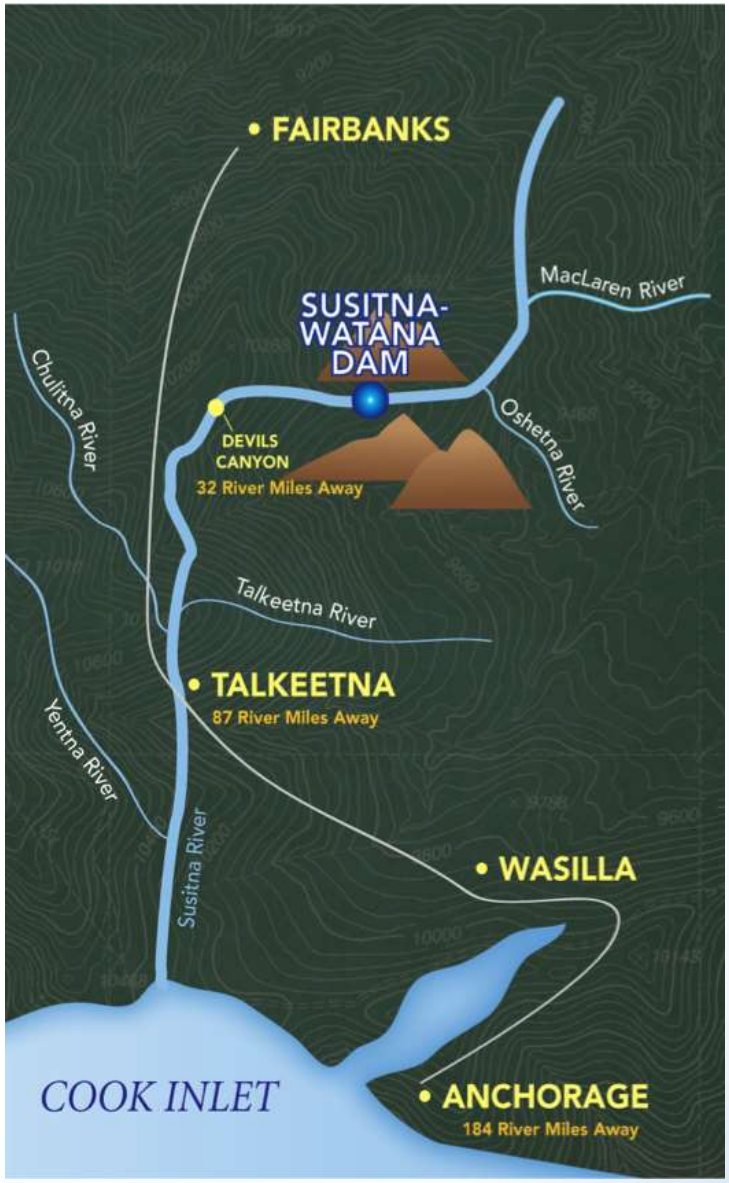
1980s Lower River Habitat Synthesis

2012 Technical Memorandum:

Synthesis of the 1980s Lower Susitna River Segment Aquatic Habitat Information

Technical Workgroup Meeting
March 28, 2012
(April 5, 2013)

Prepared by: Tetra Tech
Prepared for: Alaska Energy Authority



SUSITNA-WATANA HYDRO *Clean, reliable energy for the next 100 years.*

2012 Study Technical Memorandum: *Synthesis of the 1980s Lower Susitna River Segment Aquatic Habitat Information*

- Part of 2012 Study - G-S4: Reconnaissance-Level geomorphic and Aquatic Habitat Assessment of Project Effects on Lower River Channel

- Date Filed with FERC: March 2013
- Date Posted to AEA website: March 2013

Overall Goal – Habitat Synthesis

- Two studies from the 1980s summarized:
  - *Response of Aquatic Habitat Surface Area to Mainstem Discharge Relationships in the Yentna to Talkeetna Reach of the Susitna River* (R&M Consultants, Inc. and Trihey & Associates 1985a)
  - *Assessment of Access by Spawning Salmon into Tributaries of the Lower Susitna River* (R&M Consultants, Inc. and Trihey & Associates 1985b)
- The overall purpose of conducting this effort was to help identify whether potential Project effects warrant additional studies in the Lower River and, if necessary, help in planning those studies

Habitat Synthesis Objectives

- Assess potential changes to aquatic habitat pre- and post-Project
- Provide information for implementation of the 2013-2014 study plans

Other Efforts Used In Study

Work presented in two other technical memorandums:

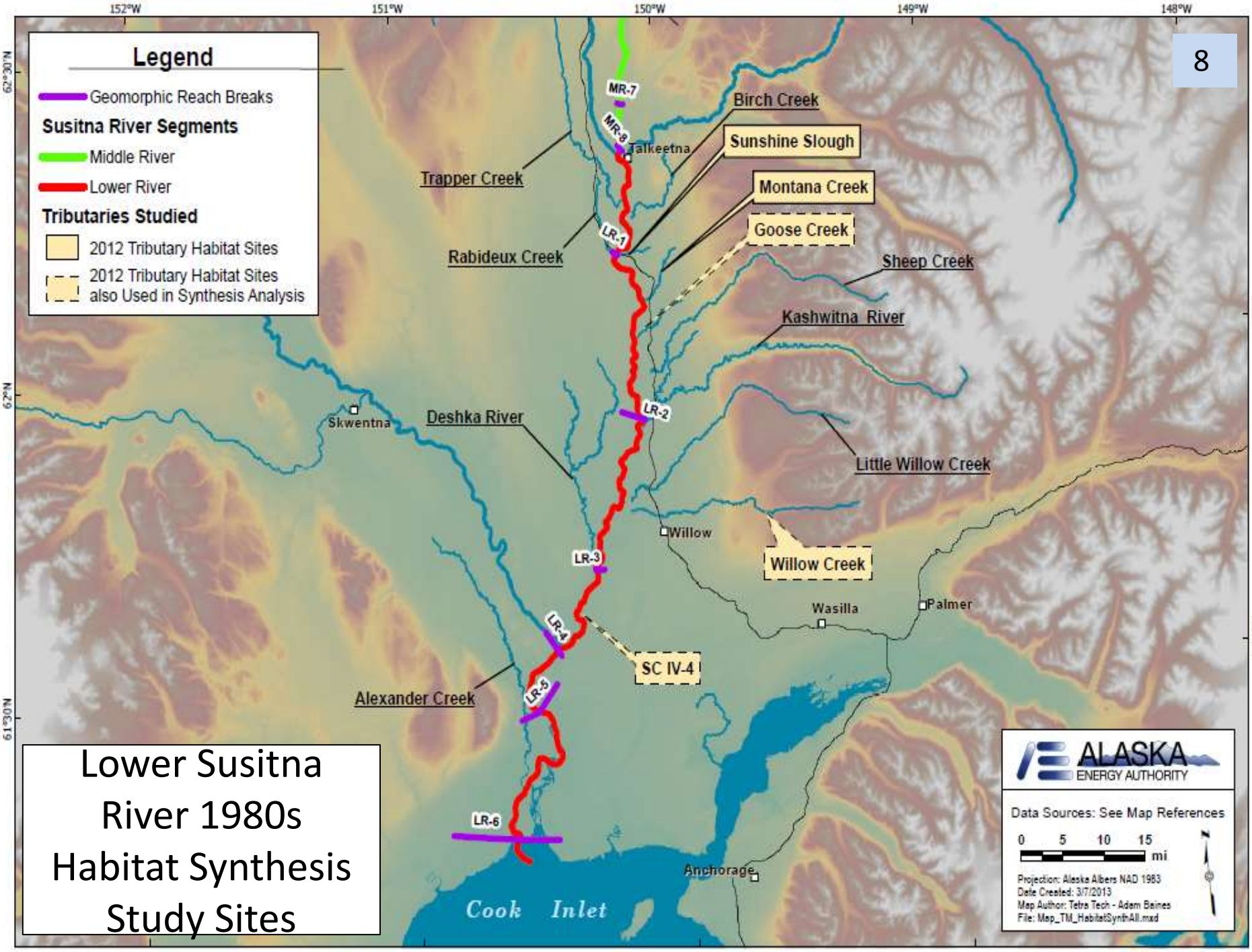
1. *Stream Flow Assessment* used to
   - identify whether the pre- and post-Project hydrology were sufficiently similar in the 1980s studies to the current Project to allow for application of the results of the 1980s efforts to planning for the 2013-2104 studies
   - provide hydrology to evaluate habitat areas for current pre- and post-Project conditions
2. *Mapping of Aquatic Macrohabitat Types at Selected Sites in the Middle and Lower Susitna River Segments from 1980s and 2012 Aerials* used to
   - assess geomorphic change at tributary mouths over the past 30 years

Methodology: Habitat Area Synthesis

- Review and summarize 1980s study results
- Use 1980s habitat area vs. flow relationships to calculate areas, by log-linear interpolation, for habitat types for
  - Pre-Project median monthly discharge
  - Post-Project median monthly discharge
- Sum habitat areas for open water and ice affected periods for evaluation of potential project impacts

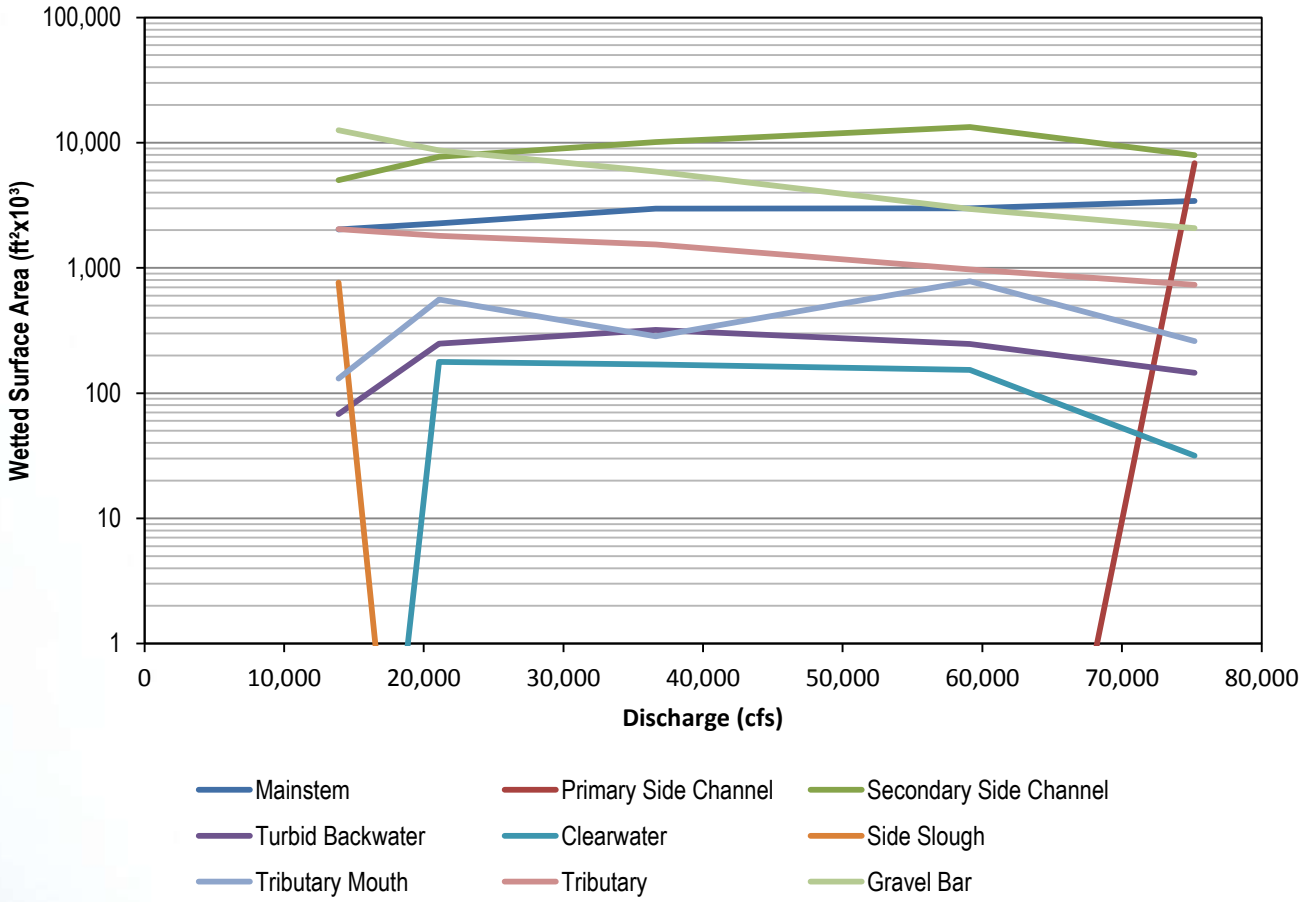
Methodology: Tributary Access

- Review and summarize 1980s study results
- Calculate median weekly discharge during salmon migration period (May-September) identified in 1980s studies
- Compare 1980s study hydrology to current study hydrology for relative determination of impacts on fish access into tributaries
- Use habitat vs. flow relationships to calculate habitat types for:
  - Pre-Project median weekly discharge
  - Post-Project median weekly discharge
- Sum habitat areas for salmon migration period and evaluate potential project impacts on backwater areas
- Compare tributary mouth areas delineated from aerial photography to determine relative stability of tributary mouths



