Susitna-Watana Hydroelectric Project
(FERC No. 14241)

Salmon Escapement Study
Study Plan Section 9.7

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

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1. INTRODUCTION

Section 1 (Part A) of the ISR for this Salmon Escapement Study (Study Plan 9.7) 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 been able to complete this study 9.7. As detailed below, AEA's recent activities for Study 9.7 have consisted of the following:

- A third year of operation of fishwheels; five were operated in 2014, to capture adult salmon for tagging;
- Completion of a third year of radio tagging and tracking salmon to document migration timing, behavior and spawning locations in the Lower, Middle and Upper Susitna River;
- Use of sonar to document fish passage at the proposed dam site, evaluate effectiveness of fishwheels, and evaluate the utility of this tool for documenting spawning in turbid waters;
- Preliminary results from 2014 were presented in a technical memorandum, Salmon Escapement Study (Study 9.7), *2014 Implementation and Preliminary Results Technical Memorandum*, filed with FERC on September 30, 2014
- On October 15, 2014, AEA held an ISR meeting for Fish and Aquatics Program, which included a presentation and discussion of the 2013 Salmon Escapement Study.
- Generating estimates of the numbers of salmon in the Susitna River and its tributaries as well as system-wide escapement estimates for Chinook and Coho salmon upstream of the Yentna River;
- Comparing data collected from 2012 through 2014 with historic data collected in the 1980s and more recently from 2007-2010 by Alaska Department of Fish & Game.
- Preparation of a Study Completion Report presenting cumulative methods, variances, and results for the 2014 study year, along with synthesis of findings from the full 3 years of implementation (2012-2014) for salmon escapement study.

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 end of calendar year 2014. In light of this additional implementation, Study 9.7 has been completed in a manner that meets the objectives of the Commission-approved Study Plan.

2. BACKGROUND

2.1. Purpose of Study

The primary goal of the study was to characterize the distribution, abundance, habitat use, and migratory behavior of all species of adult anadromous salmon across mainstem river habitats and in select tributaries located upstream of the Three Rivers Confluence, with a particular emphasis on documenting these ecological conditions for Chinook and Coho salmon upstream of confluence with the Yetna River.

2.2. Study Components

The study components were consistent with the objectives of the study established in RSP Section 9.7.1.2, and include:

- Capture, radio-tag, and track adults of five species of Pacific salmon (i.e., Chinook, Chum (*O. keta*), Coho (*O. kisutch*), Pink (*O. gorbuscha*), and Sockeye (*O. nerka*) salmon) in the Middle and Upper Susitna River in proportion to their species-specific abundance. Capture and tag Chinook, Coho, and Pink salmon in the Lower Susitna River.
- Characterize the migration behavior and spawning locations of radio-tagged salmon in the Lower, Middle, and Upper Susitna River.
- Characterize adult salmon migration behavior and timing within and above Devils Canyon.
- If shown to be an effective sampling method, and where feasible, use sonar to aid in documenting salmon spawning locations in turbid water in 2013 and 2014.
- Compare historical and current data on run timing, distribution, relative abundance, and specific locations of spawning and holding salmon.
- Generate counts of adult Chinook Salmon spawning in the Susitna River and its tributaries to estimate the proportions of fish with tags for populations in the watershed.
- Collect tissue samples to support the Fish Genetic Baseline Study (Study 9.14).
- Estimate the system-wide Chinook Salmon escapement to the entire Susitna River, the Coho Salmon escapement to the Susitna River above the confluence with the Yentna River, and the distribution of Chinook, Coho, and Pink salmon among tributaries of the Susitna River (upstream of Yentna River confluence) in 2013 and 2014.

3. STATUS, HIGHLIGHTED RESULTS, AND ACHIEVEMENTS

The following objectives were partially completed in 2013, as discussed in the June 2014 ISR:

- The catch of adult salmon in fishwheels was strong, which enabled tagging goals to be met or exceeded. AEA tagged 603 Chinook Salmon (536 large, 67 small) in the Middle Susitna River, and ADF&G tagged 698 large Chinook Salmon in the Lower Susitna River and 692 large Chinook Salmon in the Yentna River.

- Chinook Salmon continue to be the only salmon species tracked upstream of the three passage impediments within Devils Canyon. In 2013, three radio-tagged Chinook Salmon passed Devils Canyon, all of which were tagged in the Middle River.

- None of the 698 Chinook Salmon radio-tagged and released in the Lower River were tracked into the Upper River. However, three of these fish were tracked moving in Devils Canyon upstream of Impediment 2 but they never moved upstream of the third impediment.

