WHATCOM COUNTY COUNCIL
SURFACE WATER
WORK SESSION

SEPTEMBER 19, 2017
MEMORANDUM

TO: The Honorable Jack Louws, Whatcom County Executive, and Honorable Members of the Whatcom County Council

THROUGH: Jon Hutchings, Director

FROM: Gary S. Stoyka, Natural Resources Program Manager

DATE: September 12, 2017

RE: September 19, 2017 Council Surface Water Work Session

Please refer to the proposed agenda below for the next Surface Water Work Session. Additional supporting documents may be distributed at or before the meeting.

AGENDA

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If you have questions, please feel free to call me at (360) 778-6218.

cc: Mike McFarlane, Joe Rutan, Paula Harris, John Wolpers, Mike Donahue
    Beth Bushaw, Jeff Hegedus, John Thompson, Kraig Olason, Erika Douglas
    Tyler Schroeder, Josh Fleischmann, Karen Frakes, Jennifer Schneider, Jill Nixon
    Sue Blake, Kirk Christensen, Dana Brown-Davis, Atina Casas, Cathy Craver
    George Boggs, Roland Middleton, Loni Cummings, Kristi Felbinger, Mark Personius
    Ryan Ericson
Memorandum

To: County Council and Whatcom County Executive
Cc: Jon Hutchings
From: WRIA 1 Planning Unit
Date: August 23, 2017
Re: Recommendations to the County to Improve Water Resources Management.

We suggest that you consider and adopt the following recommendations to improve water resources management by Whatcom County, as the Lead Agency in WRIA 1. The Planning Unit would like to review these recommendations with the County Council at the next Surface Water Work Session.

Goal:

Whatcom County will define, own, and invest money and resources as needed in a process that will lead to binding agreements in water resource management that will address local, state, and tribal concerns.

A successful program must include:

- Accountability that withstands staff turnover;
- A clearly defined current work program;
- One- and two-year goals with staff assignments as well as long term goals;
- Coordination of work between various entities;
- Direct linkage with goals of the 2005 WRIA 1 Watershed Management Plan—Phase 1.

Recommendations to Accomplish the Goal:

1. Implement the Instream Flow Selection and Adoption Plan (IFAP) as outlined in the 2005 WRIA 1 Watershed Management Plan—Phase 1. Update the IFAP as required to meet current conditions. The WRIA 1 Watershed Management Project is currently best positioned to provide the community engagement and involvement required for this process. The update could include instream flows, water quantity, water quality, habitat, accountability.

2. Publicly develop a water resources program similar to the 2001 Whatcom County Comprehensive Water Resource Plan, which was essentially a budget document for County water resource programs. This would provide transparency and accountability for actions, better assurance of coordination, and explain the value of current and future funding.

By developing the above program, the County can better track its progress in implementing the 2005 WRIA 1 Watershed Management Plan – Phase 1.

Further, it would enhance public involvement by defining how current and planned programs are coordinated to best effect. The current water resources level of service and funding discussion is an example of how this would be helpful.
3. Establish consistent data collection and timely monitoring. Implement the Long Term Monitoring Program specified in the 2005 WRIA 1 Watershed Management Plan—Phase 1, and update as needed.

Given the current water management environment, we cannot over-emphasize the need for investigative work that incorporates monitoring of aquifers with nearby streams to obtain the empirical data critical for assessing hydraulic continuity. Such work could be done as a pilot project at a few locations. This would address the *Hirst* decision as well as providing data to evaluate the potential benefits of measures such as moving wells farther from streams, stream augmentation, storage, ditch water level management, and other remedial and enhancement strategies.
COMPREHENSIVE WATER RESOURCE PLAN

2001 UPDATE

Submitted by:
Pete Kremen, County Executive

Prepared by:
Water Team Members
Sue Blake
Regina Delahunt
Sylvia Goodwin
Craig MacConnell
Jeff Monsen
Bruce Roll
John Sproul
John Thompson

November 21, 2000
November 17, 2000

Dear Whatcom County Citizens:

In 1999, the Whatcom County Comprehensive Water Resources Plan was developed in response to the county’s new and expanding obligations around water issues. Developed by the County Water Team with input from the local community, the plan has been the centerpiece of efforts to create an effective framework for coordinating the county’s wide-ranging work in protecting our water resources and restoring our endangered species.

This update to the Comprehensive Water Resources Plan outlines accomplishments from last year and work plans for 2001. While the county has moved forward on all of the water resource issues, particular progress has been achieved in developing protection measures for Lake Whatcom water quality and in establishing a framework for county-wide watershed planning.

In the coming year, the County Water Team will continue its work to develop comprehensive responses, both short- and long-term, to meeting the water resources needs of the county. We welcome your input and support.

Sincerely,

Pete Kremen
County Executive
Whatcom County
Comprehensive Water Resource Plan
2001 Update

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Comprehensive Water Resource Plan
2001 Update

Introduction / Background
(Excerpt from the February 9, 1999, Comprehensive Water Resource Plan, Introduction)

Purpose

The people of Whatcom County have historically benefited from the abundance and availability of water resources. This region is rich in natural beauty, renewable resources and plentiful fisheries. Our community has enjoyed abundant outdoor recreation as well as a vibrant economy. However, these resources and Whatcom County's economic future depend on adequate and dependable supplies of clean water for many uses.

The time has come when all government units, citizens and industry must work together to respond to critical and unavoidable water resource issues that will decide our future quality of life. While Whatcom County is currently involved in numerous on-going water issues, many new, expanded commitments and obligations have been placed upon the County. These include groundwater protection, Lake Whatcom management, salmon and shellfish recovery, and watershed planning under HB2514. It is essential that the County help to develop and implement plans and programs to protect and manage the water supply. All will have to work together, citizens, private businesses and organizations.

In October 1998, the County administration began the development of a Comprehensive Water Resource Plan intended to address the new and expanding obligations. The initial planning documentation provided a general overview of anticipated actions and funding requirements for the various water program elements.

In December 1998, the County Council took decisive action to provide funding in order that the necessary water resource programs could begin. At the same time, the Council also indicated the need for additional information and discussion as the process moves forward. The purpose of this document is to:

- Clearly identify our water resource management goals;
- Provide additional details on the new and expanding programs and actions intended to help meet those goals;
- Identify short and long term local responses and needed resources; and
- Respond to specific comments and recommendations received on the initial Water Resource Plan.

Water Resource Management Goals & Objectives

Development of an effective plan requires having a clear vision of the path to take. The County has adopted many goals and policies related to water resource management that provide further guidance in what we need to achieve... ...These were all used as a basis for the following goals:

- WATER SUPPLY GOAL: Whatcom County will have reliable and sustainable water supplies that support existing needs, as well as provide for reasonable growth and economic vitality.

- FISH / SHELLFISH: Whatcom County will have in place, local programs and actions that protect and contribute to the enhancement of fisheries, restore shellfish, and satisfy ESA requirements.
• **SURFACE WATER MANAGEMENT**: Whatcom County will have coordinated land use and habitat management that protects the drinking water supplies and provides recreational opportunities while restoring and sustaining natural systems.

• **GROUNDWATER MANAGEMENT**: Whatcom County will have in place programs designed to protect and promote safe and healthy drinking water supplies.

To achieve these goals, initial objectives have been targeted. It must be stressed that any quantifiable objectives are only achievable if sufficient funding is made available.

• **WATER SUPPLY**: Whatcom County will have a locally developed watershed plan and implementation strategy that provides for long-term, reliable and sustainable water supplies by 2003.

• **FISH / SHELLFISH**: Whatcom County will have all shellfish harvesting areas re-opened by 2003. Whatcom County will implement programs and regulations for the protection of fish to fulfill the intent of the Endangered Species Act and state regulations.

• **SURFACE WATER MANAGEMENT**: Whatcom County will have a stormwater plan and implementation strategy in place by 2000.

• **GROUNDWATER MANAGEMENT**: Whatcom County will have a comprehensive groundwater plan and implementation strategy by 2001.

It is the intent of this plan to accomplish these goals and objectives through win-win solutions in partnership with all stakeholders. Specifically measurable objectives to attain these goals will be developed as part of the program elements specified in this plan. As much as possible, these goals should be achieved through non-regulatory approaches that allow the most practical and cost effective compliance with legal mandates.

These water resource issues are dynamic and must be addressed within a context of a volatile political, financial and regulatory environment. It is important to be mindful of this fact and expect changes. The issues ahead are large and complex. They will not be solved over the course of one year but must be approached as a long-term commitment. Substantial, cooperative, and coordinated efforts will be required between local jurisdictions and partners, including the tribes and state and federal government. Substantial financial commitments will need to be made locally. One of the benefits of this willingness to make the financial commitment locally is the opportunity to leverage greater financial resources from the state and federal governments. This opportunity also serves to assist in preserving local discretion and control to the maximum extent possible...

Each of the following sections describes the implementation status of the 1999 Comprehensive Water Resource Plan and the Water Plan 2000 Update elements. This status report will include a brief summary of the issue background, a listing of 1999 and 2000 accomplishments and the intended activities for 2001.

The reader is advised that this document does not replace the 1999 Plan or the Water Plan 2000 Update. The Water Plan 2001 Update is intended to supplement the 1999 Plan and 2000 Update and to provide focus for the year 2001. The reader is further advised that preparation of a revised Comprehensive Water Resource Plan is intended to be accomplished during 2001 for implementation in 2002.
WRIA 1 Watershed Management Project  
County Co-Leads, Bruce Roll, Division Manager, and John Sproul, Watershed Planner, Whatcom County Water Resources Division

Background

In 1998 the State legislature passed Engrossed Substitute House Bill 2514, known as the Watershed Management Act. The act provided the framework to locally plan and implement solutions to a variety of water related issues. Participation in the process was voluntary. In 1998, Whatcom County, in cooperation with other local/tribal governments and interests decided to engage in the process with the County acting as lead agency. Since that time local and state funding has been generated and actions have been taken based on requirements of the law, establishment of interlocal agreement among the initiating governments in WRIA 1, and subsequently signed contracts and memorandums of agreement.

Actions have been divided into three phases:

- Phase I – Organization - The organizational phase is designed to establish the needed structure, processes, participants, and scope of work to ensure that the watershed planning effort undertaken pursuant to ESHB 2514 results in all parties acting in unison to manage the water and fishery resource of WRIA 1.

- Phase II – Assessment - The assessment phase is designed to gather key technical information that will be used to better understand the nature and extent of the problems and help evaluate possible solutions. Specific information must be gathered for water quantity, water quality, instream flows, and fish habitat. Existing information will be evaluated and, as necessary, new information compiled.

- Phase III - Management Plan - The management phase is intended to develop strategies for solving the water resource issues identified in phase II. Such strategies should address issues relevant to water quantity, quality, instream flows, and fish habitat. Specific actions could include conservation, water reuse, transfers, aquifer recharge and recovery, establishing new instream flows, and implementation of best management practices for water quality. Coordination with existing programs and efforts, particularly related to salmon recovery, is critical.

Status of Comprehensive Water Plan Water Supply Objective

“Whatcom County will have a locally developed watershed plan and implementation strategy that provides for long-term, reliable and sustainable water supplies by 2003.”

The County has been actively working to ensure adequate water supplies through actions incorporated into the 2514 Watershed Project, Lake Whatcom Management Program, groundwater activities, and the Coordinated Water System Plan Update. Other program areas that are critical to ensuring adequate supplies include salmon recovery, shellfish, and stormwater management. As we move into 2001, the work accomplished by the WRIA 1 Watershed Planning process will lay the ground work for addressing water supply issues and aid in the development of a long term strategy. The feasibility of accomplishing this objective by 2003 will depend on the time line developed by the scope of work and adequate funding to accomplish the required watershed planning tasks.

1998 / 1999 Accomplishments, Phase I - Organizational

- Lummi Nation, PUD No. 1, Whatcom County, and the City of Bellingham signed a Memorandum of Agreement in October 1998. The Nooksack Tribe did not sign the agreement but submitted a letter of intent to participate as an Initiating Government.
• The Governor designated the Bellingham Field Office of the Department of Ecology as the State agency representative on the Planning Unit.

• The Mt. Baker office of the U.S. Forest Service is serving as the federal agency representative on the Planning Unit. The USGS, BOR, and BIA have also agreed to provide services and resources in contracts for portions of the assessment.

• The County as lead agency has created a “project headquarters” for the project and is providing staff and administrative support to the Project.

• An administrative structure and function document was approved during March 1999, describing the composition of the Planning Unit and other management units.

• A Planning Unit organizational meeting was held in May to support and facilitate caucus formation. All caucuses subsequently were formed and have functioning structures and designated representatives on the Planning Unit.

• The Planning Unit was formally established and had its first regular meeting in June. In September they began meeting on a monthly basis.

• The Planning Unit finalized an agreement that describes the Planning Unit’s process structure and procedural ground rules, which will govern the participants’ involvement.

• A Final Scope of Work for the WRIA 1 Watershed Management Project was developed by the Scope of Work Technical Team and approved on March 27, 2000 by the Planning Unit and Initiating Governments. Some actions within this Final SOW are being implemented.

• Funding to support the project has been provided through Whatcom County and the Washington State Department of Ecology through a grant. The USGS and the Lummi Nation have provided additional support for certain projects.

• A website and telephone hotline has been established and recently revised to better support community information and educational needs regarding the Watershed Management Project (http://wria1project.wsu.edu/).

• Monthly informational public meetings were held until the Planning Unit decided that, due to low attendance, the meetings should be placed on hold.

• A draft long-range education and public involvement plan exists. The plan will create audience specific educational objectives and methods.

• An interlocal agreement (ILA) now exists between the Initiating Governments. This ILA creates a jointly managed financial account for approved project expenditures.

1999 Accomplishments, Phase II - Assessment

• An Instream Flow Conference was held in September 1999. The purpose of the conference was to evaluate the different methods available for estimating the relationship between streamflow and fish, and ultimately to help determine if and how existing instream flows may be revised. A draft report has been written and distributed to the invited panelists for their review.

• Information on watershed delineation, evapotranspiration, precipitation, groundwater systems, soils, historic, current, and potential future land use, and actual water use is being compiled through a
contract with the United States Geological Survey. A sub-committee of the Planning Unit formed to further evaluate delegations of the WRIA 1 basin and its subsequent sub-basins, watersheds, sub-watersheds, and drainages.

- An evaluation of existing water rights, claims, applications, certificates, and permits has been initiated through an interlocal agreement with Public Utility District No. 1. Two full-time PUD staff was hired to assist.

- Streamflow measurements are being collected under an interagency agreement between the BIA, USGS, and Lummi Nation. Staff support from the Initiating Governments is also being provided for the actual data collection.

- Aerial and bathymetric studies of Lake Whatcom are being completed through an agreement with the Bureau of Reclamation and Walker & Associates.

2000 Accomplishments, Phase II - Assessment

- To authorize watershed planning activities during the development and initial implementation of the WRIA 1 Watershed Management Project, the Joint Administrative Board (formerly Administrative Decision-Makers) was established on January 14th 2000 under an Interlocal Agreement between Lummi Nation, Nooksack Tribe, Public Utility District No. 1, City of Bellingham, and Whatcom County.

- Whatcom County, Water Resources Division in part to support various aspects of the Watershed Management Program including administrative organization and policy analysis, hired one full-time staff.

- Two temporary Technical Teams established for specific short-term tasks were created by the Planning Unit. These were the Sub-basin Delineation Technical Team and Scope of Work Technical Team.

- The Final Scope of Work dated March 27, 2000 was completed by the SOW Technical Team and was approved by the Planning Unit in March 2000.

- The GIS map entitled Surface Water Delineation Boundaries in WRIA 1, Version 1.0 was developed by the Sub-basin Delineation Tech Team and approved by the Planning Unit in April.

- Several permanent technical teams were established to provide local knowledge and technical assist to Phase II of the watershed management project. These technical teams were established and approved by the Planning Unit for water quantity, water quality, instream flow, fish habitat, public information and education, and database management.

- The USGS contract for preliminary water quantity review and analysis was concluded. Material provided during this preliminary review helped shape the development of two additional proposals for the Phase II Technical Scope of Work. These independent proposals were submitted by USGS and Utah State University.

- In the Spring, a series of workshops where undertaken with scientist from USGS, USU and members from WRIA technical teams to facilitate selection between the USU and USGS proposals for Phase II technical assessment scope of work.

- USU was selected as the Phase II SOW contractor and approved by the Planning Unit at its July meeting. This resulted after several iterations of the proposal were generated by USU and reviewed by WRIA technical teams, the Planning Unit and Initiating Governments.

- Stage I of the Water Rights Review analysis continued to evaluate and report water right ground and surface water allocations on paper subtotaled for each area delineated and by type of water right document (certificate, permit, or claim). Stage I will be completed by the end of 2000.

- A proposal for implementing Stage II of the Water Rights Review analysis was developed by PUD No. 1 and presented to the Water Quantity Technical Team. The proposal will be submitted for consideration to the Planning Unit at its September meeting.

- Continuation of County provided administrative and accounting support for the watershed project.
• Finalization of the aerial and bathymetric studies of Lake Whatcom through the Bureau of Reclamation and Walker & Associates.
• Habitat Suitability Criteria Workshop
• Independent Peer Review selection process begun
• Create coordinated GIS based record keeping and support services.

• Upon approval of the Scope of Work for Technical Studies – July 2000 (provided as an Appendix), USU began undertaking several tasks identified in the Technical Assessment SOW. These Tasks included subject areas such as:
  - Surface Water Quantity Analysis
  - Groundwater Quantity Analysis
  - Surface Water Quality Analysis
  - Groundwater Quality Analysis
  - Appropriate Model Evaluation
  - Stream Gage Records Evaluation
  - Instream Flow Analysis Field Work

• Technical Team meetings initiated on a regular biweekly basis
• Regularly scheduled monthly coordinating meetings were planned for Tech Team Leads and USU counterparts.
• Mechanisms was established for quarterly reporting to the Planning Unit by each Tech Team regarding the status of watershed management project activities in their respective categories.
• A Draft Watershed Management Plan Outline was developed and approved by the Planning Unit

2001 Planned Actions

• Phase III of the WRFA Technical Assessment will be implemented by USU for all identified tasks within each of the four categories: instream flow, water quantity, water quality, and fish habitat.
• Water Rights Review Stage II will be implemented by a contractor (yet to be identified) as a continuation of Stage I efforts conducted and completed in 2000.
• WRFA project related meetings would continue on a regular schedule as part of the review and implementation of the Technical Scope of Work. These meeting groups include WRFA Watershed Management Project Staff Team, Technical Teams, the Planning Unit, and the Joint Board.
• Development of the WRFA Watershed Management Plan will begin and undergo further refinement as the Phase III scope of work is implemented in 2001.

Appendices:

• Structure and Function Document / Organization Chart
• Caucus Representative List
• WRFA Watershed Management Project: Final Scope of Work - March 27, 2000
• Scope of Work for Technical Studies - July 2000
Salmon Recovery
County Co-Leads: Jeff Monsen, Director Public Works and John N. Thompson, ESA Coordinator

Background

Many stocks of wild salmon, steelhead and trout have declined along the West Coast of North America. These population declines are the result of many factors. Some, such as poor ocean conditions, are natural and beyond our control. Other factors, however, have resulted directly from human activities, including water withdrawals, forestry, agriculture, urban development, dams, fishing and hatcheries. Economic development and rapid population growth have exacerbated conditions unfavorable to salmon production.

In Washington, many wild salmon, steelhead and bull trout stocks were listed or are under consideration for listing under the Endangered Species Act (ESA). Of particular significance to Whatcom County, within the Puget Sound Evolutionary Significant Units (ESU), Chinook was listed as “threatened” in February of 1999, and bull trout was listed as “threatened” in June of 1999.

The County is committed to an emphasis on non-regulatory approaches to these issues but it recognizes that regulatory options may be appropriate in certain circumstances. Consistent with state policies, local policies and actions are to be carried out at the watershed level, reflecting local needs and issues that arise. In order to implement a sustainable local response program, Whatcom County must clearly plan and operate within the context of the Puget Sound ESU as well as general statewide recovery goals.

Whatcom County is the designated 2496-lead entity for salmon recovery efforts for WRIA #1; it serves in an administrative function, providing support for local entities in the grant application and administration process. However, the county is but an element of a longstanding, collaborative regional recovery effort that involves various local, state, federal, and tribal government representatives as well as regional fisheries interest groups and private industry.

