Review Plan
U.S. Army Corps of Engineers
Seattle District
Northwestern Division

Howard A. Hanson Dam
Issue Evaluation Study

US Army Corps of Engineers®

05 November 2012

Contents

1. Introduction

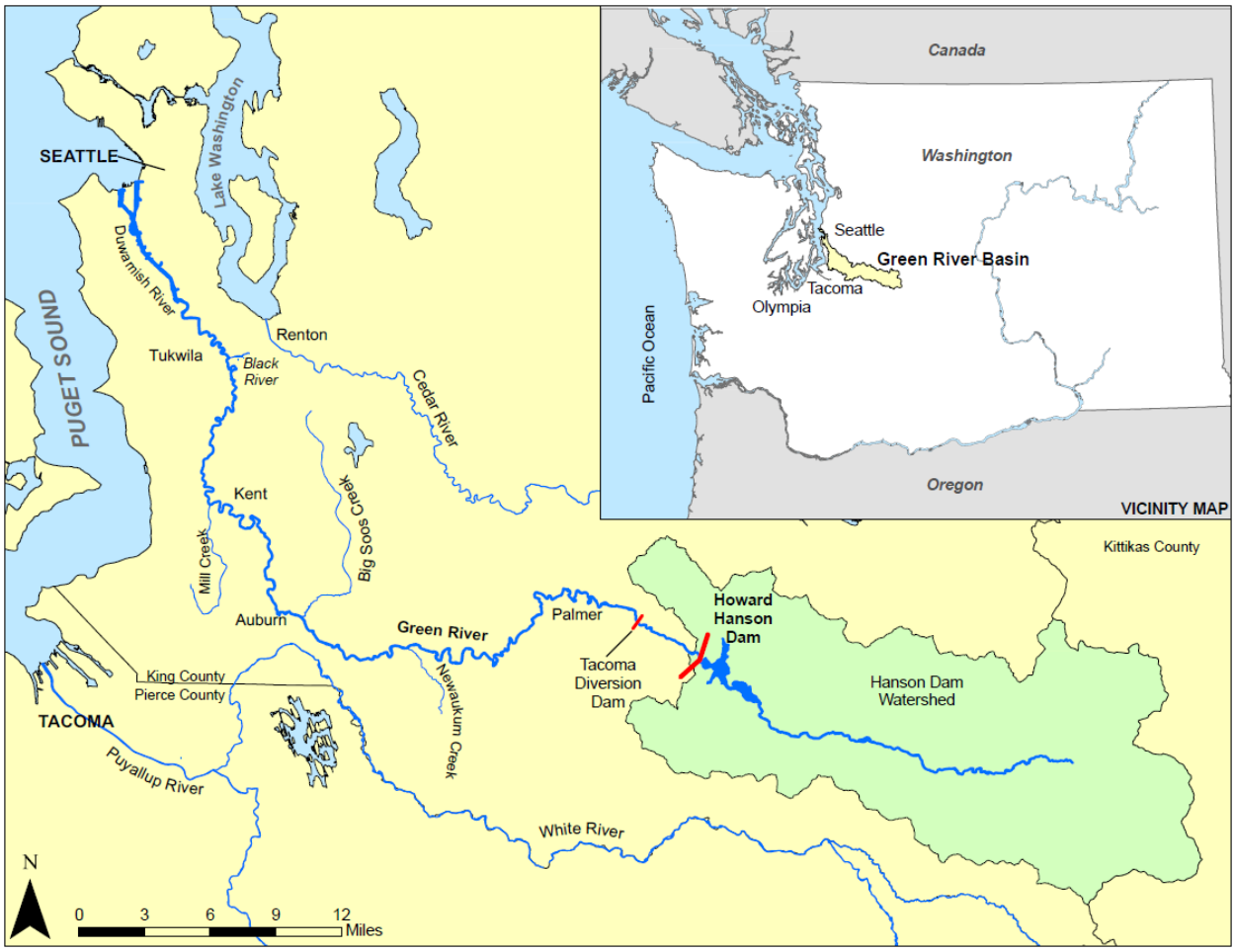
a. Purpose

This Review Plan is intended to ensure a quality-engineering Dam Safety Issue Evaluation Study developed by the Corps of Engineers. ER 1110-2-1156, "Dam Safety Policy and Procedures" dated 28 Oct 2011, Chapter 8 describes the Issue Evaluation Study (IES) Plan development, review, and approval process. This Review Plan has been developed for Howard A. Hanson Dam (HAHD). This Review Plan was prepared in accordance with EC 1165-2-209, "Civil Works Review Policy", and covers the review process for HAHD IES Report. The IES is a study that may lead to additional studies, modeling, or NEPA consultation. NEPA compliance would occur during the Dam Safety Modification Study Phase. Because the Phase 1 IES is used to potentially justify a Dam Safety Modification Study (DSMS), it is imperative that the vertical teaming efforts are proactive and well coordinated to assure collaboration of the report findings, conclusions, and recommendations, and that there is consensus at all levels of the organization with the recommended path forward.

b. Project Description and Information

HAHD is a multipurpose project, which provides flood risk mitigation benefits to over $25 billion in infrastructure located in the lower Green River Valley, which includes the cities of Kent, Auburn, Renton and Tukwila. Industrial, commercial, and residential development is located throughout the Green River Valley, as well as significant infrastructure of highways, roads, utilities, water, and sewer treatment facilities. Over 300,000 people live, work in, and transit through the Green River Valley. The Green River Valley is the fourth largest contiguous warehousing district in the United States. In addition to flood risk mitigation benefits, HAHD provides municipal and industrial water supply to the City of Tacoma directly and indirectly to several other municipalities who have contracts with the City of Tacoma. The estimated flood damages prevented by HAHD during the January 2009 flood were approximately $3.9 billion.

