File No. PLN-T1-2025-00297

CITY OF RICHLAND
Determination of Non-Significance

Description of Proposal: Removal of the existing plaza lookout area, existing basalt columns and installation of woven filter geotextile, gravel backfill, Redi-rock blocks, concrete surfacing and steel handrail.

Proponent:
Marc La Vanway
City of Richland
625 Swift Blvd
Richland, WA 99352

Location of Proposal: The location is on the Riverfront Trail on the northeast side of the Courtyard Richland Columbia Point Hotel located at 480 Columbia Point Dr, Richland, WA 99352.

Lead Agency: City of Richland

The lead agency for this proposal has determined that it does not have a probable significant adverse impact on the environment. An environmental impact statement (EIS) is not required under RCW 43.21C.030(2)(c). This decision was made after review of a completed environmental checklist and other information on file with the lead agency. This information is available to the public on request.

( ) There is no comment for the DNS.

(**X**) This DNS is issued under WAC 197-11-340(2); the lead agency will not act on this proposal for fourteen days from the date of issuance.

( ) This DNS is issued after using the optional DNS process in WAC 197-11-355. There is no further comment period on the DNS.

Responsible Official: Mike Stevens
Position/Title: Planning Manager
Address: 625 Swift Blvd., MS #35, Richland, WA 99352
Date: August 5, 2025
Comments Due: August 20, 2025

Signature _____

City of Richland
625 Swift Blvd
Richland WA 99352
(509) 942-7794

Plan Snapshot Report

Plan Type:	Type 1	**Plan #:**	PLN-T1-2025-00297	**App Date:**	07/15/2025
Work Class:	T1 - Environmental Determination	**District:**	City of Richland	**Exp Date:**	11/12/2025
Status:	In Review			**Completed:**	NOT COMPLETED
Description:	Near the Courtyard Richland Columbia Point Hotel, the project involves removal of the existing plaza lookout area, existing basalt columns and installation of woven filter geotextile, gravel backfill, Redi-rock blocks, concrete surfacing and steel handrail			**Approval Expire Date:**	

Parcel:	113983012611003	Main	**Address:**	482 Columbia Point Dr Richland, WA 99352	Main
					Zone:

Applicant
Marc La Vanway
625 Swift Blvd
Richland, WA 99352
Business: (509) 942-7791
Mobile: (509) 539-1243

Property Owner
City of Richland Economic
Development Division
Business: (509) 942-7591

SEPA[1] Environmental Checklist

Purpose of checklist

Governmental agencies use this checklist to help determine whether the environmental impacts of your proposal are significant. This information is also helpful to determine if available avoidance, minimization, or compensatory mitigation measures will address the probable significant impacts or if an environmental impact statement will be prepared to further analyze the proposal.

Instructions for applicants

This environmental checklist asks you to describe some basic information about your proposal. Please answer each question accurately and carefully, to the best of your knowledge. You may need to consult with an agency specialist or private consultant for some questions. **You may use "not applicable" or "does not apply" only when you can explain why it does not apply and not when the answer is unknown.** You may also attach or incorporate by reference additional studies reports. Complete and accurate answers to these questions often avoid delays with the SEPA process as well as later in the decision-making process.

The checklist questions apply to **all parts of your proposal**, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effects. The agency to which you submit this checklist may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impact.

Instructions for lead agencies

Please adjust the format of this template as needed. Additional information may be necessary to evaluate the existing environment, all interrelated aspects of the proposal and an analysis of adverse impacts. The checklist is considered the first but not necessarily the only source of information needed to make an adequate threshold determination. Once a threshold determination is made, the lead agency is responsible for the completeness and accuracy of the checklist and other supporting documents.

Use of checklist for nonproject proposals

For nonproject proposals (such as ordinances, regulations, plans and programs), complete the applicable parts of sections A and B, plus the Supplemental Sheet for Nonproject Actions (Part D). Please completely answer all questions that apply and note that the words "project," "applicant," and "property or site" should be read as "proposal," "proponent," and "affected geographic area," respectively. The lead agency may exclude (for non-projects) questions in "Part B: Environmental Elements" that do not contribute meaningfully to the analysis of the proposal.

[1] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-guidance/Checklist-guidance

A.Background

Find help answering background questions[2]

1. **Name of proposed project, if applicable:**

   Courtyard Marriott Plaza Wall Repair

2. **Name of applicant:**

   City of Richland

3. **Address and phone number of applicant and contact person:**

   Marc La Vanway

   509-942-7791

   625 Swift Blvd., Richland, WA 99352

4. **Date checklist prepared:**

   7/15/2025

5. **Agency requesting checklist:**

   City of Richland Public Works Department

6. **Proposed timing of schedule (including phasing, if applicable):**

   Construct project in 2026

7. **Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.**

   No.

8. **List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.**

   None.

9. **Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain.**

   N/A

10. **List any government approvals or permits that will be needed for your proposal, if known.**

    Shoreline Exemption and (possibly) a Hydraulic Permit Approval (HPA)

11. **Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page. (Lead agencies may modify this form to include additional specific information on project description.)**

[2] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-guidance/SEPA-checklist-guidance/SEPA-Checklist-Section-A-Background

Near the Courtyard Richland Columbia Point Hotel, the project involves removal of the existing plaza lookout area, existing basalt columns and installation of woven filter geotextile, gravel backfill, Redi-rock blocks, concrete surfacing and steel handrail.

12. **Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.**

    The location is on the Riverfront Trail on the northeast side of the Courtyard Richland Columbia Point Hotel located at 480 Columbia Point Dr, Richland, WA 99352.

B.Environmental Elements

1. Earth

Find help answering earth questions[3]

a. **General description of the site:**

Circle or highlight one: Flat, rolling, hilly, steep slopes, mountainous, other:

b. **What is the steepest slope on the site (approximate percent slope)?**

    30%

c. **What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them, and note any agricultural land of long-term commercial significance and whether the proposal results in removing any of these soils.**

    Fine sandy loam

d. **Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.**

    No

e. **Describe the purpose, type, total area, and approximate quantities and total affected area of any filling, excavation, and grading proposed. Indicate source of fill.**

    The purpose of the excavation is to remove the existing soil and concrete to allow for installation of the geotextile, reinforced soil crushed surface base and Redi-rock block

[3] https://ecology.wa.gov/regulations-permits/sepa/environmental-review/sepa-guidance/sepa-checklist-guidance/sepa-checklist-section-b-environmental-elements/environmental-elements-earth

wall. Approximately 4,400 SY of total material (asphalt, concrete, soil, and rock) will be removed and replaced.

f. Could erosion occur because of clearing, construction, or use? If so, generally describe.

No.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

No new impervious surfaces will be covered.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any.

Temporary and permanent BMPs will be implemented to stabilize the site during construction.

2. Air

Find help answering air questions[4]

a. What types of emissions to the air would result from the proposal during construction, operation, and maintenance when the project is completed? If any, generally describe and give approximate quantities if known.

Vehicle and construction equipment use.

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.

No.

c. Proposed measures to reduce or control emissions or other impacts to air, if any:

Measures to reduce or control emissions will be the responsibility of the contractor.

3. Water

Find help answering water questions[5]

a. Surface:

Find help answering surface water questions[6]

1. Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If

[4] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-guidance/SEPA-checklist-guidance/SEPA-Checklist-Section-B-Environmental-elements/Environmental-elements-Air
[5] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-guidance/SEPA-checklist-guidance/SEPA-Checklist-Section-B-Environmental-elements/Environmental-elements-3-Water
[6] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-guidance/SEPA-checklist-guidance/SEPA-Checklist-Section-B-Environmental-elements/Environmental-elements-3-Water/Environmental-elements-Surface-water

yes, describe type and provide names. If appropriate, state what stream or river it flows into.

Yes, Columbia River.

2. **Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.**

   Yes. The Columbia River is directly adjacent to the project site.

3. **Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.**

   N/A

4. **Will the proposal require surface water withdrawals or diversions? Give a general description, purpose, and approximate quantities if known.**

   No

5. **Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.**

   Yes

6. **Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.**

   No.

b. Ground:

Find help answering ground water questions[7]

1. **Will groundwater be withdrawn from a well for drinking water or other purposes? If so, give a general description of the well, proposed uses and approximate quantities withdrawn from the well. Will water be discharged to groundwater? Give a general description, purpose, and approximate quantities if known.**

   No

2. **Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (domestic sewage; industrial, containing the following chemicals…; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.**

   N/A

c. Water Runoff (including stormwater):

[7] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-guidance/SEPA-checklist-guidance/SEPA-Checklist-Section-B-Environmental-elements/Environmental-elements-3-Water/Environmental-elements-Groundwater

1. **Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.**

   The source of the runoff is stormwater. The method of collection is for it flow into the Columbia River as it has always done since no stormwater collection system is in place.

2. **Could waste materials enter ground or surface waters? If so, generally describe.**

   No

3. **Does the proposal alter or otherwise affect drainage patterns in the vicinity of the site? If so, describe.**

   No

d. Proposed measures to reduce or control surface, ground, and runoff water, and drainage pattern impacts, if any:

4. Plants

Find help answering plants questions

a. Check the types of vegetation found on the site:

☒ **deciduous tree: alder, maple, aspen, other**

☐ **evergreen tree: fir, cedar, pine, other**

☒ **shrubs**

☐ **grass**

☐ **pasture**

☐ **crop or grain**

☐ **orchards, vineyards, or other permanent crops.**

☐ **wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other**

☐ **water plants: water lily, eelgrass, milfoil, other**

☐ **other types of vegetation**

b. What kind and amount of vegetation will be removed or altered?

Existing shrubs/weeds and one tree will be removed.

c. List threatened and endangered species known to be on or near the site.

None known.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any.

None.

e. List all noxious weeds and invasive species known to be on or near the site.

None known.

5. Animals

Find help answering animal questions[8]

a. List any birds and other animals that have been observed on or near the site or are known to be on or near the site.

Examples include:

- **Birds: hawk, heron, eagle, songbirds, other:**
- **Mammals: deer, bear, elk, beaver, other:**
- **Fish: bass, salmon, trout, herring, shellfish, other:**

b. List any threatened and endangered species known to be on or near the site.

None known.

c. Is the site part of a migration route? If so, explain.

None known.

d. Proposed measures to preserve or enhance wildlife, if any.

None.

e. List any invasive animal species known to be on or near the site.

None known.

6. Energy and natural resources

Find help answering energy and natural resource questions[9]

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

None

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

No.

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any.

[8] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-guidance/SEPA-checklist-guidance/SEPA-Checklist-Section-B-Environmental-elements/Environmental-elements-5-Animals
[9] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-guidance/SEPA-checklist-guidance/SEPA-Checklist-Section-B-Environmental-elements/Environmental-elements-6-Energy-natural-resou

None.

7. Environmental health

Health Find help with answering environmental health questions[10]

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur because of this proposal? If so, describe.

None known.

1. **Describe any known or possible contamination at the site from present or past uses.**

   None known.

2. **Describe existing hazardous chemicals/conditions that might affect project development and design. This includes underground hazardous liquid and gas transmission pipelines located within the project area and in the vicinity.**

   None known.

3. **Describe any toxic or hazardous chemicals that might be stored, used, or produced during the project's development or construction, or at any time during the operating life of the project.**

   None known.

4. **Describe special emergency services that might be required.**

   None.

5. **Proposed measures to reduce or control environmental health hazards, if any.**

   The contractor will be required to provide all personnel with personal protective equipment (PPE) and comply will all work-site safety requirements.

b. Noise

1. **What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?**

   The adjacent local marina has boats and equipment coming and going into the marina.

2. **What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site)?**

   The construction of the project will generate temporary noise through the use of heavy equipment. Noise will be generated from construction noise during work hours, typically Monday through Friday from 7:00 am to 6:00 pm.

[10] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-guidance/SEPA-checklist-guidance/SEPA-Checklist-Section-B-Environmental-elements/Environmental-elements-7-Environmental-health

3. **Proposed measures to reduce or control noise impacts, if any:** None

8. Land and shoreline use

Find help answering land and shoreline use questions[11]

a. **What is the current use of the site and adjacent properties? Will the proposal affect current land uses on nearby or adjacent properties? If so, describe.**

   The current land use for the site and adjacent properties is Waterfront. The proposal will not affect current land use on nearby and adjacent properties.

b. **Has the project site been used as working farmlands or working forest lands? If so, describe. How much agricultural or forest land of long-term commercial significance will be converted to other uses because of the proposal, if any? If resource lands have not been designated, how many acres in farmland or forest land tax status will be converted to nonfarm or nonforest use?**

   No

   1. **Will the proposal affect or be affected by surrounding working farm or forest land normal business operations, such as oversize equipment access, the application of pesticides, tilling, and harvesting? If so, how?** No.

c. **Describe any structures on the site.**

   There is a hotel adjacent to the project site.

d. **Will any structures be demolished? If so, what?**

   No.

e. **What is the current zoning classification of the site?**

   Waterfront

f. **What is the current comprehensive plan designation of the site?**

   Waterfront

g. **If applicable, what is the current shoreline master program designation of the site?**

   Waterfront

h. **Has any part of the site been classified as a critical area by the city or county? If so, specify.**

   No

i. **Approximately how many people would reside or work in the completed project?**

   None

[11] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-guidance/SEPA-checklist-guidance/SEPA-Checklist-Section-B-Environmental-elements/Environmental-elements-8-Land-shoreline-use

j. Approximately how many people would the completed project displace?

None

k. Proposed measures to avoid or reduce displacement impacts, if any.

None

l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any.

None.

m. Proposed measures to reduce or control impacts to agricultural and forest lands of long-term commercial significance, if any:

N/A

9. Housing

Find help answering housing questions[12]

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

N/A

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

N/A

c. Proposed measures to reduce or control housing impacts, if any:

N/A

10. Aesthetics

Find help answering aesthetics questions[13]

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

8-ft exposed retaining redi-rock block wall

b. What views in the immediate vicinity would be altered or obstructed?

None

c. Proposed measures to reduce or control aesthetic impacts, if any:

None

[12] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-guidance/SEPA-checklist-guidance/SEPA-Checklist-Section-B-Environmental-elements/Environmental-elements-9-Housing
[13] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-guidance/SEPA-checklist-guidance/SEPA-Checklist-Section-B-Environmental-elements/Environmental-elements-10-Aesthetics

11. Light and glare

Find help answering light and glare questions[14]

a. **What type of light or glare will the proposal produce? What time of day would it mainly occur?**

   None

b. **Could light or glare from the finished project be a safety hazard or interfere with views?**

   None

c. **What existing off-site sources of light or glare may affect your proposal?**

   None

d. **Proposed measures to reduce or control light and glare impacts, if any:**

   None

12. Recreation

Find help answering recreation questions

a. **What designated and informal recreational opportunities are in the immediate vicinity?**

The Riverfront trail recreational pathway is located onsite and adjacent to the project site.

b. **Would the proposed project displace any existing recreational uses? If so, describe.**

No

c. **Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:**

The project will not cause impacts to recreation.

13. Historic and cultural preservation

Find help answering historic and cultural preservation questions[15]

a. **Are there any buildings, structures, or sites, located on or near the site that are over 45 years old listed in or eligible for listing in national, state, or local preservation registers? If so, specifically describe.**

   No.

b. **Are there any landmarks, features, or other evidence of Indian or historic use or occupation? This may include human burials or old cemeteries. Are there any material**

[14] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-guidance/SEPA-checklist-guidance/SEPA-Checklist-Section-B-Environmental-elements/Environmental-elements-11-Light-glare
[15] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-guidance/SEPA-checklist-guidance/SEPA-Checklist-Section-B-Environmental-elements/Environmental-elements-13-Historic-cultural-p

evidence, artifacts, or areas of cultural importance on or near the site? Please list any professional studies conducted at the site to identify such resources.

None known.

c. **Describe the methods used to assess the potential impacts to cultural and historic resources on or near the project site. Examples include consultation with tribes and the department of archeology and historic preservation, archaeological surveys, historic maps, GIS data, etc.**

GIS data.

d. **Proposed measures to avoid, minimize, or compensate for loss, changes to, and disturbance to resources. Please include plans for the above and any permits that may be required.**

N/A

14. Transportation

Find help with answering transportation questions[16]

a. **Identify public streets and highways serving the site or affected geographic area and describe proposed access to the existing street system. Show on site plans, if any.**

The closest public street is Columbia Point Drive. It is accessed through the parking lots of the local hotels.

b. **Is the site or affected geographic area currently served by public transit? If so, generally describe. If not, what is the approximate distance to the nearest transit stop?**

No.

c. **Will the proposal require any new or improvements to existing roads, streets, pedestrian, bicycle, or state transportation facilities, not including driveways? If so, generally describe (indicate whether public or private).**

The existing recreational pathway will be replaced with new hot mix asphalt with a like-for-like replacement.

d. **Will the project or proposal use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.**

Yes. The project is adjacent to the Columbia River.

e. **How many vehicular trips per day would be generated by the completed project or proposal? If known, indicate when peak volumes would occur and what percentage of the volume would be trucks (such as commercial and nonpassenger vehicles). What data or transportation models were used to make these estimates?**

[16] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-guidance/SEPA-checklist-guidance/SEPA-Checklist-Section-B-Environmental-elements/Environmental-elements-14-Transportation

None, it is a pedestrian recreational pathway.

f. Will the proposal interfere with, affect, or be affected by the movement of agricultural and forest products on roads or streets in the area? If so, generally describe.

No.

g. Proposed measures to reduce or control transportation impacts, if any:

None

15. Public services

Find help answering public service questions[17]

a. Would the project result in an increased need for public services (for example: fire protection, police protection, public transit, health care, schools, other)? If so, generally describe.

No

b. Proposed measures to reduce or control direct impacts on public services, if any.

None

16. Utilities

Find help answering utilities questions[18]

a. Circle utilities currently available at the site: electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other:

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.

None

C.Signature

Find help about who should sign[19]

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

[17] https://ecology.wa.gov/regulations-permits/sepa/environmental-review/sepa-guidance/sepa-checklist-guidance/sepa-checklist-section-b-environmental-elements/environmental-elements-15-public-services
[18] https://ecology.wa.gov/regulations-permits/sepa/environmental-review/sepa-guidance/sepa-checklist-guidance/sepa-checklist-section-b-environmental-elements/environmental-elements-16-utilities
[19] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-guidance/SEPA-checklist-guidance/SEPA-Checklist-Section-C-Signature

Type name of signee: Marc La Vanway

Position and agency/organization: Civil Engineer II, City of Richland

Date submitted: 7/15/2025

D.Supplemental sheet for nonproject actions

Find help for the nonproject actions worksheet[20]

Do not use this section for project actions.

Because these questions are very general, it may be helpful to read them in conjunction with the list of the elements of the environment.

When answering these questions, be aware of the extent the proposal, or the types of activities likely to result from the proposal, would affect the item at a greater intensity or at a faster rate than if the proposal were not implemented. Respond briefly and in general terms.

1. **How would the proposal be likely to increase discharge to water; emissions to air; production, storage, or release of toxic or hazardous substances; or production of noise?**

   - **Proposed measures to avoid or reduce such increases are:**

2. **How would the proposal be likely to affect plants, animals, fish, or marine life?**

   - **Proposed measures to protect or conserve plants, animals, fish, or marine life are:**

3. **How would the proposal be likely to deplete energy or natural resources?**

   - **Proposed measures to protect or conserve energy and natural resources are:**

4. **How would the proposal be likely to use or affect environmentally sensitive areas or areas designated (or eligible or under study) for governmental protection, such as**

[20] https://ecology.wa.gov/regulations-permits/sepa/environmental-review/sepa-guidance/sepa-checklist-guidance/sepa-checklist-section-d-non-project-actions

parks, wilderness, wild and scenic rivers, threatened or endangered species habitat, historic or cultural sites, wetlands, floodplains, or prime farmlands?

- **Proposed measures to protect such resources or to avoid or reduce impacts are:**

5. **How would the proposal be likely to affect land and shoreline use, including whether it would allow or encourage land or shoreline uses incompatible with existing plans?**

   - **Proposed measures to avoid or reduce shoreline and land use impacts are:**

6. **How would the proposal be likely to increase demands on transportation or public services and utilities?**

   - **Proposed measures to reduce or respond to such demand(s) are:**

7. **Identify, if possible, whether the proposal may conflict with local, state, or federal laws or requirements for the protection of the environment.**

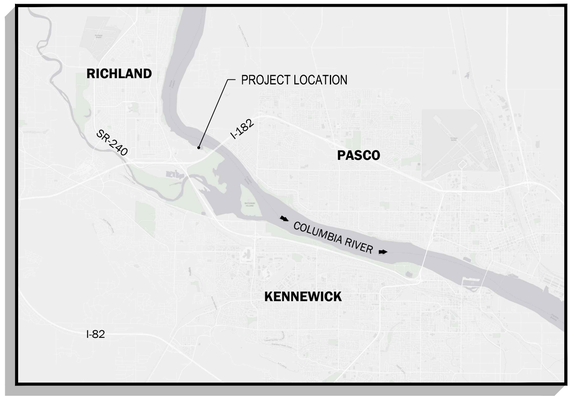

T. 9 N. R. 28 E.
SECTION 13
APPROXIMATE FLOOD ZONE BOUNDARY
FLOOD ZONE A10
PROJECT LOCATION
BUDD'S BROILER
FLOOD ZONE B
COLUMBIA POINT MARINA
APPROXIMATE FLOOD ZONE BOUNDARY
COURTYARD RICHLAND COLUMBIA POINT (MARRIOTT)
THE LODGE AT COLUMBIA POINT
COLUMBIA POINT DRIVE
N
SCALE:
1"=50' (22x34)
1"=100' (11x17)

CITY OF RICHLAND

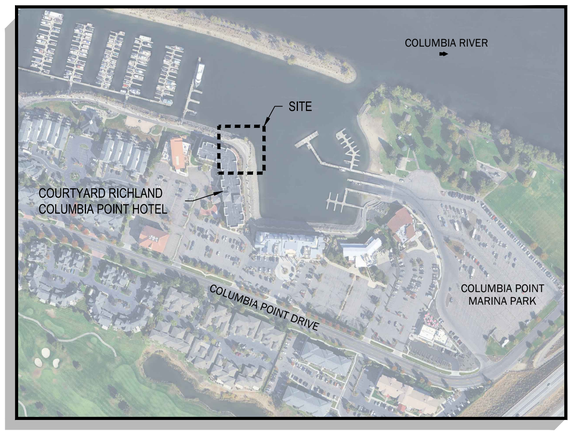
COLUMBIA POINT MARINA SHORELINE RETAINING WALL REPAIR

03725G-RIC

LOCATION MAP



VICINITY MAP



SURVEY NOTES

TOPOGRAPHIC SURVEY DATA AND THE ORDINARY HIGH WATER MARK WERE PROVIDED BY MACKAY SPOSITO, INC., AND DELIVERED TO THE CITY OF RICHLAND ON NOVEMBER 20, 2023. THE LOCATIONS OF SITE FEATURES ARE APPROXIMATE, AND THE DATA IS PROVIDED AS-IS. SURVEY COVERAGE WAS LIMITED, AND AVAILABLE DATA MAY NOT FULLY REPRESENT EXISTING CONDITIONS. PROPERTY OWNERSHIP BOUNDARIES ARE NOT DEPICTED. THE CONTRACTOR IS RESPONSIBLE FOR ESTABLISHING THEIR OWN SURVEY CONTROL AS NECESSARY TO SUPPORT CONSTRUCTION ACTIVITIES.

VERTICAL DATUM NAVD88, **HORIZONTAL DATUM:** NAD83 WASHINGTON STATE PLANE.

CALL 48 HOURS BEFORE YOU DIG
ONE CALL 811
REPORT ALL SPILLS: DEPT. OF ECOLOGY
1-800-258-5990

SHEET INDEX

SHEET	DRAWING	TITLE
1	COV	COVER
2	P01	TRAIL CLOSURE & ACCESS/STAGING PLAN
3	P02	EXISTING CONDITIONS & DEMOLITION PLAN
4	C01	RETAINING WALL PLAN & PROFILE
5	C02	WALL & GRADING DETAILS
6	C03	SURFACE RESTORATION PLAN & DETAILS
7	C04	PEDESTRIAN HANDRAIL DETAILS

CONTACT INFORMATION

CONTACT	ORGANIZATION	PHONE
LAURA CROSS REITER, PE	CROSS REITER, INC.	971-202-3708
MIKE REITER, PE	CROSS REITER, INC.	503-915-8169
MARC LA VANWAY, PE	CITY OF RICHLAND	509-942-7791
JONATHON COLVIN	CITY OF RICHLAND PARKS	509-551-5889

SUMMARY OF QUANTITIES

ID	WSDOT STD. ITEM NO.	WSDOT SPEC SECTION	UNIT	DESCRIPTION	EST. QTY
				PREPARATION	
1	0001	1-09.7	L.S.	MOBILIZATION	1
2	7736	1-07.15	L.S.	SPCC PLAN	1
3	0050	2-02	L.S.	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	1
4	0090	2-02	S.Y.	REMOVING CEMENT CONC. PAVEMENT	340
5	0120	2-02	S.Y.	REMOVING ASPHALT CONC. PAVEMENT	130
6	0262	2-02	L.S.	DECOMMISSIONING WELLS	1
				DRAINAGE	
7	0921	8-30	TON	ROCK FOR EROSION AND SCOUR PROTECTION CLASS A	130
				STRUCTURE	
8	4006	2-09	C.Y.	STRUCTURE EXCAVATION CLASS A INCL. HAUL	560
9	4013	2-09	L.S.	SHORING OR EXTRA EXCAVATION CL. A INCL. HAUL	1
10	–	6-13	S.F.	CONCRETE BLOCK FACED STRUCTURAL EARTH WALL	1160
11	4025	6-13	C.Y.	GRAVEL BORROW FOR STRUCTURAL EARTH WALL INCL. HAUL	560
12	–	6-06	L.F.	PEDESTRIAN HANDRAIL FOR STRUCTURAL EARTH WALL	140
13	7014	7-01	C.Y.	GRAVEL BACKFILL FOR DRAIN	60
14	1160	7-01	L.F.	UNDERDRAIN PIPE 6 IN. DIAM.	150
15	7530	2-12	S.Y.	CONSTRUCTION GEOTEXTILE FOR SEPARATION	160
				SURFACING	
16	5120	4-04	TON	CRUSHED SURFACING TOP COURSE	58
				CEMENT CONCRETE PAVEMENT	
17	5625	5-05	C.Y.	CEMENT CONC. PAVEMENT	40
				HOT MIX ASPHALT	
18	5766	5-04	TON	HMA CL. 3/8" PG 64H-28	30
19	6510	5-02	S.Y.	SOIL RESIDUAL HERBICIDE	470
				EROSION CONTROL AND ROADSIDE PLANTING	
20	6635	8-01	L.F.	HIGH VISIBILITY SILT FENCE	200
21	6488	8-01	L.S.	EROSION CONTROL AND WATER POLLUTION PREVENTION	1
				TRAFFIC	
22	6971	1-10	L.S.	PROJECT TEMPORARY TRAFFIC CONTROL	1
				OTHER ITEMS	
23	7728	1-04	$	MINOR CHANGE	5000

LEGENDS

EXISTING FEATURES

- GROUNDWATER MONITORING WELL
- GEOTECHNICAL BORING
- RETAINING WALL / BASALT COLUMNS
- TREE (DECIDUOUS)
- BENCHES
- LUMINAIRE
- ORDINARY HIGH WATER LINE (OHWL)
- ASPHALT AREA
- CONCRETE AREA
- GRAVEL AREA

DEMOLITION & TESC LEGEND

- SAWCUT LINE
- ASPHALT REMOVAL
- CONCRETE REMOVAL
- SILT FENCE

CIVIL SITEWORK LEGEND

- 1170 MAJOR CONTOUR
- 1171 MINOR CONTOUR
- RAILING
- REDI-ROCK MODULAR BLOCK WALL
- WALL GEOGRID REINFORCEMENT
- ASPHALT
- CONCRETE
- ROCK ARMORING

GENERAL NOTES

1. ALL WORKMANSHIP, CONSTRUCTION AND MATERIALS SHALL BE PERFORMED OR SUPPLIED IN ACCORDANCE WITH THESE SPECIAL PROVISIONS, PLANS, CITY OF RICHLAND (CITY) DESIGN AND CONSTRUCTION STANDARDS, AND THE WSDOT STANDARD SPECIFICATIONS FOR ROAD, BRIDGE, AND MUNICIPAL CONSTRUCTION, 2025 EDITION, AS ISSUED BY THE WASHINGTON STATE DEPARTMENT OF TRANSPORTATION AND THE AMERICAN PUBLIC WORKS ASSOCIATION, WHICH IS HEREINAFTER REFERRED TO AS THE STANDARD SPECIFICATIONS.
2. THE CONTRACTOR SHALL FAMILIARIZE THEMSELVES WITH THE PROJECT GEOTECHNICAL ENGINEERING REPORT, ISSUED JANUARY 27, 2025 AND PREPARED BY CROSS REITER, INC.
3. A PRECONSTRUCTION CONFERENCE IS REQUIRED PRIOR TO CONSTRUCTION, AND 48 HOURS ADVANCE NOTIFICATION PRIOR TO ACTUAL START OF WORK IS REQUIRED.
4. THE LOCATIONS AND ELEVATIONS OF EXISTING UNDERGROUND UTILITIES HAVE NOT BEEN EXPOSED AND MEASURED. THE CONTRACTOR SHALL DETERMINE THE LOCATION OF ALL EXISTING UTILITIES PRIOR TO COMMENCING WORK TO AVOID DAMAGE OR DISTURBANCE, AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE CAUSED BY THE CONTRACTOR'S FAILURE TO LOCATE AND PRESERVE ALL UNDERGROUND UTILITIES. IT IS UNDERSTOOD THAT ABOVE GROUND AND UNDERGROUND FACILITIES NOT SHOWN ON THE PLANS MAY BE ENCOUNTERED DURING THE COURSE OF THE WORK.
5. THE CONTRACTOR SHALL PROTECT ALL BUILDINGS, FENCES, PAVEMENTS, LANDSCAPING, APPURTENANCES, ABOVE GROUND UTILITIES, AND OTHER PROPERTY ADJACENT TO ALL CONSTRUCTION AREAS. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR REPAIRING ALL DAMAGE CAUSED BY CONSTRUCTION ACTIVITIES.
6. THE CONTRACTOR SHALL CONTAIN WORK TO THE CONSTRUCTION LIMITS AS ILLUSTRATED IN THE PLANS. THE CONTRACTOR SHALL NEGOTIATE DIRECTLY WITH PRIVATE PROPERTY OWNERS TO USE PRIVATE PROPERTY FOR EQUIPMENT/MATERIALS STORAGE AND STAGING.
7. ANY REVISIONS TO PLANS MUST BE MADE BY THE ENGINEER AND APPROVED BY THE CITY PRIOR TO ANY IMPLEMENTATION IN THE FIELD.
8. A COPY OF THE APPROVED PLANS MUST BE ON THE JOB SITE WHENEVER CONSTRUCTION IS IN PROGRESS.
9. MATERIALS SAMPLING AND TESTING SHALL BE AT A FREQUENCY AND MAGNITUDE AS SPECIFIED IN THE STANDARD SPECIFICATIONS OR DETERMINED BY THE ENGINEER. A PRIVATE AND INDEPENDENT TESTING LABORATORY SHALL PERFORM TESTING AND SAMPLING. CERTIFIED TEST REPORTS SHALL BE FURNISHED FOR ALL TESTS PERFORMED BY PRIVATE TESTING LABORATORIES.
10. WHERE THE LIMITS OF DISTURBANCE MEET EXISTING GRADES, THE CONTRACTOR SHALL PROVIDE A SMOOTH AND NEAT TRANSITION FROM PROPOSED TO EXISTING.
11. THE ORDINARY HIGH WATER LINE (OHWL) SHOWN ON THESE DRAWINGS REPRESENTS A REGULATORY REFERENCE ELEVATION AND DOES NOT REFLECT ACTUAL COLUMBIA RIVER OR GROUNDWATER LEVELS AT THE TIME OF CONSTRUCTION. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING DEWATERING AS NECESSARY TO PERFORM THE WORK IN THE DRY. THE CONTRACTOR IS RESPONSIBLE FOR COMPLYING WITH ALL WATER QUALITY LAWS AND REGULATIONS. REFER TO THE PROJECT GEOTECHNICAL ENGINEERING REPORT FOR DETAILS. NO MEASUREMENT OR PAYMENT WILL BE MADE FOR ANY DEWATERING ACTIVITIES. ALL COSTS ASSOCIATED WITH DEWATERING SHALL BE CONSIDERED INCIDENTAL TO THE WORK.
12. THE CONTRACTOR IS RESPONSIBLE FOR SECURING THE WORK AREA AT THE END OF EACH WORK DAY AND PROVIDING TEMPORARY CHAINLINK FENCING AND PADLOCKED GATES TO PREVENT THE PUBLIC FROM EXPOSURE TO SAFETY HAZARDS ASSOCIATED WITH THE EXISTING FAILING RETAINING WALL AND SHORELINE SLOPES.

