Lower Russell Road Levee Setback Project

Draft Alternatives Analysis Summary Report

King County, Washington

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King County

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1. Introduction

1.1 Purpose and Scope

The purpose of this Alternatives Analysis Summary is to present the planning process that was employed and the information that was developed to assist the decision makers in selecting the preferred alternative for the Lower Russell Road Levee Setback Project (LRRP). The selected alternative will be carried forward into final design. The key steps followed in the planning process include:

- Establishing the guidelines for the planning effort
- Formulating and initial screening of the conceptual alternatives options
- Completing the preliminary design and developing an opinion of probable costs for selected alternatives
- Completing a multi-criteria analysis for selected alternatives
- Comparing the alternatives

1.2 Project Background and Description

The LRRP will replace the existing flood protection system made up of levees and revetments with a new flood protection system along the right (east) bank of the Green River between river mile (RM) 17.85 (S. 212th Street) and RM 19.25 (Veterans Drive [formerly S. 231st Street]/228th Street) in the City of Kent, Washington (see Figure 1). The project reach is approximately 1.4 river miles in length. When implemented, the LRRP will improve flood protection for the residents and businesses of Kent, Tukwila, Renton, and the Green River valley.

The focus of the LRRP is to:

- Design a system that minimizes long-term maintenance needs and associated costs; construct a flood protection system that balances policy directives regarding flood protection (e.g., scour protection, stability and vegetation maintenance), habitat restoration, and recreational use;
- Increase the flow containment capacity of the flood protection system; and
- Set the new flood protection system back from the river, where feasible, to improve riverine and riparian processes, functions, and habitat.

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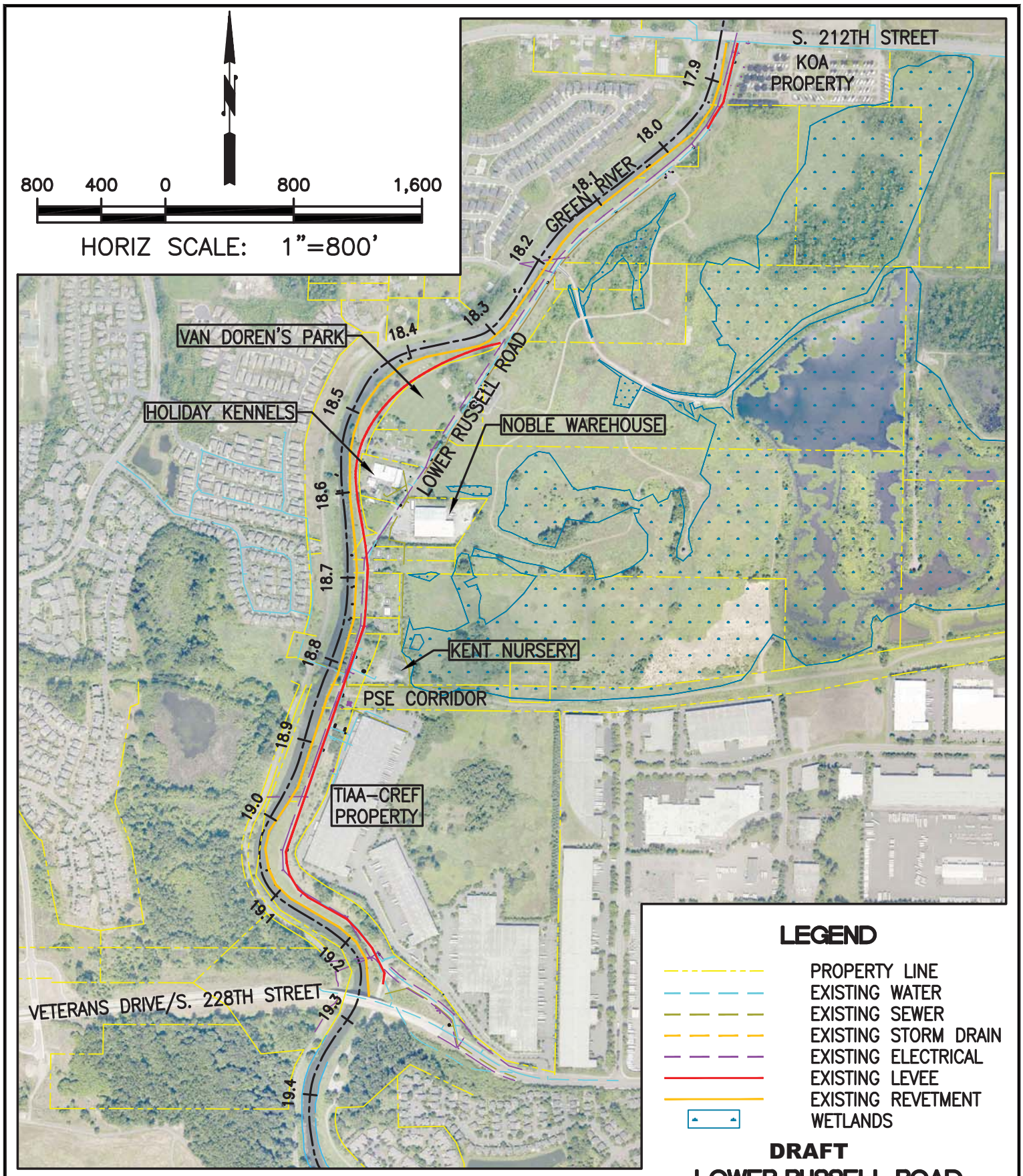

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LOWER RUSSELL ROAD LEVEE SETBACK PROJECT

PROJECT OVERVIEW MAP
FIGURE 1

2. Guidelines for the Planning Effort

Planning guidelines were established to provide the individuals involved in selecting the recommended alternative for the LRRP with a common understanding of the purpose of the planning effort. This section presents the challenges, opportunities, goals, objectives, and constraints that guided the planning process.

2.1 Challenges

The primary challenges that are driving the LRRP are:

1. The existing system of levee and revetments does not meet current engineering design standards.
2. The system does not achieve the desired level of protection (i.e., probability of flow containment).
3. The system is prone to scour and slope instability that requires ongoing maintenance to protect infrastructure built adjacent to the river.
4. The system contributes to the degradation of aquatic and riparian habitat resulting in decreasing numbers of salmonid fish, in particular Chinook salmon, listed as threatened under the federal Endangered Species Act.

2.2 Opportunities

Opportunities that may be seized while addressing the challenges include:

1. Improve recreational (in particular pedestrian and bicycle) access.
2. Improve Tribal fishing access.
3. Integrate the floodplain.
4. Improve vehicular access to Green River Natural Resources Area (GRNRA).
5. Improve vehicular access to Van Doren's Park.
6. Green River Regional Trail.

2.3 Goals

The project goals to address the challenges include:

1. Improve flood protection.
2. Improve aquatic and riparian habitat.
3. Select a flood protection system alternative for final design that achieves flood protection, restores habitat, and enhances recreational use as informed by the Green River System-wide Improvement Framework (SWIF), project site opportunities, constraints, and funding.
4. Minimize project life cycle (design, construction, maintenance, and replacement) costs.

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2.4 Objectives

The measurable objectives in support of the project goals include:

1. Flood protection:
    a. Convey the 0.2 percent annual exceedance probability (500-year) flood with 3 feet of freeboard. The design flood flow is 18,500 cfs (corresponds to 18,800 cfs at the U.S. Geological Survey [USGS] Auburn gage).
    b. Set back flood protection system (levees and/or floodwall), where feasible, to reduce scour potential, increase options for scour protection measures, increase resiliency, maximize compatibility with future efforts to expand aquatic and/or riparian habitat, and reduce life cycle costs.
2. Aquatic habitat:
    a. Provide suitable rearing habitat for juvenile salmon by creating shallow slow water edge habitats that provide suitable depths and velocities over a range of flows during the rearing period.
    b. Provide high flow refuge habitat for juvenile salmon.
    c. Provide large woody debris to perform multiple functions, including cover, velocity refuge during high flows, and scour to create pools.
    d. Provide habitats that function over a sustained period of time.
3. Riparian habitat:
    a. Provide native riparian vegetation, including trees, to reduce solar heating, stabilize streambanks, create overhanging cover, and allow for future large woody debris recruitment.
4. Recreation and access:
    a. Maintain vehicular access to Van Doren's Park and GRNRA via Russell Road.
    b. Improve pedestrian/bicycle access and tie into existing trails at 228th Street and 212th Street bridges.
    c. Reduce vehicular traffic on Russell Road that impacts recreational users.

2.5 Constraints

The constraints that cannot be violated while achieving the objectives are as follows (in no particular order):

a. Avoid or mitigate negative hydraulic impacts.
b. Design project features to meet current engineering standards.
c. Design project features to allow for levee certification under the Federal Emergency Management Agency's (FEMA) criteria.
d. Provide a secondary emergency fire access to the TIAA-CREF property.
e. Protect PSE Transmission tower/power line (RB, RM 18.85).
f. Maintain access to the Kent Nursery (RB, RM 18.8).
g. Protect the pedestrian bridge (RM 18.8) with a sanitary sewer force main and a water main.
h. Minimize the encroachment of project features into the KOA Campground (RB, RM 17.9) for the 212th Street levee tie-in, considering the balance between future scour and improved access.

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i. Maintain the current functions of Van Doren's Park. Park elements, such as the parking lot and restroom, do not need to stay in the same location.
j. Design within land use constraints from funding sources used to acquire the GRNRA (Washington State Department of Ecology's [Ecology] Centennial Clean Water Fund [CCWF], County's Conservation Futures Tax [CFT], Wastewater Treatment Division [WTD]) and Van Doren's Park Washington Recreation and Conservation Office [RCO]).
k. Avoid or mitigate negative impacts to the wetlands within the GRNRA.
l. Consider user safety and strategies to hinder illegal activities along the entire project length and the Park/GRNRA in the design approach.
m. Maintain existing city utilities (sewer and water main).

3. Formulation and Screening of Conceptual Alternatives

3.1 Alternatives Development Process

Alternatives, based on three flood protection system alignments, were developed to meet the project objectives after determining site constraints and opportunities in coordination with the City of Kent, (see Figure 2). Input was also received from the Muckleshoot Indian Tribe and other stakeholders (e.g., Water Resource Inventory Area [WRIA] 9, permitting agencies, and through a public meeting). The Alternative Development Matrix was then developed by the County's project team to identify and succinctly describe project elements (e.g., alignment, transportation, property acquisition, habitat, recreation) to support the selection of the best project alternatives for further analysis (see Table 1).

3.2 Selection Rationale for Alternatives Evaluation

Six alternatives from the matrix were selected for comparison by the County's project team (with input from the City of Kent) by using the multi-criteria decision analysis. The six alternatives captured the range of project elements that best met project objectives, fit within project constraints, and reflected stakeholder input. The output from the multi-criteria decision analysis is intended to aid the Flood Control District in the selection of a preferred alternative to carry forward into final design. These alternatives are presented in Figures 3 through 8.

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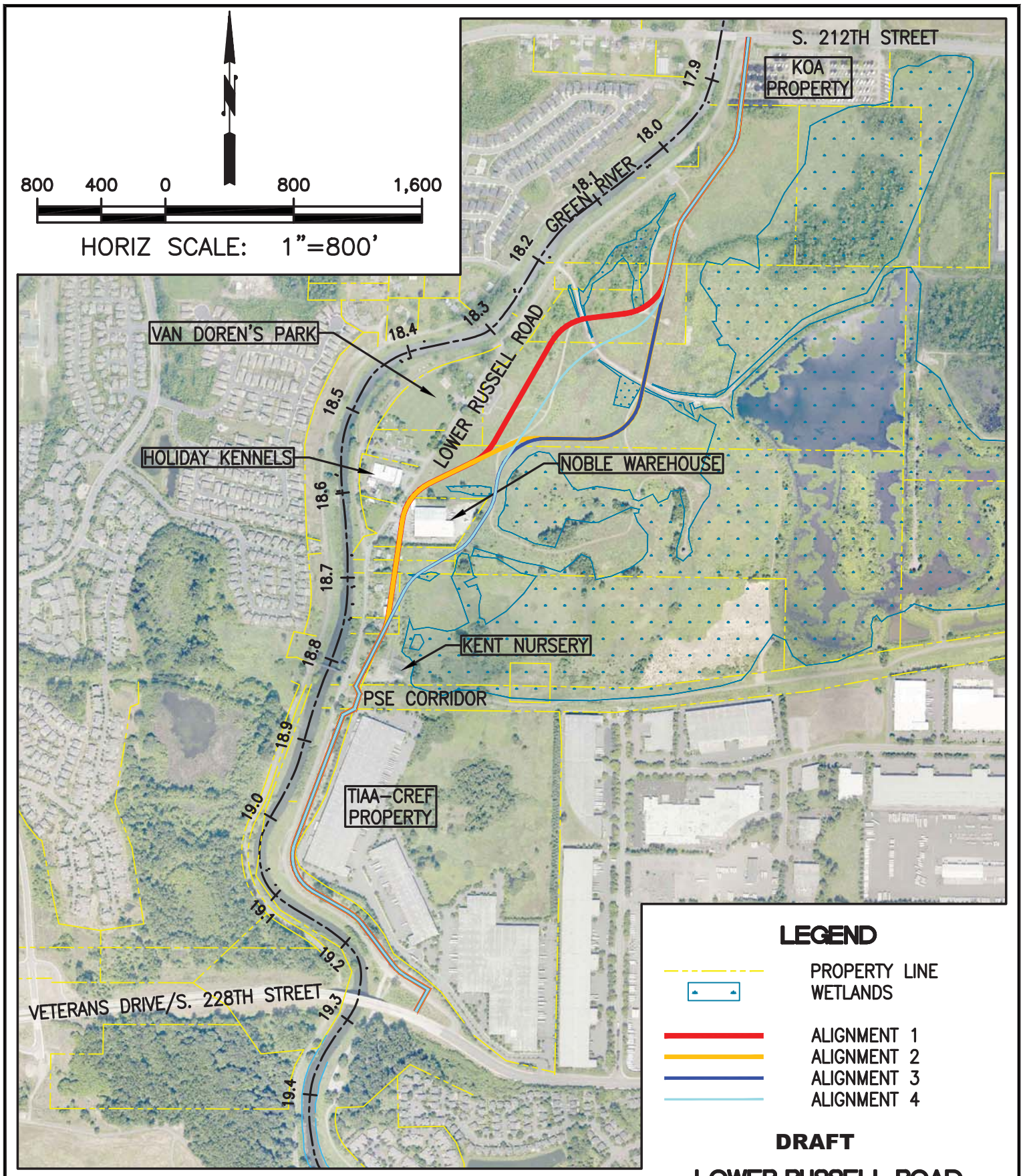

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LOWER RUSSELL ROAD LEVEE SETBACK PROJECT

FOUR ALTERNATIVE ALIGNMENTS
FIGURE 2

Table 1. Lower Russell Road Levee Setback Project Alternative Development Matrix

No.	Alternative Name	Selected for Alt. Comp. Analysis (Y or N)	Flood Protection System Alignment				Russell Road						Property Acquisition[9]		Habitat Enhancement			Rec.	Scenario Description & Assumptions
							228th St to PSE Corridor[1]		PSE Corridor to Van Doren's Park[4]		Van Doren's Park to 212th St[7]				Riparian	Aquatic			
			Align #1	Align #2	Align #3	Align #4	Existing Rd and Fldwall[2]	New Rd on Levee[3]	Keep Ex. Rd and Std Levee[5]	New Rd on Levee[6]	New Rd on Levee[8]	No Rd and Std Levee	Noble Pacific Warehouse	KOA Kamp-ground	Shade Trees Along Riverbank	Single Side Channel	Multi-thread Channel	Connect Park Trail[10] to Levee	
1	1a		X				X		X		X		X	X	X		X	X	Includes road from Van Doren's park (ex. Russell Rd) to new road on levee crest.
2	1b		X				X		X			X		X	X		X	X	Floodwall and gate(s) across Noble property
3	1c		X					X	X		X			X	X	X		X	Floodwall and gate(s) across Noble property. Includes road from Van Doren's park (ex. Russell Rd) to new road on levee crest.
4	1d		X					X	X			X		X	X		X	X	Floodwall and gate(s) across Noble property
5	2a			X			X		X		X		X	X	X	X		X	Includes road from Van Doren's park (ex. Russell Rd) to new road on levee crest.
6	2b			X			X		X			X		X	X		X	X	Floodwall and gate(s) across Noble property
7	2c			X				X	X		X		X	X	X	X		X	Includes road from Van Doren's park (ex. Russell Rd) to new road on levee crest.
8	2d			X				X	X			X		X	X		X	X	Floodwall and gate(s) across Noble property
9	3a				X		X		X			X		X	X		X	X	Noble Pacific Warehouse assumed to remain on the riverward side of levee.
10	3b				X		X		X		X			X	X	X		X	Includes road from Van Doren's park (ex. Russell Rd) to new road on levee crest. Noble Pacific Warehouse assumed to remain on the riverward side of levee.
11	3c				X		X			X	X		X	X	X		X	X	Includes road from Van Doren's park to new road on levee crest.
12	3d				X			X	X			X		X	X	X		X	Noble Pacific Warehouse assumed to remain on the riverward side of levee.
13	3e				X			X	X		X			X	X		X	X	Includes road from Van Doren's park (ex. Russell Rd) to new road on levee crest. Noble Pacific Warehouse assumed to remain on the riverward side of levee.
14	3f				X			X		X	X		X	X	X		X	X	Includes road from Van Doren's park (ex. Russell Rd) to new road on levee crest.
15	4a				X	X	X		X			X		X	X		X	X	Noble Pacific Warehouse assumed to remain on the riverward side of levee.

Notes: 1. Both alternatives require some modification of Russell Rd south of TIAA-CREF property. If a floodgate is used as a crossing, minor utility (water main and sewer) modifications are anticipated. Raising the road to ramp over the floodwall avoids a floodgate but will likely require approx. 350 feet of utlity relocations and relocation of a PSE transformer. Road width would be similar to existing (twenty feet wide). Ramping the road over a floodwall is the preferred design.