Whatcom County’s salmon response effort focuses primarily on the Nooksack River watershed. While the county is the formal 2496 salmon response lead, it would be more accurate to describe the county as a partner with and supporter of several regional cooperative ventures designed to protect and restore salmon habitat. Other groups involved in this process include the Nooksack Tribe, Lummi Nation, the Nooksack Salmon Enhancement Association and Nooksack Recovery Team (private non-profit organizations), the Whatcom Conservation District, the City of Bellingham together with the six other cities within the County, US Forest Service, state agencies, a technical advisory group, and a Salmon Habitat Restoration Citizens Advisory Committee (often truncated to citizens habitat committee, or CHC, for brevity). Thus far, the effort has resulted in tremendous cooperation among the interest groups to ensure that the Nooksack River sustains viable salmon populations into the future.

Status of Comprehensive Water Plan ESA Fish Management Objective

“Whatcom County will implement programs and regulations for the protection of fish to fulfill the intent of the Endangered Species Act and state regulations.”

1999 Accomplishments

- Organizational Response. Whatcom County has created a Water Resource Division within its Public Works Department. This Division is intended to provide water resource management focus and coordination for both the County as well as the overall region. Hiring of six new staff positions is nearly complete; one of which is an ESA Coordinator. In late 1998 the County also hired a full time Fish Biologist to support its operational programs and to assist with ESA response. In addition to these new positions, other key staff devotes significant time and effort to activities related to local salmon recovery efforts.
• **Regulatory Response.** Whatcom County is presently in the process of hiring a consultant to review and recommend possible amendments to local land-use regulations.

• **Culvert Barrier Removal.** The county is in the process of inventorying County road related fish barriers, including prioritization of potential culvert projects that would remove fish passage barriers.

• **Facilitation of Project Development, Funding, and implementation.** In addition to prioritizing culvert barriers, Whatcom County is engaged in the development, funding, and implementation of salmon enhancement projects, primarily riparian plantings and maintenance of previous local efforts. This effort is being accomplished through utilization of existing state programs (Centennial Clean Water, Washington Conservation Corps, etc.) and the assistance of local groups to assist and coordinate throughout the watershed.

• **2496 Whatcom County Habitat Committee formed.** A citizen committee was formed to prioritize countywide salmon enhancement projects before application to the state Salmon Recovery Funding Board for funds. This committee’s first meeting occurred in October of 1999, and will meet again in November to begin solicitation for and review of WRIA #1 salmon recovery projects. Whatcom County, together with the Whatcom County Conservation District, will facilitate the grant applications for a variety of applicants.

• **Fisheries Enforcement Enhancement.** Whatcom County utilized a portion of the 1999 Federal Salmon Recovery funds to finance two additional WDFW Enforcement Officers to provide Spring/Summer illegal harvest patrols and field educational opportunities. With the success of this past year, extension of the enforcement enhancement is desired if funding can be identified.

• **River Meander.** Whatcom County is in the process of developing river meander polices as a part of the Comprehensive Flood Hazard Reduction Plan. In addition to specific flood hazard reduction actions, the policy will include elements of land acquisition and habitat restoration identified as critical to salmon recovery.

**Planned Actions for 2000**

• **Project Status Reporting.** Implement a joint project summary and status reporting protocol involving all of the local salmon recovery efforts and projects. Begin consolidation of project monitoring data for future reference.

• **Fisheries Enforcement Enhancement.** Following review of the 1999 final report, consider extension of an enforcement enhancement program.

• **Recovery Goals.** While our chief concern is actual recovery of fish within the Nooksack River Basin, it is not clear how this specific, distinct water body factors into NMFS’s evolutionary significant unit species concept throughout the Puget Sound region. Continue involvement at the ESU and statewide level in order to provide a WRIA 1 perspective as state and federal goals and policies are established.

• **Inventory and Enforcement of Regulatory Compliance.** Complete the city and county operational and regulatory review. Implement recommended adjustments to local operational practices. Discuss and consider recommended regulatory response amendments.

• **State Salmon Recovery Funding Board.** Continue to aggressively pursue salmon recovery project funding through the 2496 joint process.

• **WRIA 1 Salmon Recovery Plan.** Distribute locally the Chinook Recovery Plan developed by the Co-managers. Draft and adopt a long-range salmon recovery plan for WRIA 1 implementation, ensuring consistency with the required recovery elements of a Puget Sound ESU recovery plan.

**2000 Accomplishments**

• **Project Status Reporting.** The Nooksack Recovery Team (NRT) has developed a comprehensive watershed recovery project database and associated GIS products. Specific information (project type, location, monitoring, etc.) for all local watershed and salmon recovery projects completed since the mid-1980’s were entered into the database using standardized formats. Entry of project information is subject to project sponsors submitting project information to NRT in the format required and within
the timelines for annual updates. Applicable County projects completed through the end of calendar year 2000 will be included in the next update in 2001.

- **Fisheries Enforcement Enhancement.** Enhanced fisheries enforcement did not occur during 2000. Although the pilot program conducted in 1999 demonstrated measurable benefits of an additional enforcement presence in Bellingham Bay and the Nooksack watershed, insufficient funding for enforcement through the salmon co-managers (Lummi Nation, Nooksack Tribe, Washington Department of Fish and Wildlife) prevented implementation in 2000. Lacking allocated budgets for this effort, a SRFB grant was applied for to fund a two-year effort beginning in 2001. Results of the application process will not be known until January 2001.

- **Recovery Goals.** While our chief concern is actual recovery of fish within the Nooksack River Basin, it is still not clear how specific local recovery goals will mesh with the NMFS recovery strategy for the Puget Sound evolutionarily significant unit (ESU) for Chinook salmon. The NMFS technical recovery strategy is not expected until mid-2001. In the interim, involvement continues at the ESU and statewide level in order to provide a WRIA 1 perspective as state and federal goals and policies are established.

- **Inventory and Enforcement of Regulatory Compliance.** City and county operational and regulatory review was completed under contract. Results and recommendations are integrated into the WRIA 1 Chinook Recovery Plan, discussed below, and in ongoing or proposed amendments to operational procedures and regulations.

- **State Salmon Recovery Funding Board.** Developed an Interim Salmon Recovery Strategy for WRIA 1 and a process flow chart to be used to guide and prioritize salmon recovery projects. Successfully funded 5 projects totaling $1,280,000 (73 percent of funding requested) in first SRFB grant cycle. Submitted 13 applications for the Late 2000 SRFB grant cycle with total request of $4,197,632. Hosted public, Joint Technical Advisory Group, and citizens’ committee sessions to inform of grant opportunities and to review and rank project applications. Participated in SRFB steering committee and workshops to improve grant process. Hosted SRFB and NMFS technical panels in two separate meetings to describe local process and orient to Nooksack issues and information resources.

- **WRIA 1 Salmon Recovery Plan.** Developed version 2.0 draft of Chinook Recovery Plan that is consistent with the current understanding of the required recovery elements on the NMFS Puget Sound ESU recovery plan. The local plan outlines the local policy objectives, processes to coordinate local actions, a means to provide consistency between local jurisdictions, and timelines for early actions and long term implementation. Will seek policy endorsement of plan in early 2001 following appropriate policy review and public information and comment.

- **Salmon Habitat Restoration Citizens Advisory Committee.** Facilitated and provided administrative support to the citizens committee. Developed regular meeting schedule set for the third Wednesday of each month following the Nooksack Recovery Team. This schedule was adopted to encourage coordination between the citizens committee and NRT members planning and implementing salmon recovery projects.

- **Culvert Barrier Removal.** Implemented systematic culvert inventory, culvert fish passage assessment, and GIS attribute layer and database development for County road culverts. Completed prototype for GPS and GIS products and database development for all county road culverts in the South, Middle, and North Forks of the Nooksack River. These work products will be the basis for GIS modeling and field verification of the quantity of blocked habitats and subsequent prioritization for fish passage correction. Initial results from the forks will serve as the base for expanding the project geographically to the rest of the County road system within WRIA 1. Multiple blocking culverts were replaced using county road funds based on previous assessments and construction plans.
• **Conservation Reserve Easement Program (CREP).** The Whatcom Conservation District enrolled 40 agricultural landowners to re-establish forested buffers totaling 874 acres along salmon bearing streams in Whatcom County. In return for lease payments and initial planting costs for the acreage covered, each landowner agrees to plant and maintain a forested buffer for the typical 15-year lease period. Due to the leadership of the Conservation District, Whatcom County currently has the largest number of participants by county statewide in this voluntary program and is leading the way to restoring properly functioning habitat conditions in lowland streams.

• **Farmers Planting Trees for Salmon.** Whatcom County worked cooperatively with Washington State University Cooperative Extension and six local farmers working with schools, granges, and neighbors to plant 34,000 Douglas Fir seedlings in nurseries on their farms. The farmers, on a voluntary basis, will nurture the trees for one to two years to improve plant survival when replanted at salmon recovery sites by Whatcom County, non-governmental organizations, and landowners. This initiative provides low to no-cost plant materials and invests the agricultural community in salmon recovery as a positive part of the solution.

• **Restoration Project Support.** Provided financial support and administrative oversight for a Washington Conservation Corps crew working for Nooksack Salmon Enhancement Association (October 1999- September 2000). Provided financial support for two WCC crews for NSEA and Public works for period October 2000 to September 2001. WCC crews were tasked with planting and maintenance of vegetation and animal exclusion fencing along fish bearing waterways to re-establish riparian habitats and to improve instream fish habitat functions.

**Planned Actions for 2001**

• **Nooksack Recovery Team Database.** All current and historic County salmon and watershed restoration projects will be entered into the NRT database during the 2001 update cycle.

• **Culvert Barrier Removal.** Systematically continue culvert inventory on County roads taking GPS readings and entering culvert data into GIS and culvert database. Analyze benefits to fish and establish culvert replacement priorities (based on quantity and quality of habitat blocked and restoration priorities from Interim Salmon Recovery Strategy) for geographic areas completed to date. Develop a comprehensive culvert database based on County program for all culverts within WRIA 1 using existing Washington Departments of Fish and Wildlife and Transportation, NSEA, Lummi Nation, and Nooksack Tribe databases/data sources. Replace multiple culverts as per planned road maintenance and reconstruction activities and the Johnson Creek (Hutchinson Creek drainage) culvert funded under SRFB in 2000.

• **Farmers Planting Trees for Salmon.** Work with WSU Cooperative Extension to expand the list of native plant species and the numbers of plants available to this program.

• **CREP.** Coordinate with Whatcom Conservation District to track enrollment, implementation, and effectiveness of CREP program. Facilitate coordination of CREP with other WRIA 1 initiatives as appropriate.

• **Fisheries Enforcement Enhancement.** County staff will work with salmon co-managers to support enhanced fisheries enforcement and education. The objective is to improve public understanding of salmon lifecycle needs and to reduce illegal "take" of threatened salmonid stocks as the result of intentional or unintentional actions.

• **Washington State Salmon Recovery Funding Board.** Continue to aggressively pursue salmon recovery project funding through the SRFB and other available grant funding mechanisms to meet local salmon recovery objectives.
• **Lead Entity Duties.** Fulfill administrative responsibilities of the Lead Entity under 2496 including development of salmon project applications for funding, project ranking and submission, and public information and involvement. Hold monthly meeting of Salmon Habitat Recovery Citizens Advisory Committee. Participate in JTAG to provide technical assistance to refine understanding of factors limiting salmon production in WRIA 1 and technical review of proposed projects.

• **Chinook Recovery Plan.** Finalize and obtain broad-based local support for Chinook recovery plan. Continue implementation of early action elements. Maintain involvement in state and local processes so that implementation portion of the recovery plan remains consistent with the required elements of the Puget Sound ESU recovery plan. Evaluate needs for Bull Trout beyond those specified in the Chinook Recovery Plan.

• **Coordination with WRIA 1 Watershed Management Project.** Develop clear mechanisms to coordinate and/or consolidate activities and functions under salmon recovery and under the watershed management project.

• **Project Design Assistance.** Participate in a Public Works interdisciplinary team (IDT) to proactively scope, design, and implement salmon recovery projects under specific program areas (e.g. river and flood, Parks).

**Current State Response Plan**

The State of Washington response plan currently under development is the result of a progression of documents beginning with the Wild Salmonid Policy (Washington Fish and Wildlife Commission, 1997). Policies established in the Wild Salmonid Policy guided the development of the *Statewide Strategy to Recover Salmon - Extinction Is Not An Option* (The Joint Natural Resources Cabinet, 1999). The strategy was then put into motion with the *State Agencies' Action Plan for the Statewide Strategy to Recover Salmon* (2000) and the *Salmon Recovery Scorecard* that will be used to evaluate success of action strategies. These documents and associated references can be accessed through the internet at [http://www.governor.wa.gov/esa/](http://www.governor.wa.gov/esa/).

**Current Federal Response**

The National Marine Fisheries Service and the USFWS are tasked with enforcement to protect Chinook salmon and bull trout, respectively, that have been listed as threatened under the federal Endangered Species Act. Both agencies have rules in effect for the protection of these species. NMFS is developing a Chinook salmon recovery strategy for the Puget Sound Evolutionary Significant Unit (ESU) with an anticipated release date in mid-2001. The recovery strategy will outline how NMFS will measure recovery of the species and will set goals and timelines for recovery. Supporting documents and associated references can be accessed through the internet at [http://www.nwr.noaa.gov/](http://www.nwr.noaa.gov/) for NMFS and at [http://www.r1.fws.gov/](http://www.r1.fws.gov/) for USFWS.

**County Programs and Information Sources**

Information regarding on-going salmon restoration activities in WRIA 1 can be accessed through the Whatcom County website at [http://www.co.whatcom.wa.us/pubwks/waterres/home.htm](http://www.co.whatcom.wa.us/pubwks/waterres/home.htm) and through the Whatcom Conservation District website at [http://www.whatcomcd.org/index.htm](http://www.whatcomcd.org/index.htm). The Salmon Information Center at [www.salmoninfo.org](http://www.salmoninfo.org) is an excellent source of general information about salmon and ongoing policies and processes.

**Appendices**

- Interim Salmon Restoration Strategy for Water Resources Inventory Area 1 {includes Local Process to Rank Salmon Recovery Funding Board Proposals flowchart}
- Salmon Habitat Restoration Citizens Advisory Committee membership
- JTAG Membership
Shellfish Protection
County Lead, Regina Delahunt, Environmental Health Services Manager

Background

As a result of bacterial surface water contamination, the State Department of Health (DOH) has closed shellfish harvesting in both Drayton Harbor and Portage Bay. It is essential that the County take action to restore impacted shellfish beds in order to ensure a productive resource base for long-term use.

DOH classifies shellfish growing areas on the basis of comprehensive sanitary surveys. Each survey includes assessments of water quality and pollution sources, and also takes into account meteorological and hydrographic factors that may affect the presence and distribution of contaminants.

The presence of certain levels of fecal coliform bacteria is used as the primary indicator of water quality. In classifying each shellfish growing area, DOH relies on the 30 most recent samples taken from each sampling station located in and around the shellfish harvest area. Using the Adverse Pollution Condition protocol (APC), the samples at each station must meet a two-part standard for water quality. For example, the geometric mean of the samples cannot exceed 14 fecal coliform colonies per 100 milliliters of water (fc/100ml), and no more than 10 percent of the samples can exceed 43 fc/100ml.

Under the National Shellfish Sanitation Program, DOH is required to sample approved commercial shellfish areas six times each year. Sampling stations in both Drayton Harbor and Portage Bay have failed to meet these criteria and this failure has resulted in downgrades from the approved status to either a restricted or prohibited status.

Specific local closure response plans have been developed for Drayton Harbor and Portage Bay to address these issues. These closure response plans specify the actions that must be taken in order to protect and restore these resources. The actions inter-relate with many existing water resource problems including stormwater discharge, agricultural runoff, municipal and on-site sewage treatment, industrial discharge and marina issues. The problems that we are experiencing with shellfish quality are symptoms of a very large problem. Water quality in the County must be comprehensively addressed to ensure that the quality of our streams and rivers are such that our shellfish resources are no longer impacted. The actions specified in the closure response plans must be completed as part of a comprehensive plan to improve surface water quality problems throughout the County. All of the water quality problems must be addressed if we are to have a viable shellfish resource in Whatcom County in the future.

Status of Water Resources Comprehensive Plan Objective for Shellfish

"Whatcom County will have all shellfish harvesting areas re-opened by 2003."

Monitoring in both Drayton Harbor and Portage Bay during 2000 has not shown an improvement in the water quality in shellfish growing areas. Agencies and stakeholders continue to work together to achieve improvement but due to the many potential sources of contamination, results which show improvement have been difficult to achieve. In order to achieve the goal of reopening shellfish beds by 2003, projects that result in water quality improvements must continue to be implemented. Sampling results must demonstrate improvement over an extended time period in order for the shellfish beds to be upgraded.

Drayton Harbor

In January 1995, the Washington State Department of Health (DOH) downgraded the classification of commercial shellfish growing areas in Drayton Harbor. The reclassification was based on water quality data and a Sanitary Survey of known and potential pollution sources in the watershed. In response to the downgrade, state and local agencies joined with other affected interests to develop the Drayton Harbor
Closure Response Strategy, a targeted, short-term action plan aimed at controlling the pollution sources and restoring the water quality of the harbor. The strategy was also designed to complement the more comprehensive recommendations of the Drayton Harbor Watershed Management Plan.

Problems with water quality in Drayton Harbor have been noted in the bimonthly DOH sampling for some time. In 1995, the State DOH downgraded a portion of Drayton Harbor because the classification standards were exceeded. Overall, samples collected since the downgrade in 1995 indicate that water quality in Drayton Harbor is not improving. In fact, the data indicates that conditions in the harbor are actually worsening. Sampling conducted by the DOH in December 1998 showed exceedingly high levels of fecal coliform contamination at all sampling stations in the harbor. This resulted in DOH issuing a permanent closure of the harbor to shellfish harvesting on September 3, 1999.

*State DOH identified six pollution sources as a result of the Sanitary Survey that they conducted. These pollution sources are:*

- 1. Failing on-site septic systems on or near the harbor shoreline and creeks
- 2. City of Blaine sewage treatment facilities and bypasses
- 3. Storm water runoff
- 4. Blaine and Semiahmoo marinas
- 5. Agricultural practices in California and Dakota Creek watersheds
- 6. Fish processing wastewater

The 1999 downgrade identified additional sources including:

- Marine mammals
- Possible leaks from the Blaine STP force main

Each of these point and non-point sources is recognized as significant, or potentially significant.

**1999 Accomplishments**

Attachment -- provides a summary of the status of the tasks listed in the Drayton Harbor Implementation Strategy. The Drayton Harbor Shellfish Protection Advisory Committee has been overseeing the completion of the Implementation Strategy. A list of the members of the committee is also attached. The following are notable accomplishments made in 1999:

- A coordinated water quality program was established for Drayton Harbor. Utilizing grant funding, all water quality data collected in the Drayton Harbor area has been consolidated into a single database for use by all entities working on the area water quality issues. This will enable better assessments of the potential sources of pollution in the harbor.
- Northwest Indian College fully implemented a coordinated water quality monitoring program to identify pollution sources and to track changes in water quality.
- A complete survey of all onsite sewage systems (OSS) in Drayton Harbor was completed.
- A low interest loan program has been established for repair of OSS failures.
- Five out of 18 dairies completed manure management plans. Others are working to update existing plans.
- All sewer lines in the marina area were dye tested and repaired as of 3/99.

**Proposed Actions in 2000**

- Propose Drayton Harbor for TMDL study.
- Work with DOE to insure that the Blaine Seafood Processors are meeting discharge limits.
• Coordinate additional sampling in marina area with DOH.
• Continue data analysis to determine pollution sources.

2000 Accomplishments

Progress report that provides a summary of the status of the tasks listed in the Drayton Harbor Implementation Strategy can be found in the appendix. The Drayton Harbor Shellfish Protection Advisory Committee has been overseeing the completion of the Implementation Strategy. A list of the members of the committee is also included in the appendix. The following are notable accomplishments made in 2000:

• A coordinated water quality program was implemented for Drayton Harbor. Utilizing grant funding, all water quality data collected in the Drayton Harbor area has been consolidated into a single database for use by all entities working on the area water quality issues. This will enable better assessments of the potential sources of pollution in the harbor.
• A low interest loan program was implemented for repair of OSS failures.
• Six out of 18 dairies completed manure management plans. Others are working to update existing plans.
• Farm improvements as part of the EQIP Program have been completed.
• Web site updated to include data management sections.
• Blaine established a stormwater utility that will allow for funding related to stormwater system improvements.
• Blaine made progress towards reducing sewage overflows by adding offline storage capacity, improvements to lift stations, I&I reduction activities and collection system modeling.
• Blaine evaluated the force main cathodic protection system.
• Port of Bellingham expanded sampling and monitoring within the harbor and outside of the harbor in an effort to better identify potential sources of contamination.
• Drayton Harbor was recommended for a TMDL study.

