

Port of Bellingham

Alternatives Report BLAINE MARINE DRIVE CONDITION SURVEY/ ASSESSMENT OF SHORELINE, BULKHEADS AND ROADWAY

Project Number 242015.011

November 24, 2015

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EXECUTIVE SUMMARY

The Port of Bellingham and the City of Blaine executed an Amendment to their Interlocal Agreement on May 5, 2015, to jointly coordinate the evaluation of improvements to Marine Drive from west of Lighthouse Park to Fishermen's Pier at Blaine, Washington. This report provides results of the preliminary evaluation of four alternatives for improvements to the west end of Marine Drive including a condition survey and assessment of shoreline, bulkhead, and roadway alternatives.

Reid Middleton performed a topographic survey and a visual condition assessment of the shoreline and bulkhead conditions along the roadway. A geotechnical report, prepared by Landau Associates, provided an evaluation of the existing Marine Drive roadway surface conditions, subsoil conditions, groundwater conditions, and the existing timber bulkhead condition. Anchor Environmental evaluated environmental impacts of the alternatives.

Based on the site conditions and discussion with the Port and City staff, four alternatives were evaluated. All alternatives provide a full two-way roadway width and sidewalk for public access from Lighthouse Park to Star Fish, Inc. The full roadway width requires additional intertidal fill over the mid-bay rip rap slope between the Gate 3 parking area and Sound Pacific Seafoods. Maintenance and emergency vehicles will be able to access Fishermen's Pier under all alternatives. The alternatives are for areas requiring repair where deterioration of a bulkhead or erosion of a slope was evident. The alternatives do not include complete replacement of the Semiahmoo Bay slope since only limited areas of erosion were observed on the Semiahmoo Bay side of the roadway.

The "Full Road Improvements" alternative extends the full roadway width and sidewalk to Fisherman's Pier. The "Roadway Taper" alternative provides a narrow roadway between Star Fish, Inc., and Fisherman's Pier. Both alternatives provide full two-way vehicle and pedestrian public access to Fisherman's Pier and require replacement of the failing timber bulkhead structure and intertidal fill on the Semiahmoo Bay rip rap fill slope to accommodate the widening around the building of Star Fish, Inc.

The "Single Lane ADA Access" and "Public Promenade" alternatives prohibit access west of Star Fish Inc., to Fishermen's Pier by public vehicle traffic. The "Single Lane ADA Access" alternative provides a single lane between Star Fish, Inc., and Fisherman's Pier allowing one-way-at-a-time ADA vehicle access only, while the "Public Promenade" alternative is restricted to pedestrians and bicyclists. Since both alternatives have a narrower footprint, each alternative is evaluated with two options for the replacement of the existing timber bulkhead: Option A proposes a new bulkhead and Option B proposes rip rap slope fill.

Following are the four alternatives with the associated opinion of probable project costs:

Alternative 1: Full Road Improvements	\$3,600,000
Alternative 2: Roadway Taper	\$3,410,000
Alternative 3: Single-Lane ADA Access	
Option A: Replace with a new bulkhead	\$3,130,000



Option B: Rip rap slope fill to the south	\$2,720,000
Alternative 4: Public Promenade	
Option A: Replace with a new bulkhead	\$3,110,000
Option B: Rip rap slope fill to the south	\$2.540.000

Following presentations and discussion of the alternatives with the Port Commission, City Council, and the public, the Port of Bellingham and the City of Blaine will select a preferred alternative and pursue funding for implementation of the preferred alternative.



Port of Bellingham Blaine Marine Drive Condition Survey/Assessment of Shoreline, Bulkheads, and Roadway

November 24, 2015

The engineering material and data contained in this report were prepared under the supervision and direction of the undersigned, whose seals as registered professional engineers are affixed below.



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Port of Bellingham



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INTRODUCTION

This report provides an evaluation of improvement alternatives for the Blaine Harbor Shoreline, Bulkheads, and Marine Drive. The project limits are from the western edge of Gate 3 and Lighthouse Park to Fisherman's Pier and include approximately 1,400 feet of Marine Drive roadway. See Figure 1 (Vicinity Map).

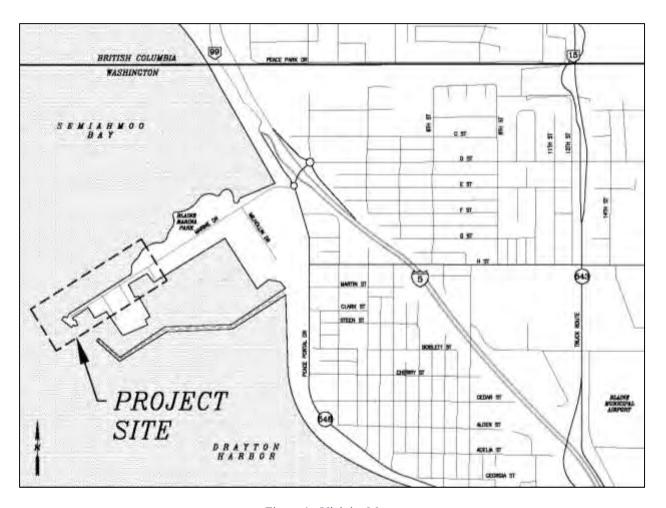


Figure 1. Vicinity Map.



BACKGROUND

The Port of Bellingham (Port) owns and operates facilities including Blaine Harbor, Blaine Industrial Area, and Fisherman's Pier in Blaine, Washington. The facilities are accessed by Marine Drive. Marine Drive provides the only access for vehicles, pedestrians, and bicycles to a variety of Port and City of Blaine (City) facilities located on the Blaine Harbor peninsula.