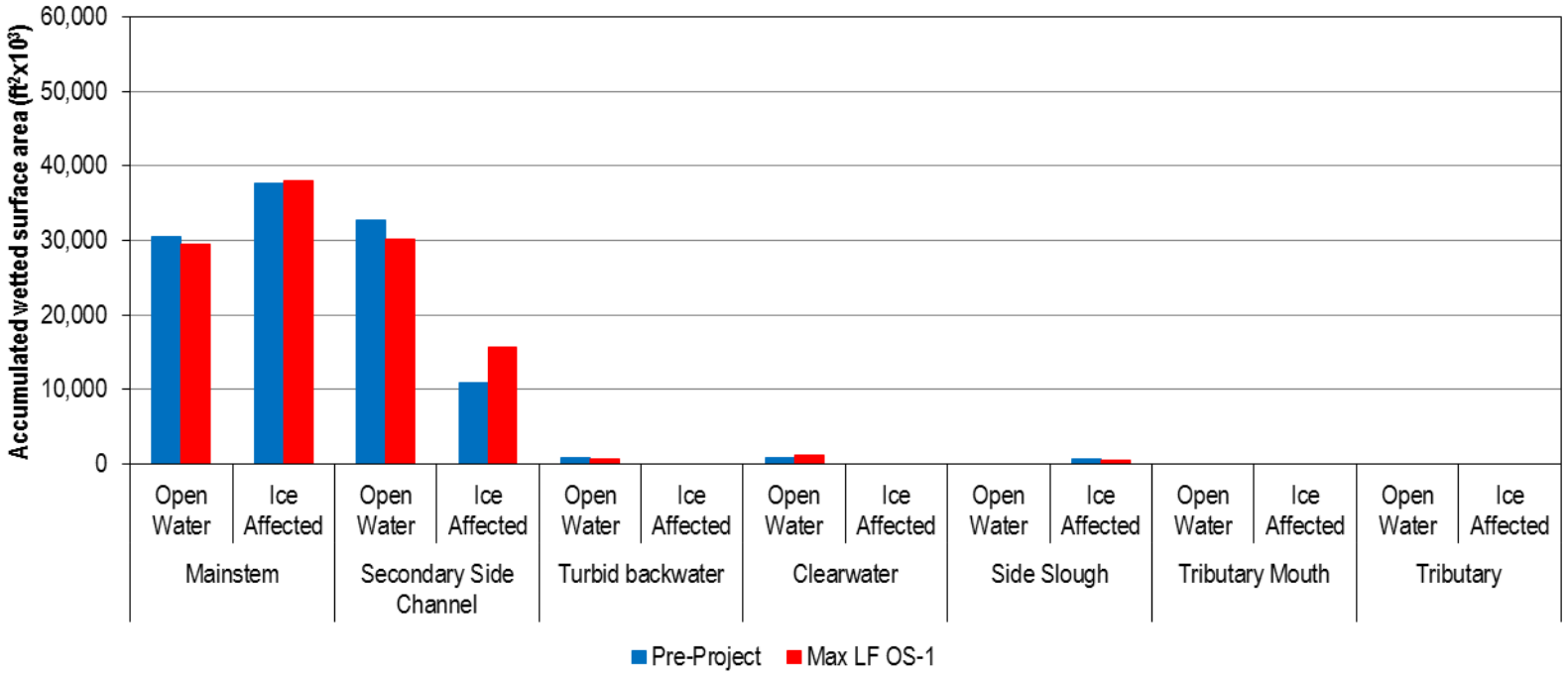
Lower Susitna River 1980s Habitat Synthesis Study Sites

Habitat vs. Discharge Relationships



Reproduced from R&M Consultants and Trihey & Associates (1985a).

