Technical Memorandum

Subject	**Segments 2A and 2B Routing Alternatives Evaluation**
Project Name	Tri-City WRRF Willamette River Outfall
Jacobs PN	D3218600
To	Jeff Stallard/WES Lynne Chicoine/WES
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1. Introduction and Scope of Technical Memorandum

This Technical Memorandum (TM) is submitted pursuant to Task 3.4.3.1, Segment 2 Routing Alternatives Evaluation, of the Jacobs contract for engineering services for the Tri-City Water Resource Recovery Facility (WRRF) Willamette River Outfall with Water Environment Services (WES). The Segment 2 route is from the end of Segment 1 to the Willamette River. Since routing on the west side of Highway 99E depends on non-engineering considerations that are not yet formative, the Segment 2 routing study has been divided into Segments 2A and 2B.

Segment 2A is from the end of Segment 1, in the vicinity of the existing diversion box, to the east side of Highway 99E. Segment 2B is from the east side of Highway 99E to the Willamette River. The routing of Segment 2B depends on what entrance into the Willamette River is selected, which depends on discussions with the Oregon Department of Transportation (ODOT) and Oregon City for WES to determine which route they prefer. Segment 2A, however, has been designed to be independent of this future decision.

Presented below are three alternative routes for Segment 2A and two alternative routes for Segment 2B. The final preferred location of the diffuser has not been determined at this time; therefore, the in-water pipeline segments are not definitive, but are presented as part of Segment 2B to adjust for disparate lengths of in-water work for the two alternatives for Segment 2B—to provide a more comprehensive comparison of the two.

2. Basis of Design

2.1 Data Utilized in Evaluation

This routing alternatives evaluation utilized data provided by WES and ODOT. Topography was based on the LIDAR "dtm" developed by the Oregon Department of Geology and Mineral Industries (DOGAMI) and converted to "dgn" format by ODOT. The primary record drawings and sources of information used in this analysis were as follows:

- *Abernethy Bridge Draft GER (Shannon & Wilson, June 2019)*
- *Draft Type, Size, and Location (TSL) Report: Abernethy Bridge* (Quincy-HDR, April 27, 2018)
- *Preliminary Plans - OR213 - Abernethy Bridge* (Quincy-HDR, June 21, 2019)

- *Willamette Interceptor 1A Outfall Oregon City Interceptor River Crossing* (B&C, 1984) [Note: many sections of the drawings are unreadable as a result of scan.]
- Tax Lot Information (WES, 2019)
- *Required Effluent Flow Capacity* (WES, August 5, 2019)
- WRRF effluent flow values from *Request for Proposals for the WES Facility Plan Update* (WES)
- *WES Master Plan Tri-City Cost Basis* updated in August 2019 to 2022

2.2 Design Assumptions

This routing alternatives evaluation assumes an 84-inch-diameter gravity pipeline for the new outfall (*Preliminary Outfall Hydraulic Analysis Memorandum*, [Jacobs, August 2019]). The design capacity for the new outfall is 101 million gallons per day (mgd) (WES, August 5, 2019). WES prefers gravity discharge to a pumped discharge. Jacobs hydraulic calculations confirm a gravity discharge is possible under design peak flow conditions.

A decision was made to base the design drawings on the North American Vertical Datum of 1988 (NAVD 88) (email from WES, July 31, 2019). The WRRF plans and record drawings for the existing outfall and Willamette Interceptor are based on National Geodetic Vertical Datum of 1927 (NGVD 27); however, the ODOT drawing, DOGAMI LIDAR, and Federal Emergency Management Agency Flood Insurance Study are based on NAVD 88. Since the majority of this work will not be at the WRRF, it was considered judicious to base the alignment work on NAVD 88 to minimize conflicts and confusion with adjacent facilities.

2.3 Design Review Criteria

Draft design review criteria were submitted to WES on June 11, 2019, for District review. The accepted Segment 2A and 2B outfall routing criteria are as follows:

- Capital Construction Cost
- Operations and Maintenance (O&M) Access
- Constructability
- Schedule Compatibility
- Geotechnical Stability
- Hazardous Materials
- Permitting
- Utility Conflicts
- Property Ownership
- Right-Of-Way (ROW) Encroachment
- Public Impacts and Public Perception

Diffuser siting criteria are not included in this TM. Diffuser siting will be addressed in a separate TM.

3. Alternatives Evaluation – Segment 2A

Three alternative alignments and construction cost estimates for Segment 2A were developed for evaluation and comparison as described below. Figure 1 contains a graphical overview of the three alignments under consideration (figures provided at end of this TM).

3.1 Segment 2A – Alternative 1: Maximize Use of ODOT Right-of-Way

See Figure 2 for plan and profile of Alternative 1. Starting at the southern end of Segment 1, it follows Tri-City Sewer District (TCSD) property to the east side of Main Street in ODOT ROW. The alignment crosses Main Street and continues along the north ROW of I205. This segment is conceived as open cut with the option for trenchless construction. This segment of the alignment is trenchless for 663 feet crossing under the I205 loop ramps and ends at the northwest corner of the Highway 99E/I-205 southbound loop ramp infield, in ODOT ROW.

The most notable segment of Alignment 1 is the 663-foot-long bore under the I-205 loop ramps. The launch shaft would be located in the northwest corner of the loop ramp infield where the finished grade is lowest (see Photo 1), minimizing the depth of the launch shaft; currently considered to be a 35-foot circular secant shaft. Based on existing ODOT geotechnical investigations for the Abernethy Bridge, the alignment is anticipated to be in sand alluvium above the groundwater table. Jacobs has determined that the trenchless drive will likely require a microtunnel machine, due to the length of the drive, and has estimated the cost of construction accordingly.

Photo 1. Launch Shaft Location Looking East

The alignment is within either ODOT, TCSD ROW, and Oregon City ROW for the Main Street crossing. The Main Street crossing was assumed to be an open cut; however, an option to allow trenchless construction for the 405 feet from Manhole (MH) 2 to MH 3 should be considered. Adding 405 feet to the bore requires favorable geotechnical conditions and should be considered following the geotechnical investigation. See Figure 3. If the option to bore from MH 1 to MH 3 is selected, there will be a segment of 1,121 feet without any manholes. The alternative cost for the for Alignment 1 Option is similar to Alternative 1 at $6,756,000. From MH 3 to MH 4, pipeline depth is controlled by the drainage swale at STA 12+60. From MH 4 to MH 5, depth is controlled by the necessity to pass over the Willamette Interceptor at STA 13+70, where the top of pipe is about 26 feet.

The most significant construction risk for this alignment is the 663-foot trenchless section due to the uncertainty of what materials are in the path of the bore. This concept development assumes the ODOT geotechnical information from Abernethy Bridge remains valid in this location. Jacobs considers this a reasonable assumption at this point in design, given the existing geotechnical information is only 300 to

600 feet distant from the bore alignment; however, it is imperative to get actual boring information along the entire alignment during design.

Alignment Alternative 1 is 1,721 linear feet long, the shortest of the three Segment 2A alignment alternatives. The bore results in a 663-foot section without manholes that will need to be maintained. The shorter the length, the greater the hydraulic performance at high Willamette River levels. The alternative construction cost estimate is $6,720,000; this includes both the launch and receiving shafts. Cost estimates are contained in Attachment 1.

3.2 Segment 2A – Alternative 2: Utilize Oregon City Shopping Center Parking Lot

See Figure 4 for plan and profile of Alternative 2. Alternative 2 replaces the long bore in Alternative 1 (MH 1 to MH 2) with a shorter bore of 190 feet to the parking lot of the Oregon City Shopping Center. From the end of Segment 1 the alternative follows the same alignment as Alternative 1 from MH 6 to MH 3, passing over the Willamette Interceptor. The alternative follows ODOT ROW north of I205 until it reaches the southeast corner of the Oregon City parking lot. The alignment continues along the south side of the parking lot by open cut until it reaches the receiving shaft (MH 2). The launch shaft for the bore is in the same location as the shaft for Alignment 1 (see Photo 1) with the receiving shaft at MH 2 in the Oregon City Shopping Center parking lot.

