Attachment 11.A

Preliminary Drainage Design Report

West Bay Yards
Olympia, WA

Prepared For:
WT3933, LLC
PO Box 1376
Sumner, WA 98390

Prepared By:
SCJ Alliance
8730 Tallon Lane NE, Suite 200
Lacey, WA 98516
360-352-1465

September 2024

SCJ ALLIANCE
CONSULTING SERVICES

Drainage Design Report

Project Information

Project:	**West Bay Yards**
Prepared for:	**WT3933, LLC** PO Box 1376 Sumner, WA 98390 Contact Name: Brandon Smith Contact Phone: 253-720-2813

Reviewing Agency

Jurisdiction:	City of Olympia

Project Representative

Prepared by:	**SCJ Alliance** 8730 Tallon Lane NE, Suite 200 Lacey, WA 98516 360.352.1465 scjalliance.com
Contact:	Whitney Holm, PE
Project Reference:	SCJ #3264.02 Path: N:\Projects\3264 Milestones Companies\3264.02 West Bay Multi-Family\Phase 02 - Civil Site Plan Review\Design\Storm\Drainage Design Report\2019-xxxx Drainage Design Report.docx

PROJECT ENGINEER'S CERTIFICATION

I hereby certify that this Drainage Control Plan for the West Bay Yards development project has been prepared by me or under my supervision and meets the minimum standards of the City of Olympia and normal standards of engineering practice. I hereby acknowledge and agree that the jurisdiction does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities designed by me.

9/20/24

Prepared by: Whitney Holm, PE — Date
Whitney.holm@scjalliance.com
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1. PROPOSED PROJECT DESCRIPTION

The following report was prepared for the proposed West Bay Yards development project in Olympia, WA. This report was prepared to comply with the minimum technical standards and requirements that are set forth in the City of Olympia *2016 Drainage Design and Erosion Control Manual (DDECM).*

Project Proponent: WT3933, LLC

Parcel Numbers: 72600200100, 91013100000

Total Parcel Area: 7.00 Acres, 12.28 Acres

Current Zoning: UW – Urban Waterfront

Required Permits: Grading, Utility, Paving, Building, etc.

Site Address: 1210 West Bay Drive NW

Section, Township, Range: Section 10, Township 18 N, Range 2 W

The proposed West Bay Yards development project is located on two parcels that is 7-acres and will disturb almost the entire parcel. The project is located on the east side of West Bay Drive. The proposed construction includes the construction of a 478-unit apartment complex, and associated parking garages, walkways, stormwater treatment systems, and extension of all available utilities. Specifically, the proposed site improvements/construction activities for this project include the following:

- Site preparation, grading, and erosion control activities
- Construction of apartment buildings, parking garages, driveways, and pedestrian walkways
- Construction/installation of on-site stormwater treatment facilities
- Extension of available utilities (i.e., water, sewer, etc.)

A site vicinity map of the proposed project location is enclosed herein as **Appendix 1**. A worksheet for determining the number of Minimum Requirements for this project has been prepared and enclosed herein as **Appendix 2**. Minimum requirements 1-9 are required for this project. Table 1 below describes the land use of the proposed drainage basin.

LAND TYPE DESIGNATION	AREA (ACRES)	% OF TOTAL AREA
Total Parcel Area	**8.65**	**100**
Existing Pervious Surface	0	0.00
Existing Impervious Surface	8.65	100.00
Proposed Pervious Surface	2.98	34.45
Proposed Impervious Surface	5.67	65.55

Table 1: On-site Land Type Designations Summary Section

1.1 SUMMARY OF COMPLIANCE ON-SITE

The stormwater design complies with all 9 minimum requirements as follows:

Minimum Requirement #1 – Preparation of Stormwater Site Plans – This summary is contained within the stormwater site plan.

Minimum Requirement #2 – Construction Stormwater Pollution Prevention – A pollution prevention plan will be prepared as a standalone document which describes the 13 required elements at the time of the civil permit submittal. Further, an erosion control plan will be prepared and be a part of the engineering plan set.

Minimum Requirement #3 – Source Control of Pollution – BMPs listed below are the minimum required for the site, additional BMPs not listed here may need to be implemented the meet the minimum requirements discussed in the 2016 *DDECM*.

- S411: BMPs for Landscaping and Lawn/Vegetation Management
- S417: BMPs for Maintenance of Stormwater Drainage and Treatment Systems
- S448: BMPs for Demolition of Buildings

Minimum Requirement #4 – Preservation of Natural Drainage Systems and Outfalls – Currently, on-site stormwater runoff sheet flows across the parcel to the east and directly into Budd Inlet. There are numerous outlets located along the coastline that discharges stormwater runoff from portions of the parcel and portions of West Bay Drive. After construction, the stormwater runoff from the proposed project improvements will be collected, treated, and discharged into a few of the existing outfalls. The existing and removed outlets have been clearly identified on the storm plans. Additionally, it is important to note that the stormwater runoff that has received treatment prior to being discharged on the project site will be conveyed separately from the on-site stormwater runoff. Flow control is not required for this project and is further discussed in Minimum Requirement #7.

Minimum Requirement #5 – On-site Stormwater Management, including Easements and Setbacks – Projects qualifying as flow control exempt per Section 2.5.7 do not have to achieve the LID performance standard, nor consider bioretention, rain gardens, permeable pavement, and full dispersion if using List #1 or List #2. However, these projects must implement BMP T5.13: Post Construction Soil Quality and Depth; BMPs T5.10A, B, or C: Downspout Full Infiltration Systems, Downspout Dispersion Systems, or Perforated Stub-Out Connections; and BMP T5.11 or T5.12, if feasible. The proposed project will trigger minimum requirements #1-9 and therefore the on-site stormwater BMPs must be chosen following List #2.

- Lawn and Landscaped Areas –
    - Post Construction Soil Quality and Depth (BMP T5.13) will be followed per the *DDECM*. See landscape plans for details.
- Roofs –
    - Downspout Full Infiltration Systems (BMP T5.10A) are not feasible for the proposed project. Due to the on-site soils and high groundwater, none of the stormwater runoff will be able to infiltrate on-site. See Section 3 of this report for more information on the on-site soils.
    - Downspout Dispersion Systems (BMP T5.10B) are infeasible for this project. The project parcel does not have the required native vegetated flow path.
    - Perforated Stub-Out Connections (BMP T5.10C) are also infeasible for this project. As mentioned above, the on-site soils are not conducive to infiltration and the parcel has high groundwater due to the proximity to Budd Inlet.
    - The stormwater runoff from the proposed roof areas will be tightlined downstream of the proposed treatment facilities since the stormwater runoff does not require treatment prior to being discharged into Budd Inlet.

- Other Hard Surfaces –
    - Sheet Flow Dispersion (BMP T5.12) and Concentrated Flow Dispersion (BMP T5.11) are both infeasible for this project for the reasons mentioned above.
    - No other BMPs will be utilized for this project. Care will be taken to maintain the current drainage patterns of the parcel after construction, see Section 9 of this report for more information.

Minimum Requirement #6 – Runoff Treatment – The proposed project will construct over 5,000 s.f. of pollution-generating impervious surface, therefore stormwater treatment is required. The proposed project is a multi-family residential project and therefore enhanced treatment is required. Treatment will be provided through the use of multiple Modular Wetland Systems. Treatment will be provided for the eastern half of West Bay Drive as well as the on-site improvements. The western portion of West Bay is already provided treatment and therefore will be conveyed separately from the proposed improvements.

Minimum Requirement #7 – Flow Control – The proposed project will construct over 10,000 s.f. of effective impervious surfaces but will discharge into Budd Inlet which is considered a flow control exempt waterbody per Section 2.5.7 of the DDECM. The project site will be drained completely by manmade systems and the outlet pipes will be improved so that they have capacity for the proposed project improvements.

Minimum Requirement #8 – Wetlands Protection – There are no wetlands on the project site nor does the project site currently discharge into a wetland.

Minimum Requirement #9 – Operation and Maintenance – An operations and maintenance manual will be included and attached herein as **Appendix 6** at the time of the civil permit submittal.

2. EXISTING CONDITIONS DESCRIPTION

2.1 EXISTING ON-SITE CONDITIONS

The subject site is +/- 7.00-acres in size. Topography within the property slopes gently to the east with grades between 1 and 4 percent and is predominantly covered with gravel and concrete. Discharge from the project site flows directly into the Puget Sound. There are no known current drainage flow control facilities on the site. Existing culverts run through the project parcel that direct the upstream runoff into the Puget Sound. In the 1990's, the project parcel appears to have been developed with industrial type buildings utilized as part of the logging industry.

Figure 1: Existing Conditions (1990)

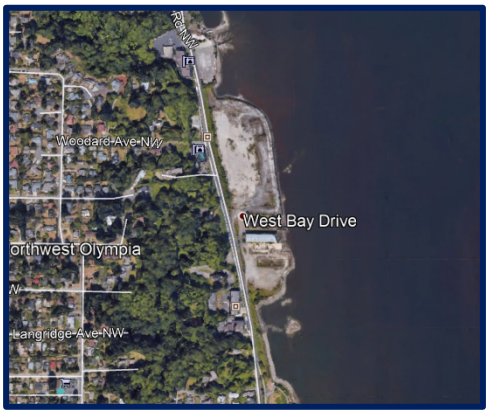

Figure 2: Existing Conditions (2018)

3. INFILTRATION RATES/SOILS REPORTS

Landau Associates performed a geotechnical investigation of the site in May, 2020. The subsurface conditions were determined by advancing eight test pits, two hollow-stem auger borings, and four cone penetration tests. The site is capped with approximately 8 to 12 feet of undocumented fill. In 2010, the site underwent a cleanup and soils in contamination hot spots were excavated and replaced with fill that consisted of sandy gravel to gravelly sand. Underneath the fill, a 4 ft to 18 ft thick layer of wood debris was encountered. The wood debris generally consisted of sawdust to wood chip-sized particles, mixed with mineral soil. Soils beneath the wood debris were interpreted to be native to the site. This soil was interpreted to be a very soft to soft, clay like material with occasional interbeds of silty or sandy material. Below this layer more very loose to loose, non-plastic silt and sand mixtures with occasional interbeds of medium dense silt, sand, and gravel mixtures was encountered. And finally, a very dense glacially consolidated soil was encountered. Due to the location of the site and the on-site soils, infiltration testing was not conducted. See **Appendix 5** for the geotechnical report.

4. WELLS AND SEPTIC SYSTEMS

There are no know wells or septic systems on-site.

5. FUEL TANKS

There are no know fuel tanks on-site.

6. SUBBASIN DESCRIPTION

6.1 QUALITATIVE UPSTREAM ANALYSIS

Portions of the upstream hillside currently flows through the site through various culverts. After construction of the project, portions of these culverts are going to be removed due to the construction of the new buildings. Therefore, this upstream stormwater runoff will be intercepted near the public right of way and routed to the existing outfalls and separate from the on-site stormwater conveyance systems. An existing and proposed drainage flow map has been provided in **Appendix 3** of this document.

6.2 QUALITATIVE DOWNSTREAM ANALYSIS

The proposed project is located adjacent to Budd Inlet. Therefore, there are no further downstream systems from the site. The stormwater runoff will be directly discharged after treatment into Budd Inlet. Budd Inlet will not be affected by the construction of this project.

7. FLOODPLAIN ANALYSIS

The flood hazard areas within this portion of Thurston County, Washington are delineated on the Federal Emergency Mapping Agency (FEMA) National Flood Insurance Program – Flood Insurance Rate Map (FIRM) No. 53067C0166F dated May 15, 2018. The project site is located within Zone AE with a based flood elevation of 15 feet. See **Appendix 6** for a copy of the FEMA Map.

8. AESTHETIC CONSIDERATIONS FOR FACILITIES

The proposed treatment facilities will be located within a storm drainage structure; therefore it will not be visible to the public.

9. FACILITY SELECTION AND SIZING

The proposed project follows the redevelopment requirements stated in the *DDECM*. Following Figure 2.4.1 (See Appendix 2), this project qualifies as a redevelopment. The site is already substantially developed (more than 35% or more of existing hard surface coverage). This redevelopment includes the demolition of the existing concrete areas. As well as, the construction of the apartment buildings, parking, roadways, utilities, and stormwater improvements. Following Figure 2.4.2 – Flow Chart for Determining Requirements for Redevelopment; minimum requirements #1-9 apply to the new and replaced hard surfaces.

The total impervious surface requiring treatment is 1.30 acres. Treatment has been split into 3 basins. See Section 9.4 of this report for the treatment facility sizing.

9.1 HYDRAULIC ANALYSIS

The proposed project is located within the flood zone and therefore measures shall be taken so that the proposed site is outside of the floodplain. However, there are no known flooding hazards on-site created by stormwater facilities.

9.2 FLOW CONTROL SYSTEM

Per Figure 2.4.2 of the *DDECM* the project triggers flow control. The project will create over 10,000 s.f. of new impervious surface. However, the project meets all of the requirements to be flow control exempt and discharges into Budd Inlet. Therefore, flow control is not required and is not proposed with this project.

9.3 PERFORMANCE STANDARDS AND GOALS

As mentioned in section 9.2 of this report, flow control is not required for this project. Enhanced treatment will be provided for all of the pollution-generating impervious surfaces through the use of Modular Wetland Systems.

9.4 WATER QUALITY SYSTEM ON-SITE

Runoff Treatment is required for this project per Figure 2.4.2 of the *DDECM.* Since the project is a multi-family development, enhanced treatment is required and will be provided through the use of 3 Modular Wetland Systems. See the tables below for the treatment basins and facility sizes. See **Appendix 3**, for the preliminary treatment basin map.

	IMPERVIOUS AREA (ACRES)	PERVIOUS AREA (ACRES)	WATER QUALITY FLOW RATE (CFS)	PEAK FLOW RATE (CFS)	FACILITY SIZE*
Basin 1	0.57	0.46	0.048	0.60	4’x6’
Basin 2	0.82	0.33	0.184	0.77	4x6’
Basin 2	0.44	0.04	0.092	0.39	4x6’

Table 2: Treatment Facility Sizing

*These are preliminary sizes and are subject to change after coordination with the treatment system manufacturer.

10. CONVEYANCE SYSTEM ANALYSIS AND DESIGN

All proposed conveyance systems will be sized to convey the 25-year storm in the pipe. All roof drain pipes will be a minimum of 6 inches in diameter at a minimum slope of 0.5%, while all other conveyance systems will be a minimum diameter of 12 inches at a minimum slope of 0.5%.

11. OFFSITE ANALYSIS AND MITIGATION

The stormwater runoff from the proposed site flows directly into Puget Sound. Therefore no other off-site facilities will be affected with the construction of this project.

12. UTILITIES

All proposed utilities will be installed to avoid conflict with the existing utilities located in the right-of-way. The majority of the existing utilities on-site will be demolished with this project.

13. COVENANTS, DEDICATIONS, EASEMENTS, AGREEMENTS

West Bay Development Group, LLC. will be responsible for inspection, operation, and maintenance of storm drainage facilities and execution of pollution source control programs.

It is important to note that only slow release fertilizers shall be applied or the life of the development at a maximum amount of 4 lbs of nitrate as Nitrogen annually and no more than 1 lb. per application for every 1,000 square feet of turf grass. Only fertilizer formulas with a minimum of 50% water insoluble form of nitrogen are permitted for use. Approved water insoluble forms of nitrogen include sulfer and/or polymer coated fertilizers, Isobutylidene Diurea (IBDU), Methylene Urea and Ureaform, and organic fertilizers registered with Washington Department of Agriculture.

14. OTHER PERMITS OR CONDITIONS PLACED ON THE PROJECT

Building, grading, paving, and utility permits will need to be secured prior to beginning construction activities. Coverage under Washington State Department of Ecology Phase II National Pollutant Discharge Elimination System Stormwater Permit will also need to be secured prior to beginning construction activities.

END OF DRAINAGE DESIGN REPORT

APPENDIX 1

SITE VICINITY MAP

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APPENDIX 2

DETERMINATION OF MINIMUM REQUIREMENTS WORKSHEET

Figure 2.4.1 – Flow Chart for Determining Requirements for New Development

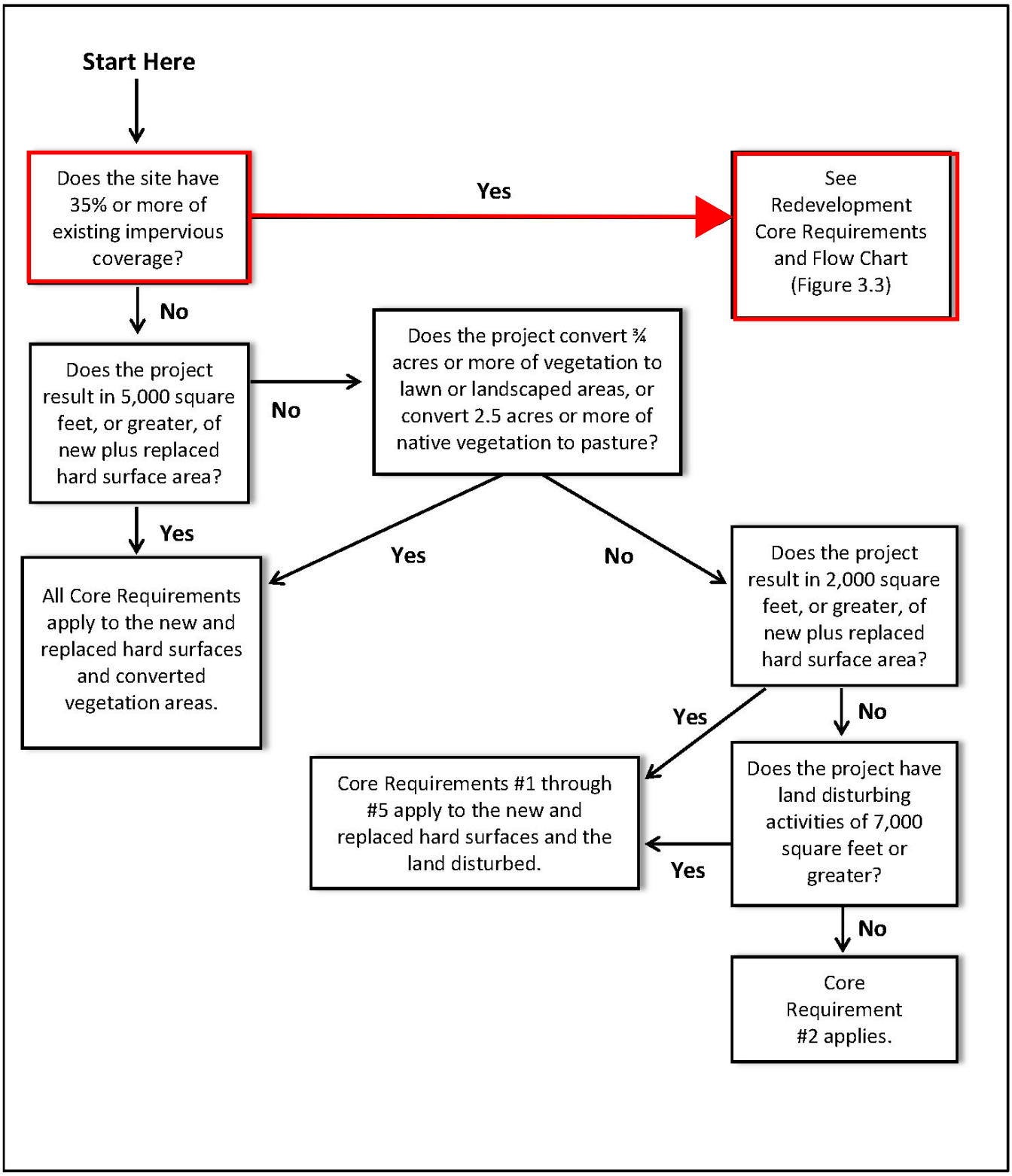
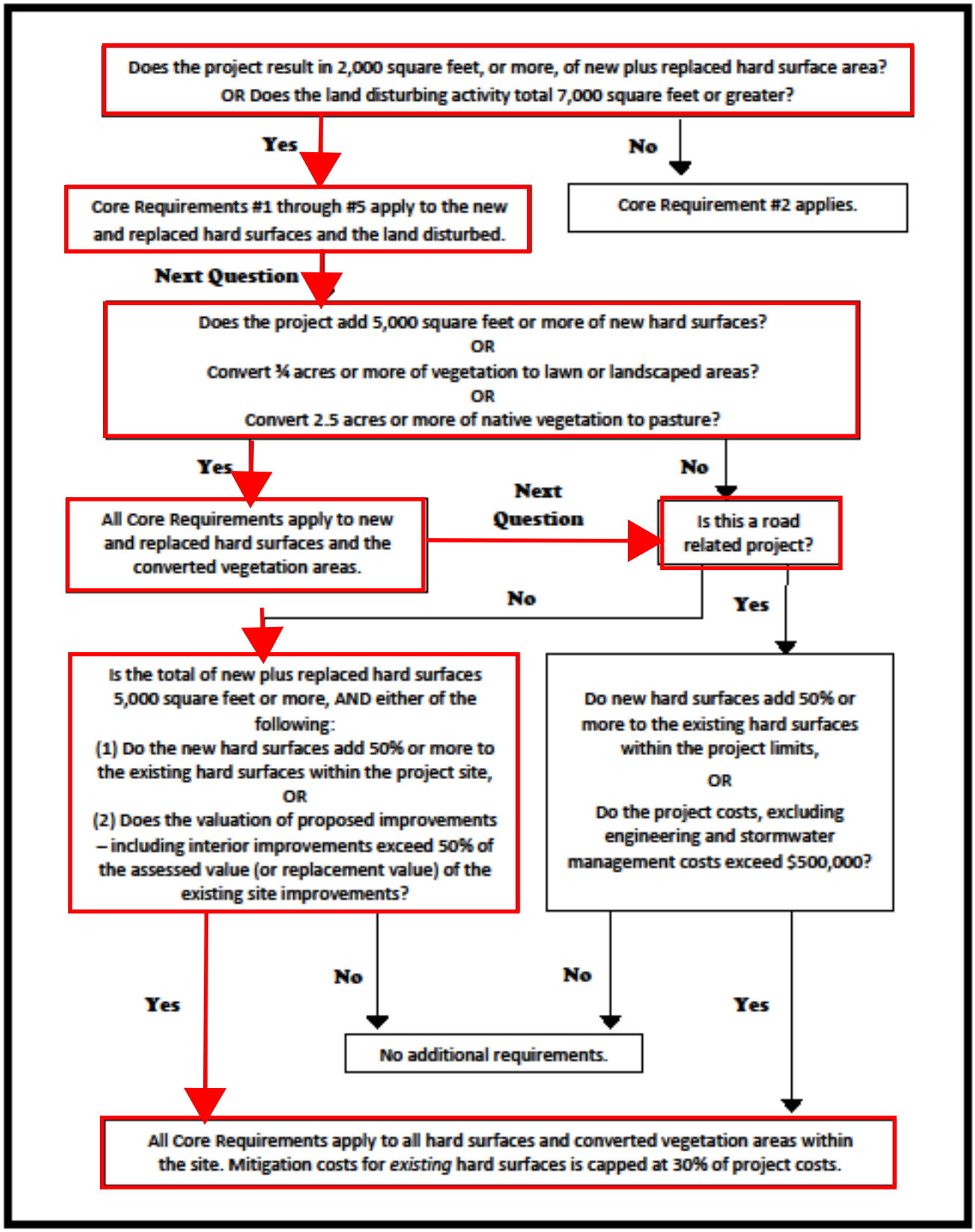


Figure 2.4.2 – Flow Chart for Determining Requirements for Redevelopment



APPENDIX 3
BASIN MAP EXHIBITS

BUDD INLET

BUDD INLET

WEST BAY DR. NW

WOODARD AVE ROW

0 40 80

SCALE IN FEET

EXISTING ON-SITE BASIN AREAS:

IMPERVIOUS	8.65 ACRES
PERVIOUS	0.00 ACRES
TOTAL	8.65 ACRES

EXISTING OFF-SITE BASIN AREAS:

IMPERVIOUS	0.29 ACRES
PERVIOUS	0.08 ACRES
TOTAL	0.37 ACRES

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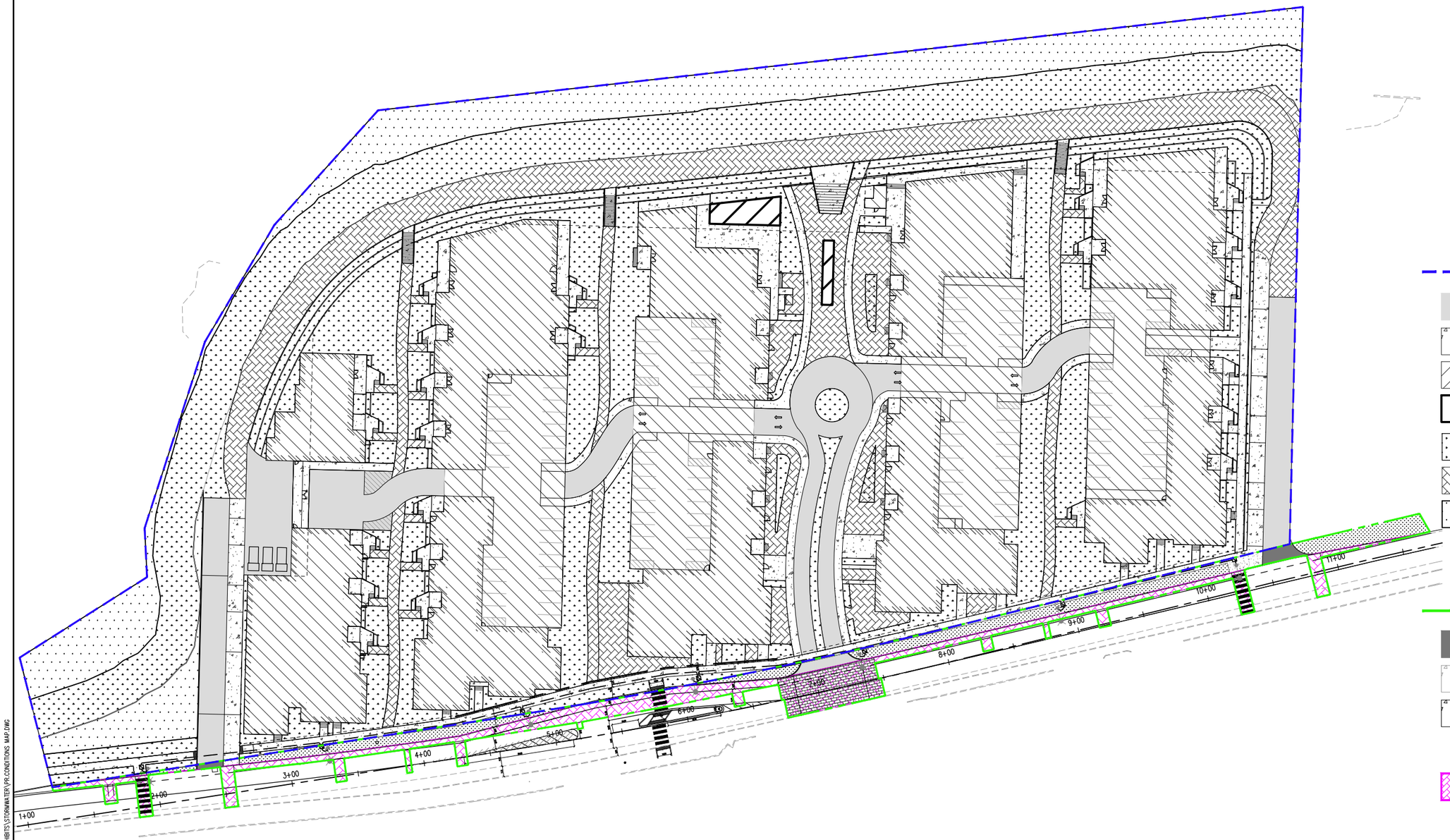
HORIZONTAL SCALE:	1"=40'
DATE:	SEPTEMBER 2024
JOB No.:	3264.02
DRAWING FILE No.:	Ex. Conditions Map.dwg

EXISTING CONDITIONS MAP

WEST BAY YARDS MULTIFAMILY, OLYMPIA, WA

EXHIBIT No: **EX-01**

SHEET No: **1**



0 40 80
SCALE IN FEET

PROPOSED ON-SITE BASIN AREAS:

ASPHALT	0.57 ACRES
CONCRETE	0.82 ACRES
ROOF	3.16 ACRES
POOL	0.03 ACRES
PERVIOUS	2.29 ACRES
TRAIL CONCRETE	1.09 ACRES
UNDISTURBED	0.69 ACRES
TOTAL	8.65 ACRES

PROPOSED OFF-SITE BASIN AREAS:

ASPHALT	0.01 ACRES
CONCRETE	0.02 ACRES
PERVIOUS	0.13 ACRES
TOTAL	0.16 ACRES
REPLACED IMPERVIOUS	0.21 ACRES

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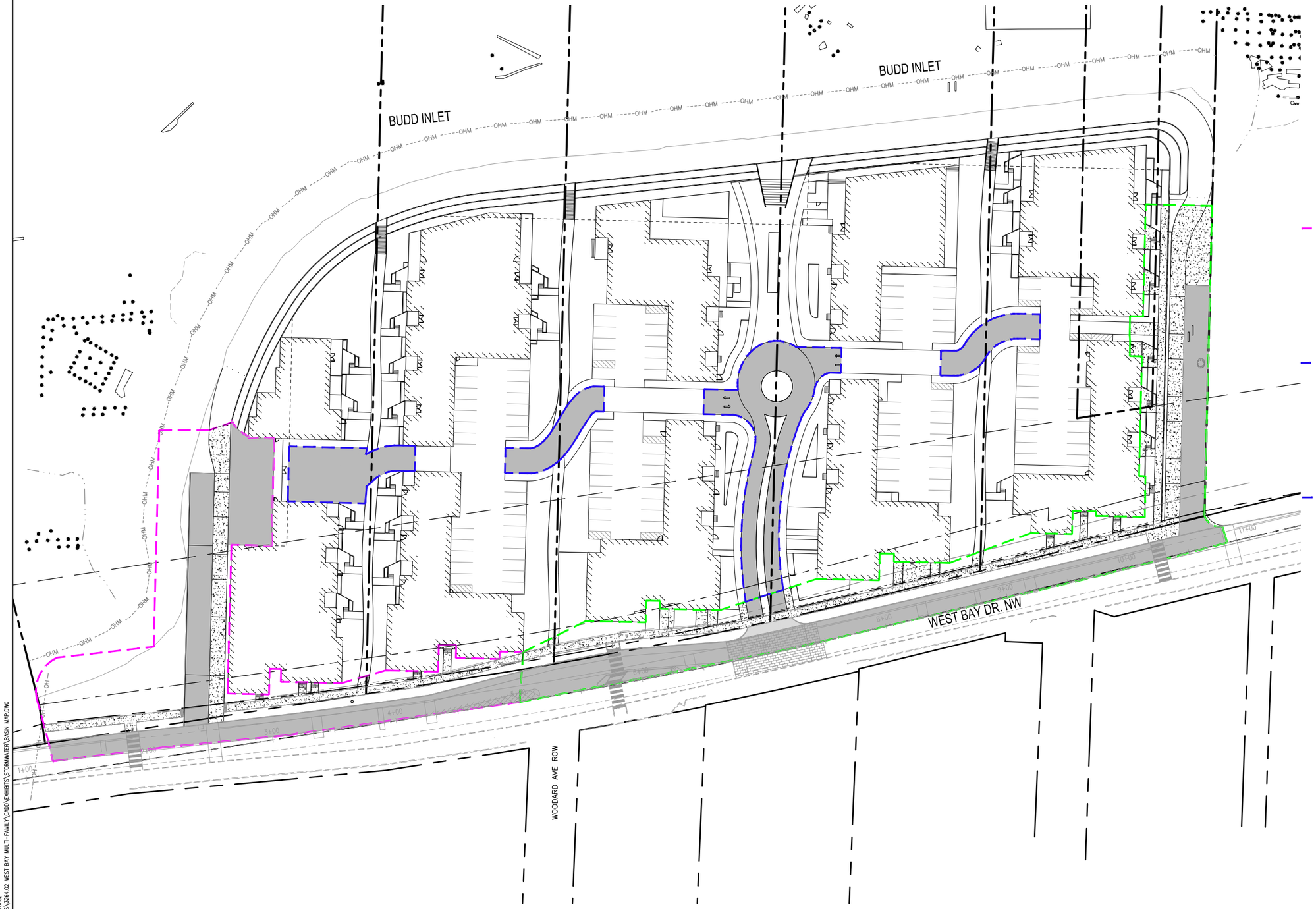
JOB No.: 3264.02
DRAWING FILE No.: Pr. Conditions Map.dwg

PROPOSED CONDITIONS MAP
WEST BAY YARDS MULTIFAMILY, OLYMPIA, WA

EXHIBIT No: EX-02
SHEET No: 2



BASIN 1:

PAVEMENT AREA:	0.40 ACRES
SIDEWALK AREA:	0.17 ACRES
LANDSCAPE AREA:	0.46 ACRES
TOTAL AREA:	1.03 ACRES
RUNOFF FLOW (100-YR):	0.60 CFS
TREATMENT FLOW:	0.048 CFS

BASIN 2:

PAVEMENT AREA:	0.46 ACRES
SIDEWALK AREA:	0.36 ACRES
LANDSCAPE AREA:	0.33 ACRES
TOTAL AREA:	1.15 ACRES
RUNOFF FLOW (100-YR):	0.77 CFS
TREATMENT FLOW:	0.184 CFS

BASIN 3:

PAVEMENT AREA:	0.44 ACRES
SIDEWALK AREA:	0.00 ACRES
LANDSCAPE AREA:	0.04 ACRES
TOTAL AREA:	0.48 ACRES
RUNOFF FLOW (100-YR):	0.39 CFS
TREATMENT FLOW:	0.092 CFS

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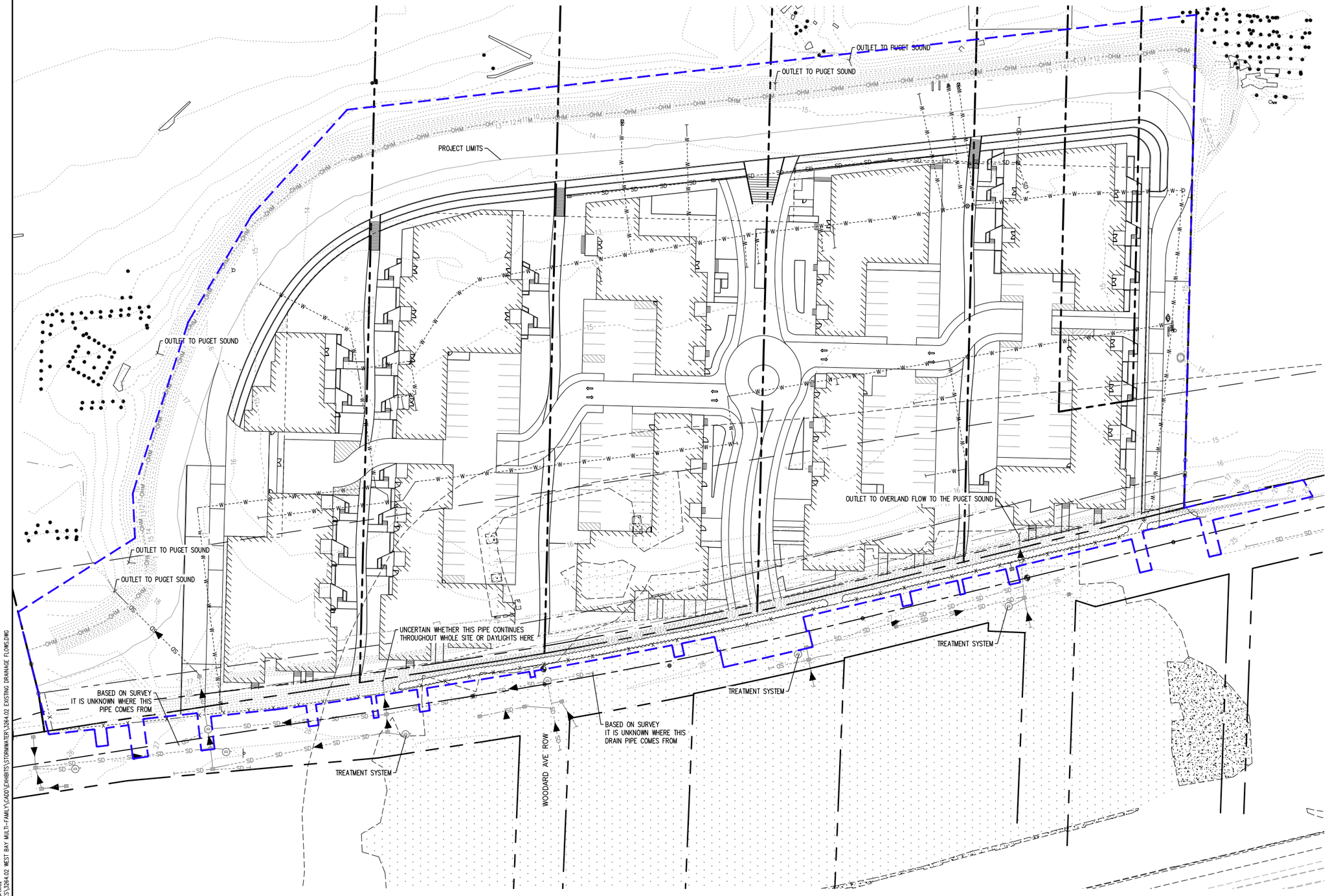
DRAWING FILE No.:	BASIN MAP.DWG

TREATMENT BASIN MAP
WEST BAY YARDS MULTIFAMILY, OLYMPIA, WA

EXHIBIT No: EX-03
SHEET No: 3

Attachment 11.A



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EXISTING DRAINAGE PATTERNS

WEST BAY YARDS MULTIFAMILY, OLYMPIA, WA

EXHIBIT No: **EX-04**

SHEET No: **4**

Attachment 11.A

OUTLET TO PUGET SOUND

PROJECT LIMITS

ENHANCED TREATMENT SYSTEM
TO TREAT EAST HALF OF WEST BAY ROAD
AND PROPOSED ON-SITE ROADWAY

OUTLET TO PUGET SOUND

ENHANCED TREATMENT SYSTEM
TO TREAT EAST HALF OF WEST BAY ROAD
AND PROPOSED ON-SITE ROADWAY

OUTLET TO PUGET SOUND

PROPOSED V-DITCH

EXISTING TREATMENT SYSTEM

EXISTING TREATMENT SYSTEM

EXISTING TREATMENT SYSTEM

BASED ON SURVEY
IT IS UNKNOWN WHERE THIS
DRAIN PIPE COMES FROM

WOODARD AVE ROW

0 40 80
SCALE IN FEET

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EXISTING DRAINAGE PATTERNS
WEST BAY YARDS MULTIFAMILY, OLYMPIA, WA

EXHIBIT No: **EX-04**

SHEET No: **4**

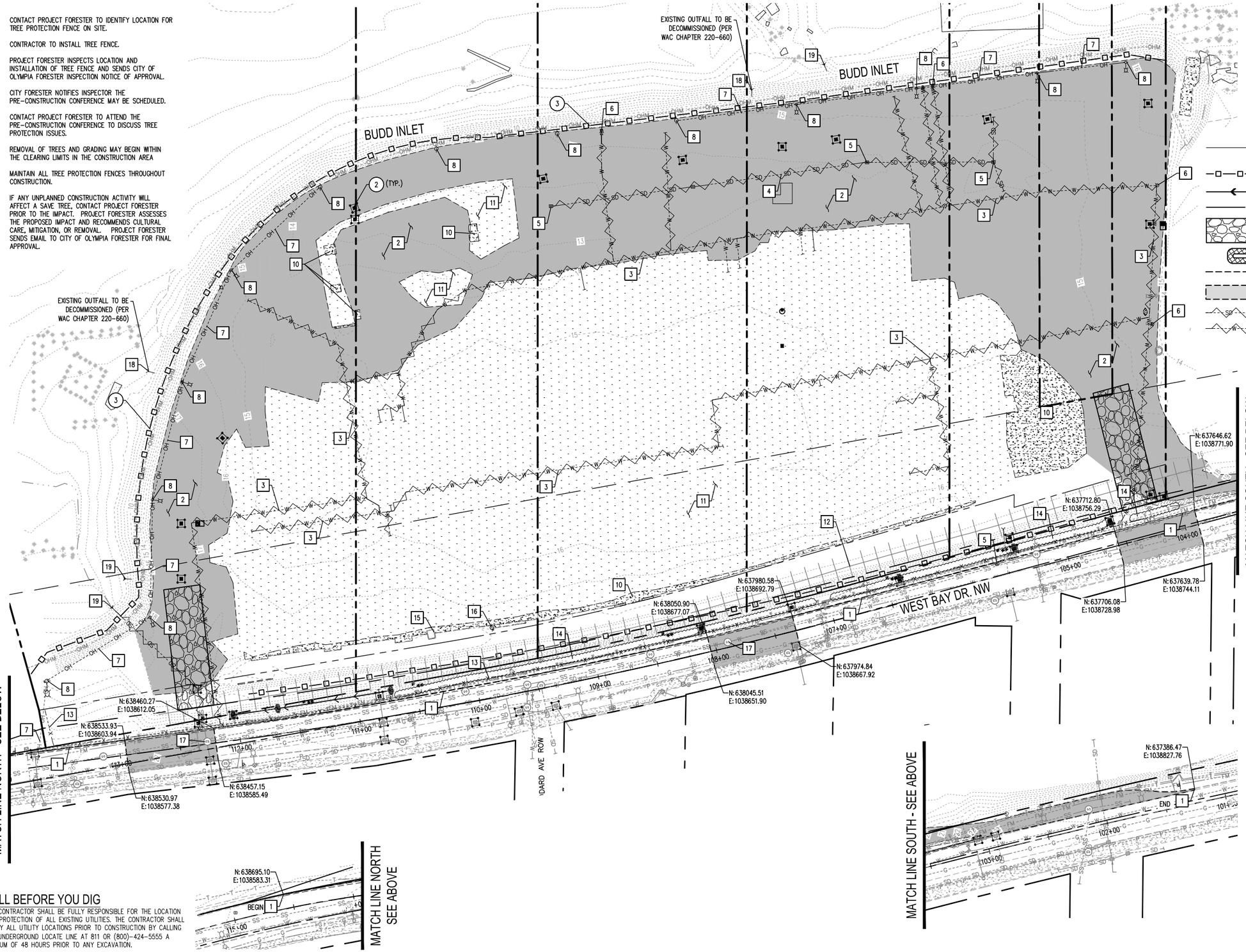
Sep 18, 2024 - 3:14:11pm - User: rikki.moorhead
N:\PROJECTS\3264 MILESTONES COMPANIES\3264.02 WEST BAY MULTI-FAMILY\CADD\EXHIBITS\STORMWATER\3264.02 PROPOSED DRAINAGE FLOWS.DWG

APPENDIX 4
PRELIMINARY CONSTRUCTION PLANS

TIMELINE FOR TREE PROTECTION FENCE INSTALLATION:

1. CONTACT PROJECT FORESTER TO IDENTIFY LOCATION FOR TREE PROTECTION FENCE ON SITE.
2. CONTRACTOR TO INSTALL TREE FENCE.
3. PROJECT FORESTER INSPECTS LOCATION AND INSTALLATION OF TREE FENCE AND SENDS CITY OF OLYMPIA FORESTER INSPECTION NOTICE OF APPROVAL.
4. CITY FORESTER NOTIFIES INSPECTOR THE PRE-CONSTRUCTION CONFERENCE MAY BE SCHEDULED.
5. CONTACT PROJECT FORESTER TO ATTEND THE PRE-CONSTRUCTION CONFERENCE TO DISCUSS TREE PROTECTION ISSUES.
6. REMOVAL OF TREES AND GRADING MAY BEGIN WITHIN THE CLEARING LIMITS IN THE CONSTRUCTION AREA
7. MAINTAIN ALL TREE PROTECTION FENCES THROUGHOUT CONSTRUCTION.
8. IF ANY UNPLANNED CONSTRUCTION ACTIVITY WILL AFFECT A SAVE TREE, CONTACT PROJECT FORESTER PRIOR TO THE IMPACT. PROJECT FORESTER ASSESSES THE PROPOSED IMPACT AND RECOMMENDS CULTURAL CARE, MITIGATION, OR REMOVAL. PROJECT FORESTER SENDS EMAIL TO CITY OF OLYMPIA FORESTER FOR FINAL APPROVAL.

SEC. 10, T18N., R2W., W.M.



0 40 80
SCALE IN FEET

LEGEND

- INLET SEDIMENT PROTECTION
- SILT FENCE
- SWALE
- CLEARING AND GRADING LIMITS
- STABILIZED CONSTRUCTION ENTRANCE
- SEDIMENT TRAP
- SAWCUT
- EXISTING ASPHALT AND BASE TO BE REMOVED
- EXISTING STORM LINE TO BE REMOVED
- EXISTING WATER LINE TO BE REMOVED

(XX) EROSION CONTROL NOTES:

1. STABILIZED CONSTRUCTION ENTRANCE
2. INLET SEDIMENT PROTECTION
3. SILT FENCE

(XX) DEMOLITION NOTES:

1. REMOVE EXISTING CURB
2. REMOVE EXISTING PAVEMENT
3. REMOVE EXISTING WATER MAIN
4. REMOVE EXISTING STORM LINE
5. EXISTING CATCH BASIN TO BE REMOVED AND BACKFILLED TO 95% COMPACTION
6. REMOVE EXISTING FIRE HYDRANT
7. REMOVE EXISTING OVERHEAD POWER
8. REMOVE EXISTING UTILITY POLE
9. REMOVE EXISTING TREE
10. REMOVE EXISTING CONCRETE AND BASE
11. REMOVE EXISTING GRAVEL
12. REMOVE EXISTING RAILROAD TRACKS
13. REMOVE EXISTING FENCE
14. REMOVE EXISTING VEGETATION
15. REMOVE EXISTING CONCRETE RETAINING WALL
16. EXISTING UTILITY POLE TO BE REMOVED
17. PROTECT EXISTING MANHOLE, RAISE RIM TO PROPOSED GRADE
18. REMOVE EXISTING STORM DRAIN AND BACKFILL TO 95% COMPACTION.
19. REMOVE EXISTING STORM DRAIN AND INSTALL NEW STORM DRAIN IN SAME LOCATION.

DEMOLITION NOTE:

REMOVE EXISTING UTILITIES THAT ARE UN-MARKED OR PREVIOUSLY ABANDONED

CALL BEFORE YOU DIG

THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR THE LOCATION AND PROTECTION OF ALL EXISTING UTILITIES. THE CONTRACTOR SHALL VERIFY ALL UTILITY LOCATIONS PRIOR TO CONSTRUCTION BY CALLING THE UNDERGROUND LOCATE LINE AT 811 OR (800)-424-5555 A MINIMUM OF 48 HOURS PRIOR TO ANY EXCAVATION.

BY	DATE	REVISIONS

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SHEET TITLE: DEMO AND TESC PLAN

PROJECT NAME: WEST BAY YARDS DEVELOPMENT
OLYMPIA, WASHINGTON

SEAL: WHITNEY G. HOLM, STATE OF WASHINGTON, 49811, REGISTERED PROFESSIONAL ENGINEER
09/19/2024

DESIGNER:	E. MARTINEZ
DRAWN BY:	S. ORDONEZ
APPROVED BY:	W. HOLM
DATE:	SEPTEMBER 2024
JOB NO:	3264.02
DRAWING FILE NO:	3264.02 EC-01
DRAWING NO:	EC-01
SHEET NO:	8 OF 25

Sep 18, 2024 - 1:35:29pm - User kyle.ams
N:\PROJECTS\3264 MILESTONES COMPANIES\3264.02 WEST BAY MULTI-FAMILY\CADD\3264.02 EC-01.DWG

Attachment 11.A

SEC. 10, T18N., R2W., W.M.