2. Preserves existing infrastructure (road, water main, PSE overhead power, etc.) except as stated under note 1.

3. Twenty foot wide aspalt road (similar to existing). Due to scour considerations at PSE tower the levee would transition to floodwall running along the landward side of the PSE tower. The road would drop down to existing ground riverward of the PSE tower.

4. Requires either a floodgate for shared access to Nursery, PSE corridor trail and TIAA-CREF fire emergency access or a ramp over a floodwall. An earthern ramp over a floodwall will require modifications to the Nursery and TIAA-CREF accesses. An earthen ramp over the a floodwall is the preferred design.

5. Preserves existing infrastructure (road, water main, PSE overhead power, etc.)

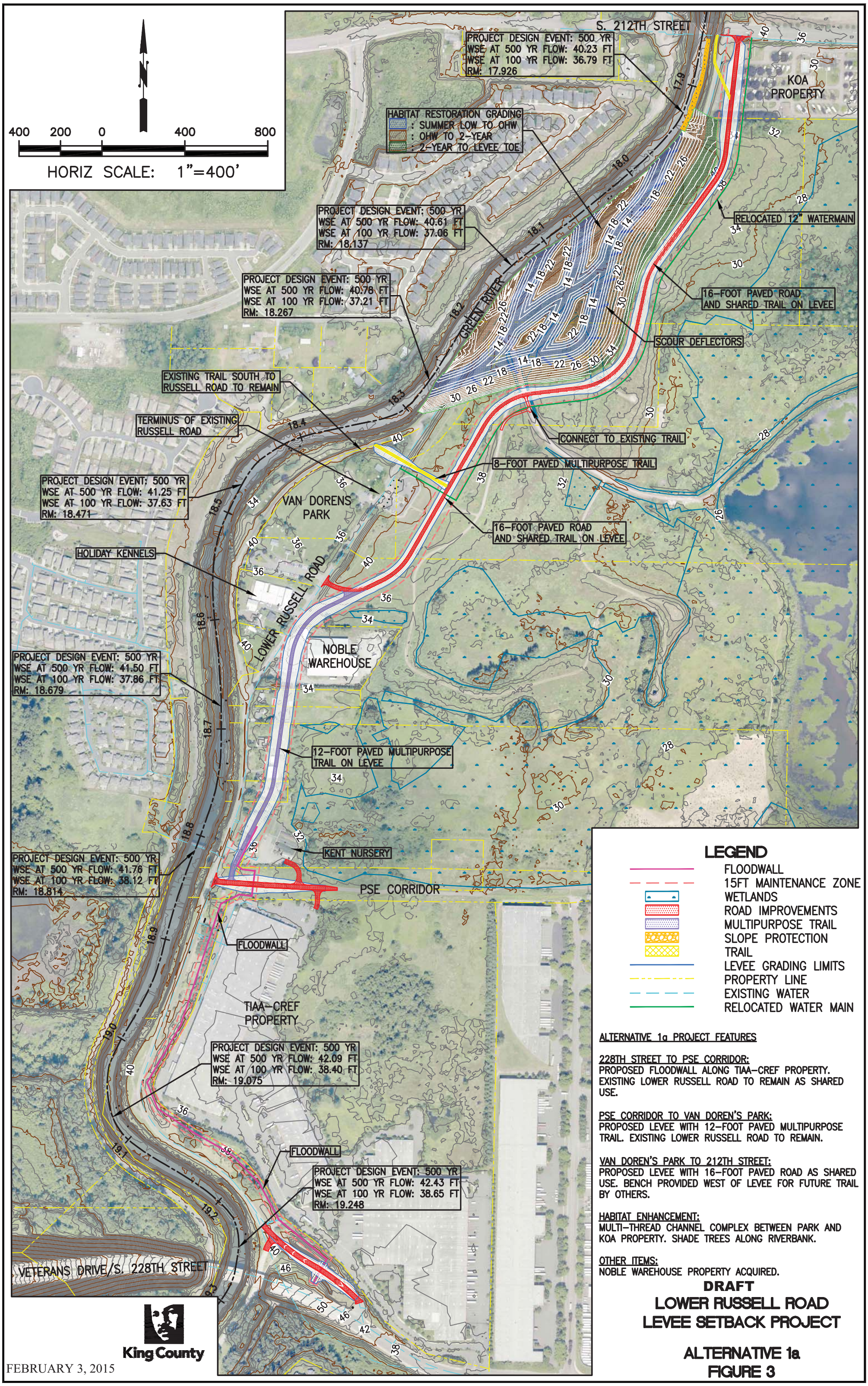
6. Twenty foot wide aspalt road (similar to existing) to Van Doren's Park.

7. No further consideration of an alternative keeping existing road in place north of Van Doren's Park due to Kent's SWIF proposal of Alignment #1 and Region's desire for habitat enhancement.

8. Sixteen foot wide asphalt road on levee crest between Van Doren's Park and 212th St. Recommended minimum width for low volume rural road with infrequent 2-way traffic that with adj. gravel shoulders allows for two vehicles to pass. Outer edges of asphalt road used as unofficial ped/bike areas (as done presently). South of the KOA property allowance will be made for a minimum 12 foot wide corridor between the levee road and excavation for habitat work to accomodate a future 8 ft wide trail (by City of Kent).

9. Gagliardi (Holiday Kennels) property not included because property isn't needed for the project and acquisition decision would not impact project.

10. The (only) existing asphalt trail running along the riverward side of Van Doren's Park. Connection at north end of Park.



ALTERNATIVE 1a PROJECT FEATURES

228TH STREET TO PSE CORRIDOR:
PROPOSED FLOODWALL ALONG TIAA-CREF PROPERTY. EXISTING LOWER RUSSELL ROAD TO REMAIN AS SHARED USE.

PSE CORRIDOR TO VAN DOREN'S PARK:
PROPOSED LEVEE WITH 12-FOOT PAVED MULTIPURPOSE TRAIL. EXISTING LOWER RUSSELL ROAD TO REMAIN.

VAN DOREN'S PARK TO 212TH STREET:
PROPOSED LEVEE WITH 16-FOOT PAVED ROAD AS SHARED USE. BENCH PROVIDED WEST OF LEVEE FOR FUTURE TRAIL BY OTHERS.

HABITAT ENHANCEMENT:
MULTI-THREAD CHANNEL COMPLEX BETWEEN PARK AND KOA PROPERTY. SHADE TREES ALONG RIVERBANK.

OTHER ITEMS:
NOBLE WAREHOUSE PROPERTY ACQUIRED.

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LOWER RUSSELL ROAD LEVEE SETBACK PROJECT

ALTERNATIVE 1a
FIGURE 3

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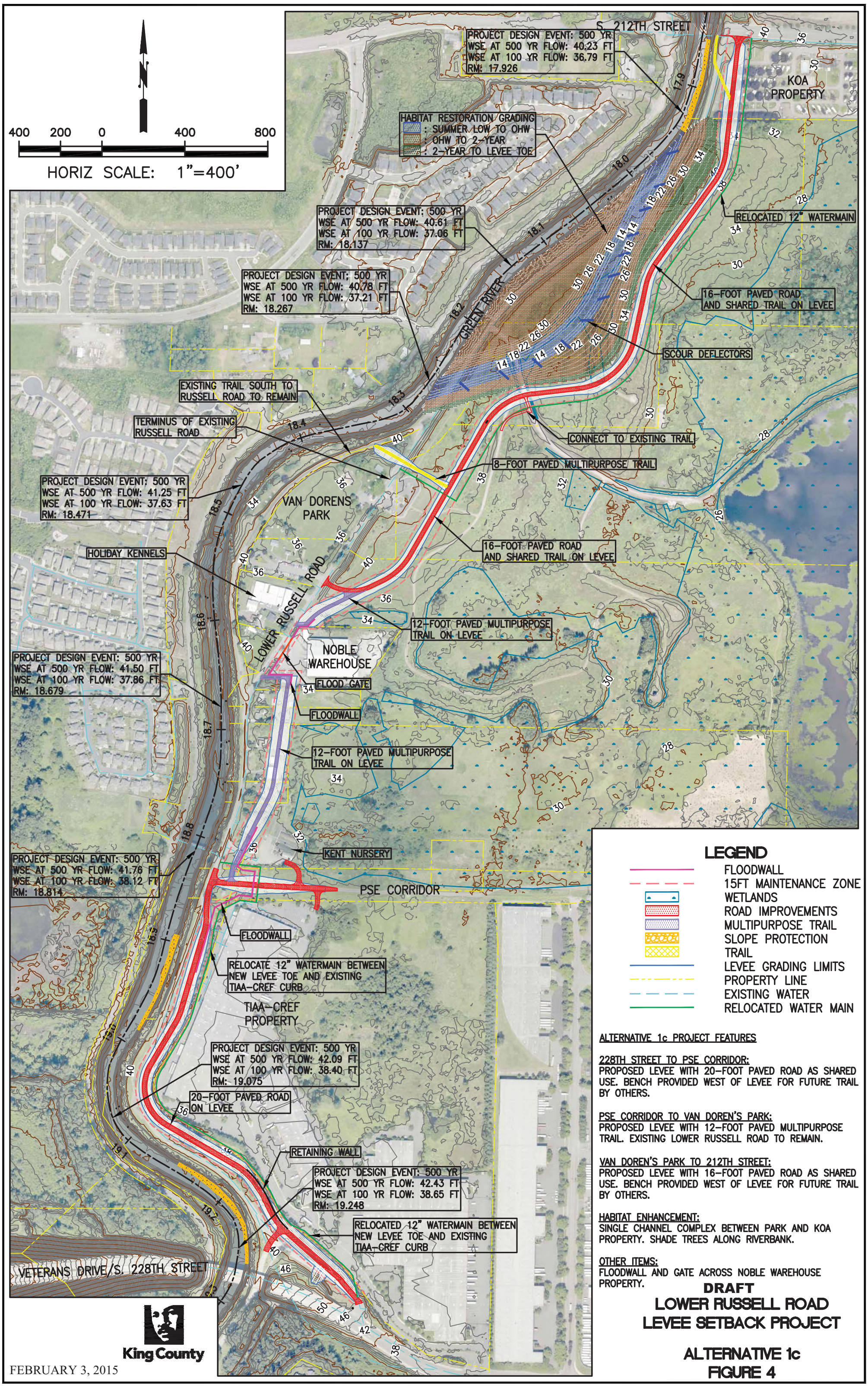

ALTERNATIVE 1c PROJECT FEATURES

228TH STREET TO PSE CORRIDOR:
PROPOSED LEVEE WITH 20-FOOT PAVED ROAD AS SHARED USE. BENCH PROVIDED WEST OF LEVEE FOR FUTURE TRAIL BY OTHERS.

PSE CORRIDOR TO VAN DOREN'S PARK:
PROPOSED LEVEE WITH 12-FOOT PAVED MULTIPURPOSE TRAIL. EXISTING LOWER RUSSELL ROAD TO REMAIN.

VAN DOREN'S PARK TO 212TH STREET:
PROPOSED LEVEE WITH 16-FOOT PAVED ROAD AS SHARED USE. BENCH PROVIDED WEST OF LEVEE FOR FUTURE TRAIL BY OTHERS.

HABITAT ENHANCEMENT:
SINGLE CHANNEL COMPLEX BETWEEN PARK AND KOA PROPERTY. SHADE TREES ALONG RIVERBANK.

OTHER ITEMS:
FLOODWALL AND GATE ACROSS NOBLE WAREHOUSE PROPERTY.

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LOWER RUSSELL ROAD LEVEE SETBACK PROJECT

ALTERNATIVE 1c
FIGURE 4

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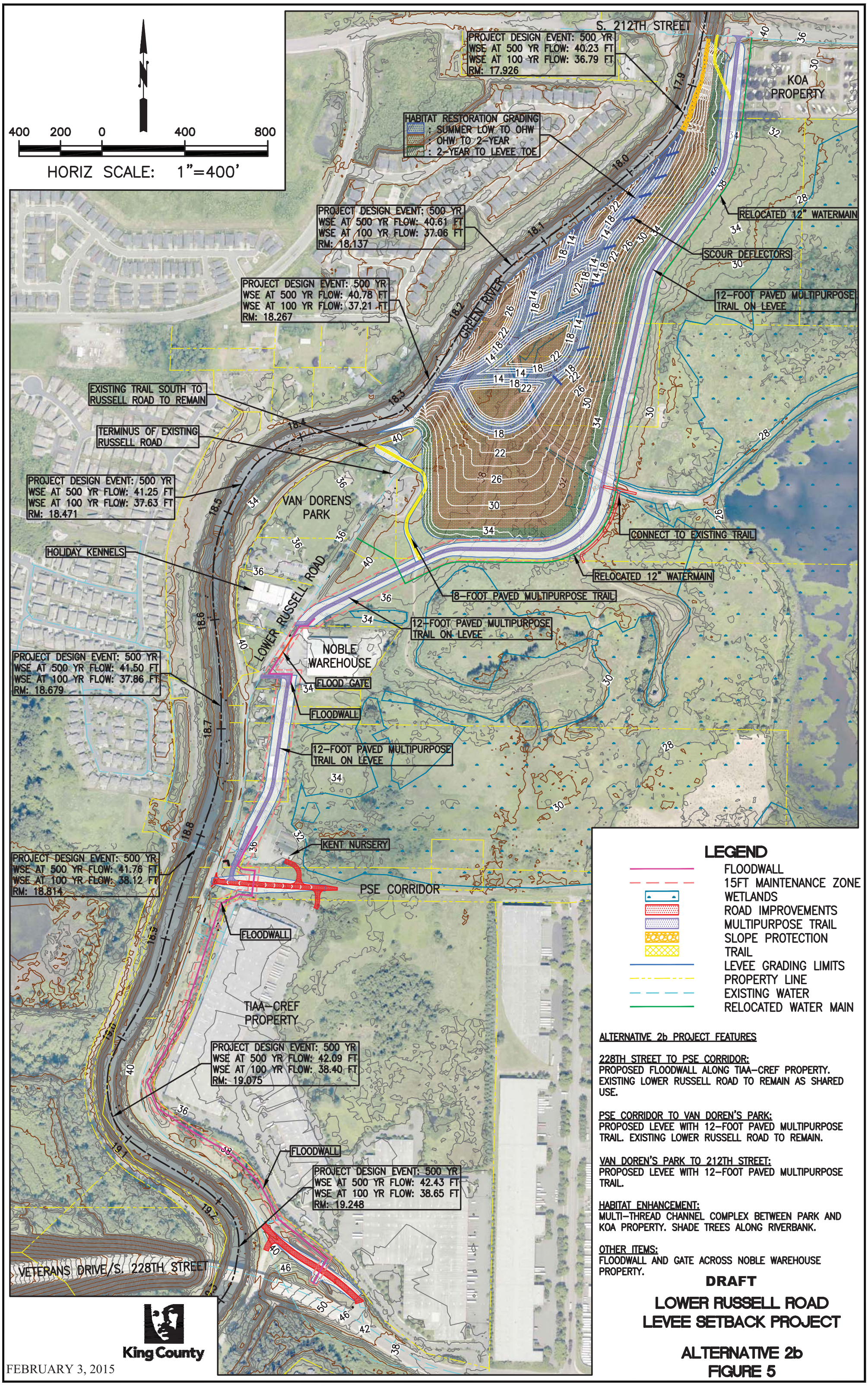

ALTERNATIVE 2b PROJECT FEATURES

228TH STREET TO PSE CORRIDOR:
PROPOSED FLOODWALL ALONG TIAA-CREF PROPERTY. EXISTING LOWER RUSSELL ROAD TO REMAIN AS SHARED USE.

PSE CORRIDOR TO VAN DOREN'S PARK:
PROPOSED LEVEE WITH 12-FOOT PAVED MULTIPURPOSE TRAIL. EXISTING LOWER RUSSELL ROAD TO REMAIN.

VAN DOREN'S PARK TO 212TH STREET:
PROPOSED LEVEE WITH 12-FOOT PAVED MULTIPURPOSE TRAIL.

HABITAT ENHANCEMENT:
MULTI-THREAD CHANNEL COMPLEX BETWEEN PARK AND KOA PROPERTY. SHADE TREES ALONG RIVERBANK.

OTHER ITEMS:
FLOODWALL AND GATE ACROSS NOBLE WAREHOUSE PROPERTY.

