Preliminary Stormwater Management Study

Colton's Crossing
Prepared for Hamblen Road Project, LLC
705 B Melody Lane
Lee's Summit, MO 64063

City of Lee's Summit Project No. PL2022217
HG Consult Project No. 21.018

Prepared by Matthew Castor
May 27, 2022
Revised: November 13, 2022

11/13/2022

HG Consult Inc engineers planners

I. Table of Contents

II. General Information

A. Description of Existing Site, Location, and Proposed Use

The Colton's Crossing Subdivision will consist of the development of a parcel, currently zoned AG, located along SE Hamblen Road directly Northeast of Shamrock Hills Golf Club. The site is currently vacant and being used as farmland.

The proposed use of the site will be Single Family residences and duplexes. The site will also include a clubhouse, swimming pool, and a parking lot to access these amenities.

Figure II.A.1 – 2021 Aerial Photo of the project site

Figure II.A.2 – 2021 Aerial Photo of the project site

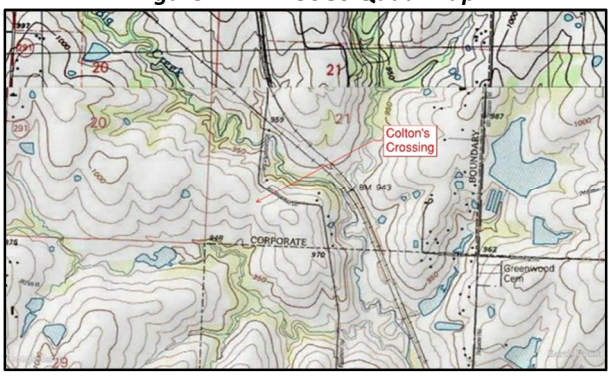
B. General Overview of Drainage Patterns

The project site is divided into several drainage areas due to an existing ridge that divides the property and the existing alignment of SE Hamblen Road.

Water that is North of the ridge is collected in several creeks/ravines and routed approximately 600 feet to a box culvert at SE Hamblen Road. The box culvert allows Big Creek to carry water under SE Hamblen Road.

Water that is South of the ridge is collected in several creeks/ravines and routed to a small tributary immediately South of the property line. From there the water is carried in the tributary South and East to Big Creek (for 1.0 mile).

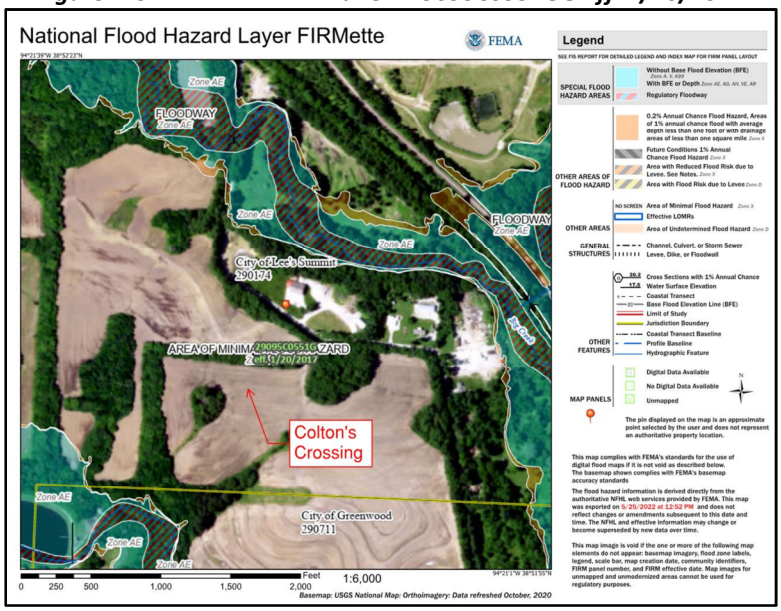
Figure II.B.1 – USGS Quad Map



C. FEMA Classification / Floodplain Issues

The Site is located primarily within a Zone X with a small portion being located within a Zone AE as represented in the NE and SW. There are no floodplain boundaries being altered and therefore a Flood Study is not required. See Figure II.C.1 for Firm Panel. Included as Figure I of this report is a Stream Buffer Evaluation.

