City of Portland Water Bureau



Guidelines for Utility Protection

October 2012



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1. PURPOSE OF THIS GUIDELINE DOCUMENT

These guidelines are intended for the use of developers, contractors, and other utilities when working in and around Portland Water Bureau (PWB) water facilities.

Construction excavation within the public right-of-way or within PWB facility easements has the potential to undermine the integrity of adjacent water facilities. A Utility Protection Plan (UPP) is a description of the plans to protect in-service utilities from initial excavation through final backfill. A UPP may include plans, drawings, and calculations, depending on the level of assessment. Not every construction project requires a UPP. These guidelines define the requirements for submitting notice and plans to PWB and describe the level of assessment that PWB will conduct.

By requiring the structural integrity of the public water system through submittal of a UPP, PWB is able to do the following:

- Comply with Oregon Administrative Rule (OAR) 333 requiring water suppliers to provide water to the public free of health hazards.
- Protect the water system from any damage by prohibiting unauthorized alteration or tampering of the public water system in accordance with Portland City Code 21.24.
- Prevent damage to private property and to city utility and roadway infrastructure from broken pressurized water mains.

1.1 Applicable Statutes for Water and Sewer Main Construction

The installation of water mains shall conform to the requirements of Oregon Administrative Rule (OAR) 333. The installation of sewer mains, combination sewer mains, or storm sewers that discharge into a sanitary or combined sewer main shall conform to the requirements of OAR 340. The Oregon Administrative Rules are available at the following website: http://arcweb.sos.state.or.us/rules/number_index.html.

1.2 City of Portland Construction Specifications for Water and Sewer Main Construction

Contractors performing work for the City of Portland are required to follow the City of Portland Standard Construction Specifications (SCS). Section 00405.41 of the SCS requires that construction operations be conducted so that existing infrastructure and improvements—both temporary as well as those that are to remain in place—will not be

¹ The City of Portland Standard Construction Specifications are updated periodically; therefore sections cited in this document may change in subsequent versions of the SCS. The SCS are posted on the City's website at www.portlandoregon.gov/transportation/40032.

damaged, but will be supported and protected for the duration of the construction, until such support is no longer needed or required.

2. DEFINITIONS OF TERMS

Definitions of key terms appear in Appendix A of this document

3. CONTACTS AND DESIGNATED PWB REPRESENTATIVES

Contact	Telephone Numbers
PWB Planning Representative—Contact for construction plan review (preliminary to	PWB Development Services Permit Desk: 503-823-7368
signed plans):	PWB Interagency Liaison: 503-823-6036
PWB Construction Representative —Contact for UPP review, inspection, start of excavation, exposure of a water line:	PWB Construction and Inspection Services: 503-823-8311 and/or 503-823-7745

4. BASIC REQUIREMENTS FOR A UPP

A UPP is required for open-trench, tunneling, or jacking operations adjacent to or crossing water facilities as determined below. In accordance with SCS 00406.41, at minimum the UPP:

- Shall be submitted for review before starting work.
- Will include a site plan with the same scale and detail as the construction drawings.
- Will include the following details:
 - Location of all utilities impacted by proposed construction by type, size, and status of use (i.e. whether in-use, abandoned, or other designation).
 - Methods employed by the contractor to locate each and every utility.
 - List of utility owners in the construction site area and the 24-hour emergency contact numbers for those utilities.
 - Schematic drawing(s) and written description of methods planned by the contractor to protect and maintain in-service utilities during construction, including initial excavation through final backfill.
 - ° A plan for compacting backfill under exposed water facilities.

These guidelines are minimum requirements. Detailed requirements of a UPP are described in Section 7. Additional measures may be required by PWB as deemed necessary.

5. DETERMINING THE NECESSITY OF A UPP

In order to determine whether a UPP is necessary to ensure the integrity of the public water system, PWB requests submission of preliminary plan drawings and requires submission of final design drawings for construction projects requiring excavations within the public right-of-way or a PWB facility easement. The construction project owner or its contractor shall submit drawings to the designated PWB Planning Representative for review to 1) identify potential areas where a UPP may be necessary to protect the public water system and 2) determine the level of PWB assessment that may be appropriate.

6. PWB LEVELS OF ASSESSMENT FOR A UPP

Excavation projects around water facilities require different levels of assessment by PWB, depending on the the planned work, the potential to affect water facilities, and the soil types. The following three sections describe the levels of assessment that PWB will conduct. Examples of UPPs for projects assessed at Levels I and III are included in Appendix B.

6.1 LEVEL I ASSESSMENT

A Level I assessment is specific to 6-inch and smaller water systems—which are typically distribution mains—and 1-inch and smaller services—which typically provide direct service to PWB customers. A project with a Level I assessment will typically require a UPP but will not be required to include plans and associated calculations stamped/sealed by a Professional Engineer registered in the state of Oregon. The following list is a guide for determining whether the work meets the criteria for a Level I assessment:

- ☑ Proposed work requires a trench less than 6 feet wide.
- Proposed work is for small-diameter pipe. For example, a 4-inch-diameter sewer lateral crossing under a 6-inch diameter water pipe. A typical UPP for this scenario describes plans for a support beam crossing over the trench with nylon straps tied off of the beam and around the existing pipe.
- ☑ Existing water system is fully restrained with no thrust blocks.
- ☑ Existing soils are suitable for typical excavations. Examples of unsuitable soil would be sand or Type C as defined in 29 CFR 1926.651 (Division 3/Subdivision P/Appendix A).
- ☑ Proposed trench (excavation) work is perpendicular to the existing water system.
- ☑ No more than one length of pipe including one joint will be exposed. A joint is defined as the location where a straight run of pipe of standard length connects to

- another straight run of pipe. (Exposure of a valve, tee, or fitting requires a Level II assessment.)
- Proposed trench (excavation) work is parallel to the existing water system and the new utility trench is more than 10 feet from the existing water system.
- ☑ A competent contractor, as defined by in Section 00170.04(b)(2) and 00170.04(k) of the SCS, is performing the proposed work using appropriate shoring systems as defined by 29 CFR 1926.650 (Division 3/Subdivision P).

6.2 LEVEL II ASSESSMENT

A Level II assessment is specific to 8-12-inch water systems, > 1-inch water services, and exposure of a valve, tee, or fitting on a ≤ 6 -inch system. The water system may be a distribution, pump main, or transmission main system.

A project that receives a Level II assessment may require a plan and associated calculations stamped/sealed by a Professional Engineer registered in Oregon. A Level II project may require 1) field visits; 2) review of quarter section plans, as-built plans, records and review of valve locations for possible isolation; 3) verification of restraint systems or lack of restraint; and 4) soil reports and review with PWB Construction Management and Inspection staff. At a minimum, a Level II project will require a support beam with nylon straps and may require advance work from PWB Maintenance Engineering and Maintenance and Construction field crews. The following list is a guide for determining whether the proposed work meets the criteria for a Level II assessment:

- ☑ Proposed work is being done by open excavation rather than directional bore, tunneling, or jacking.
- ☑ Proposed work requires a trench wider than 6 feet.
- ☑ Existing water system is not fully restrained.
- ☑ Existing water system is identified as cast iron.
- ☑ Existing soils are not suitable for excavations. Examples of unsuitable soil would be a Class C-60 soil which may stand in a open trench, but if the trench is not properly shored, the trench wall may fail.
- ☐ Trench excavation and shoring system is limited to 40 feet or less in length.
- ☑ Trench excavation is less than 20 feet in depth.
- \square The working pressure of the water system in that location is < 150 psi.
- ☑ Proposed excavation is 5–10 feet from the existing water system.

- ☑ Valves on the existing water system are operational, and the valve can be isolated so a shut-down or a throttle-down can occur. (Any operation of a valve would require involvement of the PWB Maintenance Engineering Section.)
- Existing unrestrained water system may need to be restrained in advance of the proposed excavation.
- ☑ The water system has operational constraints, for example: it supplies a school, hospital, or is needed for fire protection.
- ☑ A competent contractor, as defined by in Section 00170.04(b)(2) of the SCS, is performing the proposed work using appropriate shoring systems as defined by 29 CFR 1926.650 (Division 3/Subdivision P).