Proposed Actions in 2001

• Secure dedicated funds for implementation of shellfish plan and identify grants and loans for program implementation.
• Expedite TMDL evaluation.
• Develop a MOA for sampling signed by involved agencies based on the coordinated sampling plan.
• Designate Drayton Harbor as an OSS Area of Special Concern
• Ensure that Blaine continues to pursue a solution to waste water treatment plant issues.
• Determine the impact of the Blaine outfall location on the water quality in Drayton Harbor.
• Resolve the issues associated with the Blaine underwater force main.
• Provide financial and technical assistance to dairies and small non-commercial farmers to develop better management practice.
• Work with Blaine Seafood Processors to resolve issues related to NPDES permit requirements and discharges.
• Conduct a circulation study of Drayton Harbor.

Portage Bay

In August of 1997, the State Department of Health (DOH) downgraded a portion of the Bay from approved to prohibited. This action was necessary to protect public health. Previous sampling of marine
water showed concentrations of fecal coliform bacteria above what was safe according to the state water quality standards and National Shellfish Sanitation Program. Sampling since that time has shown that the water quality has not improved and the state DOH formally reclassified additional areas of Portage Bay as prohibited in September 1999.

Water quality is the most significant factor in determining whether clams, oysters, mussels and other shellfish are safe to eat. In polluted water, shellfish accumulate bacteria, viruses, or toxic substances. While the shellfish themselves appear to be unaffected, those who eat them can become ill. One of these common pollutants, fecal coliform, is the cause of the current restrictions on Portage Bay shellfish harvesting. Evidence has shown that the pollution in the Bay is a result of heavy bacterial loading from the Nooksack River Watershed.

The principal source of freshwater into the bay is the discharge of the Nooksack River. Sampling of the Nooksack River below the bridge at Mount Baker Highway as well as several of its tributaries intersecting below that point, are impaired by excess levels of fecal coliform. Nearly 40% of the monthly samples collected by the state Department of Ecology in the lower Nooksack River between 1993 to 1996 exceeded the established water quality standards for a Class A stream (100 fecal coliform colonies/100ml). Other studies show similar results.

- The State Department of Health identified six potential sources of fecal coliform pollution in its August 1997 Sanitary Survey of Portage Bay. Four of these sources of pollution were considered key sources which must be addressed in order to restore the shellfish resource. These are:
  - 1. Agriculture;
  - 2. On-site septic system;
  - 3. Sewage treatment plants; and
  - 4. Storm water runoff.

  Each of these point and non-point sources is recognized as significant or potentially significant. As a result of the shellfish downgraded by DOH, a local closure response strategy for Portage Bay was established to address the areas of key pollution sources. See the appendix for an up date of the actions. The Portage Bay Shellfish Protection District Advisory Committee have been overseeing implementation of the actions. A list of the members is in appendix.

1999 Accomplishments

- 17 dairies completed manure management plans and 45 are updating current plans.
- Additional enforcement personnel have been working in the Nooksack watershed to ensure compliance with CAO and other clean water legislation.
- Cooperative agreements were reached between EPA, DOE and Whatcom County regarding enforcement roles related to farming activities.
- Work was begun on the Whatcom County Comprehensive Storm water program.
- OSS Survey completed in Marietta/Country Lane/Rural Ave. area.
- OSS O&M program adopted by BOH and OSS regulations revised to allow for program implementation.
- Northwest Indian College implemented comprehensive coliform sampling in the Nooksack.
- Implemented Education and Outreach activities for general public and dairy producers.

Proposed Actions for 2000

- Review STP permits, operations and Q/A plans to ensure compliance with discharge limits.
- Continue coordinated water quality monitoring program.
• Continue educational outreach.
  Continue work with dairies to ensure compliance with manure management.

2000 Accomplishments

• Nooksack TMDL study completed.
• Sewage treatment plant discharge issues reviewed and some corrective measures have been implemented by the cities.
• Manure management plans completed by over 40 dairies. Many others are updating current plans.
• Additional enforcement personnel have been working in the Nooksack watershed to ensure compliance with CAO and other clean water legislation.
• Cooperative agreements were reached between EPA, DOE and Whatcom County regarding enforcement roles related to farming activities.
• Work continues on the Whatcom County Comprehensive Storm water program.
• Failing OSS in Marietta/Country Lane/Rural Ave. area repaired.
• Continued Education and Outreach activities for general public and dairy producers.

Proposed Actions for 2001

• Continue work on Nooksack TMDL implementation plan.
• Review STP permits, operations and Q/A plans to ensure compliance with discharge limits.
• Continue coordinated water quality monitoring program.
• Continue educational outreach.
• Continue work with dairies to ensure compliance with manure management.

Appendices:

♦ Drayton Harbor Citizen Committee membership
♦ Portage Bay Shellfish Protection District Progress Report, November 2, 2000
♦ Portage Bay Citizen Committee membership
Lake Whatcom Management
County Co-Leads, Sue Blake, Water Resource Planner and Erika Stroebel, Water Resources Planner

Background

Lake Whatcom is large multi-purpose reservoir that is the source of drinking water for the City of Bellingham, Water District 10, several other smaller water districts/associations, and about 250 homes that draw water directly from the Lake. All told, the lake provides water to about half the population of Whatcom County. There is continued interest in expanding the delivery of water from Lake Whatcom to other areas of the County where supplies are limited.

Lake Whatcom is a multiple use lake and watershed. In addition to providing water for drinking, commercial and industrial uses, the lake is used for boating, swimming, and fishing. The majority of the watershed is forested, mainly surrounding the large southernmost portion of the lake. Other land uses include residential development (approximately 5,000 homes are located within the watershed), limited agriculture and commercial development, parks, and other public facilities. The on-going management challenge is trying to determine the extent to which these practices can occur while maintaining safe, clean drinking water. The challenge is further increased by possible requirements related to the Endangered Species Act, tribal water rights, and the potential impact these issues may have on how the City’s diversion from the Nooksack River is operated.

The City of Bellingham and Water District 10 are responsible for ensuring drinking water standards are met for their customers. To date water supplies have consistently met standards. The ability to continue to economically meet drinking water standards requires maintaining source water that requires minimal treatment. For this reason the City of Bellingham maintains an on-going source water-monitoring program. Other agencies including Western Washington University, Department of Natural Resources, Department of Fish and Wildlife, Department of Ecology, Water District 10, and Whatcom County, have also conducted monitoring, studies, and/or evaluations of the lake and watershed.

Lake Whatcom is a complex system with three distinct basins. Basin 1 is the most developed portion of the watershed. Several recent studies and reports identify a number of water quality concerns in this basin including long-term trends showing degradation.

Basin 2 is currently less developed and water quality is higher than in Basin 1. The intake for the City of Bellingham is located in this basin.

There is general agreement that water quality in Basin 3 of the Lake remains high by most conventional measures although fisheries concerns have been identified by some. Basin 3 contains 96% of the volume of water in the Lake and the intake for Water District 10.

A variety of agencies, organizations, and individuals play a role in managing and protecting Lake Whatcom. In an effort to coordinate efforts of these various players, an inter-jurisdictional management program was established in 1990 involving three of the key agencies, the City of Bellingham, Whatcom County, and Water District 10. The relationship was formalized in 1998 through passage of an interlocal agreement.

1999 Accomplishments

In January 1999, the County Council, City Council, and Water District 10 Commissioners passed a resolution jointly adopting the 1999 Lake Whatcom Management Program. The program identified actions in many areas including stormwater, urbanization/land use, watershed ownership, education, and
data management. A brief summary of 1999 accomplishments is provided below. The summary does not include all of the actions accomplished by the various jurisdictions. In addition to the joint programs, each agency has a variety of programs related to Lake Whatcom that they pursue independently (e.g. the City has an extensive monitoring program). These independent programs are not included in the summary of accomplishments.

**Urbanization/Land Development**

- The Whatcom County Planning Commission passed four actions related to Lake Whatcom: a transfer of development rights (TDR) ordinance; revisions to Title 20 that would provide an overlay zone for the watershed; revisions to the stormwater ordinance designating Lake Whatcom as a Special District and requiring on-site stormwater facilities for all new construction andremodels – single family homes are currently exempt; and revisions to the land clearing ordinance requiring reduced thresholds for review, additional mechanisms for inspections, phased clearing, and changes to cover protections consistent with State requirements. The County Council is currently reviewing all of the proposals brought forward by the Planning Commission.
- Dwelling unit projections and impervious surface estimates have been completed for existing and proposed development within the Lake Whatcom watershed.
- The watershed maps have been updated to include 1999 assessors records for parcels in the watershed.
- The County has been working with Sudden Valley in their development of a density reduction plan.
- The County has developed a map and database summarizing the type and location of development activities that have occurred in 1999 in the watershed.
- A map of major landowners has been developed.
- An erosion control survey was conducted throughout the watershed.

**Stormwater Management**

- Consultants were hired in February to implement Phase I of the Comprehensive Stormwater Management Program.
- **Stakeholder Interviews:** Interviews were conducted with various local government, state agency, utility provider, and other individuals/non-profits to identify issues/concerns, perspectives and preferences on management options, perspectives on funding, early action projects, and preferred approaches for being kept updated and involved. A summary report was written and is being used to target future actions.
- **Early Actions Projects:** A list of early action projects was developed based on stakeholder interviews and other comments received. Actions which have currently been taken in response to recommendations include: increased enforcement staff in the watershed; an evaluation of County and City road and ditch maintenance activities by the consultant, assessing options for improving the performance of the Park Place Pond, development of a maintenance and operation workshop; and a pilot project in which the County will look at alternative design approaches for managing roadside drainage on an existing County road. Discussions continue regarding high priority actions that should be pursued immediately.
- **Inventory:** Preliminary inventory work has been conducted and a database and map is available that identifies private (and some public) stormwater facilities in the watershed.
- **Water Quality Report:** A draft Water Quality Report is should be sent to the Peer Review Committee in November.
- **Peer Review Committee:** The Peer Review Committee has been identified.

**Community Outreach/Education**

- A website has been developed and maintained to provide information on Lake Whatcom (www.whatcom.wsu.edu)
• An educational mural was painted on the trailer at Bloedel Donovan that holds spill response equipment.
• Public Joint Special Legislative Meetings and quarterly Management Committee meeting were held and aired on local cable access.
• Quarterly written and verbal updates were provided to legislative bodies.
• Sehome High students conducted interviews with long-time residents to document historical perspectives of life around the lake. A display has also developed that incorporates the student’s work.
• An intern was hired to investigate the potential for a demonstration/interpretive center at Bloedel Donovan Park.
• The Water Whys Newsletter was used to provide quarterly updates on Lake Whatcom activities.
• Notebooks covering information on the Management Program were completed and distributed to legislative representatives, the Bellingham/County Library, and District 10 office.
• A Lake Whatcom Citizen Committee has been established that will report to the Management Committee.
• An informational display on alternative landscape surfaces was setup at the Home Show.
• A “What’s New” update was sent to the building community alerting them to proposed changes to County land use regulations.
• An educational/informational workshop was held for the Whatcom County Planning Commission and other elected officials to provide them with information on land use, water quality perspectives, and stormwater management.
• A Lake Whatcom Management Program logo was developed.

Spill Response and Hazardous Materials

• A portable weather station was purchased for use by the Specialized Emergency Response Personnel in responding to spills
• Spill equipment is being restocked at the various storage sites in the watershed.
• A trailer that will hold spill containment equipment was purchased and located at Bloedel Donovan Park.
• A map has been developed that identifies fire districts and stations that response to spills in the watershed. Spill response equipment that is held at each station has been identified.

Data and Information Management

• Updates/abstracts for watershed related reports have been written and database updated.
• An intern has been hired in cooperation with the Institute for Watershed Studies to compile and summarize historic information that exists in the Institutes files.
• The County has hired a consultant to undertake the “y” road landfill assessment. Phase I of the assessment is expected to be completed in 2000.
• The bathymetric map of the lake is being updated in coordination with the Bureau of Reclamation.
• Existing fecal coliform information for Silver Beach Creek and Austin Creek has been compiled and mapped as the first step in determining if additional monitoring is needed.
• A report on potential water quality concerns related to Canada Geese was developed and will be used to evaluate possible future needs.
• The City, in cooperation with Western Washington University, has conducted water movement studies in Lake Whatcom.

Utilities and Waste Management

• Goal 9 (Solid Waste) and Goal 16 (On-site Waste Systems) were reviewed to determine the extent to which additional work was needed.
• **Solid Waste:** Two elements of the original goal have been completed: on-site waste burial is prohibited and landfills are prohibited as part of the proposed overlay zone. The two remaining elements of the original goal are underway: the “Y” Road landfill assessment and education efforts directed at the proper disposal of household waste. And landfills are prohibited as part of the proposed overlay zone.

• **On-site Waste Systems:** Element one of the original goal was completed/ongoing: prioritizing complaint response system. Element two, which involves an operational permit system, is under review but not compatible with the current system. Element three, the survey of older residences, is completed. Element four, which involves proper use and maintenance of the system, is ongoing and includes the latest action which was approval of an operation and maintenance work plan by the Board of Health in 1999. Element five, related to system additives, is addressed by providing system owners with State Health additive information in the materials they are provided. The final element remains to be evaluated.

**Forestry**

• The Management Committee wrote DNR to request several actions related to forest management within the watershed including adding a water quality component to the Watershed Analysis. A reply was received.

• The County, City and District participate in the legislatively established Committee that will report to DNR in November.

**Conservation**

• The City of Bellingham, Water District 10, and Georgia Pacific have updated their joint 1998/1999 Conservation Plan.

• A survey of household water use has been completed and local and statewide data has been summarized and graphed.

• An outdoor water audit kickoff meeting was conducted.

• A pilot water meter program was investigated and will be implemented in 2000.

• Water audit kits have been purchased and are available to schools, businesses, and the public for water auditing.

• A new award was designed and created for the Whatcom in Bloom competition.

• Water conservation articles were published in WaterWhys, WWIN, the City of Bellingham newsletter, and Whatcom Watch.

**Other**

• The County has hired an additional staff position to assist in the Lake Whatcom Management Program.

• Background information has been collected regarding boating in preparation for action at a later date.

• As part of the background work needed to develop criteria and identify possible geographic areas for public ownership, information from groups such as the Land Trust, Natural Heritage Foundation, and Watershed Initiative has been compiled.

**Proposed Actions for 2000**

The Draft 2000 Program was developed based on the following considerations:

• **Adopted Goals, Policies, and Action Items:** Adopted policy direction was a key factor used to develop the 2000-work program. Policy direction comes from the 1992 jointly adopted resolution, County Comprehensive Plan, City Comprehensive Plan, and Water District 10 Comprehensive Water Supply Plan.
• **Input from Public, Agencies, Staff, Others:** Many comments and recommendations were received from individuals, agencies, staff, committees, and organizations. These recommendations were summarized and used to develop the existing program. The legislative bodies have received copies of all recommendations that were received.

• **Known/Potential Water Quality Concerns:** The draft program focuses on actions on known or potential concerns. At this time nutrients inputs (particularly phosphorus), fecal coliform, and "other" contaminants of concern have been identified in various reports.

• **Prioritization on Stormwater, Urbanization/Land Use, and Public Ownership:** In 1999 the legislative bodies identified these three program areas as the highest priority for action. It is assumed that they remain the priority areas unless directed differently.

• **Uncompleted 1999 Program Elements:** Some tasks within the 1999 work plan may not be completed this year. Those that may not be completed were reviewed included in the 2000 Work Plan as appropriate.

Based on the above considerations, actions are identified in ten program areas:

1. stormwater management
2. urbanization/land use
3. watershed ownership
4. community outreach
5. data and information management
6. spill response and hazardous materials
7. recreation
8. utilities and waste management
9. transportation
10. forestry/fish/wildlife

The complete 2000 draft work program can be found within the "Lake Whatcom Management Program 2000", which can be obtained from the Whatcom County Water Resources Division, the City of Bellingham Council office, and the Water District No. 10 office. The final 2000-work program is expected to be adopted on December 16, 1999, during a joint meeting involving the three entities.

**2000 Accomplishments**

In January 2000, the County Council, City Council, and Water District 10 Commissioners passed a resolution jointly adopting the 2000 Lake Whatcom Management Program. The program identified actions in ten program areas including watershed ownership, stormwater management, urbanization/land use, community outreach, data and information management, spill response and hazardous materials, forestry/fish/wildlife, transportation, recreation, and utilities and waste management.

In 2000, a new organization structure for the management program and approaches to specific tasks were created. The organizational changes included replacing the Lake Whatcom Program Coordinator with the Inter-jurisdictional Coordinating Team (ICT) and dissolving most of the technical teams. The ICT includes a jurisdictional coordinator from each of the three jurisdictions and a coordinating team lead. This structure was created to help address communication, coordination, and budget issues within the joint program. In addition, beginning in 2000, task proposals were created for each task defined in the 2000 Program Plan. The task proposals identify the project lead, goals and objectives, scope of work, timelines and estimated budget. These aid in tracking the progress of specific tasks defined in the 2000 Program Plan.

A brief summary of 2000 accomplishments is provided below. The summary does not include all of the actions accomplished by the various jurisdictions. In addition to the joint programs, each agency has a variety of programs related to Lake Whatcom that they pursue independently (e.g. the City has an extensive monitoring program). These independent programs are not included in the summary of accomplishments.
Watershed Ownership

- **Land Preservation Program** - Whatcom County Water Resources developed a binder with background information on land preservation techniques that includes criteria and priority areas for consideration, related scientific and policy documentation, and descriptions of programs in other communities. The Lake Whatcom Management Committee requested that the Lake Whatcom Citizen Task Force work with staff to develop recommendations related to three elements of a land preservation program for the watershed. These elements include criteria for identifying high priority areas in the watershed, options for preservation (e.g. land acquisition, conservation easements, TDRs, etc.), and an implementation strategy. Recommendations for the criteria and high priority areas are expected to be complete in November 2000.

Stormwater Management

- **Draft Water Quality Assessment, Technical Report** - The draft Water Quality Assessment, Technical Report was provided to the Peer Review Committee (PRC) for their independent review. In addition to the draft document, the PRC was provided with all of the public and agency comments submitted on the draft report, databases for referenced studies, and other requested background information. The Stormwater Team, Consultants, and PRC members are discussing comments submitted by the PRC and identifying an approach for incorporating the comments into a final document.

- **Draft Data Gaps Technical Memorandum** - The consultant team has drafted a technical memorandum identifying data gaps observed during preparation of the water quality assessment. The data gaps memorandum was reviewed by the PRC for additional gaps that they may have observed when reviewing the water quality assessment document and background information. The City of Bellingham, Water District 10, and Whatcom County are evaluating these data gaps to jointly prioritize the data needs for the Lake Whatcom Management Program.

- **Draft Funding Options Report** - The consultant for Phase I of the Comprehensive Stormwater Management Program completed a first draft of the funding options for a comprehensive stormwater program. This includes a summary of three other communities and the funding structure they are currently using.

- **Early Action Projects** - A number of Early Action Projects were identified in 1999 based upon stakeholder interviews and other comments received.
  - **Street Sweeping** - The Lake Whatcom Management Committee has received a $100,000 grant that will be administered through the City of Bellingham. The grant will be applied to street sweeping in the watershed, evaluation of the effectiveness of street sweeping at reducing residential inputs, and increased tributary monitoring including primarily tributary flows.
  - **Bank Stabilization/Vegetative Buffer Pilot Project** - Whatcom County Water Resources is collaborating with the County Flood Program to act on three areas in the Beaver Creek/Austin Creek subbasin that are experiencing significant erosion problems. The pilot project involves a voluntary approach of working with property owners to provide the bank stabilization that is needed to protect the properties as well as to develop educational materials about land practices that will reduce residential impacts on water quality.
  - **Stormwater Facility Maintenance Workshop** - Approximately 75 individuals representing local and state government, representatives from homeowner associations, land use consultants, and engineers attended an all-day workshop on various aspects of maintenance of stormwater facilities, administrative tasks associated with maintenance programs, and funding approaches.
  - **Erosion Control Workshop** - The Lake Whatcom Stormwater Team is working with the Building Industry Association to develop an erosion control workshop for December 2000. The workshop will focus on erosion control BMPs, their appropriate use, proper installation, how they reduce impacts to water quality, and related regulations.
  - **Homeshow Display** - Over 190 individuals were directly reached at the three-day Whatcom County Home and Garden Show regarding stormwater and Lake Whatcom topics through conversations, answering questions, or directing to other resources for information on topics.
• **Inspection/Enforcement of Construction BMPs- Whatcom** County Planning and Development Services has increased inspections and enforcement of BMPs on construction sites. A series of flyers illustrating set-up of BMPs for temporary erosion control were created and are being used in the field as part of this effort. In 1999, eleven orders to correct were issued in the Lake Whatcom Watershed. From January through March 2000, 66 compliance cases were opened. These cases involved activities including clearing, fill & grade building, zoning, shorelines and critical areas. Of the 66 total cases, 41 have been closed, indicating compliance with applicable codes or no violation. The remaining 25 cases are active and Land Use Division staff have been working with builders, property owners or caretakers to try to obtain compliance.

