

**Susitna-Watana Hydroelectric Project  
(FERC No. 14241)**

**Baseline Water Quality Study  
Study Plan Section 5.5**

**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

URS Corporation

Tetra Tech Inc.

November 2015

## TABLE OF CONTENTS

|  |          |
|--|----------|
| <b>1. Introduction.....</b>                                  | <b>1</b> |
| <b>2. Background .....</b>                                   | <b>1</b> |
| 2.1. Purpose of Study .....                                  | 1        |
| 2.2. Study Components .....                                  | 2        |
| <b>3. Status, Highlighted Results, and Achievements.....</b> | <b>2</b> |
| <b>4. Summary of Study 5.5 Documents .....</b>               | <b>3</b> |
| <b>5. New Study Documentation Supplementing the ISR.....</b> | <b>5</b> |
| <b>6. Variances .....</b>                                    | <b>6</b> |
| 6.1. 2013 Study Season .....                                 | 6        |
| 6.2. 2014 Study Season .....                                 | 6        |
| <b>7. Study Plan Modifications .....</b>                     | <b>8</b> |
| 7.1. Modifications Identified in ISR.....                    | 8        |
| 7.2. Modifications Identified since the June 2014 ISR .....  | 9        |
| <b>8. Steps to Complete the Study .....</b>                  | <b>9</b> |

## 1. INTRODUCTION

Section 1 (Part A) of the ISR for this Baseline Water Quality Study (Study Plan 5.5) 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 completed Study 5.5 since the filing of the ISR in June 2014. As detailed below, AEA's recent activities for Study 5.5 have consisted of the following:

- Completion of continuous water temperature monitoring during winter 2013-2014 and summer 2014.
- Continued collection of meteorological data, including precipitation data, through August 2015 from the ESM-2 and ESM-3 stations. Continued (and ongoing) collection of meteorological data including precipitation and snow water equivalency (SWE) data from station ESM-1.
- Completion of Baseline Water Quality Monitoring and Focus Area Monitoring during winter 2013-2014 and summer 2014.
- Completion of sediment and porewater sample collection for baseline metals analysis from the six sites proposed in the RSP Section 5.5.4.6 that were not accessible in 2013.

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, Study 5.5 has been completed in a manner that meets the objectives of the Commission-approved Study Plan.

## 2. BACKGROUND

### 2.1. Purpose of Study

The objectives for this study are detailed in RSP Section 5.5.1. In summary, the goal of the water quality study is to document existing water quality, sediment, porewater, and meteorological conditions on the Susitna River, and provide data for modeling the impacts of the proposed Project on these resources in Study 5.6. The Project is expected to change some of the water quality characteristics of the drainage as well as the inundated area that will become the reservoir.

The study components as established in Study Plan Section 5.5.1 are as follows:

- 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 three years of current stream temperature and meteorological data to the existing data. An effort was made to collect continuous water temperature data year-round, with the understanding that records may be interrupted by equipment damage during river floods, ice formation around the monitoring devices, ice break-up and physical damage to the anchoring devices, or removal by unauthorized visitors.
- 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 imaging remote (TIR) assessment of a portion (between Talkeetna and Devils Canyon) of the Susitna River and use this data to map the groundwater discharge and possible extent of thermal refugia.

## 2.2. Study Components

The Baseline Water Quality Study has several components that generate water quality data from multiple media that will be used to evaluate current and Post-Project conditions when the reservoir is in place. The study components include:

- 1) Water quality monitoring at two spatial scales,
- 2) Focus Area monitoring for the purpose of improving the resolution of water quality predictions and in support of the fisheries and habitat evaluation, and
- 3) Mercury assessment for the purpose of determining how future reservoir operations might influence dynamics of mercury release and bioaccumulation in aquatic life. Products generated from the Baseline Water Quality Study are used in the Water Quality Modeling Study (Study 5.6), Mercury Assessment and Potential for Bioaccumulation Study (Study 5.7), Ice Processes Study (Study 7.6), Glacier Runoff and Changes Study (Study 7.7), and the Fish and Aquatics Instream Flow Study (Study 8.5).

