

**Final Stormwater
Management Report
for**

Woodland Glen - 2nd Plat

Lee's Summit, Missouri

February 17, 2020
Rev. April 28, 2020

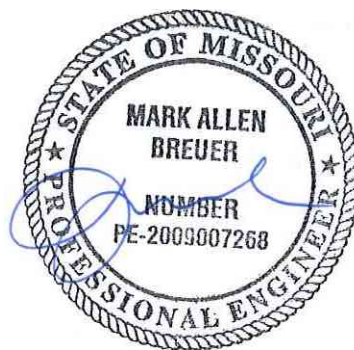
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1.0 FOREWARD

Woodland Glen – 2nd Plat is a proposed 17.26-acre development located in Lee's Summit, Missouri. The site is generally located east of SW Ward Road and north of SW Scherer Road. The site location is shown in the vicinity map in Figure 1. The property is currently zoned P-1 and PMIX. The proposed site plan is provided in Figure 2.

1.1 OBJECTIVE

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

The Attached Villas Section of this proposed plan will drain into new detention basins. It is proposed that this portion of the site will provide detention that meets the requirements of the APWA Comprehensive Control Strategy. 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.

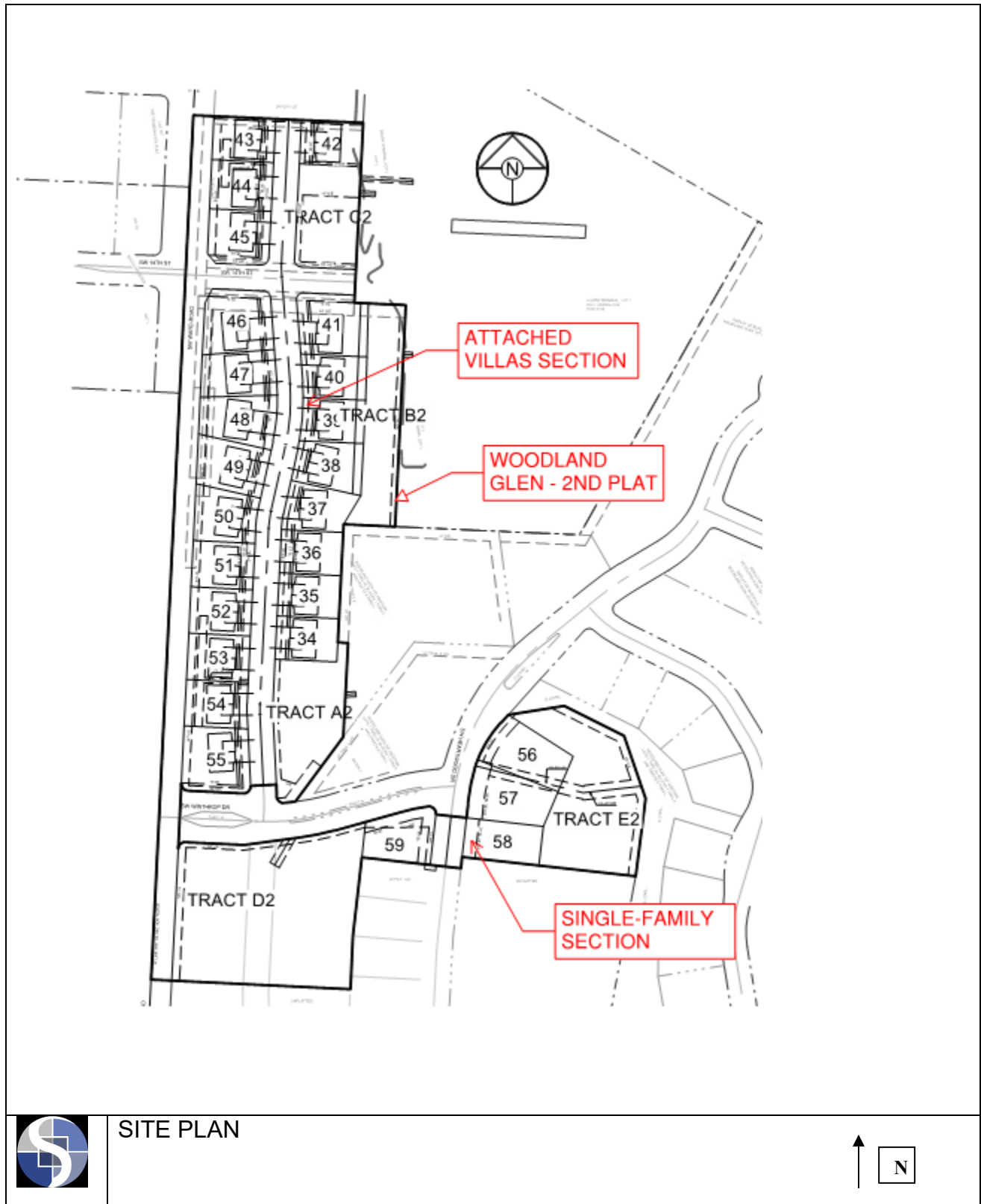
1.2 METHODOLOGY

Watersheds for the site were defined according to their soil cover and soil type, tributary area, and runoff times of concentration. Soil cover was determined from inspection of the site and aerial photography. The *N.R.C.S. Soil Survey of Jackson County, Missouri* was obtained from the NRCS website and was utilized in determining soil type. Watershed size was defined by both aerial topography and topographical survey, and by the proposed grading plan. Time of concentrations were compiled according to *NRCS TR-55 Urban Hydrology for Small Watersheds (1986)* methodology for sheet flow, shallow concentrated flow, and channel flow. *HydroCAD Version 10.0* was used to model the runoff and detention outlet structures. All storm events were modeled as 24-hour durations with S.C.S. Type II distribution. Detention analysis was completed for the 2-year, 10-year, and 100-year storm events.

Figure 1: Location Map



Figure 2: Site Plan



2.0 STORMWATER COLLECTION AND DETENTION SYSTEM

The site area being analyzed with this report are lots 34 through 55 and Tracts A2, B2, and C2, this area will be referred to as the Attached Villas Section. The remaining platted area including lots 56 through 59 and Tracts D2 and E2, and will be referred to as the Single-Family Section and will not part of this report. The drainage and detention for the Single-Family Section of this site is to be gathered and conveyed by existing storm infrastructure and then carried to the existing detention located just to the east of lots 34, 35, and 36, reference Sheet 1 of 3 of the Drainage Area Maps provided in Appendix A. The Attached Villas Section of the site general will drain from the west to east, either to the existing detention basin or towards property owned by the City of Lee's Summit. There is existing storm sewer along SW Ward Road that drains onto this section of the property, and with this development will be piped through the site directly downstream along its current drainage path. Stormwater detention will be required to limit the proposed 2-year, 10-year, and 100-year stormwater peak discharge rates per the requirements of the APWA Comprehensive Control Strategy.

2.1 EXISTING CONDITIONS

