STORM WATER DRAINAGE REPORT

GOPPERT ACRES – 2ND PLAT

LEE'S SUMMIT, MISSOURI

PREPARED FOR

DUSTY GOPPERT

PREPARED BY

HG CONSULT, INC.

May, 2019

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3. Project Overview

The proposed project is a 5 lot, 10.18 acre residential subdivision developed in southwest Lee's Summit, Jackson County, Missouri. There is an existing street that will be extended onto the site from the east. There is an existing house on this project that is located on proposed Lot 7. The existing storm water flows from the site from the east in a north west and south west direction. There are three major existing drainage areas for this project. Drainage Area 1, located in the north east corner of property drains in a north direction to an existing residential subdivision. Drainage Area 2 drains in a south western direction to a residential subdivision, via a field inlet. Drainage Area 3 drains in a south western direction and in to an existing 3.3 acre pond. At the initial review stage, City staff concurred that the existing pond would function as the detention for the additional runoff from the development.

4. Drainage Assessment of the Project Site – Phase 2

This site after development will divert some of the existing storm flow from two of the existing drainage areas to the existing pond (utilized as the storm water detention area). Drainage Area 1 directs storm water off site to the east by the roadway to an off-site public storm sewer system on the south side of Southwest 15th Street. Drainage Area 2 directs storm water to the existing pond through a 15" pipe at the cul-de-sac. Drainage Area 3 directs storm water to the north to a residential subdivision. Drainage Area 4 directs storm water to the south west into an existing residential subdivision being captured by an off-site area inlet. Drainage Area 5 is unchanged in direction of storm water flow. This storm water discharges into the existing pond.

Existing Condition Curve Number Calculations

Type	Area (ac)	CN
DA-1	1.52	46
DA-2	2.42	46
DA-3	3.09	46
Total	**7.03**	**46**

Post Developed Curve Number Calculations

Type	Area (ac)	CN
DA-1	0.12	69
DA-2	0.73	67
DA-3	1.20	46
DA-4	1.96	46
DA-5	2.47	46
Total	**7.03**	**46**

Curve Numbers are based on the SCS/NRSCS Chart for various site conditions.Time of concentration was considered using TR-55; however, due to the small size of the drainage basin and the amount of impervious area on the site that will just be conveying sheet flow, a time of concentration of 5 minutes was assumed. This is the minimum time of concentration per APWA 5600.

The existing and proposed drainage areas are 7.03 acres and flows to the same single point of interest where the proposed existing pond is located. Therefore, no off-site drainage will be bypassing the detention pond.

Discharge rates for Existing Condition

Drainage Area	Area (ac)	Q10 (cfs)	Q100 (cfs)
DA-1	1.52	1.14	4.25
DA-2	2.42	1.82	6.77
DA-3	3.09	2.32	8.65
Total	**7.03**	**5.28**	**19.67**

Discharge rates for Post Developed Condition

Drainage Area	Area (ac)	Q10 (cfs)	Q100 (cfs)
DA-1	0.12	0.47	0.74
DA-2	0.73	2.64	5.08
DA-3	1.20	0.90	3.36
DA-4	1.96	1.47	5.48
DA-5	2.47	1.86	6.91
Total	**7.03**	**7.34**	**21.57**

5. Rip Rap Design

As requested, the rip rap at the end of the 15” flared section at the pond’s edge design has been calculated and sized based on the City’s unpublished riprap pad sizing chart for a 15” diameter pipe. The dimensions of the pad and nominal rock size are shown on the plans and the City chart is included in this report.

