CONCEPT
DRAINAGE REPORT

FOR THE

Proposed

ASH PLACE SUBDIVISION

Located in the City of Spokane, Washington

November 2024
WCE W.O. No. 2023-3505

Prepared by:

Whipple Consulting Engineers, Inc.
21 S. Pines Road
Spokane Valley, WA 99206
Whipplece.com

This report has been prepared by the staff of WCE under the direction of the undersigned professional engineer whose seal and signature appear hereon.

Ryan M. Andrade, P.E.

GENERAL

The proposed Ash Place Preliminary Plat proposes the development of 20 attached, single-family residential lots (townhomes) within the Residential Single Family (RSF) zone of the City of Spokane. Within the RSF zone, the lots range in size from approximately 1,388 ft^2 to over 4,191 ft^2 located on approximately 1.32 acres. The site lies within the City of Spokane, WA, it is in-between Ash Street & Ash Place, just south of Liberty Avenue. The site lies in the SE ¼ of Section 1, T. 25 N., R 42 E., W.M. and is located within the Critical Aquifer Recharge Area. A vicinity map is attached. The proposed project is anticipated to construct east/west and north/south alleys as a part of development. Lastly, the site has steep slopes at 30% or above for a portion of the site.

PURPOSE and ANALYSIS METHODOLOGY

The purpose of this concept drainage report is to determine the storm drainage facilities that will be required to treat and dispose of the increase in storm water runoff created by development of the vacant lands for the new development. For this project and per Chapter 5 of the SRSM, the rational method of analysis will be used.

A final storm drainage analysis may include an SCS method per Chapter 5, and an NRCS Type IA 24-hour storm may be used for sizing flow control facilities. Because the site has limited infiltration, a Water Budget analysis may also be provided to verify pond sizes proposed as a result of this analysis can meet the evaporation standards should pond bottoms and infiltration become ineffective.

Site stormwater facilities will be designed to treat and dispose of the 2-, 25-, and 100-year storms as required by the SRSM.

As proposed all internal roadways/alleys are proposed to be developed with crowned roadways, catch basins and pipes to a pond/swale located south end of the project site. As proposed all stormwater will be captured and treated in detention pond(s) and released at or below the pre-developed rate. If required for various analyses the Intensity, Duration, and Frequency (IDF) curves from the Spokane, Medical Lake, Reardon, Cheney, and Rockford intensity curves as modified by the Spokane Regional Storm Manual (SRSM) may use bowstring calculations to determine basin flows for reference for the Rational storm. The 2-, 10-, 25-, 50- and 100-year rainfall intensity iso-pluvials from the Spokane Regional Stormwater Manual may be used for both TR-55 and HEC-22 calculations for a HydroCAD stormwater model.

As noted, for this concept report all basins will use the rational method to determine peak discharge and runoff volumes.

TOPOGRAPHY

The site is considered to have a "hilly" terrain site with existing slopes on site ranging averaging between 0% and over 30% west to east with varying levels north and south. As shown on the preliminary plat map, the proposed road system will generally follow contours, and the roads will be graded north/south & east/west to maintain storm water flows to generally follow the lay of the land.

SOILS

Geologic maps indicate the soils in this area consist primarily of loess with an influence of volcanic ash over residuum and/or colluvium derived from basalt. According to the Natural Resources Conservation Service (NRCS) Soil Survey of Spokane County, Washington, the site soils are classified as Northstar-Rock outcrop-Rockly complex (3117) and Speigle-Rock outcrop complex (2053).

The west half of the project site is mapped as Northstar-Rock outcrop-Rockly complex. The Northstar-Rock outcrop-Rockly soil profile is described as extremely cobbly ashy loam to very gravelly ashy loam to extremely gravelly loam to bedrock. The Speigle-Rock outcrop complex, located in the east half of the project is described as cobbly ashy loam to very gravelly ashy loam to very cobbly loam to extremely gravelly loam to extremely cobbly sandy loam. Both soil types are categorized by NRCS as well-drained and are derived from loess mixed & with an influence of volcanic ash over residuum and/or colluvium derived from basalt.

Based on our field observations and on our previous geotechnical experience in the vicinity of the site, the on-site soils appear to be consistent with the soil mapping.

Hydrologic Soil Group = B & C

The stormwater runoff may be treated within bio-detention swales/ponds and released at 0.05 cfs, well below the pre-developed rate. Recommended design rates shall be based on the onsite testing and include a factor of safety of 2.5. All stormwater management features shall be designed in accordance with the SRSM.

Swales/ponds constructed in natural soils within the proposed project should be sized using equation 6-1b and 6-1d in the SRSM based on the permeability testing results.

Equations 6-1b and 6-1d

- $V = 1815AP^{1.53}$ (6-1b)
- $V = 1815A$ (6-1d)

For this analysis, sizing will be per the Rational Method for Detention Ponds with release of excess stormwater into the City stormwater system downstream at 0.05 cfs, well below the pre-developed rate. A final drainage report may utilize a CN/SCS method to maintain the discharge at or below the development condition, or as allowed by the SRSM.

DRAINAGE NARRATIVE

BASIN SUMMARY – Pre-Developed

The existing site is 1.32 Acres +/- in size. The drainage from this site is generally from west to east, Pre Basin-A, includes the whole project site. The basin has varying slopes, from shallow to steep (over 30%) with no observed drainages other than sheet flow operating as a shallow concentrated type of flow that is present on site and generally as discussed in the SRSM and the SCS manual. Most, if not all, of Pre Basin-A flows offsite over the existing sidewalk and down the curb & gutter and into the City existing stormwater system to this day.