6.3 LEVEL III ASSESSMENT

A Level III Assessment is specific to proposed excavations in the vicinity of 1) conduits, 2) large-diameter pump or transmission water mains or supply systems with limited valves, 3) groundwater pump or collection main, or 4) systems that supply water from the Bull Run watershed to the PWB reservoirs and other water-system structures that might be exposed to damage.

A project with a Level III assessment will require a utility support plan and associated calculations stamped/sealed by a Professional Engineer registered in the state of Oregon.

7. DETAILED UPP REQUIREMENTS

7.1 UPP Submission

The excavation contractor shall submit a UPP to the PWB Construction Representative at either the preconstruction conference meeting for city contract projects or 14 working days prior to starting work for permit projects or projects constructed by city personnel.

For city-contracted projects, the contracting bureau is required to review and accept its respective contractor's UPP before submitting the UPP to the PWB Construction Representative for review.

7.2 City of Portland Specifications

The UPP shall comply with the most current version of the City of Portland Standard Construction Specifications (SCS). The provisions for utility support and protection are as follows:

Section 00150—Control of Work

00150.35 (f) – requires Contractor to refrain from performing work that requires Owner submittal review until the respective Submittal has been reviewed by the Owner.

00150.35 (i) – requires allowing 14 days for review of Submittals by the Owner's Representative.

Section 00180—Prosecution and Progress

00180.42 (b) (12) – requires submittal of a UPP at the preconstruction conference and references 00405.41 (f).

Section 00405—Trench Excavation

00405.41 (a) (1) – requires preservation of existing improvements, including utilities, by whatever means necessary to support material around existing facilities as well as the facilities themselves.

00405.41 (f) – requires a UPP as outlined in 00406.41 (a)(17) which stipulates that if the water line or facility must be supported in place during construction, the support system must be designed and stamped/sealed by a registered engineer licensed in the State of Oregon.

00405.41 (f)(1) – requires Engineered shoring for trenches or excavations greater than 20 feet deep, and for areas subject to utility crossings.

00405.43 Dewatering – states "Prevent disturbance of compacted backfill and flotation or movement of structures, water mains, sewers and other utilities."

Section 00406—Tunneling, Boring and Jacking

00406.41 (a) (17) – requires submittal of a UPP before starting work, and describes plan requirements and elements.

00406.43 (h) Excavation – Protection of Adjacent Property – states "Before beginning construction at any location, adequately protect existing structures, utilities..."

7.3 Notification Requirements

In order to comply with the rules adopted by the Oregon Utility Notification Center as set forth in the Oregon Administrative Rules (OAR) 952-001-0010-0090, excavators are required to notify the notification center at least 2 business days, but not more than 10 business days, before commencing an excavation. To comply, call 503-246-6699 (in the Portland area) or 1-800-332-2344. The center's website is www.callbeforeyoudig.org.

Copies of the rules may be obtained by calling the center business number at 503-232-1987 and by visiting the following website: http://arcweb.sos.state.or.us/rules/OARS_900/OAR 952/952 001.html.

The excavation contractor shall notify the PWB Construction Representative by phone at least 2 business days prior to excavating in or around any water line or facilities. For existing contracts, the agency shall contact the Construction Manager or PWB contact person listed in the project specifications. For all other projects, the agency shall contact the PWB Construction Representative. If a water main of any size or length is inadvertently exposed, call the PWB Construction Inspection Representative at 503-823-8311 immediately.

An agency must also contact the PWB Construction Representative prior to construction in areas where thrust blocks and/or vaults may exist, preferably during project design.

If, during construction, the structural integrity of the water line is compromised, OAR 952-001 requires the construction project owner and its contractor or excavator to stop construction and **immediately** notify the PWB Construction Representative to coordinate efforts by PWB to mitigate and rectify the situation.

7.4 General Requirements

The excavation contractor is responsible for implementation of the approved UPP. If deviations from the UPP are necessary because of field conditions, the contractor or responsible agency must submit a revised submittal UPP to PWB to be reviewed by the PWB Construction Representative. Construction cannot proceed until the submittal is approved.

The excavation contractor shall do the following:

- ☑ Protect the existing water main, including coatings, during the course of construction.
- ☑ Support the exposed water main to prevent any movement.
- Use care to avoid damaging the existing water main with mechanical construction equipment. Chains and/or wire rope will not be allowed to support exposed water mains, unless approved by the PWB Construction Representative. Use double straps to support both sides of an exposed joint. Provide a compaction plan for backfill installed under exposed water lines and facilities. If controlled low-strength material (CLSM) has been approved for use as backfill, the contractor shall install polyethylene wrap around the water main. Where CLSM will be used to support pipe crossing over the water main, install quarter-inch minus screenings or sand in the pipe zone between the water main and the CLSM backfill.
- ☑ Exercise caution when working near existing water facilities as they may be cathodically protected. Any existing PWB cathodic protection system must be

- protected and maintained in continuous operation. If the cathodic protection system is disturbed, contact the PWB Construction Representative.
- ☑ Contact the PWB Construction Representative if work around vaults is necessary. These projects will be handled on a case-by-case basis.

7.5 Requirements for Open Excavations

7.5.1 Open Excavations Parallel to PWB Pipe

If the water main is located above the bottom of the construction excavation within the zone of influence— 1.5H: 1V slope from the bottom of the construction excavation (see Figure 1), or if the soil condition is Type C (per OAR 437, Division 3, Subdivision P Construction) and the water main is within 5 feet of the excavation—the following shall apply:

- No more than 8 feet of parallel trench shall remain unsupported if backfill from the water main trench is exposed.
- Where the water main trench backfill is not exposed, no more than 30 feet of parallel trench shall be unsupported at any one time.
- Minimize duration of unsupported trench walls. No section shall be left unsupported overnight or if groundwater is observed.
- Supported sections of trench shall have positive-pressure shoring or shielded shoring backfilled between the trench wall and the shoring box. Positive-pressure shoring is defined as a system providing support to the trench wall, such that no ground movement adjacent to and within the excavated trench is possible. Positive-pressure shoring can be achieved with hydraulic jacks or by ensuring zero clearance between the shielded shoring and the trench wall.
- Positive-pressure shoring is required at all water main bends and tees, to prevent undermining of the thrust-restraint systems. No amount of unsupported trench is permitted at these locations.
- Excavation adjacent to transmission mains (all sizes), conduits, pump mains (all sizes) and distribution mains >12 inches will require structural and geotechnical calculations.
- Excavations adjacent to distribution mains ≤ 12 inches may require structural and geotechnical calculations as determined by PWB.

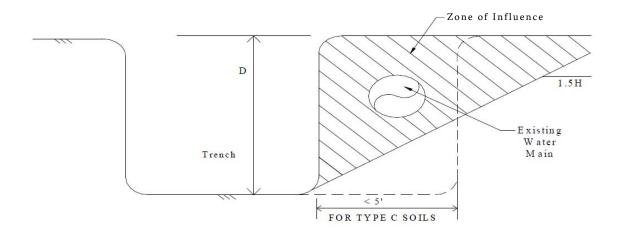


Figure 1. Zone of Influence for Mains Parallel to the Trench

7.5.2 Open Excavations Askew and Perpendicular to PWB Pipe

If the construction excavation is 5 feet or more below a > 12-inch water main, or if the excavated trench is 6 feet or wider (see Figure 2), then the following shall apply:

- Show structural and geotechnical calculations for any support beams, columns, steel plate foundation supports, blocking, and length of beams on each side of trench and columns. Pipe supports shall be adjustable, tensioned, and rated to the calculated loads.
- Provide the methods and means of excavation, backfill, and compaction to provide continuous pipe support and prevent damage.
- Monitor > 12-inch-diameter water lines for settlement. Measure water main pipe elevation directly prior to, during, and after excavation, and provide before and after elevation measurements, as described in SCS 406.41(b)(15).
- Provide required support beam with straps spaced no more than 3 feet apart and/or from the trench wall.
- If a joint is exposed, provide required support beam and double straps (one strap placed on each side of the joint) in excavations > 6 feet wide. For excavations > 6 feet wide, one strap shall be placed on each side of the joint with additional straps to be placed no further than 3 feet apart for support of the pipe spanning the excavation.
- PWB may require structural and geotechnical calculations of maximum anticipated deflection and resulting stress in pipe, maximum anticipated deflection and resulting stress in support beam, and assumed soil-bearing pressure.

