Susitna-Watana Hydroelectric Project (FERC No. 14241)

Fluvial Geomorphology Modeling below Watana Dam Study Study Plan Section 6.6

Part D: Supplemental Information to June 2014 Initial Study Report

Prepared for

Alaska Energy Authority

SUSITNA-WATANA HYDRO

Clean, reliable energy for the next 100 years.

Prepared by

Tetra Tech

Watershed Geodynamics

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TABLE OF CONTENTS

1. INTRODUCTION

Section 1 (Part A) of the June 2014 ISR for this Fluvial Geomorphology Modeling below Watana Dam Study (Study Plan 6.6) details the development of this study from the Revised Study Plan (RSP) in 2012, through the end of the 2013 study season. Section 7 of the ISR (Part C), filed in June 2014, sets forth AEA's plan and schedule, at that time, for completing this study and meeting the objectives of the RSP.

As detailed in Section 2.2 of the ISR Part D Overview, various circumstances have required AEA to extend the original timeframe for completing the Commission-approved Study Plan. However, AEA has made meaningful progress with this Study 6.6 since the filing of the ISR in June 2014. As detailed below, AEA's recent activities for Study 6.6 have consisted of the following:

- Collection of 2014 data in the Upper, Middle, and Lower Susitna River Segments including high density LiDAR, tributary cross sections, Upper River cross sections, main channel and tributary bed material surface and sub-surface samples, bank material samples, water surface elevation surveys, and discharge measurements.
- On May 25, 2014, AEA filed the "Updated Fluvial Geomorphology Modeling Approach Technical Memorandum" which included "Attachment A: FA-128 (Slough 8A) Hydraulic Modeling Proof of Concept."
- On June 3, 2014, AEA filed Part A of the Initial Study Report for Study 6.6, which included "Appendix E: Evaluation of 50-Year Simulation Period, Pacific Decadal Oscillation, and Selection of Representative Annual Hydrographs."
- On September 26, 2014, AEA filed the "Winter Sampling of Main Channel Bed Material Technical Memorandum."
- On September 26, 2014, AEA filed the "Decision Point on Fluvial Geomorphology Modeling of the Susitna River below PRM 29.9 Technical Memorandum."
- AEA held the first ISR meeting on October 15-17, 21-23, 2014 in Anchorage. The Study 6.6 portion of the meeting was on October 16, 2014.
- Prepared the "2014 – 2015 Study Implementation Report for Fluvial Geomorphology Modeling Below Watana Dam Study (6.6)" presenting methods, variances, and data collected for study components that have been completed since filing the June 2014 ISR, and filed in November 2015.
- The "Study Implementation Report" also includes Attachment 1, a technical memorandum "2014 Fluvial Geomorphology Modeling Development." The TM provides detailed information on the development, calibration, and application of the initial 1-D and 2-D Bed Evolution Models developed by Study 6.6.

The primary purpose of this Part D Supplemental Information to the ISR is to report on the implementation of the Study Plan from the filing of the ISR in June 2014, through the filing of

this ISR Part D. In light of this additional implementation, this Part D also identifies AEA's plans for completing Study 6.6 in a manner that meets the objectives of the Commission-approved Study Plan.

2. BACKGROUND

2.1. Purpose of Study

The overall goal of the Fluvial Geomorphology Modeling below Watana Dam Study is to model the effects of the proposed Project on the fluvial geomorphology of the Susitna River to assist in predicting the trend and magnitude of geomorphic response. More specifically, the purpose of the modeling study, along with the Geomorphology Study (Study 6.5), is to assess the potential impact of the Project on the behavior of the river downstream of the proposed dam, with particular focus on potential changes in instream and riparian habitat. Whether the existing channel morphology will remain the same or at least be in "dynamic equilibrium" under post-Project conditions is a significant question in any instream flow study (i.e., is the channel morphology in a state of dynamic equilibrium such that the distribution of habitat conditions will be reflected by existing channel morphology, or will changes in morphology occur that will influence the relative distribution or characteristics of aquatic habitat over the term of the license? [Bovee 1982]). This key issue prompts four overall questions that must be addressed by the two geomorphology studies:

- Is the system currently in a state of dynamic equilibrium?
- If the system is not currently in a state of dynamic equilibrium, what is the expected evolution over the term of the license in the absence of the Project?
- Will and in what ways will the Project alter the equilibrium status of the downstream river (i.e., what is the expected morphologic evolution over the term of the license under with-Project conditions)?
- What will be the expected effect of the Project-induced changes on the geomorphic features that form the aquatic habitat and therefore are directly related to the quantity, distribution, and quality of the habitat?

