

Condit Hydroelectric Project Decommissioning
FERC Project No. 2342

NORTHWESTERN LAKE BRIDGE STABILIZATION DESIGN & OVERVIEW



Prepared by



Prepared for



February 17, 2011

1 INTRODUCTION

1.1 PROJECT DESCRIPTION

PacifiCorp Energy owns and operates the Condit Hydroelectric Project, which was completed in 1913 on the White Salmon River in Skamania County and Klickitat County, Washington. The project is regulated by the Federal Energy Regulatory Commission (FERC) as project number 2342. The project is located approximately 3.3-miles upstream from the confluence of the White Salmon and Columbia Rivers. Project facilities consist of a 125-foot high, 471-foot long concrete gravity diversion dam, an intake structure that directs water into a 13.5-foot diameter by 5,100-foot long wood stave flowline, and through a 40-foot diameter concrete surge tank. The flowline bifurcates inside the surge tank into two 9-foot diameter penstocks that supply water to the powerhouse. The powerhouse contains two double horizontal Francis turbines with an installed capacity of 14,700 kilowatts. The project creates a reservoir, Northwestern Lake, which extends 1.8-miles upstream of the dam and covers approximately 92 acres. The project area is shown in Figure 1-1.

1.2 BACKGROUND

In 1968, a new license was issued by the Federal Energy Regulatory Commission for a 25-year term, which expired on December 31, 1993. In 1991, PacifiCorp Energy filed an application with the FERC for a new license authorizing the continued operation and maintenance of the project. PacifiCorp Energy has since been operating the project pursuant to annual licenses, pending determination by the FERC on the status of PacifiCorp Energy's new license issuance. In 1996, the FERC issued a Final Environmental Impact Statement (FEIS) that analyzed the environmental and economic effects of various relicensing alternatives for the project. The FEIS included a recommendation to approve licensing with mandatory conditions, including provisions for establishing fish passage facilities at the project.

PacifiCorp Energy evaluated the economic impacts of the FERC recommendations contained within the FEIS and determined that the mandatory conditions would render the project uneconomic to operate. In 1997, PacifiCorp Energy requested a temporary abeyance of the relicensing procedure in order to investigate the feasibility of various removal alternatives in collaboration with project stakeholders. PacifiCorp Energy and project stakeholders then commissioned the consulting firm of R.W. Beck, Incorporated, to evaluate removal alternatives. In 1998, R.W. Beck, Incorporated, prepared a summary report of project removal engineering considerations that identified the preferred method and schedule for project removal as well as the expected costs and associated environmental and permit issues. In 1999, the Condit Settlement Agreement was signed by PacifiCorp Energy and project stakeholders to resolve all issues in the proceeding for relicensing the project. The Settlement Agreement provides for project removal upon the expiration of an extended license term in accordance with the preferred method identified in the R.W. Beck, Incorporated, summary report.



Database Management
Geographic Information Systems

Data are projected in UTM Zone 10, NAD83, meters.

PacifiCorp GIS collects data from a variety of government and private sources. PacifiCorp makes no warranty as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. For complete validation, the source organization should be contacted or source documents consulted to verify the findings of this product.

In 2002, the FERC prepared a Final Supplemental FEIS addressing project removal, which updated the 1996 FEIS and fully assessed the effects associated with approval and implementation of the Condit Settlement Agreement.

1.3 PROJECT REMOVAL DESCRIPTION

PacifiCorp Energy proposes to remove the project in accordance with the Condit Settlement Agreement. Prior to removing the dam, PacifiCorp Energy will complete work to relocate the City of White Salmon's water supply line that crosses the reservoir and will address potential impacts to the Northwestern Lake Bridge, owned by Klickitat County.

The proposed method for dam removal involves removing sediment and debris immediately upstream from the dam and then drilling and blasting a 12-foot by 18-foot drain tunnel in the base of the dam to within a few feet of the dam's face. The remainder of the tunnel will be blasted to drain the reservoir and flush impounded sediments out of the reservoir as rapidly as possible. Following the final tunnel blast, the drain tunnel will discharge at a rate of 10,000 cubic feet-per-second – approximately 25 percent of the estimated peak discharge during the February 1996 flood event on the White Salmon River. This will drain the reservoir in approximately 6 hours. Rapid draining of the reservoir will mobilize the estimated 2.3-million cubic yards of sediment that have accumulated behind the dam since its construction. Previous modeling has indicated that between 1.6-million to 2.2-million cubic yards of sediment will be discharged into the White Salmon River immediately following dam removal and over a number of years as successive high flow events mobilize overbank sediments.

Once the reservoir is drained, the dam will then be excavated and removed along with the flowline, surge tank, and penstocks. Concrete from the dam will either be buried onsite or removed from the site for recycling or disposal. The powerhouse will be left intact. The upstream cofferdam in the White Salmon River present from original dam construction will be removed from the river by the following May. PacifiCorp Energy expects to complete the dam removal process within one year.

Following project removal, the irrigation water supply intake for the Mount Adams Orchard to the east of the dam will be reconfigured to accommodate removal of the dam and the loss of the reservoir.

Removal of Condit dam is expected to provide the following benefits:

- Anadromous salmonids will be provided access of up to 18 miles of White Salmon River mainstem and tributary habitats that have been inaccessible since the early 1990s. Restoration of natural runs of anadromous fish upstream of the project dam is consistent with the fishery management goals of the National Marine Fisheries Service, U.S. Fish and Wildlife Service, Washington Department of Fish and Wildlife, and the Yakama Nation.
- Dam removal offers the greatest potential for full utilization of anadromous fish habitat, including habitat inundated by Northwestern Lake, and therefore, full restoration of anadromous salmonids within the White Salmon River basin.

- Dam removal will benefit wildlife dependent upon anadromous fish in the area of the river reach upstream of RM 3.3.
- Dam removal will provide increased whitewater recreation opportunities. Whitewater recreation is an important and popular use of the White Salmon River and provides income for the local area.

2 DESIGN AND PLAN OVERVIEW

2.1 OVERVIEW

The work at the Northwestern Lake Bridge consists of new piers drilled into the river bottom with pier caps supporting the existing bridge structure. In addition, a truss system will be provided to support the City of White Salmon waterline (installed by others). Included in this package are the design drawings for the bridge work. WSDOT Standard Specifications for Road, Bridge, and Municipal Construction 2010 have been applied.

2.2 TRAFFIC CONTROL

The pier work will be accessed from the river below via barge, or from the land using a temporary trestle system. The selected bridge subcontractor will determine final access in coordination with JR Merit. Construction traffic and usage on the bridge will be limited due to recognized capacity deficiencies.

