Restoration Landscape Narratives

Lower Big Quilcene River Restoration: Facing an Uncertain Future

Presented to
2019 Salmon Recovery Conference
Tacoma, Washington

Presented by
Camilla Popp, Hood Canal Salmon Enhancement Group and
Peter Hummel, Anchor QEA

April 9, 2019

Presentation Goals

- Review project vision, goals, and timeline
- Present results of the hydrodynamic assessment of the three refined alternatives:
  - Geomorphology
  - Hydrodynamic modeling (flooding, velocity, and salinity)
- Provide information on shellfish tolerances and habitat
- Solicit feedback on modeling results and the performance of the three alternatives
- Explain next steps for the project

Habitat

A Community-Led Approach

Pacific Shellfish

Project Goals

- Reduce flood risk
- Improve public access to river and estuary
- Ensure compatibility with shellfish resources
- Create educational opportunities
- Restore habitat
- Benefit the local economy

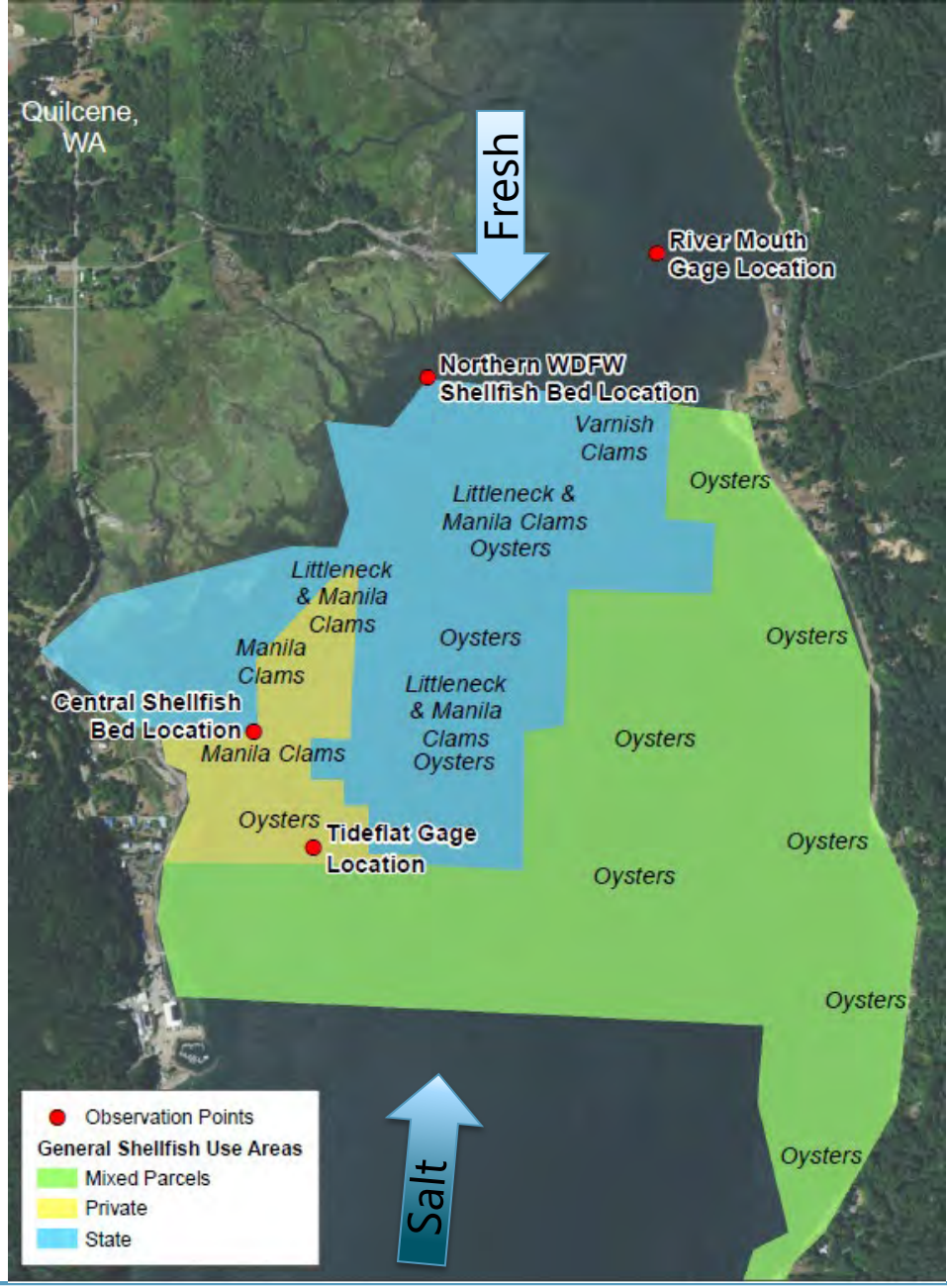
Flooding

Shellfish

Observation Points for Benthic Salinity Model Results

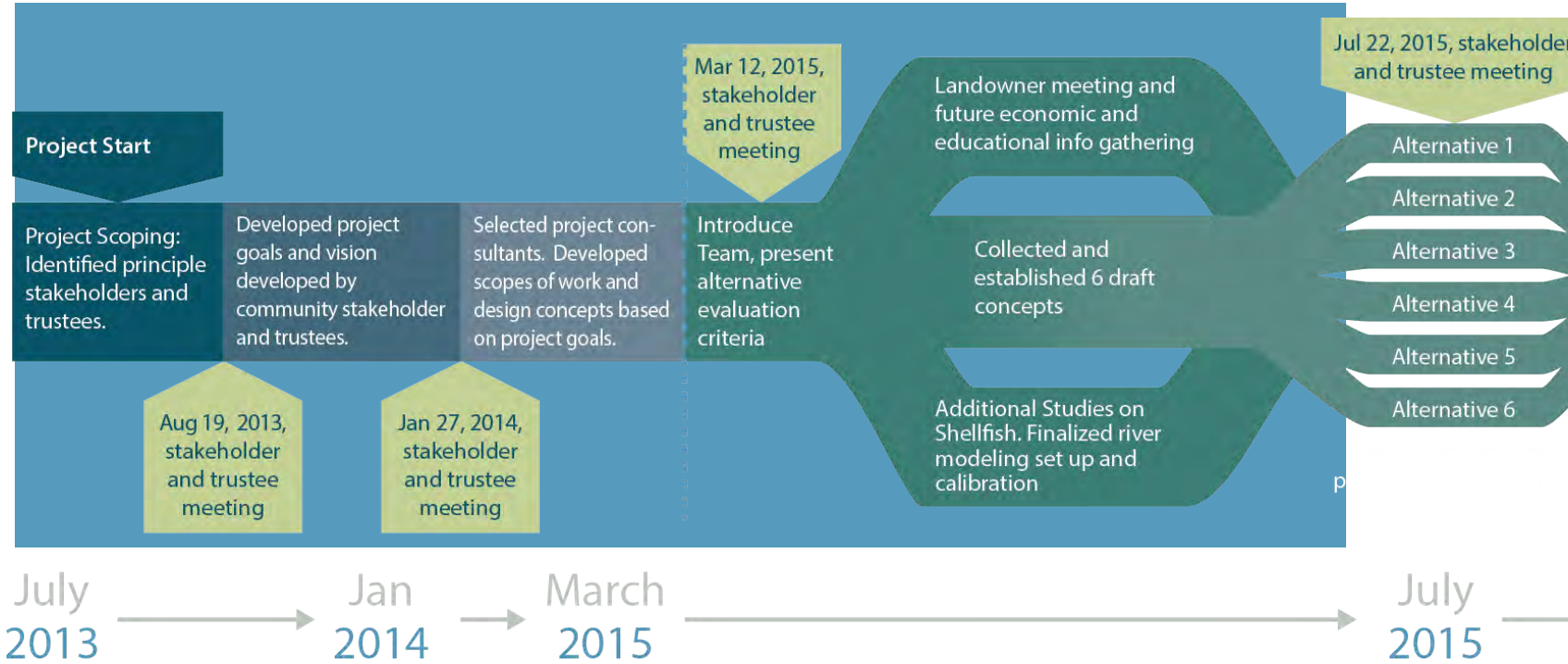
Salinity in the shellfish areas determined by:

- Freshwater input from rivers
- Hood Canal incoming salinity
- Mixing in between due to estuarine processes



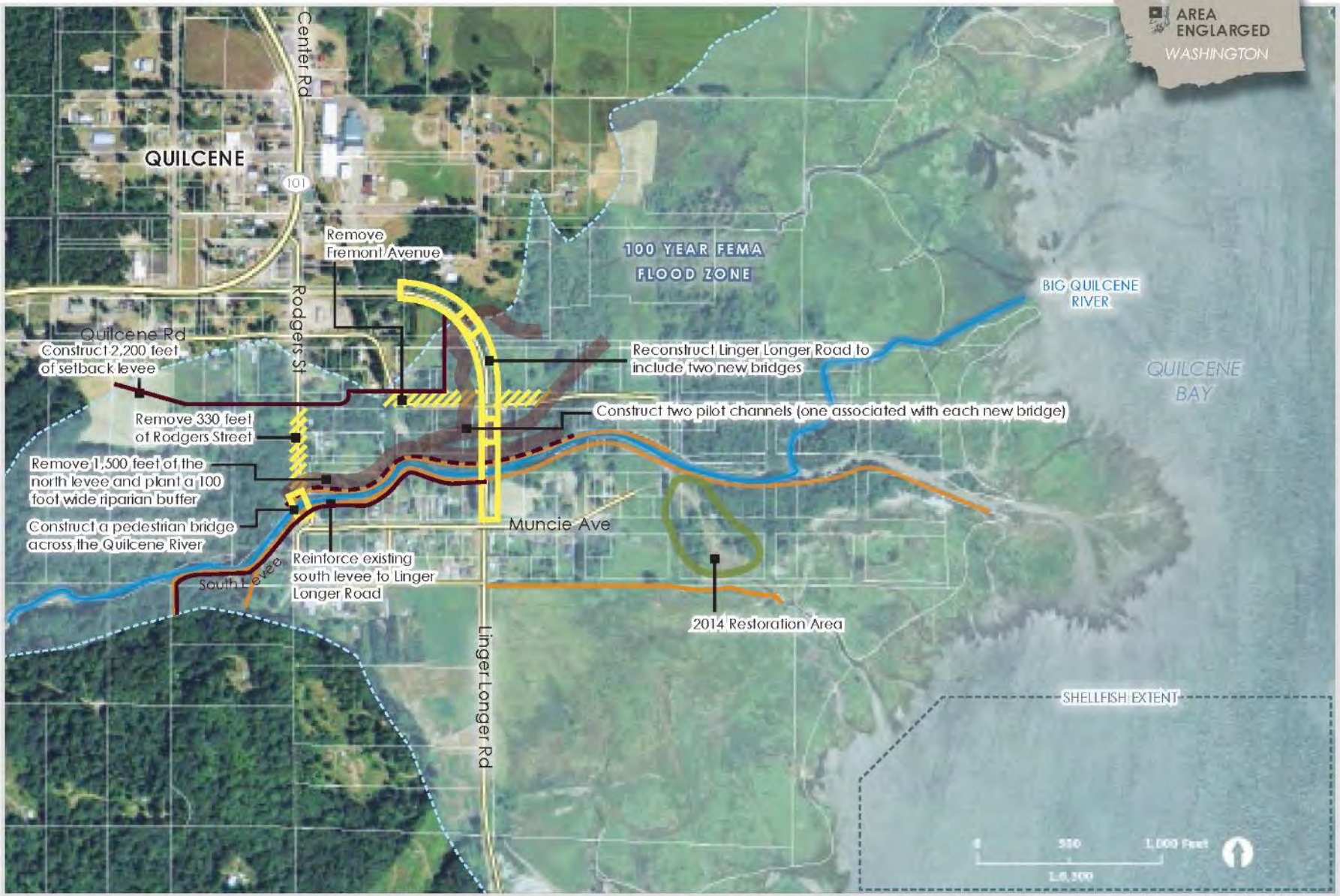
Project Timeline

Phase 2
Work Feb 2015 – 2013 2015 March 2015
Based on funding level. Project to extend beyond 2020



