The Salmon Run:

A Restoration & Recreation Plan for the Valley Creek Watershed in Port Angeles WA

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LA 572 Design Thesis | Spring 2016

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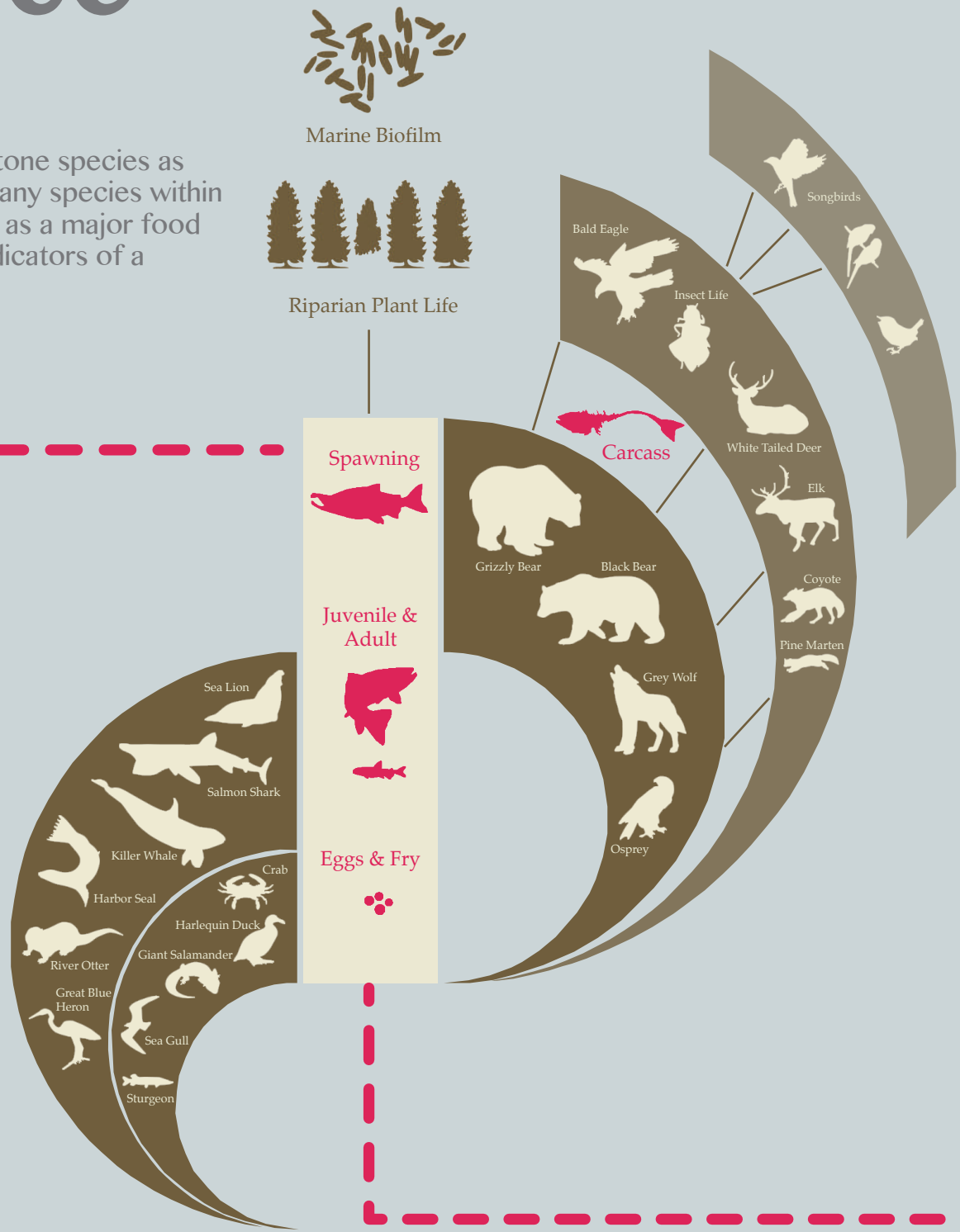
Pacific Salmon

Importance

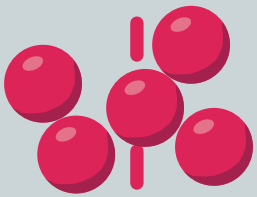
Ecological

Salmon are considered a keystone species as well as an indicator species. Many species within the ecosystem rely on salmon as a major food source. They also are great indicators of a healthy ecosystem.

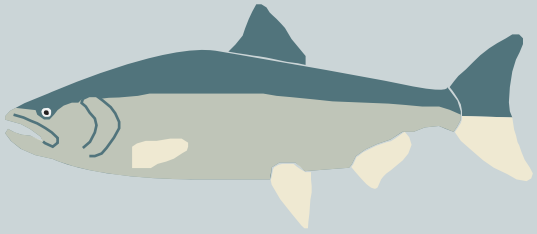


Alevin

Fry



Eggs

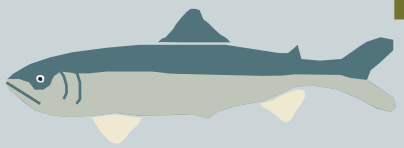


Smolt

Salmon rear (grow) within the stream system. Growing from fry to parr to smolt.

The major transition is size and changes to silver color while they migrate closer to salt water.

Bird species, fish, and other small animals are the primary predators at these stages of life.



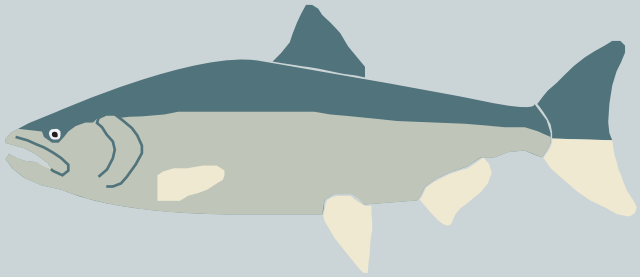
Parr

Ocean Migration

Chinook
Chum
Coho
Pink
Sockeye

Salmon spend most of their life within the ocean environment.

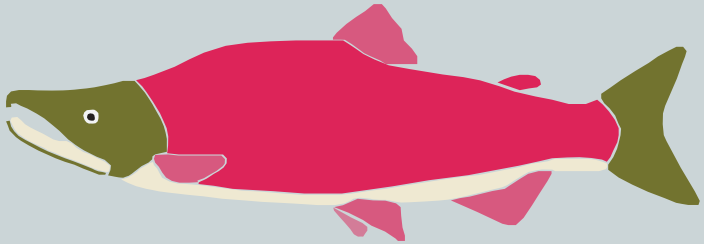
They can spend anywhere from 1 to 7 years in the ocean before returning to the river systems where they were born.



Adult

Species living in the ocean and coastal environments snack on adult salmon.

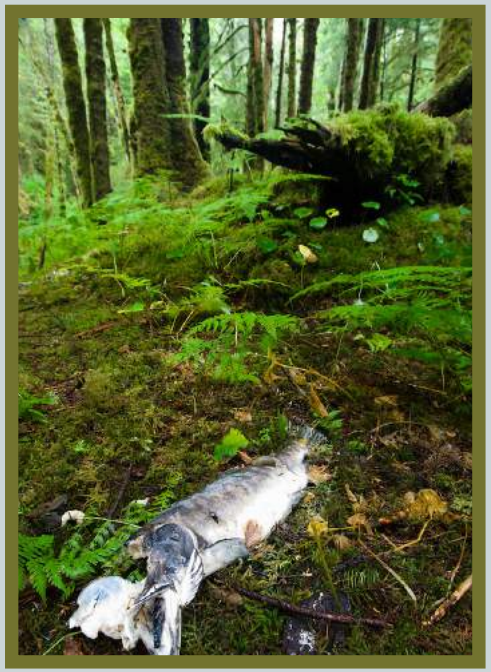
Spawning Adult



Salmon eventually migrate up stream back to where they hatched.

Salmon migrate in large numbers and the runs are feasting times for a lot of animal species

Dead Salmon



After salmon spawn and reproduce they die.

Even in death salmon supply nutrients to animals, plants, and the surrounding environment.

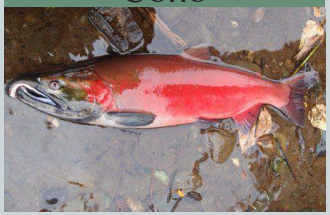
Species

Chinook

Spring

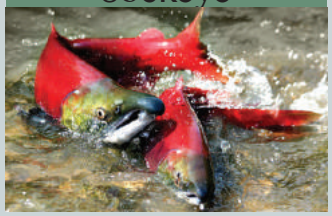
Fall

Coho



Chum

Sockeye



Pink

Stream location

Each species spawns and rears in different locations throughout the stream system

Estuary

*Lake

Downstream

Midstream

Tributaries

Upstream

This We Know:

We are the earth, through the plants and animals that nourish us.
We are the rains and the oceans that flow through our veins.
We are the breath of the forests of the land, and the plants of the sea.
We humans are but one of thirty million species weaving the thin layer of life enveloping the world.

Importance

Cultural

Salmon are very important to both the lifestyle and the spirituality of many Native American cultures, especially those of the Northwest Coast.

In artwork and literature, salmon are often used as a symbol of determination, renewal, and prosperity.

People today also enjoy fishing and eating salmon. Many of whom have grown respect for the animals.

Location

Ecological Regions within the Pacific Northwest

- A Georgie Basin
- B Coastal Rainforest
- C Northern Coastal
- D Klamath Mountains Province
- E Northern California
- F Southern California
- G California Central Valley
- H Willamette and Lower Columbia
- I Mid-Columbia River
- J Upper Columbia River
- K Lower Snake River
- L Upper Snake River
- M Columbia River Headwaters

Ecological regions within Washington State

Remaing Ecological regions

History

“In the Pacific Northwest, many runs are reduced to less than 10% of their historical numbers.”

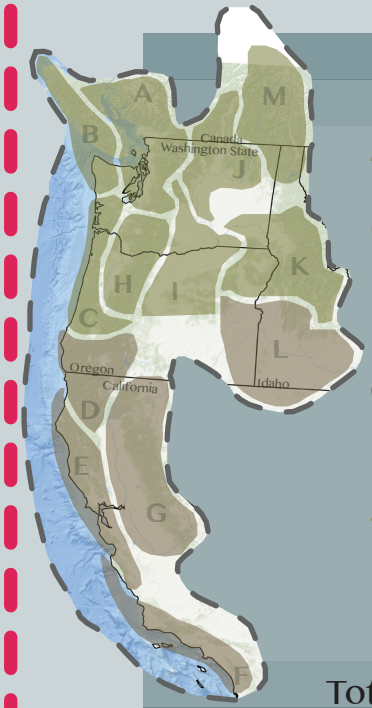
Our home, planet Earth, is finite, all life shares its resources and the energy from the sun, and therefore has limits to growth. For the first time, we have touched those limits.
When we compromise the air, the water, the soil and the variety of life, we steal from the endless future to serve the fleeting present.

This We Believe:

Humans have become so numerous and our tools so powerful that we have driven fellow creatures to extinction, dammed the great rivers, torn down ancient forests, poisoned the earth, rain and wind, and ripped holes in the sky.
Our science has brought pain as well as joy; our comfort is paid for by the suffering of millions.

Population Changes

(Extinct) vs. Extant Populations



	Chinook		Sockeye	Coho	Chum	Pink	Total Extinct (%)
	Stream-type	Ocean-type					
A	12(9)	28(6)	14(6)	50(0)	56(3)	36(6)	11
B	8(0)	24(2)	21(1)	23(0)	14(1)	6(0)	3
C	12(1)	25(5)	-	24(6)	15(7)	-	14
D	6(6)	16(0)	-	11(1)	1(1)	0(1)	16
E	0(6)	10(1)	-	15(4)	0(1)	0(1)	20
F	-	0(2)	-	0(3)	-	-	35
G	4(15)	15(17)	-	0(2)	0(1)	0(1)	7
H	8(9)	15(2)	-	12(7)	3(8)	-	35
I	11(9)	-	0(5)	0(10)	0(1)	-	52
J	10(15)	-	2(5)	0(10)	-	-	62
K	33(18)	-	1(6)	0(7)	-	-	36
L	0(25)	-	0(3)	-	-	-	100
M	0(11)	-	0(8)	-	-	-	100
Total	104(124)	133(35)	38(34)	135(50)	89(23)	42(9)	
Total Extinct (%)	54	21	47	27	21	18	
WA Region Total	94(72)	92(15)	38(31)	109(40)	88(20)	42(6)	
Total Extinct (%)	43	14	45	27	19	13	

Top 3 percentages

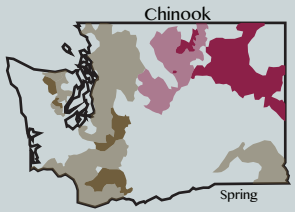
*Stream-type populations enter freshwater up to 9 months before spawning.
*Ocean-type populations spawn shortly after entering freshwater.

