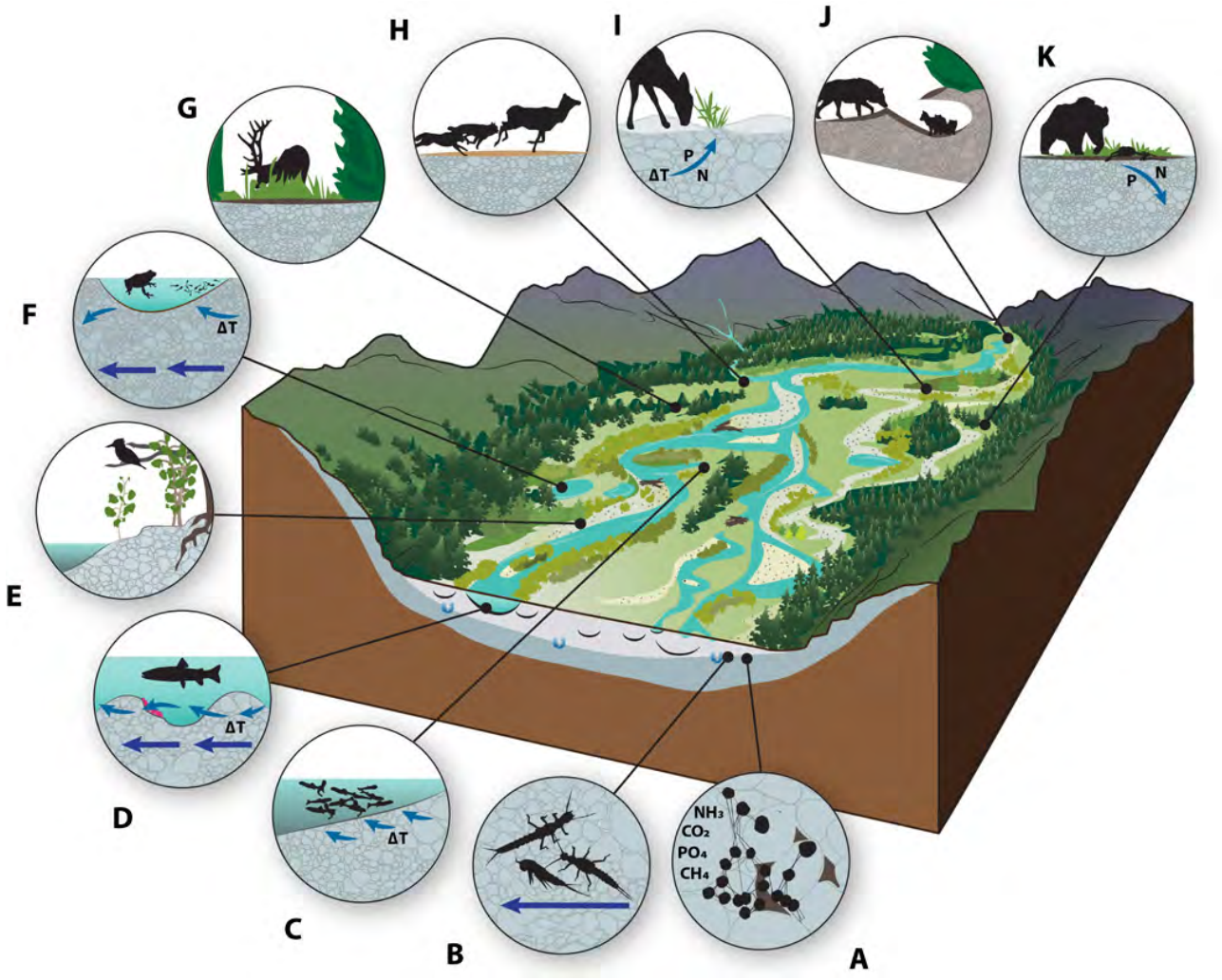
Because Bluelines Aren't Enough; Turning Brownfields Into Green Floodplains. CA Fish Passage Forum 8/9/2018

Blue-line vs green-field fish passage: the value of lateral access pathways to off-channel habitat.

Brian Cluer

NMFS WCR

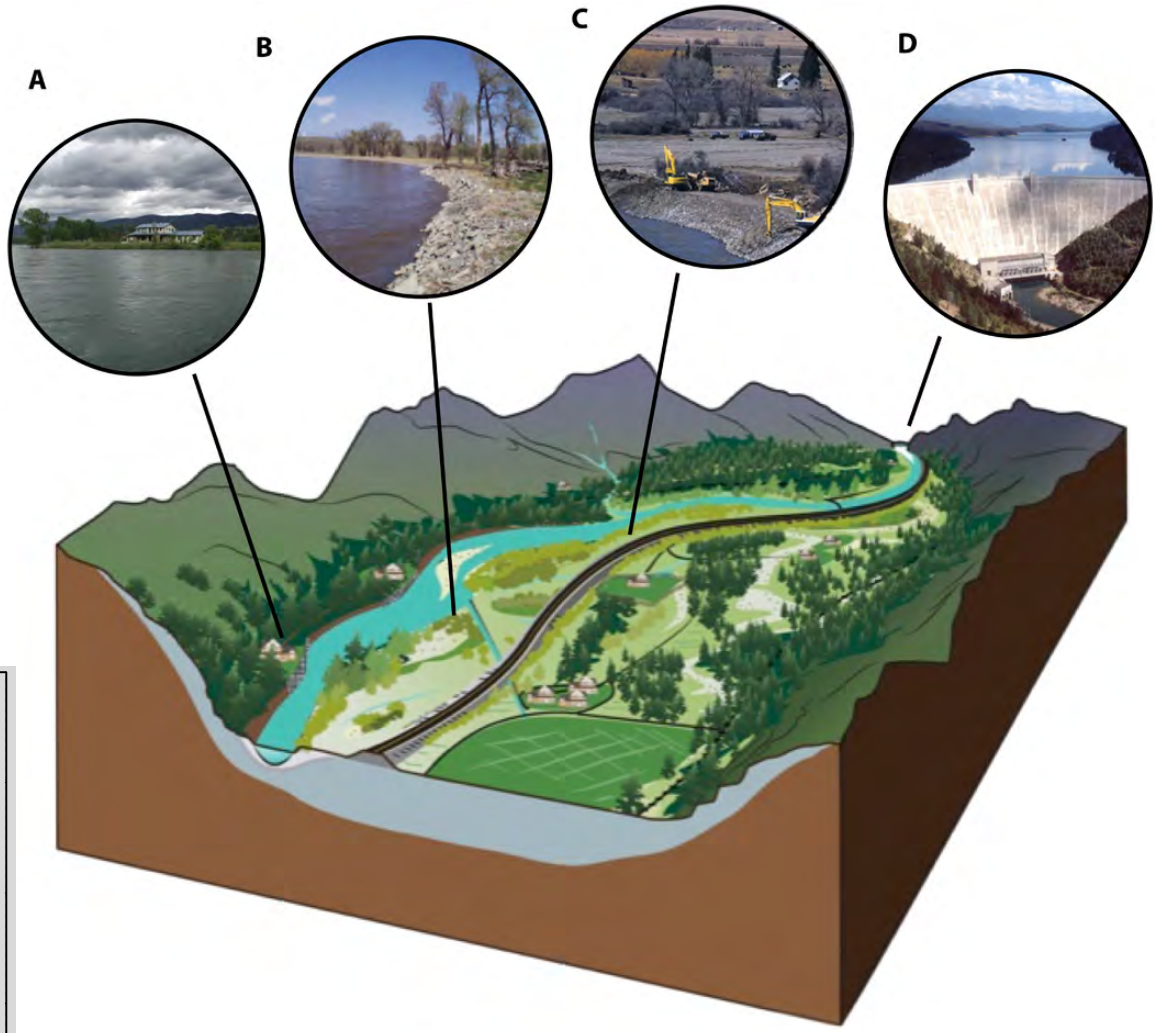
Fig. 5 The gravel-bed river floodplain as the ecological nexus of regional biodiversity.



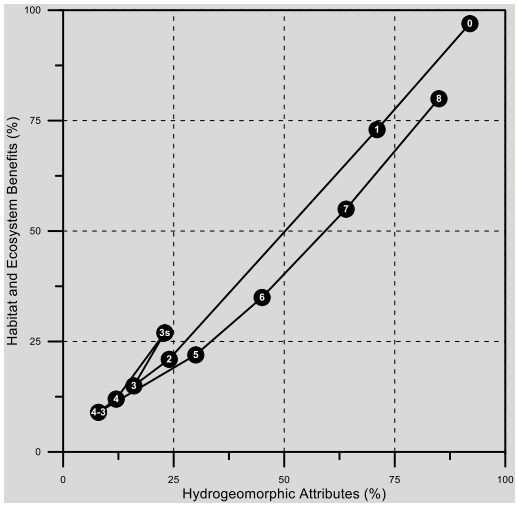
F. Richard Hauer et al. Sci Adv 2016;2:e1600026

Science Advances
AAAS

Fig. 6 The gravel-bed river floodplain as affected by human structures.



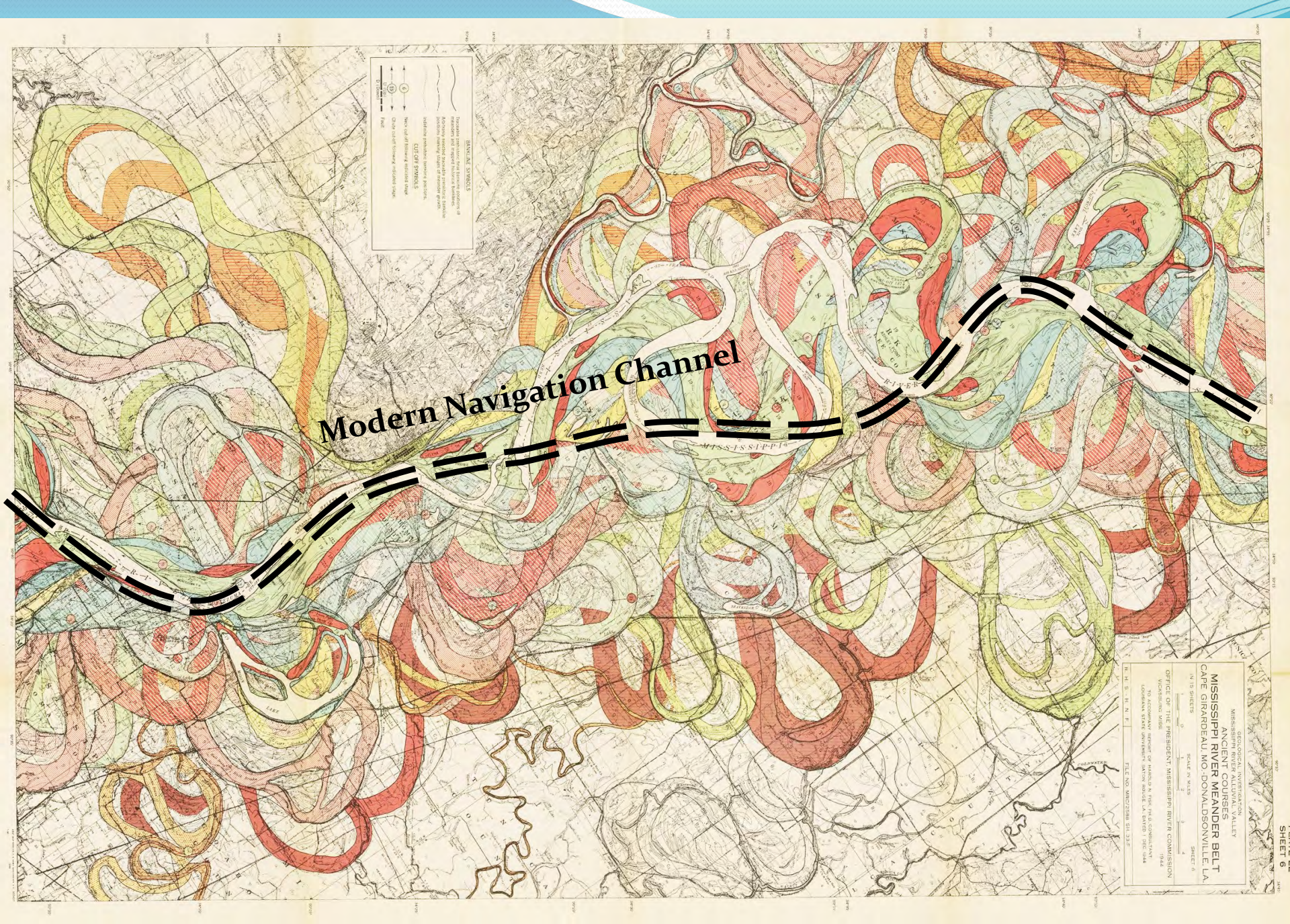
Cluer and Thorne 2013



F. Richard Hauer et al. Sci Adv 2016;2:e1600026

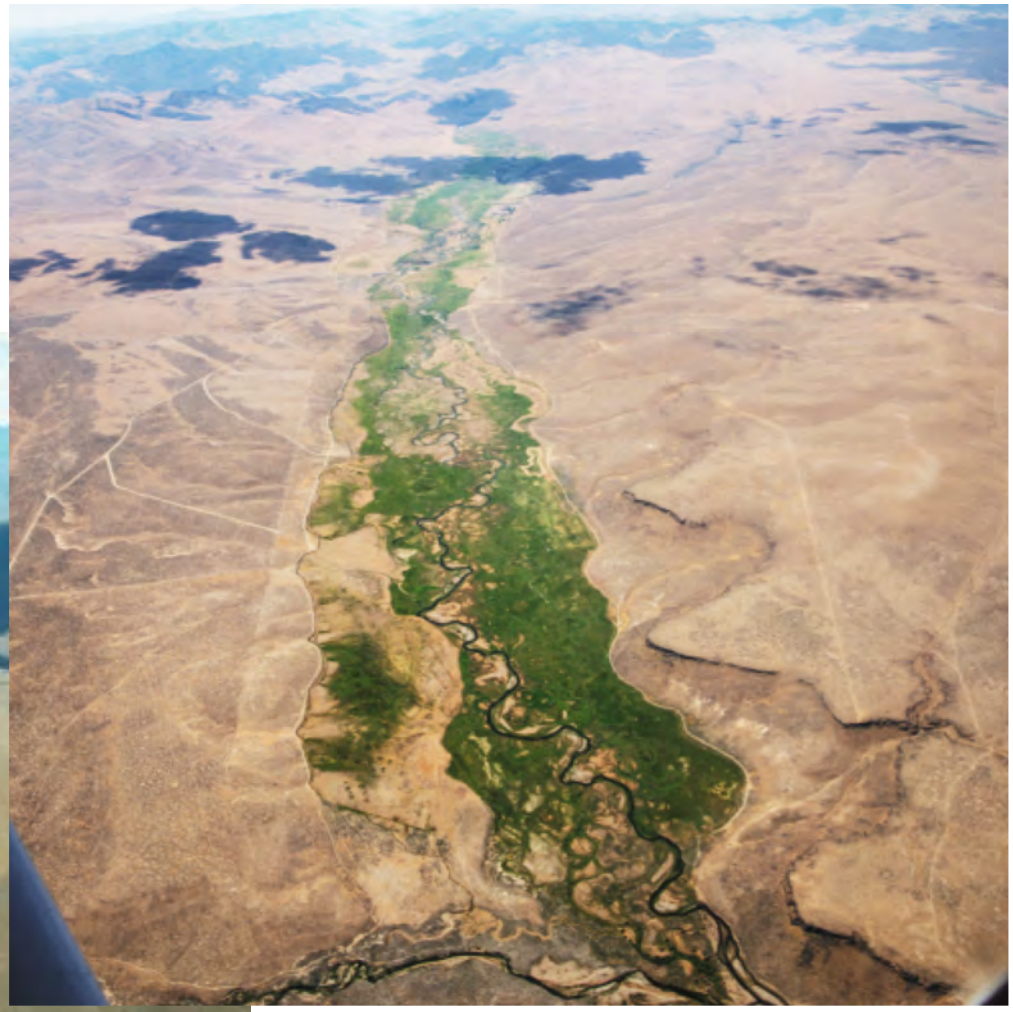
Published by AAAS

ScienceAdvances
AAAS



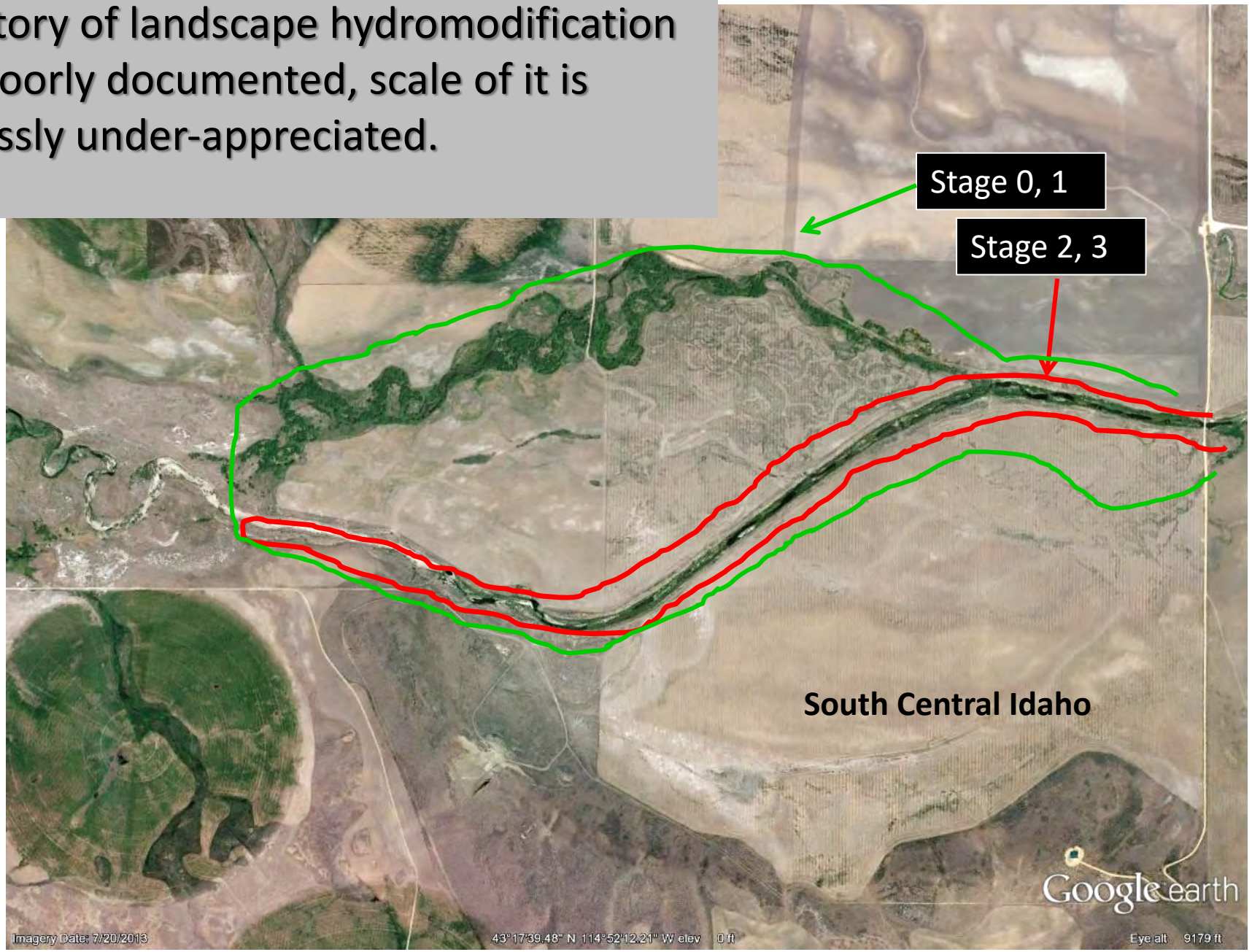
Fisk – COE - 1944

History of landscape hydromodification is poorly documented, scale of it is grossly under-appreciated.

