

# Section 3

## Science and Engineering Process

This Overview Report synthesizes scientific information and reports from a variety of new and existing sources to inform a Secretarial Determination as to whether Klamath dam removal and implementation of KBRA would advance salmonid fisheries (salmon and trout) and whether it would be in the public interest. This report section describes the Federal team that provided oversight of the science and engineering process; the guidance documents they used; the multistage approach used to develop hypotheses, collect and analyze data, and prepare final reports; and a listing of the new technical reports (in addition to this Overview Report) produced with this science and engineering process.

### 3.1 TECHNICAL OVERSIGHT

This Overview Report and the background information for the Secretarial Determination were developed by scientists and engineers from Federal agencies working within the Department of the Interior (DOI), the Department of Commerce (DOC), the Department of Agriculture, and the Environmental Protection Agency (USEPA). These agencies worked collaboratively with state agencies from California and Oregon through nine Sub-teams covering broad topical areas of the Secretarial Determination process. The sub-teams developed and carried out scientific, engineering, and other technical studies to fill data gaps and to address the four primary questions identified in the KHSA (as presented in Section 1, *Introduction*). The sidebar shows a listing of the agencies involved in undertaking and participating in these studies. A Technical Management Team (TMT), composed of a U.S Geological Survey (USGS) program manager, project managers from Bureau of Reclamation (Reclamation) and U.S. Fish and Wildlife Service (USFWS), and the leads and co-leads of each sub-team, managed the overall process for collecting, analyzing, and synthesizing information for the Secretarial Determination. The TMT evaluated the quality of these investigations and final work products of the Secretarial Determination process. The TMT and the nine sub-teams conferred regularly throughout the process to assess existing information, develop and discuss new information being developed, and apply this information to the Secretarial Determination process. The nine sub-teams are:

#### Agencies Supporting Studies for the Secretarial Determination

The following Federal and state agencies worked collaboratively as part of a technical management team (TMT) in synthesizing existing information and developing new information to inform the Secretary of the Interior on the four questions related to dam removal.

#### Department of the Interior

- Bureau of Indian Affairs
- Bureau of Land Management
- Bureau of Reclamation
- U.S. Fish and Wildlife Service
- U.S. Geological Survey

#### Department of Commerce

- National Oceanic and Atmospheric Administration Fisheries Service

#### Department of Agriculture

- U.S. Forest Service

#### U.S. Environmental Protection Agency

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## Agencies Supporting Studies for the Secretarial Determination (cont.)

### State of California

- California Department of Fish and Game
- North Coast Regional Water Quality Control Board

### State of Oregon

- Oregon Department of Environmental Quality
- Oregon Department of Fish and Wildlife
- Oregon Water Resources Department

- Economics
- Engineering, Geomorphology, & Constructability
- Environmental Compliance
- Biological
- Water Quality
- Tribal/Cultural
- Real Estate
- Recreation
- Communications

Appendix I of the KHSA outlines six “key discipline areas that need study and analysis for the Secretarial Determination.” The discipline areas drove the creation of the above sub-teams, to ensure the six discipline areas received adequate attention and review during the Secretarial Determination process. The six areas are:

- Engineering
- Sediment Composition, Fate, and Transport
- Water Quality
- Fisheries
- Economics
- Liability and Risk Management

Appendix I of the KHSA states that the Secretarial Determination study effort should concentrate on these six areas, but if other disciplines are identified during the process, they may be included. Recreation, Real Estate, and Tribal/Cultural were added as sub-teams to ensure these areas were addressed in detail. Liability and risk management issues were addressed by each of the sub-teams, as needed.

The multi-agency TMT brought a broad base of technical experience and expertise to the effort, and worked collaboratively with stakeholders and the public to identify critical information needs, design studies, and avoid duplication of effort with ongoing or completed work by other agencies or entities. As needed, the TMT or individual sub-teams engaged contractors and outside scientists and engineers to obtain individual technical input concerning studies for the Secretarial Determination. Members of the TMT were invited to a broad range of public and stakeholder meetings to provide updates on the Secretarial Determination process and receive valuable input from individual stakeholders regarding the Secretarial Determination science process.

