FINAL STORM WATER MANAGEMENT STUDY

MCPL - COLBERN ROAD BRANCH REMODEL

1000 NORTHEAST COLBERN ROAD
LEE'S SUMMIT, MISSOURI

PREPARED FOR
MID-CONTINENT PUBLIC LIBRARY

PREPARED BY
OLSSON, INC.
OVERLAND PARK, KANSAS

FEBRUARY, 2020

REVISED MARCH, 2020

OLSSON PROJECT NO. B18-0330.182

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

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TABLE OF CONTENTS

TABLES

APPENDICES

GENERAL INFORMATION

This Stormwater Management Study is being submitted on behalf of the Mid-Continent Public Library (MCPL) for the proposed demolition of the existing facility and construction of a replacement facility at the Colbern Road Branch Library location. The facility is 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 plan is to demolish the existing 18,000 sf library facility and construct a new 34,000 sf library facility. Site improvements will also include demolition and expansion of the existing parking lot and service drive, and upgrades to detention, landscaping and utilities.

The entirety of the existing and acquired site 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.

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 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. Pre and 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. 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.

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.

Undeveloped property on the west (2.15 acres) drains towards the existing library. This property is completely undeveloped and pervious. A small undefined swale existing behind the curb on the west edge of the property. Runoff from this off-site property travels north in the swale and then turns northwest at the end of the curb. It drains across the library site and then drains on to the neighboring property and continues to the northwest. This is shown as Outfall B on the Drainage Plan. The remainder off-site property drains to the southwest corner of the parking lot behind the curb and drains into the street shown as Outfall C on the drainage plan.

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

The existing library and parking area will be demolished. A new 34,000 SF library will be constructed on the site to replace the existing facility. 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 and the parking area will essentially remain in the same configuration with one exception. Since the facility is increasing in size, a portion of the site that was draining onto the west property will now be directed to the detention basin. Site runoff will be captured by an enclosed storm sewer system. 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 – Almost all of the proposed impervious areas for the site will drain to the proposed enclosed storm system and be directed into a new detention basin and water treatment facility. The entrance drive and a small area to the north of the entrance drive (approximately 0.9 acres) will not drain to the basin. This area will drain to Colbern Road, consistent with the current drainage pattern.

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 (2-Year Storm) (cfs)	Q (10-Year Storm) (cfs)	Q (100-Year Storm) (cfs)
Outfall A	3.5	10.8	21.6	30.7

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 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 the 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 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.

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 of pervious vegetated areas that will not be detained. They will have no impact on the neighboring property.

An orifice will be located above the WQv surface elevation to control the 2 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.

Flow rate have been analyzed at the 24” pipe out of the structure, at the control plate and at the 24” pipe entering the structure. The water surface elevations have been calculated at each point as the water elevation rises in the basin. A table has been placed in Appendix D of this report. The analysis was used to determine surface elevations in the following table.

An emergency spillway will be constructed in the northeast corner to control overflow from the basin should the main spillway fail. It has been designed to accommodate the 100-yr storm event. The analysis for the spillway is included in Appendix D.

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	960.53
Total Storage Volume	1.2 ac-ft
Top of Dam Elevation	967.5
WQv Orifice (IE Elevation, Pipe Size)	960.75, 4 – 1" (ft, # hole - diam)
Water Quality Volume WSE, Storage, Peak Outflow	962.4, 0.2, 0.18 (ft, ac-ft, cfs)
2-year & 10-Year Orifice (IE Elevation, Pipe Size)	962.5, 1-8" (ft, orifice size)
10–Year Storm WSE, Storage, Peak Outflow	964.7, 0.6, 4.4 (ft, ac-ft, cfs)
100–Year Storm Weir (Elevation, Length)	964.2, 0.9 (ft, lf)
100–Year Storm WSE, Storage, Peak Outflow	965.7, 0.8, 9.3 (ft, ac-ft, cfs)

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

Off-Site Drainage

In order to maintain the existing flow patterns on the west side of the site, the existing swale will be extended north to the edge of the proposed service area. The existing swale will be deepened to divert the off-site runoff from the west to the undeveloped property to the north of the site, matching the current drainage pattern. A portion of the project property (0.22 acres) that drained to the neighboring property to the north will be diverted to the proposed detention basin. This results in a reduction in the drainage area to Outfall B from 2.26 acres to 2.04 acres. The drainage area for Outfall C will remain essentially unchanged.

Appendix D provides flows and shear stresses to demonstrate grass cover is adequate were the runoff leaves the site. A turf reinforcement mat will be place in the bottom of the swale as added protection for the site curbs.

The off-site area is still undeveloped. 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. Calculations for the runoff and swale capacities from the off-site property are provided in the Appendices.

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 962.4 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

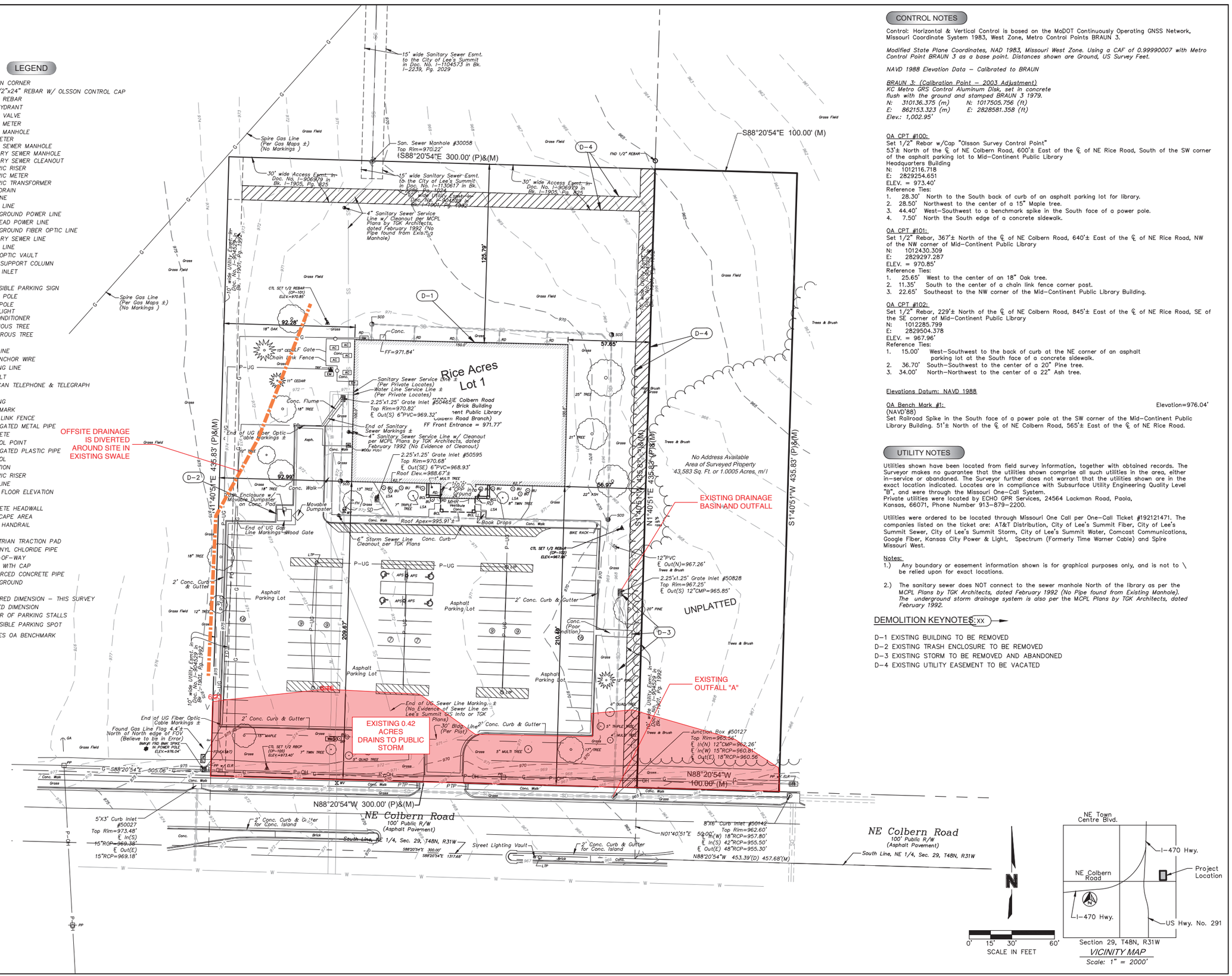
As outlined in the preceding report, increased runoff rates in the post-development conditions are mitigated by the detention basin. Drainage patterns on the site remain relatively unchanged. Lastly, an extended dry detention basin has been designed to maintain or improve the storm water quality. Based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

Appendix A

Map Exhibits

LEGEND

- SECTION CORNER
- SET 1/2"x24" REBAR W/ OLSSON CONTROL CAP
- FOUND REBAR
- FH FIRE HYDRANT
- WV WATER VALVE
- WM WATER METER
- W WATER MANHOLE
- GM GAS METER
- S STORM SEWER MANHOLE
- S SANITARY SEWER MANHOLE
- SCO SANITARY SEWER CLEANOUT
- ER ELECTRIC RISER
- EM ELECTRIC METER
- TRF ELECTRIC TRANSFORMER
- ORD ROOF DRAIN
- —G— GAS LINE
- —W— WATER LINE
- —P—UG— UNDERGROUND POWER LINE
- —P—OH— OVERHEAD POWER LINE
- — FO — UNDERGROUND FIBER OPTIC LINE
- — SS — SANITARY SEWER LINE
- — SD — STORM LINE
- FOV FIBER OPTIC VAULT
- BCL BRICK SUPPORT COLUMN
- GRATE INLET
- SIGN
- APS ACCESSIBLE PARKING SIGN
- PP POWER POLE
- LTP LIGHT POLE
- YL YARD LIGHT
- AC AIR CONDITIONER
- DECIDUOUS TREE
- CONIFEROUS TREE
- BU BUSH
- TREE LINE
- GA 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
- PG. 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
- 9 NUMBER OF PARKING STALLS
- ACCESSIBLE PARKING SPOT
- ✱ DENOTES OA BENCHMARK



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 Adjustment)
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 ℄ of NE Colbern Road, 600'± East of the ℄ of NE Rice Road, South of the SW corner of the asphalt parking lot to Mid-Continent Public Library Headquarters Building
N: 1012116.718
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 ℄ of NE Colbern Road, 640'± East of the ℄ 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 ℄ of NE Colbern Road, 845'± East of the ℄ 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: Elevation=976.04'
(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 ℄ of NE Colbern Road, 565'± East of the ℄ of NE Rice Road.

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 TGK Architects, dated February 1992 (No Pipe found from Existing Manhole). The underground storm drainage system is also per the MCPL Plans by TGK 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

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Sapp Design Associates Architects, P.C.
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SPECIAL NOTICES

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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Revision No.	Description	Date

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

Drawing No.

C1
EXISTING CONDITIONS

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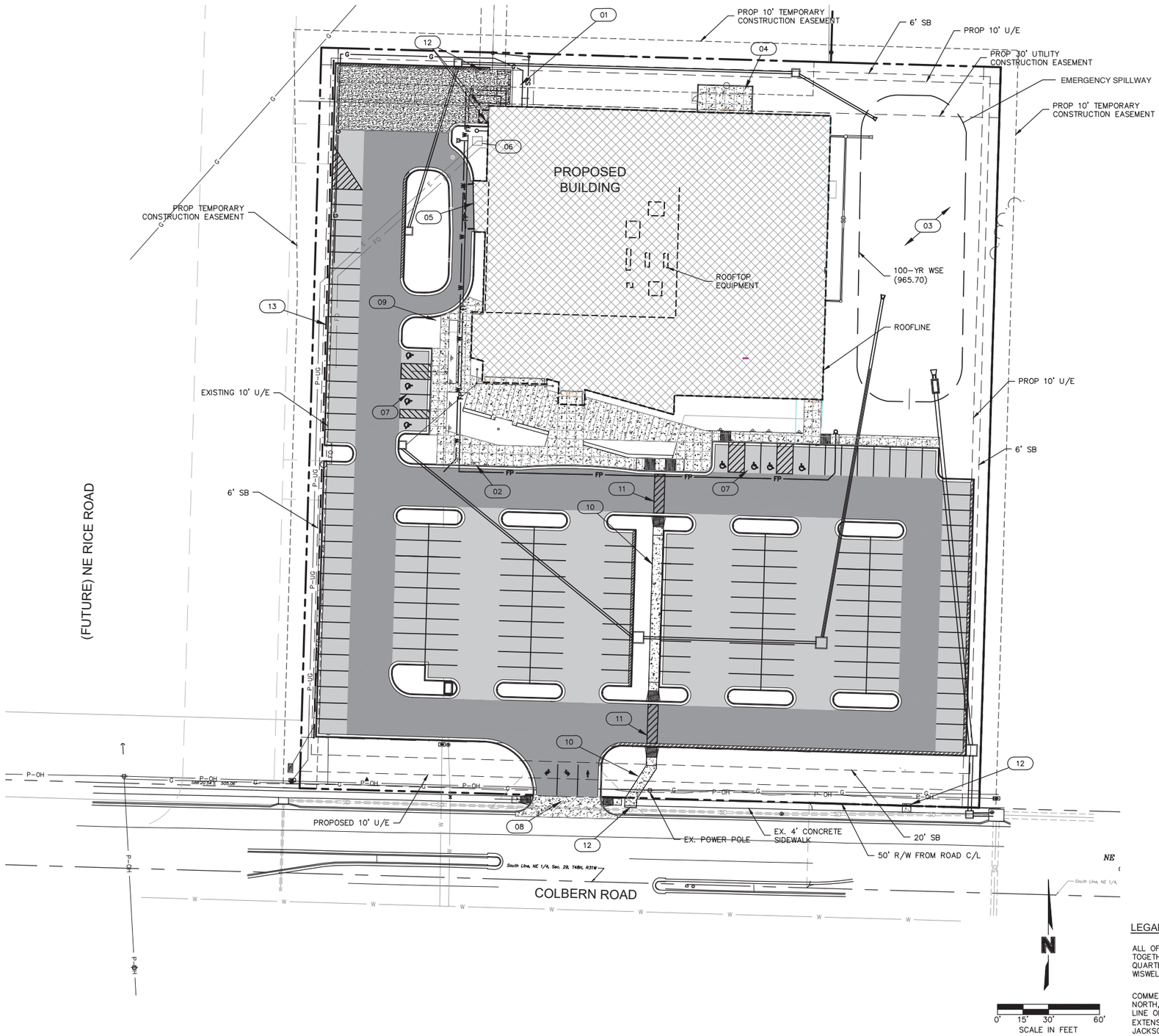

