Appendix C: DOCUMENTATION OF FLOOD MODEL

MEMORANDUM

To: Mike Dahlem, City Engineer, Sumner

From: Dan Eggers, P.E. and Raymond Walton Ph.D., P.E., P.E., WEST Consultants, Inc.

Date: May 5, 2014

Subject: Hydraulic Investigations of the Lower White River

CONSULTANTS, INC.
12509 Bel-Red Road, Suite 100
Bellevue, WA 98005-2535
Phone: (425) 646-8806
Fax: (425) 646-0570
www.westconsultants.com

Introduction

The City of Sumner (City) had previously contracted WEST Consultants, Inc. (WEST) to develop a hydraulic model of the Lower White River. The City was interested in developing a model that reflects the current conditions in the Lower White River channel and its associated floodplain. This "existing conditions" model could then be used as a tool to analyze the anticipated impacts that would be associated with potential future activities within the White River or its associated floodplain.

This memorandum presents a hydraulics assessment performed by WEST for the Lower White River. The City has contracted WEST to provide hydraulic analyses in support of the Draft Supplemental Environmental Impact Statement (SEIS) for the "City of Sumner 2013 Comprehensive Plan Annual Amendments Sumner Meadows Docket." This memorandum discusses the expected impacts associated with potential projects and development adjacent to the Lower White River in the City of Sumner.

The City is interested in understanding the floodplain impacts associated with potential future development within the White River floodplain. These potential activities include the construction of the King County, Countyline Levee Setback project. This project is being assumed to be constructed in the future and constitutes Alternative 5 or the "No Action" Alternative within the SEIS. Additionally, the City is interested in understanding the floodplain impacts that would be caused by development (filling) of the Sumner Meadows Golf Course property from Stewart Road, south to 24th Street, along with the construction of the 24th Street Bridge and roadway corridor. This scenario represents Alternatives 1 through 3 in the SEIS. Lastly, the City is interested in understanding the impacts associated with building the 24th Street Bridge and roadway corridor along with the development (filling) of the agricultural land south of 24th Street. This represents Alternative 4 or the Offsite Alternative in the SEIS.

This memorandum discusses the development of the hydraulic model that was used to analyze the hydraulics of the White River in the area discussed within the SEIS. Alternatives 1 through 3 were found to have potential increases in 100-year water surface elevations compared to Alternative 5 (No Action) that are generally less than 1 foot downstream of 24th Street, 1 to 2 feet between 24th Street and the trail bridge, and less than 0.5 feet between the trail bridge and Stewart Road. The maximum increase is 1.84 feet and occurs at RS 19083

which is between 24th Street and the Lake Tapps tailrace. Alternative 4 was found to have potential increases in 100-year water surface elevations compared to Alternative 5 (No Action) that are generally less than 1 foot in the study area except along the reach of the White River adjacent to the Sumner Meadows Golf Course upstream of 24th Street where increases ranged from 1 to 2 feet.

Existing Conditions

In the lower White River, there are a number of existing hydraulic models:

- A 2005 HEC-RAS hydraulic model developed by Northwest Hydraulic Consultants (nhc) for Pierce County developed for a flood insurance study. The study and documentation were completed, but the study was never made effective by FEMA. We believe that the model used channel cross sections from about 2002.
- A 2012 HEC-RAS hydraulic model developed by STARR for FEMA. The model development is incomplete and was halted while FEMA develop their revised levee policy. The model uses channel cross sections from a 2012 survey, and from 2009 in the lower mile and a half of the river.
- A Corps of Engineers HEC-RAS hydraulic model of the Puyallup, White and Carbon Rivers developed for their General Investigation (GI) study. This model uses cross sections from 2009, but was developed as an unsteady-flow model and uses “storage areas” to model flows along the east overbank from upstream of Stewart Road to the golf course.
- A 2009 HEC-RAS hydraulic model developed by Northwest Hydraulic Consultants (nhc) for King County developed for a flood insurance study. The study and documentation were completed but the study has not yet been made effective by FEMA. We believe that the model used channel cross sections from 2009. The model was calibrated to high water makes from the January 2009 flood.
- A 2012 HEC-RAS hydraulic model developed by Northwest Hydraulic Consultants (nhc) for King County. We understand that the model is incomplete, but replaced the channel sections in the 2009 model with surveyed sections from 2012.
- A 2012 RiverFlow-2D model developed by Herrera Environmental Consultants to evaluate a proposed setback levee in lower King County, to reduce flood levels in the City of Pacific. This model was calibrated to high water marks from the January 2009 flood event.

The 2012 “STARR” model was used as the base model for development of an updated existing conditions hydraulic model. This model extends from the King/Pierce County line to the White River confluence with the Puyallup River; a reach of approximately 5.5 miles. To make the model suitable for analyzing potential activities in the lower White River, the model was supplemented with additional channel cross sections surveyed to provide more detail in areas with sparse coverage. Further, the model was extended upstream into King County to the BNRR bridge at approximate River Mile 6.4 using cross section data from

the 2012 King County HEC-RAS model. Figure 1 shows the cross section layout of the HEC-RAS model of the Lower White River. The various reaches in the 1D model are color coded for ease of reference. Finally, areas that are permitted to be filled were added to the topography.

The calibrated Mannings *n* roughness values from the Pierce County 2005 and King County 2009 HEC-RAS models were applied to the model. There are no known recorded high water marks after 2012 (the year that most of the channel survey data were collected). This makes calibration of the existing conditions model difficult. It was assumed that although channel bed elevations may have changed (especially upstream of Stewart Road), channel roughness has not changed considerably since the 2009 King County HEC-RAS model was calibrated and that the 2009 King County calibrated roughness values are still appropriate for current conditions. This assumption was made because some of the factors that influence channel roughness, such as, bed material size, bank vegetation, sinuosity, and debris potential has changed little from 2009 based on available data. The results of the model for the 1%-annual-chance-flood event (100-year flood) are shown in Table 1, and are color coded to match the cross sections shown in Figure 1.

To validate the existing conditions model, simulated 100-year water surface elevations were compared to the 100-year water surface from the King County RiverFlow-2D model. Figure 2 shows a comparison of HEC-RAS simulated water surface elevations along the White River with RiverFlow-2D results at the same locations for the existing condition. Negative numbers indicate HEC-RAS elevations that are lower than RiverFlow-2D elevations.

The HEC-RAS model results were also compared to the King County 2009 HEC-RAS model results. The King County 2009 model extends from just downstream of the Stewart Road Bridge (River Mile 5.0) to River Mile 10.6. In the City of Sumner reach upstream of Stewart Road, the thalweg elevations are approximately 1 – 2 feet higher than those in the 2009 King County model. Computed water surface elevations are generally 1.5 to 2 feet higher than the 2009 King County elevations.

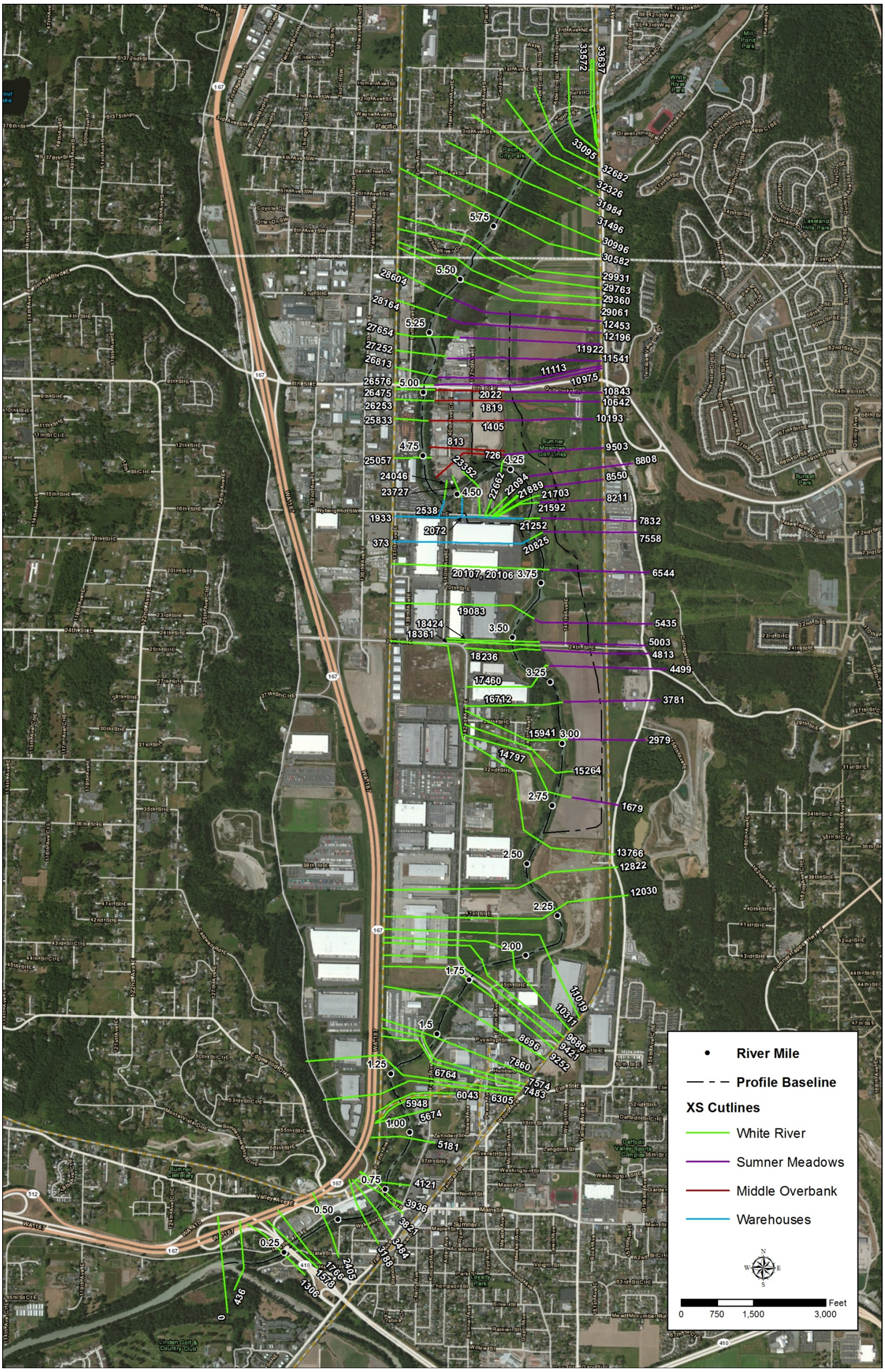

Figure 1. Lower White River Cross Section Layout

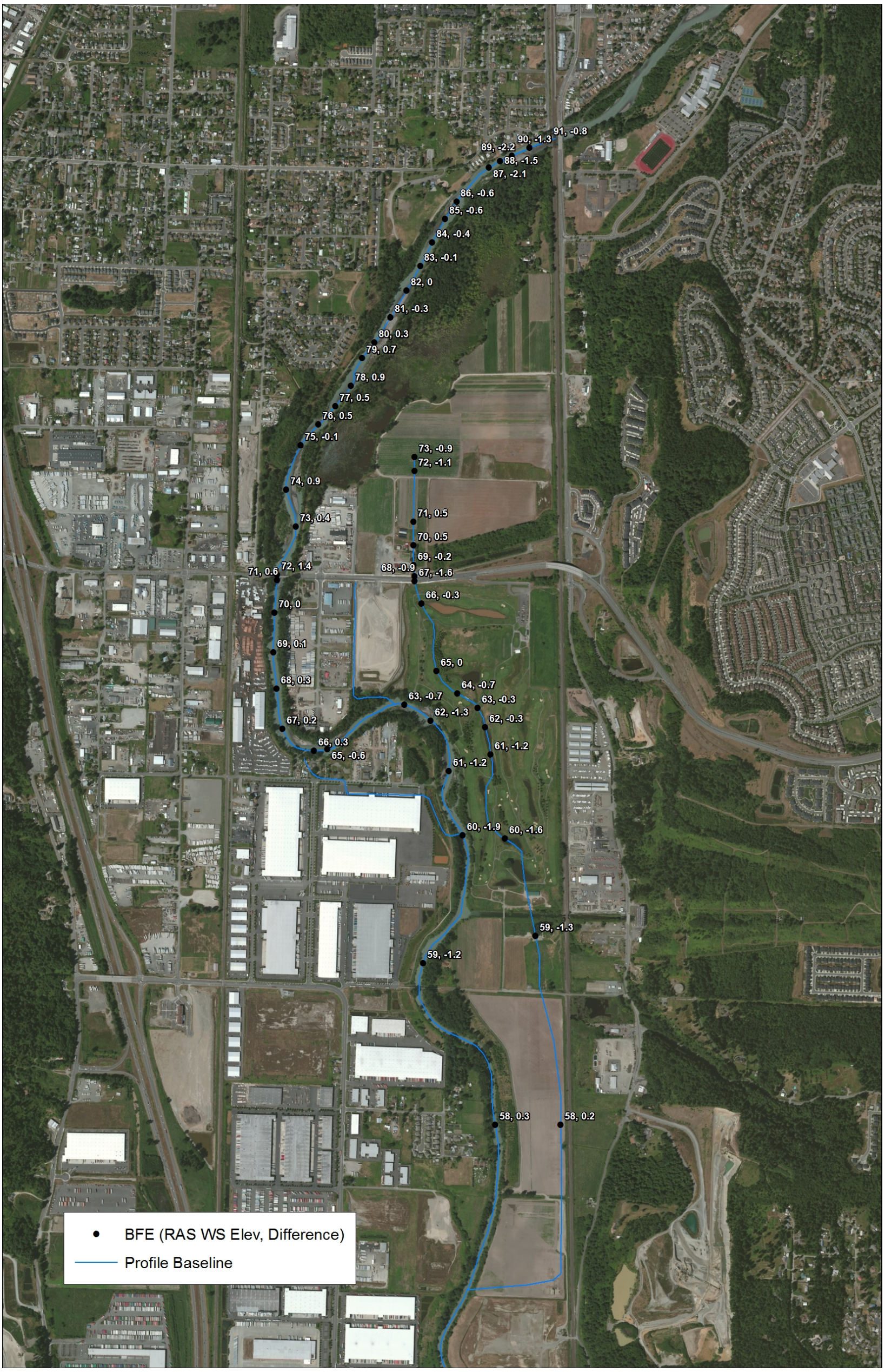

Figure 2. Comparison of HEC-RAS model results to RiverFlow2D results for the existing condition.

No Action Alternative (Alternative 5)

In the “No Action” alternative:

- The proposed King County levee setback project upstream of Stewart Road will have been built. The implications of this are that flood water will no longer overtop the banks upstream of Stewart Road and flow in a southerly direction across Stewart Road and be directed toward the Sumner Municipal Golf Course. Instead, all flow will be directed through the Stewart Road Bridge opening.
- A new crossing of White River along the alignment of 24th Street will be constructed. The implication of this would be to potentially cut off any overbank conveyance areas across the 24th Street alignment.

The results of the model for the 1%-annual-chance-flood event (100-year flood) are shown in Table 1, and are color coded to match the cross sections shown in Figure 1. To validate the “No Action” conditions model, simulated 100-year water surface elevations were compared to the 100-year water surface from the King County RiverFlow-2D model. Figure 3 shows a comparison of HEC-RAS simulated water surface elevations along the White River with RiverFlow-2D results at the same locations for the with King County levee setback project condition.

Alternatives 1, 2 and 3

SEIS Alternatives 1 through 3 include the construction of the 24th Street Bridge, roadway corridor construction, and fill within the Sumner Meadows Property. While there are planning differences, hydraulically they act in the same manner, and are therefore analyzed here collectively.

Alternatives 1-3 include:

- The proposed King County levee setback project upstream of Stewart Road will have been built. The implications of this are that flood water will no longer overtop the banks upstream of Stewart Road and flow in a southerly direction across Stewart Road and be directed toward the Sumner Municipal Golf Course. Instead, all flow will be directed through the Stewart Road Bridge opening.
- A new crossing of White River along the alignment of 24th Street will be constructed. The implication of this would be to potentially cut off any overbank conveyance areas across the 24th Street alignment.
- There will be significant fill placed in the floodway fringe on the left (east) overbank downstream of Stewart Road.

These potential future changes were incorporated in to the hydraulic model by modifying the cross sections to reflect modifications to the overbank ground elevations, by adding bridge structure geometry at the 24th Street crossing, and

by changing flow paths as appropriate to simulate overbank areas that would be cut off due to fill or other activities.

Under the Countyline Levee scenario, flow is prevented from entering the Sumner Meadows property from upstream of Stewart Road. Flow does begin to spill from the mainstem of the White River onto the Sumner Meadows property (left overbank) downstream of RS 9503 (Figure 1) and flows are conveyed through the Sumner Meadows property downstream. With the Sumner Meadows property filled, flow would not spill from the mainstem of the White River into the left overbank until downstream of the 24th Street corridor at approximately RS 4813 (Figure 1). This leaves more flow in the mainstem of the White River through this reach causing higher water surface elevations within the mainstem. The results of the model for the 1%-annual-chance-flood event (100-year flood) are shown in Table 1, and are color coded to match the cross sections shown in Figure 1.

Water surface elevations for the 100-year flow are higher in the mainstem from upstream where the flows would begin to spill from the mainstem under the Countyline Levee scenario (approximately RS 23727) to downstream of the 24th Street corridor (RS 17460). Increases in water surface elevations in the mainstem for the 100-year flood compared to the Countyline Levee scenario are generally less than 1 foot downstream of 24th Street, 1 to 2 feet between 24th Street and the trail bridge, and less than 0.5 feet between the trail bridge and Stewart Road. The maximum increase is 1.84 feet and occurs at RS 19083 which is between 24th Street and the Lake Tapps tailrace. This also means that the areas to the west of the main channel within this reach, which includes several warehouses, also would have higher 100-year water surface elevations of a similar magnitude.

Table 1 shows the expected increases in 100-year water surface elevations for the Sumner Meadows property fill and 24th Street Bridge compared to the Countyline Levee (No Action") Alternative.

The results show the differences in water surface elevations along the White River for the 100-year flow for the existing and Alternative 1-3 conditions. In general, the cumulative effects of the combination of potential future activities are increases in water surface elevations between 0.5 and 1.5 feet. The largest increases are simulated near constrictions (the future 24th Street crossing for example). When not created by the addition of a specific constriction such as the 24th Street crossing, the increases generally are caused by a reduction in the conveyance area of main channel cross sections due to the placement of fill in the cross section overbanks and cutting off of overflow pathways forcing higher peak flows back into the main channel.

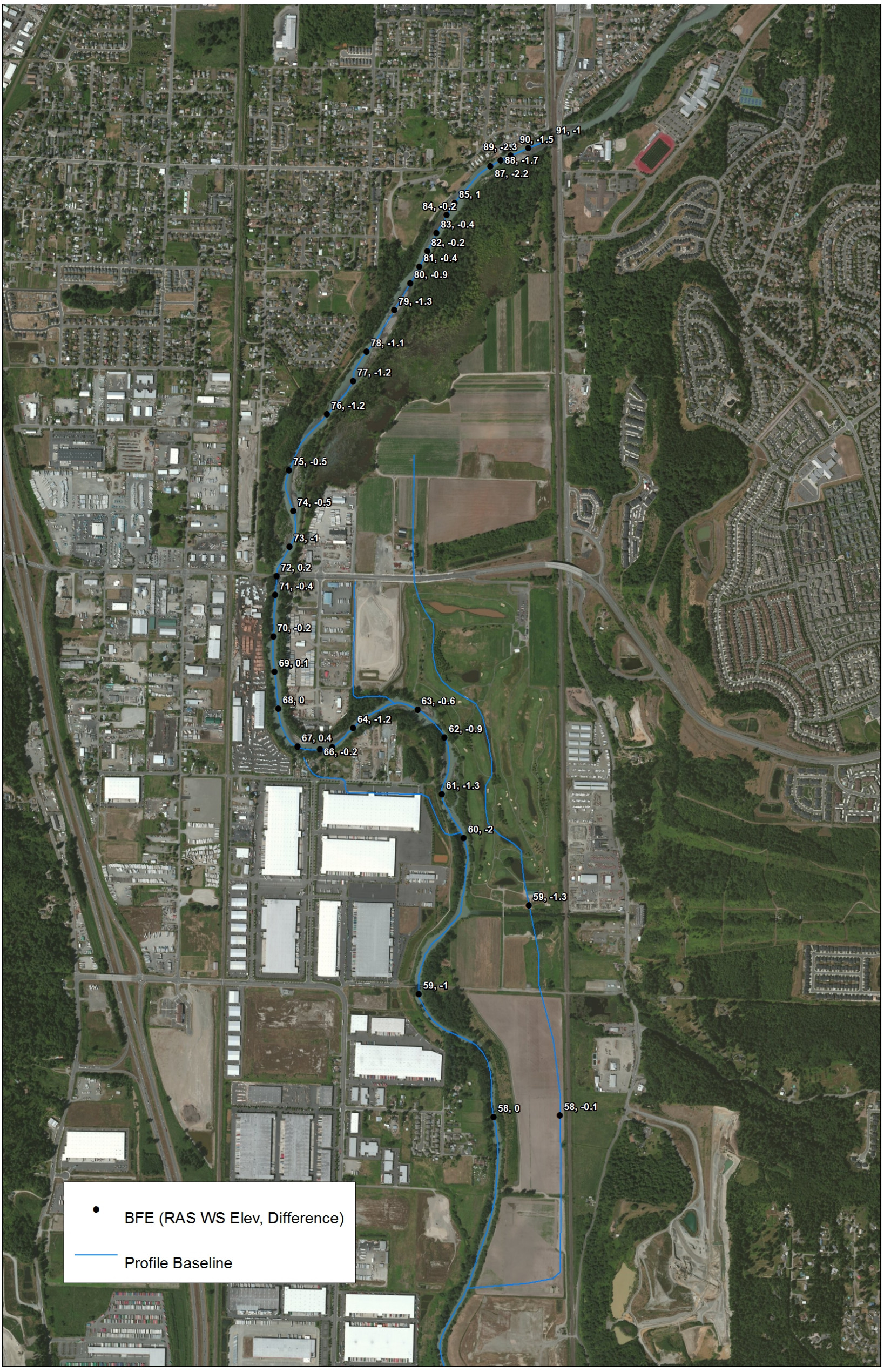

Figure 3. Comparison of HEC-RAS model results to RiverFlow2D results for the King County levee setback condition.

Alternative 4

This alternative assumes that the 24th Street Bridge will be constructed and the agricultural property to the south of 24th Street on the left (east) overbank has been filled to an elevation above the 100-year floodplain for future development. The Countyline Levee Project is also assumed to be in place. No additional fill is placed to the north of 24th Street. This analysis also assumes that no mitigation for increases in water surface elevations has been performed.

Under the Countyline Levee scenario, flow is prevented from entering the Sumner Meadows property from upstream of Stewart Road. Flow does begin to spill from the mainstem of the White River onto the Sumner Meadows property (left overbank) downstream of RS 9503 (Figure 1) and flows are conveyed through the Sumner Meadows property downstream. With the construction of the Countyline Levee Project, the 24th Street Bridge and roadway, and fill to the south of 24th Street, flow would spill from the mainstem of the White River at approximately the same location as the Countyline Levee scenario which is downstream of RS 9503 (Figure 1). However, under the scenario where the 24th Street Bridge and roadway are built, flow would no longer be conveyed in the left (east) overbank beyond 24th Street. Any flow that spilled into the left overbank from upstream would be forced back into the main channel. Additionally, the flow would not be allowed to reenter the left overbank downstream of 24th Street due to the fill that would be placed in the agricultural land to the south of the 24th Street corridor. This leaves more flow in the mainstem of the White River through this reach causing higher water surface elevations within the mainstem. Additionally, 24th Street Bridge Corridor creates a backwater that propagates upstream.

The results of the model for the 1%-annual-chance-flood event (100-year flood) are shown in Table 1, and are color coded to match the cross sections shown in Figure 1. They show the differences in water surface elevations along the White River for the 100-year flow for the existing and Alternative 1-3 conditions. Water surface elevations for the 100-year flow would be higher in the mainstem from approximately RS 24046 to RS 15941 (Figure 1) downstream of the 24th Street Corridor. Increases in water surface elevations in the mainstem for the 100-year flood compared to the Countyline Levee scenario are generally 0.5 feet or less, except for the 4,000 feet upstream of the 24th Street Corridor where they are generally over 1 foot and are 2 feet immediately upstream of the 24th Street Corridor. This also means that the areas to the west of the main channel within this reach, which includes several warehouses, also would have higher 100-year water surface elevations of a similar magnitude. Similarly, the 100-year water surface elevations within the Sumner Meadows property are higher. Table 1 shows the expected increases in 100-year water surface elevations for the 24th Street Bridge and roadway corridor along with the fill to the south of 24th Street compared to the Countyline Levee scenario.

