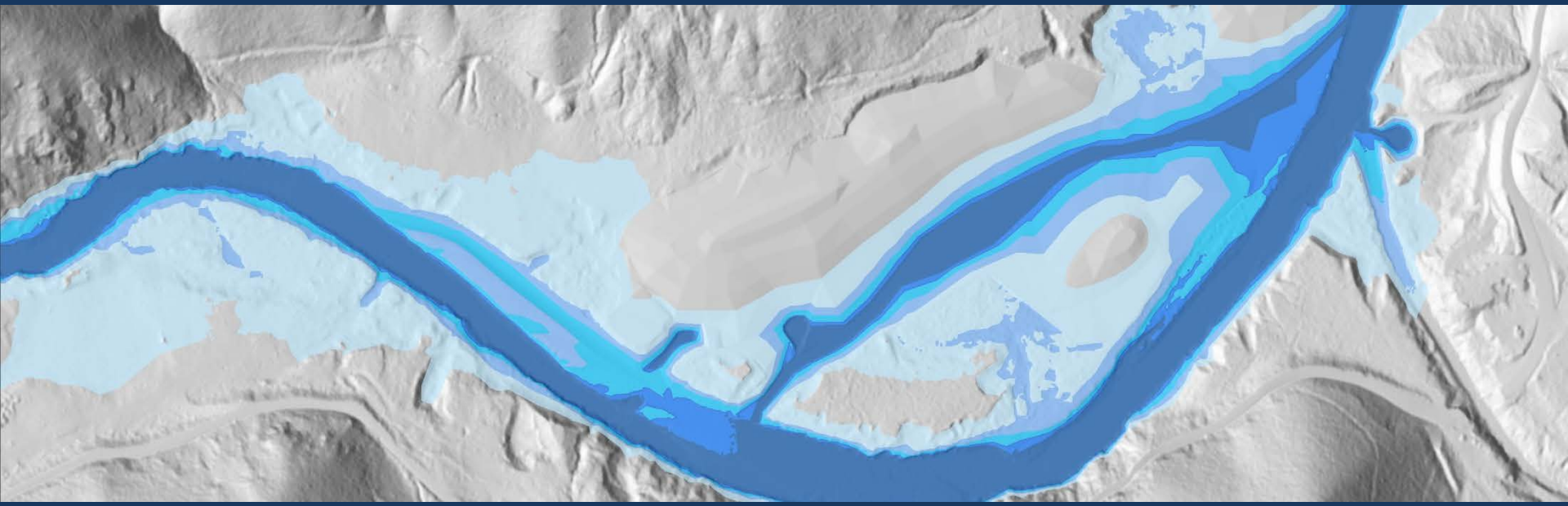
Planning for Large-Scale Floodplain Habitat Restoration in the Salmon River



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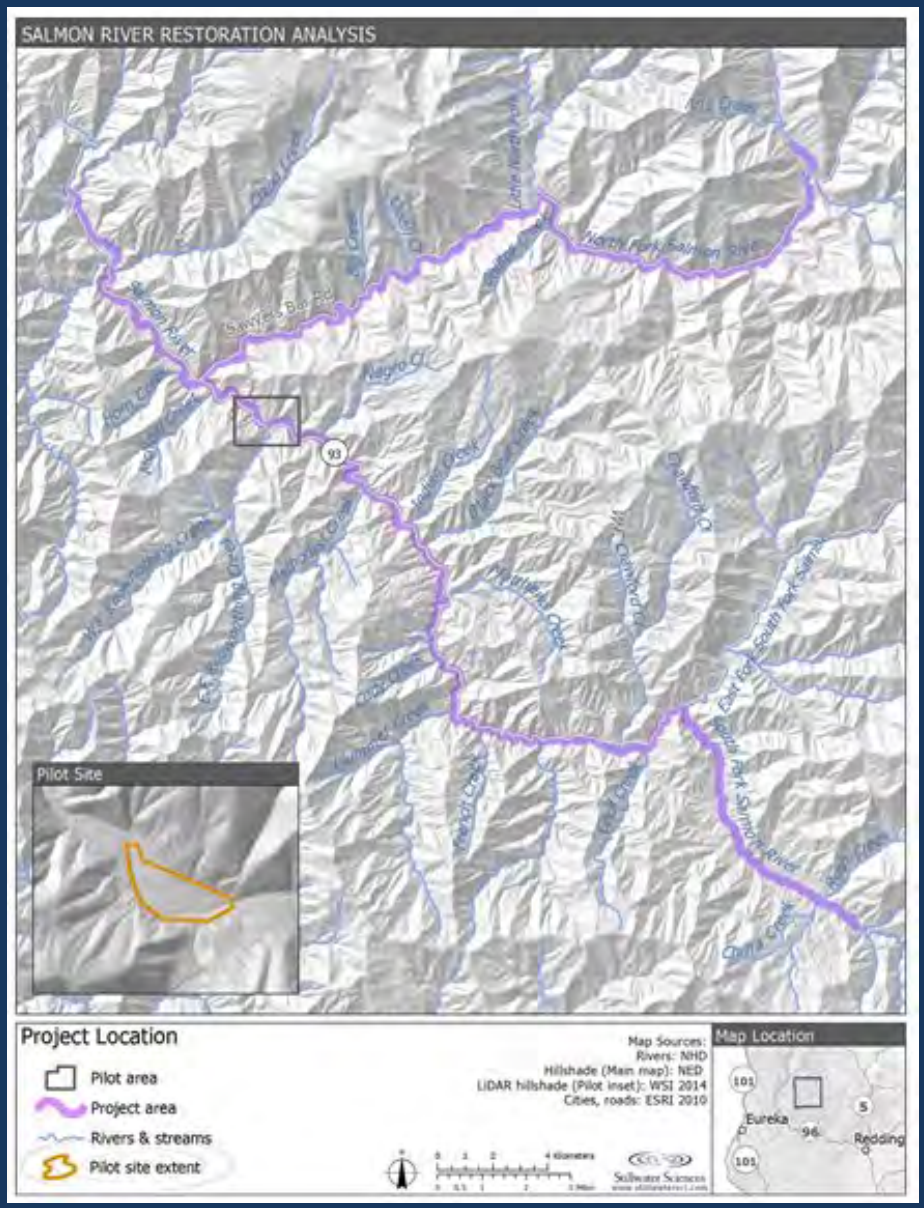
33rd Annual Salmonid Restoration Conference
March 2015 – Santa Rosa, CA