Alternatives Evaluation

ALTERNATIVE 1 - LEAST CHANGE



MAP LEGEND

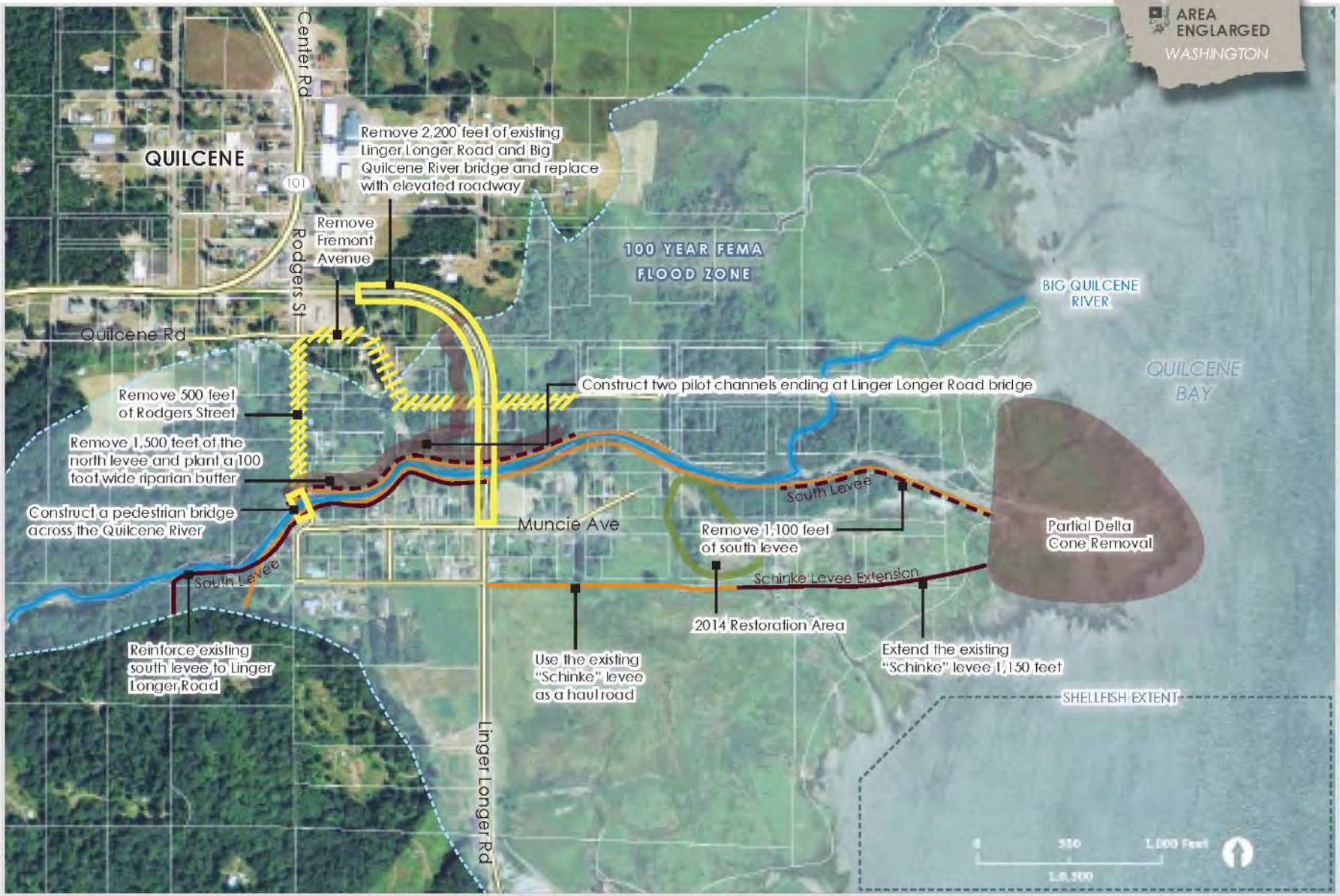
- County Parcels
- 100 Year FEMA Flood Zone
- Shellfish Extent
- Road/Bridge Construction
- Road/Bridge Removal
- Existing Levee
- Proposed Levee
- Proposed Levee Removal
- Riparian Buffer/ Overflow Channel
- Big Quilcene River
- Highway or Other Major Road

September 20, 2016

Data Sources:
Parcels, Roads - Jefferson County
Flood Zone - FEMA
Hydro - WA DNR
Imagery - NAIP (2013)
Existing Levees - PSNERP

Map: By Anchor QEA

ALTERNATIVE 2 - MEDIUM CHANGE



MAP LEGEND

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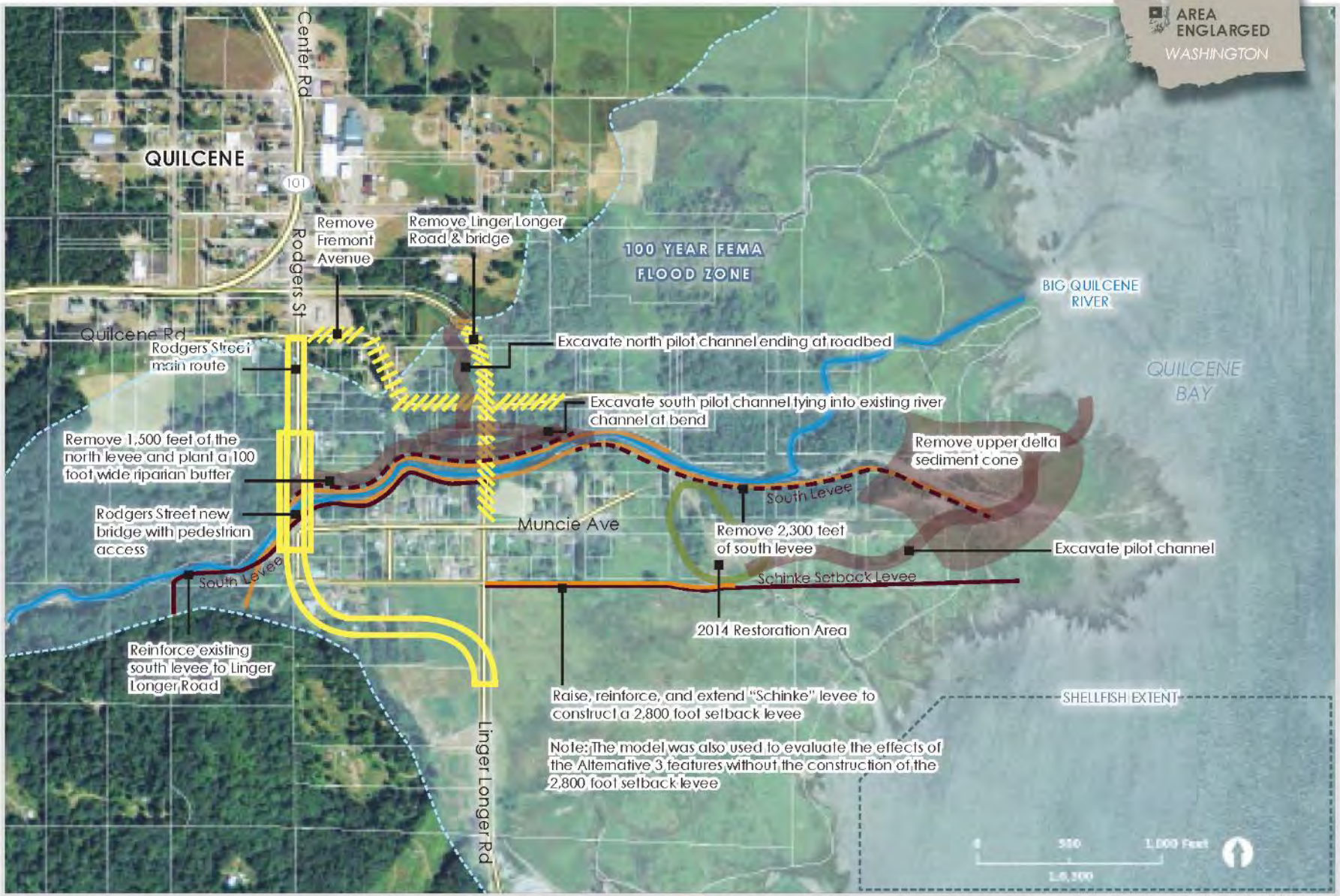
Map: By Anchor QEA