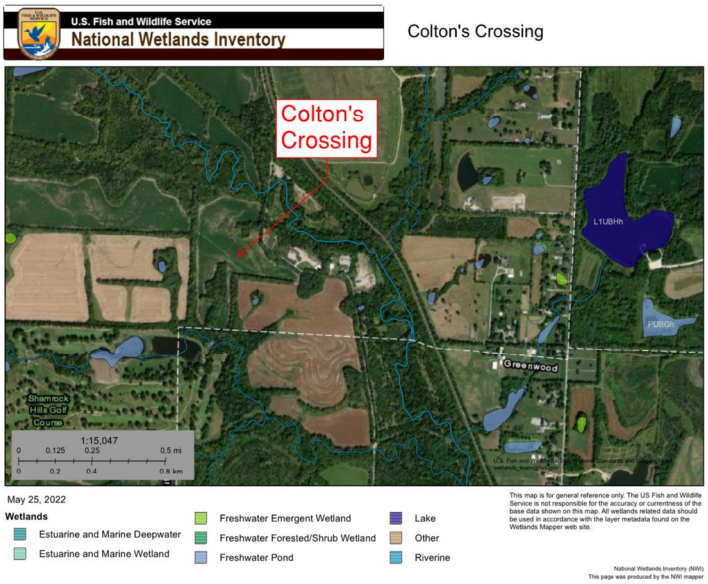
Figure II.C.1 – FEMA FIRM Panel #29095C0551GG Eff. 1/20/2017



D. Wetland and USACE Issues

There are no wetlands or Waters of the US being disturbed by this project and therefore no permits are required by the Corps of Engineers for the development of this site. See figure II.D.1 for US Fish and Wildlife Wetland Inventory Map.

Figure II.D.1 – US Fish and Wildlife National Wetland Inventory



E. Soil Classification

NRCS Web Soil Survey categorizes the soils for this project below. See appendix for additional information.

Table II.E.1 – Soil Classification

Symbol	Name	Slopes	HSG
10000	Arisburg silt loam	1-5%	C
10113	Oska silty clay loam	5-9%	D
10116	Sampsel silty clay loam	2-5%	C/D
10117	Sampsel silty clay loam	5-9%	C/D
10142	Snead-Rock outcrop	5-14%	D
13629	Colo silt loam	1-4%	C/D
30080	Greenton silty clay loam	5-9%	C/D

For this analysis, Soil group C was considered for the project as a precaution. Curve Numbers were used in accordance with APWA Section 5602.3.

III. Methodology

A. Unit Hydrograph Modeling Methods

The method for evaluating Colton's Crossing was with the use of PondPack V8i. Both Pre-Development and Post-Development conditions were considered. The unit hydrograph method used was SCS TR-55.

B. Computation Methods for Runoff Determinations

The computation methods used for runoff determinations are as follows:

- AMC II Soil Moisture conditions
- 24-Hour SCS Type II Rainfall Distribution
- SCS Runoff Curve Numbers per TR-55
- Time of Concentration developed per TR-55

C. Design Storm Events Used and Source of Rainfall Data

The design storms that were considered include the 2, 10, 100, and subsequent 100-Year storms. The rainfall data was gathered from NRCS utilizing curves for a Type II 24-hour rainfall.