Stillwater Sciences

Salmon River - Background and Motivation

- Long-term refugia for Klamath Basin coho, spring Chinook and summer steelhead
- Nearly extensive US Forest Service ownership
- Community support and leadership (SRRC)
- Most mountainous of Klamath sub-basins
- Removed from Klamath hatcheries



Effects of Mining Disturbance:

- Prohibits Floodplain inundation
- Reduces Riparian Vegetation Establishment
- Contributes to Elevated Summer Water Temperatures

Types of Mining Disturbance

- Tailing piles
- Exposed bedrock
- Filled side channels
- Gullies

Approach

- Evaluated restoration potential over 55 river miles by delineating geomorphic reach types based on:
  - Approximate 100-year floodplain width estimated from LiDAR data
  - Bedrock-dominated versus alluvial reaches determined from aerial imagery

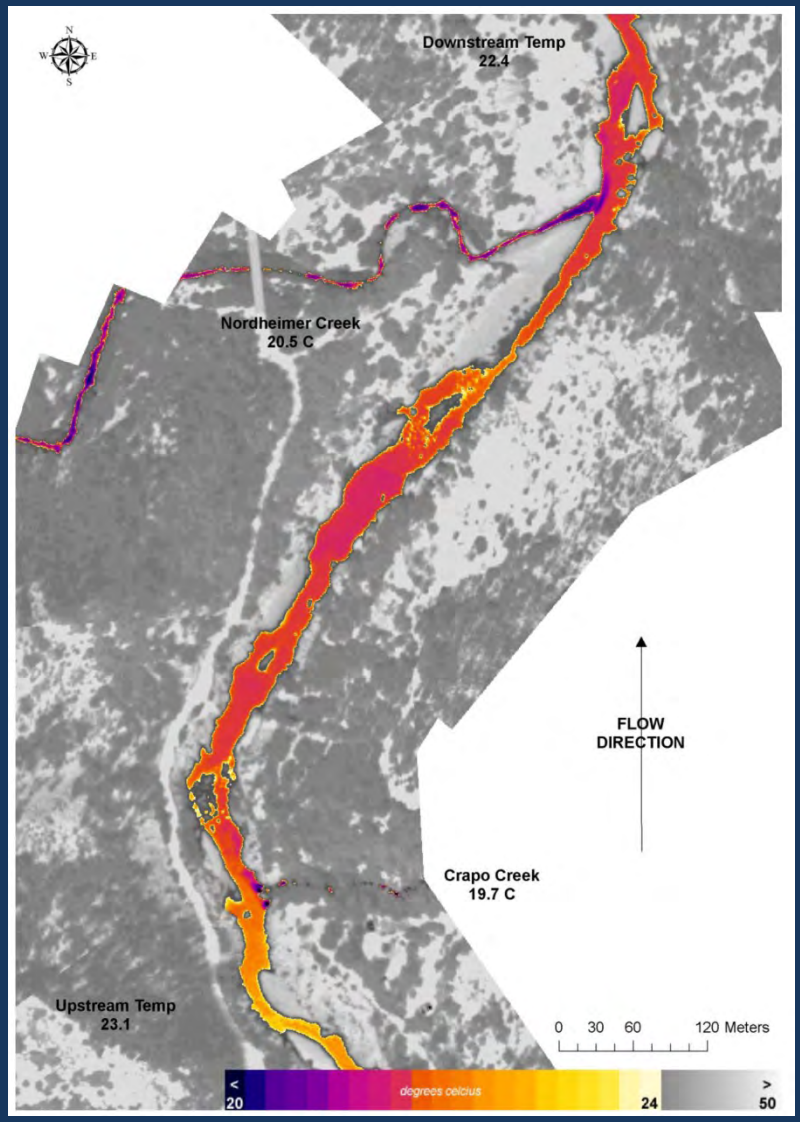
- Further refined restoration potential based on:
  - Legacy mining disturbances
  - Existing infrastructure
  - Summer water temperatures using thermal infrared (TIR) imagery

