



# **Final Briefing Memo**

## **Sequalitchew Creek Watershed**

### **Core Group**

# **Recommendations for a Restoration Plan**

*January 14, 2014*

## Executive Summary

In 2011, the CalPortland Company, the City of DuPont, the Washington Department of Ecology, and a coalition of environmental groups known as the Environmental Caucus signed an agreement called the *2011 Settlement Agreement for DuPont Mine, Restoration of Sequelitchew Creek Watershed, and Preservation of Puget Sound Shorelands and Adjacent Open Space*. The Settlement Agreement calls for the South Puget Sound Salmon Enhancement Group (SPSSEG) to lead a multi-stakeholder effort to develop a restoration plan for the Sequelitchew Creek Watershed.

The Agreement specifies that:

*“[T]he restoration Plan will be consistent with this Settlement Agreement and incorporate the following elements unless otherwise agreed to by the Parties:*

- Improvement of gradients so water discharges from Hamer and Bell marshes flow into Edmond Marsh rather than into the diversion canal.
- Improvements to create significant flows from Sequelitchew Lake into the Edmond Marsh complex to support a functional creek ecosystem, and provide for the passage of migratory fish in the Sequelitchew Creek system. To achieve this goal, the Parties will consider, at minimum, modification of the diversion canal flood control structure and gradients.
- Rehabilitation of Edmond Marsh by removal of sufficient fill and other flow impediments to provide the hydraulic gradients and capacity necessary to achieve and maintain adequate flows through the Marsh.
- Rehabilitation of Sequelitchew Creek below Edmond Marsh to reduce seepage, improve fish habitat, and help restore year-round flows.
- Active management of beaver activities to maintain the hydraulic gradients that provide flows through Hamer, Bell, and Edmond marshes. For purposes of this section, "active management of beaver activities" means management commencing with the least intrusive method and progressing to more intrusive methods only as necessary to maintain hydraulic gradients and flows, with lethal removal utilized only as a last resort.

Working with CalPortland and the Environmental Caucus, and in accordance with the Settlement Agreement's provisions, the South Puget Sound Salmon Enhancement Group created a Core Group of stakeholders to recommend actions to include in the restoration plan. The Core Group included representatives from the following entities:

- City of DuPont
- Washington Department of Ecology
- The Environmental Caucus
- CalPortland Company
- The Nisqually Tribe
- The Sequelitchew Creek Watershed Council
- Joint Base Lewis McChord
- Pierce County

After a year-long process of deliberation that included asking for and incorporating public comment, the Core Group adopted a set of recommended restoration actions on June 20, 2013. These recommendations formed the heart of the *Sequalitchew Creek Watershed Restoration Plan: Public Review Draft*. The Core Group accepted public comments on the draft through August 30, 2013. The South Puget Sound Salmon Enhancement Group incorporated these public comments, and the Core Group adopted the final set of recommendations on December 17, 2013. The *Final Briefing Memo and Core Group Recommendations for a Restoration Plan* presents the adopted set of recommended actions.

The phases of the recommended actions for the restoration plan are presented below.

**Phase 0:** Update the City of DuPont’s Critical Areas Ordinance to allow restoration actions

**Phase 1:** Rehabilitate east-west flow from Sequalitchew Lake to West Edmond Marsh

- Seasonally manage lake levels
- Manage and monitor flows through the watershed through comprehensive beaver management
- Begin enhancement actions at the Losing Reach
- Begin the planning process for the southern alignment in Phase 3 and cross-over culverts in Phase 4

**Phase 2:** Improve fish passage and habitat from West Edmond Marsh through the ravine

- Complete additional actions to enhance the Losing Reach
- Replace the Losing Reach Culvert near City Hall
- Evaluate and modify the Center Drive Culvert
- Adaptively manage flows and habitat changes within the ravine
- Support efforts to restore the mouth of Sequalitchew Creek<sup>1</sup>
- Install weir in Hamer Marsh
- Monitor water quality in Hamer Marsh

**Phase 3:** Rehabilitate flow and fish passage through the DuPont Railroad Trail

- Investigate sub-surface conditions
- Improve flow connectivity and fish passage through the DuPont Railroad Trail
- Create southern flow alignment

**Phase 4:** Restore flows and fish passage to Sequalitchew Lake

- Replace/Remove the JBLM Cross-Over Culverts
- Replace the JBLM 12-inch culvert between Hamer and Edmond Marsh if water quality in Hamer Marsh meets state water quality standards
- Change the JBLM water supply to a deep well system

Notes:

1: This action should not be tied to the sequence of phasing and can occur immediately.

The estimated costs of the proposed restoration plan are presented below.

<b>Project Phase</b>	<b>Planning Cost Estimate</b>
<b>Phase 0: Update the City of DuPont's Critical Areas Ordinance to allow restoration actions</b>	<b>\$30,000.00</b>
<b>Phase 1: Rehabilitate east-west flow from Sequalitchew Lake to West Edmond Marsh</b>	
1.1 Seasonally manage lake levels	\$1,000.00
1.2-1.3 Manage and monitor flows through the watershed through comprehensive beaver management	\$55,000.00
1.4 Begin rehabilitation actions at the Losing Reach	\$5,000.00
1.5 Begin the planning process for the DuPont Railroad Trail Bridge and southern alignment in Phase 3, and cross-over culverts in Phase 4	\$170,000.00
<b>Total Phase 1</b>	<b>\$231,000.00</b>
<b>Phase 2: Improve fish passage and habitat from West Edmond Marsh through the ravine</b>	
2.1 Complete additional actions to rehabilitate the Losing Reach as necessary	\$300,000.00
2.2 Replace the Losing Reach Culvert near City Hall	\$200,000.00
2.3 Evaluate and modify the Center Drive Culvert	\$50,000.00
2.4 Adaptively manage flows and habitat changes within the ravine	TBD
2.5 Support efforts to restore the mouth of Sequalitchew Creek	TBD
2.6 Install weir in Hamer Marsh	\$75,000.00
2.7 Monitor water quality in Hamer Marsh	\$10,000.00
<b>Total Phase 2</b>	<b>\$635,000.00</b>
<b>Phase 3: Rehabilitate flow and fish passage through the DuPont Railroad Trail</b>	
3.1 Investigate sub-surface soil and flow conditions	\$20,000.00
3.2 Improve flow connectivity and fish passage through the DuPont Railroad Trail	\$750,000.00
3.3 Create southern flow alignment	\$200,000.00
<b>Total Phase 3</b>	<b>\$970,000.00</b>
<b>Phase 4: Restore flows and fish passage to Sequalitchew Lake</b>	
4.1 Replace/Remove the JBLM Cross-Over Culverts	\$675,000.00
4.2 Replace the JBLM 12 inch culvert between Hamer and Edmond Marsh if water quality in Hamer Marsh meets state water quality standards	\$140,000.00
4.3 Change the JBLM water supply to a deep well system in the future	TBD
<b>Total Phase 4</b>	<b>\$815,000.00</b>



# Chapter 1: Background and Introduction

Sequalitchew Creek has a long history of human settlement and activity. This chapter provides a brief overview of the human history of the watershed and describes the process used to develop this restoration plan.

## HISTORY OF THE SEQUALITCHEW CREEK WATERSHED

**Figure 1. Map of the Sequalitchew Creek Watershed**



### Human History of the Watershed

Aspect Consulting conducted a review of the history of Sequalitchew Creek and its wetlands as a component of earlier mine permitting efforts (Aspect Consulting 2004). That analysis was primarily based on: 1) an historical assessment by Robert Weaver of the Environmental History Company; 2) the report *A Twentieth Century History of Sequalitchew Creek* (Andrews and Swint 1994); and 3) review of aerial photographs.

Sequalitchew Creek and its wetlands have been significant to the development of the DuPont area. From the earliest settlements, the creek was a major part of community life. As a result, any restoration work must be sensitive to the significant historic and prehistoric resources in the area. A timeline of historical events affecting the Sequalitchew Creek watershed is below:

- For several thousand years, Native Americans used the Sequalitchew Creek area, including the marine resources, shorelines, and upland areas, for subsistence and settlement. The Nisqually Indian Tribe claimed the surrounding region as their territory. Principal residence occurred along the shorelines of Puget Sound and major rivers, and

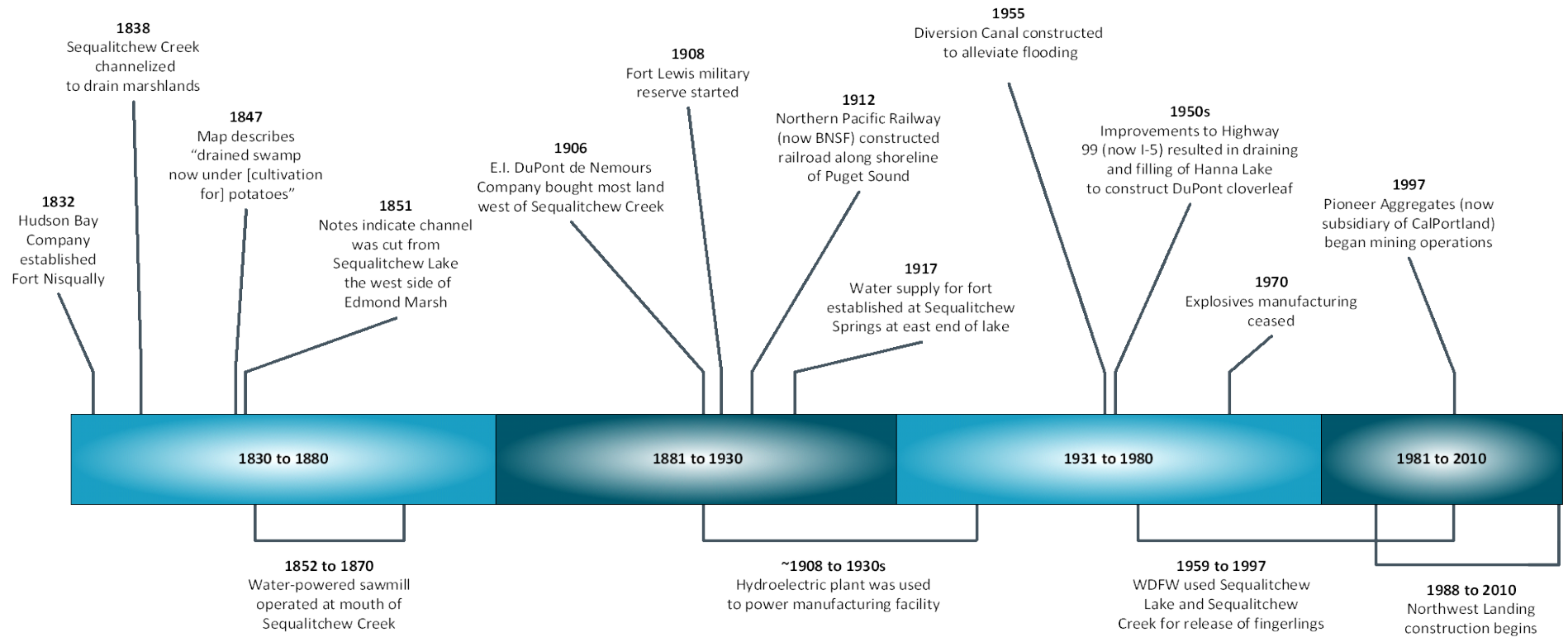
the upland areas provided sources of materials and food (game, root and berry crops, and freshwater resources).