SITE DATA			
ZONING & SITE AREA			
PROPOSED USE:	PUBLIC LIBRARY		
SITE AREA		ZONING	
LOT 2 (AS DECRIBED):	4.00 ACRES (174,237 SF)	CP-2	
IMPERVIOUS:	2.58 ACRES (112,384 SF) (64%)		
PERVIOUS:	1.42 ACRES (61,855 SF) (36%)		
FAR (0.55 MAX):	0.15		
BUILDING AREA			
BUILDING TYPE	# STORIES	SQUARE FOOTAGE	
BUILDING	1	34,030 SF	
PARKING			
USE	REQUIRED	PROVIDED	
LIBRARY	4 PER 1000 SF = 136	163	
ADA	4 (PER CITY TABLE)	8	
TOTAL	136	171 (INCLUDING ADA)	

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

THERE ARE NO FEMA DELINEATED FLOODPLAINS ON THE PROPERTY.

LEGEND

- PROPERTY LINES
- RIGHT-OF-WAY LINES
- LOT LINES
- ROAD CENTERLINE
- EASEMENT LINES
- SETBACK LINES
- EXISTING GRADE CONTOURS
- PROPOSED GRADE CONTOURS
- OVERHEAD ELECTRIC
- UNDERGROUND ELECTRIC
- UNDERGROUND TELEPHONE
- UNDERGROUND FIBER OPTIC
- GAS LINE
- WATER LINE
- FIRE PROTECTION LINE
- STORM SEWER LINE
- SANITARY SEWER LINE
- ACCESSIBLE SIDEWALK RAMP
- CONCRETE CURB & GUTTER TYPE "CG-1" RE: DETAILS
- CONCRETE CURB & GUTTER TYPE "CG-1 DRY" RE: DETAILS
- PROPOSED CONCRETE SIDEWALK
- PROPOSED HEAVY DUTY CONCRETE PAVEMENT
- PROPOSED LIGHT DUTY ASPHALT
- PROPOSED HEAVY DUTY ASPHALT

KEYNOTES: (XX)

01 TRASH ENCLOSURE RE: DETAIL ON SHEET 10.5
02 BOOK DROP
03 EXTENDED DRY DETENTION BASIN
04 CONCRETE PATIO
05 DRIVE-THRU WINDOW
06 POWER TRANSFORMER
07 ADA ACCESSIBLE SIGNAGE AND STRIPING
08 WIDENED COMMERCIAL ENTRANCE (40') WITH RECONSTRUCTED ADA RAMP
09 REMOTE FIRE DEPARTMENT CONNECTION
10 6' SIDEWALK
11 CROSSWALK STRIPING
12 BOLLARD
13 CONSTUCT 6" EARTHEN BERM TO DIVERT OFF DRAINAGE FROM THE EAST
14 KNOX BOX ON BUILDING
15 ADA TURNING AREA

LEGAL DESCRIPTION

ALL OF LOT 1, RICE ACRES, A SUBDIVISION IN THE CITY OF LEE'S SUMMIT, JACKSONCOUNTY,MISSOURI, TOGETHER WITH ALL THAT PART OF AN UNPLATTED TRAC T OF LAND, ALL LYING IN THE NORTHEAST QUARTER OF SECTION 29, TOWNSHIP 48 NORTH, RANGE 31 WEST, DESCRIBED BY TIMOTHY BLAIR WISWELL, MO-PLS 2009000067, AS FOLLOWS:

COMMENCING AT THE SOUTHEAST CORNER OF THE NORTHEAST QUARTER OF SECTION 29, TOWNSHIP 48 NORTH, RANGE 31 WEST; THENCE NORTH 88 DEGREES 28 MINUTES 52 SECONDS WEST, ON THE SOUTH LINE OF SAID NORTHEAST QUARTER, A DISTANCE OF 755.18 FEET TO A POINT ON THE SOUTHERLY EXTENSION OF THE WEST LINE OF LOT 1, RICE ACRES, A SUBDIVISION IN THE CITY OF LEE'S SUMMIT, JACKSON COUNTY, MISSOURI; THENCE NORTH 01 DEGREE 23 MINUTES 04 SECONDS EAST, DEPARTING SAID SOUTH LINE, ON SAID SOUTHERLY EXTENSION, A DISTANCE OF 55.66 FEET TO THE SOUTHWEST CORNER OF SAID LOT 1, THE POINT OF BEGINNING; THENCE NORTH 01 DEGREE 23 MINUTES 04 SECONDS EAST, ON SAID WEST LINE, A DISTANCE OF 436.21 FEET TO THE NORTHWEST CORNER OF SAID LOT 1; THENCE SOUTH 88 DEGREES 38 MINUTES 41 SECONDS EAST, ON THE NORTH LINE OF SAID LOT 1 AND ITS EASTERLY EXTENSION, A DISTANCE OF 400.00 FEET TO A POINT; THENCE SOUTH 01 DEGREE 23 MINUTES 04 SECONDS WEST, DEPARTING SAID EASTERLY EXTENSION, A DISTANCE OF 436.21 FEET TO A POINT ON THE EASTERLY EXTENSION OF THE SOUTH LINE OF SAID LOT 1; THENCE NORTH 88 DEGREES 38 MINUTES 41 SECONDS WEST, ON SAID EASTERLY EXTENSION AND ON SAID SOUTH LINE, A DISTANCE OF 400.00 FEET TO THE POINT OF BEGINNING, CONTAINING 174,485 SQUARE FEET OR 4.0056 ACRES, MORE OR LESS.

SAPP DESIGN ARCHITECTS
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1629 Walnut
Kansas City, MO 64108 816.300.0300

SPECIAL NOTICES

Mid-Continent Public Library
CONSTRUCTION DOCUMENTS FOR
COLBERN ROAD BRANCH
1000 N.E. COLBERN ROAD
LEE'S SUMMIT, MO 64086
JACKSON COUNTY

PACKAGE 10

Engineer of Record

ISSUE FOR CONSTRUCTION
02.05.20

Terry M Parsons, Engineer MO PE-2018010505

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Missouri State Certificate of Authority #001592

Revision No.	Description	Date
1	CITY COMMENTS	03.19.20

Project No.	Date	Drawn
B18-0330	02.05.20	RLK

Drawing No.
C3.0
FINAL DEVELOPMENT PLAN

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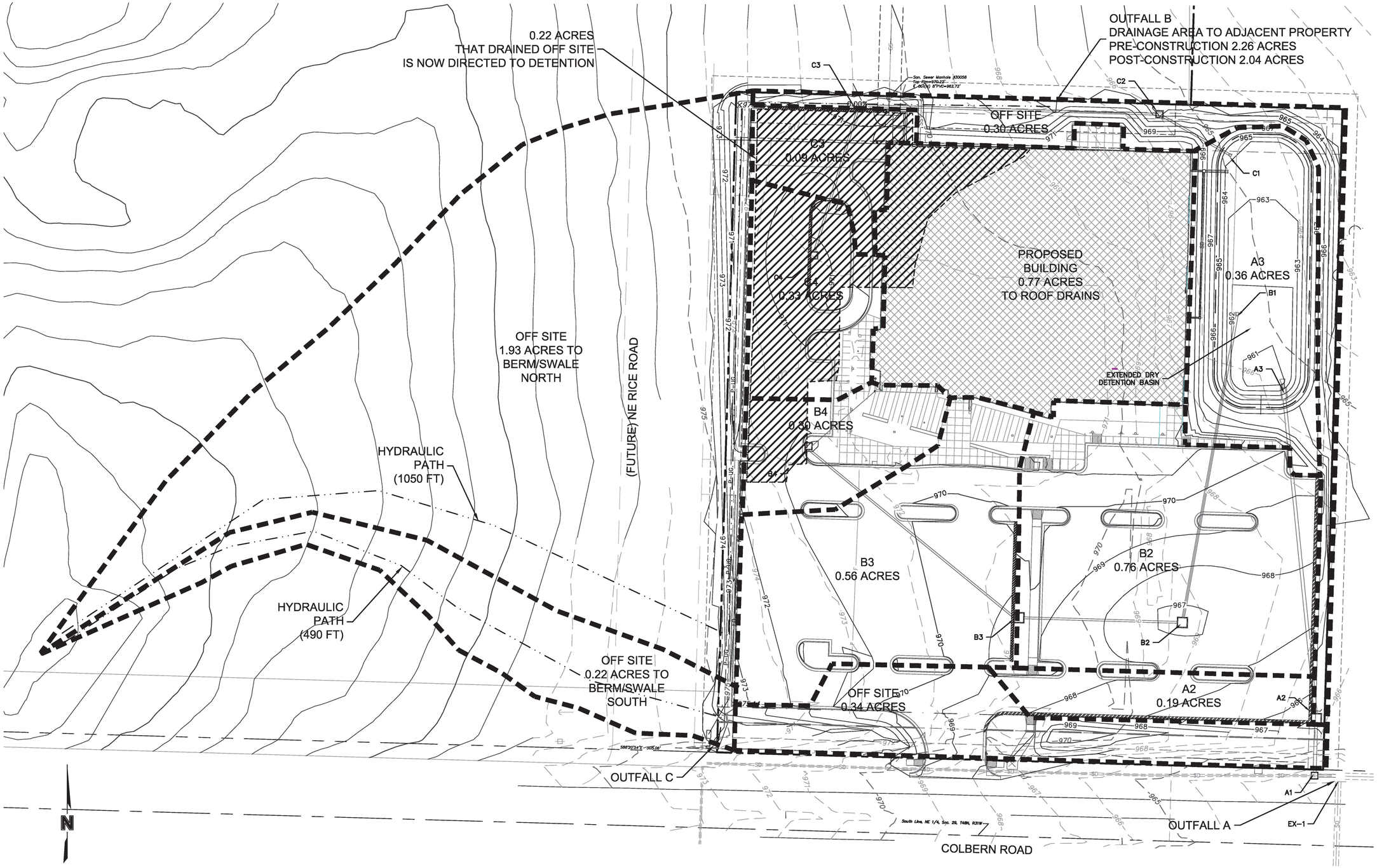

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USER: bkimmich L_PBASE_161023 A_PBASE_161023

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1629 Walnut
Kansas City, MO 64108 816.300.0300

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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.

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ISSUE FOR CONSTRUCTION
02.05.20

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Revision No.	Description	Date
1	CITY COMMENTS	03.19.20

Project No.	Date	Drawn
B18-0330	02.05.20	RLK

Drawing No.

C8.0
DRAINAGE PLAN

Appendix B

FEMA Flood Classification Firm

National Flood Hazard Layer FIRMette

FEMA

38°57'2.45"N

94°21'43.78"W

94°21'6.32"W

38°56'34.47"N

Feet

0 250 500 1,000 1,500 2,000

1:6,000

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
- 8 — 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 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.

