



WORK PLAN

Date: October 6, 2009
To: Bruce Mackey, ESA/Adolfson
From: Raymond Walton
RE: **Work Plan for Chehalis River Basin Flood Authority, Early Flood Warning Program**

INTRODUCTION

The Chehalis River and its major tributaries is one of the most flood-impacted watersheds in the state of Washington. After many years of individual efforts in the basin, the Chehalis River Basin Flood Authority was formed to provide a coordinated and concerted effort to manage the basin's flooding problems. The Chehalis River Basin Flood Authority is comprised of 11 member agencies including Thurston County, Grays Harbor County, Lewis County, City of Chehalis, City of Centralia, City of Pe Ell, City of Bucoda, City of Aberdeen, City of Oakville, City of Montesano, and the Confederated Tribes of the Chehalis Reservation. We understand that the Flood Authority was formed in response to the 2007 flooding event with the purpose of developing flood hazard mitigation measures for the Chehalis River Basin. Improvements to the Flood Early Warning capabilities are considered of high importance to the Flood Authority with the goal of improving the communication of flood warnings to the residents of the basin.

The Chehalis River Basin Flood Authority has determined that improvements to the current flood forecasting system for the Chehalis River Basin are needed in order to provide improved flood warning forecasting capabilities. This is based on looking at existing hydrologic equipment as reported in *Chehalis River Basin Stream and Precipitation Gauge Report* (March 2009), and an assessment of potential fixes and warning needs as reported in *Resident Opinions on Flood Mitigation in the Chehalis River Basin* (March 2009). Currently, the forecasting for the basin is performed by the Seattle Office of the National Weather Service based on data provided by 13 precipitation gages in the Chehalis Basin and hydrological models of the waterways within the basin. River level forecasts are made regularly on six-hour increments and more frequently during flood events. During flood events, a flood warning is issued for a specific river using a 4-stage warning system that includes the following warning or advisories; "Action Stage", "Flood Stage", "Moderate Stage", and "Record Stage". Additionally, the USGS manages 19 stream gage stations that report river levels in real-time and are included in the USGS Flood Watch System.

Improvements recommended by the National Weather Service in the Chehalis River Basin Stream and Precipitation Gauge Report Version 2-Draft report dated March 2009, prepared by ESA Adolfson, included adding three new automated gauges, one for stream stage and two for precipitation. Additionally, the ESA Adolfson report recommended improvements to the local monitoring capabilities to provide Flood Authority members with the information that they need to monitor the flooding conditions on local streams and local flood prone areas. It is our understanding that the Flood Authority

desires assistance with the design and implementation of these improvements that will enhance the National Weather Service forecasting and improve their local flood forecasting capabilities.

PROPOSED SCOPE OF WORK

The RFQ identified six work items:

1. Assess community needs
2. Develop recommendations for a flood warning system
3. Select Options
4. Identify funding sources
5. Provide technical guidance
6. Coordinate and monitor installation

To meet these objectives, we propose a Scope of Work based on a system design approach, and divided into three Phases.

In Phase 1 (covering items 1, 2, 3 and 4 above), our project team will develop a detailed understanding of the flood warning system needs for each of the member groups within the Flood Authority. We also propose to meet with the National Weather Service (NWS) to identify their specific needs and the Washington State Department of Transportation (WSDOT) to determine how their data could be integrated with the Flood Authority program improvements. We will then use this information to develop a conceptual flood warning program, and present this conceptual plan to the Basin Advisory Committee (BAC) for discussion and approval. We will also consider and present information about which state and federal programs might help fund its implementation. The purpose of this Phase is to understand the specific needs both locally and system-wide, in order to develop a concept that presents a unified approach for implementing a flood warning system in the Chehalis River basin, representing a transparent and inclusive process to the individual Authority members. Phase 1 will conclude with the selection of a “preferred alternative”.

In Phase 2 (covering items 4 and 5), the project team will develop detailed system design for the “preferred” flood warning program concept. The design will include all the elements of the preferred concept, and include the details of the recommended equipment, software, and installation effort needed to implement the program. The design report will also include recommendations for how the program will be staged (priority of flood warning elements) and which specific state and federal programs should be contacted to solicit both technical and funding support. We will present a draft of the detailed design to the Authority, and finalize it based on comments received to ensure that everyone is satisfied with the final deployment.

In Phase 3 (covering item 6), the project team will provide assistance with the coordination and implementation of the system improvements. These efforts will include coordinating the installation of the system components and providing assistance with the construction of the system improvements for those Flood Authority members that may need additional support during the implementation phase.