Table 1. Comparison of water surface elevations during 100-year flood

Reach	Cross Section	Existing conditions (ft NAVD)	No Action alternative 5 (ft NAVD	Alternatives 1-3 (ft NAVD	Alternative 4 (ft NAVD
Upper Main	30996	82.39	79.78	80.15	79.78
Upper Main	30582	81.41	78.99	79.07	78.99
Upper Main	29931	79.72	78.13	78.13	78.13
Upper Main	29763	78.91	77.71	77.71	77.71
Upper Main	29360	77.95	76.79	76.79	76.79
Upper Main	29061	77.05	76.23	76.23	76.23
Upper Main	28604	75.67	75.65	75.65	75.65
Upper Main	28164	74.43	75.18	75.18	75.18
Upper Main	27654	73.87	74.50	74.50	74.50
Upper Main	27252	73.00	73.47	73.47	73.47
Upper Main	26813	72.43	72.78	72.78	72.78
Upper Main	26576	72.22	72.50	72.50	72.49
Upper Main	26475	70.76	71.38	71.38	71.38
Upper Main	26253	70.30	70.92	70.92	70.92
Upper Main	25833	69.61	70.20	70.20	70.20
Upper Main	25057	67.96	68.50	68.49	68.50
Upper Main	24046	66.26	66.73	66.71	66.74
Upper Main	23727	64.17	64.63	64.74	64.63
Upper Main	23352	63.58	63.99	64.13	64.01
Upper Mid Main	22662	63.11	63.46	63.75	63.5
Upper Mid Main	22094	61.65	62.54	62.99	62.62
Upper Mid Main	21869	60.92	62.23	62.4	62.29
Upper Mid Main	21703	61.09	62.29	62.46	62.35
Upper Mid Main	21592	61.06	62.25	62.42	62.31
Upper Mid Main	21252	60.89	62.17	62.31	62.23
Upper Mid Main	20825	60.31	61.94	61.93	61.97
Middle Main	20107	59.81	61.74	61.60	61.76
Middle Main	20106	59.81	61.74	61.60	61.76
Middle Main	19083	59.42	61.58	61.19	61.69
Middle Main	18424	58.94	60.92	60.45	60.96
Middle Main	18361	58.94	60.28	59.58	60.33
Middle Main	18236	58.80	59.64	58.64	59.69
Middle Main	17460	58.43	58.98	58.59	58.96
Middle Main	16712	58.12	58.49	58.19	58.35
Middle Main	15941	57.91	58.15	57.96	57.91
Middle Main	15264	57.74	57.98	57.54	57.67
Middle Main	14797	57.43	57.67	57.53	57.42
Lower Main	13766	56.87	57.11	56.87	56.87
Lower Main	12822	56.39	56.65	56.39	56.39

Lower Main	12030	56.16	56.43	56.16	56.16
Lower Main	11019	55.87	56.15	55.87	55.87
Lower Main	10311	55.57	55.83	55.57	55.57
Lower Main	9686	55.19	55.45	55.19	55.19
Lower Main	9421	55.06	55.32	55.07	55.07
Lower Main	9252	54.76	55.00	54.76	54.76
Lower Main	8696	54.65	54.88	54.65	54.65
Lower Main	7860	54.39	54.62	54.39	54.39
Lower Main	7574	54.26	54.49	54.26	54.26
Lower Main	7483	54.12	54.33	54.12	54.12
Lower Main	6764	53.79	54.00	53.79	53.79
Lower Main	6305	53.70	53.91	53.70	53.70
Lower Main	6043	53.51	53.71	53.51	53.51
Lower Main	5948	52.60	52.72	52.60	52.60
Lower Main	5674	52.44	52.55	52.44	52.44
Lower Main	5181	52.31	52.42	52.31	52.31
Lower Main	4121	51.89	51.97	51.89	51.89
Lower Main	3936	51.91	51.99	51.91	51.91
Lower Main	3821	51.91	51.99	51.91	51.91
Lower Main	3484	51.53	51.59	51.53	51.53
Lower Main	3188	51.37	51.41	51.37	51.37
Lower Main	2405	51.15	51.18	51.15	51.15
Lower Main	1766	50.98	51.00	50.98	50.98
Lower Main	1578	50.78	50.79	50.78	50.78
Lower Main	1306	50.78	50.78	50.78	50.78
Lower Main	436	50.76	50.76	50.76	50.76
Lower Main	0	50.74	50.74	50.74	50.74
Mid OB	2022	66.03	67.26	67.26	67.26
Mid OB	1819	65.97	67.20	67.19	67.20
Mid OB	1405	65.24	66.39	66.39	66.39
Mid OB	813	64.54	65.64	65.64	65.64
Mid OB	726	63.37	64.54	64.54	64.55
Warehouses	2538	64.04	64.55	64.62	64.57
Warehouses	2072	62.30	62.62	62.66	62.63
Warehouses	1933	60.40	62.08	62.15	62.12
Warehouses	373	60.37	61.99	62.00	62.02

Mitigation Concepts

Because the cumulative effects of potential future activities (Alternatives 1-5) are significant, concepts were developed to mitigate the anticipated increases in water surface elevations during high flow events. A series of mitigation concepts were analyzed such that when performed in conjunction with the potential future activities, the cumulative result would be that there would be no increase in water surface elevations during the 100-year flood event compared to existing conditions. We note that this evaluation is intended to serve as a "proof of concept", and not an analysis of a specific mitigation design. The mitigation concepts are:

- Mitigation Concept A: Excavation of material on the right (west) overbank near River Mile 2.1. This lowers water surface elevations downstream of the future 24th Street crossing. This mitigates for some of the increased water surface elevations caused by a new crossing of the White River along the 24th Street alignment.
- Mitigation Concept B: Excavation of material on the left (east) overbank from approximately River Mile 2 to River Mile 3.2. This lowers water surface elevations in the reach downstream of the future 24th Street crossing. This mitigates for some of the increased water surface elevations caused by a new crossing of the White River along the 24th Street alignment and for the increased flows in the main channel due to the placement of fill in the left overbank.
- Mitigation Concept C: Excavation of an overflow channel in the left overbank from approximately River Mile 3.2 to River Mile 3.6, under the future 24th Street crossing. The overflow channel in this location would have an approximate 200-foot top width and be excavated up to 10-feet deep in some locations. The channel would convey approximately 5,000 cfs at the 100-year flood. This mitigates for some of the increased water surface elevations caused by a new crossing of the White River along the 24th Street alignment and for the increased flows in the main channel due to the placement of fill in the left overbank.
- Mitigation Concept D: Excavation of material on the left (east) overbank from approximately River Mile 3.6 to River Mile 4.3. This lowers water surface elevations in the reach upstream of the future 24th Street crossing. This mitigates for some of the increased water surface elevations caused by a new crossing of the White River along the 24th Street alignment and for the increased flows in the main channel due to the placement of fill in the left overbank.
- Mitigation Concept F: Excavation of an overflow channel in the right overbank from approximately River Mile 4.0 to River Mile 4.5 *or* removal of the trail bridge adjacent to the golf course. Floodwaters that currently travel south through the golf course and downstream would potentially be forced back into the main channel upstream of the trail bridge at some point in the future. This would increase peak discharges at the location of the trail bridge. To mitigate for this increased discharge, there are two concepts that

mitigate for the resulting increases in water surface elevations. One would be to remove the existing trail bridge. Another would be to excavate an approximately 200-foot top width overflow channel that would be 8 feet deep in places. Excavation of an overflow channel may also involve modifications to the existing trail. Note that either concept would mitigate for increases in water surface elevations and would *not* need to be done in conjunction.

- Mitigation Concept G: Excavation of material on the left (east) overbank from approximately River Mile 5.0 to River Mile 4.6. This lowers water surface elevations in the reach downstream of the Stewart Road crossing. This mitigates for the increased flows in the main channel due to the King County levee setback project.
- Mitigation Concept H: A new crossing of White River along the alignment of Stewart Road will be constructed. This would convey increased peak flows that would be created by construction of the King County levee setback project.

Figure 4 shows the locations and lateral extents of the mitigation concepts.

Mitigation for "No Action" Alternative 5

Mitigation for the "No Action" Alternative (Alternative 5) was not simulated directly. As mitigation for Alternatives 1-3 is shown in the next section to lower water surface elevations to at or below "existing conditions", and as Alternatives 1-3 contain the "No Action" changes to existing conditions, we know that mitigation of the "No Action" alternative is possible.

Mitigation for Alternatives 1-3

To mitigate for the conditions that result from Alternatives 1-3, all of the above mitigation "concepts" were included in the hydraulic model in addition to the revisions made to develop the geometry for Alternatives 1-3. Table 2 shows the resulting differences in water surface elevations along the White River for the 100-year compared to existing conditions. All mitigated elevations are at of below existing condition elevations, with a few exceptions that are close enough to zero for a "proof of concept" analysis.

Mitigation for Alternative 4

The modeling of the mitigation for Alternatives 1-3 included a conservative assumption that the areas filled under Alternative 4 would lie in the "hydraulic shadow" of the areas filled in Alternatives 1-3. Therefore, the concept used to mitigate Alternatives 1-3 would also mitigate for Alternative 4. If Alternative 4 is selected a site-specific mitigation plan can be designed and simulated to confirm the above stated assessment.

Figure 4. Potential Conceptual Mitigation Sites.

Table 2. Existing 100-year Water Surface Elevations compared to Mitigated Alternatives 1-3 Conditions on White River

Cross Section	Existing Conditions (ft NAVD)	Alternatives 1-3 (ft NAVD)	Mitigated Conditions (ft NAVD)	Difference between existing and mitigation (ft)
28604	75.67	75.67	75.27	-0.40
28164	74.43	74.43	74.68	0.25
27654	73.88	73.87	73.84	-0.04
27252	73.00	73	72.69	-0.31
26813	72.44	72.43	71.74	-0.70
26576	72.22	72.22	71.39	-0.83
26475	70.76	70.76	70.76	0.00
26253	70.30	70.3	70.13	-0.17
25833	69.61	69.61	69.37	-0.24
25057	67.96	67.96	67.67	-0.29
24046	66.26	66.26	65.47	-0.79
23727	64.16	64.17	62.38	-1.78
23352	63.58	63.58	62.01	-1.57
22662	63.10	63.11	61.37	-1.73
22094	61.64	61.65	61.04	-0.60
21869	60.92	60.92	60.81	-0.11
21703	61.08	61.09	60.74	-0.34
21592	61.06	61.06	60.69	-0.37
21252	60.88	60.89	60.52	-0.36
20825	60.31	60.31	60.09	-0.22
20107	59.80	59.81	59.42	-0.38
20106	59.80	59.81	58.98	-0.82
19083	59.42	59.42	58.59	-0.83
18424	58.94	58.94	58.62	-0.32
18361	58.93	58.94	58.58	-0.35
18236	58.80	58.8	58.55	-0.25
17460	58.43	58.43	58.14	-0.29
16712	58.12	58.12	57.76	-0.36
15941	57.91	57.91	57.46	-0.45
15264	57.74	57.74	57.24	-0.50
14797	57.43	57.43	57.08	-0.35
13766	56.87	56.87	56.62	-0.25
12822	56.39	56.39	56.14	-0.25
12030	56.16	56.16	56.06	-0.10
11019	55.87	55.87	55.88	0.01
10311	55.57	55.57	55.61	0.04
9686	55.19	55.19	55.19	0.00
9421	55.06	55.06	55.07	0.01

Note: Negative differences indicate that Mitigated Conditions are lower than Existing Conditions

Appendix D: 24TH STREET EAST SETBACK LEVEE FEASIBILITY STUDY

24th Street East Setback Levee Feasibility Study

June 2011

Parametrix

24th Street East Setback Levee Feasibility Study

Prepared for

City of Sumner
1104 Maple Street
Sumner, WA 98390

Prepared by

Parametrix
1019 39th Avenue SE, Suite 100
Puyallup, WA 98374
T. 253.604.6600 F. 253.604.6799
www.parametrix.com

June 2011 | 215-1527-073 (02/0206)

CITATION

Parametrix. 2011. 24th Street East Setback Levee Feasibility Study. Prepared by Parametrix, Puyallup, Washington. June 2011.

CERTIFICATION

The technical material and data contained in this document were prepared under the supervision and direction of the undersigned, whose seal, as a professional engineer licensed to practice as such, is affixed below.

Prepared by Andrew John Porrini, P.E.

Checked by Kenneth T. Fellows, P.E.

Approved by Kenneth T. Fellows, P.E.

KENNETH THOMAS FELLOWS
STATE OF WASHINGTON
32135
REGISTERED
PROFESSIONAL ENGINEER

6/8/11

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J Volume Calculations, Approximate Change in Flood Storage, and Concept-Level Project Cost Estimates

K Preliminary Design Memorandum for Side Channel 24th Street East Site (June 3, 2011)

KEY TERMS

BNSF	Burlington Northern Santa Fe
CAC/TAG	Citizen Advisory Committee/Technical Advisory Group
cfs	cubic feet per second
CIP	Capital Improvement Plan
City	City of Sumner
CLOMR	Conditional Letter of Map Revision
CMZ	channel migration zone
CWA	Cascade Water Alliance
CZM	Coastal Zone Management
DAHP	Department of Archaeology and Historic Preservation
DNR	Washington Department of Natural Resources
Ecology	Washington Department of Ecology
ELJs	engineered log jams
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FIS	Flood Impact Study
FS	Feasibility Study
gpm	gallons per minute
HDPE	high density polyethylene
HEC-RAS	Hydrologic Engineering Centers-River Analysis System
HPA	Hydraulic Project Approval
JARPA	Joint Aquatic Resource Permit Application
LIDAR	Light Detection and Ranging
LOMR	Letter of Map Revision
LWD	large woody debris
NFIP	National Flood Insurance Program
OHWM	Ordinary High Water Mark
Plan	2004 Comprehensive Plan Update Transportation Analysis
PSE	Puget Sound Energy
PVC	polyvinyl chloride
RCW	Revised Code of Washington
RM	River Mile
SMC	Sumner Municipal Code

KEY TERMS (CONTINUED)

SRFB	Salmon Recovery Funding Board
Trail Plan	Sumner Trail Master Plan (June 2008)
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WRIA	Water Resource Inventory Area

EXECUTIVE SUMMARY

The City of Sumner (City), through funding provided by the Salmon Recovery Funding Board (SRFB), studied the feasibility of several options to provide flood control and/or habitat benefits on the White River in the area near 24th Street East. The City currently owns over 100 acres of land on the east bank of the White River in the vicinity of 24th Street East. This property, along with several other small and isolated parcels, which the City does not own, are commonly referred to as the project area or site in this document. Figure 1-1 (page 1-3) shows the project location and Figure 1-2 shows the project area, including wetlands, utilities, and other features. Currently, most of the site is leased to a private party and cultivated for sod and rhubarb.

The purpose of this Feasibility Study (FS) is to identify a preferred option for the project area that promotes habitat development and flood mitigation. Additional considerations for the City include optimizing the financial, environmental, and community benefits that can be derived from this site. The City's parcels in the project area are owned by the City's Sanitary Sewer Utility. Title 35 of the Revised Code of Washington (RCW) Section 35.67.270: Sewerage sale acquired property – Disposition states:

> At any time after deed is issued to it pursuant to lien, a city or town may lease or sell or convey any property at public or private sale for such price and on such terms as may be determined by resolution of the city or town legislative body, any provision of law, charter or ordinance to the contrary notwithstanding.

This RCW indicates that the Sanitary Sewer Utility can sell its rights to the project area land so long as it is sold through a resolution passed through the City Council.

As part of the study, information was gathered to better understand site conditions. Several technical memorandums have been prepared regarding pertinent site characteristics such as subsurface conditions, geomorphology and hydraulic review, wetland delineation, White River watershed and salmon habitat characterization, and property, easement, and permit conditions found in the project area. The findings of these technical memorandums are summarized in the Background and Data Collection Sections of this report. Copies of the memorandums are included in the report appendices.

Four options for the project area were developed, evaluated against numerous criteria, and scored in a matrix format:

- **24th Street Point Bar Option**: Very similar to the concept included in Pierce County's study of potential setback levee sites (GeoEngineers 2008), this option would restore 6 acres to the river channel migration zone. This option is estimated to cost $6.8 million, but provides minimal benefits, and hence was ranked third, with a score of 35 out of a possible 72.
- **Expanded Channel with Federal Emergency Management Agency (FEMA) Certifiable Setback Levee Option**: This option would restore approximately 25 acres into the channel migration zone and install a FEMA-certifiable levee that would provide 64 acres of flood-protected property. This option is estimated to cost $13.4 million and would provide some benefit in a broad range of categories. However, construction of the FEMA-certifiable levee would substantially encroach into the river floodway, and hydraulic river modeling predicts that this encroachment would cause a 0.4-foot rise in the 100-year flood elevation upstream of the project site. As such, this option would not meet the "zero-rise" regulatory criteria established by the City (Sumner Municipal Code [SMC] 15.52). Therefore, this option is determined not to be implementable, and it was not scored or ranked.

- **Conservation Option 1**: This option would create 5,300 feet of new side channel. Existing ground between the side channel and the river would be excavated to aid in expanding the river channel migration zone by approximately 85 acres. This option is estimated to cost $17.7 million and provide substantial geomorphological, flood control, and habitat benefits. Conservation Option 1 was ranked in first place (tied with Conservation Option 2) with a score of 52.
- **Conservation Option 2**: This option would create 5,300 feet of new side channel. The existing mature forest on the riverbank would be retained, and the side channel would be constructed further east on the site as compared to Conservation Option 1. There would be no expansion of the river channel migration zone. This option is estimated to cost $16.8 million, and would provide good habitat benefits and the highest flood control benefits. With a score of 52, it ranked in first place (tied with Conservation Option 1).

The City reviewed the alternative rankings and selected Conservation Option 2 as the preferred alternative to carry forward through 30 percent engineering design. Conservation Option 2 is depicted in Figures 4-7 and 4-8. A preliminary engineering design for the side channel concept in Conservation Option 2 is provided in Appendix K at the end of this document.

Implementation of the selected option could be funded through several methods, including:

- Additional grant funding, such as from the SRFB.
- Develop the site as a wetland/habitat mitigation bank with funding provided by the City or through private investment. For the bank approach, the entire project would be funded through bonds or other means and constructed in one effort. The investment would be recouped through sale of mitigation credits over time.
- Develop the site as a mitigation area available to parties needing mitigation credit. With this approach, parties needing mitigation would incrementally and sequentially construct portions of the side channel and habitat, working from downstream to upstream. Construction of each segment would be funded by the party needing mitigation, and therefore, the City would need to provide only a minimal initial investment.
- While any of the above funding approaches is viable, there is limited potential to “mix and match” these approaches. For example, grant funding typically cannot be used to construct a mitigation site.

1. INTRODUCTION

The City of Sumner (City), through funding provided by the Salmon Recovery Funding Board (SRFB), studied the feasibility of several options to provide flood control and/or habitat benefits on the White River in the area near 24th Street East. The City currently owns over 100 acres of land on the east bank of the White River in the vicinity of 24th Street East. This property, along with several other small and isolated parcels, which the City does not own, are commonly referred to as the project area in this document. Figures 1-1 and 1-2 show the project area, including wetlands, utilities, and other features. Currently, most of the site is leased to a private party and cultivated for sod and rhubarb, with the remainder comprising open field and relatively mature forest.

The purpose of this Feasibility Study (FS) is to identify a preferred option for the project area that promotes habitat development and flood mitigation. Additional considerations for the City include optimizing the financial, environmental, and community benefits that can be derived from this site. The City's parcels in the project area are owned by the City's Sanitary Sewer Utility. Title 35 of the Revised Code of Washington (RCW) Section 35.67.270: Sewerage sale acquired property – Disposition states:

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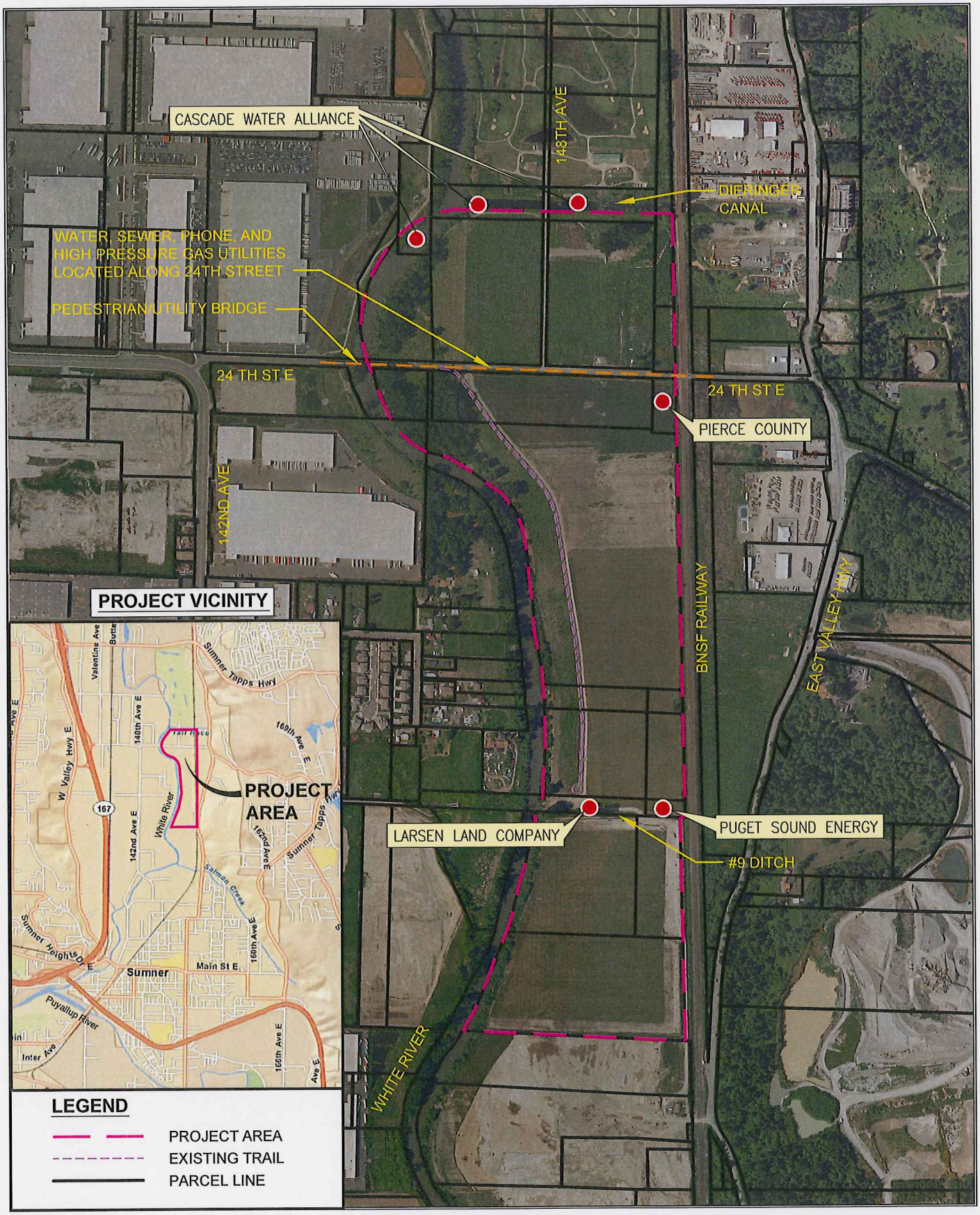
From the technical memorandums, four options for the project area were developed, evaluated against numerous criteria, and scored in a matrix format. The following sections explain the options, evaluation, and scoring in detail.



Parametrix DATE: Feb 25, 2011 FILE: SU1527073P02T06F1-1

N

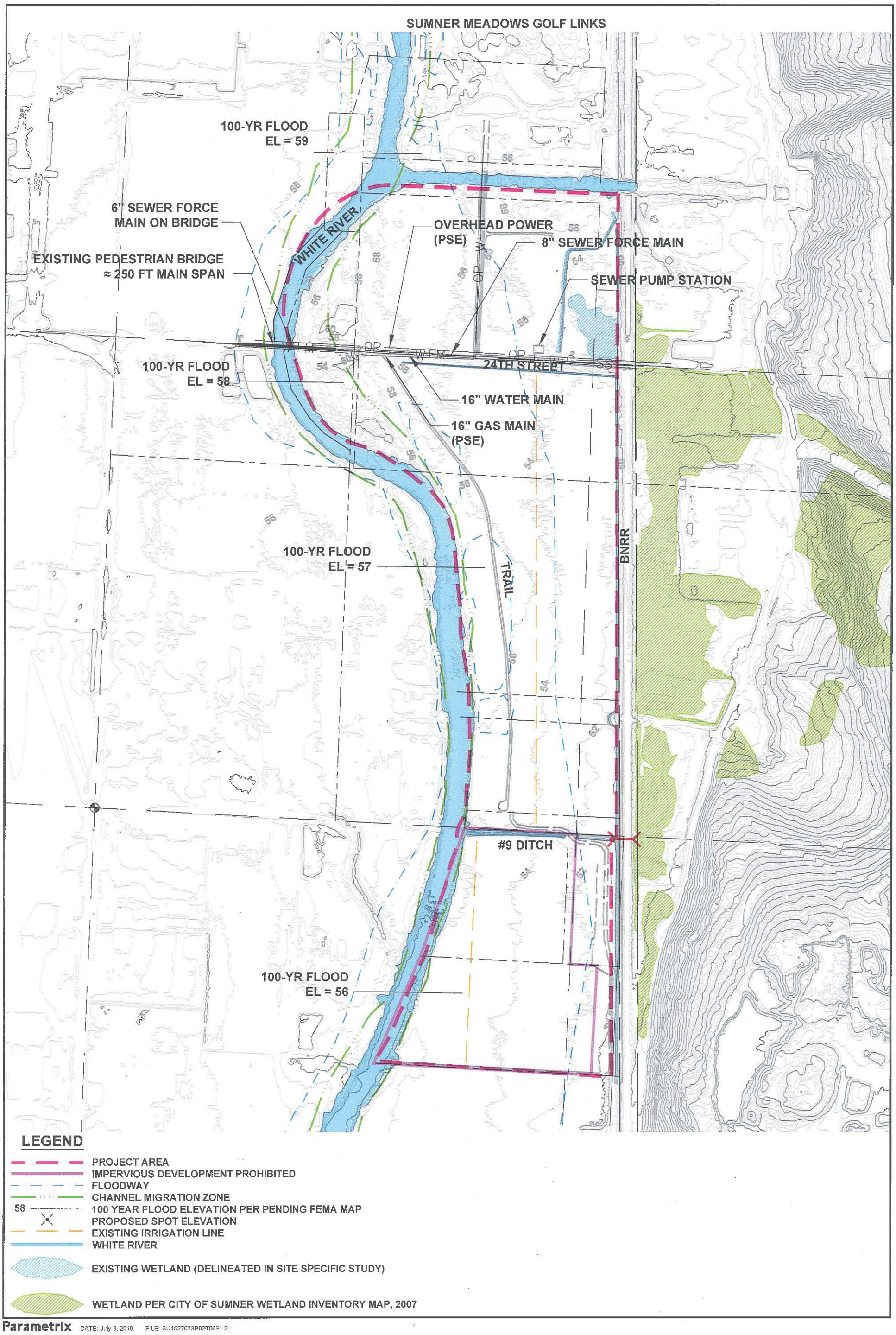
0 800'

SCALE IN FEET

NOTE:

ALL PARCELS WITHIN PROJECT AREA OWNED BY CITY OF SUMNER EXCEPT AS NOTED.