RICHLAND WASHINGTON

CROSS REITER civil + geotechnical engineers

LAURA LEIGH REITER — STATE OF WASHINGTON — PRELIMINARY — 54130 — REGISTERED PROFESSIONAL ENGINEER

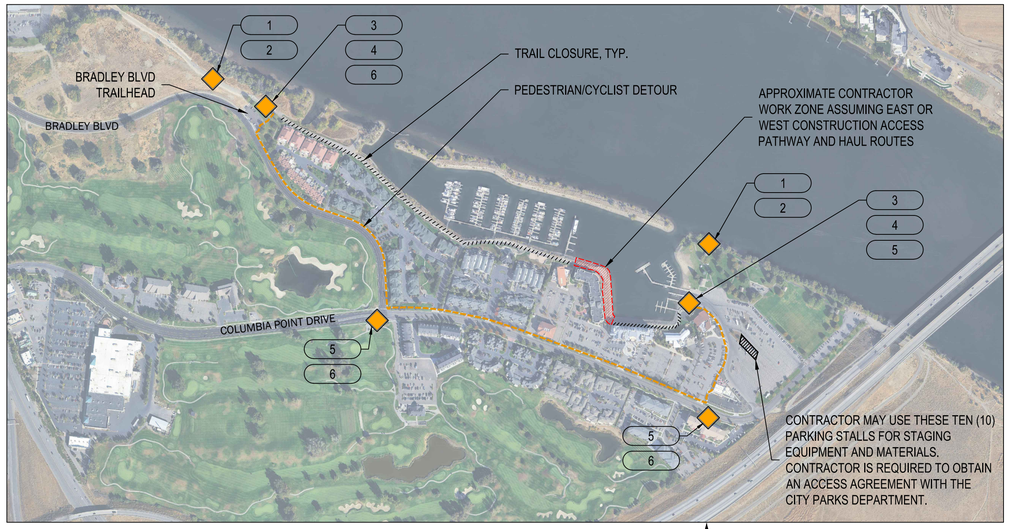
MICHAEL BENJAMIN REITER — STATE OF WASHINGTON — PRELIMINARY — 54129 — REGISTERED PROFESSIONAL ENGINEER

60% DESIGN

06/25/25
RIC-P-COV.DWG

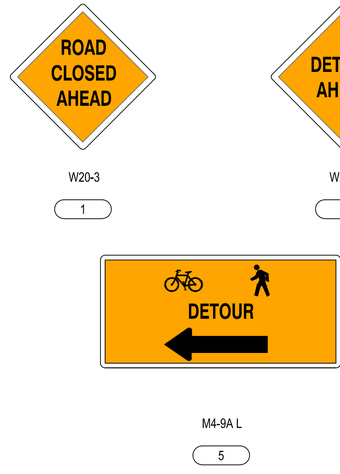
TEMPORARY CONSTRUCTION ACCESS AND STAGING PLAN

1" = 30'



TRAIL DETOUR PLAN

NTS



W20-3

1

W20-2

2

R5-10B

3

R11-2
TYPE III BARRICADE

4

M4-9A L

5

M4-9A R

6

TRAIL CLOSURE AND CONSTRUCTION ACCESS/STAGING NOTES

1. THE CONTRACTOR SHALL IMPLEMENT A FULL CLOSURE OF THE RIVERFRONT TRAIL AND ESTABLISH A SIGNED PEDESTRIAN AND CYCLIST DETOUR ROUTE VIA BRADLEY BOULEVARD AND COLUMBIA POINT DRIVE.
2. THE CONTRACTOR SHALL REVIEW SITE CONSTRAINTS AND COORDINATE EQUIPMENT AND MATERIAL STAGING WITHIN THE LIMITS OF WORK. NO ADDITIONAL STAGING OR LAYDOWN AREA IS AVAILABLE BEYOND THIS FOOTPRINT WITHOUT PROPERTY OWNER'S PERMISSION.
3. USE OF PRIVATE PROPERTY FOR ANY CONSTRUCTION ACTIVITY, STAGING, OR ACCESS IS PROHIBITED WITHOUT THE EXPRESS WRITTEN CONSENT OF THE PROPERTY OWNER. DOCUMENTATION OF SUCH CONSENT SHALL BE PROVIDED TO THE CITY PRIOR TO USE.
4. THE CONTRACTOR SHALL RESTORE ALL AREAS DISTURBED BY EQUIPMENT ACCESS OR MATERIAL STAGING TO EXISTING OR BETTER CONDITION. RESTORATION MAY INCLUDE, BUT IS NOT LIMITED TO, REPAVING ASPHALT, REGRADING OR REPLACING GRAVEL, AND REPLACING SOD OR LANDSCAPING.

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COLUMBIA POINT MARINA
SHORELINE RETAINING WALL REPAIR

TRAIL CLOSURE & ACCESS/STAGING

CITY OF RICHLAND
RICHLAND, WA

CROSS REITER civil + geotechnical engineers

LINE EQUALS 1" WHEN PLAN IS FULL SCALE

DATE: JULY 2025

PROJECT NUMBER: 03725G-RIC

DESIGNED BY: M. REITER/L. REITER

REVISION: --

DRAWING NUMBER: P01

SHEET 2 OF 7

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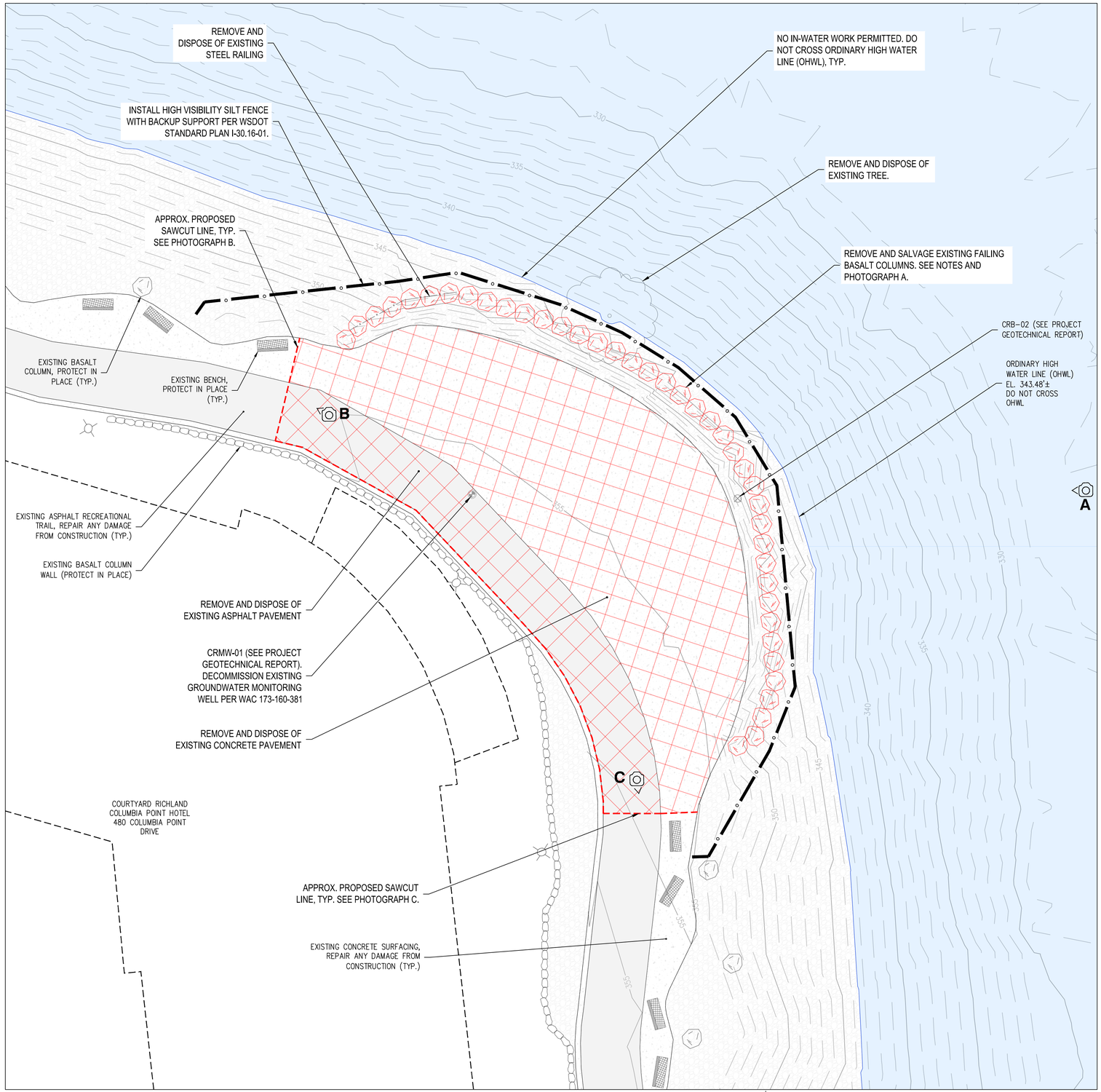
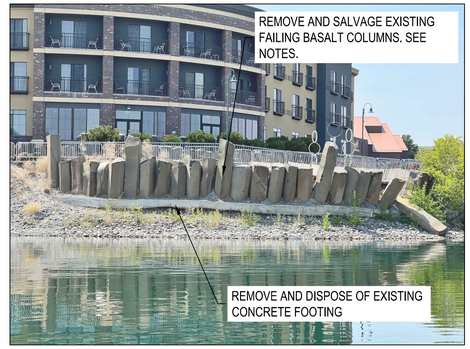


EXISTING CONDITIONS & DEMOLITION PLAN

1" = 10'



PHOTOGRAPH A

PHOTOGRAPH B

PHOTOGRAPH C

EXISTING CONDITIONS AND DEMOLITION NOTES

1. CONTRACTOR SHALL REMOVE THE EXISTING BASALT COLUMN RETAINING WALL AND SALVAGE THE BASALT COLUMNS TO THE MAXIMUM EXTENT PRACTICAL. CONTRACTOR SHALL TRANSPORT SALVAGED BASALT COLUMNS TO A LOCATION DETERMINED BY THE CITY FOR STORAGE AND FUTURE RE-USE. CONTRACTOR SHALL CONTACT CITY PARKS MAINTENANCE SUPERVISOR JONATHON COLVIN (509-551-5889) FOR DETAILS.
2. CONTRACTOR SHALL REMOVE AND DISPOSE OF THE EXISTING CONCRETE FOOTING BELOW THE BASALT COLUMNS.
3. THE EXISTING BASALT COLUMN RETAINING WALL AND CONCRETE SURFACING ARE FAILING AND POSE A POTENTIAL SAFETY HAZARD. CONTRACTOR SHALL TAKE CARE NOT TO OVERLOAD THE SLOPE OR WALL WITH CONSTRUCTION EQUIPMENT DURING DEMOLITION.
4. MINIMIZE SITE DISTURBANCE TO THE MAXIMUM EXTENT PRACTICAL.
5. PRESERVE AND PROTECT ALL FEATURES NOT OTHERWISE NOTED FOR REMOVAL.
6. DO NOT ENCROACH ONTO ADJACENT PRIVATE PROPERTIES OR BELOW ORDINARY HIGH WATER.

60% DESIGN

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MICHAEL BENJAMIN REITER — STATE OF WASHINGTON — PRELIMINARY — 54129 — REGISTERED PROFESSIONAL ENGINEER

COLUMBIA POINT MARINA
SHORELINE RETAINING WALL REPAIR
CITY OF RICHLAND
RICHLAND, WA

EXISTING CONDITIONS & DEMOLITION

CROSS REITER civil + geotechnical engineers

LINE EQUALS 1" WHEN PLAN IS FULL SCALE

DATE: JULY 2025
PROJECT NUMBER: 03725G-RIC
DESIGNED BY: M. REITER/L. REITER
REVISION: --

DRAWING NUMBER: **P02**

SHEET 3 OF 7

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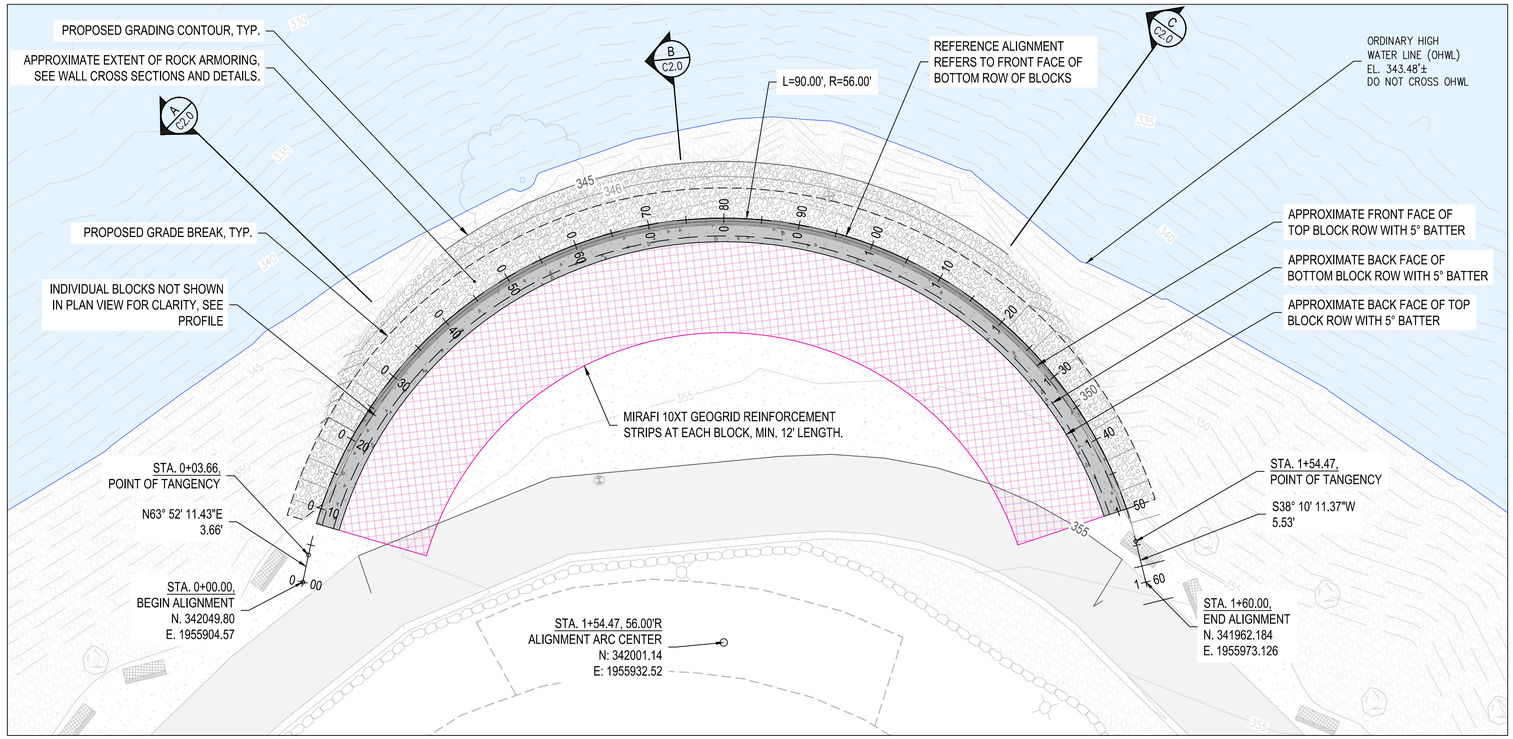
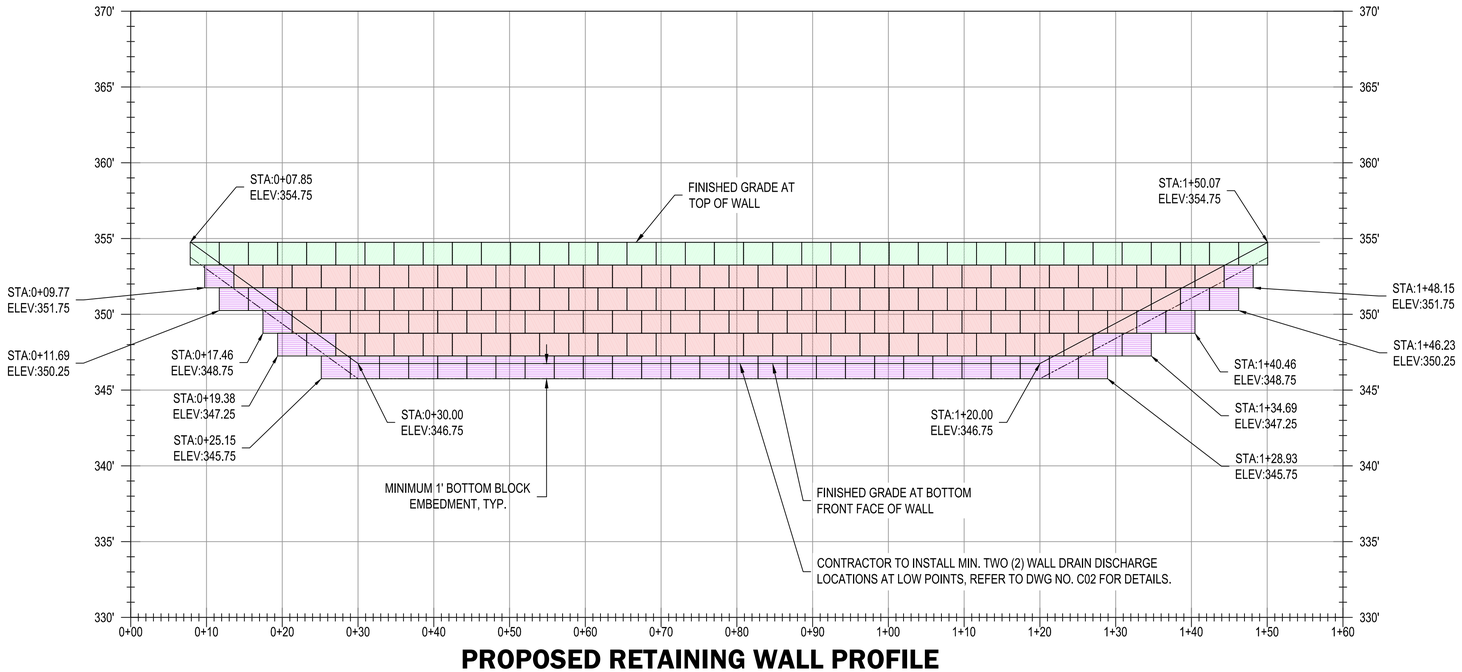


PROPOSED RETAINING WALL PLAN

1" = 10'



PROPOSED RETAINING WALL PROFILE

H: 1" = 10' V: 1" = 5'

RETAINING WALL NOTES

1. THE RETAINING WALL SHALL CONSIST OF A REDI-ROCK PRECAST MODULAR BLOCK SYSTEM WITH GEOSYNTHETIC (GEOGRID) REINFORCEMENT.
2. THE REDI-ROCK SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS AND RECOMMENDATIONS.
3. ALL REDI-ROCK BLOCKS SHALL FEATURE THE LEDGESTONE SURFACE TEXTURE. CONTRACTOR SHALL SUBMIT SURFACE TEXTURE SAMPLES TO THE CITY FOR APPROVAL PRIOR TO ORDERING.
4. GEOGRID REINFORCEMENT SHALL BE MANUFACTURED BY TENCATE MIRAFI AND FACTORY-CERTIFIED FOR LENGTH, WIDTH, AND TENSILE STRENGTH.
5. ALL OF THE FOLLOWING SHALL BE COMPACTED TO A MINIMUM OF 95% OF MAXIMUM DRY DENSITY PER ASTM D1557 (MODIFIED PROCTOR) IN MAXIMUM 6-INCH LOOSE LIFTS: CRUSHED SURFACING BASE COURSE FOR FOUNDATION BEARING PAD, GRAVEL BORROW FOR STRUCTURAL EARTH WALL FOR REINFORCED BACKFILL, AND SELECT BORROW FOR EXTRA EXCAVATION BACKFILL.
6. THE ENGINEER SHALL INSPECT AND APPROVE THE EXPOSED WALL SUBGRADE AND FOUNDATION BEARING PAD PRIOR TO PLACEMENT OF STRUCTURAL FILL OR REDI-ROCK BLOCKS.
7. WALL BATTER ANGLE MAY VARY DEPENDING ON PRECAST SUPPLIER AVAILABILITY. USE OF ALTERNATE BATTER ANGLE IS SUBJECT TO REVIEW AND APPROVAL BY THE ENGINEER AND THE CITY PRIOR TO CONSTRUCTION.
8. FOR ANY PROPOSED VARIATIONS OR DEVIATIONS, THE CONTRACTOR SHALL SUBMIT AN ALTERNATE REDI-ROCK WALL DESIGN STAMPED BY A LICENSED PROFESSIONAL ENGINEER FOR CITY AND ENGINEER REVIEW AND APPROVAL. THE DESIGN SHALL DEMONSTRATE INTERNAL STABILITY, EXTERNAL STABILITY, AND GLOBAL STABILITY ARE ACHIEVED BASED ON PROJECT-SPECIFIC LOADING AND GEOMETRY. REFER TO THE SPECIAL PROVISIONS.
9. CONTRACTOR SHALL COORDINATE TO AVOID CONFLICTS BETWEEN GEOGRID REINFORCEMENT AND UTILITIES, STRUCTURES, OR OTHER ELEMENTS BEHIND THE WALL. ALL OBSTRUCTIONS WITHIN THE REINFORCED ZONE SHALL BE REVIEWED BY THE ENGINEER.
10. EXISTING SITE SOILS CONTAIN A CONSIDERABLE AMOUNT OF COARSE, ROUNDED GRAVEL AND COBBLES.
11. THE GROUNDWATER DRAIN BEHIND THE WALL IS NOT SHOWN IN THE PLAN OR PROFILE VIEWS FOR CLARITY, BUT IS A CRITICAL AND REQUIRED ELEMENT OF THE WALL. THE CONTRACTOR SHALL INSTALL THE DRAIN AND DISCHARGE LOCATIONS AS SHOWN IN THE WALL CROSS SECTIONS AND DETAILS.

REDI-ROCK BLOCK LEGEND

- R-28PCT - 28" POSITIVE CONNECTION TOP BLOCK
- R-28PCM - 28" POSITIVE CONNECTION MIDDLE BLOCK
- R-28PCB - 28" POSITIVE CONNECTION BOTTOM BLOCK

ALL BLOCKS SHALL HAVE MIN. 12' LENGTH MIRAFI 10XT GEOGRID REINFORCEMENT.

60% DESIGN

LAURA LEIGH REITER — STATE OF WASHINGTON — PRELIMINARY — 54130 — REGISTERED PROFESSIONAL ENGINEER

MICHAEL BENJAMIN REITER — STATE OF WASHINGTON — PRELIMINARY — 54129 — REGISTERED PROFESSIONAL ENGINEER

COLUMBIA POINT MARINA
SHORELINE RETAINING WALL REPAIR
CITY OF RICHLAND
RICHLAND, WA

RETAINING WALL PLAN AND PROFILE

CROSS REITER civil + geotechnical engineers

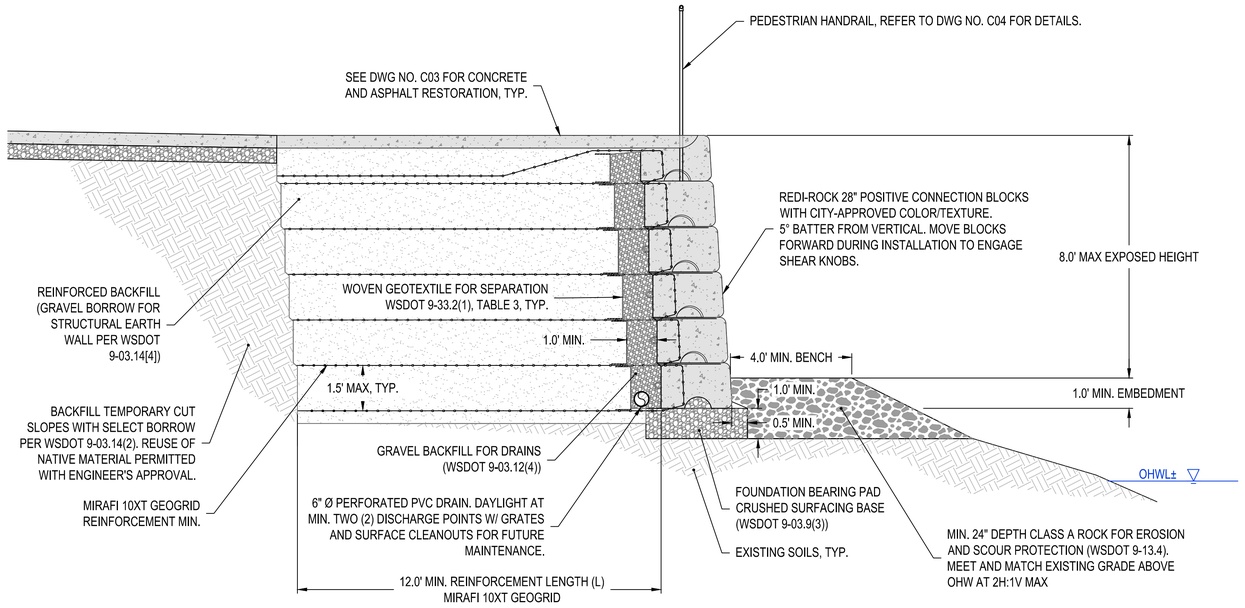
LINE EQUALS 1" WHEN PLAN IS FULL SCALE

DATE: JULY 2025
PROJECT NUMBER: 03725G-RIC
DESIGNED BY: M. REITER/L. REITER
REVISION: –

DRAWING NUMBER: C01

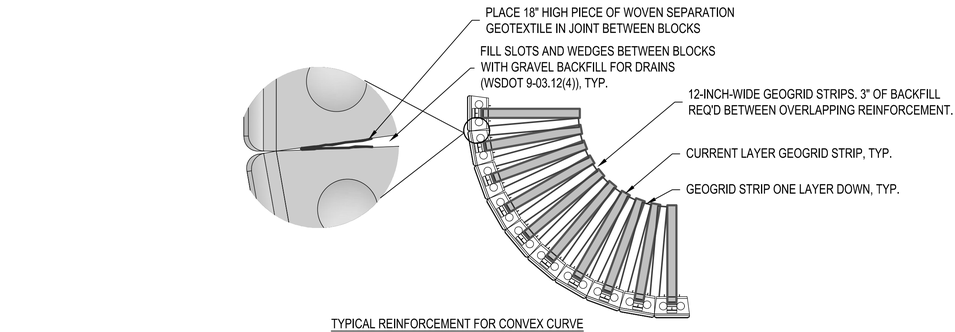
SHEET 4 OF 7

CAD Path: C:\Users\mista\OneDrive - Cross Reiter\03_Projects\03725G RIC River Stabilization\RICH-2401 Columbia River Stabilization\05_WallDesign\CAD\vtc-p-wall.dwg C01 | | Date Saved: Jun 25, 2025 10:03am

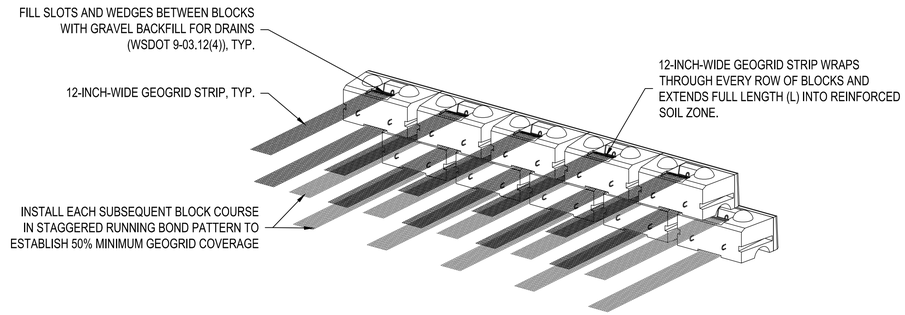


PROPOSED RETAINING WALL TYPICAL SECTION

NTS



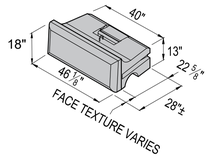
TYPICAL REINFORCEMENT FOR CONVEX CURVE



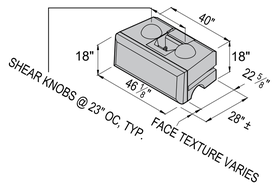
PROPOSED GEOGRID REINFORCEMENT TYPICAL DETAILS

