



City of Tacoma

Tacoma Power Generation

ADDENDUM NO. 2

DATE: 09/15/2026

REVISIONS TO:

Requests for Bids Specification No. PG26-0073F

Cushman No. 1 Dam Right & Left-Wing Wall Anchoring

NOTICE TO ALL BIDDERS:

This addendum is issued to clarify, revise, add to or delete from, the original specification documents for the above project. This addendum, as integrated with the original specification documents, shall form the specification documents. The noted revisions shall take precedence over previously issued specification documents and shall become part of this contract.

REVISIONS TO THE SPECIAL PROVISIONS:

The language has been revised in Section 01010 Summary of Work, 1.1 Project Description, as follows:

1.1 PROJECT DESCRIPTION

This project includes the supply, installation, and testing of nine (9) 61-strand restressable post-tensioned tiedown anchors and one (1) verification test anchor at the Cushman No. 1 Dam. The production anchors will be installed in the right and left wingwalls of the dam and will extend from the dam crest into the bedrock foundation.

The contractor shall supply all materials required to complete the work required by this contract.

In all cases, the City's contract is with one (1) general contractor, and it is the general contractor's responsibility to ensure all work required to provide a complete and operational facility is included in their bid. When possible, the City has attempted to reference work which should be coordinated with various trades, but it is the contractor's responsibility to coordinate and schedule the work of all subcontractors, trades, and suppliers to assure the proper and timely prosecution and completion of all items of work.

Major components of work under this contract include, but are not limited to, the following list:

- Installation and Testing of Nine (9), 61-Strand Restressable Post-Tensioned Anchors
- Installation and Testing of One (1) Verification Test Anchor



City of Tacoma

A. CONCEPT OF SCHEDULE

Notice to proceed is estimated for December 2026. Fish collection will resume in Lake Cushman on March 15, 2027 and end on approximately July 15, 2027, and will restrict operations in the lake and on the dam deck, primarily on the left wingwall. This is described further in Section 01040 - 1.5 Coordination With Others.

The language has been revised in Section 01010 Summary of Work, 1.3 Site Showing, as follows:

1.3 SITE SHOWING

The bidder will be responsible for examining the site(s) and to have compared the sites with the specifications and contract drawings contained in this specification, and be satisfied as to the facilities and difficulties attending the execution of the proposed contract (such as uncertainty of weather, floods, nature and condition of materials to be handled and all other conditions, special work conditions including work schedules, obstacles and contingencies) before the delivery of their proposal.

No allowance will be subsequently made by the City on behalf of the bidder by reason of any error or neglect on the bidder's part, for such uncertainties as aforesaid.

A site showing will be conducted on Tuesday, August 18th, 2026, at 10:00 a.m. immediately following the pre-bid meeting. Due to the nature of this project, the bidder is responsible for examining the site prior to placing a bid. **Only one (1) site showing will be conducted. It is the bidder's responsibility to assure that they attend the site showing as scheduled.** If the contractor cannot make the listed showing, they may be able to coordinate a visit to the site on their own. Failure to examine the site may be grounds to reject the bid. Tacoma Power shall make no adjustment to the price or provide any compensation to the contractor for impacts relating to the contractor's failure to consider the potential impacts of not only the site conditions observed, but changes in the observed conditions that could have been foreseen by the contractor.

By entering into the contract, the bidder represents that they have inspected in detail the project site and has become familiar with all the physical and local conditions affecting the project and/or the project site. Any information provided by the City to the contractor, relating to existing conditions on, under, or to the project and/or site including, but not limited to information pertaining to hazardous material abatement and other conditions affecting the project site, represents only the opinion of the City as to the location, character, or quantity of such conditions and is provided only for the convenience of the contractor. The contractor shall draw their own conclusions from such information and make such tests, review, and analyses as the contractor deems necessary to understand such conditions and to prepare their proposal.

The contractor shall carefully study and compare the contract documents with each other and shall at once report to the City errors, inconsistencies or omissions discovered. If the contractor performs any construction activity knowing it involves a recognized error, inconsistency or omission in the contract documents without such notice to the City, the contractor shall assume the risk and responsibility for such performance and shall bear an appropriate amount of the attributable costs for correction.



City of Tacoma

The contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to the contractor with the contract documents before commencing activities. Errors, inconsistencies or omissions discovered shall be reported to the City at once.

The language has been revised in Section 01010 Summary of Work, 1.8 Specification and Drawings, as follows:

1.8 SPECIFICATIONS AND DRAWINGS

The following drawings, attached to these specifications, are made a part of the contract:

Drawings for Bid (Included in 100% Basis of Design Memorandum – Appendix B)

<u>Drawing No.</u>	<u>Title</u>
G-1	Cover Sheet
G-2	Notes
C-1	Access Road Aerial View
C-2	Staging and Access Areas
C-3	Site Aerial View
C-4	Dam Aerial View
S-1	Plan View
S-2	Right Wing Wall Plan View
S-3	Left Wing Wall Plan View
S-4	Upstream Elevation View
S-5	Downstream Elevation View
S-6	Section Views I
S-7	Section Views II
S-8	Section Views III
S-9	Section Views IV
S-10	Section Views V
S-11	PT Anchor Details & Sch
S-12	PT Anchor Head Details
S-13	Verification Anchor Load Test Details



City of Tacoma

Drawings for Reference (Included in 100% Basis of Design Memorandum – Appendix B)

<u>Drawing No.</u>	<u>Title</u>
Exhibit F-1	Cushman Power Plant No. 1 – General Layout
BA 027	Upstream Elevation
BA 028	Downstream Elevation
BA 034	Typical Section
BS 372	Right Abutment Drainage Adit – Geological Cross Sections
BA 077	Drainage Adit Layout Plan
BA 022	Details of Parapet
BA 080	Rock Anchor System – Plans and Details
BP2802	Floating Surface Collector Installation & Mooring Site Plan

Reports for Reference Supplied at Bid

Title

100% Basis of Design Memorandum (Appendix B)
100% Geotechnical Data Report (Appendix C)
Draft Water Quality Protection Plan (Appendix D)
Construction Drilling Program Plan (DPP) (Appendix H)
Quality Control Inspection Plan (QCIP) (Appendix H)
Temporary Construction Emergency Action Plan (TCEAP) (Appendix H)

Reports for Reference Supplied after Award (These documents subject to agency Final Review)

Title

Final 100% Basis of Design Memorandum
Final 100% Geotechnical Data Report
Final Construction Drilling Program Plan (DPP)
Final Quality Control Inspection Plan (QCIP)
Final Temporary Construction Emergency Action Plan (TCEAP)
Final Water Quality Protection Plan (WQPP)

The contractor shall keep on the job site a full-size copy of the drawings and the specifications, and shall, at all times, give the engineer access thereto.



City of Tacoma

The language has been revised in Section 01025 Measurement and Payment, 1.2 Proposal Items, as follows:

1. PILOT HOLE MOBILIZATION/DEMOBILIZATION, PER LUMP SUM

A. MEASUREMENT

Pilot Hole Mobilization/Demobilization shall be measured per the lump sum (LS), not to exceed 5-percent of the base bid price.

B. PAYMENT

The lump sum (LS) contract price for Pilot Hole Mobilization/Demobilization shall be full compensation for all labor, equipment, and materials to mobilize to the job site, preparation of work areas, demobilization, including clean up and site restoration in order to complete the Pilot Hole Exploratory Drilling and Televiewer. Mobilization also includes general conformance with Water Quality Protection Plan (WQPP) excluding the activities directly associated with Drilling, Grouting and handling of process water and spoils which will be covered under the applicable items below. This includes installation and maintenance of all Best Management Practices (BMPs), inspections, monitoring, and documentation as required per the WQPP.

Phases of Pilot Hole work may require multiple mobilizations/demobilizations by some trades/subcontractors. Pilot Hole Mobilization/demobilization will only be paid once regardless of the number of mobilizations.

60-percent of the bid amount will be paid upon completion of the initial mobilization and job site preparation. The remaining 40-percent will be paid upon completion of Pilot Hole exploration and associated cleanup.

2. PILOT HOLE EXPLORATORY DRILLING

A. MEASUREMENT

Shall be measured by the linear foot (LF).

B. PAYMENT

Exploratory holes will be drilled at all tiedown anchor locations, including the verification test anchor, as indicated on the contract drawings. The contract price shall be full compensation for performing exploratory drilling, and logging of pilot holes including all necessary labor, materials, and equipment. This includes conformance with the WQPP to install and maintain BMPs associated with drilling and to contain, test, and properly dispose of any spoils and drill water as necessary.

Payment shall be made for the linear foot bid price completed in accordance with the attached plans and specifications, including Section 02 32 19 – Exploratory Drilling and Video Inspection.

3. PILOT HOLE TELEVIEWER

A. MEASUREMENT

Shall be measured per each (EA)



City of Tacoma

B. PAYMENT

Exploratory holes will be drilled at all tiedown anchor locations, including the verification test anchor, as indicated on the contract drawings. The contract price for Pilot Hole Televiwer shall include full compensation for performing video inspection at each pilot hole including all necessary labor, materials, and equipment.

Payment shall be made for each pilot hole televiwer completed in accordance with the attached plans and specifications, including Section 02 32 19 – Exploratory Drilling and Video Inspection.

4. TIEDOWN ANCHOR MOBILIZATION/DEMobilIZATION, PER LUMP SUM

A. MEASUREMENT

Tiedown Anchor Mobilization/Demobilization shall be measured per the lump sum (LS), not to exceed 10-percent of the base bid price.

B. PAYMENT

The lump sum (LS) contract price for Tiedown Anchor Mobilization/Demobilization shall be full compensation for all labor, equipment, and materials to mobilize to the job site, preparation of work areas, demobilization, including clean up and site restoration in order to complete the Verification and Tiedown Anchor installation. Mobilization also includes general conformance with Water Quality Protection Plan (WQPP) excluding the activities directly associated with Drilling, Grouting and handling of process water and spoils which will be covered under the applicable items below. This includes installation and maintenance of all Best Management Practices (BMPs), inspections, monitoring, and documentation as required per the WQPP.

Phases of Tiedown Anchor work may require multiple mobilizations/demobilizations by some trades/subcontractors. Tiedown Anchor Mobilization/demobilization will only be paid once regardless of the number of mobilizations.

60-percent of the bid amount will be paid upon completion of the initial mobilization and job site preparation for anchor installation. The remaining 40-percent will be paid upon completion of all site restoration and clean up.

5. VERIFICATION ANCHOR DEMOLITION AND SURFACE RESTORATION

A. MEASUREMENT

Shall be measured per each (EA).

B. PAYMENT

Verification anchor will be installed on the right abutment as indicated on the contract drawings. The contract price shall be full compensation to demolish the existing surfacing and prepare for anchor installation. This item also includes restoring the surface back to existing conditions.



6. VERIFICATION ANCHOR SUPPLY, DRILLING AND INSTALLATION

A. MEASUREMENT

Shall be measured by the linear foot (LF) total length of anchor installed, or the sum of the bonded and unbonded length.

B. PAYMENT

The Verification Anchor will be installed on the right abutment as indicated on the contract drawings. The verification anchor shall be constructed using the same installation procedures as the production anchors. The linear foot price shall include all labor, materials, and equipment required to drill and install the anchor.

Drilling includes setup and alignment of equipment, spoils management, all instrumentation and monitoring as outlined in this specification and the DPP, Borehole cleaning and inspection, and water testing. This includes conformance with the WQPP to install and maintain BMPs associated with drilling and grouting and to contain, test, and properly dispose of any spoils and drill water as necessary. This bid item does not include Consolidation Grouting and Redrill, if necessary, which will be paid under a separate bid item.

Installation of the anchor includes supply and placement of all materials to install, tension and corrosion protect anchor per this specification, primary and top up grouting, grouting QA/QC, and instrumentation and monitoring outlined in this specification and the DPP.

7. VERIFICATION ANCHOR TESTING

A. MEASUREMENT

Shall be measured per (EA) anchor tested.

B. PAYMENT

A preproduction verification test shall be performed on a sacrificial Tiedown Anchor prior to the start of the production anchor installation. Verification Anchor shall be tested per the Verification Test Schedule included in Section 31 68 13 – Tiedown Anchors. This bid item shall include labor, materials, and equipment required to perform Verification Test, lock-off anchor, trim tails, and associated instrumentation and monitoring required per this specification and the DPP. Re-Stressable Testing Parts are included as a separate bid item.

8. TIEDOWN ANCHOR SELECTIVE DEMOLITION AND REPAIR

A. MEASUREMENT

Shall be measured per each (EA).



B. PAYMENT

Unit price for Tiedown Anchor Selective Demolition and Repair shall include all labor, materials, and equipment in connection with selective demolition and restoration for the tiedown anchor head pockets. This includes removal of existing concrete, surface preparation, and the supply and installation of a manhole cover.

9. TIEDOWN ANCHOR SUPPLY, DRILLING AND INSTALLATION

A. MEASUREMENT

Shall be measured by the linear foot (LF) total length of anchor installed, or the sum of the bonded and unbonded length.

B. PAYMENT

The Production Anchors will be installed in the locations indicated on the contract drawings. The linear foot price shall include all labor, materials, and equipment required to drill and install the anchors.

Drilling includes setup and alignment of equipment, spoils management, all instrumentation and monitoring as outlined in this specification and the DPP, Borehole cleaning and inspection, and water testing. This includes conformance with the WQPP to install and maintain BMPs associated with drilling and grouting and to contain, test, and properly dispose of any spoils and drill water as necessary. This bid item does not include Consolidation Grouting and Redrill, if necessary, which will be paid under separate items.

Installation of the anchor includes supply and placement of all materials to install, tension and corrosion protect anchor per this specification, primary and top up grouting, grouting QA/QC, and instrumentation and monitoring outlined in this specification and the DPP.

10. TIEDOWN ANCHOR PERFORMANCE TESTING AND LOCKOFF

A. MEASUREMENT

Shall be measured per each (EA) anchor tested.

B. PAYMENT

All production tiedown anchors shall be tested per the Performance Test Schedule included in Section 31 68 13 of the specification. This bid item shall include labor, materials, and equipment required to perform Performance Test, lock-off anchor, trim tails, and associated instrumentation and monitoring required per this specification and the DPP. Re-Stressable Testing Parts are included as a separate bid item.

11. RESTRESSABLE TESTING PARTS

A. MEASUREMENT

Shall be measured per each (EA).