HAHD is currently partnering with Tacoma Public Utilities (TPU) in order to provide municipal water storage for the City of Tacoma and other communities in south King County. HAHD has one authorized project on-going, which includes the construction of a state-of-the-art out-migrating fish passage facility, downstream gravel nourishment and ecosystem restoration projects and upstream mitigation projects. HAHD also provides summertime downstream flow augmentation for fisheries which support both environmental stewardship requirements under the ESA and treaty obligations with local tribes.



Seattle District (NWS) of the U.S. Army Corps of Engineers (USACE) has conducted an Issue Evaluation study (IES) for HAHD. The purpose of an IES is to evaluate potential failure modes that pose a credible dam safety risk, verify the current dam safety action class (DSAC) rating, guide the selection and gauge the effectiveness of interim risk reduction measures, and justify the need to pursue or not pursue a DSMS.

This issue evaluation study report (IES), initially prepared as a DSMS report, is one of several actions that was triggered in 2009 following a record flood pool on 9 January at HAHD. Following the peak pool, conditions were observed that indicated seepage and possible internal erosion through the right abutment which raised concerns about the integrity of the dam. On 16 March 2009, the DSAC rating was changed from II (urgent) to I (urgent and compelling). The DSAC I rating also triggered the preparation and approval of an Interim Risk Reduction Plan (IRRP) Revision in May 2009, which included 29 actions to investigate, communicate and reduce the probability and potential consequences of a catastrophic failure, while longer term risk management

alternatives were evaluated. Following a comprehensive evaluation of potential failure modes in 2010 as part of the DSMS effort, a set of additional risk reduction measures (RRMs) were identified, evaluated, and recommended for implementation. These RRMs were implemented between October 2010 and July 2012 as part of a supplement to the IRRM Plan. Implementation of the RRMs increased the level of confidence in HAHD to perform as designed and the DSAC classification was changed to the current rating of DSAC III (high priority) on 7 October 2011. On 02 October 2012, USACE DSO concurred with the NWS request to complete the DSMS as an IES report.

c. Levels of Review

IES Reviews shall include:

- District Quality Control (DQC)
- Agency Technical Review (ATR)
- RMC Reviews
    - Quality Control and Consistency Review (QCC), composed of RMC staff and/or external experts
    - Senior Oversight Group (SOG).