ALTERNATIVE 3 - MOST CHANGE



MAP LEGEND

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- 100 Year FEMA Flood Zone
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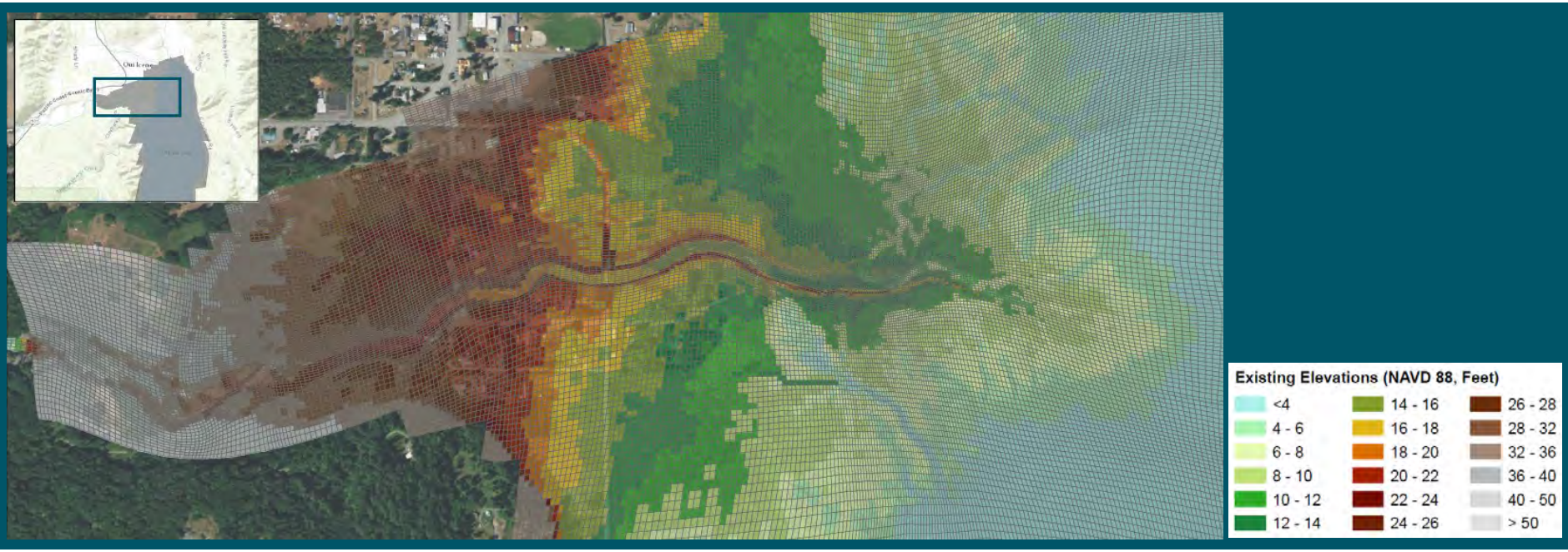
Map: By Anchor QEA

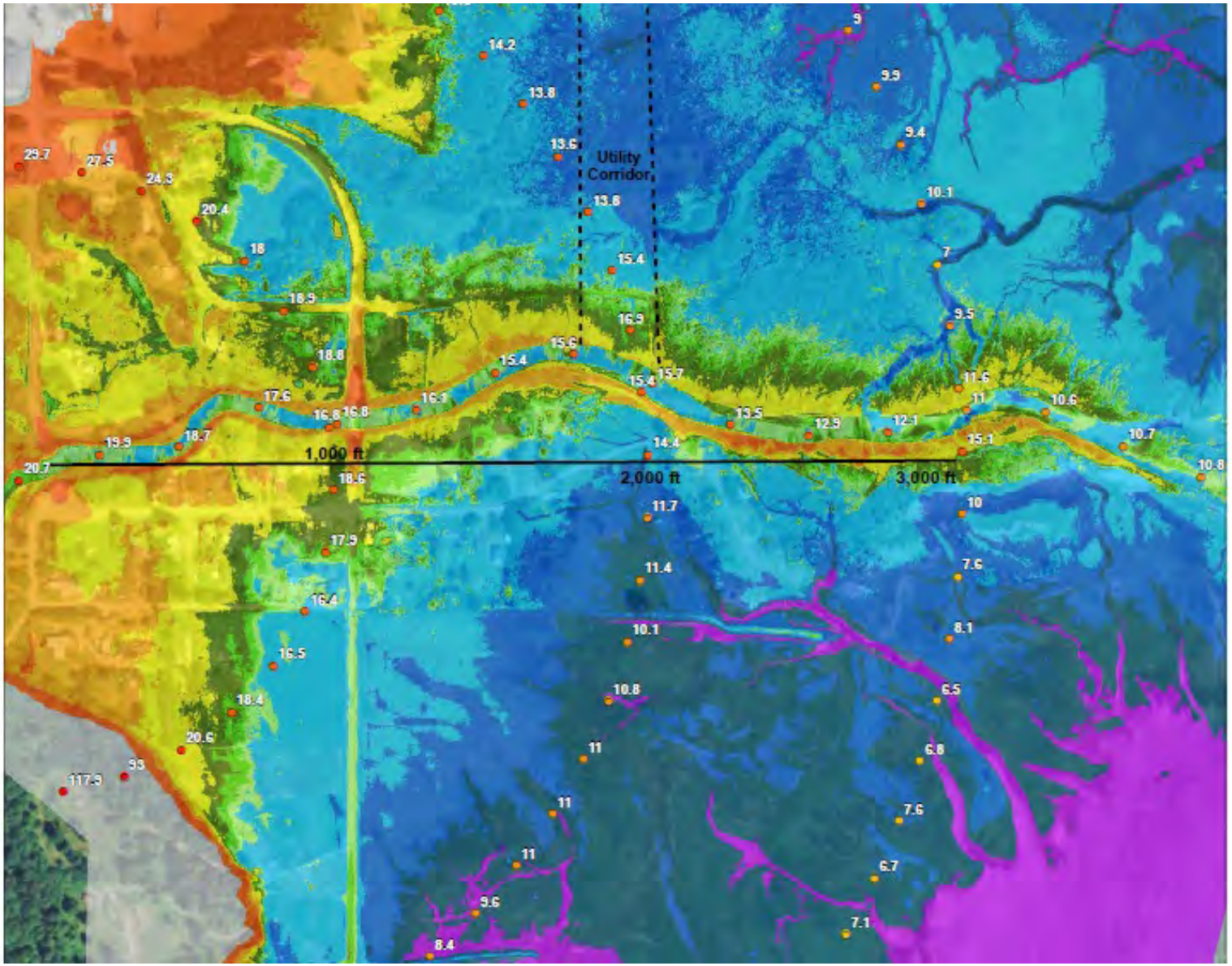
Hydrodynamic Assessment Overview



- Purpose of modeling
- Model development
- Model simulations
- Geomorphic assessment

- Modeling results:
  - Water depth (flooding)
  - Velocity and sediment transport
  - Salinity

Geomorphic Evaluation



Elevation in Feet (NAVD 88)

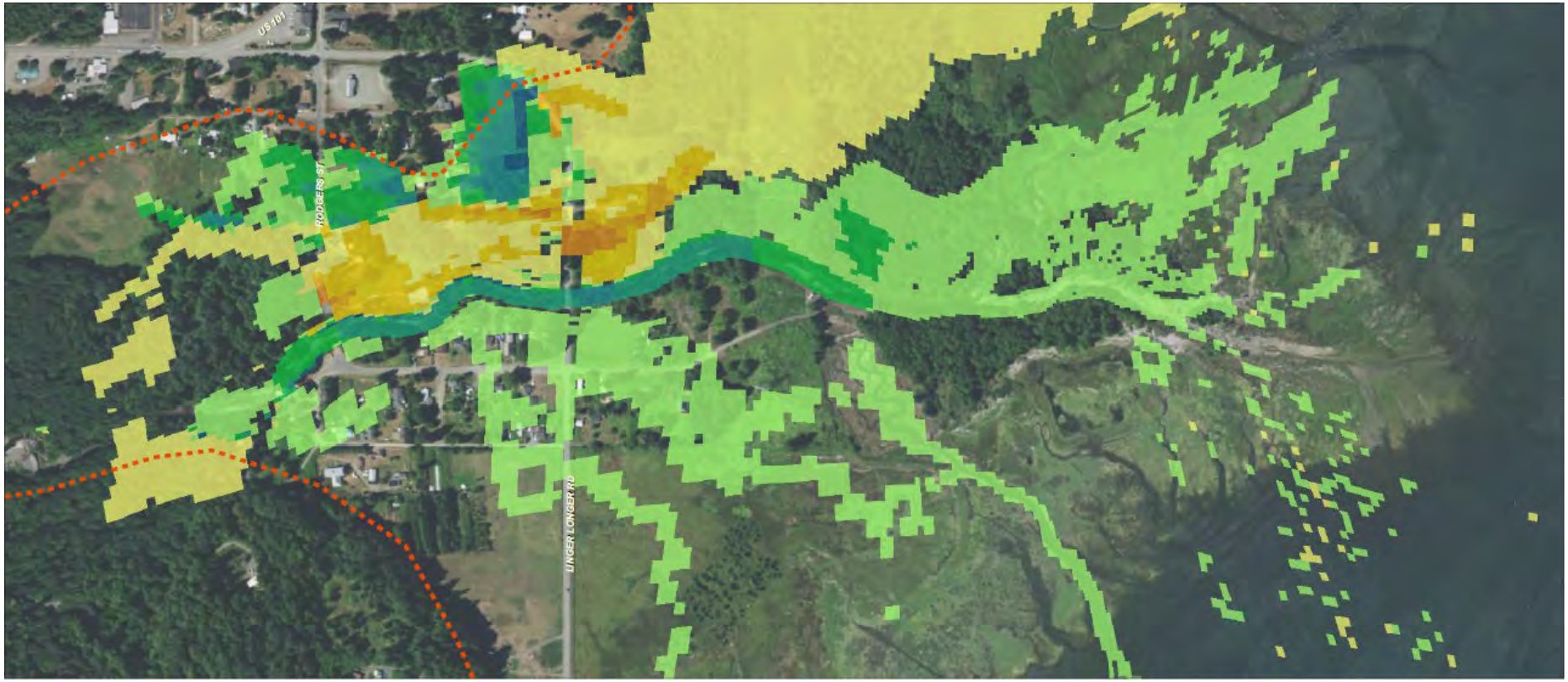
- <4
- 4 to 8
- 8 to 12
- 12 to 20
- 20 to 60
- >60

Floodplain Elevation minus Channel Elevation (feet)

- <-6
- -6 to -4
- -4 to -2
- -2 to 0
- 0 to 0.5
- 0.5 to 1
- 1 to 2
- 2 to 4
- 4 to 8
- 8 to 20
- >20

