

**PRELIMINARY STORM WATER
MANAGEMENT STUDY**

MCPL - COLBERN ROAD BRANCH REMODEL

1000 NORTHEAST COLBERN ROAD
LIBERTY, MISSOURI

**PREPARED FOR
MID-CONTINENT PUBLIC LIBRARY**

**PREPARED BY
OLSSON, INC.
OLATHE, KANSAS**



**NOVEMBER, 2019
(REVISED DECEMBER, 2019)**

OLSSON PROJECT No. B18-0330.182

7301 W. 133rd Street, Ste. 200 • , Overland Park, KS 66213 • (913) 381-1170



MCPL – Colbern Road Branch Remodel Stormwater Management Study

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MCPL – Colbern Road Branch Remodel

Stormwater Management Study

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MCPL – Colbern Road Branch Remodel Stormwater Management Study

GENERAL INFORMATION

This Stormwater Management Study is being submitted on behalf of the Mid-Continent Public Library (MCPL) for the proposed remodel and expansion of the existing Colbern Road Branch Library facility located at 1000 Northeast Colbern Road in Lee's Summit, Missouri.

Project Location and Description

The site is located on Lot 1 of the Rice Acres Plat in the Northeast ¼ of Section 29, Township 48 North, Range 31 West, in Jackson County, Lee's Summit, Missouri. Currently the site is 2.9 acres, however, the MCPL has acquired an additional 100' of the unplatted property to the east for a total of 4.0 acres (See Exhibit 1 – Appendix A).

Retail businesses surround the project to the south, while undeveloped properties are located to the west, north, and east. The proposed remodeled plans anticipate on demolishing the existing 18,000 sf. library facility and constructing a new library facility that will be approximately 34,000 sf. The improvements will consists of the expanding the existing parking lot, developing landscaping, updating grading, utilities.

The entirety of the existing and acquired sites are located outside of the 100-Year FEMA Floodplain (See Appendix B).

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.

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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:

10128 – Sharpsburg-Urban Land Complex, 2 to 5 percent slopes – HSG Type D.

*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's, Post-development discharge rates for the 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 utilized when calculating the times that were under five minutes. This method was also applied during the calculation of the proposed times of concentration.

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HYDROLOGIC/HYDRAULIC ANALYSES

Existing Conditions Analysis

The existing site is currently functioning as a branch for MCPL. The acquired property to the east is undeveloped, along with the properties to the west and north. The property is also bounded by retail businesses to the south.

Current runoff for the existing library is collected by roof drains and flumes in the parking lot that directs the water to an existing detention basin on the east side of the site. The roof drains are piped to the basin as well. The current drainage patterns consist of the paved parking area that drains to southeastern flumes, that then drain to a swale, that directs the flow to the basin. The basin is connected to an existing public storm line (existing Outfall “A”) on the north side of Colbern Road that drains to the east to unnamed tributary (See Exhibit 2 – Appendix A).

The existing basin is not clearly defined, and the outflow structure is in disrepair. It seems to still function, but no clear indication of existing storage volume or outflow.

There is an existing swale on the western edge of the property as well. This swale diverts runoff from the undeveloped property west of the site to north along the existing curb. After this, the swale turns to the northeast. This is where the runoff flows to the neighboring undeveloped property.

With the comprehensive control method is being used for drainage design, an existing curve number analysis is not required for the site. For the purpose of these calculations, the analysis will treat the site as if the existing building and parking were not there.

Proposed Conditions Analysis

A new 34,000 SF library will be constructed on the site. The parking area will also be increased to accommodate the larger building. The Stormwater Management Plan noted as Exhibit 3 in Appendix A shows the proposed improvements. The location of the building

MCPL – Colbern Road Branch Remodel Stormwater Management Study

and the parking area will essentially remain in the same configuration. Along with this, the site drainage patterns will remain the same as existing. The additional site runoff will be captured by an enclosed storm sewer system. The increase in impervious area will increase runoff from the site and to mitigate the increase in runoff, the following strategy will be implemented.

Outfall A – All impervious areas for site will drain to the enclosed storm system and be directed into a new 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. The site areas being directed to the basin includes the roof drains, the parking area, and the detention basin itself (approximately 3.2 acres). A control structure located within the basin will limit the 2, 10, and 100-year storm events to the comprehensive control levels.

Table 1: Post-Development Curve Number Analysis

Sub-Area	Area (AC)	Soil Group	Curve Number
Pavement, Buildings, Impervious	2.5	D	98
Turf (Good)	1.0	D	80

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 2. Detailed reports from HEC-HMS are available in Appendix D

Table 2: Proposed Peak Flows

Sub-Area / Outfall	Tributary Area (acres)	Q (1-Year Storm) (cfs)	Q (10-Year Storm) (cfs)	Q (100-Year Storm) (cfs)
Outfall A	3.5	10.8	21.6	30.7

In order to maintain the existing flow patterns on the west side of the property, the existing swale will be extended north to the edge of the proposed service area. The extended

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swale will continue to divert the off-site runoff from the west to the undeveloped property to the north of the site. It is assumed that when the future public road is constructed on the west side of the site, runoff from the off-site area will be collected in a public storm system.

Stormwater Detention Requirements

As stated previously, a new detention pond will be constructed to mitigate the increase in flow due to the increase in impervious area. The detention basin will be located on the east side of the site and will collect runoff from 3.2 acres of the 4.0 acre property. This includes most of the impervious areas through a series of inlets, yard drains, roof drains, and underground pipes. 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 drainage from the southeast corner of the parking lot (0.3 ac) will be collected in a curb inlet. This runoff will not be detained. The inlet is connected downstream of the control structure by the outlet pipe from the basin. It will combine with the outflow from the basin. The control structure was designed to over-detain the runoff collected in the basin. Therefore, the combined flow will not exceed the allowable release rate. HEC-HMS was used to route the storms as they enter the underground system. Hydrographs for the combined flows of the detained and undetained areas are shown in Appendix D.

To meet water treatment requirements, 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.

Two areas from the 4.0-acre property will not be detained. The entrance drive and median (0.39 acres post-construction) on Colbern Road flow to the public storm system in the road. This drainage pattern is essentially unchanged in the pre and post construction phases. There is also 0.12 acres on the north and eastern edge of the pervious vegetated areas that will not be detained, because they will have no impact on the neighboring property.

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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 place at a higher elevation in the control structure. The dam will have an emergency spillway to control the 100-year overflow.

Table 3 provides the water surface elevations (WSE's) and peak flows for the proposed detention basin.

Table 3: Detention Basin, WSE's and Peak Flows

Description	Detention Basin
Bottom of Basin	958.5
Total Storage Volume	1.2 ac-ft
Top of Dam Elevation	965.5
WQv Orifice (IE Elevation, Pipe Size)	958.5, 2 – 1" (ft, # hole - diam)
Water Quality Volume WSE, Storage, Peak Outflow	960.8, 0.2, 0.08 (ft, ac-ft, cfs)
2-year & 10-Year Orifice (IE Elevation, Pipe Size)	960.8, 1-5" (ft, orifice size)
10-Year Storm WSE, Storage, Peak Outflow	962.2, 0.5, 4.8 (ft, ac-ft, cfs)
100-Year Storm Weir (Elevation, Length)	961.2, 3 (ft, lf)
100-Year Storm WSE, Storage, Peak Outflow	963.3, 0.7, 9.3 (ft, ac-ft, cfs)

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Table 4 shows the allowable peak flow for the site based on the Comprehensive Control Method.

Table 4: Allowable Peak Flows Based on Comprehensive Control

Sub-Area / Outfall	Tributary Area (acres)	Q (2-Year Storm) (cfs)	Q (10-Year Storm) (cfs)	Q (100-Year Storm) (cfs)
Outfall A	3.5	1.8	7.0	10.5

Table 5 shows the peak flow for the site post-construction. Note that the peak flows for post-construction construction condition are at or below the allowable peak flows shown in Table 4.

