

# Preliminary Stormwater Management Plan

prepared for

**Bailey Farms  
1300 SE Ranson Road  
Lee's Summit, MO 64081**

**March 5, 2021  
Revised: April 16, 2021  
Revised: May 11, 2021  
Revised: May 25, 2021**

prepared by

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for

**Summit Homes  
120 SE 30<sup>th</sup> Street  
Lee's Summit, Missouri**



5/25/2021



## Executive Summary

March 5, 2021

Gene Williams, P.E.  
220 SE Green Street  
Lee's Summit, MO 64063

**RE: Bailey Farms  
1300 SE Ranson Road  
Lee's Summit, MO 64081**

Dear Gene Williams,

We are submitting the enclosed preliminary stormwater management study in support of the preliminary development plan for Bailey Farms. This report has been prepared to address permitting requirements and provides preliminary design calculations for the required storm water detention and BMP facilities. We have modeled the existing site conditions as they existed at the time this report was prepared.

The proposed site is an 88.80 acre single-family proposed parcel located in Lee's Summit, MO at the intersection of SE Bailey Road and SE Ranson Road. The proposed development has been analyzed and designed to meet the APWA Comprehensive Control Strategy, which entails limiting post-development peak discharge rates from the site for the 2-Year, 10-Year, and 100-Year design storm events. Two Extended Dry Detention Basins (EDDB) have been designed to detain the mentioned events as well as provided 40-hour detention of runoff from the local 90% mean annual event. All elements of the enclosed drainage system will be designed and constructed in accordance with all City of Lee's Summit, Missouri, requirements.

The project includes a request for modification to the stream setback to allow transition grading. There is sufficient space to allow for the existing stream to flow naturally. Any proposed construction activities with this development will not disrupt the natural movement of this stream. This project is also requested a waiver for a small area located in the southeast corner of the site to allow free-release off-site without additional detention facilities to be implemented.

Sincerely,

**Schlagel & Associates, P.A.**

Nick Augustine, E.I.T.  
Design Engineer

Jim Long, P.E.  
Project Engineer

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## 1.0 GENERAL INFORMATION

Summit Homes is proposing to develop the 89.60 acres of land located in Section 16, Township 47 North, Range 31 West, Jackson County, Missouri. The property is located at the intersection of SE Bailey Road and SE Ranson Road. The proposed development consists of single-family lots along with associated infrastructure.

### 1.1 OBJECTIVE

The intent of this report is to provide information pertaining to the existing and proposed watersheds, identifying and addressing any downstream drainage issues, determine and address any detention requirements, provide 40-hour extended detention of runoff from the local 90% mean annual event, and address permitting requirements. This study provides the preliminary design calculations for the development of the facility and associated infrastructure. Detailed designs will be required and provided with permit documents.

### 1.2 METHODOLOGY

The following were utilized in the assessment, preparation and analysis of watersheds in this design concept plan: *Section 5600, 2011, Storm Drainage Systems & Facilities* of the Standard Specifications & Design Criteria of the Kansas City Metropolitan Chapter of the American Public Works Association; *City of Lee's Summit, Missouri Design Criteria (2011 Revision), Storm Drainage Systems & Facilities*, prepared by the City of Lee's Summit, Missouri, Public Works Department.

Watersheds for the site were defined according to soil cover and type, tributary area, and runoff times of concentration. Soil cover was determined from inspection of the site and aerial photography. A soil survey for the project area was obtained from the United States Department of Agriculture, Natural Resources Conservation Service (NRCS), website and was utilized in determining soil type. The entire NRCS Soil Resource Report can be found in Appendix B. Watershed size was determined from both aerial topography and topographical survey, and by the proposed grading plan.

Times of concentration were compiled according to *NRCS TR-55 Urban Hydrology for Small Watersheds (1986)* methodology for sheet flow, shallow concentrated flow, and channel flow. For this report, sheet flow travel lengths were modeled at a total distance of 100'. Travel times for channel flows were determined using the length and velocity of the open channel. *HydroCAD-10* was utilized to model the runoff. All storm events were modeled using *SCS 24-hour Type II* distributions and were modeled for 2-Year, 10-Year, and 100-Year storm events.

\* \* \* \* \*

## 2.0 EXISTING CONDITIONS ANALYSIS

The site lies within the Big Creek Watershed. The existing site contains one watershed which has a release point located on the southwest portion of the site.

Offsite stormwater comes into the site from the east and drains to the same release point previously mentioned.

### 2.1 TRIBUTARY AREAS

The existing drainage tributary is provided in Appendix A, Figure A.1. The site release points have been identified as Release Point 1 (RP-1), Release Point 2 (RP-2), Release Point 3 (RP-3), and Release Point 4 (RP-4). The area has been delineated according to the existing topography and an annotation callout of Exist. On-Site #1, Exist. On-Site #2, Exist. On-Site #3, and Exist. Off-Site #1, on Figure A.2, has been provided for the watershed that drains to the release point, RP-1.

