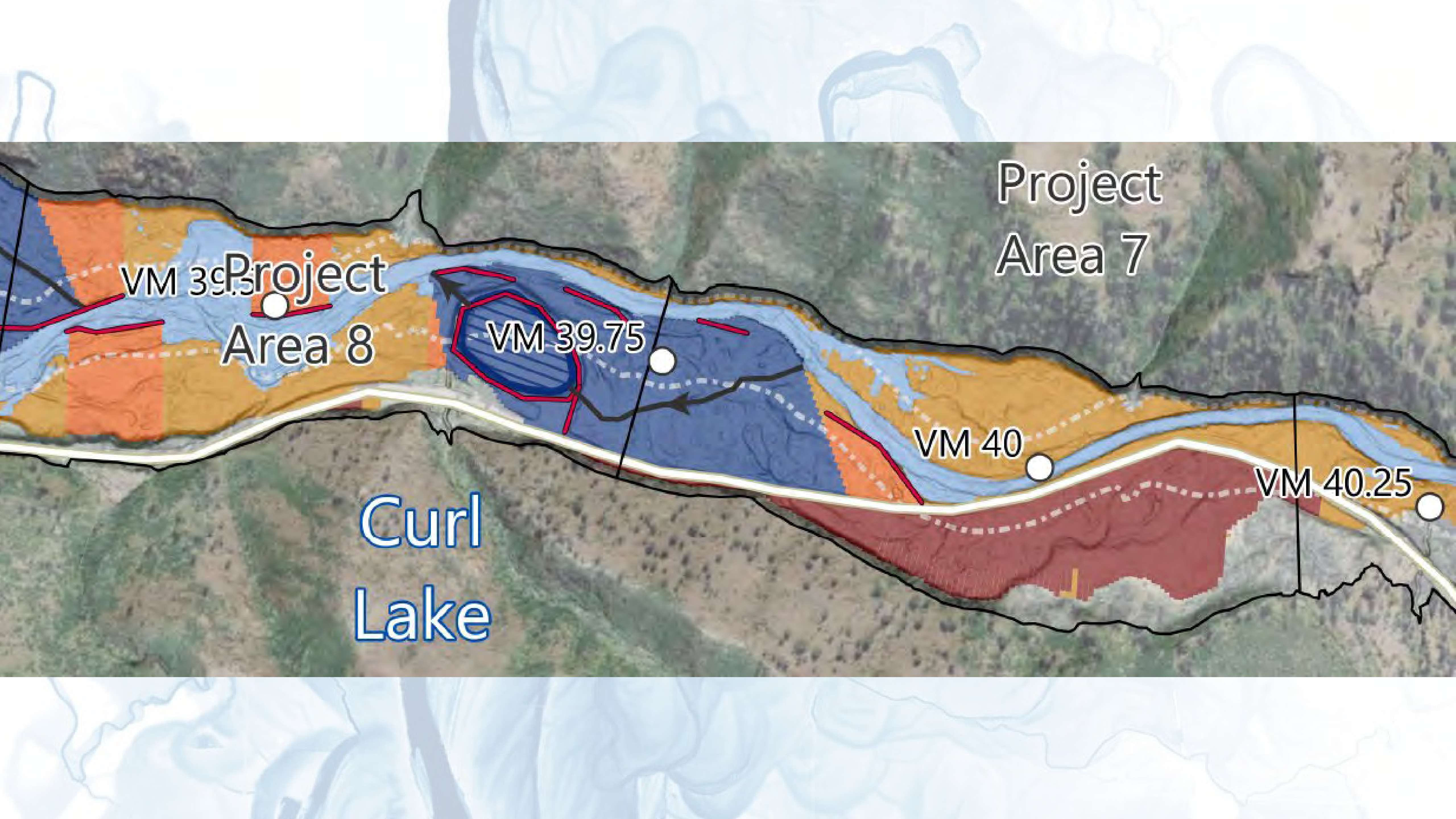
Tucannon River PA 5-15: Floodplain Connectivity Methods and Results


Project
Area 7
Project
Area 8
VM 39.75
VM 40
VM 40.25
Curl
Lake

Methods Overview

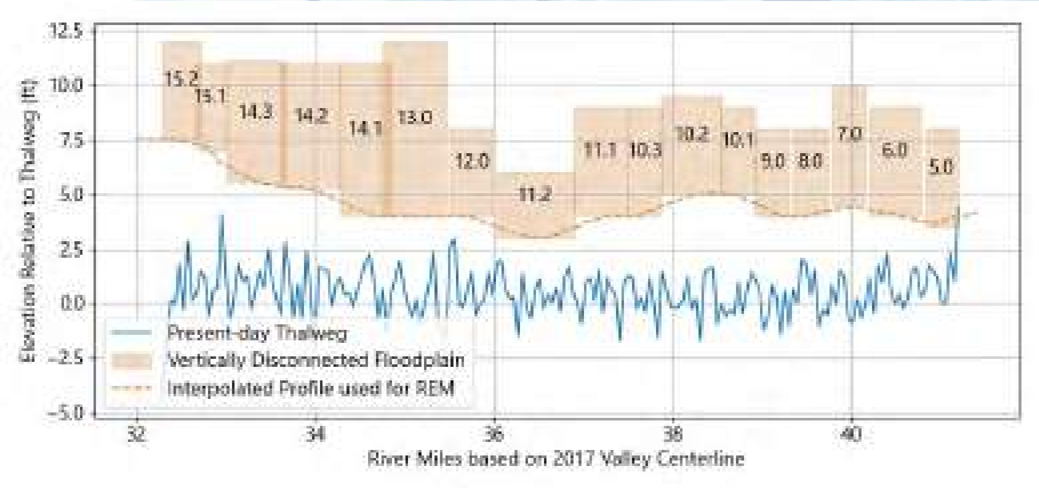
1. Generate valley bottom cross-sections
2. Map floodplain disconnection due to incision
3. Map floodplain disconnection due to infrastructure
4. Measure (dis)connected width along cross-sections
5. Floodplain Mapping Results
6. Stream Power Methods
7. Stream Power Results

1. Generate valley bottom cross-sections

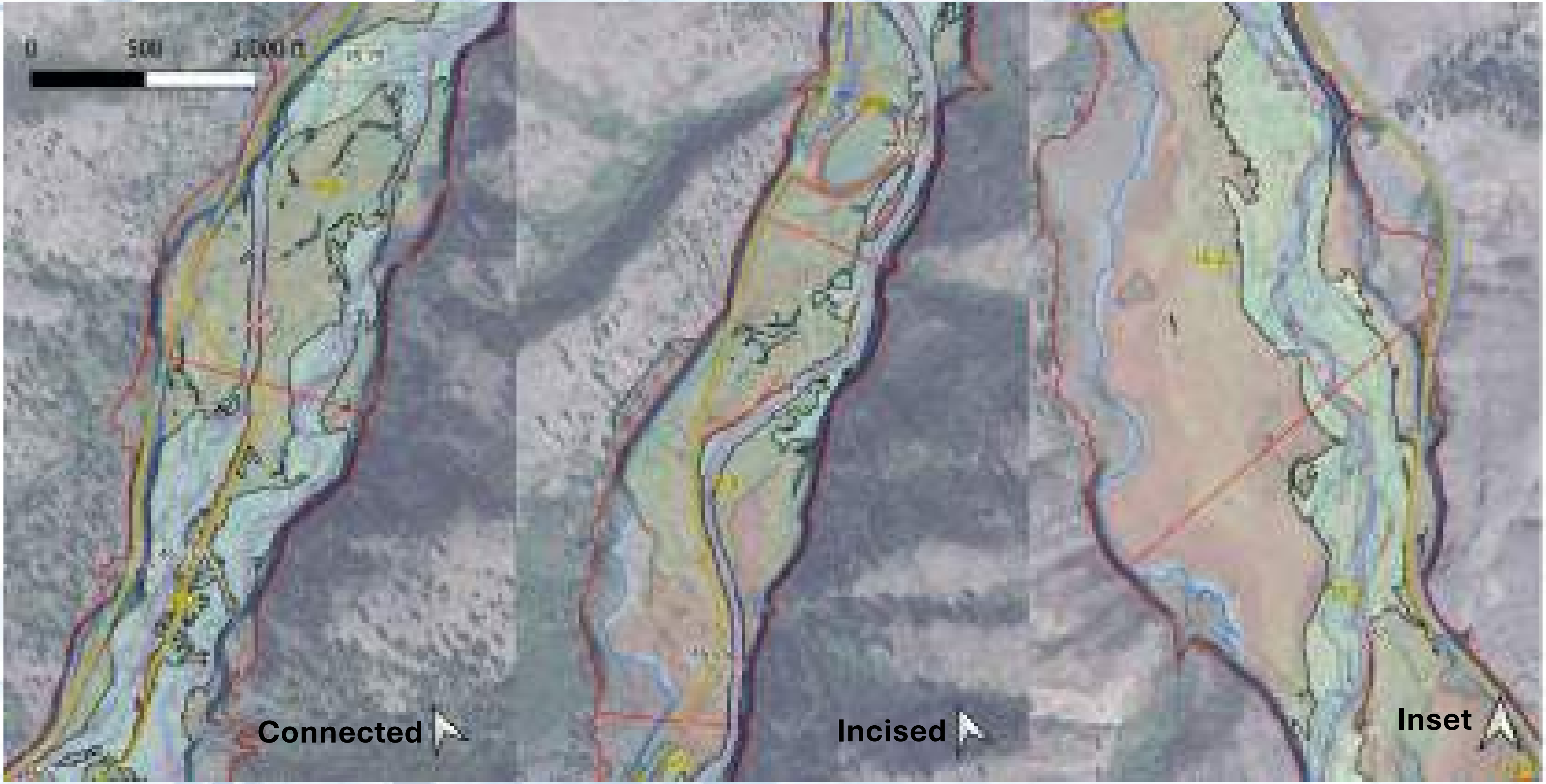
- We used cross-section-based approach to relate land use/connectivity to floodplain width
- Generated at 15-foot spacing along the 2017 valley centerline
- Clipped to only assess areas within 16-feet of the low flow WSE (this excludes features such as Pleistocene terraces and alluvial fans)

2. Map floodplain disconnection due to incision

- Based on aerial imagery, REMs, and field observations. Active geomorphic features and presence of riparian vegetation were dominant factors.
- Close to the 10-year inundation extent from the 2021 Anchor report.