Table III.C.1 – Methodology and Rainfall Data

Methods and Rainfall Data	
Pond Routing	Pondpack using SCS Method
Existing CN	74, Group C soils
T_C	5 minutes
Water Quality, Type II, 24-hr	1.4 inch
2-yr rainfall, Type II, 24-hr	3.5 inch
10-yr rainfall, Type II, 24-hr	5.3 inch
100-yr rainfall, Type II, 24-hr	7.7 inch

IV. Existing Conditions Analysis

A. Summary of Comprehensive Control Requirements

As mentioned previously the soils on-site consist of primarily Arisburg silt loam and Sampsel silty clay with a hydrologic group of C. The site has steep grades around the boundary, tree lines, and existing ravine areas with moderate grades everywhere else. Cover is low as its current use is farmland. The APWA default strategy was used to provide comprehensive protection. The APWA default strategy reads as follow:

> *"Under this strategy, peak runoff control is provided for the 1%, 10% and 50% chance storms and volumetric and/or extended detention control of the 90% mean annual event storm for broad protection of the receiving system, including channel erosion protection and flood peak reductions over a range of return periods. This strategy shall be the default strategy unless otherwise designated or approved by the local authority. Performance standards and sizing criteria are provided in Section 5608."*

B. Existing Drainage Area Map

See appendix (Pre-Developed Drainage Area Map) for all drainage areas and outfall location. See Table IV.B.1 for summary of On-Site/Off-Site Areas.

Table IV.B.1 – Pre-Developed Drainage Areas

Drainage Area	Total Area (acres)
E-1A	0.74
E-1B	5.55
E-1C	12.10
E-2A	14.82
E-2B	11.78
E-2C	9.85
E-2D	0.80
E-3	1.44
E-4	5.22
E-5	3.97
E-6	4.81

C. Description of Each Drainage Area

E-1 (A-C): These areas all occur on the North side of the site with slopes ranging from 2-15%. These areas drain North in natural ravines/creeks and then routed approximately 600 feet into Big Creek.

E-2 (A-D): These areas all occur on the South side of the site with slopes ranging from 2-20%. These areas drain South in natural ravines/creeks and then routed to a small tributary immediately South of the property line. From there the water is carried in the tributary South and East to Big Creek (for 1.0 mile).

E-3: A small area located in the SE quadrant of the site with slopes ranging from 3-10%. This area drains East towards SE Hamblen Road to the POI (18" CMP). After leaving the 18" CMP the water flows East to Big Creek (for 0.09 mile).

E-4: An area located on the Eastern boundary of the site with slopes ranging from 2-15%. Most of this area drains East to a small pond (area of standing water). As the water level rises in the pond, it is then released and flows East towards SE Hamblen Road to the POI (18" RCP). After leaving the 18" RCP the water flows East to Big Creek (for 0.07 mile).

E-5: An area located on the Eastern boundary of the site with SE Hamblen Road as the Northern boundary. The slopes in this area range from 1-10%. This area drains East towards SE Hamblen Road to the POI (24" CMP). After leaving the 24" CMP the water flows East to Big Creek (for 0.11 mile).

E-6: An area located in the center of the site with slopes ranging from 2-20%. This area drains North towards SE Hamblen Road to the POI (28"x42" CMP). After leaving the 28"x42" CMP the water flows North into a small pond. The pond discharges Northeast to Big Creek (for 0.05 mile).

D. Table Summarizing Input Data

Table IV.D.1 – Pre-Developed Input Area Data

Sub-Area Name	Area	CN	TOC (min)
E-1A	0.74	74	5
E-1B	5.55	74	5
E-1C	12.10	74	5
E-2A	14.82	74	5
E-2B	11.78	74	5
E-2C	9.85	74	5
E-2D	0.80	74	5
E-3	1.44	74	5
E-4	5.22	74	5
E-5	3.97	74	5
E-6	4.81	74	5

E. Table Summarizing Peak Runoff Rates

Table IV.E.1 – Pre-Developed Peak Runoff Rate

Sub-Area Name	Q (cfs)
E-1A	5.40
E-1B	40.54
E-1C	88.37
E-2A	108.24
E-2B	86.04
E-2C	71.94
E-2D	5.84
E-3	10.52
E-4	38.13
E-5	29.00
E-6	35.13