There will be times when bridge access will be limited to the public, although complete closures will be rare. Construction is scheduled to start in June and will be completed prior to the breach of Condit dam, scheduled for October.

At this time, we anticipate single lane traffic closures during the drilling operations. A complete closure, lasting approximately 24 hours, is needed to provide grout cure time for the final material placement directly under the existing pier caps (see drawings). During this time, an alternative route must be utilized, although pedestrian traffic will be allowed. Periodic closures may be required during the demolition of the existing pier structures near the end of the project.

During the full closure period, emergency vehicles will be allowed to pass if needed.

Outside of the scope of the JR Merit work is the installation of the City of White Salmon waterline. We would anticipate that the City may require at least a single lane closure as they perform their installation. We will coordinate as needed.

It is our understanding that Washington Department of Natural Resources (DNR) will offer a timber sale in May, which may generate 10 - 15 trucks per day for about (1) month, starting as early as mid-June. We will coordinate our work to accommodate the log trucks during this time.

General Traffic Control Notes:

1. Signage will be posted warning approaching traffic of the work at the bridge. Depending on the work underway, signage may indicate slow speed required, or single lane usage of the bridge.
2. Flaggers and/or signage will be provided as needed to control speed and lane closures.
3. During complete closure events, detours will be established and posted at appropriate points to reroute traffic.
4. JR Merit will coordinate with the City and County to identify and notify affected parties prior to bridge closures.
5. JR Merit will comply with all jurisdictional rules and regulations regarding traffic control.

2.3 IN-WATER ACTIVITIES

JR Merit acknowledges, and will comply with the conditions of the Washington Department of Ecology (Ecology) 401 Permit Order 8049, 4.3.1. We are exercising the Drilled Shaft Piers alternative. In synopsis, these conditions include:

1. Minimizing disturbance of vegetation.
2. Utilization of erosion control mats and silt fencing.
3. Sealed concrete forms to prevent fresh concrete spills.
4. Complete curing of concrete prior to contact with the water.
5. Concrete process/contact water or turbid dewatering water shall not be allowed direct entry into the state waters.
6. Clean dewatering water shall be discharged such that it does not cause erosion or scour of the channel, banks or vegetation.
7. No flocculants shall be used for treatment of turbid water without prior authorization from Ecology.

In addition, JR Merit will install a floating silt curtain to control in-water sediment and a spill containment boom will be installed as a preventative measure.

2.4 INSPECTIONS AND RECORD KEEPING

Klickitat County will rely on the PacifiCorp Energy Owner's Engineer for approvals during the course of the work and will inspect the work at the county's whim. The following documents will be made available for Klickitat County's records:

- Material certifications
- Bills of lading
- Test results
- Inspection reports
- Record drawings.

SPECIAL PROVISIONS TABLE OF CONTENTS

A. Shafts

Prepared by
Black & Veatch
In Consultation with



February 2, 2011

A. SHAFTS

Description

1.01 Shafts

- A. This item of work shall consist of furnishing all materials, labor, tools, equipment, services and incidentals necessary to construct the shafts in accordance with the Plans, the Standard Specifications, and the Special Provisions.

Materials

2.01 Casing

- A. All permanent casing shall be of steel base metal conforming to ASTM A 36. All permanent casing shall be of ample strength to resist damage and deformation from transportation and handling, installation stresses, and all pressures and forces acting on the casing.

All temporary casing shall be a smooth wall structure of steel base metal. All temporary casing shall be of ample strength to resist damage and deformation from transportation and handling, installation and extraction stresses, and all pressures and forces acting on the casing. The casing shall be capable of being removed without deforming and causing damage to the completed shaft, and without disturbing the surrounding soil.

- B. Permanent casing is defined as casing designed as part of the shaft structure and installed to remain in place after construction is complete. Temporary casing is defined as casing installed to facilitate shaft construction only, which is not designed as part of the shaft structure, and which shall be completely removed after shaft construction is complete, unless otherwise shown in the Plans.
- C. The casing shall be watertight and clean prior to placement in the excavation.
- D. The outside diameter of the casing shall not be less than the specified diameter of the shaft. The inside diameter of the casing shall not be greater than the specified diameter of the shaft plus six inches, except as otherwise noted for shafts 5'-0" or less in diameter, and as otherwise noted in subsection 3.03.C of this Special Provision for temporary telescoping casing. The inside diameter of casings for shafts 5'-0" or less in diameter shall not be greater than the specified diameter of the shaft plus 1'-0".
- E. Where the minimum thickness of the casing is specified in the Plans, it is specified to satisfy structural design requirements only. The Contractor shall increase the casing thickness as necessary to satisfy the requirements of item A of this section.

2.02 Reinforcing Steel

- A. Reinforcing steel used in the construction of shafts shall conform to Section 9-07.
- B. Steel reinforcing bar centralizers shall be used to center the shaft and rock socket cages.

2.03 Concrete

- A. Concrete used in the construction of shafts shall be Class 4000P conforming to Section 6-02.
- B. When shafts are constructed in water, the concrete used for the casing shoring seal shall be Class 4000W conforming to Section 6-02.

2.04 Slurry

Slurry shall conform to one of the following:

A. Mineral Slurry

1. Mineral slurry shall conform to the following requirements:

Property	Test	Requirement
Density (pcf)	Mud Weight (Density) API 13B-1, Section 1	64.3 to 75
Viscosity (seconds/quart)	Marsh Funnel and Cup API 13b-1, Section 2.2	26 to 50
PH	Glass Electrode, pH Meter, or pH Paper	8 to 11
Sand Content (percent)	Sand API 13B-1, Section 5	
-prior to final cleaning		4.0 max.
-immediately prior to placing concrete		4.0 max.

Use of mineral slurry in salt water installations will not be allowed.

Slurry temperature shall be at least 40F when tested.

B. Synthetic Slurries

1. Synthetic slurries shall be used in conformance with the manufacturer's recommendations and these Special Provisions. The following synthetic slurries are approved as slurry systems, with additives that have been load tested for the California Department of Transportation:

Product	Manufacturer
Novagel	Geo-Tech Services, LLC 220 North Zapata Highway, Suite 11A Laredo, TX 78043-4464
ShorePac GCV	CETCO 1500 West Shure Drive Arlington Heights IL, 60004
SlurryPro CDP	KB International, LLC Suite 216, 735 Broad Street Chattanooga, TN 37402-1855
Super Mud*	PDS Company 8140 East Rosecrans Ave. Paramount, CA 90723-2754

*Approval as a product applies to the liquid product only.

Other synthetic slurry products may be approved for use provided the product meets the acceptance criteria established by WSDOT, including status as an approved synthetic slurry (with load tested additives) with the California Department of Transportation (Caltrans).

