Whiteman Cove Feasibility

Whiteman Cove Transportation Study

November 2020

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1. Purpose

A team of consultants led by Anchor QEA, including KPFF, has been retained by the Washington Department of Natural Resources (DNR) to provide analysis, design, permitting, and outreach support for the Whiteman Cove Restoration Architecture and Engineering Design project (Project). The purpose of the project is to re-establish anadromous fish passage between Whiteman Cove and Case Inlet in Puget Sound to meet the requirements of a 2013 federal court injunction (the injunction), which requires fish passage for "all species of salmon at all life stages at all flows where the fish would naturally seek passage (United States v. Washington, No. C70-9213, W.D. Wash. Mar. 29, 2013)."

Whiteman Cove is a historical barrier lagoon located on the southwestern shoreline of the Key Peninsula in Pierce County, Washington. It is separated from Case Inlet by a natural spit formed by net littoral drift to the north and feeder bluffs to the south. The historical opening to the cove, located at the northern end of the spit, was closed in 1962 to create a perched brackish water lagoon that was intended for the rearing of juvenile salmon. The impounded lagoon is approximately 25 acres in size. Two control structures maintain water surface elevations in the lagoon at an average of 13 feet mean lower low water (MLLW) or 8.9 feet North American Vertical Datum of 1988 (NAVD88). Minimal water exchange occurs through the control structures between the perched lagoon and Case Inlet. Fish passage is almost completely blocked by the control structures. Freshwater input to the cove comes primarily from a small intermittent stream (Whiteman Creek) at the eastern end of the cove that drains the approximately 1.7-square-mile upland watershed.

Four options to provide fish passage to the Cove were considered and evaluated as part of a screening-level feasibility study conducted by the Anchor QEA team as part of this project. The results of that analysis are documented in the Feasibility Report for the Project (Anchor QEA et al., 2020). The screening analysis provided information regarding fish passage, permitting, and site use challenges and opportunities for each of the proposed options. Following the screening analysis, all four options were moved forward into the feasibility study.

1. Option 1: A new gated control structure at the current location of the DNR control structure.
2. Option 2: A new weir control structure at the historical opening to the north.
3. Option 3: An open channel at the historical opening of the Cove with a bridge crossing.
4. Option 4: An open channel at the historical opening of the Cove with road removal and rerouted access from the south.

The purpose of this study is to evaluate the four options for vehicular access to the YMCA Camp Colman. Figure 1-1 shows the two access routes in consideration. The northern route is currently the primary access to the camp. The first three options maintain this access to the north. Option 4 provides access from the south and would involve developing a new county road along existing County right-of-way.

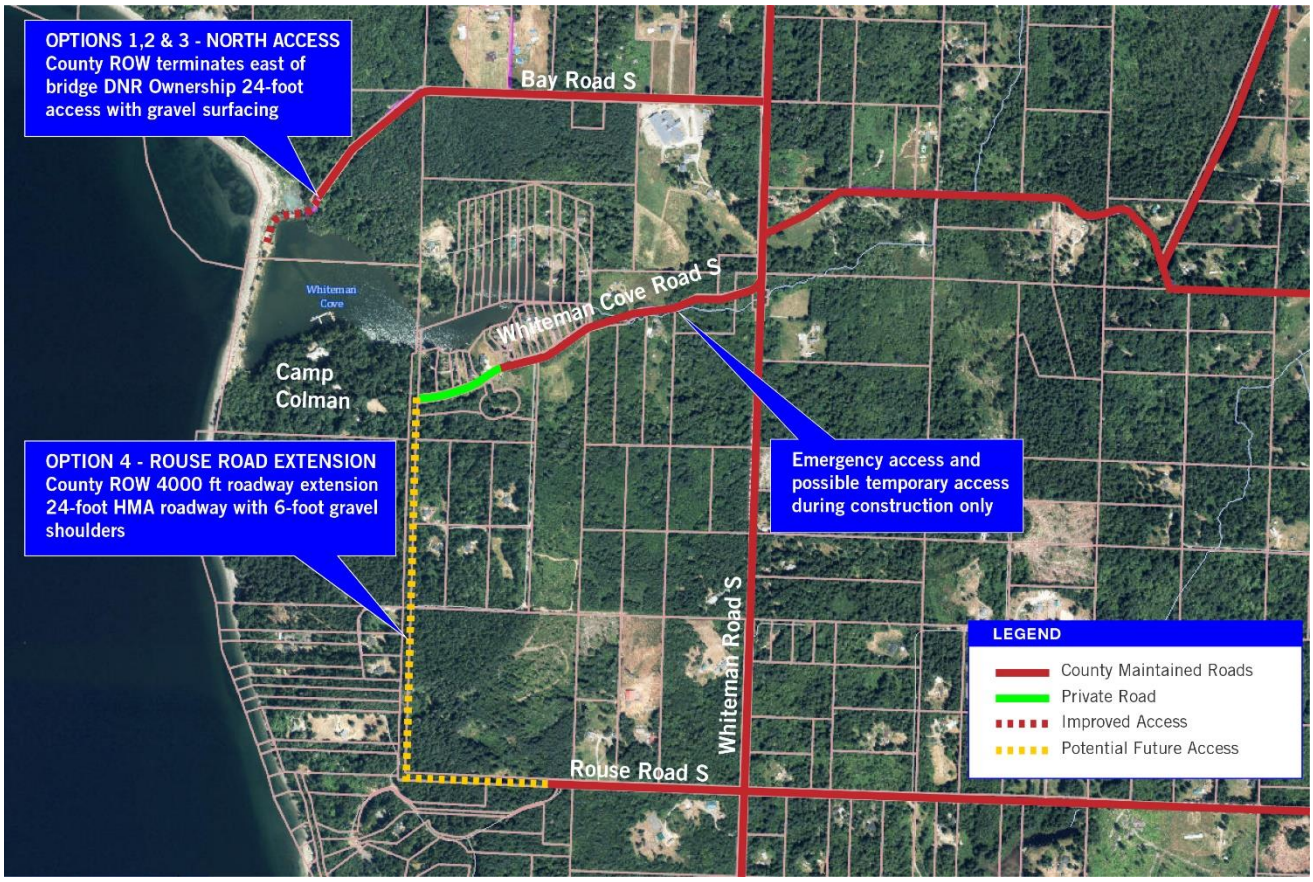

Figure 1-1: Access Options for Camp Colman

2. Existing Conditions

Whiteman Cove is a historic barrier estuary whose natural connection to Puget Sound has been closed by a roadway berm. Water levels in the Cove are regulated by two control structures. Properties adjacent to the Cove include Joemma Beach State Park to the northwest and private properties inland along the south shoreline of the Cove. The Cove itself includes Washington Department of Natural Resources (WDNR) property along the northwest portion, YMCA Camp Colman to the south of the WDNR parcel, and private residential properties on the northeast portion of the Cove.

Bay Road South is a Pierce County roadway that approaches from Whiteman Road to the east. County right-of-way extends through the WDNR parcel to a point just short of the constructed roadway berm. WDNR ownership includes the constructed roadway berm and approximately 250 feet of the northernmost portion of the historic spit; south of that point, it is owned by YMCA Camp Colman.

