Mid-Continent Public Library East Lee's Summit Branch Final Stormwater Study

BATTERY DRIVE AND SOUTHEAST BLUE PARKWAY
LEE'S SUMMIT, MISSOURI

January 25, 2019

STATE OF MISSOURI
TERRY M. PARSONS
NUMBER
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PROFESSIONAL ENGINEER

Prepared for:
Mid-Continent Public Libraries (MCPL)

Prepared by:
Olsson
7301 W. 133rd Street, Suite 200
Overland Park, KS 66213
TEL 913.381.1170
www.olsson.com

Olsson Project No. B18-0330

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GENERAL INFORMATION

This Stormwater Management Study is being submitted on behalf of the Mid-Continent Public Library (MCPL) for the proposed library facility located at the northeast corner of SE Blue Parkway and Battery Drive.

Project Location and Description

The proposed site is located on Lot 2 of the Magnolia Place at Charleston Park, 1st Plat in the Northeast ¼ of Section 10, Township 47 North, Range 31 West, in Jackson County, Lee's Summit, Missouri and includes approximately 3.8 acres. The site is located at the northeast corner of the SE Blue Parkway and Battery Drive intersection and is generally bounded by Village Cooperative of Lee's Summit to the north, SE Battery Dr to the west, SE Blue Parkway to the south, and an undeveloped lot to the east (See Figure 2). The Church of Jesus Christ of Latter-Day Saints lies east of the undeveloped lot. The proposed development includes a 18,500 S.F. library facility with associated parking lots, landscaping, grading, and utilities. The entirety of the site is located outside of the 100-Year FEMA Floodplain.

Study Purpose

The purpose of this study is to provide a Stormwater Management Plan for the proposed development in accordance with the American Public Works Association (APWA) *Standard Specifications and Design Criteria* Section 5600 "Storm Drainage Systems and Facilities", APWA Manual of Best Management Practices (BMP) for Stormwater Quality, and applicable City of Lee's Summit, Missouri guidelines.

Soils Descriptions

Soil classifications were obtained from the Natural Resource Conservation Service's website by utilizing the Web Soil Survey feature. The site soil composition and classification are listed below:

10082 – Arisburg-Urban Land Complex, 1 to 5 percent slopes – HSG Type C.
10180 – Udarents-Urban Land-Sampsel Complex, 2 to 5 percent slopes - HSG Type C.

*HSG – Hydrologic Soils Group

See Soils Map in Appendix B.

METHODOLOGY

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, Post-development discharge rates for 1, 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. Pre and post-development flows from the site are shown below and were calculated using HEC-HMS for the 1, 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. A minimum inlet time of five minutes was used when calculated times were under five minutes. Proposed times of concentration were calculated in the same manner.

HYDROLOGIC/HYDRAULIC ANALYSES

Existing Conditions Analysis

The existing site is an undeveloped parcel of land that consist of native vegetation. The site is bounded by SE Battery Drive to the west, The Village Cooperative Apartments to the north, undeveloped property to the east, and SE Blue Parkway to the South. Currently, Blue Parkway lies within MoDOT's US-50 right of way.

The existing drainage for the site is split by a ridge into two outfalls, "A" and "B". The east section drains to outfall "A" and the west section drains to outfall "B". Outfall "A" drains north into an existing storm system along SE Battery Drive. Outfall "B" drains northeast to an existing storm structure in the lot of the Village Cooperative Apartments and then east in the existing storm system.

South of the property there is an existing ditch that lies within US-50 right of way. The ditch drains run-off from Blue Parkway. There is no curb and gutter on Blue Parkway, just a graveled shoulder that allows run-off to drain into the existing ditch. There is an existing 18x24 arch culvert that drains to the ditch from under Battery Drive flows east along the north side of Blue Parkway.

As stated previously, there is an undeveloped lot to the east of the property that is owned by Richard D. Link. Mr. Link is also the person who sold Lot 2, Magnolia place to MCPL. The proposed development did not require all of the property for Lot 2. The east 81' of the property was excluded from the sale and remains the property of Richard D. Link. The proposed drive from the south will be a common access drive that will serve both the MCPL property and the future developed lot to the east. The east half of this drive will be constructed on the undeveloped lot under a mutual understanding with Mr. Link.

This property generally drains to the east to an existing swale away from the library property. None of this area drains to the proposed collection system for the library.

For the purposes of the drainage calculations moving forward this area will be included, therefore the studied area will increase from 3.8 acres to 4.5 acres.

A composite curve number was generated for the site by referencing the Web Soil Survey available in Appendix C, APWA Section 5600 and considered the following factors:

- Existing impervious area
- Existing pervious area
- Hydrologic soil group

The following tables summarize the pre-development composite curve number generation.

Table 1: Pre-Development Curve Number Analysis

Sub-Area	Area (AC)	Soil Group	Curve Number
Pasture (Good)	3.0	C	74
Pasture (Good)	1.5	C	74

The existing peak discharge rates for the 2-year, 10-year, and 100-year storm events from the site are shown in Table 2 below:

Table 2: Existing Peak Flows

Sub-Area / Outfall	Area (acres)	Q (2-Year Storm) (cfs)	Q (10-Year Storm) (cfs)	Q (100-Year Storm) (cfs)
A	3	7.2	11	19.2
B	1.5	2.6	5.5	9.6

Proposed Conditions Analysis

The proposed Public Library will include a 18,500 SF library with associated parking lots, landscaping, grading, and utilities. A site plan has been included in Appendix A. The site will generally continue to drain in the same pattern as existing. Drainage from the site will enter into an enclosed storm sewer system that will be constructed with the development.

The proposed system will collect drainage from the parking area and building. The increase in impervious area will increase runoff from the site. To mitigate the increase in runoff, the following strategy will be implemented.

Outfall A – The entire site will drain north and directed into a detention basin and water treatment facility. Due to the site design, the drainage area for this outfall will increase. However, the detention facility is designed to mitigate the increased runoff to this outfall. A control structure will limit the 1, 10, and 100-year storm events to pre-construction levels.

A proposed drainage map is included in Appendix A.

A post-development composite curve number was generated using the same methodology implemented during the pre-development curve number analysis. Table 3 below summarizes the post-development composite curve number generation.

Table 3: Post-Development Curve Number Analysis

Sub-Area	Area (AC)	Soil Group	Curve Number
Pavement, Buildings, Impervious	2.0	C	98
Turf (Good)	2.5	C	85

A peak flow analysis of the post-development site was conducted using HEC-HMS, the composite curve number, and rainfall and distribution information acquired from APWA section 5600. Post-development peak flows to the outfall are summarized in the Table 4. Detailed reports from HEC-HMS are available in Appendix D

Table 4: Proposed Peak Flows

Sub-Area / Outfall	Tributary Area (acres)	Q (2-Year Storm) (cfs)	Q (10-Year Storm) (cfs)	Q (100-Year Storm) (cfs)
Outfall A	4.5	13.7	21.1	33.4

The existing ditch to the south will remain essentially unchanged. The drainage area, for the ditch, lies within the existing right of way. An embankment will need to be constructed across the ditch for the southern entrance. A 30” culvert will be installed under the entrance to maintain flow in the ditch. The 30” culvert will receive the flow from the existing 18x24 (24” equivalent) local drainage from Blue Parkway.

Stormwater Detention Requirements

One proposed detention pond will be utilized to mitigate the increase in flow due to an increase in impervious area. The Detention Basin will be located in the northern part of the property. It will collect runoff from the 4.5-acre property and drain to Outfall A. The pond has an outlet pipe that connects to an orifice plate within a junction box structure that will be within the dam.

To meet water treatment requirements, the water quality volume (WQv) will be controlled by a conduit at the bottom of the basin. The conduit will release the water quality volume over a 40-hour period to allow pollutants to settle out of this precipitation event.

An orifice will be located above the WQv surface elevation to control the 1 and 10-year storms. Both storms have been analyzed through the control structure and will release below the pre-existing storm events. The 100-year storm event will flow into a weir placed at the top of the control structure. The dam will have an emergency spillway to control the 100-year overflow.

Table 5 provides the water surface elevations (WSE’s) and peak flows for the proposed detention basin.

Table 5: Detention Basin, WSE's and Peak Flows

Description	Detention Basin
Bottom of Basin	1007
Total Storage Volume	1.64
Top of Dam Elevation	1012
WQv Orifice (IE Elevation, Pipe Size)	1007.5, 1 – 2" (ft, pipe size)
Water Quality Volume WSE, Storage, Peak Outflow	1008.5, 0.2, 0.1 (ft, ac-ft, cfs)
2-year & 10-Year Orifice (IE Elevation, Pipe Size)	1009, 1-6" (ft, pipe size)
10–Year Storm WSE, Storage, Peak Outflow	1010.6, 0.9, 1.4 (ft, ac-ft, cfs)
100–Year Storm Weir (Elevation, Length)	1010, 16 (ft, lf)
100–Year Storm WSE, Storage, Peak Outflow	1011.2, 1.2, 9.4 (ft, ac-ft, cfs)

Table 6 shows the overall peak flow for the site pre and post-construction. Note that peak flow for post-construction has been lowered in all storm events.