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LOWER RUSSELL ROAD LEVEE SETBACK PROJECT

ALTERNATIVE 2b
FIGURE 5

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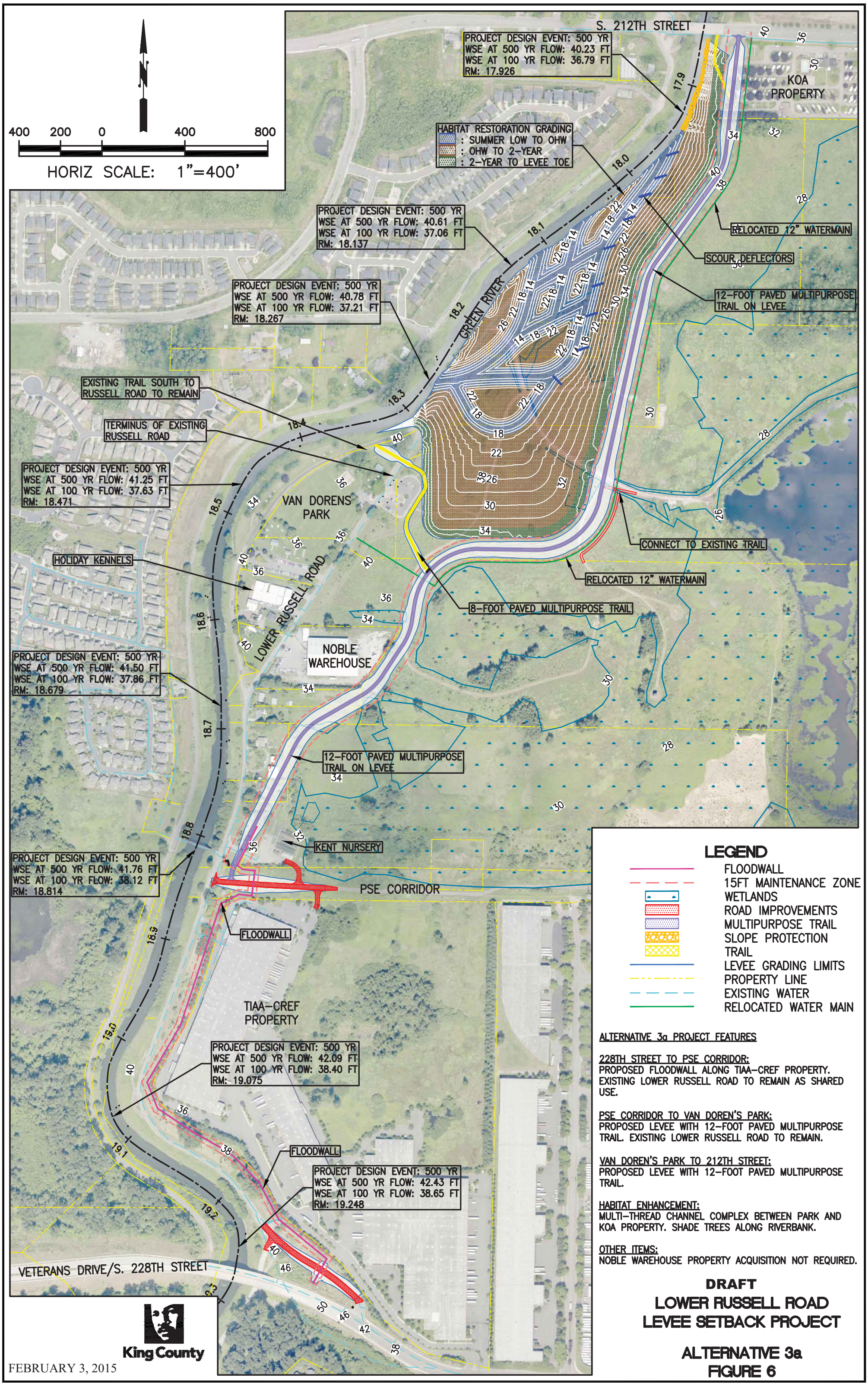
400 200 0 400 800
HORIZ SCALE: 1"=400'
S. 212TH STREET
PROJECT DESIGN EVENT: 500 YR
WSE AT 500 YR FLOW: 40.23 FT
WSE AT 100 YR FLOW: 36.79 FT
RM: 17.926
KOA PROPERTY
HABITAT RESTORATION GRADING
: SUMMER LOW TO OHW
: OHW TO 2-YEAR
: 2-YEAR TO LEVEE TOE
PROJECT DESIGN EVENT: 500 YR
WSE AT 500 YR FLOW: 40.61 FT
WSE AT 100 YR FLOW: 37.06 FT
RM: 18.137
RELOCATED 12" WATERMAIN
SCOUR DEFLECTORS
PROJECT DESIGN EVENT: 500 YR
WSE AT 500 YR FLOW: 40.78 FT
WSE AT 100 YR FLOW: 37.21 FT
RM: 18.267
12-FOOT PAVED MULTIPURPOSE TRAIL ON LEVEE
GREEN RIVER
EXISTING TRAIL SOUTH TO RUSSELL ROAD TO REMAIN
TERMINUS OF EXISTING RUSSELL ROAD
PROJECT DESIGN EVENT: 500 YR
WSE AT 500 YR FLOW: 41.25 FT
WSE AT 100 YR FLOW: 37.63 FT
RM: 18.471
VAN DORENS PARK
CONNECT TO EXISTING TRAIL
HOLIDAY KENNELS
LOWER RUSSELL ROAD
RELOCATED 12" WATERMAIN
8-FOOT PAVED MULTIPURPOSE TRAIL
NOBLE WAREHOUSE
PROJECT DESIGN EVENT: 500 YR
WSE AT 500 YR FLOW: 41.50 FT
WSE AT 100 YR FLOW: 37.86 FT
RM: 18.679
12-FOOT PAVED MULTIPURPOSE TRAIL ON LEVEE
KENT NURSERY
PROJECT DESIGN EVENT: 500 YR
WSE AT 500 YR FLOW: 41.76 FT
WSE AT 100 YR FLOW: 38.12 FT
RM: 18.814
PSE CORRIDOR
FLOODWALL
TIAA-CREF PROPERTY
PROJECT DESIGN EVENT: 500 YR
WSE AT 500 YR FLOW: 42.09 FT
WSE AT 100 YR FLOW: 38.40 FT
RM: 19.075
FLOODWALL
PROJECT DESIGN EVENT: 500 YR
WSE AT 500 YR FLOW: 42.43 FT
WSE AT 100 YR FLOW: 38.65 FT
RM: 19.248
VETERANS DRIVE/S. 228TH STREET
LEGEND
FLOODWALL
15FT MAINTENANCE ZONE
WETLANDS
ROAD IMPROVEMENTS
MULTIPURPOSE TRAIL
SLOPE PROTECTION
TRAIL
LEVEE GRADING LIMITS
PROPERTY LINE
EXISTING WATER
RELOCATED WATER MAIN
ALTERNATIVE 3a PROJECT FEATURES
228TH STREET TO PSE CORRIDOR:
PROPOSED FLOODWALL ALONG TIAA-CREF PROPERTY. EXISTING LOWER RUSSELL ROAD TO REMAIN AS SHARED USE.
PSE CORRIDOR TO VAN DOREN'S PARK:
PROPOSED LEVEE WITH 12-FOOT PAVED MULTIPURPOSE TRAIL. EXISTING LOWER RUSSELL ROAD TO REMAIN.
VAN DOREN'S PARK TO 212TH STREET:
PROPOSED LEVEE WITH 12-FOOT PAVED MULTIPURPOSE TRAIL.
HABITAT ENHANCEMENT:
MULTI-THREAD CHANNEL COMPLEX BETWEEN PARK AND KOA PROPERTY. SHADE TREES ALONG RIVERBANK.
OTHER ITEMS:
NOBLE WAREHOUSE PROPERTY ACQUISITION NOT REQUIRED.
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LOWER RUSSELL ROAD
LEVEE SETBACK PROJECT
ALTERNATIVE 3a
FIGURE 6
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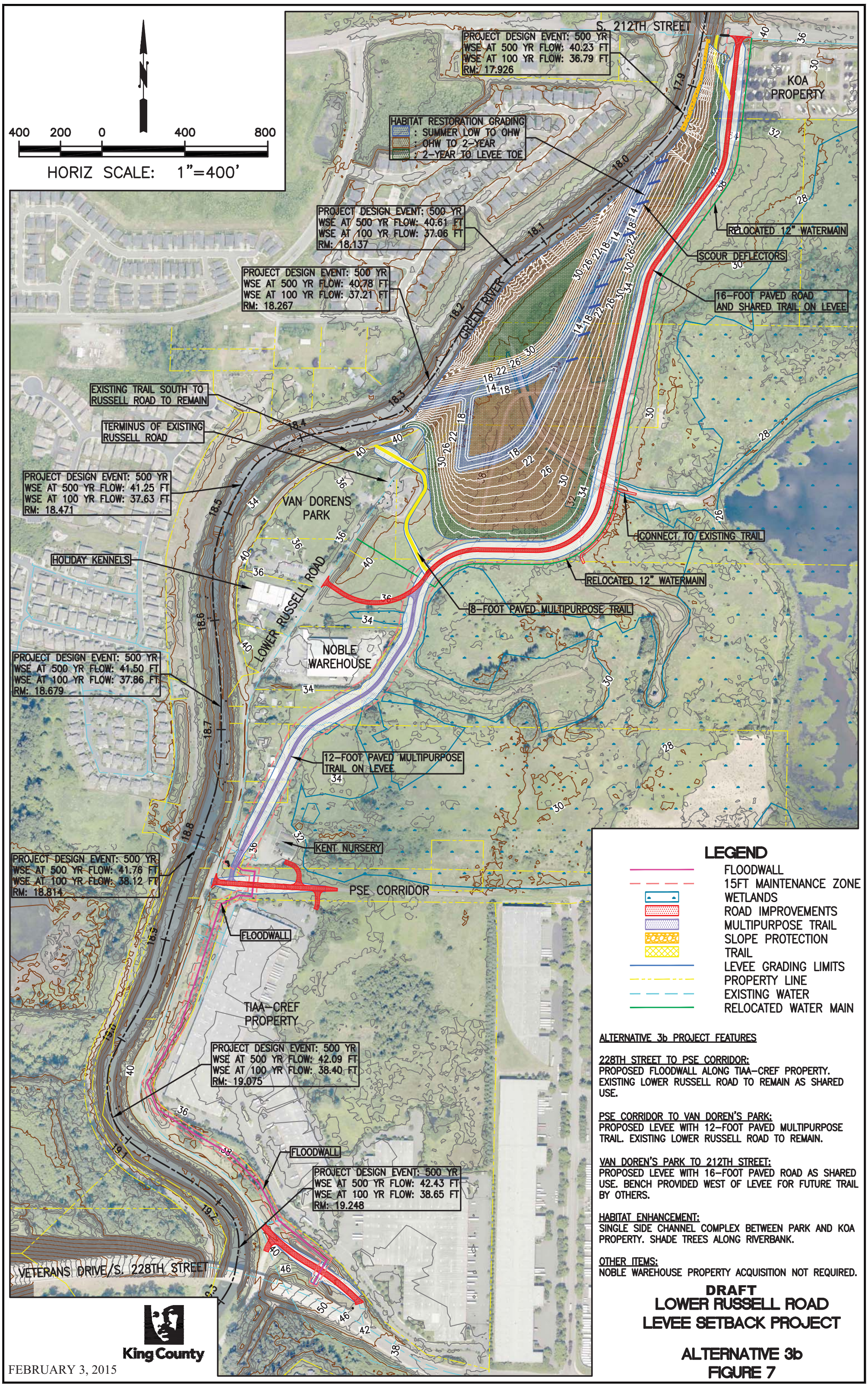

ALTERNATIVE 3b PROJECT FEATURES

228TH STREET TO PSE CORRIDOR:
PROPOSED FLOODWALL ALONG TIAA-CREF PROPERTY. EXISTING LOWER RUSSELL ROAD TO REMAIN AS SHARED USE.

PSE CORRIDOR TO VAN DOREN'S PARK:
PROPOSED LEVEE WITH 12-FOOT PAVED MULTIPURPOSE TRAIL. EXISTING LOWER RUSSELL ROAD TO REMAIN.

VAN DOREN'S PARK TO 212TH STREET:
PROPOSED LEVEE WITH 16-FOOT PAVED ROAD AS SHARED USE. BENCH PROVIDED WEST OF LEVEE FOR FUTURE TRAIL BY OTHERS.

HABITAT ENHANCEMENT:
SINGLE SIDE CHANNEL COMPLEX BETWEEN PARK AND KOA PROPERTY. SHADE TREES ALONG RIVERBANK.

OTHER ITEMS:
NOBLE WAREHOUSE PROPERTY ACQUISITION NOT REQUIRED.

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LOWER RUSSELL ROAD LEVEE SETBACK PROJECT

ALTERNATIVE 3b
FIGURE 7

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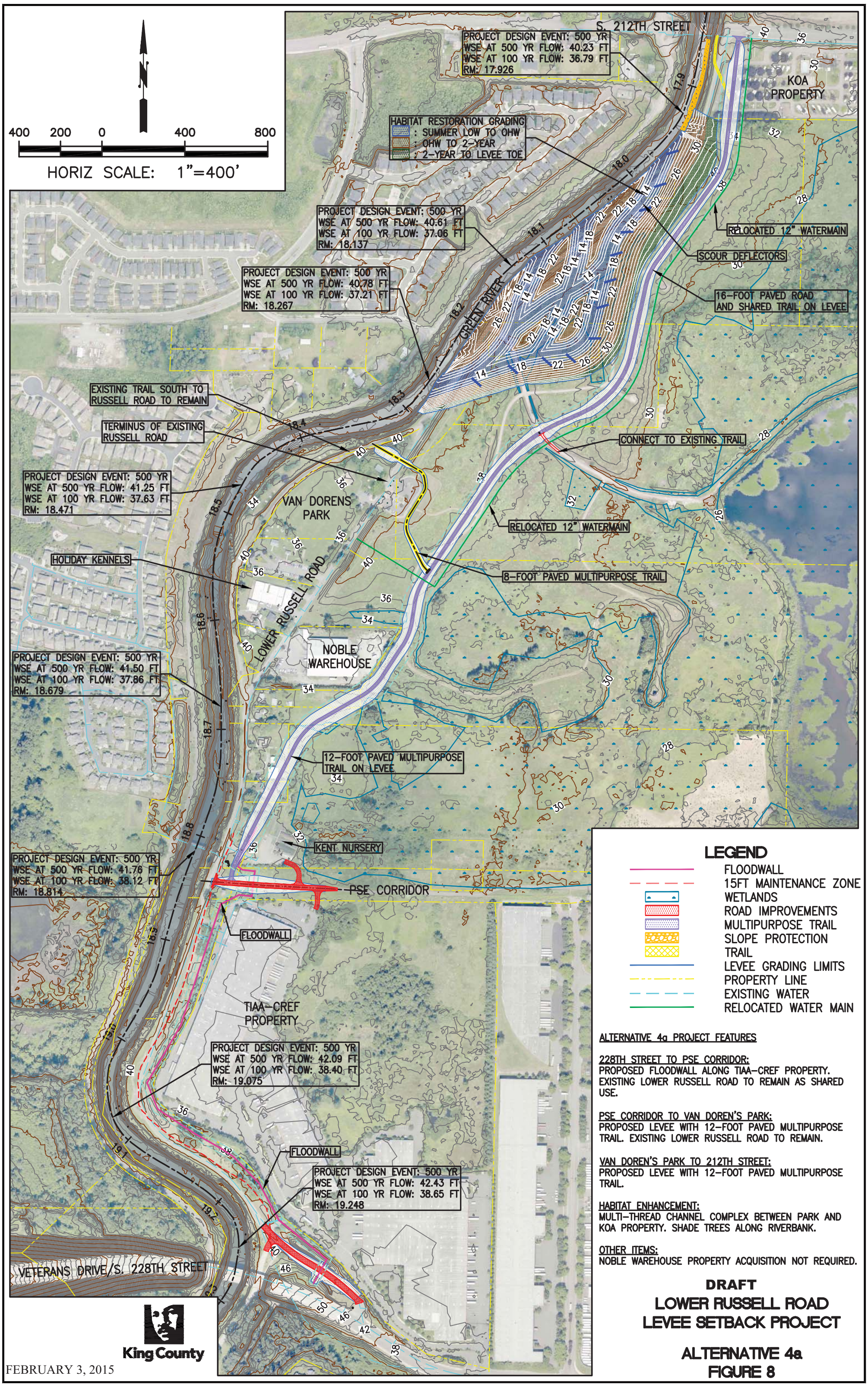

ALTERNATIVE 4a PROJECT FEATURES

228TH STREET TO PSE CORRIDOR:
PROPOSED FLOODWALL ALONG TIAA-CREF PROPERTY. EXISTING LOWER RUSSELL ROAD TO REMAIN AS SHARED USE.

PSE CORRIDOR TO VAN DOREN'S PARK:
PROPOSED LEVEE WITH 12-FOOT PAVED MULTIPURPOSE TRAIL. EXISTING LOWER RUSSELL ROAD TO REMAIN.

VAN DOREN'S PARK TO 212TH STREET:
PROPOSED LEVEE WITH 12-FOOT PAVED MULTIPURPOSE TRAIL.

HABITAT ENHANCEMENT:
MULTI-THREAD CHANNEL COMPLEX BETWEEN PARK AND KOA PROPERTY. SHADE TREES ALONG RIVERBANK.

OTHER ITEMS:
NOBLE WAREHOUSE PROPERTY ACQUISITION NOT REQUIRED.

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LOWER RUSSELL ROAD LEVEE SETBACK PROJECT

ALTERNATIVE 4a
FIGURE 8

FEBRUARY 3, 2015

4. Preliminary Designs and Opinion of Probable Costs

4.1 Designs

Preliminary designs were completed for the six alternatives presented in Figures 3 through 8. A brief summary of the design considerations is provided below. See Table 1 for a brief description of elements making up each alternative. Typical cross sections for key features are included in Appendix A.

4.1.1 Flood Protection System (levees and floodwalls)

From the perspectives of design, cost, maintenance and operations, the County prefers levees over floodwalls. However, floodwalls provide more design flexibility when setback constraints would otherwise result in levee footprint impacts to existing infrastructure. Along the TIAA-CREF and Noble Pacific warehouse properties, floodwalls and gates are assumed for some alternatives.

4.1.2 Utilities

Water Main: The City of Kent has a trunk water main (12” DIP) along the entire length of Russell Road. In locations where the project impacts (removes) the road, the water main will need to be relocated to the landward side of the flood protection system.

Sanitary Sewer: The flood protection system alignments cross sewer pipelines in two locations between the PSE corridor and Noble Pacific property. The preliminary assumption is that the pipes at these two crossings will need to be replaced.

Stormwater: New pollution-generating surfaces will be created solely from work performed to replace Russell Road. The replacement road is designed to drain by sheet flow on to vegetated areas designed to promote infiltration for water quality protection.

PSE Electric Utility along Russell Road: In locations where Russell Road will be replaced, the utility (largely overhead power) will need to be relocated to continue serving remaining customers. Relocation of the PSE electrical utility is assumed to be a PSE expense under its franchise agreement with the City of Kent.

4.1.3 Russell Road

The alternatives vary by the extent to which sections of Russell Road will be replaced. A couple of alternatives call for removing, without replacing, the section of road between Van Doren’s Park and 212th Street. In locations where Russell Road will be replaced, the road sections will be similar in width and function as to what exists today. The length of Russell Road and its design alternatives are separated into three segments on Table 1.

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4.1.4 Scour Protection

Scour protection is incorporated into each alternative based on the following criteria:

1. Incorporate scour protection, where necessary, by accounting for channel migration potential such that the likelihood of needing to replace scour protection within 20 years of construction will be low. Typically, properly installed scour protection facilities can have a lifespan of 30 years before they become vulnerable.