The critical segment of Alignment 2 is at the east end of the shopping center parking lot. This open cut segment needs to pass between the south edge of the parking lot and the south corner of the Rite Aid building. The available distance between the two is slightly less than 25 feet. Given a 28-foot trench depth through this segment, the entire width between the building and edge of the parking lot will be impacted, blocking access to the Rite Aid loading dock and to the southern exit of the one-way utility corridor circling the back of the shopping center.

Photo 2. Critical Width Area by Rite Aid Loading Dock Looking East

Construction of the open cut sections of this alignment would be difficult given the anticipated geology of sand alluvium and the trench depth. Trench shoring would need to be carefully considered to avoid running sands into the trench. Construction in the parking lot would primarily adversely affect Rite Aid and would also impact trucking operations for the entire shopping center due to the one-way loop access behind the buildings. Truck access to Rite-Aid and other stores in the shopping center would need to be mitigated to facilitate their operation.

Alignment 2 is 1,781 linear feet long, about 3.5-percent longer than Alignment 1. There would be no substantive difference in hydraulic performance between Alignments 1 and 2. The alternative construction cost estimate is $6,925,000; this includes both the launch and receiving shafts. The bore has been priced as a microtunnel to account for the possibility of a microtunnel machine being required for Segment 2B; if a microtunnel machine is required for Segment 2B the most cost-effective approach is to use it for both bores and not mobilize a different machine for the 190-foot bore. There is no substantive difference in cost between Alignment 1 and 2. Cost estimates are contained in Attachment 1.

3.3 Segment 2A – Alternative 3: Utilize Main Street

Alternative 3 is an open cut alternative following Main Street and Clackamette Drive from the terminus of Segment 1 to the start of Segment 2B. See Figures 5 and 6. This alignment eliminates the need for any trenchless construction and eliminates the need to pass over the Willamette Interceptor. This alignment follows inside of the existing outfall alignment once Segment 1 has passed over the existing outfall and does not need to pass over it again. There are local sanitary, stormwater, and water lines in Main Street that may require relocation during construction. Alternative 3 ends on Clackamette Drive on the west side of Highway 99E, since it crosses under the 99E bridge. Alternative 3 will require a ROW Street Permit from Oregon City.

The northern end of Segment 2A controls the segment depth because minimum cover for the first 2,100 feet keeps trench depths between 12 and 14 feet. After Main Street passes under Highway 99E, finished grade rises by about 10 feet, increasing trench depth to 22 to 24 feet. Where Main Street passes under Highway 99E there is limited overhead clearance that may require use of smaller excavation equipment. Assuming the excavation will be in sand alluvium, open trench construction is anticipated to be difficult.

Alignment 3 is 3,538 feet long, about 105 percent longer than Alignment 1. During high river levels, the longer pipeline length degrades hydraulic performance by 88 to 89 percent. Alternatives 1 and 2 perform at the design condition of 101 mgd at the 25-year Willamette River water level; Alternative 3 performs at the 101 mgd only during the 15- to 20-year Willamette River water level. The alternative construction cost estimate is $10,614,000; 58 percent higher than Alternative 1. Alternative 3 eliminates the need for boring under Highway 99E when combined with Segment 2B; this would potentially achieve a savings of approximately $1,833,000. Cost estimates are contained in Attachment 1.

4. Recommendation for Segment 2A

4.1 Routing Criteria Matrix for Segment 2A

The Routing Criteria Matrix for Segment 2A is contained in Attachment 2. Routing criteria are qualitative only.

Table 1 compares the Segment 2A alternatives based on estimated alternative cost and predicted hydraulic performance. Hydraulic performance is the estimated peak flow capacity when the Willamette River water surface level is at the 25-year elevation. Hydraulic performance was computed for both Segment 2B alternatives combined with the 2A alternatives: ODOT Routing and Oregon City Routing.

Table 1. Comparison of Segment 2A Alternatives

Alternative	Estimated Construction Cost	Hydraulic Performance Based on ODOT Routing (mgd)	Hydraulic Performance Based on Oregon City Routing (mgd)
Alternative 1: Maximize Use of ODOT Right-of-Way	$6,720,000	106.4	110.1
Alternative 1: Long Bore	$6,756,000	106.4	110.1
Alternative 2: Utilize Oregon City Shopping Center Parking Lot	$6,925,000	105.8	109.4
Alternative 3: Utilize Main Street	$10,614,000 ($8,781,000)*	94.6	97.1

*Estimate of construction cost minus the bore under Highway 99E.

mgd = million gallons per day.

4.2 Recommended Alternative – Segment 2A

Alternative 1 is recommended as the preferred alignment. The estimated cost of Alternative 1 is equivalent to Alternative 2 and 58 percent less than Alternative 3. Alternative 1 has the greatest estimated hydraulic performance although only 0.6 percent greater than Alternative 2. Alternative 1 is entirely within public ROW with no anticipated public negative impacts or perceptions, with the exception of crossing Main Street. Alternative 1 offers the potential for a longer trenchless section, in excess of 1,000 feet, if the optional trenchless section is pursued. As a result of trenchless construction, Alternative 1 does include either a 663-foot section or a more than 1,000-foot section without any manhole access. Also, Alternative 1 has the highest construction risk due to the long section of trenchless construction.

Alternative 2 is equivalent in cost to Alternative 1; however, it causes greater public impact, particularly to the Oregon City Shopping Center and Rite Aid. Alternative 2 requires easements from private property owners that may not be easy to obtain due to impacts to the operation of the shopping center. Although Alternative 2 has a shorter and less risky trenchless section, the open cut construction that replaces the trenchless section is not without risk due to the deep trenching through sand alluvium.

Alternative 3 is the longest and most expensive alternative. Even if the savings for elimination of the bore under Highway 99E for Segment 2B is subtracted from the cost of Alternative 3, it is still 31 percent more expensive than Alternative 1. It provides reduced hydraulic performance and has the greatest public impact due to construction within active Oregon City streets: Main Street and Clackamette Drive. The open cut construction along Clackamette Drive is relatively deep and, similar to the open cut construction of Alternative 2, entails risk due to deep trenching through sand alluvium.

Prior to design we recommend terrestrial survey of the selected alternative. During design Jacobs recommends an extensive series of geotechnical investigations to obtain more information about the subsurface characteristics of both the trenchless and open cut areas to better understand the risks and construction challenges. The geotechnical investigations should be focused on producing a Geotechnical Baseline Report (GBR), for inclusion with the contract documents. Based on the results of these investigations, consideration should be given to the long bore from MH 1 to MH 3. Jacobs also recommends that field surveys be conducted to identify and document any cultural materials that may be present. It is recommended that the construction documents be based on NAVD 88.

5. Alternatives Analysis – Segment 2B

The following section presents the salient aspects of the two Segment 2B alternatives. These alternatives extend from the east side of Highway 99 to the in-water work to access the diffuser location. Figures 7 and 8 contain a graphical view of the two alignments under consideration. Selection of the Segment 2B alternative depends on several factor that include engineering considerations, cost information as well as risk considerations that revolve around schedule and stakeholder considerations.

5.1 Segment 2B – Alternative 1: Use of ODOT Right-of-Way

The Alternative 1 alignment crosses from the east side of Highway 99E to the river entirely within ODOT ROW (see Figure 7). Developing the alignment is complicated by the necessity to accommodate both the existing structures and future planes for widening of the bridge. This alignment has been coordinated with ODOT's consultant bridge and roadway engineers to determine an acceptable alignment through ODOT's existing and future structures. This alignment still requires approval from ODOT's Executive Leadership Group. A separate Draft Risk Memorandum has been prepared for their review.

The pipeline would be bored from the east side of Highway 99E from the existing launch pit to east of Clackamette Drive within ODOT ROW (see Photo 3). The remaining pipeline would be installed by open cut construction under the Abernethy Bridge, avoiding the existing and future bridge piers. It is anticipated that the in-water construction would be accomplished by barge.