NTS

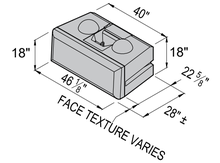
R-28PCT 28" PC TOP
FACE TEXTURE: LEDGESTONE
BLOCK WEIGHT: 1100 LB



R-28PCM 28" PC MIDDLE
FACE TEXTURE: LEDGESTONE
BLOCK WEIGHT: 1450 LB

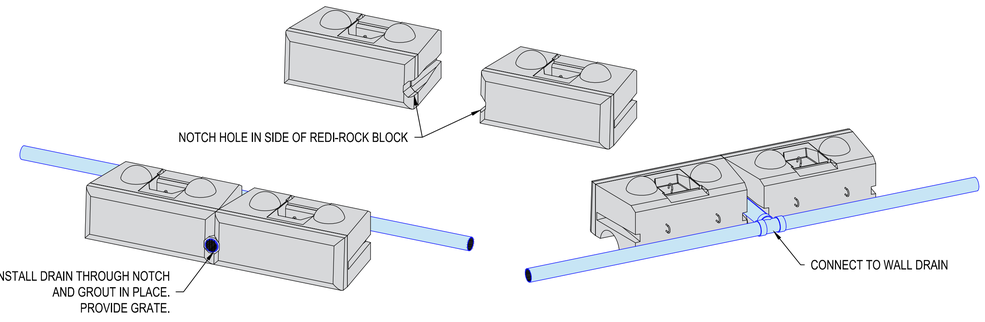


R-28PCB 28" PC BOTTOM
FACE TEXTURE: LEDGESTONE
BLOCK WEIGHT: 1550 LB



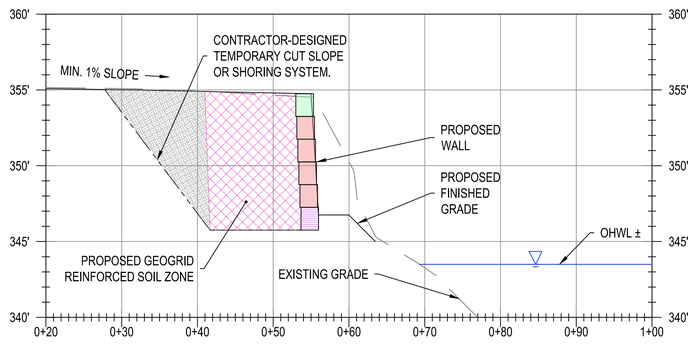
PROPOSED REDI-ROCK BLOCK DETAILS

NTS



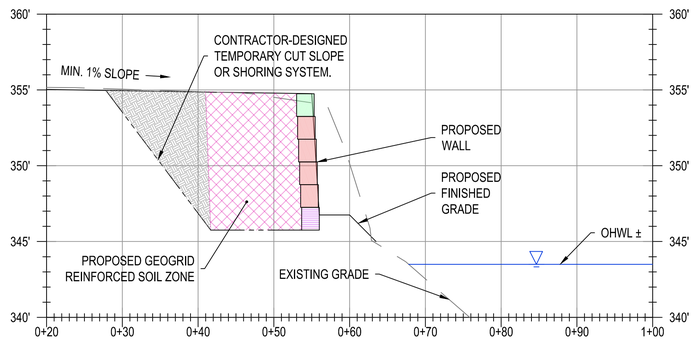
PROPOSED DRAIN DETAILS

NTS



PROPOSED GRADING SECTION A (STA. 35+00)

H: 1" = 10' V: 1" = 5'



PROPOSED GRADING SECTION B (STA. 75+00)

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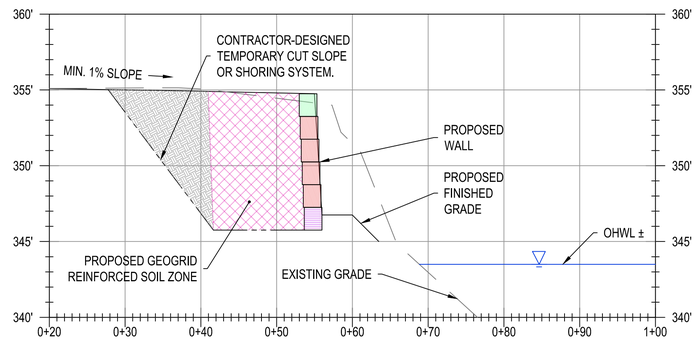

PROPOSED GRADING SECTION C (STA. 115+00)

H: 1" = 10' V: 1" = 5'

60% DESIGN

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MICHAEL BENJAMIN REITER — STATE OF WASHINGTON — PRELIMINARY — 54129 — REGISTERED PROFESSIONAL ENGINEER

COLUMBIA POINT MARINA
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WALL AND GRADING DETAILS

CITY OF RICHLAND
RICHLAND, WA

CROSS REITER civil + geotechnical engineers

LINE EQUALS 1" WHEN PLAN IS FULL SCALE

DATE: JULY 2025

PROJECT NUMBER: 03725G-RIC

DESIGNED BY: M. REITER/L. REITER

REVISION: –

DRAWING NUMBER: C02

SHEET 5 OF 7

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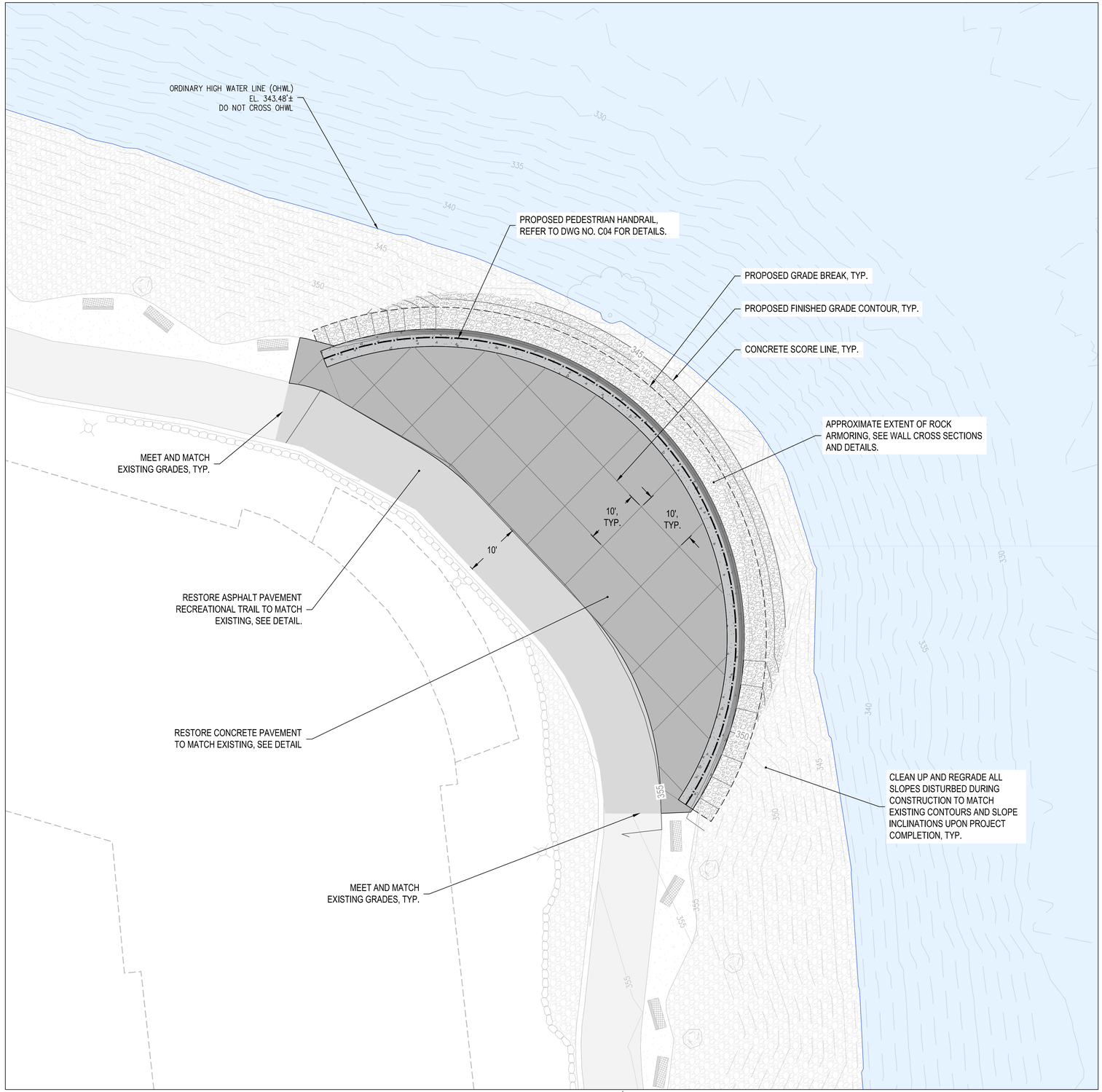
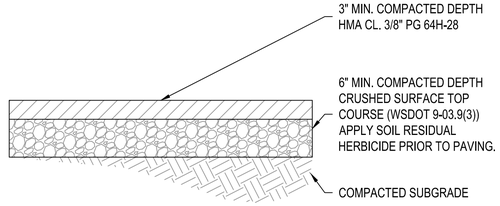


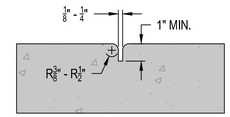
SURFACE RESTORATION PLAN

1" = 10'

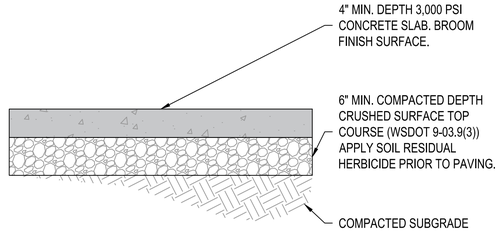


ASPHALT PAVEMENT SURFACE RESTORATION DETAIL

NTS



CONCRETE SCORING



CONCRETE PAVEMENT SURFACE RESTORATION DETAIL

NTS

SURFACE RESTORATION NOTES

1. ALL FINISHED SURFACES SHALL BE GRADED TO DRAIN POSITIVELY TOWARD THE RIVER AT A MINIMUM SLOPE OF 1.0%, UNLESS OTHERWISE NOTED.
2. THE CONTRACTOR SHALL FULLY RESTORE ALL AREAS DISTURBED BY CONSTRUCTION EQUIPMENT, HAUL ROUTES, OR MATERIAL STAGING TO EXISTING OR BETTER CONDITION. RESTORATION MAY INCLUDE, BUT IS NOT LIMITED TO, ASPHALT PAVING, GRAVEL REGRADING OR REPLACEMENT, AND SOD OR LANDSCAPE RESTORATION.
3. RESTORATION OF DAMAGE TO THE EXISTING ASPHALT RECREATIONAL TRAIL OUTSIDE THE DEFINED LIMITS OF WORK IS AT THE CONTRACTOR'S EXPENSE. EFFORTS SHALL BE MADE TO MINIMIZE DISTURBANCE AND DAMAGE TO THE ASPHALT FROM CONTRACTOR'S OPERATIONS.
5. BASE COURSES SHALL BE COMPACTED TO A MINIMUM OF 95% OF MAXIMUM DRY DENSITY PER ASTM D1557 (MODIFIED PROCTOR) IN MAXIMUM 6-INCH LOOSE LIFTS.

60% DESIGN

LAURA LEIGH REITER — STATE OF WASHINGTON — PRELIMINARY — 54130 — REGISTERED PROFESSIONAL ENGINEER

MICHAEL BENJAMIN REITER — STATE OF WASHINGTON — PRELIMINARY — 54129 — REGISTERED PROFESSIONAL ENGINEER

COLUMBIA POINT MARINA
SHORELINE RETAINING WALL REPAIR
SURFACE RESTORATION PLAN & DETAILS

CITY OF RICHLAND
RICHLAND, WA

CROSS REITER civil + geotechnical engineers

LINE EQUALS 1" WHEN PLAN IS FULL SCALE

DATE: JULY 2025

PROJECT NUMBER: 03725G-RIC

DESIGNED BY: M. REITER/L. REITER

REVISION: –

DRAWING NUMBER: **C03**

SHEET 6 OF 7

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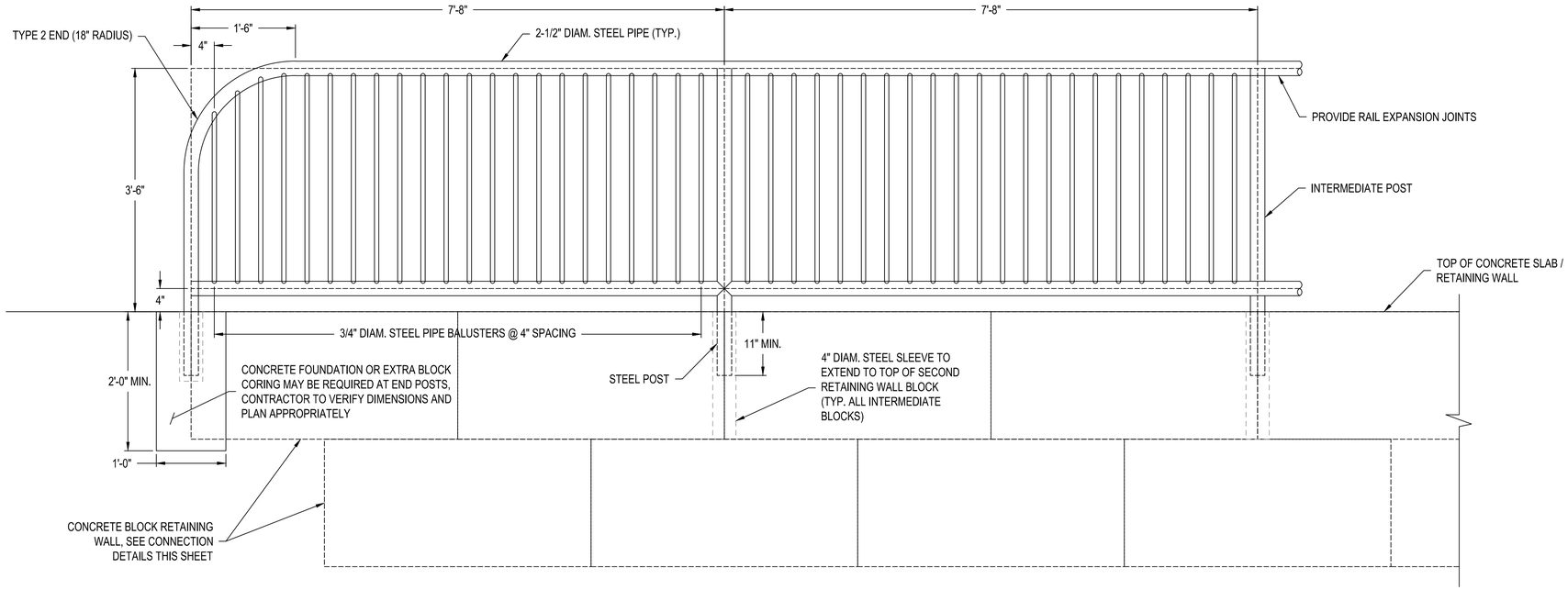
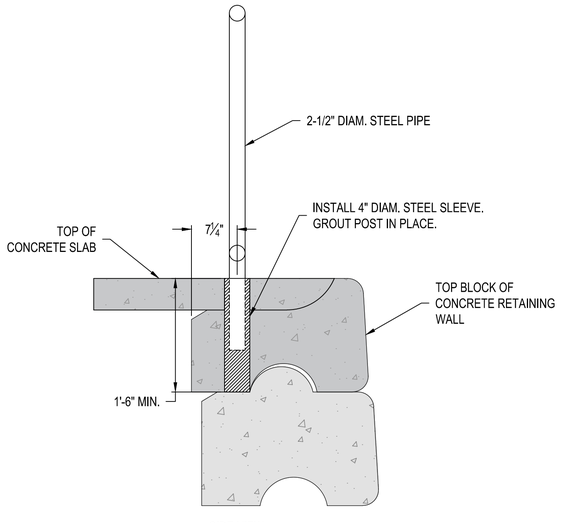


PEDESTRIAN HANDRAIL - ELEVATION

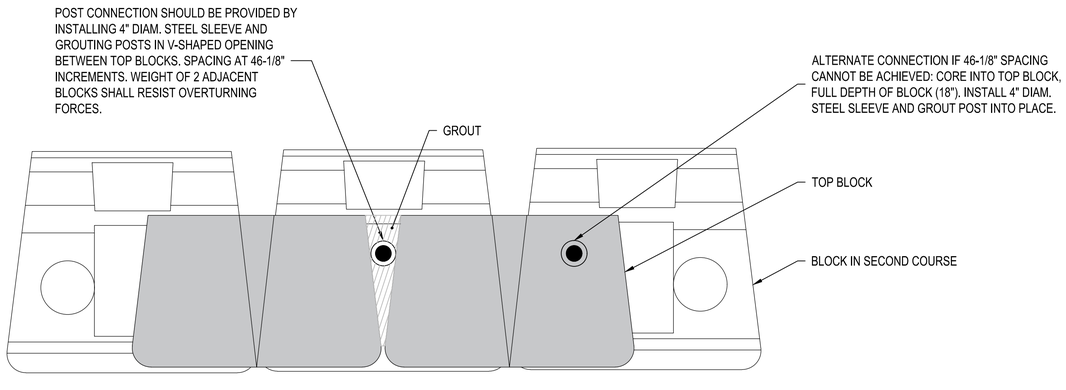
NTS

NOTES

1. CONTRACTOR SHALL SUBMIT TYPE 2E WORKING DRAWINGS FOR THE PEDESTRIAN HANDRAIL FOR ENGINEER'S APPROVAL PRIOR TO FABRICATION. DRAWINGS SHALL ADDRESS FABRICATION AND CONNECTION DETAILS AND DEMONSTRATE COMPLIANCE WITH IBC HANDRAIL LOADING REQUIREMENTS.
2. A SUPPLEMENTAL DETAIL TITLED "STEEL PEDESTRIAN RAILING" IS INCLUDED IN THE CONTRACT APPENDIX FOR REFERENCE ONLY. THE DETAIL IS INTENDED TO ILLUSTRATE DESIGN INTENT, INCLUDING GENERAL SPLICE, POST, AND WELDING CONCEPTS, BUT SHALL NOT BE USED AS THE SOLE BASIS FOR FABRICATION OR CONSTRUCTION.
3. STEEL HANDRAIL SHALL BE PAINTED IN ACCORDANCE WITH WSDOT STANDARD SPECIFICATION SECTION 6-07. COLOR SHALL BE APPROVED BY THE CITY PRIOR TO FABRICATION.
4. CONTRACTOR SHALL FIELD-VERIFY ALL POST SPACING AND WALL CONDITIONS PRIOR TO FABRICATION. CONTRACTOR SHALL BE RESPONSIBLE FOR ENSURING HANDRAIL DIMENSIONS ALIGN WITH ACTUAL SITE CONDITIONS.



SIDE VIEW



TOP VIEW

PEDESTRIAN HANDRAIL - CONNECTION DETAILS

NTS

60% DESIGN

LAURA LEIGH REITER — STATE OF WASHINGTON — PRELIMINARY — 54130 — REGISTERED PROFESSIONAL ENGINEER

MICHAEL BENJAMIN REITER — STATE OF WASHINGTON — PRELIMINARY — 54129 — REGISTERED PROFESSIONAL ENGINEER

COLUMBIA POINT MARINA
SHORELINE RETAINING WALL REPAIR
PEDESTRIAN HANDRAIL DETAILS

CITY OF RICHLAND
RICHLAND, WA

CROSS REITER civil + geotechnical engineers

LINE EQUALS 1" WHEN PLAN IS FULL SCALE

DATE: JULY 2025

PROJECT NUMBER: 03725G-RIC

DESIGNED BY: M. REITER/L. REITER

REVISION: –

DRAWING NUMBER: C04

SHEET 7 OF 7

CAD Path: C:\Users\mster\OneDrive - Cross Reiter\03_Projects\03725G-RIC River Stabilization\RIDH-2401 Columbia River Stabilization\05_WallDesign\CAD\ric-p-dt1.dwg C04 | | Date Saved: Jun 25, 2025 10:08am

Geotechnical Engineering Report

City of Richland
Columbia Point Marina
Shoreline Retaining Wall Repair

Riverfront Trail
Richland, Washington

Issued: January 27, 2025
Project: RIC-2401

Prepared for:
City of Richland

Prepared by:
Cross Reiter, Inc. | Civil + Geotechnical Engineers

CROSS REITER civil + geotechnical engineers

CROSS REITER
civil + geotechnical engineers

Geotechnical Engineering Report

City of Richland

Columbia Point Marina

Shoreline Retaining Wall Repair

Riverfront Trail

Richland, Washington

Prepared for: City of Richland

Issue Date: January 27, 2025

Prepared by: Cross Reiter, Inc.

Cross Reiter Project No. RIC-2401

01/27/2025

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01/27/2025

Laura L. Reiter, PE
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1 Introduction

This report presents the results of Cross Reiter, Inc.'s (Cross Reiter) geotechnical engineering evaluation for the proposed shoreline retaining wall repairs (Project) located northeast of the Courtyard Richland Columbia Point Hotel at the Columbia Point Marina in Richland, Washington (Site). This report summarizes the results of Cross Reiter's subsurface exploration program and presents our geotechnical engineering conclusions and recommendations for the Project. This report was prepared to fulfill the applicable provisions of Richland Municipal Code (RMC) 26.040.010 (Shoreline Stabilization) as they relate to the Project.

1.1 Project Description

Our understanding of the Project is based on our review of information provided by the City of Richland (City) and our discussions with City staff. An existing earth retention structure (retaining wall) along the Columbia River shoreline has failed. This has resulted in ongoing erosion and unstable slope conditions that threaten the riverfront recreational trail and adjacent hotel development. The Project will include demolition of the failed retaining wall and replacement with an appropriate shoreline stabilization alternative. Project permitting and design will be led by the City.

1.2 Scope of Services

This geotechnical engineering report was prepared as described in the scope of services mutually executed between Cross Reiter and the City on October 17, 2024 for City Contract Number 419-24. Cross Reiter's scope of services included desktop data review; Site reconnaissance; subsurface explorations; geotechnical analysis to support Project permitting, design, and construction; and preparation of this report.

1.3 Basis of this Report

The geotechnical engineering recommendations presented in this report are based on:

- Our understanding of the Project and information provided by the City. We assume this information is representative and accurate.
- The applicable portions of the City's municipal code and design guidance published by the United States Army Corps of Engineers (USACE), the Washington State Department of Fish and Wildlife (WDFW), the Washington State Department of Transportation (WSDOT), and the Washington State Department of Ecology (Ecology).
- Subsurface conditions we observed in the explorations as they existed at the time the explorations were completed.
- The results of testing performed on samples we collected from the explorations and submitted to a geotechnical laboratory.
- Other specific assumptions described in this report.

1.4 Use of this Report

This report was prepared for exclusive use by the City for this Project. This report should not be used for other purposes without Cross Reiter's review. This report is an engineering design document providing geotechnical recommendations to be used by the City in their own design; the development of contract documents, plans, and specifications; and permit application purposes. This document was not written nor intended to be used to direct construction activities. Cross Reiter should be retained to review the applicability of assumptions, conclusions, and recommendations of this report if any of the following occurs:

- Conditions change due to natural forces or human activity under, at, or adjacent to the Site.
- Assumptions stated in this report have changed.
- Project details change or new information becomes available such that our recommendations may be affected.

2 Site Conditions

This section presents the results of our Site reconnaissance, desktop data review, and general observations of Site conditions. This information provides context for our interpretation of the subsurface soil and groundwater conditions.

2.1 Surface Conditions

The Site is located northeast of the Courtyard Richland Columbia Point Hotel at the Columbia Point Marina, where the City's asphalt-surfaced riverfront recreational trail makes an approximately 90 degree turn from the east-west direction to the north-south direction as it enters the marina development. As originally constructed, a decorative concrete plaza with a public art display was located northeast of the trail. This plaza provided a publicly accessible viewpoint to observe the Columbia River shoreline and a pedestrian refuge from the recreational trail, which turns sharply at the Site and has limited sight distance at this location. The plaza was supported above the shoreline by a gravity-style earth retention structure (retaining wall) constructed with a series of basalt columns on a continuous, cast-in-place concrete strip footing foundation.

The existing retaining wall is failing via an overturning mechanism about its toe. Contributing factors to the failure likely include downslope erosion of soil out from beneath the foundation, insufficient passive soil support in front of the foundation, and insufficient wall mass to support the retained soil. The foundation is visibly exposed above grade, cantilevering over the slope, and exhibiting severe cracking at multiple points along its length. Several basalt columns have detached from the footing and are rotating markedly towards the river. Consequently, the concrete surfacing behind the wall has undergone substantial settlement, with sections shifting a foot or more downslope towards the river. Soil erosion has occurred beneath the settled concrete and in the gaps formed between the displaced basalt columns, further undermining the structural integrity and stability of the area. Since the retaining wall has failed, City staff have removed the public art display and portions of the existing concrete plaza surfacing. The concrete plaza has also been fenced off by the City to prevent public access for safety reasons.

The riverfront recreational trail and the adjacent concrete plaza are relatively level and located at approximate elevation 355 feet[1]. The ground elevation just below the existing retaining wall foundation is approximately 345 feet. From there, the existing slope is inclined at approximately 2.25H:1V to 2.50H:1V (Horizontal:Vertical) towards the river thalweg near elevation 328 feet. The existing shoreline slopes on either side of the Site are armored with cobbles and gravel and variably inclined at approximately 2H:1V to 3H:1V. An isolated elm tree is located near the base of the existing retaining wall. Some sparse, low shrubs have been planted on the shoreline slope west of the Site. There is little appreciable vegetation on the shoreline slope south and east of the Site within the marina development. The limited quantity of stormwater runoff from the Site likely discharges via sheet flow towards the river. We observed no evidence that the failure of the existing earth retention structure was caused by upland drainage patterns. We observed minor erosion and undercutting of the riverfront recreational trail in other locations around the Columbia Point Marina which suggests the existing shoreline slopes are oversteepened.

Figure 1 depicts the existing topography and surface conditions in the vicinity of the Site. Representative photographs of surface conditions at the Site are provided below.

[1] Elevations refer to NAVD88 vertical datum unless otherwise noted.

(a) (b) (c) (d)

Photographs: (a) Looking southwest at the face of the failed retaining wall, (b) Looking east from the concrete plaza at the top of the failed retaining wall, (c) Close up view of the overturning basalt columns and cracked foundation, (d) Close up view of the cantilevered, cracked foundation.

2.2 Geologic Setting and Mapping

The Site is depicted on the most recent geologic map (Riedel and Fecht, 1994) as underlain by Quaternary alluvium (Qa). Along the main channel and older terraces along the Columbia River these deposits may consist of silt, sand, gravel, and cobbles of varied thickness, sorting, and composition comprised of reworked loess, Ellensburg Formation, Ringold Formation, basalt, and/or Pleistocene outburst flood deposits. Artificial fill also exists along the shoreline from previous grading and development activities. When interpreting the Site geologic setting, it is important to note the Site is located approximately 425 feet south of the main channel of the Columbia River. Based on our review of historic aerial photography, the Columbia Point Marina was excavated off of the main river channel some time between 1985 and 1996. In general, the results of our subsurface explorations were consistent with the geologic map.

3 Cross Reiter Subsurface Exploration Program

3.1 Subsurface Explorations

On November 9, 2024, Cross Reiter advanced two drilled borings (CRMW-01 and CRB-02) at the Site. The drilled borings were completed via hollow stem auger drilling methods using a tracked drill rig operated by a qualified, licensed driller under subcontract to Cross Reiter (Holocene Drilling). The subsurface exploration program was observed by a Cross Reiter engineer. CRMW-01 and CRB-02 were advanced to depths of approximately 20 to 25 feet below ground surface (bgs). CRMW-01 was located southwest of the concrete plaza within the riverfront recreational trail and equipped with a groundwater elevation monitoring well installation. CRB-02 was located just behind the failed retaining wall.

The locations of each exploration are shown on **Figure 1**. A more detailed description of the exploration methods and the exploration logs are presented in **Appendix A**.

3.2 Geotechnical Laboratory Testing

Cross Reiter engaged with an accredited geotechnical testing laboratory (Hayre McElroy & Associates, LLC) to complete laboratory testing on selected samples, consisting of particle size distribution and moisture content determination. Detailed descriptions of the tests and our interpretation of the results are included in **Appendix B**. The results of the tests were also incorporated into the exploration logs in **Appendix A**.

3.3 Subsurface Conditions

At CRMW-01 we encountered medium dense, dry to wet, gray to brown gravel with varying amounts of cobbles, sand, and silt (GW, GP, GP-GM[2]) to the bottom of the exploration at approximately 25 feet bgs. At CRB-02 we encountered medium dense, slightly moist, gray to brown sand with silt and gravel (SW-SM) to approximately 5 feet bgs, underlain by medium dense, very moist to wet, gray, gravel with cobbles (GW) to the bottom of the exploration at approximately 20 feet bgs. These soils will exhibit moderate shear strength, moderate compressibility, high permeability, and low moisture sensitivity. In our opinion, the soils observed in CRMW-01 and CRB-02 are generally consistent with the alluvium (Qa) depicted on the geologic map and/or artificial fill derived from the reworked alluvium.

[2] Unified Soil Classification System (USCS) per ASTM D2488.

3.4 Groundwater

We encountered groundwater in both CRMW-01 and CRB-02 at the time of drilling at a depth of approximately 11.5 feet bgs (approximate elevation 343.5 feet). Due to the free-draining nature of the coarse soils observed in our explorations, we expect groundwater at the Site to be in close hydraulic continuity with the Columbia River. However, groundwater levels at the Site will fluctuate seasonally with precipitation, as well as with changes in Site and near-Site usage.