## 3. STATUS, HIGHLIGHTED RESULTS, AND ACHIEVEMENTS

The following objectives for the project were completed in 2013:

- Completed historical information research, including data from the 1980s Alaska Power Authority (APA) Susitna Hydroelectric Project as reported in Section 6.4 of the Baseline Water Quality Study 5.5 Site Completion Report (SCR).
- Collection of water temperature data began in July 2012 and continued through 2013.
- Collection of meteorological data began at three sites in September 2012 and continued through 2013. Rainfall and snow water equivalent (SWE) data from ESM-2 and rainfall and snow depth data from ESM-3 were collected beginning in September 2013.

- Collected and analyzed surface water quality samples from 17 mainstem sites and seven focus areas.
- Completed and analyzed groundwater Focus Area monitoring.
- Collected and analyzed sediment and porewater samples from four of the ten sites in the RSP Section 5.5.4.6.
- Measurements of baseline metals concentrations in fish tissue.
- Thermal Infrared Remote (TIR) sensing of the Susitna River.

Significant items accomplished since the completion of the June 2014 ISR:

- Collection of water temperature data at 19 sites during winter 2013-2014.
- Completed collection of water temperature data at 36 sites in summer 2014, including eight sites that could not be accessed in 2013.
- Continued collection of meteorological data from stations ESM-1, ESM-2 and ESM-3. A rain gauge and SWE sensor were installed at meteorological station ESM-1 in September 2014. Data collection from stations ESM-2 and ESM-3 was completed in August 2015.
- Completion of Baseline Water Quality Monitoring at five locations during winter 2014 and 17 locations during June to September 2014.
- Completion of Focus Area Monitoring at three sites in February, March, and April 2014 and at seven locations during July and September 2014.
- Completion of sediment and porewater sampling from the six sites that were not accessible in 2013.

#### 4. SUMMARY OF STUDY 5.5 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                                     |
|---|------------|--|--|
| 5.5 Baseline Water Quality Study (Revised Study Plan) | 12/14/2012 | This document presents the plan for this study, including goals, objectives, the study area, and proposed study methods [identify resource to be studied]. | <a href="#">RSP for Study 05.05</a>      |
| FERC Study Plan Determination for Study 5.5           | 4/1/2013   | This document presents FERC approval of Study 5.5, which approved AEA's Revised Study Plan with recommended adjustments.                                   | <a href="#">FERC SPD for Study 05.05</a> |

| Title   | Date     | Description  | Link   |
|---|----------|--|--|
| Quality Assurance Project Plan for Baseline Water Quality Monitoring Sampling and Analysis Activities | 3/1/2013 | The QAPP contains a comprehensive description of sampling design, analytical methods, and process for evaluating data quality. This document establishes minimum expectations for generating useable data that meet regulatory requirements.   | <a href="#">March 2013 TM for Study 05.05</a>  |
| Thermal Infrared Remote Sensing Pilot Test  | 3/7/2013 | Report on TIR pilot testing.   | <a href="#">March 2013 TM for Study 05.05 (File 1)</a><br><a href="#">March 2013 TM for Study 05.05 (File 2)</a>   |
| 2012 Susitna River Water Temperature and Meteorological Field Study                                   | 3/5/2013 | The objective of this study was to provide a foundation for development of reservoir and riverine temperature models for the Project. This work included a review of the previous temperature model studies performed on the river, installation of temperature monitoring stations, and installation of meteorological (MET) monitoring stations. | <a href="#">March 2013 TM for Study 05.05</a>  |
| 2012 Susitna River Water Temperature and Meteorological Field Study Appendix A                        | 3/5/2013 | Photographs and site information.  | <a href="#">March 2013 TM for Study 05.05</a>  |
| 2012 Susitna River Water Temperature and Meteorological Field Study Appendix B                        | 3/5/2013 | Water Quality Model Selection.   | <a href="#">March 2013 TM for Study 05.05</a>  |
| Draft Initial Study Report for Study 5.5  | 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 5.5. This draft ISR was later republished as Part A of the final ISR.  | <a href="#">Draft ISR for Study 05.05 (File 1)</a><br><a href="#">Draft ISR for Study 05.05 (File 2)</a><br><a href="#">Draft ISR for Study 05.05 (File 3)</a><br><a href="#">Draft ISR for Study 05.05 (File 4)</a><br><a href="#">Draft ISR for Study 05.05 (File 5)</a><br><a href="#">Draft ISR for Study 05.05 (File 6)</a> |
| Initial Study Report for Study 5.5  | 6/3/2014 | This document is the Initial Study Report (Parts A, B and C) for Study 5.5. 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.   | <a href="#">ISR Part A for Study 05.05 (File 1)</a><br><a href="#">ISR Part A for Study 05.05 (File 2)</a><br><a href="#">ISR Part A for Study 05.05 (File 3)</a><br><a href="#">ISR Part A for Study 05.05 (File 3)</a>   |

