Stormwater Drainage Report
4216 83rd Avenue SE
Mercer Island, Washington
KC Tax Parcel #362650-0065
Permit #: XXXX-XXX

Prepared For:

JayMarc Diamond, LLC
Attn.: Gary Upper
7525 SE 24th Street
Suite #520
Mercer Island, Washington 98040
425-281-2706
Gary@jaymarchomes.com

February 22, 2024

Prepared By:

Offe Engineers, PLLC
Darrell Offe, P.E.
13932 SE 159th Place
Renton, Washington 98058
425-260-3412
Darrell.Offe@comcast.net

02/22/2024

TABLE OF CONTENT

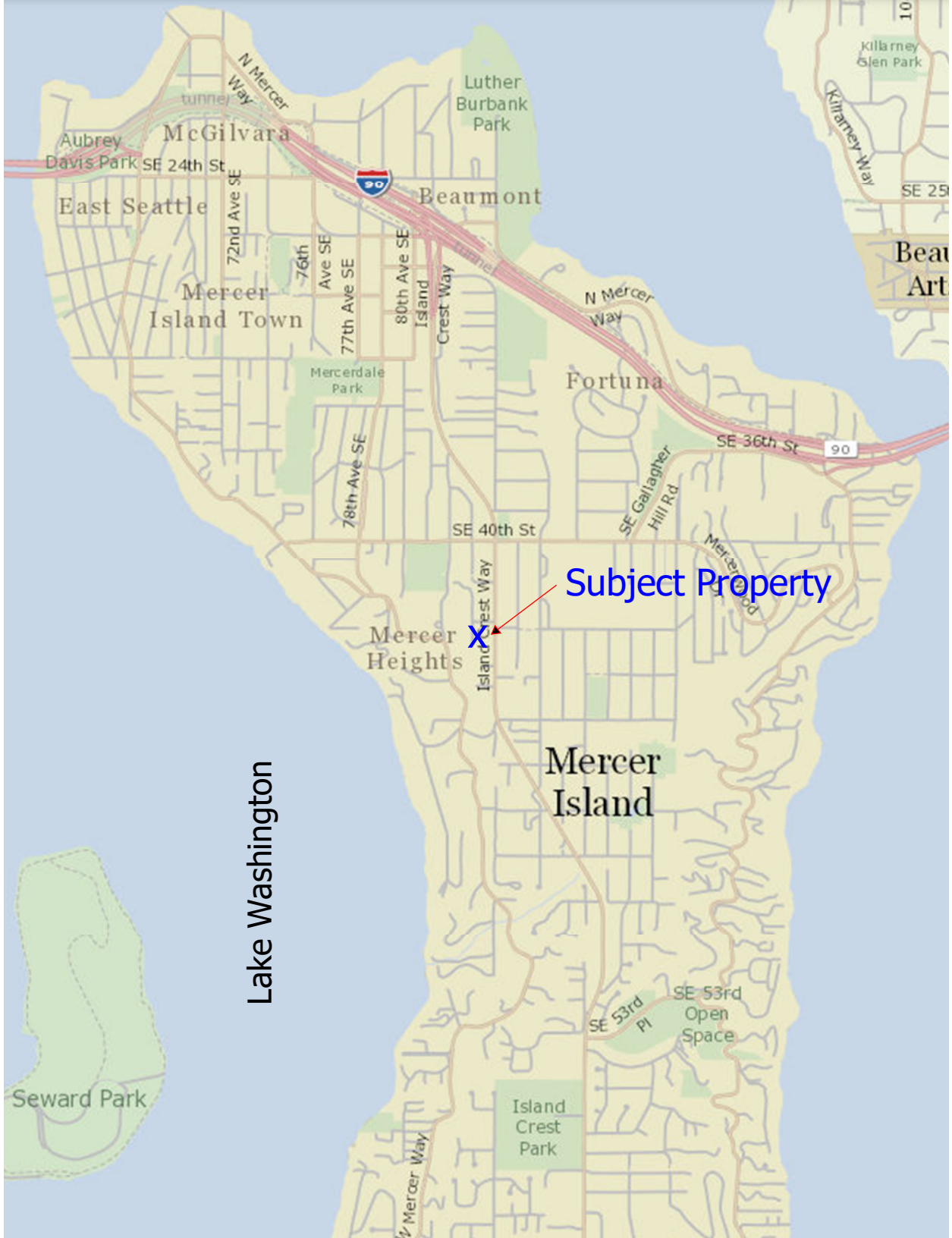
Section 1: Project Narrative:

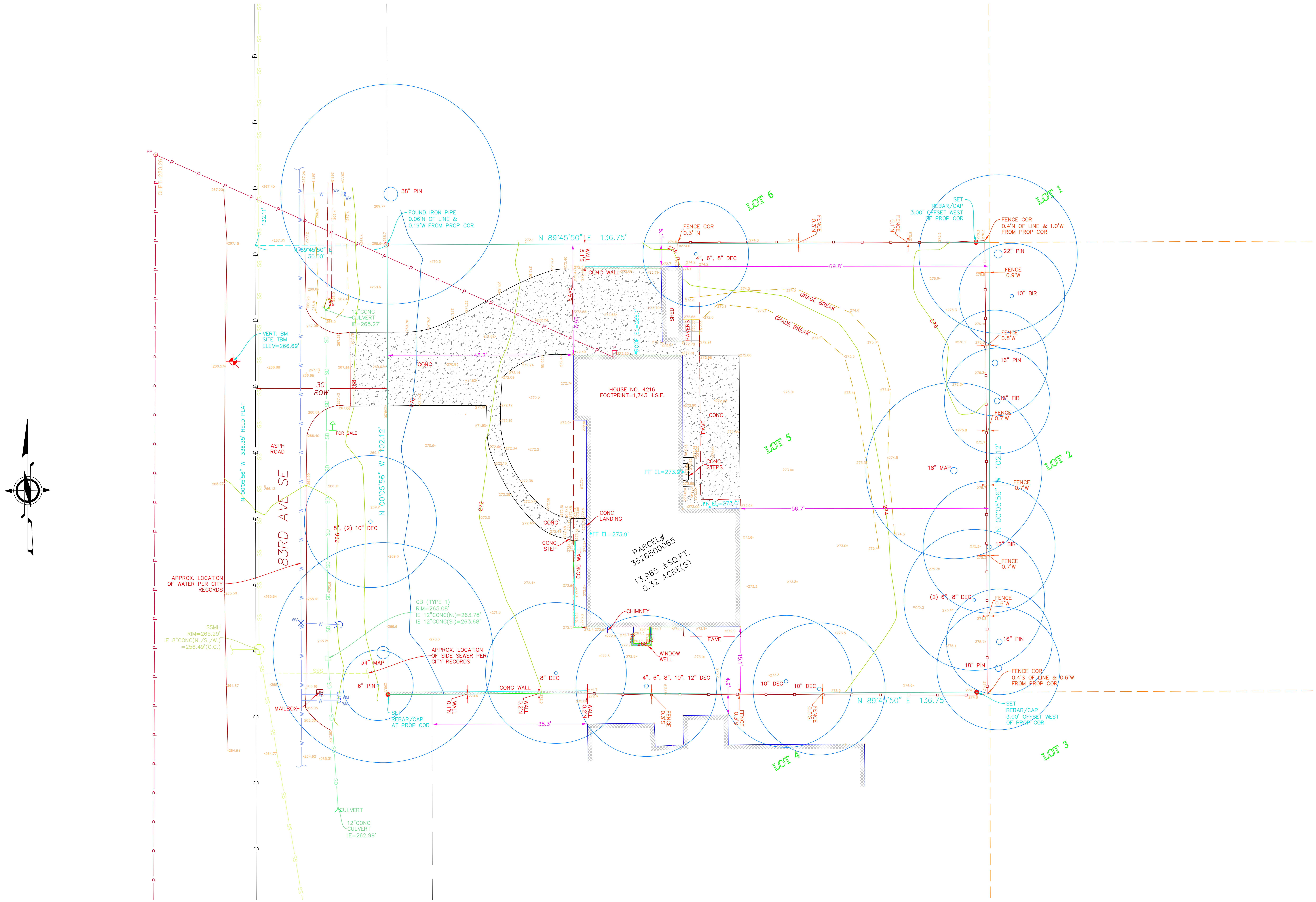
The proposed project is to remove an existing house and driveway and construct a new single-family residence. The subject property is located on the west of Island Crest Way and North of SE 42nd Street within the Mercer Heights community of the City of Mercer Island. The subject property takes access from the 83rd Avenue SE on at the northwest corner of the property. There is an existing house, long concrete driveway, and patio area on the property. These features will all be removed for the new single-family residence. All public and franchise utilities are located on the west side within 83rd Avenue SE.

The site soils are characterized between Vashon Glacial Till and infeasible for infiltration type BMPs by Cobalt Geosciences, Geotechnical Evaluation attached within this Report. City staff has determined that on-site detention is required for this new development, sizing of on-site system is included within the Report.

The property was visited in September and November 2023 to verify runoff patterns and possible storm water discharge options. The downstream system was reviewed and walked, where possible.

The project will be evaluated for storm water treatment and control using the Amended December 2019 SWMMWW (DOE Manual).


Subject Property
X
Lake Washington
Mercer Island
Mercer Heights
Mercerdale Park
Fortuna
Beaumont
East Seattle
McGilvara
Aubrey Davis Park
Luther Burbank Park
Killarney Glen Park
Seward Park
Island Crest Park
SE 53rd Open Space
SE 40th St
SE 36th St
SE 24th St
N Mercer Way
Island Crest Way
72nd Ave SE
76th Ave SE
77th Ave SE
78th Ave SE
80th Ave SE
SE Gallagher Hill Rd
Killarney Way
90



83RD AVE SE
ASPH ROAD
30' ROW
N 00°05'56" W 336.35' HELD PLAT
N 89°45'50" E 136.75'
N 89°45'50" E 30.00'
N 00°05'56" W 102.12'
HOUSE NO. 4216
FOOTPRINT=1,743 ±S.F.
PARCEL# 3626500065
13,965 ±SQ.FT.
0.32 ACRE(S)
LOT 1
LOT 2
LOT 3
LOT 4
LOT 5
LOT 6
38" PIN
FOUND IRON PIPE 0.06'N OF LINE & 0.19'W FROM PROP COR
12"CONC CULVERT IE=265.27'
VERT. BM SITE TBM ELEV=266.69'
FOR SALE
8", (2) 10" DEC
APPROX. LOCATION OF WATER PER CITY RECORDS
SSMH RIM=265.29' IE 8"CONC(N./S./W.) =256.49'(C.C.)
CB (TYPE 1) RIM=265.08' IE 12"CONC(N.)=263.78' IE 12"CONC(S.)=263.68'
APPROX. LOCATION OF SIDE SEWER PER CITY RECORDS
34" MAP
6" PIN
MAILBOX
SET REBAR/CAP AT PROP COR
CULVERT
12"CONC CULVERT IE=262.99'
CONC WALL
CONC
CONC LANDING
CONC STEP
CONC STEPS
FF EL=273.9'
FF EL=273.0'
SHED
PAVERS
EAVE
CHIMNEY
WINDOW WELL
8" DEC
4", 6", 8", 10", 12" DEC
10" DEC
4", 6", 8" DEC
FENCE COR 0.3' N
GRADE BREAK
SET REBAR/CAP 3.00' OFFSET WEST OF PROP COR
FENCE COR 0.4'N OF LINE & 1.0'W FROM PROP COR
22" PIN
10" BIR
16" PIN
16" FIR
18" MAP
12" BIR
(2) 6", 8" DEC
18" PIN
FENCE COR 0.4'S OF LINE & 0.6'W FROM PROP COR
69.8'
56.7'
42.2'
35.3'
15.1'

Section 2: Site Evaluation

Total Lot Area = 13,965 square feet (0.32 acres)

EXISTING CONDITIONS

Impervious:

Roof area = 2,677 sq. feet
Uncovered walkway/patio = 438 sq. feet
Uncovered driveway = 921 sq. feet ((PGHS))
Subtotal: 4,036 sq. feet

Pervious:

Lawn, trees, landscaping = 9,929 *sq. feet*

PROPOSED (2024) CONDITIONS

Impervious (hard) surfaces:

House roof area w/overhang = 4,734 sq. feet
Uncovered driveway = 961 sq. feet ((PGHS))
Uncovered walkway/pads/patio = 225 sq. feet
Total Impervious (Hard) Surfaces = 5,920 sq. feet

Pervious Surfaces:

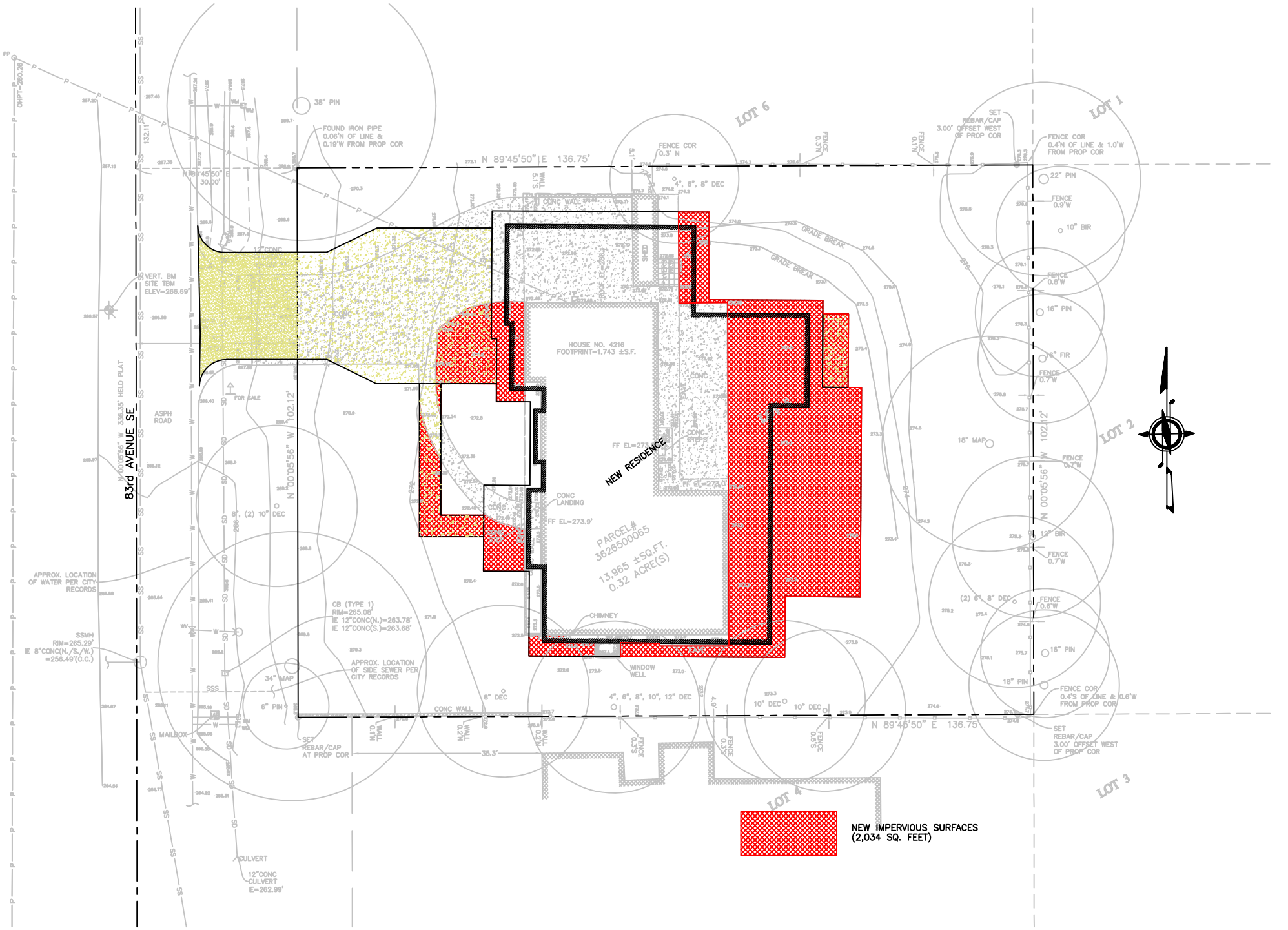
Ex. Lawn, trees, landscaping = *8,045 sq. feet*
Total Pervious Surfaces = 8,045 square feet

((PGHS)) -Pollution Generating Hard Surface

Summary of Project Information

Project Site Area	13,965 square feet
Existing Impervious Area	4,036 sq. feet
Existing Impervious Coverage	28.9%
New Impervious Area	2,034 sq. feet
Replaced Impervious Area	3,886 sq. feet
New plus Replaced Impervious	5,920 square feet
Proposed Impervious Area	5,920 square feet
Converted pervious: Native to lawn	0 sq. feet
Converted pervious: Native to pasture	0 sq. feet
Total Area of Land Disturbance	9,000 square feet

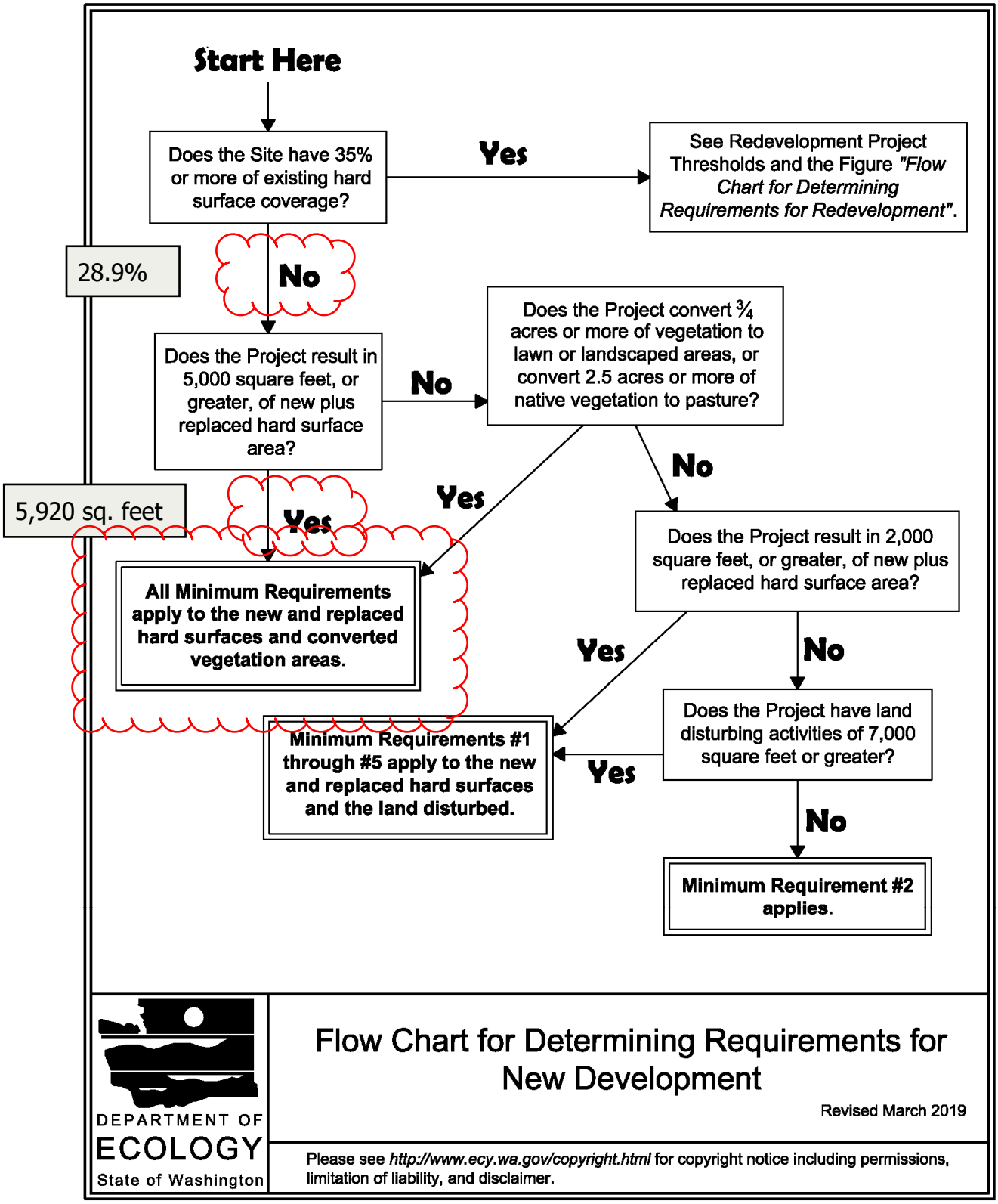
The existing property has less than 35% (28.9%) imperious coverage and the total proposed project new plus replaced impervious surfaces will be greater than 5,000 (5,920) square feet; using Figure I-2.4.2 – *"Flow Chart for Determining Minimum Requirements for Redevelopment"* page 38, 2014 Stormwater Management Manual for Western Washington, Minimum Requirements #1 – #9 apply to this project.


83rd AVENUE SE
N 89°45'50" E 136.75'
N 00°05'56" W 102.12'
HOUSE NO. 4216
FOOTPRINT=1,743 ±S.F.
NEW RESIDENCE
PARCEL#
3626500065
13,965 ±SQ.FT.
0.32 ACRE(S)
LOT 1
LOT 2
LOT 3
LOT 4
LOT 6
NEW IMPERVIOUS SURFACES
(2,034 SQ. FEET)

FLOW CHART FIGURE II-2.4.1

4216 83rd Avenue SE

Figure I-3.1: Flow Chart for Determining Requirements for New Development



Section 3: Minimum Requirements (MRs)

From 2019 SWMMWW Section I-3.4

Section I-3.4.1 MR1: Preparation of Stormwater Site Plans

A Stormwater site plan (drainage plan) has been prepared for this project together with construction details for installation of the proposed drainage control system. The Stormwater site plans and drainage narrative shall be submitted and reviewed by the City of Mercer Island as part of the building permit application.

SE 1/4 OF THE NE 1/4 OF SECTION 13, TOWNSHIP 24 NORTH., RANGE 4 EAST, W.M., KING COUNTY, WA.

EXISTING UTILITY LOCATIONS SHOWN HEREON ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT VERTICAL AND HORIZONTAL LOCATION OF ALL EXISTING UNDERGROUND UTILIITES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN HEREON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR UTILITIES NOT SHOWN IN THEIR PROPER LOCATION.

CALL BEFORE YOU DIG: 811

DOWNSPOUT TABLE

DS#1	GROUND=273.00 DOWNSPOUT LINE=269.75, 4"
DS#2	GROUND=273.00 DOWNSPOUT LINE=270.60, 4"
DS#3	CONCRETE=274.40 DOWNSPOUT LINE=273.25, 4"
DS#4	CONCRETE=274.40 DOWNSPOUT LINE=273.25, 4"
DS#5	GROUND=273.50 DOWNSPOUT LINE=272.00, 4"
DS#6	GROUND=273.00 DOWNSPOUT LINE=272.10, 4"
DS#7	GROUND=272.80 DOWNSPOUT LINE=271.40, 4"
DS#8	GROUND=272.80 DOWNSPOUT LINE=270.75, 4"
DS#9	CONCRETE=274.40 DOWNSPOUT LINE=273.00, 4"
DS#10	CONCRETE=274.40 DOWNSPOUT LINE=273.00, 4"

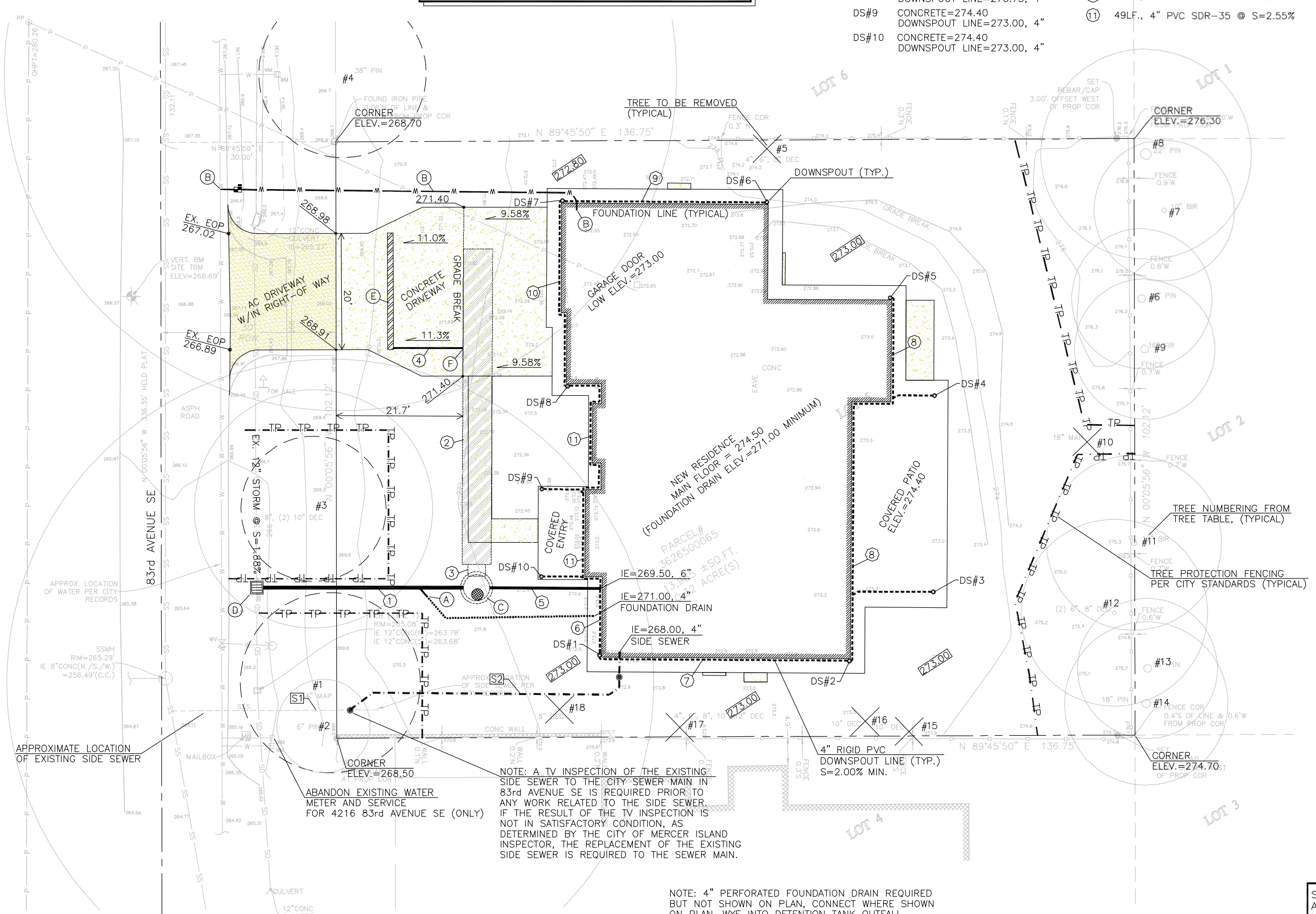
STORM PIPE TABLE

1	35LF., 8" D.I. @ S=1.00%
2	54LF., 60" CMP @ S=0.50%
3	2LF., 36" CMP @ S=0.50%
4	13LF., 4" CMP @ S=2.00%
5	19LF., 6" PVC SDR-35 @ S=3.33%
6	12LF., 4" PVC SDR-35 @ S=2.00%
7	43LF., 4" PVC SDR-35 @ S=2.00%
8	70LF., 4" PVC SDR-35 @ S=2.00%
9	35LF., 4" PVC SDR-35 @ S=2.00%
10	33LF., 4" PVC SDR-35 @ S=2.00%
11	49LF., 4" PVC SDR-35 @ S=2.55%

LEGEND

AIR CONDITION UNIT; AREA DRAIN; ASPHALT SURFACE; BUILDING; CENTERLINE ROW; CONCRETE SURFACE; RETAINING WALL; ELECTRICAL EASEMENT; DECK; FENCE LINE (WOOD); GAS LINE; GAS METER; HOSE BIB RISER; HEDGE FOLIAGE LINE; INLET (TYPE 1); INLET (TYPE 1) (SOLID); MONUMENT IN CASE (FOUND); PAVER SURFACE; POST; POWER METER; POWER (OVERHEAD); POWER POLE W/ LIGHT; REBAR AS NOTED (FOUND); REBAR & CAP (SET); ROCKERY; SEWER LINE; SEWER MANHOLE; STORM DRAIN LINE; TREE (AS NOTED); WATER LINE; WATER METER

NOTE: CONNECT 4" FOUNDATION DRAIN AT LOCATION SHOWN ON PLANS – ONLY!



