FINAL
STORMWATER STUDY

LS MIDDLE SCHOOL #4
Lee's Summit, Jackson County, Missouri

Prepared for:
Lee's Summit School District
Lee's Summit, Missouri

Prepared By
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SUMMARY

This storm drainage study is being submitted on behalf of the Lee's Summit School District for the proposed development of the property located south of Bailey Road between Dalton Drive and Ranson Road, in Lee's Summit, Jackson County, Missouri. This property is an existing terraced row crop field with no existing buildings. This preliminary report is being submitted to the City of Lee's Summit with the Preliminary Development Plans for approval of this institutional development.

1. INTRODUCTION

This final stormwater management study is being submitted on behalf of Lee's Summit School District for a development on a 51.85 acre parcel of land generally located south of Bailey Road between Dalton Drive and Ranson Road, in Lee's Summit, Jackson County, Missouri. .

1.1. Project Location and Description

The proposed site is located in the northeast quarter of Section 16, Township 47 North, Range 31 West. The existing site is currently undeveloped consisting of terraced row crop. The site drains to the southeast into an unnamed tributary that runs along the entirety of the east side of the property. The tributary flows south to Big Creek. The site is not located within the flood plain.

1.2. Study Purpose

The purpose of this report is to verify this development's conformance with the City of Lee's Summit Design Criteria and Plan Requirements for Public Improvement Plans 2019 edition. Storm water drainage facilities are designed according to section F of aforementioned criteria. This study will outline methods to mitigate impacts on storm water runoff resulting from the development for the 1, 10 and 100-year rainfall events and for treatment of stormwater runoff with the use of permanent stormwater treatment facilities.

2. METHODOLOGY

2.1. General Criteria and References

Analytical and design criteria conform to those of Division V - Section 5600 – "Storm Drainage Systems and Facilities" of the Kansas City Metropolitan Chapter of the American Public Works Association's "Standard Specifications and Design Criteria". Based on these criteria's, Post-development discharge rates for the 2, 10, and 100-year storm events will be limited to provisions in section 5608.4-C1 Performance Criteria – "Comprehensive Control". Post-development discharge rates are limited to 0.5 cfs per acre for 2-Year, 2.0 cfs per acre for 10-year, and 3.0 cfs per acre for 100-year storm events.

Post development flows from the site are shown below and were calculated using HEC-HMS for the 2, 10 and 100-year storm events. Existing and proposed hydrographs were calculated using the 24-hour SCS Type II rainfall distribution. Existing times of concentration were determined using Inlet Time and Travel Time equations found in Section 5602.7 of APWA Section 5600.

2.2. Soils Description

Soil classifications by the United States Department of Agriculture (USDA) on the Natural Resources Conservation Service (NRCS) Soils website for Johnson County, Kansas show the existing site consisting of the following soil types:

10117 – Sampsel Silty Clay Loams, 5 to 9 percent slopes – HSG Type C/D

10082 – Arisburg-Urban Land Complex, 1 to 5 percent slopes – HSG Type C

**HSG – Hydrologic Soils Group (The NRCS information is included in the appendix)*.

3. HYDROLOGIC/HYDRAULIC ANALYSES

3.1. Existing Conditions

The property is bounded by residential lots to the west and north. Bailey Road is also located on the north side of the property. To the south and east the adjacent properties are currently undeveloped. A tributary to Big Creek, that flows to the south, lies along the entire east property line of the site. The storm drainage from the residential lots to the north comes under Bailey Road and empties into the north end of the tributary. The property currently contains no impervious area and runoff flows southeasterly to the tributary. An Exhibit of the Existing Conditions is included in Appendix A.

With the comprehensive control method is being used for drainage design, an existing curve number analysis is not required for the site.

3.2. Stream Protection and Buffer Zones

A portion of the property will be defined as a Stream Protection Buffer Zone. The proposed buffer zone will meet the requirements established Section 5603.5 of the APWA Section 5600 Design Criteria.

The width of the setback is determined by the drainage area to the stream. Using USGS contours the drainage area for the stream was determined at different points. A minor tributary from the east is the location for Point 1. The drainage area to Point 1 in 138 acres. Therefore a 60’ offset from the ordinary high water mark (OHM), ie surveyed top of bank, is used to determine the buffer extent to that point. Point 2 is located where the stream exits at the southern edge of the property. The total drainage to this point is 210 acres. The setback from Point 1 to Point 2 is 100’. An exhibit of the stream setback drainage areas is included in Appendix A.

3.3. Proposed Conditions Analysis

Post development, the entirety of the of the property will continue to flow to the tributary to the east. The proposed site will include the middle school, a softball/baseball complex (with 4 fields), a track, practice fields, outdoor classrooms, parking, three extended dry detention basins, private storm, and associated utilities. Roof drains, private storm sewer pipe and inlets will allow adequate drainage of the proposed school, athletic facilities and parking areas. The private storm will drain into the detention basins and then be routed to the tributary. A private road will be constructed for access to the bus turnaround and parking areas. The road will connect to the existing Bailey Road on the north to proposed Cape Road on the south.

The proposed Cape Road will be located on the southern portion of the property. The right of way will be dedicated to the city with a portion the road being constructed to connect to existing Cape Road to the west. When the road is completely constructed a public storm system will drain to road to the tributary. Temporary provisions will be implements to drain the constructed road to the stream.

The backyards of the residential subdivisions to the west also drain onto the existing sight. This 2.5 acres will drain to the proposed north-south private road and will enter into the proposed storm system for the road.

The site will be divided into four main drainage areas. An exhibit of the Stormwater Management Plan drainage areas is included in Appendix A. Each drainage area will have collection system and an extended dry detention basin with control structure. A general description of what is draining to each area is as follows:

Drainage Area 1 (3.5 acres) - northwest ball field ball field and a portion of the common area in the ball fields

Drainage Area 2 (8.2 acres) - northeast ball field, a portion of the common areas in the

ball fields and the northeast quarter of the roof for the middle school/

Drainage Area 3 (22.6 acres) – 2 southern ball fields, the remainder of middle school

building roof, north-south drive, main parking area, bus turnaround area, the practice fields and the track.

The ball fields and the track will have synthetic surfacing with underdrain systems. The current plan is for the two north fields to have synthetic turf on the infields and outfields. The two south fields will have synthetic turf on the infields only. If the budget allows, there is a possibility that the two south fields will have also have synthetic turf in the outfields. For the purposes of this report, the ballfields will be treated as if they have a complete synthetic surface.

The synthetic surface will act as impervious surface. However, the underdrain system, with it's aggregate subsurface rock layer and underdrain piping, will increase the time of concentration (Tc) for the runoff that is guided through the underdrain system. The increase in Tc will be 32 minutes based on the final underdrain design. The HEC-HMS model based its Tc's on a time to inlet of 5 minutes and then an estimation of pipe travel time. This was used as the Tc for the impervious and pervious areas in the drainage area. The synthetic fields had an additional time of 32 minutes added to their Tc's.

Based on the completed models the peak flows for each area are included in the table below:

Table 1. Post-Development Peak Flows

Site Description	Total Area (ac)	CN	Storm Event	Runoff Q (cfs)
Area 1	3.5	79.4	2-YR	**5.7**
			10-YR	**8.6**
			100-YR	**12.5**
Area 2	8.2	89.6	2-YR	**10.9**
			10-YR	**25.5**
			100-YR	**37.5**
Area 3	22.6	87.5	2-YR	**38.4**
			10-YR	**90.7**
			100-YR	**133.8**

3.4. Stormwater Detention

As stated previously, a new detention basin will be constructed for each area to mitigate the increase in flow due to the increase in impervious area. A control structure will be located at the outlet of the basin. An orifice/weir plate in the control structure will limit outflow in the 2, 10, and 100-year storms.

The control structure for each basin is designed to limit the outlet flow to the allowable release rate for each storm based on the Comprehesive Control Strategy. Hydrographs for the combined flows of the detained and undetained areas are shown in Appendix D.

To meet water treatment requirements, the basin will act as extended dry detention. The water quality volume (WQv) will be controlled by a series of 1" orifices at the bottom of the orifice plate. The conduit will release the water quality volume over a 40-hour period to allow pollutants to settle out of this precipitation event.

Table 2. EDD-1 WSE's and Peak Flows

Description	Detention Basin
Bottom of Basin	1007.16
Total Storage Volume	0.85 ac-ft
Top of Dam Elevation	1012.20
WQv Orifice (IE Elevation, Pipe Size)	1007.16, 6 – 1" (ft, # hole - diam)
Water Quality Volume WSE, Storage	1008.41, 0.18 (ft, ac-ft)
2-year & 10-Year Orifice (IE Elevation, Pipe Size)	1008.43, 1-6" (ft, orifice size)
10–Year Storm WSE, Storage, Peak Outflow	1010.3, 0.5, 4.2 (ft, ac-ft, cfs)
100–Year Storm Weir (Elevation, Length)	999.58, 6.0 (ft, lf)
100–Year Storm WSE, Storage, Peak Outflow	1010.8, 0.6, 9.9 (ft, ac-ft, cfs)

Table 3. EDD-2 WSE's and Peak Flows

Description	Detention Basin
Bottom of Basin	997.23
Total Storage Volume	1.34 ac-ft
Top of Dam Elevation	1012.20
WQv Orifice (IE Elevation, Pipe Size)	1001.65, 8 – 1" (ft, # hole - diam)
Water Quality Volume WSE, Storage	0., 0.18 (ft, ac-ft)
2-year & 10-Year Orifice (IE Elevation, Pipe Size)	1001.73, 1-9" (ft, orifice size)
10–Year Storm WSE, Storage, Peak Outflow	1003.1, 0.8, 14.0 (ft, ac-ft, cfs)
100–Year Storm Weir (Elevation, Length)	1001.8, 8.0 (ft, lf)
100–Year Storm WSE, Storage, Peak Outflow	1003.8, 1.2, 24.0 (ft, ac-ft, cfs)

Table 4. EDD-3 WSE's and Peak Flows

Description	Detention Basin
Bottom of Basin	992.36
Total Storage Volume	0.85 ac-ft
Top of Dam Elevation	1012.20
WQv Orifice (IE Elevation, Pipe Size)	992.36, 8 – 2" (ft, # hole - diam)
Water Quality Volume WSE, Storage	994.36, 0.18 (ft, ac-ft)
2-year & 10-Year Orifice (IE Elevation, Pipe Size)	996.15, 1-15" (ft, orifice size)
10–Year Storm WSE, Storage, Peak Outflow	998.00 , 2.4, 38.9 (ft, ac-ft, cfs)
100–Year Storm Weir (Elevation, Length)	996.52, 14 (ft, lf)
100–Year Storm WSE, Storage, Peak Outflow	999.00, 3.3, 66.8 (ft, ac-ft, cfs)

Table 5. Detention Basin Information

Area	Drainage Area (acres)	Storm Event	Allowable Release Rate (cfs)	Design Release Rate (cfs)	Storage Required (ac-ft)	WSE (ft elev)
1	3.5	2-YR	1.8	1.6	0.3	1009.7
		10-YR	7.0	4.2	0.5	1010.3
		100-YR	10.4	9.9	0.6	1010.8
2	8.2	2-YR	4.1	4.0	0.4	1001.5
		10-YR	16.4	14.0	0.8	1003.1
		100-YR	24.5	24.0	1.2	1003.8
3	22.6	2-YR	11.3	11.2	0.9	996.1
		10-YR	45.3	38.9	2.4	998.0
		100-YR	67.9	66.8	3.3	999.0

4. STORM WATER TREATMENT REQUIREMENTS

As stated previously, the four detention basins will be designed to act as extended dry bottom detention facilities to treat stormwater per MARC water quality standards. The orifice plate for the basin are sized to release the water quality volume (1.37”) over a 40-hour period to allow pollutants to settle from runoff before entering the public stormwater system. The size and quantities of the orifice holes are included in Tables 3-5.

5. CLEANWATER ACT SECTION 404 PERMITTING REQUIREMENTS

Construction will not be occurring within jurisdictional Waters of the United States. Therefore, a Section 404 permit is not required.

6. FEMA/DWR PERMIT REQUIREMENTS

No FEMA permitting or submittals will be required on this site because there are no FEMA delineated floodplains on the site. A copy of the FIRM map for this area has been included in Appendix B.

7. CONCLUSIONS AND RECOMMENDATIONS

As outlined in the preceding report, increased runoff rates in the post-development conditions are mitigated by the detention basin. Drainage patterns on the site remain will relatively unchanged. Lastly, four extended dry detention basins will be designed to limit site runoff to comprehensive control rates and to improve the storm water quality. Based on these facts and other information provided herein, we request approval of this stormwater study.plot