The methods and results from the Geomorphology Study and the Fluvial Geomorphology Modeling below Watana Dam Study address these questions.

Specific objectives of the Fluvial Geomorphology Modeling below Watana Dam Study are as follows:

- 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 understanding of geomorphic processes and controls to identify potential Project effects that require interpretation of model results. And 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.

2.2. Study Components

There are 3 study components in the Fluvial Geomorphology Modeling below Watana Dam Study (6.6), each of which aligns with the 3 objectives listed in Section 2.1. The study components are:

- SC-1 – Bed Evolution Model Development, Coordination, and Calibration
- SC-2 – Model Existing and with-Project Conditions
- SC-3 – Coordination and Interpretation of Model Results

3. STATUS, HIGHLIGHTED RESULTS, AND ACHIEVEMENTS

In 2013, significant efforts were conducted on the 3 study components in the Fluvial Geomorphology Modeling below Watana Dam Study. Data collected in 2013 by Study 6.6 or collected by other studies that are required for Study 6.6 modeling include:

- Cross section surveys and bed material sampling at 11 smaller tributaries in the Middle and Lower Susitna River Segments.
- Cross section surveys, water surface elevation measurements, and bed material sampling on the Susitna, Chulitna, and Talkeetna Rivers.
- Bank material sampling on the Middle Susitna River.
- Detailed bathymetric survey, bed and bank material sampling, water surface measurements, and ADCP velocity and discharge measurements at 7 Middle Susitna River Focus Areas
- Cross section observations of bank and floodplain characteristics along the Middle and Lower Susitna River Segments
- LiDAR data acquisition of 107.7 square-miles along the Susitna, Talkeetna, and Chulitna Rivers

In June 2013, the initial version of the Fluvial Geomorphology Modeling Approach Technical Memorandum was submitted. This TM provided information on the range of modeling that was anticipated in Study 6.6 and included background on the specific model programs that were considered to perform the analyses.

In 2014, the 3 study components were all advanced using data collected in 2013. In 2014, 1-D hydraulic models were developed for the smaller tributaries, initial 1-D hydraulic and sediment transport models were developed for the Middle and Lower Susitna River Segments, initial 1-D hydraulic models were developed for the lower portions of the Chulitna and Talkeetna Rivers, an initial 2-D hydraulic model was developed for 1 focus area (FA-128 – Slouch 8A), and an initial 2-D sediment transport model was developed for one focus area (FA-128 – Slouch 8A). In addition to the modeling efforts, the following data were collected by Study 6.6 in 2014:

- Winter bed material sampling was conducted along the Upper, Middle, and Lower Susitna River Segments, Chulitna River and Talkeetna River by obtaining video of the channel bed through the ice-covered channel.
- Additional surveys and bed material samples were collected at 12 small tributaries.
- Continued bed and bank material sampling, and cross section observations were conducted along the Middle and Lower Susitna River Segments.
- Discharge measurements were conducted to characterize groundwater inputs to lateral features in 7 Focus Areas
- LiDAR data covering 223 square-miles was acquired.

The majority of the results of these efforts since filing of the ISR were documented in the following technical memorandums filed in 2014.