- This study documented the timing and flows that occurred when fish were moving through and upstream of Devils Canyon. The first successful Chinook Salmon passage past Impediment 1 occurred on June 30 when flows exceeded 28,000 cfs at the Tsusena Creek Gage. No other fish passed until July 11–17, when flows declined to between 14,383 and 16,876 cfs at the Tsusena Creek Gage. There was a period with no fish passage from July 18–22 (in which flows exceeded 17,000 cfs at the Tsusena Creek Gage), and then the final passage event occurred on July 24 with flows of 16,884 cfs at the Tsusena Creek Gage. Flows at the Tsusena Creek Gage ranged from 14,383 cfs (July 13) to 18,848 cfs (July 30) when the three Chinook Salmon moved past Impediment 3.

- Of the 621 Chinook Salmon radio-tagged in the Lower River in 2013 that were tracked to spawning destination, 617 (99 percent) were tracked to tributaries (mainly the Deshka, Talkeetna, Chulitna, or Yentna rivers), and 4 (1 percent) went to destinations in the mainstem Susitna River. Of the 500 Coho Salmon tagged in the Lower River that were classified by destination, 478 (96 percent) went to tributaries (mainly the Yentna, Deshka, Talkeetna, or Chulitna rivers) and 22 (4 percent) went to destinations in the mainstem Susitna River. Of the 116 Pink Salmon tagged in the Lower River that were classified by destination, 98 (84 percent) went to tributaries (mainly the Deshka or Yentna rivers, or Montana or Willow creeks) and 18 (16 percent) went to mainstem Susitna River destinations.

- Of the 449 large Chinook Salmon radio-tagged in the Middle River in 2013 that were tracked to a spawning destination, 422 (94 percent) were tracked moving into Middle River tributaries (mainly Portage Creek or Indian River) and 27 (6 percent) went to destinations in the mainstem Susitna River. Of the 45 small Chinook Salmon tagged in the Middle River that were classified by destination, 42 (93 percent) went to tributaries (mainly Indian River or Portage Creek), and 3 (7 percent) went to destinations in the mainstem Susitna River. Of the 164 Chum Salmon radio-tagged in the Lower River that were classified by destination, 147 (90 percent) went to tributaries (mainly Portage Creek, or Indian or Talkeetna rivers) and 17 (10 percent) went to destinations in the mainstem Susitna River. Of the 173 Coho Salmon classified by destination, 154 (89 percent) went to tributaries (mainly Talkeetna, Chulitna, or Indian rivers) and 19 (11 percent) went to mainstem Susitna River destinations. Of the 166 Pink Salmon radio-tagged in the Middle River that were classified by destination, 151 (91 percent) went to

tributaries (primarily Indian or Talkeetna rivers, and Portage, Fourth of July, or Lane creeks), and 15 (9 percent) went to destinations in the mainstem Susitna River. Of the 92 Sockeye Salmon classified by destination, 44 (48 percent) went to tributaries (mainly Chulitna, Talkeetna, or Indian rivers, or Portage Creek) and 48 (52 percent) went to destinations in the mainstem Susitna River.

- A weir and underwater video system were operated successfully on the lower Indian River from June 26 to August 20. The number of fish moving upstream past the weir included 1,405 Chinook (6.3 percent were tagged), 12,906 Chum, 525 Coho, 37,181 Pink, and 127 Sockeye Salmon adults.

- Based on the 411 Coho Salmon radio-tagged in the Lower River that appeared to spawn above the tagging site, and 22,906 fish inspected for tags at the Deshka River and Montana Creek weirs, the estimated escapement of Coho Salmon to the Susitna River above the Yentna River confluence was 130,026 (SE = 24,342). Of these, an estimated 29,215 (SE = 6,875) spawned in the Deshka River drainage, 13,372 (SE = 3,762) spawned in the Talkeetna River drainage, 11,038 (SE = 3,280) spawned in east side tributaries below the Talkeetna River, 31,204 (SE = 8,010) spawned in west side tributaries or in or near the mainstem between the Chulitna and Deshka rivers, 36,844 (SE = 8,144) spawned in the Chulitna River drainage, and 8,313 (SE = 2,961) spawned in tributaries or in or near the mainstem between the Chulitna River and Devils Canyon.