- In 1832, the Hudson Bay Company (HBC) arrived at Sequalitchew Creek and established Fort Nisqually. In 1838, a subsidiary of HBC, the Puget Sound Agricultural Company, was formed and soon dominated agricultural activities at Fort Nisqually. During this period, the creek was channelized, and a series of ditches installed to drain the marshlands and provide arable land. An 1847 map describes a “drained swamp now under [cultivation for] potatoes.” Notes indicate that in 1851, a channel was cut from Sequalitchew Lake to the west side of Edmond Marsh. Small farms and pastures characterized the region until the 20th century.
- In 1906, the E.I. DuPont de Nemours Company bought most of the land west of Sequalitchew Lake and centered on the creek for an explosives manufacturing plant. A narrow gage rail line built in the Sequalitchew Creek Ravine carried explosives to a landing located near the mouth of Sequalitchew Creek for shipment. A hydroelectric plant powered the manufacturing facility until approximately the 1930s. A diversion constructed at the head of the ravine – just north of DuPont City Hall – conveyed water along the rim of the ravine to a penstock that fed a powerhouse near the mouth of the creek.
- The facility now known as JBLM military reserve started in 1908 as a training site attached to the San Francisco Presidio, and subsequently developed into one of the country’s major bases. The growing fort affected the Sequalitchew Creek and marshes in three primary ways: development of a water supply, construction of the Diversion Canal, and addition of stormwater runoff from the fort’s impervious surfaces:
  - In 1917, the water supply for the growing fort was established at Sequalitchew Springs at the east end of Sequalitchew Lake. The water supply currently withdraws up to 8,000 gpm (18 cfs) from the springs during peak demand periods. To protect the water supply, JBLM installed an outlet weir that controls the water level in Sequalitchew Lake and discharges excess water to the Diversion Canal.
  - Development of JBLM included the construction of almost 2,000 buildings and structures as well as the accompanying road, parking, and utility infrastructure. Initially, stormwater from the growing fort was discharged to former Hanna Lake (which had no outlet) and Hamer Marsh (which connected to Sequalitchew Creek).
  - The Diversion Canal was constructed in the 1950s to alleviate flooding concerns that had developed in past decades, but were emphasized by a 6-day storm in February 1951 that resulted in widespread flooding. A 1952 planning study for the Diversion Canal (Western Engineers 1952) indicates the most serious concern was “the near flooding of the Sequalitchew Springs Pumping Station – the water rose to within a few inches of the base of the motor control cubicles.” Sequalitchew Creek lacked capacity to convey these increased flows without flooding so the Army constructed a 3.75-mile channel, called the Diversion Canal, to convey stormwater and lake overflow directly to Puget Sound.
- In 1956 and 1957, the U.S. Army Corps of Engineers constructed an overflow from American Lake to Sequalitchew Lake to control flooding in American Lake. The overflow stabilizes the water level in American Lake at an elevation of approximately 233 feet. The overflow from American Lake is routed to a storage and infiltration area located on JBLM between American Lake and Sequalitchew Lake.

- In the 1950s, improvements to Highway 99 (now I-5) resulted in the draining and filling of Hanna Lake to construct access ramps at the DuPont - Steilacoom Road exit from I-5. Hanna Lake had no outlet, and received runoff from approximately 1,500 acres of JBLM.
- From 1959 until 1997, Washington Department of Fish and Wildlife (WDFW) used Sequelitchew Lake to rear juvenile salmon in an effort to enhance salmon production. WDFW released fingerlings in 1959 and 1960 and then began a continuing hatchery operation in 1976 (Andrews and Swint 1994), which lasted until 1997 (Anteon 2003). During the period of hatchery use for the release of fingerlings, WDFW had continual problems with blockage of the creek for their release runs caused by beavers and vegetation (Andrews and Swint 1994). WDFW would remove the beaver dams each year during the period of smolt outmigration, and would periodically use a device called a "cookie cutter" to remove vegetation from the Sequelitchew Creek channel (Mills 1994).
- In 1970, explosives manufacturing ceased and the land was sold to the Weyerhaeuser Timber Company, who intended to use the land first as a proposed log export facility, and later as a mixed use, planned community—Northwest Landing. With this type of development come increased impervious surface and more stormwater runoff. Runoff from recent developments is typically managed with water quality treatment and infiltration facilities. Development, even when managed with appropriate stormwater facilities, can change the volume, timing, and distribution of groundwater recharge.
- Beaver activity has clearly modified the local hydrology of Sequelitchew Creek and its marshland throughout history (although probably less so when fur trading was active in the area), and in particular over the past few decades. Beaver dams impound water, which allows for increased infiltration and can alter flow patterns.
- In 1996, construction of Northwest Landing began. This planned 3,500 acre development has encircled Edmond Marsh and continues to change the land cover of the Sequelitchew Creek watershed through continuing residential, commercial, and light industrial development.

The combination of human and beaver activities in the Sequelitchew Creek Watershed has altered the primary direction of flows: instead of flowing from Sequelitchew Lake into the creek, water flows out through the Diversion Canal to Puget Sound. A beaver dam at the western outlet of Sequelitchew Lake blocks flows and redirects them to the Diversion Canal. Other beaver dams in the system keep water levels in Edmond Marsh higher than they were historically, and the fill beneath the DuPont Railroad trail further slows flows. This redirection of flows, in combination with highly permeable soils, creates a dry reach just west of Edmond Marsh and greatly reduces the flow through the spring-fed Sequelitchew Creek ravine.

**Figure 2: Timeline of Recent Historical Events Affecting Sequelitchew Creek and Adjacent Wetlands and Marshes**





## ***The Settlement Agreement***

In 2011, the CalPortland Company, the City of DuPont, the Washington Department of Ecology, and a coalition of environmental groups known as the Environmental Caucus signed an agreement called the *2011 Settlement Agreement for DuPont Mine, Restoration of Sequelitchew Creek Watershed, and Preservation of Puget Sound Shorelands and Adjacent Open Space*. The Settlement Agreement calls for the South Puget Sound Salmon Enhancement Group (SPSSEG) to lead a multi-stakeholder effort to develop a restoration plan for the Sequelitchew Creek Watershed.

The Agreement specifies that:

*“[T]he restoration Plan will be consistent with this Settlement Agreement and incorporate the following elements unless otherwise agreed to by the Parties:*

- Improvement of gradients so water discharges from Hamer and Bell marshes flow into Edmond Marsh rather than into the diversion canal.*
- Improvements to create significant flows from Sequelitchew Lake into the Edmond Marsh complex to support a functional creek ecosystem, and provide for the passage of migratory fish in the Sequelitchew Creek system. To achieve this goal, the Parties will consider, at minimum, modification of the diversion canal flood control structure and gradients.*
- Rehabilitation of Edmond Marsh by removal of sufficient fill and other flow impediments to provide the hydraulic gradients and capacity necessary to achieve and maintain adequate flows through the Marsh.*
- Rehabilitation of Sequelitchew Creek below Edmond Marsh to reduce seepage, improve fish habitat, and help restore year-round flows.*
- Active management of beaver activities to maintain the hydraulic gradients that provide flows through Hamer, Bell, and Edmond marshes. For purposes of this section, "active management of beaver activities" means management commencing with the least intrusive method and progressing to more intrusive methods only as necessary to maintain hydraulic gradients and flows, with lethal removal utilized only as a last resort.*

*The parties recognize that these elements may change during preparation of the Restoration Plan. The Restoration Plan will incorporate the principles of adaptive management. Monitoring, evaluation, and use of all appropriate data will be incorporated during the preparation of the Restoration Plan. Additional surface water monitoring of Edmond Marsh and Sequelitchew Creek will continue during and after Restoration Plan Implementation, as recommended in the Restoration Plan.”*

## ***The Restoration Planning Process***

Working with CalPortland and the Environmental Caucus, and in accordance with the Settlement Agreement's provisions, the South Puget Sound Salmon Enhancement Group created a Core Group of stakeholders to recommend actions to include in the restoration plan. The Core Group included representatives from the following entities:

- City of DuPont
- Washington Department of Ecology
- The Environmental Caucus
- CalPortland Company
- The Nisqually Tribe
- The Sequim Creek Watershed Council
- Joint Base Lewis McChord
- Pierce County

SPSSEG held the first meeting of the Core Group, called the Visioning Meeting, to establish guidance for the restoration plan process. Following this meeting, SPSSEG held a stakeholder and public meeting to solicit input on the restoration plan elements and sequencing from the larger community.

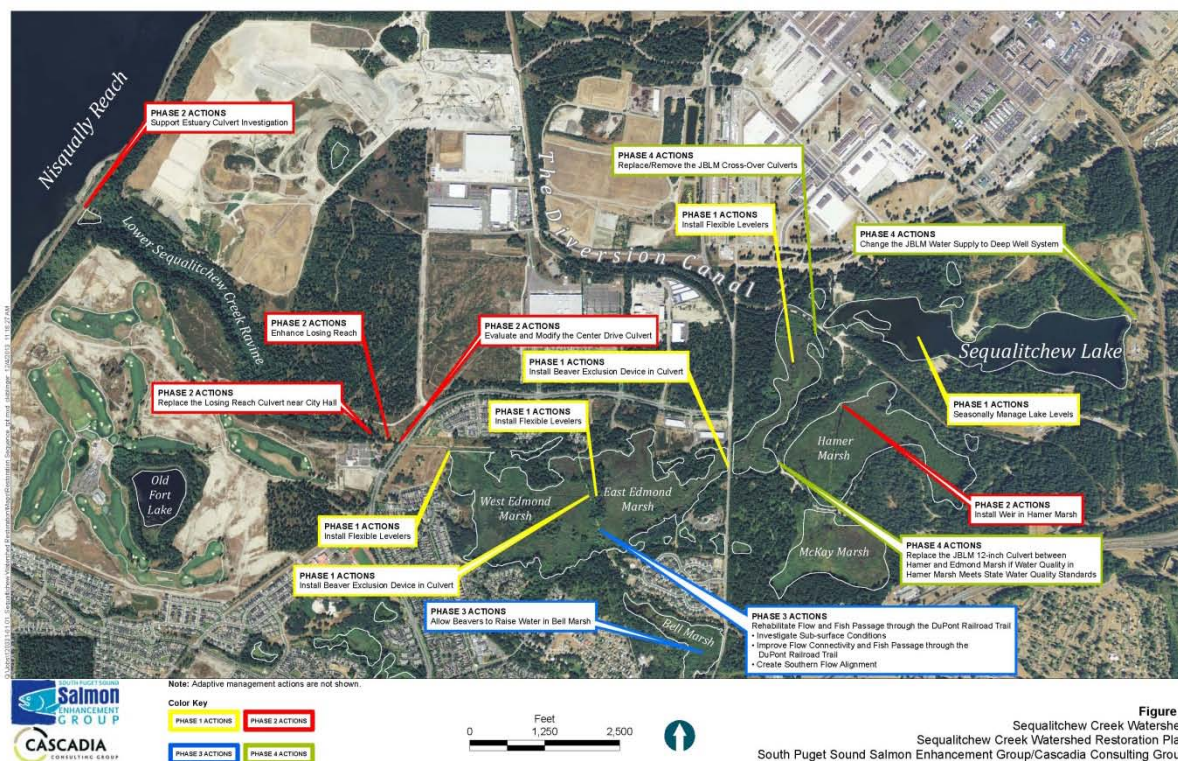
SPSSEG then convened a series of Core Group workshops to develop the restoration plan content. At the first three workshops, the Core Group developed and reviewed options to address each of the elements specified in the Settlement Agreement. After the second workshop, the Core Group requested that SPSSEG commission Ecosystem Diagnosis and Treatment modeling of the watershed to estimate the effects of different restoration options on winter chum and coho salmon. The Core Group voted unanimously to adopt the set of recommendations described in this draft conceptual plan at its fourth workshop on June 20, 2013.