Photo 3. Receiving Pit Area Looking East Toward Highway 99E

The schedule for the bridge work is unclear at this time because it is currently delayed due to lack of construction funding. This alternative would probably not be constructed until the fourth year of bridge construction. The substructure work for the bridge requires work trestles on both sides of the bridge that would prevent construction of the in-water pipeline. During the fourth and final year of bridge construction, the work bridges are to be removed and only superstructure work is anticipated.

The cost estimate for this segment is $5,319,000. This includes a 10 percent premium for ODOT construction management. The in-water construction cost estimate is a place holder since the actual diffuser location is currently unknown. This alternative would require negotiation with ODOT on sharing of environmental and construction risk, in addition to any design coordination.

5.2 Segment 2B – Alternative 2: Use of Oregon City Right-of-Way

Alternative 2 crosses from the east side of Highway 99E to the river within Oregon City, Val-U Inn Oregon City, LLC, and Oregon City Park ROW (see Figure 8). It is anticipated that crossing under Oregon City Park land would require a public vote under Chapter X of the Oregon City Charter. Additional discussions would be required with Oregon City to gain support for allowing a pipeline crossing under their Park ROW. Alternative 2 avoids an open cut approach and prevents damage to Oregon City Park property.

The pipeline would be bored from the east side of Highway 99E from the existing launch pit to a receiving pit just south of the Best Western Rivershore Motel (see Photo 4). Jacobs anticipates that the receiving pit would be used to launch a microtunnel machine into the river for a wet recovery. The microtunnel would be designed to pass between the existing in-river piles of the Oregon City Dock.

Photo 4. Receiving and Launch Pit Area Looking East Toward Highway 99E

The cost estimate for this segment is $3,841,000. The in-water construction cost estimate is a place holder since the actual diffuser location is currently unknown.

6. Recommendations for Segment 2B

6.1 Routing Criteria Matrix for Segment 2B

The Routing Criteria Matrix for Segment 2B is contained in Attachment 2. Routing criteria are qualitative only. Table 2 compares the alternative cost estimates and schedules of the Segment 2B alternatives.

Table 2. Comparison of Segment 2B Alternatives

Alternative	Estimated Construction Cost	Schedule
Alternative 1	$5,319,000	Unknown, depends on ODOT construction funding for Abernethy Bridge
Alternative 2	$3,841,000	Depends on Oregon City public vote under Chapter X

6.2 Recommended Alternative

Selection of the preferred Segment 2B alternative requires further discussions and input from WES. Additional evaluation of stakeholder and schedule risks should be considered in the Segment 2B selection. Further discussions and input from ODOT is needed to confirm that Alternative 1 is feasible, and stakeholder engagement will be required to gain support from Oregon City voters to approve a pipeline construction under Park property.

The timeline for Alternative 1 depends on the construction funding and schedule for the Abernethy Bridge. There are three potential scenarios for the bridge construction: (1) it is funded and built in the near future; (2) the bridge improvements are removed from ODOT's program; and (3) the project remains on ODOT's program but is indefinitely delayed. Scenarios 2 and 3 leave the Segment 2B outfall with no clear timeline. Alternative 1 will also require extensive negotiations with ODOT to define the various risks and responsibilities.

Alternative 2 is 44 percent less expensive, requires less complex design and construction, and could potentially proceed on a WES schedule, provided it is approved by Oregon City voters.

Attachment 1
Cost Estimates

WATER ENVIRONMENT SERVICES
SEGMENT #2A - ALTERNATIVE #1
CONCEPTUAL COST ANALYSIS

Segment	From MH	To MH	Length (ft)	Avg. Depth (ft)	$/LF	MH Cost ($)	Mobilization Cost ($)	Additional Inc. Cost ($)	Segment Cost ($)	
1	1	2	663	Trenchless	$3,000	$17,000	$200,000	$1,000,000	$3,206,000	Addl Cost for Shafts (x2)
2	2	3	405	31	$3,100	$17,000	$0	$70,000	$1,342,500	Addl Cost for Street Crossing & sand Ex.
3	3	4	276	24	$2,925	$17,500	$0	$0	$824,772	
4	4	5	377	17	$2,789	$17,000	$0	$0	$1,068,385	
									$6,441,658	
							Fence and Vegetation Restoration:		$20,000	
									$6,461,658	
							4% Inflation to 2022:		$258,466	
			1,721	lf			**Segment Total ($):**		**$6,720,124**	

WATER ENVIRONMENT SERVICES
SEGMENT #2A - ALTERNATIVE #1 OPTION
CONCEPTUAL COST ANALYSIS

Segment	From MH	To MH	Length (ft)	Avg. Depth (ft)	$/LF	MH Cost ($)	Mobilization Cost ($)	Additional Inc. Cost ($)	Segment Cost ($)	
1	1	2	1122	Trenchless	$3,000	$17,000	$200,000	$1,000,000	$4,583,000	Addl Cost for Shafts (x2)
3	3	4	276	24	$2,925	$17,500	$0	$0	$824,772	
4	4	5	377	17	$2,789	$17,000	$0	$0	$1,068,385	
									$6,476,158	
						Fence and Vegetation Restoration:			$20,000	
									$6,496,158	
							4% Inflation to 2022:		$259,846	
			1,775	lf			**Segment Total ($):**		**$6,756,004**	

WATER ENVIRONMENT SERVICES

SEGMENT #2A - ALTERNATIVE #2

CONCEPTUAL COST ANALYSIS

Segment	From MH	To MH	Length (ft)	Avg. Depth (ft)	$/LF	MH Cost ($)	Mobilization Cost ($)	Additional Inc. Cost ($)	Segment Cost ($)	
1	1	2	190	Trenchless	$3,000	$17,000	$200,000	$1,000,000	$1,787,000	Addl Cost for Shafts (x2)
2	2	3	533	27	$3,104	$17,000	$0	$10,000	$1,681,491	Addl Cost Temp Protection in Parking Lot
3	3	4	405	24	$2,925	$17,500	$0	$70,000	$1,272,085	Addl Cost for Street Crossing & sand Ex.
4	4	5	276	24	$2,925	$17,500	$0	$0	$824,772	
5	5	6	377	17	$2,789	$17,000	$0	$0	$1,068,385	
									$6,633,733	
								Fence and Concrete Wall Restoration:	$25,000	
									$6,658,733	
								4% Inflation to 2022:	$266,349	
			1,781	lf				**Segment Total ($):**	**$6,925,082**	

WATER ENVIRONMENT SERVICES

SEGMENT #2A - ALTERNATIVE #3

CONCEPTUAL COST ANALYSIS

Segment	From MH	To MH	Length (ft)	Avg. Depth (ft)	$/LF	MH Cost ($)	Mobilization Cost ($)	Additional Inc. Cost ($)	Segment Cost ($)	
1	1	2	248	22	$2,999	$18,000	$0	$0	$761,712	
2	2	3	251	22	$2,999	$18,000	$0	$0	$770,709	
3	3	4	249	23	$2,999	$18,000	$0	$0	$764,711	
4	4	5	266	23	$2,999	$18,000	$0	$0	$815,691	
5	5	6	426	20	$2,999	$18,000	$0	$0	$1,295,506	
6	6	7	117	17	$2,863	$17,500	$0	$0	$352,443	
7	7	8	351	12	$2,655	$17,000	$0	$0	$948,835	
8	8	9	349	14	$2,655	$17,000	$0	$0	$943,525	
9	9	10	242	11	$2,655	$17,000	$0	$0	$659,462	
10	10	11	239	10	$2,655	$17,000	$0	$0	$651,497	
11	11	12	255	10	$2,655	$17,000	$0	$0	$693,974	
12	12	13	160	10	$2,655	$17,000	$0	$0	$441,768	
13	13	14	268	11	$2,655	$17,000	$0	$0	$728,486	
14	14	15	117	12	$2,655	$17,000	$0	$10,000	$337,612	Concrete Traffic Circle
									$10,165,931	
								Additional Traffic Control	$40,000	
									$10,205,931	
								4% Inflation to 2022:	$408,237	
			3,538 lf					**Segment Total ($):**	**$10,614,169**	

