148th Avenue SE at Larsen Lake Flood Mitigation

Alternatives Analysis

October 2023 | Report

Consulting Engineers

Alternatives Analysis

October 2023

Prepared for:

City of Bellevue
450 110th Avenue Northeast
Bellevue, WA 98004
(425) 452-6856

Prepared by:

KPFF Consulting Engineers
1601 Fifth Avenue, Suite 1600
Seattle, WA 98101
(206) 622-5822

Subconsultants:

Shannon & Wilson
400 North 34th Street, No. 100
Seattle, WA 98103
(206) 632-8020

10/12/23

This page intentionally left blank.

Table of Contents

List of Figures

Appendices

1. Executive Summary

This report documents the preliminary planning for improvements to 148th Avenue SE between SE Eighth Street and Main Street in the city of Bellevue, Washington. The improvements serve to address underlying compressible peat deposits which have resulted in chronic settlement and subsequent flooding of the roadway over time. The purpose of this report is to define and document the process and methods used in the analysis and evaluation of the proposed solutions selected for evaluation.

148th Avenue SE has a functional classification of major arterial. The project site is bounded on the east by Larsen Lake. Field reconnaissance and review of existing documents were performed to collect information on existing conditions, utilities, environmentally sensitive areas, and cultural/historical resources.

Previous studies of the issues along this arterial included a Flood Investigation Analysis and an Alternatives Screening Technical Memorandum by Jacobs Engineering Group. The latter evaluated several concepts for addressing the flood recurrences and identified three alternatives to carry forward for further analysis:

- Downstream Improvements: Proposed modifications or removal of the drainage structure DMP 149, which controls flows from the Larsen Lake complex draining north through the drainage system through the Kelsey Creek Shopping Complex.
- Floodwall: Construction of an earthen berm or an engineered wall to protect the roadway from high water events.
- Raise Roadway: Reconstruction of 148th Avenue SE to an elevation that would reduce the frequency of flooding events and the need for road closures.

Subsequent to that memorandum, it had been decided that modifications to DMP 149 were too impactful to the downstream conveyance systems and not a practical solution. Therefore, the scope of this study includes analysis of the optimization of storage within the Lake Hills Greenbelt in the wetland complex around Larsen Lake in lieu of the downstream improvements recommendation from the memorandum.

A number of options have been developed for the three alternatives. This study will continue to use the evaluation criteria developed for the original screening process. These included:

- Technical evaluation
- Operations and Maintenance/Long Term Feasibility
- Environmental
- Permitting/Regulatory
- Community Impacts
- Cost

2. Study Description and Background

2.1 STUDY AREA BOUNDARIES AND SITE DESCRIPTION

The study area comprises the 148th Avenue SE right-of-way (ROW), and is bounded by SE Eighth Street to the south, Main Street to the north, and the greater Lake Hills Greenbelt area. 148th Avenue SE is a four-lane major arterial with an average daily traffic (ADT) of 38,300 vehicles per day. There are no other cross streets within the project limits. See Figure 1 for project study area.

The study area includes the 148th Avenue SE ROW in addition to the Lake Hills Greenbelt Area. The study area is within the Kelsey Creek Basin; see Figure 2 for the existing basin map.

Figure 1: Project Study Area

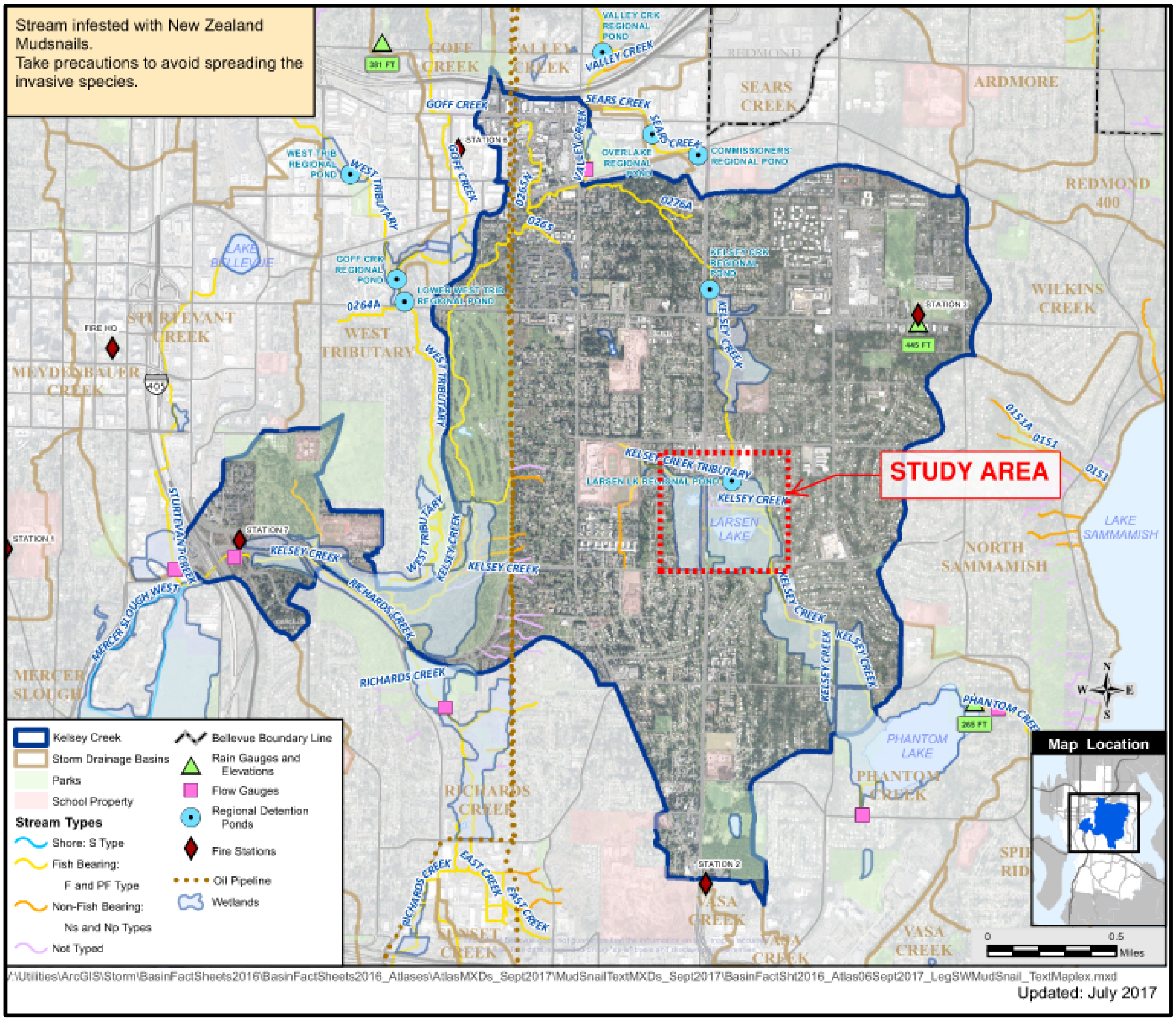


Figure 2: Kelsey Creek Basin, City of Bellevue

2.2 PURPOSE AND NEED

This study evaluates alternatives to reduce or eliminate the frequency of flooding of 148th Avenue SE between SE Eighth Street and Main Street. The current low point along the roadway is an elevation of approximately 257.00 feet and the observed water surface elevation during 100-year storm events is 258.50 feet. The roadway settlement caused by underlying peat deposits has resulted in periodic flooding of the road, which has required five closures of 148th Avenue SE since the fall of 2003.

3. Process

This study began with the establishment of goals and objectives and the collection of relevant data. After gaining an understanding of the settlement and flooding issues, three alternatives were developed. The study will begin with an initial screening of three design solutions that will address the issue of rising water levels in the basin to identify the preferred alternatives. The three alternatives are as follows:

- Optimize storage within Lake Hills Greenbelt
- Install earthen embankment or flood walls
- Raise the roadway profile

The preferred alternative will be selected based on the evaluation criteria defined in Section 3.6. A fourth alternative, which will be a combination of two or more of the alternatives listed above, is anticipated to be developed based on input received by the public, permitting agencies, and tribes.

A final recommended alternative will be presented to the City of Bellevue at the conclusion of this report.

3.1 PREVIOUS ANALYSES

Following moderate to heavy rain or long rain events, 148th Avenue SE has been fully or partially closed by the city due to high water levels on numerous occasions between SE Eighth Street and Main Street. There have been several past studies conducted by Jacobs Engineering Group:

- Monitoring Plan (Jacobs 2018)
- Site Reconnaissance Summary (Jacobs 2019a)
- Flood Investigation Analysis (Jacobs 2019b)
- Larsen Lake Preliminary Flood Investigation Alternatives Screening Technical Memorandum (2019)

The studies listed above have identified potential causes of flooding along the Upper Kelsey Creek corridor near Larsen Lake, concluding that inundation of southbound 148th Avenue SE is likely controlled by culvert capacity and antecedent conditions in Larsen Lake during smaller events, but larger events are likely to inundate the roadway regardless of culvert capacity and antecedent conditions.

The studies have also identified that a contributing factor to flooding on 148th Avenue SE is settlement due to peat and soft clay soils. Geotechnical analysis performed for the original roadway construction indicates that 148th Avenue SE would likely settle due to the construction on top of the peat and soft clay. The analysis projects that most settlement would occur within the first 20 years, with reduced settlement beyond 20 years from construction, assuming the road remains at a constant weight (Rittenhouse-Zeman & Assoc., 1974).

3.2 TOPOGRAPHIC SURVEY AND BASE MAPPING

Topographic survey and base map data collection was completed on October 21, 2022. The base map includes ROW, utility, roadway, and drainage information.

3.3 CRITICAL AREAS RECONNAISSANCE

Shannon & Wilson performed a reconnaissance-level field assessment of the wetland, stream, and habitat conditions within the study area, which includes Larsen Lake and Kelsey Creek. The reconnaissance confirmed the presence of the approximately 83-acre Larsen Lake wetland complex and Kelsey Creek and its tributaries, consistent with publicly available mapping and past studies. The wetland complex (Lake Hills Greenbelt) is on both sides of and closely abutting 148th Avenue SE, with some wetland in the vegetated medians. The wetland areas are connected by culverts carrying tributaries of Kelsey Creek from the west side of the road to the east, feeding the mainstem which passes through Larsen Lake and outlets to the north. The wetland is rated as a Category II wetland with a 110-foot buffer; the creek and its tributaries are Type F (fish-bearing) streams with a 100-foot buffer. Because the Larsen Lake wetland complex is associated with Phantom Lake, a shoreline of the state, the wetland complex is part of shoreline jurisdiction and has been assigned a shoreline environment designation of Urban Conservancy – Open Space.

3.4 HYDROLOGIC AND HYDRAULIC MONITORING

A Flood Discipline Report has been prepared by Shannon & Wilson to develop a hydraulic model of the Larsen Lake complex to evaluate the effectiveness of the proposed concepts and to identify a preferred alternative. This work was built upon the previous work of Jacobs, which included a Larsen Lake Flood Investigation Analysis and an Alternatives Screening Technical Memorandum to perform a detailed hydrologic and hydraulic analysis of the larger Larsen Lake complex.

Shannon & Wilson evaluated a range of options which focused on replacing culverts at three locations under 148th Avenue SE. The three culvert crossings are referred to as the north, central, and south crossings. The north crossing is located on the West Tributary of Larsen Lake and is the primary low flow crossing. The other two crossings drain side channel ditches from the west side of 148th Avenue SE to the east side of 148th Avenue SE to Larsen Lake.

These tributaries have been identified as having a fish presence and the three crossings have all been determined to be partial fish barriers by Washington Department of Fish and Wildlife (WDFW). The proposed alternatives will be evaluated for their ability to provide a passable crossing in accordance with WDFW's 2013 Water Crossing Design Guidelines for fish passage.

The entirety of the lake complex is within the 100-year Federal Emergency Management Agency (FEMA) Zone AE floodplain. Any alternative that results in a change to the base flood elevation will require a Conditional Letter of Map Revision (CLOMR) or Letter of Map Revision (LOMR). A preference is for a solution that does not result in a rise in the 100-year flood.

Wetland optimization to reduce flooding can be a useful flood risk reduction tool especially when wetlands have been filled previously or when significant areas that have been isolated from hydraulic connections to streams can be reconnected. Since the Larsen Lake complex is currently dominated by wetlands and regularly flooded, the opportunities for wetland optimization that would reduce flood risks are severely limited. Excavation of existing wetlands where non-native vegetation exists and restoration of stream channels to their pre-agricultural channel forms might yield nominal wetland improvements (optimization); however, the nominal increase in flood storage would not reduce flood risks and likely would be a challenge to permit given alternatives with less wetland impacts/disturbance and more flood reduction benefit are available.

3.5 GEOTECHNICAL EVALUATION

Shannon & Wilson has provided preliminary recommendations for geotechnical considerations. These recommendations are based on available subsurface data from the Washington State Department of Natural Resources (DNR), the United States Geological Survey (USGS) geologic maps, and borings obtained previously within and adjacent to the study area.

148th Avenue SE is underlain by thick deposits of compressible materials, including peat and soft clays. The compressible materials extend to a depth of approximately 25 feet below ground surface (bgs) in the study area. The compressible soils are generally underlain by medium dense to very dense glacial till. Figure 3 presents a contour map of the approximate thickness of compressible materials in the vicinity of the project site. Figure 4 presents a cross section depicting the existing ground surface and the interpreted approximate bottom elevation of compressible material. Based on the variability of the existing boring data, spatial distribution of the explorations, and interpretation of borehole samples, the compressible material depths should be considered an approximation. Depth to bottom of compressible soils may vary up to 10 feet from the values indicated at a given location.