TREE TABLE

ID	Species	DBH	Dripline	STATUS	Limt of Devlopment LOD	RETAIN	REMOVE
1	Sweetgum	34	54	Off-site	14		
2	Doutlas-fir	4	8	Off-site	6		
3	Flowering Dogwood	16	20	Off-site	12		
4	Deodara cedar	38	56	Off-site	14		
5	English laurel	11	24	significant	14		x
6	Douglas-fir	22	40	Off-site	14		
7	Silver birch	10	24	Off-site	14		
8	Deodara cedar	16	24	Off-site	14		
9	Douglas-fir	16	26	Off-site	14		
10	Sweetgum	18	42	significant	14		x
11	Silver birch	12	32	significant	14		
12	Rhododendron	N/A	N/A	N/A	N/A		
13	Douglas-fir	16	38	Off-site	14		
14	Douglas-fir	18	34	Off-site	14		
15	Rhododendron	N/A	N/A	N/A	N/A		x
16	Rhododendron	N'18	N/A	N/A	N/A		x
17	Flowering cherry	18	38	Significant	14		x
18	Flowering cherry	8	22	significant	14		x

NOTES:

(A) 4" FOUNDATION DRAIN CONNECTION
IE=264.43, 8"x4" WYE

(B) INSTALL 1-1/2" METER AND 2" SERVICE LINE PER CITY OF MERCER ISLAND STANDARD PLAN W-14.
NOTE: CONTRACTOR TO COORDINATE FINAL LOCATION OF NEW METER WITH CITY OF MERCER ISLAND INSPECTOR AT TIME OF CONSTRUCTION

(C) CB#2, CONTROL STRUCTURE, TYPE II-54"ø ((SEE DETAIL ON SHEET 3 OF 4))
W/SOLID LOCKING LID
RIM=272.40
OVERFLOW=269.78, 8"(TOP OF TEE)
IE=269.00, 6"(E)-DOWNSPOUT LINE
IE=264.50, 36"(N), 8"(W)
ELEV.=262.50, 8"(BOTTOM OF TEE)
INSIDE BOTTOM=260.50

(D) CB#1, TYPE 1
W/GRATE INLET
GRATE=265.60
IE=264.15, 8"(E)
IE=264.11, 12"(N,S)-EXISTING

(E) 20' SLOT DRAIN
GRATE ELEV.=270.00
IE=269.20, 4"(E)

(F) 4" WATER TIGHT CONNECTION
IE=268.90, 4"

SIDE SEWER NOTES

(S1) APPROXIMATE LOCATION OF EXISTING SANITARY SIDE SEWER.

(S2) INSTALL 54LF., 4" PVC SIDE SEWER @ MIN. 2% SLOPE W/SANITARY SEWER CLEANOUTS

NOTE: 4" PERFORATED FOUNDATION DRAIN REQUIRED BUT NOT SHOWN ON PLAN, CONNECT WHERE SHOWN ON PLAN, WYE INTO DETENTION TANK OUTFALL

NOTE: THE LAWN AND LANDSCAPE AREAS ARE REQUIRED TO PROVIDE POST-CONSTRUCTION SOIL QUALITY AND DEPTH IN ACCORDANCE WITH BMP T5.13. THE PROJECT CIVIL ENGINEER MUST PROVIDE A LETTER OF CERTIFICATION TO ENSURE THAT THE LAWN AND LANDSCAPE AREAS ARE MEETING THE POST-CONSTRUCTION SOIL QUALITY AND DEPTH REQUIREMENTS SPECIFIED ON THE APPROVED PLAN SET PRIOR TO FINAL INSPECTION OF THE PROJECT.

STORM PIPE PVC SHALL BE SDR-35 PVC AT SLOPE=2.00% MINIMUM (TYPICAL) UNLESS OTHERWISE NOTED

IMPERVIOUS SURFACES:
ROOF AREA (UNDER EAVES) = 4,734 SQ. FT.
UNCOVERED DRIVEWAY AREA = 961 SQ. FT.
UNCOVERED WALKWAY = 146 SQ. FT.
UNCOVERED CONCRETE PADS/PATIO = 79 SQ. FT.
TOTAL IMPERVIOUS AREAS = 5,920 SQ. FEET

GRAPHIC SCALE
0 5 10 20
1 inch = 10 feet

PERMIT #: 23XX-XXX

OFFE ENGINEERS

DESCRIPTION	
DATE	
REV. NO.	
DESIGNED BY	DLO
DRAWN BY	SLS
CHECKED BY	DLO
PROJECT	4216 83rd Avenue SE
CLIENT	JayMarc Diamond, LLC
SHEET CONTENT	Stormwater Site Plan
DATE	02/25/2024
JOB NO.	
DWG NO.	
SHEET	2 OF 4

Section I-3.4.2 MR2: Construction Storm Water Pollution Prevention Plan (SWPP)

A Construction Stormwater Pollution Prevention Plan (SWPP) has been prepared and included within this Report. The CSWPP plan shall include construction installation of erosion control, establish a construction access, preservation of existing vegetation during construction, and protection of existing drainage inlets. This will include but not limited to: the use of the existing asphalt driveway (on the north side) to provide construction access from 83rd Avenue SE; installing filter fabric silt fencing along the down gradient property lines (west and south); installation of filter socks within the public catch basins located within 83rd Avenue SE; retention of native vegetated areas including tree/vegetation retention within the rear (east) and front (west) yards; and the use straw or chipped materials placed over exposed disturbed soils to prevent runoff from carrying solids.

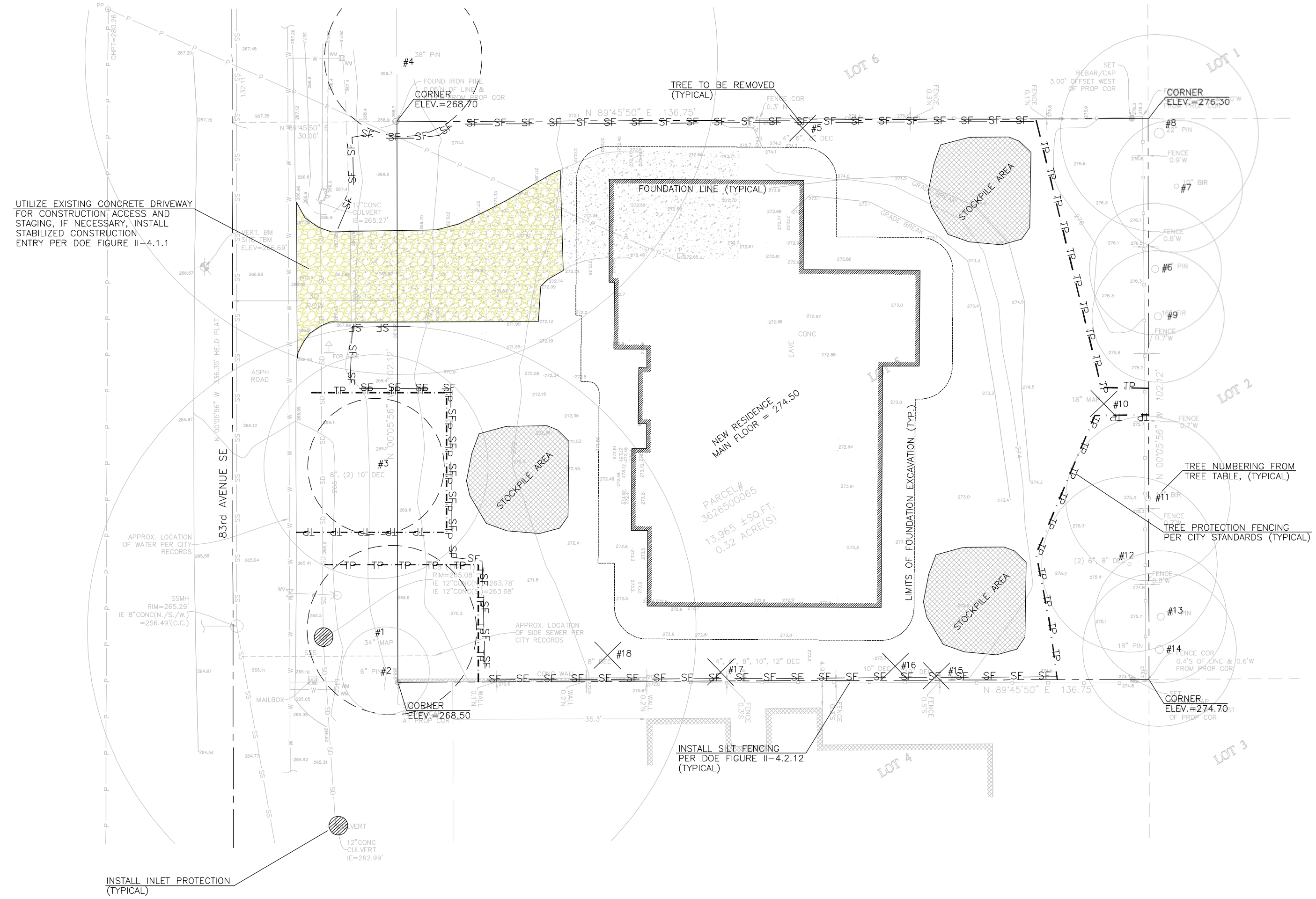
SE 1/4 OF THE NE 1/4 OF SECTION 13, TOWNSHIP 24 NORTH., RANGE 4 EAST, W.M., KING COUNTY, WA.

EXISTING UTILITY LOCATIONS SHOWN HEREON ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT VERTICAL AND HORIZONTAL LOCATION OF ALL EXISTING UNDERGROUND UTILIITES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN HEREON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR UTILITIES NOT SHOWN IN THEIR PROPER LOCATION.

CALL BEFORE YOU DIG: 811

LEGEND

- AIR CONDITION UNIT
- AREA DRAIN
- ASPHALT SURFACE
- BUILDING
- CENTERLINE ROW
- CONCRETE SURFACE
- RETAINING WALL
- ELECTRICAL EASEMENT
- DECK
- FENCE LINE (WOOD)
- GAS LINE
- GAS METER
- HOSE BIB RISER
- HEDGE FOLIAGE LINE
- INLET (TYPE 1)
- INLET (TYPE 1) (SOLID)
- MONUMENT IN CASE (FOUND)
- PAVER SURFACE
- POST
- POWER METER
- POWER (OVERHEAD)
- POWER POLE W/ LIGHT
- REBAR AS NOTED (FOUND)
- REBAR & CAP (SET)
- ROCKERY
- SEWER LINE
- SEWER MANHOLE
- STORM DRAIN LINE
- TREE (AS NOTED)
- WATER LINE
- WATER METER



TREE TABLE

ID	Species	DBH	Dripline	STATUS	Limt of Devlopment LOD	RETAIN	REMOVE
1	Sweetgum	34	54	Off-site	14		
2	Doutlas-fir	4	8	Off-site	6		
3	Flowering Dogwood	16	20	Off-site	12		
4	Deodara cedar	38	56	Off-site	14		
5	English laurel	11	24	significant	14		x
6	Douglas-fir	22	40	Off-site	14		
7	Silver birch	10	24	Off-site	14		
8	Deodara cedar	16	24	Off-site	14		
9	Douglas-fir	16	26	Off-site	14		
10	Sweetgum	18	42	significant	14		x
11	Silver birch	12	32	significant	14		
12	Rhododendron	N/A	N/A	N/A	N/A		
13	Douglas-fir	16	38	Off-site	14		
14	Douglas-fir	18	34	Off-site	14		
15	Rhododendron	N/A	N/A	N/A	N/A		x
16	Rhododendron	N'18	N/A	N/A	N/A		x
17	Flowering cherry	18	38	Significant	14		x
18	Flowering cherry	8	22	significant	14		x

GRAPHIC SCALE

0 5 10 20

1 inch = 10 feet

PERMIT #: 23XX-XXX

DESCRIPTION | DATE | REV. NO.

02/25/2024

OFFE ENGINEERS

DESIGNED BY: DLO

DRAWN BY: SL$

CHECKED BY: DLO

PROJECT: 4216 83rd Avenue SE

CLIENT: JayMarc Diamond, LLC

SHEET CONTENT: Temp. Erosion & Sedmientation Control Plan

DATE: 02/25/2024

JOB NO.

DWG NO.