APPENDIX A
Report Exhibits

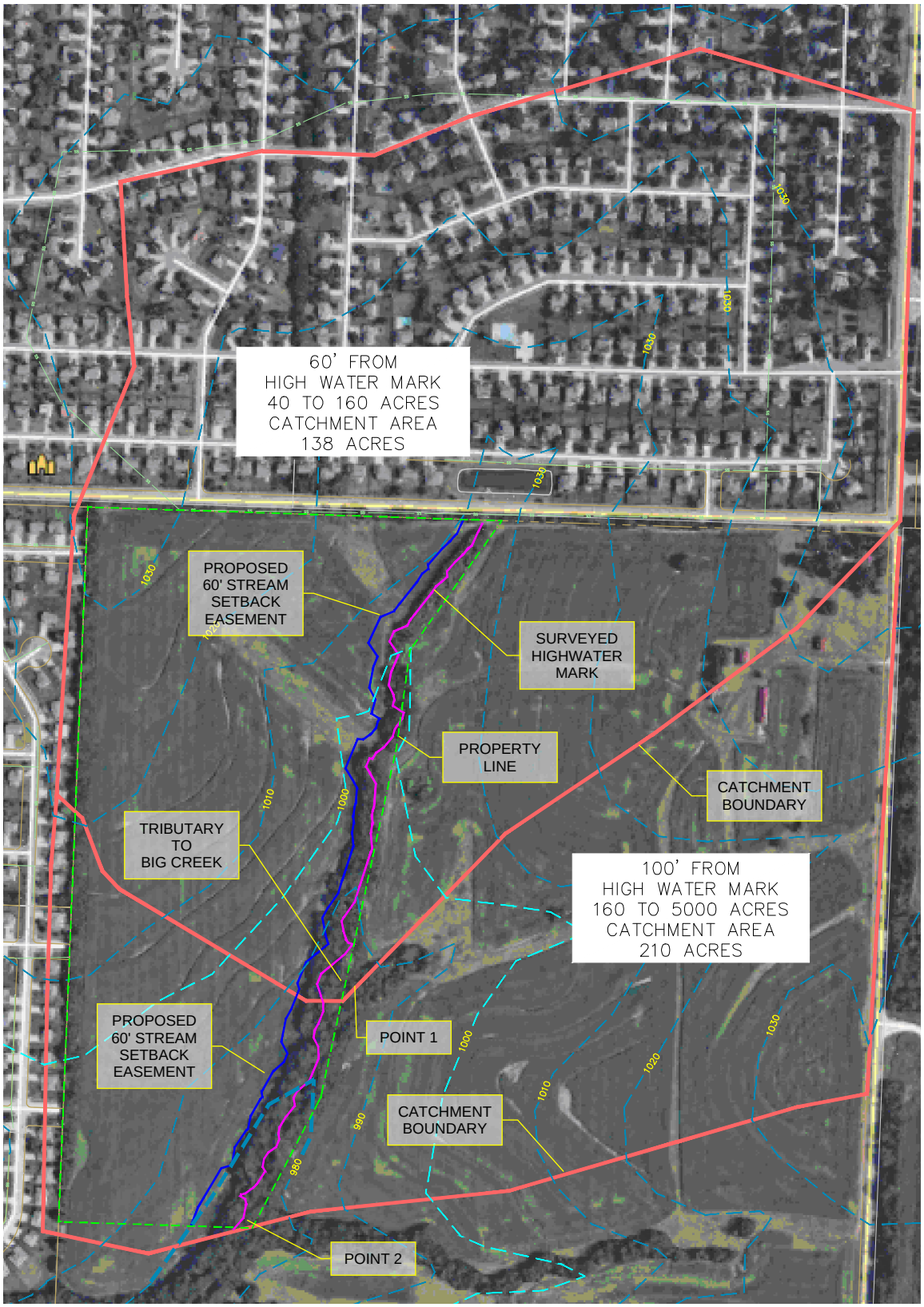
Existing Conditions

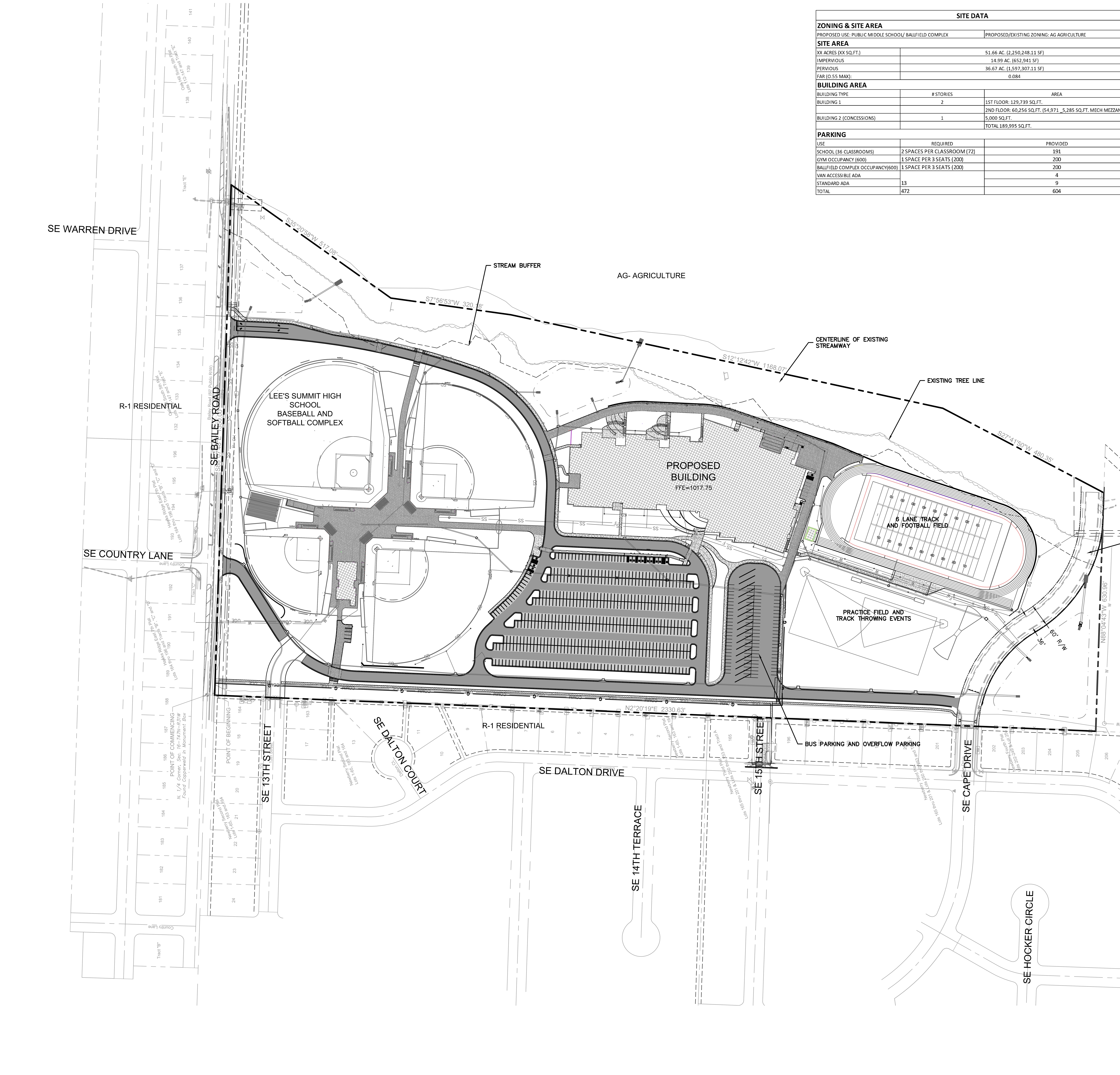
Stream Setback

Site Plan

Stormwater Management Plan

LS MIDDLE SCHOOL #4
STREAM SETBACK EXHIBIT





SITE DATA		
ZONING & SITE AREA		
PROPOSED USE: PUBLIC MIDDLE SCHOOL/ BALLFIELD COMPLEX		PROPOSED/EXISTING ZONING: AG AGRICULTURE
SITE AREA		
XX ACRES (XX SQ.FT.)	51.66 AC. (2,250,248.11 SF)	
IMPERVIOUS	14.99 AC. (652,941 SF)	
PERVIOUS	36.67 AC. (1,597,307.11 SF)	
FAR (0.55 MAX):	0.084	
BUILDING AREA		
BUILDING TYPE	# STORIES	AREA
BUILDING 1	2	1ST FLOOR: 129,739 SQ.FT.
		2ND FLOOR: 60,256 SQ.FT. (54,971 _5,285 SQ.FT. MECH MEZZANINE
BUILDING 2 (CONCESSIONS)	1	5,000 SQ.FT.
		TOTAL 189,995 SQ.FT.
PARKING		
USE	REQUIRED	PROVIDED
SCHOOL (36 CLASSROOMS)	2 SPACES PER CLASSROOM (72)	191
GYM OCCUPANCY (600)	1 SPACE PER 3 SEATS (200)	200
BALLFIELD COMPLEX OCCUPANCY(600)	1 SPACE PER 3 SEATS (200)	200
VAN ACCESSIBLE ADA		4
STANDARD ADA	13	9
TOTAL	472	604

LEGEND

- PROPERTY LINE
- LOT LINE
- UTILITY EASEMENT
- CONSTRUCT CONCRETE CURB & GUTTER
- SAWCUT PAVEMENT FULL DEPTH
- ADA PATH
- HEAVY DUTY ASPHALT PAVEMENT
- LIGHT DUTY ASPHALT PAVEMENT
- HEAVY DUTY CONCRETE PAVEMENT
- SIDEWALK AND LANDSCAPE CONCRETE PAVEMENT
- STORM SEWER
- SS SANITARY SERVICE LINE
- W WATER SERVICE LINE
- P-UG UNDERGROUND POWER SERVICE LINE
- FP FIRE PROTECTION LINE
- COMM COMMUNICATIONS SERVICE LINE
- SD LANDSCAPE/ROOF DRAIN
- ADA CONCRETE SIDEWALK AND RAMP
- SS EXISTING SANITARY SEWER MAIN
- W EXISTING WATER MAIN
- TEL EXISTING COMMUNICATIONS LINE
- P-UG EXISTING ELECTRIC LINE
- G EXISTING GAS MAIN

DLR Group

- NOT FOR CONSTRUCTION -

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LEE'S SUMMIT MIDDLE SCHOOL #4

LEE'S SUMMIT R-7 SCHOOL DISTRICT

1001 SE BAILEY ROAD
LEE'S SUMMIT, MO 64081

ISSUE FOR BID
08/28/20
REVISIONS

13-20102-00

GENERAL LAYOUT PLAN

C1002

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LEE'S SUMMIT MIDDLE SCHOOL #4

LEE'S SUMMIT R-7 SCHOOL DISTRICT

1001 SE BAILEY ROAD
LEE'S SUMMIT, MO 64081

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REVISIONS

13-20102-00

DRAINAGE PLAN

C1047

DWG: F:\2020\0001-0500\020-0103\40-Design\AutoCAD\Final Plans\Sheets\GNCV\CONSTRUCTION DOCUMENTS\C_DRN01_0200103.dwg USER: tparsons
DATE: Aug 28, 2020 8:43am XREFS: C_XBASE_0200103 C_PBASE_0200103 C_PTBLK_0200103 C_PSURF_0200103 T_PBASE_0200103 T_PSAS_0200103 C_PSTRM_0200103 V_XALT_00103

STORM SEWER PIPE AND STRUCTURE TABLE

TITLE: LSMS #4
JOB #: 020–0103
DESIGN CONDITIONS: PRIVATE - 100 YEAR STORM EVENT

	STRUCTURES		RUNOFF CALCULATIONS								PIPE DESIGN												
	FROM	TO	DIRECT AREA (ACRES)	TOTAL AREA (ACRES)	C	KC (K=1.25)	Tc (MIN)	FLOW TIME (MIN)	INTENSITY (IN/HR)	DESIGN Q (CFS)	DESCRIPTION	PIPE LENGTH (L.F.)	PIPE SLOPE (%)	PIPE DIA (IN)	Q FULL (CFS)	PIPE AREA (SQ.FT.)	V FULL (F/S)	DESIGN V (F/S)	Hw/D	MH TOP ELEVATION	UPSTREAM FLOWLINE	DOWNSTREAM FLOWLINE	Comments
EDD 1	A6		0.35		0.90	1.00	5.0		10.32	0.00	Area Inlet									1015.81			
		A5		0.35	0.90	1.00	5.0	0.85	10.32	3.61	15 in. HDPE	210.61	0.50	15	4.58	1.23	3.73	4.13	0.95		1012.83	1011.78	
	A5		0.15		0.45	0.56	5.0		10.32	0.00	Area Inlet									1015.02			
		A4		0.50	0.86	1.00	5.8	0.85	9.98	4.99	18 in. HDPE	228.76	0.50	18	7.45	1.77	4.21	4.51	0.88		1011.48	1010.34	
	A4		0.39		0.30	0.38	5.0		10.32	0.00	Area Inlet									1015.00			
		A3		0.89	0.74	0.93	6.7	0.39	9.66	7.95	24 in. HDPE	119.51	0.50	24	16.04	3.14	5.11	5.09	0.80		1010.04	1009.44	
	A3		0.27		0.30	0.38	5.0		10.32	0.00	Area Inlet									1017.13			
		A2		1.16	0.69	0.86	7.1	0.38	9.52	9.53	24 in. HDPE	120.29	0.50	24	16.04	3.14	5.11	5.31	0.85		1009.14	1008.54	
	A2		0.05		0.55	0.69	5.0		10.32	0.00	Area Inlet									1015.66			
		A1		1.21	0.69	0.86	7.5	0.10	9.39	9.80	24 in. HDPE	33.37	0.50	24	16.04	3.14	5.11	5.35	0.86		1008.24	1008.07	
EDD 2	C7		0.15		0.85	1.00	5.0		10.32	0.00	Area Inlet									1016.91			
		C6		0.15	0.85	1.00	5.0	0.46	10.32	1.55	15 in. HDPE	118.91	1.00	15	6.48	1.23	5.28	4.33	0.72		1011.68	1010.49	
	C6		0.10		0.80	1.00	5.0		10.32	0.00	Area Inlet									1015.56			
		C5		0.25	0.83	1.00	5.5	0.43	10.14	2.53	15 in. HDPE	189.11	3.00	15	11.22	1.23	9.14	7.39	0.81		1010.19	1004.52	
	C5		0.24		0.45	0.56	5.0		10.32	0.00	Area Inlet									1010.82			
		C4		1.29	0.55	0.69	5.9	0.10	9.97	8.84	15 in. HDPE	60.46	3.00	15	11.22	1.23	9.14	10.11	2.32		1004.22	1002.41	ADD LINE CC
	C4		0.52		0.52	0.65	5.0		10.32	0.00	Area Inlet									1006.89			
		C3		1.81	0.52	0.65	6.0	0.30	9.93	11.68	24 in. HDPE	128.71	1.00	24	22.68	3.14	7.22	7.26	0.95		1002.11	1000.82	
	C3		0.60		0.40	0.50	5.0		10.32	0.00	Area Inlet									1004.39			
		C2		2.41	0.46	0.58	6.3	0.25	9.82	13.60	24 in. HDPE	86.50	0.50	24	16.04	3.14	5.11	5.72	1.04		1000.09	1000.29	
	C2		0.56		0.40	0.50	5.0		10.32	0.00	Area Inlet									1005.42			
		C1		2.97	0.44	0.55	6.5	0.17	9.72	15.88	24 in. HDPE	58.52	0.50	24	16.04	3.14	5.11	5.81	1.18		999.79	999.50	
	CC2		0.50		0.45	0.56	5.0		10.32	0.00	Curb Inlet									1012.74			
		CC1		0.50	0.45	0.56	5.0	0.57	10.32	2.90	15 in. HDPE	176.95	1.00	15	6.48	1.23	5.28	5.13	0.85		1007.62	1005.85	
	CC1		0.30		0.55	0.69	5.0		10.32	0.00	Curb Inlet									1009.66			
		C4		0.80	0.49	0.61	5.6	0.44	10.09	4.94	15 in. HDPE	179.24	1.50	15	7.93	1.23	6.46	6.81	1.19		1005.55	1002.86	
	K3		0.76		0.90	1.00	5.0		10.32	0.00	Area Inlet									1007.92			
		K2		2.09	0.57	0.71	5.0	0.13	10.32	15.37	18 in. HDPE	86.84	3.00	18	18.24	1.77	10.32	11.55	2.68		1002.97	1000.36	ADD LINE L
	K2		0.18		0.78	0.98	5.0		10.32	0.00	Area Inlet									1007.02			
		K1		2.27	0.59	0.74	5.1	0.08	10.27	17.19	24 in. HDPE	36.25	1.00	24	22.68	3.14	7.22	7.93	1.27		999.86	999.50	
	L1		1.33		0.38	0.48	5.0		10.32	0.00	Area Inlet									1007.92			
		K2		1.33	0.38	0.48	5.0	0.15	10.32	6.52	18 in. HDPE	90.75	3.92	18	20.85	1.77	11.80	10.42	1.03		1003.92	1000.36	
	M4		0.28		0.52	0.65	5.0		10.32	0.00	Area Inlet									1006.67			
		M3		0.28	0.52	0.65	5.0	0.38	10.32	1.88	15 in. HDPE	103.39	1.00	15	6.48	1.23	5.28	4.57	0.74		1002.57	1001.54	
	M3		0.23		0.55	0.69	5.0		10.32	0.00	Area Inlet									1006.54			
		M2		0.51	0.53	0.66	5.4	0.42	10.17	3.44	15 in. HDPE	134.42	1.00	15	6.48	1.23	5.28	5.35	0.92		1001.14	999.80	
	M2		0.20		0.55	0.69	5.0		10.32	0.00	Area Inlet									1006.57			
		M1		0.71	0.54	0.68	5.8	0.09	10.00	4.79	15 in. HDPE	32.61	1.00	15	6.48	1.23	5.28	5.77	1.16		999.66	999.34	
EDD 3	E11		0.13		0.45	0.56	5.0		10.32	0.00	Area Inlet									1027.14			
		E10		0.13	0.45	0.56	5.0	0.87	10.32	0.75	15 in. HDPE	212.64	1.50	15	7.93	1.23	6.46	4.08	0.68		1019.84	1016.65	
	E10		0.54		0.41	0.51	5.0		10.32	0.00	Area Inlet									1025.31			
		E9		0.67	0.42	0.52	5.9	0.37	9.97	3.49	15 in. HDPE	138.26	1.50	15	7.93	1.23	6.46	6.25	0.93		1016.35	1014.30	
	E9		0.70		0.48	0.60	5.0		10.32	0.00	Area Inlet									1023.55			
		E8		1.37	0.70	0.87	6.2	0.17	9.83	11.78	24 in. HDPE	87.11	1.50	24	27.78	3.14	8.84	8.47	0.95		1014.00	1012.69	
	E8		1.23		0.52	0.65	5.0		10.32	0.00	Area Inlet									1019.97			
		E7		2.60	0.60	0.74	6.4	0.49	9.77	18.89	24 in. HDPE	248.71	1.10	24	23.79	3.14	7.57	8.39	1.39		1012.36	1009.62	
	E7		0.85		0.41	0.51	5.0		10.32	0.00	Area Inlet									1019.91			
		E6		3.45	0.54	0.68	6.9	0.87	9.59	22.40	30 in. RCP	390.98	0.70	30	34.41	4.91	7.01	7.45	1.00		1009.32	1006.58	
	E6		0.82		0.40	0.50	5.0		10.32	0.00	Area Inlet									1016.91			
		E5		4.27	0.51	0.64	7.8	0.49	9.28	25.33	30 in. RCP	224.24	0.70	30	34.41	4.91	7.01	7.65	1.09		1006.28	1004.71	
	E5		0.47		0.43	0.54	5.0		10.32	0.00	Area Inlet									1015.36			
		E4		4.74	0.50	0.63	8.3	0.54	9.12	27.14	30 in. RCP	291.35	1.00	30	41.13	4.91	8.38	8.93	1.16		1004.44	1001.53	
	E4		0.16		0.43	0.54	5.0		10.32	0.00	Area Inlet									1010.01			
		E3		4.90	0.50	0.62	8.8	0.46	8.95	27.38	36 in. RCP	192.68	0.50	36	47.29	7.07	6.69	6.92	0.87		1000.39	999.43	
	E3		0.55		0.42	0.53	5.0		10.32	0.00	Area Inlet									1006.10			
		E2		5.45	0.49	0.61	9.3	0.28	8.81	29.44	36 in. RCP	117.67	0.50	36	47.29	7.07	6.69	7.04	0.90		999.13	998.54	
	E2		0.31		0.43	0.54	5.0		10.32	0.00	Area Inlet									1004.92			
		E1		5.76	0.58	0.73	9.6	0.56	8.72	36.56	36 in. RCP	247.97	0.50	36	47.29	7.07	6.69	7.37	1.03		999.14	997.00	
	F8		1.02		0.65	0.81	5.0		10.32	0.00	Area Inlet									1006.41			
		F7		1.02	0.65	0.81	5.0	0.27	10.32	8.55	24 in. HDPE	82.70	0.50	24	16.04	3.14	5.11	5.18	0.82		1003.49	1003.08	
	F7		0.00		0.00	0.00	5.0		10.32	0.00	Area Inlet									1005.99			
		F6		1.02	0.65	0.81	5.3	0.47	10.21	8.46	24 in. HDPE	144.58	0.50	24	16.04	3.14	5.11	5.17	0.81		1002.78	1002.06	
	F6		0.15		0.85	1.00	5.0		10.32	0.00	Area Inlet									1006.34			
		F5		2.50	0.65	0.81	5.7	0.26	10.03	20.37	30 in. RCP	101.37	0.50	30	29.08	4.91	5.92	6.40	0.94		1001.76	1001.25	
	F5		0.00		0.00	0.00	5.0		10.32	0.00	Area Inlet									1008.20			
		F4		13.37	0.45	0.56	6.0	0.10	9.92	74.63	48 in. RCP	50.65	0.50	48	101.84	12.57	8.10	8.83	1.02		1000.95	999.00	ADD LINE G
	F4		0.30		0.52	0.65	5.0		10.32	0.00	Area Inlet									1006.44			
		F3		13.67	0.51	0.64	6.1	0.40	9.89	86.16	48 in. RCP	219.96	0.50	48	101.84	12.57	8.10	9.07	1.14		998.70	997.60	
	F3		1.75		0.32	0.40	5.0		10.32	0.00	Area Inlet									1003.43			
		F2		15.42	0.45	0.56	6.5	0.50	9.74	84.44	48 in. RCP	272.52	0.50	48	101.84	12.57	8.10	9.04	1.12		997.30	995.94	
	F2		1.75		0.33	0.41	5.0		10.32	0.00	Area Inlet									1004.88			
		F1		17.17	0.42	0.53	7.0	0.28	9.55	86.11	48 in. RCP	154.13	0.50	48	101.84	12.57	8.10	9.07	1.14		995.64	997.12	
	G9		0.34		0.30	0.38	5.0		10.32	0.00	Area Inlet									1017.00			
		G8		0.34	0.30	0.38	5.0	0.91	10.32	1.32	15 in. HDPE	176.44	0.50	15	4.58	1.23	3.73	3.22	0.71		1012.28	1011.40	
	G8		0.25		0.60	0.75	5.0		10.32	0.00	Area Inlet									1016.43			
		G7		0.59	0.41	0.51	5.9	0.55	9.96	3.01	15 in. HDPE	131.73	0.50	15	4.58	1.23	3.73	3.98	0.86		1011.10	1010.44	
	G7		0.17		0.54	0.68	5.0		10.32	0.00	Area Inlet									1014.97			
		G6		0.76	0.40	0.50	6.5	0.50	9.75	3.70	18 in. HDPE	127.30	0.50	18	7.45	1.77	4.21	4.21	0.79		1010.14	1009.50	
	G6		1.77		0.51	0.64	5.0		10.32	0.00	Area Inlet									1013.98			
		G5		2.53	0.43	0.54	7.0	0.24	9.56	13.00	24 in. HDPE	152.56	2.61	24	36.65	3.14	11.66	10.66	1.01		1009.00	1005.02	
	G5		1.84		0.62	0.78	5.0		10.32	0.00	Area Inlet									1010.41			
		G4		4.37	0.43	0.54	7.2	0.33	9.48	22.26	30 in. RCP	127.47	0.50	30	29.08	4.91	5.92	6.52	1.00		1005.02	1003.88	
	G4		1.11		0.62	0.78	5.0		10.32	0.00	Area Inlet									1008.10			
		G3		5.48	0.42	0.53	7.5	0.33	9.37	26.95	30 in. RCP	132.76	0.50	30	29.08	4.91	5.92	6.71	1.15		1003.88	1002.92	ADD LINE GG
	G3		3.78		0.42	0.53	5.0		10.32	0.00	Area Inlet									1007.65			
		G2		9.26	0.61	0.76	7.9	0.61	9.25	65.34	42 in. RCP	305.13	0.50	42	71.33	9.62	7.41	8.39	1.20		1001.92	1000.39	ADD LINE H, N
	G2		1.61		0.43	0.54	5.0		10.32	0.00	Area Inlet									1007.45			
		G!		10.87	0.62	0.78	8.5	0.18	9.06	76.29	48 in. RCP	98.07	0.50	48	101.84	12.57	8.10	8.87	1.04		1000.19	999.70	
	G1		1.61		0.43	0.54	5.0		10.32	0.00	Area Inlet									1007.45			
		F4		12.48	0.62	0.78	8.7	0.07	9.00	87.02	48 in. RCP	39.84	0.50	48	101.84	12.57	8.10	9.08	1.15		999.20	999.00	
	GG1		2.34		0.58	0.73	5.0		10.32	0.00	Area Inlet									1008.65			
		G3		2.34	0.58	0.73	5.0	0.38	10.32	17.51	24 in. HDPE	157.63	0.70	24	18.98	3.14	6.04	6.84	1.29		1003.34	1002.24	
	H1		0.84		0.38	0.48	5.0		10.32	0.00	Area Inlet									1010.25			
		G2		0.84	0.38	0.48	5.0	0.13	10.32	4.12	18 in. HDPE	81.63	5.28	18	24.20	1.77	13.70	10.20	0.81		1005.56	1001.25	
	N1		0.65		0.58	0.73	5.0		10.32	0.00	Area Inlet									1008.75			
		G2		0.65	0.58	0.73	5.0	0.45	10.32	4.86	15 in. HDPE	157.63	1.00	15	6.48	1.23	5.28	5.79	1.17		1003.75	1002.44	