Modeling Results: Flooding; Velocity/Sediment; and Salinity

Flooding (Water Depth) – Alt. 1 Comparison



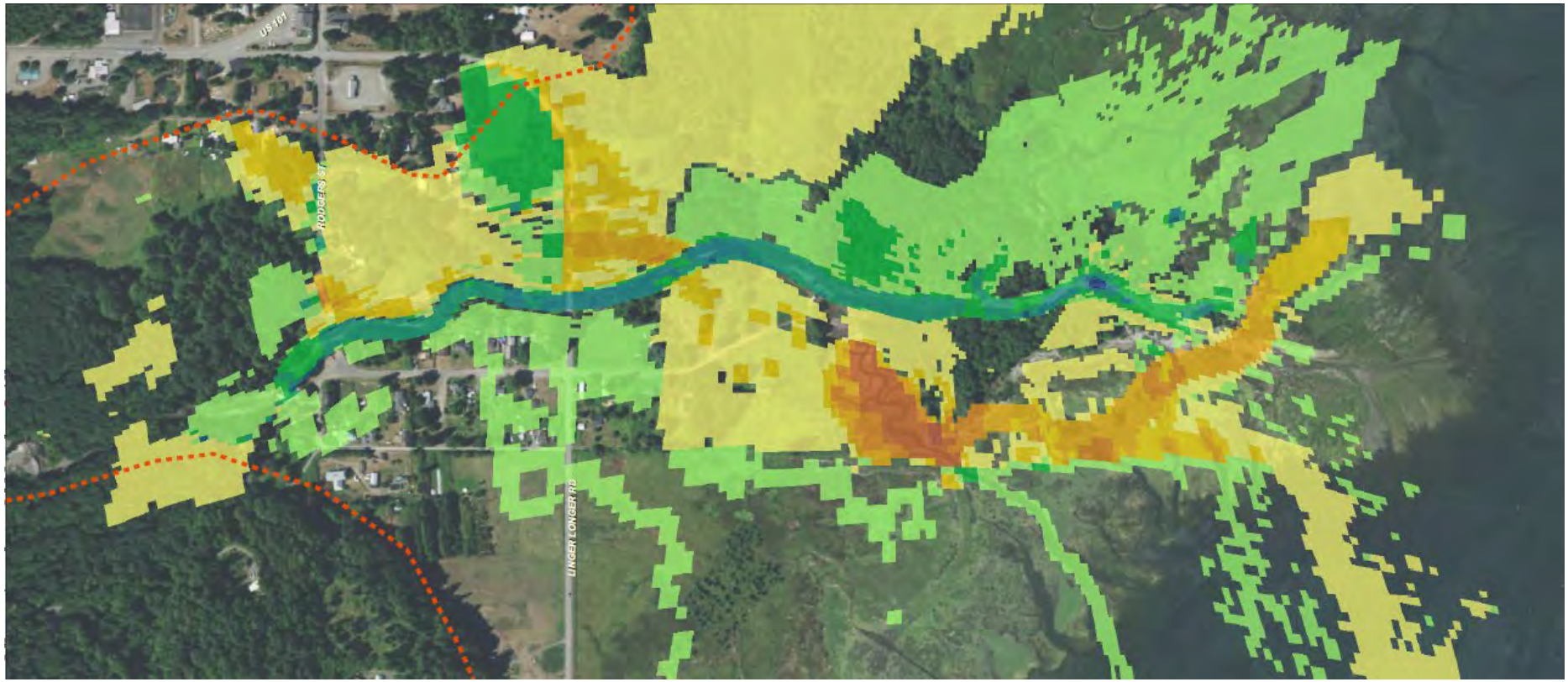
Alternative 1 Depths minus Existing Conditions Depths

Water Depth Change (feet)

- -5.5 - -5
- -4.9 - -4
- -3.9 - -3
- -2.9 - -2
- -1.9 - -1
- -0.9 - -0.1
- -0.1 - 0.1
- 0.11 - 1
- 1.1 - 2
- 2.1 - 3
- 3.1 - 4
- 4.1 - 5
- 5.1 - 6

FEMA 100-Year Floodplain (1982)

Flooding (Water Depth) – Alt. 3 Comparison



Alternative 3 Depths minus Existing Conditions Depths

Water Depth Change (feet)

- -5.5 - -5
- -4.9 - -4
- -3.9 - -3
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- -1.9 - -1
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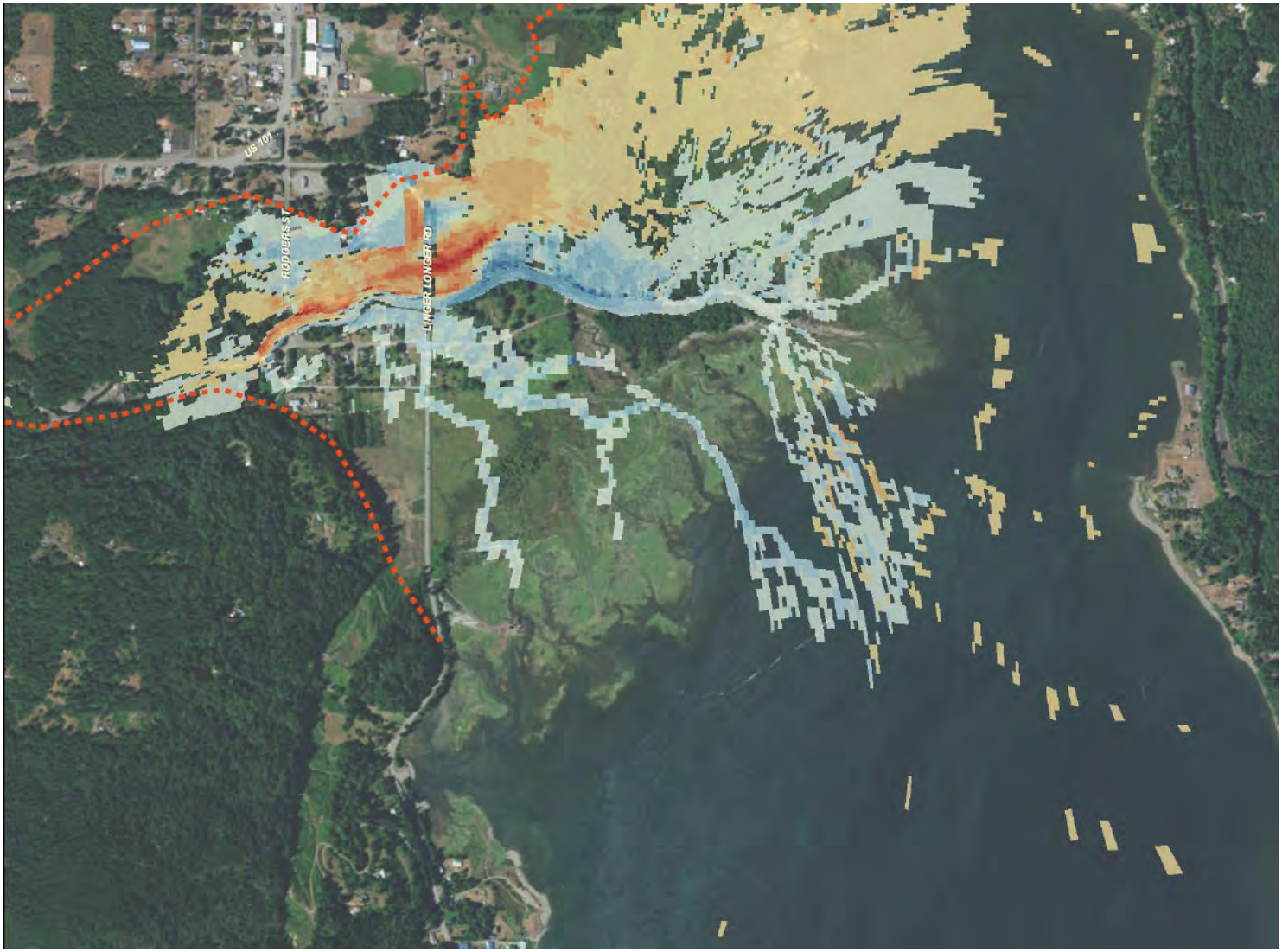
FEMA 100-Year Floodplain (1982)

Depth-Averaged Velocity – Alt. 1 Comparison

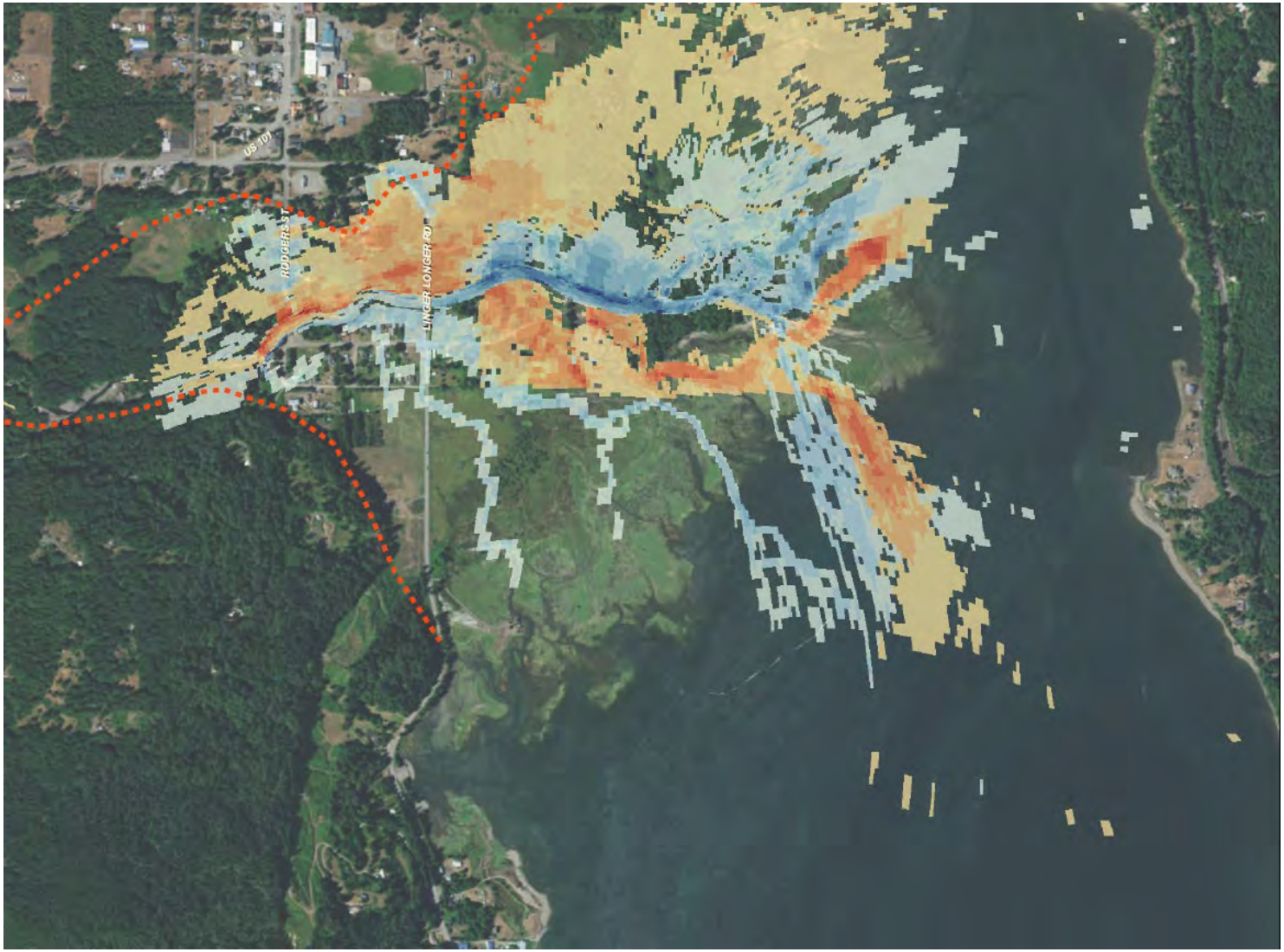


Depth-Averaged Velocity Change (ft/sec)