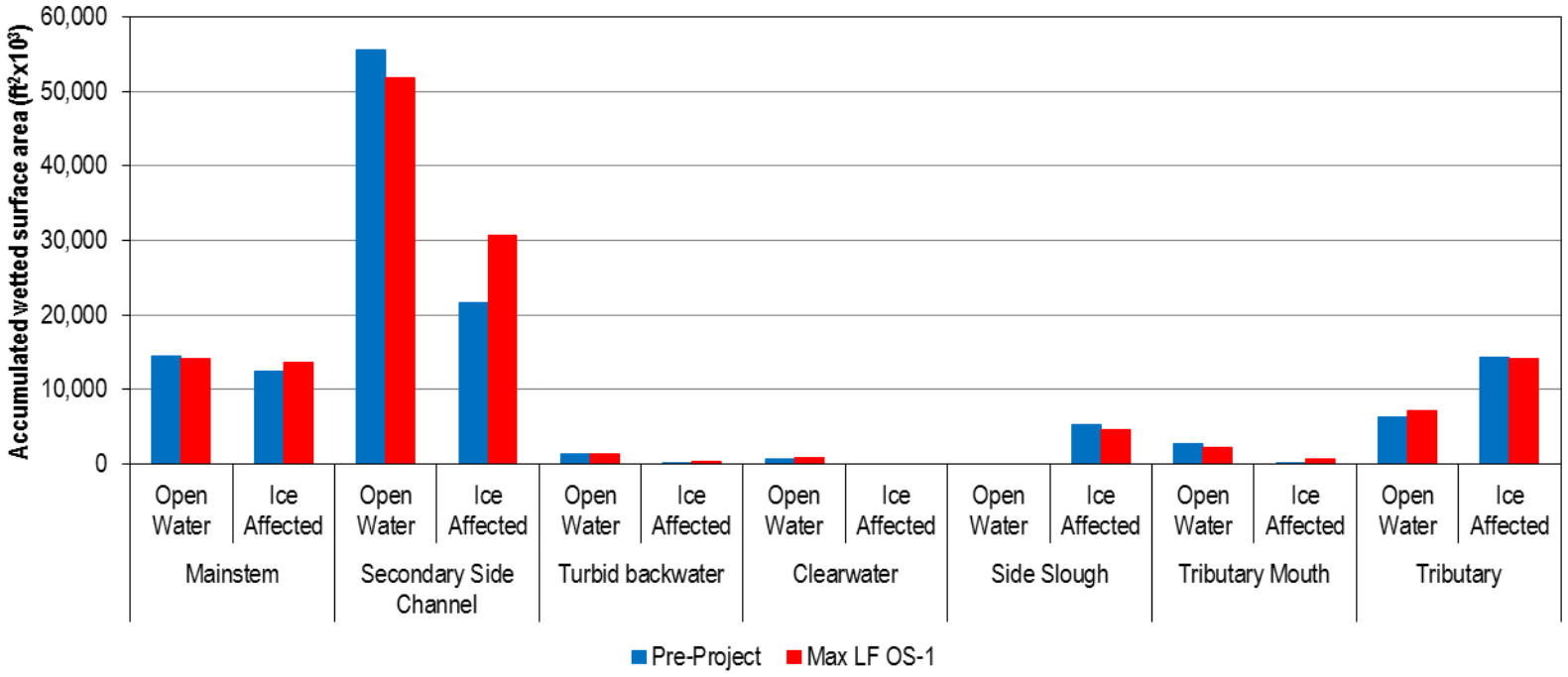
Habitat Area for SC IV-4



Note

- open water period (May-September)
- ice affected period (October-April)

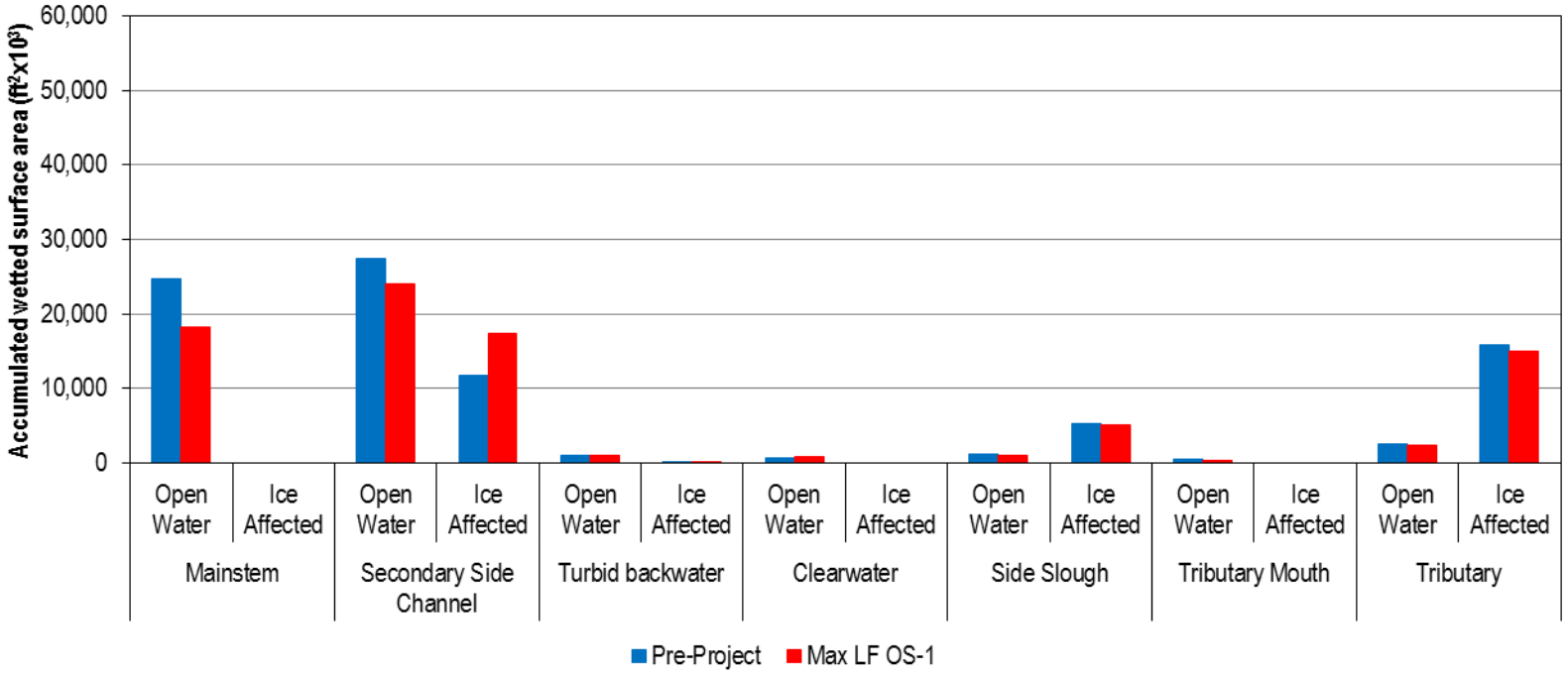
Habitat Area for Willow Creek



Note

- open water period (May-September)
- ice affected period (October-April)