**Urbanization/ Land Development**

• **City Land Use Control Emergency Ordinance-** The Bellingham City Council adopted an interim emergency ordinance for the Silver Beach neighborhood that limits footprints or impervious surfaces, prohibits particular land uses, prohibits accessory dwellings, and limits the seasonal period for construction. A citizen advisory committee is developing recommendations for a final ordinance to be considered in the fall of 2000.

• **Transfer of Development Rights Program-** In December 1999, the Whatcom County Council adopted an ordinance that led to the implementation of a Transferable Development Rights (TDR) program for the Lake Whatcom watershed.
  - An application packet has been developed which includes background information, the TDR process from the buyers’ and sellers’ perspectives, and all needed forms for the program.
  - An outreach plan for the TDR program was developed and is being implemented. Several presentations to building industry representatives have been conducted. A brochure describing Whatcom County’s new Transfer of Development Rights (TDR) program was developed and is available at the Land Use Division of Whatcom County Planning and Development Services and the Water Resources Division of Public Works.

**Community Outreach**

• **Lake-Friendly Gardening Workshop-** Approximately 40 members of the general public attended a workshop on lake-friendly gardening techniques which was hosted by WSU Cooperative Extension and the Master Gardeners in April. Participants indicated that the workshop was helpful and they would recommend similar workshops to others.

• **Master Gardener Clinics-** Six gardening clinics were held from late March through the end of April at the Barkley Village Haggen. Volunteers donated 28 hours of time to educating Haggen shoppers about lake-friendly gardening practices, such as appropriate fertilizer and pesticide use.

• **Celebrate Lake Whatcom-** The First Annual Celebrate Lake Whatcom festival was held at Bloedel Donovan in early September as a part of the statewide Water Weeks program. The festival included a fun run, a ceremony for the “Excellence in Stewardship Awards”, a diving “treasure hunt” sponsored by Adventures Down Under, and numerous educational displays, demonstrations, contests, and informational pieces. Several local community groups were also involved.

• **Pesticide Roundup-** A pesticide roundup program was held during the first week of October 2000. Residents were encouraged to turn in their old pesticides in exchange for a coupon to be used a participating garden store. The objective of the program was to educate and encourage residents to use lake-friendly alternatives for their pest problems.

• **Stewardship Awards-** Whatcom County and the City of Bellingham accepted nominations for the “First Annual Excellence in Watershed Stewardship Award” during July. Three “Excellence in Watershed Stewardship”, three “Watershed Stewardship Honorable Mention”, and two “Junior Watershed Steward” awards were presented.

• **Watershed Living Kit-** A watershed living kit is being developed for watershed residents by the WSU Cooperative Extension. The kit will include information on lake-friendly gardening, shoreline and critical area regulations, alternative transportation strategies, septic system maintenance, and animal waste management. Coupon incentives will also be included. It is expected to be available in early 2001.
• Fecal Coliform Program- Seven dog-waste stations (Mutt Mitt dispensers) have been installed in the watershed. Sudden Valley Community Association, Bellingham Parks, Whatcom County Parks, and a Silver Beach youth group are maintaining these stations. An educational display describing the relationship between pet waste, fecal coliform, and water quality was developed for the Whatcom County Home Show. This display has been used at a number of events and the information is being consolidated for flyers at three dog-waste stations.

• Utility Bills- Twelve stewardship messages and graphics were developed and included in the July printing of the City of Bellingham utility bills.

• Educational Signs- A Lake Whatcom poster contest was held for 5th graders in April. Awards were presented in early May and the work from the contest was used to create bathroom signs in public facilities in the watershed.

• Website- Lake Whatcom website (www.lakewhatcom.wsu.edu) is regularly updated and expanded with information about the Lake Whatcom Management Program and lake-friendly living.

• Water Whys Newsletter- A section of the WaterWhys quarterly newsletter is dedicated to the Lake Whatcom Management Program. Topics that have been covered this year include stormwater management, reduction of fecal coliforms, lake-friendly gardening, water quality and car washing, motorized watercraft and water quality and safety issues, and changes in land use regulations. The distribution of the newsletter has continued to expand through the fair, home show booths, and one expanded mailing to the watershed.

• Mini-grant program- Background information has been collected from other communities that support mini-grant programs. Recommendations for a local program are being developed.

Data and Information Management

• Fish Tissue Sampling- A Sampling and Analysis Plan was developed by the Washington State Department of Health (DOH) for a fish tissue mercury level analysis. The sampling and analysis, conducted by Washington State Department of Fish and Wildlife and Washington State Department of Ecology, began in June 2000.

• Fish Consumption Survey- Washington State Department of Health and Western Washington University conducted a fish consumption survey in July. Approximately 300 survey forms from residents and anglers were completed.

• Bloedel Donovan Bacterial Sampling- Whatcom County Health and Human Services collected bacterial samples at the Bloedel Donovan swimming area throughout the summer. Based upon EPA recreational criteria the water quality at the swimming area was considered safe.

• Y-Road Assessment- The sampling for Phase 1 of the Y-Road Assessment is complete. The final report was submitted to Whatcom County Public Works in June 2000.

• Updated Data Catalog- Reports completed in 1999 and 2000 were compiled and added to the Lake Whatcom Data Catalog and the library collections.

Spill Response and Hazardous Materials

• Spill Response Equipment- Supplies of absorbent pads and boom were distributed to six fire stations and storage facilities in the Lake Whatcom watershed.

• Underground Storage Tanks- Whatcom County Water Resources is selecting a consultant to assist in identifying mechanisms to provide watershed residents with technical and/or financial assistance to remove underground storage tanks.

• Spill Response Tabletop Exercise- A spill response tabletop exercise was held in late July 2000. Participants included Fire District 2, Fire District 4, Bellingham Fire Department, and Whatcom County Division of Emergency Management, Whatcom County Health and Human Services, Water District 10. A number of observers from the City of Bellingham and Whatcom County also attended. This was a successful exercise that helped representatives learn more about who would be involved in responding to a large spill and identifying a number of additional community resources.

Transportation
• **Motorized Vehicle Education** - Background information regarding the potential impacts of motorized vehicles on water quality has been compiled. A diagram of pollutants associated with automobiles and information about car washing in the watershed was developed for use in educational articles and displays.

**Recreation**
• **Boating Education** - An educational flyer with information related to boating and water quality and water safety issues was developed. Research was conducted on education campaigns on boating issues in other communities. A boating kit is being developed based upon the compiled information. The boating kit will be available at the beginning of the 2001 boating season.

**Utilities and Waste Management**
• **Pilot Metering Project** - The City of Bellingham installed 222 meters in early April. Customer response to the project has been positive with 50% of the participant surveys returned
• **WaterWise Garden Tours** - Information about several regional waterwise demonstration gardens was compiled. Educational brochures and a webpage will be developed to convey information about waterwise garden tips and demonstration gardens that provide ideas and examples for gardening with water conservation in mind.

**Proposed Actions for 2001**

The Draft 2000 Program was a five-year program plan developed for the following ten program areas.
1. stormwater management
2. urbanization/land use
3. watershed ownership
4. community outreach
5. data and information management
6. spill response and hazardous materials
7. recreation
8. utilities and waste management
9. transportation
10. forestry/fish/wildlife

The complete 2000-2004 work program can be found within the “Lake Whatcom Management Program 2000”, which can be obtained from the Whatcom County Water Resources Division, the City of Bellingham Council office, and the Water District No. 10 office.

**Appendix:**
• Lake Whatcom Management organizational structure chart

**Groundwater Protection & Management**

**County Lead, Regina Delahunt, Environmental Health Services Manager**

Background

Whatcom County residents rely heavily on groundwater for drinking water, agriculture, and commercial and industrial needs. Groundwater also plays an important role in maintaining stream flows.

Many studies have been conducted related to groundwater quality in Whatcom County. These studies have revealed that there are many water quality issues particularly in the northern portion of the County. In general, groundwater in Whatcom County is very vulnerable to contamination because much of the County’s groundwater lies within a shallow unconfined aquifer. Activities that occur on the surface of
the ground directly affect groundwater quality. Shallow wells that draw water from unconfined water table aquifers are at highest risk. Below is a listing of key facts related to groundwater quality in Whatcom County.

- Nitrate contamination is the major concern for groundwater in the County.

- The Blaine Sumas Aquifer has been impacted by agricultural and other activities causing both nitrate and pesticide contamination problems in drinking water supplies. Though there is some variation in study results, approximately 20% of wells have levels of nitrate above the MCL of 10 ppm, with 40 – 50% of wells with levels that exceed half the MCL.

- Nitrate concentrations in some (particularly shallow) wells can vary significantly throughout the year. Concentrations can range from less than the MCL to well over the MCL depending on when the sample is taken.

- The main sources for excess nitrate in drinking water have been determined to include improper application of commercial fertilizers, improper animal manure applications, and improperly designed, installed or maintained septic systems.

- The presence of pesticides, such as the soil fumigants Ethylene Dibromide (EDB) and 1,2-Dichloropropane (1,2-DCP), and Dibromochloropropane (DBCP) have been well documented since the mid-1980s.

- Limited data for wells sampled in 1991 and 1998 suggests that levels of the soil fumigants in well water may be decreasing. However results from sampling conducted in 1998 and revealed that soil fumigant levels above the MCL still exist in several private wells.

- Sources of soil fumigants appear to be associated with historic commercial applications of EDB, 1,2-DCP and DBCP to fields prior to growing potatoes or berries. These fumigants were used to control worms in the soil that attack the roots. EDB and DBCP were banned from use in the 1980's and production of 1,2-DCP was discontinued in 1991.

- Bacterial contamination is also a concern. Many shallow private wells test positive for the presence of coliform bacteria. This indicates improper well construction or sealing.

- Some areas of the county including Lummi Island has naturally occurring arsenic levels in groundwater that is some instances exceeds drinking water standards.

- Certain areas within the Lummi Reservation have problems with saltwater intrusion

### Status of the Water Resources Plan Groundwater Objective

"Whatcom County will have a comprehensive groundwater plan and implementation strategy by 2001."

### 1999 Accomplishments

- Leukemia study completed. The study found no common factors, including drinking water sources among the cases studied.
- EPA completed the Site Investigation to determine if there was a point source related to the North county fumigant contamination. No point source was discovered. Agricultural application of fumigants most likely was the cause of the contamination.
- DOE completed additional sampling of the north county area. A more complete assessment of the contamination problem was obtained.
ATSDR completed an exposure assessment related to dermal and inhalation exposure to fumigants.
ATSDR completed a health assessment of the north county groundwater. The health assessment addressed nitrates, fumigants and coliform bacteria.
USGS completed additional sampling in the North County relating levels of fumigants to historical application data.
DOE completed a preliminary assessment of alternative water supply options for the north county area impacted by fumigant contamination in the groundwater.
Whatcom County completed a fumigant database and completed mapping of all data related to nitrate and fumigant contamination.
Information related to health risk associated with nitrates and fumigants was mailed to north county residents.
DOH completed an assessment of the water supply for all migrant labor camps in north Whatcom County.
DOH completed additional sampling of private wells in the north county area.
DOH notified public supplies in the North County of the need to test for organic contaminants.

Proposed Actions for 2000

• Complete the determination of appropriate supply options for the North County and implement the option selected.
• Continue providing educational materials to the community related to fumigants, nitrates and coliform contamination.
• Propose drinking water supply regulations that address required testing in areas of known contamination prior to new construction or sale of a residence.
• Conduct arsenic testing in areas of the county suspected of having naturally elevated levels.
• Continue efforts to implement Integrated Pest Management efforts specified in the Abbotsford Sumas International Task Force Agriculture Plan.
• Continue to work with dairies to develop Farm Management Plans.
• Examine the benefits of designating the Sumas aquifer a Groundwater Management Area (GWMA). Participate with DOH in studies to determine health effects of high levels of nitrate in infants.

2000 Accomplishments:

• Completed the determination of appropriate supply options for the North County. Permitting necessary for construction is in progress.
• Continue providing educational materials to the community related to fumigants, nitrates and coliform contamination.
• Drafted drinking water supply regulations that address testing in areas of known contamination prior to new construction or sale of a residence.
• Conducted arsenic testing in areas of the county suspected of having naturally elevated levels.
• Continue efforts to implement Integrated Pest Management efforts specified in the Abbotsford Sumas International Task Force Agriculture Plan.
• Continue to work with dairies to develop Farm Management Plans.
• Ensure that early action groundwater projects are implemented through participation in the WRIA 1 Watershed Planning process.
• Enhanced Whatcom dairy farmers' nutrient management through a pilot demonstration project that distributed personal digital assistants (PDAs) and farm software packages to test new technology with cooperating dairy producers; a workshop on grazing practices that reduce nutrient accumulation; and assistance with composting techniques.
• Instituted IPM field research on biorational (non-chemical) pesticides in small fruits, beneficial insects used in greenhouses, evaluation of vermicompost tea in greenhouse and other crops for disease suppression, and alternative control methods of crane flies for homeowners.
Proposed Actions for 2001

- Ensure installation of alternate supply options for the North County.
- Continue providing educational materials to the community related to fumigants, nitrates arsenic and coliform contamination.
- Adopt drinking water supply regulations that address testing in areas of known contamination prior to new construction or sale of a residence.
- Continue efforts to implement Integrated Pest Management efforts specified in the Abbotsford Sumas International Task Force Agriculture Plan.
- Continue to work with dairies to develop Farm Management Plans.
Public Education & Involvement
County Lead Craig MacConnell, Cooperative Extension Chair

Background

The Whatcom County Comprehensive Water Plan states:

"It is the intent of this plan to accomplish these goals through win-win solutions in partnership with all stakeholders. As much as possible, these goals need to be achieved through non-regulatory approaches that allow us to find practical and cost effective compliance with legal mandates."

These goals require an informed and educated public that has many opportunities for participation and involvement in addressing the County’s water resource issues.

Actions in 1998 - 1999

- Initiated development of a long-range education and public involvement plan for WRIA1 watershed planning effort, which will create audience specific educational objectives and methods.
- Created and maintained internet sites for
  - WRIA1 watershed planning: http://wria1project.wsu.edu
  - Lake Whatcom: http://lakewhatcom.wsu.edu
  - Drayton Harbor & Portage Bay Shellfish districts: http://whatcomshellfish.wsu.edu
  - Cooperative Extension's web site: http://whatcom.wsu.edu/environ
- Expanded professional staff to support water resource education needs by:
  - Hiring on Oct. 25, 1999 a Program Specialist - Watershed Education & Public Involvement staff person in Cooperative Extension to support the PIE needs for the Whatcom County Comprehensive Water Plan.
  - Hiring on August 1, 1999, in partnership with Washington State University, a Nutrient Management Extension Educator to address education and research needs related to dairy waste and water quality.
- Conducted educational programming for commercial agriculture to create awareness and management practice changes on:
  - Nitrogen Management of Raspberries for Yield and Groundwater Protection
  - Groundwater Conditions in Whatcom County
  - Groundwater Investigations by the USGS in Whatcom County
  - Toxicology of Groundwater Contaminants
  - 1998 Integrated Pest Management Trials with Raspberry Growers
  - Using the IPM Decision Making Guide For Raspberry Growers
  - Pesticide Application Equipment Setup & Maintenance
- Hosted Salmon Town Hall meeting to build awareness of Salmon & ESA
- Using an ad-hoc advisory committee, developed a Salmon Steward volunteer educator curriculum
- Implemented the education section of the Lake Whatcom Management Plan including:
  - Conducted a decision maker (elected officials & planning commissioners) workshop on stormwater and Lake Whatcom
  - Developed and distributed “What’s New” fact sheets informing the building community of changes in land use regulations
  - Developed Lake Whatcom Past Perspectives display
Planned Actions for 2000

- Continue expansion of education and public involvement efforts on the internet through:
  - Cooperative Extension’s web site http://whatcom.wsu.edu/environ
  - WRIA1 watershed planning; http://wria1project.wsu.edu
  - Lake Whatcom http://lakewhatcom.wsu.edu
  - Drayton Harbor & Portage Bay
  - Shellfish districts: http://whatcomshellfish.wsu.edu

- Implement components of the education section of the Year 2000 Lake Whatcom Management Plan including:
  - Homeowner nutrient & pesticide related environmental protection
  - Audience specific education focused on high priority issues

- Establish an Integrated Pest Management program to address environmental protection from pesticides, including agricultural and home uses.

- Guide the completion of the development of the long term WRIA1 Watershed Planning Education Plan.

- Begin implementation of the long term WRIA1 Watershed Planning Education Plan with preliminary priorities of:
  - Planning Unit caucus education
  - Planning effort awareness and understanding for the general public
  - Information dissemination to decision makers

- Develop and implement an educational program for Endangered Species/Salmon/Bull Trout for the general public and other priority audiences

- Develop and implement an educational program directed to reducing animal manure impacts on the environment

2000 Accomplishments

- Led the development of a long-range education and public involvement plan for the WRIA 1 Watershed Management Project, which outlined target audiences, methods tied to specific objectives, and evaluation measures.

- Enhanced Whatcom dairy farmers’ nutrient management through a pilot demonstration project that distributed personal digital assistants (PDAs) and farm software packages to test new technology with cooperating dairy producers; a workshop on grazing practices that reduce nutrient accumulation; and assistance with composting techniques.

- Instituted IPM field research on biorational (non-chemical) pesticides in small fruits, beneficial insects used in greenhouses, evaluation of vermicompost tea in greenhouse and other crops for disease suppression, and alternative control methods of crane flies for homeowners.

- Conducted a three-hour workshop on lake-friendly gardening, attended by 50 citizens, primarily residents of the Lake Whatcom watershed, whose comment forms indicated the lawn care and pest management topics as being particularly useful.

- Developed the Pesticide Roundup, an educational effort to encourage county residents, particularly those in the Lake Whatcom watershed, to safely dispose of their unused pesticides and to use water-friendly methods of pest control.
- Updated and maintained internet sites for several water resource web sites:
  - WRIA 1 Watershed Management Project, http://wria1project.wsu.edu
  - Drayton Harbor & Portage Bay shellfish districts, http://whatcomshellfish.wsu.edu

- Provided public outreach for Lake Whatcom management efforts such as the Transferable Development Rights program, the Excellence in Watershed Stewardship Awards, and the Celebrate Lake Whatcom festival.

- Organized educational workshops on WRIA 1 Watershed Management Project issues, including water quantity and instream flows. Publicized forum on private well owner issues.

- In support of watershed planning, Lake Whatcom management, and salmon recovery, developed various media relations’ materials such as news releases and information kits.

Planned Actions for 2001

- Continue updating and maintaining the various water resources web sites, and develop a new web site for salmon recovery issues in Whatcom County.

- Develop and implement a master volunteer program, with a probable initial focus on Lake Whatcom, to expand individual and community capacity to understand and act on water issues.

- Provide information based on the best available science to schools on water-related education.

- Begin implementation of the WRIA 1 education and public involvement plan.

- Continue educational efforts focused on Lake Whatcom watershed residents, through a “watershed living” kit of informational materials and a series of workshops on lake-friendly gardening, pest management, and other residential practices.

- Disseminate information about on-farm research that successfully demonstrates ecologically based pest management approaches.

- Educate owners of small farms on nutrient management through a web site and workshop.

- Develop and implement a compost marketing strategy, to increase consumer demand for local compost (particularly dairy manure) and to encourage farmers to use an effective and appropriate nutrient management strategy.

- Develop and implement an educational program for endangered salmonid species recovery for the general public and other priority audiences.

- Provide public involvement opportunities and public education with respect to high-priority Lake Whatcom management projects.
Additional Water Resource Program Issues and Coordination Needs

In addition to the above matters addressed in the 1999 Comprehensive Water Resources Plan, the following program areas are of similar importance. They were not included in the previous Plan since they were not new or expanding programs for calendar year 1999. They are summarized here in order to provide additional information to the reader as well as to emphasize the importance of coordination with the above programs.

Flood Control Zone District (Flood Hazard Management)
County Lead, Paula Cooper, Engineering Manager – Surface Water

Background

Following the severe floods of 1989 and 1990, in 1992 Whatcom County created the county-wide Flood Control Zone District (FCZD), including both incorporated and unincorporated areas of the County. The FCZD is a quasi-municipal corporation that is a separate legal entity from the Whatcom County government. Even though this legal separation exists, the Whatcom County Council and the County Executive (Board of Supervisors) and the Public Works Department (staff) perform the governance and administrative support for the district.