2. Map floodplain disconnection due to incision



3. Map floodplain disconnection due to infrastructure

- Infrastructure was prioritized as:

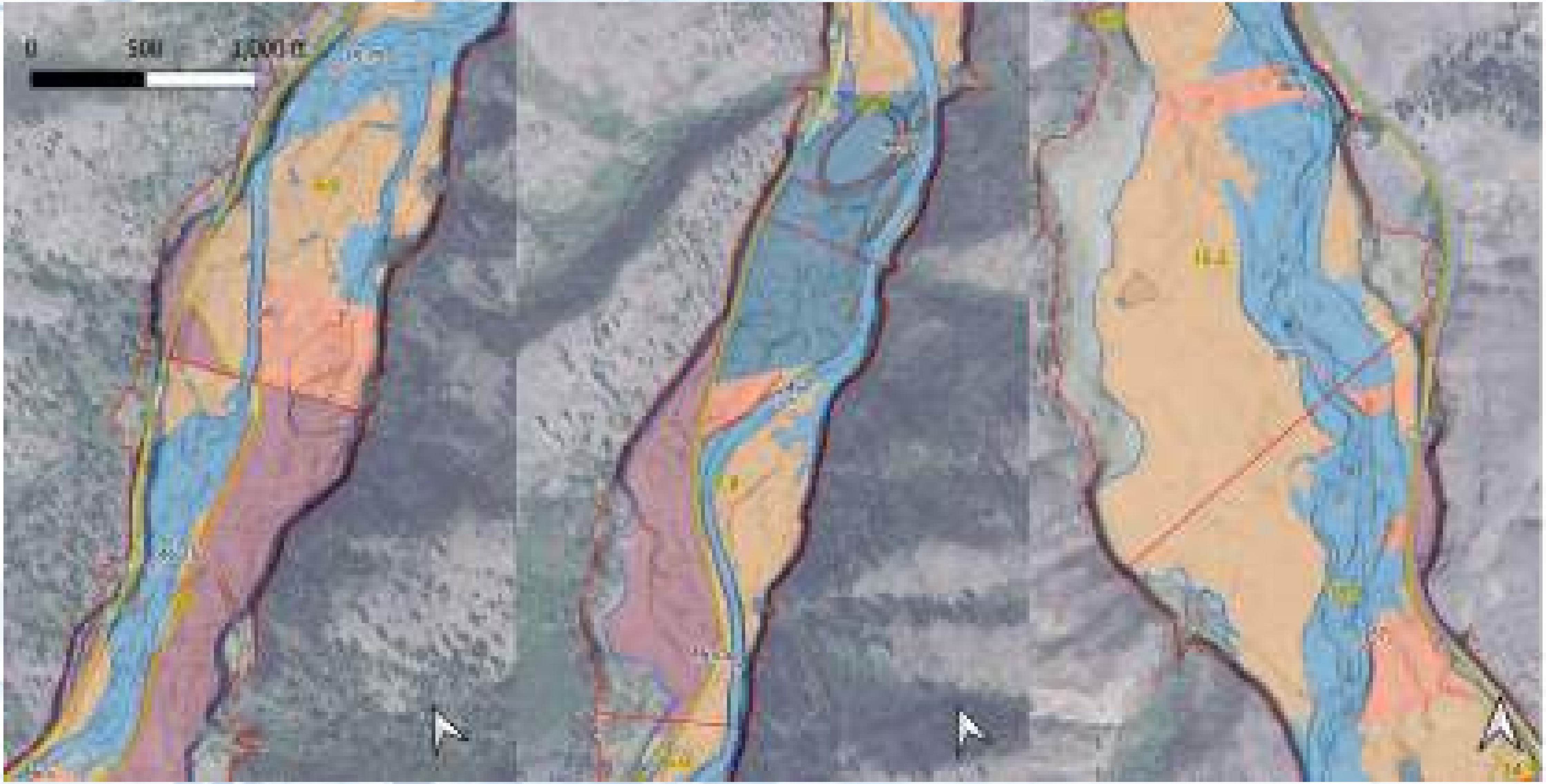
  lakes > roads > levees

- Lake influence was determined by the Zone of Influence from inlet to outlet.
- Levees and roads disconnected the floodplain laterally, orthogonal to the valley centerline

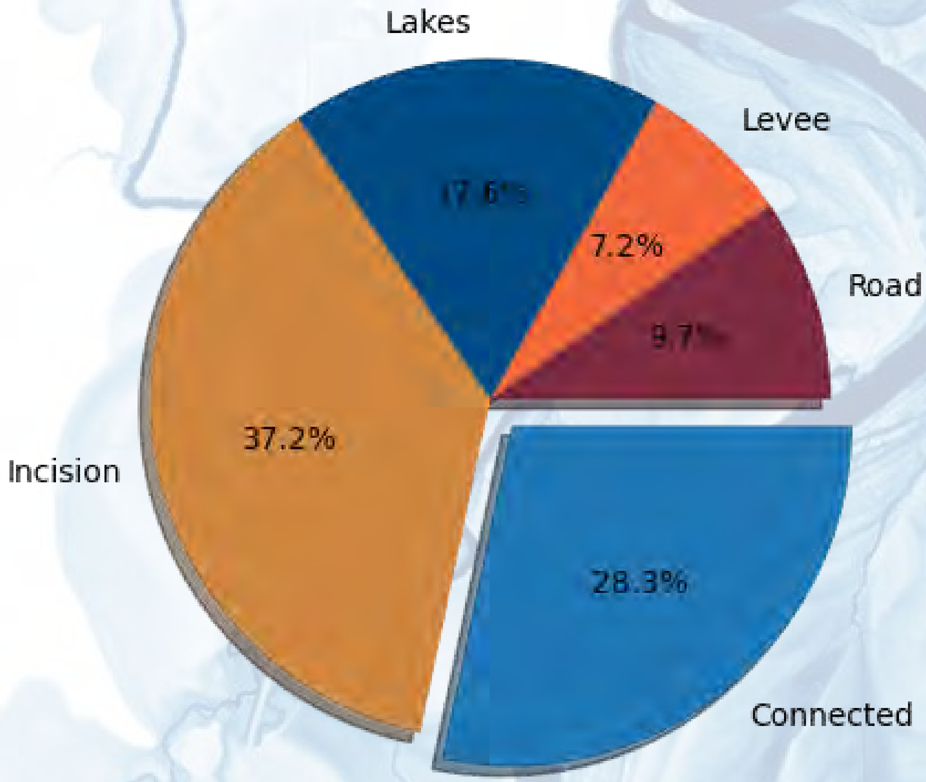
4. Measure (dis)connected width along cross-sections

- Regions within the lakes zone of influence, vertically disconnected floodplain, and/or behind roads/levees are deemed “disconnected”
- Infrastructure is prioritized over vertical incision
- The portions of the cross-sections left are deemed “connected”

5. Floodplain Mapping Results

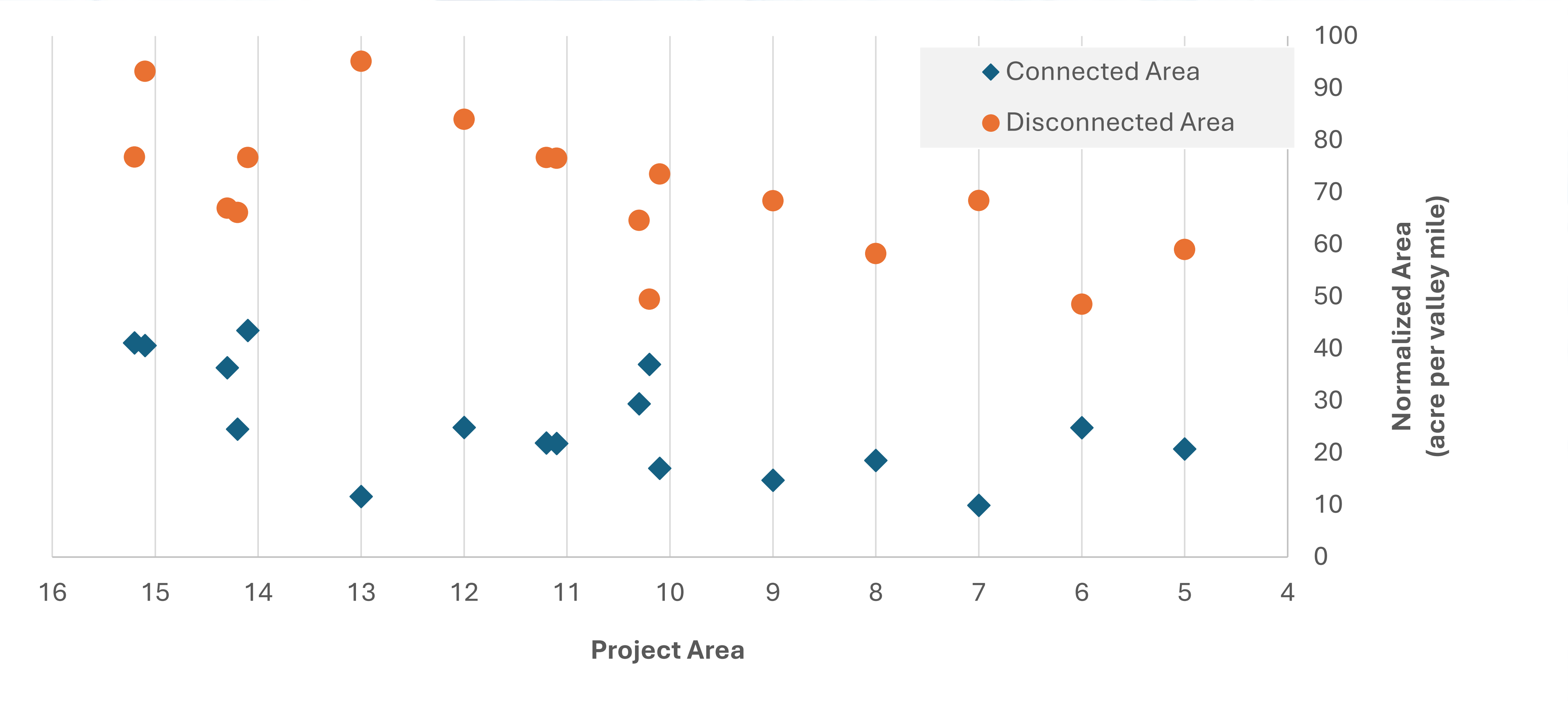


5. Floodplain Mapping Results



Project Area	Average Connected Width (ft)	Dominant Disconnecting Mechanism	
		Total Floodplain	300-ft Minimum Swath
15.2	330	Incision	Levees
15.1	328	Incision	Levees
14.3	318	Incision	Incision
14.2	185	Incision	Incision
14.1	371	Incision	Incision
13	95	Lakes (Rainbow)	Lakes (Rainbow)
12	207	Incision	Incision
11.2	180	Incision	Incision
11.1	181	Lakes (Watson/Beaver)	Lakes (Watson/Beaver)
10.3	245	Incision	Incision
10.2	298	Incision	Levees
10.1	143	Lakes (Big Four)	Lakes (Big Four)
9	125	Lakes (Big Four)	Lakes (Big Four)
8	152	Lakes (Curl)	Lakes (Curl)
7	83	Roads	Incision
6	205	Incision	Incision
5	171	Roads	Incision