- Updated Fluvial Geomorphology Modeling Approach Technical Memorandum, which included Attachment A: FA-128 (Slough 8A) Hydraulic Modeling Proof of Concept (May 2014)
- Evaluation of 50-Year Simulation Period, Pacific Decadal Oscillation, and Selection of Representative Annual Hydrographs (Appendix E of Study 6.6 ISR, June 2014)
- Winter Sampling of Main Channel Bed Material Technical Memorandum (September 2014)
- Decision Point on Fluvial Geomorphology Modeling of the Susitna River below PRM 29.9 Technical Memorandum (September 2014)

The SIR includes an additional technical memorandum as Attachment 1:

- 2014 Fluvial Geomorphology Modeling Development Technical Memorandum

4. SUMMARY OF STUDY 6.6 DOCUMENTS

Since filing of the RSP in 2012, AEA and FERC have prepared several documents pertaining to this study. To aid review by FERC staff and licensing participants, each of these documents is listed below. Each of these documents is accessible on AEA's Project licensing website (http://www.susitna-watanahydro.org/type/documents/) by clicking on the entry in the "Link"

column in the table. In addition, these documents are available on FERC's eLibrary system (http://www.ferc.gov/docs-filing/elibrary.asp), in Docket No. P-14241.

Title	Date	Description	Link
Revised Study Plan Section 6.6, Fluvial Geomorphology Modeling below Watana Dam Study	12/14/2012	This document presents the plan for this study, including goals, objectives, the study area, and proposed study methods to, in conjunction with Study 6.5, determine Project effects to the fluvial geomorphology of the Susitna River including its channel and floodplain with particular focus on providing information to assist in predicting Project impacts to aquatic and terrestrial habitat.	RSP for Study 6.6
FERC Study Plan Determination	4/1/2013	This document presents FERC approval of Study 6.6, which approved AEA's Revised Study Plan with recommended adjustments.	FERC SPD for Study 6.6
Fluvial Geomorphology Modeling Approach Technical Memorandum	7/1/2013	The objective of the technical memorandum was to document the procedures for modeling fluvial geomorphology of the Susitna River below Watana Dam. Methods for addressing reach-scale and local-scale issues were discussed.	July 2013 TM for Study 6.6
Draft Initial Study Report: Fluvial Geomorphology Modeling Below Watana Dam Study (6.6), Part A	2/3/2014	This draft of the ISR summarized the study methods and variances during the 2013 study season, and presented preliminary data collected for Study 6.6. This draft ISR was later republished as Part A of the final ISR.	Draft ISR for Study 6.6 (File 1) Draft ISR for Study 6.6 (File 2)
Appendix A (Draft Initial Study Report, Study 6.6, Part A)	2/3/2014	Appendix A includes a summary of bed-material samples from the 2013 field data collection effort.	Draft ISR for Study 6.6 (File 3)
Appendix B (Draft Initial Study Report, Study 6.6, Part A)	2/3/2014	Appendix B includes a summary of bed-material sample locations in Focus Areas as part of the 2013 field data collection effort.	Draft ISR for Study 6.6 (File 4)
Appendix C (Draft Initial Study Report, Study 6.6, Part A)	2/3/2014	Appendix C includes a summary of bank material samples from the 2013 field data collection effort.	Draft ISR for Study 6.6 (File 5)
Appendix D (Draft Initial Study Report, Study 6.6, Part A)	2/3/2014	Appendix D includes a summary of the water surface measurements collected as part of the 2013 field data collection effort.	Draft ISR for Study 6.6 (File 6)
Evaluation of 50-Year Simulation Period, Pacific Decadal Oscillation, and Selection of Representative Annual Hydrographs	6/3/2014	The objective of this technical memorandum was to document the selection of the hydrologic conditions that are to be used in the 1-D and 2-D fluvial geomorphology modeling, including (1) identification of the 50 years that will be used for reach-scale modeling out of the 61 available years from the USGS streamflow record extension study, (2) identify candidate years from the 50	Draft ISR for Study 6.6 (File 7)