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0' 50' 100' 200'
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ISSUE FOR BID
08/28/20
REVISIONS

13-20102-00

DRAINAGE CALCULATIONS - 100 YEAR

C1048

DWG: F:\2020\0001-0500\020-0103\40-Design\AutoCAD\Final Plans\Sheets\GNCV\CONSTRUCTION DOCUMENTS\C_DRN01_0200103.dwg USER: tparsons
DATE: Aug 28, 2020 8:50am XREFS: C_XBASE_0200103 C_PBASE_0200103 C_PTBLK_0200103 C_PSURF_0200103 T_PBASE_0200103 T_PSAS_0200103 C_PSTRM_0200103 V_XALT_00103

STORM SEWER PIPE AND STRUCTURE TABLE

TITLE: LSMS #4
JOB #: 020–0103
DESIGN CONDITIONS: PRIVATE - 10 YEAR STORM EVENT

	STRUCTURES		RUNOFF CALCULATIONS								PIPE DESIGN												
	FROM	TO	DIRECT AREA (ACRES)	TOTAL AREA (ACRES)	C	KC (K=1.25)	Tc (MIN)	FLOW TIME (MIN)	INTENSITY (IN/HR)	DESIGN Q (CFS)	DESCRIPTION	PIPE LENGTH (L.F.)	PIPE SLOPE (%)	PIPE DIA (IN)	Q FULL (CFS)	PIPE AREA (SQ.FT.)	V FULL (F/S)	DESIGN V (F/S)	Hw/D	MH TOP ELEVATION	UPSTREAM FLOWLINE	DOWNSTREAM FLOWLINE	Comments
EDD 1	A6		0.35		0.90	0.90	5.0		10.32	0.00	Area Inlet									1015.81			
		A5		0.35	0.90	0.90	5.0	0.87	10.32	3.25	15 in. HDPE	210.61	0.50	15	4.58	1.23	3.73	4.05	0.89		1012.83	1011.78	
	A5		0.15		0.45	0.45	5.0		10.32	0.00	Area Inlet									1015.02			
		A4		0.50	0.86	0.86	5.9	0.88	9.97	4.29	18 in. HDPE	228.76	0.50	18	7.45	1.77	4.21	4.36	0.83		1011.48	1010.34	
	A4		0.39		0.30	0.30	5.0		10.32	0.00	Area Inlet									1015.00			
		A3		0.89	0.74	0.74	6.7	0.41	9.64	6.35	24 in. HDPE	119.51	0.50	24	16.04	3.14	5.11	4.80	0.75		1010.04	1009.44	
	A3		0.27		0.30	0.30	5.0		10.32	0.00	Area Inlet									1017.13			
		A2		1.16	0.69	0.69	7.2	0.40	9.50	7.60	24 in. HDPE	120.29	0.50	24	16.04	3.14	5.11	5.03	0.79		1009.14	1008.54	
	A2		0.05		0.55	0.55	5.0		10.32	0.00	Area Inlet									1015.66			
		A1		1.21	0.69	0.69	7.6	0.11	9.36	7.81	24 in. HDPE	33.37	0.50	24	16.04	3.14	5.11	5.07	0.79		1008.24	1008.07	
EDD 2	C7		0.15		0.85	0.85	5.0		10.32	0.00	Area Inlet									1016.91			
		C6		0.15	0.85	0.85	5.0	0.48	10.32	1.32	15 in. HDPE	118.91	1.00	15	6.48	1.23	5.28	4.14	0.71		1011.68	1010.49	
	C6		0.10		0.80	0.80	5.0		10.32	0.00	Area Inlet									1015.56			
		C5		0.25	0.83	0.83	5.5	0.45	10.13	2.10	15 in. HDPE	189.11	3.00	15	11.22	1.23	9.14	7.01	0.76		1010.19	1004.52	
	C5		0.24		0.45	0.45	5.0		10.32	0.00	Area Inlet									1010.82			
		C4		1.29	0.55	0.55	5.9	0.10	9.95	7.06	15 in. HDPE	60.46	3.00	15	11.22	1.23	9.14	9.65	1.72		1004.22	1002.41	ADD LINE CC
	C4		0.52		0.52	0.52	5.0		10.32	0.00	Area Inlet									1006.89			
		C3		1.81	0.52	0.52	6.0	0.31	9.91	9.33	24 in. HDPE	128.71	1.00	24	22.68	3.14	7.22	6.85	0.85		1002.11	1000.82	
	C3		0.60		0.40	0.40	5.0		10.32	0.00	Area Inlet									1004.39			
		C2		2.41	0.46	0.46	6.3	0.26	9.79	10.85	24 in. HDPE	86.50	0.50	24	16.04	3.14	5.11	5.48	0.91		1000.09	1000.29	
	C2		0.56		0.40	0.40	5.0		10.32	0.00	Area Inlet									1005.42			
		C1		2.97	0.44	0.44	6.6	0.17	9.69	12.67	24 in. HDPE	58.52	0.50	24	16.04	3.14	5.11	5.65	0.99		999.79	999.50	
	CC2		0.50		0.45	0.45	5.0		10.32	0.00	Curb Inlet									1012.74			
		CC1		0.50	0.45	0.45	5.0	0.61	10.32	2.32	15 in. HDPE	176.95	1.00	15	6.48	1.23	5.28	4.84	0.78		1007.62	1005.85	
	CC1		0.30		0.55	0.55	5.0		10.32	0.00	Curb Inlet									1009.66			
		C4		0.80	0.49	0.49	5.6	0.46	10.08	3.95	15 in. HDPE	179.24	1.50	15	7.93	1.23	6.46	6.45	1.00		1005.55	1002.86	
	K3		0.76		0.90	0.90	5.0		7.35	0.00	Area Inlet									1007.92			
		K2		2.09	0.57	0.57	5.0	0.14	7.35	8.76	18 in. HDPE	86.84	3.00	18	18.24	1.77	10.32	10.20	1.32		1002.97	1000.36	ADD LINE L
	K2		0.18		0.78	0.78	5.0		7.35	0.00	Area Inlet									1007.02			
		K1		2.27	0.59	0.59	5.1	0.09	7.31	9.79	24 in. HDPE	36.25	1.00	24	22.68	3.14	7.22	6.94	0.86		999.86	999.50	
	L1		1.33		0.38	0.38	5.0		7.35	0.00	Area Inlet									1007.92			
		K2		1.33	0.38	0.38	5.0	0.17	7.35	3.72	18 in. HDPE	90.75	3.92	18	20.85	1.77	11.80	8.90	0.79		1003.92	1000.36	
	M4		0.28		0.52	0.52	5.0		10.32	0.00	Area Inlet									1006.67			
		M3		0.28	0.52	0.52	5.0	0.40	10.32	1.50	15 in. HDPE	103.39	1.00	15	6.48	1.23	5.28	4.29	0.72		1002.57	1001.54	
	M3		0.23		0.55	0.55	5.0		10.32	0.00	Area Inlet									1006.54			
		M2		0.51	0.53	0.53	5.4	0.44	10.16	2.75	15 in. HDPE	134.42	1.00	15	6.48	1.23	5.28	5.05	0.83		1001.14	999.80	
	M2		0.20		0.55	0.55	5.0		10.32	0.00	Area Inlet									1006.57			
		M1		0.71	0.54	0.54	5.8	0.10	9.98	3.83	15 in. HDPE	32.61	1.00	15	6.48	1.23	5.28	5.49	0.98		999.66	999.34	
EDD 3	E11		0.13		0.45	0.45	5.0		7.35	0.00	Area Inlet									1027.14			
		E10		0.13	0.45	0.45	5.0	1.02	7.35	0.43	15 in. HDPE	212.64	1.50	15	7.93	1.23	6.46	3.47	0.67		1019.84	1016.65	
	E10		0.54		0.41	0.41	5.0		7.35	0.00	Area Inlet									1025.31			
		E9		0.67	0.42	0.42	6.0	0.43	7.05	1.97	15 in. HDPE	138.26	1.50	15	7.93	1.23	6.46	5.37	0.75		1016.35	1014.30	
	E9		0.70		0.48	0.48	5.0		7.35	0.00	Area Inlet									1023.55			
		E8		1.37	0.70	0.70	6.5	0.20	6.93	6.65	24 in. HDPE	87.11	1.50	24	27.78	3.14	8.84	7.25	0.76		1014.00	1012.69	
	E8		1.23		0.52	0.52	5.0		7.35	0.00	Area Inlet									1019.97			
		E7		2.60	0.60	0.60	6.7	0.56	6.88	10.64	24 in. HDPE	248.71	1.10	24	23.79	3.14	7.57	7.35	0.90		1012.36	1009.62	
	E7		0.85		0.41	0.41	5.0		7.35	0.00	Area Inlet									1019.91			
		E6		3.45	0.54	0.54	7.2	1.01	6.73	12.58	30 in. RCP	390.98	0.70	30	34.41	4.91	7.01	6.45	0.77		1009.32	1006.58	
	E6		0.82		0.40	0.40	5.0		7.35	0.00	Area Inlet									1016.91			
		E5		4.27	0.51	0.51	8.2	0.56	6.48	14.13	30 in. RCP	224.24	0.70	30	34.41	4.91	7.01	6.65	0.80		1006.28	1004.71	
	E5		0.47		0.43	0.43	5.0		7.35	0.00	Area Inlet									1015.36			
		E4		4.74	0.50	0.50	8.8	0.63	6.34	15.10	30 in. RCP	291.35	1.00	30	41.13	4.91	8.38	7.72	0.82		1004.44	1001.53	
	E4		0.16		0.43	0.43	5.0		7.35	0.00	Area Inlet									1010.01			
		E3		4.90	0.50	0.50	9.4	0.54	6.20	15.18	36 in. RCP	192.68	0.50	36	47.29	7.07	6.69	5.95	0.73		1000.39	999.43	
	E3		0.55		0.42	0.42	5.0		7.35	0.00	Area Inlet									1006.10			
		E2		5.45	0.49	0.49	10.0	0.32	6.09	16.28	36 in. RCP	117.67	0.50	36	47.29	7.07	6.69	6.06	0.74		999.13	998.54	
	E2		0.31		0.43	0.43	5.0		7.35	0.00	Area Inlet									1004.92			
		E1		5.76	0.58	0.58	10.3	0.64	6.02	20.18	36 in. RCP	247.97	0.50	36	47.29	7.07	6.69	6.41	0.78		999.14	997.00	
	F8		1.02		0.65	0.65	5.0		7.35	0.00	Area Inlet									1006.41			
		F7		1.02	0.65	0.65	5.0	0.31	7.35	4.88	24 in. HDPE	82.70	0.50	24	16.04	3.14	5.11	4.47	0.72		1003.49	1003.08	
	F7		0.00		0.00	0.00	5.0		7.35	0.00	Area Inlet									1005.99			
		F6		1.02	0.65	0.65	5.3	0.54	7.26	4.81	24 in. HDPE	144.58	0.50	24	16.04	3.14	5.11	4.46	0.72		1002.78	1002.06	
	F6		0.15		0.85	0.85	5.0		7.35	0.00	Area Inlet									1006.34			
		F5		2.50	0.65	0.65	5.8	0.30	7.10	11.54	30 in. RCP	101.37	0.50	30	29.08	4.91	5.92	5.57	0.76		1001.76	1001.25	
	F5		0.00		0.00	0.00	5.0		7.35	0.00	Area Inlet									1008.20			
		F4		13.37	0.45	0.45	6.2	0.11	7.01	42.20	48 in. RCP	50.65	0.50	48	101.84	12.57	8.10	7.71	0.78		1000.95	999.00	ADD LINE G
	F4		0.30		0.52	0.52	5.0		7.35	0.00	Area Inlet									1006.44			
		F3		13.67	0.51	0.51	6.3	0.46	6.98	48.68	48 in. RCP	219.96	0.50	48	101.84	12.57	8.10	8.00	0.82		998.70	997.60	
	F3		1.75		0.32	0.32	5.0		7.35	0.00	Area Inlet									1003.43			
		F2		15.42	0.45	0.45	6.7	0.57	6.86	47.58	48 in. RCP	272.52	0.50	48	101.84	12.57	8.10	7.95	0.81		997.30	995.94	
	F2		1.75		0.33	0.33	5.0		7.35	0.00	Area Inlet									1004.88			
		F1		17.17	0.42	0.42	7.3	0.32	6.71	48.37	48 in. RCP	154.13	0.50	48	101.84	12.57	8.10	7.98	0.82		995.64	997.12	
	G9		0.34		0.30	0.30	5.0		7.35	0.00	Area Inlet									1017.00			
		G8		0.34	0.30	0.30	5.0	1.07	7.35	0.75	15 in. HDPE	176.44	0.50	15	4.58	1.23	3.73	2.76	0.68		1012.28	1011.40	
	G8		0.25		0.60	0.60	5.0		7.35	0.00	Area Inlet									1016.43			
		G7		0.59	0.41	0.41	6.1	0.63	7.04	1.70	15 in. HDPE	131.73	0.50	15	4.58	1.23	3.73	3.46	0.73		1011.10	1010.44	
	G7		0.17		0.54	0.54	5.0		7.35	0.00	Area Inlet									1014.97			
		G6		0.76	0.40	0.40	6.7	0.59	6.86	2.09	18 in. HDPE	127.30	0.50	18	7.45	1.77	4.21	3.61	0.71		1010.14	1009.50	
	G6		1.77		0.51	0.51	5.0		7.35	0.00	Area Inlet									1013.98			
		G5		2.53	0.43	0.43	7.3	0.28	6.71	7.30	24 in. HDPE	152.56	2.61	24	36.65	3.14	11.66	9.08	0.78		1009.00	1005.02	
	G5		1.84		0.62	0.62	5.0		7.35	0.00	Area Inlet									1010.41			
		G4		4.37	0.43	0.43	7.6	0.37	6.64	12.47	30 in. RCP	127.47	0.50	30	29.08	4.91	5.92	5.69	0.77		1005.02	1003.88	
	G4		1.11		0.62	0.62	5.0		7.35	0.00	Area Inlet									1008.10			
		G3		5.48	0.42	0.42	7.9	0.37	6.54	15.06	30 in. RCP	132.76	0.50	30	29.08	4.91	5.92	5.97	0.82		1003.88	1002.92	ADD LINE GG
	G3		3.78		0.42	0.42	5.0		7.35	0.00	Area Inlet									1007.65			
		G2		9.26	0.61	0.61	8.3	0.68	6.45	36.46	42 in. RCP	305.13	0.50	42	71.33	9.62	7.41	7.44	0.83		1001.92	1000.39	ADD LINE H, N
	G2		1.61		0.43	0.43	5.0		7.35	0.00	Area Inlet									1007.45			
		G!		10.87	0.62	0.62	9.0	0.21	6.30	42.43	48 in. RCP	98.07	0.50	48	101.84	12.57	8.10	7.72	0.78		1000.19	999.70	
	G1		1.61		0.43	0.43	5.0		7.35	0.00	Area Inlet									1007.45			
		F4		12.48	0.62	0.62	9.2	0.08	6.25	48.35	48 in. RCP	39.84	0.50	48	101.84	12.57	8.10	7.98	0.82		999.20	999.00	
	GG1		2.34		0.58	0.58	5.0		7.35	0.00	Area Inlet									1008.65			
		G3		2.34	0.58	0.58	5.0	0.43	7.35	9.98	24 in. HDPE	157.63	0.70	24	18.98	3.14	6.04	6.11	0.87		1003.34	1002.24	
	H1		0.84		0.38	0.38	5.0		7.35	0.00	Area Inlet									1010.25			
		G2		0.84	0.38	0.38	5.0	0.16	7.35	2.35	18 in. HDPE	81.63	5.28	18	24.20	1.77	13.70	8.67	0.72		1005.56	1001.25	
	N1		0.65		0.58	0.58	5.0		7.35	0.00	Area Inlet									1008.75			
		G2		0.65	0.58	0.58	5.0	0.52	7.35	2.77	15 in. HDPE	157.63	1.00	15	6.48	1.23	5.28	5.07	0.83		1003.75	1002.44	