The Port and the City have signed an Interlocal Agreement to pursue the refurbishment of the infrastructure along Marine Drive. Marine Drive within the project limits is a narrow roadway constructed on fill. The shoreline slopes of the roadway are protected by various rock rip rap, concrete rubble, and timber bulkhead structures in varying conditions.

There is erosion, settlement, and loss of roadway in this area. The western end of the roadway, adjacent to Fisherman's Pier and the timber bulkhead, is in particularly poor condition. The roadway in this area has been closed to vehicle traffic and is open only to pedestrians and pier maintenance vehicles.

The Port and City requested a site condition assessment and an alternatives analysis be conducted for Marine Drive and the shoreline fill and bulkhead areas between Lighthouse Park and Fishermen's Pier. A topographic survey and site condition assessment was performed as part of the alternatives analysis. The alternatives analysis also included review of existing documentation such as the 2007 Blaine, Washington, Wharf District Master Plan, and discussion of goals and objectives with Port and City staff.

Considerations discussed included access for commercial vehicles to the Blaine Industrial Area, access needs for Star Fish Inc., public access to Fishermen's Pier, access for pedestrian and bicyclists along Marine Drive, avoiding or minimizing impacts to intertidal habitats, shoreline enhancement, safety and security, and other elements related to the potential improvements.

The following provides a summary of the existing conditions and preliminary alternatives analysis for the project. Following presentation and discussion of the alternatives with the Port Commission, the City Council, and the public, the Port of Bellingham and the City of Blaine will select a preferred alternative and pursue funding for implementation of the preferred alternative.

EXISTING CONDITIONS

See the Existing Topographic Survey Plan in Appendix A. Marine Drive is a low-volume, two-lane roadway serving fishing and crabbing businesses and the large Fisherman's Pier at the west end. The roadway width at the east end of the project limits transitions from 28 feet to 22 feet.

Marine Drive, between Star Fish, Inc., and Fisherman's Pier, has been closed to vehicle traffic since April 2014 but remains accessible to pedestrians and bicyclists. The closure was based on observations of pavement cracking and the presence of sink holes in the western 300 feet of Marine Drive as identified in a geotechnical Memorandum prepared by Geo Engineers in April 2014, see Figure 2.



Figure 2. Marine Drive closed to vehicle traffic from Star Fish, Inc., to Fisherman's Pier.

Per the geotechnical report, prepared by Landau Associates "Sinkholes and ground loss that extends several feet horizontally north of the bulkhead were observed behind the existing timber bulkhead. Pavement has been removed in this area and it appears that past filling activity had been attempted to bring the ground surface up to level for safety considerations; the area immediately behind the bulkhead wall is now fenced off to prevent pedestrian access." See Figure 3.



Figure 3. Marine Drive existing pavement reduced and fencing to prevent pedestrian access.

Based on visual inspection of the timber pile and lagging bulkhead at low tide, the timber bulkhead has reached the end of its useful life and is in need of replacement. The existing bulkhead consists of vertical timber piling, timber wales with a tieback rod system, and timber plank lagging. All timber members are in poor condition with loss of cross section and wood rot present. Many of the piling are split and have rotted from rainwater exposure on their tops. The steel tieback system is also in poor condition with corroded rods and hardware and missing nuts and washers.

The existing shoreline along Marine Drive in locations other than the bulkhead consists primarily of large angular rip rap slopes with various other material, including concrete rubble and debris intermixed with the rip rap. Old concrete slabs, reinforced concrete rubble, and concrete sidewalk debris are particularly present on the north Semiahmoo Bay side of the roadway slope.

While there are some pockets of erosion on the Semiahmoo Bay side of the roadway, there does not appear to be evidence of extensive erosion along the entire length of the shoreline on the north side of the roadway. Because of this, the proposed alternatives do not include complete replacement of the existing Semiahmoo Bay slope and only include minor replacement or expansion as needed to address limited pockets of erosion or areas where additional roadway width is required.

An existing timber and rock abutment is located at the end of Marine Drive where it intersects with Fishermen's Pier. This abutment is also showing signs of deterioration and is in poor condition. The fill along Marine Drive is eroding, especially along the backside of the timber bulkhead and around the end abutment, though minor erosion is occurring at other locations along the roadway as well.

Minor potholing was conducted to determine information on the condition of the pavement and subsurface conditions. The results of this site investigation are included in the Landau memorandum, see Appendix D. In general, the subsurface fill material and pavement overall from Lighthouse Park to Star Fish, Inc., is in fairly good condition; therefore, the existing pavement will be pulverized, compacted, and then paved. In areas of expanded roadway widths and from Star Fish Inc. to Fishermen's Pier, a new subgrade and pavement section should be installed.



Figure 4. Marine Drive existing timber bulkhead in poor condition.

STUDY METHODOLOGY

Design Standards

The design standards utilized for the roadway and civil design are the City of Blaine Standards.

Preliminary Alternatives

The study for Marine Drive improvements consisted of the development of four alternative cross-sections for the roadway and bank protection.

From Lighthouse Park at the east end of the project limits to Star Fish, Inc., all four alternatives propose the same roadway width consisting of two 12-foot driving lanes and an 8-foot sidewalk on the Semiahmoo Bay side. The proposed north edge of the sidewalk is set at an approximately 2-foot offset from the top of the rip rap slope on the Semiahmoo Bay side. The wider lanes require additional fill material be placed on the mid-bay rip rap fill slope between approximately the location of the abandoned timber pier in the center section of the mid-bay rip rap area and Sound Pacific Seafoods

For all the alternatives, the proposed centerline profile was held to match the existing ground elevation at the centerline.

From Star Fish, Inc., to Fisherman's Pier, all four alternatives have various roadway width scenarios as discussed below. Proposed improvements in all alternatives tie into the Fisherman's Pier by matching the existing north edge of pavement. Expansion of the abutment to Fisherman's Pier is to the south since bulkhead replacement or fill will be required for all the alternatives.