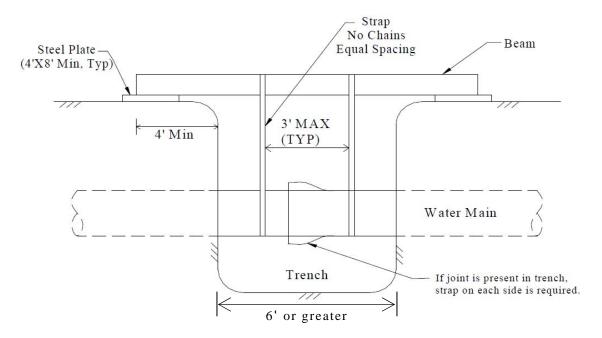


Figure 2. Open Trench Perpendicular to Water Main-6 Feet or Greater in Length

7.5.3 Excavations Near Thrust Blocks

If a thrust restraint system supporting the existing water main is uncovered (see Figure 3), and a UPP has not been submitted, the excavating contractor or agency must do the following:

- 1. Immediately stop excavation in the influence zone of the thrust block (an area 3 times the length of the thrust block).
- 2. Field-verify the thrust block dimension by exposing the top surface of the thrust block.
- 3. Notify the PWB Construction Representative.
- 4. Prepare and submit a UPP for review by PWB before proceeding with further excavation.

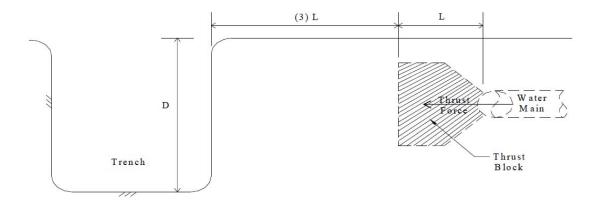


Figure 3. Zone of Influence for Nearby Thrust Block

7.5.4 Construction of Manholes, Catch Basin Inlets, and Laterals

During excavation for and construction of a manhole and/or catch basin inlet with a depth ≥ 6 feet, a UPP with associated calculations, stamped/sealed by a Professional Engineer registered in the state of Oregon shall be required for supporting and maintaining in service the adjacent conduit or transmission water main.

PWB requires a minimum separation of 5 feet skin-to-skin horizontal distance between conduits and transmission water mains and new manholes and/or catch basin inlets. Any deviation from this minimum 5 feet of separation will require the written authorization of a PWB Principal or Chief Engineer.

A UPP may be required for protecting and maintaining in service the distribution water main where less than 3 feet skin-to-skin separation is proposed between a new manhole or new stormwater inlet/catch basin and the existing water main.

A UPP may be required for protecting and maintaining in service the water main where it will be crossed by a new storm inlet/catch basin lateral connection to a manhole and/or catch basin inlet. The excavating contractor or agency must provide a minimum of 1.5 feet of vertical clearance where a new storm lateral crosses an existing conduit or transmission main. PWB prefers 1.5 feet of vertical clearance over existing distribution water mains for future maintenance purposes.

7.6 Tunneling or Pipe-Jacking

The following shall be included in the UPP required for all tunneling or pipe-jacking projects:

- Per SCS 00406.41 (a) provide plans showing proposed equipment, equipment guidance system, type and kind of cutter head, anticipated soil conditions, jacking pit and pipe locations, tolerances and clearances.
- Per SCS 00406 (a) (11) show proposed grout plan around jacked pipe/casing.
- Provide Oregon registered Professional Engineer stamped/sealed calculated pipe deflections and stresses under estimated settlements.
- Vacuum-excavate to install fixed-point settlement monitoring station directly over the water main crossing. Provide before and after elevation measurements.

8. Training for City Employees

In addition to the guidelines outlined in this document, PWB training on Utility Protection Plans is available. The training can be delivered to Design Engineers at the City of Portland if desired by the respective bureaus (such as the Bureau of Environmental Services).

Adopted by the Portland Water Bureau,	October	, 2012
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Wand Peters (signature)		2012
Principal Engineer, Engineering Services, De	esign	
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Principal Engineer, Engineering Services, Co	H107000-044	

SIGNATURE PAGE

Appendix A. Definitions of Terms Used in this Document

Adjacent construction—Construction is considered adjacent when it is less than 5 feet from an existing water main.

Competent contractor—A contractor is considered competent when it meets the criteria established in City of Portland Standard Construction Specifications Section 00170.04(b)(2) and 29 CFR 1926.650 (Division 3/Subdivision P).

Conduits—These are large-diameter mains that supply water from the Bull Run watershed to the PWB reservoirs, Washington County Supply Line, and the groundwater pump main.

Distribution main—For the purposes of this document, water mains ≤ 12 inches in diameter are considered to be distribution mains. Distribution water mains provide service directly to customers.

Joint— A joint is defined as the location where a straight run of pipe of standard length connects to another straight run of pipe.

Large-diameter pipes—Large diameter pipes are ≥ 16 inches.

Shoring—Shoring is appropriate when it meets the criteria described in 29 CFR 1926.650 (Division 3/Subdivision P).

Soil types—See 29 CFR 1926.651 (Division 3/Subdivision P/Appendix A) for a discussion of soil types.

Transmission and/or supply mains—For the purposes of this document, water mains > 12 inches in diameter are considered to be transmission and/or supply mains. Transmission and supply water mains typically convey water to and from tanks and reservoirs and to distribution mains and pressures zones. These mains do not typically provide direct service to customers, although some may have services on an exception basis.

Water main—Any PWB water pipe (or "potable water pipe"), hydrant run, or ≥ 6-inch water service connection, including components such as valves, bends, tees, and other appurtenances.

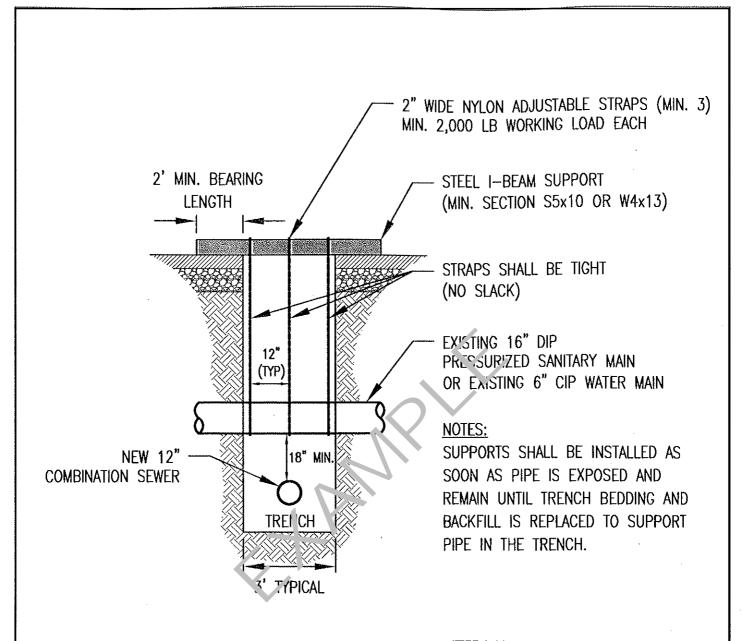
Zone of influence— 1.5H: 1V slope from the bottom of the construction excavation or where the soil condition is Type C (per OAR 437, Division 3, Subdivision P Construction) and the water main is within 5 feet of the excavation.