N

0' 50' 100' 200'
SCALE IN FEET

DWG: F:\2020\0001-0500\020-0103\40-Design\AutoCAD\Final Plans\Sheets\GNCV\CONSTRUCTION DOCUMENTS\C_DRN01_0200103.dwg USER: tparsons
DATE: Aug 28, 2020 8:51am XREFS: C_XBASE_0200103 C_PBASE_0200103 C_PTBLK_0200103 C_PSURF_0200103 T_PBASE_0200103 T_PSAS_0200103 C_PSTRM_0200103 V_XALT_00103

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LEE'S SUMMIT MIDDLE SCHOOL #4
LEE'S SUMMIT R-7 SCHOOL DISTRICT
1001 SE BAILEY ROAD
LEE'S SUMMIT, MO 64081

ISSUE FOR BID
08/28/20
REVISIONS

13-20102-00

DRAINAGE CALCULATIONS - 10 YEAR

C1049

APPENDIX B
Accompanying Documents

Soils Map

FEMA Firmette

Soil Map—Jackson County, Missouri
(LS MIDDLE SCHOOL #4)

Map Scale: 1:4,630 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 50 100 200 300

Feet
0 200 400 800 1200

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Jackson County, Missouri
Survey Area Data: Version 20, Sep 16, 2019

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

Date(s) aerial images were photographed: Sep 6, 2019—Nov 16, 2019

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
10082	Arisburg-Urban land complex, 1 to 5 percent slopes	28.5	61.1%
10117	Sampsel silty clay loam, 5 to 9 percent slopes	18.1	38.9%
Totals for Area of Interest		**46.6**	**100.0%**

Jackson County, Missouri

10117—Sampsel silty clay loam, 5 to 9 percent slopes

Map Unit Setting

National map unit symbol: 2qkzz
Elevation: 600 to 900 feet
Mean annual precipitation: 33 to 41 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 177 to 220 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Sampsel and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sampsel

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex, concave
Parent material: Residuum weathered from shale

Typical profile

Ap - 0 to 13 inches: silty clay loam
Bt - 13 to 80 inches: silty clay

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C/D
Ecological site: Interbedded Sedimentary Upland Savanna (R109XY010MO)

Other vegetative classification: Grass/Prairie (Herbaceous Vegetation)
Hydric soil rating: No

Data Source Information

Soil Survey Area: Jackson County, Missouri
Survey Area Data: Version 20, Sep 16, 2019

Jackson County, Missouri

10082—Arisburg-Urban land complex, 1 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2w7ld
Elevation: 750 to 1,130 feet
Mean annual precipitation: 39 to 45 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 177 to 220 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Arisburg and similar soils: 61 percent
Urban land: 30 percent
Minor components: 9 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Arisburg

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loess

Typical profile

Ap - 0 to 6 inches: silt loam
A - 6 to 13 inches: silt loam
Bt - 13 to 19 inches: silty clay loam
Btg - 19 to 56 inches: silty clay loam
BCg - 56 to 79 inches: silty clay loam

Properties and qualities

Slope: 1 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 11.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e

Hydrologic Soil Group: C
Ecological site: Loess Upland Prairie (R107BY007MO)
Hydric soil rating: No

Description of Urban Land

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Minor Components

Sampsel

Percent of map unit: 3 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Concave
Ecological site: Interbedded Sedimentary Upland Savanna (R109XY010MO)
Hydric soil rating: Yes

Greenton

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Loess Upland Prairie (R109XY002MO)
Hydric soil rating: No

Sharpsburg

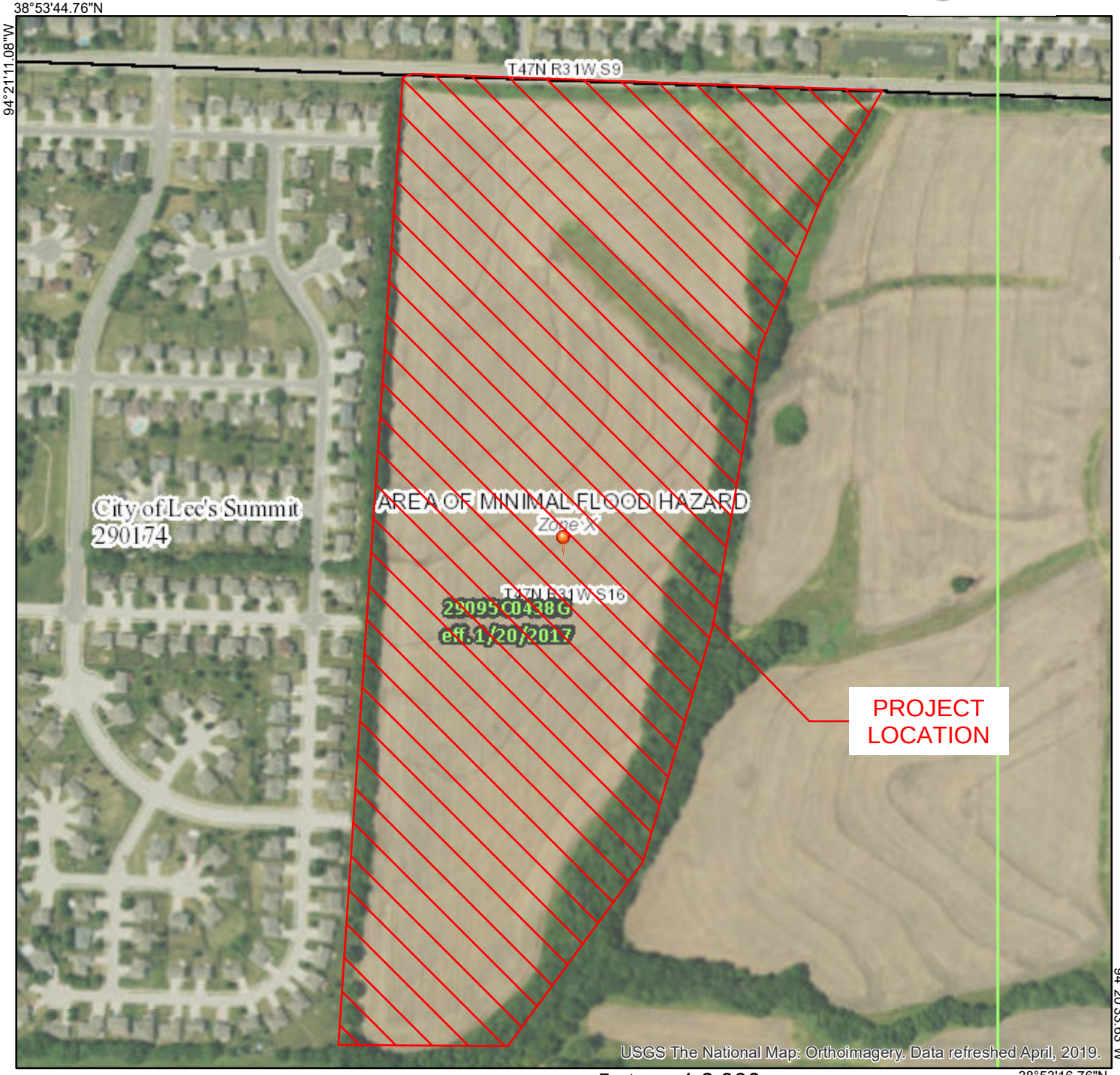
Percent of map unit: 3 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loess Upland Prairie (R109XY002MO)
Hydric soil rating: No

Data Source Information

Soil Survey Area: Jackson County, Missouri
Survey Area Data: Version 20, Sep 16, 2019

National Flood Hazard Layer FIRMette

FEMA



Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 — Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- 513 — Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/5/2020 at 4:01:03 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

APPENDIX C
Detention Calculations

EDD-1

1.72 AC AREA TO BASIN

1.05 AC SYNTHEIC TURF TO BASIN

EDD-2

5.93 AC AREA TO BASIN

2.95 AC SYNTHETIC TURF TO BASIN

EDD-3

16.55 AC AREA TO BASIN

2.15 AC SYNTHETIC TURF TO BASIN

OTHER DRAINAGE AREAS

2.40 AC DRAINAGE AREA TO BE DIRECTED TO PUBLIC STORM SEWER ON CAPE DRIVE TO BE DESIGNED LATER

14.20 AC AREA DIRECTLY DRAINING TO CREEK

0' 50' 100' 200'
SCALE IN FEET

DWG: F:\2020\0001-0500\020-0103\40-Design\AutoCAD\Final Plans\Sheets\GNCV\CONSTRUCTION DOCUMENTS\C_DRN01_0200103.dwg USER: tparsons
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LEE'S SUMMIT MIDDLE SCHOOL #4

LEE'S SUMMIT R-7 SCHOOL DISTRICT

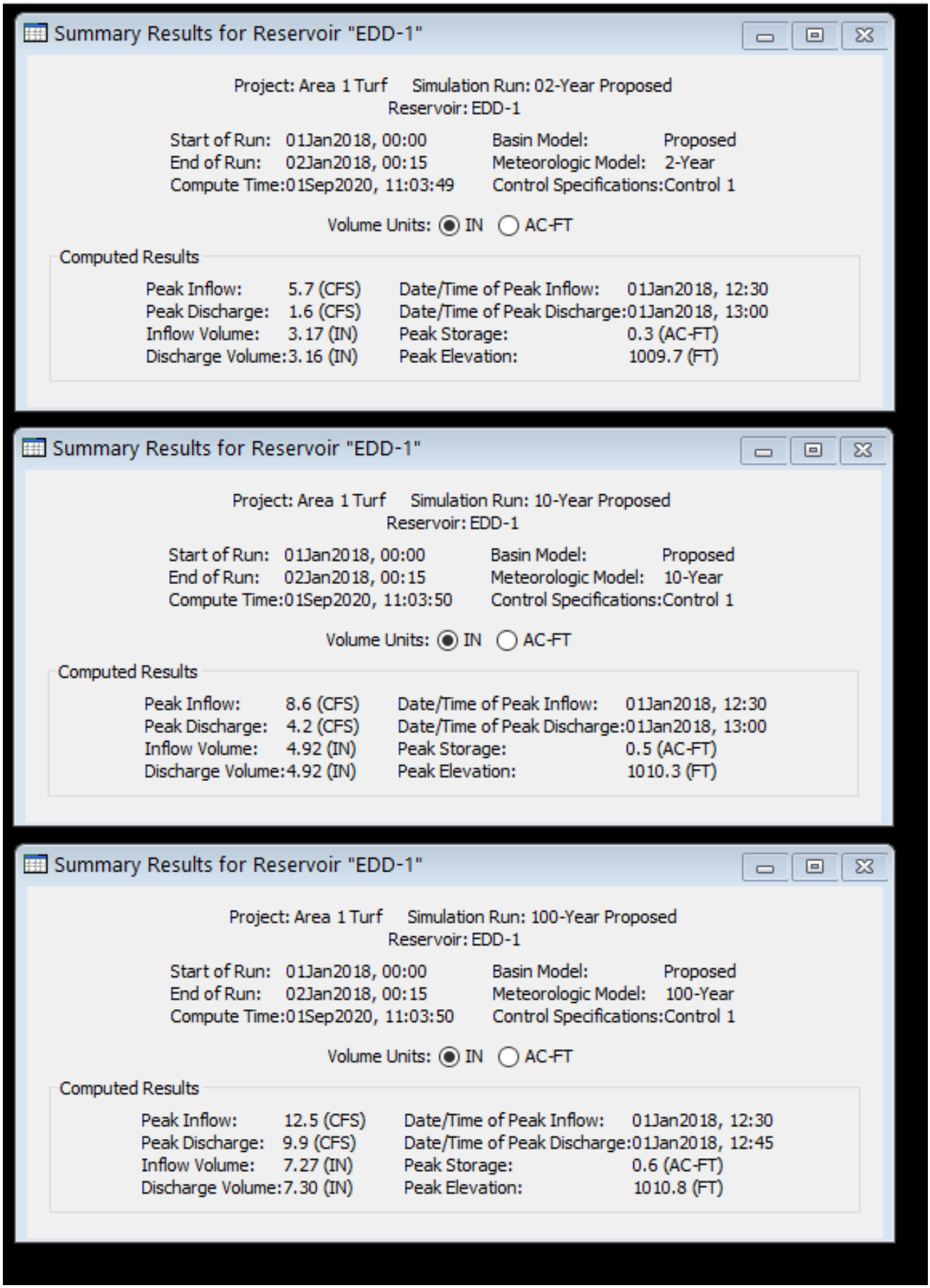
1001 SE BAILEY ROAD
LEE'S SUMMIT, MO 64081

