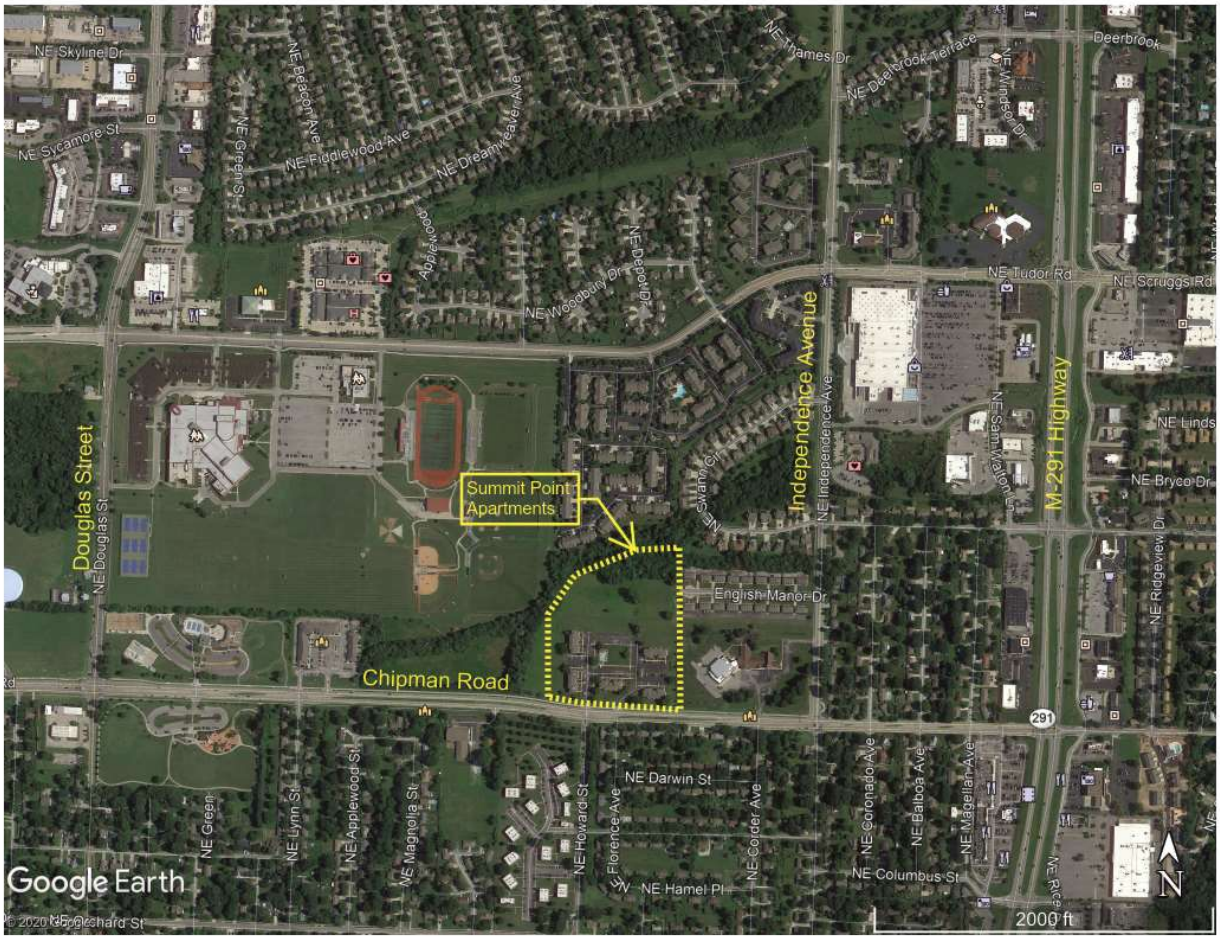
HEC-RAS Analysis of Tributary P3 To Prairie Lee Lake
Adjacent to the Proposed Summit Point Apartments, Phase-II
504 NE Chipman Road
City of Lee's Summit, Jackson County, Missouri 64063
CFS Project #21-5065 / #19-5293
March 31, 2021