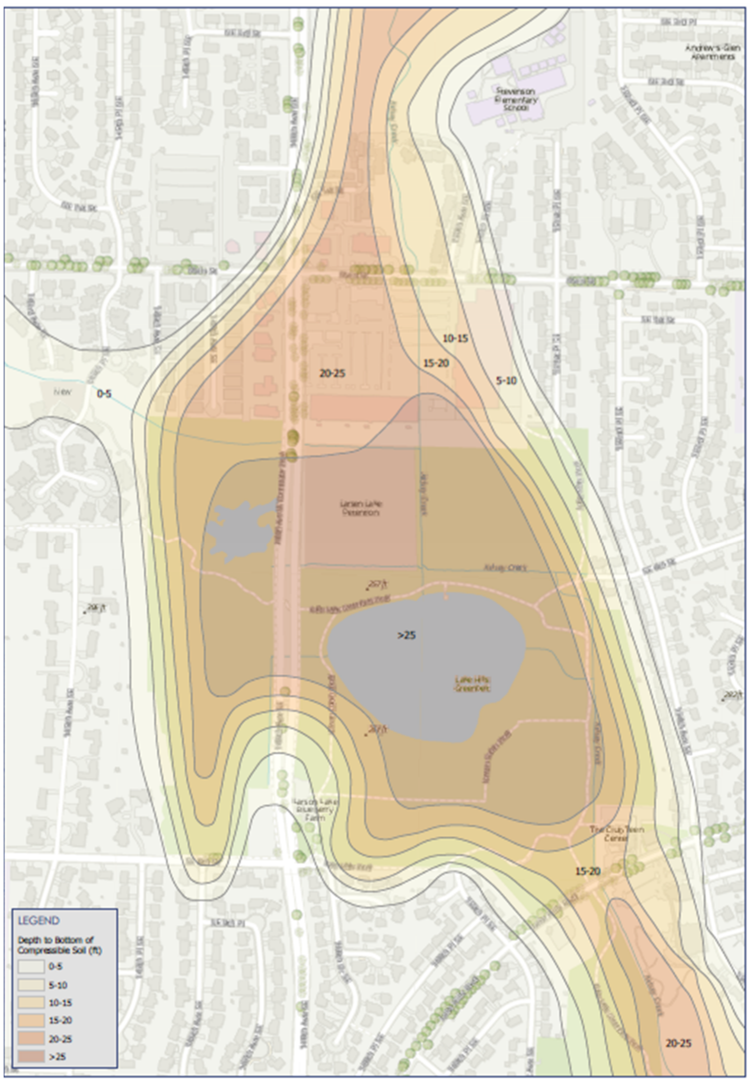


Figure 3: Contours of Compressible Material Thickness

Long-term settlement of the compressible materials beneath the study area has contributed to flooding issues along 148th Avenue SE. Geotechnical considerations for each of the alternatives to address roadway flooding presented in this report are included in the associated sections below.

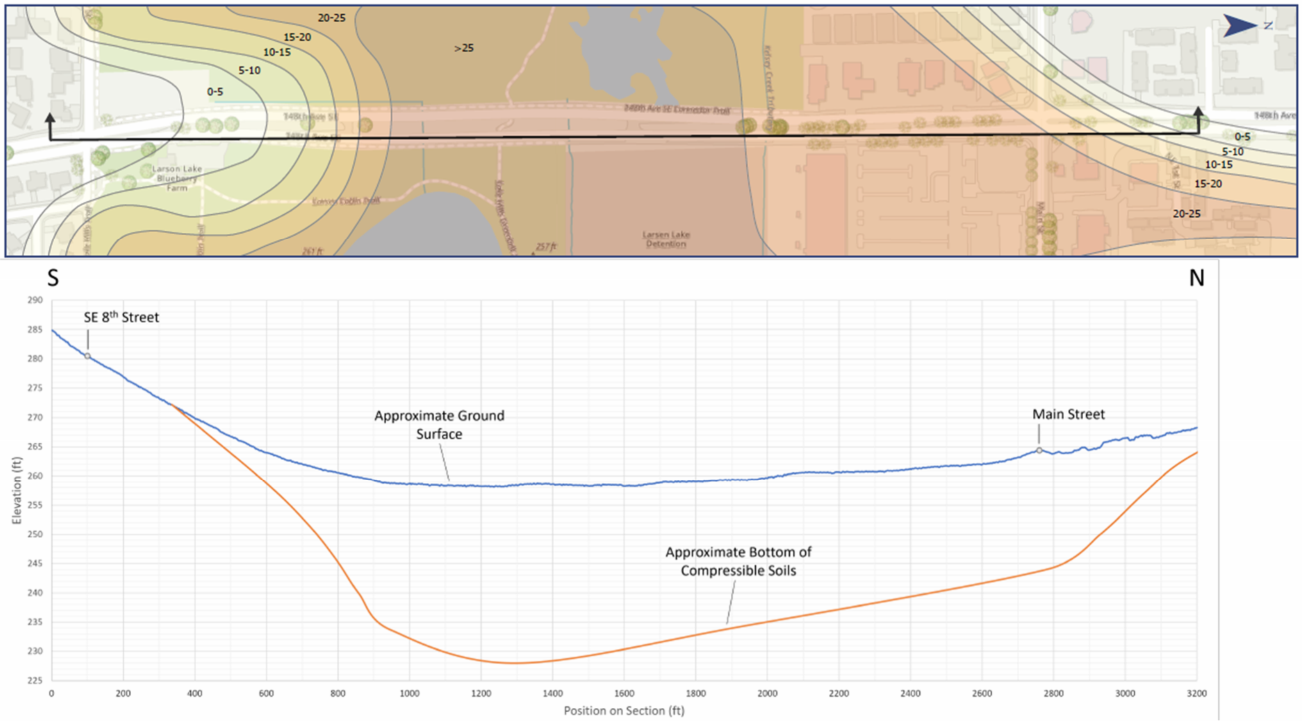


Figure 4: Cross Section of Subsurface Along 148th Avenue SE

3.6 ALTERNATIVE EVALUATION

Each of the alternatives is evaluated in Section 5 based on the following criteria:

- Technical Evaluation

  Criteria under this category include the technical feasibility to implement the alternative and constructability including geotechnical considerations and other impacts such as utilities and private properties including ROW needs.

- Long-Term Feasibility

  This criterion considers the feasibility of each alternative as determined by its capability to eliminate chronic roadway settlement and flooding. Alternatives with short-term project effectiveness will be assessed negatively.

- Operations and Maintenance

  This criterion takes into consideration the level of resources needed to maintain operation of the system and prevent flooding of 148th Avenue SE. In addition, the feasibility of each alternative is determined by its capability to eliminate chronic roadway settlement. Alternatives with additional required maintenance will be assessed negatively.

- Environmental

  Reasonable efforts are required to avoid and minimize impacts to critical areas and buffers. A concept that results in less impact to critical areas and buffers, and therefore has lower compensatory mitigation obligations, will be viewed as favorable to others. In addition, alternatives that improve fish passage in the area will be assessed positively.

- Permitting/Regulatory

  This criterion takes into consideration the ability to obtain permits and the level of effort required to obtain those permits from the regulatory authorities for any given alternative. Because each alternative includes some degree of wetland and/or stream alteration, all alternatives will require the full suite of local, state, and federal permits. However, there are differences in level of effort and agency scrutiny associated within those; for example, a Shoreline Conditional Use Permit or Shoreline Variance is substantially more intensive than a Shoreline Substantial Development Permit, and a U.S. Army Corps of Engineers (Corps) Individual Permit has greater effort and a longer timeline than a Nationwide Permit. A concept that has lower-complexity permits with shorter timelines would be viewed more favorably.

  The three culverts located under 148th Avenue SE which convey flows from the wetland complex west of the roadway to the east and Kelsey Creek have been identified as partial barriers to fish passage by WDFW. An alternative that addresses these barriers by replacing them with passable structures that meet WDFW guidelines for fish passage are considered a significantly positive attribute by all agencies. The ability to obtain approval from the Tribes and regulatory agencies is expected to be challenging without addressing this in some manner.

- Community Impacts

  Factors considered under this criterion include impacts to private property or the general character of the neighborhood or park, the amount of truck traffic anticipated for construction and general level of impact to traffic during and after construction.

- Equity, Social Justice, and Sustainability

  The criterion takes into consideration long-term annual energy use, construction duration impacts to traffic, and construction duration impacts to existing pedestrian facilities. The goal of this criterion is to develop facility and system improvements responsive to the values and priorities of residents and stakeholders and achieve pro-equity outcomes, by taking into consideration the following:

  - Changes in community cohesion (splitting or isolating areas, generating new development, and separation from services).
  - Changes in travel patterns, travel time and accessibility for all modes.
  - Direct and indirect impacts to social services caused by displacing households (school districts, churches, law enforcement, fire protection, and recreation areas).
  - Traffic, bicyclist, and pedestrian safety, and changes in overall public safety.
  - Impacts to human health.
  - Project benefits to the community.
  - Project effects on elderly, disabled, and transit-dependent populations within the study area.
  - Any relocation (businesses, housing, etc.) needed.
  - Impacts to public services and utilities.

- Construction Cost

  Preliminary design and construction cost estimates have been developed for each of the concept alternatives and ranked accordingly. This criterion also includes consideration for costs associated with the long-term maintenance of any given alternative. Costs for permitting and any mitigation are not included, as they are highly variable depending on the actual project design; the assessment of potential short-term, long-term, construction-related, and operation-related adverse effects that could accompany this alternative; the quantity of impacts; and the selected mitigation strategy. Note: all costs provided are in unadjusted 2023 dollars; backup cost estimate info is in the appendix B.

Preferred alternatives are evaluated in Section 5 and a final recommendation is provided in Section 6.

4. Design Criteria and Standards

4.1 GOVERNING STANDARDS

The alternatives and options developed in this study will be developed based on the following design standards:

4.1.1 City of Bellevue

- City of Bellevue Transportation Design Manual (TDM)
- City of Bellevue Storm and Surface Water Engineering Standards (January 2023)
- City of Bellevue General Special Provisions

4.1.2 WSDOT Publications

- WSDOT/APWA Standard Specifications for Road, Bridge, and Municipal Construction
- Standard Plans
- Design Manual (M22-01)
- Plans Preparation Manual (M22-31)

4.1.3 Other Publications or Requirements

- Washington Department of Fish and Wildlife “Water Crossing Design Guidelines” (2013)
- Washington State Department of Ecology “Stormwater Manual for Western Washington” (2019)
- APWA General Special Provisions
- AASHTO Geometric Design of Highways and Streets

4.2 ROADWAY SECTION

The City of Bellevue Roadway Functional Classification defines the minimum roadway widths for an arterial roadway as 11 feet for vehicle lanes and 6 feet for sidewalks.

It is assumed that all proposed concepts will maintain the existing roadway section, which is a four-lane separated roadway with a median between northbound and southbound traffic. Pedestrian facilities are located on both sides of 148th Avenue SE with connections to a path system that runs through the park and wetlands. The existing lane widths are approximately 11 feet. The widths of the pedestrian facilities vary from 6 feet for concrete cement sidewalks to 8 feet for asphalt paths. The median width varies and is vegetated with two breaks to allow for U-turns.

4.3 ALIGNMENTS

The existing alignment is generally straight with a few appreciable horizontal curvatures. The posted speed is 35 miles per hour (mph) and the design speed is 40 mph. Any changes to the vertical alignment will be evaluated for sight distance.

4.4 DEVIATIONS

No deviations from City of Bellevue standards are anticipated at this time.

5. Evaluation of Design Alternatives

The three alternatives were evaluated to assess the relative degree of benefit or impact for each element of the criteria stated in Section 3.6. This section will provide a summary of that evaluation process.

5.1 ALTERNATIVE 1 – OPTIMIZE WETLAND STORAGE

5.1.1 Description

This alternative would modify the surrounding drainage courses and/or wetland areas to provide additional flood storage. This could be accomplished through a stream and wetland restoration alternative that would realign the existing drainage channels by providing sinuosity through the wetland areas to better engage them during storm events and excavating uplands to create additional wetlands. Woody material could be installed or provide grade controls to roughen the channel, provide instream complexity, and encourage a stage zero channel form (sheet flow). This alternative would look at providing additional flood storage in the wetland complex to the north of Larsen Lake and/or the wetlands on the west side of 148th Avenue SE. This alternative also would include one upsized culvert for fish passage and drainage.

5.1.2 Technical Evaluation

As an alternative to provide flood risk reduction, this would have nominal value, particularly for a 100-year event. This may have benefits at smaller, more frequent events but is not the most effective or economical alternative to provide additional flood storage or meaningfully reduce roadway flooding.

This would require additional hydraulic modeling with an unsteady state model to specifically quantify the reduction in overtopping of the roadway.

Low-pressure ground equipment typically used for construction within wetlands and restoration projects would be required, but there are no major challenges to construction.

5.1.3 Operations and Maintenance/Long-Term Feasibility

This alternative would likely sustain itself over the road project design life but likely would ultimately revert over geologic time to a peat bog process and fill with decomposing vegetation and some sediment inputs from the tributaries. Further design refinement and analysis would be required to completely understand the sustainability.

5.1.4 Environmental Impacts

The specific locations of wetland alterations and details about the nature of the alterations are needed to provide a full assessment of the possible beneficial or negative impacts of this alternative. To maximize benefits, wetland disturbance (both permanent and for temporary construction access) should be concentrated in areas dominated by invasive vegetation (such as Himalayan blackberry or reed canary grass) and should avoid areas with native vegetation, particularly forest and shrub communities. The resulting hydroperiods will also need to be evaluated; if the modified areas are "flashy," that can adversely affect development and maintenance of native vegetation communities and degrade amphibian habitat. Converting forested wetland communities to shrub or emergent communities through the change in hydroperiods would also be an undesirable tradeoff. This alternative has the potential to enhance the wetland/stream complex without requiring supplemental wetland mitigation if these likely challenging pitfalls can be avoided.