Independent External Peer Review (IEPR) is applied in cases that meet certain criteria. This IES is not a decision document and does not cover work requiring a Type I or Type II IEPR. IESs are used to justify Dam Safety Modification Studies. If this project requires a Dam Safety Modification Study, both Type I and Type II IEPR will be conducted.

d. Review Team

Review Management Office: The USACE Risk Management Center (RMC) is the Review Management Organization (RMO) for dam safety related work, including this IES. Contents of this review plan have been coordinated with the RMC and the Northwestern Division (NWD), the Major Subordinate Command (MSC). Informal coordination with NWD will occur throughout the IES development, including briefings to the NWD Dam Safety Committee and Program Review Board updates. In-Progress Review (IPR) team meetings with the RMC, NWD, and HQ will be scheduled on an “as needed” basis to discuss programmatic, policy, and technical matters. The NWD Dam Safety Program Manager will be the POC for vertical team coordination. This review plan will be updated for each new project phase.

Agency Technical Review Team. The minimum expertise required for this IES review is listed below.

Biologist. Biologist with 5 to 10 years of experience working with the assessment of construction impacts on Pacific Northwest anadromous fish, and related ecosystem species and habitat. Should have experience working on design or construction teams that work in or around fresh water lakes and streams. Should have detailed knowledge of the NEPA/ESA with regional knowledge of Pacific Northwest specific regulatory requirements, tribal treaty obligations, and relevant regulations.

Engineering cost estimator. Engineering cost estimator should have 5-10 years experience working with estimating complex, phased costing of multi-year civil construction projects. Should have direct experience working with hydraulic retention structures in a design or construction management capacity.

Hydrologist. Hydrologist should have 5-10 years experience or equivalent education in water management especially with managing water outflows from a reservoir. Should have experience with characterizing surface water flows in a watershed using inundation mapping software, and other water-flow scenario development techniques.

Plan Formulator. Should have 10 – 15 years experience as a plan formulator who has worked with project teams, to identify and evaluate measures and alternatives using appropriate planning methodologies to address the probable failure modes. Must have extensive experience reviewing the analysis with which the measures and alternatives were evaluated and that they are sufficiently comprehensive and complete to result in approval of a recommended alternative. Review the documentation of the selection of a recommended plan and ensure the team used an approved plan selection methodology.

Required ATR Team Expertise: The ATR team will be chosen based on each individual's qualifications and experience with similar projects.

ATR Lead: The ATR team is a senior professional with extensive experience in preparing Civil Works documents and conducting ATRs (or ITRs). The lead has the necessary skills and experience to lead a virtual team through the ATR process. The ATR lead may also serve as a reviewer for a specific discipline, in this case, structural engineering, geology, or geotechnical engineering.

Geotechnical engineer. Geotechnical engineer with 5-10 years of experience and graduate study in soils engineering or related field. Must have dam safety experience through participation in dam safety expert panels, risk evaluation/mitigation studies or similar experience with hydraulic retaining structures. Should have several years of direct experience with hydraulic retaining structure rehabilitation projects as either designer or construction project engineer. Must be adroit with the USACE risk informed approach to dam risk decision making. Should have design or construction experience evaluating slope sufficiency under a seismic load using geological analysis provided.

Should have design or construction management experience with underground concrete structures including necessary worksite earthwork preparation and workflow management.

Geologist. Geologist with 5 to 10 years of experience or equivalent education examining land-slide materials with striated aquifers in heterogeneous materials. Must have dam safety experience through participation in dam safety expert panels, risk evaluation/mitigation studies, projects or similar experience with assessment techniques of complex geologies. Should have experience with deep earth concrete structures, common grouting and related construction techniques. Should have several years experience evaluating the results of ground water models using computer aided techniques.

Structural engineer. Structural engineer with experience evaluating dam structural elements such as spillway and regulating gates. Should have design experience or education evaluating reinforced concrete structures with emphasis on seismic analysis of buried concrete structures.

Hydraulic engineer. Hydraulic engineer with 5-10 years experience or equivalent education assessing hydraulic retention structures. This individual should have direct design or construction management experience with dam rehabilitation projects especially with regard to spillways, stilling basins and drainage pipes and tunnels.

Mechanical Engineer. Mechanical engineer with 5-10 years experience or equivalent education in design, installation, and operating mechanical dewatering pump systems, including controllers, pumps, and wells/drains. This position requires experience with pump design, materials selection, and well design at USACE operating projects, especially related to dam safety repairs.

Economist. Should have 5-10 years experience or equivalent education from the USACE who knows policies and guidelines including the new policy ER 1110-2-1156 regarding Dam Safety as well as extensive experience in analyzing flood risk management projects in accordance with ER 1105-2-100, the Planning Guidance Notebook. The economist should have experience working with the USACE risk-informed approach to decision-making, risk models, and disaster scenarios with regard to economic impact.