APPENDIX A. DEFINITIONS A-1

Appendix B. Examples of Level I and III UPPs

Level I UPP Example, Support Plan Detail	B-3
Level III UPP Example, Walker Creek Culvert	B-4
Level III UPP Example, West Hotel	B-15

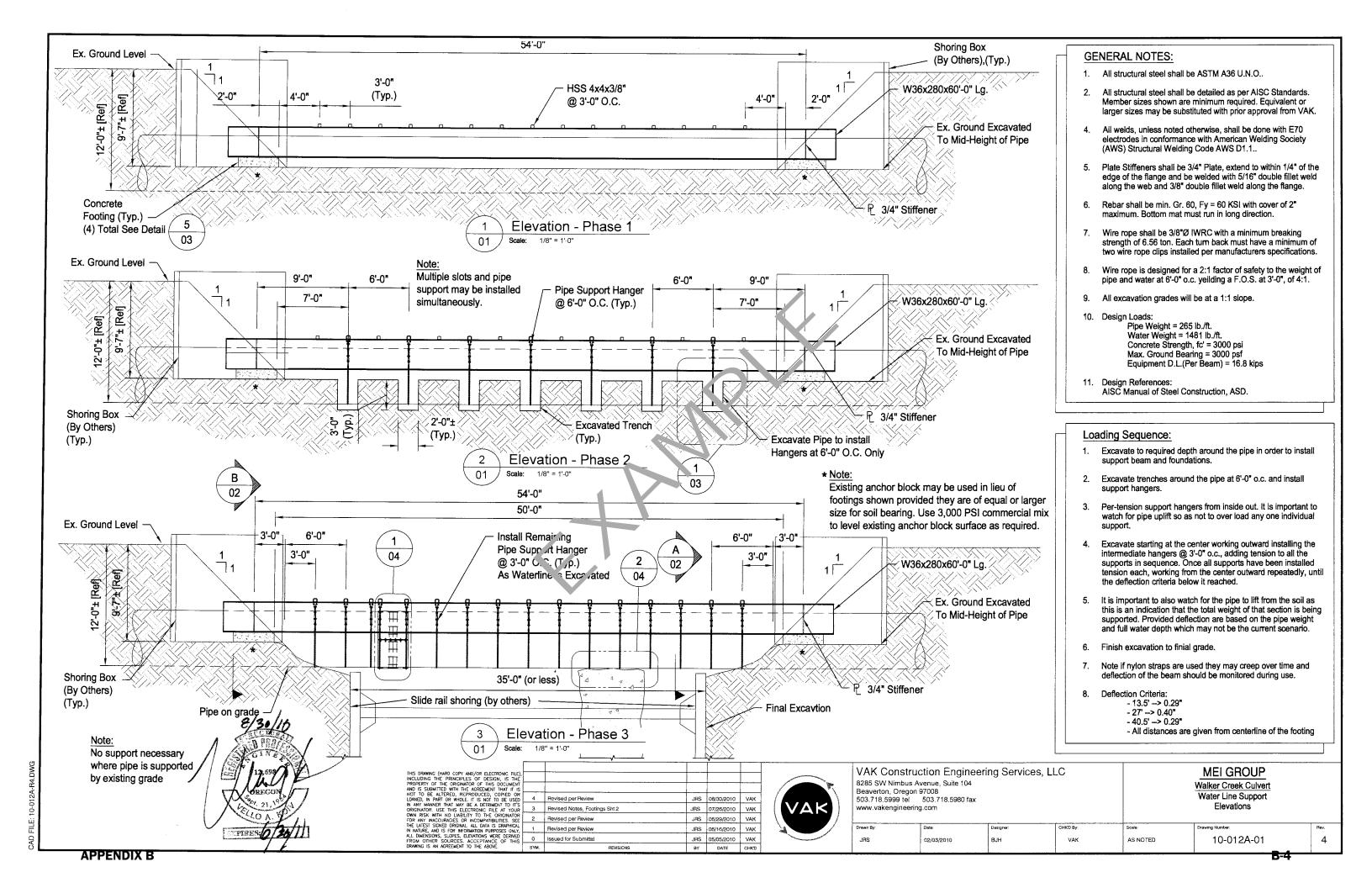
APPENDIX B. EXAMPLES B-1

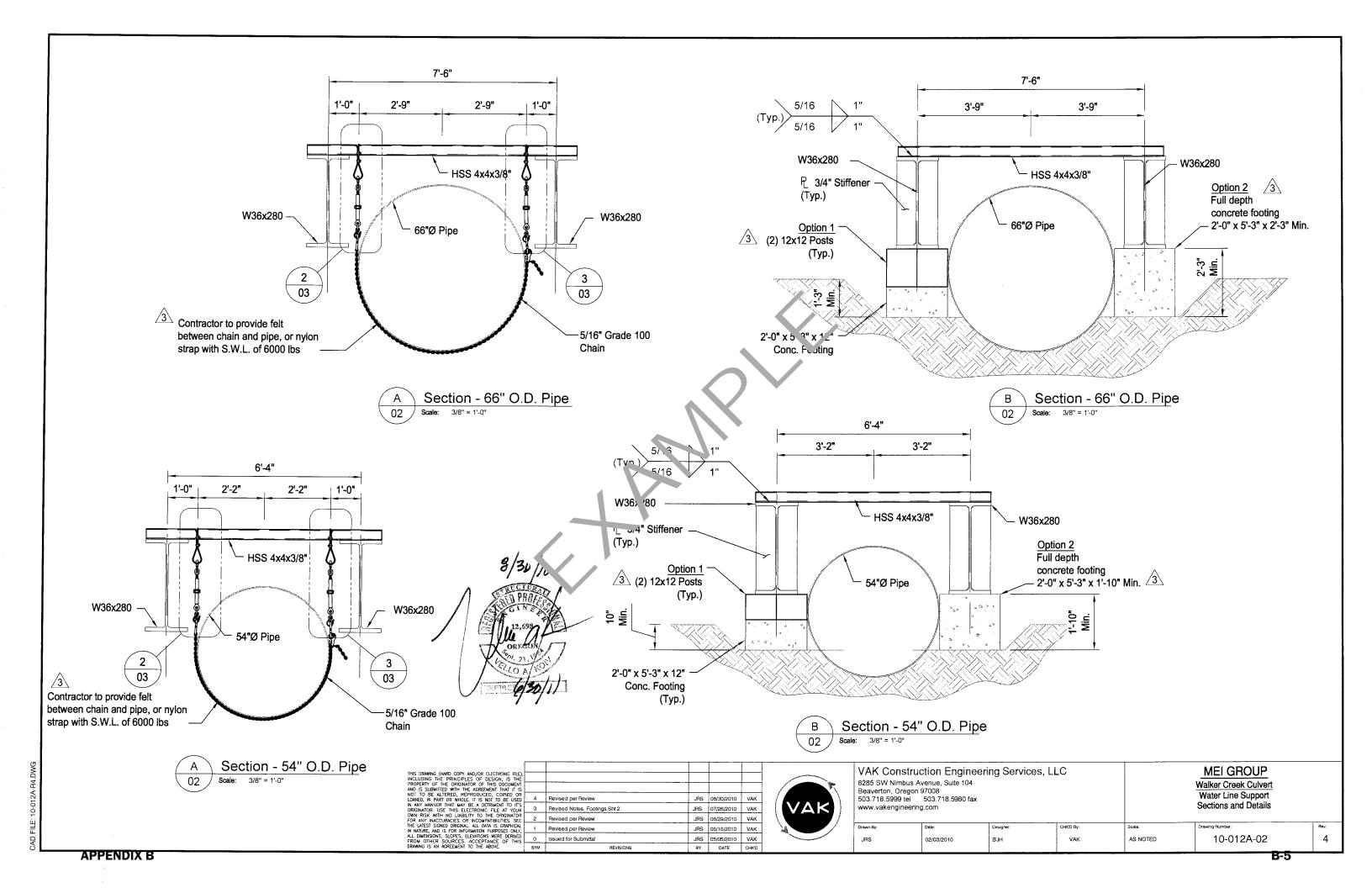


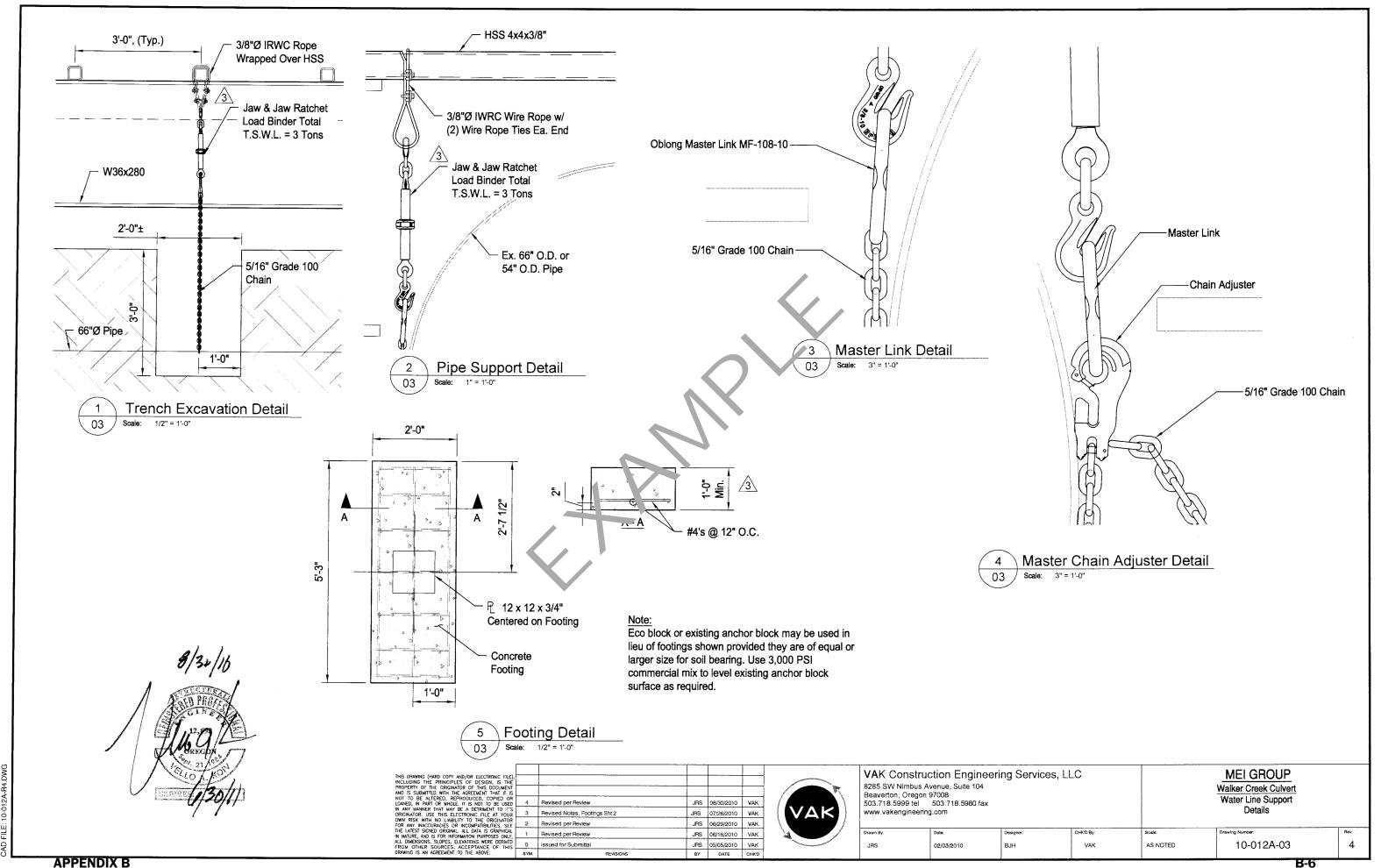
SUPPORT PLAN DETAIL

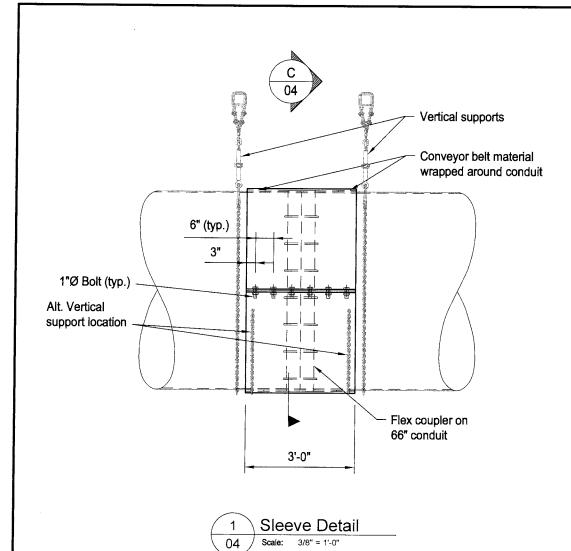
NOT TO SCALE

APPENDIX B B-3

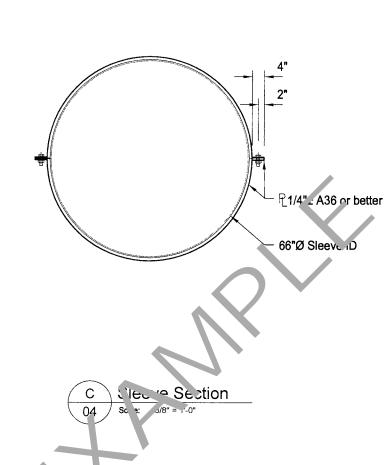








Sleeve is for contractor convenience only. Sleeve is not required to complete conduit support. (2) additional supports to be installed at each side or directly over sleeve @ conveyor belt spacer.



3'-0" (typ.) Pipe support hangar (typ.) - Break concrete as required to allow for pipe support installation Concrete anchor block Concrete Anchor Block Detail

Scale: 3/8" = 1'-0"

JRS 08/30/2010 VAK JRS 07/26/2010 VAK JRS 06/29/2010 VAK JRS 06/16/2010 VAK JRS 05/05/2010 VAK
BY DATE CHKD



VAK Construction Engineering Services, LLC 8285 SW Nimbus Avenue, Suite 104 Beaverton, Oregon 97008 503.718.5999 tel 503.718.5980 fax www.vakengineering.com				MEI GROUP Walker Creek Culvert Water Line Support Details	
Drawn By:	Date:	Designer:	снко ву:	Scale:	Drawing Number:
JRS	02/03/2010	вун	VAK	AS NOTED	10-012A-04

APPENDIX B

4

SECTION 314900 - EXCAVATION SHORING AND CONDUIT SUPPORT SYSTEMS

PART 1 - GENERAL

1.01 SCOPE - Work covered in this Section shall include shoring and support systems of all types necessary to protect existing facilities and new facilities constructed under this Contract.