Figure 1-1
Site Map
24th Street Site
City of Sumner



Parametrix DATE: July 8, 2010 FILE: SU1527073P02T06F1-2

N

0 500

SCALE IN FEET

Figure 1-2
Existing Site Conditions
24th Street Site
Sumner, WA

2. BACKGROUND

The SRFB funds projects throughout the Puget Sound. The general goal of the SRFB is to provide grants to protect or restore salmon habitat and assist related activities. This reach of the White River currently does not provide substantial salmon habitat. In the project area, high banks and manmade revetments disconnect the river channel from its floodplain. The disconnection reduces the active channel width, which prevents the river from migrating freely and producing quality salmon habitat.

Setback levees are designed to restore natural riverine floodplain and channel migration processes for the purposes of restoring salmon habitat. A secondary benefit of some setback levees is additional flood protection through additional flood storage via excavation in the floodplain or a FEMA-certifiable levee with protection behind the levee.

Pierce County is actively studying projects that will aid in flood protection and prevention in the Puyallup River watershed. The County recently completed a levee setback study to evaluate and rank sites for potential setback levees (GeoEngineers 2008). The study included a 9.2-acre site within the project area that ranked third out of six sites on the White River. The project was to reconnect the point bar area into the river channel migration zone as shown on Figure 1-2.

2.1 LAND USE AND PROPERTY OWNERSHIP

The land use in the project area is currently a mix of farmland, drainages, forest, wetland, river buffer, utility easements, and recreation trail. The project lies within the 100-year floodplain as shown on the pending FEMA flood map described above. Land use in adjacent areas consists of light industrial sites, wetlands, roads, and a golf course.

Appendix A contains a technical memorandum that describes in detail the easements, lease agreements, and other restrictions on the parcels in the project area. There are numerous access and utility easements on project area parcels that would need to be vacated or modified prior to substantially developing or modifying the site. Some of these easements appear obsolete. The easements will need to be reviewed by the City and the grantees when a specific option is selected for implementation.

The project area contains a restrictive covenant that was placed on two parcels near the southern limit of the project area which prohibits impervious development on approximately 30 acres. The same covenant limits impervious development to 40 percent of the area on a majority of the remaining project area.

Two lease agreements are currently in effect within the project area. One is a lease of City land (north of 24th Street East and east of 148th Avenue) by KZIZ radio for a current rent of approximately $4,500 per year for the purpose of installing and operating three radio towers. The lease was executed in 2006, with a duration of 25 years; however, KZIZ has defaulted and the lease has been terminated. The other lease is a farming agreement with Ota Farms for the right to farm approximately 95 acres of City-owned land in the project area, with a rent of approximately $22,000 per year. This lease expired in 2003 and is being maintained through informal agreement. Therefore, neither lease contains long-term commitments that would affect site redevelopment or restoration.

The City of Sumner parcels in the project area are all owned by the sanitary sewer utility. Therefore, the sewer utility will require reasonable compensation for the investment made into the property. If the project area is converted into habitat, channel migration zone (CMZ) or wetland; a conservation easement or other similar covenant must be purchased from the utility for the right to change the property use.

2.2 ZONING AND REGULATORY BUFFERS

The current zoning for all parcels within the project area is "agriculture."

The project area is located in an "Urban Conservancy" shoreline designation. According to the City of Sumner's Shoreline Mater Program, the development buffer extends 200 feet from the Ordinary High Water Mark (OHWM).

2.3 BURLINGTON NORTHERN SANTA FE (BNSF) RAILROAD

The BNSF railroad lies directly adjacent to the project area on the east side. North of the site in Auburn, BNSF has proposed to expand the existing rail embankment to accommodate a third set of tracks. It is unclear at this point if the new tracks would extend south to the project area, and if so, would they lie east or west of the two existing tracks.

2.4 TRAIL SYSTEM

The City of Sumner has an existing trail for nonmotorized use in the project area. The trail crosses the river at an existing pedestrian bridge at 24th Street East, and extends south of the bridge approximately 3,000 feet, where it dead ends. The trail is located approximately 200 feet east of the river channel.

The Sumner Trail Master Plan (June 2008) (Trail Plan) calls for extension of the trail to the south through the project area and connecting to the other parts of the Sumner Trail System. The cost to complete the trail connection is estimated at $450,000. This trail segment through the project area is critical to completing the missing link between the Sumner Trail System and the Interurban Trail to the north. The Trail Plan states that the trail must be located on the east side of the White River (in the project area) due to restrictions prohibiting a trail on the both sides of the river.

Due to Shoreline Master Program buffers, any new trail will have to be located at least 200 feet from the river OHWM.

2.5 UTILITIES

The utilities located in the project area are mostly along the 24th Street East corridor. These utilities are described further below.

2.5.1 Water

A City of Sumner water main is present the full width of the property along 24th Street East and extends northward along 148th Avenue. The water main is supported by the pedestrian bridge crossing the White River. The water main is a 16-inch-diameter ductile iron pipe.

2.5.2 Sewer

A City of Sumner sanitary sewer flows by gravity from East Valley Highway, under the BNSF railroad, to the Forest Canyon Pump Station No. 14, located within the project area. The gravity sewer main is 12 inches in diameter and a combination of ductile iron and polyvinyl chloride (PVC). The force main from the pump station to the pedestrian bridge over the river is 8 inches in diameter and a combination of high density polyethylene (HDPE) and ductile iron. The force main on the bridge is 6-inch-diameter ductile iron.

2.5.3 Gas

Puget Sound Energy (PSE) owns a parcel just east of the BNSF railroad. PSE's gas main extends from that parcel along the 24th Street East corridor and over the pedestrian bridge to the west side of the White River. The gas main consists of a 12-inch-diameter gas main in the easterly portion and a 16-inch-diameter gas main in the westerly portion. The 16-inch-diameter gas main is directionally drilled under the river. The location where the line transitions from shallow to deep burial is not known.

2.5.4 Electrical, Power, and Telephone

Overhead power, cable, and phone lines are present adjacent to the pedestrian bridge. East of the pedestrian bridge, some of these utilities remain overhead and some are buried, but they all appear to remain within the 24th Street East and 148th Avenue corridors.

2.5.5 Stormwater

Stormwater conveyance facilities in the project area consist of ditches in the farm fields (also adjacent to the BNFS rail embankment) and a culvert through the rail embankment. The culvert is located at the No. 9 Ditch.

2.5.6 FEMA Flood Maps

FEMA has released proposed flood maps of the White River showing that virtually all of the project area lies within the 100-year floodplain, and most of the site lies within the floodway. The proposed FEMA map is included in Appendix B. Currently, the BNSF rail embankment is considered "high ground" that confines the easterly reach of the flood waters.

2.5.7 Channel Migration Zone

Pierce County adopted boundaries for the CMZ for the White River in 2007 (see Figure 1-2) in accordance with Ecology guidance. Upon completion of a setback levee project, the County would need to formally adopt a revision to the CMZ mapping to change the CMZ boundaries. The proposed CMZ map is provided in Appendix B.

2.6 CITY OF SUMNER CAPITAL IMPROVEMENT PLAN (CIP) AND COMPREHENSIVE PLAN

The City's 2011 Stormwater Capital Improvement Plan (City of Sumner 2011) has several proposed projects in the project area. Proposed improvements to the No. 9 Ditch will include replacing a small culvert under the BNSF railroad with an acceptable fish passage and other miscellaneous habitat improvements upstream of the culvert. The existing culvert is a fish barrier and is not sized appropriately. This CIP project is listed on the City's storm sewer CIP list as "CIP No. 52 – Number 9 Ditch and Forest Canyon Class III Habitat Improvements." It is currently budgeted for $611,000 and forecast to be implemented in 2016.

City planning documents mention the 24th Street East corridor in the 2004 Comprehensive Plan Update Transportation Analysis (Plan) (The Transpo Group 2004). The Plan has noted the potential of constructing a vehicular bridge crossing the White River within the next 20 years, but the likelihood that the project will be pursued is somewhat questionable because of the costs and proximity of the existing 8th Street/Stewart Road Bridge over the White River just north of the project area. Right-of-way will likely need to be maintained for the 24th Street East corridor because of the existing utilities in the area.

The City has two sanitary sewer CIP projects in the project area. One is to install a new generator at Forest Canyon Pump Station No. 14, which is adjacent to 24th Street East between the BNSF railroad and 148th Avenue. The other project is to install a STEP line from the Sumner Meadows Golf Links to the existing sanitary sewer system in East Valley Highway. The proposed alignment of the STEP line could be through the project area on 148th Avenue and 24th Street East.

The City also has plans for a new water source in the project area. The City has proposed to drill a well in the vicinity of 24th Street East and 148th Avenue according to the City's 2009 Water System Plan. The well is contingent on the availability of water rights, and the City's goal is that the well produce between 750 and 1,250 gallons per minute (gpm).

3. DATA COLLECTION

The site was evaluated to determine its suitability for implementing a levee setback or other habitat restoration project. Detailed technical memoranda and reports on the various investigation areas are provided in Appendices A, D, E, F, G, and I.

3.1 TOPOGRAPHIC SURVEY

Site topography is shown in Figure 1-2 (page 1-5). Coarse grid topographic survey was completed to locate site features and identify site topography for comparison to topographic data obtained via Light Detection and Ranging (LIDAR). Site topography as measured by field survey was determined to match well with LIDAR data. LIDAR data is shown on project site figures in this report, and was used for technical analysis of site concepts. Elevations near the river are generally greatest, typically dropping 4 to 6 feet moving east to the rail embankment.

3.2 HISTORIC AND CULTURAL RESOURCES

Review of available literature indicates the site contains no known historic or cultural resources. Appendix C contains the submittal package to the State Department of Archaeology and Historic Preservation (DAHP). The EZ-1 form requests concurrence of a "no effect" determination for the project area.

3.3 WHITE RIVER WATERSHED

The White River watershed is described in detail in Appendix D. The memo describes the watershed processes surrounding the project area, including the hydrogeologic setting, hydrology, water quality, sediment, large woody debris, and land use. Biological resources are discussed, including various salmon (and other fish) species and their respective spawning characteristics. Project site conditions and limitations are also described.

The project area is within the Puyallup-White River Water Resource Inventory Area (WRIA) 10 watershed and lies on the east bank of the White River between River Mile (RM) 2.3 and 3.7. The White River originates from glaciers on Mount Rainier and flows approximately 68 miles to the confluence with the Puyallup River near Sumner. Prior to 1906, the White River flowed northerly into the Green River. A flood event diverted the White River into the Puyallup River through the Stuck River. Following this flood event, the White River was permanently diverted to the Puyallup River by a diversion dam completed in 1915. In 1911, the Lake Tapps project was completed. This project diverts flow from the White River near Buckley at RM 24.3, through Lake Tapps, and discharges back into the White River at RM 3.5 via the Dieringer Canal. This canal is located immediately upstream of the project site (see Figure 1-1, page 1-3). In 1948, the Mud Mountain Dam was constructed at RM 29.6 by the U.S. Army Corps of Engineers (USACE) for flood control.

Climate is driven by maritime patterns that produce mild, wet fall to spring months and cool dry summer months. Precipitation in the upper White River watershed falls as snow and provides flows during the spring and early summer. Precipitation in the lower watershed is predominately rain and tends to fall in late fall, winter, and spring.

Large flooding events occur in response to rain-on-snow events; smaller tributary flooding in the lower watershed is generally associated with large rain events. During rain-on-snow events, flood flow can be attenuated through temporary storage in floodplains, wetlands, lakes, and in-channel features that add roughness and decrease flow velocities. Typically, storage areas occur near low-gradient streams and in lowland areas where physical relief is very low, coarse glacial outwash stores high volumes of water, and subsurface flow velocities are rapid.

Based on analysis of U.S. Geological Survey (USGS) gauge data, summer base flows in the lower White River have been declining since 1973 even though precipitation has remained average. Reduced summer base flows may be due to increased groundwater withdrawal and/or increases in impervious surfaces.

The main source of water to the site is the White River (see Figure 1-2). The Dieringer Canal provides some additional water to the White River near the northern boundary of the site. A small perennial tributary also provides some additional water to the site. The small unnamed stream flows onto the floodplain east of 24th Street East and into an area of wetlands located east of the rail embankment. The water collects in the wetlands and eventually flows south along the east side of the railroad tracks, and enters the project area through a culvert under the rail embankment, where flow continues out to the White River via the No. 9 Ditch.

The new Cascade Water Alliance (CWA) water right for Lake Tapps identifies several requirements:

- Water diversion from the White River to Lake Tapps is limited. Minimum flows in the White River range between 500 cubic feet per second (cfs) in the winter and 875 cfs in the early summer.
- No minimum flow in the Dieringer canal is required at any time of the year. The maximum release rate through the Dieringer canal is set at 50 cfs, except under certain conditions.

Modifying the site for development or restoration would have little to no effect on the watershed as a whole including hydrology, large-scale sediment transport processes, or systematic problems with water quality. A potential alternative for the site, as explained later in this report, is to construct a side channel throughout the project area. A side channel has the potential to support a variety of salmonid species, providing habitat for spawning and rearing. A side channel would replace some of the natural habitat that has been lost through the construction of river revetments and filling of floodplain that has restricted the White River to its current channel.

3.4 GEOMORPHOLOGY

Appendix E contains a memorandum describing the geomorphology of the project reach. As noted in Section 3.3, the White River originates from glaciers on Mount Rainier and flows into the Puyallup River near Sumner. The White River originally flowed into the Green River until a flood event diverted the White River into the Puyallup River through the Stuck River. The geomorphology review in Appendix E provides additional detail regarding White River historical events. Flow and sediment movement in White River is altered by the Mud Mountain Dam.

In the project area, the existing river channel is generally straight and constricted on both banks by existing riverbank revetments composed of silt and sand fill soil placed during prior river dredging events.

No levees are present at the site that were previously, or are currently, certified by FEMA as flood-control structures. Site observation and review of topographic data confirms that no levees are present at the site in the form of a discrete berm of soil. The riverbank in the project area is likely covered with a layer of rock or other armoring, but this could not be visually verified due to the presence of sediment deposits and vegetation.

As the White River flows downstream, its channel character changes in response to a variety of factors. Upstream of the project site, the channel can be characterized as a meandering channel with active channel side bars in an entrenched channel corridor. Extensive areas of shifting in-channel gravel bars occur within 1 to 2 miles upstream of the site, but not within the project reach due to the lower river gradient. Downstream of the Dieringer Canal, the channel character is generally straight and incised. Based on field evaluation, the depth of incision increases as the flow continues downstream. In the vicinity of Sumner, the channel is entrenched by as much as 15 feet and is well detached from its floodplain.

In the project area, the active river channel is disconnected from its floodplain (except at extreme flood levels) by a riverbank revetment resulting in a constricted main channel and the loss of access to side channel habitat for flood refuge and rearing habitat for salmonids. In addition, the revetment limits in-stream habitat complexity and the river has very little in-stream large woody debris (LWD) or channel complexity. That said, there is a large log jam about one-quarter mile upstream from the project site.

Sediment found in the project reach can be attributed mostly to upstream sources. Undercut erosional surfaces are present along most of the bank. It is suggested that the sediment influx and transport capacity are somewhat out of balance in the reach, with deposition of relatively fine-grained material occurring on the riverbed below the OHWM.

In-stream gravel mining was conducted periodically upstream of the Dieringer Hydroelectric outfall from the 1920s to the mid-1990s. No in-stream gravel mining is known to have been completed within the project reach.

3.5 HYDRAULIC MODEL REVIEW

Appendix E provides a detailed discussion of White River hydraulic modeling issues.

This hydraulic model used for the Levee Setback Feasibility Study (GeoEngineers 2008) was developed for Pierce County by GeoEngineers for the purpose of evaluating the effectiveness of different setback levee sites throughout the Puyallup River system, including the White River. This model was reviewed and updated with new cross-sections in order to evaluate impacts associated with the project concepts presented in Chapter 4 of this report.

Sources of topographic information available for use in the modeling analysis include LIDAR information from 2004, USGS bathometric survey, and a field topographic survey completed for this project in the summer of 2010 (see Section 3.1). The model used for the Levee Setback Feasibility Study relied on river cross-sections surveyed during 2001 and 2002 by King County and USACE, respectively. The USGS completed additional river cross-section surveys in the fall of 2008. These cross-sections were compared to the 2001/2002 cross-sections, and the results showed that the river channel within the project area had aggraded 1 to 3 feet compared to the 2001/2002 cross-sections. Therefore, the model was updated with the new USGS cross-sections to avoid under predicting flood elevations. Figure 3-1 (page 3-7) (taken from Figure 7, Appendix E) shows a comparison of site topography and river cross-section data at RM 2.63 (looking downstream). The data in Figure 3-1 is typical of the entire project reach. Additional cross-sections are provided in Appendix E.

The preliminary Flood Impact Study (FIS) that is currently under review by FEMA is based on a 100-year flow rate in the White River near Sumner of 15,500 cfs. Upon inquiry, Pierce County staff concurred that a 100-year flow of 15,500 cfs should be used for project analyses for floodplain regulatory purposes (such as compliance with the “no-rise” requirement). A variety of other flow rates in the White River near Sumner have been established for other purposes. Previously approved FEMA flood maps are based on a 100-year flow of 19,100 cfs, and this higher value is related to the maximum allowable release rate of 17,500 cfs at the Mud Mountain Dam. Currently, the maximum operational release rate from Mud Mountain Dam is limited to 13,000 cfs, although releases up to the allowable flow of 17,500 cfs are

possible in an emergency situation. We recommend that modeling, completed as part of final design of any project at the site, consider both the 15,500-cfs regulatory flow rate, and the higher 19,100-cfs potential flow rate. Modeling of the latter value would identify potential impacts to site features and facilities due to the higher flow rate. For example, it may be appropriate to size erosion protection and armoring based on the higher flow rate.

Additional flows of interest are the 10-year return frequency flow (14,000 cfs) and the 50-year return frequency flow (15,300 cfs). Mud Mountain Dam operations are the reason these flows are similar to the 100-year return frequency flow (15,500 cfs), rather than substantially lower as they would be in a free-flowing river.

3.6 WHITE RIVER SALMON HABITAT

Salmon habitat in the White River is described in detail in Appendix D, including watershed-based biological resource spawning characteristics and project site conditions.

There are three Endangered Species Act (ESA)-listed salmonid species that occur in the White River in the vicinity of the project area: Chinook salmon, steelhead, and bull trout. The White River also supports Coho, chum, pink, and sockeye salmon and cutthroat trout. Table 3-1 summarizes the various species use of the White River and project area.

Table 3-1. Salmon Presence in White River and Project Area

Species	ESA Listed?	Site is Critical Habitat?	Adult Runs	Juvenile Rearing and Out Migration
Chinook	Yes	Yes	Spring and Fall: The project area is mostly a migration corridor; little spawning likely occurs.	Year-round rearing; out-migration occurs February to August.
Steelhead	Yes	No	Return December to April and spawn March to June. No information is available about specific use of the project area.	Year-round rearing; out-migration occurs March to May. No information is available about specific use of the project area.
Bull Trout	Yes	Yes	No information is available about specific use of the project area.	No information is available about specific use of the project area.
Coho	No	No	Fall: Project area is mostly a migration corridor; some spawning may occur.	Year-round rearing; out-migration occurs in Spring.
Chum	No	No	October and November: Spawning may occur in project area.	Out-migration occurs March to May.
Pink	No	No	July to November.	Out-migration occurs February to June.
Sockeye	No	No	July to September: Project area is a migration corridor.	Rear in freshwater lakes prior to out-migration.

3.7 WETLAND INVESTIGATION AND DELINEATION

A wetland investigation and delineation was completed for the project area by Widener and Associates. The detailed wetland report is included in Appendix F.

The field investigation identified two jurisdictional wetlands located just northwest of the junction of 24th Street East and the BNSF railroad.

Wetland A is a 1.29-acre depression bordered on the east and south by the railroad and road fill for 24th Street. Wetland B (approximately 0.22 acre) is a grass-lined swale directly west of Wetland A. Water from both wetlands flows northerly through a drainage ditch running parallel to the BNSF rail embankment, ultimately discharging to the Dieringer Canal.

3.8 SOILS AND HYDROLOGY

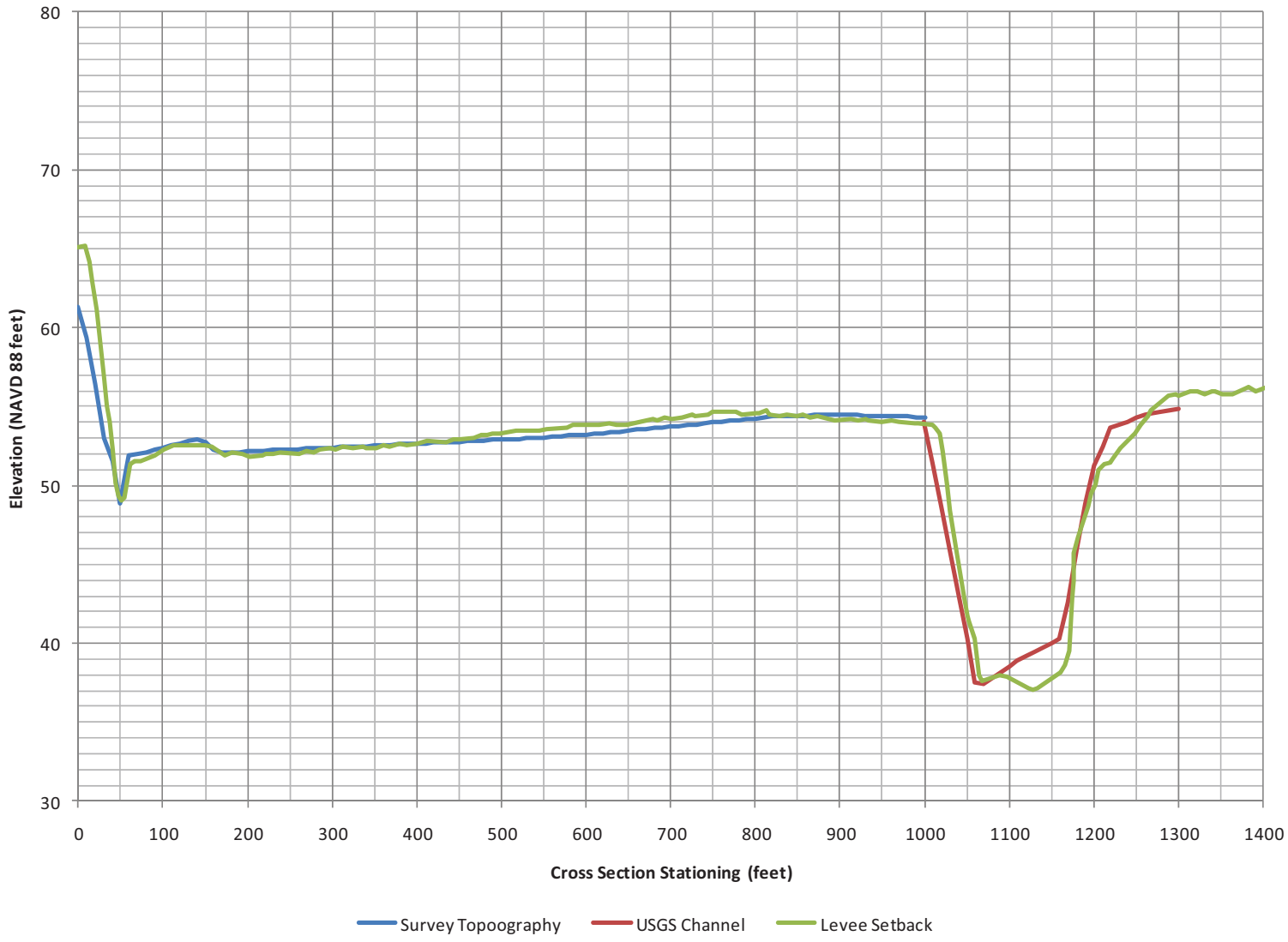
Appendix G contains a detailed geotechnical report describing surface and subsurface soil conditions in the project area identified through completion of a preliminary geotechnical investigation, which involved the analysis of available geotechnical reports for the area, as well as the excavation of nine test pits dug throughout the project area (including three located between the existing trail and the White River).