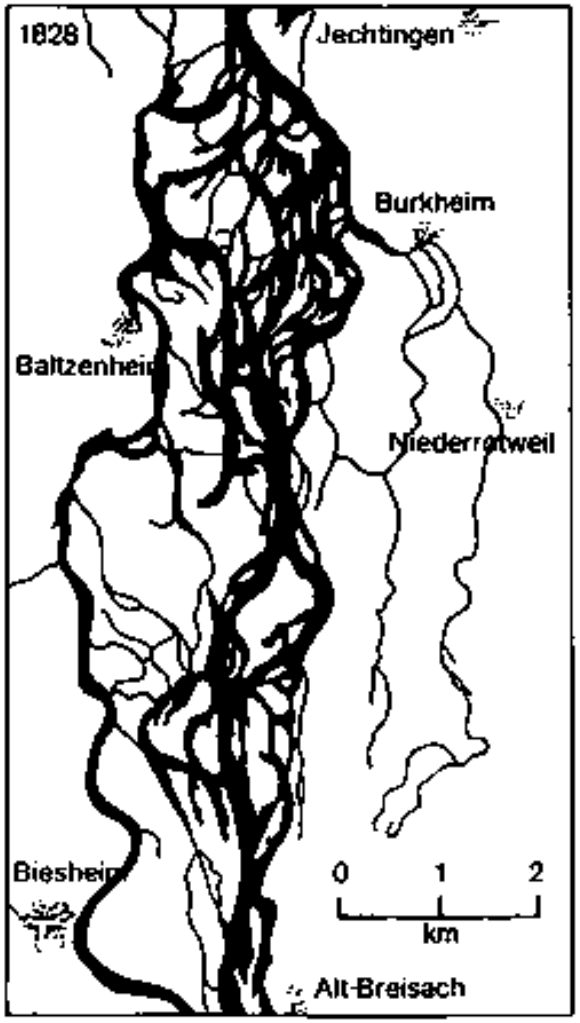


North Central Nevada
Edge of Arable Lands

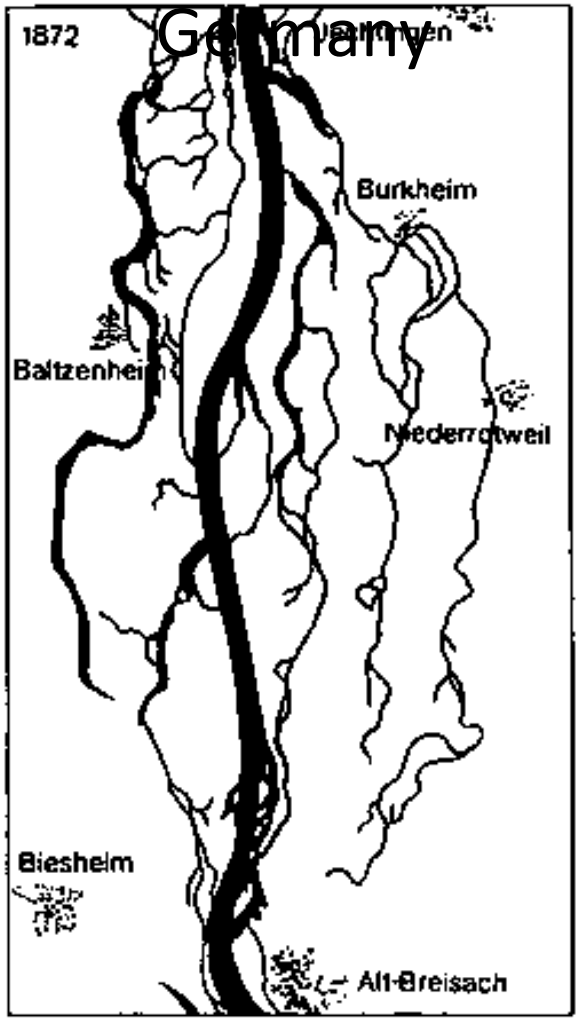
History of landscape hydromodification is poorly documented, scale of it is grossly under-appreciated.



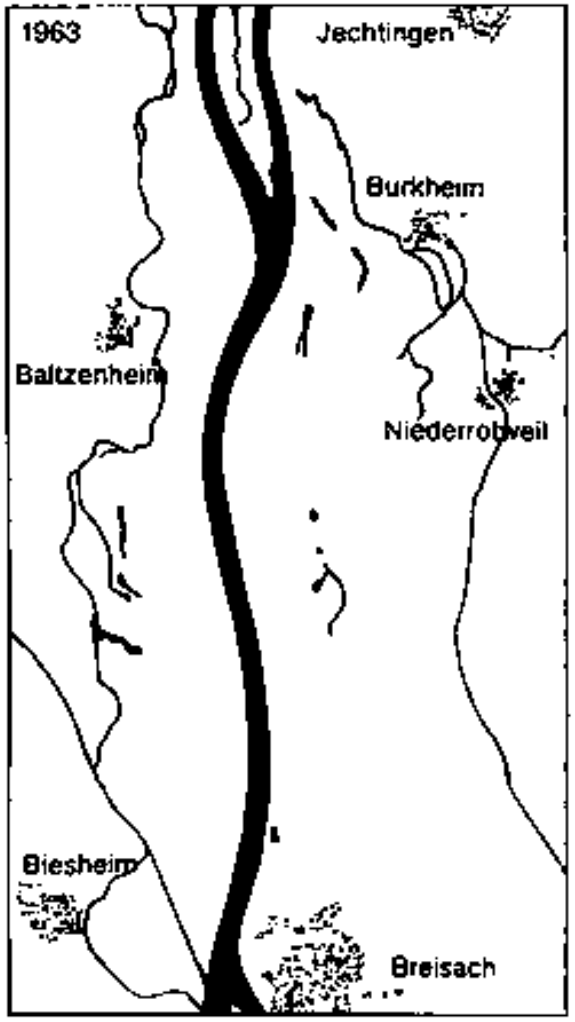
Evidence from Europe - Upper River Rhine at Breisach Germany



Anastomosed
1828 – Prior to river training



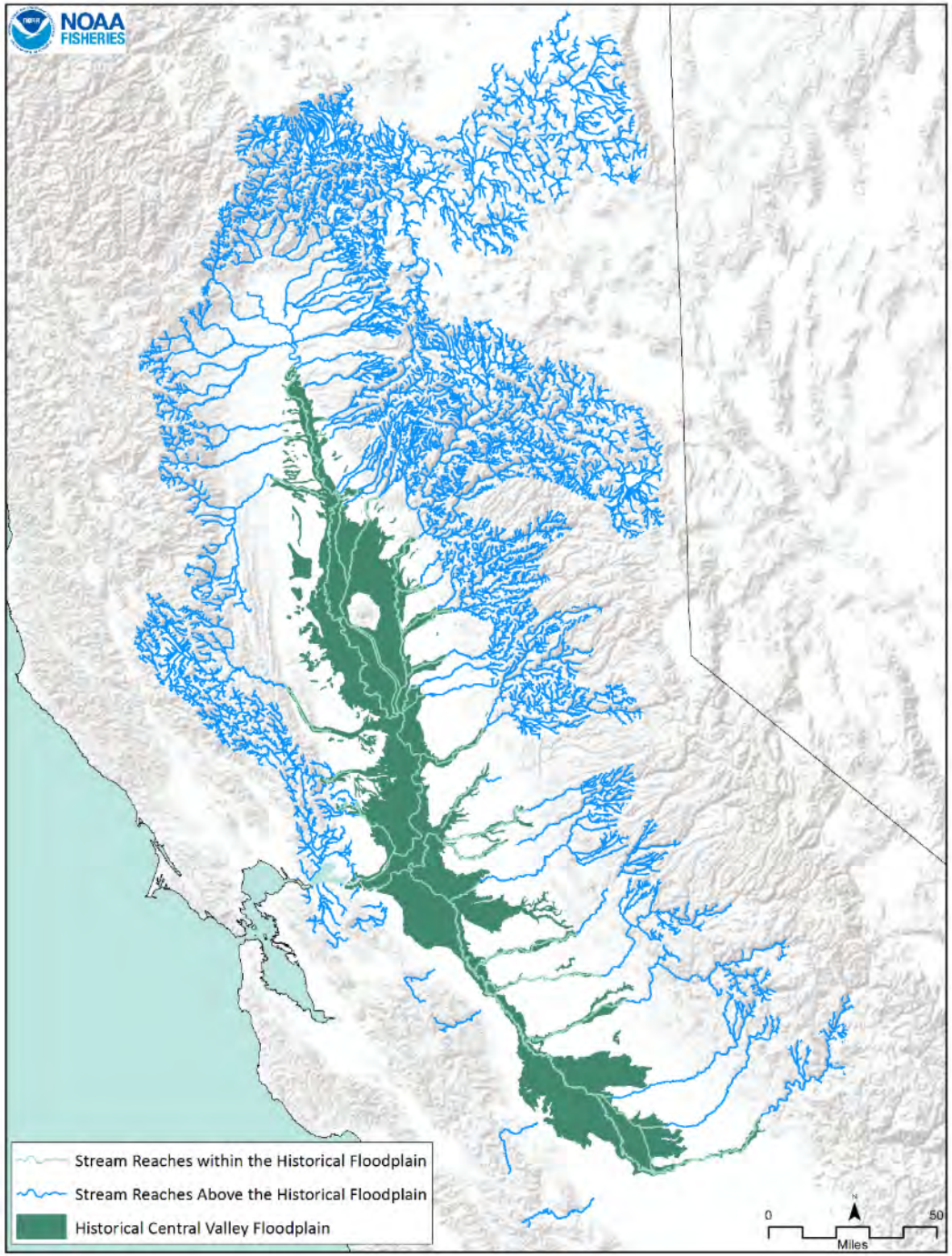
Anabranched
1872 – after re-alignment by Johann Gottfried Tulla



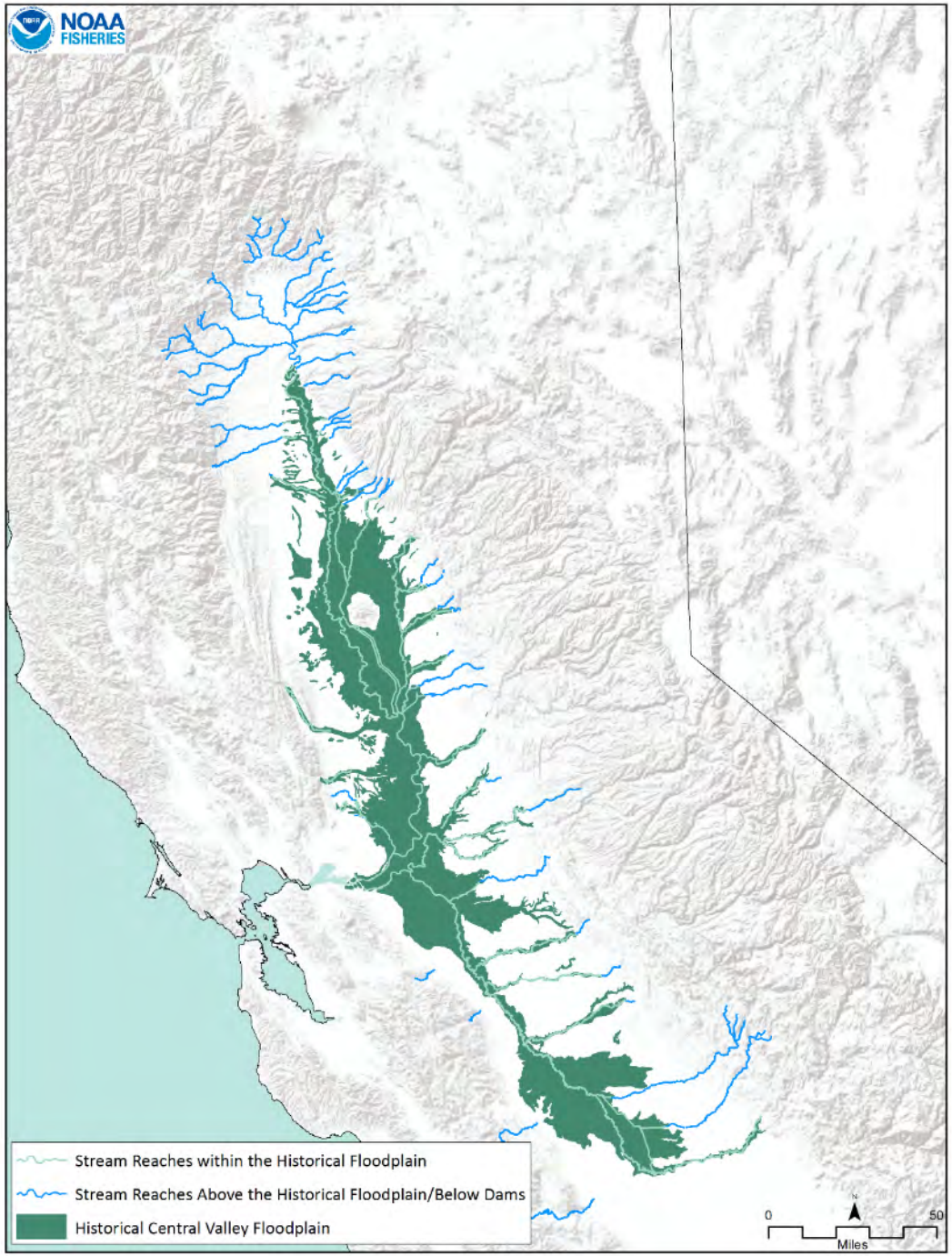
Meandering
1963 – fully canalised single-thread

Data from the SWFSC IP model (streams)