Appendix C

Soil Map

Soil Map—Jackson County, Missouri
(SOILS SURVEY)

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

N

Meters
0 10 20 40 60

Feet
0 40 80 160 240

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: 2ql09
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

STORM SEWER PIPE AND STRUCTURE TABLE

STORM SEWER PIPE AND STRUCTURE TABLE
TITLE: COLBERN ROAD LIBRARY (LEES SUMMIT)
JOB #: B18-0330

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
RD		0.77		0.90	0.90	5.0	-	7.35	5.09	ROOF DRAINS									N/A												
			0.77	0.90	0.90	5.0	-	7.35	5.09	18 in. HDPE	30.00	1.20	15	11.54	1.77	6.53	6.32	0.89		969.00	968.64	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			END SECTION TO BASIN
C4		0.33		0.80	0.80	5.0	-	7.35	1.76	CURB INLET									971.33										965.92	969.86	
	C3		0.33	0.80	0.80	5.0	-	7.35	3.76	18 in. HDPE	99.00	1.00	15	8.81	1.77	4.99	4.78	0.79		971.33	967.18	964.49	0.23	0.40	0.40	0.14	0.37	965.92	964.86			
C3		0.09		0.80	0.65	5.0	-	7.35	2.68	CURB INLET									970.59										964.49	968.82	
	C2		0.41	0.80	0.80	5.0	-	7.35	6.40	24 in. HDPE	195.00	1.00	15	18.98	3.14	6.04	5.44	0.75		966.88	964.90	963.47	0.09	0.40	0.40	0.18	0.27	964.49	963.74			
C2		0.00		0.00	0.80	5.0	-	7.35	3.63	CURB INLET									967.51										963.47	966.00	
	C1		0.41	0.80	0.80	5.0	-	7.35	10.05	24 in. HDPE	52.00	1.00	15	18.98	3.14	6.04	6.11	0.87		964.59	965.45	962.20	0.36	0.50	0.50	0.29	0.65	963.47	962.85			END SECTION TO BASIN
B4		0.30		0.80	0.80	5.0	-	7.35	1.76	CURB INLET									970.86										965.92	969.86	
	B3		0.72	0.71	0.71	5.0	-	7.35	3.76	18 in. HDPE	179.00	0.70	18	8.81	1.77	4.99	4.78	0.79		965.31	963.48	964.49	0.23	0.40	0.40	0.14	0.37	965.92	964.86			
B3		0.56		0.65	0.65	5.0	-	7.35	2.68	CURB INLET									969.62										964.49	968.82	
	B2		1.28	0.68	0.68	5.0	-	7.35	6.40	24 in. HDPE	108.00	0.70	24	18.98	3.14	6.04	5.44	0.75		963.76	962.70	963.47	0.09	0.40	0.40	0.18	0.27	964.49	963.74			
B2		0.76		0.65	0.65	5.0	-	7.35	3.63	CATCH BASIN									967.00										963.47	966.00	
	B1		2.04	0.67	0.67	5.0	-	7.35	10.05	24 in. HDPE	207.00	0.50	24	18.98	3.14	6.04	6.11	0.87		962.70	962.31	962.20	0.36	0.50	0.50	0.29	0.65	963.47	962.85			END SECTION TO BASIN
A3		0.36		0.30	0.30	5.0	-	7.35	0.79	Control Structure									965.00										961.77	964.00	
	A2		3.17	0.68	0.68	5.0	-	7.35	4.40	18 in. HDPE	220.00	0.50	18	7.45	1.77	4.21	4.47	0.87		960.47	959.34	960.66	0.46	1.00	1.00	0.31	0.78	961.77	961.43			Design Q based on Detained Flows (includes all areas to basin)
A2		0.19		0.80	0.80	5.0	-	7.35	0.88	CURB INLET									966.02										960.66	965.02	
	A1		3.36	0.69	0.69	5.0	-	7.35	4.90	18 in. HDPE	38.00	0.50	18	7.45	1.77	4.21	4.71	1.00		958.84	958.65	960.18	0.13	0.50	1.00	0.34	0.48	960.34	960.66			Design Q based on Detained Flows

STORM SEWER PIPE AND STRUCTURE TABLE

STORM SEWER PIPE AND STRUCTURE TABLE
TITLE: COLBERN ROAD LIBRARY (LEES SUMMIT)
JOB #: B18-0330

DESIGN CONDITIONS: 100 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
RD		0.77		0.90	0.90	5.0	-	7.35	5.09	ROOF DRAINS									N/A												
			0.77	0.90	0.90	5.0	-	7.35	5.09	18 in. HDPE	30.00	1.20	15	11.54	1.77	6.53	6.32	0.89		969.00	968.64	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			END SECTION TO BASIN
C4		0.33		0.80	0.80	5.0	-	7.35	1.76	CURB INLET									971.33										965.92	969.86	
	C3		0.33	0.80	0.80	5.0	-	7.35	3.76	18 in. HDPE	99.00	1.00	15	8.81	1.77	4.99	4.78	0.79		971.33	967.18	964.49	0.23	0.40	0.40	0.14	0.37	965.92	964.86			
C3		0.09		0.80	0.65	5.0	-	7.35	2.68	CURB INLET									970.59										964.49	968.82	
	C2		0.41	0.80	0.80	5.0	-	7.35	6.40	24 in. HDPE	195.00	1.00	15	18.98	3.14	6.04	5.44	0.75		966.88	964.90	963.47	0.09	0.40	0.40	0.18	0.27	964.49	963.74			
C2		0.00		0.00	0.80	5.0	-	7.35	3.63	CURB INLET									967.51										963.47	966.00	
	C1		0.41	0.80	0.80	5.0	-	7.35	10.05	24 in. HDPE	52.00	1.00	15	18.98	3.14	6.04	6.11	0.87		964.59	965.45	962.20	0.36	0.50	0.50	0.29	0.65	963.47	962.85			END SECTION TO BASIN
B4		0.30		0.80	0.80	5.0	-	7.35	1.76	CURB INLET									970.86										965.92	969.86	
	B3		0.72	0.71	0.71	5.0	-	7.35	3.76	18 in. HDPE	179.00	0.70	18	8.81	1.77	4.99	4.78	0.79		965.31	963.48	964.49	0.23	0.40	0.40	0.14	0.37	965.92	964.86			
B3		0.56		0.65	0.65	5.0	-	7.35	2.68	CURB INLET									969.62										964.49	968.82	
	B2		1.28	0.68	0.68	5.0	-	7.35	6.40	24 in. HDPE	108.00	0.70	24	18.98	3.14	6.04	5.44	0.75		963.76	962.70	963.47	0.09	0.40	0.40	0.18	0.27	964.49	963.74			
B2		0.76		0.65	0.65	5.0	-	7.35	3.63	CATCH BASIN									967.00										963.47	966.00	
	B1		2.04	0.67	0.67	5.0	-	7.35	10.05	24 in. HDPE	207.00	0.50	24	18.98	3.14	6.04	6.11	0.87		962.70	962.31	962.20	0.36	0.50	0.50	0.29	0.65	963.47	962.85			END SECTION TO BASIN
A3		0.36		0.30	0.30	5.0	-	7.35	0.79	Control Structure									965.00										961.77	964.00	
	A2		3.17	0.68	0.68	5.0	-	7.35	4.40	18 in. HDPE	220.00	0.50	18	7.45	1.77	4.21	4.47	0.87		960.47	959.34	960.66	0.46	1.00	1.00	0.31	0.78	961.77	961.43			Design Q based on Detained Flows (includes all areas to basin)
A2		0.19		0.80	0.80	5.0	-	7.35	0.88	CURB INLET									966.02										960.66	965.02	
	A1		3.36	0.69	0.69	5.0	-	7.35	4.90	18 in. HDPE	38.00	0.50	18	7.45	1.77	4.21	4.71	1.00		958.84	958.65	960.18	0.13	0.50	1.00	0.34	0.48	960.34	960.66			Design Q based on Detained Flows

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Revision No.	Description	Date
1	CITY COMMENTS	03.19.20

Project No.	Date	Drawn
B18-0330	02.05.20	RLK

Drawing No.
C8.1
DRAINAGE CALCULATIONS

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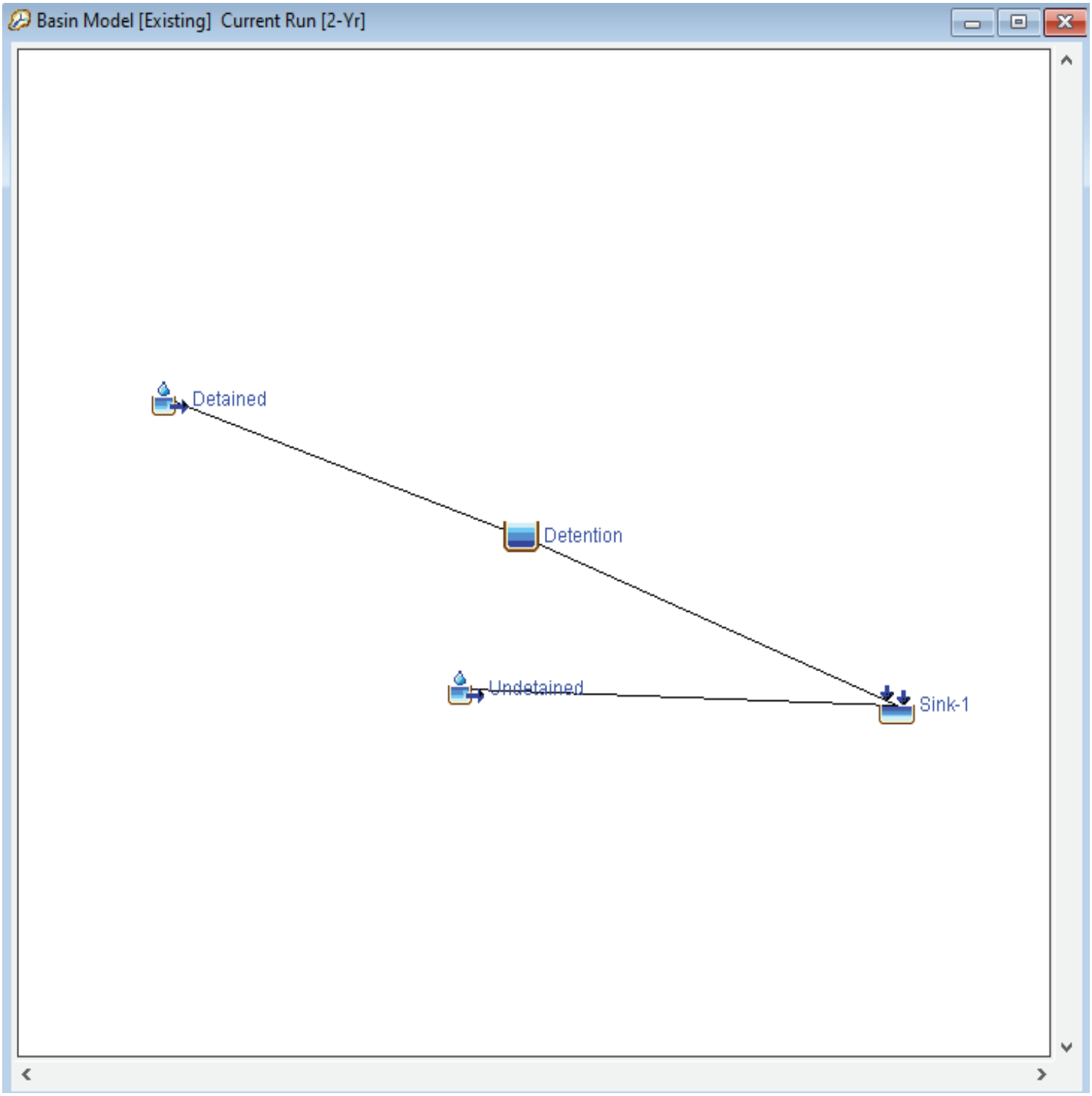
BASIN MODEL