Table 1. Pre-Developed Basin Summary Table

Pre Basin	Area (sf)				RM Rate (cfs)				
	Imp	Pervious	Offsite	Total	2-yr	10-yr	25-yr	50-yr	100-yr
A	0	57,590	0	57,590	1.12	2.08	2.63	3.05	3.48

BASIN SUMMARY – Post-Developed Narrative

The post-developed site is separated and designated into 3 basins (Basins 1 through 3) based upon their anticipated storage and discharge locations, as shown on the attached basin map. The following are narratives on the various basins and where and how the water is treated and discharged.

POST Basin 1

This basin is located through the center of the project and includes the two alleys & front half of the proposed buildings and collects and consolidates drainage from the developed condition. For Post Basin 1 the following summarizes the intent of the overall design.

- All sheetflow runoffs will be conveyed overland to street gutters & catch basins & pipe and enter a bio-detention and treatment swale, Pond 1.
- All stormwater in Pond 1 will be treated by 18-inches of treatment soil and then discharged to the existing City municipal stormwater system at a rate of 0.05 cfs through the use of a perforated drain pipe (underneath the pond bottom) and catch basin with an orifice tee inside the catch basin metering the outflow at the specified rate.
- For this analysis, it was presumed that all generated stormwaters will be maintained on site, with overflow to the existing City stormwater system.
- A summary section follows the basin narratives.

POST Basin 2

This basin is located through the eastern half of the development and includes the majority of the unimproved/pervious, hilly portion of the development. The basin includes the back half of the proposed buildings along the east side of the north/south alley. For Post Basin 2 the following summarizes the intent of the overall design.

- All sheetflow runoffs will be conveyed downstream, overland to existing Ash Street and into the existing City municipal stormwater system.
- For this analysis, offsite flows in the post-developed condition will be substantially less than that of the pre-developed condition. For example, in the 25- & 100-year pre-developed condition the offsite flows are approximately 2.63 & 3.48 cfs respectively. The post-development offsite flows for this Basin 2 are approximately 1.19 & 1.57 cfs respectively, therefore, generating a much lesser impact downstream.
- A summary section follows the basin narratives.

POST Basin 3

This basin is located through the west side of the development and includes a portion of the unimproved/pervious, flatter portion of the development. The basin includes the back half of the proposed buildings along the west side of the north/south alley. For Post Basin 3 the following summarizes the intent of the overall design.

- All sheetflow runoffs will be conveyed downstream, overland to existing Ash Place and into the existing City stormwater system.
- For this analysis, it was presumed that all generated stormwaters will be maintained on site within the backyards & landscaped areas of each lot, with emergency overflows to the existing City stormwater system only in the frozen-ground condition.
- A summary section follows the basin narratives.

PGIS CHECK

While this project is intended to be a bioretention pond design, the intent as described, due to shallow bedrock/refusal & poor infiltration rates due to said refusal on the project site, is NOT to install drywells and to use gravel galleries underneath the swale.

The Final drainage report is anticipated to include flooded width calculations, all flooded widths for the design storms, provide appropriate non flooded widths for access and fire. Because the pond on this project has some minor infiltration capacity and as this project is in the moderate susceptible part of CARA, Table 2 below lists the pond requirements by basin, a weighted 'C" calculation is in the appendix and summarized below.

Table No. 2 – Weighted C and Pond and Basin Summary

Post Basin	Total Area (sf)	Impervious Area (sf)	Pervious Area (sf)	Weighted 'C'	Required Pond Vol. (cf)	Provided Pond Vol. (cf)
1	23,880	19,285	4,595	0.76	804	914
2	24,205	3,600	20,605	0.64	0	0
3	9,505	3,600	5,905	0.43	0	0

As this is a concept report, the provided pond area as described within the table is an estimate of the treatment volume that may be provided in the designated areas. As can be seen, overall, the project provides or is anticipated to provide the required treatment volume per the SRSM.

POND DESIGN

In Post Basin 1, the increase in stormwater and PGIS on the various roads/alleys will be treated/stored within the onsite bio-detention pond. In the case that stormwater overflows the onsite pond, the stormwater will discharge offsite into the existing City municipal stormwater system as allowed per City guidelines by design deviation request.

In order to ensure that any stormwater overflowing the onsite pond will be released at the allotted rate of 0.05 cfs, the stormwater will be equipped with a properly sized overflow structure (an orifice tee within a catch basin). The overflow structure requires that the stormwater entering the structure to crest the rim of the structure and filling the structure for release via an orifice. The orifice will be size appropriate to allow stormwater to be released at the maximum discharge rate of 0.05 cfs.

Though the project site is not anticipated to encounter any stormwater issues, in the event that there are heavy rain periods, the ability to discharge offsite into the existing City municipal stormwater system provides assurance that the project site will not inundate and negatively impact surrounding properties with excess stormwater.

Table No. 3 –Pond Volume Summary

Basin/ Pond	Pond Volume Summary		
	100-YR Required Storage Volume (cf)	Provided Storage Volume (cf)	Overflow Basin
1	1,472	1,495	Ex. City System

As shown in Table 3, Pond 1 is anticipated to hold the required volume per the rational method for the 100-year storm event. What is not included is the anticipated discharge via the pond/swale bottom.