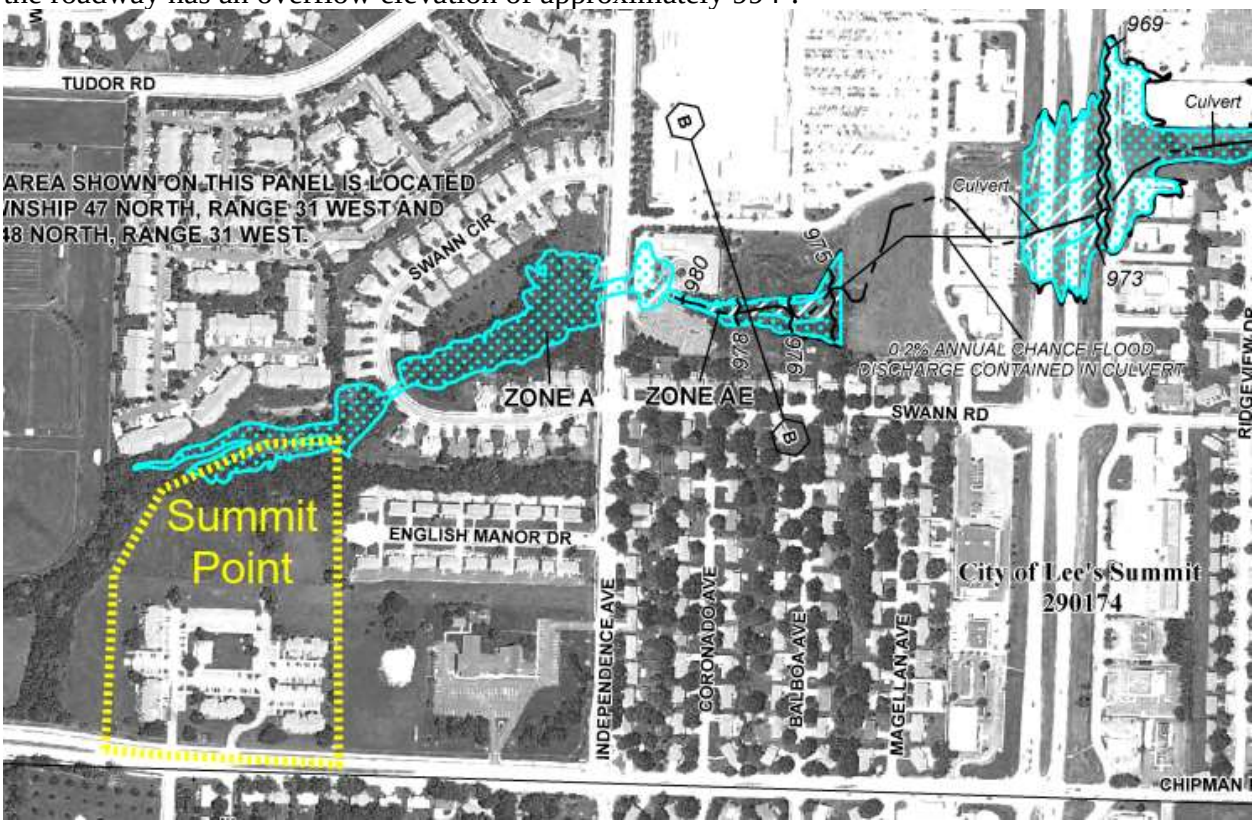
General: The owners of the proposed Summit Point Apartments at 504 NE Chipman Road have proposed to develop the Phase-II of the site. The Phase-II addition would be constructed directly to the north of the existing Phase-I apartments located at 504 NE Chipman Road in Lee's Summit, Missouri. Phase I included five multi-unit apartment buildings plus a swimming pool on a 6.49 acre site constructed in 1980. The proposed Phase-II addition would cover 7.21 acres and include six new multi-apartment buildings along with parking lots and service drives.



Vicinity Map of the Summit Point Apartments at 504 NE Chipman Road in Lee's Summit

The site slopes downwards to the north where an existing creek (Tributary P3 to Prairie Lee Lake) flows eastwards along the site's northern boundary. The existing Tributary P3 to Prairie Lee Lake creek has flowline elevations ranging between approximately 994' to 1000' along the northern side of the Summit Point Apartments, Phase II. NE Swann Circle is located directly to the east of Summit Point and has triple 48" HDPE culverts draining the existing creek below the roadway. The existing

triple 48" HDPE culvert's have upstream flowline elevations of approximately 986.91'and the top of the roadway has an overflow elevation of approximately 994'.