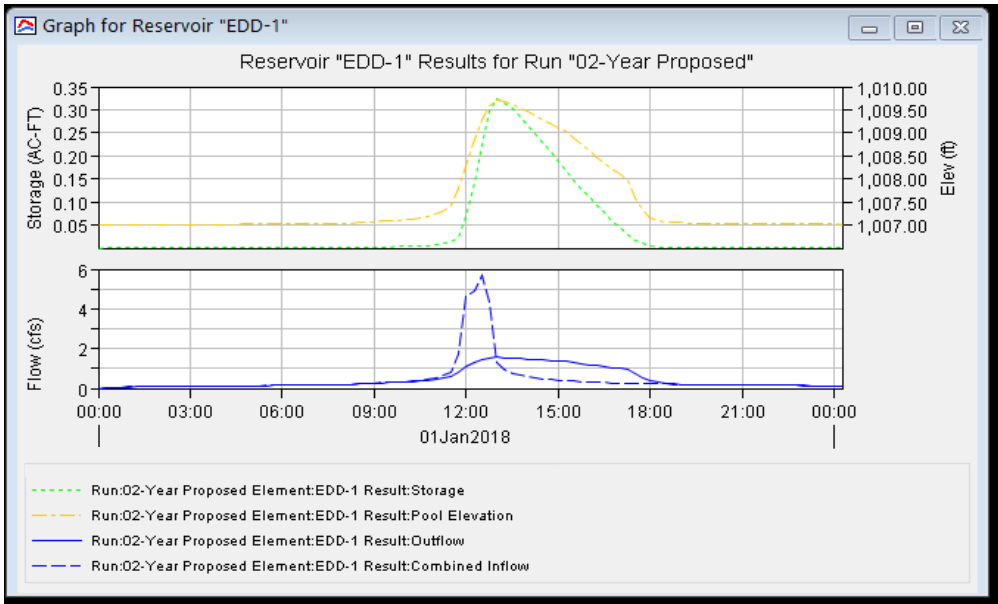
FINAL
DEVELOPMENT PLAN
08/28/20
REVISIONS

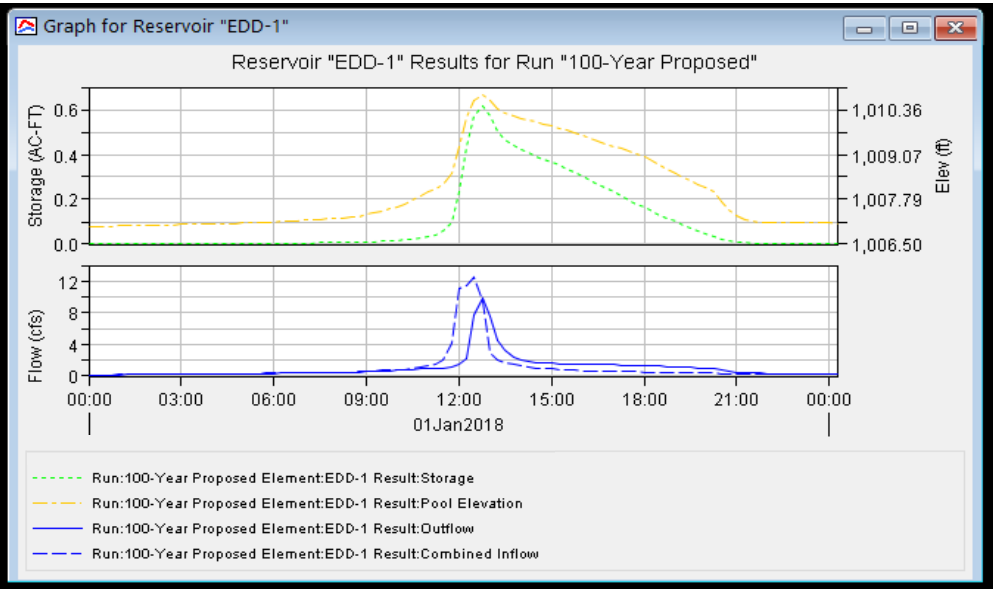
13-20102-00

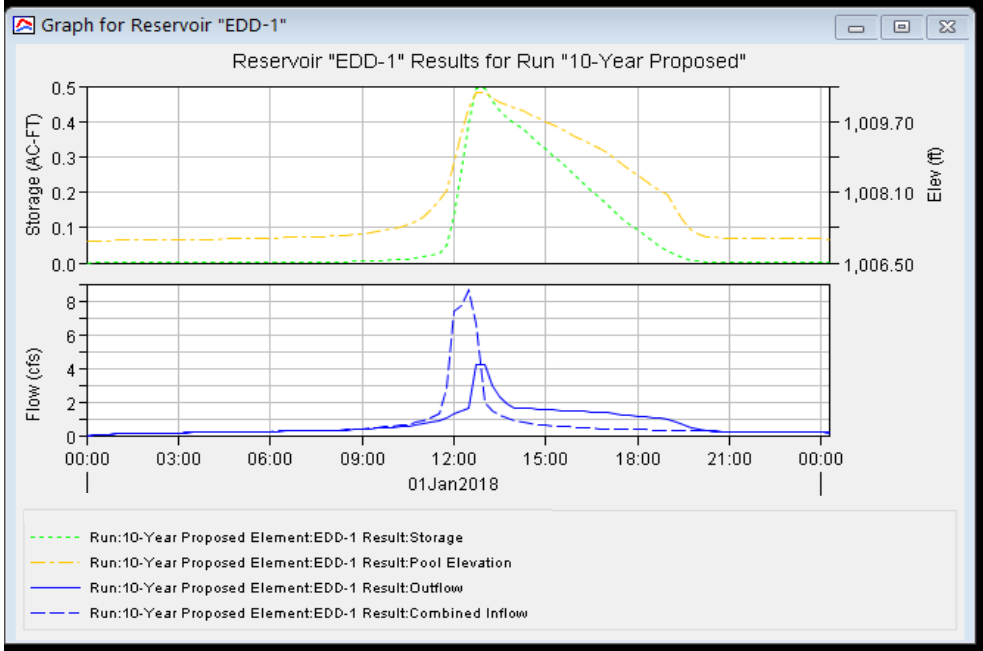
DRAINAGE PLAN

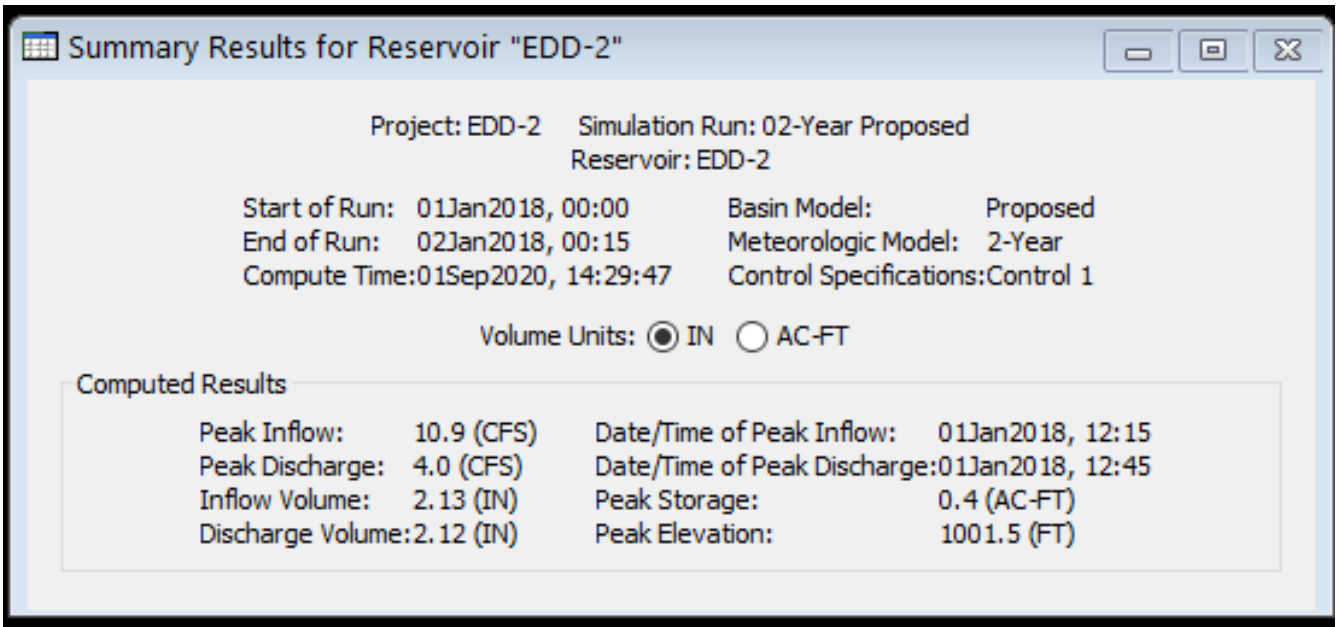
C1047

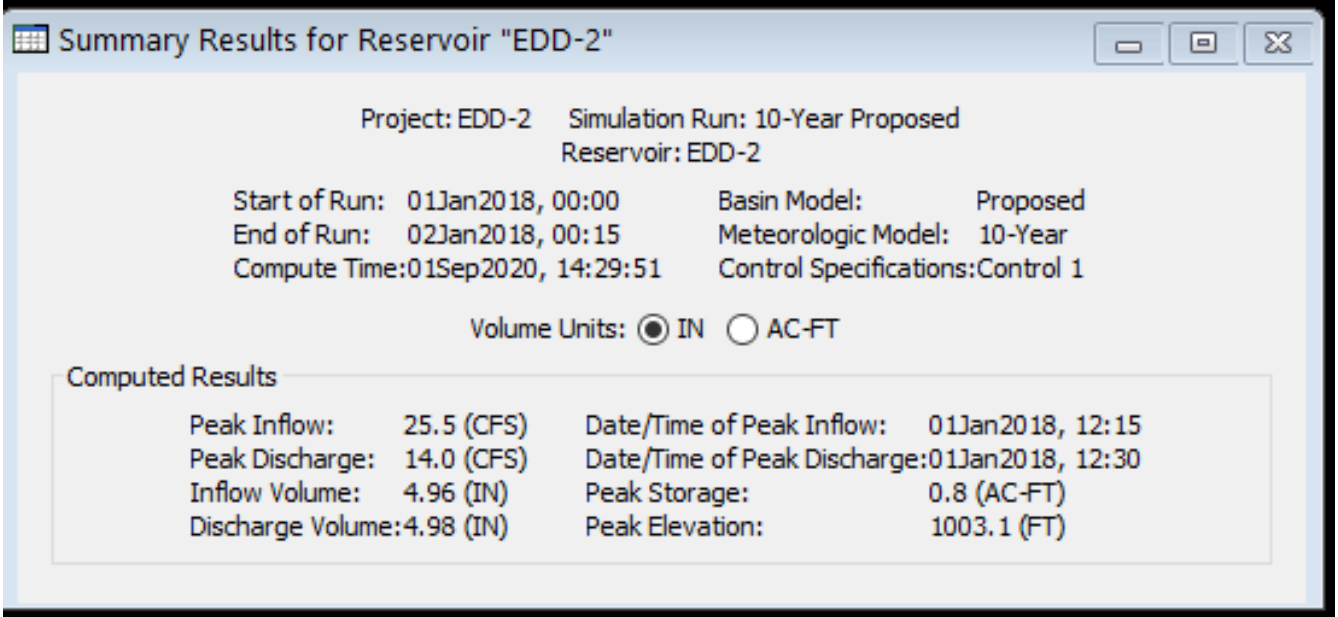

Summary Results for Reservoir "EDD-1"
Project: Area 1 Turf Simulation Run: 02-Year Proposed
Reservoir: EDD-1
Start of Run: 01Jan2018, 00:00
End of Run: 02Jan2018, 00:15
Compute Time: 01Sep2020, 11:03:49
Basin Model: Proposed
Meteorologic Model: 2-Year
Control Specifications: Control 1
Volume Units: IN AC-FT
Computed Results
Peak Inflow: 5.7 (CFS)
Peak Discharge: 1.6 (CFS)
Inflow Volume: 3.17 (IN)
Discharge Volume: 3.16 (IN)
Date/Time of Peak Inflow: 01Jan2018, 12:30
Date/Time of Peak Discharge: 01Jan2018, 13:00
Peak Storage: 0.3 (AC-FT)
Peak Elevation: 1009.7 (FT)
Summary Results for Reservoir "EDD-1"
Project: Area 1 Turf Simulation Run: 10-Year Proposed
Reservoir: EDD-1
Start of Run: 01Jan2018, 00:00
End of Run: 02Jan2018, 00:15
Compute Time: 01Sep2020, 11:03:50
Basin Model: Proposed
Meteorologic Model: 10-Year
Control Specifications: Control 1
Volume Units: IN AC-FT
Computed Results
Peak Inflow: 8.6 (CFS)
Peak Discharge: 4.2 (CFS)
Inflow Volume: 4.92 (IN)
Discharge Volume: 4.92 (IN)
Date/Time of Peak Inflow: 01Jan2018, 12:30
Date/Time of Peak Discharge: 01Jan2018, 13:00
Peak Storage: 0.5 (AC-FT)
Peak Elevation: 1010.3 (FT)
Summary Results for Reservoir "EDD-1"
Project: Area 1 Turf Simulation Run: 100-Year Proposed
Reservoir: EDD-1
Start of Run: 01Jan2018, 00:00
End of Run: 02Jan2018, 00:15
Compute Time: 01Sep2020, 11:03:50
Basin Model: Proposed
Meteorologic Model: 100-Year
Control Specifications: Control 1
Volume Units: IN AC-FT
Computed Results
Peak Inflow: 12.5 (CFS)
Peak Discharge: 9.9 (CFS)
Inflow Volume: 7.27 (IN)
Discharge Volume: 7.30 (IN)
Date/Time of Peak Inflow: 01Jan2018, 12:30
Date/Time of Peak Discharge: 01Jan2018, 12:45
Peak Storage: 0.6 (AC-FT)
Peak Elevation: 1010.8 (FT)

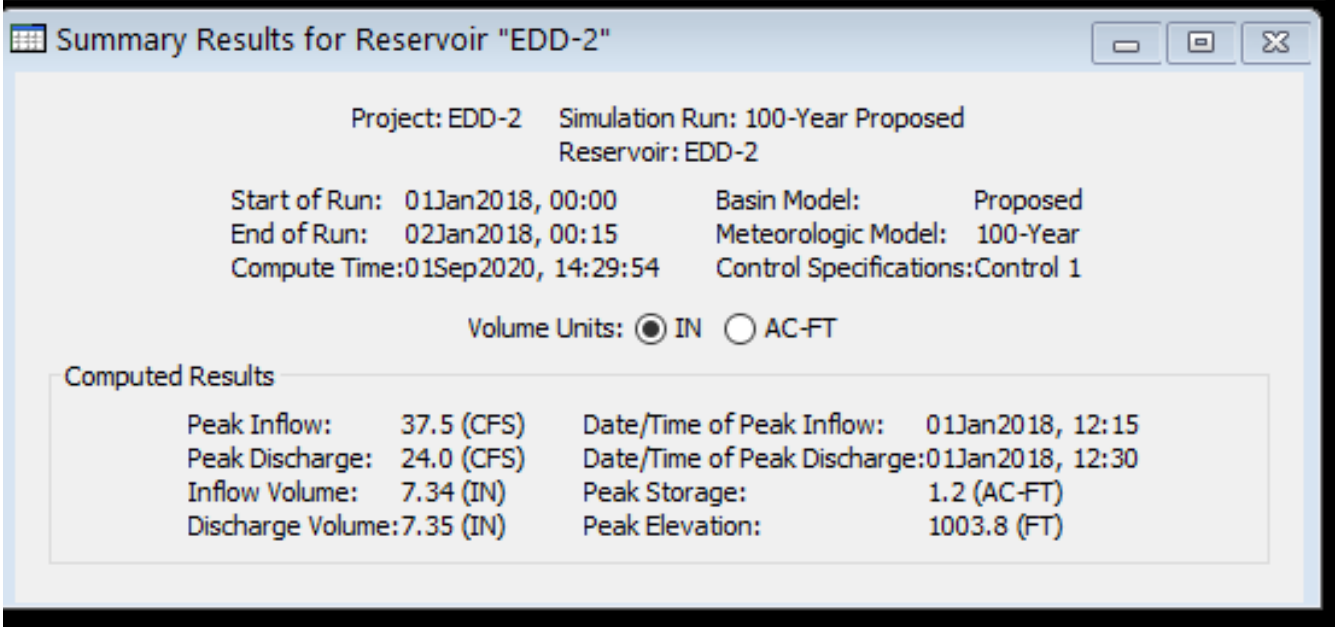

Graph for Reservoir "EDD-1"
Reservoir "EDD-1" Results for Run "02-Year Proposed"
Storage (AC-FT)
Elev (ft)
Flow (cfs)
01Jan2018
Run:02-Year Proposed Element:EDD-1 Result:Storage
Run:02-Year Proposed Element:EDD-1 Result:Pool Elevation
Run:02-Year Proposed Element:EDD-1 Result:Outflow
Run:02-Year Proposed Element:EDD-1 Result:Combined Inflow