Title	Date	Description	Link
(Draft Initial Study Report 6.6, Part A, Appendix E)		years of representative dry, average and wet conditions including warm and cool PDO, and (3) from the candidate years, recommend representative years for fluvial geomorphology modeling in the Focus Areas	
Field Assessment of Underwater Camera Pilot Test for Sediment Grain Size Distribution (Draft Initial Study Report 6.6, Part A, Attachment A)	2/3/2014	This field report summarizes the field assessment in March 2013 of underwater camera use and acquisition of bed material imagery for the purpose of quantifying main channel grain size distribution. The goals of this effort were to (1) determine if the collecting images for bed material size distribution through ice is feasible and (2) to test various equipment for underwater bed material image acquisition and determine equipment and methods to apply to future full-scale studies.	Draft ISR for Study 6.6 (File 8)
Updated Fluvial Geomorphology Modeling Approach Technical Memorandum	5/25/2014	The objective of the technical memorandum was to update and document modifications to the procedures included in the June 2013 FGM Approach TM. The final selected 1-D and 2-D models were identified.	May 2014 TM for Study 6.6 (File 1)
FA-128 (Slough 8A) Hydraulic Modeling Proof of Concept (Updated Fluvial Geomorphology Modeling Approach Technical Memorandum, Attachment A)	5/25/2014	The Proof of Concept 2-D hydraulic model of FA-128 was documented in Attachment A of the Updated Fluvial Geomorphology Modeling Approach TM, and presented in the Fish and Aquatics Instream Flow Technical Team meeting held on April 15-17, 2014.	May 2014 TM for Study 6.6 (File 2)
Initial Study Report: Fluvial Geomorphology Modeling below Watana Dam Study (6.6), Parts A, B and C	6/3/2014	This document is the Initial Study Report (Parts A, B and C) for Study 6.6. Part A republishes the Draft ISR. Part B identifies supplemental information and errata in Part A. Part C presents study modifications and plans for completing the study.	ISR Part A for Study 6.6 (File 1) ISR Part A for Study 6.6 (File 2) ISR Part A for Study 6.6 (File 3) ISR Part B for Study 6.6 ISR Part C for Study 6.6
Winter Sampling of Main Channel Bed Material Technical Memorandum	9/26/2014	The overall purpose of the work presented in this technical memorandum was to quantify main channel bed material gradations at selected sites in the Upper, Middle, and Lower Susitna River Segments. To accomplish this work, sampling was performed in the winter through the ice when low turbidity allowed the collection of high quality videography of the bed. Screen captures of the videography were orthorectified. This effort was a result of innovations developed as part of the Susitna-Watana licensing effort.	Sept. 2014 TM for Study 6.6

Title	Date	Description	Link
Decision Point on Fluvial Geomorphology Modeling of the Susitna River below PRM 29.9 Technical Memorandum	9/26/2014	This technical memorandum describes the decision of whether to extend the downstream limit of the 1-D bed evolution model below Susitna Station at PRM 29.9. Because flows, sediment volumes, and hydraulic variables fall outside (below) the range of natural variability infrequently and by small amounts, AEA recommended that the bed evolution model not be extended below PRM 29.9.	Sept. 2014 TM for Study 6.6
Initial Study Report (ISR) Meetings, Fluvial Geomorphology Modeling below Watana Dam Study (6.6)	11/15/2014	The purpose of the ISR Meetings was to describe the status of Study Plan implementation and explain any variances and proposed modifications to ongoing studies for completion of the Study Plan. Includes transcripts and AEA's agenda and PowerPoint presentations for the ISR meeting.	Transcripts from ISR Meeting Materials from ISR Meeting
2014 to 2015 Study Implementation Report (SIR), Study 6.6 Fluvial Geomorphology Modeling below Watana Dam Study	11/4/2015	This report describes data collected in 2014 and analyses that were conducted in 2014 and 2015.	2014-2015 SIR for Study 6.6 (File 1)
2014 Fluvial Geomorphology Modeling Development Technical Memorandum (2014 to 2015 Study Implementation Report, Study 6.6 Fluvial Geomorphology Modeling below Watana Dam Study, Attachment 1)	11/4/2015	The purpose of this technical memorandum is to document the development, calibration, validation, and application of the initial 1- and 2-D sediment transport models following the methods described in the "Updated Fluvial Geomorphology Modeling Approach Technical Memorandum" from May 2014.	2014-2015 SIR for Study 6.6 (File 2) 2014-2015 SIR for Study 6.6 (File 3) 2014-2015 SIR for Study 6.6 (File 4)

5. NEW STUDY DOCUMENTATION SUPPLEMENTING THE ISR

The following table identifies and describes additional reports and other documents that update, refine, or otherwise supplement certain sections of the ISR pertaining to this Study 6.6, during AEA's continued implementation of the Study Plan through calendar year 2014.