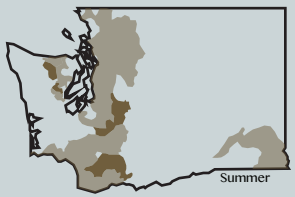
Extinct: no longer in existence

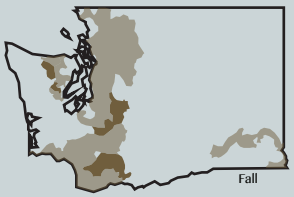
Extant: still in existence

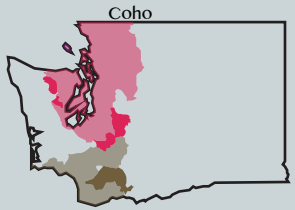
Critical Habitat

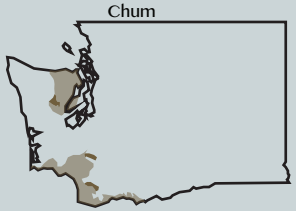
- Endangered, accessible
- Endangered, Historical watershed: man-made blockage
- Threatened, accessible
- Threatened, Historical watershed: man-made blockage
- Species of concern, accessible
- Species of concern, Historical watershed: man-made blockage











Causes of Decline

Natural

Top disturbances

1. Pollution
2. Predators
3. Climate change

4. Water temperature too high
5. Drought
6. Flooding

Lifecycle stage	Disturbance: water temperature (too high)	Pollution	Predators	Drought	Climate change	Flooding
Egg	◆	◆	◆	◆	◆	◆
Alevin	◆	◆	◆	◆	◆	◆
Fry	◆	◆	◆	◆	◆	◆
Smolt		◆	◆	◆	◆	◆
Adult	◆	◆	◆		◆	
Spawner	◆	◆	◆	◆	◆	◆
	5	6	6	5	6	5

Causes of Decline

Human-Induced

Top disturbances

1
- Vegetation clearing
- Channelization
- Overgrazing

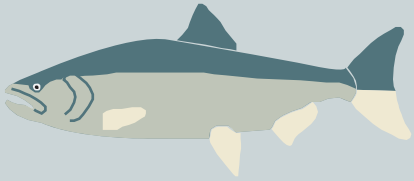
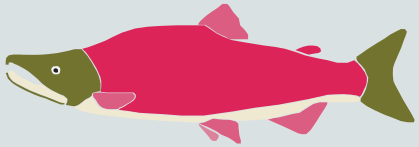
2
- Stream bed disturbances
- Levees
- Wood removal

3
- Dredging

4
- Dams
- Hard Surfacing
- Reduction of floodplain

Potential effects \ Disturbance	Vegetation clearing	Withdrawal of	Stream bed disturbances	Channelization	Dams	Levees	Hard surfacing	Overgrazing	Reduction of floodplain	Dredging	Wood removal
Pollution	◆		◆	◆	◆	◆	◆	◆		◆	◆
Increased surface runoff	◆						◆	◆			
Increased fine sediment	◆		◆	◆	◆	◆	◆	◆	◆	◆	◆
Increased flood elevation	◆			◆	◆	◆	◆	◆	◆		
Increased contaminants	◆		◆	◆			◆	◆		◆	◆
Decreased stream filtration			◆	◆		◆				◆	◆
Increased stream bank erosion	◆		◆	◆	◆	◆		◆		◆	◆
Loss of in stream organic matter	◆		◆	◆	◆	◆		◆	◆	◆	◆
Increased element exposure	◆		◆	◆		◆	◆	◆	◆	◆	◆
Increased water temperature	◆		◆	◆	◆	◆	◆	◆	◆	◆	◆
Reduce invertebrate population	◆		◆	◆	◆	◆	◆	◆	◆	◆	◆
Reduced in stream oxygen	◆		◆	◆	◆	◆	◆	◆	◆	◆	◆
Reduced gene pool of native species	◆		◆	◆		◆		◆	◆		◆
Loss of riparian vegetation	◆		◆	◆	◆	◆		◆	◆	◆	◆
Totals:	13		12	13	9	12	9	13	9	11	12

Vulnerability

Lifecycle stage	Vulnerability	Interaction
Eggs to Parr 	High	Passive
Smolt to Adult 	Low	Active
Spawning 	Medium	Passive

We are learning from our mistakes, we are mourning our vanished kin, and we now build a new politics of hope.
We respect and uphold the absolute need for clean air, water and soil.
We see that economic activities that benefit the few while shrinking the inheritance of many are wrong.
We are one brief generation in the long march of time; the future is not ours to erase.
So where knowledge is limited, we will remember all those who will walk after us, and err on the side of caution.

Research Question

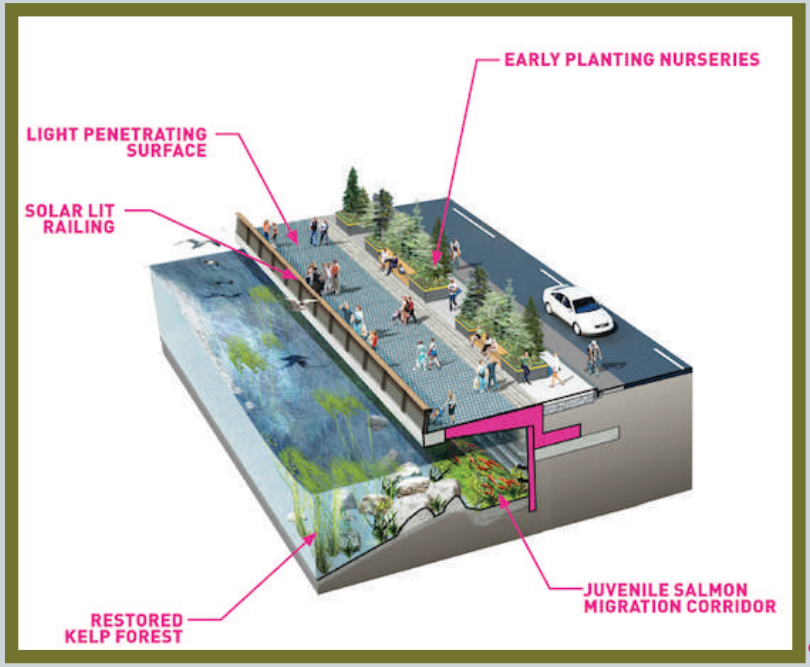
How can we restore a river so that it provides habitat resources and protection for salmon as well as promote safe human interaction and activity?

Case Studies

Seattle Central Waterfront

Primary Objectives

1. Waterfront destinations
2. Access and Mobility
3. Sustainability



Cache La Poudre River

Primary Objectives

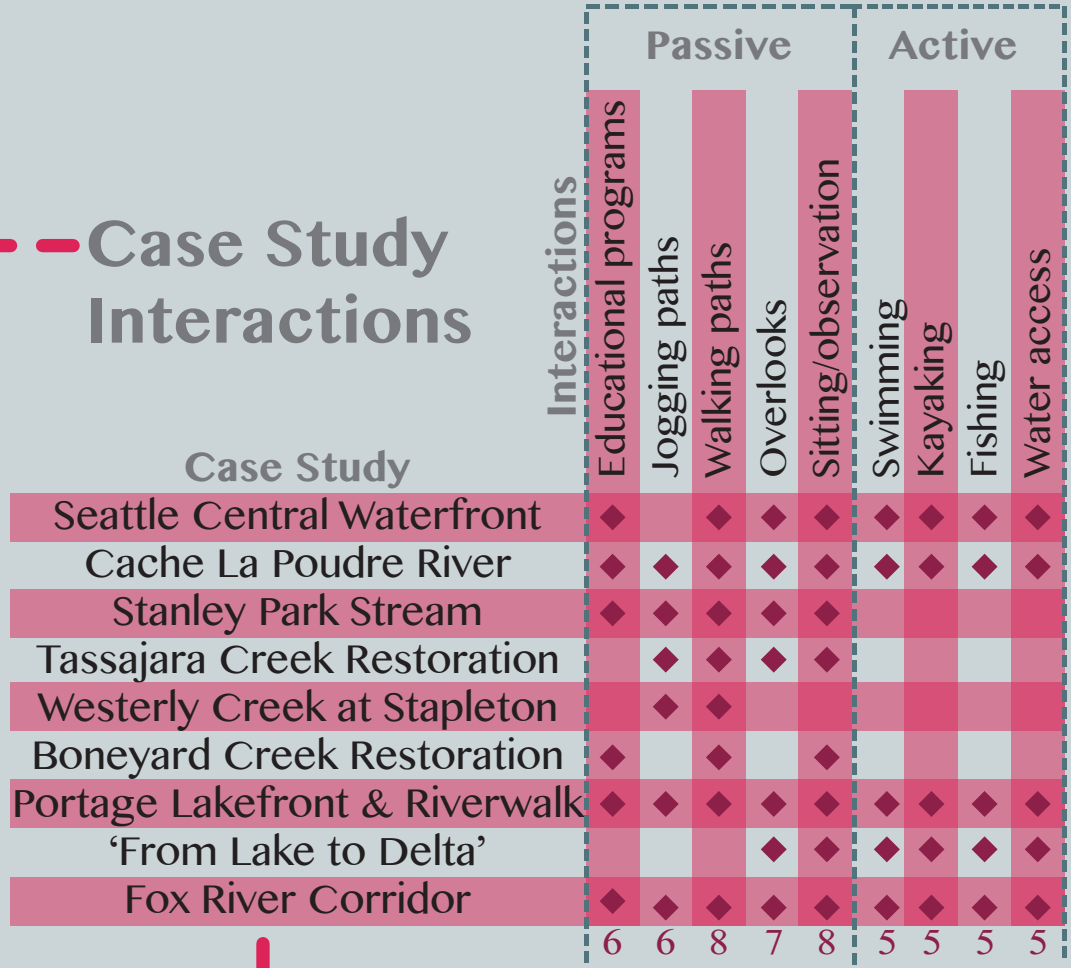
1. Habitat
2. Recreation
3. Flood Mitigation

Stanley Park Salmon Stream

Primary Objectives

1. Habitat
2. Education
3. Recycling

Case Study Interactions

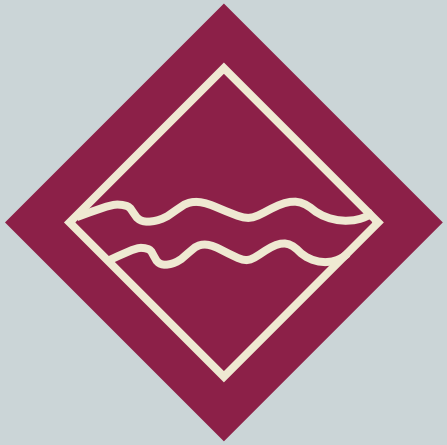


Passive Passive interactions are defined as interactions and activities that do not directly interact with the stream and water.

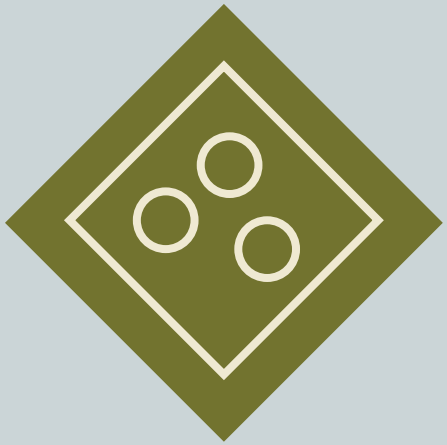
Active Active interactions are defined as interactions and activities that directly interact with the stream wand water

Design Goals

Implementation of habitat restoration practices to benefit salmon habitat.

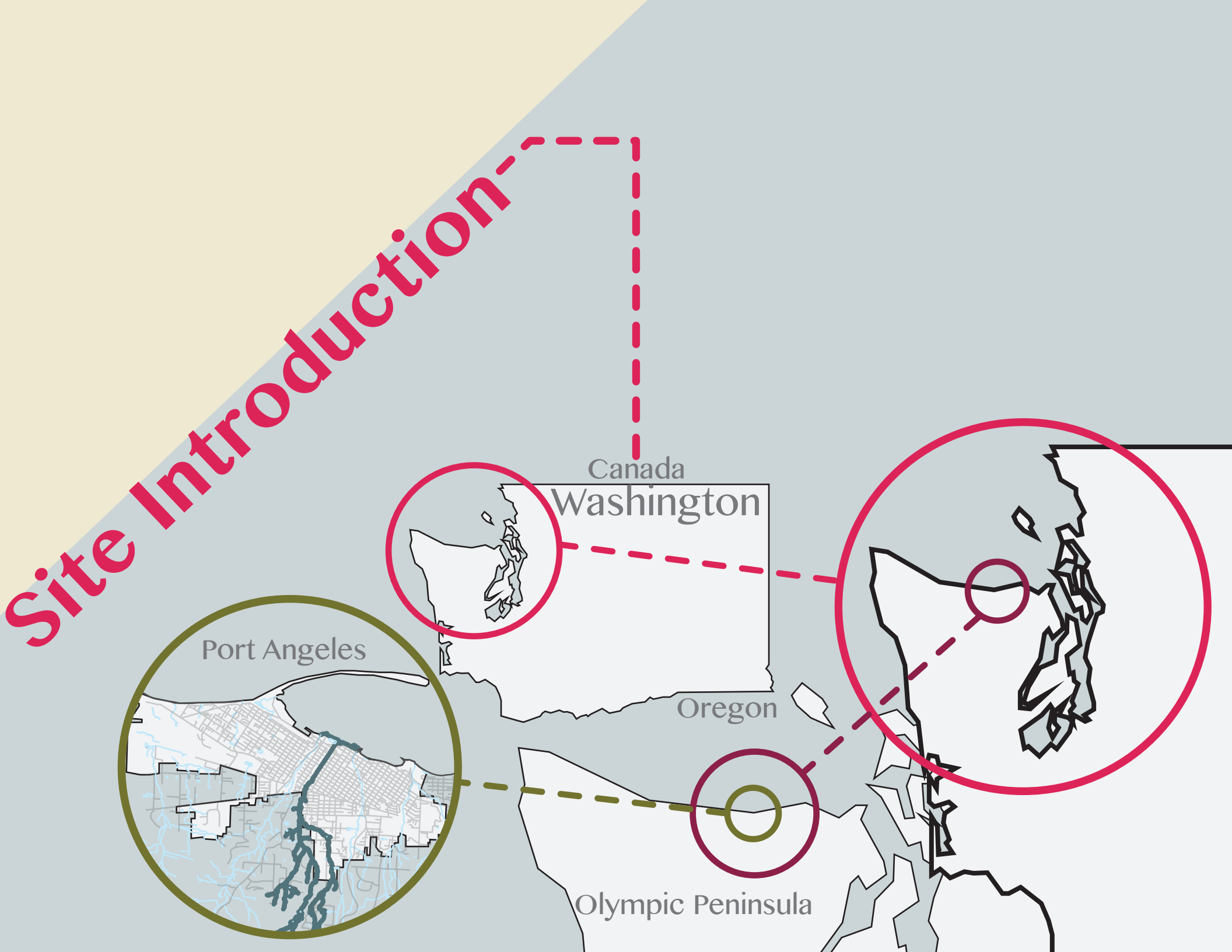


Create opportunity for people to interact with the water and the environment in passive and active ways.



Educate the public on ecological systems of salmon and the environment through safe interaction.