6. Temporary Erosion and Sediment Control

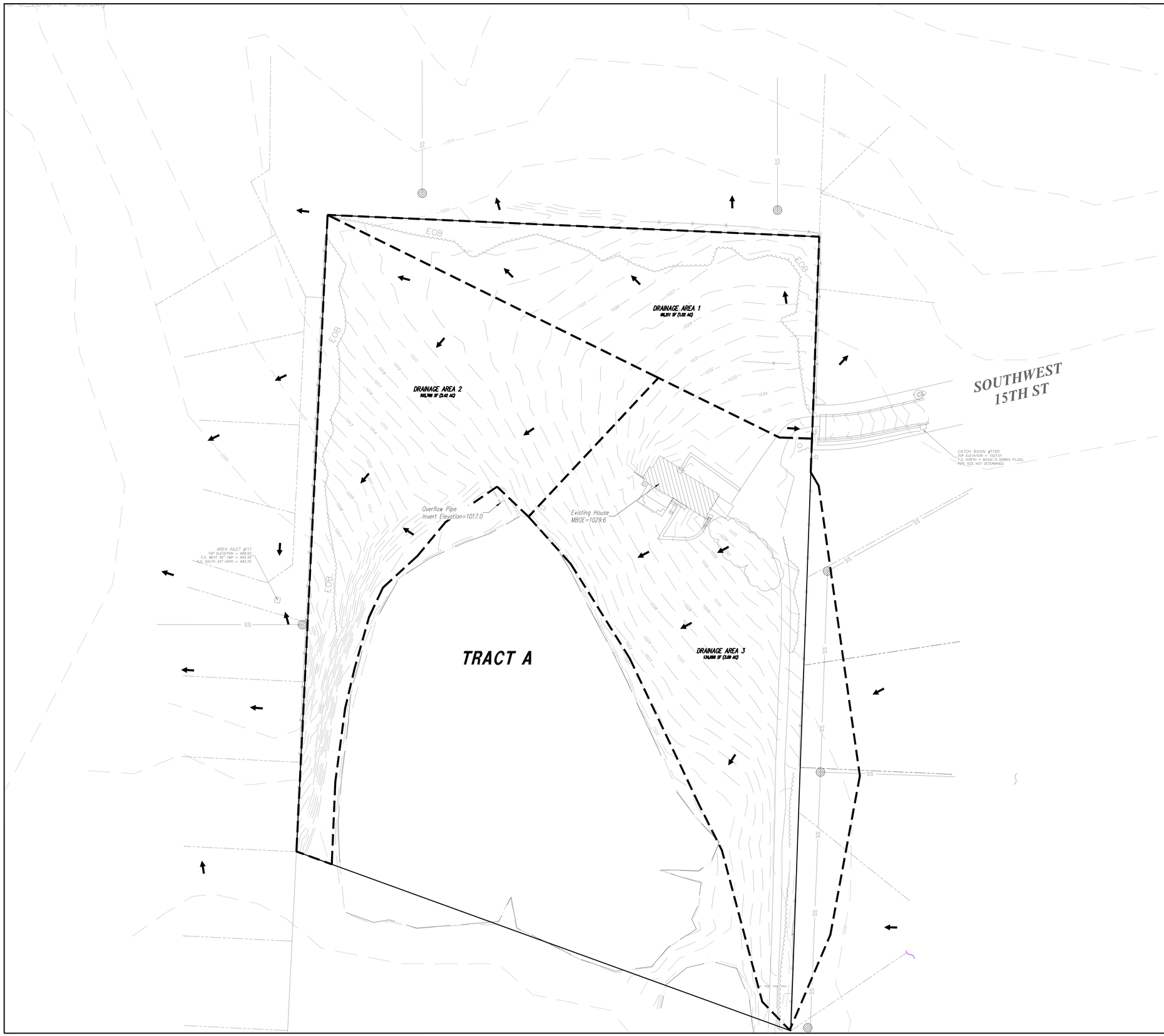
During construction and prior to paving, it will be necessary to control erosion and sediment from the site during storms with in the construction timeframe. To insure that sediment does not enter the existing storm system or runs off to the existing street, perimeter containment is controlled by silt fence installation, inlet protection and an engineered detention release structure. To keep construction traffic from tracking mud onto the adjacent city street, a stabilized rock construction entrance will need to be installed. These erosion control devices, and their maintenance throughout the construction timeframe, are required by ordinance and the details for them are referenced by the City's Design and Construction Manual and shown on Detail Sheets 9 and 10.