NOTE:

REFER TO SHEET EC-01 FOR INFORMATION REGARDING DECOMMISSIONING EXISTING OUTFALLS

EMERGENCY VEHICLE ACCESS DOES NOT REQUIRE TREATMENT

EXISTING OUTFALL TO BE DECOMMISSIONED (PER WAC CHAPTER 220-660)

EXISTING OUTFALL TO BE RECONSTRUCTED

CB #1
N:638177.22
E:1039058.67
CATCH BASIN TYPE 1
RIM:14.67
IE IN:13.08 (12" N)
IE OUT:13.08 (12" S)

CB #2
N:637980.83
E:1038700.13
CATCH BASIN TYPE 1
RIM:27.74
IE IN:24.04 (12" N)
IE OUT:24.04 (12" S)

CB #3
N:637891.16
E:1038719.62
CATCH BASIN TYPE 1
RIM:26.40
IE IN:23.32 (12" N)
IE OUT:23.32 (12" S)

CB #4
N:637796.12
E:1038743.26
CATCH BASIN TYPE 1
RIM:24.10
IE IN:22.52 (12" N)
IE OUT:22.52 (12" S)

CB #5
N:637716.66
E:1038765.04
CATCH BASIN TYPE 1
RIM:25.25
IE IN:22.07 (12" N)
IE OUT:22.07 (12" SE)

CB #6
N:637671.57
E:1038784.14
CATCH BASIN TYPE 1
RIM:25.11
IE IN:21.83 (12" NW)
IE OUT:21.83 (12" E)

CB #7
N:637676.67
E:1039108.53
CATCH BASIN TYPE 1
RIM:16.07
IE IN:12.69 (12" W)
IE OUT:12.69 (12" N)

CB #8
N:637809.53
E:1039098.86
CATCH BASIN TYPE 1
RIM:15.18
IE IN:12.02 (12" S)
IE IN:12.02 (12" N)

CB #9
N:637934.89
E:1039085.16
PRETREAMENT HYDRODYNAMIC DEVICE
RIM:13.03
IE IN:11.45 (12" N)
IE OUT:11.39 (12" S)
IE OUT:11.39 (12" E)

CB #10
N:638061.76
E:1039071.29
CATCH BASIN TYPE 1
RIM:14.08
IE IN:12.50 (12" N)
IE OUT:12.50 (12" S)

CB #11
N:638177.22
E:1039058.67
CATCH BASIN TYPE 1
RIM:14.67
IE IN:13.08 (12" N)
IE OUT:13.08 (12" S)

CB #12
N:638333.40
E:1039038.51
CATCH BASIN TYPE 1
RIM:15.46
IE IN:13.87 (12" W)
IE OUT:13.87 (12" S)

CB #13
N:638333.45
E:1039028.93
CATCH BASIN TYPE 1
RIM:15.50
IE OUT:13.92 (12" E)

CB #14
N:638484.08
E:1038736.00
CATCH BASIN TYPE 1
RIM:21.65
IE IN:13.33 (12" E)
IE OUT:13.33 (12" N)

CB #15
N:638482.96
E:1038781.65
CATCH BASIN TYPE 1
RIM:19.55
IE IN:13.56 (12" S)
IE OUT:13.56 (12" W)

CB #16
N:638447.20
E:1038851.24
CATCH BASIN TYPE 1
RIM:17.00
IE OUT:14.00 (12" W)

CB #17
N:638469.22
E:1038620.40
CATCH BASIN TYPE 1
RIM:27.29
IE IN:22.85 (12" S)
IE OUT:22.85 (12" E)

CB #18
N:638443.88
E:1038622.73
CATCH BASIN TYPE 1
RIM:27.96
IE OUT:22.98 (12" N)

CB #19
N:638472.83
E:1038616.55
CATCH BASIN TYPE 1
W/ SOLID LID
RIM:25.78
IE IN:21.73 (12" S)
IE OUT:21.73 (12" E)

CB #20
N:638322.81
E:1038635.14
CATCH BASIN TYPE 1
W/ SOLID LID
INTERCEPT EX. STORM PIPE
RIM:26.33
IE OUT:22.49 (12" N)

CB #21
N:637799.44
E:1038753.25
CATCH BASIN TYPE 1
W/ SOLID ANTI-SLIP LID
INTERCEPT EXISTING STORM PIPE
RIM:26.29
IE OUT:23.30 (12" S)

CB #22
N:637682.56
E:1038785.76
CATCH BASIN TYPE 1
W/ SOLID LID
RIM:25.46
IE IN:22.69 (12" N)
IE OUT:22.69 (12" E)

CB #23
N:637677.72
E:1039009.00
CATCH BASIN TYPE 1
W/ SOLID LID
RIM:15.52
IE IN:13.19 (12" W)
IE IN:13.19 (12" S)
IE OUT:13.19 (12" E)

CB #24
N:637983.47
E:1038915.92
CATCH BASIN TYPE 1
RIM:26.51
IE OUT:23.50 (12" E)

CB #25
N:637979.38
E:1039080.29
CATCH BASIN TYPE 1
RIM:14.66
IE IN:11.67 (12" N)
IE IN:11.67 (12" W)
IE OUT:11.67 (12" S)

MWS #1
N:637666.91
E:1039008.92
MODULAR WETLAND
SEE DETAIL ON SHEET SD-02
RIM:15.21
IE IN:13.74 (12" W)
IE OUT:13.24 (12" N)

MWS #2
N:638469.13
E:1038781.33
MODULAR WETLAND
SEE DETAIL ON SHEET SD-02
RIM:18.26
IE IN:13.63 (12" E)
IE IN:13.63 (12" W)
IE OUT:13.63 (12" N)

MWS #3
N:637982.77
E:1038944.53
MODULAR WETLAND
RIM:26.47
IE IN:23.29 (12" W)
IE OUT:21.00 (12" E)

EX. CB 3076
N:638472.83
E:1038644.38
CONNECT TO EX. CATCH BASIN
ADJUST RIM TO PROPOSED GRADE
RIM:25.78
IE IN:21.59 (12" W)
IE IN:21.59 (12" NE)

EXISTING 8" CPP CULVERT TO REMAIN
IE:10.29

62 LF OF 12" @ 13.21%
45 LF OF 12" @ 0.50%
126 LF OF 12" @ 0.50%
133 LF OF 12" @ 0.50%
83 LF OF 12" @ 1.00%
116 LF OF 12" @ 0.50%
157 LF OF 12" @ 0.50%
10 LF OF 12" @ 0.50%
14 LF OF 12" @ 0.50%
73 LF OF 12" @ 0.50%
46 LF OF 12" @ 0.50%
46 LF OF 12" @ 17.94%
91 LF OF 12" @ 17.07%
161 LF OF 12" @ 5.57%
28 LF OF 12" @ 0.50%
151 LF OF 12" @ 0.50%
25 LF OF 12" @ 0.50%
136 LF OF 12" @ 6.87%
29 LF OF 12" @ 0.74%
11 LF OF 12" @ 0.50%
233 LF OF 12" @ 4.25%
233 LF OF 12" @ 3.60%
49 LF OF 12" @ 0.50%
121 LF OF 12" @ 0.50%
82 LF OF 12" @ 0.50%
98 LF OF 12" @ 0.82%
92 LF OF 12" @ 0.78%
77 LF OF 12" @ 0.50%
100 LF OF 12" @ 0.50%

INSTALL TRENCH DRAIN
INSTALL 180 LF 6" @ 0.50% MIN. SLOPE
INSTALL 177 LF 6" @ 0.50% MIN. SLOPE
INSTALL 160 LF 6" @ 0.50% MIN. SLOPE DAYLIGHT INTO DITCH ALONG WEST BAY DR.
INSTALL 18 LF 6" @ 0.50% MIN. SLOPE
INSTALL CURB CUT WITH RIP RAP TO COLLECT ROADWAY RUNOFF
V-DITCH

FFE:26.00

WOODARD AVE ROW

WEST BAY DR NW

0 40 80
SCALE IN FEET

LEGEND

- XX — EXISTING CONTOURS (MAJOR/MINOR)
- XX — PROPOSED CONTOURS (MAJOR/MINOR)
- SD — STORM PIPE
- RD — ROOF DRAIN
- FD — FOUNDATION DRAIN
- TYPE 1 CATCH BASIN
- TYPE 2 CATCH BASIN

NOTES:

1. ALL SPOT ELEVATIONS ARE TO TOP OF PAVEMENT UNLESS OTHERWISE NOTED.
2. ALL CATCH BASINS ARE STATIONED TO THE CENTER OF GRATE.

CALL BEFORE YOU DIG

THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR THE LOCATION AND PROTECTION OF ALL EXISTING UTILITIES. THE CONTRACTOR SHALL VERIFY ALL UTILITY LOCATIONS PRIOR TO CONSTRUCTION BY CALLING THE UNDERGROUND LOCATE LINE AT 811 OR (800)-424-5555 A MINIMUM OF 48 HOURS PRIOR TO ANY EXCAVATION.

Sep 18, 2024 - 1:39:32pm - User: kyle.ems
N:\PROJECTS\3264 MILESTONES COMPANIES\3264.02 WEST BAY MULTI-FAMILY\CADD\3264.02 SD-01.DWG

BY	DATE	REVISIONS

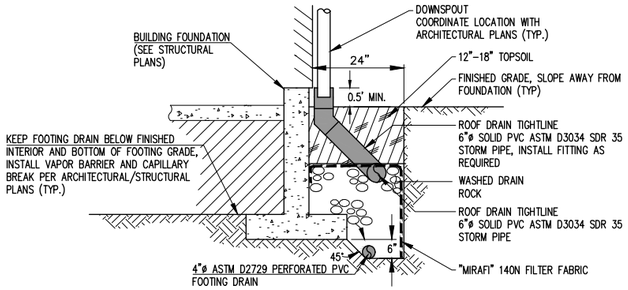
SCJ ALLIANCE
CONSULTING SERVICES
8730 TALLON LANE NE, SUITE 200, LACEY, WA 98516
P: 360.352.1465 F: 360.352.1509
SCJALLIANCE.COM

SHEET TITLE: DRAINAGE PLAN

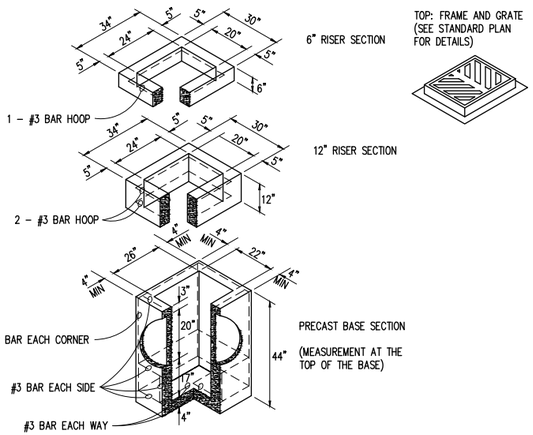
PROJECT NAME: WEST BAY YARDS DEVELOPMENT
OLYMPIA, WASHINGTON

SEAL:
WHITNEY G. HOLM
STATE OF WASHINGTON
22811
REGISTERED
PROFESSIONAL ENGINEER
09/19/2024

DESIGNER:	E. MARTINEZ
DRAWN BY:	M. DOBBS
APPROVED BY:	W. HOLM
DATE:	SEPTEMBER 2024
JOB NO:	3264.02
DRAWING FILE NO:	3264.02 SD-01
DRAWING NO:	SD-01
SHEET NO:	13 OF 25



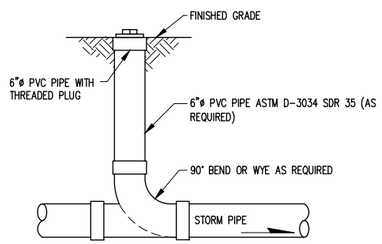
FOOTING AND ROOF DRAIN DETAIL
NTS



NOTES:

1. CATCH BASINS TO BE CONSTRUCTED IN ACCORDANCE WITH ASTM C 478 (AASHTO M 199) AND ASTM C 890, UNLESS OTHERWISE SHOWN ON PLANS OR NOTED IN THE STANDARD SPECIFICATIONS.
2. AS AN ACCEPTABLE ALTERNATE TO REBAR, WELDED WIRE FABRIC HAVING A MINIMUM AREA OF 0.12 SQUARE INCHES PER FOOT MAY BE USED. WELDED WIRE FABRIC SHALL COMPLY TO ASTM A 497 (AASHTO M 221). WIRE FABRIC SHALL NOT BE PLACED IN THE KNOCKOUTS.
3. THE BOTTOM OF THE PRECAST BASE SECTION MAY BE ROUNDED.
4. PRECAST BASES SHALL BE FURNISHED WITH CUTOUTS OR KNOCKOUTS. KNOCKOUTS SHALL HAVE A WALL THICKNESS OF 2 INCHES MINIMUM. KNOCKOUTS MAY BE ON ALL 4 SIDES EITHER ROUND OR "D" SHAPE. PIPE TO BE INSTALLED IN FACTORY SUPPLIED KNOCKOUTS. KNOCKOUT OR CUTOUT HOLE SIZE IS EQUAL TO PIPE OUTER DIAMETER PLUS CATCH BASIN WALL THICKNESS (20 INCHES MAXIMUM).
5. THE MAXIMUM DEPTH FROM THE FINISHED GRADE TO THE PIPE INVERT IS 5 FEET.
6. THE TAPER ON THE SIDES OF THE PRECAST BASE SECTION AND RISER SECTION SHALL NOT EXCEED 0.5 INCHES PER FOOT.
7. FRAME AND GRATE MAY BE INSTALLED WITH FLANGE DOWN OR CAST INTO RISER.

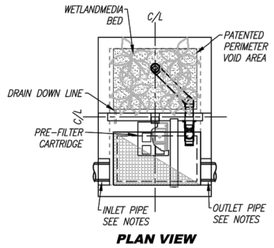
CATCH BASIN TYPE 1
NTS



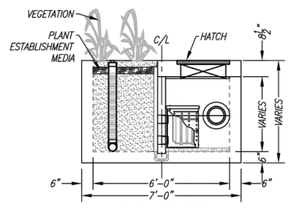
STORM DRAIN CLEANOUT DETAIL
NTS

SITE SPECIFIC DATA			
PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.073	
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PEDESTRIAN		
FRAME & COVER	24" X 42"	OPEN PLANTER	N/A
NOTES:			

* PRELIMINARY NOT FOR CONSTRUCTION



PLAN VIEW



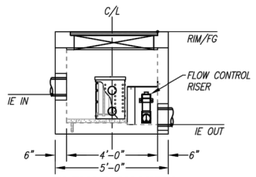
LEFT END VIEW

INSTALLATION NOTES

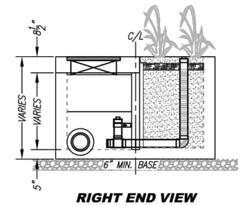
1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL PIPES SHALL BE SEALED WATER TIGHT PER MANUFACTURERS STANDARD CONNECTION DETAIL.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING BIO CLEAN FOR ACTIVATION OF UNIT. MANUFACTURERS WARRANTY IS VOID WITH OUT PROPER ACTIVATION BY A BIO CLEAN REPRESENTATIVE.

GENERAL NOTES

1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT BIO CLEAN.



ELEVATION VIEW



RIGHT END VIEW

TREATMENT FLOW (CFS)	0.073
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	1.3
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

Bio Clean — A Forterra Company

MWS-L-4-6-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

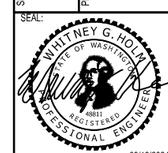
REVISIONS	DATE	BY
1		

SCJ ALLIANCE
CONSULTING SERVICES
8730 TALLON LANE NE, SUITE 200, LACEY, WA 98516
P: 360.352.1465 F: 360.352.1509
SCJALLIANCE.COM

SHEET TITLE: DRAINAGE DETAILS

PROJECT NAME: WEST BAY YARDS DEVELOPMENT
OLYMPIA, WASHINGTON

"SEAL:"



09/19/2024

DESIGNER:	E. MARTINEZ
DRAWN BY:	DRAWN BY
APPROVED BY:	W. HOLM
DATE:	SEPTEMBER 2024
JOB NO:	3264.02
DRAWING FILE NO:	3264.02 SD-02
DRAWING NO:	SD-02
SHEET NO:	15 OF 25

APPENDIX 5
GEOTECHNICAL REPORT

Technical Memorandum

TO: Brandon Smith, Milestone Companies West Bay Development Group, LLC

FROM: Daniel Simpson, PE, and Calvin McCaughan, PE

DATE: August 27, 2020

RE: **Preliminary Geotechnical Engineering Recommendations**
West Bay Yards
Olympia, Washington
Project No. 1912001.010.011

Introduction

This memorandum summarizes the results of geotechnical engineering services provided by Landau Associates, Inc. (LAI) in support of the West Bay Yards project, located at 1210 West Bay Drive Northwest in Olympia, Washington (site; Figure 1). LAI's findings will be used to facilitate selection of a foundation type.

Based on the subsurface data collected during LAI's geotechnical investigation, the site is underlain by liquefiable soil, soft soil, and wood debris. The geotechnical implications of these finding are as follows:

- Seismically induced soil liquefaction could cause 5 to 10 feet (ft) of lateral spreading. This degree of ground displacement is more than shallow or deep foundations, alone, typically can withstand. Without mitigation, lateral spreading could result in structural collapse.
- To mitigate the effects of soil liquefaction and lateral spreading, structures could be supported by deep foundations coupled with limited ground improvement (GI) or by shallow foundations coupled with site-wide GI.
- LAI has provided parameters for estimating costs associated with foundation support and GI. A GI contractor also should be consulted.
- Before a GI contractor is consulted, the performance objective for GI (limit lateral spreading to 12 inches and vertical seismic settlement to 1 inch) should be reviewed with the structural engineer.
- Wood debris in site soils could lead to continued long-term settlement, which could cause rigid site features to crack or tilt. Site-wide GI could mitigate this risk.
- Without GI or pile support, wood debris and soft soil are likely to cause significant static settlement of heavily loaded shallow foundations.

Site and Project Description

Milestone Companies West Bay Development Group, LLC (project owner) proposes to develop the site with ten six-story, mixed-use buildings; a single-level, daylight-basement parking garage; a public plaza; and an esplanade. Construction will be performed in multiple phases. LAI understands that the

first phase will include general site improvements as well as construction of the parking garage and two mixed-use buildings.

The site elevation is approximately 12 ft lower than the elevation of the main access point (i.e., West Bay Drive Northwest). The finished floor elevation of the new buildings will approximate the elevation of West Bay Drive Northwest. Two to three feet of fill will be used to raise site grades, and the daylight parking garage (daylighted on the side of the site nearest Budd Inlet) will make up the difference.

The site consists of approximately 6.7 acres of upland and 11.1 acres of tideland. Between 1924 and 1951, the site was occupied by various logging and timber companies. The most recent tenant was a plywood manufacturing business. In 1996, nearly all infrastructure at the site was destroyed in a fire. The site was the subject of a 2007 agreed order between the Washington State Department of Ecology (Ecology) and the former owner, Hardel Mutual Plywood Corporation. A site cleanup was completed in 2010; during the cleanup, contaminated site soils were excavated and replaced with fill (Greylock Consulting LLC 2007). Ecology issued a no further action determination in 2012.

Surface Conditions

The site is generally level and is situated at an elevation of 13 to 14 ft North American Vertical Datum of 1988 (NAVD88; the elevation datum used herein). The site is bordered by industrial development to the north and south, by West Bay Drive Northwest and residential development to the west, and by Budd Inlet to the east.

West Bay Drive is situated at an elevation of 23 to 24 ft. The roadway embankment slopes at approximately 1.75 horizontal to 1 vertical (1.75H:1V) and meets a former rail spur grade, located approximately 2 ft below the site grade. The rail spur parallels West Bay Drive; former concrete railcar loading docks are located along the east side of the spur.

The remainder of the site is surfaced with construction/demolition debris, aggregate, asphalt, sparse vegetation, and occasional abandoned concrete foundations. The west edge of the site consists of a riprap (approximately one-man boulder and smaller)-protected, 2H:1V slope. The slope meets a tide flat, located at an approximate elevation of 0 ft. The tide flat is assumed to slope approximately 5 percent to the west, based on bathymetric data provided by the U.S. Army Corps of Engineers (2019). Mean sea level (MSL) near the site is 4.32 ft; mean highest high water (MHHW) is 10.53 ft; and mean lowest low water (MLLW) is −4.03 ft (NOAA; accessed May 18, 2020).

Subsurface Conditions

LAI explored site subsurface conditions on May 4 through May 6, 2020 by advancing eight test pits, two hollow-stem auger borings, and four cone penetration tests (CPTs). The approximate locations of

the explorations are shown on Figure 2. Representative soil samples were collected from the explorations and transported to LAI's soils laboratory for further examination and testing. Details about the field explorations are included in Attachment 1; details about the geotechnical laboratory testing program are included in Attachment 2.

Generalized site subsurface conditions are shown on Figure 3 and include the following engineering stratigraphic units (ESUs):

- **ESU 1:** undocumented fill;
- **ESU 2:** wood debris;
- **ESU 3:** very soft to soft, fine-grained, cohesive/plastic native soil;
- **ESU 4:** very loose to loose, non-plastic silt or sandy native soil; and
- **ESU 5:** very dense glacially consolidated soil.

ESU 1. The site is capped with approximately 8 to 12 ft of undocumented fill. During the 2010 site cleanup, soils in contamination hotspots were excavated and replaced with fill that consisted of sandy gravel to gravelly sand. Based on site observations and cleanup documentation, some of the fill also consisted of crushed concrete. Surface fill that was not placed during the 2010 site cleanup generally consists of silt or sand with gravel and debris. This fill was also found to contain occasional larger debris, such as concrete blocks and timber piles. Typical ESU 1 spoils from the test pit excavations are shown on Figures 4a through 4j.

ESU 2. An approximately 4- to 18-ft-thick layer of wood debris was encountered beneath ESU 1. This layer was encountered in all explorations that extended beyond the bottom of ESU 1. The wood debris generally consisted of sawdust- to wood chip-sized particles, mixed with mineral soil. Samples of ESU 2 typically could not be collected with a standard split-spoon sampler, but were recovered with a modified California sampler. Typical ESU 2 material is shown on Figures 5a and 5b.

ESU 3. Soils beneath the wood debris are interpreted to be native to the site. ESU 3 was classified based on a normalized soil behavior-type index (I_c, Robertson 2010). ESU 3 is interpreted to be a very soft to soft, clay-like (plastic fines) material ($I_c \approx 3$) with occasional interbeds of silty or sandy material.

ESU 4. ESU 4 consists of very loose to loose, non-plastic silt and sand mixtures ($I_c \approx 2.4$) with occasional interbeds of medium dense silt, sand, and gravel mixtures. ESU 4 was classified based on I_c and on split-spoon samples collected from borings B-1 and B-2. The split-spoon samples contained shell fragments and occasional wood debris.

ESU 5. ESU 5 is interpreted to be very dense glacially consolidated soil. This unit is the likely cause of the refusal encountered in all four CPT soundings.

The groundwater gradient at the site is oriented west to east (Greylock Consulting LLC 2007). LAI's site observations corroborate this orientation. At the time of LAI's field investigation, surface water was accumulating within the depressed rail spur along the west edge of the site. Groundwater in this area likely fluctuates between MSL and a few feet below ground surface, depending on the season. Groundwater in areas closer to Budd Inlet is likely influenced by tidal stage.