The primary purpose of the FCZD is flood hazard management. Revenue generated for this purpose is accomplished in two ways: (1) a county-wide uniformly applied service charge; and, (2) supplemental revenue generated within localized Diking Districts and Sub-Flood Districts where specific local project activity is planned.

In November, 1999, the Lower Nooksack River Comprehensive Flood Hazard Management Plan (CFHMP) was adopted and is now the guiding document for future programs along the lower Nooksack River, and is the template for flood hazard programs within the balance of the district.

The goals of the CFHMP are:

- Protect lives.
- Minimize damage to public and private property and to public resources.
- Provide a comprehensive understanding of the river.
- Propose projects with a positive environmental benefit.
- Maintain ongoing jurisdictional involvement and cooperation.
- Emphasize long-term solutions.
- Minimize public expenditures related to flooding.

While the primary purpose of the FCZD is flood hazard management, the district is allowed to address a wide variety of water resource issues. Due to this ability, revenue generated by the district is currently utilized to finance the majority of efforts identified within the Comprehensive Water Resources Plan, and this financial relationship is expected to continue for at least the next two years.

Current Status / Short Term Actions

In the 2000 Water Plan update, it was recognized that with the listing of salmon under ESA it has become extremely difficult to design, permit, and construct repairs and improvements within any scope or timeline certainty. Due to this, there continues to be limited expenditures for “on-the-ground” projects.
While progress has been made to resolve permitting procedures and design standards issues, they are not yet finalized and significant application of resources towards improvement and repair activities will continue to occur.

Elements of the CFHMP that were noted in the Water Plan 2000 Update and that have received substantial attention and/or will be completed during 2000 include:

- Hydraulic modeling and alternatives analysis:
  Significant progress has been made in the development of an unsteady flow model for the lower Nooksack River. As of the beginning of October, a preliminary model has been developed from the Guide Meridian to Bellingham Bay. The model is currently being extended upstream to Deming and will include the Everson-Sumas overflow corridor.

- Floodplain mapping and land use in the flood plain:
  FEMA issued new preliminary Flood Insurance Rate Maps (FIRMs) late in 1999. Due to problems with the floodplain delineations shown for the Nooksack basin, the County successfully appealed the new maps. Staff is currently working with FEMA to develop a set of interim maps that will incorporate the results of detailed studies on streams outside of the Nooksack basin, until the hydraulic model can be used to re-map the Nooksack floodplain.

- Land and easement acquisition program development:
  The Whatcom County Land and Easement Acquisition and Flood Mitigation Assistance Program has been developed and adopted by the Board of Supervisors. In addition, a Hazard Mitigation Grant Program application to acquire repetitive loss properties has been submitted to FEMA. We have received verbal notification that a $450,000 grant will be awarded to acquire three repetitive loss properties.

In addition to the Lower Nooksack activities, the FCZD and staff have made the following progress related to program activity:

- Saar Creek – A management plan to address the sedimentation and related flooding problems on Saar Creek has been developed. Implementation of the first phase of the plan is underway.
- Coastal Floodplain Mapping – The need for accurate floodplain elevations in coastal areas has prompted the initiation of a coastal mapping study. Coastal analyses and mapping for Sandy Point is underway.
- Canyon Creek – Alternatives analysis for long-term management strategies has been performed. Field survey data is being collected to better define at-risk area. Ongoing discussions with the Board of Supervisors and the public should provide direction in the future.
- Swift Creek- Ongoing monitoring has been completed and feasibility of implementation of the management plan has been evaluated.

In addition to the items noted above, a significant function of the FCZD is organized response during flood events. A reserve fund of $5,000,000 is being maintained for the purpose of flood event response efforts and for post flood event recovery.

With the increased effort required for the design and permitting of individual projects, together with the increasing number of projects being proposed, project delays and project backlog are becoming more common. Since not all proposed work can be accomplished with the staff resources currently available, prioritization of programs and projects has occurred with the help of the FCZD Advisory Committee.

Following is a generalized list of the FCZD program areas, listed in recommended priority order. The complete result of this exercise is attached as an appendix, and includes prioritization of specific activities for 2001.
FCZD 2001 General Budget Priorities for major program areas:

1 Coordination of the County Flood Response and Damage Recovery Program
   This activity is only conducted in direct response to a flood event and supersedes all other activities. It includes both sector watch coordination and flood fighting during the event and damage assessment and repair after the event.

2 Operation and maintenance of the Early Flood Warning System
   This is primarily coordination with NRCS and evaluation of future forecasting needs.

3 Administration of the National Flood Insurance Program (NFIP)
   This includes flood review of building permit applications, as well as response to flood inquiries and coordination of the CRS program.

4 Completion of past project permit requirements (monitoring / maintenance)
   The activities within this task are a direct result of project requirements placed by permitting agencies at the time of permit issuance. We must complete these items.

5 Implementation of programmatic elements of adopted plans
   Items in this category include studies and analysis aimed at developing long-term programs or specific capital projects.

6 Implementation and administration of the Flood Control Maintenance Program
   This is the annual repair and maintenance program (also known as 80/20 program).

7 Development and refinement of comprehensive flood hazard management plans
   This includes the up-front planning tasks to develop an overall plan.

8 Implementation of capital elements of adopted plans
   This includes capital projects, primarily construction projects, but also individual buyout projects.

9 Technical and administrative assistance to diking and drainage districts, subzones, individuals, etc.
   This includes all of the miscellaneous technical support we provide to districts, County departments, individuals, etc. (Maintain rolls, process district invoices, etc.)

Appendix

- FCZD 2001 Budget Priorities (memo and attachments)
Comprehensive Stormwater Management Program
County Lead, Jeff Monsen, Director of Public Works

Background

Whatcom County is one of many entities required to manage stormwater within the context of the 1994 Puget Sound Water Quality Management Plan. Originally developed as a part of the Puget Sound Water Quality Authority, this plan and subsequent amendments and short term work plans are currently being developed and monitored by the Puget Sound Water Quality Action Team, in coordination with the Department of Ecology.

Local comprehensive stormwater programs are required to include:

- Ordinances containing minimum requirements for new development and re-development
- Technical manual containing source control and treatment BMP's
- Operation and maintenance programs and ordinances
- Education programs
- Growth management planning and interlocal coordination
- Identify and rank significant water pollution storm drains
- Investigate and correct problem storm drains
- Water quality response program
- Adequate funding
- Local coordination agreements
- Inspection, compliance, and enforcement measures
- Implementation schedule

With the recent ESA listings and shellfish bed closures, the above required local stormwater response must include measures and associated monitoring of the relationship between local stormwater management and the other issues described within the Comprehensive Water Resource Plan.

Adopted Plans / Policies

- Manage stormwater runoff to minimize surface water quality and quantity impacts.

- Maintain or enhance, when appropriate, natural drainage systems and natural water storage sites to better protect water quality, moderate water quantity, minimize environmental degradation, and reduce public costs.

- Limit the alteration of natural drainage systems and natural water storage sites without acceptable mitigating measures. Such measures should not significantly degrade water quality or fish and wildlife habitat, and should not increase hazards to the community.

- Support the use by resource industries, such as agriculture, forestry, and mineral resource extraction, of management practices that minimize erosion and sedimentation and significantly reduce pollutants.

- Evaluate the role of watersheds in the maintenance of water quality and quantity and determine what cumulative impact development activity may have on watershed hydrology.

- Develop specific stormwater management programs for each drainage basin within the county's jurisdiction that may be impacted by urban levels of development. Recognize the Lake Whatcom
Watershed as a high priority in this effort. Coordinate efforts with the Lake Whatcom Management Committee program.

- Establish, as a high priority, a stormwater maintenance program that assures stormwater systems function at or near design capacity.

- Minimize the amount of impervious surface whenever practicable by using natural engineering design methods such as the use of open, grassed street swales instead of curbs and gutters. Where feasible, encourage alternate surfacing options.

**Current Status of Short Term Actions**

The following guidance documents are each in process at the state level:

- 2000 update to the Puget Sound Water Quality Management Plan
- DOE Western Washington Stormwater Manual
- DOE Stormwater Management Study
- DOE Stormwater Management Plan
- DOE Guidance on implementation of NPDES Phase II under the Clean Water Act

The following previously noted action items have had limited effort applied to them during 2000 due in large part to the decision to wait for the completion of the above guidance documents. It also remains unknown whether the current work being completed by the state will be compliant with ESA standards and, therefore, may require further modification.

**Ordinances** - The Whatcom County stormwater management codes and Development Standards are similar to but are not equivalent to the Ecology Model ordinance. The County is still in the process of addressing some of the DOE recommendations within the joint Lake Whatcom watershed stormwater program.

**Technical Manual** - The County Standards make direct reference to the use of Ecology’s BMPs, however there are differences in the application, design, and use of BMPs. Until DOE completes its update to the stormwater manual, this cannot be completed.

The following is a summary of the status of other proposed short-term actions:

**Operations and Maintenance** - The County currently conducts and operation and maintenance program consisting of:

- Ditch cleaning and mowing
- Selected catch basin cleaning; and
- Pipe culvert repair and replacement

Evaluation of County ditch and road cleaning procedures have begun with selected programs currently being redesigned specifically for application in the Lake Whatcom watershed

**Education** - The County is involved in a variety of stormwater related education efforts including:

- Project specific, informal education

- The development and implementation of watershed specific programs beginning with the Lake Whatcom watershed. The Lake Whatcom program includes on-going efforts such as:
targeting residents, developers, decision-makers, spillers, and others potentially affecting water quality (specific audiences are involved in developing the programs)

- As part of the development of the Lake Whatcom Comprehensive Stormwater Program, resources have been allocated specifically toward public education and involvement in the process. Education/involvement efforts have/will include: stakeholder interviews, workshops, written updates/materials distributed through written, verbal, and electronic media, and other avenues as necessary

- Development of educational/informational material for distribution with building permits

- Activities targeted by the inter-jurisdictional Whatcom Watershed Information Network

Growth Management Planning - The County Comprehensive Land Use Plan developed under GMA includes numerous goals, policies, and action items related to stormwater management, surface water, and groundwater protection. These goals, policies, and action item build upon the Ecology basic and comprehensive stormwater requirements.

The potential need for capital facilities is being evaluated beginning with the Lake Whatcom watershed. The County will also continue to work with existing programs and jurisdictions to address stormwater program needs, including potential capital facility needs.

Identify and Rank Pollution Sources and Local Coordination - County efforts include:

- Participation in the 2514 watershed planning process. One element of this process is to conduct a comprehensive evaluation of sources, water quality data (including additional monitoring), and modeling/loading estimates.

- Participation in the development/review of Source Protection Plans for Lake Whatcom and the Nooksack basin. These plans include an inventory and ranking of pollutant sources.

- Development and implementation of the Lake Whatcom Management Program. The program includes data/information elements and development of a Comprehensive Stormwater Program. The stormwater program will include an inventory of the stormwater facilities/drainage systems, identification of priority sources, and an identification of problems. Recently, an inventory of private facilities in the watershed was completed.

- Participation in a variety of other programs that seek to inventory and identify sources, and recommends strategies to reduce pollutants (both preventative and corrective). Such programs include as shellfish programs, groundwater protection strategies, and salmon recovery efforts.

Adequate Funding - Funding for stormwater related activities come from the general fund, road fund, and flood fees. While long-term mechanisms to fund stormwater programs is being examined as part of the Lake Whatcom Comprehensive Stormwater Program, a similar exercise needs to occur relative to other areas of the County.

Inspection / Enforcement - Whatcom County has developed a draft code enforcement ordinance that would coordinate and streamline the code enforcement process. A temporary enforcement staff position was approved for the Lake Whatcom watershed.

Implementation Schedule - By the end of 2000 adoption of a variety of policy and operational adjustments are intended to be reviewed and adopted to come into compliance with current state requirements. This cannot be said for any state or federal regulatory changes that may occur unexpectedly during 2000.
2001 Priorities

With local resources being consumed by existing program areas, only limited effort will be applied to comprehensive stormwater management outside of the Lake Whatcom watershed. Those activities that will receive attention include:

Finalize Road BMPs and practices in the Lake Whatcom watershed and begin to apply as appropriate to other areas of Whatcom County.

Participate at the state level in the development and/or finalization of stormwater related standards, including ESA influenced elements.

Begin to create a comprehensive inventory/description of the stormwater handling system within unincorporated Whatcom County.

Appendices

♦ Internet reference to the Puget Sound Water Quality Action Plan (2 pages)
♦ Memo and attachments relating to DOE stormwater related efforts (12 pages)
**Marine Resources**  
County Lead, Bruce Roll, Water Resources Division Manager  

**Background**  
In 1998 the Northwest Straits Commission was established by Congress (HR 3461) to provide an ecosystem focus on the marine resources of the Northwest Straits to help mobilize science to focus on key priorities, and to guide and provide resources to county Marine Resources Committees (see Murray-Metcalf Northwest Straits Citizens Advisory Commission Report to Convenors). An outgrowth of this commission was the development of local marine resource committees. Whatcom County Council recognized a need to protect the local marine environment and on May 18th, 1999 established the Whatcom County Marine Resources Committee. 

The mission of the Whatcom County Marine Resources Committee, guided by sound science and the needs of the Northwest Straits marine ecosystem, is to address local marine issues, recommend remedial actions to local authorities, and build local awareness of the issues and support for remedies consistent with the Benchmarks for Performance set out in the Murray-Metcalf Northwest Straits Citizens Advisory Commission Report to Convenors. 

This mission is further defined in the attached ordinance establishing the Whatcom County Marine Resource Committee.  

**1999 Accomplishments**  
- Formulation of the Whatcom County Marine Resources Committee.  
- Passage of Whatcom County Ordinance appointing members of broad-based expertise and interests.  
- Securing of a $10,000 start-up grant from the Northwest Straits Commission.  
- Selection of a chairperson for a one year term.  
- Selection of Whatcom County NWSC representative  

**Planned Actions in 2000**  
- Identify and implement early action items for funding in 2000.  
- Identify and prioritize marine resource needs within Whatcom County.  

**2000 Accomplishments**  
- Process and Procedural Agreement finalized  
- Existing Marine Resources identified and report generated  
- Whatcom County MRC awarded $25,000 early action front from NWSC  
- Shoreline inventory implemented with Re-Sources  
- Whatcom County MRC awarded $10,000 administrative grant  
- MRC members attend training session in Oak Harbor  

**Planned Actions in 2001**  
- Development of grant proposal for second round of MRC funding  
- Identification of specific areas in Whatcom County for preservation and/or restoration  
- Coordination with existing salmon recovery efforts in Whatcom County  
- MRC representative to attend NWSC monthly meetings  
- Implementation of marine restoration projects
Appendices:

- Shoreline Inventory Bellingham Herald Article
- Marine Resources in Whatcom County Report (cover page)
- Shoreline Inventory maps
- MRC Membership list
Coordinated Water System Plan
County Lead, Regina Delahunt, Environmental Health Services Manager

Background

The 1993 Whatcom County Coordinated Water System Plan (CWSP) was developed under the authority and requirements established by the Coordinated Water System Act (Chapter 246-293 WAC). The Public Water System Coordination Act, (Chapter 70.116RCW) establishes a procedure for the State's water utilities to coordinate their planning and construction programs with adjacent water utilities and other local governmental activities. This Act specifies that the DOH or the County legislative authority may declare an area within a County as a Critical Water Supply Service Area (CWSSA). The two primary objectives of the Act are:

- To coordinate development of water utilities within a given geographical area, and
- To integrate water system planning and development with land use planning in a given geographical area.

These objectives are met through the coordinated efforts of water utilities and local and state agencies. The CWSP articulates water policy for Whatcom County and is the official guide for water system development.

Based upon an assessment of water systems in the county and their problems, in 1990, the County Council made a preliminary determination that the majority of the County should be declared a CWSSA. A Water Utility Coordinating Committee (WUCC) was then established to recommend boundaries for the CWSSA and to prepare a CWSP. In 1991, the County Council declared all of Whatcom County a Critical Water Supply Service Area and the WUCC began preparation of the CWSP following the requirements defined by the Coordination Act and the associated DOH Guidelines.

The Whatcom County CWSP was completed in 1993. It consists of two parts: Individual Water System Plans and an Area Wide Supplement. The Individual plans are prepared by the individual utilities and must address specific system needs and be consistent with the CWSP. The Area Wide Supplement addresses issues such as Design Standards, Service Area Declarations, Utility Service Review Procedures, Satellite System Management Programs and Future Water Supplies.

The County Council approved 1993 CWSP but due to issues related to Growth Management and Lummi Water Negotiations, DOH was not able to approve the 1993 plan. Since the plan was never formally approved by DOH, implementation of the plan was incomplete.

In 1998, DOH provided funding to complete an update of the 1993 CWSP so that DOH approval could be given. The WUCC was reconvened and worked through 1999 to complete and update of the 1993 plan.

The Coordinated Water System Plan (CWSP) represents the continued efforts of Whatcom County in managing the County's potable water resources according to all applicable State and County public policy. The recent CWSP update provides a further refinement of process and strategy for existing water utilities to provide quality, responsive service in a manner that supports the Growth Management Act and the County's Comprehensive Plan.

Adopted Plans/Policies:

The following plans and policies have been adopted in Whatcom County and relate to the CWSP and its implementation:
• Critical Water Supply Service Area Designation for all of Whatcom County
• County Council Adoption of 1993 CWSP
• Whatcom County Comprehensive Plan
• Individual Water System Service Area Designations

Current Status:

The update is complete and brings the 1993 CWSP into compliance with current state law. Additional areas were also updated. The revision of the 1993 Draft CWSP has been completed and includes:

• Revision of the appeals process to comply with language of E2SSB 5448.
• Incorporation of satellite management procedures into the Utility Service Review Procedure (USRP).
• Coordination of USRP design standards and service area responsibilities with the County's land use plans and policies.
• Revision of Public Water Supply service area boundaries as needed.

Other Activities:

In conjunction with the CWSP process, Health and Human Services is completing a project to locate and map all public water system wells utilizing GPS and GIS technology. This should be completed in 2000.

Short-term County Actions:

• Obtain completed Service Area Designations from all Public Water Systems.
• Map Service Area Designations.
• Map Well Head Protection areas.
• Begin implementation of adopted CWSP.
• Assure all new and expanding systems comply with the Minimum Design Standards identified in the CWSP.
• Initiate the resolution process when an applicant or a utility files an appeal.
• Implement the new USRP procedures for all water availability requests.

Long-term Direction:

• Complete implementation of CWSP and elimination of conflicting language between the CWSP and other county land use documents.
• Incorporate source protection requirements mandated by State and federal government for water utilities with protection strategies developed for County Comprehensive Plan Goal 11F.
• Establish an agreement with Whatcom County PUD, Water District 10, and other interested Satellite System Management Agency candidates to manage failing water associations that fall into receivership.

Full implementation of the CWSP will require some additional staff resources in both the Health and Human Services Department and Planning and Development Services Department in the coming years. It will also be necessary for the two departments to coordinate efforts and delineate roles and responsibilities in relation to implementation of the CWSP.

2000 Accomplishments

• Plan completed by WUCC on February 2000
• Plan was adopted by resolution May 2, 2000
• Approved by State Health August 7, 2000

Planned Actions in 2001

• Continued work to complete service area designations. GIS maps will be updated as service areas are identified
• Ongoing implementation by Health Department.

Whatcom County Comprehensive Plan
County Lead, Sylvia Goodwin, Planning Division Manager

Background

The 1990 Washington State Growth Management Act Planning Goals (RCW 36.70A.020) were adopted to guide the development and adoption of comprehensive plans and development regulations of those counties and cities that are required or choose to plan under RCW 36.70A.040. While a number of the 13 GMA goals relate directly and indirectly to water resources, goal (10) Environment specifically refers to water quality and water availability:

Goal (10) Environment. Protect the environment and enhance the state's high quality of life, including air and water quality and the availability of water.

The Whatcom County Comprehensive Plan, adopted in 1997, includes considerable background information regarding water resources and numerous goals and policies related to water quality and availability. Water Resources information and goals are located primarily within Chapter Eleven—Environment, but are also included in chapters relating to Land Use, Utilities, Resource Lands, Recreation and Economy. (See appendix G-2 of the Comprehensive Water Resource Plan for Comprehensive Plan goals and policies relating to water resources.)