B. PAYMENT

Restressable Testing Parts shall include full compensation for the design, and supply of restressable anchor head components based on the manufacturer's anchor wedge plate, including but not limited to the conversion coupler and stressing bars. This includes removable components that will be installed for stressing anchors in order to adapt from the proposed anchor wedge plates to the jack used for stressing. The contractor shall engage a professional engineer to design the restressable testing parts in accordance with this specification and they will be compatible with all anchors installed as part of this project.

12. CONSOLIDATION GROUT

A. MEASUREMENT

Shall be measured by the cubic foot (CF) in-place.

B. PAYMENT

Consolidation Grout refers to grout required to pregrout anchor holes which fail the water tightness test per this specification and as confirmed by the Engineer. Upon confirmation of a failed water test, the Engineer will provide extents of hole to be consolidation grouted. This item shall be full compensation for the supply and installation of all labor, equipment, and materials for consolidation grout placed per this specification. This includes conformance with the WQPP to install and maintain BMPs associated with consolidation grouting and to contain, test, and properly dispose of any spoils as necessary.

13. REDRILL

A. MEASUREMENT

Shall be measured by the linear foot (LF) of depth to redrill anchor hole through consolidation grouted sections.

B. PAYMENT

Redrilling may be necessary on anchor holes that require consolidation grouting as determined by the Engineer. Redrilling includes setup and alignment of equipment, spoils management, all instrumentation and monitoring as outlined in this specification and the DPP, borehole cleaning, and inspection. Redrill shall be full compensation for all labor, equipment and materials necessary to drill the anchor hole after consolidation grouting has been completed. This includes conformance with the WQPP to install and maintain BMPs associated with redrilling and to contain, test, and properly dispose of any spoils and drill water as necessary

Redrill does not include the initial round of drilling to establish the anchor hole which shall be included under the Tiedown Anchor Supply, Drilling and Installation bid item.



14. RE-WATER TEST

A. MEASUREMENT

Shall be measured per each (EA).

B. PAYMENT

Re-Water Test includes water testing of the anchor hole after an initial failed water test, consolidation grout and redrill cycle. Re-water test shall include full compensation for all labor, materials, and equipment necessary to complete a water tightness test after a consolidation grout and redrill cycle. This cycle may be repeated until the anchor holes meet the water pressure testing requirements of this specification.

Re-water Test does not include the initial water test after the anchor hole is established which shall be included under the Tiedown Anchor Supply, Drilling and Installation bid item.

15. HQ SIZE DOUBLE PACKER SUPPLY

A. MEASUREMENT

Shall be measured per each (EA) HQ size Double Packer setup supplied and available for drain flushing during grouting.

B. PAYMENT

The DPP (Appendix H) includes a Primary Flushing Procedure which consists of isolating target zones in existing HQ sized boreholes to flush water through adit drains if they are contaminated during grouting. HQ Size Double Packer Supply includes full compensation for a set of packers on standby during grouting. These packers will be used to perform the Primary Flushing Procedure if turbidity is seen in the adit drains during grouting and deemed necessary by the Engineer.

16. ANCHOR HOLE DOUBLE PACKER SUPPLY

A. MEASUREMENT

Shall be measured per each (EA) Anchor Hole size Double packer setup supplied and available for drain flushing during grouting.

B. PAYMENT

The DPP (Appendix H) includes a Secondary Flushing Procedure which consists of isolating target zones in adjacent anchor holes to flush water through adit drains if they are contaminated during grouting. Anchor Hole size Double Packer Supply includes full compensation for a set of packers on standby during grouting. These packers will be used to perform the Secondary Flushing Procedure if turbidity is seen in the adit drains during grouting and deemed necessary by the Engineer.



17. ADIT DRAIN FLUSHING

A. MEASUREMENT

Shall be measured per each (EA) Flushing Procedure, either Primary or Secondary, performed in a borehole or anchor hole.

B. PAYMENT

The DPP (Appendix H) includes a Primary and Secondary Flushing Procedure which consist of isolating target zones in nearby boreholes or anchor holes with packers (supplied under separate bid items) and pumping 500 gallons of water in the target zone to flush the existing adit drains. While grouting the anchor holes if the Engineer sees an increase in turbidity in the adit drains, the contractor may be directed to perform either the Primary or Secondary flushing procedure. This item includes full compensation for all labor, equipment and materials (excluding the packers covered under separate bid items) to perform either flushing procedure including setting the packers in the target zone as determined by the Engineer, pumping 500 gallons of water into the isolated zone, and removal of equipment from the hole.

18. FORCE ACCOUNT, PER LUMP SUM

A. MEASUREMENT

Measurement will be made for Force Account in accordance with Section 1-09.6 of the latest edition of the Standard Specifications for Road, Bridge and Municipal Construction of the Washington State Department of Transportation as modified by Force Account Work in the Special Provisions or on negotiated lump sum or unit price change orders added to the contract.

B. PAYMENT

Payment shall be made for change order items added to the contract which shall be treated as a deduction from the force account remaining available.

“Force Account,” as listed in the price proposal



REVISIONS TO THE TECHNICAL PROVISIONS:

The language has been revised in Section 02 32 19 Exploratory Drilling and Televiwer as follows:

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes requirements for performing exploratory drilling of tiedown anchor pilot holes at locations indicated on the Contract Drawings and for furnishing all labor, materials, tools, supervision, transportation, installation equipment, and incidentals necessary to complete the Work.
- B. The purpose of the pilot hole exploratory concrete and rock coring at each tiedown anchors is to evaluate the depth and characteristics of the dam foundation contact, potential rock joints impacting anchor length, competency of the rock for the tiedown anchor bonded zones, and minimize anchor hole deviation from vertical. This information will be used to adjust the design as necessary.
- C. Related Sections:
 - 1. Section 31 68 13 – Tiedown Anchors

1.2 MEASUREMENT AND PAYMENT

- A. The basis for measurement and payment is provided in Section 01025 – Measurement and Payment.

1.3 REFERENCES

- A. Reference Standards:
 - 1. American Society for Testing and Materials (ASTM):

ASTM D2113	Standard Practice for Rock Core Drilling and Sampling of Rock for Soil Investigation
ASTM D6032	Standard Test Method for Determining Rock Quality Designation (RQD) of Rock Core

1.4 QUALITY ASSURANCE

- A. All drilling and downhole televiwer operations shall be performed in the presence of the Engineer or their designated representative.
- B. The Contractor is responsible for providing 5'-0" long wooden core boxes. The Engineer is responsible for logging the core samples.
- C. The drilling, sampling, and televiwer methods shall conform with the Engineer's Drilling Program Plan (DPP).



1.5 SUBMITTALS

- A. Tiedown Anchor Pilot Hole Exploratory Drilling: Submit names and qualifications of the drilling firm that will perform the tiedown anchor pilot hole exploratory drilling at the preconstruction meeting. The drilling firm shall have a minimum 5 years of experience performing exploratory drilling using methods and procedures similar to those required in this specification.
- B. Proposed methodology for collecting cuttings and drill fluid and offsite disposal.
- C. Proposed methodology and equipment for measuring drill hole verticality.
- D. Pilot Hole Logs: Pilot hole logs shall be completed in the presence of the Engineer. In addition to the Engineer's boring logs, the Contractor shall complete boring logs of the pilot holes. Boring logs shall include drilling methods, pilot hole number, depth, drill action and pressure observations, and a description of the material encountered. Submit field boring logs for tiedown anchor pilot holes to Engineer within 3 days of completion.
- E. Downhole Televiwer: Provide downhole acoustic and optical televiwer of the entire length of each pilot hole. Televiwer shall be performed in the presence of the Engineer. Submit one PDF copy of the interpreted televiwer data including images, amplitude, aperture, orientations, and raw data files to Engineer within 3 days of completion. The data file shall be compatible with WellCAD.
- F. Submit names and qualifications of the firm and operator that will perform the downhole televiwer for the pilot holes at the preconstruction conference. The televiwer operator shall have a minimum 5 years of experience performing downhole acoustic and optical televiwer. The interpretation of the data shall be performed under the supervision of a Professional Engineer and/or Professional Geologist.

1.6 PILOT HOLE LOCATIONS

- A. Exploratory pilot holes shall be drilled at verification and production tiedown anchor locations indicated on the Contract Drawings. Top of pilot hole shall be at the precise location of proposed tiedown anchor. Drilling shall be vertical, with a tolerance from vertical, including plumbness and alignment, of a maximum of 0.06 inches horizontal per foot of depth (0.5%) as measured on each pilot hole.
- B. After successful completion and televiwer of the pilot holes and once the pilot hole logs and televiwer have been approved by the Engineer, production tiedown anchor holes shall be drilled at the pilot hole locations to the specified tiedown anchor depth and socket diameter. Compatibility between the pilot holes and the installation of tiedowns through the pilot holes is the responsibility of the Contractor.



City of Tacoma

PART 2 PRODUCTS

2.1 DOWNHOLE TELEVIEWER SYSTEM

- A. Provide acoustic televiewer (ATV) and optical televiewer (OTV) with the following features:
 - 1. Accessibility through HQ-diameter boreholes.
 - 2. Ability to function underwater.
 - 3. Reel-mounted cable with depth increments.

PART 3 EXECUTION

3.1 DRILLING PROCEDURES

- A. Drill exploratory pilot holes at the tiedown anchor locations indicated on Contract Drawings. Each pilot hole shall be drilled to the planned anchor depth shown in the Contract Drawings.
- B. Water shall be used as a drilling fluid. Unless directed by the Engineer, conduct drilling and sampling in accordance with the referenced ASTM procedures using a minimum drill hole diameter equivalent to HQ core bit size. Samples shall be placed in labeled core boxes provided by the Contractor.
- C. Drill fluid shall be discharged at the top of the drill hole so as to not charge the hole with excessive pressure. Drill pressures shall be monitored at all times. If pressure builds due to clogging of the hole or any other reason, the contractor shall immediately stop and clear the hole to restore unrestricted flushing.
- D. Drilling spoils shall be collected in a controlled manner that prevents spoils from draining off of the dam crest. Spoils shall be disposed of at an approved location off-site.

3.2 TELEVIEWER PROCEDURE

Perform downhole televiewer for each pilot hole in the presence of the Engineer and as specified in this section. Submit inspection reports to the Engineer.

The language has been revised in Section 31 68 13 Tiedown Anchors as follows:

PART 1 GENERAL

1.1 SUMMARY

- A. The Work of this Section consists of furnishing all labor, materials, tools, supervision, transportation, installation equipment, and incidentals necessary to complete the Work specified herein and shown on the Contract Drawings. The Work shall include installation of restressable post-tensioned tiedown anchors at the locations shown on the Contract Drawings and providing Tacoma Power with the materials required for stressing and restressing the anchors, as specified herein.



City of Tacoma

B. Related Sections:

1. Section 02 03 41 – Selective Demolition and Repair
2. Section 02 32 19 – Exploratory Drilling and Televiewer

1.2 REGULATORY REQUIREMENTS

- A. The basis for measurement and payment is provided in Section 01025 – Measurement and Payment.

1.3 REFERENCES

A. Reference Standards:

1. American Society for Testing and Materials (ASTM)

ASTM A36	Carbon Structural Steel
ASTM A53	Steel Pipe
ASTM A416	Steel Strand, Uncoated Seven-Wire for Prestressed Concrete
ASTM A500	Cold-formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A536	Ductile Iron Castings
ASTM A572	High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A588	High-Strength Low-Alloy Structural Steel, up to 50 ksi Minimum Yield Point, with Atmospheric Corrosion Resistance
ASTM A709	(2011) Structural Steel for Bridges
ASTM A981	(2007) Evaluating Bond Strength for 0.600 in. Diameter Steel Prestressing Strand, Grade 270, Uncoated, Used in Prestressed Ground Anchors
ASTM C109	Compressive Strength of Hydraulic Cement Mortars (Using 2 inch Cube Specimens)
ASTM C150	Portland Cement
ASTM C595	Blended Hydraulic Cements
ASTM D1248	Polyethylene Plastics Extrusion Materials for Wire and Cable
ASTM D1429	Standard Test Method for Specific Gravity (Method C)
ASTM D1784	Rigid Poly Vinyl Chloride (PVC) Compounds and Chlorinated Poly Vinyl Chloride (CPVC) Compounds
ASTM D4101	Polypropylene Injection and Extrusion Materials



City of Tacoma

2. Post Tensioning Institute (PTI):
PTI DC35.1-14 Recommendations for Prestressed Rock and Soil
Anchors

1.4 QUALITY ASSURANCE

- A. Anchor materials, installation, and testing shall be in accordance with Post-Tensioning Institute (PTI DC35.1-14) Recommendations for Prestressed Rock and Soil Anchors (2014), unless specified otherwise herein.
- B. The drilling and grouting methods shall conform with the Engineer's Drilling Program Plan (DPP).
- C. All anchor operations including drilling, placing, grouting, and testing shall be performed in the presence of the Engineer or their designated representative.
- D. Changes to the requirements of the contract documents must be provided by the Engineer in writing. Oral approvals shall not relieve the Contractor of the responsibility to perform the Work in accordance with the Contract Documents and referenced standards.
- E. Design Criteria:
 1. The anchors are designed with restressable anchor heads.
 2. The anchors are designed as permanent Class I anchors based upon criteria stated in PTI.
 3. Bond socket diameter and socket lengths shown on the Contract Drawings are minimum values required for geotechnical bond capacity. The Contractor is responsible for selecting installation method, and socket diameter that meet the minimum values shown on the drawing, and provide corrosion protection and minimum grout cover as required for permanent Class I anchors as specified by PTI. Contractor shall select socket diameter that meets minimum value shown on drawing and provides adequate space for installation of tendons.
 4. Socket diameters, unbonded lengths, and bond lengths shown on the Contract Drawings are minimum required values. Use of methods or materials that result in a value exceeding the minimum specified is left to the Contractor's discretion. Any costs associated with exceeding the minimum required values shall be included in the contract price.
 5. The Contractor shall establish and maintain quality control for all operations to assure compliance with contract requirements, and maintain records of their quality control for all operations.

1.5 GROUND CONDITIONS

- A. Temporary reinforcement from original dam may be encountered but is not anticipated.



