MS 01

Mason Creek Habitat Enhancement – Conceptual Design

Reach: Mason Creek 1; EF Lewis 4C, EF Lewis 5A
River mile: 0 to 1
Reference page in main document: 71

Site Description

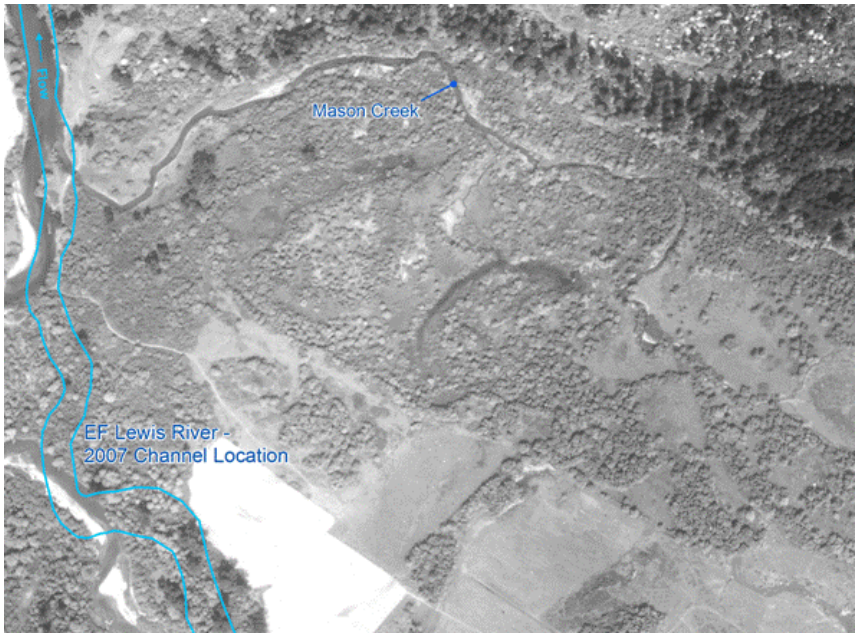
This site is associated with the lower mile of Mason Creek (see overview photo on page 5), aligned along the north (river right) margin of the East Fork floodplain located between EF Lewis river miles 5.5 and 7. The site is located on private property and is located just below a significant slope break that results as the tributary drainage emerges into the EF Lewis valley. The upper section of the reach is located on the tributary depositional fan. The channel occupied a range of positions in the upper section historically, with alignment shifts and avulsions occurring in response to deposition events associated with major floods. In this area, the historical photos also suggest losing channel conditions associated with the slope break and tributary fan setting. In contrast, the lower section of the reach appears to have been a gaining reach historically. The historic photos suggest water lost upstream by the EF Lewis was captured by this channel in the lower section along the valley wall as the valley constricts. Additionally, the lower section has historically also captured cool water originating from springs in the northwest wall of the EF Lewis valley.

Presently, Mason Creek is incised and degraded, resulting from response to prior incision and base level lowering in the main stem EF Lewis (due to dredging for navigation) and past channel and floodplain manipulation associated with adjacent land use. Mason Creek is characterized by a lack of instream habitat structure, lack of floodplain connectivity, excessive fine sediment, and degraded riparian corridor. Stream water temperature may also be a concern although more data is necessary. Several remnant oxbow wetlands were historically present adjacent to Mason Creek on the EF Lewis floodplain. These wetlands are in a degraded condition due to drainage by ditching and lowered groundwater table. Current average channel slope in this reach of Mason Creek is 0.2%.

This site offers a good opportunity to restore a low gradient tributary that will potentially provide suitable main- and side-channel habitat for a range of life history needs (spawning, rearing, high flow refugia) for coho, steelhead and chum (potential). An integrated restoration approach will provide water quality benefits by developing cold water refuge and addressing fine sediment limitations.