MCPL COLBERN ROAD BRANCH
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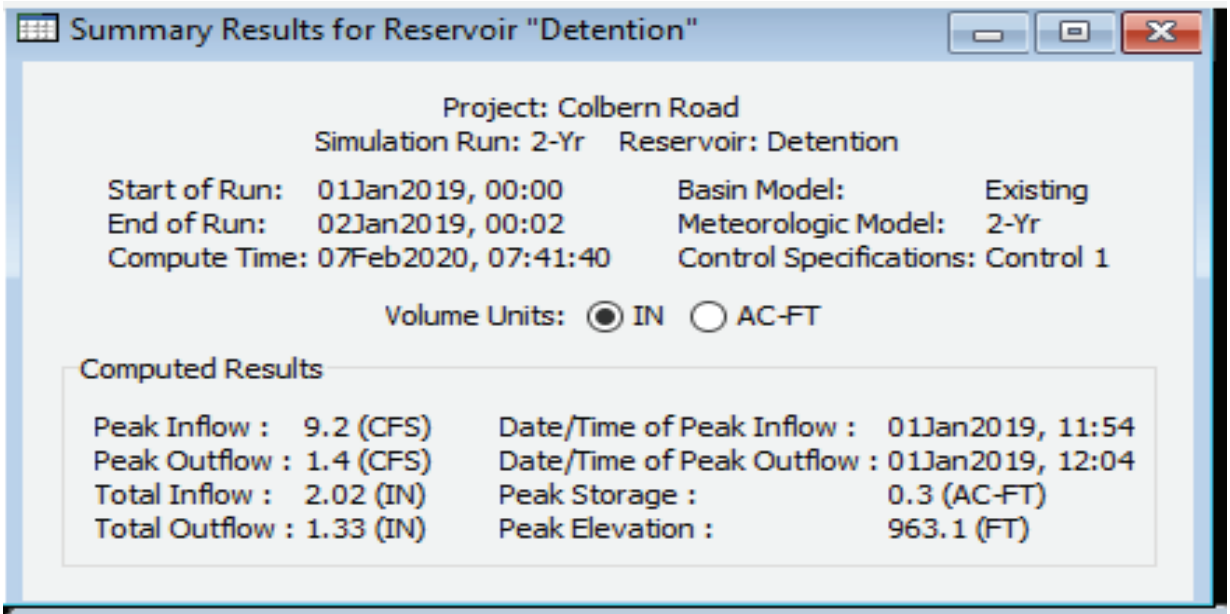
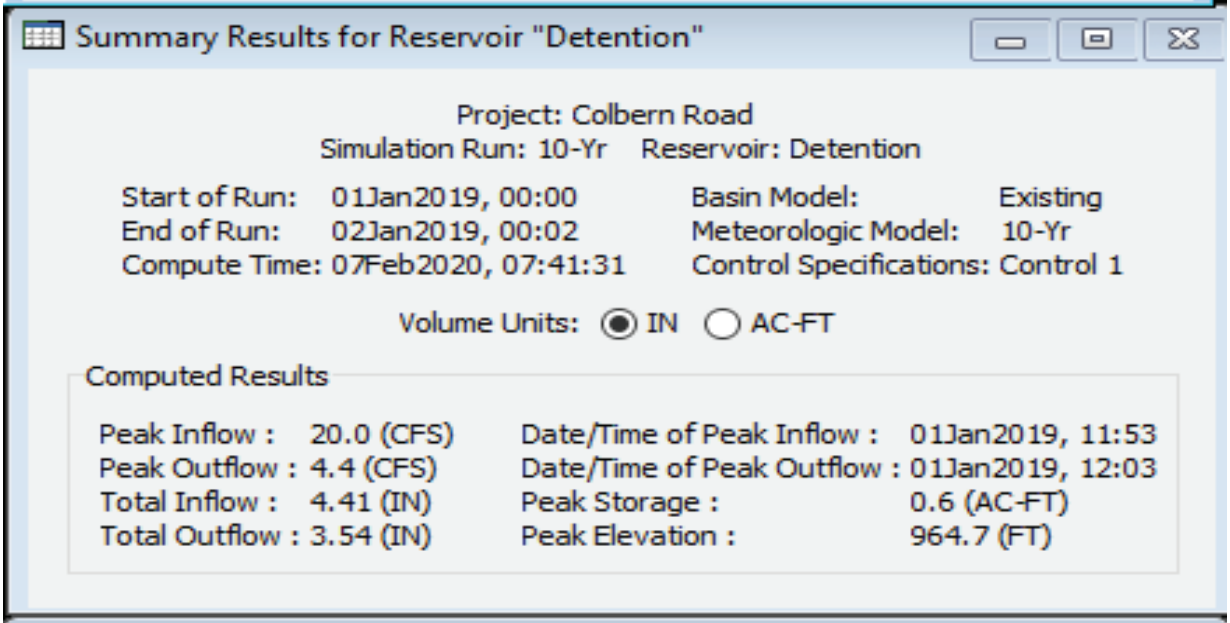
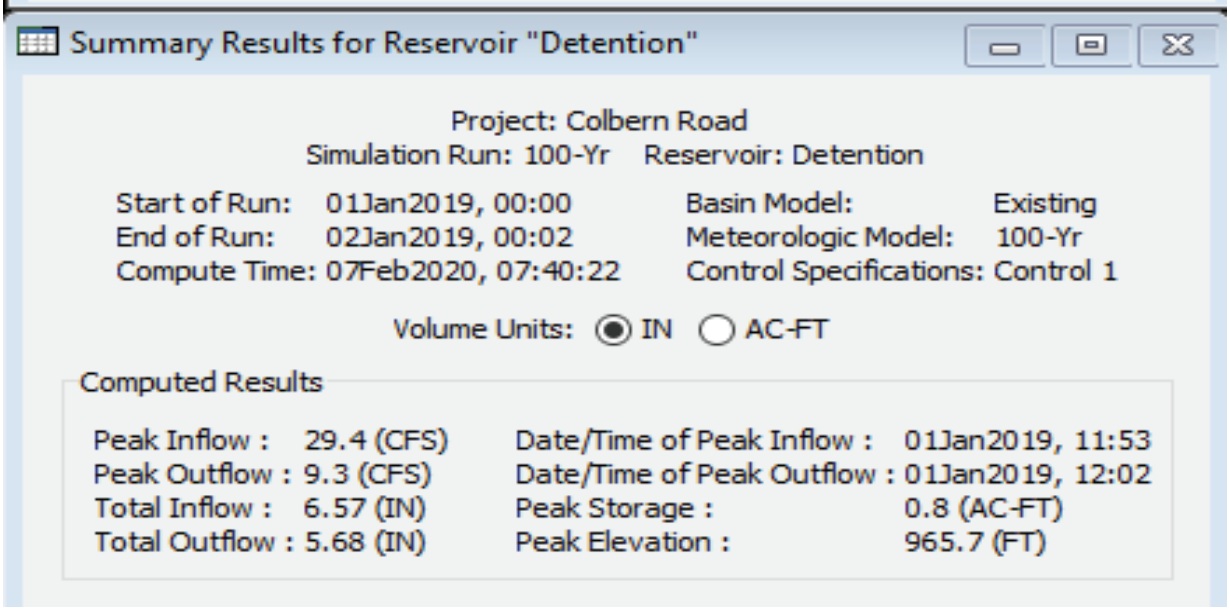
PEAK FLOWS FOR DETENTION BASIN

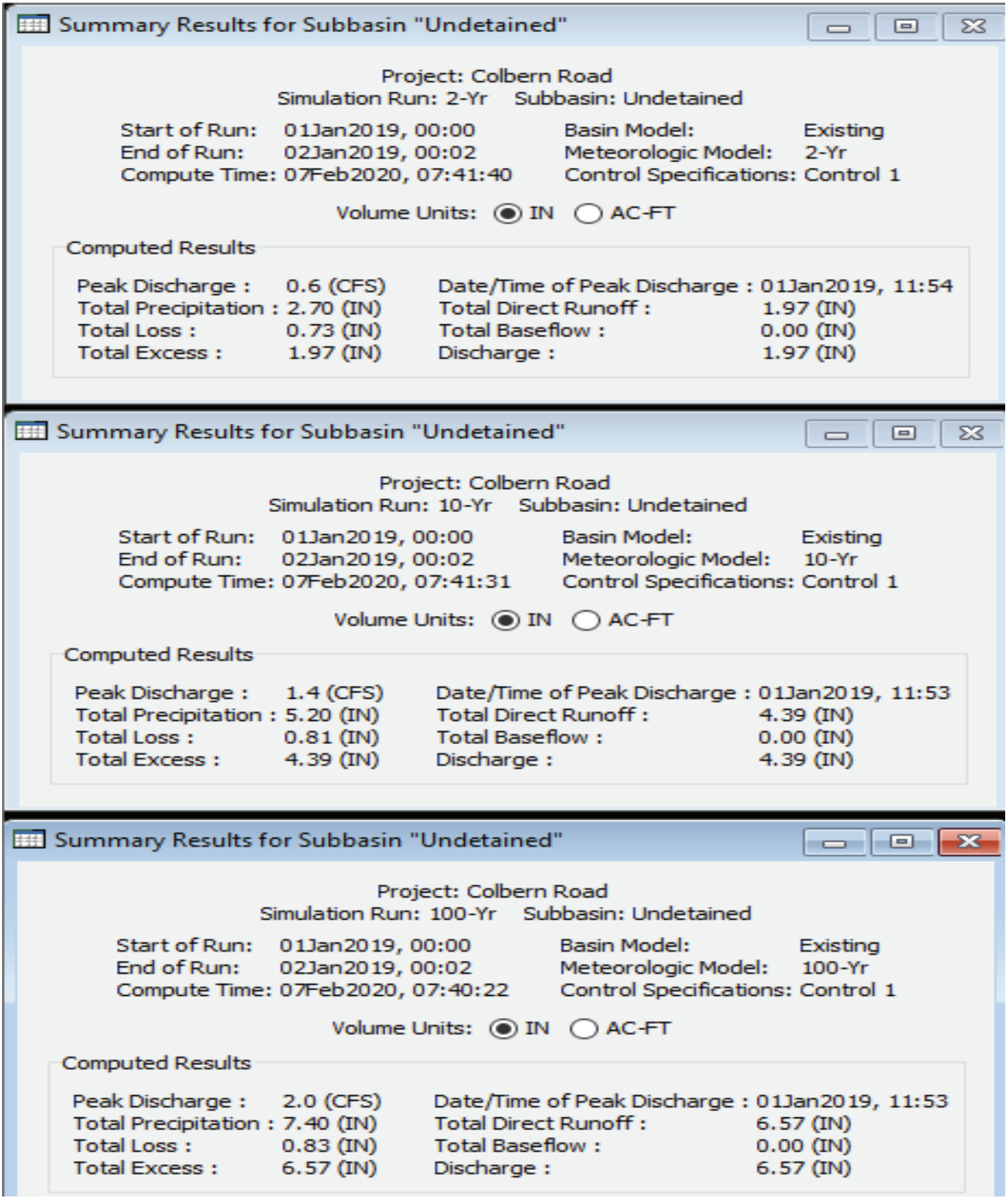






MCPL COLBERN ROAD BRANCH
HEC-HMS

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:	07Feb2020, 07:41:40	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: 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:	07Feb2020, 07:41:31	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)

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:	07Feb2020, 07:40:22	Control Specifications:	Control 1