SPSSEG released the draft conceptual plan for public review and comment on August 13, 2013, and held a stakeholder and public meeting on August 27 to collect additional input on the draft. The South Puget Sound Salmon Enhancement Group incorporated these public comments, and the Core Group adopted the final set of recommendations on December 17, 2013. The *Final Briefing Memo and Core Group Recommendations for a Restoration Plan* presents the adopted set of recommended actions. In accordance with the Settlement Agreement, the Environmental Caucus and CalPortland Company will develop the Sequim Creek Restoration Plan.

## Chapter 2: Restoration Plan

This chapter is the heart of the *Final Briefing Memo and Core Group Recommendations for a Restorative Plan*. It presents the Core Group's vision for restoration, as well as a phased approach to the proposed set of recommended actions to restore flows and ecological conditions suitable for salmon in this watershed. Figure 3, below, illustrates the proposed phases and actions.

**Figure 3: Map of the Sequelitchew Creek Watershed Showing Locations and Phases of Recommended Actions**



## VISION

On September 6, 2012, the Core Group approved the following vision for the restoration of Sequelitchew Creek.

*The Sequelitchew Creek Restoration Plan will identify actions and probable project costs necessary to restore flows and ecological conditions suitable for native salmonid populations in the Sequelitchew Creek Basin.*

The phases and actions described below are the Core Group's recommendations to achieve this vision for Sequelitchew Creek.

## Approach

The Core Group recommends that the restoration project uses monitoring and adaptive management to evaluate and build on success. **The details and order of specific restoration elements may need to be adjusted over time as new information is available.**

## PHASE 0: UPDATE THE CITY OF DUPONT'S CRITICAL AREAS ORDINANCE

Currently, the City of DuPont's Critical Areas Ordinance prohibits alteration of Category I wetlands not associated with marine shorelines. As a result, the City cannot permit any work in East or West Edmond Marsh, even work that is intended to improve the ecosystem function of the watershed.

The City's code will need to be amended for much of the Sequelitchew Creek restoration plan to move forward. The City recently adopted an updated Shoreline Master Program (SMP) which allows restoration activities in Category I wetlands covered by the SMP. The City could adopt this code language into its Critical Areas Ordinance with confidence, since it has undergone public review and the Department of Ecology has approved it as part of the SMP update process.

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### *Estimated Costs*

Typically, the City secures consultant support to assist with amending its codes. The City estimates that this code amendment would require approximately \$30,000 in consulting support.

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### *Expected Outcome*

Phase 0 should result in an update to the City's Critical Areas Ordinance that is consistent with the wetland protection in the City's existing shoreline Master Program. This change would allow habitat restoration in Category I wetlands and will allow the rest of this Watershed Restoration Plan to move forward. Without it, most of the projects necessary to restore flows and salmonid habitat in Sequelitchew Creek cannot occur.

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### *Recommendation*

The Core Group recommends to the City of DuPont that it reviews and amend its Critical Areas Ordinance in a timely fashion to allow work on the restoration of the Sequelitchew Creek Watershed to move forward.

#### **Phase 0 Expected Outcome:**

**Phase 0 will provide the City of DuPont with a more flexible Critical Areas Ordinance that will allow restoration actions to occur in Category I wetlands.**

## PHASE 1: REHABILITATE EAST-WEST FLOW FROM SEQUALITCHEW LAKE TO WEST EDMOND MARSH.

The gradient between Sequelitchew Lake and West Edmond marsh is very low. This low grade has facilitated the reversal of flow due to beaver activity (dams) and human infrastructure. The surface water flowing from Sequelitchew Lake flows almost entirely through the Diversion Canal



rather than through Sequalitchew Creek ravine. Phase 1 includes three major actions designed to redirect flows from Sequalitchew Lake into Sequalitchew Creek and through Edmond Marsh, and some preliminary work to support future phases:

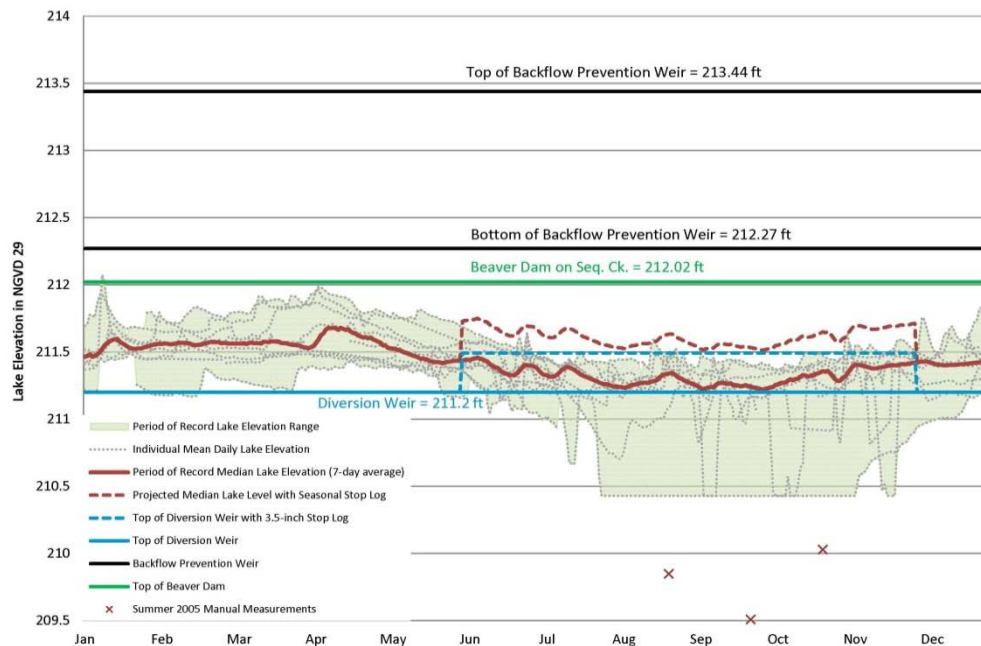
1. Seasonally manage lake levels with JBLM
2. Comprehensively manage beavers and beaver dams in the watershed
3. Rehabilitate the losing reach by clearing out invasive vegetation, garbage, and monitoring flows
4. Begin planning for the construction of the DuPont Railroad Trail Bridge, the southern alignment in Phase 3, and removal of the cross-over culverts in Phase 4.

### ***1.1 Seasonally Manage Water Levels in Sequalitchew Lake***

JBLM manages the level of Sequalitchew Lake to protect its water supply at Sequalitchew Springs. Currently, the diversion weir is operated at a fixed elevation throughout the year. As a result, the lake level is highest in the winter when flow at the springs is highest, and lowest in summer. Under this action, JBLM will actively modify its lake management protocols to raise water levels in summer while staying within the existing operating range (water surface elevation of approximately 211.2 to 211.8 feet NGVD 29). By adding stop logs in the summer and removing them in winter, JBLM can increase the lake level in summer without affecting winter lake levels and the safety or security of the JBLM water source.

Historical lake level data (shown in Figure 4) indicate that JBLM typically maintains the lake level between 211.2 feet (equal to the top of diversion weir) in summer and up to 211.8 feet in winter. The primary water source to Sequalitchew Lake is groundwater discharge, so it takes several months for precipitation to affect water levels. Water levels are typically highest in January through May and lowest in August through September. Historical water level data for each year of the period of record are shown as dotted traces within the gray band that represents the full range. There have been several summers where lake levels are below the top of the diversion weir. In these cases, it would not be possible to increase lake levels by adding stop logs.

**Figure 4: Sequelitchew Lake Levels with Seasonal Management**



Aspect Consulting

4/5/2013

S:\SPSSEG\Sequalitchew Creek Restoration Plan - 120100\Report Drafts\Seq Lake Levels.xlsx

**Figure 4  
Seq. Lake Levels with Seasonal Management**

Dupont, WA

The dashed red line in Figure 4 shows the effect of adding a 3.5-inch stop log from June 1 to November 30, illustrating that median summer water levels would be higher, but still within the historical operating range for the lake.

Raising lake level seasonally would assist in providing flow through the marshes to Sequelitchew Creek by incrementally providing more head to help overcome beaver dams and push flow downstream. However, modifying the seasonal operation of the Sequelitchew Lake on its own is not enough to restore flow. Summer lake levels would continue to be within the historical range, and the level of protection of JBLM's Sequelitchew Springs water supply from surface water intrusion would not be changed.

### *Estimated Costs*

The staff team estimates that seasonal management of Sequelitchew Lake's water levels would have the following costs:

- \$1,000 initial capital costs
- Annual labor 8 to 16 hours (one stop log installed and removed on set dates annually).

If JBLM prefers, it could install a gate valve in the weir to facilitate a gradual transition in water levels at the end of the season. This option would cost approximately \$10,000.

Modifying lake operations would require on-going seasonal maintenance, most likely to be performed by JBLM. This maintenance would be limited to installation and removal of the stop

logs since beaver management at the diversion weir is already required under existing operations.

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#### *Related Actions*

Before implementing this action, JBLM likely will conduct additional analysis to ensure this action will have no detrimental effects on its water supply.

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#### *Expected Outcome*

Seasonal management of the lake to increase water levels in the summer, while keeping them within the average range of lake levels, will provide additional head to assist in redirecting flows from Sequelitchew Creek through Edmond Marsh while protecting the JBLM water supply.

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#### *Recommendation*

The Core Group recommends that JBLM seasonally manage lake levels to increase summer lake levels to 211.8 feet.

### **1.2 Manage Beavers and Beaver Dams in Watershed**

The goal of managing beaver activity in Sequelitchew Creek watershed is to increase east to west flows from Sequelitchew Lake through Edmond Marsh to Puget Sound, rather than out through the Diversion Canal. At its first meeting, the Core Group agreed to use the least invasive beaver management methods possible. At its June 2013 meeting, the Core Group also agreed that they prefer a more aggressive flow gradient in the creek. Therefore, this plan presents a combination of escalating beaver management strategies designed to work with the existing beavers to the extent possible to achieve the desired flow gradients. Beaver management strategies can be escalated depending on how the beaver population responds to more aggressive treatments.

