INFORMATION ITEM

Findings of the Elk River Recovery Assessment

Item No. 12

Darren Mierau, California Trout
Bonnie Pryor, Northern Hydrology & Engineering
Chuck Striplen, Environmental Scientist, Basin Planning

Santa Rosa
February 21, 2019

CALIFORNIA Water Boards

PRESENTATION OVERVIEW

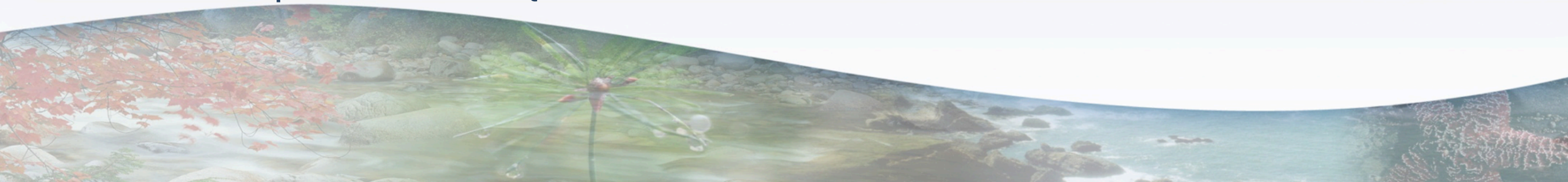
1. Actions Leading to the Elk River Recovery Assessment
2. Overview of Program Partners, Objectives, and Scope
3. Approach to the ERRA

Break for Questions

4. Summary of Key Findings
5. Brief Review of ERRA Analyses and Results
   - Salmon and Steelhead Beneficial Uses
   - Geomorphic and Watershed Setting
   - Sediment and Hydrodynamics
   - Modeling Scenarios

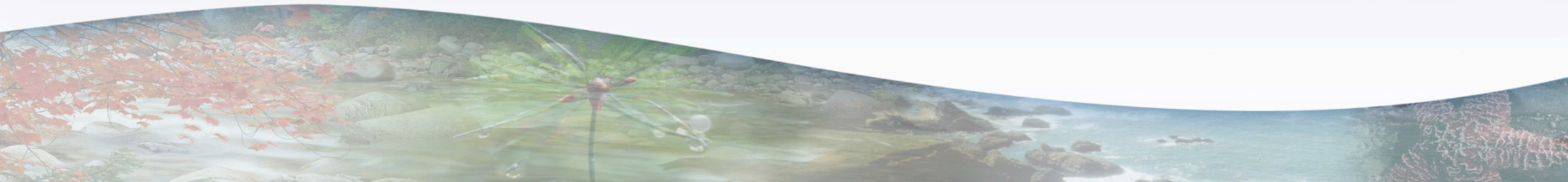
Break for Questions

6. Recommended Actions
7. Next Steps
8. Open Discussion Q&A



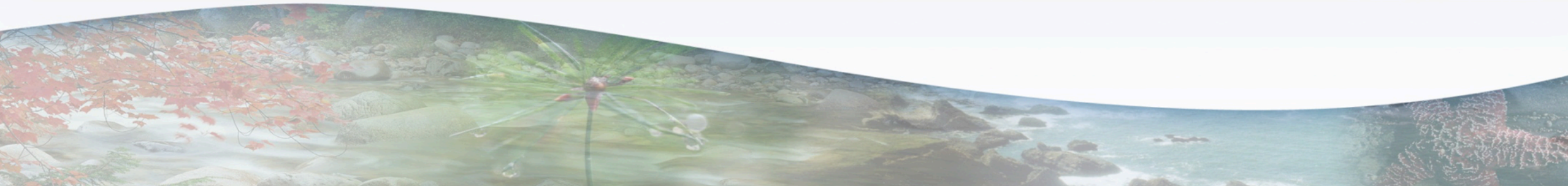
ACTION PLAN FOR THE UPPER ELK RIVER SEDIMENT TMDL

- Regional Water Board adoption on May 12, 2016
- State Water Board adoption on August 1, 2017
- Office of Administrative Law approval on March 8, 2018
- US EPA approval on April 4, 2018



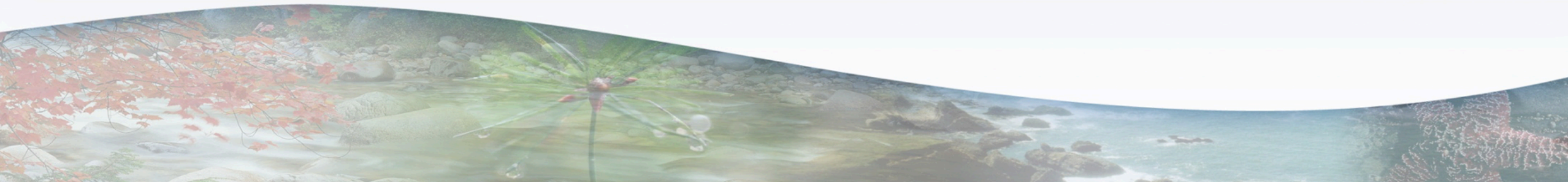
ACTIONS LEADING TO ELK RIVER RECOVERY ASSESSMENT

- 2000 – Staff Report for Proposed Regional Water Board Actions in the North Fork Elk River, Bear Creek, Freshwater Creek, Jordan Creek and Stitz Creek Watersheds
- 2002 – Independent Scientific Review Panel's Final Report on Sediment Impairment and Effects on Beneficial Uses of the Elk River and Stitz, Bear, Jordan and Freshwater Creeks
- 2003 – Independent Scientific Review Panel's Phase II of the Final Report on Sediment Impairment and Effects on Beneficial Uses of the Elk River and Stitz, Bear, Jordan and Freshwater Creeks



ACTIONS LEADING TO ELK RIVER RECOVERY ASSESSMENT

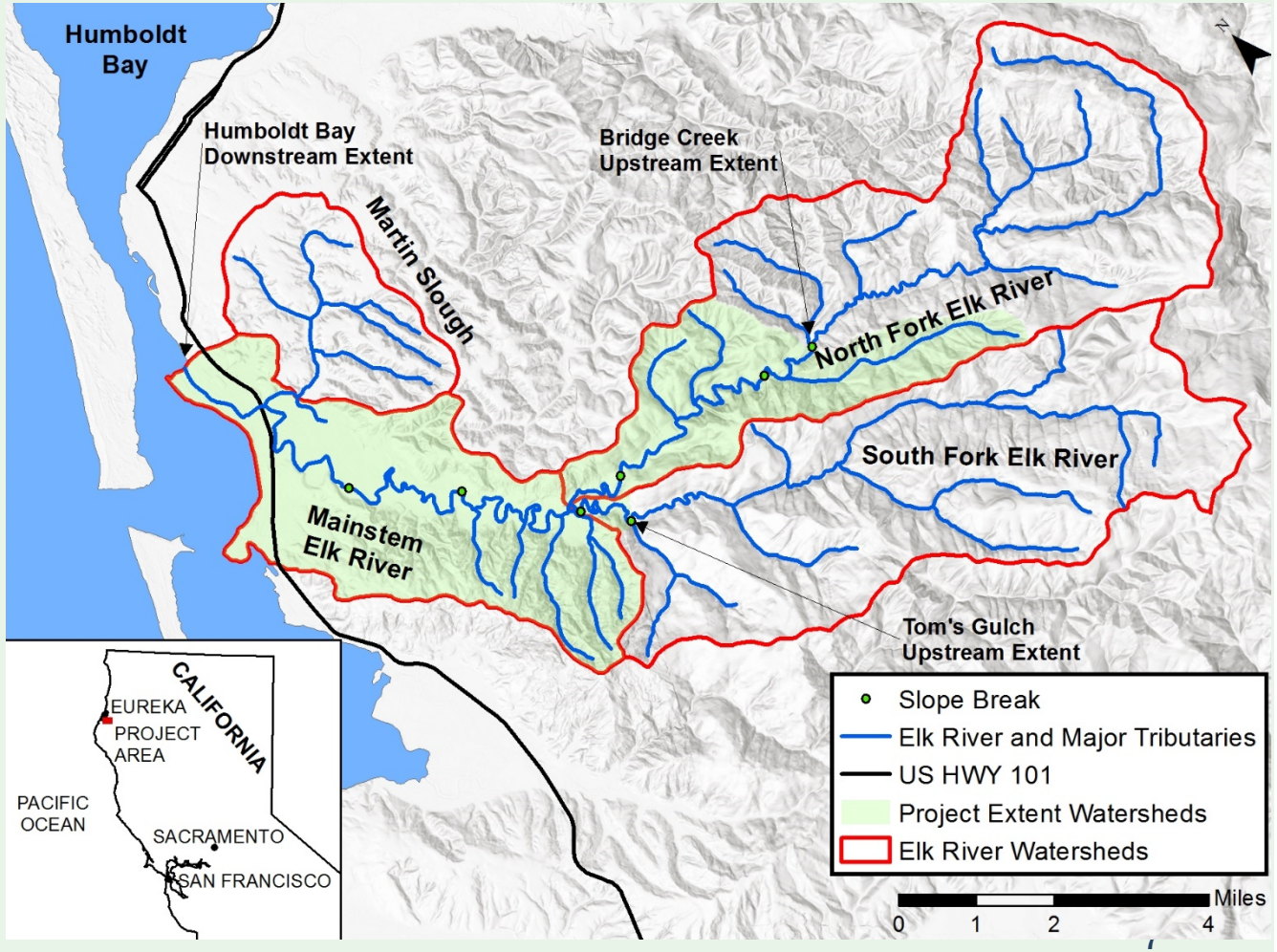
- 2004 – Preliminary Assessment of Flooding In Lower Elk River
- 2009 – CEQA scoping starts
- 2011 – Upper Elk River Source Analysis
- 2012 – Elk River Restoration Summit - Elk River Pilot Project Hydrodynamic and Sediment Transport Model introduced
- 2013 – Elk River Recovery Assessment and Pilot Project Implementation (Steel Bridge) funded
- 2016 – Pilot Sediment Remediation Project (Forest Legacy) funded



Berta Road 3-24-2018. Photo by Mike Wier

Approach

- Document existing morphology and sediment conditions within the Project Area
- Develop tools to assess future conditions in response to potential actions
  - a conceptual model
  - a numerical hydrodynamic and sediment transport (HST) model
- Analyze system trajectory under various management scenarios (1) existing conditions, (2) reduced sediment loads, (3) modified channel
- Identify opportunities and constraints (Actions) to hasten recovery of Beneficial Uses



Primary ERRA focus is remediation of sediment impairment and abatement of nuisance flooding

- **If no action is taken, will Elk River recover?**
- **If sediment loads are reduced, will the Elk River recover? More rapidly?**
- **If load reductions are insufficient, what additional actions may be required?**

Integration with Stewardship has increased emphasis on “Conceptual Model”

Permitting of Pilot Projects has expanded focus to include ESA Recovery Objectives

- **Chinook Salmon, Coho Salmon, Steelhead**

Elk River Estuary 1-18-2016. Photo by Brad Finney

Desired Conditions

Opportunities & Constraints

Trajectory of River with Existing Conditions (Scenario 1)

Existing Conditions

Develop Actions

Trajectory of River with Reduced SSC (Scenario 2)

No

****

Develop Plans, Permitting, Implementation, Monitoring, Assessment, Adapt

****

YES!

Are Objectives Met?

Analyze Actions Individually

Analyze Actions Collectively Modified Channel (Scenario 3)

SSC REDUCTION SCENARIO

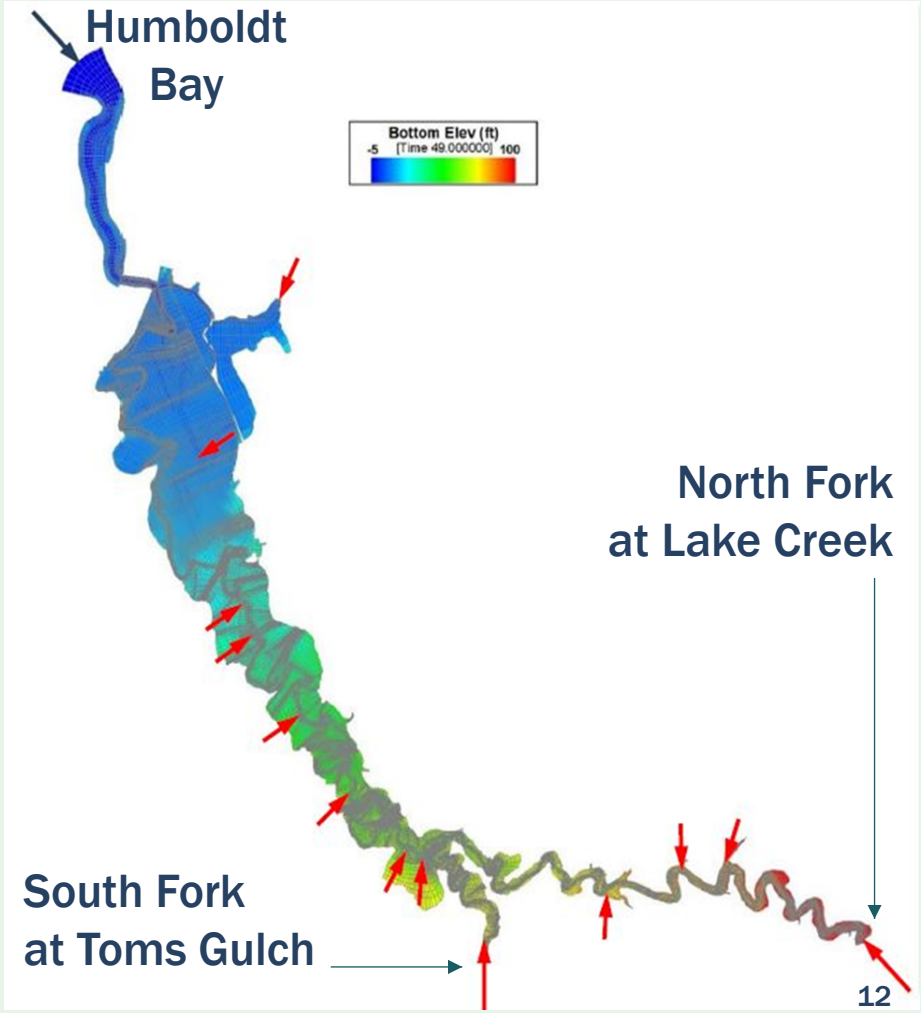
Option	South Fork	North Fork	Description
1	49%	30%	Minimum loads
2	40%	28%	Based on professional judgement and TMDL targets
3	26%	40%	Average of 1988-1997 ratios
4	11%	8%	Average of random permutations
Average	32%	27%	Average of Options

TAC INPUT ON SET OF ACTIONS TO MODEL

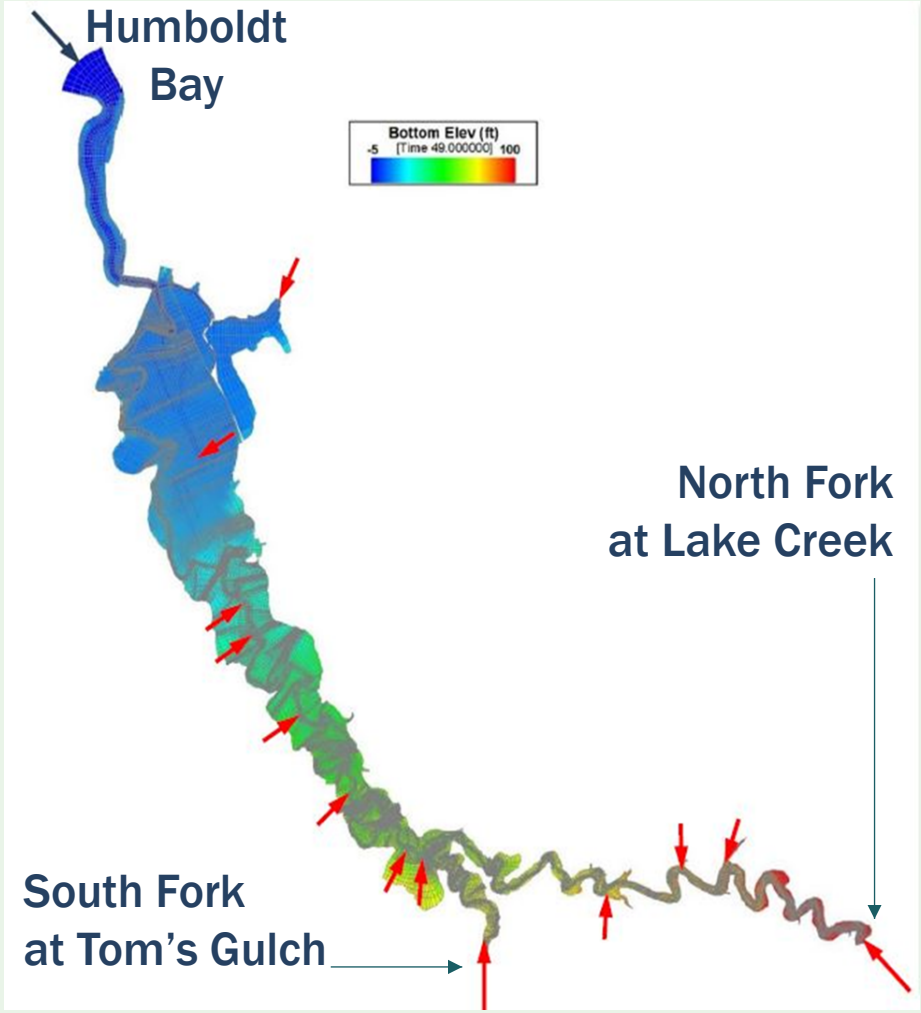
Model Input	Existing	Modified	Type of Modification
Channel topography	4	8	Excavate channel to Pre-1980's channel geometry
Sediment supply	7	3	Reduced SSC by 30%
Vegetation on the floodplain	10	2	Apply target vegetation across all floodplains
Vegetation on banks	5	7	Apply target vegetation on banks
Vegetation in channel bed	0	12	Remove vegetation from the channel bed
Large woody debris	5	6	Apply target wood frequency and size to entire channel
Roughness height	2	9	Reduce roughness height by removing increased roughness due to live vegetation, fine wood, etc.