2. Requirements

a. Reviews

The review of all work products will be in accordance with the requirements of EC 1165-2-209 by following the guidelines established within this review plan. All engineering and design products will undergo District Quality Control Reviews.

i. District Quality Control (DQC)

DQC is the review of basic science and engineering work products focused on fulfilling the project quality requirements. DQC will be performed for all district engineering products by staff not involved in the work and/or study. Basic quality control tools include a plan providing for seamless review, quality checks and reviews, supervisory reviews, and Project Delivery Team (PDT) reviews. The DQC review will be completed before any review external to the District is initiated to ensure that the reviewed document has been vetted through the District as a product suitable and of sufficient quality for external distribution.

ii. Agency Technical Review (ATR)

ATR is an in-depth review, managed within USACE, and conducted by a qualified team outside of the home district that is not involved in the day-to-day production of the project/product. The purpose of this review is to ensure the proper application of clearly established criteria, regulations, laws, codes, principles and professional practices. The ATR team reviews the various work products and assure that all the parts fit together as a coherent whole. ATR teams will be comprised of senior USACE personnel (Regional Technical Specialists, etc.), and may be supplemented by outside experts as appropriate. To assure independence, the leader of the ATR team shall be from outside the home Major Subordinate Command (MSC).

iii. Independent External Peer Review (IEPR)

IEPR is the most independent level of review, and is applied in cases that meet certain criteria. This IES is not a decision document and does not cover work requiring a Type I or Type II IEPR. Issue Evaluation Studies are used to justify Dam Safety Modification Studies. If this project requires a Dam Safety Modification Study, both Type I and Type II IEPR will be conducted.

iv. Policy and Legal Compliance Review

Policy and Legal Compliance Review is required for decision documents. Since this IES is not a decision document it does not require a Policy and Legal Compliance Review. If this project requires a Dam Safety Modification Study, a Policy and Legal Compliance Review will be conducted.

v. Peer Review of Sponsor In-Kind Contributions

There will be no in-kind contributions for this IES.

b. Approvals

i. Review Plan Approval and Updates

The MSC for this IES is the Northwestern Division. The MSC Commander is responsible for approving this Review Plan. The Commander's approval reflects vertical team input (involving the Seattle District, MSC, RMC and HQUSACE members) as to the appropriate scope and level of review for the study and endorsement by the RMC. Like the PMP, the Review Plan is a living document and may change as the study progresses. The District is responsible for keeping the Review Plan up to date. Minor changes to the review plan since the last MSC. Commander approval will be documented in an Attachment to this plan. Significant changes to the Review Plan (such as changes to the scope and/or level of review) should be re-endorsed by the RMC and re-approved by the MSC Commander following the process used for initially approving the plan. The latest version of the Review Plan, along with the Commanders' approval memorandum, will be posted on the District's webpage and linked to the HQUSACE webpage.

ii. IES Report

The IES Report shall undergo a DQC and formal ATR. After the ATR, the PDT will present the IES to the Quality Control and Consistency (QCC) Panel for review. The district and the risk assessment cadre present the IES risk assessment, IES findings, conclusions, and recommendations for review. After the QCC meeting, the Risk Cadre and RMC will certify that the risk estimate was completed in accordance with the Corps' current guidelines and risk management best practices. The IES will then be presented to the SOG. The SOG generally consists of the following members: Special Assistant for Dam Safety (Chair); Community of Practice (CoP) and regional representatives to include geotechnical and materials CoP Leader, structural CoP leader, and hydraulics and hydrologic CoP leader; regional representatives determined by Special Assistant for Dam Safety; Corps business line and program representatives to include the USACE Dam

Safety Program Manager, Flood Damage Reduction, Navigation, Programs, and RMC Director, and any other representatives determined by the Special Assistant for Dam Safety. The District Dam Safety Officer (DSO), the MSC DSO, and the SOG Chairman will jointly approve the final IES after all comments are resolved.