Alternative 1: Full Road Improvements

Alternative 1, Figure 11, Full Road Improvements consists of two 12-foot driving lanes and an 8-foot sidewalk the entire length of the project from Lighthouse Park to Fisherman's Pier. This alternative includes replacement of the timber bulkhead structure and Semiahmoo Bay rip rap fill slope to accommodate the widening around the building of Star Fish, Inc. This alternative maintains two-way vehicle traffic to Fisherman's Pier. See Figure 5 below for the roadway section at the west end of the project by the bulkhead.

Expansion of the abutment, pier, and approach to Fisherman's Pier will be required to accommodate the roadway widening. Both the top and bottom portions of the fill area will be widened by approximately 11 feet from the current width of 22 feet. The widening would be to specific areas on both the north and south sides of the existing roadway to maintain the proposed width while also minimizing potential fill. All of the widening portions would require placing fill in water to build slopes or for installation of bulkhead walls. Placing fill outside of the existing footprint of the fill area or a vertical bulkhead waterward of the existing bulkhead will require mitigation for intertidal impacts.



The existing fire hydrant, power vaults, and transformer immediately west of Star Fish, Inc., on the north side of the road will be fully impacted with the proposed roadway improvements. Those utilities will require adjustment to grade if feasible or relocation behind the proposed sidewalk, which would require additional rip rap fill into Semiahmoo Bay.

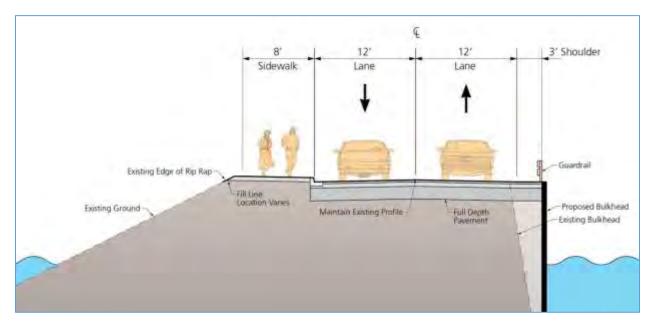


Figure 5. Alternative 1: Marine Drive Section A-A – Vehicle & Pedestrian Access

The proposed back of walk (BOW) at Star Fish, Inc., transitions to the south slightly to match into the existing north edge of pavement at the Fisherman's Pier.

Alternative 2: Roadway Taper

Alternative 2, Figure 12, improvements consist of two 12-foot driving lanes and an 8-foot sidewalk from Lighthouse Park to Star Fish, Inc. At Star Fish, Inc., the roadway width will taper from two 12-foot lanes to two 10-foot lanes with an 8-foot sidewalk to Fisherman's Pier. This alternative includes replacement of the timber bulkhead structure and Semiahmoo Bay rip rap fill slope to accommodate the widening around the Star Fish, Inc., building. This alternative maintains two-way vehicle traffic to the Fisherman's Pier. See Figure 6 below for the roadway section at the west end of the project by the bulkhead.

Expansion of the abutment, pier, and approach to Fisherman's Pier will be required to accommodate the roadway widening. Both the top and bottom portions of the fill area will be widened by approximately 7 feet from the current width of 22 feet. The widening would be to specific areas on both the north and south sides of the existing roadway to maintain the proposed width while also minimizing potential fill. All of the widening portions would require placing fill in water to build slopes or for installation of bulkhead walls. Placing fill outside of the existing footprint of the fill area or a vertical bulkhead waterward of the existing bulkhead will require mitigation for intertidal impacts.

The existing fire hydrant, power vaults and transformer immediately west of Star Fish, Inc. on the north side of the road will be partially impacted with the proposed roadway improvements. Those utilities will require adjustment to grade if feasible, or relocation behind the proposed sidewalk which would require additional rip rap fill into Semiahmoo Bay.

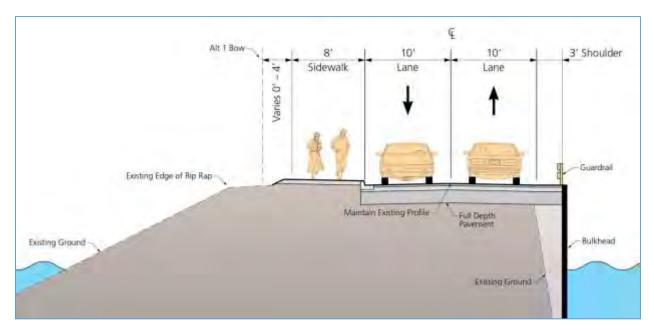


Figure 6. Alternative 2: Marine Drive Section A-A – Vehicle & Pedestrian Access

The Alternative 2 cross-section is 4 feet narrower than Alternative 1. The Alternative 2 proposed back of walk (BOW) line extension at Star Fish, Inc., matches into the existing north edge of pavement at the Fisherman's Pier. The Alternative 2 BOW line relative to Alternative 1 BOW line varies from 4 feet down to zero, matching at the existing north edge of pavement at the Fisherman's Pier.

The alignment difference between the alternatives and the transition to match the existing north edge of pavement at Fisherman's Pier leads to varying width between the back of sidewalk and the existing edge of rip rap depending on the section location.

Alternative 3: Single Lane ADA Access

Alternative 3 improvements consist of two 12-foot driving lanes and an 8-foot sidewalk from Lighthouse Park to Star Fish, Inc. At Star Fish, Inc., the roadway width will be reduced from 24 feet to 16 feet, providing one 11-foot driving lane, a 5-foot bike lane, and an 8-foot sidewalk to Fisherman's Pier. All traffic will be required to turn left into the public parking lot east of Star Fish, Inc. Traffic will be routed to the parking lot by use of a chicane curb extension. This alternative will provide one-way vehicle access from Star Fish, Inc., to the Fisherman's Pier, limited to ADA (American's with Disability Act), emergency, and maintenance vehicles.