Table 6: Peak Flow Change Analysis

Site	Q (2-Year Storm) (cfs)	Q (10-Year Storm) (cfs)	Q (100-Year Storm) (cfs)
Pre-Construction	7.2	11	19.2
Section 5600 Allowable Release Rate	2.3	9	13.5
Post Construction	1.6	3.3	9.4
% Change	22%	30%	48%

STORMWATER TREATMENT REQUIREMENTS

As stated previously, the proposed detention is designed to act an extended dry bottom detention facility will be used to treat stormwater per MARC water quality standards. The orifice plate for the basin will be 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 maximum storage for the water quality event in the basin will be 0.2 acre-ft reaching a peak water surface of elevation 1008.5 feet.

CLEAN WATER ACT SECTION 404 PERMITTING REQUIREMENTS

No jurisdictional Waters of the United States have been identified on the study site. Therefore, a Section 404 permit is not required.

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.

CONCLUSIONS AND RECOMMENDATIONS

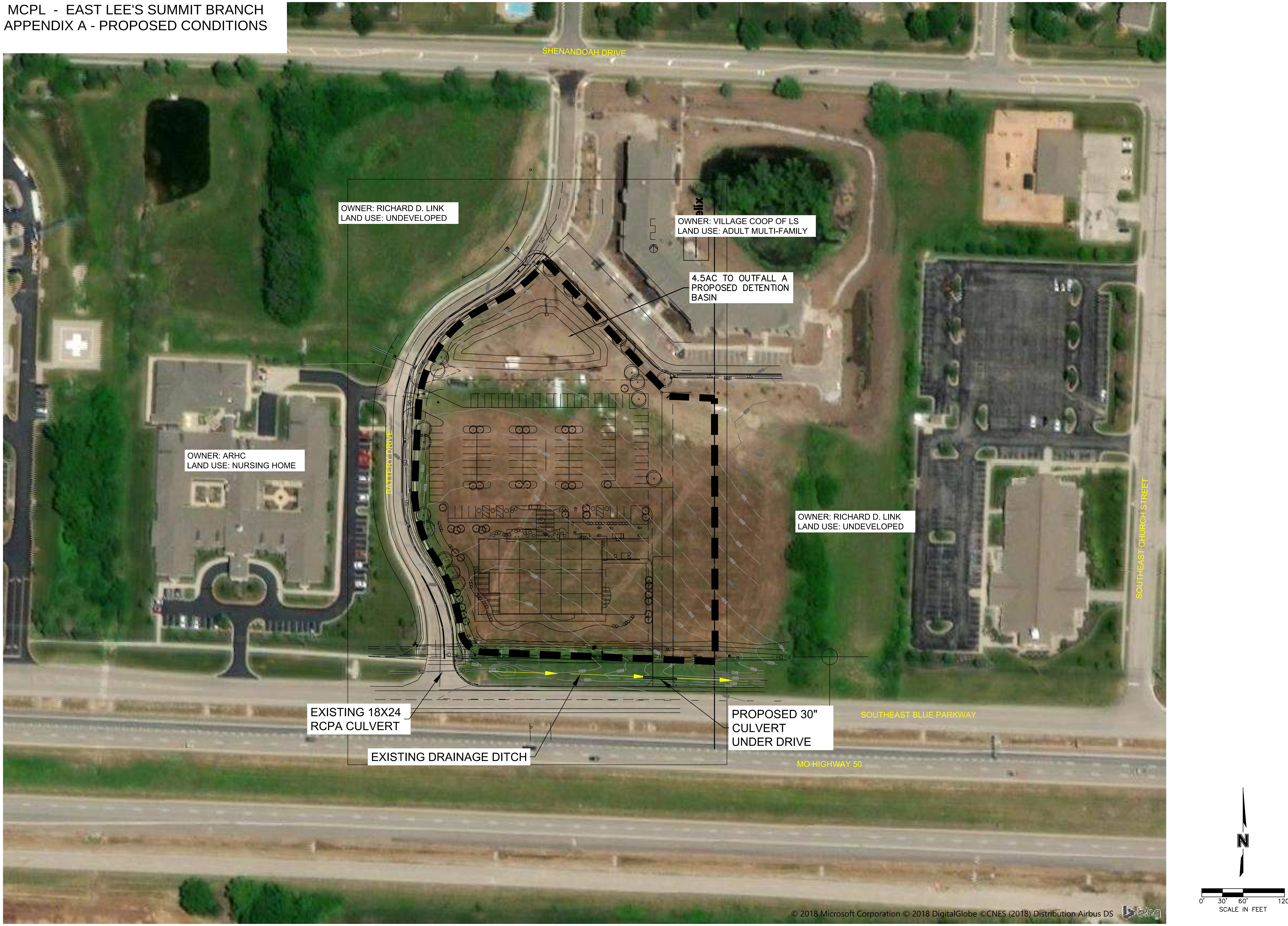
As outlined in the preceding report, increased runoff rates in the post-development conditions are mitigated by the detention basins. Drainage patterns on the site remain relatively unchanged. An extended dry detention basin has been designed to maintain or improve storm water quality. Based on these facts and other information provided herein, we request that this stormwater study be approved.

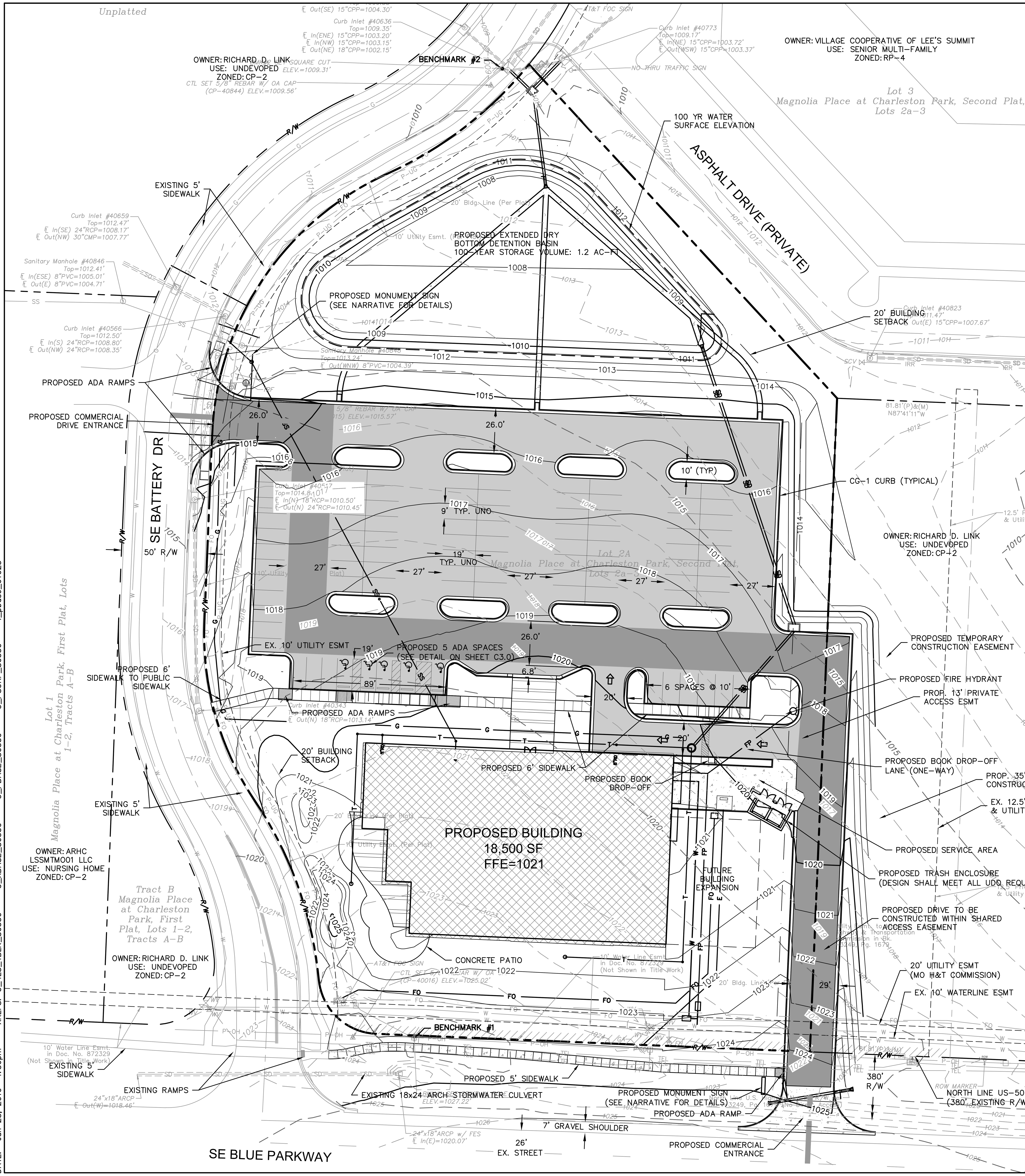
Appendix A

Map Exhibits

MCPL - EAST LEE'S SUMMIT BRANCH
APPENDIX A - EXISTING CONDITIONS

MCPL - EAST LEE'S SUMMIT BRANCH
APPENDIX A - PROPOSED CONDITIONS





SITE DATA		
ZONING & SITE AREA		
PROPOSED USE:	PUBLIC LIBRARY	
	SITE AREA	ZONING
LOT 2 (AS DECRIBED):	3.80 ACRES (165,528 SF)	CP-2
IMPERVIOUS:	1.71 ACRES (74,488 SF) (45%)	
PERVIOUS:	2.09 ACRES (91,040 SF) (55%)	
FAR (0.55 MAX):	0.15	
BUILDING AREA		
BUILDING TYPE	# STORIES	SQUARE FOOTAGE
BUILDING	1	18,500 SF
FUTURE	1	4,700 SF
PARKING		
USE	REQUIRED	PROVIDED
LIBRARY	4 PER 1000 SF = 74	83
ADA	3 (PER CITY TABLE)	5
TOTAL	74	88 (INCLUDING ADA)

NOTE:
ACCORDING TO MDNR STATE OIL & GAS COUNSEL THERE ARE NO OIL AND GAS WELLS LOCATED WITHIN OR ADJACENT TO THE PROPERTY.