Seismic Design Parameters

LAI performed a ground motion hazard analysis (GMHA) in general accordance with Chapter 21 of the American Society of Civil Engineers' *Minimum Design Loads for Buildings and Other Structures* (ASCE-7; 2011). The results of the GMHA were used to estimate seismic design parameters for a 2018 International Building Code-level earthquake (2 percent in 50-year probability of exceedance). The design parameters are summarized in the following table. Because a GMHA was performed, the exceptions for Site Class E, noted in Section 11.4.8 of ASCE 7, need not be observed.

Site-adjusted maximum considered earthquake peak ground acceleration (PGA_M)	0.67 g
Site-specific, risk-targeted maximum considered earthquake (MCE_R) short-period spectral ordinate (S_{MS})	1.35 g
Site-specific, MCE_R 1-second spectral ordinate (S_{M1})	1.68 g
Recommended MCE_R moment magnitude	7.95

Liquefaction Considerations

Liquefaction is a seismic hazard in which ground shaking causes saturated sands and low-plasticity silts to lose shear strength. Liquefaction can lead to bearing capacity failures, ground settlement, and lateral ground displacement (lateral spreading). LAI evaluated liquefaction susceptibility using the Bray and Sancio (2006) plasticity criteria and an I_c liquefaction cutoff ($I_{c,liq}$) of 2.8 (based on a correlation between site-specific and regional plasticity testing and measured I_c). Based on these criteria, ESU 1 and ESU 4 are susceptible to liquefaction. LAI used the Boulanger and Idriss (2014) empirical method to determine the safety factor against liquefaction for the maximum considered earthquake ground motion parameters (peak ground acceleration and moment magnitude). LAI completed Newmark sliding block analyses to estimate lateral spreading displacements.

The results of LAI's analyses indicate that liquefaction is likely to occur in the saturated portions of ESU 1 and ESU 4 during a design-level earthquake. Thin to medium dense lenses in ESU 4 may not liquefy during a design-level earthquake. Soil liquefaction could cause approximately 2 to 10 inches of free-field vertical ground settlement (increasing toward Budd Inlet) as well as 5 to 10 ft of lateral spreading near the eastern edge of the proposed buildings.

Foundation Support

LAI concludes that lateral spreading is likely to cause deep foundation elements to yield beyond the limits set forth in Section 12.13.9 of ASCE 7-16. Therefore, GI is recommended. Deep, large-diameter drilled shafts could be used to support structures, but are unlikely to be as cost-effective as GI. Foundation support could be provided with one of the two methods described below.

GI buttress with deep foundations. With this approach, GI would be installed along a swath, approximately 50 to 75 ft wide and 700 to 800 ft long. The swath would be located along the upland area of the site, immediately adjacent to Budd Inlet. GI would be used to buttress the site and reduce lateral spreading. Structures would likely require deep foundations, such as driven piles, to mitigate static and liquefaction settlement. For the purpose of cost-estimating, LAI has assumed that open-end pipe piles, with 16-inch diameters and ⅜-inch-thick walls, will be driven 10 ft into ESU 5 and will have an allowable bearing capacity of 250 kips. (Refer to Figure 3 for estimated pile lengths.)

Site-wide GI with shallow foundations. With this approach, GI would be installed across most of the site to reduce the risk of lateral spreading, vertical liquefaction settlement, and static settlement. Structures could be founded on shallow spread footings or slabs-on-grade, and GI could be concentrated under heavily loaded columns to increase bearing capacity locally. Allowable bearing capacities on the order of 3 to 4 kips per square foot could be achievable.

Ground Improvement Overview

There are many types of generic and proprietary GI, each suited to particular site conditions and performance objectives. LAI recommends consulting GI or foundation contractors to determine cost-effective GI methods for this project. With a typical design-build project, a GI design is completed by a specialty contractor and reviewed by the geotechnical engineer of record. LAI can complete a GI design if a traditional design-bid-build approach is desired.

Types of GI include the drainage type (which decreases soil pore drainage length to prevent liquefaction), the densification type (which densifies soil to make it stronger and prevent liquefaction), and the reinforcement type (which reinforces soil with stiff elements to mitigate the effects of liquefaction).

Considering the high fines content of the liquefiable soil layers, reinforcement is likely the only applicable GI type for the site. In soils with high fines content, drainage is not a reliable method for long-term liquefaction mitigation. Densification is typically unsuccessful in soils with a significant fines content.

The following GI-reinforcement methods could be implemented at the site: rigid inclusions (typically drilled piles filled with unreinforced grout), soil mixing (soil mixed with cement using a mechanical

tool), and jet grouting (a soil-cement mixture created with a subterranean, rotating jet of grout). Rigid inclusions and soil mixing could be implemented throughout the site to mitigate the effects of liquefaction and provide a relatively high bearing capacity for shallow foundation support. Jet grouting, coupled with deep foundations, could be used to buttress the site.

Based on conversations with Pioneer Technologies (project environmental consultant), LAI understands that soils cleanup levels for unrestricted land use have been achieved. Pioneer Technologies should be included in discussions with GI contractors to determine the cost implications, if any, of disposing of spoils.

Ground Improvement Design

The following preliminary information is intended to facilitate GI design; it will be updated after the geotechnical engineering report has been completed:

1. Performance objectives:
    a. Allowable bearing capacity: Minimum 4 kips per square foot beneath footings, less than 1 inch of settlement at the allowable load.
    b. Seismic displacements: Limit lateral spreading to 12 inches or less at the leading edge of the buildings. Limit seismic differential settlement to the thresholds in Table 12.13-3 of ASCE 7-16 (assume multi-story structure with concrete or masonry wall systems).
2. Minimum extents:
    a. At least 30 percent of the building height beyond the edge of foundations, except at the west edge of the property (may be less along the west edge due to geologic conditions and property constraints).
3. Design constraints:
    a. $I_{c,liq}$ (liquefaction cut-off I_c) should be taken as 2.8, unless additional site-specific plasticity or cyclic simple shear testing indicates otherwise.
    b. ESU 2 (wood debris) should be assumed to have a unit weight of 65 pounds per cubic foot, a friction angle of 30 degrees, and no cohesion. A considerable amount of strain would be required to reach peak strength. ESU 2 is considered non-liquefiable.
    c. Soil densification and accelerated drainage methods should not be considered.
    d. Assume a design groundwater elevation of 10 ft NAVD88 at the western property line, sloping to MSL (4.3 ft NAVD88) at the eastern property line. The design groundwater elevation could differ from actual groundwater elevations during construction.
    e. When using empirical liquefaction triggering calculations, soil deeper than 80 ft bgs can be excluded from potential liquefaction.

Use of This Technical Memorandum

Landau Associates has prepared this technical memorandum for the exclusive use of the Milestone Companies West Bay Development Group, LLC and the project design team for specific application to the West Bay Yards project in Olympia, Washington. No other party is entitled to rely on the information, conclusions, and recommendations included in this document without the express written consent of Landau Associates. Reuse of the information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by Landau Associates shall be at the user's sole risk. Landau Associates warrants that, within the limitations of scope, schedule, and budget, its services have been provided in a manner consistent with that level of skill and care ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions as this project. Landau Associates makes no other warranty, either express or implied.

Closing

We trust that this memorandum provides you with the information needed to proceed with the project. If you have questions or comments, please call the undersigned at (360) 791-3178.

LANDAU ASSOCIATES, INC.

Daniel Simpson, PE
Associate

Calvin McCaughan, PE
Principal

DCS/CAM/mcs
[Y:\1912\001.010\R\WEST BAY YARDS TECHNICAL MEMORANDUM 8.27.2020.DOCX]

Attachments: Figure 1. Vicinity Map
Figure 2. Site and Exploration Plan
Figure 3. Geologic Cross-Section A-A'
Figures 4a through 4j. Selected Site Photographs – Test Pit Explorations
Figures 5a and 5b. Selected Site Photographs – Wood Debris
Attachment 1. Field Explorations
Attachment 2. Laboratory Testing

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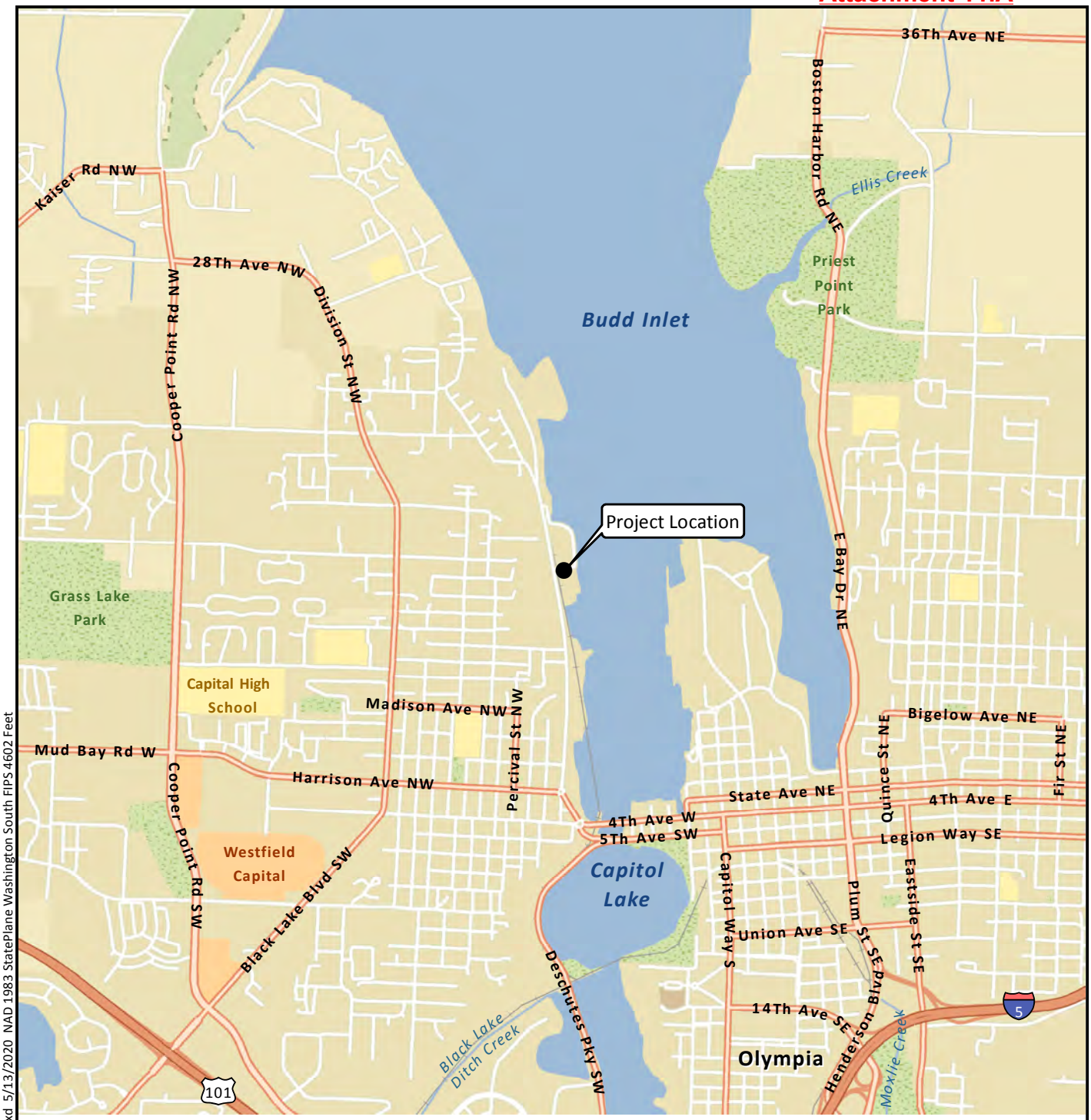
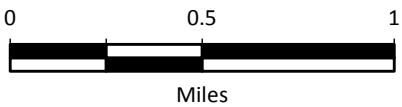
Attachment 11.A





Data Source: Esri 2012

G:\Projects\1912\001\010\011\F01 VicinityMap.mxd 5/13/2020 NAD 1983 StatePlane Washington South FIPS 4602 Feet

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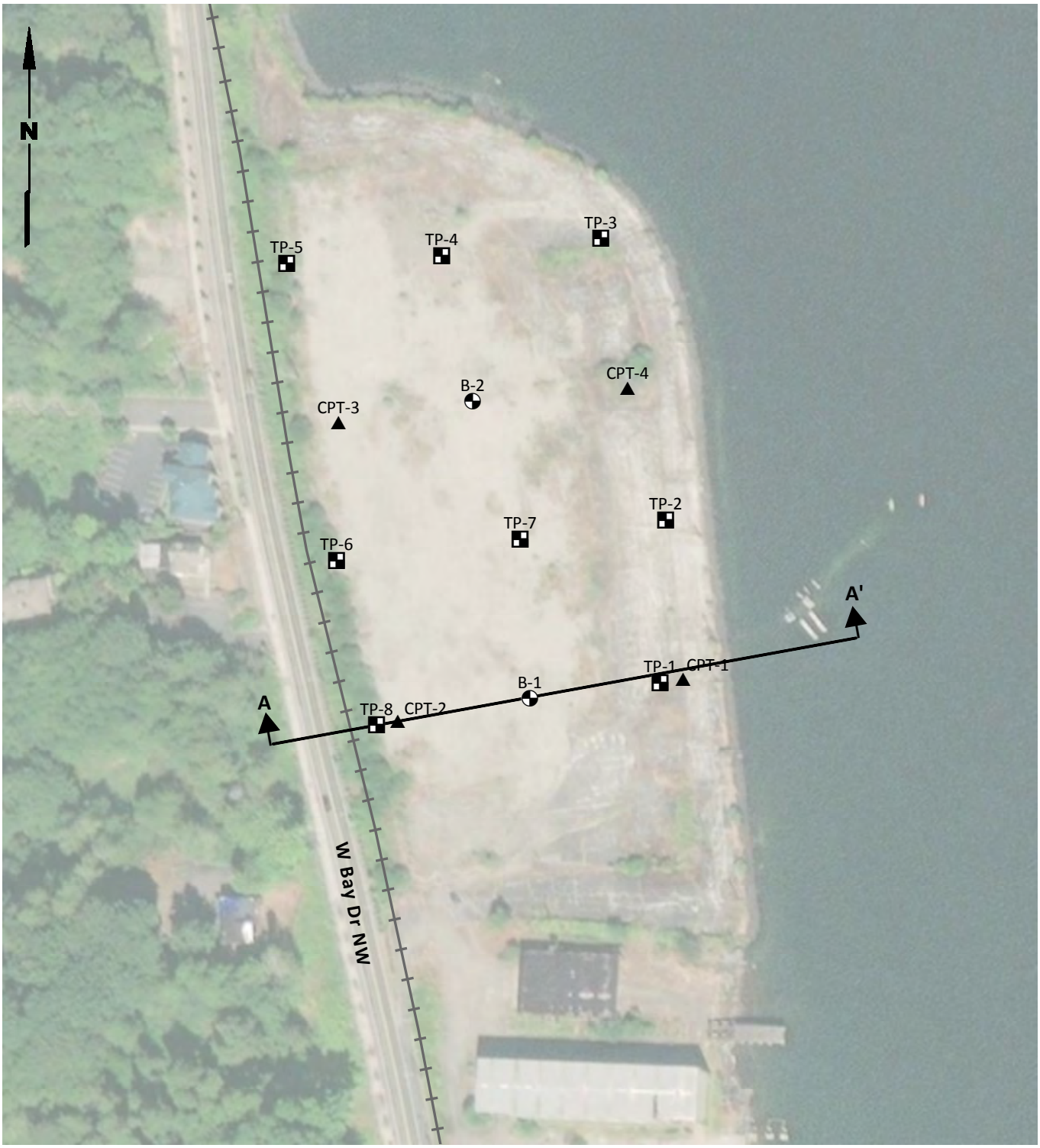
West Bay Yards Olympia, Washington	**Vicinity Map**	Figure 1



Legend

Cross Section
Boring
Cone Penetration Test
Test Pit

0 150 300
Feet

Note
1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Source: Esri 2012

G:\Projects\1912\001\010\011\F02 SiteExpPlan.mxd 5/22/2020 NAD 1983 StatePlane Washington South FIPS 4602 Feet

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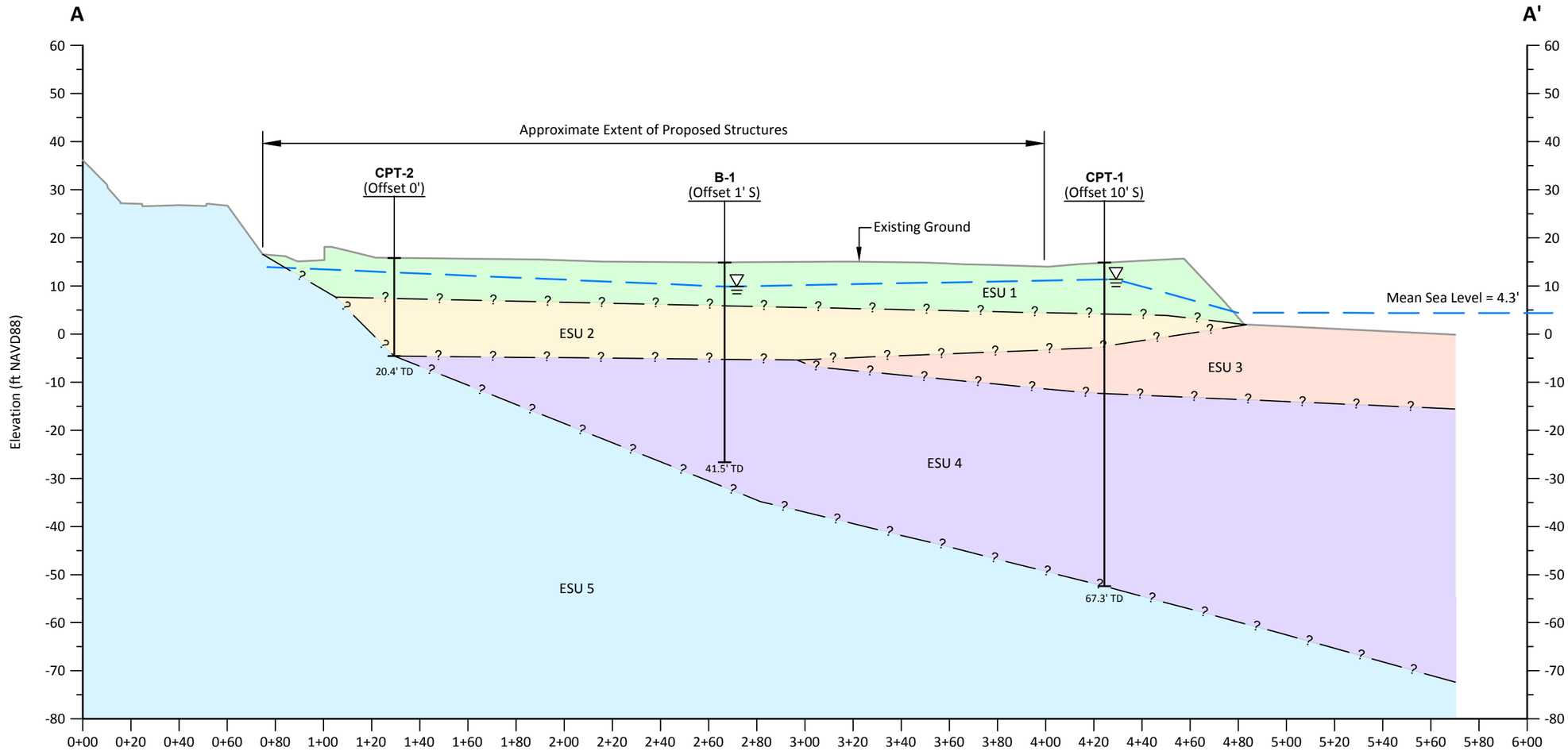
West Bay Yards Olympia, Washington	**Site and Exploration Plan**	Figure 2



Geologic Cross Section A-A'

Horizontal Scale in Feet: 1"=50'
Vertical Scale in Feet: 1"=25'

0 50 100
Scale in Feet

Legend

- **MW-1** — Project Exploration Designation
- (Offset 160' W) — Offset Distance in Feet and Direction
- Top of Exploration
- Groundwater Level (At time of drilling)
- Design Groundwater Table
- ? — Inferred Geologic Contact
- Bottom of Exploration
- 14' TD — Total Depth of Exploration

ESU 1	Loose to Medium Dense Undocumented Fill
ESU 2	Wood Debris
ESU 3	Very Soft to Soft Plastic/Cohesive Fine-grained Soil
ESU 4	Very Loose to Medium Dense Non-plastic Silt and Sand
ESU 5	Glacially Consolidated Soil

Notes

1. Refer to report text for complete interpretation of subsurface conditions.
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

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West Bay Yards Olympia, Washington	**Geologic Cross Section A-A'**	Figure 3

1. Test pit TP-1.

2. Test pit TP-1.

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West Bay Yards
Olympia, Washington

Selected Site Photographs

Figure
4a

3. Test pit TP-1.

4. Test pit TP-1.

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West Bay Yards Olympia, Washington	**Selected Site Photographs**	Figure 4b

5. Test pit TP-2.

6. Test pit TP-2.

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West Bay Yards Olympia, Washington	**Selected Site Photographs**	Figure 4c

7. Test pit TP-3.

8. Test pit TP-3.

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West Bay Yards
Olympia, Washington

Selected Site Photographs

Figure
4d

9. Test pit TP-4.

10. Test pit TP-4.

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Olympia, Washington

Selected Site Photographs

Figure
4e

11. Test pit TP-4.

12. Test pit TP-4.

13. Test pit TP-4.

14. Test pit TP-5.

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Olympia, Washington

Selected Site Photographs

Figure
4g

15. Test pit TP-5.

16. Test pit TP-6.

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West Bay Yards Olympia, Washington	**Selected Site Photographs**	Figure 4h

17. Test pit TP-7.

18. Test pit TP-7.

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West Bay Yards Olympia, Washington	**Selected Site Photographs**	Figure 4i

19. Test pit TP-7.

1. Wood debris from boring B-1.

2. Wood debris from boring B-2.

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West Bay Yards
Olympia, Washington

Selected Site Photographs

Figure
5a

3. Wood debris from boring B-1.

4. Wood debris from boring B-2.

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West Bay Yards Olympia, Washington	**Selected Site Photographs**	Figure 5b

ATTACHMENT 1

Field Explorations

Soil Classification System

MAJOR DIVISIONS			GRAPHIC SYMBOL	USCS LETTER SYMBOL[1]	TYPICAL DESCRIPTIONS [2][3]
COARSE-GRAINED SOIL (More than 50% of material is larger than No. 200 sieve size)	GRAVEL AND GRAVELLY SOIL (More than 50% of coarse fraction retained on No. 4 sieve)	CLEAN GRAVEL (Little or no fines)		GW	Well-graded gravel; gravel/sand mixture(s); little or no fines
				GP	Poorly graded gravel; gravel/sand mixture(s); little or no fines
		GRAVEL WITH FINES (Appreciable amount of fines)		GM	Silty gravel; gravel/sand/silt mixture(s)
				GC	Clayey gravel; gravel/sand/clay mixture(s)
	SAND AND SANDY SOIL (More than 50% of coarse fraction passed through No. 4 sieve)	CLEAN SAND (Little or no fines)		SW	Well-graded sand; gravelly sand; little or no fines
				SP	Poorly graded sand; gravelly sand; little or no fines
		SAND WITH FINES (Appreciable amount of fines)		SM	Silty sand; sand/silt mixture(s)
				SC	Clayey sand; sand/clay mixture(s)
FINE-GRAINED SOIL (More than 50% of material is smaller than No. 200 sieve size)	SILT AND CLAY (Liquid limit less than 50)			ML	Inorganic silt and very fine sand; rock flour; silty or clayey fine sand or clayey silt with slight plasticity
				CL	Inorganic clay of low to medium plasticity; gravelly clay; sandy clay; silty clay; lean clay
				OL	Organic silt; organic, silty clay of low plasticity
	SILT AND CLAY (Liquid limit greater than 50)			MH	Inorganic silt; micaceous or diatomaceous fine sand
				CH	Inorganic clay of high plasticity; fat clay
				OH	Organic clay of medium to high plasticity; organic silt
	HIGHLY ORGANIC SOIL			PT	Peat; humus; swamp soil with high organic content

OTHER MATERIALS	GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
PAVEMENT		AC or PC	Asphalt concrete pavement or Portland cement pavement
ROCK		RK	Rock (See Rock Classification)
WOOD		WD	Wood, lumber, wood chips
DEBRIS		DB	Construction debris, garbage

Notes:
1. USCS letter symbols correspond to symbols used by the Unified Soil Classification System and ASTM classification methods. Dual letter symbols (e.g., SP-SM for sand or gravel) indicate soil with an estimated 5-15% fines. Multiple letter symbols (e.g., ML/CL) indicate borderline or multiple soil classifications.
2. Soil descriptions are based on the general approach presented in the Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), outlined in ASTM D 2488. Where laboratory index testing has been conducted, soil classifications are based on the Standard Test Method for Classification of Soils for Engineering Purposes, as outlined in ASTM D 2487.
3. Soil description terminology is based on visual estimates (in the absence of laboratory test data) of the percentages of each soil type and is defined as follows:

Primary Constituent:	> 50% - "GRAVEL," "SAND," "SILT," "CLAY," etc.
Secondary Constituents:	> 30% and ≤ 50% - "very gravelly," "very sandy," "very silty," etc.
	> 15% and ≤ 30% - "gravelly," "sandy," "silty," etc.
Additional Constituents:	> 5% and ≤ 15% - "with gravel," "with sand," "with silt," etc.
	≤ 5% - "with trace gravel," "with trace sand," "with trace silt," etc., or not noted.