F. Table Summarizing "Allowable Release Rate"

Table IV.F.1 – Pre-Developed Allowable Peak Runoff Rate

Sub-Area Name	2-Year (cfs)	10-Year (cfs)	100-Year (cfs)
E-1 Total (E-1A+E-1B+E-1C)	9.20	36.78	55.17
E-2 Total (E-2A+E-2B+E-2C+E-2D)	18.63	74.50	111.75
E-3	0.72	2.88	4.32
E-4	2.61	10.44	15.66
E-5	1.99	7.94	11.91
E-6	2.41	9.62	14.43

Comprehensive values utilizing 0.5 cfs (2-YR), 2 cfs (10-YR), and 3 cfs (100-YR) per site acre

V. Proposed Conditions Analysis

A. Proposed Drainage Area Map

See appendix (Post-Developed Drainage Area Map) for all on-site and off-site areas and outfall locations for each drainage area. See Table IV.A.1 for more detailed information.

Table V.A.1 – Post-Developed Drainage Areas

Drainage Area	Total Area (acres)
P-1A	12.96
P-1B	1.59
P-2A	43.37
P-2B	4.86
P-3	1.22
P-4	2.63
P-5	3.66
P-6	4.01

B. Narrative Description of All Proposed Drainage Areas

P-1 (A-B): A large area containing most of the developed site North of the Hook Road re-alignment. This area decreased from the existing condition of 18.39 acres (E-1A, E-1B, and E-1C) to the proposed condition of 14.55 acres (P-1A and P-1B). This area is divided into two sub-areas. Sub-area P-1A drains into the North pond which is designed to over-detain to account for P-1B which does not get routed through the pond. The P-1 POI is reduced below the allowable rates (Table IV.F.1) using the comprehensive values of 0.5, 2, and 3 cfs per developed drainage acre (2, 10, & 100-Year values respectively). The pond also meets the freeboard requirements for APWA. The CN value increased from 74 to 83 for single family areas per APWA 5602.3.

P-2 (A-B): A large area containing most of the developed site South of the Hook Road re-alignment. This area increased from the existing condition of 37.25 acres (E-2A, E-2B, E-2C, and E-2D) to the proposed condition of 48.23 acres (P-2A and P-2B). This area is divided into two sub-areas. Sub-area P-2A drains into the South pond which is designed to over-detain to account for P-2B which does not get routed through the pond. The P-2 POI is reduced below the allowable rates (Table IV.F.1) using the comprehensive values of 0.5, 2, and 3 cfs per developed drainage acre (2, 10, & 100-Year values respectively). The pond also meets the freeboard requirements for APWA. The CN value increased from 74 to 83 for single family areas per APWA 5602.3.

P-3: A small area located in the SE quadrant of the site. This area decreased from the existing condition to the proposed condition. Although not designed yet, the anticipated design of this area would force water to flow to the same outlet as the existing condition. The CN value increased from 74 to 83 for single family areas per APWA 5602.3.

P-4: An area located on the Eastern boundary of the site where the new cul-de-sac of Hamblen Court will be constructed. This area decreased from the existing condition to the proposed condition. Although not designed yet, the anticipated design of this area would force water to flow near the same outlet as the existing condition. The CN value increased from 74 to 83 for single family areas per APWA 5602.3.

P-5: An area located on the Eastern boundary of the site where the new alignment of Hamblen Court will be constructed. This area decreased from the existing condition to the proposed condition. Although not designed yet, the antici-

pated design of this area would force water to flow near the same outlet as the existing condition. The CN value increased from 74 to 83 for single family areas per APWA 5602.3.

P-6: An area located in the center of the site that accounts for the future underground storm system for the re-aligned Hook Road. This area decreased from the existing condition to the proposed condition. Although not designed yet, the anticipated design of this area would force water to flow near the same outlet as the existing condition. The CN value increased from 74 to 83 for single family areas per APWA 5602.3.