The Comprehensive Plan recognizes that water resources within the County provide natural beauty, recreation, habitat for fish and wildlife, water for drinking, agriculture and industry, and other benefits essential to the quality of life and economic health of the community. The Water Resources section of the plan provides the following background information regarding the water resources in Whatcom County:

Whatcom County has 16 major freshwater lakes, 3,012 miles of rivers and streams, over 37,000 acres of wetlands, 134 miles of marine shorelines, and aquifers containing an undetermined amount of groundwater. These water resources serve multiple uses including providing a source of drinking water for the people of Whatcom County. Surface water sources such as Lake Whatcom and the Nooksack River provide water to about half the county residents with the...
remainder relying on groundwater either from individual wells or from about 250 public water systems. Agriculture relies on both ground and surface water for irrigation, drinking water for livestock, and facility wash down. Businesses and industries may also require water, sometimes in substantial quantities, for non-potable as well as potable supplies. Water is also essential to meet many of what are referred to as "in-stream" uses such as for recreation, shellfish growing and harvesting, habitat for fish and wildlife, aesthetics and other benefits.

Groundwater is contained in aquifers, which are subterranean layers of porous rock or soil. Most aquifers are replenished by rainwater, though some may contain water trapped during glacial periods. Aquifers are often integrally linked with surface water systems and are essential for meeting in-stream water needs such as for drinking water, agriculture and industry.

Rainfall that does not soak into the ground or evaporate is regarded as surface water and runs into drainage courses, streams, wetlands, rivers, lakes and the Strait of Georgia. Natural drainage systems have many important functions, including storing excess water flow, purifying surface water, recharging groundwater, conveying water and supporting important biological activities. As more areas in Whatcom County are being urbanized, natural water resource systems are being replaced with built systems.

The Whatcom County Comprehensive Plan describes surface and groundwater quality problems in many areas of Whatcom County and recognizes the legal limitations in obtaining water, the need for better information about the physical characteristics and availability of the resource, and the importance of coordination between and within jurisdictions regarding water issues. The plan calls for long term resolution of the numerous, complex and changing water issues requires actions in many areas.

Current Status

The County Comprehensive Plan is implemented through the following Whatcom County development regulations:

- Whatcom County Critical Area Ordinance,
- State Environmental Policy Act (SEPA) Regulations,
- Whatcom County Shellfish Protection Districts,
- Manure and Agricultural Nutrient Management regulations,
- Whatcom County Shoreline Management Program,
- Official Whatcom County Zoning Code,
- Whatcom County Subdivision Regulations,
- Whatcom County Development Regulations.

The comprehensive plan also includes "Action Plans" in each Chapter, which are the basis for annual work programs, including code amendments, research projects, interlocal agreements with Cities or Special Districts, public education programs, staffing, and budget decisions. A number of the Comprehensive Plan Action Plan recommendations have been incorporated into other programs described in the Water Comprehensive Plan, including the Lake Whatcom Management, Shellfish Protection, Stormwater, Flood Control, and Coordinated Water System Plan programs.

1999 Accomplishments

- The Lake Whatcom Water Resource Protection Overlay Zone was drafted and adopted to prohibit or restrict certain uses likely to impact water quality, reduce impervious surfaces and require more stringent development standards and review of development in the Lake Whatcom Watershed.
- Amendments were drafted to the County Transferable Development Rights program and Lake Whatcom Watershed was designated as a sending area for Transferable Development Rights.
• Amendments to Title 21 Subdivision regulations were drafted, and will likely be adopted in 2000. These regulations establish water system requirements for new subdivisions, require public water systems in areas of known groundwater contamination, require compliance with critical area regulations and require that critical area notes be recorded with the final plat.

• Agricultural Nutrient Management Ordinance was adopted to reduce water quality impacts of dairy waste application and storage.

• Increased code enforcement activity was possible due to the addition of two code enforcement officers. Enforcement efforts were directed toward agricultural nutrients and the Lake Whatcom Watershed.

• The City of Blaine aquifer recharge area was removed from the City Urban Growth Area and policies were adopted to protect this area from future development.

• The Drayton Harbor Area was designated as a provisional Short Term Planning Area to allow for the development of a sewer program to replace failing septic tanks in the area and was also designated as a Stormwater Special District to require better stormwater planning for new development.

• Permanent zoning was adopted for the Lummi Reservation, reducing density from the interim zoning to a level of development more consistent with available water supply.

• Text amendments were adopted to better define the procedures for approval of water and sewer lines and water storage tanks.

• Draft update of Coordinated Water System Plan was completed. (See previous section for additional detail.)

• Review of Water and Sewer Comprehensive Plans prepared for Cities Districts for consistency with the Whatcom County Comprehensive Plan and Coordinated Water System Plan.

• Interlocal agreements were adopted between the County and the Cities of Bellingham, Lynden, Ferndale and Sumas, including provisions for joint watershed planning and extension of utilities within Urban Growth Areas.

• The Geographic Information System (GIS) was utilized to develop an improved database for water resource planning, fisheries habitat protection and enhancement, and Lake Whatcom management.

Proposed Actions in 2000

• Continued use of the GIS to map and analyze water resource data.

• Consideration of a Water Resource Protection overlay district for Lake Samish, similar to the one developed for Lake Whatcom.

• Public information program to encourage the use of TDRs to reduce density in the Lake Whatcom Watershed.

• Continued work on stormwater standards (see section on stormwater for greater detail)

• Continued work to complete and adopt Coordinated Water System Plan (See detail in CWSP Section.)

• Increased Code Enforcement in the Lake Whatcom Watershed through a temporary code enforcement position funded through the first quarter of 2000.

• Complete Interlocal Agreements between Whatcom County and the Cities of Blaine, Nooksack and Everson to address development, utilities and watershed management issues in the City UGAs and aquifer recharge areas.

• Begin work to update Shoreline Management Program to comply with state requirements, once adopted. First phase will include considerable inventory and mapping of shoreline resources.

2000 Accomplishments

• Formed the Lake Samish Citizen’s Advisory Committee for the purposes of providing recommendations to Planning Commission regarding the proposed inclusion of Lake Samish under the Water Resource Protection Overlay District.
• The Technical Advisory Committee has reviewed the on-site stormwater quality and quantity system requirements of the Water Resource Protection Overlay District and has prepared recommendations to the Whatcom County Planning Commission regarding on-site stormwater facilities.

• Increased planning and code enforcement activity within the Lake Whatcom Watershed became possible due to the addition of a Planner I position that was designed with an emphasis on watershed issues.

• Conducted public information meetings to encourage the use of TDRs to reduce density in the Lake Whatcom Watershed. Information packets and brochures have also been developed and made available to the public.

• Began preliminary review of shoreline data sets required for inventorying and mapping of shoreline resources.

• Amendments to the County Transferable Development Rights program have been drafted to clarify the language regarding transfer densities within the UR zone, TDR banking, incentives, etc.

• The Geographic Information System (GIS) was utilized to develop an improved database for water resource planning, fisheries habitat protection and enhancement, and Lake Whatcom management.

Proposed Actions in 2001

• Lake Samish will likely be considered by the Planning Commission and County Council as a Water Resource Protection Overlay District in 2001.

• Continued use of the GIS to inventory and map shoreline resources. Begin work to update the Shoreline Management Program to comply with state requirements.

• Adoption of on-site stormwater quality and quantity system standards for single family residences, as required under the adopted Water Resource Protection Overlay District for Lake Whatcom and Drayton Harbor.

• Adoption of amendments to the County Transfer of Development Rights (TDR) Program.
• APPENDICES •

Watershed Management Project Structure and Function Document
Caucus Planning Unit Participants
Governmental Planning Unit Participants
WRIA 1 Watershed Management Project Final Scope of Work
WRIA 1 Watershed Management Project Scope of Work For Technical Studies
Interim Salmon Recovery Project Prioritization Document
Portage Bay Shellfish Protection District Progress Report
Portage Bay Shellfish Protection District Advisory Committee List
Lake Whatcom Management Structure
FCZD 2001 Budget Priorities Memo
FCZD 2001 General Budget Priorities Document
2000 Puget Sound Water Quality Management Plan
Process for Committee Recommendation Development
Shoreline Inventory News Article
Whatcom County Marine Resources Shoreline Inventory for Drayton Harbor
Whatcom County Marine Resources Committee Contact List
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WRJA 1 Watershed Management Project
Final Scope of Work
March 27, 2000
# WRJA 1 Watershed Management Project

## Scope of Work

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- B. Grant Application to Ecology
- C. Contract with Ecology
- D. Nooksack Tribe Letter of Participation
- E. Memorandum of Agreement
- F. Planning Unit Procedural Document
- G. Public Involvement and Education Conceptual Plan
- H. Memorandum Regarding Scope of Work Sub-Committee
- I. Administrative Decision-makers and the Staff Team Roles and Operating Procedures

### Figures/Flow Chart d)

### References

1. RCW
2. Contract with Ecology
3. MOA

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1 The following documents are referenced throughout this draft by their associated number. The purpose is to illustrate the relationship between the scope of work and regulatory/other requirements and agreements.
50  5.  PU/IG direction
51  6.  Presentation from Thomas Hardy
52  7.  Existing draft SOW
53  8.  Public Involvement and Education Conceptual Plan
54  9.  Statewide Strategy to Recover Salmon: Extinction is not an Option
Executive Summary

Residents of Whatcom County are faced with an increasing number of challenges related to water resources, despite what at times appears to be a seemingly abundant resource. These challenges include limited water supplies to meet current and future needs, water quality degradation, and the listing of Chinook salmon and bull trout as “threatened” under the Endangered Species Act (ESA). Left unresolved, these issues will have a broad and far-reaching affect on the economic and environmental health of the community.

In 1998 the State legislature passed Engrossed Substitute House Bill 2514, codified as RCW 90.82, known as the Watershed Management Act. This Act included a grant-funding element requiring completion of a Watershed Management Plan within four years of receipt of grant funding. The Act provides a framework to better understand the nature and extent of water resource management issues and to locally plan and implement solutions to identified problems.

Participation in the process is voluntary. In May 1998, Whatcom County, the City of Bellingham, and the Public Utility District No. 1 of Whatcom County decided to engage in the process with the County acting as lead agency. Pursuant to RCW 90.82, these three local governments invited the Lummi Nation and the Nooksack Tribe to join the process. The Nooksack Tribe described their involvement in the project through a July 1998 letter. After a Memorandum of Agreement (MOA) was signed by the three local governments and the Lummi Nation in October 1998, both of the tribal governments had joined the process. The MOA further defines the project objectives, participants, and the decision-making process. Since May 1998, funding (grant and other) has been obtained, resources have been allocated, and actions are underway based on requirements of the law, subsequently signed contracts and agreements, and input from the local community. Together, the five Governments initiated public involvement, water quantity, and instream flow work tasks, in parallel with the Planning Unit formation work task. In May 1999 Planning Unit Caucuses were formed. In June 1999 the first Planning Unit meeting was held.

The issues that will be addressed by the WRIA 1 Watershed Management Project include water quantity, water quality, instream flows, and habitat. Project assessments and decision-making will utilize best available science (3).

The purpose of this scope of work is to outline the general process, strategy, and actions necessary to effectively manage water resources in WRIA 1. This scope of work includes actions taken to date. It provides the framework from which more detailed work plans will be developed and approved by appropriate entities. These work plans will include goals/objectives, specific tasks, budgets, who will implement, work products, and schedules. Where appropriate, work plans will include design parameters such as time step, probable error, and expected contribution to satisfying informational needs. The standard established in the MOA is “best available science,” defined as objective and repeatable analysis based on adequate empirical data collected with appropriate quality assurance/quality control procedures in place.

In many cases, specific work plans will be developed and implemented under the guidance of Technical Teams. Technical Teams will generally be composed of representatives from the Initiating Governments and the Planning Unit or their designees, and other technical experts. The Technical Teams will report to and receive direction from the Initiating Governments and Planning Unit.

Community members, private consultants, and/or local, state, tribal, federal government agencies may be recommended by the Technical Teams to assist in developing and implementing work plans.

The approach taken with this scope of work reflects the requirements of the Watershed Management Act, adopted agreements and contracts, recommendations from program participant (Initiating...
Governments and Planning Unit), and the Guide to Watershed Planning and Management. This scope of work is designed to guide the development of a Watershed Management Plan for WRIA 1. The Plan may include elements deemed desirable by local planning participants that exceed the minimum requirements of the Act. This scope of work is a working document that may need to be refined as work progresses and more information is collected.

1.0 Initiation

1.1 Background

Beginning in 1998 and continuing over the next few years, decisions will be made and plans developed and implemented regarding the water resources of the Nooksack River watershed and certain adjacent streams (Water Resources Inventory Area 1 or WRIA 1). These decisions and plans will coordinate with the land use/resource management planning under the Growth Management Act, the Shorelines Management Act, and other similar Acts, along with planning/projects in response to the Endangered Species Act (ESA) listing for Chinook salmon and bull trout, and will largely determine the landscape, the environmental health, and the economic future of Whatcom County residents. Agencies of federal, tribal, state, and local governments are authorized to make these decisions. The state legislature, with agreements from federal agencies, provided an opportunity for watershed management decisions to be made locally.

In 1998 the State legislature passed Engrossed Substitute House Bill 2514, codified as RCW 90.82, known as the Watershed Management Act. The Act provides a framework to better understand the nature and extent of water resources issues and to locally plan and implement a variety of solutions to address those issues. More specifically, the Act requires the development and implementation of a Watershed Management Plan that:

- Balances the competing resource demands in the watershed;
- Provides for the economic well-being of the citizenry and community;
- Protects existing water rights;
- Is consistent with current law;
- Does not conflict with existing state statutes, federal laws including Endangered Species Act (ESA) recovery actions, tribal laws, and tribal treaty rights; and
- Provides local citizens with the maximum possible input concerning their goals and objectives for water resource management and development.

Participation in the process is voluntary. In May 1998, Whatcom County, the City of Bellingham, and the Public Utility District No. 1 of Whatcom County decided to engage in the process with the County acting as lead agency. Pursuant to RCW 90.82, these three local governments invited the Lummi Nation and the Nooksack Tribe to join the process. The Nooksack Tribe described their involvement in the project through a July 1998 letter. After a MOA was signed by the three local governments and the Lummi Nation in October 1998, both of the tribal governments had joined the process. The MOA further defines the project objectives, participants, and the decision-making process. Since May 1998, funding (grant and other) has been obtained, resources have been allocated, and actions are underway based on requirements of the law, subsequently signed contracts and agreements, and input from the local community. Together, the five Governments initiated public involvement, water quantity, and instream flow work tasks, in parallel with the Planning Unit formation work task. In May 1999 Planning Unit Caucuses were formed. In June 1999 the first Planning Unit meeting was held.

The decision to engage in the Watershed Management Process was made because of the increasing number of water problems the community is facing. Competing demands for the finite water resources in WRIA 1 pose a host of interconnected, serious challenges that threaten to have a variety
of negative impacts to our environment and our economy. While these challenges have been
recognized for years, the need to address them has now become imperative.

The demands for water include the needs of fish for sufficient water in streams (known as instream
flow) to enable migration and propagation. Since some local fish populations have been listed under
the federal Endangered Species Act, we must find a means to ensure that there is sufficient water
available for fish, or face federal sanctions. In addition, tribal treaty rights include the right to harvest
fish at all usual and accustomed grounds and stations throughout WRIA 1. Meanwhile, a growing
human population means growing demands for water for farming, homes, businesses, and industries --
demands that are largely going unmet, which in turn is limiting economic development.

The quality of our water is also a problem. Human activities affect both surface and ground water
quality and have lowered water quality below that necessary for people and for fish in some areas.

The immediate challenge is to collect or generate sufficient information upon which to base rational
water resource management decisions. We need to know how much water naturally occurs throughout
the year, how much water is represented by both state and federal (including tribes) water rights and
claims, how much water is already allocated, or how much additional water, if any, is available for
other uses. In addition, the extent to which ground and surface are interconnected varies throughout
the watershed and represents both a water resource management challenge and opportunity.

Because all elements of the watershed management project -- quantity, quality, habitat, and instream
flow -- are physically, chemically, and biologically interconnected throughout WRIA 1, any successful
management plan needs to address all of these components.

Because water resource issues and policies are both complex and contentious, a collaborative decision
making model appears to hold the greatest promise for developing a water resource management plan
that will be successful over time. This collaborative effort will be conducted in a manner that does not
violate the government-to-government principles of the Indian Nation and Indian Tribe in WRIA 1.

In March 1999, a preliminary draft scope of work was developed by the Initiating Governments. This
initial draft identified a number of actions required by law that could be acted on while obtaining
further input from the general public, Planning Unit, and others. The initial draft was presented to the
public and Planning Unit when they began meeting in June. The Planning Unit recommended a
number of modifications of the initial draft. This revised draft is much less detailed than the initial
scope of work and is intended to provide a broader framework for the WRIA 1 Watershed
Management Project. This revised scope of work incorporates those recommendations, adopted
agreements and contracts, requirements of the Watershed Planning Act, and suggestions from the
"Guide to Watershed Planning and Management." These documents are referenced throughout this
draft and listed by a number as reference documents in the Table of Contents.

1.2 Scope of the Watershed Planning Project

1.2.1 Geographic

The geographic scope of project is Water Resource Inventory Area 1 (figure to be added) and certain
parts of Canada that drain to WRIA 1. This area includes the drainage area of the Nooksack River and
its tributaries, including portions of Skagit County which are drained by the South Fork of the
Nooksack River. The area also includes the U.S. portions of the Abbotsford-Sumas Aquifer and the
Sumas River drainage that extend into British Columbia. In addition, the study area includes several
coastal drainages that drain water into marine waters along the coastline of Whatcom County. The
study area includes the Lake Whatcom drainage.
1.2.2 Issues
The scope of issues to be addressed under the Act must include water quantity, but may also include
water quality, instream flows, and habitat. The Initiating Governments have chosen to address all four
issues/components in the WRIA 1 Watershed Management Project as they are inseparable. If, during
the course of their work, technical teams encounter new information which in their opinion, warrants a
modification of the Scope of Work to ensure their new information is adequately addressed, the
technical team shall propose an amendment to the Scope of Work for approval by the Planning Unit
and the Initiating Governments.

1.2.3 Time Frame
Under the Watershed Planning Act, a proposed plan that has been approved by the Planning Unit must
be submitted to the County within four years of the date that the Planning Unit first received funding.
For WRIA 1, the Watershed Plan must be submitted by June 30, 2002. Implementation, monitoring,
and evaluation of the Plan will continue indefinitely into the future.

1.2.4 Affected Parties
It is understood that all federal, tribal, state, and local governments with jurisdiction, as well as all
types of private water resource interests and their customers, clients, and members within WRIA 1 and
hydrologically connected areas are affected parties. It has been determined, however, that it is in the
best interest of all affected parties that the membership of the WRIA 1 Planning Unit, as defined by
the Act, shall consist of the Initiating Governments (Whatcom County, City of Bellingham, PUD 1,
Lummi Nation, and Nooksack Tribe), other governments (state agencies, federal agencies, small cities,
diking/drainage districts, and water districts), and Water Resource Interests caucuses (fishers,
agriculture, non-municipal water systems, forestry, environmental, land development, and private well
owners). It is extremely important that early on, and throughout this process, there is a clear
understanding of the extent to which the issues and interests of the governments and water resource
interests are addressed. Although the scope of work and goals/purposes have been written in a manner
that attempts to recognize those needs, each government and water interest will be responsible for
ensuring that as the Project progresses its interests are being addressed.

1.3 Implementation Strategy for Scope of Work
The purpose of this scope of work is to outline the general process, strategy, and actions necessary to
address water resource issues in WRIA 1, including the actions taken to date. It provides the
framework from which more detailed work plans will be developed and implemented. These work
plans will include goals/objectives, specific tasks, budgets, who will implement, work products, and
schedules. Specific tasks should be clearly linked to the requirements specified in the RCW, MOAs,
contracts, or other agreed upon documents (5). A distinction should be made if proposed actions
exceed the minimum requirements (5). Where appropriate, work plans will include design parameters
such as time step, probable error, and expected contribution to satisfying specific information needs
(5). Some of this may not be known until the work plans are implemented. The standard established in
the MOA is “best available science,” defined as objective and repeatable analysis based on adequate
empirical data collected with appropriate quality assurance/quality control procedures in place.

In many cases, Technical Teams will facilitate the development and implementation of specific work
plans. Technical Teams will generally be composed of representatives from the Initiating
Governments and Planning Unit or their designees, and other technical experts. Formation of the
Technical Teams must be approved by the PU and IGS. Representation on the Teams is determined by
each caucus/interest. The Technical Teams will report to and receive direction from the Initiating
Governments and Planning Unit. The Technical Teams may choose to develop and implement specific
work plans themselves or they may recommend that community members, private consultants and/or
government agencies assist. Once work plans are approved, consistent with the March 1999
"Administrative Decision-Makers and the Staff Team Roles and Operating Procedures," updates will be provided to both groups and the Planning Unit on a regular basis.