- B. The only anticipated underground structures or utilities at the locations of the tiedown anchors within the anchor length limits are the adit drains on the right abutment as shown on the drawings.
- C. If, during installation of a tendon, an obstruction is encountered that prevents the practical advancement of the hole, the Engineer shall be notified immediately.
- D. The contractor shall review the project geotechnical information contained in the Geotechnical Data Report (Appendix C) prepared by Schnabel Engineering, LLC, and select an appropriate drilling method and grouting methods. The drilling methods shall not adversely affect the ground condition, loosen concrete or rock adjacent to the drill holes, or contaminate the right abutment adit drains. Core drilling for the final anchor drill hole is not permitted. Evidence of adverse conditions include connection between holes or rock face, connection with the right abutment adit drains, loss of return during drilling and/or grouting without collaring (i.e. engaging the drill bit into the bedrock), other means observed by the Contractor or Engineer. The Contractor shall stop work, review changes to the drilling process and modify as required. This change is at no cost to the owner. Drilling shall be vertical, with a tolerance from vertical, including plumbness and alignment, of a maximum of 0.06 inches horizontal per foot of depth (0.5%) as measured on each pilot hole.

1.6 SUBMITTALS

- A. Preconstruction: The following shall be submitted to the Engineer for review and approval at least 30 days prior to start of construction.
 - 1. Resumes of the Contractor's key staff. Key staff includes Project Manager, Foremen, Project Engineer, lead drillers and stressing specialist. Resumes submitted shall be the actual personnel used for this project.
 - 2. Barge, Mooring, and Operations Plan
 - a. Docking operations.
 - b. Details on mooring including anchoring points and redundant techniques to prevent drift, impact, or unintended loading on the dam or Floating Surface Collector (FSC).
 - c. Plans for addressing reservoir level changes.
 - d. Description of procedures to address severe weather protocols, including storms, high winds, and rapid weather shifts.
 - e. Calculations, including but not limited to buoyancy checks, mooring cables, and crane picks.
 - 3. Verification Load Test Frame Design that includes to the following:
 - a. Shop drawings



City of Tacoma

- b. Calculations signed and sealed by a Professional Engineer
- 4. Working Plan that includes the following:
 - a. Proposed staging areas for materials and equipment.
 - b. Erosion and Sediment Control Plan in accordance with the Contract Documents.
 - c. Detailed description of drilling and installation method, including a discussion of the approach to installing the anchors in the project subsurface conditions and steps planned to prevent dam destabilization. The installation method shall include measures taken to limit the pressure exerted on the subsurface materials and methods to collect drill spoils. The plan should detail the equipment setup and depict how drill flush is discharged, collected and disposed. The plan shall also address methods to prevent potential grout loss and contamination of the existing adit drains.
 - d. Method and procedures for monitoring drilling pressures at drill head during anchor drilling and installation and remedial measures for pressure build up.
 - e. Load testing equipment and procedures.
 - f. Grouting materials and methods. Submit the grout mix design(s) proposed for use, including estimated setting time, stability, strength properties (including rate of gain of strength), temperature-set time curve, specific gravity, and recommended installation procedures. Mix designs required at a minimum are consolidation grout, primary grout, and secondary tendon grout.
 - g. Anticipated equipment loads and any temporary anchorage for equipment.
 - h. Installation Sequence.
 - i. Contingency plan for installation problems and failed anchors.
 - j. Shop drawing of the anchor tendon, socket diameter, and the corrosion protection system including details for the following.
 - 1) Spacers and their location
 - 2) Centralizers and their location
 - 3) All grout tubes and the location required for complete installation
 - 4) Unbonded length corrosion protection system
 - 5) Bond length corrosion protection system
 - 6) Anchorage and trumpet, restressable anchor head assembly
 - 7) Anchorage corrosion protection system



City of Tacoma

k. Certificates of Compliance for the following materials, if used. The certificate shall state that the materials or assemblies to be provided will full comply with the requirements of the Contract.

- 1) Prestressing steel, strand
- 2) Portland cement
- 3) Prestressing hardware
- 4) Restressing hardware
- 5) Bearing plates
- 6) Corrosion protection system

5. Approval of the Contractor's Working Drawings and design submission does not relieve the Contractor of his responsibility for the successful completion of the Work.

B. During Construction:

1. Contractor shall keep drilling and installation records. Drilling and installation records shall be submitted to the Engineer for review within 3 days of anchor installation completion. Drilling records shall include:
 - a. Observations during drilling related to drill pressure, loss of flush, buildup or plugging
 - b. Dated drilling logs
 - c. Anchor drilling duration and drilling rates including instantaneous penetration times for each 5-foot advancement of the hole
 - d. Final tendon lengths
 - e. Unbonded and Bonded lengths
 - f. Corrosion protection sleeve length
 - g. Description and depth of rock cuttings, presence of groundwater, and unusual behavior or conditions including, but not limited to, voids and soil-filled seams
 - h. Grout pressures
 - i. Grout quantities pumped (take)
 - j. Gallons of water per bag of cement used for grouting of anchors
 - k. Tendon materials and dimensions
 - l. As-built inclination and splay
 - m. Difficulties in drilling holes (if any)
 - n. Details of all water testing, regrouting and redrilling operations.



City of Tacoma

2. The Contractor shall submit to the Engineer for review calibration data and certificates for each test jack, load cell, primary pressure gauge, and reference pressure gauge to be used prior to start of testing, including serial numbers and calibration dates. The test jack, load cell, and pressure gauge should be tested together. Testing cannot commence until the Engineer has approved the jack, load cell, primary pressure gauge, and reference pressure gauge calibrations.
3. Prestressing steel manufacturer's mill test reports for the tendons incorporated in the installation.
4. Grouting records indicating the purpose of the grout and/or where the grout will be placed (i.e. consolidation grout, annulus grout placed outside of the corrugated duct, primary grout placed inside the corrugated duct and around the steel tendons, or secondary grout), cement type, grout volume, source of water, weight of water, water-cement ratio by weight, specific gravity, grouting start and end times, quantity injected, and the grout pressures.
5. Anchor test results and graphs.

1.7 QUALIFICATIONS

A. Contractor Qualifications:

1. The Contractor or Specialty Subcontractor performing the Work described in this Specification shall have successfully installed permanent ground anchors for a minimum of 3 projects with anchors of similar capacity, length and complexity.
2. The drilling foreman shall be on site at all times during anchor construction and shall have a minimum of 5 years of experience overseeing installation of anchors on similar sites.
3. The Contractor's Project Manager shall have a minimum of 10 years of experience as Project Manager for anchor installation projects of similar length and complexity. The Project Manager shall be on site full-time for the installation of the first two tendons and, at a minimum, make weekly site visits thereafter.

B. Professional Engineer Qualifications:

1. The Contractor shall engage a professional engineer to design the restressable anchor head components based on the manufacturer's wedge plate, including but not limited to stressing tails and reaction plates.
2. The Contractor shall engage a professional engineer to design the load test apparatus for verification anchor VA-1. The apparatus includes but is not limited to cribbing, plates, and beams.



1.8 ANCHOR LOCATIONS

- A. Site Access Plan: The Contractor shall design and construct working platforms, scaffolding, or temporary anchorage as necessary to provide access to all equipment at anchor locations. The Contractor's design for site access shall be prepared by a Professional Engineer registered in the State of Washington with at least 5 years of experience designing similar structures.
- B. Anchor holes shall be drilled within 3 inches of the location shown on the contract drawings. Anchor locations shall be field verified by a Professional Surveyor licensed in the State of Washington prior to the start of drilling.
- C. The anchor head pockets are located in the dam crest such that there is no anticipated encounter with steel reinforcement for the existing concrete pilasters based on historic drawing BA022. If reinforcement is encountered the Contractor shall notify the Engineer.
- D. Sacrificial verification test anchor, VA-1, is located beyond the right wing wall on asphalt. The anticipated subsurface conditions are shown in the Contract Drawings. The final location of the test anchor will be per the Contractor's approved Work Plan.

PART 2 PRODUCTS

2.1 GENERAL

- A. The designated materials storage location or locations shall be protected by the Contractor from theft, vandalism, passage of vehicles, and other potential sources of damage to materials delivered to the site.
- B. The Contractor shall protect the materials from the elements by appropriate means. Prestressing steel shall be stored and handled in accordance with the manufacturer's recommendations, and in such manner that no corrosion or damage to the component parts occurs. All steel components shall be protected from the elements at all times. Cement and additives for grout shall be stored under cover and protected against moisture. Avoid over- stacking grout bags.
- C. The anchors shall meet the requirements of a Class I Protection system as defined in the PTI DC35.1-14.

2.2 ADMIXTURES

- A. Admixtures that control bleed, improve flowability, reduce water content, and retard set may be used in the grout with approval of the Engineer. Admixtures, if used, shall be compatible with the prestressing steels and mixed in accordance with the manufacturer's recommendations. Expansive admixtures may only be added to the grout used for filling sealed encapsulations, trumpets, and anchorage covers. Accelerators shall not be permitted.



2.3 AGGREGATES

- A. Fine aggregate if used for consolidation grouting, must conform to ACI 301. Aggregates must not contain substances which may be deleteriously reactive with alkalis in the cement.

2.4 ANCHORAGE DEVICES

- A. Anchorages shall be a combination of a steel bearing plate with a restressable wedge plate and wedges. Anchorage devices shall be capable of developing 95% of the minimum ultimate tensile strength (MUTS) of the prestressing steel tendon. The anchorage devices shall conform to the static strength requirements of PTI TAB.1, Section 3.1.6 (1) and Section 3.1.8 (1 and 2).
- B. The bearing plate shall conform to the requirements of ASTM A36, with minimum yield strength (F_y) of 36 ksi and shall be galvanized.
- C. The trumpet shall be fabricated from a steel pipe or tube and shall be galvanized. Steel pipe or tube shall conform to the requirements of ASTM A53 for pipe or ASTM A500 for tubing. Steel trumpet pipe size shall be designed by the Contractor and submitted to Engineer for review.
- D. Wedges shall be designed to preclude premature failure of the prestressing steel due to notch or pinching effects under static and dynamic strength requirements of PTI TAB.1, Section 3.1.6 (1) and Section 3.1.8 (1 and 2). Wedges shall not be reused. Wedges shall be steel and comprise three parts per strand.

2.5 BONDBREAKER

- A. The bondbreaker (sheath around individual strands) shall be fabricated from a smooth plastic tube or pipe having the following properties: (1) resistant to chemical attack from aggressive environments, grout, or corrosion-inhibiting compound; (2) resistant to aging by ultra-violet light; (3) fabricated from material nondetrimental to the tendon; (4) capable of withstanding abrasion, impact, and bending during handling and installation; (5) enable the tendon to elongate during testing and stressing; and (6) allow the tendon to remain unbonded after lock-off.

2.6 PRIMARY AND SECONDARY CEMENT GROUT

- A. Type I, II Portland cement conforming to ASTM C150 or ASTM C595 Type 1L cement. The grout shall be a pumpable mixture of cement and water and shall be stable (bleed less than 1%), fluid, and provide a minimum 28-day compressive strength of 4,000 psi measured according to ASTM C109 at time of stressing.



2.7 CENTRALIZERS

- A. Centralizers shall be fabricated from plastic, steel, or material that is nondetrimental to the prestressing steel. Wood shall not be used. The centralizer shall be able to support the tendon in the drill hole and position the tendon so a minimum of 0.5 inch of grout cover is provided and shall permit grout to freely flow around the tendon and up the drill hole. (Note: the centralizers are required on the outside of the corrugated duct, with spacer / centralizers required on the tendon inside the corrugated).
- B. Centralizers shall be provided at maximum intervals of 10 ft, with the deepest centralizer located 1 ft from the end of the anchor, and the upper centralizer for the bond zone located no more than 5 ft from the top of the tendon bond length. Spacers shall be used to separate the steel strands comprising the tendons. Spacers shall be provided at maximum intervals of 10 ft.

2.8 CONSOLIDATION GROUT

- A. Consolidation Grout refers to grout required to pregrout anchor holes which fail the watertightness test under the requirements of Section 3.8. The grout mix composition proportions shall be the responsibility of the Contractor. The mix design shall be submitted to the Engineer for review. Several mix designs may be required.
 - 1. Anchor holes at the right wing wall (PA-1 through PA-5) require the use of a sanded grout mix to minimize migration into existing adit drains and known geologic features.
 - 2. Neat cement grout is permitted for the left wing wall anchor holes (PA-6 through PA-9).

2.9 CONVERSION COUPLER

- A. The conversion coupler is defined as the apparatus that allows for the restressing of the threaded strand anchor wedge plate by using all-thread bars.
- B. Conversion coupler shall be sized to thread on to the strand wedge plate and shall be capable of developing 95% of the specified minimum ultimate tensile strength (MUTS) of the prestressing steel tendon.

2.10 CORROSION-INHIBITING COMPOUND

- A. The corrosion-inhibiting compound placed in either the free length or the trumpet area shall be an organic compound (i.e., grease or wax) with appropriate polar moisture displacing, corrosion-inhibiting additives, and self-healing properties. The compound shall permanently stay viscous, and be chemically stable and nonreactive with the prestressing steel, the sheathing material, and the anchor grout. Corrosion-inhibiting compounds shall conform to the requirements in PTI DC35.1, Section 3.2.5.



2.11 END CAPS

- A. Anchor steel end caps shall meet the requirements of the strand manufacturer for the respective anchor size. Caps shall be filled with corrosion-inhibiting grease or wax to allow future restressing and shall be galvanized.

2.12 GROUT TUBES

- A. Grout tubes shall have an adequate inside diameter to enable the grout to be pumped to the bottom of the drill hole. Grout tubes shall be strong enough to withstand the anticipated grout pressure.

2.13 HEAT SHRINKABLE SLEEVES

- A. Heat shrinkable sleeves shall be fabricated from a radiation crosslinked polyolefin tube internally coated with an adhesive sealant. Prior to shrinking, the tube shall have a nominal wall thickness of 0.024 inch. The adhesive sealant inside the heat shrinkable tube shall have a nominal thickness of 0.02 inch.

2.14 PRESTRESSING STEEL

- A. Seven-Wire Strand Tendons shall conform to ASTM A416, including the Supplementary Requirement S1, Grade 270, low-relaxation grade, weldless grade, 0.6-inch nominal diameter.

2.15 PRESTRESSING STEEL COUPLERS

- A. Steel strands used for tendons shall be continuous with no splices. Couplers shall not be used.

2.16 SPACERS

- A. Spacers shall be used to separate elements of a multi-element tendon and shall permit grout to freely flow around the strands and up the drill hole. Spacers shall be fabricated from plastic, steel, or other material that is nondetrimental to the prestressing steel. Wood shall not be used.