5.1.5 Permitting/Regulatory

Permitting for flood storage optimization will be extensive since it will require work within an existing wetland and streams. Supporting studies may be required to evaluate the effects of changes to wetland hydroperiods on wetland functions. Depending on the design, this may require additional wetland mitigation for temporary and permanent impacts to wetlands.

5.1.6 Community Impacts

There will be minimal to no impacts to 148th Avenue SE for the wetland optimization alternative.

5.1.7 Equity, Social Justice, and Sustainability

No major advantages or disadvantages were identified in terms of equity, social justice, and sustainability for the wetland optimization.

5.1.8 Construction Cost

An estimated design and construction cost is $8,300,000See Appendix B for details.

5.2 ALTERNATIVE 2 – EARTHEN EMBANKMENT OR FLOOD WALL

5.2.1 Description

This alternative will regulate the water level within the roadway by implementing one of the following possible options.

- Earthen Embankment
- Flood Wall

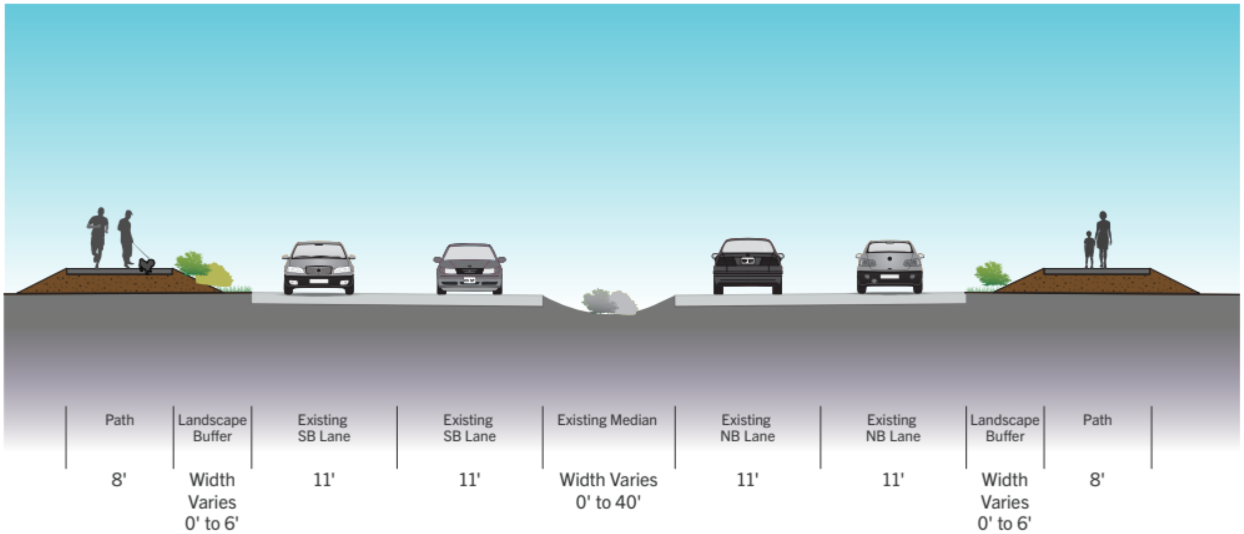


Figure 5: Earthen Embankment Roadway Section

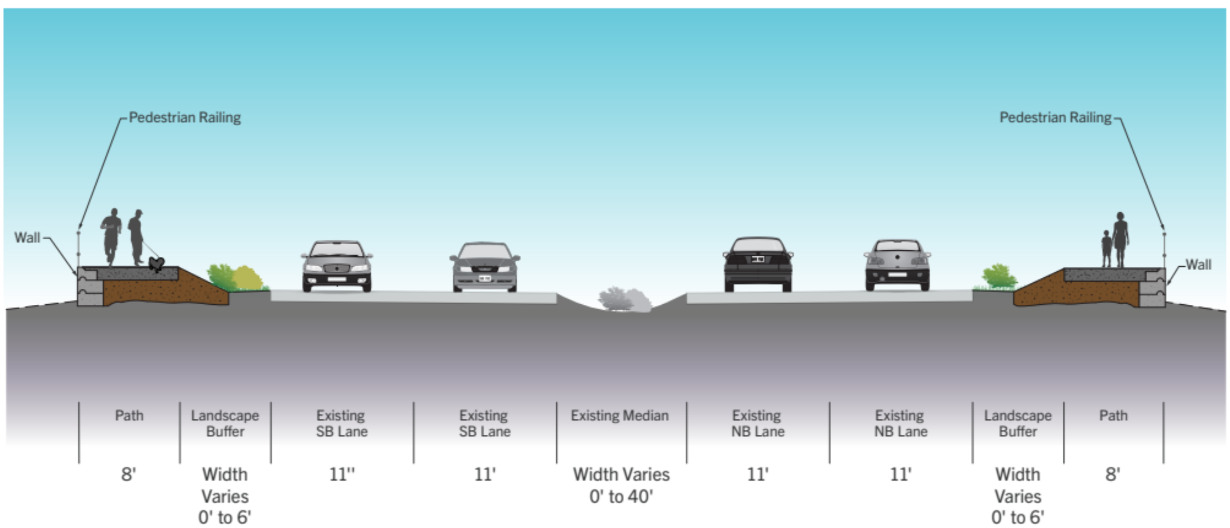


Figure 6: Flood Wall Roadway Section

5.2.2 Technical Evaluation

An elongated earthen embankment or structural earth wall (SEW) will span along the entire east and west sides of the 148th Avenue SE from SE Eighth Street to Main Street. The earthen embankment or SEW would be constructed by removing the existing pavement, placing high-strength geosynthetic base reinforcement, placing embankment fill, placing a surcharge fill, and applying temporary roadway surfacing. The roadway and pedestrian paths would be open to the public during the settlement period. Because the soil under the roadway alignment is soft, highly compressible, and extends to significant depth, the fill is expected to settle multiple feet. For preliminary assessment of this alternative, we recommend assuming the ground below the fill will settle a distance equal to 1.0 to 1.4 times the height that the embankment is raised above the existing grade. That is, to raise the embankment 5 feet above the existing grade, 10 to 12 feet of soil will need to be placed. Some settlement would occur simultaneous with fill placement. A soil surcharge would be placed above the embankment fill. For preliminary assessment of this alternative, we recommend assuming the soil surcharge would be 3 feet thick. Thus, a total of 15 feet of fill would be placed. The thickness of fill would decrease at the north and south ends of the alignment, where the thickness of the underlying soft soil decreases.

After placing the fill and surcharge, settlement would be monitored. After the settlement period, the temporary surfacing and surcharge would be removed. The depth of fill to be removed would be determined based on observed settlement and anticipated future settlement of the embankment or SEW. Final surfacing would then be applied for the pedestrian paths.

Geosynthetic base reinforcement will likely be needed below the earthen embankment and SEW. The rate of fill placement would be limited to allow settlement to occur during construction and reduce potential for a foundation failure caused by placing the soil too quickly. For preliminary assessment of this alternative, we have assumed fill and surcharge placement, before initiation of the settlement period, would be distributed over a three-month period. We have assumed a 12-month settlement period after surcharge placement.

The earthen embankment could be constructed with 2 Horizontal:1 Vertical (2H:1V) side slopes. To minimize the embankment footprint, the embankment could also be constructed with reinforced steepened slopes at 1.5H:1V or steeper.

If a flood wall is selected, SEW is the preferred wall type due to its ability to accommodate differential settlement better than alternative wall types such as a cast-in-place concrete wall on a spread footing or a gravity block wall.

Installing embankments/flood walls to reduce the frequency of overtopping or prevent overtopping the roadway will inherently result in a rise to the 100-year flood elevation. By extension, the existing culverts under 148th Avenue SE will need to be upsized to meet FEMA no-rise due to road raising (reduction in overtopping/flow from Western tributaries to eastern floodplain/lake). Upsizing culverts will require that replacement culverts meet WDFW stream crossing requirements.

There is the potential to consolidate crossings into a single location (currently three culverts); however, that may require wetland/stream channel modifications within the western portion of the of the floodplain to ensure connectivity from the consolidated crossing. Our initial analysis indicates that replacement of the south culvert with a single fish passage culvert would meet FEMA no-rise; however, replacing only the north culvert would not.

Replacing all culverts with fish passage structures would likely be the least challenging to permit as it would generally maintain the current hydrology associated with the existing culverts and not require channel excavation/modifications within the western floodplain. Our initial analysis indicates that this alternative would meet FEMA no-rise requirements. However, this would effectively require implementation of the third alternative to raise the roadway. Therefore, to make this alternative feasible from a regulatory standpoint, we must assume that at a minimum the northernmost culvert must be replaced as part of this concept requiring the roadway to be raised near the northern limits.

5.2.3 Operations and Maintenance/Long-Term Feasibility

With a design life of approximately 50 years, significant measures will need to be taken to ensure these systems function properly over this period of time.

An earthen embankment and SEW wall would both experience long-term settlement due increased loading on soft soils. To mitigate for settlement, the earthen embankment or SEW could be designed and constructed such that after removal of the surcharge, the roadway surface is higher than the "design" roadway elevation so the roadway can accommodate continuing long-term settlement that occurs after surcharge removal. The long-term settlement would be expected to occur at a much slower rate than settlement that occurs during initial construction and with the surcharge in place. Overbuild and surcharge removal will be designed to limit and partially compensate for long-term settlement and therefore limit long-term operation and maintenance costs. Settlement would be monitored during the settlement period and a decision would be made as to when the excess surcharge should be removed. This option does include some risk of long-term settlement exceeding the estimates developed based on settlement period monitoring and therefore reducing the anticipated flood protection levels.

Proper drainage design and maintenance will play a crucial role in the embankment's success. Runoff should not be concentrated where it could erode path surfacing, soil or slopes, or damage SEW walls. Surface drainage measures and site grading should be designed to reduce infiltration into the embankment or wall and reduce groundwater buildup. Where practicable, the ground surface should be sloped away from the embankment or wall toe. Wall tilting and sliding are also potential problems considering the soil conditions.

Erosion and slope stability problems will need to be monitored and addressed as needed. Stone or rip-rap may be needed to control these problems. Major embankment earthwork may be necessary in some cases. Debris and unwanted growth will also need to be removed.

The earthen embankment or flood wall option would require modified culvert crossings and a new upsized culvert to allow for positive drainage conditions and mitigate any flooding in the median. It is possible one to two pump stations would be required in the median to ensure water can drain.

5.2.4 Environmental Impacts

This alternative accommodates the removal and replacement of the northernmost existing culvert beneath 148th Avenue SE, which is a partial barrier to fish passage. Although the remaining two culverts are also fish passage barriers, they carry flow from smaller ditched tributaries and would be abandoned or left as is. Constructed stream channels would be provided to convey water that would have otherwise passed through those culverts to the larger tributary and improved culvert at the north end. Considering the current condition of those smaller tributaries' channels and their buffers on the east side of the road, this alternative may provide the greatest benefits to fish habitat. Addressing fish passage is considered a critical criterion for this project and as such this alternative is perceived as having a positive environmental impact.

The earthen embankment option would impact existing wetland from an extended fill footprint. This impact would be avoided or minimized with the floodwall concept. Depending on actual heights and side slopes of the embankments, the earthen embankment could have significant wetland buffer impacts, whereas the flood wall alternative would have significantly less wetland and wetland buffer impacts.

The earthen embankment option could impact existing wetland by causing settlement of the ground beyond the embankment footprint. This settlement could increase wetland area where areas not currently classified as wetlands settle, or could change the hydroperiod of existing wetland. Fill may need to be placed beyond the embankment footprint in non-wetland areas if the settlement impacts drainage or land use.

5.2.5 Permitting/Regulatory

Compared to non-wetland-fill alternatives, the earthen embankment will have a high degree of permitting and regulatory effort due to its avoidable encroachment on the existing wetland. Substantial wetland mitigation for impacts to Category II wetlands would be required, resulting in at least 1.5 acres of wetland enhancement if that method is the selected mitigation strategy. Other strategies would have lower acreage requirements, but may have higher design, implementation, and/or monitoring costs. There are several on-site opportunities for wetland enhancement and some limited opportunities for buffer enhancement, primarily related to replacement of non-native invasive vegetation communities (e.g., Himalayan blackberry and reed canary grass) with native vegetation.

The walled option would be easier to permit from the standpoint of wetland and shoreline impacts, but would still require the full suite of local, state, and federal permits related to wetland fill and culvert replacement work.

5.2.6 Community Impacts

The earthen embankment option will be constructed where the existing path is and raise the path section. The embankment will slope at 2% towards the existing roadway section and have a width of approximately 8 feet. It will maintain 2H:1V embankment slopes without slope reinforcement, or potentially 1.5H:1V or steeper embankment slopes with slope reinforcement. Therefore, the embankment slopes will extend outside of the City of Bellevue ROW boundary and into existing wetland along some portions of the alignment.

A floodwall system would not require any ROW acquisition along any segment of the improvements for the wall itself. It will be constructed 1 foot offset from the existing path.

If the earthen embankment or SEW is overbuilt and surcharged to allow for settlement, the new elevated path would need to be closed to the public during initial construction and again during the surcharge removal and path re-surfacing effort about 12 months after surcharge placement.

Construction impacts would be moderate for the earthen embankment/flood wall alternative. Constructing the earthen embankment and wall would require one lane in each direction, northbound and southbound (NB/SB), to be closed for the duration of construction. These lanes would also need to be closed during surcharge removal and resurfacing of the paths following the settlement period of approximately 12 months after surcharge placement. In addition, the installation of the upsized culvert would require a traffic shift either before or after construction of the embankment/walls. All traffic would be shifted on NB or SB 148th Avenue SE and limited to one lane of traffic in each direction.

5.2.7 Equity, Social Justice, and Sustainability

No major advantages or disadvantages are identified in terms of equity, social justice, and sustainability for both the earthen embankment and flood walls.