7. Conclusion

The proposed project is a proposed residential subdivision. The report has been prepared to evaluate the storm water discharge. Even though there is an increase in impervious coverage due to the street improvements and houses, it has been shown that with the majority of this changed coverage is directed to the pond and therefore very minimal impact or increase in sheet flow to downstream areas, especially to the north and east of the project, from roof drainage only.

8. Design Calculations and Exhibits

See the attached for drainage area calculations, flows, rip rap, pipe and inlet sizing for the project.



Know what's below.
Call before you dig.

0 30' 45' 60'
SCALE IN FEET

NO.	REVISION	DATE	BY	CK/APP

IF THIS IS NOT A BLUE INK SEAL AND THE SIGNATURE IN BLUE INK, THE PLAN IS A COPY AND MAY CONTAIN UNAUTHORIZED ALTERATIONS. THE CERTIFICATION CONTAINED ON THIS DOCUMENT SHALL NOT APPLY TO ANY COPIES

STATE OF MISSOURI
R. KEVIN STERRETT
NUMBER E-26440
REGISTERED PROFESSIONAL ENGINEER

5/16/19

R. KEVIN STERRETT, MO E-26440

Consult Inc engineers planners
CORPORATE LICENSE No. E2010005873

EXISTING CONDITION DRAINAGE AREA MAP

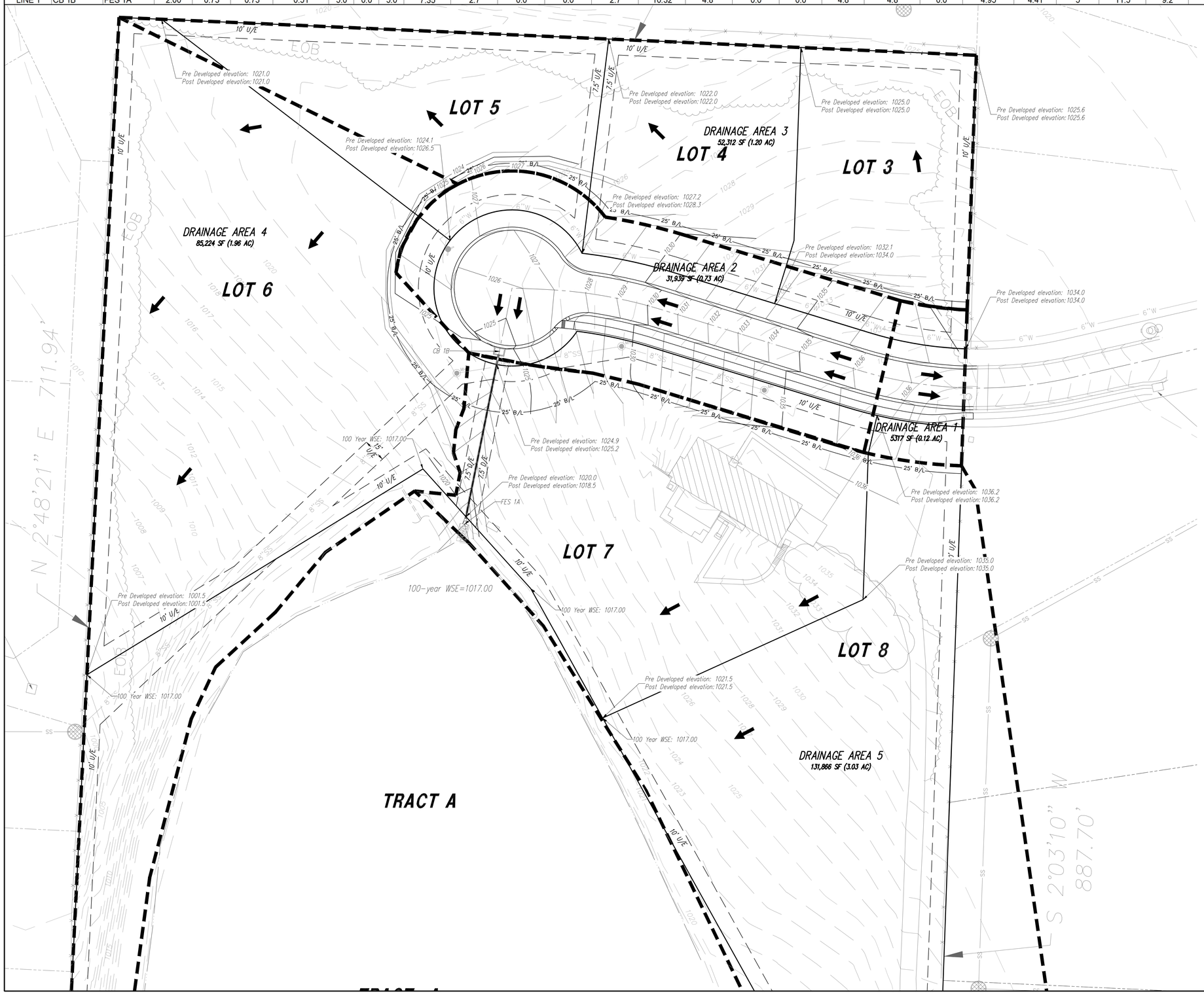