2.17 STRAND SHEATHING

- A. A sheath shall be used as part of the corrosion protection system for the unbonded length portion of the tendon. The sheath shall be fabricated from one of the following:
 - 1. A polyethylene tube pulled or pushed over the prestressing steel. The polyethylene shall be Type II, III, or IV as defined by ASTM D1248 (or approved equal). The tubing shall have a minimum wall thickness of 0.060 inch.
 - 2. A hot-melt extruded polypropylene tube. The polypropylene shall be cell classification B55542-11 as defined by ASTM D4101 (or approved equal). The tubing shall have a minimum wall thickness of 0.060 inch.



City of Tacoma

3. A hot-melt extruded polyethylene tube. The polyethylene shall be high density Type III as defined by ASTM D1248 (or approved equal). The tubing shall have a minimum wall thickness of 0.06 inch.
 4. Plastic pipe or tube of PVC conforming to ASTM D1784, Class 13464
- B. The pipe or tube shall be Schedule 40 at a minimum.

2.18 STRESSING BARS AND ANCHORAGE

- A. Stressing bars for future restressing of the tendon shall consist of all-thread steel bars and shall conform to the strength properties of ASTM A722 for Type II (deformed) bars, Grade 75 or 150. The size and length of the stressing tails shall be per the approved restressable anchorage shop drawings, determined by the Contractor's Engineer.
- B. Nuts shall comply with the performance requirements of Section 4.2 in PTI M50.1.
- C. Washers and hex nuts shall be per the approved stressing tail bar size.

2.19 TENDON BOND LENGTH ENCAPSULATIONS

- A. The tendon bond length encapsulation shall be fabricated from one of the following:
1. High density corrugated polyethylene tubing conforming to the requirements of AASHTO M252 and having a minimum wall thickness of 0.06 inch except pregrouted tendons that may have a minimum wall thickness of 0.04 inch.
 2. Corrugated, polyvinyl chloride tubes manufactured from rigid PVC compounds conforming to ASTM D1784, Class 13464-B.

2.20 WATER

- A. Water for mixing grout shall be potable, clean, and free of injurious quantities of substances known to be harmful to Portland cement or prestressing steel.

PART 3 EXECUTION

3.1 EQUIPMENT LIMITATIONS

- A. All heavy equipment employed must be able to perform without damaging the existing structures.
- B. Reservoir access for barges shall be coordinated with Tacoma Power and may require coordination with existing structures such as a boat barrier and fish guide net.
- C. Tacoma Power may require access to the dam crest occasionally. The Contractor is responsible for coordinating removal of equipment and materials from the dam crest with the Tacoma Power Operator when access is required.



- D. Installation Equipment: All equipment shall be capable of installing the required tendons at the locations indicated, for the subsurface conditions anticipated, and to avoid damage to the wing walls.
- E. The grouting equipment shall produce a grout free of lumps and undispersed cement. The mixer must be of a high-speed "colloidal mill" type. A positive displacement grout pump shall be used. The pump shall be equipped with a pressure gauge to monitor grout pressures. The pressure gauge shall be capable of measuring pressures of at least twice the actual grout pressures used by the Contractor. The grouting equipment shall be sized to enable the grout to be pumped in one continuous operation. The annulus around the corrugated duct must be grouted in stages. The mixer should be capable of continuously agitating the grout. Paddle mixers are prohibited.

3.2 CORROSION PROTECTION

- A. Anchors shall be protected in accordance with PTI recommendations for Class I, Encapsulated Tendons. The corrosion protection systems shall be designed and constructed to provide reliable anchors for permanent structures.
- B. Anchorage Protection:
 - 1. Steel bearing plates, trumpets, and end caps shall be hot dip galvanized.
 - 2. Damage to protective coatings shall be repaired.
 - 3. All stressing anchorages shall have a corrosion-inhibiting grease-filled or wax-filled cover.
 - 4. The trumpet shall be sealed to the bearing plate and shall overlap the unbonded length corrosion protection by at least 12 inches. The trumpet shall be long enough to accommodate movements of the tendon during testing and stressing. On strand tendons, the trumpet shall be long enough to enable the tendon to make a transition from the diameter of the tendon along the unbonded length to the diameter of the tendon at the wedge plate without damaging the encapsulation.
 - 5. The trumpet shall be completely filled with corrosion-inhibiting grease or wax. Compounds may be placed any time during construction. Compound-filled trumpets shall have a permanent seal between the trumpet and the unbonded length corrosion protection. Grease must be placed after the anchor has been tested and stressed to the lock-off load.
- C. Unbonded Length Protection:



City of Tacoma

1. Corrosion protection of the unbonded length shall be provided by a combination of sheaths, sheaths filled with a corrosion-inhibiting compound or grout, or a heat shrinkable tube internally coated with a mastic compound. The corrosion-inhibiting compound shall completely coat the tendon elements, fill the void between them and the sheath, and fill the interstices between the wires of 7-wire strands. Provisions shall be made to retain the compound within the sheath.
 2. The corrosion protective sheath surrounding the unbonded length of the tendon shall be long enough to extend into the trumpet, but shall not come into contact with the stressing anchorage during testing. Any excessive protection length shall be trimmed off.
- D. Unbonded Length/Bond Length Transition: The transition between the corrosion protection for the bonded and unbonded lengths shall be designed and fabricated to ensure continuous protection from corrosive attack.
- E. Tendon Bond Length Protection for Grout Protected Tendons (Class I):
1. Following the placement of the full-length plastic corrugation duct into the prepared borehole, the annulus space in between the borehole and the duct shall be grouted such that the duct is not distressed or otherwise damaged. Then, the tendon shall be placed in the corrugated duct and grouted in per Section 3.
 2. Centralizers or grouting techniques shall ensure a minimum of 0.5 inch of grout cover over the encapsulation.

3.3 TENDON STORAGE AND ANCHORAGE

- A. Tendons shall be handled and stored in such a manner as to avoid damage or corrosion. Damage to the prestressing steel, the corrosion protection, and/or the epoxy coating as a result of abrasions, cuts, nicks, welds, and weld splatter will be cause for rejection by the Engineer. The prestressing steel shall be protected if welding is to be performed in the vicinity. Grounding of welding leads to the prestressing steel is forbidden. Prestressing steel shall be protected from dirt, rust, or deleterious substances. A light coating of rust on the steel is acceptable. If heavy corrosion or pitting is noted, the Engineer shall reject the affected tendons.
- B. The Contractor shall use care in handling and storing the tendons at the site. Prior to inserting a tendon in the drill hole, the Contractor and the Engineer shall examine the tendon for damage to the encapsulation and the sheathing. If, in the opinion of the Engineer, the encapsulation is damaged, the Contractor shall repair the encapsulation in accordance with the tendon supplier's recommendations. If, in the opinion of the Engineer, the smooth sheathing has been damaged, the Contractor shall repair it with ultra-high molecular weight polyethylene tape. The tape should be spiral wound around the tendon to completely seal the damaged area. The pitch of the spiral shall ensure a double thickness at all points.



- C. Banding for fabricated tendons shall be padded to avoid damage to the tendon corrosion protection. Upon delivery, the fabricated anchors or the prestressing steel for fabrication of the tendons on site and all hardware shall be stored and handled in such a manner to avoid mechanical damage, corrosion, and contamination with dirt or deleterious substances.
- D. Prestressing steel shall not be exposed to excessive heat (i.e., more than 230°C).

3.4 TENDON FABRICATION

- A. Tendons shall be either shop or field fabricated from materials conforming to Part 2 of the Specification and as shown in the approved Working Drawings and schedules.
- B. Prestressing steel shall be cut with an abrasive saw. Use of an oxyacetylene torch is prohibited.
- C. All of the tendon bond length must be free of dirt, manufacturers' lubricants, corrosion-inhibitive coatings, or other deleterious substances that may significantly affect the grout-to-tendon bond or the service life of the tendon.

3.5 PRECONSTRUCTION MEETING

- A. Prior to the test anchor and production anchor installation, a preconstruction meeting shall be organized by the Contractor and held at the site. The Representatives of the Contractor, quality control personnel, Owner, and Engineer shall attend. Detailed minutes of the meeting shall be prepared by the Contractor and submitted to the Engineer within 3 days.
- B. The meeting should include a review of the contract documents, discussion of potential issues and solutions, responsibilities of the parties, communication procedures, and testing requirements.

3.6 EXPLORATORY DRILLING OF ANCHOR HOLE

- A. Prior to drilling anchor holes, exploratory pilot holes shall be drilled at all anchor locations, as shown on the Contract Drawings, to help minimize deviations from vertical of the anchor holes and to confirm geologic features/conditions. Pilot holes shall be drilled at precise location and alignment of anchors. Drill pilot holes in accordance with Specification Section 02 32 19 – Exploratory Drilling and Televiewer.
- B. Before drilling the anchor holes, the Engineer shall measure and confirm adequate verticality of the pilot hole and confirm required depth of the anchor. Upon receiving approval of pilot hole exploration from Engineer, the Contractor can proceed to drill the anchor boreholes to the specified diameter. The anchors at pilot hole locations shall be drilled through the pilot hole to the minimum length and socket diameter specified on the Contract Drawings. The Engineer reserves the right to modify the length of the anchors based on results of the exploration.



3.7 DRILLING

- A. The Contractor shall be responsible for using a drilling method to establish a stable hole of adequate dimensions, within the tolerances specified. Drilling methods that distress the existing structure and foundation shall not be used.
- B. Holes shall be drilled using water or air as drilling fluid. The drilling fluid shall be returned at the top of the drill hole, and the spoils collected and disposed. Drill spoils and return shall not induce pressures exceeding the threshold values outlined in the Engineer's DPP. Contractor shall continuously monitor and observe drilling action for signs of pressure build up. If observations indicate pressure build up, the Contractor shall stop immediately and clear the hole. If signs of pressure build up continue after the hole is cleared, Contractor shall revise drilling method to reduce pressure.
- C. Holes for anchors shall be drilled at the locations and to the length, inclination, and diameter shown on the Contract Drawings. The drill bit shall not be more than 0.12-inch smaller than the specified hole diameter. At the dam crest surface, the drill hole shall be located within 3 inches of the location shown on the Contract Drawings unless otherwise directed by the Engineer. The drill hole location is not allowed to be offset in the upstream direction. The drill hole shall be located so the longitudinal axis of the drill hole and the longitudinal axis of the tendon are parallel. In particular, the anchor hole shall not be drilled in a location that requires the tendon to be bent to enable the bearing plate to be connected to the supported structure. At the point of entry, the anchor shall be installed within ± 1 degrees of the inclination from vertical shown on the Contract Drawings or the approved Working Drawings. The Contractor shall measure the inclination of the drill hole every 25 feet and report data to the Engineer Representative on site. The anchor shall be installed within ± 0.5 degrees from vertical over the total length of the anchor.
- D. The tendon bond zone shall not be permitted to begin within 15 feet of the dam foundation contact and shall meet the minimum lengths shown in the Contract Drawings.

3.8 WATER TIGHTNESS TESTING

- A. The corrugated sheathing shall be water pressure tested by the Contractor prior to installation into the anchor drill hole. The corrugation shall be water tested at a minimum initial pressure of 5 psi. If perforations in the corrugated sheathing are observed, the Contractor shall repair the corrugated sheathing using methods approved by the tendon manufacturer. The Engineer must be present during the repair of any corrosion protection.



- B. The anchor holes shall be water pressure (packer) tested for the full length of the anchor by the Contractor as directed by the Engineer using approved methods and equipment. All holes shall be water tested at a minimum initial pressure of 5 psi in excess of the hydrostatic head at the time of testing when measured at the top of the hole, and the flow rate be measured over a 10-minute period. If the water take of the hole exceeds 2.75 gallons of water, the Engineer may require the hole to be consolidation grouted to the extent determined by the Engineer. The sequence of pressure testing, regrouting, and redrilling shall be repeated until the hole meets the water pressure testing requirements in this section or as otherwise determined by the Engineer.

3.9 TENDON INSERTION

- A. Tendons shall be placed in accordance with the Contract Drawings and details, and the recommendations of the tendon manufacturer.
- B. The corrugated sheathing shall first be installed in the drill hole to the desired depth without difficulty, and the outer annulus grouted. When the corrugation cannot be completely inserted, the Contractor shall remove the sheathing from the drill hole and clean or redrill the hole to permit insertion. Partially inserted sheaths shall not be driven or forced in the hole.
- C. Once the annulus grout surrounding the corrugated sheathing has achieved a minimum compressive strength per Section 3.10. The tendon shall be inserted into the corrugated sheath to the desired depth without difficulty. When the tendon cannot be completely inserted, the Contractor shall remove the tendon from the sheath, notify the Engineer, and inspect the obstruction. Partially inserted tendons shall not be driven or forced into the sheath.
- D. Each anchor tendon shall be inspected by field personnel during installation into the drill hole. Damage to the corrosion protection system shall be repaired, or the tendon replaced if not repairable. Loose spacers or centralizers shall be reconnected to prevent shifting during insertion. If the patch is not allowed to cure prior to inserting the tendon in the drill hole, the patched area shall be protected by tape or other suitable means.
- E. The rate of placement of the tendon into the hole shall be controlled, such that the sheathing, coating, and grout tubes are not damaged during installation of the tendon. Anchor tendons shall not be subjected to sharp bends. The bottom end of the tendon may be fitted with a cap or bullnose to aid its insertion into the hole, casing, or sheathing.
- F. Reinforcement shall be centered in the hole with appropriate centering devices. Reinforcement shall be placed prior to grouting. Reinforcement should not be subjected to sharp bends.
- G. Protect the tail of the anchor from exposure to wet weather at all times.



3.10 GROUTING

- A. The grout shall be injected from the lowest point of the drill hole. The grout shall be placed for the annulus after insertion of the corrugated sheathing. Grout shall be placed inside of the corrugated sheathing after insertion of the tendon. The tendon shall not be inserted into the in-place corrugated sheath until the annulus grout has reached a compressive strength of at least 2,000 psi. The location of grout, quantity of the grout and the grout pressures shall be recorded. The grout pressures and grout takes shall be controlled to prevent excessive heave or fracturing.
- B. The corrugated sheathing and tendon shall be supported at the top of the anchor such that the sheathing and tendon are straight during the respective grouting operations. Supports shall remain in place until the grout has initially cured.
- C. Engineer shall be notified if grout volumes exceed 1.5 times the theoretical amount. Contractor shall employ remedial measures for grout loss per the approved Work Plan.
- D. The grout tube may remain in the hole on completion of grouting if the tube is filled with grout.
- E. Use neat cement grout that only contains cement and water with a water cement ratio of 0.4 to 0.5 which is approximately 5.5 gallons of water per 94 lb of Portland cement. The corresponding specific gravity of the grout shall range from 1.8 to 1.9. During grouting, the wet grout specific gravity shall be measured and confirmed using mud balance testing or other approved testing device.
- F. After grouting, the tendon shall not be tested until the grout strength has reached 4,000 psi.