Available geotechnical reports prepared by other firms for projects near or within the project area were reviewed to assess site soil conditions. These reports described the findings of different geotechnical investigations performed along the 24th Street East corridor, along the existing trail, near the pedestrian bridge, and at various other locations throughout the project area. Data in these reports indicated site soils consist of alluvial and floodplain deposits, consisting primarily of sand, silty sand, silt, and occasional peat layers. Groundwater was encountered between depths of 5-1/2 to 12-1/2 feet. The test pit located along the south side of 24th Street East, just east of the pedestrian bridge over the river, contained 5.5 feet of fill soil with some scattered debris.

The report in Appendix G also contains detailed analysis and conclusions for potential levee cross-sections, slope stability, seepage, settlement, and seismicity.

3.8.1 Groundwater Monitoring

A private party interested in developing the site as a wetland bank has installed 10 piezometers at the site to monitor groundwater levels (see Appendix H). Data collected during late 2010/early 2011 indicate that groundwater levels just west of the BNSF rail embankment are typically 2 to 4 feet below ground surface, and typically 5 to 10 feet below ground surface near the river. Because the ground surface is approximately 4 to 5 feet higher near the river than near the rail embankment, this implies a relatively flat hydraulic gradient from east to west.



GeoEngineers

Topography Comparison – White River Cross Section 2.63

24th Street E Levee Setback - Sumner, Washington

Figure 3-1

(Figure 7 in original document)

4. CONCEPTS

In a meeting on October 13, 2010, the City, Parametrix, and Widener and Associates crafted three site development/restoration options to be evaluated in the FS. These options were further refined in the weeks following the meeting and presented at the Citizen Advisory Committee/Technical Advisory Group (CAC/TAG) – Pierce County WRIA 10/12 Lead Entity meeting on Thursday, November 4, 2010. A fourth restoration option was added in January 2011 after further discussions with City staff.

The four options are identified as:

- **24th Street Point Bar Option**: Very similar to the concept included in Pierce County's study of potential setback levee sites (GeoEngineers 2008). This option would restore 6 acres to the river channel migration zone.
- **Expanded Channel with FEMA-Certifiable Setback Levee Option**: This option would restore approximately 25 acres into the channel migration zone and install a FEMA-certifiable levee that would provide 64 acres of flood-protected property.
- **Conservation Option 1**: This option would create 5,300 feet of new side channel. Existing ground between the side channel and the river would be excavated to aid in expanding the river channel migration zone by approximately 85 acres.
- **Conservation Option 2**: This option would create 5,300 feet of new side channel. The existing mature forest on the riverbank would be retained, and the side channel would be constructed further east on the site as compared to Conservation Option 1. There would be no expansion of the river channel migration zone.

These four options for the project area are described in detail in the following sections. Figures 4-1 through 4-8 (located at the end of this chapter) provide conceptual plans and cross-sections for each option. Table 4-1 summarizes key metrics for each option. The City has identified that maintaining agricultural activity through commercial farming or community farm plots and providing public education related to habitat and flood control are community values to be considered when evaluating site development and restoration options.

Table 4-1. Summary of Key Metrics for Site Options

Metric	Point Bar Option	Expanded Channel with FEMA-Certifiable Setback Levee Option	Conservation Option 1	Conservation Option 2
Land Area (Acres)				
Protected by FEMA-Certifiable Levee	0	71	0	0
Unexcavated – Channel Migration Zone (existing riparian retained)	12	0	7	0
Unexcavated (existing riparian retained)	0	6	9	33
Excavated – Channel Migration Zone (excluding side channel)	0	24	44	0
Excavated – New Wetland/Riparian (outside CMZ)	0	0	6	51
Excavated – Side Channel	0	0	10	10
Excavated – Off Channel	0	22	0	0
Other/Unchanged	116	5	17	17
Fill	0	0	35	17
TOTAL:	**128**	**128**	**128**	**128**
Flood Storage Gained (acre-feet)	-1	80	170	220
Side Channel Length (feet)	0	0	5,270	5,280
Relocate/Modify 24th Street E Pedestrian Bridge and Utilities	Yes (in CMZ at point bar)	No	Utilities only (at side channel)	Utilities only (at side channel)
Retain Existing Farmland	100%	0%	5%	5%
Public Education Potential	Low	Low	High	High

4.1 24TH STREET POINT BAR OPTION

This option is similar to the 24th Street East Point Bar project in the Levee Setback Feasibility Analysis, Puyallup River Watershed (GeoEngineers 2008) prepared for Pierce County Public Works and Utilities. As shown in Figure 4-1, this option would restore 6 acres into the CMZ. It is assumed Pierce County would modify the CMZ boundary upon request by the City. A typical cross-section is provided in Figure 4-2. Table 4-1 summarizes key metrics for this option.

As noted previously, there does not appear to be a levee (in the form of a berm of soil lying above the surround grade) along the riverbank at the point bar that could be removed to reconnect the flood plain to the river. Currently, most of the point bar area lies at the approximate elevation of the 100-year flood level. During a major flood event, shallow water would cover portions of the point bar, and deeper flows would pass to both the west (in the river channel) and to the east where the ground surface is lower.

Most of the point bar area is mature forest, and in order to maintain this existing riparian habitat, the area would not be excavated, and there would be no gain in flood storage volume. As an alternative, the CMZ zone could be excavated to the 2-year water level, which would require the removal of approximately 150,000 cubic yards (CY) of soil.

Existing armoring along the riverbank in the CMZ area, if any, would be removed to encourage new channel formation. However, river channel characteristics in this area, such as the point bar being on the inside of a substantial river bend, suggest that natural channel forming processes have a relatively low likelihood of expanding the CMZ into the point bar area.

To shield the City's property and infrastructure (road, utilities, etc.) that lie east of the CMZ, from overland flows, and to maintain the channel within the new CMZ, a non-FEMA-certified embankment located up to 400 feet landward of the existing riverbank would be constructed. The crest elevation of the embankment would be set 1 foot higher than the elevation of the 100-year flood event water surface (see Figure 4-1 and Appendix B).

The embankment would be constructed entirely in the floodway. City regulations require that structures built in the floodway cause no net rise in flood elevation. In order to potentially maintain a zero-rise condition in the river, the embankment would not connect to the rail embankment, thereby allowing flood waters to continue to flow around the area to the east.

The embankment is proposed to have a covering of light rock armoring that would extend 8 feet below the existing ground surface; however, armoring would not be placed to a low elevation (such as the river thalweg elevation) so as to provide robust protection against scour. Instead, engineered log jams (ELJs) and cottonwood fences would be installed along the river side of the embankment to contain the channel within the CMZ. ELJs provide habitat benefits to the project area, and the accumulation of large woody debris would increase the stability of the bank while increasing the complexity of the river and improving area habitat.

Existing infrastructure in the new CMZ would need to be modified or relocated to implement this option. This infrastructure includes the existing trail, pedestrian bridge, and utilities including water, sewer, high-pressure petroleum gas main, power, cable, and telephone. These utilities could be retained in place by not allowing the river channel to potentially migrate into the point bar, but then the option would provide little value.

The infrastructure in the CMZ would need to be modified to be stable in the CMZ considering potential channel migration and erosion, or would need to be re-routed out of the CMZ area. No reasonable cost options exist for re-routing these utilities over another existing bridge over the White River. The nearest bridge to the south, at a distance of 1.4 miles, is 142nd Avenue East/Tacoma Avenue. The nearest bridge to the north, at a distance of 1.1 miles, is 8th Street/Stewart Road. Re-routing utilities along one of these routes would be a substantial and costly effort. A preliminary estimate to re-route the utilities is in the range of $5 million to $6 million.

Protecting the infrastructure in place appears to be a more cost-effective solution. The existing pedestrian bridge would be extended approximately 400 feet with deep foundation piers at approximately 200 feet on-center. The bridge would be built to maintain structural stability within the CMZ and thus would remove a barrier of channel migration. The existing water, sewer, and overhead utilities would be re-routed onto the new bridge section. The gas line would be reinstalled under the river using directional drilling, but with the deep burial extending east of the new embankment. The cost for extending the bridge and relocating the utilities is estimated to be in the range of $2 million to $3 million.

4.2 EXPANDED CHANNEL WITH FEMA-CERTIFIABLE SETBACK LEVEE OPTION

The Expanded Channel with FEMA-Certifiable Setback Levee option consists of removing the existing east riverbank revetment to allow the CMZ to increase up to 200 feet to the east, and constructing a FEMA-certifiable setback levee along the east edge of the new CMZ area

to provide flood-protected land between the new setback levee and the rail embankment. Figure 4-3 provides a plan view of the option, and Figure 4-4 indicates a typical section. Table 4-1 summarizes key metrics for this option. The proposed levee would extend into the floodway.

The proposed levee would begin at the BNSF embankment near the northern limit of the project area. The levee would run west along the Dieringer Canal and then south parallel to the White River, offset between 200 to 300 feet landward from the existing riverbank. At the No. 9 Ditch, the levee would turn east and extend back into the BNSF embankment. The new levee would tie into the BNSF rail embankment at its north and south ends, which would require BNSF approval. BNSF is expected to support this option as it would lessen potential flood impacts on the rail embankment. BNSF was contacted as part of this study, but offered no specific comments.

The location of the proposed setback levee would increase the area available for river channel migration. In order to increase the potential for actual channel migration, a majority of the new CMZ would be excavated to approximately the elevation of the OHWM. Reconnecting the White River to the floodplain would support natural riverine processes, creating off-channel habitat for salmon. Coho and Chinook salmon have been found in the project area reach, and both populations would benefit from the floodplain reconnection. Constructing setback levees are the most beneficial action type, as noted in the March 2008 *Salmon Habitat Protection and Restoration Strategy* by the Chambers/Puyallup Partners for Salmon Recovery, and are listed on the Puget Sound Partnership's action agenda.

South of 24th Street East, the proposed option would restore 26 acres of floodplain into the CMZ, mostly within the 200-foot buffer adjacent to the riverbank. Approximately 30 to 40 percent of the existing riverbank will be left in place as vegetated islands to help maintain existing established habitat. These "islands" will be approximately 20 to 30 feet wide on top and will be located between 24th Street and the No. 9 Ditch. The existing trees and vegetation will maintain existing habitat in the project area. The island locations would promote river channel braiding and shading, encouraging habitat diversity, and will provide off-channel habitat in locations of slower flow. ELJs would be installed upstream of each island, as well as at other strategic locations throughout the site to promote proper channel alignment as well as the accumulation of LWD.

North of 24th Street East, the existing 6 acres of riparian habitat on the point bar would be maintained in place to contain the existing river channel in order to avoid potential impacts to the pedestrian bridge and utilities within the 24th Street East corridor. The existing pedestrian bridge crossing the river at 24th Street will not be modified. The bridge, as well as the utilities abutting the bridge, would be protected from scour and erosion. Riprap or other erosion protection will be added to the upstream side of the 24th Street Trail to help protect the trail and utilities.

The proposed setback levee would be constructed with the intent to achieve FEMA certification. To meet the requirements for certification, the levee must be constructed to a height that is at least 3 feet above the base (100-year) flood elevation to protect the land adjacent to the levee from flood events. This would allow for the protection of approximately 71 acres east of the new levee. The project area is 128 acres, and 30 acres in the southern portion of the project area is restricted from any impervious development. The City is required to limit impervious development to 40 percent of the remaining acreage due to a restrictive covenant issued by the Seattle District of the USACE. The USACE Permit is included within the Property/Easement/Permit Condition Technical Memorandum in Appendix A.

The construction of the levee would remove approximately 212 acre-feet of flood storage from the river. This change will be offset, however, by excavation in the expanded CMZ and the southern portion of the property to achieve a net increase in flood storage of approximately 77 acre-feet.

4.3 CONSERVATION OPTION 1

Conservation Option 1 involves the excavation of a side channel to run through the project area, and restoring and protecting approximately 93 acres of CMZ and habitat area. North of 24th Street, all property will be maintained as riparian habitat with the exception of the proposed side channel. ELJs and cottonwood fences would be strategically placed in order to deter channel migration and protect the existing bridge and utilities. Figure 4-5 provides a concept plan, and Figure 4-6 contains a typical cross-section. Table 4-1 summarizes key metrics for this option.

The side channel would be excavated to a depth several feet below the 2-year water level, with the goal that the side channel contain flow diverted from the White River most of the time. Flow in the side channel would also occur from surface water run-off, groundwater discharge, and in the southern portion from flow in the No. 9 Ditch. The side channel substrate would be comprised of a gravel bottom including cobbles and spawning gravel. Spawning gravel size shall be 2-inch minus sand and gravel. This substrate would promote an ideal habitat for salmon spawning in the side channel. Woody habitat features, such as root wads, would be placed in the channel to aid in accumulating additional woody debris to provide habitat and cover for fish by adding to the river's complexity. The banks of the side channel will be vegetated with cottonwoods and other native species.

North of 24th Street East, the existing 6 acres of riparian habitat on the point bar would be maintained in place to contain the existing river channel in order to avoid potential impacts to the pedestrian bridge and utilities within the 24th Street East corridor. The existing pedestrian bridge crossing the river at 24th Street will not be modified. The bridge, as well as the utilities abutting the bridge, would be protected from scour and erosion. Riprap, or other erosion protection, will be added to the upstream side of 24th Street East to help protect the trail and utilities. A new bridge, approximately 100 feet long, would be constructed over the proposed side channel along 24th Street East. All existing utilities would be re-routed onto the proposed bridge.

South of 24th Street East, the property adjacent to the side channel would be excavated to approximately the OHWM to allow for channel migration and to improve habitat. Excavation would result in the removal of the existing riverbank and trail. ELJs and cottonwood fences would be placed to maintain the side channel in the desired corridor. Similar to the Expanded Channel with FEMA-Certifiable Setback Levee option described above, approximately 30 to 40 percent of the existing riverbank will be left in place as islands that retain the existing mature forest vegetation.

The vegetation the City previously planted as mitigation (located between the river and the trail south of 24th Street East) would be carefully removed and stockpiled during construction, and replanted in the excavation area or CMZ. Invasive species found in the project area, such as blackberries and ivy, would be removed. Maintenance work will be required to prevent these invasive plant species from returning to the project area.

The area along the east and southeastern corner of the project would be filled to above the 100-year flood elevation to allow for public uses (i.e., trail, community gardens/farm plots, park, educational kiosks, etc.) and provide a location for filling of excavated soils. Off-site disposal of excavated soil would increase the project cost. The fill area will also potentially

provide the start of a protective levee system for downstream properties. The proposed fill area would extend into the floodway. River modeling during final design will be needed to determine the extent to which the fill can extend into the floodway so as not to cause an increase in base flood elevation. If modeling does not indicate compliance with the zero-rise requirement, the fill area may need to be reduced from that shown in Figure 4-5, which would increase project costs due to increased off-site disposal of excavated soils.

Conservation Option 1 complies with the USACE permit restrictions to limit impervious development at the site.

Excavation in the project area would lead to a net flood storage increase of approximately 170 acre-feet.

4.4 CONSERVATION OPTION 2

Conservation Option 2 is similar to Conservation Option 1, except that the side channel is shifted to the west. Figure 4-7 provides a conceptual plan and Figure 4-8 provides a typical cross-section. Table 4-1 summarizes key metrics for this option.

The existing riverbank and adjacent riparian vegetation is retained, and hence the river CMZ is not increased. This may be an advantage over Conservation Option 1, as there would be much less potential for future channel migration to destroy the side channel.

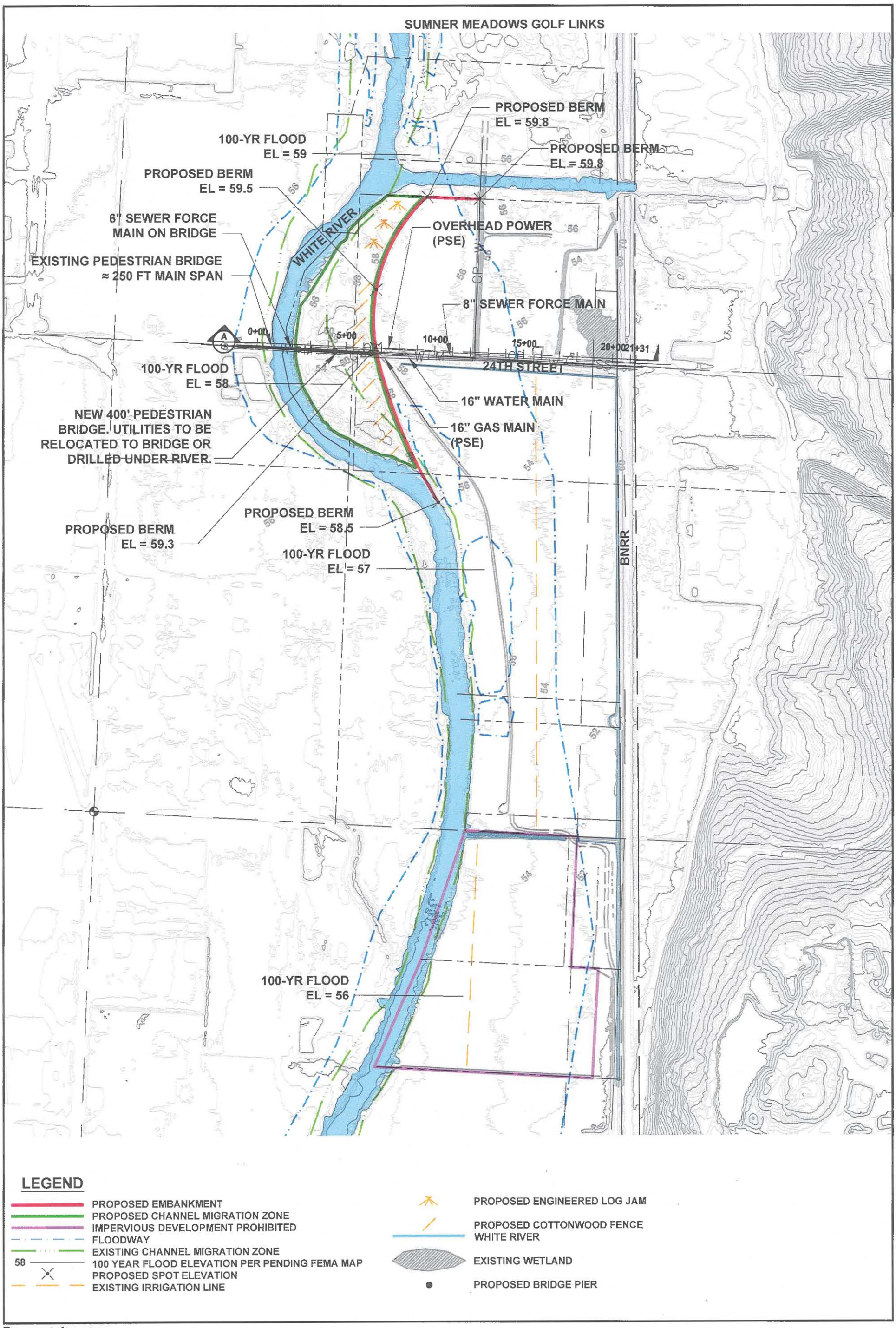
With Conservation Option 2, the existing City trail is retained. Compared to Conservation Option 1, less area is available to fill excavated soils between the side channel and the rail embankment, potentially increasing project disposal costs.

The side channel would be constructed to meet the same criteria as Conservation Option 1, including the same channel size and depth, and the same materials in the channel. The property adjacent to the channel, between the trail to the BNSF railroad right-of-way, would be excavated to approximately the OHWM.

Conservation Option 2 has many of the same features as Conservation Option 1. North of 24th Street East, no excavation would be completed between the east riverbank and the side channel. The area would be retained as riparian habitat. ELJs and cottonwood fences would be strategically placed in order to deter channel migration and protect the existing bridge and utilities. A bridge would be constructed over the side channel for the trail and utilities. The southeastern corner of the project would be filled to above the 100-year flood elevation to allow for potential public uses and provide a location for filling of excavated soils. Off-site disposal of excavated soil would increase the project cost. This option complies with the USACE permit on the property.

The existing City trail would be extended further south to connect to the broader Sumner trail system south of the project area. A pedestrian bridge, approximately 100 feet in length, would be constructed to cross the proposed side channel near its southern end.

Excavation in the project area would lead to a net flood storage increase of approximately 240 acre-feet, the most of any of the four options.



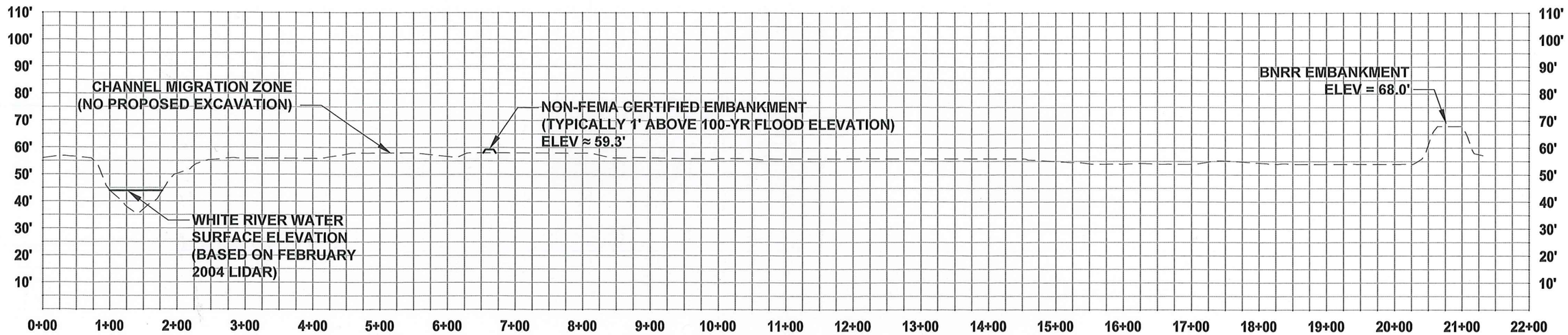
Parametrix DATE: July 8, 2010 FILE: SU1527073P01T08F-03

N

0 500

SCALE IN FEET

Figure 4-1
24th Street Point Bar Option
24th Street East Project Area
Sumner, WA



24TH STREET POINT BAR OPTION

SECTION A

NO SCALE

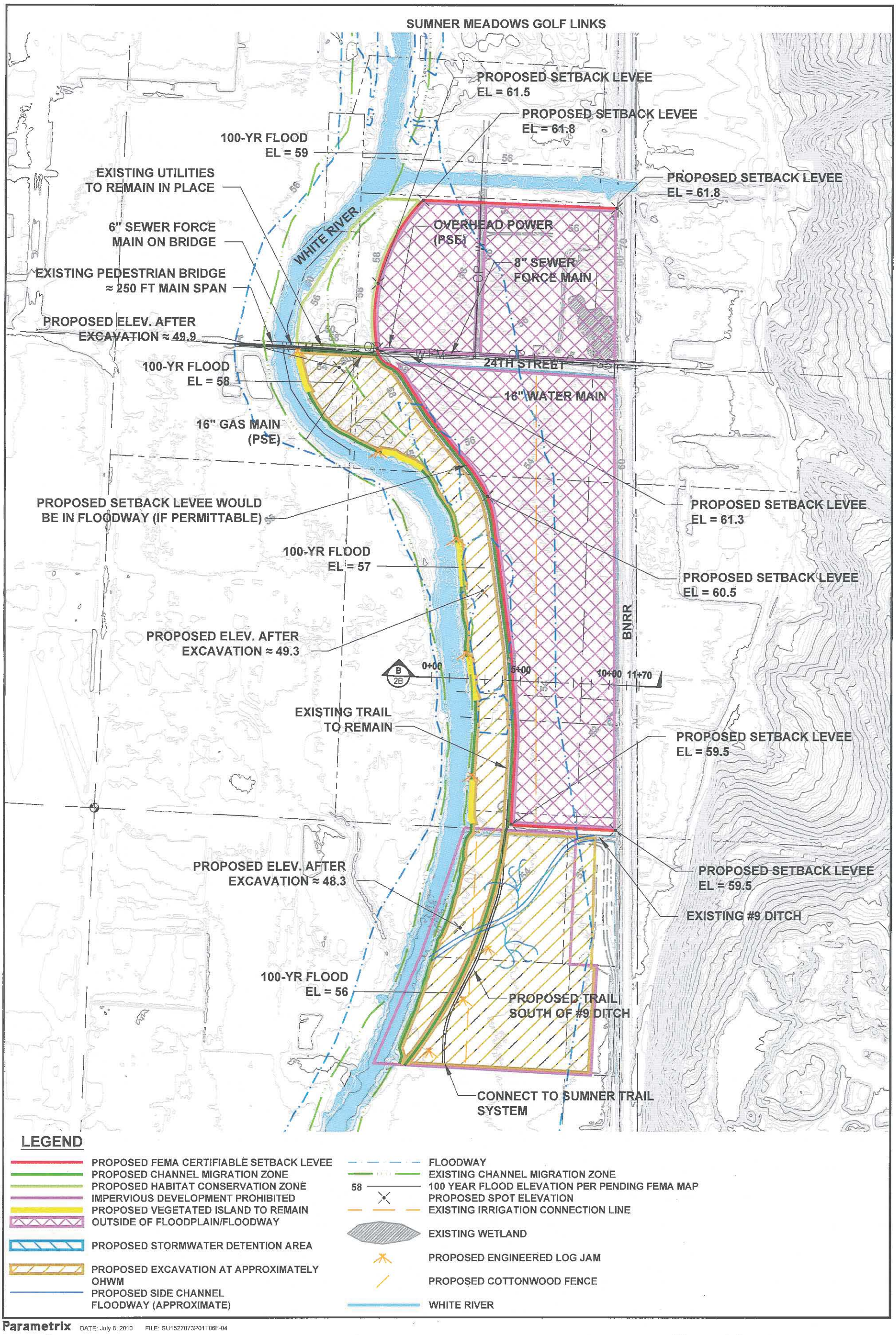
Parametrix DATE: July 8, 2010 FILE: SU1527073P01T06F-03