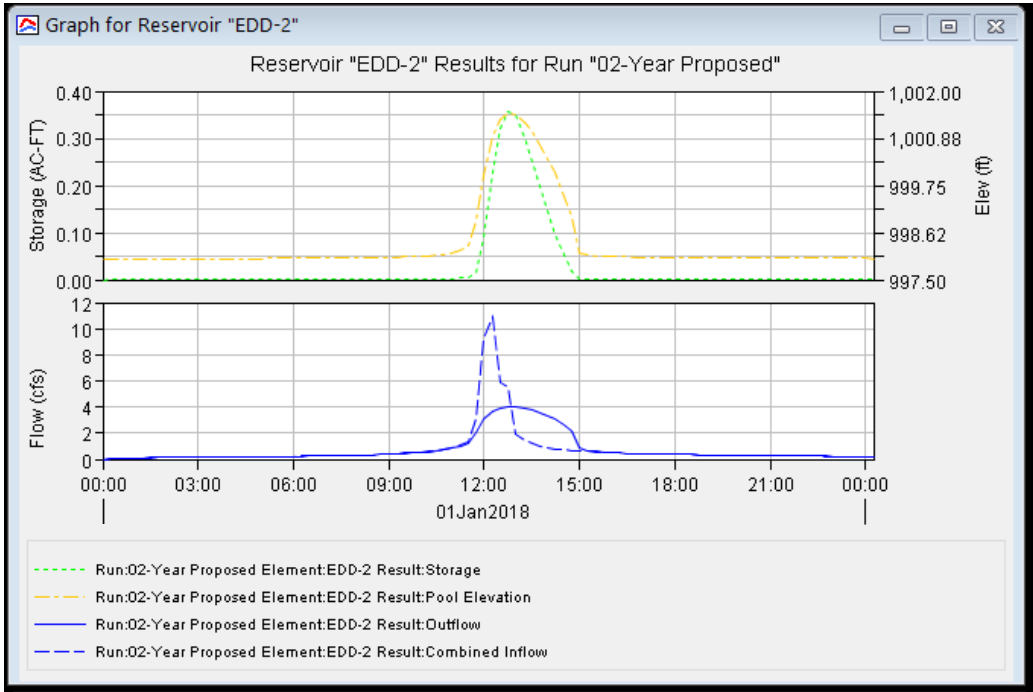

Graph for Reservoir "EDD-1"
Reservoir "EDD-1" Results for Run "100-Year Proposed"
Storage (AC-FT)
Elev (ft)
Flow (cfs)
01Jan2018
Run:100-Year Proposed Element:EDD-1 Result:Storage
Run:100-Year Proposed Element:EDD-1 Result:Pool Elevation
Run:100-Year Proposed Element:EDD-1 Result:Outflow
Run:100-Year Proposed Element:EDD-1 Result:Combined Inflow

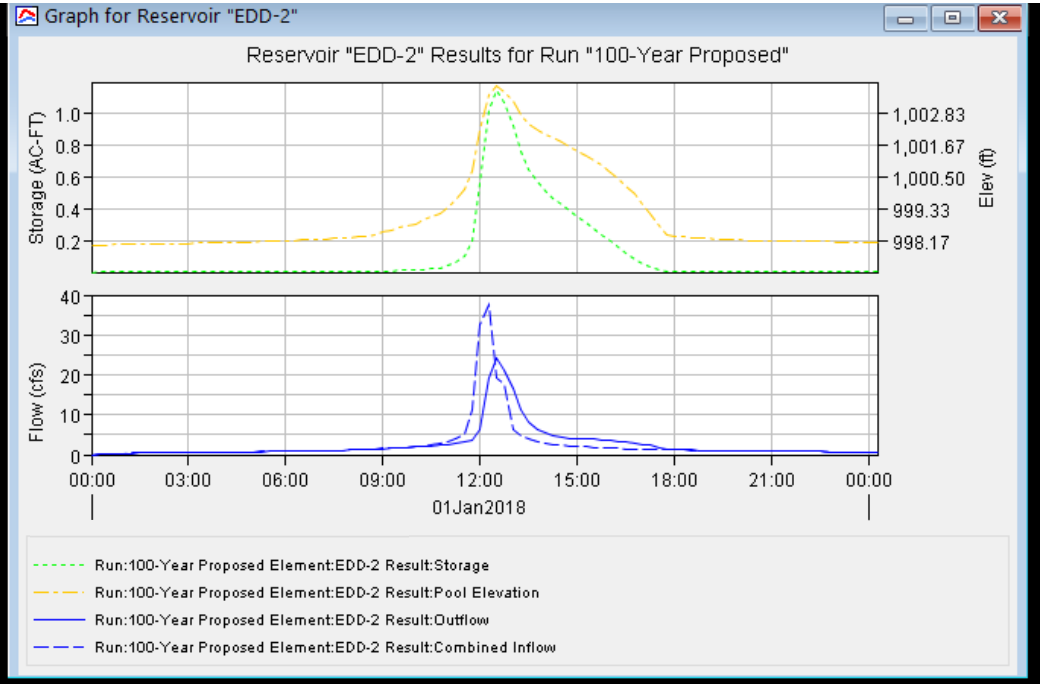

Graph for Reservoir "EDD-1"
Reservoir "EDD-1" Results for Run "10-Year Proposed"
Storage (AC-FT)
Elev (ft)
Flow (cfs)
01Jan2018
Run:10-Year Proposed Element:EDD-1 Result:Storage
Run:10-Year Proposed Element:EDD-1 Result:Pool Elevation
Run:10-Year Proposed Element:EDD-1 Result:Outflow
Run:10-Year Proposed Element:EDD-1 Result:Combined Inflow

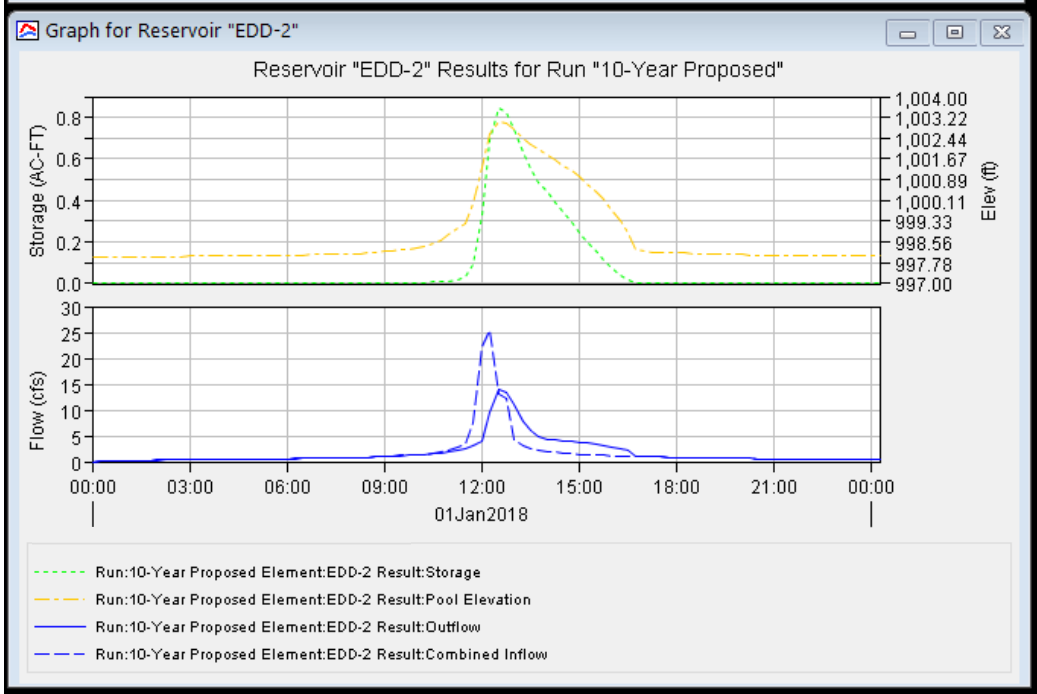

Summary Results for Reservoir "EDD-2"
Project: EDD-2 Simulation Run: 02-Year Proposed
Reservoir: EDD-2
Start of Run: 01Jan2018, 00:00
End of Run: 02Jan2018, 00:15
Compute Time: 01Sep2020, 14:29:47
Basin Model: Proposed
Meteorologic Model: 2-Year
Control Specifications: Control 1
Volume Units: IN AC-FT
Computed Results
Peak Inflow: 10.9 (CFS)
Peak Discharge: 4.0 (CFS)
Inflow Volume: 2.13 (IN)
Discharge Volume: 2.12 (IN)
Date/Time of Peak Inflow: 01Jan2018, 12:15
Date/Time of Peak Discharge: 01Jan2018, 12:45
Peak Storage: 0.4 (AC-FT)
Peak Elevation: 1001.5 (FT)

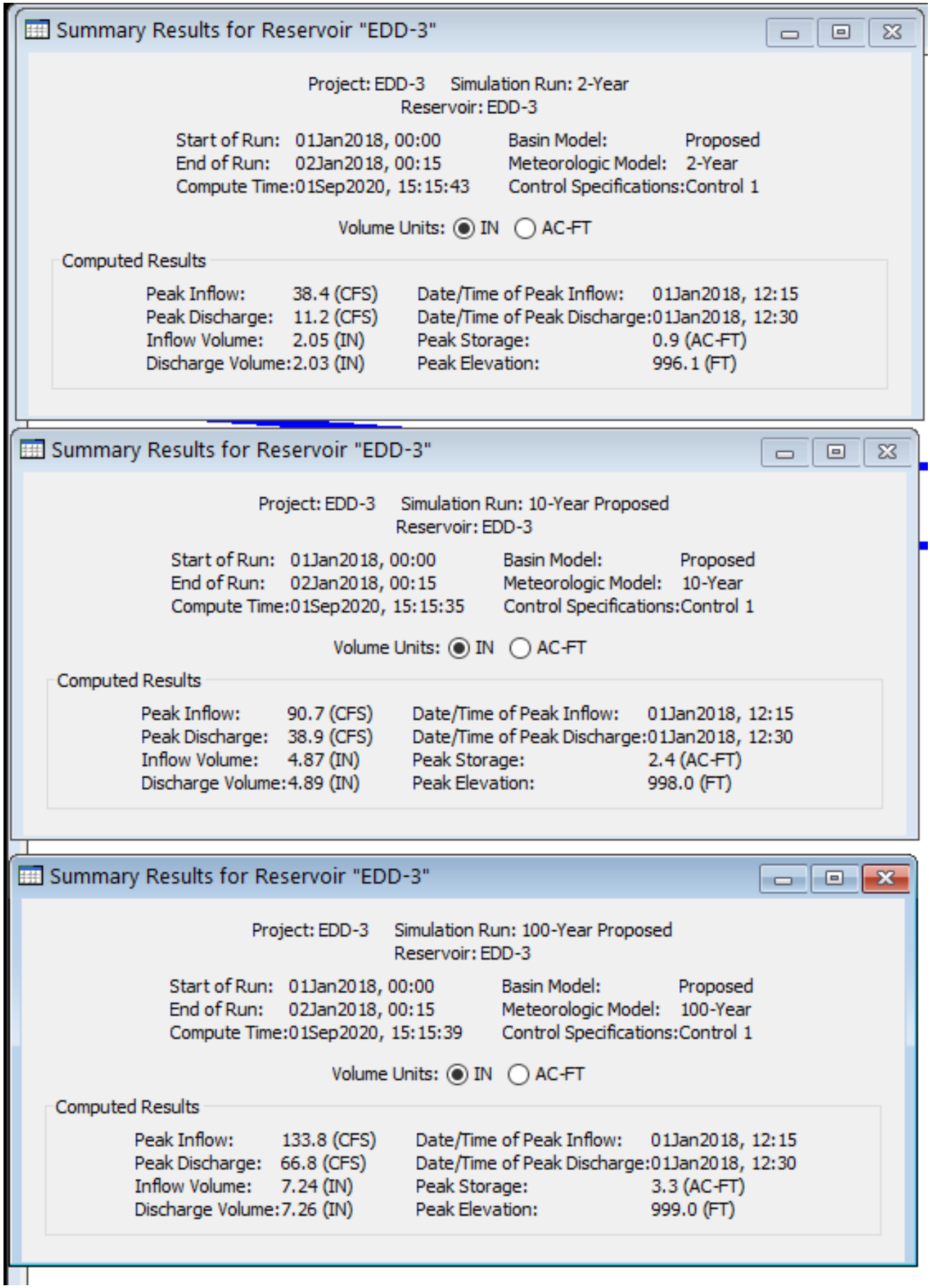

Summary Results for Reservoir "EDD-2"
Project: EDD-2 Simulation Run: 10-Year Proposed
Reservoir: EDD-2
Start of Run: 01Jan2018, 00:00
End of Run: 02Jan2018, 00:15
Compute Time: 01Sep2020, 14:29:51
Basin Model: Proposed
Meteorologic Model: 10-Year
Control Specifications: Control 1
Volume Units: IN AC-FT
Computed Results
Peak Inflow: 25.5 (CFS)
Peak Discharge: 14.0 (CFS)
Inflow Volume: 4.96 (IN)
Discharge Volume: 4.98 (IN)
Date/Time of Peak Inflow: 01Jan2018, 12:15
Date/Time of Peak Discharge: 01Jan2018, 12:30
Peak Storage: 0.8 (AC-FT)
Peak Elevation: 1003.1 (FT)

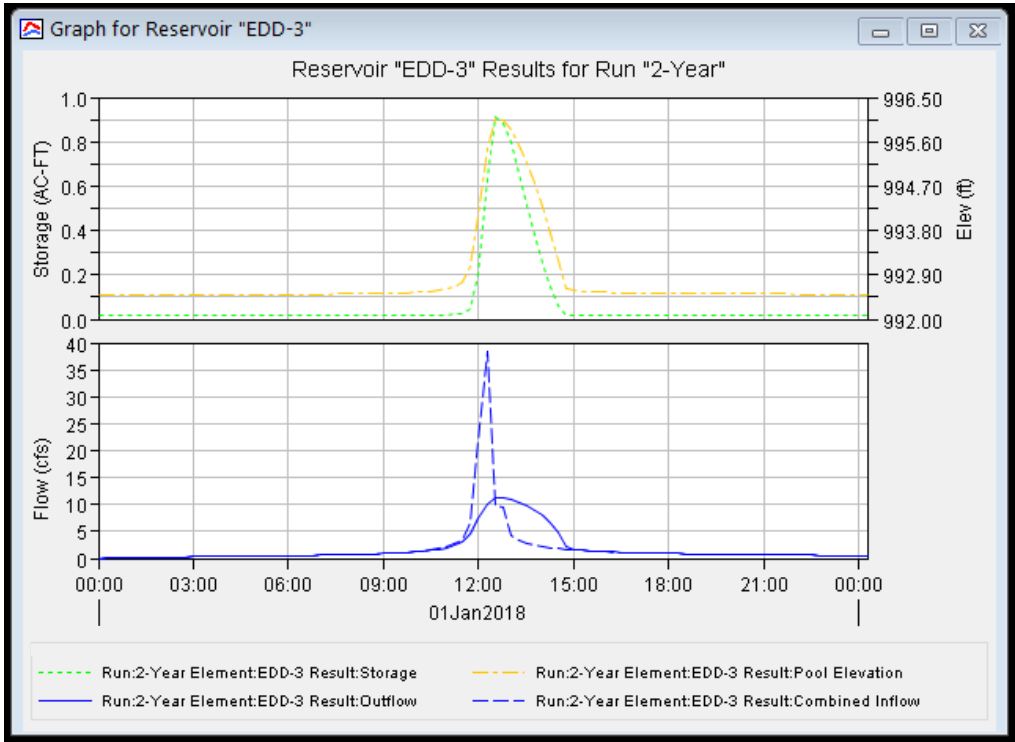

Summary Results for Reservoir "EDD-2"
Project: EDD-2 Simulation Run: 100-Year Proposed
Reservoir: EDD-2
Start of Run: 01Jan2018, 00:00
End of Run: 02Jan2018, 00:15
Compute Time: 01Sep2020, 14:29:54
Basin Model: Proposed
Meteorologic Model: 100-Year
Control Specifications: Control 1
Volume Units: IN AC-FT
Computed Results
Peak Inflow: 37.5 (CFS)
Peak Discharge: 24.0 (CFS)
Inflow Volume: 7.34 (IN)
Discharge Volume: 7.35 (IN)
Date/Time of Peak Inflow: 01Jan2018, 12:15
Date/Time of Peak Discharge: 01Jan2018, 12:30
Peak Storage: 1.2 (AC-FT)
Peak Elevation: 1003.8 (FT)