GOPPERT ACRES, 2ND PLAT
LEE'S SUMMIT - JACKSON COUNTY - MISSOURI

X-REF NO.	42259_TOPO
DRAWING NO.	18028
DATE	FEBRUARY 7, 2019
JOB NO.	18028
SHEET OF	6 OF 11

STORM SEWER CALCULATIONS

PROJECT

STORM SEWER NO.	SEWER LOCATION		TRIBUTARY AREA (AC.)			COMPOSITE RUNOFF COEFFICIENT	TIME OF FLOW			10 YEAR DESIGN					100 YEAR DESIGN					In Pipe Downstream [cfs]	By Pass Out [cfs]	GUTTER SLOPE [%]	GUTTER CAPACITY [cfs]	CURB INLET					PIPE DESIGN					
											RUNOFF [cfs]					RUNOFF [cfs]																		
	FROM STRUCTURE NO.	TO STRUCTURE NO.	AREA DESIGNATION ACRES		TOTAL		Ti	Tt	Tc	INTENSITY [in/hr] I[10]	AREA Q[10]	In Pipe Upstream (cfs)	By Pass (cfs) In	Total Q[10]	INTENSITY [in/hr] I[100]	AREA Q[100]	In Pipe Upstream (cfs)	By Pass In (cfs)	TOTAL Q[100]					Inlet Length	INLET CAPACITY [cfs]	INLET CAPACITY 80% [cfs]	Pipe Size [in]	Pipe Slope [%]	Pipe Type	Rough Coeff [MANNG]	Design Velocity [fps]	Depth Flow (inches) Q[100]	Full Velocity [fps]	Full Flow [cfs]
LINE 1	CB 1B	FES 1A	2.00	0.73	0.73	0.51	5.0	0.0	5.0	7.35	2.7	0.0	0.0	2.7	10.32	4.8	0.0	0.0	4.8	4.8	0.0	4.95	4.41	5	11.5	9.2	15	2.90	HDPE	0.011	5.85	6.3	5.9	13.0



Know what's below. Call before you dig.