Expansion of the abutment, pier, and approach to Fisherman's Pier will be required to accommodate the roadway widening as it connects to the Pier. Both the top and bottom portions of the fill area will be widened by approximately 3 feet from the current width of 22 feet. The

widening would be to specific areas on both the north and south sides of the existing roadway to maintain the proposed width while also minimizing potential fill. All of the widening portions would require placing fill in water to build slopes or for installation of bulkhead walls. This alternative is evaluated with two options for the existing timber bulkhead structure:

Option A: Replace with a new bulkhead (see Figure 13).

Option B: Rip rap slope fill to the south (see Figure 14).

A Semiahmoo Bay rip rap fill slope is needed with this alternative to accommodate the widening around the Star Fish, Inc., building.

The existing fire hydrant, power vaults, and transformer immediately west of Star Fish, Inc., on the north side of the road will be minimally impacted with the proposed roadway improvements. One power vault may require adjustment to grade if feasible or relocation behind the proposed sidewalk with minimal impact to the Semiahmoo Bay rip rap fill.

Figures 7 and 8 below show the roadway sections at the west end of the project, Options A and B, respectively.

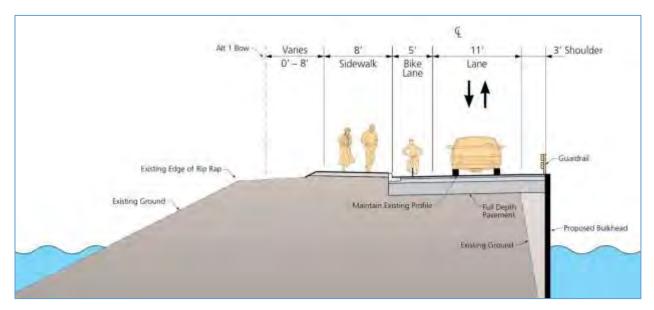


Figure 7. Alternative 3 – Option A: Marine Drive Section A-A – Vehicle & Pedestrian Access

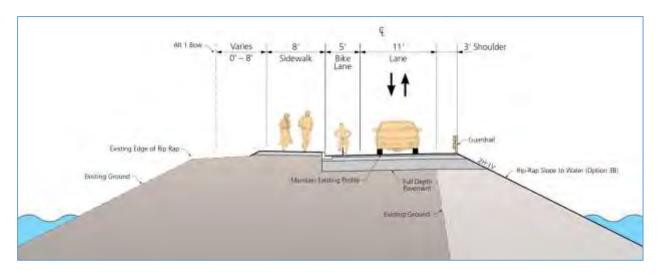


Figure 8. Alternative 3 - Option B: Marine Drive Section A-A - Vehicle & Pedestrian Access

The Alternative 3 cross-section is 8 feet narrower than Alternative 1. The Alternative 3 proposed back of walk (BOW) line is transitioned to match into the existing north edge of pavement at Fisherman's Pier. The Alternative 3 BOW line relative to Alternative 1 BOW line varies from 8 feet down to zero matching at the existing north edge of pavement at the Fisherman's Pier.

The alignment difference between the alternatives and the transition to match the existing north edge of pavement at Fisherman's Pier leads to varying width between the back of sidewalk and the existing edge of rip rap depending on the section location.

<u>Alternative 4: Public</u> Promenade

Alternative 4 improvements consist of two 12-foot driving lanes and an 8-foot sidewalk from Lighthouse Park to Star Fish, Inc. From Star Fish, Inc., to Fisherman's Pier, a Public Promenade is proposed. The proposed Promenade consists of a 14-foot meandering, textured-cement-concrete, shared-use path for pedestrians and bicyclists with rain gardens. All vehicle traffic will be required to turn left into the public parking area east of Star Fish, Inc. Removable bollards will be installed immediately west of the parking entrance. The bollards will be removed to allow for emergency and maintenance vehicle access to Fishermen's Pier.

This alternative is evaluated with two options for the existing timber bulkhead structure:

Option A: Replace with a new bulkhead (see Figure 15)

Option B: Rip rap slope fill to the south (see Figure 16)

Abutment improvements to the Fisherman's Pier will be required; however, no expansion of the abutment will be required with Alternative 4. The only areas where widening would occur that would require additional fill would be on the south side of Marine Drive. These would require placing fill in water to expand the existing rip rap slopes (mid-bay area) or to replace the existing timber bulkhead with a new rip-rap slope (from Star Fish, Inc., to Fishermen's Pier).

A Semiahmoo Bay rip rap fill slope will not be required with Alternative 4.

The existing fire hydrant, power vaults, and transformer immediately west of Star Fish, Inc., on the north side of the road will not be impacted with the proposed roadway improvements.

Figures 9 and 10 below show the roadway sections at the west end of the project, Options A and B, respectively.