5.2.8 Construction Cost

The construction cost for the earthen embankment will primarily be removal of the existing path, materials for fill, and the new path section on the embankment. The estimated design and construction cost for the earthen embankment is $4,800,000. See Appendix B for details.

The construction cost for the SEW floodwall will primarily be removal of the existing path, materials for the walls, and the new path section on the SEW. The estimated design and construction cost for the flood wall is $8,400,000. See Appendix B for details.

5.3 ALTERNATIVE 3 – RAISE ROADWAY

This alternative will elevate the roadway above the Base Flood Elevation of 258.7 feet with at least a minimum freeboard of 3 feet at culvert crossings. Based on the option selected to raise the roadway, the roadway will be raised in accordance to that design.

Where the existing culvert crossings are to be replaced with fish-passable structures, 10’x10’ precast concrete culverts are conceptually proposed. These dimensions are based on the observed approximate bank-full widths of the streams, sufficient embedment to install streambed material within the structure to account for scour, and providing a proposed 3 feet freeboard for the 100-year elevation to the inside bottom of structure. Four-sided box culverts allow the culvert to float on the compressible soil beneath the roadway and the net load added to the culvert area is less than the existing embankment load that has been in place for many years.

There are several options to this alternative:

- Pin Pile-Supported Slab
- Lightweight Fill
- Overbuild and Long-Term Settlement
- Ground Improvements

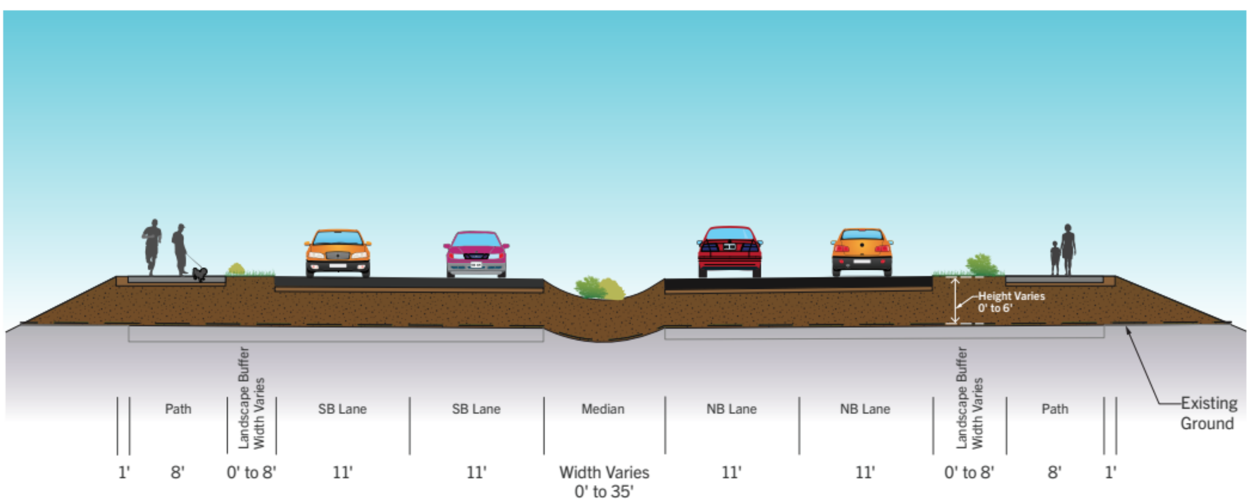


Figure 7: Raise Roadway Fill Section

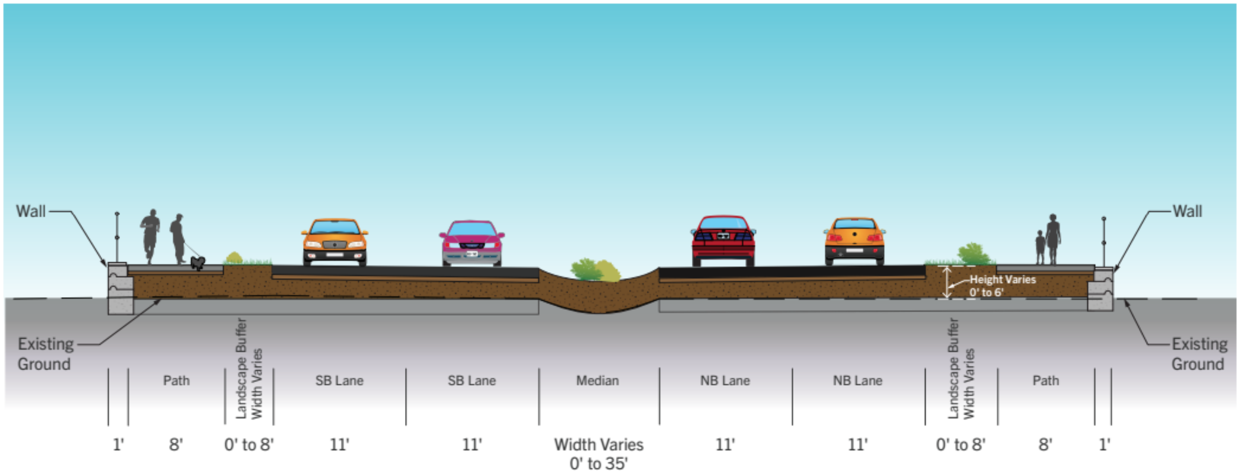


Figure 8: Raise Roadway Wall Section

5.3.1 Option 3a Pin Pile-Supported Slab

Description

The pile-supported slab option involves supporting a structural slab with small-diameter steel pin piles. The piles would transfer the embankment and traffic loads to the medium-dense to very dense soils beneath the compressible materials. The slab would be placed on the existing roadway surface and fill placed above the slab to construct the final profile grade and provide the appropriate freeboard above the base flood elevation. The foundation could include 4-inch-diameter piles with 4- to 5-foot spacing or 6-inch-diameter piles with 6- to 8-foot spacing. Piles would be driven approximately 15 feet into the competent soils underlying the compressible peat and clay layers (pile lengths anticipated up to about 40 feet).

Technical Evaluation

The long-term feasibility of this option is the best as the long-term settlement can be minimized with a pile-supported slab. Estimated pile settlement under static loading would be 1/2 inch or less. Because the piles are closely spaced and connected to a rigid slab, differential settlement between piles would be negligible. Embankment slopes on either side of the roadway raise are likely to experience settlement because they are not supported by the pin pile-supported slab.

Due to the width and length of the roadway to be raised, many pin piles would be required, increasing the installation time and costs. If the pin pile-supported slab is elevated instead of placed on the existing grade, seismic design must be considered and could be challenging due to the anticipated height of roadway raise. The pin pile supported roadway slab alternative works best if soil is placed adjacent to the roadway slab to resist seismic ground motions. It is recommended that the slab be buried and fill placed on top of it. Final pin pile spacing, length, and pile capacity would be designed based on the thickness of compressible soils, design loading, and design soil parameters.

Erosion and slope stability problems for the embankment slopes will need to be monitored and addressed as needed. Stone or rip-rap may be needed to control these problems. Debris and unwanted growth will also need to be removed.

Operation and Maintenance/Long-Term Feasibility

Raising the roadway profile will offer the longest design life and the best long-term feasibility relative to the other alternatives. A new roadway constructed above a pin pile-supported slab will offer the best option to keep the road surface above the recommended design elevation. Maintenance will be required for embankment slopes on either side of the pin pile-supported roadway raise because they are not pile-supported.

Environmental Impacts

This option accommodates the removal and replacement of three existing culverts beneath 148th Avenue SE, which are partial barriers to fish passage. Addressing these barriers is considered a critical criterion for this project and as such this option is perceived as having a positive environmental impact.

Additionally, the pin pile-supported slab option would impact existing wetland from an extended fill footprint. This impact could be minimized with soil earth walls instead of fill slopes.

Permitting/Regulatory

The pin-pile slab with fill slopes will have a high degree of permitting and regulatory effort due to its avoidable encroachment on the existing wetland. Substantial wetland mitigation for impacts to Category II wetlands would be required, resulting in up to 11.6 acres of wetland enhancement, depending on the use of slopes or walls, if that method is the selected mitigation strategy. Other strategies would have lower acreage requirements, but may have higher design, implementation, and/or monitoring costs. There are several on-site opportunities for wetland enhancement and some limited opportunities for buffer enhancement, primarily related to replacement of non-native invasive vegetation communities (e.g., Himalayan blackberry and reed canary grass) with native vegetation. There is probably not sufficient on-site enhancement opportunity, so other strategies would be necessary. With a fill of this magnitude, mitigation banks or in-lieu fee programs may be a better solution.

Any fill slope option would likely require an Individual Permit from the Corps based on the quantity of wetland impacts; the application must be accompanied by an alternatives analysis that demonstrates the proposed project is the least impacting practicable alternative. The walled option would be easier to permit from the standpoint of wetland and shoreline impacts, but would still require the full suite of local, state, and federal permits related to wetland fill and culvert replacement work.

Community Impacts

This option would be constructed for the northbound lanes first, reducing traffic to a single lane in each direction on the southbound lanes. Traffic would then be shifted onto the northbound lanes and construction repeated for the southbound lanes.

Equity, Social Justice, and Sustainability

No major advantages or disadvantages were identified in terms of equity, social justice, and sustainability for the pin pile-supported slab option.

Construction Cost

The estimated cost for Alternative 3 is $15,600,000. A detailed cost estimate for this option can be found in Appendix B.

5.3.2 Option 3b Lightweight Fill

Description

The lightweight fill option involves excavating the existing alignment to a predetermined depth, replacing it with lightweight fill to an elevation above the 100-year flood elevation, and reconstructing the roadway. Three possible lightweight fill materials include Expanded Polystyrene Geofoam Fill (EPS), Foamed Glass fill (FG), and Cellular Concrete Fill. These lightweight fill options allow rapid installation and the ability to minimize post-construction settlement by designing for zero net change in vertical stress.

Technical Evaluation

EPS geofoam is a lightweight fill material that could be used to construct the roadway embankment on the compressible soil. EPS road raise construction would involve removing existing pavement and excavation into existing fill. Excavation would be performed to the depth necessary to counterbalance additional weight imposed both by the road raise and by the weight of soil that would need to be placed over the EPS to counterbalance uplift forces associated with buoyancy of the EPS. The excavation area would require dewatering until fill is placed over the lightweight fill. EPS geofoam blocks would then be installed with geosynthetic reinforcement included below and above the EPS blocks to help hold them together under the rolling loads of vehicles. A minimum soil thickness equal to 9 inches for every foot vertical thickness of EPS or a minimum of 2-foot embankment and pavement section, whichever thickness is greater, would need to be placed on top of the EPS to prevent the blocks from floating should the adjacent areas flood. Another layer of geosynthetic could be placed between the subbase and base coarse materials in the minimum 2-foot-thick pavement section.

FG is another option for lightweight fill. FG is an open-cell manufactured product that is not buoyant, in contrast to EPS. Currently, FG is manufactured on the east coast, which could affect availability, schedule, and transportation costs. An FG plant is planned to open in California in 2023, which would reduce transportation costs.

Cellular concrete, a lightweight fill material composed of foamed cement, could also be placed as fill for the roadway embankment. Cellular concrete would require more excavation than EPS or FG due to its higher unit weight. For a cellular concrete embankment placed on very soft ground, cellular concrete would ideally be manufactured, then broken down into 6-inch chunks, and placed as fill. Doing so would result in an embankment that can tolerate differential movement better than a relatively thin cast-in-place weak unreinforced concrete mass. If the cellular concrete is cast without breaking it into 6-inch minus chunks, reinforcement should be installed in the top and bottom of the cellular concrete.

Operation and Maintenance/Long-Term Feasibility

Raising the roadway profile will offer the longest design life and therefore, the best long-term feasibility relative to the other alternatives. Lightweight fill options minimize post-construction settlement and therefore long-term operation and maintenance costs.

Environmental Impacts

The lightweight fill option would have similar environmental impacts to the pile-supported slab. See Section 5.3.1 “Environmental Impacts” for more information.

Permitting/Regulatory

The lightweight fill option would have similar permitting and regulatory challenges to the pile-supported slab. See Section 5.3.1 “Permitting/Regulatory” for more information.

Community Impacts

This option would be constructed for the northbound lanes first, reducing traffic to a single lane in each direction on the southbound lanes. Traffic would then be shifted onto the northbound lanes and construction repeated for the southbound lanes.

Equity, Social Justice, and Sustainability

No major advantages or disadvantages were identified in terms of equity, social justice, and sustainability for the lightweight fill option.

Construction Cost

The construction cost for lightweight fill is dependent on what type of fill is utilized. EPS is approximately $100 to $160 per cubic yard, plus the cost of the geosynthetic reinforcement. FG is currently manufactured on the east coast, with production planned for the west coast in the future. FG is approximately $135 to 150 per cubic yard when purchased from the east coast. There would be potential for costs to decrease with a west coast plant. Cellular concrete costs approximately $80 to $100 per cubic yard. The design and construction cost estimate assuming EPS is used for fill is $20,900,000. See Appendix B for details.

5.3.3 Option 3c Overbuild and Long-Term Settlement

Description

The new roadway and path section would be designed and built with a several feet of overbuild fill. Over time, the settlement of the roadway and path would be monitored, and the excess surcharge would be removed when sufficient settlement is complete. Settlement duration will vary based mainly on final load applied and thickness of compressible materials beneath the roadway. Excess surcharge must be removed following the settlement period to reduce long-term settlement that would occur due to the increased load.

Technical Evaluation

The earthen embankment would be designed and constructed with overbuild and surcharge fill. The earthen embankment would be constructed with a temporary surfacing and open to the public during the settlement period. Because the soil under the roadway alignment is soft, highly compressible, and extends to significant depth, the fill is expected to settle multiple feet. For preliminary assessment of this option, we recommend assuming the ground below the fill will settle a distance equal to 1.0 to 1.4 times the height that the embankment is raised above the existing grade. That is, to raise the roadway 5 feet above the existing grade, 10 to 12 feet of soil will need to be placed. Some settlement would occur simultaneous with fill placement. A soil surcharge would be placed above the embankment fill. For preliminary assessment of this alternative, we recommend assuming the soil surcharge would be 3 feet thick. Thus, a total of 15 feet of fill would be placed. The thickness of fill would decrease at the north and south ends of the alignment, where the thickness of the underlying soft soil decreases.