SHEET 1 OF 4

Section I-3.4.3 MR3: Source Control of Pollution

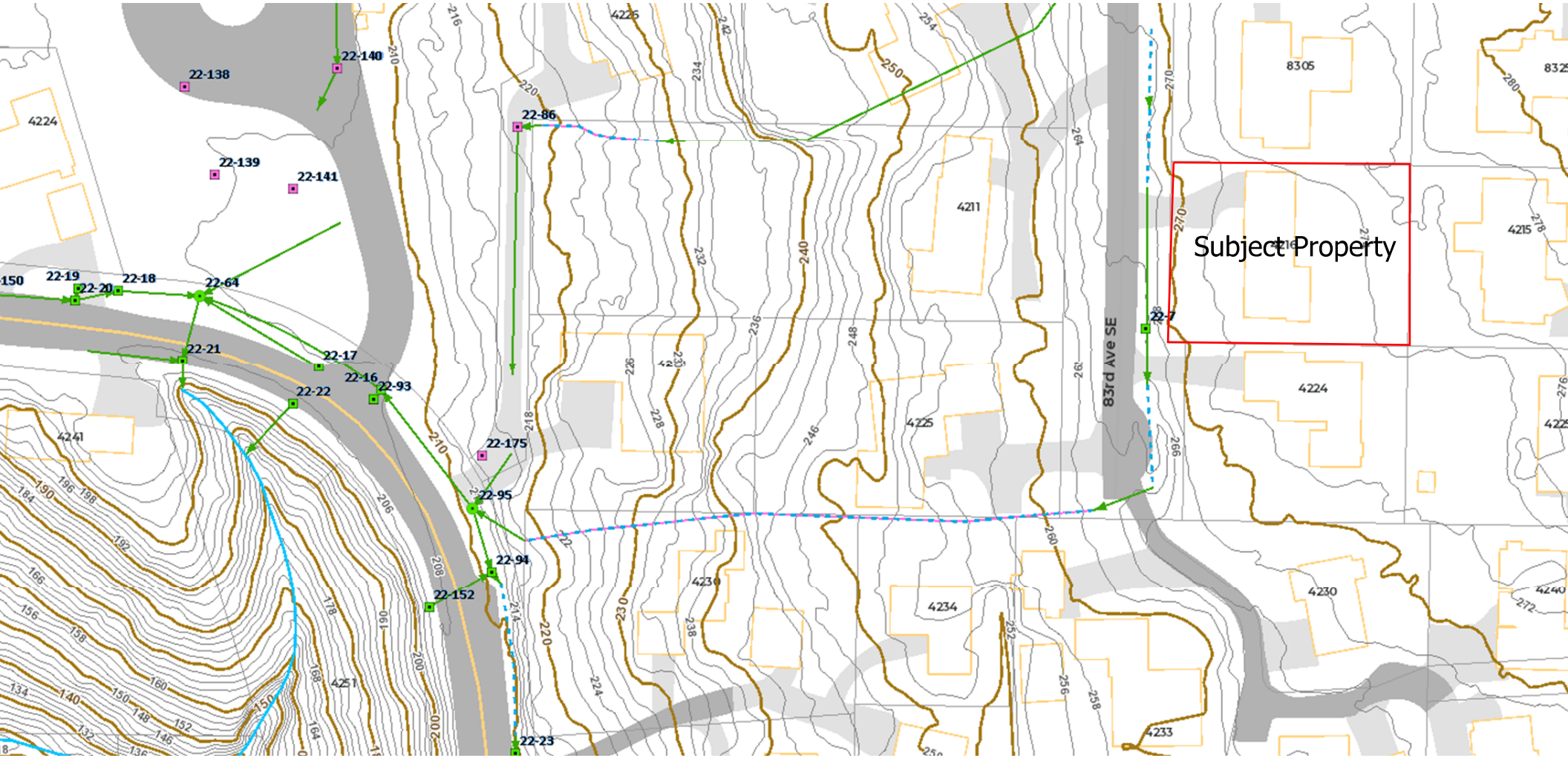
Source control BMP's will be utilized to contain pollution generating runoff. No concrete washout will be allowed on the property during construction. No fuel materials will be placed or stored on site during construction.

Section I-3.4.4 MR4: Preservation of Natural Drainage Systems and Outfalls

The subject property slopes from a high point at the northeast corner (at elevation 276.30) towards the southwest corner (at elevation 268.50). The existing house roof area discharges onto the ground with splash blocks and then sheet flows over the landscape area and into 83rd Avenue SE. The existing driveway sheet flows towards the shoulder of 83rd Avenue SE. Both these areas combine into public catch basin (CB#22-7) within 83rd Avenue SE at the southwest corner of subject property. The natural discharge and outfall from the subject property is sheet flow and collection by a public storm basin in the southwest corner of the property. The proposed discharge will be to convey the onsite drainage from the driveway and roof area within a storm pipe and connect to into CB#22-7. The natural outfall has been preserved by the new development.

The subject property was visited in September and November 2023 to review and evaluate on-site drainage patterns and walk and review the downstream system. The downstream system below CB#22-7 is an open ditch along the east side of 83rd Avenue SE (@ 4224 83rd). The drainage then crosses 83rd Avenue SE (at the southerly end of the road) and flows within an open ditch/landscape swale along the south side of 4225 83rd Avenue SE. The ditch flows west within private property and heavily vegetated area between 83rd Avenue SE and West Mercer Way. The downstream, where accessible, has no indications of flooding, overtopping, scouring.

4216 83rd Avenue SE Downstream map



Section I-3.4.5 MR5: On-Site Stormwater Management

The proposed project drainage shall be evaluated using *"List #2, On-Site Stormwater Management BMPs for projects triggering Minimum Requirements #1 - #9"* – DOE Volume 1, chapter 2, pages 57 - 58. A Geotechnical Evaluation was prepared by Cobalt Geosciences and is attached to this Report in Appendix A.

List #2

Lawn and landscape areas – ***feasible -*** The use of Post-Construction Soil Quality and Depth shall be implemented within areas of the property that are not covered by hard surfaces and were disturbed during condition.

Roofs:

1.a. Full Dispersion BMP T5.30 – ***infeasible*** due to lack of available 100' of vegetated flow path downgradient from the roof area.

1.b. Full Infiltration BMP T5.10A – ***infeasible*** due to lack of permeable soils.

2. Rain Garden/Bioretention BMP T7.30 – ***infeasible*** due to lack of available area on the downgradient portion of the property (west side) and preserved tree area on the west side. Can not remove trees in this area nor work under.

3. Downspout Dispersion System BMP T5.10B – ***infeasible*** due to lack of available 50' flow path downgradient of the downspout leaders.

4. *Perforated Pipe Connection BMP T5.10C* - ***infeasible*** due to lack of permeable soils.

Other Hard Surfaces:

1. Full Dispersion BMP T5.30 – ***infeasible*** due to the lack of available 100' of vegetated flow path length.

2. Permeable Pavement BMP T5.15 – ***infeasible*** infiltration type BMP not recommended by City of Mercer Island Infiltration Infeasibility Map.

3. Rain Garden/Bioretention BMP T7.30 – ***infeasible*** due to lack of available area on the downgradient portion of the property (west side) and preserved tree area on the west side. Can not remove trees in this area nor work under.

4.a. Sheet Flow Dispersion BMP T5.12 – ***infeasible*** due to lack of available 25 feet of flow path downgradient from driveway.

4.b. Concentrated Flow Dispersion BMP T5.11 - ***infeasible*** due to lack of available flow path downgradient from hard surfaces.

There are no available BMPs to provide treatment of the roof area or other hard surfaces. Therefore, a connection to the public storm system within 83rd Avenue SE will be provided.

Section I-3.4.6 MR6: Runoff Treatment

Determine if thresholds for runoff treatment have been exceeded:

(a) *Projects that exceed 5,000 square feet of pollution generating hard surfaces (PGHS)* – The proposed project will generate 961 square feet of PGHS – threshold not exceeded

(b) *Projects that create or modify ¾ acre (32,670 square feet) of pollution generating pervious surface (PGPS)* – The proposed project will create or modify 8,045 square feet (0.18 acres) of PGPS – threshold not exceeded.

The thresholds for runoff treatment have not been exceeded, therefore proposed project does not have to provided runoff treatment.

Section I-3.4.7 MR7: Flow Control

Determine if thresholds for flow control have been exceeded:

TDA Thresholds:

(a) *Project effective impervious surfaces exceed 10,000 square feet* – Proposed project will create 5,920 square feet of effective impervious surfaces – threshold not exceeded.

(b) *Project converts ¾ acre (0.75 acres) of vegetation to lawn or landscape area* – Proposed project will convert 0.18 acres to landscape area – threshold not exceeded.

(c) *Project will cause a 0.15 cfs increase in the 100-year event between the existing condition and the proposed condition* – Project modeling will be required to determine if there is an increase in the 100-year event that exceeds threshold.

Modeling: Using WWHM model

Existing condition input: Existing residence was built in 1954

Roof area (flat) – 0.0615 acres
Driveway (moderate) – 0.0211 acres
Walkways/patio (flat) – 0.0101 acres
Lawn (moderate) – 0.2273 acres

Mitigated condition (proposed) input: (Proposed (2024) Conditions from Section 2)

Roof area (moderate) – 0.1087 acres
Driveway (moderate) – 0.0221 acres
Walkways/pads (flat) – 0.0052 acres
Lawn (moderate) – 0.1840 acres

WWMH Modeling can be found within Appendix B.

Modeling results: (page 7 of WWHM Modeling)

100-year mitigated = 0.1739 cfs
100-year existing = 0.1609 cfs

Difference = 0.013 cfs << 0.15 cfs Therefore threshold has not been exceeded

No flow control thresholds will be exceeded; therefore, DOE flow control is not required. However, City of Mercer Island (MI) does require flow control. Calculations for MI flow control is attached.

Detention Tank sizing per Mercer Island Requirements

Sizing of required for on-site detention system

(A) The Geotechnical Evaluation by Cobalt Geosciences has determined the underlying soils type to be Class B

(B) The proposed total impervious surface is 5,814 square feet

Using "*City of Mercer Island On-Site Detention Design Requirements, Table 1*", the required detention tank will be 54 linear feet of 60" (5') CMP pipe.

Table 1

ON-SITE DETENTION DESIGN FOR PROJECTS BETWEEN 500 SF AND 9,500 SF NEW PLUS REPLACED IMPERVIOUS SURFACE AREA

New and Replaced Impervious Surface Area (sf)	Detention Pipe Diameter (in)	Detention Pipe Length (ft)		Lowest Orifice Diameter (in)[3]		Distance from Outlet Invert to Second Orifice (ft)		Second Orifice Diameter (in)	
		B soils	C soils	B soils	C soils	B soils	C soils	B soils	C soils
500 to 1,000 sf	36"	30	22	0.5	0.5	2.2	2.0	0.5	0.8
	48"	18	11	0.5	0.5	3.3	3.2	0.9	0.8
	60"	11	7	0.5	0.5	4.2	3.4	0.5	0.6
1,001 to 2,000 sf	36"	66	43	0.5	0.5	2.2	2.3	0.9	1.4
	48"	34	23	0.5	0.5	3.2	3.3	0.9	1.2
	60"	22	14	0.5	0.5	4.3	3.6	0.9	0.9
2,001 to 3,000 sf	36"	90	66	0.5	0.5	2.2	2.4	0.9	1.9
	48"	48	36	0.5	0.5	3.1	2.8	0.9	1.5
	60"	30	20	0.5	0.5	4.2	3.7	0.9	1.1
3,001 to 4,000 sf	36"	120	78	0.5	0.5	2.4	2.2	1.4	1.6
	48"	62	42	0.5	0.5	2.8	2.9	0.8	1.3
	60"	42	26	0.5	0.5	3.8	3.9	0.9	1.3
4,001 to 5,000 sf	36"	134	91	0.5	0.5	2.8	2.2	1.7	1.5
	48"	73	49	0.5	0.5	3.6	2.9	1.6	1.5
	60"	46	31	0.5	0.5	4.6	3.5	1.6	1.3
5,001 to 6,000 sf	36"	162	109	0.5	0.5	2.7	2.2	1.8	1.6
	48"	90	59	0.5	0.5	3.5	2.9	1.7	1.5
	60"	54	37	0.5	0.5	4.6	3.6	1.6	1.4
6,001 to 7,000 sf	36"	192	128	0.5	0.5	2.7	2.2	1.9	1.8
	48"	102	68	0.5	0.5	3.7	2.9	1.9	1.6
	60"	64	43	0.5	0.5	4.6	3.6	1.8	1.5
7,001 to 8,000 sf	36"	216	146	0.5	0.5	2.8	2.2	2.0	1.9
	48"	119	79	0.5	0.5	3.8	2.9	2.2	1.7
	60"	73	49	0.5	0.5	4.5	3.6	2.0	1.6
8,001 to 8,500 sf[1]	36"	228	155	0.5	0.5	2.8	2.2	2.1	1.9
	48"	124	84	0.5	0.5	3.7	2.9	1.9	1.8
	60"	77	53	0.5	0.5	4.6	3.6	2.0	1.6
8,501 to 9,000 sf	36"	NA [1]	164	0.5	0.5	NA [1]	2.2	NA [1]	1.9
	48"	NA [1]	89	0.5	0.5	NA [1]	2.9	NA [1]	1.9
	60"	NA [1]	55	0.5	0.5	NA [1]	3.6	NA [1]	1.7
9,001 to 9,500 sf[2]	36"	NA [1]	174	0.5	0.5	NA [1]	2.2	NA [1]	2.1
	48"	NA [1]	94	0.5	0.5	NA [1]	2.9	NA [1]	2.0
	60"	NA [1]	58	0.5	0.5	NA [1]	3.7	NA [1]	1.7

Notes:

▪ Minimum Requirement #7 (Flow Control) is required when the 100-year flow frequency causes a 0.15 cubic feet per second increase (when modeled in WWHM with a 15-minute timestep). Breakpoints shown in this table are based on a flat slope (0-5%). The 100-year flow frequency will need to be evaluated on a site-specific basis for projects on moderate (5-15%) or steep (> 15%) slopes.

▪ Soil type to be determined by geotechnical analysis or soil map.

▪ Sizing includes a Volume Correction Factor of 120%.

▪ Upper bound contributing area used for sizing.

