Columbia River CROSSING

Memorandum

May 16, 2013

TO: Dominic Yballe

FROM: Steve Morrow

SUBJECT: NWP-2008-414 – Proposed Project Amendment

Introduction

The Columbia River Crossing team is currently developing advanced design of the roadway improvements and bridge crossings over the Columbia River and North Portland Harbor, including those for light rail and pedestrian/bicycle access. In the period between submittal of the U.S. Army Corps of Engineers (USACE) Section 404 Clean Water Act Joint Permit Application (404 JPA) (November 2012) and the present, the project design team conducted additional calculations to ensure the proposed structures would meet seismic standards. For all the North Portland Harbor bridges identified in the initial construction package and the Hayden Island to I-5 south bridge (Figure 1 and Plan Sheets 1, 2, and 3), the use of cofferdams and concrete seals is now proposed to allow for connection of drilled shafts to columns below water level. Below is a summary of changes involving the use of cofferdams within North Portland Harbor during construction activities.

North Portland Harbor

As a result of further refinement in design, one change involving the use of cofferdams within NPH will occur, as follows:

- The construction of each column will require the installation of an over-sized casing (small diameter cofferdam).

Cofferdams/Oversized Casings

The conceptual designs of the bridges crossing the North Portland Harbor used for the determination of impacts in the 404 JPA assumed a single shaft/single column substructure configuration where each column was supported by a single drilled shaft. This resulted in 28 drilled shafts for the bridges in the ICP and an additional 8 drilled shafts for the Hayden Island to I-5 South bridge. Additionally, it was assumed that the transition between the shaft and the column would occur above the waterline present at the time of construction – allowing for column construction to occur above the water. The primary benefit of this design approach was that this substructure could be constructed without the use of a cofferdam. The refined designs for the bridges across the North Portland Harbor that have been performed since the submittal of the 404 JPA have highlighted some seismic concerns regarding this approach, thus the need for a change in design resulting in the required use of cofferdams.

The current designs for the bridges across the North Portland Harbor include lowering of the shaft-to column transition to approximately the mudline and maintaining the single shaft-to single-column approach. The construction of the column-to-drilled shaft transition would require isolating the work area in the water to allow the work to be performed in the dry. This

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construction method will be implemented by installing either an oversized circular casing or a circular cofferdam. Tables 1, 2, and 3 below summarize the dimensions and timing of these cofferdams, the approximate area for each cofferdam, and the total areas anticipated for all the cofferdams in the North Portland Harbor. Casings/cofferdams will be seated into the sediment with a vibratory driver. Fish salvage would occur during and after isolation. The first six feet of sediment will be removed to provide a stable foundation for a concrete seal, and the drilled shaft casing will be installed. The top of the drilled shaft casing will extend above the top of casing/cofferdam to allow construction of the drilled shaft prior to dewatering. The drilled shaft will be constructed within the drilled shaft casing, and the excavated material from the drilling will be removed. Removed sediments will be disposed of in accordance with relevant permits. As presented in the Oregon JPA, a reinforcement cage and concrete will be placed within the drilled shaft casing up to the shaft/column transition zone. A concrete seal will be poured in the annular space around the drilled shaft casing within each casing/cofferdam at the mudline to prevent water from entering the cofferdam through hydraulic pressure. The top of the seal will be at or within one foot of the existing mudline, resulting in a concrete seal that is six feet in depth. Rebar or other reinforcing structure will likely not be needed in the seal concrete. Water from within the casing/cofferdam will be pumped to a holding tank and disposed of in accordance with permit requirements to provide a dry work area. Once the casing/cofferdam is pumped dry, the drilled shaft casing will be cut off at the elevation of the bottom of the column (approximately the top of the seal), and the column of the bridge will be constructed. As many as 16 of the 36 total over-sized casings/cofferdams will be in place at any one time.

Due to safety concerns and the potential that seal removal would require extensive disturbance of sediments, the seal is not able to be removed after construction is completed. After construction of the shaft and supported substructure, the casing/cofferdam will be filled with water to equalize the hydraulic pressure and then be vibrated out.

The presence of the casings/cofferdams in North Portland Harbor will result in the temporary loss of approximately 285 square feet and 316 cubic yards of habitat per casing/cofferdam. For the North Portland Harbor Bridges – ICP this total equals 7,980 square feet and 8,837 cubic yards (Table 1). For the Hayden Island to I-5 South bridge this total equals 2,280 square feet and 2,525 cubic yards (Table 2). This habitat will not be accessible to fish for the duration of casing/cofferdam use – a period of approximately 30-36 days per casing/cofferdam (Table 3).