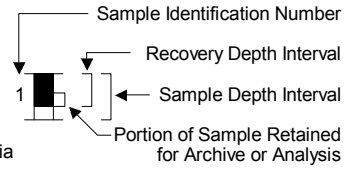
4. Soil density or consistency descriptions are based on judgement using a combination of sampler penetration blow counts, drilling or excavating conditions, field tests, and laboratory tests, as appropriate.

Drilling and Sampling Key

SAMPLER TYPE

Code	Description
a	3.25-inch O.D., 2.42-inch I.D. Split Spoon
b	2.00-inch O.D., 1.50-inch I.D. Split Spoon
c	Shelby Tube
d	Grab Sample
e	Single-Tube Core Barrel
f	Double-Tube Core Barrel
g	2.50-inch O.D., 2.00-inch I.D. WSDOT
h	3.00-inch O.D., 2.375-inch I.D. Mod. California
i	Other - See text if applicable
1	300-lb Hammer, 30-inch Drop
2	140-lb Hammer, 30-inch Drop
3	Pushed
4	Vibrocore (Rotosonic/Geoprobe)
5	Other - See text if applicable

SAMPLE NUMBER & INTERVAL



Field and Lab Test Data

Code	Description
PP = 1.0	Pocket Penetrometer, tsf
TV = 0.5	Torvane, tsf
PID = 100	Photoionization Detector VOC screening, ppm
W = 10	Moisture Content, %
D = 120	Dry Density, pcf
-200 = 60	Material smaller than No. 200 sieve, %
GS	Grain Size - See separate figure for data
AL	Atterberg Limits - See separate figure for data
GT	Other Geotechnical Testing
CA	Chemical Analysis

Groundwater

▽ Approximate water level at time of drilling (ATD)

▼ Approximate water level at time after drilling/excavation/well

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Olympia, Washington

Soil Classification System and Key

Figure 1-1

TP-1

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	
0		S-1	d			SM	Dark brown, silty, fine to coarse SAND with gravel and organics (loose, moist) **(TOPSOIL)**
		S-2	d			SP-SM	
		S-3	d			GP-GM	Gray, fine to coarse SAND with gravel and silt (medium dense, moist) **(FILL)**
5						ML	
							Bluish-gray, fine to coarse GRAVEL with sand, silt, cobbles, and boulders (dense, moist)
10							Gray SILT with sand and organics (medium stiff, moist)
		S-4	d	W = 37 AL			Grades to soft
15		S-5	d			WD	Grades to include industrial debris. Debris includes wood and metal pieces, including 1-inch-diameter steel cables.
							Decaying sawdust debris (soft, wet)
20							

Excavation Method: Tracked Excavator
Ground Elevation (ft): Not measured
Excavated By: Howard's Const.
Logged By: DAR

ATD

Test Pit Completed 05/04/20
Total Depth of Test Pit = 15.0 ft.

TP-2

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	
0		S-1	d			AC	4 inches of asphalt
						SP-SM	Gray, fine to coarse SAND with gravel and silt (medium dense, moist)
		S-2	d			AC	**(FILL)**
5						SP-SM	4 inches of asphalt
						ML	Gray, fine to coarse SAND with gravel and silt (medium dense, moist)
10							Gray, sandy SILT with organics (medium stiff, moist)
		S-3	d	W = 19 AL		WD	Decaying sawdust (soft, moist to wet)
15		S-4	d			SP	Gray, fine to coarse SAND with shells (medium dense, wet) **(BEACH DEPOSITS)**
20							

Excavation Method: Tracked Excavator
Ground Elevation (ft): Not measured
Excavated By: Howard's Const.
Logged By: DAR

ATD

Test Pit Completed 05/04/20
Total Depth of Test Pit = 16.0 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1912001.01 8/27/20 C:\USERS\MSKINNER\DESKTOP\1912001.010.GPJ TEST PIT LOG

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West Bay Yards
Olympia, Washington

Log of Test Pits

Figure
1-2

TP-3

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol		
0						SP-SM	Dark brown, fine to coarse SAND with silt and organics (loose, moist) **(TOPSOIL)**	
		S-1	d			SP-SM	Gray, fine to coarse SAND with gravel, silt, and organics (loose, moist) **(FILL)**	ATD
5		S-2	d			GP-GM	Observed top of wood pile	
							Gray, fine to coarse GRAVEL with sand and silt. Terminated test pit at 7 feet due to rapid groundwater seepage and severe caving. (loose, moist to wet)	
10								
15								
20								

Excavation Method: Tracked Excavator
Ground Elevation (ft): Not measured
Excavated By: Howard's Const.
Logged By: DAR

Test Pit Completed 05/04/20
Total Depth of Test Pit = 7.0 ft.

TP-4

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol		
0						AC	4 inches of asphalt over 6 inches of crushed rock **(ASPHALT)**	
		S-1	d			SP-SM	Gray, fine to coarse SAND with gravel, silt, and debris. Debris consists of metal pieces. (medium dense, moist) **(FILL)**	ATD
5		S-2	d			GP-GM	Gray, fine to coarse GRAVEL with sand, silt, and wood debris. Test pit terminated at 8 feet due to rapid groundwater seepage and severe caving. (medium dense, wet)	
10								
15								
20								

Excavation Method: Tracked Excavator
Ground Elevation (ft): Not measured
Excavated By: Howard's Const.
Logged By: DAR

Test Pit Completed 05/04/20
Total Depth of Test Pit = 8.0 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1912001.01 8/27/20 C:\USERS\MSKINNER\DESKTOP\1912001.010.GPJ TEST PIT LOG

LANDAU ASSOCIATES

West Bay Yards
Olympia, Washington

Log of Test Pits

Figure
1-3

TP-5

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol		
0						GP	Excavation Method: Tracked Excavator Ground Elevation (ft): Not measured Excavated By: Howard's Const. Logged By: DAR Recycled concrete - 2-inch x 4-inch spalls (dense, moist)	
		S-1	d			GP	**(FILL)** Gray, very sandy, fine to coarse GRAVEL (medium dense, moist)	ATD
5		S-2	d				Grades to include cobbles and wood debris	
							Test pit terminated at 8 feet due to rapid groundwater seepage and severe caving.	
10								
15								
20								

Test Pit Completed 05/04/20
Total Depth of Test Pit = 8.0 ft.

TP-6

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol		
0						GP	Excavation Method: Tracked Excavator Ground Elevation (ft): Not measured Excavated By: Howard's Const. Logged By: DAR Recycled concrete - 2-inch x 4-inch quarry spalls (dense, moist)	
		S-1	d			SP	**(FILL)**	ATD
5						GP	Gray, very gravelly, fine to coarse SAND (medium dense, moist)	
						SP	Gray, coarse gravel - drain rock (medium dense, wet)	
10							Gray, very gravelly, fine to coarse SAND. Test pit terminated at 5 feet due to rapid groundwater seepage and severe caving. (medium dense, wet)	
15								
20								

Test Pit Completed 05/04/20
Total Depth of Test Pit = 5.0 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1912001.01 8/27/20 C:\USERS\MSKINNER\DESKTOP\1912001.010.GPJ TEST PIT LOG

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West Bay Yards
Olympia, Washington

Log of Test Pits

Figure
1-4

TP-7

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	
0						GP	Recycled concrete - 2-inch x 4-inch quarry spalls (dense, moist)
						SP-SM	**(FILL)**
						SP	Brown, fine to coarse SAND with gravel and silt (medium dense, moist)
5							Gray, fine to coarse SAND with gravel. Test pit terminated due to rapid groundwater seepage and severe caving (medium dense, moist)
							Wood pile embedded in pea gravel observed at about 2 feet.
10							
15							
20							

Excavation Method: Tracked Excavator
Ground Elevation (ft): Not measured
Excavated By: Howard's Const.
Logged By: DAR

▽ ATD

Test Pit Completed 05/04/20
Total Depth of Test Pit = 5.0 ft.

TP-8

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	
0						GP	Recycled concrete - 2-inch x 4-inch quarry spalls (dense, moist)
		S-1	d			GP-SP	**(FILL)**
							Gray, coarse GRAVEL - 1-inch drain rock (loose, wet)
5							Gray, very gravelly, fine to coarse SAND. Test pit terminated at 6 feet due to rapid groundwater seepage and severe caving. (medium dense, wet)
10							
15							
20							

Excavation Method: Tracked Excavator
Ground Elevation (ft): Not measured
Excavated By: Howard's Const.
Logged By: DAR

▽ ATD

Test Pit Completed 05/04/20
Total Depth of Test Pit = 6.0 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1912001.01 8/27/20 C:\USERS\MSKINNER\DESKTOP\1912001.010.GPJ TEST PIT LOG

LANDAU ASSOCIATES

West Bay Yards
Olympia, Washington

Log of Test Pits

Figure
1-5

B-1

LAI Project No: 1912001.010

SAMPLE DATA | **SOIL PROFILE**

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): Not measured
Drilled By: Holocene Drilling Inc.
Logged By: DAR Date: 05/06/20

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Description	Groundwater
0							GP	Recycled concrete - 2-inch x 4-inch quarry spalls (dense, moist)	
							GP-GM	**(FILL)**	
		S-1	b2	29				Gray, very sandy, fine to coarse GRAVEL with silt (medium dense, moist to wet)	
5		S-2	b2	8			SP	Gray, fine to coarse SAND with shells (loose, wet)	5.0 ft ATD
		S-3	b2	29				Grades to include wood debris	
10		S-4	b2	19					
							WD	Wood debris (medium dense, wet)	
15		S-5	b2	16				Resampled 15-foot interval using a Modified California split spoon.	
		S-6	b2	9				Grades to loose. Resampled the 17.5-foot interval using a Modified California split spoon.	
20		S-7	b2	7					
		S-8	b2	3			ML	Gray SILT with shells (soft, wet) **(GLACIOMARINE DEPOSITS)**	
25		S-9	b2	0	W = 43 AL			Gray silt with wood debris. Resampled the 25-foot interval using a Modified California split spoon. (very soft, wet)	
30		S-10	b2	3	W = 26 GS AL			Grades to include sand and shells	
35									

Moisture Content (%) — Plastic Limit — Liquid Limit — 20 40 60 80
▲ SPT N-Value ▲ △ Non-Standard N-Value △ — 20 40 60 80
× Fines Content (%) × — 20 40 60 80

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1912001.01 8/27/20 C:\USERS\MSKINNER\DESKTOP\1912001.010.GPJ SOIL BORING LOG WITH GRAPH

LANDAU ASSOCIATES

West Bay Yards
Olympia, Washington

Log of Boring B-1

Figure
1-6
(1 of 2)

B-1

LAI Project No: 1912001.010

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	SOIL PROFILE	Groundwater	Moisture Content (%) / SPT N-Value / Fines Content (%)
								Drilling Method: Hollow-Stem Auger Ground Elevation (ft): Not measured Drilled By: Holocene Drilling Inc. Logged By: DAR Date: 05/06/20		Plastic Limit – Liquid Limit; 20 40 60 80 ▲ SPT N-Value ▲ △ Non-Standard N-Value △; 20 40 60 80 × Fines Content (%) ×; 20 40 60 80
35		S-11	b2	6	W = 28 AL		ML	Gray SILT with shells (soft, wet) **(GLACIOMARINE DEPOSITS)** Gray SILT with wood debris (medium stiff, wet)		
40		S-12	b2	10	W = 75 GS AL			Gray SILT (stiff, wet)		
45										
50										
55										
60										
65										
70										

Boring Completed 05/06/20
Total Depth of Boring = 41.5 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1912001.01 8/27/20 C:\USERS\MSKINNER\DESKTOP\1912001.010.GPJ SOIL BORING LOG WITH GRAPH

LANDAU ASSOCIATES

West Bay Yards
Olympia, Washington

Log of Boring B-1

Figure
1-6
(2 of 2)

B-2

LAI Project No: 1912001.010

SAMPLE DATA | **SOIL PROFILE**

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): Not measured
Drilled By: Holocene Drilling Inc.
Logged By: DAR Date: 05/06/20

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Groundwater
0							GP	2.0 ft ATD
							GP	
		S-1	b2	11			SP	
5		S-2	b2	10				
		S-3	b2	16				
10		S-4	b2	13				
15		S-5	b2	5			WD	
20		S-6	b2	10				
25		S-7	b2	4				
30		S-8	b2	5				
35							ML	

Recycled concrete - 2-inch x 4-inch quarry spalls (dense, moist)
(FILL)

Brown, fine to coarse GRAVEL with sand (medium dense, wet)

Brown, fine to coarse SAND with gravel (medium dense, wet)

Resampled the 5-foot interval using a Modified California split spoon.

Grades to without gravel

Grades to include shells and wood debris

Wood debris. Resampled the 15-foot interval using a Modified California split spoon. (loose, wet)

Grades to medium dense

Grades to loose. Resampled the 25-foot interval using a Modified California split spoon.

Grades to with silt

Gray SILT (stiff, wet)
(GLACIOMARINE DEPOSITS)

Moisture Content (%)
Plastic Limit — Liquid Limit
20 40 60 80

▲ SPT N-Value ▲
△ Non-Standard N-Value △
20 40 60 80

× Fines Content (%) ×
20 40 60 80

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1912001.01 8/27/20 C:\USERS\MSKINNER\DESKTOP\1912001.010.GPJ SOIL BORING LOG WITH GRAPH

LANDAU ASSOCIATES

West Bay Yards
Olympia, Washington

Log of Boring B-2

Figure
1-7
(1 of 2)

B-2

LAI Project No: 1912001.010

SAMPLE DATA						SOIL PROFILE				
Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Hollow-Stem Auger Ground Elevation (ft): Not measured Drilled By: Holocene Drilling Inc. Logged By: DAR Date: 05/06/20	Groundwater	Moisture Content (%) Plastic Limit / Liquid Limit; SPT N-Value; Fines Content (%)
35		S-9	b2	7	W = 35 GS AL		ML	Gray SILT (stiff, wet) **(GLACIOMARINE DEPOSITS)**		
40		S-10	b2	22				Grades to very stiff and with gravel		

Boring Completed 05/06/20
Total Depth of Boring = 41.5 ft.

45
50
55
60
65
70

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

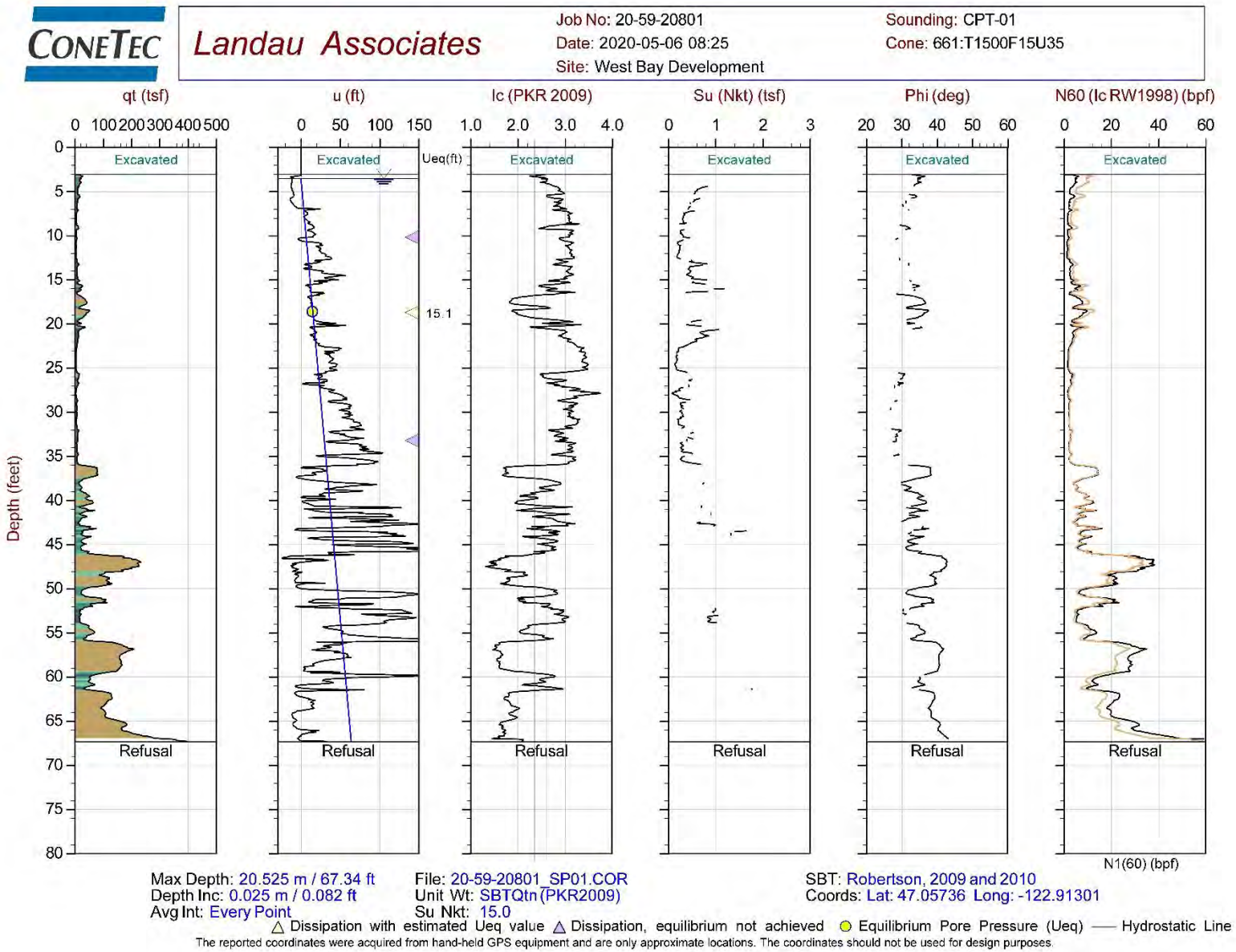
1912001.01 8/27/20 C:\USERS\MSKINNER\DESKTOP\1912001.010.GPJ SOIL BORING LOG WITH GRAPH

LANDAU ASSOCIATES

West Bay Yards
Olympia, Washington

Log of Boring B-2

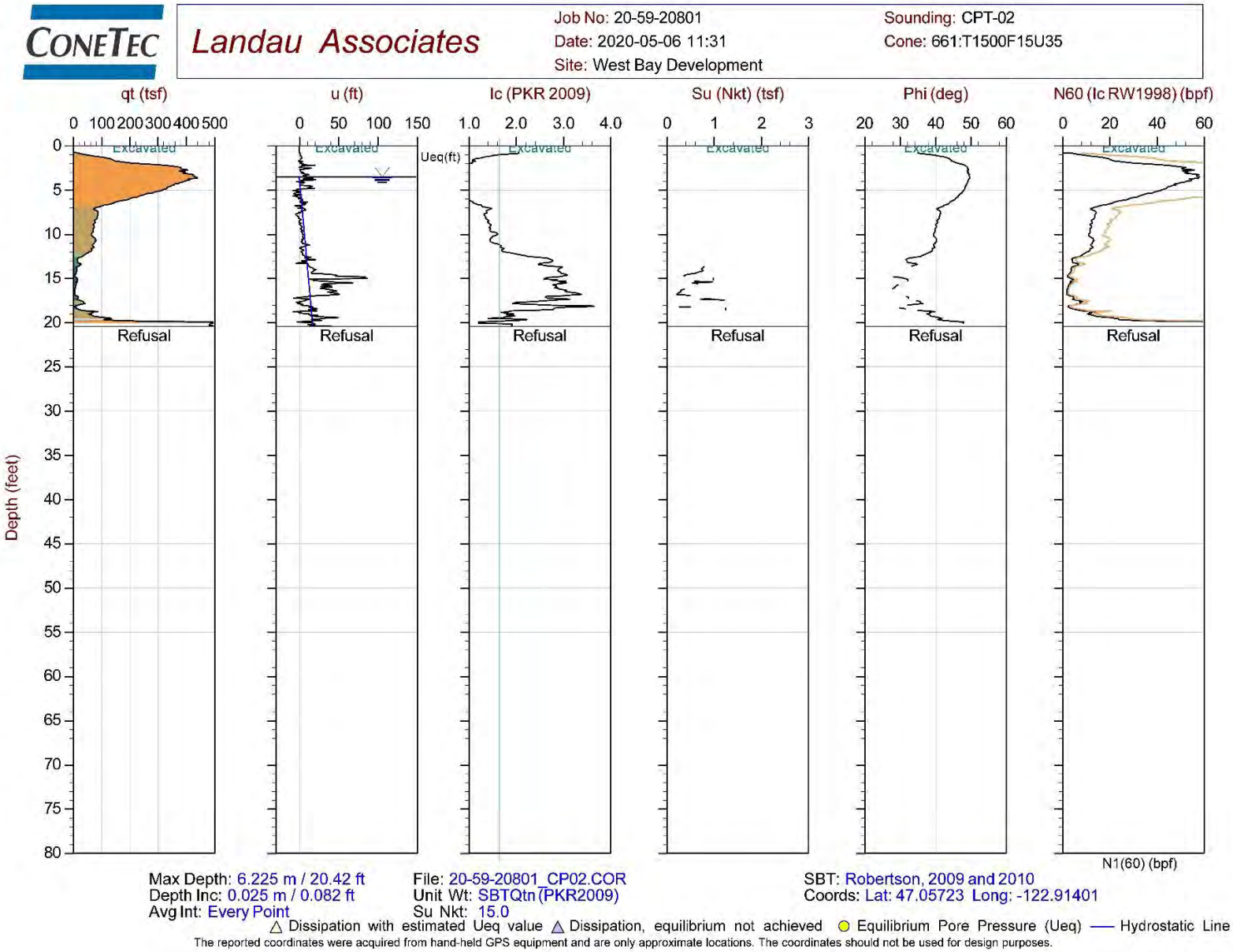
Figure
1-7
(2 of 2)