The Contractor shall be responsible for the selection and design of excavation support systems and the design of conduit support systems in conformance with OSHA, City of Portland Water Bureau requirements, and the minimum design criteria specified herein. The Contractor shall secure all necessary permits to complete the requirements of this Section.

1.02 REFERENCE SPECIFICATIONS – Comply with Standard Construction Specifications (SCS) Section 00510.04 Shoring Plans, Calculations and Construction Inspection, as modified herein, and this Special Provision.

1.03 RESTRICTIONS

A. Excavations

- 1. The Contractor's attention is directed to the provisions of Subpart P, Section 1926.652 of the OSHA Safety and Health Standards for Construction which require that all banks and trenches over 5 feet high shall be since decreased as sloped to the angle of repose.
- 2. Open slopes should not be cut within 10 feet of any existing spread footing unless approved by the Owner's Representative. Waste or excess excavation material shall not be placed adjacent to existing or proposed structures.

B. Conduit Support Systems

- Water supply Conduits No. 2 and No. 4 shall remain pressurized and in service at all times, except for Conduit No. 2 which may be deactivated as approved by the Owner for the installation of the Conduit No. 2 bypass tee and 24-inch diameter bypass line. Refer to Section 011100, Summary of Work, for information relating to the existing conduits.
- 2. Existing cathodic protection systems for Conduits No. 2 and No. 4 shall be protected, including existing exterior pipe coatings.