2. Install scour protection to the extent that the project outcome is anticipated to increase habitat values that would otherwise constrain future efforts to install scour protection when needed.

Different types of scour protection measures are anticipated based on several considerations including: 1) keeping work outside the summer low flow channel to minimize impacts and facilitate permitting, 2) taking into account the estimated scour depth, and 3) maintaining space between the river channel and the protected slope. Where space is available, flow deflectors are anticipated. Where space is constrained, a launchable rock toe and rock along the lower slope is the assumed scour protection method.

4.1.5 Habitat Restoration

Project goals include aquatic and riparian habitat restoration and no net loss of bird habitat (although individual bird species may benefit differently). Aquatic habitat restoration is largely focused in the setback area between Van Doren's Park and the KOA Campground. The grading of this habitat restoration is colored in Figures 3 through 8 based on elevation and inundation as follows:

- Blue: Below the ordinary high water (OHW) elevation
- Brown: Between the OHW and the 50 percent annual exceedance (2-year) event water surface elevation (WSE)
- Green: Above the 50 percent annual exceedance (2-year) event

Riparian habitat improvements focus on the planting of native trees and shrubs along the entire riverbank.

4.1.6 Property Acquisition

Each alternative requires private property acquisition. Private properties impacted by the project are listed below:

- KOA Campground: Partial acquisition of the property is necessary to the same extent for all alternatives to address flood protection design requirements.
- Gagliardi (Holiday Kennel): No acquisition of the Gagliardi properties (two parcels, including the Holiday Kennels business) is assumed as these properties are not needed for the project. Every alternative would allow the business to remain on the riverward side of the new flood protection system.
- Noble Pacific Warehouse: Acquisition of the property is assumed in one alternative. The other alternatives either seek to protect the business with a floodwall and gate, or route the flood protection system behind (landward) the warehouse.

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4.2 Quantities and Engineer's Opinion of Probable Cost

Opinions of the total first costs and life cycle costs were developed based upon the preliminary designs.

4.2.1 Project (First) Cost

A comparative Engineer's Opinion of Probable Cost has been developed for each alternative. The first costs for flood control improvements and habitat restoration presented in Appendix B are feasibility-level estimates of opinion of probable cost. These estimates have been prepared using unit costs developed for similar projects in the same general area. Where applicable, unit cost data and other information from the U.S. Corps of Engineers (USACE) were used to prepare the cost estimates. For those features where unit cost data was not available, the following sources were used:

- Unit construction costs developed by HDR Engineering, Inc. for similar facilities;
- Washington State Department of Transportation (WSDOT) contract cost data; and
- Site work cost data published by R.S. Means Company, Inc.

Property Acquisition Costs: City of Kent property used for the flood control improvements is assumed to be available for the project and no costs are assumed for their use. Private property acquisition will be necessary as listed here:

- KOA Campground: Partial acquisition of the property is necessary to the same extent for all alternatives.
- Noble Pacific Warehouse: Acquisition of the entire Noble Pacific Warehouse property is assumed in a few alternatives. Alternatives that would not require the acquisition of this property are being considered as well, however, the cost for protecting the business with a floodwall and a flood gate is estimated to be over $2.2 Million (approximately two-thirds of the likely acquisition cost). Consequently, selecting an alternative based on alignments #3 and #4 (see Figure 2) that routes the flood protection system behind (landward) the warehouse and/or acquiring the property for other uses has merit.

The project costs are presented in Table 2 below. The construction cost estimate is based on 2014 construction costs and includes a 20 percent construction contingency allowance. A sales tax of 9.5 percent has been added to the construction cost subtotal to develop the total estimated construction cost. An itemized cost estimate breakdown is provided in Appendix B.

Engineering, legal, administration, and permitting costs; and construction management costs have been calculated at 14 percent and 8 percent, respectively, of the total estimated construction cost. The cost estimate also includes $200,000 for cultural resources identification and construction survey activities. These percentages are based upon cost experienced by the County, HDR, and the USACE for similar projects.

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Table 2. Estimated Project Costs

Item Description		Alternative 1A Total Amount	Alternative 1C Total Amount	Alternative 2B Total Amount	Alternative 3A Total Amount	Alternative 3B Total Amount	Alternative 4A Total Amount
Part 1 - Site Removals and General		$ 335,538	$ 248,347	$ 233,995	$ 235,296	$ 236,171	$ 230,297
Part 2 - Erosion and Sediment Control		$ 212,984	$ 212,323	$ 215,200	$ 214,928	$ 214,928	$ 212,456
Part 3 - Levee		$ 1,518,072	$ 1,826,103	$ 1,563,589	$ 1,675,255	$ 1,719,855	$ 1,507,476
Part 4 - Structural Floodwall		$ 3,069,850	$ 3,213,000	$ 4,931,166	$ 3,069,850	$ 3,069,850	$ 3,069,850
Part 5 - Utility Relocations		$ 788,563	$ 1,170,281	$ 872,487	$ 785,118	$ 785,118	$ 786,688
Part 6 - Roadway		$ 351,431	$ 458,160	$ 299,444	$ 305,937	$ 356,895	$ 297,355
Part 7 - Scour		$ 1,560,450	$ 2,514,745	$ 1,266,900	$ 1,266,900	$ 1,266,900	$ 1,560,450
Part 8 - Habitat Restoration		$ 7,157,327	$ 5,890,155	$ 10,179,846	$ 10,179,846	$ 8,837,443	$ 7,157,327
Parts 1 - 8 Subtotal		**$ 14,994,215**	**$ 15,533,114**	**$ 19,562,625**	**$ 17,733,129**	**$ 16,487,160**	**$ 14,821,900**
Construction Contingency	*20%*	*$ 2,998,843.07*	*$ 3,106,622.74*	*$ 3,912,525.09*	*$ 3,546,625.88*	*$ 3,297,432.10*	*$ 2,964,380.01*
Construction Cost Subtotal		***$ 17,993,058***	***$ 18,639,736***	***$ 23,475,151***	***$ 21,279,755***	***$ 19,784,593***	***$ 17,786,280***
WA State Sales Tax	*9.5%*	$ 1,709,341	$ 1,770,775	$ 2,230,139	$ 2,021,577	$ 1,879,536	$ 1,689,697
Construction Cost Total		**$ 19,702,399**	**$ 20,410,511**	**$ 25,705,290**	**$ 23,301,332**	**$ 21,664,129**	**$ 19,475,977**
Real Estate Acquisition		$ 4,500,000	$ 1,000,000	$ 1,000,000	$ 1,000,000	$ 1,000,000	$ 1,000,000
Cultural Resources		$ 200,000.00	$ 200,000.00	$ 200,000.00	$ 200,000.00	$ 200,000.00	$ 200,000.00
Planning, Engineering and Design (% of Construction Cost Total)	14%	$ 2,758,335.86	$ 2,857,471.60	$ 3,598,740.58	$ 3,262,186.48	$ 3,032,978.05	$ 2,726,636.73
Construction Survey		$ 200,000.00	$ 200,000.00	$ 200,000.00	$ 200,000.00	$ 200,000.00	$ 200,000.00
Construction Management (% of Construction Cost Total)	8%	$ 1,576,191.92	$ 1,632,840.91	$ 2,056,423.19	$ 1,864,106.56	$ 1,733,130.31	$ 1,558,078.13
Project Total		**$ 28,936,927**	**$ 26,300,824**	**$ 32,760,454**	**$ 29,827,625**	**$ 27,830,237**	**$ 25,160,692**

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4.2.2 Life Cycle Costs

Life cycle costs are based on the King County Life Cycle Cost Analysis Guide in order to address, not only construction costs, but also to compare future costs associated with the maintenance, operation, and replacement of the design alternatives presented in Appendix B. Alternatives were compared using the net present value of each alternative with a life cycle of 50 years and an interest rate of 8 percent. It was assumed that construction would take one year to complete. An Operations and Maintenance (O&M) cost was estimated by assuming that the setback of the levees would make the need for periodic repair of the river bank less urgent, and therefore less frequent and less costly. The O&M cost was estimated to be $6,000 per mile, per year for the setback levees. Floodwall O&M costs was estimated to be $3,500 per mile, per year, and include floodwall costs along with patrol road O&M costs.

5. Multi-criteria Decision Analysis

A multi-criteria evaluation framework was established to value the merits of each alternative in meeting objectives within constraints. Results of the multi-criteria evaluation will be used by decision makers to inform selection of a preferred alternative. The proposed framework follows techniques presented in the “Trade-Off Analysis Planning and Procedures Guidebook,” USACE; IWR 2002. The multi-criteria decision framework and results are detailed below.

5.1 Process

The process established to conduct the multi-criteria decision analysis included the following steps:

1. Establish the main decision support criteria, sub-criteria that support the main criteria, and the associated metrics and weights.
2. Evaluate the sub-criteria to establish the metrics for the main criteria:
   a. Determine the metric value assigned to each sub-criteria.
   b. Normalize the transformed metrics by presenting them as a percent of the maximum value.
   c. Weight the criteria by percent to reflect their importance relative to one another.
   d. Develop a weighted product matrix that will present the weight assigned to each criterion and the product of the weight times the normalized metric for each alternative.
   e. Sum the weighted products to determine the total value assigned to the main criteria.
3. Evaluate the main criteria to determine the alternative(s) with the highest total weighted product, which will indicate the alternative(s) that most successfully meet(s) the planning objectives:
   a. Normalize the transformed metrics by presenting them as a percent of the maximum value.
   b. Weight the criteria by percent to reflect their importance relative to one another.
   c. Develop a weighted product matrix that will present the weight assigned to each criterion and the product of the weight times the normalized metric for each alternative.
   d. Sum the weighted products to determine the total value assigned to the main criteria.

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5.2 Analysis

5.2.1 Criteria, Metrics, and Weighting

Main criteria and sub-criteria were developed for use in differentiating and choosing among the alternatives. The criteria were weighted by percent, reflecting their importance relative to one another with respect to their contributions towards meeting the objectives, and any other attributes that are important to the entities involved. The criteria, metrics, and weightings are presented in Table 3.

Table 3. Lower Russell Road Levee Setback Project Multi-criteria Decision Criteria, Metrics, and Weighting

MAIN CRITERIA	SUB-CRITERIA	METRICS	WEIGHTING (percent)	
FLOOD PROTECTION		Contribution towards flood protection objectives based on the sum of the weighted products of the sub-criteria metrics.		40
	Conveyance Capacity:	The degree to which the system conveys the 0.2 percent annual exceedance probability (500-year) flood meeting freeboard requirements. The design flood flow is 18,500 cfs. 0 = Does not meet design capacity 3 = Meets design capacity	50	
	Scour Protection Needed:	The degree to which the location of the flood protection system reduces scour potential and the need for scour protection measures based on qualitative assessment scored as: 1 = High scour protection needs 2 = Moderate scour protection needs 3 = Minor scour protection needs	50	
RIPARIAN AND AQUATIC HABITAT		Contribution towards riparian and aquatic habitat objectives based on the sum of the weighted products of the sub-criteria metrics.		30
	Riparian and Aquatic Habitat Proposed Current Improvements:	Contribution towards riparian and aquatic habitat objectives based on the multi-criteria analysis presented in Appendix C3.	75	
	Compatibility with Potential Future Restoration:	The degree to which the location of the flood protection system reduces potential conflicts with future efforts to expand aquatic and/or riparian habitat based on a qualitative assessment scored as: 1 = Low compatibility due to the relatively small acreage remaining	25	

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MAIN CRITERIA	SUB-CRITERIA	METRICS	WEIGHTING (percent)	
		between the proposed levee/floodwall alignment and the river. 2 = Moderate compatibility due to the relatively moderate amount of acreage remaining between the proposed levee/floodwall alignment and the river. 3 = High compatibility due to the relatively moderate amount of acreage remaining between the proposed levee/floodwall alignment and the river.		
PERMITABILITY OF ALTERNATIVE		The degree to which the alternative is permitable by federal, state, and local agencies based on the sum of the weighted products of the sub-criteria metrics.		10
	Federal Permitability	1 = Federal Individual Permit required; alternative requires longer permit process for agency approvals 2 = Federal Nationwide Permits required; alternative requires shorter permit process 3 = No permits required	40	
	State Permitability	1 = State Permits required; alternative requires longer permit process for agency approvals and Tribal concurrence 3 = No permits required	30	
	Local Permitability	1 = Permits from City of Kent and other local entities required; alternative requires longer permit process (ie, Hearing Examiner or City Council Decision) 2 = Permits from City of Kent and other local entities required; alternative can be approved through administrative processes. 3 = No permits required	30	
ACCESS AND RECREATION		Contribution towards access and recreation objectives based on the sum of the weighted products of the sub-criteria metrics.		20
	Vehicular Connectivity	The degree to which the alternative maintains vehicular connectivity between the park, businesses, and streets based upon a qualitative assessment scored as: 1 = Low connectivity	30	

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MAIN CRITERIA	SUB-CRITERIA	METRICS	WEIGHTING (percent)
		2 = Medium connectivity 3 = High connectivity	
	Pedestrian/Bicycle Connectivity	The degree to which the alternative maintains pedestrian/bicycle connectivity between the trails, the park, and streets based on a qualitative assessment scored as 1 = Low connectivity 2 = Medium connectivity 3 = High connectivity	30
	Pedestrian/Bicycle Safety	The degree to which the alternative improves pedestrian/bicycle safety and user experience by increasing widths of facilities, separating facilities from traffic, and/or providing visual monitoring from the roadway based on a qualitative assessment scored as: 1 = Low improvement 2 = Medium improvement 3 = High improvement	40

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5.2.2 Analysis

The multi-criteria analysis of the main criteria for each alternative is summarized in Table 4. Review of the Weighted Product Matrix table indicates that Alternatives 3a and 3b have the largest weighted product sum. The evaluation of the associated sub-criteria is presented in Appendix C.

Table 4. Lower Russell Road Levee Setback Project Multi-criteria Decision Analysis of Main Criteria

Decision Matrix

	Flood Protection	Riparian / Aquatic Habitat	Permitability of Alternative	Access and Recreation
Alternative 1a	1.00	0.66	1.00	0.87
Alternative 1c	0.67	0.76	0.80	0.63
Alternative 2b	1.00	0.92	1.00	0.70
Alternative 3a	1.00	1.00	1.00	0.80
Alternative 3b	1.00	0.92	1.00	0.87
Alternative 4a	1.00	0.74	1.00	0.80

Normalized Criteria Matrix (by Percent of Maximum)

	Flood Protection	Riparian / Aquatic Habitat	Permitability of Alternative	Access and Recreation
Alternative 1a	1.00	0.66	1.00	1.00
Alternative 1c	0.67	0.76	0.80	0.73
Alternative 2b	1.00	0.92	1.00	0.81
Alternative 3a	1.00	1.00	1.00	0.92
Alternative 3b	1.00	0.92	1.00	1.00
Alternative 4a	1.00	0.74	1.00	0.92

Weighted Product Matrix

	Flood Protection	Riparian / Aquatic Habitat	Permitability of Alternative	Access and Recreation	Total
Weight %	40.00%	30.00%	10.00%	20.00%	100.00%
Alternative 1a	1.00	0.66	1.00	1.00	
Product	0.400	0.197	0.100	0.200	0.897
Alternative 1c	0.67	0.76	0.80	0.73	
Product	0.267	0.227	0.080	0.146	0.719
Alternative 2b	1.00	0.92	1.00	0.81	
Product	0.400	0.275	0.100	0.162	0.937
Alternative 3a	1.00	1.00	1.00	0.92	
Product	0.350	0.300	0.100	0.185	0.985
Alternative 3b	1.00	0.92	1.00	1.00	
Product	0.400	0.277	0.100	0.200	0.977
Alternative 4a	1.00	0.74	1.00	0.92	
Product	0.400	0.222	0.100	0.185	0.907

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6. Comparison of Alternatives

Table 5 provides a comparison between alternatives of the weighted product sum, first cost, and life cycle costs. This information will support the decision makers in selecting the preferred alternative that will continue on into the 30-percent design phase.

Table 5. Lower Russell Road Levee Setback Project Comparison of Alternatives

Alternative	Multi-criteria Analysis Score	First Costs	Life Cycle Costs
Alternative 1a	0.897	$28,936,927.	$2,482,260.
Alternative 1c	0.719	$26,300,824.	$2,176,560.
Alternative 2b	0.937	$32,760,454.	$2,715,230.
Alternative 3a	0.985	$29,827,625.	$2,571,960.
Alternative 3b	0.977	$27,830,237.	$2,312,160.
Alternative 4a	0.907	$25,160,692.	$2,080,240.