In some cases, actions and strategies may be developed without the use of Technical Teams. In those situations, a similar review process will be followed with review and input provided by both the Initiating Governments and the Planning Unit.

1.4 Planning Unit

Under the Watershed Planning Act, the Initiating Governments are charged with, among other things, defining the composition of the Planning Unit. In March 1999, the Planning Unit composition was defined in the administratively adopted "Structure and Function" document. Since that time the Planning Unit has formed with water resource interests and other participants identified.

Implementation Strategy/Status

The Planning Unit has been meeting on a regular basis since June 1999. Through these meetings and other discussions it has become apparent that clarity is needed regarding the role of the Planning Unit. More specifically, the Structure and Function document contains a organization diagram that describes the composition and roles/functions of the various players in the process. These descriptions have generated some confusion regarding the role of the Planning Unit. Clarification to the organization diagrams needed to reflect the combined understanding of the Initiating Governments and Planning Unit.

The Initiating Governments are developing a new organization diagram that will clarify the role of the Planning Unit. The organization diagram will be brought to the Planning Unit for input after the revised version is completed.

2.0 Organization of the Watershed Planning Project (Phase 1)

The organizational phase outlines the general information and actions needed to support the technical assessment, solutions evaluation, plan development, and implementation strategy.

2.1 Goal/ Purpose of the Watershed Management Project

The goals/purposes of the WRIA 1 Watershed Management Project are defined by the RCW and other legal agreements such as the intergovernmental MOA signed in October 1998. In addition, the local interests and needs of the public participating in the project have also shaped the project goals. As the project evolves and new information is obtained, these interests/needs may be modified. A summary of the public interests is provided in Appendix G.

2.1.1 General Purpose/Goals of the Watershed Management Project

In general, the goal of the WRIA 1 Watershed Management Project is to have water of sufficient quantity and quality to meet the needs of current and future human generations, including the restoration of salmon, steelhead, and trout populations to healthy and harvestable levels and the improvement of habitats on which fish rely (9).

2.1.2 Goals of the Watershed Management Project Components

2 The WRIA 1 Planning Unit interprets that char and shellfish are also included in this goal, that improvement to habitat will focus on degraded habitats, and the term "fish" refers back to the groups listed earlier. This language is meant to be consistent with the goals and mandates of the 2496 process and the objectives of the salmon co-managers. Salmon co-management is defined in The Puget Sound Salmon Management Plan, implemented under a 1985 Court order under U.S. v. Washington 384 F. Supp. 312 (W.D. Wash. 1974). The co-managers of the fisheries resources are defined as the State of Washington, Western Washington Treaty Tribes, and the federal government. For WRIA 1, the salmon co-managers are the Washington Department of Fish and Wildlife, Nooksack Tribe, and Lummi Nation.
More specifically, the Project will address the following specific goals/purposes for each of the four components identified in the Watershed Management Act and the intergovernmental MOA:

- **Water Quantity**: The goal of the water quantity component is to assess water supply and use and to develop strategies to meet current and future needs (1). The strategies should retain or provide adequate amounts of water to protect and restore fish habitat (9), provide water for future out-of-stream uses and to ensure that adequate water supplies are available for agriculture, energy production, and population and economic growth under the requirements of the state’s growth management act (1).
- **Water Quality**: The goal of the water quality component is to ensure that the quality of our water is sufficient for current and future uses, including restoring and protecting water quality to meet the needs of salmon and shellfish (9), contact recreational uses, cultural uses, protection of wildlife, providing affordable, safe domestic water supplies, and other beneficial uses. The initial objectives of the water quality management strategy will be to meet the water quality standards (3).
- **Instream Flow**: The goal of the instream flow component is to supply water in sufficient quantities to restore salmon, steelhead, and trout populations to healthy and harvestable levels and improve habitats on which fish rely (9).
- **Fish Habitat**: The goal of the fish habitat component is to protect or enhance fish habitat in the management area (1) and to restore salmon, steelhead, and trout populations to healthy and harvestable levels and improve habitats on which fish rely (9).

The approach used in this project will explicitly recognize that the four project components are interconnected to a high degree. Actions intended to affect change in one component may affect one or more of the components. The approach will capitalize on the interrelationships between the four identified project components by systematically integrating the data collection and analysis efforts. The effort will be coordinated with other resource management efforts such as land use/resource planning, flood management, Salmon Recovery Project (NEAT/2496), and a myriad of other similar efforts.

### 2.2 Criteria for Evaluating Proposed Solutions

In order to achieve the above goals, the WRIA 1 Watershed Management Project will initially develop a watershed management plan that identifies specific actions to address the water resource problems identified. It is anticipated that during the plan development, specific alternatives and recommendations will be considered. Specific criteria will be developed to assist in selecting the best alternatives. The following criteria are provided by the Guidance Manual and should be considered when establishing the criteria:

**Effectiveness Criteria**
- **Overall Effectiveness** – Among the alternatives considered, which do the best job of addressing the issue at hand?
- **Cost Effectiveness** – Which alternatives deliver “the most bang for the buck”, even if they do not completely address the issues of interest?
- **Flexibility Over Time** – Which solutions offer the ability to be readily modified over time, in response to changing conditions and new information?
- **Potential Side Effects** – Do some of the potential solutions appear to create new problems, or exacerbate existing problems?
- **Equity Considerations** – What are the differing effects on various groups and economic activities in the Management Area?
Feasibility Criteria

- Legal Authority – Do the implementing organizations have the authority to implement the proposed solution? If not, can ordinances or rules be adopted to provide that authority?
- Approvals/permits – What approvals or permits will be required, especially by organizations not represented on the Planning Unit. Are those approvals or permits likely to be granted?
- Cost and Funding Sources – How expensive is each alternative, and who will bear the cost? Will funding sources be available, both in the short-term and long-term?
- Administration and Staffing – What organization will administer each solution? Do they have the capabilities to do the job? Will additional staff be required?
- Integration with Related Programs – How will each solution fit in with related programs and plans?
- Acceptability – Are solutions acceptable to participants, elected officials, and key outside organizations (e.g., NMFS)?

Implementation Strategy/Status

A Technical Team will be established to help develop specific criteria.

2.3 Sub-basin Delineation and Prioritization

The Watershed Management Act requires that watershed planning be conducted for management areas consisting of one or more WRias. This does not require, however, that equal resources or focus be devoted to all areas within the management area. Within each WRIA, there may be sub-basins that have differing priorities for technical assistance and management actions (7).

The entire WRIA is being evaluated in the WRIA 1 Watershed Management Project. Consistent with basic principals of effective watershed management, sub-basins are being delineated within the WRIA. The sub-basins will serve as geographic areas to gather and analyze information, solutions, and management actions. Prioritization of work by sub-basins will be considered as the planning process progresses and more information is obtained.

Many different sub-basin delineations have been completed previously by different organizations and planning efforts in WRIA 1. The USGS is developing a sub-basin map of WRIA 1 as part of their Phase I contract. The USGS delineations will be the foundation for defining appropriate sub-basins. The delineations will allow for changes and flexibility in designations as field verifications are completed and management implications are considered.

Implementation Strategy/Status

A Technical Team has been established to support the sub-basin delineation effort. The Team has developed a detailed work plan with products and a schedule. It is anticipated that a preliminary map will be available by the end of April 2000.

2.4 Linkage/Coordination with Existing and Potential Programs

A critical and required element of the watershed planning effort is to effectively use limited resources. To preclude a “reinvention of the wheel” and to avoid potential conflicts, the project participants will review, build upon, and coordinate with historic and current data, regulations, and programs (1,2). Tracking and providing input to potential new local, state, tribal, or federal regulations and programs that could affect the planning effort will also occur.

Historic, current, and potential new data, regulations, and programs should be considered in order to (7):

- Coordinate data collection efforts – data collection is occurring through many different programs.
  The quality (accuracy) of these data need to be evaluated and this information should be used
wherever possible prior to collecting additional data. When additional data are collected, efforts
should be made to ensure that all parties needing the data are involved in the design of the data
collection efforts and in ensuring that the quality is acceptable for all anticipated uses.
- Understand potential constraints on management options that may exist due to local, state, tribal,
and federal requirements. The watershed plan developed under the Watershed Management Act
does not supersede other federal, tribal, state, or local requirements. However, a well-done
watershed plan can provide a framework for federal, tribal, state, or local agencies to modify
existing or pending actions.
- Coordinate potential funding. In some cases one or more programs may need the same
information that is needed for the watershed planning effort. Costs may be significantly reduced
by adequate coordination with other programs.
- Consider appropriate implementation tools. In some cases, solutions may be best achieved by
modifications to existing programs.
- Determine how to handle proposed new actions that could affect the watershed plan. During the
course of the watershed planning effort new local, state, tribal, or federal actions may be proposed.
a strategy for ensuring that these potential new actions are coordinated with the WRIA 1
Watershed Management Project.

Some examples of the many programs and activities that need to be considered in developing a
coordination strategy include: County-wide Planning Policies; Comprehensive Plans; Coordinated
Water System Plans; Drinking Water Source Protection Plans; Shoreline Programs; Shellfish
Protection Plans; Storm Water Programs; Ground Water Management; education and technical
assistance programs; Salmon Recovery Plans; Instream Flow regulations; Critical Area regulations,
and Flood Hazard Management Strategies.

Implementation Strategy/Status

Initial efforts were taken in 1999 to develop a strategy to ensure coordination and linkage
between programs and actions. These efforts were placed on hold for several months for a
number of reasons including pending revisions to the initial draft scope of work and the
Whatcom Creek fire. Recently, a group has been meeting to discuss how to best coordinate
these efforts. The group is not an official Technical Team under the Watershed Management
Project however, their work may be used to help develop a strategy to ensure adequate
linkage and coordination.

2.5 Information/ Data Management Program

An important part of the Watershed Management Project is to establish a program to assist in the
collection, storage, maintenance, retrieval, analysis, distribution, and display (e.g., maps and charts) of
the information obtained. A Geographic Information System (GIS) will be a fundamental tool for
organizing and displaying collected data. Additional elements that will be considered in developing
the data management program include:

- Hardware requirements and availability as in-kind contributions (4)
- Software requirements (4)
- Staffing needs and availability as in-kind contributions (4)
- Techniques for providing remote access via Internet or other means (4)
- Quality Assurance/Quality Control
- Glossary (5)
- Coordination as appropriate with other data bases
- Consistency with Ecology requirements as noted in contract (2)

Implementation Strategy/Status
A Data and Information Management Technical Team will be formed to develop a comprehensive strategy to deal with the considerable data that will be compiled, generated, and analyzed in the Watershed Management Project and similar efforts. It will likely be necessary that a designated data management staff person be assigned for this project.

2.6 Public Education/Involvement Program

One of the purposes of the Watershed Management Act is to provide local citizens with the opportunity for maximum possible input concerning their goals and objectives for water resource management and development. (1) In order to achieve this purpose it is necessary to provide a mechanism for citizens to understand the process, translate technical documents into layperson terms, help citizens to understand the complex technical and policy issues that will be addressed through the planning effort, and provide opportunities for meaningful and substantive input. One of those opportunities is through participation on the Planning Unit, but others are needed as well.

In recognition of the critical importance of public involvement and education in the process, the Initiating Governments early in the process endorsed a conceptual plan for public involvement and education (8). The adopted goal of the plan was to:

- Provide numerous opportunities for constructive public participation in the Watershed Management Project;
- Assist and support the public involvement process under NEPA and SEPA;
- Build incremental understanding of issues and throughout each of the phases of the planning process and, through this understanding, foster widespread community understanding of the final watershed management plan.

**Implementation Strategy/Status**

A technical team was formed during the summer of 1999 to help develop and implement actions related to public involvement and education. The team is developing a long-range plan to meet the goals noted above, however many education/information related actions have been needed in the interim. Some of the interim methods that have been and are being used to meet these goals include:

- **Establishing and maintaining a Website for the project**
- **Setting up a telephone hotline**
- **Providing support for caucus formation and function**
- **Providing facilitation for the Planning Unit and consistent interaction/communication with the caucuses**
- **Hiring a staff person to provide lead support to the Public Involvement and Education program**
- **Providing monthly public forums (these were placed on hold due to low attendance)**
- **Inviting the public to suggest participants for a 3-day Instream Flow Methods conference, attending the 3-day conference, and providing for public comment on the draft report.**
- **Developing a resource kit on instream flows for the media and general public, holding open houses**
- **Establishing a long-term education plan which includes a needs assessment of the major anticipated audiences (caucuses, general public, decision makers, etc), articulation of educational goals, the development and implementation of audience appropriate educational methods and products, and the use of evaluative tools to measure achievement of the stated educational goals. The long-range plan will also identify other elements of the scope of work where public input is needed, as well as opportunities for general public outreach.**

2.7 Process Flow Control Protocol
The WRIA 1 watershed planning process, and the implementation of the action elements thereof, shall be executed in a specific sequence of steps that have been established in order to maximize the chances of the plan’s success. The sequence embodies and employs the principles of adaptive management. The sequence shall apply to each plan section for each sub-basin and each plan component.

2.7.1 Planning Process Flow Control Protocol

The planning process shall consist of the execution of each task within each section in this Scope of Work, in a sequence to be determined by the decision making logic set forth below. The planning process applies to each plan component (water quantity, water quality, instream flow, and fish habitat) within each sub-basin.

From time to time the planning process will likely be carried on simultaneously within more than one section. The process flow control protocol shall apply independently to each activity within each section; provided, however, that prior to the completion of Section 4.2, Select Best Solutions, all tasks in all prior sections shall be completed.

The planning sequence shall follow the decision making logic below. It is also depicted in the WRIA 1 Watershed Planning Process Flow Sequence diagram (Figure 2).

Update the status of the planning process and collect any relevant new information (upper left box in Figure 2). New information could arise from any or all of the following sources: changes in statutes, contracts, agreements, court cases, initiatives and referenda; new developments in related projects public input; new discoveries from relevant science and engineering fields, including new modeling and simulation methodologies.

If any tasks within the pending section remain incomplete, or need to be updated based upon new information, then the pending section shall be addressed. After completing a section, return to the update (upper left box in Figure 2) process. If it is determined that there is no need to address the pending section, then the same decision making process shall be undertaken for each subsequent section, until Section 5.0, Approval, is reached.

If approval (upper right triangle in Figure 2) is achieved, implementation can begin. If approval is not achieved, return to the update process (upper left box in Figure 2).

2.7.2 Management/Implementation Process Flow Control Protocol

Provisions for adaptive management within the implementation phase (upper right shaded box of Figure 2) are discussed below. Adaptive management provisions are also depicted in the WRIA 1 Watershed Management Process Flow Sequence diagram (Figure 3).

During the implementation phase, for each project within each plan component, the implementing action shall be carried out, meanwhile data will be collected via established monitoring protocols to enable evaluation of the success of the project. The collected data will be analyzed by comparing actual results with expected results for the point in time at which the data are analyzed (middle diamond — “Objectives Achieved” — from Figure 3).

If the comparison is favorable, the project (and data collection) will continue without modification. If the project is failing to achieve its objectives, the question needs to be answered, is the project being done properly, that is, according to the specifications provided in the plan?

If the answer is no, then corrective action shall be taken by the implementing party(ies) to bring actions on the ground in line with project specifications. If the answer is yes, it implies that the project
specifications themselves, hence the plan element, has a flaw that shall be corrected by returning to the planning process and amending the plan, based upon the results of the data analysis. The party(ies) responsible for reviewing and amending the plan shall be specified by the plan prior to its completion.

2.7.3 Process Flow Protocols

The intent of these Process Flow Control Protocols and their accompanying diagrams is to portray only general process flow. Specific, detailed process flow control protocols will be established, when and if needed, for particular sections or sub-sections of the planning and/or implementation process.

2.7.4 Implementation Strategy/Status Files

In order to provide a clear and easily accessible record of the progress of each planning activity within each section of this Scope of Work, project managers shall create and maintain files in a suitable and uniform electronic format that describe the current implementation status of each such activity.

2.7.4.1 Content

The content of each such status file shall contain at least the following:

- File title: general format: sub-basin xyz water quality planning status.
- Project personnel: list manager, other staff, roles; provide hot links to data such as: by whom employed; contact data.
- Sub-basin Name, Number (as/if applicable).
- Component: (water quantity, water quality, instream flow, fish habitat).
- Sub-component: (as/if applicable; example: water rights study).
- Sub-sub-component: (as/if applicable; example: paper rights investigation).
- Current Status: For each SOW section, sub-section, sub-sub-section, as applicable, display section, sub-section, sub-sub-section number(s) and title(s), pass number (i.e., number of times subject activity has undertaken that Section, sub-section, sub-sub-section); title of activity; product(s) file(s) title, type, hot links to locations (if applicable and appropriate) and contents summary.

2.7.4.2 File Types

There shall be two such file types: Current Files, as described in Section 2.7.4.1, and Archive Files, which shall consist of the accumulation of previous Current Status Files, structured as a Last-in, First Out stack.

2.7.4.3 Implementation Strategy/Status Files Procedure

- Each project manager of each planning activity shall update each activity's Current File at least each time one of the sections of this Scope of Work is completed for that activity, and may update the file more often as warranted.
- Each time a project manager updates a Current File, authorized personnel shall update the associated Archive File.
- In order to provide public access to the implementation status of each planning activity, both the Current and Archive Files will be made accessible on the WRIA 1 Watershed Management Project web site.

3.0 Technical Assessment/Analysis of Water Quantity, Quality, Instream Flows, and Fish Habitat (Phase 2)

3.1 Problem Definition/Analysis

3.1.1 Purpose

The purpose of the technical assessment phase is to gather, analyze, and evaluate data to clearly understand the nature, conditions, and extent of problems and/or desired outcomes for each project component.
3.1.2 General Approach

The assessment results will be the foundation for knowledge-based decision-making that will be used to develop the most effective solutions that meet the project goals and address the bulleted items in Section 1.1. Data will be collected that are necessary to enable an assessment of current conditions and an understanding of the causal factors underlying these conditions. The collected data and analysis will enable direct action to manage those factors to achieve desired outcomes.

3.1.2.1 Data Validity and Reliability

Following the definition of "best available science" (3), in order to ensure that the results of the data collection, analysis and modeling processes are of maximum utility to this planning process, for each set of data collected, each analysis performed, and any modeling undertaken, parameters shall be specified for measurement of validity and reliability. Validity measures include acceptable level of probable error and expected percentage contribution to total result.

In order to ensure that the results of data collection, analysis and modeling are reliable (i.e., repeatable over time), the types of data collected and the methodologies used for analysis and modeling shall be functionally consistent and well documented.

3.1.3 Tools and Methods

The best available science, including state-of-the-art analytical methodologies, will be employed in the WRIA 1 Watershed Management Project (3). Mathematical models and computer simulations will likely play a key role in the assessment and evaluation of information.

3.1.4 Data Collection

3.1.4.1 Existing Data

Information gathering for each of the program components will be an iterative process starting with the collection and assessment of what is already known through existing studies, programs, and input from individuals and groups.

3.1.4.2 Field Research

As data gaps and new information needs are identified they will be collected, assessed, and evaluated. Data gathering will extend over a number of years and will continue beyond the adoption of the Watershed Management Plan.

3.1.4.3 Routine Monitoring

Long-term routine monitoring and analysis will be needed to evaluate project success and ensure that goals are met (4).

3.1.4.4 Catalog of Project Actions

All watershed projects, including those underway prior to the adoption of the WRIA 1 Watershed Management Plan, will be cataloged and incorporated into the WRIA 1 watershed management database.

3.1.4.5 Water Quantity

At a minimum the following information and analyses will be collected and evaluated for water quantity:

- Estimate the amount of surface and groundwater present (1);
- Estimate the amount of surface and groundwater actually being used in the WRIA (1);
- Conduct a depletion analysis to accurately estimate the spatial and temporal uses of water in the WRIA throughout the year (2,3);
• Estimate the amount of water represented by claims in the water rights claims registry, water use permits, certificated rights, existing minimum instream flow rules, federally reserved rights, and any other rights to water (1); Use the best available science to make reliable estimates of the Lummi Nation water rights for both instream and out-of-stream uses (2,3);

• Identify the most senior instream and out-of-stream water rights in the WRIA and the next most senior rights in turn based on the priority date of existing water right holders (3);

• Estimate future water needs (1);

• Estimate the amount of surface and ground water available taking into consideration seasonal and other variations (1,2,3);

• Estimate the amount of surface and ground water available [to junior users and (3)] for further appropriation taking into account seasonal and other variations (1,2,3) and the minimum instream flows adopted by rule or to be adopted by rule under the RCW for streams in the management area including the data necessary to evaluate necessary flows for fish (1,2,3);

• Estimate the total amount of water available in an undepleted condition (3);

• Identify location of areas where aquifers are known to recharge surface bodies of water and areas known to provide for the recharge of aquifers from the surface (1);

• Contract with USGS to collect streamflow data throughout the watershed for the multi-year [10 year (3)] effort (2);

• Measure and/or estimate climate data (precipitation, evapotranspiration) at representative locations in the WRIA (2,3);

• Evaluate existing land use/land cover data for its suitability in making water resource related decisions (2,3).