In this proposal, we have provided a detailed scope and cost estimate for Phase 1 and a preliminary scope for Phases 2 and 3. Because Phase 1 will identify a “preferred alternative” flood warning program concept, we do not know the level of effort that would be required to design and install the warning systems at this point. We will prepare a refined scope and preliminary cost estimate for the Phase 2 and Phase 3 efforts as part of the Phase 1 report for consideration by and approval of the Flood Authority.

A detailed discussion of our proposed Scope of Work is presented in the following sections.

PHASE 1: ASSESS COMMUNITY NEEDS

Task 1.1 Needs Meetings. To gain further information regarding the specific community needs of each of the Flood Authority members, we will hold six meetings with flood management and emergency management staff from the member groups. The topics of the meetings will address the additional details, before the existing studies, that are needed to produce the conceptual program design. These topics will be divided between “data collection/forecasting” and “communicating”, and will include:

Data Collection/Forecasting

- Specifically what needs to be monitored?
- Where is the optimal monitoring location?
- What is the required reading frequency of the data?
- Is there a need for additional data to be collected during alarms?
- Who are the system users and how will they access the information?
- How will the monitoring data be used?
- How will the flood warning data be presented? (i.e. system alarm screens, time history data, hydrographs, real time displays, system status screens)
- How will data transfers be safeguarded during a flood event?

Communicating

- How do you currently determine the severity of the flood threat (area flooded, people impacted, facilities threatened)?
- How are the public currently notified of a flood threat, and what improvements would you like to see?
- How can the threat be conveyed to the public in a way they can understand and respond to?
- How will the alarm notifications be sent and to whom?
- How is the flood threat communicated between Flood Authority members?
- Who will operate and maintain the system?

We plan to hold two meetings per day with flood management and emergency management staff from the Flood Authority members in the groups detailed below. We will also extend invitations to the fire departments in smaller communities to ensure coverage

1. Lewis County and Town of Pe Ell
2. Thurston County and Town of Bucoda
3. Gray Harbor County, City of Montesano and City of Aberdeen
4. The Confederated Tribes of the Chehalis Reservation and City of Oakville
5. The City of Centralia
6. The City of Chehalis

In addition to the six Flood Authority member meetings, we will meet with the National Weather Service (NWS) and the Washington State Department of Transportation (WSDOT). We will also coordinate with the Emergency Management Division (EMD), the Department of Ecology and the Department of Natural Resources to ensure coordination for emergency response.

The meeting with the National Weather Service will be to discuss the details of the recommended improvements that were identified in the ESA Adolfson report. In the report, improvements to station 23G060 and two Weyerhaeuser precipitation gages were recommended to assist the National Weather Service with refining their flood forecasting model used in the basin. At the meeting, the design criteria

for the recommended improvements and how the improvements will be integrated with the existing National Weather Service systems will be discussed.

The meeting with the Washington State Department of Transportation, will be to discuss the details of WSDOT's flood warning system along the Interstate 5 corridor and to identify opportunities for Flood Authority members to exchange data with the WSDOT system.

Task 1.2 Needs Assessment and Program Concept. Following the Task 1 meetings, the project team will compile the results of the meetings with the Flood Authority members, NWS, and WSDOT, and develop a summary memorandum for the Flood Authority. Once reviewed, we will develop a conceptual level flood warning program and options that (1) includes elements that address the needs of the individual Flood Authority members, including both data collection/forecasting and communicating, and (2) integrates these elements into a unified basin-wide conceptual program. This work will include the development and consideration of a range of alternatives and rough costs associated with those alternatives.

Task 1.3 Funding Sources. This task will involve the identification and description of the various funding sources at the federal, state, and local levels that might be available to assist in the implementation of an Early Flood Warning Program for the Chehalis River Basin. The description will include the following information for each potential funding source:

- Narrative description of the funding program
- Examples of activities/equipment eligible for funding
- Maximum amounts of funding available
- Process involved and timing for requesting funding
- Local matching fund requirements

Entities with programs for potential funding sources could include the following:

Federal

- U.S. Geological Survey
- National Weather Service
- U.S. Army Corps of Engineers
- Federal Emergency Management Agency

State

- Office of Financial Management
- Department of Ecology
- Military Department, Emergency Management Division
- Department of Fish and Wildlife
- Department of Transportation

Local

- Lewis County
- Grays Harbor County
- Thurston County
- City of Centralia
- City of Chehalis
- Public Utility District No. 1 of Lewis County
- Tri-County Flood Control District(Proposed)

Task 1.4 Present Conceptual Design to the Board Advisory Committee. Once a basin-wide conceptual program has been developed, and an overview of potential funding sources identified, we will present this information to the expanded Board Advisory Committee (staff from the 3 counties and the Confederated Tribes of the Chehalis Reservation) group, and work through their feedback. The outcome of this meeting will be to select a preferred alternative concept for the detailed design effort in Phase 2 after approval by the full Flood Authority.