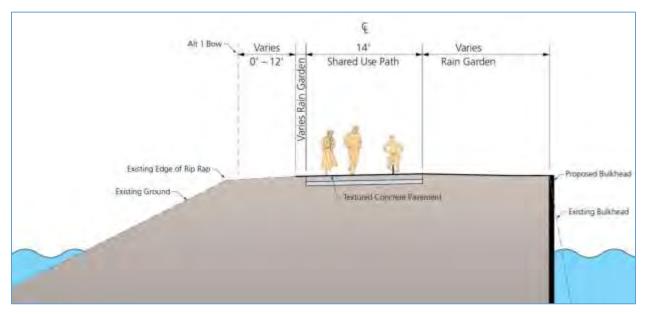


Figure 9. Alternative 4 - Option A: Marine Drive Section A-A - Vehicle & Pedestrian Access

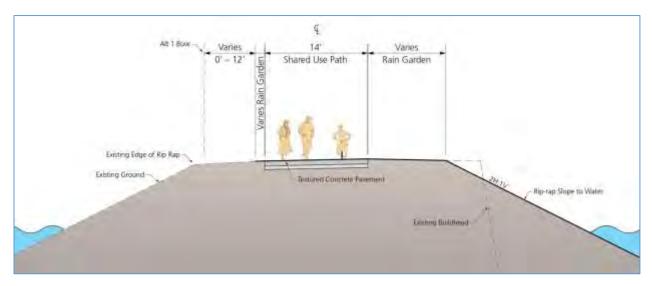


Figure 10. Alternative 4 - Option B: Marine Drive Section A-A - Vehicle & Pedestrian Access

The Alternative 4 cross-section is 12 feet narrower than Alternative 1. The Alternative 4 proposed back of walk (BOW) line is transitioned to match into the existing north edge of pavement at the Fisherman's Pier. The Alternative 4 BOW line relative to Alternative 1 BOW line varies from 12 feet down to zero, matching at the existing north edge of pavement at the Fisherman's Pier.

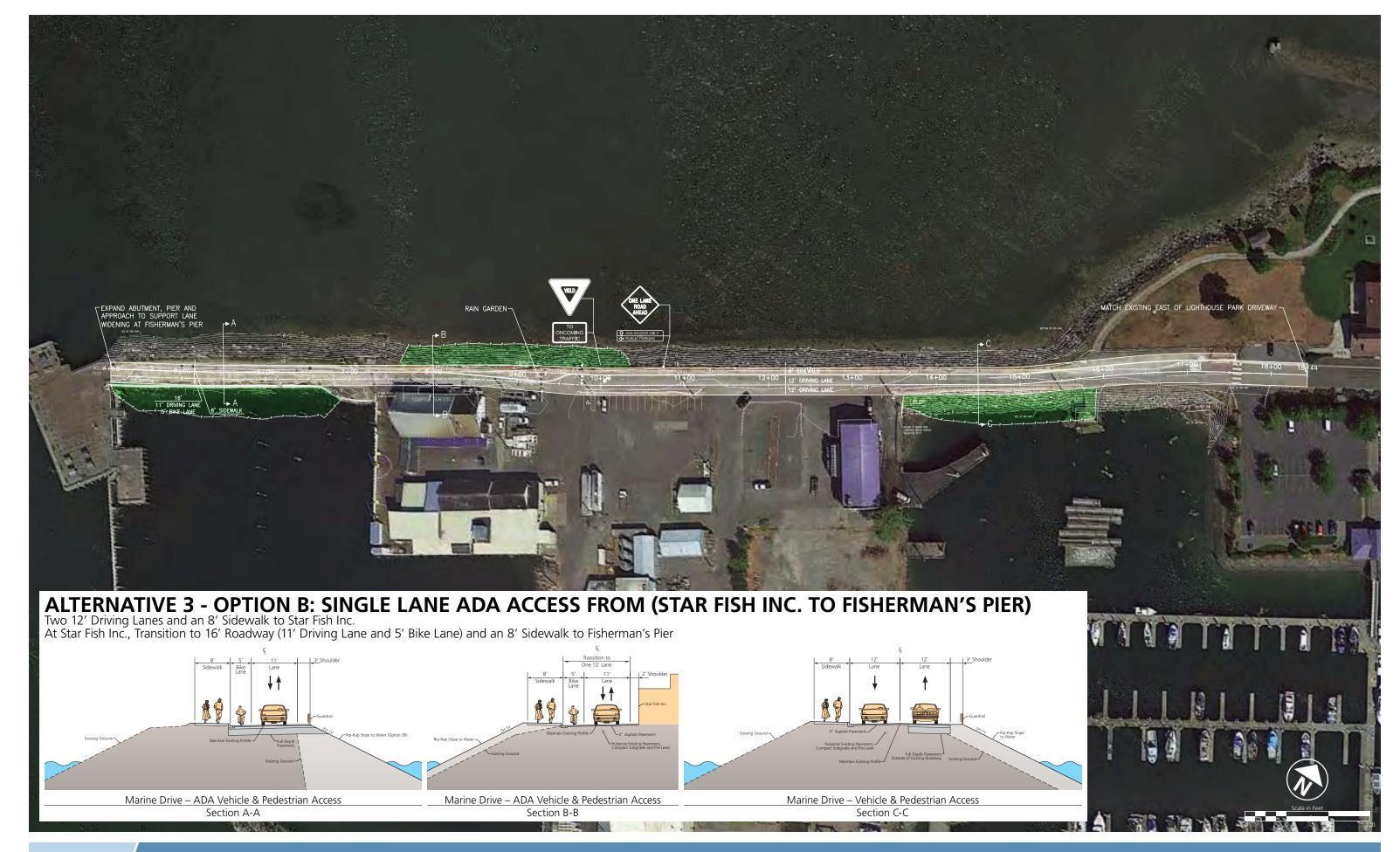
The alignment difference between the alternatives and the transition to match the existing north edge of pavement at Fisherman's Pier leads to varying widths between the back of sidewalk and the existing edge of rip rap depending on the section location.