This project scored high in the project evaluation process due to its benefit to multiple species life-stages and due to its large size. Although the project is located in a Tier 2 reach, the project was ranked as a Tier 1 reach due to its potential to benefit fish originating in the mainstem East Fork Lewis (i.e. to serve as off-channel habitat for mainstem rearing fish).

General location of Mason Creek. View looking downstream towards East Fork Lewis River at approximately RM 0.3 on Mason Creek.



1939 aerial photo of project area showing 2007 channel alignment. Note evidence of gaining condition in lower reach.

Treatment Strategy and Alternatives

Recommended treatments:

- Select grading and channel realignment to create an incipient flood terrace and speed post-incision channel recovery.
- Excavate connected backwater channels to the north of the main channel to provide off-channel habitat and capture cool groundwater originating from the valley wall.
- Create pool-riffle sequences in main channel. Install habitat enhancement features including large woody debris.
- Use excavated material to fill ditches draining remnant oxbow wetlands.
- Control invasive species and restore native riparian habitat.

Alternatives:

- It would be possible to only treat a portion of the project reach (i.e. the upstream portion not affected by backwater conditions) or to phase treatments over time as available resources allow.
- An additional alternative involves further enhancing the remnant oxbow wetlands to receive and store wet season overbank flows (see aerial photo overlay on page 7). This project would enhance wetland values and endeavor to enhance local groundwater recharge and hyporheic flow to the mainstem EF Lewis, thereby providing additional cooling benefit. However, significant additional data collection and analyses would be required to confirm the viability of this alternative (see below).

Examples of typical restored channels

Expected Benefits – Limiting Factors Addressed

Physical habitat – 1) Enhanced quantity and quality of habitat features including pools and riffles, bank complexity and cover, and instream woody debris, 2) Enhanced availability of side-channel and off-channel habitat throughout the year, 3) Cold water refuge, 4) Enhanced stream shading.

Biological – 1) Enhanced winter high flow refuge for coho and steelhead, 2) Enhanced spawning for coho, with potential benefits to chum, winter steelhead, and Chinook spawning, 3) Enhanced quantity and quality of cool-water summer rearing for coho and steelhead, 4) Increased habitat complexity and cover for rearing fish that will provide diverse foraging opportunities and protection from predators.

Access and Landownership

The site is located on private land and crosses multiple parcels. Preliminary indications suggest that landowners may be amenable to a restoration project on their land. Access can be easily obtained at multiple locations along the project reach. Considerations must be given to the power transmission right of way that is located in the project area. Coordination with the utility will be necessary.

Data and Analysis Requirements

Mapping and select subsurface exploration is recommended to determine sources of groundwater input along the north valley wall and to locate backwater channels to collect cold groundwater. Detailed site survey, hydraulic analysis, flood inundation analysis, and a geomorphic assessment will be required to support final designs. In addition, the identified wetland and mainstem hyporheic exchange enhancement alternative would require a range of analyses to confirm viability, including evaluation of potential heating of ponded water in the wetland area, groundwater monitoring and modeling to assess subsurface flow conditions and anticipated degree of cooling, and evaluation of requirements related to fish exclusion and potential stranding. Habitat enhancements will be subject to significant potential impact from beavers; these impacts should be addressed as part of project design.