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#### *Beaver Management*

Beaver dams are located throughout the marsh areas of the watershed and have significant effects on water levels. Beaver dams have created a larger and more stagnant marsh; for example, Edmond Marsh is larger today than it was historically. The marsh is also highest in the center (between Steilacoom – DuPont Road and the DuPont Railroad trail). In addition, with three possible discharge routes to Puget Sound (Sequelitchew Creek, Diversion Canal, and infiltration to groundwater), beavers can shift discharge from one route to another by impounding water. For example, beaver dams in East Edmond Marsh have impounded water higher than Sequelitchew Lake, shifting stream flow to the Diversion Canal and away from Sequelitchew Creek. Less obviously, if beaver dams result in the impoundment of water in areas of highly permeable soils, they can increase infiltration of surface waters and reduce stream flow (this phenomenon was observed in early monitoring data in the Diversion Canal prior to removal of several large dams). Beaver dams can also expand pools over more permeable sediment layers, resulting in much higher rates of infiltration to groundwater.

The Diversion Canal will remain in use for two reasons: to reduce the risk of flooding, and to prevent contamination of the JBLM water supply. Since this discharge route will remain open for the foreseeable future, beaver management will be a key to maintaining sufficient flows down Sequelitchew Creek and preventing excessive flow to the Diversion Canal.

While beaver dams occur frequently throughout the system, not all beaver dams are detrimental to or inconsistent with restoration activities. The key beaver dams are primarily those which control water levels near human infrastructure and prevent water flows throughout the system. Known key beaver dam locations are as follows:

- The far east end of East Edmond Marsh near the JBLM “cross-over” culvert
- East Edmond Marsh, just upstream of the DuPont Railroad trail culvert
- West Edmond Marsh near the outlet

Table 1, below, breaks the upper watershed and Edmond Marsh into segments whose water levels currently are controlled by a weir (Sequalitchew Lake) and beaver dams (all others). The table shows current water levels and conservative restoration water levels that would allow flows. The conservative restoration water levels are those that would establish a low gradient from the east end of East Edmond Marsh to the middle of West Edmond Marsh that moves flows while still maintaining marsh sizes.



**Table 1. Current and predicted surface water elevations under restored conditions in the marshes of the Sequalitchew Creek watershed – Conservative Scenario**

Waterbody	Monitoring Point	Current Water Surface Elevation in feet NGVD 29		Restoration Water Surface Elevation in feet NGVD 29		
		Range	Average	Range	Average	Average Change in ft
Sequalitchew Lake	Diversion Weir	209.5 - 212	211.38	209.5 - 212	211.57	0.19
East Edmond Marsh						
Eastern (on JBLM)	SG-SCM-1	210.6 - 212	212.32	210.6 - 212	211.47	-0.85
Central (DuPont Steilacoom Rd to midpoint)	SC-EM-3W	210.5 - 213.2	212.26	210.3 - 212	211.27	-0.99
Western (midpoint to trail)	SG-EM-2E	210.8 - 212.7	212.05	209.6 - 211.6	211.15	-0.91
West Edmond Marsh						
Eastern (trail to midpoint)	SG-EM-2W	209.6 - 211.8	211.22	209.6 - 211.6	211.02	-0.2
Western (midpoint to western beaver dam)	SG-EM-1A	205.3 - 210	207.95	205.27 - 209.95	207.95	0
Other Marshes						
Bell Marsh	SG-BM-1	215.6 - 219.9	218.38	215.6 - 219.9	218.38	0
McKay Marsh	SG-MKM-1	213.6 - 217.4	215.55	213.6 - 217.4	215.55	0
Hamer Marsh	SG-HM-1	211.7 - 215.2	213.90	212 - 215.8	214.40	0.5

Figure 4 showed an increase in the *average* water level in Sequalitchew Lake through the use of a stop log in summer (see Seasonally Manage Lake Levels, above), but the *range* of water levels in the lake would remain the same. The three segments of East Edmond Marsh each would be lower by about one foot. Just west of the DuPont Railroad Trail, the water level would be a few inches lower (0.2 feet). The westernmost portion of West Edmond Marsh would remain unchanged. Using beaver management techniques to achieve these water levels would create a slight 0.006% gradient through the system, which is enough to move 10 cfs of water, assuming flow is broad (150 feet) and shallow (1 foot) through marsh vegetation. Velocity of flow would be approximately 0.1 feet per second (fps). The technical staff team that supported the Core Group's deliberations believes that this gradient and these predicted flows are achievable.

Table 2, below, shows current and predicted water levels under more aggressive restoration conditions that would create a significantly greater gradient from Sequalitchew Lake through Edmond Marsh. The feasibility of this gradient depends on the success of beaver management, the actual elevations of the bottom of Edmond Marsh, and the willingness of permitting agencies to consider greater decreases in marsh water levels. However, this gradient would provide room for higher flows. Higher flows (above 10 cfs) are typically only available during winter.

**Table 2. Current and predicted surface water elevations under restored conditions in the marshes of the Sequalitchew Creek watershed – Aggressive Scenario**

Waterbody	Monitoring Point	Current Water Surface Elevation in feet NGVD 29		Restoration Water Surface Elevation in feet NGVD 29		
		Range	Average	Range	Average	Average Change in ft
Sequalitchew Lake	Diversion Weir	209.5 - 212	211.38	209.5 - 212	212.07	0.69
East Edmond Marsh						
Eastern (on JBLM)	SG-SCM-1	210.6 - 212	212.32	210.6 - 212	211	-1.32
Central (DuPont Steilacoom Rd to midpoint)	SC-EM-3W	210.5 - 213.2	212.26	210.3 - 212	210	-2.26
Western (midpoint to trail)	SG-EM-2E	210.8 - 212.7	212.05	209.6 - 211.6	209	-3.05
West Edmond Marsh						
Eastern (trail to midpoint)	SG-EM-2W	209.6 - 211.8	211.22	209.6 - 211.6	208	-3.22
Western (midpoint to western beaver dam)	SG-EM-1A	205.3 - 210	207.95	205.27 - 209.95	206.5	-1.45
Other Marshes						
Bell Marsh	SG-BM-1	215.6 - 219.9	218.38	215.6 - 219.9	218.38	0
McKay Marsh	SG-MKM-1	213.6 - 217.4	215.55	213.6 - 217.4	215.55	0
Hamer Marsh	SG-HM-1	211.7 - 215.2	213.90	212 - 215.8	214.40	0.5

At its June 2013 meeting, the Core Group agreed that it prefers the surface water elevations in Table 2. Achieving this profile requires a more aggressive and upfront approach to beaver management that includes the following steps:

1. Survey existing beaver dams, install staff gauges at each, and monitor them over time. The initial survey will establish a baseline of dam and water level elevations, against which future monitoring data can be compared. Public comments expressed interest in the use of citizen volunteers; monitoring the staff gauges is one of several opportunities for citizen volunteer work. This monitoring will help to track the dams and water levels over time and identify where problem areas may be.
2. Remove the dam at the eastern end of Edmond Marsh, immediately downstream of the diversion weir, and likely the beaver family that inhabits it. If beavers rebuild this dam, install a flexible pond leveler in it. Flexible pond levelers are flow devices installed at the desired water depth that extend upstream and downstream of a dam to control the height of water behind a beaver dam.
3. Clear the culverts in the DuPont Railroad Trail and at Steilacoom-DuPont Road of beaver debris, install beaver exclusion devices in them, and regularly maintain the exclusion. Pierce County is working actively with JBLM on an agreement to manage beaver activity in the Steilacoom-DuPont Road culvert through beaver excluders.
4. Install flexible pond levelers in the two other key dams according to Table 2: near the outlet of West Edmond Marsh, and in East Edmond Marsh, just upstream of the DuPont Railroad Trail culvert.
5. Retain the beaver dam in Bell Marsh. Currently, a beaver dam keeps the level of Bell Marsh fairly high, most likely higher than its historic levels. This natural impoundment is likely sufficient to increase groundwater contributions from Bell Marsh to the southern alignment.

These steps will help get flow started with a more aggressive profile, reflect public desire for more assertive beaver management, and create a baseline from which to adaptively manage beaver dams in the future. It also works with the existing beaver population and potentially disrupts only one beaver family, accommodates others, and even relies on existing beaver dams to increase water levels in Bell Marsh.

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#### *Estimated Costs*

Estimated costs are \$45,000 to manage and monitor flows through the watershed. This includes installation of flexible levelers, exclusion devices, and staff gauges to monitor.

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#### *Required Permits*

Modification of a beaver dam requires a Hydraulic Project Approval (HPA), a permit issued by WDFW for work that will use, obstruct, change, or divert the bed or flow of state waters. Flexible pond levelers and culvert exclusion devices are regularly permitted by WDFW. The effects of this alternative on water resources may also be subject to Ecology's Water Pollution Control regulations (Chapter 90.48 RCW and Chapter 173-201A WAC). There are applicable state and local permits and a process in place to remove beavers.

The City of DuPont's sensitive areas code [DMC 25.105.070(1)(f)] must be amended to allow alteration of Category I wetlands for this action to be implemented.



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### *Expected Outcome*

Installing and monitoring staff gauges will provide data to illustrate whether beaver management is working, and to trigger more assertive methods if necessary. Installing flexible levelers in two key beaver dams, as well as the removal of one key dam and two blocked culverts in the flow path, are an effective first method of increasing flows through beaver dams with minimal disruption to most beavers. The flexible levelers proposed in this plan will allow for increased flows from Sequalitchew Lake through Edmond Marsh. These flows would result in increased habitat function and improved water quality in the marsh system, but may ultimately slow or reverse the growth of the marshes.

---

### *Recommendation*

The Core Group recommends pursuit of the more aggressive restoration actions to increase gradient as the conditions allow and to support escalating beaver management as necessary to maintain flows.

### **1.3 Monitor flows through Edmond Marsh and Adaptively Manage Flexible Levelers**

Flexible levelers will require maintenance at least annually and/or seasonally. However, after installation there is an initial trial and error period to monitor and react to the beaver's response to the new pond level. This period of careful monitoring and adaptive management is crucial to the success of the flexible leveler approach. Once the beavers and flexible levelers reach equilibrium, the flexible levelers should require only routine maintenance. Flexible levelers can last for several years.

The implementation team and/or citizen volunteers could monitor flows from Sequalitchew Lake through Edmond Marsh and record water elevations in the marshes using the staff gauges. If the flexible levelers are insufficient to maintain positive flows through the system, the implementation team should re-evaluate the beaver management plan to determine whether to use more aggressive methods, such as lowering flexible pond levelers, removal of more key dams, trapping and relocation of beavers, or lethal removal.

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### *Estimated Costs*

As noted above, annual monitoring and maintenance costs for the flexible levelers are approximately \$10,000. Costs will increase if monitoring shows that more aggressive beaver management is required to maintain flows through the system. Volunteer groups could provide some in-kind services, such as monitoring water elevations and removing debris from flexible levelers.