WATER ENVIRONMENT SERVICES

SEGMENT #2B - Alternative #1 - ODOT ALTERNATIVE

CONCEPTUAL COST ANALYSIS

Segment	From MH	To MH	Length (ft)	Avg. Depth (ft)	$/LF	MH Cost ($)	Mobilization Cost ($)	Additional Inc. Cost ($)	Segment Cost ($)	
1	1	2	386	Trenchless	$3,000	$0	$0	$500,000	$1,658,000	Addl Cost for Receiving Shaft
2	2	3	56	29	$3,104	$18,500	$0	$40,000	$232,330	Addl Cost for Street Crossing
3	3	4	250	28	$3,104	$18,500	$0	$0	$794,528	
4	4	5	550	17	$3,500	$0	$0	$0	$1,925,000	Approx. cost for In-Water Barge Stl. Pipeline
									$4,609,858	
								Bank & Utility Restoration:	$40,000	
									$4,649,858	
								4% Inflation to 2022:	$185,994	
			1,242	lf				Segment Subtotal ($):	$4,835,852	
								10% ODOT Administrative Costs:	$483,585	
								Segment Total:	**$5,319,437**	

WATER ENVIRONMENT SERVICES

SEGMENT #2B - Alternative #2 - OREGON CITY ALTERNATIVE

CONCEPTUAL COST ANALYSIS

Segment	From MH	To MH	Length (ft)	Avg. Depth (ft)	$/LF	MH Cost ($)	Mobilization Cost ($)	Additional Inc. Cost ($)	Segment Cost ($)	
1	1	2	355	Trenchless	$3,000	$18,500	$0	$750,000	$1,833,500	Addl Cost for 50' Deep Launch & Receiving Shaft
2	2	3	500	Trenchless	$3,500	$0	$0	$100,000	$1,850,000	Approx. In-Water Trenchless & In-Water Machine Reco\
									$3,683,500	
							Concrete Circle Restoration:		$10,000	
									$3,693,500	
							4% Inflation to 2022:		$147,740	
			855	lf			**Segment Total ($):**		**$3,841,240**	

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Attachment 2
Routing Criteria Matrix

TriCity Outfall - Segment #2A Outfall

Alt No.	Alternative Alignment/ Description	Capital Cost	O&M Access	Constructability	Schedule	Geotechnical Stability	Hazardous Materials	Permitting	Utility Conflicts	Property Ownership	ROW Encroachment	Public Impacts & Perception
		Initial Capital Construction Costs	*Relative maintenance access issues*	*Construction risk and construction access considerations*	*Meets 2021 timeframe and impacts from other development along route (Cove development, ODOT Widening, etc.).*	*Long term stability of pipeline and seismic considerations*	*Encounter buried hazardous materials or landfill wastes that require special handling during pipeline construction (impact is also reflected in construction cost and schedule)*	*Complexity and cost of permitting for environmental and land use, inclusive of anticipated timeframe and diffuser placement*	*Construction risk to adjacent utilities and potential need to move utilities*	*Requirements to purchase easements or ROW, inclusive of potential condemnation*	*Potential encroachments into non-WES ROW*	*Perceived impacts by the public and/or other potential negative impacts; inclusive of diffuser placement*
	Weight	*100*	*75*	*50*	*100*	*100*	*10*	*25*	*25*	*25*	*25*	*50*
1	**Maximize use of ODOT ROW - Requires 663' trenchless reach**	6,720,000 (Alt 1 OPTION $6,756,000)	1,721 lf to maintain & 663 ft reach without a MH	Longest trenchless section 663'	No known schedule constraints	No know issues	No know issues	ROW Street Permit for Main St cut	No known issues	ODOT & TCSD	ODOT Easements required. Oregon City easement required for crossing Main Street.	No anticipated negative impacts or perception of
2	**Utilize Oregon City Shopping Center Parking Lot for Open Cut Construction**	$6,925,000	1,781 lf to maintain	190' Bore	No known schedule constraints	No know issues	No know issues	Need to coordinate with Oregon City Shopping Center & ROW Street Permit for Main St cut	No known issues	Oregon City Shopping Center & ODOT & TCSD	Oregon City Shopping Center & ODOT easements required. Oregon City easement required for crossing Main Street.	Interferes with operation of Rite-Aid loading dock.
3	**Follows Main Street and Clackamette Drive**	10614000 ($8,781,000)	3,538 lf to maintain	Open Cut construction only	No known schedule constraints	No know issues	No know issues	Requires ROW Street Permit from Oregon City for 3,600 feet of open cut	Anticipated conflicts with local utilities	Oregon City and TCSD	Oregon City easements required	Traffic impacts to Main St. and Clackamette Dr.

TriCity Outfall - Segment #2B Outfall

Alt No.	Alternative Alignment/ Description	Capital Cost	O&M Access	Constructability	Schedule	Geotechnical Stability	Hazardous Materials	Permitting	Utility Conflicts	Property Ownership	ROW Encroachment	Public Impacts & Perception
		Initial Capital Construction Costs	*Relative maintenance access issues*	*Construction risk and construction access considerations*	*Meets 2021 timeframe and impacts from other development along route (Cove development, ODOT Widening, etc.).*	*Long term stability of pipeline and seismic considerations*	*Encounter buried hazardous materials or landfill wastes that require special handling during pipeline construction (impact is also reflected in construction cost and schedule)*	*Complexity and cost of permitting for environmental and land use, inclusive of anticipated timeframe and diffuser placement*	*Construction risk to adjacent utilities and potential need to move utilities*	*Requirements to purchase easements or ROW, inclusive of potential condemnation*	*Potential encroachments into non-WES ROW*	*Perceived impacts by the public and/or other potential negative impacts; inclusive of diffuser placement*
	Weight	*100*	*75*	*50*	*100*	*100*	*10*	*25*	*25*	*25*	*25*	*50*
1	**Alternative 1** **Use of ODOT ROW**	$5,319,000	Difficult to access MH on river bank & approx. 1,200 feet long	Riskier construction due to proximity to bridge	Totally dependent upon ODOT's schedule	Pipeline reacts independently from bridge	No known issues	Requires ROW Street Permit from Oregon City for cutting Clackamette Dr	Storm, sanitary & electrical conflicts in ODOT ROW	ODOT easement required	Encroachment into ODOT & Oregon City ROW	Shor term disruption of Clackamette Dr
2	**Alternative 2** **Use of Oregon City ROW**	$3,841,000	Easy to access terrestrial portion of alignment	Low risk if constructed by microtunnel	Oregon City Chapter X vote the only schedule constraint	Minimal known seismic issues	No known issues	Requires Chapter X vote by Oregon City	No known issues	Requires easement from VAL-U Inn Oregon City LLC	Requires easement from VAL-U Inn Oregon City LLC & Chapter X vote	Minimal public disruption