ELK RIVER HST MODEL

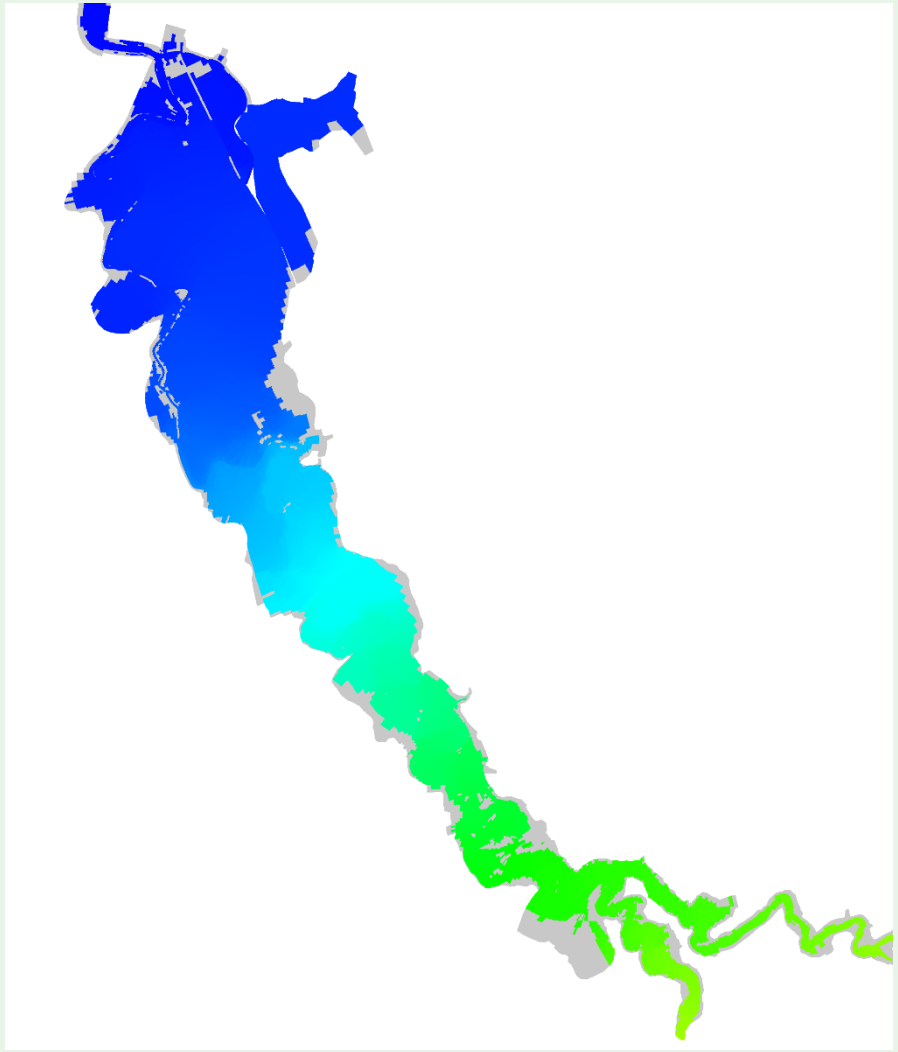
- Environmental Fluid Dynamics Code (EFDC)
- Two-dimensional
- Length: ~18 miles
- Time Scale: 13 years
- Calibrated: WY2015 (1 year)
- Verified: WY2003-2014 (12 years)
  - Met EPA performance measures for depth, flow and SSC
  - Nash-Sutcliffe and Relative Bias: good to excellent



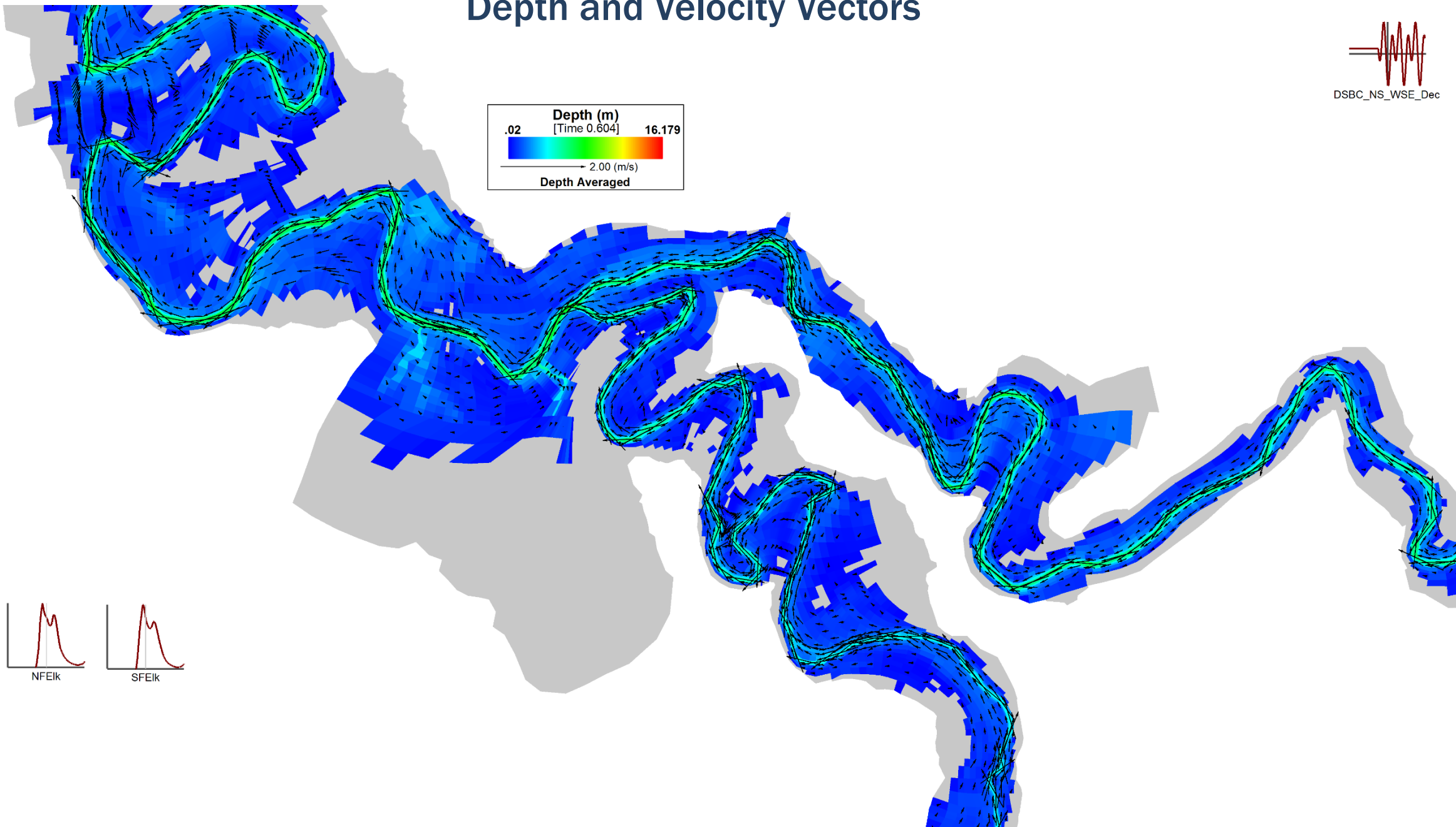
- **Model Domain**
  - Topography
  - Channel and Floodplain Materials
  - Vegetation
  - Infratructure
- **Boundary Conditions**
  - Flow
  - Suspended Sediment Concentration
  - Water surface elevation



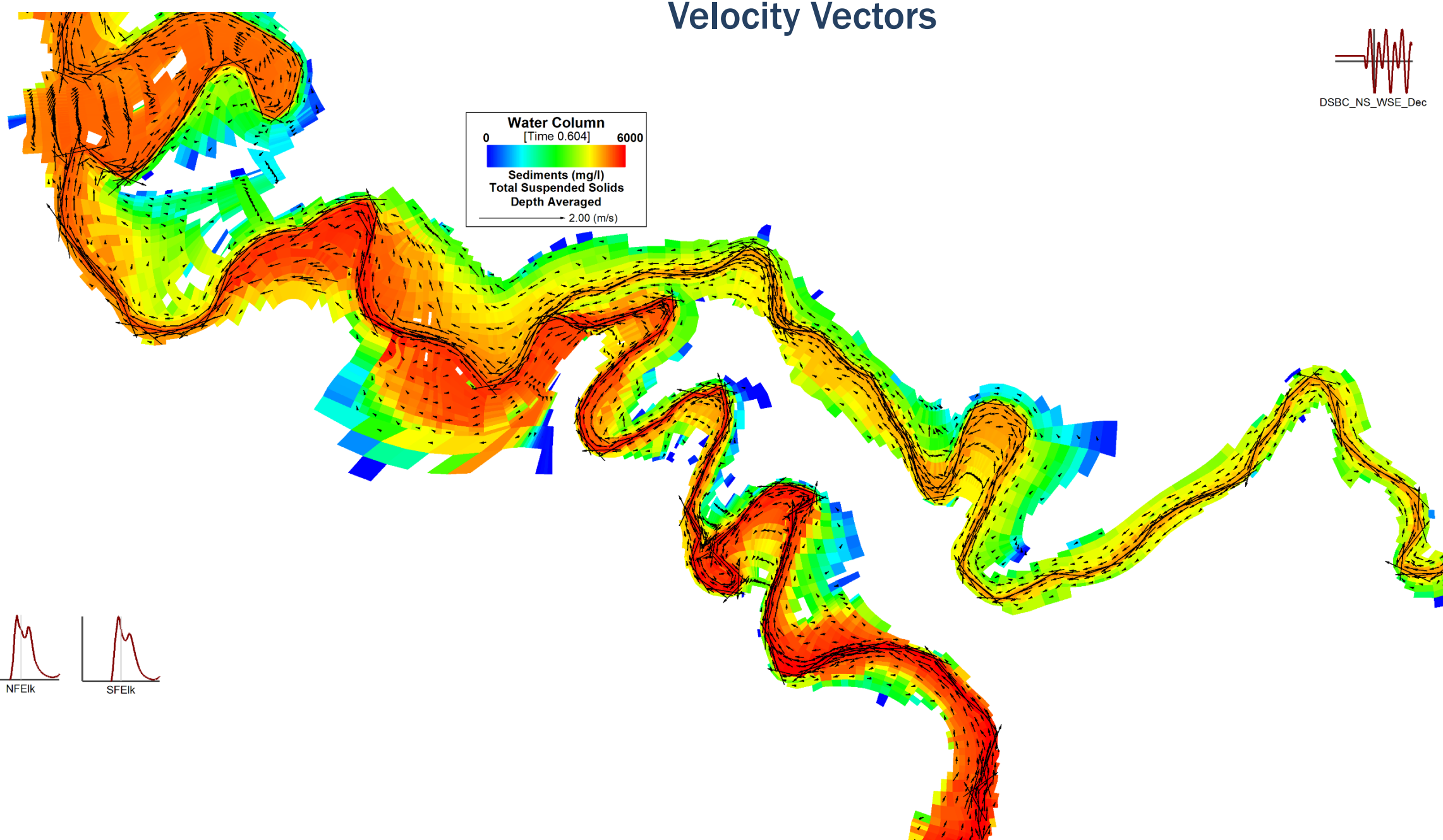
- Flood inundation magnitude and duration
- Depth
- Velocity
- Topographic changes (scour and deposition)
- Suspended sediment concentration (SSC)
- Substrate composition



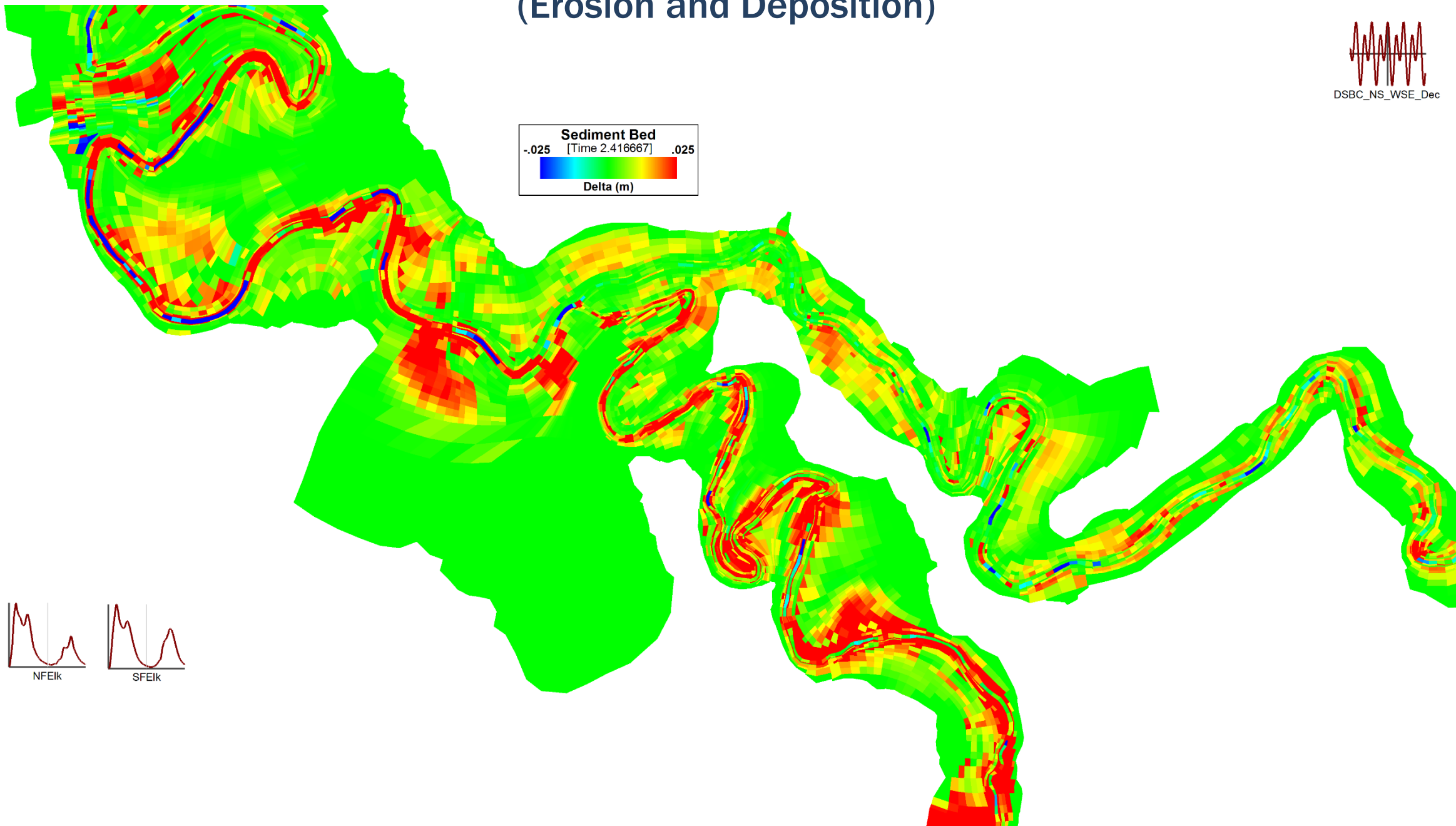
Depth and Velocity Vectors



Suspended Sediment Concentration and Velocity Vectors



Topographic Change
(Erosion and Deposition)