TABLE 1. DIMENSIONS OF TEMPORARY COFFERDAMS USED IN NORTH PORTLAND BRIDGES – ICP CONSTRUCTION

DIAMETER (FT)	HEIGHT (FT)A	AREA PER COFFERDAM (SQ. FT.)	TOTAL COFFERDAMS	TOTAL AREA OF COFFERDAMS (SQ. FT.)	TOTAL VOLUME OF COFFERDAMSA (CY)
19	29.9	285	28	7,980	8,837

a Values are for between approximate average depth of mudline at -14 feet CRD and OHW of 15.9 feet CRD.

TABLE 2. DIMENSIONS OF TEMPORARY COFFERDAMS USED IN HAYDEN ISLAND TO I-5 SOUTH BRIDGE CONSTRUCTION

DIAMETER (FT)	HEIGHT (FT)A	AREA PER COFFERDAM (SQ. FT.)	TOTAL COFFERDAMS	TOTAL AREA OF COFFERDAMS (SQ. FT.)	TOTAL VOLUME OF COFFERDAMSA (CY)
19	29.9	285	8	2,280	2,525

a Values are for between approximate average depth of mudline at -14 feet CRD and OHW of 15.9 feet CRD.

TABLE 3. CONSTRUCTION SUMMARY FOR COFFERDAMS IN NORTH PORTLAND HARBOR

	DAYS		
LOCATION	DURATION TO INSTALLA	DURATION OF CONSTRUCTION	DURATION TO REMOVE
Each column	5	30	1

a Days are calendar days.

For permanent impacts, resulting from the concrete seals being left in place, each concrete seal represents an additional permanent substrate impact of 206 square feet and 46 cubic yards of fill per casing/cofferdam. This value is in addition to the approximately 79 square feet of permanent impact related to each bridge shaft already described in the November 2012 404 JPA. Therefore an additional permanent impact to waters of the US of 7,416 square feet (0.17 acre) and 1,647 cubic yards fill for all cofferdam/casing locations will occur.

Impact Tables and Sequencing

In the November 2012 404 JPA, the project proposed to permanently fill approximately 1.62 acres with 50,486 cubic yards in jurisdictional waters of the Columbia River and North Portland Harbor within Oregon with structure.[1] The project also proposed to permanently remove 0.639

[1] The USACE, Oregon Department of State Lands, Washington Department of Ecology, and Washington Department of Fish and Wildlife regulate material placed in or removed from subject jurisdictional waters in different ways. For USACE, structures consist of that material that acts as a structure that could affect hydrologic characteristics. Temporary piles, wharf piles, barges, and other floating structures are not considered structure under this definition.

acre of and 43,928 cubic yards of existing structures (fill) in the Columbia River.[2] The project proposed to temporarily fill up to 0.646 acres with 40,047 cubic yards of material, and remove an equal amount when these temporary structures are removed after use.

This amendment proposes the addition of the 7,416 square feet (0.17 acres) and 1,648 cubic yards of new permanent concrete seals at 36 column sites in North Portland Harbor (Table 4). No additional permanent removal is proposed at this time. Temporary impacts related to the proposed cofferdams/casings would include an additional 11,362 cubic yards of fill, with an equal amount of removal when these structures are removed (Table 5).

As stated in the November 2012 404 JPA, no jurisdictional wetlands will be impacted within Oregon during construction or operation of the project.

For the purposes of this 404 Removal-Fill application, fill below the ordinary high water (OHW) level on the mainstem Columbia River continues to consist of the following structures:

- geotechnical borings,
- temporary cofferdams,
- permanent steel casings for bridge supports, and
- permanent shaft caps.

Fill below the OHW level in North Portland Harbor consists of the following structures:

- geotechnical borings,
- temporary steel sheet piles or oversized casing
- permanent concrete seals, and
- permanent steel casings and columns for bridge supports.

Removal of structures below the OHW level on the mainstem Columbia River consists of the following structures:

- existing bridge piers.

No removal of USACE-defined permanent structures below the OHW level in North Portland Harbor is proposed.

The project will have a net areal increase of permanent structure below the OHW level of 1.1509 acres and a slight increase in volume of 8,205 cubic yards (compared to the previously calculated values of approximately 0.9819 acres and 6,558 cubic yards respectively) after the existing bridge piers are removed.

