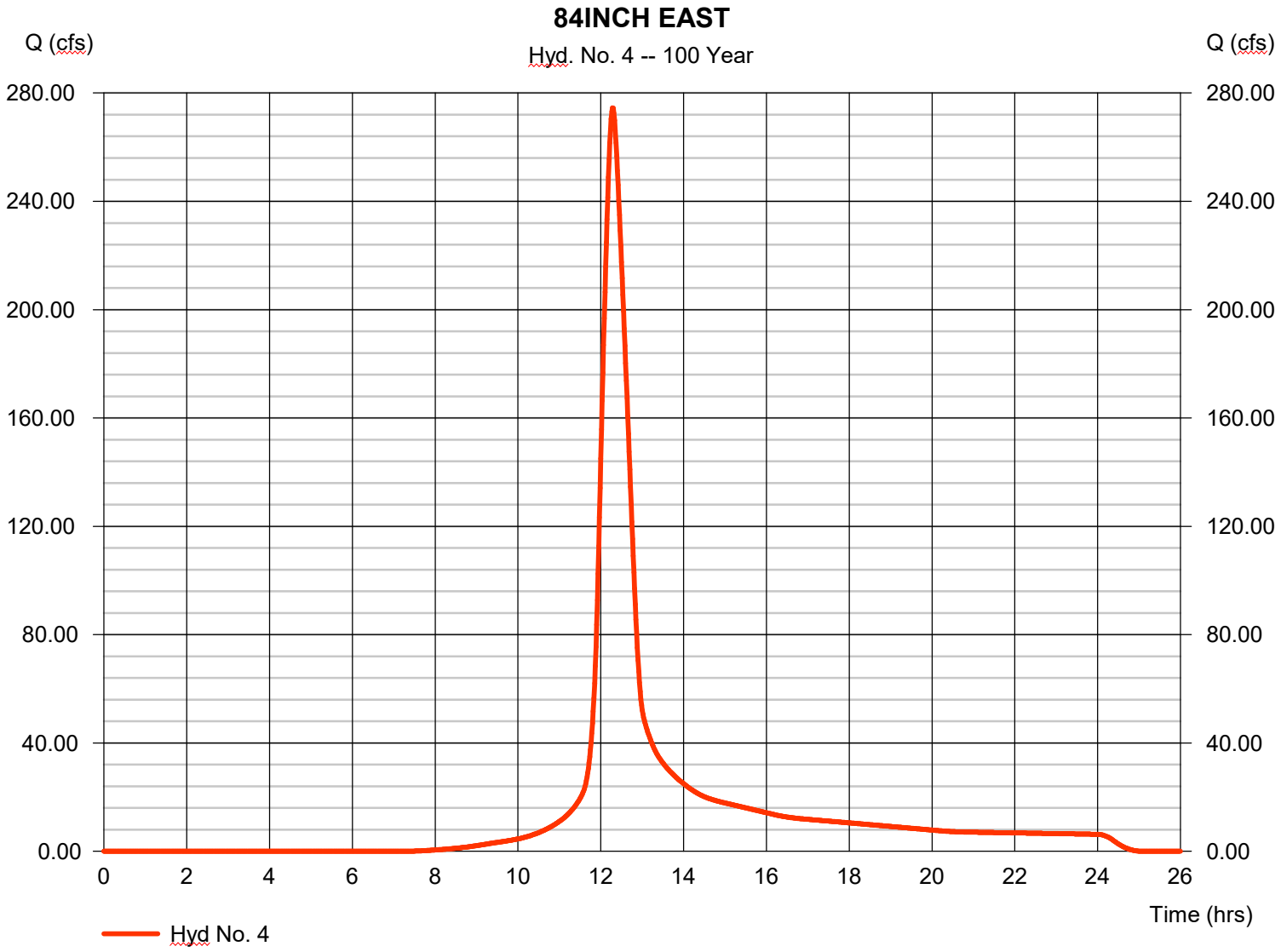
Friday, 04 / 7 / 2023

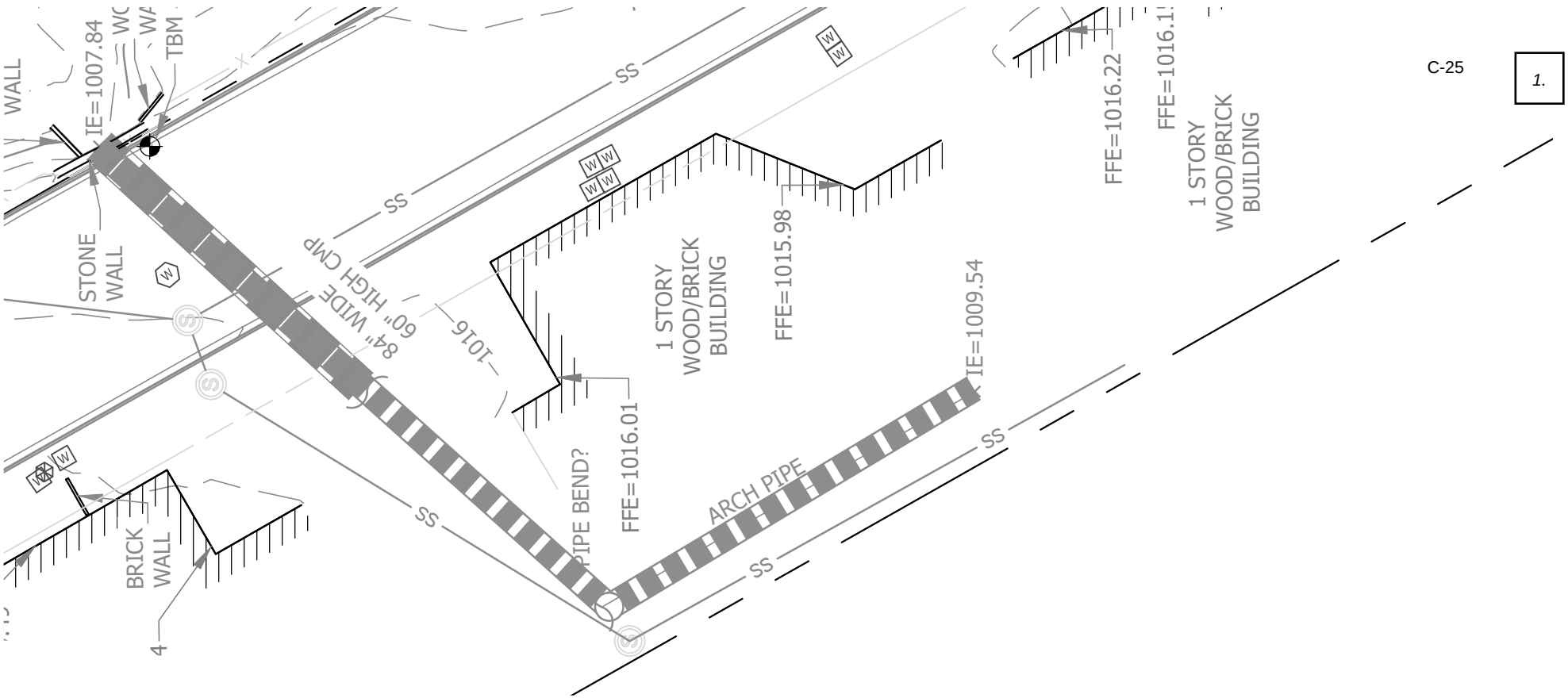
Hyd. No. 4

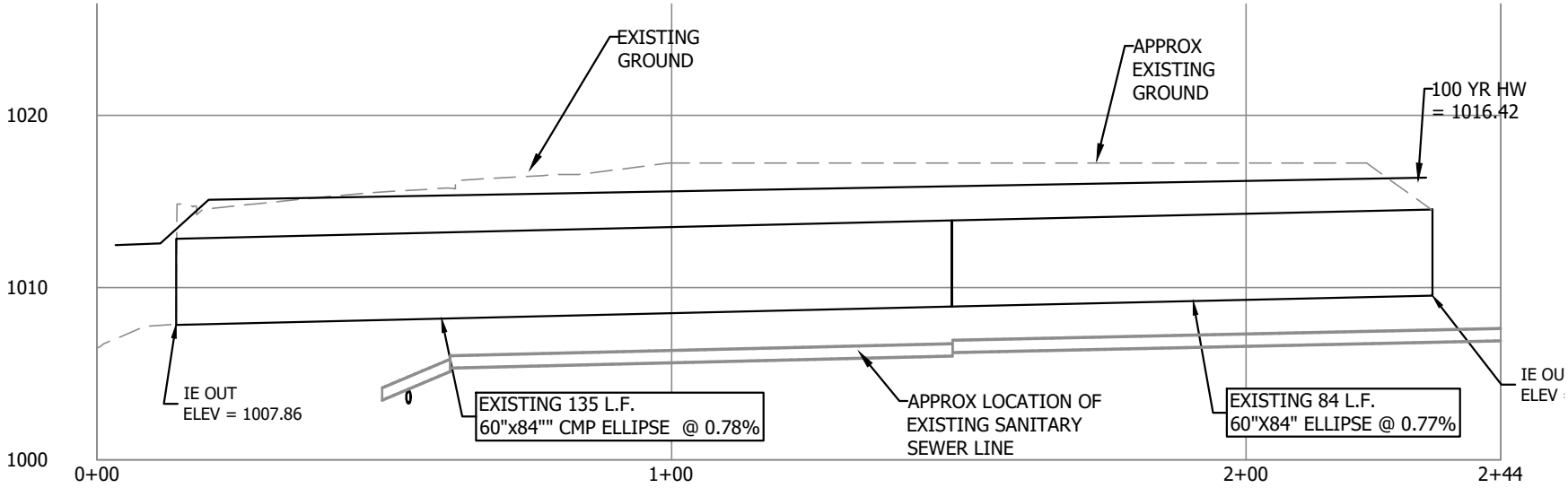
84INCH EAST

Hydrograph type	=	SCS Runoff	Peak discharge	=	274.49 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.28 hrs
Time interval	=	1 min	Hyd. volume	=	1,329,022 cuft
Drainage area	=	86.200 ac	Curve number	=	73*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	40.12 min
Total precip.	=	7.36 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(20.000 x 68) + (66.200 x 74)] / 86.200







PROFILE OF STORM LINE '84in CULVERT EAST'
VERT. SCALE 1"=10'
HORZ. SCALE 1"=30'

84IN SANDALWOOD EAST

Invert Elev Dn (ft)	=	1007.84
Pipe Length (ft)	=	227.00
Slope (%)	=	0.75
Invert Elev Up (ft)	=	1009.54
Rise (in)	=	60.0
Shape	=	Elliptical
Span (in)	=	84.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Horizontal Ellipse Concrete
Culvert Entrance	=	Square edge w/headwall (H)
Coeff. K,M,c,Y,k	=	0.01, 2, 0.0398, 0.67, 0.5

Embankment

Top Elevation (ft)	=	1016.00
Top Width (ft)	=	27.00
Crest Width (ft)	=	200.00

Calculations

Qmin (cfs)	=	275.00
Qmax (cfs)	=	275.00
Tailwater Elev (ft)	=	1010.34

Highlighted

Qtotal (cfs)	=	275.00
Qpipe (cfs)	=	249.37
Qovertop (cfs)	=	25.63
Veloc Dn (ft/s)	=	9.70
Veloc Up (ft/s)	=	9.07
HGL Dn (ft)	=	1012.23
HGL Up (ft)	=	1015.10
Hw Elev (ft)	=	1016.42
Hw/D (ft)	=	1.38
Flow Regime	=	Inlet Control

SUMMARY – 84" CMP SANDALWOOD - EAST

An existing compressed 84" corrugated metal pipe measuring (60" H x 84"W) crosses Sandalwood carrying runoff from 86.2 acres of upstream residential area. According to Gwinnett County GIS, the existing pipe was installed in 1981. The pipe collects runoff in the rear of the condominiums, carries it parallel to the units for approximately 86 feet then turns at a custom-built junction box ~107 degrees and discharges into the headwater of the lake. The drainage area to the pipe was computed from GIS topographic information. CN's were computed based on current aerial photography provided by Microsoft. Although there may be detention facilities within the upstream basin, detention was not accounted for within this analysis. The time of concentration was estimated, and the 100-year flow was calculated using the SCS method and checked using the Regression Equation. An analysis was performed on the pipe (see Page C-26). According to the analysis, the pipe can convey the 25-year storm frequency. In higher frequency storms, the water appears to rise above the finished floor elevations of 4 units, backs up to the northeast and flows between the two units. It does not appear that the backwater from the downstream lake is a factor in the carrying capacity of the pipe. A site visit was made by Hussey Gay Bell in April 2023. See page C-30 to C-33 for photographs.