3. Technical Data and Design Assumptions

3.1 CODES AND REFERENCES

- Manual on Design Guidelines and Specifications for Road and Bridge Construction in Pierce County
- WSDOT Design Manual
- WSDOT Bridge Design Manual
- AASHTO Guidelines for Geometric Design of Very Low-Volume Local Roads
- AASHTO LRFD Bridge Design Specifications, 9th Edition AASHTO Guide
- Specifications for LRFD Seismic Bridge Design, 2nd Edition, 2011 with interims
- Pierce County Stormwater Management and Site Development Manual
- Flood Insurance Study, Federal Emergency Management Agency (FEMA), 2017
- Water Crossing Design Guidelines, Washington State Department of Fish and Wildlife (WDFW), 2013
- Preliminary Hydraulic Study, Anchor QEA, 2015
- Coastal Engineering Study, Blue Coast Engineering, 2020

3.2 ROADWAY DESIGN STANDARDS

Roadway Classifications

Bay Road South is classified as a Local Road, and the roadway section would be 36 feet in width (12-foot lanes with 6-foot shoulders) with asphalt pavement per Pierce County Standard Drawing PC.A4.2. Typically, where work is performed within County right-of-way improvements would be constructed to the current standard. For the purpose of this study, however, a very limited portion of the roadway would fall within County right-of-way. The bulk of the work would be within DNR-owned property or private property and a variance to the standard would be justifiable. The minimum width would be based on providing emergency access. The minimum width for a private road would be 24 feet, and minimum bridge width would be 28 feet (measured from face of barrier to face barrier). A variance would be required at the time of permitting through Pierce County Planning and Land Services (PALS).

Rouse Road South is located 3,200 feet to the south of Whiteman Cove and Camp Colman. Pierce County owns right-of-way the entire length from Whiteman Road South to Camp Colman via Rouse Road and a north-south oriented right-of-way for what would be 202nd Avenue South. Rouse Road South is classified as a Local Road Feeder and will use the same roadway section described above for Bay Road South. The road is improved to 1,400 feet west of Whiteman Road. Beyond that it is wooded and undeveloped.

Whiteman Cove Road South is the most direct route to Camp Colman and is a County-owned and -maintained roadway from Whiteman Road South to a point 1,300 feet west to 194th Avenue South. West of this point ownership is more complicated. It is a private right-of-way, but it has been maintained by the County for an extended period of time. RCW 36.75.070 states that roadways that have been maintained at public expense for a period of seven years or more are considered County roads. While the County could claim prescriptive rights, use of this roadway would present legal challenges and has not been considered for permanent access

in this study. Access for a temporary duration during construction could be negotiated with the property owners as part of an option that would temporarily take out the north access.

Stormwater Management

Implementation of these projects must be done in conformance with Pierce County's stormwater code. This study has not developed specific concepts to address this; however, it can become a significant cost associated with the construction of a roadway, particularly for the Rouse Road extension option. For the purpose of evaluating these concepts, this project cost has been considered for this element of the work qualitatively with an order-of-magnitude cost applied.

Utilities

The cost of installing utilities as part of the project has not been included as it will not be a cost realized by the project proponent. The proposed improvements may be an opportune time to implement utility extensions. However, that will be a cost that would be borne by the provider.

3.3 PRELIMINARY DESIGN ASSUMPTIONS

Hydraulic Parameters

- Minimum Channel Width — 40 feet (Preliminary Hydraulic Study)
- Bottom of Channel — El 4, NAVD88 (Preliminary Hydraulic Study)
- 100-Year Still-Water-Level — El 13.2, NAVD88 (FEMA)
- Minimum Vertical Clearance — 3 feet (WDFW)
- Scour — In Progress (Coastal Engineering Study, 2020)

Geotechnical Parameters

At the time of this report, geotechnical data has not been collected. For the purposes of developing costs for the options listed below, this report assumes driven piles will be necessary to support a structure over the new channel. The number, size, and location of piles is based on previous project experience and is subject to change after in-depth geotechnical information becomes available.

3.4 CONSTRUCTABILITY CONSIDERATIONS

The project is located in Pierce County. While it is not a rural area, the setting for the project is relatively remote. The only access to and from the project site, or the camp beyond the project site, is Bay Road South, a narrow two-lane road. This creates several challenges to construction at the project site. A split fork in the road at the 0.5-mile mark takes vehicles onto a 20-foot-wide gravel road for an additional 0.25 miles before reaching the project site.

Camp Access During Construction

Camp Colman currently uses Bay Road South as the primary access for campers and camp staff. The current configuration will not allow traffic to pass while a new crossing is under construction without a temporary bypass. Option 1 includes the construction of a shoofly, or temporary bypass road, around the work zone to maintain access. It would be removed upon completion of the tide gate installation and restoration of the existing access. Options 2 and 3B, which included bridges over a new channel, propose constructing the

bridge on an alignment offset from the existing access road. This would allow traffic to continue to access Camp Colman via the historic spit until the bridge and approaches are complete.

There is a second entrance to the camp via Whiteman Cove Road South. Access via the Camp's secondary entrance would provide the most economical project and the least interruption to the Camp; however, as discussed above in Section 3.2, ownership is expected to be in dispute and access would need to be coordinated with the local land owners.

Construction Access to Project Site

The narrow road is sufficiently wide enough to facilitate most construction activities and equipment reaching the jobsite. However, use of longer-span bridges that use prestressed concrete girders for the project site will be limited in span by the geometry of the access roadway. Based on local supplier recommendations, the maximum girder length that can access the site is 100 feet.

Construction Staging Area

With only a 20-foot road separating Case inlet to the west and Whiteman Cove to the east, there is little space for construction staging. The existing berm could be widened to the east to provide sufficient staging during construction; this berm would be removed prior to completion of the project. Widening the berm to the east may pose permitting challenges due to in-water filling required to widen the berm.

4. Option 1 – Gate Controlled Structure

Option 1 provides access to Camp Colman via the existing northern access along Bay Road South. The gate-controlled structure would be located at, or near, the existing DNR gate-controlled structure. This option would not require a bridge or large culvert because the gate-controlled structure would be buried below the driving surface of the berm. There are two approaches to the construction of this alternative:

1. Full closure of the access road. Access to Camp Colman during construction would be provided via Whiteman Cove Road South.
2. Construct a temporary embankment within the lagoon, which would provide access for traffic as well as act as a coffer dam to provide a work zone for installation of the tide gate.

Roadway

The roadway alignment under this scenario would follow the existing berm alignment. The new construction would be as a private road 24 feet in width with 3:1 side slopes. As a private road, the geometrics of this option would strive to balance environmental impacts with the geometric design criteria. Designed as a low-speed and low-volume roadway, the geometric design would be based on the AASHTO Manual for Very Low-Volume Roads. Coordination with Pierce County PALS will be required to obtain a variance.

Advantages

- Lowest cost.
- Maintains existing access to camp.
- Smallest footprint.

Disadvantages

- Intermittent road closures during construction.
- May not meet requirements for fish passage based on Washington State Hydraulic Code or the injunction.
- May increase risk of breaching of the berm/spit during construction because the area of the spit where the structure would be constructed is more exposed to wind-wave events than the other three options.