STATE OF MISSOURI
R. KEVIN STERRETT
NUMBER 2006
REGISTERED PROFESSIONAL ENGINEER

5/16/19

R. KEVIN STERRETT | MO.E-26440

Consult Inc engineers planners
CORPORATE LICENSE No. E2010005873

NO.	BY	CK/APP	REVISION	DATE

POST DEVELOPED DRAINAGE AREA MAP

GOPPERT ACRES, 2ND PLAT

LEE'S SUMMIT - JACKSON COUNTY - MISSOURI

X-REF NO.	42259_TOPO
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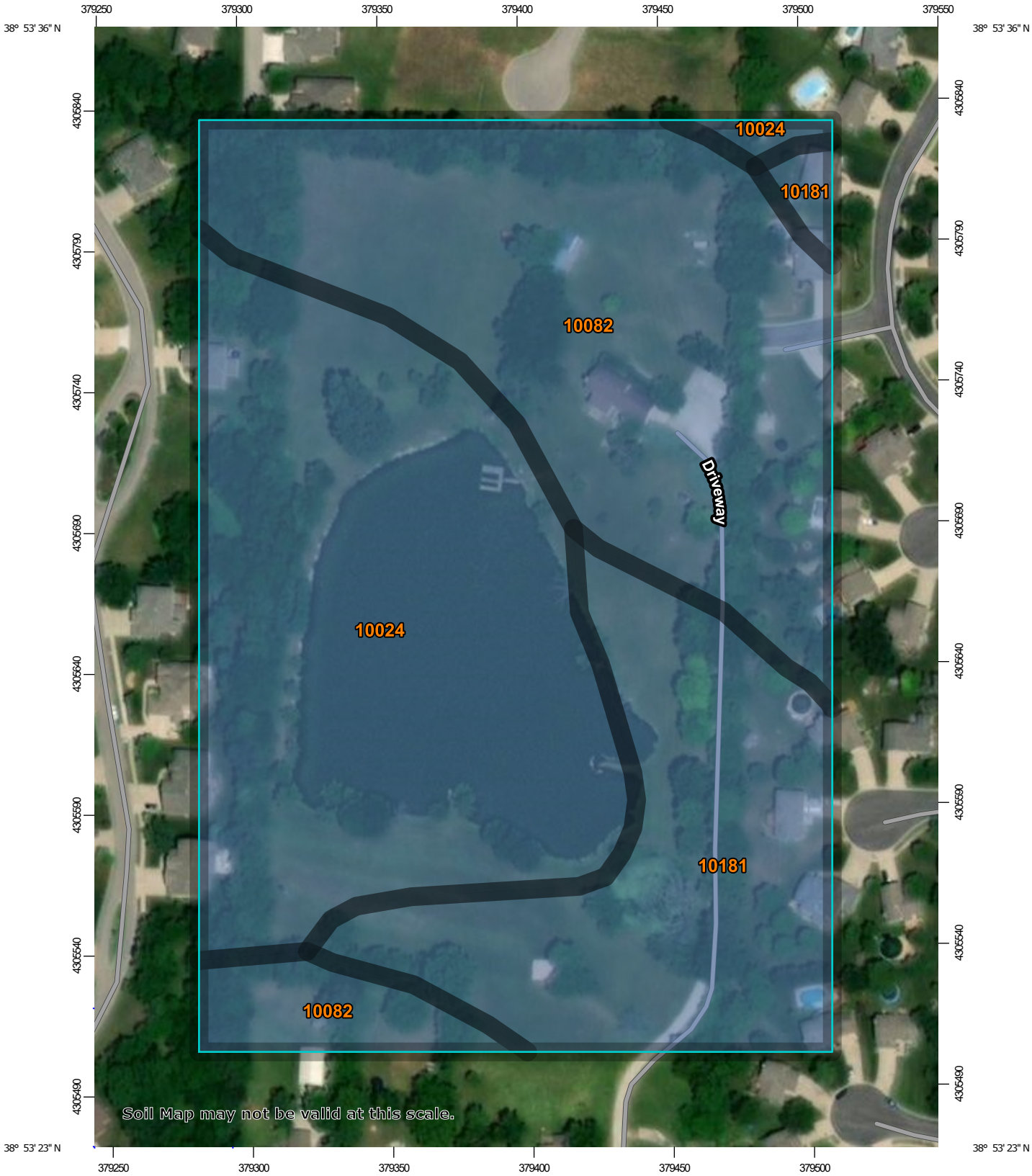
AASHTO Group Classification (Surface)—Jackson County, Missouri
(GOPPERT ACRES - 2ND PLAT)



Map Scale: 1:1,940 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A-1
- A-1-a
- A-1-b
- A-2
- A-2-4
- A-2-5
- A-2-6
- A-2-7
- A-3
- A-4
- A-5
- A-6
- A-7
- A-7-5
- A-7-6
- A-8
- Not rated or not available