[2] Volume calculations do not include the material that would be removed from within the casings for the drilled shafts from the mudline to tip elevation in the Troutdale Formation; likewise fill calculations do not include the fill material that would be placed within the casings from mudline to tip elevation in the Troutdale Formation.

TABLE 4. PROJECT FILL (APPROXIMATE VALUES)

	TEMPORARY FILL TOTALS		PERMANENT FILL TOTALS	
ELEMENT TYPE/LOCATION	AREA (AC)	VOLUME (CY)	AREA (AC)	VOLUME (CY)
Mainstem Columbia River – ICP	0.9471	60,348	1.5554	46,375
North Portland Harbor – ICP	0.0	0.0	0.0505	3,444
Hayden Island to I-5 South Bridge	0.0	0.0	0.014	667
North Portland Harbor – ICP Cofferdams	0.183	8,837	0.132	1,281
Hayden Island to I-5 South Bridge Cofferdams	0.052	2,525	0.038	366
Geotechnical Borings	<0.001	60	0	0
Total Fill	**1.1827**	**71,770**	**1.7903**	**52,133**

TABLE 5. PROJECT REMOVAL

	TEMPORARY REMOVAL TOTALS		PERMANENT REMOVAL TOTALS	
ELEMENT TYPE/LOCATION	TOTAL AREA (AC)	TOTAL VOLUME (CY)	TOTAL AREA (AC)	TOTAL VOLUME (CY)
Mainstem Columbia River – ICP	0.9471	60,348	0.6394	43,868
North Portland Harbor – ICP	0	0	0	0
Hayden Island to I-5 South Bridge	0	0	0	0
North Portland Harbor – ICP Cofferdams	0.183	8,837	0	0
Hayden Island to I-5 South Bridge Cofferdams	0.052	2,525	0	0
Geotechnical Borings	<0.001	60	<0.001	60
Total Removal	**1.1827**	**71,770**	**0.6394**	**43,928**

Other project elements will be placed below ordinary high water but are not considered fill by USACE. For the purposes of this 404 JPA application, the following elements are not considered structure or fill below the OHW level:

- Mainstem Columbia River
  - temporary steel piles for work platforms and barge moorings, and
  - barges.
- North Portland Harbor
  - temporary steel piles for work platforms and barge moorings.

For the purposes of this 404 JPA, the following elements are not considered removed structure or removed fill below the OHW level:

- Mainstem Columbia River

  - portions of the wharf for the Red Lion at the Quay hotel, and
  - a dock and ship on the southern shore near the former Thunderbird Hotel.
- North Portland Harbor
  - floating homes at Jantzen Beach moorage, and
  - docks and boathouses immediately upstream and downstream of the existing bridge.

Work barges will cover approximately 0.69 acres of water surface (proposed exclusively in the mainstem Columbia River). Removal of floating homes, boathouses, and docks encompass another 3.1 acres of area at the water surface. With the removal of these on-water elements (i.e., floating homes, docks, and quay) less water surface will be impacted after the project than is currently impacted.

Alternatives Considered but not Advanced

Other methods of construction were considered but were not feasible or resulted in additional impacts to aquatic resources. Among these methods was increasing the number of drilled shafts at each pier and incorporating a shaft cap above the water line. The current seismic design criteria for this type of earthquake resisting system require the foundation elements to remain undamaged (elastic) while the supported column sustains some controlled damage (plasticity) to most efficiently and safely dissipate the energy imparted by the earthquake. The magnitude of the lateral force that the foundation is subjected to is inversely proportional to the height of the column. Further, the bending forces the foundation is subjected to is directly proportional to the distance the foundation extends above the mudline. Constructing a shaft cap above the water line would not only result in significantly shorter columns and higher lateral forces, but also would dramatically increase the maximum bending forces in the foundation due to the extension of the drilled shaft above the mudline. It's anticipated that these increased forces would require approximately twice the number of shafts at each pier to maintain stability of the bridge. Constructing twice the number of drilled shafts and constructing the shaft cap would result in more hydroacoustic impacts for driven temporary piles to support the temporary work bridges and drilling equipment platforms, increased permanent footprint in the bed of the river, and higher project cost. Due to the small width and flow capacity of the North Portland Harbor relative to the Columbia River, the waterline shaft cap would have an noticeable impact on the safe width available for recreational watercraft, would increase the volume of fill in the floodplain, and would prohibitively restrict hydraulic flows and lead to an unacceptable rise in the water surface elevation.