EXISTING CONDITIONS LEGEND

- PROPERTY LINES
- RIGHT-OF-WAY LINES
- EASEMENT LINES
- BUILDING SETBACK LINES
- P-OH OVERHEAD ELECTRIC
- P-UG UNDERGROUND ELECTRIC
- TEL UNDERGROUND TELEPHONE
- FO UNDERGROUND FIBER OPTIC
- G GAS LINE
- W WATER LINE
- SD STORM SEWER LINE
- SS SANITARY SEWER LINE
- 851 GRADE CONTOURS

PROPOSED CONDITIONS LEGEND

- E PROPOSED UNDERGROUND ELECTRIC
- FO PROPOSED FIBER OPTIC
- W PROPOSED WATER LINE
- FP PROPOSED FIRE PROTECTION LINE
- SD PROPOSED STORM SEWER LINE
- T PROPOSED TURF DRAIN LINE
- SS PROPOSED SANITARY SEWER SERVICE
- CONCRETE CURB & GUTTER
- PROPOSED BUILDING
- PROPOSED CONCRETE SIDEWALK
- PROPOSED LIGHT DUTY ASPHALT
- 851 PROPOSED GRADE CONTOURS
- PROPOSED FIRE ACCESS ROAD

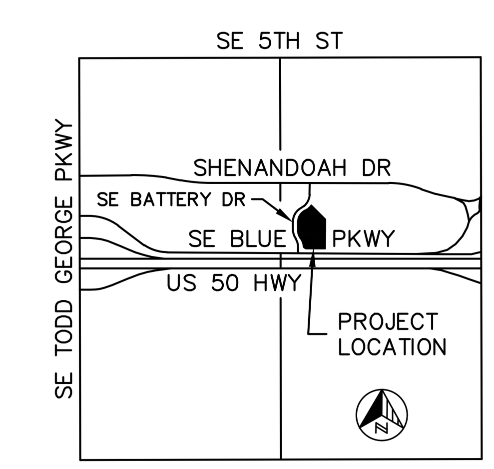
BENCHMARKS:

BENCHMARK #1:
ELEVATION=1027.22'
SET RAILROAD SPIKE IN THE NORTH SIDE OF A POWER POLE, 66'± NORTH OF THE ℄ OF SE BLUE PARKWAY, 86' EAST OF THE ℄ OF SE BATTERY DRIVE.

BENCHMARK #2:
ELEVATION=1009.31'
SET CHISELED "□" CUT ON THE SOUTHWESTERLY CORNER OF A CONCRETE CURB INLET #40636, 630'± NORTH OF THE ℄ OF SE BLUE PARKWAY, 15' EAST OF THE ℄ OF SE BATTERY DRIVE.

LEGAL DESCRIPTION:

LOT 2A, MAGNOLIA PLACE AT CHARLESTON PARK, SECOND PLAT, LOTS 2A-3, A SUBDIVISION IN LEE'S SUMMIT, JACKSON COUNTY, MISSOURI, EXCEPT THE EAST 81.81 FEET THEREOF, CONTAINING 165,561 SQUARE FEET OR 3.8008 ACRES, MORE OR LESS .



SECTION 10, T.47N., R.31W.

VICINITY MAP

SCALE: 1" = 2000'

SAPP DESIGN ARCHITECTS
3750 S. Fremont Ave.
Springfield, MO 65804 417.877.9600
Sapp Design Associates Architects, P.C.
Missouri State Certificate of Authority #000607

helix.
1629 Walnut
Kansas City, MO 64108 816.300.0300

SPECIAL NOTICES

Mid-Continent Public Library
CONSTRUCTION DOCUMENT PLANS FOR
EAST LEE'S SUMMIT BRANCH
2240 SE BLUE PARKWAY
LEE'S SUMMIT, MO 64063
JACKSON COUNTY

PACKAGE 04

Engineer of Record

Terry M Parsons, Engineer MO PE-2018010505

olsson
7301 West 133rd Street, Suite 200
Overland Park, KS 66213
TEL 913.381.1170
FAX 913.381.1174
www.olsson.com
Olsson
Missouri State Certificate of Authority #001592

Revision No.	Description	Date
1	ASI#1	01.14.19

Project No.	Date	Drawn
B18-0330	12.07.18	RLK

Drawing No.
C1.0
FINAL DEVELOPMENT PLAN

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DATE: Jan 28, 2019 4:56pm
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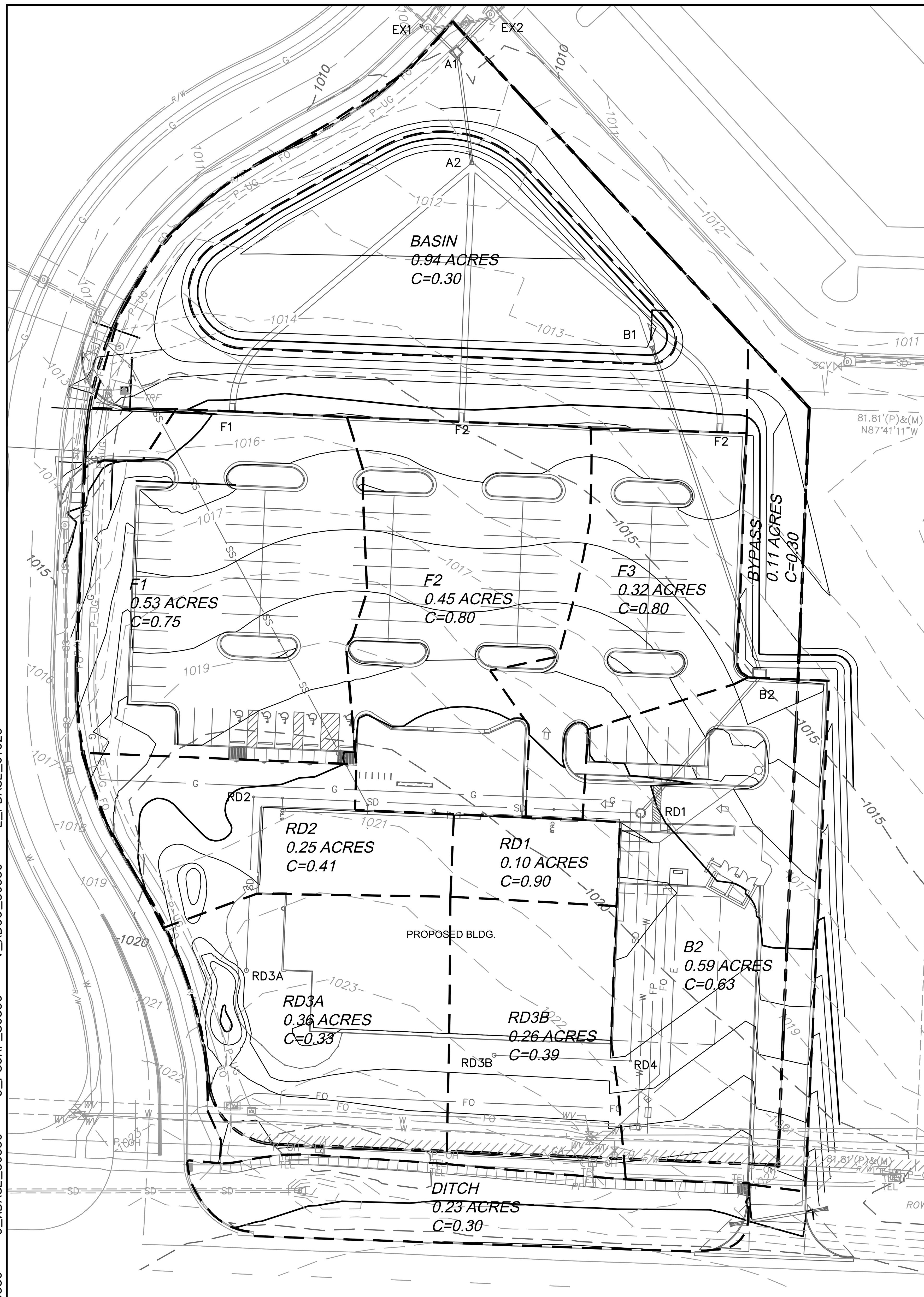
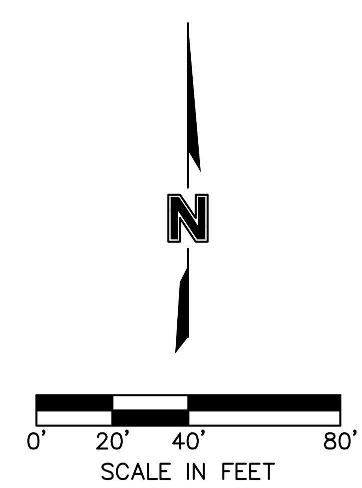
USER: tparsons