LANDAU ASSOCIATES

West Bay Yards Olympia, Washington	**Sounding CPT-01**	Figure 1-8

5/27/20 Y:\1912\001.010\R\Figure 1-9.docx



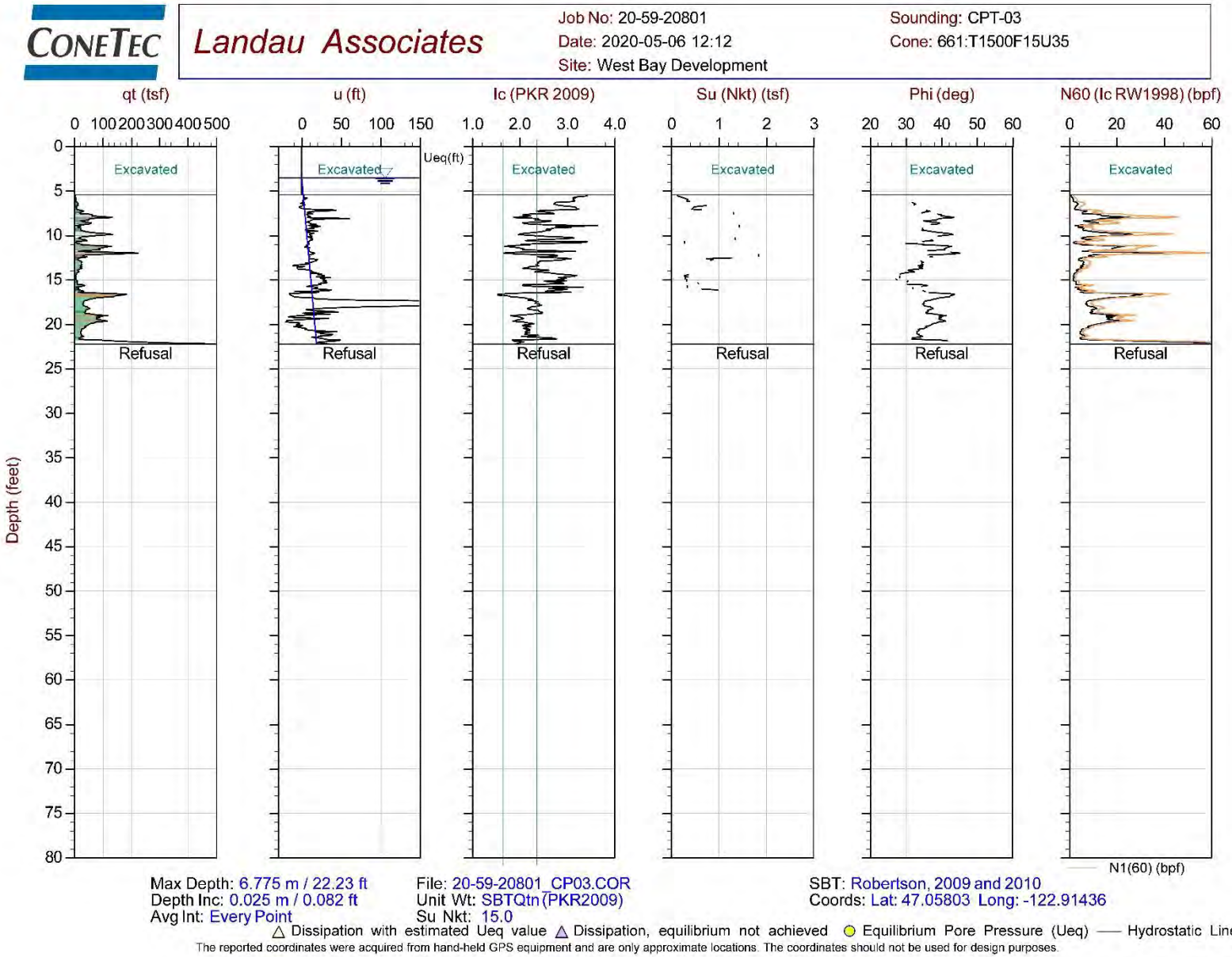
LANDAU ASSOCIATES

West Bay Yards
Olympia, Washington

Sounding CPT-02

Figure
1-9

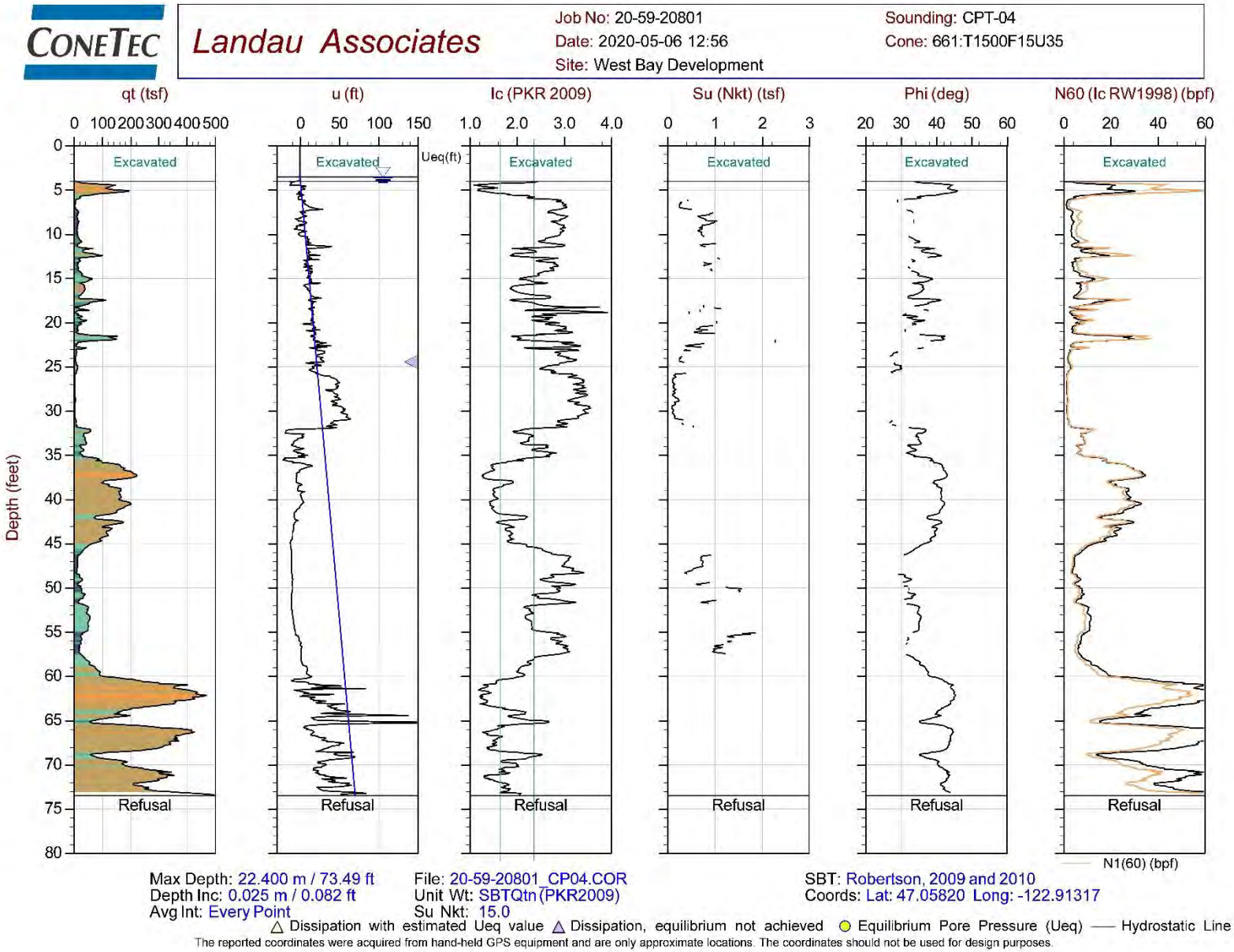
5/27/20 Y:\1912\001.010\R\Figure 1-10.docx



LANDAU ASSOCIATES

West Bay Yards Olympia, Washington	**Sounding CPT-03**	Figure 1-10

5/27/20 Y:\1912\001.010\R\Figure 1-11.docx



LANDAU ASSOCIATES

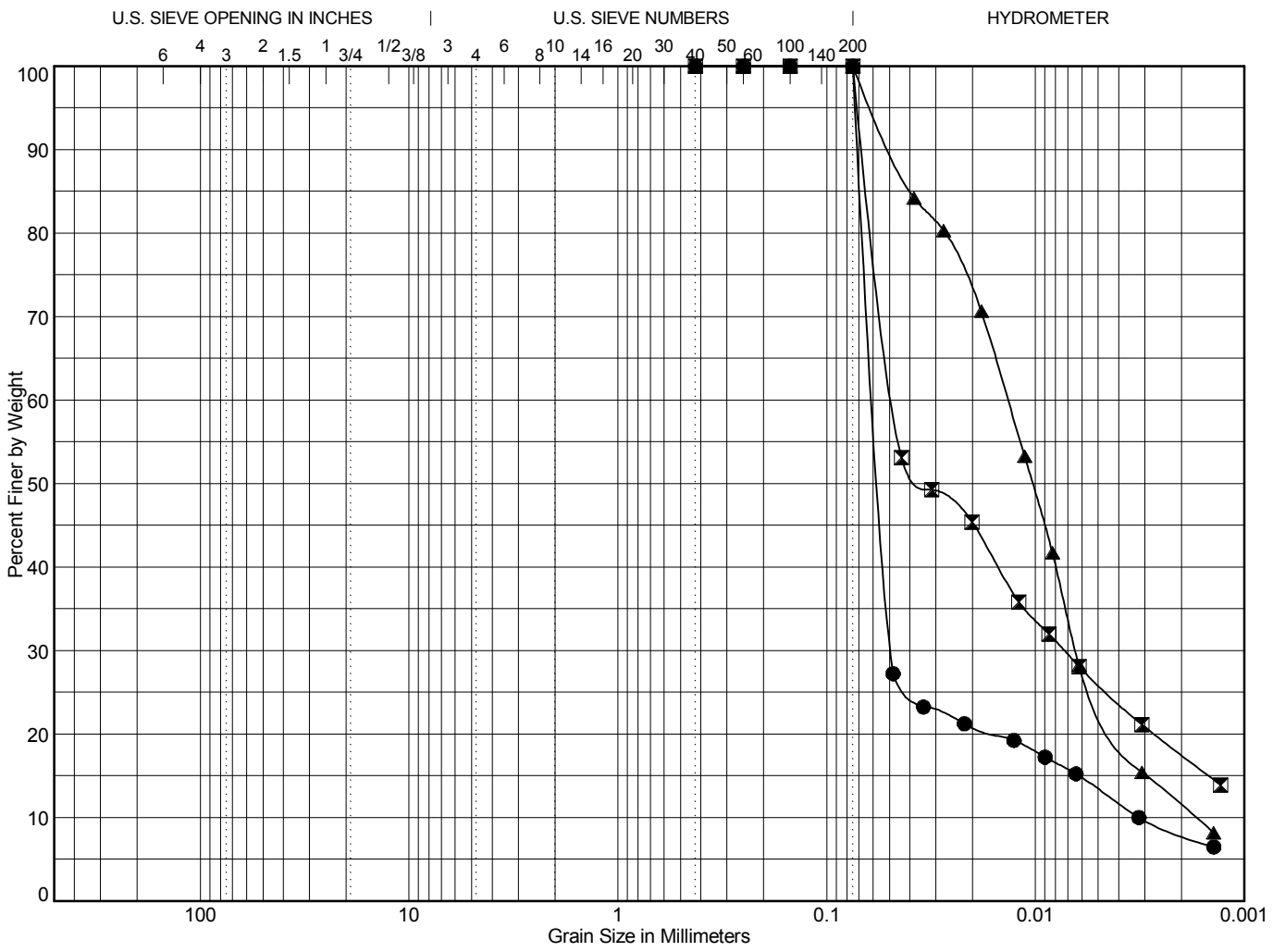
West Bay Yards
Olympia, Washington

Sounding CPT-04

Figure
1-11

ATTACHMENT 2

Laboratory Testing



Cobbles	Gravel		Sand			Silt or Clay
	coarse	fine	coarse	medium	fine	

Point		Depth	Classification	LL	PL	PI	C_c	C_u
●	B-1	30.0	SILT (ML)	25	25	NP	12.76	18.41
⧓	B-1	40.0	Clayey SILT (CL-ML)	21	17	4		
▲	B-2	35.0	SILT (ML)	29	27	2	1.79	7.95

Point		Depth	D_{100}	D_{60}	D_{50}	D_{30}	D_{10}	%Coarse Gravel	% Fine Gravel	% Coarse Sand	% Medium Sand	% Fine Sand	% Fines
●	B-1	30.0	0.425	0.059	0.055	0.049	0.003	0.0	0.0	0.0	0.0	0.0	100.0
⧓	B-1	40.0	0.425	0.047	0.033	0.007		0.0	0.0	0.0	0.0	0.0	100.0
▲	B-2	35.0	0.425	0.014	0.01	0.006	0.002	0.0	0.0	0.0	0.0	0.0	100.0

$C_c = D_{30}^2/(D_{60} * D_{10})$
$C_u = D_{60}/D_{10}$

To be well graded: $1 < C_c < 3$ and $C_u > 4$ for GW or $C_u > 6$ for SW

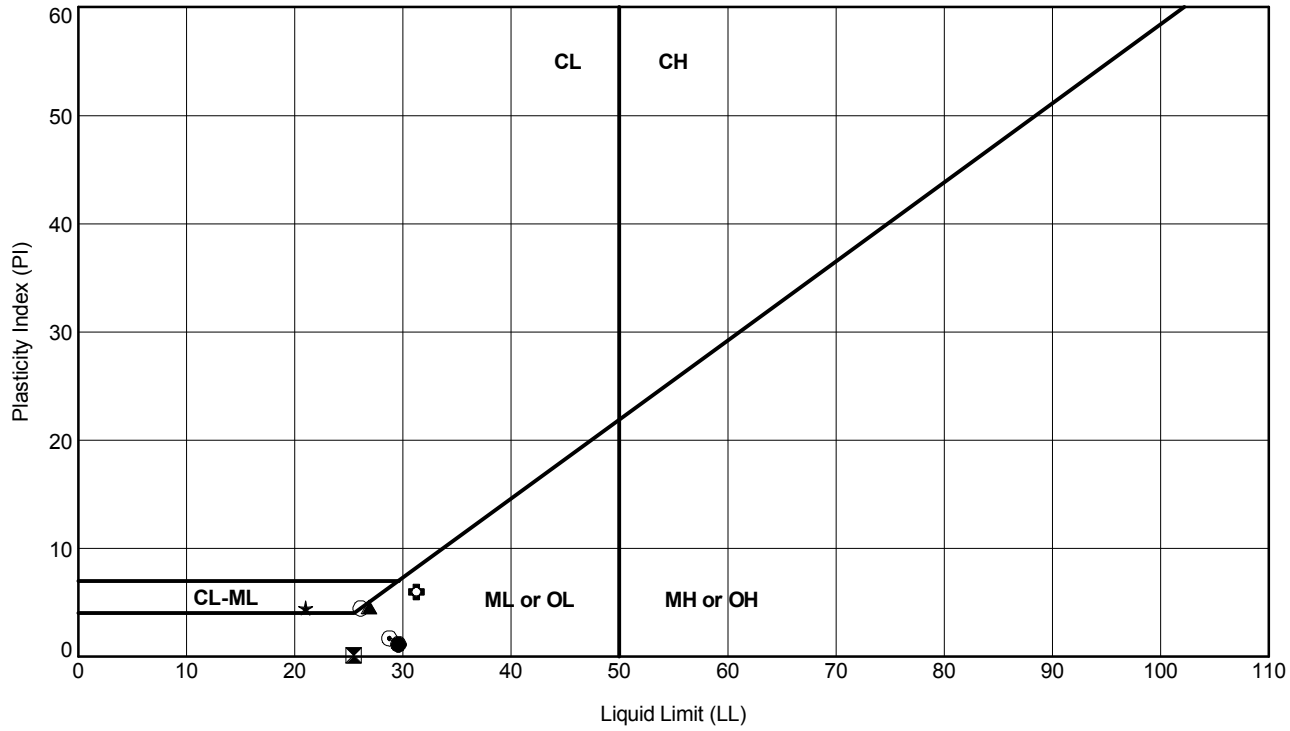
1912001.01 8/27/20 C:\USERS\MSKINNER\DESKTOP\1912001.010.GPJ GRAIN SIZE W/STATS

LANDAU ASSOCIATES

West Bay Yards
Olympia, Washington

Grain Size Test Data

Figure
2-1



ATTERBERG LIMIT TEST RESULTS

Symbol	Exploration Number	Sample Number	Depth (ft)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Natural Moisture (%)	Soil Description	Unified Soil Classification
●	B-1	S-9	25.0	30	28	2	43	SILT	ML
⧓	B-1	S-10	30.0	25	25	0	26	SILT	ML
▲	B-1	S-11	35.0	27	22	5	28	SILT	ML
★	B-1	S-12	40.0	21	17	4	75	Clayey SILT	CL-ML
⊙	B-2	S-9	35.0	29	27	2	35	SILT	ML
✿	TP-1	S-4	13.0	31	25	6	37	SILT	ML
○	TP-2	S-3	11.0	26	22	4	19	Clayey SILT	CL-ML

ASTM D 4318 Test Method

APPENDIX 6

FEMA FLOOD INSURANCE RATE MAP

National Flood Hazard Layer FIRMette

FEMA

47°3'40.24"N

122°55'11.48"W

122°54'34.02"W

47°3'15.72"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Legend Attachment 11.A

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/13/2020 at 8:21:42 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

APPENDIX 7
DESIGN CALCULATIONS AND COMPUTATIONS

Attachment 11.A

WWHM2012

PROJECT REPORT

General Model Information

WWHM2012 Project Name: 3264.02 West Bay Preliminary Treatment Basin 1
Site Name:
Site Address:
City:
Report Date: 9/18/2024
Gage: Courthouse
Data Start: 1955/10/01
Data End: 2011/09/30
Timestep: 15 Minute
Precip Scale: 1.000
Version Date: 2024/06/28
Version: 4.3.1

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
A B, Forest, Flat	1.03
Pervious Total	1.03

Impervious Land Use	acre
Impervious Total	0
Basin Total	1.03

Element Flow Componants:

Surface	Interflow	Groundwater

Componant Flows To:

POC 1	POC 1	

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A B, Lawn, Flat	0.46
Pervious Total	0.46

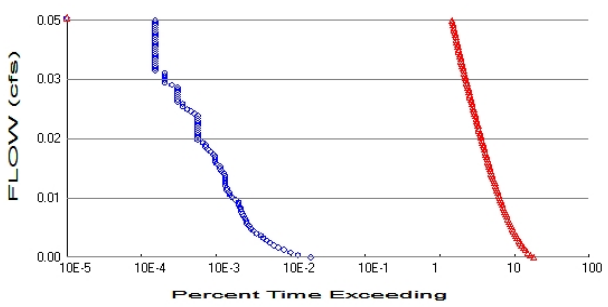
Impervious Land Use	acre
SIDEWALKS FLAT	0.17
PARKING FLAT	0.4
Impervious Total	0.57
Basin Total	1.03

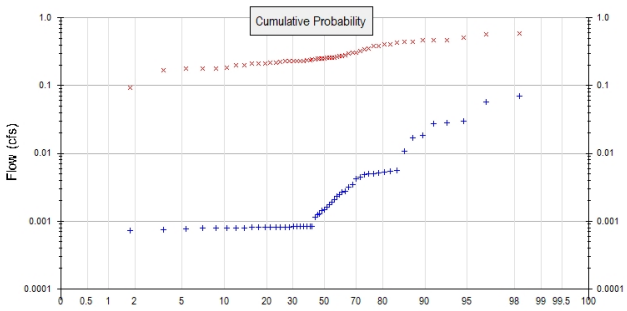
Element Flow Componants:

Surface	Interflow	Groundwater
Componant Flows To:		
POC 1	POC 1	

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 1.03
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.46
Total Impervious Area: 0.57

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.001946
5 year	0.006041
10 year	0.011913
25 year	0.026314
50 year	0.045629
100 year	0.076856

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.273523
5 year	0.371678
10 year	0.431753
25 year	0.502655
50 year	0.552232
100 year	0.59934

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1956	0.003	0.200
1957	0.001	0.436
1958	0.002	0.268
1959	0.002	0.242
1960	0.005	0.589
1961	0.004	0.210
1962	0.001	0.200
1963	0.005	0.503
1964	0.005	0.255
1965	0.005	0.273

1966	0.001	0.179
1967	0.028	0.441
1968	0.004	0.234
1969	0.001	0.184
1970	0.001	0.180
1971	0.006	0.214
1972	0.058	0.428
1973	0.001	0.242
1974	0.017	0.306
1975	0.001	0.223
1976	0.003	0.236
1977	0.001	0.343
1978	0.001	0.249
1979	0.001	0.304
1980	0.001	0.220
1981	0.003	0.380
1982	0.002	0.327
1983	0.002	0.468
1984	0.019	0.350
1985	0.001	0.301
1986	0.001	0.257
1987	0.005	0.248
1988	0.001	0.178
1989	0.001	0.169
1990	0.005	0.403
1991	0.030	0.467
1992	0.001	0.260
1993	0.001	0.218
1994	0.001	0.227
1995	0.001	0.233
1996	0.069	0.473
1997	0.001	0.085
1998	0.001	0.092
1999	0.002	0.252
2000	0.001	0.283
2001	0.001	0.229
2002	0.002	0.272
2003	0.001	0.230
2004	0.028	0.569
2005	0.001	0.214
2006	0.001	0.252
2007	0.011	0.382
2008	0.001	0.261
2009	0.001	0.410
2010	0.001	0.229
2011	0.003	0.232

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0690	0.5885
2	0.0578	0.5690
3	0.0300	0.5025
4	0.0281	0.4728
5	0.0277	0.4682
6	0.0186	0.4666
7	0.0168	0.4412
8	0.0106	0.4361

9	0.0055	0.4278
10	0.0054	0.4103
11	0.0052	0.4030
12	0.0051	0.3825
13	0.0050	0.3799
14	0.0050	0.3497
15	0.0049	0.3433
16	0.0045	0.3265
17	0.0042	0.3060
18	0.0035	0.3044
19	0.0032	0.3011
20	0.0027	0.2830
21	0.0027	0.2726
22	0.0024	0.2722
23	0.0023	0.2677
24	0.0021	0.2610
25	0.0019	0.2597
26	0.0017	0.2567
27	0.0016	0.2545
28	0.0015	0.2522
29	0.0014	0.2521
30	0.0013	0.2490
31	0.0012	0.2481
32	0.0011	0.2423
33	0.0008	0.2420
34	0.0008	0.2358
35	0.0008	0.2339
36	0.0008	0.2331
37	0.0008	0.2324
38	0.0008	0.2300
39	0.0008	0.2292
40	0.0008	0.2287
41	0.0008	0.2269
42	0.0008	0.2229
43	0.0008	0.2198
44	0.0008	0.2180
45	0.0008	0.2140
46	0.0008	0.2137
47	0.0008	0.2101
48	0.0008	0.2004
49	0.0008	0.2002
50	0.0008	0.1845
51	0.0008	0.1805
52	0.0008	0.1790
53	0.0008	0.1782
54	0.0008	0.1690
55	0.0007	0.0916
56	0.0007	0.0850