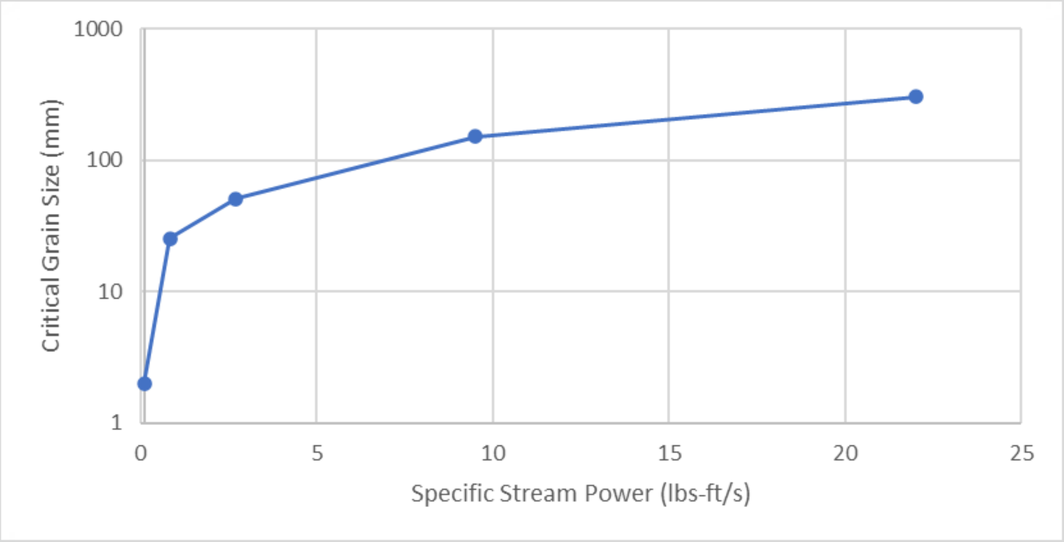
5. Floodplain Mapping Results



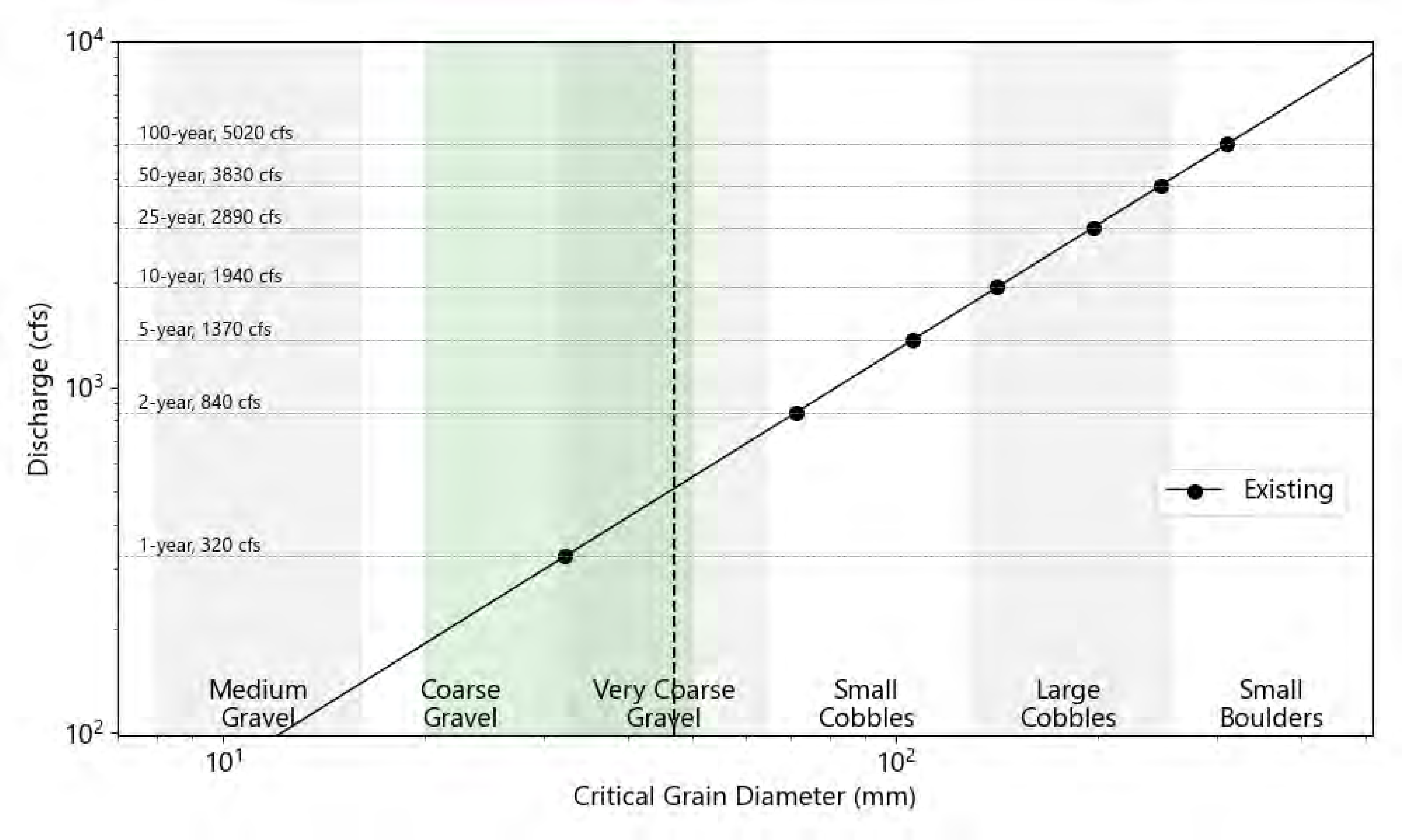
6. Stream Power Methods

- We calculated specific stream power for the 1- to 100-year flows using our mapped floodplain widths
- Specific stream power was related to critical grain size using empirical values (Fischenich 2001)
- We assessed changes in stream power/critical grain size using the mapped disconnected floodplain width

$$Specific\ Stream\ Power = \frac{\rho g Q S}{width}$$



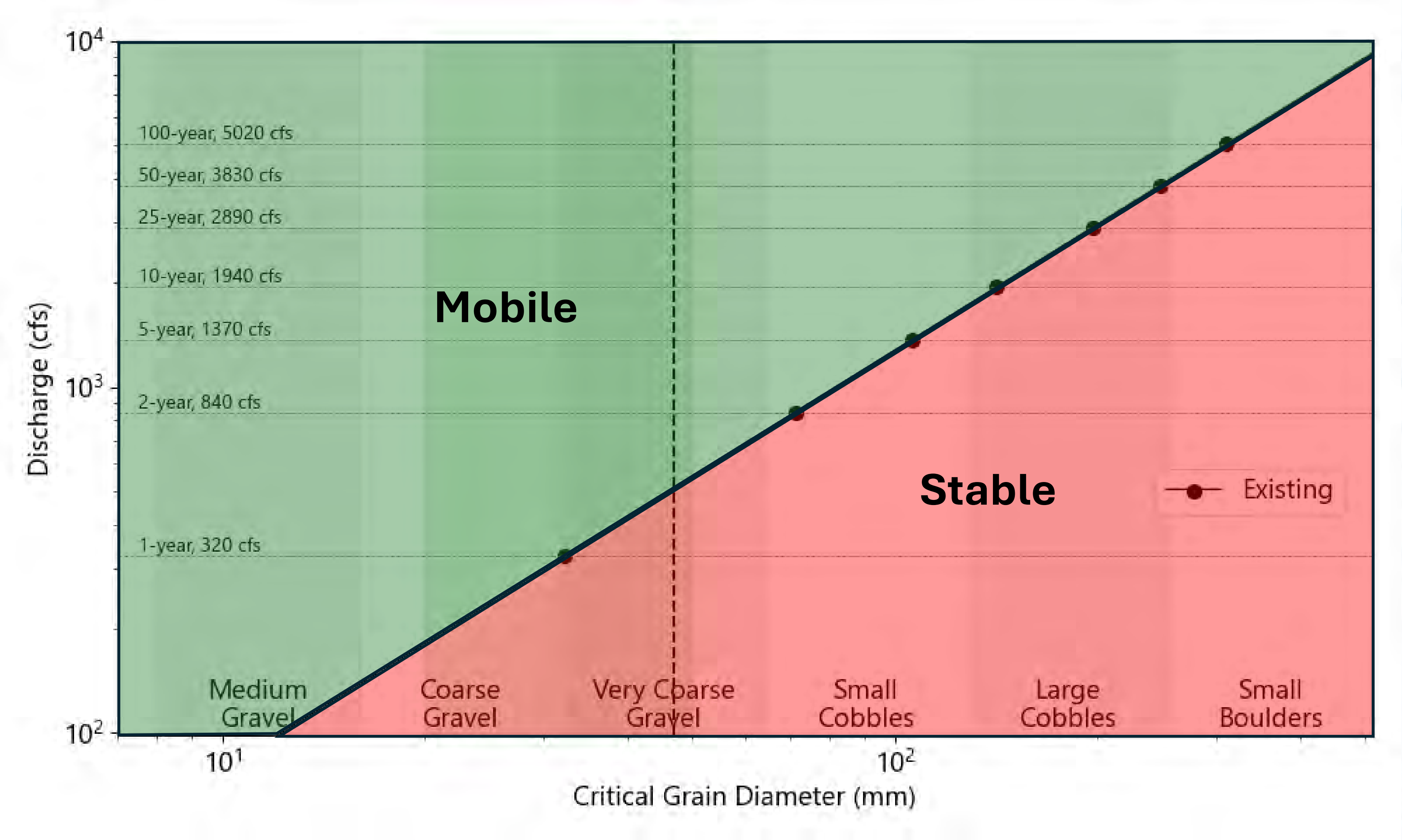
6. Stream Power Methods



Shaded green area is the preferred spawning gravel size of Chinook and Steelhead.

