Susitna-Watana Hydroelectric Project
(FERC No. 14241)

Initial Study Report Meetings
October 16, 2014
Part B – Agenda and Presentations

Millennium Hotel
4800 Spenard Road
Anchorage, Alaska 99517

Filed November 15, 2014

SUSITNA-WATANA HYDRO

Clean, reliable energy for the next 100 years.

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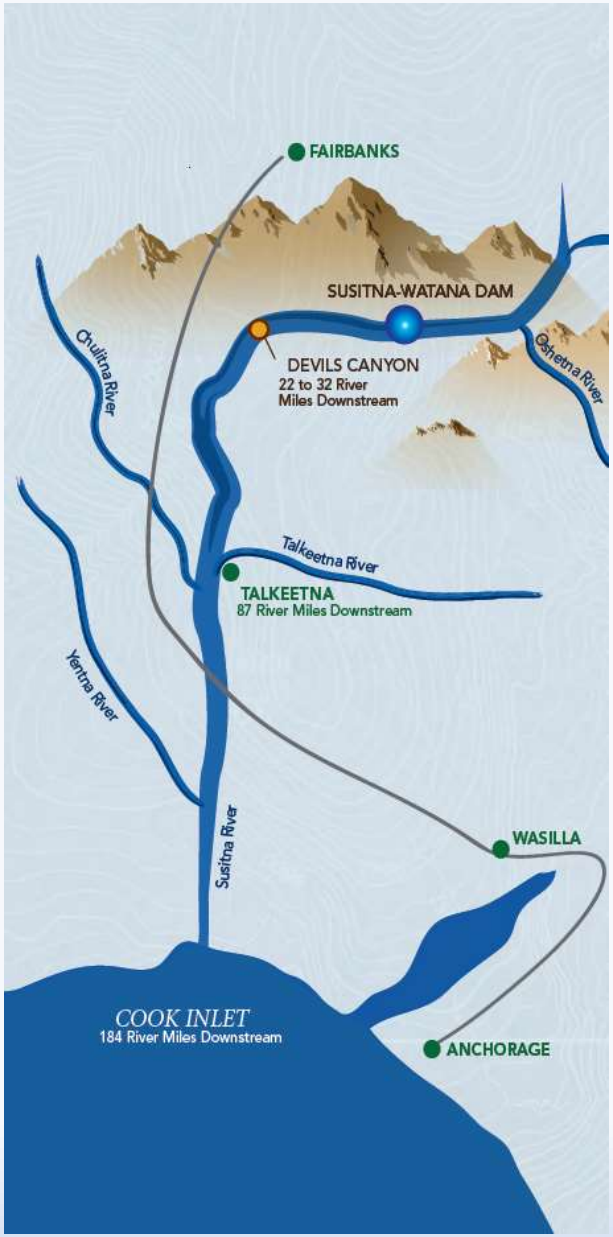
Agenda and Schedule
Initial Study Report (ISR) Meetings
Glacial (Study 7.7), Geomorphology (Studies 6.5 + 6.6), Water Quality (Studies 5.5-5.7), Groundwater (Study 7.5)
October 16th, 2014

LOCATION:	**Millennium Hotel** **4800 Spenard Road** **Anchorage AK, 99517**
TIME:	**8:30 am to 4:30 pm AKDT Time**
SUBJECT:	**ISR Meetings**
GoTo MEETING:	**https://www4.gotomeeting.com/register/417855407** **1-888-585-9008 CODE: 810-056-852**
Goal	**Describe the status of Study Plan implementation and explain any variances and proposed modifications to ongoing studies for completion of the Study Plan.**

Agenda Items

8:30 – 8:45	**Introduction**
8:45 – 9:15	**Glacier and Runoff Changes Study (Study 7.7) – G. Wolken**
9:15 – 10:15	**Geomorphology Study (Study 6.5) – B. Fullerton**
10:15 – 10:30	**Break**
10:30 – 12:00	**Fluvial Geomorphology Modeling below Watana Dam Study (Study 6.6) – L. Zevenbergen**
12:00 – 1:00	**Lunch**
1:00 – 1:45	**Baseline Water Quality Study (Study 5.5) – R. Plotnikoff**
1:45 – 2:30	**Water Quality Modeling Study (Studies 5.6) – J. Hamrick**
2:30 – 3:00	**Mercury Assessment and Potential for Bioaccumulation Study (Study 5.7) – R. Plotnikoff**
3:00 – 3:15	**Break**
3:15 – 4:15	**Groundwater Study (Study 7.5) – Michael Lilly**
4:15 – 4:30	**Next Steps and Adjourn**



Initial Study Report Meeting

Study 7.7 Glacier and Runoff Changes

October 16, 2014

Prepared by

Dr. Gabriel Wolken,

Alaska Div. of Geological & Geophysical Surveys

Study 7.7 Objectives

- Review existing literature relevant to glacier retreat in south-central Alaska and the Upper Susitna watershed. This review will summarize the current understanding of potential future changes in runoff associated with glacier wastage and retreat.

Study 7.7 Components

- Glacier Changes in Alaska (ISR Part A, Section 4.1; pg 3)
- Runoff from Glaciers (ISR Part A, Section 4.2; pg 4)

- Trends in Permafrost (ISR Part A, Section 5.1; pg 11)
- Controls on Permafrost (ISR Part A, Section 5.2; pg 12)
- Periglacial Landforms (ISR Part A, Section 5.3; pg 13)
- Permafrost Modeling (ISR Part A, Section 5.4; pg 13)

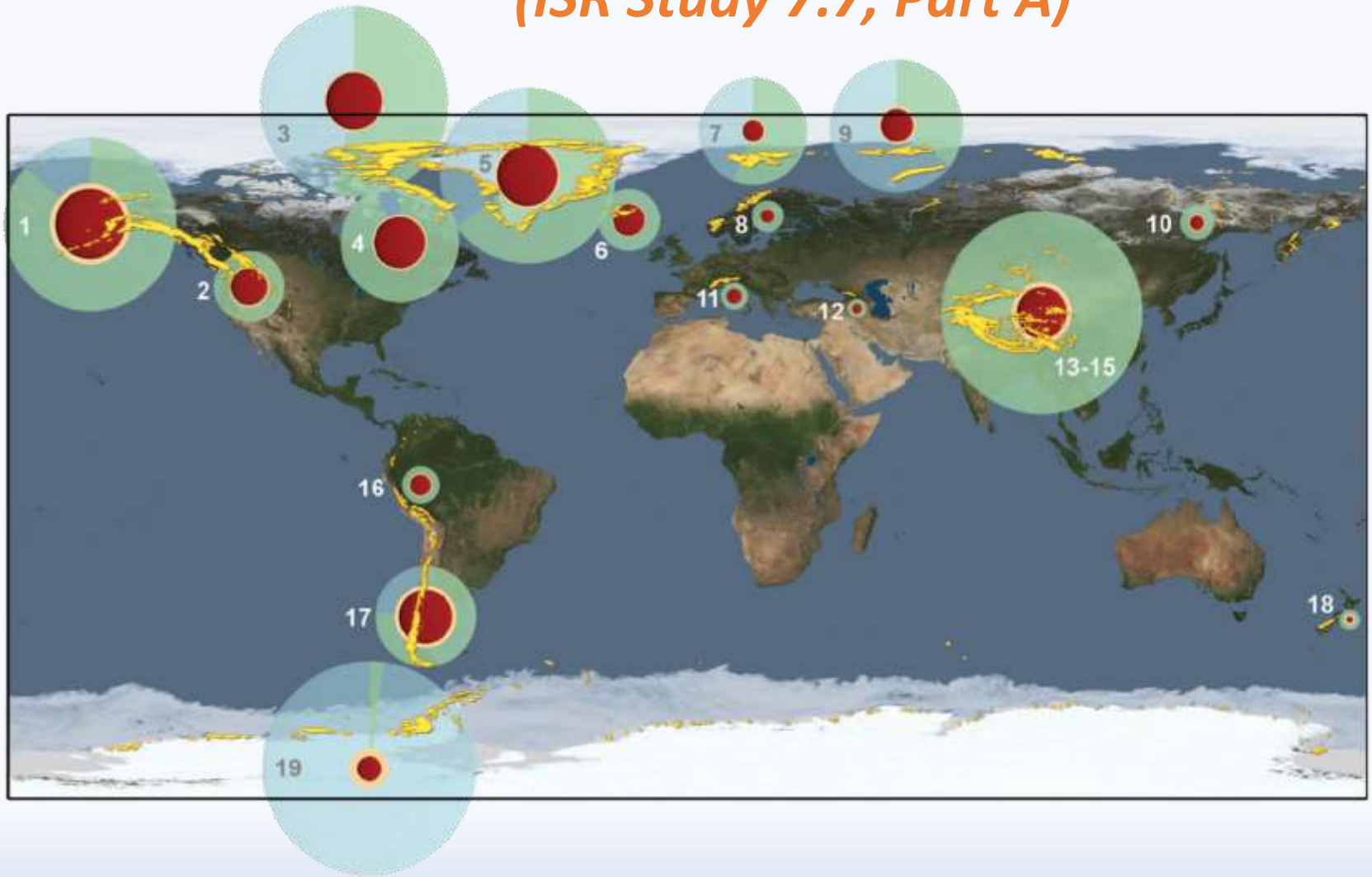
- Runoff (ISR Part A, Section 6.1; pg 14)
- Surface Water and Wetlands (ISR Part A, Section 6.2; pg 15)
- Groundwater and Infiltration (ISR Part A, Section 6.3; pg 15)
- Evapotranspiration (ISR Part A, Section 6.4; pg 16)

- Observed Changes in Climate (ISR Part A, Section 7.1; pg 16)
- Existing Meteorological and Climatological Data (ISR Part A, Section 7.2; pg 17)
- Projections of Future Climate (ISR Part A, Section 7.3; pg 18)

Study 7.7 Variances

- There were no variances to this study as described in RSP Section 7.7.4

Study 7.7 Summary of Results in ISR (ISR Study 7.7, Part A)



2003-2009

Mass Budget [Gt yr^{-1}]

-1

-10

-100

Area [km^2]

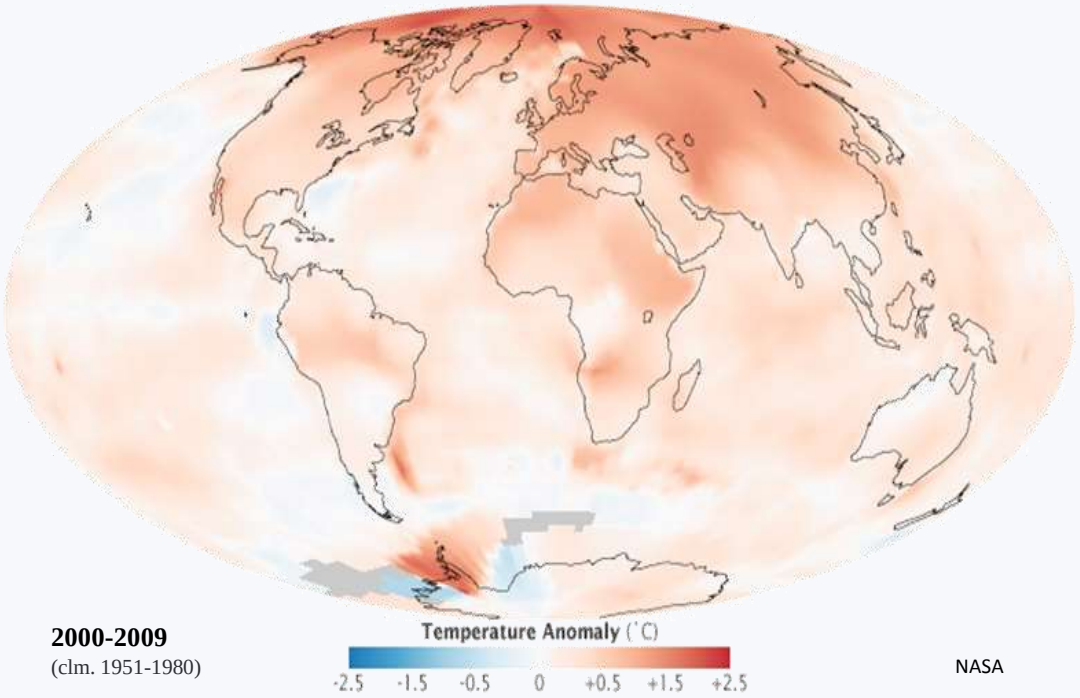
TW

50,000

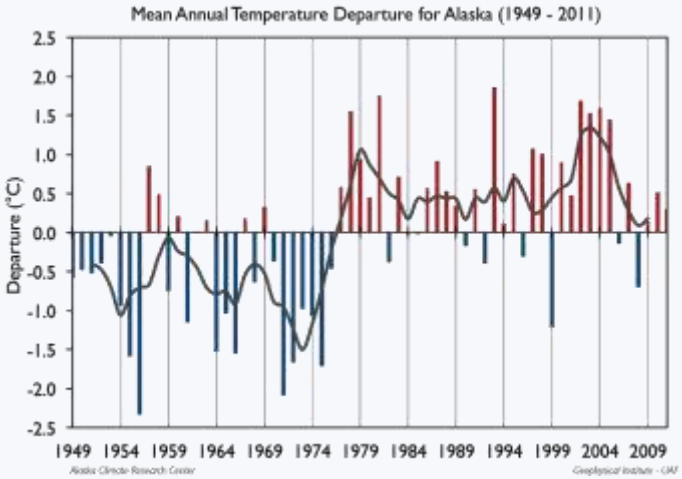
95 % confidence interval

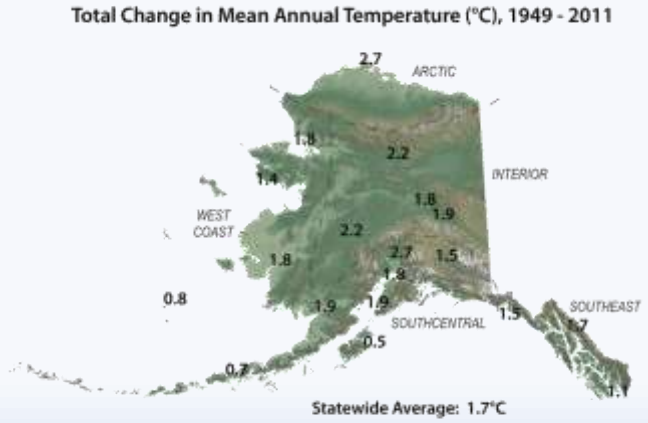
Gardner et al., 2013

Study 7.7 Summary of Results in ISR (ISR Study 7.7, Part A)



Study 7.7 Summary of Results in ISR (ISR Study 7.7, Part A)

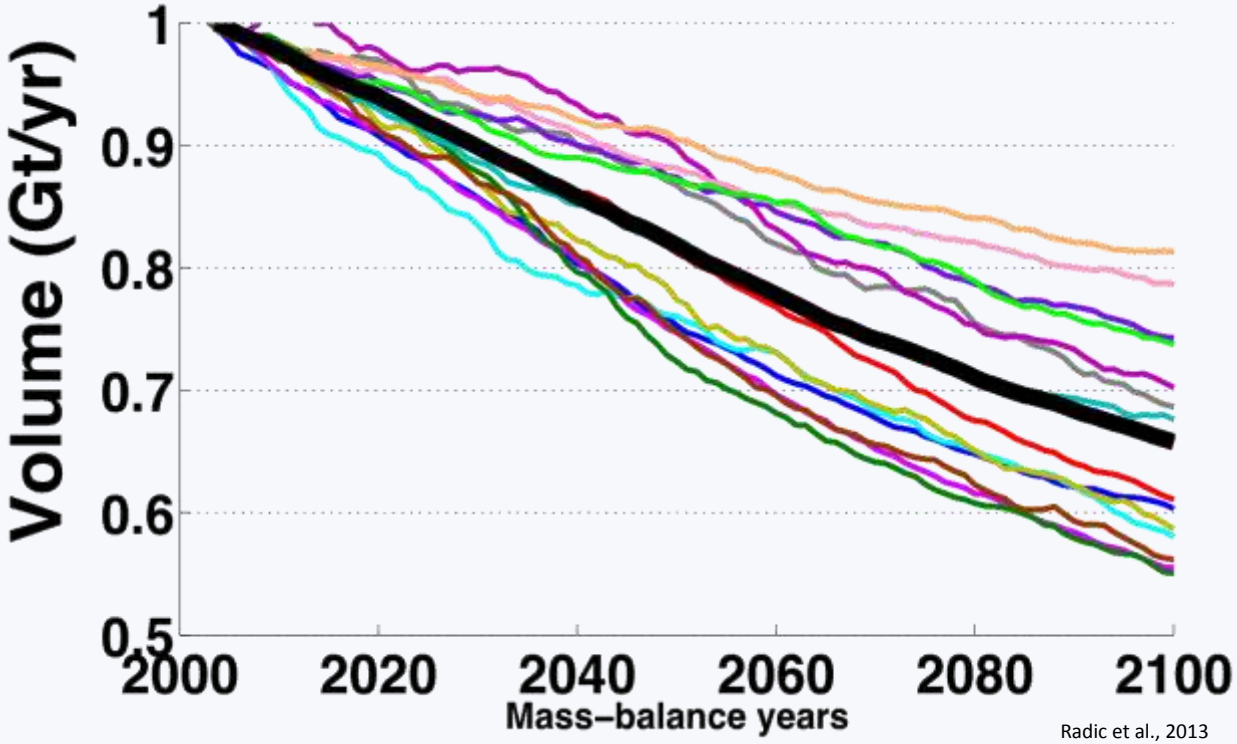




Study 7.7 Summary of Results in ISR (ISR Study 7.7, Part A)

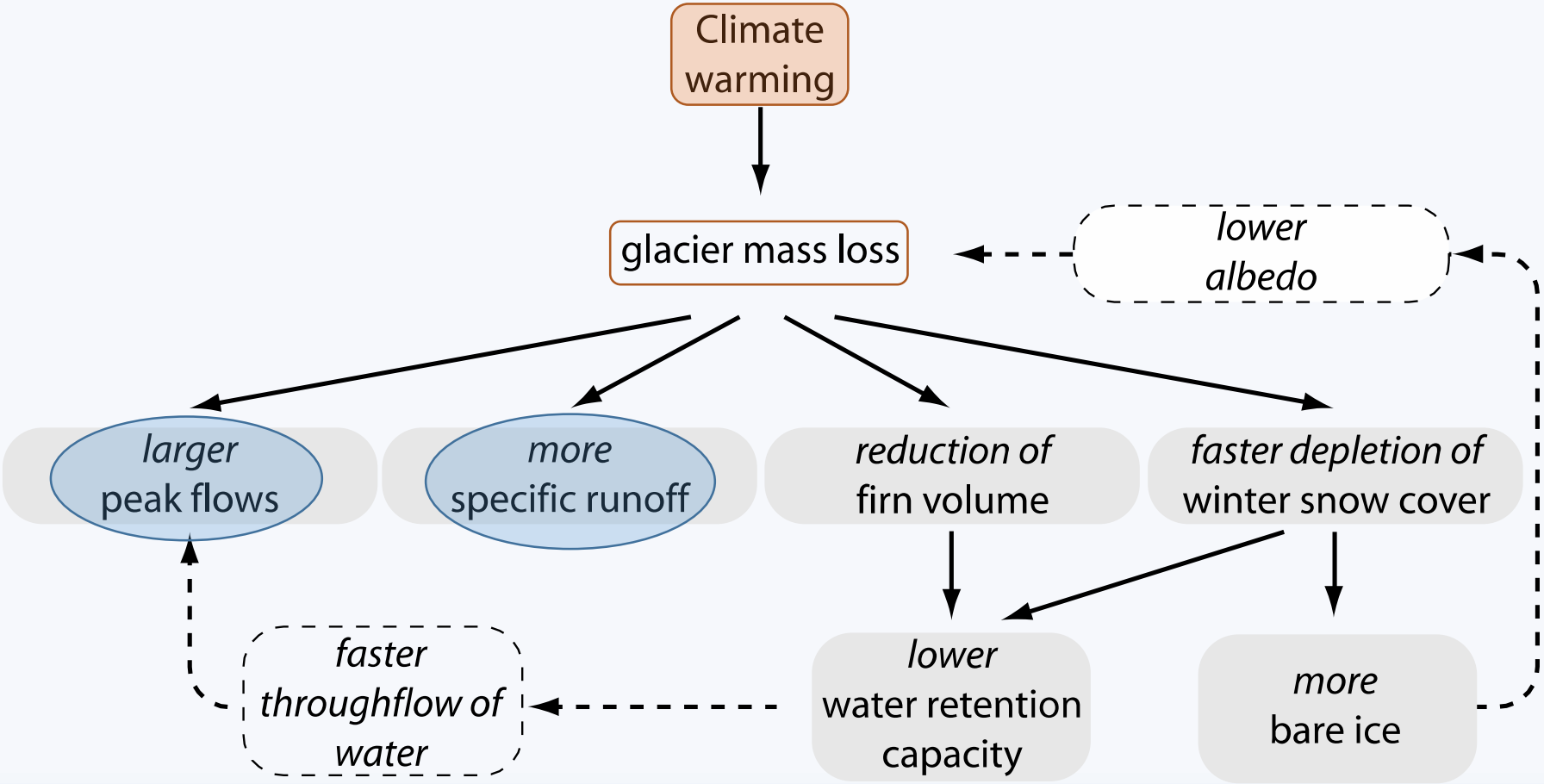
Reference	Original unit	Mass change (Gt yr^{-1})	Specific mass change (m w.e. yr^{-1})	Domain (area, km^2)	Period	Method
Alaska and NW Canada						
Arendt et al. 2002	–52±15 km^3 yr^{-1} w.e.	–52±15	-0.57	Alaska (90,000)	1955-5/1995	Laser altimetry/maps
Arendt et al. 2002	–96±35 km^3 yr^{-1} w.e.	–96±35	-1.07	Alaska (90,000)	5/1995-5/2000	Laser altimetry
Tamisiea et al. 2005	-110±30 km^3 yr^{-1} w.e.	-110±30	-1.26	Alaska (87,000)	4/2002-6/2004	GRACE
Chen et al. 2006	-101±22 km^3 yr^{-1} w.e.	-101±22	-1.11	Alaska (90,957)	4/2002-11/2005	GRACE
Luthcke et al. 2008	-84±5 Gt yr^{-1}	-84±5	-1.02	Gulf of Alaska (82,505)*	4/2003-9/2007	GRACE
Berthier et al. 2010	-41.9±8.6 km^3 yr^{-1} w.e.	-41.9±8.6	-0.48	Alaska (87,860)	1962-2006	geodetic
Wu et al. 2010	-101±23 Gt yr^{-1}	-101±23		Alaska **	4/2002-12/2008	GRACE
Luthcke et al. 2013	-68.8±11 Gt yr^{-1}	-68.8±11	-0.91	Alaska (76,000)	12/2003-12/2010	GRACE
Gardner et al. 2013	-50±17 Gt yr^{-1}	-50±17	-0.57	Alaska (87,100)	2003-2009	GRACE
Arendt et al. 2013	-65±11 Gt yr^{-1}	-65±11	-0.79	Gulf of Alaska (82,505)	12/2003-12/2010	GRACE
Arendt et al. 2013	-61±11 Gt yr^{-1}	-61±11	-0.74	Gulf of Alaska (82,505)	10/2003-10/2009	GRACE
Arendt et al. 2013	-65±12 Gt yr^{-1}	-65±12	-0.79	Gulf of Alaska (82,505)	10/2003-10/2009	ICESat
Subregions in Alaska						
Adalgeirsdottir 1998	-34 km^3 ice	-0.71	-0.39	Harding Icefield (1,800)	1950/52-1994/96	Laser altimetry/map
Arendt et al. 2002	-5.3 km^3 yr^{-1} w.e.	-5.3		Alaska Range **	1955-5/1995	Laser altimetry/maps
Arendt et al. 2002	-1.0 km^3 yr^{-1} w.e.	-1.0		Brooks Range **	1955-5/1995	Laser altimetry/maps
Arendt et al. 2002	-5.4 km^3 yr^{-1} w.e.	-5.4		Coast Range **	1955-5/1995	Laser altimetry/maps
Arendt et al. 2002	-2.7 km^3 yr^{-1} w.e.	-2.7		Kenai Mountains **	1955-5/1995	Laser altimetry/maps
Arendt et al. 2002	-25.7 km^3 yr^{-1} w.e.	-25.7		St. Elias Mountains **	1955-5/1995	Laser altimetry/maps
Arendt et al. 2002	-6.8 km^3 yr^{-1} w.e.	-6.8		Western Chugach Mountains **	1955-5/1995	Laser altimetry/maps
Arendt et al. 2002	-1.3 km^3 yr^{-1} w.e.	-1.3		Wrangell Mountains **	1955-5/1995	Laser altimetry/maps
Arendt et al. 2002	-4.2 km^3 yr^{-1} w.e.	-4.2		Tidewater glaciers **	1955-5/1995	Laser altimetry/maps
Arendt et al. 2006	-7.4 ± 1.1 km^3 yr^{-1} weq	-7.4 ± 1.1	-0.80	Western Chugach Mts (9,300)	1955-5/1995	Laser altimetry/maps
Larsen et al. 2007	-16.7 ± 4.4 km^3 ice yr^{-1}	-15.0±4.0	-1.03	Southeast Alaska (14,580)	8/1948-2/2000	geodetic
Arendt et al. 2008	-0.43±0.12 m w.e. yr^{-1}	-21.2±3.8	-0.64	St Elias Mtns (32,900)	9/2003-8/2007	Laser altimetry
Arendt et al. 2008	-0.63±0.09 m w.e. yr^{-1}	-20.6±3.0	-0.63	St Elias Mtns (32,900)	9/2003-8/2007	GRACE
Johnson et al. 2013	3.93±0.89 Gt yr^{-1}	3.93±0.89	-0.61	Glacier Bay (6,428)	1995-2011	Laser altimetry
Das et al. in press	-0.07±0.19 m w.e. yr^{-1}	-0.34±0.93	-0.07	Wrangell Mountains (4,900)	1957-2000	Laser altimetry/DEM
Das et al. in press	-0.24±0.16 m w.e. yr^{-1}	-1.18±0.78	-0.24	Wrangell Mountains (4,900)	2000-2007	Laser altimetry/DEM

Study 7.7 Summary of Results in ISR (ISR Study 7.7, Part A)



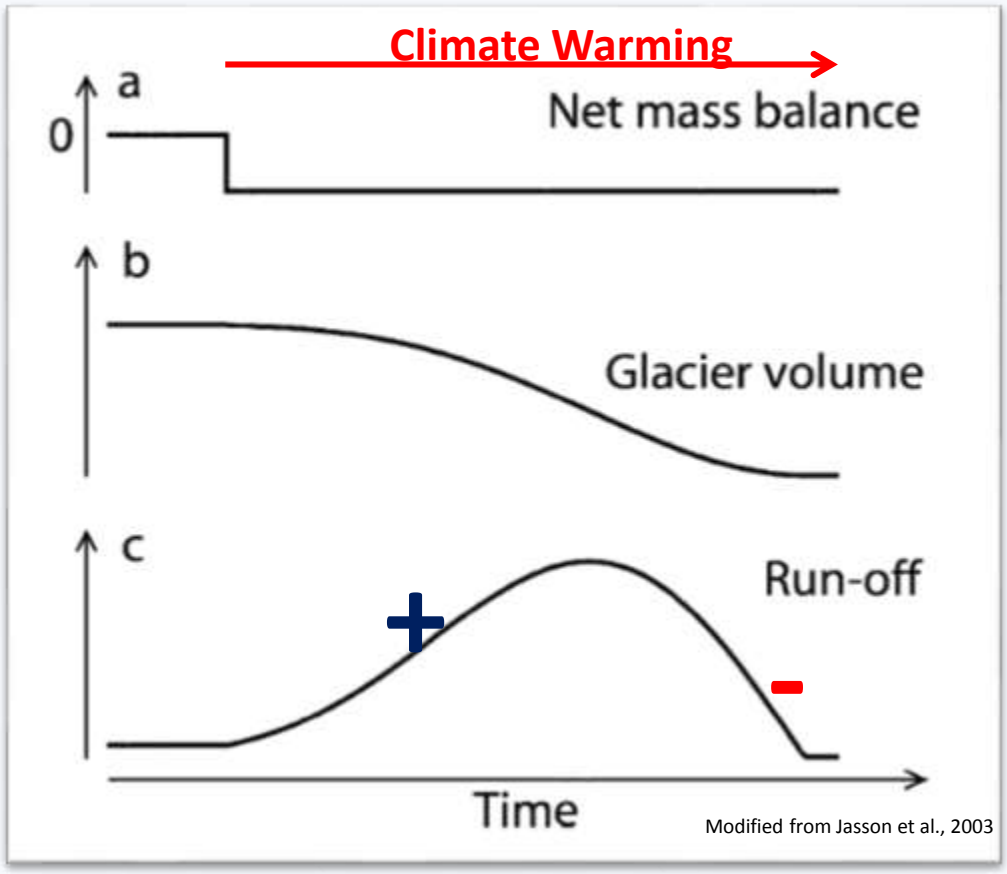
Radic et al., 2013

Study 7.7 Summary of Results in ISR (ISR Study 7.7, Part A)