PRESENTATION OVERVIEW

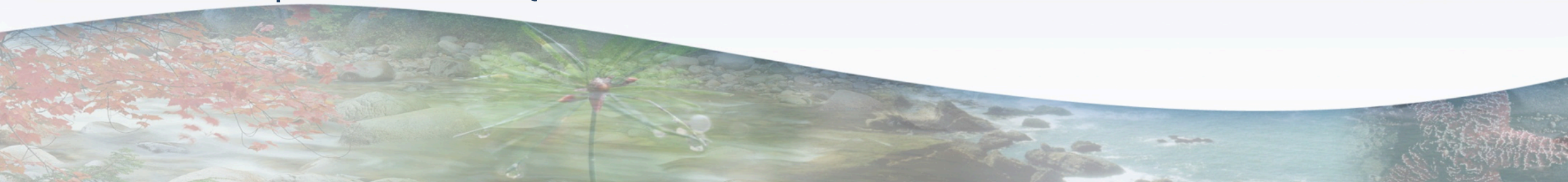
1. Actions Leading to the Elk River Recovery Assessment
2. Overview of Program Partners, Objectives, and Scope
3. Approach to the ERRA

Break for Questions

4. Summary of Key Findings
5. Brief Review of ERRA Analyses and Results
   - Salmon and Steelhead Beneficial Uses
   - Geomorphic and Watershed Setting
   - Sediment and Hydrodynamics
   - Modeling Scenarios

Break for Questions

6. Recommended Actions
7. Next Steps
8. Open Discussion Q&A



Impairment:

- Continues to aggrade; no decline in SSC
- No recovering to pre-1980s channel conditions
- Nuisance flooding will continue to worsen
- Impairments to beneficial uses may stay the same, or worsen.

Positive Functions:

- Sediment deposition reduces downstream impacts

Recommendation:

- Include similar or more areas to trap sediment with other actions that will reduce nuisance flooding and improve beneficial uses

Impairment:

- No recovering toward pre-1980s channel conditions
- Aggrades at a slower rate
- Nuisance flooding worsens at a slower rate
- Most beneficial uses continued to be impaired.

Positive Functions:

- Lower SSC improves some beneficial uses
- **Reduction in SSC benefits the entire river downstream of the reduction**

Recommendation:

- Aggressively reduce SSC levels (more than 30%)

Impairment:

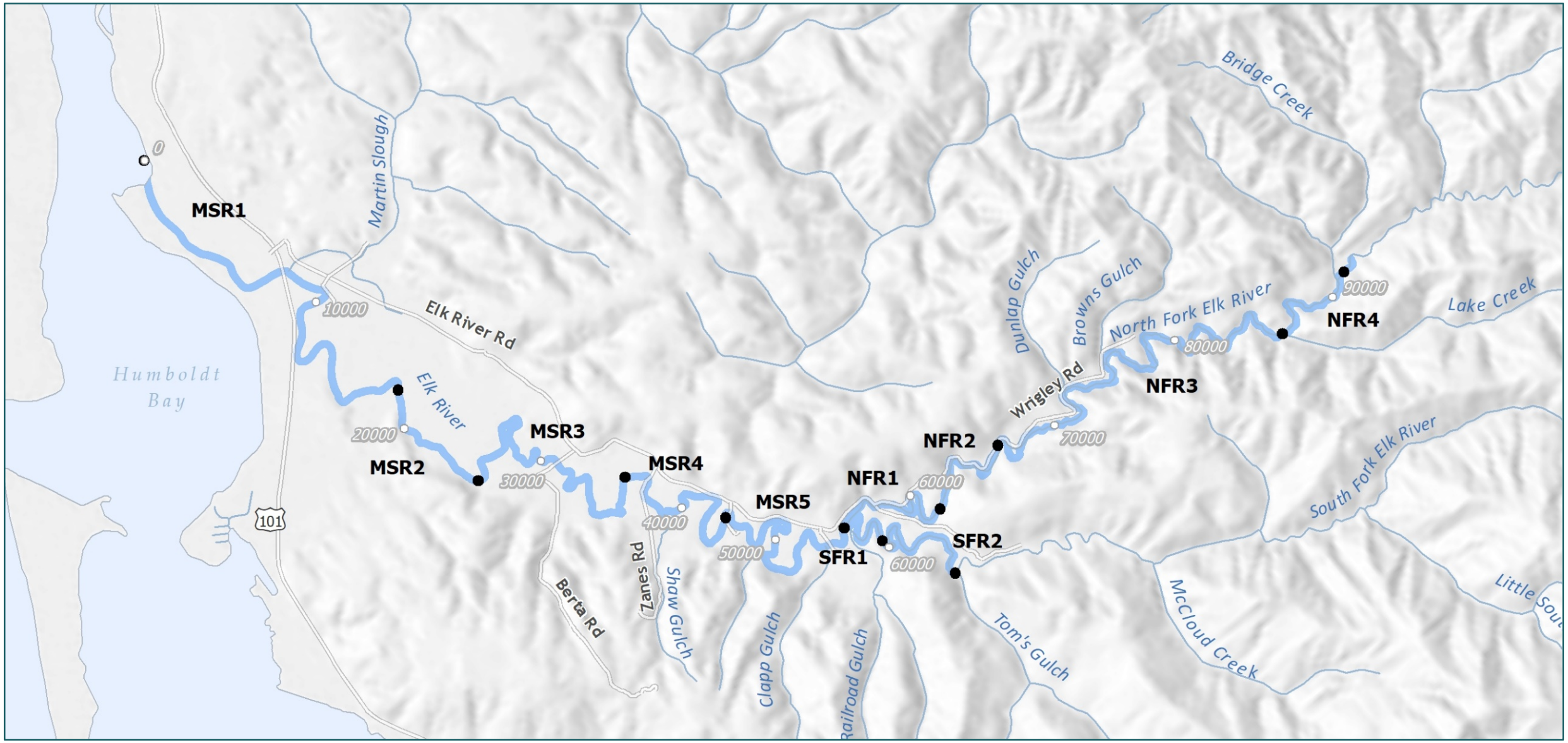
- SSC increases
- Increase sediment delivery to the tidal reaches and the bay
- Floodplain function is reduced

Positive Functions:

- Substantial reduction in nuisance flooding
- Improvement to many beneficial uses
- Channel does not rapidly re-aggrade

Recommendation:

- Combine this action with other actions that reduce SSC, trap sediment, improve floodplain habitat and connectivity, provide a long-term source of wood


0
MSR1
Martin Slough
10000
Elk River Rd
Humboldt Bay
Elk River
20000
MSR2
MSR3
30000
MSR4
40000
MSR5
50000
SFR1
60000
SFR2
NFR1
NFR2
70000
Wrigley Rd
NFR3
80000
North Fork Elk River
90000
NFR4
Bridge Creek
Dunlap Gulch
Browns Gulch
Lake Creek
South Fork Elk River
McCloud Creek
Tom's Gulch
Railroad Gulch
Clapp Gulch
Shaw Gulch
Zanes Rd
Berta Rd
101

ACTION CATEGORIES

- Sediment load reduction
- Channel rehabilitation
- Floodplain rehabilitation
- Infrastructure
- Vegetation management

Photo Date: 4/7/2013

SFR 2 ACTIONS

(Tom's Gulch to SFR1)

- **Sediment Load Reduction**
  - Tom's Gulch source reduction and detention
  - Recontour floodplains
- **Channel Rehabilitation**
  - Remove sediment
  - Add large wood
- **Floodplain Rehabilitation**
  - Selective near channel floodplain lowering
- **Infrastructure**
  - Ensure passage of wood at bridge
- **Vegetation**
  - Expand conifer-dominated riparian community
  - Discourage vegetation in active channel

Table 7-1 p.129

Channel conditions do not currently meet water quality objectives (in some seasons/locations)for:

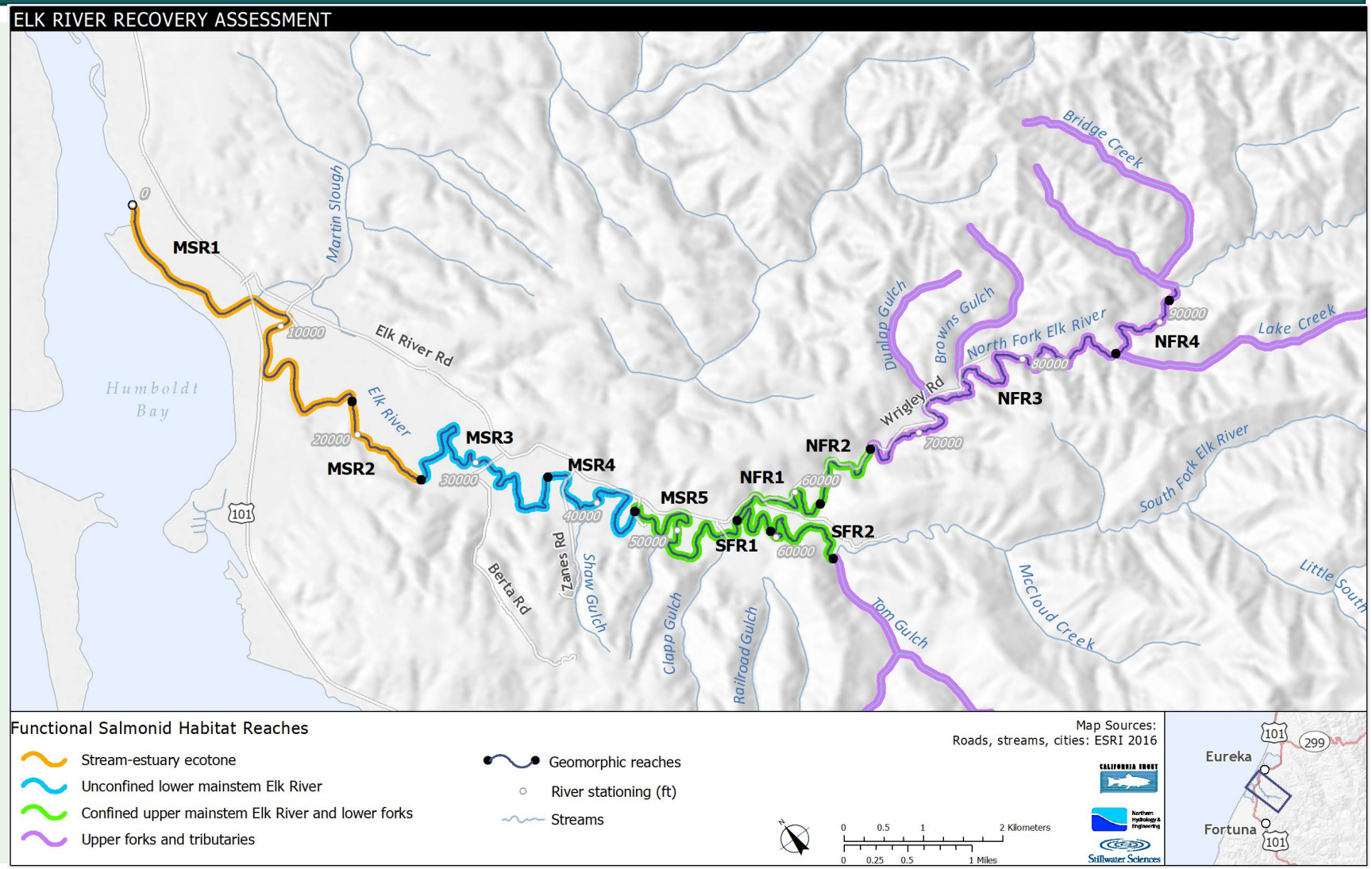
- Sediment
- Suspended material
- Settleable matter
- Turbidity
- Dissolved oxygen

Adversely impact multiple Beneficial Uses:

- Municipal [MUN] and Agricultural [AGR] water supplies
- Cold freshwater habitat [COLD]
- Rare, threatened and endangered species [RARE]
- Migration of aquatic organisms [MIGR]
- Spawning, reproduction, and/or early development [SPWN]
- Water contact recreation [REC-1])

HABITAT REACHES

- **4 Functional Habitat Reaches**
  - Upper Forks and Tribs
  - Confined Upper Mainstem/Lower Forks
  - Unconfined Lower Mainstem
  - Stream-Estuary Ecotone



NF Elk River “POOL” 08-25-2018. Photo by Matt Metheny

Site/WY[2]	Juvenile salmonids only						Salmonid eggs + larvae					
	Suspended sediment concentration (mg/L)						Suspended sediment concentration (mg/L)					
	SSC 2981	SSC 1097	SSC 403	SSC 148	SSC 55	SSC 20	SSC 2981	SSC 1097	SSC 403	SSC 148	SSC 55	SSC 20
SF 2003	7.7	8.3	7.9	7.9	7.6	7.8	8.2	10	10.1	11	11.3	12.4
NF 2003	0	7.8	7.7	7.3	7.1	7.3	0	9.1	9.8	9.9	10.5	11.6
SF 2004	0	6.8	7.4	7.4	6.9	6.8	0	7.6	9.3	10.1	10.1	10.7
NF 2004	0	6.2	7.3	7.2	6.8	7.2	0	6.7	9.2	9.9	9.9	11.4
SF 2005	0	7.2	7.3	7.4	7.4	7.3	0	8.2	9.3	10.1	10.9	11.6
NF 2005	0	7.2	7	6.8	7.2	7.5	0	8.3	8.8	9.2	10.6	11.9
SF 2006	5.7	7.9	8.3	8.6	8.5	7.9	5	9.4	10.8	12.1	12.6	12.6
NF 2006	0	7.3	7.6	7.4	7.7	7.9	0	8.3	9.6	10.1	11.4	12.5
SF 2007	0	7.6	7.6	7.3	7.5	7.3	0	8.8	9.6	10.1	11.1	11.5
NF 2007	0	6.2	7.2	7	7.5	7.1	0	6.7	9	9.5	11.1	11.2
SF 2008	0	7.6	7.6	7.6	7.5	7.9	0	8.9	9.6	10.5	11.1	12.6
NF 2008	0	6.5	7	6.9	7.4	7.1	0	7.2	8.7	9.3	10.9	11.2
SF 2011	7.4	7.6	8.1	8.2	8.5	8	7.8	8.9	10.4	11.4	12.7	12.6
NF 2011	0	7.3	7.3	7.3	7	7.6	0	8.4	9.2	9.9	10.3	12.1
SF 2013	0	7.6	7.8	7.4	7.2	7.2	0	8.8	9.9	10.1	10.7	11.4
NF 2013	0	7.2	7.1	7.3	7.5	8.5	0	8.2	8.9	10	11.1	13.4