- Based on 568 Chinook Salmon radio-tagged in the Lower River that appeared to spawn above the tagging site, and an estimated 19,952 Chinook Salmon measuring 50 cm METF or greater inspected for tags at the Deshka River and Montana Creek weirs, the estimated escapement of Chinook Salmon to the Susitna River above the Yentna River confluence was 89,463 (SE = 9,523). Of these, an estimated 18,469 (SE = 2,262) spawned in the Deshka River drainage, 24,408 (SE = 3,545) spawned in the Talkeetna River drainage, 16,867 (SE = 1,873) spawned in east side tributaries below the Talkeetna River, 2,432 (SE = 757) spawned in west side tributaries or in or near the mainstem between the Chulitna and Deshka rivers, 19,607 (SE = 2,823) spawned in the Chulitna River drainage, and 7,680 (SE = 1,494) spawned in tributaries or in or near the mainstem between the Chulitna River and Devils Canyon

The study team has completed the following activities for Study 9.7 since the June 2014 filing of the ISR:

- Catch rates in the Lower River, Yentna River, and Middle River were sufficient to achieve all of the requirements of study Objective 1, and met or exceeded the majority of species-specific tag goals in each of the three study years. In 2014, AEA radio-tagged 622 Chinook Salmon (590 large, 32 small) in the Middle Susitna River, and ADF&G radio-tagged 659 large Chinook Salmon in the Lower Susitna River and 296 large Chinook Salmon in the Yentna River.

- Chinook Salmon continue to be the only salmon species tracked upstream of the three passage impediments within Devils Canyon. In 2014, two radio-tagged Chinook Salmon passed Devils Canyon, both of which were tagged in the Middle River.

- None of the 659 Chinook Salmon radio-tagged and released in the Lower River were tracked into the Upper River. However, one of these fish was tracked in Devils Canyon upstream of Impediment 2, but it never moved upstream of Impediment 3; and one of these fish was tracked upstream of Impediment 1, but it never moved upstream of Impediment 2.

- This study documented the timing and flows that occurred in 2014 when fish were moving through and upstream of Devils Canyon. The first successful Chinook Salmon passage past Impediment 1 occurred on June 30 when flows were at 19,600 cfs at the Tsusena Creek Gage. No other fish passed until July 1 and July 6, when flows ranged between 23,300 and 23,800 cfs at the Tsusena Creek Gage. There was a period with no fish passage from July 7 to 17 (flows ranged between 19,900 and 35,300 cfs at the Tsusena Creek Gage), and then the final passage event occurred on August 1 with flows of 16,000 cfs at the Tsusena Creek Gage. Flows at the Tsusena Creek Gage ranged from 15,900 cfs (July 30) to 16,400 cfs (August 4) when 2 Chinook Salmon moved past Impediment 3.

- Of the 581 Chinook Salmon radio-tagged in the Lower River in 2014 that were tracked to a spawning destination, 574 (99 percent) were tracked to tributaries (mainly the Deshka, Talkeetna, Chulitna, or Yentna rivers), and 7 (1 percent) went to destinations in the mainstem Susitna River. Of the 581 Coho Salmon tagged in the Lower River that were classified by destination, 565 (97 percent) went to tributaries (mainly the Yentna, Deshka, Talkeetna, or Chulitna rivers) and 16 (3 percent) went to destinations in the mainstem Susitna River. Of the 156 Pink Salmon tagged in the Lower River that were classified by destination, 155 (~99 percent) went to tributaries (mainly the Deshka, Yentna, or Chulitna rivers, or Willow Creek) and 1 (< 1 percent) went to mainstem Susitna River destinations.

- Of the 472 large Chinook Salmon radio-tagged in the Middle River in 2014 that were tracked to a spawning destination, 438 (93 percent) were tracked moving into tributaries (mainly Portage Creek or Indian River in the Middle River and the Talkeetna and Chulitna rivers in the Lower River) and 34 (7 percent) went to destinations in the mainstem Susitna River. Of the 24 small Chinook Salmon tagged in the Middle River that were classified by destination, 20 (83 percent) went to tributaries (mainly Indian River or Portage Creek), and 4 (17 percent) went to destinations in the mainstem Susitna River. Of the 159 Chum Salmon radio-tagged in the Middle River that were classified by destination, 141 (89 percent) went to tributaries (mainly Portage Creek, or Indian, Talkeetna, or Chulitna rivers) and 18 (11 percent) went to destinations in the mainstem Susitna River. Of the 184 Coho Salmon classified by destination, 173 (94 percent) went to tributaries (mainly Portage Creek and Talkeetna or Indian rivers) and 11 (6 percent) went to mainstem Susitna River destinations. Of the 176 Pink Salmon radio-tagged in the Middle River that were classified by destination, 164 (93 percent) went to tributaries (primarily Indian, Talkeetna, or Chulitna rivers, and 4th of July Creek), and 12 (7 percent) went to destinations in the mainstem Susitna River. Of the 142 Sockeye Salmon classified by destination, 76 (54 percent) went to tributaries (mainly Chulitna, Talkeetna, or Indian rivers, or Portage Creek) and 66 (46 percent) went to destinations in the mainstem Susitna River.