- Floodplain habitat restoration opportunities were analyzed at one pilot site

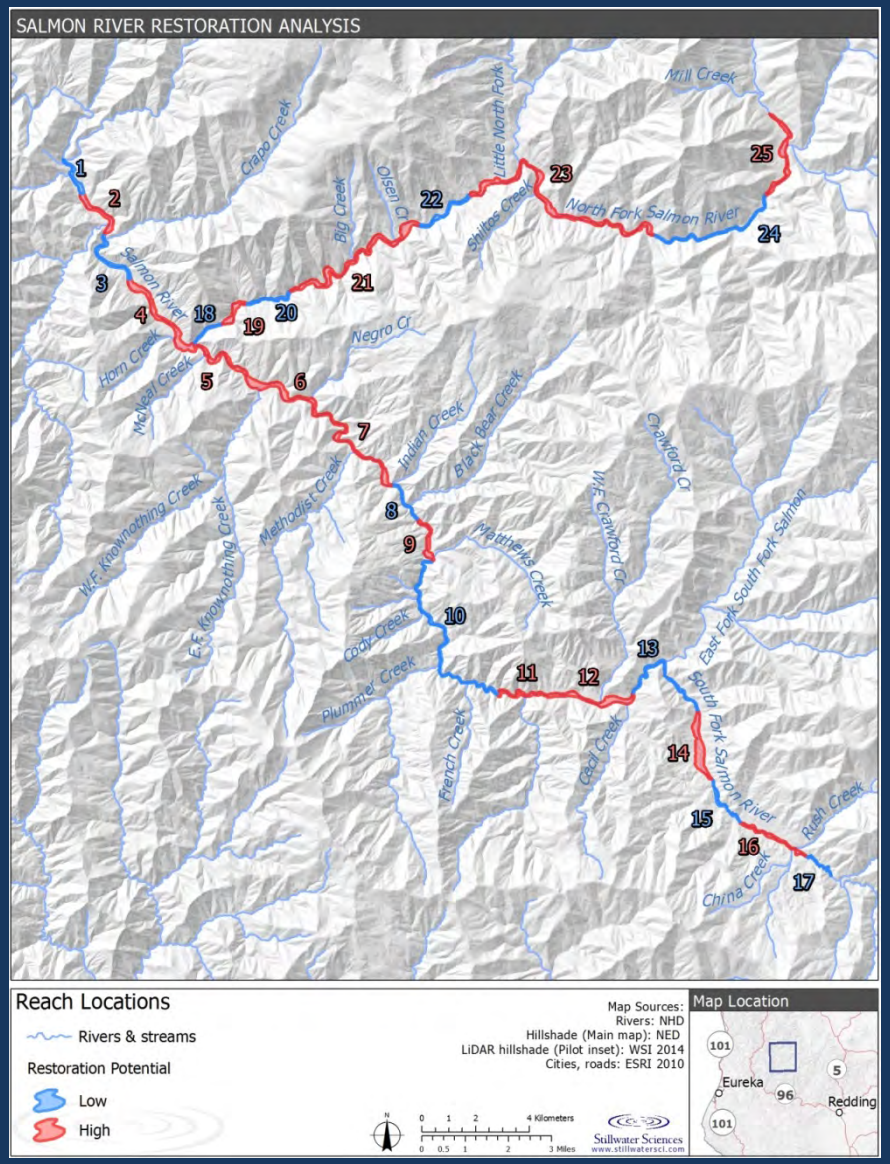
Data Sources

- LiDAR data: Collected by QSI in February and April 2014

- TIR data: Collected by Watershed Sciences, Inc. in July 2009

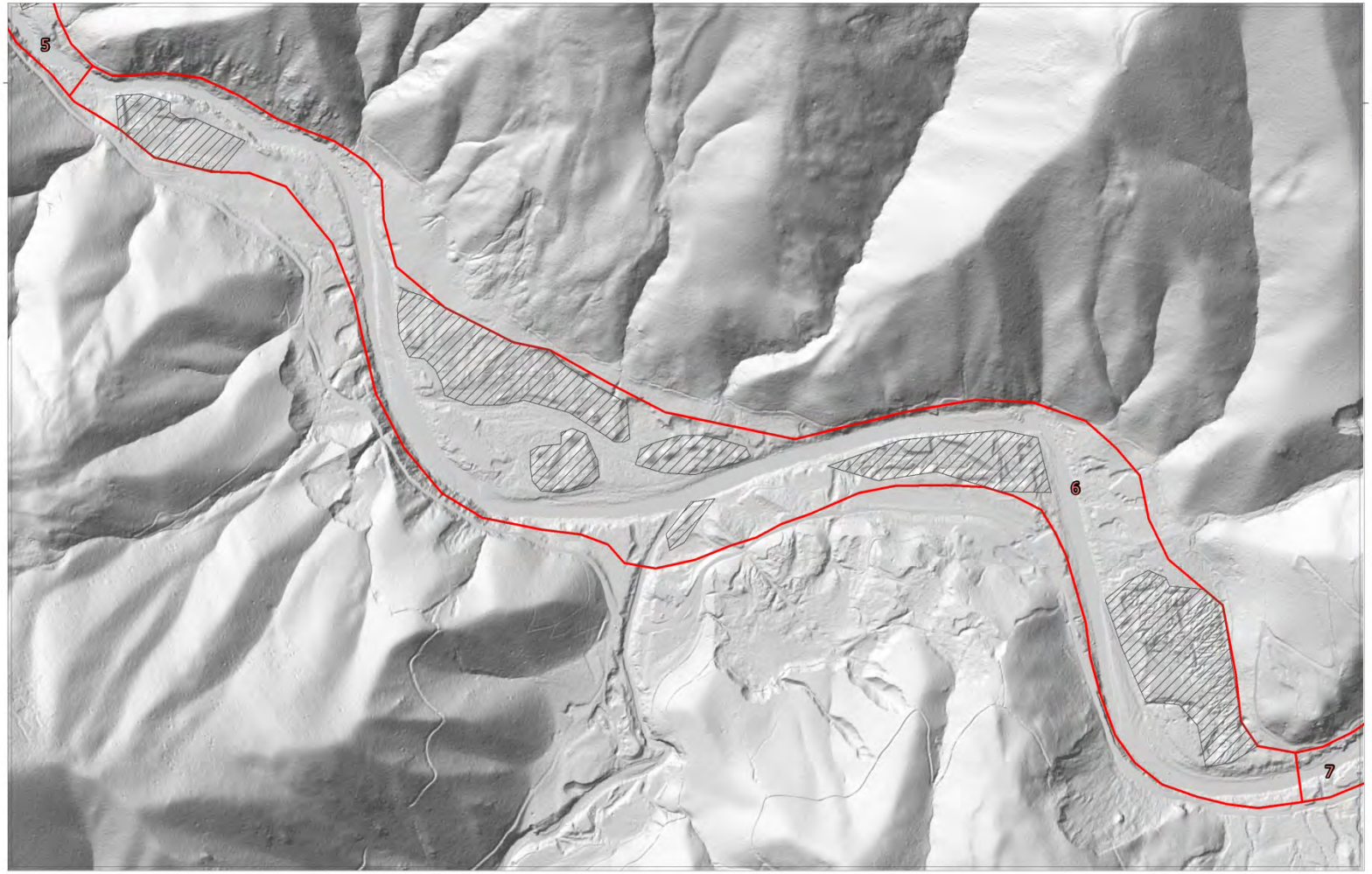


Reach Delineation and Enhancement Potential



Reach #	River Segment	Length (miles)	Width	Average Width (ft)	Bedrock	Mine Tailings	Restoration Potential	Notes/ Comments
1	Mainstem	1.0	Narrow	350	Yes	No	Low	Downstream extent
2	Mainstem	1.3	Moderate	540	Yes	Yes	High	
3	Mainstem	1.7	Narrow	280	Yes	No	Low	
4	Mainstem	2.4	Wide	740	No	Yes	High	Confluence with NF & SF
5	SF	1.4	Moderate	410	Yes	Yes	High	Confluence with main-stem
6	SF	1.8	Wide	750	Yes	Yes	High	
7	SF	4.2	Moderate	360	Yes	Yes	High	
8	SF	1.1	Narrow	180	Yes	No	Low	
9	SF	1.3	High	470	Yes	Yes	High	