ISR Reference	Description
Part A, Section 4	This Section is updated and supplemented by the Study Implementation Report for Study 6.6 (Section 4), which described the study methods and variances in 2014 – 2015.
Part A, Section 5	This Section is updated and supplemented by the Study Implementation Report for Study 6.6 (Section 5), which described the study results in 2014 – 2015.
Part A, Section 6	This Section is updated and supplemented by the Study Implementation Report for Study 6.6 (Section 6), which discusses the study results in 2014 – 2015.
Part C, Section 7	The decision points and modifications in this section are updated and supplemented by the Study Implementation Report for Study 6.6 (Section 7), which presents the decision points from 2014 and proposed modifications after conducting studies in 2014 -2015.
Part C, Section 7	The Steps to Complete the Study in this section are superseded by Section 8 in this document (Part D).

6. VARIANCES

6.1. 2013 Study Season

As noted in Section 4 of the ISR (Parts A and B) for this study, AEA encountered no variances when implementing this study in 2013.

6.2. 2014 Study Season

Variances are reported in the Study 6.6 SIR Section 4 under their corresponding study components. In all cases, the variances did not interfere with AEA's ability to meet study objectives. (Note: Variances that solely address the timing of study efforts have not been included in this list.)

- Subsequent to submittal of the ISR, a variance was identified as part of the 1-D bed evolution model sediment calibration. This involved use of the Ackers White sediment transport function rather than the planned use of the Wilcock Crowe function. The Model Development TM (SIR Attachment 1) describes the use of Ackers White and demonstrates its suitability. This variance does not affect AEA's ability to meet the objectives of this study component.

- ISR Part C, Section 7.1.2.1 describes a proposed Study Plan modification to include groundwater sources into the 2-D hydraulic models at Focus Areas to more accurately maintain wetted areas in some sloughs and other lateral features when they become disconnected from upstream river sources. This modification is currently considered a variance because it has not been approved, but has been implemented as discussed in the

Proof of Concept. This variance increases AEA's ability to meet the objectives of this study component.

- ISR Part C, Section 7.1.2.2 includes a recommended modification related to representative hydrology. The modification, which is currently a variance, is to not consider Pacific Decadal Oscillation (PDO) for open water conditions because it was determined that PDO is not a significant distinguishing factor affecting hydrologic characteristics. Because PDO has not been used do select representative hydrologic conditions used in subtasks 1 and 2 efforts, this is currently a variance from the Study Plan. The basis for this recommended modification is described in ISR Study 6.6 Part A, Appendix E. The modification does not affect AEA's ability to meet the objectives of this study component.

7. STUDY PLAN MODIFICATIONS

7.1. Modifications Identified in ISR

As noted in Section 7 of the ISR (Part C) for this study, AEA proposed modifications to the study plan.

- ISR Part C, Section 7.1.2.1 includes a requested modification to include groundwater sources into the 2-D hydraulic models at Focus Areas to more accurately maintain wetted areas in some sloughs and other lateral features when they become disconnected from upstream river sources. This requested modification is currently considered a variance because it has not been approved, but has been implemented as discussed in the FA-128 (Slough 8A) Hydraulic Modeling Proof of Concept. This led to the efforts by Studies 6.6 and 8.5 (Fish and Aquatics Instream Flow) to measure and estimate flows in lateral features as described in the Study 6.6 SIR Section 5.1.2.4. This variance increases AEA's ability to meet the objectives of this study component.