- Based on the 582 Coho Salmon radio-tagged in the Lower River that appeared to spawn above the tagging site, and 12,512 fish inspected for tags at the Deshka River and Montana Creek weirs, the estimated escapement of Coho Salmon to the Susitna River above the Yentna River confluence was 84,879 (SE = 9,550). Of these, an estimated 15,377 (SE = 1,138) spawned in the Deshka River drainage, 12,130 (SE = 2,244) spawned in the Talkeetna River drainage, 16,515 (SE = 2,790) spawned in east side tributaries below the Talkeetna River, 10,889 (SE = 2,096) spawned in west side tributaries or in or near the mainstem between the Chulitna and Deshka rivers, 23,783 (SE = 3,788) spawned in the Chulitna River drainage, and 6,184 (SE = 1,414) spawned in tributaries or in or near the mainstem between the Chulitna River and Devils Canyon.

- Based on 494 Chinook Salmon radio-tagged in the Lower River that appeared to spawn above the tagging site, and an estimated 15,120 Chinook Salmon measuring 50 cm METF or greater inspected for tags at the Deshka River and Montana Creek weirs, the estimated escapement of Chinook Salmon to the Susitna River above the Yentna River confluence was 68,225 (SE = 10,615). Of these, an estimated 14,024 (SE = 816) spawned in the Deshka River drainage, 14,024 (SE = 3,713) spawned in the Talkeetna River drainage, 16,867 (SE = 1,873) spawned in east side tributaries below the Talkeetna River, 2,098 (SE = 682) spawned in west side tributaries or in or near the mainstem between the Chulitna and Deshka rivers, 16,397 (SE = 3,961) spawned in the Chulitna River drainage, and 6,609 (SE = 2,365) spawned in tributaries or in or near the mainstem between the Chulitna River and Devils Canyon.

4. SUMMARY OF STUDY 9.7 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 Filed	Description	Links
9.7 Fish and Aquatic Resources (Revised Study Plan)	12/14/2012	This document presents the study plan for the Salmon Escapement Study, including goals, objectives, the study area, and proposed study methods.	RSP for Study 9.7
FERC Study Plan Determination for Study 9.7	2/1/2013	This document presents FERC approval of Study 9.7, which approved AEA's Revised Study Plan with recommended adjustments to the study.	FERC SPD for Study 9.7
Adult Salmon Distribution and Habitat Utilization Study	3/4/2013	This report describes the methods and results of the 2012 study implementation for the Salmon Escapement Study.	Mar. 2013 TM for Study 9.7

Title	Date Filed	Description	Links
Director's Formal Study Dispute Determination	4/26/2013	FERC's determination required no additional changes to the study.	FERC SPD for Study 9.7
Distribution of Spawning Susitna River Chinook *Oncorhynchus tshawytscha* and Pink Salmon *O. gorbuscha*, 2012	6/20/2013	This attachment includes ADF&G's report on the results of Chinook and Pink salmon radio telemetry in the Susitna River in 2012.	June 2013 TM for Study 9.7
Draft Initial Study Report for Study 9.7	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 9.7. This draft ISR was later republished as Part A of the final ISR.	Draft ISR Part A for Study 9.7
Initial Study Report for Study 9.7	6/3/2014	This document is the Initial Study Report (Parts A, B and C) for Study 9.7. 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 9.7 ISR Part B for Study 9.7 ISR Part C for Study 9.7
Salmon Escapement Study (Study 9.7), 2014 Implementation and Preliminary Results Technical Memorandum	9/30/2014	This attachment includes a report describing the methods and variances related to 2014 implementation of the Salmon Escapement Study, and preliminary results.	Sept. 2014 TM for Study 9.7
Salmon Escapement Study, Study Plan 9.7, Study Completion Report	11/6/2015	This report described methods, variances and results for 2014 study year, along with synthesis of findings from the full 3 years of implementation (2012-2014) for salmon escapement study.	SCR for Study 9.7

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 9.7, during AEA's continued implementation of the Study Plan through calendar year 2014.0