STORM SEWER PIPE AND STRUCTURE TABLE

STORM SEWER PIPE AND STRUCTURE TABLE
TITLE: EAST LEES SUMMIT LIBRARY
JOB #: 017-1488

DESIGN CONDITIONS: 10 YEAR STORM EVENT

STRUCTURES		RUNOFF CALCULATIONS									PIPE DESIGN																					
FROM	TO	DIRECT AREA (ACRES)	TOTAL AREA (ACRES)	C	KC (K=1.00)	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	DOWNSTREAM WATER ELEVATION	FRICTION HEAD (h f)	ENTRY LOSS COEFFICIENT (k)	ACTUAL ENTRY LOSS (k)	ENTRY LOSS (h m)	h f + h m (FT)	HW, INLET CONTROL	HW, OUTLET CONTROL	HYDRAULIC GRADE ELEV.	HYDRAULIC GRADE (MAX)	Comments
RD3A		0.36		0.33	0.33	5.0	-	7.35	0.87	ADS BASINS/ROOF DRAINS									1020.20											1017.54	1018.70	
	RD2		0.36	0.33	0.33	5.0	-	7.35	0.87	8 in. HDPE	88.00	1.00	8	1.21	0.35	3.47	3.80	1.04		1016.70	1015.82	1016.85	0.47	0.40	1.00	0.22	0.69	1017.40	1017.54			
RD2		0.25		0.41	0.41	5.0	-	7.35	0.75	ADS BASINS/ROOF DRAINS									1020.20											1016.85	1018.70	
	RD1		0.61	0.42	0.42	5.0	-	7.35	1.88	10 in. HDPE	193.00	1.00	10	2.20	0.55	4.03	4.53	1.24		1015.82	1013.89	1013.26	1.45	0.40	0.40	0.13	1.57	1016.85	1015.82			
RD1		0.10		0.90	0.90	5.0	-	7.35	0.66	JUNCTION BOX									1020.20											1018.97	1018.70	
	B2		0.97	0.53	0.53	5.0	-	7.35	3.78	12 in. HDPE	89.00	2.84	12	6.02	0.79	7.67	8.09	1.59		1013.39	1011.86	1017.54	1.01	0.40	0.40	0.41	1.42	1014.98	1018.97			
B2		0.59		0.63	0.63	5.0	-	7.35	2.73	CURB INLET									1017.86											1013.26	1016.36	
	B1		1.56	0.67	0.67	5.0	-	7.35	7.68	15 in. HDPE	174.00	3.66	15	12.39	1.23	10.10	10.62	1.92		1010.86	1004.51	1005.77	2.49	0.40	0.40	0.70	3.19	1013.26	1010.86			END SECTION TO BASIN
RD3B		0.26		0.39	0.39	5.0	-	7.35	0.75	ADS BASINS/ROOF DRAINS									1020.20											1017.33	1018.70	
	RD4		0.26	0.39	0.39	5.0	-	7.35	0.75	8 in. HDPE	67.00	1.00	8	1.21	0.35	3.47	3.64	0.94		1016.70	1016.01	1016.59	0.26	0.40	1.00	0.21	0.46	1017.33	1017.06			
RD4		0.00		0.39	0.39	5.0	-	7.35	0.00	ADS BASINS/ROOF DRAINS									1020.20													
	RD1		0.26	0.39	0.39	5.0	-	7.35	0.75	8 in. HDPE	125.00	1.00	8	1.21	0.35	3.47	3.64	0.94		1016.01	1014.76	1015.34	0.48	0.40	1.00	0.21	0.69	1016.64	1016.03			
F1	BAS	0.53	0.53	0.75	0.75	5.0	-	7.35	2.92	FLUME																						
F2	BAS	0.45	0.45	0.80	0.80	5.0	-	7.35	2.65	FLUME																						
F3	BAS	0.32	0.32	0.80	0.80	5.0	-	7.35	1.88	FLUME																						

STORM SEWER PIPE AND STRUCTURE TABLE

STORM SEWER PIPE AND STRUCTURE TABLE
TITLE: EAST LEES SUMMIT LIBRARY
JOB #: 017-1488

DESIGN CONDITIONS: 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	DOWNSTREAM WATER ELEVATION	FRICTION HEAD (h f)	ENTRY LOSS COEFFICIENT (k)	ACTUAL ENTRY LOSS (k)	ENTRY LOSS (h m)	h f + h m (FT)	HW, INLET CONTROL	HW, OUTLET CONTROL	HYDRAULIC GRADE ELEV.	HYDRAULIC GRADE (MAX)	Comments
RD3A		0.36		0.33	0.41	5.0	-	7.35	1.09	ADS BASINS/ROOF DRAINS									1020.20											1017.82	1018.70	
	RD2		0.36	0.33	0.41	5.0	-	7.35	1.09	8 in. HDPE	88.00	1.00	8	1.21	0.35	3.47	3.94	1.25		1016.70	1015.82	1016.85	0.73	0.40	1.00	0.24	0.97	1017.54	1017.82			
RD2		0.25		0.41	0.51	5.0	-	7.35	0.94	ADS BASINS/ROOF DRAINS									1020.20											1016.85	1018.70	
	RD1		0.61	0.42	0.53	5.0	-	7.35	2.35	12 in. HDPE	193.00	1.00	12	3.57	0.79	4.55	4.86	1.03		1015.82	1013.89	1014.14	0.85	0.40	0.40	0.15	1.00	1016.85	1015.82			
RD1		0.10		0.90	1.13	5.0	-	7.35	0.83	JUNCTION BOX									1020.20											1019.85	1018.70	
	B2		0.97	0.53	0.66	5.0	-	7.35	4.72	12 in. HDPE	89.00	2.84	12	6.02	0.79	7.67	8.48	2.11		1013.39	1011.86	1017.82	1.59	0.40	0.40	0.45	2.03	1015.50	1019.85			
B2		0.59		0.63	0.79	5.0	-	7.35	3.41	CURB INLET									1017.86											1014.14	1016.36	
	B1		1.56	0.67	0.84	5.0	-	7.35	9.60	15 in. HDPE	174.00	3.66	15	12.39	1.23	10.10	11.14	2.62		1010.86	1004.51	1005.92	3.89	0.40	0.40	0.77	4.66	1014.14	1010.86			END SECTION TO BASIN
RD3B		0.26		0.39	0.49	5.0	-	7.35	0.93	ADS BASINS/ROOF DRAINS									1020.20											1017.43	1018.70	
	RD4		0.26	0.39	0.49	5.0	-	7.35	0.93	8 in. HDPE	67.00	1.00	8	1.21	0.35	3.47	3.84	1.10		1016.70	1016.01	1016.68	0.40	0.40	1.00	0.23	0.63	1017.43	1017.31			
RD4		0.00		0.39	0.49	5.0	-	7.35	0.00	ADS BASINS/ROOF DRAINS									1020.20											1016.74	1018.70	
	RD1		0.26	0.39	0.49	5.0	-	7.35	0.93	8 in. HDPE	125.00	1.00	8	1.21	0.35	3.47	3.84	1.10		1016.01	1014.76	1015.43	0.76	0.40	1.00	0.23	0.98	1016.74	1016.41			
F1	BAS	0.53	0.53	0.75	0.94	5.0	-	7.35	3.65	FLUME																						
F2	BAS	0.45	0.45	0.80	1.00	5.0	-	7.35	3.31	FLUME																						
F3	BAS	0.32	0.32	0.80	1.00	5.0	-	7.35	2.35	FLUME																						

SAPP DESIGN ARCHITECTS
3750 S. Fremont Ave.
Springfield, MO 65804 417.877.9600
Sapp Design Associates Architects, P.C.
Missouri State Certificate of Authority #000607

helix.
1629 Walnut
Kansas City, MO 64108 816.300.0300

SPECIAL NOTICES

In the event the client consents to, allows, authorizes or approves of changes to any plans, specifications or other construction documents, and these changes are not approved in writing by the design professional, the client recognizes that such changes and the results thereof are not the responsibility of the design professional. Therefore, the client agrees to release the design professional from any liability arising from the construction, use or result of such changes. In addition, the client agrees to the fullest extent permitted by law, to indemnify and hold the design professional harmless from any damage, liability or cost (including reasonable attorney's fees and costs of defense) arising from such changes.

~

The personal seal of the registered Architect or Engineer shall be the legal equivalent of his signature whenever & wherever used, and the owner of the seal shall authenticate this sheet and the specification sections pertaining to this sheet. Responsibility shall be disclaimed for all other plans, specifications, estimates, reports or other documents or instruments relating to or intended to be used for any part or parts of the architectural project.