Analysis of Potential Impacts

The incorporation of the over-sized casings or circular cell cofferdams will result in an increase in impacts to water quality from turbidity, impacts to substrate, temporary loss of shallow-water habitat, direct effects to fish from work area isolation and fish salvage, and hydroacoustic impacts.

Elevated turbidity from installation of casings/cofferdams using vibratory methods, as well as removal of casings/cofferdams using direct pull or vibratory methods, is expected to extend to no more than 25 feet from the casings/cofferdams. It is likely that turbidity generated by casing/cofferdam use will cause fish avoidance of the work area, may affect fish foraging success, may impact eulachon spawning, and may cause physiological stress to fish. Turbidity is not expected to cause mortality to any fish species.

Installation of the casings/cofferdams is likely to generate low level noise and visual disturbance. For this reason, fish are likely to actively avoid the work area during the construction of casings/cofferdams. However, it is impossible to guarantee that no fish will become trapped inside a casing/cofferdam. To minimize impacts to fish, the project will perform measures to remove fish from the work area during and after the installation of the casings/cofferdams.

Use of casings/cofferdams is not anticipated to restrict recreational boating beyond what was already considered. Casings/cofferdams would be adjacent to work bridges supported by temporary piles and under an oscillator for at least several days. Recreational craft should not be using the area next to the work bridges or within the 4.5 feet between the highly active drilled shaft/column construction zone and the edge of the proposed casing/cofferdam even if the casing/cofferdam was not present.

The project will have a net areal increase of permanent structure below the OHW level of 1.1509 acres and a slight increase in volume of 8,205 cubic yards. Design of the compensatory mitigation sites at the Lewis River confluence in Washington and Dabney State Recreation Area on the Sandy River in Oregon continues with agency coordination. At this time, the CRC project team feels additional mitigation actions or areas are not required to mitigate for the impacts presented in the 404 JPA and this amendment.

Revisions to Section 3 – Proposed Project Information of the JPA are attached, accounting for the increased area and volume of cofferdams/casings in the temporary fill and removal sections. Likewise, the value for total cubic yards for the project has been updated to account for the increased volume associated with the casings/cofferdams. The values also reflect clarifications to the temporary fill and removal values, so that all temporary fill is balanced by temporary removals.

(2) PROJECT LOCATION

Street, Road or Other Descriptive Location	Legal Description (attach *tax lot map**)			
	Township	Range	Section	Quarter/Quarter
The CRC project includes portions of the I-5 corridor between Victory Boulevard on the north side of Portland, Oregon to SR-500 in Vancouver, Washington. The project includes the replacement of the current I-5 bridge over the mainstem Columbia River, the expansion of the I-5 bridge over North Portland Harbor, and extension of light rail into the City of Vancouver with a terminus at Clark College.	1N	1E	3	NE, SE, NW, SW
	1N	1E	4	NE, SE
	2N	1E	33	NE, SE
	2N	1E	34	NE, NW, SW
	2N	1E	27	NE, SE, NW, SW
	2N	1E	26	NW
	2N	1E	22	SE
	2N	1E	23	SW

In or near (City or Town)	County	Tax Map # (Oregon only)	Tax Lot #[2]
City of Portland, OR City of Vancouver, WA	Multnomah County, OR Clark County, WA	1N1E03, 1N04A, 1N1E04, 2N1E33, 1N1E04AA, 1N1E03BB, 2N1E34CA, 2N1E34C, 2N1E34, 2N1E33A, 1N1E03B, 1N1E03, 1N1E03C, 1N1E03D, 1N1E03AC, 1N1E03CC	**See Appendix B of Attachment A.**
Wetland/Waterway (pick one)	River Mile (if known)	Latitude (in DD.DDDD format)	Longitude (in DD.DDDD format)
Columbia River	RM 106.5	45.6167	-122.6750
Directions to the site	I-5 Corridor from Portland, OR at Victory Boulevard to SR-500 in Vancouver, WA.		