Soil Rating Lines

- A-1
- A-1-a
- A-1-b
- A-2
- A-2-4
- A-2-5
- A-2-6
- A-2-7
- A-3
- A-4
- A-5
- A-6
- A-7
- A-7-5
- A-7-6
- A-8
- Not rated or not available

Soil Rating Points

- A-1
- A-1-a
- A-1-b
- A-2
- A-2-4
- A-2-5
- A-2-6
- A-2-7
- A-3
- A-4
- A-5
- A-6
- A-7
- A-7-5
- A-7-6
- A-8
- Not rated or not available

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Jackson County, Missouri
Survey Area Data: Version 19, Sep 13, 2018

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

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

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

AASHTO Group Classification (Surface)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
10024	Greenton-Urban land complex, 5 to 9 percent slopes	A-6	7.3	39.4%
10082	Arisburg-Urban land complex, 1 to 5 percent slopes	A-6	7.0	37.5%
10181	Udarents-Urban land-Sampsel complex, 5 to 9 percent slopes	A-6	4.3	23.1%
Totals for Area of Interest			**18.5**	**100.0%**

Description

AASHTO group classification is a system that classifies soils specifically for geotechnical engineering purposes that are related to highway and airfield construction. It is based on particle-size distribution and Atterberg limits, such as liquid limit and plasticity index. This classification system is covered in AASHTO Standard No. M 145-82. The classification is based on that portion of the soil that is smaller than 3 inches in diameter.

The AASHTO classification system has two general classifications: (i) granular materials having 35 percent or less, by weight, particles smaller than 0.074 mm in diameter and (ii) silt-clay materials having more than 35 percent, by weight, particles smaller than 0.074 mm in diameter. These two divisions are further subdivided into seven main group classifications, plus eight subgroups, for a total of fifteen for mineral soils. Another class for organic soils is used.

For each soil horizon in the database one or more AASHTO Group Classifications may be listed. One is marked as the representative or most commonly occurring. The representative classification is shown here for the surface layer of the soil.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Layer Options (Horizon Aggregation Method): Surface Layer (Not applicable)

Events for Subcatchment 1S: DRAINAGE AREA 1

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
1-Year	3.00	0.01	0.003	0.02
2-Year	3.50	0.02	0.010	0.08
5-Year	4.60	0.50	0.038	0.30
10-Year	5.30	1.14	0.064	0.50
25-Year	6.20	2.18	0.104	0.82
50-Year	6.90	3.10	0.141	1.11
100-Year	**7.70**	**4.25**	**0.188**	**1.48**
Custom	3.00	0.00	0.000	0.00

Events for Subcatchment 2S: DRAINAGE AREA 2

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
1-Year	3.00	0.01	0.004	0.02
2-Year	3.50	0.03	0.015	0.08
5-Year	4.60	0.79	0.060	0.30
10-Year	5.30	1.82	0.101	0.50
25-Year	6.20	3.47	0.166	0.82
50-Year	6.90	4.94	0.225	1.11
100-Year	**7.70**	**6.77**	**0.299**	**1.48**
Custom	3.00	0.00	0.000	0.00

Events for Subcatchment 3S: DRAINAGE AREA 3

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
1-Year	3.00	0.01	0.005	0.02
2-Year	3.50	0.04	0.020	0.08
5-Year	4.60	1.01	0.077	0.30
10-Year	5.30	2.32	0.129	0.50
25-Year	6.20	4.42	0.212	0.82
50-Year	6.90	6.31	0.287	1.11
100-Year	**7.70**	**8.65**	**0.382**	**1.48**
Custom	3.00	0.00	0.000	0.00

Events for Subcatchment 3S: DRAINAGE AREA 3

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
1-Year	3.00	0.01	0.005	0.02
2-Year	3.50	0.04	0.020	0.08
5-Year	4.60	1.01	0.077	0.30
10-Year	5.30	2.32	0.129	0.50
25-Year	6.20	4.42	0.212	0.82
50-Year	6.90	6.31	0.287	1.11
100-Year	**7.70**	**8.65**	**0.382**	**1.48**
Custom	3.00	0.00	0.000	0.00