10	SF	5.1	Narrow	230	Yes	No	Low	
11	SF	1.5	Moderate	310	Yes	No	High	
12	SF	2.3	Moderate	440	No	Yes	High	Cecilville reach
13	SF	2.7	Narrow	190	Yes	No	Low	
14	SF	1.7	Wide	620	No	Yes	High	
15	SF	1.4	Narrow	190	Yes	No	Low	
16	SF	1.8	Moderate	320	No	Yes	High	
17	SF	0.9	Narrow	130	No	No	Low	Upstream extent
18	NF	0.9	Narrow	190	Yes	No	Low	Confluence with Main-stem
19	NF	1.0	Wide	500	Yes	Yes	High	
20	NF	1.2	Narrow	220	Yes	Yes	Low	
21	NF	4.9	Moderate	400	Yes	Yes	High	
22	NF	1.5	Narrow	270	Yes	No	Low	
23	NF	6.4	Moderate	340	Yes	Yes	High	Sawyers Bar reach
24	NF	3.4	Narrow	180	Yes	No	Low	
25	NF	2.5	Moderate	420	No	No	High	Upstream extent

High Restoration and Enhancement Potential – Reach 6



SALMON RIVER RESTORATION ANALYSIS
High Restoration Potential Page 6 of 13

DATA SOURCES
Imagery: ESRI World Mapping Service
Roads, cities, streams: ESRI 2010