- -7.1 - -6
- -5.9 - -5
- -4.9 - -4
- -3.9 - -3
- -2.9 - -2
- -1.9 - -1
- -0.9 - -0.1
- -0.1 - 0.1
- 0.11 - 1
- 1.1 - 2
- 2.1 - 3
- 3.1 - 4
- 4.1 - 5
- 5.1 - 6
- 6.1 - 7
- FEMA 100-Year Floodplain (1982)

Alternative 1 minus Existing Conditions Depth-Averaged Velocity

Depth-Averaged Velocity – Alt. 3 Comparison



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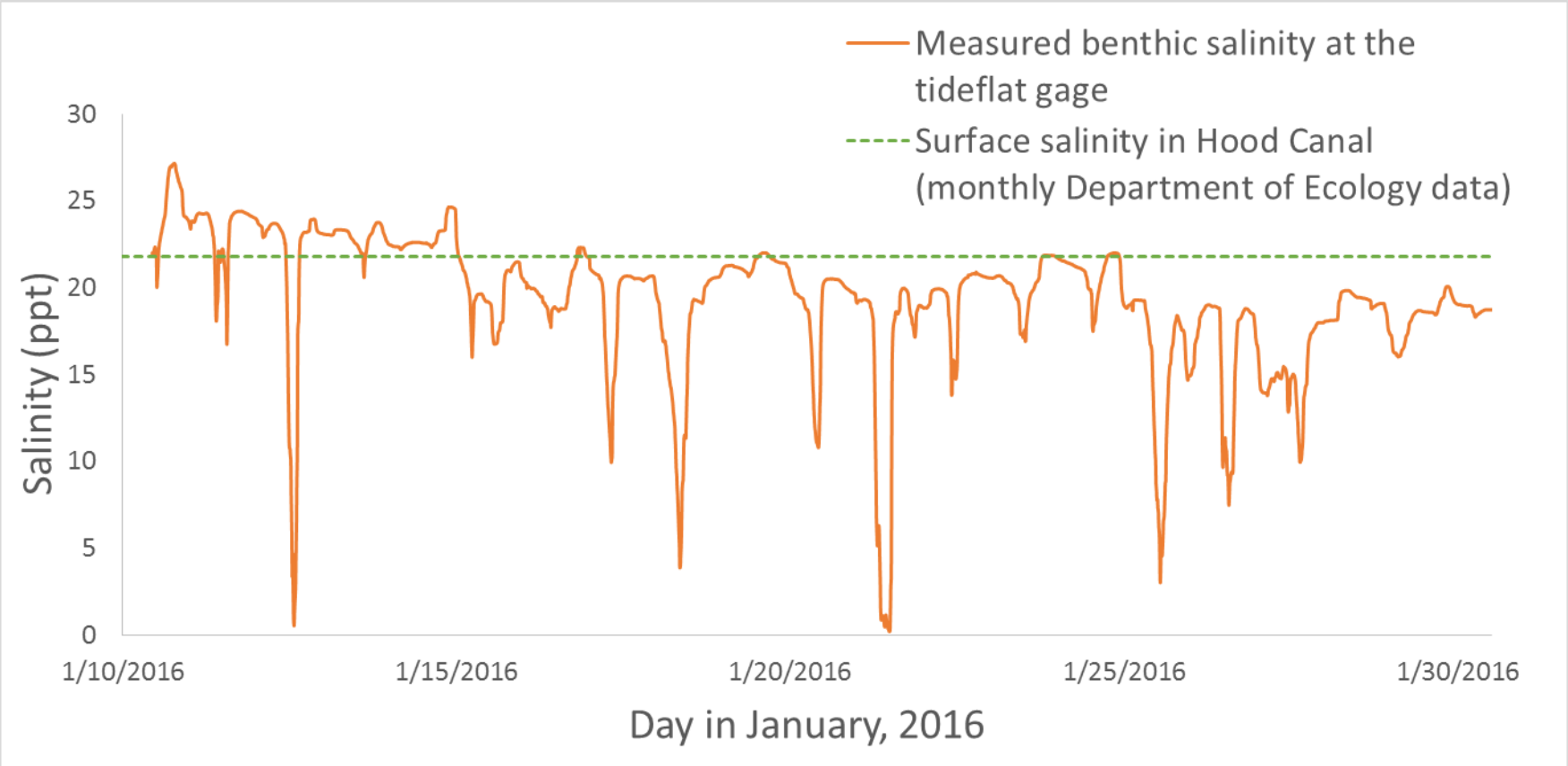
- -0.1 - 0.1
- 0.11 - 1
- 1.1 - 2
- 2.1 - 3
- 3.1 - 4
- 4.1 - 5
- 5.1 - 6
- 6.1 - 7
- FEMA 100-Year Floodplain (1982)

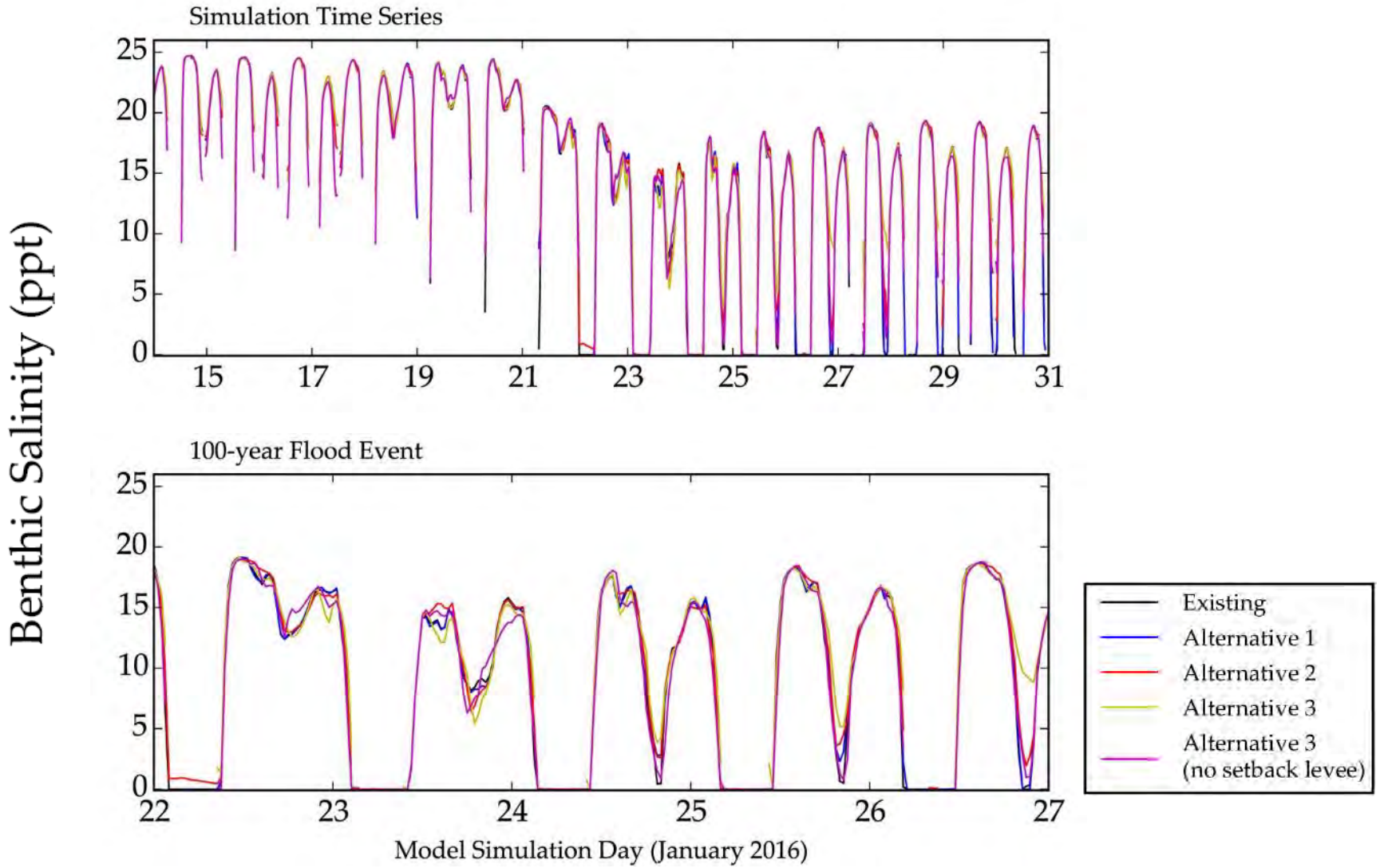
Alternative 3 minus Existing Conditions Depth-Averaged Velocity

Salinity in Hood Canal

- Low salinity in Hood Canal (January 2016)
  - Sustained southerly winds over previous months
  - Ocean down welling
  - Record warm air temperatures led to snowpack melting