Table 5: Post Construction Peak Flows

Sub-Area / Outfall	Tributary Area (acres)	Q (2-Year Storm) (cfs)	Q (10-Year Storm) (cfs)	Q (100-Year Storm) (cfs)
Detained	3.2	1.3	4.8	9.3
Undetained	0.3	0.6	1.4	2.0
Outfall A	3.5	1.8	5.2	10.1

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 0.1 acre-ft reaching a peak water surface of elevation 960.8 feet.

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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. Lastly, an extended dry detention basin has been designed to maintain or improve the storm water quality. Based on these facts and other information provided herein, we request approval of this stormwater study.

Appendix A

Map Exhibits

MCPL - Colbern Road

Existing Conditions

EXHIBIT 1

Legend

 Mid-Continent Public Library



EXISTING BLDG
APPROX
18,000 SF

EXISTING
DETENTION
BASIN

ACQUIRED
LOT
(1.0 ACRES)

EXISTING LOT
(2.9 ACRES)

EXISTING
DETENTION
BASIN

EXISTING
PRIVATE
STORM

OUTFALL "A"

EXISTING
PUBLIC
STORM

Google Earth



EXISTING CONDITIONS

LEGEND

- SECTION CORNER
- SET 1/2"x24" REBAR W/ OLSSON CONTROL CAP
- FOUND REBAR
- FIRE HYDRANT
- WATER VALVE
- WATER METER
- WATER MANHOLE
- GAS METER
- STORM SEWER MANHOLE
- SANITARY SEWER MANHOLE
- SANITARY SEWER CLEANOUT
- ELECTRIC RISER
- ELECTRIC METER
- ELECTRIC TRANSFORMER
- ROOF DRAIN
- GAS LINE
- WATER LINE
- UNDERGROUND POWER LINE
- OVERHEAD POWER LINE
- UNDERGROUND FIBER OPTIC LINE
- SANITARY SEWER LINE
- STORM LINE
- FIBER OPTIC VAULT
- BRICK SUPPORT COLUMN
- GRATE INLET
- SIGN
- ACCESSIBLE PARKING SIGN
- POWER POLE
- LIGHT POLE
- YARD LIGHT
- AIR CONDITIONER
- DECIDUOUS TREE
- CONIFEROUS TREE
- BUSH
- TREE LINE
- GUY ANCHOR WIRE
- BUILDING LINE
- ASPH. ASPHALT
- AT&T AMERICAN TELEPHONE & TELEGRAPH
- BK. BOOK
- BLDG. BUILDING
- BMK. BENCHMARK
- CLF. CHAIN LINK FENCE
- CMP. CORRUGATED METAL PIPE
- CONC. CONCRETE
- CP. CONTROL POINT
- CPP. CORRUGATED PLASTIC PIPE
- CTL. CONTROL
- ELEV. ELEVATION
- ELR. ELECTRIC RISER
- FLOW LINE
- FF. FINISH FLOOR ELEVATION
- FND. FOUND
- HDWL. CONCRETE HEADWALL
- LSA. LANDSCAPE AREA
- MHR. METAL HANDRAIL
- PAGE. PAGE
- PTP. PEDESTRIAN TRACTION PAD
- PVC. POLYVINYL CHLORIDE PIPE
- R/W. RIGHT-OF-WAY
- RBCP. REBAR WITH CAP
- RCP. REINFORCED CONCRETE PIPE
- UG. UNDERGROUND
- W/. WITH
- (M). MEASURED DIMENSION - THIS SURVEY
- (P). PLATTED DIMENSION
- (N). NUMBER OF PARKING STALLS
- (S). ACCESSIBLE PARKING SPOT
- (*) DENOTES OA BENCHMARK

OFFSITE DRAINAGE IS DIVERTED AROUND SITE IN EXISTING SWALE

EXISTING DRAINAGE BASIN AND OUTFALL

EXISTING 0.42 ACRES DRAINS TO PUBLIC STORM

EXISTING OUTFALL "A"

CONTROL NOTES

Control: Horizontal & Vertical Control is based on the MoDOT Continuously Operating GNSS Network, Missouri Coordinate System 1983, West Zone, Metro Control Points BRAUN 3.
 Modified State Plane Coordinates, NAD 1983, Missouri West Zone. Using a CAF of 0.99990007 with Metro Control Point BRAUN 3 as a base point. Distances shown are Ground, US Survey Feet.
 NAVD 1988 Elevation Data - Calibrated to BRAUN
 BRAUN 3 (Calibration Point - 2003 Adjustments)
 KC Metro GRS Control Aluminum Disk, set in concrete flush with the ground and stamped BRAUN 3 1979.
 N: 310136.375 (m) N: 1017505.756 (ft)
 E: 862153.323 (m) E: 2828581.358 (ft)
 Elev.: 1,002.95'

QA CPT #100:
 Set 1/2" Rebar w/Cap "Olsson Survey Control Point"
 53'± North of the CL of NE Colbern Road, 600'± East of the CL of NE Rice Road, South of the SW corner of the asphalt parking lot to Mid-Continent Public Library Headquarters Building
 N: 1012118.718
 E: 2829254.651
 ELEV. = 973.40'
 Reference Ties:
 1. 28.30' North to the South back of curb of an asphalt parking lot for library.
 2. 28.50' Northwest to the center of a 15" Maple tree.
 3. 44.40' West-Southwest to a benchmark spike in the South face of a power pole.
 4. 7.50' North the South edge of a concrete sidewalk.

QA CPT #101:
 Set 1/2" Rebar, 367'± North of the CL of NE Colbern Road, 640'± East of the CL of NE Rice Road, NW of the NW corner of Mid-Continent Public Library
 N: 1012430.309
 E: 2829297.287
 ELEV. = 970.85'
 Reference Ties:
 1. 25.65' West to the center of an 18" Oak tree.
 2. 11.35' South to the center of a chain link fence corner post.
 3. 22.65' Southeast to the NW corner of the Mid-Continent Public Library Building.

QA CPT #102:
 Set 1/2" Rebar, 229'± North of the CL of NE Colbern Road, 845'± East of the CL of NE Rice Road, SE of the SE corner of Mid-Continent Public Library
 N: 1012285.799
 E: 2829504.378
 ELEV. = 967.96'
 Reference Ties:
 1. 15.00' West-Southwest to the back of curb at the NE corner of an asphalt parking lot at the South face of a concrete sidewalk.
 2. 36.70' South-Southwest to the center of a 20" Pine tree.
 3. 34.00' North-Northwest to the center of a 22" Ash tree.

Elevations Datum: NAVD 1988
 QA Bench Mark #1:
 (NAVD'88)
 Set Railroad Spike in the South face of a power pole at the SW corner of the Mid-Continent Public Library Building. 51'± North of the CL of NE Colbern Road, 565'± East of the CL of NE Rice Road. Elevation=976.04'