After placing the fill and surcharge, settlement would be monitored. After the settlement period, the temporary surfacing and surcharge would be removed. The amount of fill to be removed would be determined based on observed settlement and anticipated future settlement of the embankment. Final surfacing would then be applied for the roadway and pedestrian paths. Geosynthetic base reinforcement would likely be needed below the fill embankment. The rate of fill placement would be limited to allow settlement to occur during construction and reduce potential for a foundation failure caused by placing the soil too quickly. For preliminary assessment of this alternative, we have assumed fill and surcharge placement, before initiation of the settlement period, would be distributed over a three-month period. We have assumed a 12-month settlement period after surcharge placement.

The embankment could be constructed with 2H:1V side slopes. To minimize the embankment footprint, the embankment could also be constructed with reinforced steepened slopes at 1.5H:1V or steeper.

Erosion and slope stability problems for the embankment slopes will need to be monitored and addressed as needed. Stone or rip-rap may be needed to control these problems. Debris and unwanted growth will also need to be removed.

<u>Operation and Maintenance/Long-Term Feasibility</u>

Raising the roadway profile will offer the longest design life and the best long-term feasibility relative to the other alternatives. The embankment would experience long-term settlement due increased loading on soft soils. To mitigate for settlement, the embankment could be designed and constructed such that after removal of the surcharge, the roadway surface is higher than the “design” roadway elevation so the roadway can accommodate continuing long-term settlement that occurs after surcharge removal. The long-term settlement would be expected to occur at a much slower rate than settlement that occurs during initial construction and with the surcharge in place. This option is the least desirable for the roadway’s long-term feasibility as it would require monitoring during the settlement period and would incorporate long-term settlement. Overbuild and surcharge removal will be designed to limit and partially compensate for long-term settlement and therefore limit long-term operation and maintenance costs. Settlement would be monitored during the overbuild period and a decision would made as to when the excess surcharge should be removed. This option does include some risk of long-term settlement exceeding the estimates developed based on overbuild period monitoring and therefore reducing the anticipated flood protection levels.

<u>Environmental Impacts</u>

The overbuild option would have similar environmental impacts to the pile-supported slab. See Section 5.3.1 “Environmental Impacts” for more information.

<u>Permitting/Regulatory</u>

The overbuild option would have similar permitting and regulatory challenges to the pile-supported slab. See Section 5.3.1 “Permitting/Regulatory” for more information.

<u>Community Impacts</u>

This option will have multiple rounds of traffic impacts. Traffic impacts are anticipated to occur not only during construction, similar to other road raise options, but also following the settlement period. This option would be constructed for the northbound lanes first, reducing traffic to a single lane in each direction on the southbound lanes. Traffic would then be shifted onto the northbound lanes and construction repeated for the southbound lanes. Both northbound and southbound lanes could be open to traffic using a temporary road surfacing while settlement is monitored. After a period of settlement as determined by the geotechnical engineer, traffic would be once again shifted to one side, reducing traffic to a single lane in each direction. The temporary roadway surfacing and excess surcharge fill would be removed and final paving would occur.

<u>Equity, Social Justice, and Sustainability</u>

No major advantages or disadvantages were identified in terms of equity, social justice, and sustainability for the overbuild and long-term settlement option.

Construction Cost

Construction costs for this option would be lower than for the other roadway raise option due to the lower cost of needed materials. However, the additional maintenance of traffic requirements during surcharge removal and potential settlement issues in the future would incur costs down the line that make this option undesirable from a cost standpoint. The estimated design and construction cost is $13,500,000. See Appendix B for details.

5.3.4 Option 3d Ground Improvement

Description

Deep Soil Mixing (DSM) is an in-situ ground improvement method in which weak native soils are blended with cementitious materials, typically referred to as binders. DSM options for this study could include either DSM panels perpendicular to the roadway alignment or individual DSM column elements. See Figure 10 for a typical section with DSM column elements.

Technical Evaluation

If DSM shear panels are selected, they would extend from a few feet outside of the path on one side of the roadway to about 20 feet under the roadway. The shear panels would be 3 to 4 feet wide and placed on 8 feet center-to-center spacing along each side of the embankment along the roadway alignment. DSM columns would support the embankment in the central portion of the embankment between the inward limits of the shear panels. A cast-in-place reinforced concrete slab would be constructed across the top of panels to support the raised roadway and to avoid undulation developing in the roadway surface.

Alternatively, 3-foot-diameter DSM elements could be created on 8-foot centers. The DSM column alternative is depicted in Figure 10. This option would create large soil columns of the blended materials that support additional load from raising the roadway. Because the DSM columns are brittle in flexure, the DSM column alternative may not perform as well in a seismic event as the DSM shear panel alternative.

All DSM options considered in this study would have a lengthy construction period.

Operation and Maintenance/Long-Term Feasibility

Raising the roadway profile will offer the longest design life and the best long-term feasibility relative to the other alternatives. Ground improvement will be designed to minimize long-term settlement issues and therefore minimize long-term operation and maintenance costs.

Environmental Impacts

The ground improvement option would have similar environmental impacts to the pile-supported slab. See Section 5.3.1 “Environmental Impacts” for more information.

This option also has the potential for environmental impacts due to mixing the cementitious materials with native soils. Carefully constructed containment measures would be required to facilitate performance of the cement mixing operations adjacent to the wetlands.

Permitting/Regulatory

The ground improvement option would have similar permitting and regulatory challenges to the pile-supported slab. See Section 5.3.1 “Permitting/Regulatory” for more information.

Community Impacts

This option would be constructed for the northbound lanes first, reducing traffic to a single lane in each direction on the southbound lanes. Traffic would then be shifted onto the northbound lanes and construction repeated for the southbound lanes.

Equity, Social Justice, and Sustainability

No major advantages or disadvantages were identified in terms of equity, social justice, and sustainability for the ground improvements option.

Construction Cost

The construction cost for DSM panels or column elements is high; the estimated design and construction cost is $27,000,000. See Appendix B for details.

6. Evaluation Summary and Recommendations

Criteria have been developed to analyze and recommend an alternative. The criteria are defined below:

- Technical Evaluation

  Technical feasibility to implement and construct a given alternative.

- Long Term Feasibility

  Ability to eliminate chronic roadway settlement and flooding. Alternatives with a short-term project effectiveness will be assessed negatively.

- Environmental Impacts

  Ability to avoid or minimize impacts to critical areas and buffers. Additionally, addressing the fish barriers within the project site with a new crossing that accommodates fish would be viewed positively.

- Construction Cost

  Costs associated with construction. Projects costing less than $3 million would be considered positive and exceeding the minimum criteria. Greater than $10 million would be failing to meet expectations.

- Operations and Maintenance

  Level of resources needed to maintain the operation of the proposed design and prevent ongoing settlement and flooding of 148th Avenue SE.

- Permitting/Regulatory

  The ability to obtain permits and anticipated level of effort required to obtain those permits.

- Community Impacts

  Impacts to private property or general character of neighborhood, and the general level of impact to traffic and the neighborhood during construction.

- Equity, Social Justice, and Sustainability

  This criterion includes changes to travel patterns, impacts to social services, traffic and pedestrian safety, impacts to public services, and project benefits to the community.

The qualitative evaluation is based upon the performance parameters defined for each alternative on its own merits as opposed to comparatively. However, some factors such as construction cost are based on total estimated construction costs. The evaluation of each alternative is based on its ability to meet or exceed the project goals, which are to address the chronic settlement of the roadway, eliminate flooding, and address barriers to fish passage.

See below for a summary evaluation table of all three alternatives.

CRITERIA	PERFORMANCE PARAMETERS	ALTERNATIVES		
		Optimize Storage in Larsen Lake Complex	Install Levee or Flood walls	Raise the Roadway Profile
Technical Evaluation	Feasibility to implement and constructibility	/	/	/
Long Term Feasibility	Addresses flooding	-	/	+
	Addresses long term settlement	-	-	+
Environmental Impacts	Minimize wetland/buffer impacts Addresses fish barriers	/	/	/
Construction Cost	> $10M $3M - $10M < $3M	-	/	-
Operations & Maintenance	Resources needed to prevent ongoing settlement/flooding and to maintain operation	-	-	+
Permitting / Regulatory	Ability to obtain permits/ ease of obtaining permits	-	-	-
Community Impacts During Construction	Minimize level of construction and traffic impacts	+	/	-
Equity, Social Justice, & Sustainability	Minimize long term impacts to social services (transit), impacts to pedestrians and cyclists	/	+	+

LEGEND: + Exceeds criteria / Meets criteria - Does not meet criteria

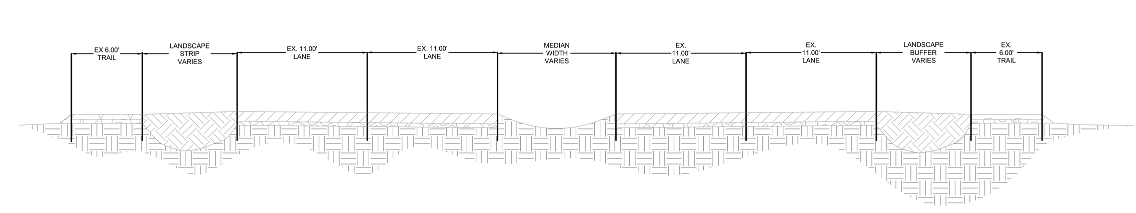
Figure 9: Evaluation Matrix

The project team recommends the Raise Roadway alternative (Alternative 3), as it provides the most effective solution for reducing flooding of 148th Avenue SE balanced with minimized impacts. While the initial project costs are high and community impacts during construction will be significant for any option to raise the roadway, this alternative will minimize or eliminate flooding events, reduce or eliminate chronic roadway settlement, and improve the existing environment by removing three existing fish barriers.