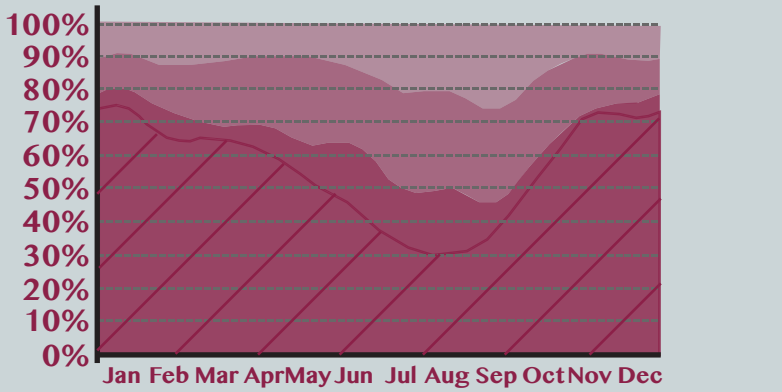
Site Introduction



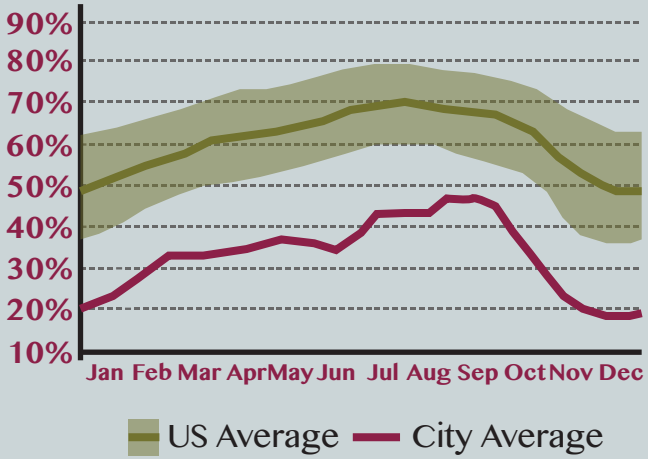
Inventory

Climate

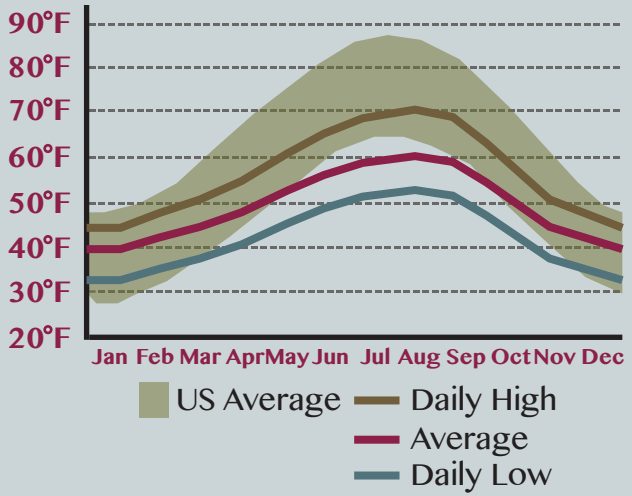
Cloudy Days



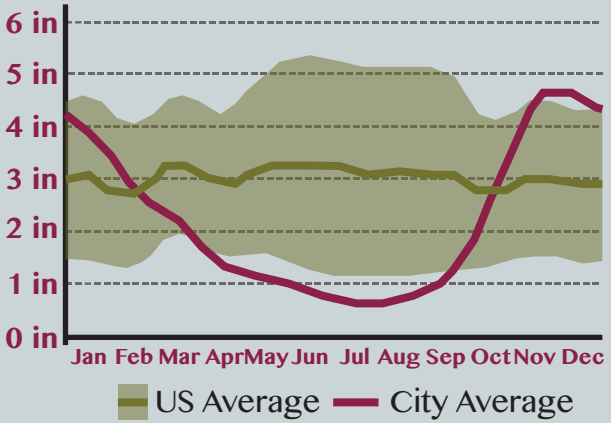
Sunshine



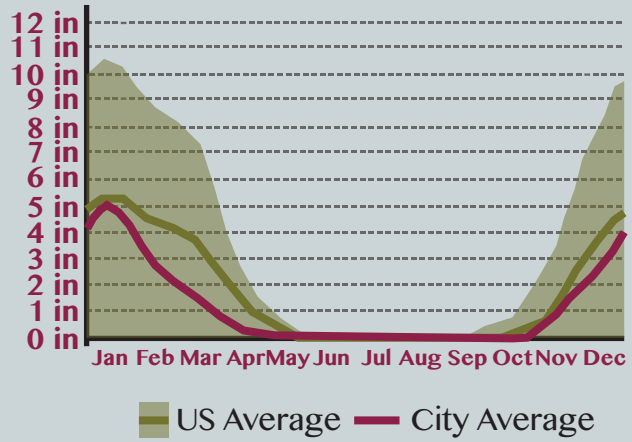
Average Temperature



Precipitation



Snowfall



Hydrology

Valley Creek Mainstream

Valley Creek Tributaries

Valley Creek Estuary & waterfront

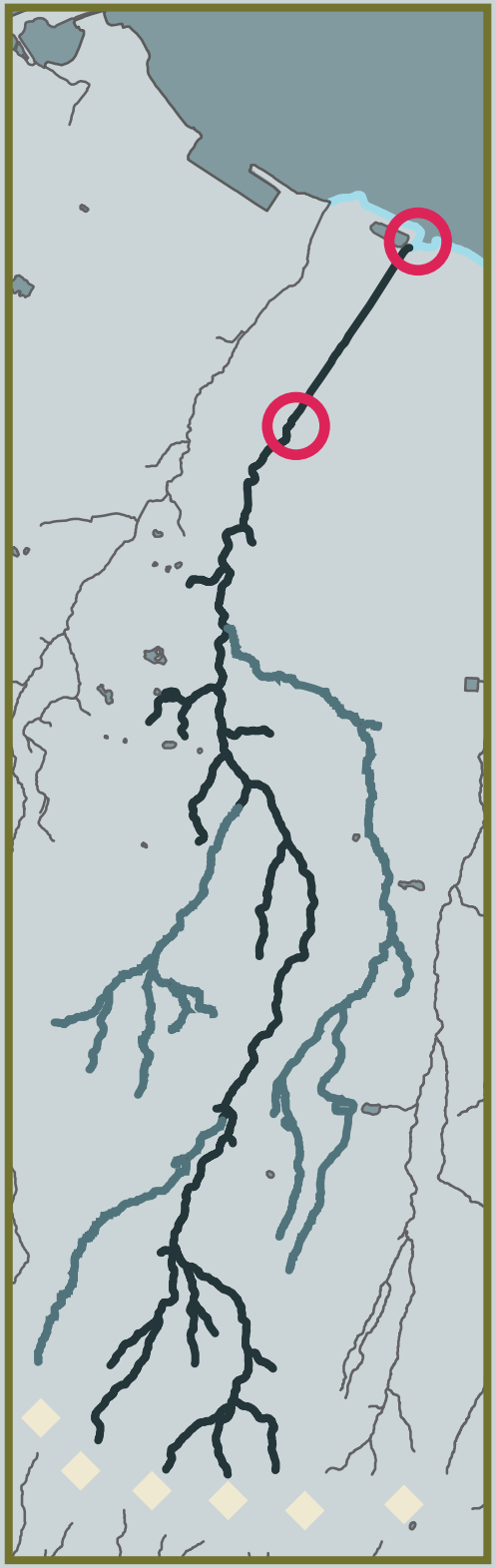
Secondary stream systems

Port Angeles Harbor (Leads to Straight of Juan de Fuca)

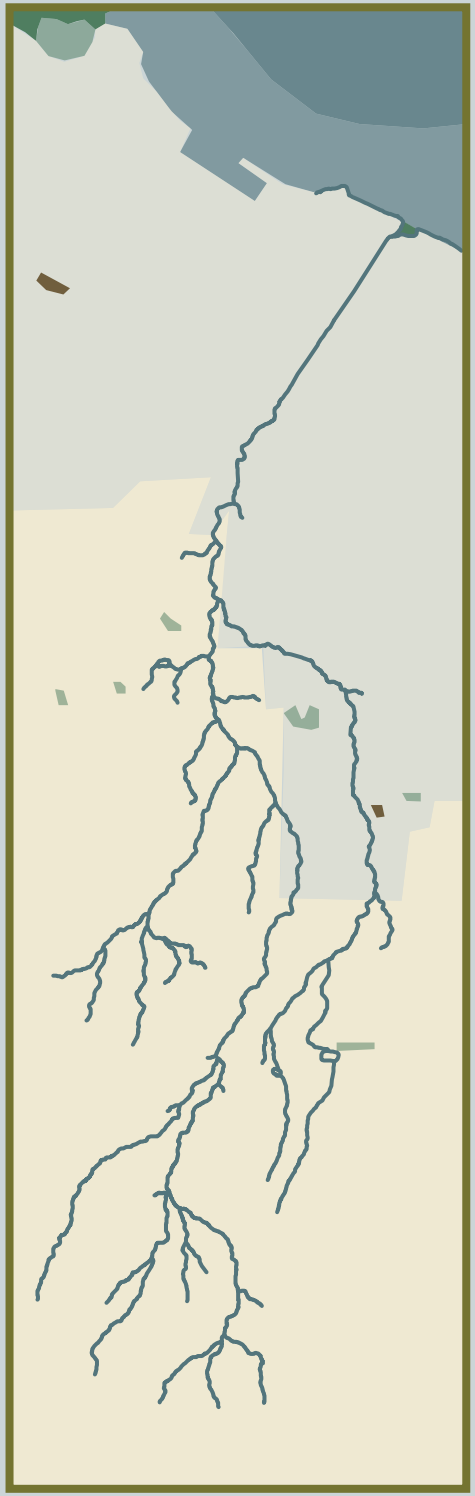
Inland water Bodies (Lakes and wetlands)

Valley Creek starts at the foothills of the Olympic Mountains

Fish passage obstruction
Culvert: 2000 ft
Channelization: 2000 ft



Current Wildlife Habitat Types



- Inland Marine Deeper Waters
- Marine Nearshore
- Urban & Mixed Environments
- Westside Lowlands Conifer-Hardwood Forest
- Herbaceous Wetlands
- Bays and Estuaries
- Westside Riparian-Wetlands
- Valley Creek (Site Location)

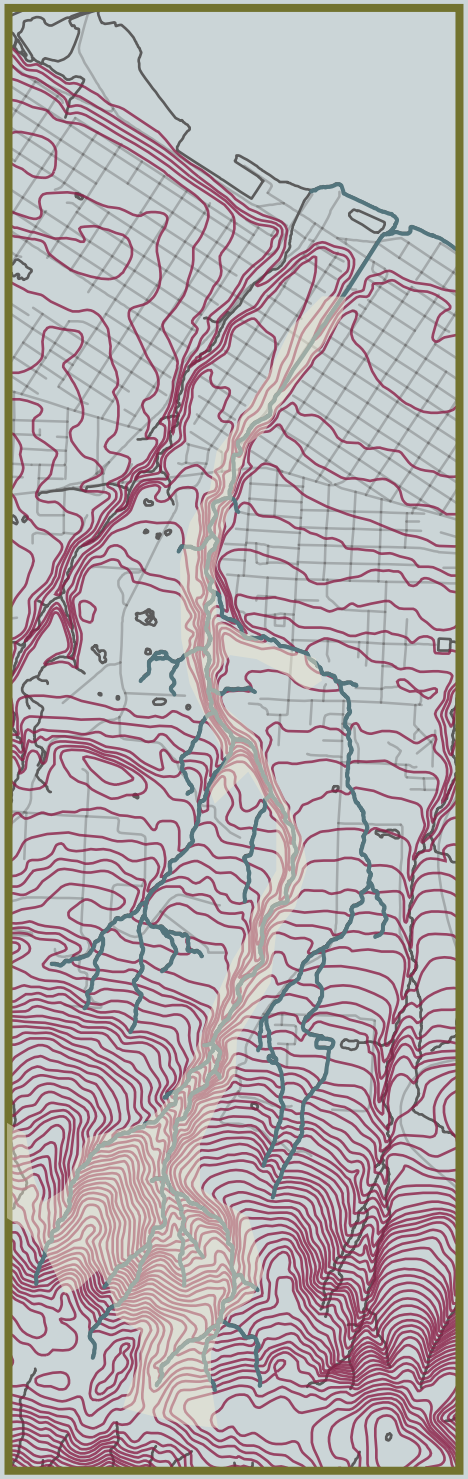
Conifer-Hardwood Forest Composition

Trees

Shrubs

Forbs

Topography



Valley Creek
(Site Location)