FEMA FIRM Flood Map 29095C0436G, Showing the Existing Tributary P3 to Prairie Lee Lake Flowing along the Northern Border of the Summit Point Apartments

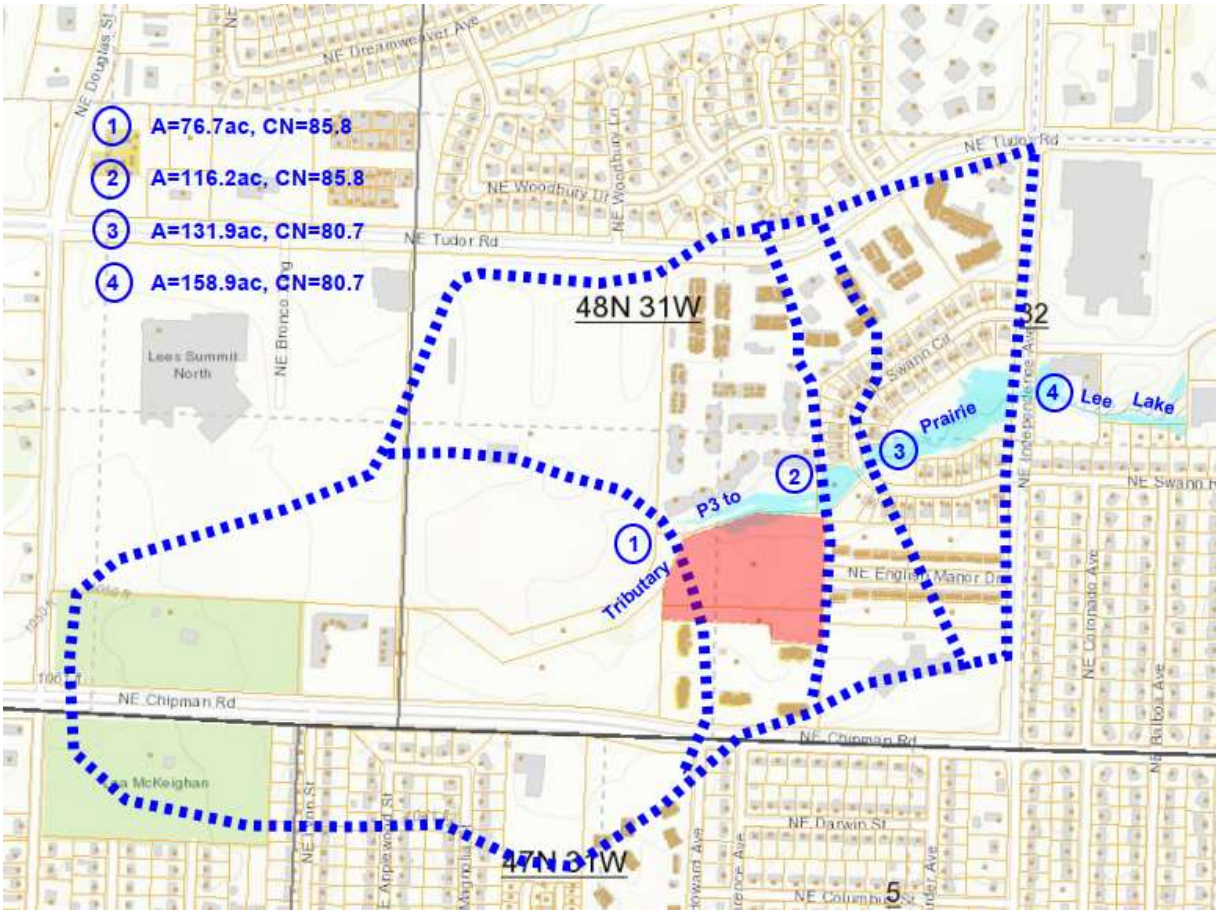
The FEMA flood map shows the defined 1% (100-year) flood elevations to the east along the creek stop short of Independence Avenue. A portion of the northern side of the site is within the FEMA 1% (100-year) floodplain, with the remaining ground above the flood limits.