5. Option 2 – Weir Control Structure at Historic Opening

Option 2 provides access to Camp Colman via the existing northern access along Bay Road South. The weir control structure is located on the existing roadway berm at the historical opening of the channel and would provide a minimum water surface elevation within the lagoon. A 40-foot-long bridge would support traffic above the weir-controlled structure. Construction could be approached in a similar fashion to Option 1 described above with a full closure or with a temporary shoofly; however, a third approach could also be considered, which is to build the weir north (toward the Sound) of the existing access road and realign the road to this location. Once the realigned road is in place, the existing embankment would be removed. This latter approach is the one that has been evaluated and is similar to that of Option 3A, described below.

Superstructure

Five precast, prestressed concrete deck bulb tee girders (W35DG) with an HMA overlay make up the 40-foot clear span. While more shallow girders can span that length, the deck bulb tee girders are the most economical because they are lighter and do not require a cast-in-place topping slab. Precast concrete deck bulb tee girders are commonly used throughout Washington State. This solution provides a single-span girder and bridge deck combined in a single element. Deck bulb tee girders do not require the additional step of constructing a cast-in-place deck after the girders have been erected. Deck bulb tees are typically topped with an asphalt overlay that provides an additional wearing surface that extends the life of the girders. These elements would be fabricated at a precast plant and shipped to the site where they would be placed in their final location with large cranes. The bridge has been designed with a typical 3-inch HMA overlay. Approach slabs are used at each abutment to minimize settlement of the approach embankment that results in a tall bump at the ends of the bridge.

The existing 16.5-foot roadway elevation does not provide the 3-foot minimum clearance from the bottom of the girder to the 100-year water-surface elevation of 13.2 feet. The roadway elevation will need to be raised approximately 3 feet.

Substructure

Concrete abutment walls will be supported on approximately 10 steel piles per abutment. Steel pile configuration and length is largely dependent on site soil properties. For cost-estimating purposes, a pile length of 100 feet has been used. The number, size, and location of piles is based on previous project experience and is subject to change after in-depth geotechnical information becomes available. This option is more likely to allow for a single row of piles; however, two rows of piles have been assumed for cost-estimating purposes since a geotechnical investigation has not been completed.

Wing walls will be used to account for the change in grade from the top of the roadway to the channel elevation. These cast-in-place wing walls will be approximately 15 feet and 6 inches in length, extending back at a 45-degree angle from the abutments.

Roadway

The roadway and bridge alignment under this scenario would follow the existing berm alignment. The new construction would be as a private road 24 feet in width with 3:1 side slopes. As a private road and bridge, the geometrics of this option would strive to balance environmental impacts with the geometric design criteria. Designed as a low-speed and low-volume roadway, the geometric design would be based on the AASHTO Manual for Very Low-Volume Roads. Coordination with Pierce County PALS will be required to obtain a variance.

Advantages

- Lower cost.
- Maintains existing access to camp.
- Smaller footprint than Options 3A and 4.

Disadvantages

- Intermittent road closures during construction.
- May not meet fish passage requirements of the Washington State Hydraulic Code or the injunction.
- Weir under bridge will add rock armoring or other hardened surface to the newly exposed intertidal area under the bridge in order to maintain a set elevation under the bridge.

6. Option 3 – Open Channel with Bridge

Option 3 provides access to Camp Colman via the existing northern access along Bay Road South. Two options are provided to envelop the cost and benefit of Option 3. Option 3A provides the smallest structure that meets the environmental goals for the project. The structure is located on the existing roadway berm. Construction along this alignment would require alternative access to the camp during construction. Option 3B provides the largest single-span opening available using prestressed concrete girders. This structure is located adjacent to the existing roadway berm. Construction on this alignment could be completed with minimal disruptions to the existing access for the camp. Either alignment could be selected for each bridge. For the purposes of simplicity, only one alignment was evaluated for each structure.

6.1 OPTION 3A – MINIMUM CHANNEL WIDTH

Option 3A is configured for the smaller structure and lower-cost solution that also meets the fish passage and habitat restoration project goals. This option has a 40-foot clear distance between the face of abutments and meets the minimum requirements of the channel opening.

Superstructure

Five precast, prestressed concrete deck bulb tee girders (W35DG) with an HMA overlay make up the 40-foot clear span. While more shallow girders can span that length, the deck bulb tee girders are the most economical because they are lighter and do not require a cast-in-place topping slab. Precast concrete deck bulb tee girders are commonly used throughout Washington State. This solution provides a single-span girder and bridge deck combined in a single element. Deck bulb tee girders do not require the additional step of constructing a cast-in-place deck after the girders have been erected. Deck bulb tees are typically topped with an asphalt overlay that provides an additional wearing surface that extends the life of the girders. These elements would be fabricated at a precast plant and shipped to the site where they would be placed in their

final location with large cranes. The bridge has been designed with a typical 3-inch HMA overlay. Approach slabs are used at each abutment to minimize settlement of the approach embankment that results in a tall bump at the ends of the bridge.

The existing 16.5-foot roadway elevation does not provide the 3-foot minimum clearance from the bottom of the girder to the 100-year water-surface elevation of 13.2 feet. The roadway elevation will need to be raised approximately 3 feet.

Substructure

Concrete abutment walls will be supported on approximately 10 steel piles per abutment. Steel pile configuration and length is largely dependent on site soil properties. For cost-estimating purposes, a pile length of 100 feet has been used. The number, size, and location of piles is based on previous project experience and is subject to change after in-depth geotechnical information becomes available. This option is more likely to allow for a single row of piles; however, two rows of piles have been assumed for cost-estimating purposes since a geotechnical investigation has not been completed.

Wing walls will be used to account for the change in grade from the top of the roadway to the channel elevation. These cast-in-place wing walls will be approximately 15 feet and 6 inches in length, extending back at a 45-degree angle from the abutments.

Roadway

The roadway and bridge alignment under this scenario would follow the existing berm alignment. The new construction would be as a private road 24 feet in width with 3:1 side slopes. As a private road and bridge, the geometrics of this option would strive to balance environmental impacts with the geometric design criteria. Designed as a low-speed and low-volume roadway, the geometric design would be based on the AASHTO Manual for Very Low-Volume Roads. Coordination with Pierce County PALS will be required to obtain a variance.

Advantages

- Lower cost.
- Maintains existing access to camp.
- Smaller environmental footprint.

Disadvantages

- Intermittent road closures during construction.
- May not meet fish passage requirements of the Washington State Hydraulic Code or the injunction.

6.2 OPTION 3B – WIDER CHANNEL WIDTH

Option 3B provides a wider channel that more closely matches the historic channel width than the minimum channel width required to meet fish passage requirements. This option uses precast, prestressed concrete girders with concrete abutment walls and driven steel piles. This utilizes the longest single-span concrete girders that are accessible via a transporter truck resulting in a 100-foot clear span between the abutments.

Superstructure

Eight precast, prestressed concrete deck bulb tee girders (W35DG) with an HMA overlay make up the 100-foot clear span. Precast concrete deck bulb tee girders are commonly used throughout Washington State. This solution provides a single span girder and bridge deck combined in a single element. Deck bulb tee girders do not require the additional step of constructing a cast-in-place deck after the girders have been erected. Deck bulb tees are typically topped with an asphalt overlay that provides an additional wearing surface that extends the life of the girders. These elements would be fabricated at a precast plant and shipped to the site where they would be placed in their final location with large cranes. The bridge has been designed with a typical 3-inch HMA overlay. Approach slabs are used at each abutment to minimize settlement of the approach embankment that results in a tall bump at the ends of the bridge.