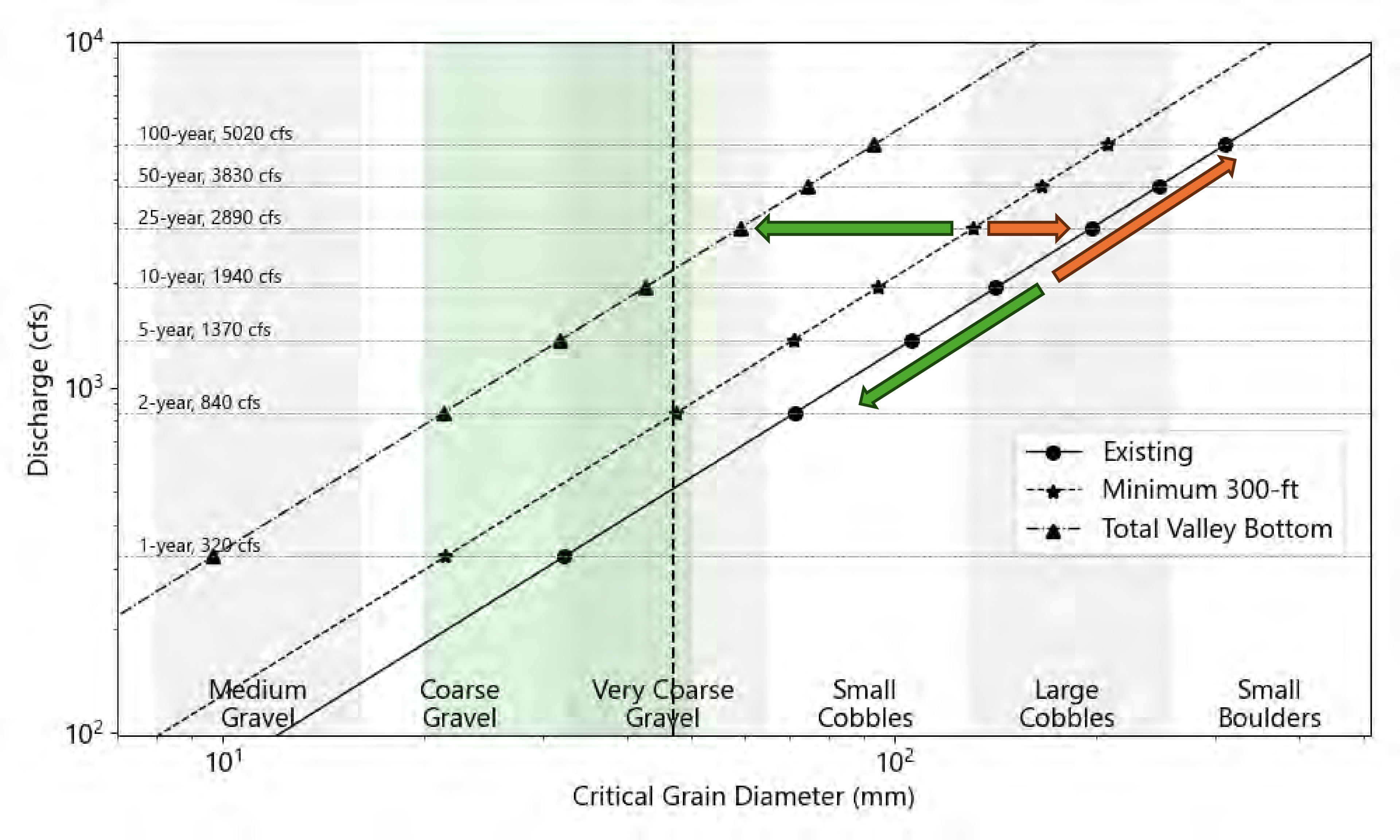
Vertical dashed line is the project reach D50.

6. Stream Power Methods



Area (i.e. grain sizes) to the left of the line are mobile at a given flow, while grain sizes to the right are stable.

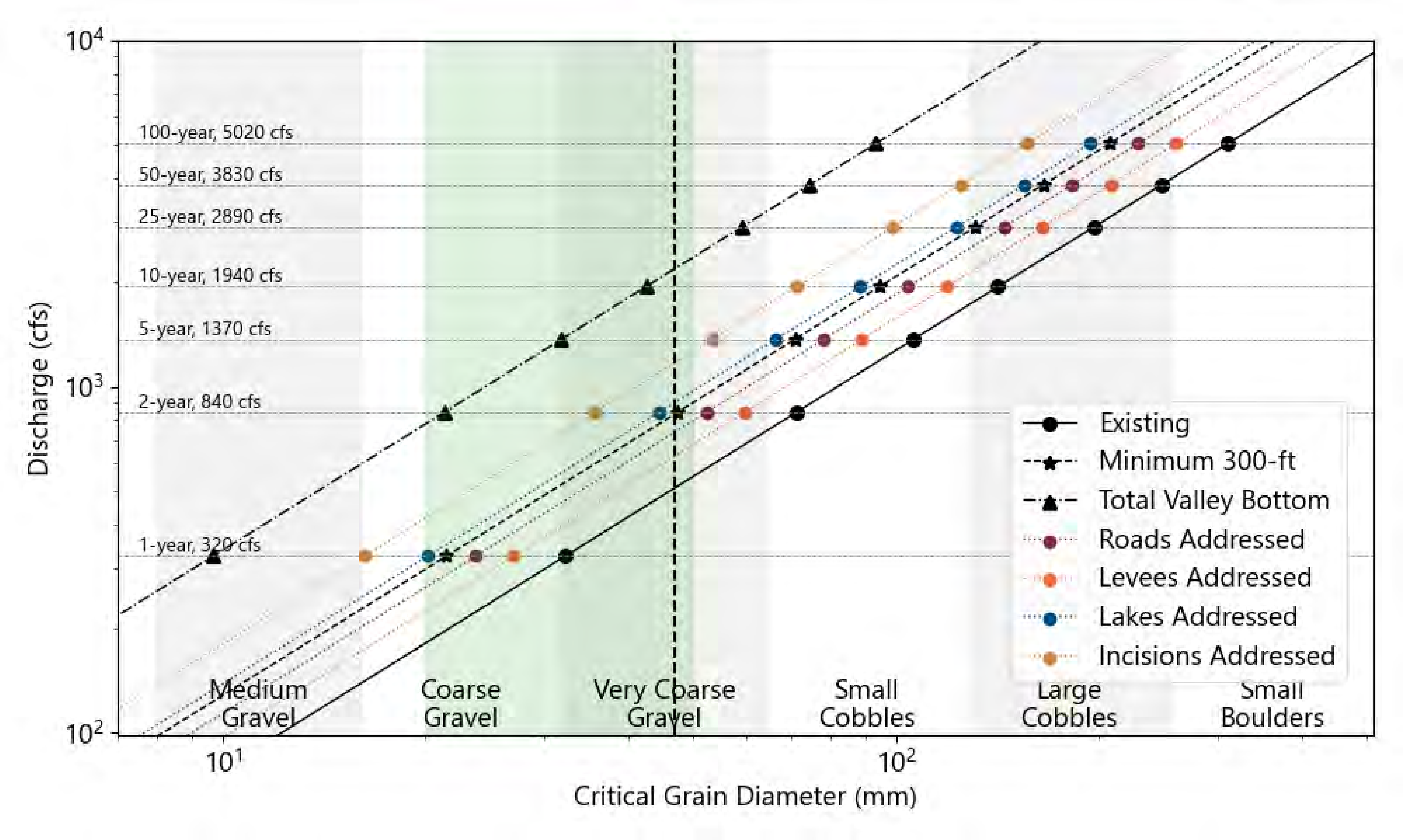
6. Stream Power Methods



Changing floodplain width shifts the line horizontally.

Changing hydrology shifts the points obliquely along the line.

6. Stream Power Results



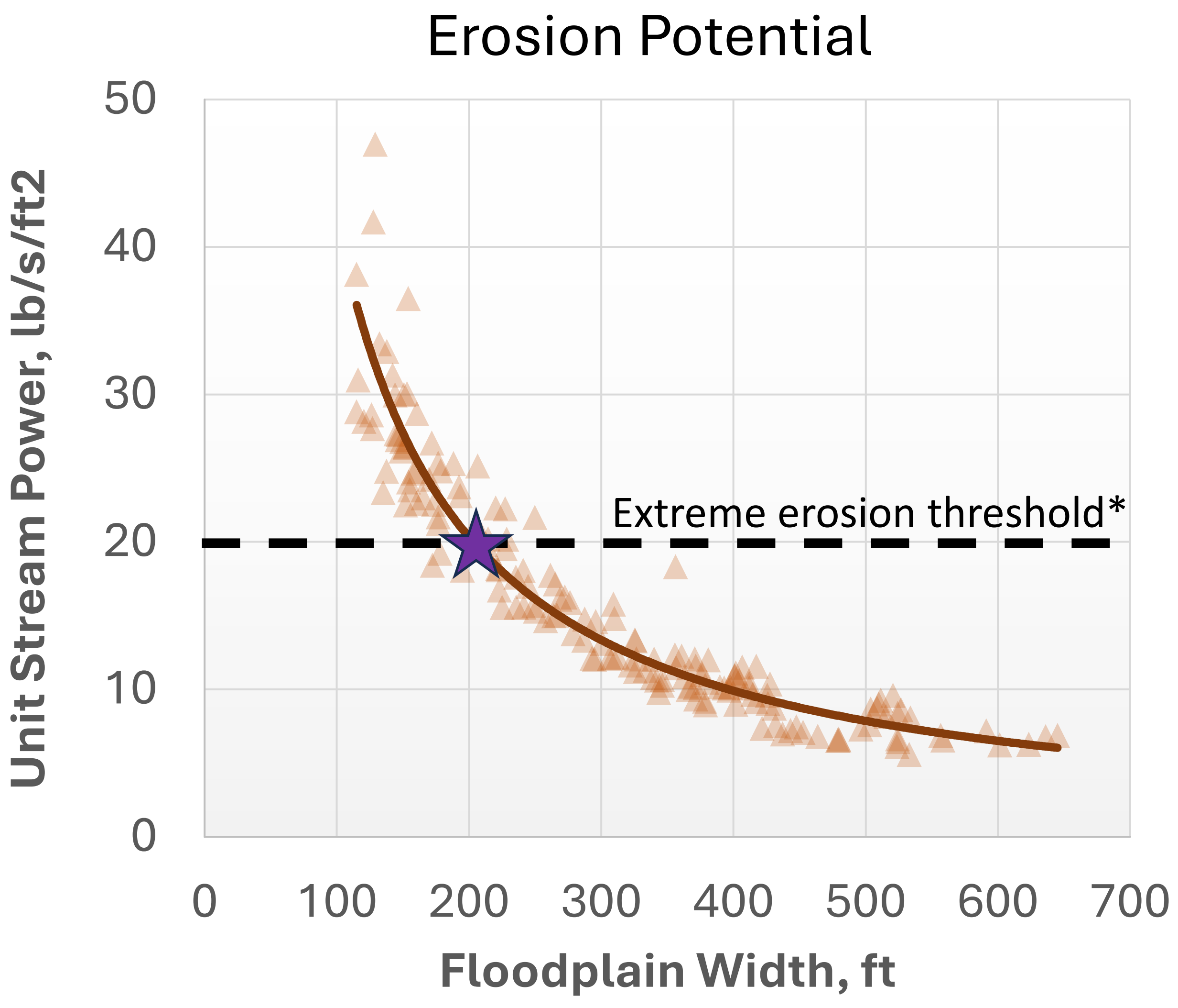
Shaded green area is the preferred spawning gravel size of Chinook and Steelhead.