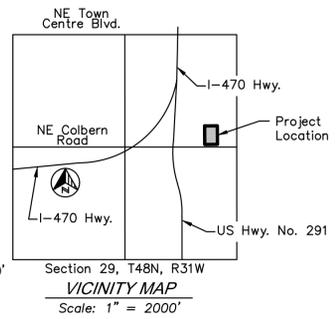
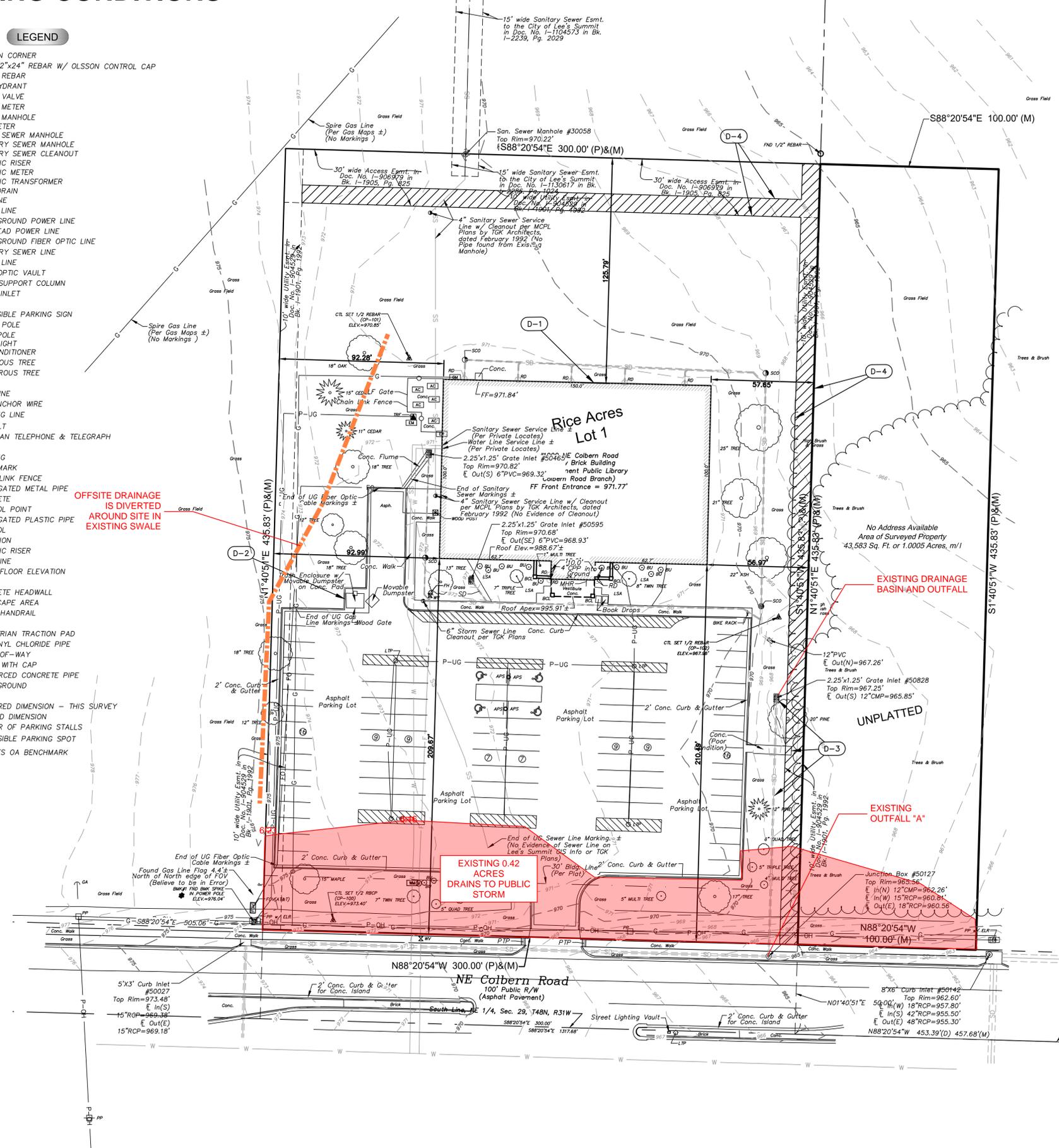
UTILITY NOTES

Utilities shown have been located from field survey information, together with obtained records. The Surveyor makes no guarantee that the utilities shown comprise all such utilities in the area, either in-service or abandoned. The Surveyor further does not warrant that the utilities shown are in the exact location indicated. Locates are in compliance with Subsurface Utility Engineering Quality Level "B", and were through the Missouri One-Call System.
 Private utilities were located by ECHO GPR Services, 24564 Lackman Road, Paola, Kansas, 66071, Phone Number 913-879-2200.
 Utilities were ordered to be located through Missouri One Call per One-Call Ticket #192121471. The companies listed on the ticket are: AT&T Distribution, City of Lee's Summit Fiber, City of Lee's Summit Sewer, City of Lee's Summit Storm, City of Lee's Summit Water, Comcast Communications, Google Fiber, Kansas City Power & Light, Spectrum (Formerly Time Warner Cable) and Spire Missouri West.

Notes:
 1.) Any boundary or easement information shown is for graphical purposes only, and is not to be relied upon for exact locations.
 2.) The sanitary sewer does NOT connect to the sewer manhole North of the library as per the MCPL Plans by T&K Architects, dated February 1992 (No Pipe found from Existing Manhole). The underground storm drainage system is also per the MCPL Plans by T&K Architects, dated February 1992.

DEMOLITION KEYNOTES: xx

D-1 EXISTING BUILDING TO BE REMOVED
 D-2 EXISTING TRASH ENCLOSURE TO BE REMOVED
 D-3 EXISTING STORM TO BE REMOVED AND ABANDONED
 D-4 EXISTING UTILITY EASEMENT TO BE VACATED



SAPP DESIGN ARCHITECTS

3750 S. Fremont Ave.
 Springfield, MO 65804 417.877.9600

Sapp Design Associates Architects, P.C.
 Missouri State Certificate of Authority #0020607

helix.

1629 Walnut
 Kansas City, MO 64108 816.300.0300

SPECIAL NOTICES

In the event the client consents to allow, authorize or approve 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 the design professional from any liability arising from the construction, use or result of such changes. In addition, the client agrees to 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 wherever used, and the use of the seal shall authorize the use of the design professional's name on any documents or instruments relating to or intended to be used for any part or parts of the architectural project.

PRELIMINARY DEVELOPMENT PLANS FOR COLBERN ROAD BRANCH

1000 N.E. COLBERN ROAD
 LEE'S SUMMIT, MO 64086
 JACKSON COUNTY

PACKAGE 10

Mid-Continent Public Library
 PRELIMINARY DEVELOPMENT PLAN
 NOT FOR CONSTRUCTION
 12.10.19

olsson

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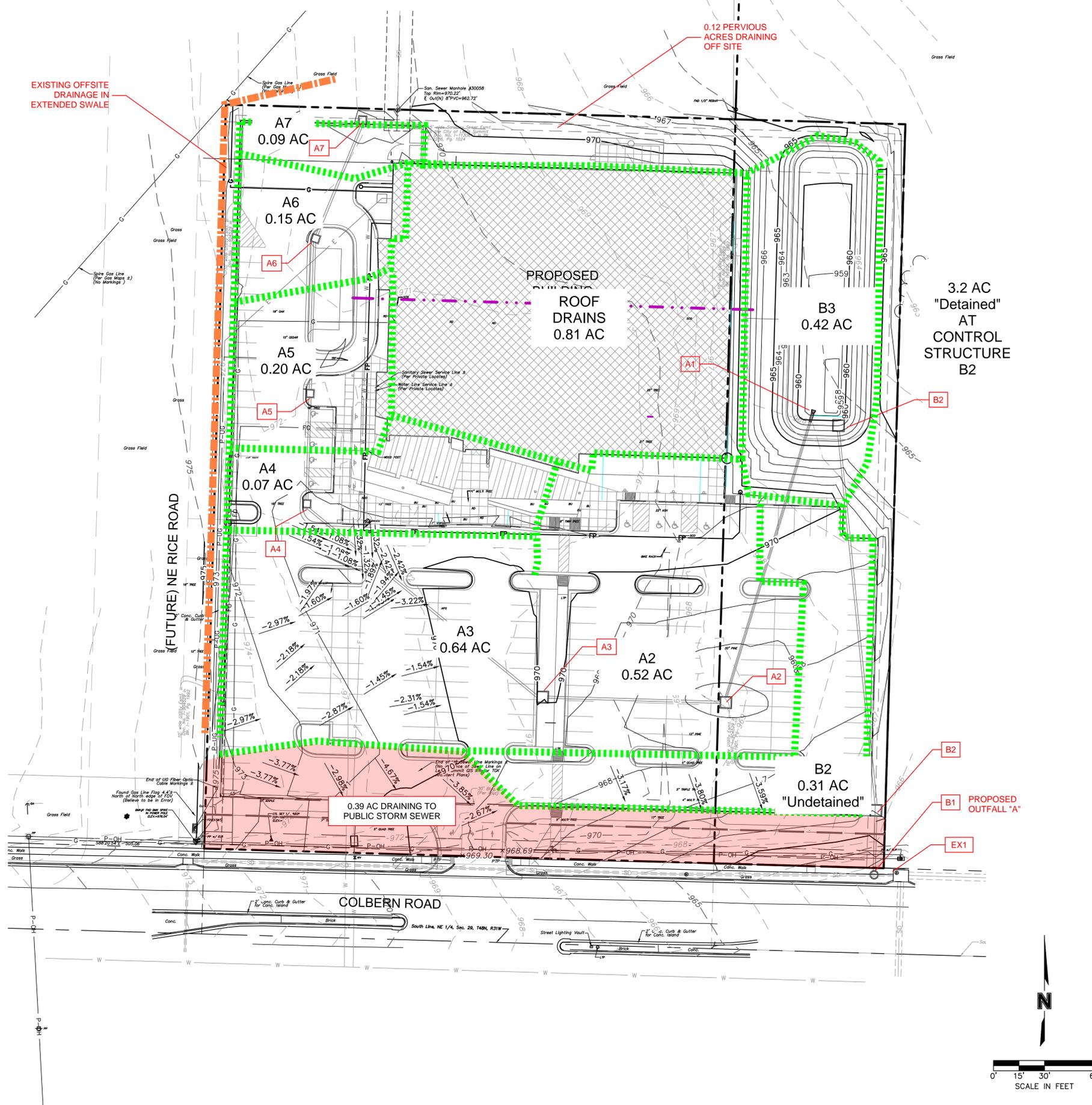
Olsson Missouri State Certificate of Authority #001592