Events for Subcatchment 1S: DRAINAGE AREA 1

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
1-Year	3.00	0.13	0.006	0.59
2-Year	3.50	0.20	0.009	0.85
5-Year	4.60	0.36	0.015	1.52
10-Year	5.30	0.47	0.020	1.99
25-Year	6.20	0.62	0.026	2.63
50-Year	6.90	0.74	0.032	3.16
100-Year	**7.70**	**0.88**	**0.038**	**3.78**

Events for Subcatchment 2S: DRAINAGE AREA 2

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
1-Year	3.00	0.70	0.031	0.51
2-Year	3.50	1.06	0.046	0.76
5-Year	4.60	1.99	0.084	1.38
10-Year	5.30	2.64	0.111	1.83
25-Year	6.20	3.53	0.149	2.45
50-Year	6.90	4.25	0.180	2.96
100-Year	**7.70**	**5.08**	**0.217**	**3.57**

Events for Subcatchment 3S: DRAINAGE AREA 3

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
1-Year	3.00	0.00	0.002	0.02
2-Year	3.50	0.02	0.008	0.08
5-Year	4.60	0.39	0.030	0.30
10-Year	5.30	0.90	0.050	0.50
25-Year	6.20	1.72	0.082	0.82
50-Year	6.90	2.45	0.111	1.11
100-Year	**7.70**	**3.36**	**0.148**	**1.48**

Events for Subcatchment 4S: DRAINAGE AREA 4

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
1-Year	3.00	0.01	0.003	0.02
2-Year	3.50	0.02	0.012	0.08
5-Year	4.60	0.64	0.049	0.30
10-Year	5.30	1.47	0.082	0.50
25-Year	6.20	2.81	0.135	0.82
50-Year	6.90	4.00	0.182	1.11
100-Year	**7.70**	**5.48**	**0.242**	**1.48**

Events for Subcatchment 5S: DRAINAGE AREA 5

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
1-Year	3.00	0.01	0.004	0.02
2-Year	3.50	0.03	0.016	0.08
5-Year	4.60	0.81	0.062	0.30
10-Year	5.30	1.86	0.104	0.50
25-Year	6.20	3.54	0.170	0.82
50-Year	6.90	5.04	0.229	1.11
100-Year	**7.70**	**6.91**	**0.305**	**1.48**

Rip-Rap Apron

Max Velocity: <= 36" 10 ft/s
> 36" 12 ft/s

Outlet Diameter (In.)	Apron Dimensions			Rip-Rap Quantity (Cu. Yd.)	Rip-Rap Size - D50 (In.)	Rip-Rap Weight (Lb.)	DS Channel Width (Min.) (ft)
	Length (Ft.)	Width (Ft.)	Thickness (Ft.)				
15	12	5	1.5	3	12	50	5
18	12	5	1.5	3	12	50	5
24	14	6	1.5	5	12	50	5
30	16	8	1.5	7	12	50	6
36	18	9	2	12	15	100	8
42	21	11	2	17	15	100	8
48	24	12	2	21	15	100	10
54	27	14	2.5	35	18	200	10
60	30	15	2.5	42	18	200	12
>60"	Additional Considerations For Use of Rip-Rap Apron						

Minimum Notation needed on plans

Standard Construction Note (Example):

200 STA. 0+00.00, LINE 2
INSTALL 18" RCP FLARED END SECTION W/ TOEWALL AND
AND 3 CU. YD. (12'Lx5'Wx1.5'T) STONE RIP-RAP USING
A MIN. 50# (D50=12") STONE. PLACE FILTER FABRIC PRIOR TO
INSTALLATION OF RIP-RAP
N 12563.1256 E 9568.2357

Standard Detail (Place in all projects using rip-rap apron)

XRIPRAP-STONE.DWG

NOTE:
Make sure to include city standard detail for toewall. Typically called "End Section Detail".