Vertical dashed line is the project reach D50.

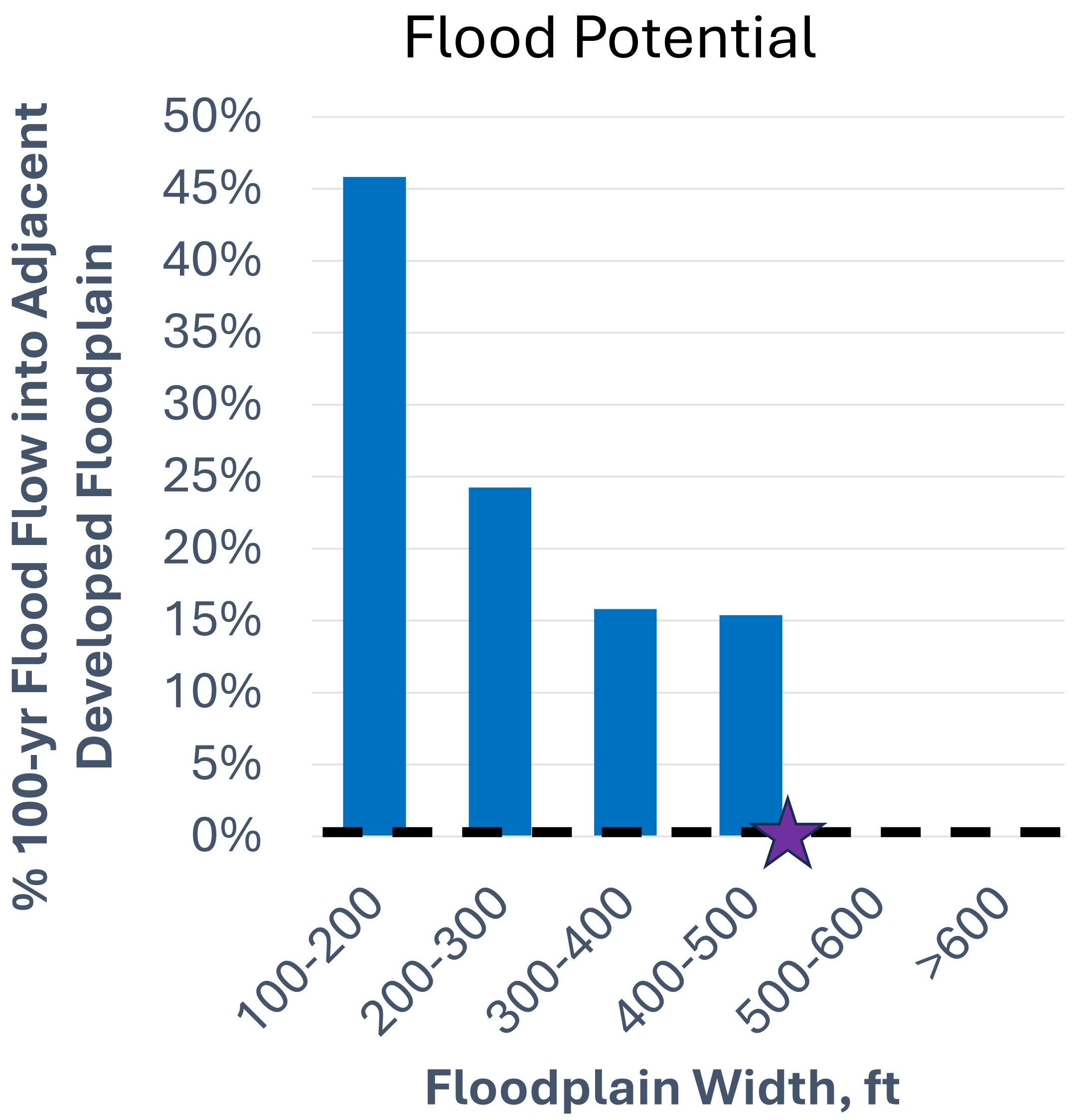
6. Stream Power Results

Project Area	Connected Floodplain			Levee Removal			Lake Removal			Road Removal			Incision Addressed			Total Floodplain		
	Width	ω	D_c	Width	ω	D_c	Width	ω	D_c	Width	ω	D_c	Width	ω	D_c	Width	ω	D_c
5	171	✗4.3	79	204	✗3.6	68	171	✗4.3	79	530	✓1.4	31	269	✗2.7	54	660	✓1.1	26
6	205	✗3.6	68	275	✗2.7	54	205	✗3.6	68	241	✗3.1	60	498	✓1.5	33	605	✓1.2	28
7	83	✗7.9	131	105	✗6.2	107	228	✗2.9	56	305	✓2.1	44	260	✗2.5	51	652	✓1.0	24
8	152	✗3.9	73	276	✓2.1	44	340	✓1.7	37	162	✗3.6	69	307	✓1.9	41	628	✓0.9	22
9	125	✗6.2	107	125	✗6.2	107	620	✓1.3	28	156	✗5.0	89	210	✗3.7	70	707	✓1.1	26
10.1	143	✗5.6	99	143	✗5.6	99	565	✓1.4	32	151	✗5.3	94	328	✗2.5	50	758	✓1.1	25
10.2	298	✓2.1	44	416	✓1.5	33	320	✓2.0	41	312	✓2.0	42	540	✓1.2	27	695	✓0.9	22
10.3	245	✗3.2	61	245	✗3.2	61	245	✗3.2	61	251	✗3.1	60	776	✓1.0	24	784	✓1.0	23
11.1	181	✗3.6	69	182	✗3.6	69	529	✓1.2	28	312	✓2.1	44	337	✓2.0	41	817	✓0.8	20
11.2	180	✗3.6	69	197	✗3.3	64	346	✓1.9	40	274	✗2.4	49	531	✓1.2	28	809	✓0.8	20
12	207	✗3.3	63	215	✗3.2	61	419	✓1.6	35	240	✗2.8	56	652	✓1.0	24	906	✓0.7	19
13	95	✗6.7	115	300	✓2.1	44	514	✓1.3	29	166	✗3.9	73	237	✗2.7	54	876	✓0.7	18
14.1	371	✓1.8	39	499	✓1.4	31	398	✓1.7	37	605	✓1.1	26	665	✓1.0	24	1027	✓0.7	17
14.2	185	✗3.5	67	198	✗3.3	63	210	✗3.1	60	391	✓1.7	36	464	✓1.4	31	683	✓0.9	23
14.3	318	✓2.1	43	322	✓2.0	43	356	✓1.9	39	366	✓1.8	38	826	✓0.8	20	905	✓0.7	18
15.1	328	✓2.2	46	444	✓1.7	36	331	✓2.2	46	377	✓2.0	41	916	✓0.8	20	1083	✓0.7	17
15.2	330	✓1.8	38	424	✓1.4	31	330	✓1.8	38	333	✓1.8	38	849	✓0.7	18	946	✓0.6	16

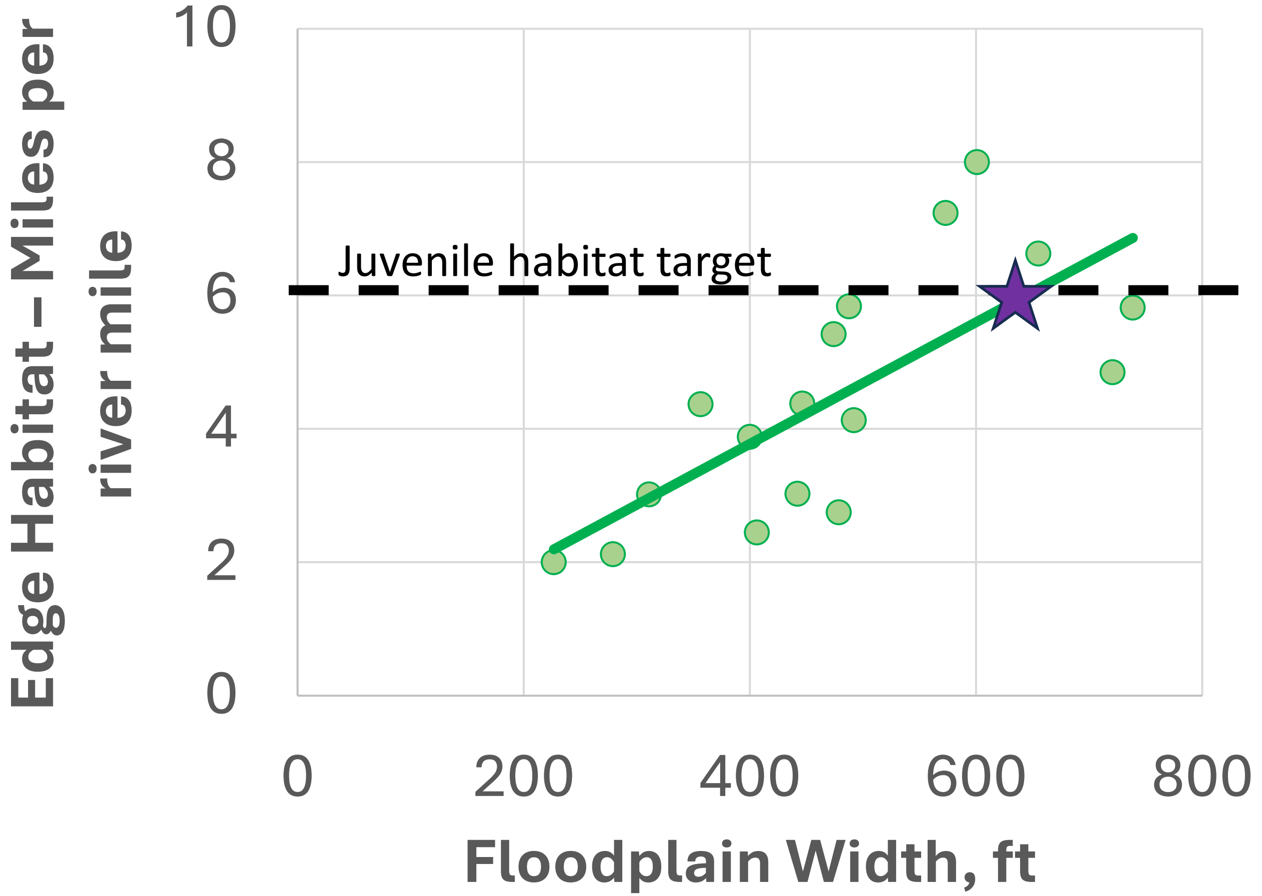
Benefits Curves: Wider Floodplains Reduce Erosion and Flood Risk (100-yr Flood)