Revision No.	Description	Date

Project No. B18-0330 Date 09-18-18 Drawn KDP
 Drawing No.

EXHIBIT 2

STORMWATER MANAGEMENT PLAN



EXISTING CONDITIONS LEGEND

- — — — — PROPERTY LINES
- — — — — RIGHT-OF-WAY LINES
- — — — — EASEMENT LINES
- P-OH ——— OVERHEAD ELECTRIC
- P-UG ——— UNDERGROUND ELECTRIC
- TEL ——— UNDERGROUND TELEPHONE
- FO ——— UNDERGROUND FIBER OPTIC
- G ——— GAS LINE
- W ——— WATER LINE
- SS ——— STORM SEWER LINE
- SS ——— SANITARY SEWER LINE

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

SAPP DESIGN ARCHITECTS

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Kansas City, MO 64108 816.300.0300

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The personal seal of the registered Architect or Engineer shall be the legal equivalent of his signature wherever & whenever 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
PRELIMINARY DEVELOPMENT PLANS FOR
COLBERN ROAD BRANCH
1000 N.E. COLBERN ROAD
LEE'S SUMMIT, MO 64086
JACKSON COUNTY

PACKAGE
10

Engineer of Record
PRELIMINARY DEVELOPMENT PLAN
NOT FOR CONSTRUCTION
12.10.19
Terry M Parsons, Engineer MO PE-2018010505

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Olsson
Missouri State Certificate of Authority #001592

Revision No.	Description	Date

Project No.	Date	Drawn
B18-0330	09-18-18	KDP

Drawing No.

EXHIBIT 3

DWG: F:\2018\0001-0500\018-0330-B140-Design\AutoCAD\Pre\liminary Plans\Sheets\GNCV\WORK PACKAGE 10\C_GRD_0180330.dwg USER: bkmmich
 DATE: Dec 09, 2019 2:30pm XREFS: C:\TBLK_018330 C:\PBASE_018330 C:\XBASE_018330 C:\PSURF_018330 C:\PBASE_161023 A_PBASE_0161023

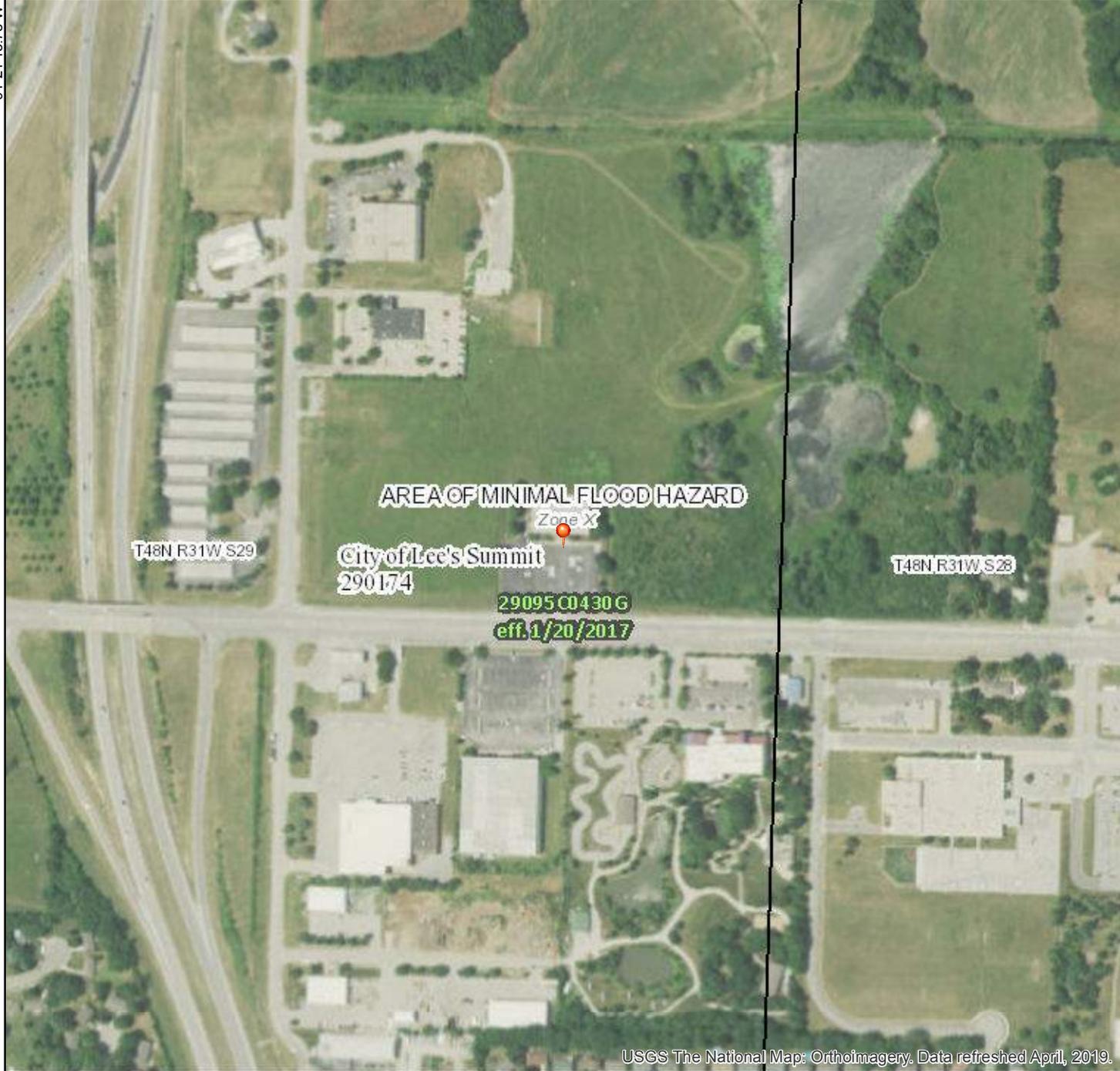
Appendix B

FEMA Flood Classification Firm

National Flood Hazard Layer FIRMette



38°57'2.45"N



Legend

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

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) <i>Zone A, V, A99</i>
		With BFE or Depth <i>Zone AE, AO, AH, VE, AR</i>
		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 <i>Zone X</i>
		Future Conditions 1% Annual Chance Flood Hazard <i>Zone X</i>
		Area with Reduced Flood Risk due to Levee. See Notes. <i>Zone X</i>
		Area with Flood Risk due to Levee <i>Zone D</i>

OTHER AREAS		Area of Minimal Flood Hazard <i>Zone X</i>
		Effective LOMRs
		Area of Undetermined Flood Hazard <i>Zone D</i>

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

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

MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped

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 **10/30/2019 at 10:40:35 AM** 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.