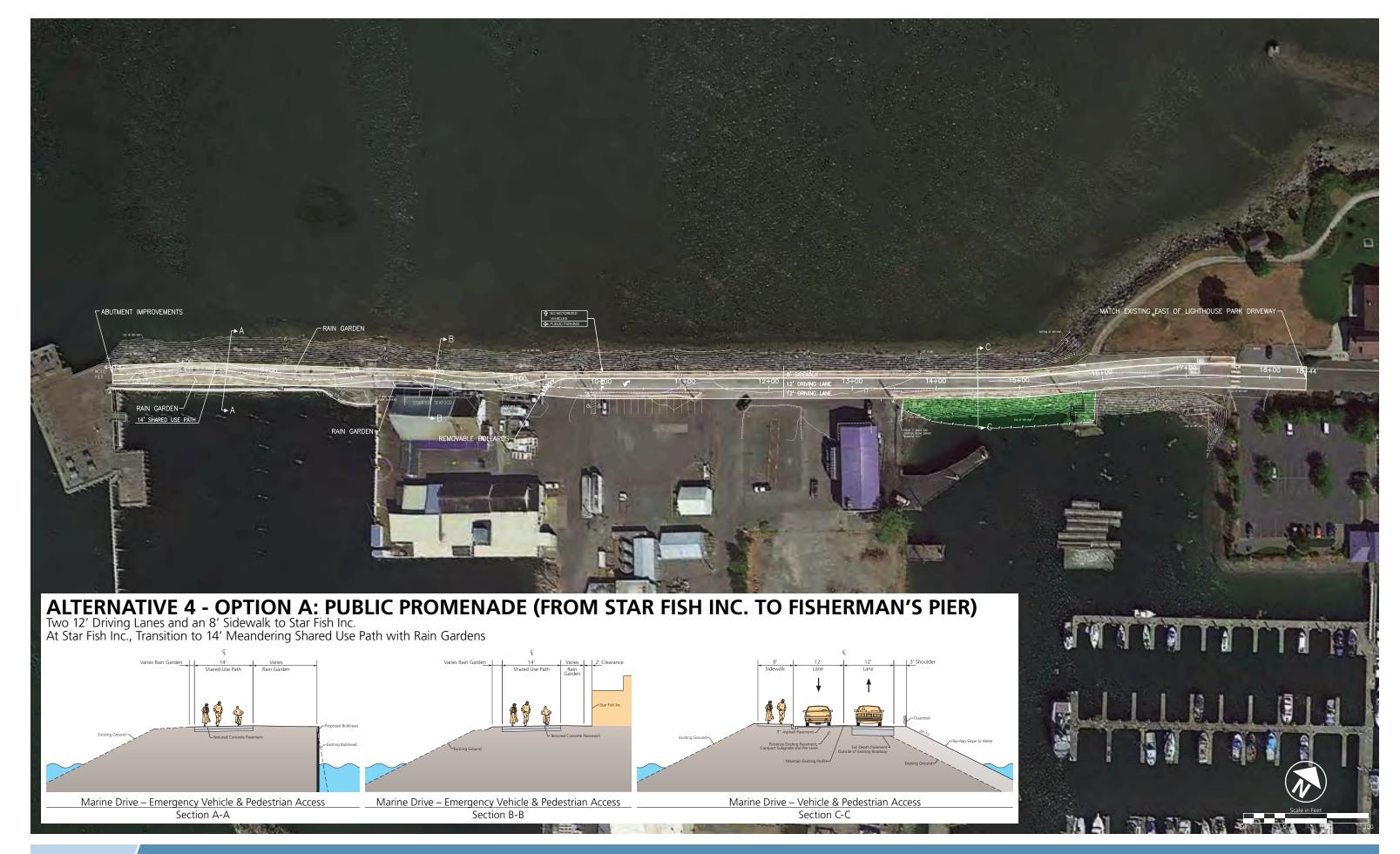


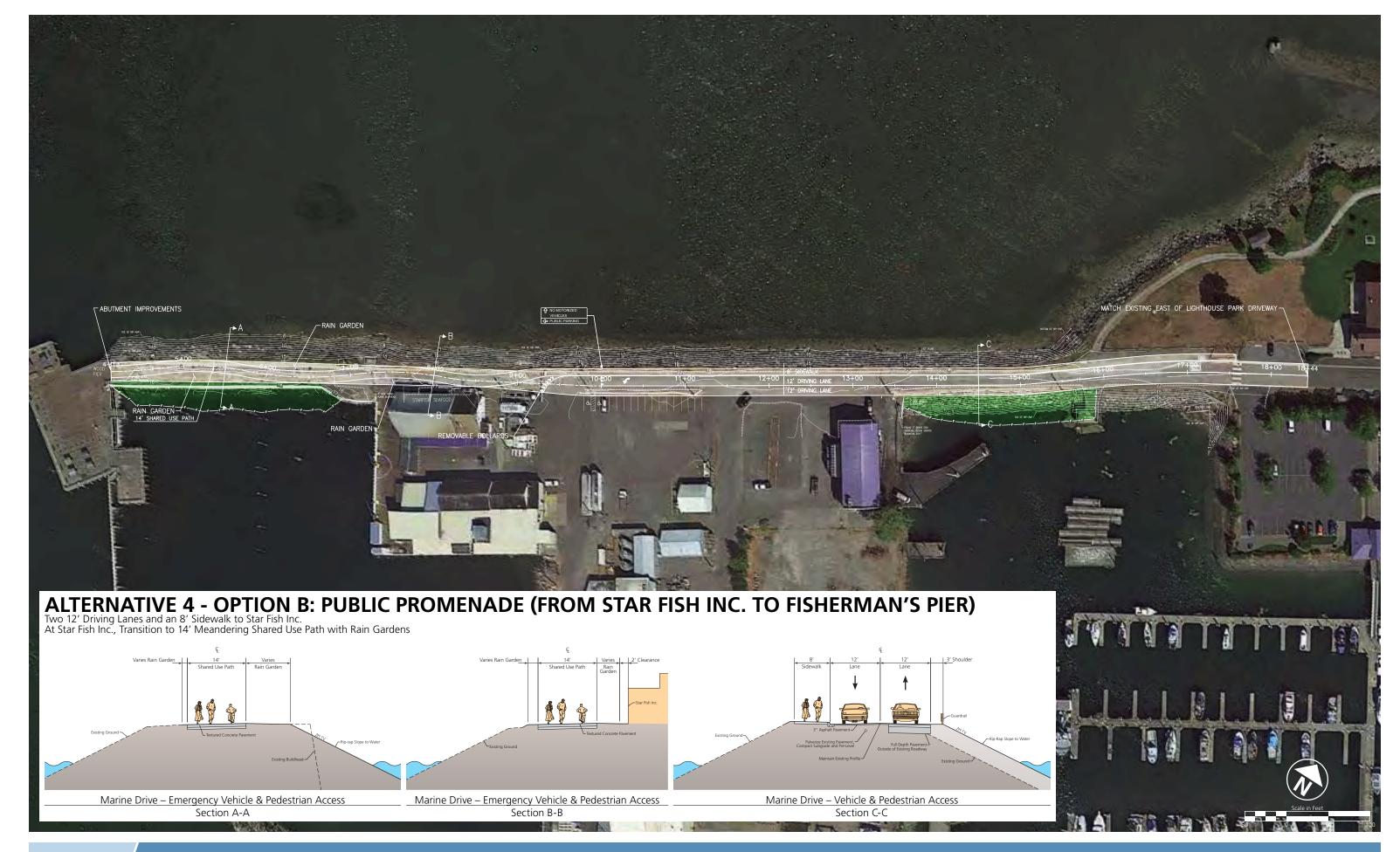












Roadway Pavement Section

According to the geotechnical report, Appendix D, Marine Drive Bulkhead and Pavement Condition Assessment, for Marine Drive from Lighthouse Park, east end of the project limits, to Star Fish, Inc., "The existing pavement is in reasonable good condition and the pavement subgrade appears to be adequate for support of current traffic loads." Therefore, for this section, the existing pavement will be pulverized, the existing subgrade compacted, and 3-inches of HMA (Hot Mix Asphalt) installed. Some new pavement sections will be applied along the roadway alignment to accommodate the roadway widening.

For the section between Star Fish, Inc., and Fisherman's Pier behind the failing bulkhead, the recommended pavement section is 3 inches of HMA over 6 inches of CSTC (Crushed Surfacing Top Course) over 18 inches of Gravel Borrow.

Any sinkholes or unsuitable foundation materials encountered during construction will be excavated before building any embankment over the top. The potential exists for liquefaction of soils to occur during excavation as evidenced by a past sewer installation project in 2011 where liquefaction was observed during construction. Measures to control liquefaction and groundwater during construction and in the completed facility should be considered and included in the design and bid documents. Measures could include over excavation of unsuitable materials, the use of geotextiles and graded material, or other control measures.

Bulkhead

The existing bulkhead is in poor condition and should be replaced for each of the options. Preliminary recommendations are to replace the existing bulkhead with a new sheet pile bulkhead driven in location as required at the edge of the roadway section for any of the alternatives or to replace the vertical bulkhead with a rip rap slope for options in Alternatives 3 and 4. The proposed new sheet pile wall would be made of solid steel interlocking sheets that would be driven well below the mudline. This wall would not have any openings and would prevent loss of material from the roadway while also providing support.

Some of the alternatives require placement of the bulkhead or fill slope waterward of the existing bulkhead. This will require additional permitting and potential mitigation for the impacts to the intertidal habitat. Potential mitigation measures are discussed in the appendix but may include improvement of the Semiahmoo Bay slope by removal of some of the concrete and manmade debris and replacement with natural materials. Preliminary environmental and geotechnical recommendations for a bulkhead construction are shown in the appendices.