2. The sand content of synthetic slurry prior to final cleaning and immediately prior to placing concrete shall be less than 2.0 percent, in accordance with API 13B-1, Section 5.

C. Water Slurry (with or without site soils)

1. Water with or without site soils may be used as slurry when casing is used for the entire length of the drilled hole.
2. Water slurry shall conform to the following requirements:

Property	Test	Requirement
Density (pcf)	Mud Weight (Density) API 13B-1, Section 1	65 max.
Sand Content (percent)	Sand API 13B-1, Section 5	1.0 max.

Use of water slurry in salt water installations will not be allowed.

Slurry temperature shall be at least 40F when tested.

2.05 Access Tubes for Crosshole Sonic Log Testing

- A. Access tubes for crosshole sonic log testing shall be steel pipe of 0.145 inches minimum wall thickness and at least 1-1/2 inch inside diameter.
- B. The access tubes shall have a round, regular inside diameter free of defects and obstructions, including all pipe joints, in order to permit the free, unobstructed passage of 1.3 inch maximum diameter source and receiver probes used for the crosshole sonic log tests. The access tubes shall be watertight, free from corrosion with clean internal and external faces to ensure good bond between the concrete and the access tubes. The access tubes shall be fitted with watertight threaded PVC caps on the bottom, and shall be fitted with watertight PVC caps, secured in position on the top.

2.06 Grout

- A. Grout for filling the access tubes at the completion of the crosshole sonic log tests shall be a neat cement grout conforming to Section 9-20.3 with a maximum water/cement ratio of 0.45.

Construction Requirements

3.01 Quality Assurance

A. Shaft Construction Tolerances

1. Shafts shall be constructed so that the center at the top of the shaft is within the following horizontal tolerances:

<u>Shaft Diameter</u>	<u>Tolerance</u>
Less than or equal to 2'-0"	3"
Greater than 2'-0" and less than 6'-0"	3"
6'-0" or larger	6"

2. Shafts shall be within 1.5 percent of plumb. For rock excavation, allowable tolerance can be increased to 2 percent max.
3. During drilling or excavation of the shaft, the Contractor shall make frequent checks on the plumbness, alignment, and dimensions of the shaft. Any deviation exceeding the allowable tolerances shall be corrected.
4. Shaft steel reinforcing bar placement tolerances shall conform to Section 6-02.3(24)C.

B. Nondestructive Testing of Shafts

1. Unless otherwise specified in this Special Provision, the contractor will perform crosshole sonic log testing of specific shafts, except for those constructed completely in the dry, selected in accordance with subsection 3.09.A of this Special Provision. The Contractor shall furnish and install access tubes in accordance with subsection 3.06 of this Special Provision.

C. Shaft Preconstruction Conference

1. A shaft preconstruction conference shall be held at least five working days prior to the Contractor beginning any shaft construction work at the site to discuss construction procedures, personnel, and equipment to be used, and other elements of the approved shaft installation plan as specified in subsection 3.01.D of this Special Provision. Those attending shall include:
 - a. (representing the Contractor) The superintendent, on site supervisors, and all foremen in charge of excavating the shaft, placing the casing and slurry as applicable, placing the steel reinforcing bars, and placing the concrete. If synthetic slurry is used to construct the shafts, the slurry manufacturer's representative or approved Contractor employees trained in the use of the synthetic slurry shall also attend.
 - b. (representing the Bridge Owner) The Bridge Owner's Representative, key inspection personnel, and representatives from Klickitat County.
2. If the Contractor proposes a significant revision of the approved shaft installation plan, as determined by the Engineer, an additional conference shall be held before any additional shaft construction operations are performed.

D. Submittals

1. Shaft Installation Plan
 - a. The contractor shall submit a shaft installation plan for approval to the Engineer and Bridge Owner a minimum of 4 weeks prior to

beginning construction of the shafts. At a minimum, the shaft installation plan shall include:

1. Name, address and phone number of shaft installation contractor and a list of experience related to this project in the past 5 years.
2. Names phone numbers of key workers and their relevant experience.
3. Name, address and phone number of the supplier of each of the materials listed in Section 2 of this Special Provision.
4. Sampling frequencies and quantities of each of the materials listed in Section 2 of this Special Provision as recommended by the material manufacturer.
5. Names, phone numbers and addresses of the company(ies) that the contractor will use to conduct the materials testing.
6. Names, phone numbers and addresses of the company that the contractor will use to conduct the cross hole sonic logging testing of the shafts.
7. Slurry disposal plan
8. Plans for field modifications of casing and reinforcing cage in the event that suitable rock is encountered higher or lower than the anticipated elevation shown in the plans.
9. Bracing or other Plans for ensuring the proper placement of the drilled shaft
10. Any deviations from the project plans

2. Testing Results

- a. The contractor shall submit results of the tests performed to the Engineer and Bridge Owner within 24 hours of receipt of the test results.

3.02 Shaft Excavation

A. Excavation

1. Shafts shall be excavated to the required depth as shown in the Plans. Shaft excavation operations shall conform to this Special Provision. Once the

excavation operation has been started, the excavation shall be conducted in a continuous operation until the excavation of the shaft is completed, except for pauses and stops as noted, using approved equipment capable of excavating through the type of material expected. Pauses during this excavation operation, except for casing splicing, tooling changes, slurry maintenance, and removal of obstructions, are not allowed.

Pauses, defined as momentary interruptions of the excavation operation, will be allowed only for casing splicing, tooling changes, slurry maintenance, and removal of obstructions. Shaft excavation operation interruptions not conforming to this definition shall be considered stops. Stops for uncased excavations (including partially cased excavations) shall not exceed 16 hours duration. Stops for fully cased excavations, excavations in rock, and excavations with casing seated into rock, shall not exceed 65 hours duration.

During stops, the Contractor shall stabilize the shaft excavation to prevent bottom heave, caving, head loss, and loss of ground. The Contractor bears full responsibility for selection and execution of the method(s) of stabilizing and maintaining the shaft excavation, in accordance with Section 1-07.13.

If slurry is present in the shaft excavation, the Contractor shall conform to the requirements of subsection 3.04.B of this Special Provision regarding the maintenance of the slurry and the minimum level of drilling slurry throughout the stoppage of the shaft excavation operation, and shall recondition the slurry to the required slurry properties in accordance with subsection 3.04 of this Special Provision prior to recommencing shaft excavation operations.

2. The contractor shall perform exploratory shaft excavation below the bottom elevations shown on the plans. The contractor shall extend rock socket or drilled shaft tip elevations if the material encountered during this exploratory excavation is unsuitable or differs from that anticipated in the design of the drilled shaft.