Stillwater Sciences
www.stillwatersci.com

LEGEND

Approximate area of mining disturbance

Reach restoration potential

Low

High

SCALE & NORTH ARROW

0 260 520 1,040 Feet
0 65 130 260 Meters

1:7,870 1 in = 656 feet

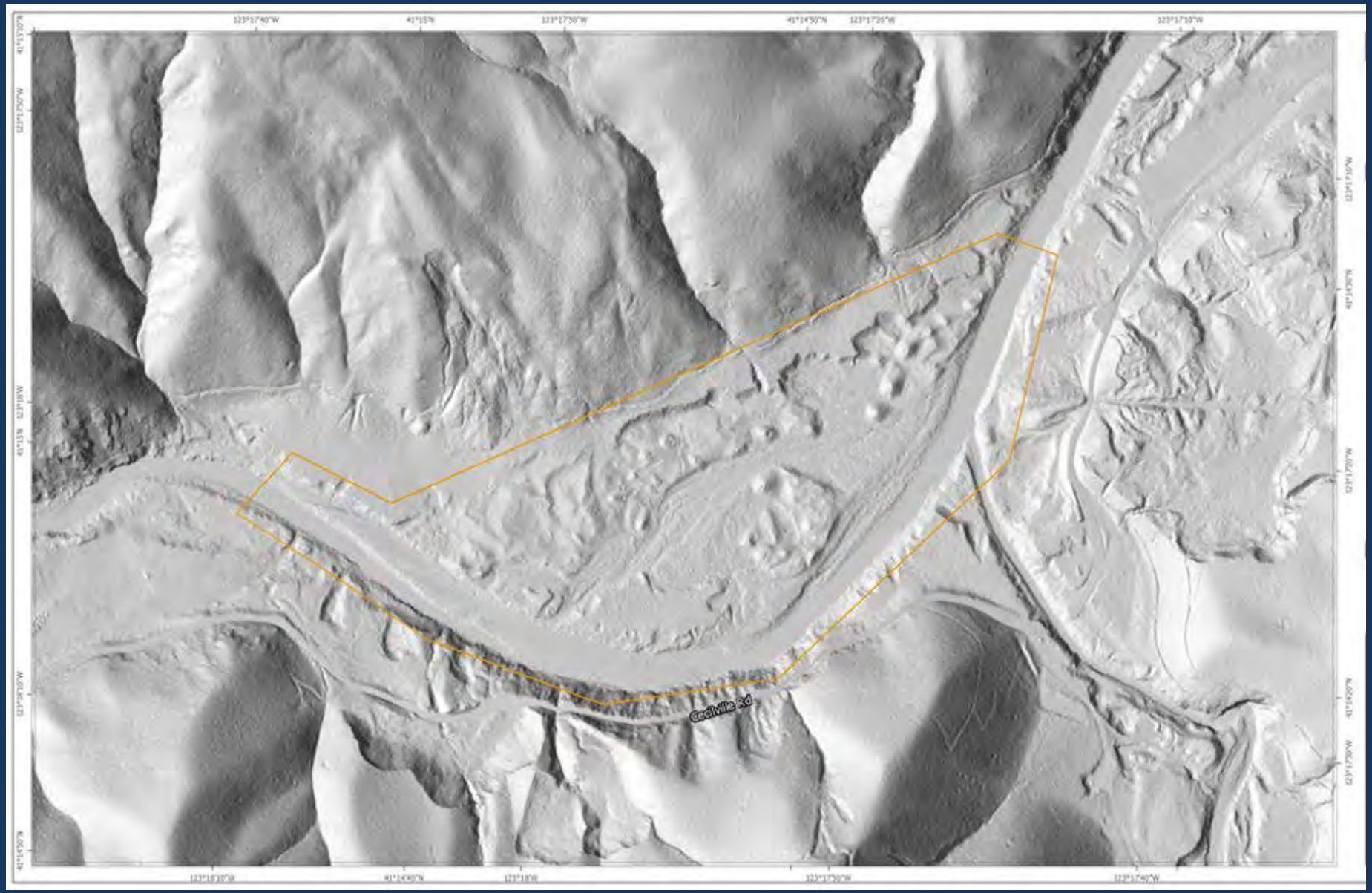
MAP LOCATION

Pilot Site Conceptual Design

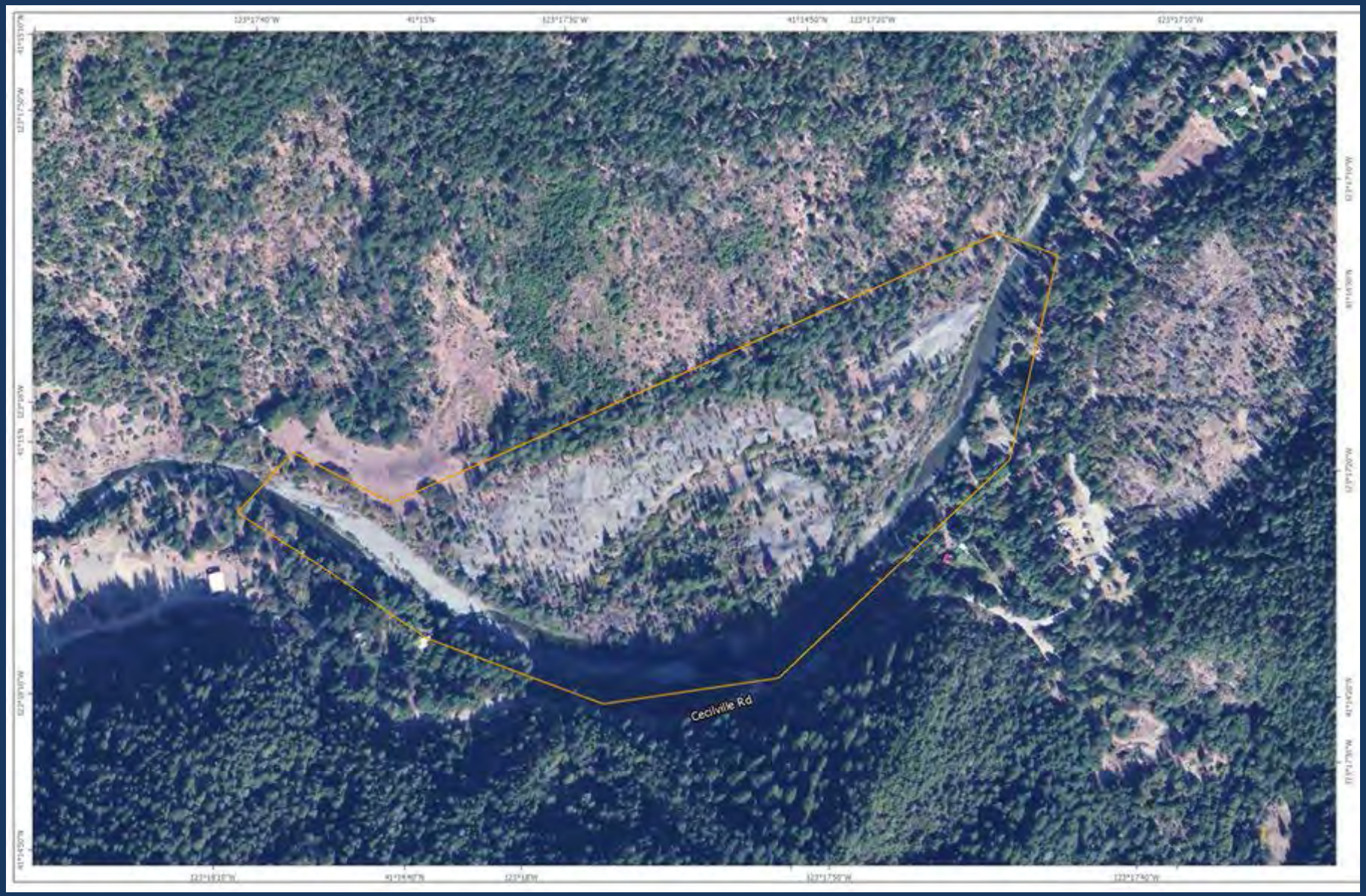
Goal: test, refine, and demonstrate approach for analyzing restoration feasibility at the project site scale

- Geomorphic mapping to characterize surface and shallow subsurface materials and assess excavation potential
- Existing conditions hydraulic modeling to define flows at which existing floodplains are inundated
- Developed a conceptual restoration design and grading plan
- Proposed conditions hydraulic modeling based on conceptual grading
- Compared inundation area (potential usable habitat) under existing and proposed conditions