Substructure

Concrete abutment walls will be supported on approximately 14 steel piles per abutment. Steel pile configuration and length is largely dependent on site soil properties. For cost-estimating purposes, the pile length of 100 feet has been used. The number, size, and location of piles is based on previous project experience and is subject to change after in-depth geotechnical information becomes available. This option is more likely to require two rows of piles due to the longer span length.

Short wing walls will be necessary to support the approach embankment. These cast-in-place wing walls will be approximately 15 feet and 6 inches in length, extending back at a 45-degree angle from the abutments.

Roadway

Similar to Option 3A, the geometric design criteria would be based on the AASHTO Manual for Very Low-Volume Roads and coordination with Pierce County PALS will be required to obtain a variance. A small portion of these improvements may extend into County right-of-way; however, it will be for a short distance in order to tie into existing and will not be expected to be constructed to the full County standard for a Local Road.

Advantages

- Likely to meet fish passage requirements of the Washington State Hydraulic Code and the injunction.
- Maintains existing access to camp.
- Less impact to camp access during construction.

Disadvantages

- More expensive structure.
- Larger footprint.

6.3 EXAMPLE PHOTOS

Illabot Creek Bridge, completed by KPFF in 2018, uses precast, prestressed wide flange deck girders (WF39DG), cast-in-place concrete abutments, and wing walls. The span length is approximately 105 feet. Wing walls extend back at a 45-degree angle from the abutments. The structure is similar to that proposed by Options 3A and 3B. See Figure 6-1 below.

Figure 6-1: Illabot Creek Bridge Elevation

Another bridge with a similar structure to the proposed options is Davis Slough Bridge, a project completed by KPFF in 2014. This bridge uses precast, prestressed concrete deck bulb tee (W35DG) girders and cast-in-place concrete abutments and wing walls. The span length is approximately 60 feet, with the same-shape girders as those proposed in both options. The wing walls on this bridge extend back at a 90-degree angle from the abutment. See Figure 6-3 below.

Figure 6-2: Davis Slough Bridge

6.4 OTHER OPTIONS CONSIDERED

Two additional structure types were explored, including a three-sided box culvert and a bridge structure using slab girders. These options were ruled out due to cost and constructability considerations.

The three-sided box culvert structure utilized seven WSDOT FC40 segments supported on concrete abutment walls and steel piles. Due to segment shape and 100-year WSE, the roadway elevation would need to be raised a minimum of approximately 5 feet. This structure would have provided the minimum channel opening width with a higher cost than Option 3A.

The voided slab structure used nine 24-inch-deep segments and was supported on concrete abutment walls and steel piles. The voided slabs and concrete deck required would have resulted in a similar roadway elevation change. This option would have provided the minimum channel opening but would have had a higher cost than Option 3A due to the cost of slab girders and cast-in-place concrete deck.

7. Option 4 – Open Channel with New County Road

7.1 OPTION 4A – ROUSE ROAD EXTENSION

A restoration option that would open the Cove to its historic condition would eliminate the primary access to Camp Colman, which currently uses the natural spit as its access. There is a second access along Whiteman Cover Road located to the east of the parcel, but a portion of that is private. Currently, it is only used for emergency access. Further discussion is provided below. In order to maintain access to the Camp Colman, an option was evaluated that uses existing County right-of-way. Rouse Road Southwest currently terminates to the west of Whiteman Road Southwest to the southeast of Camp Colman. The Rouse Road Southwest right-of-way extends 2,650 feet to the west, where the County right-of-way for what would be 198th Avenue Southwest continues north 3,270 feet to Whiteman Cove, bordering the east property line of Camp Colman.

The roadway classification of Rouse Road Southwest is a Local Road Access or Feeder. The roadway section consists of two 12-foot lanes with 6-foot gravel shoulders. Roadway surfacing is HMA pavement and drainage is accommodated with roadside ditches.

A significant cost component for construction of the roadway will be stormwater mitigation, which will be required for the conversion of forested and other landcover areas to pavement. At this study level, we have attempted to account for these costs by quantifying the clearing and new pavement associated with the roadway extension and approximating a volume of stormwater detention that would be required within this region. Subsequent design will need to perform additional analyses to determine the most appropriate form or forms of mitigation. Potential options include infiltration or dispersion through natural areas. While these options could potentially reduce the volume of detention, the reduction of costs would not be directly proportional as these methods would have their own unique costs. Dispersion, for example, is an option that would reduce the construction costs and ongoing lifecycle costs associated with maintaining infrastructure but would require acquisition of property in order to maintain a natural area in perpetuity. For these reasons, the approach taken here will provide an adequate basis for comparing relative project costs.

7.2 OPTION 4B – PRIVATE ROAD EXTENSION

An additional access to Camp Colman that was evaluated was one that would provide a private access from Whiteman Cove Road South on property owned by the YMCA. The YMCA owns a parcel that is to the west of

Camp Colman and south of the residences along Whiteman Cove Road South. This private road would extend from the County-owned portion of the roadway south, following the east property line of the parcel, then turning west along the south property line.

This would be designed as a private roadway with an assumed section of 20 feet. Roadway surfacing would be HMA pavement and drainage accommodated with roadside ditches. Similar to the Rouse Road Extension, this would require stormwater mitigation for new pavement. The same approach as described above was used to approximate costs for construction of detention facilities.

7.3 OTHER CONSIDERATIONS

Whiteman Cove Road South extends west from Whiteman Road South and follows the south side of the Cove. It is a County-owned and -maintained roadway for some distance to the west. At some point it becomes a private tract and access for the residential community on the south shore of the cove. It is used for emergency access to Camp Colman, but it is not used as a regular access. As described in Section 3.2, ownership is in question. Use of this roadway as the main access could be pursued as an option and would be the most economical solution in terms of construction cost; however, there would be legal issues to resolve, which would take an unknown period of time to resolve and confirm feasibility. For these reasons, it was not evaluated as an option in this study.

Advantages

The advantages of the Rouse Road Extension Option are:

- Likely to meet fish passage requirements of the Washington State Hydraulic Code and the injunction.
- County to maintain road; Avoids maintenance costs associated with a privately-owned bridge.

The advantages of the Private Road Extension option are the same except that the roadway would be maintained by the YMCA.

Disadvantages

The disadvantages of the Rouse Road Extension Option are:

- Highest cost.
- Eliminates existing camp access.
- Larger footprint.
- May require mitigation due to environmental impact in area outside the Cove.

Similar disadvantages apply to the Private Road Extension Option with the notable exception that this would be the lowest cost alternative in terms of construction to be considered in this study. This option would require the concurrence with the private property owners.

8. Cost Considerations

Cost breakdowns for the options considered are included in the table below. The breakdowns provided show the rough distribution of costs for each part of the project. Costs associated with construction of the channel are not included.