N

0

NOT TO SCALE

Figure 4-2
24th Street Point Bar Option
24th Street East Project Area
Sumner, WA



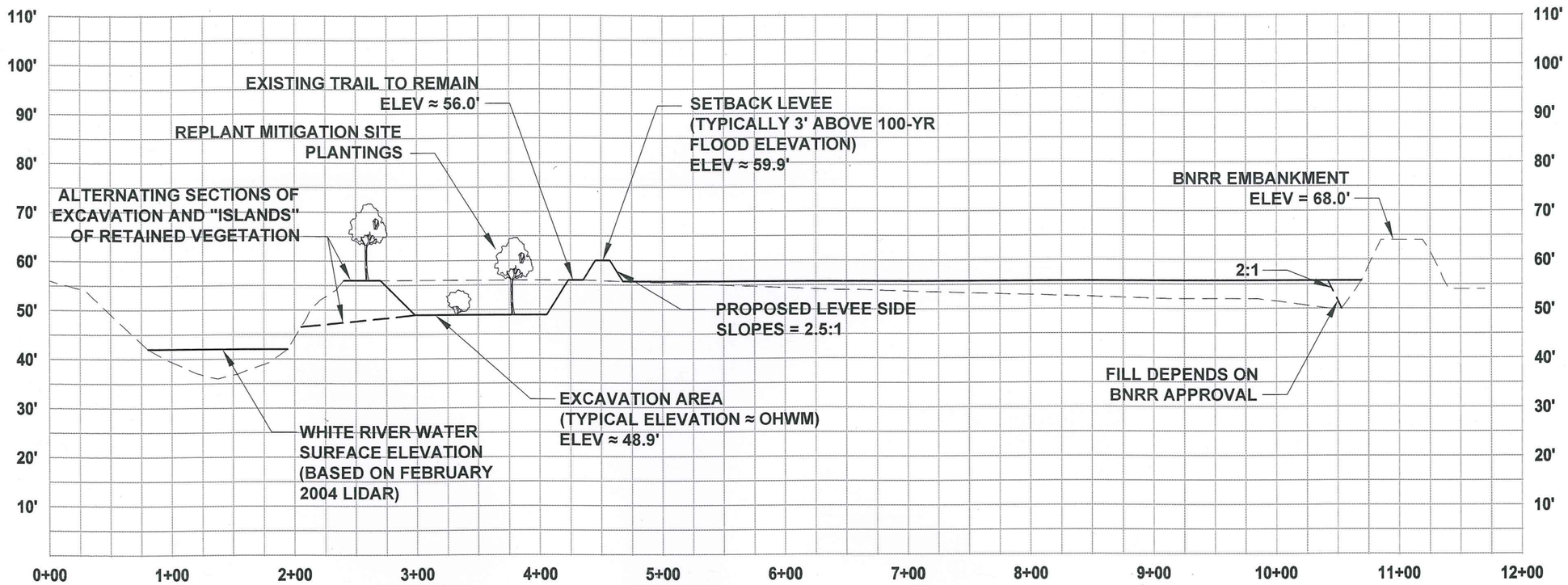
Parametrix DATE: July 8, 2010 FILE: SU1527073P01T06F-04

N

0 500

SCALE IN FEET

Figure 4-3
Expanded Channel with FEMA Certifiable Setback Levee Option
24th Street East Project Area
Sumner, WA



EXPANDED CHANNEL WITH
FEMA CERTIFIABLE SETBACK LEVEE OPTION

SECTION B

1"=100'

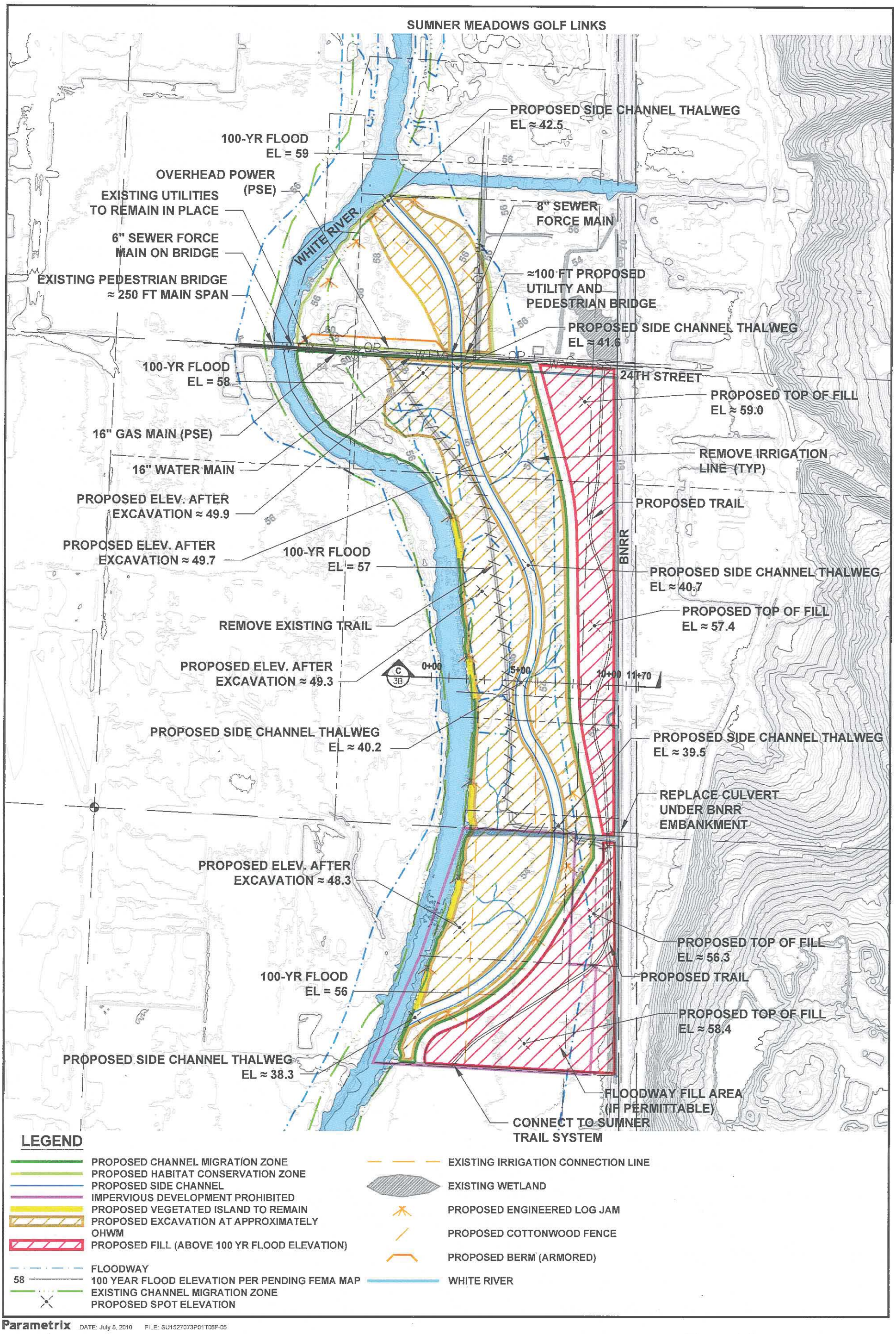
Parametrix DATE: July 8, 2010 FILE: SU1527073P01T06F-04

N

0 100

SCALE IN FEET

Figure 4-4
Expanded Channel with FEMA Certifiable Setback Levee Option
24th Street East Project Area
Sumner, WA



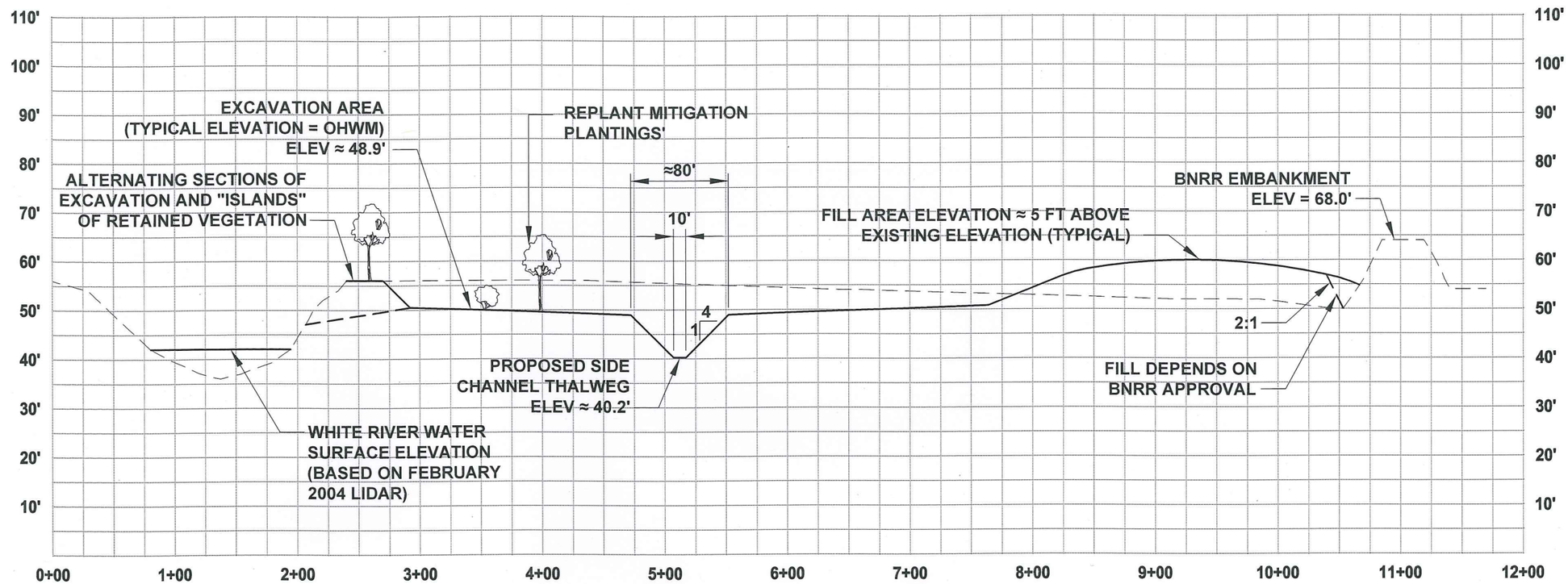
Parametrix DATE: July 8, 2010 FILE: SU1527073P01T06F-05

N

0 500

SCALE IN FEET

Figure 4-5
Conservation Option 1
24th Street East Project Area
Sumner, WA



CONSERVATION OPTION 1

SECTION C

1"=100'

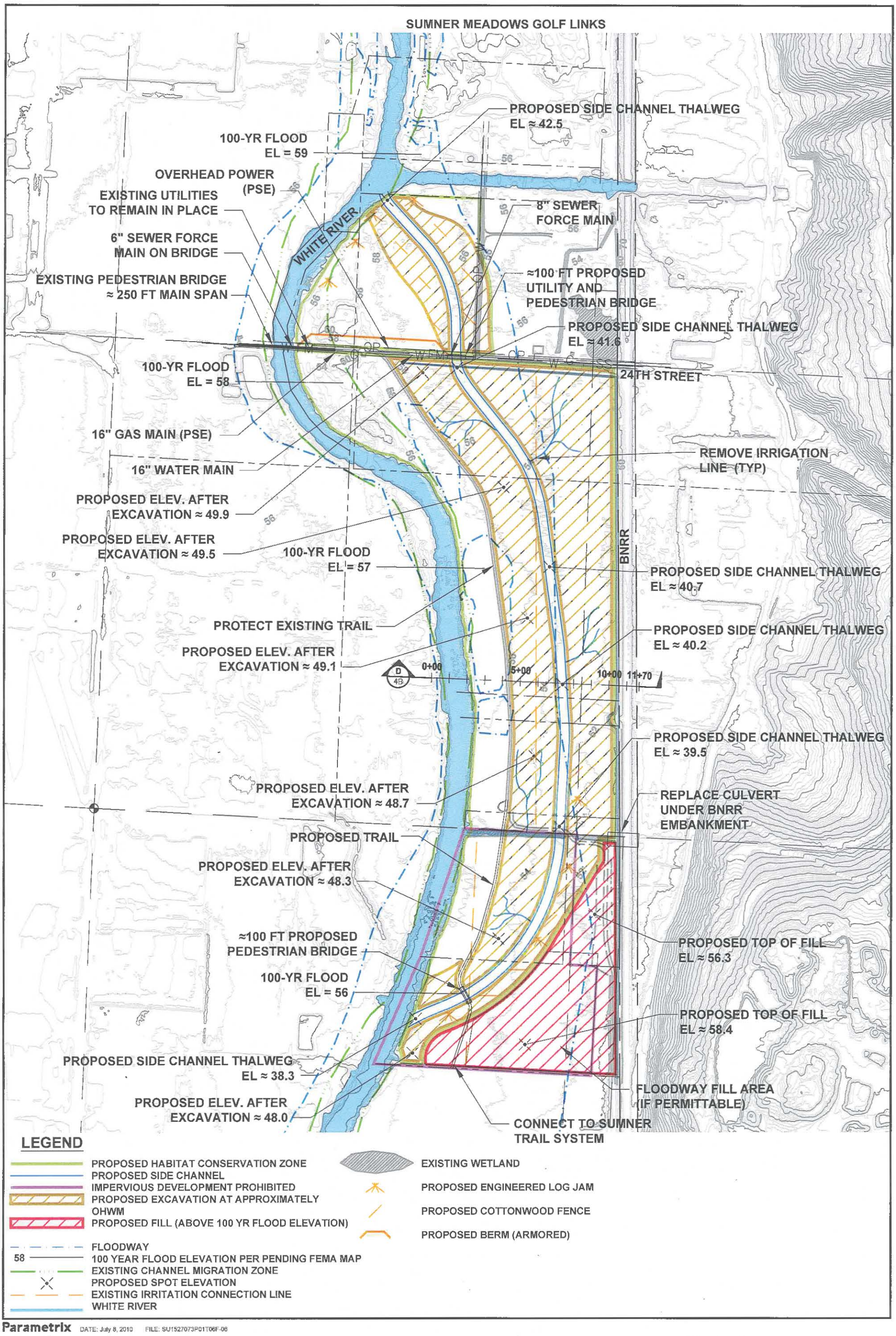
Parametrix DATE: July 8, 2010 FILE: SU1527073P01T06F-05

N

0 100

SCALE IN FEET

Figure 4-6
Conservation Option 1
24th Street East Project Area
Sumner, WA



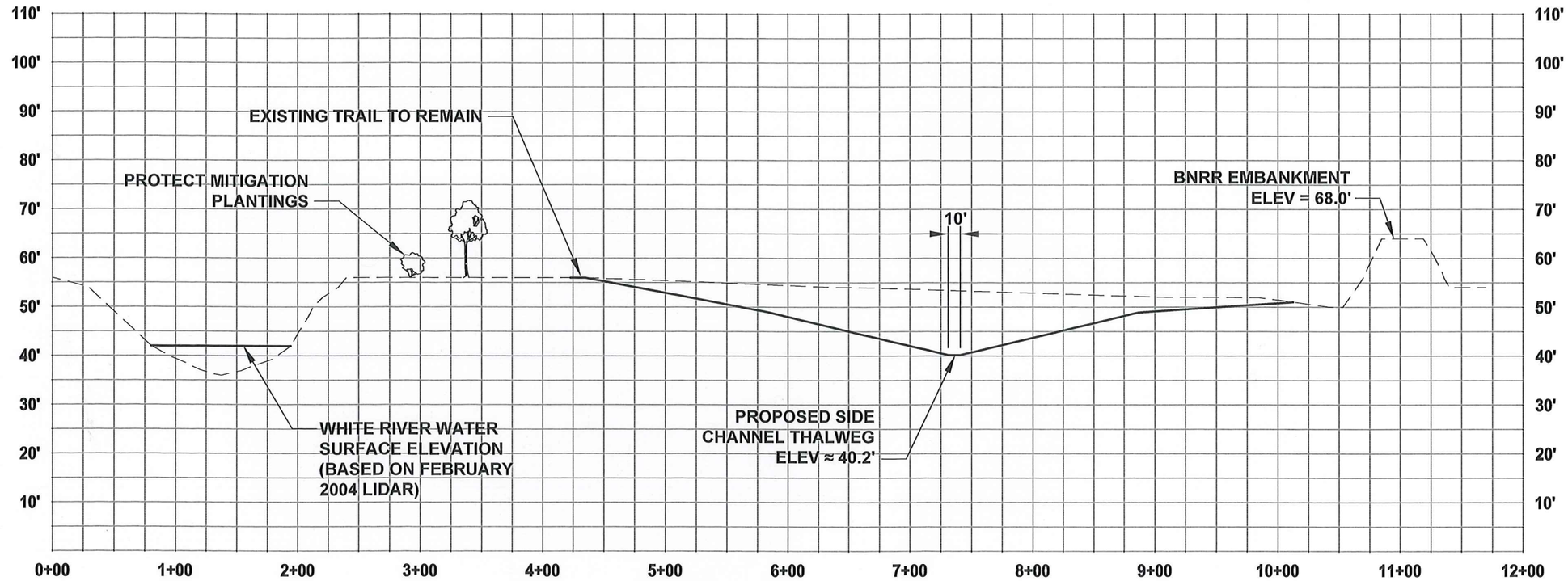
Parametrix DATE: July 8, 2010 FILE: SU1527073P01T06F-06

N

0 500

SCALE IN FEET

Figure 4-7
Conservation Option 2
24th Street East Project Area
Sumner, WA



CONSERVATION OPTION 2

SECTION D

1"=100'

Parametrix DATE: July 8, 2010 FILE: SU1527073P01T06F-06

N

0 100

SCALE IN FEET

Figure 4-8
Conservation Option 2
24th Street East Project Area
Sumner, WA

5. ANALYSIS

This chapter describes analyses completed to evaluate the options presented in Chapter 4. The options were also evaluated against numerous criteria, and scored in a matrix format.

5.1 BENEFITS TO SALMON

An important objective of the project is to improve habitat for salmonids. Potential benefits to salmon from the four options are described below.

5.1.1 24th Street Point Bar Option

This option would restore 6 acres into the CMZ; however, the river channel at this location lies on the inside of a major bend where natural channel migration processes are not likely to move into the site. This action would provide little or no benefit to salmonids. Potentially over time the natural migration of the river channel within the site would improve habitat conditions slightly for salmonid rearing.

5.1.2 Expanded Channel with FEMA-Certifiable Setback Levee

This option would restore approximately 25 acres into the channel migration zone, and also restore a portion of the natural physical processes to the river channel; however, it would provide little benefit to salmonids. Potentially over time the natural migration of the river channel within the 25 acres would improve habitat conditions slightly for salmonid rearing. This option would provide benefits to salmon that are slightly greater than the Point Bar option.

5.1.3 Conservation Option 1

This option includes constructing a new 5,300-foot-long side channel and expanding the channel migration zone by approximately 85 acres, but removes nearly all existing riparian vegetation along the left bank. Approximately 1.5 acres of riparian vegetation would be conserved near the project's northern terminus, and five small habitat islands (0.8–0.9 acre in size above OHWM) will remain along the left bank of the White River to provide shading. The remaining 82.5 acres would be graded as appropriate and planted with native vegetation.

The side channel would be excavated to a depth of several feet below the 2-year water level. Side channel substrate would be composed of cobbles and spawning gravels. The channel will be designed to provide potential rearing habitat juvenile salmonids known to spawn north of the site, as well as potential spawning habitat salmonids such as cutthroat trout, chum salmon, and possibly Coho salmon. Woody habitat features, such as root wads, will be placed in the channel to aid in accumulation of additional woody debris to provide refuge for fish and increase habitat complexity (riffle-pool complexes). The banks of side channels will be vegetated with native species as appropriate. The food production benefits of the existing left-bank mature riparian zone would be substantially reduced with removal of much of this riparian habitat.

Natural channel migration at some future time may potentially modify the side channel as the main river channel migrates eastward, and, if this occurred, the resulting river channel would likely feature improved habitat as compared to the existing river channel.

5.1.4 Conservation Option 2

This option includes constructing a new 5,300-foot-long side channel and retaining the existing pedestrian trail and approximately 11 acres of riparian vegetation along the left bank. The channel migration zone would not expand. The remaining 75 acres would be graded to provide flood control as appropriate and planted with native vegetation.

The new side channel would provide rearing habitat for juvenile salmonids produced upstream from the action. It would also potentially provide spawning habitat for some salmonids such as cutthroat trout, chum salmon, and possibly Coho salmon. Channel migration into the area of the new side channel would not occur unless an extreme flood event modified the existing levee and riparian area. The food production benefits of the existing left-bank mature riparian zone would be maintained by retention of most of this habitat.

5.1.5 Comparison of Conservation Options 1 and 2

Conservation Option 1 is estimated to have the potential for greater long-term benefits, depending upon the outcome of future channel migration. In the short-term, Conservation Option 2 may have greater habitat benefits due to retention of a substantial area of existing riparian vegetation; however, this benefit will be somewhat offset by maintaining the existing pedestrian trail within the habitat area. Conservation of the existing trail not only allows for potential wildlife disturbance but also divides the floodplain.

Pedestrian trails within wildlife areas, while beneficial for educating the public, have been known to negatively affect wildlife in many ways. Wildlife is not only affected by both the noise and activity created by humans but also by those activities of domesticated dogs. The City of Sumner may post signs requiring that the trail is an on-leash area as well as provide sanitary pet waste stations; however, it has been shown, that unless enforced, compliance with leash laws is generally 30 percent. Dogs with inattentive owners, as well as disrespectful humans, have been known to degrade wildlife areas by trampling vegetation, braiding trails, leaving waste behind, and chasing wildlife. Waste left along trails has been known to negatively impact water quality degrading aquatic habitat.

While adverse impacts related to trail use may occur under both conservation options, Conservation Option 2 proposes to allow use of a pedestrian trail in higher quality habitat between the river and side channel where more wildlife species are likely to be affected by the public. In contrast, the trail for Conservation Option 1 would be placed near the existing BNSF railroad tracks and, therefore, have less adverse impacts, because the trail will not be directly in the wildlife area and also because less wildlife are likely to use the area near the railroad due to noise and railroad activity, as compared to the riparian area near the river for Conservation Option 2.

In addition to public use of the trail, the City of Sumner will also need to maintain the trail and adjacent grounds, and these maintenance activities are also likely to adversely affect wildlife. Trail maintenance activities for Conservation Option 2 would likely be greater than for Conservation Option 1 due to the presence of the pedestrian bridge over the side channel at the south end of the project. Conservation Option 2 does not have this location. High flood events are likely to deposit sediment on the trail for Conservation Option 2, which would require removal using heavy equipment, whereas the trail for Conservation Option 1 would lie above the 100-year flood elevation. Additionally, Conservation Option 1 may reduce maintenance activities by the railroad on the rail embankment sideslope.

5.2 GEOMORPHIC ANALYSIS

Potential issues and channel responses that may result from the four options are described below.

5.2.1 24th Street Point Bar Option

This option would expand the CMZ by approximately 6 acres. However, based on the existing form of the channel bend, few changes in channel forming processes would likely take place. The setback area is located on the inside bank of the bend, where little dynamic activity, such as erosion or deposition, has taken place over the past several decades. Subsequently, no local or downstream changes in channel behavior, or local rates of channel migration, are expected to result from this Option.

5.2.2 Expanded Channel with FEMA-Certifiable Setback Levee

This option would reconnect the river channel with approximately 25 acres of the floodplain. The vegetated islands shown on the concept drawing will be roughly 250 feet long, set 500 feet apart, and would be placed along the channel bank, giving the effect of a perforated berm. The new levee will be positioned 500 feet back from the channel bank across the bend, and from 500 to 250 feet from the bank/vegetated island south of the bend. At high stage flows, this setback distance could have the effect of widening the channel over the length of the setback. However, the positioning of the vegetated islands would likely damp overbank flow velocities between the islands and the levee, and may encourage deposition of fine sand and silt in this area. This option is expected to impose only small changes in channel forming processes and/or migration behavior, although a small increase in erosion on the islands could occur at high stage flows. No changes in the rates or character of migration, either local or nearby, are expected from this option.

5.2.3 Conservation Option 1

This option includes constructing a new 5,300-foot-long side channel through the setback area. The side channel inlet will engage with the main stem at the upstream end of the 24th Street bend and will be set at a 90-degree angle with the main stem channel. The new side channel floor will be set 8 to 9 feet below the OHWM elevation, and the channel form will consist of five linked bends. Vegetated islands will be set along the channel bank from 250 to 500 feet apart. The location of the side channel inlet will allow both river water and sediment to enter the channel. Sediment entering the side channel will comprise the finer fraction of the bedload and portions of the suspended load. Unless side channel flow velocities are high enough to move incoming sediment through the side channel, sediment will deposit in and downstream of the inlet. The proposed dimensions (width and depth) and gradient of side channel will not be sufficient for dynamic processes to cause side channel migration and subsequently, few if any, adverse channel responses are expected in the side channel or the main stem. An increase in erosion on the islands could occur at high stage flows. No changes in the rates or character of main stem migration, either local or nearby, are expected from this option.