USGS The National Map: Orthoimagery. Data refreshed April, 2019.

38°56'34.47"N

94°21'43.78"W

94°21'6.32"W



Appendix C

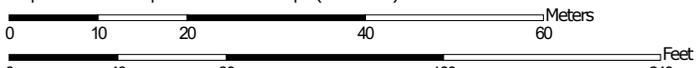
Soil Map

Soil Map—Jackson County, Missouri
(SOILS SURVEY)



Soil Map may not be valid at this scale.

Map Scale: 1:844 if printed on A landscape (11" x 8.5") sheet.



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



Jackson County, Missouri

10128—Sharpsburg-Urban land complex, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2q109

Elevation: 1,000 to 1,300 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: All areas are prime farmland

Map Unit Composition

Sharpsburg and similar soils: 60 percent

Urban land: 35 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sharpsburg

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

A - 0 to 17 inches: silt loam

Bt - 17 to 55 inches: silty clay loam

C - 55 to 60 inches: silty clay loam

Properties and qualities

Slope: 2 to 5 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Moderately well drained

Runoff class: 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 24 to 35 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: Very high (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2e

Hydrologic Soil Group: D

Ecological site: Loess Upland Prairie (R109XY002MO)
Other vegetative classification: Grass/Prairie (Herbaceous Vegetation)
Hydric soil rating: No

Description of Urban Land

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve

Interpretive groups

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

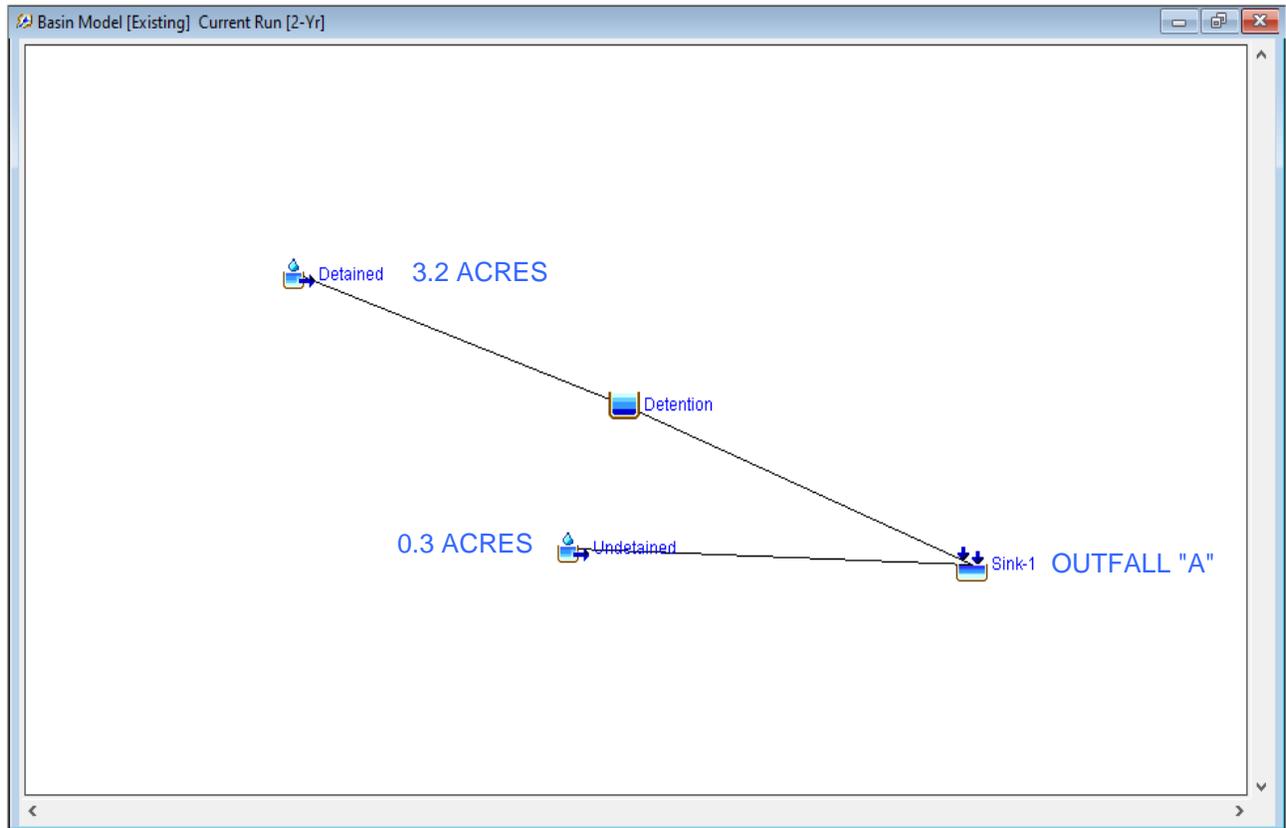
Data Source Information

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

Appendix D

Drainage and Detention Calculations

MCPL COLBERN ROAD BRANCH
HEC-HMS
BASIN MODEL



MCPL COLBERN ROAD BRANCH HEC-HMS

PEAK FLOWS TO PROPOSED OUTFALL "A"

Summary Results for Sink "Sink-1"

Project: Colbern Road
Simulation Run: 2-Yr Sink: Sink-1

Start of Run: 01Jan2019, 00:00 Basin Model: Existing
End of Run: 02Jan2019, 00:02 Meteorologic Model: 2-Yr
Compute Time: 10Dec2019, 06:19:10 Control Specifications: Control 1

Volume Units: IN AC-FT

Computed Results

Peak Outflow : 1.8 (CFS) Date/Time of Peak Outflow : 01Jan2019, 11:56
Total Outflow : 2.01 (IN)

Summary Results for Sink "Sink-1"

Project: Colbern Road
Simulation Run: 100-Yr Sink: Sink-1

Start of Run: 01Jan2019, 00:00 Basin Model: Existing
End of Run: 02Jan2019, 00:02 Meteorologic Model: 100-Yr
Compute Time: 10Dec2019, 06:19:08 Control Specifications: Control 1

Volume Units: IN AC-FT

Computed Results

Peak Outflow : 10.1 (CFS) Date/Time of Peak Outflow : 01Jan2019, 12:00
Total Outflow : 6.55 (IN)

Summary Results for Sink "Sink-1"

Project: Colbern Road
Simulation Run: 10-Yr Sink: Sink-1

Start of Run: 01Jan2019, 00:00 Basin Model: Existing
End of Run: 02Jan2019, 00:02 Meteorologic Model: 10-Yr
Compute Time: 10Dec2019, 06:19:09 Control Specifications: Control 1

Volume Units: IN AC-FT

Computed Results

Peak Outflow : 5.2 (CFS) Date/Time of Peak Outflow : 01Jan2019, 12:00
Total Outflow : 4.40 (IN)

PEAK FLOWS FOR UNDETAINED AREA

Summary Results for Subbasin "Undetained"

Project: Colbern Road
Simulation Run: 2-Yr Subbasin: Undetained

Start of Run: 01Jan2019, 00:00 Basin Model: Existing
End of Run: 02Jan2019, 00:02 Meteorologic Model: 2-Yr
Compute Time: 10Dec2019, 06:19:10 Control Specifications: Control 1

Volume Units: IN AC-FT

Computed Results

Peak Discharge : 0.6 (CFS) Date/Time of Peak Discharge : 01Jan2019, 11:54
Total Precipitation : 2.70 (IN) Total Direct Runoff : 1.97 (IN)
Total Loss : 0.73 (IN) Total Baseflow : 0.00 (IN)
Total Excess : 1.97 (IN) Discharge : 1.97 (IN)

Summary Results for Subbasin "Undetained"