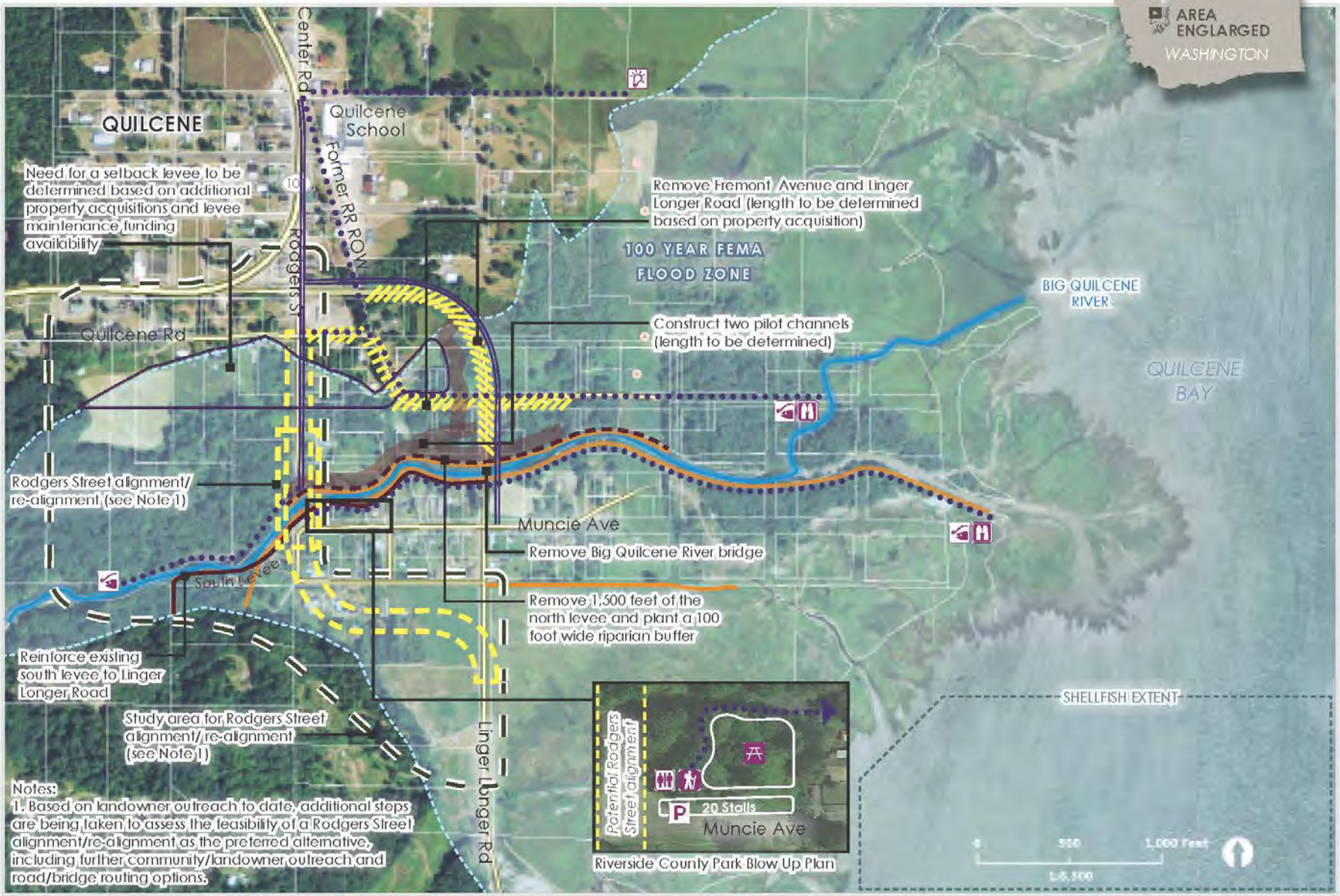


Salinity Time Series – North WDFW Shellfish Bed



Preferred Alternative

DRAFT PREFERRED ALTERNATIVE

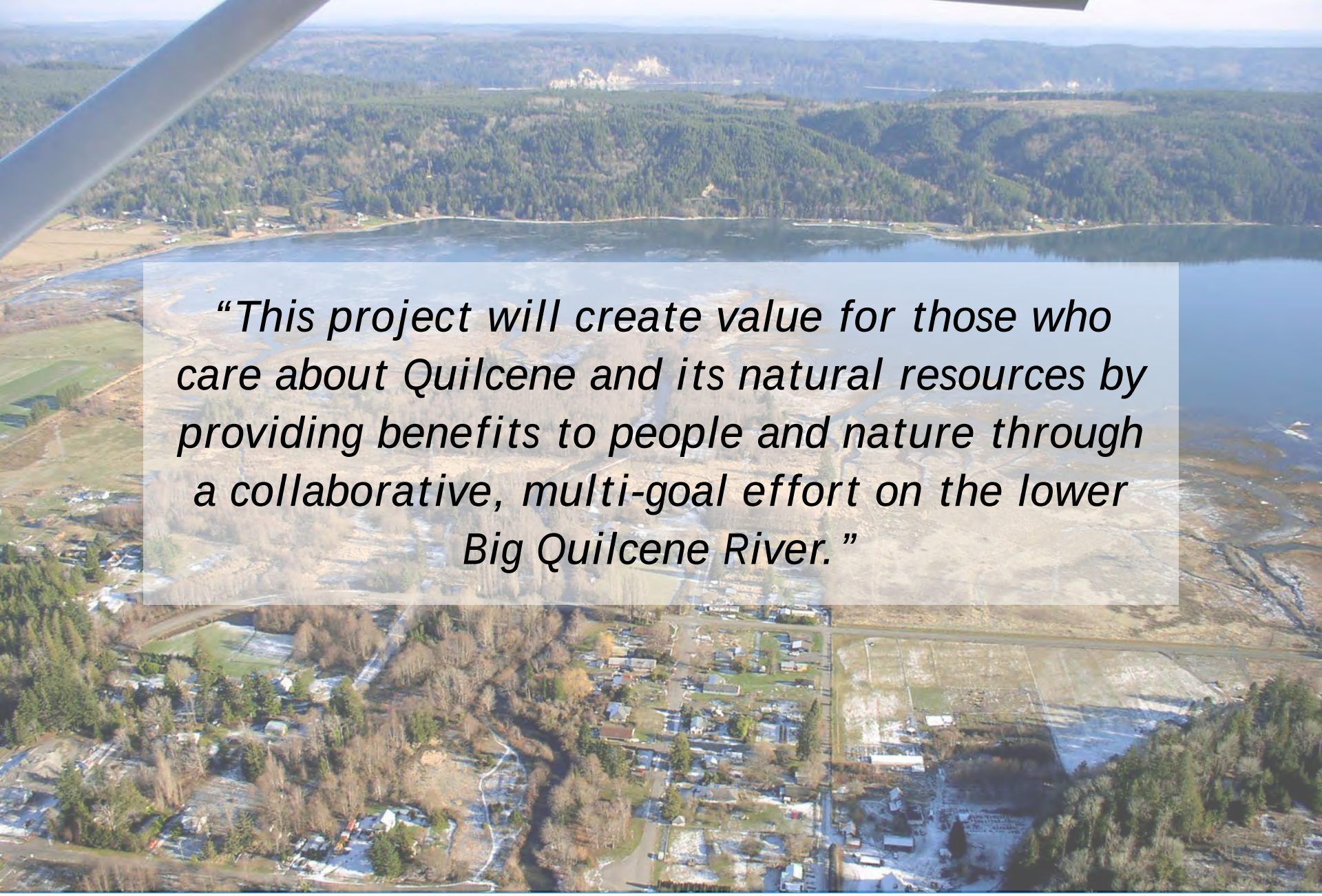


MAP LEGEND

- Shellfish Extent
- 100 Year FEMA Flood Zone
- County Parcels
- Big Quilcene River
- Highway or Other Major Road
- Road/Bridge Construction
- Road/Bridge Removal
- Powerline Tower Base Armor
- Rodgers Street Study Area
- Existing Levee
- Proposed Levee
- Proposed Levee Removal
- Riparian Buffer/ Overflow Channel
- Trail
- Trail along road
- Fish Access
- Birdwatching
- Env. Education
- Parking
- Restroom
- Trailhead
- Picnicking

February 27, 2017

Data Sources:
Parcels, Roads - Jefferson County
Flood Zone - FEMA
Hydro - WA DNR
Imagery - NAIP (2013)
Existing Levees - PSNERP
Map: By Anchor QEA



"This project will create value for those who care about Quilcene and its natural resources by providing benefits to people and nature through a collaborative, multi-goal effort on the lower Big Quilcene River."

Questions/Comments

Project Contacts

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- Peter Hummel, Anchor QEA, LLC
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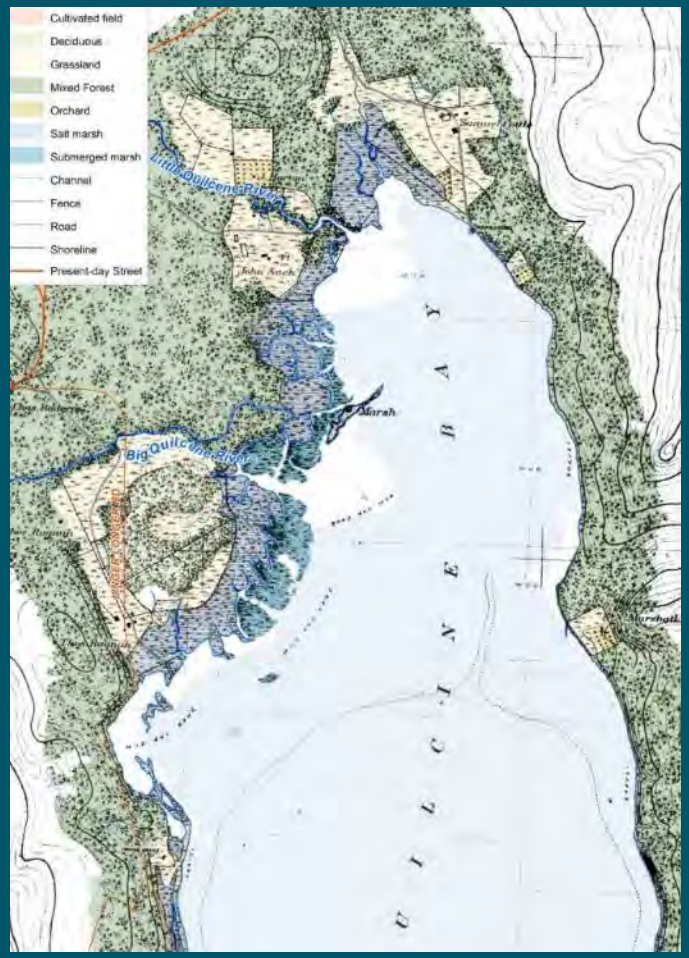
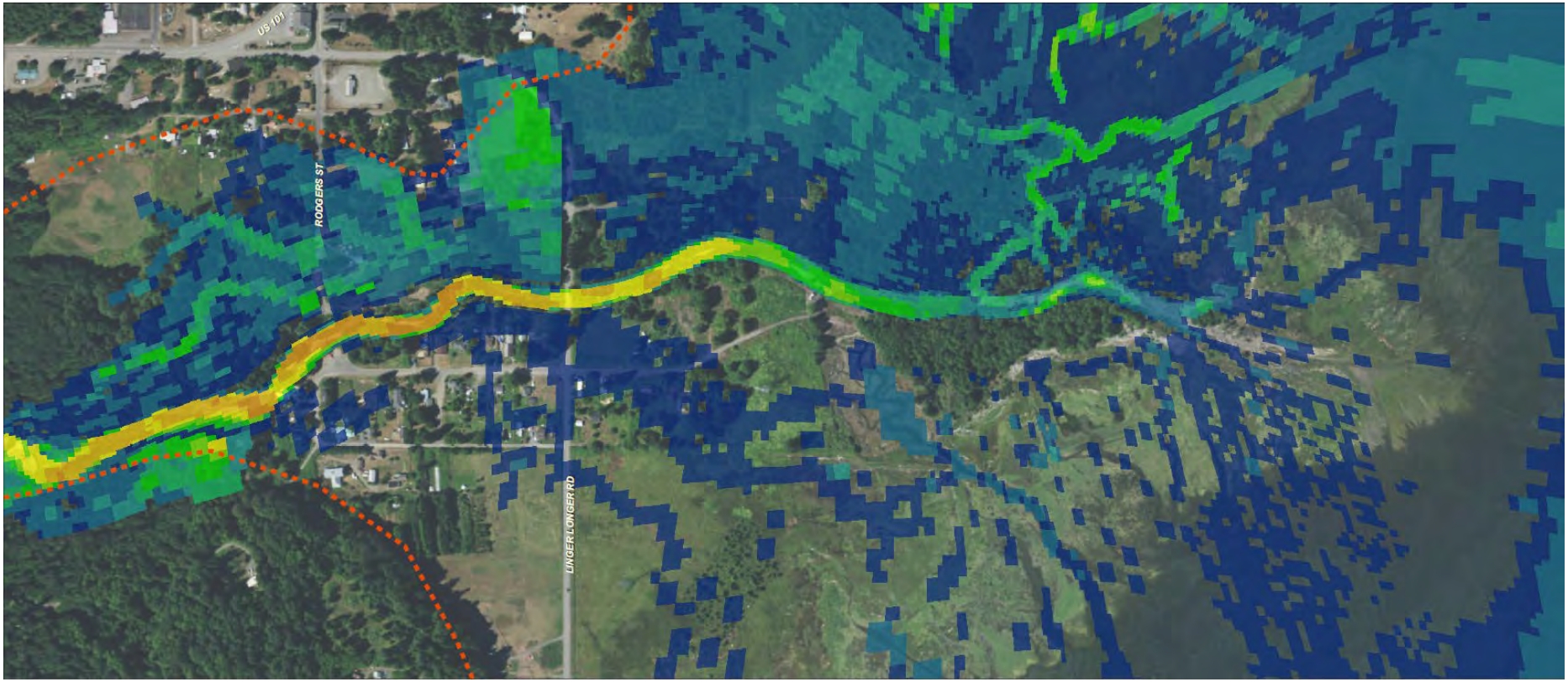
  206-287-9130