Mid-Continent Public Library
CONSTRUCTION DOCUMENT PLANS FOR
EAST LEE'S SUMMIT BRANCH
2240 SE BLUE PARKWAY
LEE'S SUMMIT, MO 64063
JACKSON COUNTY

PACKAGE 04

Engineer of Record

Terry M Parsons, Engineer MO PE-2018010505

olsson
7301 West 133rd Street, Suite 200
Overland Park, KS 66213
TEL 913.381.1170
FAX 913.381.1174
www.olsson.com
Olsson
Missouri State Certificate of Authority #001592

Revision No.	Description	Date
1	ASI#1	01.14.19

Project No.	Date	Drawn
B18-0330	12.07.18	RLK

Drawing No. C8.0

DRAINAGE PLAN

DWG: F:\2018\0001-0500\018-0330-B\40-Design\AutoCAD\Final Plans\Sheets\GNCA\WORK_PACKAGE_4\LES_SUMMIT\C_DRN_80330.dwg USER: bkimmich
DATE: Jan 14, 2019 5:33pm XREFS: C_4LS_TBLK_80330 C_PBASE_80330 C_XBASE_80330 C_PSURF_80330 V_XBOU_80330 L_PBASE_61023

Appendix B

FEMA Flood Classification Firm

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) Report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS Report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study Report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study Report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Missouri State Plane West Zone (FIPS zone 2403). The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713- 3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from the U.S.D.A Farm Service National Agriculture ImageryProgram (NAIP) dated 2014. Produced at scale of 1:24,000.

The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X — Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X — Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D — Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% Annual Chance Floodplain Boundary

0.2% Annual Chance Floodplain Boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.

513 — Base Flood Elevation line and value; elevation in feet*

(EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

A — A: Cross section line

23 - - - 23: Transect line

Culvert

Bridge

45° 02' 08", 93° 02' 12" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere

3100000 FT — 5000-foot ticks: Missouri State Plane West Zone (FIPS Zone 2403), Transverse Mercator projection

DX5510 × — Bench mark (see explanation in Notes to Users section of this FIRM panel)

• M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
September 29, 2006

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
January 20, 2017 - to change Special Flood Hazard Areas

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

N

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0439G

FIRM
FLOOD INSURANCE RATE MAP
JACKSON COUNTY, MISSOURI
AND INCORPORATED AREAS

PANEL 439 OF 625
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
JACKSON COUNTY, Unincorporated	290492	0439	G
LEE'S SUMMIT, CITY OF	290174	0439	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
29095C0439G

MAP REVISED
JANUARY 20, 2017

Federal Emergency Management Agency

Soil Map—Jackson County, Missouri
(MCPL - East Lees Summit)

Map Scale: 1:1,070 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 15, 30, 60, 90

Feet: 0, 50, 100, 200, 300

N

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

Appendix C

Soil Map

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 18, Sep 16, 2017

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

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

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

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	3.3	79.5%
10180	Udarents-Urban land-Sampsel complex, 2 to 5 percent slopes	0.9	20.5%
Totals for Area of Interest		**4.2**	**100.0%**

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

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

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

Data Source Information

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

Jackson County, Missouri

10180—Udarents-Urban land-Sampsel complex, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: 1n85h
Elevation: 600 to 900 feet
Mean annual precipitation: 33 to 43 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 175 to 220 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Udarents and similar soils: 41 percent
Urban land: 39 percent
Sampsel and similar soils: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udarents

Setting

Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Mine spoil or earthy fill

Typical profile

C1 - 0 to 5 inches: silt loam
C2 - 5 to 80 inches: silty clay loam

Properties and qualities

Slope: 2 to 5 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 (0.14 to 0.57 in/hr)
Depth to water table: More than 80 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 9.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: Deep Loess Upland Prairie (R107BY002MO)

Other vegetative classification: Mixed/Transitional (Mixed Native Vegetation)
Hydric soil rating: No

Description of Urban Land

Setting

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

Interpretive groups

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

Description of Sampsel

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Convex
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: 2 to 5 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)

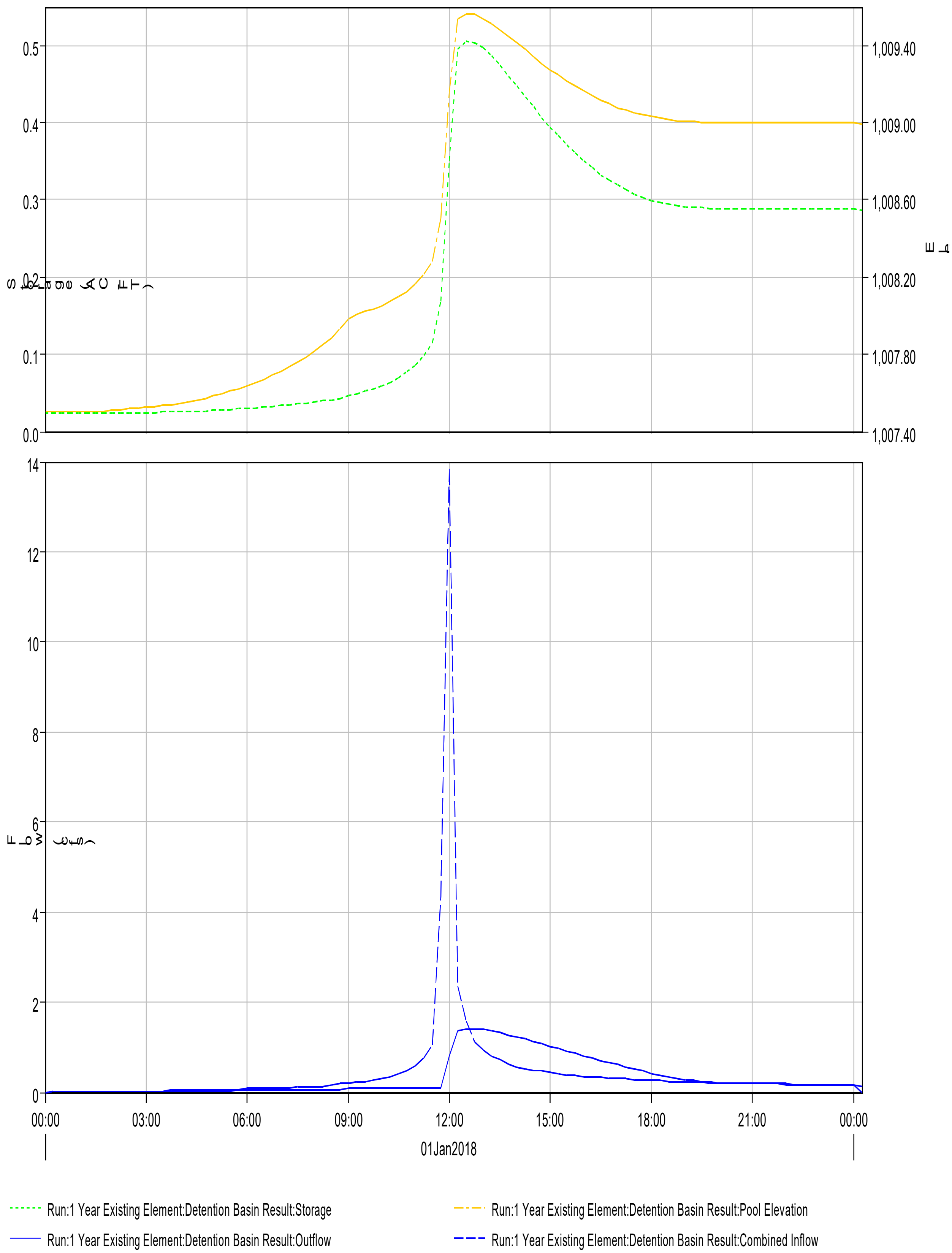
Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C/D
Ecological site: Wet Footslope Prairie (R112XY041MO)
Other vegetative classification: Grass/Prairie (Herbaceous Vegetation)

Appendix D

Drainage and Detention Calculations

Reservoir "Detention Basin" Results for Run "2 Year Existing"