We deployed a pressure transducer into CRMW-01 on November 12, 2024 to record groundwater elevations and retrieved it on January 22, 2025. The results are shown below in **Chart 1**. They indicate groundwater closely tracks the elevation of the adjacent Columbia River. The elevation of the Columbia River near the Site is controlled at McNary Dam, which is located approximately 45 river miles downstream of the Site. Additional information and discussion on Columbia River elevations at the Site are included in **Appendix C**.

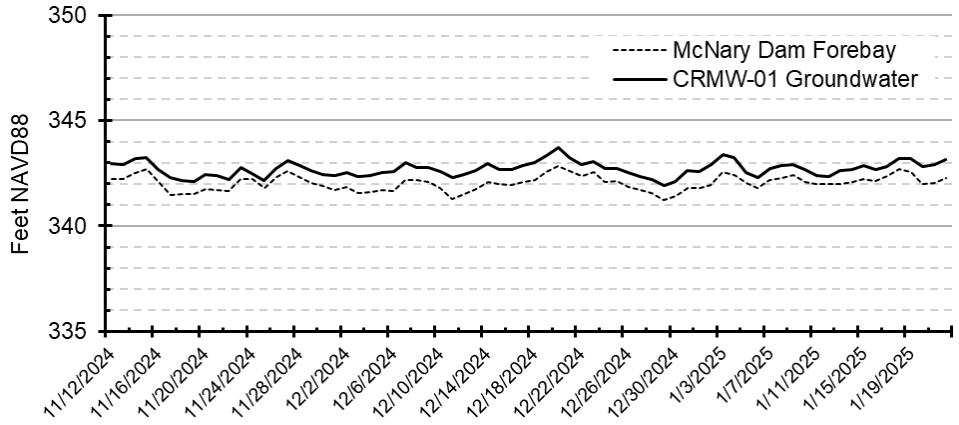

Chart 1: Groundwater elevation at CRMW-01 and the Columbia River elevation at the McNary Dam forebay.

4 Geotechnical Engineering Conclusions and Recommendations

Our geotechnical engineering conclusions and recommendations for the Project are summarized in the subsequent sections.

4.1 Feasible Stabilization Alternatives

RMC 26.40.010 regulates shoreline stabilization actions taken to address erosion impacts to property and dwellings, businesses, or structures. This geotechnical engineering report has been prepared to fulfill applicable requirements of RMC 26.40.010 for the Project, which permit removal and replacement of an existing shoreline stabilization structure with a similar structure if there is a demonstrated need to protect existing primary uses, structures, or public facilities.

In our opinion, the existing failed retaining wall poses a significant risk to public safety and upgradient infrastructure (including the concrete plaza, riverfront recreational trail, and adjacent hotel development). The existing retaining wall no longer adequately serves its purpose. We have performed detailed slope stability analyses to identify geotechnically feasible stabilization alternatives at the Site, which are described in **Appendix C**. Based on our geotechnical engineering analyses, we recommend the failed retaining wall be replaced with shoreline stabilization measures that protect public use of the plaza, riverfront recreational trail, and adjacent structures. We identified two feasible stabilization approaches that can achieve minimum recommended factors of safety for slope stability and protect public safety and upgradient infrastructure at the Site:

1. **Replace the failed retaining wall with a new, mechanically stabilized earth (MSE) precast modular block wall.** This approach minimizes upland encroachment and preserves available space to re-establish the concrete plaza, public viewpoint access, and pedestrian refuge area as they currently exist. This alternative aligns with the provisions of 26.040.010(I) (i.e., permitted replacement of an existing structure with a similar structure). See **Figure 2** for a graphical depiction of this approach.
2. **Replace the failed retaining wall with a new, vegetated armored slope.** This approach will require significant upland encroachment and will require permanent removal of the existing concrete plaza, public viewpoint access, and pedestrian refuge. See **Figure 3** for a graphical depiction of this approach.

RMC 26.040.010 prescribes a hierarchy of preference for shoreline stabilization measures. We evaluated each alternative in **Table 1** below as they apply to the Project to arrive at the two feasible solutions presented above.

Table 1: Shoreline Stabilization Alternatives

RMC 26.040.010 Hierarchy	Alternative	Determination
1	No action (allow the shoreline to retreat naturally), increase building setbacks, and relocate structures.	**Not feasible**, due to immediate risks to public safety and space constraints that prevent setback or relocation.
2	Stabilization constructed of natural materials incorporating measures such as soft-shore protection and bioengineering, including beach nourishment, protective berms, or vegetative stabilization.	**Not recommended**. Insufficient protection provided against future erosion and slope failures given current site conditions and risks. Adjacent slopes are already armored with gravel and cobbles. Robust ecological improvements are not compatible with the intended function of the Site vicinity: a marina constructed off the main river channel to ensure safe and reliable boater access to the river.
3	Soft-shore stabilization, as described above, in combination with rigid works, as described below, constructed as a protective measure.	**Feasible**, but requires removal of concrete plaza and loss of public viewpoint access and pedestrian refuge from limited sight distance curve. See vegetated armored slope alternative.
4	Rigid works constructed of artificial materials such as riprap or concrete.	**Feasible**, see mechanically stabilized earth (MSE) precast modular block wall alternative.

The two alternatives presented in the remainder of this report adhere to the requirements and preferences set forth in RMC 26.40.010, ensuring the safety, functionality, and ecological function of the shoreline are preserved.

4.2 Mechanically Stabilized Earth (MSE) Precast Modular Block Wall

In our opinion it is geotechnically feasible to replace the existing, failed retaining wall with a new precast modular block wall that incorporates mechanically stabilized earth (MSE) elements. This type of wall is cost-effective to construct and comes in several visual styles/textures to match desired Site aesthetics. Detailed wall design can be efficiently completed by the construction contractor or the block wall manufacturer using the geotechnical recommendations in this report, which will simplify and streamline the City-led design and bidding process. We completed slope stability analyses to verify global stability can be achieved at the Site for a MSE precast modular block wall with a maximum exposed height of up to 8 feet (**Appendix C**). We also used proprietary wall design software from a readily available and widely used precast modular block wall manufacturer (Redi-Rock) to verify internal and external stability can be achieved at the Site (**Appendix D**). The Redi-Rock wall system is commonly used in marine and shoreline environments where the wall face will periodically or permanently be submerged below water. Recommended design parameters for an MSE precast modular block wall at the Site are included in **Table 2** below.

Table 2: Recommended MSE Precast Modular Block Wall Design Parameters

Design Parameter	Recommendation
Maximum Exposed Wall Height	8 feet
Wall Batter From Vertical	5 degrees
Reinforcement Type	Mirafi Geogrid 10XT[1]
Minimum Reinforcement Coverage	50 percent[1]
Minimum Reinforcement Length	12 feet[1]
Maximum Reinforcement Vertical Spacing	1.5 feet[1]
Reinforced Soil Unit Weight	130 pounds per cubic foot
Reinforced Soil Friction Angle	38 degrees
Retained Soil Unit Weight	125 pounds per cubic foot
Retained Soil Friction Angle	34 degrees
Minimum Bottom Block Embedment	1 foot[1]
Allowable Foundation Bearing Pressure	1,500 pounds per square foot
Minimum Horizontal Bench at Wall Face	4 feet[1]
Seismic Acceleration Coefficient	0.0815[2]

Notes:
1. Required for global stability. See **Appendix C**.
2. Corresponding with the maximum considered design earthquake per USACE ER 1110-2-1806, refer to **Appendix C** for details.

We recommend that detailed design of the MSE precast modular block wall system be delegated to the construction contractor or otherwise completed by a qualified professional using the parameters in **Table 2**. If a contractor-designed wall is specified, a design submittal stamped by a registered professional engineer should be submitted to the City for review and approval prior to construction. We recommend Cross Reiter review the wall design to ensure the recommendations in this report have been properly incorporated. The wall design must account for all relevant internal and external failure modes.

The wall design should consider the inclined foreslope at the toe of the wall and include provisions for a minimum four-foot-wide horizontal bench below the wall, to mitigate future erosion and facilitate construction. The bench and foreslope should be surfaced with a minimum 24-inch-thick layer of Class A Rock for Erosion and Scour Protection meeting the requirements of Section 9-13.4 of the WSDOT Standard Specifications. We recommend the wall's internal and external stability be checked for variable groundwater and river elevations that will be experienced over the wall's life, ranging between elevation 338 feet and elevation 355 feet on both sides of the wall face. We also recommend the wall design consider the effects of a temporary 250 pound per square foot surcharge load at the top ground surface behind the wall. However, the surcharge load need not be considered at the same time as the design seismic load.

We present additional conceptual design considerations for a MSE precast modular block wall in **Figure 2**.

4.2.1 MSE Precast Modular Block Wall Bearing Pad and Subgrade Preparation

MSE precast modular block walls should bear on a crushed rock bearing pad placed directly over a suitably prepared subgrade. Subgrade preparation should include removal of soils containing roots, organics, debris, and any other deleterious materials. Foundation subgrades should be observed and probed with a steel T-probe by a Cross Reiter engineer prior to foundation construction to verify subgrades are suitable and have been prepared in conformance with our recommendations. Foundation subgrades should be compacted to a firm and unyielding condition. Any excessively loose, soft, wet, or disturbed subgrade areas should be removed and replaced with compacted structural fill consisting of crushed surfacing base course (CSBC) as specified in Section 9-03.9(3) of the WSDOT Standard Specifications.

A crushed rock bearing pad should be placed and compacted to bring the prepared subgrade up to the desired wall bottom elevation. The crushed rock bearing pad should consist of CSBC as specified in Section 9-03.9(3) of the WSDOT Standard Specifications. The CSBC should be placed in lifts no greater than 6 inches thick and compacted to a minimum of 95 percent of the modified proctor maximum dry density (ASTM D1557). The crushed rock pad should be a minimum of 12 inches thick. The pad should extend a minimum of 6 inches (horizontally) behind and in front of the bottom blocks. We recommend Cross Reiter observe and evaluate the

foundation bearing pad during construction to verify our recommendations have been followed and that the bearing pad conditions are suitable for support of the wall.

4.2.2 MSE Precast Modular Block Wall Drainage

A zone at least 1 foot wide of a clean, free-draining gravel meeting the requirements for Gravel Backfill for Drains per Section 9-03.12(4) of the WSDOT Standard Specifications should be installed behind the wall to ensure proper drainage. The wall should also be provided with a drain located at the rear of the wall. The drain should be embedded in the drain rock and consist of a rigid, plastic, perforated pipe with a minimum diameter of 6 inches. The drain should be located two feet minimum above ordinary high water elevation and include a grate at each discharge point to prevent clogging. The drain should discharge at a minimum of two suitable locations that provide positive drainage away from the wall and are armored with gravel to prevent erosion. In addition, we recommend incorporating a geotextile between the drain rock and the reinforced soil to reduce the potential for piping of soil through or beneath the wall. The geotextile should be woven and meet the requirements for soil separation as specified in Table 3 of Section 9-33.2(1) of the WSDOT Standard Specifications.

4.2.3 MSE Precast Modular Block Wall Construction

The embedment depth of the bottom course of blocks, below adjacent finished grade in front of the wall, should be a minimum of 12 inches. Subsequent block placement and geosynthetic reinforcement installation should be in accordance with the manufacturer's recommendations. Reinforced backfill for MSE walls should consist of CSBC per Section 9-03.9(3) of the WSDOT Standard Specifications. The CSBC should be placed in lifts no greater than 6 inches thick and compacted to a minimum of 95 percent of the modified proctor maximum dry density (ASTM D1557). Within 2 feet of the wall face, the level of compaction may be reduced to 90 percent of the modified proctor maximum dry density (ASTM D1557). Moisture content of wall backfill should be controlled to within 2 to 3 percent of the optimum moisture content. Optimum moisture is the moisture content corresponding to the maximum modified proctor dry density.

4.3 Vegetated Armored Slope

Based on our geotechnical evaluation, it is also feasible to replace the existing, failed retaining wall with a permanent, stabilized cut slope that incorporates long-term erosion and scour protection measures. To promote the intent of the shoreline stabilization hierarchy prescribed by RMC 26.040.010, the slope can be enhanced with native vegetation that provides ecological benefits. However, this alternative will result in permanent removal of the existing concrete plaza, public viewpoint, and pedestrian refuge area.

We recommend permanent cut slopes of 3H:1V inclination be maintained for the vegetated armored slope, except where short, limited transition zones to steeper, pre-existing grades are required at the Project limits. Permanent cut or fill slopes should not exceed 2H:1V on the Project. We recommend the slope face be surfaced with a minimum 18-inch-thick layer of Class A Rock for Erosion and Scour Protection meeting the requirements of Section 9-13.4 of the WSDOT Standard Specifications. The armoring should be placed over a minimum 6-inch-thick filter layer of permeable ballast meeting the requirements of Section 9-03.9(2) of the WSDOT Standard Specifications. The purpose of the filter layer is to prevent the piping of fines, sand, and fine gravel into the armoring. We completed global stability analyses to verify global stability will be achieved at the Site for a vegetated armored slope (**Appendix C**).

The armoring can be vegetated by placing soil into the joints between rocks and planting native seed, cuttings, or rooted, woody species. Soil can fill the interstitial voids between rocks but should not hold rocks apart from each other or otherwise prevent interlocking of the armoring. The soil surface should be at least 6 inches below the top of the armoring to prevent it washing away before vegetation is established. Once the soil is in place, vegetation can be planted in the soil-filled joints between the rocks in conjunction with armoring placement. The planting plan should allow for species selection and spacing for discrete zones on the slope, considering

topography, soils, slope aspect, exposure, microclimate, drainage, and existing vegetation patterns. We recommend that no irrigation occur on the slope.

We present additional conceptual design considerations for a vegetated armored slope in **Figure 3**.

4.4 General Earthwork Considerations

Based on our subsurface explorations and our understanding of the Project, it is our opinion that the contractor will be able to complete planned excavations and earthwork activity with relatively standard construction equipment (i.e., mid-size to large, tracked excavators with toothed buckets; hand-operated plate compactors). The contractor should be prepared to encounter a significant amount of cobbles during excavation activities, and may also encounter boulders, debris, or other obstructions that will need to be hauled off-Site for disposal. The contractor should take special care not to overload the existing slope or wall when removing the existing basalt columns or excavated soils for disposal.

4.4.1 Temporary Excavation Slopes and Shoring

Maintenance of safe working conditions, including temporary excavation stability, is the responsibility of the contractor. All temporary cuts more than 4 feet in height that are not protected by trench boxes or otherwise shored, should be sloped in accordance with Part N of Washington Administrative Code (WAC) 296-155 for worker safety. Using guidance provided by the WAC and our Site observations, we classify the Site soils as Type C with a maximum allowable temporary slope inclination of 1.5H:1V (Horizontal:Vertical).

With time and the presence of seepage and/or precipitation, the stability of temporary unsupported cut slopes can be significantly reduced. Therefore, all temporary slopes should be protected from erosion by installing a surface water diversion ditch or berm at the top of the slope if precipitation is expected. In addition, the contractor should monitor the stability of the temporary cut slopes and adjust the construction schedule and slope inclination accordingly. Vibrations created by construction equipment may cause caving and raveling of the temporary slopes. In such an event, lateral support for the temporary slopes should be provided by the contractor.

4.4.2 Construction Dewatering

We expect excavations may occur below groundwater and in areas with localized seepage. Dewatering of these excavations may be required to facilitate construction. The dewatering system components will depend on the time of year dewatering is performed and the means and methods of the contractor. We anticipate that groundwater levels will be at their lowest during the annual winter drawdown of Lake Wallula, which occurs as part of McNary Dam operations each year to prepare for the spring runoff. At this time it will be feasible in our opinion to use a system of sumps and pumps for any dewatering that may be required. The contractor should be required to adequately dewater excavations so that subgrade preparation and structural fill placement can be completed in dry conditions. Sumps are often constructed by placing a short section of perforated pipe in a small hole excavated below the excavation bottom elevation. The annular space around the pipe is backfilled with drain rock, with several inches placed inside the pipe to help control the pumping of fines. Pumps are then placed inside the casing (e.g., submersible pumps or trash pump inlets). The contractor should be responsible for design, implementation, and any necessary discharge permits associated with any construction dewatering system used for the Project.

4.4.3 Re-Use of On-Site Soils as Structural Fill

On-Site soils contain a considerable proportion of coarse, rounded gravel and rounded cobbles. As such, on-Site soils are generally unsuitable for re-use as structural fill on the Project. Excavated soil should be hauled off-Site for disposal. If required, Cross Reiter should be obtained to review on-Site soils on a case-by-case basis to determine suitability in specific applications.

5 Recommendations for Continuing Geotechnical Services

At the time of this report Project plans and construction methods have not been finalized. We are available to provide additional geotechnical consultation as the Project design develops and possibly changes from that upon which this report is based.

We are also available to provide geotechnical engineering and monitoring services during construction. The integrity of geotechnical elements depends on proper Site preparation and construction procedures. In addition, engineering decisions may have to be made in the field in the event that variations in Site conditions become apparent. During the construction phase of the project, we recommend that Cross Reiter be retained to perform the following tasks:

- Review contractor submittals related to Project geotechnical elements, including contractor-designed retaining walls.
- Observe and evaluate subgrade preparation and structural fill compaction operations.
- Attend meetings by telephone or on-Site, as needed.
- Address other geotechnical engineering considerations that may arise during the course of construction.

The purpose of our observations is to verify compliance with design concepts and recommendations, and to allow design changes or evaluation of appropriate construction methods in the event that Site conditions differ from those anticipated prior to the start of construction.

6 References

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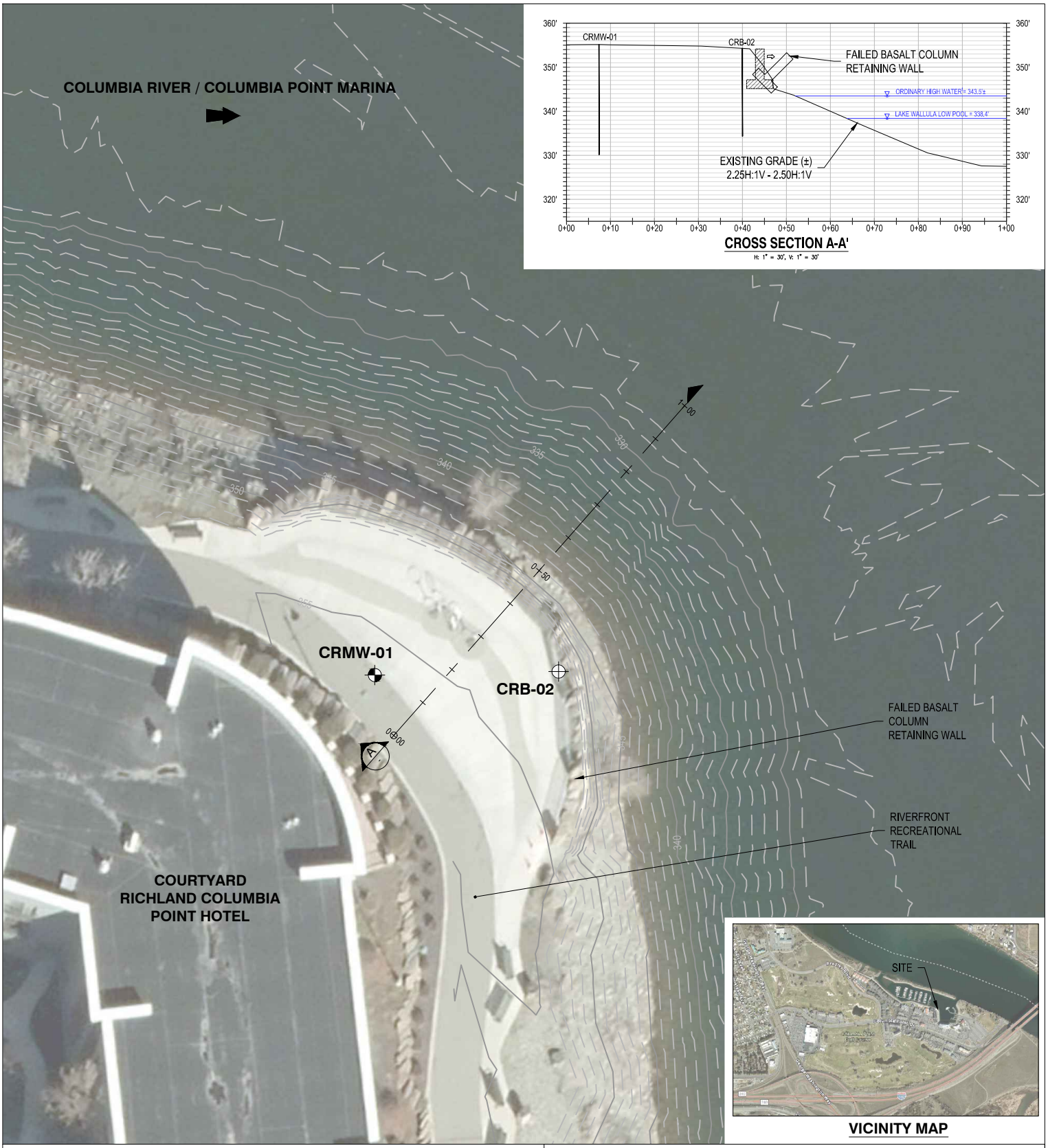
FIGURES



CROSS SECTION A-A'

H: 1" = 30', V: 1" = 30'

VICINITY MAP

Legend

- Boring Location
- Monitoring Well Location

[1] Surveyed topography provided by the City (undated).

0 15' 30'

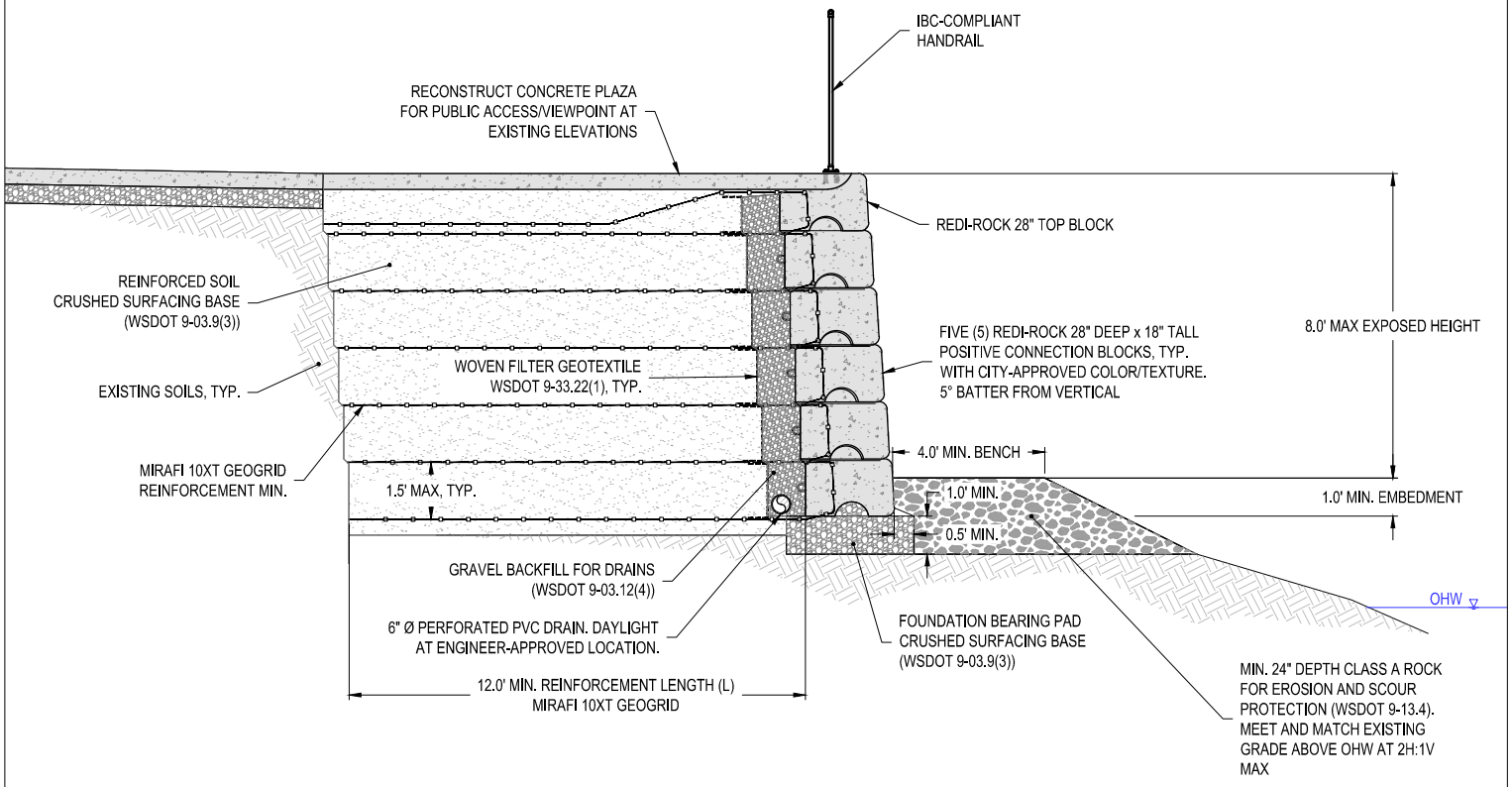
Subsurface Exploration Location Map

Columbia Point Marina Shoreline Retaining Wall Repair
Geotechnical Engineering Report
Richland, Washington

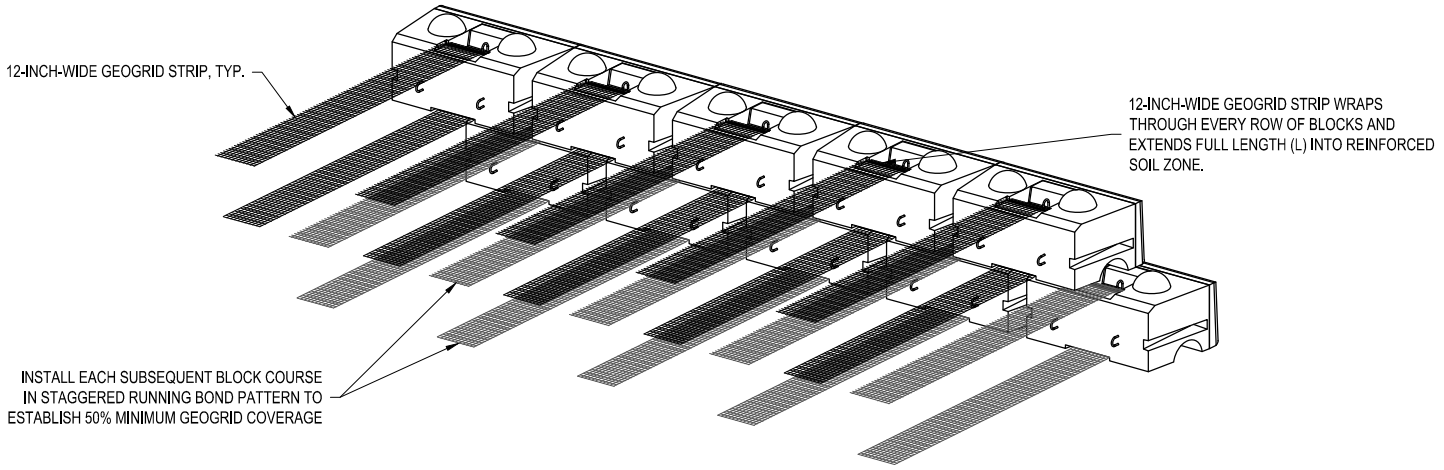
CROSS REITER civil + geotechnical engineers	Nov-2024	BY: MBR	FIGURE NO. 1
	PROJECT NO. RIC-2401	REVISED BY: -	

NOTES:

1. DETAILS SHOWN HERE ARE CONCEPTUAL ONLY. REFER TO THE REPORT TEXT FOR GEOTECHNICAL ENGINEERING RECOMMENDATIONS AND CONCLUSIONS.
2. THE PROPOSED RETAINING WALL SHALL CONSIST OF A REDI-ROCK MECHANICALLY-STABILIZED EARTH (MSE) PRECAST MODULAR BLOCK EARTH RETENTION SYSTEM OR EQUAL, DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS AND THE RECOMMENDATIONS IN THE PROJECT GEOTECHNICAL ENGINEERING REPORT.



TYPICAL MSE PRECAST MODULAR BLOCK WALL ELEVATION



MSE PRECAST MODULAR BLOCK WALL CONNECTION AND REINFORCEMENT DETAIL

Not to scale.