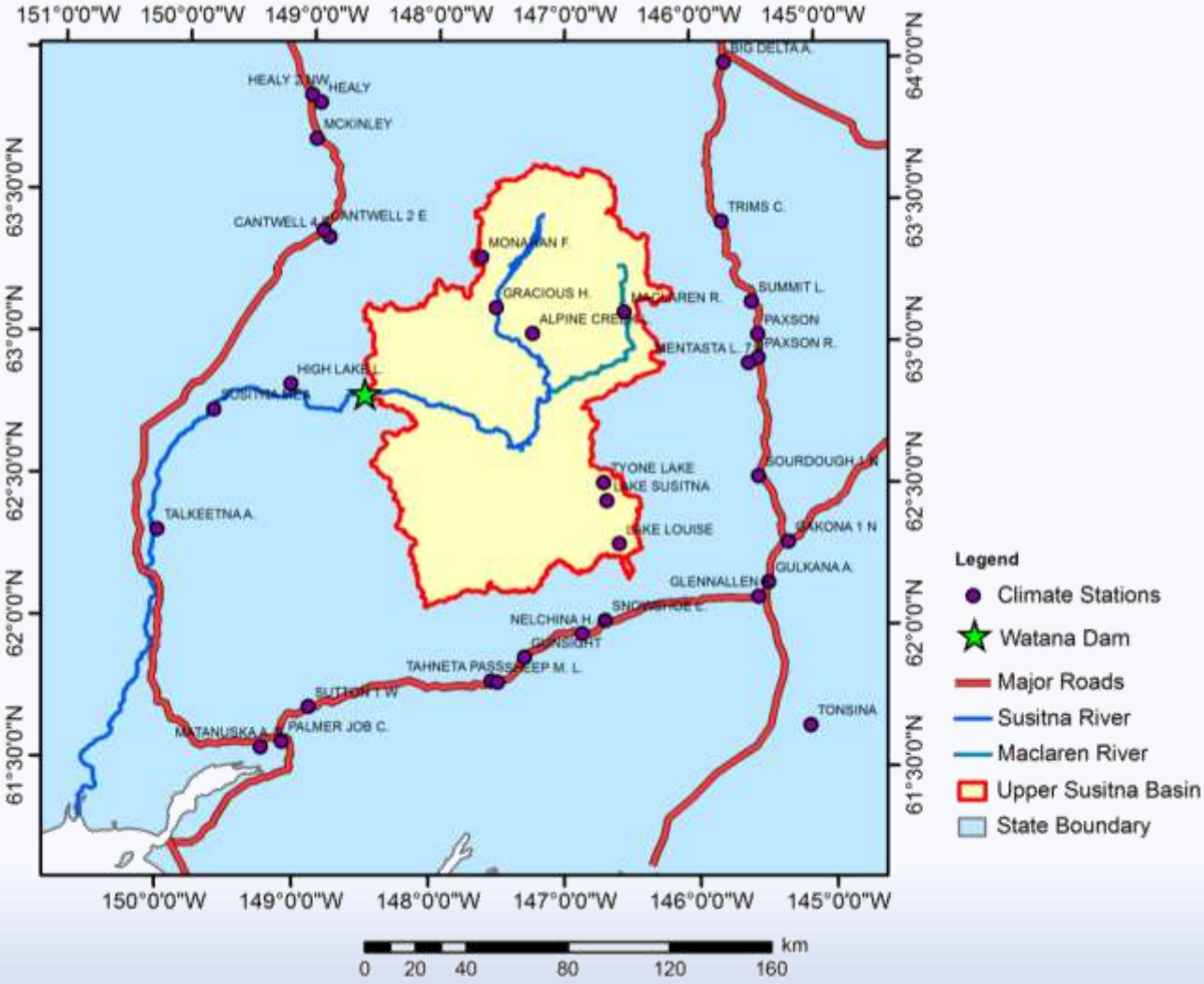
Hock et al., 2005

Study 7.7 Summary of Results in ISR (ISR Study 7.7, Part A)

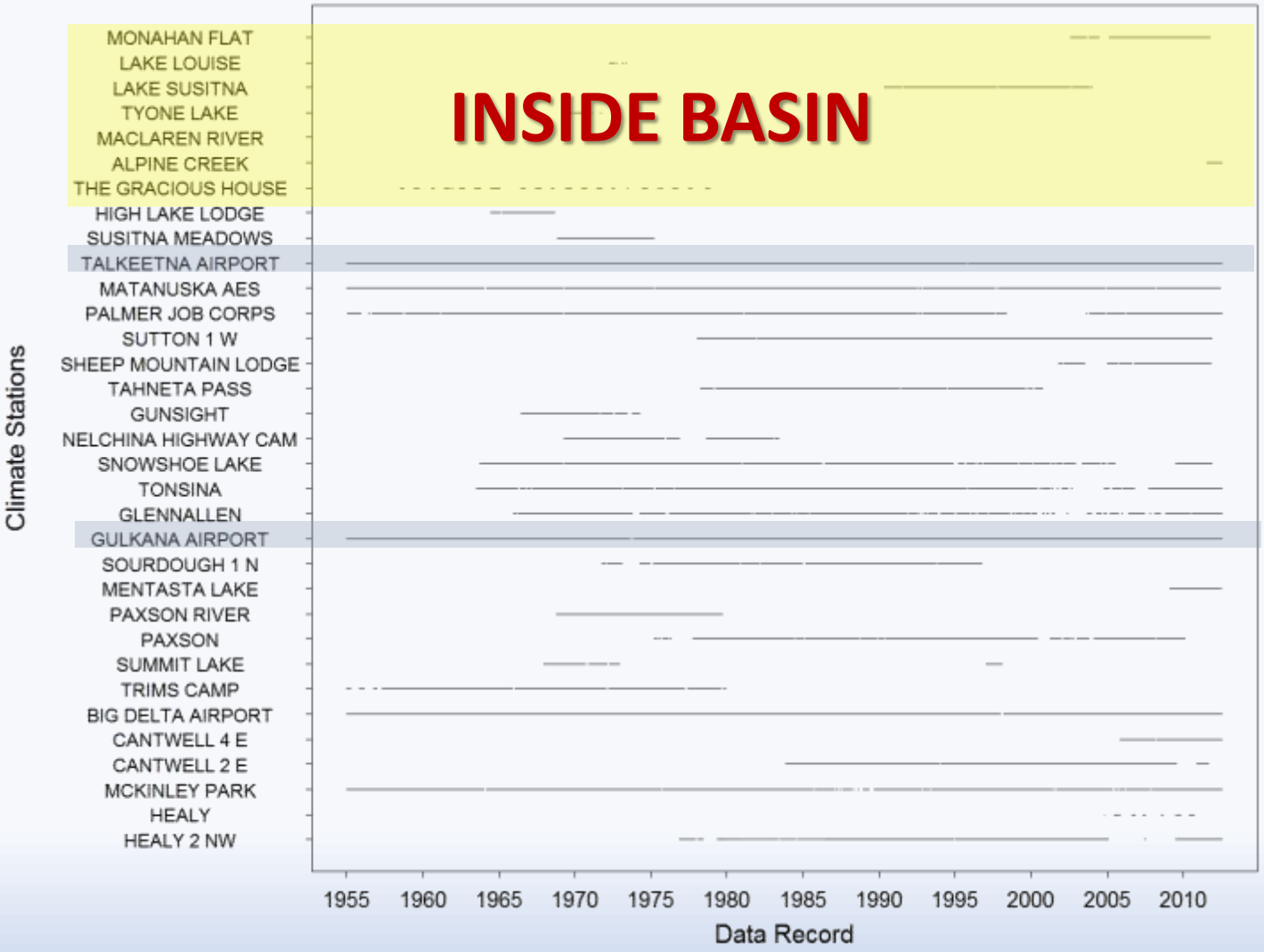


Modified from Jasson et al., 2003

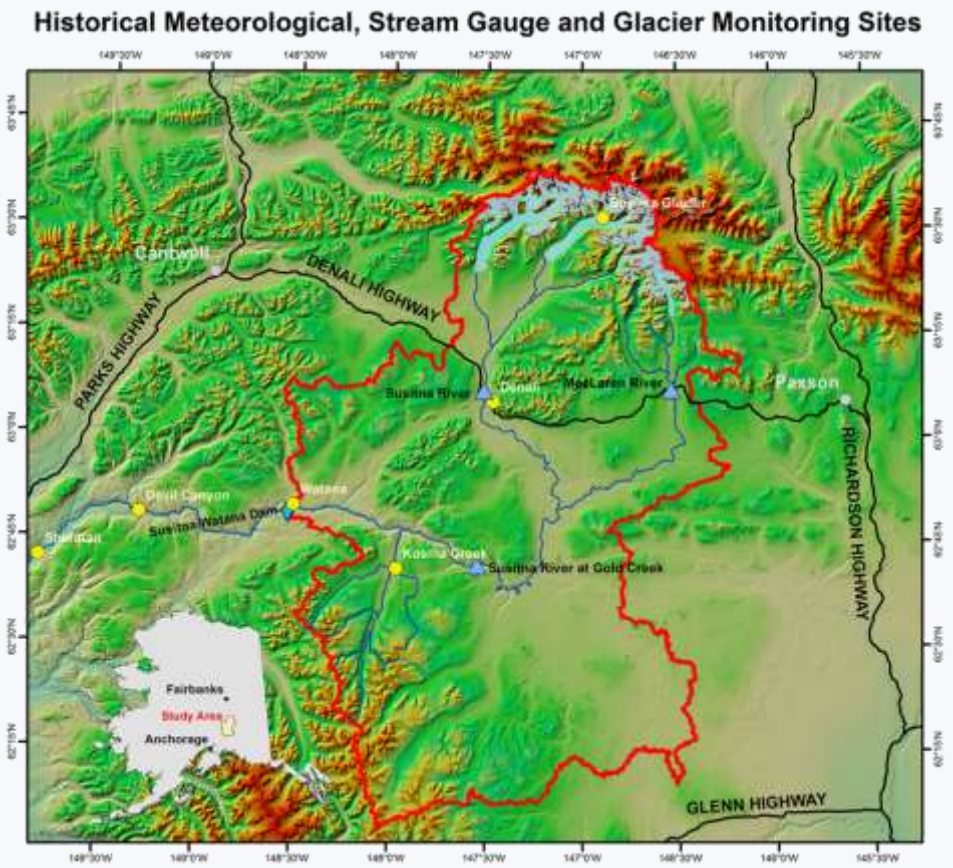
Study 7.7 Summary of Results in ISR (ISR Study 7.7, Part A)

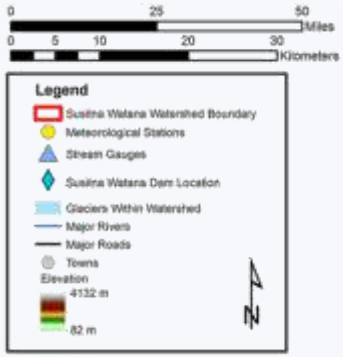


Study 7.7 Summary of Results in ISR (ISR Study 7.7, Part A)

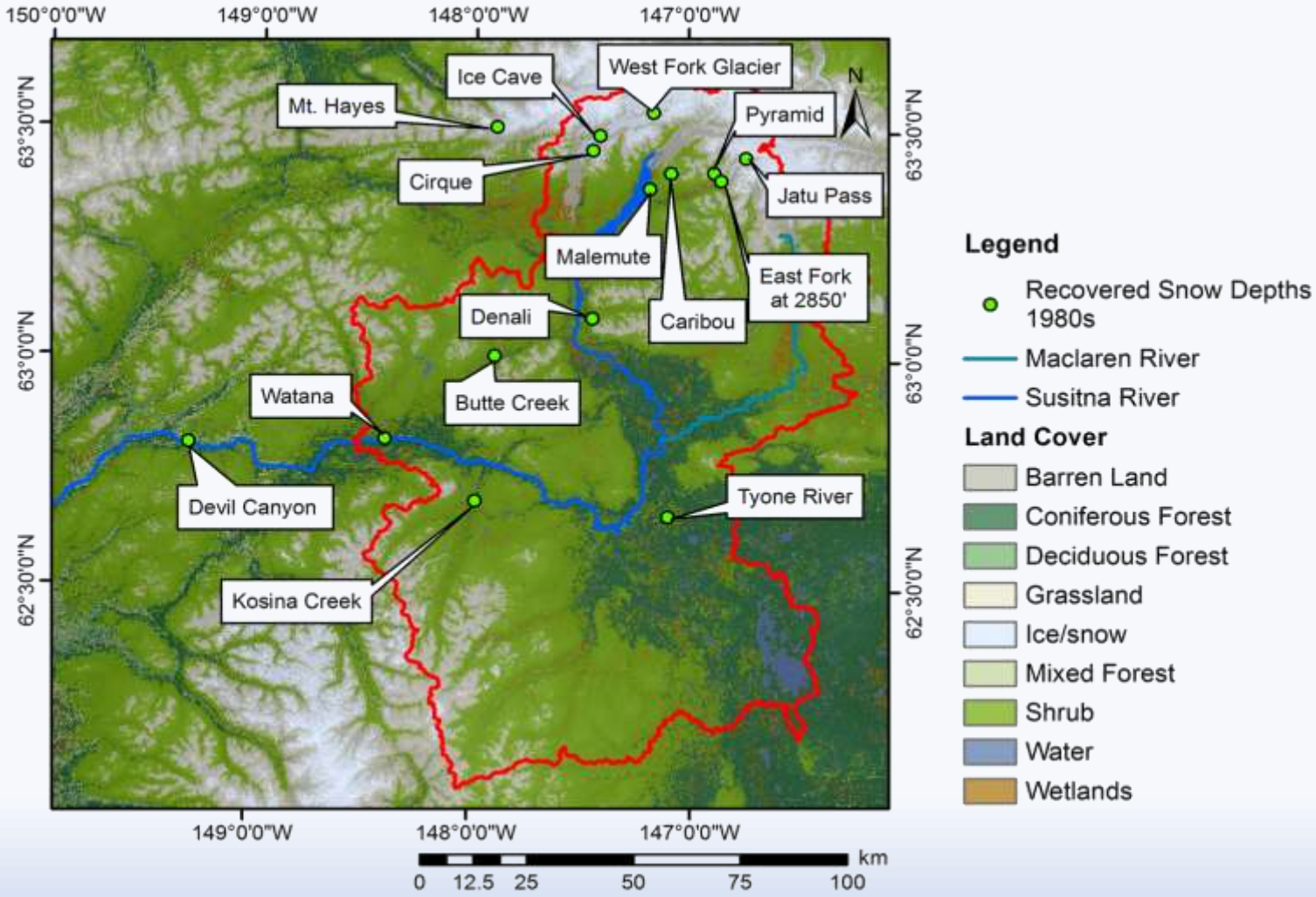


Study 7.7 Summary of Results in ISR (ISR Study 7.7, Part A)

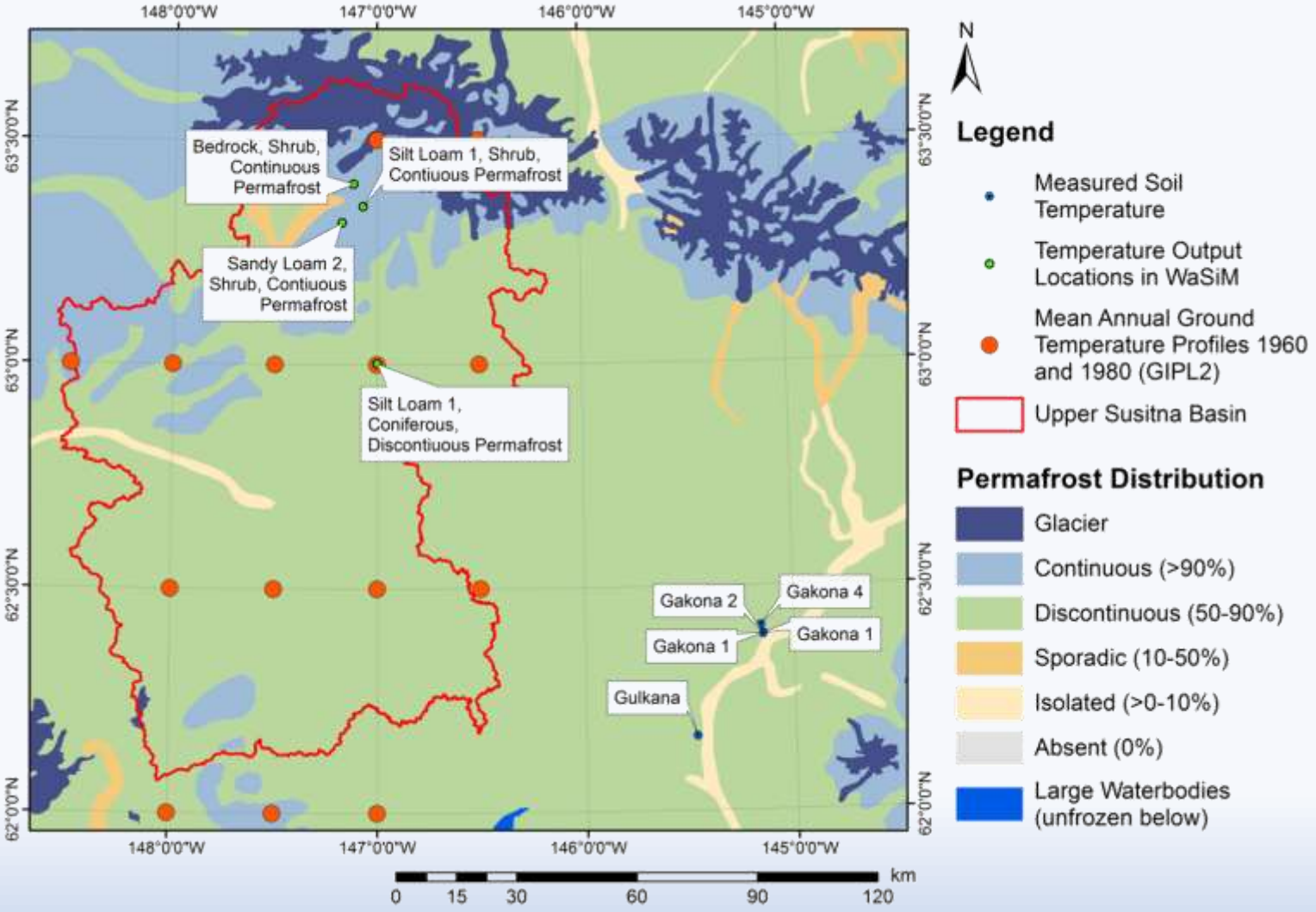




Study 7.7 Summary of Results in ISR (ISR Study 7.7, Part A)



Study 7.7 Summary of Results in ISR (ISR Study 7.7, Part A)



AEA Proposed Modifications to Study 7.7 in ISR

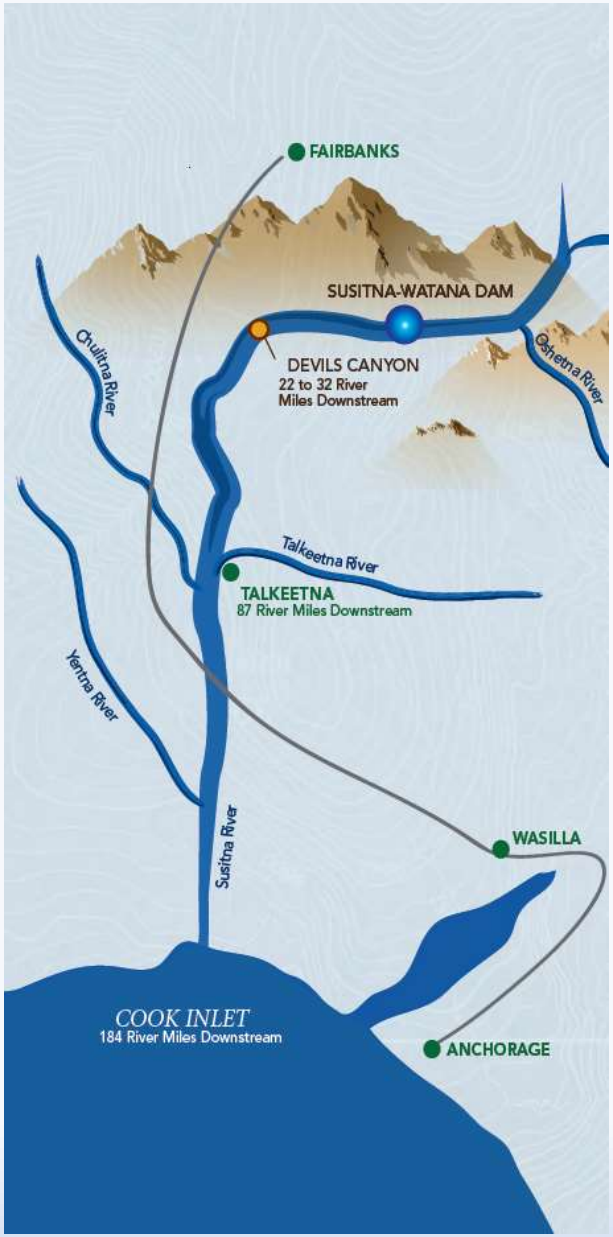
- This FERC required portion of this study is complete

Steps to Complete Study 7.7 (ISR Study 7.7, Part A – Executive Summary)

- This FERC required portion of this study is complete

Licensing Participants Proposed Modifications to Study 7.7?

- Agencies
- CIRWG members and Ahtna
- Public



Initial Study Report Meeting

Study 6.5 Geomorphology

October 16, 2014

Prepared by

Tetra Tech, Inc.

Study 6.5 Objectives

1. **Geomorphically characterize** the Project-affected **river channels and floodplain**
2. Collect **sediment transport data** to supplement historical data (USGS)
3. Determine **sediment supply and transport** in Susitna MR and LR
4. **Assess geomorphic stability/change** Susitna MR and LR
5. Characterize the surface area vs. flow relationships for **riverine macrohabitat** in the Susitna MR
6. Conduct a reconnaissance-level **geomorphic assessment of potential Project effects** on the Susitna MR and LR

Study 6.5 Objectives

7. Conduct a phased characterization of the surface area versus flow relationships for **riverine macrohabitat** types in the **Lower Susitna River** Segment
8. Characterize the proposed Watana **Reservoir geomorphology and changes** due to the reservoir
9. Assess **large woody debris** transport, recruitment, and influence on the geomorphology of the Susitna River
10. Characterize geomorphic conditions at **stream crossings** along **access road/transmission line** alignments
11. **Integration with the Fluvial Geomorphology Modeling** below Watana Dam Study

Study 6.5 Components

1. Delineate Geomorphically Similar Reaches and Characterize the Geomorphology of the Susitna River (4.1, 4)*
2. Bed Load and Suspended-load Data Collection (4.2, 10)
3. Sediment Supply and Transport Susitna MR and LR (4.3, 15)
4. Assess Geomorphic Change in Susitna MR and LR (4.4, 23)
5. Riverine Habitat versus Flow in Susitna MR (4.5, 32)
6. Reconnaissance-Level Assessment of Project Effects on Susitna MR and LR (4.6, 40)
7. Riverine Habitat Area versus Flow in Susitna LR (4.7, 47)
8. Reservoir Geomorphology (4.8, 53)
9. Large Woody Debris (4.9, 58)
10. Geomorphology of Stream Crossings along Transmission Lines and Access Alignments (4.10, 61)
11. Integration with Fluvial Geomorphology Modeling below Watana Dam Study (4.11, 63)

*(ISR Part A, Section #, pg. #)

Study 6.5 Variances

- The **bed-material samples were not collected** by the USGS in 2012 (ISR Part A, Section 4.2.3).
- **Bed load samples Susitna River at Tsusena Creek were terminated** after 2012 (ISR Part A, Section 4.2.3).
- The initial sediment balance task calls for comparison of the total sediment load at the Sunshine and Susitna Station gages for wet, average, and dry years between pre- and post-Project conditions. Entire 61-year extended record was used (ISR Part A, Section 4.3.3).
- The determination of effective discharge of the Susitna River below Tsusena Creek and at Gold Creek and Sunshine. Tsusena Creek location was not analyzed but additional locations were calculated at Susitna Station, Chulitna River, Talkeetna River and the Yentna River (ISR Part A, Section 4.3.3).

Study 6.5 Variances

- **Rather than obtaining three sets of aerial photography in 2012 at 23,000, 12,500, and 5,100 cfs a single target flow of 12,500 cfs will be supplemented with Focus Area analyses (ISR Part A, Section 4.5.3).**
- Literature review of the downstream effects of dams delayed from Q4 2013 to 2014 to allow for integration with the Riparian IFS (Study 8.6) to produce a single, comprehensive document (ISR Part A, Section 4.6.3).
- Initial analysis of the modified braiding index (MBI) planned for Q3 2013 will be performed in 2014 when information will be available from the 1-D Bed Evolution Model (ISR Part A, Section 4.6.3).
- Hydrologic analysis of operational scenarios beyond the initial streamflow assessment will be performed in the Fish and Aquatics IFS (Study 8.5) (ISR Part A, Section 4.6.3).

Study 6.5 Variances

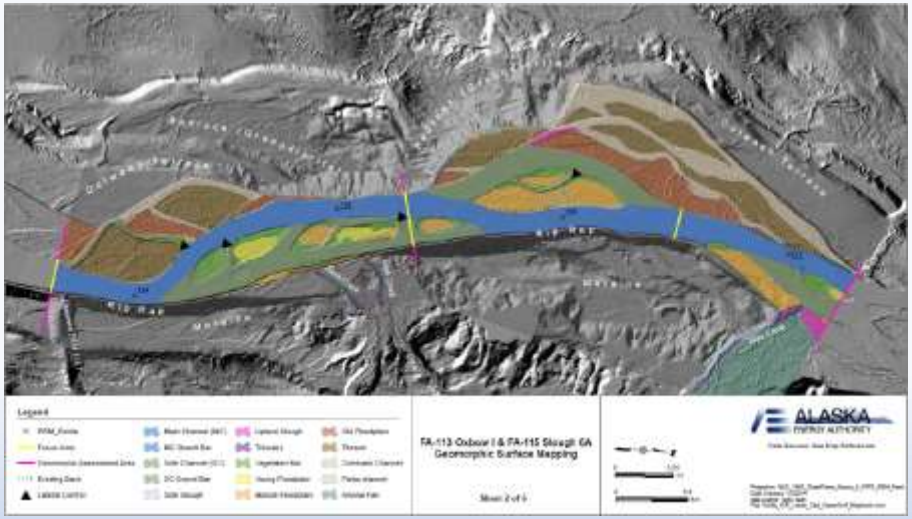
- Concurrent flow analysis planned in Q4 2013 will now be performed in 2014 (ISR Part A, Section 4.6.3)
- Assessment of reservoir erosion planned in 2013 will be performed in 2015 (ISR Part A, Section 4.8.3).
- LWD study component opportunistically included August 2013 high-flow event; this was an unanticipated event and was not included in the Study Plan (ISR Part A, Section 4.9.3).
- Planned data collection for LWD study component in summer 2013 will be completed in 2014/2015 (ISR Part A, Section 4.9.3).
- Planned field assessment of stream crossings would take place in 2013 is now planned for 2015 (ISR Part A, Section 4.10.3).