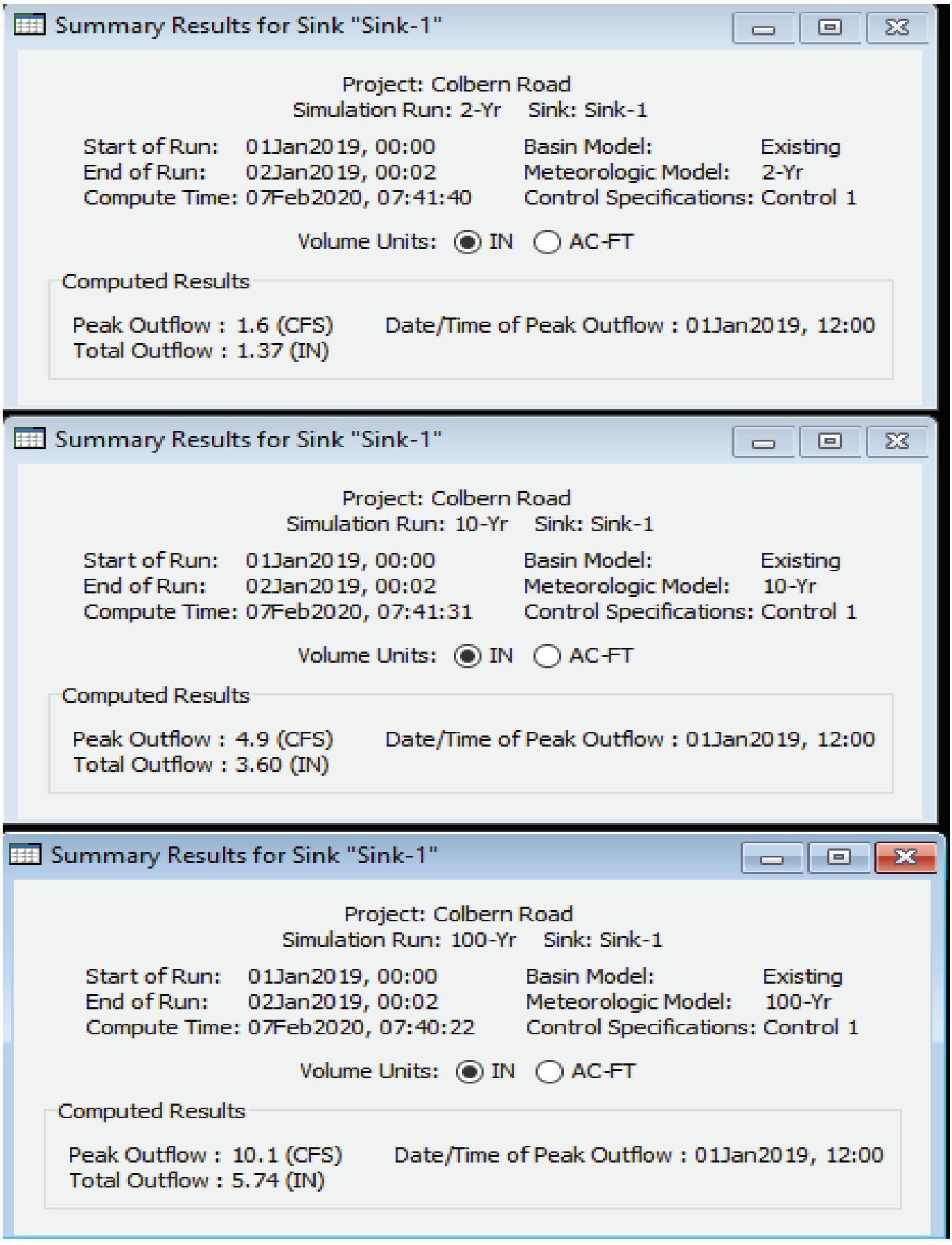
Volume Units: (•) IN ( ) AC-FT

Computed Results

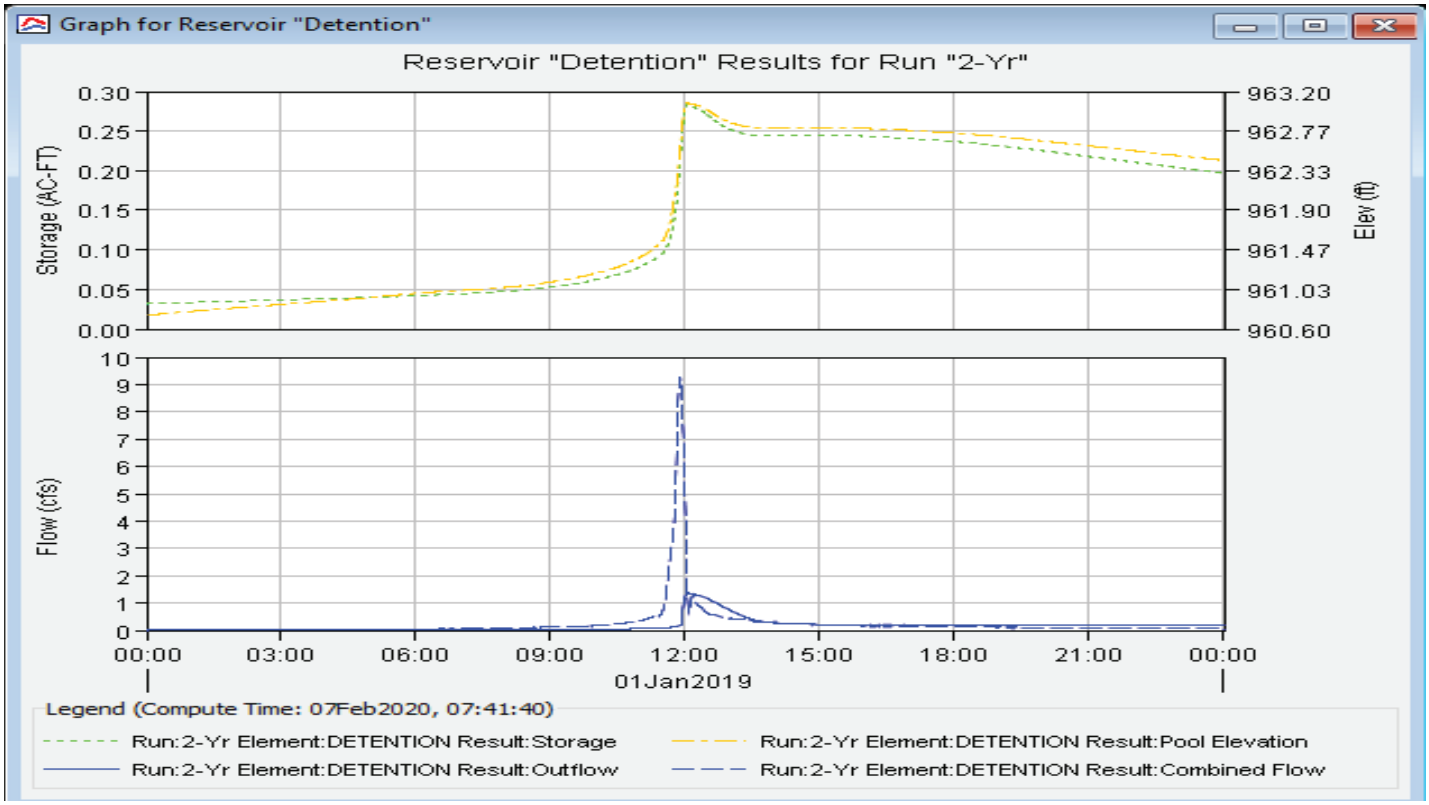
Peak Discharge :	2.0 (CFS)	Date/Time of Peak Discharge :	01Jan2019, 11:53
Total Precipitation :	7.40 (IN)	Total Direct Runoff :	6.57 (IN)
Total Loss :	0.83 (IN)	Total Baseflow :	0.00 (IN)
Total Excess :	6.57 (IN)	Discharge :	6.57 (IN)

MCPL COLBERN ROAD BRANCH
HEC-HMS

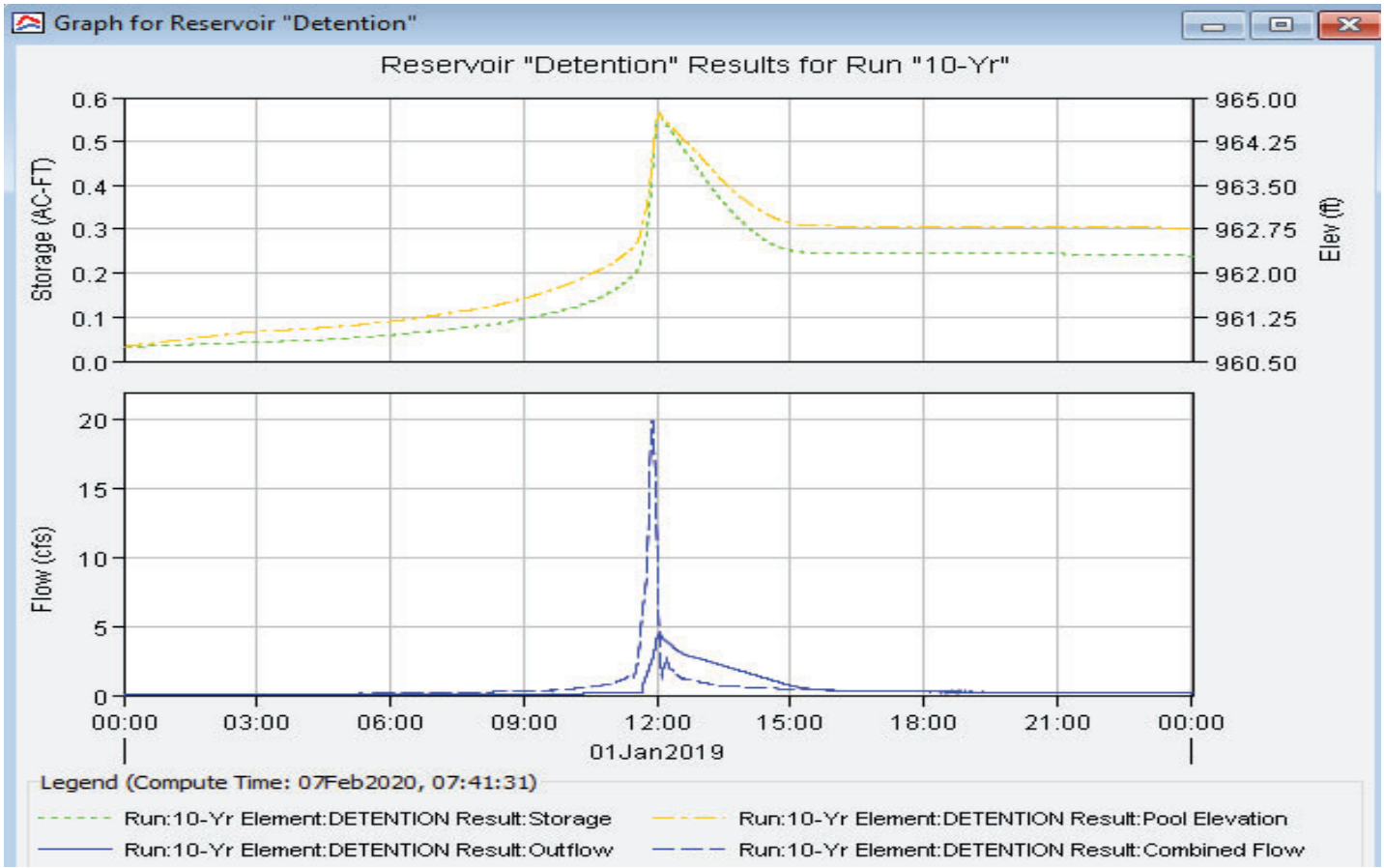
PEAK FLOWS TO PROPOSED OUTFALL "A"