(3) PROPOSED PROJECT INFORMATION

Type: Fill ☒ Excavation (removal) ☒ In-Water Structure ☒ Maintain/Repair an Existing Structure ☐

Brief Description: The CRC project will entail both fill and removal below the OHW line of the Columbia River Mainstem and North Portland Harbor. A new crossing will be constructed over the Columbia River Mainstem. Over North Portland Harbor a new mainland connector structure and up to three connector structures associated with I-5 will be constructed The existing crossing over the Columbia River Mainstem will be demolished and removed after the new structures over the river are complete.

Fill *(See Section 2 of Attachment A for a full impact analysis)*

Riprap ☐ Rock ☐ Gravel ☐ Organics ☐ Sand ☐ Silt ☐ Clay ☐ Other: ☒ Steel/concrete

Wetlands	Permanent (cy)	Temporary (cy)						Total cubic yards for project (including outside OHW/wetlands)	0
	0	0							
	Impact Area in Acres	Dimensions (feet)							
	0	L'	0	W'	0	H'	0		
Waters below OHW	Permanent (cy)	Temporary (cy)						Total cubic yards for project (including outside OHW/wetlands)	533,009
	52,133	71,770							
	Impact Area in Acres	Dimensions (feet)							
	1.7903 perm(1.1827tmp)	L'	varies	W'	varies	H'	varies		

Removal (See Section 2 of Attachment A for a full impact analysis)

Wetlands	Permanent (cy)	Temporary (cy)						Total cubic yards for project (including outside OHW/wetlands)	0
	0	0							
	Impact Area in Acres	Dimensions (feet)							
	0	L'	0	W'	0	H'	0		
Waters below OHW	Permanent (cy)	Temporary (cy)						Total cubic yards for project (including outside OHW/wetlands)	311,770
	43,928	71,770							
	Impact Area in Acres	Dimensions (feet)							
	0.6394perm(1.1827tmp)	L'	varies	W'	varies	H'	varies		

[2] Attach a copy of all tax maps with the project area highlighted.

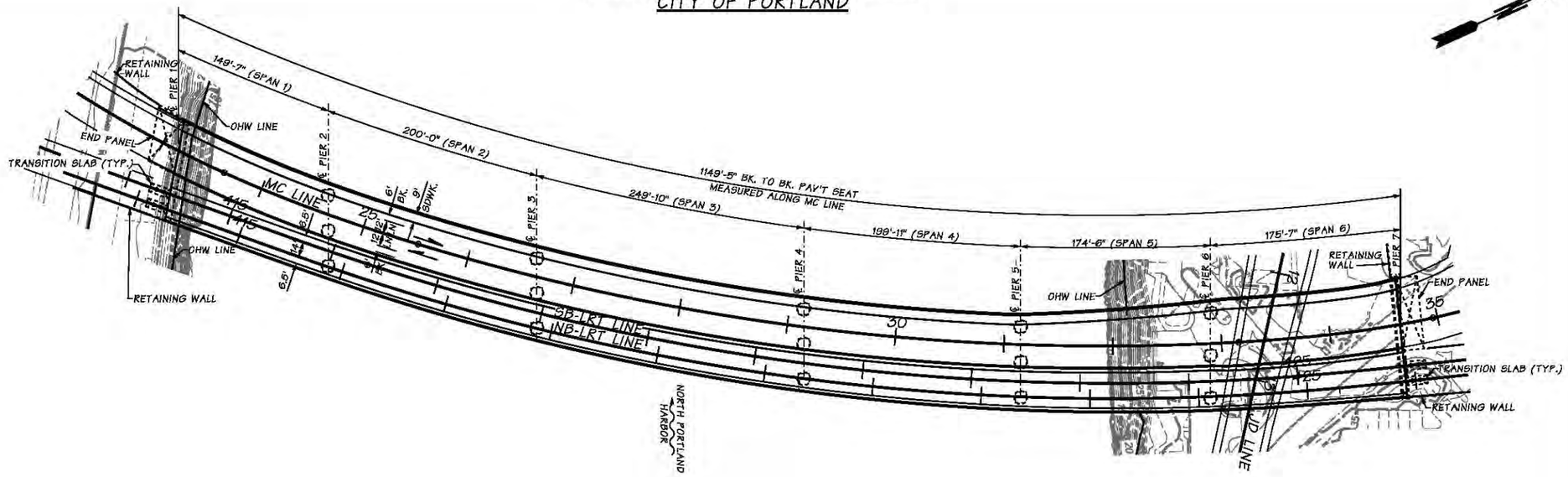
- ***Italicized areas are not required by the Corps for a complete application, but may be necessary prior to final permit decision by the Corps.***

Figure 1
Bridge numbers correspond to
Plan Sheets 1 - 3.