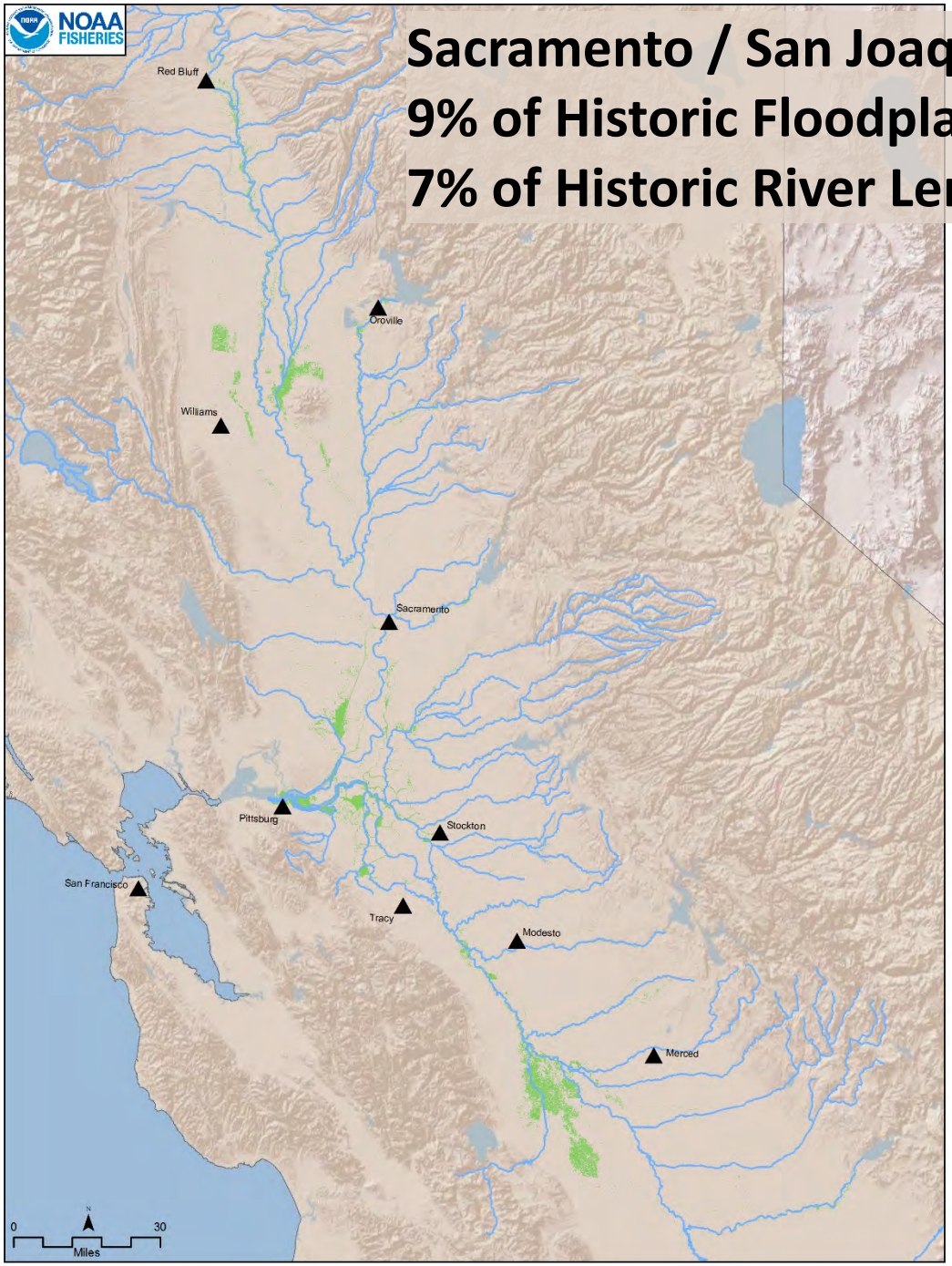
The Bay Institute “From the Sierra to the Sea - The Ecological History of the San Francisco Bay Delta Watershed” 1998 (floodplain)



Historical Central Valley with Intact Floodplain [4,450 sq mi] and Connected Streams [17,200 mi]



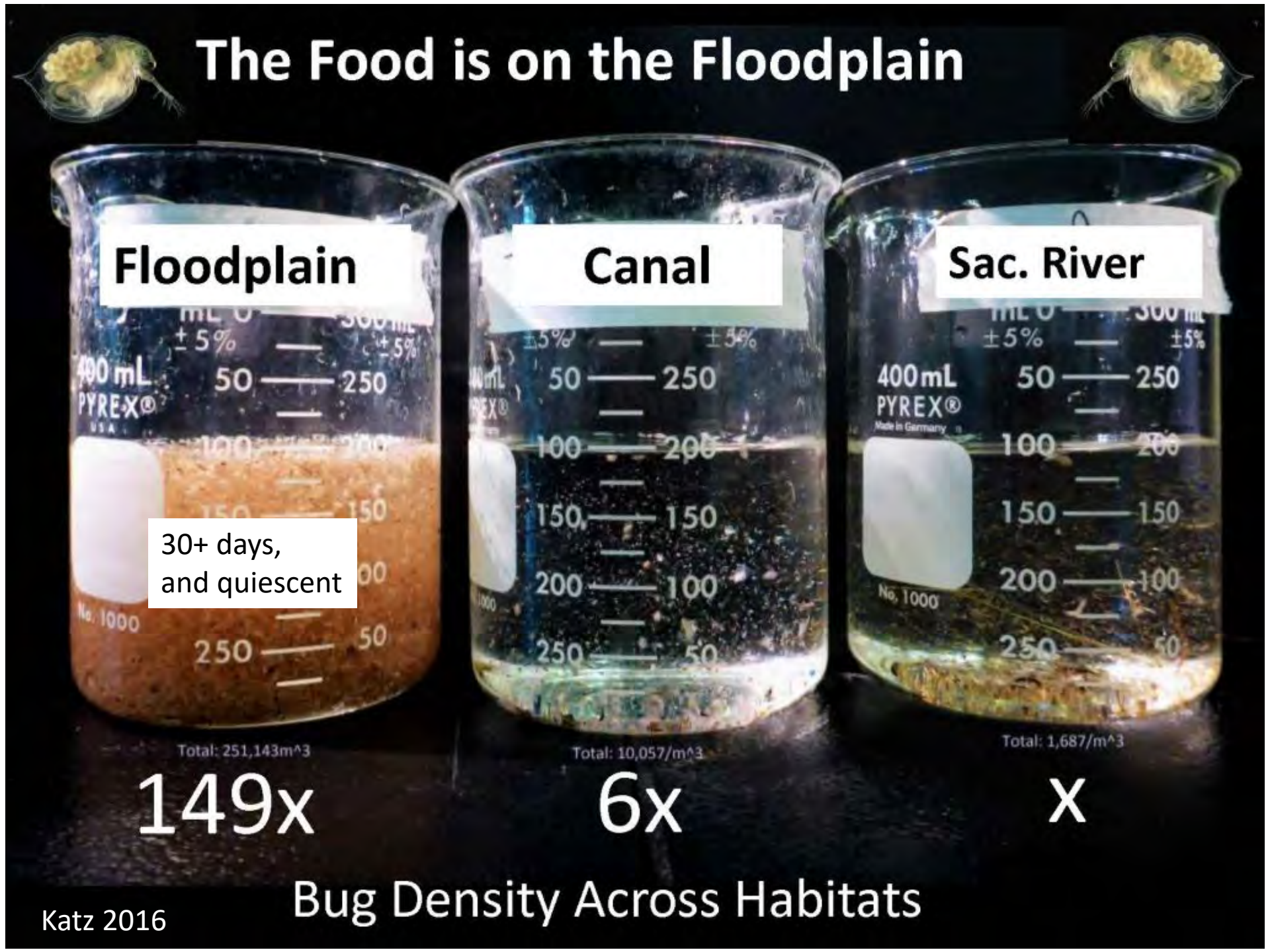
Historical Central Valley with Intact Floodplain and Stream Reaches currently accessible

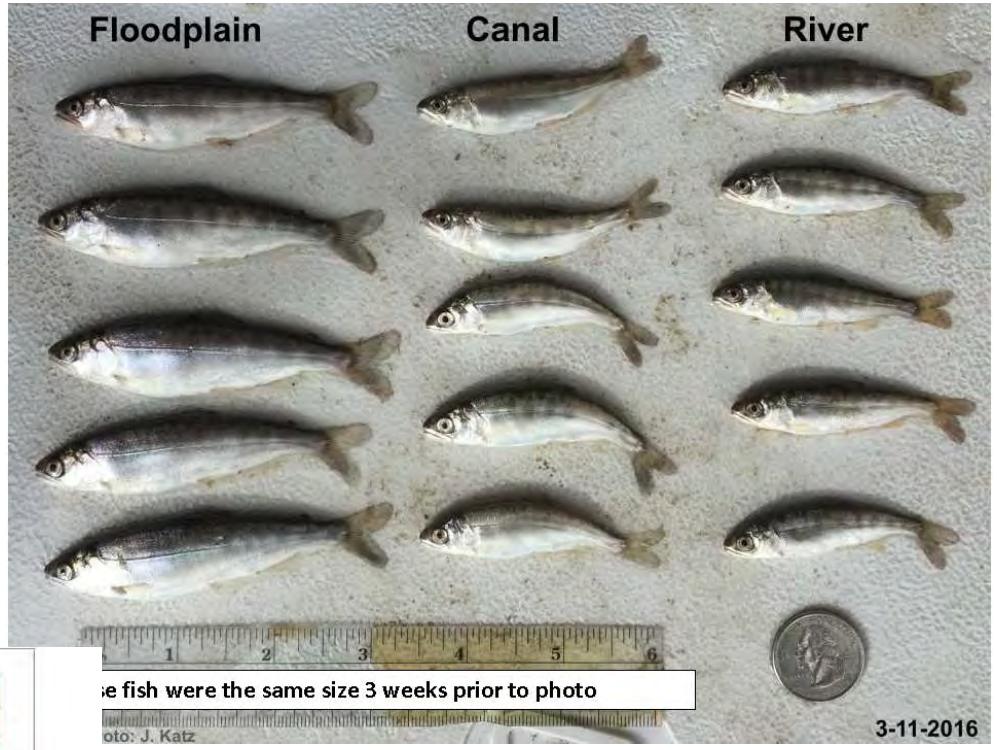


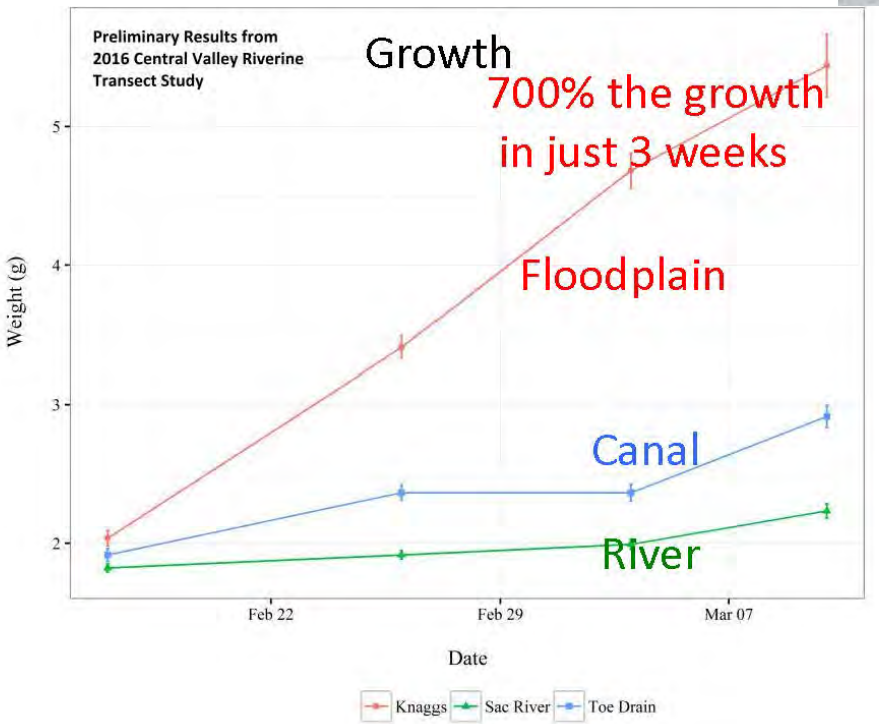
Sacramento / San Joaquin Rivers
9% of Historic Floodplain
7% of Historic River Length

Quantity and function: blue-line streams are misleading; floodplain remnants are misleading.

Fluvial Processes


The Food is on the Floodplain
Floodplain
Canal
Sac. River
30+ days,
and quiescent
Total: 251,143m^3
Total: 10,057/m^3
Total: 1,687/m^3
149x
6x
X
Bug Density Across Habitats
Katz 2016


Floodplain
Canal
River
e fish were the same size 3 weeks prior to photo
oto: J. Katz
3-11-2016


Preliminary Results from
2016 Central Valley Riverine
Transect Study
Growth
700% the growth
in just 3 weeks
Floodplain
Canal
River
Weight (g)
5
4
3
2
Feb 22
Feb 29
Mar 07
Date
Knaggs
Sac River
Toe Drain

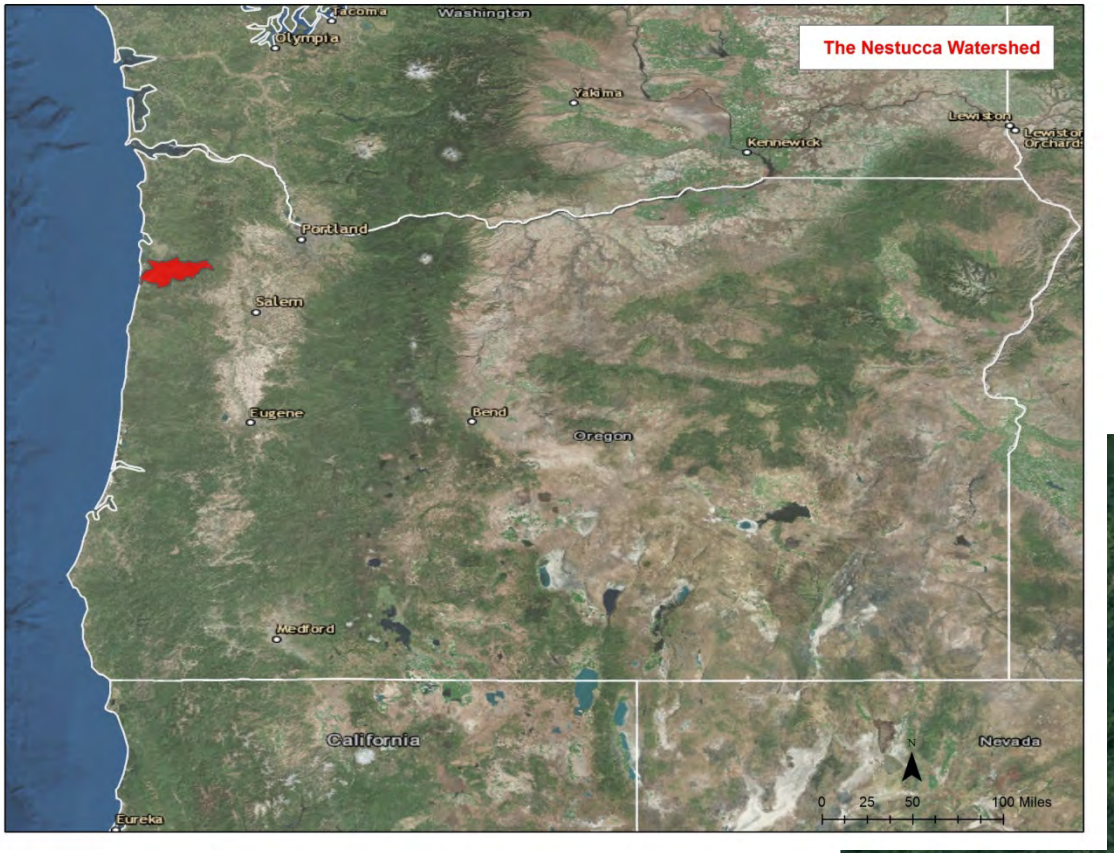
How do we quantify fry rearing habitat?

Areas where food density is high and energy expenditure is low (rel. shallow and near zero V)