Project: ELS Simulation Run: 2 Year Existing
Reservoir: Detention Basin

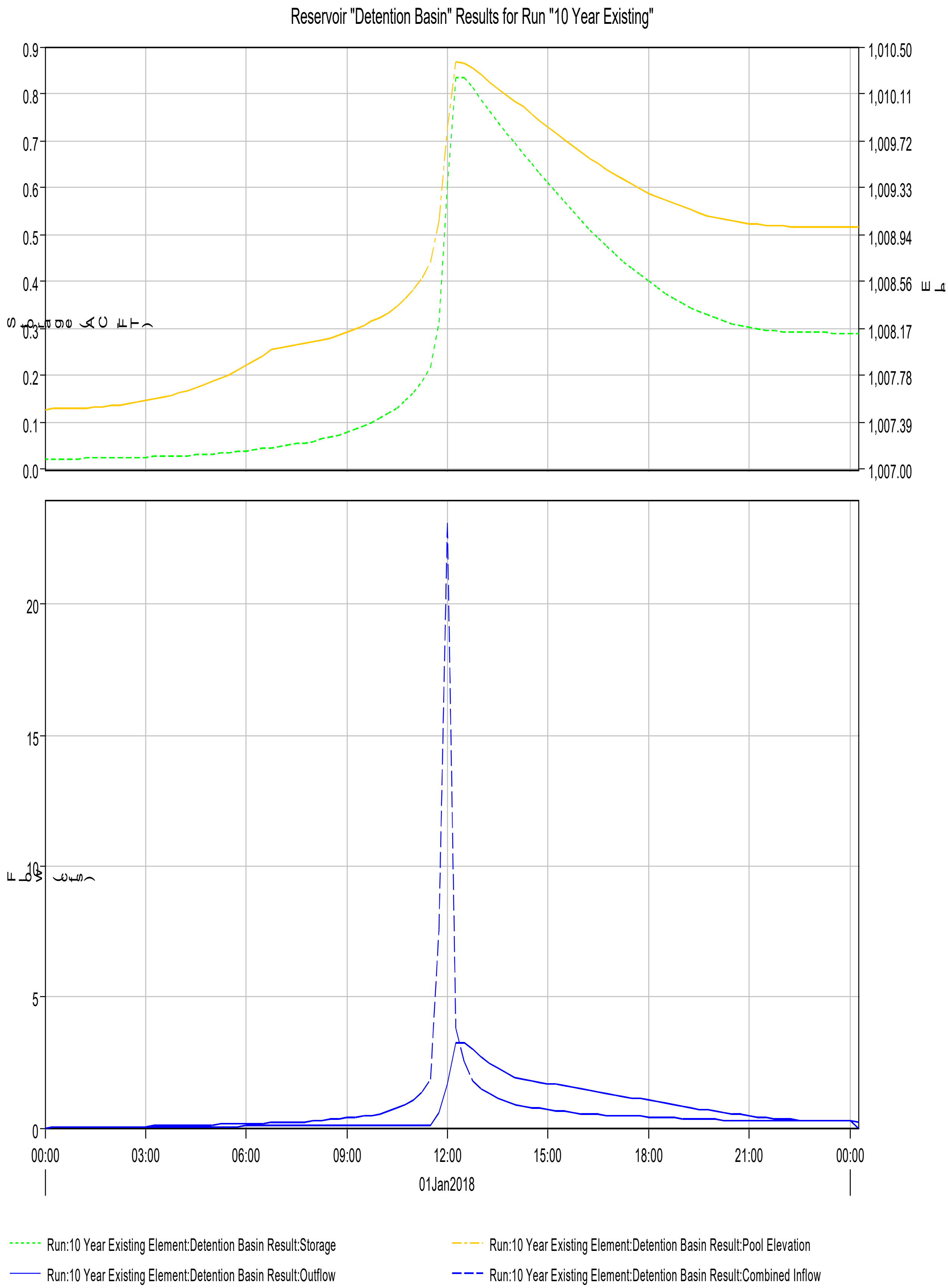
Start of Run: 01Jan2018, 00:00 Basin Model: Proposed
End of Run: 02 Jan2018,00:15 Meteorologic Model: 2-Year
Compute Time: 09Sep2018, 12:26:01 Control Specifications:Control 1

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2018	00:00	0.0	0.0	1007.5	0.0
01Jan2018	00:15	0.0	0.0	1007.5	0.0
01Jan2018	00:30	0.0	0.0	1007.5	0.0
01Jan2018	00:45	0.0	0.0	1007.5	0.0
01Jan2018	01:00	0.0	0.0	1007.5	0.0
01Jan2018	01:15	0.0	0.0	1007.5	0.0
01Jan2018	01:30	0.0	0.0	1007.5	0.0
01Jan2018	01:45	0.0	0.0	1007.5	0.0
01Jan2018	02:00	0.0	0.0	1007.5	0.0
01Jan2018	02:15	0.0	0.0	1007.5	0.0
01Jan2018	02:30	0.0	0.0	1007.5	0.0
01Jan2018	02:45	0.0	0.0	1007.5	0.0
01Jan2018	03:00	0.0	0.0	1007.5	0.0
01Jan2018	03:15	0.0	0.0	1007.5	0.0
01Jan2018	03:30	0.0	0.0	1007.5	0.0
01Jan2018	03:45	0.0	0.0	1007.5	0.0
01Jan2018	04:00	0.0	0.0	1007.5	0.0
01Jan2018	04:15	0.0	0.0	1007.6	0.0
01Jan2018	04:30	0.0	0.0	1007.6	0.0
01Jan2018	04:45	0.0	0.0	1007.6	0.0
01Jan2018	05:00	0.1	0.0	1007.6	0.0
01Jan2018	05:15	0.1	0.0	1007.6	0.0
01Jan2018	05:30	0.1	0.0	1007.6	0.0
01Jan2018	05:45	0.1	0.0	1007.6	0.0
01Jan2018	06:00	0.1	0.0	1007.6	0.0
01Jan2018	06:15	0.1	0.0	1007.7	0.0

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2018	06:30	0.1	0.0	1007.7	0.0
01Jan2018	06:45	0.1	0.0	1007.7	0.0
01Jan2018	07:00	0.1	0.0	1007.7	0.0
01Jan2018	07:15	0.1	0.0	1007.7	0.1
01Jan2018	07:30	0.1	0.0	1007.8	0.1
01Jan2018	07:45	0.1	0.0	1007.8	0.1
01Jan2018	08:00	0.1	0.0	1007.8	0.1
01Jan2018	08:15	0.1	0.0	1007.8	0.1
01Jan2018	08:30	0.2	0.0	1007.9	0.1
01Jan2018	08:45	0.2	0.0	1007.9	0.1
01Jan2018	09:00	0.2	0.0	1008.0	0.1
01Jan2018	09:15	0.2	0.0	1008.0	0.1
01Jan2018	09:30	0.2	0.1	1008.0	0.1
01Jan2018	09:45	0.2	0.1	1008.0	0.1
01Jan2018	10:00	0.3	0.1	1008.1	0.1
01Jan2018	10:15	0.3	0.1	1008.1	0.1
01Jan2018	10:30	0.4	0.1	1008.1	0.1
01Jan2018	10:45	0.5	0.1	1008.1	0.1
01Jan2018	11:00	0.6	0.1	1008.2	0.1
01Jan2018	11:15	0.8	0.1	1008.2	0.1
01Jan2018	11:30	1.0	0.1	1008.3	0.1
01Jan2018	11:45	4.3	0.2	1008.5	0.1
01Jan2018	12:00	13.8	0.4	1009.2	0.8
01Jan2018	12:15	2.3	0.5	1009.5	1.4
01Jan2018	12:30	1.6	0.5	1009.6	1.4
01Jan2018	12:45	1.1	0.5	1009.6	1.4
01Jan2018	13:00	0.9	0.5	1009.5	1.4
01Jan2018	13:15	0.8	0.5	1009.5	1.4
01Jan2018	13:30	0.7	0.5	1009.5	1.3
01Jan2018	13:45	0.6	0.5	1009.4	1.3
01Jan2018	14:00	0.6	0.4	1009.4	1.2

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2018	14:15	0.5	0.4	1009.4	1.2
01Jan2018	14:30	0.5	0.4	1009.3	1.1
01Jan2018	14:45	0.5	0.4	1009.3	1.1
01Jan2018	15:00	0.4	0.4	1009.3	1.0
01Jan2018	15:15	0.4	0.4	1009.2	1.0
01Jan2018	15:30	0.4	0.4	1009.2	0.9
01Jan2018	15:45	0.4	0.4	1009.2	0.9
01Jan2018	16:00	0.3	0.4	1009.2	0.8
01Jan2018	16:15	0.3	0.3	1009.1	0.8
01Jan2018	16:30	0.3	0.3	1009.1	0.7
01Jan2018	16:45	0.3	0.3	1009.1	0.7
01Jan2018	17:00	0.3	0.3	1009.1	0.6
01Jan2018	17:15	0.3	0.3	1009.1	0.6
01Jan2018	17:30	0.3	0.3	1009.1	0.5
01Jan2018	17:45	0.3	0.3	1009.0	0.5
01Jan2018	18:00	0.3	0.3	1009.0	0.4
01Jan2018	18:15	0.3	0.3	1009.0	0.4
01Jan2018	18:30	0.2	0.3	1009.0	0.3
01Jan2018	18:45	0.2	0.3	1009.0	0.3
01Jan2018	19:00	0.2	0.3	1009.0	0.3
01Jan2018	19:15	0.2	0.3	1009.0	0.3
01Jan2018	19:30	0.2	0.3	1009.0	0.2
01Jan2018	19:45	0.2	0.3	1009.0	0.2
01Jan2018	20:00	0.2	0.3	1009.0	0.2
01Jan2018	20:15	0.2	0.3	1009.0	0.2
01Jan2018	20:30	0.2	0.3	1009.0	0.2
01Jan2018	20:45	0.2	0.3	1009.0	0.2
01Jan2018	21:00	0.2	0.3	1009.0	0.2
01Jan2018	21:15	0.2	0.3	1009.0	0.2
01Jan2018	21:30	0.2	0.3	1009.0	0.2
01Jan2018	21:45	0.2	0.3	1009.0	0.2

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2018	22:00	0.2	0.3	1009.0	0.2
01Jan2018	22:15	0.2	0.3	1009.0	0.2
01Jan2018	22:30	0.2	0.3	1009.0	0.2
01Jan2018	22:45	0.2	0.3	1009.0	0.2
01Jan2018	23:00	0.2	0.3	1009.0	0.2
01Jan2018	23:15	0.2	0.3	1009.0	0.2
01Jan2018	23:30	0.2	0.3	1009.0	0.2
01Jan2018	23:45	0.2	0.3	1009.0	0.2
02Jan2018	00:00	0.2	0.3	1009.0	0.2
02Jan2018	00:15	0.0	0.3	1009.0	0.1