Columbia River CROSSING

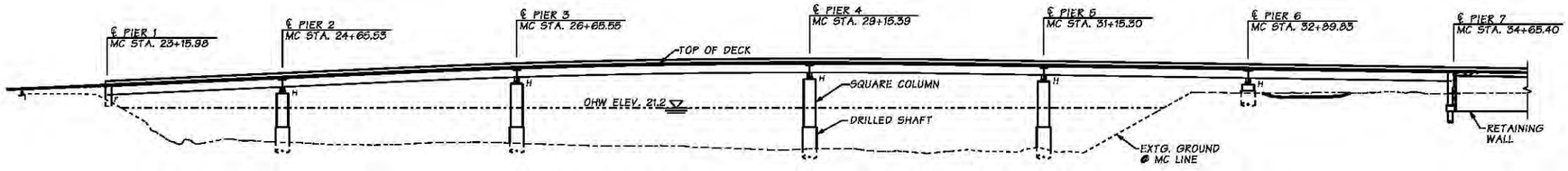
Date: 5/10/2013 Path: P:\GIS\CRC\GIS\PH_404_Permits\Ph_404_Oregon_InWater.mxd

SEC. 33 & 34, T. 2N., R1 E., W.M.
CITY OF PORTLAND



PLAN

BEARING OF PIER 1 IS S 54°39'04" E
BEARING OF PIERS 2, 3, 4, 5, AND 6 IS S 65°37'28" E
BEARING OF PIER 7 IS N 71°29'03" W



DEVELOPED ELEVATION

STEEL PLATE GIRDERS
LOADING HL-93

DATUM
NAVD 88

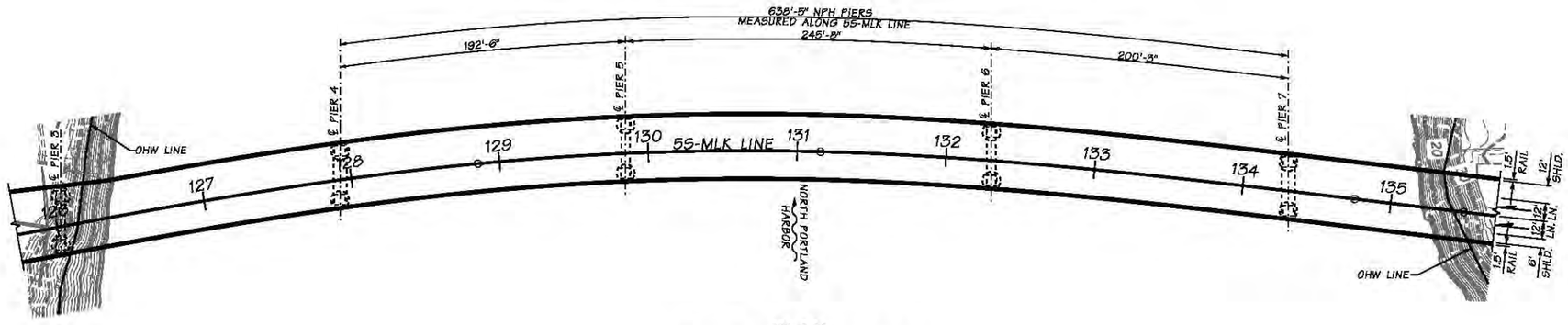
FOR PERMITTING PURPOSES ONLY
NOT FOR CONSTRUCTION

LRT(NPH) PLAN AND ELEVATION

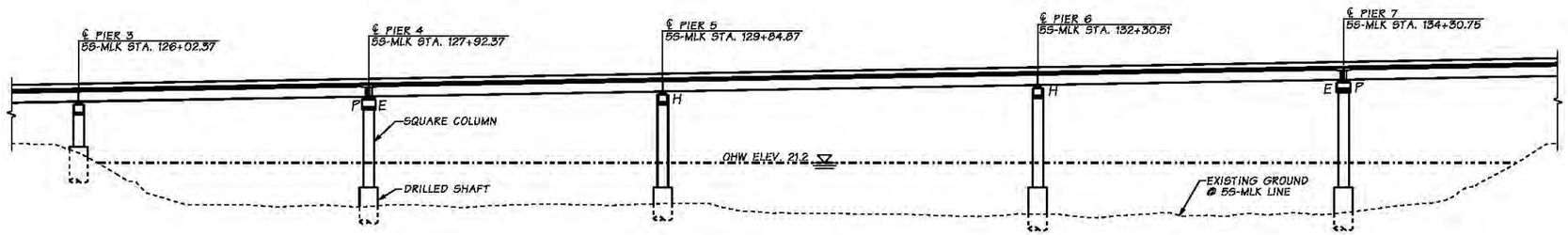
Plan Sheet

Washington State Department of Transportation
Oregon Department of Transportation
Columbia River CROSSING