1876 T-sheet

End of Presentation

Flooding (Water Depth) – 100-Year Flood Event



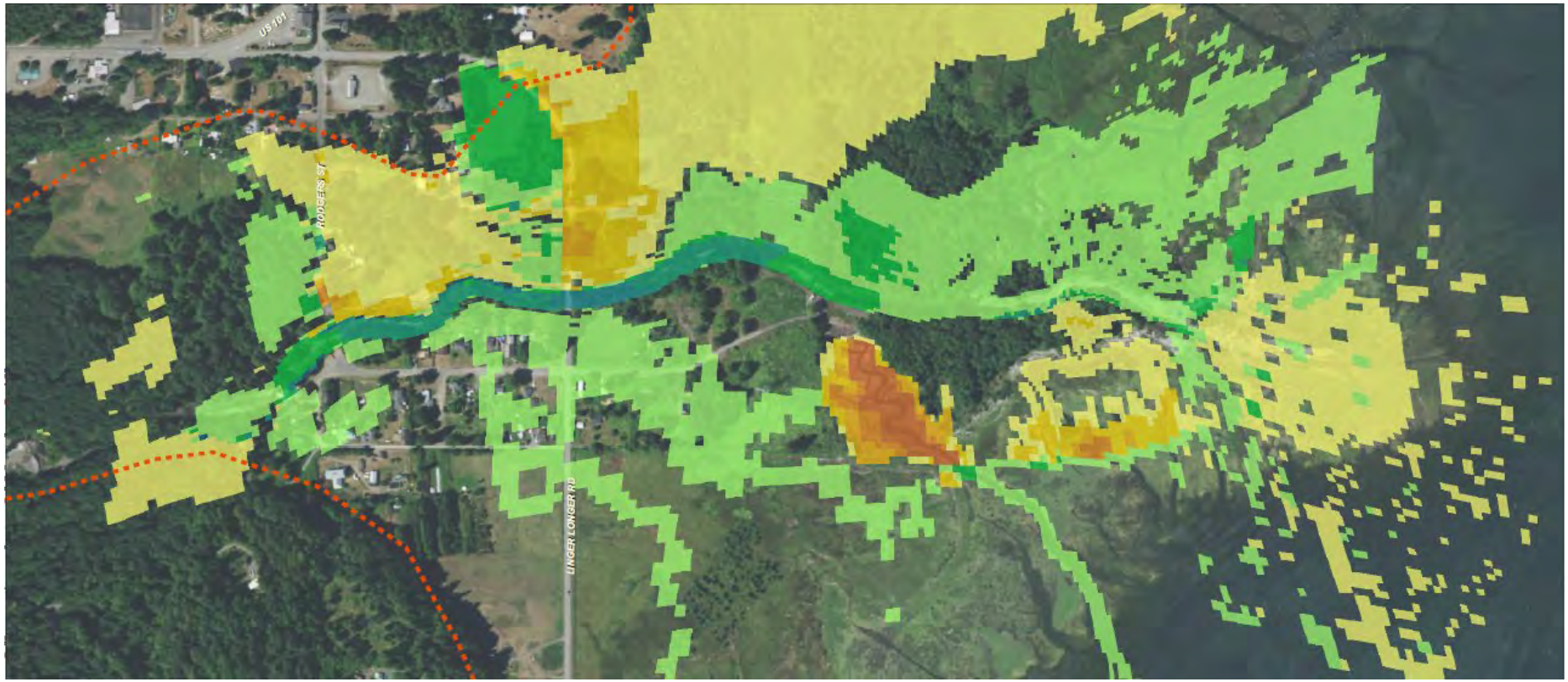
Existing Conditions

Water Depth (feet)

- 0.2 - 1
- 1.1 - 2
- 2.1 - 3
- 3.1 - 4
- 4.1 - 5
- 5.1 - 6
- 6.1 - 7
- 7.1 - 8
- 8.1 - 9
- 9.1 - 10
- > 10

FEMA 100-Year Floodplain (1982)

Flooding (Water Depth) – Alt. 2 Comparison



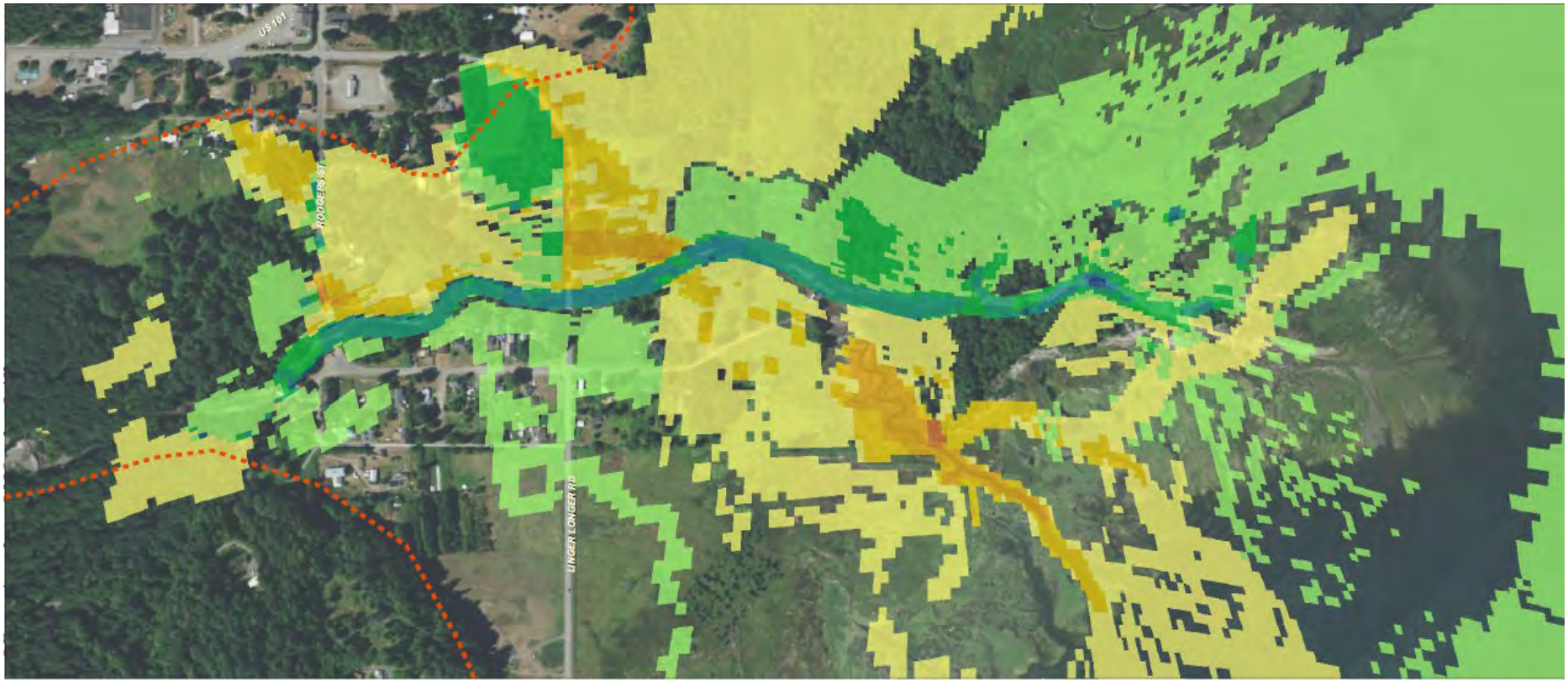
Alternative 2 Depths minus Existing Conditions Depths

Water Depth Change (feet)

- -5.5 - -5
- -4.9 - -4
- -3.9 - -3
- -2.9 - -2
- -1.9 - -1
- -0.9 - -0.1
- -0.1 - 0.1
- 0.11 - 1
- 1.1 - 2
- 2.1 - 3
- 3.1 - 4
- 4.1 - 5
- 5.1 - 6

FEMA 100-Year Floodplain (1982)

Flooding (Water Depth) – Alt. 3 (Modified) Comparison



Alternative 3 Depths minus Existing Conditions Depths (without the 2,800-foot setback levee)

Water Depth Change (feet)

- -5.5 - -5
- -4.9 - -4
- -3.9 - -3
- -2.9 - -2
- -1.9 - -1
- -0.9 - -0.1
- -0.1 - 0.1
- 0.11 - 1
- 1.1 - 2
- 2.1 - 3
- 3.1 - 4
- 4.1 - 5
- 5.1 - 6

FEMA 100-Year Floodplain (1982)

