

# FINAL STORMWATER REPORT

## **Automotive Sales & Detail Center 2100 NE Independence Avenue Lee's Summit, Missouri 64064**

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## GENERAL INFORMATION

The proposed commercial development for Lee's Summit Town Center, LLC is located northwest of the intersection of Town Center Drive and Independence Avenue. The total area for the development is this property is approximately 5.57 acres.

The current site soil condition for this property is classified as "Greenton-Urban, 5 to 9 percent Slopes", with a Map Unit Symbol of '10024'. The hydrological soil group for this site is Class D. The site lies entirely within 'Zone X', areas determined to be outside the 0.2% annual chance floodplain as depicted on the FEMA Flood Insurance Rate Map (FIRM) no. 29095C0430G, Revision Date: January 20, 2017.



Figure 1 – Location Map (no scale)

## METHODOLOGY

KCAPWA IDF curves were used to determine the rainfall intensity for 2, 10, and 100-year storm events. Hydraflow Hydrographs Extension for AutoCAD 2020 was used to determine runoff flow amounts for existing and proposed site conditions. Hydraflow computes the rational method runoff hydrographs by convoluting a rainfall hyetograph through a unit hydrograph. Convolution is known as linear superpositioning where each ordinate of the rainfall hyetograph is multiplied by each ordinate of the unit hydrograph, thus creating a series of hydrographs. These hydrographs are then summed to form the final runoff hydrograph.

## EXISTING CONDITIONS

The existing project site location is 5.57 acres, with the entirety of the property being pervious area. Runoff from this site flows from the northwest of the property to east. For analysis, the majority of the undeveloped area, encompassed by NE Town Center Boulevard was taken into consideration for runoff volume contribution. The resulting area is approximately 29.35 acres of pervious area. The area for the two existing ponds was added to the overall impervious area contributing to runoff. The total runoff volume, including the areas for the existing ponds, will be considered for the detention ponds design.

An existing storm inlet at the east end of the property along NE Independence Avenue allows runoff to be conveyed east toward an existing dedicated drainage area. Refer to Sheet C3.1 “Existing Drainage Map” in Appendix A for the existing drainage patterns for the property.

**Table 1** below shows the peak discharges for the 2, 10, and 100-year rainfall events. Refer to Appendix B for Complete Hydraflows Report and results for the existing site conditions.

<b>Table 1 – Existing Site Runoff Hydraflow Results</b>	
<b>Storm Event</b>	<b>Pre-developed Peak Flow (cfs)</b>
2-Yr	34.18
10-Yr	47.72
100-Yr	71.89

## PROPOSED CONDITIONS

The existing property will undergo development for a proposed commercial area for Lee's Summit Town Center LLC. The proposed development will increase the impervious area from 0.60 acres to 2.90 acres, with the remaining 29.35 acres as open grass area. Refer to sheet C3.2 "Proposed Drainage Map" in Appendix A for the proposed drainage patterns for the property. The runoff will be collected and conveyed to a detention pond by way of natural topography and proposed storm sewer network where the existing storm inlet, at the eastern edge of the property, will further convey the runoff towards the existing dedicated drainage area.

**Table 2** shows the increase in peak discharge rates for the 2, 10, and 100-year storms rainfall events, due to the increase in impervious area.

<b>Table 2 – Proposed Site Runoff Hydraflow Results without Detention</b>	
Storm Event	Pre-developed Peak Flow (cfs)
2-Yr	39.21
10-Yr	53.77
100-Yr	89.21

In order to mitigate the increase in discharge rates from the site due to the increase in impervious area created by the proposed development, two separate storm networks are proposed to direct runoff to the existing drainage area via the existing storm inlet at the east edge of the property.

**Table 3** shows the resulting discharge rates for the 2, 10, and 100-year rainfall events with the proposed storm networks and detention pond.

<b>Table 3 – Proposed Site Runoff Hydraflow Results with Detention</b>	
Storm Event	Post-developed Peak Flow (cfs)
2-Yr	1.07
10-Yr	2.66
100-Yr	16.55

Hydraflow Hydrographs Extension for AutoCAD civil 3D was used to model the post developed site with the proposed storm system. A complete hydrograph can be found in Appendix C.

The above mentioned methodology was used to design the proposed detention pond to effectively capture and discharge the total runoff from the contributing drainage area, per the requirements set by APWA Section 5601.5.A.4.a. The discharge rates are controlled by a proposed storm structure to maintain release rates less than the rates, while also achieving water quality requirements indicated within APWA Section 5608.4.C.1, where post-development peak discharge rates shall not exceed those indicated below:

- 50% storm peak rate less than or equal to 0.5 cfs per acre
  - Site specific allowable release rate: 14.68
- 10% storm peak rate less than or equal to 2.0 cfs per acre
  - Site specific allowable release rate: 58.7
- 1% storm peak rate less than or equal to 3.0 cfs per acre
  - Site specific allowable release rate: 88.05

The above site specific release rates are considerably high due to the large area that is under consideration for detention design. Using a larger time of concentration for the undeveloped areas provides skewed release rates as the developed area is conveyed through the system before the additional impact of the undeveloped areas, yielding in a reduction in release rates for post-development conditions. Adjusting time of concentration to allow for contribution from the undeveloped grass land before developed area is released allows a more intuitive understanding of overall volume of runoff to be detained and released.

The design of the detention basin and outlet elevations were determined by using varying rainfall events to both effectively discharge the collected runoff and meeting water quality requirements.

For water quality design consideration, a perforated riser is proposed to reach the water quality rainfall event elevation. Perforations within the riser allow for a controlled discharge from the detention pond through the proposed storm network, meeting the minimum forty-hour extended detention requirement for comprehensive control.

Any overflow from the existing pond to the west will be collected and routed via a proposed earthen drainage swale to the north of the proposed development, and then to the detention pond. Outlet pipes convey storm water to existing infrastructure leading to an existing detention area to the east.

A spillway for the proposed detention pond was designed using the 100-yr water surface elevation of 983.93'. Manipulating the design within the Hydraflows program to simulate clogged conditions and zero available storage the spillway crest elevation was set 0.5' above the 100-yr water surface elevation at 986.41'. One foot of freeboard is available above the 100-yr water surface elevation to the top of the berm at 987'. The emergency spillway will allow the overflow to drain towards NE Independence Ave, and into the existing storm infrastructure.



## SUMMARY

The proposed commercial development for Lee's Summit Town Center, LLC is located northwest of the intersection of Town Center Drive and Independence Avenue increases the amount of impervious area within the property. To account for the increase in runoff, storm networks and a detention basin have been designed to maintain the discharge rates below existing conditions flow rates.

Off-site contributions to runoff have been considered for the detention pond design. Outlet pipes and structures control peak discharge rates to less than that of existing conditions, while also meeting water quality requirements for the water quality rainfall event.

Table 4 below provides the discharge rates for the existing and post developed conditions for the 2, 10, and 100-year rainfall events for this site.

<b>Table 4 – Total Runoff Volume Comparison</b>			
Storm Event (yr)	Pre-development Discharge (cfs)	Post-development Discharge (cfs)	Difference (cfs)
2	34.18	1.07	33.11
10	47.72	2.66	45.06
100	71.89	16.55	55.34

**Appendix A**  
**Supporting Data**



## **Appendix B**

### **Existing Conditions Hydraflow Hydrograph Output Data**

## **Appendix C**

### **Proposed Conditions Hydraflow Output Data**