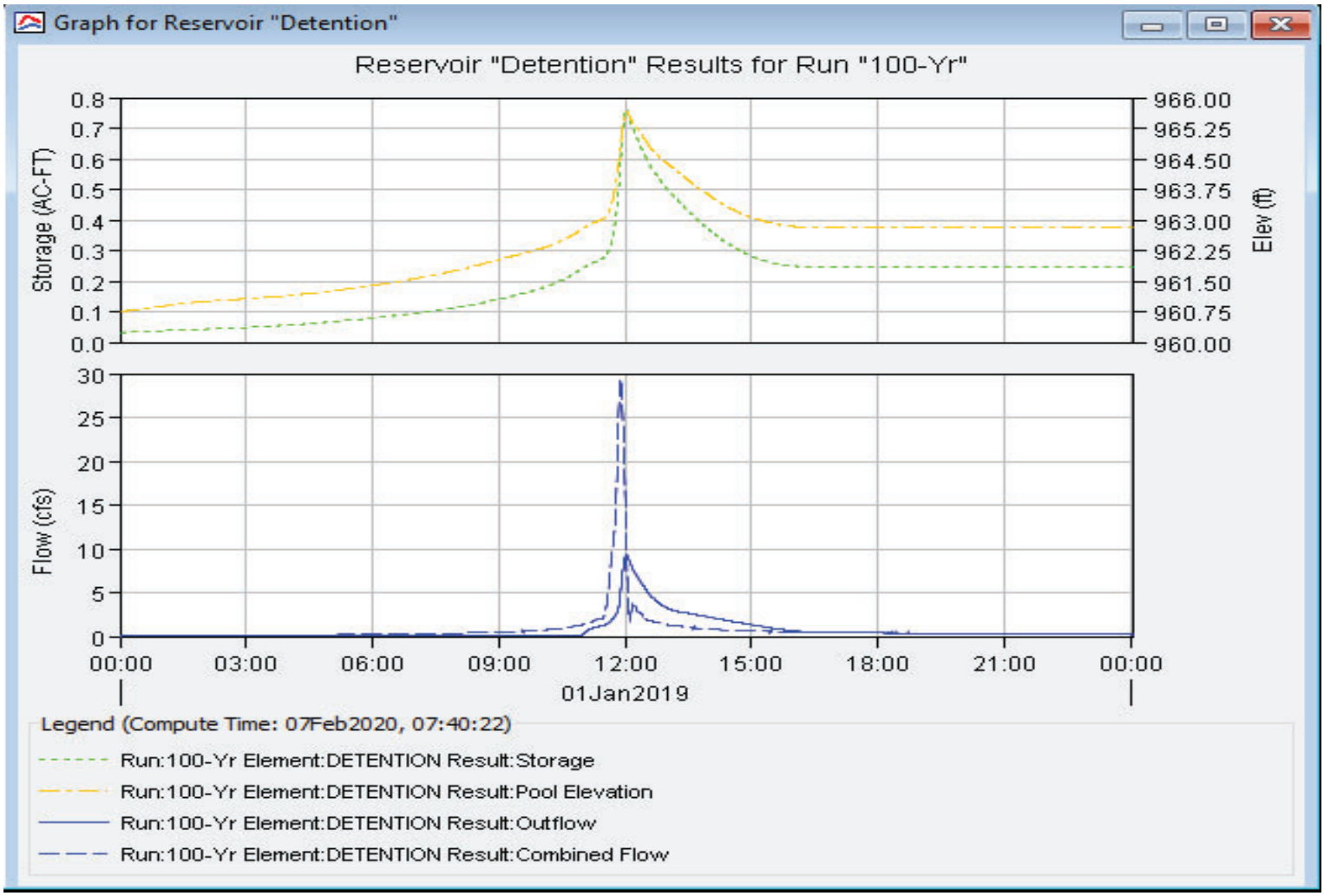
MCPL COLBERN ROAD BRANCH
HEC-HMS
DETENTION HYDROGRAPH 2-YEAR



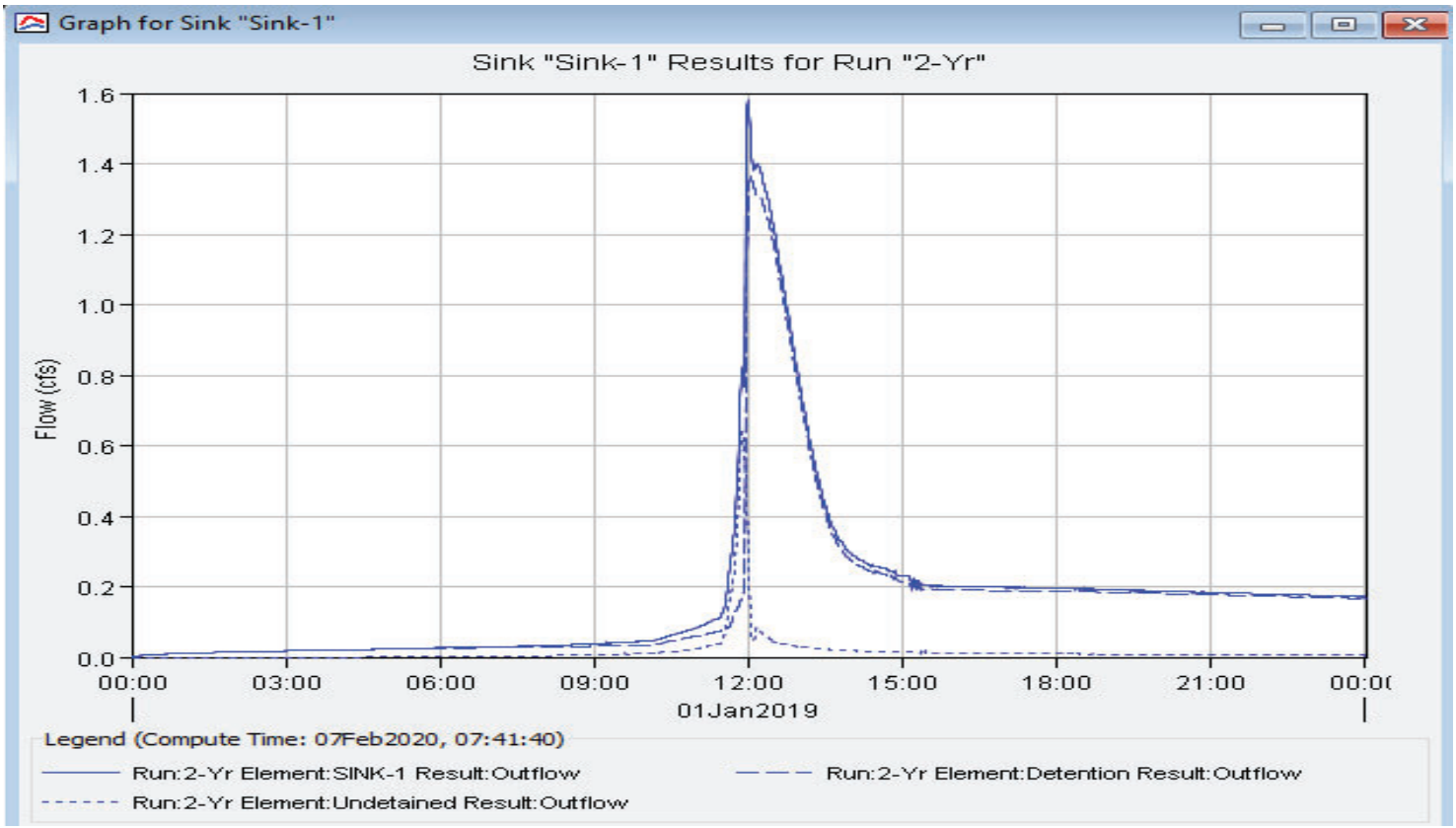
DETENTION HYDROGRAPH 10-YEAR



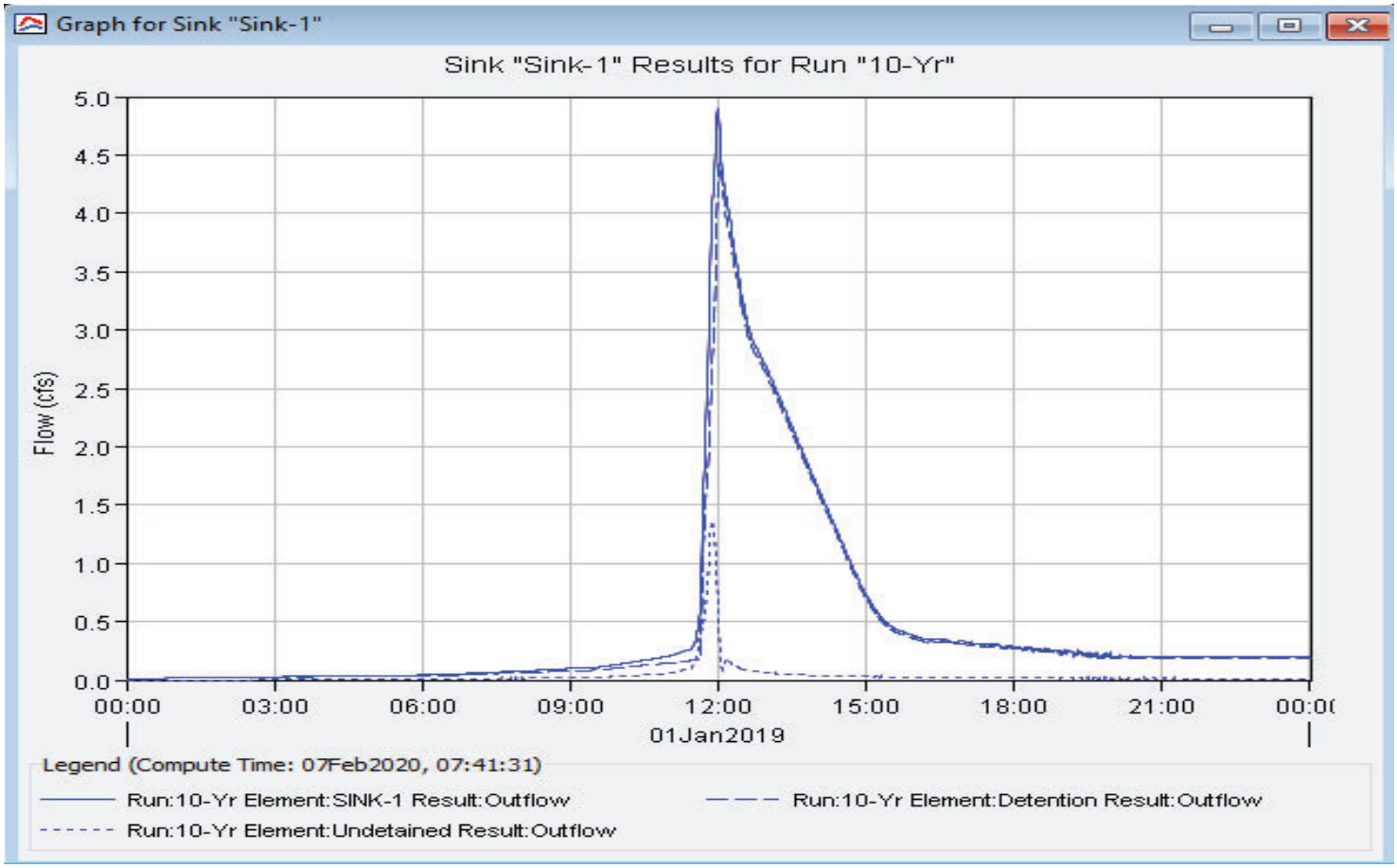
MCPL COLBERN ROAD BRANCH
HEC-HMS
DETENTION HYDROGRAPH 100-YEAR



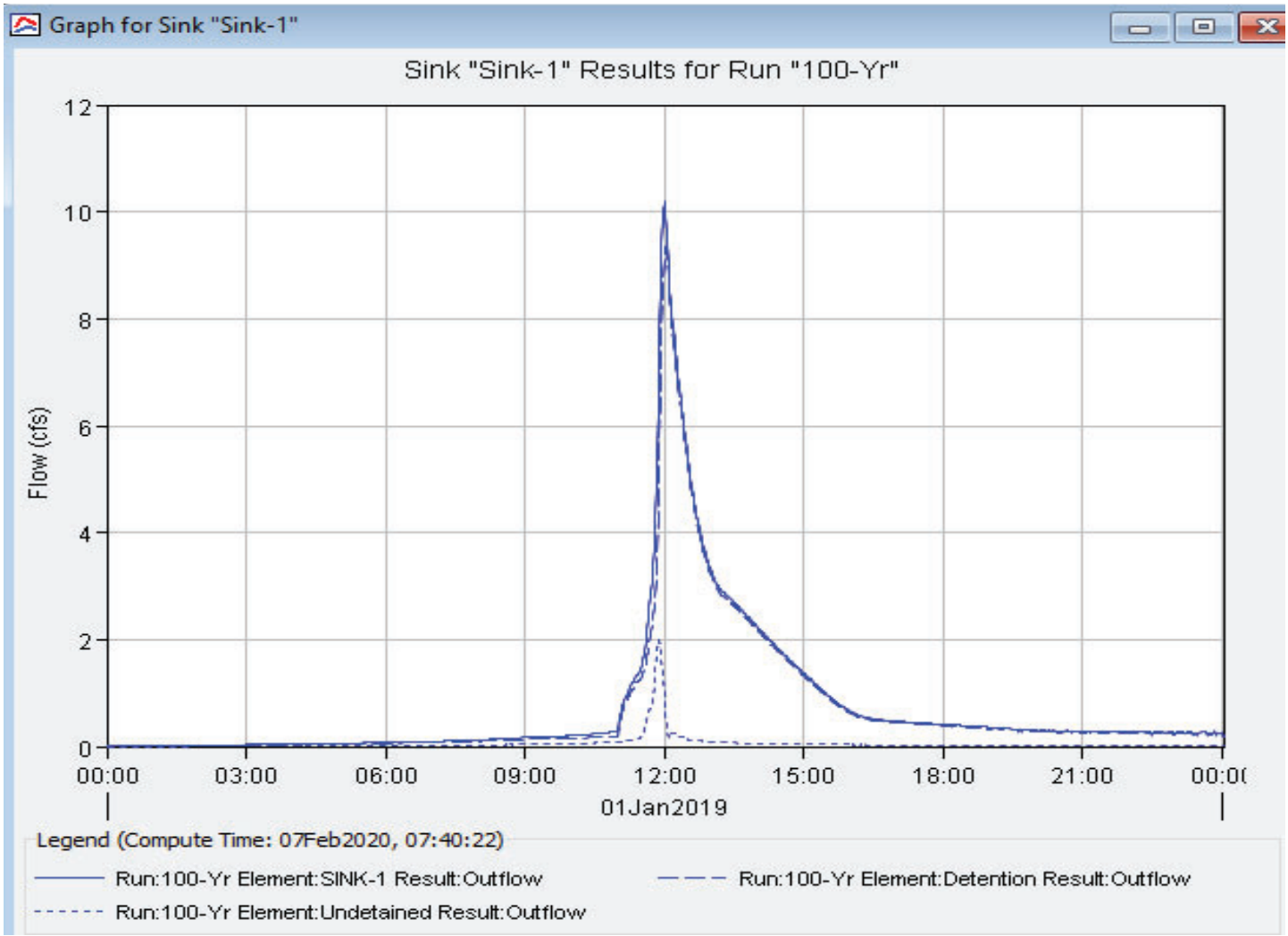
MCPL COLBERN ROAD BRANCH
HEC-HMS
OUTFALL "A" - OUTFLOW HYDROGRAPH - 2-YEAR



OUTFALL "A" - OUTFLOW HYDROGRAPH - 10-YEAR

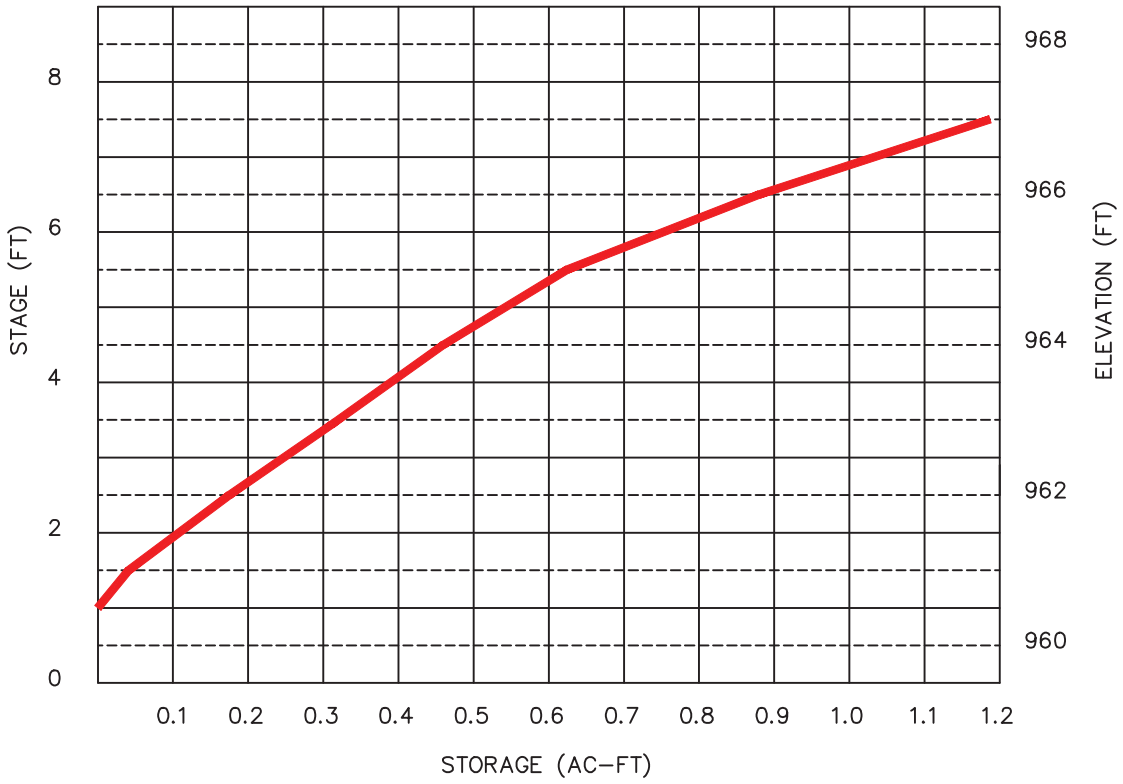


MCPL COLBERN ROAD BRANCH
HEC-HMS
OUTFALL "A" - OUTFLOW HYDROGRAPH - 100-YEAR

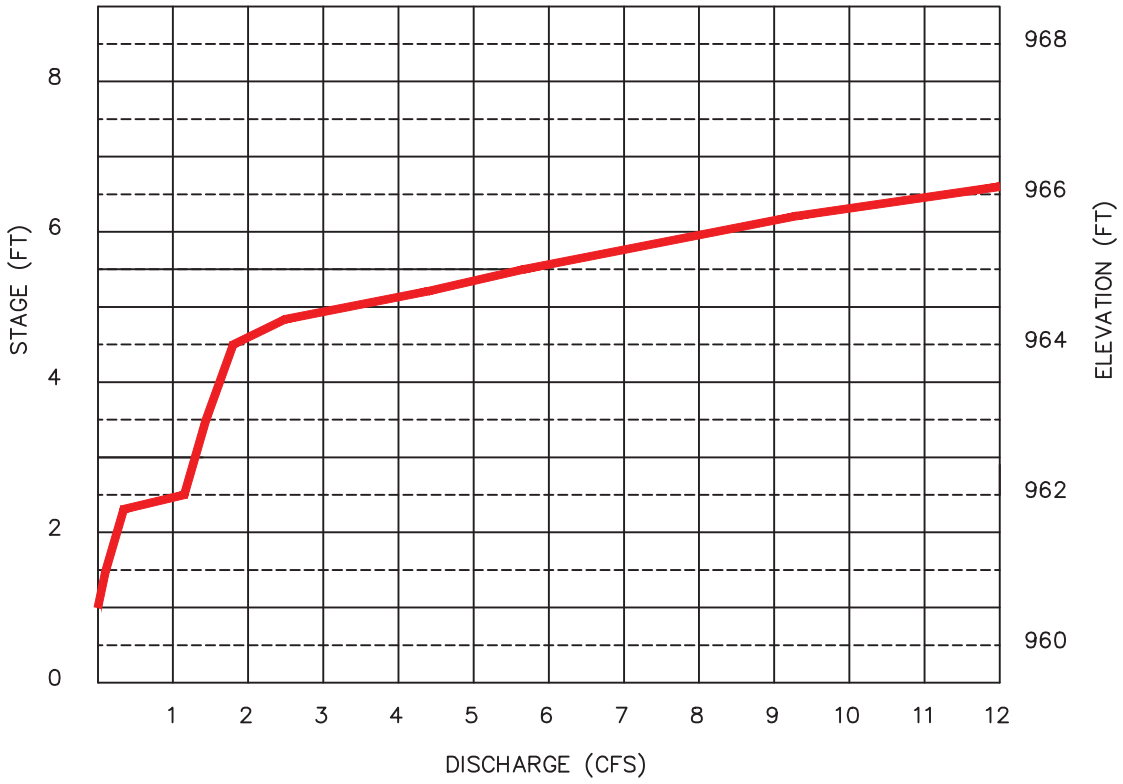


MCPL COLBERN ROAD BRANCH
EXTENDED DRY DETENTION BASIN
STAGE-STORAGE & STAGE-DISCHARGE CURVES

STAGE-STORAGE CURVE



STAGE-DISCHARGE CURVE



MID CONTINENT PUBLIC LIBRARY - COLBERN ROAD BRANCH
DETENTION BASIN STAGE DISCHARGE
MARCH 2020

STAGE	ELEV	TOTAL DISCHARGE	24" OUTLET PIPE FROM STRUCTURE WSE FOR DESIGN RELEASE RATE		FLOW AND ELEVATION AT OUTLET CONTROL PLATE			24" INLET PIPE FROM POND TO STRUCTURE WSE FOR DESIGN RELEASE RATE		REMARK
					FLOW THROUGH 1" PERF HOLES	FLOW THROUGH WEIR	WSE			
	elev ft	cfs	cfs	elev ft	cfs	cfs	elev ft	cfs	elev ft	
0	960.50	0	0	960.5	0	0	960.75	0	960.82	**INVERT OF OUTLET STRUCTURE**
+0.50	961.00	0.02	0.02	960.56	0.02	0	961.00	0.02	961.00	
+1.50	962.00	0.08	0.08	960.64	0.08	0	962.00	0.08	962.00	