REGRESSION EQUATION (Region 2) Used to verify 100-year SCS computed flow.

Q100 = 644a^.7tia^.17

A = 86.2 ac = .135 smi

TIA ~ 32%

Q100 = 644(.135)^.7(32)^.17 =315.6(1.77)= 285 cfs, SCS = 274 cfs

FREQUENCY	INFLOW (cfs)	HW	COMMENTS
2	81.4	1012.92	~2.68' freeboard *TW used is 1010.34 (100-year elvation)*
5	116.9	1013.54	~2.06' freeboard
10	148.8	1014.19	~.7' freeboard
25	195.9	1015.14	~.46 freeboard
100	274.5	1016.22	~.62' over road: Condos flooded (FFE~1015.98, 1016.01, 1016.22 & 1016.15)

** Tw used = (dc+D)/2 which is more conservative than 100-year lake elevation*

The downstream headwall is in good condition; however, a tree is growing out of the joint. This tree is causing cracks in the headwall. Approximately 25' upstream from the headwall an 8" waterline crosses through the pipe. The intersection of the waterline and the pipe is grouted and there is no sediment or leakage visible. There are gaps in a couple of the joints along the pipe. It is unclear whether the sediment observed at these gaps is deposited or entering through the pipe joints. Further upstream, there is what appears to be a round opening in the top of the pipe that has been grouted (possibly from a former repair). A custom junction box turns the pipe. The box is constructed of granite block with a concrete slab roof. This box has an access manhole. The concrete roof has multiple cracks radiating from the manhole opening. At the bottom of the manhole the grout has disappeared between the blocks. There is

approximately 2” of flow within the pipe. Upstream of the pipe is a concrete flume approximately 52” wide with 3:1 side slopes ranging in height. The flume is in good condition considering the age. There are some cracks along the side slopes. There is a large blockage approximately 3’ high upstream of the headwall. (See Photo 15 Page C-32).

RECOMMENDATIONS:

Remove and kill the tree growing within the downstream headwall.
Replace the grout at the base of the junction box.
Monitor the cracking in the junction box roof.
It is critical to remove the 3’ deep blockage within the concrete channel. The resulting backwater from this blockage is very likely to flood the adjacent townhomes.

8’W x 4’H Box Culverts on New Hope Rd

Picture 1: Upstream Headwall

Picture 2: Right box culvert (facing East/downstream) has ~7” of sediment. Very small chips present in concrete at the south end in the top left corner (as seen in the picture).

Picture 3: Left box culvert (facing East/downstream) has about 2’ of sediment. There are islands of sediment about a quarter of distance downstream and halfway through the culvert causing 6” of ponding.

Picture 4: Left downstream headwall

Picture 5: Right downstream headwall

84” CMP on the East side of Sandalwood Circle

Picture 1: Downstream headwall

Picture 2: A tree is causing cracks in downstream headwall.

Picture 3: The invert of the pipe was somewhat corroded but solid. The crossing pipe ±25’ from downstream headwall appears to be a water or sewer pipe. Penetrations appear to be sealed with concrete. Spillage present.

Picture 4: 3” gap at joint.

Picture 5: Small round rupture about 4” wide about 60 feet from downstream headwall. Possibly from repair work. No sediment visible.

Picture 6: 3” gap at joint. Sediment present.

Picture 7: Customized junction box structure where the pipe turns.

Picture 8

Picture 9

Picture 10

Picture 11

Pictures 8 thru 11: Concrete slab/roof of junction box is cracking. Multiple cracks visible on the corners of the slab. Grout appears to be missing between the bricks at the base of the manhole. No sediment visible.

Picture 12: Bent pipe about 15’ from upstream headwall.

Picture 13: Upstream headwall

Picture 14: Large tree on right side of upstream headwall.

Picture 15: Logs and branches have clogged up the flume upstream of the pipe. Lack of freeboard endangers adjacent town homes.

84” CMP on South side of Sandalwood Circle

Picture 1: Downstream headwall.

Picture 2: Gas pipe crosses at ± 5’ from downstream headwall.

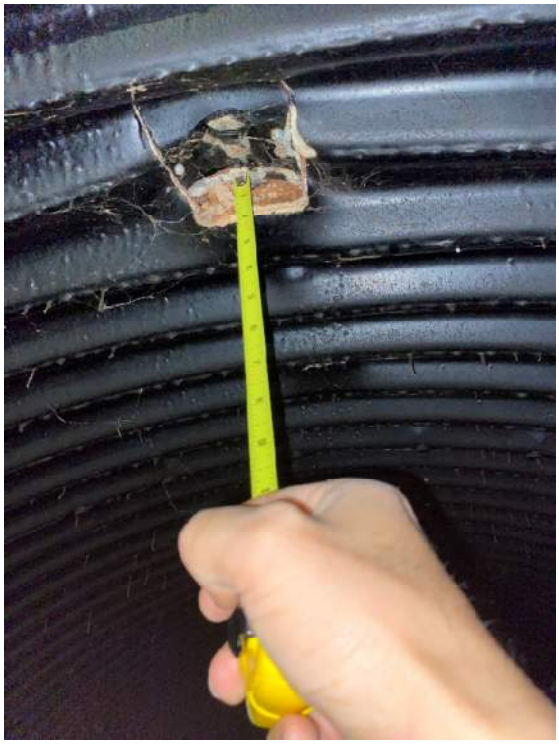
Picture 3: 5” bulge next to pipe in picture 2.

Picture 4: 2” gap between pipes at pipe joint. Some sediment making its way into the pipe.