3.11 ANCHORAGE INSTALLATION

- A. If ordered with excess unbonded length, the Contractor may cut excess unbonded length upon the Engineer's approval of the pilot hole and as-built drill depths. The excess length shall be cut according to the tendon manufacturer's recommendation and shall leave enough tail for anchor stressing. All trimming of the tendons shall be done on the unbonded length. The bonded length shall not be cut without Engineer's approval.
- B. The anchor bearing plate and the wedge plate shall be installed perpendicular to the tendon, within ± 3 degrees and centered on the bearing plate, without bending or kinking of the prestressing steel elements. Wedge holes and wedges shall be free of rust, grout, and dirt.
- C. The stressing tail shall be cleaned and protected from damage until final testing and lock-off. After the anchor has been accepted by the Engineer, the stress tail shall be cut to its final length according to the tendon manufacturer's recommendations.



City of Tacoma

- D. The corrosion protection surrounding the unbonded length of the tendon shall extend up beyond the bottom seal of the trumpet, or 4 inches into the trumpet if no trumpet seal is provided.
- E. The corrosion protection surrounding the unbonded length of the tendon shall not contact the bearing plate or the anchor head during testing and stressing.

3.12 STRESSING, LOAD TESTING, AND ACCEPTANCE

A. General:

- 1. Each anchor shall be tested. No load greater than 10% of the design working load can be applied to the anchor prior to testing. The maximum test load shall be 80% of the minimum ultimate tensile strength (MUTS) of the prestressing steel of the tendon as shown on the Contract Drawings. The test load shall be simultaneously applied to the entire tendon. Stressing of single elements of multi-element tendons shall not be permitted.
- 2. Contractor shall provide a flat, stable bearing surface for stressing equipment.
- 3. The Engineer will monitor existing cracks in the concrete wing walls at each load increment of the load test for anchors adjacent to the cracks. The cracks are shown in the Contractor Drawings. The Contractor shall work cooperatively with the Engineer during these readings and shall not proceed to the subsequent load increment without the Engineer's approval.

B. Stressing Equipment:

- 1. The testing equipment shall consist of:
 - a. Three dial gauges or vernier scales capable of measuring to the nearest 0.001 inch shall be used to measure the tendon extension. At least one of the dials must be digital. The movement-measuring device shall have a minimum travel equal to the theoretical elastic elongation of the total anchor length at the maximum test load, and it shall have adequate travel so the anchor movement can be measured without resetting the device at an interim point. To allow for accuracy of readings for the pressure gauges, the range of the gauge shall be such that the pressures recorded at the 100% design load shall be within the mid-range of the gauge.



City of Tacoma

- b. A hydraulic jack and pump shall be used to apply the test load. The use of monostrand jacks to apply the alignment load is permitted. The jack(s) and a calibrated primary pressure gauge(s) shall be used to measure the applied load. The jack(s) and primary pressure gauge(s) shall be calibrated by an independent firm as a unit. The calibration shall have been performed within 60 working days of the date when the calibration submittals are provided to the Engineer. Testing cannot commence until the Engineer has approved the calibration(s). The primary pressure gauge shall be graduated in 100 psi increments or less. The ram travel shall be at least 8 inches, and preferably not be less than the theoretical elongation of the tendon at the maximum test load. If elongations greater than 8 inches are required, restroking is allowed.
- c. A calibrated reference pressure gauge shall also be kept at the site to periodically check the production (i.e., primary pressure) gauge. The reference gauge shall be calibrated with the test jack and primary pressure gauge. The reference pressure gauge shall be stored indoors and not subjected to rough treatment.
- d. The stressing equipment shall be placed over the tendon in such a manner that the jack, bearing plates, and stressing anchorage are axially aligned with the tendon and the tendon is centered within the equipment.

C. Load Test Setup:

- 1. Dial gauges shall bear on the pulling head of the jack, and their stems shall be coaxial with the tendon direction. The gauges shall be supported on an independent, fixed frame, such as a tripod, which will not move as a result of stressing, tidal action, freeze thaw, or other ground movements or construction activities during the operation.
- 2. The Engineer is responsible for monitoring crack gauges to measure deformations at existing cracks in the concrete, if any.
- 3. Prior to setting the dial gauges, the Alignment Load (AL) shall be accurately placed on the tendon.
- 4. Regripping of strands, which would cause overlapping wedge bites, or wedge bites on the tendon below the anchor head, shall be avoided.
- 5. Stressing and testing of multiple element tendons with single element jacks is not permitted.
- 6. Stressing shall not begin before the grout has reached its design strength.



City of Tacoma

D. Verification Tests: A preproduction verification test shall be performed by Contractor on a sacrificial Tiedown Anchor prior to the start of anchor installation, as indicated below. The verification test location shall be at the location shown on the Contract Drawings. The anchor shall be bonded in rock similar to the foundation of the dam and be tested. The verification test anchor shall be constructed using the same installation procedures as the production anchors.

1. The tiedown anchor shall be tested to at least 200 percent of the geotechnical capacity of the bond zone, where the geotechnical capacity is denoted herein as the Verification Test Load (VTL) and calculated using the equation below. The VTL shown on the contract drawings assumes a 20-foot bonded length and 15-inch diameter drill hole and is subject to change based on the as-built bonded zone. VTL shall not exceed 80 percent of the ultimate strength of the steel.

$$VTL = d_{hole} \times \pi \times T_{ult} \times L_{bond}$$

Where,

d_{hole} = drill hole diameter (in)

π = 3.14159

T_{ult} = design ultimate bond stress, assumed to be 250 psi

L_{bond} = length of verification anchor bond zone (in)

2. The verification test shall be performed by incrementally loading and unloading the sacrificial anchor in accordance with schedule below and approved by Engineer but shall generally follow the provisions of a Performance Test (including an Extended Creep Test). The load shall be raised from one increment to another immediately after recording the anchor movement. The anchor movement shall be measured and recorded to the nearest 0.001 inch with respect to an independent fixed reference point at the alignment load and at each increment of load. The load increase shall be established using the calibrated primary pressure gage. The load recorded shall be as per the calibrated load cell readings. At load increments other than the maximum test load, the load shall be held just long enough to record the movement reading.



City of Tacoma

The verification test shall be made by incrementally loading the anchor in accordance with the following schedule:

VERIFICATION TEST SCHEDULE					
Step	Loading	Applied Load	Record and Plot Total Movement (δ_{ti})	Record and Plot Residual Movement (δ_{ri})	Calculate and Plot Elastic Movement (δ_{ei})
1	Apply alignment load (AL)				
2	Cycle 1	0.20VTL	δ_{t1}		$\delta_{t1}-\delta_{r1}=\delta_{e1}$
		AL		δ_{r1}	
3	Cycle 2	0.20VTL	δ_2		$\delta_{t2}-\delta_{r2}=\delta_{e2}$
		0.40VTL	δ_{t2}		
		AL		δ_{r2}	
4	Cycle 3	0.20VTL	δ_3		$\delta_{t3}-\delta_{r3}=\delta_{e3}$
		0.40VTL	δ_3		
		0.60VTL*	δ_{t3}		
		AL		δ_{r3}	
5	Cycle 4	0.20VTL	δ_4		$\delta_{t4}-\delta_{r4}=\delta_{e4}$
		0.40VTL	δ_4		
		0.60VTL	δ_4		
		0.80VTL*	δ_{t4}		
		AL		δ_{r4}	
6	Cycle 5	0.20VTL	δ_5		$\delta_{t5}-\delta_{r5}=\delta_{e5}$
		0.40VTL	δ_5		
		0.60VTL	δ_5		
		0.80VTL	δ_5		
		0.9VTL*	δ_{t5}		
		AL		δ_{r5}	
7	Cycle 6	0.20VTL	δ_6		
		0.40VTL	δ_6		
		0.60VTL	δ_6		
		0.8VTL	δ_6		
		0.9VTL	δ_6		
		1.0VTL**	δ_{t6} , zero reading for creep test		
8	*Hold load for 10 minutes while recording movement at specific times. If the total load movement measured during the load hold exceeds the specified maximum value, then the load hold shall be extended to a total of 60 minutes. ** Hold load for 60 minutes while recording movement at specific times				
9	Cycle 6 cont'd	AL		δ_{r6}	$\delta_{t6}-\delta_{r6}=\delta_{e6}$
Notes: AL = Alignment Load, VTL = Verification Test Load, δ_i = total movement at a load other than maximum for cycle, i = number identifying a specific load cycle.					



City of Tacoma

E. Performance Tests:

1. All of the production anchors shall be performance tested in accordance with the procedures described below
2. The performance test shall be made by incrementally loading and unloading the anchor in accordance with the schedule provided. The load shall be raised from one increment to another immediately after recording the anchor movement. The anchor movement shall be measured and recorded to the nearest 0.001 inch with respect to an independent fixed reference point at the alignment load and at each increment of load. The load shall be monitored with the primary pressure gauge. The reference pressure gauge shall be placed in series with the primary pressure gauge during each performance test. If the load determined by the reference pressure gauge and the load determined by the primary pressure gauge differ by more than 10%, the jack, primary pressure gauge, and reference pressure gauge shall be recalibrated at no expense to the Owner. At load increments other than the maximum test load, the load shall be held just long enough to obtain the movement reading.
3. The maximum test load in a performance test shall be held for a minimum of 10 minutes. A load cell shall be used to monitor small changes in load during constant load-hold periods.



City of Tacoma

PERFORMANCE TEST SCHEDULE					
Step	Loading	Applied Load	Record and Plot Total Movement (δ_{ti})	Record and Plot Residual Movement (δ_{ri})	Calculate and Plot Elastic Movement (δ_{ei})
1	Apply alignment load (AL)				
2	Cycle 1	0.25DL	δ_{t1}		$\delta_{t1}-\delta_{r1}=\delta_{e1}$
		AL		δ_{r1}	
3	Cycle 2	0.25DL	δ_2		$\delta_{t2}-\delta_{r2}=\delta_{e2}$
		0.50DL	δ_{t2}		
		AL		δ_{r2}	
4	Cycle 3	0.25DL	δ_3		$\delta_{t3}-\delta_{r3}=\delta_{e3}$
		0.50DL	δ_3		
		0.75DL	δ_{t3}		
		AL		δ_{r3}	
5	Cycle 4	0.25DL	δ_4		$\delta_{t4}-\delta_{r4}=\delta_{e4}$
		0.50DL	δ_4		
		0.75DL	δ_4		
		1.00DL	δ_{t4}		
		AL		δ_{r4}	
6	Cycle 5	0.25DL	δ_5		$\delta_{t5}-\delta_{r5}=\delta_{e5}$
		0.50DL	δ_5		
		0.75DL	δ_5		
		1.00DL	δ_5		
		1.20DL	δ_{t5}		
		AL		δ_{r5}	
7	Cycle 6	0.25DL	δ_6		
		0.50DL	δ_6		
		0.75DL	δ_6		
		1.00DL	δ_6		
		1.20DL	δ_6		
		1.33DL	δ_{t6} , zero reading for creep test		
8	Hold load for 10 minutes while recording movement at specific times. If the total load movement measured during the load hold exceeds the specified maximum value, then the load hold shall be extended to a total of 60 minutes.				
9	Cycle 6 cont'd	AL		δ_{r6}	$\delta_{t6}-\delta_{r6}=\delta_{e6}$
10		LO	δ		
Notes: AL = Alignment Load, DL = Design Load, LO = Lockoff, δ_i = total movement at a load other than maximum for cycle, i = number identifying a specific load cycle.					



4. The jack shall be adjusted as necessary in order to maintain a constant load. The load-hold period shall start as soon as the maximum test load is applied; and the anchor movement, with respect to a fixed reference, shall be measured and recorded at 1 minute, 2, 3, 4, 5, 6, and 10 minutes. If the anchor movement between 1 minute and 10 minutes exceeds 0.04 inch, the maximum test load shall be held for an additional 50 minutes. If the load hold is extended, the anchor movement shall be recorded at 15 minutes, 20, 30, 40, 50, and 60 minutes.
5. The field log and submitted performance test schedule shall show the applied load values, not fractions of the design load.

F. Anchor Acceptance Criteria:

1. A performance-tested or verification-tested anchor with a 10-minute load hold shall be acceptable if: (1) the anchor resists the maximum test load with less than 0.04 inch of movement between 1 minute and 10 minutes; and (2) the total elastic movement at the maximum test load exceeds 80% of the theoretical elastic elongation of the unbonded length.
2. A performance-tested or verification-tested anchor with a 60-minute load hold shall be acceptable if: (1) the anchor resists the maximum test load with a creep rate that does not exceed 0.08 inch between 6 and 60 minutes; and (2) the total elastic movement at the maximum test load exceeds 80% of the theoretical elastic elongation of the unbonded length.
3. An anchor subjected to extended creep testing is acceptable if: (1) the anchor resists the maximum test load with a creep rate that does not exceed 0.08 inch in the last log cycle of time; and (2) the total elastic movement at the maximum test load exceeds 80% of the theoretical elastic elongation of the unbonded length.
4. Elastic movement at the maximum load is no greater than theoretical elastic elongation of 100% free length plus 50% bond length, and no less than theoretical elastic elongation of 80% free length.
5. The initial lift-off reading shall be within $\pm 5\%$ of the designed lock-off load. If this criterion is not met, then the tendon load shall be adjusted accordingly and the initial lift-off reading repeated.

G. Anchor Lock-Off:

1. Each anchor tendon shall be locked off at the lockoff load specified on the Contract Drawings.
2. After testing has been completed, the load in the tendon shall be such that after seating losses (i.e., wedge seating), the specified lock-off load has been applied to the anchor tendon.