+1.9	962.40	0.18	0.18	960.69	0.18	0	962.40	0.18	962.40	**WQv WSE**
+2.0	962.50	0.8	0.8	960.7	0.2	0.6	962.50	0.8	962.50	**8" ORIFICE INVERT**
+2.50	963.00	1.2	1.2	961.01	0.32	0.6	962.99	1.2	963.00	
+3.50	964.00	1.8	1.8	961.13	0.44	0	963.99	1.8	964.00	
+3.70	964.20	3.4	3.4	961.39	0.46	0	964.17	3.4	964.20	**BOTTOM OF WEIR**
+4.20	964.70	4.4	4.4	961.62	0.56	3.84	964.65	4.4	964.70	**10-Yr WSE**
+4.50	965.00	6.7	6.7	962.81	0.92	5.78	964.89	6.7	965.00	
+5.20	965.70	9.3	9.3	962.11	0.65	8.65	965.49	9.3	965.70	**100-Yr WSE**
+5.50	966.00	11.3	11.3	962.33	0.98	10.32	965.68	11.3	966.00	

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Mar 26 2020

DIVERSION SWALE ON WEST OF PROPERTY DRAINING TO THE NORTH TO OUTFALL B

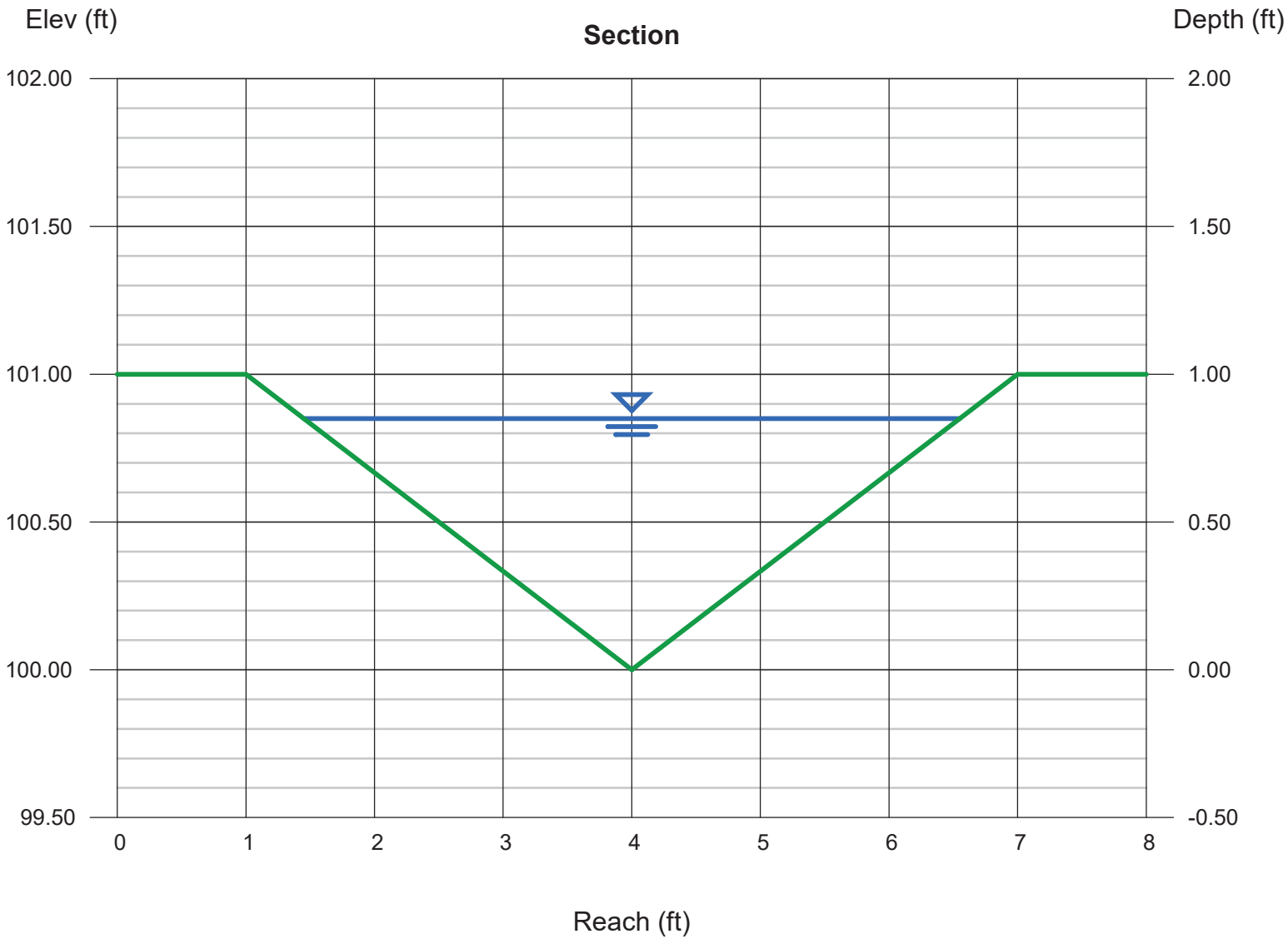
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 100.00
Slope (%)	= 1.00
N-Value	= 0.033

Calculations

Compute by:	Known Q
Known Q (cfs)	= 5.32

Highlighted

Depth (ft)	= 0.85
Q (cfs)	= 5.320
Area (sqft)	= 2.17
Velocity (ft/s)	= 2.45
Wetted Perim (ft)	= 5.38
Crit Depth, Yc (ft)	= 0.73
Top Width (ft)	= 5.10
EGL (ft)	= 0.94



Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Mar 26 2020

DIVERSION SWALE ON WEST OF PROPERTY DRAINING TO THE SOUTH TO OUTFALL C

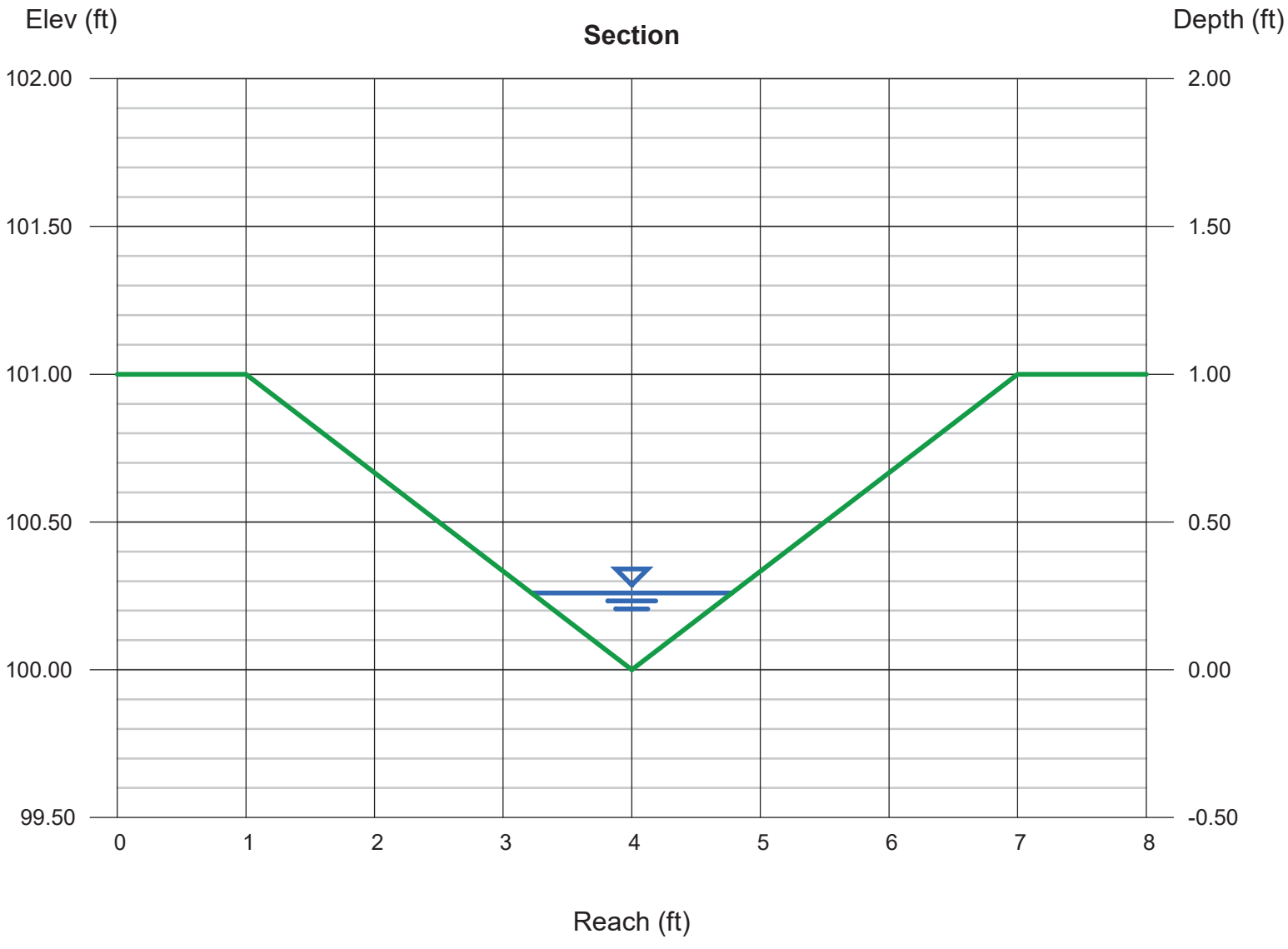
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 100.00
Slope (%)	= 1.00
N-Value	= 0.033