X

Duration

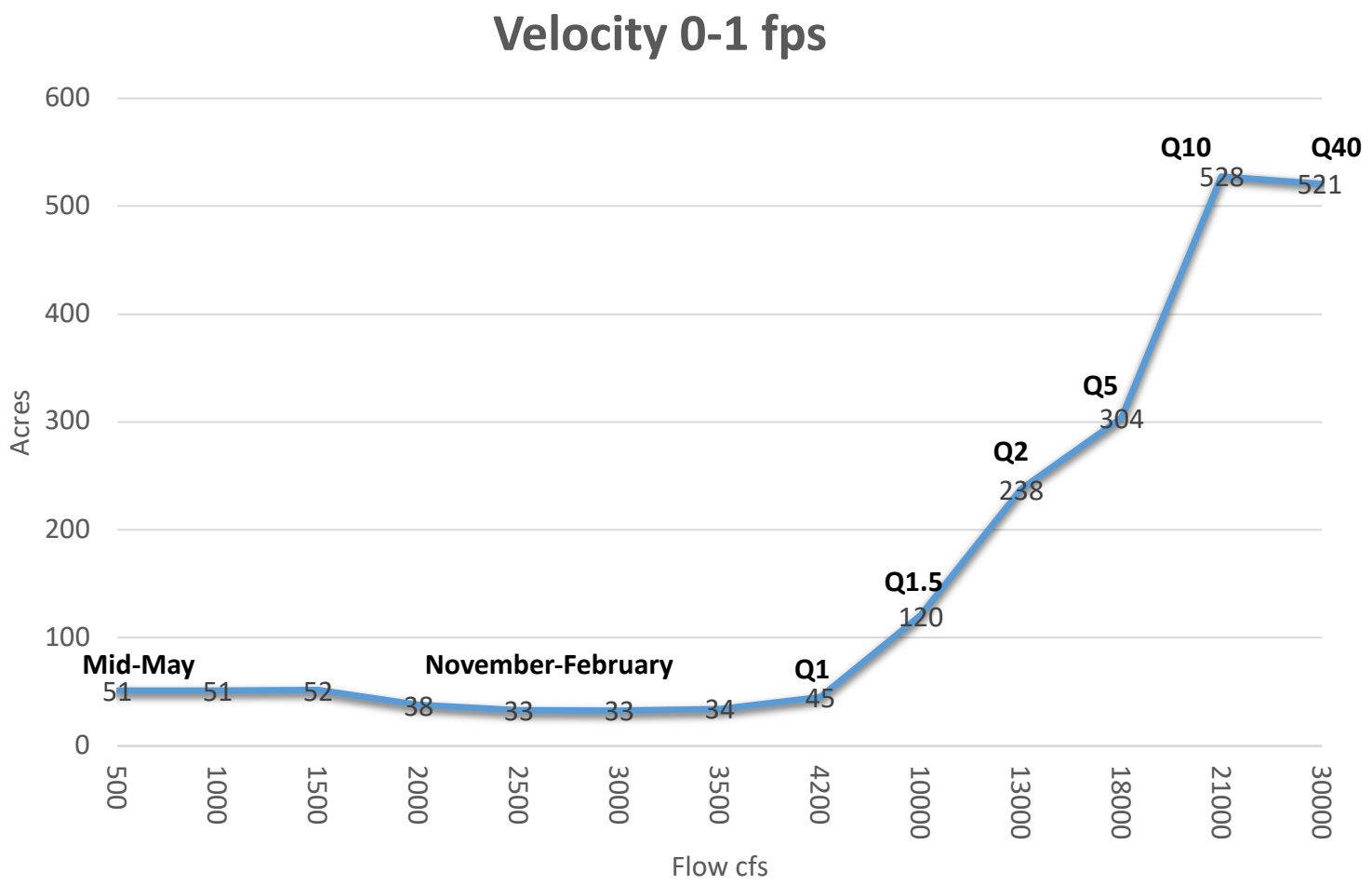
Nestucca River



16.4 river km
12.9 valley km
sinuosity 1.3
2500 acres

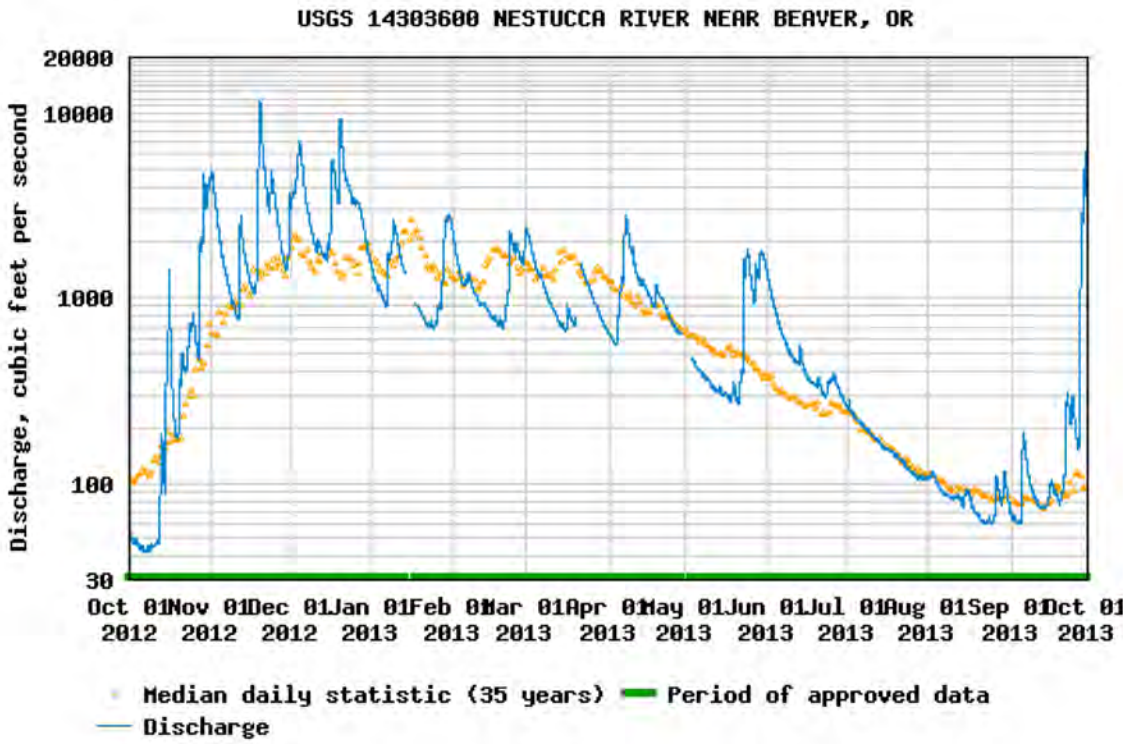
Habitat / Flow

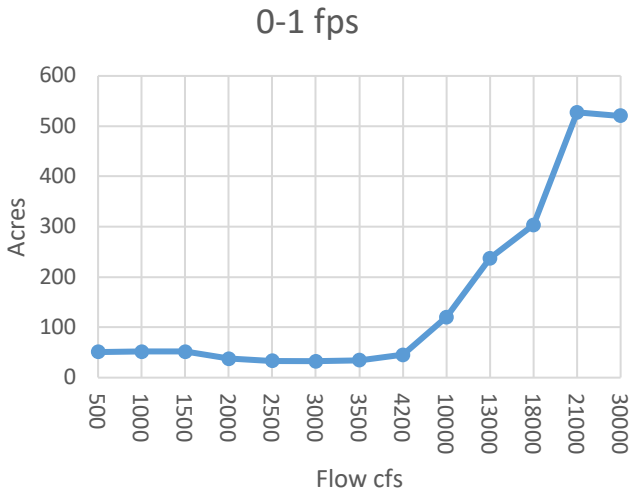
- X Y graph of habitat area vs flow

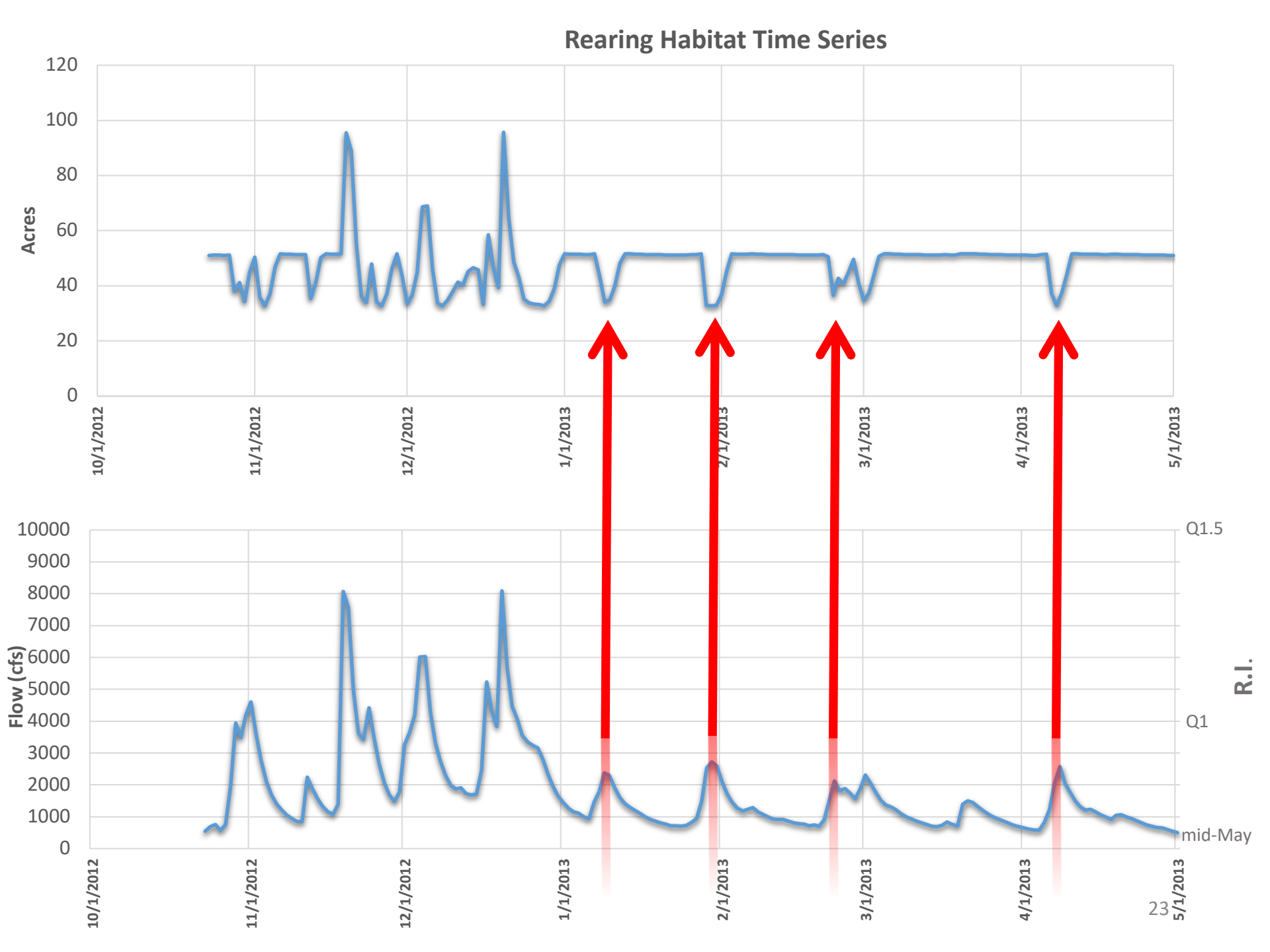


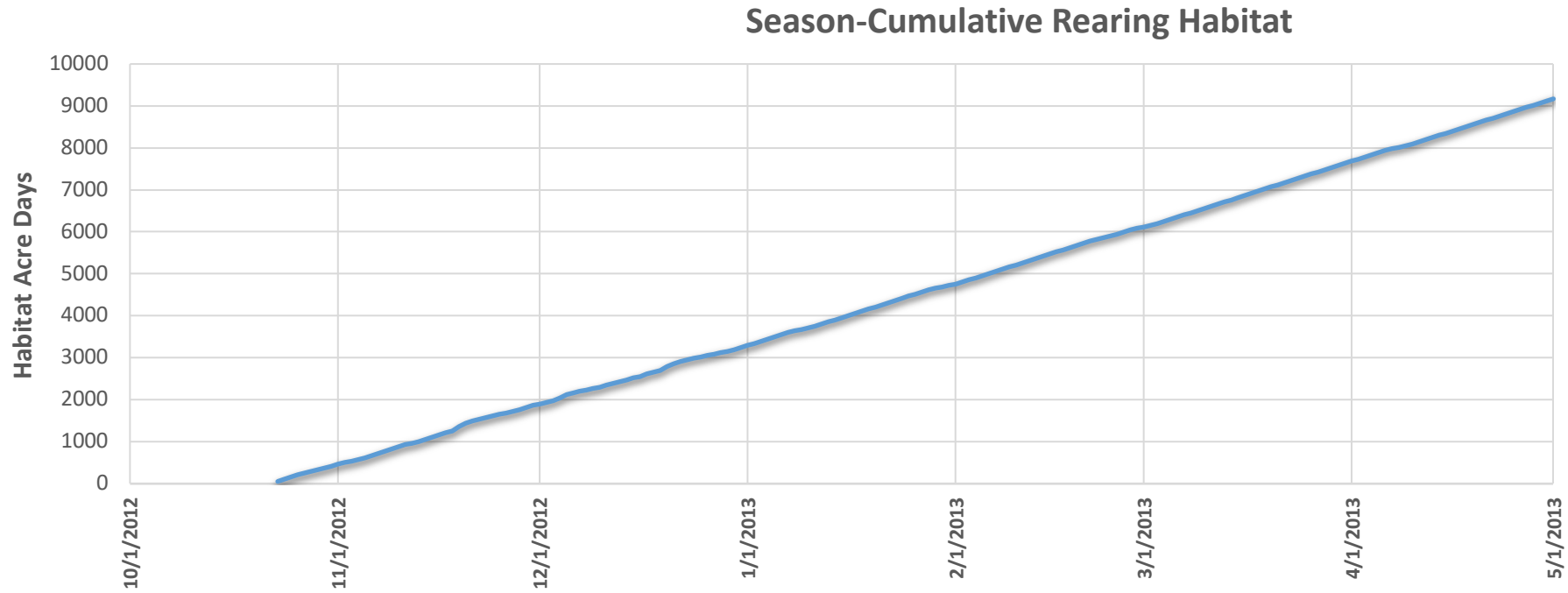
Integrate habitat over a flow time-series