1.04 SUBMITTALS - Conform to the requirements of Section 013300 Submittals. The submittals required for this Section include:

Item	Submittal
Excavation Shoring Plans	Stamped excavation shoring plans and design calculations
Conduit Support System Plans	Stamped conduit support system plans and design calculations

The Contractor shall submit plans for excavation and conduit support systems to the Owner for review prior to the beginning of construction activities requiring such systems. No excavations shall be started until the submittal review is complete. Said review by the Owner of the Contractor's design shall not be construed as a detailed analysis of the adequacy of the support system, nor shall any provisions of the above requirements be construed as relieving the Contractor of its overall responsibility and liability for the work. Information to be provided with the submittal, in addition to that listed in SCS Section 00510.04, shall include the following:

- A. Design calculations and shop drawings of all excavation and conduit support systems. Calculations and shop drawings shall be prepared and stamped by an Oregon registered Professional Engineer experienced in the design of excavation support systems and shall comply with the applicable requirements of OSHA and the Oregon Structural Specialty Code with respect to excavation and construction.
- B. Arrangement, size, lotalls and phasing for each support system.
- C. Construction methods and sequencing to be used for the installation and removal of each support system.
- D. Monitoring plan to identify ground movement and conduit movement.
- E. Contingency plan for alternative procedures to be implemented if a support system is found to perform unfavorably or if obstructions are encountered in the installation.
- F. Replace the second paragraph of SCS Section 00510.04 with the following: Submit a Shoring Design Summary prepared by the Professional Engineer, to accompany the plans and calculations. Include the following in the summary:
 - A list of shoring members with their allowable and design stresses
 - Design loading assumptions for each member
 - Design references
- G. The Contractor shall submit the qualifications and experience of the shoring and conduit support system design engineer.

H. The Contractor shall submit the qualifications and experience of the Professional Land Surveyor.

1.05 DESIGN CRITERIA

Shop drawings with supporting calculations for the various support systems shall be prepared in accordance with the following minimum criteria:

- A. Design the excavation support system and all components to support the earth pressures, unrelieved hydrostatic pressures, utility loads, equipment, traffic, and construction loads including impact, and other surcharge loads in such manner as will allow the safe and expeditious construction of the permanent structures to minimize ground movement or settlement, and to prevent damage to adjacent structures, and utilities.
- B. Design support members to resist the maximum loads expected to occur during the excavation and support removal stages.
- C. Design system so that water seepage is minimized. Provide dewatering and positive means for preventing slourning and containing material behind lagging. Provide dewatering for potential leakage from conduit joints.
- D. Vertical support capacity shall be provided for wall systems and internal bracing elements for loads due to vertical force components and live loads on any portion of the system.
- E. Design conduit suplort system to fully support conduits under hydrostatic pressure, provide jo in estraint as necessary, and provide protection of conduit coatings and other cathodic protection system components. Design shall incorporate a factor of safety of 2. Allowable conduit movement tolerances shall be no more than one-inch laterally and/or one-inch vertically from the existing conduit orientation.

Conduit supports/saddles shall provide a minimum of 120 degrees of contact to the bottom of the existing conduits and shall be suitably padded with felt or other protective material. Supports/saddles shall be provided at a maximum spacing of three feet on center. Supports/saddles shall be adjustable vertically to account for deflection of the conduit support members.

Acceptable support systems shall be of like kind to those identified in the Geotechnical Report, or as otherwise approved by the Owner.

1.06 QUALITY CONTROL

A. Monitor performance of support system components for both vertical and horizontal movement.

B. Provide contingency plan for alternative procedures to be implemented if unfavorable performance is evidenced, and keep materials and equipment on hand necessary to implement contingency plan.

PART 2 - MATERIALS AND PRODUCTS

2.01 GENERAL

Materials and equipment shall be safe and shall conform to local, state and federal codes.

PART 3 - CONSTRUCTION

- 3.01 GENERAL The Contractor shall be solely responsible for excavation protection and worker safety and shall provide sheeting, shoring and contraction and support systems wherever required, all in accordance with current local, state and federal laws, codes and ordinances. The Contractor shall be surely responsible for the protection of Conduits No. 2 and No. 4, and shall in no circumstance threaten the integrity (physical and operational) of these conduits.
- 3.02 Excavation Shoring/Support Systems
 - A. The excavation support systems shall not disturb the state of soil adjacent to the trench or excavation and below the excavation bottom. All excavation support systems shall be received after placement and compaction of initial backfill.
 - B. The support system shall extend below the main excavation bottom elevation to a depth adequate to prevent hydrostatic uplift, seepage and piping, and lateral movement and to adequately support applied vertical loads. Damage to existing utilities during installation of excavation support system shall be avoided. If damage occurs it shall be repaired at no cost to the Owner and to the satisfaction of the utility Owner.
 - C. Water control measures shall be provided at all times in accordance with the requirements specified in Section 312319, Dewatering.

3.03 Conduit Support Systems

- A. Conduit support systems shall be installed and maintained during all adjacent excavation and fill activities. Support systems shall be removed after placement and compaction of conduit bedding and initial pipe zone backfill.
- B. The Contractor shall closely monitor the support systems and integrity of the conduits. The Contractor shall take immediate corrective actions and/or

implement contingency alternative measures as required to alleviate and eliminate any lateral movement or vertical deflection of the conduits. The Contractor shall perform any and all repairs to the conduits, including joint restraint/welding, coating repair, piping replacement, testing, and disinfection, as directed and as approved by the Owner, at no cost to the Owner.

3.04 Field Inspection and Monitoring

- A. The Contractor's shoring design engineer shall field inspect the excavation and conduit support systems upon their installation and immediately upon detection of any vertical or lateral movement of ground or conduits. The shoring design engineer shall furnish the Owner's Representative a written statement that the support systems conform to the design and will serve the intended purpose.
- B. The Contractor shall provide the services of an independent, Oregon registered Professional Land Surveyor to install temporary monitoring points and take readings for monitoring the stability of the excavition and conduit support systems.
- C. Monitoring points shall be established at spacing not greater than 10 feet along the top of the excavation support system and not greater than 5 feet along the top of each conduit. Reference points shall be established at least 100 feet from the excavation support system.
- D. The horizontal and vertical position of the monitoring points shall be surveyed in relation to the reference, oints prior to excavation, immediately following installation of the excavation and conduit support systems, every other day while the excavation and conduit support systems are in place, and immediately following removal of the excavation and conduit support systems to an accuracy of 0.01 foot. Peadings shall be taken at approximately the same time and ambient conditions. Results shall be submitted to the Owner's Representative within 24 hours of measurement.
- E. These readings are intended to certify the actual movement, to verify that this movement does not exceed the design allowances, and to ensure that no significant soil movement occurred during the abandoned culvert removal and new culvert installation. The reporting of this information does not relieve the Contractor of its responsibility as stated in this Contract, nor does it place on the Owner responsibility for control and protection of the Work.
- F. If readings of the monitoring points indicate that ground or conduit movement exceeds the design allowances, all work shall be stopped, the Owner's Representative and excavation shoring and conduit support system design engineer shall be notified and immediate corrective action shall be taken. Work shall not resume without approval from the Owner.

3.05 Removal of Support Systems

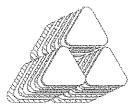
- A. Removal of excavation and conduit support systems shall be performed in a manner that does not disturb or damage adjacent new or existing structures or utilities. Fill all voids immediately with specified backfill material.
- B. All damage to property resulting from removal shall be promptly repaired at no cost to the Owner. The Owner's Representative shall be the sole judge as to the extent and determination of the methods and materials for repair.