| Title   | Date       | Description   | Link   |
|---|------------|---|--|
|   |            |   | <a href="#">05.05 (File 4)</a><br><a href="#">ISR Part A for Study 05.05 (File 5)</a><br><a href="#">ISR Part A for Study 05.05 (File 6)</a><br><a href="#">ISR Part B for Study 05.05</a><br><a href="#">ISR Part C for Study 05.05</a> |
| Water Quality and Lower River Modeling Technical Memorandum           | 9/30/2014  | TM evaluates QA/QC water quality data (including continuous water temperature monitoring) collected 2012 through 2014 for adequacy in representation of current riverine conditions. The need for continued monitoring of surface water temperature and for meteorological data beyond 2014 is evaluated at the spatial and temporal scale. | <a href="#">Sept. 2013 TM for Study 05.05</a>  |
| Initial Study Report Meetings, Study 5.5 Baseline Water Quality Study | 11/15/2014 | Transcripts and AEA's agenda and PowerPoint presentations for the ISR meeting concerning water quality studies.   | <a href="#">Transcripts from ISR Meeting</a><br><a href="#">Materials from ISR Meeting</a>   |
| 2014 Study Completion Report, Study 5.5 Baseline Water Quality Study  | 11/2015    | Study Completion Report   | <a href="#">SCR for Study 05.05 (File 1)</a><br><a href="#">SCR for Study 05.05 (File 2)</a>   |

## 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 5.5, 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 5.5 (Section 4), which described the study methods and variances in 2014. |
| Part A, Section 5   | This section is updated and supplemented by the Study Implementation Report for Study 5.5 (Section 5), which described the study results in 2014.               |
| Part A, Section 5.1 | This section is supplemented by Water Quality and Lower River Modeling Technical Memorandum (September 30, 2014).   |
| Part A, Section 6   | This section is updated and supplemented by the Study Implementation Report for Study 5.5 (Section 6), which discusses the study results in 2014.               |

|                   |   |
|-------------------|---|
| Part C, Section 7 | The decision points in this section are updated and supplemented by the Study Implementation Report for Study 5.5 (Section 7), which presents the decision point from 2014. |
| Part C, Section 7 | The Steps to Complete the Study in this section of Part C have been performed and this study is now considered complete.  |

## 6. VARIANCES

### 6.1. 2013 Study Season

The following variances are reported in the June 2014 ISR Part C Executive Summary:

- 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.
- 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. These sites were visited in 2014.
- 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).

