DRAINAGE PUMP DESIGN

FOR

SINGLE FAMILY RESIDENCE

2247 66TH AVE SE

MERCER ISLAND, WA 98040

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Prepared by

C2MY Engineers, LLC
P.O. Box 52883
Bellevue, WA 98015-2883
Contact: Choomeng Chin
(206) 451-7856
cmchin.c2my@gmail.com

Prepared for

David Sheldon & Jianchu Fan
2247 66th Ave SE
Mercer Island, WA 98040
Contact: Peik Li Pang, AIA
*(*425)-287-1567
Peikli.pang@5ft2studio.com

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I. PROJECT OVERVIEW

This report provides the roof and driveway drainage pump system design calculation for the redevelopment of a single-family residence building. The site is lower than the street drainage system and site drainage runoff cannot be drained by gravity to the roadway drainage system and hence a pump is needed. The pump system will include the footing drain runoff using 2 gpm flow rate.

A. Pump Design Requirements:

Per city requirements:

a. The pump system shall have dual, alternating pumps with emergency on-site, back-up power supply and an external alarm system for system failure and highwater level indicator.

b. Provide a detail section for the pump system and the structure with all dimensions and invert elevations shown.

c. Pumped flows shall not exceed the allowable discharge rates set forth herein. Each pump shall be capable of discharging the design flow rate for the 100-year, 24-hour design storm. Provide detail calculations for the pump system including pump curve.

d. The pump system shall discharge to an elevation higher than the downstream design water surface elevation to prevent backwater/backflow conditions. Provide such design.