SEC. 34, T. 2N., R1 E., W.M.
CITY OF PORTLAND



PLAN
BEARING OF NPH PIERS IS S 65°37'28" E



DEVELOPED ELEVATION

STEEL PLATE GIRDERS
LOADING HL-93

DATUM
NAVD 88

55-MLK(NPH) PLAN AND ELEVATION

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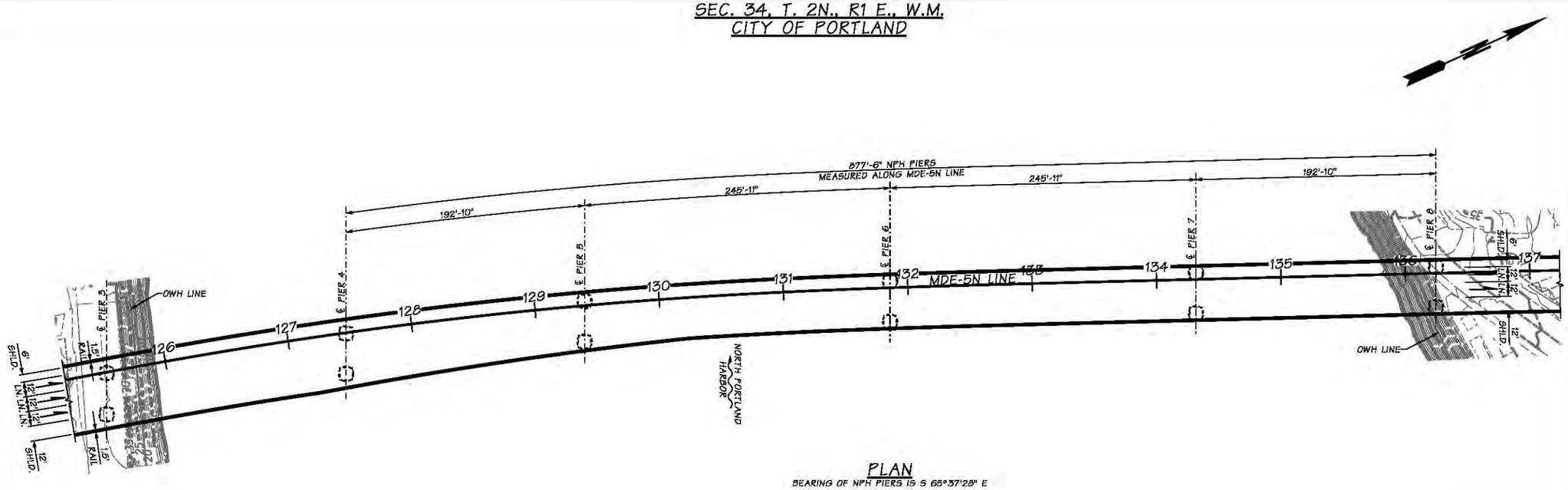
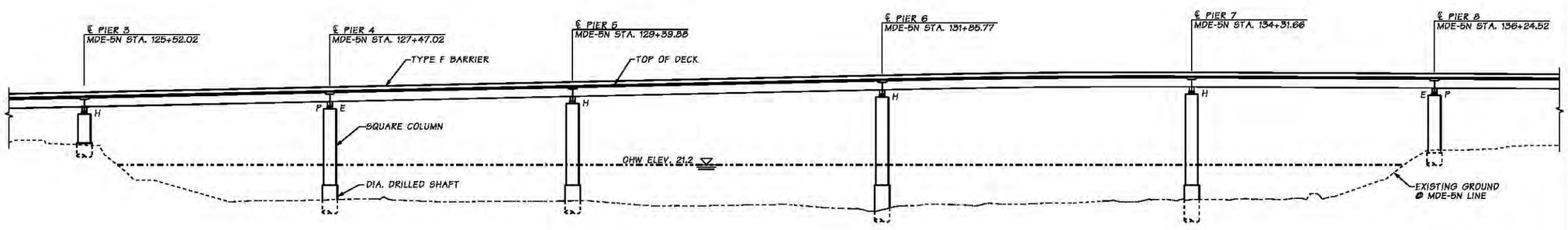
Plan Sheet