C. Table Summarizing Input Data

Table V.C.1 – Post-Developed Input Area Data

Sub-Area Name	Area	CN	TOC (min)
P-1A	12.96	83	5
P-1B	1.59	83	5
P-2A	43.37	83	5
P-2B	4.86	83	5
P-3	1.22	83	5
P-4	2.63	83	5
P-5	3.66	83	5
P-6	4.01	83	5

D. Table Summarizing Peak Runoff Rates

Table V.D.1 – Post-Developed Peak Runoff Rate

Sub-Area Name	**Q (cfs)**
P-1A (Pond In)	112.56
P-1A (Pond Out)	37.70
P-1B	13.81
P-1 Total (P-1A+P-1B)	46.71
P-2A (Pond In)	376.68
P-2A (Pond Out)	82.93
P-2B	42.21
P-2 Total (P-2A+P-2B)	110.54
P-3	10.60
P-4	22.84
P-5	31.79
P-6	34.83

E. Table Summarizing Allowable and Proposed Release Rates

Table V.E.3 – Post-Developed Allowable Peak Runoff Rate

Sub-Area Name	2-Year (cfs)	10-Year (cfs)	100-Year (cfs)
P-1 Total Allowable	9.20	36.78	55.17
P-1 Total Proposed	9.10	29.51	46.71
P-1 Total Difference	**0.10**	**7.27**	**8.46**
P-2 Total Allowable	18.63	74.50	111.75
P-2 Total Proposed	18.63	65.47	110.54
P-2 Total Difference	**0.00**	**9.03**	**1.21**
P-3 Allowable	0.61	2.44	3.66
P-3 Proposed	3.57	6.55	10.60
P-3 Difference	**2.96**	**4.11**	**6.94**
P-4 Allowable	1.32	5.26	7.89
P-4 Proposed	7.69	14.12	22.84
P-4 Difference	**6.37**	**8.86**	**14.95**
P-5 Allowable	1.83	7.32	10.98
P-5 Proposed	10.71	19.66	31.79
P-5 Difference	**8.88**	**12.34**	**20.81**
P-6 Allowable	2.00	8.02	12.03
P-6 Proposed	11.73	21.54	34.83
P-6 Difference	**9.73**	**13.52**	**22.80**

F. Tables Summarizing Detention/Retention Input Data and Results

Table V.F.1 –North Pond Input Data

	ELEV
30" Culvert (Upstream Invert)	949.40
1.75" Orifice (WQ)	949.50
.4'x2' Orifice (2-Year)	951.60
.7'x5' Orifice (10-Year)	953.50
.4'x2' Orifice (100-Year)	954.60
5'x5' Riser (100-Year*)	956.50
Top of Pond	959.00

Table V.F.2 – North Pond Results

	2-Year	10-Year	100-Year	100-Year*
Allowable Discharge (cfs) P-1 Total	9.20	36.78	55.17	
Pond Discharge (cfs) P-1A	6.65	24.18	37.70	72.40
P-1B Discharge (cfs)	4.65	8.54	13.81	
Total Discharge (P-1)	9.10	29.51	46.71	
Difference	**0.10**	**7.27**	**8.46**	
Pond WSE	953.56	954.61	955.96	958.00
Top of Pond	959.00	959.00	959.00	959.00
Freeboard	**5.52**	**4.45**	**3.10**	**1.00**

*Assumes zero flow through primary outlet with subsequent 1% storm event

Table V.F.3 –South Pond Input Data

	ELEV
48" Culvert (Upstream Invert)	948.40
3" Orifice (WQ)	948.50
0.5'x1.5' Orifice (2-Year)	951.25
1.0'x4.75' Orifice (10-Year & 100-Year)	953.50
6'x5' Riser (100-Year*)	956.75
500' Weir (100-Year*)	956.75
Top of Pond	958.25