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Appendix A

Lower Russell Road Levee Setback Project

Typical Cross Sections

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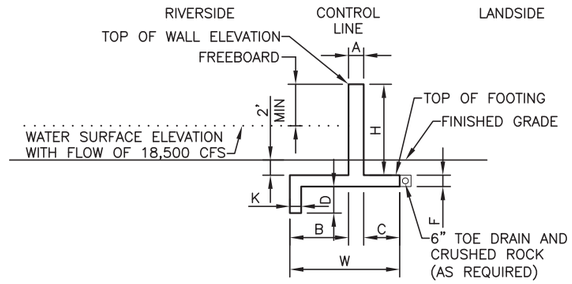
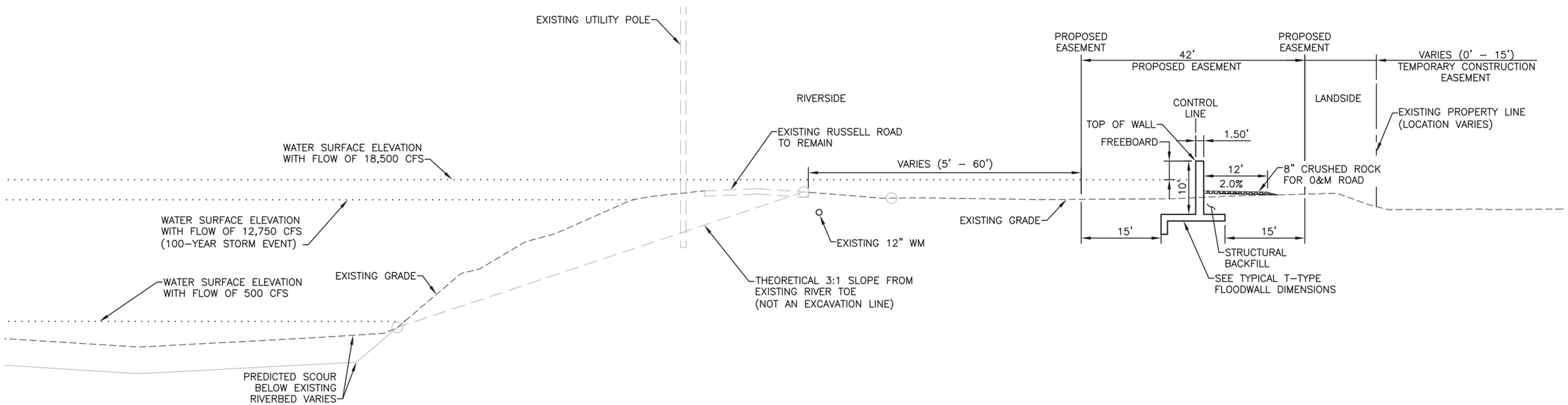


T–TYPE FLOODWALL DIMENSION TABLE (DIMENSIONS BELOW ARE IN FEET)							
WALL (H)	A	W	B	C	F	K	D
4.00	1.00	4.00	1.67	1.33	1.00	0.00	0.00
6.00	1.00	7.00	3.67	2.33	1.00	0.00	0.00
8.00	1.25	11.00	6.25	3.50	1.25	0.00	0.00
10.00	1.50	12.00	6.50	4.00	1.25	1.20	2.50
12.00	2.00	14.50	7.75	4.75	1.50	1.50	3.50
14.00	2.00	17.00	9.25	5.75	1.50	1.50	4.00

A TYPICAL T–TYPE FLOODWALL DIMENSIONS
NTS



NEW FLOODWALL AND KEEP EXISTING ROAD
228TH STREET TO PSE CORRIDOR

1 NTS

CALL 2 WORKING DAYS
BEFORE YOU DIG
1-800-424-5555
(UNDERGROUND UTILITY LOCATIONS ARE APPROX.)

Know what's below.
Call before you dig.

SURVEY JOB NO/SOURCE:	--	--				FUNDING:	-- --	XX% DESIGN PROGRESS COPY XX/XX/XX	PRELIMINARY NOT FOR CONSTRUCTION	King County Department of Natural Resources and Parks Water and Land Resources Division *River and Floodplain Management Section* *Christie True, Director*	LOWER RUSSELL ROAD BASIS OF DESIGN **DRAFT** NEW FLOODWALL AND KEEP EXISTING ROAD 228TH STREET TO PSE CORRIDOR	SHEET 1 OF 4 SHEETS
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DESIGNED:	--	--	NUM.	REVISION	BY	DATE						
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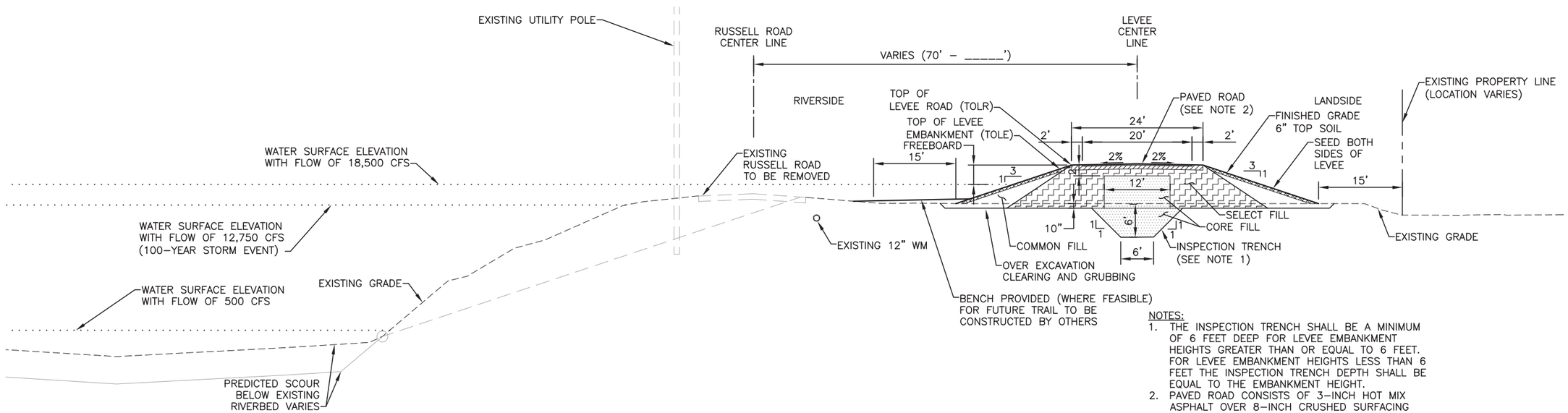
SUPERVISOR:	--	--										
			NUM.	RECORD CHANGES APPROVED	BY	DATE						



NOTES:

1. THE INSPECTION TRENCH SHALL BE A MINIMUM OF 6 FEET DEEP FOR LEVEE EMBANKMENT HEIGHTS GREATER THAN OR EQUAL TO 6 FEET. FOR LEVEE EMBANKMENT HEIGHTS LESS THAN 6 FEET THE INSPECTION TRENCH DEPTH SHALL BE EQUAL TO THE EMBANKMENT HEIGHT.
2. PAVED ROAD CONSISTS OF 3–INCH HOT MIX ASPHALT OVER 8–INCH CRUSHED SURFACING BASE COURSE.

NEW 20–FOOT ROAD ON LEVEE
228TH STREET TO PSE CORRIDOR

2 NTS

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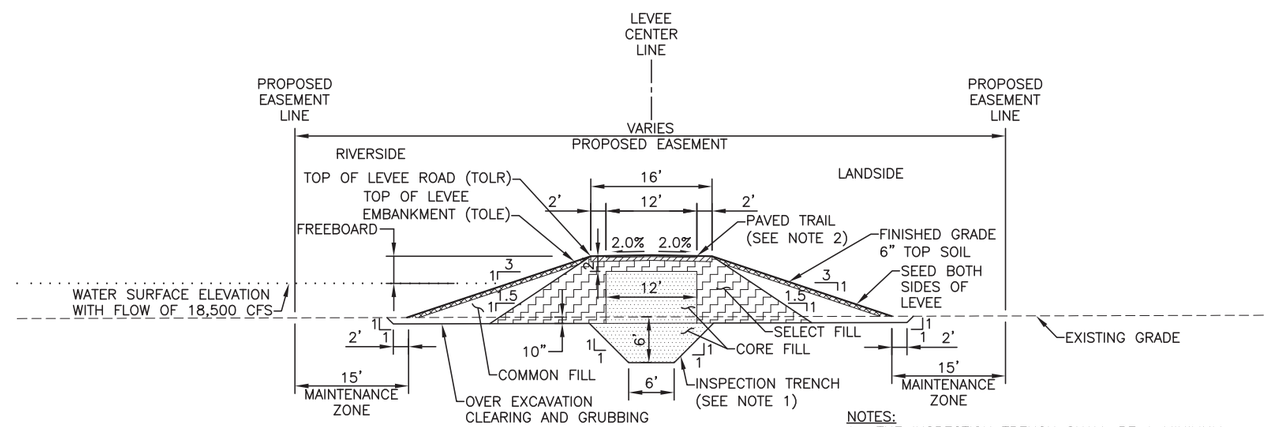
Water and Land Resources Division
River and Floodplain Management Section
Christie True, Director

LOWER RUSSELL ROAD
BASIS OF DESIGN
DRAFT
NEW 20–FOOT ROAD ON LEVEE
228TH STREET TO PSE CORRIDOR

SHEET **2** OF **4** SHEETS



NOTES:

1. THE INSPECTION TRENCH SHALL BE A MINIMUM OF 6 FEET DEEP FOR LEVEE EMBANKMENT HEIGHTS GREATER THAN OR EQUAL TO 6 FEET. FOR LEVEE EMBANKMENT HEIGHTS LESS THAN 6 FEET THE INSPECTION TRENCH DEPTH SHALL BE EQUAL TO THE EMBANKMENT HEIGHT.
2. PAVED TRAIL CONSISTS OF 2.5–INCH HOT MIX ASPHALT OVER 6–INCH CRUSHED SURFACING BASE COURSE.

TYPICAL STANDARD LEVEE
PSE CORRIDOR TO VAN DOREN'S PARK
AND VAN DOREN'S PARK TO 212TH STREET

3 NTS

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			NUM. RECORD CHANGES APPROVED	BY	DATE

FUNDING: -- --
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LOWER RUSSELL ROAD
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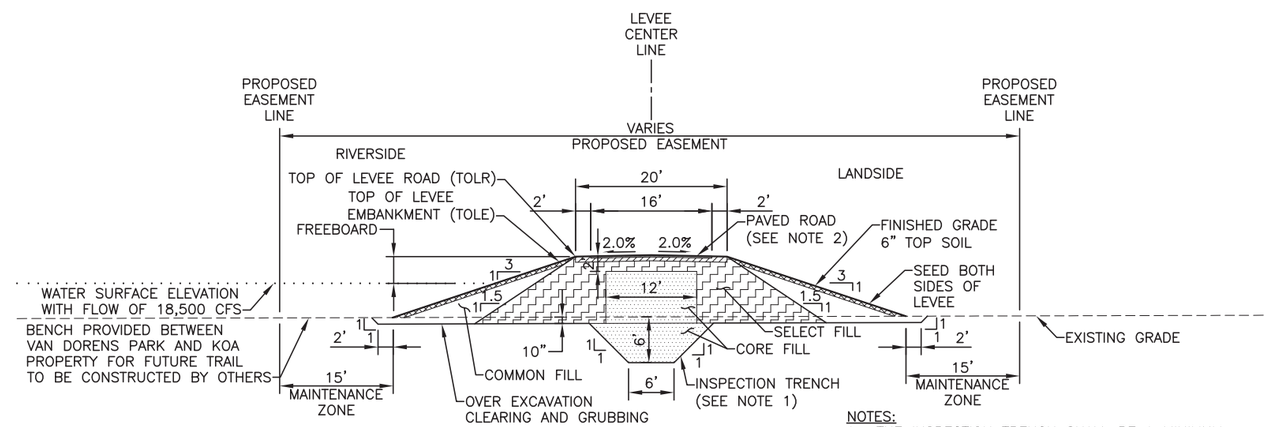
TYPICAL STANDARD LEVEE
PSE CORRIDOR TO VAN DOREN'S PARK
AND VAN DOREN'S PARK TO 212TH STREET

SHEET **3** OF **4** SHEETS



NOTES:

1. THE INSPECTION TRENCH SHALL BE A MINIMUM OF 6 FEET DEEP FOR LEVEE EMBANKMENT HEIGHTS GREATER THAN OR EQUAL TO 6 FEET. FOR LEVEE EMBANKMENT HEIGHTS LESS THAN 6 FEET THE INSPECTION TRENCH DEPTH SHALL BE EQUAL TO THE EMBANKMENT HEIGHT.
2. PAVED ROAD CONSISTS OF 3–INCH HOT MIX ASPHALT OVER 6–INCH CRUSHED SURFACING BASE COURSE.

NEW 16–FOOT ROAD ON LEVEE
VAN DOREN'S PARK TO 212TH STREET

4 NTS

CALL 2 WORKING DAYS
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(UNDERGROUND UTILITY LOCATIONS ARE APPROX.)

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SUPERVISOR:	--	--			
			NUM. RECORD CHANGES APPROVED	BY	DATE

FUNDING: -- --
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PROJECT No. -- --
CONTRACT No. -- --

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King County
Department of Natural Resources and Parks
Water and Land Resources Division
River and Floodplain Management Section
Christie True, Director

LOWER RUSSELL ROAD
BASIS OF DESIGN
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NEW 16–FOOT ROAD ON LEVEE
VAN DOREN'S PARK TO 212TH STREET

SHEET **4** OF **4** SHEETS

Appendix B1

Lower Russell Road Levee Setback Project

Detailed Engineer's Opinion of Costs

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Lower Russell Road Levee Setback Project