Study 6.5 Summary of Results in ISR (ISR Study 6.5, Part A – Section 5)

- Completed 7 Technical Memoranda presenting results of 2012 study efforts conducted under Study 6.5
  - Initial **Geomorphic Reach Delineation and Characterization**, Middle and Lower Susitna River Segments (ISR Part A, Sections 5.1.1, 5.1.2 and 5.6.2)
  - Development of **Sediment Transport Relationships** and an Initial **Sediment Balance** for the Middle and Lower Susitna River Segments (ISR Part A, Sec. 5.2 & 5.3)
  - Reconnaissance Level **Assessment of Potential Channel Change in the Lower Susitna River** Segment (ISR Part A, Section 5.6.3)
  - **Stream Flow Assessment** (ISR Part A, Section 5.6.1)
  - **Synthesis of 1980s Aquatic Habitat Information** (ISR Part A, Section 5.7.2)
  - **Mapping of Aquatic Macrohabitat** Types at Selected Sites in the Middle and Lower Susitna River Segments from 1980s and 2012 Aerials (ISR Part A, Sections 5.5 and 5.7.1)
  - **Mapping of Geomorphic Features and Assessment of Channel Change** in the Middle and Lower Susitna River Segments from 1980s and 2012 Aerials (ISR Part A Sec. 5.4)

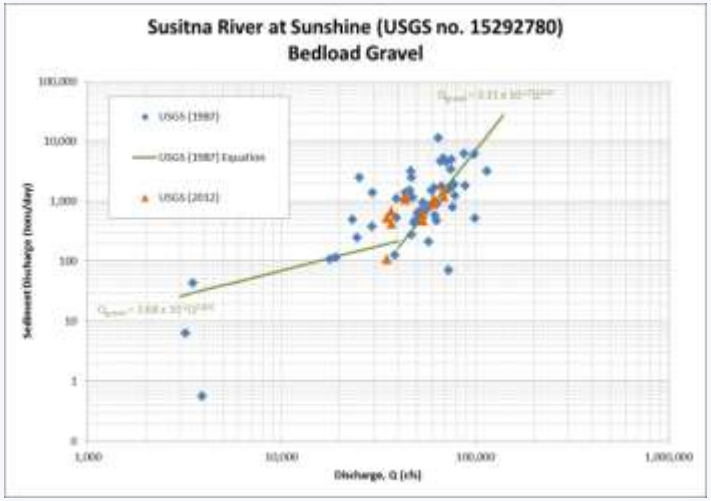
Study 6.5 Summary of Results in ISR (ISR Study 6.5, Part A – Section 5)

- Significant Appendices Included in Study 6.5 ISR Part A
  - **Surficial Geologic Mapping** in the Lower and Middle Susitna River Segments (Appendix A.1)
  - **Geomorphic Surface Mapping in 7 Focus Areas** (Appendix A.2)
  - Initial **Effective Discharge Analysis** for the Mainstem Susitna River and Tributaries (Appendix B)
  - **Large Wood Debris** : Aerial Photography Digitizing, Field inventory Protocols and Study Area **Maps** (Appendix D)

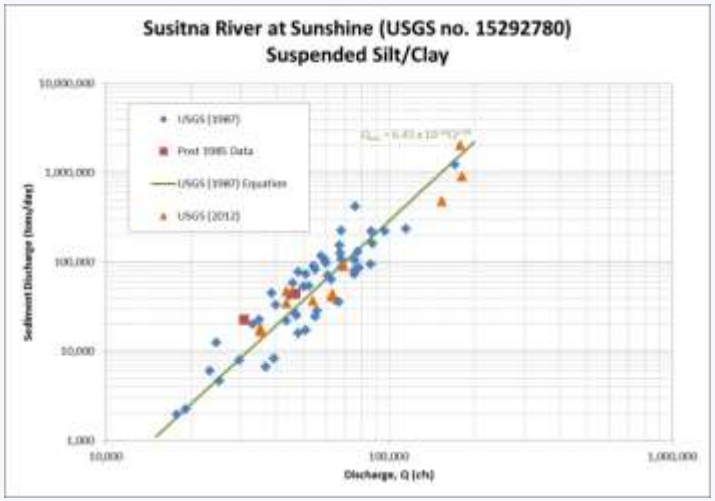


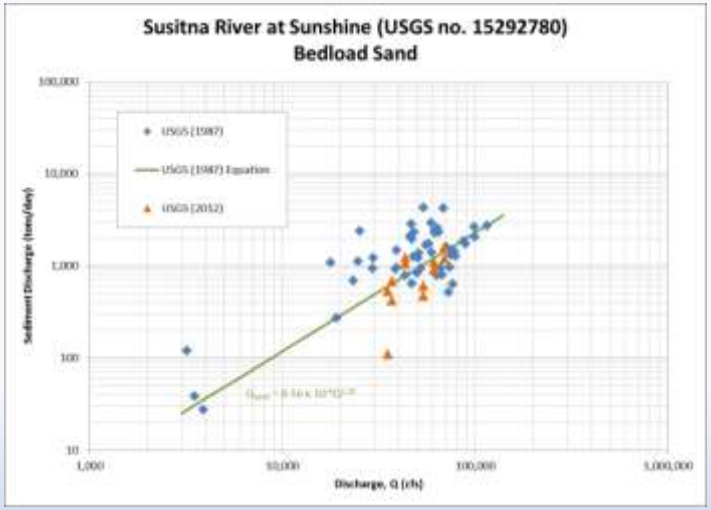
- Updated Technical Memorandum Filed May 2014
  - **Geomorphic Reach Delineation and Characterization**, Upper, Middle and Lower Susitna River Segments. Susitna-Watana Hydroelectric Project (ISR Part A, Section 7.1)

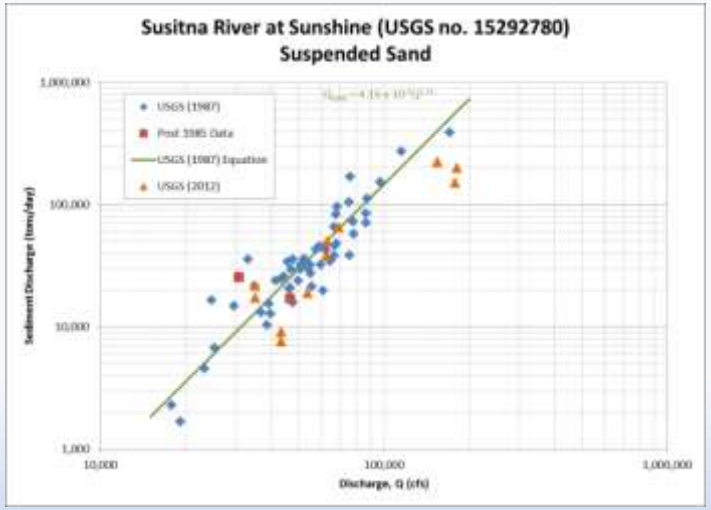
Study 6.5 Summary of Results in ISR (ISR Study 6.5, Part A – Section 5)



Development of Sediment Transport Relationships (Section 5.2 and 5.3)



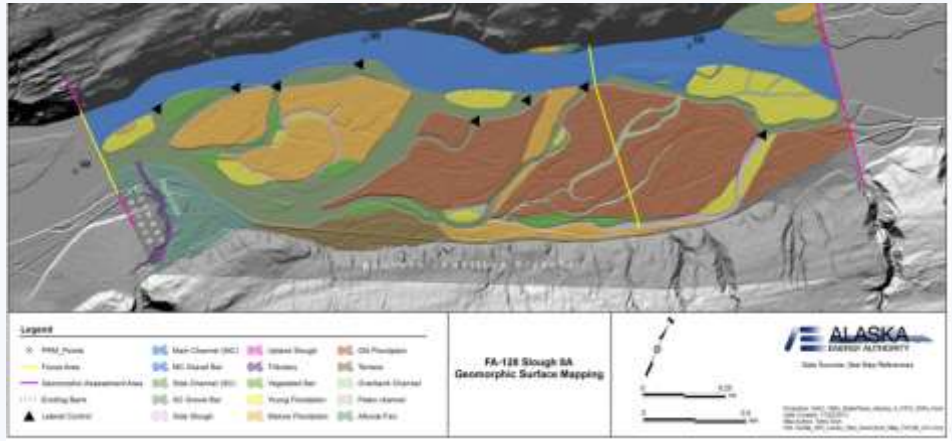


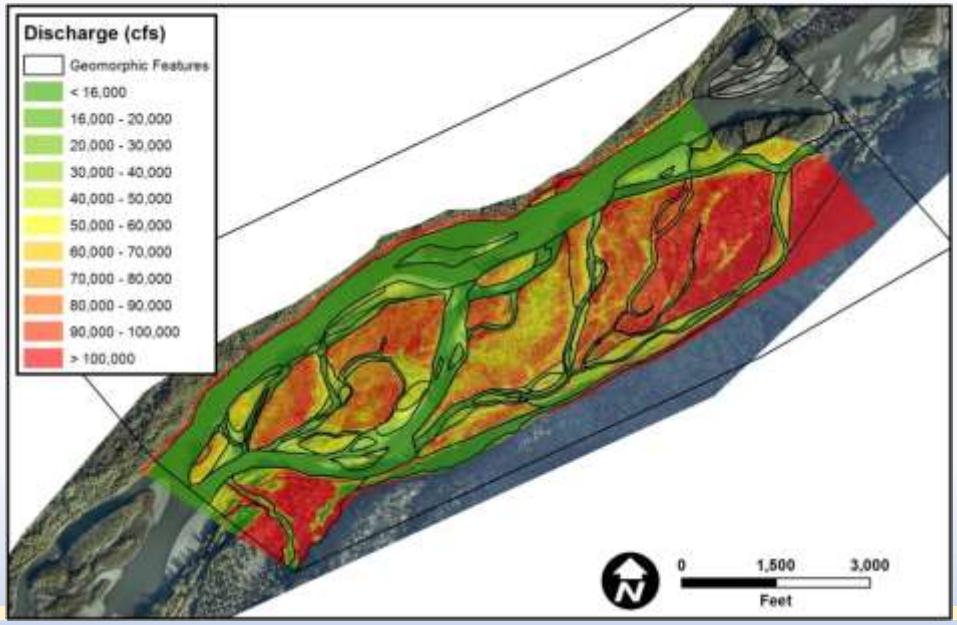


Study 6.5 Summary of Results in ISR (ISR Study 6.5, Part A – Section 5)

- Developed Geomorphic Succession Model (Section 5.1.3.3.1)
  - Progression of surfaces
  - Frequency of inundation influenced by ice

Geomorphic Feature	Overtopping Discharge (cfs)	Flood Frequency (years)	Flow Duration (days/year)
		Pre-Dam	Pre-Dam
Main Channel Gravel Bar	16,190	<1	101
Side Channel Gravel Bar	24,030	<1	44
Vegetated Bar	48,320	2.7	1.2
Young Flood Plain	54,840	4.5	0.7
Mature Flood Plain	77,870	25	0.1
Old Flood Plain	87,570	50	--





Study 6.5 Summary of Results in ISR (ISR Study 6.5, Part A – Section 7)

- Six Reservoir Area Tributaries Selected for Assessment of Delta Formation (Section 7.1.1.8)

Tributary	PRM[1]	D.A. (mi²)	Bank[2]	2012/2013 Fish Distribution (Study 9.5)					Existing Fish Passage Barriers Eliminated by Reservoir[3]			Selected	Rationale for Not Selecting[7]
				Chinook	Burbot	Dolly Varden	Round Whitefish	Arctic Grayling	Type[4]	Trib. RM[5]	Elevation[6]		
Oshetna River	235.1	556.4	L	X		X	X	X				Y	
Goose Creek	232.8	106.5	L	X	X		X	X				Y	
Un. Tributary	228.5	46.9	R									N	TOB elev. at 2,375 feet
Un. Tributary	215.2	2.3	L									N	TOB elev. at 2,200 feet; small D.A.
Jay Creek	211.0	62.4	R		X	X	X	X				Y	
Kosina Creek	209.1	402.5	L	X	X	X	X	X				Y	
Un. Tributary	204.5	12.3	L						Cmpd.	0.4 & 0.6	1,830 & 1,925	N	Steep channel; small D.A
Un. Tributary	203.4	19.5	R									N	TOB elev. at 2,030 feet; small D.A.
Un. Tributary	198.4	1.8	L			X						N	Small D.A.
Un. Tributary	197.7	8.1	L						Falls	1.3	1,990	N	Steep channel; small D.A.
Watana Creek	196.9	176.4	R	X	X	X	X	X				Y	
Un. Tributary	194.8	23.2	R			X		X				N	Small D.A.
Un. Tributary	189.7	1.9	L						Chute	0.4	1,990	N	Small D.A.
Deadman Creek	189.4	175.4	R		X	X	X	X	Falls	0.6	1,760	Y	

Notes:

1 PRM = Project River Mile

2 Bank defines the location of the tributary confluence with the Susitna River, as viewed facing downstream on the Susitna River. L = left; R = right.

3 Identifies existing fish passage barriers potentially inundated by the proposed Watana Reservoir. Reservoir low pool elevation is 1,850 feet (NAVD88) with an upstream extent at PRM 222.5; reservoir maximum pool elevation is 2,050 feet (NAVD88) with an upstream extent at PRM 232.5.

4 Type of fish passage barrier, as identified in Study 9.12. Cmpd. = compound feature, such as a chute and falls.

5 Trib. RM = tributary river mile, with RM 0.0 at confluence with Susitna River, to locate existing fish passage barrier.

6 Elevation = elevation in feet (NAVD88) of the most upstream top of barrier (TOB) as estimated using 2011 MatSu LiDAR.

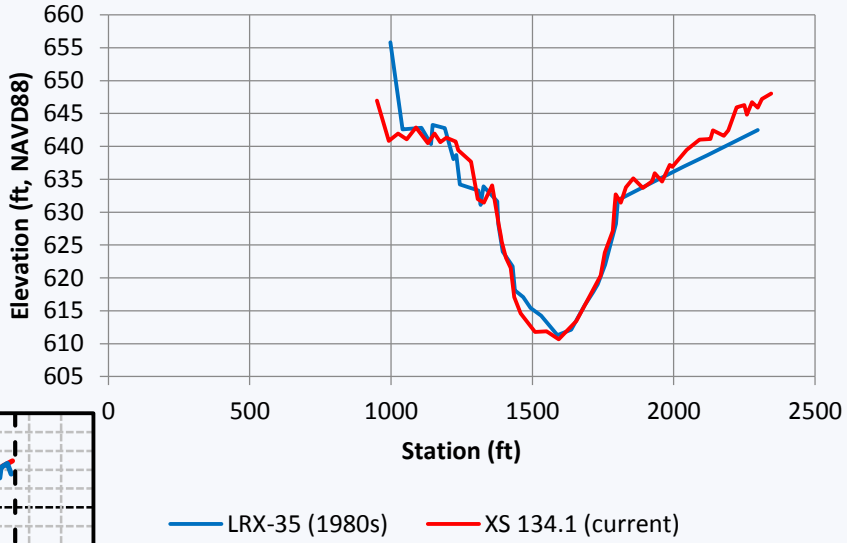
7 Primary basis for excluding tributary from further studies of potential delta formation.

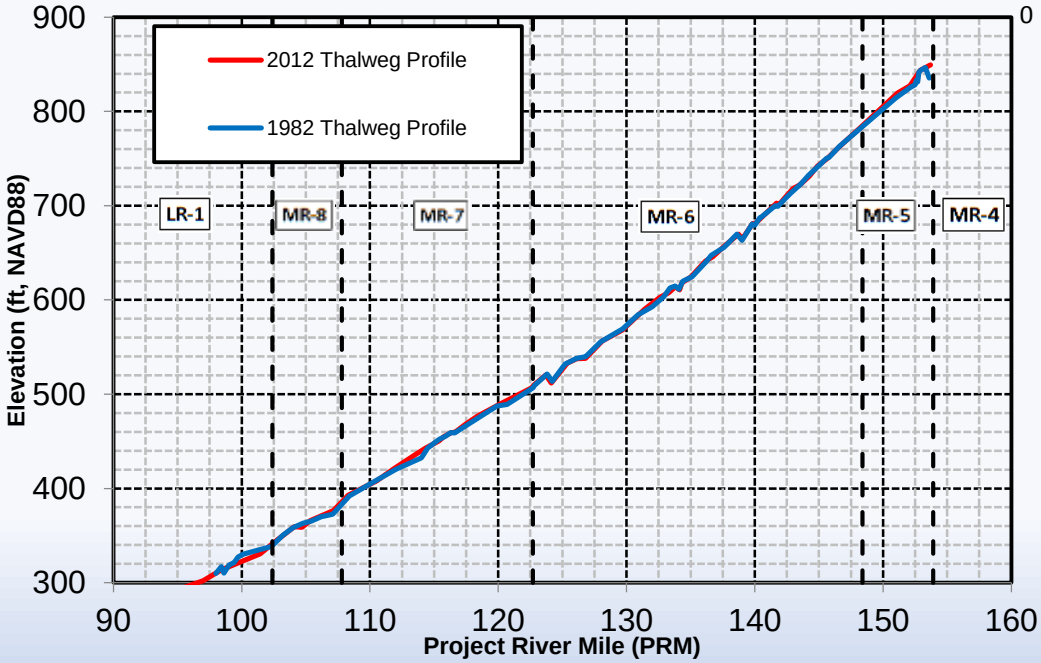
Study 6.5 Summary of Results since ISR Technical Memorandums

- Update of **Sediment-Transport Relationships** and a Revised Sediment Balance for the Middle and Lower Susitna River Segments (ISR Part C, Section 7.2.1.3)
- Susitna River **Historical Cross Section Comparison** (1980s to Current) (ISR Part C, Section 7.2.1.3)
- **Mapping of Geomorphic Features and Turnover** within the Middle and Lower Susitna River Segments from 1950s, 1980s, and Current Aerials (ISR Part C Section 7.2.1.4)
- **Updated Mapping of Aquatic Macrohabitat Types** in the Middle Susitna River Segment from 1980s and Current Aerials (ISR Part C, Section 7.2.1.5)

Study 6.5 Summary of Results since ISR
Historical Cross Section Comparison

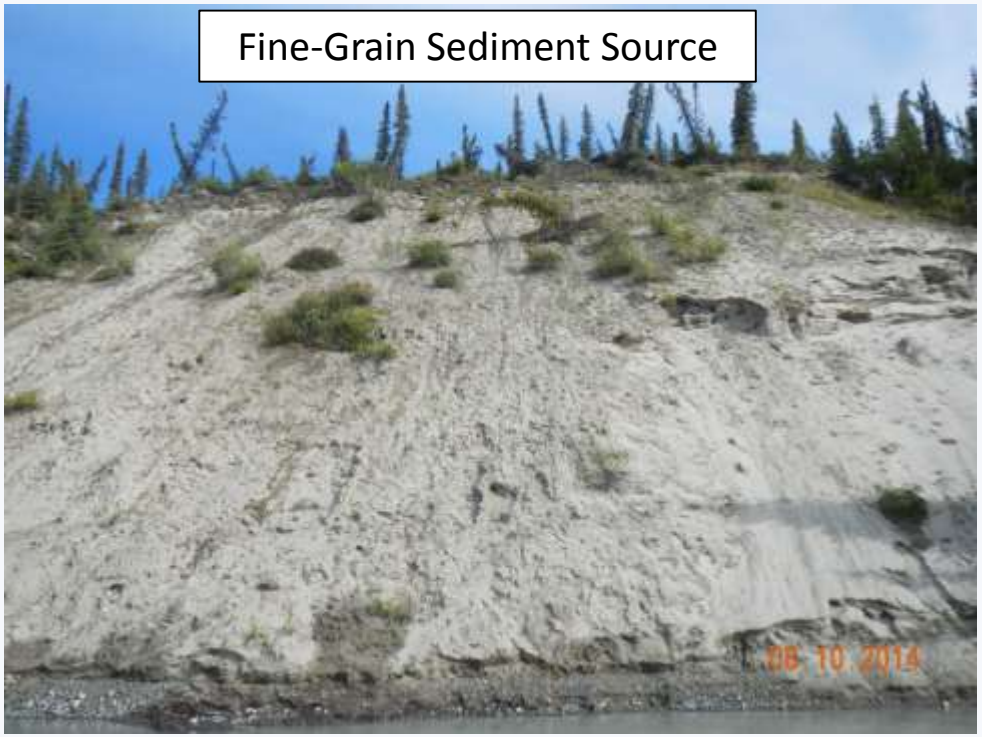
- Identified changes in 1980s and 2012 cross sections and thalweg profile
- No consistent widespread trends of either aggradation or degradation





- Changes were on the order of several feet or less
- Most cross sections showed less than 1 foot change in average bed elevation
- The most consistent trend – slight aggradation in MR-7 and MR-8

Study 6.5 Summary of Results since ISR
Upper River Reconnaissance

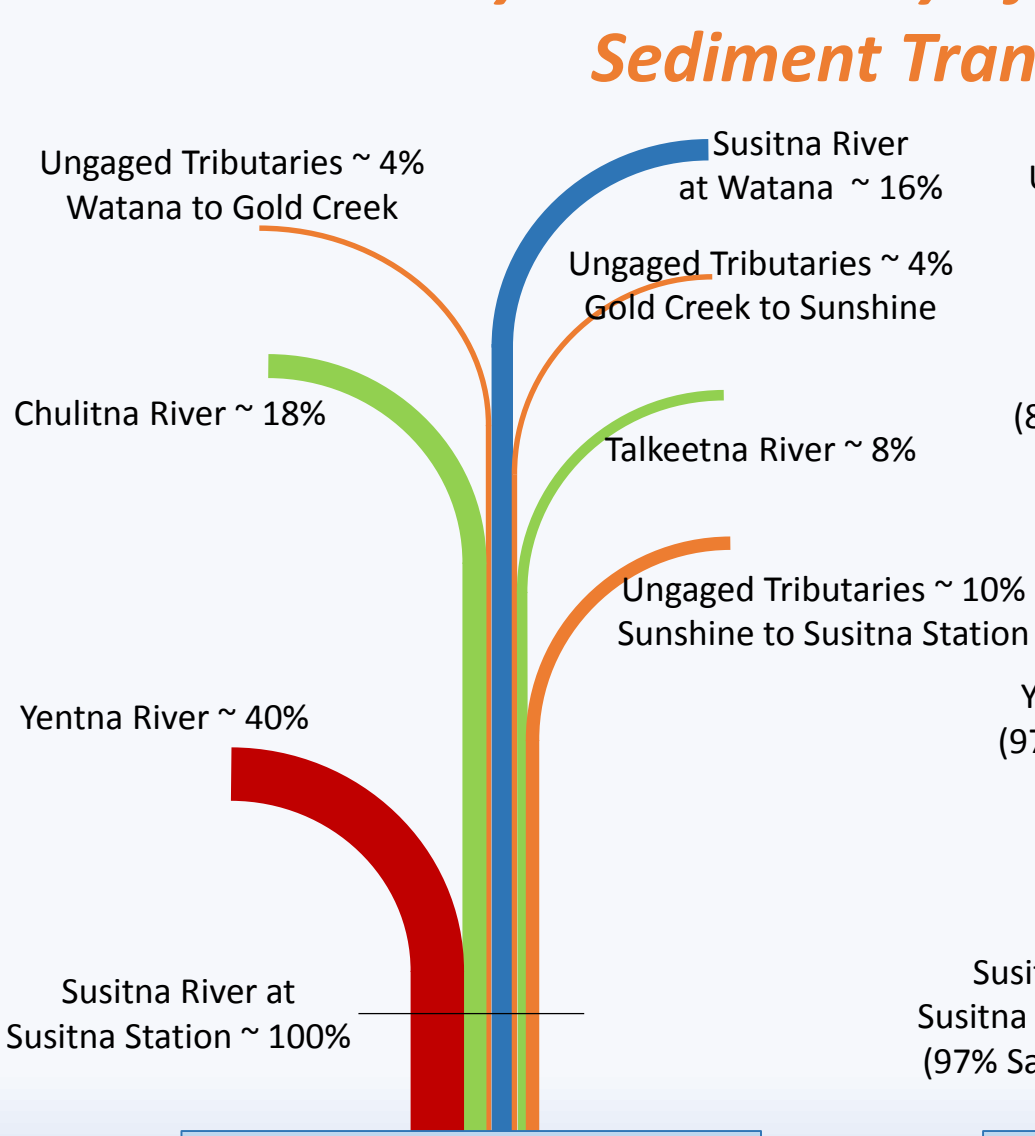


- Geologic and Geomorphic Mapping
- Bed Material Sampling
- Approximate Cross Sections

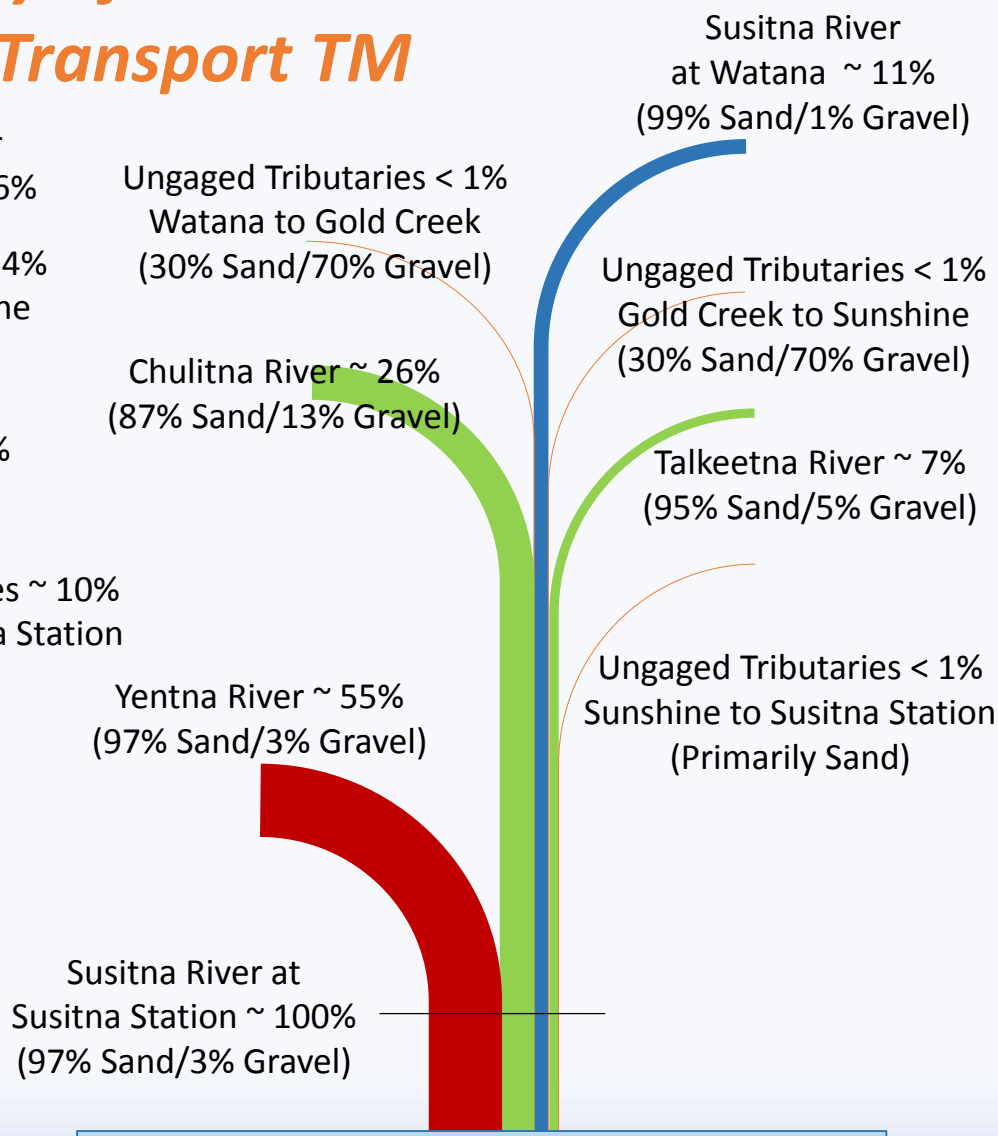
Study 6.5 Summary of Results since ISR
Geomorphic Drivers in Upper, Middle, and Lower Susitna River Segments