Table V.F.4 – South Pond Results

	2-Year	10-Year	100-Year	100-Year*
Allowable Discharge (cfs) P-2 Total	18.63	74.50	111.75	
Pond Discharge (cfs) P-2A	5.86	52.94	82.93	368.56
P-2B Dishcarge (cfs)	14.22	26.10	42.21	
P-2 POI	18.63	65.47	110.54	
Difference (Allowable - P-2 POI)	**0.00**	**9.03**	**1.21**	
Pond WSE	953.48	954.53	956.25	957.11
Top of Pond	958.25	958.25	958.25	958.25
Freeboard	**4.77**	**3.72**	**2.00**	**1.14**

*Assumes zero flow through primary outlet with subsequent 1% storm event

G. Undetained Drainage Areas

There are six areas within this development which are undetained. Explanations of each are below:

P-1 B: Sub-area P-1B is undetained due to elevation and grading constraints. When looking at the entirety of E-1 vs. P-1 the total acreage has been reduced. The north pond has been designed to over-detain to account for P-1B being un-detained. The P-1 POI is below the allowable for all storm events.

P-2B: Sub-area P-2B is undetained due to elevation and grading constraints. When looking at the entirety of E-2 vs. P-2 the total acreage has been increased. The south pond has been designed to over-detain to account for P-2B being un-detained. The P-2 POI is below the allowable for all storm events.

P-3: This area is undetained due to elevation and grading constraints. This area also accounts for a portion of the future Hook Road alignment storm system which will not be the responsibility of this development to detain. This area decreased from the existing condition to the proposed condition. The anticipated peak flows have increased by 0.08 cfs because of a higher CN value but there are no concerns with downstream effects. We would like to request a waiver from DCM for this fringe area.

P-4: This area is undetained due to elevation, grading, and location constraints. This area also accounts for portions of the future Hook Road & Hamblen Court alignment storm systems which will not be the responsibility of this development to detain. This area decreased from the existing condition to the proposed condition. The anticipated peak flows have decreased and there are no concerns with downstream effects.

P-5: This area is undetained due to elevation, grading, and location constraints. This area also accounts for portions of the future Hook Road & Hamblen Court alignment storm systems which will not be the responsibility of this development to detain. This area decreased from the existing condition to the proposed condition. The anticipated peak flows have increased by 2.28 cfs because of a higher CN value but there are no concerns with downstream effects.

P-6: This area is undetained because it accounts for the future Hook Road alignment storm system which will not be the responsibility of this development to detain. This area decreased from the existing condition to the proposed condition. The anticipated peak flows have decreased and there are no concerns with downstream effects.

H. Water Quality Requirements

The proposed development is providing stormwater treatment per APWA 5608.4 and Chapter 6 of the MARC/APWA BMP Manual. As indicated in this study the proposed stormwater treatment is extended dry detention with a 1.37" storm release over a 40-hour period.