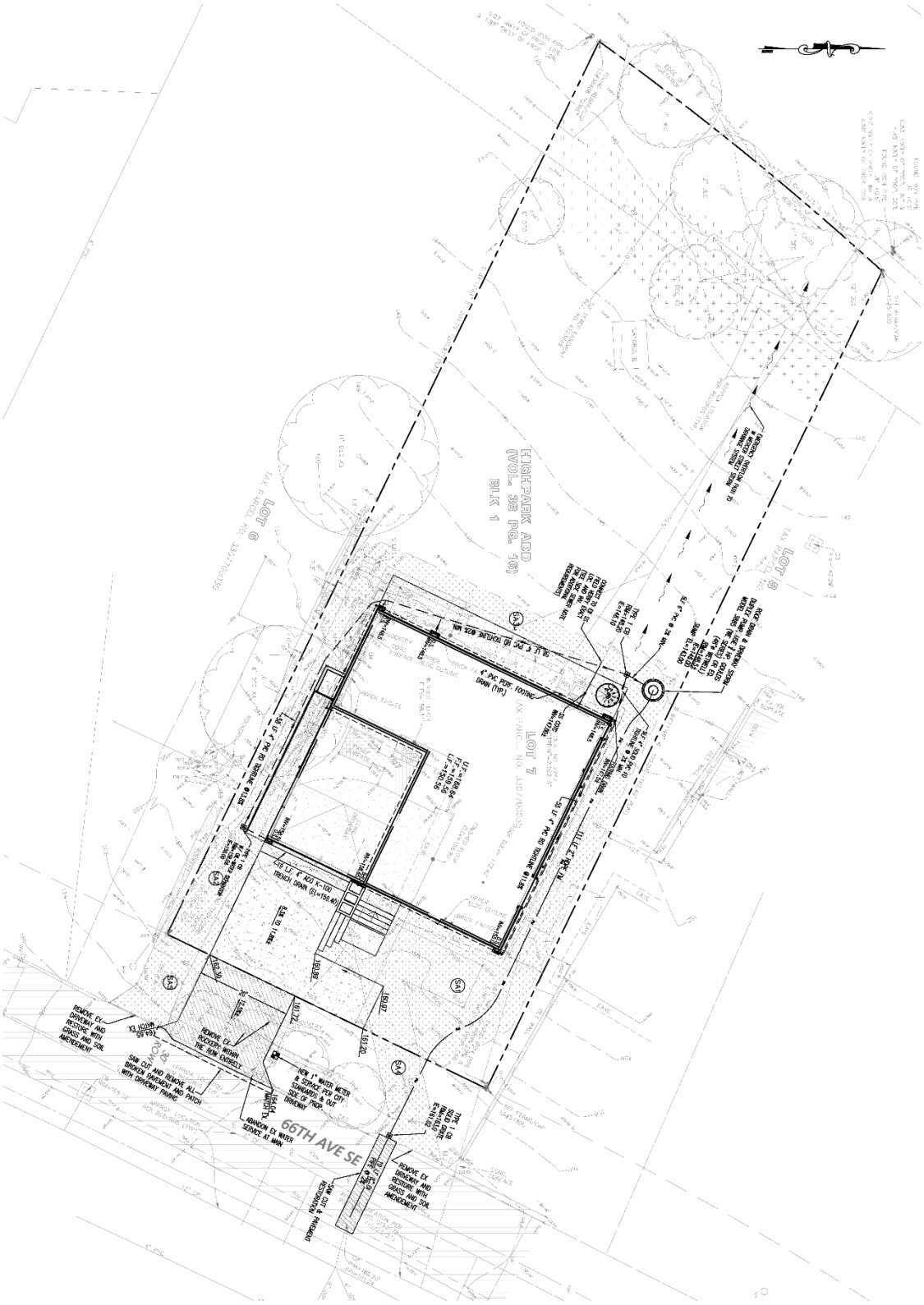

FIGURE 1: PROPOSED SITE DEVELOPEMENT MAP (NTS)

II. PUMP DESIGN DESIGN

The calculated peak runoffs using the SBUH methodology are as follow:

Drainage area= 4,769 S.F. (0.1095 acs)

The proposed driveway design storm flow frequencies are calculated as follow:

- 2-yr/24hr – 0.0499 cfs
- 25-yr/24hr – 0.0904 cfs
- 100-yr/24hr – 0.1037 cfs

The flow rate for the footing drain is estimated to be 2 gpm and added to the peak runoff for pump calculation.

A. SUMMARY OF INPUT DATA:

Drainage area = 1005 SF

TIME OF CONCENTRATION CALCULATIONS

24 hr. ISOPLUVIALS:

P2=	2.00	in/day
P10=	3.00	in/day
P100=	4.00	in/day

sheet flow: Tt = {(.42)(Ns*L)^0.8}/{(P2)^0.5*(So)^0.4}
Tt =
conc. flow: L/(60*Ks*(So)^0.5)

TIME OF CONCENTRATION CALCULATIONS

Existing	Status						
Segment		Length	Ns	Ks	So%(ave)	Tt(min)	Tc Used (min.)
Proposed							
Impervious	Sheet Flow	46	0.011		12.5	0.37	5
Pervious	Sheet Flow						

B. DEVELOPED PEAK FLOW CALCULATION:

Project Precips

[2 yr]	2.00 in
[5 yr]	2.80 in
[10 yr]	3.00 in

[25 yr]	3.50 in
[100 yr]	4.00 in
[6-mo]	1.28 in

Dev1 Event Summary:

BasinID	Peak Q (cfs)	Peak T (hrs)	Peak Vol (ac-ft)	Area ac	Method /Loss	Raintype	Event
Dev1	0.0499	7.83	0.0162	0.11	SBUH/SCS	TYPE1A	2 yr
Dev1	0.0770	7.83	0.0252	0.11	SBUH/SCS	TYPE1A	10 yr
Dev1	0.0904	7.83	0.0298	0.11	SBUH/SCS	TYPE1A	25 yr
Dev1	0.1037	7.83	0.0343	0.11	SBUH/SCS	TYPE1A	100 yr

Drainage Area: Dev1

Hyd Method:	SBUH Hyd		Loss Method:	SCS CN Number
Peak Factor:	484.00		SCS Abs:	0.20
Storm Dur:	24.00 hrs		Intv:	10.00 min
	Area	CN	TC	
Pervious	0.0000 ac	86.00	0.00 hrs	
Impervious	0.1094 ac	98.00	0.01 hrs	
Total	0.1094 ac			

Supporting Data:

Impervious CN Data:

Driveway, open parking & access		98.00	0.0276 ac
Roof	98.00	0.0819 ac	

Impervious TC Data:

Flow type:	Description:	Length:	Slope:	Coeff:	Travel Time
Sheet	Overland	46.00 ft	12.50%	0.0110	0.40 min

C. STORM DUPLEX PUMP DESIGN:

2427 66th Ave SE SE, Mercer Is, WA - STORM PUMP CAPACITY ANALYSIS 11/11/2024

STORM WATER LIFT STATION DESIGN

A. DETERMINE THE REQUIRED RATE OF PUMPING;

100-YR PEAK FLOW, Qmax = 0.1037 cfs = 49 GPM (From SBUH)
(Including 2gpm for ftg. Drain)

B. COMPUTE THE STORAGE REQUIREMENT FOR THE WETWELL:

USING 2 PUMPS AND 1 CYCLE PER HOUR
TIME FOR ONE PUMP CYCLE:

$$T=(V/Q-S)+(V/S)$$

Where:

T = THE TIME FOR ONE PUMP CYCLE IN MINUTES = 24
V = THE EFFECTIVE VOLUME OF THE WETWELL IN GALLON = V
Q = THE PUMPING RATE IN GALLONS PER MINUTE = 49
S = THE FLOW INTO THE WETWELL IN GALLONS PER MINUTE = 22 0.0499 cfs
(Using 2-yr Peak)

V = TS(Q-S)/Q = **290**

USE 4 FEET DIAMETER WET WELL
VOLUME PER FOOT = **94.00** GAL/FT
WORKING DEPTH = **3.08** FEET

C. DETERMINE THE FORCEMAIN DIAMETER:

Qmax = 49 GPM = 0.11 CFS

MAXIMUM CROSS SECTION REQUIRED = 0.04 SF
(FOR VEL. = 3 FPS) = 5.19 SI

USE	2	INCH DIAMETER HDPE PIPE, V= Q/A						
(AREA =	0.02	(SF)	=	4.96	FPS	<10 FPS	OK	
FOR	3	INCH DIAMETER HDPE PIPE, V= Q/A						
	0.05	(SF)	=	2.20	FPS	<< 3FPS	NG	

D. DETERMINE HEAD LOSS OF HDPE FORCE MAIN:

H = (Q/(0.006757)(C)(D^2.63))^1.85

WHERE:	H = THE HEAD LOSS IN FEET PER 1000 FEET OF PIPE =	H	
	Q = THE FLOW IN GALLON PER MINUTE =	49	
	C = THE HAZEN-WILLIAM COEFFICIENT OF ROUGHNESS =	140	
	D = THE PIPE DIAMETER IN INCHES =	2	USED

H = 50.03 FEET

LENGTH OF PIPE = 111 FEET HEAD LOSS IN PIPE = **6** FT.

E. COMPUTE THE TOTAL DYNAMIC HEAD (TDH)

a) STATIC DISCHARGE HEAD =	**18.62**	FEET
DISCHARGE ELEVATION =	161.62	
PUMP OFF ELEVATION =	143	
b) MINOR LOSSES =	**5.9**	
2 - 90 DEG. ELL =	1.4	
1 - GATE VALVE =	0.2	
1 - CHECK VALVE =	2.5	
1 - TEE	1.8	

c) TOTAL DISCHARGE HEAD LOSS = **30.07** FEET

G. COMPUTE THE REQUIRED BRAKE HORSEPOWER:

Hpbrake = (GPMxTDH) / (3960 X EFF.) = **0.61** (Required Pump)

USING SUBMERSIVE PUMP WITH EFF. OF 60 %
(Use 3/4 HP pump)

WHERE: GPM = FLOW RATE IN GALLON PER MINUTE
TDH = TOTAL DYNAMIC HEAD OF THE SYSTEM IN FEET WHEN DELIVERING THE REQUIRED FLOW RATE
3930 = A CONSTANT
EFF = PUMP EFFICIENCY EXPRESSED IN DECIMAL FORM

D. PUMP CURVE:

Use Goulds Pump WS_BHF Series, Model WE0718H (3/4 HP) or Equal.
See Plan for pump details.