Table 8-1: Whiteman Cove Construction Cost Comparison

	Option 1 Gate Controlled Structure	Option 2 Weir-Controlled Structure	Option 3A Minimum Channel Width	Option 3B Wider Channel Width	Option 4A Rouse Road Extension	Option 4A Private Road
Superstructure	---------	$250,000	$250,000	$520,000	---	---
Foundations	---------	$590,000	$590,000	$715,000	---	---
Roadway	$550,000	$189,000	$138,000	$140,000	$3,700,000	$600,000
10% Mobilization	$55,000	$102,900	$98,000	$135,000	$370,000	$60,000
Subtotal:	$605,000	$1,132,000	$1,080,000	$1,510,000	$4,070,000	$660,000
30% Contingency	$181,500	$340,000	$325,000	$450,000	$1,221,000	$200,000
Grand Total	***$786,500***	***$1,471,500***	***$1,400,000***	***$1,960,000***	***$5,290,000***	***$860,000***

Notes:

1. Cost in 2020 dollars.
2. Cost does not include sales tax, engineering, construction administration, or permitting.
3. Costs for foundations are based on previous projects.
4. Costs do not include construction of the channels (e.g., channel excavation, slope protection, erosion control, channel armoring, etc.) or tide gate structure for the respective options.

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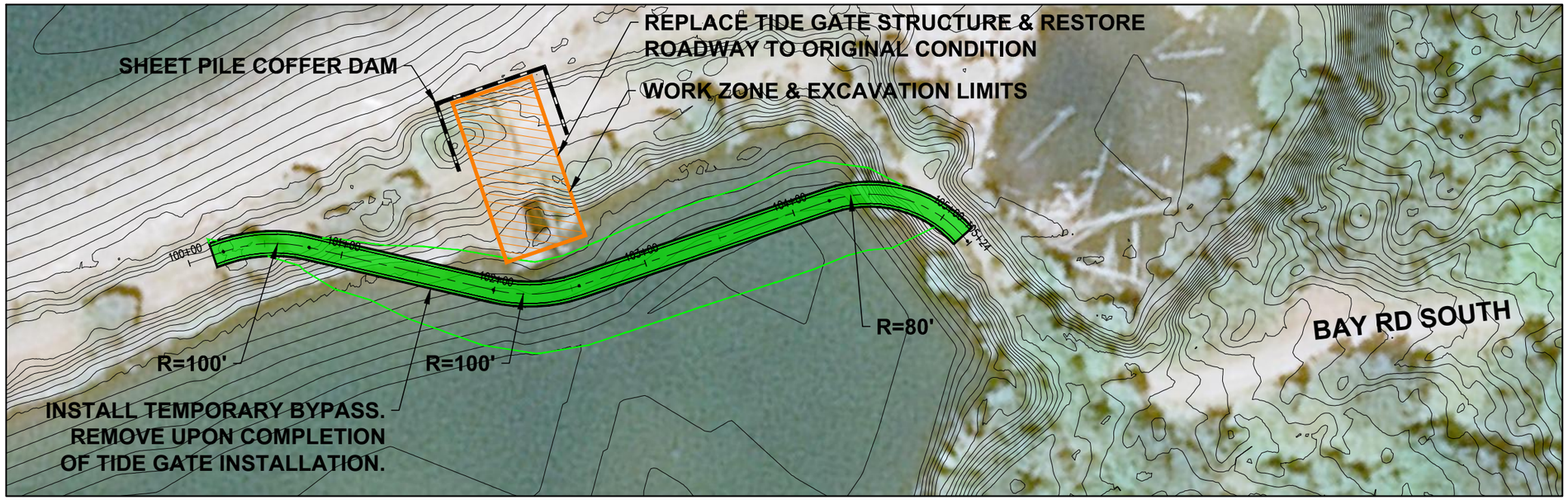
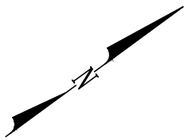
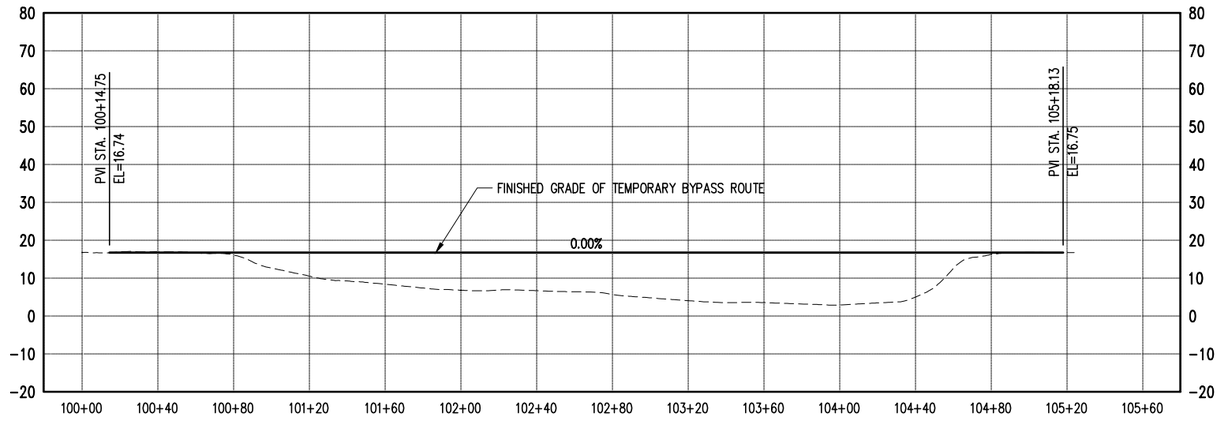
Appendix A