Roads

40 ft Contours

Slopes up to 70%

Historic Salmon Species

Stream Location for Rearing & Spawning

Coho

Chum

Upstream

Tributaries

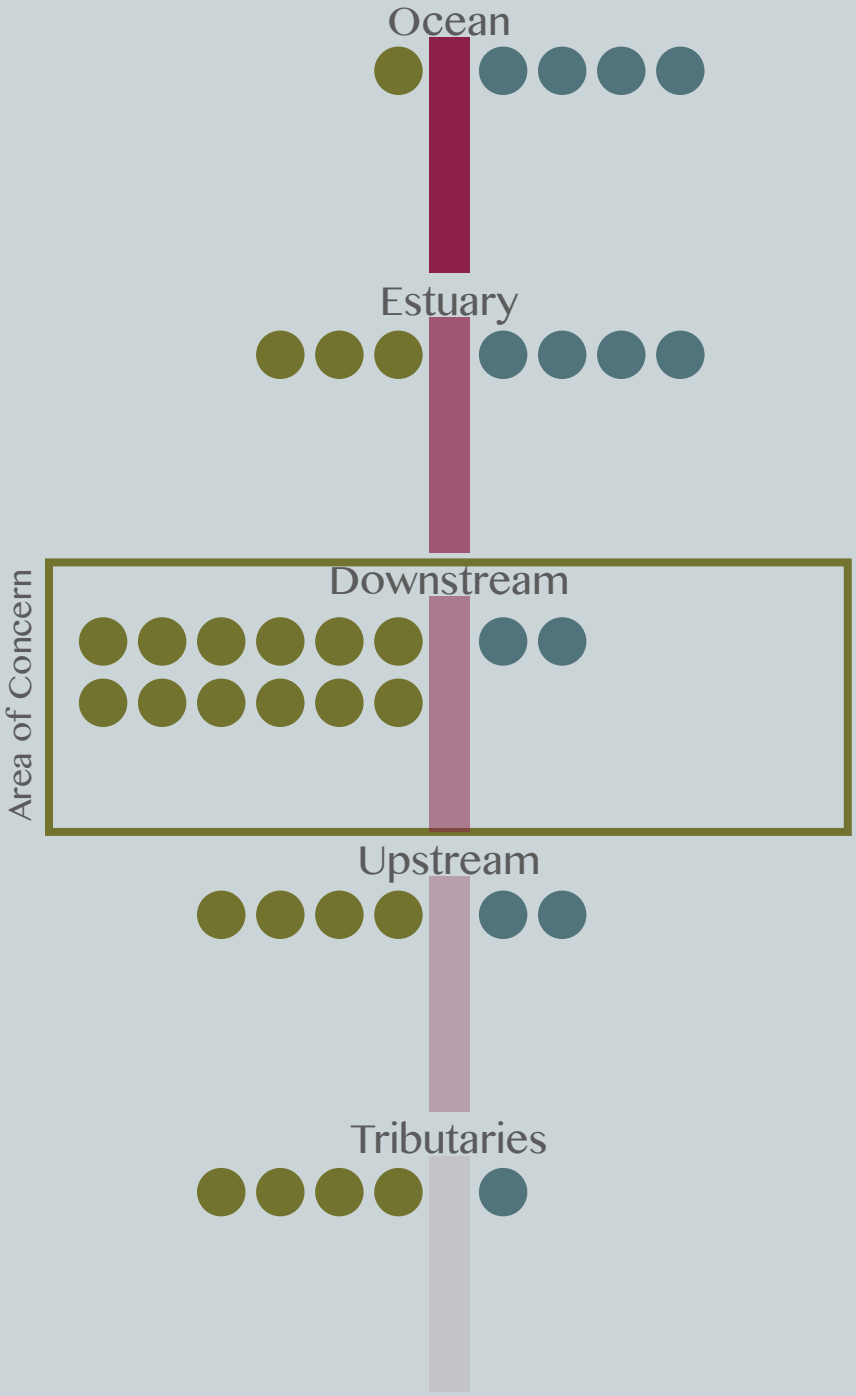
Midstream

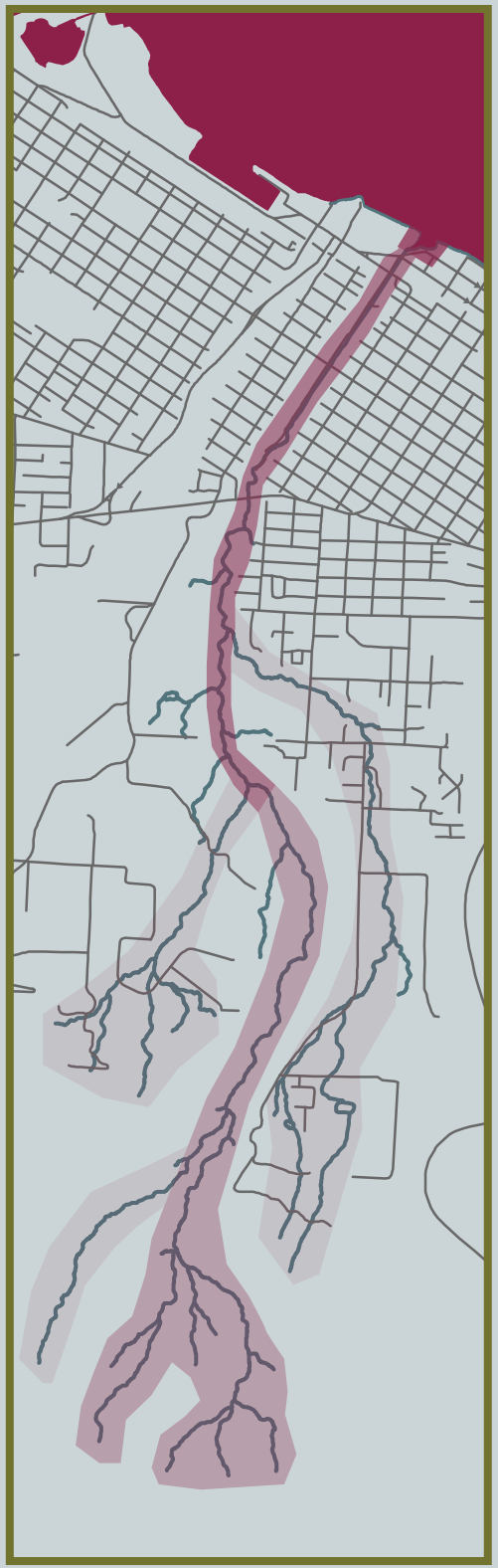
Downstream

Estuary

Analysis

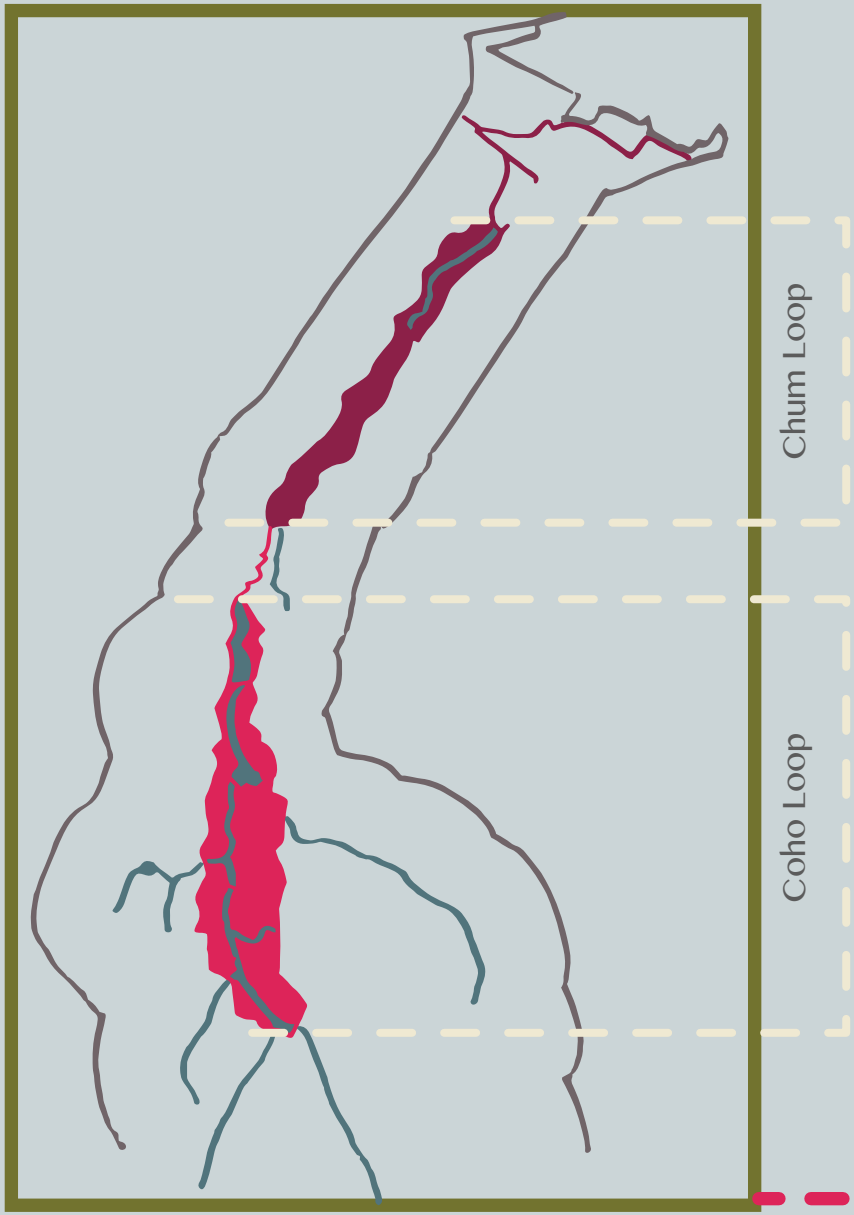
Ecological problems Human interaction





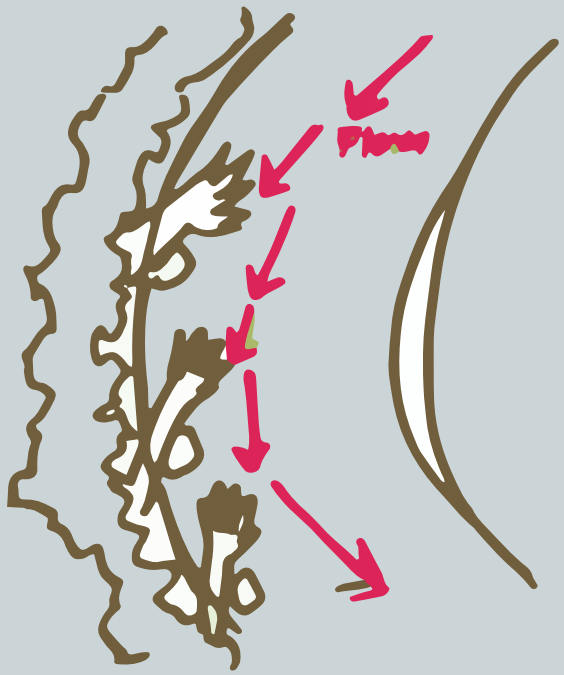
Design Development

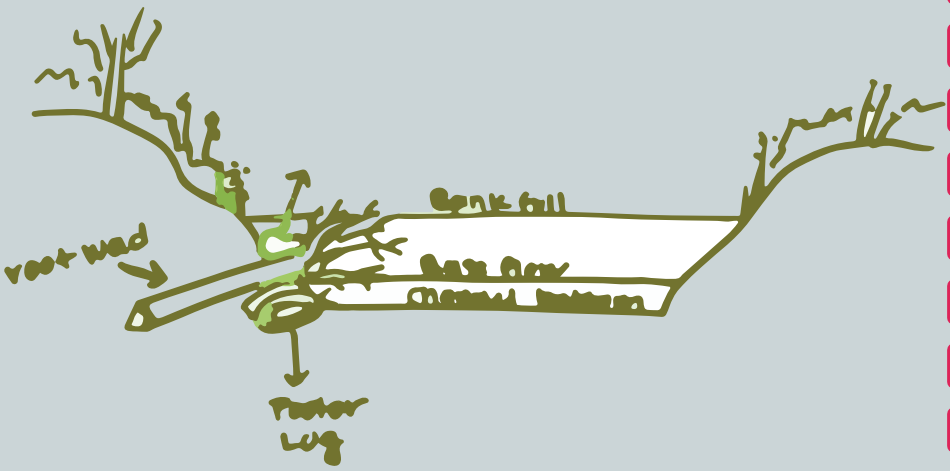
Trail System Creation



Ecological Improvement Options

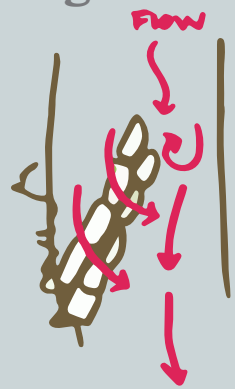
Root Wads

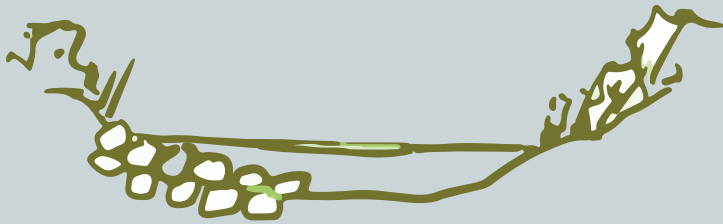




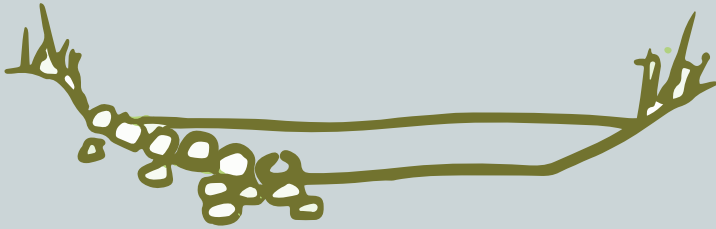
Rock Vanes

Single

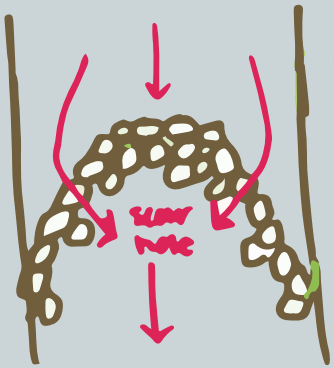


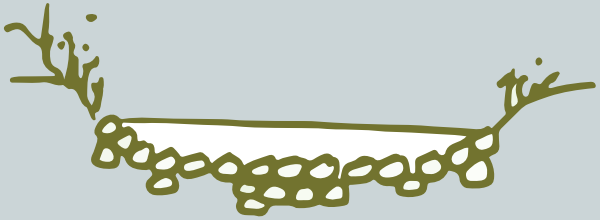


J-Hook



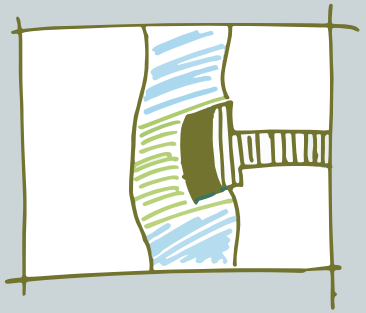
Cross

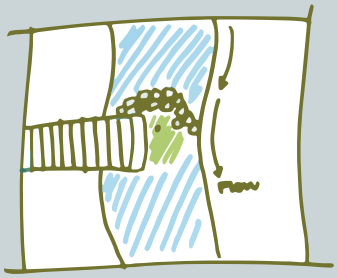


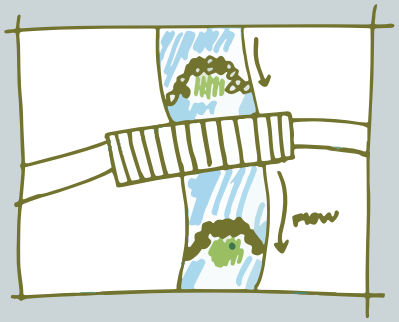


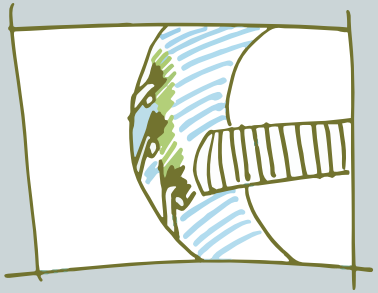
Interaction Exploration

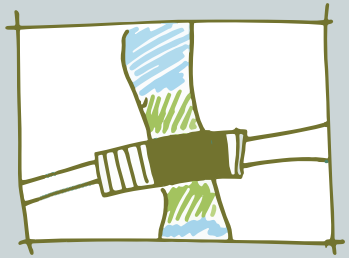
Passive Condition



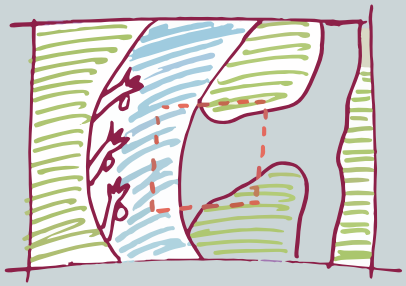