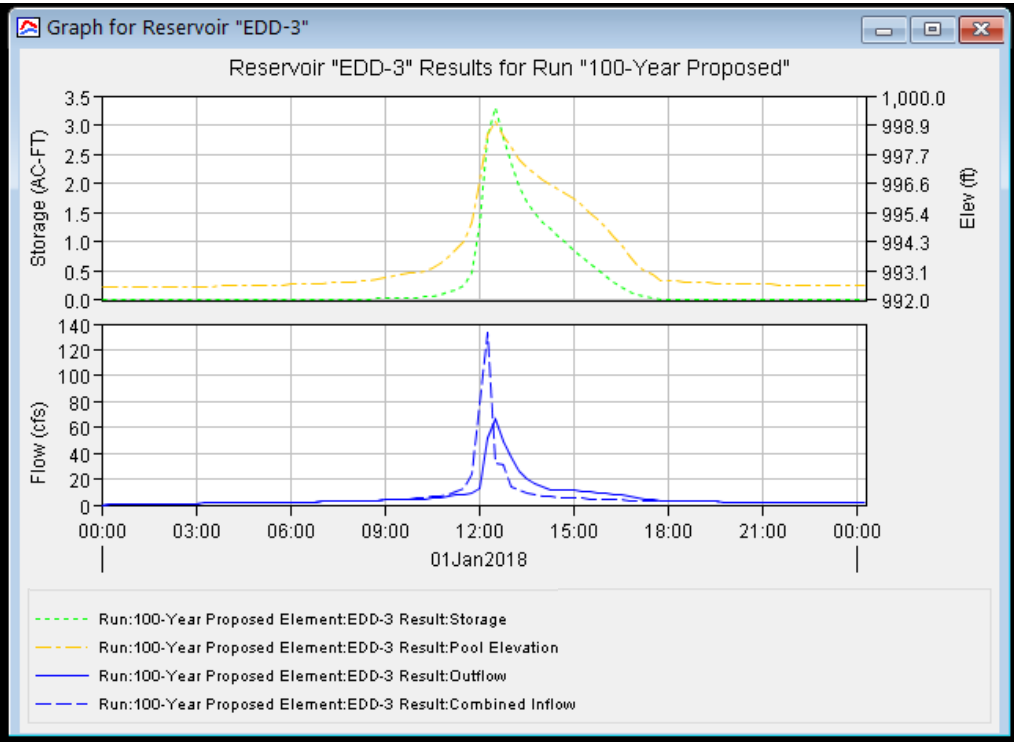

Graph for Reservoir "EDD-2"
Reservoir "EDD-2" Results for Run "02-Year Proposed"
Storage (AC-FT)
Elev (ft)
Flow (cfs)
01Jan2018
Run:02-Year Proposed Element:EDD-2 Result:Storage
Run:02-Year Proposed Element:EDD-2 Result:Pool Elevation
Run:02-Year Proposed Element:EDD-2 Result:Outflow
Run:02-Year Proposed Element:EDD-2 Result:Combined Inflow

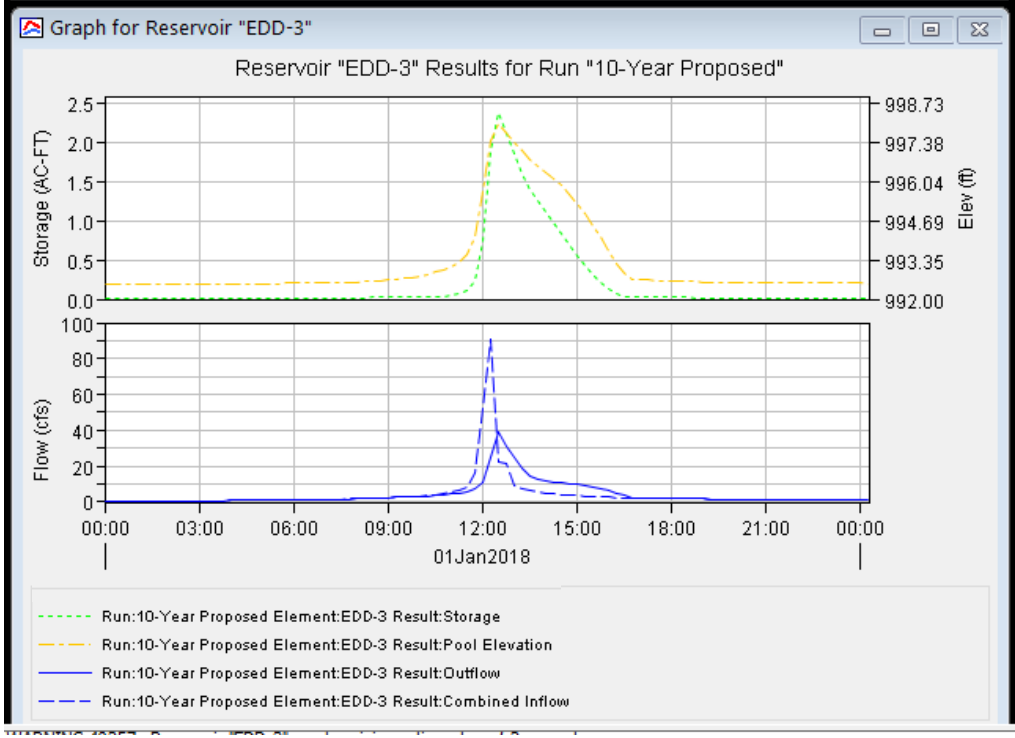

Graph for Reservoir "EDD-2"
Reservoir "EDD-2" Results for Run "100-Year Proposed"
Storage (AC-FT)
Elev (ft)
Flow (cfs)
01Jan2018
Run:100-Year Proposed Element:EDD-2 Result:Storage
Run:100-Year Proposed Element:EDD-2 Result:Pool Elevation
Run:100-Year Proposed Element:EDD-2 Result:Outflow
Run:100-Year Proposed Element:EDD-2 Result:Combined Inflow


Graph for Reservoir "EDD-2"
Reservoir "EDD-2" Results for Run "10-Year Proposed"
Storage (AC-FT)
Elev (ft)
Flow (cfs)
01Jan2018
Run:10-Year Proposed Element:EDD-2 Result:Storage
Run:10-Year Proposed Element:EDD-2 Result:Pool Elevation
Run:10-Year Proposed Element:EDD-2 Result:Outflow
Run:10-Year Proposed Element:EDD-2 Result:Combined Inflow

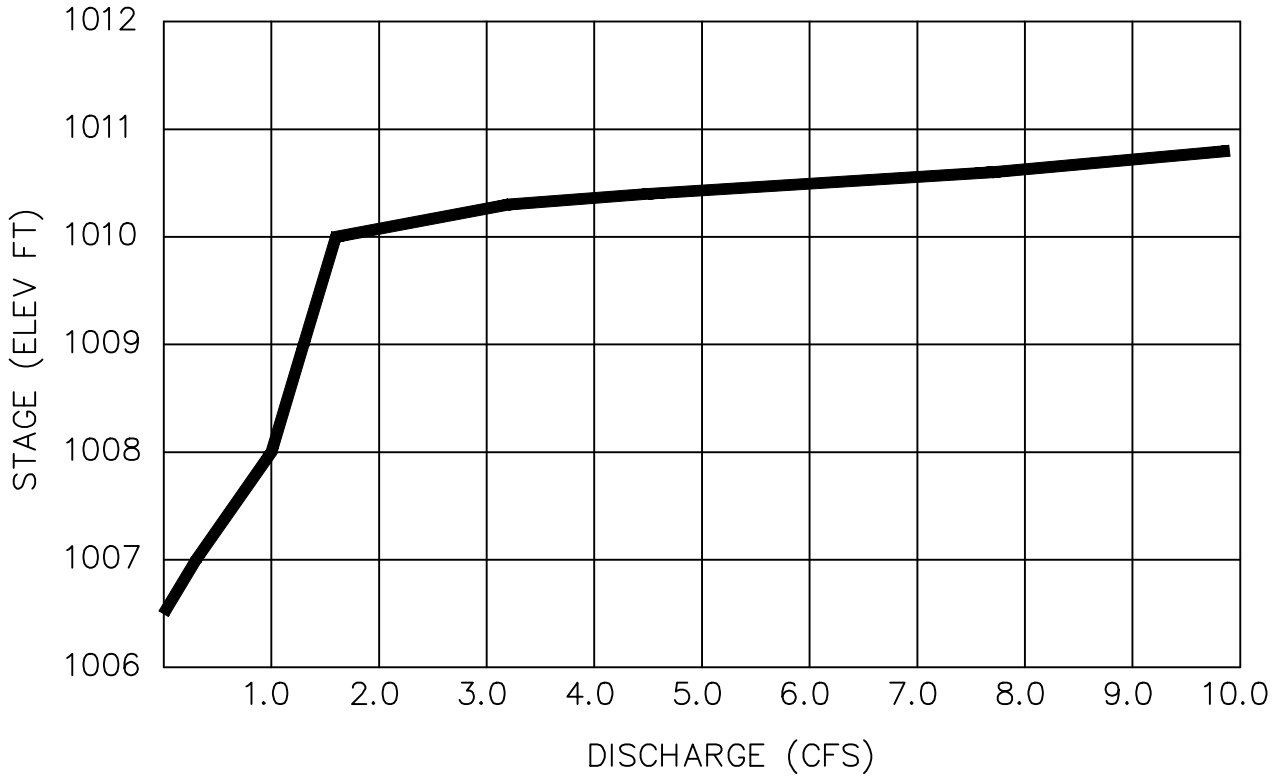

Summary Results for Reservoir "EDD-3"
Project: EDD-3 Simulation Run: 2-Year
Reservoir: EDD-3
Start of Run: 01Jan2018, 00:00
End of Run: 02Jan2018, 00:15
Compute Time: 01Sep2020, 15:15:43
Basin Model: Proposed
Meteorologic Model: 2-Year
Control Specifications: Control 1
Volume Units: IN AC-FT
Computed Results
Peak Inflow: 38.4 (CFS)
Peak Discharge: 11.2 (CFS)
Inflow Volume: 2.05 (IN)
Discharge Volume: 2.03 (IN)
Date/Time of Peak Inflow: 01Jan2018, 12:15
Date/Time of Peak Discharge: 01Jan2018, 12:30
Peak Storage: 0.9 (AC-FT)
Peak Elevation: 996.1 (FT)
Summary Results for Reservoir "EDD-3"
Project: EDD-3 Simulation Run: 10-Year Proposed
Reservoir: EDD-3
Start of Run: 01Jan2018, 00:00
End of Run: 02Jan2018, 00:15
Compute Time: 01Sep2020, 15:15:35
Basin Model: Proposed
Meteorologic Model: 10-Year
Control Specifications: Control 1
Volume Units: IN AC-FT
Computed Results
Peak Inflow: 90.7 (CFS)
Peak Discharge: 38.9 (CFS)
Inflow Volume: 4.87 (IN)
Discharge Volume: 4.89 (IN)
Date/Time of Peak Inflow: 01Jan2018, 12:15
Date/Time of Peak Discharge: 01Jan2018, 12:30
Peak Storage: 2.4 (AC-FT)
Peak Elevation: 998.0 (FT)
Summary Results for Reservoir "EDD-3"
Project: EDD-3 Simulation Run: 100-Year Proposed
Reservoir: EDD-3
Start of Run: 01Jan2018, 00:00
End of Run: 02Jan2018, 00:15
Compute Time: 01Sep2020, 15:15:39
Basin Model: Proposed
Meteorologic Model: 100-Year
Control Specifications: Control 1
Volume Units: IN AC-FT
Computed Results
Peak Inflow: 133.8 (CFS)
Peak Discharge: 66.8 (CFS)
Inflow Volume: 7.24 (IN)
Discharge Volume: 7.26 (IN)
Date/Time of Peak Inflow: 01Jan2018, 12:15
Date/Time of Peak Discharge: 01Jan2018, 12:30
Peak Storage: 3.3 (AC-FT)
Peak Elevation: 999.0 (FT)


Graph for Reservoir "EDD-3"
Reservoir "EDD-3" Results for Run "2-Year"
Storage (AC-FT)
Elev (ft)
Flow (cfs)
01Jan2018
Run:2-Year Element:EDD-3 Result:Storage
Run:2-Year Element:EDD-3 Result:Pool Elevation
Run:2-Year Element:EDD-3 Result:Outflow
Run:2-Year Element:EDD-3 Result:Combined Inflow

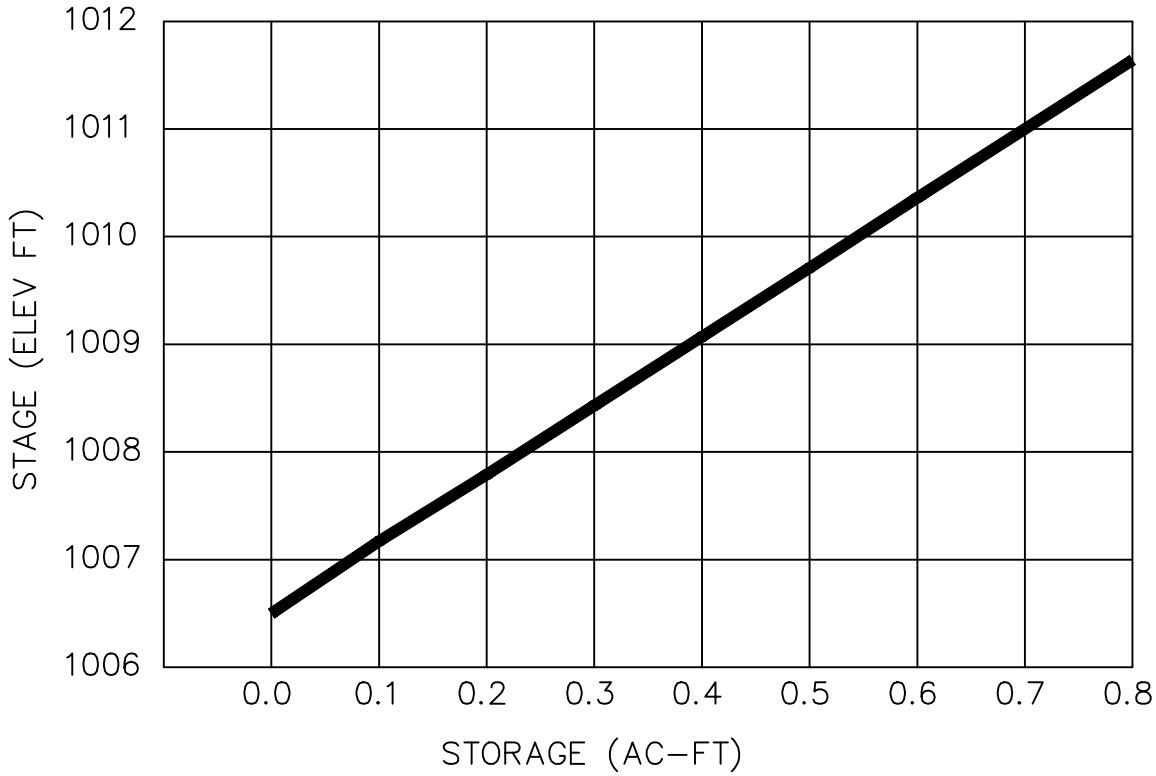

Graph for Reservoir "EDD-3"
Reservoir "EDD-3" Results for Run "100-Year Proposed"
Storage (AC-FT)
Elev (ft)
Flow (cfs)
01Jan2018
Run:100-Year Proposed Element:EDD-3 Result:Storage
Run:100-Year Proposed Element:EDD-3 Result:Pool Elevation
Run:100-Year Proposed Element:EDD-3 Result:Outflow
Run:100-Year Proposed Element:EDD-3 Result:Combined Inflow