Plan and Profile Drawings

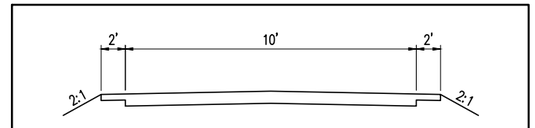




0 20 40 80
1 inch = 40 ft. HORZ
0 10 20 40
1 inch = 20 ft. VERT

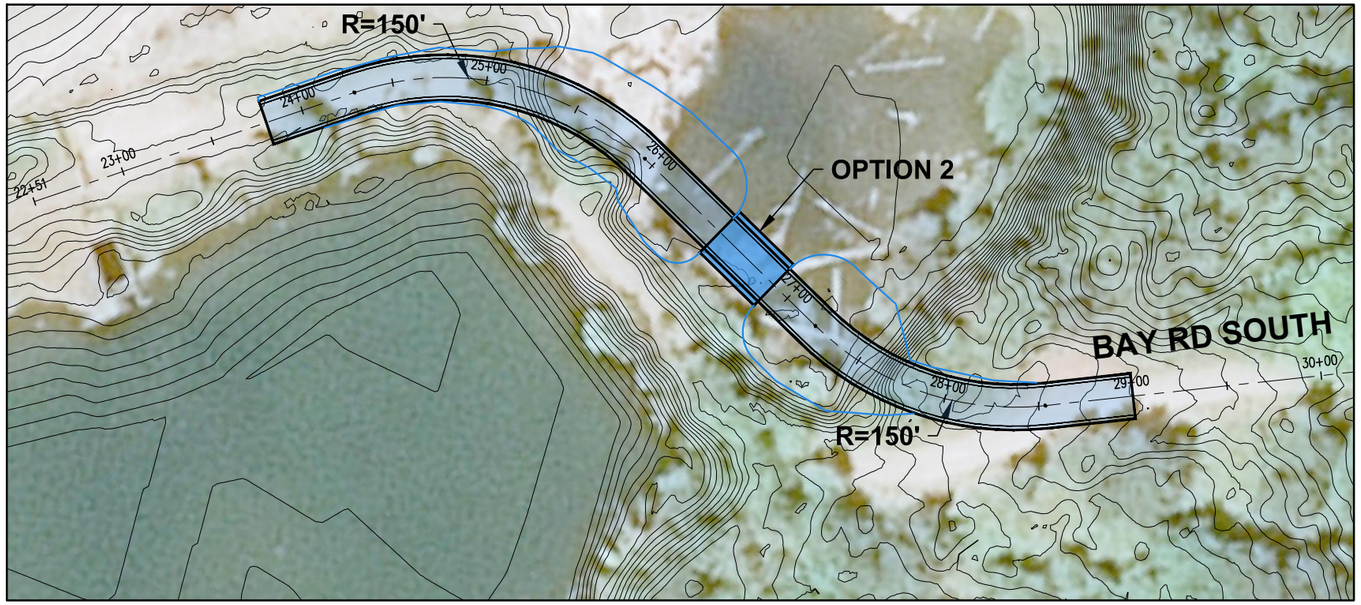


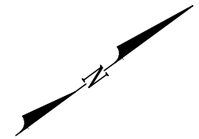
CUT = 47 CY
FILL = 5396 CY



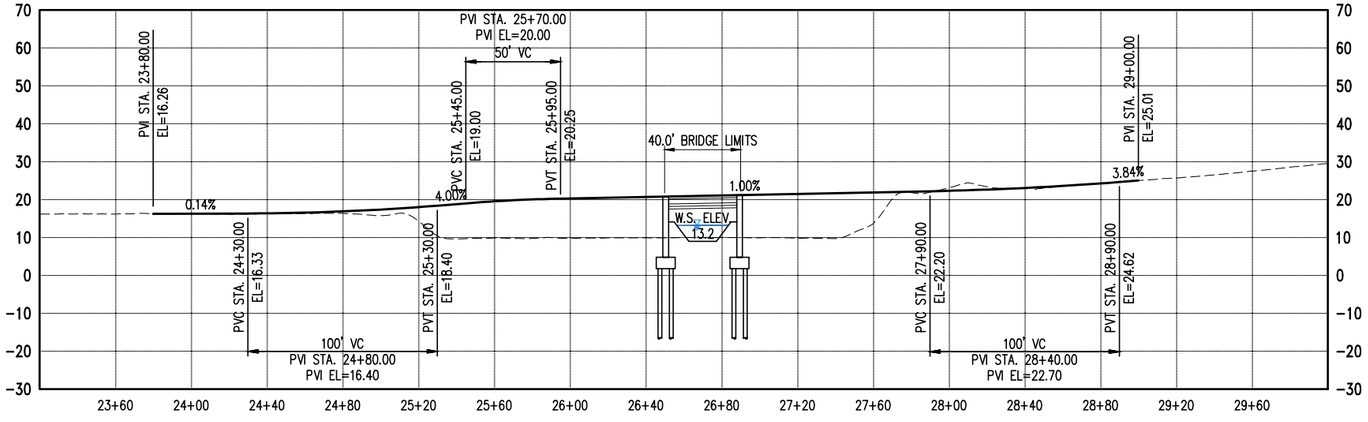
TYPICAL SECTION

WHITEMAN COVE - OPTION 1



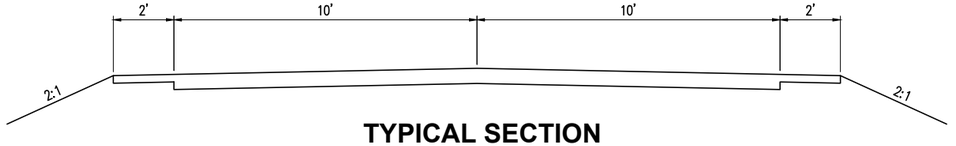


0 20 40 80
1 inch = 40 ft. HORZ
0 10 20 40
1 inch = 20 ft. VERT



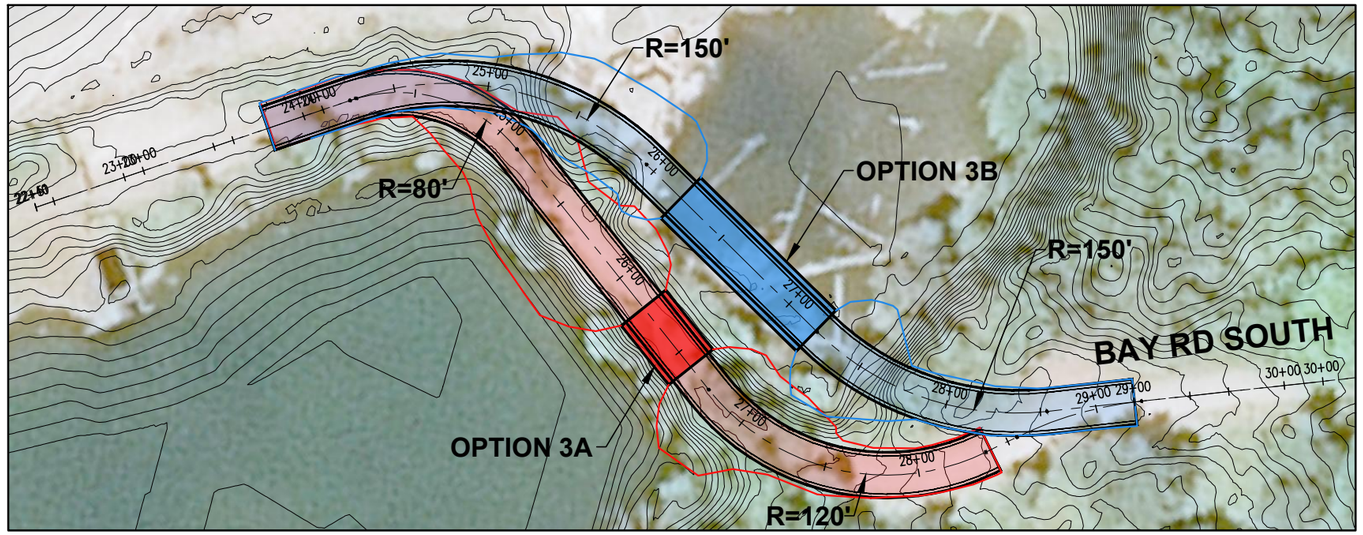