FIGURES

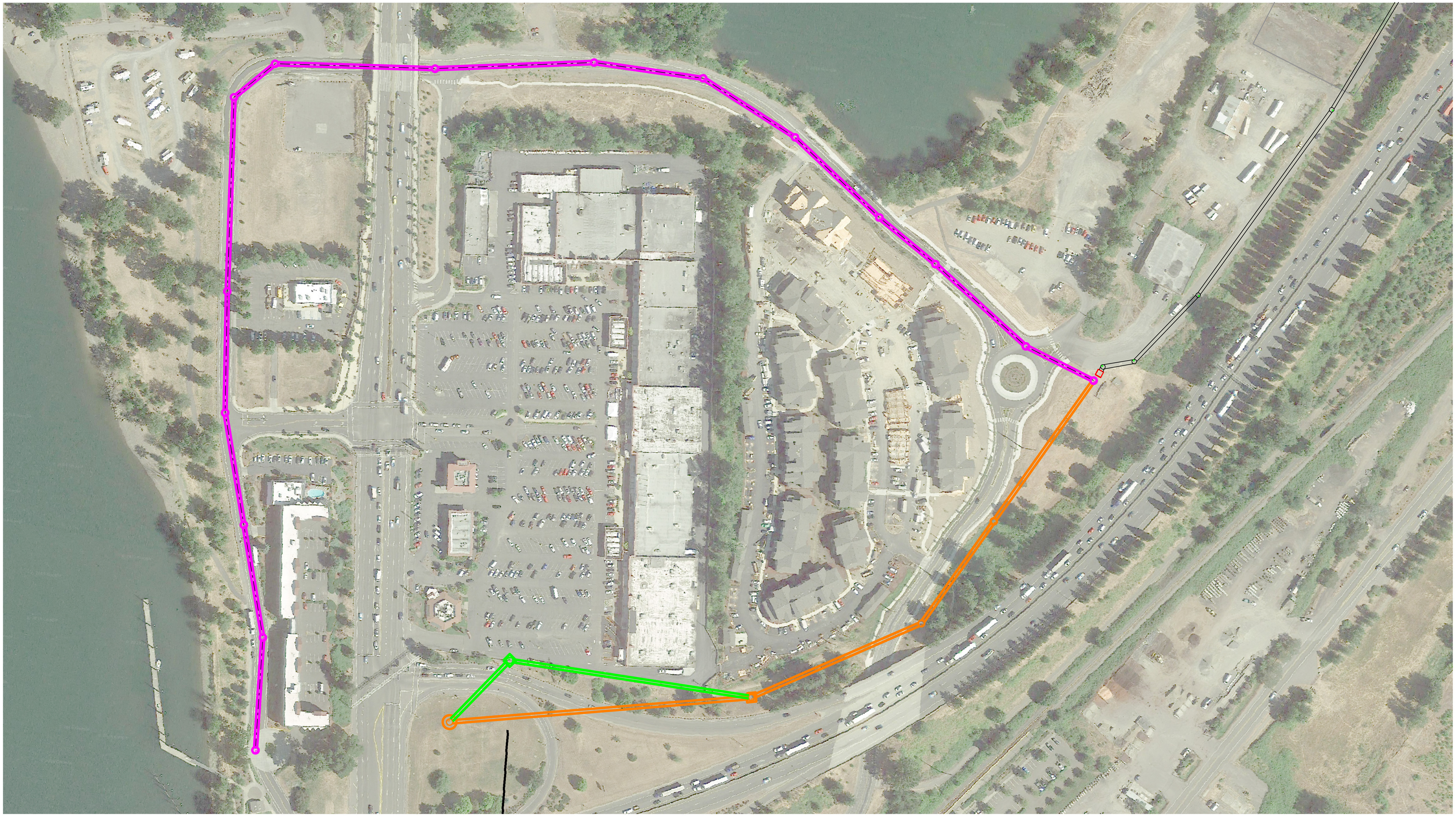
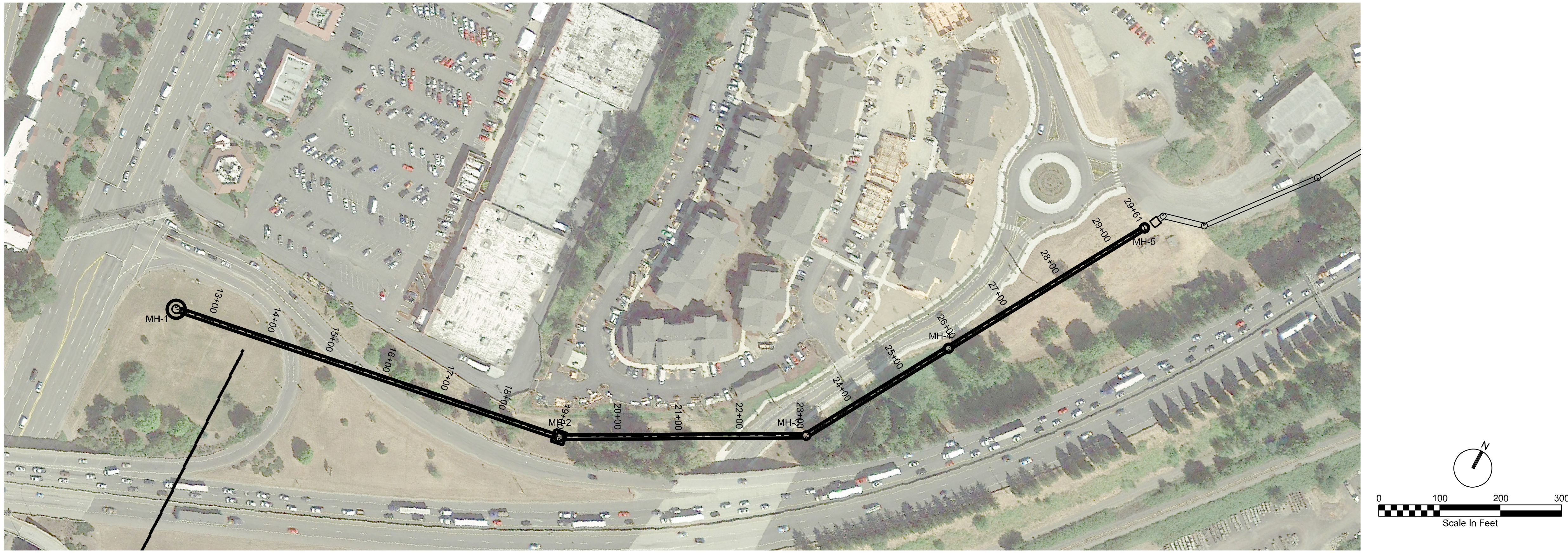