ISR Reference	Description
Part A, Section 4.1, Objective1	This Section is supplemented by the *2014 Implementation and Preliminary Results TM*, Section 4.1, describing 2014 study plan implementation.
Part A, Section 4.3, Objective3	This Section is supplemented by SCR Section 4.3, describing 2014 study plan implementation.
Part A, Section 4.6, Objective 6	This Section is supplemented by the *2014 Implementation and Preliminary Results TM,* Section 4.6, describing 2014 study plan implementation.
Part A, Sections 5.1 – 5.6	These sections are supplement by the *2014 Implementation and Preliminary Results TM,* Section 5, describing results of 2014 implementation.
Part A, Section 4	This section is supplemented with SCR Section 4, describing results of 2014 implementation.
Part A, Section 5	This section is supplemented with SCR Section 5, describing results of 2014 implementation.
Part A, Appendix A	This appendix is supplemented by SCR, Appendix A, describing results of 2014 implementation.
Part A, Appendix B	This appendix is supplemented by SCR, Appendix B, describing results of 2014 implementation.
Part A, Appendix C	This appendix is supplemented by SCR, Appendix C, describing results of 2014 implementation.
Part A, Appendix D	This appendix is supplemented by SCR, Appendix D, describing results of 2014 implementation.
Part A, Appendix E	This appendix is supplemented by SCR, Appendix E, describing results of 2014 implementation.
Part A, Appendix F	This appendix is supplemented by SCR, Appendix F, describing results of 2014 implementation.
Part A, Appendix G	This appendix is supplemented by SCR, Appendix G, describing results of 2014 implementation.
Part A, Appendix H	This appendix is supplemented by SCR, Appendix H, describing results of 2014 implementation.
Part A, Appendix I	This appendix is supplemented by SCR, Appendix I, describing results of 2014 implementation.

6. VARIANCES

6.1. 2013 Study Season

As noted in the June 2014 ISR Part A for Study 9.7, the following variances to the proposed methods occurred in 2013:

- Due to land access limitations, AEA did not operate a fishwheel in Devils Canyon to supplement the Middle River fishing effort for Chinook salmon (see ISR Part A, Section 4.1.8.1). Instead, AEA increased the tagging goal (from 400 to 560) and fishing effort at the Curry fishwheels.

- AEA operated a floating picket weir and underwater video system on the Indian River in 2013 to sample adult salmon for mark rates and size distributions (to test capture probabilities at the tag and recovery locations; see ISR Part A, Section 4.1.8.3). The Study Plan (RSP Section 9.7.4.1.5) indicated these samples would be collected on selected spawning grounds.

- Due to land access limitations, five of the fixed-station receiver sites listed in the Study Plan (RSP Section 9.7.4.2.1) were not installed in 2013. Because of this, AEA added six new fixed-station receiver sites (see ISR Part A, Section 4.2.4). In addition, to compensate for the absence of fixed stations within Devils Canyon (RSP Section 9.7.4.3), helicopter surveys for tagged fish were flown through Devils Canyon daily starting in late June, and twice daily during the period of Chinook salmon passage (see ISR Part A, Section 4.3.5).

- Due to high stream discharges, it was not safe or feasible to operate weirs as recapture sites on Willow and Lake Creeks, or the Talachulitna and Middle Fork Chulitna rivers. In place of Willow Creek, a weir site on Montana Creek was selected in 2013; and sonar was operated on the Talachulitna and Middle Fork Chulitna rivers. (RSP Section 9.7.4.8; see ISR Part A, Section 4.8.1 for more detail).

6.2. 2014 Study Season

As noted in Section 4 of the Study Completion Report for this study, the following variances occurred while implementing this study in 2014:

- RSP Section 9.7.4.1.1 stated that fishwheels would be used to capture adult salmon for tagging in the Middle River. ISR Part C, Section 7.1.2.1.2 indicated that beach seining would be added for sampling in September. Instead, set gillnets were used to capture Coho Salmon in September 2014 and proved effective. Relative to using fishwheels, this variance increased the study team's ability to achieve Objective 1.

- RSP Section 9.7.4.1.3 indicated that a portion of Chinook, Chum, and Sockeye salmon captured in the Middle River would be spaghetti-tagged. However, as described in the Study Completion Report, Section 4.1.4.2, no spaghetti tags were applied in 2014. Instead, fixed-site sonar was used at Site 1, to compare bank of capture and length-frequencies in order to evaluate capture probabilities at the Middle River tag site (as described in Study Completion Report, Section 4.1.4.2).

- As presented in ISR Part C, Section 7.1.2.1.1, the Study Plan was modified such that all Chinook Salmon captured at the Yentna River tag site in 2014 were marked with uniquely numbered dart tags. This modification better supported the study team's objective (Objective 8) to estimate Chinook Salmon escapement to the entire Susitna River (see Study Completion Report Section 4.8.1 for more detail).

- As described in ISR Section 7.1.2.1.2, it was not feasible to operate a fishwheel in Devils Canyon for a variety of reasons. The study team implemented modifiations to compensate for this: three fishwheels were operated in the vicinity of Curry instead of two (RSP Section 9.7.4.1.1), and the number of Chinook Salmon radio tags was increased

from 400 to 650 (RSP Section 9.7.4.1). These variances were modifications to the Study Plan described in ISR Part C, Section 7.1.2.1.2 that increased the study team's ability to achieve Objective 1.