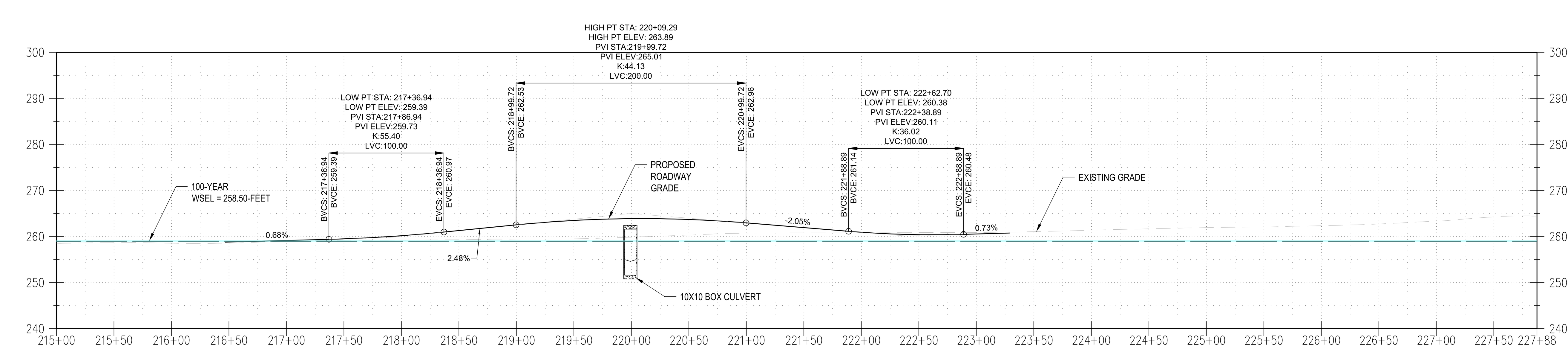
Appendix A

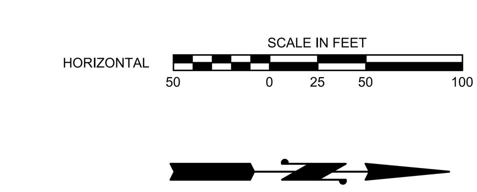
Concept Plans and Sections

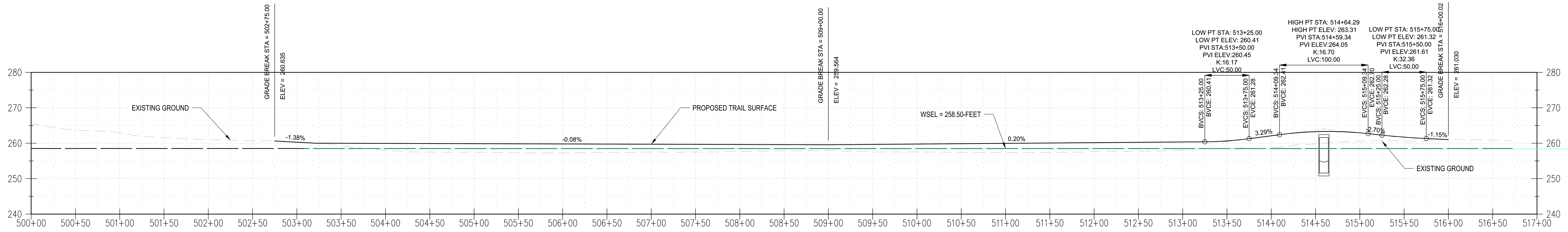
BELLEVUE 148TH SE - CONCEPTUAL PLAN
WETLAND STORAGE OPTIMIZATION

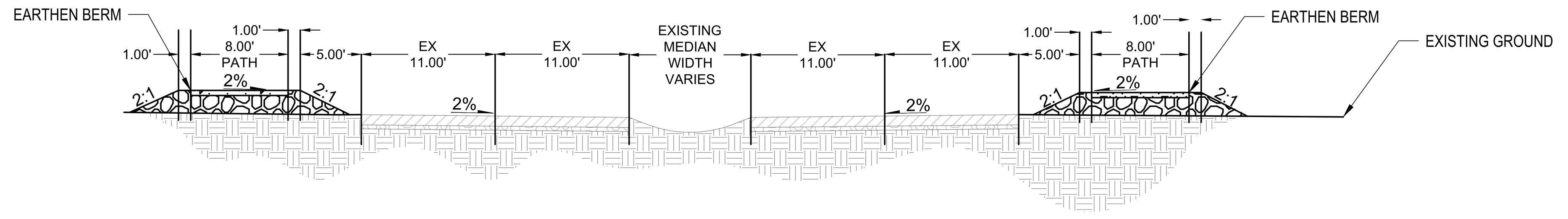


EXISTING TYPICAL SECTION VIEW
NTS



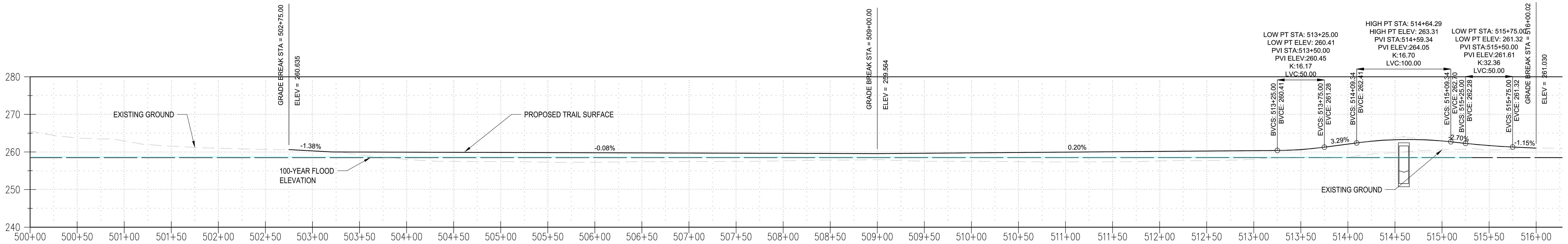


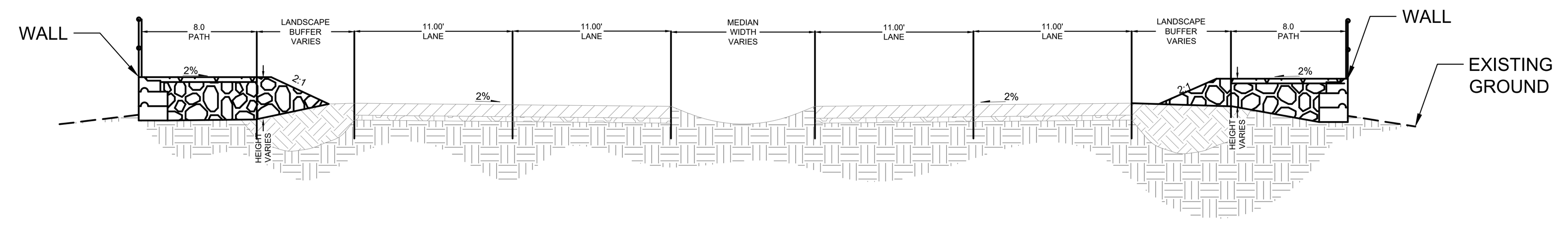




TYPICAL SECTION
NTS

BELLEVUE 148TH SE
CONCEPTUAL PLAN, PROFILE, SECTION
EARTHEN EMBANKMENT

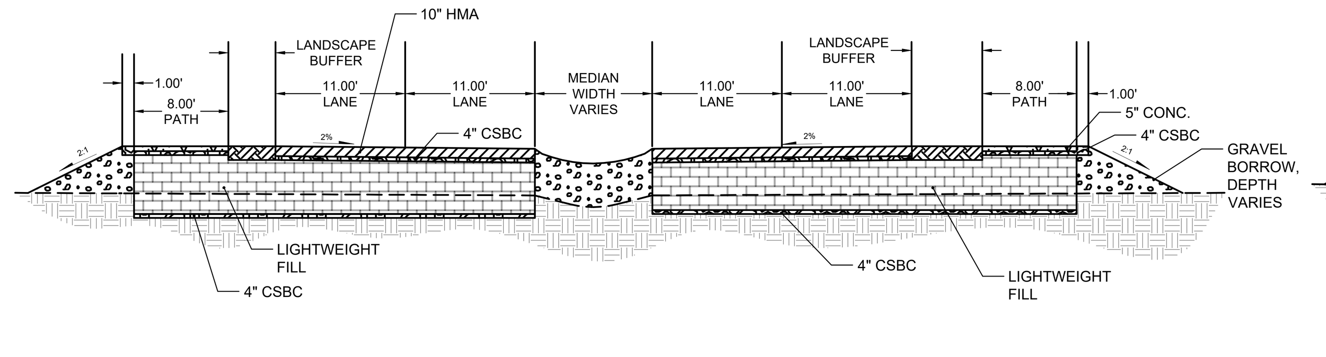




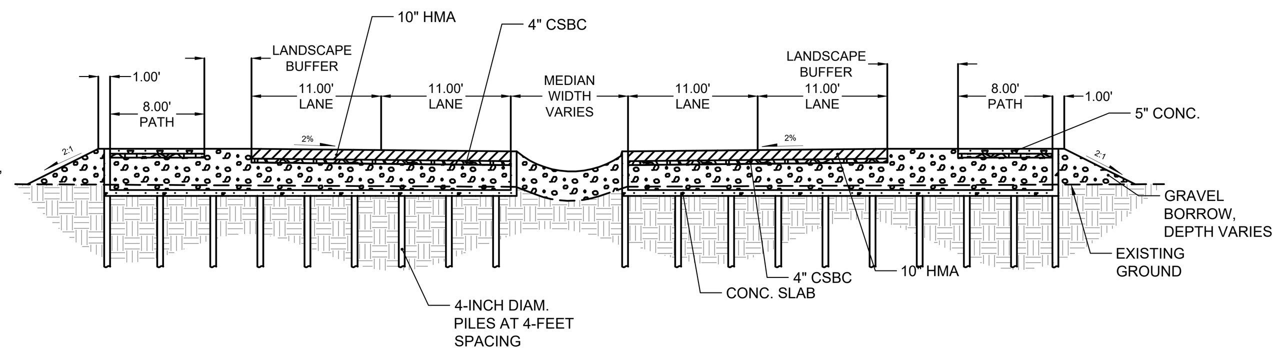
TYPICAL SECTION
NTS

BELLEVUE 148TH SE
CONCEPTUAL PLAN, PROFILE, SECTION
FLOOD WALLS

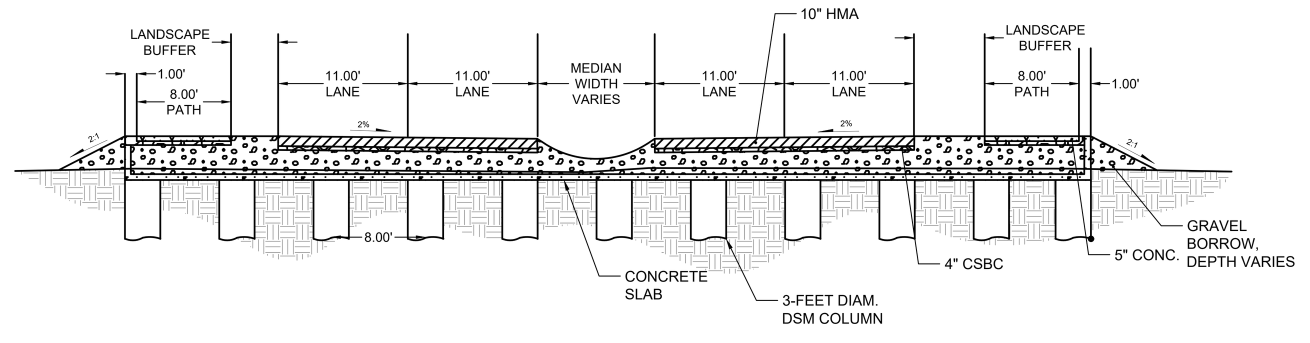
BELLEVUE 148TH SE
RAISE ROADWAY CONCEPTUAL PLAN, PROFILE, SECTION
FILL ONLY, NO WALLS



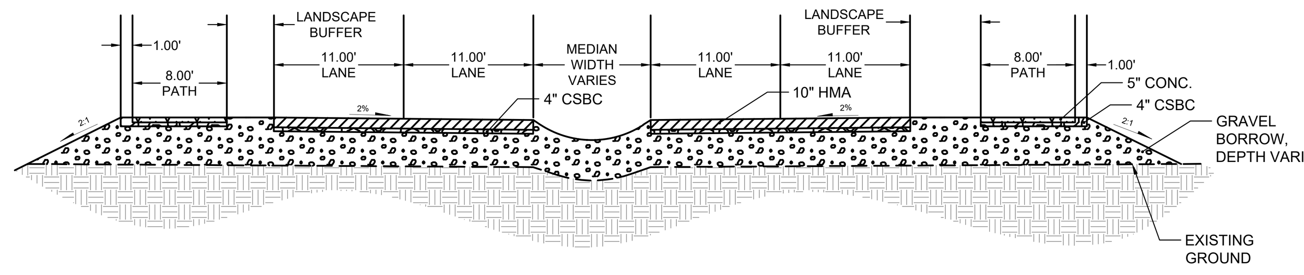
LIGHTWEIGHT FILL SECTION
NTS



PIN-PILE SUPPORTED SLAB SECTION
NTS

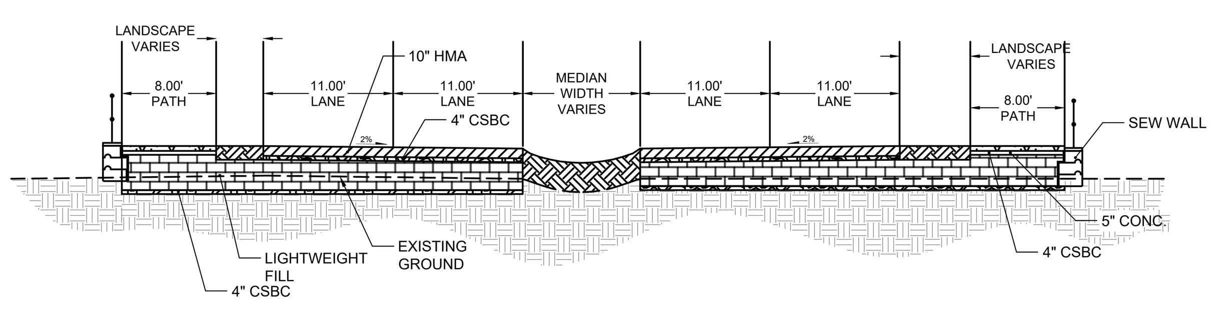


GROUND IMPROVEMENT SECTION
NTS

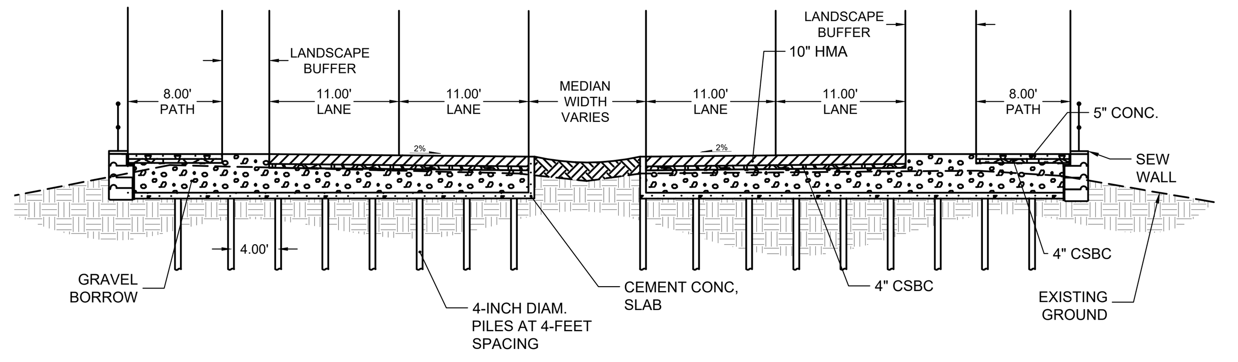


OVER-FILL SECTION
NTS

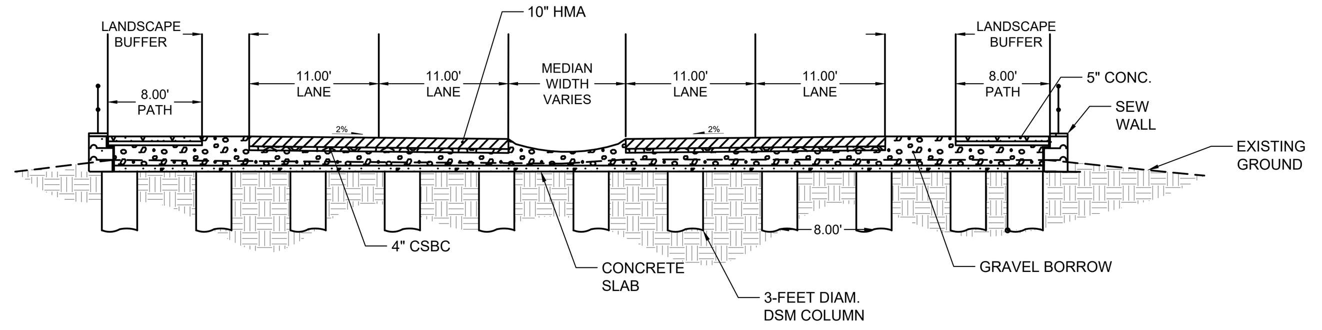
BELLEVUE 148TH SE
RAISE ROADWAY CONCEPTUAL PLAN, PROFILE, SECTION
RAISE ROADWAY WITH WALLS