FIGURE 1

SEGMENT 2A
COMPOSIT PLAN OVERVIEW
TRI CITY WWRF OUTFALL

JACOBS



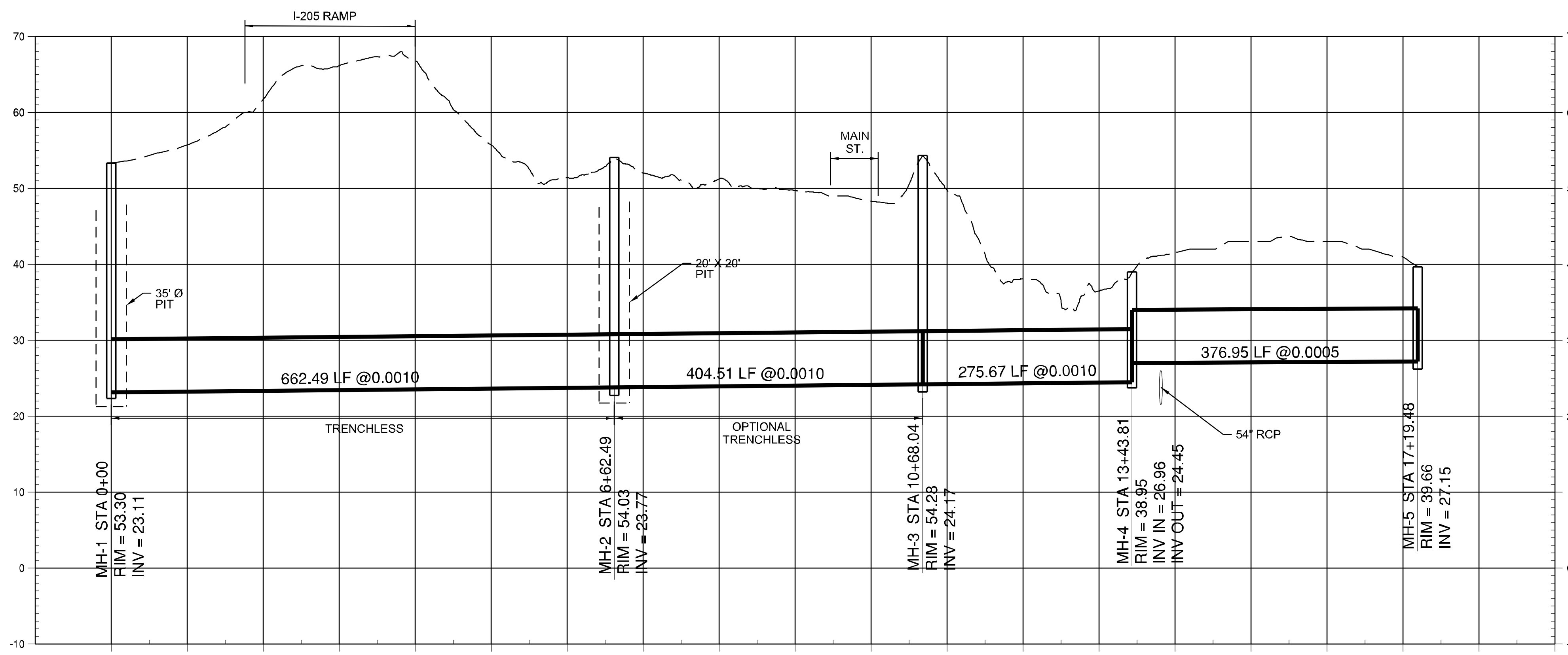


FIGURE 2

SEGMENT 2A - ALIGNMENT #1
PLAN AND PROFILE
TRI CITY WWRF OUTFALL

JACOBS

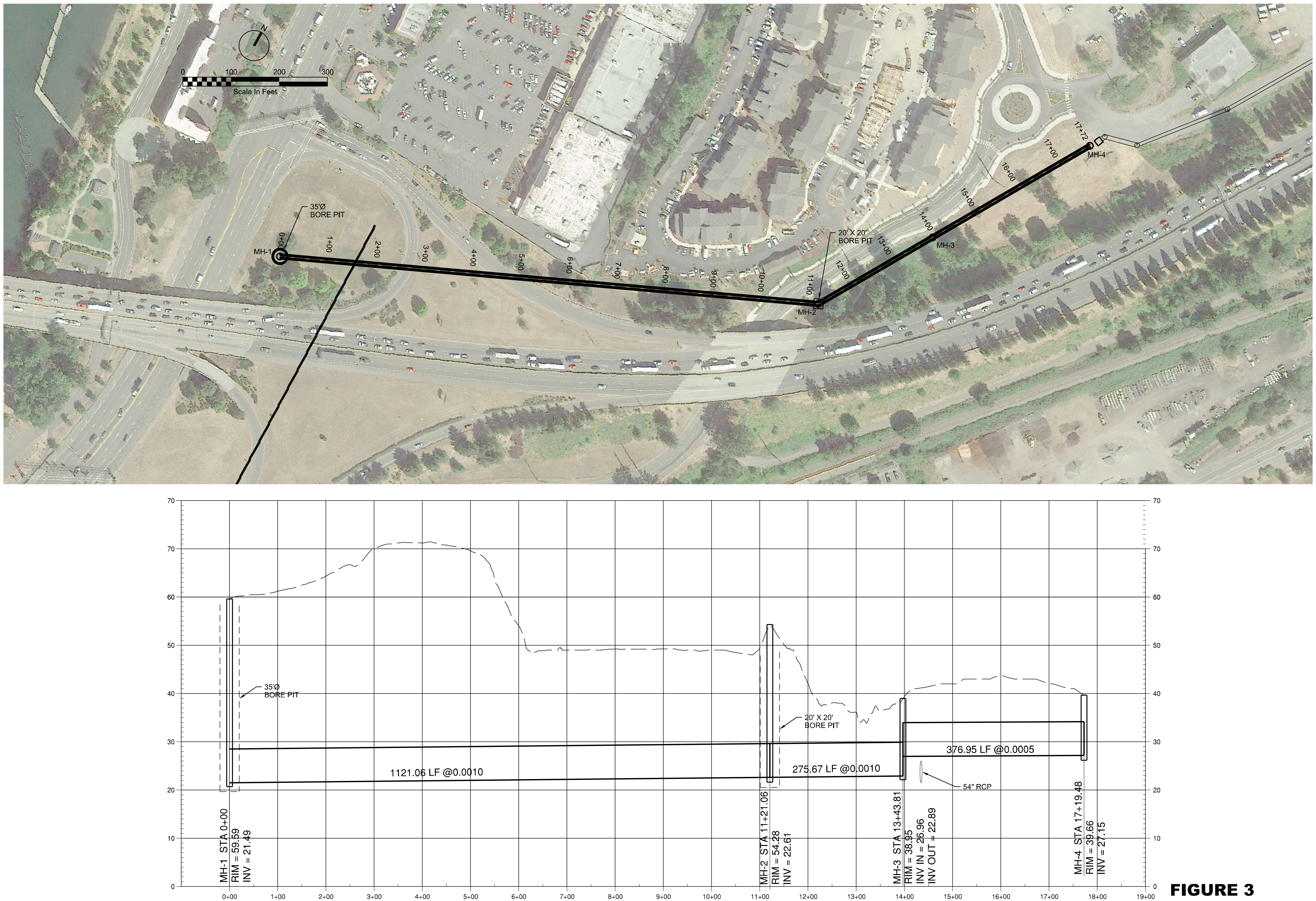
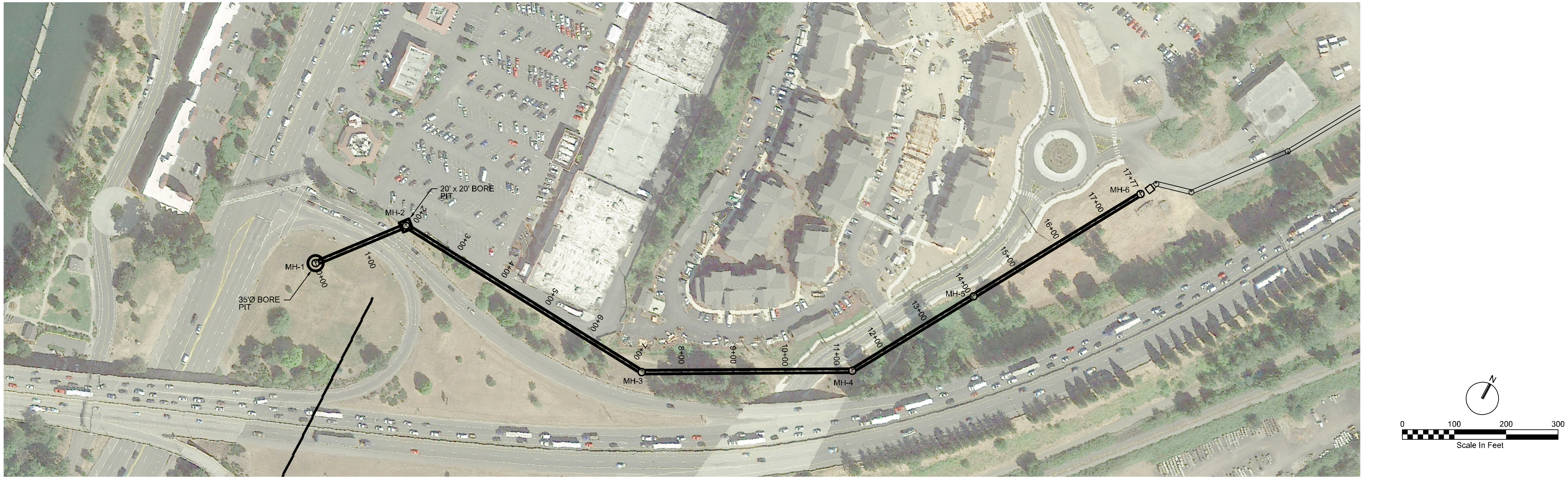