## 3.2 GUIDANCE ON SCIENTIFIC INTEGRITY

Dedication to high quality, rigorous, and objective research and reliable results is an important part of the Secretarial Determination process. The focus on quality research and results was essential to meet the Federal guidelines for scientific integrity articulated in the White House Memorandum on Scientific Integrity (White House Memorandum 2009) as well as to follow the peer review requirements for individual Federal agencies and the Office of Management and Budget’s 2004 Bulletin on Peer Review (OMB 2004). In addition, the review process complies with the DOI’s 2011 Policy on Scientific Integrity and satisfies the requirements for the science process in Appendix I and J of the KHSA.

The KHSA defines the scientific process for the Secretarial Determination as the “essential technical studies undertaken that will support the Secretarial Determination...” The process seeks to make “reasonable, objective, accurate, technically appropriate use of data and analysis, including existing work, and not advocate or otherwise limit the analyses and conclusions of the studies to fit a predetermined outcome. The studies developed or used, or the process used to review existing studies, will be conducted in accordance with the White House Memorandum.” The KHSA (Appendix J) also states “that all new studies and analyses undertaken, or any existing data sets or studies relied upon in whole or in part, shall be of high technical quality, scientifically defensible, and of sufficient depth and scope to support fully informed decision-making by the Secretary.”

### 3.3 SCIENTIFIC METHOD AND DATA COLLECTION

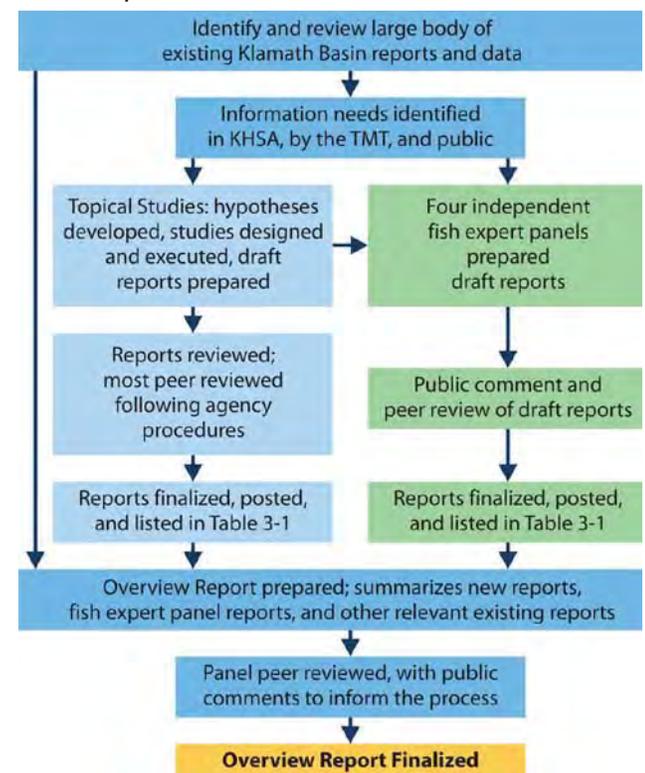
Development of the Overview Report followed the multistage process shown in Figure 3-1 in order to address the four overarching questions described in Section 1, *Introduction*. This flow diagram depicts the Overview Report’s reliance on three primary sources of technical information in order to address the questions: existing data and reports; new topical reports developed by and for the TMT; and reports prepared by four independent science panels describing the likely impacts on fish with and without implementing the agreements. This section briefly describes how these sources of information were developed, how peer review was conducted on new reports, and the opportunities for public and stakeholder input during these processes. This section also describes the independent peer review process for this Overview Report and the opportunity for the public to provide written technical input to inform the peer review panel.

#### 3.3.1 Existing Reports and Data

The TMT and its Sub-teams first searched the large body of existing reports and data (see Figure 3-1). The Klamath Basin has been studied extensively for many years, and for some subjects (such as fish biology) there is a relatively rich body of existing reports and data sets to draw upon. In particular, the FERC relicensing process identified and produced a considerable amount of literature which was then available for use in this analysis. In other subject areas, such as the potential economic impacts of dam removal, the amount of existing information was sparse and new information had to be developed. Each report produced for the Secretarial Determination process identifies the existing literature considered when reaching conclusions. The literature and sources of information (existing and new) used in this Overview Report are listed in Section 6, *References*.