The contractor shall take one 2.0 inch minimum diameter rock core at each drilled shaft location to determine the bedrock elevation and the character of the material directly below the completed shaft excavation. The cores shall be taken to a minimum of 10 feet below the bottom of the rock socket. Rock core samples shall be measured, visually identified and described on the contractor's log. The samples shall be placed in suitable containers, identified by shaft location and elevation, and made available to the Engineer.

- B. The casing shall be advanced prior to or concurrently with the excavation. Excavation in advance of the casing tip shall not exceed 5 feet, except that in no case shall shaft excavation and casing placement extend below the bottom of shaft excavation as shown in the Plans.

To maintain stable excavations and to facilitate construction, the Contractor may furnish and install temporary casing in addition to the required casing specified above. The Contractor shall provide temporary casing at the site in sufficient quantities to meet the needs of the anticipated construction method.

- C. Where the acceleration coefficient used for seismic design of the structure, as specified in the General Notes of the structure Plans, is less than or equal to 0.16, the Contractor may use temporary telescoping casing for the shafts at any bridge intermediate or interior pier, subject to the following conditions:
 - 1. The Contractor shall submit the request to use temporary telescoping casing to the Owner for approval. The request shall specify the diameters of the temporary telescoping casing, and shall specify the shafts where use is requested. The Contractor shall not proceed with the use of temporary telescoping casing until receiving the Engineer's approval.
 - 2. The minimum diameter of the shaft shall be as shown in the Plans.
 - 3. The temporary telescoping casing shall conform to subsections 2.01.A, 2.01.B, 2.01.C, and 2.01.E of this Special Provision.
- D. The Contractor shall conduct casing installation and removal operations and shaft excavation operations such that the adjacent soil outside the casing and shaft excavation for the full height of the shaft is not disturbed. Disturbed soil is defined as soil whose geotechnical properties have been changed from those of the original in-situ soil, and whose altered condition adversely affects the structural integrity of the shaft foundation.
- E. The Contractor shall use appropriate means such as a cleanout bucket or air lift to clean the bottom of the excavation of all shafts. No more than 2 inches of loose or disturbed material shall be present at the bottom of the shaft just prior to placing concrete.
- F. The excavated shaft shall be inspected prior to proceeding with construction. The bottom of the excavated shaft shall be sounded with an airlift pipe, a tape with a heavy weight attached to the end of the tape, or other means to determine that the shaft bottom meets the requirements in the Contract.
- G. When obstructions are encountered, the Contractor shall notify the Engineer promptly. An obstruction is defined as a specific object (including, but not limited to, boulders, logs, and man made objects) encountered during the shaft excavation operation which prevents or hinders the advance of the shaft excavation. When efforts to advance past the obstruction to the design shaft tip elevation result in the rate of advance of the shaft drilling equipment being significantly reduced relative to the rate of advance for the portion of the shaft excavation in the geological unit that contains the obstruction, then the Contractor shall remove, break-up, or push aside the obstruction. The method of dealing with such obstructions, and the continuation of excavation shall be as proposed by the Contractor and approved by the Engineer.

- H. When permanent casing is specified, excavation shall conform to the specified outside diameter of the shaft. After the casing has been filled with concrete, all void space occurring between the casing and shaft excavation shall be filled with a material which approximates the geotechnical properties of the in-situ soils.
- I. Drilling equipment shall not be operated from an existing bridge.
- J. When shafts are constructed in water, the permanent casing may extend to the elevation shown on the plans.
- K. The Contractor shall use slurry, in accordance with subsection 3.04 of this Special Provision, to maintain a stable excavation during excavation and concrete placement operations once water begins to enter the shaft excavation at an infiltration rate of 12 inches of depth or more in one hour and remain present at a three inch depth or greater.

3.03 Not used.

3.04 Slurry Installation Requirements

A. Slurry Technical Assistance

- 1. If slurry other than water slurry is used, the manufacturer's representative, shall:
 - a. provide technical assistance for the use of the slurry,
 - b. shall be at the site prior to introduction of the slurry into a drilled hole, and
 - c. shall remain at the site during the construction and completion of a minimum of one shaft to adjust the slurry mix to the specific site conditions.
- 2. After the manufacturer's representative is no longer present at the site, the Contractor's employee trained in the use of the slurry, shall be present at the site throughout the remainder of shaft slurry operations for this project to perform the duties specified in items 1a through 1c above.

B. Minimum Level of Slurry in the Excavation

- 1. When slurry is used to maintain a stable excavation, the slurry level in the excavation shall be maintained above the groundwater level the greater of the following dimensions, except as otherwise noted in subsection 3.04.B.3 of this Special Provision:
 - a. not less than five feet for mineral slurries,

- b. not less than ten feet for water slurries,
- c. not less than ten feet for synthetic slurries,
- d. one shaft diameter,
- e. dimension as required to provide and maintain a stable hole.

The Contractor shall provide casing, or other means, as necessary to meet these requirements.

- 2. The slurry level shall be maintained above all unstable zones a sufficient distance to prevent bottom heave, caving or sloughing of those zones.
- 3. Throughout all stops in shaft excavation operations, as specified in subsection 3.03.A of this Special Provision, the Contractor shall monitor and maintain the slurry level in the excavation the greater of the following elevations:
 - a. no lower than the water level elevation outside the shaft,
 - b. elevation as required to provide and maintain a stable hole.

C. Slurry Sampling and Testing

- 1. Mineral slurry and synthetic slurry shall be mixed and thoroughly hydrated in slurry tanks, ponds, or storage areas. The Contractor shall draw sample sets from the slurry storage facility and test the samples for conformance with the appropriate specified material properties before beginning slurry placement in the drilled hole. Mineral slurry shall conform to the material specifications in subsection 2.04.A of this Special Provision. Synthetic slurry shall conform to subsection 2.04.B of this Special Provision and be included in the shaft installation plan in accordance with subsection 3.01.D of this Special Provision and as approved by the Engineer. A sample set shall be composed of samples taken at mid-height and within two feet of the bottom of the storage area.
- 2. The Contractor shall sample and test all slurry in the presence of the Owner's Representative, unless otherwise directed. The date, time, names of the persons sampling and testing the slurry, and the results of the tests shall be recorded. A copy of the recorded slurry test results shall be submitted to the Owner's Representative at the completion of each shaft, and during construction of each shaft when requested by the Owner's Representative.
- 3. Sample sets of all slurry, composed of samples taken at mid-height and within two feet of the bottom of the shaft, shall be taken and tested during drilling as necessary to verify the control of the properties of the slurry. As a minimum,

sample sets of synthetic slurry shall be taken and tested at least once every four hours after beginning its use during each shift. Sample sets of all slurry shall be taken and tested at least once every two hours if the slurry is not recirculated in the drilled hole or if the previous sample set did not have consistent specified properties. All slurry shall be recirculated, or agitated with the drilling equipment, when tests show that the sample sets do not have consistent specified properties.