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### *Required Permits*

Permits are not usually necessary for monitoring and maintenance of flexible levelers. More aggressive beaver management techniques may require additional permits from WDFW and/or other regulatory agencies. If more aggressive gradient control affects the wetlands, these actions may require a state water quality review under the State Clean Water Act anti-degradation clause.

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#### *Expected Outcome*

Careful monitoring and maintenance of flexible levelers will help ensure that they are as effective as possible, and would provide early identification of the need for more aggressive beaver management techniques.

#### ***1.4 Rehabilitate and Monitor the Losing Reach***

As described below in section 2.1, the reach of Sequelitchew Creek from Edmond Marsh under Center Drive and downstream to the trail crossing from the DuPont City Hall is typically dry, and under the current flow regimes would not achieve the goal of improving flows and habitat conditions. When water does spill from Edmond Marsh, it is assumed that a substantial fraction of the flow easily infiltrates in this short (approximately 400-meter) reach.

Section 2.1 describes rehabilitation of the Losing Reach, including placing compacted sediments (if necessary) in the new channel to reduce loss of water to infiltration. Comment on the Public Review Draft of this plan suggested that once flow is restored through Edmond Marsh, sediments would deposit in the channel naturally, eliminating the need for human intervention.

In Phase 1, the implementation team should support the removal of trash and invasive vegetation from the Losing Reach channel, and monitor it to determine whether the channel seals naturally once flows are restored. This action is another good opportunity for citizen involvement.

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#### *Estimated Costs*

This action would cost very little – probably under \$5,000 – especially if citizen volunteers remove the trash, invasive vegetation, and conduct the follow-up monitoring.

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#### *Required Permits*

We do not think that any permits should be needed to accomplish this task.

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#### *Expected Outcome*

In addition to making the Losing Reach more aesthetically pleasing, this action will allow citizen involvement in a restoration project and the opportunity to determine whether the Losing Reach channel will seal on its own or require human intervention in the future.

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#### *Recommendation*

The Core Group recommends cleaning out and monitoring the Losing Reach.

#### ***1.5 Begin the Planning and Design for DuPont Railroad Trail Bridge and Southern Flow Alignment (Phase 3), and Removal of Cross-Over Culverts (Phase 4)***

The southern flow alignment and DuPont Railroad Trail bridge planned for Phase 3, and removal or replacement of the cross-over culverts planned for Phase 4, are critical components in the success of the overall plan, and could be conducted earlier if desired. Planning for these restoration elements should begin in Phase 1 to allow them to be incorporated in other efforts to improve connectivity to Edmond Marsh and Sequelitchew Lake.

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### *Estimated Costs*

The cost for planning for the southern alignment and bridge is estimated at \$95,000. The estimated cost for planning for removal or replacement of the cross-over culverts is \$75,000.

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### *Required Permits*

Permits are not required for planning or design.

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### *Expected Outcomes*

Creating plans for the southern flow alignment, bridge, and cross-over culverts early in the project may allow construction to occur in earlier phases if funding is available.

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### *Recommendation*

The Core Group recommends beginning the planning for these elements in Phase 1.

#### **Phase 1 Expected Outcomes:**

**The outcome of Phase 1 should be improved gradient and flow from Sequalitchew Lake to West Edmond Marsh. The Edmond Marsh complex may decrease in size as a result of Phase 1 actions. Work also will begin on the Losing Reach and on planning for future phases.**

## **PHASE 2: IMPROVE FISH PASSAGE AND HABITAT FROM WEST EDMOND MARSH THROUGH THE RAVINE**

West of the outlet of West Edmond Marsh, Sequalitchew Creek is often dry. A series of culverts – one under Center Drive, one near City Hall, and one at the estuary – block or reduce fish passage. Actions in this phase would restore year-round flows to this section of the creek, remove fish passage barriers, and improve fish habitat from West Edmond Marsh through the ravine.

### **2.1 Rehabilitate the Losing Reach**

As noted above, the reach of Sequalitchew Creek from Edmond Marsh under Center Drive and downstream to the trail crossing from the DuPont City Hall (the Losing Reach) appears to be human-made, cut in a generally straight line through the highly permeable Vashon Recessional Outwash, and above the water table. Therefore, this reach is typically dry, and under the current flow regimes would not achieve the goal of improving flows and habitat conditions. Flow in the reach has been observed after removal of large beaver dams and after severe precipitation events. When water does spill from Edmond Marsh, it is assumed that a substantial fraction of the flow easily infiltrates in this short (approximately 400-meter) reach. Reconfiguring the channel of Sequalitchew Creek through this area would improve stream habitat conditions and reduce the loss of surface water flows to groundwater at this location.

Enhancing this reach of Sequalitchew Creek is anticipated to include improving 725 linear feet immediately upstream and 275 linear feet immediately downstream of the Center Drive culvert, as follows:

1. If the Losing Reach channel does not seal itself naturally once flows are restored in Phase 1, reconstruct the channel to help reduce infiltration and/or “loss” of water.
2. Enhance the channel to increase aquatic habitat diversity.
3. Improve stream channel conditions by importing and placing a well-graded mix of appropriately sized, rounded cobbles, gravels, and sand meeting WDFW criteria in the Stream Habitat Restoration Guidelines (Cramer 2012).
4. Re-plant native riparian vegetation, amend the soils with compost or import topsoil. Maintain plantings and temporarily irrigate these areas to establish a riparian corridor.
5. Place large woody debris (LWD) in the channel to help encourage natural pool-riffle spacing, and to meet WDFW guidelines for fish passage through the channel. Hydraulic guidelines for fish passage are a function of depth and velocity of water. For adult coho, WDFW recommends a minimum depth of 1 foot and a maximum velocity of 3 feet per second. These requirements may be difficult to sustain during summer low flow periods without the creation of backwater effects from LWD and riparian vegetation.

These actions would not add flows to the system; rather, they would improve habitat within the reach by increasing channel complexity and limiting infiltration to groundwater. Rehabilitation would allow fish to pass between the ravine and the Edmond Marsh complex, which currently is impossible most days of the year. Some flows will continue to be subsurface.

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#### *Estimated Costs*

Enhancing the losing reach would require approximately \$300,000 in capital costs and about \$2,000 to \$3,000 in annual maintenance costs (approximately 1% of estimated capital cost). Citizen volunteers could be used to help maintain the reach.

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#### *Required Permits*

The effects of this alternative on water resources may be subject to the City of DuPont's Sensitive Area regulation (Chapter 25.105 DMC) and Ecology's Water Pollution Control regulations (Chapter 90.48 RCW and Chapter 173-201A WAC). All necessary local, state, and federal permits will be obtained. However, this project should be relatively easy to permit as described.

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#### *Expected Outcomes*

Enhancement of the losing reach will allow surface water flows from West Edmond Marsh to the ravine year-round. Additional in-stream and riparian habitat will improve the ecological conditions suitable for salmonids throughout this reach.

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#### *Recommendation*

The Core Group recommends enhancing the losing reach as needed.

## **2.2 Replace the Losing Reach Culvert near City Hall**

The City of DuPont owns the culvert near City Hall, known as the Losing Reach Culvert. This round corrugated steel culvert should be replaced with a bridge. The existing culvert is perched above the stream channel and would not meet WDFW requirements for fish passage with increased water flows.

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### *Estimated Costs*

Replacing this culvert would cost approximately \$200,000. There is high road fill located at this site, which drives the cost higher.

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### *Required Permits*

Hydraulic Project Approval from WDFW, Section 404, Nationwide 27, or Section 10 permit from USACE, 401 Water Quality Certificate from Ecology, and a sensitive areas alteration permit from the City of DuPont. All necessary local, state, and federal permits will be obtained.

---

### *Expected Outcomes*

Replacing this culvert with a bridge will allow fish passage through the culvert while maintaining trail/vehicle access (assuming that adequate flow is restored).

---

### *Recommendation*

The Core Group recommends the replacement of the Losing Reach culvert with a bridge.

## **2.3 Evaluate and Modify the Center Drive Culvert**

The existing box culvert under Center Drive will need to be re-evaluated and possibly modified to match the channel widths both upstream and downstream of the crossing. In the future, there may not be pedestrian access year round through the culvert sidewalk due to higher water flows. Under existing conditions, during high periods of rain, the water level is only about 1 foot below the sidewalk elevation. If flows are increased through the box culvert, the sidewalk may be under flowing water, especially in the winter. The City of DuPont is willing to investigate options to improve and/or abandon this particular crossing for pedestrians.

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### *Estimated Costs*

Project costs would vary depending on whether the City can safely abandon the sidewalk crossing and use an existing crosswalk and stop light over Center Drive. Additional engineering will need to be completed to determine actual project costs. \$50,000 is a planning level cost.

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### *Required Permits*

Hydraulic Project Approval from WDFW, Section 404, Nationwide 27, or Section 10 permit from USACE, a Section 401 Water Quality Certificate from Ecology, and a sensitive areas alteration permit from the City of DuPont. All necessary local, state, and federal permits will be obtained.

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### *Expected Outcomes*

Relocating the pedestrian trail from the Center Drive culvert will protect public safety while maintaining trail access and improving the channel conditions.



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### *Recommendation*

The Core Group recommends that the City modify the Center Drive culvert.

## **2.4 Adaptively Manage Flows and Habitat Changes within the Ravine**

This approach involves observing the habitat changes that occur in the ravine as “peak” flows form habitat there, and determining whether any additional restoration work might be beneficial. If restored flows do not create pools and habitat structure, the implementation team should consider placing additional wood in the channel. If the pedestrian railcar foot bridge and borrow pit/berm are significantly limiting floodplain function, remove them and/or replace them with another crossing structure that allows better floodplain function.

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### *Habitat Restoration in the Canyon*

South Puget Sound Salmon Enhancement Group staff conducted a field survey of the Sequelitchew Creek ravine on Monday, December 3, 2012. During that survey, staff observed that habitat conditions are generally good throughout the ravine. However, the creek channel is homogeneous, with no real pools and very little wood in the streambed. The water in the creek was clear even after the large amounts of precipitation over the past week; water in other creeks nearby was turbid. Habitat surveys conducted in 2004 found that woody debris was present in the system – and in fact some areas were difficult to traverse due to the presence of large woody debris – but only a small percentage of the wood was submerged. The majority of the large wood caused the flow to move around it, since there was not enough force in the flow to cause scour underneath the woody debris and form pools (Anchor, 2004). These observations suggest that the peak flows needed to create good stream habitat are not occurring in the Sequelitchew Creek ravine under existing conditions.

However, one of the challenges facing the Core Group is that we are unsure how much flow ultimately will be restored to the ravine through this restoration planning process. Therefore, it is difficult to say with certainty what changes will occur in the ravine. However, we can say that if we are successful in restoring a surface water connection between the Edmond Marsh complex and the ravine, we are also likely to restore the ability for some habitat-forming peak flows to occur in the ravine. If so, these peak flows will scour out some pools in the channel and begin to add wood to the stream naturally. These changes will be beneficial to the creek and the organisms it supports.

The existing steel footbridge near the creek mouth may need to be removed and replaced with a longer span pedestrian footbridge structure and/or be moved to a more appropriate crossing. There does not appear to be adequate freeboard above the creek and the channel is somewhat confined compared to the floodplain channel width. Staff recommends observing the habitat conditions around this bridge after flows are restored to determine whether replacing this bridge is strictly necessary.