### 6.2. 2014 Study Season

The following variances occurred following the filing of the June 2014 ISR and are reported in the Study 5.5 Study Completion Report:

- In 2014, continuous temperature monitoring was completed at 36 of the 37 planned sites on the Susitna River mainstem and tributaries (Study 5.5 SCR Section 4.1). Temperature data collection in 2014 ended when logging equipment was removed from sites in September 2014. Temperature data collection was discontinued before winter 2014/2015 as the two previous winter collections yielded the same results in timing of ice cover and ice breakup (Study 5.5 SCR Section 4.1.1).
- Temperature data collection in 2014 ended when logging equipment was removed from sites in September 2014. The ISR Part C stated temperature logging would continue

through June 2015. Temperature data collection was discontinued before winter 2014/2015 as the two previous winter collections yielded the same results in timing of ice cover and ice breakup. Temperature drops to 0°C during winter temperature data collection until ice breakup occurs (see Section 6.2). Temperature data collected during winter 2012/2013 and 2013/2014 was adequate to construct the reservoir and riverine water quality models and will not impact AEA's ability to meet study objectives (Study 5.5 SCR Section 4.1.1).

- RSP Section 5.5.4.3 indicated rain gauges would be installed at all MET stations. These sensors were installed at ESM-2 (Oshetna River) and ESM-3 (Indian River) on September 2013 and at the ESM-1 (Watana Dam site) on October 2014 (Study 5.5 SCR Section 4.2.1).
- Operation of MET Stations were expected to operate for a period of two years (Section 5.5.4.2 of the RSP). One of the MET Stations (ESM-1 Watana Dam) is continuing measurement of meteorological data for other purposes and will operate through 2016 and possibly beyond that year.
- Sample results from 2013 showed little horizontal or vertical variability at samples locations, suggesting the river is well mixed. Given the lack of variability, only a single grab sample was collected at each site transect in 2014 (Study 5.5 SCR Section 4.2.1).
- The Study Plan (RSP Section 5.5.4.4) indicated that water quality monitoring would occur at the Susitna River near Cantwell (PRM 225.5). Due to limited access to the area via helicopter during summer 2013 and 2014, sampling occurred instead just upstream of the Oshetna River confluence at PRM 235.2. During the winter of 2014, the Susitna River near Cantwell (PRM 225.5) was accessible with a helicopter and sampling occurred at that site. Collection of water quality samples at PRM 225.5 does not impact objectives of the study plan, because there is very little difference in physical and chemical water quality conditions between PRM 235.2 and PRM 187.2 (Study 5.5 SCR Section 4.3.2).
- In winter 2014, helicopter access to PRM 187.2 (Susitna at the Watana Dam site) was limited, and monitoring occurred a couple of miles downriver at PRM 185, above the confluence with Tsusena Creek, instead. This change does not impact study objectives as there are no substantial tributary influences expected to appreciably change sample results (Study 5.5 SCR Section 4.3.2).
- During winter 2014 baseline monitoring, samples were collected in January instead of December as indicated in RSP Section 5.5.4.4.1. This change is not anticipated to impact the results of this study (Study 5.5 SCR Section 4.3.2).
- Water quality parameters collected during 2013 in Focus Areas satisfied requirements described in RSP Section 5.5.4.5. The 2014 sampling locations at each Focus Area transect is shown in Figure 4.4-2 through Figure 4.4-8 in the ISR. Unlike in 2013, samples were not collected at point samples, groundwater locations, or longitudinal profiles bracketing the point sample locations. Instead, samples were collected near the surface at three locations along each transect in a Focus Area and no samples were

collected at depth. Water quality parameters collected during 2013 in Focus Areas satisfied requirements of the RSP as described in Section 5.5.4.5. Additional 2014 sampling occurred in order to determine why select water quality parameters had estimated concentrations much higher than expected ranges described in Table A4-1 in Attachment 5-1 of the RSP. The combination of data satisfies requirements for use in calibrating the reservoir and riverine models from Study 5.6 (Water Quality Modeling) (Study 5.5 SCR Section 4.4.1).

- Use of an Ekman Dredge or a modified Van Veen grab sampler was proposed in RSP Section 5.5. However, due to sampling site conditions and access via helicopter instead of boat, all sediment samples were collected using either a hand auger or stainless steel spoon by wading into shallow nearshore areas. This change should not impact the results of this study (Study 5.5 SCR Section 4.5.1).