4. Sample sets of all slurry, as specified, shall be taken and tested prior to final cleaning of the bottom of the hole and again just prior to placing concrete. Cleaning of the bottom of the hole and placement of the concrete shall not start until tests show that the samples taken at mid-height and within two feet of the bottom of the hole have consistent specified properties.
- D. The Contractor shall clean, recirculate, de-sand, or replace the slurry to maintain the required slurry properties.
- E. The Contractor shall maintain stable conditions. If the Engineer determines that stable conditions are not being maintained, the Contractor shall immediately take action to stabilize the shaft. The Contractor shall address the problem and prevent future instability. The Contractor shall not continue with shaft construction until the damage which has already occurred is repaired in accordance with the specifications, and until receiving the Engineer's approval.
- F. When mineral slurry, conforming to subsection 2.04. A of this Special Provision, is used to stabilize the unfilled portion of the shaft, the Contractor shall remove the excess slurry buildup inside of the shaft diameter prior to continuing with concrete placement. The Contractor shall use the same methods of shaft excavation and the same diameter of drill tools to remove the excess slurry buildup as was used to excavate the shaft to its current depth.
- G. The contractor shall be responsible for the disposal of the slurry as required by the environmental permits obtained for the project and shall contain and dispose of the slurry at a waste water treatment facility or as otherwise required.

3.05 Assembly And Placement Of Reinforcing Steel

- A. The reinforcing cage shall be rigidly braced to retain its configuration during handling and construction. Individual or loose bars will not be permitted. Shaft reinforcing bar cages shall be supported on a continuous surface to the extent possible. All rigging connections shall be located at primary handling bars. Internal bracing is required at each support and lift point.
- B. The reinforcement shall be carefully positioned and securely fastened to provide the minimum clearances listed below, and to ensure that no displacement of the reinforcing steel bars occurs during placement of the concrete. The steel reinforcing bars shall be securely held in position throughout the concrete placement operation. The reinforcing

steel centralizers at each longitudinal space plane shall be placed at least at the quarter points around the circumference of the steel reinforcing bar cage, and at a maximum longitudinal spacing of either 2.5 times the shaft diameter or 20'-0", whichever is less.

- C. Place bars as shown in the contract plans with minimum concrete cover as shown in the table below.

<u>Shaft Diameter</u>	<u>Minimum Concrete Cover</u>
Less than or equal to 3'-0"	3"
Greater than 3'-0" and less than 6'-0"	4"
6'-0" or larger	6"

3.06 Access Tubes for Crosshole Sonic Log Testing

- A. The Contractor shall install access tubes for crosshole sonic log testing in all shafts, except as otherwise noted, to permit access for the crosshole sonic log test probes.
- B. The Contractor shall securely attach the access tubes inside of the reinforcement cage of the shaft. One access tube shall be furnished and installed for each foot of shaft diameter, rounded to the nearest whole number, as shown in the Plans. The number of access tubes for shaft diameters specified as "X feet 6 inches" shall be rounded up to the next higher whole number. The access tubes shall be placed around the shaft, inside the spiral or hoop reinforcement. Where circumferential components of the rebar cage bracing system prevent bundling the access tubes directly to the vertical reinforcement, the access tubes shall be placed inside the circumferential components of the rebar cage bracing system as close as possible to the nearest vertical steel reinforcement bar.
- C. The access tubes shall be installed in straight alignment and as near to parallel to the vertical axis of the reinforcement cage as possible. The access tubes shall extend from the bottom of the reinforcement cage to at least two feet above the top of the shaft. Splice joints in the access tubes, if required to achieve full length access tubes, shall be watertight. The Contractor shall clear the access tubes of all debris and extraneous materials before installing the access tubes. The tops of access tubes shall be de-burred. Care shall be taken to prevent damaging the access tubes during reinforcement cage installation and concrete placement operations in the shaft excavation.
- D. The access tubes shall be filled with potable water before concrete placement, and the top watertight PVC caps shall be reinstalled and secured in accordance with subsection 2.05.B of this Special Provision. The Contractor shall keep all of a shaft's access tubes full of water through the completion of CSL testing of that shaft. When temperatures below freezing are possible, the Contractor shall protect the access tubes against freezing by wrapping the exposed tubes with insulating material or adding anti-freeze to the water in the tubes.

3.07 Placing Concrete

- A. Concrete placement shall commence immediately after completion of excavation by the Contractor and inspection. Immediately prior to commencing concrete placement, the shaft excavation and the properties of the slurry (if used) shall conform to section 3.04 of this Special Provision. Concrete placement shall continue in one operation to the top of the shaft, or as shown in the Plans.

During concrete placement, the Contractor shall monitor, and minimize, the difference in the level of concrete inside and outside of the steel reinforcing bar cage. The Contractor shall conduct concrete placement operations to maintain the differential concrete head as 1'-0" maximum.

- B. When placing concrete in the dry, only the top five feet of concrete shall be vibrated, in accordance with Section 6-02.3(9), except that the entire depth of concrete placed in the shaft-column steel reinforcing bar splice zone shall be vibrated. If a temporary casing is used it shall be removed before vibration. This requirement may be waived if a temporary casing is used and removed with a vibratory hammer during the concrete placement operation. Vibration of concrete does not affect the maximum slump allowed for the concrete class specified.
- C. If water is not present, the concrete shall be deposited through the center of the reinforcement cage by a method which prevents segregation of aggregates and splashing of concrete on the reinforcement cage. The concrete shall be placed such that the free-fall is vertical down the center of the shaft without hitting the sides, the steel reinforcing bars, or the steel reinforcing bar cage bracing.
- D. When placing concrete underwater, including when water in a shaft excavation exceeds three inches in depth with an infiltration rate of 12 inches of depth or more in one hour, the Contractor shall use a concrete pump or tremie. A tremie shall have a hopper at the top that empties into a watertight tube at least eight inches in diameter. If a pump is used, a watertight tube shall be used with a minimum diameter of four inches. The discharge end of the tube on the tremie or concrete pump shall include a device to seal out water while the tube is first filled with concrete.
- E. Throughout the underwater concrete placement operation, the discharge end of the tube shall remain submerged in the concrete at least 5 feet and the tube shall always contain enough concrete to prevent water from entering. The concrete placement shall be continuous until the work is completed, resulting in a seamless, uniform shaft. If testing reveals voids or joints, the Contractor shall repair them or replace the shaft at no expense to the Owner.
- F. Before placing any fresh concrete against concrete deposited in water or slurry, the Contractor shall remove all scum, laitance, loose gravel and sediment on the upper surface of the concrete deposited in water or slurry and chip off any high spots on the

upper surface of the existing concrete that would prevent the steel reinforcing bar cage from being placed in the position required by the Plans.