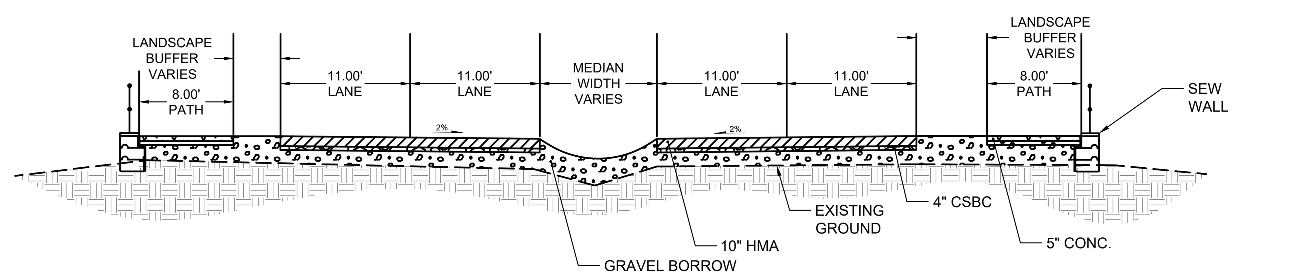
LIGHTWEIGHT FILL SECTION
NTS



PIN-PILE SUPPORTED SLAB SECTION
NTS



GROUND IMPROVEMENT SECTION
NTS



OVER-FILL SECTION
NTS

Appendix B

Cost Estimate

OPINION OF PROBABLE COST AT PLANNING LEVEL

ALTERNATIVE 1 WETLAND STORAGE OPTIMIZATION

PROJECT:	148TH Ave SE at Larsen Lake Flood Mitigation
TFP/CIP NO.	PW-M-21
DATE:	10-Oct-23
Estimated By:	J.Shinn
Checked By:	P.Sloan

I. RIGHT OF WAY ACQUISITION & EASEMENT AND REIMBURSEMENT COSTS					
II. CONSTRUCTION					
1. Grading/Drainage	$1,267,690				
1.A) Clear, Grub, Demo, Removal	*$1,029,940*	*1.D) Drainage (WQ/Det/Conv)*	*$100,000*		
1.B) Roadway Excav./Unsuit.	*$31,500*	*1.E) NDP*	*$0*		
1.C) CSTC, Gravel Borrow	*$106,250*				
2. Structures	$350,000				
2.A) Retaining Walls	*$0*				
2.B) Other	*$350,000*				
3. Surfacing/Paving	$202,500				
3.A) Pavement/Shldrs	*$112,500*				
3.B) Curb Gutter & Sidewalk	*$90,000*				
4. Roadside Development	$2,100,000				
4.A) Landscaping/mitigation	*$2,000,000*				
4.B) Temp Erosion Control	*$100,000*				
4.C) Site Improvements	*$0*				
4.D) Utilities	*$0*				
5. Traffic Services & Safety	$75,000				
5.A) Traffic Control Devices	*$75,000*	*5.E) Channelization*	*$0*		
5.B) Signals	*$0*	*5.F) Traffic Control Labor*	*$0*		
5.C) Illumination (Roadway)	*$0*				
5.D) Signing	*$0*				
6. Miscellaneous Items Not Yet Estimated	$199,760				
5.0% of (Lines 1 through 5)				$4,194,950	
7. Allowance for Planning-Level Accuracy	$419,495				
10.0% of (Lines 1 through 6)					
8. Mobilization, Survey, Potholing	$838,990				
20% of (Line 1 through 6)				$5,453,435	
9. Sales Tax	$0				
8.9% of (Utilities - Line 4.D)					
10. Construction Work by Others at Owner's Expense	$0				
Construction Work by Others					
11. Agreements	$0				
Utility Agreements, etc.				$5,453,435	
12. Construction Engineering	$545,343				
10.0% of (Lines 1 through 10)					
13. Construction Contingency	$545,343				
10.0% of (Lines 1 through 10)					$6,544,122
III. DESIGN ENGINEERING AND CITY COSTS					
1. Design Engineering (Consultant Contract)	$1,090,687				
20.0% of (CONSTRUCTION cost not incl contingency)					
2. Agency Administration	$545,343				
10.0% of (CONSTRUCTION cost not incl contingency)					
3. Alignment Survey	$109,069				
2.0% of (CONSTRUCTION cost not incl contingency)					
					$1,745,099
TOTAL ESTIMATED COST (UNADJUSTED 2023 DOLLARS)					$8,300,000

Assumptions:

1. Estimate calculated in 2023 dollars.

OPINION OF PROBABLE COST AT PLANNING LEVEL

ALTERNATIVE 2A EARTHEN EMBANKMENT

PROJECT:	148TH Ave SE at Larsen Lake Flood Mitigation
TFP/CIP NO.	PW-M-21
DATE:	10-Oct-23
Estimated By:	J.Shinn
Checked By:	P.Sloan

I. RIGHT OF WAY ACQUISITION & EASEMENT AND REIMBURSEMENT COSTS							
II. CONSTRUCTION							
1. Grading/Drainage	$387,500						
1.A) Clear, Grub, Demo, Removal	*$25,000*	*1.D) Drainage (WQ/Det/Conv)*	*$210,000*				
1.B) Roadway Excav./Unsuit.	*$30,000*	*1.E) NDP*	*$0*				
1.C) CSTC, Gravel Borrow	*$122,500*						
2. Structures	$250,000						
2.A) Retaining Walls	*$0*						
2.B) Other	*$250,000*						
3. Surfacing/Paving	$467,500						
3.A) Pavement/Shldrs	*$62,500*						
3.B) Curb Gutter & Sidewalk	*$405,000*						
4. Roadside Development	$1,050,000						
4.A) Landscaping/mitigation	*$1,000,000*						
4.B) Temp Erosion Control	*$50,000*						
4.C) Site Improvements	*$0*						
4.D) Utilities	*$0*						
5. Traffic Services & Safety	$150,000						
5.A) Traffic Control Devices	*$150,000*	*5.E) Channelization*	*$0*				
5.B) Signals	*$0*	*5.F) Traffic Control Labor*	*$0*				
5.C) Illumination (Roadway)	*$0*						
5.D) Signing	*$0*						
6. Miscellaneous Items Not Yet Estimated	$115,250						
5.0% of (Lines 1 through 5)				$2,420,250			
7. Allowance for Planning-Level Accuracy	$242,025						
10.0% of (Lines 1 through 6)							
8. Mobilization, Survey, Potholing	$484,050						
20% of (Line 1 through 6)				$3,146,325			
9. Sales Tax	$0						
8.9% of (Utilities - Line 4.D)							
10. Construction Work by Others at Owner's Expense	$0						
Construction Work by Others							
11. Agreements	$0						
Utility Agreements, etc.				$3,146,325			
12. Construction Engineering	$314,633						
10.0% of (Lines 1 through 10)							
13. Construction Contingency	$314,633						
10.0% of (Lines 1 through 10)							$3,775,590
III. DESIGN ENGINEERING AND CITY COSTS							
1. Design Engineering (Consultant Contract)	$629,265						
20.0% of (CONSTRUCTION cost not incl contingency)							
2. Agency Administration	$314,633						
10.0% of (CONSTRUCTION cost not incl contingency)							
3. Alignment Survey	$62,927						
2.0% of (CONSTRUCTION cost not incl contingency)							
							$1,006,824
TOTAL ESTIMATED COST (UNADJUSTED 2023 DOLLARS)							$4,800,000

Assumptions:

1. Estimate calculated in 2023 dollars.

OPINION OF PROBABLE COST AT PLANNING LEVEL

ALTERNATIVE 2B FLOOD WALL

PROJECT:	148TH Ave SE at Larsen Lake Flood Mitigation
TFP/CIP NO.	PW-M-21
DATE:	10-Oct-23
Estimated By:	J.Shinn
Checked By:	P.Sloan

I. RIGHT OF WAY ACQUISITION & EASEMENT AND REIMBURSEMENT COSTS					
II. CONSTRUCTION					
1. Grading/Drainage	$349,500				
1.A) Clear, Grub, Demo, Removal	*$41,000*	*1.D) Drainage (WQ/Det/Conv)*	*$210,000*		
1.B) Roadway Excav./Unsuit.	*$21,000*	*1.E) NDP*	*$0*		
1.C) CSTC, Gravel Borrow	*$77,500*				
2. Structures	$2,003,000				
2.A) Retaining Walls	*$1,750,000*				
2.B) OTHER	*$253,000*				
3. Surfacing/Paving	$467,500				
3.A) Pavement/Shldrs	*$62,500*				
3.B) Curb Gutter & Sidewalk	*$405,000*				
4. Roadside Development	$1,050,000				
4.A) Landscaping/mitigation	*$1,000,000*				
4.B) Temp Erosion Control	*$50,000*				
4.C) Site Improvements	*$0*				
4.D) Utilities	*$0*				
5. Traffic Services & Safety	$150,000				
5.A) Traffic Control Devices	*$150,000*	*5.E) Channelization*	*$0*		
5.B) Signals	*$0*	*5.F) Traffic Control Labor*	*$0*		
5.C) Illumination (Roadway)	*$0*				
5.D) Signing	*$0*				
6. Miscellaneous Items Not Yet Estimated	$201,000				
5.0% of (Lines 1 through 5)				$4,221,000	
7. Allowance for Planning-Level Accuracy	$422,100				
10.0% of (Lines 1 through 6)					
8. Mobilization, Survey, Potholing	$844,200				
20% of (Line 1 through 6)				$5,487,300	
9. Sales Tax	$0				
8.9% of (Utilities - Line 4.D)					
10. Construction Work by Others at Owner's Expense	$0				
Construction Work by Others					
11. Agreements	$0				
Utility Agreements, etc.				$5,487,300	
12. Construction Engineering	$548,730				
10.0% of (Lines 1 through 10)					
13. Construction Contingency	$548,730				
10.0% of (Lines 1 through 10)					$6,584,760
III. DESIGN ENGINEERING AND CITY COSTS					
1. Design Engineering (Consultant Contract)	$1,097,460				
20.0% of (CONSTRUCTION cost not incl contingency)					
2. Agency Administration	$548,730				
10.0% of (CONSTRUCTION cost not incl contingency)					
3. Alignment Survey	$109,746				
2.0% of (CONSTRUCTION cost not incl contingency)					
					$1,755,936
TOTAL ESTIMATED COST (UNADJUSTED 2023 DOLLARS)					$8,400,000

Assumptions:

1. Estimate calculated in 2023 dollars.

OPINION OF PROBABLE COST AT PLANNING LEVEL

PROJECT:	148TH Ave SE at Larsen Lake Flood Mitigation
TFP/CIP NO.	PW-M-21
DATE:	30-Jun-23
Estimated By:	J.Shinn
Checked By:	P.Sloan

ALTERNATIVE 3A RAISE ROADWAY - PIN-PILE SUPPORTED SLAB

I. RIGHT OF WAY ACQUISITION & EASEMENT AND REIMBURSEMENT COSTS					
II. CONSTRUCTION					
1. Grading/Drainage	$858,000				
1.A) Clear, Grub, Demo, Removal	*$35,000*	*1.D) Drainage (WQ/Det/Conv)*	*$0*		
1.B) Roadway Excav./Unsuit.	*$108,500*	*1.E) NDP*	*$0*		
1.C) CSTC, Gravel Borrow	*$714,500*				
2. Structures	$3,575,000				
2.A) Retaining Walls	*$0*				
2.B) Other	*$3,575,000*				
3. Surfacing/Paving	$1,607,500				
3.A) Pavement/Shldrs	*$812,500*				
3.B) Curb Gutter & Sidewalk	*$795,000*				
4. Roadside Development	$1,250,000				
4.A) Landscaping/mitigation	*$1,200,000*				
4.B) Temp Erosion Control	*$50,000*				
4.C) Site Improvements	*$0*				
4.D) Utilities	*$0*				
5. Traffic Services & Safety	$200,000				
5.A) Traffic Control Devices	*$200,000*	*5.E) Channelization*	*$0*		
5.B) Signals	*$0*	*5.F) Traffic Control Labor*	*$0*		
5.C) Illumination (Roadway)	*$0*				
5.D) Signing	*$0*				
6. Miscellaneous Items Not Yet Estimated	$374,525				
5.0% of (Lines 1 through 5)				$7,865,025	
7. Allowance for Planning-Level Accuracy	$786,503				
10.0% of (Lines 1 through 6)					
8. Mobilization, Survey, Potholing	$1,573,005				
20% of (Line 1 through 6)				$10,224,533	
9. Sales Tax	$0				
8.9% of (Utilities - Line 4.D)					
10. Construction Work by Others at Owner's Expense	$0				
Construction Work by Others					
11. Agreements	$0				
Utility Agreements, etc.				$10,224,533	
12. Construction Engineering	$1,022,453				
10.0% of (Lines 1 through 10)					
13. Construction Contingency	$1,022,453				
10.0% of (Lines 1 through 10)					$12,269,439
III. DESIGN ENGINEERING AND CITY COSTS					
1. Design Engineering (Consultant Contract)	$2,044,907				
20.0% of (CONSTRUCTION cost not incl contingency)					
2. Agency Administration	$1,022,453				
10.0% of (CONSTRUCTION cost not incl contingency)					
3. Alignment Survey	$204,491				
2.0% of (CONSTRUCTION cost not incl contingency)					
					$3,271,850
TOTAL ESTIMATED COST (UNADJUSTED 2023 DOLLARS)					$15,600,000

Assumptions:
1. Estimate calculated in 2023 dollars.