5.2.4 Conservation Option 2

This option includes constructing a new 5,300-foot-long side channel and retaining the existing riparian vegetation along the left bank. As in Conservation Option 1, the side channel inlet will engage with the main stem at the upstream end of the 24th Street bend at a 90-degree angle, and will be set 8 to 9 feet below the OHWM elevation. However, the channel form will consist of a single gently curved bend with a very broad bank full width. The long swath of existing riparian zone will extend the full length of the setback area and

subsequently separate the main stem from the floodplain. The location of the side channel inlet will allow both river water and sediment to enter the channel. Sediment entering the side channel will comprise the finer fraction of the main stem bedload and some percentage of the suspended load. Unless side channel flow velocities are high enough to move incoming sediment through the side channel, sediment will deposit in and downstream of the inlet area. Sediment deposition within the side channel may cause local aggradation of the channel floor, which may in turn cause local bank erosion and bar building. Under these conditions, dynamic processes could result in formation (and eventually the migration) of a low-flow channel within the bank full corridor of the side channel. No changes in the rates or character of main stem migration, either local or nearby, are expected from this option.

5.3 FLOOD IMPACTS

River hydraulic modeling of all options, except the point bar, was completed to assess flood reduction benefits as well as compliance with zero rise requirements. The point bar option was not modeled due to providing minimal benefits and due to a limited project budget. River modeling was completed using the Hydrologic Engineering Centers-River Analysis System (HEC-RAS) model previously developed for the White River for the Pierce County Levee Setback Study (GeoEngineers 2008), updated with new topography data (see Section 3.5).

Results of the modeling analysis are provided in Table 5-1. These results indicate that the Expanded Channel with FEMA-Certifiable Setback Levee Option would not meet the zero-rise requirement, whereas Conservation Options 1 and 2 generally meet the zero-rise requirement. The prediction of a 0.1-foot rise for Conservation Options 1 and 2 appears to be a spurious modeling result, but this will need to be evaluated in the future during final design. For Conservation Option 1, the fill at the south end of the site that is proposed to extend into the floodway may need to be omitted to meet the zero-rise criteria.

For the FEMA-Certifiable Levee, it may be possible to reconfigure the proposed levee to produce less rise than occurs with the present concept; however, moving the levee wholly out of the floodway would reduce the area of land protected by the levee to less than 30 acres. The resulting small and long narrow shaped parcel is estimated to have little value for commercial development or other City use.

Table 5-1. Summary of River Hydraulic Modeling Results – Predicted Rise in 100-Year Flood Event Water Surface Elevation (Feet)

Location	Expanded Channel with FEMA-Certifiable Setback Levee Option	Conservation Option 1	Conservation Option 2
North of Project Area (RM 3.84)	0.4	-0.9	-1.0
North end of Project Area (RM 3.63)	-0.1 (0.2)	-1.0	-1.2
Middle of Project Area (RM 3.38)	-0.1	-0.4	-0.5
South end of Project Area (RM 2.83)	0 (0.05)	0 (0.1)	0 (0.1)

Notes: Values are averaged over the distinct areas.
Value in () indicate the average rise in water surface elevation at the specific RM noted.

5.4 GEOTECHNICAL

Geotechnical analysis was completed for the proposed levee element of the Expanded Channel with FEMA-Certifiable Setback Levee Option (see Appendix G). Results indicate soils on the site consist of moisture-sensitive silty soils on which it will be difficult to operate equipment during wet weather and that cannot be compacted properly if wet. Stripped subgrades should not be left exposed to inclement weather for extended periods.

Geotechnical analysis also indicates that:

- The proposed levee should have a crest width of at least 12 feet. Levee sideslopes should be 2.5 vertical to 1 horizontal, or flatter.
- Settlement of the proposed levee is anticipated to be in the range of 4 to 6 inches, which is not significant.
- Seepage under the proposed levee would be with design criteria and additional seepage mitigation measures would not be required.
- The proposed levee is expected to be stable during flood conditions.
- The proposed levee is expected to be stable under design seismic conditions.

5.5 COST

For each option, project design, permitting, and construction costs were estimated at the feasibility study level (plus 50 percent to minus 30 percent). Quantities were estimated based on the Concepts in Figures 4-1, 4-3, 4-5, and 4-6. Table 5-2 summarizes estimated project costs. Detailed cost analyses are provided Appendix J.

Table 5-2. Summary of Estimated Costs (in millions)

Cost Item	Point Bar Option	Expanded Channel with FEMA-Certifiable Setback Levee Option	Conservation Option 1	Conservation Option 2
Design, Permitting, Construction Management, and City Administration:	$1.3	$2.9	$3.4	$3.2
Construction:	$5.5	$10.5	$14.3	$13.6
Total:	**$6.8**	**$13.4**	**$17.7**	**$16.8**

5.6 REGULATORY

In general, permitting requirements for each of the options are similar in terms of the permits and approvals needed to implement construction activities. The following permits and approvals are anticipated to be required:

- City of Sumner – SEPA Determination. The following will need to be submitted:
  - SEPA Checklist.
  - Cultural Resources Report.
  - Critical Areas Study.

- City of Sumner – Shoreline Substantial Development Permit, Shoreline Conditional Use Permit, and Grading/Filling Permit. The following will need to be submitted:
  - Joint Aquatic Resource Permit Application (JARPA) and any additional development permit application materials.
  - SEPA Checklist.
- Washington Department of Fish and Wildlife (WDFW) – Hydraulic Project Approval (HPA). The following will need to be submitted:
  - JARPA.
  - SEPA determination.
  - Standard drawings (general plans and specifications).
- USACE – Section 404 Permit. The following will need to be submitted:
  - JARPA.
  - Cultural Resources Report.
  - Biological Evaluation (BE).
  - Section 404(b)(1) alternatives analysis.
- Washington Department of Ecology (Ecology) Section 401 Water Quality Certification. The following will need to be submitted:
  - JARPA.
  - Ecology Coastal Zone Management (CZM) Program Consistency Determination
- Washington Department of Natural Resources (DNR) – Right-of-Entry. The following will need to be submitted:
  - JARPA.
  - Application for DNR Right-of-Entry.

Obtaining the above-noted permits and approvals can reasonably be expected to take 6 to 12 months following submittal of permit applications.

For the Expanded Channel with FEMA-Certifiable Setback Levee Option, early coordination with FEMA is recommended to aid in obtaining FEMA certification of the levee. Detailed geotechnical and river hydraulic modeling studies, levee design information, and construction quality control/quality assurance documentation must be prepared and submitted to FEMA for approval. Additional project information must be submitted to FEMA in accordance with National Flood Insurance Program (NFIP) Section 65, including levee operation and maintenance plans. Levee certification occurs through FEMA's map revision project, by either a Conditional Letter of Map Revision (CLOMR) obtained prior to construction or a Letter of Map Revision (LOMR) obtained after levee construction. Similar documentation is needed with this approach. Levee certification can be a lengthy process, sometimes taking 1 to 2 years or longer.

5.7 COMMUNITY BENEFITS

The implementation of a wetland and side channel habitat in the project area has the potential to provide additional community benefits to the City and the citizens of Sumner, including open space and environmental education. Creating a wetland mitigation bank would create a large natural area or greenspace with multiple uses and benefits. The wetlands could aid in improving water quality and decreasing stormwater runoff volumes. Habitat for numerous

species would be provided and enhanced. Additionally, the area would provide opportunities for recreation such as bird watching, wildlife viewing, biking, and hiking. The existing trail would be improved and connected to the City trail system to promote such activities. The area would also provide an opportunity for public education and outreach regarding the features of the system and how they aim to address the important issues of flood protection and ecological health.

One adverse effect of implementing Conservation Option 1 is the loss of use of the land for agriculture. While leasing the land for agriculture generates little revenue for the City (approximately $22,000 per year for 95 acres), the practice of agriculture has strong roots in the Sumner community, and there is social value that cannot be quantified monetarily in maintaining the land in cultivation, both intrinsically and for potential public education value.

5.8 MATRIX SCORING

The four options presented in Chapter 4 were scored against a number of relevant criteria (see Table 5-3) using a scoring system ranging from 0 (no benefit, fails, etc.) to 3 (highest, best, etc.). Scores were summed to produce a total score for each option. The maximum possible score was 72.

Table 5-3. Scoring Matrix – 24th Street Setback Levee[a]

	24th Street Point Bar[b] (Figure 4-1)	Expanded Channel with FEMA-Certifiable Levee (Figure 4-3)	Conservation Option 1 (Figure 4-5)	Conservation Option 2 (Figure 4-7)
PROJECT METRICS				
Engineering/Technical Feasibility	3	1	2	2
Implementability (Permits, Approvals, etc.)	3	2	2	3
Stakeholder Coordination	3	2	2	2
Timeframe to Implement	3	2	1	1
ECONOMIC				
Capital Cost	$6.8 M	$13.4 M	$17.7 M	$16.8 M
Capital Cost Score	3	2	1	1
Maintenance Costs	1	2	2	2
Potential for Grant Funding	1	1	2	2
Potential for Private Funding as Mitigation Site or Bank	1	1	3	3
Potential for Sale of Developable Land to Fund Project	0	3	0	0
Potential for City Reimbursement of Property Investment via Conservation Easement	1	2	3	3
COMMUNITY BENEFITS				
Maintain Existing Farmland	3	0	1	1
Education Potential	1	1	3	3
INFRASTRUCTURE				
Impact to Existing Utilities	1	1	2	2
Allows for Future 24th Street River Crossing	1	3	2	2
Allows for Future Southerly Road Connection	3	3	3	1
Maintain Existing Trail or Construct New Trail	3	3	1	3
RIVER AND ENVIRONMENT				
Flood Storage	0	1	3	3
Meets “No Rise” Criteria	1	0	3	3
Flood Elevation Reduction(b)	0	1	3	3
Increase in Channel Migration Zone	1	2	3	0

(Table Continues)

Table 5-3. Scoring Matrix – 24th Street Setback Leveea (Continued)

	24th Street Point Bar[b] (Figure 4-1)	Expanded Channel with FEMA-Certifiable Levee (Figure 4-3)	Conservation Option 1 (Figure 4-5)	Conservation Option 2 (Figure 4-7)
POTENTIAL HABITAT DEVELOPMENT				
Side Channel Habitat Value	0	0	3	3
New Wetland Habitat Value	0	2	3	3
Existing Riparian Habitat Maintained	2	1	1	3
Integrates with Existing Stormwater Drainages	0	2	3	3
TOTAL SCORE:	**35**	**38**	**52**	**52**
FATAL FLAWS?	**No**	**Yes. Does not meet zero rise criteria.**	**No**	**Yes**
OVERALL RANK:	**3**	**N/A**	**1 (tie)**	**1 (tie)**

[a] Scoring:
0 = None, Fails, No Benefit
1 = Lowest Benefit, Worst, Most Complex, Most Costly
2 = Middle, Medium, Fair
3 = Highest Benefit, Best, Easiest, Lowest Cost

[b] Point Bar Not Modeled. Score is based on estimated results.

The results of the matrix scoring indicate the following rankings:

- **24th Street Point Bar Option**: Very similar to the concept included in Pierce County's study of potential setback levee sites (GeoEngineers 2008), this option would restore 6 acres to the river CMZ. This option is estimated to cost $6.8 million, but provides minimal benefits, and hence was ranked third, with a score of 35.
- **Expanded Channel with FEMA-Certifiable Setback Levee Option**: This option would restore approximately 25 acres into the CMZ, and install a FEMA-certifiable levee that would provide 64 acres of flood-protected property. This option is estimated to cost $13.4 million, and would provide some benefit in a broad range of categories. However, construction of the FEMA-certifiable levee would substantially encroach into the river floodway, and hydraulic river modeling predicts that this encroachment would cause a 0.4-foot rise in the 100-year flood elevation upstream of the project site. As such, this option would not meet the "zero-rise" regulatory criteria established by the City (SMC 15.52). Therefore, this option is determined not to be implementable, and it was not scored or ranked.
- **Conservation Option 1**: This option would create 5,300 feet of new side channel. Existing ground between the side channel and the river would be excavated to aid in expanding the river channel migration zone by approximately 85 acres. This option is estimated to cost $17.7 million, and provide substantial geomorphological, flood control, and habitat benefits. Conservation Option 1 was ranked in first place (tied with Conservation Option 2) with a score of 52.
- **Conservation Option 2**: This option would create 5,300 feet of new side channel. The existing mature forest on the riverbank would be retained, and the side channel would be constructed further east on the site as compared to Conservation Option 1. There would be no expansion of the river CMZ. This option is estimated to cost $16.8 million, and would provide good habitat benefits and the highest flood control benefits. With a score of 52, it tied for first place with Conservation Option 1.

6. PREFERRED ALTERNATIVE

Conservation Option 1 and Conservation Option 2 tied for first place in the options ranking analysis. Based on further consultation with the City, Conservation Option 2 was selected as the concept that provides the overall greatest benefit considering the factors evaluated in the matrix scoring, including habitat, flood control, and cost. The side channel concept in Conservation Option 2 will be carried forward to complete 30 percent engineering design analysis and drawings.

7. PRELIMINARY DESIGN

Preliminary design of the side channel for Conservation Option 2 was completed and is provided in Appendix K. The preliminary design includes a technical memorandum documenting the basis for design, preliminary drawings, a preliminary planting concept, and a preliminary design level cost estimate. The estimated project cost considering design, permitting, construction, sales tax, and construction management/administration is $16 million. The proposed goals of the project are to establish a new side channel between RM 3.6 and 2.6 that has the following characteristics:

- A flow of 10 to 20 cfs, and velocities less than 2 feet per second, under typical conditions.
- A wider, flatter, deeper, slow-flowing upstream section to provide off-channel refuge habitat for juvenile salmonids.
- A narrower, steeper, shallower, faster-flowing middle section with a meandering riffle/pool structure to provide spawning habitat.
- A wider, flatter, deeper, slow-flowing downstream section to provide off-channel refuge habitat for juvenile salmonids.

Based on review of White River monthly average flow data, the minimum monthly flow occurs in October (378 cfs), and the maximum monthly flow occurs in February (1,270 cfs). Juvenile salmon will be present in October and would benefit from off-channel refuge. Therefore, the monthly average flow for October was selected as the design condition for the side channel, and additional hydraulic modeling was completed to predict elevations of the White River for both the October and February flow rates, at both the side channel inlet and outlet locations, in order to define the hydraulic profile for the side channel. The technical memorandum in Appendix K provides the hydraulic profile for the side channel.

During exceptionally low flow periods, flow through the side channel could cease. This specific flow rate in the White River at which the side channel ceases flowing was not determined, but can be confirmed through additional modeling during final design.

The principle design options for the side channel project are listed below. These design options are selected for the purposes of illustrating a preliminary design and could be revisited or revised during final design.

- **Side Channel Inlet Options**:
  - Open Channel: Excavate the head of the side channel for a direct connection to the river.
  - Culvert: Install culvert through existing riverbank revetment to convey water to the head of the side channel.
  - "Leaky Levee": Replace approximately a 50-foot-wide section of the riverbank using coarse riprap to provide seepage flow to the head of the side channel.
  - **Selected Option – Culvert:** The open channel would create a high risk for a major channel avulsion that would produce excessive flow down the side channel or even cause the side channel to become the new main channel. This risk could be mitigated through extensive use of engineered log jams or possibly by re-orienting the inlet direction of the side channel, but a moderate risk of avulsion would remain. The culvert is preferred over the leaky levee because it is easier to obtain a specific desired flow. Additionally, culverts can readily be maintained via flushing or jetting if sedimentation occurs, whereas a leaky levee would need to be entirely rebuilt should void spaces in the riprap plug with fine sediment.

The culvert option will not increase flood elevation in the White River compared to existing levels; however, the magnitude of the predicted reductions in flood elevations (see Appendix I of the Feasibility Study) may not be as great as predicted due to using culverts rather than having an open entrance to the side channel.

- **Design Notes:**
  - The inlet culverts are intended to constrict and regulate flow into the side channel and hence they are designed to achieve this objective rather than conform to *Design of Road Culverts for Fish Passage* (WDFW 2003). If a larger open box culvert were used, it is estimated that flows would be excessive. A box culvert option with flow restriction devices could be evaluated as an alternative during final design.
  - During high flow rates in the White River, the side channel would be flooded by backwatering from the White River via the side channel outlet. During the 100-year flood event, water would extend over the White River banks and flood plain (between the river and the rail embankment to the east). Damaging high flows through the inlet culverts are not anticipated since a substantial hydraulic drop across the inlet culverts would not occur.

- **24th Street/Side Channel Crossing Options**:
  - Vehicle bridge over open channel, 30 to 100 feet long, located above the 100-year flood elevation, designed to support the numerous existing utilities that currently cross the proposed side channel alignment.
  - Pedestrian bridge over open channel, approximately 100 feet long located above the 100-year flood elevation, designed to support the numerous existing utilities that currently cross the proposed side channel alignment.
  - Earth embankment with 30-foot-wide by 12-foot-high box culvert, approximately 60 feet long.
  - **Selected Option – Earth Embankment with Box Culvert:** The City must have vehicle access to the west portion of the side channel property; and therefore, a pedestrian bridge only is eliminated. A vehicle bridge, along with converting the existing underground and overhead utilities to exposed support of utilities on the bridge, would have higher capital and operation/maintenance costs than a box culvert.
    - **Design Note:**
      - The box culvert was sized using the "No Slope Design Option" in *Design of Road Culverts for Fish Passage* (WDFW 2003). Additional details are provided in Appendix K.

- **Pedestrian Bridge Options** (near downstream end of side channel):
  - Elevated bridge, approximately 300 feet long, elevated above the 100-year base flood elevation.
  - Earth embankment with box culvert, approximately 100-foot-long culvert.
  - Terrain level bridge, approximately 130 feet long, set slightly above the 2-year flood elevation.

- **Selected Option – Terrain Level Bridge**: This is the least costly option, and avoids the adverse impact to the side channel habitat that would occur by routing the side channel through a box culvert. Additionally, the terrain level bridge provides improved opportunities for public education, due to the bridge being closer to the side channel. The bridge will need to be well anchored (anchors to be sized during final design).

Additional design coordination with agencies and other stakeholders would be completed during final design.

8. FUNDING OPTIONS

Implementation of the selected Option (Conservation Option 2 – Side Channel) could be funded through several methods, including:

- Additional grant funding, such as from the SRFB.
- Develop the site as a wetland mitigation bank, funded by the City or through private investment. For the bank approach, the entire project would be funded through bonds or other means, and constructed in one effort. The investment would be recouped through sale of mitigation credits over time.
- Develop the site as a wetland mitigation area available to parties needing mitigation credit. With this approach, parties needing mitigation would incrementally and sequentially construct portions of the side channel and habitat, working from downstream to upstream. Construction of each segment would be funded by the party needing mitigation and, therefore, the City would need to provide only a minimal initial investment.
- Develop a Compensatory Flood Bank to provide developers with regulated and approved means to place fill in the flood plain as needed to raise their structures above the predicted flood level. The fill placed for these off-site projects would be off-set by excavation completed within the project area.

While any of the above funding approaches is viable, there is limited potential to "mix and match" these approaches. For example, grant funding typically cannot be used to construct a mitigation site or bank.

8.1 GRANT FUNDING

A number of grant programs exist that could potentially provide funding for design and construction of the selected option. The SRFB is one of the best known and best funded local authorities to provide grants. SRFB grant funding could be accepted in combination with City or private funding for a mitigation bank or site only if the funds were specifically allocated to separate areas of the site. Washington State recently announced it may eliminate the SRFB or substantially modify the method in which grant funds are distributed for salmon habitat restoration.

8.2 WETLAND MITIGATION BANK

The City could develop the site as a wetland mitigation bank, using either City funding or by partnering with a private party. The implementation of wetland and side channel habitat at the site would provide local habitat improvements at the project site, but these improvements would be offset by off-site development impacts, for minimal net environmental benefit.

Wetland mitigation banks in Washington are governed by RCW 90.84 and regulated by Washington Administrative Code (WAC) 173-700. As one method to implement a bank, a private party has approached the City with a proposal to lease the property from the City for a period of 10 years, construct wetland and fish habitat, and sell "wetland mitigation credits." Potential buyers are parties that need environmental mitigation due to causing environmental impacts as part of other development projects. These parties would buy their credits from the bank in lieu of completing their own individual mitigation actions. Similarly, if the City needed mitigation credits as a result of developing City infrastructure, the City could obtain credits from the bank.

To contract with a developer to implement a wetland mitigation bank, the City would need to conduct a public bid to identify the most qualified and least costly contractor to complete the work. The City and the private developer would engage in a profit sharing agreement, whereby the City receives the revenue for a certain percentage of these credit sales. The private developer would be responsible for all development and maintenance over the terms of the lease, and the property would eventually return to the full control of the City at the end of the project.

Soil excavated from the site and disposed of off-site (out of the flood plain) would provide increased flood storage (see Section 7.4).

8.3 MITIGATION SITE

Developing the project area as a site where other parties could complete mitigation actions would reduce the initial capital cost of the project. As with a wetland mitigation bank, the implementation of wetland and side channel habitat at the site would provide local habitat improvements at the project site, but these improvements would be offset by off-site development impacts, for minimal net environmental benefit.

With the mitigation site approach, parties needing mitigation would incrementally and sequentially construct portions of the side channel and wetland habitat, working from downstream to upstream. Construction of each segment would be funded by the party needing mitigation, and therefore, the City would need to provide only a minimal initial investment. Figure 8-1 (located at the end of this chapter) provides an example phasing scheme overlain on Conservation Option 2.

In Washington, mitigation sites are not directly regulated. Rather, they are indirectly regulated in the sense that each party and project needing mitigation must craft a project-specific agreement with the regulatory agencies to construct specific habitat within the City's specific project area; however, no "master plan" is submitted to any agency for specific pre-approval of the site as a mitigation site. The City could use the site if it had mitigation needs.

The City would likely retain overall site administration and maintenance responsibilities. Funding for maintenance would be part of the payment made to the City by the parties implementing the mitigation actions.

Soil excavated from the site and disposed of off-site (out of the flood plain) would provide increased flood storage (see Section 7.4).

8.4 COMPENSATORY FLOOD STORAGE BANK

Excavation completed to construct the selected option would provide an increase in flood storage volume (assuming the excavated soil is disposed of out of the flood plain), which would aid in reducing the flood water surface elevation and duration within the project area, and potentially downstream as well.

The NFIP floodway standard in 44 CFR 60.3(d) restricts new development from obstructing the flow of water and increasing flood heights. Within the FEMA-regulated flood area, placement of fill to raise structures above the flood plain requires compensating excavation to ensure no rise in flood levels, especially in flat areas where the floodplain provides a valuable function by storing floodwaters. When fill or buildings are placed in the flood areas, the flood storage areas are lost, and flood heights will go up because there is less room for the floodwaters.

Compensatory flood storage allows developers to offset new fill put in the floodplain by excavating an additional floodable area to replace the lost flood storage area. This should be done at "hydraulically equivalent" sites—fill put in below the 10-year flood elevation should be compensated by removal of soil below that elevation elsewhere in the floodplain. Community Rating System credits are available for communities that adopt compensatory storage requirements, and these credits are noted in determining community flood insurance rates. More credits mean lower flood insurance rates.

The City could use the net excavation volume from constructing the selected option to implement a Compensatory Flood Storage Bank. Under a Compensatory Flood Storage Bank program, the net excess excavation volume created by the City could be sold to provide developers with a regulated and approved means to place fill in the flood plain as needed to raise their structures above the predicted flood level. The City would sell volume credits to developers upon application. A Compensatory Flood Storage Bank program could be set up and implemented by the City without external agency approvals or regulatory review.

Implementing a Compensatory Flood Storage Bank would generate revenue for the City, which might be needed to attain the above-noted habitat benefits; however, it would negate the overall net flood reduction benefits from the selected option. A Compensatory Flood Storage Bank could be implemented in combination with any of the three habitat funding options described above.

The City of Sumner currently has no compensatory flood storage regulations. Pierce County requires compensatory flood storage for fill in flood hazard areas (Pierce County Code 18E.70.40 C[4][a]). A developer can avoid the requirement to submit a zero-risk analysis if 25 percent additional excavation is completed compared to the proposed fill volume (Pierce County Code 18E.70.30 E[6][d]).

Compensatory flood storage banks do not appear to be common, and no information could be identified that would indicate typical values for credits.