Prior to performing any of the crosshole sonic log testing operations specified in subsection 3.09 of this Special Provision, the Contractor shall remove the concrete at the top of the shaft down to sound concrete.

- G. The Contractor's construction operation in the vicinity of a shaft excavation with freshly placed concrete and curing concrete shall conform to Section 6-02.3(6)D.
- H. Concrete shall not be placed above the top of shaft (for column splice zones, columns, footings, or shaft caps) until the Contractor receives the Owner's acceptance of CSL testing results, and acceptance of the shaft.

3.08 Casing Removal

- A. As the temporary casing is withdrawn, a minimum 5 foot head of concrete shall be maintained to balance the foundation material and water pressure at the bottom of the casing.
- B. Tops of permanent casings for the shafts shall be removed to 2 feet above normal water elevation or finished groundline, whichever is lower, unless directed otherwise by the Owner.
- C. The Contractor shall completely remove all temporary casings, except as noted.

3.09 Nondestructive Testing of Shafts (Crosshole Sonic Log Testing)

- A. The Contractor shall provide for crosshole sonic log testing and analysis on all completed shafts designated for testing by the Engineer. The testing and analysis shall be performed by the independent testing organization submitted by the Contractor and approved by the Owner.

The testing shall be performed after the shaft concrete has cured at least 96 hours. Additional curing time prior to testing may be required if the shaft concrete contains admixtures, such as set retarding admixture or water reducing admixture, added in accordance with Section 6-02.3(3). The additional curing time prior to testing required under these circumstances shall not be grounds for additional compensation or extension of time to the Contractor in accordance with Section 1-08.8.

Crosshole sonic log testing shall be conducted at all shafts in which access tubes for test probe access have been installed (see subsection 3.06.A of this Special Provision).

- B. After placing the shaft concrete and before beginning the crosshole sonic log testing of a shaft, the Contractor shall inspect the access tubes. Each access tube that the test

probe cannot pass through shall be replaced, at the Contractor's expense, with a two inch diameter hole cored through the concrete for the entire length of the shaft. Unless directed otherwise by the Engineer, cored holes shall be located approximately six inches inside the reinforcement and shall not damage the shaft reinforcement. Descriptions of inclusions and voids in cored holes shall be logged and a copy of the log shall be submitted to the Engineer. Findings from cored holes shall be preserved, identified as to location, and made available for inspection by the Engineer.

- C. The Contractor shall submit the results and analysis of the crosshole sonic log testing for each shaft tested to the Engineer for approval. The Engineer will determine final acceptance of each shaft, based on the crosshole sonic log test results and analysis for the tested shafts, and will provide a response to the Contractor within three working days after receiving the test results and analysis submittal.
- D. For all shafts determined to be unacceptable, the Contractor shall submit a plan for further investigation or remedial action to the Engineer for approval. All modifications to the dimensions of the shafts, as shown in the Plans, required by the investigation and remedial action plan shall be supported by calculations and working drawings as specified in Section 6-01.9. All investigation and remedial correction procedures and designs shall be submitted to the Engineer for approval. The Contractor shall not begin repair operations until receiving the Engineer's approval of the investigation and remedial action plan.
- E. All access tubes and cored holes shall be dewatered and filled with grout after tests are completed. The access tubes and cored holes shall be filled using grout tubes that extend to the bottom of the tube or hole or into the grout already placed.

Measurement

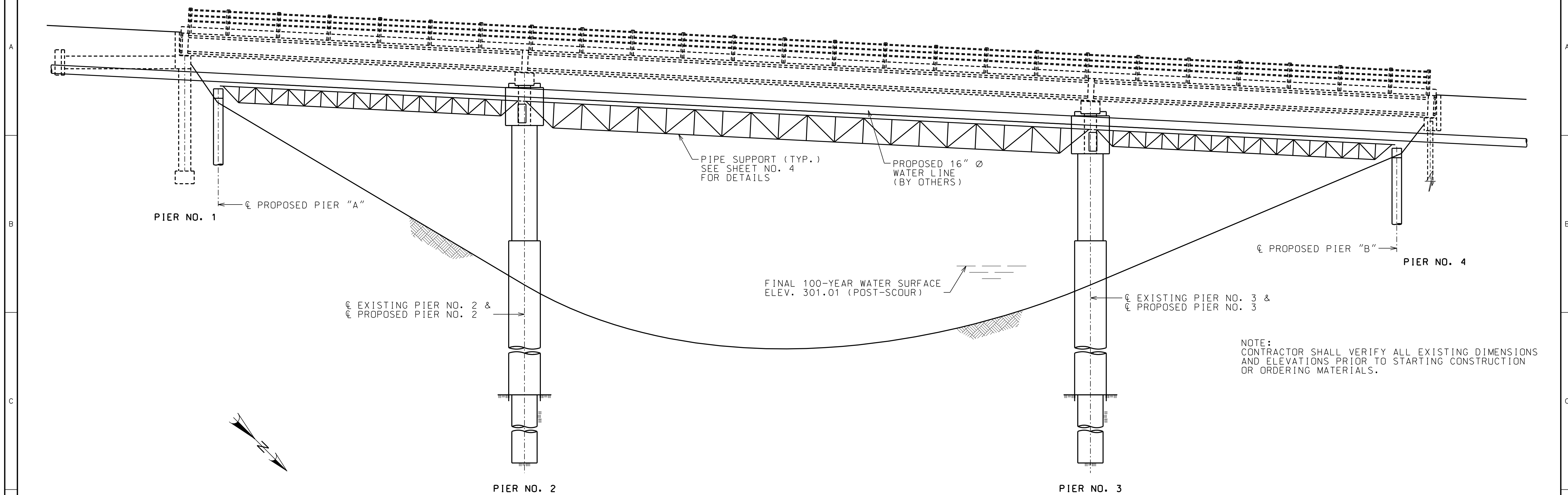
4.01 Measurement

- A. Measurement will be made as follows:
 - 1. Soil excavation for shaft including haul will be included in the cost of Drilled Shafts.
 - 2. Rock Excavation for rock sockets including haul will be included in the cost of Rock Sockets.
 - 3. Concrete Class 4000P for shaft will be measured by the cubic yards of concrete in place. The cubic yards will be computed using the shaft diameter shown in the Plans, and the top and bottom elevations shown in the Plans, unless adjusted by the Engineer.
 - 4. Steel reinforcing bar for shaft will be measured by the computed weight of all reinforcing steel in place, as shown in the Plans. Bracing for steel reinforcing bar cages shall be considered incidental to this item of work.