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.22

Highlighted

Depth (ft)	= 0.26
Q (cfs)	= 0.220
Area (sqft)	= 0.20
Velocity (ft/s)	= 1.08
Wetted Perim (ft)	= 1.64
Crit Depth, Yc (ft)	= 0.21
Top Width (ft)	= 1.56
EGL (ft)	= 0.28



MCPL COLBERN ROAD BRANCH
FLOW AND SHEAR STRESS IN DIRVESION
SWALE OFFSITE RUNOFF FROM THE WEST

	OUTFALL B	OUTFALL C		
	Off Site Area to Berm North	Off Site Area to Berm South	Unit	Remark
Time of Concentration				
Length of Drainage Path	1050	490	ft	
Slope	0.025	0.030	ft/ft	
C	0.3	0.3		
Ti	10.6	10.0	min	
Length - Ti	950	390	ft	
Swale Velocity	2.2	2.2	ft/s	
Tt	7.2	3.0	min	
Tc = Ti+Tt	17.8	13.0	min	>15, Us 15 min
Flow				
Area	1.93	0.22	ac	
Tc	15.0	13.0	min	
C	0.30	0.30		
k	1.25	1.25		
I(100)	7.36	7.81	in/hr	
Q=kCIA	5.32	0.64	cfs	
Shear Stress				
Depth in Channel	0.85	0.19	ft	from HydraExpress
Max Slope	0.03	0.05	ft/ft	
y (weight of water)	62.4	62.4	lb/ft3	
Shear Stress	1.59	0.59	lb/ft2	
Permissible Shear Stress	2.1	2.1	lb/ft2	Class C - Native Grass Good Condition
Shear Stress < Permissible	OK	OK		

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Mar 23 2020

FLOW THROUGH EMERGENCY SPILLWAY

Trapezoidal

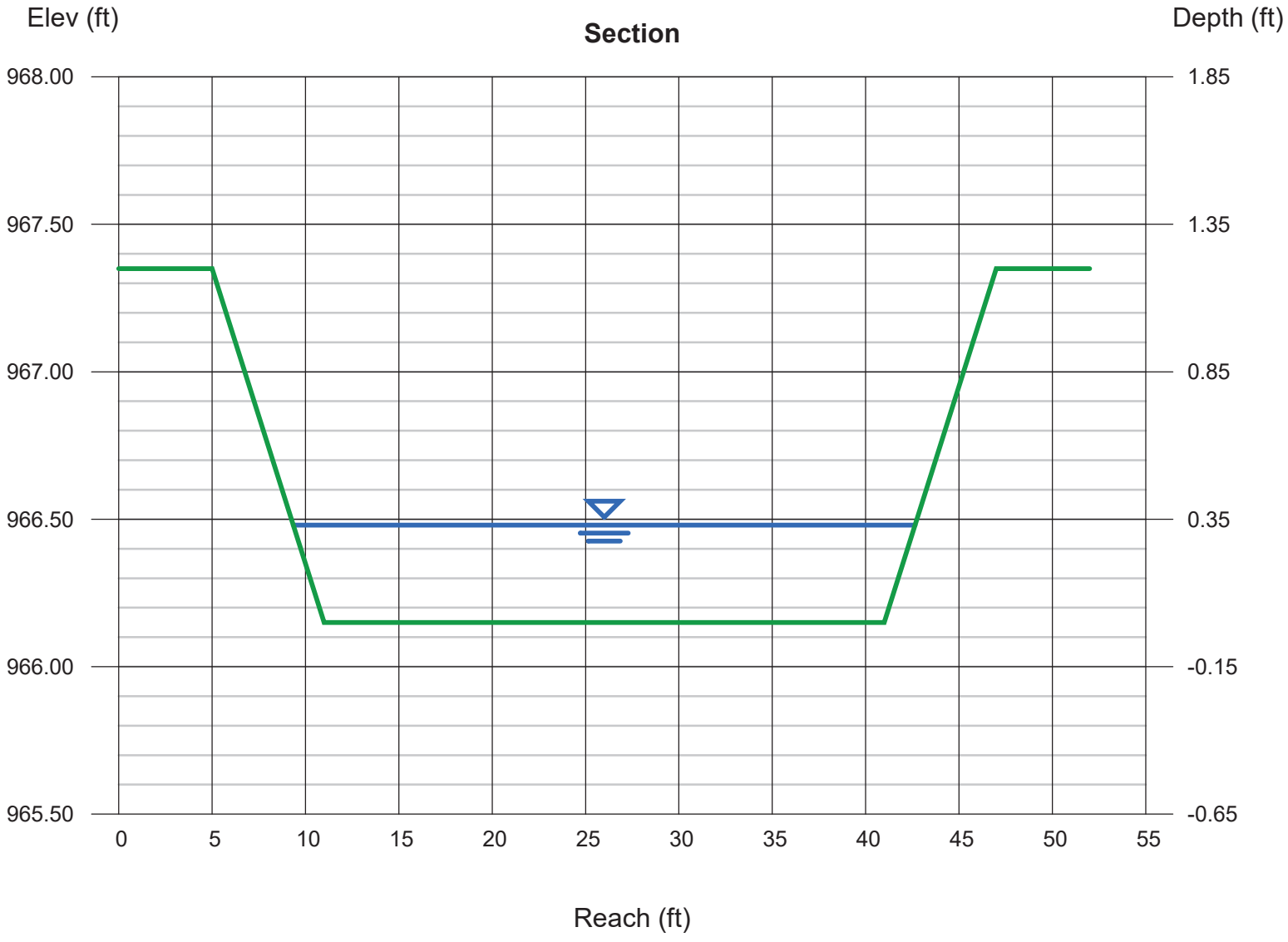
Bottom Width (ft)	= 30.00
Side Slopes (z:1)	= 5.00, 5.00
Total Depth (ft)	= 1.20
Invert Elev (ft)	= 966.15
Slope (%)	= 2.00
N-Value	= 0.033

Calculations

Compute by:	Known Q
Known Q (cfs)	= 29.40

Highlighted

Depth (ft)	= 0.33
Q (cfs)	= 29.40
Area (sqft)	= 10.44
Velocity (ft/s)	= 2.81
Wetted Perim (ft)	= 33.37
Crit Depth, Yc (ft)	= 0.31
Top Width (ft)	= 33.30
EGL (ft)	= 0.45



MCPL COLBERN ROAD BRANCH
SCOUR PROTECTION IN BOTTOM OF BASIN

(/)

ScourStop® Transition Mats

ScourStop® Transition Mats are an engineered, proven, bio-technical alternative to traditional hard-armor systems. ScourStop® Transition Mats are manufactured of a semi-rigid HDPE. When combined with soft-armor soil cover and deep-soil earth anchors, the ScourStop® system mechanically protects soil from severe scour and erosion. The ScourStop® system offers greater protection than vegetation alone or rip rap and is lab-tested and field-proven to protect against considerably higher shear stresses and velocities. ScourStop® Transition Mats provide a permanent, low-maintenance solution with immediate, day-one protection and impact resistance over highly erosive areas such as stormwater outfalls, curb outfalls, overflow structures, drainage channels, levees, and shorelines. ScourStop® Transition Mats conform to the property values listed below:

MCPL COLBERN ROAD BRANCH
SCOUR PROTECTION IN BOTTOM OF BASIN

Property List | Additional Downloads

All values provided are intended for rapid comparison purposes, only. Please refer to a specific product's Product Data Sheet (PDS) and the disclaimers therein for a detailed listing of all characteristics, associated definitions and values needed for structure design, specification compliance review and product submittal purposes. Please Download PDS (/document/load/scourstop-transition-mats-spec-sheet-1661.pdf) for all information transfer, printing and submittal purposes.

Property	Test Method	English	Metric
Properties			
Mass/Unit Area	ASTM D6566	**0.942** lbs/ft^2	**4.599** kg/m^2
Thickness	ASTM D6525	**0.463** in	**11.735** mm
Wide Width Tensile Strength	ASTM D4595	**3,053** lbs/ft	**4.139** kN/m
Percent Open Area	Calculated	**50** %	**50** %
UV Stability	ASTM D4355	**87** %	**87** %
Manning's n	Calculated	**0.039**	**0.039**
Culvert Outfall Test Exit Velocity Discharge	Prototype	**16** ft/sec	**4.877** m/sec
Velocity Day 1 Performance Fully Vegetated	Flume Testing ASTM D6460	**19** ft/sec	**5.791** m/sec
Shear Day 1 Performance Fully Vegetated	Flume Testing ASTM D6460	**13** lbs/ft^2	**63.472** kg/m^2

HANES GEO COMPONENTS – 815 Buxton Street, Winston-Salem, NC 27101-1310

LANDLOK®
BY PROPEX

Product Data
LANDLOK® 435

LANDLOK® 435 turf reinforcement mat (TRM) ***features X3® technology*** *that* consists of a dense web of crimped, interlocking, multi-lobed polypropylene fibers positioned between two biaxially oriented nets and mechanically bound together by parallel stitching with polypropylene thread. The TRM is designed to accelerate seedling emergence, exhibit high resiliency, and possess strength and elongation properties to limit stretching in a saturated condition. Every component of **LANDLOK 435** is stabilized against chemical and ultraviolet degradation which are normally found in a natural soil environment. Furthermore, the TRM contains no biodegradable components.

LANDLOK 435 conforms to the property values listed below[1] and is manufactured at a Propex facility having achieved ISO 9001:2000 certification. Propex performs internal Manufacturing Quality Control (MQC) tests that have been accredited by the Geosynthetic Accreditation Institute – Laboratory Accreditation Program (GAI-LAP). This product NTPEP approved for AASHTO standards.

PROPERTY	TEST METHOD	TYPICAL[2] ENGLISH	TYPICAL[2] METRIC
ORIGIN OF MATERIALS			
% U.S. Manufactured Inputs		100%	100%
% U.S. Manufactured		100%	100%
PHYSICAL			
Mass/Unit Area	ASTM D-6566	8.0 oz/yd^2	271 g/m^2
Thickness	ASTM D-6525	0.35 in	8.9 mm
Light Penetration (% Passing)	ASTM D-6567	40%	40%
Color	Visual	Green	
MECHANICAL			
Tensile Strength	ASTM D-6818	225 x 175 lb/ft	3.3 x 2.6 kN/m
Elongation	ASTM D-6818	50% (max)	50% (max)
Resiliency	ASTM D-6524	80%	80%
Flexibility	ASTM D-6575	0.015 in-lb (avg)	16,000 mg-cm (avg)
ENDURANCE			
UV Resistance % Retained 1000 hrs	ASTM D-4355	80%	80%
PERFORMANCE			
Velocity[3] (Vegetated)	Large Scale	12 ft/s	3.7 m/s
Shear Stress[3] (Vegetated)	Large Scale	8 lb/ft^2	383 Pa
Manning's "n"[4] (Unvegetated)	Calculated	0.025	0.025
Seedling Emergence[4]	ECTC Draft Method #4	273%	273%

ROLL SIZES	6.5 ft x 138.5 ft	2.0 m x 42.2 m

NOTES:
1. The property values listed are effective 04/2011 and are subject to change without notice.
2. Typical Values
3. Maximum permissible velocity and shear stress has been obtained through vegetated testing programs featuring specific soil types, vegetation classes, flow conditions, and failure criteria. These conditions may not be relevant to every project nor are they replicated by other manufacturers. Please contact Propex for further information.
4. Calculated as typical values from large-scale flexible channel lining test programs with a flow depth of 6 to 12 inches.

Propex™ Geotextile Systems

TESTED. PROVEN. TRUSTED.
www.geotextile.com

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ph 423 899 0444 · ph 800 621 1273 · fax 423 899 7619