3. Guidance and Policy References

- ER 5-1-11, USACE Business Process

- EC 1165-2-209, Civil Works Review Policy, 31 Jan 2010
- ER 1110-2-1156, Safety of Dams – Policy and Procedure, 28 Oct 2011
- ER 1110-1-12, Quality Management, 31 Mar 2011

4. Summary of Required Levels of Review

The dam safety program follows the policy review process described in EC1165-2-209, Civil Works Review Policy. The RMC will be the review management office for the ATR, and the RMC must certify that the risk assessment was completed in accordance with the USACE current guidelines and best risk management practices. A QCC review will be conducted including the district, MSC, and RMC. The district and the risk assessment cadre will present the IES risk assessment, IES findings, conclusions, and recommendations for review. After resolution of QCC review comments, the MSC and HQUSACE will complete quality assurance and policy compliance review.

5. Models

a. General

The use of certified or approved models for all planning activities is required by EC 1105-2-407. The EC defines planning models as any models and analytical tools that planners use to define water resources management problems and opportunities, to formulate potential alternatives to address the problems and take advantage of the opportunities, to evaluate potential effects of alternatives, and to support decision-making. The EC does not cover engineering models. Engineering software is being addressed under the Engineering and Construction (E&C) Science and Engineering Technology (SET) initiative. Until an appropriate process that documents the quality of commonly used engineering software is developed through the SET initiative, engineering type models will not be reviewed for certification and approval. The responsible use of well-known and proven USACE developed and commercial engineering software will continue and the professional practice of documenting the application of the software and modeling results will be followed.

b. List

Model	Status
HEC-FIA 2.2	Certified as engineering model
HEC-FIA 2.1	Certified as engineering model
HEC-FIA 2.2	Not certified as a planning model
Hydrologic Engineering Center - River Analysis System (HEC-RAS) Version 4.1	Fully certified and approved

6. Review Schedule

Project Phase / Submittal	Review Start	Review Complete
DQC Review	**26 November 2012**	**31 December 2012**
ATR Review	**07 January 2013**	**21 January 2013**
Report Revisions and Backcheck	**22 January 2013**	**19 February 2013**
Submit Report to QCC	**20 February 2013**	**20 February 2013**
QCC Review	**21 February 2013**	**07 March 2013**
Report Revisions	**08 March 2013**	**03 April 2013**
Submit Report to SOG	**April 2013**	**April 2013**
SOG Review	**April 2013**	**May 2013**
Report Revisions	**May 2013**	**30 June 2013**

7. Public Participation

Public participation will not take place until the IES phase is completed. Public and stakeholder coordination has been performed to inform interested parties about the DSAC 3 rating and ongoing IES. Findings of the Final IES will also be shared with appropriate stakeholders. If this project results in a Dam Safety Modification Study (DSMS), future public coordination will occur for NEPA compliance.

8. Cost Estimate

Task Description	Review Start	Review Cost
DQC Review	**26 November 2012**	**$59,000**
ATR Review	**07 January 2013**	**$80,000**
QCC Review	**20 February 2013**	**$7,400**
SOG Review	**April 2013**	**$7,400**

9. Execution Plan

a. District Quality Control

i. General

DQC will be conducted after completion of the final draft IES. DQC requires both supervisory oversight and District technical experts. The district will conduct a robust DQC in accordance with EC 1165-2-209, Civil Works Review Policy, the District's Quality Management Plan, and ER 1110-2-12, Quality Management. Documentation of DQC activities is required and will be in accordance with the District and MSC Quality manuals. The DQC and ATR will be concurrent. Comments and responses from DQC will be available for the ATR team to review through ProjNet DrChecks.

ii. DQC Review and Control

The District DSAC Project Manager will schedule DQC review meetings. The in progress review meetings should include PDT members from Geotechnical, Dam Safety, Hydrology & Hydraulics, Structures, Mechanical, General Engineering, Cost Engineering, Project Management, Planning, and Operations as applicable. DQC Review will be conducted on the completed final draft IES including all Sections and Appendixes and will include comments, backcheck and IES revisions. ProjNet DrChecks review software will be used to document reviewer comments, responses and associated resolutions. Comments should be limited to those that are required to ensure the adequacy of the product.

b. Agency Technical Review

i. General

Draft ER 1110-2-1156, Chapter 8 describes the purpose, process, roles and responsibilities for an IES in addition to the submittal, review, and approval process. The Risk Management Center (RMC) is responsible for coordinating and managing agency technical review of the IES Report in accordance with EC 1165-2-209. The ATR Lead will be an RMC team member unless otherwise approved by the RMC Director. The ATR Lead in cooperation with the PDT, MSC, and vertical team will determine the final make-up of the ATR team.