- UPPER RIVER
  - Ice-driven → ice-sheared banks, ice-paved wide channels, boulders on floodplain, very high geomorphic surfaces
- MIDDLE RIVER
  - Ice- and Fluvial-driven → ice chute channels, sheared banks, small boulders & cobbles on floodplain, high geomorphic surfaces
- LOWER RIVER
  - Fluvial Driven → absence of ice scars and deposits on floodplain, geomorphic surface heights typical of fluvial-driven system

Study 6.5 Summary of Results since ISR Sediment Transport TM



Average Annual Flow



Average Annual Bed Material Load

AEA Proposed Modifications to Study 6.5 in ISR (ISR Part C – Section 7.1.2)

- There are no new modifications proposed for Study 6.5
- All modifications for the 2nd year of study are continuation of variances identified from the 1st year of study

Decision Points from Study Plan (Tech Memos Supporting Decision Point)

- Study 6.5 Tech Memos filed since ISR that support Study 6.6 Decision Point on 1-D Bed Evolution extension below PRM 29.9 (Study 6.6 ISR Part C, Section 7.1.1.1.2)
  - Update of **Sediment-Transport Relationships** and a Revised Sediment Balance for the Middle and Lower Susitna River Segments (ISR Part C, Section 7.2.1.3)
  - Susitna River **Historical Cross Section Comparison** (1980s to Current) (ISR Part C, Section 7.2.1.3)
  - **Mapping of Geomorphic Features and Turnover** within the Middle and Lower Susitna River Segments from 1950s, 1980s, and Current Aerials (ISR Part C Section 7.2.1.4)

Current Status and Steps to Complete Study 6.5 (ISR Study 6.5, Part C – Section 7.1 and 7.2)

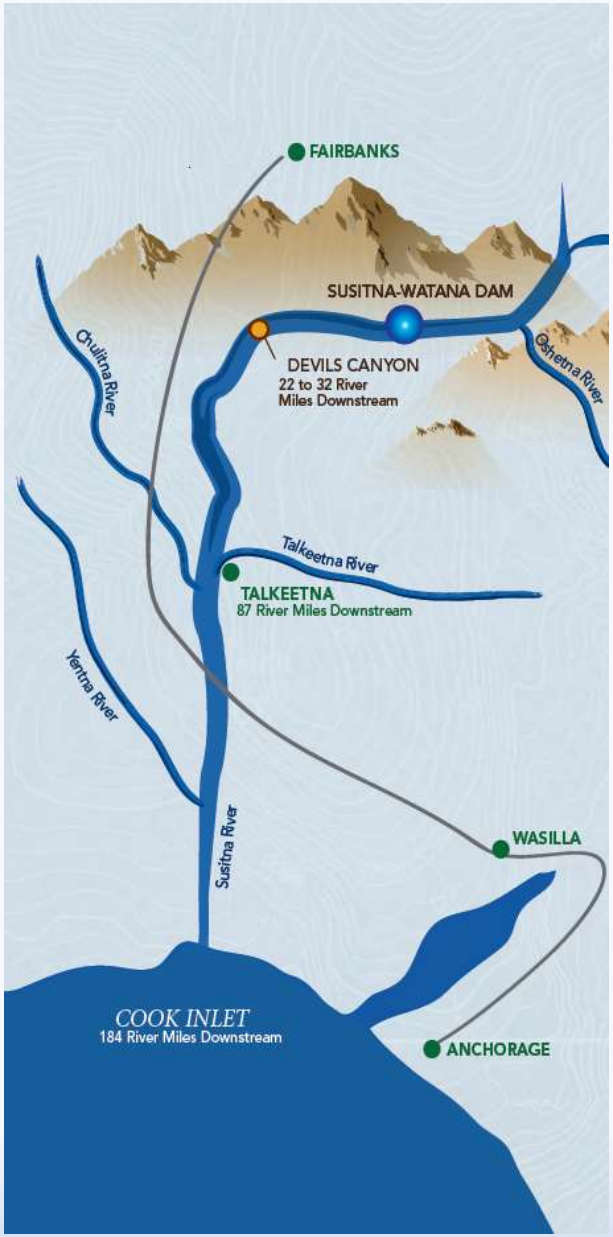
Study Component	Completed ISR/2014	Planned 2014/2015
1. Geomorphic Reaches and Characterization	TM and Updated TM, Completed MR and LR Characterization	Complete UR characterization, update MR and LR characterization, final TM
2. Sediment Transport Data Collection	Collected 2012, 2013 and 2014 data, reported 2012 and 2013	*Report 2014 data (USGS) – No additional data collection*
3. Sediment Supply and Transport	TM and updated TM, sediment balance and transport eq.	Refine tributary MR and LR sediment loading
4. Geomorphic Change Middle and Lower Rivers	TM and Updated TM, 1950s/80s/current geomorphic feature mapping and Turnover	*Study component completed – interact with others on results*
5. Middle River Macrohabitat vs. Flow	TM and Updated TM (added 100% mapping 1980s/current), acquired aerials 2013 2014	*Study component completed – interact with others on results*

Current Status and Steps to Complete Study 6.5 (ISR Study 6.5, Part C – Section 7.1 and 7.2)

Study Component	Completed ISR/2014	Planned 2014/2015
6. Recon-Level Assess-ment of Proj. Effects LR	2 TMs, supported decision to extend 1-D model to PRM 29.9	Perform assessment for scenarios, MBI determination
7. Lower River Macrohabitat vs. Flow	TM, decision not to map additional sites	*Study component completed – interact with others on results*
8. Reservoir Geomorphology	Initial trap efficiency estimates, selection of tribs., aerial recon	**Data and analysis for: tribs and res. erosion, coord study 5.6**
9. Large Woody Debris	Appendix in ISR, completed MR and LR data	Mapping in UR, LWD assessment, coord w/ Study 6.6
10. Corridor Stream Crossings	Aerial recon and desktop assessment	**Data collection and analysis**
11. Integration with Fluvial Geomorphology Modeling Study	Geomorphic context of initial 1-D model runs, support LR decision pt.	Interpret results of 1-D and 2-D model runs as they become available

Licensing Participants Proposed Modifications to Study 6.5?

- Agencies
- CIRWG members and Ahtna
- Public



Initial Study Report Meeting

Study 6.6 Fluvial Geomorphology Modeling below Watana Dam

October 16, 2014

Prepared by

Tetra Tech, Inc

Study 6.6 Objectives

- **Develop calibrated models** to predict the magnitude and trend of geomorphic response to the Project
- **Apply the** developed **models** to estimate the potential for channel change for **with-Project operations compared to existing conditions**
- **Coordinate with the Geomorphology Study** to integrate model results with the understating of geomorphic **processes and controls** to identify potential Project effects that require interpretation of model results
- **Support** the evaluation of Project effects by **other studies** in their resource areas providing channel output data and assessment of **potential changes** in the geomorphic features that help comprise the aquatic and riparian habitats of the Susitna River

Study 6.6 Components

- Bed Evolution Model Development, Coordination, and Calibration
  (ISR Part A, Section 4.1; pg 7)

- Model Existing and with-Project Conditions
  (ISR Part A, Section 4.2; pg 48)

- Coordination and Interpretation of Model Results
  (ISR Part A, Section 4.3; pg 51)

Study 6.6 Variances

- There were no variances to the 2013 Study Plan.

  While land access was not available for portions of the river and tributaries adjacent to Cook Inlet Regional Working Group (CIRWG) lands, this was not considered a variance because this study was designed to collect data over multiple years.

Study 6.6 Summary of Results in ISR (ISR Study 6.6, Part A – Section 5)

Bed Evolution Model Development

- 1-D HEC-RAS (Version 5.0) selected for reach-scale modeling below Watana Dam
  Modeling in process at time of ISR

- 2-D SHR-2D selected for local-scale models of Focus Areas
  Modeling of FA-104 (Whiskers Slough) in process at time of ISR

Study 6.6 Summary of Results in ISR (ISR Study 6.6, Part A – Section 5)

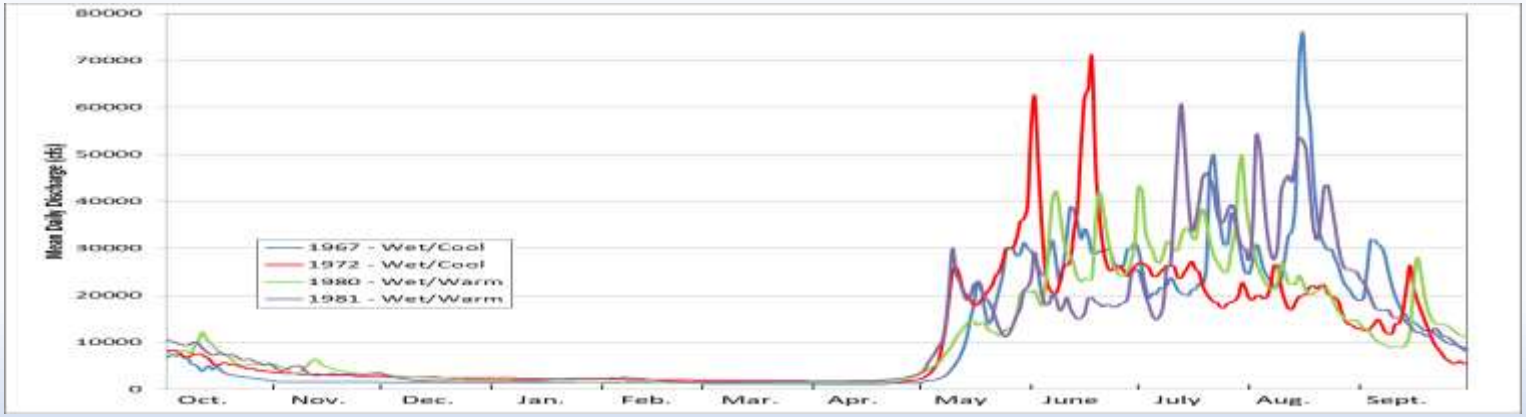
Bed Evolution Model Development

- 2013 Field Data
  - Cross sections (Study 8.5)
  - Bathymetry (Study 8.5)
  - LiDAR (Study 6.6)
  - Bed and Bank material sampling (Study 6.6 Appendices A - C)
  - Substrate mapping (Study 8.5)
  - Water surface elevations (Studies 8.5 and 6.6 Appendix D)
  - ADCP (velocity and discharge) (Study 8.5)
  - Stage hydrographs (Study 7.5)
  - Sediment transport (USGS) (analysis in Study 6.5)
  - Tributary surveys and bed materials (Study 6.6)
  - Geomorphic mapping (Study 6.5)
  - Winter bed sampling pilot (Study 6.6 Attachment A Field Report)

Study 6.6 Summary of Results in ISR (ISR Study 6.6, Part A – Section 5)

Model Existing Conditions and with-Project Conditions

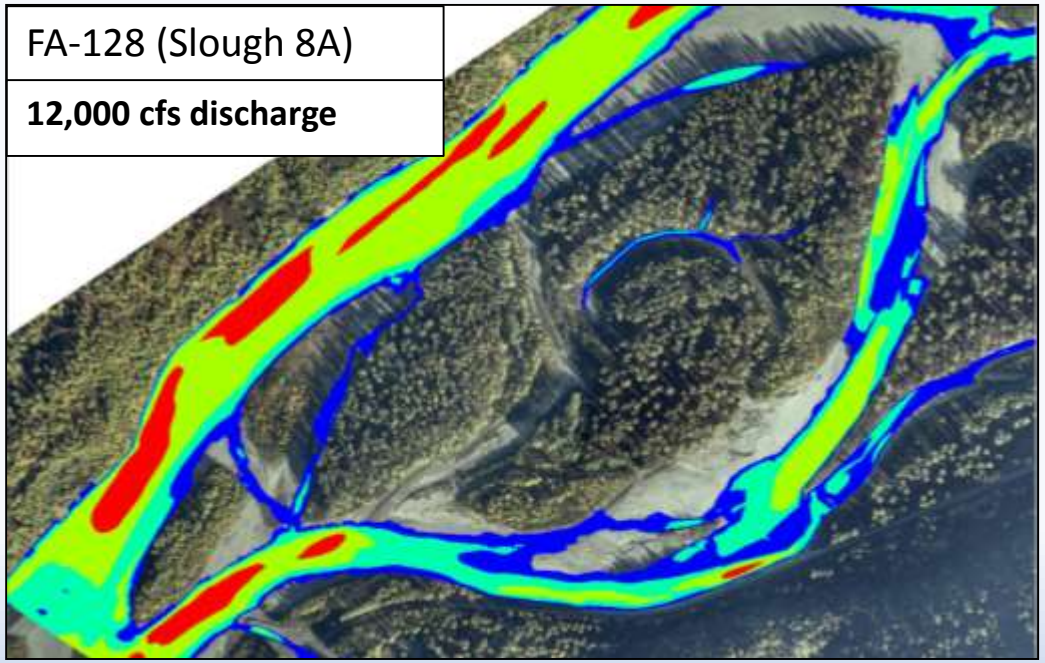
- 50-year subset selected from 61-year extended flow record
- Representative dry, average, and wet years selected in conjunction with Studies 8.5 and 7.6
  (Appendix E of ISR Study 6.6 includes these results)
- Fluvial Geomorphology Modeling Approach TM June 2013
- 2-D Hydraulic Modeling for IFS Proof-of-Concept



Study 6.6 Summary of Results in ISR (ISR Study 6.6, Part A – Section 5)

Coordination in Interpretation of Model Results

- Continuous internal coordination on Geomorphology
- Frequent external coordination with other studies
- Proof-of-Concept (IFS) meeting (April 2014) was initial demonstration



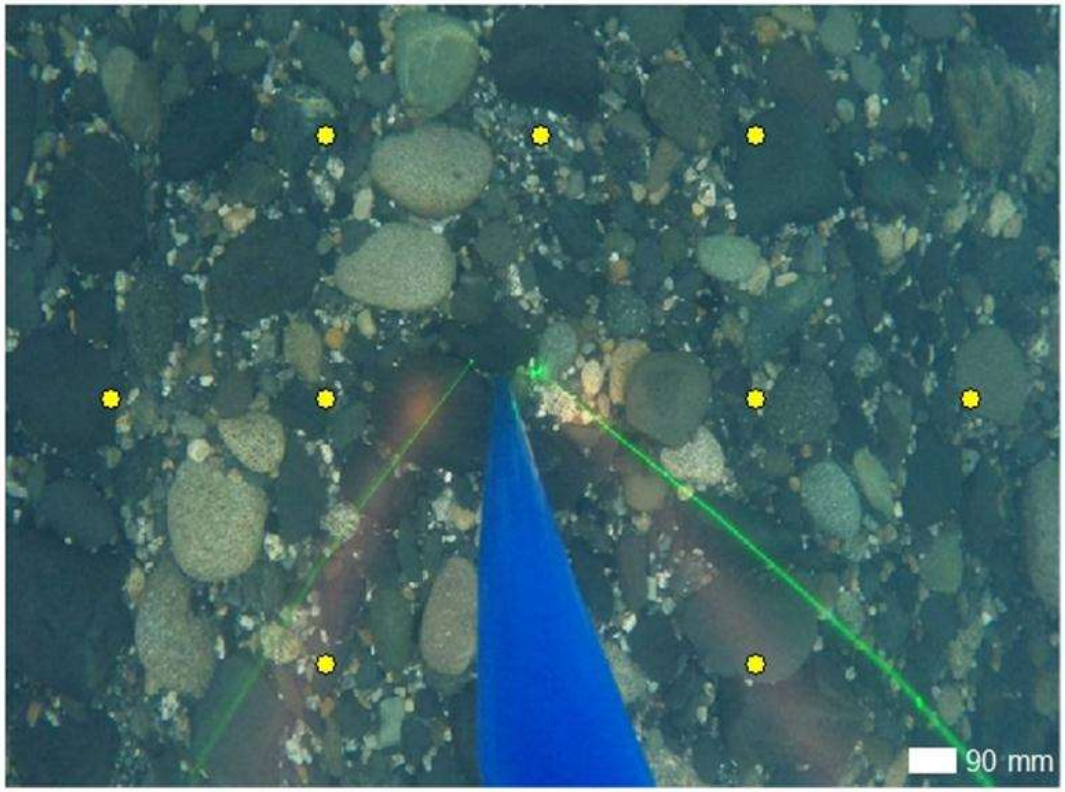
Study 6.6 Summary of Results since ISR Technical Memorandums

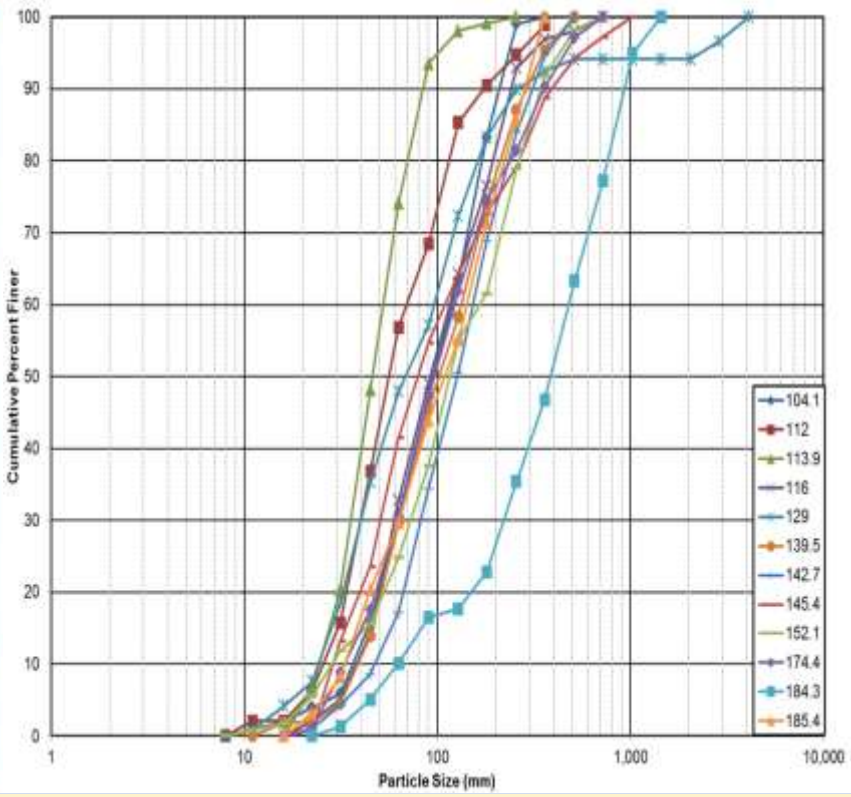
- **Winter Sampling of Main Channel Bed Material** – TM in September 2014 (ISR Part C, Section 7.2.1.1.9)

- Decision Point on **Fluvial Geomorphology Modeling of the Susitna River below PRM 29.9** – TM in September 2014 (ISR Part C, Section 7.1.1.1.2)

Study 6.6 Summary of Results since ISR
Winter Bed Sampling TM (September 2014)

- Middle Susitna River: Bed nearly twice as coarse as bar heads
- Lower Susitna River: Bed similar to bar heads

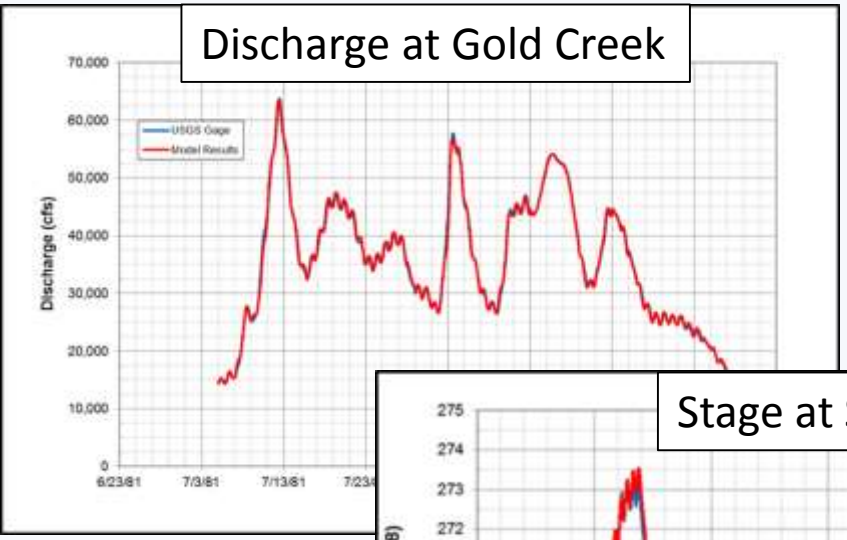




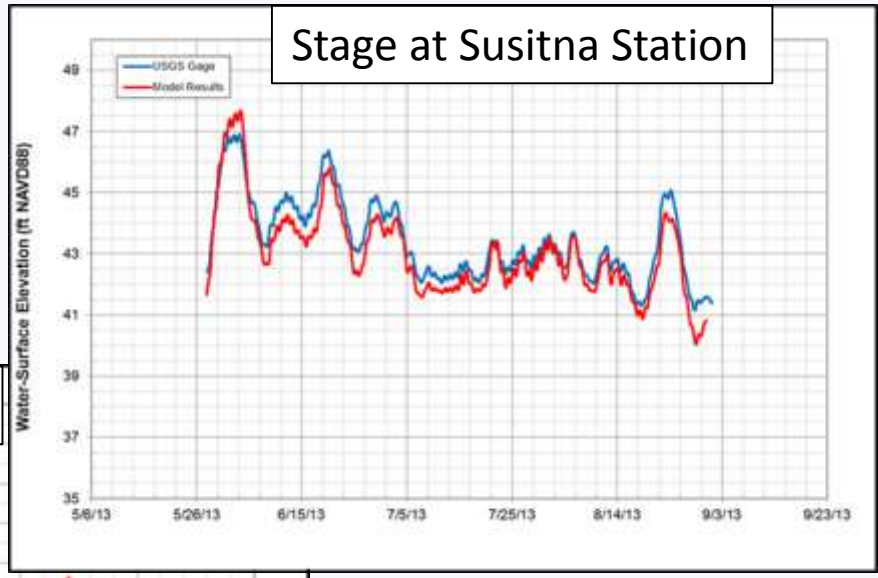
Study 6.6 Summary of Results since ISR
Modeling in support of Decision TM (Sept. 2014)

- Models calibrated well hydraulically

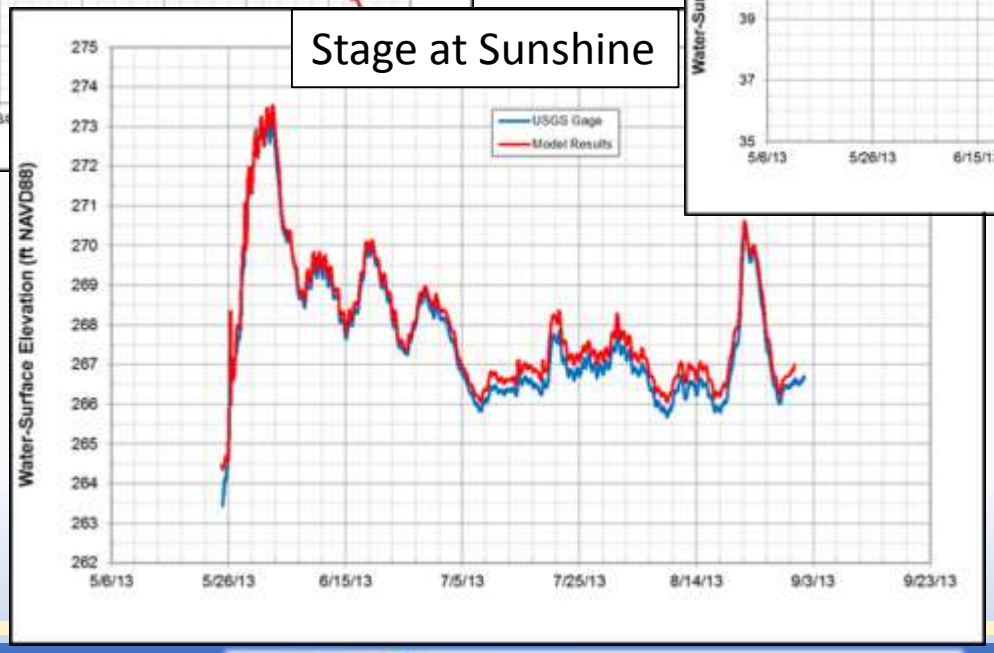
Discharge at Gold Creek



Stage at Susitna Station



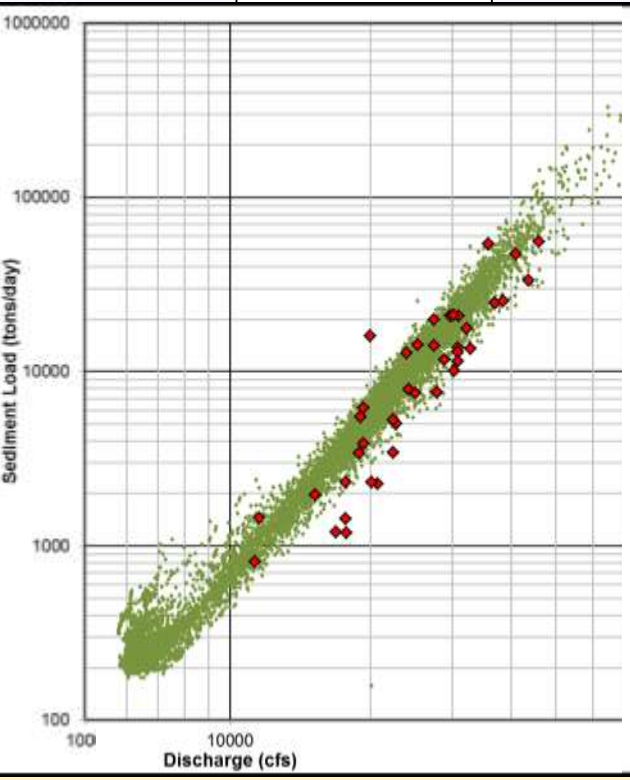
Stage at Sunshine



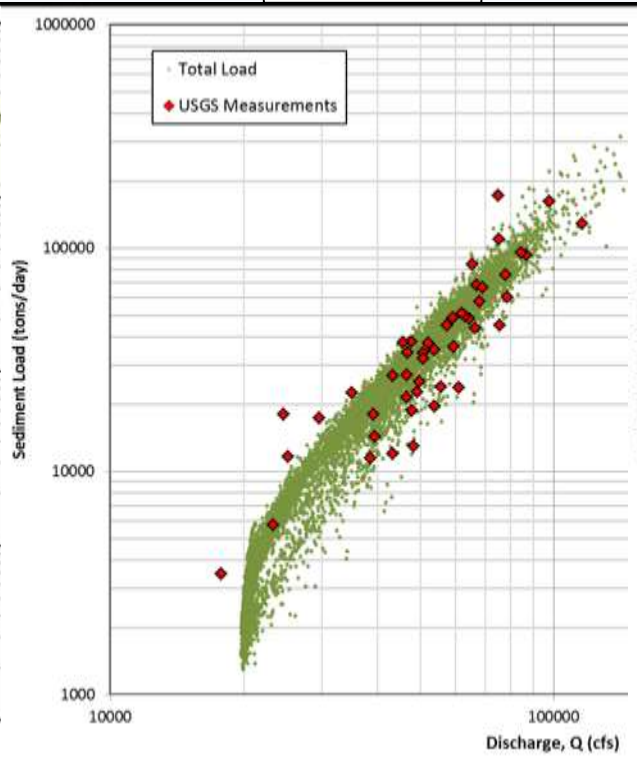
Study 6.6 Summary of Results since ISR Modeling in support of Decision TM (Sept. 2014)