There is a trade off in environmental impacts between a fill slope and a vertical wall. The fill slope can impact a larger footprint but also provides a gradual slope at the water's edge which is better for smaller endangered juvenile salmon to escape from larger predator fish. A vertical wall has a smaller footprint but creates deep water at the shoreline's edge. Predator fish can hide in the deeper water nearshore and prey on migrating juvenile salmon. As stated, any work outside the existing footprint of the fill area will likely require mitigation as part of the permit approval process.

Semiahmoo Bay Rip Rap

In general, the goal of the alternatives was to minimize impacts to the north, Semiahmoo Bay, side of the project as this area is the most exposed and consists of the more-natural intertidal and subtidal areas waterward of the rip rap slopes. There are some areas of erosion on this slope that should be repaired for any of the options. These areas include the northwest corner near the abutment with the Pier, around the utility structures, and in various other minor areas. These repairs could consist of removal of loose concrete rubble and repair with an engineered rock slope. Due to the high exposure to waves and currents at this location, a soft natural shoreline slope is not recommended and any new slope should be faced with rip rap. Only pockets of erosion were observed along the Semiahmoo Bay side of the roadway. Therefore, the alternatives do not include complete replacement and reengineering of this slope.

Due to the location of the Star Fish, Inc., building and the narrow top width of the fill area in this location, additional fill and rip rap slope protection is required in the vicinity of Star Fish, Inc., for Alternatives 1, 2, and 3 in order to accommodate the required roadway width. The approximate extent of the fill areas are shown in the Alternative Figures. This fill area will likely require mitigation for impact to intertidal habitats. This mitigation may include removal of concrete debris on the slope and replacement with natural rock materials or other measures, see Appendix E.

A vertical sheet pile wall is not proposed for the Semiahmoo Bay side of the fill area. This is due to a variety of environmental and design considerations. While a vertical wall would reduce the overall fill area on the north side of the roadway, the regulatory agencies generally prefer maintaining intertidal slopes over replacing them with vertical walls since vertical walls create areas of deep water along the shore where predator fish can feed on migrating endangered juvenile salmon. A vertical wall on this exposed side of the roadway would also be subject to high wave action, overtopping, and potential scour of the intertidal area at the toe of the breakwater creating environmental and long-term durability issues. For these reasons, none of the alternatives include a vertical wall on the Semiahmoo Bay side of the roadway.