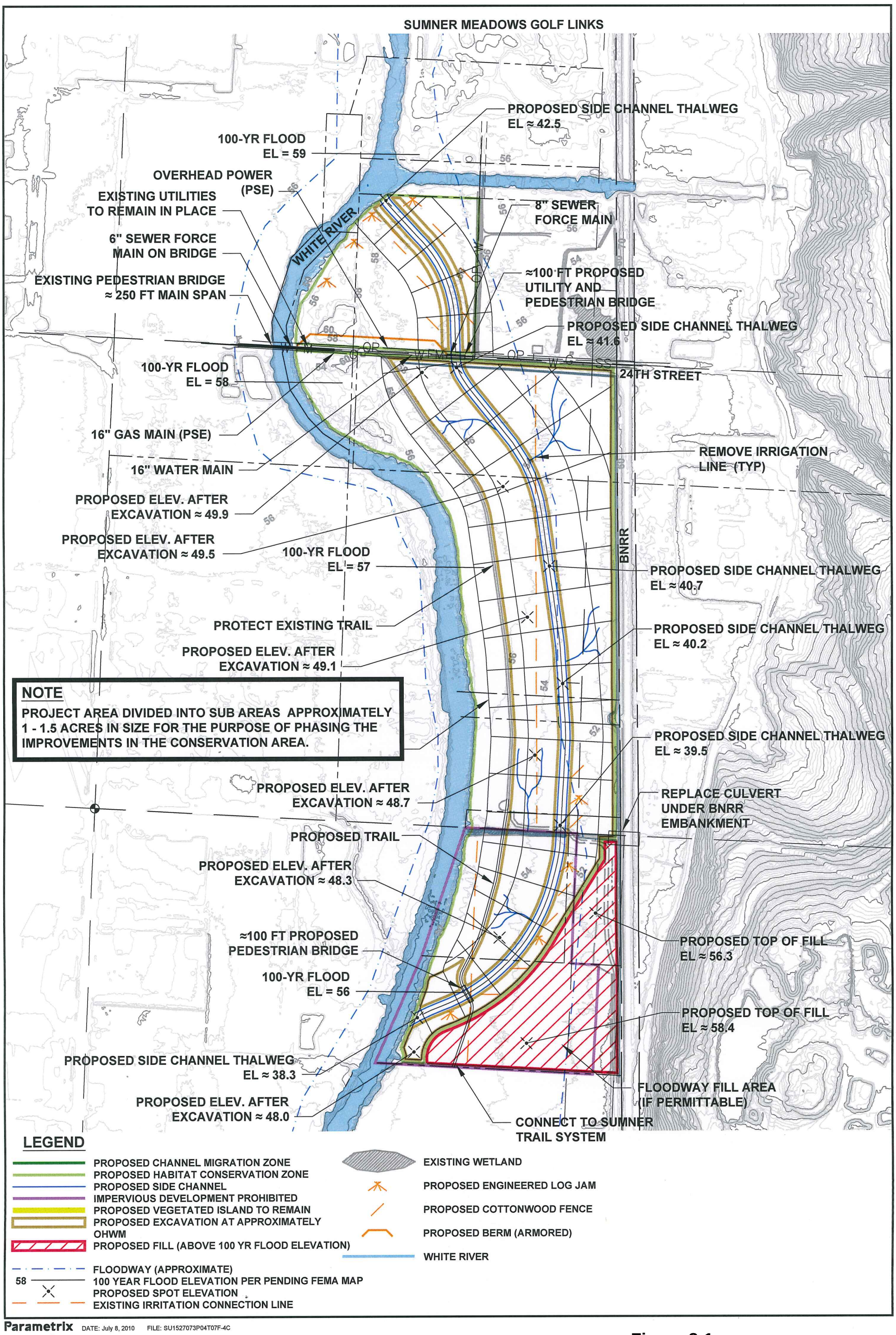


Figure 8-1
Conservation Option 2 Example Phasing
24th Street East Project Area
Sumner, WA

9. RECOMMENDED ADDITIONAL STUDIES

The following additional data collection and studies are recommended prior to final design of the project:

- Complete detailed topographic survey of the site.
- Further evaluate existing property restrictions and easements to determine the best approach to removing obsolete encumbrances.
- Confirm the value of specific areas of existing riparian habitat to determine the optimum areas to retain.
- Complete additional river modeling and groundwater studies to ensure wetland and side channel water elevations and flows are suitable for the proposed habitat types.
- Complete additional geomorphic evaluation of the proposed side channel to assess the potential for sediment erosion or accumulation that would adversely impact created habitat.
- Evaluate soil nutrient characteristics and amendments needed for healthy wetland and riparian plant establishment.

Combining the selected option with replacement of the culvert under the rail embankment at the No. 9 Ditch may provide design, permitting, and construction efficiencies that will reduce the cost and schedule as compared to completing each project separately.

Additional items to consider for the future include reserving corridors for the following:

- Future extension of 24th Street East through the site.
- Future development of a north/south connector road located just west of the rail embankment.
- Future extension of a recreation trail through the site.

10. REFERENCES

City of Sumner. 2008. Sumner trail master plan. Prepared for the City of Sumner by Jongejan, Gerrard, McNeal. June 2008.

City of Sumner. 2011 Stormwater capital improvement plan. Prepared for the City of Sumner by Parametrix, Inc. February 2011.

GeoEngineers. 2008. Levee setback feasibility analysis, Puyallup River watershed. Prepared for Pierce County Public Works and Utilities. June 19, 2008.

The Transpo Group. 2004. 2004 Comprehensive plan update – transportation analysis. Prepared for the City of Sumner. July 2004.

Appendix E: EXCERPTS FROM THE LOWER WHITE RIVER BIODIVERSITY MANAGEMENT AREA, DRAFT STEWARDSHIP PLAN

City of Sumner

General Description
Although the LWR BMA ends just below the Dieringer Canal, the Biodiversity Network's connecting corridor continues through the White and Puyallup Rivers to Commencement Bay. The April, 2007 bioblitz data collected on both sides of the river beginning at Stewart Road moving north to Pacific's City Park showed sizable flood damage with silt covering most of the understory vegetation on both sides of the river. (See Figure 21.)

Figure 21. Sumner BMA Orthophoto

Fish and Wildlife Resources
Predicted and Confirmed Wildlife Species
The 2006 Bioblitz was conducted in three large areas of the LWR BMA. One team of birders collected data at the golf course (See Table 9). The 2007 Bioblitz was focused at Auburn's Game Farm Park and south to Steward Road. The City of Pacific's data should be included as species that would be observed in the City of Sumner because of the similarity of habitats.

Confirmed Invertebrates
The invertebrates were mainly collected between Buckley and Auburn during the 2006 and 2007 Biobitzes (See Table 2).

Confirmed Plant Species Plant data were collected throughout the BMA but only down to Steward Road (See Tables 3 and 4).

Demographics, Land Use and Growth Potential
Existing Land Use and Population
Current land use is a combination of resource use, residential, civic, vacant, and limited industrial and commercial land use in and around the BMA. Population is 9,060.

There are fifteen properties located within or partially within the BMA that are publicly owned by local and state governments. The City of Sumner owns six parcels for a total of 9 acres. Table 6 provides a breakdown of publicly owned lands within the Lower White River BMA.

Current Zoning and Shoreline Environments
Zoning
On the Pierce County side, very small portions of the Lower White River BMA are located within the City of Sumner (78 acres), and the remaining area is located in unincorporated Pierce County.

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Within the City of Sumner, the BMA is zoned _____
Within unincorporated Pierce County, the BMA is predominately zoned Rural 10 (R10) and Employment Centers Table 7 provides a breakdown of the zones that apply within the BMA.

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TABLE 9 - PREDICTED AND CONFIRMED WILDLIFE AND FISH SPECIES FOR THE LOWER WHITE RIVER BMA

PREDICTED SPECIES Note: Species observed but not predicted are italicized

BIRDS	Sumner Golf Course		BIRDS (Cont'd)	Sumner Golf Course
American bittern [2]			House finch	
American coot			*House sparrow*	
American crow			House wren	
American dipper			Hutton's vireo	
American goldfinch			Killdeer	X
American kestrel			Lazuli bunting	
American robin	X		Macgillivray's warbler	
Bald eagle [3,4]			Mallard	
Band-tailed pigeon [4]			Marsh wren	X
Bank swallow	X		*Mourning dove*	
Barn swallow			Northern flicker	
Barred owl			Northern harrier	
Belted kingfisher			Northern oriole	
Bewick's wren			Northern rough-winged swallow	
Black-capped chickadee			Northern shoveler	
Black-headed grosbeak			Olive-sided flycatcher [3]	
Black-throated gray warbler			Orange-crowned warbler	
Blue-winged teal			Osprey [3]	
Brewer's blackbird			Pacific slope flycatcher (Western)	
Brown creeper			Pied-billed grebe [4]	
Brown-headed cowbird			*Pileated woodpecker*	
Bushtit			*Pine siskin*	
California quail			Purple finch	
Canada goose	X		*Red-breasted nuthatch*	
Cedar waxwing			Red-breasted sapsucker	
Chestnut-backed chickadee			Red-eyed vireo	
Cinnamon teal			Red-tailed hawk	X
Cliff swallow	X		Red-winged blackbird	X
Common barn-owl			Rock dove	
Common merganser			Ruddy duck	
Common nighthawk			Ruffed grouse	
Common raven			Rufous hummingbird	
Common snipe			Savannah sparrow	
Common yellowthroat	X		Song sparrow	X
Cooper's hawk [2]			Sora	
Dark-eyed junco			Spotted sandpiper [4]	
Downy woodpecker			Spotted towhee (Rufous-sided)	
European starling	X		Steller's jay	
Evening grosbeak			Swainson's thrush	
Gadwall			*Townsend's warbler*	
Glaucous-winged gull			Tree swallow	
Golden-crowned kinglet			Turkey vulture [3]	X
Great blue heron [3,4]			Vaux's swift [3,4]	
Great horned owl			Violet-green swallow	
Green heron (Green-backed) [3]			Virginia rail	
Green-winged teal			Warbling vireo	
Hairy woodpecker			*Western meadowlark*	
Hooded merganser [4]			Western screech-owl	
			Western tanager	

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TABLE 9 - PREDICTED AND CONFIRMED WILDLIFE AND FISH SPECIES FOR THE LOWER WHITE RIVER BMA

PREDICTED SPECIES Note: Species observed but not predicted are italicized

BIRDS (Cont'd)	**Sumner Golf Course**			
Western wood-pewee				
White-crowned sparrow				
Willow flycatcher [3]				
Wilson's warbler				
Winter wren				
Wood duck [4]				
Yellow warbler [2]				
Yellow-rumped warbler				
Footnote:				
(1) - Trigger Species - Species that needed				
additional mapped land cover units to ensure				
representation within the network				
(2) - At-Risk - Washington Gap Analysis				
Project (WAGAP) selected species				
considered to be most as risk of continued				
or future population declines due to human				
activities				
(3) - Listed (State or Federal) - Species listed				
as State endangered, threatened, sensitive,				
candidate or monitor, as well as species listed				
or proposed for listing by the U.S. Fish and				
Wildlife Service				
(4) - PHS - a species defined as priority under				
the WDFW Priority Habitats and Species				
(PHS) Program				
(5) - Included based on species significance				
under the WDFW PHS/Heritage database,				
although not predicted to occur				
Italicized species:				
Observed but not predicted				
Non-native species in red				

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Shoreline Environments
A small section at the west tip of the BMA in Sumner is classified as Urban. Urban shorelines are areas of high intensity land use including residential, commercial and industrial development. These areas are presently subjected to intensive use pressure as well as those areas planned to accommodate urban expansion.
The river between Stewart Road down to the end of the golf course is classified as Shoreline Residential with a 100-foot setback. This is the part of the river included in the BMA. The rest of the river to the confluence of the Puyallup River is Urban Conservancy with a 200-foot setback.

URS Consulting surveyed the reach between the outlet of the Dieringer Canal and the Stewart Road Bridge in 2004 for the White River Basin Plan. The river in this area is confined, with very little channel migration. The channel has similar riparian habitat and land use. A few riffles and pools are present as are limited spawning gravels for summer/fall Chinook, Chum, and Pink salmon, but it is unknown if they are utilized.

The White River Basin Plan scored the Aquatic Habitat and Riparian Corridor as poor and poor respectively at the Dieringer Canal, and fair and fair at the stream entering the river above Stewart Road.

Open Space Corridors
Need open space information – is there designated open space within the BMA?
Is any BMA land within the Comp plan? (See Figure 22).

Future Growth Potential

Threats to Conservation Targets
The main threats that are or may potentially be occurring to conservation targets include:

- Flooding issues include the Sumner golf course, residences near the intersection of 8th Street and 138th Avenue East and the Sumner sewage treatment plant
- Habitat conversion and fragmentation due to development, removal of native vegetation and roads
- Poor water quality caused by residential use of fertilizers, domestic animal feces, septic tank leakage, spraying of herbicides along public roads, and road runoff
- Loss of pools, large woody debris (LWD) due to development and channelization of the river.
- Introduction of invasive, exotic, non-native species including plant species, wildlife species (e.g. bullfrogs, Japanese knotweed)
- Fish passage blockage from culverts
- Wildlife movement blockages from roads, driveways and fencing
- Erosion and damage of riparian habitat from dikes/levees along City's of Buckley, Pacific, and Sumner
- Predation of native species by domestic cats and dogs
- Water fluctuations due to storm drains redirecting water flow into the river and not into wetlands, dikes, and stormwater from development
- Pollution caused by dumping of trash and debris into or near the river
- Stormwater and illegal discharge dumped directly into the river

Overview of Conservation Strategies
Conservation strategies have been identified to ascertain the level or severity of a potential threat, directly abate known threats, or identify restoration opportunities where degradation has occurred. Some threats

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Figure 22 Sumner Comp Plan

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applied to multiple conservation targets and as such the conservation strategies have been grouped under the following categories, which have been stated as a positive outcome:

- Reduce Habitat Conversion and Fragmentation (due to development and human activity)
- Enhance Water Quality
- Decrease Flooding
- Eliminate Invasive and Introduced Species
- Remove Fish and Wildlife Movement Blockages
- Control Erosion and Siltation
- Halt Predation by Domestic Animals

ADD TO OR MODIFY THE CONSERVATION STRATEGIES LISTED IN THE MAIN SECTION OF THE REPORT

Reduce Habitat Conversion and Fragmentation

Source of Stress: Development, Vegetation Removal and Deforestation

Conservation Strategies
1.

Short-Term Actions (1 year)
See Figure 23 for suggested targeted areas to begin short-term actions.

Mid-Term Actions (2-3 years)

Long-Term Actions (5+ years)

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Figure 23: City of Sumner Example Recommendations

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Chapter VIII – City of Buckley

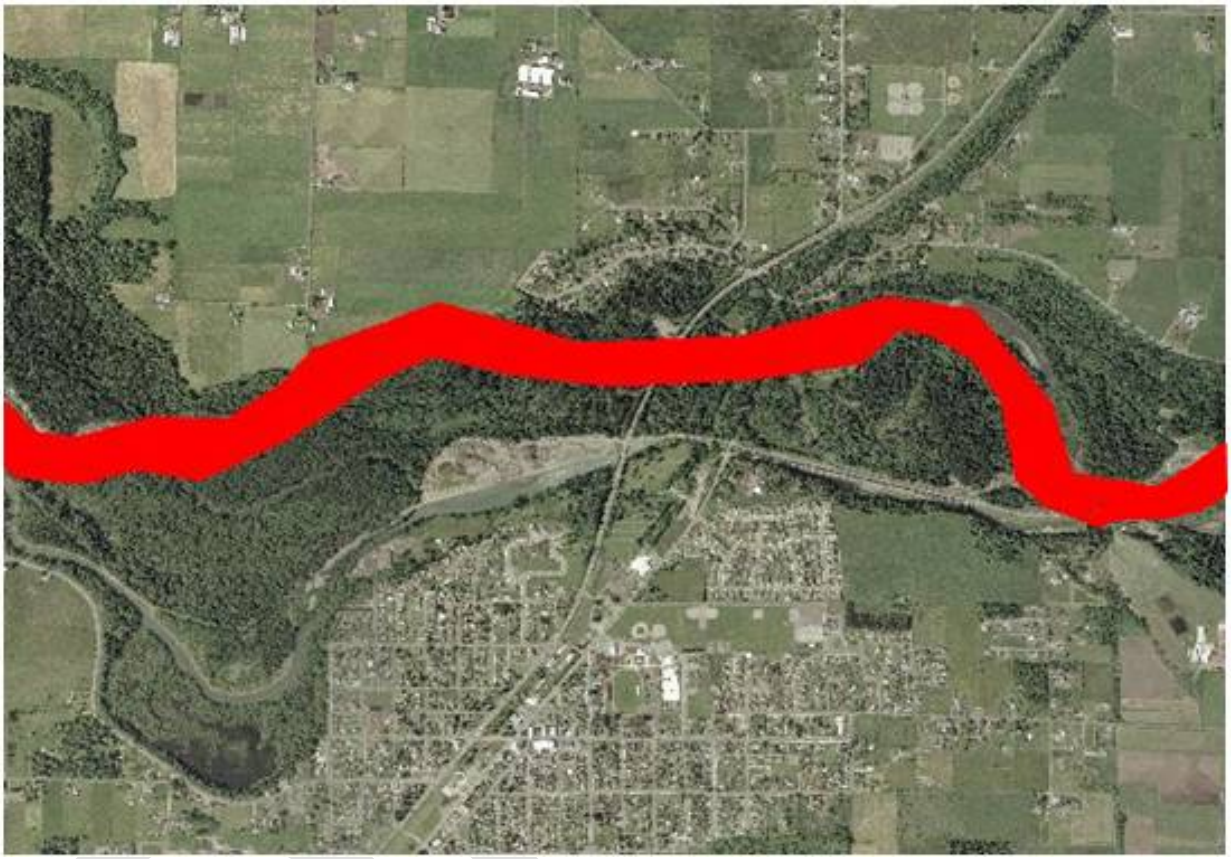

Figure 21. City of Buckley BMA orthophoto

City of Buckley and Vicinity

General Description

The LWR BMA is situated between the cities of Buckley and Enumclaw and portions of unincorporated Pierce and King counties. The small city of Buckley is found at the junction of State Routes 410 and 165 and lies at the eastern end of the LWR BMA (See Figure 21) and at the western end of the White River BMA. The landcover within the BMA is non-irrigated agriculture, riparian dominated by hardwood trees and small shrubs, hardwood and mixed hardwood/conifer forests.

The Greenwater BMA is subdivided into 4 geographic units, of which the Buckley Area (4B) butts up to the City of Buckley's south-eastern limits. Buckley's drinking water supply lies within this BMA. The landcover within the Greenwater BMA is dominated by conifer forests with sections of hardwood trees.

Fish and Wildlife Resources

A bioblitz was conducted June 2-3, 2006 to confirm all species predicted to inhabit the LWR BMA (see below). Considering it is impossible to survey all properties in a 24-hr period it is assumed that species confirmed A total of 73 bird, mammal, reptile and amphibian species, 4 fish and 42 terrestrial and 14

aquatic invertebrates were confirmed in the Buckley city limits or in close proximity during the Bioblitz. Fourteen species are of interest. Two of those species (Pileated woodpecker and Silver-haired bat) are considered GAP at-risk species[1]. Three species, Bald eagle, Great blue heron, and Vaux's swift are listed and WDFW Priority Habitat of Species (PHS) and four species, Red-legged frog, Olive-sided flycatcher, Turkey vulture, and Willow flycatcher are also listed species. The Band-tailed pigeon, Spotted sandpiper, Big brown bat, California myotis, and the Little brown myotis are WDFW PHS species.

Predicted and Confirmed Wildlife Species (See Figure 22 and Table 13)
Seven species in this area are considered at-risk by GAP Analysis. Seventeen species in this area have been listed in Pierce County Title 18E as endangered, threatened, sensitive, or other (candidate, and monitored). Several species have high association with riparian corridors and natural vegetation suggesting that appropriate buffers could be particularly beneficial.

The LWR BMA within this area is mostly the Lower White River and its shoreline. The 2006 Bioblitz was conducted in three large areas within and surrounding the LWR BMA extending into the riparian forests. Data points collected on lands around the City of Buckley and the Marion Grange (2006 Bioblitz's Science Central location) are shown on Figure 22 and data are listed in Table 13. Due to the inclement weather during most of the 2006 Bioblitz, a 2007 Biobilitz was conducted at the western end of the LWR BMA at Auburn's Game Farm Park and south to Steward Road. It is recommended that another Bioblitz focused in the Buckley area be conducted.

Confirmed Invertebrates
The invertebrates were mainly collected between Buckley and Auburn during the 2006 and 2007 Biobitzes (See Table 2).

Confirmed Plant Species Plant data were collected throughout most the BMA ending at Steward Road (See Tables 3 and 4).

[1] Pierce County GA Application Pilot Project: A Biodiversity Plan for Pierce County, Washington, January 2000.

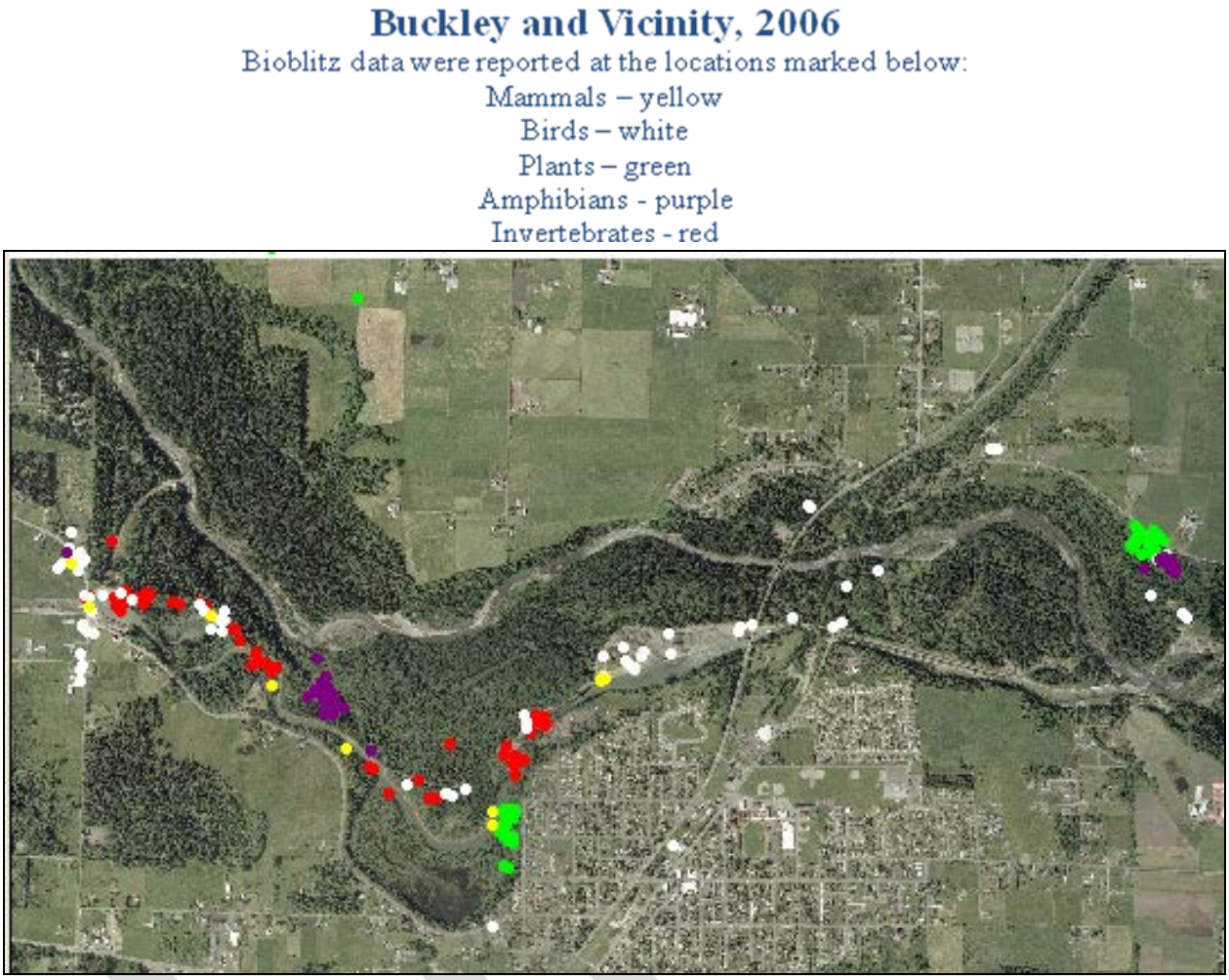

Figure 22. Bioblitz Data Locations 2006

Table 13 - PREDICTED AND CONFIRMED WILDLIFE AND FISH SPECIES FOR THE LOWER WHITE RIVER BMA

Note: Predicted species lists were not developed for fish

AMPHIBIANS	Buckley	
Bullfrog	X	
Ensatina		
Long-toed salamander	X	
Northwestern salamander	X	
Pacific treefrog (Chorus frog)	X	
Red-legged frog [3]	X	
Roughskin newt	X	
Western toad [3]		
REPTILES		
Common garter snake	X	
Northern alligator lizard		
Northwestern garter snake		
Painted turtle [1]		
Rubber boa		
Western terrestrial garter snake	X	
FISH		
Prickly sculpin	X	
Sculpin spp.	X	
Speckled dace	X	
Western brook lamprey	X	
INVERTEBRATES		
42 terrestrial species, 7 non-native	X	
14 aquatic species, 3 non-native		

BIRDS	Buckley	
American bittern [2]		
American coot		
American crow	X	
American dipper		
American goldfinch	X	
American kestrel		
American robin	X	
Bald eagle [3,4]	X	
Band-tailed pigeon [4]	X	
Bank swallow	X	
Barred owl	X	
Barn swallow	X	
Belted kingfisher	X	
Bewick's wren	X	
Black-capped chickadee	X	
Black-headed grosbeak		
Black-throated gray warbler	X	
Blue-winged teal		
Brewer's blackbird	X	
Brown creeper	X	
Brown-headed cowbird	X	
Bushtit		
California quail		
Canada goose	X	
Cedar waxwing		
Chestnut-backed chickadee		
Cinnamon teal		
Cliff swallow		
Common barn-owl	X	
Common merganser	X	
Common nighthawk	X	
Common raven	X	
Common snipe		
Common yellowthroat	X	
Cooper's hawk [2]		
Dark-eyed junco		
Downy woodpecker		
European starling	X	
Evening grosbeak	X	
Gadwall		
Glaucous-winged gull		
Golden-crowned kinglet		
Great blue heron [3,4]	X	
Great horned owl		
Green heron (Green-backed) [3]		
Green-winged teal		
Hairy woodpecker		
Hooded merganser [4]		
House finch	X	
House sparrow	X	
House wren		

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Table 13 - PREDICTED AND CONFIRMED WILDLIFE AND FISH SPECIES FOR THE LOWER WHITE RIVER BMA