SEV 8–8.9	SEV 9–9.9	SEV 10–0.9	SEV 11–11.9	SEV ≥12
major physio-logical stress	reduced growth, delayed hatching	10–20% mortality	20–40% mortality	40–60% mortality

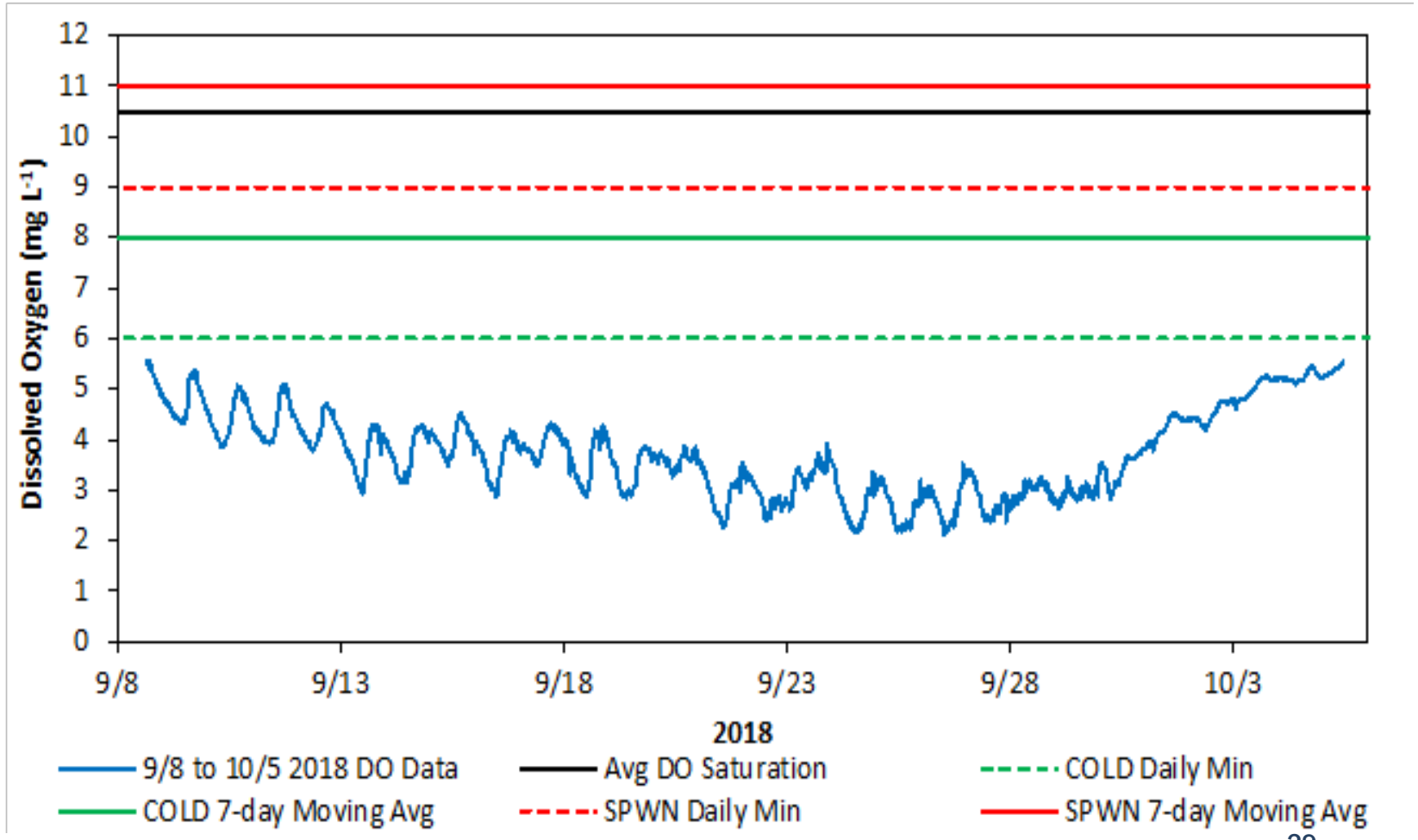
SSC & SEV

Severity of Ill Effects "SEV" Analysis

- Based on Newcombe and Jensen (1996)
- Lewis (2013)
- Used by NMFS in Section 7 consultations
- Applies to winter storm periods*

* No fish surveys during storm periods.

- **Continuous Dissolved Oxygen Monitoring at KRW**
  (at right)
  - NHE: Sept-Oct 2018
- **Synoptic Measurements in NF and SF Elk**
  (not shown)
  - CalTrout Sept-Oct 2018
  - RWB Data from 2007 and 2008



The direct and cumulative effects of sediment, habitat, and water quality impairment are affecting all life stages of salmonids

- Extensive physical habitat impairment (spawning and rearing habitat)
- Water quality impairment (SSC, Turbidity, DO)

Landscape scale alterations and ongoing land uses reduce productivity (survival)

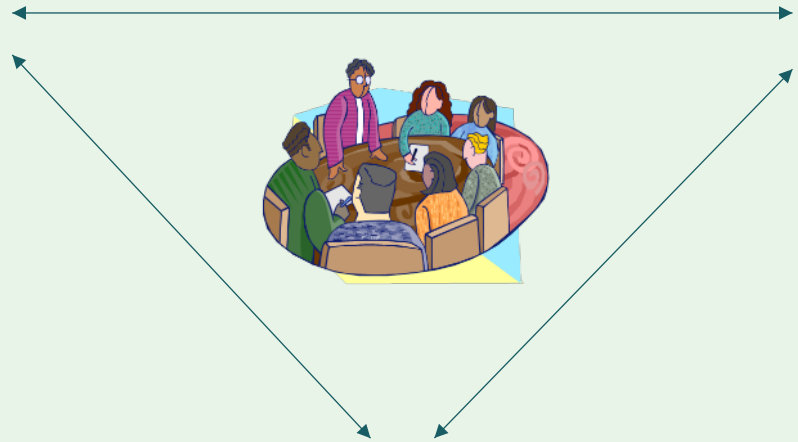
Population abundance is low and unlikely to increase in the foreseeable future

NF Elk River "POOL" 08-25-2018. Photo by Matt Metheny

TOOLS

Conceptual Model

- Develop a qualitative understanding of how a system works
- Identify natural and anthropogenic drivers and likely responses to changes in controlling variables
- Integrate and interpret different types of information (data, model results, qualitative information)

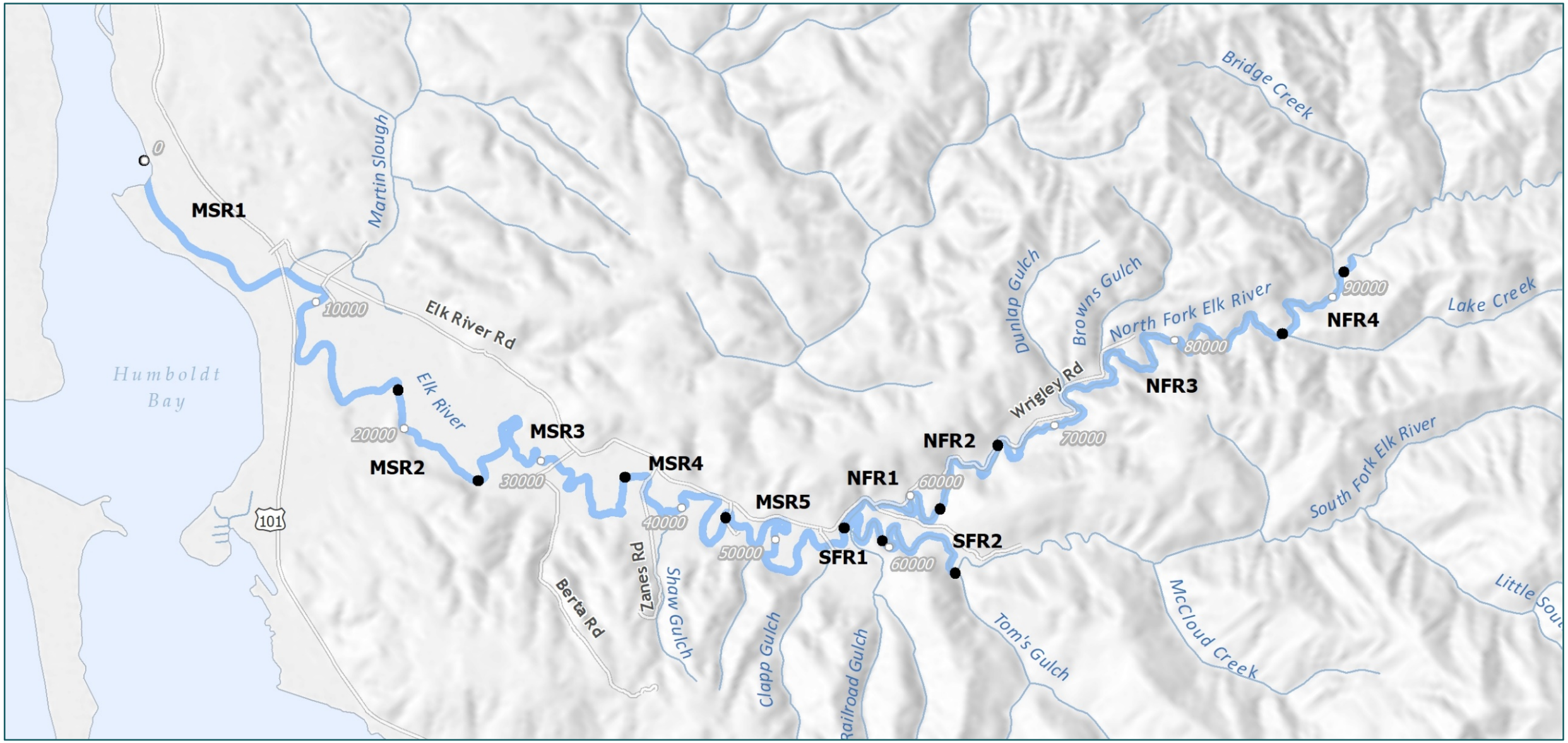


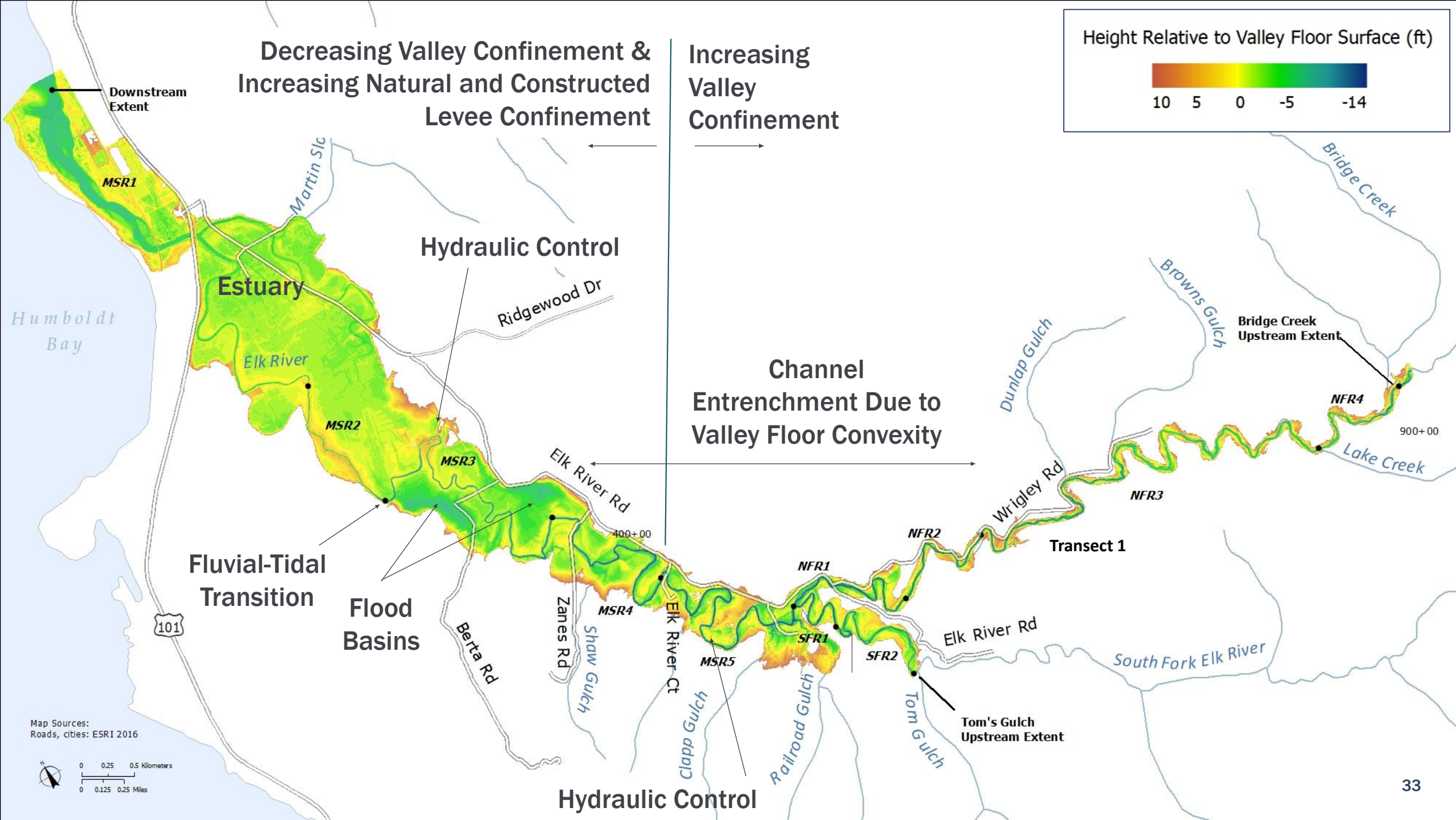
Data

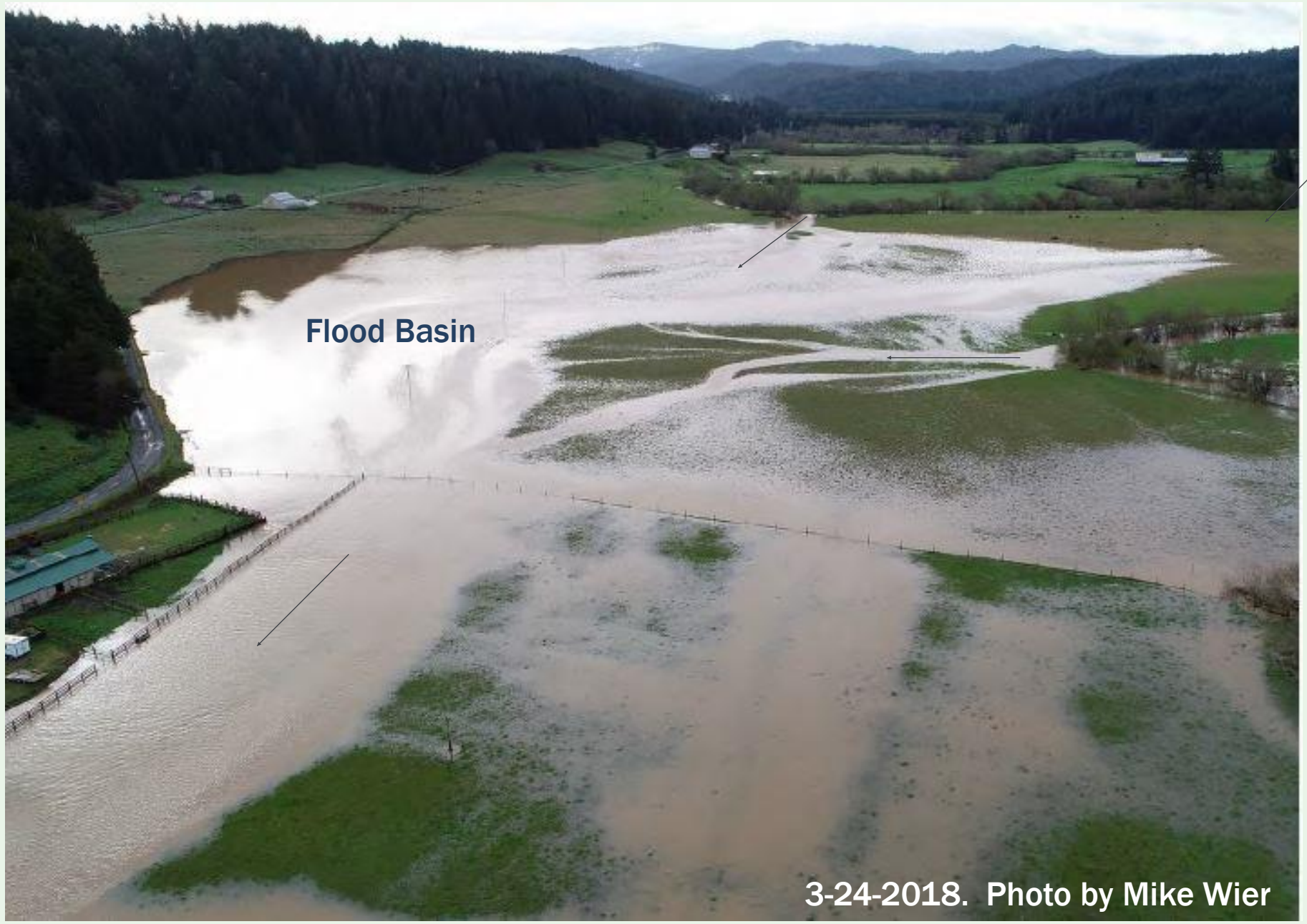
- Direct measure of system response
- Support numerical and conceptual models