### 2.2 CURVE NUMBER AND TIME OF CONCENTRATION

The existing curve numbers and time of concentrations for each area have been established based on the procedures outlined in *NRCS TR-55 Urban Hydrology for Small Watersheds (1986)*. Existing curve numbers were based upon aerial photography, site inspection, and the soil types present on site.

The NRCS Soil Resource Report indicated that a Hydrologic Soil Group (HSG) of C and D were present on site. A current aerial photograph can be found in Appendix A; it depicts the existing cover conditions. Table 2-1 found in section 2.3 Existing Flow Rates summarizes the curve numbers for each of the watershed areas.

Cover types for existing conditions were considered to be “pasture/grassland” in good condition for the on-site area, and “Woods/grass combo” in fair condition for the off-site area. Procedures outlined in *NRCS TR-55 Urban Hydrology for Small Watersheds* recommends utilizing curve numbers 74 and 80 for HSG C and D for pasture/grassland, and 76 and 82 for the Woods/Grass combination.



Time of concentration flow paths were based upon sheet flow and shallow concentrated flow for the existing conditions. Sheet flow lengths were limited to where a grade break occurred. Flow was then considered shallow concentrated flow until a channel was visible either from the USGS topographic map or the aerial photograph, and then from that point was considered channel flow determined by the length of the channel and the velocity of flow.

### 2.3 EXISTING FLOW RATES

Existing flow rates were determined for the 2-Year, 10-Year, and 100-Year design storms. Offsite runoff is included in the calculations for Table 2-1 and Table 2-2 below for Ex. Drainage Area A, Ex. DA-A. Appropriate runoff coefficient curve numbers were based upon aerial photography, site inspection, and the soil types present on site. Detailed calculations with composite curve numbers and time of concentration can be found in the HydroCAD Model Output in Appendix B.

**Table 2-1 - Existing Flow Rates**

Drainage Sub-Basin	Area (Acres)	CN	Storm Event	Runoff (CFS)
Exist. On-Site #1	64.82	77	2-YR	56.78
			10-YR	118.07
			100-YR	206.11
Exist. On-Site #2	6.42	76	2-YR	11.69
			10-YR	24.16
			100-YR	41.99
Exist. On-Site #3	17.54	77	2-YR	18.79
			10-YR	38.90
			100-YR	67.74
Exist. Off-Site #1	18.50	77	2-YR	31.44
			10-YR	64.09
			100-YR	110.52

RP-1 represents the total outfall for the site located in the southwest corner. RP-2 represents the release point located in the southeast corner of the site. RP-3 represents the run-off for Exist. On-site #3 that is the point of convergence just before exiting the site in the southwest corner. RP-4 represents the point of convergence between the main tributary running north/south and the minor tributary running east/west.

## **2.4 DOWNSTREAM DRAINAGE ISSUES**

The existing downstream drainage system has been reviewed with this development plan. FEMA flood maps have been checked and currently no immediate downstream issues appear to be present. A FEMA FIRMette is included in Appendix A. The project lies outside of the identified FEMA floodplain per map number 29095C0438G.

## **2.5 AGENCY REVIEW**

Permitting requirements of the following agencies were reviewed as part of the existing conditions analysis.

### **2.5.1 Corps of Engineers Review**

A preliminary jurisdictional determination prepared by Terra Technologies has identified existing wetlands onsite. A preliminary assessment figure has been provided in Appendix A.

### **2.5.2 FEMA Requirements**

No FEMA identified floodplain is located on the proposed property per Flood Insurance Rate Map Panel No. 29095C0430G. There is currently no work proposed in the regulated floodplain. Please see the attached FEMA FIRMette in Appendix A, Figure A.4.

### **2.5.3 Missouri Department of Natural Resources**

All land disturbance activities will be permitted in accordance with the City of Lee's Summit, MO specifications as well as the Missouri Department of Water Pollution Control

### **2.5.2 FEMA Requirements**

No FEMA identified floodplain is located on the proposed property per Flood Insurance Rate Map Panel No. 29095C0430G. There is currently no work proposed in the regulated floodplain. Please see the attached FEMA FIRMette in Appendix A, Figure A.4.

### **2.5.3 Missouri Department of Natural Resources**

All land disturbance activities will be permitted in accordance with the City of Lee's Summit, MO specifications as well as the Missouri Department of Water Pollution Control general permit under the National Pollution Discharge Elimination System (NPDES) and an authorized Notice of Intent (NOI) application form. The disturbance of the site is greater than one acre; therefore, NPDES and NOI applications are required with the future permitting of the site in compliance with local, state and federal guidelines.