Duration Flows

The Duration Matching Failed

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0010	365	352267	96511	Fail
0.0014	243	319082	131309	Fail
0.0019	196	294538	150274	Fail
0.0023	160	275098	171936	Fail
0.0028	133	258997	194734	Fail
0.0032	115	245252	213262	Fail
0.0037	103	233274	226479	Fail
0.0041	95	222867	234596	Fail
0.0046	84	213245	253863	Fail
0.0050	78	204605	262314	Fail
0.0055	68	196751	289339	Fail
0.0059	62	189348	305400	Fail
0.0064	57	182417	320029	Fail
0.0068	54	176075	326064	Fail
0.0073	51	170282	333886	Fail
0.0077	50	164823	329646	Fail
0.0082	48	159639	332581	Fail
0.0086	46	154927	336797	Fail
0.0091	44	150312	341618	Fail
0.0095	43	145894	339288	Fail
0.0100	42	141751	337502	Fail
0.0104	41	137903	336348	Fail
0.0109	39	134132	343928	Fail
0.0113	39	130480	334564	Fail
0.0118	36	127024	352844	Fail
0.0122	32	123647	386396	Fail
0.0127	30	120525	401750	Fail
0.0132	29	117324	404565	Fail
0.0136	27	114438	423844	Fail
0.0141	27	111649	413514	Fail
0.0145	26	108959	419073	Fail
0.0150	26	106308	408876	Fail
0.0154	26	103736	398984	Fail
0.0159	26	101262	389469	Fail
0.0163	26	98925	380480	Fail
0.0168	25	96549	386196	Fail
0.0172	23	94350	410217	Fail
0.0177	22	92288	419490	Fail
0.0181	22	90266	410300	Fail
0.0186	20	88401	442004	Fail
0.0190	19	86476	455136	Fail
0.0195	19	84650	445526	Fail
0.0199	19	82903	436331	Fail
0.0204	18	81116	450644	Fail
0.0208	17	79270	466294	Fail
0.0213	15	77620	517466	Fail
0.0217	14	75991	542792	Fail
0.0222	14	74420	531571	Fail
0.0226	13	72967	561284	Fail
0.0231	11	71455	649590	Fail
0.0235	11	70002	636381	Fail
0.0240	11	68627	623881	Fail
0.0244	11	67213	611027	Fail
0.0249	11	65878	598890	Fail

0.0253	11	64543	586754	Fail
0.0258	11	63267	575154	Fail
0.0262	11	62049	564081	Fail
0.0267	11	60832	553018	Fail
0.0271	11	59693	542663	Fail
0.0276	11	58534	532127	Fail
0.0280	10	57396	573960	Fail
0.0285	9	56276	625288	Fail
0.0289	8	55137	689212	Fail
0.0294	7	54057	772242	Fail
0.0298	7	52997	757100	Fail
0.0303	6	52035	867250	Fail
0.0307	6	51073	851216	Fail
0.0312	6	50111	835183	Fail
0.0316	6	49188	819800	Fail
0.0321	6	48304	805066	Fail
0.0325	6	47381	789683	Fail
0.0330	6	46537	775616	Fail
0.0335	5	45653	913059	Fail
0.0339	4	44789	1119725	Fail
0.0344	4	43965	1099125	Fail
0.0348	4	43179	1079475	Fail
0.0353	4	42374	1059350	Fail
0.0357	4	41628	1040700	Fail
0.0362	3	40843	1361433	Fail
0.0366	3	40136	1337866	Fail
0.0371	3	39389	1312966	Fail
0.0375	3	38702	1290066	Fail
0.0380	3	38015	1267166	Fail
0.0384	3	37347	1244900	Fail
0.0389	3	36660	1222000	Fail
0.0393	3	36051	1201700	Fail
0.0398	3	35462	1182066	Fail
0.0402	3	34873	1162433	Fail
0.0407	3	34284	1142800	Fail
0.0411	3	33695	1123166	Fail
0.0416	3	33126	1104200	Fail
0.0420	3	32556	1085200	Fail
0.0425	3	32046	1068200	Fail
0.0429	3	31535	1051166	Fail
0.0434	3	31025	1034166	Fail
0.0438	3	30494	1016466	Fail
0.0443	3	29964	998800	Fail
0.0447	3	29473	982433	Fail
0.0452	3	28963	965433	Fail
0.0456	3	28511	950366	Fail

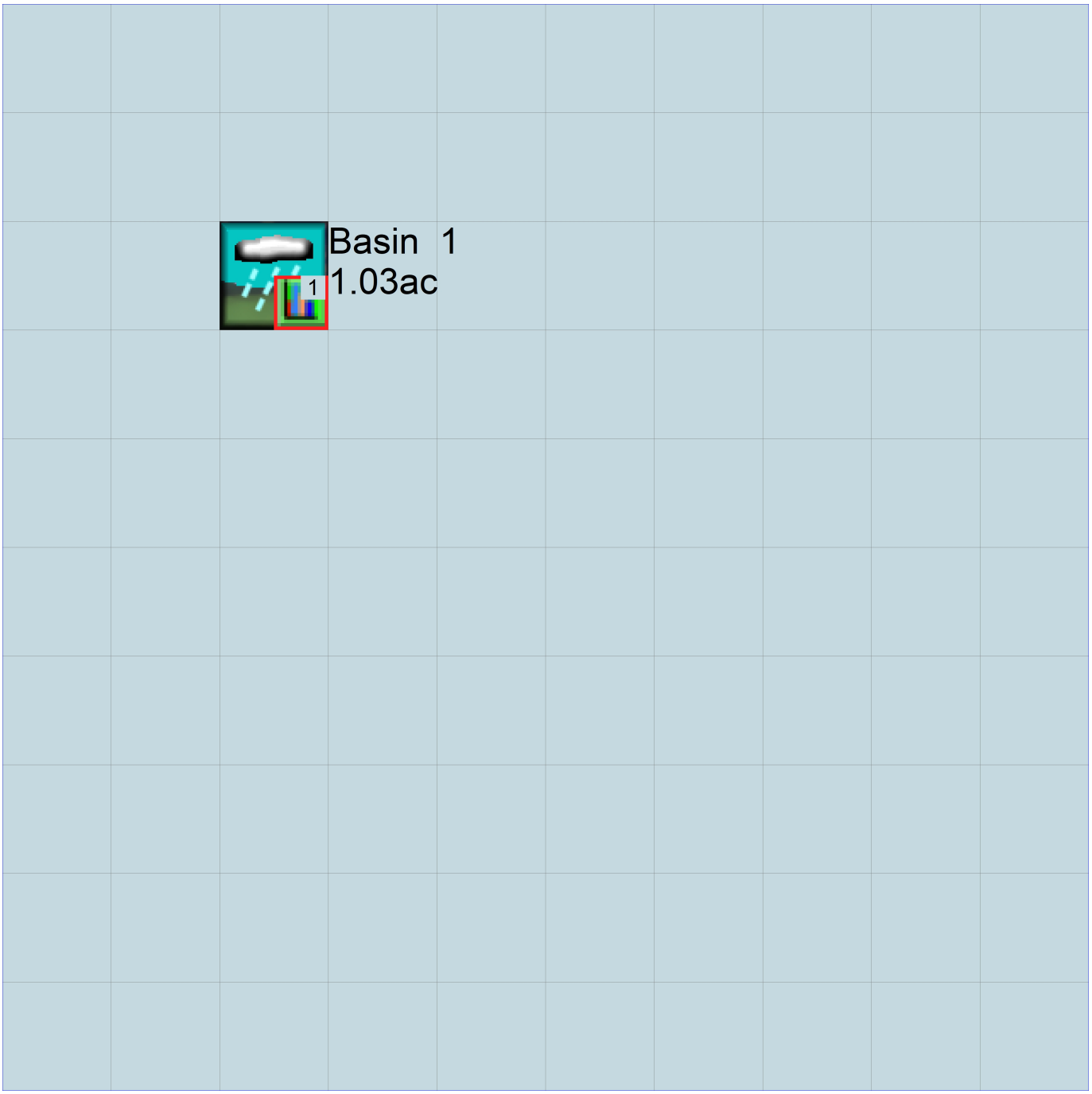
The development has an increase in flow durations from 1/2 Predeveloped 2 year flow to the 2 year flow or more than a 10% increase from the 2 year to the 50 year flow.
The development has an increase in flow durations for more than 50% of the flows for the range of the duration analysis.

Water Quality

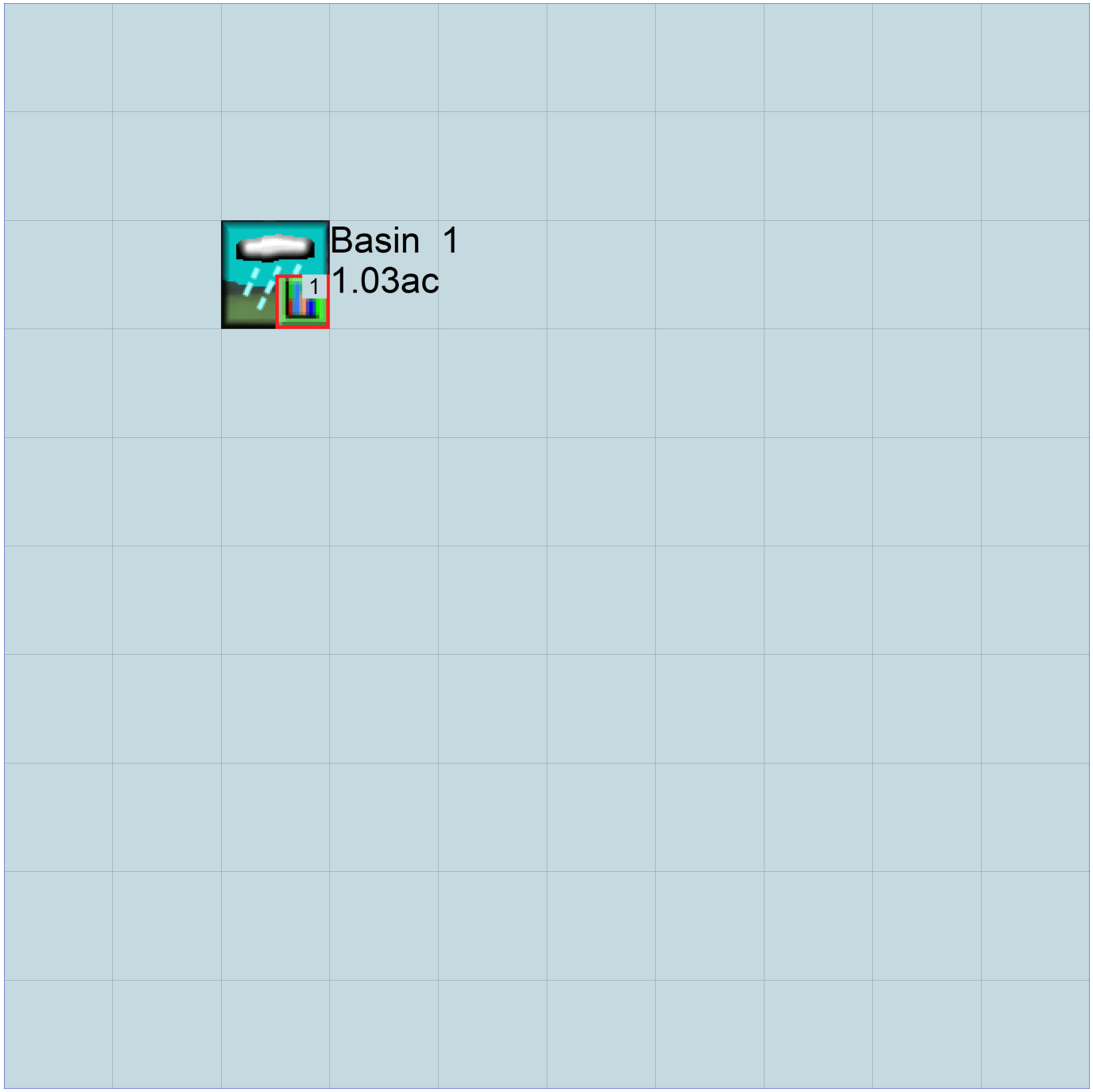
Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0.0715 acre-feet
On-line facility target flow:	0.0857 cfs.
Adjusted for 15 min:	0.0857 cfs.
Off-line facility target flow:	0.0482 cfs.
Adjusted for 15 min:	0.0482 cfs.

Appendix
Predeveloped Schematic



Mitigated Schematic



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Attachment 11.A

WWHM2012

PROJECT REPORT

General Model Information

WWHM2012 Project Name: 3264.02 West Bay Preliminary Treatment Basin 2
Site Name:
Site Address:
City:
Report Date: 9/18/2024
Gage: Courthouse
Data Start: 1955/10/01
Data End: 2011/09/30
Timestep: 15 Minute
Precip Scale: 1.000
Version Date: 2024/06/28
Version: 4.3.1

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 2

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A B, Forest, Flat	1.15
Pervious Total	1.15

Impervious Land Use	acre
Impervious Total	0
Basin Total	1.15

Element Flow Componants:

Surface	Interflow	Groundwater

Componant Flows To:

POC 1	POC 1

Mitigated Land Use

Basin 2

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A B, Lawn, Flat	0.33
Pervious Total	0.33

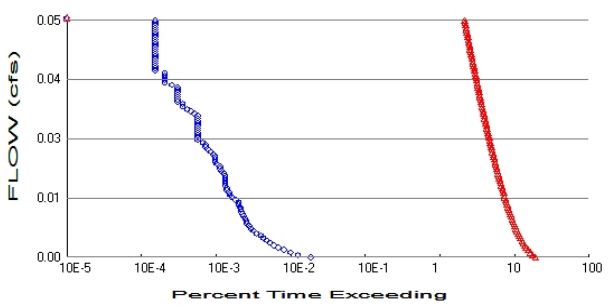
Impervious Land Use	acre
SIDEWALKS FLAT	0.36
PARKING FLAT	0.46
Impervious Total	0.82
Basin Total	1.15

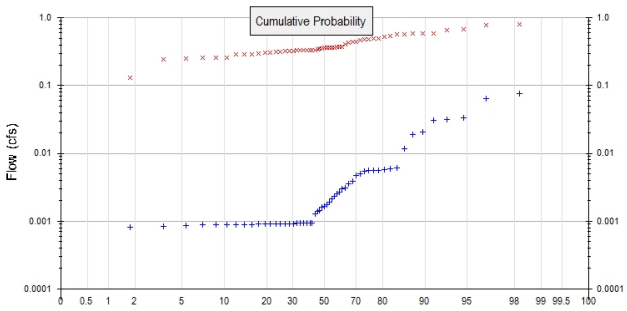
Element Flow Componants:

Surface	Interflow	Groundwater
Componant Flows To:		
POC 1	POC 1	

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 1.15
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.33
Total Impervious Area: 0.82

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.002173
5 year	0.006745
10 year	0.013301
25 year	0.02938
50 year	0.050945
100 year	0.08581

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.381725
5 year	0.506531
10 year	0.579688
25 year	0.663063
50 year	0.719541
100 year	0.771876

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1956	0.003	0.288
1957	0.001	0.568
1958	0.003	0.359
1959	0.002	0.348
1960	0.006	0.784
1961	0.005	0.286
1962	0.001	0.288
1963	0.005	0.651
1964	0.006	0.366
1965	0.006	0.363

1966	0.001	0.258
1967	0.031	0.565
1968	0.005	0.313
1969	0.001	0.258
1970	0.001	0.253
1971	0.006	0.294
1972	0.065	0.538
1973	0.001	0.334
1974	0.019	0.439
1975	0.001	0.319
1976	0.003	0.323
1977	0.001	0.494
1978	0.002	0.358
1979	0.001	0.438
1980	0.001	0.316
1981	0.004	0.496
1982	0.003	0.466
1983	0.002	0.673
1984	0.021	0.485
1985	0.001	0.433
1986	0.001	0.345
1987	0.006	0.331
1988	0.001	0.256
1989	0.001	0.243
1990	0.006	0.526
1991	0.034	0.580
1992	0.001	0.368
1993	0.002	0.302
1994	0.001	0.326
1995	0.001	0.335
1996	0.077	0.582
1997	0.001	0.122
1998	0.001	0.132
1999	0.002	0.363
2000	0.001	0.407
2001	0.001	0.330
2002	0.002	0.377
2003	0.001	0.331
2004	0.031	0.799
2005	0.001	0.308
2006	0.001	0.354
2007	0.012	0.484
2008	0.001	0.373
2009	0.001	0.590
2010	0.001	0.329
2011	0.004	0.334

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0770	0.7986
2	0.0646	0.7845
3	0.0335	0.6734
4	0.0313	0.6507
5	0.0309	0.5902
6	0.0207	0.5816
7	0.0187	0.5800
8	0.0118	0.5683

9	0.0062	0.5655
10	0.0060	0.5377
11	0.0058	0.5262
12	0.0057	0.4963
13	0.0056	0.4938
14	0.0055	0.4846
15	0.0055	0.4837
16	0.0050	0.4659
17	0.0047	0.4391
18	0.0039	0.4379
19	0.0035	0.4331
20	0.0031	0.4071
21	0.0030	0.3773
22	0.0027	0.3727
23	0.0026	0.3683
24	0.0023	0.3661
25	0.0021	0.3628
26	0.0019	0.3626
27	0.0018	0.3594
28	0.0017	0.3581
29	0.0016	0.3539
30	0.0014	0.3481
31	0.0014	0.3453
32	0.0013	0.3354
33	0.0009	0.3343
34	0.0009	0.3338
35	0.0009	0.3314
36	0.0009	0.3309
37	0.0009	0.3297
38	0.0009	0.3290
39	0.0009	0.3255
40	0.0009	0.3227
41	0.0009	0.3194
42	0.0009	0.3161
43	0.0009	0.3126
44	0.0009	0.3079
45	0.0009	0.3019
46	0.0009	0.2943
47	0.0009	0.2883
48	0.0009	0.2880
49	0.0009	0.2858
50	0.0009	0.2583
51	0.0009	0.2575
52	0.0009	0.2563
53	0.0009	0.2528
54	0.0008	0.2430
55	0.0008	0.1318
56	0.0008	0.1222

Duration Flows

The Duration Matching Failed

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0011	366	373670	102095	Fail
0.0016	243	340878	140279	Fail
0.0021	196	316922	161694	Fail
0.0026	160	297679	186049	Fail
0.0031	133	281774	211860	Fail
0.0036	115	268226	233239	Fail
0.0041	103	256248	248784	Fail
0.0046	95	245841	258780	Fail
0.0051	84	236416	281447	Fail
0.0056	78	227579	291767	Fail
0.0061	68	219921	323413	Fail
0.0066	62	212656	342993	Fail
0.0071	57	205980	361368	Fail
0.0076	54	199696	369807	Fail
0.0081	51	193747	379896	Fail
0.0086	50	188033	376066	Fail
0.0091	48	182711	380647	Fail
0.0096	46	177626	386143	Fail
0.0102	44	173031	393252	Fail
0.0107	43	168692	392306	Fail
0.0112	42	164529	391735	Fail
0.0117	41	160464	391375	Fail
0.0122	39	156714	401830	Fail
0.0127	39	153140	392666	Fail
0.0132	36	149586	415516	Fail
0.0137	32	146150	456718	Fail
0.0142	30	142831	476103	Fail
0.0147	29	139827	482162	Fail
0.0152	27	136862	506896	Fail
0.0157	27	133877	495840	Fail
0.0162	26	131069	504111	Fail
0.0167	26	128359	493688	Fail
0.0172	26	125650	483269	Fail
0.0177	26	123136	473600	Fail
0.0182	26	120741	464388	Fail
0.0187	25	118306	473224	Fail
0.0192	23	115910	503956	Fail
0.0197	22	113633	516513	Fail
0.0202	22	111512	506872	Fail
0.0207	20	109431	547155	Fail
0.0212	19	107310	564789	Fail
0.0217	19	105307	554247	Fail
0.0222	19	103324	543810	Fail
0.0227	18	101360	563111	Fail
0.0232	17	99613	585958	Fail
0.0237	15	97767	651780	Fail
0.0243	14	95980	685571	Fail
0.0248	14	94272	673371	Fail
0.0253	13	92662	712784	Fail
0.0258	11	91032	827563	Fail
0.0263	11	89559	814172	Fail
0.0268	11	88106	800963	Fail
0.0273	11	86633	787572	Fail
0.0278	11	85200	774545	Fail

0.0283	11	83766	761509	Fail
0.0288	11	82451	749554	Fail
0.0293	11	81037	736700	Fail
0.0298	11	79604	723672	Fail
0.0303	11	78327	712063	Fail
0.0308	11	77051	700463	Fail
0.0313	10	75775	757750	Fail
0.0318	9	74577	828633	Fail
0.0323	8	73399	917487	Fail
0.0328	7	72260	1032285	Fail
0.0333	7	71082	1015457	Fail
0.0338	6	69962	1166033	Fail
0.0343	6	68883	1148050	Fail
0.0348	6	67763	1129383	Fail
0.0353	6	66703	1111716	Fail
0.0358	6	65682	1094700	Fail
0.0363	6	64661	1077683	Fail
0.0368	6	63659	1060983	Fail
0.0373	5	62717	1254340	Fail
0.0379	4	61755	1543875	Fail
0.0384	4	60812	1520300	Fail
0.0389	4	59948	1498700	Fail
0.0394	4	59025	1475625	Fail
0.0399	4	58142	1453550	Fail
0.0404	3	57238	1907933	Fail
0.0409	3	56374	1879133	Fail
0.0414	3	55511	1850366	Fail
0.0419	3	54647	1821566	Fail
0.0424	3	53841	1794700	Fail
0.0429	3	53017	1767233	Fail
0.0434	3	52251	1741700	Fail
0.0439	3	51485	1716166	Fail
0.0444	3	50739	1691300	Fail
0.0449	3	49993	1666433	Fail
0.0454	3	49266	1642200	Fail
0.0459	3	48579	1619300	Fail
0.0464	3	47892	1596400	Fail
0.0469	3	47185	1572833	Fail
0.0474	3	46537	1551233	Fail
0.0479	3	45830	1527666	Fail
0.0484	3	45162	1505400	Fail
0.0489	3	44514	1483800	Fail
0.0494	3	43886	1462866	Fail
0.0499	3	43277	1442566	Fail
0.0504	3	42629	1420966	Fail
0.0509	3	42060	1402000	Fail

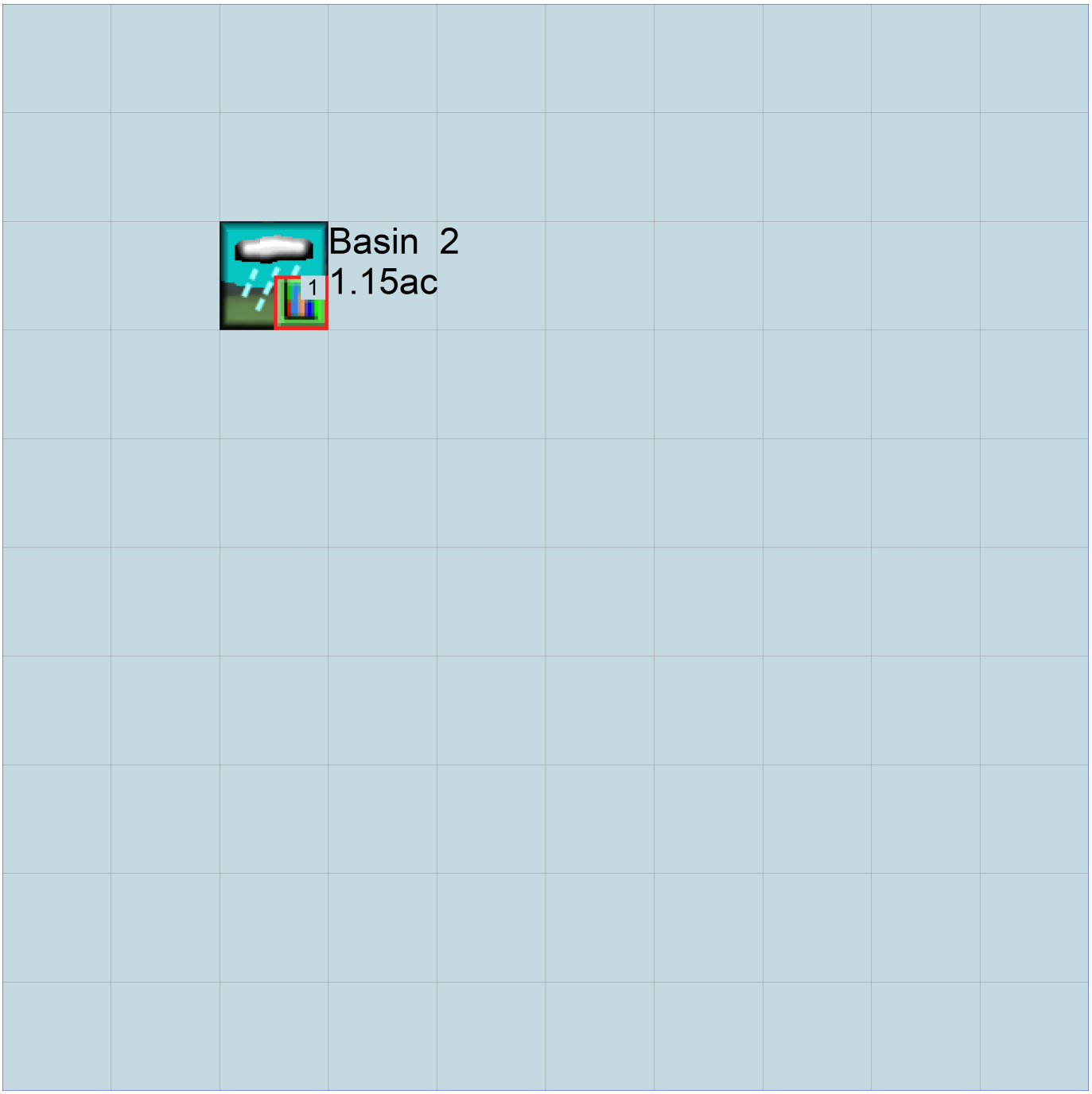
The development has an increase in flow durations from 1/2 Predeveloped 2 year flow to the 2 year flow or more than a 10% increase from the 2 year to the 50 year flow.
The development has an increase in flow durations for more than 50% of the flows for the range of the duration analysis.