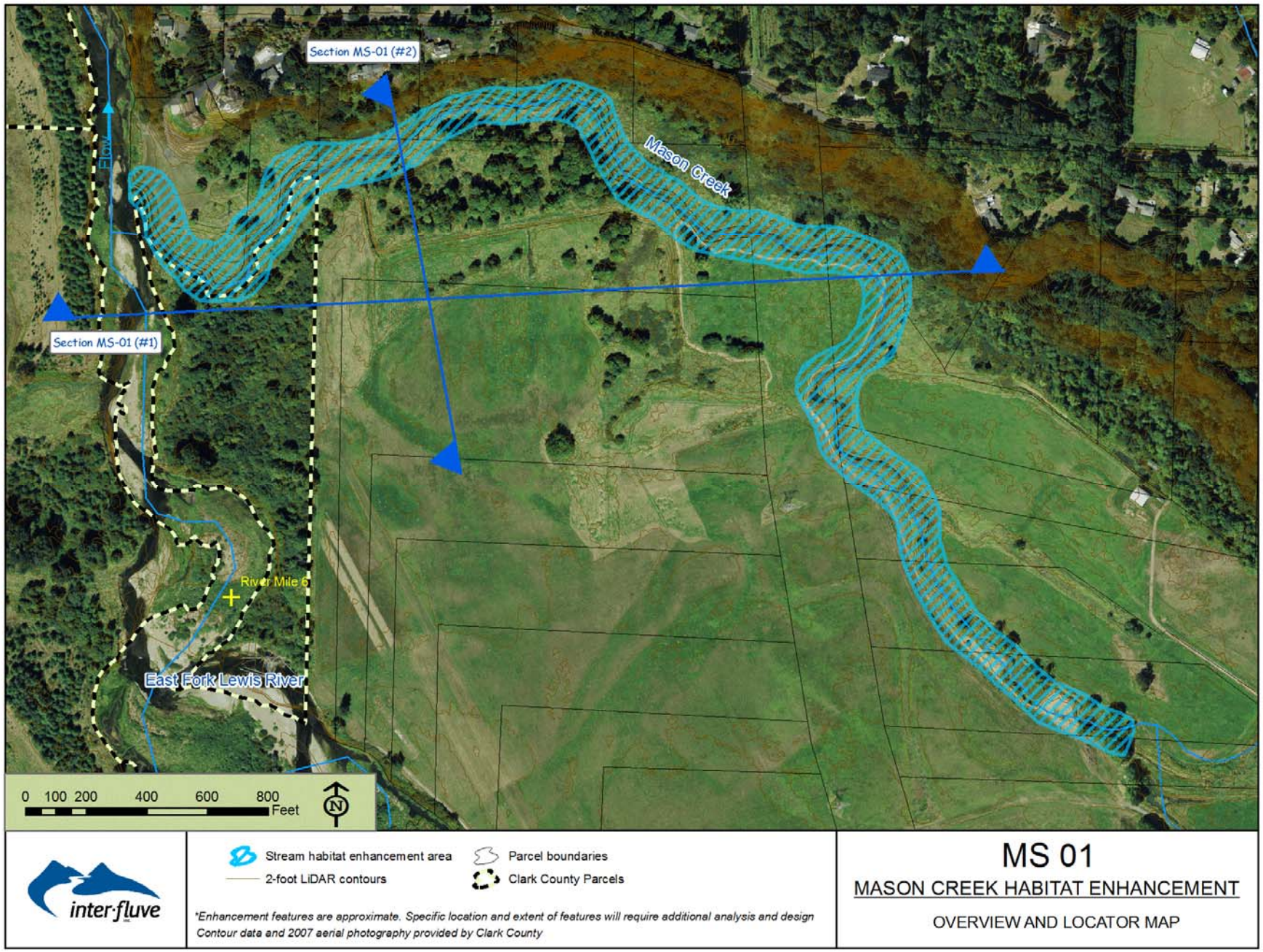
LCFRB Habitat Strategy Summary

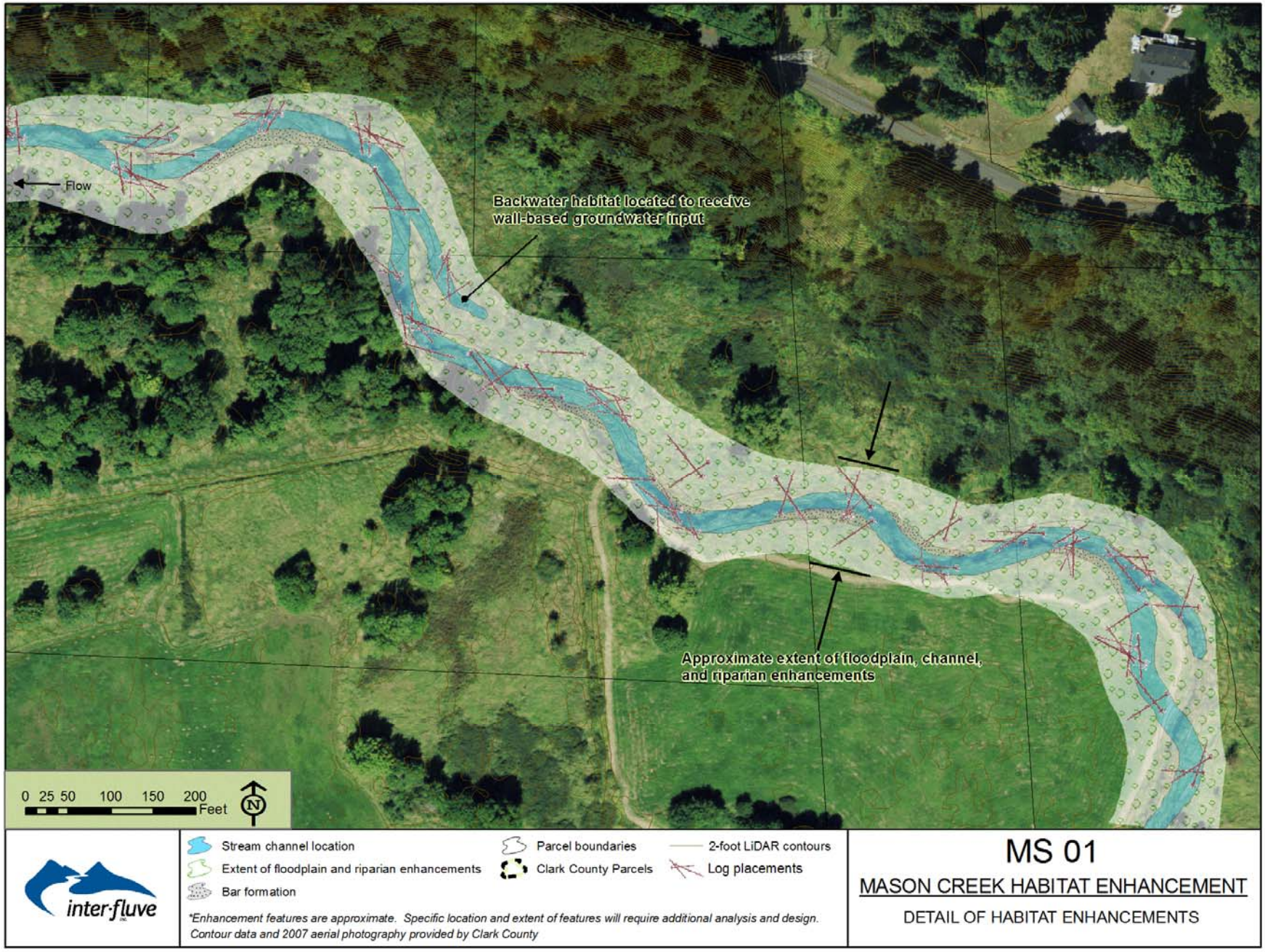
Mason Cr 1						
Tier	**2**					
Length (m)	**1,609**					
Population	**WSTH**	**SSTH**	**FCH**	**Coho**	**Chum**	**Multi Species**
Recovery Plan Priority	P			P	P	
Species Reach Potenial (H,M,L)	L			M	L	
Restoration Vaue	75%			87%	53%	72%
Preservation Value	25%			13%	47%	28%
Access to blocked habitats	-	-	-	-	-	L
Stream channel habitat structure & bank stability	H	-	-	H	M	H
Off channel & side channel habitat	H	-	-	H	M	H
Floodplain function and channel migration processes	H	-	-	H	M	H
Riparian conditions & functions	H	-	-	H	M	H
Water quality	M	-	-	H	L	H
Instream flows	M	-	-	H	L	H
Regulated stream management for habitat functions	-	-	-	-	-	L
Watershed conditions & hillslope processes	H	-	-	H	M	H