\* \* \* \* \*

### 3.0 PROPOSED CONDITIONS ANALYSIS

With the proposed development, the site watershed will be divided into four sub-basins for analysis. These sub-basins correspond to: Onsite #1, On-site #2, On-site #3, and On-site #4. On-site #1 and On-site #2 area stormwater runoff will be conveyed through the site via open sheet flow, shallow concentrated flow to the proposed Extended Dry Detention Basins. Both proposed dry detention basins have been sized to detain the 2, 10, and 100-year storm events for on-site drainage.

All components of the overland and enclosed storm sewer systems will meet or exceed the specifications provided in *Section 5600 – Storm Drainage Systems & Facilities* of the *Standard Specifications and Design Criteria* compiled by the Kansas City Metropolitan Chapter of the American Public Works Association.

A stream buffer protection zone will be located on the west side of the property. The proposed buffer zone will meet the requirements provided in APWA Section 5600. Drainage areas have been pulled to determine the required width of the stream buffer zone. Point 1 is located where the major tributary along the west property line meets with the minor tributary coming from the east side of the property. The drainage area to Point 1 is 158 acres, which requires a 60' offset. Point 2 is located in the southwest corner where the major tributary running in the north/south direction exits the site. The total drainage area to Point 2 is 206 acres, which requires a 100' offset. Both stream buffer offsets provided are measured from the ordinary high-water mark, or surveyed top of bank. An exhibit has been provided in Appendix A.

#### 3.1 TRIBUTARY AREAS

The post-development site will be divided into four sub-catchments, On-Site #1, On-site #2, and On-site #3, and On-Site #4. On-site #1 and On-site #3 will collect into two proposed dry detention basins. On-site #3 and #4 will bypass to release point #1. These tributary areas and their release point can be located in Appendix A.

### **3.2 CURVE NUMBER AND TIME OF CONCENTRATION**

Curve numbers for the proposed development were developed in a similar manner as the existing conditions. Hydrologic Soil Group (HSG) of D was utilized for post-development conditions. Cover types for the proposed conditions were considered to be 1/8 acre lots, 1/4 acre lots, 1/2 acre lots, open space, and urban commercial in good condition.

Time of concentration was established in a similar manner as the existing conditions. Shallow concentrated flow lengths were shortened and considered paved. Detailed calculations with composite curve numbers and time of concentration can be found in the HydroCAD Model Output in Appendix B. Appendix A, Figure A.2 depicts the proposed drainage conditions.

### 3.3 PROPOSED FLOW RATES

Proposed flow rates were determined for the 2-Year, 10-Year, and 100-Year design storms. Detailed calculations can be found in the HydroCAD Model Output Report in Appendix B.

**Table 3-1 – HydroCAD Runoff Conditions**

Drainage Sub-Basin	Drainage Area (Acres)	Storm Event	Peak Discharge (CFS)
On-Site #1	38.54	2-YR	118.86
		10-YR	199.77
		100-YR	306.72
On-Site #2	32.44	2-YR	94.02
		10-YR	162.45
		100-YR	253.52
On-Site #3	2.00	2-YR	7.04
		10-YR	11.36
		100-YR	17.05
On-Site #4	3.60	2-YR	7.81
		10-YR	15.04
		100-YR	25.06
On-Site #5	13.02	2-YR	28.24
		10-YR	54.39
		100-YR	90.64
Off-Site #1	18.50	2-YR	30.96
		10-YR	63.16
		100-YR	108.98

### 3.4 DETENTION ANALYSIS

The runoff hydrographs utilized to determine the peak flow volumes for each tributary area were determined using *TR-55* methodology and *HydroCAD-10*. For the 2-Year, 10-

Year, and 100-Year storm events, the complete hydrograph routing and model output can be found in the HydroCAD Model Output Report in Appendix B.

The site will need to provide detention that meets the requirement under the Comprehensive Control release rates under Section 5608.4C1a and 5608.4C1b of the APWA. This entails limiting post-development peak discharge rates from the site for the 2-Year, 10-Year, and 100-Year design storm events, as well as providing 40-Hour extended detention of runoff from the local 90% mean annual event. The post-development peak discharge rates from the site shall not exceed the following:

- 50% storm peak rate less than or equal to 0.5 cfs per site acre
- 10% storm peak rate less than or equal to 2.0 cfs per site acre
- 1% storm peak rate less than or equal to 3.0 cfs per site acre

For Release Points 1, 3, and 4, HydroCAD output represents the design release rate. For Release Point 2, since there is no detention proposed and given that the drainage area has been decreased from 6.42 acres to 2.00 acres, the Rational Method was used to calculate the allowable and design release rates.