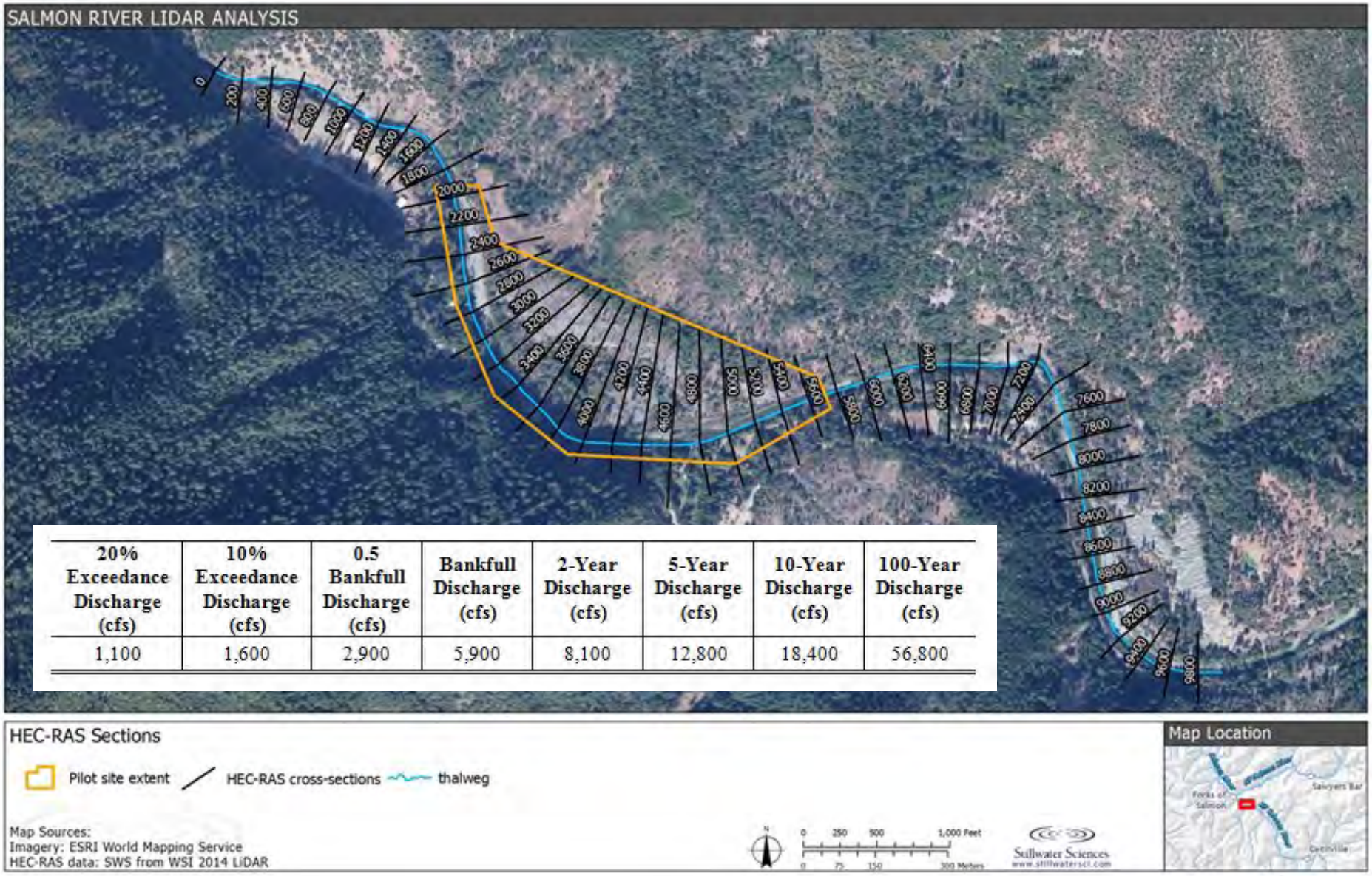
Pilot Site – Knownothing Creek



Pilot Site – Knownothing Creek



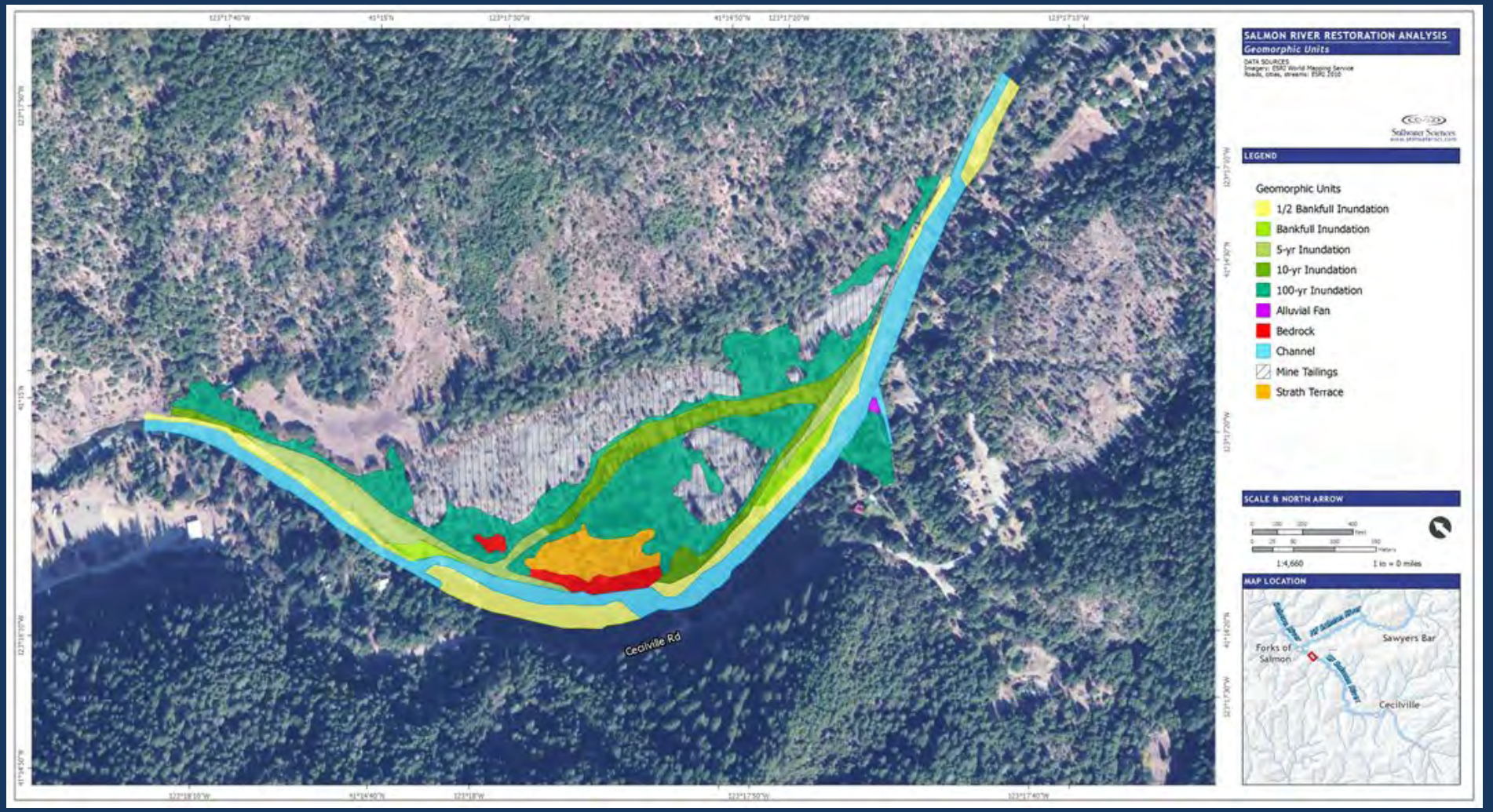
Hydraulic Analysis



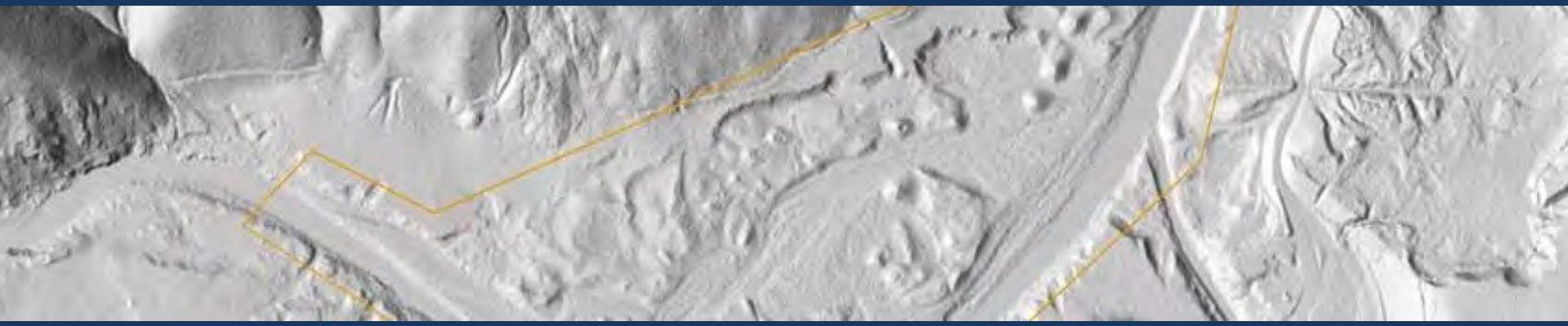
20% Exceedance Discharge (cfs)	10% Exceedance Discharge (cfs)	0.5 Bankfull Discharge (cfs)	Bankfull Discharge (cfs)	2-Year Discharge (cfs)	5-Year Discharge (cfs)	10-Year Discharge (cfs)	100-Year Discharge (cfs)
1,100	1,600	2,900	5,900	8,100	12,800	18,400	56,800