Mid Bay Rip Rap Slope

In order to install two 12-foot lanes and a sidewalk between the Gate 3 parking area and Sound Pacific Seafoods additional fill and a rip rap slope will be required in the Mid Bay rip rap slope area on the south side of the roadway. There are also a few minor areas of erosion in the Mid Bay Area that should be addressed outside of the area of new rip rap placed for the roadway. Since all alternatives include two 12-foot lanes in this area, all alternatives include fill in the Mid Bay rip rap slope area. This fill should also be faced with rip rap due to the wave and wake exposure at this location. However, smaller fish rock (gravel material) or other mitigation measures may be appropriate in this area since the wave climate is less than the exposure on the north side of the roadway fill area. See Appendix E for additional environmental discussion.

Special Reports and Studies

The following special reports or studies are associated with this improvement project. See Appendices D and E.

- 1. "Draft Report Geotechnical Engineering Services, Marine Drive Bulkhead and Pavement Condition Assessment," prepared by Landau Associates, dated September 23, 2015.
- 2. "Environmental Memorandum," prepared by Anchor QEA, LLC, dated October 13, 2015.

Additional Reference

"Geotechnical Consultation Marine Drive Sinkhole Evaluation," Memorandum prepared by GeoEngineers, dated April 21, 2014.

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OPINION OF PROBABLE CONSTRUCTION COST

The detailed Opinion of Probable Construction Cost for each alternative is included in Appendix C. The summary of probable construction cost is depicted in Table 1.

Alternative 2 1 **3A 3B 4A 4B** Item **Roadway Improvements** \$995,130 \$940,510 \$853,140 \$837,140 \$929,770 \$911,270 \$163,800 \$132,600 \$95,400 \$244,800 \$65,400 \$142,200 Rip Rap Bulkhead \$360,000 \$360,000 \$360,000 \$27,000 \$360,000 \$24,000 \$41,000 \$37,000 \$33,000 \$33,000 \$30,000 \$30,000 Fisherman's Pier Modification \$30,000 \$30,000 \$30,000 \$30,000 \$30,000 \$30,000 Shoreline Erosion Repairs \$51,000 \$51,000 **Abutment Improvement** \$68,000 \$62,000 \$56,000 \$56,000 Environmental Mitigation \$100,000 \$100,000 \$100,000 \$100,000 \$50,000 \$50,000 Sub-Total \$1,757,930 | \$1,662,110 | \$1,527,540 | \$1,327,940 \$1,516,170 \$1,238,470 8.5% Sales Tax (Excluding Mobilization) \$135,824 \$128,444 \$118,026 \$102,590 \$117,144 \$95,665 **Total Construction Costs** \$1,893,754 \$1,790,554 \$1,645,566 \$1,430,530 \$1,633,314 \$1,334,135 \$527,379 \$498,633 \$458,262 \$454,851 \$371,541 Design Contingency (30%) \$398,382 \$351,586 \$332,422 \$305,508 \$303,234 \$247,694 Planning Level Contingency (20%) \$265,588 Permitting and Engineering (18%) \$474,641 \$448,770 \$412,436 \$358,544 \$409,366 \$334,387 Construction Contingency (20%) \$332,422 \$303,234 \$351,586 \$305,508 \$265,588 \$247,694 **Total Project Costs** \$3,600,000 | \$3,410,000 | \$3,130,000 | \$2,720,000 \$3,110,000 | \$2,540,000

Table 1. Summary of Probable Construction Costs

The project costs above include the improvements for the entire length of the project from Lighthouse Park to Fisherman's Pier. The proposed roadway improvements for all the alternatives are the same from the Lighthouse Park to Star Fish, Inc. Therefore, the cost difference between the alternatives is reflected in the section between Star Fish, Inc., and Fisherman's Pier.

The opinion of probable construction cost shows a difference of \$1,060,000 between the most expensive alternative (Alternative 1) and the least expensive alternative (Alternative 4B).

The proposed roadway surface from Star Fish, Inc., to Fisherman's Pier for Alternatives 1 to 3 is Hot Mixed Asphalt (HMA). The roadway is 24 feet wide in Alternative 1, 20 feet wide in Alternative 2, and 16 feet wide in Alternative 3, resulting in a gradual cost reduction from Alternative 1 to Alternative 3. The proposed pavement surface for Alternative 4, Public Promenade, is 14-foot-wide textured cement concrete and is estimated to cost about \$100,000. This adds some costs to Alternative 4 and reduces the cost differential between the Alternative 4 options and the other options that do not include Textured Cement Concrete.

The other major cost variation between the alternatives is reflected in the bulkhead replacement versus the rip rap fill, Options A and B of Alternatives 3 and 4.

SUMMARY & RECOMMENDATION

As discussed above, from Lighthouse Park at the east end of the project limits to Star Fish, Inc., all four alternatives have the same roadway width and from Star Fish, Inc., to Fisherman's Pier, all four alternatives have various roadway width scenarios. All alternatives require additional fill in the Mid Bay rip rap area and replacement of the existing timber pile bulkhead. All alternatives with roadway access to Fishermen's Pier (Alternatives 1, 2, and 3) require some fill on the Semiahmoo Bay rip rap slope around the Star Fish Inc., building.

The four alternatives presented are all feasible alternatives. The opinion of probable construction cost shows a difference of \$1,060,000 between the most expensive alternative (Alt 1) and the least expensive alternative (Alt 4B).

The alternatives will be presented to the Port Commission, the City Council, and the public at an open house. Then the Port of Bellingham and the City of Blaine will select a preferred alternative and pursue funding for implementation of the preferred alternative.

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