The existing drainage area (EX-1) drains from the west to east and is shown on the Existing Conditions Drainage Area Map, Sheet 2 of 3, provided in Appendix A.

2.1.1 Curve Number

The existing ground cover conditions were generally classified as woods/grass combination, in fair condition. The Curve Number (CN) was assigned based on the existing cover conditions and Hydrologic Soil Group (HSG), as tabulated in TR-55. The site is predominately classified as HSG D soils. This results in a CN for the woods/grass combination of 82. The existing condition runoff calculations are provided for informational and comparison purposes only, as the proposed post-development peak discharge rates will need to comply with the reduced allowed runoff rates as outlined in the APWA Comprehensive Control Strategy.

The CN and sub-basin existing drainage area is provided in Table 1.

2.1.2 Time of Concentration

As mentioned in Section 1.2, time of concentrations were compiled according to *NRCS TR-55 Urban Hydrology for Small Watersheds (1986)* methodology for sheet flow, shallow concentrated flow, and channel flow. Sheet flow lengths were limited to 100 feet. The flow was then considered shallow concentrated until a channel was visible from either the USGS topographic map or the aerial photograph, and then from that point was considered channel flow. All channel flow velocities were assumed to be six feet per second. The existing sub-basin time of concentration is provided in Table 1. Detailed calculations of the existing times of concentration are provided in Appendix B.

Table 1: Existing Drainage Sub-Basin Characteristics

Sub-Basin	Area (ac.)	CN	Tc (min)	2-year (cfs)	10-year (cfs)	100-year (cfs)
EX-1	9.73	82	6.8	29.47	54.23	87.90
Totals	9.73			29.47	54.23	87.90

2.2 PROPOSED CONDITIONS

In the proposed conditions, drainage area (PR-1), containing 2.59 acres, will be routed to an extended dry detention basin (EDDB-1) located in the southeast corner of the site. An outlet from this basin will drain east and be located just upstream of the existing detention basin.

Drainage area (PR-2), containing 4.99 acres, will be routed to an extended dry detention basin (EDDB-2) located near the north end of the site just east of Lot 13. An outlet from this basin will drain east to land owned by the City of Lee's Summit.

Drainage area (PR-3), containing 1.26 acres, consists of rear yard drainage and will be routed to another extended dry detention basin (EDDB-3) located east of Lots 4 through 8 and will similarly drain to land owned by the City of Lee's Summit.

The three extended dry detention basins (EDDB-1, EDDB-2, and EDDB-3) will provide post-development peak discharge rate control as well as 40-hour extended detention of runoff from the local 90% mean annual event (1.37 inch, 24-hour event).

At the north end of the site, drainage area (PR-4), containing 0.22 of an acre, consists of rear yard drainage and will drain directly offsite.

In the southeast corner of the site, a small drainage area (PR-5), containing 0.67 of an acre, consists of rear yard drainage and will drain towards the existing detention basin. In the peak discharge rates comparison later on in this report, this area has been excluded from the Comprehensive Control Strategy comparison as this will drain to the existing basin.