EF Lewis 4c						
Tier	**1**					
Length (m)	**563**					
Population	**WSTH**	**SSTH**	**FCH**	**Coho**	**Chum**	**Multi Species**
Recovery Plan Priority	P	P	p	P	P	
Species Reach Potenial (H,M,L)	L	L	L	L	H	
Restoration Vaue	62%	55%	25%	50%	69%	53%
Preservation Value	38%	45%	75%	50%	31%	47%
Access to blocked habitats	-	-	-	-	-	L
Stream channel habitat structure & bank stability	H	M	M	M	H	H
Off channel & side channel habitat	H	M	M	M	H	H
Floodplain function and channel migration processes	H	M	M	M	H	H
Riparian conditions & functions	H	M	L	L	H	H
Water quality	M	L	L	L	L	M
Instream flows	H	M	M	M	H	H
Regulated stream management for habitat functions	-	-	-	-	-	L
Watershed conditions & hillslope processes	H	M	L	L	H	H

EF Lewis 5A						
Tier	**1**					
Length (m)	**2,076**					
Population	**WSTH**	**SSTH**	**FCH**	**Coho**	**Chum**	**Multi Species**
Recovery Plan Priority	P	P	P	P	P	
Species Reach Potenial (H,M,L)	L	L	L	L	H	
Restoration Vaue	57%	27%	28%	50%	56%	44%
Preservation Value	43%	73%	72%	50%	44%	56%
Access to blocked habitats	-	-	-	-	-	L
Stream channel habitat structure & bank stability	H	L	M	M	H	H
Off channel & side channel habitat	H	L	M	M	H	H
Floodplain function and channel migration processes	H	L	M	M	H	H
Riparian conditions & functions	H	L	M	M	H	H
Water quality	H	L	L	L	L	H
Instream flows	H	L	M	M	H	H
Regulated stream management for habitat functions	-	-	-	-	-	L
Watershed conditions & hillslope processes	H	L	M	M	H	H

Note: EF Lewis 4C and 5A are included due to the benefit of this project for off-channel rearing for fish that originate in the mainstem. This project was ranked as a Tier 1 reach in order to reflect this benefit.


Section MS-01 (#2)
Section MS-01 (#1)
Mason Creek
Flow
River Mile 6
East Fork Lewis River
0 100 200 400 600 800
Feet
N
inter·fluve
Stream habitat enhancement area
2-foot LiDAR contours
Parcel boundaries
Clark County Parcels
*Enhancement features are approximate. Specific location and extent of features will require additional analysis and design
Contour data and 2007 aerial photography provided by Clark County
MS 01
MASON CREEK HABITAT ENHANCEMENT
OVERVIEW AND LOCATOR MAP