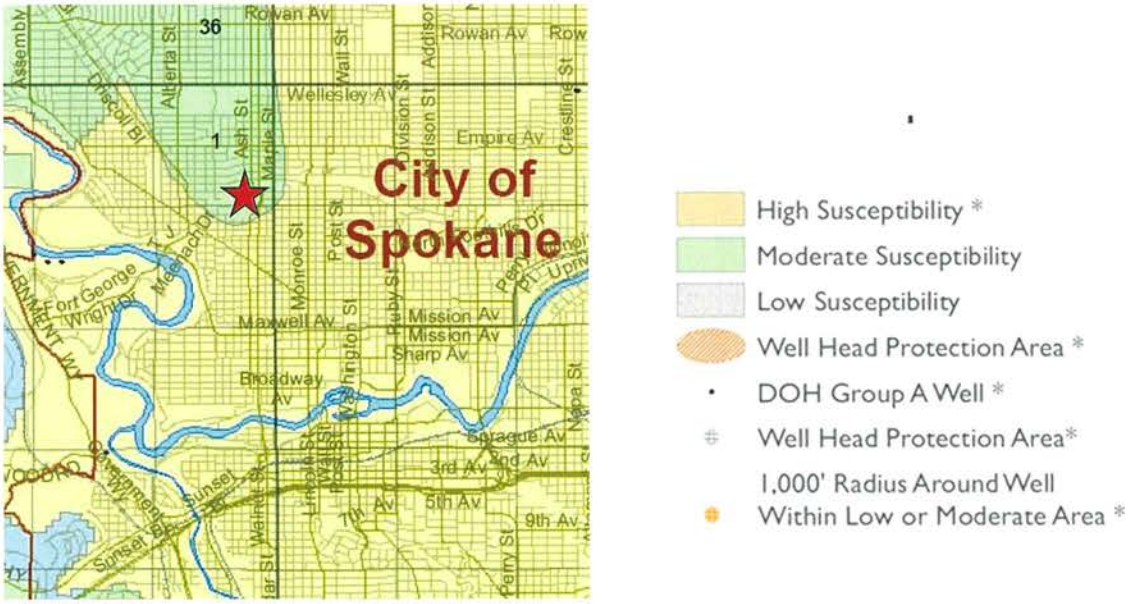
CONCLUSION

This report demonstrates that per the rational method that the anticipated increase in stormwater from the development can capture, detain, treat, and discharge the proposed storm water design for this system to meet SRSM requirements.

Per Page 3-6 of the SRSM, there are additional items that need to be addressed; these areas are as follow:

Critical Area Discussion:

- There are no DNR streams on site
- The soil types are Type B and should not be considered "erodible soils",
- There are no identified susceptible species present on site, please refer to the SEPA Checklist prepared for this project, not attached, see City of Spokane Planning.
- The site is in the Critical Aquifer Recharge Area and moderate susceptibility area



Perpetual Maintenance of Facilities:

The proposed storm drainage system will be a system of street flow and catch basins & pipes within public or private roads and as such will be owned by the Jurisdiction. The pond will be maintained in a Tract within the plat and will be maintained by the project HOA.

Offsite Easements:

None are required at this time, if any are required these will be pursued at the time of final design.

Regional Facilities:

This project is not a part of any City of Spokane regional system.