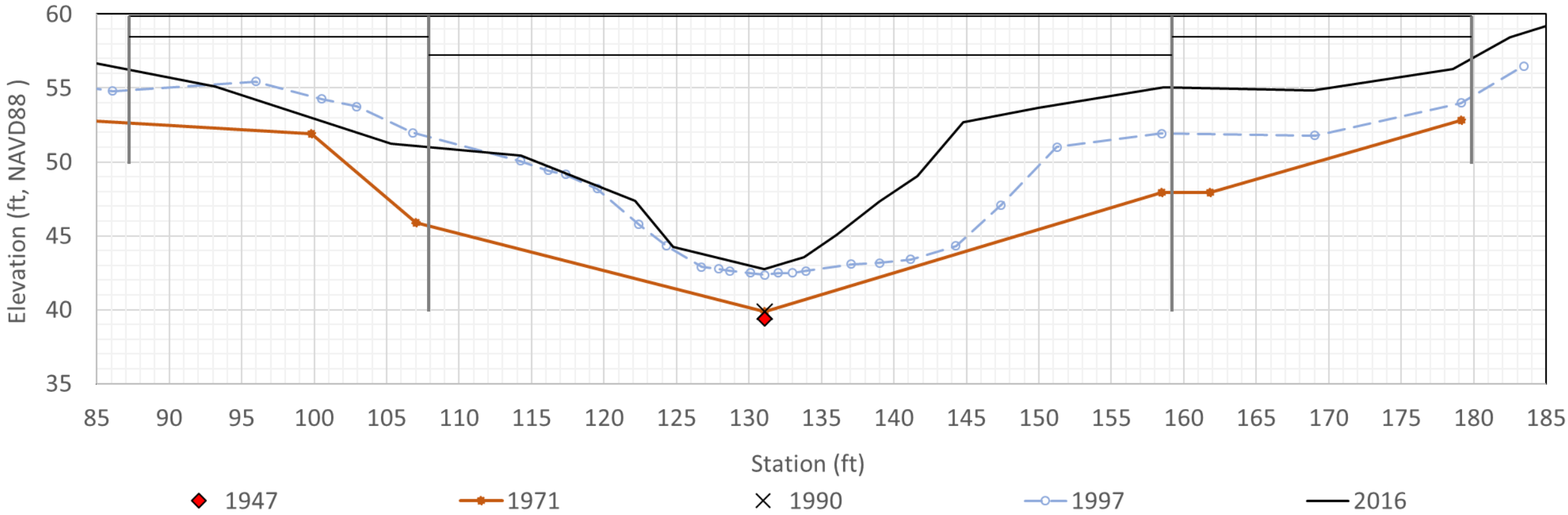
Numerical Model

- Predictive Tool (What-if scenarios)
- Isolate different components of the system
- Inform data collection


0
MSR1
Martin Slough
10000
Elk River Rd
Humboldt Bay
Elk River
20000
MSR2
MSR3
30000
MSR4
40000
MSR5
50000
SFR1
60000
SFR2
NFR1
NFR2
70000
Wrigley Rd
NFR3
80000
North Fork Elk River
90000
NFR4
Bridge Creek
Dunlap Gulch
Browns Gulch
Lake Creek
South Fork Elk River
McCloud Creek
Tom's Gulch
Railroad Gulch
Clapp Gulch
Shaw Gulch
Zanes Rd
Berta Rd
101


Height Relative to Valley Floor Surface (ft)
10 5 0 -5 -14
Decreasing Valley Confinement & Increasing Natural and Constructed Levee Confinement
Increasing Valley Confinement
Downstream Extent
MSR1
Martin Slough
Hydraulic Control
Estuary
Humboldt Bay
Ridgewood Dr
Elk River
MSR2
MSR3
Channel Entrenchment Due to Valley Floor Convexity
Bridge Creek
Browns Gulch
Dunlap Gulch
Bridge Creek Upstream Extent
NFR4
900+00
Lake Creek
Elk River Rd
400+00
NFR3
Wrigley Rd
NFR2
Transect 1
NFR1
Fluvial-Tidal Transition
Flood Basins
MSR4
Zanes Rd
Elk River Ct
SFR1
SFR2
MSR5
Berta Rd
Shaw Gulch
Clapp Gulch
Railroad Gulch
Tom Gulch
South Fork Elk River
Tom's Gulch Upstream Extent
101
Map Sources:
Roads, cities: ESRI 2016
0 0.25 0.5 Kilometers
0 0.125 0.25 Miles
Hydraulic Control


Sediment
Levee
Flood Basin
3-24-2018. Photo by Mike Wier

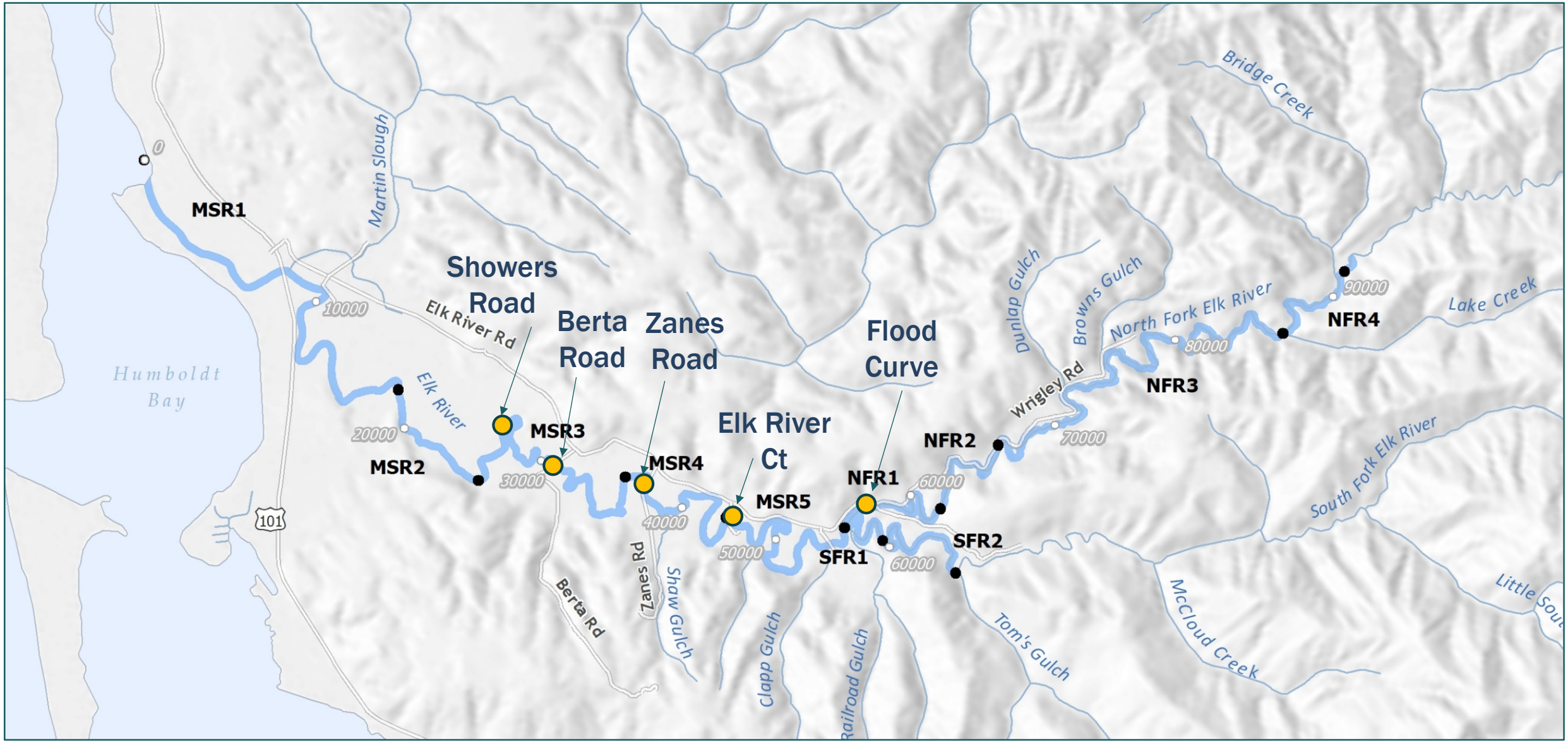

60
55
50
45
40
35
Elevation (ft, NAVD88)
85
90
95
100
105
110
115
120
125
130
135
140
145
150
155
160
165
170
175
180
185
Station (ft)
1947
1971
1990
1997
2016