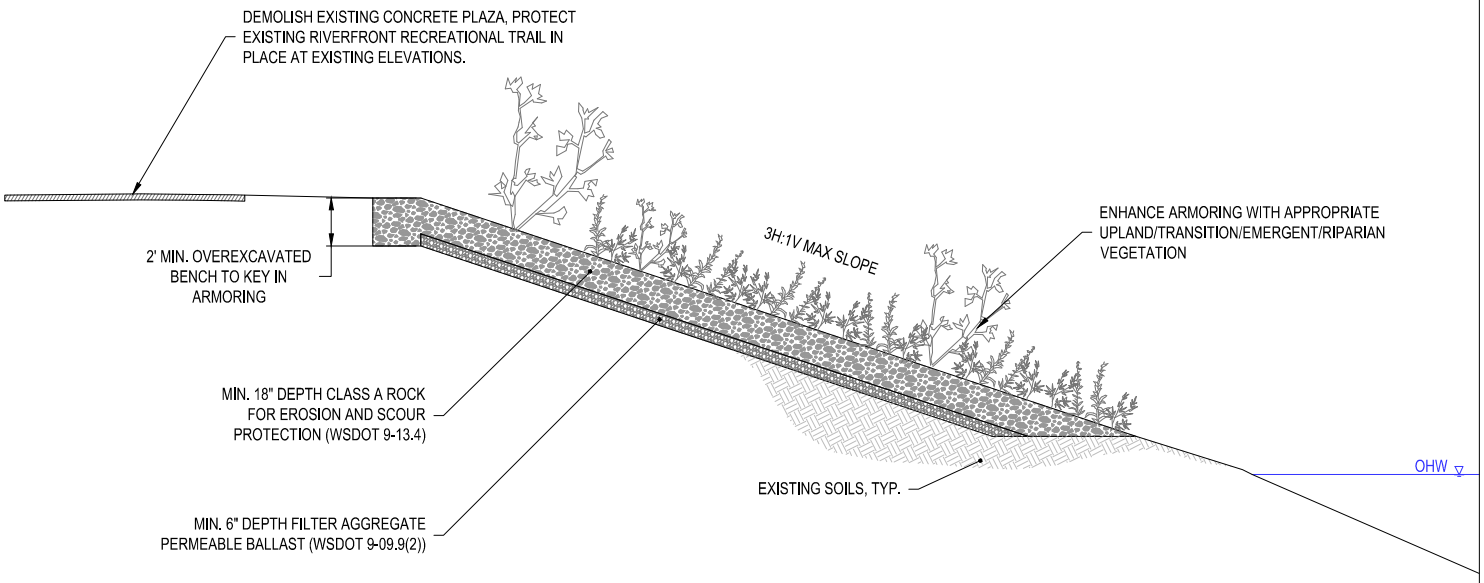
MSE Precast Modular Block Wall Conceptual Design Considerations

Columbia Point Marina Shoreline Retaining Wall Repair
Geotechnical Engineering Report
Richland, Washington

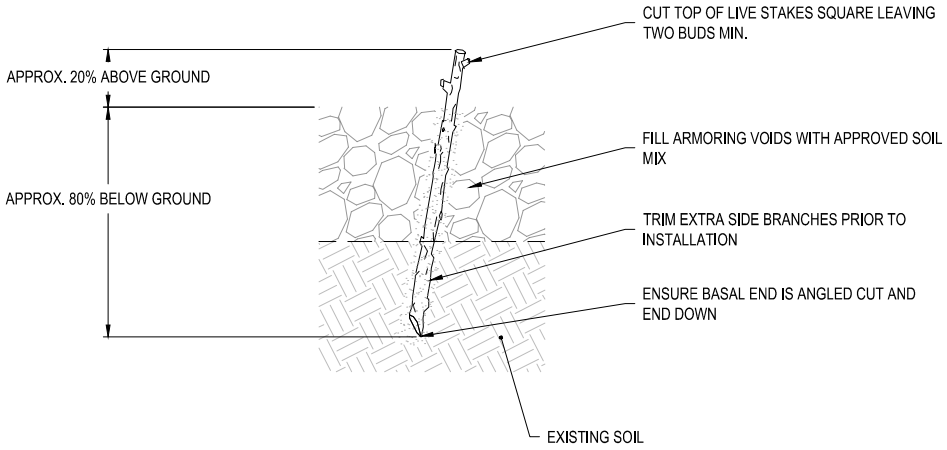
CROSS REITER civil + geotechnical engineers	Nov-2024	BY: MBR	FIGURE NO. 2
	PROJECT NO. RIC-2401	REVISED BY: -	

NOTES:

1. DETAILS SHOWN HERE ARE CONCEPTUAL ONLY. REFER TO THE REPORT TEXT FOR GEOTECHNICAL ENGINEERING RECOMMENDATIONS AND CONCLUSIONS.
2. REVEGETATION SPECIES AND SPACING SHOULD BE SPECIFIED BY A QUALIFIED PROFESSIONAL.



TYPICAL VEGETATED ARMORED SLOPE ELEVATION



TYPICAL LIVE STAKE INSTALLATION IN ARMORING

Not to scale.

Vegetated Armored Slope
Conceptual Design Considerations

Columbia Point Marina Shoreline Retaining Wall Repair
Geotechnical Engineering Report
Richland, Washington

CROSS REITER civil + geotechnical engineers	Nov-2024	BY: MBR	FIGURE NO. 3
	PROJECT NO. RIC-2401	REVISED BY: -	

APPENDIX A

Cross Reiter Subsurface Exploration Logs

Appendix A – Cross Reiter Subsurface Exploration Logs

On November 9, 2024, Cross Reiter advanced two drilled borings (CRMW-01 and CRB-02) at the Site. The drilled borings were completed via hollow stem auger drilling methods using a tracked drill rig operated by a qualified, licensed driller under subcontract to Cross Reiter (Holocene Drilling). The subsurface exploration program was observed by a Cross Reiter engineer. CRMW-01 and CRB-02 were advanced to depths of approximately 20 to 25 feet below ground surface (bgs) until reaching practical refusal. CRMW-01 was located southwest of the concrete plaza within the riverfront recreational trail and equipped with a groundwater monitoring well installation. CRB-02 was located just behind the failed earth retention structure.

In the drilled borings, disturbed soil samples were obtained at approximately 2.5- to 5-foot intervals using a Modified California Sampler in general accordance with ASTM D1586, Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils. Typically, the Standard Penetration Test involves driving a 2-inch-outside-diameter split-barrel sampler 18 inches into the soil with a 140-pound hammer free-falling a distance of 30 inches. In this Project a larger Modified California Sampler (3-inch) was used due to the gravelly soils. The number of blows for each 6-inch interval is recorded and the number of blows required to drive the sampler for the final two intervals (a total of 12 inches) is known as the Standard Penetration Resistance ("N-value") or blow count. The N-value provides a measure of relative density of granular soils or the relative consistency of cohesive soils. Upon completion, CRB-02 was backfilled with 3/8-inch bentonite chips. CRMW-01 was equipped with a groundwater monitoring well in accordance with Washington State Department of Ecology requirements.

The explorations were advanced at the locations shown in **Figure 1**.

Cross Reiter staff observed and documented soil, groundwater, and excavation characteristics for all explorations. Exploration logs were created using the Unified Soil Classification System (USCS), as defined in ASTM D2488 and/or ASTM D2487, and standard geologic unit nomenclature. The stratigraphic contacts shown on the individual summary logs represent the approximate boundaries between soil types; actual transitions may be more gradual. The subsurface conditions depicted are only for the specific date and locations reported, and are therefore not necessarily representative of other locations and times.

Our observations are specific to the locations, depths, and times noted on the logs and figures and may not be applicable to all areas of the Site. No amount of explorations, instruments, wells, testing, or monitoring can precisely predict the characteristics, quality, or distribution of subsurface and Site conditions. Potential variations include, but are not limited to:

- The conditions between and below explorations, instruments, and testing may be different.
- The passage of time or intervening causes (natural and manmade) may result in changes to site and subsurface conditions.
- Groundwater levels and flow directions fluctuate due to seasonal variations.
- In-situ penetration test results in soils with gravels and cobbles may overestimate actual soil density that may be lower than indicated by the test.
- Obstructions such as cobbles, boulders, rock, debris, and/or rubble may be present.

Geotechnical Laboratory Tests

MC	=	Natural Moisture Content
PSD	=	Particle Size Distribution
FC	=	Fines Content (% < 0.075mm)
GH	=	Hydrometer
AL	=	Atterberg Limits
C	=	Consolidation Test (1D Oedometer)
STR	=	Strength Test (e.g., Triaxial, Direct Shear)
OC	=	Organic Content (% Loss on Ignition)
COMP	=	Moisture-Density Relation (Proctor)
K	=	Hydraulic Conductivity
SG	=	Specific Gravity Test

Field Tests

T-Probe	=	Penetration with $\frac{1}{2}$" Steel Rod
Thumb	=	Penetration with Thumbnail or Thumb
SPT	=	Standard Penetration Test (ASTM D1586)
DCPT	=	Dynamic Cone Penetrometer

Estimated Percentage

% by Weight		*Descriptor*	*% by Weight*		*Descriptor*
<1	=	Subtrace	15 to 25	=	Little
1 to 5	=	Trace	30 to 45	=	Some
5 to 10	=	Few	>50	=	Mostly

Component Definitions

Descriptor		*Particle Size and U.S. Sieve No.*
Boulders	=	>12"
Cobbles	=	3" to 12"
Coarse Gravel	=	3" to $\frac{3}{4}$"
Fine Gravel	=	$\frac{3}{4}$" to No 4. (4.75 mm)
Coarse Sand	=	No. 4 (4.75 mm) to No. 10 (2.00 mm)
Medium Sand	=	No. 10 (2.00 mm) to No. 40 (0.425 mm)
Fine Sand	=	No. 40 (0.425 mm) to No. 200 (0.075 mm)
Silt and Clay	=	< No. 200 (0.075 mm)

Moisture Content

Dry	=	Absence of moisture
Slightly Moist	=	Perceptible moisture
Moist	=	Damp but no visible water
Very Moist	=	Water visible but not free draining
Wet	=	Visible free water

Relative Density (Non-Cohesive or Coarse-Grained)

Density	*SPT Blows/Foot*	*Penetration w/ $\frac{1}{2}$" Steel Rod*
Very Loose	0 to 4	>2'
Loose	5 to 10	1' to 2'
Medium Dense	11 to 30	3" to 1'
Dense	31 to 50	1" to 3"
Very Dense	<50	<1"

Consistency (Cohesive or Fine-Grained)

Consistency	*SPT Blows/Foot*	*Manual Test*
Very Soft	0 to 1	Penetrated >1" easily by thumb
Soft	2 to 4	Penetrated $\frac{1}{4}$" to 1" easily by thumb
Medium Stiff	5 to 8	Penetrated ~$\frac{1}{4}$" w/ effort by thumb
Stiff	9 to 15	Indented ~$\frac{1}{4}$" w/ effort by thumb
Very Stiff	16 to 30	Indented easily w/ thumbnail
Hard	>30	Indented w/ difficulty by thumbnail

Note: The USCS group name modifiers "WITH GRAVEL/SAND/SILT/CLAY, or GRAVELLY/SANDY/SILTY/CLAYEY" are assigned per ASTM D2488.

Soils with More Than 50% Retained on the No. 200 Sieve

Gravels (50% or More of Coarse Fraction Retained on No. 4 Sieve)	5% or Less Fines	GW	Well Graded GRAVEL Well Graded GRAVEL WITH SAND
		GP	Poorly Graded GRAVEL Poorly Graded GRAVEL WITH SAND
	15% or More Fines	GM	SILTY GRAVEL SILTY GRAVEL WITH SAND
		GC	CLAYEY GRAVEL CLAYEY GRAVEL WITH SAND
Sands (50% or More of Coarse Fraction Passes No. 4 Sieve)	5% or Less Fines	SW	Well Graded SAND Well Graded SAND WITH GRAVEL
		SP	Poorly Graded SAND Poorly Graded SAND WITH GRAVEL
	15% or More Fines	SM	SILTY SAND SILTY SAND WITH GRAVEL
		SC	CLAYEY SAND CLAYEY SAND WITH GRAVEL

Soils with Less Than 50% Retained on the No. 200 Sieve

Silt and Clays Liquid Limit Less than 50%		ML	SILT SANDY or GRAVELLY SILT SILT WITH SAND SILT WITH GRAVEL
		CL	LEAN CLAY SANDY or GRAVELLY LEAN CLAY LEAN CLAY WITH SAND LEAN CLAY WITH GRAVEL
		OL	ORGANIC SILT SANDY or GRAVELLY ORGANIC SILT ORGANIC SILT WITH SAND ORGANIC SILT WITH GRAVEL
Silt and Clays Liquid Limit 50% or More		MH	ELASTIC SILT SANDY or GRAVELLY ELASTIC SILT ELASTIC SILT WITH SAND ELASTIC SILT WITH GRAVEL
		CH	FAT CLAY SANDY or GRAVELLY FAT CLAY FAT CLAY WITH SAND FAT CLAY WITH GRAVEL
		OH	ORGANIC CLAY SANDY or GRAVELLY ORGANIC CLAY ORGANIC CLAY WITH SAND ORGANIC CLAY WITH GRAVEL
Highly Organic Soils		PT	PEAT and/or other mostly organic soils

CROSS REITER civil + geotechnical engineers

Exploration Log Key

CROSS REITER civil + geotechnical engineers

City of Richland Shoreline Stabilization

Geotechnical Exploration Log

Site and Exploration Location	Approx. Coordinates (Lat/Long)	Exploration ID
Columbia Point Marina, Richland, WA (See Figure 1)	(46°15'51.84"N,119°15'8.57"W)	CRMW-01

Contractor	Equipment	Sampling Method	Ground Surface Elevation (NAVD88)	Ecology Well Tag No.
Holocene Drilling	Diedrich D70 Turbo	3" SPT, Autohammer, 140#, 30" drop	355'±	BQB 906

Operator	Exploration Method(s)	Work Start/Completion Dates	Top of Casing Elevation (NAVD88)	Approx. Groundwater Depth
Jesse	Hollow Stem Auger	11/9/2024	354.5'±	11.5'± (ATD)

Depth (feet)	Elev. (feet)	Exploration Notes and Completion Details	Sample Type/ID	Blows/Foot ▲ Water Content (%) ● 0 10 20 30 40 50	Blows/6"	Field/Lab Tests	USCS Type	Description	Depth (feet)
0	355	Well No. BQB 906 flush monument set in concrete						GRAVEL WITH COBBLES (GW); medium dense, dry, gray; fine to coarse, rounded gravel; rounded cobbles up to approximately 4-inches; few fine to coarse sand; trace silt	0
		2" PVC pipe set in concrete	S1		50/2"				
5	350		S2		50/5"	PSD MC = 1.2% FC = 2.0%			5
		2" PVC pipe set in bentonite chips	S3		50/4"				
10	345		S4		50/4"			Becomes slightly moist to moist	10
		▽ 11/9/2024	S5		49 50/5"			Becomes wet, gray to brown	
15	340	2" PVC 20 slot screen set in sand.	S6		50/4"	PSD MC = 2.1% FC = 2.2%		GRAVEL WITH COBBLES (GP); medium dense, wet, gray to brown; fine to coarse, rounded gravel; rounded cobbles up to approximately 4-inches; few fine to coarse sand; trace silt	15
20	335		S7		50/2"			GRAVEL WITH SILT, SAND, AND COBBLES (GP-GM); medium dense, wet, gray to brown; fine to coarse, rounded gravel; rounded cobbles up to approximately 4-inches; some fine to coarse sand; few silt	20
		Exploration backfilled with bentonite chips							
25	330		S8		50/2"	PSD MC = 5.8% FC = 5.3%		Refusal at 25'± bgs due to heave and cobbles.	25
								Laboratory samples supplemented with material from the auger cuttings due to low SPT recovery.	

Legend

Sample Type
- ○ No soil sample recovery
- ◪ Modified California Split Barrel SPT (3"x2.375")

Plastic Limit ⊢ Liquid Limit

Water Level
- ▽ Water Level ATD

Logged by: LLC/MBR

EXPLORATION LOG
CRMW-01
SHEET 1 of 1

CROSS REITER civil + geotechnical engineers

City of Richland Shoreline Stabilization

Geotechnical Exploration Log

Site and Exploration Location	Approx. Coordinates (Lat/Long)	Exploration ID
Columbia Point Marina, Richland, WA (See Figure 1)	(46°15'51.74"N,119°15'7.98"W)	**CRB-02**

Contractor	Equipment	Sampling Method	Ground Surface Elevation (NAVD88)	Ecology Well Tag No.
Holocene Drilling	Diedrich D70 Turbo	3" SPT, Autohammer, 140#, 30" drop	355'±	N/A

Operator	Exploration Method(s)	Work Start/Completion Dates	Top of Casing Elevation (NAVD88)	Approx. Groundwater Depth
Jesse	Hollow Stem Auger	11/9/2024	N/A	11.5'± (ATD)

Depth (feet)	Elev. (feet)	Exploration Notes and Completion Details	Sample Type/ID	Blows/Foot ▲ Water Content (%) ● 0 10 20 30 40 50	Blows/6"	Field/Lab Tests	USCS Type	Description	Depth (feet)
0	355	Exploration backfilled with bentonite chips						SAND WITH SILT AND GRAVEL (SW-SM); medium dense, slightly moist, gray to brown; fine to coarse sand; few fine, rounded gravel; few non-plastic silt	0
								Drilling action suggests increasing gravel	
5	350		S1		12 15 12			GRAVEL WITH COBBLES (GW); medium dense, very moist, gray; fine to coarse, rounded gravel; rounded cobbles up to approximately 4-inches; few fine to coarse sand; trace silt	5
10	345	▽ 11/9/2024	S2		50/5"			Becomes wet	10
15	340		S3		50/3"	PSD MC = 2.0% FC = 2.0%			15
20	335		S4		50/3"			Refusal at 20'± bgs due to cobbles. Bottom auger flight abandoned in place. Laboratory samples supplemented with material from the auger cuttings due to low SPT recovery.	20
25	330								25

Legend

Sample Type
- ◯ No soil sample recovery
- ◪ Modified California Split Barrel SPT (3"x2.375")

Plastic Limit ⊢ ⊣ Liquid Limit

Water Level
- ▽ Water Level ATD

Logged by: LLC/MBR

EXPLORATION LOG
CRB-02
SHEET 1 of 1

APPENDIX B

Geotechnical Laboratory Testing Results

Appendix B – Geotechnical Laboratory Testing Results

Geotechnical laboratory tests were conducted on selected soil samples collected during the field exploration programs. Laboratory testing was performed by Hayre McElroy, LLC under subcontract to Cross Reiter. The tests performed and the procedures followed are outlined below.

Particle-Size Distribution

Particle-size distribution of selected soil samples collected from the explorations were determined in general accordance with ASTM D6913. The results of the tests are presented graphically here in **Appendix B** and incorporated into the exploration logs in **Appendix A**.

Moisture Content Determination

Moisture contents of selected soil samples collected from the explorations were determined in general accordance with ASTM D2216. The results of the tests are presented graphically here in **Appendix B** and incorporated into the exploration logs in **Appendix A**.

hayremcelroy & associates, llc

9644 153rd Ave NE
Redmond, WA 98052
p 425.869.6750

Moisture Content
ASTM D-2216

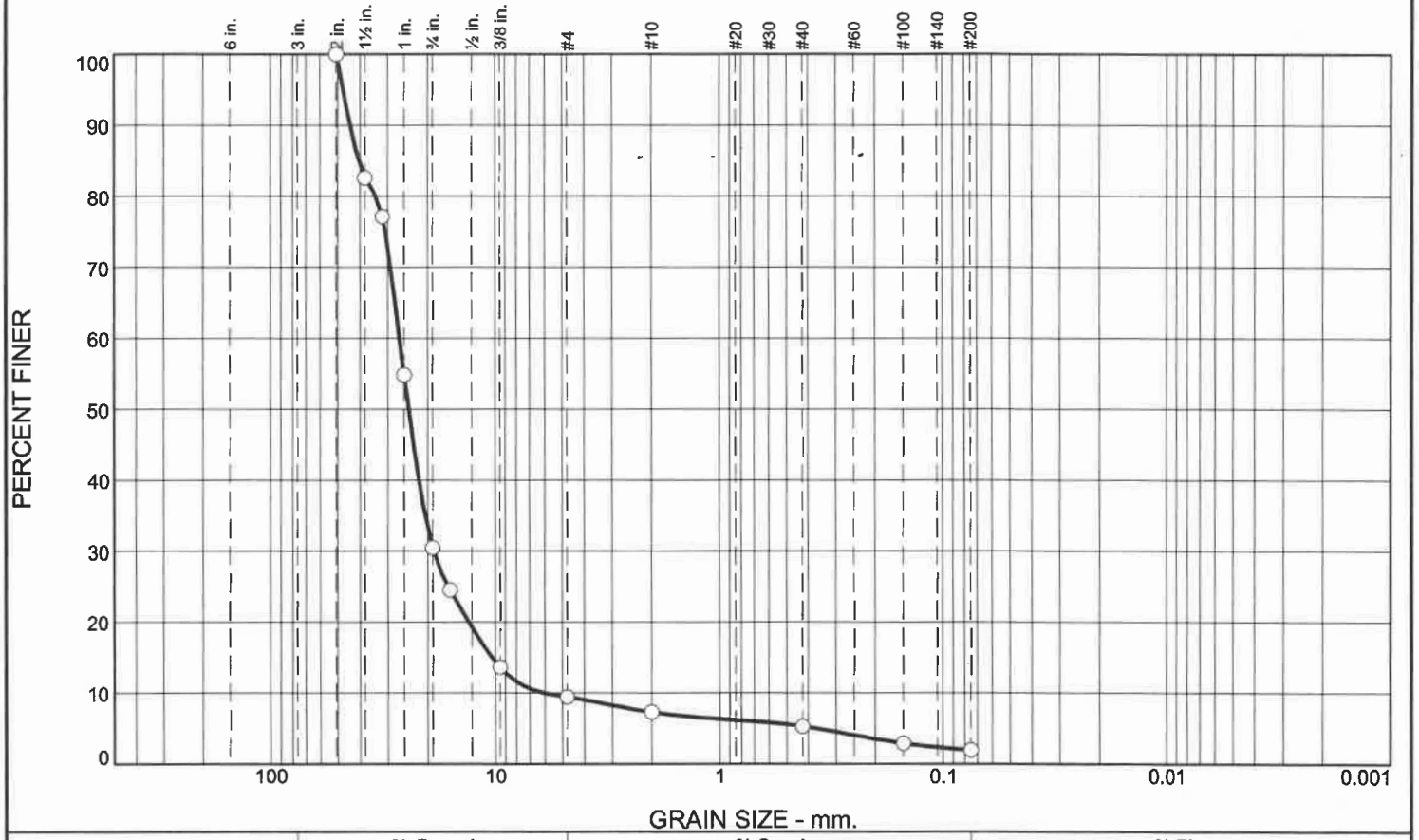
HMA Project Number: 23-1581
Project Name: City of Richmond Shoreline Stabilization
Description: Soil
Lab Number: 8867

Received Date: 11/13/24
Start Date: 11/18/24
Finish Date: 11/25/24
Technician: HL

Lab #	Tare ID	Boring	Sample #	Depth (ft)	Weight of Moist Soil + Tare (g)	Weight of Dry Soil + Tare (g)	Tare Weight (g)	Weight of Water (g)	Moisture Content (%)
8867-A	G-41	**CRMW-01**	S-2	5'	1751.80	1731.30	16.00	20.50	**1.2**
8867-B	F-62	**CRMW-01**	S-6	15'	1739.40	1704.20	16.30	35.20	**2.1**
8867-C	A-8	**CRMW-01**	S-8	25'	1319.90	1248.40	12.90	71.50	**5.8**
8867-D	A-6	**CRB-02**	S-6	15'	1574.20	1543.50	12.70	30.70	**2.0**

Oven No.	Oven In-Calibration	Calibration Due	Balance	In Calibration	Calibration Due
B23ERS-0026	8/9/2024	August 2025	545249	8/9/2025	August 2025

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	69.5	21.1	2.1	2.0	3.3	2.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1 1/2"	82.6		
1 1/4"	77.1		
1"	54.8		
3/4"	30.5		
5/8"	24.5		
3/8"	13.7		
#4	9.4		
#10	7.3		
#40	5.3		
#100	2.9		
#200	2.0		

* (no specification provided)

Soil Description

Well-graded GRAVEL

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 44.2308 D_{85}= 40.5186 D_{60}= 26.5720
D_{50}= 24.2995 D_{30}= 18.8590 D_{15}= 10.3400
D_{10}= 6.0109 C_u= 4.42 C_c= 2.23

Classification

USCS= GW AASHTO=

Remarks

MC - 1.2%

Source of Sample: CRMW-01 **Depth:** 5 ft.
Sample Number: S-2

Date: 11/25/2024

Hayre McElroy & Associates, LLC

Redmond, WA

Client: Cross Reiter, Inc.
Project: City of Richland Shoreline Stabilization
RIC-2401
Project No: Lab #8867 **Figure**

Tested By: HL **Checked By:** JM

GRAIN SIZE DISTRIBUTION TEST DATA

11/25/2024

Client: Cross Reiter, Inc.
Project: City of Richland Shoreline Stabilization
RIC-2401
Project Number: Lab #8867
Location: CRMW-01
Depth: 5 ft. **Sample Number:** S-2
Material Description: Well-graded GRAVEL
Date: 11/25/2024
USCS Classification: GW
Testing Remarks: MC - 1.2%
Tested by: HL **Checked by:** JM

Sieve Test Data

Post #200 Wash Test Weights (grams): **Dry Sample and Tare =** 1698.88
Tare Wt. = 16.00
Minus #200 from wash = 1.9%

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
1731.30	16.00	0.00	2"	0.00	100.0
			1 1/2"	298.60	82.6
			1 1/4"	392.10	77.1
			1"	774.80	54.8
			3/4"	1192.30	30.5
			5/8"	1294.70	24.5
			3/8"	1481.00	13.7
			#4	1553.40	9.4
			#10	1590.10	7.3
			#40	1624.50	5.3
			#100	1665.80	2.9
			#200	1681.80	2.0

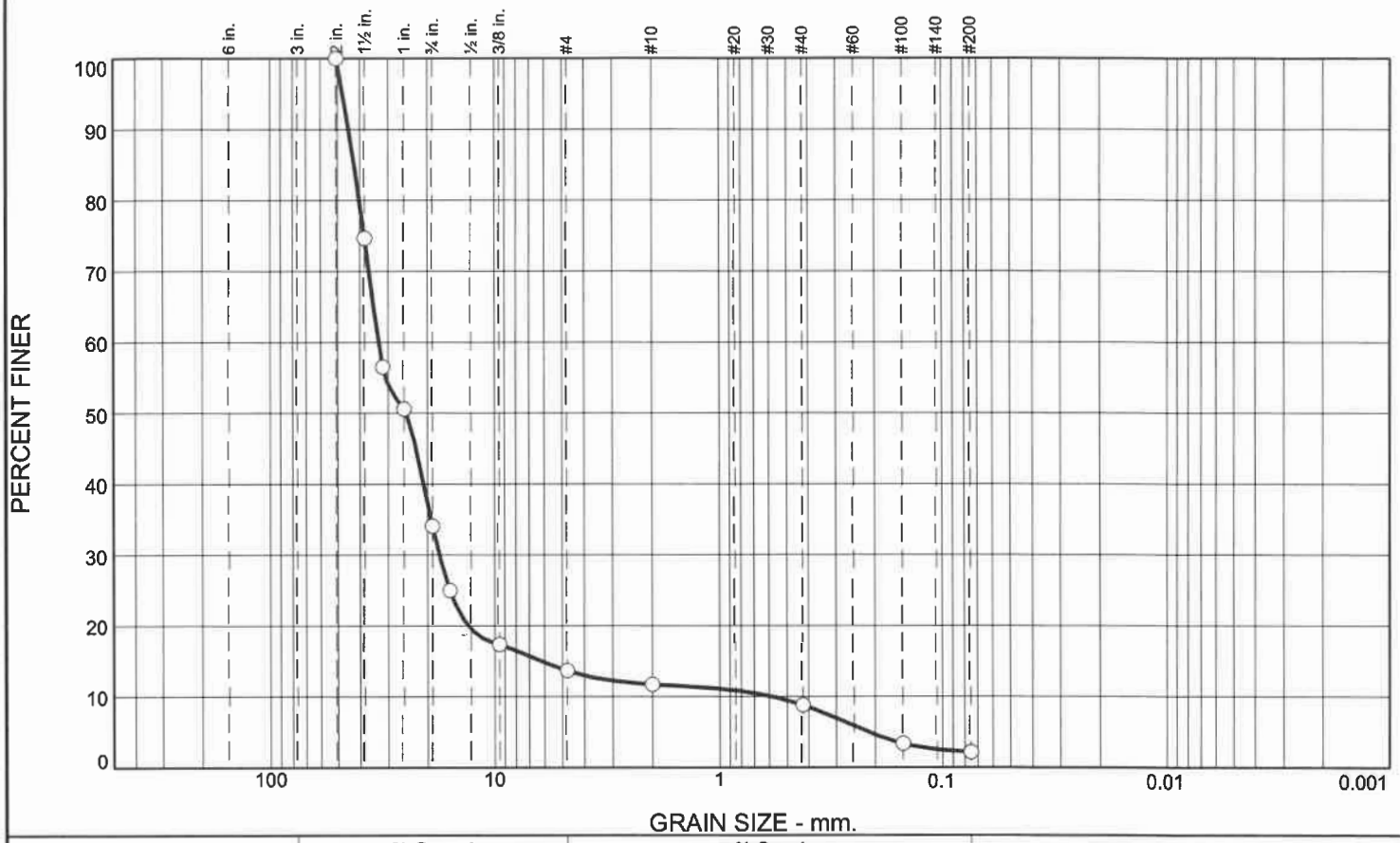
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	69.5	21.1	90.6	2.1	2.0	3.3	7.4			2.0

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.3679	6.0109	10.3400	13.1417	18.8590	21.8905	24.2995	26.5720	34.0609	40.5186	44.2308	47.5206

Fineness Modulus	C_u	C_c
7.36	4.42	2.23

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	65.9	20.4	2.0	2.9	6.6	2.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1 1/2"	74.7		
1 1/4"	56.5		
1"	50.6		
3/4"	34.1		
5/8"	25.0		
3/8"	17.4		
#4	13.7		
#10	11.7		
#40	8.8		
#100	3.4		
#200	2.2		

* (no specification provided)

Soil Description

Poorly graded GRAVEL

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 44.8282 D_{85}= 42.3174 D_{60}= 33.2116
D_{50}= 24.9158 D_{30}= 17.7476 D_{15}= 6.1287
D_{10}= 0.5830 C_u= 56.97 C_c= 16.27

Classification

USCS= GP AASHTO=

Remarks

MC - 2.1%

Source of Sample: CRMW-01 **Depth:** 15 ft.
Sample Number: S-6

Date: 11/25/2024

Hayre McElroy & Associates, LLC

Redmond, WA

Client: Cross Reiter, Inc.
Project: City of Richland Shoreline Stabilization
RIC-2401
Project No: Lab #8867 **Figure**

Tested By: HL **Checked By:** JM

GRAIN SIZE DISTRIBUTION TEST DATA

11/25/2024

Client: Cross Reiter, Inc.
Project: City of Richland Shoreline Stabilization
RIC-2401
Project Number: Lab #8867
Location: CRMW-01
Depth: 15 ft. **Sample Number:** S-6
Material Description: Poorly graded GRAVEL
Date: 11/25/2024
USCS Classification: GP
Testing Remarks: MC - 2.1%
Tested by: HL **Checked by:** JM

Sieve Test Data

Post #200 Wash Test Weights (grams): **Dry Sample and Tare =** 1668.26
Tare Wt. = 16.30
Minus #200 from wash = 2.1%

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
1704.20	16.30	0.00	2"	0.00	100.0
			1 1/2"	427.60	74.7
			1 1/4"	734.30	56.5
			1"	833.60	50.6
			3/4"	1113.00	34.1
			5/8"	1266.00	25.0
			3/8"	1394.50	17.4
			#4	1456.80	13.7
			#10	1489.80	11.7
			#40	1539.10	8.8
			#100	1630.90	3.4
			#200	1651.00	2.2