- Models calibrated well for sediment transport (USGS measured vs. Model total loads)

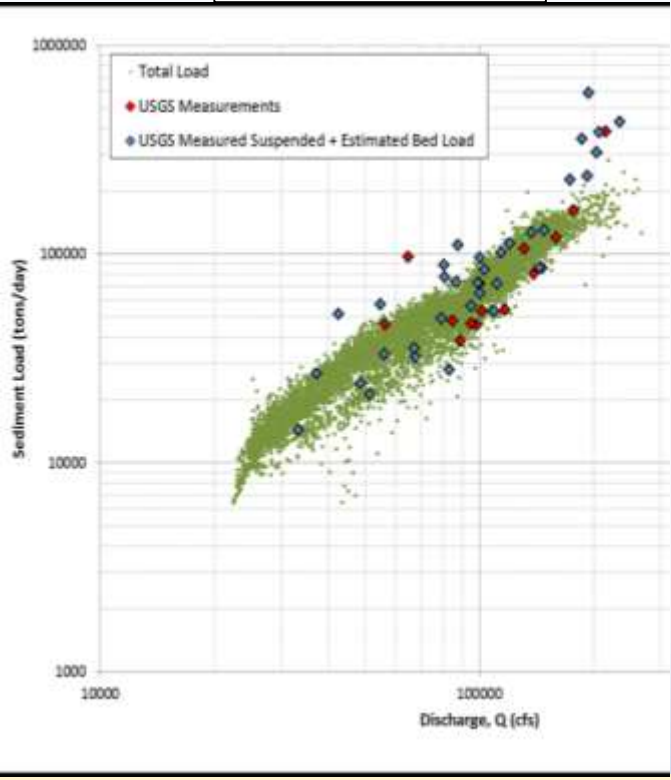
Gold Creek



Sunshine



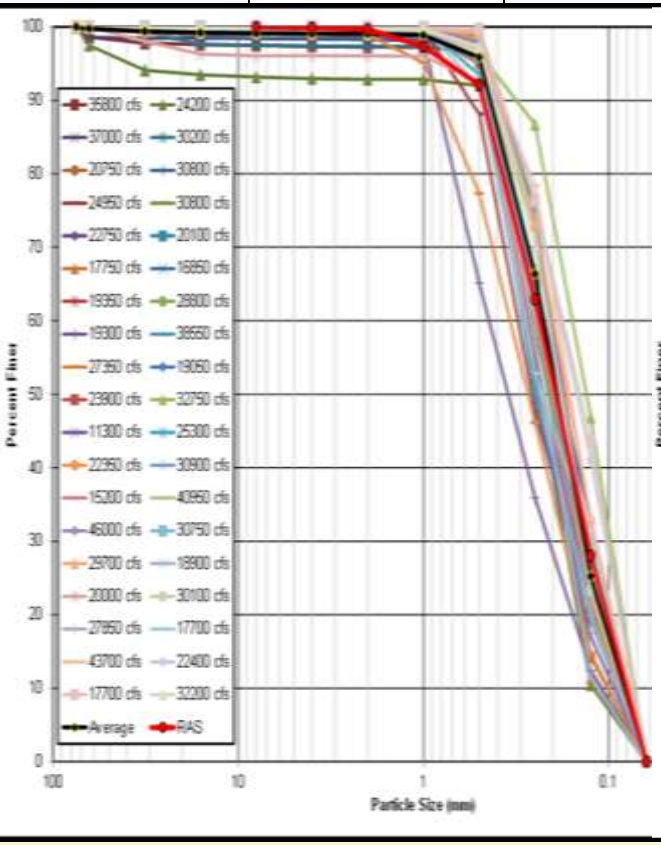
Susitna Station



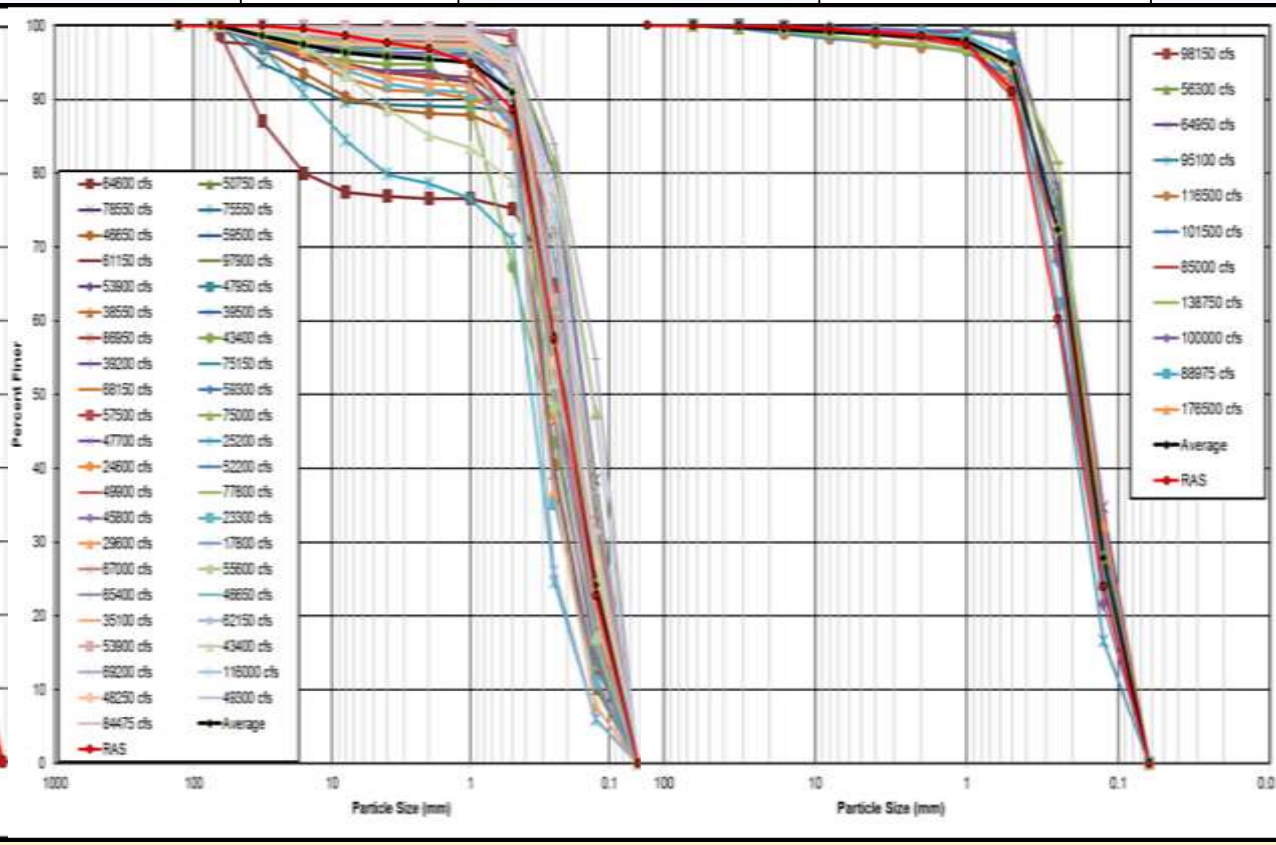
Study 6.6 Summary of Results since ISR Modeling in support of Decision TM (Sept. 2014)

- Models calibrated well for sediment transport
  (USGS measured vs. Model transported gradation)

Gold Creek



Sunshine



Susitna Station

AEA Proposed Modifications to Study 6.6 in ISR (ISR Study 6.6, Part C – Section 7.1.2)

7.1.2.1. Bed Evolution Model Development, Coordination, and Calibration

- Introduction of point sources in the **2-D open-water period hydraulic model** to account for **groundwater inflows**

7.1.2.2. Model Existing and with-Project Conditions

- Dimensionless critical shear may not be available as a parameter for the sensitivity analysis as originally indicated in the RSP (based on selection of sediment transport equation)
- The **PDO (Pacific Decadal Oscillation) is not a significant factor affecting the hydrologic characteristics during the open-water period** of the representative years

7.1.2.3. Coordination and Interpretation of Model Results

- There are no variances from 2013 or proposed modifications to the Study Plan for 2014/2015 for this study component

Decision Points from Study Plan (ISR Study 6.6, Part C – Section 7.1.1)

Decision Point on **Fluvial Geomorphology Modeling of the Susitna River below PRM 29.9** – TM in September 2014 (ISR Part C, Section 7.1.1.1.2)

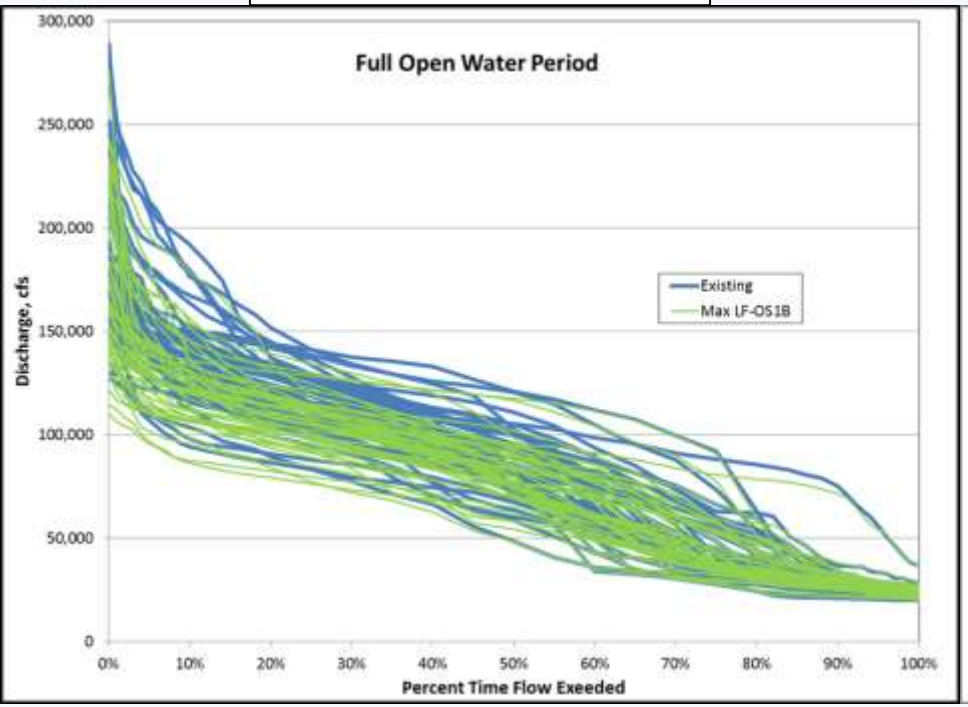
Decision based on with-Project (Max LF OS-1b) change relative to natural variability in four criteria (change in:)

1. Flow and associated potential for width adjustment
2. Sediment transport volume (bed material)
3. Bed elevations (aggradation and degradation)
4. Flow depths and velocities

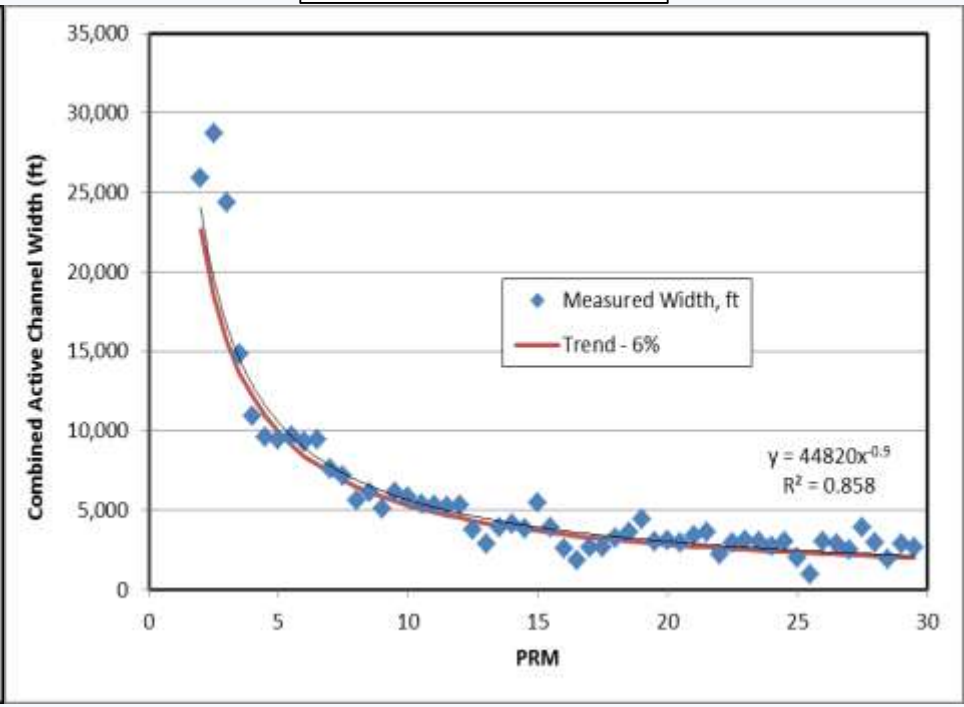
Decision Points from Study Plan
Extend FGM below PRM 29.9?

Flow and associated potential for width adjustment

Flow Duration Curves

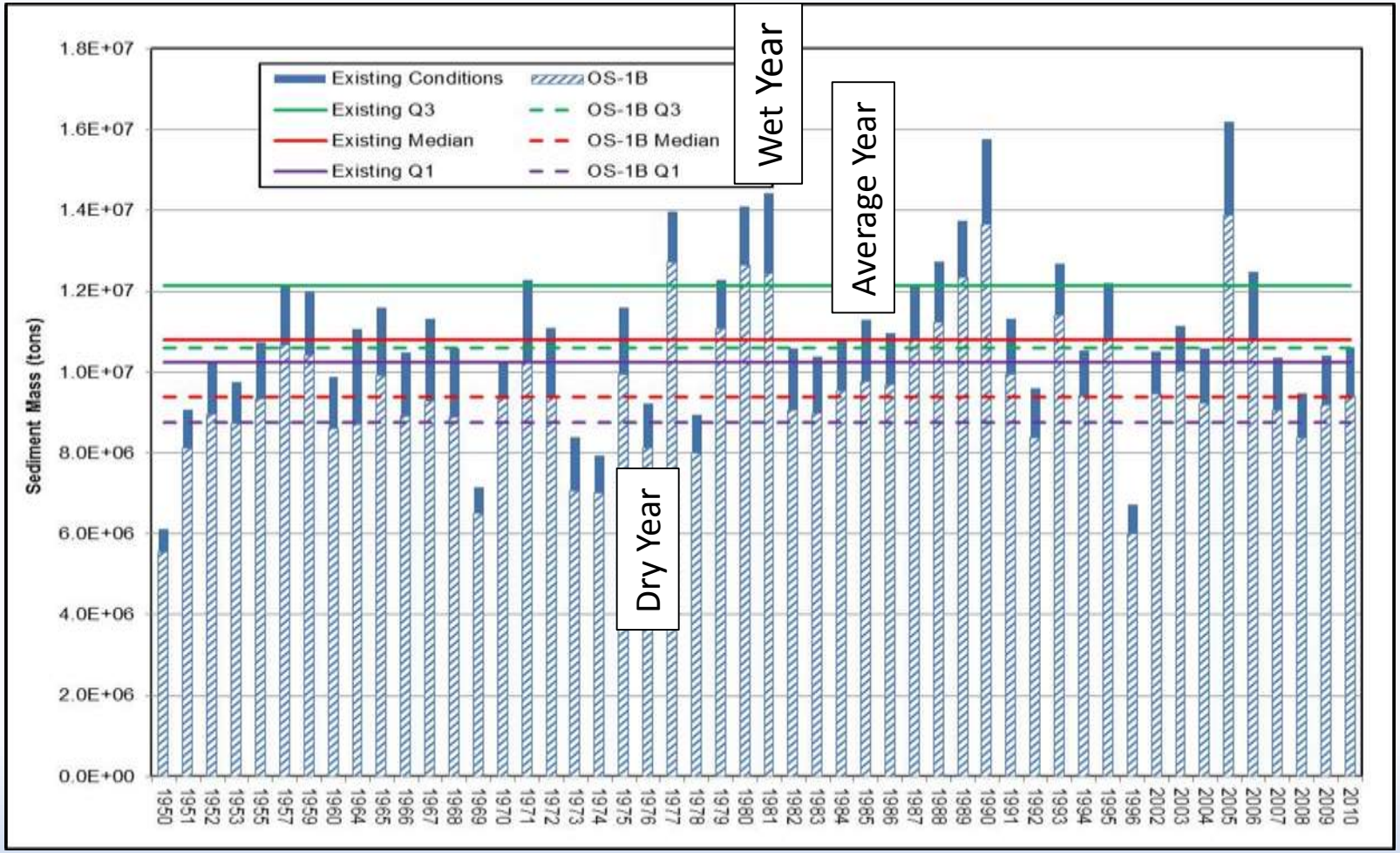


Width Variability



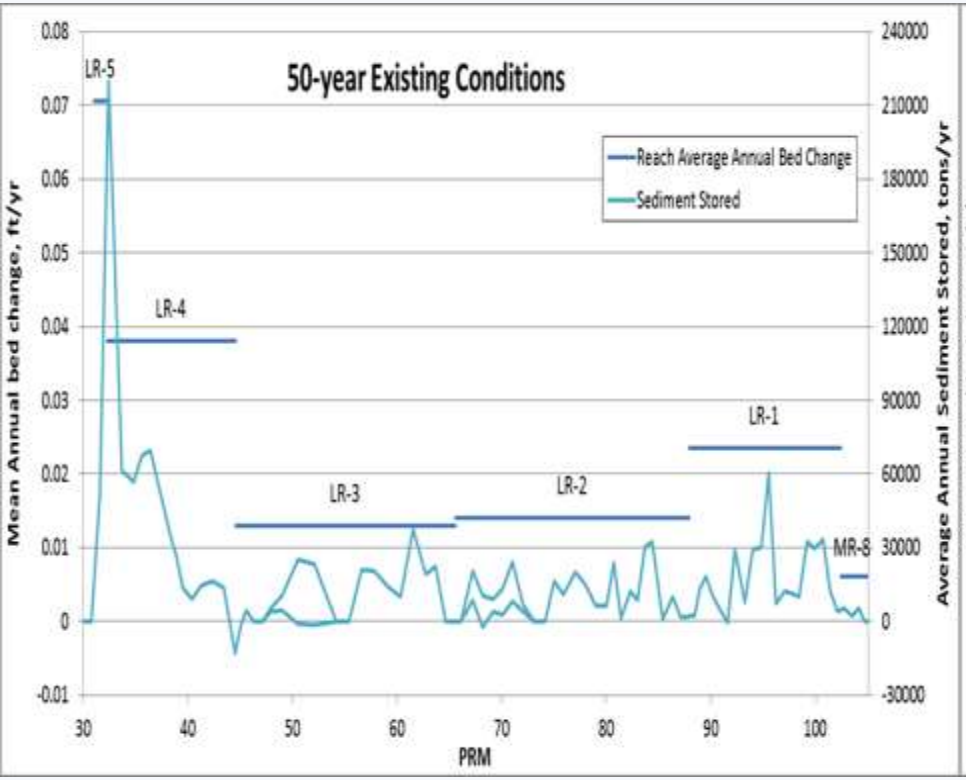
Decision Points from Study Plan
Extend FGM below PRM 29.9?

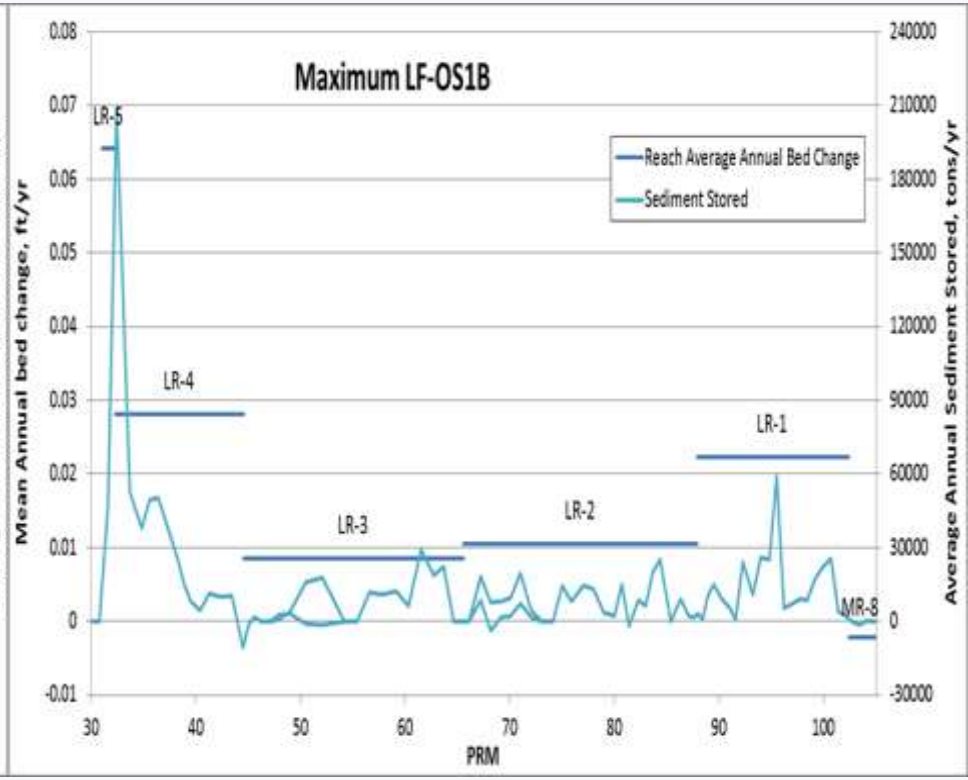
Sediment transport volume (bed material)



Decision Points from Study Plan
Extend FGM below PRM 29.9?

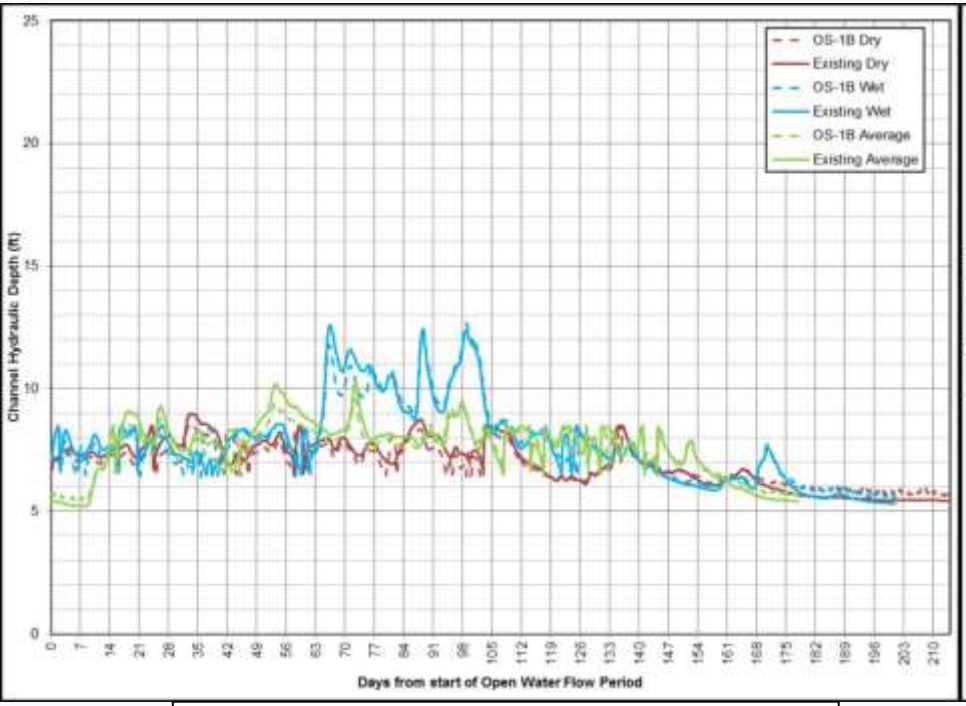
Bed elevations (aggradation and degradation)



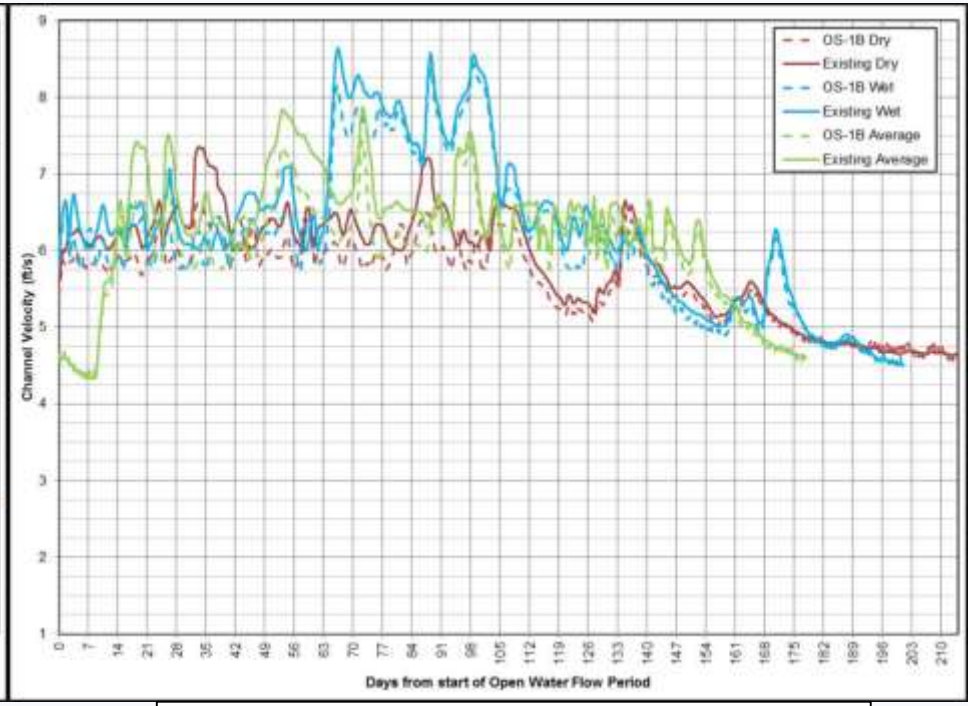


Decision Points from Study Plan
Extend FGM below PRM 29.9?

Flow depths and velocities



Depths for Representative Years for Existing and Max LF-OS1b



Velocities for Representative Years for Existing and Max LF-OS1b

Decision Points from Study Plan
Extend FGM below PRM 29.9?