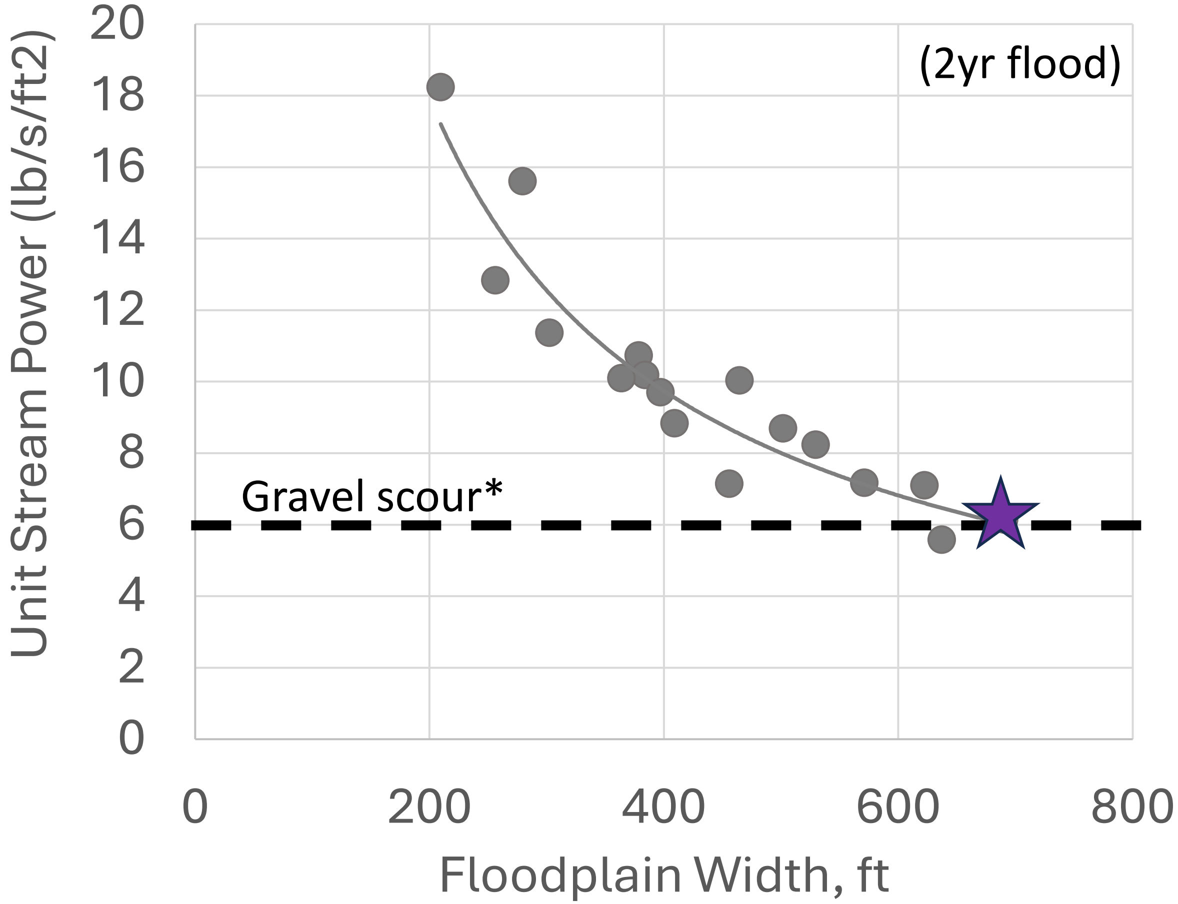
*Magilligan, 1992



Benefits Curve: Juvenile Salmon Habitat Increases with Width

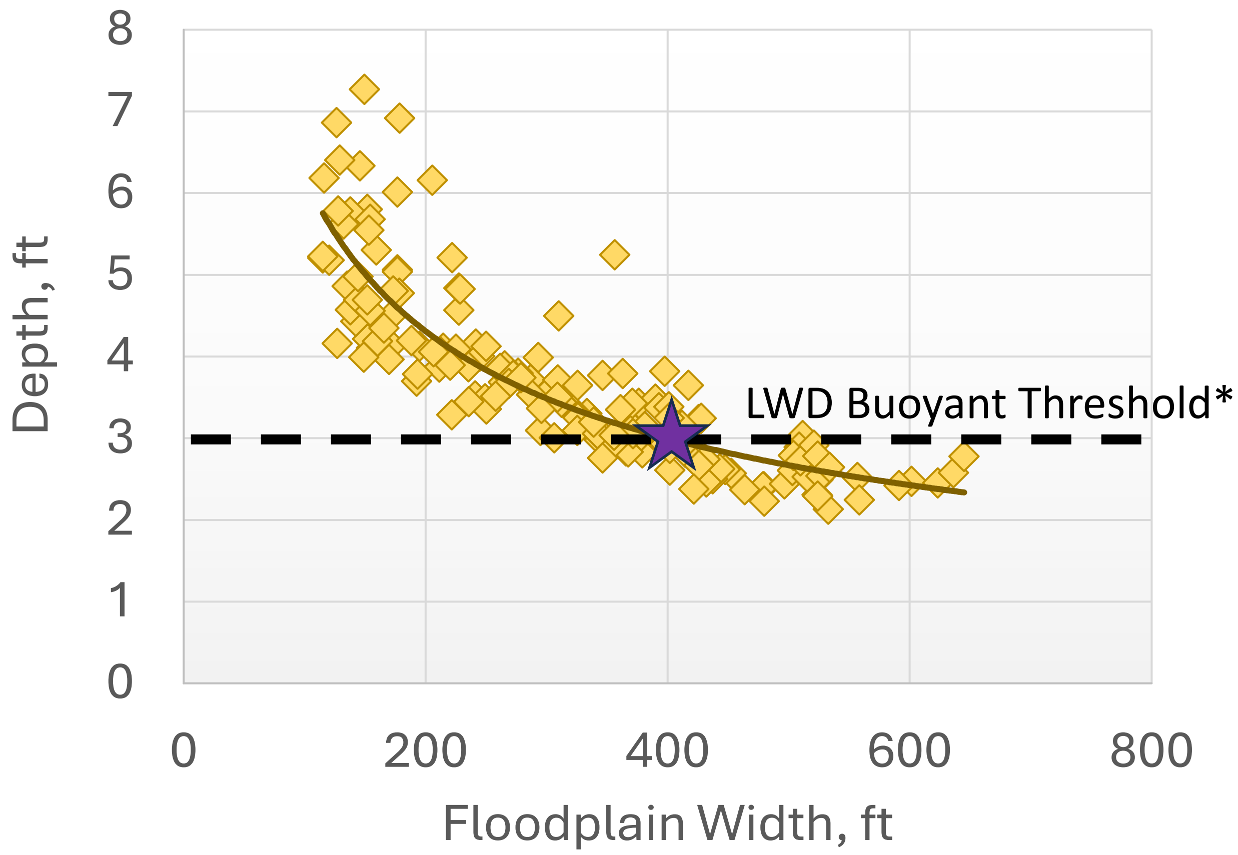


Benefits Curve: Spawning Gravel Retention Increases with Width



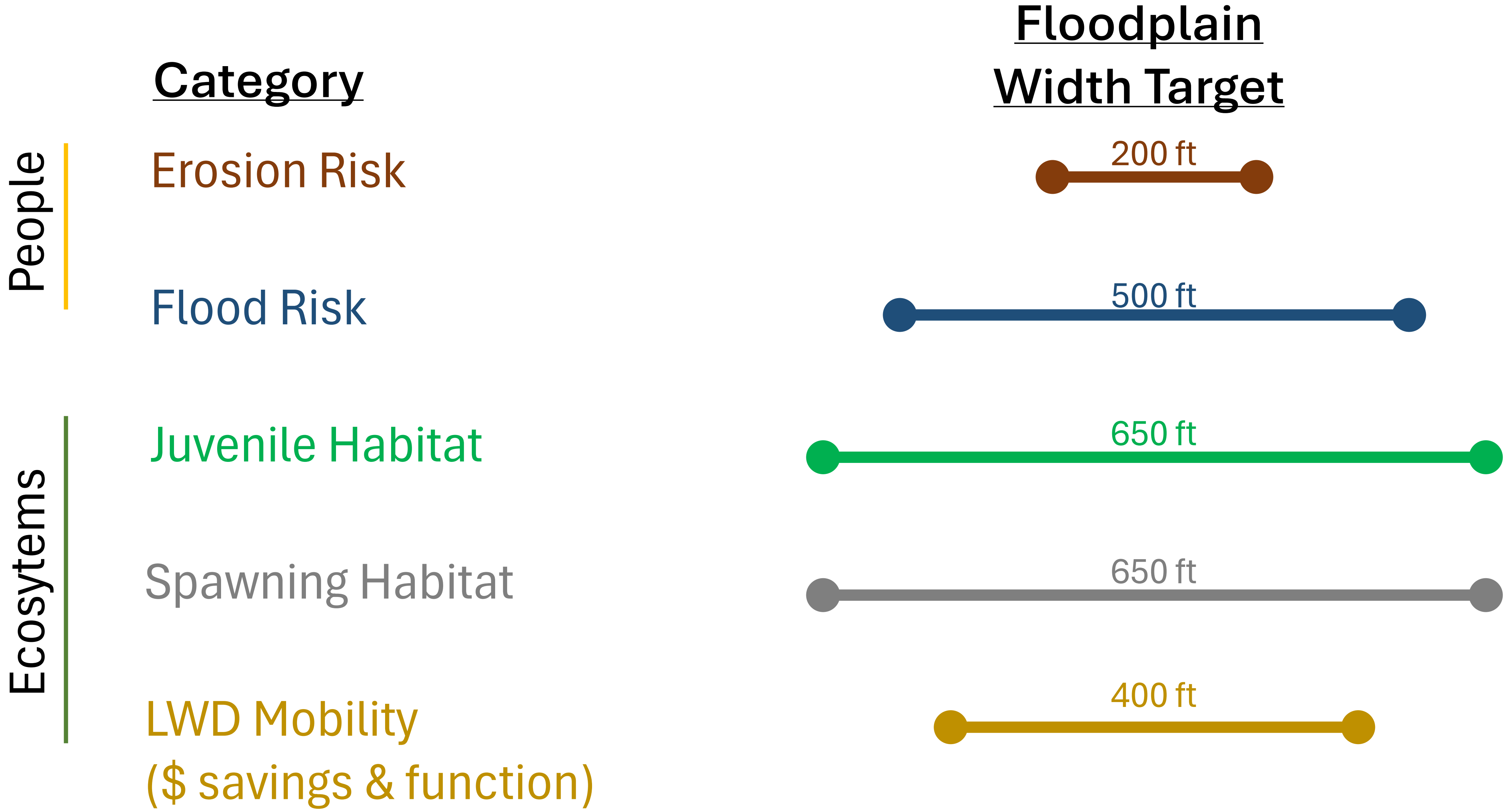
Petit 2005

Benefits Curve: Wood Mobility Decreases with Width (Saving Costs for Engineered LWD)