Habitat Area for Goose Creek



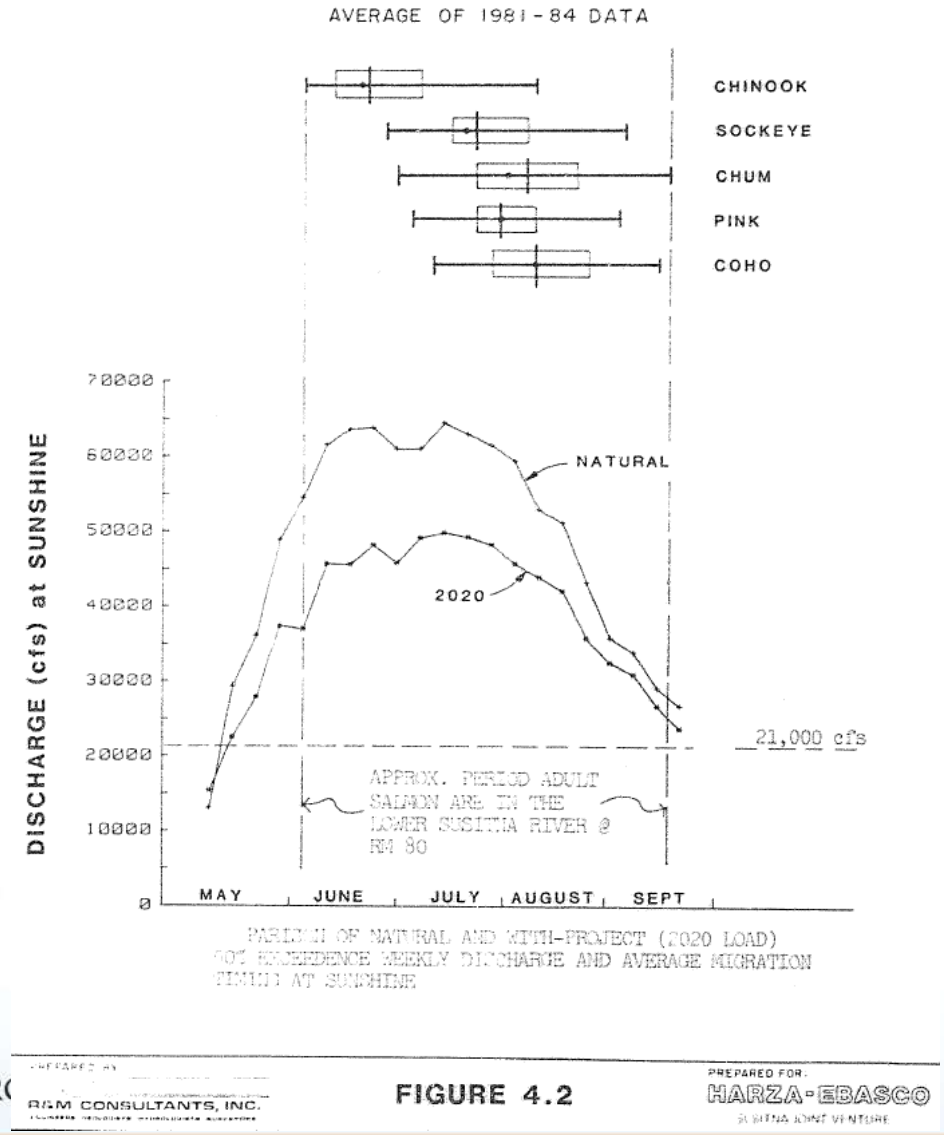
Note

- open water period (May-September)
- ice affected period (October-April)

Important Findings: Aquatic Macrohabitat

- Application of habitat area vs. flow relationships for the main channel and lateral habitats indicated that post-Project change in flows would alter habitat areas
- For the 3 sites and 8 habitat types assessed, 64% showed reduction in wetted surface area under the post-Project condition
  - 3 habitat types, *main channel, secondary side channel, and tributary mouth* showed a decrease at all three sites
  - Remaining habitat types indicated both increases and decreases in wetted surface area under post-Project conditions

1980s Pre- and Post-Project Hydrology



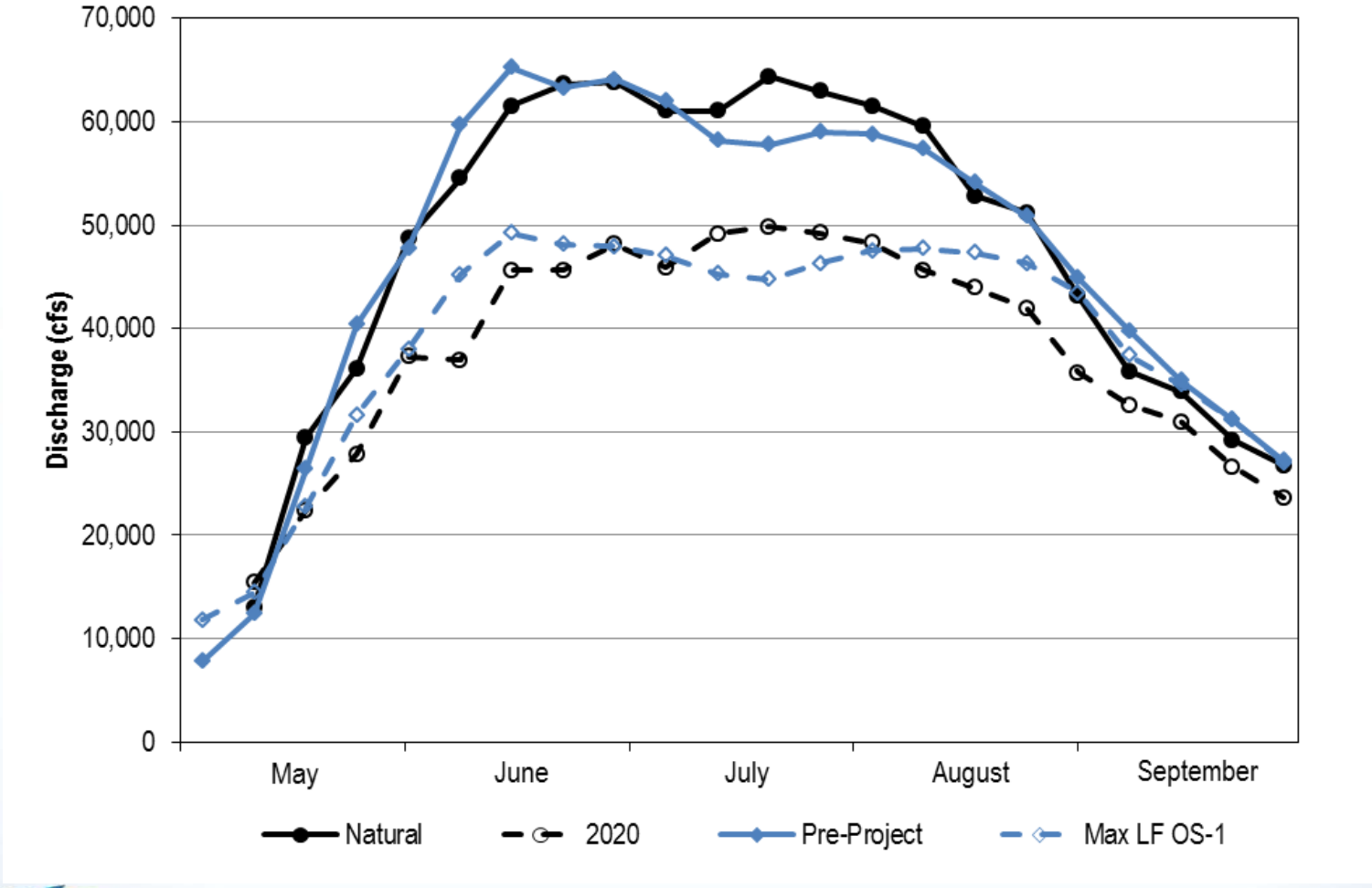
PARISON OF NATURAL AND WITH-PROJECT (2020 LOAD) 50% EXCEEDENCE WEEKLY DISCHARGE AND AVERAGE MIGRATION PERIOD AT SUNSHINE

PREPARED BY:
R&M CONSULTANTS, INC.

