

# Final Stormwater Management Plan

prepared for

**Lakewood Business Park – Lot 35  
4101 NE Port Drive  
Lee's Summit, MO 64064**

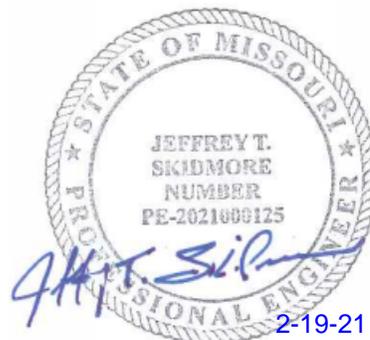
February 19, 2021

prepared by

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for

**Lakewood Self-Storage, LLC  
1220 Washington, Suite 300  
Kansas City, Missouri**



## Executive Summary

February 19, 2021

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

**RE: Lakewood Business Park – Lot 35  
4101 NE Port Drive  
Lee's Summit, MO 64064**

Dear Gene Williams,

We are submitting the enclosed stormwater management study in support of the preliminary development plan/special use permit application for Lakewood Business Park. 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.

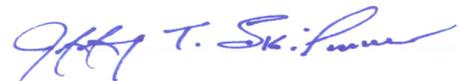
The proposed site is a 2.93 acres commercial/industrial proposed parcel located in Lee's Summit, MO east of I-470 and north of Northeast Lakewood Way. The proposed development has been analyzed and designed to meet the APWA Comprehensive Control Strategy, which entails limiting post-development peak discharge rates from the site for the 2-Year, 10-Year, and 100-Year design storm events. An Extended Dry Detention Basin (EDDB) along with a Proprietary Media Filtration Device has 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.

Sincerely,

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



Ryan P. McGinnis, P.E.  
Design Engineer



Jeff T. Skidmore, P.E.  
Project Engineer

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## 1.0 GENERAL INFORMATION

Lakewood Self-Storage, LLC is proposing to develop the 2.93 acres of land located in the West half of Section 9, Township 48 North, Range 31 West, Jackson County, Missouri. The property is located in commercial/industrial vacant land and is bounded on the North by similar industrial development and on the East by agricultural/residential land. The property is bounded on the West by Northeast Port Drive and on the South the property is bounded by Northeast Lakewood Way and the North 2.5 Million Gallon Water Tank. The proposed development includes a single commercial, climate controlled self-storage, warehouse building 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. 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 Little Blue River 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 southeast and drains to the same release point previously mentioned.

### 2.1 TRIBUTARY AREAS

The existing drainage tributary is provided in Appendix A, Figure A.2. The site release point has been identified as Release Point 1(RP-1). The area has been delineated according to the existing topography and an annotation callout of, EX. DA-A, Ex. Off DA-B, and Ex. Off DA-C, 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 D was present on site. Hydrologically poor conditions indicate a state of land use that will provide higher runoff compared to good conditions. Therefore, group D was utilized to model the existing runoff conditions. A current aerial photograph can be found in Appendix A, Figure A.1; 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 a “pasture, grassland, or range” in fair condition and a small section of “unconnected pavement”. Procedures

outlined in *NRCS TR-55 Urban Hydrology for Small Watersheds* recommends utilizing curve numbers 89 and 98 for HSG D, for the respective cover types mentioned.

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	Runoff Coeff. (CN)	Time of Concentration (minutes)	Area (acres)	2-Year Peak Flow (cfs)	10-Year Peak Flow (cfs)	100-Year Peak Flow (cfs)
Ex. DA-A	84	9.8	2.93	8.64	15.53	24.83
Ex. Off DA-B	89	5.4	0.64	2.50	4.12	6.30
Ex. Off DA-C	89	6.6	0.12	0.45	0.75	1.15

Table 2-2 below reflects the total existing runoff for the sites stormwater at the release point identified in Figure A.2 found in Appendix A.

**Table 2-2 - Existing Runoff Evaluation**

Drainage Sub-Basin Release Points	2-Year Peak Flow (cfs)	10-Year Peak Flow (cfs)	100-Year Peak Flow (cfs)
RP 1	11.43	20.21	31.99

## 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, Figure A.6 and Figure A.7. The project lies outside of the identified FEMA floodplain per map number 29095C0430G.