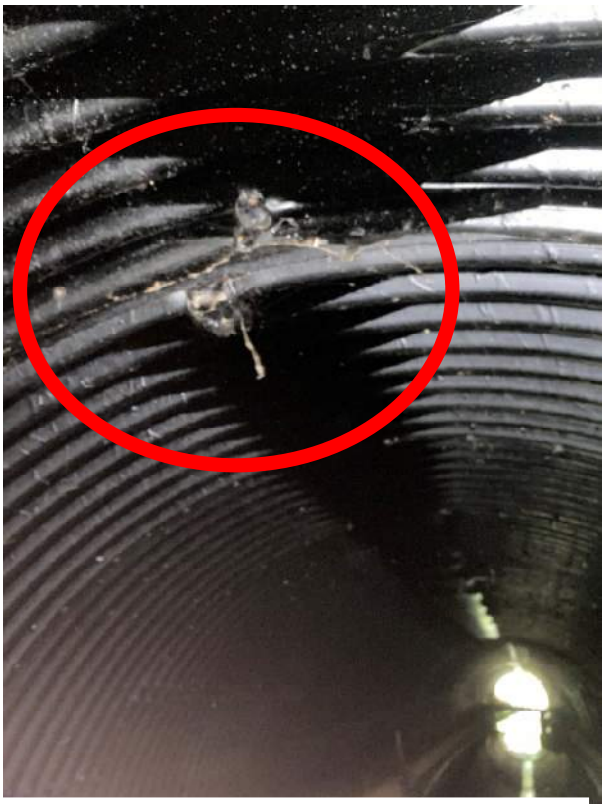
Picture 5: Customized junction box where pipe turns. A small embankment of dirt against one of the walls.

Picture 6: Concrete slab as roof of junction box. Wood forms remain across structure.

Picture 7: Sediment increases in depth upstream of the turn.

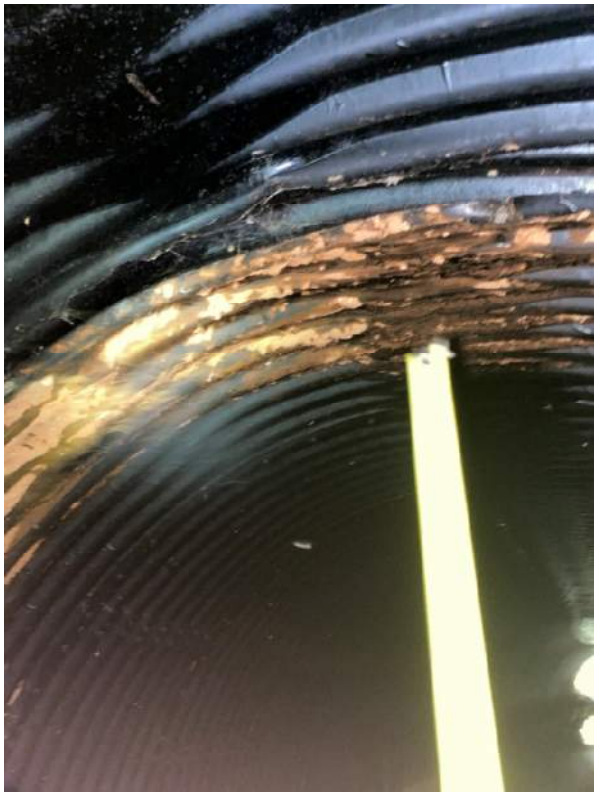


Picture 8: A rupture on the pipe about 4” wide and 6” long. Sediment is visible.



Picture 9: Bulge

Picture 10: Second bulge



Picture 11: Corrosion on top of pipe.

Picture 12: Water pipe crossing ±30’ from upstream headwall. Penetration sealed with concrete. Spillage present.

Picture 13: Small gap where pipe penetrates. Some sediment is escaping into the pipe.

Picture 14: Gap between pipes at pipe joint. Gap located ± 25’ from upstream headwall.

Picture 15: Gap shown on picture 14 at pipe joint. Some sediment is infiltrating.

Picture 16: Solid sediment berm on the upstream end of the pipe.

Picture 17: Branches, logs, and sediment clogging the upstream headwall of the pipe.

Picture 18: 1.5-2” of debris/sediment build up at upstream headwall.

Picture 19: Water ponding up at upstream headwall.

Picture 20: Upstream swale.

Picture 21: Pothole on road in the vicinity of the pipe.

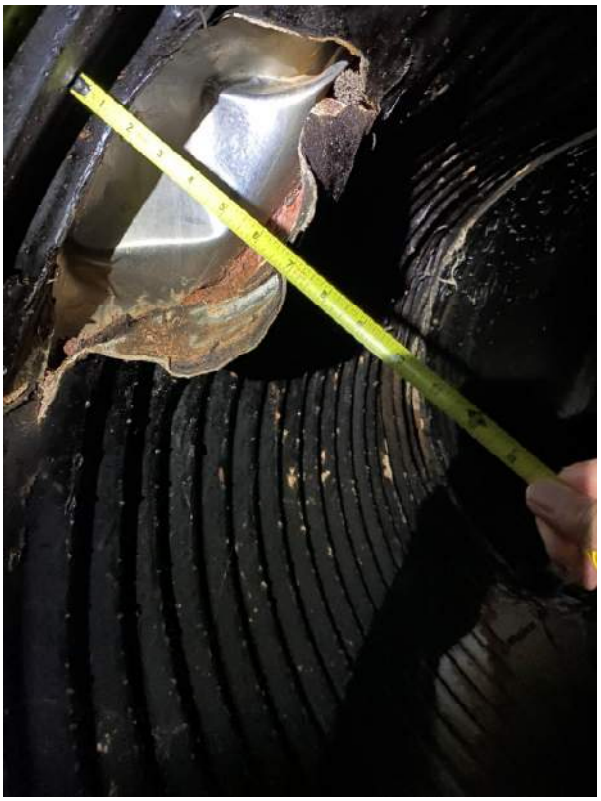
Picture 22: Second pothole on road in the vicinity of the pipe.

Picture 23: Tree appears to be above the pipe's path.

48” CMP on West side of Sandalwood Circle

Picture 1: Upstream headwall.