APPENDIX

1. VICINITY MAP

2. ASH PLACE PRELIMNINARY PLAT

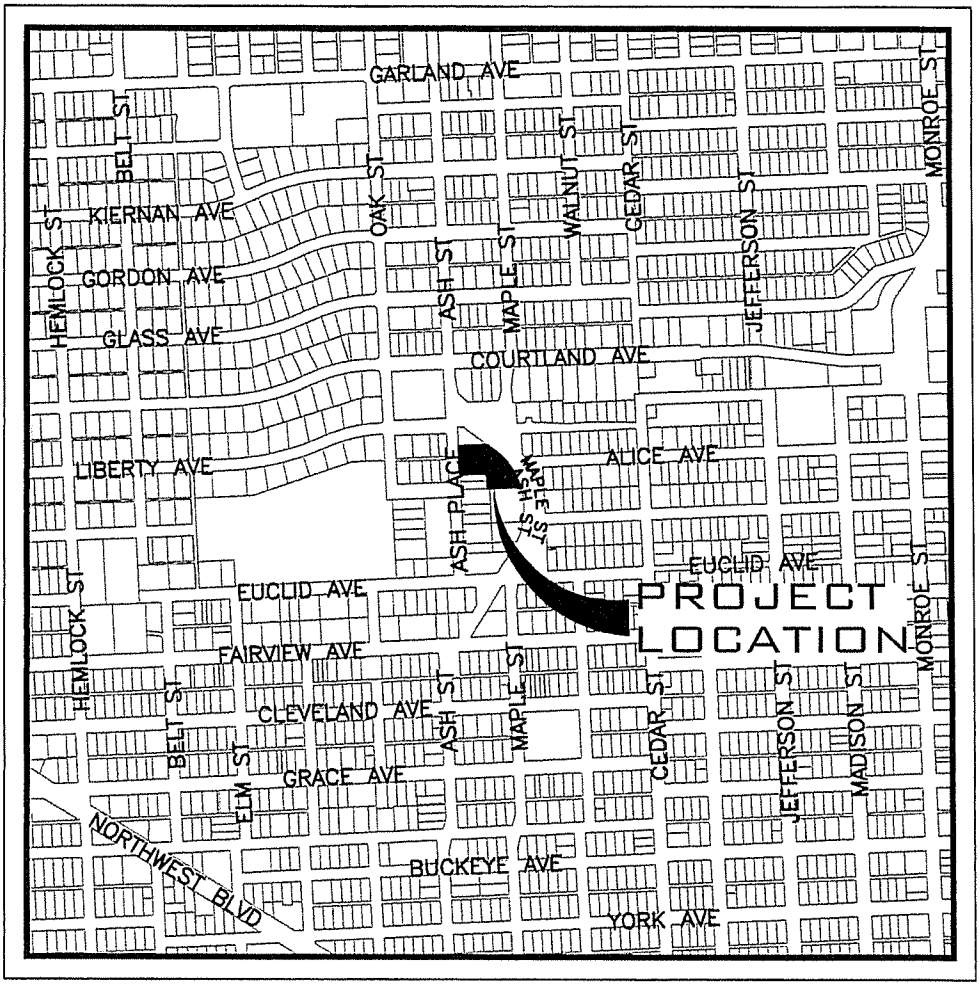
3. PRE AND POST BASIN MAPS

4. BASIN AND WEIGHTED 'C' SPREADSHEET

5. POND VOLUME CALC SHEET

6. BOWSTRINGS

7. GEOTECHNICAL REPORT



VICINITY MAP

N

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S

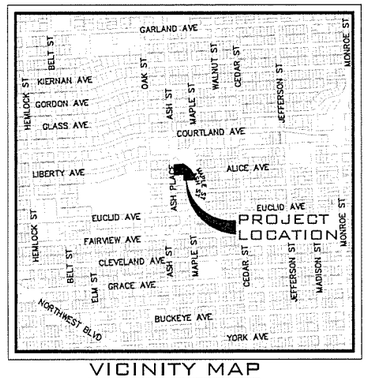
NOT TO SCALE

PROJ #: 23-3505 DATE: 09/24/24 DRAWN: RMA APPROVED: TRW	CONCEPT DRAINAGE REPORT **ASH PLACE** 3242 N ASH PLACE SPOKANE, WASHINGTON	WCE WHIPPLE CONSULTING ENGINEERS 21 SOUTH PINES ROAD SPOKANE VALLEY, WASHINGTON 99206 PH: 509-893-2617 FAX: 509-926-0227
FIGURE 1	VICINITY MAP	

PRELIMINARY PLAT
ASH PLACE
A REPLAT OF DRUMHELLER SPRING ADD. AND KELLEY SHORT PLAT
LOCATED IN A PORTION OF THE SE 1/4, SEC 01, T 25 N, R 42 E, W.M.
SPOKANE COUNTY, WA

SLOPES TABLE				
NUMBER	MIN. SLOPE	MAX. SLOPE	2d AREA (sf)	COLOR
1	30%	115%	17,000.68	

SD/OS =STORM DRAINAGE/OPEN SPACE



VICINITY MAP

UNDERGROUND SERVICE ALERT
ONE-CALL NUMBER
811
CALL TWO BUSINESS DAYS BEFORE YOU DIG

SITE DATA	
PARCEL NUMBER	25014.4207 25014.4701 25014.4702
REPLATTED PORTIONS OF DRUMHELLER SPRING ADDITON AND KELLEY SHORT PLAN	
ZONING	RSF

	SF	AC
PROJECT AREA	57,590.01	1.32
NUMBER OF LOTS *	20	
NUMBER OF TRACTS	3	
PROPOSED DENSITY DATA		
GROSS DENSITY	15.13	
NET DENSITY	18.61	
	SF	AC
AREA OF LOTS	45,863.13	1.05
AREA OF TRACTS	5,007.14	0.11
AREA OF ALLEY TRACT	6,719.74	0.15
MIN LOT AREA	1,280.00	0.03
IMPERVIOUS AREAS		
	SF	
PAVEMENT	6,370.57	
CONCRETE	7,733.09	
BUILDING	15,528.00	
TOTAL IMPERVIOUS AREA	29,631.66	
PERCENTAGE OF IMPERVIOUS	51%	
SERVICE PROVIDERS		
FIRE DISTRICT	CITY OF SPOKANE	
WATER SERVICE	CITY OF SPOKANE	
SANITARY SEWER SERVICE	CITY OF SPOKANE	

LEGAL DESCRIPTION

PARCEL # 25014.4207

DRUMHELLER SPRING ADDITION LTS 4, 5, 6, 8, 9 & 10 BLK 3 TOGETHER WITH N1/2 VAC DALTON AVE S OF & ADJ TO LT 10 (VAC ORD #C-27577) EXC PTN THEREOF DEEDED FOR ASH ST

PARCEL # 25014.4701

01-25-42: KELLY FINAL CITY SHORT PLAT Z22-233 (AFN 7249860) LOT 1

PARCEL # 25014.4702

01-25-42: KELLY FINAL CITY SHORT PLAT Z22-233 (AFN 7249860) LOT 2

NOTES

1. 30% SLOPES FOUND ON PROPERTY SEE PLAN VIEW
2. NO ERODIBLE SOILS FOUND ON PROPERTY
3. * PROPOSED DENSITY BASED ON SMC 17C.400.010.C.5: NOTWITHSTANDING MAXIMUM DENSITY STANDARDS IN TABLE 17C.110-3, LOTS THAT CONFORM TO THE APPLICABLE DEVELOPMENT STANDARDS OF THIS SECTION (17C.400.010) SHALL BE CONSIDERED TO MEET THE MAXIMUM DENSITY REQUIREMENTS.
4. FRONT, SIDE AND REAR SETBACKS TO BE CONSISTENT TO ORDINANCE NO. C36232 (OR ADOPTED CODE AT TIME OF PERMIT)
5. SEE SHEET PP2 FOR EXISTING EASEMENT INFORMATION