## 2.5 AGENCY REVIEW

Permitting requirements of the following agencies were reviewed as part of the existing conditions analysis. These sections provide a discussion of the federal and state stormwater permitting that may be required for the proposed development. Supporting maps are located in Appendix A.

### 2.5.1 Corps of Engineers Review

The National Wetlands Inventory (NWI) map was reviewed for the site and there are no identified wetlands located within the project site. The NWI map can be found in Appendix A, Figure A.5. We do not anticipate any Corps of Engineers requirements associated with this project at this time.

### 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 sub-basins for analysis. Stormwater runoff will be conveyed through the site via open sheet flow, shallow concentrated flow and a detention pond. An Extended Dry Detention Basin will collect the 2-Year, 10-Year, and 100-Year storm events for On-site Drainage Area-1, Off-site Drainage Area-1, and Off-site Drainage Area-2. On-Site Drainage Area-3 will be un-detained and allowed to run off the site as sheet flow.

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.

#### 3.1 TRIBUTARY AREAS

Existing Drainage Area A, will be divided into sub-catchments, On-site Drainage Area-1, Off-Site Drainage Area-1, and Off-Site Drainage Area-2 will collect into the extended dry detention basin. On-Site Drainage Area-3 will bypass the storage areas and the extended dry detention basin. The parcel's release point designation remains the same for the proposed conditions. These tributary areas and their release point can be located in Appendix A, Figure A.3.

#### 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 heavily grassed in good condition with impervious areas, such as roofs and pavement.

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.3 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	Ruoff Coeff. (CN)	Time of Concentration (minutes)	Area (acres)	2-Year Peak Flow (cfs)	10-Year Peak Flow (cfs)	100-Year Peak Flow (cfs)
DA-1	93	24.1	2.43	6.41	10.28	15.37
OFF DA-1	84	13.0	0.12	0.32	0.58	0.92
OFF DA-2	80	10.7	0.64	1.55	2.96	4.92
DA-3	82	14.8	0.50	1.15	2.15	3.51

### 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

Based on the proposed drainage area of 2.93 acres, the required peak discharge with additional allowable offsite drainage peak discharge rates from Table 3-1 – HydroCAD Runoff Conditions are shown in Table 3-2 - Required & Proposed Runoff Comparison. The proposed post-development peak discharge rates are shown next to the maximum allowable peak discharge rates for comparison.

**Table 3-2 - Required & Proposed Runoff Comparison**

Site Release Information (cubic feet per second) (w/ EDDB)				
	Required Peak Discharge (A)	Allowable Offsite Discharge (B)	Required + Offsite Discharge (A+B)	Proposed Discharge
2-Year (50%)	1.47	2.95	4.42	3.16
10-Year (10%)	5.86	4.87	10.73	10.17
100-Year (1%)	8.79	7.45	16.24	12.24

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 DA-1, OFF DA-1, and OFF DA-2 is mitigated and detained by Extended Dry Detention Basin on the southwest corner of the property. Stormwater runoff for DA-3 will run freely through the site and ultimately detained by near-by existing street inlets. Proposed stormwater drainage structures have been aptly located throughout the site to capture and convey not only offsite but proposed stormwater runoff to the EDDB. The Water Quality volume above at the EDDB will be released over 40 hours.

Additionally, erosion control procedures will be designed and implemented at the 12" HDPE outlet to reduce impact on the site downstream. Table 3-3 summarizes the exiting flow and velocity for the EDDB for the 2-Year, 10-Year, and 100-Year storm events. EDDB Water Quality Design calculations can be found in Appendix A.

**Table 3-3 - Exit Flow & Velocity For EDDB**

	2-Year Event	10-Year Event	100-Year Event
Q (cfs)	2.99	9.53	10.73
V (fps)	9.00	12.10	13.65

\* \* \* \* \*

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

The proposed drainage site is a 2.93 acres commercial/industrial parcel of land located in Lee's Summit, MO east of I-470 and north of Northeast Lakewood Way. 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. An EDDB has 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.

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