FIGURE 3

SEGMENT 2A - ALIGNMENT #1 OPTION
PLAN AND PROFILE
TRI CITY WWRF OUTFALL

JACOBS



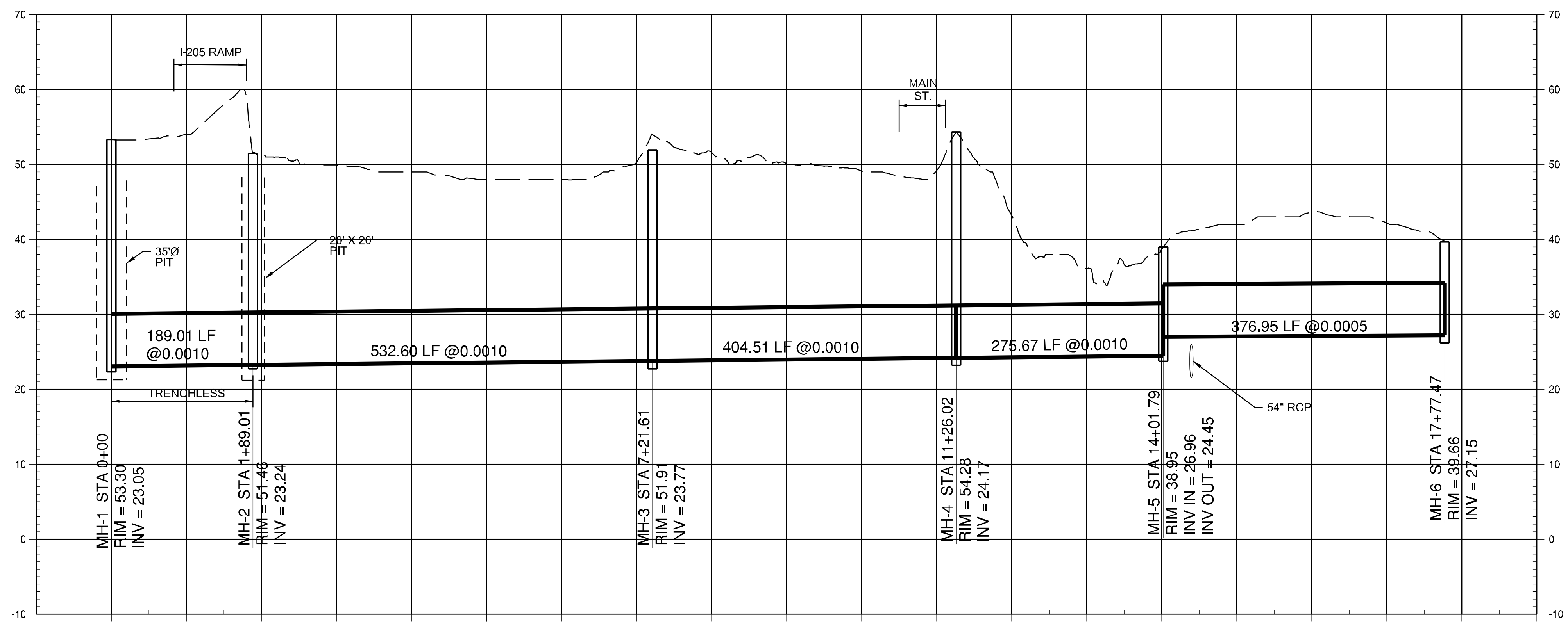
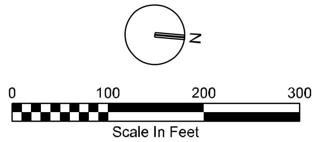


FIGURE 4

SEGMENT 2A - ALIGNMENT #2
PLAN AND PROFILE
TRI CITY WWRF OUTFALL

JACOBS



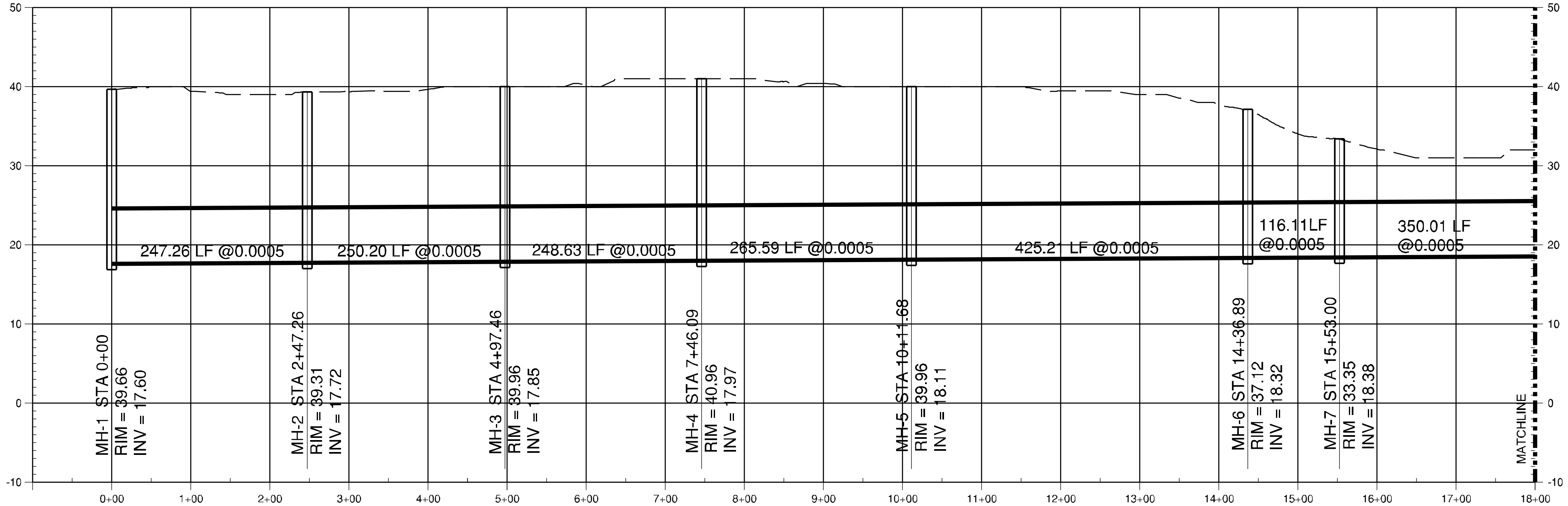
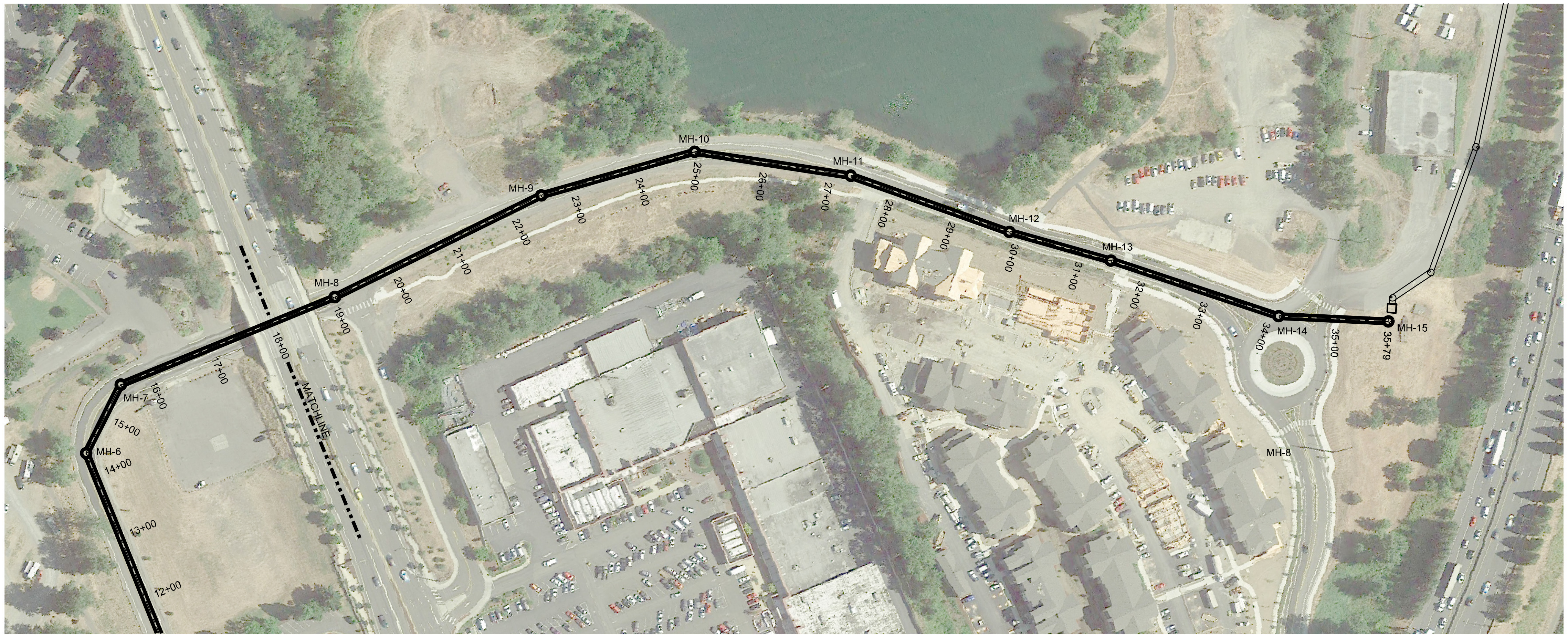