---

### *Estimated Costs*

Project costs in the canyon would vary depending on what habitat projects are needed. Replacing the pedestrian foot bridge and borrow pit/berm would cost approximately \$50k-\$100k (depending on new bridge location and span).

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### *Required Permits*

Adaptive management requires no permits. However, habitat restoration projects in the ravine would require appropriate permits according to their nature.

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### *Expected Outcomes*

Adaptive management of habitat changes in the ravine, rather than active management, will allow the creek to restore itself to accommodate increased flows.

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### *Recommendation*

The Core Group recommends adaptively managing flows and habitat changes in the ravine. If restored flows do not create pools and habitat structure, the implementation team should consider placing additional wood in the channel. If the pedestrian railcar foot bridge and borrow pit/berm are significantly limiting floodplain function, remove them and/or replace them with another crossing structure that allows better floodplain function.

## **2.5 Support Efforts to Restore the Mouth of Sequelitchew Creek**

The Core Group supports restoration of estuarine functions and adult and juvenile salmonid access to the mouth of Sequelitchew Creek. This recommendation involves supporting the work of the Puget Sound Nearshore Ecosystem Restoration Project (PSNERP), Washington Department of Fish & Wildlife, and others to obtain funding to restore the estuary. This project is difficult and will be a multi-million endeavor for any habitat restoration project selected.

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### *Estuary Culvert*

Historically, the mouth of Sequelitchew Creek was a wide, shallow cove. Burlington Northern Santa Fe railroad (BNSF) filled the ravine at the mouth of the creek with a high embankment to support railroad tracks. A 180-foot long, 5-foot by 5-foot box culvert in the upper intertidal zone now connects the brackish marsh near the mouth of the creek with Puget Sound. This culvert constricts the connection of Sequelitchew Creek with the Sound, and the embankment eliminates the marsh's natural exposure to wind and wave action.

PSNERP has identified the restoration of the mouth of Sequelitchew Creek as one of a suite of 36 potential nearshore restoration actions. Their *Strategic Restoration Conceptual Engineering – Final Design Report* (2011) is available online at <http://www.pugetsoundnearshore.org/cdr.html>. The report presents two options for restoring the mouth of Sequelitchew Creek:

1. **Full restoration:** This alternative would replace the railroad embankment across the mouth of Sequelitchew Creek with a 1,000-foot bridge. The area under the new bridge would be graded to create a series of tidal channels connecting the marsh to Puget Sound. Shoreline armoring and fill material would be removed from the intertidal zone. Over time, the existing brackish marsh would be exposed to wind and waves from Puget Sound, which would eventually transform it into an open coastal inlet.
2. **Partial restoration:** This alternative would leave the railroad embankment in place. An additional culvert or series of culverts would be installed through the embankment. As much shoreline armoring and fill would be removed as possible without jeopardizing the stability of the railway. This action would improve tidal flows and formation of tidal

channels in the existing brackish marsh, but would not fully restore an open coastal inlet at the mouth of Sequelitchew Creek.

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#### *Estimated Costs*

Total estimated costs of restoring estuarine functions and adult and juvenile salmonid access to the mouth of Sequelitchew Creek are unknown, but are likely to be in the tens of millions of dollars.

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#### *Required Permits*

Restoring the mouth of Sequelitchew Creek will require a wide variety of permits, including NEPA, SEPA, Shoreline, sensitive areas, HPA, and 404/401 permits under the Clean Water Act, among others. Given the human history of the area, there is significant risk of disturbing both historical and archaeological resources, as well as the potential risk of exposing chemically affected soils and sediments. All necessary local, state, and federal permits will be obtained.

---

#### *Expected Outcomes*

Restoring the mouth of Sequelitchew Creek would ensure that winter chum and coho have full unimpeded access to the rearing and spawning habitat in the watershed. It also would restore estuarine habitats, which are limited in Puget Sound. This location would have particular benefit to juvenile Chinook salmon migrating from the Nisqually River.

---

#### *Recommendation*

The Core Group supports restoration of estuarine functions and adult and juvenile salmonid access to the mouth of Sequelitchew Creek, and recommends supporting the efforts of others to fund this restoration work.

### ***Phase 2.6 Capture Additional Water in Hamer Marsh***

Enhance the groundwater connection between Hamer and Edmond Marsh by constructing a weir on the primary outlet from Hamer Marsh to the Diversion Canal. This weir will impound additional water in Hamer Marsh which should enhance the groundwater connection to Edmond Marsh and incrementally improve water quality by increasing infiltration rates. This weir installation will improve wetland conditions in Hamer Marsh.

An initial, short-term evaluation of water quality in Hamer Marsh did not rule out Hamer Marsh as a potential source of water for restoration of Sequelitchew Creek; however, the analysis did not include the summer period, when water temperatures are highest and dissolved oxygen is lowest. Further year round water quality monitoring of Hamer Marsh will clarify whether connecting Hamer and Edmond Marshes would affect water quality adversely. If monitoring demonstrates that water quality in Hamer Marsh is suitable for connection with Edmond Marsh, the small JBLM culvert that passes under the gravel road connecting the two marshes could be replaced in Phase 4 to strengthen the connection between Hamer and Edmond Marshes.

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#### *Estimated Costs*

Engineering and installing the weir in Hamer Marsh should cost approximately \$75,000.

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### *Required Permits*

Federal actions on federal property do not require state and local permits. However, actions not on federal property in a Category 1 wetland are subject to the City of DuPont's Critical Areas Ordinance (Chapter 25.105 DMC), Ecology's Water Pollution Control regulations (Chapter 90.48 RCW and 173-201A WAC), and the state's hydraulic code (HPA). It may also require a permit from the US Army Corps of Engineers under the Clean Water Act.

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### *Expected Outcomes*

Installing the weir in Hamer Marsh should increase the marsh's ability to impound water, thus enhancing groundwater flows from Hamer Marsh to East Edmond Marsh and incrementally improving water quality.

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### *Recommendation*

The Core Group recommends installing a weir in Hamer Marsh, continuing to monitor and evaluate water quality in Hamer Marsh, and constructing a better connection in Phase 4 if water quality is suitable for connection. The weir should be installed regardless of water quality in Hamer Marsh.

#### **Phase 2 Expected Outcomes:**

**Phase 2 should provide the ability for coho, winter chum, and possibly other salmonids to access habitat in Sequelitchew Creek from the estuary into West Edmond Marsh. It should also improve groundwater recharge from Hamer Marsh.**

## **PHASE 3: REHABILITATE FLOW AND FISH PASSAGE THROUGH THE DUPONT RAILROAD TRAIL**

Currently, the DuPont Railroad Trail bisects Edmond Marsh, creating East and West Edmond Marshes. A sewer line runs through the trail. This phase will restore flows through the trail, and allow fish passage up to Sequelitchew Lake.

### **3.1 Investigate sub-surface conditions**

Further study of conditions under the DuPont Railroad Trail is necessary to support the restoration design, to better understand the upwelling of groundwater in the vicinity, and investigate iron leaching. A geotechnical study would likely involve drilling at multiple locations along the trail to investigate the strength of subsurface soils and presence and quality of groundwater.

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### *Estimated Costs*

Geotechnical services will cost approximately \$20,000.

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### *Required Permits*

Although permits are not required, the implementation team should seek landowner permission.

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### *Expected Outcomes*

These studies will assist with engineering of the southern alignment and the pedestrian bridge described below. It also will inform the understanding of groundwater discharge in Edmond Marsh.

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### *Recommendation*

The Core Group recommends conducting these studies prior to construction activities.

## **3.2 Improve Flow Connectivity and Fish Passage through the DuPont Railroad Trail**

As noted earlier in Section 1.5, this action would replace part of the southern end of the DuPont Railroad trail with a pedestrian bridge(s). It also would suspend the existing sewer pipe from the bridge, within a steel pipe and protected by additional measures to be determined in the design phase. This action would reconnect the suspended pipe to the existing sewer line in the northern end of the trail.

The installation of a bridge would provide the most reliable connection between East and West Edmond Marshes. The broad opening would resist damming by beavers and facilitate unimpeded fish passage. By maintaining the sewer at its current elevation, only the section to be suspended below the bridge would need to be replaced with stronger pipe (e.g., ductile iron). The bridge structure would need to be designed to safely support the sewer pipe. Even with a stronger pipe and structural support, this option would still increase the risk of damage to the sewer relative to a below ground installation. However, there are many safety redundancies that can be incorporated into the proposed designs. This bridge will be installed at the lowest elevation in the marsh providing maximum freeboard above the proposed surface water levels.

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### *Estimated Costs*

Replacing the southern portion of the trail with a pedestrian bridge and suspending the sewer pipe from it would cost approximately \$750,000.

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### *Required Permits*

Actions in a Category 1 wetland are subject to the City of DuPont's Sensitive Area regulations (Chapter 25.105 DMC) and Ecology's Water Pollution Control regulations (Chapter 90.48 RCW and 173-201A WAC). These actions also would require permits under the HPA and federal Clean Water Act. All necessary local, state, and federal permits will be obtained.

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### *Expected Outcomes*

Replacing part of the trail with a bridge will reconnect flows between East and West Edmond Marshes while reducing the ability of beavers to dam the flows. It also will allow unobstructed fish passage through the marsh.

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### *Recommendation*

The Core Group recommends replacing the southern portion of the DuPont Railroad trail with a pedestrian bridge, suspending the sewer pipe from it, and reconnecting the pipe at the northern end.



### 3.3 Create Southern Flow Alignment

As noted earlier in Section 1.5, the planning for this restoration will begin in Phase 1. This restoration action would convert existing marsh vegetation and possibly remove a layer of accumulated fine sediment along a historic southern flow alignment in Edmond Marsh to utilize existing topography to improve water conveyance, fish passage, and groundwater connectivity in Edmonds Marsh. This action would abandon the “cookie cutter” channel and improve interception of groundwater along the toe of Bell Hill.

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#### *Estimated Costs*

This cost is difficult to determine without additional engineering information. A planning estimate is \$200,000.

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#### *Required Permits*

Actions in a Category 1 wetland are subject to the City of DuPont’s Critical Areas Ordinance (Chapter 25.105 DMC) and Ecology’s Water Pollution Control regulations (Chapter 90.48 RCW and 173-201A WAC). State and Federal permits including HPA and ACOE, and DOE.

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#### *Expected Outcomes*

Re-creating a more historical southern flow alignment would maximize topography, water conveyance, fish passage, and groundwater connectivity.

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#### *Recommendation*

The Core Group recommends restoring southern flow alignment through Edmond Marsh.

#### **Phase 3 Expected Outcomes:**

**Phase 3 should create the opportunity for fish passage all the way from the estuary to the easternmost end of East Edmond Marsh. Phase 3 also reduces the need to manage beaver activity through the DuPont Railroad Trail, and should improve water quality through abandonment of the old “cookie-cutter” channel and increased interception of groundwater along the toe of Bell Hill.**

### **PHASE 4: RESTORE FLOWS FROM AND FISH PASSAGE TO SEQUALITCHEW LAKE**

This phase includes actions that the Core Group believes are on a longer time-horizon than the other phases. These actions focus on working with JBLM to alter their infrastructure at the mouth of Sequelitchew Lake and at Sequelitchew Springs.