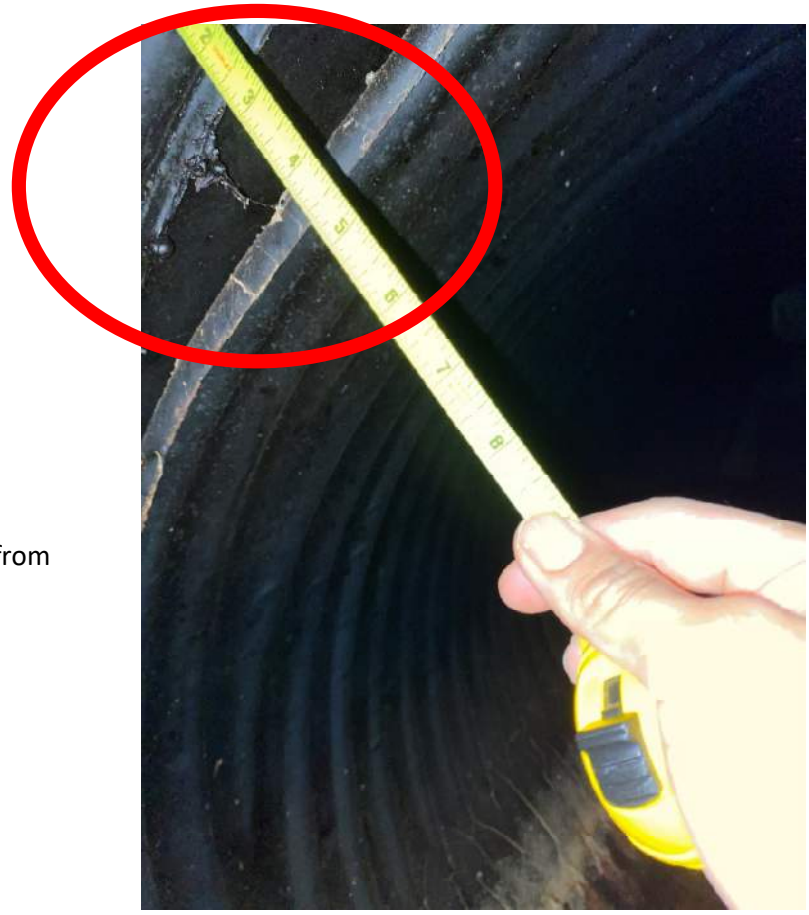
Picture 2: Bottom is slightly corroded but solid.



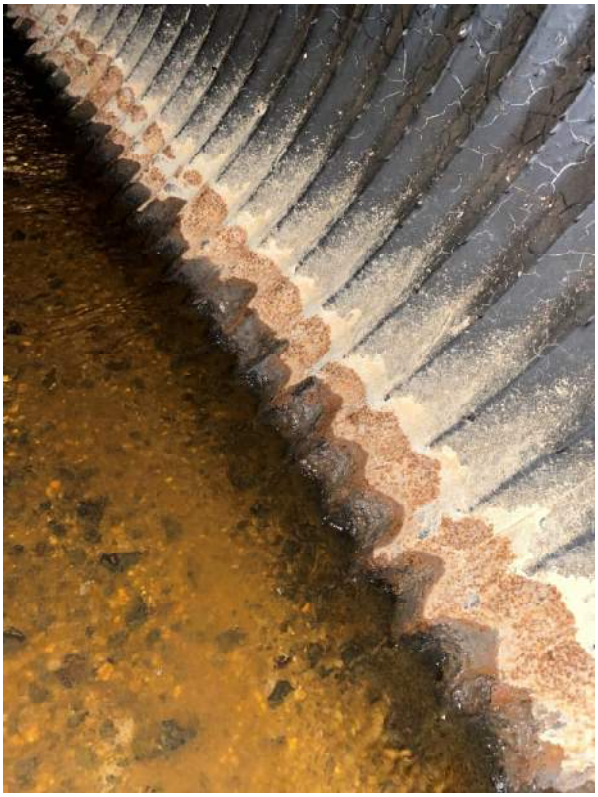
Picture 3: The pipe is damaged 10’ from upstream headwall. 5” bulge and sediment noticeable.

Picture 4: Small rupture close to upstream headwall. Small traces of dirt.

Picture 5: Gap at pipe joint ±20’ from upstream headwall. Small traces of dirt.



Picture 6: 4” gap at pipe joint ±30’ from upstream headwall.



Picture 7: Corrosion along flowline but invert of pipe is solid.

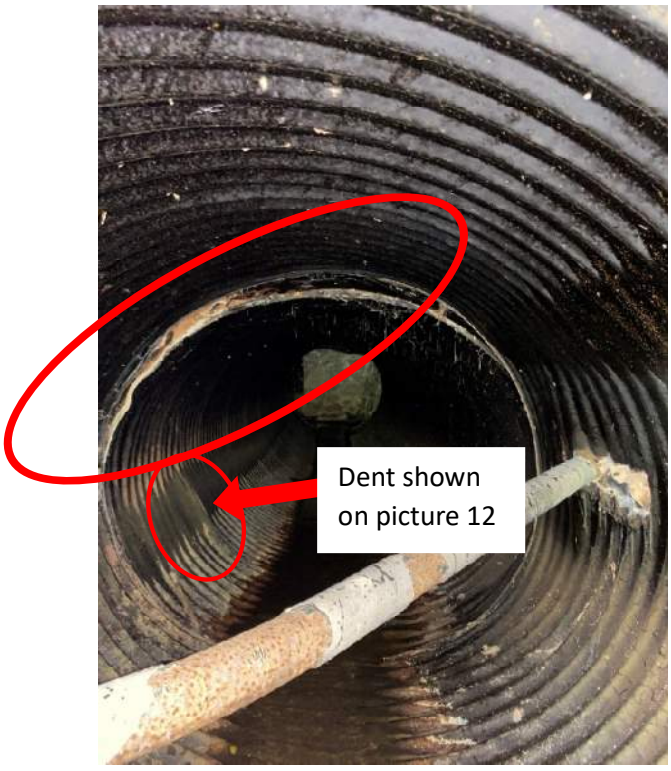
Picture 8: Some sediment is visible.

Picture 9: Customized junction box where pipe turns.

Picture 10: ±4” pipe crossing close to downstream headwall. Dirt is visible where pipe penetrates.

Picture 11: Other end of crossing pipe shown on picture 8. Dirt visible where pipe penetrates.

Picture 12: Small crease on pipe that seems to be cracked close to downstream headwall.



Picture 13: Gap at pipe joint. Sediment is visible.

Picture 14: Undermining at downstream headwall. The grout at joints is loosening and falling out in headwall. Rip-rap recommended.