ADJACENT PROPERTY DATA		
PARCEL #	OWNER	PLAT DATA
25014.4305	CULVER, JOHNNY 1532 W ALICE AVE, SPOKANE, WA, 99205	DRUMHELLER SPRING ADDITION
25014.4606	WHIPPS, RICHARD L 3203 N MAPLE ST, SPOKANE, WA, 99205	DRUMHELLER SPRING ADDITION
25014.4601	TESKE, THEODORE D & KATHRYN A 3138 N ASH PL, SPOKANE, WA, 99205	DRUMHELLER SPRING ADDITION
25014.2202	SPOKANE, CITY OF 808 W SPOKANE FALLS BLVD, SPOKANE, WA, 99201	SPRING HILL ADDITION
25014.2111	FERRER,RAFAEL/SCHMIDT,MARY LOU 1210 ALKI AVE SW UNIT 501, SEATTLE, WA, 98116	SPRING HILL ADDITION
25014.2101	FERRER ETAL, R G 1210 ALKI AVE SW UNIT 501, SEATTLE, WA, 98116	SPRING HILL ADDITION
25014.4201	SATTERFIELD, SHARON L 3252 N ASH PL, SPOKANE, WA, 99205	DRUMHELLER SPRING ADDITION

ENGINEER/CONTACT
WHIPPLE CONSULTING ENGINEERS
21 SOUTH PINES
SPOKANE VALLEY, WA 99206
PHONE: 893-2617
CONTACT: TODD WHIPPLE, P.E.

SURVEYOR
WHIPPLE CONSULTING ENGINEERS 21 SOUTH PINES
SPOKANE VALLEY, WA 99206
PHONE: 893-2617
CONTACT: BRETT A. GRIFFITH, P.L.S.

OWNER/DEVELOPER
GROVE ROAD LLC
1102 N MONROE ST.
SPOKANE, WA 99201-2116

BRETT A. GRIFFITH STATE OF WASHINGTON 21723144 REGISTERED PROFESSIONAL LAND SURVEYOR

NO.	DATE	BY	REVISIONS

SCALE:
HORIZONTAL: 1"=20'
VERTICAL: N/A

PROJ #: 23-3505
DATE: 11/26/24
DRAWN: SLS
REVIEWED: TRW

	CIVIL
	STRUCTURAL
	SURVEYING
	TRAFFIC
X	PLANNING
	LANDSCAPE
	OTHER

WCE
WHIPPLE CONSULTING ENGINEERS
21 S. PINES ROAD
SPOKANE VALLEY, WA 99206
PH 509-893-2617 FAX 509-926-0227

ASH PLACE
PRELIMINARY PLAT
3242 N ASH PL
SPOKANE, WA

SHEET PP1

JOB NUMBER 23-3505

P:\WCE_WORK\2023 WCE PROJECTS\2023-3505 Boswell - Ash Place\DWG\3505-BASIN MAP.dwg, 11/26/2024 2:36:46 PM, randrade, PrimeLink C9065 PCL6, 1:1

NOT TO SCALE

W E S N

SHEET 1 OF 2	PRE-DEVELOPMENT BASIN MAP ASH PLACE 3242 N ASH PLACE SPOKANE, WASHINGTON	PROJ #: 23-3505 DATE: 11/26/24 DRAWN: RMA APPROVED: TRW	WCE WHIPPLE CONSULTING ENGINEERS CIVIL , STRUCTURAL AND TRANSPORTATION ENGINEERING 21 SOUTH PINES ROAD SPOKANE VALLEY, WASHINGTON 99206 PH: 509-893-2617 FAX: 509-926-0227

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SHEET 2 OF 2

POST-DEVELOPMENT BASIN MAP
ASH PLACE
3242 N ASH PLACE
SPOKANE, WASHINGTON

PROJ #: 23-3505
DATE: 11/26/24
DRAWN: RMA
APPROVED: TRW

WCE
WHIPPLE CONSULTING ENGINEERS
CIVIL , STRUCTURAL AND
TRANSPORTATION ENGINEERING
21 SOUTH PINES ROAD
SPOKANE VALLEY, WASHINGTON 99206
PH: 509-893-2617 FAX: 509-926-0227

Whipple Consulting Engineers

Basin Calculation Worksheet

			Imp	0.9	Intensities from SRSM eqn. 5-13, per Table 5-7, Assumes Tc = 5 min					
			Per	0.15	I (2 yr) =	1.418 inches	I (10 yr)=	2.619 inches	NOTE:	
	WCE No.	Project Name	Earth	0.6 Table 5-5	I (25 yr) =	3.319 inches	I (50 yr)=	3.843 inches		
11/26/2024	23-3505	Ash Place			I (100 yr) =	4.381 inches				
RMA										

SPOKANE COUNTY - SRSM - GRASSED PERCOLATION METHOD

Basin	Total	Access/Parking	Sidewalk	Adj. SW	Buildings	Total	Total	Weighted	PGIS	1815 A Pond	1815 A Pond	Q=CIA (cfs)				
	sf	/Street (sf)	sf	sf	sf	Impervious	Pervious	"C"	sf	Area (sf)	Vol (cf)	2 yr	**10 yr**	25 yr	**50 yr**	100 yr
PRE A	57,590	0	0	0	0	0	57,590	0.60	0	0	0	1.12	**2.08**	2.63	**3.05**	3.48
Pre Total	**57,590**	**0**	**0**	**0**	**0**	**0**	**57,590**	**0.60**	**0**	**0**	**0**	1.12	**2.08**	2.63	**3.05**	3.48
Post Onsite Flow																
POST 1	23,880	6,485	0	5,600	7,200	19,285	4,595	0.76	19,285	1,607	804	0.59	**1.08**	1.37	**1.59**	1.81
POST 2	24,205	0	0	0	3,600	3,600	20,605	0.64	0	0	0	0.51	**0.94**	1.19	**1.38**	1.57
POST 3	9,505	0	0	0	3,600	3,600	5.905	0.43	0	0	0	0.13	**0.25**	0.31	**0.36**	0.41
TOTAL	**57,590**	**6,485**	**0**	**5,600**	**14,400**	**26,485**	**31,105**	-	**19,285**	**1,607**	**804**	**1.23**	**2.27**	**2.88**	**3.33**	**3.80**