Graph for Reservoir "EDD-3"
Reservoir "EDD-3" Results for Run "10-Year Proposed"
Storage (AC-FT)
Elev (ft)
Flow (cfs)
01Jan2018
Run:10-Year Proposed Element:EDD-3 Result:Storage
Run:10-Year Proposed Element:EDD-3 Result:Pool Elevation
Run:10-Year Proposed Element:EDD-3 Result:Outflow
Run:10-Year Proposed Element:EDD-3 Result:Combined Inflow

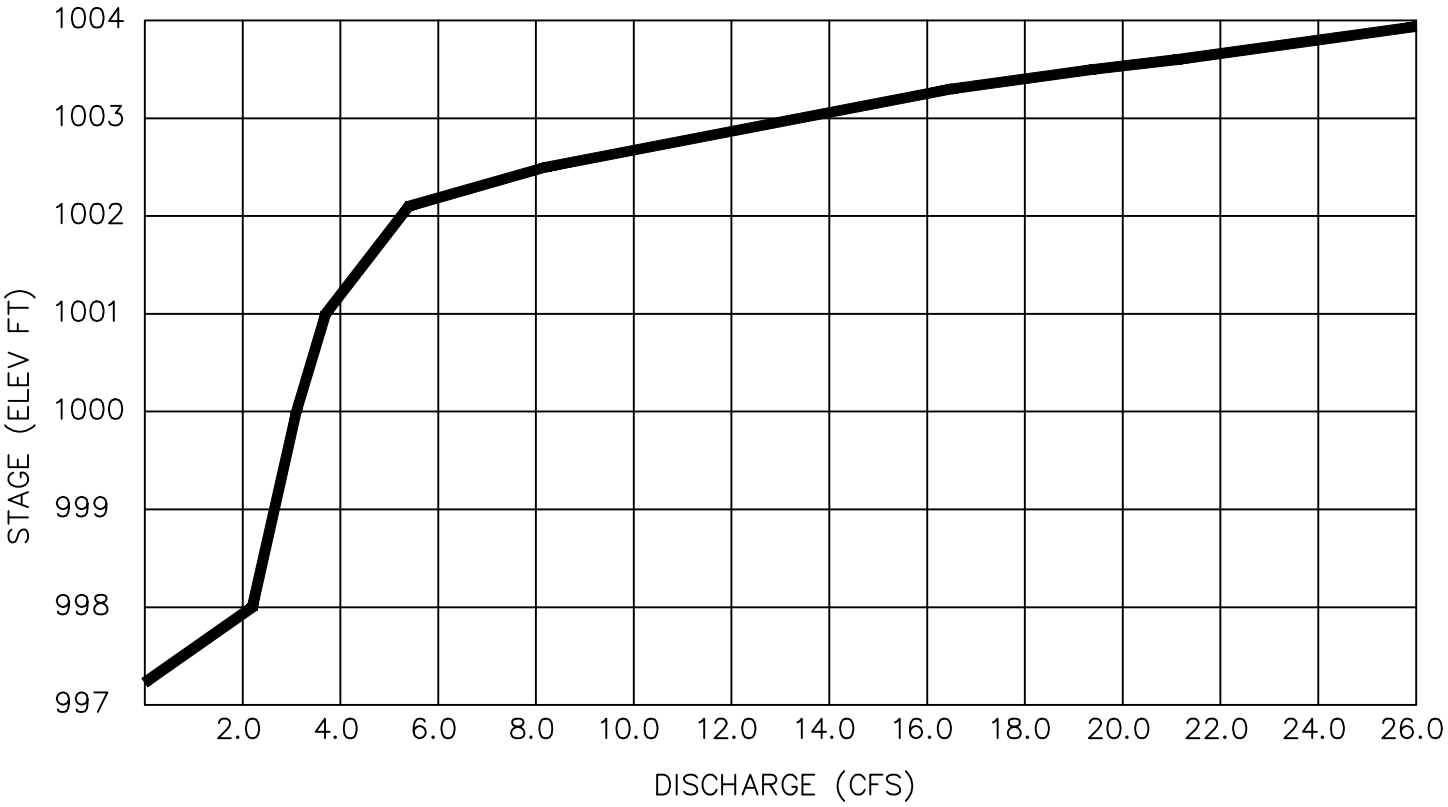
LSMS EDD-1
STAGE-DISCHARGE CURVE



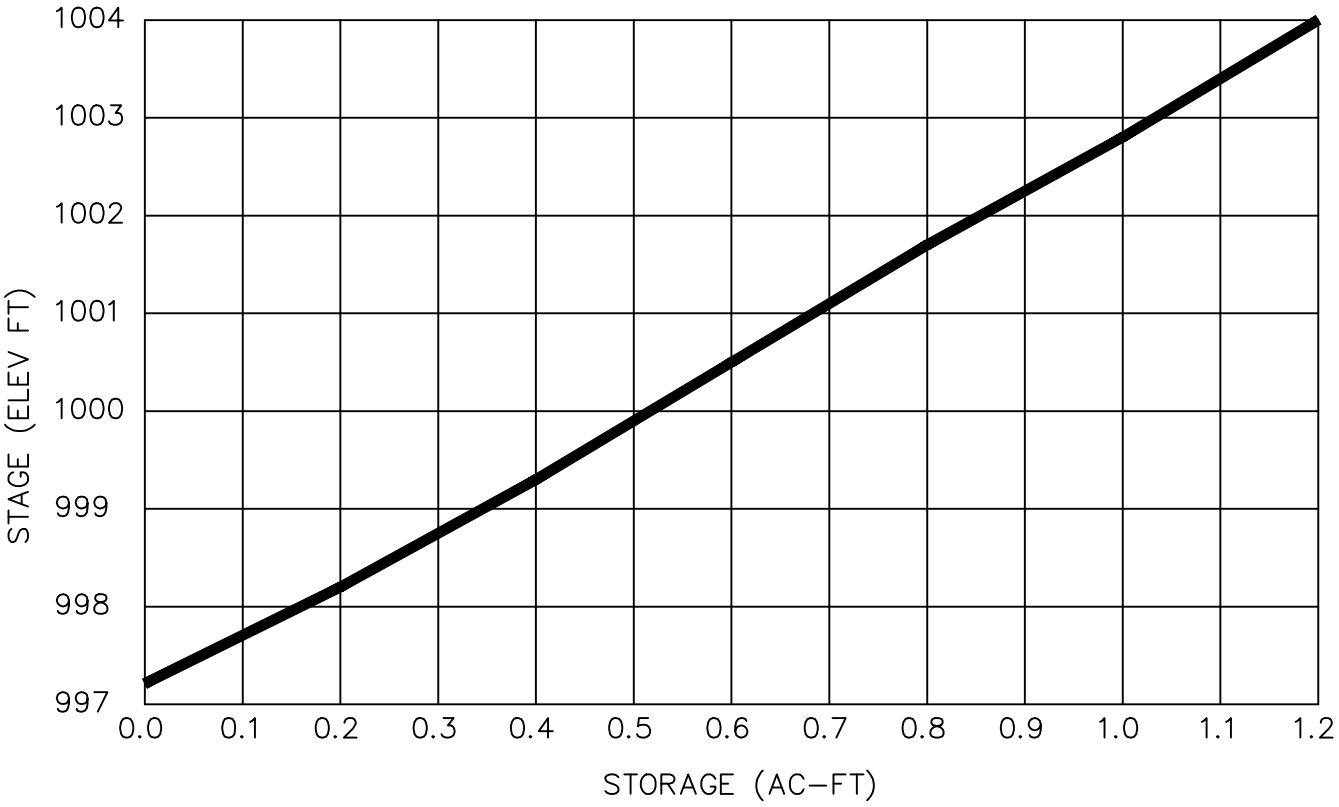
STAGE-STORAGE CURVE



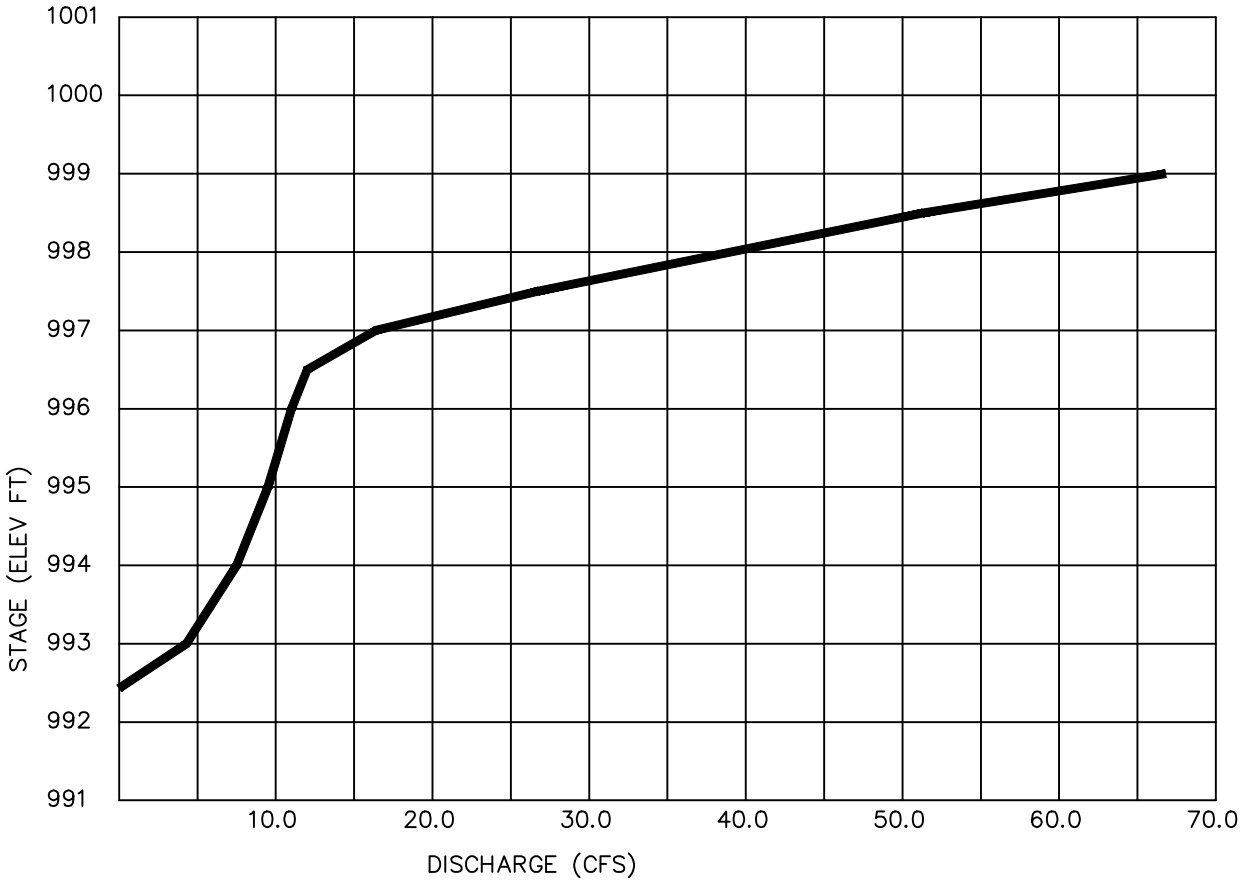
LSMS EDD-2
STAGE-DISCHARGE CURVE



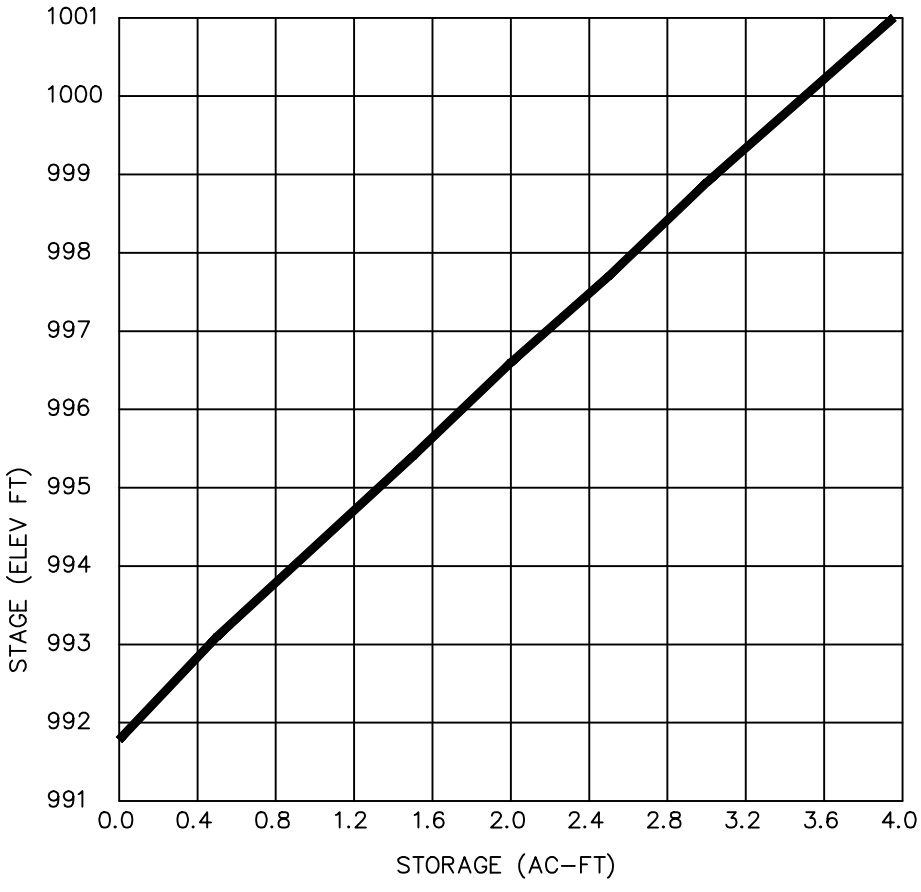
STAGE-STORAGE CURVE

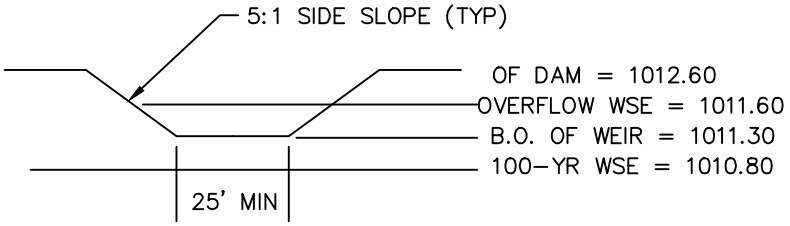


LSMS EDD-3
STAGE-DISCHARGE CURVE



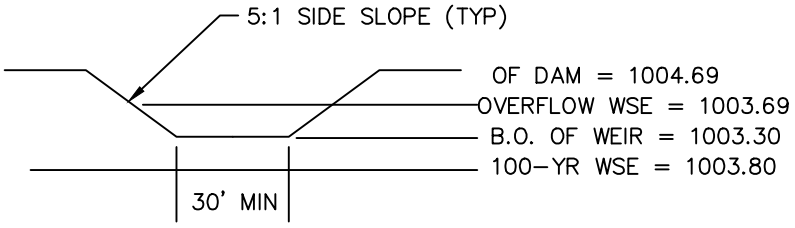
STAGE-STORAGE CURVE





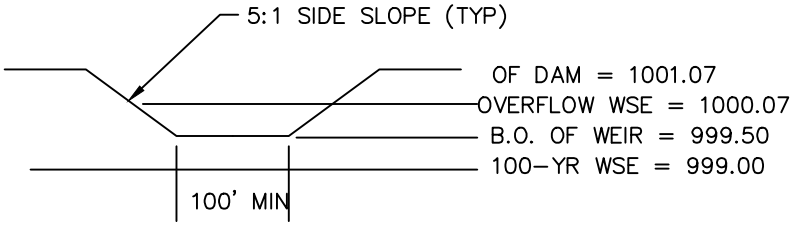
Q = 12.5 CFS
DEPTH = 0.30 FT
V = 2.2 FPS

EDD-1
EMERGENCY SPILLWAY DETAIL



Q = 37.8 CFS
DEPTH = 0.30 FT
V = 2.2 FPS

EDD-2
EMERGENCY SPILLWAY DETAIL



Q = 134 CFS
DEPTH = 0.57 FT
V = 2.3 FPS

EDD-3
EMERGENCY SPILLWAY DETAIL