One of the purposes of the many stakeholder and public meetings held throughout the Klamath Basin beginning in March 2010 (see Table 2-1) was to request any information sources the TMT may have not known about. Discussions associated with these meetings identified a number of important sources of information the TMT

Figure 3-1: Multistage Science and Engineering Process Leading to this Overview Report.



may have overlooked, taking advantage of the extensive local knowledge in the basin, and thereby improving the quality, breath, and accuracy of the findings in the new technical reports being prepared for the Secretarial Determination.

In a few cases, the TMT elected to conduct independent expert reviews of existing reports that had not undergone an outside review but could prove important for informing a Secretarial Determination. For example, Stillwater Sciences (2009) prepared a report describing the likely effects of dam removal on aquatic biota in the Klamath Basin. This report was given an expert review (PBS&J 2010) to verify its technical quality and identify limitations (if any) so that it could be used appropriately and with a high level of confidence and certainty in its conclusions.

### 3.3.2 Identification of Data and Information Needs

Following the evaluation of existing literature and data, the TMT Sub-teams identified new data and information needs (see Figure 3-1) in order to address the four major questions identified in the KHSA, and refined by the TMT, for a Secretarial Determination (see Section 1, *Introduction*). These four major questions, however, are broad and not conducive for posing testable hypotheses or designing studies. Each sub-team broke these major questions down into specific, testable questions and sub-questions that could be analyzed. For example, the broad question “Is facilities removal and implementation of the KBRA in the public interest?...” was broken down into specific questions of potential impacts on sectors of the economy and jobs (e.g., commercial ocean fisheries, reservoir recreation, and hydropower) or potential impacts on identifiable groups of people (e.g. an Indian tribe or the property owners near the reservoirs).

This list of specific questions was expanded and refined based on input at the many public and stakeholder meetings held throughout the Klamath Basin (see Table 2-1) that provided valuable local knowledge of resources in the basin, how resources were used, and their value to people. Identifying a comprehensive list of specific questions to be addressed for a Secretarial Determination was an essential step for identifying important information gaps and what new studies would be needed to fill those information gaps.

### 3.3.3 Study Design and Drawing Scientific Conclusions to Fill Information Needs

Once important questions to be address and hypotheses to test were identified in order to fill information gaps, the TMT Sub-teams designed studies, incorporating valuable input received during stakeholder and public meetings on possible methodologies and information sources. Study design (see Figure 3-1) was guided by the principles of the scientific method, which allows conclusions to be drawn and reports to be written from a rigorous process of literature review, proposing one or more hypotheses, collecting data, assessing support for hypotheses with data or models, refining hypotheses, and thereby building

an understanding of a system (or answering a question) by going through the process iteratively.

The application of the scientific method in the design and execution of studies varied depending on the type and complexity of the question, the amount of existing data, whether standard analysis procedures and models were available, whether findings could be expressed qualitatively or quantitatively, and many other variables. Consequently, no single design can be described here for all the Secretarial Determination studies; however, each of the customized study designs, including the question to be answered (or hypothesis to be tested), data sources, methods and approaches, study assumptions, and how conclusions were drawn from the analysis are described in individual reports.

How scientific conclusions are drawn in a report also varied among studies. Synthesis reports, expert science panels, National Research Council reviews, and assessments of the “state-of science” (e.g. as this Overview Report), typically draw scientific conclusions based on the weight-of-evidence after considering findings from multiple reports and information sources. More weight is typically placed on reports that are recent, have a rigorous scientific approach, are peer reviewed, and have direct or similar application to the system being analyzed. Certainty of a conclusion in these reports is relatively high when other independent investigators reach a similar conclusion, when the conclusion is supported by a particularly definitive study, and/or when there are few (if any) reports presenting a contrary conclusion. In contrast, certainty of a conclusion is relatively low when the number of relevant supporting studies is small, when there are no definitive studies upon which to rely, and/or when the relevant studies present conflicting conclusions.

For topical reports, the ability to draw defensible scientific conclusions often included a weight-of-evidence analysis (comparing results to other similar studies) along with other approaches intended to increase the certainty of conclusions. These include, but are not limited to: using accepted scientific procedures and statistically valid sample sizes; testing multiple hypotheses; repeating previous investigations to verify accuracy of important conclusions; and using multiple lines of evidence to support a conclusion. Not every Secretarial Determination study could use all of these approaches to strengthen their conclusions; however, they were all used when possible, for example, in the study of reservoir sediment chemistry, providing a good example of how a strong design leads to increased certainty of conclusions.