Reservoir "Detention Basin" Results for Run "10 Year Existing"
Storage (AC-FT)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1,007.00
1,007.39
1,007.78
1,008.17
1,008.56
1,008.94
1,009.33
1,009.72
1,010.11
1,010.50
Flow (cfs)
0
5
10
15
20
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
01Jan2018
Run:10 Year Existing Element:Detention Basin Result:Storage
Run:10 Year Existing Element:Detention Basin Result:Pool Elevation
Run:10 Year Existing Element:Detention Basin Result:Outflow
Run:10 Year Existing Element:Detention Basin Result:Combined Inflow

Project: ELS Simulation Run: 10 Year Existing
Reservoir: Detention Basin

Start of Run: 01Jan2018, 00:00 Basin Model: Proposed
End of Run: 02Jan2018, 00:15 Meteorologic Model: 10-Year
Compute Time: 15Aug2018, 17:26:07 Control Specifications: Control 1

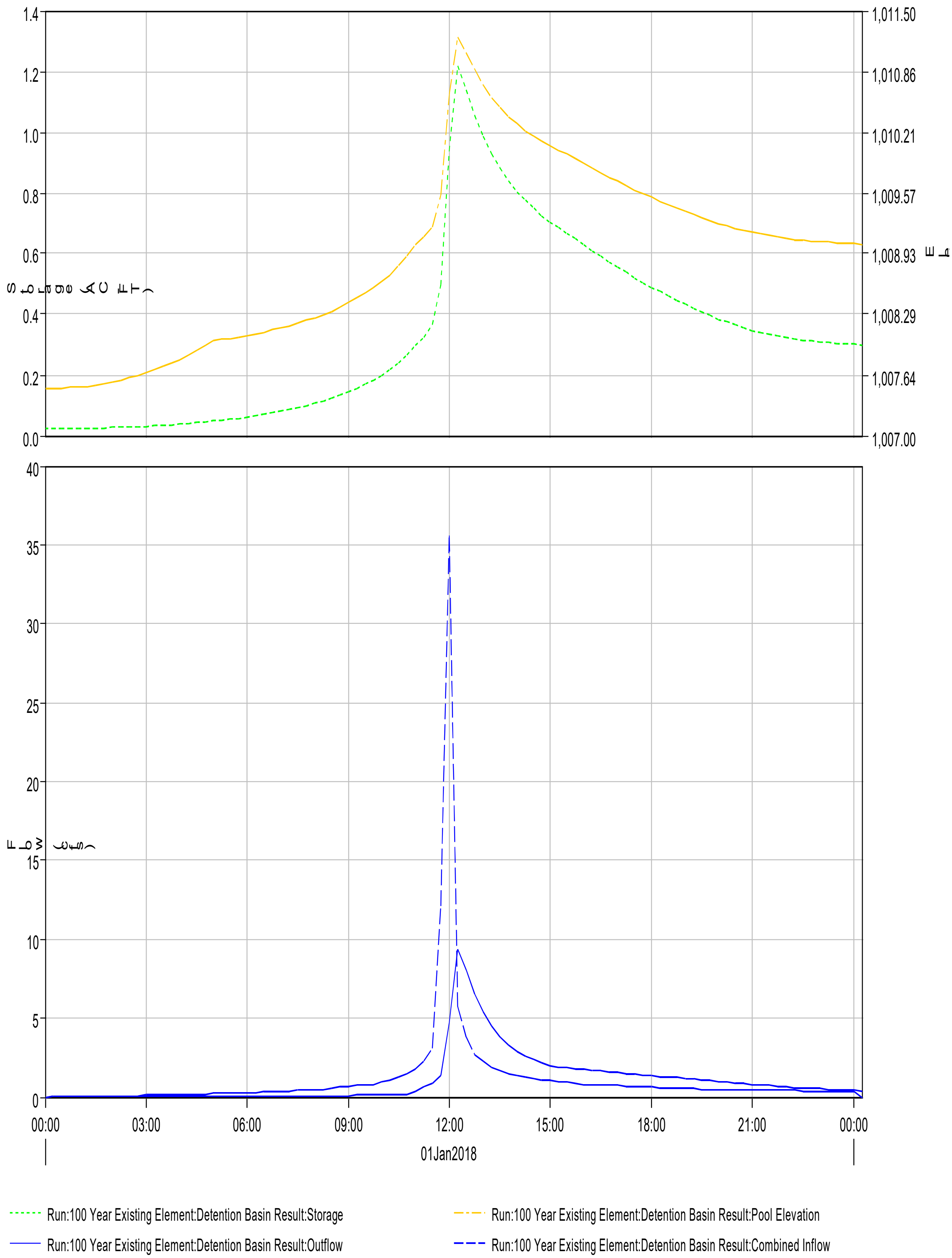
Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2018	00:00	0.0	0.0	1007.5	0.0
01Jan2018	00:15	0.0	0.0	1007.5	0.0
01Jan2018	00:30	0.0	0.0	1007.5	0.0
01Jan2018	00:45	0.0	0.0	1007.5	0.0
01Jan2018	01:00	0.0	0.0	1007.5	0.0
01Jan2018	01:15	0.0	0.0	1007.5	0.0
01Jan2018	01:30	0.0	0.0	1007.5	0.0
01Jan2018	01:45	0.0	0.0	1007.5	0.0
01Jan2018	02:00	0.0	0.0	1007.5	0.0
01Jan2018	02:15	0.0	0.0	1007.5	0.0
01Jan2018	02:30	0.0	0.0	1007.5	0.0
01Jan2018	02:45	0.1	0.0	1007.6	0.0
01Jan2018	03:00	0.1	0.0	1007.6	0.0
01Jan2018	03:15	0.1	0.0	1007.6	0.0
01Jan2018	03:30	0.1	0.0	1007.6	0.0
01Jan2018	03:45	0.1	0.0	1007.6	0.0
01Jan2018	04:00	0.1	0.0	1007.6	0.0
01Jan2018	04:15	0.1	0.0	1007.7	0.0
01Jan2018	04:30	0.1	0.0	1007.7	0.0
01Jan2018	04:45	0.1	0.0	1007.7	0.0
01Jan2018	05:00	0.1	0.0	1007.7	0.0
01Jan2018	05:15	0.1	0.0	1007.8	0.1
01Jan2018	05:30	0.1	0.0	1007.8	0.1
01Jan2018	05:45	0.1	0.0	1007.8	0.1
01Jan2018	06:00	0.2	0.0	1007.9	0.1
01Jan2018	06:15	0.2	0.0	1007.9	0.1

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2018	06:30	0.2	0.0	1007.9	0.1
01Jan2018	06:45	0.2	0.0	1008.0	0.1
01Jan2018	07:00	0.2	0.0	1008.0	0.1
01Jan2018	07:15	0.2	0.1	1008.0	0.1
01Jan2018	07:30	0.2	0.1	1008.0	0.1
01Jan2018	07:45	0.2	0.1	1008.0	0.1
01Jan2018	08:00	0.2	0.1	1008.1	0.1
01Jan2018	08:15	0.3	0.1	1008.1	0.1
01Jan2018	08:30	0.3	0.1	1008.1	0.1
01Jan2018	08:45	0.4	0.1	1008.1	0.1
01Jan2018	09:00	0.4	0.1	1008.1	0.1
01Jan2018	09:15	0.4	0.1	1008.2	0.1
01Jan2018	09:30	0.4	0.1	1008.2	0.1
01Jan2018	09:45	0.5	0.1	1008.2	0.1
01Jan2018	10:00	0.5	0.1	1008.3	0.1
01Jan2018	10:15	0.6	0.1	1008.3	0.1
01Jan2018	10:30	0.7	0.1	1008.4	0.1
01Jan2018	10:45	0.9	0.1	1008.4	0.1
01Jan2018	11:00	1.1	0.2	1008.5	0.1
01Jan2018	11:15	1.4	0.2	1008.6	0.1
01Jan2018	11:30	1.9	0.2	1008.7	0.1
01Jan2018	11:45	7.6	0.3	1009.1	0.6
01Jan2018	12:00	23.1	0.6	1009.8	1.7
01Jan2018	12:15	3.8	0.8	1010.4	3.3
01Jan2018	12:30	2.5	0.8	1010.4	3.2
01Jan2018	12:45	1.8	0.8	1010.3	3.0
01Jan2018	13:00	1.5	0.8	1010.3	2.7
01Jan2018	13:15	1.3	0.8	1010.2	2.5
01Jan2018	13:30	1.1	0.7	1010.2	2.3
01Jan2018	13:45	1.0	0.7	1010.1	2.1
01Jan2018	14:00	0.9	0.7	1010.0	1.9