- RSP Section 9.7.4.1.6 indicated that the study team would assess the effects of holding time and density on the behavior of tagged fish. Due to stipulations in the Fish Resource Permit, all fish were tagged soon after capture in 2014, thereby reducing holding times and densities to levels that made comparisons of post-release survival and migration behavior unnecessary. This variance was implemented in 2013 (ISR Part A, Section 4.1.8.3) and 2014 and it was discussed as a Study Plan modification in ISR Part C, Section 7.1.2.1.2. This variance did not affect achieving study Objective 1.

- RSP Section 9.7.4.1.7 indicated that analyses would be used to compare the sex and age composition of radio-tagged fish. As discussed in ISR Part C, Section 7.1.2.1.2, AEA modified the Study Plan and did not use sex and age to evaluation fishwheel selectivity. However due to the loss of the Indian River weir size selectivity also could not be directly tested in 2014. In lieu of these methods, the study team relied on various other length-frequency comparisons and results from previous study years to provide insights into capture probabilities based on size at the Middle River tag site.

- RSP Section 9.7.4.2.1 listed ten fixed-station receiver sites to be used in the Middle and Upper rivers. ISR Part C, Section 7.1.2.2 indicated that the study team would modify the Study Plan to include eleven fixed-station receiver sites in the Middle and Upper rivers in 2014: however, only 10 sites were implemented (related to no weir on the Indian River). This variance did not affect the study team's ability to achieve Objective 3.

- RSP Section 9.7.4.2.2 indicated that aerial telemetry surveys would be scheduled at five-day intervals with the intent to ensure a maximum of seven days between surveys with weather contingencies. In 2014, the study team implemented a variance to the Study Plan and increased the frequency of surveys in the Middle River to every 1-2 days between Portage Creek and Devils Island from June 28 to August 6, and every third day between the Chulitna River and Devils Island from August 9 to October 28 (ISR Part C, Section 7.1.2.2). This variance improved the resolution of the geographic positions of tagged fish in the Middle River (below, within, and above Devils Canyon) and helped the study team achieve study Objectives 1, 2, and 3.

- To support further assessment of the fish migration corridor at the Watana Dam sonar site, the study team conducted seven ADCP transects in 2014. To supplement the velocity transects, bathymetric data were also collected. This variance increased the likelihood of the study team achieving study Objective 3.

- RSP Section 9.7.4.4 indicated that sonar would be used to characterize any suspected salmon spawning in turbid water of the mainstem habitats of the Susitna River (as indicated by radio-telemetry analysis). As in 2013 (ISR Part A, Section 6.5), the use of sonar was limited by habitat conditions Thus in 2014, the study used sonar only to characterize suspected Chinook Salmon spawning. This variance was a Study Plan modification addressed in ISR Part C, Section 7.1.2.4. Although this variance limited the ability to document spawning locations in turbid water for Chum, Coho, Pink, and

Sockeye salmon in 2014, it still met the Objective by demonstrating that sonar is not an effective tool given the typical habitat conditions where these species spawn.

- RSP Section 9.7.4.4 indicated that side-scan sonar and/or DIDSON would be used for the turbid water surveys. ISR Part C, Section 7.1.2.4 indicated that the study team would modify the Study Plan and use ARIS instead of side-scan sonar or DIDSON in 2014. ARIS was used in 2013 for this study component. In 2014, the study team used DIDSON to complete this task and, thus, did not implement a variance or modify the Study Plan. Given the relatively short detection range of fish targets for this study component, both ARIS and DIDSON had similar utility to accomplish the Objective.

- RSP Section 9.7.4.6 indicated that Chinook Salmon would be examined on selected spawning grounds to test whether fish probabilities of being captured and radio-tagged. Results from the 2012 escapement study, indicated that this approach would not work due to too few recoveries. Therefore, the study team replaced the spawning ground surveys with the operation of a weir, underwater video system, and a fixed-station receiver site on the Indian River to enumerate tagged and untagged fish, and establish mark rates (ISR Part A, Section 4.1.8.3 and ISR Part C, Section 7.1.2.1.2). However, the Indian River weir was rendered inoperable by a flood just prior to the onset of the Chinook Salmon run.

  Thus, an immediate adjustment was required to ensure data were collected that would fulfill the objectives of estimating the escapement of Chinook Salmon returning to the Indian River and establishing a mark rate that could be used to make inferences about the relative abundance among recovery locations (e.g., above the proposed dam site). The best available option was to increase the number of aerial spawner surveys and aerial telemetry surveys (every third day during the spawning period) in the Indian River and use and area-under-the-curve methods to generate an escapement estimate. This variance enabled AEA to meet the Objective in 2014.