Project: Colbern Road
Simulation Run: 100-Yr Subbasin: Undetained

Start of Run: 01Jan2019, 00:00 Basin Model: Existing
End of Run: 02Jan2019, 00:02 Meteorologic Model: 100-Yr
Compute Time: 10Dec2019, 06:19:08 Control Specifications: Control 1

Volume Units: IN AC-FT

Computed Results

Peak Discharge : 2.0 (CFS) Date/Time of Peak Discharge : 01Jan2019, 11:53
Total Precipitation : 7.40 (IN) Total Direct Runoff : 6.57 (IN)
Total Loss : 0.83 (IN) Total Baseflow : 0.00 (IN)
Total Excess : 6.57 (IN) Discharge : 6.57 (IN)

Summary Results for Subbasin "Undetained"

Project: Colbern Road
Simulation Run: 10-Yr Subbasin: Undetained

Start of Run: 01Jan2019, 00:00 Basin Model: Existing
End of Run: 02Jan2019, 00:02 Meteorologic Model: 10-Yr
Compute Time: 10Dec2019, 06:19:09 Control Specifications: Control 1

Volume Units: IN AC-FT

Computed Results

Peak Discharge : 1.4 (CFS) Date/Time of Peak Discharge : 01Jan2019, 11:53
Total Precipitation : 5.20 (IN) Total Direct Runoff : 4.39 (IN)
Total Loss : 0.81 (IN) Total Baseflow : 0.00 (IN)
Total Excess : 4.39 (IN) Discharge : 4.39 (IN)

MCPL COLBERN ROAD BRANCH HEC-HMS

PEAK FLOWS FOR DETAINED AREA

Summary Results for Reservoir "Detention"

Project: Colbern Road
Simulation Run: 2-Yr Reservoir: Detention

Start of Run: 01Jan2019, 00:00 Basin Model: Existing
End of Run: 02Jan2019, 00:02 Meteorologic Model: 2-Yr
Compute Time: 10Dec2019, 06:19:10 Control Specifications: Control 1

Volume Units: IN AC-FT

Computed Results

Peak Inflow : 9.2 (CFS)	Date/Time of Peak Inflow : 01Jan2019, 11:54
Peak Outflow : 1.3 (CFS)	Date/Time of Peak Outflow : 01Jan2019, 12:04
Total Inflow : 2.02 (IN)	Peak Storage : 0.3 (AC-FT)
Total Outflow : 2.01 (IN)	Peak Elevation : 961.0 (FT)

Summary Results for Reservoir "Detention"

Project: Colbern Road
Simulation Run: 100-Yr Reservoir: Detention

Start of Run: 01Jan2019, 00:00 Basin Model: Existing
End of Run: 02Jan2019, 00:02 Meteorologic Model: 100-Yr
Compute Time: 10Dec2019, 06:19:08 Control Specifications: Control 1

Volume Units: IN AC-FT

Computed Results

Peak Inflow : 29.4 (CFS)	Date/Time of Peak Inflow : 01Jan2019, 11:53
Peak Outflow : 9.3 (CFS)	Date/Time of Peak Outflow : 01Jan2019, 12:02
Total Inflow : 6.57 (IN)	Peak Storage : 0.7 (AC-FT)
Total Outflow : 6.55 (IN)	Peak Elevation : 963.3 (FT)

Summary Results for Reservoir "Detention"

Project: Colbern Road
Simulation Run: 10-Yr Reservoir: Detention

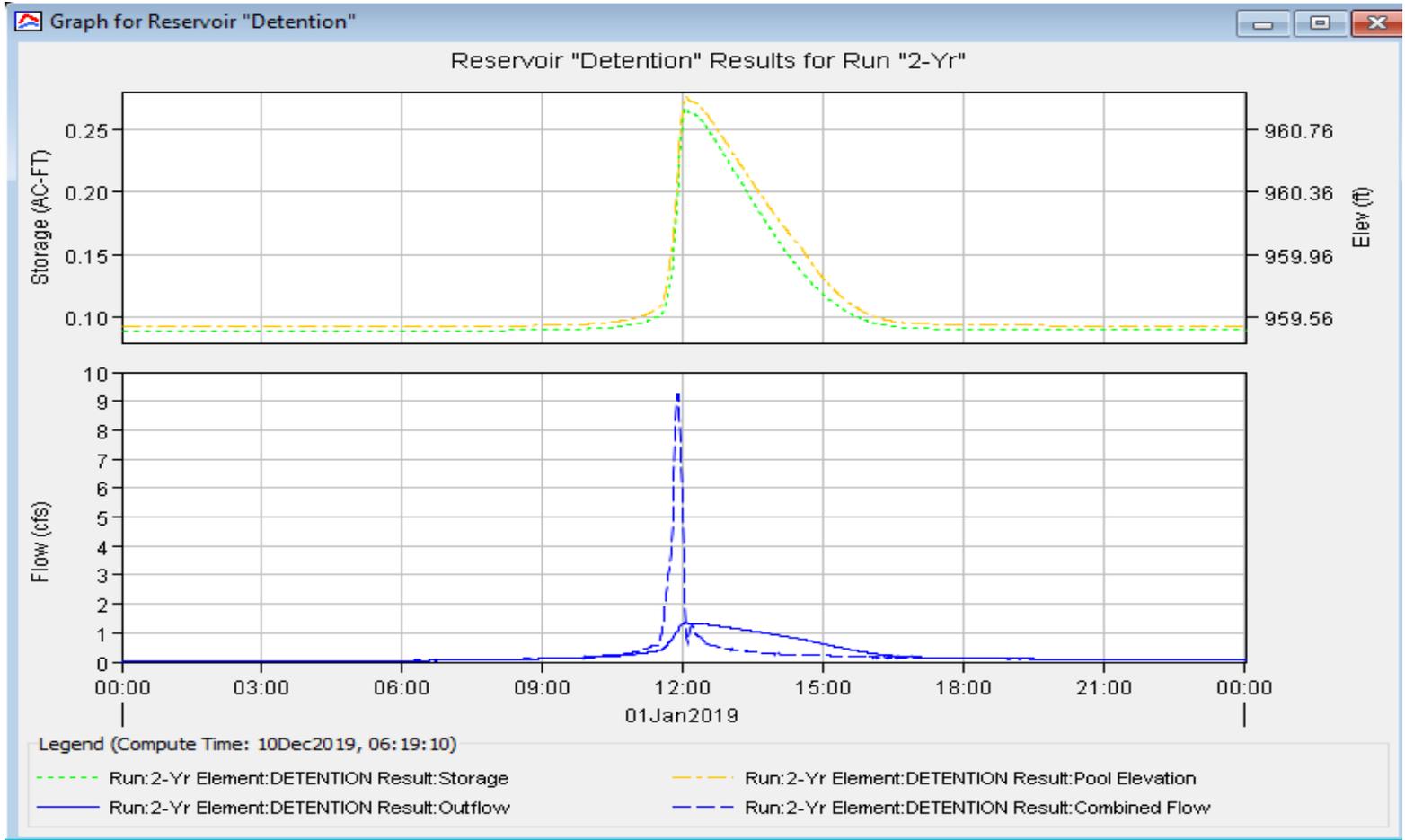
Start of Run: 01Jan2019, 00:00 Basin Model: Existing
End of Run: 02Jan2019, 00:02 Meteorologic Model: 10-Yr
Compute Time: 10Dec2019, 06:19:09 Control Specifications: Control 1