Flow
Backwater habitat located to receive wall-based groundwater input
Approximate extent of floodplain, channel, and riparian enhancements
0 25 50 100 150 200 Feet
N
inter·fluve
Stream channel location
Extent of floodplain and riparian enhancements
Bar formation
Parcel boundaries
Clark County Parcels
2-foot LiDAR contours
Log placements
*Enhancement features are approximate. Specific location and extent of features will require additional analysis and design.
Contour data and 2007 aerial photography provided by Clark County
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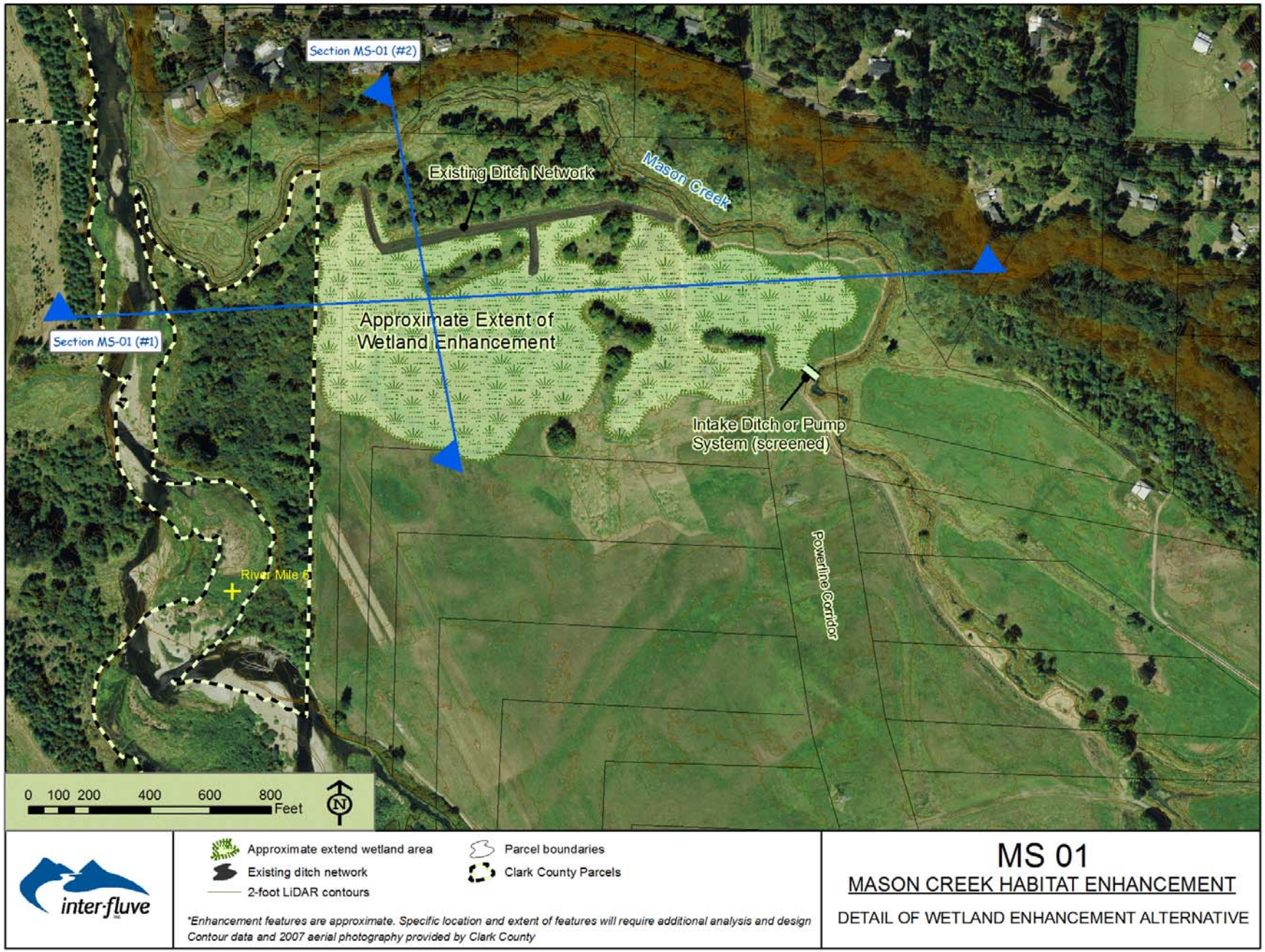
MASON CREEK HABITAT ENHANCEMENT
DETAIL OF HABITAT ENHANCEMENTS