Washington State Department of Transportation
Oregon Department of Transportation
Columbia River CROSSING

SEC. 34, T. 2N., R1 E., W.M.
CITY OF PORTLAND



PLAN
BEARING OF NPH PIERS IS S 65°37'28" E



DEVELOPED ELEVATION

STEEL PLATE GIRDERS
LOADING HL-93

DATUM
NAVD 88

MDE-5N PLAN AND ELEVATION

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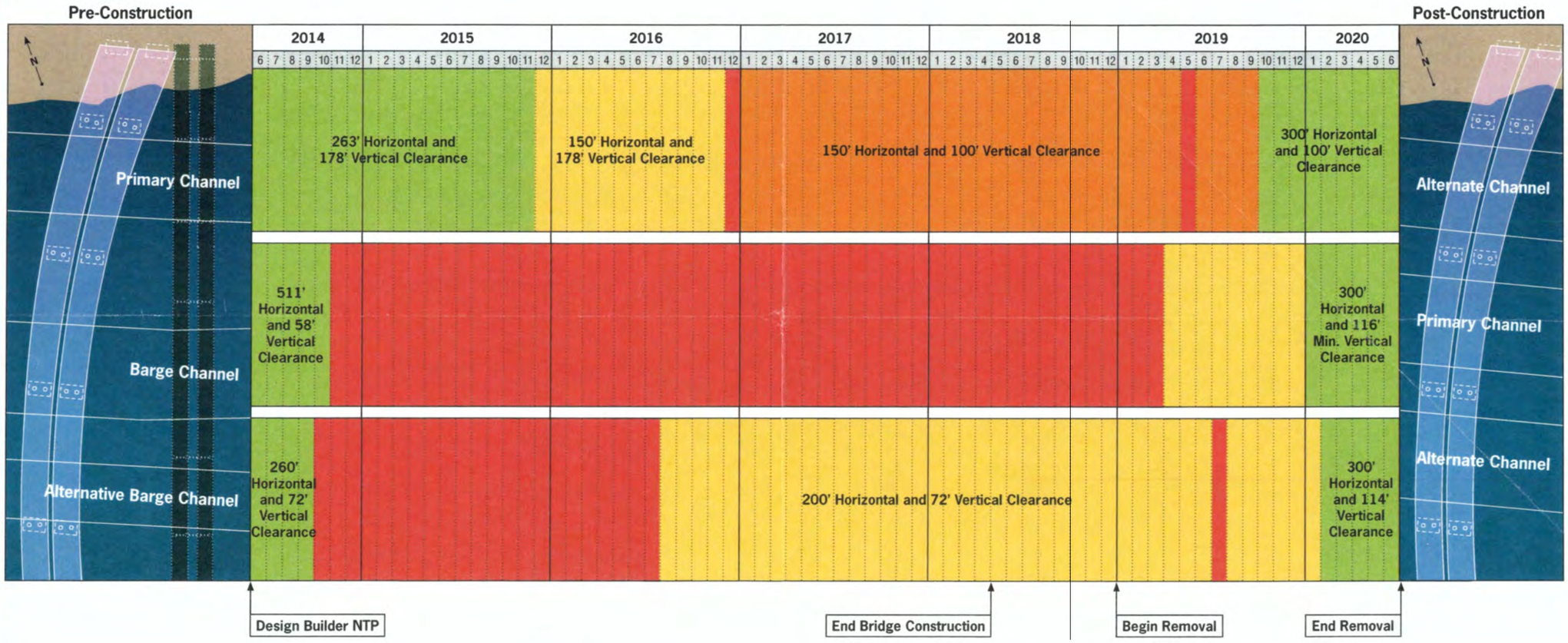
Plan Sheet

Washington State Department of Transportation
Oregon Department of Transportation
Columbia River CROSSING

Columbia River CROSSING

Navigation clearance during construction



NOTE: Schedule is a projection. Actual construction durations will vary. All vertical clearances are referenced from 0 CRD. All identified clearance constraints are in reference to pre-construction conditions.

UPDATED: 03/11/13