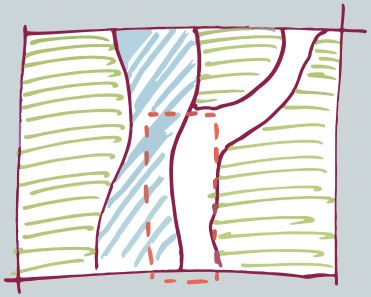






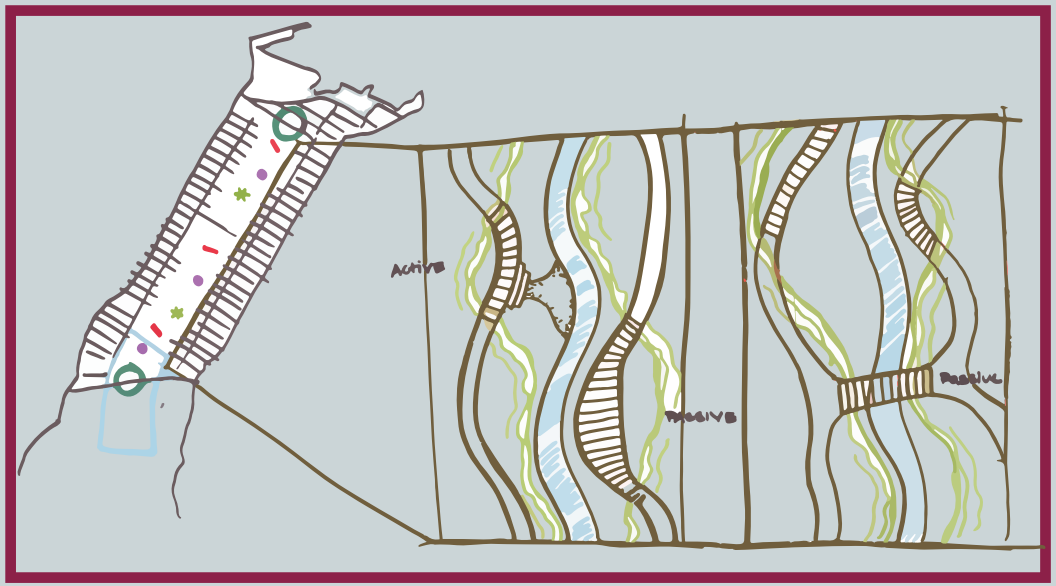
Active Conditions





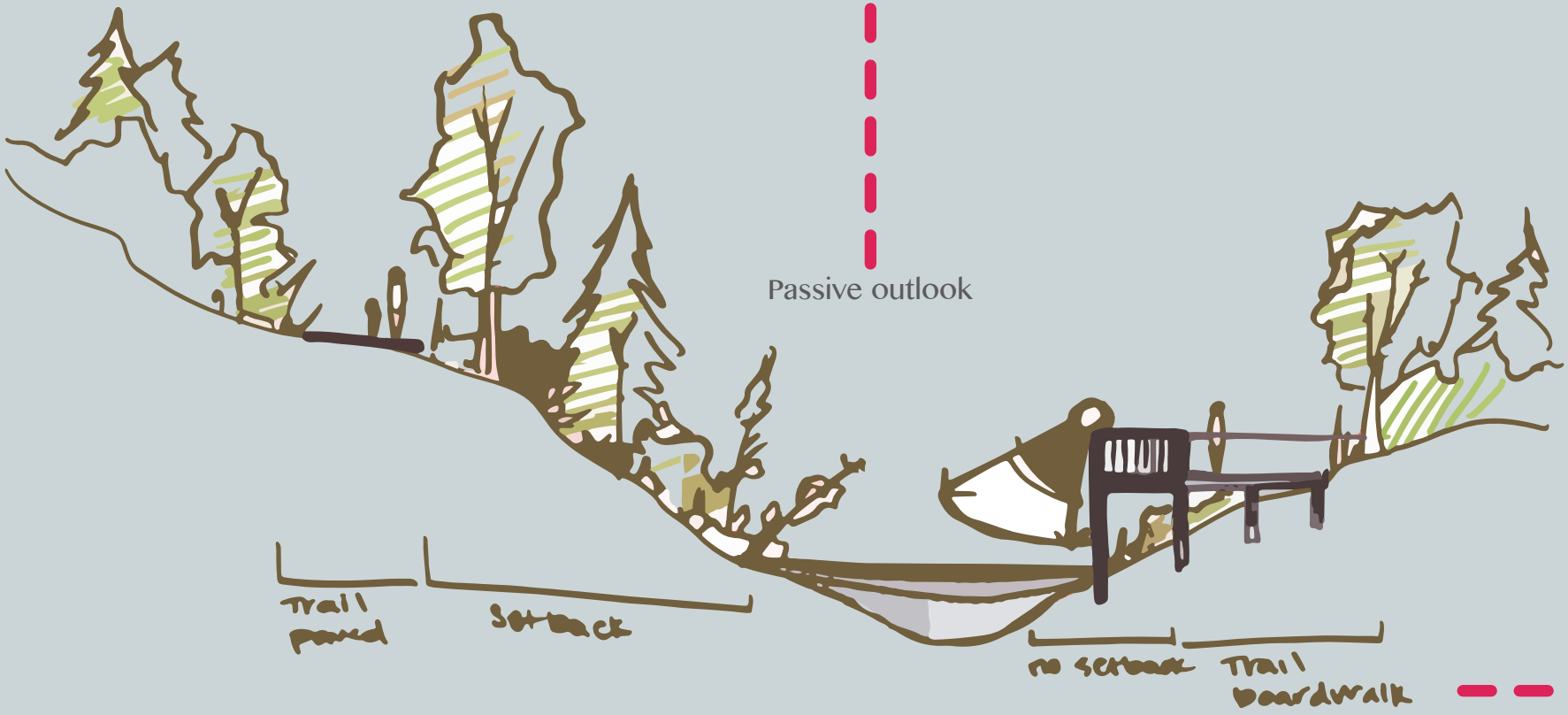
Active and Passive

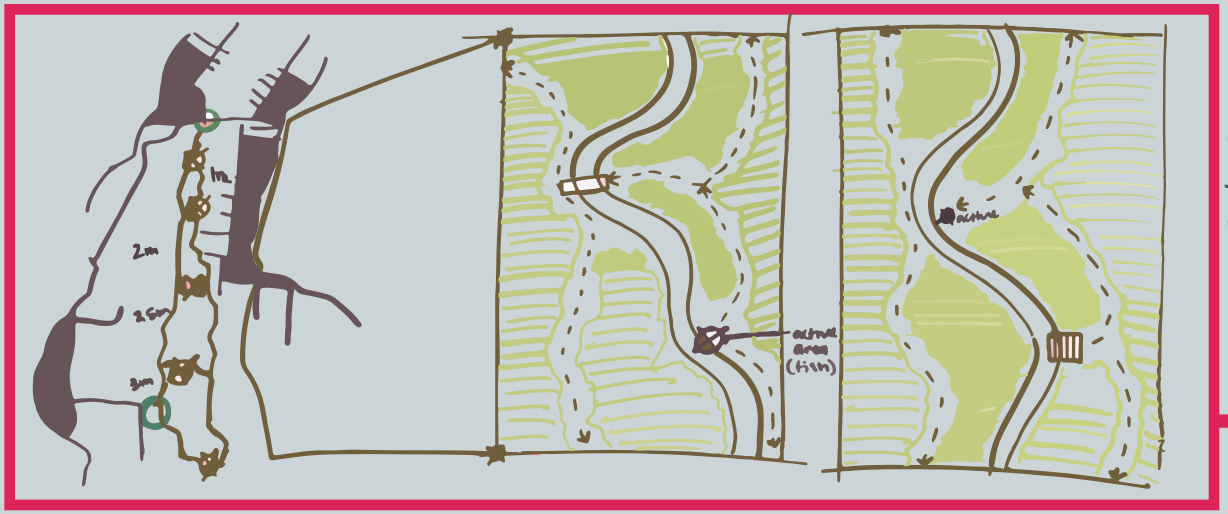
Trail System Characteristics

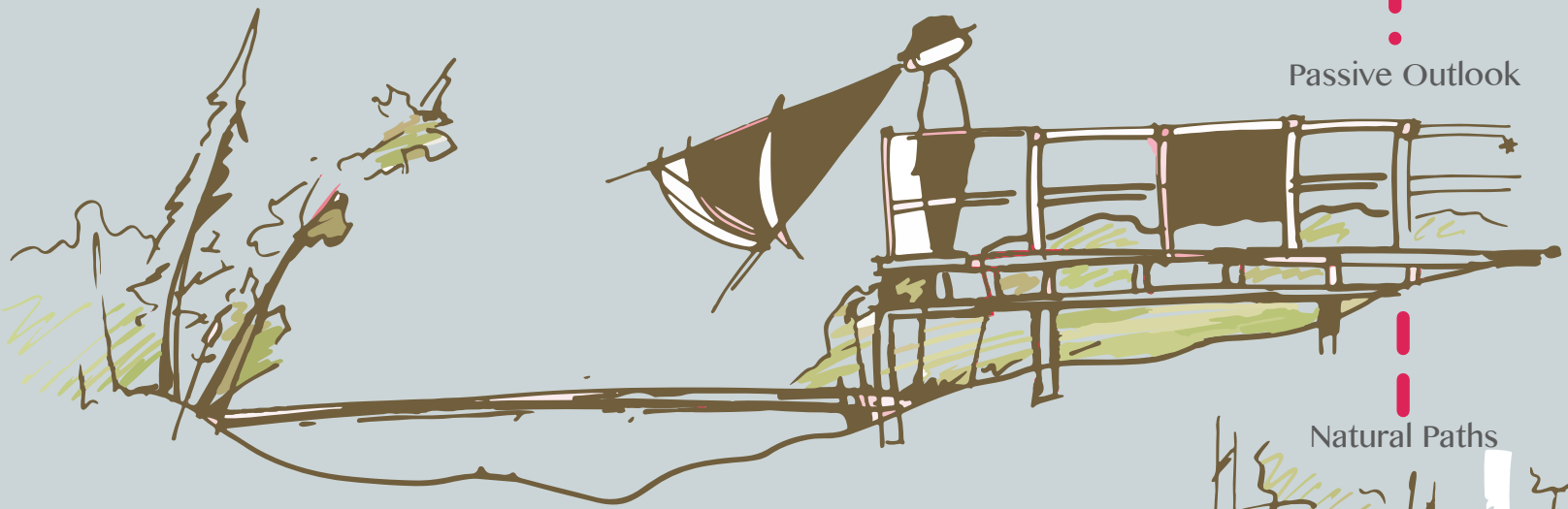


Chum Loop

Passive outlook




Coho Loop


Passive Outlook


Natural Paths

Design Solution

Master Plan

Trail Access Points

Ecological Improvements

Water Flow Improvements

Erosion Control

Riparian Vegetation Restoration

Pollution Control

Stream Habitat Restoration

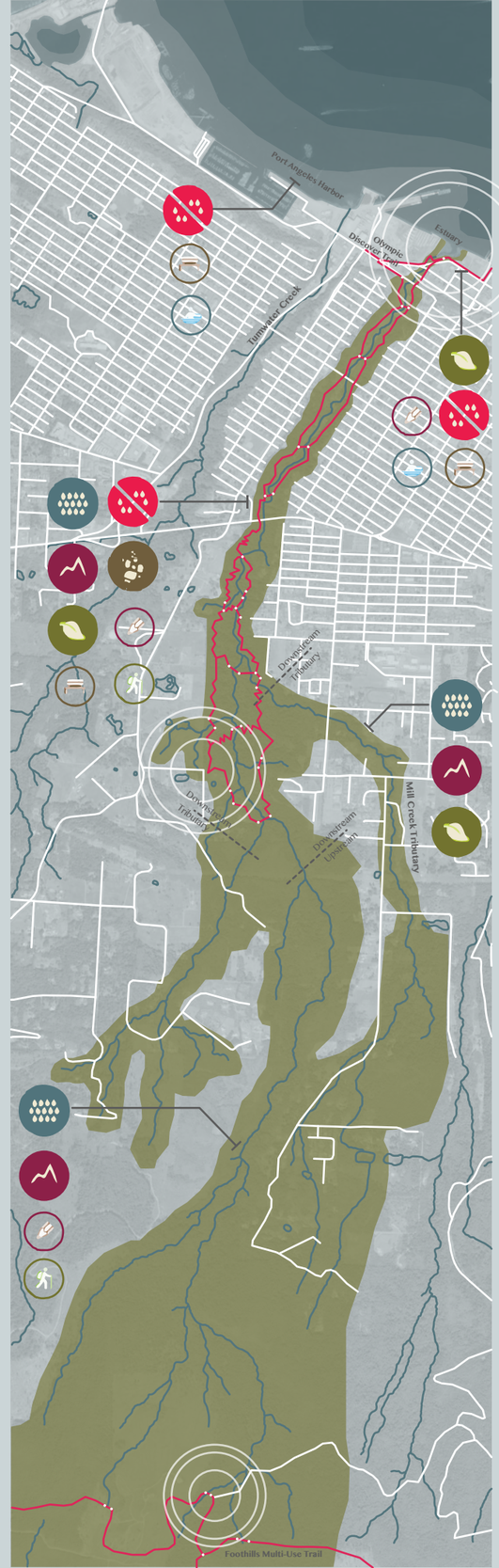
Recreational Improvements

Education

Observation

Water Sports

Hiking



Master Plan

Interaction Areas

A Salmon Migration

B Spawning & Beginning of Life

C Juvenile Stream Bend

D Salmon Investigation

Salmon Migration

Lifecycle stages: Adult Salmon, Spawning Adult

Vulnerability State: Medium

Passive interaction area with multi-level platforms for viewing salmon migrating upstream to spawn, jumping over boulders and resting in pools along the stream bed.