WHIPPLE CONSULTING ENGINEERS
POND VOLUME CALC SHEET

Date: 9/24/2024

Project: 23-3505 Ash Place
Designer: RMA

								Treatment					*Storage*
Basins	Ponds/ Swales	Bottom Area sf	Treatment Area (w/ Side Slopes)	Squared Side lf	Pond Bottom Elevation at Drywell	Pond Drywell Elevation	Pond Inlet Elevation (avg)	Conic Volume to Rim cf	Side Slope Volume cf	Total Volume to to Rim cf	Conic Volume to Inlet cf	Side Slope Volume cf	Total Volume to Inlet cf
1	**1**	**750**	960	27.39	1000.00	1001.00	1001.50	750	164	**914**	1,125	370	**1,495**
Totals		**750**	**960**	-	-	-	-	-	-	**914**	-	-	**1,495**

PEAK FLOW CALCULATION PROJECT:
25-Year Design Storm **Ash Place**

BASIN: 1

Tot. Area	23,880 SF	0.55	Acres
Imp. Area	19,285 SF	C=	0.9
Perv. Area	4,595 SF	C=	0.15
Wt. C =	0.76	PGIS Area =	19,285

WCE Applicable Travel Time Ground Cover Coefficients

Per Table 5-6 SRSM	
Type of Cover	K (ft/min)
Short Pasture	420
Nearly Bare Ground	600
Small Roadside Ditch/ Grass	900
Paved Area (use for parking lots)	1200
Gutter - 4 inches deep	1500
Gutter - 6 inches deep	2400
Pipe - 12-inch PVC/DI	3000
Pipe - 15/18-inch PVC/DI	3900
Pipe - 24-inch PVC/DI	4700

Reaches

Reach 1	Offsite	also applicable for Pre-Developed Tc
Length	0.00	
K	420.00	
Slope (ft/ft)	0.0400	be sure this is decimal equivalent slope 0.0000
Travel Time	0.00	Minutes
Reach 2	Finished Lot from House to Street	
Length	0.00	
K	420.00	
Slope (ft/ft)	0.0300	be sure this is decimal equivalent slope 0.0000
Travel Time	0.00	Minutes
Reach 3	Gutter Flow to Inlet/Catch Basin	
Length	300.00	
K	2400.00	
Slope (ft/ft)	0.0200	be sure this is decimal equivalent slope 0.0000
Travel Time	0.88	Minutes
Reach 4	Pipe Flow	Pipe Reach One (only need one if no Dia change)
Length	130.00	
K	3000.00	12-inch Pipe minimum
Slope (ft/ft)	0.0300	Average Slope for total pipe run
Travel Time	0.25	Minutes
Reach 5	Pipe Flow	Add additional pipe reacheds for other Dia
Length	0.00	
K	3900.00	15/18-inch Pipe
Slope (ft/ft)	0.0200	Average Slope for total pipe run
Travel Time	0.00	Minutes
Sum of Tc	1.13	Minutes
Tc for Analysis	5.00	Minutes

Whipple Consulting Engineers

BOWSTRING METHOD PROJECT: Ash Place
DETENTION BASIN DESIGN BASIN: 1
DESIGNER: RMA
DATE: 24-Sep-24

Time Increment (min)	10
Time of Conc. (min)	5.00
Outflow (cfs)	0.05
Design Year Flow	25
Area (acres)	0.55
Impervious Area (sq ft)	19,285
'C' Factor	0.76
Area * C	0.414
PGIS Area	19,285

Time (min)	Time Inc. (sec)	Intens. (in/hr)	Q Devel. (cfs)	Vol.In (cu ft)	Vol.Out (cu ft)	Storage (cu ft)	
5.00	300	3.32	1.37	553	15	538	
15	900	1.67	0.69	693	45	648	
25	1500	1.21	0.50	804	75	729	
35	2100	0.98	0.41	896	105	791	
45	2700	0.84	0.35	974	135	839	
55	3300	0.74	0.31	1043	165	878	
65	3900	0.67	0.28	1105	195	910	
75	4500	0.61	0.25	1161	225	936	
85	5100	0.56	0.23	1214	255	959	
95	5700	0.53	0.22	1263	285	978	
105	6300	0.49	0.20	1309	315	994	
115	6900	0.47	0.19	1352	345	1007	
125	7500	0.44	0.18	1394	375	1019	
135	8100	0.42	0.17	1433	405	1028	
145	8700	0.40	0.17	1470	435	1035	
155	9300	0.39	0.16	1506	465	1041	
165	9900	0.37	0.15	1541	495	1046	
175	10500	0.36	0.15	1574	525	1049	
185	11100	0.35	0.14	1607	555	1052	
195	11700	0.33	0.14	1638	585	1053	
205	12300	0.32	0.13	1668	615	1053	<==
215	12900	0.32	0.13	1697	645	1052	
225	13500	0.31	0.13	1726	675	1051	
235	14100	0.30	0.12	1754	705	1049	
245	14700	0.29	0.12	1781	735	1046	
255	15300	0.28	0.12	1807	765	1042	
265	15900	0.28	0.11	1833	795	1038	
275	16500	0.27	0.11	1858	825	1033	
285	17100	0.26	0.11	1882	855	1027	
295	17700	0.26	0.11	1906	885	1021	
305	18300	0.25	0.10	1930	915	1015	
315	18900	0.25	0.10	1953	945	1008	
325	19500	0.24	0.10	1976	975	1001	
335	20100	0.24	0.10	1998	1005	993	
345	20700	0.23	0.10	2020	1035	985	
355	21300	0.23	0.09	2028	1065	963	
365	21900	0.22	0.09	2045	1095	950	
375	22500	0.22	0.09	2048	1125	923	
385	23100	0.22	0.09	2102	1155	947	