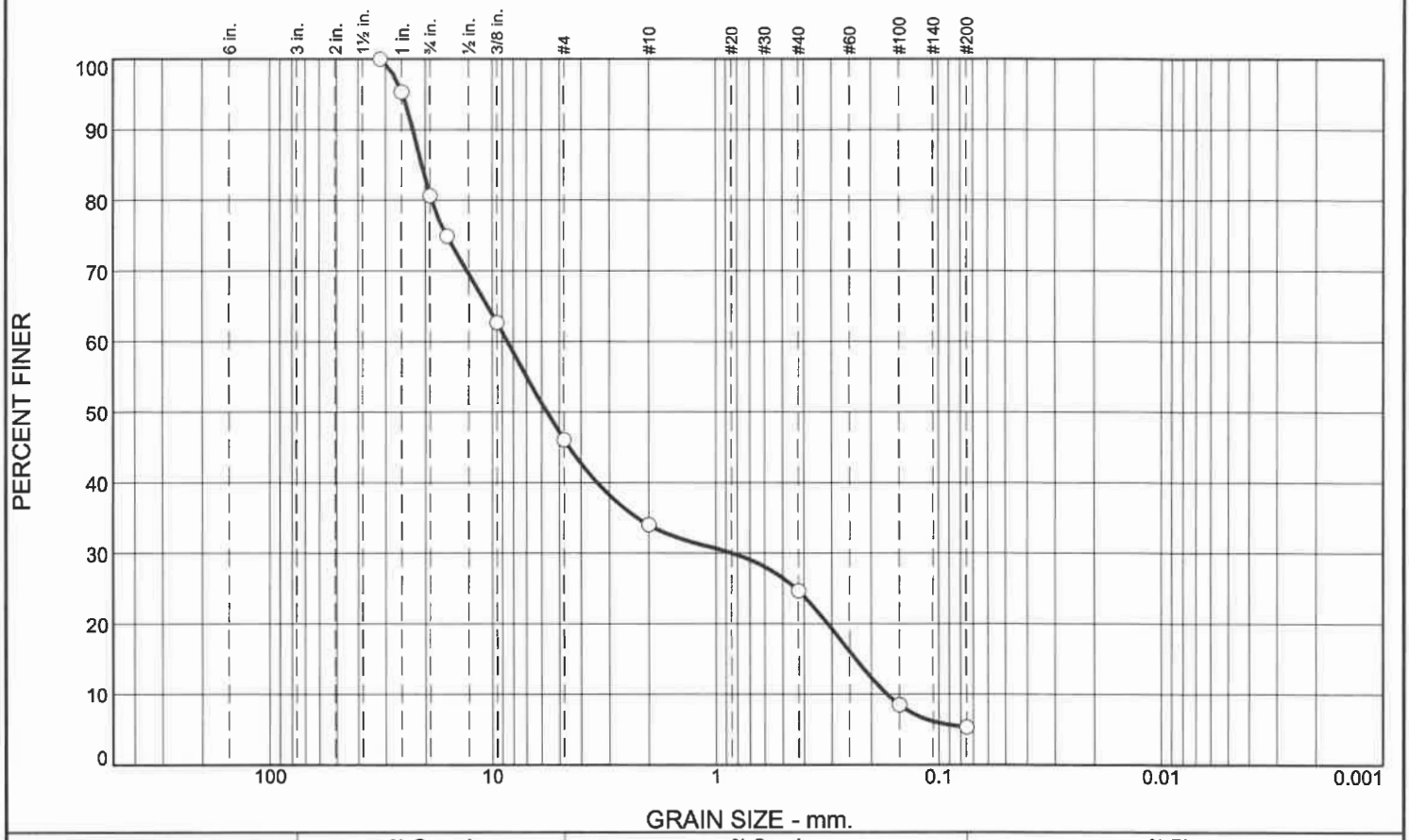
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	65.9	20.4	86.3	2.0	2.9	6.6	11.5			2.2

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.2132	0.5830	6.1287	13.1085	17.7476	20.8438	24.9158	33.2116	40.1256	42.3174	44.8282	47.6677

Fineness Modulus	C_u	C_c
7.17	56.97	16.27

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	19.3	34.6	12.1	9.3	19.4	5.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1 1/4"	100.0		
1"	95.4		
3/4"	80.7		
5/8"	74.9		
3/8"	62.7		
#4	46.1		
#10	34.0		
#40	24.7		
#100	8.5		
#200	5.3		

* (no specification provided)

Soil Description

Poorly graded GRAVEL with silt and sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 22.7162 D_{85}= 20.7680 D_{60}= 8.5412
D_{50}= 5.6780 D_{30}= 0.8440 D_{15}= 0.2349
D_{10}= 0.1702 C_u= 50.17 C_c= 0.49

Classification

USCS= GP-GM AASHTO=

Remarks

MC - 5.8%

Source of Sample: CRMW-01 **Depth:** 25 ft.
Sample Number: S-8

Date: 11/25/2024

Hayre McElroy & Associates, LLC

Redmond, WA

Client: Cross Reiter, Inc.
Project: City of Richland Shoreline Stabilization
RIC-2401
Project No: Lab #8867 **Figure**

Tested By: HL **Checked By:** JM

GRAIN SIZE DISTRIBUTION TEST DATA

11/25/2024

Client: Cross Reiter, Inc.
Project: City of Richland Shoreline Stabilization
RIC-2401
Project Number: Lab #8867
Location: CRMW-01
Depth: 25 ft. **Sample Number:** S-8
Material Description: Poorly graded GRAVEL with silt and sand
Date: 11/25/2024
USCS Classification: GP-GM
Testing Remarks: MC - 5.8%
Tested by: HL **Checked by:** JM

Sieve Test Data

Post #200 Wash Test Weights (grams): **Dry Sample and Tare =** 1186.74
Tare Wt. = 12.90
Minus #200 from wash = 5.0%

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
1248.40	12.90	0.00	1 1/4"	0.00	100.0
			1"	57.40	95.4
			3/4"	238.80	80.7
			5/8"	309.90	74.9
			3/8"	461.10	62.7
			#4	666.40	46.1
			#10	815.20	34.0
			#40	930.70	24.7
			#100	1130.40	8.5
			#200	1169.60	5.3

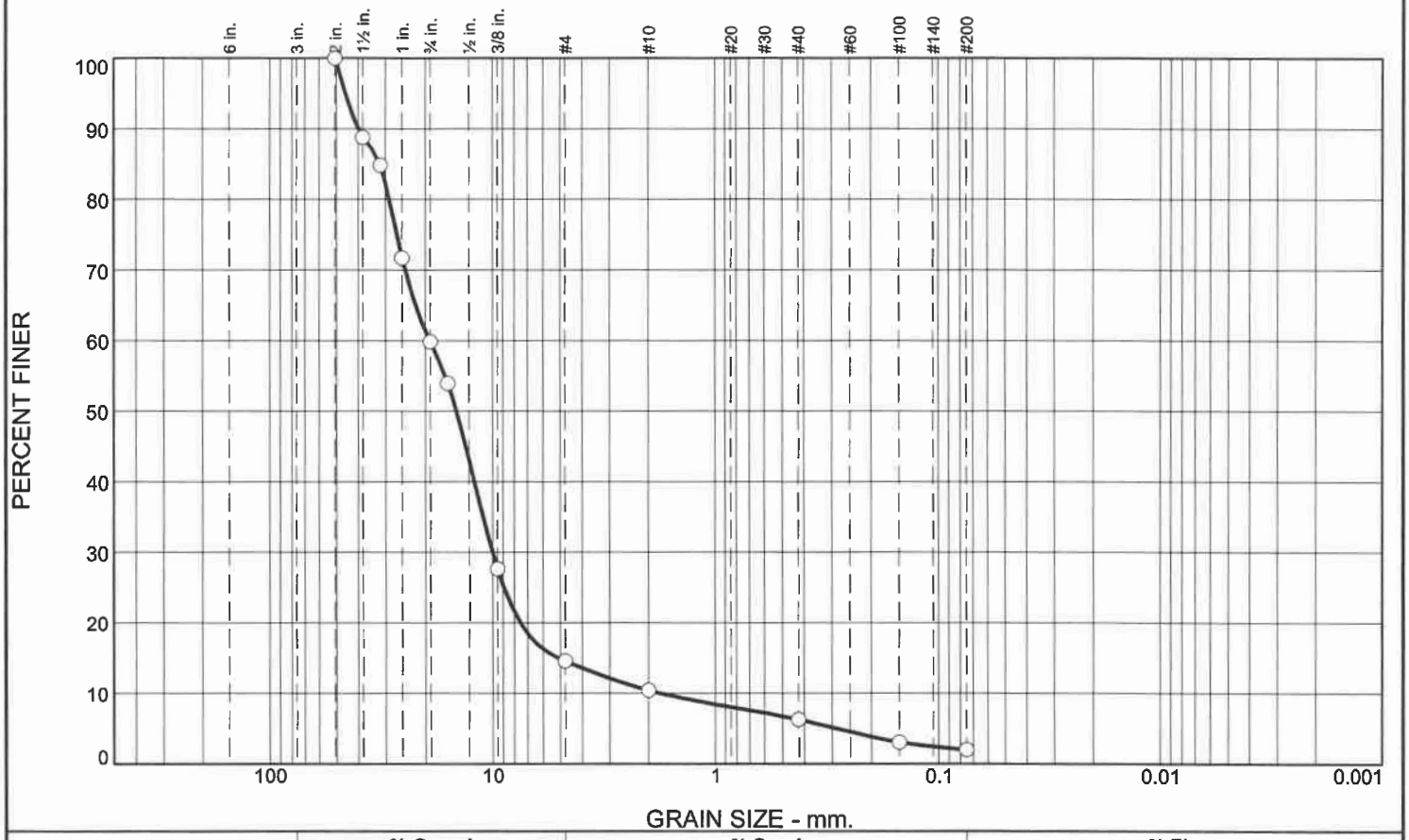
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	19.3	34.6	53.9	12.1	9.3	19.4	40.8			5.3

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
	0.1702	0.2349	0.3132	0.8440	3.3876	5.6780	8.5412	18.7486	20.7680	22.7162	25.1710

Fineness Modulus	C_u	C_c
4.88	50.17	0.49

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	40.2	45.2	4.1	4.2	4.3	2.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1 1/2"	88.8		
1 1/4"	84.9		
1"	71.7		
3/4"	59.8		
5/8"	54.0		
3/8"	27.7		
#4	14.6		
#10	10.5		
#40	6.3		
#100	3.1		
#200	2.0		

* (no specification provided)

Soil Description

Well-graded GRAVEL

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 39.9348 D_{85}= 31.8706 D_{60}= 19.1524
D_{50}= 14.5133 D_{30}= 10.0184 D_{15}= 5.0832
D_{10}= 1.7561 C_u= 10.91 C_c= 2.98

Classification

USCS= GW AASHTO=

Remarks

MC - 2.0%

Source of Sample: CRB-02 **Depth:** 15 ft.
Sample Number: S-6

Date: 11/25/2024

Hayre McElroy & Associates, LLC

Redmond, WA

Client: Cross Reiter, Inc.
Project: City of Richland Shoreline Stabilization
RIC-2401
Project No: Lab #8867 **Figure**

Tested By: HL **Checked By:** JM

GRAIN SIZE DISTRIBUTION TEST DATA

11/25/2024

Client: Cross Reiter, Inc.
Project: City of Richland Shoreline Stabilization
RIC-2401
Project Number: Lab #8867
Location: CRB-02
Depth: 15 ft. **Sample Number:** S-6
Material Description: Well-graded GRAVEL
Date: 11/25/2024
USCS Classification: GW
Testing Remarks: MC - 2.0%
Tested by: HL **Checked by:** JM

Sieve Test Data

Post #200 Wash Test Weights (grams): **Dry Sample and Tare =** 1515.06
Tare Wt. = 12.70
Minus #200 from wash = 1.9%

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
1543.50	12.70	0.00	2"	0.00	100.0
			1 1/2"	171.50	88.8
			1 1/4"	231.80	84.9
			1"	432.90	71.7
			3/4"	614.80	59.8
			5/8"	704.80	54.0
			3/8"	1107.50	27.7
			#4	1307.40	14.6
			#10	1370.80	10.5
			#40	1434.40	6.3
			#100	1483.80	3.1
			#200	1500.10	2.0

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	40.2	45.2	85.4	4.1	4.2	4.3	12.6			2.0

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.2848	1.7561	5.0832	7.5423	10.0184	12.0560	14.5133	19.1524	28.9081	31.8706	39.9348	45.6127

Fineness Modulus	C_u	C_c
6.74	10.91	2.98

APPENDIX C

Slope Stability Analyses

Appendix C – Slope Stability Analyses

Methodology

To evaluate slope stability for the proposed shoreline stabilization alternatives, we performed analyses using the slope stability module within the computer program Slide (Rocscience, 2024). The Slide slope stability module is a two-dimensional, limit equilibrium program that performs slope stability computations based on the modeled slope conditions and calculates factors of safety against slope failure. The factor of safety is defined as the ratio of resisting forces to driving forces. A factor of safety of 1.0 indicates a "just-stable" condition, and a factor of safety less than 1.0 would indicate unstable conditions. Key inputs into the Slide slope stability module are slope geometry, soil parameters such as unit weight, soil shear strength parameters, and groundwater conditions. We used Spencer's limit equilibrium method in our Slide analyses.

Through iterative calculations of successive model runs, the slope stability module computes forces and performs limit equilibrium calculations on each slip surface. Key outputs from the Slide slope stability module are the factors of safety of thousands of slip surfaces through the slope. Analysis outputs for this Project only depict failures that intersect the proposed stabilization alternative. Shallow, surficial failures on the existing slopes outside the limits of work are not considered.

Design Basis

We performed slope stability analyses in general accordance with the United States Army Corps of Engineers (USACE) Engineering Manual (EM) 1110-2-1902 for Slope Stability (USACE, 2003). We assessed four total design cases for each shoreline stabilization alternative. Three design cases are based on the potential water elevations of Lake Wallula (i.e., Columbia River) as controlled by McNary Dam[3]. These elevations are historically reported in the NGVD29 vertical datum. To transform NGVD29 elevations to NAVD88 at the Project Site, we applied a correction factor of 3.4 feet to the reported elevations in accordance with guidance by the National Oceanic and Atmospheric Administration[4]. The key Lake Wallula water elevations are Normal Pool (340 feet NGVD29, 343.4 feet NAVD88) and Minimum Pool (335 feet NGVD29, 338.4 feet NAVD88). We also assessed a "high water" scenario, where the water inundates the riverfront recreational trail at 355 feet NAVD88. The design case for normal pool elevation also includes a 250 psf surcharge load on the ground surface behind the shoreline. The fourth design case considers seismic loading when Lake Wallula is at normal pool elevation. For seismic conditions, we applied a horizontal seismic coefficient of 0.0815g to represent the inertial forces induced by the design seismic event. This is equal to one half of the Site Class D peak ground acceleration (PGA) for the maximum design earthquake (MDE) as outlined in United States Army Corps of Engineers (USACE) Engineering Manual (EM) 1110-2-1806 Earthquake Design and Evaluation for Civil Works Projects (2016). The MDE corresponds to a 10-percent probability of exceedance over a project life of 100 years, which corresponds to an approximately 950-year return period event.

Because of the highly permeable nature of the soils encountered in our subsurface explorations, we used drained shear strengths and effective stresses for all analyses and assumed groundwater will be at continuous equilibrium with the Columbia River. This assumption aligns well with our measurements of groundwater elevations at CRMW-01. We did not consider rapid drawdown effects, as they are not applicable to the highly permeable Site soils encountered in our subsurface explorations.

We performed our slope stability calculations at a representative cross section located at the approximate location of Section A-A' shown on **Figure 1**. We used surveyed topographic information provided by the City to model the geometry of the existing shoreline. We designated the soil units and assigned the engineering parameters shown below in **Table C1** based on engineering judgement, our experience with similar materials, and the results of our subsurface exploration program.

[3] https://www.nwd-wc.usace.army.mil/dd/common/projects/www/mcn.html, accessed November 11, 2024.
[4] https://www.ngs.noaa.gov/NCAT/.

Table C1: Soil Engineering Properties for Slope Stability Analyses

Unit	Unit Weight (pcf)	Cohesion (psf)	Friction Angle (deg)
Alluvium (Qa): GW, GP, GP-GM, SW-SM	125	0	34
Crushed Aggregate Structural Fill	130	0	38
Crushed Aggregate Filter Material	130	0	38
MSE Reinforced Soil	130	0	38
Erosion and Scour Protection Rock	135	0	40

Results

The groundwater/river elevations and minimum recommended factors of safety we considered for each design case, along with the calculated factors of safety, are shown in **Table C2** below.

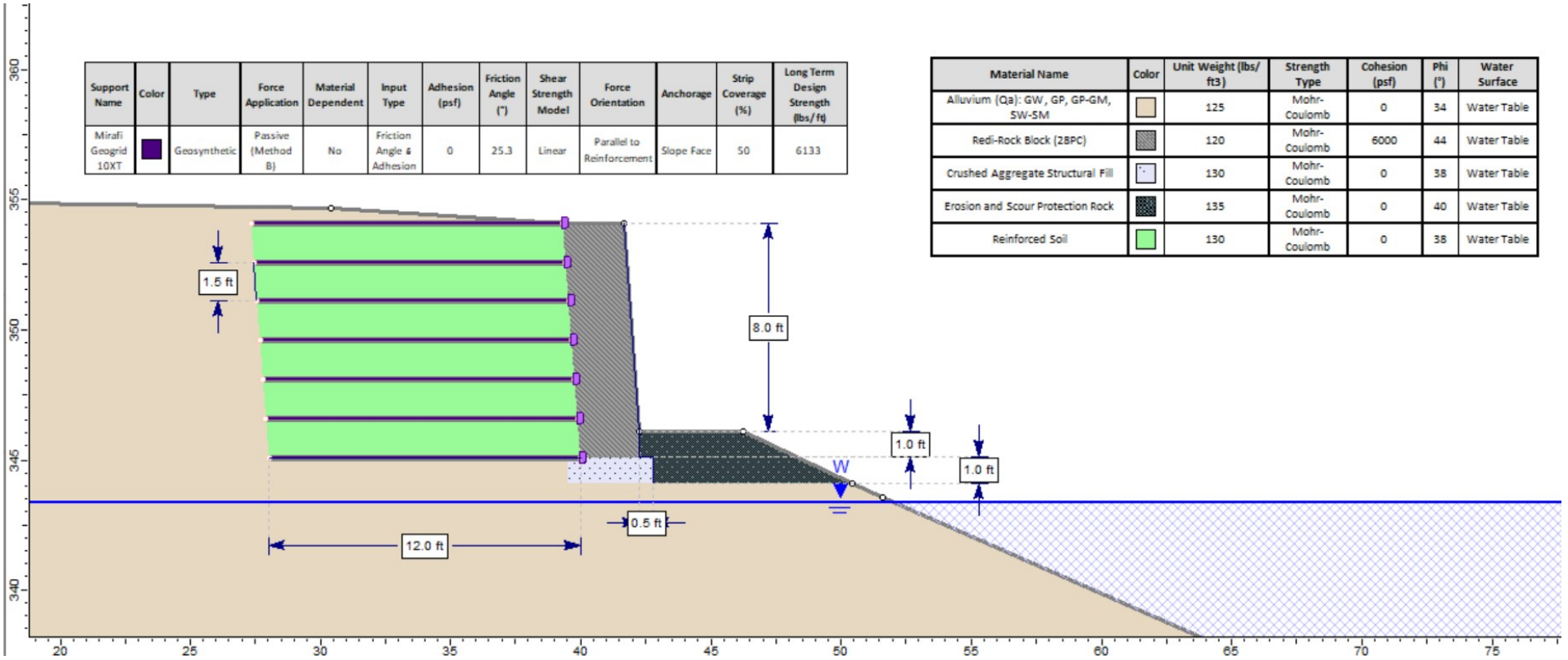
Table C2: Minimum Recommended Factors of Safety for Slope Stability Analyses and Calculated Results

Design Case	Groundwater/River Elevation	Minimum Factor of Safety	Calculated Factor of Safety	
			MSE Precast Modular Block Wall	Vegetated Armored Slope
Normal Pool with 250 psf Surface Surcharge Load	343.4 feet	1.5	1.5	1.6
Low Pool	338.4 feet	1.5	1.5	1.5
High Water	355.0 feet	1.5	1.8	1.6
Normal Pool with Seismic Loading	343.4 feet	1.1	1.2	1.1

The results of our slope stability analyses are depicted graphically in the following pages.

Support Name	Color	Type	Force Application	Material Dependent	Input Type	Adhesion (psf)	Friction Angle (°)	Shear Strength Model	Force Orientation	Anchorage	Strip Coverage (%)	Long Term Design Strength (lbs/ft)
Mirafi Geogrid 10XT		Geosynthetic	Passive (Method B)	No	Friction Angle & Adhesion	0	25.3	Linear	Parallel to Reinforcement	Slope Face	50	6133

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Water Surface
Alluvium (Qa): GW, GP, GP-GM, SW-SM		125	Mohr-Coulomb	0	34	Water Table
Redi-Rock Block (28PC)		120	Mohr-Coulomb	6000	44	Water Table
Crushed Aggregate Structural Fill		130	Mohr-Coulomb	0	38	Water Table
Erosion and Scour Protection Rock		135	Mohr-Coulomb	0	40	Water Table
Reinforced Soil		130	Mohr-Coulomb	0	38	Water Table

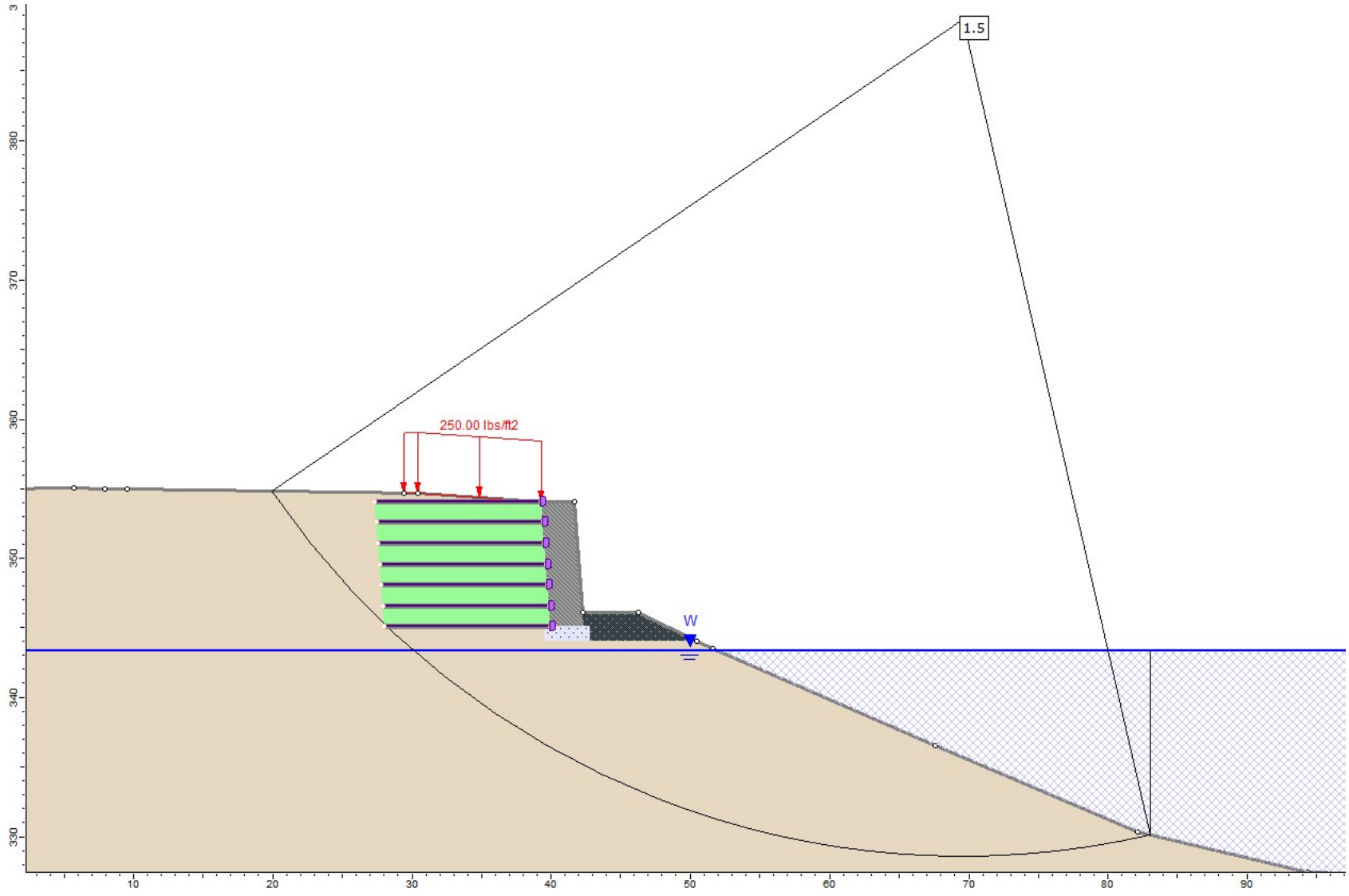


MSE Precast Modular Block Wall - Model Setup

Slope Stability Analyses Results
Columbia Point Marina Shoreline Retaining Wall Repair
City of Richland
Richland, Washington

Scale: As shown.
Note: Selected failure surface shown is intended to highlight risk of global instability and is not necessarily depicting the minimum calculated factor of safety in the model domain. Very shallow, surficial failure surfaces and failures of existing slopes outside the limits of work are not shown for clarity.

CROSS REITER civil + geotechnical engineers	Date	Project No.	Appendix No.
	Nov 2024	RIC-2401	C-1

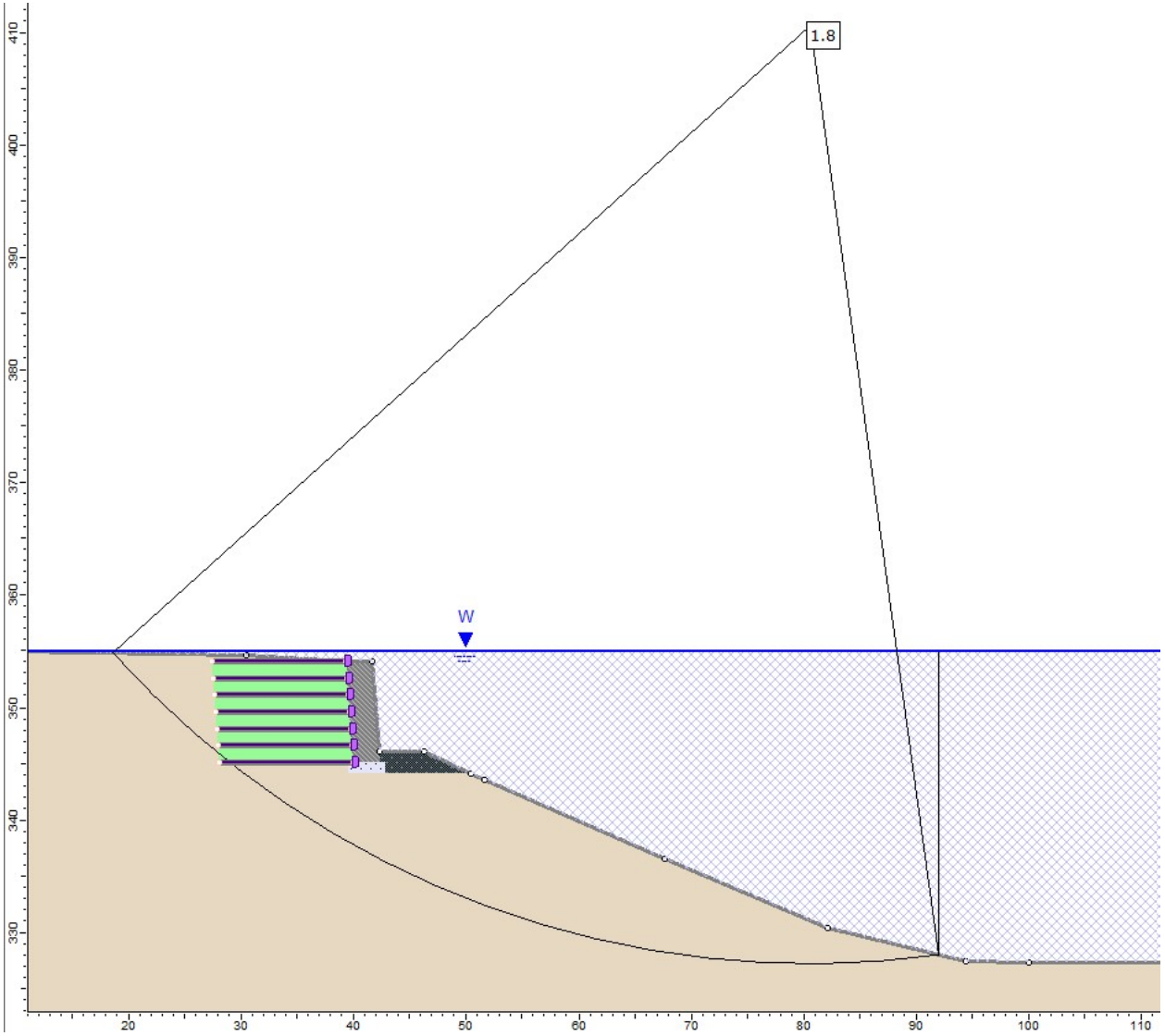


MSE Precast Modular Block Wall - Normal Pool

Slope Stability Analyses Results
Columbia Point Marina Shoreline Retaining Wall Repair
City of Richland
Richland, Washington

Scale: As shown.
Note: Selected failure surface shown is intended to highlight risk of global instability and is not necessarily depicting the minimum calculated factor of safety in the model domain. Very shallow, surficial failure surfaces and failures of existing slopes outside the limits of work are not shown for clarity.