Section MS-01 (#2)
Existing Ditch Network
Mason Creek
Approximate Extent of Wetland Enhancement
Section MS-01 (#1)
Intake Ditch or Pump System (screened)
River Mile 6
Powerline Corridor
0 100 200 400 600 800 Feet
N
inter·fluve
Approximate extend wetland area
Existing ditch network
2-foot LiDAR contours
Parcel boundaries
Clark County Parcels
*Enhancement features are approximate. Specific location and extent of features will require additional analysis and design
Contour data and 2007 aerial photography provided by Clark County
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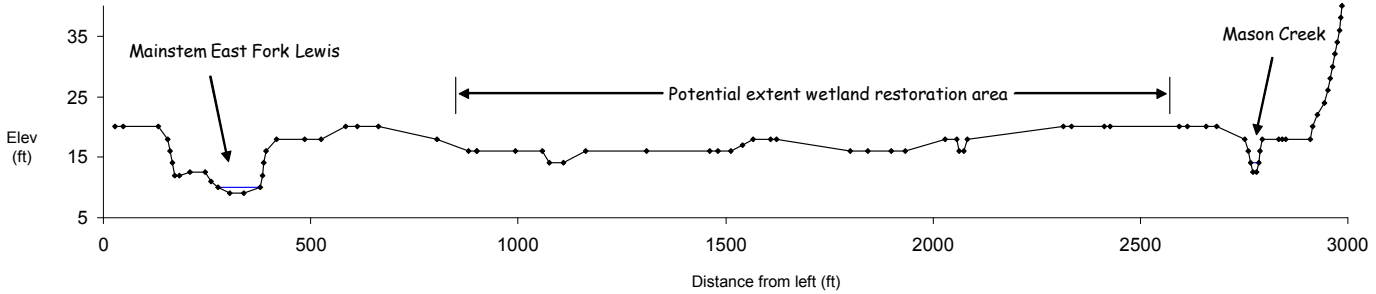
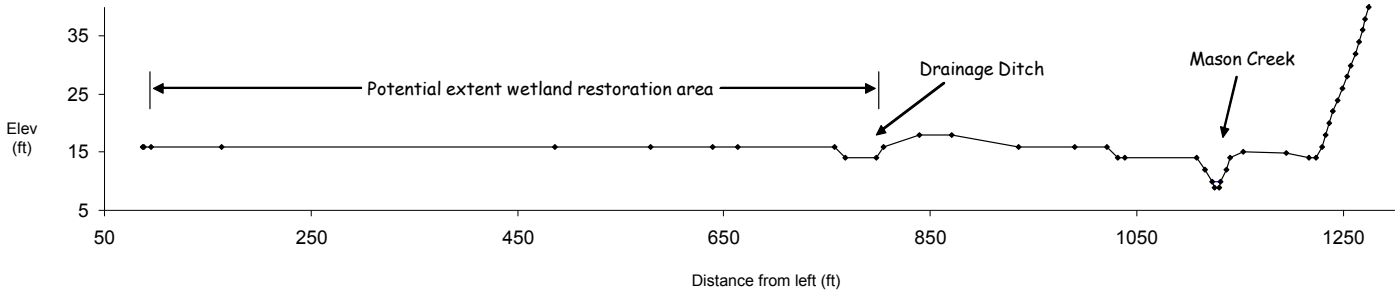
MASON CREEK HABITAT ENHANCEMENT
DETAIL OF WETLAND ENHANCEMENT ALTERNATIVE