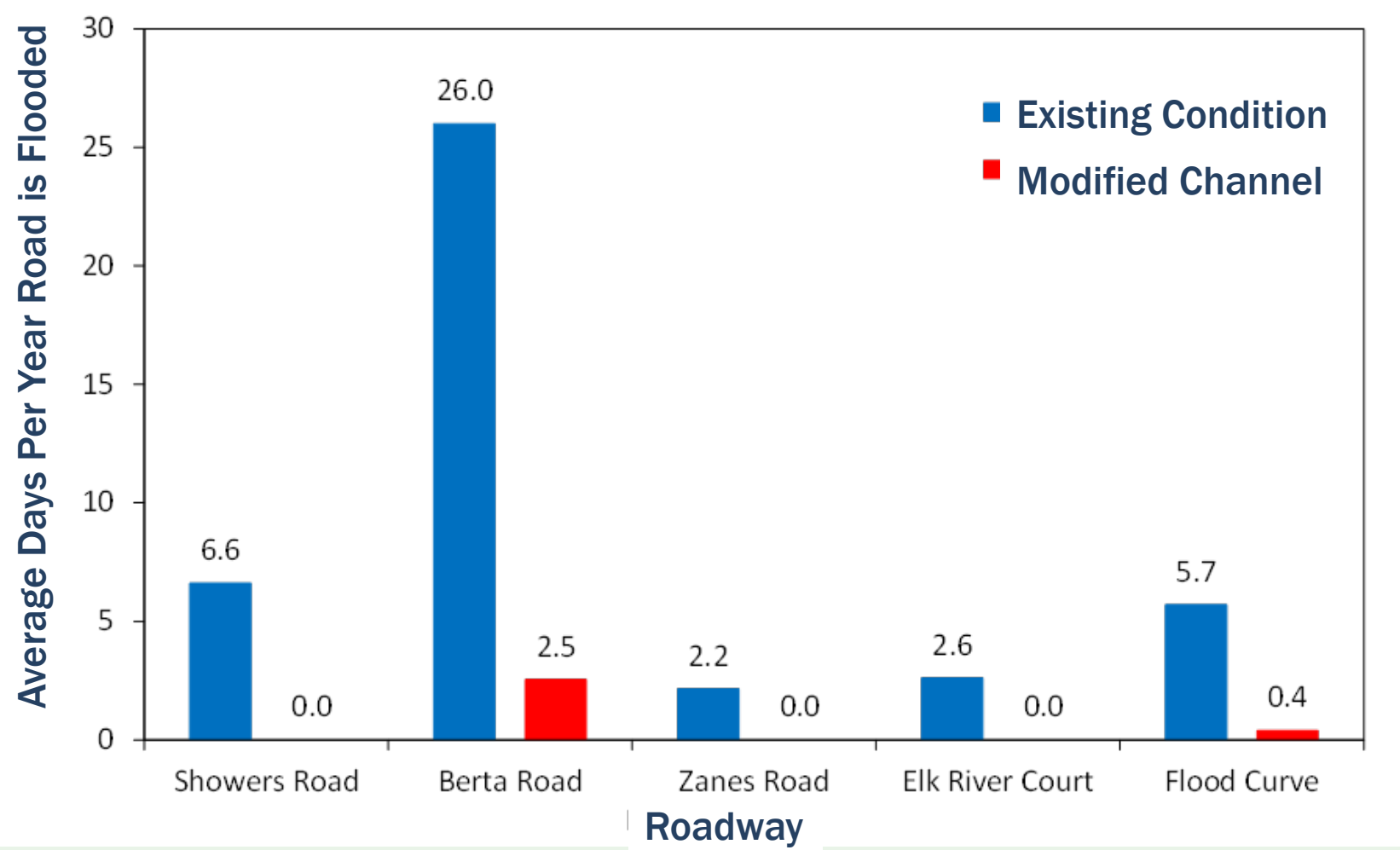
Vegetation Anchors Sediment Deposits

Riparian Veg And Fine Woody Debris Create Hydraulically Rough Channel

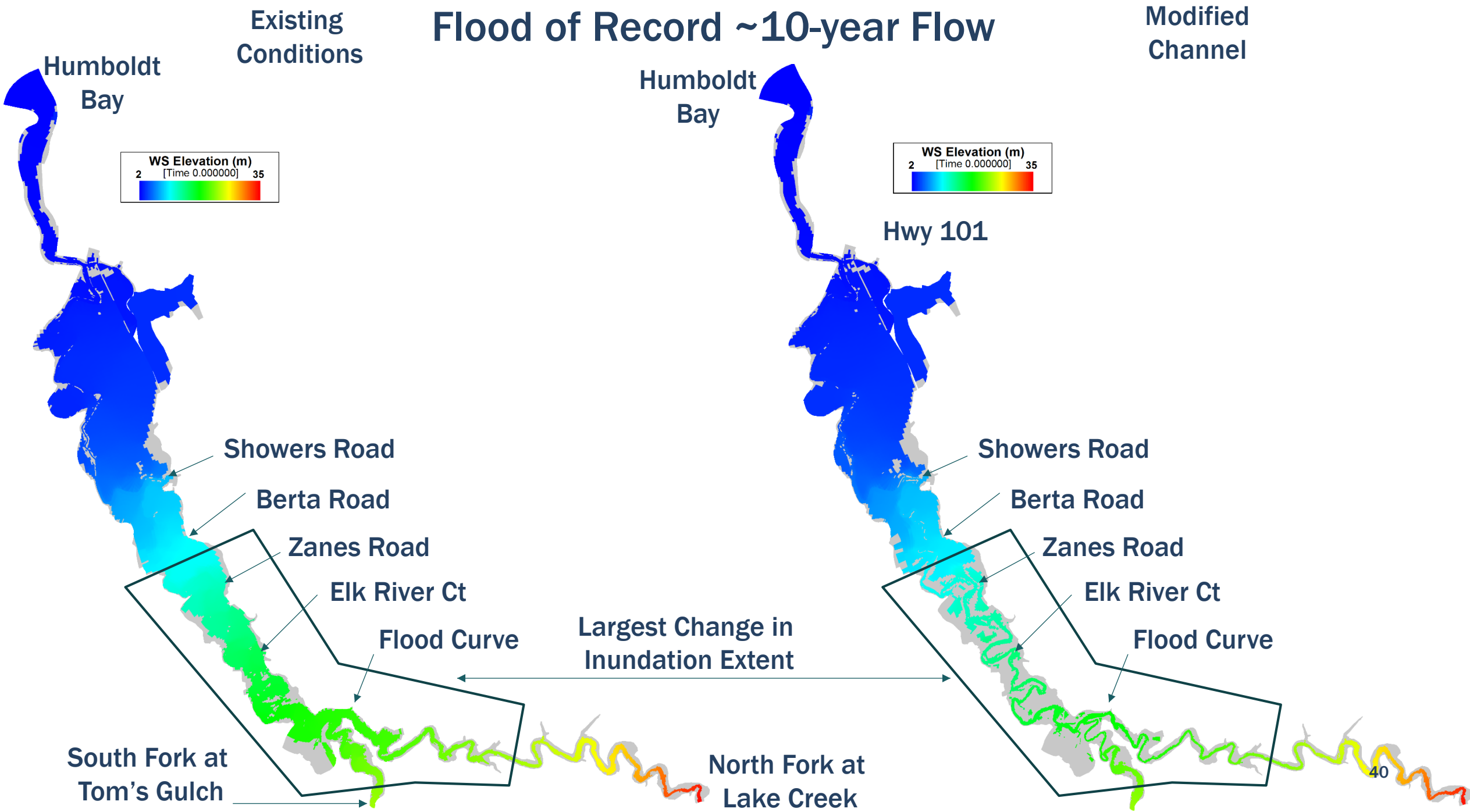
Management Scenarios

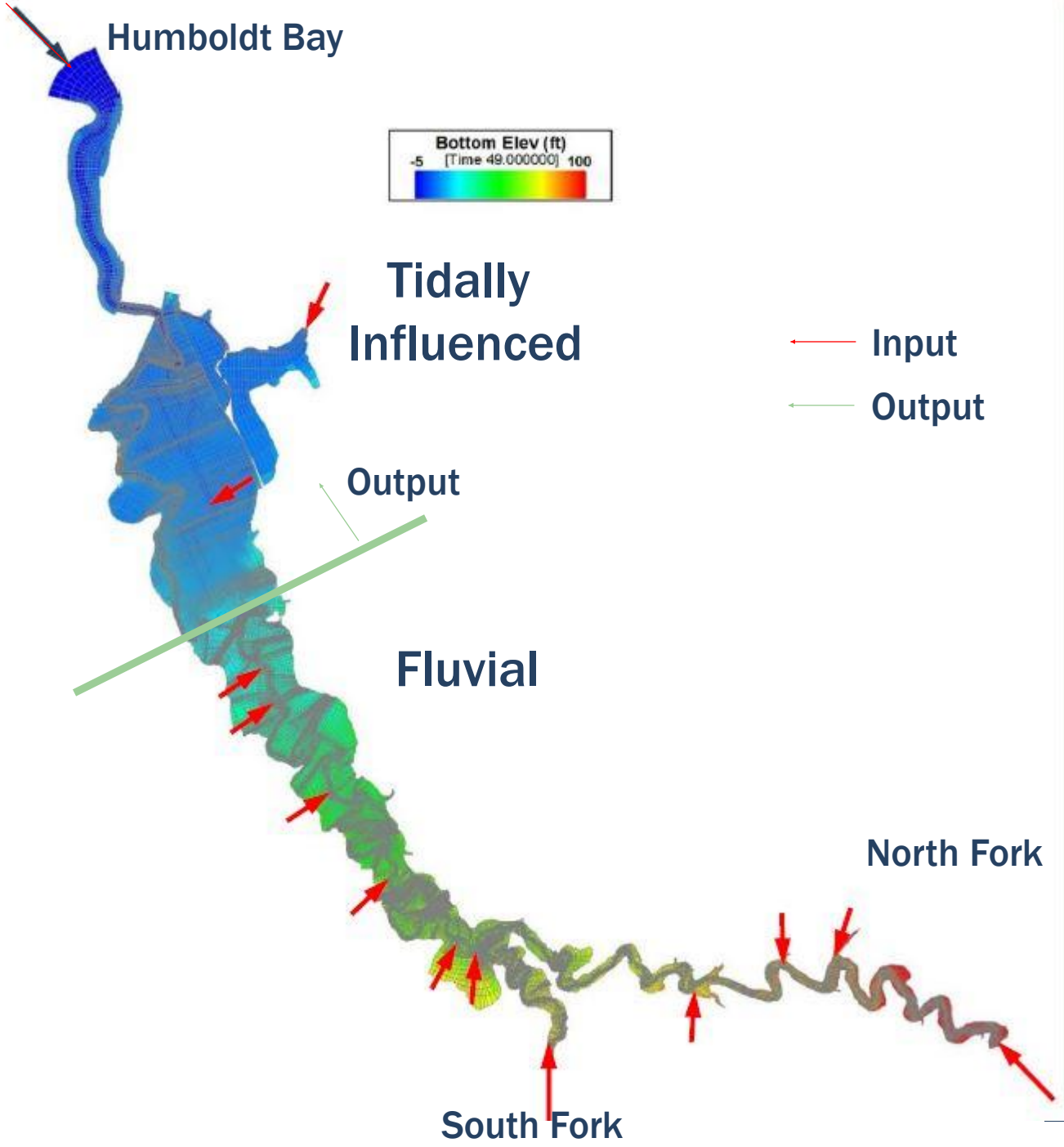
SSC	Existing Conditions with No Restoration Actions In the Project Area	Set of Actions Developed by ERRA with Input from TAC	Set of Actions Developed with Stewardship (Landowner/Community) Feedback
Existing SSC	<u>Scenario 1 (Existing Condition):</u> Provide base line for existing conditions (Calibration/Validation Run)	<u>Scenario 3 (Modified Channel):</u> Identify actions that hasten recovery of beneficial uses of water and related aquatic ecosystem functions and reduce nuisance flooding.	<u>Scenario 4 (Action Plan):</u> Identify community supported actions hasten recovery of beneficial uses of water and related aquatic ecosystem functions and reduce nuisance flooding.
Reduced SSC (provided by RWQCB)	<u>Scenario 2 (Reduced SSC):</u> Test whether recovery is initiated as a result of sediment load reduction alone.		
Response Variables	Topographic changes (channel and floodplain) Substrate composition Flood inundation magnitude and duration Suspended sediment concentration		


0
MSR1
Martin Slough
10000
Elk River Rd
Showers Road
Berta Road
Zanes Road
Flood Curve
Humboldt Bay
Elk River
20000
MSR2
MSR3
30000
MSR4
Elk River Ct
40000
MSR5
50000
NFR1
SFR1
60000
SFR2
NFR2
Wrigley Rd
70000
NFR3
80000
North Fork Elk River
90000
NFR4
Dunlap Gulch
Browns Gulch
Bridge Creek
Lake Creek
South Fork Elk River
McCloud Creek
Little Sou
Tom's Gulch
Railroad Gulch
Clapp Gulch
Shaw Gulch
Zanes Rd
Berta Rd
101


Average Days Per Year Road is Flooded
30
25
20
15
10
5
0
26.0
6.6
0.0
2.5
2.2
0.0
2.6
0.0
5.7
0.4
Existing Condition
Modified Channel
Showers Road
Berta Road
Zanes Road
Elk River Court
Flood Curve
Roadway

Flood of Record ~10-year Flow

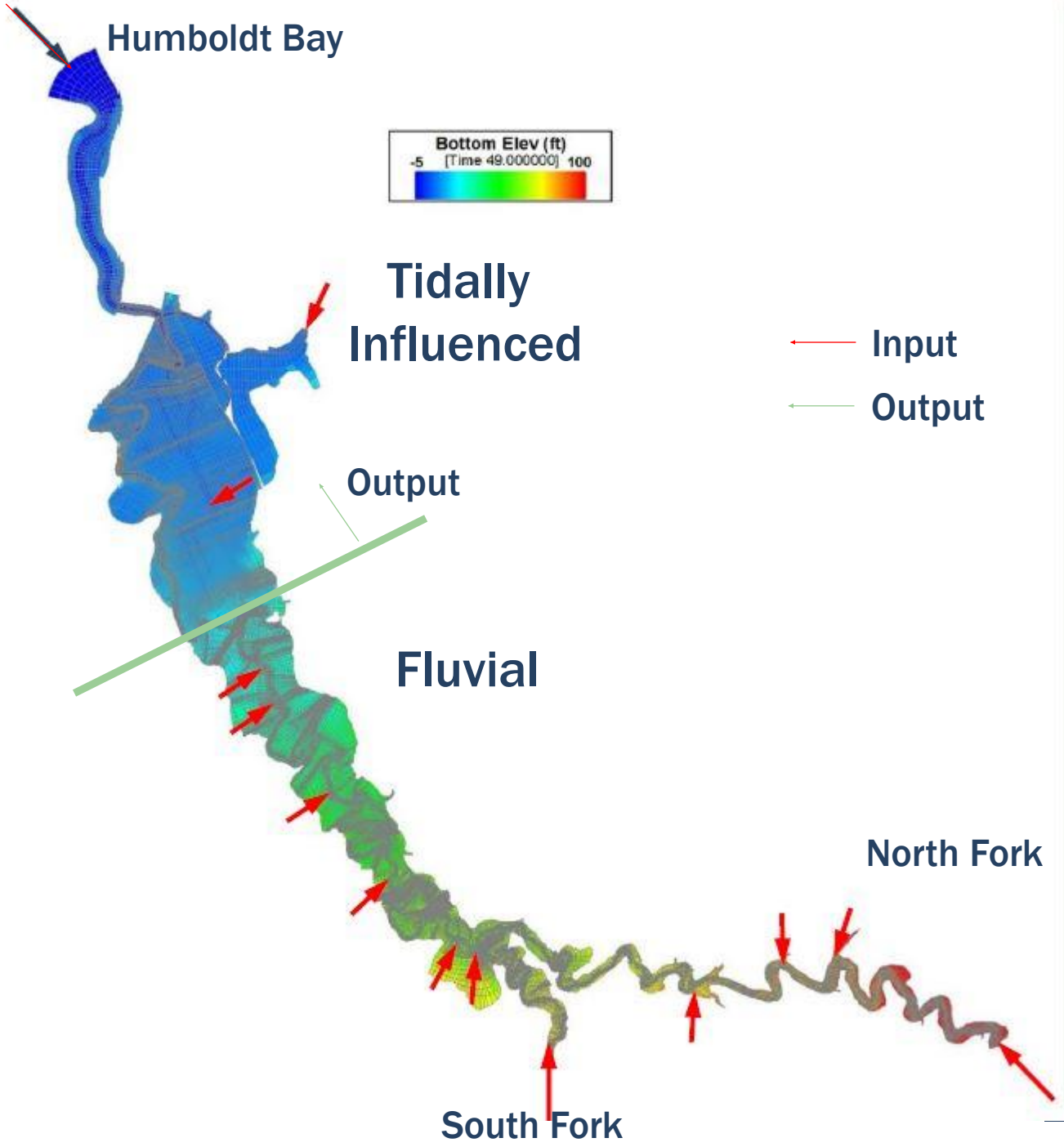




SEDIMENT BUDGET

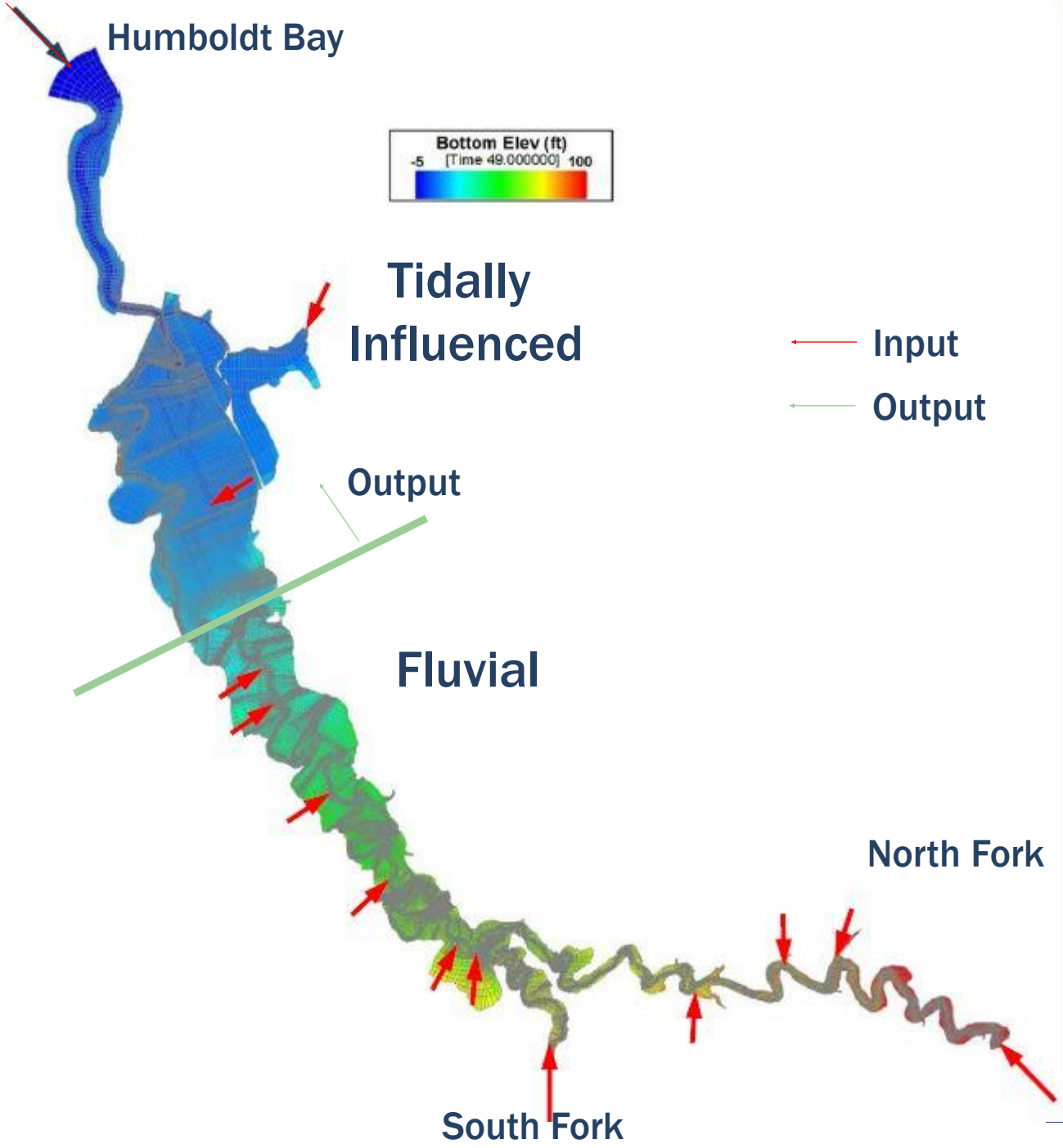
- **Sediment budgets:**
  - Track sediment transport and storage patterns within a system
  - Vary in spatial scale and complexity
  - All terms can be simplified to input, output, and storage terms with the following relation:

Input - Change in Storage = Output



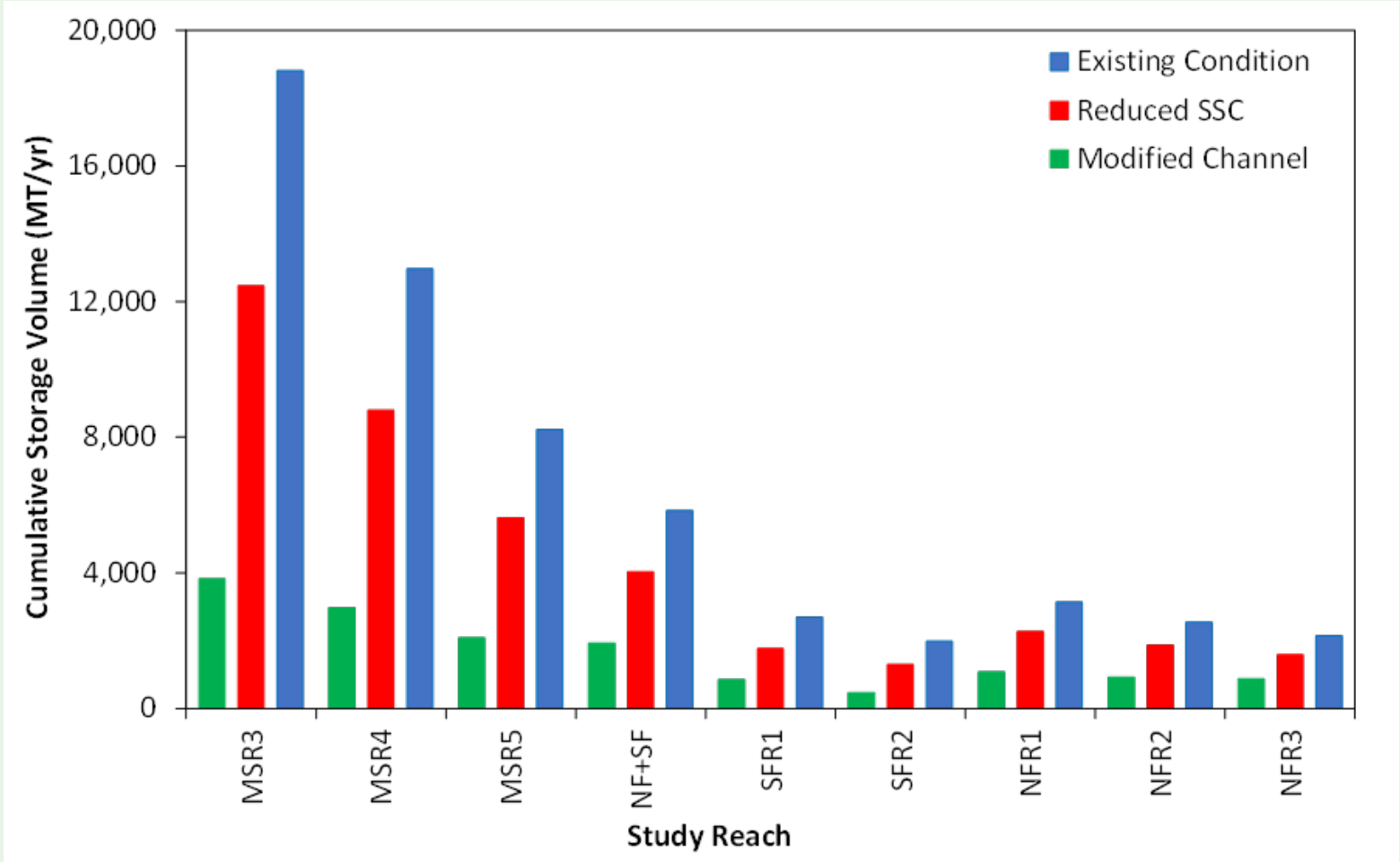
SEDIMENT BUDGET UPSTREAM OF TIDAL REACHES

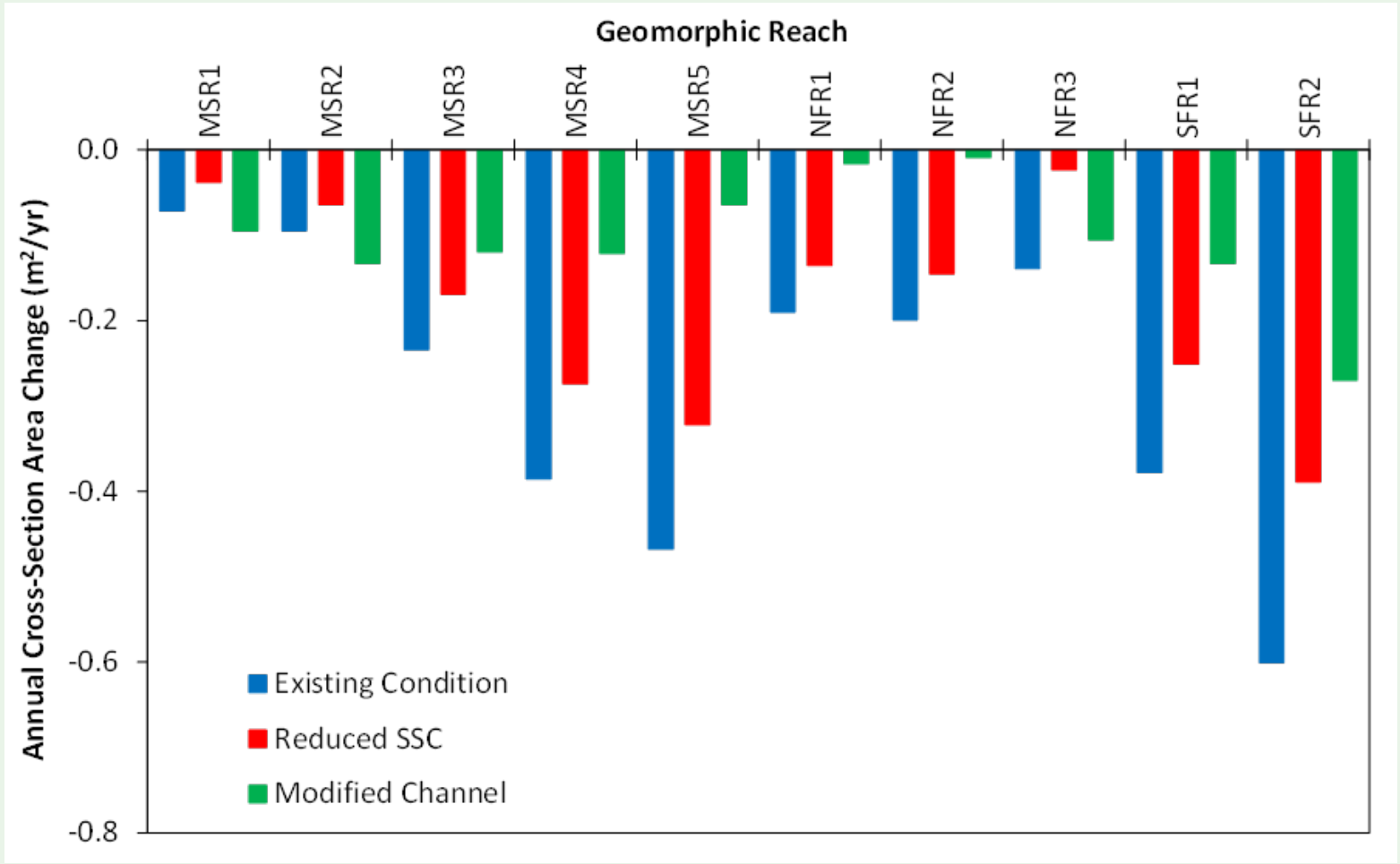
Sediment budget Term	Existing Conditions % of input	Reduced SSC % of input
Total Output	46%	48%
Storage in Channel	22%	22%
Storage on Floodplains	32%	30%

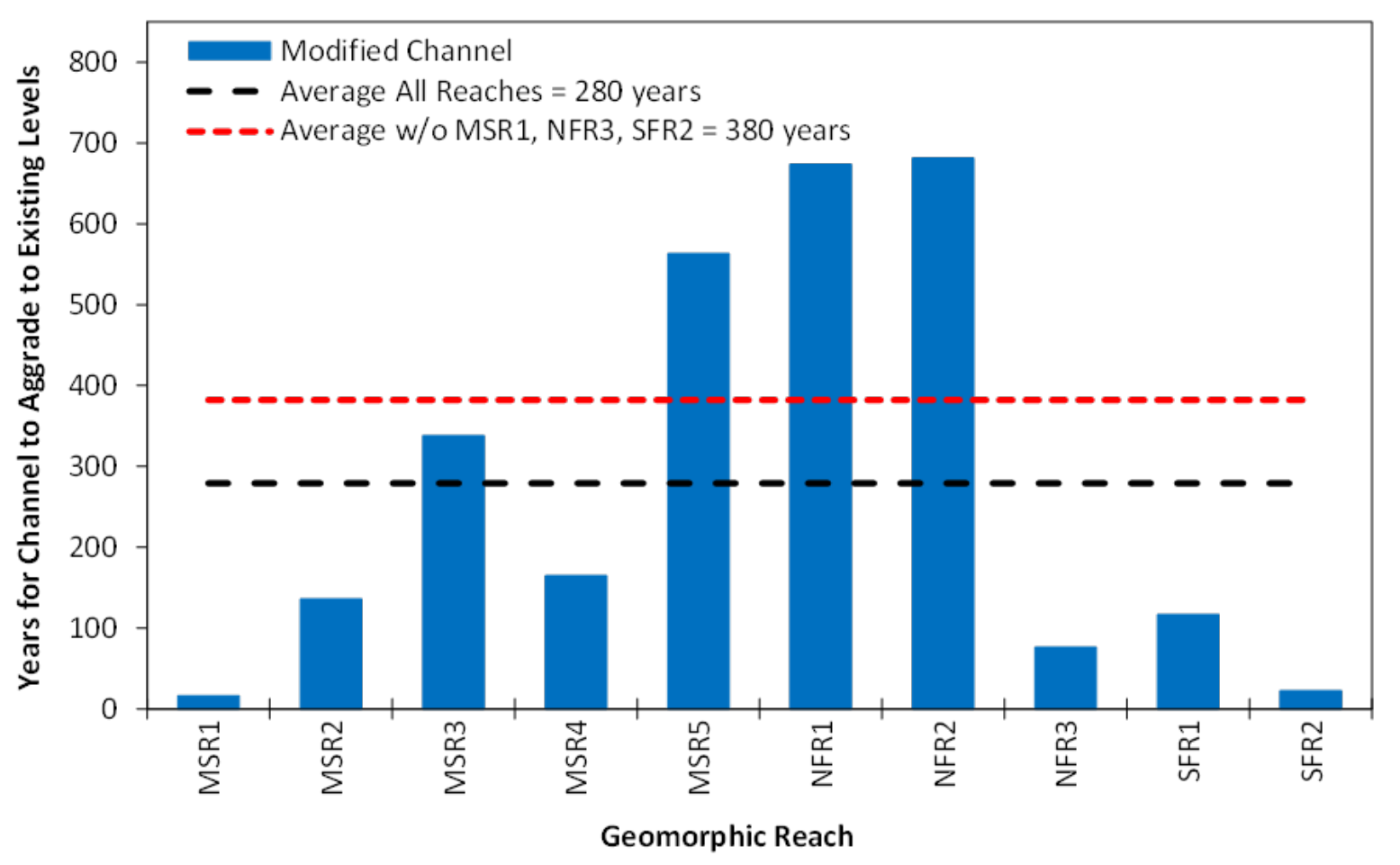


SEDIMENT BUDGET UPSTREAM OF TIDAL REACHES

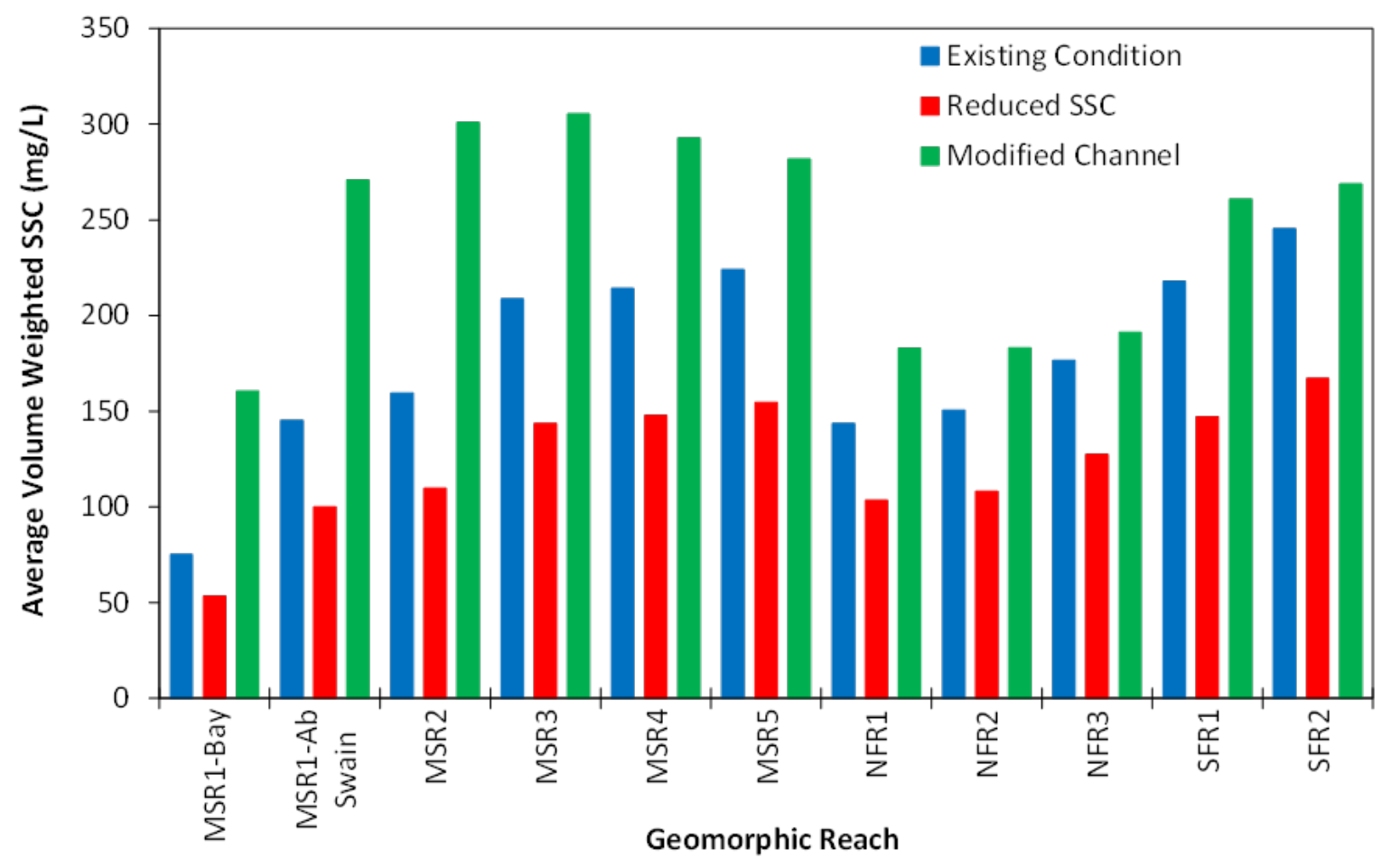
Sediment budget Term	Existing Conditions % of input	Modified Channel % of input
Total Output	46%	89%
Storage in Channel	22%	9%
Storage on Floodplains	32%	2%


20,000
16,000
12,000
8,000
4,000
0
Cumulative Storage Volume (MT/yr)
Existing Condition
Reduced SSC
Modified Channel
MSR3
MSR4
MSR5
NF+SF
SFR1
SFR2
NFR1
NFR2
NFR3
Study Reach


Geomorphic Reach
MSR1
MSR2
MSR3
MSR4
MSR5
NFR1
NFR2
NFR3
SFR1
SFR2
0.0
-0.2
-0.4
-0.6
-0.8
Annual Cross-Section Area Change (m²/yr)
Existing Condition
Reduced SSC
Modified Channel



Answer: It will take a while, even under existing sediment loading



- No significant reduction in the severity of ill-effects index.