CROSS REITER civil + geotechnical engineers	Date	Project No.	Appendix No.
	Nov 2024	RIC-2401	C-2

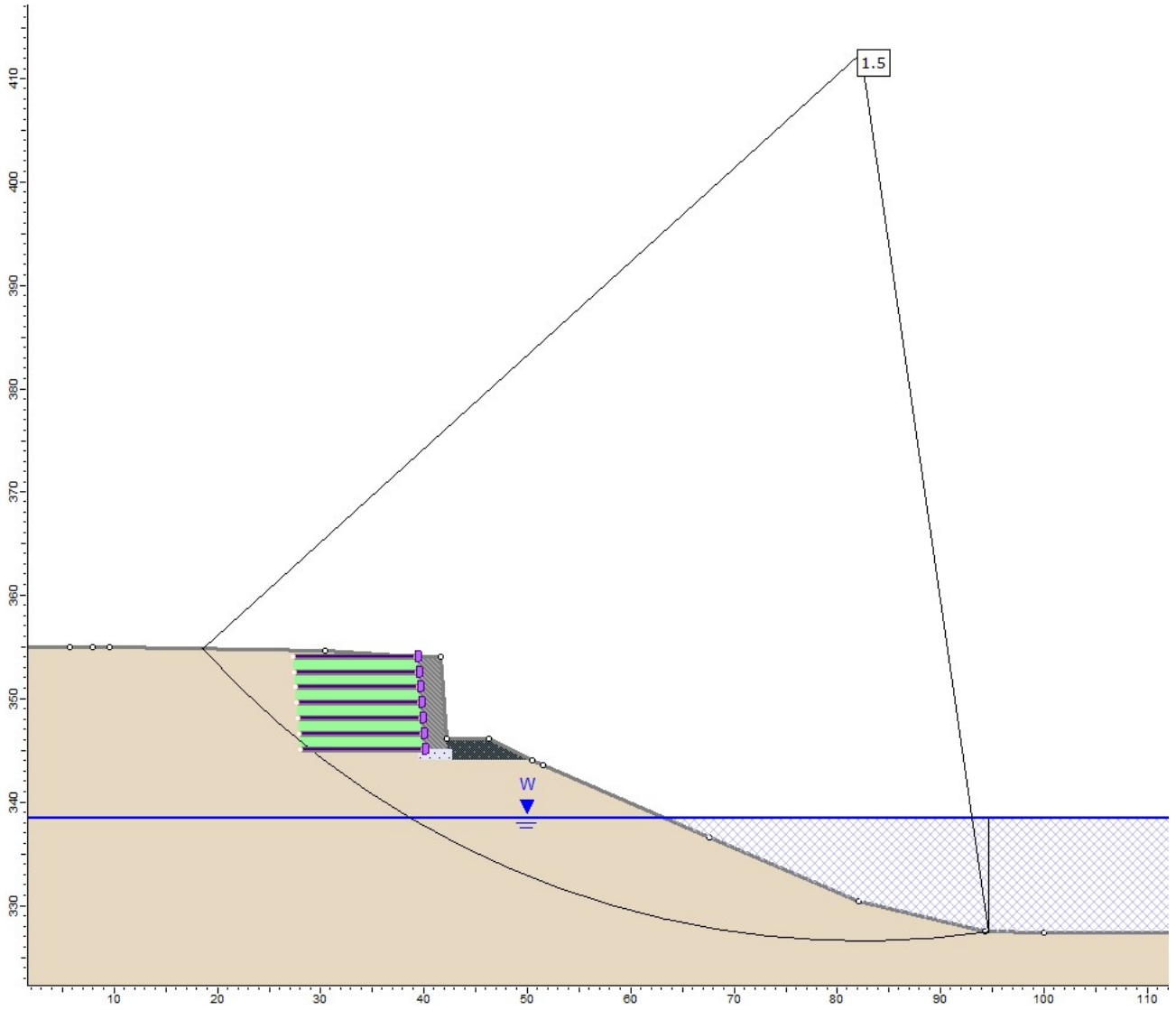


MSE Precast Modular Block Wall - High Water

Slope Stability Analyses Results
Columbia Point Marina Shoreline Retaining Wall Repair
City of Richland
Richland, Washington

Scale: As shown.
Note: Selected failure surface shown is intended to highlight risk of global instability and is not necessarily depicting the minimum calculated factor of safety in the model domain. Very shallow, surficial failure surfaces and failures of existing slopes outside the limits of work are not shown for clarity.

CROSS REITER civil + geotechnical engineers	Date	Project No.	Appendix No.
	Nov 2024	RIC-2401	C-3

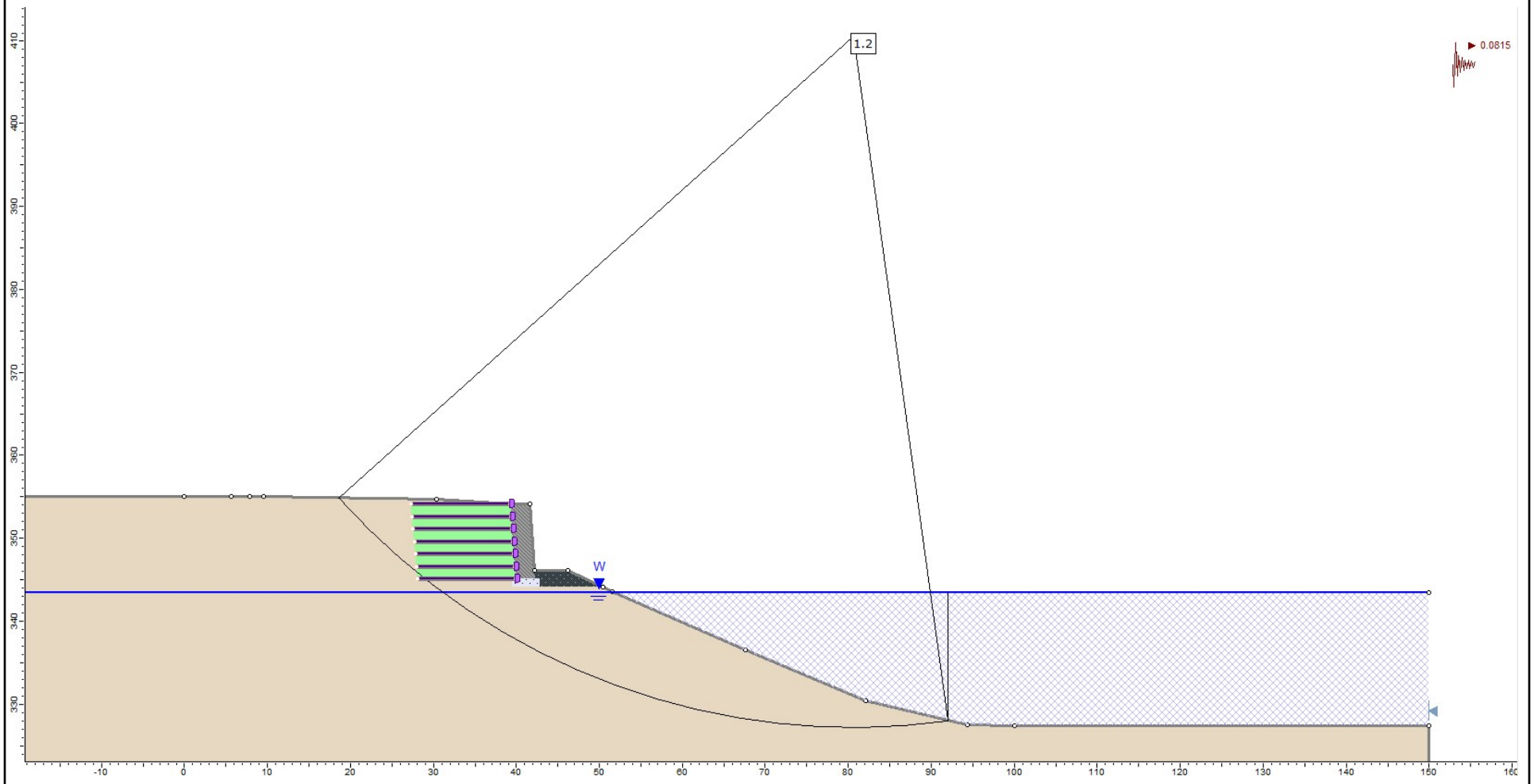


MSE Precast Modular Block Wall - Low Pool

Slope Stability Analyses Results
Columbia Point Marina Shoreline Retaining Wall Repair
City of Richland
Richland, Washington

Scale: As shown.
Note: Selected failure surface shown is intended to highlight risk of global instability and is not necessarily depicting the minimum calculated factor of safety in the model domain. Very shallow, surficial failure surfaces and failures of existing slopes outside the limits of work are not shown for clarity.

CROSS REITER civil + geotechnical engineers	Date	Project No.	Appendix No.
	Nov 2024	RIC-2401	C-4



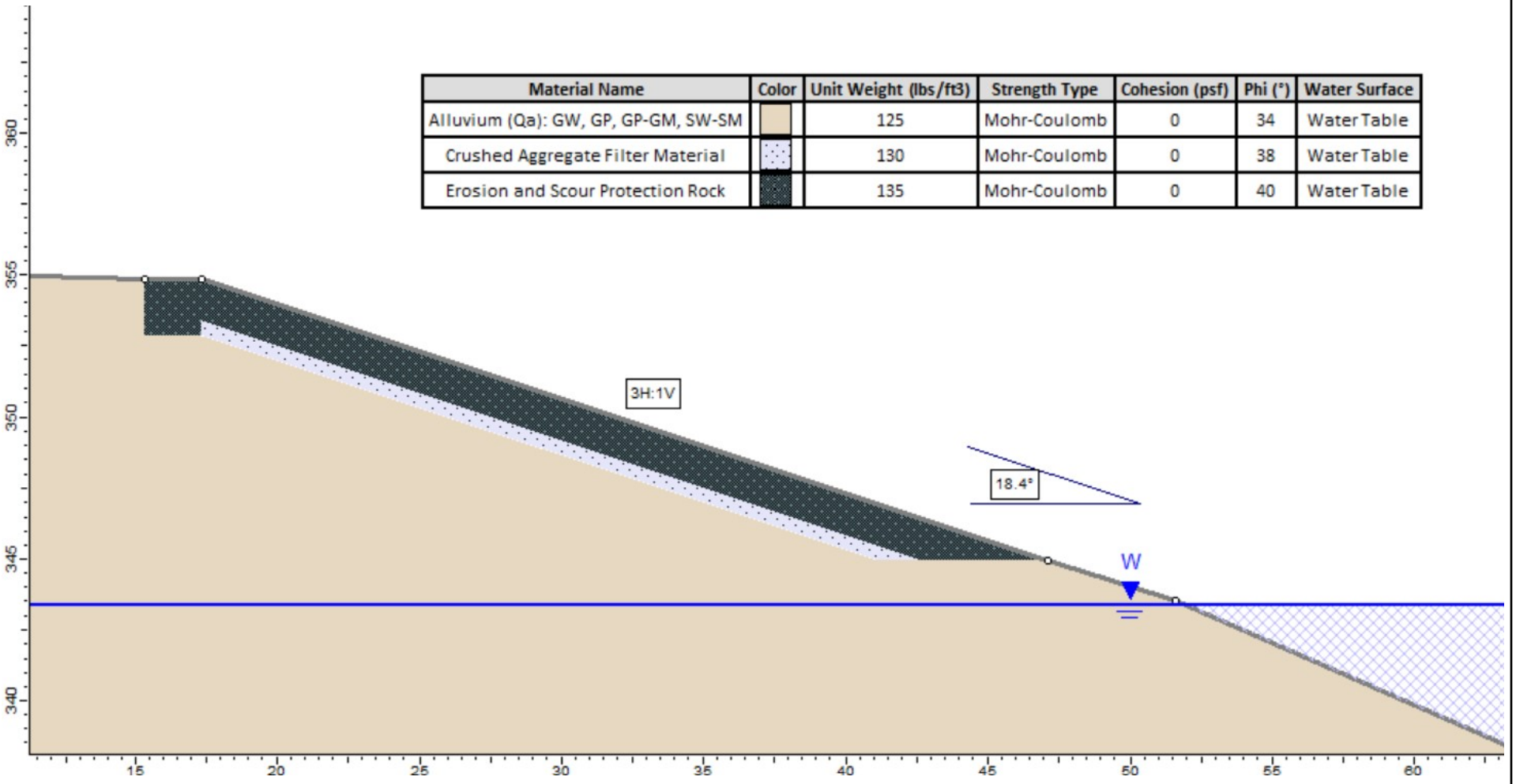
MSE Precast Modular Block Wall - Seismic

Slope Stability Analyses Results
Columbia Point Marina Shoreline Retaining Wall Repair
City of Richland
Richland, Washington

Scale: As shown.
Note: Selected failure surface shown is intended to highlight risk of global instability and is not necessarily depicting the minimum calculated factor of safety in the model domain. Very shallow, surficial failure surfaces and failures of existing slopes outside the limits of work are not shown for clarity.

CROSS REITER civil + geotechnical engineers	Date	Project No.	Appendix No.
	Nov 2024	RIC-2401	C-5

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Water Surface
Alluvium (Qa): GW, GP, GP-GM, SW-SM		125	Mohr-Coulomb	0	34	Water Table
Crushed Aggregate Filter Material		130	Mohr-Coulomb	0	38	Water Table
Erosion and Scour Protection Rock		135	Mohr-Coulomb	0	40	Water Table

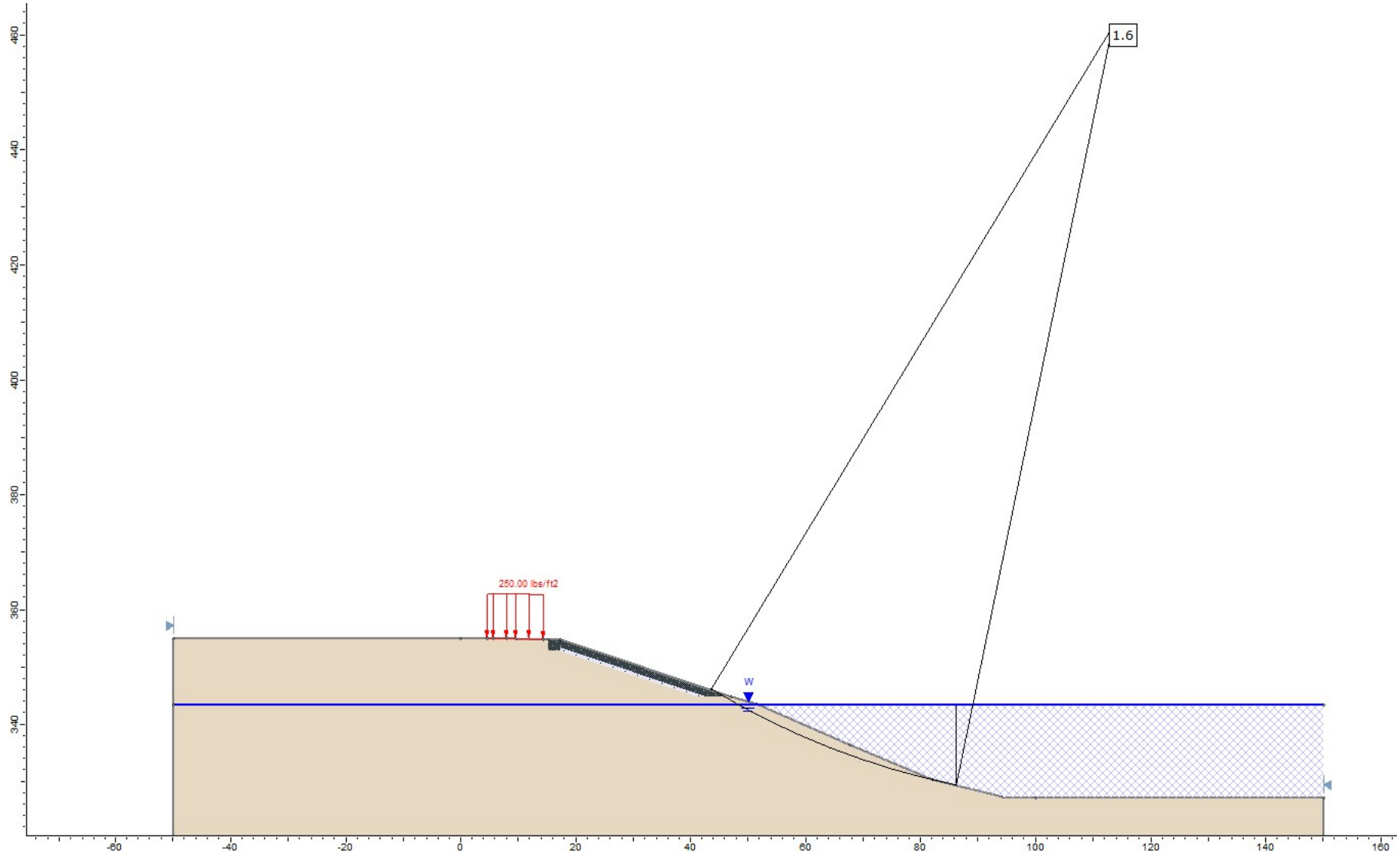


Scale: As shown.
Note: Selected failure surface shown is intended to highlight risk of global instability and is not necessarily depicting the minimum calculated factor of safety in the model domain. Very shallow, surficial failure surfaces and failures of existing slopes outside the limits of work are not shown for clarity.

Vegetated Armored Slope - Model Setup

Slope Stability Analyses Results
Columbia Point Marina Shoreline Retaining Wall Repair
City of Richland
Richland, Washington

CROSS REITER civil + geotechnical engineers	Date	Project No.	Appendix No.
	Nov 2024	RIC-2401	C-6

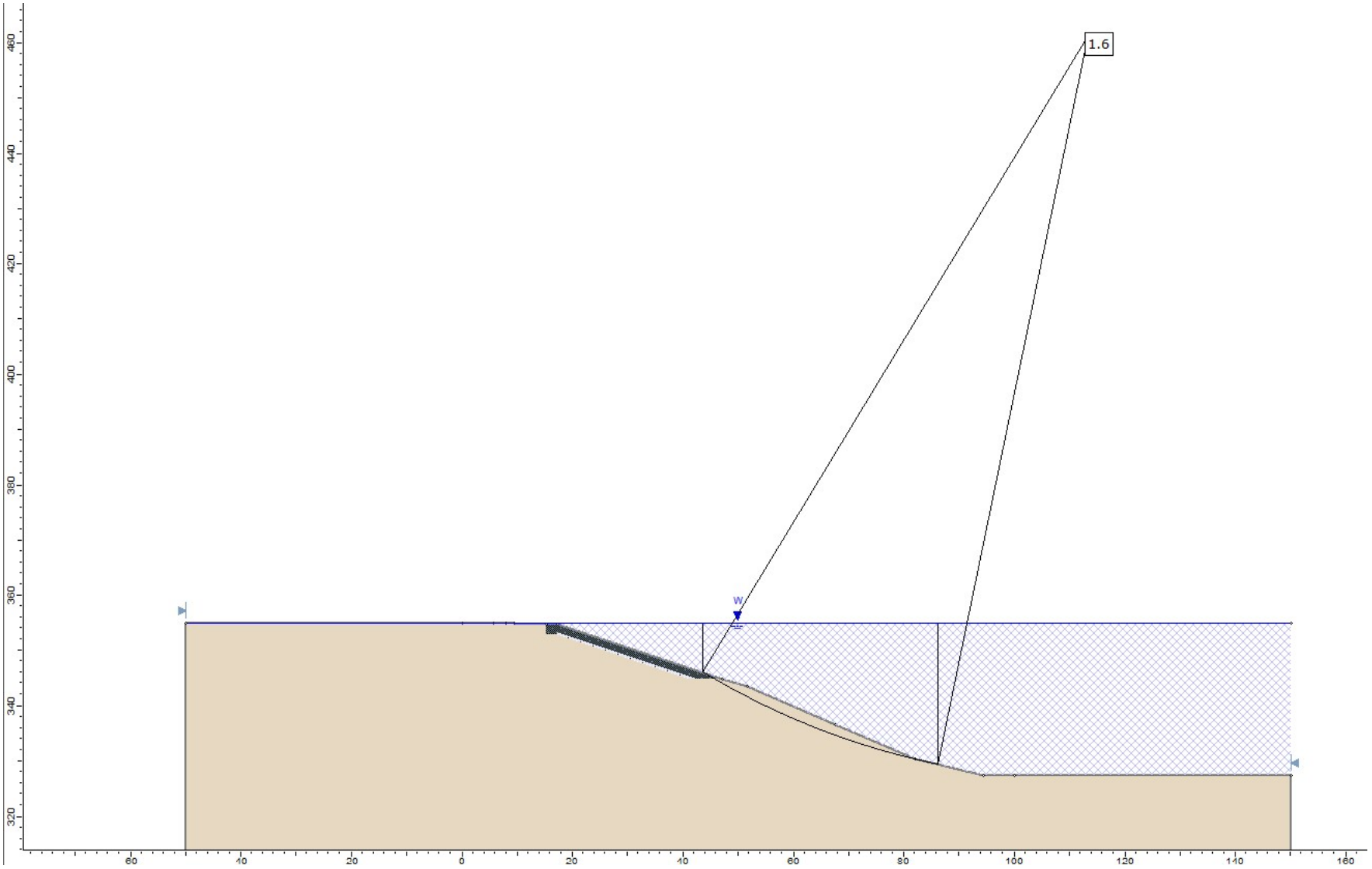


Vegetated Armored Slope - Normal Pool

Slope Stability Analyses Results
Columbia Point Marina Shoreline Retaining Wall Repair
City of Richland
Richland, Washington

Scale: As shown.
Note: Selected failure surface shown is intended to highlight risk of global instability and is not necessarily depicting the minimum calculated factor of safety in the model domain. Very shallow, surficial failure surfaces and failures of existing slopes outside the limits of work are not shown for clarity.

CROSS REITER civil + geotechnical engineers	Date	Project No.	Appendix No.
	Nov 2024	RIC-2401	C-7

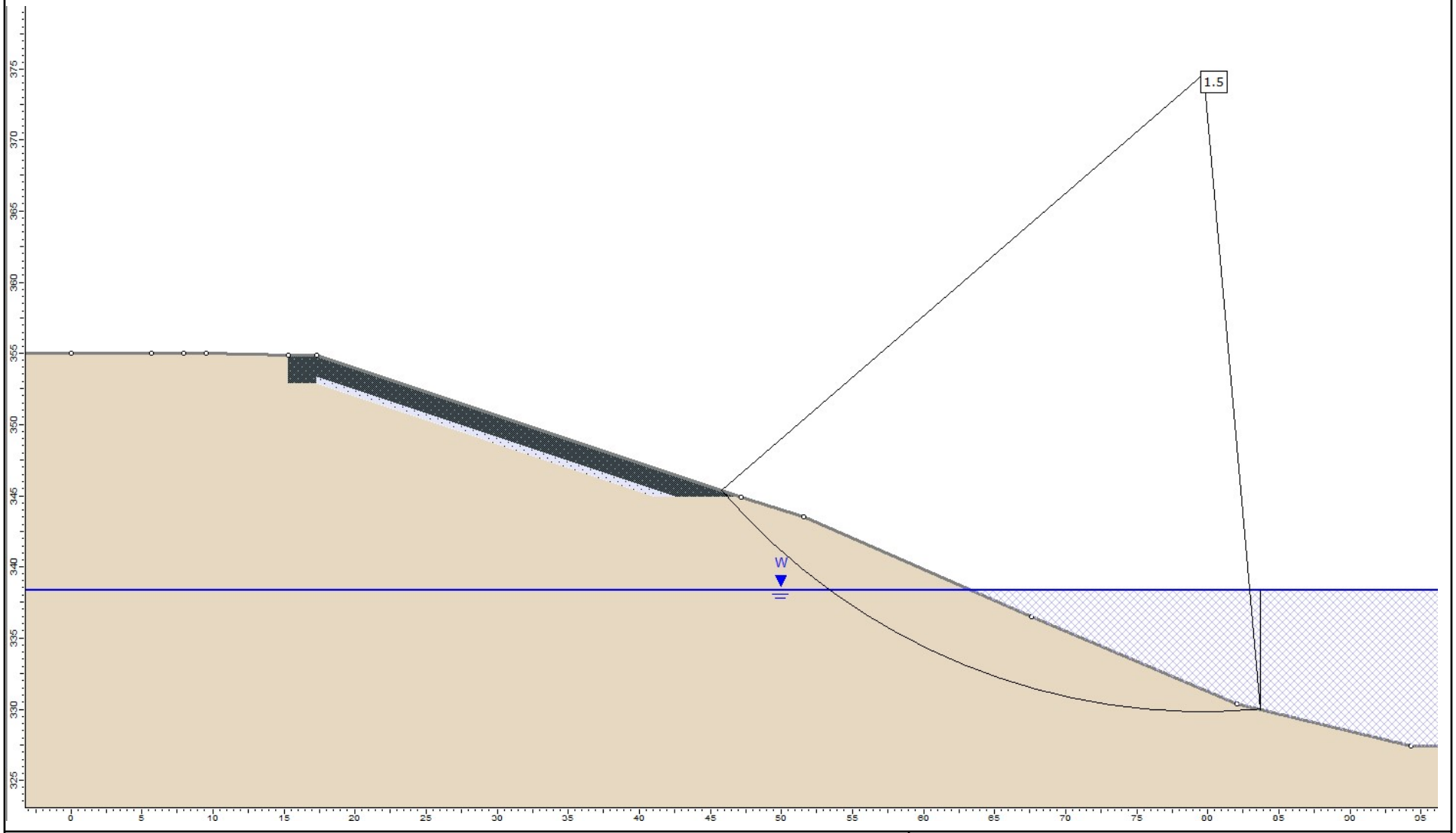


Vegetated Armored Slope - High Water

Slope Stability Analyses Results
Columbia Point Marina Shoreline Retaining Wall Repair
City of Richland
Richland, Washington

Scale: As shown.
Note: Selected failure surface shown is intended to highlight risk of global instability and is not necessarily depicting the minimum calculated factor of safety in the model domain. Very shallow, surficial failure surfaces and failures of existing slopes outside the limits of work are not shown for clarity.

CROSS REITER civil + geotechnical engineers	Date	Project No.	Appendix No.
	Nov 2024	RIC-2401	C-8

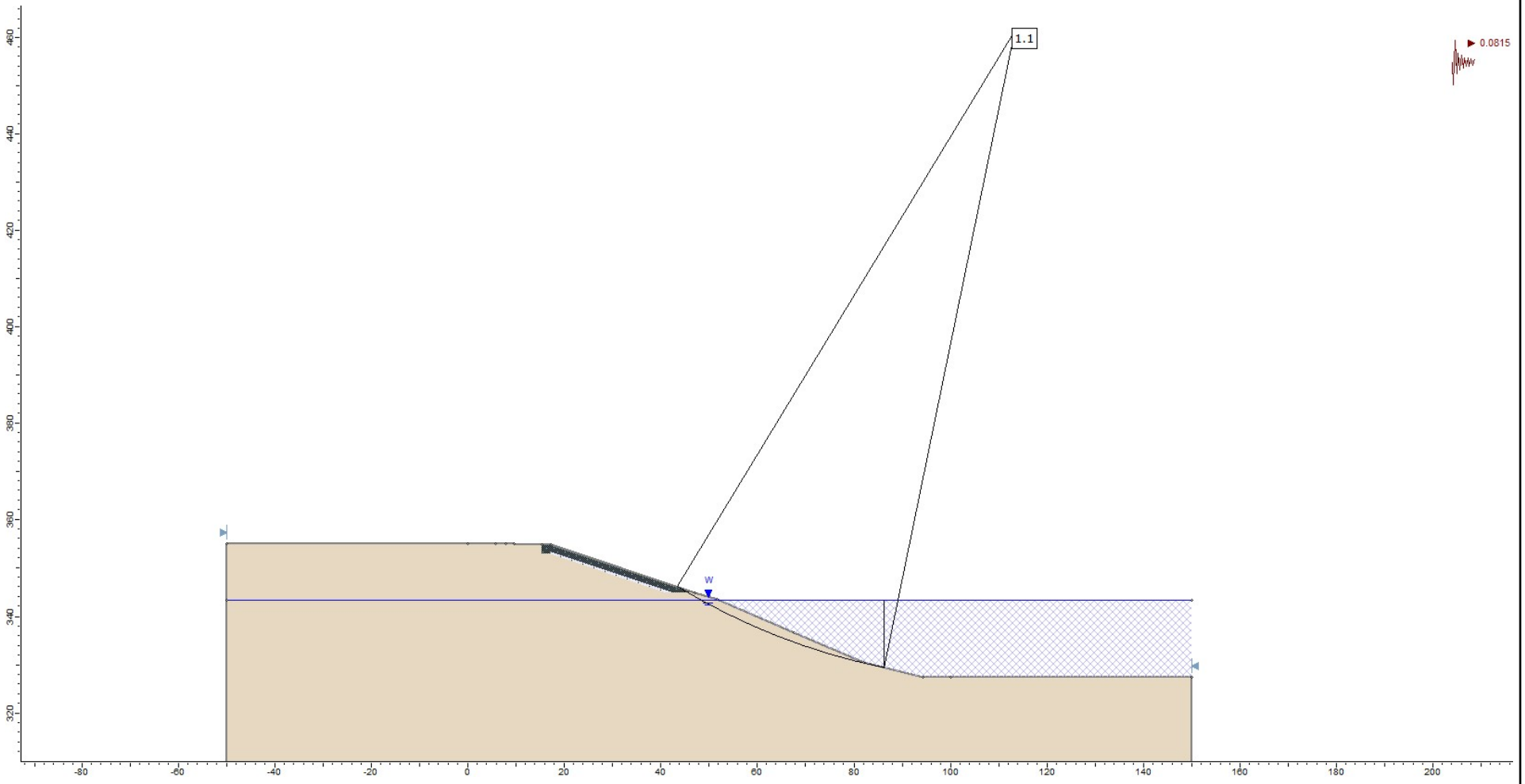


Vegetated Armored Slope - Low Pool

Slope Stability Analyses Results
Columbia Point Marina Shoreline Retaining Wall Repair
City of Richland
Richland, Washington

Scale: As shown.
Note: Selected failure surface shown is intended to highlight risk of global instability and is not necessarily depicting the minimum calculated factor of safety in the model domain. Very shallow, surficial failure surfaces and failures of existing slopes outside the limits of work are not shown for clarity.

CROSS REITER civil + geotechnical engineers	Date	Project No.	Appendix No.
	Nov 2024	RIC-2401	C-9



Vegetated Armored Slope - Seismic

Slope Stability Analyses Results
Columbia Point Marina Shoreline Retaining Wall Repair
City of Richland
Richland, Washington

Scale: As shown.
Note: Selected failure surface shown is intended to highlight risk of global instability and is not necessarily depicting the minimum calculated factor of safety in the model domain. Very shallow, surficial failure surfaces and failures of existing slopes outside the limits of work are not shown for clarity.