3. The wedges shall be seated at a minimum load of 50% MUTS. If the lock-off load is less than 50% MUTS, shims shall be used under the wedge plate and the wedges seated at 50% MUTS. The shims shall then be removed to reduce the load in the tendon to the desired lock-off load.
 - H. Anchor Lift-Off Test: After transferring the load to the anchorage, and prior to removing the jack, a lift-off test shall be conducted to confirm the magnitude of the load in the anchor tendon. This load is determined by reapplying load to the tendon to lift off the wedge plate without unseating the wedges. The lift-off load shall be within 5% of the lock-off load. This moment represents zero time for any long-term monitoring.
- ### 3.13 DRILLING AND GROUTING SPOILS
- A. Drilling and grouting spoils shall be collected in a controlled manner that prevents spoils from ponding on the dam crest or spilling into the dam face and/or reservoir. Spoils shall be collected using hoses that connect to a dumpster or storage bin located at a location per the approved Work Plan, and disposed of at an approved location off-site.

PART 4 CONTRACTOR'S QUALITY CONTROL PROGRAM

4.1 FIELD QUALITY CONTROL

- A. The following describes the minimum inspection and testing requirements for the work of this section:
 1. Installation and testing of all tiedown components, including grout and load testing as specified in this section.
 2. The following records will be prepared for the Engineer. The records shall be completed within 24 hours after each tiedown installation is completed. The records shall include the following minimum information:
 - a. Drilling duration and observations (e.g., flush return)
 - b. Information on concrete and rock encountered, including description of strata, water, etc.
 - c. Length of unbonded zone, bonded zone, and total length of tiedown
 - d. Description of unusual installation behavior, conditions
 - e. Any deviations from the intended parameters
 - f. Grout pressures attained, where applicable
 - g. Grout quantities pumped
 - h. Grout strength data
 - i. Tiedown materials and dimensions
 - j. Tiedown test records, analysis, and details



City of Tacoma

REVISIONS TO THE PROPOSAL PAGES:

The Price Proposal page has been revised. Bidders shall use the Revised Price Proposal page included with this Addendum No. 2 when submitting their bid.

REVISIONS TO THE APPENDICES:

1. Appendix B – CONFIDENTIAL 75% Basis of Design Memorandum has been revised. Replace Appendix B in its entirety with the revised Exhibit B – CONFIDENTIAL 100% Basis of Design Memorandum attached to this Addendum.
2. Appendix C – CONFIDENTIAL 75% Geotechnical Data Report has been revised. Replace Appendix C in its entirety with the revised Appendix C – CONFIDENTIAL 100% Geotechnical Data Report, attached to the Addendum.
3. Appendix D – Cushman Dam No. 1 Anchoring WQPP has been revised. Replace Appendix D in its entirety with the revised Appendix D - Cushman Dam No. 1 Anchoring WQPP, attached to the Addendum.
4. Appendix H – CONFIDENTIAL Construction Document DPP QCIP TCEAP is hereby added to the Specification and is attached to this Addendum.
5. Appendix I – FSC Mooring Arrangement is hereby added to the Specification and is attached to this Addendum.

Appendix B, Appendix C and Appendix H contain confidential technical information and are available only upon execution of the City's Confidentiality/Non-Disclosure Agreement (NDA).

Prospective bidders shall submit a request for the NDA to Ryan Foster, Senior Contracting and Procurement Specialist, at rfoster1@tacoma.gov. Upon receipt and acceptance of the executed NDA, access to the confidential appendices will be provided.

NOTE: Acknowledge receipt of this addendum by initialing the corresponding space as indicated on the signature page. Vendors who have already submitted their bid/proposal may contact the Purchasing Division at 253-502-8468 and request return of their bid/proposal for acknowledgment and re-submittal. Or, a letter acknowledging receipt of this addendum may be submitted in an envelope marked Request for Bids Specification No. PG26-0073F Addendum No. 2. The City reserves the right to reject any and all bids, including, in certain circumstances, for failure to appropriately acknowledge this addendum.

cc: Kevin Smith, Power Systems Engineer PE

 Name of Bidder
PROPOSAL

	<u>QUANTITY</u>	<u>BID UNIT</u>	<u>UNIT COST</u>	<u>TOTAL COST</u>
<u>ITEM 1</u>				
Pilot Hole Mobilization/Demobilization	1	LS	\$ _____	\$ _____
<u>ITEM 2</u>				
Pilot Hole Exploratory Drilling	1014	LF	\$ _____	\$ _____
<u>ITEM 3</u>				
Pilot Hole Televiewer	10	EA	\$ _____	\$ _____
<u>ITEM 4</u>				
Tiedown Anchor Mobilization/Demobilization	1	LS	\$ _____	\$ _____
<u>ITEM 5</u>				
Verification Anchor Demolition and Surface Restoration	1	EA	\$ _____	\$ _____
<u>ITEM 6</u>				
Verification Anchor Supply, Drilling and Installation	80	LF	\$ _____	\$ _____
<u>ITEM 7</u>				
Verification Anchor Testing	1	EA	\$ _____	\$ _____
<u>ITEM 8</u>				
Tiedown Anchor Selective Demolition and Repair	9	EA	\$ _____	\$ _____
<u>ITEM 9</u>				
Tiedown Anchor Supply, Drilling and Installation	934	LF	\$ _____	\$ _____
<u>ITEM 10</u>				
Tiedown Anchor Performance Testing and Lockoff	9	EA	\$ _____	\$ _____

ITEM 11

Re-Stressable Testing Parts	2	EA	\$ _____	\$ _____
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ITEM 12

Consolidation Grout	1500	CF	\$ _____	\$ _____
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ITEM 13

Redrill	1014	LF	\$ _____	\$ _____
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ITEM 14

Re-Water Test	10	EA	\$ _____	\$ _____
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ITEM 15

HQ Size Double Packer Supply	2	EA	\$ _____	\$ _____
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ITEM 16

Anchor Hole Double Packer Supply	2	EA	\$ _____	\$ _____
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ITEM 17

Adit Drain Flushing	2	EA	\$ _____	\$ _____
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ITEM 18

*Force Account				\$ <u>1,200,000</u>
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*Bidders shall include the \$1,200,000 figure as part of their overall bid.

TOTAL ITEMS 1 - 14	\$ _____
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**Sales Tax @ <u>8.6%</u>	\$ _____
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(**Note Paragraph 1.13 of General Provisions)

TOTAL AMOUNT	\$ _____
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APPENDIX D

Cushman Dam No. 1 Anchoring WQPP

**DRAFT INCLUDED FOR INFORMATION AND BIDDING. WILL BE UPDATED TO REFLECT
CONTRACTOR'S MEANS AND METHODS FOR CONSTRUCTION. CONTRACTOR SHALL
BE RESPONSIBLE FOR ALL WORK ASSOCIATED WITH THE WQPP AND TO MEET
DEPARTMENT OF ECOLOGY REGULATIONS**

Cushman Dam No. 1 Anchoring

Draft Water Quality Protection Plan (WQPP)

01/01/2027 — 12/31/2027



Tacoma Power

9/10/2026

List of Acronyms and Abbreviations

Acronym / Abbreviation	Explanation
303(d)	Section of the Clean Water Act pertaining to Impaired Waterbodies
BFO	Bellingham Field Office of the Department of Ecology
BMP(s)	Best Management Practice(s)
CESCL	Certified Erosion and Sediment Control Lead
CO₂	Carbon Dioxide
CRO	Central Regional Office of the Department of Ecology
CSWGP	Construction Stormwater General Permit
CWA	Clean Water Act
DMR	Discharge Monitoring Report
DO	Dissolved Oxygen
Ecology	Washington State Department of Ecology
EPA	United States Environmental Protection Agency
ERO	Eastern Regional Office of the Department of Ecology
ERTS	Environmental Report Tracking System
ESC	Erosion and Sediment Control
GULD	General Use Level Designation
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Units
NWRO	Northwest Regional Office of the Department of Ecology
pH	Power of Hydrogen
RCW	Revised Code of Washington
SPCC	Spill Prevention, Control, and Countermeasure
su	Standard Units
SWMMEW	Stormwater Management Manual for Eastern Washington
SWMMWW	Stormwater Management Manual for Western Washington
SWPPP	Stormwater Pollution Prevention Plan
TESC	Temporary Erosion and Sediment Control
SWRO	Southwest Regional Office of the Department of Ecology
TMDL	Total Maximum Daily Load
VFO	Vancouver Field Office of the Department of Ecology
WAC	Washington Administrative Code
WSDOT	Washington Department of Transportation
WWHM	Western Washington Hydrology Model

Table of Contents

Introduction	1
General purpose of the WQPP	1
Existing permits, certifications, regulations, and/or authorizations	1
Project Summary	1
Project Description:.....	2
Project Location	2
Project Narrative.....	2
Work Sequence.....	2
Near- and/or In-Water Work	3
General BMPs	3
Erosion, Sediment and Pollution Control Best Management Practices (BMPs).....	4
Site-Specific BMPs	4
See attached maps for proposed locations of actions, BMPs and monitoring compliance points.....	4
Specific Work Areas/Activities	5
1. Installation of BMPs.....	5
2. Site Preparation.....	5
3. Drawing Lake Water	5
4. Drilling	5
5. Disposal of Process Water	6
6. Backfilling Boreholes	Error! Bookmark not defined.
7. Site Demobilization	6
Monitoring Methodology	7
Applicable project criteria and information:	8
Points of compliance	8
pH Monitoring	8
Turbidity Monitoring	8
Site Inspections.....	9
Site Maps.....	10
Relevant Project Contacts	14

Introduction

General purpose of the WQPP

The Water Quality Protection Plan (WQPP) is a compliance tool that provides the Washington State Department of Ecology (Ecology) with “reasonable assurance” of the protection of water quality.

Existing permits, certifications, regulations, and/or authorizations

	Number	Date(s)	Conditions
401 WQC	7158	8/19/2010	N/A
WAC 173-201A-200	Char Spawning and Rearing (see “Project Information” for Numeric Criteria)		
HPA	2025-6-420+01	9/22/2025 — 12/21/2025	For Water Diversion
SEPA Exemption	2026-01	N/A	
Mason County Shoreline Exemption	2026-01	N/A — N/A	

Project Summary

- Project/Site Name: Cushman Dam No. 1 Anchoring
- Street/Location: 391 Standstill Drive
- City: Hoodspport
- County: Mason
- State: WA
- Zip code: 98548
- Parcel Number: 422050060000, 422052222222
- Location (lat/long): 47.42269881495392, -123.22286063968181
- Waterbody: Lake Cushman
- Ordinary High Water Mark: 738 Feet (Tacoma City Light Datum)
- FERC License Number: 460

This document presents the Water Quality Protection Plan (WQPP) for activities related to the Cushman Dam No. 1 Anchoring located in Mason County, Washington. Activities performed under this WQPP are covered by Tacoma Power’s Hydraulic Project Approval (HPA), Cushman Dam No. 1 Water Diversion (2025-6-420+01), issued by the Washington Department of Fish and Wildlife (WDFW). The HPA covers the period 11/6/2025 through 11/5/2030.

This WQPP describes the project area, activities performed, and Best Management Practices (BMPs) utilized to prevent environmental degradation resulting from the actions. The Washington Department of Ecology (Ecology) regulates hydroelectric projects as it relates to Section 401 Water Quality Certification (WQC) of the Federal Water Pollution Control Act (Clean Water Act 33) (U.S.C § 1341). Specific WQC conditions for the Cushman Hydroelectric Project (FERC No.460) are found in the WQCs dated 8/19/2010 (Order 7158). Tacoma Power, per

Ecology's guidance, has prepared this WQPP to comply with the above referenced documents. It is our intent to proceed with this work as soon as Ecology has provided written approval of this document and all required permits have been obtained.

Project Description:

The proposed anchoring consists of 9 anchors in the wing walls of the dam and one verification anchor on the right abutment of the dam. All anchors will be installed from the crest (top) of the dam. The drilling will consist of two phases, diamond-core fluidrotary methods for drilling pilot holes and likely air drilling for sizing the holes up for the anchor installation. After the holes are created, the anchors will be lowered down by a crane and grout will be used to secure the anchors into the dam. A spud barge may be used as the work site for the crane so it can be positioned at the right location along the dam. There will be an access hole at the top of the anchor to allow for tensioning adjustments as the anchors settle. The intent of this WQPP is to prevent all discharge of water runoff to waters of the state during drilling and backfilling actions.

Project Location

Cushman Dam No. 1 is located in Hoodspport, Washington and impounds Lake Cushman. From I-5 take exit 104 towards US-101 N toward Aberdeen/Port Angeles. In 5.5 miles continue right onto US-101 N. Continue on US-101 N for 28.9 miles. Turn left onto N Lake Cushman Rd. In 3.9 miles turn left onto N Standstill Dr S. Cushman Dam No. 1 is on the left in about 1 mile.

Project Narrative

This project is required by the Federal Energy Regulatory Commission's Dam Safety department. Tacoma Power must complete these actions in order to satisfy our FERC Dam Safety obligations. This work is crucial in ensuring structural integrity of the dam.

For the pilot holes, rock drilling will be completed using HQ3 triple-barrel diamond core techniques that result in a 3.78-inch diameter hole. Pilot holes will range in depth from 80 to about 140 feet. Rock drilling will be conducted using water from the reservoir to keep the equipment cool and remove cuttings while drilling. Polymer designed for use in drilling may be added to the drill water to increase viscosity and aid in retrieving cuttings and to increase lubrication. Approximately 2,000 gallons of water per day will be used resulting in up to 100,000 gallons for the project. Drilling fluids that return to the top of the drill casing will be collected in barrels and tested for pH. If the water meets state water quality standards it can be disposed of at an upland location on site via pump and sprinkler.

After pilot holes are drilled, the contractor will drill 15-inch anchor holes with air-based drilling methods that do not require water. A barge may be deployed to install the anchor tendons. This will be a spud barge, and the barge will be securely anchored in front of the dam. A crane will operate from the barge to lift the anchors vertically and lower them into their holes. Grout will be used to secure the anchor tendons in place. Water from the lake may be used for mixing grout if it meets standards, if not, a nearby potable water source will be used, likely from a water truck.

Anchors will be tensioned once all grout is cured and then will be finished inside a 3.5 foot head pocket. Anchors may need to be re-tensioned in the next year or two, but this will not require remobilization of much of the heavy machinery. Once the tensioning is sufficient, the anchors will be sealed with more grout.

Work Sequence

Work will begin on or near January 1, 2027. The total project will likely take about 5 months. Because a barge may be necessary, Anchor installation must occur within the fish work window which falls between approximately July 15th and March 15th.