OPINION OF PROBABLE COST AT PLANNING LEVEL

ALTERNATIVE 3B RAISE ROADWAY - LIGHTWEIGHT FILL

PROJECT:	148TH Ave SE at Larsen Lake Flood Mitigation
TFP/CIP NO.	PW-M-21
DATE:	30-Jun-23
Estimated By:	J.Shinn
Checked By:	P.Sloan

I. RIGHT OF WAY ACQUISITION & EASEMENT AND REIMBURSEMENT COSTS						
II. CONSTRUCTION						
1. Grading/Drainage	$2,473,000					
1.A) Clear, Grub, Demo, Removal	*$35,000*	*1.D) Drainage (WQ/Det/Conv)*	*$590,000*			
1.B) Roadway Excav./Unsuit.	*$1,608,500*	*1.E) NDP*	*$0*			
1.C) CSTC, Gravel Borrow	*$239,500*					
2. Structures	$4,500,000					
2.A) Retaining Walls	*$0*					
2.B) Other	*$4,500,000*					
3. Surfacing/Paving	$1,607,500					
3.A) Pavement/Shldrs	*$812,500*					
3.B) Curb Gutter & Sidewalk	*$795,000*					
4. Roadside Development	$1,250,000					
4.A) Landscaping/mitigation	*$1,200,000*					
4.B) Temp Erosion Control	*$50,000*					
4.C) Site Improvements	*$0*					
4.D) Utilities	*$0*					
5. Traffic Services & Safety	$200,000					
5.A) Traffic Control Devices	*$200,000*	*5.E) Channelization*	*$0*			
5.B) Signals	*$0*	*5.F) Traffic Control Labor*	*$0*			
5.C) Illumination (Roadway)	*$0*					
5.D) Signing	*$0*					
6. Miscellaneous Items Not Yet Estimated	$501,525					
5.0% of (Lines 1 through 5)				$10,532,025		
7. Allowance for Planning-Level Accuracy	$1,053,203					
10.0% of (Lines 1 through 6)						
8. Mobilization, Survey, Potholing	$2,106,405					
20% of (Line 1 through 6)					$13,691,633	
9. Sales Tax	$0					
8.9% of (Utilities - Line 4.D)						
10. Construction Work by Others at Owner's Expense	$0					
Construction Work by Others						
11. Agreements	$0					
Utility Agreements, etc.					$13,691,633	
12. Construction Engineering	$1,369,163					
10.0% of (Lines 1 through 10)						
13. Construction Contingency	$1,369,163					
10.0% of (Lines 1 through 10)						$16,429,959
III. DESIGN ENGINEERING AND CITY COSTS						
1. Design Engineering (Consultant Contract)	$2,738,327					
20.0% of (CONSTRUCTION cost not incl contingency)						
2. Agency Administration	$1,369,163					
10.0% of (CONSTRUCTION cost not incl contingency)						
3. Alignment Survey	$273,833					
2.0% of (CONSTRUCTION cost not incl contingency)						
						$4,381,322
TOTAL ESTIMATED COST (UNADJUSTED 2023 DOLLARS)						$20,900,000

Assumptions:

1. Estimate calculated in 2023 dollars.

OPINION OF PROBABLE COST AT PLANNING LEVEL

PROJECT:	148TH Ave SE at Larsen Lake Flood Mitigation
TFP/CIP NO.	PW-M-21
DATE:	30-Jun-23
Estimated By:	J.Shinn
Checked By:	P.Sloan

ALTERNATIVE 3C RAISE ROADWAY - OVERBUILD AND LONG-TERM SETTLEMENT

I. RIGHT OF WAY ACQUISITION & EASEMENT AND REIMBURSEMENT COSTS					
II. CONSTRUCTION					
1. Grading/Drainage	$2,123,000				
1.A) Clear, Grub, Demo, Removal	*$35,000*	*1.D) Drainage (WQ/Det/Conv)*	*$90,000*		
1.B) Roadway Excav./Unsuit.	*$208,500*	*1.E) NDP*	*$0*		
1.C) CSTC, Gravel Borrow	*$1,789,500*				
2. Structures	$750,000				
2.A) Retaining Walls	*$0*				
2.B) Other	*$750,000*				
3. Surfacing/Paving	$1,607,500				
3.A) Pavement/Shldrs	*$812,500*				
3.B) Curb Gutter & Sidewalk	*$795,000*				
4. Roadside Development	$1,250,000				
4.A) Landscaping/mitigation	*$1,200,000*				
4.B) Temp Erosion Control	*$50,000*				
4.C) Site Improvements	*$0*				
4.D) Utilities	*$0*				
5. Traffic Services & Safety	$300,000				
5.A) Traffic Control Devices	*$300,000*	*5.E) Channelization*	*$0*		
5.B) Signals	*$0*	*5.F) Traffic Control Labor*	*$0*		
5.C) Illumination (Roadway)	*$0*				
5.D) Signing	*$0*				
6. Miscellaneous Items Not Yet Estimated	$301,525				
5.0% of (Lines 1 through 5)				$6,332,025	
7. Allowance for Planning-Level Accuracy	$633,203				
10.0% of (Lines 1 through 6)					
8. Mobilization, Survey, Potholing	$1,899,608				
30% of (Line 1 through 6)				$8,864,835	
9. Sales Tax	$0				
8.9% of (Utilities - Line 4.D)					
10. Construction Work by Others at Owner's Expense	$0				
Construction Work by Others					
11. Agreements	$0				
Utility Agreements, etc.				$8,864,835	
12. Construction Engineering	$886,484				
10.0% of (Lines 1 through 10)					
13. Construction Contingency	$886,484				
10.0% of (Lines 1 through 10)					$10,637,802
III. DESIGN ENGINEERING AND CITY COSTS					
1. Design Engineering (Consultant Contract)	$1,772,967				
20.0% of (CONSTRUCTION cost not incl contingency)					
2. Agency Administration	$886,484				
10.0% of (CONSTRUCTION cost not incl contingency)					
3. Alignment Survey	$177,297				
2.0% of (CONSTRUCTION cost not incl contingency)					
					$2,836,747
TOTAL ESTIMATED COST (UNADJUSTED 2023 DOLLARS)					$13,500,000

Assumptions:

1. Estimate calculated in 2023 dollars.

OPINION OF PROBABLE COST AT PLANNING LEVEL

PROJECT: 148TH Ave SE at Larsen Lake Flood Mitigation
TFP/CIP NO. PW-M-21
DATE: 30-Jun-23
Estimated By: J.Shinn
Checked By: P.Sloan

ALTERNATIVE 3D RAISE ROADWAY - GROUND IMPROVEMENT

I. RIGHT OF WAY ACQUISITION & EASEMENT AND REIMBURSEMENT COSTS					
II. CONSTRUCTION					
1. Grading/Drainage	$858,000				
1.A) Clear, Grub, Demo, Removal	*$35,000*	*1.D) Drainage (WQ/Det/Conv)*	*$0*		
1.B) Roadway Excav./Unsuit.	*$108,500*	*1.E) NDP*	*$0*		
1.C) CSTC, Gravel Borrow	*$714,500*				
2. Structures	$9,000,000				
2.A) Retaining Walls	*$0*				
2.B) Other	*$9,000,000*				
3. Surfacing/Paving	$1,607,500				
3.A) Pavement/Shldrs	*$812,500*				
3.B) Curb Gutter & Sidewalk	*$795,000*				
4. Roadside Development	$1,300,000				
4.A) Landscaping/mitigation	*$1,200,000*				
4.B) Temp Erosion Control	*$100,000*				
4.C) Site Improvements	*$0*				
4.D) Utilities	*$0*				
5. Traffic Services & Safety	$200,000				
5.A) Traffic Control Devices	*$200,000*	*5.E) Channelization*	*$0*		
5.B) Signals	*$0*	*5.F) Traffic Control Labor*	*$0*		
5.C) Illumination (Roadway)	*$0*				
5.D) Signing	*$0*				
6. Miscellaneous Items Not Yet Estimated	$648,275				
5.0% of (Lines 1 through 5)				$13,613,775	
7. Allowance for Planning-Level Accuracy	$1,361,378				
10.0% of (Lines 1 through 6)					
8. Mobilization, Survey, Potholing	$2,722,755				
20% of (Line 1 through 6)				$17,697,908	
9. Sales Tax	$0				
8.9% of (Utilities - Line 4.D)					
10. Construction Work by Others at Owner's Expense	$0				
Construction Work by Others					
11. Agreements	$0				
Utility Agreements, etc.				$17,697,908	
12. Construction Engineering	$1,769,791				
10.0% of (Lines 1 through 10)					
13. Construction Contingency	$1,769,791				
10.0% of (Lines 1 through 10)					$21,237,489
III. DESIGN ENGINEERING AND CITY COSTS					
1. Design Engineering (Consultant Contract)	$3,539,582				
20.0% of (CONSTRUCTION cost not incl contingency)					
2. Agency Administration	$1,769,791				
10.0% of (CONSTRUCTION cost not incl contingency)					
3. Alignment Survey	$353,958				
2.0% of (CONSTRUCTION cost not incl contingency)					
					$5,663,330
TOTAL ESTIMATED COST (UNADJUSTED 2023 DOLLARS)					$27,000,000

Assumptions:
1. Estimate calculated in 2023 dollars.

Appendix C

Alternatives Matrix

ALTERNATIVES		ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3
		WETLAND STORAGE OPTIMIMZATION	EARTHEN BERM/FLOODWALL	RAISE ROADWAY
Alternative Overview				
ALTERNATIVE DESCRIPTION		Wetlands surrounding Larsen Lake modified/optimized to increase storage in addition to stream restoration.	Construct berm or wall to the east and west of the existing roadway to provide flood protection.	Raise roadway above the floodplain. Alternative includes sub-options including pin-pile supported slab, lightweight fill, over-fill, and ground improvements.
BENEFITS		Increase available storage in wetlands, improve stream function, no impacts to existing roadway. Removes one fish barrier.	Construction would have minimal impact to traffic on 148th Ave SE. Level of protection would be for both smaller and larger precipitation events. Removes one fish barrier.	Provides a high level of flood protection and ecological benefits by improving wetland and unnamed tributary connectivity. Allows ability to increase size of three existing culverts to make fish passable.
CONCERNS		Small improvements to flood risk, roadway settlement not addressed, large ecological impacts that require temporary wetland and stream impacts in addition to mitigation.	May require a pump for internal drainage in median. Does not address chronic roadway settlement and flooding may persist. May be visually unappealing.	High cost alternative that may be difficult to permit. Disruptive to traffic during construction.
Criteria	***Performance Criteria***			
Technical				
Long term feasibility – Reduce Recurrent Road Closure Due to Flooding	Does this meet the requirement to reduce or eliminate long term settlement and flooding of 148th AVE SE.	**Does not meet** Alternative does not address ongoing chronic settlement of roadway. While this option may relieve flooding temporarily by providing additional flood storage, this will not be a long term solution and flooding will reoccur.	**Meets** Alternative will provide a level of protection and reduce recurrent flooding issues. This alternative will not address settlement of roadway and will require long term maintenance of pump systems in median.	**Exceeds** Alternative will increase the roadway elevation above the 100-year floodplain; low risk of inundation. This alternative will address both chronic settlement of the roadway and flooding for at least a 50-year design life.
Technical Evaluation - Technical complexity, geotechnical complexity, constructability	Feasibility to implement design and constructability	**Meets** Alternative will include multi-disciplinary design, which increases technical complexity.	**Meets** Alternative may include multi-disciplinary design, which increases technical complexity.	**Meets** Alternative requires roadway design, which may increase technical complexity.
Operations & Maintenance	Resources needed to prevent ongoing settlement and flooding, and to maintain operation.	**Does not meet** **Maintenance of wetland and DMP required to reduce flooding events. Future project to addres settlement of roadway may be required.**	**Does not meet** **Ongoing maintenance will be required for pump system in median. Future project to address settlement of roadway may be required.**	**Exceeds** Alternative will require regular maintenance of proposed culvert structures and typical roadway maintenance.
Environmental				
Environmental Impacts	Minimize wetland and buffer impacts and address any existing fish barriers.	**Meets** Temporary impacts to streams and wetlands, liquefaction zones, and flood-prone areas. Additionally, permanent fill likely within regulatory floodplain. One fish barrier eliminated.	**Meets** Temporary impacts to streams and wetlands, liquefaction zones, and flood-prone areas. Additionally, permanent fill likely within regulatory floodplain. One fish barrier eliminated.	**Meets** Temporary impacts to streams and wetlands, liquefaction zones, and flood-prone areas. Additionally, permanent fill likely within regulatory floodplain. Three fish barriers eliminated.
Permitting and Regulatory Complexity	Ability to obtain permits and the ease of obtaining permits.	**Meets** Numerous jurisdictions and permits required.	**Meets** Numerous jurisdictions and permits required.	**Meets** Numerous jurisdictions and permits required.
Community				
Community impacts - Residential impacts, economical impacts, commute/traffic disruptions	Minimize the level of construction and traffic impacts to the community.	**Exceeds** Minor impacts to traffic during construction.	**Meets** Some impacts to traffic during construction.	**Does not meet** Major impacts to traffic during onstruction.
Equity, Social Justice, and Sustainability	Minimize long term impacts to social services (transit), and impacts to pedestrian and cyclist	**Meets** Alternative does not significantly improve flood risk and recurrent flooding which can impact the nearby blueberry farm, access to nearby businesses, and community connectivity and accesibility.	**Exceeds** Post-construction, alternative not expected to have negative impact on businesses	**Exceeds** Post-construction, alternative not expected to have negative impact on businesses
Cost				
Construction Cost	Miss: Greater than $10 Million , Meets : Greater than $3 Million Less than $10 Million , Exceeds: Less than $3 Million	**Does not meet**	**Meets**	**Does not meet**
Overall Evaluation Criteria				
Total Number of Criteria with "Exceeds" Rating		**1**	**1**	**3**
Total Number of Criteria with "Meets" Rating		**4**	**6**	**3**
Total Number of Criteria with "Does not Meet" Rating		**3**	**1**	**2**