[1] On Type B soils, new plus replaced impervious surface areas exceeding 8,500 sf trigger Minimum Requirement #7 (Flow Control)

[2] On Type C soils, new plus replaced impervious surface areas exceeding 9,500 sf trigger Minimum Requirement #7 (Flow Control)

[3] Minimum orifice diameter = 0.5 inches

in = inch

ft = feet

sf = square feet

Basis of Sizing Assumptions:

Sized per MR#5 in the Stormwater Management Manual for Puget Sound Basin (1992 Ecology Manual)

SBUH, Type 1A, 24-hour hydrograph

2-year, 24-hour storm = 2 in; 10-year, 24-hour storm = 3 in; 100-year, 24-hour storm = 4 in

Predeveloped = second growth forest (CN = 72 for Type B soils, CN = 81 for Type C soils)

Developed = impervious (CN = 98)

0.5 foot of sediment storage in detention pipe

Overland slope = 5%

Section I-3.4.8 MR8: Wetlands Protection

Proposed project does not discharge into a wetland; therefore, Minimum Requirement #8 does not apply.

Section I-3.4.9 MR9: Operation and Maintenance
Attached

Table V-4.5.2(3) Maintenance Standards - Closed Detention Systems (Tanks/Vaults)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Storage Area	Plugged Air Vents	One-half of the cross section of a vent is blocked at any point or the vent is damaged.	Vents open and functioning.
	Debris and Sediment	Accumulated sediment depth exceeds 10% of the diameter of the storage area for 1/2 length of storage vault or any point depth exceeds 15% of diameter. (Example: 72-inch storage tank would require cleaning when sediment reaches depth of 7 inches for more than 1/2 length of tank.)	All sediment and debris removed from storage area.
	Joints Between Tank/Pipe Section	Any openings or voids allowing material to be transported into facility. (Will require engineering analysis to determine structural stability).	All joint between tank/pipe sections are sealed.
	Tank Pipe Bent Out of Shape	Any part of tank/pipe is bent out of shape more than 10% of its design shape. (Review required by engineer to determine structural stability).	Tank/pipe repaired or replaced to design.
	Vault Structure Includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch and any evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determines that the vault is not structurally sound. Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or any evidence of soil particles entering the vault through the walls.	Vault replaced or repaired to design specifications and is structurally sound. No cracks more than 1/4-inch wide at the joint of the inlet/outlet pipe.
Manhole	Cover Not in Place	Cover is missing or only partially in place. Any open manhole requires maintenance.	Manhole is closed.

Table V-4.5.2(3) Maintenance Standards - Closed Detention Systems (Tanks/Vaults) (continued)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread (may not apply to self-locking lids).	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. Intent is to keep cover from sealing off access to maintenance.	Cover can be removed and reinstalled by one maintenance person.
	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, misalignment, not securely attached to structure wall, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Catch Basins	See "Catch Basins" (No. 5)	See "Catch Basins" (No. 5).	See "Catch Basins" (No. 5).

Table V-4.5.2(4) Maintenance Standards - Control Structure/Flow Restrictor

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris (Includes Sediment)	Material exceeds 25% of sump depth or 1 foot below orifice plate.	Control structure orifice is not blocked. All trash and debris removed.
	Structural Damage	Structure is not securely attached to manhole wall. Structure is not in upright position (allow up to 10% from plumb). Connections to outlet pipe	Structure securely attached to wall and outlet pipe. Structure in correct position. Connections to outlet pipe are water tight; structure repaired or replaced and works as

Table V-4.5.2(4) Maintenance Standards - Control Structure/Flow Restrictor (continued)

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
		are not watertight and show signs of rust. Any holes - other than designed holes - in the structure.	designed. Structure has no holes other than designed holes.
Cleanout Gate	Damaged or Missing	Cleanout gate is not watertight or is missing. Gate cannot be moved up and down by one maintenance person. Chain/rod leading to gate is missing or damaged. Gate is rusted over 50% of its surface area.	Gate is watertight and works as designed. Gate moves up and down easily and is watertight. Chain is in place and works as designed. Gate is repaired or replaced to meet design standards.
Orifice Plate	Damaged or Missing	Control device is not working properly due to missing, out of place, or bent orifice plate.	Plate is in place and works as designed.
	Obstructions	Any trash, debris, sediment, or vegetation blocking the plate.	Plate is free of all obstructions and works as designed.
Overflow Pipe	Obstructions	Any trash or debris blocking (or having the potential of blocking) the overflow pipe.	Pipe is free of all obstructions and works as designed.
Manhole	See "Closed Detention Systems" (No. 3).	See "Closed Detention Systems" (No. 3).	See "Closed Detention Systems" (No. 3).
Catch Basin	See "Catch Basins" (No. 5).	See "Catch Basins" (No. 5).	See "Catch Basins" (No. 5).

Table V-4.5.2(5) Maintenance Standards - Catch Basins

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
General	Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%. Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe. Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height. Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No Trash or debris located immediately in front of catch basin or on grate opening. No trash or debris in the catch basin. Inlet and outlet pipes free of trash or debris. No dead animals or vegetation present within the catch basin.
	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch. (Intent is to make sure no material is running into basin).	Top slab is free of holes and cracks. Frame is sit-

Table V-4.5.2(5) Maintenance Standards - Catch Basins (continued)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
		Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached	ting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound. Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Basin replaced or repaired to design standards. Pipe is regrouted and secure at basin wall.
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening. Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation blocking opening to basin. No vegetation or root growth present.
	Contamination and Pollution	See "Detention Ponds" (No. 1).	No pollution present.
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Catch basin cover is closed
	Locking Mechanism Not	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into	Mechanism opens with

Table V-4.5.2(5) Maintenance Standards - Catch Basins (continued)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
	Working	frame have less than 1/2 inch of thread.	proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
Metal Grates (If Applicable)	Grate opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
	Damaged or Missing.	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.

Table V-4.5.2(6) Maintenance Standards - Debris Barriers (e.g., Trash Racks)

Maintenance Components	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris	Trash or debris that is plugging more than 20% of the openings in the barrier.	Barrier cleared to design flow capacity.
Metal	Damaged/ Missing	Bars are bent out of shape more than 3 inches.	Bars in place with no bends more than 3/4

Appendix A: Geotechnical Evaluation

Cobalt Geosciences, LLC
P.O. Box 1792
North Bend, WA 98045

November 13, 2023

JayMarc Homes
C/O Darrell Offe
Darrell.offe@comcast.net

RE: Geotechnical Evaluation
Proposed Residence
4104 83rd Avenue SE
Mercer Island, Washington

In accordance with your authorization, Cobalt Geosciences, LLC has prepared this letter to discuss the results of our geotechnical evaluation at the referenced site.

The purpose of our evaluation was to provide recommendations for foundation design, grading, and earthwork.

Site Description

The site is located at 4104 83rd Avenue SE in Mercer Island, Washington. The site consists of one nearly rectangular parcel (No. 3626500040) with a total area of 14,085 square feet.

The central portion of the property is developed with a residence and driveway. The site slopes downward from northeast and east to west and southwest at magnitudes of about 5 to 15 percent and relief of about 10 feet. There is a short cut slope about 4 feet tall and at magnitudes of over 50 percent near the west property line and right of way. There is an apparent wall near the north property line that is about 6 feet tall and 15 feet long (obscured by vegetation).

The site is vegetated with grasses, bushes, and variable diameter trees. The site is bordered to the north, south, and east by residences, and to the west by 83rd Avenue SE.

The proposed development includes a new residence and driveway in the central portion of the property.

Stormwater will include infiltration or other systems depending on feasibility. Site grading may include cuts and fills of 3 feet or less and foundation loads are expected to be light. We should be provided with the final plans to verify that our recommendations remain valid and do not require updating.

Area Geology

The Geologic map of the Mercer Island, indicates that the site is underlain by Vashon Glacial Till.

Vashon Glacial Till includes dense mixtures of silt, sand, gravel, and clay. These deposits are typically impermeable below a weathered zone.

Soil & Groundwater Conditions

As part of our evaluation, we excavated two hand borings where accessible. The explorations encountered approximately 6 inches of grass and topsoil underlain by approximately 3.25 to 4.25 feet of loose to medium dense, silty-fine to medium grained sand with gravel (Weathered Glacial

Till). These materials were underlain by dense, silty-fine to medium grained gravel (Glacial Till), which continued to the termination depths of the explorations.

Groundwater was not encountered during the exploration work. Perched groundwater may develop within 5 feet of the existing site elevations during the wet season based on the presence of soil mottling. Volumes would generally be light.

Water table elevations often fluctuate over time. The groundwater level will depend on a variety of factors that may include seasonal precipitation, irrigation, land use, climatic conditions and soil permeability. Water levels at the time of the field investigation may be different from those encountered during the construction phase of the project. It would be necessary to install a piezometer to determine groundwater depths over a typical year.

Seismic Parameters

The overall subsurface profile corresponds to a Site Class *D* as defined by Table 1613.5.2 of the International Building Code (IBC). A Site Class *D* applies to an overall profile consisting of medium dense to very dense soils within the upper 100 feet.

We referenced the U.S. Geological Survey (USGS) Earthquake Hazards Program Website to obtain values for S_S, S_1, F_a, and F_v. The USGS website includes the most updated published data on seismic conditions. The following tables provide seismic parameters from the USGS web site with referenced parameters from ASCE 7-16.

Seismic Design Parameters (ASCE 7-16)

Site Class	Spectral Acceleration at 0.2 sec. (g)	Spectral Acceleration at 1.0 sec. (g)	Site Coefficients		Design Spectral Response Parameters		Design PGA
			F_a	F_v	S_{DS}	S_{D1}	
D	1.418	0.493	1.0	Null	0.945	Null	0.607

Additional seismic considerations include liquefaction potential and amplification of ground motions by soft/loose soil deposits. The liquefaction potential is highest for loose sand with a high groundwater table. The site has a relatively low likelihood of liquefaction. For items listed as "Null" see Section 11.4.8 of the ASCE.

Conclusions and Recommendations

General

The site is underlain by soils consistent with Vashon Glacial Till. These soils become relatively dense below a weathered zone. The proposed residential structure may be supported on a shallow foundation system bearing on medium dense or firmer native soils or on structural fill placed on the native soils.

Local overexcavation or recompaction of loose weathered native soils may be necessary depending on the proposed elevations and locations of the new footings.

Widespread infiltration is not feasible due to the soil conditions and anticipated seasonal groundwater conditions. We recommend utilizing direct or perforated connection to an approved conveyance.

Site Preparation

Trees, shrubs and other vegetation should be removed prior to stripping of surficial organic-rich soil and fill. Based on observations from the site investigation program, it is anticipated that the stripping depth will be 6 to 18 inches. Deeper excavations will be necessary below larger trees and foundation systems.

The native soils consist of silty-sand with gravel. Most of the native soils may be used as structural fill provided they achieve compaction requirements and are within 3 percent of the optimum moisture. Some of these soils may only be suitable for use as fill during the summer months, as they will be above the optimum moisture levels in their current state. These soils are variably moisture sensitive and may degrade during periods of wet weather and under equipment traffic.

Imported structural fill should consist of a sand and gravel mixture with a maximum grain size of 3 inches and less than 5 percent fines (material passing the U.S. Standard No. 200 Sieve). Structural fill should be placed in maximum lift thicknesses of 12 inches and should be compacted to a minimum of 95 percent of the modified proctor maximum dry density, as determined by the ASTM D 1557 test method.

Temporary Excavations

Based on our understanding of the project, we anticipate that the grading could include local cuts on the order of approximately 3 feet or less for foundation and most of the utility placement. Temporary excavations should be sloped no steeper than 1.5H:1V (Horizontal:Vertical) in loose native soils and fill, 1H:1V in medium dense native soils and 3/4H:1V in dense to very dense native soils (if encountered). If an excavation is subject to heavy vibration or surcharge loads, we recommend that the excavations be sloped no steeper than 2H:1V, where room permits.

Temporary cuts should be in accordance with the Washington Administrative Code (WAC) Part N, Excavation, Trenching, and Shoring. Temporary slopes should be visually inspected daily by a qualified person during construction activities and the inspections should be documented in daily reports. The contractor is responsible for maintaining the stability of the temporary cut slopes and reducing slope erosion during construction.

Temporary cut slopes should be covered with visqueen to help reduce erosion during wet weather, and the slopes should be closely monitored until the permanent retaining systems or slope configurations are complete. Materials should not be stored or equipment operated within 10 feet of the top of any temporary cut slope.

Soil conditions may not be completely known from the geotechnical investigation. In the case of temporary cuts, the existing soil conditions may not be completely revealed until the excavation work exposes the soil. Typically, as excavation work progresses the maximum inclination of temporary slopes will need to be re-evaluated by the geotechnical engineer so that supplemental recommendations can be made. Soil and groundwater conditions can be highly variable. Scheduling for soil work will need to be adjustable, to deal with unanticipated conditions, so that the project can proceed and required deadlines can be met.

If any variations or undesirable conditions are encountered during construction, we should be notified so that supplemental recommendations can be made. If room constraints or groundwater conditions do not permit temporary slopes to be cut to the maximum angles allowed by the WAC, temporary shoring systems may be required. The contractor should be responsible for developing temporary shoring systems, if needed. We recommend that Cobalt Geosciences and the project structural engineer review temporary shoring designs prior to installation, to verify the suitability of the proposed systems.

Foundation Design

The proposed structure may be supported on a shallow spread footing foundation system bearing on undisturbed medium dense or firmer native soils or on properly compacted structural fill placed on the suitable native soils. Any undocumented fill and/or loose native soils should be removed and replaced with structural fill below foundation elements. Structural fill below footings should consist of clean angular rock 5/8 to 4 inches in size. We should verify soil conditions during foundation excavation work.

For shallow foundation support, we recommend widths of at least 16 and 24 inches, respectively, for continuous wall and isolated column footings supporting the proposed structure. Provided that the footings are supported as recommended above, a net allowable bearing pressure of 2,500 pounds per square foot (psf) may be used for design.

A 1/3 increase in the above value may be used for short duration loads, such as those imposed by wind and seismic events. Structural fill placed on bearing, native subgrade should be compacted to at least 95 percent of the maximum dry density based on ASTM Test Method D1557. Footing excavations should be inspected to verify that the foundations will bear on suitable material.