HEC-RAS Analysis: CFS Engineers created a HEC-RAS model to evaluate the water surface elevations of stormwater in the Tributary P3 to Prairie Lee Lake creek channel along the north side of the proposed Summit Point Apartments, Phase II site. Stream flows were calculated at three key locations along the northern property line and where the creek crosses NE Swann Circle approximately 200 ft downstream of the Summit Point Apartments, Phase-II site.

Drainage areas were estimated using the City GIS mapping. Channel cross-sections for the HEC-RAS models were cut across the surveyed ground surface, based on a recent topographic field survey of the site done by CFS Engineers. The FEMA FIRM Flood Map of the region (FEMA FIRM Flood Map 29095C0436G, Panel 436 of 625, January 20, 2017), shows the Tributary P3 to Prairie Lee Lake directly to the north of the site as Zone A (defined as a Special Flood Hazard Area subject to inundation by the 1% annual chance flood where no base flood elevations have been determined). The time of concentration for each drainage basin was determined using TR-55 methodology for overland flow, shallow concentrated flow and channelized flow segments. Estimates of flow path length and slope were estimated using Jackson County GIS topography and also the USGS Quadrangle maps of the vicinity. The USGS StreamStats web-based hydrologic analysis program was also used to check the contributing drainage areas to the points of interest along the creek. The StreamStat flows appeared to

be overly conservative when checked against the flows calculated using the conventional TR-55 methodologies. Calculations have been included in the appendix.

The existing triple 48" HDPE culverts at NE Swann Circle were also included in the HEC-RAS model to evaluate the potential back-up of flood water in the creek from the culvert crossing. Six cross-sections were cut along the Summit Point Apartments, Phase-II site, and an additional three cross-sections were cut downstream to model the NE Swann Circle culverts. CFS surveyors measured the invert elevations of all three 48" HDPE culverts along with the top of road elevation for determining overflow.



Schematic Off-Site Drainage Area Map for Tributary P3 to Prairie Lee Lake

The CFS survey topography was used to cut cross-sections for the HEC-RAS models. Jackson County GIS topography was also used to supplement the cross-section data outside of the limits of the CFS survey. Manning's roughness factors for the main channel and overbank areas were assumed based on photos and field observations of the creek. A roughness factor of n=0.030 was used for the main channel that was generally clean, straight and full with no rifts or deep pools. A roughness factor of n=0.060 was used for the left and right overbanks that generally consisted of light brush and trees under summer conditions.

Cross-sections were cut across the digital contours to set the station-elevations. The cross-sections in the river channel were stationed based on an assumed 10000 ft at the point where the centerline of NE Swann Circle crossed the creek. The left and right stream bank locations were set based on the apparent break in slope locations along the sides of the main creek channel. The main channel lengths

were based on the digital alignment of the creek's flowline and the left and right overbank lengths were estimated based on the general curvature of the creek alignment.

Current Effective Model: There was no readily available HEC-RAS model of Tributary P3 to Prairie Lee Lake. The FEMA FIRM flood map showed the creek within the limits of Zone AE on the eastern/downstream side of NE Independence Avenue, located approximately 900 ft downstream from the Summit Point site. The flood map showed that the creek along the northern side of Summit Point, was set inside Zone A where the defined base flood elevations were not determined. This indicates that the detailed HEC-RAS model stopped at NE Independence Avenue and did not extend upstream to cover the Summit Point site.

Duplicate Effective Model: CFS Engineers created a HEC-RAS model using the recent topographic survey and the Jackson County GIS data. There were six cross-sections cut along the northern side of the Summit Point site and another three cut further downstream to model the Swann Circle roadway crossing. The methods for setting the left and right bank stations and overbank lengths were described above. RS 9759.91 was the furthest downstream located approximately 240 ft downstream from the centerline of Swann Circle, and RS 11275.44 was the furthest upstream located on the western side of the Summit Point site. The stream flows for the 2 year storm ranged from 135 cfs at the lower end of the creek by Swann Circle, to 77 cfs at the upstream end. Likewise, the 10-year stream flows ranged from 255 cfs to 146 cfs, and the 100-year stream flows ranged from 454 cfs to 264 cfs. The channel slope averaged approximately 1.1%. 100-year flow depths along the Summit Point site ranged from 2.58 ft to 4.42 ft, with corresponding flow velocities ranging from 3.53 fps to 6.78 fps.