FIGURE 4.2

SUSITNA-WATANA HYDRO

Comparison of 1980s and current hydrology



Important Findings: Hydrology comparison

- Pre- and Post-Project hydrology used in the 1980s reports and the current Project are very similar for the adult salmon migration period of May through September.
- Based on this finding, it was concluded that the potential impacts identified for the 13 tributaries studied in the 1980s relative to salmon spawning access were applicable to planning 2013-2014 studies.

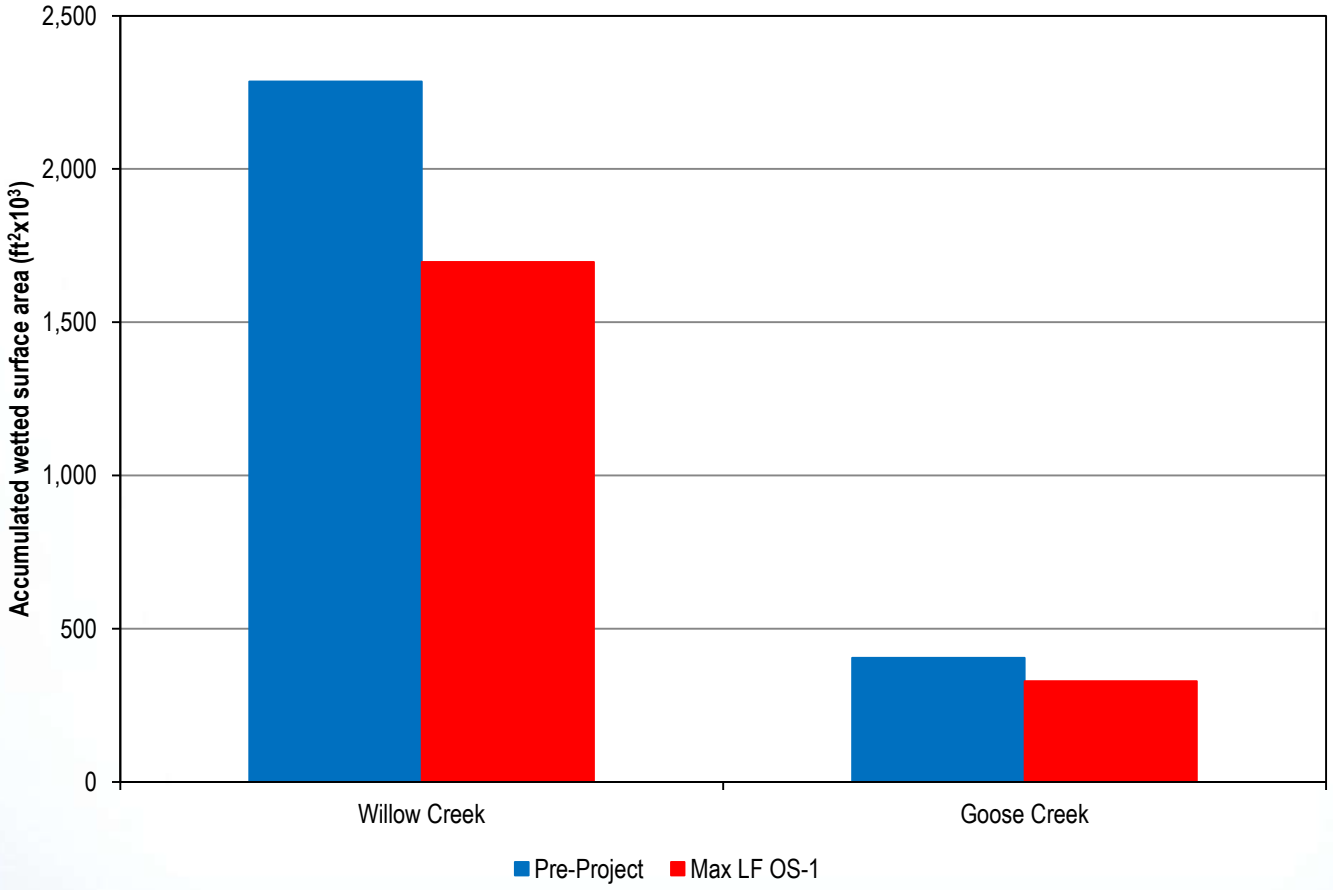
Tributary access results presented in the 1980s studies

General Tributary Information								Effects of With-Project Flows On					
		Tributary Mouth in		Breaching Discharge at Sunshine (cfs)	Summary of Adult Salmon Usage of Stream Interface Reach 1984(1)		Passage Conditions Near Tributary Mouth		Fish Access Into Tributaries at 21,100 cfs (2)		On Backwater Areas (3)		Morphologic Stability of Tributary Mouth (4)	
Tributary	River Mile	Side Channel	Main Channel		Passage	Spawning	Water Depth (ft)	Discharge at Sunshine (cfs)	Possible Problem	No Problem	Moderate Change	Slight Change	Present	With-Project
Alexander Cr	9.1	X		---	Not Surveyed		--	--		X	X		Good	Good
Deshka R	40.6		X	---	Ch, S, P, Co	--	--	--		X	X		Fair	Fair
Willow Cr	49.1	X		<13,900	S, P, Ch, Co	P, Ch	2.8	18,300		X		X	Good	Good
L Willow Cr	50.5	X		58,000	Ck, S, P, Ch, Co	P	1.5	18,300		X	X		Good	Good
Kashwitna R	61.0	X		---	P, Ch	--	--	--		X		X	Fair	Fair
Caswell Cr	64.0	X		35,000	Ck, S, P, Ch	P, Ch	0.8	21,100	X		X		Fair	Fair/ Good
Sheep Cr	66.1	X		<13,900	S, P, Ch, Co	P	3.0	18,300		X	X		Good	Good
Goose Cr	72.0	X		21,000	Ck, S, P, Ch, Co	P	0.4	--	X			X	Fair	Fair/ Good
Montana Cr	77.0		X	35,000	Ck, P, Ch, Co	P, Ch	1.1	18,300	X			X	Poor	Poor/ Fair
Rabideux Cr	83.1		X	---	Ck, S, P, Ch	--	--	--		X	X		Fair	Good
Sunshine Cr	85.1	X		<13,900	Ck, S, P, Ch	P, Ch	1.5	28,400		X	X		Good	Good
Birch Cr	89.2		X	54,100	Ck, S, P, Ch, Co	P	--	--		X	X		Fair	Fair/ Good
Trapper Cr	91.5	X		44,000	Ck, S, P, Ch, Co	P, Ch	0.6	20,900	X		X		Fair	Fair