FIGURE 5

SEGMENT 2A - ALIGNMENT #3a
PLAN AND PROFILE
TRI CITY WWRF OUTFALL

JACOBS



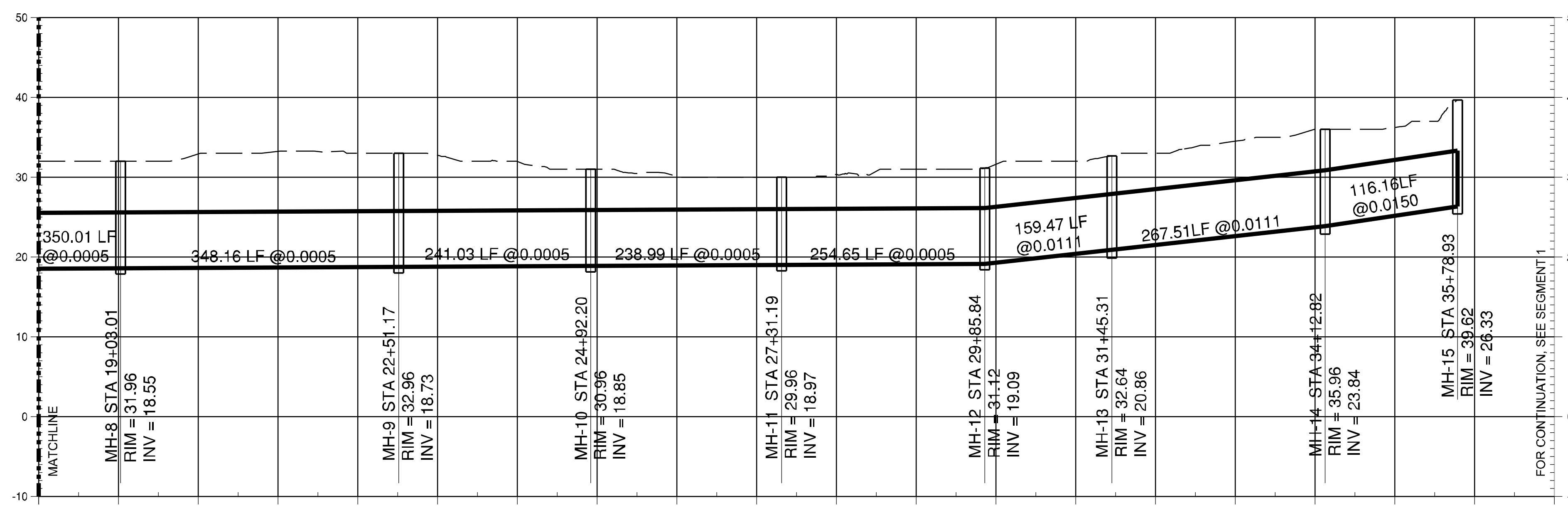


FIGURE 6

SEGMENT 2A - ALIGNMENT #3b
PLAN AND PROFILE
TRI CITY WWRF OUTFALL

JACOBS

N

0 100 200 300
Scale In Feet

FIGURE 7

SEGMENT 2B - ALTERNATIVE 1
PROPOSED ODOT
OUTFALL ALIGNMENT
TRI CITY WWRF OUTFALL

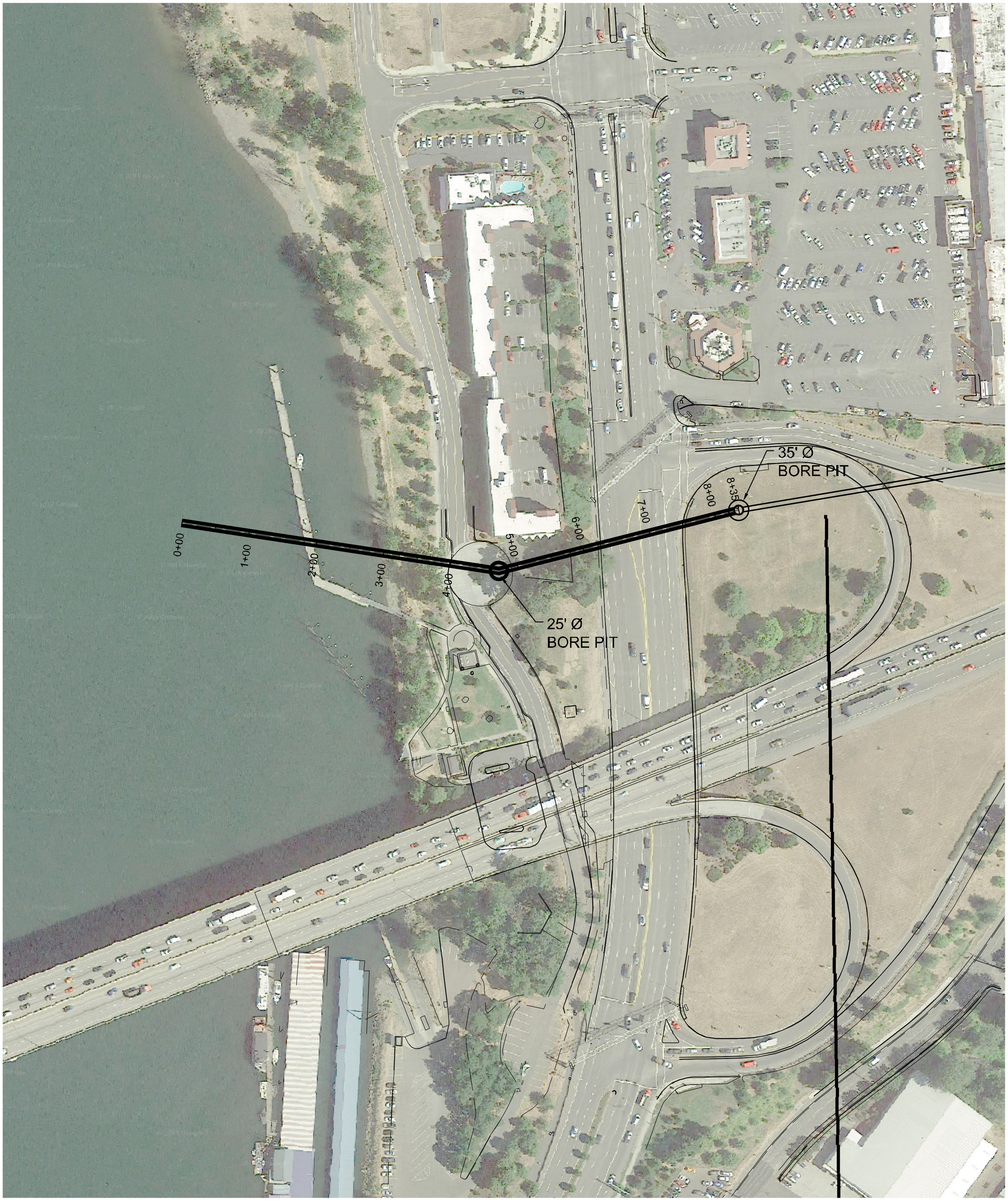


FIGURE 8

SEGMENT 2B - ALTERNATIVE 2
PROPOSED OREGON CITY
OUTFALL ALIGNMENT
TRI CITY WWRF OUTFALL

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