Conclusions

- Change in criteria **small relative to** large range of **natural** (and with-Project) **variability**
- Criteria **infrequently outside range of natural variability** and by **small amounts**
- Channel form unchanged (**Lower River stays aggradational**)

Recommendation

- Do not extend Fluvial Geomorphology Modeling below PRM 29.9
- Do not extend associated 1-D hydraulic modeling below PRM 29.9
- Do not perform tidal hydrodynamic modeling in tidal zone

Decision Points from Study Plan (ISR Study 6.6, Part C – Section 7.1.1)

Future Decision on Identification of Focus Areas to Run **Specific 2-D Model Scenarios**

- 1-D model may show **geomorphic responses similar between scenarios** so separate 2-D models are not necessary at an FA
- There may **not be enough change** to warrant running 25- and 50-year models at all FAs
- The **response may be similar among FAs**, so modeling all FAs at the same level may not be necessary
- The **1-D model may be adequate to evaluate potential project effects** without additional 2-D modeling

Steps to Complete Study 6.6 (ISR Study 6.6, Part C – Section 7.2.1)

Status

- Successful field data collection seasons
- Characterization of groundwater inflows to lateral habitats
- LiDAR data collection completed
- 1-D modeling
  - Initial models of Middle and Lower Susitna Rivers
- 2-D Modeling
  - FA-128 (Slough 8A) used in Proof-of-Concept
  - Other FA models in development
- 2014 Fluvial Geomorphology Modeling – TM in Q4 2014) (ISR Part C, Section 7.2.1.1)

Steps to Complete Study 6.6 (ISR Study 6.6, Part C – Section 7.2.1)

Planned 2015 Activities

- **Field data collection**
  - FGM Data collection complete in 2014 – need 2015 data for 2 FAs above Devils Canyon (e.g. bathymetry, substrate)
  - Data to fill data gaps identified during modeling efforts
- **1-D and 2-D modeling**
  - Include 2014 survey, LiDAR and bed material
  - Finalize tributary water and sediment inflow
  - Calibration and validation
  - Existing conditions and operational scenarios runs
  - Sensitivity analyses

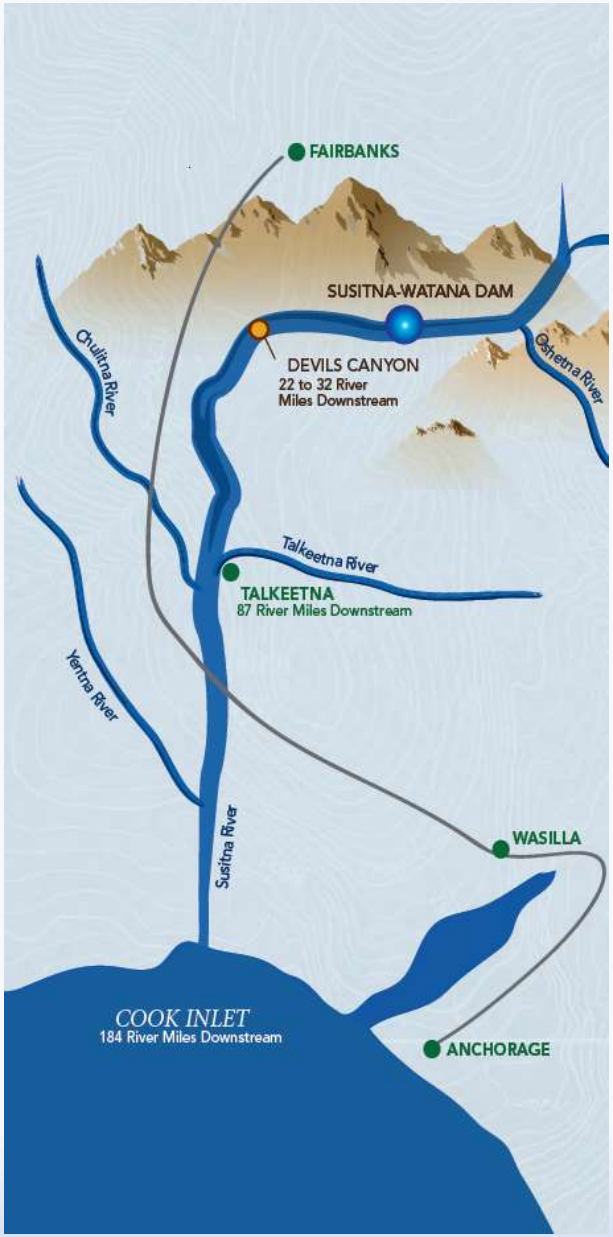
Steps to Complete Study 6.6 (ISR Study 6.6, Part C – Section 7.2.1)

Planned 2015 Activities

- **Model integration**
  - Reservoir trap efficiency (Water Quality, 5.6)
  - Ice breakup surges (Ice Processes, 7.6)
  - Groundwater in lateral habitats (IFS, 8.5 and GW, 7.5)
  - LWD (part of FGM, 6.6)
  - Turnover analysis (Geomorphology, 6.5)
  - Floodplain accretion and vegetation (Riparian, 8.6)

Licensing Participants Proposed Modifications to Study 6.6?

- Agencies
- CIRWG members and Ahtna
- Public



Initial Study Report Meeting

Study 5.5 Baseline Water Quality

October 16, 2014

Prepared by

URS/Tetra Tech, Inc.

Study 5.5 Objectives

- Document **historical water quality data** and **combine with data generated from this study**. The combined dataset will be used in the Water Quality Modeling Study to predict Project impacts under various operations
- **Add current** stream **temperature** and **meteorological** data **to the existing data**
- Develop a monitoring program to adequately **characterize surface water physical, chemical, and bacterial conditions** in the Susitna River **within and downstream of the proposed Project area**
- Measure **baseline metals concentrations** in **sediment** and **fish tissue** for comparison to state criteria
- Perform **Thermal Infrared Remote (TIR) sensing** of the Susitna River from Susitna Station **(Project River Mile [PRM] 29.9) to Deadman Creek (PRM 235.6)**, and use this data to map the groundwater discharge and possible extent of thermal refugia

Study 5.5 Components

- Water Temperature Data Collection (ISR Part A, Section 4.1; pg 3)
- Meteorological Data Collection (ISR Part A, Section 4.2; pg 7)
- Baseline Water Quality Monitoring (ISR Part A, Section 4.3; pg 9)
- Focus Area Water Quality Monitoring (ISR Part A, Section 4.4; pg 13)
- Sediment Samples for Mercury/Metals in the Reservoir Area (ISR Part A, Section 4.5; pg 15)
- Baseline Metals Levels in Fish Tissue (ISR Part A, Section 4.6; pg 17)
- Thermal Infrared Remote Sensing (ISR Part A, Section 4.7; pg 17)
- Groundwater Quality in Selected Habitats (ISR Part A, Section 4.8; pg 20)

Study 5.5 Variances

- **Establishment of water temperature monitoring sensors was planned for 37 sites in 2013. Equipment deployment for temperature monitoring was completed at 28 sites on the Susitna River mainstem and tributaries (RSP Section 5.5.4.1).**
- Sampling from Baseline Water quality sites resulted in minor adjustments of location at 3 of the 17 sites proposed in the RSP (RSP Section 5.5.4.4). A location was added at PRM 174.0 to characterize water quality conditions below the dam site.
- Ten Focus Areas were described in RSP Section 5.5 for water quality sampling during 2013. Seven Focus Areas of the ten candidate Focus Areas were monitored in 2013 (RSP Section 5.5.4.5). While land access was not available for portions of the river and tributaries adjacent to Cook Inlet Regional Working Group (CIRWG) in 2013, *this was not considered a variance because this study was designed to collect data over multiple years.*
- Visits to ten sites for collection of sediment samples were proposed in the RSP Section 5.5.4.6. Six sites were not visited in 2013 (Susitna Above Watana Dam, Susitna Below Watana Dam, Fog Creek, Deadman Creek, Watana Creek, and Tsusena Creek) due to lack of access to CIRWG lands.
- Groundwater sampling piezometer wells were originally described for placement at the end of each mainstem transect within each Focus Area. However, the wells had to be relocated to areas where they could be successfully installed and were also more applicable in support of the Instream Flow Study (Section 8.5 of the ISR).

Study 5.5 Summary of Results in ISR (ISR Study 5.5, Part A – Section 5)

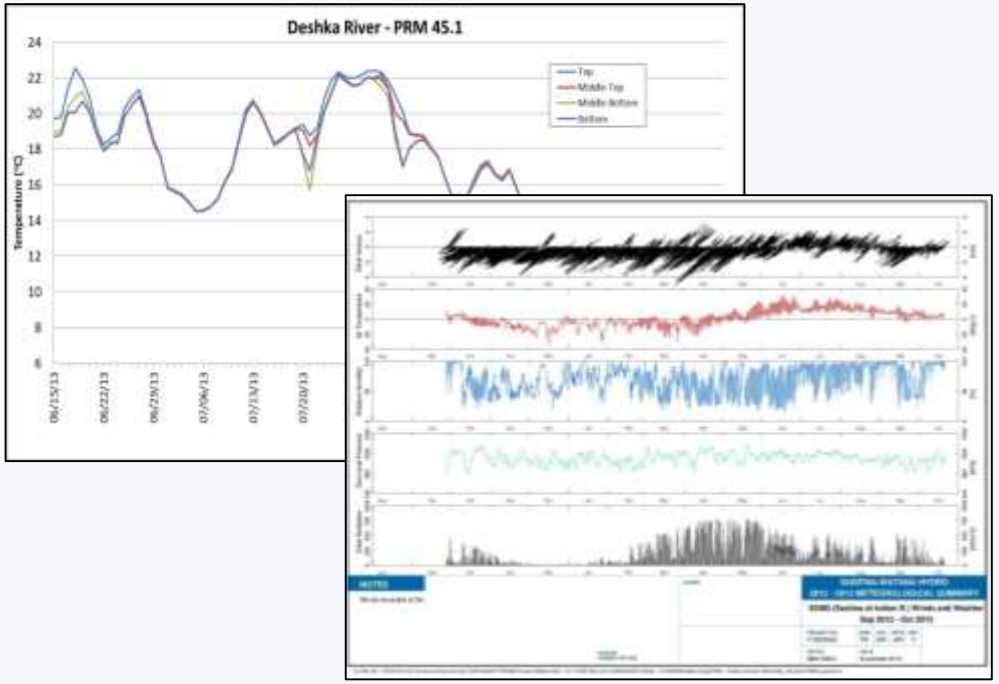
QA/QC completed on field parameters from 2013

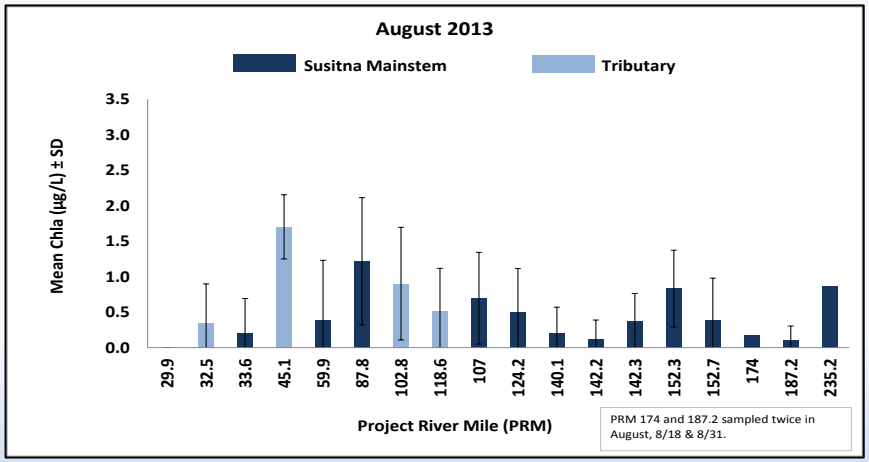
Water Temperature Data Collection

- 28 sites monitored from PRM 29.9 to 235.2

Meteorological Data Collection

- Three stations from September 2012 to October 2013)





Baseline Water Quality Monitoring

- Field collected water temperature, dissolved oxygen, pH, specific conductance, redox potential, chlorophyll *a*, color

Study 5.5 Summary of Results in ISR (ISR Study 5.5, Part A – Section 5)

QA/QC completed on field parameters from 2013, *cont.*

Focus Area Field Measurements

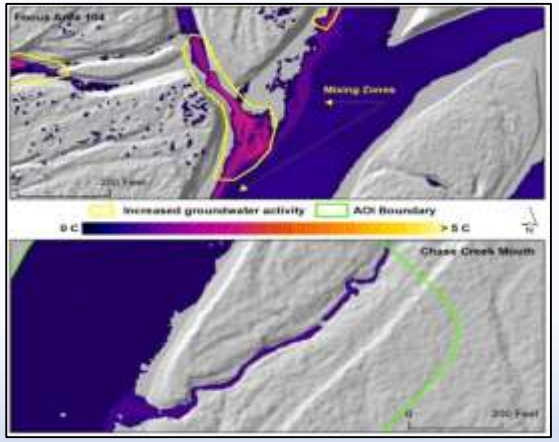
- Field collected water temperature, dissolved oxygen, pH, specific conductance, redox potential, chlorophyll *a*

Groundwater Field Measurements

- Wells located in Focus Areas: FA-104 (Whiskers Slough), FA-113 (Oxbow I), FA-128 (Slough 8A), and FA-138 (Gold Creek)
- Field collected water temperature, dissolved oxygen, pH, specific conductance redox potential

Thermal Infrared Remote Sensing

- 10 Focus Areas and 9 additional areas of interest along the Middle Susitna River



Study 5.5 Summary of Results since ISR

QA/QC completed on analytical lab results from 2013 samples:

Baseline Water Quality Characterization

- Nutrients, turbidity, metals, total dissolved solids, ions, organic carbon, and other parameters (e.g., BTEX, PAHs, radionuclides, fecal coliform)

Focus Area Water Quality Characterization

- Nutrients, turbidity, metals, hardness, organic carbon

Groundwater Quality

- TP, TKN, total Al, total Fe, and total Hg

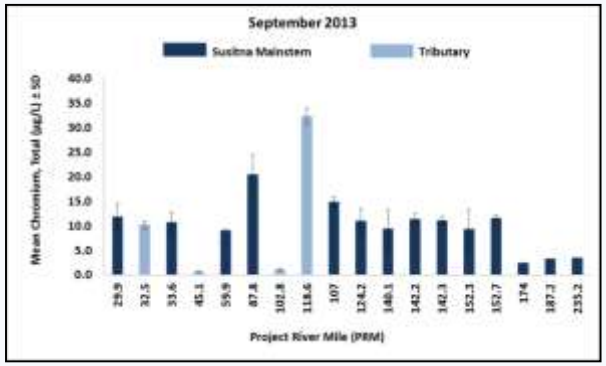
Sediment Samples

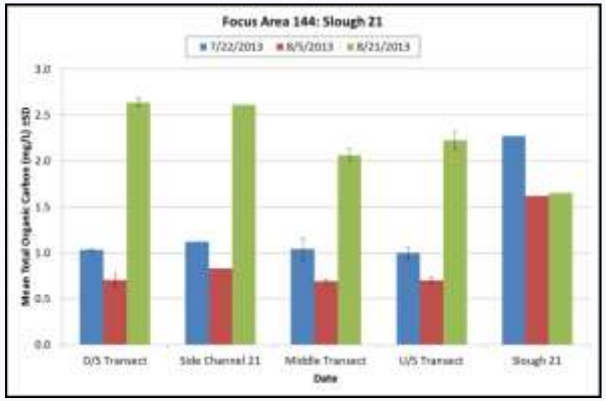
- TOC, As, Cd, Cu, Fe, Pb, Hg, Ni, Se, Zn, sediment size

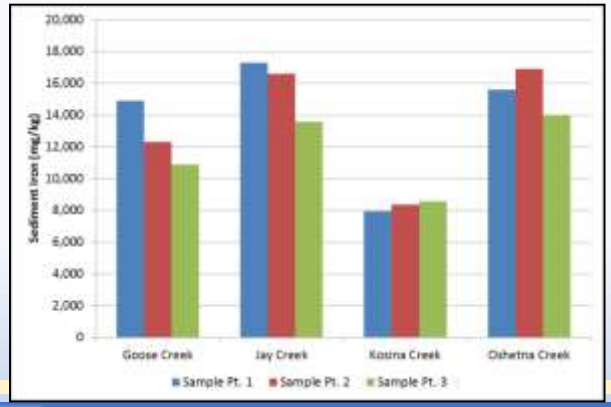
Porewater Samples

- Hardness, alkalinity, DOC, Al, As, Cd, Cu, Fe, Pb, Mg, Hg, Ni, Se, Zn

All results will be presented in the Updated Study Report







Study 5.5 Summary of Results since ISR

Completed Winter and Summer 2014 Sample Collection

Water Temperature Data Collection

- Over-winter and summer monitoring 2014
- Thermistors downloaded and removed Sept 2014

Baseline Water Quality

- In-situ field data (e.g., temperature, DO, redox potential, specific conductance)
- Total metals (except Ca and Mg), and dissolved aluminum, TP, TKN NO_3+NO_2- nitrogen

Focus Area Water Quality

- In-situ field data
- Total metals (except Ca and Mg), and dissolved aluminum, TP, TKN NO_3+NO_2^- nitrogen

Field and laboratory data for 2014 under QA/QC review and will be presented in the Updated Study Report

Study 5.5 Summary of Results since ISR

Completed Winter and Summer 2014 Sample Collection, *cont.*

Groundwater Well Monitoring

- In-situ field data

Meteorological Data Collection

- Scheduled maintence and winter preparation scheduled for Oct 2014

Sediment Samples at Remaining Sites

- TOC, As, Cd, Cu, Fe, Pb, Hg, Ni, Se, Zn, sediment size

Porewater Samples at Remaining Sites

- Hardness, alkalinity, DOC, Al, As, Cd, Cu, Fe, Pb, Mg, Hg, Ni, Se, Zn

Field and laboratory data for 2014 under QA/QC review and will be presented in the Updated Study Report

AEA Proposed Modifications to Study 5.5 in ISR (ISR Study 5.5, Part C – Section 7.1.2)

Water Temperature Data Collection

- Water Temperature Data Collection Logging interval (October 2013 through June 2014) to be 30-minutes (instead of 15-minutes (RSP Section 5.5.4.1))
- Data logging intervals from 15-minutes to 30-minutes on final download of summer monitoring (August-September 2014) depending on ice formation

Meteorological Data Collection

- Rain gauge and CS725 snow water equivalency (SWE) sensor to be installed at MET station ESM1, if possible

AEA Proposed Modifications to Study 5.5 in ISR (ISR Study 5.5, Part C – Section 7.1.2) (Continued)

Baseline Water Quality Monitoring

- Extent of sampling for baseline water quality monitoring refined based on review of remaining data collected during 2013 and how quality objectives were met
- **Select water quality parameters outside acceptance limit during lab analysis**
  - **Sample preservative affected detection of target analyte by lab equipment**
  - **Parameters affected – total metals (except Ca and Mg), total mercury, total phosphorus, total Kjeldahl nitrogen (TKN), total nitrate+nitrite-nitrogen, and dissolved aluminum**
  - **Samples that were 'rejected' or 'estimated' and will be re-sampled in 2014**

Current plans – continued sampling for baseline water quality (June to September 2014) at same sites sampled in 2013

- **Single grab sample to be collected at each site transect and monthly site will be analyzed for all total metals (except Ca and Mg), dissolved Al, TP, TKN, and nitrate+nitrite-nitrogen (change from study plan (RSP Section 5.5.4.4.2.) and Table 5.5-4)**
- **Analytical inconsistencies (ISR Section 5.4) call for the following water quality parameters for lab split sample analysis (only during July 2014): all total metals (except Ca and Mg), dissolved Al, TP, TKN, and nitrate+nitrite-nitrogen**

AEA Proposed Modifications to Study 5.5 in ISR (ISR Study 5.5, Part C – Section 7.1.2) (Continued)

Focus Area Water Quality Monitoring

- Focus Areas and groundwater wells to be re-sampled in 2014 (generate valid water quality data and determine if a correction factor is necessary)
- **Re-sampling during 2014 to consist of collecting single grab sample once in July and August at each location and at depth of 1.5m (where possible) at center of each transect in main channel and at side channels where flow differs from main channel**
  - **Analyzed for total metals (except Ca and Mg), dissolved Al, TP, TKN, and nitrate+nitrite-nitrogen (modification of RSP Section 5.5.4.5.)**

Sediment and Porewater Sampling

- Sediment and porewater samples to be collected (August to September 2014) from 6 locations around Watana Dam site not collected during 2013 field effort
  - If not accessible, sampling will be moved to alternate locations with same setting as proposed sites (RSP Section 5.5.4.6.)
  - Hand auger or stainless steel spoon to be used for sediment sampling (modification from RSP Section 5.5.4.6)

Thermal Infrared Remote Imaging

- Not all data from lower river collected in 2013 due to adverse weather conditions, remaining data will be collected during 2014 field season (weather permitting)

New Modifications to Study 5.5 since ISR

Water Temperature Data Collection

- ISR Section C, Part 7 indicates

  Over-winter systems will be installed and thermistors will be adjusted to log at 30 minute intervals in order to conserve space for data to be stored through winter 2014-2015 (September 2014-June 2015)

  - **Over-winter thermistors were not installed for third year; As demonstrated by select sites in 2012/2013 and 2013/2014, no interannual winter temperature variation**

Thermal Infrared Remote Sensing

- ISR Section C, Part 7 indicates

  The remaining portions of the Lower River (approximately 27% of the total) will be flown during the 2014 field season.

  - **TIR of the remaining 27% of the LR will not be conducted 2014 as data generated in previous effort was adequate to meet objectives of the study.**

Steps to Complete Study 5.5 (ISR Study 5.5, Part C – Section 7.1)

Water Temperature Data Collection

- QA/QC data

Meteorological Data Collection

- Scheduled maintence and winter preparation scheduled for Oct 2014

Baseline Water Quality Monitoring

- QA/QC monthly grab samples and in-situ field measurements

Focus Area Water Quality Monitoring

- QA/QC grab samples and in-situ field measurements

Sediment and Porewater Sampling

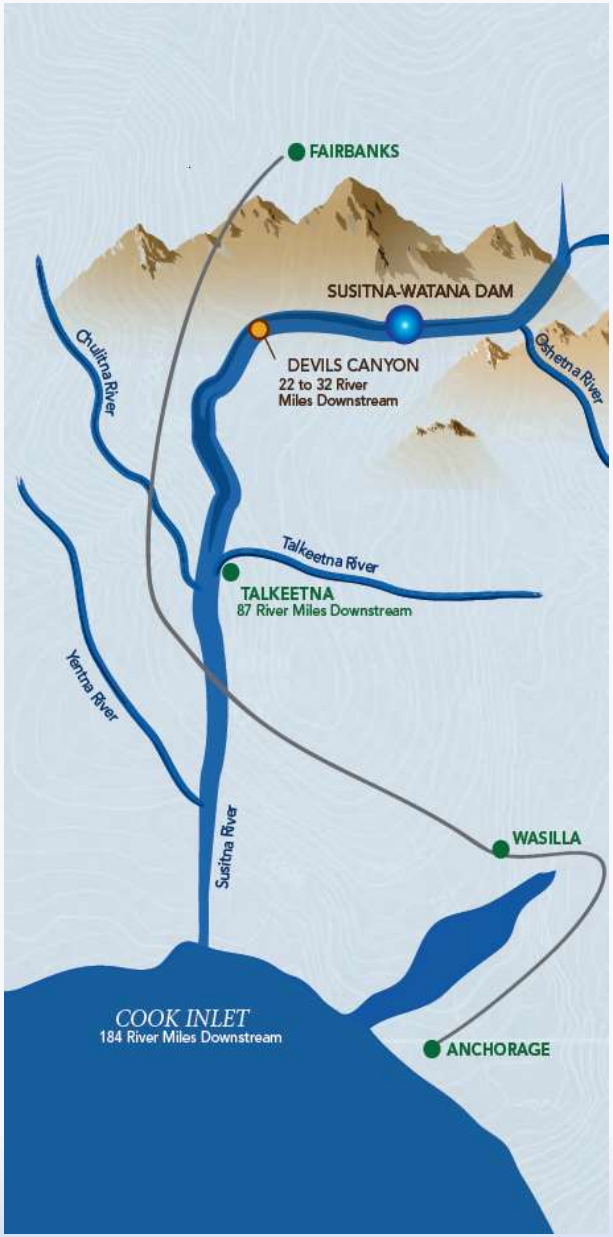
- QA/QC samples collected at six sites that were not visited in 2013

Data QA/QC

- All water quality sample results from 2014 will be QA/QC and summarized in the USR

Licensing Participants Proposed Modifications to Study 5.5?

- Agencies
- CIRWG members and Ahtna
- Public



Initial Study Report Meeting

Study 5.6 Water Quality Modeling

October 16, 2014

Prepared by

URS/Tetra Tech, Inc.