A

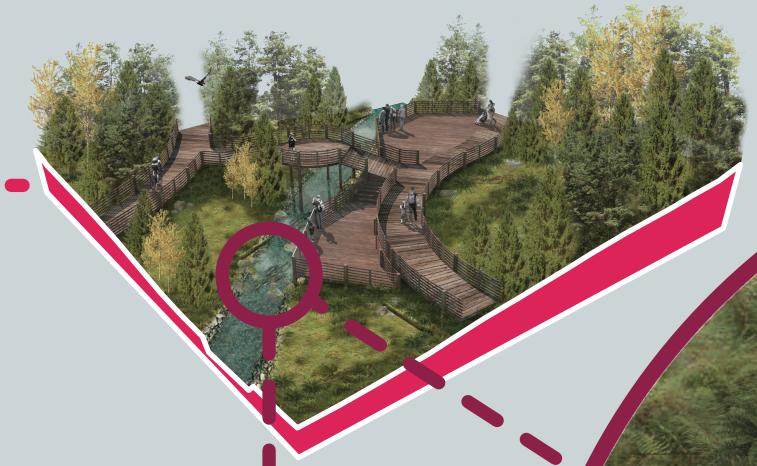
Boardwalk

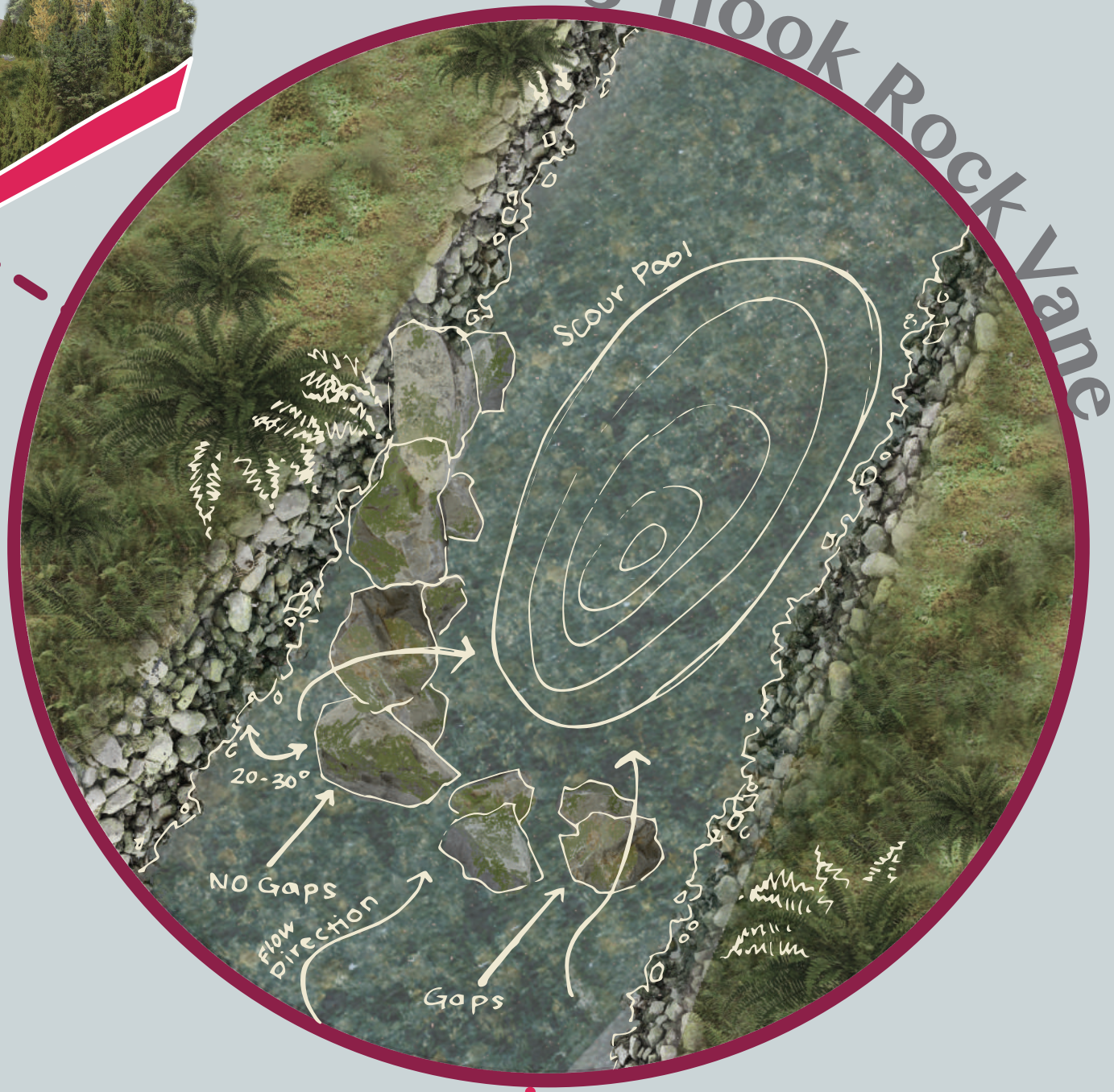
Glass Wall

Viewing Platform

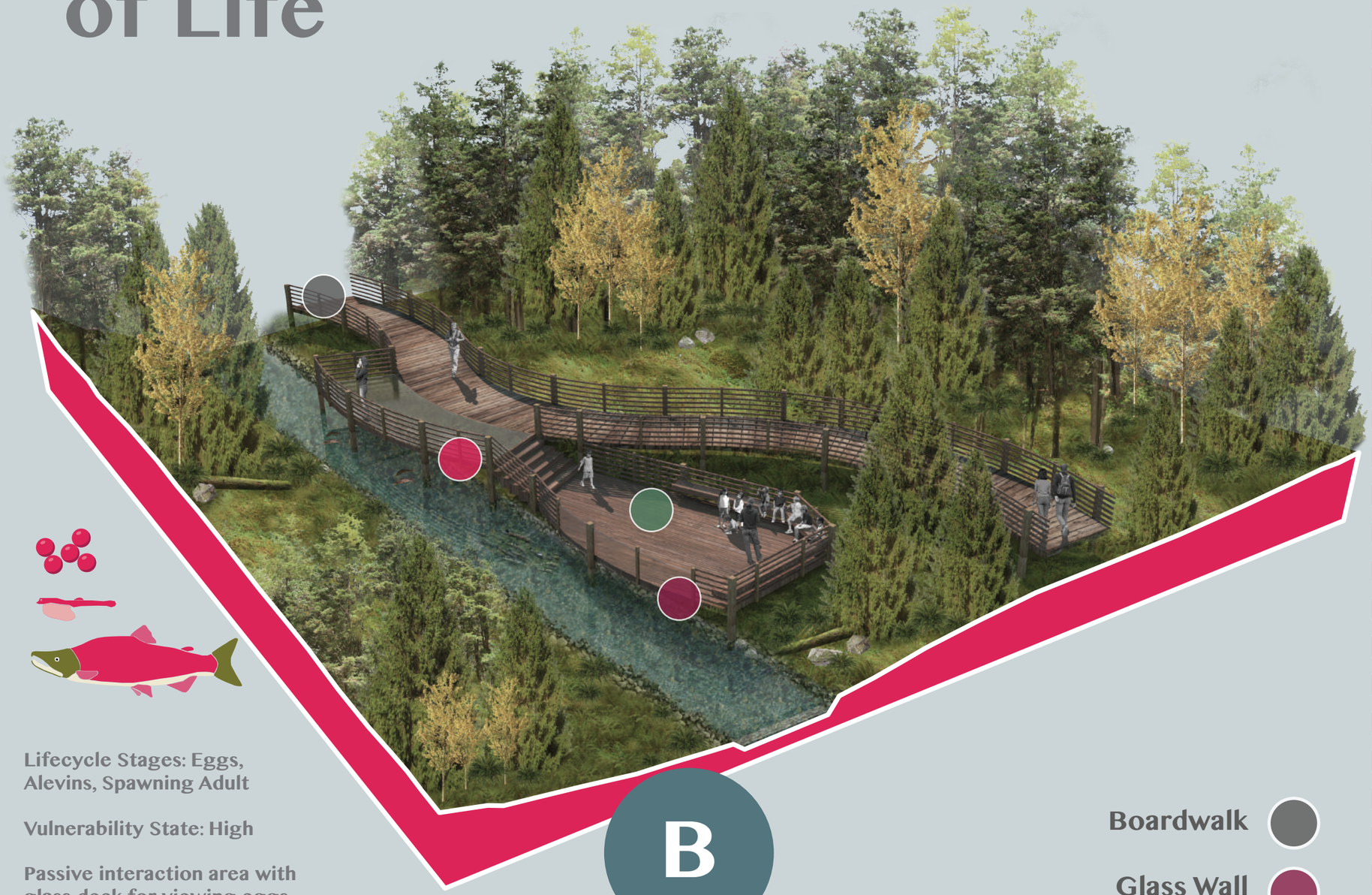
Outdoor classroom

J-Hook Rock Vane





Spawning & Beginning of Life



Lifecycle Stages: Eggs, Alevins, Spawning Adult

Vulnerability State: High

Passive interaction area with glass deck for viewing eggs and salmon spawning in the stream. Outdoor classroom brings you closer to the water to view the salmon in their natural habitat.