66” CMP on Juniper Ct

Picture 1: Upstream headwall

Picture 2: 6”-18” of sediment in pipe bottom.

Picture 3: Gap at pipe joint.

Picture 4: Approximately midway through the pipe a 6” bulge protrudes ± 3’ along the top of the pipe.

Picture 5: 6” bulge shown in picture 4.

Picture 6: ±4” bulge protrudes from the side of the pipe.

Picture 7: ±2” gap at pipe joint.

Picture 8: Downstream headwall. Large tree sits on top of headwall.

APPENDIX D

FLOOD PLAIN ANALYSIS

DESCRIPTION:

In 2008 a flood study, “Flood Elevation Study for Shoal Creek, Tributaries 1, 2, 3, 4 & 5”, dated May 30, 2008, by Hayes, James & Associates was completed on the Tributaries to Shoal Creek. The purpose of that study was to comply with the Model Floodplain Management/Flood Damage Prevention Ordinance. The Sandalwood Lake lies within Tributary 4, specifically, Tributary 4.1 of that study. In the original study, flows for Tributary 4.1 were calculated in three locations and relied on the 2020 map of Lawrenceville to determine CN’s within the basin. This report provides an additional flow change location to model more accurately the 66” culvert under Juniper Ct. and a more accurate reflection of the detention provided by the lake within the tributary.

FLOW SUMMARIES

Cross Section	2020 (2008 study)	Current	Option 1 (Spillway)	Option 2 (Wet-riser)	Option 3 (Water Quality)	Option 4 (Detention only)
	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
0+00 to 3+70	865	671.4	665.9	606.3	490.4	473.4
4+80 to 6+80	945	751.9	751.9	751.9	751.9	751.9
10+95 to 14+45	557	484.3	751.9	751.9	751.9	751.9
14+45 to 15+18	557	484.3	484.3	484.3	484.3	484.3
16+63 to 17+15	557	432.5	432.5	432.5	432.5	432.5

PROCEDURE:

1. The HEC-RAS model used in the 2008 report was obtained.
2. The flows were altered to reflect the above modifications.
3. The starting Water Surface Elevation at section 10+95 was revised to reflect the proposed options.

Cross Section	2020 (2008 study)	Current	Option 1 (Spillway)	Option 2 (Wet-Riser)	Option 3 (Water Quality)	Option 4 (Detention only)
0+00	989.82	989.82	989.82	989.82	989.82	989.82
10+95	1010.74	1010.9	1010.34	1010.87	1010.32	1010.18

4. The cross section across the dam was altered to reflect the updated survey.
5. The cross section across Sandalwood was altered to reflect the updated survey.
6. The cross section across Juniper was altered to reflect the updated survey. The pipe size was changed from a 60” to a 66”.
7. The cross section across the Private Drive was altered to reflect the updated survey.

RESULTS:

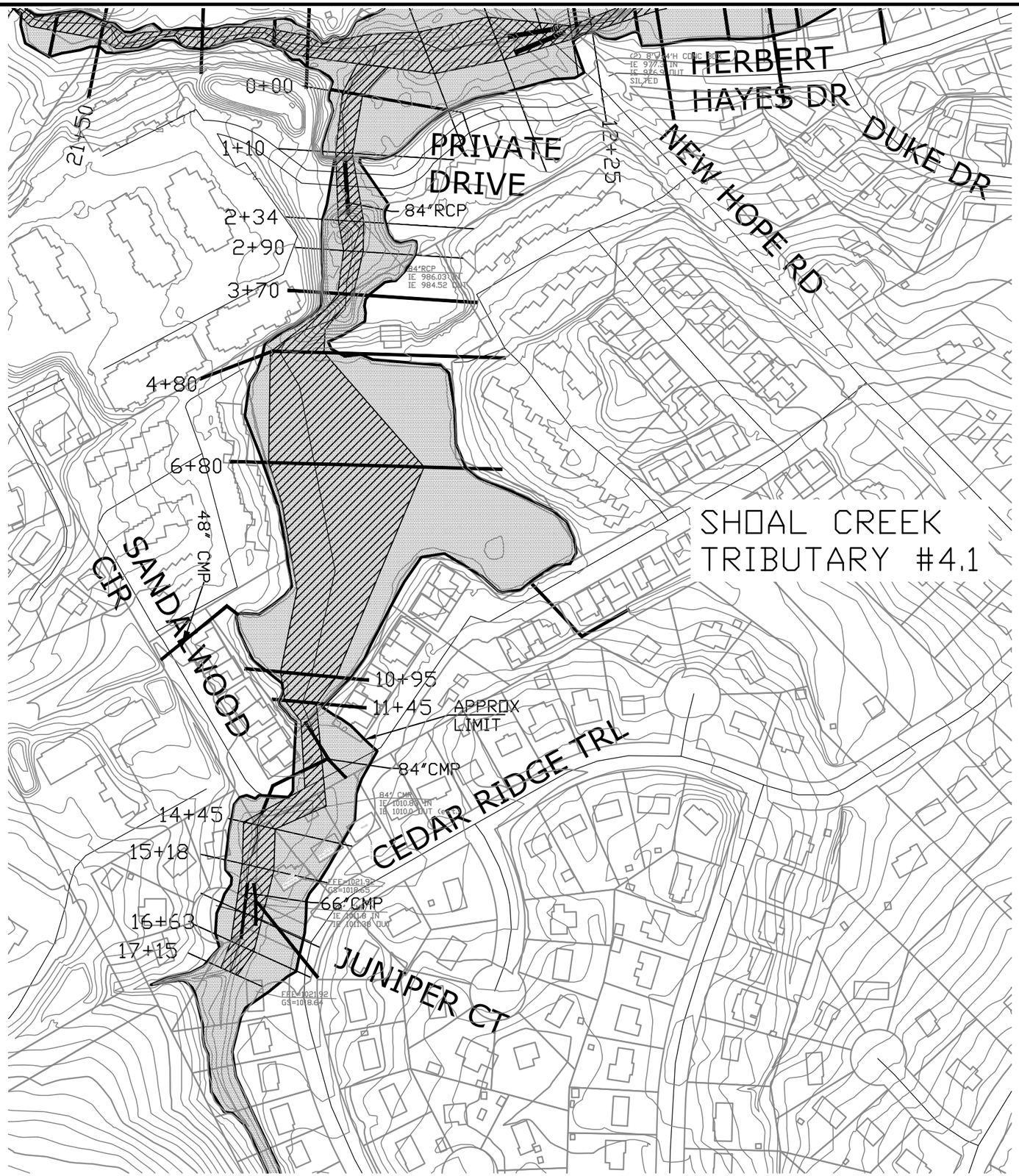
100-Year Computed Elevations

Cross Section	2020 (2008 study)	Current	Option 1 (Spillway)	Option 2 (Wet-riser)	Option 3 (Water Quality)	Option 4 (Detention only)
	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
0+00 (mouth)	989.82	989.82	989.82	989.82	989.82	989.82
1+10	989.85	989.84	989.84	989.84	989.83	989.83
2+34	1000.38	999.38	999.34	998.97	996.97	996.53
2+90	1000.39	999.39	999.34	998.97	996.97	996.53
3+70	1000.33	999.35	999.31	998.94	996.93	996.49
4+80 (at dam)	1010.38	1010.05	1010.05	1010.05	1010.06	1010.06
6+80 (in lake)	**1011.27*	**1010.91*	**1010.91*	**1010.91*	**1010.90*	**1010.90*
10+95 (in lake)	1010.74	1010.90	1010.34	1010.87	1010.32	1010.08
11+45 (ds 84")	1010.64	1010.83	1010.23	1010.80	1010.21	1010.05
14+45 (us 84")	1018.13	1018.56	1018.56	1018.56	1018.56	1018.56
15+18 (ds 66")	1018.14	1018.54	1018.54	1018.54	1018.54	1018.54
16+63 (u.s 66")	1019.76	1019.75	1019.75	1019.75	1019.75	1019.75
17+15	1019.81	1019.78	1019.78	1019.78	1019.78	1019.78

** Computed by HEC-RAS not considering storage volume.*

DISCUSSION - TRIBUTARY 4.1:

1. In general, the proposed modifications to the lake do not significantly affect the upstream properties or headwaters on the upstream culverts.
2. A site visit to Juniper Court was made. Unusually large amounts of sediment and debris could be seen collected in the gutter on the downstream side of the road indicating that the creek overtops the road.
3. The 66"CMP under Juniper Ct. is undersized for the 100-year storm. The 100-year runoff overtops the road and backwater appears to encroach on the house located on the southwest corner of Cedar Ridge Trail and Juniper Ct. The 100-year floodplain was computed at 1019.8. The FFE of the house is 1021.92; however, the ground shot at the NW corner of the house is 1018.6.
4. The 66" pipe under Juniper has 6" to 12" of sand throughout.
5. The 84"CMP under Sandalwood Circle is undersized for the 100-year storm. The upstream elevation of the 100-year floodplain is 1018.56. The house adjacent to the floodplain has an FFE = 1018.55. Currently, the upstream end of the pipe is blocked by 1.5' to 2' of sediment and debris causing ponding that reaches to the 66" culvert under Juniper Ct.
6. The downstream 84" RCP under the private drive does not pass the 100-year storm in the current condition or in Options 1 or 2.



N

GRAPHIC SCALE

200 100 0 200

1 inch = 200 ft.

D-4

1.

HUSSEY GAY BELL
Established 1958

ENGINEERS, PLANNERS & SURVEYORS

3100 BRECKINRIDGE BLVD
BUILDING 300
DULUTH, GEORGIA 30096TEL:
(770) 923-1600
FAX: (770) 923-4202

Client

CITY OF LAWRENCEVILLE
P.O. BOX 2200
Lawrenceville, GA 30046
Phone: (678) 407-6582

Contact: Jim Wright (404) 427-3017

NO.	BY	APPROVED	DATE

Project Title

SANDALWOOD DRAINAGE IMPROVEMENT PROJECT

Project Location

SANDALWOOD TOWNHOMES

Project No.	**23-001**
Drawn By:	**RH**
Checked By:	**MB**
Date:	**April 15, 2023**

Sheet Title

SHOAL CREEK TRIBUTARY 4.1 100–YEAR FLOOD MAP

Sheet Number

D-4

RECOMMENDATIONS:

From a floodplain perspective, based on the above analysis, Option 4 creating a dry pond with detention only would be the best option. This option would reduce flows to the downstream 84" RCP. A more extensive analysis would be required to determine the effect at New Hope and beyond. Regarding the upstream homes at 159 and 169 Cedar Ridge Trail that are in the floodplain, it does not appear that the lake itself affects the elevation of the floodplain on these properties. The FFE of the house upstream of the 66" culvert (169 Cedar Ridge Trail) appears to be ~ 2' above the flood elevation; however, because the 100-year flow will touch the house, it is in the floodplain and may require flood insurance.