## 7. STUDY PLAN MODIFICATIONS

### 7.1. Modifications Identified in ISR

Section 7.1.2 of the 2014 ISR (Part C) details modifications for this study following the 2013 study season. These modifications are generally summarized as follows:

- Water Temperature Data Collection Logging interval from October 2013 through June 2014 was proposed to be increased to 30-minutes (instead of 15 minutes as stated in RSP Section 5.5.4.1) to expand data storage capacity. This would increase the amount of time the logger could be left unattended, without diminishing data quality. The data logging interval remained at 15 minutes and this modification was not implemented.
- It was proposed that a rain gauge and CS725 snow water equivalency (SWE) sensor be installed at MET station ESM-1. This is a modification as there was no reference for installation of a snow water equivalency sensor to the MET stations in the Study Plan (RSP Section 5.5.4.2). This modification was implemented in September 2014.
- This modification involved the extent of sampling efforts for baseline water quality monitoring and included refinements based on review of remaining data collected during 2013 and how data quality objectives could be met. Through validation of laboratory data it was determined that select water quality parameters were outside of acceptance limits during laboratory analysis. Apparently the sample preservative affected detection of the target analyte by the laboratory equipment, and bottles or reagent water was contaminated with the target analyte(s). A table summarizing the results of the lab data validation/verification can be found in the GINA database at the following location: <http://gis.suhydro.org/reports/isr/05-WaterQuality/>. The parameters affected were total metals (except for Ca and Mg), total mercury, total phosphorus, total Kjeldahl nitrogen (TKN), total nitrate+nitrite-nitrogen, and dissolved aluminum. The parameter results that were either qualified as “rejected” or “estimated” throughout the 2013 study were sampled again in 2014 as this modification was implemented. In addition, given the lack of horizontal or vertical variability in the results for 2013 (ISR Section 5.4.1), only a single grab sample was collected at each site transect in 2014, a change in the sampling

protocols reported in the Study Plan (RSP Section 5.5.4.4.2.). The single grab sample from each location was analyzed for all the parameters affected during the previous sampling effort as proposed in the modification.

- As proposed a modification, the Focus Areas were re-sampled in 2014 to generate valid water quality data and to determine if a correction factor may be used to validate 2013 data (this effort is in coordination with Study Plan 8.5, Instream Flow).
- RSP Section 5.5.4.6 specified the use of an Ekman dredge or modified Van Veen grab sampler for sediment sampling, but due to sampling site conditions a hand auger or stainless steel spoon was proposed instead. This method was implemented in both 2013 (variance) and 2014 (proposed modification).
- The RSP Section 5.5.4.9 describes the TIR study and the potential limitations of the study. The study was characterized as a pilot study, with the option to expand the study if successful. While the pilot portion of the study was successful due to ideal conditions in 2012, not all the river could be imaged in 2013 due to adverse weather conditions. Acquisition of the data requires that the air temperature be cold (near freezing), with no wind, no ice on the river, and no precipitation. Despite six weeks of effort during October and November of 2013, approximately five days of usable data were recovered. These data include all the Focus Areas, and 73% of the Lower River. Given the sole purpose of this study was to facilitate identification of groundwater for Study 8.5 (Instream flow), and this task is complete, there does not appear to be any need to pursue collecting additional TIR data. The modification proposes that the remaining portions of the Lower River will be collected during the 2014 field season as weather permits. This modification was not implemented.

## **7.2. Modifications Identified since the June 2014 ISR**

As detailed in the Study Completion Report, AEA plans no modifications of the methods for this study, as this study is now complete.

## **8. STEPS TO COMPLETE THE STUDY**

The field work, data collection, data analysis, and reporting for this study successfully met all study objectives in the FERC-approved Study Plan.

Data collection pursuant to this study is complete and meets the study plan objectives. However, additional meteorological data will continue to be collected beyond 2015. This data will be inform modeling efforts in other studies and considered in the FERC license application. As Study 5.5 has been completed the responsibilities for collection, QA/QC and reporting of this data will be occur as part of Study 5.6.

In light of the results, variances, and modifications described above, AEA has completed this study.