The reservoir sediment chemistry question analyzed was: Would chemicals in reservoir sediments have adverse effects to people or animals if dams were removed? This screening-level evaluation considered a range of possible human and animal exposure pathways to the reservoir sediments (five hypotheses). Over 500 chemicals were analyzed from 77 sediment cores using standard and accepted laboratory procedures by an independent laboratory. The study repeated (and confirmed) a similar chemical analysis of reservoir sediments published in 2006. And a second line of evidence, using bioassays (toxicity and bioaccumulation testing of sensitive aquatic organisms), supported the chemistry evaluation’s conclusions.

Strong study designs, and conscientious execution of those designs produced reports that fill important information gaps for a Secretarial Determination. Peer review of these reports increases the confidence scientists and the public places in the findings and conclusions in these reports. Moreover, peer reviews often correct errors and improve report clarity. The following sections describe the peer review process for topical reports.

### **3.3.3.1 Peer Review**

The process below outlines the general elements of a peer review for a topical report prepared for the Secretarial Determination (see Figure 3-1). Each agency has discretion as to what process of peer review is best suited for their reports, so exact processes vary among agencies. The five elements below capture the general guidance agencies used when obtaining an independent review of a report.

1. The lead agency, or the agency contracting for scientific work, oversaw the peer review. In some cases an independent contractor specializing in conducting scientific reviews assisted in conducting aspects of the peer review process.
2. Peer reviewers were subject-matter technical experts, they were independent of the study, and they did not have a conflict of interest.
3. Peer reviewer's comments, or a summary of their comments, may have been made part of the public record, at the discretion of the lead agency.
4. Author(s) responded to review comments and make appropriate changes to the report to correct technical errors and improve clarity. At the discretion of the lead agency, these author responses may have been made part of the public record.
5. The agency conducting or overseeing the peer review determined when a report was final and ready for dissemination.

### **3.3.4 Preparation and Review of Fish Expert Panel Reports**

To meet the standards of the KHSAs, the TMT determined that the existing and new scientific information on fish populations in the Klamath Basin should be reviewed and evaluated by independent expert panels of scientists not currently involved with studies in the Klamath Basin. The purpose of the expert panels was to provide another expert review, independent of the Federal scientists, as to whether dam removal and KBRA would advance the restoration of salmonid fisheries and other fish populations. The TMT's goal for the expert panels was that they consist of independent reviewers, be transparent, add to the body of information for decision-making, open the process up to participation by a broad range of scientists and the public, and provide accessible synthesis reports of existing information.

The independent consulting firm of Atkins North America (Atkins), formerly PBS&J, was contracted by the USFWS to assemble four groups of experts to evaluate the potential effects of two management scenarios on four groups of anadromous and resident fish species native to the Klamath Basin (see Figure 3-1). The expert panels were asked to review the existing data and to provide an independent analysis of the conditions in the basin and the likely outcome of two management scenarios. The two management scenarios analyzed were 1) dams in and no change from current management, laws, and regulations; and 2) dams out and full implementation of the KBRA. The panel's reviews were captured in four expert panel reports on the following four groups of native fish, available on [KlamathRestoration.gov](http://KlamathRestoration.gov):

1. Chinook salmon (Goodman et al. 2011)
2. Coho salmon and steelhead (Dunne et al. 2011)
3. Resident trout and other resident fish (Buchanan et al. 2011)
4. Lamprey species (Close et al. 2010)

Atkins was responsible for managing the screening and selection process for the panelists, facilitating their deliberation process, ensuring that the panelists and their work products were not biased, and assisting with the preparation of their final reports. Editorial control of each final report was retained by the expert panels and Atkins to ensure an independent review and to increase the public's confidence in the objectivity and outcome of the process.

Atkins identified almost 60 potential expert panelists, with the goal of four to six experts per panel. These panelists had no working relationship with Atkins prior to the screening process. The panels contained hydrologists, fish ecologists, population modelers, and experts on the biology of the fish species being reviewed. In addition to being experts in the field, each of the panelists also had to be able to meet the timeframe of the review process, provide a review that was both credible and independent, and be free from actual, potential, or perceived conflicts of interest.