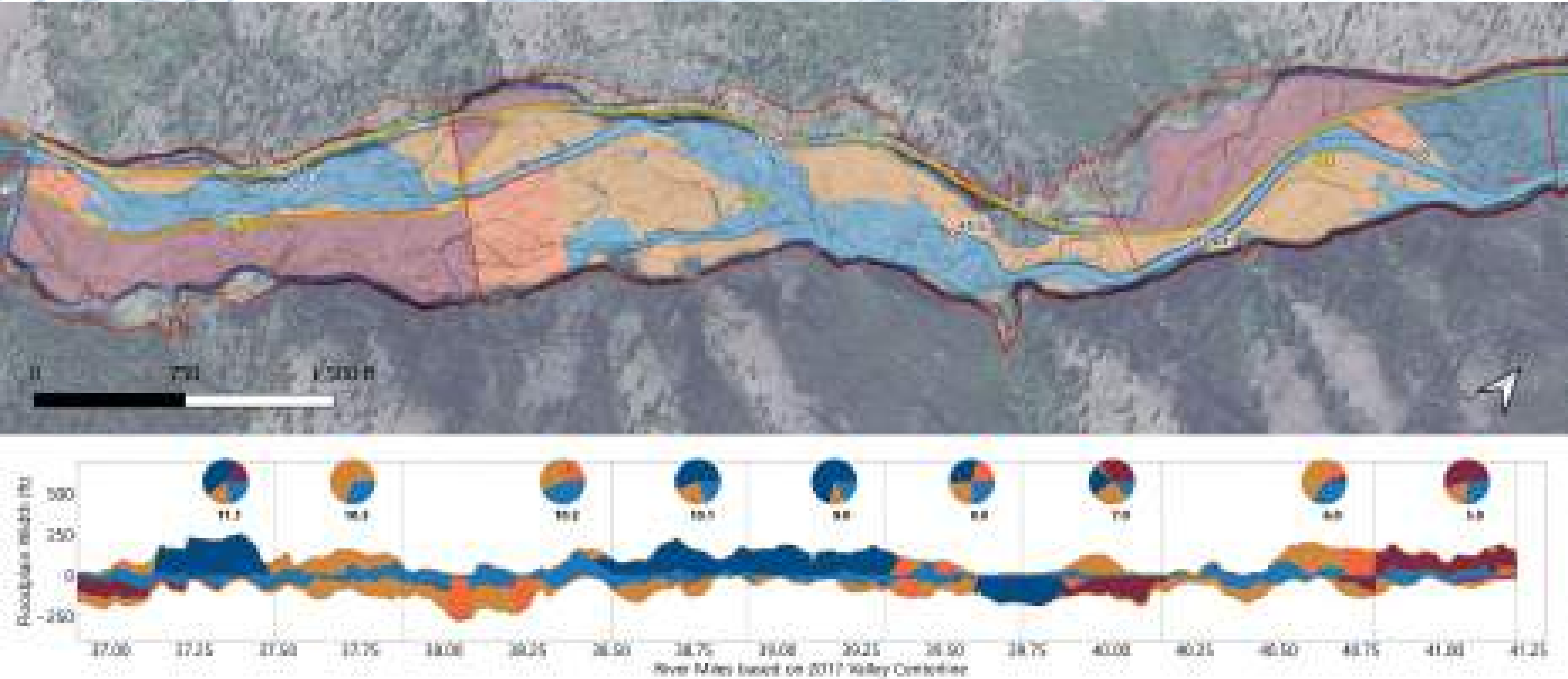


* Depends on stem diameter, tree species (density), and rootwad size –Braudrick and Grant (2000)

Floodplain Width: Common Currency for Integrated Floodplain Management



5. Floodplain Mapping Results



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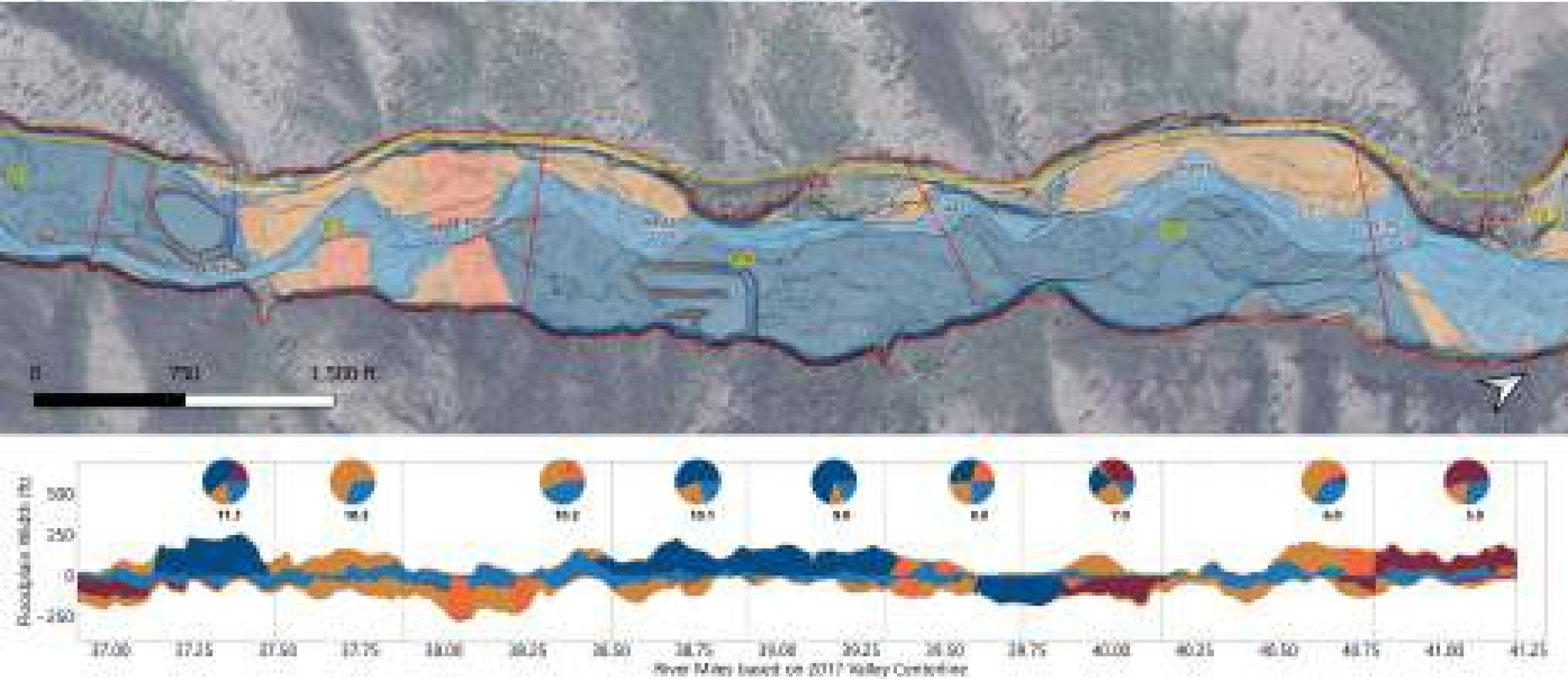