Table 3-1 – HydroCAD Runoff Conditions are shown in Table 3-3.B - Required & Proposed Runoff Comparison. The proposed post-development design release rates are shown next to the allowable release rates for comparison.

**Table 3-2.B – Allowable Release Rate Calculations**

Release Point	Allowable Release Rate (CFS) Calculations				
	Area (Acres)	Storm Event	Allowable On-Site Release Rate (CFS) (A)	Allowable Off-Site Release Rate (CFS) (B)	Allowable Release Rate (CFS) (A+B)
RP-1	89.60	2-YR	44.80	31.44	76.24
		10-YR	179.20	64.09	243.29
		100-YR	268.80	110.52	379.32
RP-2	2.00	2-YR	3.21	0.00	3.21
		10-YR	12.84	0.00	7.50
		100-YR	19.26	0.00	19.26
RP-3	32.44	2-YR	16.22	0.00	16.22
		10-YR	64.88	0.00	64.88
		100-YR	97.32	0.00	97.32
RP-4	42.14	2-YR	21.07	0.00	21.07
		10-YR	84.28	0.00	84.88
		100-YR	126.42	0.00	126.42



**Table 3-3.B - Required & Proposed Runoff Comparison**

Site Release Information (cubic feet per second) (w/ EDDB)				
Area	Drainage Area	Storm Event	Allowable Release Rate (CFS)	Design Release Rate (CFS)
RP-1	89.60	2-YR	76.24	49.32
		10-YR	243.29	91.60
		100-YR	379.32	174.39
RP-2	Prop. = 2.00 Exist. = 6.42	2-YR	3.21	5.52
		10-YR	12.84	7.50
		100-YR	19.26	13.15
RP-3	32.44	2-YR	16.22	6.29
		10-YR	64.88	33.28
		100-YR	97.32	40.81
RP-4	42.14	2-YR	21.07	9.62
		10-YR	84.28	19.62
		100-YR	126.42	70.92

Please note: Site release rates are not a direct addition of sub-basin runoff due to differences in the time peak as well as storage effects within the basins.

Stormwater runoff for On-Site #1 is mitigated and detained by Extended Dry Detention Basin 1 located on the west side of the property and discharges to RP-4. Stormwater runoff for On-Site #3 is mitigated and detained by Extended Dry Detention Basin 2 located in the southwest corner of the site and discharges to RP-3. Stormwater run-off from On-Site #2 free releases from the site at RP-3. RP-2, RP-3, and RP-4 all converge to RP-4 located in the southwest corner of the site.

Proposed stormwater drainage structures will be located throughout the site to capture and convey proposed stormwater runoff to both dry detention basins. The Water Quality volume for both basins will be released over 40 hours. Water quality outlet structures

have been provided for each basin and have been designed to meet the allowable release rates provided in Table 3-2 for the 2, 10, and 100 year storm events. The water quality storm event will be controlled by a 10" and 12" diameter orifice plate for Basin 1 and Basin 2 respectively.

Emergency spillways will be provided for each basin per Section 5600 of the Design and Construction Manual. Each emergency spillway will be set 0.5 feet above the 100-year water surface elevation and designed to carry the 100-year storm event assuming a 100% clogged condition. An additional 1 foot of freeboard will be provided from the water surface elevation in the spillway and the top of dam. Final emergency spillway details will be provided with the Final Stormwater Management Report and construction documents.

Additionally, erosion control procedures will be designed and implemented at the outlets to reduce impact on the site downstream.

Release Point 2 (RP-2) does not meet the allowable release rate required by the comprehensive control requirements for the 2-year storm event. Given that this is a small drainage area and the entire site is collectively meeting comprehensive control requirements, we are asking for a waiver for this peripheral drainage area to avoid adding any additional detention facilities.

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#### **4.0 SUMMARY AND RECOMMENDATIONS**

The proposed drainage site is an 89.60 acre single-family parcel of land located in Lee's Summit, MO at the intersection of SE Bailey Road and SE Ranson Road. The proposed development has been analyzed and designed to meet the APWA Comprehensive Control Strategy, which entails limiting post-development peak discharge rates from the site for the 2-Year, 10-Year, and 100-Year design storm events. Two extended dry detention basins have been designed to detain the mentioned events as well as provided 40-hour detention of runoff from the local 90% mean annual event. All elements of the enclosed drainage system will be designed and constructed in accordance with all City of Lee's Summit, Missouri, requirements.

The project includes a request for modification to the stream setback to allow transition grading. There is sufficient space to allow for the existing stream to flow naturally. Any proposed construction activities with this development will not disrupt the natural movement of this stream. This project is also requested a waiver for a small area located in the southeast corner of the site to allow free-release off-site without additional detention facilities to be implemented.

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