There is a large amount of existing research on the Klamath Basin that describes the physical characteristics of the basin, including water quality, temperature, geomorphology, and tributary conditions. The challenge before the panels was to evaluate the existing information and provide logical potential outcomes of the two management scenarios based on their knowledge of the species and their experience and knowledge of other river systems.

The panels did not re-examine original data or re-do analyses conducted by other researchers. The panelist assessed and interpreted the reliability and relevance of the technical information provided, evaluated its relevance to the target species, and estimated the impacts of the two management scenarios. To assist the panels, Atkins held public meetings where scientists and engineers with knowledge of the Klamath Basin could present their scientific views and findings and be available for questioning by the panels to help in their deliberations.

Each panelist was responsible for specific sections for the panel's report. The panel reviewed the individual sections and prepared a draft final report from the individually crafted sections. The panel's draft final reports were then submitted to another peer review panel that provided feedback and suggestions on language, coverage, and analysis to the expert panels (see Figure 3.1). The panelists then responded to these comments and made changes to the draft reports, as appropriate. Each draft expert panel report was made publicly available for written comments that were then considered by the panel before finalizing their reports. All comments on the reports, and all comment responses by the panels, are included in the final reports to maximize the transparency of the process.

Although each expert panel ultimately reached general conclusions regarding the likely effects of dam removal and KBRA implementation on these groups of fish, at least two of the panels (Chinook and Coho/Steelhead) were unable to assimilate all relevant information on their topics, were distracted by some of the questions posed to them by the TMT, and faced much uncertainty in their deliberations, particularly with regard to the lack of detail and specificity about KBRA and the institutional framework for implementing it.

Frustration of the Coho/Steelhead Panel in meeting its charge within the time constraints is evident in these quotes from their Executive Summary (page i). "The panel furthermore was funded to meet for only 5 days and the report at the end of that time. While a tight deadline does concentrate the mind, and encourages focus on the most important of the evident issues, it also exacts a cost in limiting the depth of the review." "The Panel's statements are based on careful review of this material and group discussions. However, the Panel's statements are no substitute for further scientific investigation. The Panel recommends that its statements not be used in lieu of doing the necessary and feasible data collection, analyses, and modeling that is recommended below." It is clear from these comments that the Coho/Steelhead Panel did not want their conclusions to be overly relied upon for decision making, used without disclosing their reservations, or as a replacement for further study.

The Chinook Panel primarily attempted to answer only the broader (key) questions, provided conclusions that were largely qualitative, and expressed uncertainty in their conclusions that may have reflected their inability to assimilate and analyze the large amount of information provided to them because of time constraints (e.g. nearly 800 documents and web links for the Chinook Panel to assimilate in less than 2 weeks). They also expressed frustration that quantitative tools (models) do not exist to predict likely changes in Chinook production. Since the time they completed their report, Hendrix (2011) published a peer-reviewed basin-wide stock-recruitment model that quantifies annual production and harvest, with associated statistical uncertainties. It is unfortunate this model (Hendrix 2011) was not available to the panel in time for their deliberations.

### 3.3.5 Preparation and Peer Review of the Overview Report

Preparation of the Overview Report represents collaboration among the consulting firm CDM Smith, the TMT, and the TMT Sub-teams. This collaboration ensured that findings from topical reports, existing reports, and expert panel reports were accurately summarized in the Overview Report and that the four major questions for a Secretarial Determination were adequately and objectively addressed. The purpose and scope of the Overview Report, and how it will be used in a Secretarial Determination, was discussed earlier in Section 1.1, *Purpose and Scope of this Report*.

The Overview Report underwent peer review as a Highly Influential Scientific Assessment as defined by OMB's Bulletin on peer review. "A scientific assessment is considered 'highly influential' if the agency or the Office of Information and Regulatory Affairs Administrator determines that the dissemination could have a potential impact of more than \$500 million in any one year on either the public or private sector or that the dissemination is novel, controversial, or precedent-setting, or has significant interagency interest" (OMB 2004). The details of this peer review process are described below.

#### 3.3.5.1 Peer Review of the Overview Report

The rigor of the peer review process was increased for this Overview Report in comparison to the peer review of topical reports described earlier (Section 3.3.3.1, *Peer Review*) by including a larger number of reviewers on the peer review panel and by giving the public an opportunity to provide written technical comments for the peer reviewers to consider during their deliberations. Elements of the Overview Report peer review process are described below; much of the peer review process, including the collection of written comments from the public regarding the draft Overview Report, was run by an independent contractor (Atkins) which specializes in conducting peer reviews (see Figure 3-1).