Northwestern Lake Road Bridge Pier Replacement
Klickitat County, Washington

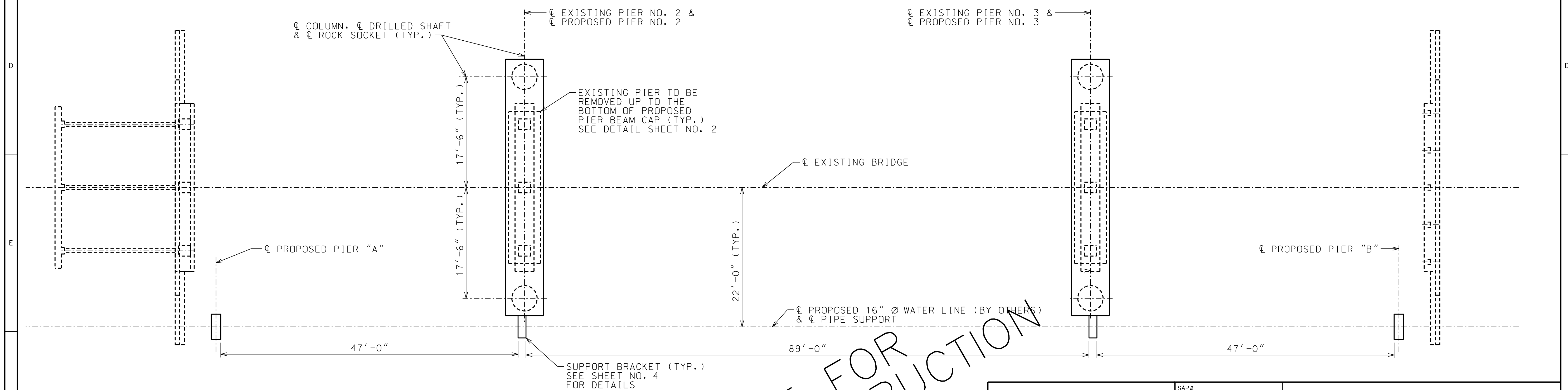
5. CSL access tube will be included in the cost of Drilled Shafts.
6. CSL test will be measured once per shaft tested.

USE-IN-PLACE AND MODIFY PIERS OF (54' - 90' - 54') PRESTRESSED I-GIRDER SPANS



NOTE:
CONTRACTOR SHALL VERIFY ALL EXISTING DIMENSIONS
AND ELEVATIONS PRIOR TO STARTING CONSTRUCTION
OR ORDERING MATERIALS.

ELEVATION



89'-0"

NOT FOR CONSTRUCTION

PLAN

BLA

Black



BLACK & VEATCH

Black & Veatch Corporation
Kansas City, Missouri

SAP #	
PL #	
DATE	
ENG	DES
DR	CH
APPROVAL	

APPROVAL

NORTHWESTERN LAKE BRIDGE PLAN & ELEVATION



SCALE:

SHEET 1 OF 5

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RELOCATED WATER LINE

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REVISION

REFERENCE DRAWINGS

DESIGN SPECIFICATIONS:
2007 - AASHTO LRFD 4TH EDITION AND 2008 INTERIMS
LOAD AND RESISTANCE FACTOR DESIGN
SEISMIC ZONE 1
ACCELERATION COEFFICIENT = 0.15

2010 STANDARD SPECIFICATIONS FOR ROAD, BRIDGE AND MUNICIPAL CONSTRUCTION
BY WASHINGTON DEPARTMENT OF TRANSPORTATION

HL-93

CLASS 4000 CONCRETE (COLUMNS & PIER CAP)	$f'c = 4000$ psi
CLASS 4000P CONCRETE (ROCK SOCKETS & DRILLED SHAFTS)	$f'c = 3400$ psi
REINFORCING STEEL (GRADE 60)	$fy = 60000$ psi
STRUCTURAL CARBON STEEL (ASTM A709 GRADE 36)	$fy = 36000$ psi
TYPE 2 GROUT	$f'c = 4000$ psi

MINIMUM CLEARANCE TO REINFORCING STEEL SHALL BE 1 1/2", UNLESS OTHERWISE SHOWN.

REMOVAL OF THE EXISTING PIERS SHALL TAKE PLACE ONLY AFTER THE PIER CAP CONCRETE AND GROUT BED HAVE REACHED THEIR DESIGN UNIT STRESS.

CONTRACTOR SHALL VERIFY ALL EXISTING DIMENSIONS PRIOR TO STARTING CONSTRUCTION OR ORDERING MATERIALS.