Exterior footings should have a minimum depth of 18 inches below pad subgrade (soil grade) or adjacent exterior grade, whichever is lower. Interior footings should have a minimum depth of 12 inches below pad subgrade (soil grade) or adjacent exterior grade, whichever is lower.

If constructed as recommended, the total foundation settlement is not expected to exceed 1 inch. Differential settlement, along a 25-foot exterior wall footing, or between adjoining column footings, should be less than ½ inch. This translates to an angular distortion of 0.002. Most settlement is expected to occur during construction, as the loads are applied. However, additional post-construction settlement may occur if the foundation soils are flooded or saturated. All footing excavations should be observed by a qualified geotechnical consultant.

Resistance to lateral footing displacement can be determined using an allowable friction factor of 0.40 acting between the base of foundations and the supporting subgrades. Lateral resistance for footings can also be developed using an allowable equivalent fluid passive pressure of 250 pounds per cubic foot (pcf) acting against the appropriate vertical footing faces (neglect the upper 12 inches below grade in exterior areas). The frictional and passive resistance of the soil may be combined without reduction in determining the total lateral resistance.

Care should be taken to prevent wetting or drying of the bearing materials during construction. Any extremely wet or dry materials, or any loose or disturbed materials at the bottom of the footing excavations, should be removed prior to placing concrete. The potential for wetting or drying of the bearing materials can be reduced by pouring concrete as soon as possible after completing the footing excavation and evaluating the bearing surface by the geotechnical engineer or his representative.

Stormwater Management Feasibility

The site is underlain by weathered and unweathered glacial soil deposits. We evaluated the infiltration characteristics in HB-2 at a depth of 4 feet below grade.

We attempted to perform an in-situ infiltration test; however, during the saturation period, the inflow of testing water was reduced to the lowest possible rate and the water level in the exploration consistently increased. This indicates that vertical infiltration was reduced to near zero, confirming infiltration infeasibility due to the presence of an aquitard.

We recommend direct or perforated connection of runoff collection devices to City infrastructure. We can provide additional input if other systems are being considered or proposed.

Slab-on-Grade

We recommend that the upper 18 inches of the existing native soils within slab areas be re-compacted to at least 95 percent of the modified proctor (ASTM D1557 Test Method).

Often, a vapor barrier is considered below concrete slab areas. However, the usage of a vapor barrier could result in curling of the concrete slab at joints. Floor covers sensitive to moisture typically requires the usage of a vapor barrier. A materials or structural engineer should be consulted regarding the detailing of the vapor barrier below concrete slabs. Exterior slabs typically do not utilize vapor barriers.

The American Concrete Institutes ACI 360R-06 Design of Slabs on Grade and ACI 302.1R-04 Guide for Concrete Floor and Slab Construction are recommended references for vapor barrier selection and floor slab detailing.

Slabs on grade may be designed using a coefficient of subgrade reaction of 180 pounds per cubic inch (pci) assuming the slab-on-grade base course is underlain by structural fill placed and compacted as outlined above. A 4- to 6-inch-thick capillary break layer should be placed over the prepared subgrade. This material should consist of pea gravel or 5/8 inch clean angular rock.

A perimeter drainage system is recommended unless interior slab areas are elevated a minimum of 12 inches above adjacent exterior grades. If installed, a perimeter drainage system should consist of a 4-inch diameter perforated drain pipe surrounded by a minimum 6 inches of drain rock wrapped in a non-woven geosynthetic filter fabric to reduce migration of soil particles into the drainage system. The perimeter drainage system should discharge by gravity flow to a suitable stormwater system.

Exterior grades surrounding buildings should be sloped at a minimum of one percent to facilitate surface water flow away from the building and preferably with a relatively impermeable surface cover immediately adjacent to the building.

Erosion and Sediment Control

Erosion and sediment control (ESC) is used to reduce the transportation of eroded sediment to wetlands, streams, lakes, drainage systems, and adjacent properties. Erosion and sediment control measures should be implemented, and these measures should be in general accordance with local regulations. At a minimum, the following basic recommendations should be incorporated into the design of the erosion and sediment control features for the site:

- Schedule the soil, foundation, utility, and other work requiring excavation or the disturbance of the site soils, to take place during the dry season (generally May through September).

However, provided precautions are taken using Best Management Practices (BMP's), grading activities can be completed during the wet season (generally October through April).

- All site work should be completed and stabilized as quickly as possible.
- Additional perimeter erosion and sediment control features may be required to reduce the possibility of sediment entering the surface water. This may include additional silt fences, silt fences with a higher Apparent Opening Size (AOS), construction of a berm, or other filtration systems.
- Any runoff generated by dewatering discharge should be treated through construction of a sediment trap if there is sufficient space. If space is limited other filtration methods will need to be incorporated.

Utilities

Utility trenches should be excavated according to accepted engineering practices following OSHA (Occupational Safety and Health Administration) standards, by a contractor experienced in such work. The contractor is responsible for the safety of open trenches. Traffic and vibration adjacent to trench walls should be reduced; cyclic wetting and drying of excavation side slopes should be avoided. Depending upon the location and depth of some utility trenches, groundwater flow into open excavations could be experienced, especially during or shortly following periods of precipitation.

In general, silty and sandy soils were encountered at shallow depths in the explorations at this site. These soils have low cohesion and density and will have a tendency to cave or slough in excavations. Shoring or sloping back trench sidewalls is required within these soils in excavations greater than 4 feet deep.

All utility trench backfill should consist of imported structural fill or suitable on site soils. Utility trench backfill placed in or adjacent to buildings and exterior slabs should be compacted to at least 95 percent of the maximum dry density based on ASTM Test Method D1557. The upper 5 feet of utility trench backfill placed in pavement areas should be compacted to at least 95 percent of the maximum dry density based on ASTM Test Method D1557. Below 5 feet, utility trench backfill in pavement areas should be compacted to at least 90 percent of the maximum dry density based on ASTM Test Method D1557. Pipe bedding should be in accordance with the pipe manufacturer's recommendations.

The contractor is responsible for removing all water-sensitive soils from the trenches regardless of the backfill location and compaction requirements. Depending on the depth and location of the proposed utilities, we anticipate the need to re-compact existing fill soils below the utility structures and pipes. The contractor should use appropriate equipment and methods to avoid damage to the utilities and/or structures during fill placement and compaction procedures.

CONSTRUCTION FIELD REVIEWS

Cobalt Geosciences should be retained to provide part time field review during construction in order to verify that the soil conditions encountered are consistent with our design assumptions and that the intent of our recommendations is being met. This will require field and engineering review to:

- Monitor and test structural fill placement and soil compaction
- Observe bearing capacity at foundation locations

- Observe slab-on-grade preparation
- Monitor foundation drainage placement
- Observe excavation stability

Geotechnical design services should also be anticipated during the subsequent final design phase to support the structural design and address specific issues arising during this phase. Field and engineering review services will also be required during the construction phase in order to provide a Final Letter for the project.

CLOSURE

This report was prepared for the exclusive use of JayMarc Homes and their appointed consultants. Any use of this report or the material contained herein by third parties, or for other than the intended purpose, should first be approved in writing by Cobalt Geosciences, LLC.

The recommendations contained in this report are based on assumed continuity of soils with those of our test holes and assumed structural loads. Cobalt Geosciences should be provided with final architectural and civil drawings when they become available in order that we may review our design recommendations and advise of any revisions, if necessary.

Use of this report is subject to the Statement of General Conditions provided in Appendix A. It is the responsibility of JayMarc Homes who is identified as "the Client" within the Statement of General Conditions, and its agents to review the conditions and to notify Cobalt Geosciences should any of these not be satisfied.

Sincerely,

Cobalt Geosciences, LLC

11/13/2023
Phil Haberman, PE, LG, LEG
Principal

Statement of General Conditions

USE OF THIS REPORT: This report has been prepared for the sole benefit of the Client or its agent and may not be used by any third party without the express written consent of Cobalt Geosciences and the Client. Any use which a third party makes of this report is the responsibility of such third party.

BASIS OF THE REPORT: The information, opinions, and/or recommendations made in this report are in accordance with Cobalt Geosciences present understanding of the site specific project as described by the Client. The applicability of these is restricted to the site conditions encountered at the time of the investigation or study. If the proposed site specific project differs or is modified from what is described in this report or if the site conditions are altered, this report is no longer valid unless Cobalt Geosciences is requested by the Client to review and revise the report to reflect the differing or modified project specifics and/or the altered site conditions.

STANDARD OF CARE: Preparation of this report, and all associated work, was carried out in accordance with the normally accepted standard of care in the state of execution for the specific professional service provided to the Client. No other warranty is made.

INTERPRETATION OF SITE CONDITIONS: Soil, rock, or other material descriptions, and statements regarding their condition, made in this report are based on site conditions encountered by Cobalt Geosciences at the time of the work and at the specific testing and/or sampling locations. Classifications and statements of condition have been made in accordance with normally accepted practices which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behavior. Extrapolation of in situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock and groundwater conditions as influenced by geological processes, construction activity, and site use.

VARYING OR UNEXPECTED CONDITIONS: Should any site or subsurface conditions be encountered that are different from those described in this report or encountered at the test locations, Cobalt Geosciences must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the report conclusions or recommendations are required. Cobalt Geosciences will not be responsible to any party for damages incurred as a result of failing to notify Cobalt Geosciences that differing site or sub-surface conditions are present upon becoming aware of such conditions.

PLANNING, DESIGN, OR CONSTRUCTION: Development or design plans and specifications should be reviewed by Cobalt Geosciences, sufficiently ahead of initiating the next project stage (property acquisition, tender, construction, etc), to confirm that this report completely addresses the elaborated project specifics and that the contents of this report have been properly interpreted. Specialty quality assurance services (field observations and testing) during construction are a necessary part of the evaluation of sub-subsurface conditions and site preparation works. Site work relating to the recommendations included in this report should only be carried out in the presence of a qualified geotechnical engineer; Cobalt Geosciences cannot be responsible for site work carried out without being present.

HB-1 **Approximate Hand Boring Location**

King County imap Image

N

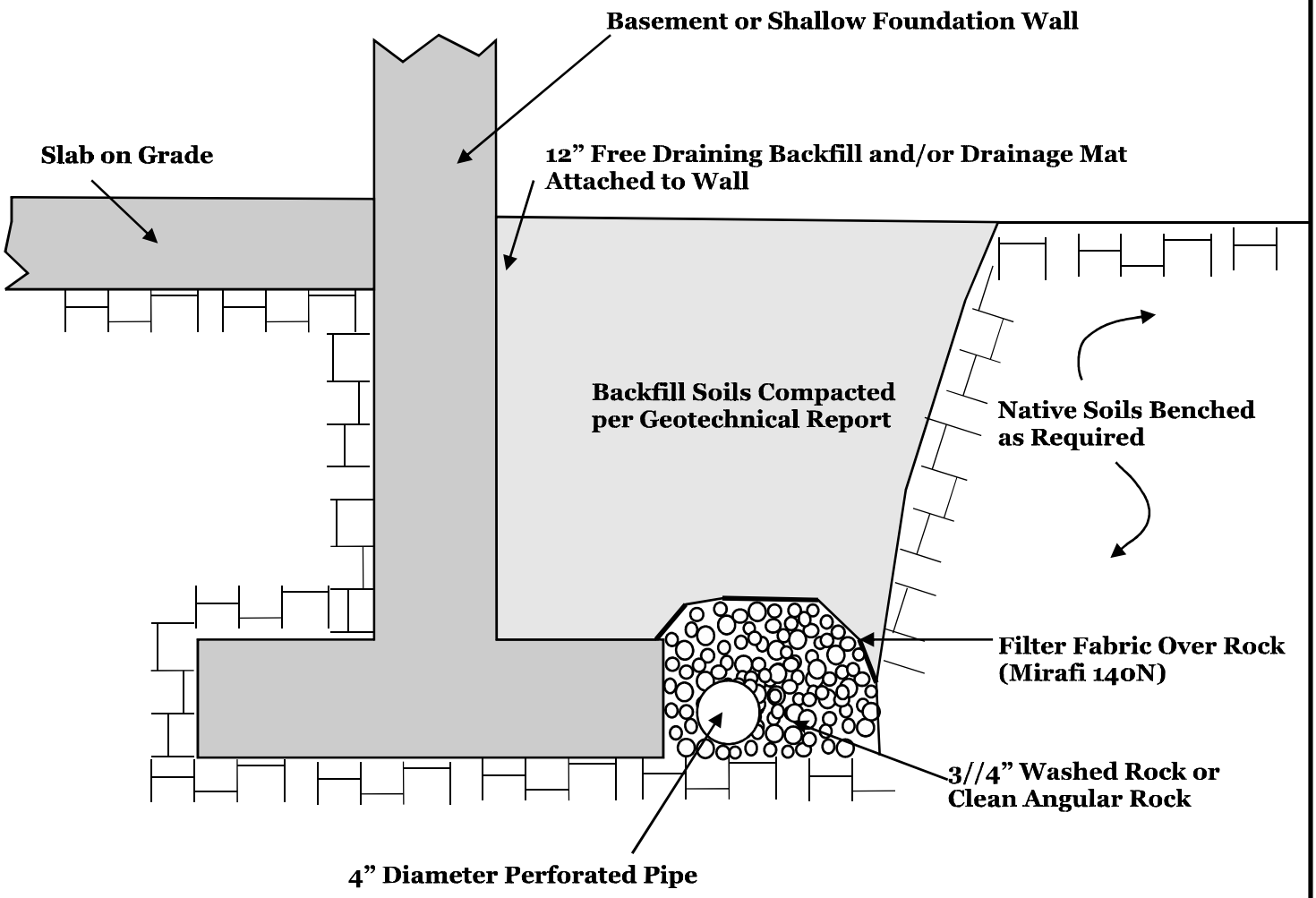
COBALT GEOSCIENCES

Proposed Residence
4014 83rd Ave SE
Mercer Island, Washington

Site Image

Figure 1

Cobalt Geosciences, LLC
P.O. Box 82243
Kenmore, WA 98028
(206) 331-1097
www.cobaltgeo.com
cobaltgeo@gmail.com



Not to Scale

COBALT GEOSCIENCES	**Typical Foundation Drain Detail**	**Attachment**	Cobalt Geosciences, LLC PO Box 1792 North Bend, WA 98045 (206) 331-1097 www.cobaltgeo.com phil@cobaltgeo.com

Unified Soil Classification System (USCS)

MAJOR DIVISIONS			SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS (more than 50% retained on No. 200 sieve)	Gravels (more than 50% of coarse fraction retained on No. 4 sieve)	Clean Gravels (less than 5% fines)	GW	Well-graded gravels, gravels, gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines
		Gravels with Fines (more than 12% fines)	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands (50% or more of coarse fraction passes the No. 4 sieve)	Clean Sands (less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines
			SP	Poorly graded sand, gravelly sands, little or no fines
		Sands with Fines (more than 12% fines)	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
FINE GRAINED SOILS (50% or more passes the No. 200 sieve)	Silts and Clays (liquid limit less than 50)	Inorganic	ML	Inorganic silts of low to medium plasticity, sandy silts, gravelly silts, or clayey silts with slight plasticity
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays silty clays, lean clays
		Organic	OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays (liquid limit 50 or more)	Inorganic	MH	Inorganic silts, micaceous or diatomaceous fine sands or silty soils, elastic silt
			CH	Inorganic clays of medium to high plasticity, sandy fat clay, or gravelly fat clay
		Organic	OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor		PT	Peat, humus, swamp soils with high organic content (ASTM D4427)

Classification of Soil Constituents

MAJOR constituents compose more than 50 percent, by weight, of the soil. Major constituents are capitalized (i.e., SAND).