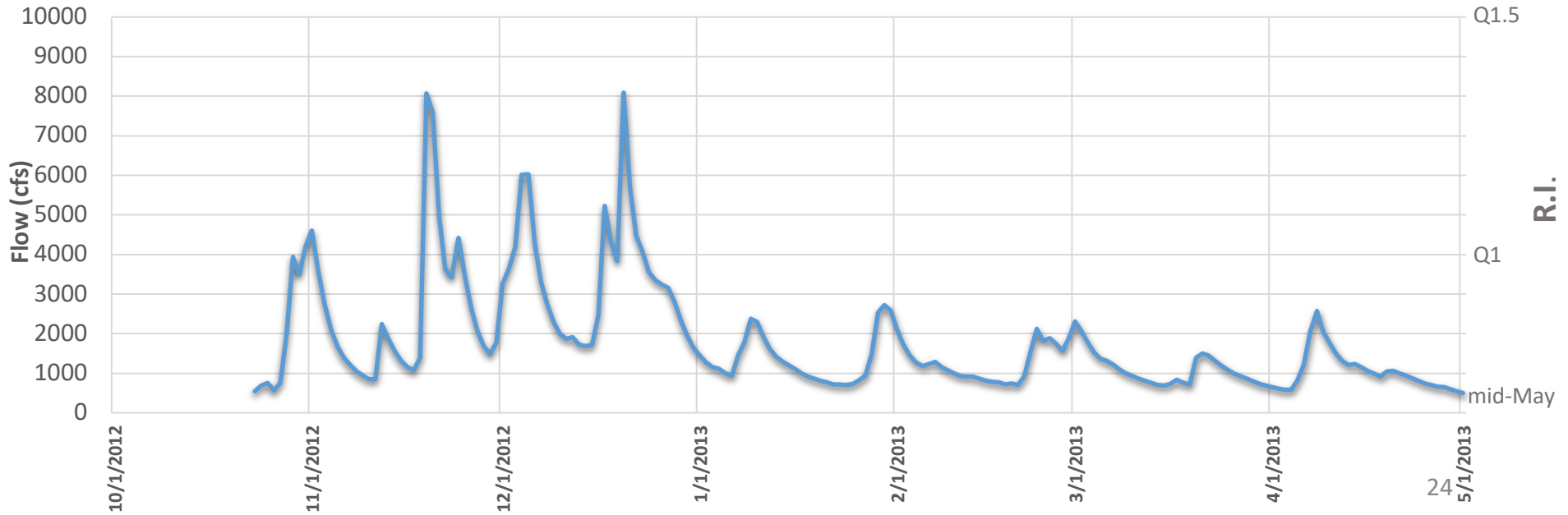
Representative Average Year



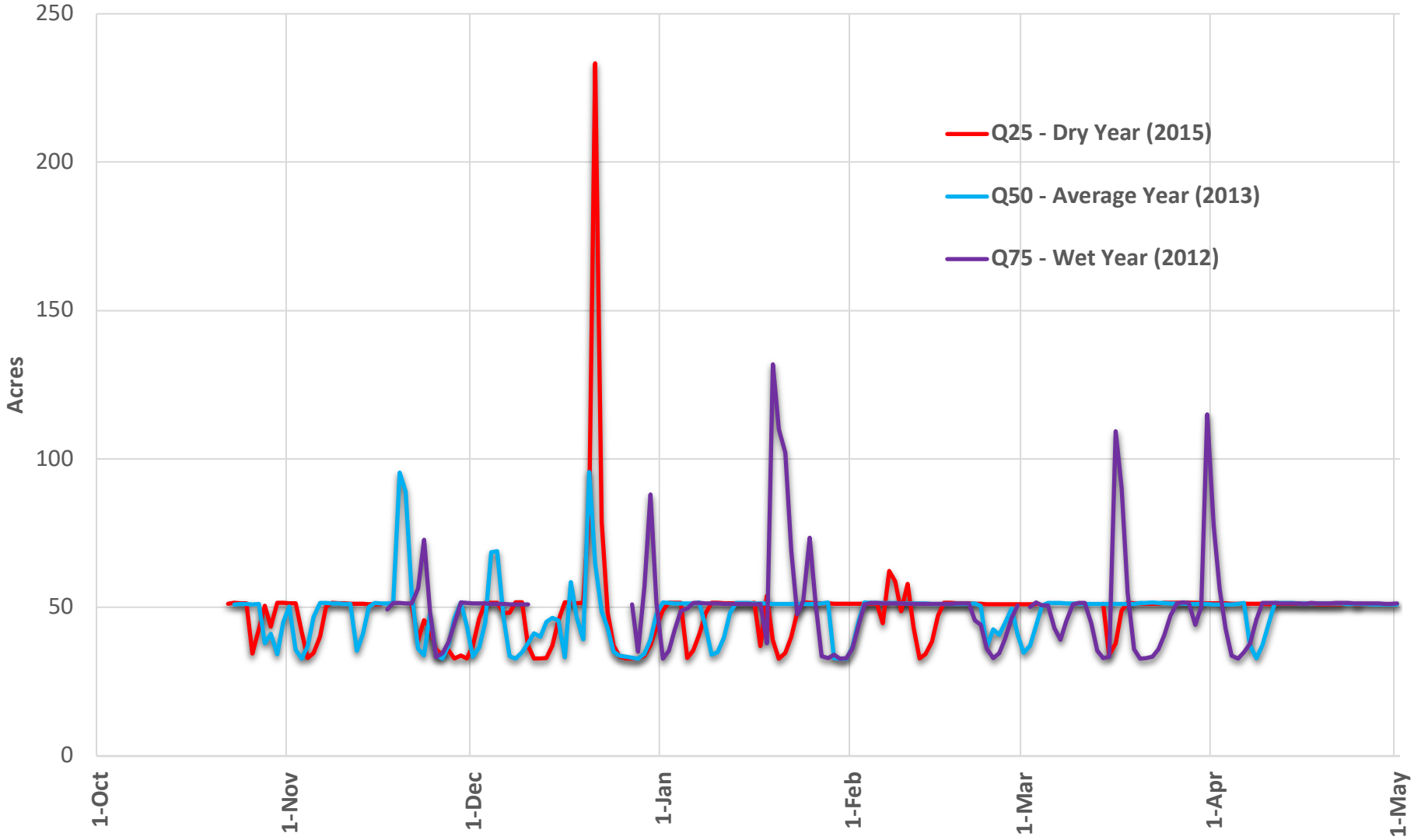


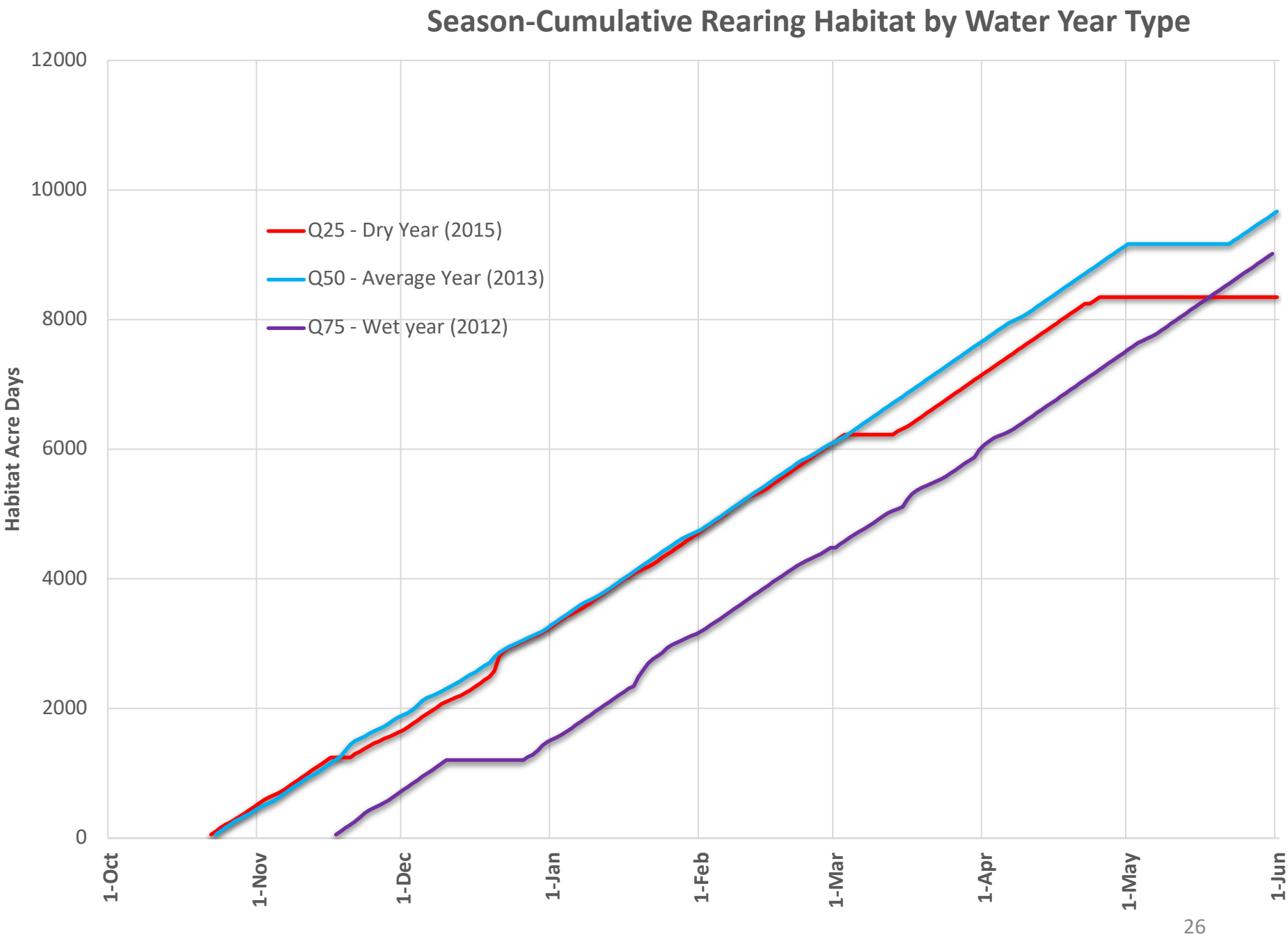

Rearing Habitat Time Series
Acres
120
100
80
60
40
20
0
10/1/2012
11/1/2012
12/1/2012
1/1/2013
2/1/2013
3/1/2013
4/1/2013
5/1/2013
Flow (cfs)
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Q1.5
Q1
mid-May
R.I.


Season-Cumulative Rearing Habitat
Habitat Acre Days
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
10/1/2012
11/1/2012
12/1/2012
1/1/2013
2/1/2013
3/1/2013
4/1/2013
5/1/2013

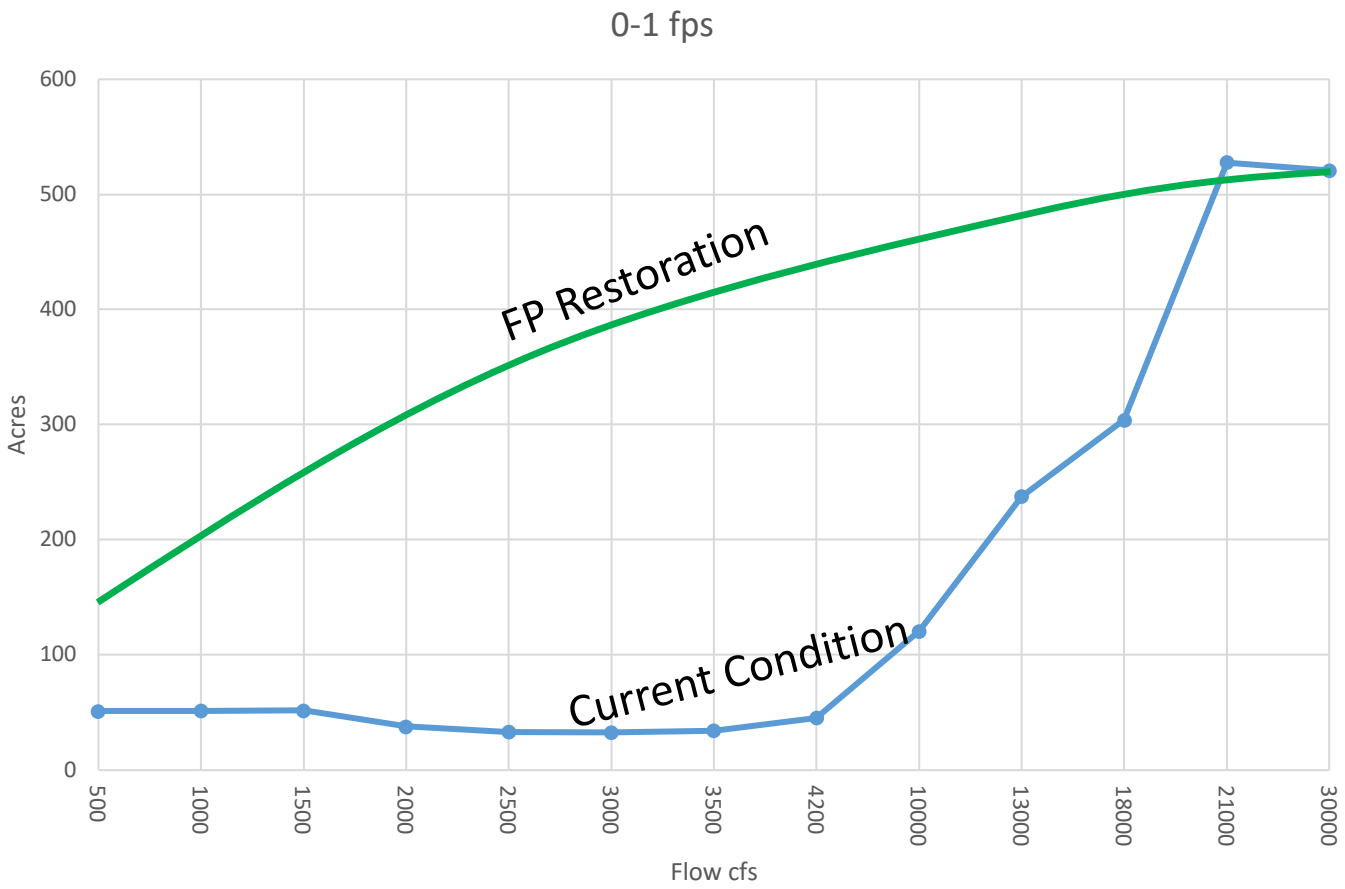

Flow (cfs)
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Q1.5
Q1
mid-May
R.I.
10/1/2012
11/1/2012
12/1/2012
1/1/2013
2/1/2013
3/1/2013
4/1/2013
5/1/2013

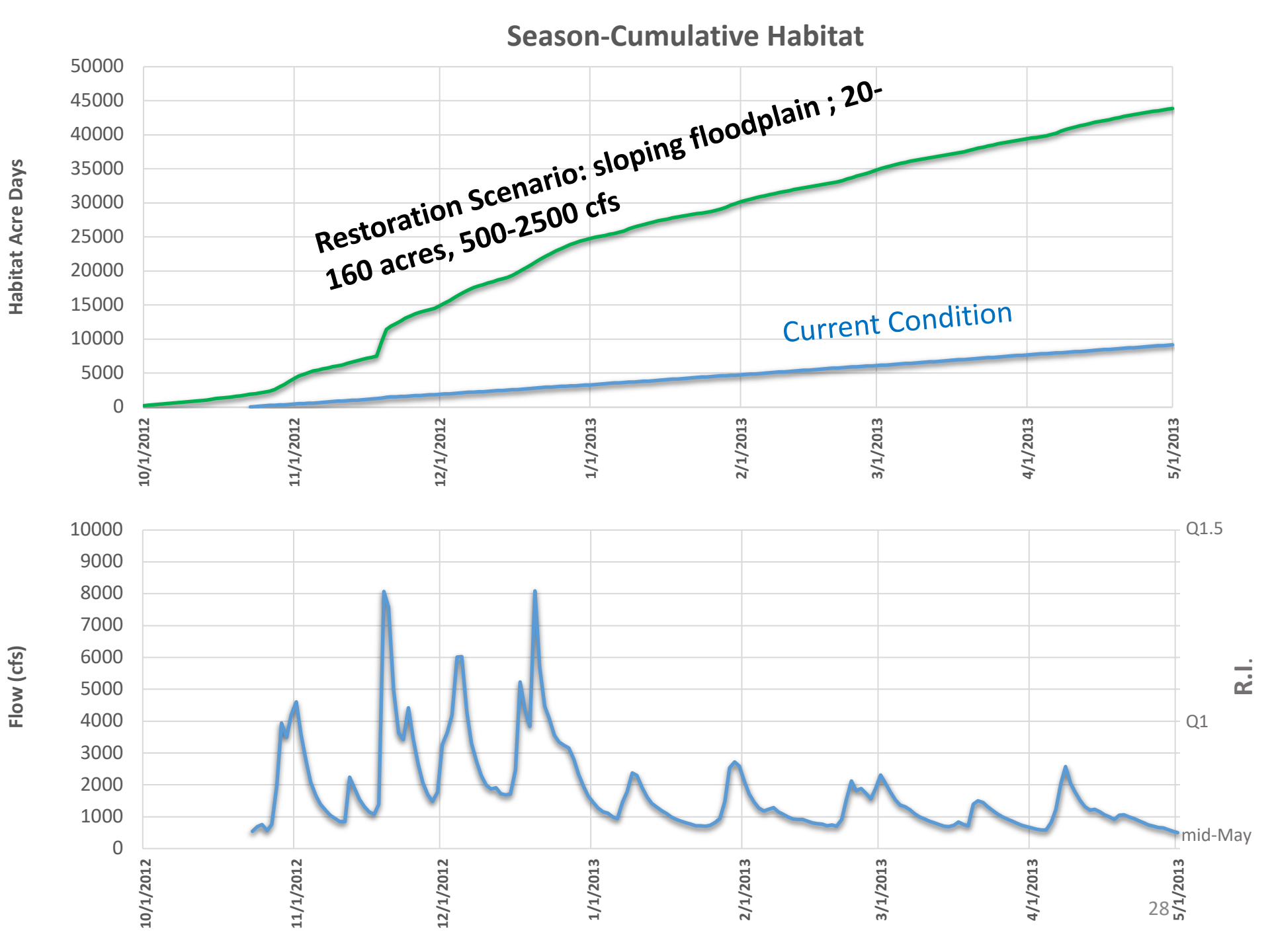
Rearing Habitat Time Series By Water Year Type




Season-Cumulative Rearing Habitat by Water Year Type
Habitat Acre Days
12000
10000
8000
6000
4000
2000
0
Q25 - Dry Year (2015)
Q50 - Average Year (2013)
Q75 - Wet year (2012)
1-Oct
1-Nov
1-Dec
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun

Objective-Based Scenario Modeling

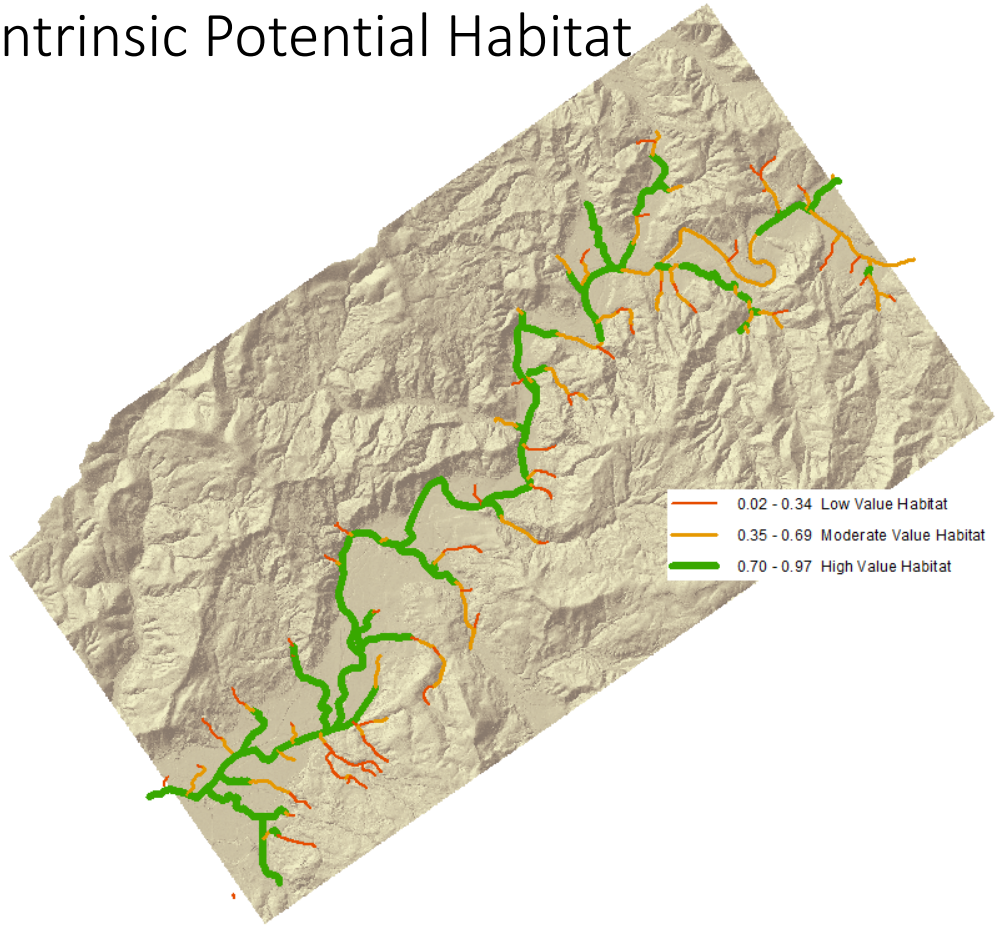



Season-Cumulative Habitat
Habitat Acre Days
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
Restoration Scenario: sloping floodplain ; 20-160 acres, 500-2500 cfs
Current Condition
10/1/2012
11/1/2012
12/1/2012
1/1/2013
2/1/2013
3/1/2013
4/1/2013
5/1/2013
Flow (cfs)
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Q1.5
Q1
mid-May
R.I.
10/1/2012
11/1/2012
12/1/2012
1/1/2013
2/1/2013
3/1/2013
4/1/2013
5/1/2013