Rainfall Intensity Coefficients for ***Spokane***
taken from Table 5-7 SRSM

M_{25} = 9.09
N_{25} = 0.626

Flow (weighted c)
Qwc= 1.37 cfs
Flow (time of concentration)
Qtc= 1.37 cfs

Time (min)	Time Inc. (sec)	Intens. (in/hr)	Q Devel (cfs)	Vol.In (cu ft)	Vol.Out (cu ft)	Storage (cu ft)
385						
395	23700	0.21	0.09	2058	1185	873
405	24300	0.21	0.09	2110	1215	895
415	24900	0.20	0.08	2058	1245	813
425	25500	0.20	0.08	2108	1275	833
435	26100	0.19	0.08	2048	1305	743
445	26700	0.19	0.08	2095	1335	760
455	27300	0.18	0.07	2029	1365	664
465	27900	0.18	0.07	2073	1395	678
475	28500	0.17	0.07	1999	1425	574
485	29100	0.17	0.07	2041	1455	586
495	29700	0.16	0.07	1960	1485	475
505	30300	0.16	0.07	1999	1515	484
515	30900	0.15	0.06	1910	1545	365
525	31500	0.15	0.06	1947	1575	372
535	32100	0.14	0.06	1851	1605	246
545	32700	0.14	0.06	1885	1635	250
555	33300	0.13	0.05	1781	1665	116
565	33900	0.13	0.05	1813	1695	118
575	34500	0.12	0.05	1702	1725	-23
585	35100	0.12	0.05	1731	1755	-24
595	35700	0.11	0.05	1612	1785	-173
605	36300	0.11	0.05	1640	1815	-175
615	36900	0.10	0.04	1513	1845	-332
625	37500	0.10	0.04	1538	1875	-337
635	38100	0.09	0.04	1404	1905	-501
645	38700	0.09	0.04	1426	1935	-509
655	39300	0.08	0.03	1285	1965	-680
665	39900	0.08	0.03	1305	1995	-690
675	40500	0.07	0.03	1156	2025	-869
685	41100	0.07	0.03	1173	2055	-882
695	41700	0.06	0.02	1017	2085	-1068
705	42300	0.06	0.02	1031	2115	-1084
715	42900	0.05	0.02	868	2145	-1277
725	43500	0.05	0.02	880	2175	-1295
735	44100	0.04	0.02	709	2205	-1496
745	44700	0.04	0.02	719	2235	-1516

"1815A" TREATMENT REQUIREMENTS	
Minimum "1815A" Volume Required	804 cu ft
Provided Treatment Volume - Min.	914 cu ft

STORAGE REQ. - 25 YEAR DESIGN STORM	
Maximum Storage Required by Bowstring	1,053 cu ft
Provided Pond Storage Volume to Inlet - Min.	1,495 cu ft
Provided Drywell/Gallery Storage Volume	0 cu ft
Total Provided Volume	**1,495 cu ft**

PEAK FLOW CALCULATION — PROJECT:
100-Year Design Storm — **Ash Place**

BASIN: 1

Tot. Area	23,880 SF	0.55 Acres	
Imp. Area	19,285 SF	C=	0.9
Perv. Area	4,595 SF	C=	0.15
Wt. C =	0.76	PGIS Area =	19,285

WCE Applicable Travel Time Ground Cover Coefficients	
Per Table 5-6 SRSM	
Type of Cover	K (ft/min)
Short Pasture	420
Nearly Bare Ground	600
Small Roadside Ditch/ Grass	900
Paved Area (use for parking lots)	1200
Gutter - 4 inches deep	1500
Gutter - 6 inches deep	2400
Pipe - 12-inch PVC/DI	3000
Pipe - 15/18-inch PVC/DI	3900
Pipe - 24-inch PVC/DI	4700

Reaches		
Reach 1	Offsite	also applicable for Pre-Developed Tc
Length	0.00	
K	420.00	
Slope (ft/ft)	0.0400	be sure this is decimal equivalent slope 0.0000
Travel Time	0.00	Minutes
Reach 2	Finished Lot from House to Street	
Length	0.00	
K	420.00	
Slope (ft/ft)	0.0300	be sure this is decimal equivalent slope 0.0000
Travel Time	0.00	Minutes
Reach 3	Gutter Flow to Inlet/Catch Basin	
Length	300.00	
K	2400.00	
Slope (ft/ft)	0.0200	be sure this is decimal equivalent slope 0.0000
Travel Time	0.88	Minutes
Reach 4	Pipe Flow	Pipe Reach One (only need one if no Dia change)
Length	130.00	
K	3000.00	12-inch Pipe minimum
Slope (ft/ft)	0.0300	Average Slope for total pipe run
Travel Time	0.25	Minutes
Reach 5	Pipe Flow	Add additional pipe reacheds for other Dia
Length	0.00	
K	3900.00	15/18-inch Pipe
Slope (ft/ft)	0.0200	Average Slope for total pipe run
Travel Time	0.00	Minutes
Sum of Tc	1.13	Minutes
Tc for Analysis	5.00	Minutes