#### **4.1 Replace the Cross-Over Culverts**

This action involves work with JBLM to remove/redesign the cross-over culverts and associated fill near the mouth of Sequelitchew Lake to create a larger Sequelitchew Marsh. It would remove the existing diversion weir, and construct a new weir north of the existing weir with a prescribed elevation to avoid backwater effects to the lake and protect their water supply.

The “cross-over” culverts are located near the mouth of Sequelitchew Lake on JBLM (Figure 5). There are two sets of culverts in this structure, an upper set and a lower set. The upper set

### Figure 5: Option 1 for Replacing the Cross-Over Culverts



ANCHOR  
QEA

1. The entire area near the mouth of Sequalitchew Lake would become a larger marsh, creating new habitat and potentially serving as wetland mitigation for any changes in marsh area downstream.
2. Flows from Sequalitchew Lake would be much more likely to go into Sequalitchew Creek, rather than down the Diversion Canal.

3. If JBLM maintains its water supply at Sequalitchew springs, the lower set of culverts would be replaced with a stormwater pipe to below the diversion weir. If so, stormwater from Hamer Marsh would flow directly into the Diversion Canal, eliminating the possibility of it entering either the lake (and contaminating the JBLM water supply) or the creek.
4. Removing human-placed fill from the marsh area would make it much more difficult for beavers to impound water and removing culverts would improve fish passage to Sequalitchew Lake.

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#### *Estimated Costs*

The technical team estimates that eliminating the cross-over culverts would cost approximately \$675,000, pending federal approval.

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#### *Required Permits*

Removing the cross-over culverts would require federal approval at JBLM and Army Headquarters in Washington, DC.

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#### *Expected Outcomes*

This action would create a larger marsh area, increase the chances of flows moving down Sequalitchew Creek instead of down the Diversion Canal, and reduce the likelihood of beaver dams adversely affecting flows. It also would provide fish passage all the way to Sequalitchew Lake.

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#### *Recommendation*

The Core Group recommends continuing to work with JBLM to remove the cross-over culverts in the future.

### ***4.2 Replace the Culvert between Hamer and Edmond Marshes***

If water quality in Hamer Marsh is deemed suitable after the monitoring recommended in Phase 3.1, the small culvert currently connecting Hamer Marsh and Edmond Marshes should be replaced. The marshes are currently connected by a single 12-inch diameter culvert. This should be replaced with a concrete box culvert or pre cast bridge. Replacing this culvert would help to convey water under the JBLM access road from Hamer Marsh to East Edmond Marsh and build on marsh connectivity resulting from the construction of a weir in Phase 2.6.

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#### *Estimated Costs*

Enhancing the connection between Hamer and Edmond Marsh likely will cost about \$140,000.

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#### *Required Permits*

Federal actions on federal property do not require state and local permits. However, actions not on federal property in a Category 1 wetland are subject to the City of DuPont's Sensitive Area regulations (Chapter 25.105 DMC), Ecology's Water Pollution Control regulations (Chapter 90.48 RCW and 173-201A WAC), and the state's hydraulic code (HPA). It may also require a permit from the US Army Corps of Engineers under the Clean Water Act.

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#### *Expected Outcomes*

Replacing the small culvert will enhance the surface water connection between Hamer Marsh and East Edmond Marsh.

### **4.3 Change JBLM Water Supply to Deep Well System**

This action calls for working with JBLM on future infrastructure maintenance and improvement planning to change their water supply to a deep well system, and allowing the lake levels to fluctuate without human management. Constructing a new diversion weir north of the existing weir to pass flows from large storm events down the Diversion Canal will avoid significant flooding of existing downstream infrastructure.

Currently, JBLM draws its water supply from Sequalitchew Springs. One long-term option is to convert the JBLM water system to a set of wells that access the sea-level aquifer rather than Sequalitchew Springs. This option would return the surface water that JBLM currently uses as its water supply to the creek. Based on one year of consumption data presented in Briefing Memo #2, this change could increase flows by an additional 6 cfs in winter and up to 10cfs in summer.

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#### *Estimated Costs*

True costs are unknown, but are likely to be in excess of \$10M.

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#### *Required Permits*

Removing the existing surface water spring and installing deeper wells would require federal approval at JBLM and Army Headquarters in Washington, DC. The Washington State Department of Health also likely would need to provide a source approval.

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#### *Expected Outcomes*

This project would return nearly all historic flows, except peak storm flows, to Sequalitchew Creek.

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#### *Recommendation*

The Core Group recommends continuing to work with JBLM to investigate shifting its water supply to a deep well system and constructing a new diversion weir north of the existing weir.

#### **Phase 4 Expected Outcomes:**

**Phase 4 would further enhance flows between Hamer and Edmond Marshes, and would restore nearly all flows from Sequalitchew Lake and Sequalitchew Springs into Sequalitchew Creek. It also would provide fish passage to the lake.**

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- Western Engineers & Consultants, Inc., 1952. *Survey of Storm Drainage Requirements, Fort Lewis, Washington*. Seattle District, U.S. Army Corps of Engineers. January 15, 1952.



## Appendix A: Opportunities for Citizen Engagement

Citizen Volunteers will be engaged in the restoration and monitoring and adaptive management of Sequelitchew creek whenever possible. The following are a few parts of the plan identified as good opportunities for citizen volunteer engagement.

Phase	Opportunity
Phase 1.2 and 1.3	Installation and monitoring of staff gauges and assist with beaver management. Citizen monitoring of water quality in Edmond Marsh.
Phase 1.4	Clear out and monitor the Losing Reach.
Phase 2.1	Assist with plantings and other restoration work in the Losing Reach.
Phase 2.4	Monitor flows and habitat changes in the ravine.
Phase 2	Assist with the clearing and maintenance of culverts.
Phase 3.3	Assist with the removal of vegetation

## Appendix B: Public Comments on the Draft Plan with Staff Responses

Origin	Summary of Comment	Staff Response
<b><i>Adaptive Management</i></b>		
Chambers-Clover Creek Watershed Council	Phase 1.3 Monitor flows through Edmond Marsh and Adaptively Manage Flexible Levelers: We support adaptive management as a whole (boots on the ground so to speak) but would prefer initial beaver dam and beaver removal in lieu of the flexible levelers. Install levelers if beavers return.	This Phase has been updated. At least one key beaver dam (and family) is proposed to be removed near the cross-over culvert. The other key dams will be adaptively managed with escalating management techniques as needed.
Chambers-Clover Creek Watershed Council	Phase 2.4 Adaptively Manage Flows and Habitat Changes within the Ravine: We support these activities. We do encourage use of citizen volunteers for this and other work.	Good, since staff doesn't know how much water will flow here, it is difficult to know what will happen with any certainty. Citizens can monitor the canyon.
Citizen	There needs to be more language that provides flexibility for adaptation and learning from stage to stage. People need to have a clear expectation of how the information will be used between phases. For example: Stage 2 depends on how much the flow is changed in Stage 1.	Agreed. Staff supports a plan that recognizes the importance of adaptive management and a sequenced approach that successfully builds upon each Phase.
<b><i>Beaver Dams and Flexible Levelers</i></b>		
Chambers-Clover Creek Watershed Council	Phase 1.1 Install flexible levelers in key beaver dams: Would prefer initial removal of dams (and beavers if possible). This was done here in the past as well as elsewhere (Flett wetland example in Lakewood). Install levelers if they return.	Staff feels that beavers will likely rebuild dams if all of the dams are removed. The plan now recommends starting off with removing one key dam and beaver family and install a flexible leveler if they return. This plan is trying to be up-front using some flexible levelers and to co-exist with beavers if possible. The sequence can be changed or escalated over time as needed to provide additional flows.
Chambers-Clover Creek Watershed Council	Table 1 vs. 2: we support Table 2, the more aggressive restoration conditions to increase the gradient from the lake through the marsh thus restoring needed flows for improved	Table 2 might require additional beaver maintenance and adaptive management to ensure flows through the system. Staff

Origin	Summary of Comment	Staff Response
	salmon habitat.	supports Table 2.
Citizen	During the wet season beaver dams, starting with the western most beaver dam, should be removed by citizen volunteers in such a fashion as to control pond water release so as not to overwhelm the Sequelitchew Creek canyon reach's ability to safely pass the flows released. Once this beaver dam impounded pond is drained as a result of the dam's removal the next upstream beaver dam should be removed in the same controlled flow fashion. This dam removal process accompanied by removal of beaver debris in the culvert beneath the railroad berm trail should proceed in a timely one wet season fashion up to DuPont-Steilacoom Road.	The draft plan also proposes to work from downstream to upstream regarding the beaver dams/levelers/culverts. The plan recognizes the need for citizens to participate, but the citizen plan should be complimentary and not required.
Chambers-Clover Creek Watershed Council	Phase 3.2 Allow Beavers to Manage Surface Water Elevations in Bell Marsh: We support leaving the beaver dam in place as noted so groundwater contributions can increase.	Great.
Chambers-Clover Creek Watershed Council	Phase 3.3 Install a Beaver Exclusion Device in the Steilacoom – DuPont Road Culvert: We support this activity.	Great.
Citizen	<p><i>Pond levelers should not be implemented because there shouldn't be ponds.</i></p> <p>Pond levelers assume that ponds in this environmental setting are an appropriate restoration action. Currently beaver dam ponded areas in Edmond Marsh are <u>the problem</u> since they are stagnant bodies of high dry season temperatures and dry and wet season low dissolved oxygen concentration and pH and high iron concentration. <u>There should be no ponds</u>. There should be a low gradient free flowing, gravel bottom Sequelitchew Creek within the current Edmond Marsh complex that has a dry season groundwater discharge base flow and adjacent groundwater fed off channel marshes that provide suitable dry season salmon rearing habitat. It is this natural function condition that</p>	It is not a sustainable plan to remove all beaver dams consistently and in perpetuity (using citizens). Flexible pond levelers can be used to help augment flow through the system. Some derelict beaver dams can be removed and if needed a flexible pond leveler could be installed in these dams. Under existing conditions it is unlikely that a gravel bottomed stream is sustainable here. Also, there is considerable surface water flow entering the system via Seq Lake. There is currently too much water flowing down the diversion canal that should be flowing into the marshes. Not all water in system

Origin	Summary of Comment	Staff Response
	must be restored if the goal of the Core Group's Sequalitchew Creek watershed restoration plan is to be achieved.	is groundwater based.
<b>Center Drive Culvert</b>		
Chambers-Clover Creek Watershed Council	Phase 2.2 Evaluate and Possibly Modify the Center Drive Culvert: Definitely support but again during Phase 1 before creek flows are restored (remove the sidewalk to increase the creek channel width; route pedestrians up and over the culvert).	WDFW is not able to provide with any certainty if this culvert is a fish barrier through their Level B or hydraulic barrier criteria. If the sidewalk can be structurally removed and pedestrians moved to the above ground crosswalk that would preferred.  These Phases are recommendations and if an opportunity arises early on to replace a culvert(s) that is great. If not, it does seem to strengthen the plan to wait until water is flowing through the losing reach prior to any culvert construction.
Citizen	Phase 2.2. There's no need to remove the sidewalk under Center Drive. Instead, the fix should be a mini-weir with sheet piles that force creek bottom to be at sidewalk level. With the increased culvert width there is still plenty of height to pass peak flows. This would be cheaper.  Getting a hydraulic balance at all the restrictions is somewhat guess work but it need not be over conservative such as an 80 foot bridge when the Center Drive culvert is only about 30 feet. Ditto for the foot bridge.	Staff is not sure that the Core Group wanted to create a larger marsh system here. It seems the goal is to create moving water to improve water quality and ecological function. This is closer to historical conditions.
<b>Citizen Volunteer Involvement</b>		
Citizen	The City of DuPont and citizen volunteers should actively manage and maintain Edmond Marsh and all reaches of restored Sequalitchew Creek to assure that it continues, in perpetuity, to provide suitable habitat for native salmonid.	Staff totally agrees that citizens can and should be engaged to support any version of a restoration plan. However, citizens should not be the sole work force as that does not seem to be very sustainable either.