PHASE 1 DELIVERABLES:

1. Meeting minutes from the six Flood Authority staff member representatives meetings, and the meetings with the NWS and WSDOT
2. A Summary Memorandum providing details regarding:
 - Monitoring objectives and design criteria for improvements to the local monitoring capabilities for each Flood Authority member
 - Objectives and design criteria for flood notification methods for each Flood Authority member
 - Design criteria for the National Weather Service forecasting system improvements
 - Design criteria for integration or data exchange with the WSDOT system
3. A Draft Phase 1 report presenting the preferred concept and options, potential funding sources, and a detailed scope and preliminary cost estimate to develop a detailed design of the conceptual plan.
4. Meeting with the expanded BAC group to present the Draft Phase 1 Report and receive feedback.
5. A Final Phase 1 Report to the Flood Authority based on the staff member representatives review comments received.
6. Scope and cost proposal for Phase 2 work.

PHASE 2: PROGRAM DESIGN

The scope of work needed to accomplish the program design effort is unknown at this time and will depend on the preferred concept identified in Phase 1. However, system improvements will be needed for the National Weather Service forecasting and it is likely that some combined program improvements will be needed for members in the different reaches of the Chehalis watershed. The following is a **preliminary** draft of the potential scope of work for Phase 2.

Task 2.1 - Program Designs for Local Flood Warning. We will prepare program designs for improving the monitoring and flood warning notification capabilities for Flood Authority members that will provide improved localized flood detection and an overall plan for using shared data to help forecast when a flood event is likely to occur. The program designs will be based on the site conditions and the project requirements determined from information gathered from each Flood Authority staff member representatives, discussions with state and federal agencies, and site visits to the proposed monitoring locations. The program designs will include an evaluation of sensors, data acquisition equipment, methods for remote communications with the stations, data management and presentation tools specifications, and implementation details. Additionally, details regarding integration or data exchange with the WSDOT system will be provided. The design for each of the systems will be documented in system design memorandums.

The memorandums will each include the following items:

Summary of the monitoring objectives for the program improvements. The objectives of the monitoring systems as determined from the meetings with the Flood Authority members and site reconnaissance will be summarized.

Recommended program design. The description of the recommended system layout and components for the local flood warning systems will be presented. The purpose of each component will be defined as well as how the components are integrated to meet the overall system objectives. A data flow diagram will also be provided to illustrate how the data will be collected, transmitted, and presented to the Flood Authority members.

Recommended process for evaluating the magnitude of the flood threat. The memorandum will present ways in which the forecast can be used to improve the estimate of the degree of flooding, and the potential threats to population and infrastructure.

Recommended process to improve communications. The memorandum will present ways in which information can be better communicated to and between emergency managers, and how the population at risk can be informed day or night.

Recommended process for implementing the local flood warning program. The design memorandum will also include a recommended process for implementing the program. This process will discuss 1) finalizing any remaining design details; 2) the tasks and responsibilities for procuring, programming, bench testing, and installing the system, and 3) preparing appropriate operations and maintenance documentation and providing training for system users.

Estimate of costs for implementation. A cost estimate will be developed and presented for implementing the program.

A draft memorandum will be submitted to the expanded BAC group for review and comments. The project team will finalize the memorandum based on Flood Authority comments and submit 1 electronic and 11 hardcopies of each final memorandum to the Flood Authority.

Task 2.2 Funding Sources. Once a specific program design has been proposed, the team can contact the various funding agencies to determine what specific assistance can be provided by federal and state agencies, and prepare any supporting documents. This information can be used to help prioritize the approach to installing elements of the early flood warning program.

Task 2.3 Rank Needs. Once the program design report in Task 2.1 is complete, and funding sources considered in Task 2.2, we will use a ranking system to determine the “best” or appropriate order in which to install systems and upgrades. This, together with an estimate of the funds remaining and potential future funding will lead to an estimate of Phase 3 activities and costs.