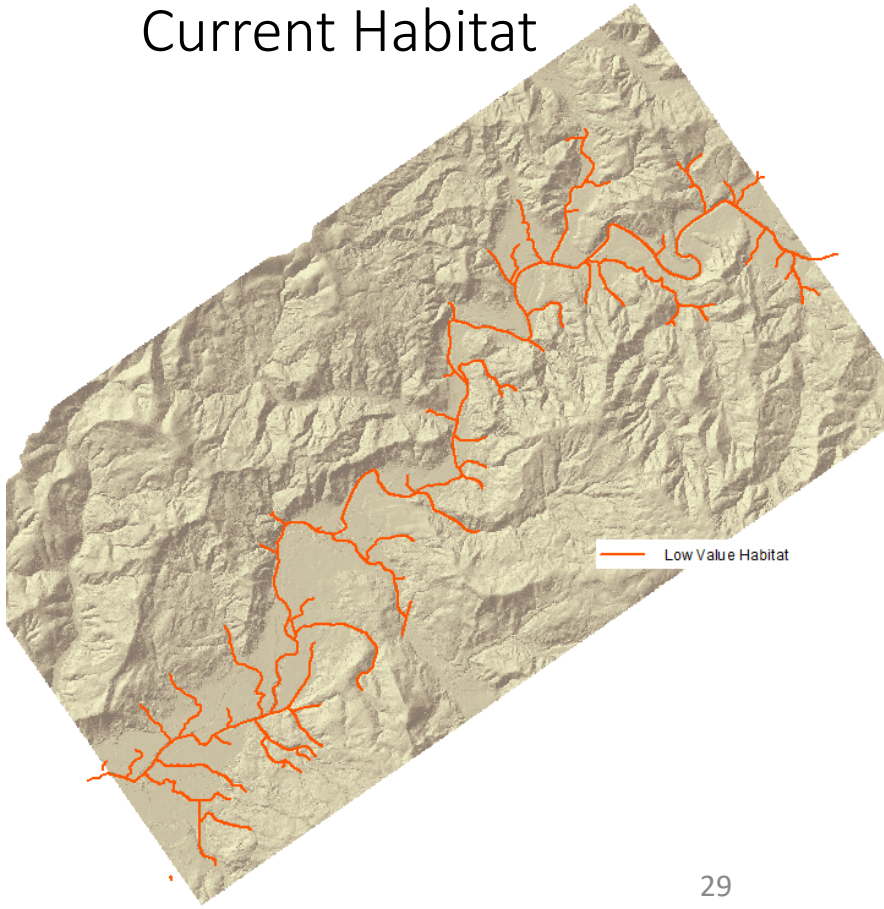
Coho Salmon Intrinsic Potential

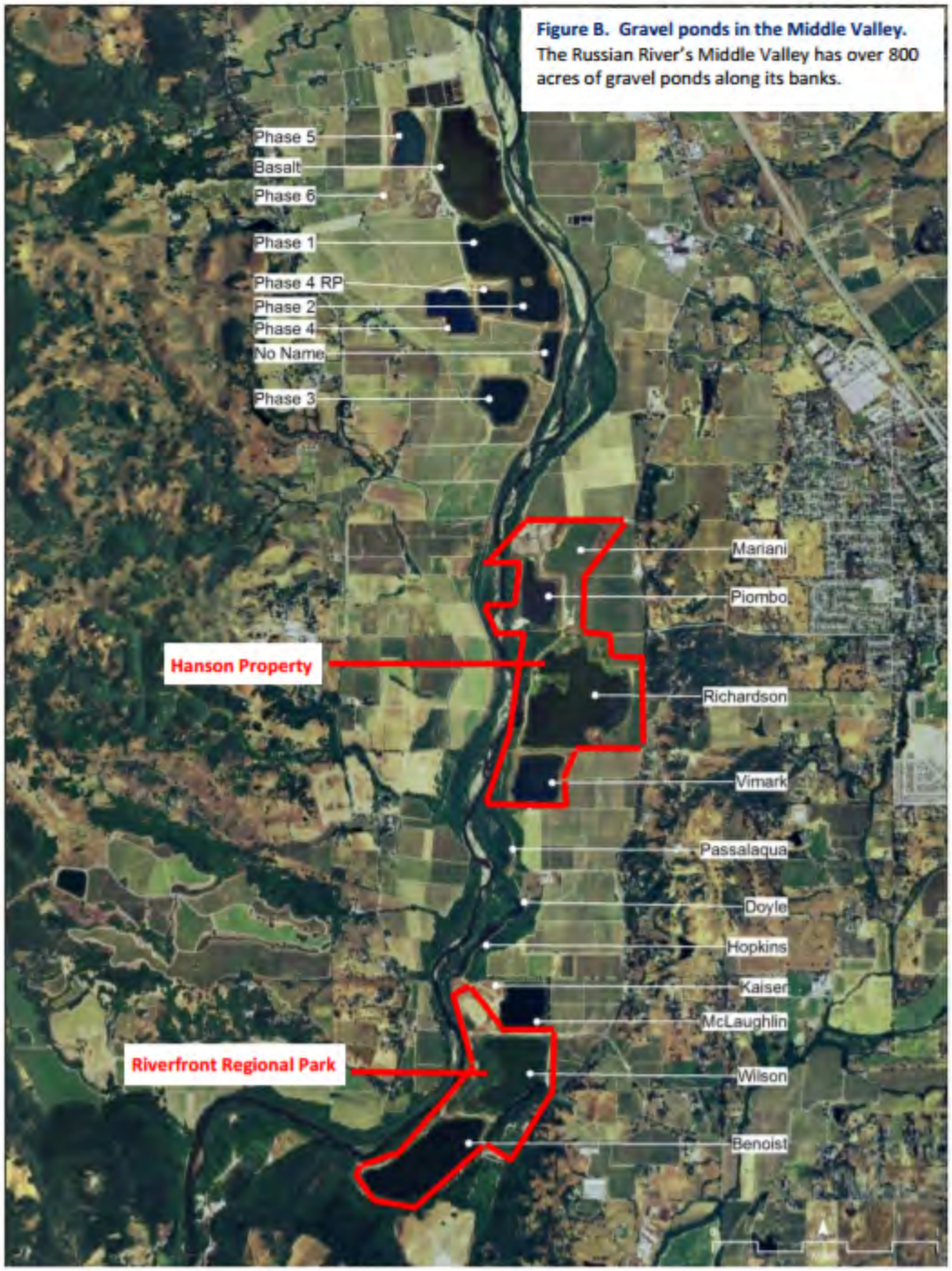
Historic vs. Current

Intrinsic Potential Habitat



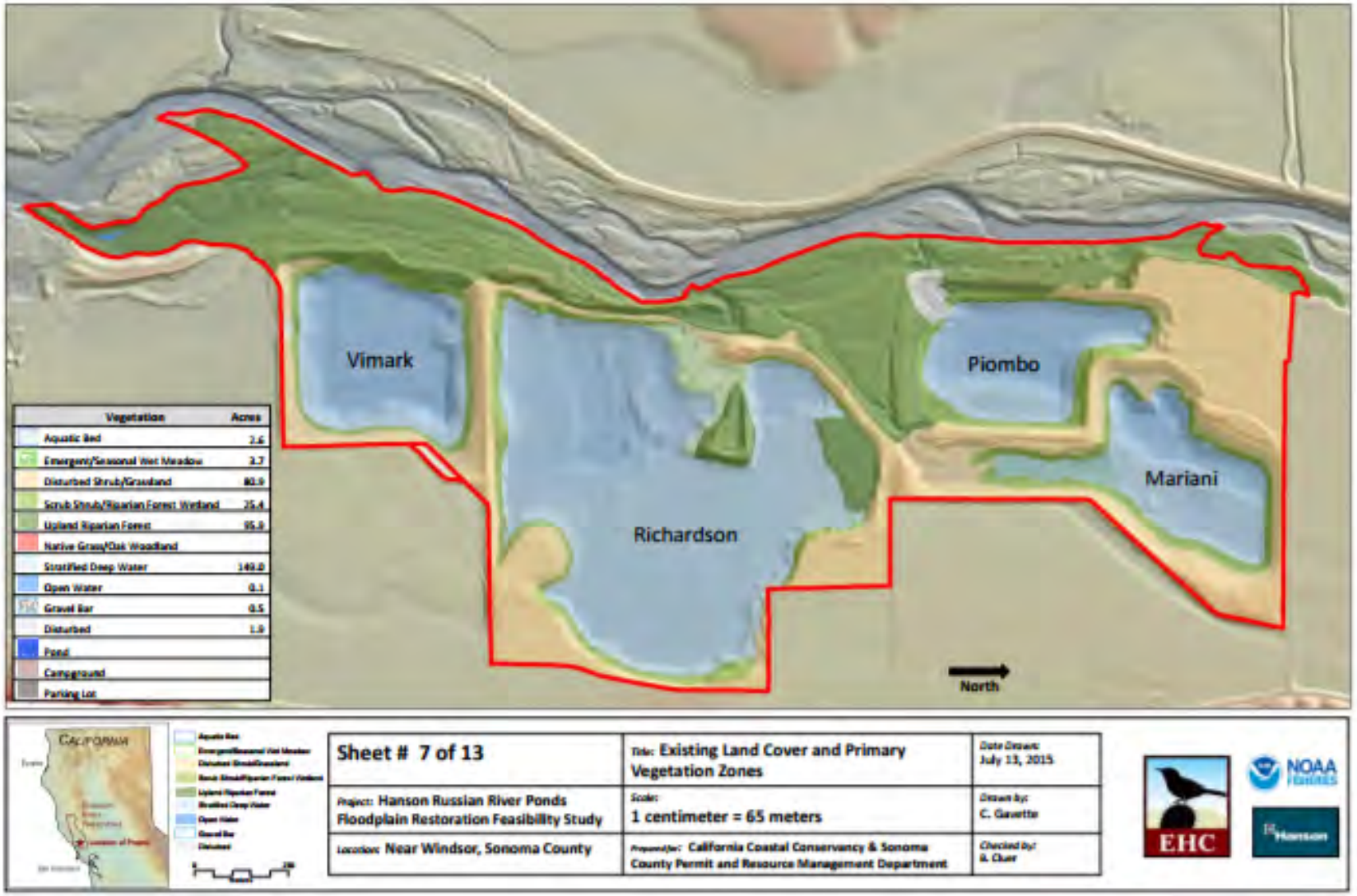
Current Habitat



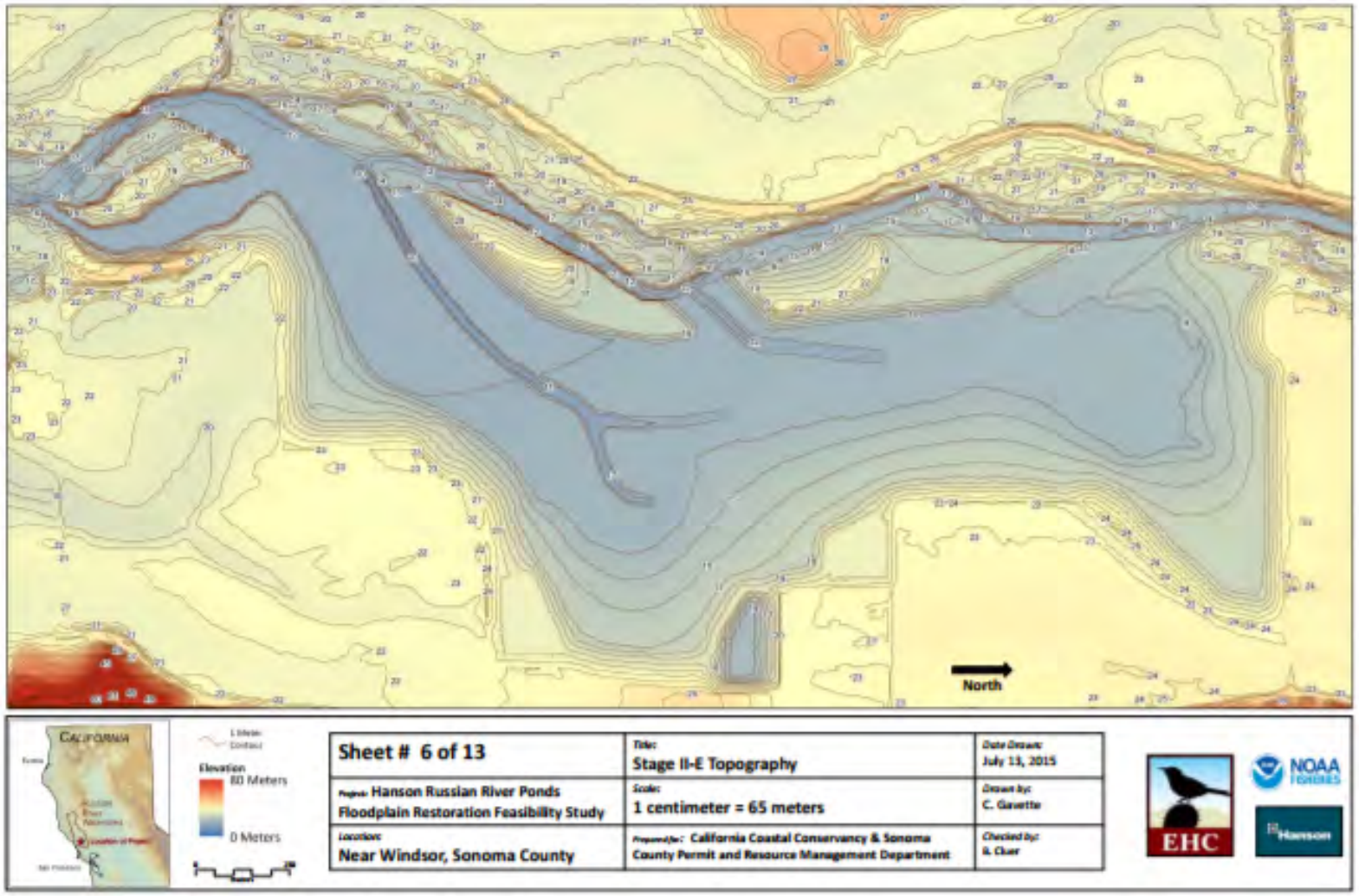


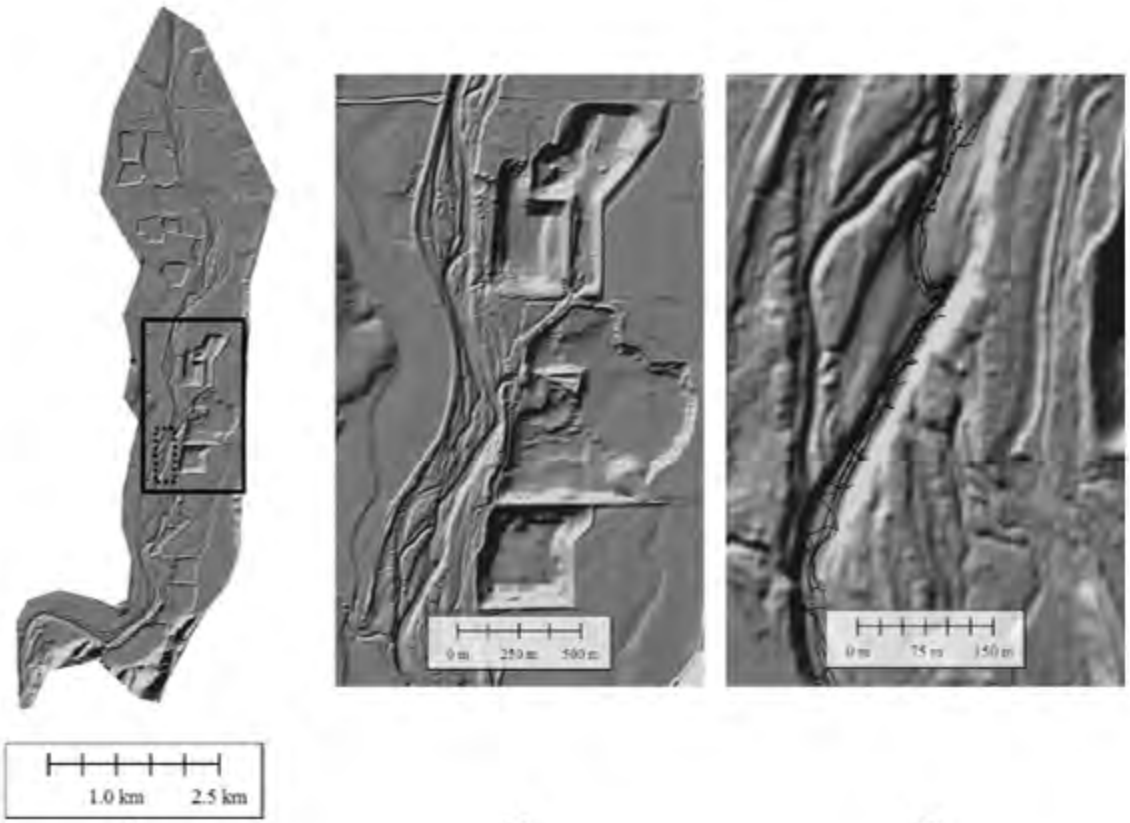
Developed Valleys have some really ruined land

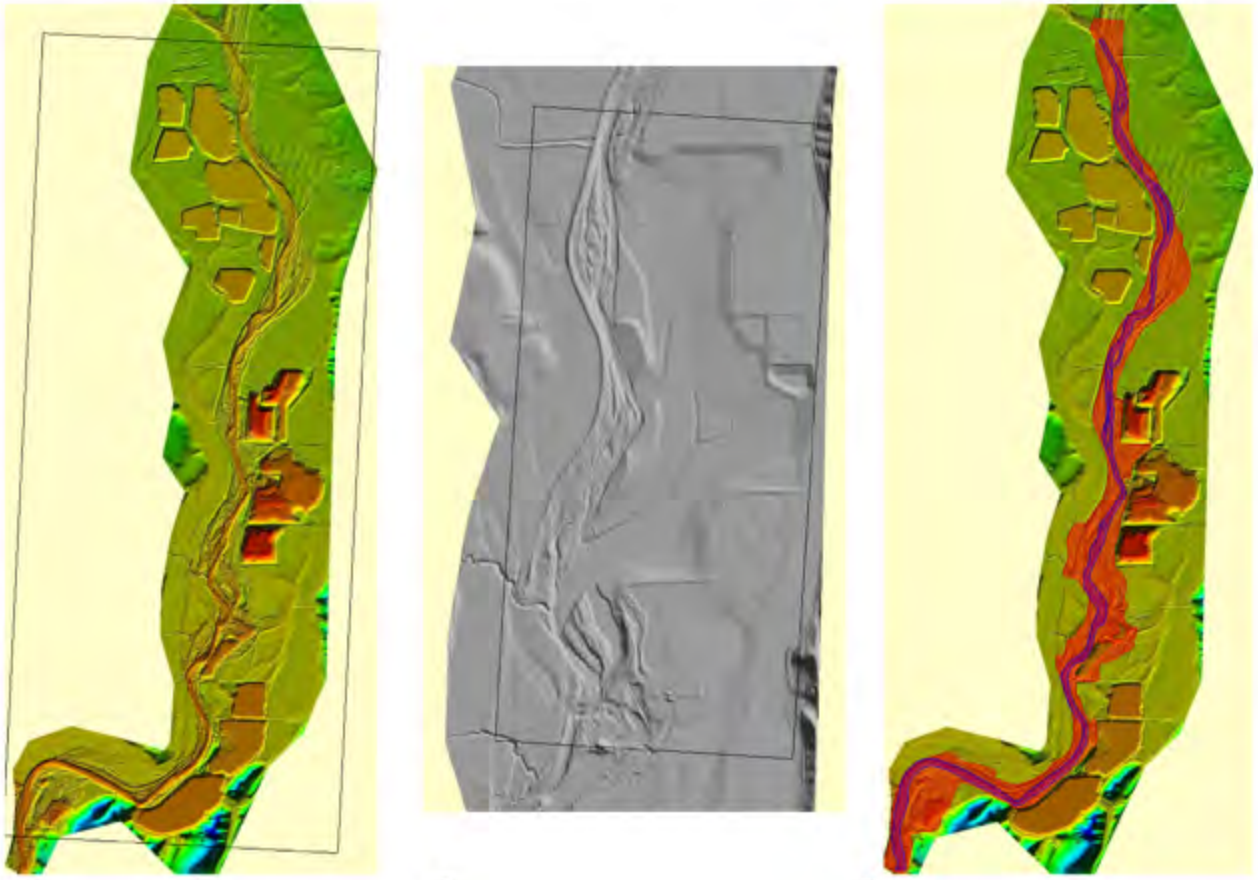
Current condition.