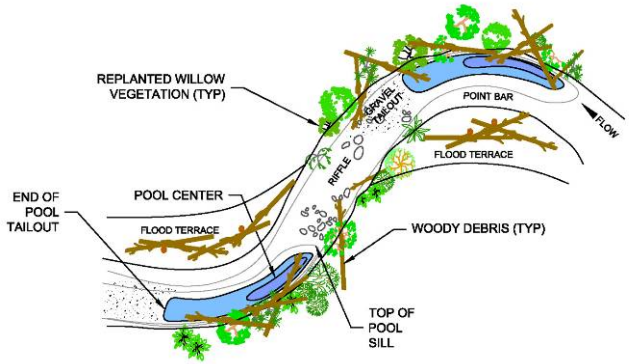
Cross-Section 1: MS-01



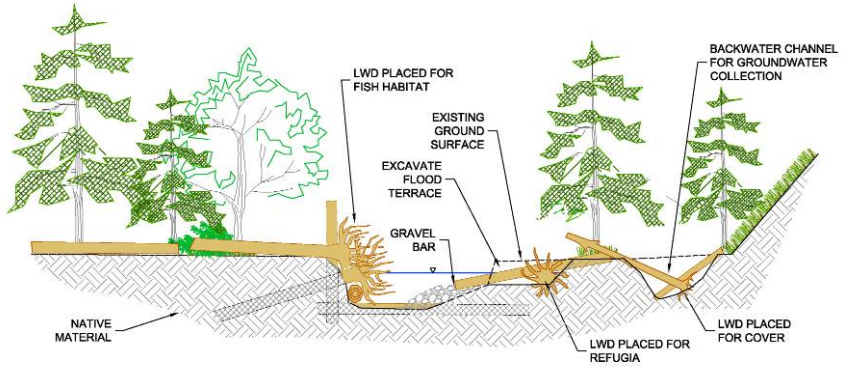
Cross-Section 2: MS-01



Typical Restored Channel – Plan View



Typical Restored Channel – Section View



CROSS-SECTIONS AND TYPICALS

Notes:

Cross-sections for MS-01 are derived from LiDAR contours. Bathymetry is estimated based on site and aerial photograph observations. In some cases, minor corrections are made to LiDAR data that is believed to be representative of vegetation and not the ground surface.

MS 01

INSTREAM HABITAT ENHANCEMENT

Planning-level cost estimate for MS 01

Note: This is a preliminary cost estimate for planning purposes. Actual costs for design and construction activities may vary substantially from these estimates. Assumptions for time requirements and material quantities have been made based on limited information that is available for the site. Additional information obtained during site investigations will be needed to determine actual quantities and costs. Estimates based on 2009 costs.

Description	Unit	Quantity	Unit Cost	Total Cost	Comment
Mobilization and demobilization	LS	1	$22,000	$22,000	Calculated at 5% of construction sub-total
Channel earthwork and reshaping	LF	1,300	$40	$52,000	Assumes one-third of the upstream portion of project area receives channel re-grading improvements
Large wood purchased and delivered to site	EA	325	$400	$130,000	Assumes 20% delivered with root wads attached. Frequency of LWD = ~20 pieces/100 meters.
Wood placement	EA	325	$300	$97,500	Wood placed in small jams and individual placements
Dewatering and sediment control	LS	1	$25,000	$25,000	Assumes water will be encountered throughout construction.
Streambank revegetation	SF	55,000	$0.75	$41,250	Assumes average of 5 feet on each bank for entire length. Economy of scale factored into unit cost.
Riparian revegetation (above bank)	AC	5	$10,000	$50,000	Assumes 20 feet revegetation on each side of channel. Includes follow-up maintenance. Economy of scale factored into unit cost.
Construction oversight	HR	360	$130	$46,800	Assumes 4 weeks of construction oversight, construction staking and associated coordination, 12 hour days, 1.5 staff.
Construction Sub-Total				**$464,550**	
Concept Level Construction Contingency (20%)				$92,910	
Construction Total				**$557,500**	
Project Delivery					Items below are calculated as a percent of the construction sub-total
Permitting (4%)				$18,582	
Detailed Engineering Design (15%)				$69,683	
Contract Administation (5%)				$23,228	
Project Delivery Sub-Total				**$111,500**	
TOTAL ESTIMATE				**$669,000**	rounded to nearest $1,000

General Notes:

Cost includes a 20% construction contingency
Costs assume all materials (wood) is purchased and hauled to the site from a nearby source.
Total length of treatment is over 1 mile long. Savings could be gained by reducing the total length of treatments.
Assumes wood ballast is provided through burial. Cost will increase if boulder ballast is required.
Costs do not include wetland inventory and impacts analysis
Costs do not include wetland restoration

Key

LS = Lump sum
CY = Cubic yard
LF = Lineal foot
SF = Square foot
AC = Acre
EA = Each
FF = Face foot (square foot of bank face)
HR = Hours