Whipple Consulting Engineers

BOWSTRING METHOD — PROJECT: Ash Place
DETENTION BASIN DESIGN — BASIN: 1
DESIGNER: RMA
DATE: 24-Sep-24

Time Increment (min)	10
Time of Conc. (min)	5.00
Outflow (cfs)	0.05
Design Year Flow	50
Area (acres)	0.55
Impervious Area (sq ft)	19285
'C' Factor	0.76
Area * C	0.414
PGIS Area	19,285

Time (min)	Time Inc. (sec)	Intens. (in/hr)	Q Devel. (cfs)	Vol.In (cu ft)	Vol.Out (cu ft)	Storage (cu ft)	
5.00	300	4.38	1.81	730	15	715	
15	900	2.16	0.90	897	45	852	
25	1500	1.56	0.64	1033	75	958	
35	2100	1.25	0.52	1143	105	1038	
45	2700	1.07	0.44	1238	135	1103	
55	3300	0.94	0.39	1321	165	1156	
65	3900	0.84	0.35	1396	195	1201	
75	4500	0.77	0.32	1464	225	1239	
85	5100	0.71	0.29	1527	255	1272	
95	5700	0.66	0.27	1585	285	1300	
105	6300	0.62	0.26	1640	315	1325	
115	6900	0.58	0.24	1692	345	1347	
125	7500	0.55	0.23	1741	375	1366	
135	8100	0.53	0.22	1788	405	1383	
145	8700	0.50	0.21	1833	435	1398	
155	9300	0.48	0.20	1875	465	1410	
165	9900	0.46	0.19	1916	495	1421	
175	10500	0.45	0.18	1956	525	1431	
185	11100	0.43	0.18	1994	555	1439	
195	11700	0.42	0.17	2031	585	1446	
205	12300	0.40	0.17	2067	615	1452	
215	12900	0.39	0.16	2101	645	1456	
225	13500	0.38	0.16	2135	675	1460	
235	14100	0.37	0.15	2168	705	1463	
245	14700	0.36	0.15	2200	735	1465	
255	15300	0.35	0.14	2231	765	1466	
265	15900	0.34	0.14	2261	795	1466	
275	16500	0.33	0.14	2290	825	1465	
285	17100	0.33	0.13	2319	855	1464	
295	17700	0.32	0.13	2348	885	1463	
305	18300	0.31	0.13	2375	915	1460	
315	18900	0.31	0.13	2402	945	1457	
325	19500	0.30	0.12	2429	975	1454	
335	20100	0.29	0.12	2455	1005	1450	
345	20700	0.29	0.12	2480	1035	1445	
355	21300	0.28	0.12	2512	1065	1447	
365	21900	0.28	0.12	2532	1095	1437	
375	22500	0.27	0.11	2559	1125	1434	
385	23100	0.27	0.11	2627	1155	1472	<==

Rainfall Intensity Coefficients for ***Spokane***
taken from Table 5-7 SRSM
M_{100} = 12.33
N_{100} = 0.643

Flow (weighted c)
Qwc= 1.81 cfs
Flow (time of concentration)
Qtc= 1.81 cfs

Time (min)	Time Inc. (sec)	Intens. (in/hr)	Q Devel (cfs)	Vol.In (cu ft)	Vol.Out (cu ft)	Storage (cu ft)
385						
395	23700	0.26	0.11	2597	1185	1412
405	24300	0.26	0.11	2662	1215	1447
415	24900	0.25	0.10	2624	1245	1379
425	25500	0.25	0.10	2687	1275	1412
435	26100	0.24	0.10	2641	1305	1336
445	26700	0.24	0.10	2702	1335	1367
455	27300	0.23	0.10	2649	1365	1284
465	27900	0.23	0.10	2707	1395	1312
475	28500	0.22	0.09	2646	1425	1221
485	29100	0.22	0.09	2702	1455	1247
495	29700	0.21	0.09	2634	1485	1149
505	30300	0.21	0.09	2687	1515	1172
515	30900	0.20	0.08	2611	1545	1066
525	31500	0.20	0.08	2662	1575	1087
535	32100	0.19	0.08	2579	1605	974
545	32700	0.19	0.08	2627	1635	992
555	33300	0.18	0.08	2537	1665	872
565	33900	0.18	0.08	2582	1695	887
575	34500	0.17	0.07	2485	1725	760
585	35100	0.17	0.07	2528	1755	773
595	35700	0.16	0.07	2423	1785	638
605	36300	0.16	0.07	2463	1815	648
615	36900	0.15	0.06	2350	1845	505
625	37500	0.15	0.06	2389	1875	514
635	38100	0.14	0.06	2268	1905	363
645	38700	0.14	0.06	2304	1935	369
655	39300	0.13	0.06	2176	1965	211
665	39900	0.13	0.06	2210	1995	215
675	40500	0.12	0.05	2074	2025	49
685	41100	0.12	0.05	2105	2055	50
695	41700	0.11	0.05	1963	2085	-122
705	42300	0.11	0.05	1991	2115	-124
715	42900	0.10	0.04	1841	2145	-304
725	43500	0.10	0.04	1866	2175	-309
735	44100	0.09	0.04	1709	2205	-496
745	44700	0.09	0.04	1732	2235	-503

"1815A" TREATMENT REQUIREMENTS	
Minimum "1815A" Volume Required	804 cu ft
Provided Treatment Volume - Min.	914 cu ft

STORAGE REQ. - 100 YEAR DESIGN STORM	
Maximum Storage Required by Bowstring	1,472 cu ft
Provided Pond Storage Volume to Inlet - Min.	1,495 cu ft
Provided Drywell/Gallery Storage Volume	0 cu ft
Total Provided Volume	**1,495 cu ft**