Inundation Mapping: Existing Conditions

Geomorphic Mapping

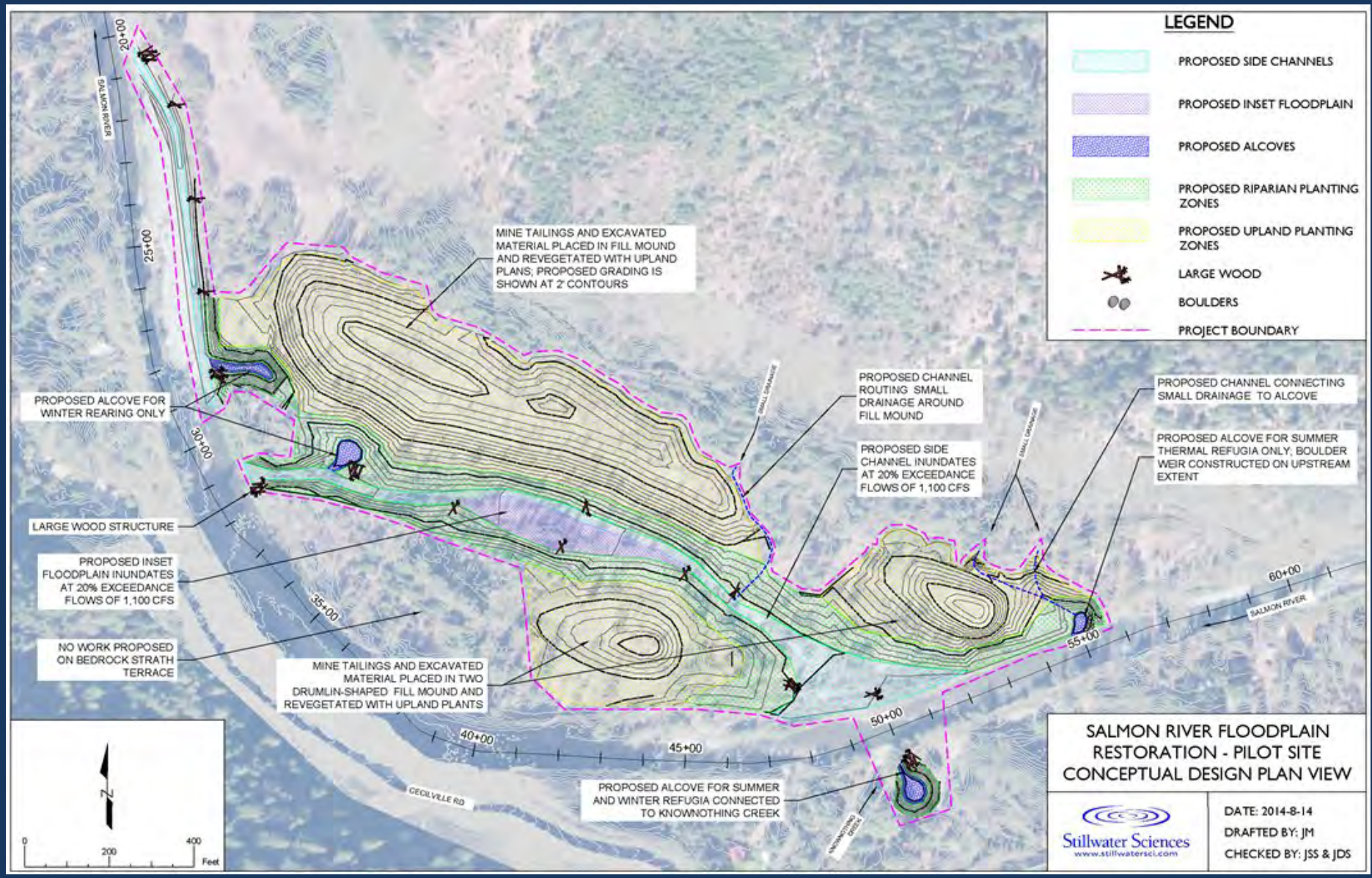


Conceptual Design Objectives

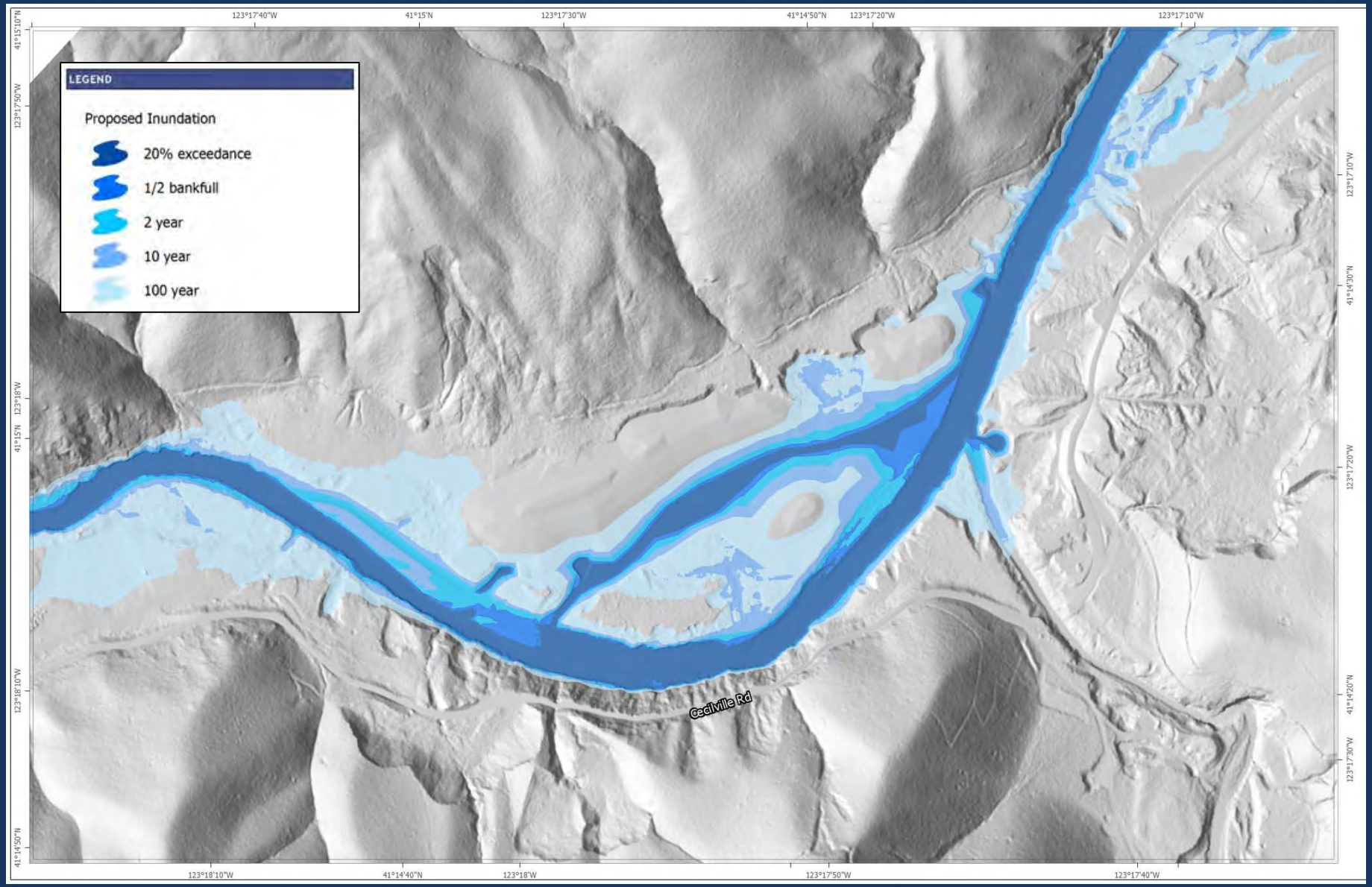


1. Reconnect floodplain areas and high-flow side channel
2. Increase shallow spring rearing habitat
3. Create off-channel winter refuge
4. Enhance summer thermal refuge
5. Dispose of and vegetate mine tailings on site to reduce air temperature
6. Strike a balance between benefits and cost

Conceptual Design



Inundation Mapping: Proposed Conditions



Comparison of Existing and Proposed Inundation

Pilot Site	Flow Levels						
	Summer Low Flow Existing	20% Exceedance Existing	20% Exceedance **Proposed**	0.5 Bankfull Existing	0.5 Bankfull **Proposed**	2 year Existing	2 year **Proposed**
Area (acres)	5.5	8.8	11.0	10.2	13.9	12.8	18.3
Total area inundated beyond low flow channel extents (acres)	-	3.3	5.6	4.7	8.4	7.3	12.8
Increase in floodplain area (acres)	-	-	2.3	-	3.7	-	5.5
% Increase in floodplain area	-	-	**69%**	-	**78%**	-	**75%**

Project Outcomes

- ~37 river miles along 14 alluvial-dominated reaches have high restoration potential
- LiDAR and TIR imagery provide valuable large-scale planning tools
- Pilot site work articulated a cost–effective conceptual design process
- Next steps:
  - Conceptual designs for each reach with high restoration potential
  - Programmatic permitting
  - Prioritize specific restoration projects
  - Implement projects that increase salmon and steelhead production.

Next Steps

- Conceptual designs for each reach with high restoration potential
- Programmatic federal permitting
- Prioritize specific restoration projects
- Final design and implementation of highest priority habitat enhancement projects

Acknowledgments

Project Proponent:
Salmon River Restoration Council

Project Funders:
US Fish and Wildlife Service Yreka Office
US Forest Service

Thank You!