Minor constituents compose 12 to 50 percent of the soil and precede the major constituents (i.e., silty SAND). Minor constituents preceded by "slightly" compose 5 to 12 percent of the soil (i.e., slightly silty SAND).

Trace constituents compose 0 to 5 percent of the soil (i.e., slightly silty SAND, trace gravel).

Grain Size Definitions

Description	Sieve Number and/or Size
Fines	<#200 (0.08 mm)
Sand	
-Fine	#200 to #40 (0.08 to 0.4 mm)
-Medium	#40 to #10 (0.4 to 2 mm)
-Coarse	#10 to #4 (2 to 5 mm)
Gravel	
-Fine	#4 to 3/4 inch (5 to 19 mm)
-Coarse	3/4 to 3 inches (19 to 76 mm)
Cobbles	3 to 12 inches (75 to 305 mm)
Boulders	>12 inches (305 mm)

Relative Density (Coarse Grained Soils)

N, SPT, Blows/FT	Relative Density
0 - 4	Very loose
4 - 10	Loose
10 - 30	Medium dense
30 - 50	Dense
Over 50	Very dense

Consistency (Fine Grained Soils)

N, SPT, Blows/FT	Relative Consistency
Under 2	Very soft
2 - 4	Soft
4 - 8	Medium stiff
8 - 15	Stiff
15 - 30	Very stiff
Over 30	Hard

Moisture Content Definitions

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, from below water table

COBALT GEOSCIENCES
Cobalt Geosciences, LLC
P.O. Box 82243
Kenmore, WA 98028
(206) 331-1097
www.cobaltgeo.com
cobaltgeo@gmail.com

Soil Classification Chart

Figure C1

Hand Boring HB-1

Date: November 2023	Depth: 6'	Groundwater: None
Contractor: Cobalt	Elevation:	Logged By: PH Checked By: SC

Depth (Feet)	Interval	Graphic Log	USCS Symbol	Material Description	Groundwater
				Topsoil/Vegetation	
1			SM	Loose to medium dense, silty-fine to medium grained sand with gravel dark yellowish brown to grayish brown, moist. (Weathered Glacial Till)	
2					
3				Locally mottled	
4					
5			SM	Dense, silty-fine to medium grained sand with gravel grayish brown, moist. (Glacial Till)	
6				End of Hand Boring 6'	
7					
8					
9					
10					

Moisture Content (%)
Plastic Limit — Liquid Limit

DCP Equivalent N-Value
0 10 20 30 40 50

Cobalt Geosciences, LLC
P.O. Box 82243
Kenmore, WA 98028
(206) 331-1097
www.cobaltgeo.com
cobaltgeo@gmail.com

Hand Boring HB-2

Date: November 2023	Depth: 6'	Groundwater: None
Contractor: Cobalt	Elevation:	Logged By: PH Checked By: SC

Depth (Feet)	Interval	Graphic Log	USCS Symbol	Material Description	Groundwater
				Topsoil/Vegetation	
1			SM	Loose to medium dense, silty-fine to medium grained sand with gravel dark yellowish brown to grayish brown, moist. (Weathered Glacial Till)	
2					
3				Locally mottled	
4			SM	Dense, silty-fine to medium grained sand with gravel grayish brown, moist. (Glacial Till)	
5					
6				End of Hand Boring 6'	
7					
8					
9					
10					

Moisture Content (%)
Plastic Limit — Liquid Limit

DCP Equivalent N-Value
0 10 20 30 40 50

Cobalt Geosciences, LLC
P.O. Box 82243
Kenmore, WA 98028
(206) 331-1097
www.cobaltgeo.com
cobaltgeo@gmail.com

Appendix B: WWHM Modeling

WWHM2012

PROJECT REPORT

General Model Information

WWHM2012 Project Name: 4216

Site Name:	4216
Site Address:	4216 83rd Avenue SE
City:	Mercer Island
Report Date:	2/20/2024
Gage:	Seatac
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2023/01/27
Version:	4.2.19

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year

Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C, Lawn, Mod	0.2273
Pervious Total	0.2273

Impervious Land Use	acre
ROOF TOPS FLAT	0.0615
ROADS FLAT	0.0211
SIDEWALKS FLAT	0.0101
Impervious Total	0.0927
Basin Total	0.32

Mitigated Land Use

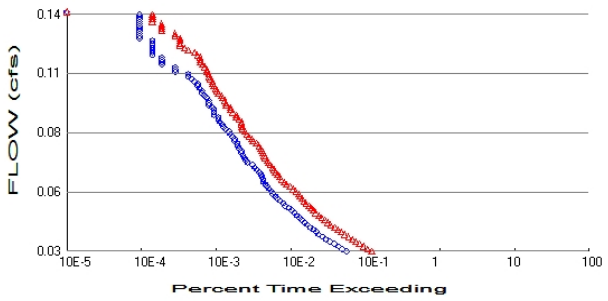
Basin 1

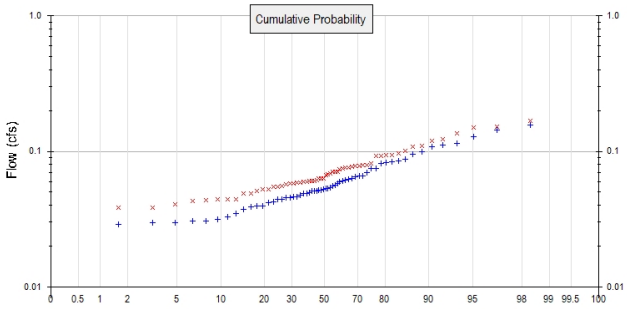
Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Mod	0.184
Pervious Total	0.184
Impervious Land Use	acre
ROOF TOPS FLAT	0.1087
ROADS FLAT	0.0221
SIDEWALKS FLAT	0.0052
Impervious Total	0.136
Basin Total	0.32

Routing Elements
Predeveloped Routing

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.2273
Total Impervious Area: 0.0927

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.184
Total Impervious Area: 0.136

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.054588
5 year	0.078566
10 year	0.096189
25 year	0.120472
50 year	0.14005
100 year	0.160927

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.066838
5 year	0.091573
10 year	0.109461
25 year	0.133834
50 year	0.153309
100 year	0.173943

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.088	0.101
1950	0.085	0.094
1951	0.052	0.061
1952	0.032	0.040
1953	0.031	0.043
1954	0.044	0.055
1955	0.046	0.059
1956	0.045	0.058
1957	0.063	0.075
1958	0.039	0.051

1959	0.030	0.044
1960	0.054	0.063
1961	0.049	0.060
1962	0.033	0.044
1963	0.050	0.060
1964	0.042	0.053
1965	0.066	0.078
1966	0.035	0.044
1967	0.084	0.093
1968	0.075	0.093
1969	0.059	0.071
1970	0.051	0.063
1971	0.062	0.076
1972	0.081	0.092
1973	0.030	0.039
1974	0.062	0.074
1975	0.065	0.077
1976	0.046	0.056
1977	0.043	0.052
1978	0.051	0.063
1979	0.056	0.078
1980	0.099	0.109
1981	0.053	0.067
1982	0.096	0.110
1983	0.052	0.070
1984	0.039	0.049
1985	0.053	0.067
1986	0.051	0.061
1987	0.058	0.079
1988	0.030	0.044
1989	0.037	0.055
1990	0.157	0.169
1991	0.112	0.124
1992	0.040	0.049
1993	0.029	0.038
1994	0.025	0.037
1995	0.046	0.059
1996	0.075	0.081
1997	0.060	0.071
1998	0.047	0.058
1999	0.128	0.150
2000	0.056	0.068
2001	0.044	0.061
2002	0.083	0.097
2003	0.069	0.079
2004	0.115	0.136
2005	0.051	0.061
2006	0.049	0.057
2007	0.144	0.153
2008	0.108	0.120
2009	0.065	0.075

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.1571	0.1686
2	0.1437	0.1529
3	0.1283	0.1500

4	0.1151	0.1364
5	0.1117	0.1235
6	0.1081	0.1200
7	0.0992	0.1101
8	0.0957	0.1087
9	0.0878	0.1012
10	0.0853	0.0965
11	0.0843	0.0941
12	0.0829	0.0934
13	0.0810	0.0932
14	0.0753	0.0922
15	0.0752	0.0812
16	0.0692	0.0794
17	0.0659	0.0789
18	0.0654	0.0783
19	0.0651	0.0780
20	0.0626	0.0766
21	0.0623	0.0756
22	0.0615	0.0754
23	0.0602	0.0746
24	0.0594	0.0740
25	0.0580	0.0710
26	0.0560	0.0705
27	0.0558	0.0703
28	0.0543	0.0683
29	0.0534	0.0674
30	0.0530	0.0672
31	0.0525	0.0633
32	0.0518	0.0631
33	0.0515	0.0627
34	0.0510	0.0610
35	0.0507	0.0608
36	0.0507	0.0607
37	0.0496	0.0605
38	0.0488	0.0599
39	0.0487	0.0599
40	0.0474	0.0590
41	0.0465	0.0586
42	0.0464	0.0577
43	0.0457	0.0576
44	0.0452	0.0568
45	0.0441	0.0559
46	0.0441	0.0549
47	0.0426	0.0546
48	0.0416	0.0525
49	0.0396	0.0521
50	0.0394	0.0512
51	0.0389	0.0491
52	0.0375	0.0488
53	0.0345	0.0444
54	0.0329	0.0441
55	0.0317	0.0441
56	0.0308	0.0439
57	0.0305	0.0430
58	0.0299	0.0404
59	0.0296	0.0386
60	0.0288	0.0384
61	0.0250	0.0366

Duration Flows

The Duration Matching Failed

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0273	1198	2605	217	Fail
0.0284	1034	2291	221	Fail
0.0296	930	2023	217	Fail
0.0307	816	1785	218	Fail
0.0318	710	1586	223	Fail
0.0330	630	1434	227	Fail
0.0341	568	1268	223	Fail
0.0353	509	1125	221	Fail
0.0364	466	1007	216	Fail
0.0375	431	910	211	Fail
0.0387	387	830	214	Fail
0.0398	359	737	205	Fail
0.0410	327	669	204	Fail
0.0421	303	610	201	Fail
0.0432	279	553	198	Fail
0.0444	257	506	196	Fail
0.0455	241	462	191	Fail
0.0467	219	431	196	Fail
0.0478	202	402	199	Fail
0.0489	179	375	209	Fail
0.0501	170	341	200	Fail
0.0512	155	319	205	Fail
0.0524	142	302	212	Fail
0.0535	134	283	211	Fail
0.0546	122	273	223	Fail
0.0558	118	251	212	Fail
0.0569	111	228	205	Fail
0.0580	103	209	202	Fail
0.0592	98	186	189	Fail
0.0603	91	174	191	Fail
0.0615	91	161	176	Fail
0.0626	88	152	172	Fail
0.0637	85	143	168	Fail
0.0649	80	133	166	Fail
0.0660	75	127	169	Fail
0.0672	71	121	170	Fail
0.0683	65	114	175	Fail
0.0694	56	107	191	Fail
0.0706	53	103	194	Fail
0.0717	52	97	186	Fail
0.0729	49	94	191	Fail
0.0740	47	91	193	Fail
0.0751	47	88	187	Fail
0.0763	43	84	195	Fail
0.0774	42	80	190	Fail
0.0785	41	74	180	Fail
0.0797	38	67	176	Fail
0.0808	38	64	168	Fail
0.0820	35	59	168	Fail
0.0831	33	55	166	Fail
0.0842	32	52	162	Fail
0.0854	29	48	165	Fail
0.0865	27	47	174	Fail
0.0877	26	47	180	Fail

0.0888	24	47	195	Fail
0.0899	23	43	186	Fail
0.0911	23	40	173	Fail
0.0922	20	40	200	Fail
0.0934	20	36	180	Fail
0.0945	20	33	165	Fail
0.0956	19	33	173	Fail
0.0968	17	29	170	Fail
0.0979	17	29	170	Fail
0.0990	17	28	164	Fail
0.1002	16	26	162	Fail
0.1013	15	25	166	Fail
0.1025	14	23	164	Fail
0.1036	14	22	157	Fail
0.1047	13	21	161	Fail
0.1059	12	20	166	Fail
0.1070	12	19	158	Fail
0.1082	11	19	172	Fail
0.1093	10	18	180	Fail
0.1104	9	17	188	Fail
0.1116	9	17	188	Fail
0.1127	6	16	266	Fail
0.1139	6	16	266	Fail
0.1150	6	15	250	Fail
0.1161	4	14	350	Fail
0.1173	4	13	325	Fail
0.1184	4	13	325	Fail
0.1195	4	13	325	Fail
0.1207	3	12	400	Fail
0.1218	3	11	366	Fail
0.1230	3	9	300	Fail
0.1241	3	8	266	Fail
0.1252	3	7	233	Fail
0.1264	3	7	233	Fail
0.1275	3	7	233	Fail
0.1287	2	7	350	Fail
0.1298	2	6	300	Fail
0.1309	2	6	300	Fail
0.1321	2	4	200	Fail
0.1332	2	4	200	Fail
0.1344	2	4	200	Fail
0.1355	2	4	200	Fail
0.1366	2	3	150	Fail
0.1378	2	3	150	Fail
0.1389	2	3	150	Fail
0.1401	2	3	150	Fail

The development has an increase in flow durations from 1/2 Predeveloped 2 year flow to the 2 year flow or more than a 10% increase from the 2 year to the 50 year flow.
The development has an increase in flow durations for more than 50% of the flows for the range of the duration analysis.