- RSP Section 9.7.4.8 indicated that weirs would be operated on the Middle Fork Chulitna River and Willow Creek among other locations to inspect fish for estimating the proportion with tags. However, Montana Creek was selected as a weir site instead of Willow Creek in 2014. This variance also occurred in 2013 (ISR Part A, Section 4.8.1) and did not affect the study team's ability to achieve study Objective 8.

- A weir was not operated for Chinook Salmon on the Middle Fork Chulitna River in 2013 or 2014 as the stream discharge was too high for weir installation. Instead, a sonar unit was used to obtain the counts necessary for the abundance experiment. Post-season data analysis revealed focus and aiming problems prevented obtaining reliable counts and length measurements. This variance did not prevent meeting the abundance and distribution objectives for the Lower River and the Susitna River abundance estimate component of study Objective 8 in either year.

- RSP Section 9.7.4.8 indicated that weirs would be operated on the Talachulitna River and Lake Creek in the Yentna River drainage. No weir operations occurred at either location in 2014 due to discharges too high for installation (ISR Part A, Section 4.8.1). As presented in ISR Part C, Section 7.1.2.6.1, the study team modified the Study Plan and

used two fishwheels and gillnets in the Yentna River (RM 18) as recapture methods in 2014 instead of weirs. This modification helped the study team achieve study Objective 8 in 2014.

7. STUDY PLAN MODIFICATIONS

7.1. Modifications Identified in ISR

Section 7 of the ISR (Part C) details modifications for this study following the 2013 study season. These modifications are generally summarized as follows:

- Use sonar to count the number of salmon-sized fish passing the proposed Watana Dam site (FERC SPD; decision point based on 2013 feasibility study).
- On the Yentna River, use fishwheels at a new site for recapture, instead of weirs, and deploy fewer Chinook salmon radio tags (RSP Section 9.7.4.1 and 9.7.4.8).
- Use beach seining in September near Curry, instead of fishwheels, to capture and radio-tag salmon (RSP Section 9.7.4.1.1 and FERC SPD).
- Operate three fishwheels near Curry, instead of two, and not operate a fishwheel at Devils Canyon (RSP Section 9.7.4.1.1).
- Radio tag 650 Chinook salmon at Curry (RSP Section 9.7.4.1).
- Operate a picket weir and underwater video system on the Indian River to enumerate tagged and untagged Chinook salmon (RSP Sections 9.7.4.1.3 and 9.7.4.1.5).
- Tag fish at the Curry fishwheels as soon as they are caught, thus precluding the need to examine any effects of holding times and density (RSP Section 9.7.4.1.6).
- Not use sex and age composition of radio-tagged fish to assess fishwheel selectivity (RSP Section 9.7.4.1.7).
- Increase the frequency of aerial telemetry surveys in the Middle River between Curry and Impediment 1 to every three days (RSP Section 9.7.4.2.2).
- Changed some of the fixed-station receiver sites that were proposed in the Study Plan (RSP Section 9.7.4.2.1).
- Use ARIS sonar only to confirm Chinook salmon spawning activity in turbid waters (RSP Section 9.7.4.4.2).

As detailed in the 2014 Study Completion Report for this study, AEA implemented the following modifications in 2014:

- Set gillnets were used to capture Coho Salmon in September 2014. Gillnets proved to be an effective alternative capture method. Relative to using fishwheels, this variance increased the study team's ability to achieve Objective 1.

- The study team used fixed-site sonar at Site 1, bank of capture comparisons, and various length-frequency comparisons to provide insights into capture probabilities at the Middle River tag site (as described in the Study Completion Report, Section 4.1.4.2).

- The study team modified the Study Plan such that all Chinook Salmon captured at the Yentna River tag site in 2014 were marked with uniquely numbered dart tags. This modification better supported the study team's objective (Objective 8) to estimate Chinook Salmon escapement to the entire Susitna River (see Study Completion Report, Section 4.8.1 for more detail).

- The study team modified the Study Plan in 2014 to compensate for the lack of a Devils Canyon fishwheel: three fishwheels were operated in the vicinity of Curry, and the number of radio tags allocated to Chinook Salmon was increased to 650. These variances were also modifications to the Study Plan described in ISR Part C, Section 7.1.2.1.2 that increased the study team's ability to achieve Objective 1.

- In 2014, the study team modified the Study Plan to provide for a total of 650 Chinook Salmon to be radio-tagged in the Middle River in 2014, with a goal of tagging 550 large and up to 100 small Chinook Salmon. The study team implemented this modification to the Study Plan in ISR Part C, Section 7.1.2.1.2. In both years, this variance increased the study team's ability to achieve Objectives 1, 2, and 3.