- ISR Part C, Section 7.1.2.2 includes a modification related to representative hydrology. The modification, which is currently a variance, is to not consider Pacific Decadal Oscillation (PDO) for open water conditions because it was determined that PDO is not a significant distinguishing factor affecting hydrologic characteristics. This determination is described in ISR Study 6.6 Part A, Appendix E. The modification does not affect AEA's ability to meet the objectives of this study component.

- ISR Part C, Section 7.1.2.2, AEA proposes to exclude dimensionless critical shear as a parameter to evaluate model sensitivity and uncertainty depending on the selected sediment transport function. Other suitable variables will be included in the sensitivity analysis based on the formulation of the function. This proposed modification does not affect AEA's ability to meet the objectives of this study component.

7.2. Modifications Identified since the June 2014 ISR

As detailed in the 2014 Implementation Report for this study, AEA proposed modifications to this study to complete the study in a manner that meets Study Plan objectives. These modifications are generally summarized as follows:

- Subsequent to the submittal of the ISR, a modification was identified as part of the 2-D model application of the Bank Energy Index (BEI) in Study Component 2, Model Existing and with-Project Conditions and is described in Attachment 1 of the SIR in Section 6.2.4. The BEI analysis was planned as an approach to address bank erosion and production of large woody debris. The analysis results indicate that open water flows do not contribute appreciably to bank erosion at FA-128 (Slough 8A) and that bank erosion is more likely related to ice processes. The proposed modification is to perform the BEI at one other Focus Area, and if the results are similar, not continue BEI analyses for open water conditions at the remaining Focus Areas. Because the evaluation of ice processes on channel geomorphology (ISR Section 4.1.2.8) will still be conducted, this modification does not affect AEA's ability to meet the objectives of this study component.

- Also subsequent to the submittal of the ISR, a modification was identified as part of the 2-D bed evolution modeling of existing and future conditions. As described in the SIR Attachment 1, Section 5.2.1, in addition to simulating the Wet, Average and Dry open water period hydrographs at FA-128 (Slough 8A), a sequence of 8 annual flow periods was simulated to effectively project conditions out to years 25 and 50. This was due to the continued accretion of Skull Creek fan. Therefore, at other Focus Areas, additional years may be run in addition to the Wet, Average and Dry representative hydrographs. The number of years will be selected for each Focus Area based primarily on tributary fan development. This proposed modification increases AEA's ability to meet the objectives of this study component.

8. STEPS TO COMPLETE THE STUDY

In light of the variances and modifications described above, the steps necessary for AEA complete this study are summarized below. As necessary and appropriate, these steps have been updated from those appearing in Section 7 of the ISR (Part C).

8.1. Study Component: Bed Evolution Model Development, Coordination, and Calibration

Work under the tasks included in this study component followed methods described in the RSP Section 6.6.4.1 and Study 6.6 ISR Section 4.1.2. Efforts for completing the study are detailed in Study 6.6 ISR Sections 7.1.2.1 and 7.2.2.1. Work under several other tasks has been completed and others have progressed but will need to be completed as described below:

Development of Bed Evolution Model Approach and Model Selection: Work on this task is largely complete as the models have been selected and the approaches have been identified.

Development of additional metrics from the model output is expected to evolve through coordination with other studies.

Coordination with other Studies: Coordination with other studies will be ongoing.

Model Resolution and Mesh Size Considerations: This task is complete.

Focus Area Selection: This task is complete.

Model Calibration and Validation: This task will continue as described below:

- Develop and calibrate version 2 of the 1-D BEM for the Middle and Lower Susitna River Segments by incorporating 2014 survey and LiDAR, including the Chulitna and Talkeetna Rivers as model reaches, incorporating sediment supply from smaller tributaries incorporating bed material sampling data collected in 2014.
- Develop and calibrate 2-D hydraulic models and 2-D BEMs for additional Focus Areas including the 2014 LiDAR.

Tributary Delta Modeling: Finalize development of sediment supplies from smaller tributaries in the Middle and Lower Susitna River Segments. Based on the sediment and flow supplied from the tributaries and Susitna River hydraulic conditions, evaluate tributary delta formation for existing and with-Project conditions.