Water Quality

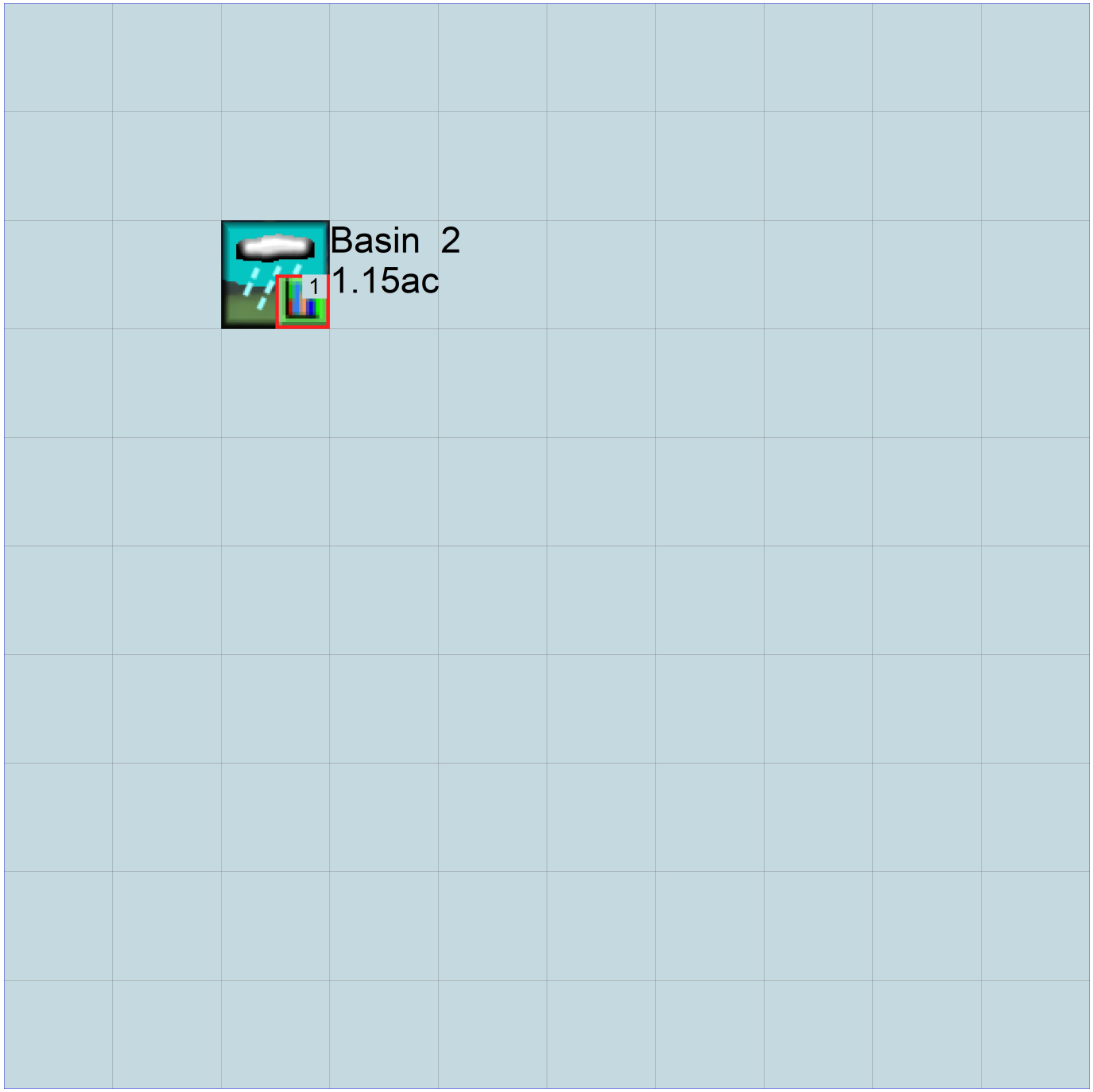
Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0.2714 acre-feet
On-line facility target flow:	0.3269 cfs.
Adjusted for 15 min:	0.3269 cfs.
Off-line facility target flow:	0.1839 cfs.
Adjusted for 15 min:	0.1839 cfs.

Appendix
Predeveloped Schematic



Mitigated Schematic



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Attachment 11.A

WWHM2012

PROJECT REPORT

General Model Information

WWHM2012 Project Name: 3264.02 West Bay Preliminary Treatment Basin 3
Site Name:
Site Address:
City:
Report Date: 9/18/2024
Gage: Courthouse
Data Start: 1955/10/01
Data End: 2011/09/30
Timestep: 15 Minute
Precip Scale: 1.000
Version Date: 2024/06/28
Version: 4.3.1

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 3

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A B, Forest, Flat	0.48
Pervious Total	0.48

Impervious Land Use	acre
Impervious Total	0
Basin Total	0.48

Element Flow Componants:

Surface	Interflow	Groundwater

Componant Flows To:

POC 1	POC 1	

Mitigated Land Use

Basin 3

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A B, Lawn, Flat	0.04
Pervious Total	0.04

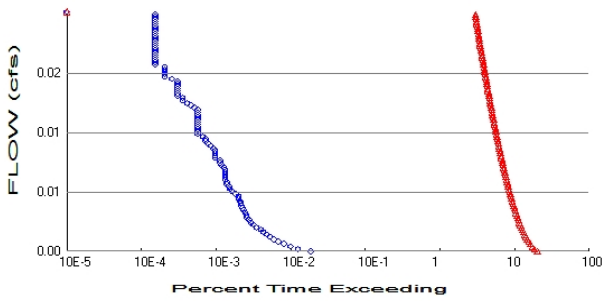
Impervious Land Use	acre
PARKING FLAT	0.44
Impervious Total	0.44
Basin Total	0.48

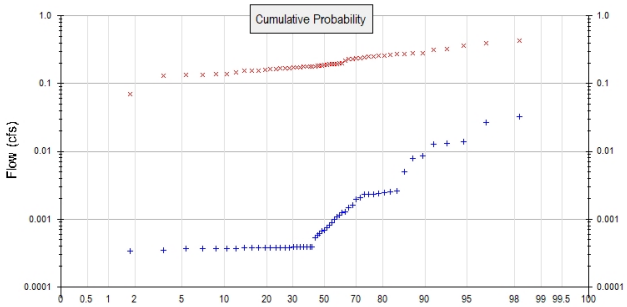
Element Flow Componants:

Surface	Interflow	Groundwater
Componant Flows To:		
POC 1	POC 1	

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.48
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.04
Total Impervious Area: 0.44

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.000907
5 year	0.002815
10 year	0.005552
25 year	0.012263
50 year	0.021264
100 year	0.035816

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.199195
5 year	0.261024
10 year	0.29694
25 year	0.337629
50 year	0.365061
100 year	0.390395

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1956	0.001	0.155
1957	0.000	0.281
1958	0.001	0.182
1959	0.001	0.187
1960	0.002	0.395
1961	0.002	0.147
1962	0.000	0.155
1963	0.002	0.319
1964	0.002	0.196
1965	0.002	0.182

1966	0.000	0.138
1967	0.013	0.275
1968	0.002	0.158
1969	0.000	0.136
1970	0.000	0.133
1971	0.003	0.153
1972	0.027	0.256
1973	0.000	0.173
1974	0.008	0.235
1975	0.000	0.171
1976	0.001	0.170
1977	0.000	0.265
1978	0.001	0.192
1979	0.000	0.235
1980	0.001	0.170
1981	0.002	0.246
1982	0.001	0.248
1983	0.001	0.361
1984	0.009	0.252
1985	0.000	0.232
1986	0.001	0.181
1987	0.002	0.167
1988	0.000	0.138
1989	0.000	0.130
1990	0.003	0.260
1991	0.014	0.280
1992	0.000	0.195
1993	0.001	0.162
1994	0.000	0.174
1995	0.000	0.180
1996	0.032	0.272
1997	0.000	0.066
1998	0.000	0.071
1999	0.001	0.195
2000	0.000	0.218
2001	0.000	0.177
2002	0.001	0.201
2003	0.001	0.178
2004	0.013	0.428
2005	0.000	0.165
2006	0.000	0.186
2007	0.005	0.232
2008	0.000	0.199
2009	0.000	0.317
2010	0.000	0.177
2011	0.001	0.179

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0322	0.4283
2	0.0269	0.3952
3	0.0140	0.3612
4	0.0131	0.3193
5	0.0129	0.3167
6	0.0087	0.2806
7	0.0078	0.2798
8	0.0049	0.2748

9	0.0026	0.2717
10	0.0025	0.2649
11	0.0024	0.2603
12	0.0024	0.2564
13	0.0023	0.2524
14	0.0023	0.2484
15	0.0023	0.2455
16	0.0021	0.2351
17	0.0020	0.2349
18	0.0016	0.2324
19	0.0015	0.2320
20	0.0013	0.2185
21	0.0013	0.2007
22	0.0011	0.1989
23	0.0011	0.1965
24	0.0010	0.1954
25	0.0009	0.1947
26	0.0008	0.1921
27	0.0007	0.1868
28	0.0007	0.1863
29	0.0007	0.1823
30	0.0006	0.1823
31	0.0006	0.1814
32	0.0005	0.1800
33	0.0004	0.1794
34	0.0004	0.1776
35	0.0004	0.1769
36	0.0004	0.1765
37	0.0004	0.1743
38	0.0004	0.1730
39	0.0004	0.1708
40	0.0004	0.1701
41	0.0004	0.1696
42	0.0004	0.1673
43	0.0004	0.1652
44	0.0004	0.1620
45	0.0004	0.1579
46	0.0004	0.1547
47	0.0004	0.1545
48	0.0004	0.1525
49	0.0004	0.1465
50	0.0004	0.1382
51	0.0004	0.1375
52	0.0004	0.1357
53	0.0004	0.1328
54	0.0004	0.1304
55	0.0003	0.0707
56	0.0003	0.0655

Duration Flows

The Duration Matching Failed

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0005	367	394877	107595	Fail
0.0007	243	362478	149167	Fail
0.0009	196	338718	172815	Fail
0.0011	160	319868	199917	Fail
0.0013	133	304159	228690	Fail
0.0015	115	290610	252704	Fail
0.0017	103	279025	270898	Fail
0.0019	95	268618	282755	Fail
0.0021	84	259193	308563	Fail
0.0023	78	250553	321221	Fail
0.0026	68	242699	356910	Fail
0.0028	62	235434	379732	Fail
0.0030	57	228758	401329	Fail
0.0032	54	222670	412351	Fail
0.0034	51	216583	424672	Fail
0.0036	50	211085	422170	Fail
0.0038	48	205980	429125	Fail
0.0040	46	201071	437110	Fail
0.0042	44	196319	446179	Fail
0.0044	43	191901	446281	Fail
0.0047	42	187522	446480	Fail
0.0049	41	183340	447170	Fail
0.0051	39	179275	459679	Fail
0.0053	39	175662	450415	Fail
0.0055	36	172128	478133	Fail
0.0057	32	168711	527221	Fail
0.0059	30	165452	551506	Fail
0.0061	29	162251	559486	Fail
0.0063	27	159148	589437	Fail
0.0065	27	156301	578892	Fail
0.0068	26	153493	590357	Fail
0.0070	26	150725	579711	Fail
0.0072	26	148035	569365	Fail
0.0074	26	145403	559242	Fail
0.0076	26	142870	549500	Fail
0.0078	25	140514	562056	Fail
0.0080	23	138118	600513	Fail
0.0082	22	135880	617636	Fail
0.0084	22	133543	607013	Fail
0.0087	19	131344	691284	Fail
0.0089	19	129204	680021	Fail
0.0091	19	127103	668963	Fail
0.0093	19	125021	658005	Fail
0.0095	18	123097	683872	Fail
0.0097	17	121271	713358	Fail
0.0099	15	119366	795773	Fail
0.0101	14	117422	838728	Fail
0.0103	14	115596	825685	Fail
0.0105	13	113888	876061	Fail
0.0108	11	112238	1020345	Fail
0.0110	11	110550	1005000	Fail
0.0112	11	108940	990363	Fail
0.0114	11	107310	975545	Fail
0.0116	11	105739	961263	Fail

0.0118	11	104188	947163	Fail
0.0120	11	102656	933236	Fail
0.0122	11	101164	919672	Fail
0.0124	11	99789	907172	Fail
0.0126	11	98336	893963	Fail
0.0129	11	96942	881290	Fail
0.0131	10	95627	956270	Fail
0.0133	9	94272	1047466	Fail
0.0135	8	92995	1162437	Fail
0.0137	7	91739	1310557	Fail
0.0139	7	90541	1293442	Fail
0.0141	6	89402	1490033	Fail
0.0143	6	88283	1471383	Fail
0.0145	6	87124	1452066	Fail
0.0147	6	85966	1432766	Fail
0.0150	6	84866	1414433	Fail
0.0152	6	83766	1396100	Fail
0.0154	6	82726	1378766	Fail
0.0156	5	81607	1632140	Fail
0.0158	4	80507	2012675	Fail
0.0160	4	79466	1986650	Fail
0.0162	4	78465	1961625	Fail
0.0164	4	77483	1937075	Fail
0.0166	4	76482	1912050	Fail
0.0168	3	75500	2516666	Fail
0.0171	3	74577	2485900	Fail
0.0173	3	73634	2454466	Fail
0.0175	3	72731	2424366	Fail
0.0177	3	71808	2393600	Fail
0.0179	3	70925	2364166	Fail
0.0181	3	70041	2334700	Fail
0.0183	3	69197	2306566	Fail
0.0185	3	68372	2279066	Fail
0.0187	3	67488	2249600	Fail
0.0190	3	66683	2222766	Fail
0.0192	3	65878	2195933	Fail
0.0194	3	65073	2169100	Fail
0.0196	3	64307	2143566	Fail
0.0198	3	63522	2117400	Fail
0.0200	3	62795	2093166	Fail
0.0202	3	62049	2068300	Fail
0.0204	3	61342	2044733	Fail
0.0206	3	60577	2019233	Fail
0.0208	3	59909	1996966	Fail
0.0211	3	59202	1973400	Fail
0.0213	3	58495	1949833	Fail

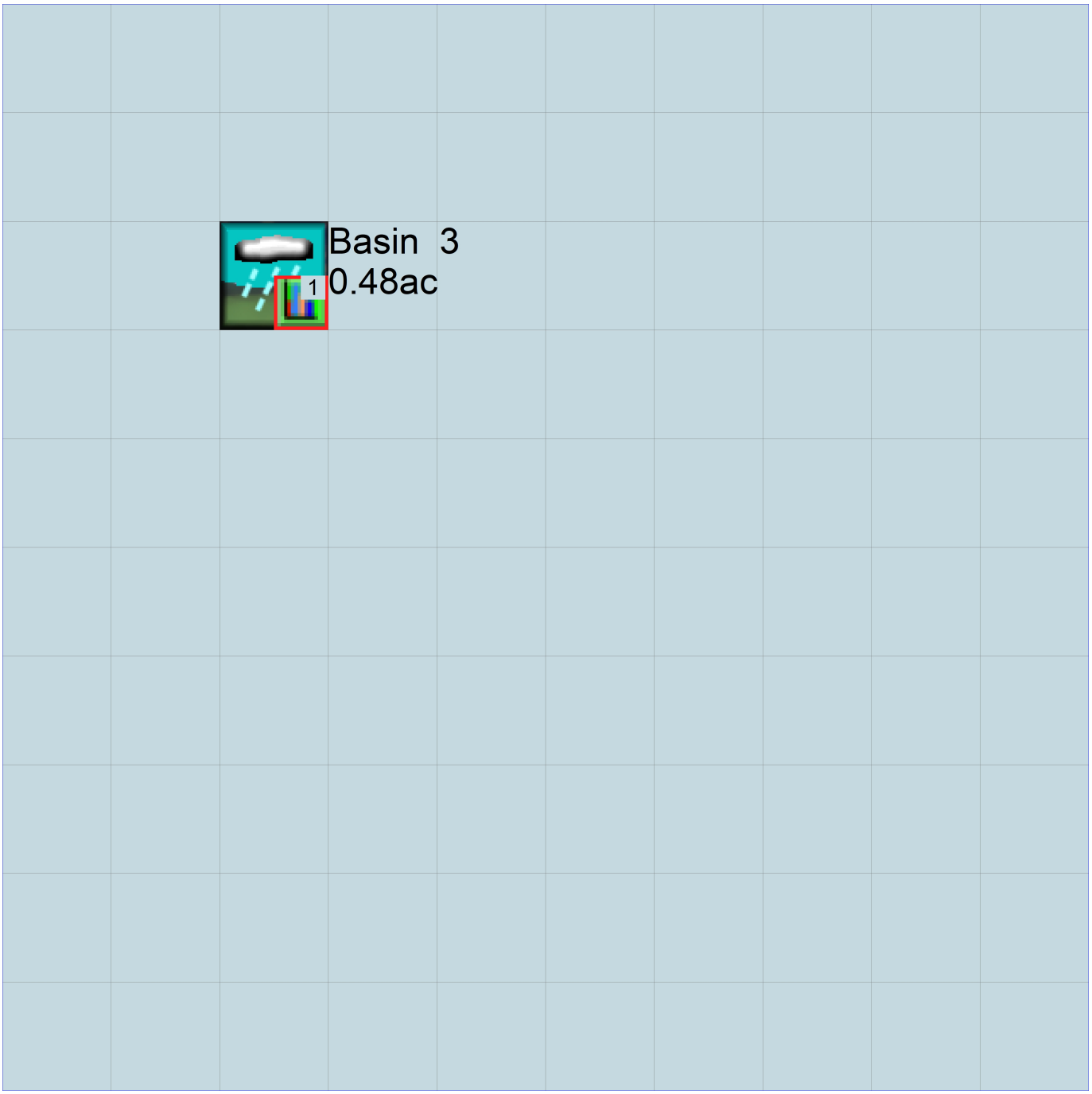
The development has an increase in flow durations from 1/2 Predeveloped 2 year flow to the 2 year flow or more than a 10% increase from the 2 year to the 50 year flow.
The development has an increase in flow durations for more than 50% of the flows for the range of the duration analysis.

Water Quality

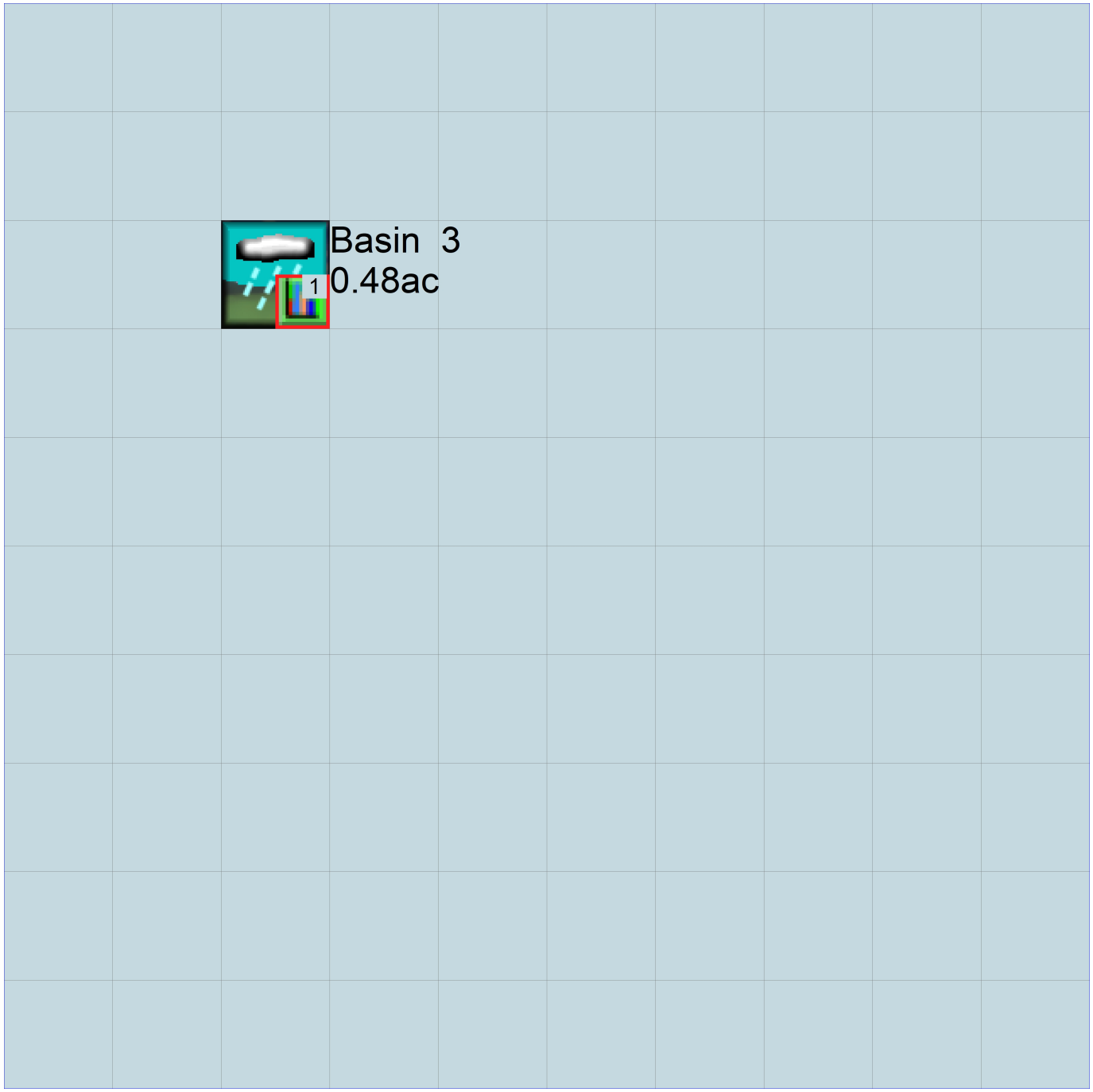
Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0.1349 acre-feet
On-line facility target flow:	0.163 cfs.
Adjusted for 15 min:	0.163 cfs.
Off-line facility target flow:	0.0917 cfs.
Adjusted for 15 min:	0.0917 cfs.

Appendix
Predeveloped Schematic



Mitigated Schematic



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