- The effects of holding time and density on the behavior of tagged fish was not evaluated as discussed in ISR Part C, Section 7.1.2.1.2. This variance did not affect achieving study Objective 1.

- Contingency table analyses were not conducted in 2014. The Study Plan was modified to rely on various other length-frequency comparisons and results from previous study years to provide insights into capture probabilities based on size at the Middle River tag site.

- Only ten fixed-station receiver sites in the Middle and Upper rivers were used in 2014. The site planned for the Indian River weir was not used since the weir was rendered inoperable by a flood on June 26. This variance did not affect the study team's ability to achieve Objective 3.

- In 2014, the study team modified the Study Plan and increased the frequency of surveys in the Middle River to every 1-2 days between Portage Creek and Devils Island from June 28 to August 6, and every third day between the Chulitna River and Devils Island from August 9 to October 28. This change was a Study Plan modification described in ISR Part C, Section 7.1.2.2. This variance improved the resolution of the geographic positions of tagged fish in the Middle River (below, within, and above Devils Canyon) and helped the study team achieve study Objectives 1, 2, and 3.

- In ISR Part C, Section 7.1.2.2, the study team modified the Study Plan by increasing the frequency of aerial telemetry surveys from the mouth of the Chulitna River to Devils Island to three-day intervals in 2014. This modification enhanced the study team's ability to characterize migration behavior and achieve study Objective 3.

- To support further assessment of the fish migration corridor at the Watana Dam sonar site, the study team conducted seven ADCP transects in 2014. To supplement the velocity transects, bathymetric data were also collected. This variance increased the likelihood of the study team achieving study Objective 3.

- In 2014, the study team modified the Study Plan and used sonar only to characterize suspected Chinook Salmon spawning as discussed in ISR Part C, Section 7.1.2.4. This variance limited the study team's ability to document spawning locations in turbid water for Chum, Coho, Pink, and Sockeye salmon as described for study Objective 4.

- RSP Section 9.7.4.6 was modified as described in ISR Part C, Section 7.1.2.1.2 to replace the spawning ground surveys with the operation of a weir and underwater video system, along with a fixed-station receiver site, on the Indian River to enumerate tagged and untagged fish, and establish mark rates.

- Montana Creek was selected as a weir site instead of Willow Creek in 2014. Montana Creek had a more uniform channel configuration and lower water velocity than Willow Creek. The two creeks were located near each other, had similar discharge and watershed characteristics, and had similar Chinook and Coho salmon run sizes. This variance also occurred in 2013 (ISR Part A, Section 4.8.1) and did not affect the study team's ability to achieve study Objective 8.

- A weir was not operated for Chinook Salmon on the Middle Fork Chulitna River in 2014. While a sonar was operated in 2014, post-season data analysis revealed focus and aiming problems that prevented obtaining reliable counts and length measurements. Sonar counts and measurements were obtained for 2013, but post-season analysis was completed after the ISR and did not affect the validity of the Chinook Salmon escapement estimate. This variance did not prevent meeting the abundance and distribution objectives for the Lower River and the Susitna River abundance estimate component of study Objective 8 in either year, but it does impact the results. Without the Middle Fork Chulitna River, it must be assumed that all Chinook Salmon stocks in the Susitna River were adequately represented by the Deshka River and Montana Creek stocks for the tag recapture sampling. Depending upon how similar the Middle Fork Chulitna River sampling results had been to the Deshka River and Montana Creek results, the accuracy and precision of the Lower River Chinook Salmon abundance estimate could be affected in either a positive or negative way.

- RSP Section 9.7.4.8 was modified by using two fishwheels and gillnets in the Yentna River (RM 18) as recapture methods in 2014 instead of weirs. This modification helped the study team achieve study Objective 8 in 2014.

8. STEPS TO COMPLETE THE STUDY

From 2012 to 2014, the study team completed three consecutive years of adult salmon escapement studies on the Susitna River. The *2012 Adult Salmon Distribution and Habitat Utilization Study* was an AEA-sponsored initiative that successfully met all seven study objectives and helped to refine the scope and methods of the 2013–2014 studies. As reported in

the *Initial Study Report for Study 9.7*, the 2013 Salmon Escapement Study met seven of the eight study objectives outlined in RSP Section 9.7.1.2 and adopted both of the modifications outlined in FERC's February 1 SPD as part of the approved Study Plan. The 2014 Salmon Escapement Study (Study 9.7), as reported in the *2014 Salmon Escapement Study (9.7) Implementation and Preliminary Results Technical Memorandum* and the *2014 Salmon Escapement Study (9.7) Study Completion Report* successfully met all eight study objectives as outlined in the Study Plan. The study team has completed all field work, data analysis, and reporting related to the Salmon Escapement Study (Study 9.7).