The Proposed Drainage Area Map, Sheet 3 of 3, is provided in Appendix A.

2.2.1 Curve Number

For all on-site developed areas, the HSG was increased a minimum of one level. Curve Numbers were assigned according to impervious areas at CN=98 and grass/open areas at CN=80 (>75% grass cover in good condition). The composite CN calculations are provided in Appendix B. The composite CN and sub-basin drainage areas for the proposed sub-basins are provided in Table 2.

2.2.2 Time of Concentration

The proposed watersheds were divided into sub-basins for analysis. Time of concentration for the proposed conditions have been conservatively estimated at 5.0 minutes due to the small nature of each sub-watershed and with the amount of paved surfaces that is proposed in each sub-watershed. Detailed calculations of the proposed times of concentration are provided in Appendix B. The proposed sub-basin times of concentration are provided in Table 2.

Table 2: Proposed Drainage Sub-Basin Characteristics

Sub-Basin	Area (ac.)	CN	Tc (min)	2-year (cfs)	10-year (cfs)	100-year (cfs)
PR-1	2.59	90	5.0	10.96	18.05	27.39
PR-2	4.99	90	5.0	21.12	34.78	52.77
PR-3	1.26	83	5.0	4.20	7.61	12.23
PR-4	0.22	85	5.0	0.79	1.39	2.20
PR-5*	0.67	83	5.0	2.23	4.05	6.50
Totals	9.73			39.30	65.88	101.09

* Indicates this area drains to an existing detention basin and will be exempt from proposed calculations.

2.2.3 Detention Analysis

The site will need to provide detention that meets the requirements of the APWA Comprehensive Control Strategy. 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:

- 2-year storm peak rate less than or equal to 0.5 cfs per site acre
- 10-year storm peak rate less than or equal to 2.0 cfs per site acre
- 100-year storm peak rate less than or equal to 3.0 cfs per site acre

Based on the proposed drainage area of 9.06 acres (note that PR-5 has been excluded from this calculation as this area drains directly to the existing detention basin), the allowable maximum post-development peak discharge rates are shown below:

Area (acres)	2-year (cfs)	10-year (cfs)	100-year (cfs)
	(max. 0.5 cfs/acre)	(max. 2.0 cfs/acre)	(max. 3.0 cfs/acre)
9.06	4.53	18.12	27.18

The proposed site release peak runoff rate results are shown below:

	Area (ac.)	WQv (cfs)	2-year (cfs)	10-year (cfs)	100-year (cfs)
EDDB-1	2.59	0.22	0.44	0.54	2.42
EDDB-2	4.99	0.28	1.08	7.68	15.58
EDDB-3	1.26	0.10	0.45	0.59	0.71
PR-4	0.22	N/A	0.79	1.39	2.20
Totals	9.06		2.76	10.20	20.91
Allowed			4.53	18.12	27.18

The proposed extended dry detention basins (EDDB-1, EDDB-2, and EDDB-3) have been modeled with Single Orifice openings to control the water quality event, which provides 40-hour extended detention of runoff from the local 90% mean annual event. The volume required for the Water Quality Volume (WQv) is not being used for the volume to detain the 100-year storm event. All EDDB outlet structures are designed to handle the 100-year storm event and the 100-year “Clogged” event should the orifices become impaired during a storm event. If such an event should occur the basins are designed to receive the flow and will not over top the extents of the basins (reference the following table). There are also Emergency Spillways located on the east side of the basins, should the outlet structures become compromised in any way.

	Area (ac.)	100-year (Clogged) (cfs)	Water Surface Elevation (ft.)	Top of Basin (ft.)
EDDB-1	2.59	7.17	990.76	992.00
EDDB-2	4.99	19.33	976.35	979.00
EDDB-3	1.26	0.65	973.55	974.00

The detailed detention calculations, as well as outlet structure design assumptions are provided in Appendix B.

2.3 PERMIT REQUIREMENTS

The following 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”

2.3.1 Corp of Engineers (COE)

The National Wetland Inventory Map was reviewed for the site which shows a freshwater pond (0.17 acres in size) and a freshwater emergent wetland (0.23 acres in size). The proposed project does not intend to impact the pond or wetland; therefore, no permitting requirements are anticipated with the COE. A copy of the NWI map is included in Appendix A.

2.3.2 Federal Emergency Management Agency (FEMA)

The site is contained in Zone X on FIRM map number 29095C0419G, panel 419. Therefore, no FEMA requirements are associated with this project. A copy of the FIRM map is included in Appendix A.

2.3.3 Missouri Department of Natural Resources

A Notice of Intent (NOI) and Stormwater Pollution Prevention Plan (SWPPP) will be required by MDNR for the permitting of construction stormwater discharge for the site. This permit will be applied for before development and will be held open until the completion of the project.

3.0 CONCLUSION

Woodland Glen – 2nd Plat is a proposed 17.26-acre development located in Lee's Summit, Missouri. The proposed development provides detention that meets the requirements of the APWA Comprehensive Control Strategy. 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.

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