Study 5.6 Objectives

- Implement (with input from licensing participants) an appropriate **reservoir and river water temperature model** for use with **past** and **current monitoring data**
- Using the data developed as part of the Baseline Water Quality Study, **model water quality conditions in the proposed Watana Reservoir**, including (but not necessarily limited to) temperature, DO, fine suspended sediment and turbidity, chlorophyll-a, nutrients, ice, and metals
- **Model water quality conditions in the Susitna River** from the proposed site of the Watana Dam downstream, including (but not necessarily limited to) temperature, DO, fine suspended sediment and turbidity, chlorophyll-a, and nutrients. **Ice processes effects** are accounted for using output **from the River 1D Ice Processes Model** (in coordination with the Ice Processes Study)

Study 5.6 Components

- Model Description (ISR Part A, Section 4.1; pg 2)
- Reservoir and Downstream River Modeling Approaches (ISR Part A, Section 4.2; pg 3)
- Focus Area Modeling (ISR Part A, Section 4.3; pg 5)
- Scales for Modeling and Resolution of the Output (ISR Part A, Section 4.4; pg 5)

Study 5.6 Variances

- AEA implemented the methods as described in the Study Plan with no variances

Study 5.6 Summary of Results in ISR (ISR Study 5.6, Part A – Section 5)

- Consistent state variables between 3-D reservoir and 2-D river models
- Hydrodynamics
  - Water surface elevation
  - Velocity
- Water Quality
  - Temperature including ice cover in reservoir
  - TSS (very fine sand, silt, and clay size material)
  - Dissolved oxygen
  - Phytoplankton and periphyton
  - Dissolved and particulate organic carbon, nitrogen and phosphorous
  - Ammonia, nitrite+nitrate-nitrogen, inorganic phosphorous
- Toxic and Mercury State Variables
  - Dissolved and particulate phases of selected metal
  - Dissolved and particulate elemental, divalent, and methyl mercury

Study 5.6 Summary of Results in ISR (ISR Study 5.6, Part A – Section 5)

- Reservoir Model Configuration
  - Approximately 1400 horizontal cells and 20 layers
  - 400 to 800 m longitudinally, 75 to 150 m laterally

- Reservoir Modeling Results
  - Demonstrated annual time scale hydrodynamic and temperature simulation with 45 m variation in pool level

- River Model Configuration
  - Approximate 1000 horizontal grid cells between PRM 80 and 189 with a 500 m longitudinal resolution and three cells across channel

Study 5.6 Summary of Results in ISR (ISR Study 5.6, Part A – Section 5)

- River Modeling Results
  - Demonstrated annual time scale hydrodynamic and temperature simulation under pre- and post-Project conditions
  - Pre-Project river model will be calibrated with 2012 through 2014 field observations

- River Focus Area Modeling
  - Focus Area modeled as embedded high resolution regions of the full river model
  - Anticipated 100 m longitudinal and 30 m lateral resolution
  - Demonstrated approach for FA-115 (Slough 6A)

Study 5.6 Summary of Results since ISR

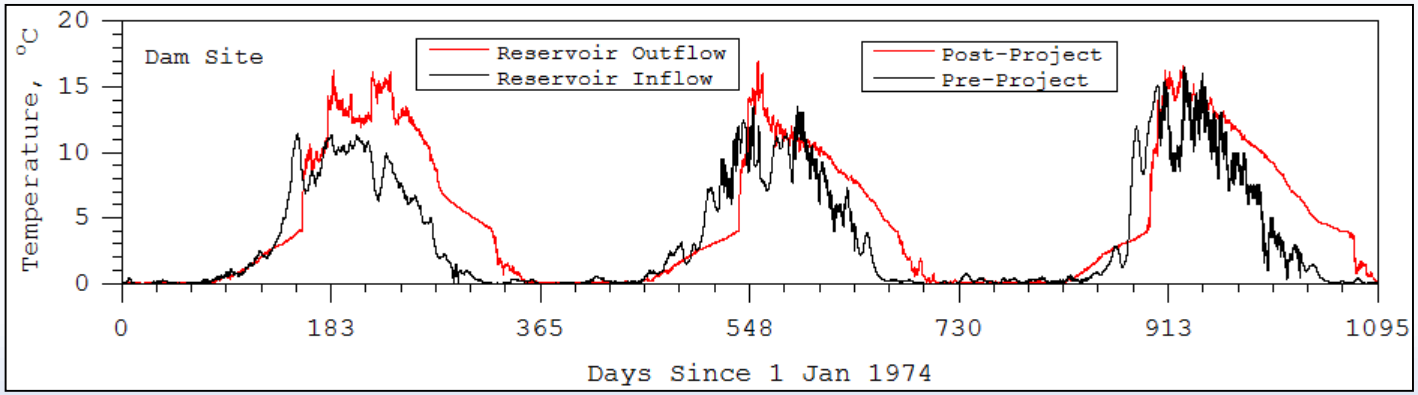
(Water Quality & Lower River Modeling Tech Memo, September 2014)

Reservoir Model Configuration Updated

- Configured model for simulation of two 3-year periods, 1974-76 and 1979-81 using maximum load following flow scenario
- Outflow level based to proposed operation of shutters
- Developed loading to simulate very fine sand and silt-clay size material

Reservoir modeling results

- Robust performance over the 3-year simulation period
- Summer reservoir outflow temperatures are 1-2°C higher than pre-project temperatures at the dam site **(scenario using top-water withdrawal from the reservoir)**
- Fine sand entirely trapped by reservoir
- Significant retention of silt-clay size material



Example: Dam Site, 1974-1976

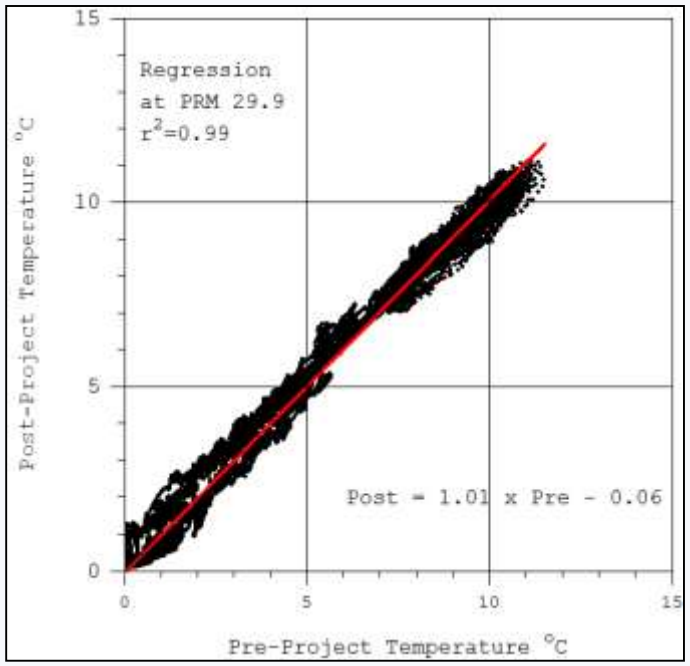
Study 5.6 Summary of Results since ISR
(Water Quality & Lower River Modeling Tech Memo, September 2014)

River Model Configuration Updated

- Full river model grid extended to PRM 30
- Configured model for simulation of two 3-year periods, 1974-76 and 1979-81 for pre- and post-project conditions
- Post-Project boundary conditions based on reservoir model outflow for maximum load following flow scenario

River Modeling Results

- Post-Project river temperatures are higher than pre-Project although the difference is less than 1 °C at PRM 29.9
- TSS in middle river is lower due to trapping all fine sand and a significant portion of silt-clay in reservoir



Example: PRM 29.9, River Temperature

Study 5.6 Summary of Results since ISR

(Water Quality & Lower River Modeling Tech Memo, September 2014)

Focus Area Model Configuration

- Individual high resolution models for focus areas
- Upstream and downstream boundary conditions from full river model
- Bathymetry consistent with other focus area hydrodynamic models
- Currently completing model grids for focus areas

Focus Area Modeling Results

- Demonstrated focus area model approach for FA-128 (Slough 8A)
- May-October 1976 and 1981 simulations under pre- and post-Project conditions

AEA Proposed Modifications to Study 5.6 in ISR (ISR Study 5.6, Part C – Section 7.1.2)

No modifications to the Study Plan are needed to complete the study and meet Study Plan objectives

Decision Points from Study Plan
River Model Downstream Boundary Decision Point

- The river model will not be extended downstream of PRM 29.9
- Decision based on model predictions of pre- and post-Project river temperature at PRM 29.9
  - Temperature results presented in preceding slides show that river temperature impacts of the dam are less than 1°C PRM 29.9
- The absence of data to support model configuration downstream of PRM 29.9 was a secondary consideration
- Document
  - Decision Points for Study 5.6: Water Quality Modeling Study, Draft Technical Memorandum, Sept. 2014

Current Status and Steps to Complete Study 5.6

Reservoir modeling

- Model spatial configuration and testing (2013)
- Completed final model spatial configuration (2014)
- Completed multi-year hydrodynamic, temperature and fine sediment simulation (2014)
- Complete approach for ice cover and thickness simulation (2014)
- Complete configuration of water quality model (2014-15)
- Complete configuration of toxics and mercury model (2014-15)
- Evaluate model predications for reasonableness and consistency (2014-15)
- Incorporate alternate operational scenarios for the 60 hydrologic period (2014-15)
- Scenario simulations (2015)

Current Status and Steps to Complete Study 5.6

River modeling

- Model spatial configuration and testing (2013)
- Completed final model spatial configuration (2014)
- Completed multi-year hydrodynamic, temperature and fine sediment simulation (2014)
- Implement procedure for importing ice cover and thickness from ice processes model (2014)
- Complete configuration of water quality model (2014-15)
- Complete configuration of toxics and mercury model (2014-15)
- Calibration model to 2012-14 observational data (2014-15)
- Incorporate alternate operational scenario outputs from reservoir model (2014-15)
- Scenario simulations (2015)

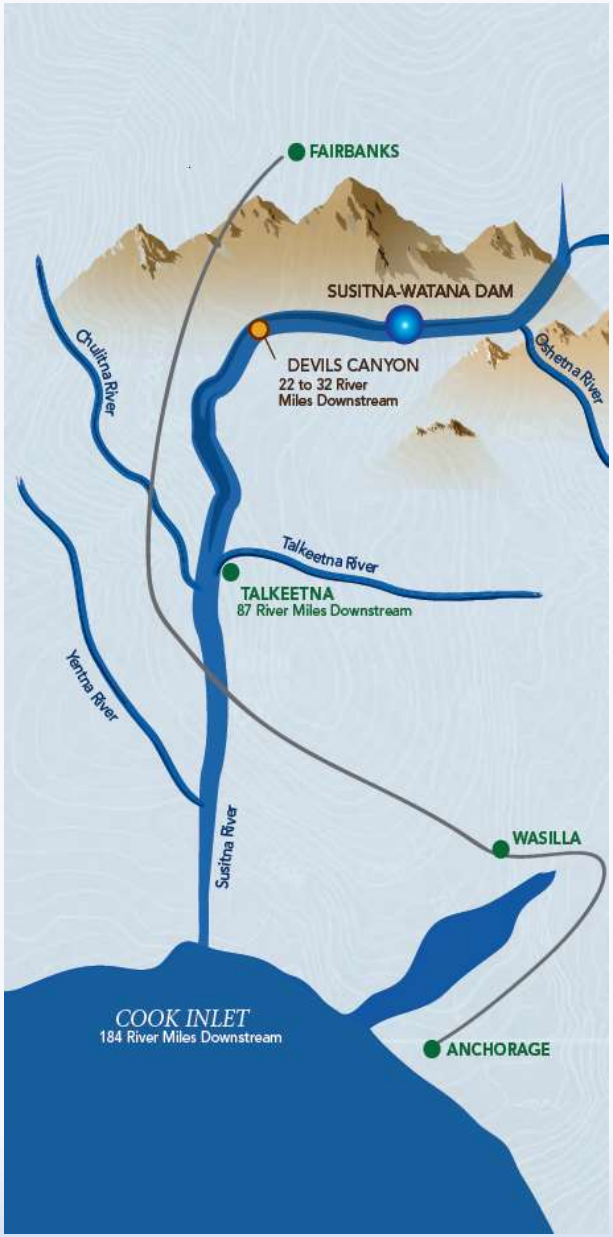
Current Status and Steps to Complete Study 5.6

Focus Area Modeling

- Completed spatial configuration for focus areas (2014)
- Completed coupling to full river model (2014)
- Completed open water season hydrodynamic, temperature and fine sediment simulation (2014)
- Implement procedure for importing ice cover and thickness from ice processes model (2014)
- Implement procedure to transfer model results to habitat modeling studies (2014)
- Complete configuration of water quality model (2014-15)
- Calibrate model to 2012-14 observational data (2014-15)
- Incorporate alternate operational scenario outputs from river model (2014-15)
- Scenario simulations (2015)

Licensing Participants Proposed Modifications to Study 5.6?

- Agencies
- CIRWG members and Ahtna
- Public



Initial Study Report Meeting

Study 5.7 Mercury Assessment and Potential for Bioaccumulation

October 16, 2014

Prepared by
Tetra Tech, Inc.

Study 5.7 Objectives

- Summarize **available and historic mercury information** for the Susitna River basin, including data collection from the 1980s Alaska Power Authority (APA) Susitna Hydroelectric Project
- **Characterize the baseline mercury concentrations** of the Susitna River and tributaries. This will include collection and analyses of vegetation, soil, water, sediment pore water, sediment, piscivorous birds and mammals, and fish tissue samples for mercury
- Utilize **available geologic information** to determine if a mineralogical **source of mercury** exists within the inundation area
- **Map mercury concentrations** of soils and vegetation within the proposed inundation area. This information will be used to develop maps of where mercury methylation may occur
- Use the **water quality model to predict** where in the reservoir **conditions** (pH, dissolved oxygen [DO], turnover) are likely **to be conducive to MeHg formation**
- Use **modeling to estimate MeHg** concentrations in fish.
- **Assess potential pathways for MeHg** to migrate to the surrounding environment
- **Coordinate study results with other study areas**, including fish, instream flow, and other piscivorous bird and mammal studies

Study 5.7 Components

- Vegetation (ISR Part A, Section 4.2.1; pg 3)
- Soil (ISR Part A, Section 4.2.2; pg 3)
- Water (ISR Part A, Section 4.2.3; pg 4)
- Sediment and Sediment Porewater (ISR Part A, Section 4.2.4; pg 7)
- Piscivorous Birds and Mammals (ISR Part A, Section 4.2.5; pg 8)
- Fish Tissue (ISR Part A, Section 4.2.6; pg 9)

Study 5.7 Variances

- Table 5.7-5 in Study Plan Section 5.7.4.2.3 summarizes the proposed water sampling locations for mercury analysis in water. PRM 225.5 (Susitna near Cantwell) could not be sampled due to limited access by helicopter. The sample site was relocated to PRM 235.2 (Susitna River adjacent to Oshetna Creek). See subsection 4.2.3.4 in this ISR.

- RSP Section 5.5.4.4.2 indicated that water samples would be collected at three locations along each transect for mainstem samples. Water samples were collected from just one position in the river due to limited access by wading at PRM 235.2 (Susitna River adjacent to Oshetna Creek) and 187.2 (Susitna at Watana Dam site). See subsection 4.2.3.4 in this ISR.

- Study Plan Attachment 5-1 indicated that an Ekman dredge or modified Van Veen grab sampler would be deployed from a boat; however, this approach was impractical and other approaches (wading) were employed (as identified in the QAPP). See subsection 4.2.4.1 in this ISR.

- EPA Method 1631 recommends digestion of mineral soil with aqua regia and oxidized with bromine monochloride (BrCl) to extract mercury from samples for analyses. The soil samples collected in 2013 contained a significant fraction of peat and organic material mixed with soil. For these types of organic soils, EPA recommends digestion with HNO_3/H_2SO_4 digestion before using BrCl. Given the soil was a mix of organic and inorganic components, each sample was split and analyzed them using both digestion methods, giving two analytical results for each sample.

Study 5.7 Variances

- RSP Section 5.7.4.6.1 indicated seven to ten of each target species of fish would be collected; however, additional fish were collected for some species (Arctic grayling and round whitefish). The Study Plan also indicated that only adult fish would be collected; however, some juvenile specimens were incidentally collected. While most were released, if a juvenile fish was captured accidentally and died, it was analyzed.

- The Study Plan indicated that all fish would be speciated; however, two fish could not be successfully speciated. Also, it was not possible to successfully extract otoliths from all fish captured; however, sufficient otolith data is available from other studies.

- The Study Plan required determination of the sex and sexual maturity of the fish, however, determination of gender for the fish proved to be problematic in the field, and the sex of only 12 fish was determined. The proposed field collection period for fish was from August to September; however, the sample period was extended into October to obtain sufficient samples. Polyethylene sheets rather than Teflon sheets were used for the fish when placed in the sample bag. See subsection 4.2.6.1.

Study 5.7 Summary of Results in ISR (ISR Study 5.7, Part A – Section 5)

- Samples collected in 2013 include:
  - Vegetation and soil samples collected from ten locations at five different sites within each location.
  - Water quality samples collected from 17 baseline sites and 7 focus areas.
  - Sediment and sediment porewater samples collected from 4 sites.
  - 60 fish tissue samples collected including tissues from trout, longnose sucker, Dolly Varden, Arctic grayling, slimy sculpin, burbot, and whitefish.

- 2013 Lab results for mercury concentrations in vegetation, soil, water, sediment, sediment porewater, and fish tissue were not received in time for inclusion in the ISR. Results have been QA/QCd and will be included in the USR.

Study 5.7 Summary of Results since ISR

(Evaluation of Continued Mercury Monitoring Beyond 2014, September 2014 Tech Memo)

- Average concentration of dissolved mercury in the water column was 1.06 ng/L from 2013 results . This concentration is substantially lower than the criterion for chronic effects.

- The average sediment mercury result was 23.01 ng/g . One result from mercury in sediment (220 ng/g) exceeded the recommended SQuiRT Threshold from a total of 13 results.

- Background information for mercury in fish tissue was acquired from recent fish tissue analysis by ADEC with results ranging from 29.07ng/g (total mercury in Sockeye salmon) – 380.0 ng/g (total mercury in lake trout) in the Susitna Drainage (ADEC 2012). The average concentration among several species of fish sampled in 2013 from the Susitna drainage was within the range described by ADEC.

Study 5.7 Summary of Results since ISR Cont.

(Evaluation of Continued Mercury Monitoring Beyond 2014, September 2014 Tech Memo)

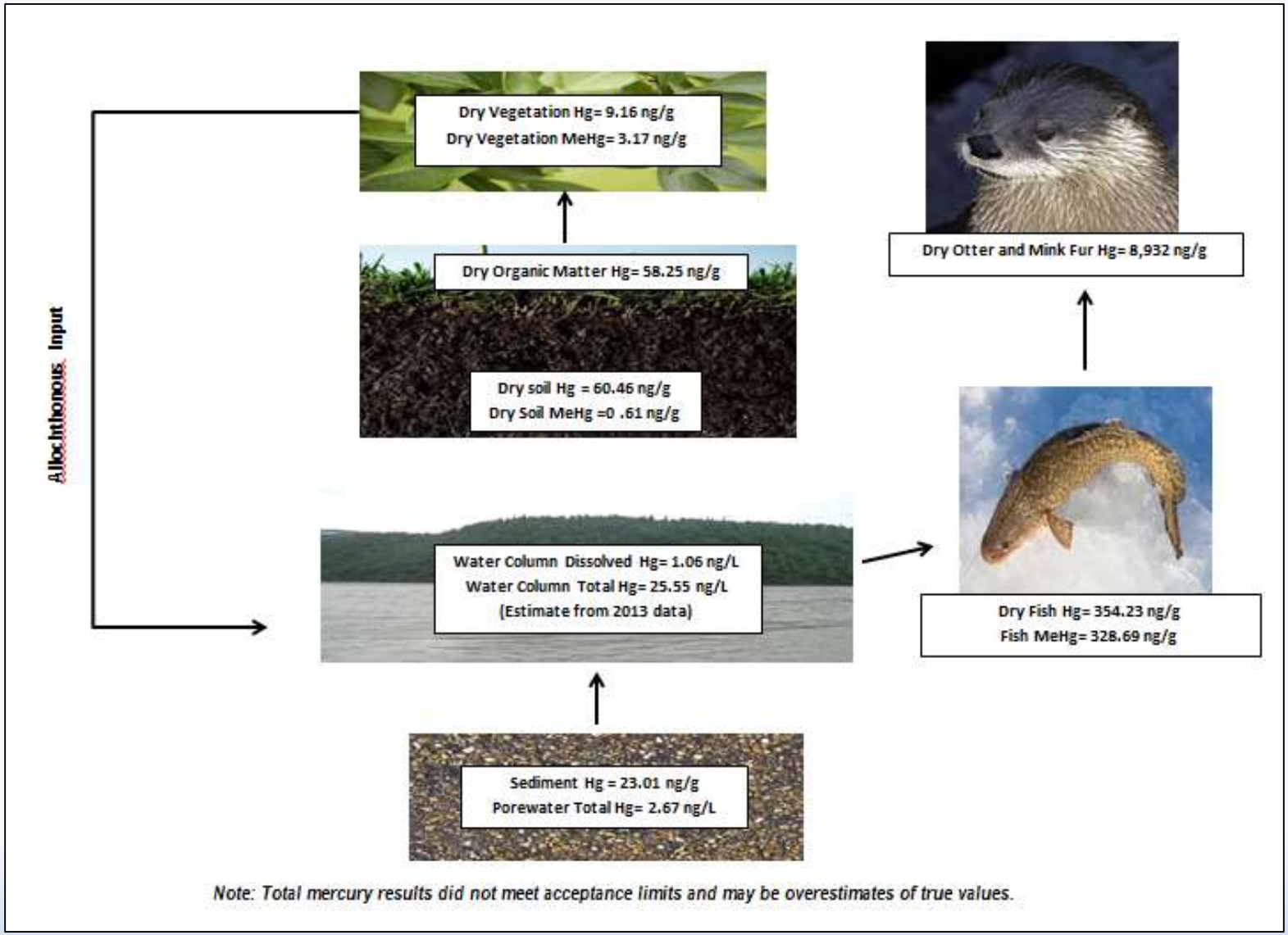
Sample Matrix	Max (ng/g dry or ng/L wet)	Min (ng/g dry or ng/L wet)	Criteria or Threshold
Hg in Dry Vegetation	16.1	6.71	
MeHg in Dry Vegetation	5.15	2.54	
Hg in Dry Organic Matter	129	26.8	
Hg in Dry Soil	119	27.1	
MeHg in Dry Soil	4.34	0.096	
[1]Dissolved Hg in Water Column	58.7	0.5	Acute = 2,040 ng/L
Total Recoverable Hg in Water Column	See note [2]	See note [2]	Aquatic Life: Chronic = 12 ng/L Acute = 2,400 ng/L Human Health = 50 ng/L
Hg in Sediment	220	1.82	(SQuiRT) 174 ng/g
Hg in Sediment Porewater	12.5	0.5	
Dry Fish Tissue Hg (no liver included)	2,920	26.9	[3]29.07 ng/g – 380 ng/g
Dry Fish MeHg (no liver included)	2,860	25.2	
Dry Otter/Mink Fur Hg	29,950	2070	

[1] Dissolved acute criterion is 85% of total recoverable mercury.

[2] Based on results from 2013 sampling, the total mercury concentrations for 2013 from water column samples are considered high estimates as results did not meet acceptance limits for laboratory performance. A correction factor will be developed for the 2013 results following QA/QC review of 2014 data

[3] Indicates range of total mercury reported from ADEC (2012) Susitna Basin study from several species with minimum concentration in Sockeye Salmon and maximum concentration in lake trout. (not an AWQS).

Study 5.7 Summary of Results since ISR Cont.



Note: Total mercury results did not meet acceptance limits and may be overestimates of true values.

AEA Proposed Modifications to Study 5.7 in ISR (ISR Study 5.7, Part C – Section 7.1.2)

7.1.2.1. Extension of Mercury Water Quality Sampling

- "Estimated" laboratory results call for more total mercury sampling in 2014 (change from RSP Section 5.7.4.2.3.)
  - Parameters affected: total metals (except Ca and Mg), total mercury, total phosphorus, total Kjeldahl nitrogen, total nitrate+nitrite-nitrogen, and dissolved aluminum

7.1.2.2. In-Accessible Sediment Sampling Locations

- Six sediment samples (planned for 2013) located on CIRWG lands will be collected for mercury analysis in 2014 (change from RSP Section 5.7.4.2.4.)

7.1.2.3. Modifications to Sediment Sampling Methods

- Originally planned to use a Van Veen sampler lowered from a boat (RSP Section 5.7.4.2.4.), but a boat in the upper river has proven impractical
  - Back to sediment sampling methods used in 2013 (ISR 5.5; Section 4.5)

AEA Proposed Modifications to Study 5.7 in ISR (ISR Study 5.7, Part C – Section 7.1.2) (Continued)

7.1.2.4. Modification of Sediment, Water, and Porewater Sampling Locations

- Sample locations for water, sediment, and sediment porewater sites in Upper River were modified slightly due to lack of access
  - Available data shows river as well mixed and water quality to have little variability

7.1.2.5. Modification of Fish Tissue Sampling

- Previous fish sampling in Upper Susitna Basin indicate humpback whitefish to be rare, they have been taken out of the study
- Rainbow trout and stickleback not found in inundation zone and also take out of the study
- Round whitefish were added to the study (all changes from RSP Section 5.7.4.6.1. and 5.5.4.7.)
- Only older aged burbot were caught, no younger (no additional sampling planned)

AEA Proposed Modifications to Study 5.7 in ISR (ISR Study 5.7, Part C – Section 7.1.2)

7.1.2.6. Modification of Piscivorous Wildlife Tissue Sampling

- Initial evaluation of the potential for bioaccumulation will focus on the aquatic environment
  - Samples for mercury study collected in 2014 only from water and sediment for analysis of mercury and methylmercury
- Collection of tissue samples from piscivorous wildlife for mercury analysis described for various species groups in Studies 10.11, 10.14, 10.15, and 10.16 is being consolidated under Study 5.7
- Very few samples of river otter or mink hair have been attained (trappers and hair snags)
  - Last resort would be to hire trappers for lethal collection of animals in study area for mercury analysis

AEA Proposed Modifications to Study 5.7 in ISR (ISR Study 5.7, Part C – Section 7.1.2) (Continued)

7.1.2.6. Modification of Piscivorous Wildlife Tissue Sampling

- Collecting feathers from vacated nests of piscivorous birds was found to be unproductive
  - Study 10.14 added three tasks to assist Study 5.7: provide info on distribution, abundance, foot habits and diet of piscivorous raptors, collect feather samples from active nests after nesting season for characterization of mercury levels, and provide information on the effects of methylmercury on piscivorous raptors
  - Possible use of contractor to capture live Bald Eagles to obtain blood and feather samples for mercury analysis
- Collecting feathers from vacated nests of piscivorous waterbirds (Study 10.15) was unsuccessful
  - Possible hiring of highly skilled specialty contractor to do live tissue sampling for mercury analysis
- Single target species of piscivorous landbird (Belted Kingfisher) because the species is rare and no nests were found
  - No longer considered suitable target species for mercury analysis

Current Status and Steps to Complete Study 5.7

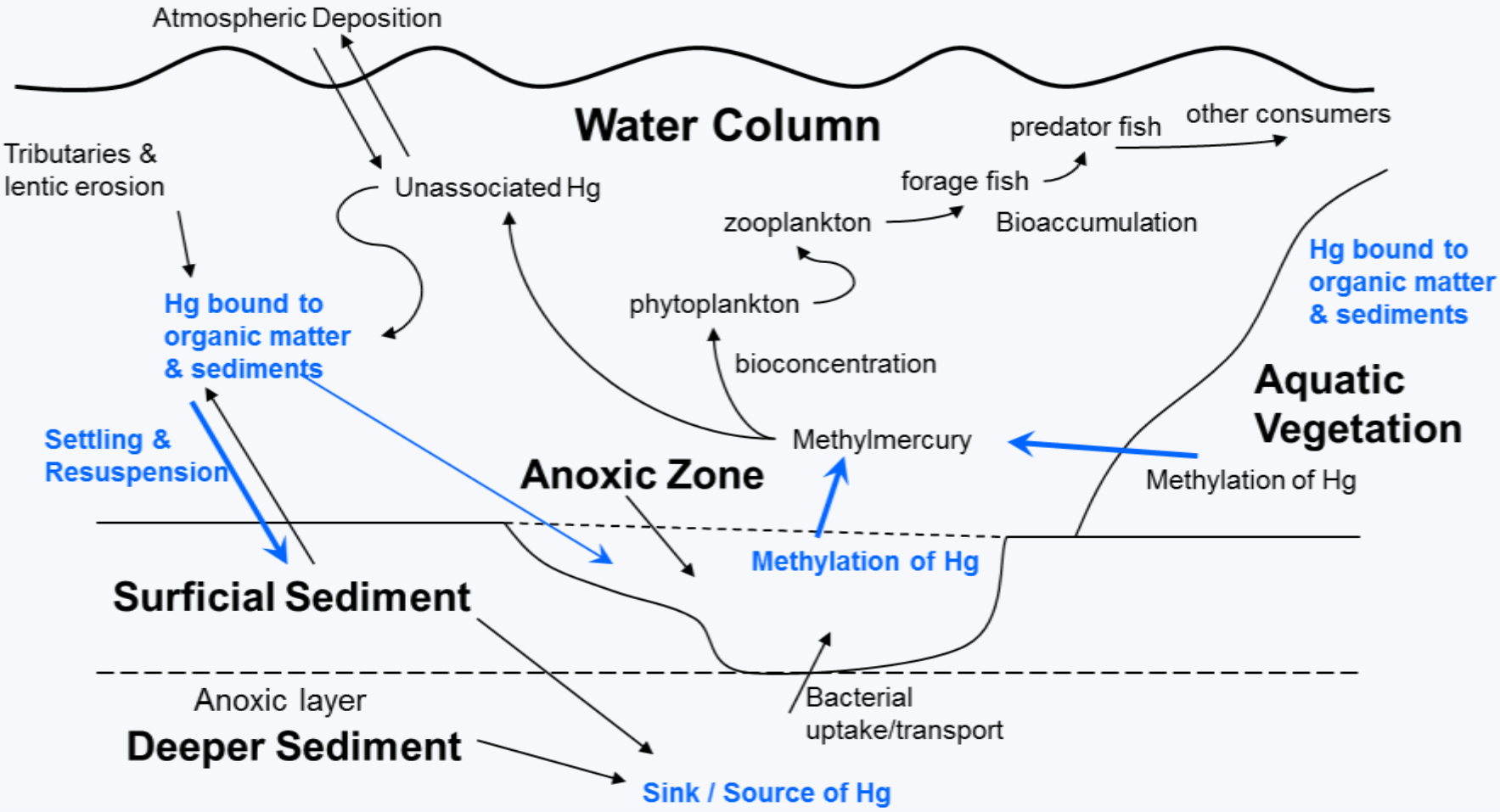
- In 2013, vegetation, soil, and fish tissue mercury sampling was completed and referenced in the ISR Study 5.7 Section 5.

- Planned activities for 2014 as referenced in ISR Study 5.7, Part C- Section 7.1 that have been completed include
  - Collection of sediment samples at the six remaining sites located on CIRWG lands (RSP Section 5.7.4.2.4)
  - Limited winter water quality sampling occurred in January and March of 2014 (RSP Section 5.7.4.2.3)
  - Summer monthly water sampling from June to September 2014 (see ISR Section 5.5 for details)

- Pathway analysis has not yet been completed and is the next major component of this study that will determine potential sources for bioaccumulation.