I. Water Quality Summary

Figure V.I.1 – North Pond WQ Results

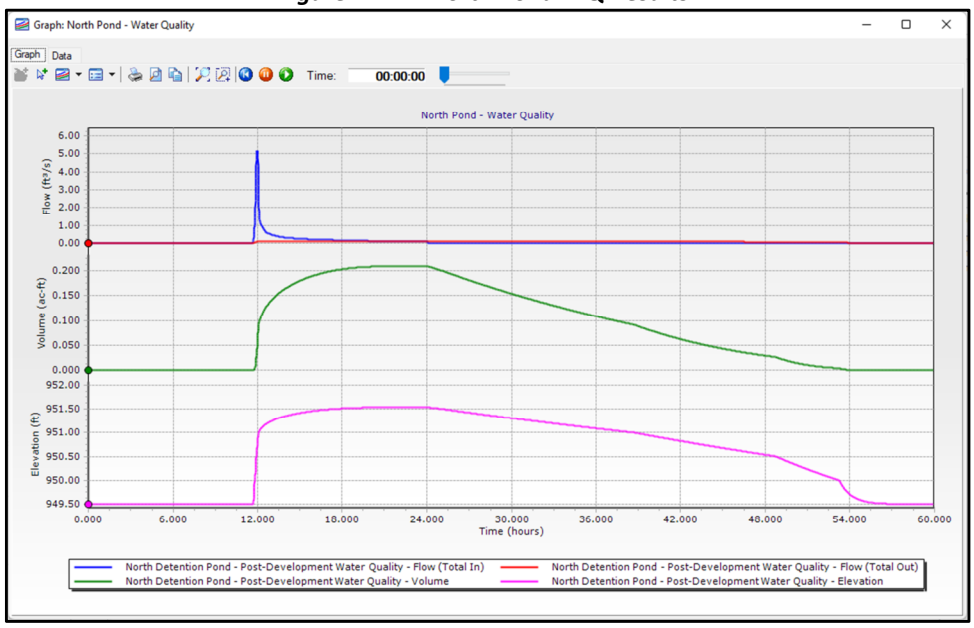
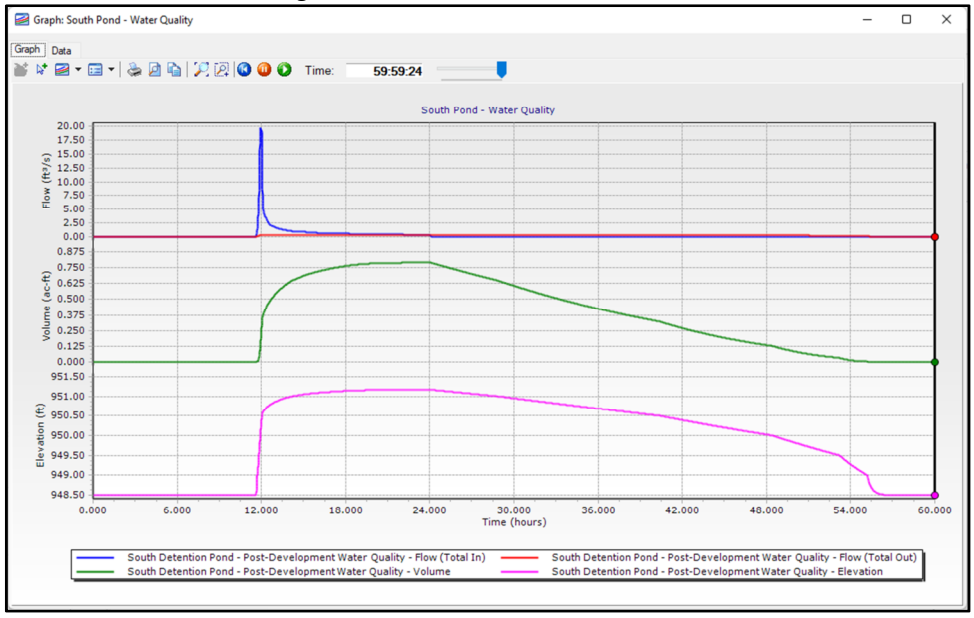


Figure V.I.2 – South Pond WQ Results



VI. Conclusions and Recommendations

A. Overview of the Report

As indicated in the report the project has 8 POI's. Within the developed area there are 2 dry ponds being proposed to provide comprehensive control on-site. These ponds will treat WQ, 2, 10, 100, and subsequent 100-Year events. There are 6 fringe areas which pose difficulty in providing comprehensive control. Three area are linear in nature (P-4, P-5, and P-6) because they encompass the new alignments of Hook Road and Hamblen Court future storm systems and do not require a waiver. P-3 is peripheral drainage and we are requesting a waiver. P-1B and P-2B are not being detained but the ponds are being overdesigned in order to account for these areas. We would like to request a waiver for the P-3 drainage area.