B

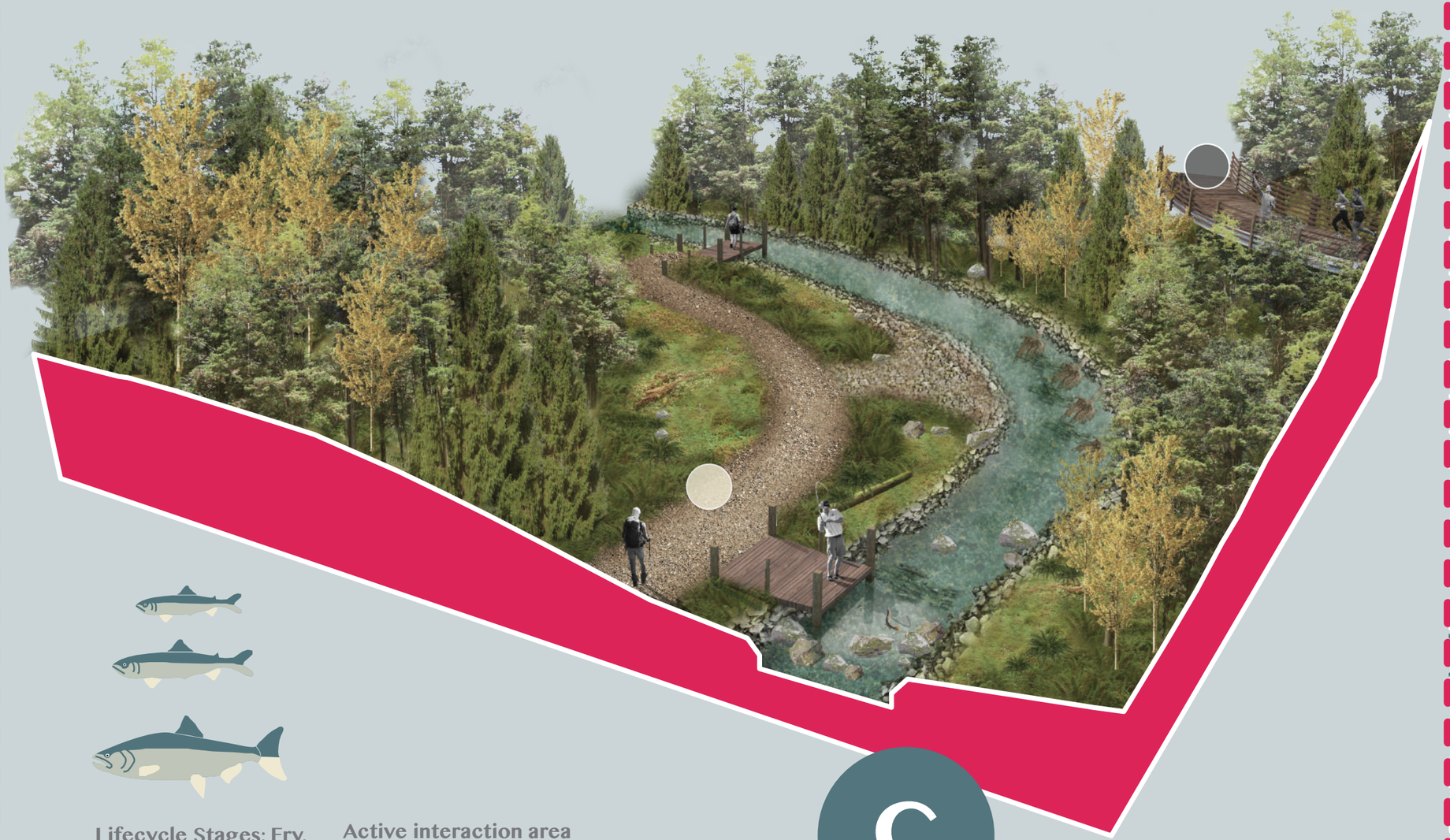
Boardwalk

Glass Wall

Glass Platform

Outdoor classroom

Juvenile Stream Bend

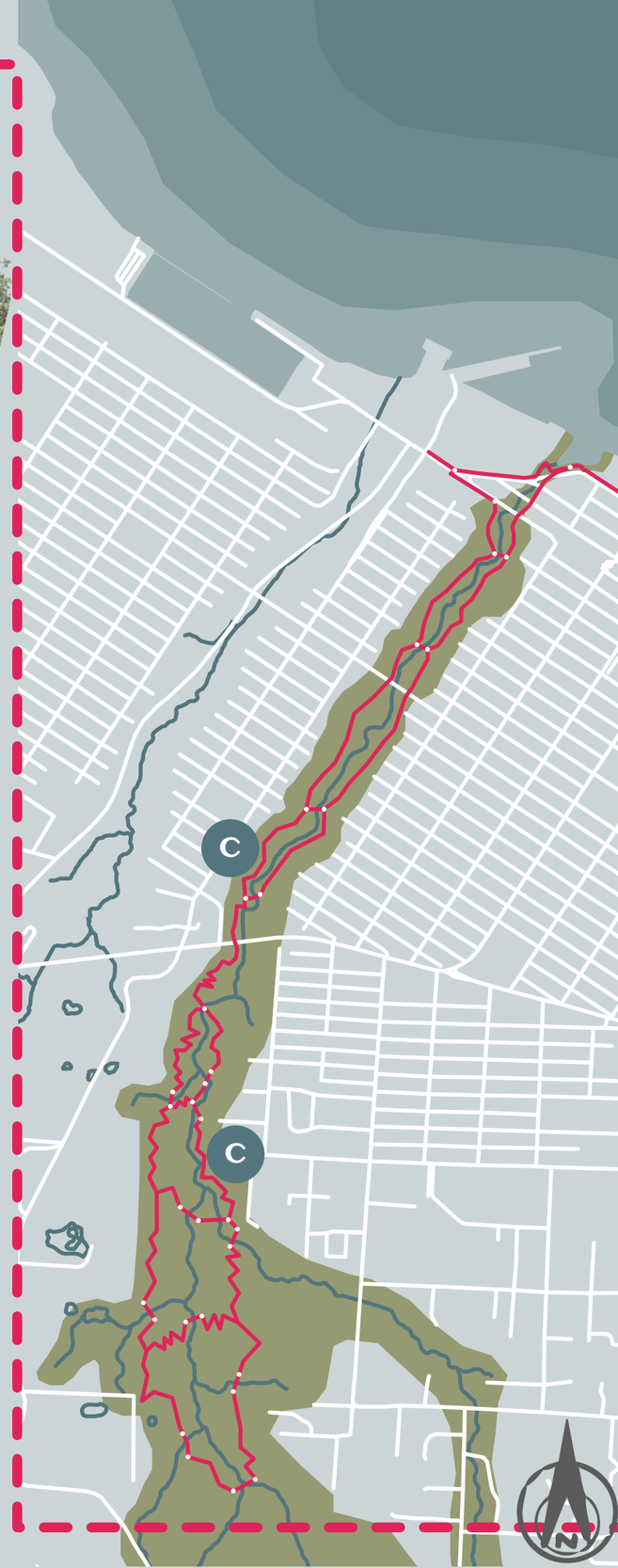


Lifecycle Stages: Fry, Parr, Smolt

Vulnerability State: Medium to Low

Active interaction area where fishing is allowed. The rood wads for erosion control create great fish habitat for juveniles and all migrating salmon. Different private and public fishing spots available.

C



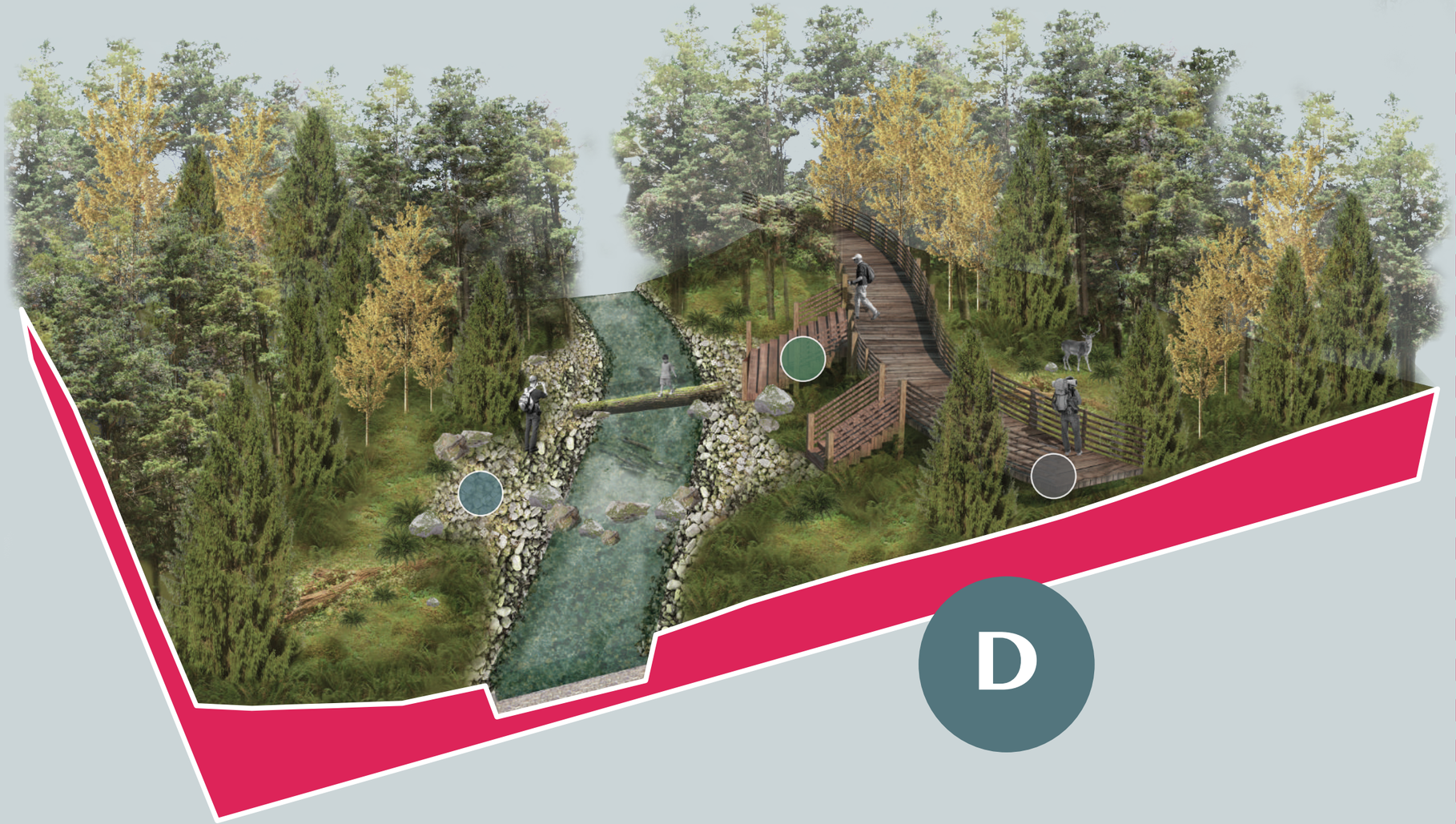
Boardwalk

Hiking Trail

Root Wads


follow stream bend
Flow Direction
Live cuttings for erosion control
Create Fish cover For Juvenile Salmon
Streambed
Footer Log
Boulders
ROOT Wad 16" D min. 8-12 Length

Salmon Investigation



D

Lifecycle Stages: Parr, Smolt, Spawning Adult

Vulnerability State: Low to Medium

Active area to interact with the water and fish themselves. Small outdoor classroom available. Great space to actively cross the river and study the fish within their habitat.

Boardwalk

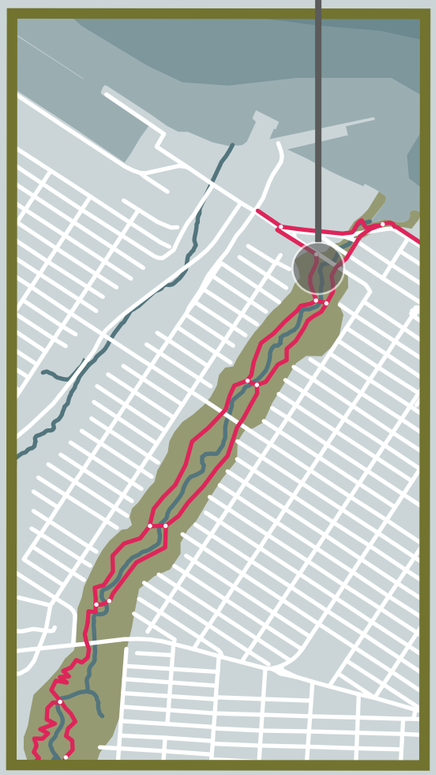
Outdoor classroom

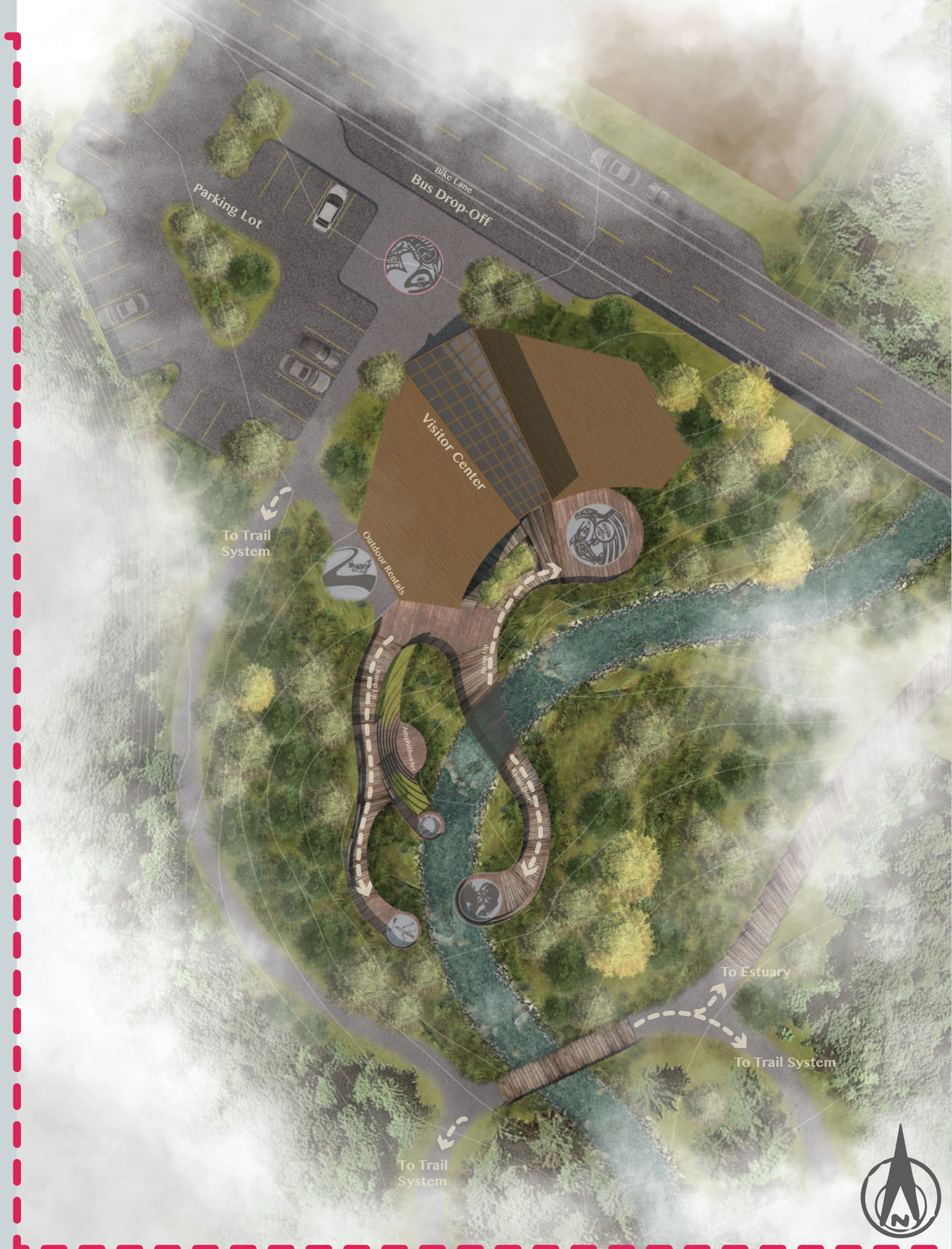
Rock stream bank

Wayfinding

Design Solution

Site Plan





Visitor Center

Ecosystem Support Story

Salmon are known as a keystone species because of their unique lifecycle. They supply food to a variety of species within their ecosystem as well as nutrients to the water and surrounding riparian vegetation. Each area of the ecosystem support story can be seen within the site plan, represented by art on the ground plain