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2018	14:15	0.8	0.7	1010.0	1.8
01Jan2018	14:30	0.8	0.7	1009.9	1.8
01Jan2018	14:45	0.7	0.6	1009.9	1.7
01Jan2018	15:00	0.7	0.6	1009.8	1.7
01Jan2018	15:15	0.7	0.6	1009.8	1.6
01Jan2018	15:30	0.6	0.6	1009.7	1.6
01Jan2018	15:45	0.6	0.5	1009.7	1.5
01Jan2018	16:00	0.5	0.5	1009.6	1.5
01Jan2018	16:15	0.5	0.5	1009.6	1.4
01Jan2018	16:30	0.5	0.5	1009.5	1.4
01Jan2018	16:45	0.5	0.5	1009.5	1.3
01Jan2018	17:00	0.5	0.5	1009.4	1.3
01Jan2018	17:15	0.5	0.4	1009.4	1.2
01Jan2018	17:30	0.4	0.4	1009.4	1.2
01Jan2018	17:45	0.4	0.4	1009.3	1.1
01Jan2018	18:00	0.4	0.4	1009.3	1.0
01Jan2018	18:15	0.4	0.4	1009.3	1.0
01Jan2018	18:30	0.4	0.4	1009.2	0.9
01Jan2018	18:45	0.4	0.4	1009.2	0.9
01Jan2018	19:00	0.4	0.4	1009.2	0.8
01Jan2018	19:15	0.3	0.3	1009.1	0.8
01Jan2018	19:30	0.3	0.3	1009.1	0.7
01Jan2018	19:45	0.3	0.3	1009.1	0.7
01Jan2018	20:00	0.3	0.3	1009.1	0.6
01Jan2018	20:15	0.3	0.3	1009.1	0.6
01Jan2018	20:30	0.3	0.3	1009.1	0.5
01Jan2018	20:45	0.3	0.3	1009.0	0.5
01Jan2018	21:00	0.3	0.3	1009.0	0.4
01Jan2018	21:15	0.3	0.3	1009.0	0.4
01Jan2018	21:30	0.3	0.3	1009.0	0.4
01Jan2018	21:45	0.3	0.3	1009.0	0.4

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2018	22:00	0.3	0.3	1009.0	0.3
01Jan2018	22:15	0.3	0.3	1009.0	0.3
01Jan2018	22:30	0.3	0.3	1009.0	0.3
01Jan2018	22:45	0.3	0.3	1009.0	0.3
01Jan2018	23:00	0.3	0.3	1009.0	0.3
01Jan2018	23:15	0.3	0.3	1009.0	0.3
01Jan2018	23:30	0.3	0.3	1009.0	0.3
01Jan2018	23:45	0.3	0.3	1009.0	0.3
02Jan2018	00:00	0.3	0.3	1009.0	0.3
02Jan2018	00:15	0.0	0.3	1009.0	0.2

Reservoir "Detention Basin" Results for Run "100 Year Existing"



Project: ELS Simulation Run: 100 Year Existing
Reservoir: Detention Basin

Start of Run: 01Jan2018, 00:00 Basin Model: Proposed
End of Run: 02Jan2018, 00:15 Meteorologic Model: 100-Year
Compute Time: 15Aug2018, 17:26:10 Control Specifications: Control 1

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2018	00:00	0.0	0.0	1007.5	0.0
01Jan2018	00:15	0.0	0.0	1007.5	0.0
01Jan2018	00:30	0.0	0.0	1007.5	0.0
01Jan2018	00:45	0.0	0.0	1007.5	0.0
01Jan2018	01:00	0.0	0.0	1007.5	0.0
01Jan2018	01:15	0.0	0.0	1007.5	0.0
01Jan2018	01:30	0.0	0.0	1007.5	0.0
01Jan2018	01:45	0.1	0.0	1007.6	0.0
01Jan2018	02:00	0.1	0.0	1007.6	0.0
01Jan2018	02:15	0.1	0.0	1007.6	0.0
01Jan2018	02:30	0.1	0.0	1007.6	0.0
01Jan2018	02:45	0.1	0.0	1007.6	0.0
01Jan2018	03:00	0.1	0.0	1007.7	0.0
01Jan2018	03:15	0.1	0.0	1007.7	0.0
01Jan2018	03:30	0.1	0.0	1007.7	0.1
01Jan2018	03:45	0.1	0.0	1007.8	0.1
01Jan2018	04:00	0.2	0.0	1007.8	0.1
01Jan2018	04:15	0.2	0.0	1007.9	0.1
01Jan2018	04:30	0.2	0.0	1007.9	0.1
01Jan2018	04:45	0.2	0.0	1008.0	0.1
01Jan2018	05:00	0.2	0.0	1008.0	0.1
01Jan2018	05:15	0.2	0.1	1008.0	0.1
01Jan2018	05:30	0.2	0.1	1008.0	0.1
01Jan2018	05:45	0.3	0.1	1008.0	0.1
01Jan2018	06:00	0.3	0.1	1008.1	0.1
01Jan2018	06:15	0.3	0.1	1008.1	0.1

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2018	06:30	0.3	0.1	1008.1	0.1
01Jan2018	06:45	0.3	0.1	1008.1	0.1
01Jan2018	07:00	0.4	0.1	1008.1	0.1
01Jan2018	07:15	0.4	0.1	1008.2	0.1
01Jan2018	07:30	0.4	0.1	1008.2	0.1
01Jan2018	07:45	0.4	0.1	1008.2	0.1
01Jan2018	08:00	0.4	0.1	1008.2	0.1
01Jan2018	08:15	0.5	0.1	1008.3	0.1
01Jan2018	08:30	0.5	0.1	1008.3	0.1
01Jan2018	08:45	0.6	0.1	1008.4	0.1
01Jan2018	09:00	0.7	0.1	1008.4	0.1
01Jan2018	09:15	0.7	0.2	1008.5	0.1
01Jan2018	09:30	0.7	0.2	1008.5	0.1
01Jan2018	09:45	0.8	0.2	1008.6	0.1
01Jan2018	10:00	0.9	0.2	1008.6	0.1
01Jan2018	10:15	1.1	0.2	1008.7	0.1
01Jan2018	10:30	1.2	0.2	1008.8	0.1
01Jan2018	10:45	1.5	0.3	1008.9	0.1
01Jan2018	11:00	1.8	0.3	1009.0	0.4
01Jan2018	11:15	2.3	0.3	1009.1	0.7
01Jan2018	11:30	3.0	0.4	1009.2	0.9
01Jan2018	11:45	12.1	0.5	1009.5	1.4
01Jan2018	12:00	35.6	0.9	1010.6	4.7
01Jan2018	12:15	5.8	1.2	1011.2	9.4
01Jan2018	12:30	3.8	1.1	1011.1	8.0
01Jan2018	12:45	2.7	1.1	1010.9	6.6
01Jan2018	13:00	2.3	1.0	1010.7	5.4
01Jan2018	13:15	1.9	0.9	1010.6	4.5
01Jan2018	13:30	1.7	0.9	1010.5	3.8
01Jan2018	13:45	1.5	0.8	1010.4	3.3
01Jan2018	14:00	1.3	0.8	1010.3	2.9

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2018	14:15	1.2	0.8	1010.2	2.6
01Jan2018	14:30	1.1	0.7	1010.2	2.3
01Jan2018	14:45	1.1	0.7	1010.1	2.1
01Jan2018	15:00	1.0	0.7	1010.1	2.0
01Jan2018	15:15	1.0	0.7	1010.0	1.9
01Jan2018	15:30	0.9	0.7	1010.0	1.8
01Jan2018	15:45	0.9	0.6	1009.9	1.8
01Jan2018	16:00	0.8	0.6	1009.9	1.7
01Jan2018	16:15	0.8	0.6	1009.8	1.7
01Jan2018	16:30	0.8	0.6	1009.8	1.6
01Jan2018	16:45	0.7	0.6	1009.7	1.6
01Jan2018	17:00	0.7	0.6	1009.7	1.6
01Jan2018	17:15	0.7	0.5	1009.6	1.5
01Jan2018	17:30	0.7	0.5	1009.6	1.5
01Jan2018	17:45	0.6	0.5	1009.6	1.4
01Jan2018	18:00	0.6	0.5	1009.5	1.4
01Jan2018	18:15	0.6	0.5	1009.5	1.3
01Jan2018	18:30	0.6	0.5	1009.4	1.3
01Jan2018	18:45	0.6	0.4	1009.4	1.2
01Jan2018	19:00	0.5	0.4	1009.4	1.2
01Jan2018	19:15	0.5	0.4	1009.3	1.1
01Jan2018	19:30	0.5	0.4	1009.3	1.1
01Jan2018	19:45	0.5	0.4	1009.3	1.0
01Jan2018	20:00	0.5	0.4	1009.2	1.0
01Jan2018	20:15	0.4	0.4	1009.2	0.9
01Jan2018	20:30	0.4	0.4	1009.2	0.9
01Jan2018	20:45	0.4	0.4	1009.2	0.8
01Jan2018	21:00	0.4	0.3	1009.2	0.8
01Jan2018	21:15	0.4	0.3	1009.1	0.8
01Jan2018	21:30	0.4	0.3	1009.1	0.7
01Jan2018	21:45	0.4	0.3	1009.1	0.7

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2018	22:00	0.4	0.3	1009.1	0.6
01Jan2018	22:15	0.4	0.3	1009.1	0.6
01Jan2018	22:30	0.4	0.3	1009.1	0.6
01Jan2018	22:45	0.4	0.3	1009.1	0.5
01Jan2018	23:00	0.4	0.3	1009.1	0.5
01Jan2018	23:15	0.4	0.3	1009.0	0.5
01Jan2018	23:30	0.4	0.3	1009.0	0.5
01Jan2018	23:45	0.4	0.3	1009.0	0.5
02Jan2018	00:00	0.4	0.3	1009.0	0.4
02Jan2018	00:15	0.0	0.3	1009.0	0.4