B. List of Requested Waivers

P-3 – Waiver requested. See section V.G.

VII. Appendix - Figures / Maps / Exhibits / Supporting Calculations

Figure A – Web Soil Survey
Figure B – Pre-Developed Drainage Area Map
Figure C – Post-Developed Drainage Area Map
Figure D – Elevation-Area-Volume Curves
Figure E – Inflow Hydrographs
Figure F – Stage-Discharge Rating Curves & Input Data Per Basin Outlet
Figure G – Routing Curves for all Design Storms
Figure H – Pondpack Master Summary
Figure I – Stream Buffer Evaluation

FIGURE B

E-1A
0.74 ACRES
CN=74

E-1B
5.55 ACRES
CN=74

E-1C
12.10 ACRES
CN=74

E-6
4.81 ACRES
CN=74

E-2A
14.82 ACRES
CN=74

E-2B
11.78 ACRES
CN=74

E-2C
9.85 ACRES
CN=74

E-2D
0.80 ACRES
CN=74

E-5
3.97 ACRES
CN=74

E-4
5.22 ACRES
CN=74

E-3
1.44 ACRES
CN=74

SE HAMBLEN RD

RAINBOW RIDGE ADDITION

FLATTERY
DOC.#200110015224

0 100' 150' 200'
SCALE: 1" = 100'

DATE	REVISION	NO.	BY	CKAPP

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STATE OF MISSOURI
MATTHEW JAMES CASTOR
NUM3ER 2015035109
REGISTERED PROFESSIONAL ENGINEER

MATT CASTOR, PE 2015035109
November 14, 2022

Consult inc engineers planners
1533 Locust Street, Kansas City, Missouri 64108
CORPORATE LICENSE No. E2010000573 (MO.) / E-1736 (NS.) / LS 2019000573 (MO.) / LS 2019055467

PRE-DEVELOPED DRAINAGE AREA MAP

COLTON'S CROSSING
FIRST PLAT
CITY OF LEE'S SUMMIT JACKSON COUNTY, MISSOURI

X-REF NO.
21-018 Base
DRAWING NO.
21-018 Preliminary Plat
DATE
May 27, 2022
JOB NO.
21-018
SHEET 1 OF 2

PLOT DATE: 11/14/2022 3:29 PM by RICHARD MICHAEL
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FIGURE C

P-1B
1.59 ACRES
CN=83

P-1A
12.96 ACRES
CN=83

P-6
4.01 ACRES
CN=83

P-2A
43.37 ACRES
CN=83

P-2B
4.86 ACRES
CN=83

P-5
3.66 ACRES
CN=83

P-4
2.63 ACRES
CN=83

P-3
1.22 ACRES
CN=83

FLATTERY
DOC.#2001I0015224

RAINBOW RIDGE ADDITION

HOOK ROAD

BAXTER LANE

BENNET LANE

COLTONS DRIVE

STEPHENS LANE

HAMBLEN COURT

SCALE: 1" = 100'

DATE	REVISION	NO.	BY	CK/APP

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POST-DEVELOPED DRAINAGE AREA MAP

COLTON'S CROSSING
FIRST PLAT

CITY OF LEE'S SUMMIT JACKSON COUNTY, MISSOURI

X-REF NO.
21-018 Base

DRAWING NO.
21-018 Preliminary Plat

DATE
May 27, 2022

JOB NO.
21-018

SHEET 2 OF 2

PLOT DATE: 11/14/2022 3:33 PM by RICHARD MICHAEL
FILE LOCATION: G:\SHARED PROJECTS\PROJECTS (YR 2021+)\2021\21-018 HAMBLEN ROAD MULTI-FAMILY RESIDENTIAL (HAMBLEN)\CIVIL\DWG\RETENTION DESIGN\ RAWS\21-018 RETENTION DESIGN.DWG