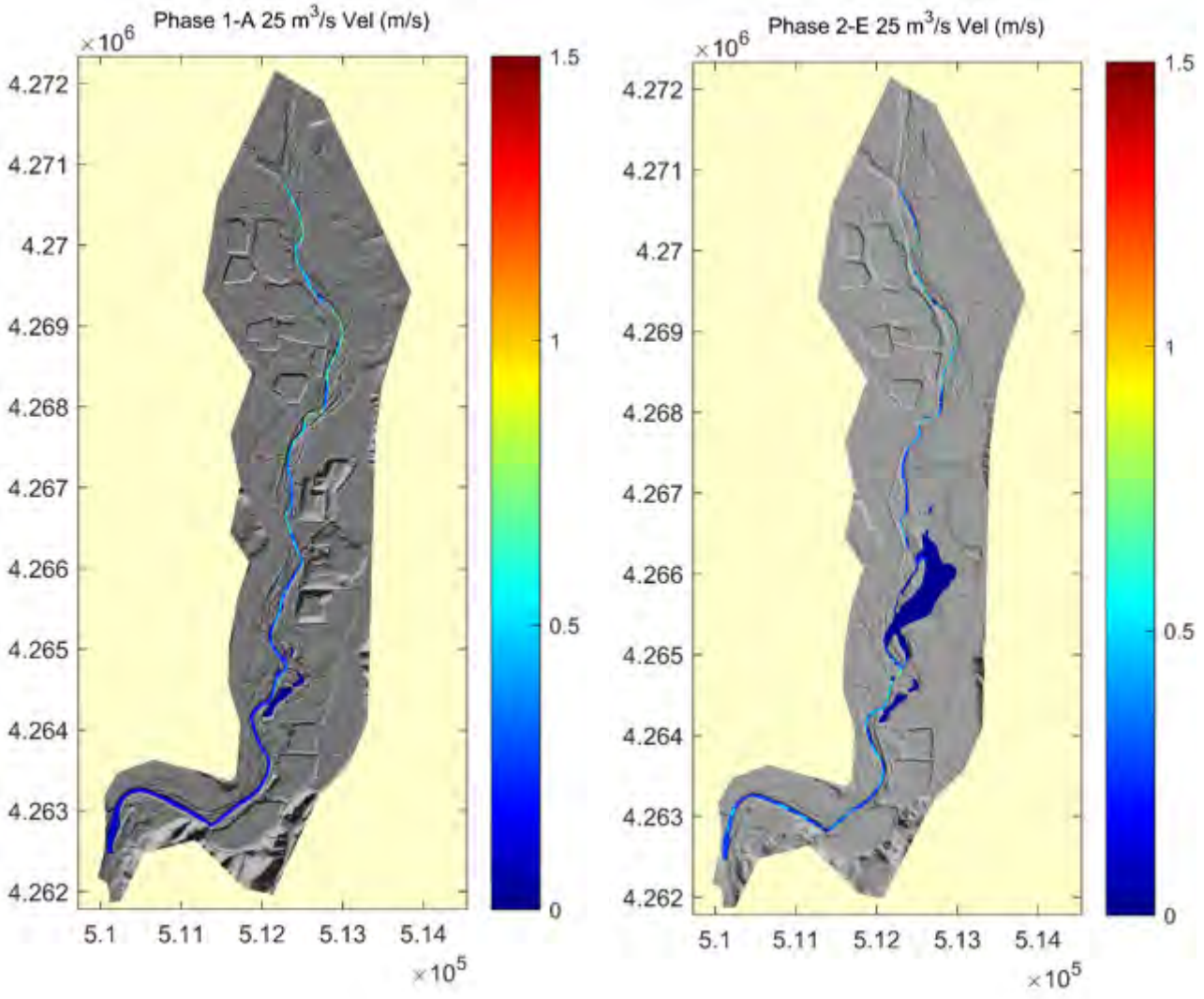


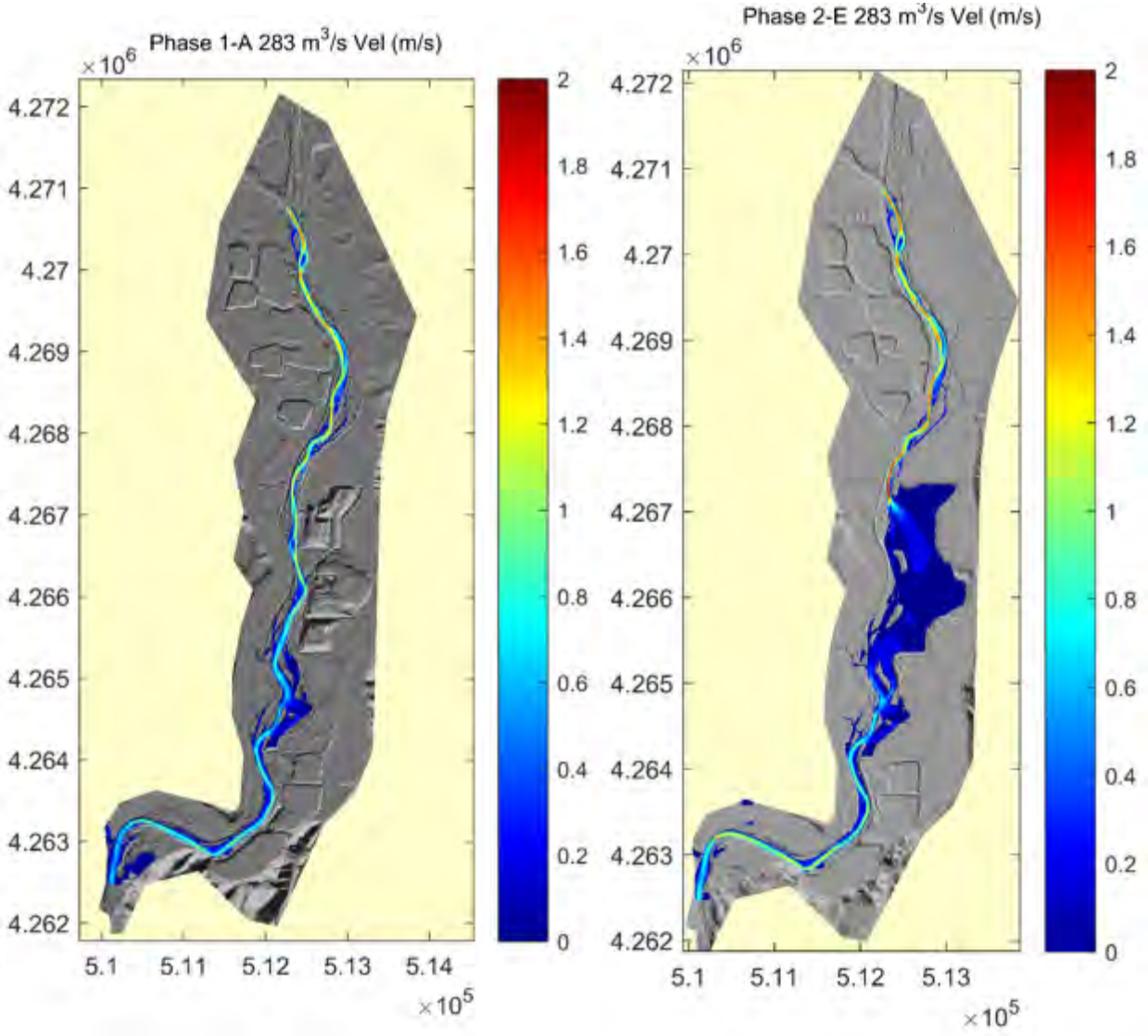
Proposed condition.

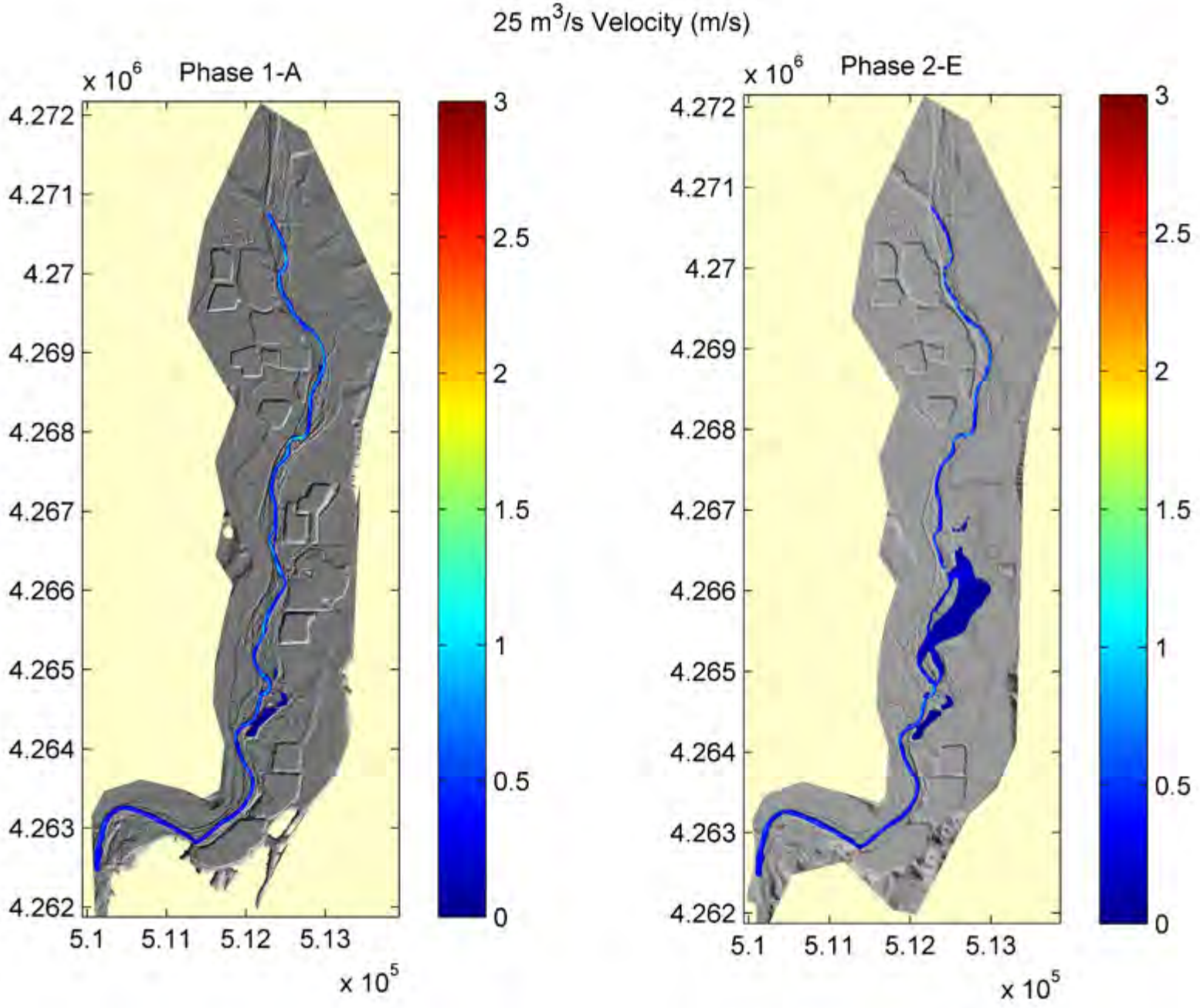


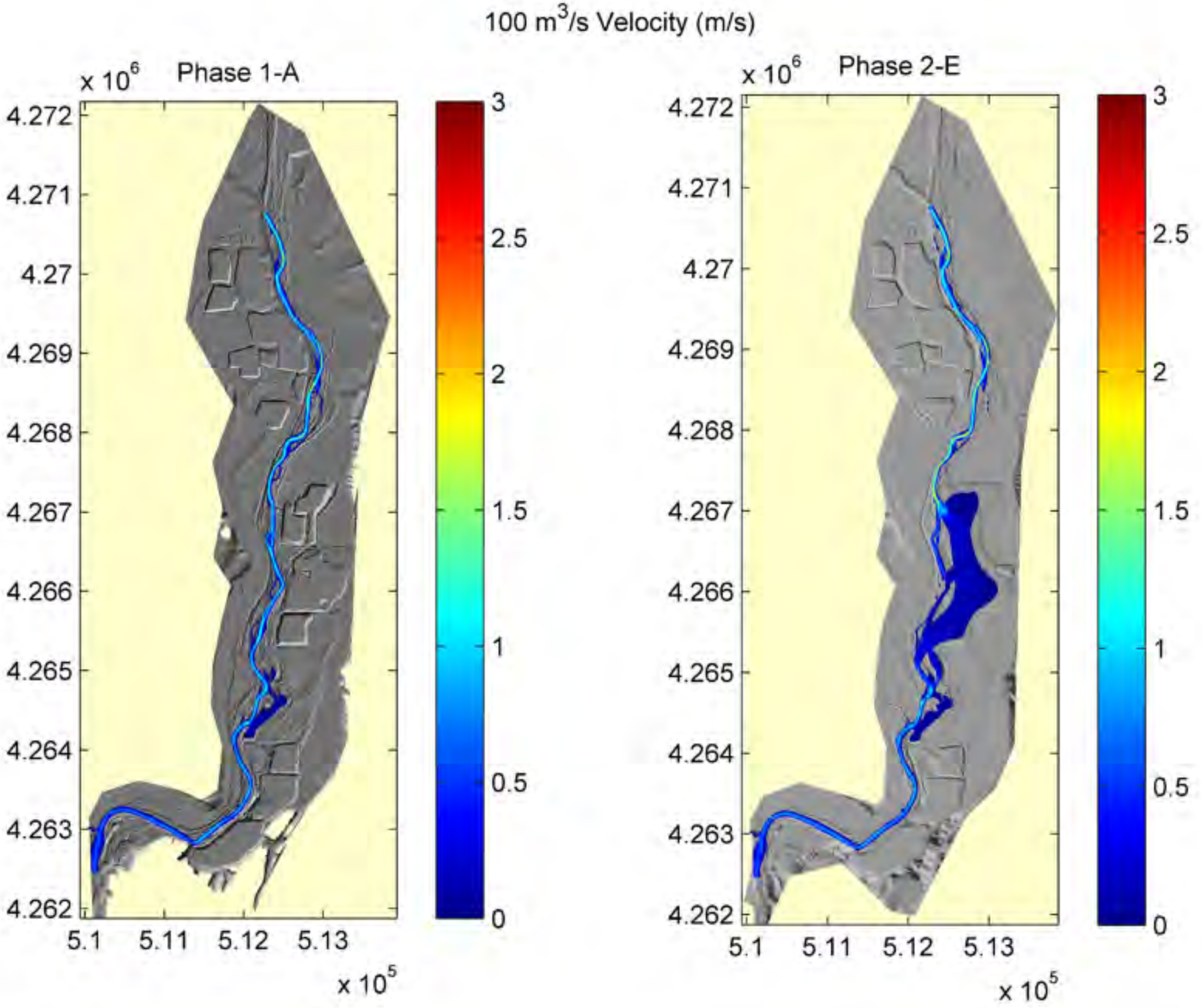

1.0 km
2.5 km
A
B
C


A)
B)
C)