Note: Predicted species lists were not developed for fish

BIRDS (Cont'd)	Buckley		BIRDS (Cont'd)	Buckley	
Lazuli bunting	X		Wilson's warbler	X	
Macgillivray's warbler			Winter wren	X	
Mallard	X		Wood duck [4]		
Marsh wren			Yellow warbler [2]		
Mourning dove			Yellow-rumped warbler	X	
Northern flicker	X				
Northern harrier			**MAMMALS**		
Northern oriole			Beaver		
Northern rough-winged swallow	X		Big brown bat [4]	X	
Northern shoveler			Black bear		
Olive-sided flycatcher [3]	X		Black rat		
Orange-crowned warbler			Black-tailed deer [4]		
Osprey [3]			Bobcat		
Pacific slope flycatcher (Western)			California myotis [4]	X	
Pied-billed grebe [4]			Coast mole		
Pileated woodpecker[2,3]	X		Coyote		
Pine siskin	X		Creeping vole		
Purple finch	X		Deer mouse	X	
Red-breasted nuthatch			Douglas squirrel		
Red-breasted sapsucker	X		Dusky (Montane) shrew		
Red-eyed vireo			*Eastern cottontail*	X	
Red-tailed hawk	X		*Eastern gray squirrel*		
Red-winged blackbird	X		Elk	X	
Rock dove			Ermine		
Ruddy duck			Fisher [2,3,4]		
Ruffed grouse			Hoary bat	X	
Rufous hummingbird	X		Little brown myotis [4]	X	
Savannah sparrow			Long-eared myotis [3,4]		
Song sparrow	X		Long-legged myotis [3,4]		
Sora			Long-tailed (Forest) deer mouse	X	
Spotted sandpiper [4]	X		Long-tailed vole		
Spotted towhee (Rufous-sided)			Long-tailed weasel		
Steller's jay			Mink [4]		
Swainson's thrush	X		Mole spp.		
Townsend's warbler			Mountain beaver		
Tree swallow			Mountain lion		
Turkey vulture [3]	X		Muskrat		
Vaux's swift [3,4]	X		Northern flying squirrel		
Violet-green swallow	X		*Norway rat*		
Virginia rail			*Nutria*	X	
Warbling vireo	X		Pacific jumping mouse		
Western meadowlark			Pacific water shrew [3]		
Western screech-owl			Porcupine		
Western tanager	X		Raccoon		
Western wood-pewee	X		Red fox		
White-crowned sparrow	X		River otter	X	
Willow flycatcher [3]	X		Shrew-mole		

Table 13 - PREDICTED AND CONFIRMED WILDLIFE AND FISH SPECIES FOR THE LOWER WHITE RIVER BMA

Note: Predicted species lists were not developed for fish

MAMMALS (Cont'd)	Buckley	
Shrew spp.		
Silver-haired bat [2]	X	
Southern red-backed vole		
Spotted skunk		
Striped skunk		
Townsend's big-eared bat [2,3,4]		
Townsend's chipmunk		
Townsend's mole		
Townsend's vole		
Vagrant shrew		
Virginia opossum		
Vole spp		
Yuma myotis [3,4]		

Footnote:

(1) - Trigger Species - Species that needed additional mapped land cover units to ensure representation within the network

(2) - At-Risk - Washington Gap Analysis Project (WAGAP) selected species considered to be most as risk of continued or future population declines due to human activities

(3) - Listed (State or Federal) - Species listed as State endangered, threatened, sensitive, candidate or monitor, as well as species listed or proposed for listing by the U.S. Fish and Wildlife Service

(4) - PHS - a species defined as priority under the WDFW Priority Habitats and Species (PHS) Program

(5) - Included based on species significance under the WDFW PHS/Heritage database, although not predicted to occur

Non-native species are italicized

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Demographics, Land Use and Growth Potential

Unincorporated Pierce and King County
The area surrounding the LWR BMA is characterized by low- and medium-density residential and commercial land uses, and forest resource lands owned and managed either by the state or by private entities. The habitat is fragmented by the City of Buckley, but the lands generally present abundant opportunities for protection. Review of the orthophoto data of the Greenwater BMA indicates that this is a managed forest landscape with ages of coniferous trees.

City of Buckley
The population is 4,560.

Current Zoning and Shoreline Environments
Zoning
On the Pierce County side, very small portions of the Lower White River BMA are located within the City of Buckley (69 acres) and the remaining area is located in unincorporated Pierce County. Within the City of Buckley, the BMA is zoned Sensitive. (See Figure 36) Sensitive is defined as follows: '*The purpose of this zone is to protect, conserve, and manage existing natural resources and to ensure a continuous flow of recreational benefits to the public and to achieve and sustain natural resource utilization by maintaining that resource's existing character, and preserve or enhance the natural environment and the enjoyment of the same by the members of the community. Any use intended in this area shall first be reviewed by the planning commission, subject to approval by the council'*. However, recently an interim designation of R-20,000 (i.e., 20k ft^2 minimum lot size or ~ 2.2 dwelling units/acre) has been applied. Within unincorporated Pierce County, the BMA is predominately zoned Rural 10 (R10) and Employment Centers Table 7 provides a breakdown of the zones that apply within the BMA.

Shoreline Environments
Under the Washington State Shoreline Management Act (SMA) the Lower White River is considered as a "Shorelines of the State." All lands within 200 feet of the ordinary high water mark, and associated wetlands and floodplains, fall within the jurisdiction of Shorelines of the State. Shorelines can be classified into five types of environments including Urban, Residential Rural, Rural, Conservancy, and Natural. These environments are similar to zoning designations allowing different land uses, densities and activities ranging from the most intensive uses (Urban) to very limited uses (Natural).

Most of the shorelines down and upstream from Buckley are designated as Rural (See Figure 13). Buckley's shoreline is designated Conservancy Environments with a small segment as Rural. There will be an opportunity to review these designations during the Shoreline Master Plan Update process which is to be completed by the end of 2011. Shorelines could be upgraded to a more protected level.

However, the shoreline currently offered under Conservancy designation could provide additional protection by reducing the number of allowed activities and increasing buffer requirements. On-the-ground survey could provide further information regarding the value of increasing these protections in appropriate areas.

Open Space Corridors
The Comprehensive Plan Land Use chapter includes Resource Protection Goals 1.4 & 1.5 for critical and environmentally sensitive areas and for endangered fish and wildlife habitat. Within these goals are supporting policies to identify and protect an integrated system of open space corridors as buffers between natural areas and urban land uses and to identify and conserve critical wildlife habitat including nesting

sites, foraging areas and migration corridors, and to protect native plant communities. There is no mention of these elements in an overall context of biodiversity and it does not appear that any specific corridors have been identified to accomplish these goals or plans for conservation developed.

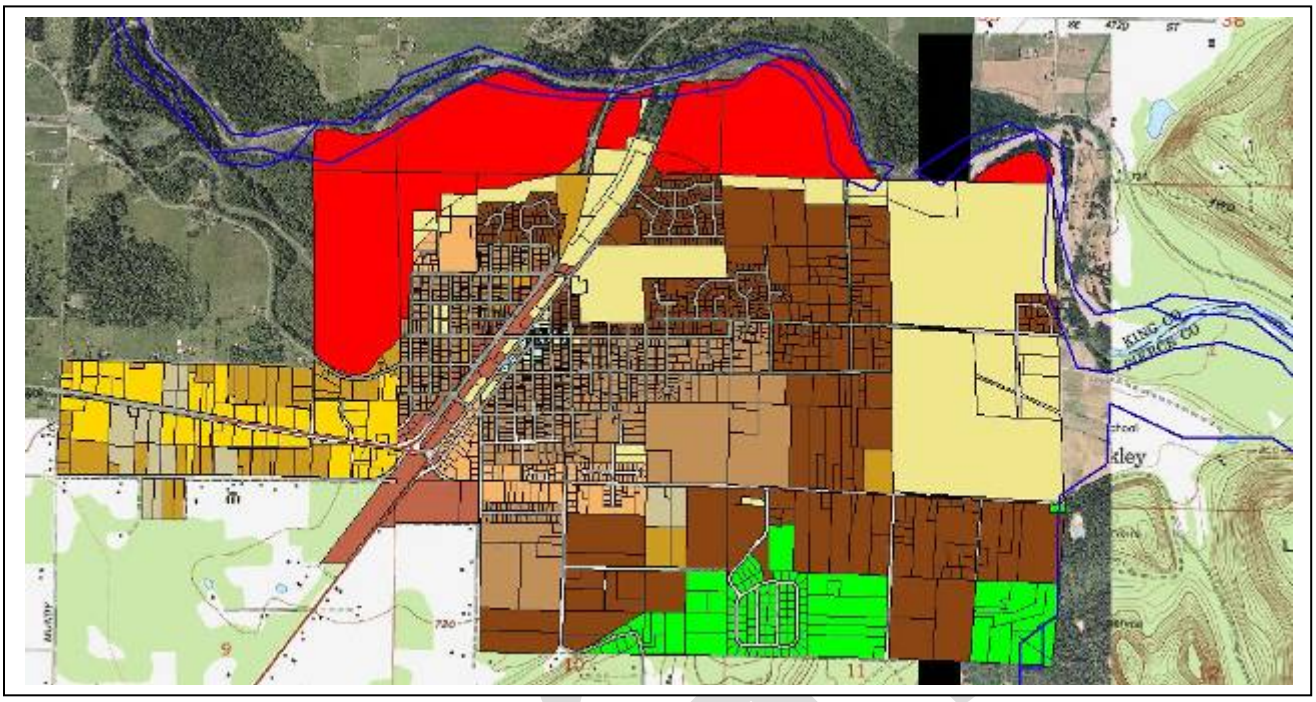
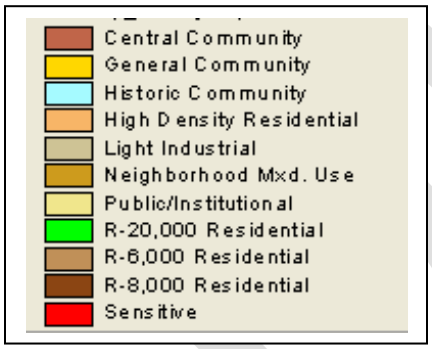


Figure 23 City of Buckley Land Use Map



Future Growth Potential

There are fifteen properties located within or partially within the LWR BMA that are publicly owned by local and state governments. Table 6 provides a breakdown of publicly owned lands within the Lower White River BMA. Potential growth along the LWR BMA has been extremely limited because of the river, wetlands and Puget Sound Energy (PSE) ownership. Currently, PSE is selling all of their property along the LWR BMA.

City of Buckley

Buckley owns one property .17 acres in size and is in the process of acquiring 4.61 acres from PSE for open space.

The Greenwater BMA extends into Buckley's city limits bisecting 4 privately owned properties. The overlap into the city limits may be the result of the coarse scale when digitizing the boundary. The boundary should be groundtruthed to decide if the parcels should or should not be included in the BMA.

Impacts of Growth and Development on Habitat and Species Presence

The Lower White River BMA will only remain rich in species diversity if care is given to maintaining large enough habitat areas for species viability and good quality habitat conditions, including corridors for safe movement between primary and seasonal habitats. Stressors to habitat include a variety of factors such as:

- Fragmentation in habitat below the threshold for species viability due to land development, removal of vegetation
- Actions that change the hydrology within the watershed such as water diversion
- Species mortality caused by vehicular traffic on roads and predation by non-native animals (cats, dogs, bullfrogs, non-native fish, etc.)
- Conversion of native vegetation to non-native and invasive plant species
- And other human actions that cause species mortality or negatively impact habitat such as failing septic systems and outflow pipes from agricultural lands.

As noted above, the fate of the PSE properties along the White River will play a critical role for the long-term protection of biodiversity within the Lower White River BMA. Negotiations between PSE and the Cascade Land Conservancy have been taking place. Most of the PSE properties were inventoried in the 2006 LWR Bioblitz. A report was prepared for the Cascade Land Conservancy identifying which parcels had the great potential for long-term conservation.

Conservation Targets

In the Lower White River BMA several conservation targets were selected to represent the key ecological functions occurring throughout the area. These conservation targets include

- Lower White River
- Tributaries, wetlands, and oxbows
- Conifer/deciduous mixed forest areas

Each of these conservation targets provides the systems that collectively create the rich variety of habitats necessary to foster a high level of biodiversity in the BMA. A detailed description of each conservation target can be found in Chapter 3.

Threats to Conservation Targets

The main threats that are or may potentially be occurring to conservation targets include:

- Water fluctuations due to storm drains redirecting water flow into the river and not into wetlands
- Potential for flooding as Buckley and Enumclaw reach buildout similar to flood events experienced upriver in Auburn, Pacific, and Sumner.
- Habitat conversion and fragmentation due to development, removal of native vegetation and roads
- Poor water quality caused by residential use of fertilizers, domestic animal feces, septic tank leakage, spraying of herbicides along public roads, and road runoff
- Loss of pools, large woody debris (LWD) due to development.
- Introduction of invasive, exotic, non-native species including plant species, wildlife species (e.g. bullfrogs, Japanese knotweed)
- Wildlife movement blockages from roads, driveways and fencing
- Erosion and damage of riparian habitat from dikes/levees
- Predation of native species by domestic cats and dogs
- Pollution caused by dumping of trash and debris into or near the river
- Stormwater and illegal discharge dumped directly into the river

Overview of Conservation Strategies

Conservation strategies have been identified to ascertain the level or severity of a potential threat, directly abate known threats, or identify restoration opportunities where degradation has occurred. Some threats applied to multiple conservation targets and as such the conservation strategies have been grouped under the following categories, which have been stated as a positive outcome:

- Reduce Habitat Conversion and Fragmentation (due to development and human activity)

- Enhance Water Quality
- Mitigate for potential future flooding events
- Eliminate Invasive and Introduced Species
- Remove Fish and Wildlife Movement Blockages
- Control Erosion and Siltation
- Halt Predation by Domestic Animals

Role of City Government

Biodiversity goals fall into two general areas: protection of existing elements and restoration and recovery of elements that have been damaged by human intervention. A community driven biodiversity stewardship plan which incorporates regulatory tools, voluntary incentives, public education and outreach, and multi-jurisdictional coordination provides the best environment for success.

Update existing regulatory tools so that they can be used to protect biodiversity.

As a first step Buckley will update its Comprehensive Plan to introduce the Lower White River Biodiversity Management Area as a unique and valuable community natural asset and add biodiversity goals and policies as a way to preserve it. The Comprehensive Plan is the primary policy document for City governance and sets the foundation for land use and development regulations. Once the Comprehensive Plan is updated, biodiversity management can be incorporated into existing and future regulations and programs. These may include examining zoning codes within the BMA and adjacent areas that establish acceptable land uses and complementary development ordinances (critical areas, stormwater management, etc.) The Lower White River Biodiversity Stewardship Plan should be used to inform this process. A Shoreline Master Program can also serve to protect biodiversity and is scheduled to be developed for the White River to comply with Washington State Shoreline Management Act.

Conservation tax incentive or purchase programs encourage voluntary community actions to protect biodiversity

Landowners who certify their property as Open Space under Pierce County Public Benefits Rating System can qualify for property tax reduction. Additional mechanisms the City can use for biodiversity protection involve ownership of lands or purchase of development rights. The City may purchase land outright or create its own TDR/PDR (Transfer of Development Rights/Purchase Development Rights) program. Transfer or purchase of development rights programs could be established to encourage the retention of biodiversity areas and transfer urban development to more appropriate locations within the city boundaries.

Public education and outreach programs encourage individual landowners to incorporate biodiversity friendly practices into their everyday life

Efforts could include disseminating general information on the benefits of biodiversity, enrolling in formal coordinated programs such as Community Wildlife Habitats certified by the National Wildlife Federation, and sponsoring habitat restoration projects.

Coordinate conservation efforts among partners

An important requirement for success will be the coordination of efforts among all jurisdictions within the White River BMA (Pierce County, King County, the Cities of Auburn and Enumclaw, etc.), support from various environmental organizations (Pierce Conservation District, Cascade Land Conservancy, Puyallup River Watershed Council), and an engaged citizen group. Periodic reviews of biodiversity plans should be scheduled.

Suggested City Government Priorities

Short Term Actions (1 year)

1. The PCBA will introduce the Lower White River Stewardship Plan to the Planning Commission and City Council.
    a. Advocate community members participate in land use decisions regarding proposed developments that affect the BMA
    b. Identify and advocate for conditions that eliminate or minimize threats to habitat fragmentation.
    c. Incorporate information from the LWR Stewardship Plan into the rezoning of parcels along the White River. These parcels currently have an interim zoning designation of "R-20,000" but a new zoning designation is scheduled to be created.
2. Identify parcels within and adjacent to BMA that may become available for purchase or conservation
    a. Consult with PCBA to identify highest value parcels
    b. Work with PSE and applicable jurisdictions to determine the best conservation strategy for PSE properties within the BMA. Encourage County and city purchase of ecologically rich properties currently owned by PSE with a target for wildlife and open space conservation and passive recreation:
        i. Wickersham Basin to LWR riparian corridor has high amphibian, reptile and fish value. Consider Oregon spotted frog, western toad and western pond turtle surveys and management.
        ii. Use as a connection to a trail system for birding and elk viewing and possible hunting and fishing especially for wheelchair access.
        iii. Continue to implement elk winter range habitat protection standards through WDFW.
    c. Work with Cascade Land Conservancy and others to discuss purchase opportunities and options
    d. Any large undeveloped properties considered for park purchase by jurisdictions should be for passive, non-manicured recreational use. Manicured parks (e.g., sports fields, pavement, etc) provide limited fish and wildlife value. Park designs that maintain the native, natural features of the lands with limited high-intensity use provide the most benefits to wildlife and ecological services.
        i. Investigate purchase options of WSU public land adjacent to BMA for City Park.
            1. Design the park with native vegetation buffering the LWR and high density usage furthest from the river.
    e. Publicize County Open Space and Conservation incentives to landowners
3. Identify interested local residents or community organizations that may form a 'Friends of Group' to can provide citizen input to prioritize conservation strategies and action plans that will be incorporated into this LWR Stewardship Plan
4. Apply for National Wildlife Federation – Community Habitat Program for the City. *(Registered)*
    a. See if Parks Board or other community group might play a role in this
    b. Set participation goals for 10 landowners in or buffering both of the BMA's.
    c. Conduct public education and outreach efforts to property owners to participate in this program and certify their property as backyard wildlife sanctuaries

5. Work with the City of Buckley to identify Comprehensive Plan amendments that incorporate biodiversity management goals and policies in the 2011 Comprehensive Plan amendment cycle.

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    a. Adopt the Lower White River BMA Stewardship Plan as a part of Buckley's Open Space Map for Fish and Wildlife
6. Participate in review of Pierce County White River Basin Plan.
7. Work together with King County residents to address the Boise Creek TMDL (A TMDL is a process that creates a plan under the Clean Water Act to clean up impairments in the water by telling us how much pollution needs to be reduced or eliminated to achieve clean water.) Boise Creek runs into the Lower White River near Buckley.

<u>Mid-Term Actions (2-3 years)</u>

1. Improve the quality of stormwater runoff going into the White River and impacting the LWR habitat.
    a. Plant more trees throughout the City.
    b. Create and promote the creation of rain gardens.
2. Revise the municipal code to ensure that development and other activities in the City's jurisdiction mitigate impacts to the LWR habitat.
3. Create a PDR/TDR mechanism to help the City purchase land along the LWR.
4. Apply Low Impact Development (LID) standards along ½ mile of the BMA. (long term to extend LID to within Buckley)
5. Help the community to embrace and cherish the LWR habitat by providing educational opportunities to understand what exists in the ecosystem and how it works.
    a. Create a wildlife center in Buckley to explore the LWR and other wildlife corridors near/within the city limits.
    b. Create a display (seasonal or permanent) in the Buckley library on the LWR habitat
6. Publicize shoreline designations and Buckley's water supply with maps

<u>Long-term Actions (3-5 years)</u>

1. Purchase land along the LWR
2. Create a plan for care of the land along the LWR owned by the City.
    a. Schools adopt sections of the lands to monitor
3. Locate open space set-aside areas in contiguous tracts or within contiguous conservation easements in such a manner as to promote connectivity and proximity to the conservation targets.
    a. Develop a network of backyard habitats, city parks, and rain gardens that can become the wildlife corridor within the City.
4. Identify and provide sewer access in vulnerable areas along the river.

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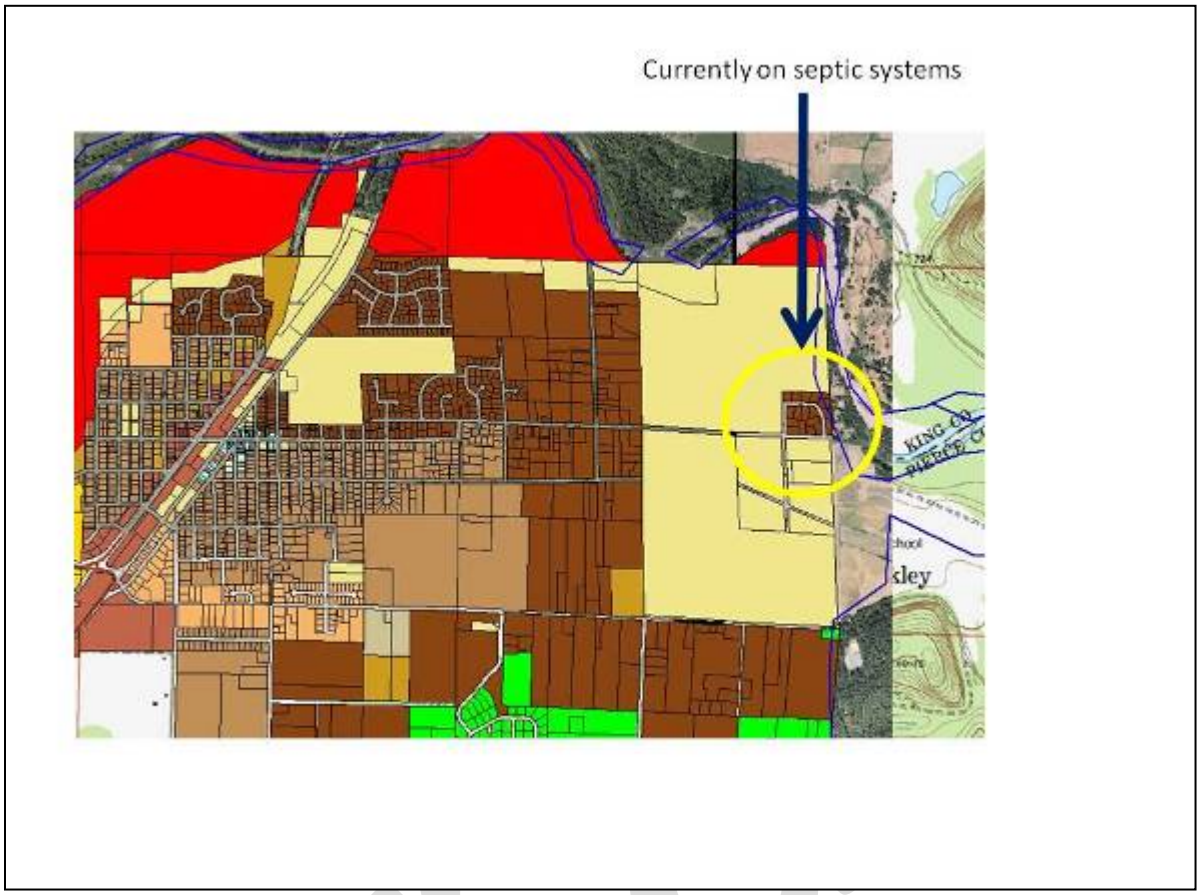

Figure 24. High priority area for a sewer system.

Community Conservation Strategies (to be completed)
A community led group when formed will choose strategies from those listed in Chapter 4 such as:

Short Term Actions (1 year) (to be completed)

1. Register 10 new backyard habitats
2. Develop signage with the City to highlight the BMA

1. Support native vegetation retention and critical area buffer regulations to environmentally sensitive areas within Biodiversity Management Area (BMA) and report any violations to these regulations.
2. Conduct surveys and collect 'best science' information about the BMA
3. Provide increased education and outreach to property owners, developers and real estate agents regarding impacts of vegetation removal and earth moving. Create and dispense educational materials concerning fish and wildlife habitat stewardship actions.
4. Participate in local land use decisions regarding proposed developments that affect the BMA.
    a. Identify the Kayak pull-out areas to minimize disturbance to the habitat and wildlife.
5. Organize volunteer work parties. Partner with local Boy or Girl Scout

troops, schools, or other environmental or civic organizations for volunteers.

a. Sponsor annual or biannual native vegetation planting event.

b. Sponsor invasive species eradication events.

c. Sponsor volunteer "bioblitz" activities led by professional experts.

Mid-Term Actions (2-3 years) (to be completed)

1. Apply for National Wildlife Federation – Community Habitat Program for local neighborhoods or in partnership with the cities of Buckley and Enumclaw.
2. Consider a project with Buckley Parks and Recreation to create a demonstration project within a new park, cooperating with Pierce County Conservation District, Master Gardeners, schools, Boy Scout troops, or other local volunteers. And use the site to promote shoreline dependent species through nest box placement (e.g., wood ducks) and monitor to see if this strategy is effective.
3. Work with the City to identify expansion of the BMA into City limits.

Long-term Actions (3-5 years) (to be completed)

1. Work with citizens in King County to protect both sides of the LWR.
2. Conduct water quality monitoring along any creek/ditch feeding into the LWR and running through the City.

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