PART 4 - MEASUREMENT AND PAYMENT

- 4.01 No separate measurement shall be made for Excavation and Conduit Support Systems.
- 4.02 Payment for Excavation And Conduit Support System's shall be paid on a lump sum basis and include all design, submittals, materials, labor, equipment, and monitoring and maintenance of such systems.
- 4.03 The pay items for this Section will be as follows

Item N	Vo.	Pay items	Units
20		Excavation And Conduit Support Systems	LS

END OF SECTION 314900



J.M. TURNER ENGINEERING, INC. CONSULTING ENGINEERS

CIVIL, STRUCTURAL, & CONSTRUCTION ENGINEERING

1325 College Avenue

Santa Rosa, CA 95404 *

Phone (707) 528-4503 *

Fax (707) 528-4505

E-MAIL TRANSMITTAL COVER SHEET

TO: <u>Tia Olsen</u> COMPANY: <u>Lauzon Contracting</u>	FROM: DATE:	Shaun Jones 04/03/2012
PHONE: 503-482-5445	PAGES:	09 including cover sheet
E-MAIL: See Below	RE:	Prelim Design
L 149 (tL. OCC DOIOW	II V.L.,	1.emii Design
the first of the second state of the second st		
	F-MAILED BY:	LS TIME: <u>3:30 PM</u>
MESSAGE: tiaolsen@lauzoncontracting.com		
Please review and return.		
Thank you.		
	·	.:

APPENDIX B B-14

CONSULTING ENGINEERS

CIVIL ENGINEERING STRUCTURAL ENGINEERING CONSTRUCTION ENGINEERING

WEST HOTEL PUBLIC IMPROVEMENTS PORTLAND, OR

UTILITY SUPPORT DESIGN CALCULATIONS

Lauzon Contracting 13577 SE Willingham Court Clackamas, OR 97015

Check of 6' maximum unsupported span for a 20" diameter steel pipe with both 1/4" and 3/8" wall thickness performed. Where exposed pipe joints are present within the excavation a check of a tube steel support beam with nylons straps was preformed.

DATE: 04/03/12

BY: S.J.

BY DIRECTION OF: A.J.V.

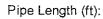
SHEET NO: 1 of 6 JOB#: 13085-3



1325 COLLEGE AVENÚE SANTA ROSA, CA 95404 PH#: (707) 528-4503 FAX#: (707) 528-4505

SU BJECT:	Lauzon Contracting	SHEET NO:	OF
÷	West Hotel	BY:	DATE
Litility Su	innort Design Calculations	CHKD BA	DATE

Check Pipe Support:



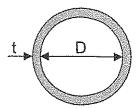
Pipe Diameter (in):

Weight of Water (pcf):

$$\gamma_w := 62.4$$

Weight of Water in Pipe (plf):

$$W_{w} := \frac{\pi \cdot D^{2}}{4} \cdot \left(\frac{\gamma_{w}}{144}\right)$$



Weight of Steel Pipe:

Approximate Thickness of Pipe (in):

$$\gamma_{\rm s} := 490$$

$$D1 := D + 2 \cdot t$$

$$D1 = 20.5$$

$$Fy_{pipe} := 35$$

$$S_x := \frac{\pi \cdot \left[(D1)^4 - (D)^4 \right]}{32 \cdot (D1)}$$

$$S_{x} = 79.7$$

$$I := \frac{\pi \cdot \left(D1^4 - D^4\right)}{64}$$

$$W_{\text{wi}} = \frac{\pi \cdot \left(\frac{D}{12}\right)^2}{4}$$

$$W_{w} = 136$$

$$W_{p} := \frac{\pi \cdot \left[\left(\frac{D_{1}^{2}}{12} \right)^{2} - \left(\frac{D}{12} \right)^{2} \right]}{4} \cdot \gamma_{s}$$

$$W_p = 54$$

$$W_{totai} := W_w + W_p$$

$$W := \frac{W_{\text{total}}}{1000}$$

Check Bending:

$$M_{max} := \frac{\left(0.6 \cdot Fy_{pipe}\right) \cdot S_x}{12}$$

$$M_{max} = 139.21$$

$$L_{max} := \sqrt{\frac{M_{max} \cdot 8}{W}}$$

$$L_{max} = 76.51$$

$$\Delta \text{max} := \frac{5 \cdot \text{W} \cdot \text{L}^4 \cdot 1728}{284 \text{ F L}}$$

J.M. TURNER ENGINEERING, INC. 1325 COLLEGE AVENUE



1325 COLLEGE AVENUE SANTA ROSA, CA 95404 PH#: (707) 528-4503

PH#: (707) 528-4503 FAX#:(707) 528-4505

SUBJECT:	Lauzon	Contracting
	NAME OF TAXABLE PARTY O	

West Hotel

Utility Support Design Calculations

SHEET NO: _____ OF ____

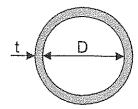
DATE ____

CHKD BY:_____ DATE ____

Check Pipe Support:

$$\gamma_w := 62.4$$

$$W_w := \frac{\pi \cdot D^2}{4} \cdot \left(\frac{\gamma_w}{144}\right)$$



Weight of Steel Pipe:

$$t := 0.375$$

$$\gamma_{\rm s} := 490$$

$$D1 := D + 2 \cdot t$$

$$Fy_{pipe} := 35$$

$$S_{x} := \frac{\pi \cdot \left[\left(D1 \right)^{4} - \left(D \right)^{4} \right]}{32 \cdot \left(D1 \right)}$$

$$I := \frac{\pi \cdot (D1^4 - D^4)}{64}$$

$$l = 1 \times 10^3$$

$$W_{WV} = \frac{\pi \cdot \left(\frac{D}{12}\right)^2}{4} \cdot \gamma_{V}$$

$$W_{p} := \frac{\pi \cdot \left[\left(\frac{D1}{12} \right)^{2} - \left(\frac{D}{12} \right)^{2} \right]}{4} \cdot \gamma_{e}$$

$$W_{\rm D} = 82$$

$$W_{total} := W_w + W_p$$

$$W_{total} = 218$$

$$W := \frac{W_{\text{tota}}}{1000}$$

$$W = 0.22$$

Check Bending:

$$M_{max} := \frac{\left(0.6 \cdot Fy_{pipe}\right) \cdot S_x}{12}$$

$$M_{max} = 210.17$$

$$L_{max} := \sqrt{\frac{M_{max} \cdot 8}{W}}$$

$$\Delta \text{max} := \frac{5 \cdot \text{W} \cdot \text{L}^4 \cdot 172}{2}$$

$$\Delta \text{max} = 0.0002$$



1325 COLLEGE AVENUE SANTA ROSA CA 95404

PH#: (707) 528-4503 FAX#: (707) 528-4505

SU	BJECT:	Lauzon Contractir	ıg	SHEET NO:		OF
	***************************************	West Hotel			DATE	
	Utility S	upport Design Calcu	lations	CHKD BY:	DATE	

W

Check Pipe Support:

Length of Pipe Load on Beam (ft):

Bearing Setback (ft):

Pad Bearing Length (ft):

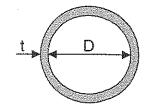
Pipe Diameter (in):

Weight of Water (pcf):

$$\gamma_{\rm w} := 62.4$$

$$W_w := \frac{\pi \cdot D^2}{4} \cdot \left(\frac{\gamma_w}{144}\right)$$

$$W_{w} = 136$$



Weight of Steel Pipe:

Approximate Thickness of Pipe (in):

Weight of Steel (pcf):

$$\gamma_{s} := 490$$

Ws :=
$$\left[\frac{\pi \cdot (D + 2 \cdot t)^2}{4} - \frac{\pi \cdot D^2}{4}\right] \cdot \left(\frac{\gamma_s}{144}\right)$$

Section Properties:

Shape: TS4x4x5/16

Weight of Tube Steel (plf):

Thickness:

t;= .3125

Modulus of Elasticity (ksi):

E := 29000

Moment of Inertia:

 $l_{xx} := 9.58$

Yield Strength (ksi):

Depth:

d := 4

 $F_{V} := 42$

Section Modulus (in^3):

 $S_{xx} := 4.79$

Radius of Gyration (in):

 $r_{xx} := 1.48$

Allowable Bending Stress (ksi):

$$Fb = 25.2$$



1325 COLLEGE AVENUE SANTA ROSA CA 95404

PH#: (707) 528-4503 FAX#:(707) 528-4505

SU	BJECT:	Lauzon Contracting	SHEET NO: 5 OF		OF
		West Hotel	BY:		
	Utility	Support Design Calculations	CHKD BY:	DATE	

Check Beam Support:

Check TS4x4x5/16 Beam

Construction Duration Factor:

 $F_{SD} := 1.0$

Given:

Design Pipe Load (klf):

$$w_d := \frac{Ws + W_w}{1000}$$

$$w_d = 0.218$$

Support Dead Weight (klf):

Total Load on Beam (klf):

$$w := w_d + BW$$

$$w = 0.338$$

Results:

Reactions (kips):

$$R := \frac{W \cdot (L)}{2}$$

$$R = 1.01$$

Max. Shear (kips):

Max. Bending (k*ft):

$$Mmax := \frac{w \cdot [L + (L1 \cdot 2)]^2}{8}$$

$$Mmax = 1.5202$$

Shear (ksi):

$$f_{\text{W}} = \frac{V_{\text{max}}}{d \cdot t} \cdot \frac{1}{2}$$

$$fv = 0.4$$

$$Fv = 16.8$$

Bending (ksi):

$$fb := \frac{Mmax \cdot 12}{S_{xx}}$$

$$fb = 3.8$$

$$Fb = 25.2$$

Deflection (in):

$$\Delta \text{max} := \frac{5 \cdot w \cdot \left[L + (L1 \cdot 2)\right]^4 \cdot 1728}{384 \cdot E \cdot I_{xx}}$$



1325 COLLEGE AVENUE SANTA ROSA, CA 95404

PH#: (707) 528-4503 FAX#: (707) 528-4505

Lauzon Contracting

SHEET NO:_

West Hotel

Utility Support Design Calculations

BY:_____ DATE _

CHKD BY: DATE

Check Nylon Strap Sling:

Number of Supports:

 $N_{\text{strap}} := 1$

(1 = Single or 2 = Double)

Width of Strap (in):

Strapwidth := 2

Reaction @ Strap (lbs):

Allowable Capacity of Cable (lbs):

Capacity_{strap} := 2000 ≥ R_S = 653 <u>OK</u>

Check Pipe Support Bearing:

Reaction @ Each End of Beam (lbs):

$$R := \frac{[[L + (L2 \cdot 2)] \cdot Wb] + (L \cdot Ws + W_w)}{}$$

Max. Vertical Surcharge Load (psf):

Bearing Area Required (sqft):

Length of Bearing Pad (ft):

Width of Bearing Pad (in):

$$Pw := \frac{Ba}{1.2} \cdot 12$$

GENERAL NOTES

- 1. PROVIDE ACCESS AND BARRICADING PER OSHA REQUIREMENTS.
- 2. FIELD ENGINEER TO VERIFY LOCATION & SIZE OF ALL EXISTING UNDERGROUND UTILITIES AND/OR PIPES, PRIOR TO COMMENCING EXCAVATION, IN ORDER TO ELIMINATE ANY CONFLICTS WITH SHORING SYSTEM.
- 3. THIS PLAN IS DESIGNED FOR PROTECTION OF WORKERS, EXISTING UTILITIES, STRUCTURES AND/OR SUBSTRUCTURES CLEARLY SPECIFIED ON PLANS. LAYOUT IS PER CONTRACT DRAWINGS, FIELD ENGINEER TO VERIFY THAT THERE IS SUFFICIENT CLEARANCE & WORKING SPACE.
- 4. THIS PLAN IS IN ACCORDANCE WITH FEDERAL AND/OR STATE OSHA REGULATIONS, DESIGN BY A REGISTERED CIVIL ENGINEER.
- 5. THESE PLANS ARE NOT INTENDED TO SHOW THE METHOD AND MEANS OF EXCAVATION OF THE WORK, WHICH IS THE RESPONSIBILITY OF THE FIELD ENGINEER.
- 6. FIELD ENGINEER SHALL HAVE A COMPETENT PERSON AT THE SITE WHERE THIS PLAN IS IN USE. THEY SHALL BE RESPONSIBLE MAKING SURE THAT ALL ELEMENTS OF THIS PLAN ARE ADHERED TO AND SHALL NOTIFY THE ENGINEER IF CONDITIONS ENCOUNTERED ARE DIFFERENT THAN ANTICIPATED AND SHOWN ON THIS PLAN. IF CONDITIONS ARE DIFFERENT, THIS PLAN MUST BE MODIFIED TO COVER THOSE CONDITIONS OR A NEW PLAN SHALL BE USED.
- 7. IF ANY EXISTING STRUCTURE(S), BUILDING(S) OR RAILROAD(S), NOT ALREADY SHOWN ON SHORING PLANS, IS WITHIN A DISTANCE EQUAL TO THE DEPTH OF EXCAVATION, FROM EDGE OF EXCAVATION TO STRUCTURE, FIELD ENGINEER TO CONTACT J.M. TURNER ENGINEERING FOR PLAN REVIEW AND/OR POSSIBLE PLAN REVISIONS.
- 8. IF EXISTING PARALLEL UTILITIES ARE 48" IN DIAMETER OR LARGER AND ARE CLOSER THAN 48" FROM EDGE OF EXCAVATION FIELD ENGINEER TO CONTACT J.M. TURNER ENGINEERING FOR PLAN REVIEW AND/OR PLAN REVISIONS.

SHIELD SHORING NOTES:

- 1. TABULATED DATA FOR EQUIPMENT TO BE USED SHALL BE PROVIDED AT THE JOBSITE.
- 2. MANUFACTURERS TABULATED DATA APPLIES EXCEPT AS IS NOTED HERE.
- 3. SHORING MUST BE PROPERLY INSTALLED PRIOR TO ENTERING EXCAVATION, WORKERS MUST ENTER, EXIT, AND WORK IN SHORED AREAS ONLY.
- 4. FILL VOID BETWEEN SHIELD AND EXCAVATION LINE WITH SOIL OR BEDDING MATERIAL

LAUZON CONTRACTING

13577 SE WILLINGHAM CT CLACKAMAS, OR 97015

WEST HOTEL PORTLAND, OR

UTILITY SUPPORT PLAN

INDEX: SHEET 5,1 COVER PAGE SHECT S'S PLAN VIEW & SECTIONS

INSTALLATION/REMOVAL SEQUENCE:

- 1. EXCAVATE TO NO MORE THAN THE SPRING LINE (HALF THE DEPTH) OF THE EXISTING UTILITY.
- 2. EXCAVATE SMALL WIDTH TRENCH DOWN & AROUND UTILITY JUST ENOUGH TO INSTALL SUPPORT STRAPS.
- 3. INSTALL SUPPORT STRAPS AND CINCH TIGHT.
- 4. CONTINUE TO EXCAVATE AS REQUIRED

TIMBER REQUIREMENTS

N/A

STEEL REQUIREMENTS

- STEEL PLATES TO BE ASTM A36, MINIMUM Fy=36 KSi.
- STEEL TUBE TO BE ASTM A500 GRADE B MIN. Fy=42 KSI.

WELDING REQUIREMENTS

N/A

DEWATERING REQUIREMENTS

- DEWATERING WELLS MAY BE REQUIRED (AS MANY AS NEEDED) TO MAINTAIN THE WATER LEVEL AT THE BOTTOM OF THE EXCAVATION...
- DEWATERING IS THE RESPONSIBILITY OF THE FIELD ENGINEER. IF DEWATERING WELLS, SPECIAL SUMP PUMPS OR ANY REQUIREMENTS FOR DEWATERING REQUIRED BY THE REVIEWING AGENCY, FIELD ENGINEER SHALL ADDRESS IN A SEPARATE SUBMITTAL.

TOLL FREE

1-800-227-2600

TWO WORKING DAYS BEFORE YOU DIG

PLAN

REVISIONS BY

WEST HOTEL PORTLAND, OR. SHIELD SHORING PL

UZON CONTRACTING
13577 SE WILINGHAM CT
CLACKAMAS, OR. 97015
PH: (503) 482--5445 LAUZON

TURNER ENGINEERING, INC.
CONSULTING ENGINEERS
1325 COLLEGE AVE. SANTA ROSA, CA. 55404
(707) 528-4503 FAX (707) 528-4505



SCALE: N.T.S DATE: 04/03/12 DRAWN BY: CHECKED BY: A.J.V

13085-3/5

APPENDIX B