DELIVERABLES:

1. Draft Design Memorandum (4 documents)
2. Draft Review Meeting with the expanded BAC group (4 meetings)
3. Final Design Memorandum (4 documents)
4. Memorandum describing proposed ranking of projects.
5. Phase 2 report covering Phase 2 tasks

PHASE 3: TECHNICAL GUIDANCE, COORDINATION AND MONITORING

It is our understanding that the Flood Authority desires technical guidance, coordination, and installation support during the implementation of the program improvements. Our project team has the technical experience and resources to provide a wide range of implementation services ranging from assisting the Flood Authority members with construction administration of the improvements to providing procurement and on-site installation services of the system components.

Because the design details and installation requirements for the flood warning program are unknown at this time, the scope of work required to provide technical guidance and assistance with the installation can be determined after the Phase 2 work is complete. A preliminary scope for the Phase 3 effort is provided below.

Task 3.1 Implementation Strategy Meeting: To determine the level of technical and installation support needed by the Flood Authority to assist in the installation of the program components, the project team will conduct an Implementation Strategy Meeting. During the Implementation Strategy meeting, the installation requirements presented in each Program Design Memorandum will be presented to the expanded BAC group. Based on the available resources, the desired level and type of technical assistance and installation coordination from the project team will be determined.

The project team will then produce a Memorandum of Understanding that will present the Implementation Strategy and a scope of work and cost estimate for the project team to provide the desired services.

DELIVERABLES:

1. Implementation Strategy Memorandum of Understanding

PROJECT STAFFING

The **Project Manager** will be Dr. **Raymond Walton**, P.E., D.WRE. Dr. Walton is a Vice President with WEST Consultants, and has complete authority to negotiate contracts and sign all documents. Below is a table of “key staff” identified for this project.

TASK	KEY STAFF
Project Manager	Raymond Walton (WEST)
Community needs and funding	Jerry Louthain (HDR), Raymond Walton (WEST)
System design	Barry Myers (EMS), Greg Dutson (EMS), Steve Gustafson (WEST)
Gauges hardware and installation	Steve Gustafson (WEST)

SCHEDULE

EVENT	CALENDAR DAYS AFTER RECEIPT OF NOTICE TO PROCEED
Notice to Proceed	0
PHASE 1	
Meetings (Tasks 1.1)	30
Needs Assessment and Concept (Task 1.2)	50
Funding Sources (Task 1.3)	50
Present Concept to BAC group (Task 1.4)	60
PHASE 1 Report	70
PHASE 2	120
PHASE 3	TBD

Chehalis River Basin Flood Authority.
Early Flood Warning System

DESCRIPTION HOURLY RATE	WEST				HDR		EMS			Total Task Hours	ITEM COSTS
	Program Manager \$175.42	Lead Hydrologist \$123.93	Staff Engineer \$89.72	Clerical \$44.14	Senior Engineer \$160.00	Support staff \$70.00	lead Engineer \$160.00	Support Staff \$125.00	Admin \$70.00		

Phase ITEM DESCRIPTION

1	Assess Community Needs											
1.1	Needs Meetings	40	16	8	4	32	2	4	40		146	\$20,794
1.2	Needs Assessment and Program Concept	16	16			8	2	16	100		158	\$21,270
1.3	Funding sources	4				28	8				40	\$5,742
1.4	Present Concept to Authority	8	8			16	2	4	12		50	\$7,235
	Phase 1 report	8	8		8	12	2	4	32		74	\$9,448
	<i>Task 1 Subtotal</i>	<i>76</i>	<i>48</i>	<i>8</i>	<i>12</i>	<i>96</i>	<i>16</i>	<i>28</i>	<i>184</i>	<i>0</i>	<i>468</i>	<i>\$64,488</i>
2	Comprehensive System Design (PHASE 2 SCOPE AND COSTS WILL BE DEVELOPED AT END OF PHASE 1)											
2.1	System Designs for Local Flood Warning.										0	\$0
2.2	Detailed Funding Sources										0	\$0
2.3	Rank Needs										0	\$0
	Phase 2 report										0	\$0
	<i>Task 2 Subtotal</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>\$0</i>
3	Technical Guidance and Monitoring (PHASE 3 SCOPE AND COSTS WILL BE DEVELOPED AT END OF PHASE 2)											
3.1	TBD										0	\$0
3.2	TBD										0	\$0
3.3	TBD										0	\$0
3.4	TBD										0	\$0
	<i>Task 3 Subtotal</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>\$0</i>
Direct Costs												
	mileage				2500	miles at	\$0.55					\$1,375
	Per Diem Days				8	days at	\$135.00					\$1,080
	Misc. Expenses (phone, computers, etc.)											\$1,500
	Subtotal											\$3,955
Total for all Tasks											\$68,443	