Phase 1-A 25 m3/s Vel (m/s)
×10^6
4.272
4.271
4.27
4.269
4.268
4.267
4.266
4.265
4.264
4.263
4.262
5.1
5.11
5.12
5.13
5.14
×10^5
1.5
1
0.5
0
Phase 2-E 25 m3/s Vel (m/s)
×10^6
4.272
4.271
4.27
4.269
4.268
4.267
4.266
4.265
4.264
4.263
4.262
5.1
5.11
5.12
5.13
5.14
×10^5
1.5
1
0.5
0


Phase 1-A 283 m3/s Vel (m/s)
×10^6
4.272
4.271
4.27
4.269
4.268
4.267
4.266
4.265
4.264
4.263
4.262
5.1
5.11
5.12
5.13
5.14
×10^5
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Phase 2-E 283 m3/s Vel (m/s)
×10^6
4.272
4.271
4.27
4.269
4.268
4.267
4.266
4.265
4.264
4.263
4.262
5.1
5.11
5.12
5.13
×10^5
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0


25 m3/s Velocity (m/s)
Phase 1-A
Phase 2-E
x 10^6
4.272
4.271
4.27
4.269
4.268
4.267
4.266
4.265
4.264
4.263
4.262
5.1
5.11
5.12
5.13
x 10^5
3
2.5
2
1.5
1
0.5
0


100 m3/s Velocity (m/s)
Phase 1-A
x 10^6
4.272
4.271
4.27
4.269
4.268
4.267
4.266
4.265
4.264
4.263
4.262
5.1
5.11
5.12
5.13
x 10^5
3
2.5
2
1.5
1
0.5
0
Phase 2-E
x 10^6
4.272
4.271
4.27
4.269
4.268
4.267
4.266
4.265
4.264
4.263
4.262
5.1
5.11
5.12
5.13
x 10^5
3
2.5
2
1.5
1
0.5
0

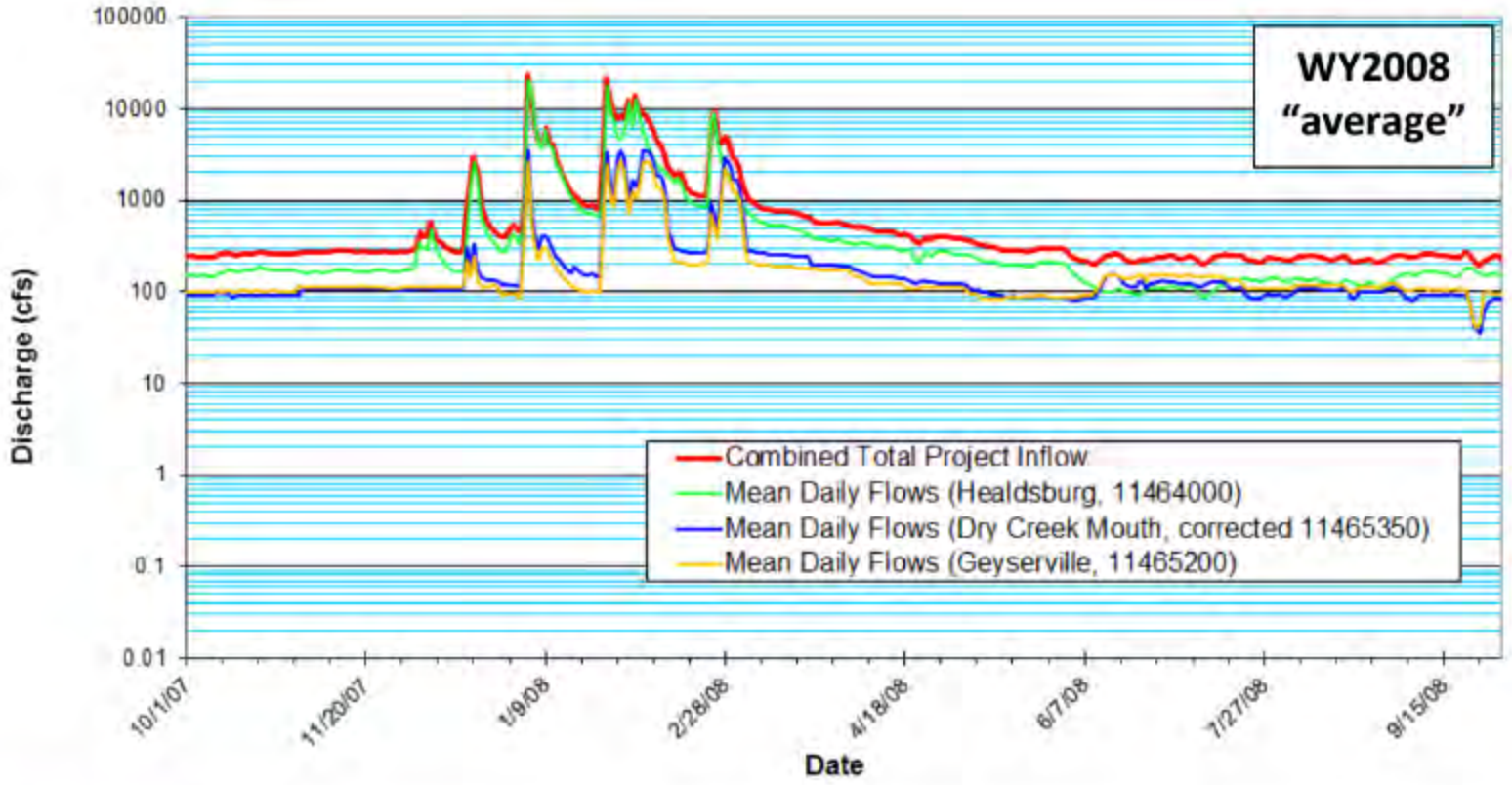
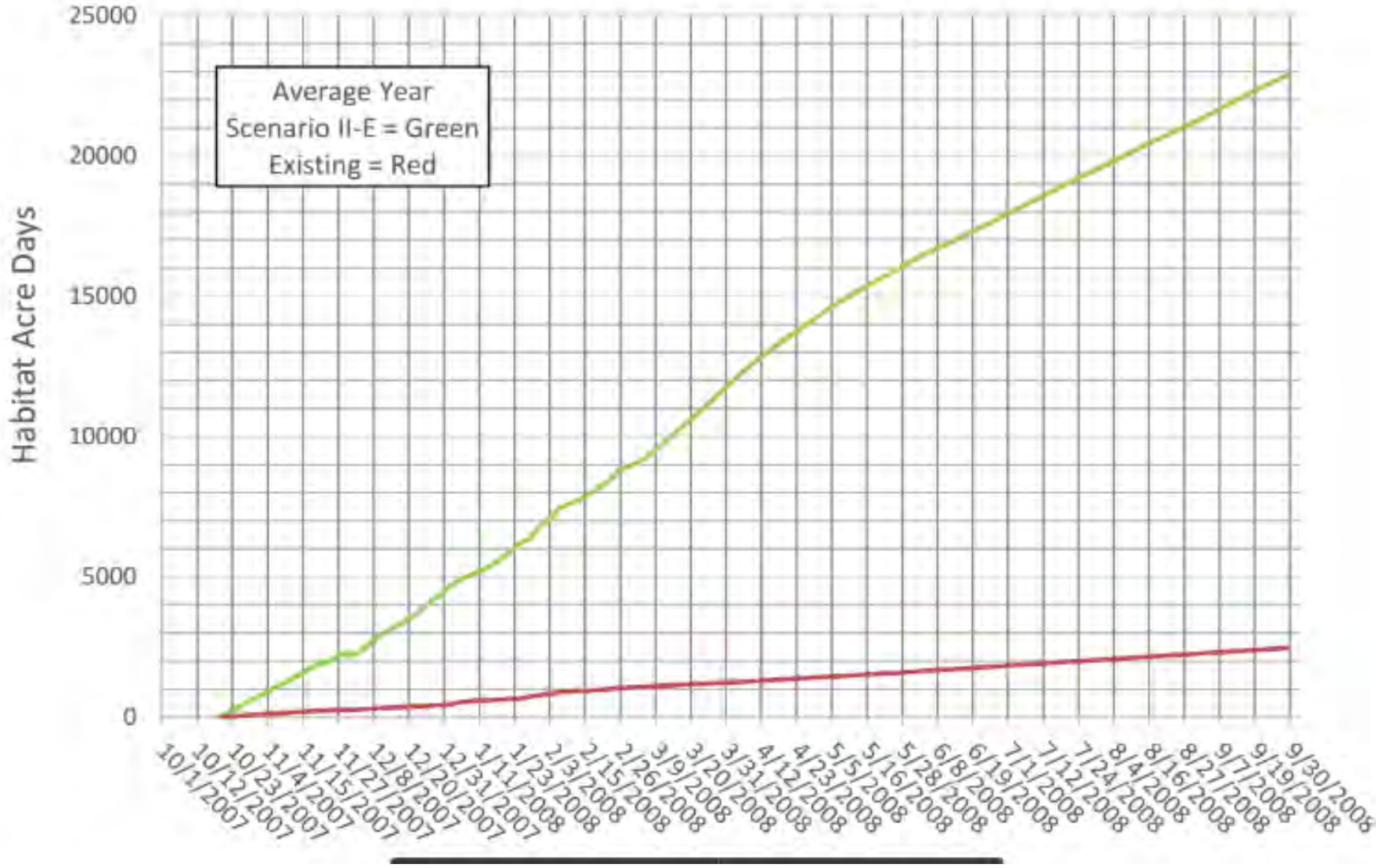
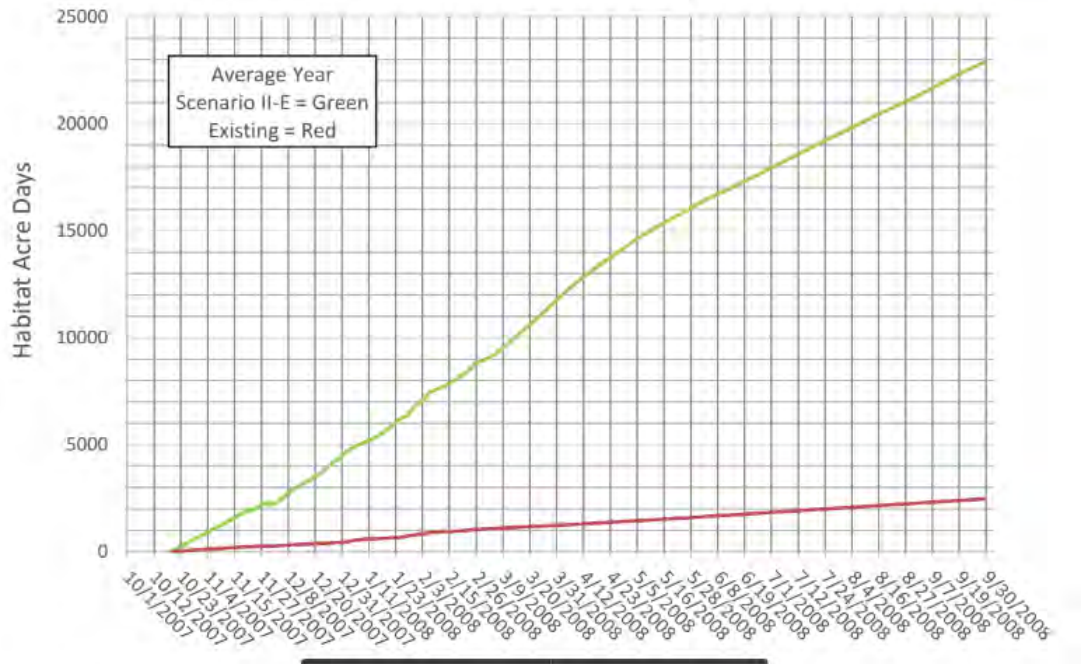


Figure 4.2.12C. 2008 annual hydrograph used to assess hydraulics and sediment transport of Stage 1 Scenarios for an average water year.

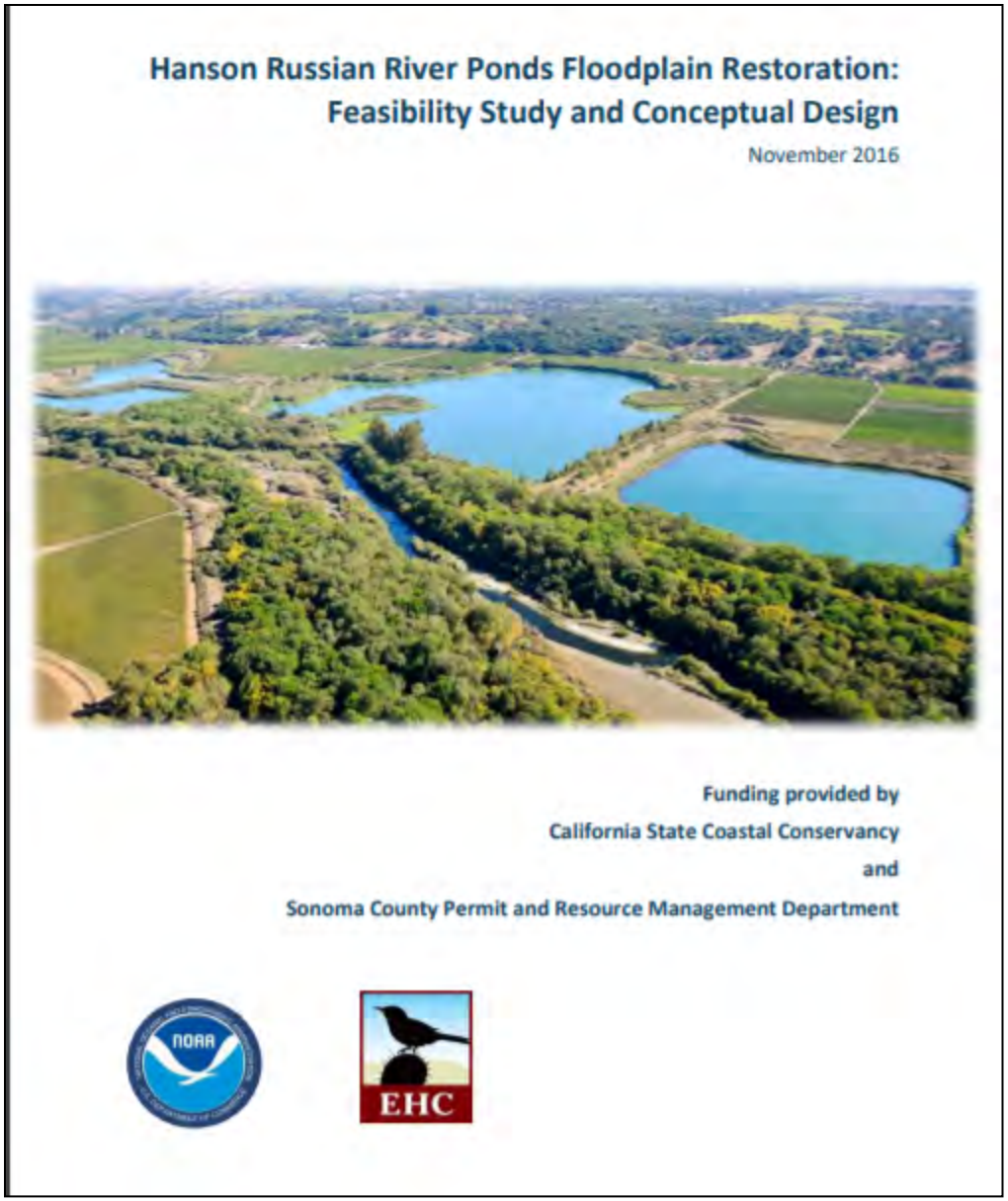

Average Year
Scenario II-E = Green
Existing = Red
Habitat Acre Days
25000
20000
15000
10000
5000
0
10/1/2007
10/12/2007
10/23/2007
11/4/2007
11/15/2007
11/27/2007
12/8/2007
12/20/2007
12/31/2007
1/11/2008
1/23/2008
2/3/2008
2/15/2008
2/26/2008
3/9/2008
3/20/2008
3/31/2008
4/12/2008
4/23/2008
5/5/2008
5/16/2008
5/28/2008
6/8/2008
6/19/2008
7/1/2008
7/12/2008
7/24/2008
8/4/2008
8/16/2008
8/27/2008
9/7/2008
9/19/2008
9/30/2008

- The 1 mile floodplain adds 11x the habitat to the 8 mile reach
- Mathematically equivalent to 90 miles of river, but far more valuable.
- That's the power of passage onto floodplain.



status:

- Concept plans and FR being revised for permit application and design/build grant proposals
  - ~$600k available
- Supporting consortium:
  - Hanson
  - Endangered Habitats Conservancy
  - CA Coastal Conservancy
  - Sonoma County – PRMD and SWCA
  - Russian River Keeper
  - Noble Engineering – Rachel Kamman



FR online at https://russianriverkeeper.org/

Further reading:

- Hauer et al 2016. Gravel bed river floodplains are the ecological nexus for glaciated mountain landscapes. *Science Advances* 24 Jun 2016: Vol. 2, no. 6, e1600026 DOI: 10.1126/sciadv.1600026
- An Ecosystem Perspective of Riparian Zones Gregory, Stanley V; Swanson, Frederick J; et al *Bioscience*; Sep 1991; 41, 8; Research Library Core pg. 540
- Cluer and Thorne 2013. A Stream Evolution Model Integrating Habitat and Ecosystem Benefits. *River Research and Applications* 30: 135-154
- Nicholas J. Corline, Ted Sommer, Carson A. Jeffres & Jacob Katz. Zooplankton ecology and trophic resources for rearing native fish on an agricultural floodplain in the Yolo Bypass California, USAManagement ISSN 0923-4861 *Wetlands Ecol Manage* DOI 10.1007/s11273-017-9534-2 Z