Table B1 - Detail Breakdown of Engineer's Opinion of Costs

Bid Item No.	Item Description	Unit Price	Alternative 1A Quantity	Alternative 1A Total Amount	Alternative 1C Quantity	Alternative 1C Total Amount	Alternative 2B Quantity	Alternative 2B Total Amount	Alternative 3A Quantity	Alternative 3A Total Amount	Alternative 3B Quantity	Alternative 3B Total Amount	Alternative 4A Quantity	Alternative 4A Total Amount
Part 1 - Site Removals and General														
1000	Mob/Demob (% of Site Removal Bid Item Costs)	3%	-	$ 9,773	-	$ 7,233	-	$ 6,815	-	$ 6,853	-	$ 6,879	-	$ 6,708
1005	Minor Work Allowance	$ 20,000.00	1 AL	$ 20,000	1 AL	$ 20,000	1 AL	$ 20,000	1 AL	$ 20,000	1 AL	$ 20,000	1 AL	$ 20,000
1010	Excavator with Operator	$ 250.00	20 HR	$ 5,000	20 HR	$ 5,000	20 HR	$ 5,000	20 HR	$ 5,000	20 HR	$ 5,000	20 HR	$ 5,000
1015	General Laborer	$ 60.00	40 HR	$ 2,400	40 HR	$ 2,400	40 HR	$ 2,400	40 HR	$ 2,400	40 HR	$ 2,400	40 HR	$ 2,400
1020	Foreman with Truck	$ 115.00	20 HR	$ 2,300	20 HR	$ 2,300	20 HR	$ 2,300	20 HR	$ 2,300	20 HR	$ 2,300	20 HR	$ 2,300
1025	Plastic Construction Fence	$ 2.00	14,395 LF	$ 28,791	15,735 LF	$ 31,471	14,326 LF	$ 28,652	14,607 LF	$ 29,215	14,607 LF	$ 29,215	14,007 LF	$ 28,015
1030	Demolition of Noble Pacific Property	$ 100,000.00	1 LS	$ 100,000	0 LS	$ -	0 LS	$ -	0 LS	$ -	0 LS	$ -	0 LS	$ -
1035	Clearing and Grubbing	$ 2,500.00	26.27 AC	$ 65,675	27.85 AC	$ 69,637	26.89 AC	$ 67,227	27.17 AC	$ 67,928	27.51 AC	$ 68,777	25.71 AC	$ 64,275
1040	Remove Tree	$ 30,000.00	1 LS	$ 30,000	1 LS	$ 30,000	1 LS	$ 30,000	1 LS	$ 30,000	1 LS	$ 30,000	1 LS	$ 30,000
1045	Salvage Tree	$ 500.00	10 EA	$ 5,000	10 EA	$ 5,000	10 EA	$ 5,000	10 EA	$ 5,000	10 EA	$ 5,000	10 EA	$ 5,000
1050	Remove Guardrail	$ 3.00	0 LF	$ -	1,102 LF	$ 3,306	0 LF	$ -	0 LF	$ -	0 LF	$ -	0 LF	$ -
1055	Salvage and Replace Split Rail Fence	$ 10.00	4,200 LF	$ 42,000	4,200 LF	$ 42,000	4,200 LF	$ 42,000	4,200 LF	$ 42,000	4,200 LF	$ 42,000	4,200 LF	$ 42,000
1060	Remove Fence	$ 3.00	0 LF	$ -	1,800 LF	$ 5,400	0 LF	$ -	0 LF	$ -	0 LF	$ -	0 LF	$ -
1065	Salvage and Reinstall GRNRA Gates	$ 800.00	2 EA	$ 1,600	2 EA	$ 1,600	2 EA	$ 1,600	2 EA	$ 1,600	2 EA	$ 1,600	2 EA	$ 1,600
1070	5 ft Chain Link Fence	$ 50.00	100 LF	$ 5,000	100 LF	$ 5,000	100 LF	$ 5,000	100 LF	$ 5,000	100 LF	$ 5,000	100 LF	$ 5,000
1075	Field Office	$ 18,000.00	1 LS	$ 18,000	1 LS	$ 18,000	1 LS	$ 18,000	1 LS	$ 18,000	1 LS	$ 18,000	1 LS	$ 18,000
Subtotal	***Part 1 - Site Removals and General***			***$ 335,538***		***$ 248,347***		***$ 233,995***		***$ 235,296***		***$ 236,171***		***$ 230,297***
Part 2 - Erosion and Sediment Control														
2000	Mob/Demob (% of Site Removal Bid Item Costs)	3%	-	$ 6,203.40	-	$ 6,184.16	-	$ 6,267.95	-	$ 6,260.04	-	$ 6,260.04	-	$ 6,188.04
2005	Construction Entrance, Rock	$ 30.00	140 TN	$ 4,200	140 TN	$ 4,200	140 TN	$ 4,200	140 TN	$ 4,200	140 TN	$ 4,200	140 TN	$ 4,200
2010	Construction Entrance, Grate	$ 4,000.00	2 EA	$ 8,000	2 EA	$ 8,000	2 EA	$ 8,000	2 EA	$ 8,000	2 EA	$ 8,000	2 EA	$ 8,000
2015	Water For Dust Control (1,000 Gallon)	$ 50.00	1,500 EA	$ 75,000	1,500 EA	$ 75,000	1,500 EA	$ 75,000	1,500 EA	$ 75,000	1,500 EA	$ 75,000	1,500 EA	$ 75,000
2020	Silt Fencing	$ 5.00	1,937 LF	$ 9,687	909 LF	$ 4,547	2,208 LF	$ 11,040	1,937 LF	$ 9,687	1,937 LF	$ 9,687	1,937 LF	$ 9,687
2025	Storm BMP Straw Rolls	$ 4.00	12,458 LF	$ 49,832	14,826 LF	$ 59,304	12,118 LF	$ 48,472	12,670 LF	$ 50,680	12,670 LF	$ 50,680	12,070 LF	$ 48,280
2030	Wood Slash Mulch Berm	$ 3.10	3,875 LF	$ 12,011	1,819 LF	$ 5,638	4,416 LF	$ 13,690	3,875 LF	$ 12,011	3,875 LF	$ 12,011	3,875 LF	$ 12,011
2035	Seeding	$ 2,000.00	3.65 AC	$ 7,300	4.35 AC	$ 8,700	3.89 AC	$ 7,780	4.17 AC	$ 8,340	4.17 AC	$ 8,340	4.17 AC	$ 8,340
2040	Straw Mulch	$ 700.00	30 TN	$ 21,000	30 TN	$ 21,000	30 TN	$ 21,000	30 TN	$ 21,000	30 TN	$ 21,000	30 TN	$ 21,000
2045	Plastic Covering	$ 3.25	3,000 SY	$ 9,750	3,000 SY	$ 9,750	3,000 SY	$ 9,750	3,000 SY	$ 9,750	3,000 SY	$ 9,750	3,000 SY	$ 9,750
2050	Hydraulic Mulch	$ 1,000.00	10 TN	$ 10,000	10 TN	$ 10,000	10 TN	$ 10,000	10 TN	$ 10,000	10 TN	$ 10,000	10 TN	$ 10,000
Subtotal	***Part 2 - Erosion and Sediment Control***			***$ 212,984***		***$ 212,323***		***$ 215,200***		***$ 214,928***		***$ 214,928***		***$ 212,456***
Part 3 - Levee														
3000	Mob/Demob (% of Levee Bid Item Costs)	3%	-	$ 44,215.69	-	$ 53,187.48	-	$ 45,541.41	-	$ 48,793.82	-	$ 50,092.87	-	$ 43,907.06
3005	Over Excavation, 10" Deep	$ 12.00	14,858 CY	$ 178,292	17,931 CY	$ 215,178	14,899 CY	$ 178,788	15,838 CY	$ 190,052	16,294 CY	$ 195,534	14,531 CY	$ 174,372
3010	Over Excavation, 2' Deep (5% of 10" Deep Over Excavation)	$ 12.00	1,040 CY	$ 12,480	1,255 CY	$ 15,062	1,043 CY	$ 12,515	1,109 CY	$ 13,304	1,141 CY	$ 13,687	1,017 CY	$ 12,204
3015	Inspection Trench Excavation	$ 12.00	13,310 CY	$ 159,724	15,840 CY	$ 190,084	12,947 CY	$ 155,365	13,537 CY	$ 162,442	13,537 CY	$ 162,442	12,896 CY	$ 154,752
3020	Levee Fill - Common Fill	$ 3.25	47,495 CY	$ 154,359	56,403 CY	$ 183,310	51,051 CY	$ 165,916	55,305 CY	$ 179,741	55,807 CY	$ 181,373	48,353 CY	$ 157,147
3025	Levee Fill - Select Fill	$ 7.00	32,947 CY	$ 230,629	41,446 CY	$ 290,122	34,178 CY	$ 239,246	37,813 CY	$ 264,691	42,928 CY	$ 300,496	31,304 CY	$ 219,128
3030	Levee Fill - Core Fill	$ 22.00	32,425 CY	$ 713,348	38,607 CY	$ 849,359	33,616 CY	$ 739,553	35,801 CY	$ 787,620	35,801 CY	$ 787,620	32,738 CY	$ 720,236
3035	Place Salvaged Topsoil	$ 8.50	2,944 CY	$ 25,024	3,506 CY	$ 29,801	3,137 CY	$ 26,665	3,366 CY	$ 28,611	3,366 CY	$ 28,611	3,027 CY	$ 25,730
Subtotal	***Part 3 - Levee***			***$ 1,518,072***		***$ 1,826,103***		***$ 1,563,589***		***$ 1,675,255***		***$ 1,719,855***		***$ 1,507,476***
Part 4 - Structural Floodwall														
4000	Mob/Demob (% of Structural Bid Item Costs)	3%	-	$ 89,413.12	-	$ 93,582.53	-	$ 143,626.18	-	$ 89,413.12	-	$ 89,413.12	-	$ 89,413.12
4005	Foundation Excavation Sent Off-Site	$ 12.00	6,760 CY	$ 81,117	3,627 CY	$ 43,519	7,599 CY	$ 91,189	6,760 CY	$ 81,117	6,760 CY	$ 81,117	6,760 CY	$ 81,117
4010	Toe Drain Crushed Rock	$ 62.00	135 CY	$ 8,341	63 CY	$ 3,915	153 CY	$ 9,507	135 CY	$ 8,341	135 CY	$ 8,341	135 CY	$ 8,341
4015	6" Diameter HDPE Toe Drain	$ 16.00	2,906 LF	$ 46,496	1,364 LF	$ 21,824	3,312 LF	$ 52,992	2,906 LF	$ 46,496	2,906 LF	$ 46,496	2,906 LF	$ 46,496
4020	Concrete Wall	$ 564.00	4,280 CY	$ 2,413,884	2,457 CY	$ 1,385,524	4,776 CY	$ 2,693,753	4,280 CY	$ 2,413,884	4,280 CY	$ 2,413,884	4,280 CY	$ 2,413,884
4025	Structural Backfill	$ 21.00	3,885 CY	$ 81,589	1,917 CY	$ 40,262	4,409 CY	$ 92,582	3,885 CY	$ 81,589	3,885 CY	$ 81,589	3,885 CY	$ 81,589
4030	Reinforcement	$ 1,821.00	169 TN	$ 307,178	84 TN	$ 152,739	191 TN	$ 347,841	169 TN	$ 307,178	169 TN	$ 307,178	169 TN	$ 307,178
4035	Flood Gate (120ft W x 10ft H)	$ 1,452,000.00	0 LS	$ -	1 LS	$ 1,452,000	1 LS	$ 1,452,000	0 LS	$ -	0 LS	$ -	0 LS	$ -
4040	Prep Road	$ 1.00	4,520 SY	$ 4,520	2,122 SY	$ 2,122	5,152 SY	$ 5,152	4,520 SY	$ 4,520	4,520 SY	$ 4,520	4,520 SY	$ 4,520
4045	CSBC for O&M of Patrol Road	$ 40.00	933 CY	$ 37,312	438 CY	$ 17,513	1,063 CY	$ 42,524	933 CY	$ 37,312	933 CY	$ 37,312	933 CY	$ 37,312
Subtotal	***Part 4 - Structural Floodwall***			***$ 3,069,850***		***$ 3,213,000***		***$ 4,931,166***		***$ 3,069,850***		***$ 3,069,850***		***$ 3,069,850***

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Lower Russell Road Levee Setback Project

Table B1 - Detail Breakdown of Engineer's Opinion of Costs

Bid Item No.	Item Description	Unit Price	Alternative 1A Quantity	Alternative 1A Total Amount	Alternative 1C Quantity	Alternative 1C Total Amount	Alternative 2B Quantity	Alternative 2B Total Amount	Alternative 3A Quantity	Alternative 3A Total Amount	Alternative 3B Quantity	Alternative 3B Total Amount	Alternative 4A Quantity	Alternative 4A Total Amount
Part 5 - Utility Relocations														
5000	Mob/Demob (% of Utility Bid Item Costs)	3%	-	$ 22,967.85	-	$ 34,085.85	-	$ 25,412.25	-	$ 22,867.50	-	$ 22,867.50	-	$ 22,913.25
5005	Trench Safety System	$ 20,000.00	1 LS	$ 20,000	1 LS	$ 20,000	1 LS	$ 20,000	1 LS	$ 20,000	1 LS	$ 20,000	1 LS	$ 20,000
5010	12" Diameter Water Main (Removal)	$ 15.00	2,975 LF	$ 44,625	4,690 LF	$ 70,350	2,975 LF	$ 44,625	3,740 LF	$ 56,100	3,740 LF	$ 56,100	2,975 LF	$ 44,625
5015	12" Diameter Water Main	$ 130.00	3,739 LF	$ 486,070	6,089 LF	$ 791,570	4,335 LF	$ 563,550	3,625 LF	$ 471,250	3,625 LF	$ 471,250	3,725 LF	$ 484,250
5020	Connect to Existing Water Main	$ 1,500.00	5 EA	$ 7,500	5 EA	$ 7,500	5 EA	$ 7,500	5 EA	$ 7,500	5 EA	$ 7,500	5 EA	$ 7,500
5025	Remove Hydrant	$ 725.00	4 EA	$ 2,900	7 EA	$ 5,075	4 EA	$ 2,900	4 EA	$ 2,900	4 EA	$ 2,900	4 EA	$ 2,900
5030	Hydrant	$ 5,000.00	4 EA	$ 20,000	7 EA	$ 35,000	4 EA	$ 20,000	4 EA	$ 20,000	4 EA	$ 20,000	4 EA	$ 20,000
5035	12" Bends	$ 1,000.00	6 EA	$ 6,000	9 EA	$ 9,000	6 EA	$ 6,000	6 EA	$ 6,000	6 EA	$ 6,000	6 EA	$ 6,000
5040	12" x 6" Tee	$ 1,000.00	4 EA	$ 4,000	7 EA	$ 7,000	4 EA	$ 4,000	4 EA	$ 4,000	4 EA	$ 4,000	4 EA	$ 4,000
5045	12" Gate Valve and Box	$ 4,000.00	6 EA	$ 24,000	9 EA	$ 36,000	7 EA	$ 28,000	6 CY	$ 24,000	6 EA	$ 24,000	6 CY	$ 24,000
5050	6" Gate Valve and Box	$ 1,400.00	4 EA	$ 5,600	7 EA	$ 9,800	4 EA	$ 5,600	4 CY	$ 5,600	4 EA	$ 5,600	4 CY	$ 5,600
5055	Remove 15" PVC Sewer Pipe	$ 15.00	200 LF	$ 3,000	200 LF	$ 3,000	200 LF	$ 3,000	200 LF	$ 3,000	200 LF	$ 3,000	200 LF	$ 3,000
5065	15" PVC, SDR 35, Sewer Pipe	$ 55.00	200 LF	$ 11,000	200 LF	$ 11,000	200 LF	$ 11,000	200 LF	$ 11,000	200 LF	$ 11,000	200 LF	$ 11,000
5060	Remove Sanitary Sewer Manhole	$ 600.00	4 EA	$ 2,400	4 EA	$ 2,400	4 EA	$ 2,400	4 EA	$ 2,400	4 EA	$ 2,400	4 EA	$ 2,400
5070	4' Dia. Sanitary Sewer Manhole	$ 5,000.00	4 EA	$ 20,000	4 EA	$ 20,000	4 EA	$ 20,000	4 EA	$ 20,000	4 EA	$ 20,000	4 EA	$ 20,000
5075	Remove 8" PVC Sewer Pipe	$ 15.00	800 LF	$ 12,000	800 LF	$ 12,000	800 LF	$ 12,000	800 LF	$ 12,000	800 LF	$ 12,000	800 LF	$ 12,000
5080	8" PVC, SDR 35, Sewer Pipe	$ 40.00	800 LF	$ 32,000	800 LF	$ 32,000	800 LF	$ 32,000	800 LF	$ 32,000	800 LF	$ 32,000	800 LF	$ 32,000
5085	Remove 8" DIP Sanitary Sewer FM, CL 52	$ 15.00	500 LF	$ 7,500	500 LF	$ 7,500	500 LF	$ 7,500	500 LF	$ 7,500	500 LF	$ 7,500	500 LF	$ 7,500
5090	8" DIP Sanitary Sewer FM, CL 52	$ 100.00	500 LF	$ 50,000	500 LF	$ 50,000	500 LF	$ 50,000	500 LF	$ 50,000	500 LF	$ 50,000	500 LF	$ 50,000
5095	Connect to Existing Sanitary Sewer FM	$ 3,500.00	2 EA	$ 7,000	2 EA	$ 7,000	2 EA	$ 7,000	2 EA	$ 7,000	2 EA	$ 7,000	2 EA	$ 7,000
5100	PSE OP Utility Relocate (to be relocated by PSE)	$ -	0 LS	$ -	0 LS	$ -	0 LS	$ -	0 LS	$ -	0 LS	$ -	0 LS	$ -
Subtotal	***Part 5 - Utility Relocations***			***$ 788,563***		***$ 1,170,281***		***$ 872,487***		***$ 785,118***		***$ 785,118***		***$ 786,688***
Part 6 - Roadway														
6000	Mob/Demob (% of Roadway Bid Items)	3%	-	$ 10,040.89	-	$ 13,090.29	-	$ 8,555.53	-	$ 8,741.05	-	$ 10,197.01	-	$ 8,495.86
6005	Traffic Control (% of Roadway Bid Items)	2%	-	$ 6,693.93	-	$ 8,726.86	-	$ 5,703.69	-	$ 5,827.37	-	$ 6,798.01	-	$ 5,663.91
6010	Hot Mix Asphalt	$ 85.00	1,714 TN	$ 145,690	2,274 TN	$ 193,290	1,298 TN	$ 110,330	1,348 TN	$ 114,580	1,750 TN	$ 148,750	1,293 TN	$ 109,905
6015	Crushed Surface Base Course	$ 22.00	4,301 TN	$ 94,622	5,870 TN	$ 129,140	3,750 TN	$ 82,500	3,897 TN	$ 85,734	4,378 TN	$ 96,316	3,738 TN	$ 82,236
6020	4" Solid, White Paint Line	$ 3.00	10,200 LF	$ 30,600	14,450 LF	$ 43,350	10,050 LF	$ 30,150	10,350 LF	$ 31,050	10,350 LF	$ 31,050	10,350 LF	$ 31,050
6025	Street Signs	$ 420.00	17 EA	$ 7,140	35 EA	$ 14,700	8 EA	$ 3,360	8 EA	$ 3,360	17 EA	$ 7,140	8 EA	$ 3,360
6030	Bollards, Removable	$ 500.00	2 EA	$ 1,000	4 EA	$ 2,000	4 EA	$ 2,000	2 EA	$ 1,000	2 EA	$ 1,000	2 EA	$ 1,000
6035	Bollards, Fixed	$ 300.00	4 EA	$ 1,200	8 EA	$ 2,400	8 EA	$ 2,400	4 EA	$ 1,200	4 EA	$ 1,200	4 EA	$ 1,200
6040	Removing Asphalt Concrete Pavement	$ 3.00	10,000 SY	$ 30,000	8,056 SY	$ 24,167	10,000 SY	$ 30,000	10,000 SY	$ 30,000	10,000 SY	$ 30,000	10,000 SY	$ 30,000
6045	Roadway Excavation Including Haul	$ 22.00	1,111 CY	$ 24,444	1,241 CY	$ 27,296	1,111 CY	$ 24,444	1,111 CY	$ 24,444	1,111 CY	$ 24,444	1,111 CY	$ 24,444
Subtotal	***Part 6 - Roadway***			***$ 351,431***		***$ 458,160***		***$ 299,444***		***$ 305,937***		***$ 356,895***		***$ 297,355***
Part 7 - Scour														
7000	Mob/Demob (% of Scour Bid Items)	3%	-	$ 45,450.00	-	$ 73,245.00	-	$ 36,900.00	-	$ 36,900.00	-	$ 36,900.00	-	$ 45,450.00
7005	Rock Revetment	$ 700.00	450 LF	$ 315,000	1,585 LF	$ 1,109,500	450 LF	$ 315,000	450 LF	$ 315,000	450 LF	$ 315,000	450 LF	$ 315,000
7010	Wood Structure (wood atop launchable toe)	$ 12,000.00	5 EA	$ 60,000	16 EA	$ 192,000	5 EA	$ 60,000	5 EA	$ 60,000	5 EA	$ 60,000	5 EA	$ 60,000
7015	Scour Protection Deflectors	$ 95,000.00	12 EA	$ 1,140,000	12 EA	$ 1,140,000	9 EA	$ 855,000	9 EA	$ 855,000	9 EA	$ 855,000	12 EA	$ 1,140,000
Subtotal	***Part 7 - Scour***			***$ 1,560,450***		***$ 2,514,745***		***$ 1,266,900***		***$ 1,266,900***		***$ 1,266,900***		***$ 1,560,450***
Part 8 - Habitat Restoration														
8000	Mob/Demo	3%	-	$ 208,465.83	-	$ 171,557.91	-	$ 296,500.37	-	$ 296,500.37	-	$ 257,401.25	-	$ 208,465.83
8005	Remove Riprap (LV)	$ 45.00	1,556 CY	$ 70,020	1,556 CY	$ 70,020	1,556 CY	$ 70,020	1,556 CY	$ 70,020	1,556 CY	$ 70,020	1,556 CY	$ 70,020
8010	Turbidity Curtain, Type 2	$ 35.00	700 LF	$ 24,500	700 LF	$ 24,500	700 LF	$ 24,500	700 LF	$ 24,500	700 LF	$ 24,500	700 LF	$ 24,500
8015	Turbidity Curtain, Type 2 with Filter Screen Skirt	$ 50.00	700 LF	$ 35,000	700 LF	$ 35,000	700 LF	$ 35,000	700 LF	$ 35,000	700 LF	$ 35,000	700 LF	$ 35,000
8020	Turbidity Curtain Relocation	$ 1,000.00	14 EA	$ 14,000	14 EA	$ 14,000	14 EA	$ 14,000	14 EA	$ 14,000	14 EA	$ 14,000	14 EA	$ 14,000
8025	Acres Planted - Excavation Area	VARIES	1 LS	$ 101,300	1 LS	$ 115,200	1 LS	$ 222,600	1 LS	$ 222,600	1 LS	$ 234,800	1 LS	$ 101,300
8030	Acres Planted - Upstream Areas and Van Dorens Park	$ 225,800.00	1 LS	$ 225,800	1 LS	$ 225,800	1 LS	$ 225,800	1 LS	$ 225,800	1 LS	$ 225,800	1 LS	$ 225,800
8035	Wood Structure (Indiviual)	$ 2,348.00	8 EA	$ 18,784	17 EA	$ 39,916	10 EA	$ 23,480	10 EA	$ 23,480	16 EA	$ 37,568	8 EA	$ 18,784
8040	Wood Structure (Floodplain)	$ 10,317.00	24 EA	$ 247,608	27 EA	$ 278,559	23 EA	$ 237,291	23 EA	$ 237,291	24 EA	$ 247,608	24 EA	$ 247,608
8045	Wood Structure (Channel)	$ 12,643.00	28 EA	$ 354,004	27 EA	$ 341,361	27 EA	$ 341,361	27 EA	$ 341,361	24 EA	$ 303,432	28 EA	$ 354,004
8050	Log Cluster	$ 8,093.00	11 EA	$ 89,023	11 EA	$ 89,023	8 EA	$ 64,744	8 EA	$ 64,744	8 EA	$ 64,744	11 EA	$ 89,023
8055	Chain	VARIES	1 LS	$ 79,500	1 LS	$ 238,500	1 LS	$ 79,500	1 LS	$ 79,500	1 LS	$ 79,500	1 LS	$ 79,500
8060	Bar Apex	$ 19,583.00	4 EA	$ 78,332	0 EA	$ -	7 EA	$ 137,081	7 EA	$ 137,081	0 EA	$ -	4 EA	$ 78,332
8065	Inlet ELJ	$ 33,990.00	2 EA	$ 67,980	2 EA	$ 67,980	1 EA	$ 33,990	1 EA	$ 33,990	1 EA	$ 33,990	2 EA	$ 67,980
8070	Wet Excavation	$ 18.00	118,608 CY	$ 2,134,944	66,587 CY	$ 1,198,557	147,471 CY	$ 2,654,477	147,471 CY	$ 2,654,477	111,855 CY	$ 2,013,391	118,608 CY	$ 2,134,944
8075	Salvage Topsoil	$ 8.50	8,100 CY	$ 68,850	10,000 CY	$ 85,000	19,100 CY	$ 162,350	19,100 CY	$ 162,350	20,900 CY	$ 177,650	8,100 CY	$ 68,850
8080	Dry Excavation	$ 12.00	278,268 CY	$ 3,339,216	241,265 CY	$ 2,895,181	463,096 CY	$ 5,557,152	463,096 CY	$ 5,557,152	418,170 CY	$ 5,018,039	278,268 CY	$ 3,339,216
Subtotal	***Part 8 - Habitat Restoration***			***$ 7,157,327***		***$ 5,890,155***		***$ 10,179,846***		***$ 10,179,846***		***$ 8,837,443***		***$ 7,157,327***