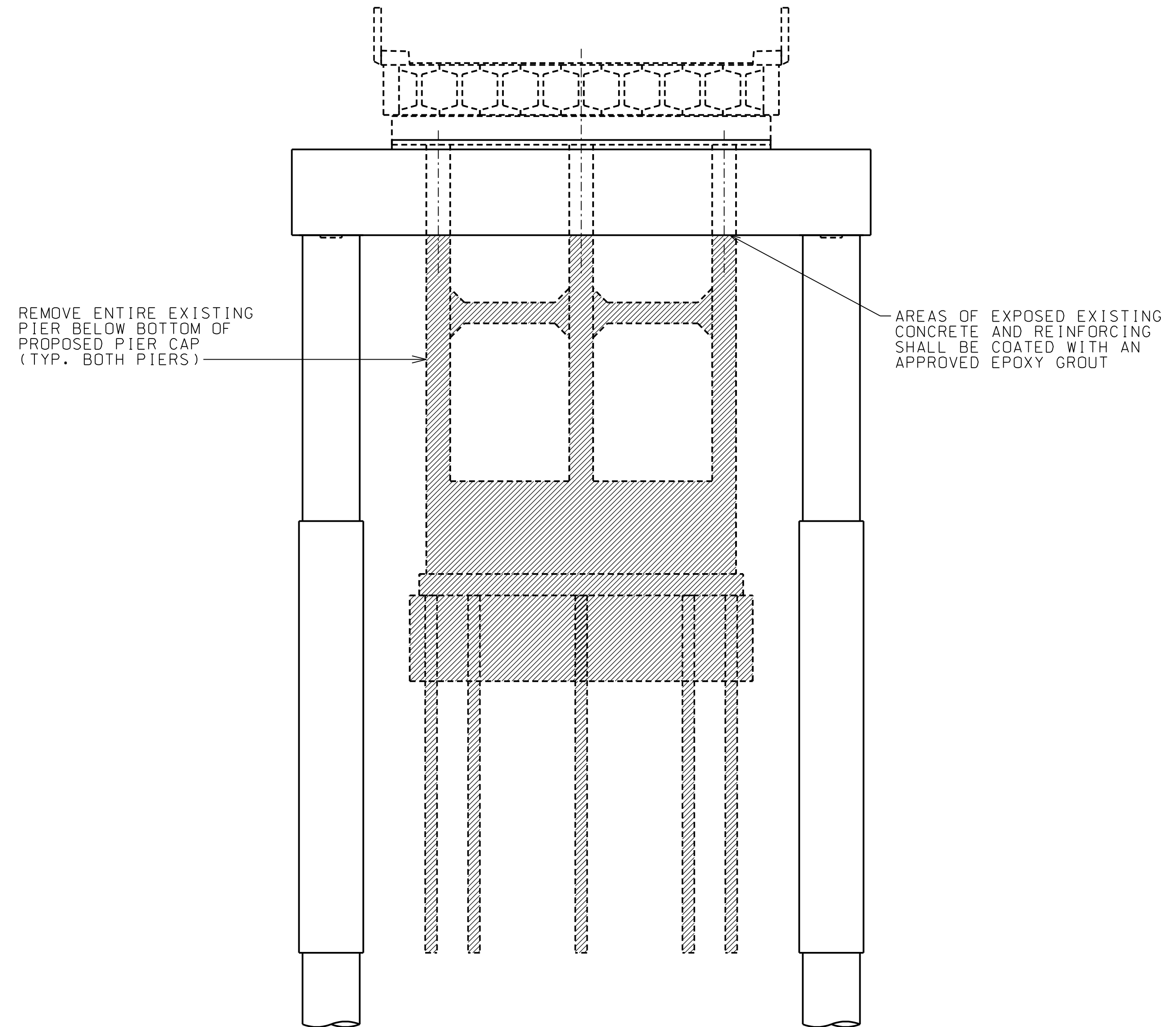
PIPE SUPPORT QUANTITY SHALL INCLUDE ALL NECESSARY BAR JOISTS, BRACING, FOUNDATIONS AND SUPPORT HARDWARE. SEE SHEET NO. 4.

ALL STEEL ELEMENTS OF PIPE SUPPORT SHALL BE GALVANIZED OR OTHERWISE COATED FOR CORROSION PROTECTION.

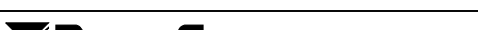
THE GROUT BED SHALL BE INSTALLED NO SOONER THAN 3 DAYS AFTER THE PROPOSED PIER CAP IS POURED. GROUT FOR THE GROUT BED SHALL BE TYPE 2 NON-SHRINK GROUT WITH AGGREGATE IN ACCORDANCE WITH THE CONSTRUCTION SPECIFICATIONS. PROVISIONS SHALL BE MADE TO ENSURE COMPLETE CONTINUITY BETWEEN THE EXISTING AND PROPOSED PIER CAPS VIA THE GROUT BED. NO GAPS, AIR POCKETS OR OTHER DISCONTINUITIES OF ANY KIND ARE ACCEPTABLE.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE LOCATION, IDENTIFICATION AND AVOIDANCE OF ALL UTILITIES AT THE PROJECT SITE.

THE BRIDGE SHALL BE REDUCED TO ONE LANE OF TRAFFIC FOR 24 HOURS FOLLOWING THE INSTALLATION OF THE GROUT BEDS. NO VEHICLE WEIGHING MORE THAN 6000 POUNDS SHALL CROSS THE BRIDGE FOR A PERIOD OF 8 HOURS FOLLOWING THE GROUT INSTALLATION. IF ANY VEHICLE WEIGHING MORE THAN 6000 LBS MUST CROSS THE BRIDGE FOR AN EMERGENCY, THE GROUT BED SHALL BE THOROUGHLY INSPECTED BY THE BRIDGE OWNER'S REPRESENTATIVE AND REMOVED AND REPLACED TO THEIR SATISFACTION, IF DEEMED NECESSARY. ANY REPLACEMENT OF THE GROUT BED SHALL BE AT THE CONTRACTOR'S EXPENSE.



NOT FOR CONSTRUCTION

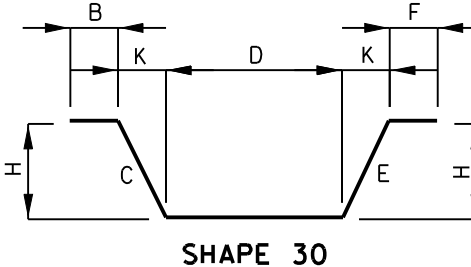
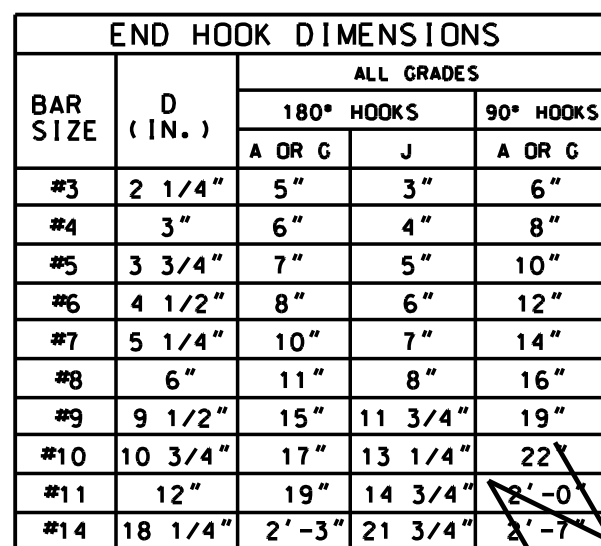
 BLACK & VEATCH Black & Veatch Corporation Kansas City, Missouri	SAP#		GENERAL NOTES AND QUANTITIES			
	PL#					
	DATE					
	ENG	DES				
	DR	CH				
	APPROVAL		 A PACIFICORP COMPANY			
	_____	_____				_____
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	SCALE:		SHEET 2 OF 5		REV.	

GENERAL NOTES AND QUANTITIES

PACIFICORP ENERGY
A PACIFICORP COMPANY

SCALE:	SHEET 2 OF 5	REV.
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BILL OF REINFORCING STEEL

[illegible]

BLACK & VEATCH

Black & Veatch Corporation
Kansas City, Missouri

SCALE:	SHEET 5 OF 5	REV.
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