Impairment:

- Continues to aggrade
- No decline in SSC
- No recovering to pre-1980s channel conditions
- Nuisance flooding will continue to worsen
- Impairments to beneficial uses may stay the same, or worsen

KEY FINDINGS OF EXISTING CONDITIONS

- **Cold freshwater habitat will continue to be impaired**
  - Sediment deposition causes pool infilling, reduces channel complexity, and increases fines the channel bed
  - Low DO concentrations in some reaches will remain below water quality standards
  - Spawning habitat will continue to be affected by fine sediment deposition and high SSC
  - Riparian vegetation lacking in mature conifer species will not provide a long-term supply of large wood to the channel
  - Stranding risk will continue to be high in areas where roads and other infrastructure intersect return flow paths

Positive Functions:

- Sediment deposition reduces downstream impacts

Recommendation for Actions:

- Include similar or more areas to trap sediment with other actions that will reduce nuisance flooding and improve beneficial uses

Impairment:

- Aggrades at a slower rate
- No recovering to pre-1980s channel conditions
- Nuisance flooding worsens at a slower rate
- Most beneficial uses continued to be impaired

KEY FINDINGS OF REDUCED SSC

- **Cold freshwater habitat:**
  - No improvement in channel conditions except for selective coarsening
  - No improvement in SEV
  - No improvement in DO concentrations
  - No improvement in wood storage or recruitment
  - No improvement in off-channel habitat

Benefit:

- Coarsening in some reaches may improve spawning habitat
- Lower SSC may improve water supply
- **Reduction in SSC benefits the entire river downstream of the reduction**

Recommendation:

- Aggressively reduce SSC to achieve >30% Reduction:
  - Source control
  - Project area: Engineered sediment detention
- Include actions that reduce SSC levels in conjunction with other actions that reduce nuisance flooding and improve beneficial uses

Impairment:

- SSC increases during storm periods
- Increase sediment delivery to the tidal reaches and the bay
- Decrease in connectivity with floodplains

Positive Functions:

- Substantial reduction in nuisance flooding.
- Channel does not rapidly re-aggrade.
- Improved habitat conditions:
  - Increase channel coarsening
  - Increased capacity to scour bed sediments (erosion)
  - Increased large wood storage and loading
  - Less fine sedimentation of pools and spawning gravels
- Improvement in DO concentrations
- Improvement in water supply and recreation

Recommendation:

- Combine this action with other actions that reduce SSC, trap sediment, improve floodplain connectivity, provide a long-term source of wood

PRESENTATION OVERVIEW

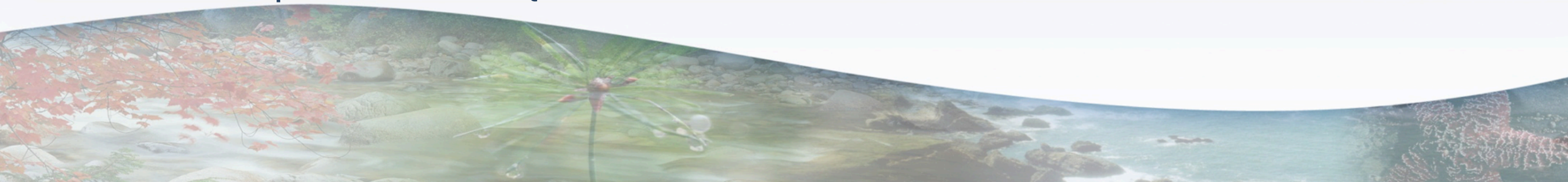
1. Actions Leading to the Elk River Recovery Assessment
2. Overview of Program Partners, Objectives, and Scope
3. Approach to the ERRA

Break for Questions

4. Summary of Key Findings
5. Brief Review of ERRA Analyses and Results
   - Salmon and Steelhead Beneficial Uses
   - Geomorphic and Watershed Setting
   - Sediment and Hydrodynamics
   - Modeling Scenarios

Break for Questions

6. Recommended Actions
7. Next Steps
8. Open Discussion Q&A



- **Sediment load reduction**
  - Continue upper watershed sediment load reduction actions
  - Consider sediment detention near sources
- **Channel Rehabilitation**
  - Sediment removal
  - Pool formation
  - Bank complexity
  - Substrate enhancement
  - Addition of large wood

- **Floodplain rehabilitation**
  - Retention and improvement of floodplain connectivity
  - Floodplain benches
- **Infrastructure**
  - Large wood debris passage at bridges
  - Removal of unused infrastructure from channel and floodplains
  - Improve flow conveyance
  - Levee modification
- **Vegetation Management**
  - Maintain or increase tree diversity in riparian habitat
  - Discourage live vegetation in the active channel

Example Recommended Action	Sediment Load Reduction	Floodplain Rehabilitation	Infrastructure	Vegetation Management
Channel Rehabilitation	Sediment load reductions that reduce channel sedimentation.	Floodplain actions that do not reduce channel sediment transport capacity and promote sediment storage.	Infrastructure improvements that pass large wood and minimize backwater conditions during high flows.	Channel bed vegetation management that improve sediment transport capacity. Channel bank and floodplain vegetation management that provides a long-term source of wood to the channel.

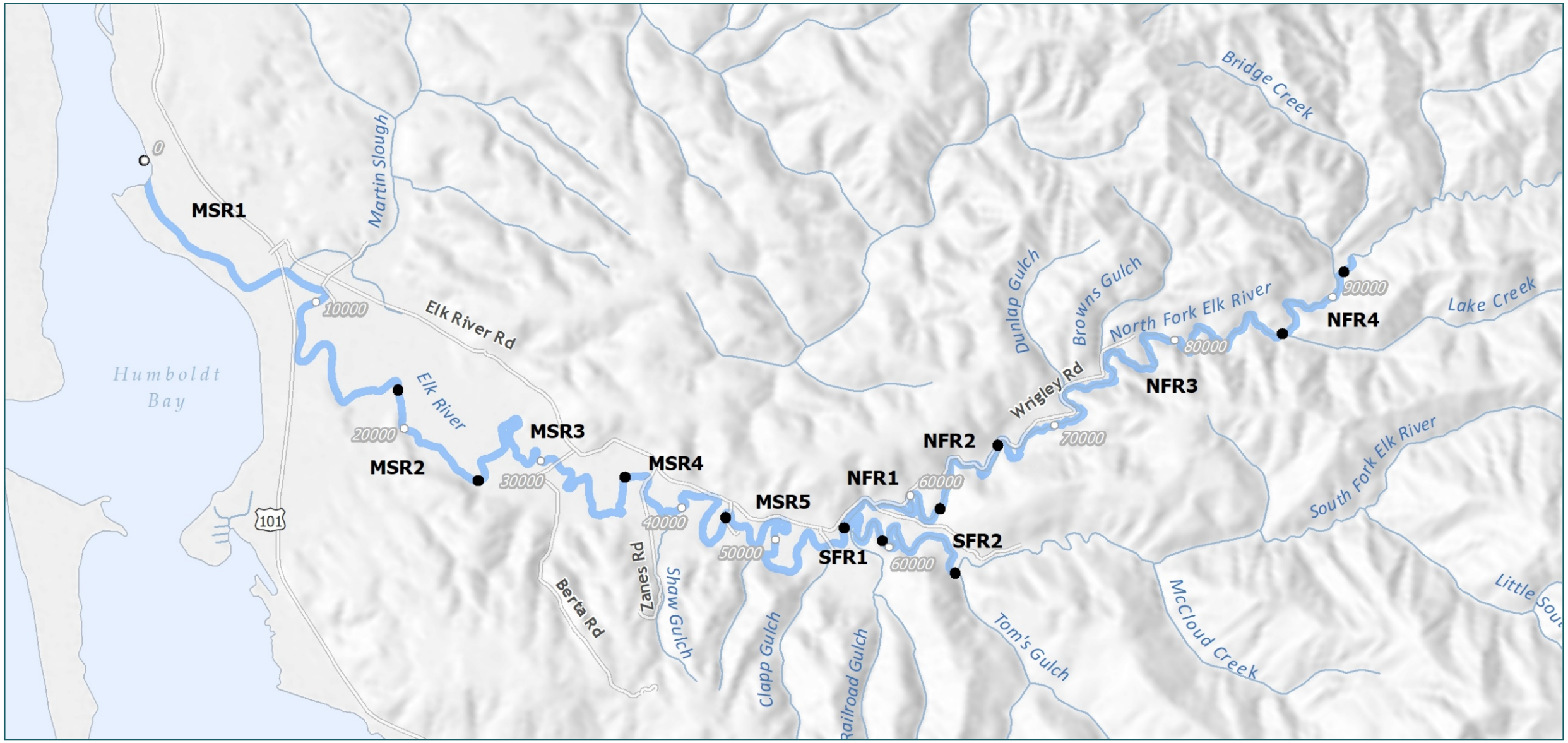

0
MSR1
Martin Slough
10000
Elk River Rd
Humboldt Bay
Elk River
20000
MSR2
MSR3
30000
MSR4
40000
MSR5
50000
SFR1
60000
SFR2
NFR1
NFR2
70000
Wrigley Rd
NFR3
80000
North Fork Elk River
90000
NFR4
Bridge Creek
Dunlap Gulch
Browns Gulch
Lake Creek
South Fork Elk River
McCloud Creek
Tom's Gulch
Railroad Gulch
Clapp Gulch
Shaw Gulch
Zanes Rd
Berta Rd
101

Photo Date: 4/7/2013

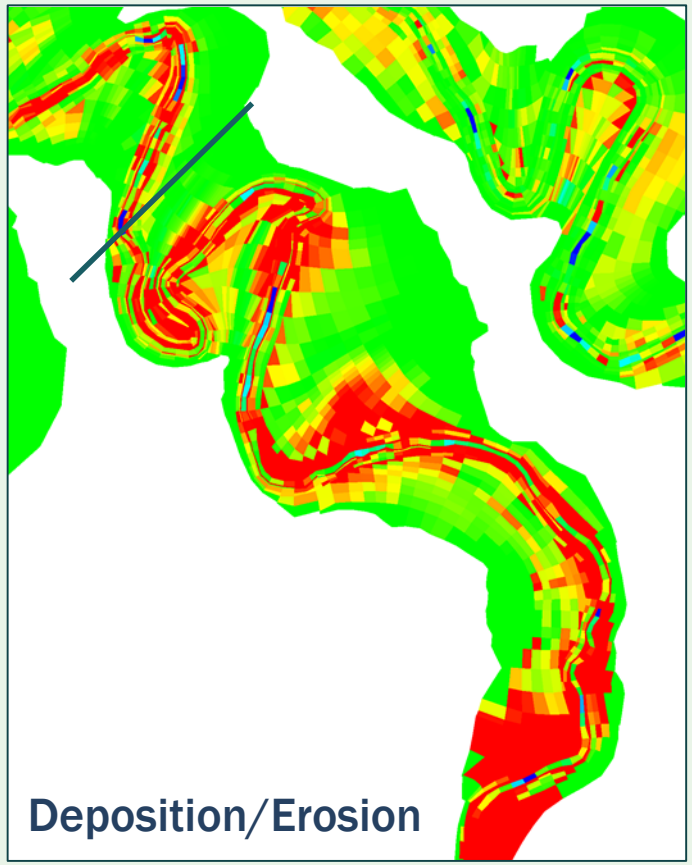
SFR 2 ACTIONS

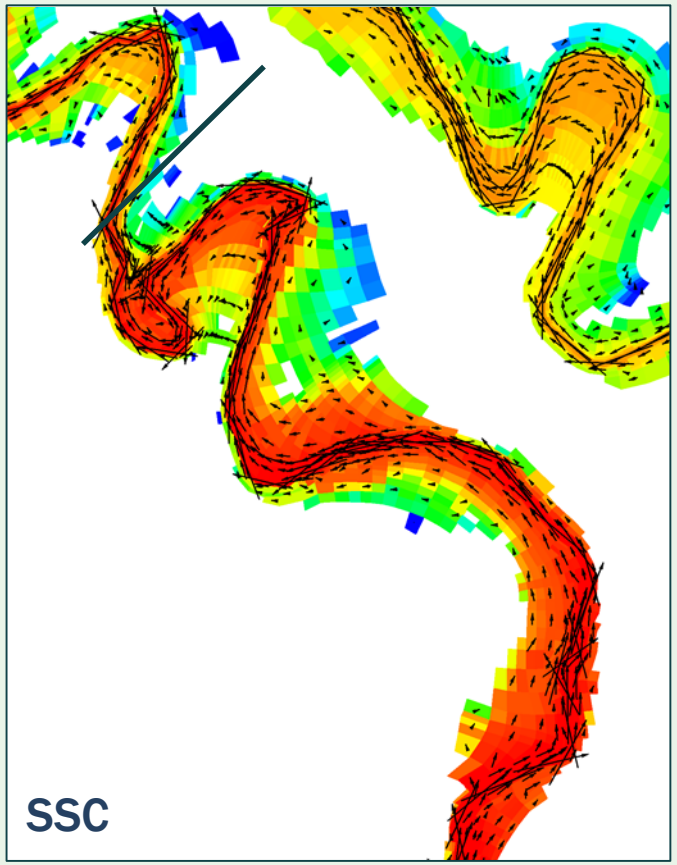
(Tom's Gulch to SFR1)

- **Sediment Load Reduction**
  - Tom's Gulch source reduction and detention
  - Recontour floodplains
- **Channel Rehabilitation**
  - Remove sediment
  - Add large wood
- **Floodplain Rehabilitation**
  - Selective near channel floodplain lowering
- **Infrastructure**
  - Ensure passage of wood at bridge
- **Vegetation**
  - Expand conifer-dominated riparian community
  - Discourage vegetation in active channel

Table 7-1 p.129

USING RESULTS TO DEVELOP SITE SPECIFIC ACTIONS: SEDIMENT DETENTION



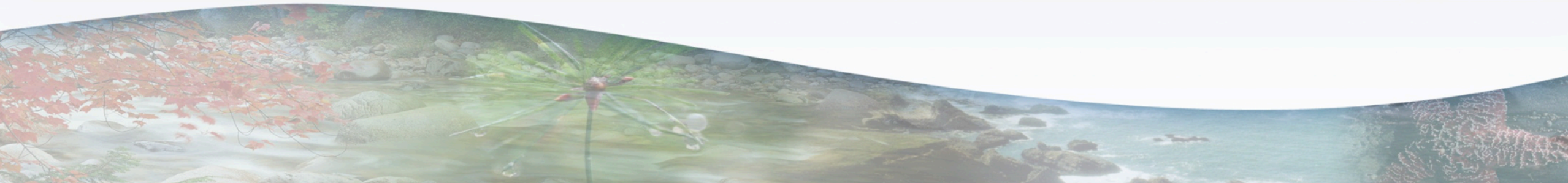


- **Sediment Detention**
  - Enhance areas that are currently trapping sediment
  - Develop new areas to trap sediment where there is high SSC by lowering velocities

NEXT STEPS

- Permitting and construction of sediment remediation pilot projects
  - ✓ NOAA-NMFS/CDFW/ACOE consultation
  - ✓ Public Review period (Mar-Apr 2019)
  - ✓ Board hearing (Notice of Determination) on IS-MND
  - ✓ Project Construction (Aug 15 – Oct 15, 2019)

- Elk River Watershed Stewardship program
  - ✓ Identify community supported actions to hasten recovery of beneficial uses of water and related aquatic ecosystem functions and reduce nuisance flooding
  - ✓ Commence stakeholder meetings (Feb 2019)
  - ✓ Commercial timber; lower basin Ag community; residents



COMMENTS AND QUESTIONS?

Darren Mierau
North Coast Director
California Trout, Inc.
DMierau@caltrout.org

Bonnie Pryor
Northern Hydrology & Engineering
bonnie@northernhydrology.com

Chuck Striplen
Elk River Sediment Remediation Pilot Projects
Elk River Watershed Stewardship Program
Charles.Striplen@waterboards.ca.gov