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Appendix B2

Lower Russell Road Levee Setback Project

Summary of Engineer's Opinion of Costs

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Lower Russell Road Levee Setback Project
Table B2 - Summary of Engineer's Opinion of Costs

Bid Item No.	Item Description	Unit Price	Alternative 1A Quantity	Alternative 1A Total Amount	Alternative 1C Quantity	Alternative 1C Total Amount	Alternative 2B Quantity	Alternative 2B Total Amount	Alternative 3A Quantity	Alternative 3A Total Amount	Alternative 3B Quantity	Alternative 3B Total Amount	Alternative 4A Quantity	Alternative 4A Total Amount
	Part 1 - Site Removals and General			$ 335,538		$ 248,347		$ 233,995		$ 235,296		$ 236,171		$ 230,297
	Part 2 - Erosion and Sediment Control			$ 212,984		$ 212,323		$ 215,200		$ 214,928		$ 214,928		$ 212,456
	Part 3 - Levee			$ 1,518,072		$ 1,826,103		$ 1,563,589		$ 1,675,255		$ 1,719,855		$ 1,507,476
	Part 4 - Structural Floodwall			$ 3,069,850		$ 3,213,000		$ 4,931,166		$ 3,069,850		$ 3,069,850		$ 3,069,850
	Part 5 - Utility Relocations			$ 788,563		$ 1,170,281		$ 872,487		$ 785,118		$ 785,118		$ 786,688
	Part 6 - Roadway			$ 351,431		$ 458,160		$ 299,444		$ 305,937		$ 356,895		$ 297,355
	Part 7 - Scour			$ 1,560,450		$ 2,514,745		$ 1,266,900		$ 1,266,900		$ 1,266,900		$ 1,560,450
	Part 8 - Habitat Restoration			$ 7,157,327		$ 5,890,155		$ 10,179,846		$ 10,179,846		$ 8,837,443		$ 7,157,327
	Parts 1 - 8 Subtotal			**$ 14,994,215**		**$ 15,533,114**		**$ 19,562,625**		**$ 17,733,129**		**$ 16,487,160**		**$ 14,821,900**
	Construction Contingency	*20%*		*$ 2,998,843.07*		*$ 3,106,622.74*		*$ 3,912,525.09*		*$ 3,546,625.88*		*$ 3,297,432.10*		*$ 2,964,380.01*
	Construction Cost Subtotal			***$ 17,993,058***		***$ 18,639,736***		***$ 23,475,151***		***$ 21,279,755***		***$ 19,784,593***		***$ 17,786,280***
	WA State Sales Tax	*9.5%*		$ 1,709,341		$ 1,770,775		$ 2,230,139		$ 2,021,577		$ 1,879,536		$ 1,689,697
	Construction Cost Total			**$ 19,702,399**		**$ 20,410,511**		**$ 25,705,290**		**$ 23,301,332**		**$ 21,664,129**		**$ 19,475,977**
	Real Estate Acquisition			$ 4,500,000		$ 1,000,000		$ 1,000,000		$ 1,000,000		$ 1,000,000		$ 1,000,000
	Cultural Resources			$ 200,000.00		$ 200,000.00		$ 200,000.00		$ 200,000.00		$ 200,000.00		$ 200,000.00
	Planning, Engineering and Design (% of Construction Cost Total)	14%		$ 2,758,335.86		$ 2,857,471.60		$ 3,598,740.58		$ 3,262,186.48		$ 3,032,978.05		$ 2,726,636.73
	Construction Survey			$ 200,000.00		$ 200,000.00		$ 200,000.00		$ 200,000.00		$ 200,000.00		$ 200,000.00
	Construction Management (% of Construction Cost Total)	8%		$ 1,576,191.92		$ 1,632,840.91		$ 2,056,423.19		$ 1,864,106.56		$ 1,733,130.31		$ 1,558,078.13
	Project Total			**$ 28,936,927**		**$ 26,300,824**		**$ 32,760,454**		**$ 29,827,625**		**$ 27,830,237**		**$ 25,160,692**

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Appendix B3

Lower Russell Road Levee Setback Project

Engineer's Opinion of Probable Life Cycle Costs

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Lower Russell Road Levee Setback Project

Table B3 - Engineer's Opinion of Probable Life Cycle Costs

Item	Item Description	Unit Price	Alternative 1A Quantity	Alternative 1A Total Amount	Alternative 1C Quantity	Alternative 1C Total Amount	Alternative 2B Quantity	Alternative 2B Total Amount	Alternative 3A Quantity	Alternative 3A Total Amount	Alternative 3B Quantity	Alternative 3B Total Amount	Alternative 4A Quantity	Alternative 4A Total Amount
Interest During Construction														
	Total Project Cost			$ 28,936,927		$ 26,300,824		$ 32,760,454		$ 29,827,625		$ 27,830,237		$ 25,160,692
	Interest Rate		0.08		0.08		0.08		0.08		0.08		0.08	
	Construction Period		1 YR		1 YR		1 YR		1 YR		1 YR		1 YR	
	0.5 YR													
	Uniform Construction Expenditure			$ 28,936,927		$ 26,300,824		$ 32,760,454		$ 29,827,625		$ 27,830,237		$ 25,160,692
	Interest During Construction			$ 1,140,000		$ 1,040,000		$ 1,290,000		$ 1,180,000		$ 1,100,000		$ 990,000
TOTAL INVESTMENT COST				$ 30,076,927		$ 26,299,391		$ 32,759,171		$ 31,007,625		$ 27,828,861		$ 25,159,454

Item	Item Description	Unit Price	Alternative 1A Quantity	Alternative 1A Total Amount	Alternative 1C Quantity	Alternative 1C Total Amount	Alternative 2B Quantity	Alternative 2B Total Amount	Alternative 3A Quantity	Alternative 3A Total Amount	Alternative 3B Quantity	Alternative 3B Total Amount	Alternative 3B Quantity	Alternative 3B Total Amount
Interest and Amortization														
	Total First Cost			$ 30,076,927		$ 26,299,391		$ 32,759,171		$ 31,007,625		$ 27,828,861		$ 25,159,454
	Interest Rate		0.08	$ -	0.08	$ -	0.08	$ -	0.08	$ -	0.08	$ -	0.08	$ -
	Amortization Period		50 YR	$ 2,458,600	50 YR	$ 2,149,800	50 YR	$ 2,677,900	50 YR	$ 2,534,700	50 YR	$ 2,274,900	50 YR	$ 2,056,700
Operation and Maintenance														
	Multipurpose Trail	$1,000	0.97 MI	$ 970	1.37 MI	$ 1,370	0.95 MI	$ 960	0.98 MI	$ 990	0.98 MI	$ 990	0.94 MI	$ 950
	Channel Maintenance	$2,000	0.09 MI	$ 180	0.30 MI	$ 610	0.09 MI	$ 180	0.09 MI	$ 180	0.09 MI	$ 180	0.09 MI	$ 180
	Scour Protection	$2,000	0.2 AC	$ 400	0.7 AC	$ 1,330	0.2 AC	$ 400	0.2 AC	$ 400	0.2 AC	$ 400	0.2 AC	$ 400
	Levees	$5,000	0.97 MI	$ 4,830	1.37 MI	$ 6,850	0.95 MI	$ 4,760	0.98 MI	$ 4,910	0.98 MI	$ 4,910	0.94 MI	$ 4,730
	Floodwalls	$2,500	0.55 MI	$ 1,380	0.28 MI	$ 700	0.65 MI	$ 1,630	0.55 MI	$ 1,380	0.55 MI	$ 1,380	0.55 MI	$ 1,380
	Habitat Restoration	$1,000	15.9 AC	$ 15,900	15.9 AC	$ 15,900	29.4 AC	$ 29,400	29.4 AC	$ 29,400	29.4 AC	$ 29,400	15.9 AC	$ 15,900
TOTAL ANNUAL COST				**$ 2,482,260**		**$ 2,176,560**		**$ 2,715,230**		**$ 2,571,960**		**$ 2,312,160**		**$ 2,080,240**

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Appendix B4

Lower Russell Road Levee Setback Project

Noble Warehouse Floodwall and Gate Costs

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Lower Russell Road Levee Setback Project
Table B4 - Noble Pacific Warehouse Floodwall and Gate

Bid Item No.	Item Description		Unit Price	Floodwall and Gate Alternative Quantity		Floodwall and Gate Alternative Total Amount
Part 4 - Structural Floodwall						
4000	Mob/Demob (% of Structural Bid Item Costs)		3%	-	$	54,191
4005	Foundation Excavation Sent Off-Site	$	12.00	839 CY	$	10,068
4010	Toe Drain Crushed Rock	$	62.00	19 CY	$	1,178
4015	6" Diameter HDPE Toe Drain	$	16.00	406 LF	$	6,496
4020	Concrete Wall	$	564.00	496 CY	$	279,744
4025	Structural Backfill	$	21.00	523 CY	$	10,983
4030	Reinforcement	$	1,821.00	22 TN	$	40,062
4035	Flood Gate (120ft W x 10ft H)	$	1,452,000.00	1 LS	$	1,452,000
4040	Prep Road	$	1.00	632 SY	$	632
4045	CSBC for O&M of Patrol Road	$	40.00	130 CY	$	5,200
Subtotal	***Part 4 - Structural Floodwall***				***$***	***1,860,554***
	Construction Contingency		20%		$	372,111
	Construction Cost Subtotal				**$**	**2,232,665**

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Appendix B5

Lower Russell Road Levee Setback Project

Floodwall vs Levee Cost Comparison (Between 228th Street and Kent Nursery)

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Lower Russell Road Levee Setback Project

Table B5 - Floodwall Alternative (Alternative 1a, 2b, 3a, 3b, and 4a) vs Levee Alternative (Alternative 1c) between 228th Street and Kent Nursery

Bid Item No.	Item Description	Unit Price	Floodwall Alternative Quantity	Floodwall Alternative Total Amount	Levee Alternative Quantity	Levee Alternative Total Amount
Part 3 - Levee						
3000	Mob/Demob (% of Levee Bid Item Costs)	3%	-	$ 3,316	-	$ 15,159
3005	Over Excavation, 10" Deep	$ 12.00	1,227 CY	$ 14,724	5,261 CY	$ 63,132
3010	Over Excavation, 2' Deep (5% of 10" Deep Over Excavation)	$ 12.00	86 CY	$ 1,032	368 CY	$ 4,416
3015	Inspection Trench Excavation	$ 12.00	1,228 CY	$ 14,736	4,487 CY	$ 53,844
3020	Levee Fill - Common Fill	$ 3.25	3,344 CY	$ 10,868	15,869 CY	$ 51,574
3025	Levee Fill - Select Fill	$ 7.00	2,138 CY	$ 14,966	13,329 CY	$ 93,303
3030	Levee Fill - Core Fill	$ 22.00	2,464 CY	$ 54,208	10,865 CY	$ 239,030
3035	Place Salvaged Topsoil	$ 8.50	202 CY	$ 1,717	983 CY	$ 8,356
Subtotal	***Part 3 - Levee***			***$ 115,567***		***$ 528,814***
Part 4 - Structural Floodwall						
4000	Mob/Demob (% of Structural Bid Item Costs)	3%	-	$ 83,575	-	$ 33,548
4005	Foundation Excavation Sent Off-Site	$ 12.00	6,378 CY	$ 76,536	2,406 CY	$ 28,872
4010	Toe Drain Crushed Rock	$ 62.00	135 CY	$ 8,370	44 CY	$ 2,728
4015	6" Diameter HDPE Toe Drain	$ 16.00	2,906 LF	$ 46,496	958 LF	$ 15,328
4020	Concrete Wall	$ 564.00	3,971 CY	$ 2,239,644	1,652 CY	$ 931,728
4025	Structural Backfill	$ 21.00	3,885 CY	$ 81,585	1,394 CY	$ 29,274
4030	Reinforcement	$ 1,821.00	160 TN	$ 291,360	53 TN	$ 96,513
4035	Flood Gate (120ft W x 10ft H)	$ 1,452,000.00	0 LS	$ -	0 LS	$ -
4040	Prep Road	$ 1.00	4,520 SY	$ 4,520	1,490 SY	$ 1,490
4045	CSBC for O&M of Patrol Road	$ 40.00	933 CY	$ 37,320	308 CY	$ 12,320
Subtotal	***Part 4 - Structural Floodwall***			***$ 2,869,406***		***$ 1,151,801***
Part 5 - Utility Relocations						
5000	Mob/Demob (% of Utility Bid Item Costs)	3%	-	$ 5,498	-	$ 16,636
5005	Trench Safety System	$ 20,000.00	1 LS	$ 20,000	1 LS	$ 20,000
5010	12" Diameter Water Main (Removal)	$ 15.00	575 LF	$ 8,625	2,290 LF	$ 34,350
5015	12" Diameter Water Main	$ 130.00	575 LF	$ 74,750	2,930 LF	$ 380,900
5020	Connect to Existing Water Main	$ 1,500.00	2 EA	$ 3,000	2 EA	$ 3,000
5025	Remove Hydrant	$ 725.00	0 EA	$ -	3 EA	$ 2,175
5030	Hydrant	$ 5,000.00	0 EA	$ -	3 EA	$ 15,000
5035	12" Bends	$ 1,000.00	2 EA	$ 2,000	5 EA	$ 5,000
5040	12" x 6" Tee	$ 1,000.00	1 EA	$ 1,000	4 EA	$ 4,000
5045	12" Gate Valve and Box	$ 4,000.00	2 EA	$ 8,000	5 EA	$ 20,000
5050	6" Gate Valve and Box	$ 1,400.00	1 EA	$ 1,400	4 EA	$ 5,600
5080	8" PVC, SDR 35, Sewer Pipe	$ 40.00	0 LF	$ -	0 LF	$ -
5085	Remove 8" DIP Sanitary Sewer FM, CL 52	$ 15.00	500 LF	$ 7,500	500 LF	$ 7,500
5090	8" DIP Sanitary Sewer FM, CL 52	$ 100.00	500 LF	$ 50,000	500 LF	$ 50,000
5095	Connect to Existing Sanitary Sewer FM	$ 3,500.00	2 EA	$ 7,000	2 EA	$ 7,000
5100	PSE OP Utility Relocate (to be relocated by PSE)	$ -	0 LS	$ -	0 LS	$ -
Subtotal	***Part 5 - Utility Relocations***			***$ 188,773***		***$ 571,161***
Part 6 - Roadway						
6000	Mob/Demob (% of Roadway Bid Items)	3%	-	$ 1,128	-	$ 4,617
6005	Traffic Control (% of Roadway Bid Items)	2%	-	$ 751.72	-	$ 3,078.13
6010	Hot Mix Asphalt	$ 85.00	208 TN	$ 17,714	830 TN	$ 70,550
6015	Crushed Surface Base Course	$ 22.00	587 TN	$ 12,914	2,336 TN	$ 51,392
6040	Removing Asphalt Concrete Pavement	$ 3.00	1,278 SY	$ 3,834	1,556 SY	$ 4,668
6045	Roadway Excavation Including Haul	$ 22.00	142 CY	$ 3,124	1,241 CY	$ 27,296
Subtotal	***Part 6 - Roadway***			***$ 39,465***		***$ 161,602***
Part 7 - Scour						
7000	Mob/Demob (% of Scour Bid Items)	3%	-	$ -	-	$ 37,245.00
7005	Rock Revetment	$ 700.00	0 LF	$ -	1,585 LF	$ 1,109,500
7010	Wood Structure (wood atop launchable toe)	$ 12,000.00	0 EA	$ -	11 EA	$ 132,000
Subtotal	***Part 7 - Scour***			***$ -***		***$ 1,278,745***
	Part 3 - Levee			$ 115,567		$ 528,814
	Part 4 - Structural Floodwall			$ 2,869,406		$ 1,151,801
	Part 5 - Utility Relocations			$ 188,773		$ 571,161
	Part 6 - Roadway			$ 39,465		$ 161,602
	Part 7 - Scour			$ -		$ 1,278,745
	Part 3 - 7 Subtotal			**$ 3,213,212**		**$ 3,692,122**
	Construction Contingency	20%		$ 642,642		$ 738,424
	Construction Cost Subtotal Part 3 - 7			**$ 3,855,854**		**$ 4,430,546**