The schedule for the panel peer review proceeded as follows: (1) on January 25, 2012, each peer reviewer received the draft Overview Report and supporting material to evaluate individually; (2) on February 8, 2012, Atkins provided the panelists electronic access to all the public comments regarding the draft Overview Report to consider as they individually developed comments and recommendations; (3) from February 13 - 17, 2012, the panelists met face-to-face to discuss the strengths and weaknesses of the draft Overview Report, determine whether the public comments justified modification of the Overview Report, and prepared draft group comments and recommendations; and (4) Atkins prepared a final peer review report that was approved by the entire panel and delivered to DOI on March 2, 2012.

**Peer reviewers and the selection process:** The TMT nominated 34 potential peer reviewers. Eighteen individuals from academia, private consulting, and non-profit organizations were contacted by Atkins to determine their interest, availability, and eligibility to serve on the peer review panel. Six individuals (listed below) were selected. The Panel was made up of nationally recognized

experts from the following disciplines: natural resources economics, riverine geomorphology, dam removal engineering, aquatic ecosystems, Pacific salmonid biology, and anthropology. Each candidate was evaluated to verify that no real or perceived conflicts of interest existed and each candidate specifically disclosed any potential conflicts of interest according to the National Academies' Conflict of Interest Disclosure process.

- Stephen Dow Beckham, Ph.D., Pamplin Professor of History, Emeritus, Lewis & Clark College
- Charles C. Coutant, Ph.D., retired Distinguished Research Ecologist, Oak Ridge National Laboratory
- William L. Graf, Ph.D., University Foundation Distinguished Professor Emeritus, University of South Carolina
- Steve Higinbotham, P.E., practicing hydraulic engineer with 40 years of experience
- Dan Huppert, Ph.D., Professor Emeritus, School of Marine and Environmental Affairs, University of Washington
- Daniel Schindler, Ph.D., Harriet Bullitt Chair of Conservation, School of Aquatic and Fishery Sciences, University of Washington

**Charge to the Peer Review Panel (December 26, 2011):** The charge directed the panel to focus on ensuring that the Overview Report accurately reflected cited reports, adequately covered the four major questions essential for a Secretarial Determination (see Section 1.1, *Purpose and Scope of this Report*), reached defensible conclusions, and clearly presented information accessible to the public. The peer reviewers were also directed to consider public comments that are technical or scientific in nature to determine whether the comments justify modification of the draft Overview Report during their face-to-face deliberations and during preparation of the panel's written report.

**Information Sources:** The reviewers were given copies of the draft Overview Report, all new reports prepared for the Secretarial Determination process, other technical reports cited in the draft Overview Report, the KHSA and KBRA, and the written public comments on the draft Overview Report (collected by Atkins).

**Peer Review Report:** The panel prepared a 42-page report (plus three appendices) titled: *Peer Review Panel Report on Draft Klamath Dam Removal Overview Report for the Secretary of the Interior (2012)*. This report includes general review comments that identified the strengths of the draft Overview Report and areas where its effectiveness could be strengthened. In addition, this peer review report includes about 60 specific comments and recommendations to be considered and responded to by the authors when preparing the final Overview Report.

**Response to Peer Review Comments:** The TMT responded in writing, in a separate report, to each written peer review comment and recommendation, and made changes as appropriate in preparing the final Overview Report. Reasoning is fully disclosed when a recommended change to the Overview Report was not made or if the authors differed with the peer reviewers' comments and recommendations.

**Referee of the Peer Review Process:** Atkins also served as "referee" for the peer review process. The peer review referee verified that all peer review comments and recommendations were responded to in writing, that peer review comments and recommendations accepted by the TMT resulted in satisfactory changes to the Overview Report, and that comments and recommendations not accepted by the TMT were justifiable and adequately explained.