Volume Units: IN AC-FT

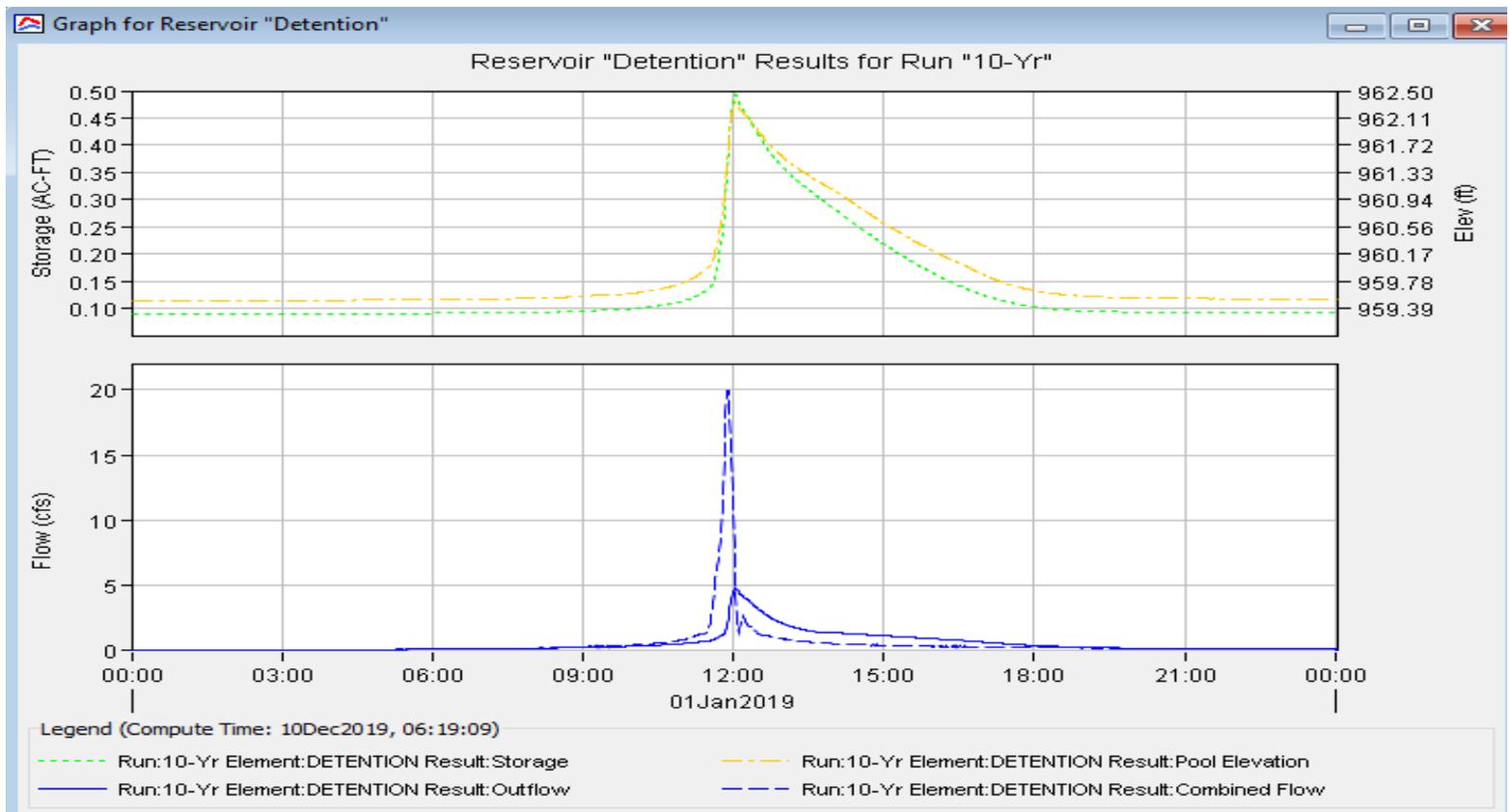
Computed Results

Peak Inflow : 20.0 (CFS)	Date/Time of Peak Inflow : 01Jan2019, 11:53
Peak Outflow : 4.8 (CFS)	Date/Time of Peak Outflow : 01Jan2019, 12:03
Total Inflow : 4.41 (IN)	Peak Storage : 0.5 (AC-FT)
Total Outflow : 4.40 (IN)	Peak Elevation : 962.3 (FT)