CROSS REITER civil + geotechnical engineers	Date	Project No.	Appendix No.
	Nov 2024	RIC-2401	C-10

APPENDIX D

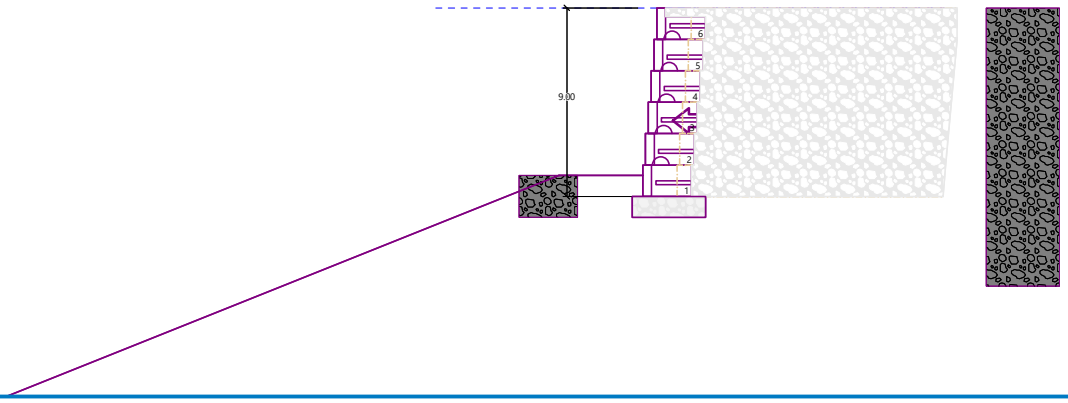
Redi-Rock Wall Design Calculations

Analysis of Redi Rock wall

Input data

Project : Columbia Point Marina Shoreline Retaining Wall Repair
Part : Redi-Rock Wall Internal/External Stability Verification
Customer : City of Richland, WA
Author : MBR/LLC (Cross Reiter, Inc.)
Date : 11/26/2024
Project ID : RIC-2401

Name : Project	Stage - analysis : 1 - 0



Settings

USA - Safety factor

Wall analysis

Verification methodology :	Safety factors (ASD)
Active earth pressure calculation :	Coulomb
Passive earth pressure calculation :	Mazindrani (Rankine)
Earthquake analysis :	Mononobe-Okabe
Shape of earth wedge :	Calculate as skew
Allowable eccentricity :	0.333
Internal stability :	Standard - straight slip surface
Reduction coeff. of contact first block - base :	1.00

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	1.50	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	2.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Blocks

No.	Description	Block height h [in]	Block width w [in]	Unit weight γ [pcf]
1	Block 28 PC	18.00	28.00	120.00
2	Top block 28	18.00	28.00	120.00

No.	Description	Shear bearing capacity of joint F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Block friction f [°]
1	Block 28 PC	6061.00	11276.00	44.00
2	Top block 28	6061.00	11276.00	44.00

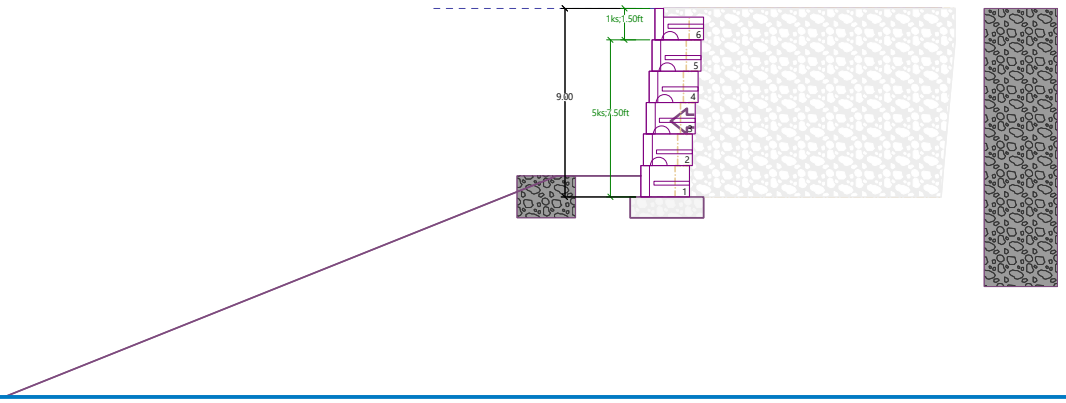
Setbacks

No.	Setback s [in]
1	0.000
2	0.033
3	0.135
6	0.269

Geometry

No. group	Description	Count	Setback s [in]
1	Block 28 PC	5	0.13
2	Top block 28	1	-

Name : Geometry | **Stage - analysis : 1 - 0**



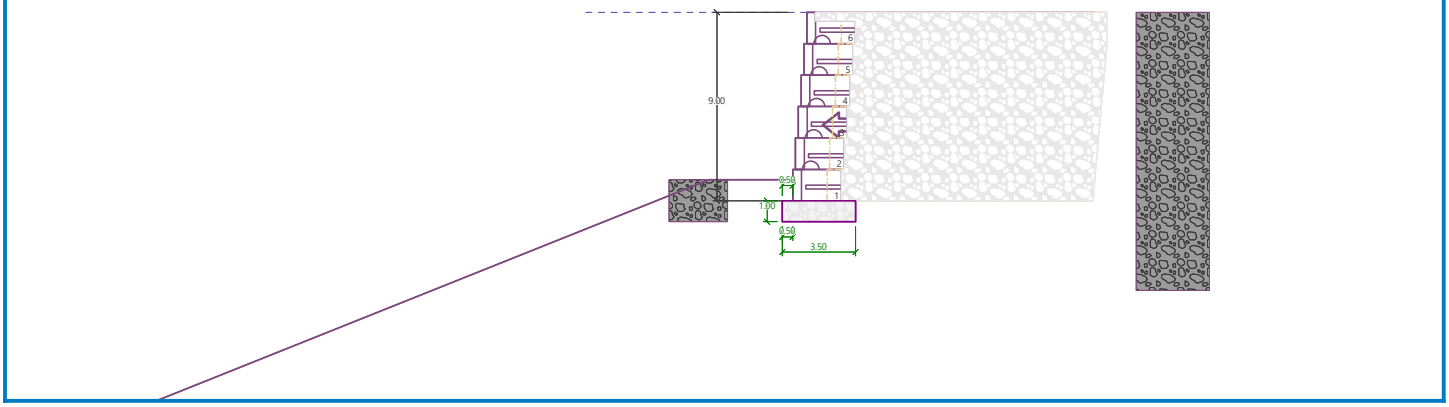
Base

Geometry

Upper setback a_1 = 0.50 ft
Lower setback a_2 = 0.50 ft
Height h = 1.00 ft
Width b = 3.50 ft

Material
Soil creating foundation - Crushed Rock Structural Fill

Name : Base	Stage - analysis : 1 - 0



Types of reinforcements

No.	Name	Type of reinforcement	Line type	Tensile strength		
				T_{ult} [lbf/ft]	R_t [lbf/ft]	R_{con} [lbf/ft]
3	Miragrid 10XT	Miragrid 10XT	– · – · – · – · – · – · –	9500.00	4357.00	4287.39

3. Miragrid 10XT

Reinforcement details

Short-term char. strength	T_{ult}	=	9500.00	lbf/ft
Creep red. factor	RF_{CR}	=	1.58	
Durability red. factor	RF_D	=	1.15	
Installation damage red. factor	RF_{ID}	=	1.20	
Long-term design strength	R_t	=	4357.00	lbf/ft
Coefficient of direct slip along reinforcement	C_{ds}	=	0.67	
Coefficient of interaction of soil and geo-reinforcement	C_i	=	0.67	
Scale correction factor	α	=	0.8	
Long-term strength reduction factor	CR_{cr}	=	0.519	
Calculation of long-term connection strength	R_{con}	=	4287.39	lbf/ft

Reinforcements

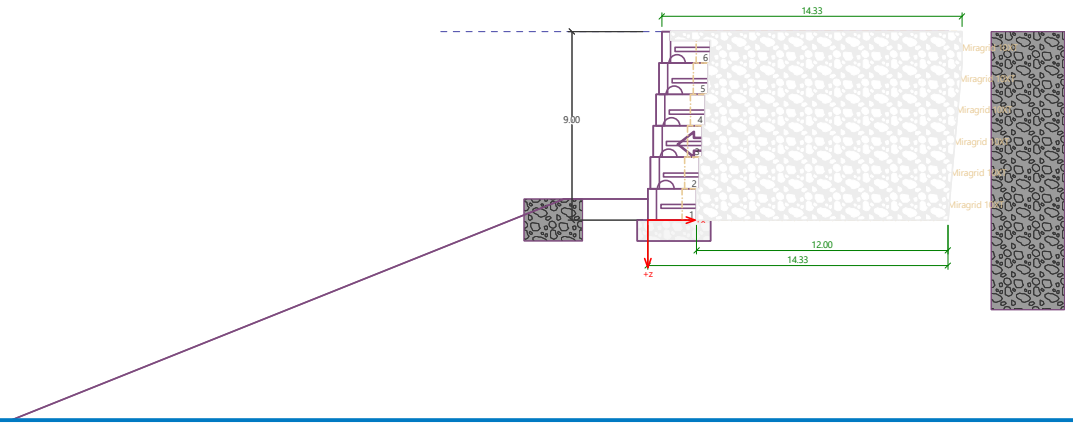
Input mode : 1 reinforcement type
Reinf. installation : in every row of blocks (50%)
Type of reinforcement : Miragrid 10XT
Top reinforcement : straight (25%)
Reinforcement geometry : identical length of reinforcements
Length of reinforcement l = 12.00 ft
Reinforced soil - Crushed Rock Structural Fill

Reinforcements

No.	Consider	Name	Length of reinforcement l [ft]	End pt. coordinate l_k [ft]
1	Yes	Miragrid 10XT	12.00	
2	Yes	Miragrid 10XT	12.00	

No.	Consider	Name	Length of reinforcement l [ft]	End pt. coordinate l_k [ft]
3	Yes	Miragrid 10XT	12.00	
4	Yes	Miragrid 10XT	12.00	
5	Yes	Miragrid 10XT	12.00	
6	Yes	Miragrid 10XT	12.00	

Name : Reinforcements | **Stage - analysis : 1 - 0**



Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	Crushed Rock Structural Fill		38.00	0.0	130.00	67.50	25.33
2	Alluvium (Qa): GW, GP, GP-GM, SW-SM		34.00	0.0	125.00	62.50	22.67

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Crushed Rock Structural Fill

Unit weight : γ = 130.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 38.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 25.33 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Alluvium (Qa): GW, GP, GP-GM, SW-SM

Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 34.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 22.67 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Geological profile and assigned soils

Position information
Terrain elevation = 355.00 ft
Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Elevation [ft]	Assigned soil	Pattern
1	-	0.00 .. ∞	355.00 .. -	Alluvium (Qa): GW, GP, GP-GM, SW-SM	

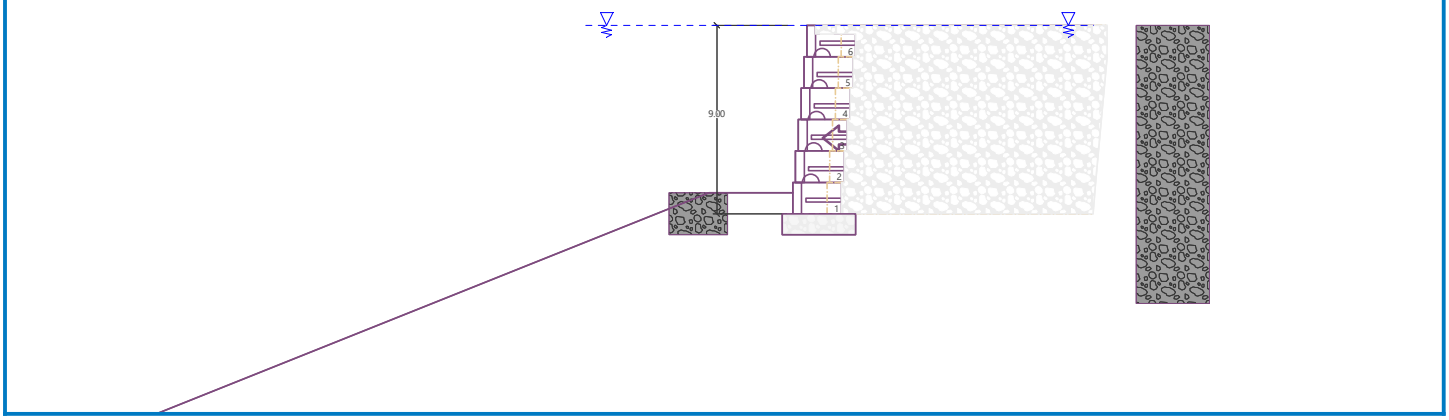
Terrain profile

Terrain behind the structure is flat.

Water influence

GWT behind the structure lies at a depth of 0.00 ft
GWT in front of the structure lies at a depth of 0.00 ft
Subgrade at the heel is not permeable.
Uplift in foot. bottom due to different pressures is not considered.

Name : Water	Stage - analysis : 1 - 0



Resistance on front face of the structure

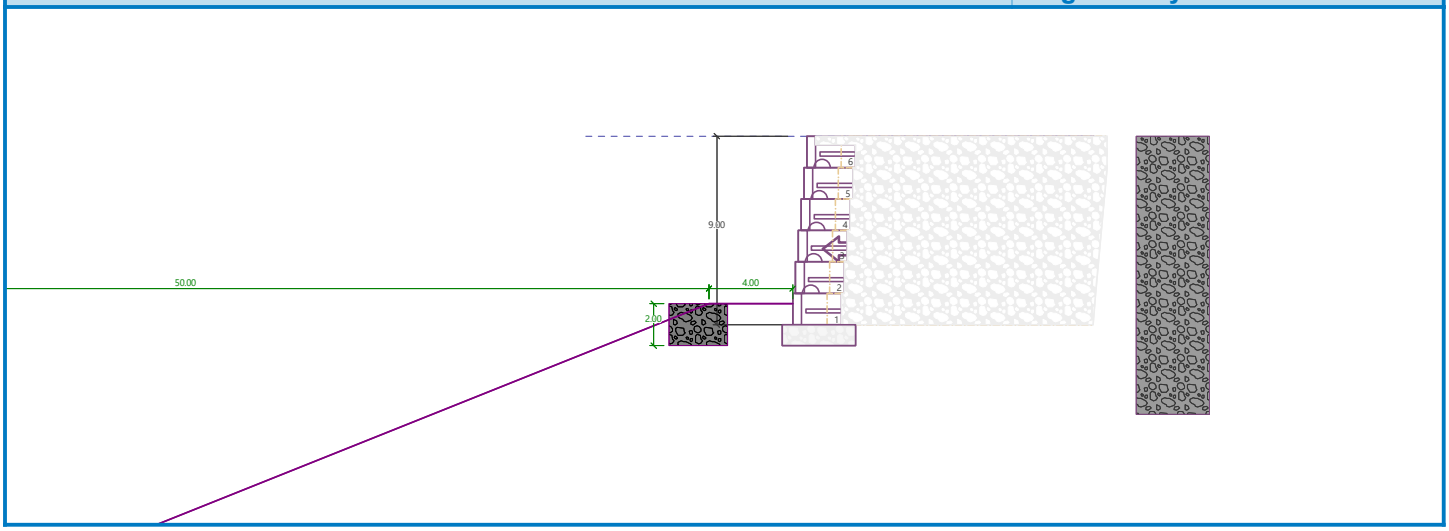
Resistance on front face of the structure: 1/3 pass., 2/3 at rest
Soil on front face of the structure - Alluvium (Qa): GW, GP, GP-GM, SW-SM
Soil thickness in front of structure h = 2.00 ft

Terrain shape in front of structure

No.	Coordinate x[ft]	Depth z[ft]
1	0.00	0.00
2	0.00	-2.00
3	-4.00	-2.00
4	-54.00	18.00
5	-55.00	18.00

Origin [0,0] is located in bottom left edge of construction.
Positive coordinate +z has downward direction.

Name : FF resistance	Stage - analysis : 1 - 0



Earthquake

Factor of horizontal acceleration K_h = 0.0815
Factor of vertical acceleration K_v = 0.0000

Water below the GWT is restricted.

Settings of the stage of construction

Design situation : permanent
Reduction of soil/soil friction angle : do not reduce

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
FF resistance	-46.0	-0.33	0.0	0.00	1.000
Weight - reinforced soil	0.0	-4.53	7378.0	8.65	1.000
Earthquake - soil wedge	1113.5	-4.53	0.0	8.65	1.000
Active pressure	542.5	-3.00	365.9	15.01	1.000
Water pressure	0.0	-9.00	0.0	28.25	1.000
Earthq.- act.pressure	262.1	-6.00	176.8	15.01	1.000
Dyn. water pressure at the front	240.7	-3.60	0.0	15.01	1.000
Weight - wall	0.0	-4.33	2424.2	1.48	1.000
Earthq.- constr.	197.6	-4.33	0.0	1.48	1.000

Verification of complete wall

Place of verification : bottom of blocks

Check for overturning stability
Resisting moment M_{res} = 75545.7 lbfft/ft
Overturning moment M_{ovr} = 9950.1 lbfft/ft

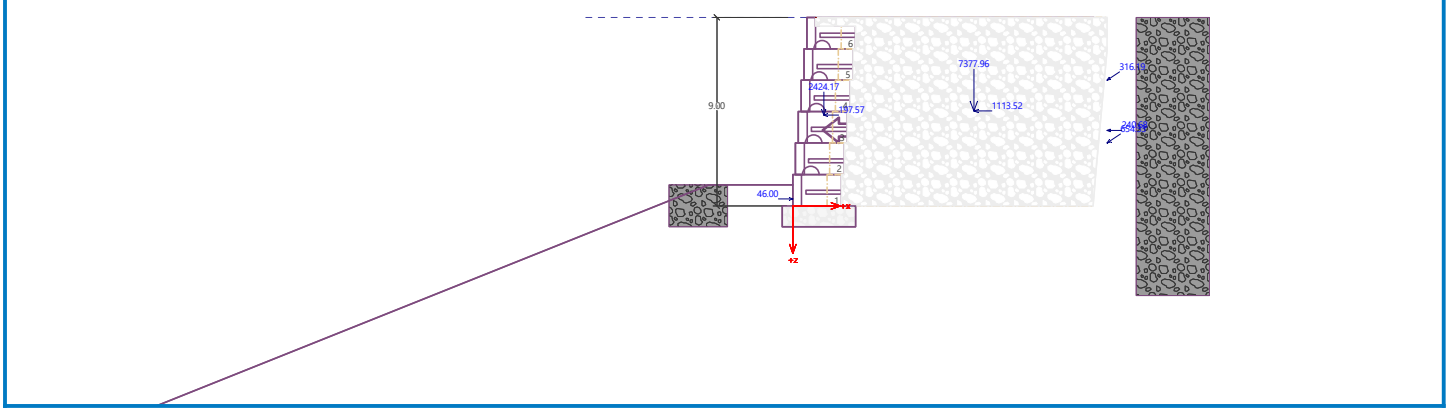
Safety factor = 7.59 > 1.50
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 6402.02 lbf/ft
Active horizontal force H_{act} = 2310.38 lbf/ft

Safety factor = 2.77 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Name : Verification	Stage - analysis : 1 - 1



Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	8542.3	10344.83	2310.38	0.058	815.7

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	8542.3	10344.83	2310.38

Verification of foundation soil

Place of verification : bottom of blocks
Stress in the footing bottom : rectangle

Eccentricity verification
Max. eccentricity of normal force e = 0.058
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity
Max. stress at footing bottom σ = 815.7 psf
Allowable bearing capacity of foundation soil R_d = 4500.0 psf

Safety factor = 5.52 > 2.00
Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Verification of slip on georeinforcement No. 1

Forces acting on construction (verification of reinforcement No.: 1)

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-4.33	1190.3	-0.85	1.000
Earthq.- constr.	199.9	-4.33	0.0	-0.85	1.000
Active pressure	542.3	-3.00	365.8	12.00	1.000
Earthq.- act.pressure	262.1	-6.00	176.8	12.00	1.000
Dyn. water pressure at the front	240.6	-3.60	0.0	12.00	1.000
Weight - reinforced soil	0.0	-4.46	7176.1	6.16	1.000
Earthquake - soil wedge	1071.4	-4.46	0.0	6.16	1.000

Verification against slip along geotextile No.: 1

Inclination of slip surface	=	90.00	°
Overall normal force acting on reinforcement	=	7718.69	lbf/ft
Coefficient of reduction of slip along geo-textile	=	0.92	
Resistance along geo-reinforcement	=	4776.80	lbf/ft
Wall resistance	=	929.97	lbf/ft
Overall bearing capacity of reinforcements	=	0.00	lbf/ft

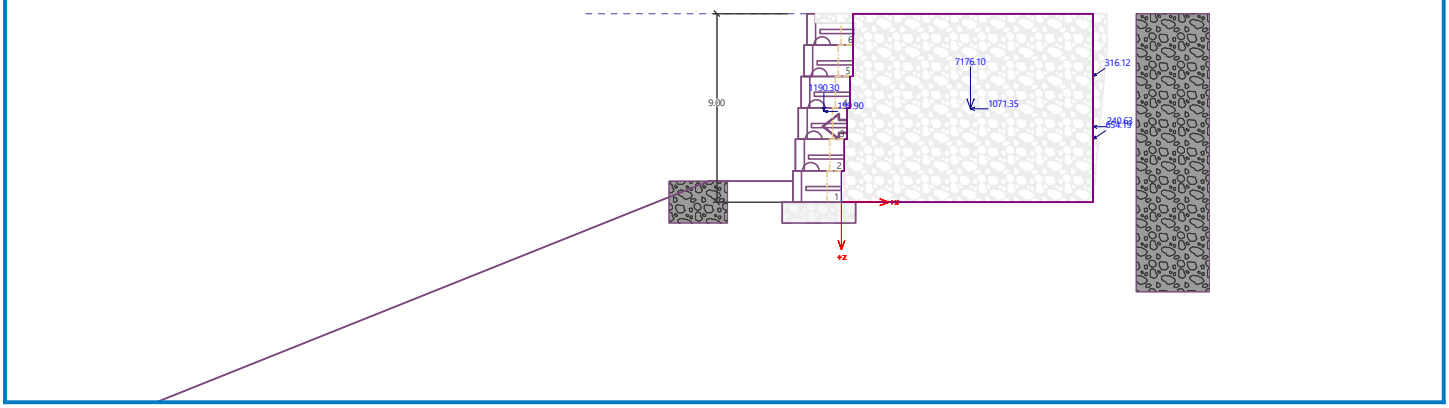
Check for slip:

Resisting horizontal force H_{res} = 5706.77 lbf/ft
Active horiz. force H_{act} = 1045.05 lbf/ft

Factor of safety = 5.46 > 1.50

Slip along geotextile is SATISFACTORY

Name : Slip on georeinf.	Stage - analysis : 1 - 1



Calculation of internal stability No. 1

Calculated forces and strength of reinforcements

No.	Name	F_x [lbf/ft]	Depth z[ft]	R_t [lbf/ft]	Utiliz. [%]	T_p [lbf/ft]	Utiliz. [%]	R_{con} [lbf/ft]	Utiliz. [%]
1	Miragrid 10XT	-107.79	9.00	1089.25	14.84	1526.41	10.59	1071.85	15.08
2	Miragrid 10XT	-199.72	7.50	2178.50	13.75	2399.43	12.49	2143.70	13.98
3	Miragrid 10XT	-178.57	6.00	2178.50	12.30	1803.87	14.85	2143.70	12.50
4	Miragrid 10XT	-157.42	4.50	2178.50	10.84	1266.15	18.65	2143.70	11.02
5	Miragrid 10XT	-136.27	3.00	2178.50	9.38	786.26	26.00	2143.70	9.54
6	Miragrid 10XT	-168.82	1.50	2178.50	11.62	364.21	69.53	2143.70	11.81

Check for tensile strength (reinforcement No.1)
Tension strength R_t = 1089.25 lbf/ft
Force in reinforcement F_x = 107.79 lbf/ft

Safety factor = 10.11 > 1.50
Reinforcement for tensile strength is SATISFACTORY

Check for pull out resistance (reinforcement No.6)
Pull out resistance T_p = 364.21 lbf/ft
Force in reinforcement F_x = 168.82 lbf/ft

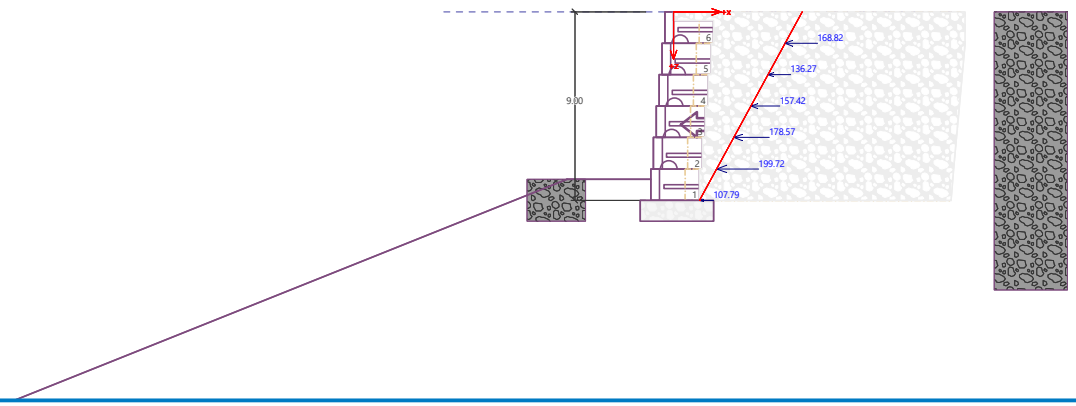
Safety factor = 2.16 > 1.50
Reinforcement for pull out resistance is SATISFACTORY

Verification of connection strength (reinforcement No.1)
Connection strength R_{con} = 1071.85 lbf/ft
Force in reinforcement F_x = 107.79 lbf/ft

Safety factor = 9.94 > 1.50
Connection strength is SATISFACTORY

Overall verification - reinforcement is SATISFACTORY

Name : Internal stability	Stage - analysis : 1 - 1



APPENDIX E

Report Limitations and Guidelines for Use

Appendix E – Limitations and Guidelines for Use

Limitations
Work for this project was performed for the client named on the cover page (Client), and this report was prepared consistent with recognized standards of professionals in the same locality and involving similar conditions, at the time the work was performed. No other warranty, expressed or implied, is made by Cross Reiter, Inc. (Cross Reiter).

Recommendations presented herein are based on our interpretation of site conditions, geotechnical engineering calculations, and judgment in accordance with our mutually agreed-upon scope of work. Our recommendations are unique and specific to the project, site, and Client. Application of this report for any purpose other than the project should be done only after consultation with Cross Reiter.

Variations may exist between the soil and groundwater conditions reported and those actually underlying the site. The nature and extent of such soil variations may change over time and may not be evident before construction begins. If any soil conditions are encountered at the site that are different from those described in this report, Cross Reiter should be notified immediately to review the applicability of our recommendations.

Risks are inherent with any site involving slopes and/or soft/unsuitable soils and no recommendations, geologic analysis, or engineering design can assure slope stability or settlement mitigation. Our observations, findings, and opinions are a means to identify and reduce the inherent risks to the Client.

It is the Client's responsibility to see that all parties to this project, including the designer, contractor, subcontractors, and agents, are made aware of this report in its entirety. At the time of this report, design plans and construction methods have not been finalized, and the recommendations presented herein are based on preliminary project information. If project developments result in changes from the preliminary project information, Cross Reiter should be contacted to determine if our recommendations contained in this report should be revised and/or expanded upon.

The scope of work does not include services related to construction safety precautions. Site safety is typically the responsibility of the contractor, and our recommendations are not intended to direct the contractor's site safety methods, techniques, sequences, or procedures. The scope of our work also does not include the assessment of environmental characteristics, particularly those involving potentially hazardous substances in soil or groundwater.

All reports prepared by Cross Reiter for the Client apply only to the services described in the Agreement(s) with the Client. Any use or reuse by any party other than the Client is at the sole risk of that party, and without liability to Cross Reiter. Cross Reiter's original files/reports shall govern in the event of any dispute regarding the content of electronic documents furnished to others.

Please refer to the additional guidelines to the right for additional information governing the use of this report.

Geoscience is Not Exact
The geoscience practices (geotechnical engineering, geology, and environmental science) are far less exact than other engineering and natural science disciplines. It is important to recognize this limitation in evaluating the content of the report. If you are unclear how these "Limitations and Guidelines for Use" apply to your project or property, you should contact Cross Reiter.

This Report and Project-Specific Factors
Cross Reiter's services are designed to meet the specific needs of our clients. Cross Reiter has performed the services in general accordance with our agreement (the Agreement) with the Client (defined under the Limitations section of this project's work product). This report has been prepared for the exclusive use of the Client. This report should not be applied for any purpose or project except the purpose described in the Agreement.

Cross Reiter considered many unique, project-specific factors when establishing the Scope of Work for this project and report. You should not rely on this report if it was:

- Not prepared for you;
- Not prepared for the specific purpose identified in the Agreement;
- Not prepared for the specific subject property assessed; or
- Completed before important changes occurred concerning the subject property, project, or governmental regulatory actions.

If changes are made to the project or subject property after the date of this report, Cross Reiter should be retained to assess the impact of the changes with respect to the conclusions contained in the report.

Reliance Conditions for Third Parties
This report was prepared for the exclusive use of the Client. No other party may rely on the product of our services unless we agree in advance to such reliance in writing. This is to provide our firm with reasonable protection against liability claims by third parties with whom there would otherwise be no contractual limitations. Within the limitations of scope, schedule, and budget, our services have been executed in accordance with our Agreement with the Client and recognized geoscience practices in the same locality and involving similar conditions at the time this report was prepared.

Property Conditions Change Over Time
This report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by events such as a change in property use or occupancy, or by natural events, such as floods, earthquakes, slope instability, or groundwater fluctuations. If any of the described events may have occurred following the issuance of the report, you should contact Cross Reiter so that we may evaluate whether changed conditions affect the continued reliability or applicability of our conclusions and recommendations.

Geotechnical, Geologic, and Environmental Reports Are Not Interchangeable
The equipment, techniques, and personnel used to perform a geotechnical or geologic study differ significantly from those used to perform an environmental study and vice versa. For that reason, a geotechnical engineering or geologic report does not usually address any environmental findings, conclusions, or recommendations (e.g., about the likelihood of encountering underground storage tanks or regulated contaminants). Similarly, environmental reports are not used to address geotechnical or geologic concerns regarding the subject property.