**Transparency:** Documents regarding the panel peer review process of this Overview Report are posted on [KlamathRestoration.gov](http://KlamathRestoration.gov), including: (1) Charge to the Peer Review Panel, (2) the draft Overview Report provided to the peer review panel, (3) *Peer Review Panel Report on Draft Klamath Dam Removal Overview Report for the Secretary of the Interior (2012)*, (4) TMT responses to the peer reviewer comments and recommendations, (5) a letter from the independent peer review "referee" verifying the successful completion of the peer review process, and (6) the final Overview Report.

### 3.4 LIST OF TECHNICAL STUDIES DEVELOPED FOR THE SECRETARIAL DETERMINATION PROCESS

Table 3-1 lists new reports prepared to fill information gaps, verify results of earlier studies, and synthesize a large body of information into single reports to inform the Secretarial Determination. These studies represent the collaborative efforts of agencies of the TMT, individual TMT Sub-teams, or contractors overseen by the TMT. The reports below are publicly available at [KlamathRestoration.gov](http://KlamathRestoration.gov).

**Table 3-1: List of Studies and Reports Developed or Reviewed for the Secretarial Determination Overview Report**

Document Name
<b>Biological Sub-team</b>
Compilation of Information Relating to Myxozoan Disease Effects to Inform the Klamath Basin Restoration Agreement. (Bartholomew and Foott 2010)
Compilation of Information to Inform USFWS Principals on the Potential Effects of the Proposed Klamath Basin Restoration Agreement (Draft 11) on Fish and Fish Habitat Conditions in the Klamath Basin, with Emphasis on Fall Chinook Salmon. (Hetrick et al. 2009)
Effects of the Klamath Basin Restoration Agreement to Lower Klamath, Tule Lake and Upper Klamath National Wildlife Refuges. (Mausser and Mayer 2011)
Forecasting the response of Klamath Basin Chinook populations to dam removal and restoration of anadromy versus no action. (Hendrix 2011)
Klamath Dam Removal Drawdown Scenario 8: Potential Impacts of Suspended Sediments on Focal Fish Species with and without Mechanical Sediment Removal. (Stillwater Sciences 2011a)
Scientific Assessment of Two Dam Removal Alternatives on Chinook Salmon. Final Report from the Expert Panel. Addendum to Final Report, July 20, 2011. (Goodman et al. 2011)
Scientific Assessment of Two Dam Removal Alternatives on Coho Salmon and Steelhead. Final Report from the Expert Panel. (Dunne et al. 2011)
Scientific Assessment of Two Dam Removal Alternatives on Lamprey. Final Report from the Expert Panel. (Close et al. 2010)