- Based upon its preliminary review of the mercury results measured in each of the media, AEA is not proposing any additional sampling for mercury in 2015.

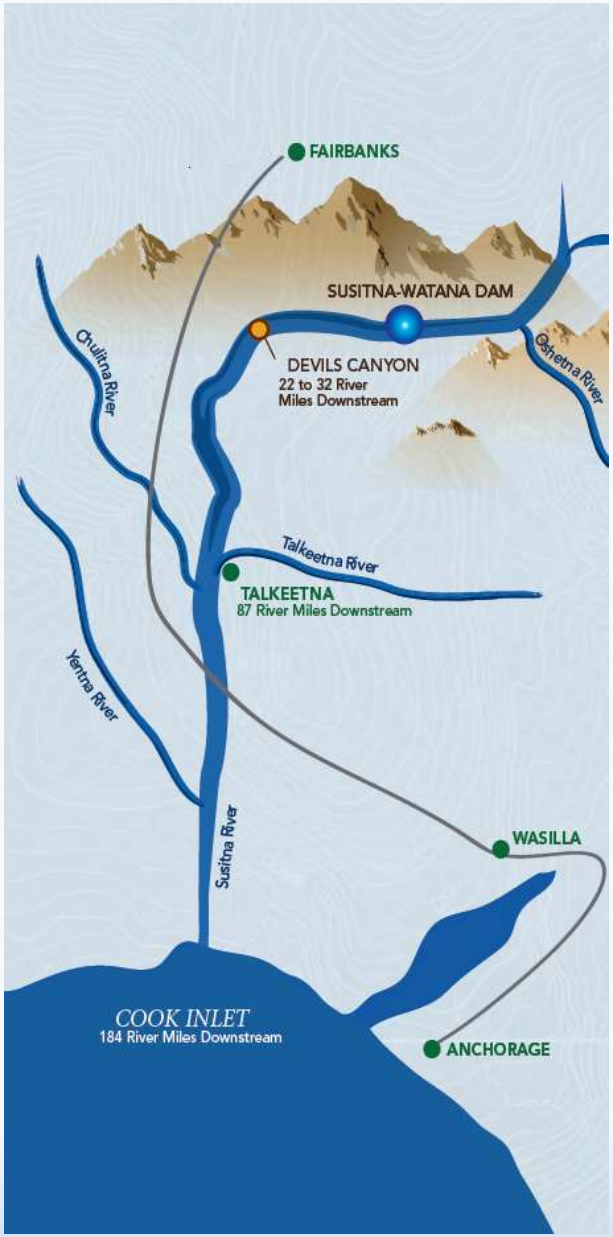
Potential Mercury Processes in Aquatic Ecosystems



Potential Mercury Pathway in a Mature Reservoir

Licensing Participants Proposed Modifications to Study 5.7?

- Agencies
- CIRWG members and Ahtna
- Public



Initial Study Report Meeting

Study 7.5 Groundwater

October 16, 2014

Prepared by GW Scientific

Study 7.5 Objectives

- **Synthesize** historical and contemporary groundwater data available for the Susitna River groundwater and groundwater dependent aquatic and floodplain habitat, including that from the 1980s and other studies including reviews of **GW/SW interactions in cold regions**
- Use the available groundwater data to **characterize large-scale geohydrologic process-domains/terrain of the Susitna River** (e.g., geology, topography, geomorphology, regional aquifers, shallow groundwater aquifers, GW/SW interactions)
- **Assess** the potential effects of **Watana Dam/Reservoir** on **groundwater and groundwater-influenced aquatic habitats** in the vicinity of the proposed dam
- Work with other resource studies to **map groundwater-influenced aquatic and floodplain habitat** (e.g., upwelling areas, springs, groundwater-dependent wetlands) within the Middle River Segment of the Susitna River including within selected Focus Areas (see Fish and Aquatic Instream Flow Study Section 8.5.4.2.1.2)
- Determine the **GW/SW relationships of floodplain shallow alluvial aquifers** within selected Focus Areas as part of the **Riparian Instream Flow Study** (Riparian Instream Flow Study, Section 8.6)
- Determine **GW/SW relationships** of **upwelling/downwelling** in relation to spawning, incubation, and rearing habitat (particularly in the winter) within selected Focus Areas as part of **the Fish and Aquatics Instream Flow Study** (Fish and Aquatic Instream Flow Study 8.5)
- **Characterize water quality** (e.g., temperature, dissolved oxygen [DO], conductivity) of **selected upwelling areas** that provide biological cues for fish spawning and juvenile rearing, in Focus Areas as part of the **Fish and Aquatics Instream Flow Study** (Fish and Aquatic Instream Flow Study (Study 8.5))
- Characterize the **winter flow in the Susitna River** and how it relates to **GW/SW interactions**
- Characterize the **relationship** between the **Susitna River flow** regime and **shallow groundwater users** (e.g., domestic wells)

Study 7.5 Components

- **Existing Data Synthesis** (ISR Part A, Section 4.1; pg 3)
- **Geohydrologic Process-Domains** (ISR Part A, Section 4.2; pg 4)
- **Watana Dam/Reservoir** (ISR Part A, Section 4.3; pg 5)
- **Upwelling/Springs Broad-Scale Mapping** (ISR Part A, Section 4.4; pg 7)
- **Riparian Vegetation Dependency on Groundwater/Surface-Water Interactions** (ISR Part A, Section 4.5; pg 8)
- **Aquatic Habitat Groundwater/Surface-Water Interactions** (ISR Part A, Section 4.6; pg 13)
- **Water Quality in Selected Habitats** (ISR Part A, Section 4.7; pg 15)
- **Winter Groundwater/Surface-Water Interactions** (ISR Part A, Section 4.8; pg 16)
- **Shallow Groundwater Users** (ISR Part A, Section 4.9; pg 17)

Study 7.5 Variances

- The schedule for completion of the annotated bibliography and literature review was adjusted to be complete in 2014. (ISR Part A, Section 4.1.1)
- The schedule for completion of the mapping of geohydrologic units and associated analysis will be completed in 2014. (ISR Part A, Section 4.2.1)
- The schedule for completion of the groundwater flow models, including model input and calibration data sets, files and model documentation was rescheduled into 2015. (ISR Part A, Section 4.5.1)
- The schedule for completion of the groundwater flow models, including model input and calibration data sets, files and model documentation was rescheduled into 2015. (ISR Part A, Section 4.6.1)
- The schedule for completion of the groundwater flow models, including model input and calibration data sets, files and model documentation was rescheduled into 2015. (ISR Part A, Section 4.7.1)
- Water quality data from other studies completed in the first study year will be used in the next year of study to describe the differences between productive and non-productive habitat types. (ISR Part A, Section 4.7.1)

Study 7.5 Summary of Results in ISR (ISR Study 7.5, Part A – Section 5)

- Completed all the planned **57 hydrology station installations and 66 shallow groundwater wells** by end of 2013 summer
- Data collection at continuously operated stations since installation in 2013
- Manual empirical measurements of groundwater and surface water
- Data station collection efforts continued during the winter season.
- **Empirical data collected over spring snowmelt and breakup, summer, fall freeze-up and winter hydrologic periods** is improving understanding of groundwater processes
- Empirical data **providing all of the physical process modeling efforts** (aquatic IFS, riparian IFS, water quality, geomorphology, and ice processes) **on-the-ground empirical benchmarks** for calibration and verification of physical process models.
- **Shallow groundwater found to be prevalent in the Middle River study area**.
- **Upland hydrological recharge from adjacent sides of the river valley to the floodplain** were observed and measured: springs and seeps, upland beaver ponds, areas without winter snow due to shallow groundwater conditions, and observed **winter open water conditions** in sloughs and creeks (open leads).

Study 7.5 Summary of Results since ISR

(September 2014 Tech Memo - Preliminary Groundwater and Surface-Water Relationships in Lateral Aquatic Habitats within Focus Areas FA-128 (Slough 8A) and FA-138 (Gold Creek) in the Middle Susitna River)

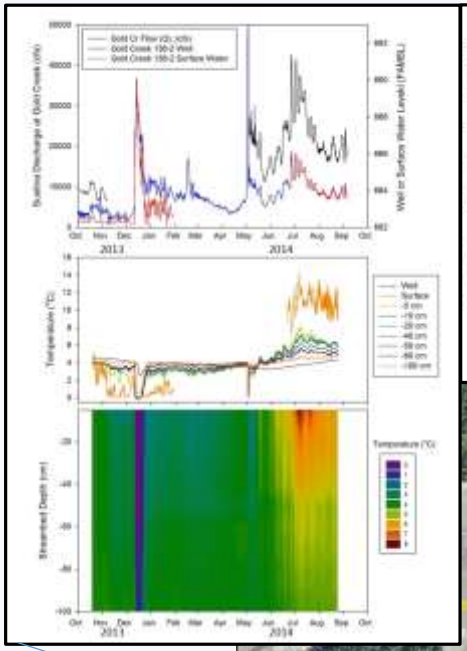
- End of winter hydrologic measurements, discharge measurements to determine groundwater recharge fluxes.

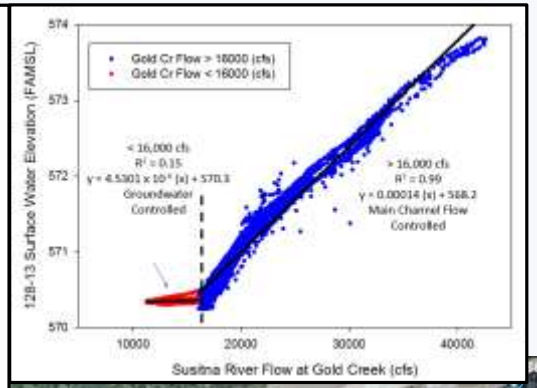
- Installation of 42 new staff gage locations in 2014. Discharge measurement planned at 25 of these locations in Fall of 2014.

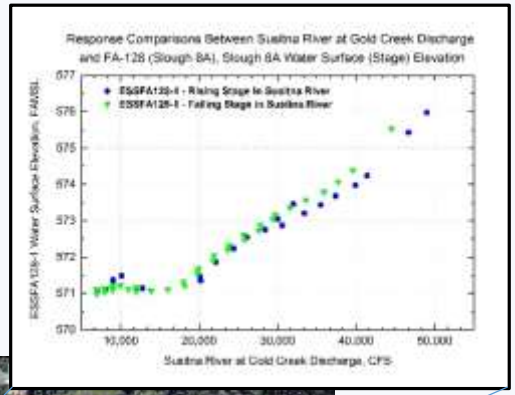
- New staff gage stations located at FA-144 (Slough 21) and FA-141 (Indian River) and PRM-112.

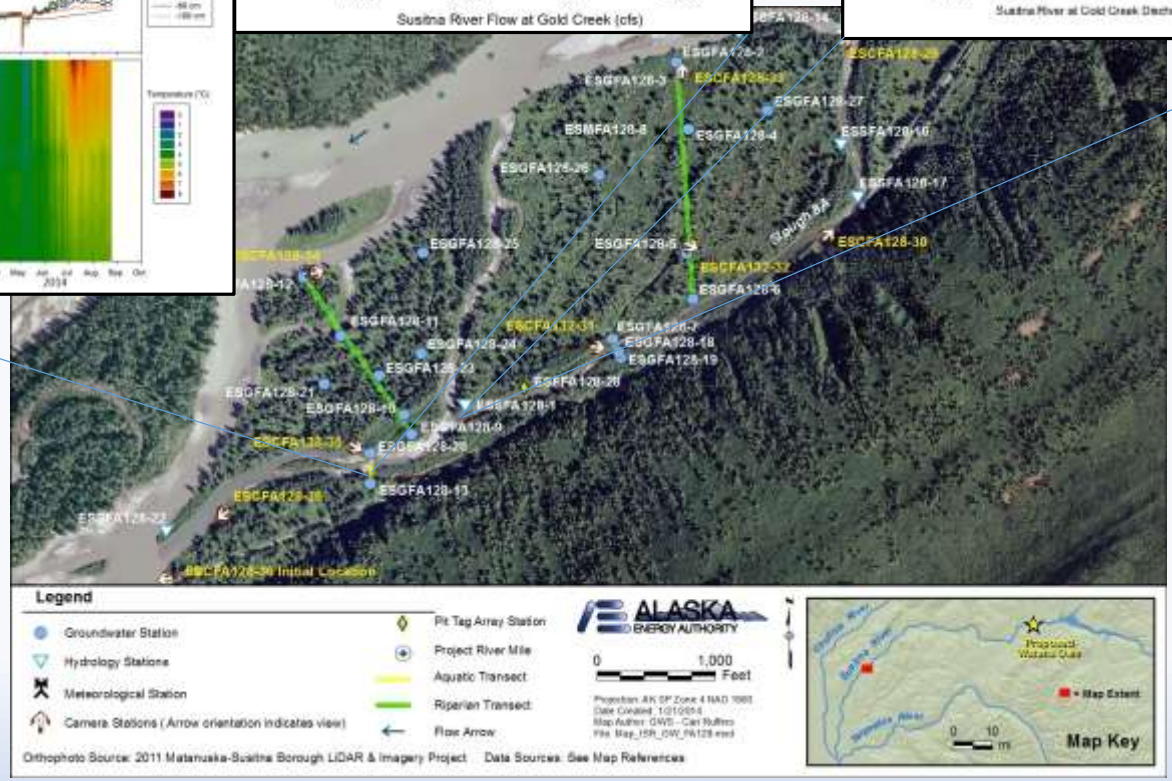
- Continued data collection at the following Focus Areas:
  - FA-138 (Gold Creek)
  - FA-128 (Slough 8A)
  - FA-115 (Slough 6A)
  - FA-113 (Oxbow 1)
  - FA-104 (Whiskers Slough)

Study 7.5 Summary of Results since ISR





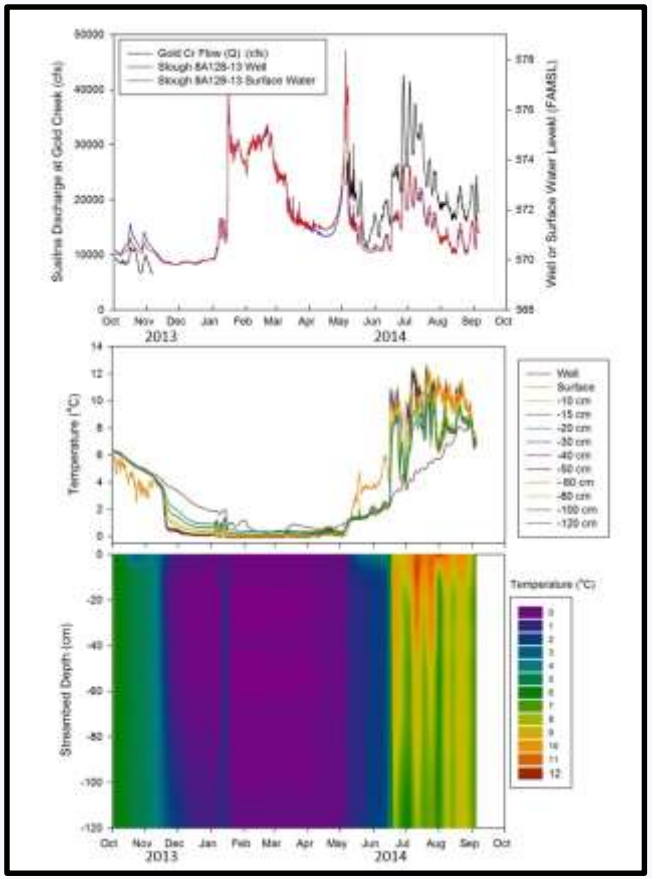




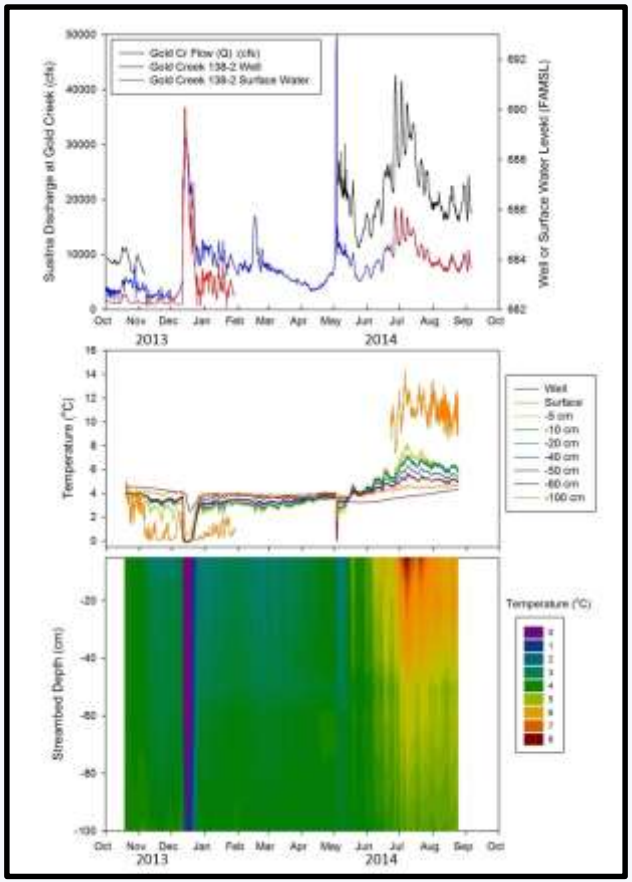
Examples of FA-128 (Slough 8A) Responses To Mainstem Flow *(note – results are preliminary)*

September 2014 Technical Memorandum - Preliminary Groundwater and Surface-Water Relationships in Lateral Aquatic Habitats within Focus Areas FA-128 (Slough 8A) and FA-138 (Gold Creek) in the Middle Susitna River.

Study 7.5 Summary of Results since ISR



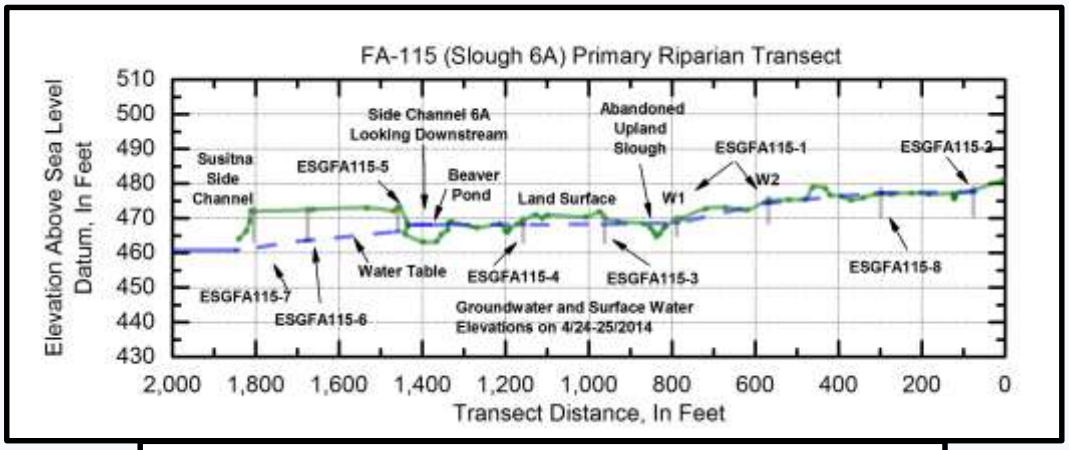
FA-128 (Slough 8A)
Middle Side Channel 8A
Lower Aquatic Transect
Downwelling Example



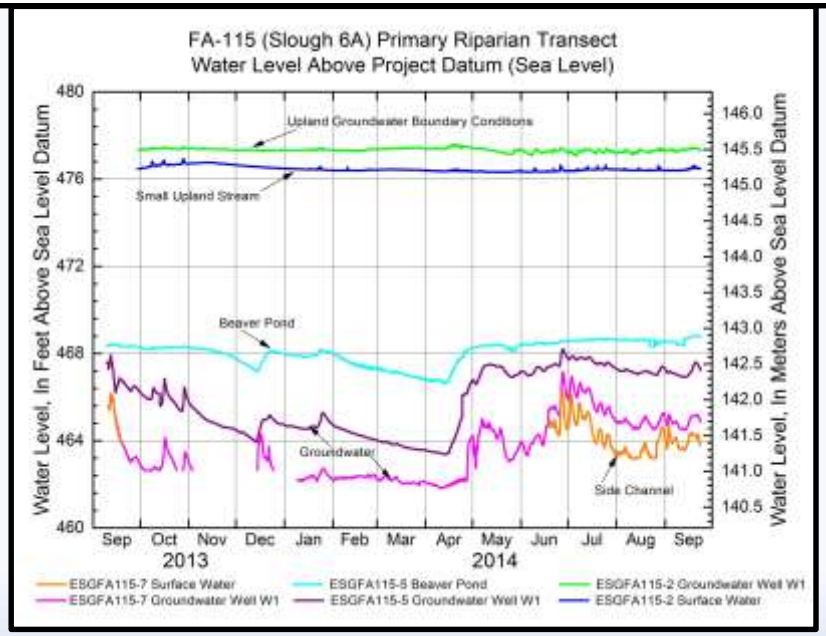
FA-138 (Gold Creek)
Upper Side Channel 11
Upper Aquatic Transect
Upwelling Example

September 2014 Technical Memorandum - Preliminary Groundwater and Surface-Water Relationships in Lateral Aquatic Habitats within Focus Areas FA-128 (Slough 8A) and FA-138 (Gold Creek) in the Middle Susitna River.

Study 7.5 Summary of Results since ISR



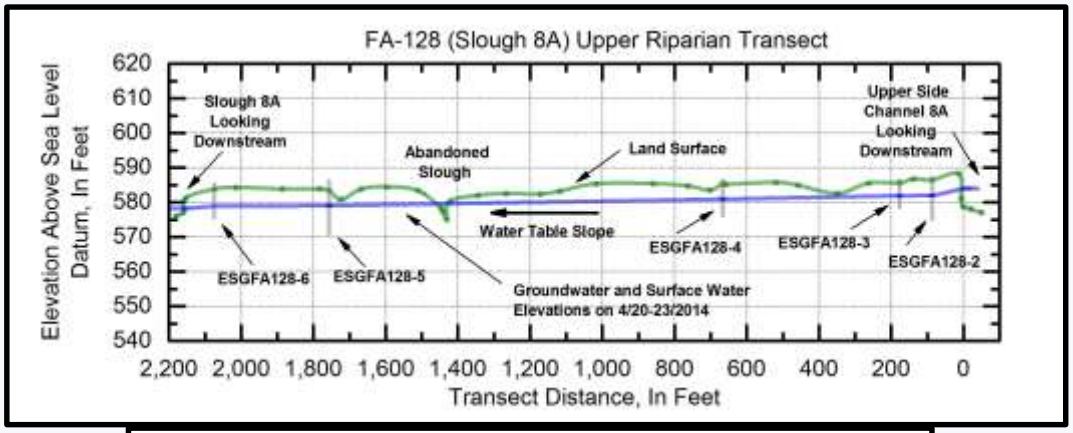
FA-115 (Slough 6A)
Primary Riparian Transect
Lateral Hydraulic Gradients



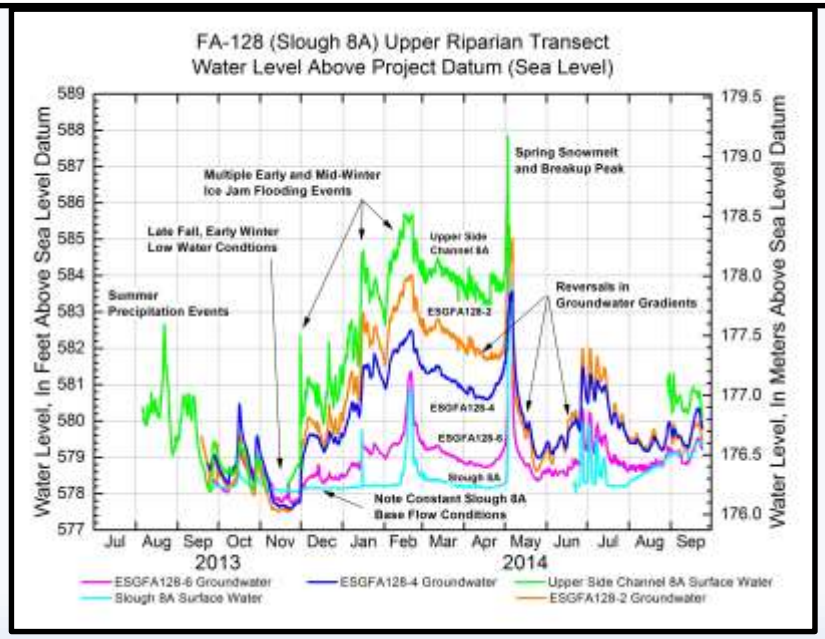
September 2014 Technical Memorandum - Groundwater and Surface-Water Relationships in Support of Riparian Vegetation Modeling

FA-115 (Slough 6A)
Primary Riparian Transect
Seasonal Water-Level Variation

Study 7.5 Summary of Results since ISR



FA-128 (Slough 8A)
Upper Riparian Transect
Lateral Hydraulic Gradients



- September 2014 Technical Memorandum - Groundwater and Surface-Water Relationships in Support of Riparian Vegetation Modeling

FA-128 (Slough 8A)
Upper Riparian Transect
Seasonal Water-Level Variation

AEA Proposed Modifications to Study 7.5 in ISR (ISR Study 7.5, Part C – Section 7.1.2)

- Schedule for completion of the ***groundwater flow models***, including model input and calibration datasets, files, and model documentation is now ***scheduled for Q3 2015*** to provide better integration with other hydrologic modeling efforts. This change in schedule will not impact the objectives of the study. AEA is scheduled to complete the first phase of groundwater flow models and associated analysis in 2014. (See discussion in ISR Sections 4.5, 4.6, and 4.7)

New Modifications to Study 7.5 since ISR

- The schedule for completion of the ***annotated bibliography*** and ***literature review*** was adjusted to be completed in ***2015***. This will allow additional information to be incorporated from the 1980s references located that the ARLIS library is still processing and new information from other studies. This change in schedule ***will not impact the objectives*** of the study.
- Collection of groundwater data from ***shallow groundwater user*** wells and other hydrologic data collection with analysis and reporting completed in ***2015***.
- The schedule for completion of the ***mapping of geohydrologic units*** and associated analysis was adjusted to be completed in ***2015***. This will allow incorporation of supporting information from other studies to be used to meet the study objectives. This change in schedule ***will not impact the objectives*** of the study.

Current Status and Steps to Complete Study 7.5

- AEA expects to complete the FERC-approved Study Plan through the filing of the Updated Study Report by February 1, 2016, in accordance with the ILP schedule issued by FERC on January 28, 2014. With regard to this specific study, AEA expects to complete data collection in both the 2014 and 2015 study seasons, which will be reported in the USR.

- Based on data collection completed in 2013, preliminary analyses, and plans for continued data collection in the next study year, the study is on track to meeting all study objectives.

Steps to Complete Study 7.5 (ISR Study 7.5, Part C – Section 7.1)

Tasks Being Completed in 2014

- Collection of water quality data to describe water quality conditions in lateral habitat and potential differences between selected productive and non-productive aquatic habitats.
- Modeling development and documentation of groundwater models and integration methods for linkages to 1D river flow routing models.
- Development of process relationship methods between mainstem flow and flow in select lateral habitat

Steps to Complete Study 7.5 (ISR Study 7.5, Part C – Section 7.1)

- Annotated bibliography and literature review
- Geohydrologic process-domains delineation
- Surveying of select hydrologic sites in Watana Dam area
- Watana Dam aquatic hydrology evaluation
- Upwelling/springs broad scale mapping
- Winter and summer data collection to refine understanding of groundwater/surface-water interactions
- Finalization of the groundwater flow models, model input and calibration datasets, files, and model documentation

Licensing Participants Proposed Modifications to Study 7.5?

- Agencies
- CIRWG members and Ahtna
- Public