Definitions:

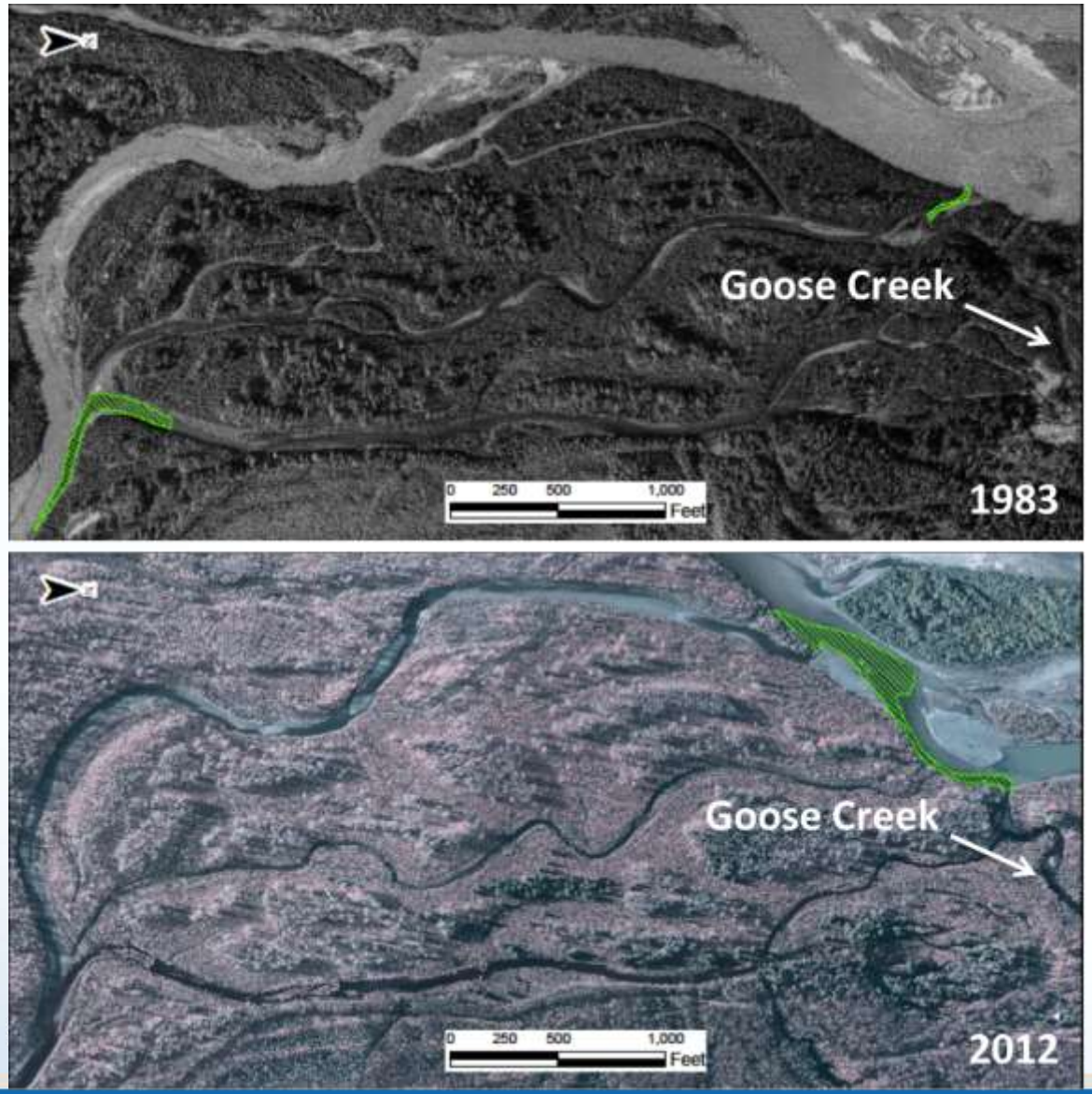
1. The interface reach is first third mile from mouth up the tributary. Source Barrett et al. 1985. Ck = chinook, S= sockeye, P = pink, Ch = chum, and Co = coho.
2. Possible Problem - There is the potential for access problems depending on low tributary flows, debris jams, or channel changes.
   No Problem - No problem with access currently exists.
3. Moderate Change - The extent of backwater area could be moderately reduced by with-project flows during June and July.
   Slight Change - The extent of backwater area could be slightly reduced by with-project flows during June and July
4. Good - No change in tributary mouth morphology since 1951.
   Fair - Some change in tributary mouth morphology since 1951.
   Poor - Change in tributary mouth morphology from 1951 to present.

Tributary Mouth Habitat Area During Salmon Migration Period



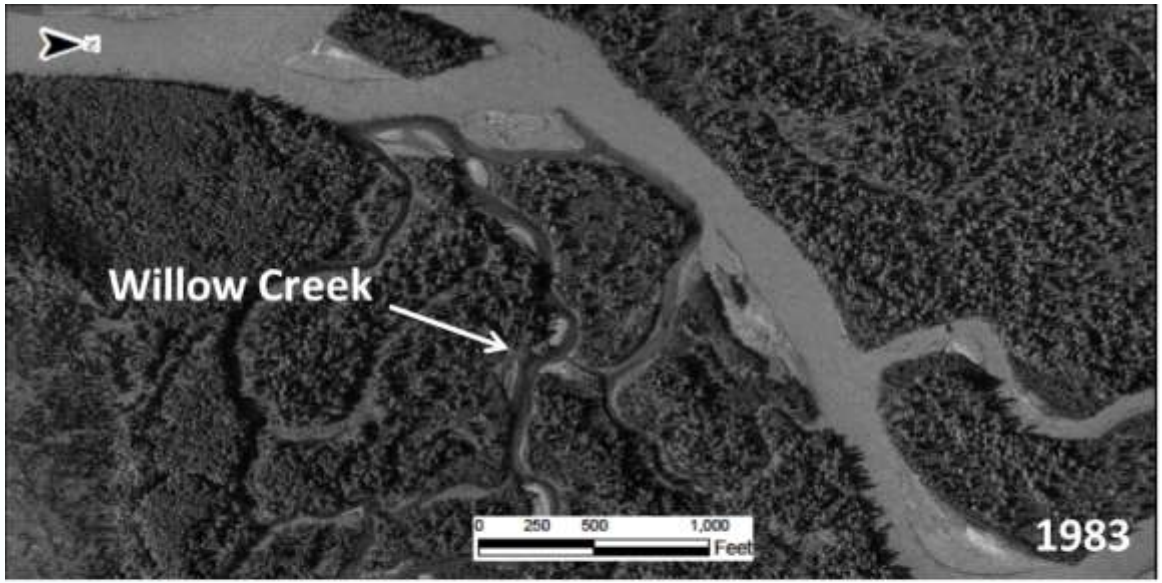
Comparison of Aerial Photographs for Goose Creek