1. Install signage and High-Vis fencing to close the area. Establishing laydown area on left abutment and staging equipment and material.
2. Install BMPs.
3. Launch and Set up Barge. Install Crane.
4. Positioning Drilling Rig and Setting Up Water Delivery System.
5. Drilling pilot holes. Dispose of process water during drilling operations.
6. Drill anchor holes with air-fed drill. No process water.
7. Install Anchors with Crane.
8. Tension anchors with a hydraulic jack.
9. Secure tensioned anchors.
10. Safely demobilize.

Near- and/or In-Water Work

Near- and/or In-Water Work will consist of a five gallon per minute (gpm) pump positioned off the top deck of the dam extracting water for the drilling process. This pump will be behind a Transition Net Structure that prevents fish from entering the forebay near the dam and guides fish to the Floating Surface Collector. The floating surface collector will not be running during the time of the construction so fish attraction towards the action area is not anticipated. A fish screen will be used on the pump as required by HPA 2025-6-360+01.

General BMPs

- 1) Equipment utilized will be free of external petroleum based products while working in- or near-water.
- 2) Accumulations of soils or other debris will be removed from the drive mechanisms and undercarriage of utilized equipment prior to performing work.
- 3) Equipment will be checked for leaks and necessary repairs prior to commencing in- or near-water actions.
- 4) Equipment will be positioned to protect and minimize disturbance to riparian vegetation.
- 5) Equipment will remain on developed roadways and structures as practical.
- 6) Equipment will operate below ordinary high water but drive mechanisms (wheels, tires, tracks, etc.) will not enter the wetted perimeter when possible.
- 7) Refueling activities will be performed a minimum of 50 feet from waters of the state.

- 8) Water quality will be monitored as appropriate (see Monitoring section below).
- 9) Spoils will not be stockpiled in or adjacent to the water to prevent backflow of turbid waters to the river.
- 10) Dump truck beds will be sealed or lined to prevent leakage of saturated spoils and debris.

Erosion, Sediment and Pollution Control Best Management Practices (BMPs)

This Water Quality Protection Plan (WQPP) describes Best Management Practices (BMPs) associated with the Cushman Dam No. 1 Anchoring. Personnel noted in the Relevant Project Contacts section below will ensure proper implementation and effectiveness of the WQPP. Should the measures initially installed prove to be inadequate, the personnel identified in the Relevant Project Contacts section will immediately implement additional measures to protect receiving waters. Where appropriate, additional contingency measures are not limited to those mentioned. This plan recognizes the obligation to employ all known and reasonable methods of prevention, control and treatment (AKART) to prevent pollution of the waters of the State of Washington. Appropriate BMPs to prevent erosion and sedimentation, and identify, reduce, eliminate or prevent water pollution associated with construction activities will be implemented. BMPs utilized for this project, and methodologies for their proper installation are found in the 2024 Stormwater Management Manual for Western Washington (updated 2024). See link below:

Site-Specific BMPs

BMPs and methodologies found in the 2024 [Stormwater Management Manual for Western Washington](#) (or most recent version) that may be utilized include:

BMP C101: Preserving Natural Vegetation
BMP C105: Stabilized Construction Entrance / Exit
BMP C107: Construction Road/Parking Area Stabilization
BMP C151: Concrete Handling
BMP C162: Scheduling
BMP C233: Silt Fence (potential)
BMP C235: Wattles
BMP C236: Vegetative Filtration

Though the SWMMWW is generally associated with upland construction work, these BMPs are effective when used as protection for in-or-near water work.

BMPs, details, and installation guidelines found in WSDOT's [Best Management Practices, Regional Road Maintenance Program List of BMPs](#), and [Best Management Practices Field Guide for ESA § 4 \(d\) Habitat Protection](#) that may be utilized for in-or-near water work include:

Coir Log
Silt Fence (potential)
Straw Log

See attached maps for proposed locations of actions, BMPs and monitoring compliance points.

Specific Work Areas/Activities

1. Installation of BMPs

Location of Activities and Associated BMPs

See Figures 1 through 3.

Description of Activities:

Prior to construction, BMPs will be implemented to protect waters of the state from potential discharge and/or wastewater runoff. Adaptive management of BMPs will occur throughout actions as necessary to maintain state water quality standards outlined in WAC 173-201(A).

2. Site Preparation

Location of Activities and Associated BMPs

See Figures 1 through 3

Description of Activities:

Some vegetation management may be necessary to create a stabilized construction access so the contractor can navigate the drilling rig down to the lower abutments. This would require very minimal clearing of grass and or small trees (less than 6 inches diameter at breast height) and all vegetation material would be taken off site and kept out of waters of the state. Natural vegetation will be preserved when possible.

3. Drawing Lake Water

Location of Activities and Associated BMPs

See Figures 1 through 3

Description of Activities:

A pump will be used to draw water at a rate of 5 gpm to the drilling rig. This project will use approximately 2,000 gallons of water a day and 100,000 gallons total. A fish screen will be placed on the pump's intake to ensure no fish are entrapped in the pump. No water quality BMPs are anticipated to pump the water.

4. Pilot Hole Drilling

Location of Activities and Associated BMPs

See Figures 1 through 3.

Description of Activities:

Drilling will take place in 10 different locations on/near the dam. Nine boreholes will occur in the wing walls, and one on the right abutment of the dam. Wattles (potentially plastic lined) will be used to surround the drilling area to contain any process water that comes out of the top of the borehole. An additive called EZ-Mud Plus may be added to the process water to increase viscosity which will aid in removing the process water from the borehole via a pump. The drilling system

is a contained system that uses pressure to both add and remove water during the drilling process and is designed to prevent process water from leaving the borehole. BMPs such as wattles or straw logs will be deployed around the drilling area. Leaks in the process water disposal route will be addressed as they arise. Process water is not anticipated to enter waterbodies of the state, however, if a discharge event occurs, work will temporarily stop until the source of discharge can be identified and remediated.

5. Disposal of Process Water

Location of Activities and Associated BMPs

See Figures 1 and 2.

Description of Activities:

Process water will be held in 55-gallon barrels. The water in the barrels will be tested with pH strip technology. If the pH reading is between 6.5 to 8.5, the water will be disposed in a forested/grassy area upland of the right bank abutment via a sprinkler system. Tacoma Power will take advantage vegetative filtration to filter the water and allow it to disperse into the ground. The sprinklers will stay in the same area as much as possible but may be moved as needed to ensure no area is over-inundated by process water. Water that does not meet the 6.5 to 8.5 pH requirement will be hauled offsite for disposal.

6. Drilling Anchor Holes

Location of Activities and Associated BMPs

See Figures 1 and 2.

Description of Activities:

Anchor holes will be drilled using air based methods. No water will be required for this method. Once the anchor holes are drilled, they will be water tested to ensure watertightness. If they are not water tight, they may be redrilled or grouted to ensure water tightness. Necessary BMPs such as wattles or straw logs will be installed around the holes during testing if necessary and water used for testing will be disposed of through the established sprinkler system as long as it meets the 6.5 to 8.5 pH criteria.

7. Anchor Installation

Location of Activities and Associated BMPs

See Figures 1 through 3.

Description of Activities:

A spud barge may be installed in the water near lake Cushman and a crane will be installed on top of the barge once it is secured. The barge will not be dragged along the shoreline and will not be moved while the spuds are down. A spill kit will be kept on or near the barge in the case of spill and proper secondary containment will be present on the barge.

8. Site Demobilization

Location of Activities and Associated BMPs

See Figures 1 through 3.

Description of Activities:

When the drilling locations are stabilized BMPs such as plastic lining or wattles will be left in place until the cement-bentonite grout is cured. Once grout is cured all BMPs will be removed from the action area.

Site Inspections

Daily site monitoring, weekly documented site inspections and/or any other required monitoring will be led by a qualified individual (CESCL) designated by Tacoma Power. A site inspections log will be kept on site when the site is in use. Any required monitoring will be logged and kept on site. The qualified individual will examine discharge for the presence of suspended sediment, turbidity and discoloration. Pictures will be taken if a turbid or potentially pH altering discharges to waters of the state and will be documented in the site inspections logbook. They will evaluate and document the effectiveness of the installed BMPs and determine if repair or replacement of any BMP is warranted to improve the quality of project discharge. New BMPs and design changes will be updated in the WQPP and communicated to Ecology by the qualified individual within seven days.

Monitoring Methodology

WSDOT typically samples for turbidity, pH, and sheen. Sheen is not physically sampled, just visually observed. If your in-water work occurs within a 303(d) listed water body or has a Total Maximum Daily Load (TMDL) established by Ecology (<https://fortress.wa.gov/ecy/approvedwqa/ApprovedSearch.aspx>), you may need to implement specific BMPs and sample for additional parameters. Projects that receive additional permit conditions or sampling requirements, such as those for 303(d) or TMDL-listed water bodies or contaminated sites, should coordinate with their region environmental office or the Headquarters Environmental Services Office for assistance with incorporating additional sampling parameters and procedures into their protocols. Contact the TMDL Lead for assistance with 303(d) and TMDL-related permit conditions.

Rivers and streams require a sampling location upstream and downstream of the in- water work. The upstream sample determines the background value, and the downstream sample reveals the effect of the work on water quality (by comparing it to the background). Locate and clearly name the sampling points on a map and in the field according to the following:

- Upstream (Background) – Typically, 100 feet upstream of construction activities. The key consideration for determining a background sample location is that it has to be outside the area of influence from the project. Be mindful of water quality influences that may occur between your background sample location and the in-water activity that could affect your sample readings (e.g., outfalls, tributaries, etc.); and
- Downstream – locate the point of compliance downstream of the construction activity based on the parameters for which you will be sampling. Remember that there is no area of mixing for pH. Use the area of mixing granted in the standards (based on the velocity of the water (cubic feet per second) at the time of construction), or the area of mixing granted in the 401 Certification to determine the compliance point for turbidity.

- Visual turbidity monitoring will be employed during dredging actions. Per WAC 173-201A-200 (1)(e), a temporary area of mixing shall be as follows:
 - (iii) For waters above 100 cfs flow at the time of construction, the point of compliance shall be 300 feet downstream of the activity causing the turbidity exceedance.
 - (iv) For projects within or along lakes, ponds, wetlands, or other non-flowing waters, the point of compliance shall be at a radius of one hundred fifty feet from the activity causing the turbidity exceedance.

Applicable project criteria and information:

Aquatic Life Use Category: Char Spawning and Rearing

Aquatic Life Turbidity Criteria in Freshwater: 5 NTU over background when the background is 50 NTU or less; or A 10 percent increase in turbidity when the background turbidity is more than 50 NTU.

Flow at time of construction: Lake and/or greater than 100 cfs.

Temporary area of mixing for turbidity: 150 foot radius or 300 feet downstream.

Aquatic Life pH Criteria in Freshwater: pH shall be within the range of 6.5 to 8.5, with a human-caused variation within the above range of less than 0.2 units.

Points of compliance

pH Monitoring

Process water from the drilling will be tested with a hand held electronic pH meter. Each 55-gallon drum will be tested the results will determine whether the water can be discharged at an upland location or if the barrel must be hauled off site for disposal.

Turbidity Monitoring

For near- or in-water work, compliance points for each of the actions are illustrated in Figures 2 and 3 and defined as follows:

1) Drilling

Turbidity Compliance Points:

- 150-foot radius for drilling in dam
- 300 feet downstream of the dam in the riverine section

Visual turbidity monitoring will be performed throughout drilling actions. Lake Turbidity will be observed from the dam. If there appears to be a turbid discharge in the river downstream of the powerhouse, turbidity can be observed from a trail or from the deck of the powerhouse. If a visible turbidity plume is observed at a point of compliance, it will be documented on a site inspection form/logbook, actions will be suspended and Ecology's SWRO Federal Permit Coordinator, Andrew Luymes, will be notified. Work stoppage will continue until the turbidity plume has completely dissipated and no visual difference in turbidity is perceived. A

visible plume is defined as any difference between upstream of the action location and at the downstream compliance points. See attached list of contacts below.

Site Inspections

Daily site monitoring/inspections and any other required monitoring will be led by a qualified individual designated by Tacoma Power. A site monitoring/inspections log containing monitoring/inspection data (including tables) and comments will be kept on site at all times along with this WQPP. The qualified individual will examine discharge for the presence of suspended sediment, turbidity and discoloration. They will evaluate and document in the monitoring/inspection log the effectiveness of the installed BMPs and determine if repair or replacement of any BMP is warranted to improve the quality of project discharge. Any major changes to the WQPP and associated BMPs will be reviewed with Ecology.