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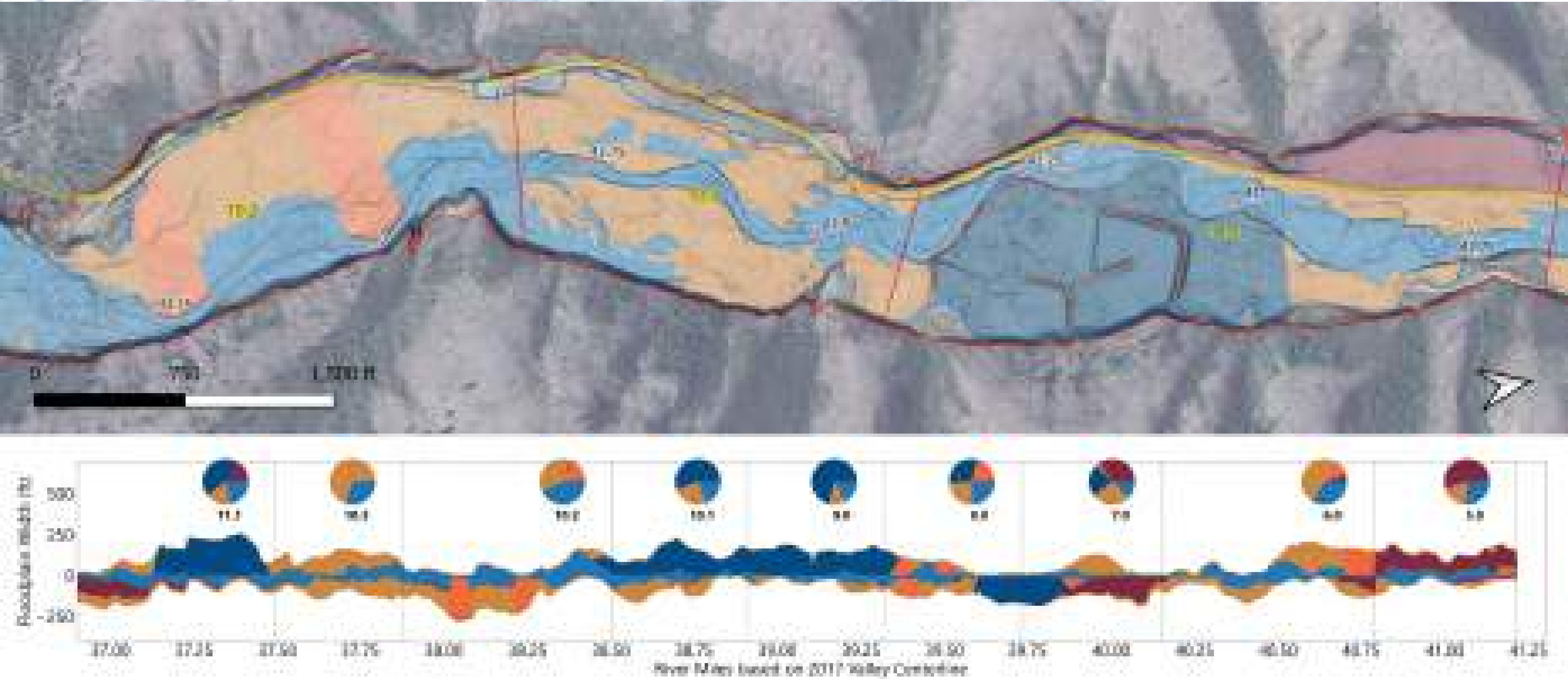

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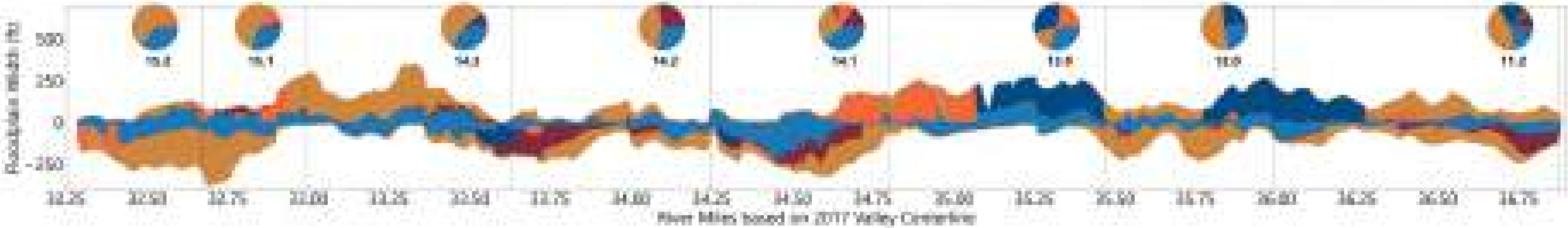

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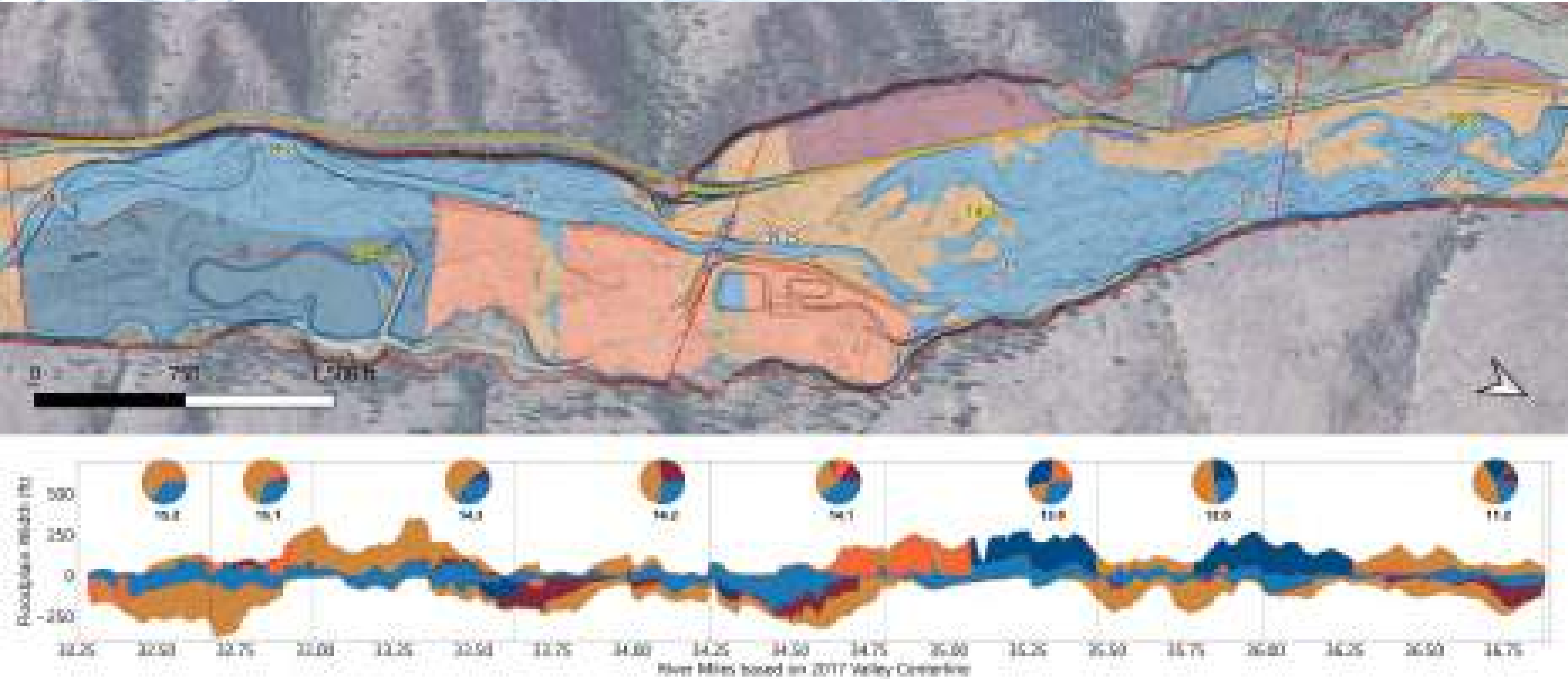

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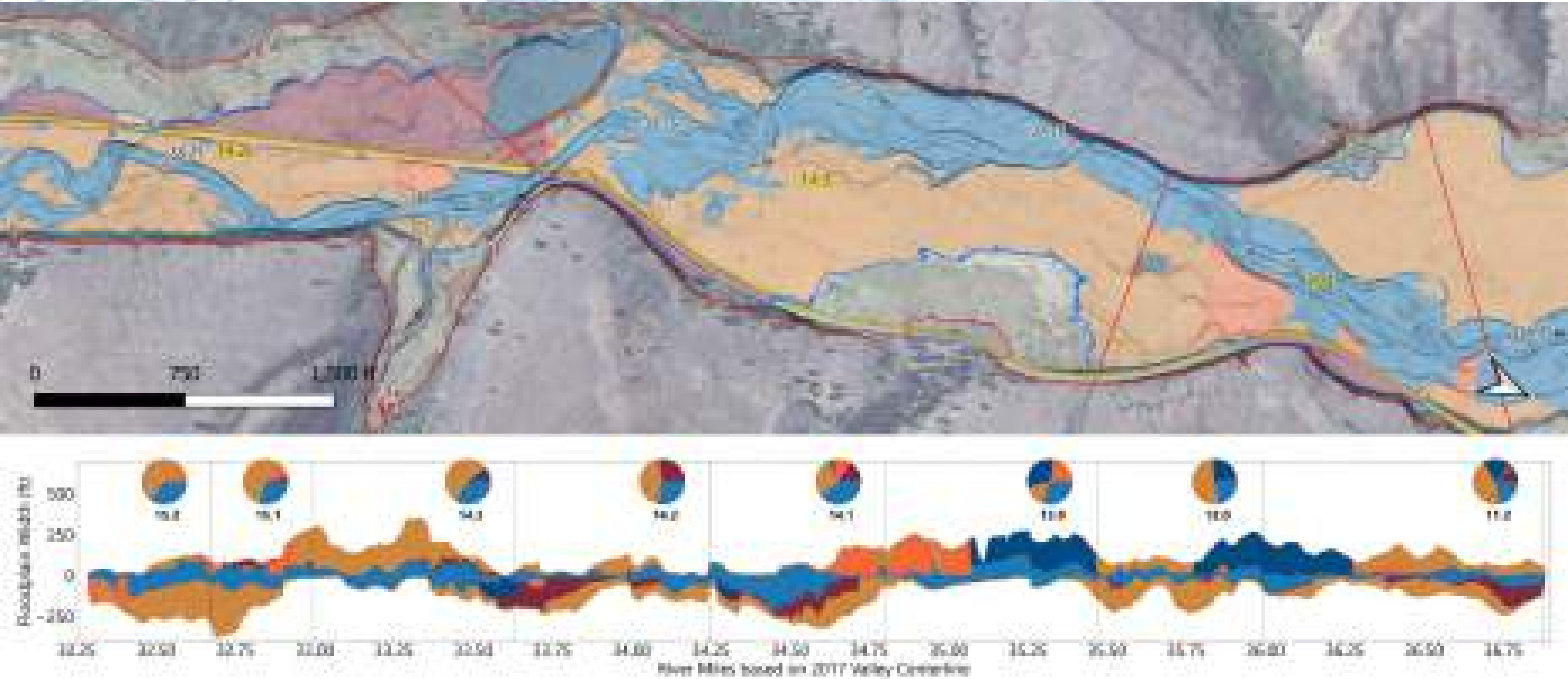

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