Comparison of Tributary Mouth Habitat Area for Goose Creek

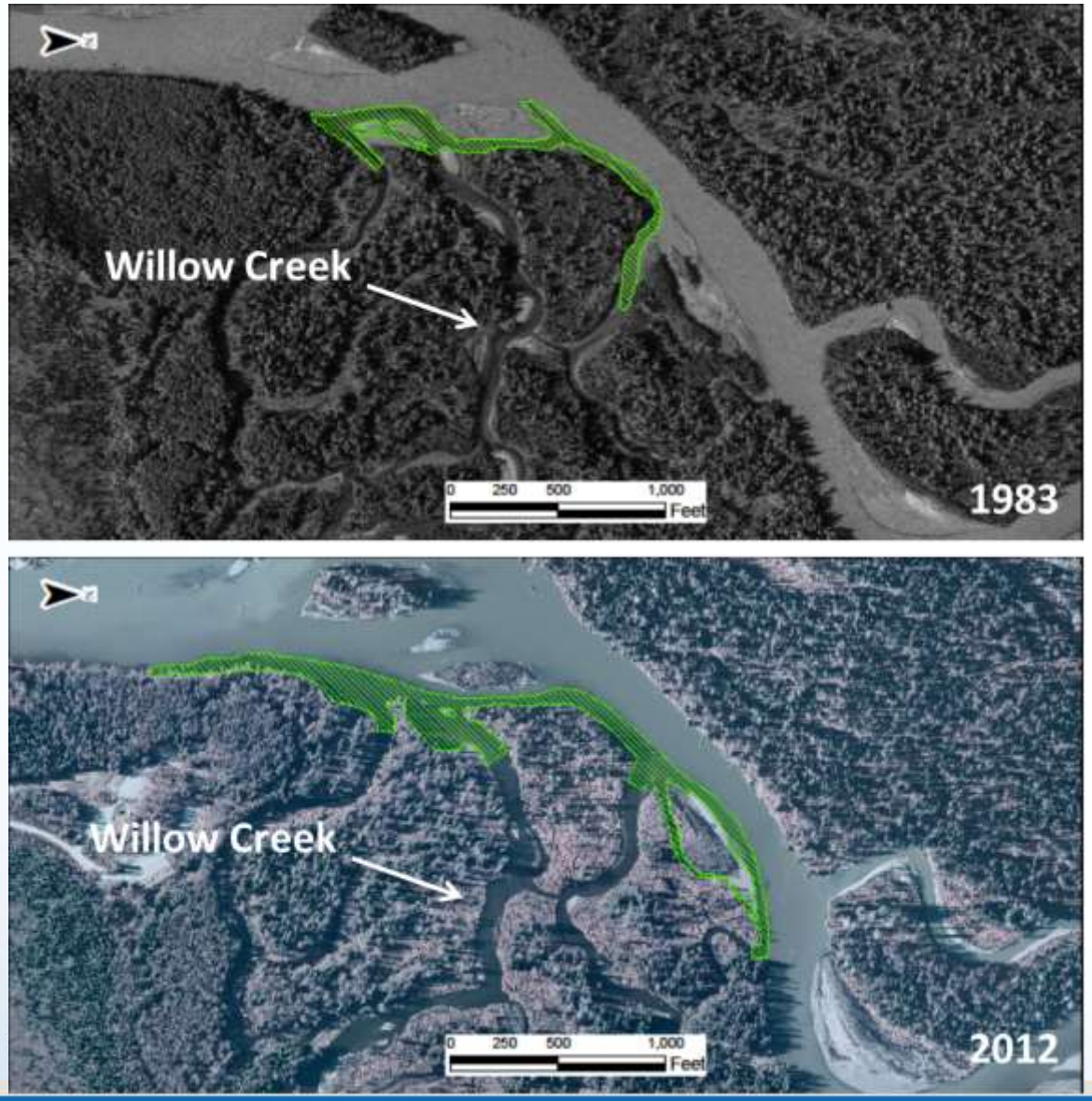


Tributary Mouth Habitat Area

Comparison of Aerial Photographs for Willow Creek



Comparison of Tributary Mouth Habitat Area for Willow Creek



Tributary Mouth Habitat Area

Important Findings: Backwater Area

- Nine out of 13 tributaries studied in 1980s identified potential for moderate reduction
- The 4 remaining tributaries identified as having potential for slight reduction
- Applications of current pre- and post-Project hydrology and habitat vs. flow relationships from 1980s indicated potential average reductions as:
  - 19% at Goose Creek
  - 26% at Willow Creek

Important Findings: Tributary Access

- Four of 13 tributaries studied identified as potentially having problems associated with access by migrating salmon due to reduction in flow depths for the post-Project conditions
  - Caswell Creek
  - Goose Creek
  - Montana Creek
  - Trapper Creek

Conclusions

- Based on these results, the further study of potential Project-related changes to aquatic habitat and tributary access conditions in the Lower River is warranted
- 2013 Lower River Studies
  - Extend open-water flow routing model to PRM 30 (Susitna Station)
  - Extend 1-D sediment transport to PRM 30
  - Extend Riparian IFS into LR-1 through LR-5

Conclusions (cont.)

- 2013 Lower River Studies
  - IFS sample sites
    - LR-1 near PRM 94.5 (Trapper Creek Area)
    - LR-2 near PRM 67 (Caswell Creek Area)
  - Five tributaries:
    - Trapper Creek (PRM 94.5)
    - Birch Creek (PRM 92.5)
    - Sheep Creek (PRM 69.5)
    - Caswell Creek (PRM 67)
    - Deshka River (PRM 45)