Large Woody Debris Modeling: In coordination with the Geomorphology Study (Study 6.5) and Ice Processes Study (Study 7.6) estimate project effects on bank erosion and LWD recruitment from bank erosion. Apply procedures for accounting for the hydraulic effects of changes in LWD on local- and reach-scales.

Wintertime Modeling and Load-Following Operations: Further integration with the Ice Processes (Study 7.6) and Riparian Instream Flow (Study 8.6) Studies will occur. These studies will coordinate on the procedures used to simulate the inundation and potential sedimentation that can occur during breakup. The results of the Study 7.6 River1D and River2D models will be used to evaluate changes in bed mobilization and erosion that can occur.

Field Data Collection Efforts: Data collection efforts are complete for this study except that channel cross sections and focus area bathymetry and ADCP measurements are required upstream of Devils Canyon [FA-173 (Stephan Lake) and FA-184 (Watana Dam)]. Future data needs that are identified would also need to be addressed.

8.2. Study Component: Model Existing and with-Project Conditions

Work under the tasks included in this study component followed methods described in the RSP Section 6.6.4.2 and Study 6.6 ISR Section 4.2.2. Efforts for completing the study are detailed in Study 6.6 ISR Sections 7.1.2.2 and 7.2.2.2. Work under the tasks has progressed but will need to be completed as described below:

Existing Conditions – Base Case Modeling: Perform existing conditions runs with version 2 of the 1-D BEM (in process) and final 2-D hydraulic and BEM models developed in Study Component 1. Initial 2-D hydraulic models are in process at FA-104 (Whiskers Slough), FA-113/115 (Oxbow 1 and Lane Creek).

Future Conditions – With Project Scenarios: Perform parallel efforts to the existing conditions runs for the selected operational conditions.

Uncertainty: Conduct a sensitivity analysis of the final 1-D and 2-D BEMs.

Synthesis of Reach-Scale and Local-Scale Analyses: As was demonstrated in the 2014 Fluvial Geomorphology Modeling Development Technical Memorandum (Attachment 1 of the Study 6.6 SIR), results from the 1-D BEM will be used as input for boundary conditions to the 2-D BEMs. This approach will be used at the remaining focus areas.

8.3. Study Component: Coordination and Interpretation of Model Results

Work under the tasks included in this study component followed methods described in the RSP Section 6.6.4.3 and Study 6.6 ISR Section 4.3.2. Efforts for completing the study are detailed in Study 6.6 ISR Sections 7.1.2.3 and 7.2.2.3. Work under the tasks has progressed but will need to be completed as described below:

Integration of Geomorphology and Fluvial Geomorphology Modeling below Watana Dam Study: The integration of the Geomorphology (Study 6.5) with the Fluvial Geomorphology Modeling below Watana Dam Study (Study 6.6) will continue throughout the Study. Results of the existing conditions 1-D and 2-D BEM runs will be reviewed and interpreted in terms of the geomorphic response. This will include further refinement as necessary of the conceptual models describing the system, including refinement of the First- and Second-order effects of the Susitna-Watana Project on the Susitna River downstream of Watana Dam as described in the Geomorphology Study (Study 6.5) Sections 5.11 and 6.11. Results from the 1-D and 2-D Bed Evolution Model runs of with-Project scenarios will be also be reviewed and interpreted in terms of the geomorphic response.

Coordination of Results with other Resource Studies: Coordination and feedback between the Geomorphology (Study 6.5), Fluvial Geomorphology Modeling below Watana Dam (Study 6.6), Groundwater (Study 7.5), Ice Processes in the Susitna River (Study 7.6), Fish and Aquatics IFS (Study 8.5), Riparian IFS (Study 8.6), Water Quality Modeling (Study 5.6), and Characterization and Mapping of Aquatic Habitats (Study 9.9) studies will be on-going through remainder of the Study.

9. LITERATURE CITED

Bovee, K.B. 1982. A guide to stream habitat analysis using the instream flow incremental methodology. Instream Flow Information Paper No. 12. FWS/OBS-82/26. U.S. Fish and Wildlife Service, Office of Biological Services, Fort Collins, Colorado.