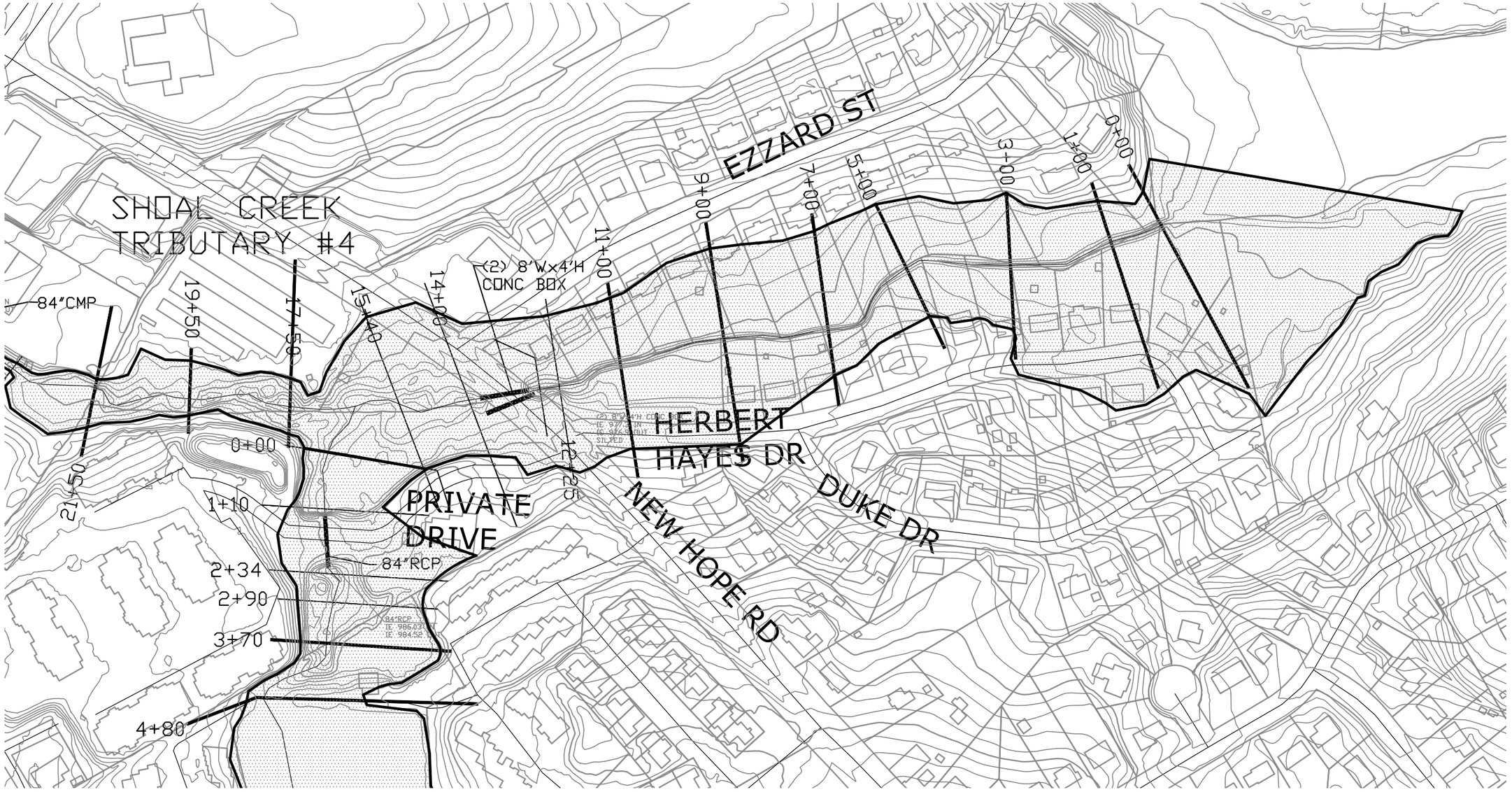
The house downstream of the 66" culvert (159 Cedar Ridge Trail) is at the flood elevation and any blockage of the downstream pipe or creek would cause flooding. *(Currently, the 84" pipe under Sandalwood has 1.5' to 2' of sediment blocking the inlet).* Removing these houses from the floodplain by adding pipes would require significant cost. In the case of the 84" pipe, there are numerous conflicts and accessibility obstacles to overcome. Hussey Gay Bell's recommendation is that the City should consider the option of purchasing these properties and removing the houses in lieu of attempting to lower the floodplain elevation.

APPROXIMATION OF DOWNSTREAM FLOODPLAIN WITH LAKE VOLUME ADDED:

Storage in lake = 1,568,049 cft = 36 acre-ft <100 acre-ft
Top of Dam elevation ~ 1012.4 Proposed Invert at toe ~ 991.6 Height of Dam ~ 20.8' <25'
Assumed 5 min breach = 1,568,049/(5x60) = 5,227 cfs

The zone affected by a dam breach was approximated by assuming that the entire storage volume of the lake discharges over a 5-minute period of time at the same time as the 100-year flood occurs. Refer to Exhibit 3, page D-6 for Mapped Area.

Cross Section	Q100 (cfs)	Elev100	Q100+Lake Vol (cfs)	Elev100+Lake Vol
0+00 (Trib 4)	1714	972.85	6941	975.41
1+00 (Trib 4)	1714	974.46	6941	976.77
3+00 (Trib 4)	1714	976.2	6941	979.56
5+00 (Trib 4)	1714	978.15	6941	981.49
7+00 (Trib 4)	1714	980.14	6941	984.19
9+00 (Trib 4)	1714.	982.61	6941	987.29
11+00 (Trib 4)	1714	983.59	6941	987.94
12+25 (Trib 4)	1652	984.76	6879	991.11
14+00 (Trib 4)	1652	987.22	6879	993.58
15+00 (Trib 4)	1652	988.00	6879	994.00
0+00 (Trib 4.1)	865	989.86	5895 5700	994.20
1+10 (Trib 4.1)	865	989.89	5895 5700	994.13 994.14
2+34 (Trib 4.1)	865	1000.01	5895 5700	1004.74 1004.64
2+90 (Trib 4.1)	865	1000.01	5895 5700	1004.95 1004.84
3+70 (Trib 4.1)	865	999.96	5895 5700	1004.79 1004.68



IT SHOULD BE NOTED THAT THIS MAP REPRESENTS THE LAKE VOLUME SUPERIMPOSED ON THE 100-YEAR FLOOD ELEVATION. NO ALLOWANCE WAS MADE FOR STORAGE VOLUME OCCURING ALONG THE TRIBUTARY. NARROWER BOUNDARIES ARE EXPECTED WHEN STORAGE VOLUMES ARE INCLUDED IN CALCULATIONS.

N

GRAPHIC SCALE

200 100 0 200

1 inch = 200 ft.

HUSSEY GAY BELL
Established 1958

ENGINEERS, PLANNERS & SURVEYORS

3100 BRECKINRIDGE BLVD
BUILDING 300
DULUTH, GEORGIA 30096TEL:
(770) 923-1600
FAX: (770) 923-4202

Client

CITY OF LAWRENCEVILLE
P.O. BOX 2200
Lawrenceville, GA 30046
Phone: (678) 407-6582

Contact: Jim Wright (404) 427-3017

NO.	BY	APPROVED	DATE

Project Title

SANDALWOOD DRAINAGE IMPROVEMENT PROJECT

Project Location

SANDALWOOD TOWNHOMES

Project No.	23-001
Drawn By:	RH
Checked By:	MB
Date:	April 15, 2023

Sheet Title

APPROXIMATE LIMIT FLOODPLAIN VOLUME W/ LAKE VOLUME

Sheet Number

EXHIBIT