ii. ATR Review and Control

Reviews will be conducted in a fashion which promotes dialogue regarding the quality and adequacy of the IES and baseline risk assessment necessary to achieve the purposes of the IES. The ATR team will review the IES report which includes supporting risk and stability analysis documentation. A QCC of the baseline risk estimate and supporting documentation will be performed under the leadership of the RMC. Therefore, the level of effort for each ATR reviewer is expected to be between 16 and 32 hours. DrChecks review software will be used to document reviewer comments, responses and associated resolutions. Comments should be limited to those that are required to ensure the adequacy of the product. The RMC in conjunction with the MSC, will prepare the charge to the reviewers, containing instructions regarding the objective of the review and the specific advice sought. A kick off meeting will be held with the ATR team to familiarize reviewers with the details of the project.

The four key parts of a review comment will normally include:

(1) The review concern – identify the product's information deficiency or incorrect application of policy, guidance, or procedures.

(2) The basis for the concern – cite the appropriate law, policy, guidance, or procedure that has not been properly followed.

(3) The significance of the concern – indicate the importance of the concern with regard to its potential impact on the plan selection, recommended plan components, efficiency (cost), effectiveness (function/outputs), implementation responsibilities, safety, Federal interest, or public acceptability.

(4) The probable specific action needed to resolve the concern – identify the action(s) that the PDT must take to resolve the concern.

In some situations, especially addressing incomplete or unclear information, comments may seek clarification in order to then assess whether further specific concerns may exist. The ATR documentation in DrChecks will include the text of each ATR concern, the PDT response, a brief summary of the pertinent points in any discussion, including any vertical coordination, and lastly the agreed upon resolution. The ATR team will prepare a Review Report which includes a summary of each unresolved issue; each unresolved issue will be raised to the vertical team for resolution. Review Reports will be considered an integral part of the ATR documentation and shall also:

(1) Disclose the names of the reviewers, their organizational affiliations, and include a short paragraph on both the credentials and relevant experiences of each reviewer.

(2) Include the charge to the reviewers prepared by the RMC in accordance with EC 1165-2-209, 7c.

(3) Describe the nature of their review and their findings and conclusions.

(4) Include a verbatim copy of each reviewer's comments and the PDT's responses.

ATR may be certified when all ATR concerns are either resolved or referred to HQUSACE for resolution and the ATR documentation is complete. Certification of ATR should be completed, based on work reviewed to date, for the final report. A draft certification is included in Attachment 1.

10. Review Plan Points of Contact

Name/Title	Organization	Email/Phone

ATTACHMENT 1

COMPLETION OF AGENCY TECHNICAL REVIEW

The Agency Technical Review (ATR) has been completed for the *IES* for HAHD, located near Ravensdale, WA. The ATR was conducted as defined in the project's Review Plan to comply with the requirements of EC 1165-2-209. During the ATR, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified. This included review of: assumptions, methods, procedures, and material used in analyses, alternatives evaluated, the appropriateness of data used and level obtained, and reasonableness of the results, including whether the product meets the customer's needs consistent with law and existing US Army Corps of Engineers policy. The ATR also assessed the District Quality Control (DQC) documentation and made the determination that the DQC activities employed appear to be appropriate and effective. All comments resulting from the ATR have been resolved and the comments have been closed in DrChecks[sm].

SIGNATURE _____ _____

Richard Allwes Date
ATR Team Leader
CEIWR-RMC

SIGNATURE _____ _____

Mamie S. Brouwer Date
Project Manager, NWS
CENWS-PM-CP-CJ

SIGNATURE _____ _____

Richard E. Smith Date
Dam Safety Program Manager, NWS
CENWS-EN

SIGNATURE _____ _____

Nathan Snorteland Date
CEIWR-RMC

CERTIFICATION OF AGENCY TECHNICAL REVIEW

Significant concerns and the explanation of the resolution are as follows: As noted above, all concerns resulting from the ATR of the project have been fully resolved.

SIGNATURE _____ _____

Mark A. Ohlstrom Date
Chief, Engineering Division, NWS
CENWS-EN

ATTACHMENT 2: TEAM ROSTERS