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0 acre-feet
On-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.
Off-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Total Volume Infiltrated		0.00	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Failed

Model Default Modifications

Total of 0 changes have been made.

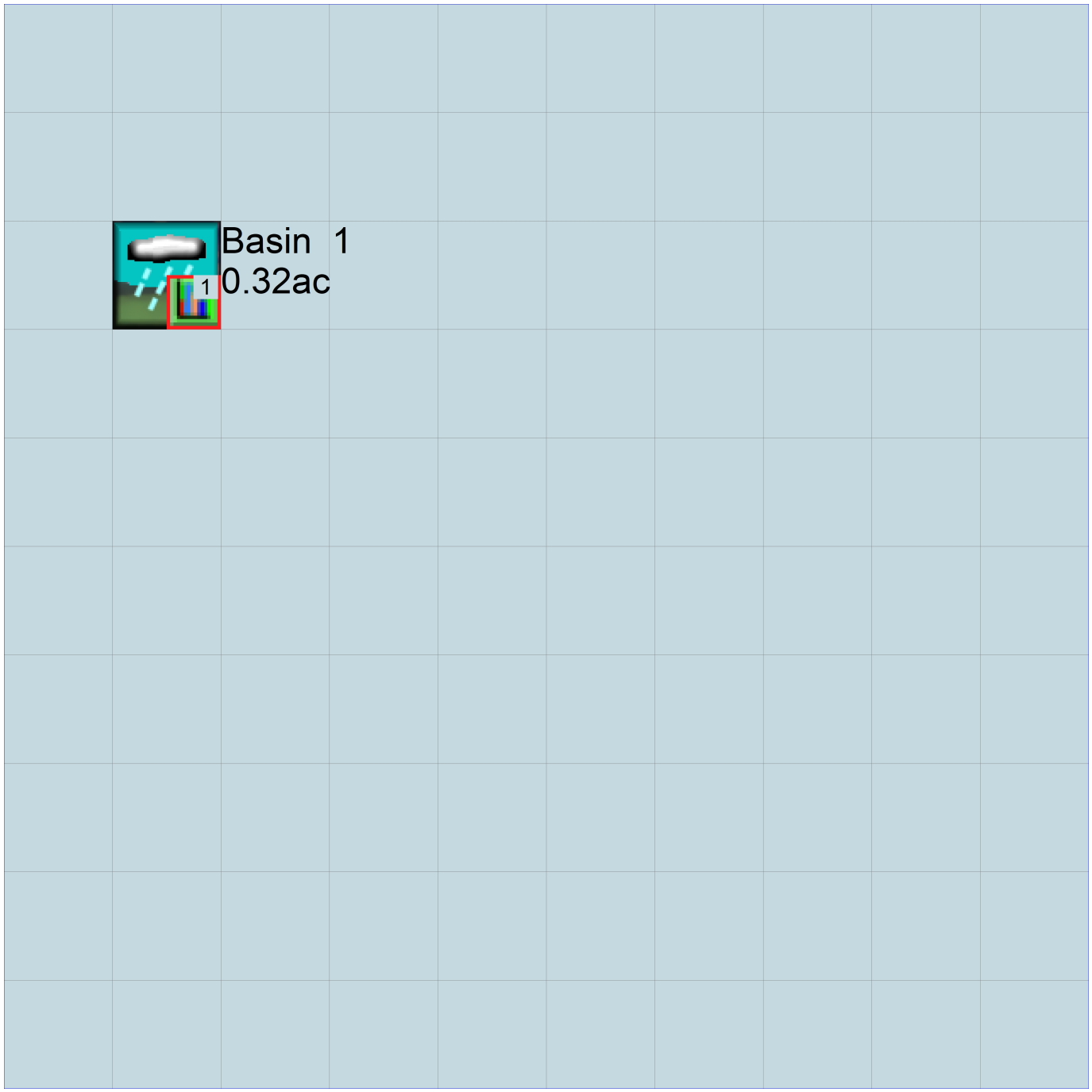
PERLND Changes

No PERLND changes have been made.

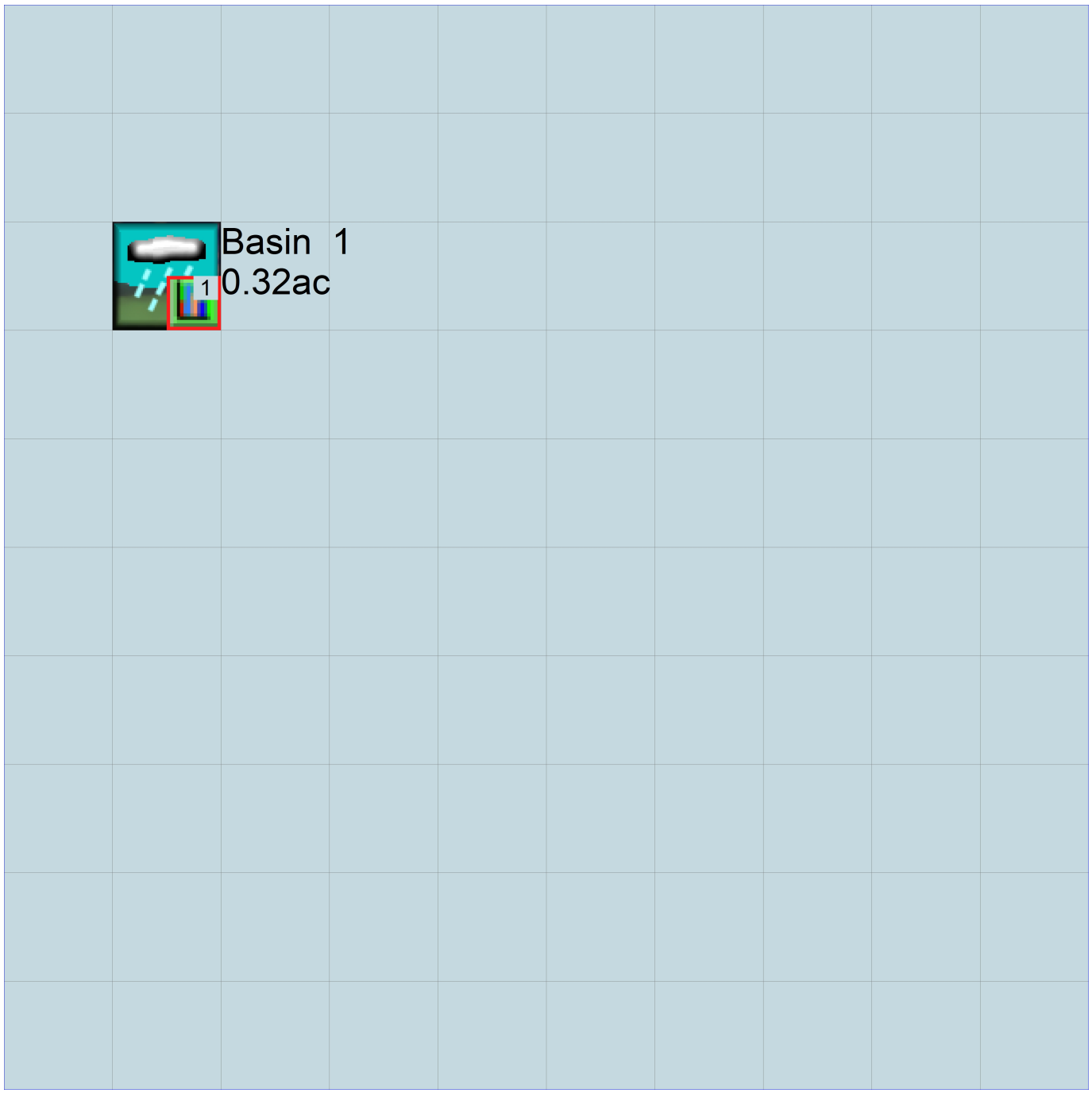
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM        26   4216.wdm
MESSU      25   Pre4216.MES
           27   Pre4216.L61
           28   Pre4216.L62
           30   POC42161.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:15
      PERLND      17
      IMPLND       4
      IMPLND       1
      IMPLND       8
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title---------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  1                   MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                      in  out           ***
   17     C, Lawn, Mod            1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   17         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
```

```
 17         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
 17         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
 17             0       4.5      0.03       400       0.1       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
 17             0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
 17            0.1      0.25      0.25         6       0.5      0.25
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS       GWVS
 17             0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out           ***
    4      ROOF TOPS/FLAT         1    1    1   27    0
    1      ROADS/FLAT             1    1    1   27    0
    8      SIDEWALKS/FLAT         1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections ******************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    4         0    0    1    0    0    0
    1         0    0    1    0    0    0
    8         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    4         0    0    4    0    0    4    1    9
    1         0    0    4    0    0    0    1    9
    8         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    4         0    0    0    0    0
    1         0    0    0    0    0
    8         0    0    0    0    0
  END IWAT-PARM1
```

```
  IWAT-PARM2
    <PLS >       IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    4            400      0.01       0.1       0.1
    1            400      0.01       0.1       0.1
    8            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >       IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    4              0         0
    1              0         0
    8              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    4              0         0
    1              0         0
    8              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                 <--Area-->     <-Target->   MBLK   ***
<Name>   #                 <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND  17                     0.2273     COPY   501     12
PERLND  17                     0.2273     COPY   501     13
IMPLND   4                     0.0615     COPY   501     15
IMPLND   1                     0.0211     COPY   501     15
IMPLND   8                     0.0101     COPY   501     15

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG           ***
                                       in  out                              ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                  ***
```

```
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
             FG FG FG FG  possible  exit  *** possible  exit     possible  exit
              *  *  *  *    *  *  *  *  *       *  *  *  *  *        ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                          ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
           *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1             PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1             IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76          PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76          IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY   501 OUTPUT MEAN   1 1      48.4      WDM    501 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   4216.wdm
MESSU       25   Mit4216.MES
            27   Mit4216.L61
            28   Mit4216.L62
            30   POC42161.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:15
      PERLND      17
      IMPLND       4
      IMPLND       1
      IMPLND       8
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title---------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  1                   MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                      in  out           ***
   17     C, Lawn, Mod            1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   17         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
```

```
 17         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
 17         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
 17             0       4.5      0.03       400       0.1       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
 17             0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
 17            0.1      0.25      0.25         6       0.5      0.25
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS       IFWS       LZS       AGWS       GWVS
 17             0         0         0         0       2.5          1          0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out           ***
    4      ROOF TOPS/FLAT         1    1    1   27    0
    1      ROADS/FLAT             1    1    1   27    0
    8      SIDEWALKS/FLAT         1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections ******************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    4         0    0    1    0    0    0
    1         0    0    1    0    0    0
    8         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    4         0    0    4    0    0    4    1    9
    1         0    0    4    0    0    0    1    9
    8         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    4         0    0    0    0    0
    1         0    0    0    0    0
    8         0    0    0    0    0
  END IWAT-PARM1
```

```
  IWAT-PARM2
    <PLS >       IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    4            400      0.01       0.1       0.1
    1            400      0.01       0.1       0.1
    8            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >       IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    4              0         0
    1              0         0
    8              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    4              0         0
    1              0         0
    8              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                 <--Area-->     <-Target->   MBLK   ***
<Name>   #                 <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND  17                      0.184     COPY   501     12
PERLND  17                      0.184     COPY   501     13
IMPLND   4                     0.1087     COPY   501     15
IMPLND   1                     0.0221     COPY   501     15
IMPLND   8                     0.0052     COPY   501     15

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG           ***
                                       in  out                              ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                  ***
```

```
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
             FG FG FG FG  possible  exit  *** possible  exit      possible  exit
              *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                          ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1             PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1             IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76          PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76          IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY     1 OUTPUT MEAN   1 1      48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1      48.4      WDM    801 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15


END MASS-LINK

END RUN
```

Disclaimer

Legal Notice

This program and accompanying documentation are provided 'as-is' without warranty of any kind. The entire risk regarding the performance and results of this program is assumed by End User. Clear Creek Solutions Inc. and the governmental licensee or sublicensees disclaim all warranties, either expressed or implied, including but not limited to implied warranties of program and accompanying documentation. In no event shall Clear Creek Solutions Inc. be liable for any damages whatsoever (including without limitation to damages for loss of business profits, loss of business information, business interruption, and the like) arising out of the use of, or inability to use this program even if Clear Creek Solutions Inc. or their authorized representatives have been advised of the possibility of such damages.

Clear Creek Solutions, Inc.
6200 Capitol Blvd. Ste F
Olympia, WA. 98501
Toll Free 1(866)943-0304
Local (360)943-0304

www.clearcreeksolutions.com