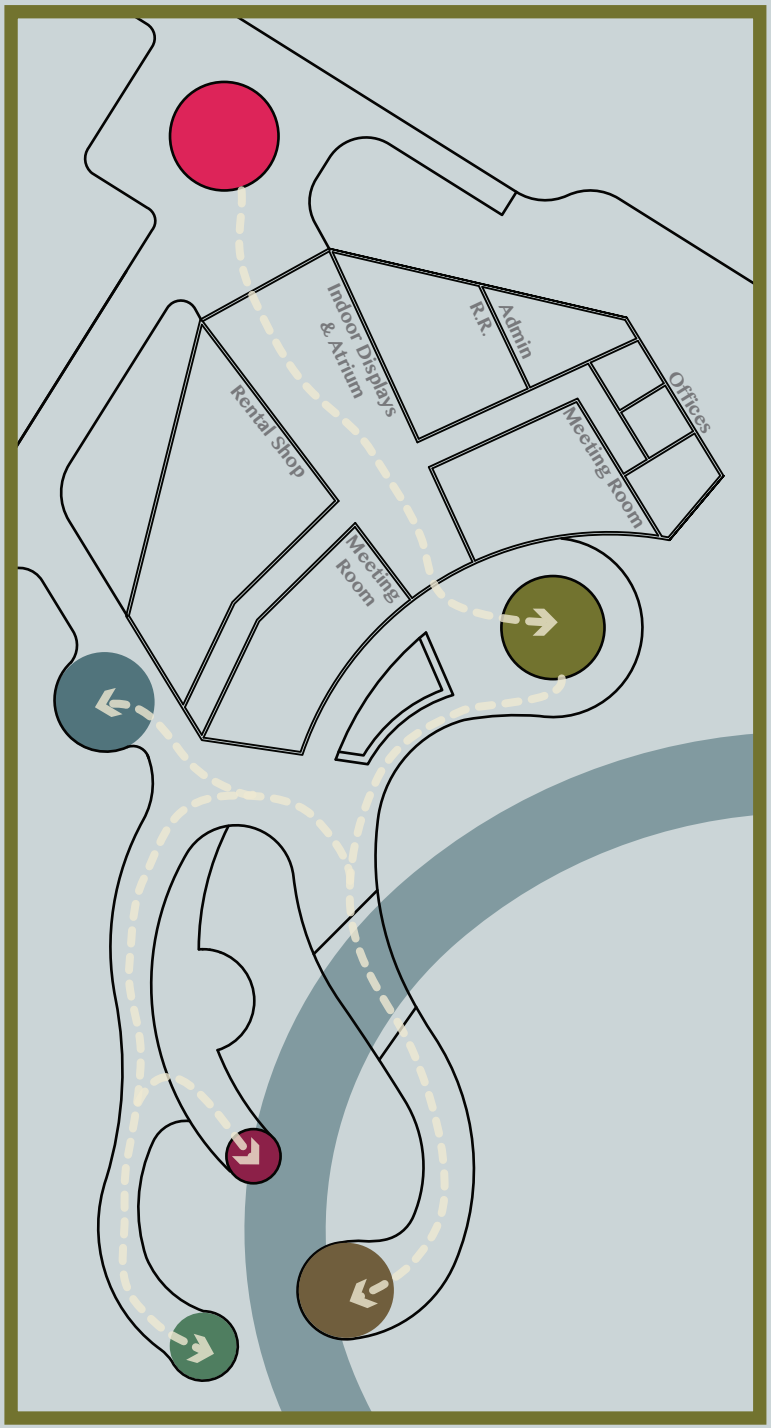
Water Quality

Bird Species

Ocean Species

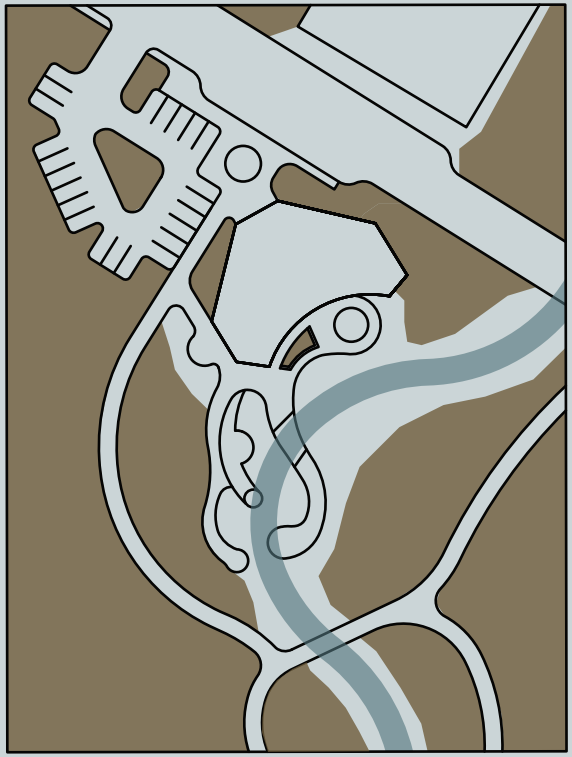
Mammal Species

Riparian Plant Life

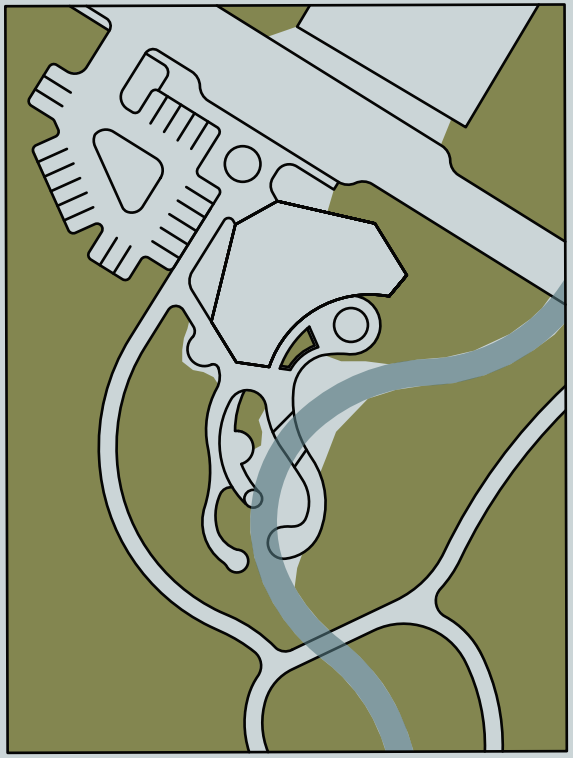


Vegetation

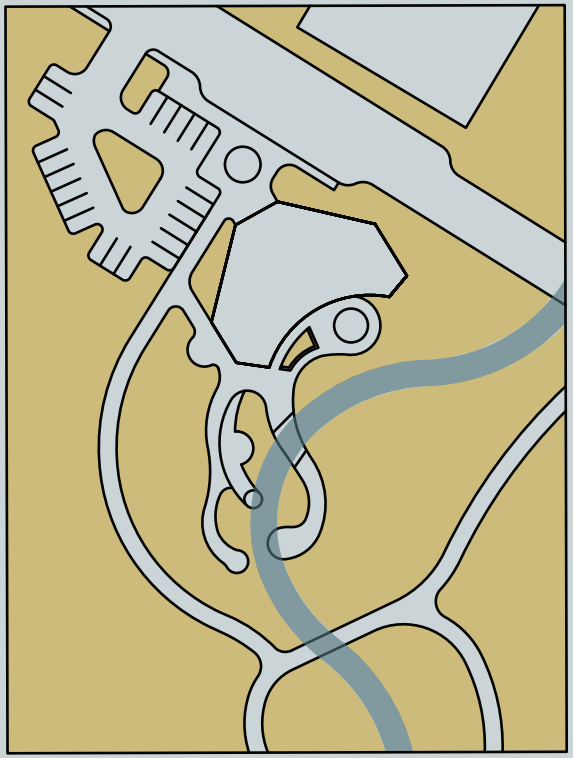
Trees

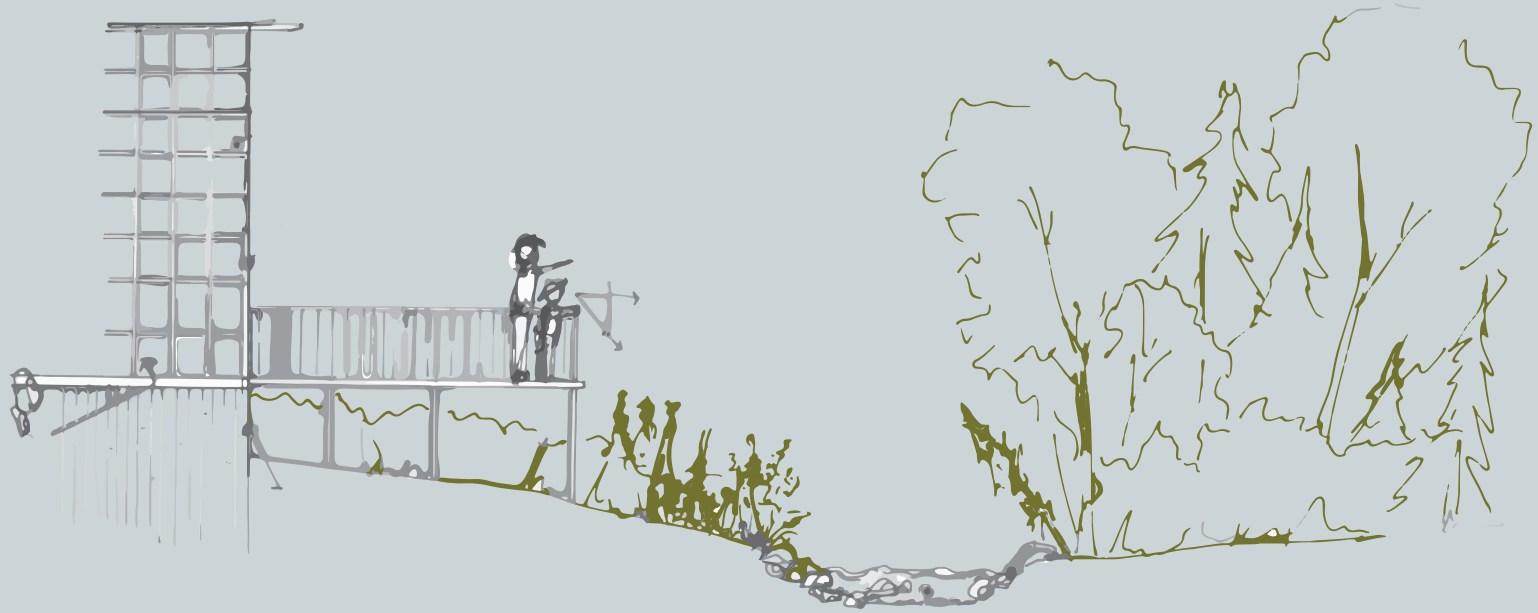


Shrubs

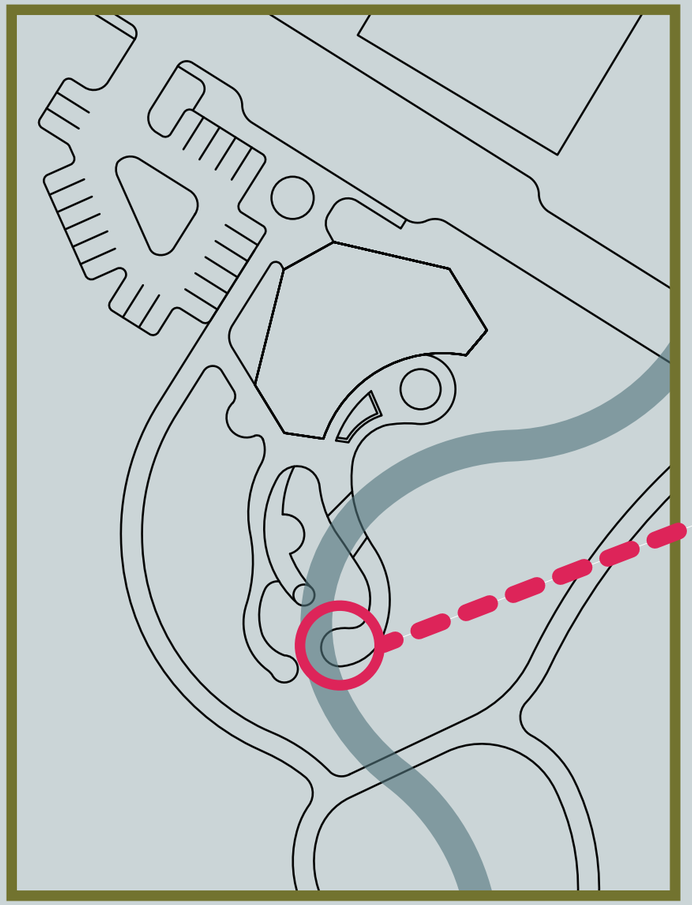


Forbs





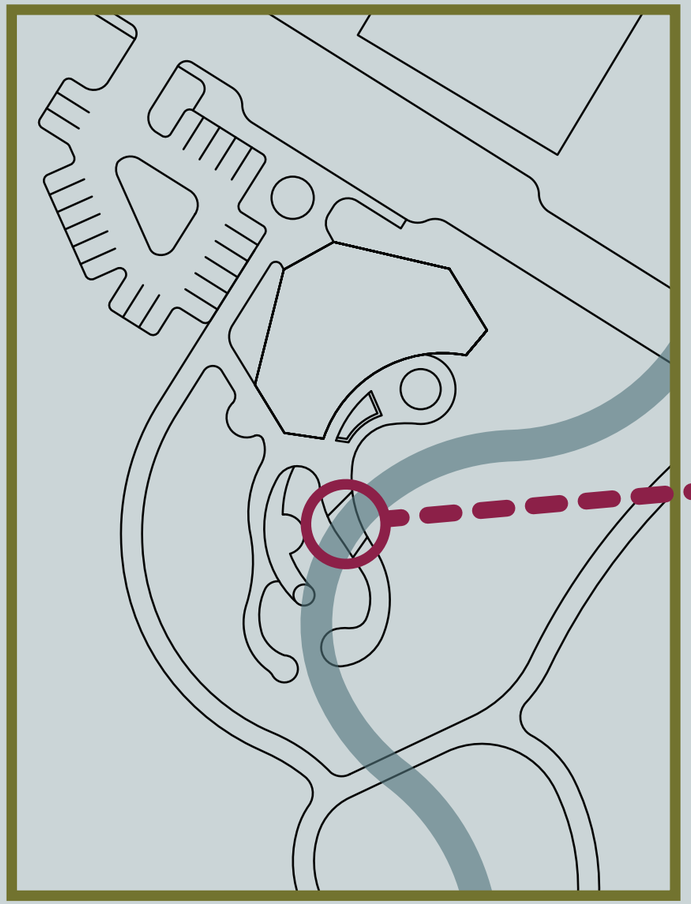
Aquarium Wall



The aquarium wall allows for people to get close to the salmon and see them underneath the water in a safe way.

Outdoor Rental

Glass Walk



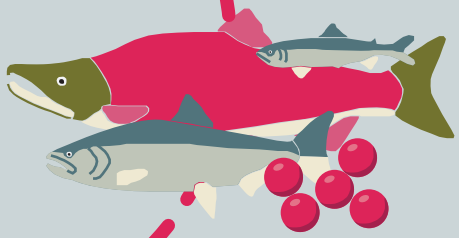
The glass walk allows for a different perspective for viewing the salmon. While walking over the glass, one is immersed in the water environment, feeling like they are one of the fish.

Platform Viewing

The restoration of Valley Creek will improve its ecological functions & performance as well as add to the beauty of the Pacific Northwest.

This We Resolve:

All this that we know and believe must now become the foundation of the way we live.
At this turning point in our relationship with Earth, we work for an evolution:
from dominance to partnership;
from fragmentation to connection;
from insecurity, to interdependence.



Questions?