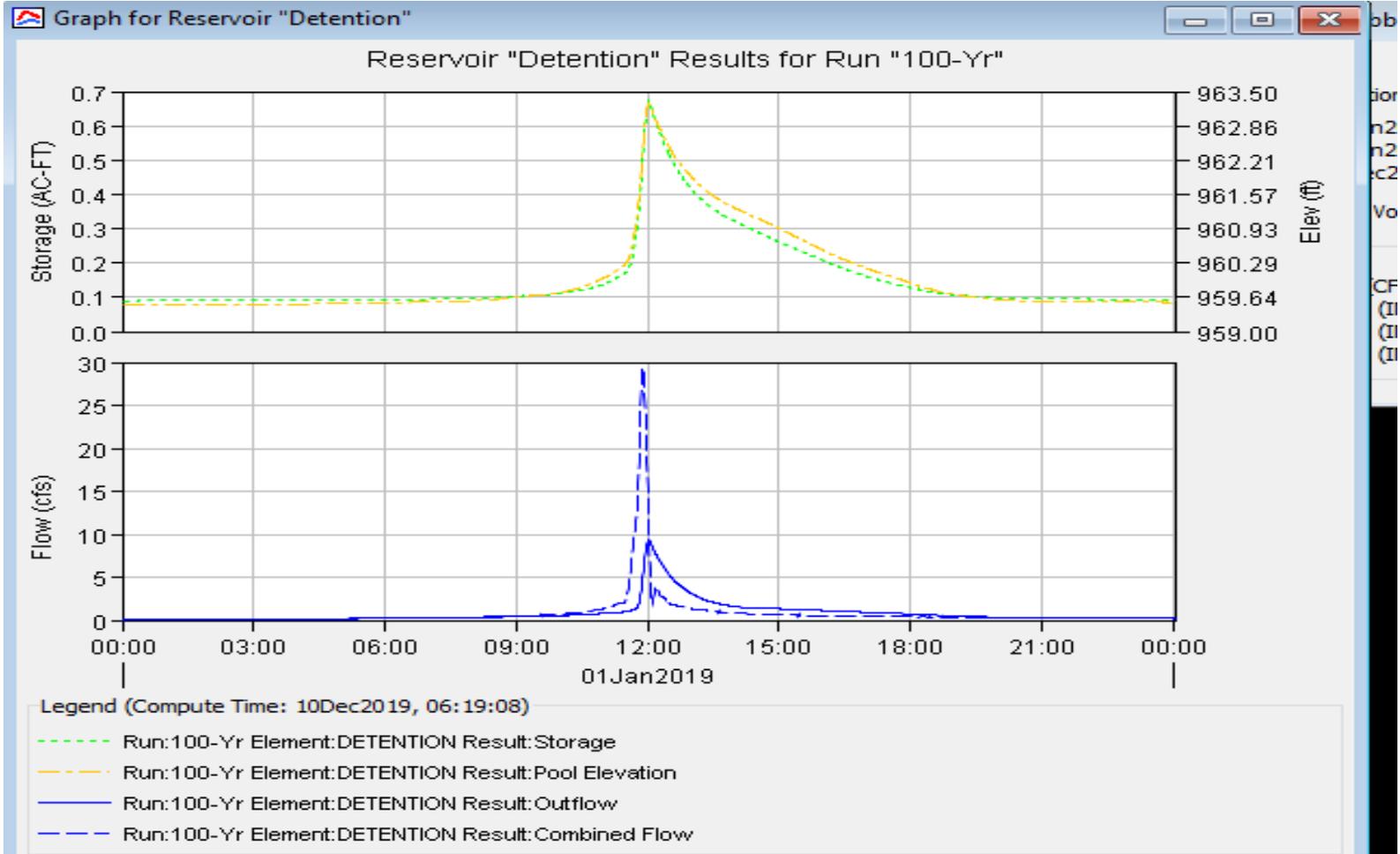
MCPL COLBERN ROAD BRANCH
 HEC-HMS
 DETENTION HYDROGRAPH 2-YR



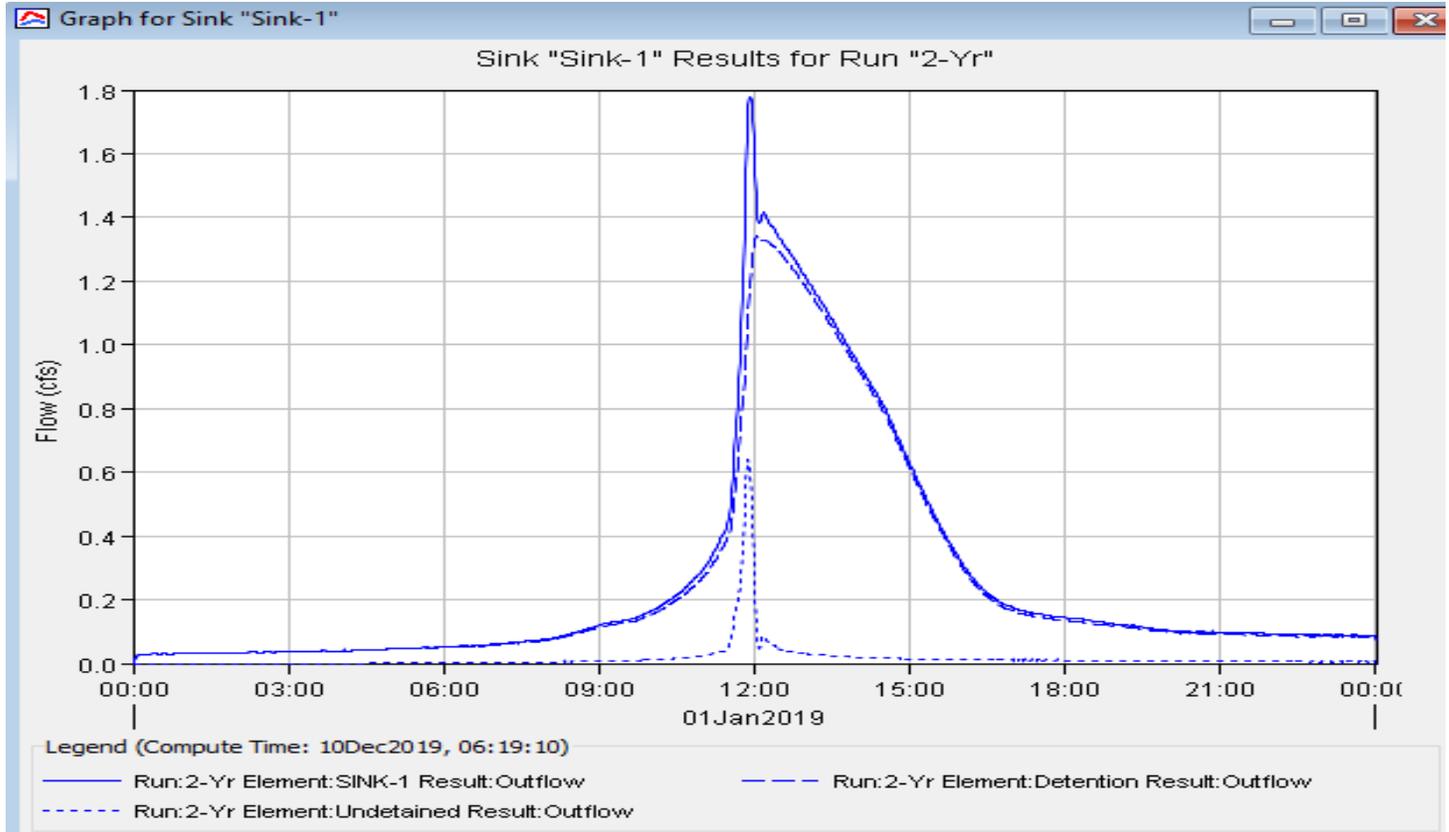
DETENTION HYDROGRAPH 10-YR



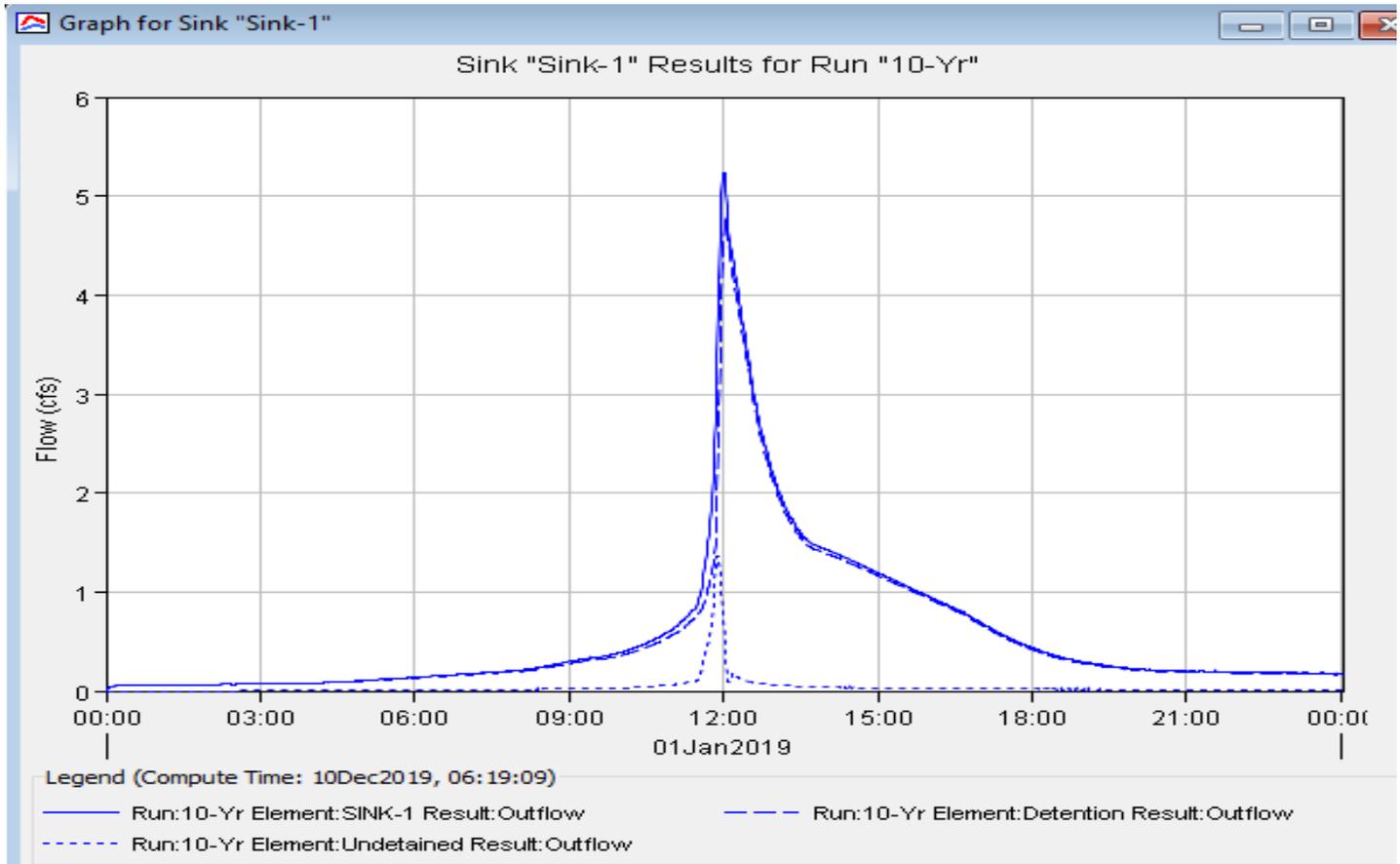
MCPL COLBERN ROAD BRANCH
HEC-HMS
DETENTION HYDROGRAPH 100-YEAR



MCPL COLBERN ROAD BRANCH
HEC-HMS
OUTFALL "A" - OUTFLOW HYDROGRAPH - 2-YEAR



OUTFALL "A" - OUTFLOW HYDROGRAPH - 10-YEAR



MCPL COLBERN ROAD BRANCH
HEC-HMS
OUTFALL "A" - OUTFLOW HYDROGRAPH - 100-YEAR