OPTION 2 - 40 FT BRIDGE

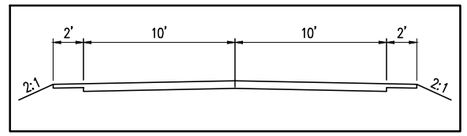
CUT = 202 CY
FILL = 4,050 CY



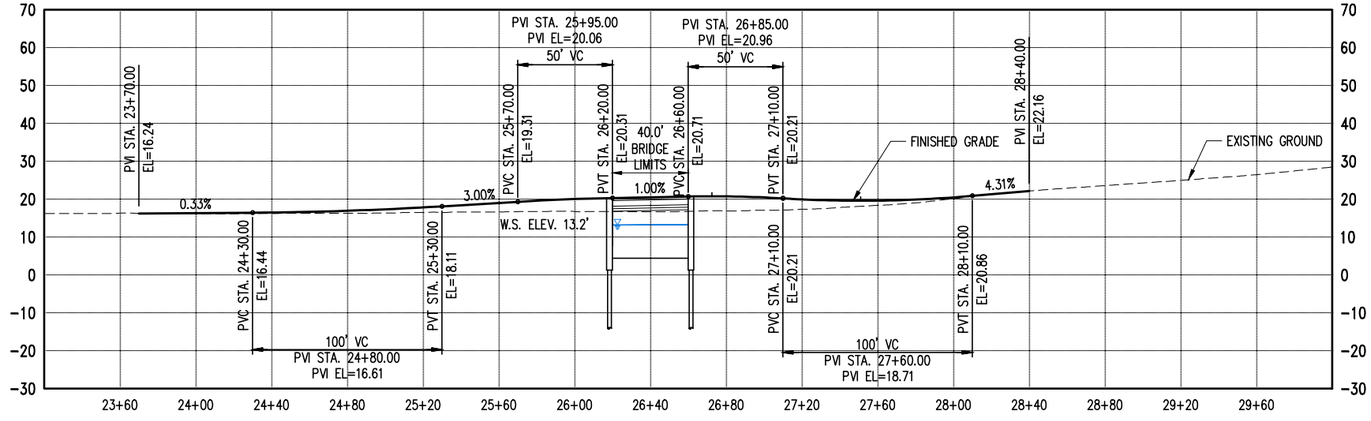
TYPICAL SECTION

WHITEMAN COVE - OPTION 2 - BAY RD SOUTH

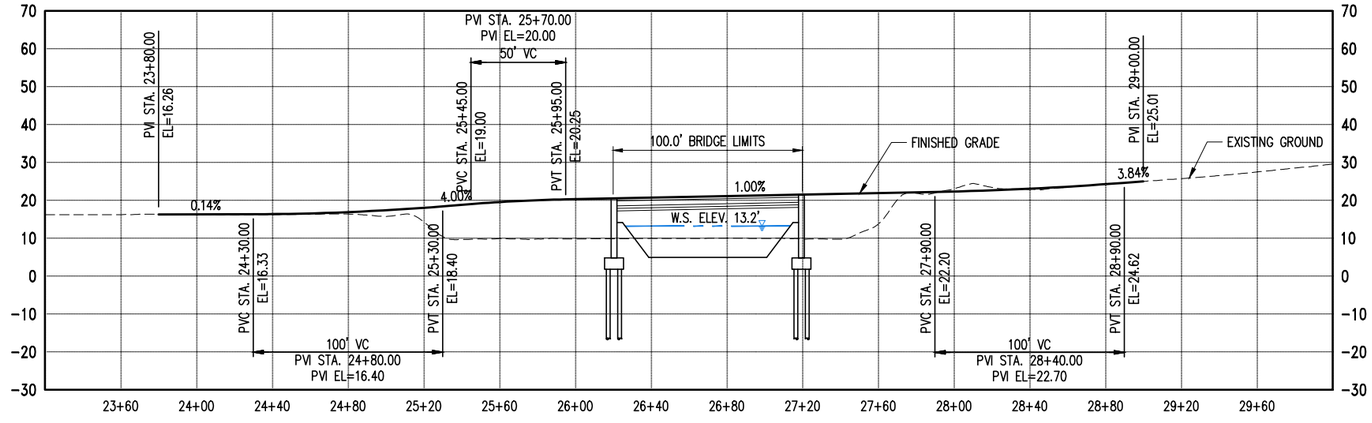




TYPICAL SECTION



OPTION 3A - 40 FT BRIDGE



OPTION 3B - 100 FT BRIDGE

0 20 40 80
1 inch = 40 ft. HORZ
0 10 20 40
1 inch = 20 ft. VERT

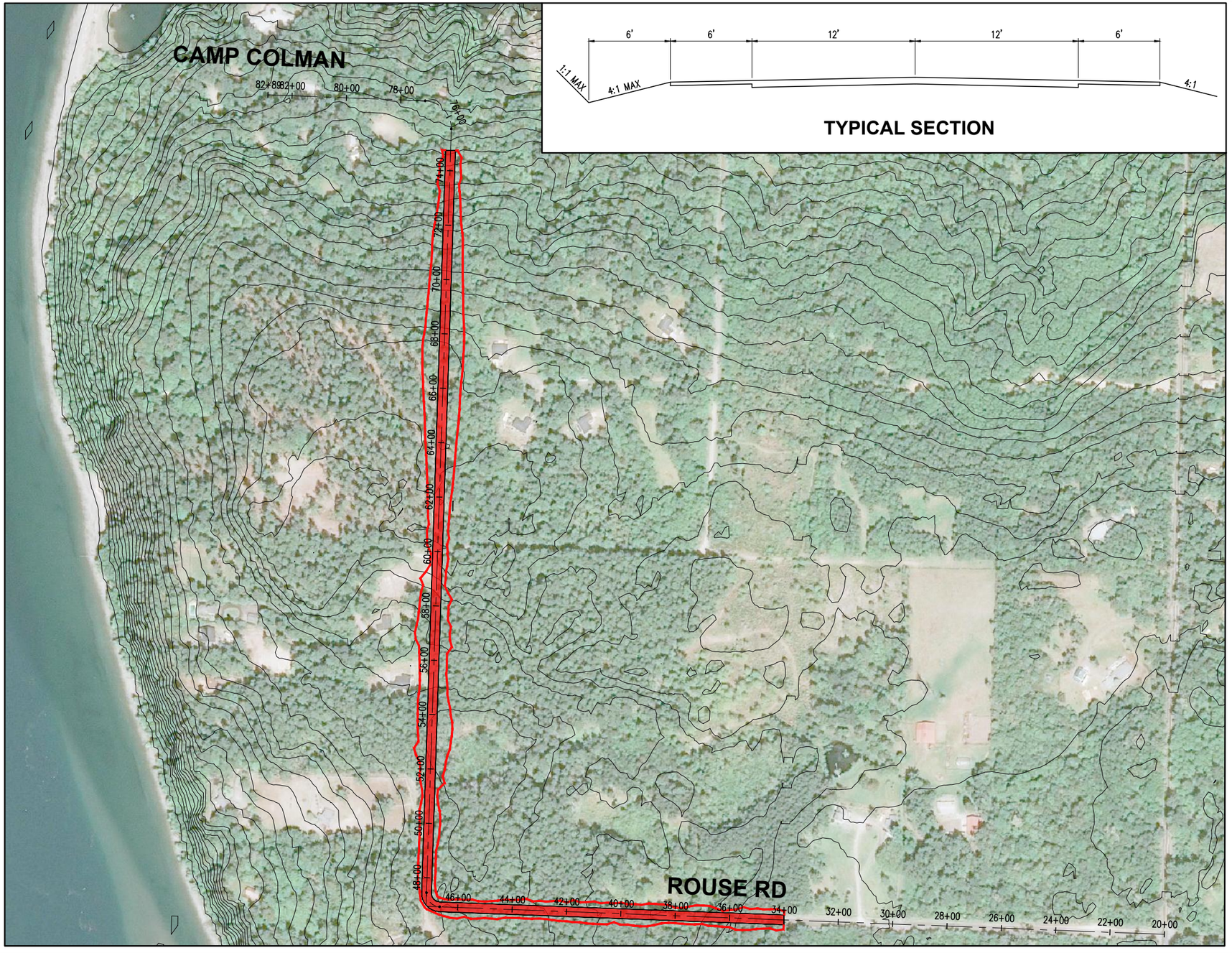
OPTION 3A

CUT = 130 CY
FILL = 1,250 CY

OPTION 3B

CUT = 202 CY