Origin	Summary of Comment	Staff Response
		The City will need to be an active participant.
Citizen	<p><i>The restoration plan doesn't identify the agencies responsible for implementing the plan</i></p> <p>Since funds are scarce there should be heavy reliance on volunteer citizen stream stewardship to accomplish much of the restoration mission. The restoration plan is silent on the use of this resource.</p>	Yes, citizens can help where appropriate. At a minimum JBLM, Pierce County, and City of DuPont will need to coordinate and participate in any actions.
<b>Losing Reach</b>		
Citizen	Before any Sequelitchew Creek flows are established in the "losing" reach the pedestrian side walk in the open box culvert beneath the Center Drive should be removed and all invasive vegetation and trash should be removed from the drainage ditch reach (a.k.a. "losing" reach) of the Creek. DuPont's existing City ordinances require maintenance of surface water drainage ditches (22.01.310) and allow the foregoing recommended actions under 25.105.050(1)(b) and (2)(a). Since all this restoration work will be done under dry conditions no HPA permit will be required.	<p>Any "construction" project here will still need all permits, including an HPA.</p> <p>The City of DuPont should review the existing codes to fully determine if it qualifies as a "surface water drainage ditch", or not.</p>
Citizen	Restoration of the losing reach is not necessary. Once a significant east to west flow through Edmond Marsh is established, fine grained bottom sediment material in areas East and West Edmond Marsh will be dislodged and carried downstream to creating a semi-permeable "seal" thus minimizing their infiltration losses to underlying unsaturated soil. No need for human intervention (i.e., "restoration"). Sediment transport and packing will provide the "seal" in "losing" reaches at no cost once the beaver dams are breached. Besides the water lost to infiltration in the "losing" reach of Sequelitchew Creek and the northwest lobe of West Edmond Marsh will reappear in the Creek as groundwater	<p>There is not enough evidence to confirm that future surface water flows will scour and move adequate fine sediments throughout the system and deposit them within the losing reach to seal the channel. There will be some on-site organics that will help contribute to the sealing process but maybe not enough to completely rely on. Plus there have been occasional winter surface water flows over the years that have not yet sealed this channel. These flows have disappeared mid-channel repeatedly.</p> <p>However, if costs are a limiting factor in the future, this project could be</p>



Origin	Summary of Comment	Staff Response
	discharge (base flow) down gradient of the “losing” Sequalitchew Creek infiltration site.	<p>phased and a “test and monitor” could be performed to ensure that surface water flows are sealing the channel. If the site seals up naturally, that would be great. Regardless, the channel will need to be cleaned out and planted with an appropriate riparian buffer and some habitat structures would need to be installed. If the site doesn’t seal naturally, it would need to be reconfigured in future phases.</p> <p>Surface water flow is critical for salmon passage into the marshes. If there is not a consistent flow, habitat connection to the upstream marshes is not possible.</p>
Chambers-Clover Creek Watershed Council	Phase 2.1 Replace the Losing Reach Culvert near City Hall: We support this work but suggest doing it during Phase 1 (before the creek flows are restored). Good project for grant funding based on fish blockage.	<p>The sequence of the culvert removals doesn’t really matter to the success of the plan other than it seems to make sense that water is flowing to them prior to replacing any culverts. Replacing them in the dry doesn’t necessarily make them easier, since there are proven water diversion techniques to dewater sites. There will likely be water in the excavation depths anyways. But if an opportunity arises sooner to replace culverts, that is okay.</p> <p>Grant funds for this watershed have been difficult to obtain in the past</p>
Chambers-Clover Creek Watershed Council	Phase 2.3 Rehabilitation of the “Losing” Reach: We do not support the full rehab work. Other local efforts to seal creek bottoms have had limited success. For the proposed cost of the work (high), we would suggest letting the creek sealing occur naturally. We do support removal of invasive vegetation and trash; and planting of native species.	<p>Again, this could be acceptable, as long as there is an adaptive management approach to enhance the channel somehow if it’s not sealed by natural sediment. Staff feels that some in-channel improvements are needed to repair the losing reach and to promote fish passage and usage.</p>
<b>Railroad Trail</b>		

Origin	Summary of Comment	Staff Response
Citizen	<p>Phase 2: Bridge plus 6 culverts is overkill with the weir concept. Don't need the bridge but probably do need the 6 culverts for \$420,000.</p> <p>\$300,000 for the Losing Reach is too much if Bennonite (Driller's Mud) panels plus "free" gravel is all that is needed.</p>	<p>The plan recommends adding at least one 80 foot bridge(s) with a suspended sewer pipe. The 6 culverts would only be proposed if the bridge could not be installed for any unknown reasons (as of today).</p> <p>The losing reach needs to flow consistently. Staff feels that additional habitat structures would also be helpful to promote fish usage here.</p>
Citizen	<p>The railroad berm trail should be removed and a pedestrian bridge with suspended sewer line constructed to allow Sequalitchew Creek within Edmond Marsh to relocate itself along the groundwater discharging toe of the southeast highlands. Citizen volunteers should remove any shrubs or vegetation that obstructs flow in this newly relocated open flow channel of Sequalitchew Creek within Edmond Marsh.</p>	<p>Agreed. This is one of the key parts of the plan, however, it is expensive. Staff feels it will be better supported if water conveyance can be achieved/proved elsewhere in the watershed first. Citizens can potentially help with removing vegetation along the lowest elevation flow routes, but it should not be relied on. The planning for this phase should begin early on.</p> <p>This is recommended in Phase 3 due to costs and timeline, but it can be implemented sooner if desired. It is a critical component for the success of the overall plan. The railroad prism is a significant flow conveyance and water quality factor. It should be corrected. The southern alignment is also an important factor to incorporate the lowest topography into the plan. The planning for these actions can begin early on.</p>
Chambers-Clover Creek Watershed Council	<p>Phase 4: Rehabilitate Flow and Fish Passage through the DuPont Railroad Trail: We support these activities but suggest they happen sooner rather than later (during an earlier phase) so flows can be reestablished along the southern edge of West Edmond Marsh; and improve connectivity to East Edmond Marsh and Sequalitchew Lake.</p>	<p>This is recommended in Phase 3 due to costs and timeline, but it can be implemented sooner if desired. It is a critical component for the success of the overall plan. The railroad prism is a significant flow conveyance and water quality factor. It should be corrected. The southern alignment is also an important factor to incorporate the lowest topography into the plan. The planning for these actions can begin early on.</p>

Origin	Summary of Comment	Staff Response
<b>Water Flow and Quality</b>		
Chambers-Clover Creek Watershed Council	Phase 3.1 Capture Additional Water in Hamer Marsh [by replacing the small culvert]: We do not support these actions. Currently normal summer flow is lower than the existing culvert and any water exchanged between the marshes is via groundwater. Seasonal high water flow (winter & spring months) is at least partially untreated stormwater runoff from JBLM that is currently bypassed to the diversion canal. Improving flow between the marshes with culvert and weir work will allow the untreated water to reach Edmond Marsh more readily. We prefer the existing groundwater exchange where water has a better chance of being filtered before reaching Edmond Marsh.	<p>This is fine, and this culvert isn't a key priority. It is only recommended because water resources are needed to flow through the system. By accepting water earlier, it would also avoid the tricky cross over culvert scenario. "Storm water" is treated by JBLM and it could still be conveyed through the crossover and diversion canal if it's not clean. Staff is okay with not connecting this culvert at this time since it could be added later if it's deemed necessary.</p> <p>The plan does support adding the weir on Hamer Marsh. This will incrementally improve WQ by storing water longer and increasing infiltration. It will also improve the overall Hamer Marsh quality.</p>
Citizen	Surface water flows from Sequalitchew Lake and Hamer Marsh are not possible/desirable sources of water flowing into Edmond Marsh during the dry season.	There is surface water flow coming from the Lake and flowing down the diversion canal. Staff acknowledges that sometimes it will be lower than the diversion weir in summer. But we can also raise lake elevations incrementally in the summer (during low flow periods). We also recognize that there is ground water throughout the entire system, and especially along the southern alignment.
Chambers-Clover Creek Watershed Council	Phase 1.1 Seasonally manage water levels in Sequalitchew Lake: We support this activity but suggest it happen during a later phase after some of the other work is completed.	Why not do this action early (during Phase 1)? This is a very simple and easy way to increase water surface elevation in the lake. JBLM is most likely on board, and it will provide additional head in a very flat system (albeit incrementally). It shouldn't hurt to do it concurrently with beaver management and it keeps JBLM active in the overall process
<b>Other</b>		

Origin	Summary of Comment	Staff Response
Citizen	Until everything gets a few years of testing the Diversion Canal can be used as a backup for limiting water depth in the marsh. Also, spawning time may need to be selected to assure there is enough flow but not too much.	Basically, under any circumstances the diversion canal will need to be open for emergency flood relief. Staff feels spawning time/flows is more important once we determine that spawning is occurring in the canyon. We don't think we will have too much water in the system. Peak flows will help create and maintain functional salmonid habitat.
Citizen	<p><i>Summary:</i></p> <p>Remove the City Hall culvert, remove the sidewalk beneath Center Drive, remove beaver dams, remove the south end of the railroad berm trail and viola salmonid habitat is restored in Edmond Marsh.</p>	<p>These suggestions seem consistent to what is proposed. But instead of starting off with removal of all beavers and beaver dams, the draft plan suggests removing one key dam/family and trying out flexible levelers and escalating to more aggressive options from there. It does not prohibit the use of trapping or killing beavers in the future. If the Core Group would like to remove more beaver dams upfront, that is certainly possible. Any beaver dam that is rebuilt would have a leveler installed.</p> <p>The City of DuPont has not yet determined if it is safe to remove the sidewalk. If the "losing reach" channel was reconfigured it would be great to tie the restoration into the sidewalk removal action.</p> <p>The southern section of the railroad berm is proposed to be removed in the plan regardless.</p>