Site Maps

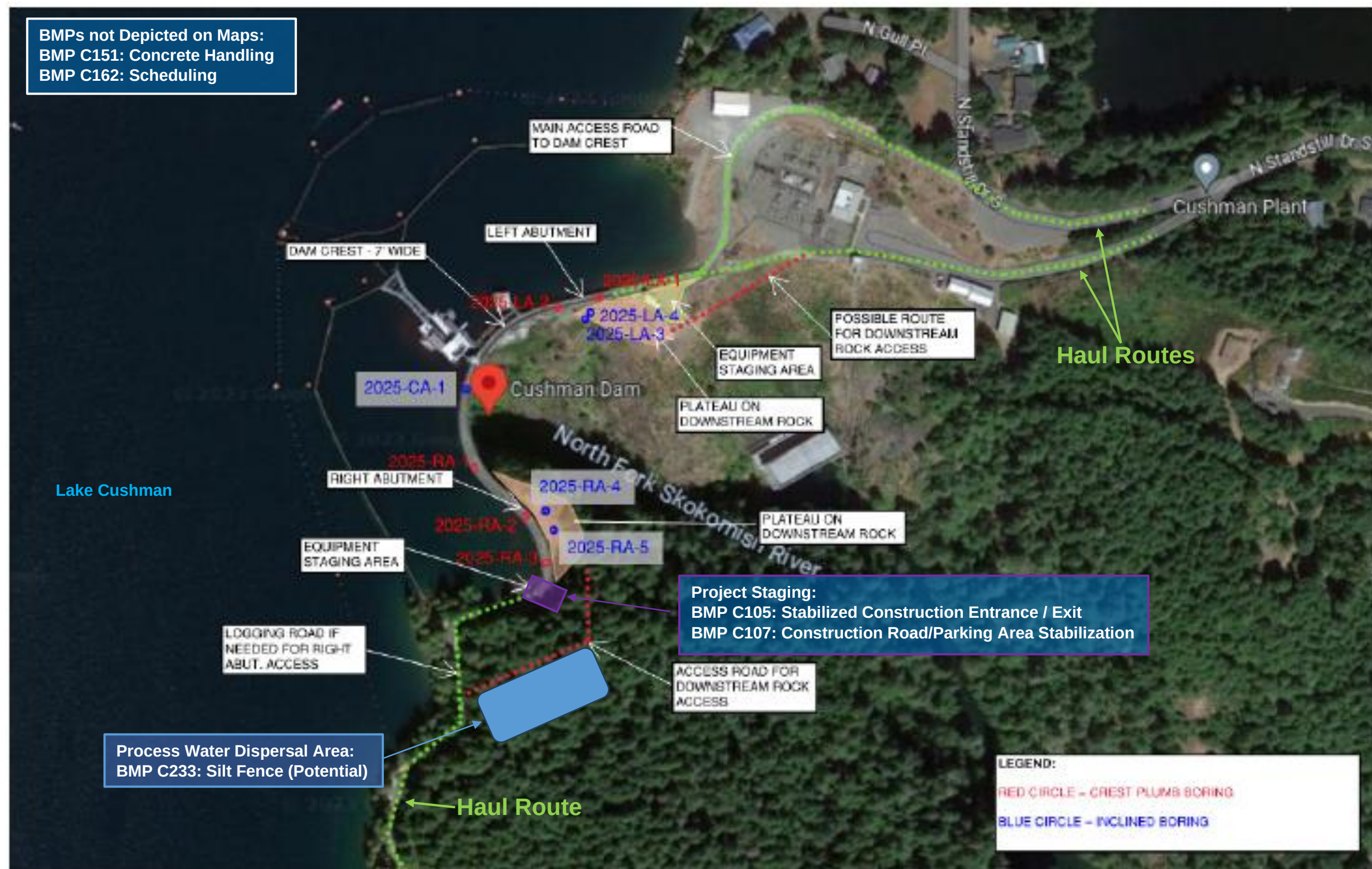


Figure 5-1: Proposed Boring Plan

Figure 1. Locations of project actions for Cushman Dam No. 1 Anchoring and BMPs.

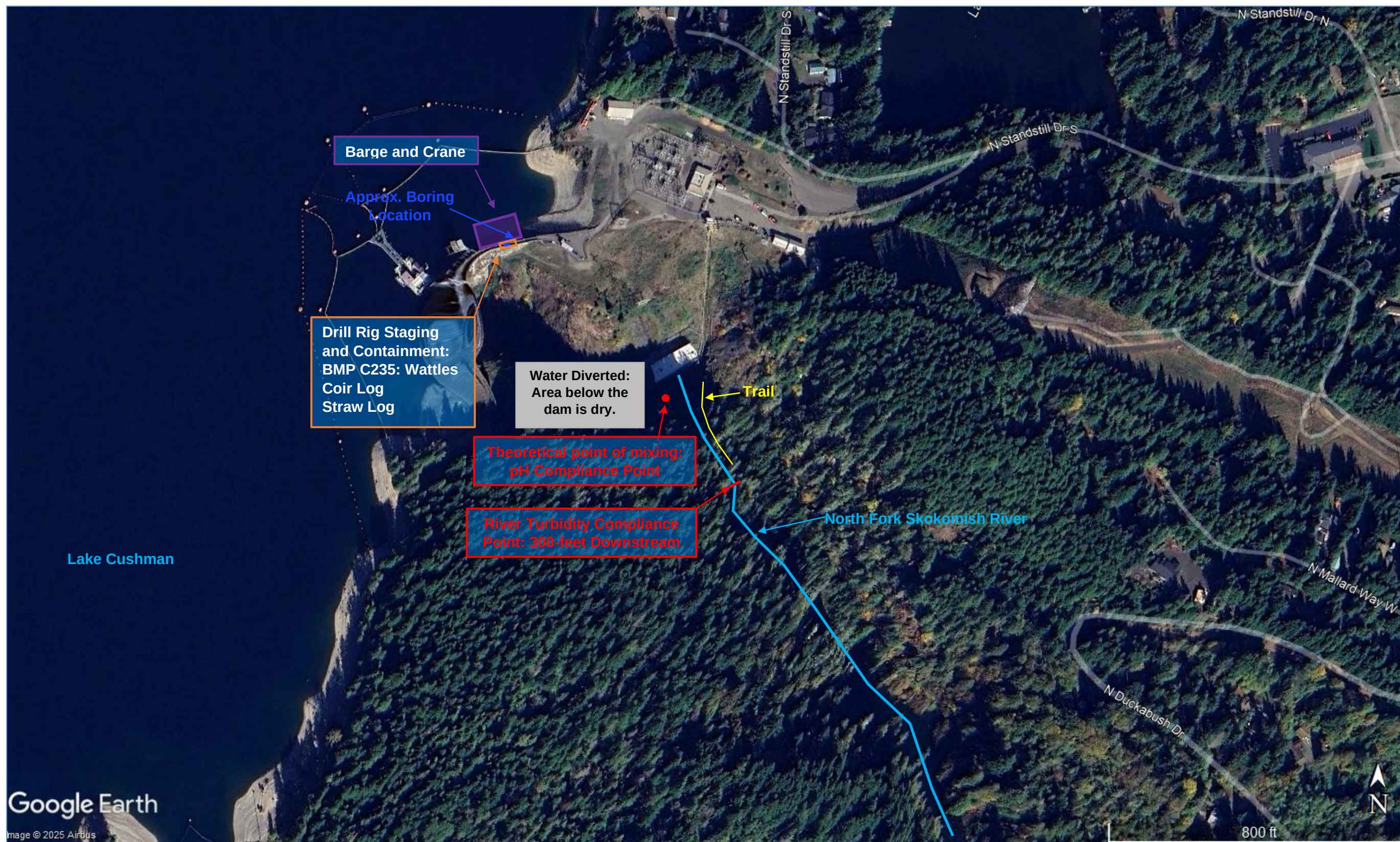


Figure 2. Cushman Dam No. 1 Anchoring BMPs, visual turbidity and pH compliance monitoring locations.



Figure 3. Cushman Dam No. 1 Anchoring locations of actions, visual turbidity and pH compliance monitoring locations.

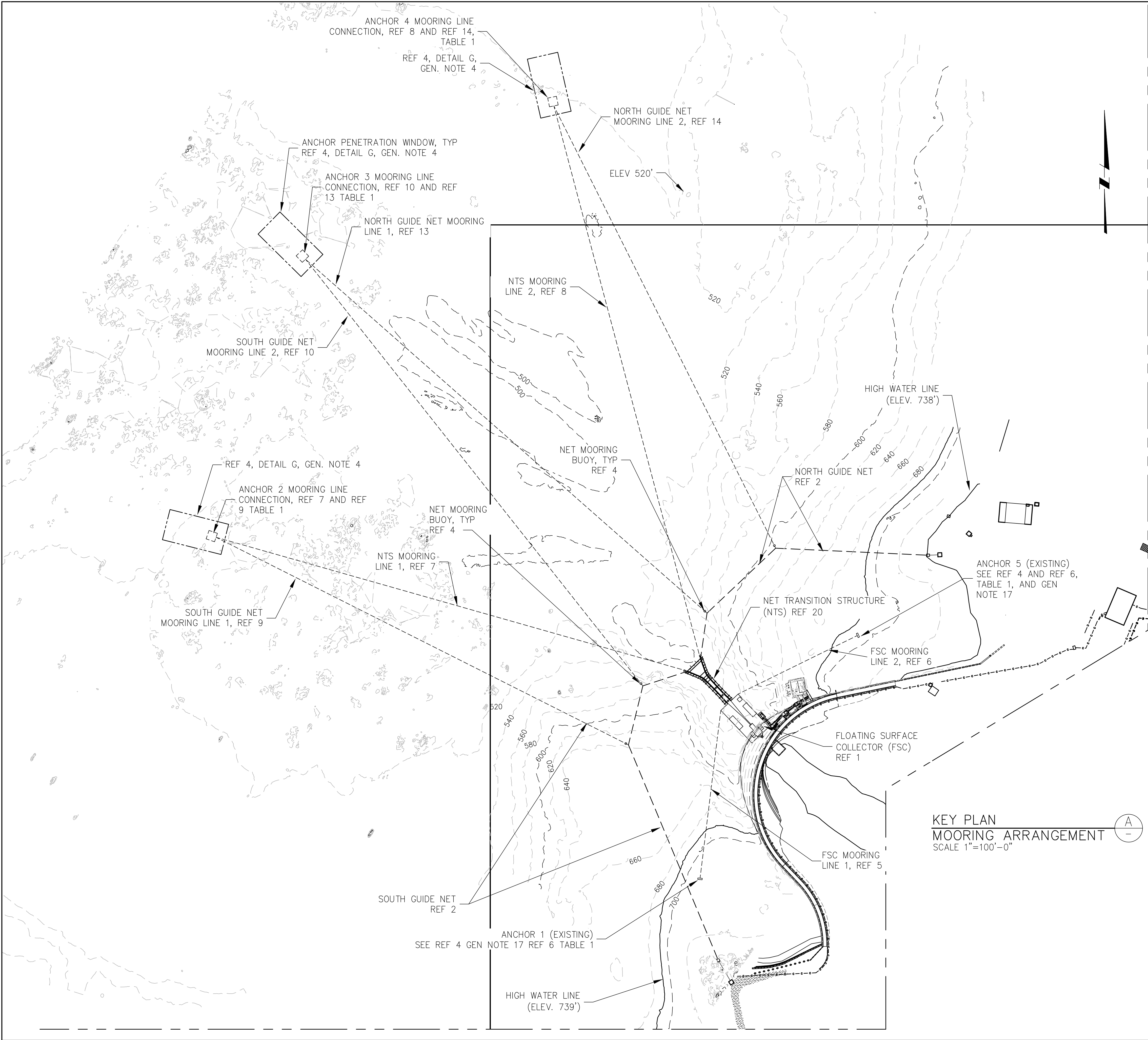
Relevant Project Contacts

Table 1. Project contacts for dredging maintenance actions associated with the Cushman Dam No. 1 Anchoring.

Title	Name	Phone Contact	Email Contact
Permitting Lead	Benjamin Caviness	Cell: 253-888-5412	bcaviness2@tacoma.gov
Ecology Contact	Andrew Luymes	N/A	Aluy461@ecy.wa.gov
WDFW Contact	Will Robinson	Office: 360-890-5912	William.Robinson@dfw.wa.gov
Emergency Site Contact	Justin Davis	Cell: 253.677.0488 Office: 253.779.7206	JEDavis@tacoma.gov
Project Manager	Kevin Smith	Office: 253-514-5660	kesmith@tacoma.gov
Environmental Response Tracking system (ERTS)	N/A	360-407-6300	N/A

APPENDIX I

FSC Mooring Arrangement



KEY PLAN
MOORING ARRANGEMENT
SCALE 1"=100'-0"

GENERAL SHEET NOTES

1. SEE REF 4 FOR MOORING SYSTEM GENERAL NOTES.

REFERENCES

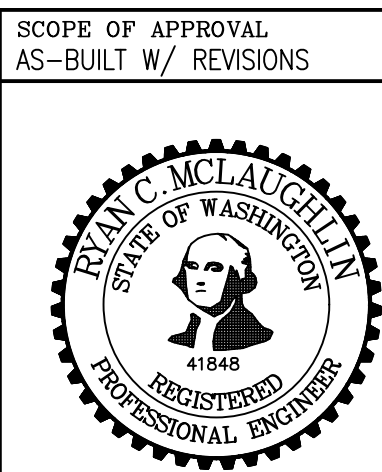
- | | | |
|-----|----------|---|
| 1. | 5-S00.01 | NOT USED |
| 2. | 3-S01.01 | GUIDE NET SITE PLAN |
| 3. | | NOT USED |
| 4. | 2-S01.02 | MOORING ARRANGEMENT. TYPICAL DETAILS |
| 5. | 2-S01.03 | MOORING ARRANGEMENT. FSC MOORING LINE 1 ELEV. |
| 6. | 2-S01.04 | MOORING ARRANGEMENT. FSC MOORING LINE 2 ELEV. |
| 7. | 2-S01.05 | MOORING ARRANGEMENT. NTS MOORING LINE 1 ELEV. |
| 8. | 2-S01.06 | MOORING ARRANGEMENT. NTS MOORING LINE 2 ELEV. |
| 9. | 2-S01.07 | MOORING ARRANGEMENT. SOUTH GUIDE NET LINE 1 |
| 10. | 2-S01.08 | MOORING ARRANGEMENT. SOUTH GUIDE NET LINE 2 |
| 11. | 2-S01.09 | NOT USED |
| 12. | 2-S01.10 | NOT USED |
| 13. | 2-S01.11 | MOORING ARRANGEMENT. NORTH GUIDE NET LINE 1 |
| 14. | 2-S01.12 | MOORING ARRANGEMENT. NORTH GUIDE NET LINE 2 |
| 15. | 2-S01.13 | GUIDE NET ANCHOR DETAILS - 1 |
| 16. | 2-S01.14 | GUIDE NET ANCHOR DETAILS - 2 |
| 17. | 2-S01.15 | NOT USED |
| 18. | 2-S01.16 | NOT USED |
| 19. | 2-S01.17 | GUIDE NET AND FSC MOORING SITE PLAN |
| 20. | 4-S01.01 | NET TRANSITION STRUCTURE TOP PLAN |

1	12/4/2015	AS-BUILT W/ REVISIONS	KAJ		RCM
0	1/14/2014	FOR CONSTRUCTION	JXB	MEJ	SDH
NO.	DATE	REVISION DESCRIPTION	DRAWN	CHECKED	STAMPED

CITY OF TACOMA
DEPARTMENT OF PUBLIC UTILITIES
LIGHT DIVISION

CUSHMAN NO. 1 DAM
FLOATING SURFACE COLLECTOR
MOORING ARRANGEMENT
KLEY PLAN

DESIGNED SDH	FIELD BOOK
REVIEWED RYAN C. McLAUGHLIN	
APPROVED DAVID L. HAMMOND SUPERVISING ENGINEER	1/14/2015 DATE AS SHOWN SCALE
APPROVED STEVEN H. FISCHER APPROVING ENGINEER	DRAWING NO. BP2809 SHEET OF 2-S01.01



SCOPE OF APPROVAL
AS-BUILT W/ REVISIONS

DRAWN
KAJ

CHECKED

REV. NO.
1