**Table 3-1: List of Studies and Reports Developed or Reviewed for the Secretarial Determination Overview Report**

Document Name
Scientific Assessment of Two Dam Removal Alternatives on Resident Fish. Final Report from the Expert Panel. (Buchanan et al. 2011)
Synthesis of Effects to Fish Species of Two Management Scenarios for the Secretarial Determination on Removal of the Lower Four Dams on the Klamath River. (Hamilton et al. 2011)
Using Model Selection and Model Averaging to Predict the Response of Chinook Salmon to Dam Removal. (Lindley and Davis 2011)
<b>Tribal / Cultural Sub-team</b>
Current Effects of PacifiCorp Dams on Indian Trust Resources and Cultural Values in the Klamath River Basin. (DOI 2012a)
Potential Effects of Implementing the KHS and KBRA on Trust Resources and Cultural Values. (DOI 2011b)
<b>Economics Sub-team</b>
Benefit Cost and Regional Economic Development Technical Report for the Secretarial Determination on Whether to Remove Four Dams on the Klamath River in California and Oregon. Bureau of Reclamation Technical Services Center, Denver CO. (Reclamation 2012a)
Commercial Fishing Economics Technical Report for the Secretarial Determination on Whether to Remove Four Dams on the Klamath River in California and Oregon. (NOAA Fisheries Service 2012a)
Economics and Tribal Summary Technical Report for the Secretarial Determination on Whether to Remove Four Dams on the Klamath River in California and Oregon. Bureau of Reclamation Technical Services Center, Denver CO. (Reclamation 2012b)
Hoopa Valley Tribe Fishery Socioeconomics Technical Report for the Secretarial Determination on Whether to Remove Four Dams on the Klamath River in California and Oregon. (NOAA Fisheries Service 2012b)
Hoopa Valley Tribe Sociocultural/ Socioeconomic Effects Analysis Technical Report for the Secretarial Determination on Whether to Remove Four Dams on the Klamath River in California and Oregon. Bureau of Reclamation Technical Services Center, Denver CO. (Reclamation 2011b)
Hydropower Benefits Technical Report for the Secretarial Determination on Whether to Remove Four Dams on the Klamath River in California and Oregon. EC-2011-02. Bureau of Reclamation Technical Services Center, Denver CO. (Reclamation 2012c)
In-River Sport Fishing Economics Technical Report for the Secretarial Determination on Whether to Remove Four Dams on the Klamath River in California and Oregon. (NOAA Fisheries Service 2012c)
Irrigated Agriculture Economics Technical Report for the Secretarial Determination on Whether to Remove Four Dams on the Klamath River in California and Oregon. Bureau of Reclamation Technical Services Center, Denver CO. (Reclamation 2012d)
Karuk Tribe Fishery Socioeconomics Technical Report for the Secretarial Determination on Whether to Remove Four Dams on the Klamath River in California and Oregon. (NOAA Fisheries Service 2012d)
Karuk Tribe Sociocultural/ Socioeconomic Effects Analysis Technical Report for the Secretarial Determination on Whether to Remove Four Dams on the Klamath River in California and Oregon. Bureau of Reclamation Technical Services Center, Denver CO. (Reclamation 2011d)
Klamath Tribes Fishery Socioeconomics Technical Report for the Secretarial Determination on Whether to Remove Four Dams on the Klamath River in California and Oregon. (NOAA Fisheries Service 2012e)
Klamath Tribes Sociocultural/Socioeconomics Effects Analysis Technical Report for the Secretarial Determination on Whether to Remove Four Dams on the Klamath River in California and Oregon. Bureau of Reclamation Technical Services Center, Denver CO. (Reclamation 2011e)
Ocean Sport Fishing Economics Technical Report for the Secretarial Determination on Whether to Remove Four Dams on the Klamath River in California and Oregon. (NOAA Fisheries Service 2012f)
Refuge Recreation Economics Technical Report for the Secretarial Determination on Whether to Remove Four Dams on the Klamath River in California and Oregon. (Reclamation 2011f)
Reservoir Recreation Economics Technical Report for the Secretarial Determination on Whether to Remove Four Dams on the Klamath River in California and Oregon. (Reclamation 2012g)
Resighini Rancheria Fishery Socioeconomics Technical Report for the Secretarial Determination on Whether to Remove Four Dams on the Klamath River in California and Oregon. (NOAA Fisheries Service 2012g)
Resighini Rancheria Tribe Sociocultural/Socioeconomics Effects Analysis Technical Report for the Secretarial Determination on Whether to Remove Four Dams on the Klamath River in California and Oregon. (Reclamation 2011h)
Whitewater Boating Recreation Economics Technical Report for the Secretarial Determination on Whether to Remove Four Dams on the Klamath River in California and Oregon. (DOI 2012b)
Yurok Tribe Fishery Socioeconomics Technical Report for the Secretarial Determination on Whether to Remove Four Dams on the Klamath River in California and Oregon. (NOAA Fisheries Service 2012h)
Yurok Tribe Sociocultural/ Socioeconomic Effects Analysis Technical Report for the Secretarial Determination on Whether to Remove Four Dams on the Klamath River in California and Oregon. (Reclamation 2011k)
Klamath River Basin Restoration Nonuse Value Survey Final Report. (RTI International 2011)
<b>Engineering/ Geomorphology/ Constructability Sub-team</b>
Detailed Plan for Dam Removal– Klamath River Dams. Klamath Hydroelectric Project FERC License No. 2082, Oregon-California. Public Review Draft. (Reclamation 2012e)
Feasibility, Risk, and Uncertainty of Mechanical Sediment Removal with the Proposed Action (Full Facility Removal) (River Design Group 2011)

**Table 3-1: List of Studies and Reports Developed or Reviewed for the Secretarial Determination Overview Report**

Document Name
Hydrology, Hydraulics and Sediment Transport Studies for the Secretary's Determination on Klamath River Dam Removal and Basin Restoration. Technical Report No. SRH-2011-02. Bureau of Reclamation Technical Services Center, Denver, CO. (Reclamation 2012g)
Klamath Settlement Process: Sediment Management in the Reservoirs. (CDM 2011c)
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