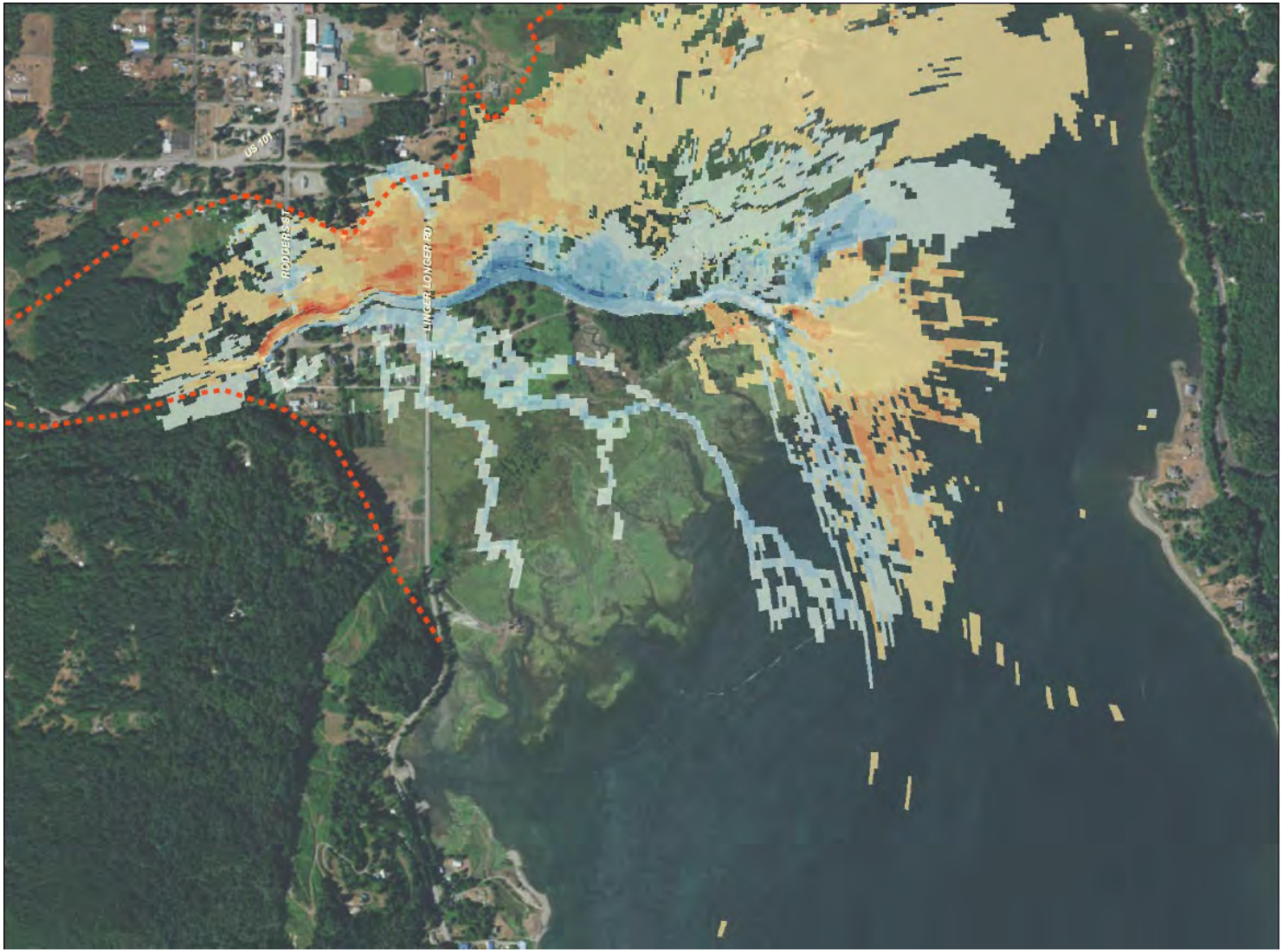
Depth-Averaged Velocity – 100-Year Flood Event

Depth-Averaged Velocity (ft/sec)

- 0 - 1
- 1.1 - 2
- 2.1 - 3
- 3.1 - 4
- 4.1 - 5
- 5.1 - 6
- 6.1 - 7
- 7.1 - 8
- 8.1 - 9
- 9.1 - 10
- 10.1 - 11
- FEMA 100-Year Floodplain (1982)

Existing Conditions

Depth-Averaged Velocity – Alt. 2 Comparison



Depth-Averaged Velocity Change (ft/sec)

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- 4.1 - 5
- 5.1 - 6
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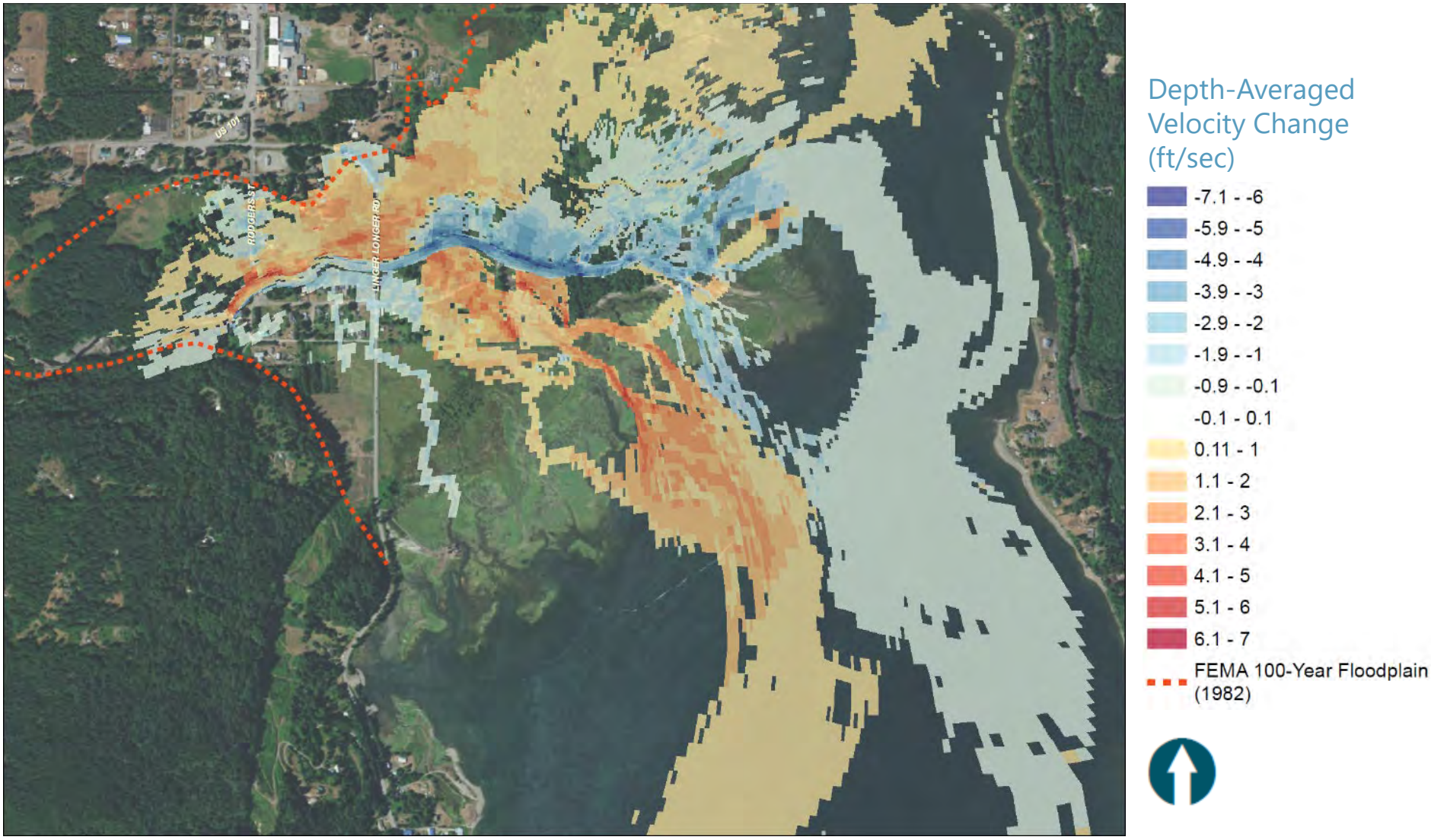
Alternative 2 minus Existing Conditions Depth-Averaged Velocity

Depth-Averaged Velocity – Alt. 3 (Modified) Comparison



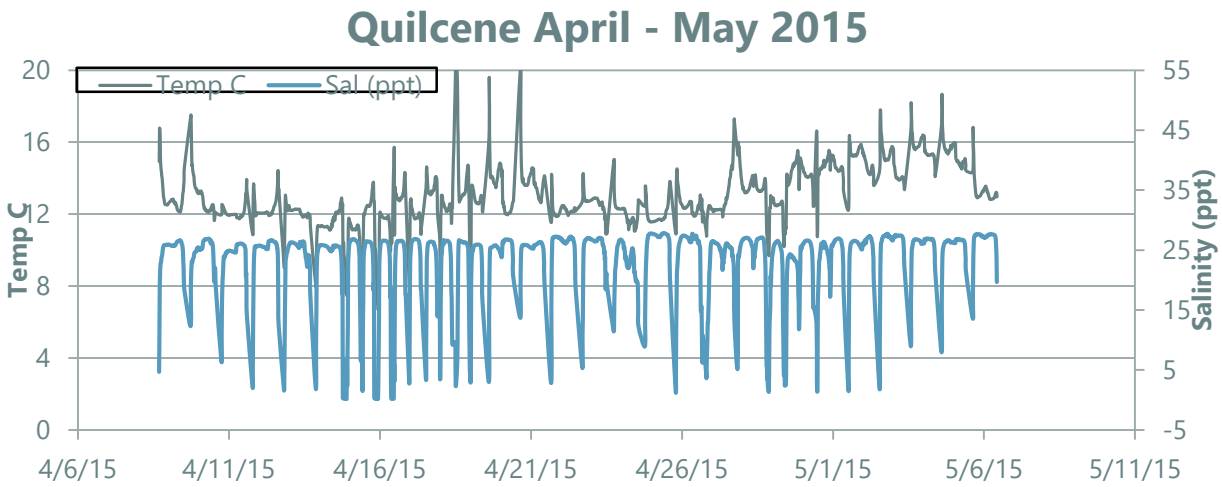
Alternative 3 minus Existing Conditions Depth-Averaged Velocity (without the 2,800-foot setback levee)

Salinity

- Oysters
  - Larvae grow slower below 20 practical salinity units (psu)
  - Adults die below 13 psu
- Mussels
  - Larvae and adults die below 10 psu (10 days)
- Manila clams
  - Larvae grow slower below 15 psu
  - Larvae and adults die in 10 psu (14 days)
- Varnish clams
  - Larvae grow slower below 15 psu
  - Adults survive 1 to 45 psu
- Hardshell clams
  - Larval/juvenile growth slows below 20 psu
  - Adults less active and more die below 15 psu

Salinity Review

- Shellfish larvae less tolerant
- Shell thinning can occur
- Prolonged exposure can kill adults
- Varnish clams more tolerant
- Low temperatures, turbidity, and/or lack of food increases stress and mortality



Sedimentation and Turbidity

- Oysters
  - Larvae settlement reduced with sediment deposition
  - Reduced larval growth at >500 mg/L
  - Adults die when buried 1.5 to 2 inches
- Mussels
  - Decreased growth at 20 mg/L
  - Low levels increase growth (5 mg/L)
  - Harvest shut downs
- Manila, varnish, and native hardshell clams
  - Larvae grow slower at 3 to 4 g/L silt
  - Adults tolerate sand better than fine mud; growth slows at 23 mg/L
  - Burial death occurs with significant coverage (>6 cm)
  - Burial of clam nets will result in death

Sedimentation and Turbidity Review

- Sediment can smother oysters and clams
- Netting can inhibit vertical movement
- Decreased growth in clams and oysters
- Fine sediments have increased impact (clams)
- Harvest may shut down