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Appendix B6

Lower Russell Road Levee Setback Project

Habitat Concept Cost Comparison

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Lower Russell Road Levee Setback Project

Table B6 - Habitat Restoration Concepts between Van Doren's Park and KOA Property

Bid Item No.	Item Description	Unit Price	Habit Concept A Quantity	Habit Concept A Total Amount	Habit Concept B Quantity	Habit Concept B Total Amount	Habit Concept C Quantity	Habit Concept C Total Amount	Habit Concept C Quantity	Habit Concept D Total Amount
Part 7 - Scour										
7000	Mob/Demob (% of Scour Bid Items)	3%	-	$ 34,200.00	-	$ 34,200.00	-	$ 25,650.00	-	$ 25,650.00
7015	Scour Protection Deflectors	$ 95,000.00	12 EA	$ 1,140,000	12 EA	$ 1,140,000	9 EA	$ 855,000	9 EA	$ 855,000
Subtotal	***Part 7 - Scour***			***$ 1,174,200***		***$ 1,174,200***		***$ 880,650***		***$ 880,650***
Part 8 - Habitat Restoration										
8000	Mob/Demo	3%	-	$ 171,557.91	-	$ 208,465.83	-	$ 257,401.25	-	$ 296,500.37
8005	Remove Riprap (LV)	$ 45.00	1,556 CY	$ 70,020	1,556 CY	$ 70,020	1,556 CY	$ 70,020	1,556 CY	$ 70,020
8010	Turbidity Curtain, Type 2	$ 35.00	700 LF	$ 24,500	700 LF	$ 24,500	700 LF	$ 24,500	700 LF	$ 24,500
8015	Turbidity Curtain, Type 2 with Filter Screen Skirt	$ 50.00	700 LF	$ 35,000	700 LF	$ 35,000	700 LF	$ 35,000	700 LF	$ 35,000
8020	Turbidity Curtain Relocation	$ 1,000.00	14 EA	$ 14,000	14 EA	$ 14,000	14 EA	$ 14,000	14 EA	$ 14,000
8025	Acres Planted - Excavation Area	VARIES	1 LS	$ 115,200	1 LS	$ 101,300	1 LS	$ 234,800	1 LS	$ 222,600
8030	Acres Planted - Upstream Areas and Van Dorens Park	$ 225,800.00	1 LS	$ 225,800	1 LS	$ 225,800	1 LS	$ 225,800	1 LS	$ 225,800
8035	Wood Structure (Individual)	$ 2,348.00	17 EA	$ 39,916	8 EA	$ 18,784	16 EA	$ 37,568	10 EA	$ 23,480
8040	Wood Structure (Floodplain)	$ 10,317.00	27 EA	$ 278,559	24 EA	$ 247,608	24 EA	$ 247,608	23 EA	$ 237,291
8045	Wood Structure (Channel)	$ 12,643.00	27 EA	$ 341,361	28 EA	$ 354,004	24 EA	$ 303,432	27 EA	$ 341,361
8050	Log Cluster	$ 8,093.00	11 EA	$ 89,023	11 EA	$ 89,023	8 EA	$ 64,744	8 EA	$ 64,744
8055	Chain	VARIES	1 LS	$ 238,500	1 LS	$ 79,500	1 LS	$ 79,500	1 LS	$ 79,500
8060	Bar Apex	$ 19,583.00	0 EA	$ -	4 EA	$ 78,332	0 EA	$ -	7 EA	$ 137,081
8065	Inlet ELJ	$ 33,990.00	2 EA	$ 67,980	2 EA	$ 67,980	1 EA	$ 33,990	1 EA	$ 33,990
8070	Wet Excavation	$ 18.00	66,587 CY	$ 1,198,557	118,608 CY	$ 2,134,944	111,855 CY	$ 2,013,391	147,471 CY	$ 2,654,477
8075	Salvage Topsoil	$ 8.50	10,000 CY	$ 85,000	8,100 CY	$ 68,850	20,900 CY	$ 177,650	19,100 CY	$ 162,350
8080	Dry Excavation	$ 12.00	241,265 CY	$ 2,895,181	278,268 CY	$ 3,339,216	418,170 CY	$ 5,018,039	463,096 CY	$ 5,557,152
Subtotal	***Part 8 - Habitat Restoration***			***$ 5,890,155***		***$ 7,157,327***		***$ 8,837,443***		***$ 10,179,846***
	Part 7 - Scour			$ 1,174,200		$ 1,174,200		$ 880,650		$ 880,650
	Part 8 - Habitat Restoration			$ 5,890,155		$ 7,157,327		$ 8,837,443		$ 10,179,846
	Part 7 - 8 Subtotal			**$ 7,064,355**		**$ 8,331,527**		**$ 9,718,093**		**$ 11,060,496**
	Construction Contingency	20%		$ 1,412,871		$ 1,666,305		$ 1,943,619		$ 2,212,099
	Construction Cost Subtotal Part 7 & 8			**$ 8,477,226**		**$ 9,997,832**		**$ 11,661,711**		**$ 13,272,595**

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Appendix B7

Lower Russell Road Levee Setback Project

Levee with Trail vs Levee with Road Cost Comparison
(Between Van Doren's Park and 212th Street)

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Lower Russell Road Levee Setback Project

Table B7 - Levee with Trail (Alternative 3a) vs Levee with Road (Alternative 3b) between Van Doren's Park and 212th Street

Bid Item No.	Item Description	Unit Price	Levee with Trail Alternative 3a Quantity	Levee with Trail Alternative 3a Total Amount	Levee with Road Alternative 3b Quantity	Levee with Road Alternative 3b Total Amount
Part 3 - Levee						
3000	Mob/Demob (% of Levee Bid Item Costs)	3%	-	$ 28,085	-	$ 29,383
3005	Over Excavation, 10" Deep	$ 12.00	9,078 CY	$ 108,936	9,534 CY	$ 114,408
3010	Over Excavation, 2' Deep (5% of 10" Deep Over Excavation)	$ 12.00	635 CY	$ 7,620	667 CY	$ 8,004
3015	Inspection Trench Excavation	$ 12.00	7,906 CY	$ 94,872	7,906 CY	$ 94,872
3020	Levee Fill - Common Fill	$ 3.25	31,848 CY	$ 103,506	32,350 CY	$ 105,138
3025	Levee Fill - Select Fill	$ 7.00	20,751 CY	$ 145,257	25,866 CY	$ 181,062
3030	Levee Fill - Core Fill	$ 22.00	20,877 CY	$ 459,294	20,877 CY	$ 459,294
3035	Place Salvaged Topsoil	$ 8.50	1,961 CY	$ 16,669	1,961 CY	$ 16,669
Subtotal	***Part 3 - Levee***			***$ 964,238***		***$ 1,008,829***
Part 6 - Roadway						
6000	Mob/Demob (% of Roadway Bid Items)	3%	-	$ 4,240	-	$ 5,582
6005	Traffic Control (% of Roadway Bid Items)	2%	-	$ 2,827	-	$ 3,722
6010	Hot Mix Asphalt	$ 85.00	671 TN	$ 57,035	1,073 TN	$ 91,205
6015	Crushed Surface Base Course	$ 22.00	1,961 TN	$ 43,142	2,442 TN	$ 53,724
6040	Removing Asphalt Concrete Pavement	$ 3.00	7,556 SY	$ 22,668	7,556 SY	$ 22,668
6045	Roadway Excavation Including Haul	$ 22.00	840 CY	$ 18,480	840 CY	$ 18,480
Subtotal	***Part 6 - Roadway***			***$ 148,391***		***$ 195,381***
	Part 3 - Levee			$ 964,238		$ 1,008,829
	Part 6 - Roadway			$ 148,391		$ 195,381
	Part 3 - 6 Subtotal			**$ 1,112,629**		**$ 1,204,210**
	Construction Contingency	20%		$ 222,526		$ 240,842
	Construction Cost Subtotal Part 3 & 6			**$ 1,335,155**		**$ 1,445,052**

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Appendix C1

Lower Russell Road Levee Setback Project

Flood Protection Multi-sub Criteria Analysis

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Lower Russell Road Levee Setback Project
Flood Protection Multi Sub-criteria Analysis

Decision Matrix

	Flood Protection Objectives	Comments	Scour Protection Needed	Comments
Alternative 1a	3	Provides freeboard requirement for the design flow	3	Floodwall along TIAA-CREF is setback from river and doesn't require scour protection.
Alternative 1c	3	Provides freeboard requirement for the design flow	1	Levee along TIAA-CREF requires scour protection due to its proximity to the river.
Alternative 2b	3	Provides freeboard requirement for the design flow	3	Floodwall along TIAA-CREF is setback from river and doesn't require scour protection.
Alternative 3a	3	Provides freeboard requirement for the design flow	3	Floodwall along TIAA-CREF is setback from river and doesn't require scour protection.
Alternative 3b	3	Provides freeboard requirement for the design flow	3	Floodwall along TIAA-CREF is setback from river and doesn't require scour protection.
Alternative 4a	3	Provides freeboard requirement for the design flow	3	Floodwall along TIAA-CREF is setback from river and doesn't require scour protection.

Normalized Criteria Matrix (By Percent of Maximum)

	Flood Protection Objectives	Scour Protection Needed
Alternative 1a	1.00	1.00
Alternative 1c	1.00	0.33
Alternative 2b	1.00	1.00
Alternative 3a	1.00	1.00
Alternative 3b	1.00	1.00
Alternative 4a	1.00	1.00

Weighted Product Matrix

		Flood Protection Objectives	Scour Protection Needed	Total
Weight %		50.00%	50.00%	100.00%
Alternative 1a		1.00	1.00	
	Product	0.500	0.500	1.000
Alternative 1c		1.00	0.33	
	Product	0.500	0.167	0.667
Alternative 2b		1.00	1.00	
	Product	0.500	0.500	1.000
Alternative 3a		1.00	1.00	
	Product	0.500	0.500	1.000
Alternative 3b		1.00	1.00	
	Product	0.500	0.500	1.000
Alternative 4a		1.00	1.00	
	Product	0.500	0.500	1.000

Appendix C2

Lower Russell Road Levee Setback Project

Riparian and Aquatic Habitat Multi-sub Criteria Analysis

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Lower Russell Road Levee Setback Project
Riparian and Aquatic Habitat Multi Sub-criteria Analysis

Decision Matrix

	Proposed Improvements	Comments	Compatibility w/ Future Restoration	Comments
Alternative 1a	3.38	See Appendix C3	1	Smallest amount of area between river and levee.
Alternative 1c	3.96	See Appendix C3	1	Smallest amount of area between river and levee.
Alternative 2b	4.42	See Appendix C3	2	Medium amount of area between river and levee.
Alternative 3a	4.42	See Appendix C3	3	Largest amount of area between river and levee.
Alternative 3b	3.97	See Appendix C3	3	Largest amount of area between river and levee.
Alternative 4a	3.38	See Appendix C3	2	Medium amount of area between river and levee.

Normalized Criteria Matrix (By Percent of Maximum)

	Proposed Improvements	Compatibility w/ Future Restoration
Alternative 1a	0.76	0.33
Alternative 1c	0.90	0.33
Alternative 2b	1.00	0.67
Alternative 3a	1.00	1.00
Alternative 3b	0.90	1.00
Alternative 4a	0.76	0.67

Weighted Product Matrix

		Proposed Improvements	Compatibility w/ Future Restoration	Total
Weight %		75.00%	25.00%	100.00%
Alternative 1a		0.76	0.33	
	Product	0.574	0.083	0.657
Alternative 1c		0.90	0.33	
	Product	0.672	0.083	0.755
Alternative 2b		1.00	0.67	
	Product	0.750	0.167	0.917
Alternative 3a		1.00	1.00	
	Product	0.750	0.250	1.000
Alternative 3b		0.90	1.00	
	Product	0.674	0.250	0.924
Alternative 4a		0.76	0.67	
	Product	0.574	0.167	0.740

Appendix C3

Framework to Evaluate Ecological Benefits of Alternatives

in the King County Lower Russell Road Levee Setback Project

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Appendix C4

Lower Russell Road Levee Setback Project

Permitability of Alternative

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Lower Russell Road Levee Setback Project
Permitability Multi Sub-criteria Analysis

Decision Matrix

	Federal Permitability	Comments	State Permitability	Comments	Local Permitability	Comments
Alternative 1a	2	Alternative likely can be covered under NWPs	1	Alternatvie requires state agency approvals and Muckleshoot Indian Tribe concurrence	1	Alternative likely will require Hearing Examiner and/or City Council approval for land use permits
Alternative 1c	1	Additional scour protection may trigger IP	1	Alternatvie requires state agency approvals and Muckleshoot Indian Tribe concurrence	1	Alternative likely will require Hearing Examiner and/or City Council approval for land use permits
Alternative 2b	2	Alternative likely can be covered under NWPs	1	Alternatvie requires state agency approvals and Muckleshoot Indian Tribe concurrence	1	Alternative likely will require Hearing Examiner and/or City Council approval for land use permits
Alternative 3a	2	Alternative likely can be covered under NWPs	1	Alternatvie requires state agency approvals and Muckleshoot Indian Tribe concurrence	1	Alternative likely will require Hearing Examiner and/or City Council approval for land use permits
Alternative 3b	2	Alternative likely can be covered under NWPs	1	Alternatvie requires state agency approvals and Muckleshoot Indian Tribe concurrence	1	Alternative likely will require Hearing Examiner and/or City Council approval for land use permits
Alternative 4a	2	Alternative likely can be covered under NWPs	1	Alternatvie requires state agency approvals and Muckleshoot Indian Tribe concurrence	1	Alternative likely will require Hearing Examiner and/or City Council approval for land use permits

Normalized Criteria Matrix (By Percent of Maximum)

	Federal Permitability	State Permitability	Local Permitability
Alternative 1a	1.00	1.00	1.00
Alternative 1c	0.50	1.00	1.00
Alternative 2b	1.00	1.00	1.00
Alternative 3a	1.00	1.00	1.00
Alternative 3b	1.00	1.00	1.00
Alternative 4a	1.00	1.00	1.00

Weighted Product Matrix

		Federal Permitability	State Permitability	Local Permitability	Total
Weight %		40.00%	30.00%	30.00%	100.00%
Alternative 1a		1.00	1.00	1.00	
	Product	0.400	0.300	0.300	1.000
Alternative 1c		0.50	1.00	1.00	
	Product	0.200	0.300	0.300	0.800
Alternative 2b		1.00	1.00	1.00	
	Product	0.400	0.300	0.300	1.000
Alternative 3a		1.00	1.00	1.00	
	Product	0.400	0.300	0.300	1.000
Alternative 3b		1.00	1.00	1.00	
	Product	0.400	0.300	0.300	1.000
Alternative 4a		1.00	1.00	1.00	
	Product	0.400	0.300	0.300	1.000

Appendix C5

Lower Russell Road Levee Setback Project

Access and Recreation

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Lower Russell Road Levee Setback Project
Access and Recreation Multi Sub-criteria Analysis

Decision Matrix

	Vehicular Connectivity	Comments	Pedestrian/Bicycle Connectivity	Comments	Pedestrian/Bicycle Safety	Comments
Alternative 1a	3	Road is connected from 228th St to 212th St	3	Trail is connected from 228th St to 212th St, including the park.	2	Additional vehicle traffic not preferred because of the connecton to 212th. Utilizing the existing roadway south of PSE corridor is preferred.
Alternative 1c	3	Road is connected from 228th St to 212th St	2	Trail is connected from 228th St to 212th St. Trail has to go from at-grade to top of levee multiple times	1	Additional vehicle traffic not preferred because of the connection to 212th. The shared trail and road on a levee south of the PSE corridor also not preferred.
Alternative 2b	1	Road ends at Van Dorens Park, No Access From 212th	2	Trail is connected from 228th St to 212th St, including the park. Trail goes from existing road to levee and back to existing road for a circuitous path around Noble Warehouse.	3	Less vehicle traffic and less steep side slopes where vehicles and non-motorized users mix is preferred.
Alternative 3a	1	Road ends at Van Dorens Park, No Access From 212th	3	Trail is connected from 228th St to 212th St, including the park.	3	Less vehicle traffic and less steep side slopes where vehicles and non-motorized users mix is preferred.
Alternative 3b	3	Road is connected from 228th St to 212th St	3	Trail is connected from 228th St to 212th St, including the park.	2	Additional vehicle traffic not preferred.
Alternative 4a	1	Road ends at Van Dorens Park, No Access From 212th	3	Trail is connected from 228th St to 212th St, including the park.	3	Less vehicle traffic is preferred

Normalized Criteria Matrix (By Percent of Maximum)

	Vehicular Connectivity	Pedestrian/Bicycle Connectivity	Pedestrian/Bicycle Safety
Alternative 1a	1.00	1.00	0.67
Alternative 1c	1.00	0.67	0.33
Alternative 2b	0.33	0.67	1.00
Alternative 3a	0.33	1.00	1.00
Alternative 3b	1.00	1.00	0.67
Alternative 4a	0.33	1.00	1.00

Weighted Product Matrix

		Vehicular Connectivity	Pedestrian/Bicycle Connectivity	Pedestrian/Bicycle Safety	Total
Weight %		30.00%	30.00%	40.00%	100.00%
Alternative 1a		1.00	1.00	0.67	
	Product	0.300	0.300	0.267	0.867
Alternative 1c		1.00	0.67	0.33	
	Product	0.300	0.200	0.133	0.633
Alternative 2b		0.33	0.67	1.00	
	Product	0.100	0.200	0.400	0.700
Alternative 3a		0.33	1.00	1.00	
	Product	0.100	0.300	0.400	0.800
Alternative 3b		1.00	1.00	0.67	
	Product	0.300	0.300	0.267	0.867
Alternative 4a		0.33	1.00	1.00	
	Product	0.100	0.300	0.400	0.800