FILL = 2,163 CY

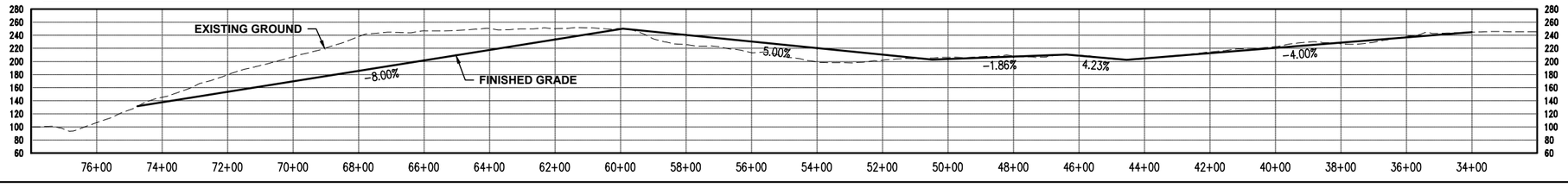
WHITEMAN COVE - OPTION 3 - BAY RD SOUTH



TYPICAL SECTION

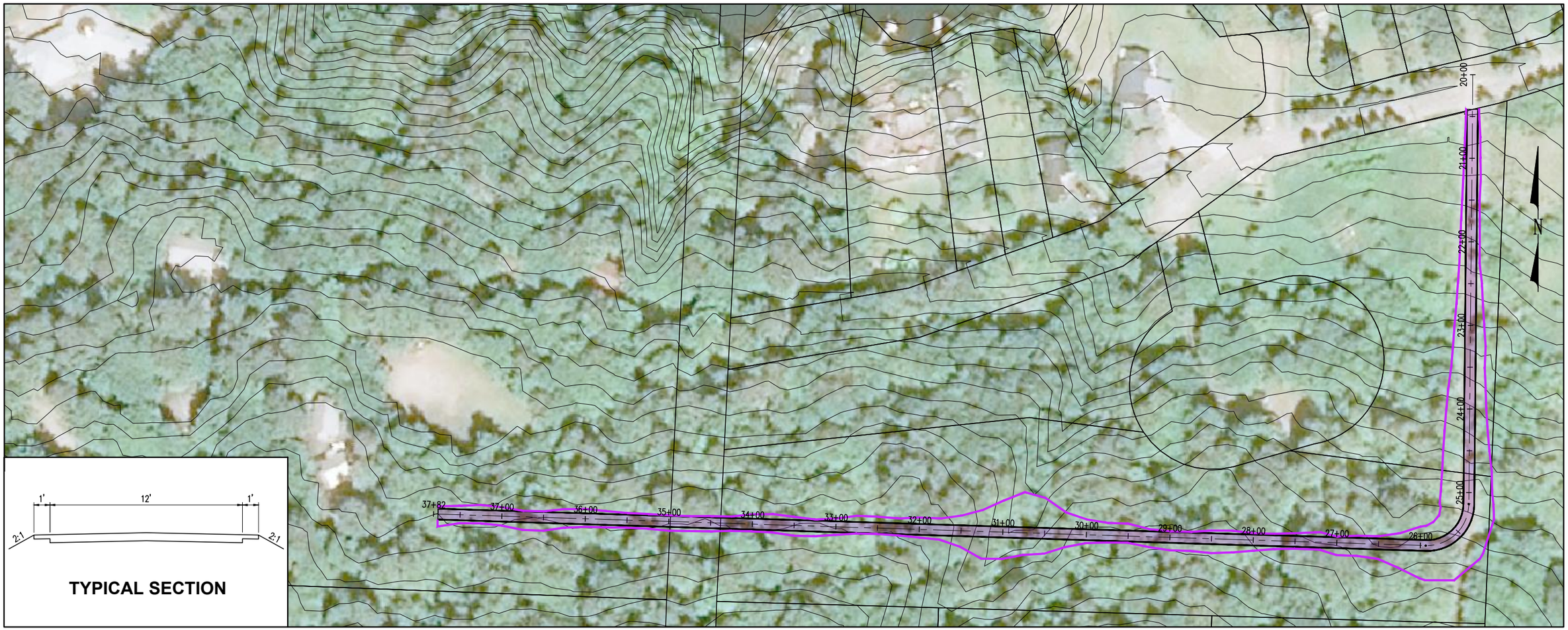
N

CUT = 144,880 CY
FILL = 31,150 CY

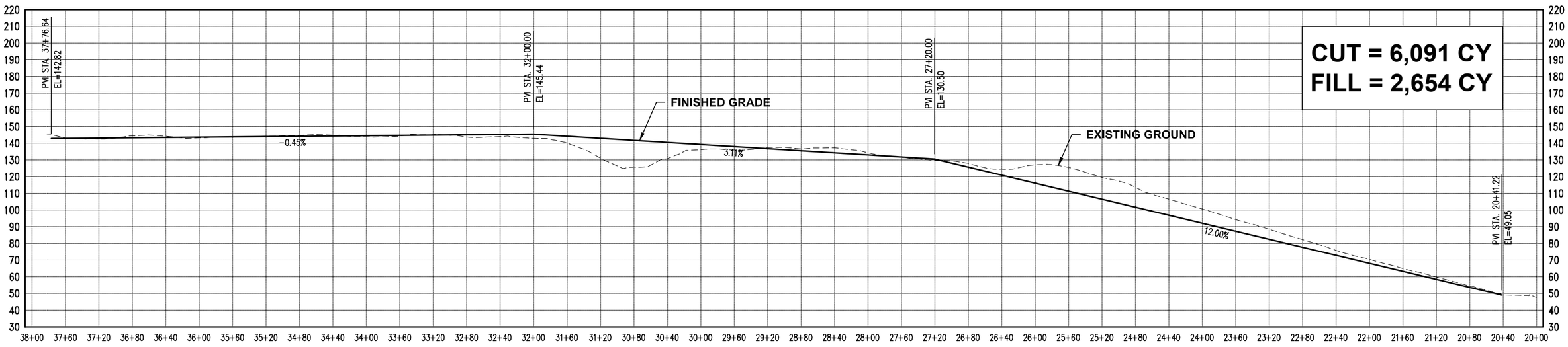


WHITEMAN COVE - OPTION 4A - CAMP COLMAN ACCESS

0 100 200 400
1 inch = 200 ft. HORZ
0 50 100 200
1 inch = 100 ft. VERT



TYPICAL SECTION



WHITEMAN COVE - OPTION 4B - CAMP COLMAN ACCESS

0 40 80 160
1 inch = 80 ft. HORZ
0 20 40 60
1 inch = 40 ft. VERT