Implementation Strategy/Status

The following actions have been taken to date to implement part of the initial data needs assessment for the water quantity component:

• The United States Geological Survey was hired to conduct a “Phase I Data Assessment” in the summer of 1999. Their draft report was delivered on January 31, 2000. Among other information, the report provides information on evapotranspiration, precipitation, hydrogeologic information, streamflow discharge measurements, soil survey reports/data, current and historical land use and cover, facilities with NPDES permits, irrigation water use, current and historical water use, and a sub-basin delineation.

• An evaluation of existing state water rights, claims, applications, certificates, and permits has been initiated under the supervision of the Public Utility District. Two full-time staff have been hired to assist. As noted in Section 3.3, sub-basin delineations are being critically evaluated and defined as part of that process.

• Streamflow measurements are being collected under an interagency agreement between the BIA, USGS, the Lummi Nation, and the Nooksack Tribe. Staff support from the Initiating Governments is also being provided for the actual data collection.

• Aerial and bathymetric studies of Lake Whatcom are being completed through an agreement with the Bureau of Reclamation.

Using the above information, a Water Quantity Technical Team should be formed and charged with developing a detailed work plan to meet the component goal and address the informational needs specified previously. The strategy should include an initial compilation and assessment of existing data (much of which has been done). The Team should start with the approach detailed in the previous draft scope of work and the comments/concerns submitted by the Non-municipal Water System Caucus (including definitions/interpretations of key terms, and specific recommendations, interpretations, questions, etc.).
Water quality will be assessed in two sections, surface and ground water (5), where appropriate. Information collected and analyzed must include:

- Legally established/designated characteristic uses of each of the nonmarine water bodies in the management area (1);
- An examination based on existing studies of the degree to which legally established water quality standards are being met (1);
- An examination based on existing studies of the causes of water quality exceedences, including an examination of information regarding pollutants, point and nonpoint sources of pollution, and pollution-carrying capacities of water bodies in the management area. The analysis should take into account seasonal stream flow or level variations, natural events, and pollution from natural sources that occurs independent of human activities (1);
- An examination of any total maximum daily load established for nonmarine bodies of water in the management area, unless a total maximum daily load process has begun in the management area as of the date the watershed planning process is initiated under RCW.82.060 (1);
- Conduct the necessary data collection and analysis to estimate TMDLs for fecal coliform (in progress), temperature, [BOD (3)], sediment, and other water quality attributes of concern in order to ensure water quality standards are being achieved (2); and
- An examination of existing data related to the impact of fresh water on marine water quality (1).

**Implementation Strategy/Status**

*Using the above information a Water Quality Technical Team should be formed and charged with developing a detailed work plan to meet the component goal and address the informational needs specified previously. The strategy should include an initial compilation and assessment of existing data. The Team should start with the approach detailed in the previous draft scope of work and the comments/concerns submitted by the Non-municipal Water System Caucus (including definitions/interpretations of key terms, and specific recommendations, interpretations, questions, etc.).*

3.1.4.7 Instream Flows

Instream flows were established for WRIA 1 by the Department of Ecology in 1986. Over the years many questions have been raised as to whether the methods used to establish those flows adequately do so – particularly in light of advances in science over subsequent years. The Watershed Management Act provides an opportunity for modifications to established instream flows if agreed to by the parties specified in the act.

TheInitiating Governments agreed that instream flow needs will be examined as part of the WRIA 1 Watershed Management Project. The MOA further states that an analysis will be conducted to estimate optimal instream flows for fisheries resources in the WRIA throughout the year (3). Consistent with the agreement to base decisions on best available science, the purpose of the analysis is to evaluate the method used to establish current instream flows relative to advances in methodology.

**Implementation Strategy/Status**

*The analysis is currently evaluating the various approaches to estimating streamflow levels needed to optimize fish habitat quality and quantity. The recommended "state-of-the-art" method(s) will be used during 2000-2001 in order to provide the information needed to develop a watershed management plan by June 30, 2002. In order to modify existing flows, a unanimous vote by parties specified in the Act will be required – if a unanimous vote is not achieved, flows will not be modified as part of this process (1).*
A 3-day Instream Flow Methods conference was held in September 1999. The purpose of the conference was to evaluate the different methods available for estimating the relationship between streamflow and fish, and to help determine the best methods to use to reevaluate existing instream flows. A draft report was written by the conference chairperson (Dr. Thomas Hardy) and has been presented to the public and Planning Unit for review.

A Technical Team will be established to develop a recommendation for how to proceed with respect to instream flows.

3.1.4.8 Fish Habitat
Coordinate with salmon recovery efforts to 1) develop information that summarizes current and historic fish habitat and populations 2) evaluates physical, biological, and chemical processes in terms of good habitat, and 3) evaluates factors limiting current finfish and shellfish populations throughout WRIA 1.

Implementation Strategy/Status
Initial efforts occurred in 1999 to develop a strategy to ensure coordination and linkage between WRIA 1 Watershed Management Project and salmon recovery as well as other related programs. These efforts were placed on hold for several months for a number of reasons including pending revisions to the initial draft scope of work and the Whatcom Creek fire. Recently, a group has been meeting to discuss how to best coordinate salmon recovery with the Watershed Management Project. A coordination strategy is being developed. Quarterly updates on this coordination effort will be provided to the Planning Unit with additional updates as needed.

3.2 Assessment
For each plan component within each sub-basin, an assessment of conditions and extent of problems shall be undertaken once sufficient data have been collected to enable such assessment. The end product of the assessment phase is the identification of the specific locations where corrective actions are needed, and the type and extent of the problems that need such corrective action.

3.2.1 Establish Criteria for Evaluation of Success
For each component and within each sub-basin, specific measurable objectives shall be established. The purpose of the objectives is to define the measure of whether the plan goals have been achieved. If the achievement of any objectives does not result in the achievement of associated goals, new objectives will be defined through the adaptive management process.

3.2.2 Define Monitoring Protocols
Protocols shall be established during the assessment phase to provide specific guidance for collecting information that shall be used to monitor and evaluate the effectiveness of corrective actions.

4.0 Develop/Revise Watershed Management Plan
4.1 Develop and Evaluate Solutions/Alternatives
As with the assessment phase of the project, the identification and evaluation of solutions will be an incremental/iterative process building upon recommendations from previous planning efforts and considering existing laws, programs, and other efforts. Information obtained under Section 2.4 – Linkage and Coordination, will be used to help identify existing/previous efforts. Solutions shall not be added that obligate a particular government unless that government has at least one representative on the Planning Unit and the respective members appointed to represent the obligated government agree to adding the element that creates the obligation (1).

At a minimum the following alternatives/solutions will be considered:

**Water Quantity:**
Increasing water availability through strategies that include but are not limited to: conservation, water reclamation and reuse, voluntary water transfers, additional water allocations, and additional water storage and water storage enhancements including aquifer recharge and recovery (1).

**Water Quality:**
Developing a recommended approach for implementing the TMDL established for achieving compliance with water quality standards unless a TMDL process has begun in the WRIA as of the date the watershed planning process is initiated under RCW 90.82.060 (1). In addition, explore options to manage groundwater quality.

**Instream Flow:**
Aside from establishing or modifying existing instream flows, no specific strategies are specified in the Act for meeting the goal of ensuring that water is available in sufficient quantities to satisfy the minimum instream flows for fish. This is an area where there is tremendous opportunity for creative solutions.

**Fish Habitat:**
Coordinate and integrate analysis and assessment with other salmon recovery and management efforts.

Information collected in Section 2.4 – Linkage/Coordination will be used to assist in identifying alternatives. Criteria developed in Section 2.2 – Criteria for Evaluating Proposed Solutions will be used to help identify recommended solutions.

**Implementation Strategy/Status**
Because solutions are dependent on obtaining a better understanding of the problems through the assessment phase, it is recommended that immediate actions related to solutions will be limited to compiling suggestions and recommendations from recent planning and management efforts. On a regular basis the Initiating Governments should review overall progress and determine when to initiate further action for solution identification. This does not preclude the need to move forward with early action activities.

4.2 Select Best Solutions
For each component within each sub-basin, using the criteria developed in Section 2.2, the various solutions developed in 4.1 shall be sorted and those solutions with the most promise shall be selected for incorporation into the Watershed Management Plan.

4.3 Assemble Plan
The Watershed Planning Act requires that a watershed management plan be written, however, it does not prescribe the exact contents or form of the plan (4). The outline below will be followed for general format, although it may be modified as the project progresses. The outline follows the one recommended in the Guidance Manual with some modifications.

Cover letter-recommending plan to various legislative authorities and others as needed

Executive Summary

Introduction and Background
- Goals/objectives of the WRIA1 Watershed Management Project
- Scope
- Key issues addressed
- Relationship to other programs and planning
- Conformance with SEPA/NEPA

Planning Process
- Initiating Governments
- Planning Unit participants
- Public involvement process and documentation of SEPA/NEPA integration
- Problem and issue definition
- Method of decision-making

Technical Assessment and Findings
- Historical context
- Existing data
- New studies performed
- Summary of key findings
- Overview of technical validation process
- Reference to complete studies or reports in appendices or elsewhere

Alternatives Analysis
- Water Quantity
  - Description of alternatives
  - Criteria applied
  - Recommended alternatives (ordinances, rules, technical assistance, education, funding, formal agreements, etc.)
  - Environmental Impact Analysis (SEPA/NEPA linkage)
- Water Quality
  - Description of alternatives
  - Criteria applied
  - Recommended alternatives (ordinances, rules, technical assistance, education, funding, formal agreements, etc.)
  - Environmental Impact Analysis (SEPA/NEPA linkage)
- Instream Flows
  - Description of alternatives
  - Criteria applied
  - Recommended alternatives (ordinances, rules, technical assistance, education, funding, formal agreements, etc.)
  - Environmental Impact Analysis (SEPA/NEPA linkage)
- Fish Habitat
  - Description of alternatives
  - Criteria applied
  - Recommended alternatives (ordinances, rules, technical assistance, education, funding, formal agreements, etc.)
• Environmental Impact Analysis (SEPA/NEPA linkage)

Recommended Implementation Strategy
- For each recommendation include who will implement action and why, integration with related programs/processes, funding and other resources needs including sources of funds, methods to implement and ensure compliance, and schedule;
- Long-term data collection;
- Long-term organized institutional structure to ensure implementation, review progress, take corrective action, involve public, report to entities, and respond to new needs or information;
- Contingencies and process for cases where an organization designated for implementing a plan recommendation is unable or unwilling to do so; and
- Monitoring and other measures to evaluate success.

Conclusion
- Recommendation of plan to legislative bodies and others as appropriate.

Appendices
- MOAs or other agreements
- Criteria used to evaluate alternative action plans
- Dissenting opinions if applicable
- Coordination Plan
- Technical documentation
- Long-term data collection and management program
- Implementation structure and responsibilities
- Glossary of key terms (5)
- Public processes required for SEPA/NEPA and other items as needed
- Public written comments (including application to SEPA/NEPA)

Implementation Strategy/Status
To be determined.

5.0 Approval
In order for a watershed plan to draw on the authority granted by the Watershed Management Act, at a minimum it must be approved by county legislative authorities, using a specific process described in the Act.

Implementation Strategy/Status
The approval process should be reviewed to ensure that it is clear to all parties. When and how this will be done will need to be determined.

6.0 Implementation of the Watershed Management Plan
One of the most important elements that will be considered is the implementation strategy for plan recommendations. Issues related to actual implementation should be considered as the recommendations are being developed. The implementation strategy should consider the following.

- Who the party(ies) is(are) that will carry out each element of the management plan, and the responsible individuals in each case where the party is a corporate entity;
- Why each party was selected to perform that plan element;
- Integration with related programs and processes;
• Funding and other resource needs including whether funding is available and/or how the funding will be provided for each element of the plan;
• What methods will be employed by each party to ensure their compliance with the requirements of the plan element(s) for which they are responsible;
• What special relationships, rule changes, agreements, contracts, or other arrangements, if any, shall be established by or among the various parties involved in implementing the recommendation;
• Schedule for implementation recognizing actions that are time sensitive;
• Long-term data collection;
• Long-term organized institutional structure to ensure implementation, review progress, take corrective action, involve public, report to entities, and respond to new needs or information;
• Contingencies and process for cases where an organization designated for implementing a plan recommendation is unable or unwilling to do so; and
• Monitoring and other measures to evaluate success (1).

Implementation Strategy/Status
A Technical Team will be formed to help guide development of the implementation strategy.

7.0 Early Action Projects and Activities
The Watershed Management Act encourages the Planning Unit to identify projects and activities that are likely to serve both short-term and long-term management goals and that warrant immediate financial assistance from the state, federal, or local government. If there are multiple projects, the Planning Unit shall give consideration to ranking projects that have the greatest benefit and schedule those projects that should be implemented first (1).

Steps and Criteria:
• Determine scope of problem: location(s), affected parties, impacts;
• Determine what, if anything, is being done to address the problem already, who is doing it, and evaluate effectiveness;
• If there are multiple projects, rank projects that have the greatest benefit and schedule those projects first;
• If existing action is working, Planning Unit simply issues recommendation of support;
• If existing process isn’t working, or nothing is being done, explore means to get it done;
• Evaluate alternatives based upon criteria in Section 2.2 above;
• Chart location(s), details of actions taken, and;
• Monitor results.

Implementation Strategy/Status
To be determined.
Scope of Work

For

Technical Studies

Prepared for the

WRIA 1 Watershed Management Project

by the

Utah Water Research Laboratory
Utah State University
Logan, Utah  84322-8200

July 26, 2000
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1. INTRODUCTION

Background

As described in the Watershed Management Act (RCW 90.82), the March 27, 2000 general
scope of work, and other legal agreements such as the October 1998 intergovernmental
Memorandum of Agreement, the overall goal of the WRIA 1 Watershed Management Project
(WMP) is to have water of sufficient quantity and quality to meet the needs of current and future
human generations, including the restoration of salmon, steelhead, and trout populations to
healthy and harvestable levels and the improvement of habitats on which fish rely. The work
necessary to achieve this goal is being conducted in several interrelated parts. Specifically, Part
1 is the initial project organization and formation of the Planning Unit, Part 2 is the data
assessment that will provide the information needed for knowledge-based decision-making, and
Part 3 is the watershed plan development.

The first part of the project was completed during 1999 and Part 2 (data assessment) is currently
underway. The data assessment part is being conducted in three phases. The purpose of Phase I
is to define the technical scope of work that will be implemented during Phase II and Phase III of
the project. Phase II of the technical scope of work corresponds to work scheduled for
completion during the 2000 calendar year and Phase III is the work planned for the January 2001
through June 2002 project period.

This Phase I report presents the proposed scope-of-work for Phases II and III for the technical
studies of the WRIA 1 WMP. Pursuant to the project scope of work (SOW) adopted by the
Administrative Decision Makers and Planning Unit during March and April 2000, Phase II and
Phase III of the WRIA 1 WMP will include technical studies of water quantity, water quality,
instream flows, and fish habitat. The Utah State University (USU) project team has explicitly
added descriptions of needed work in database construction and development of a decision
support system (DSS) for the WRIA 1 WMP. Also included in this Phase I report are
descriptions of tasks related to overall project management and support of the development of
the watershed management plan.

The scope-of-work materials in this document are primarily aimed at Phase II activities. For the
work recommended for water quantity, water quality, database management, and development of
the DSS, the principal efforts revolve around accumulating data, evaluating and analyzing
available data in light of the scoping meetings held during Phase I, and establishing a systematic
process for identifying, implementing, calibrating, and verifying models. Because of the
extensive previous technical scoping on instream flows (Hardy, 2000), the required effort for the
instream flow component of the project is better defined, and this is reflected in the scope-of-
work for the study.
Ample resources have been allocated for meetings between USU project personnel and representatives of the Technical Teams formed under the WRIA 1 WMP. This will include at least monthly teleconferences with the Technical Team leaders and approximately three meetings in the WRIA during Phase II. Further, in the spirit of adaptive management, a workshop is scheduled for late fall 2000 to refine and update the Phase III technical scope-of-work, subcontracts, and level-of-effort for all project components. Accordingly, the costs estimated herein for Phase III work are only approximate at this time.

Overview

The ultimate goal of this effort is to provide technical assistance in the development of a management plan for WRIA 1. This effort will require the capability to easily identify and explore trade-offs among competing management alternatives and policies that address specific components of water quantity, water quality, instream flows, and fish habitat. The overall linkages among project components, data, systems, and related on-going studies are illustrated in Figure 1. Given the technical nature of these components, this requires a tool that allows users to easily navigate the complex of data, models, and analytic methods that will be assembled from the water quantity, quality, instream flow, and habitat components of the project. This also requires that access to and interpretation of information must occur within the context of available decision-relevant variables, constraints, and management options. The goal of this project is to construct such a tool in the form of the decision support system (DSS), described below as part of this technical scoping document, and to assist WMP personnel in using it to develop the WRIA 1 watershed management plan.
Figure 1: Linkages among Project Technical Components
2. TECHNICAL SCOPE

2.1 Water Quantity (SOW Section 3.1.4.5)

The purpose of the water quantity portion of the project is to systematically develop the database
and hydrologic simulation capabilities needed to address water management problems in WRIA
1. The specific information to be collected and analyses to be conducted include, but are not
limited to, those itemized in Section 3.1.4.5 of the WRIA 1 Watershed Management Project
(WMP) Final Scope of Work (March 27, 2000), i.e.,

- Estimate the amount of surface and groundwater present;
- Estimate the amount of surface and groundwater actually being used in the WRIA;
- Conduct a depletion analysis to accurately estimate the spatial and temporal uses of water in
  the WRIA throughout the year;
- Estimate the amount of water represented by claims in the water rights claims registry, water
  use permits, certificated rights, existing minimum instream flow rules, federally reserved
  rights, and any other rights to water; Use the best available science to make reliable estimates
  of the Lummi Nation water rights for both instream and out-of-stream uses;
- Identify the most senior instream and out-of-stream water rights in the WRIA and the next
  most senior rights in turn based on the priority date of existing water right holders;
- Estimate future water needs;
- Estimate the amount of surface and groundwater available taking into consideration seasonal
  and other variations;
- Estimate the amount of surface and groundwater available to junior users and for further
  appropriation taking into account seasonal and other variations and the minimum instream
  flows adopted by rule or to be adopted by rule under the RCW for streams in the
  management area including the data necessary to evaluate necessary flows for fish;
- Estimate the total amount of water available in an undepleted condition;
- Identify location of areas where aquifers are known to recharge surface bodies of water and
  areas known to provide for the recharge of aquifers from the surface;
- Collect streamflow data throughout the watershed for the multi-year year effort;
- Measure and/or estimate climate data (precipitation, evapotranspiration) at representative
  locations in the WRIA;
- Evaluate existing land use/land cover data for its suitability in making water resource related
  decisions.
- Assess strategies for increasing water supplies in the WRIA 1 which may include, but are not
  limited to, increasing water supplies through water conservation, water reuse, use of
  reclaimed water, voluntary water transfers, aquifer recharge and recovery, additional water
  allocations, or additional water storage and water storage enhancements.
Key Water Quantity Problems

Several water quantity issues were identified during the Phase I scoping meetings. The data collection, analysis, and modeling in the WRIA 1 WMP should be designed to address these issues in conjunction with those listed above. Among the concerns mentioned, the following are key.

There are numerous drainages in the WRIA that are already closed (or partially closed) to new consumptive water allocations. The rationale for closure of a drainage was based upon the need to provide instream flows for protection of fisheries resources. Since the adoption of the instream flow levels and basin closures, there has been an increased focus on the need for understanding of the degree of connectivity between ground water and surface flows. Current Washington water law provides that, if there is hydraulic continuity between surface water and a proposed ground water source, any water right permit or certificate issued shall be subject to the same conditions as affected surface waters. In the case of surface water closures to protect instream flows, ground water in hydraulic continuity is also closed. This has been interpreted under what is called the “one molecule” rule, that is, a permit for a new well will not be issued if the well will change streamflow by even a single molecule of water. This has made closure the principal tool in management of instream flows in the study area, and streamflow has become a major concern in maintenance of fish habitat. Minimum instream flows were established in January, 1986, for most of the streams in the WRIA. The instream flows constitute a water right with regard to other uses with a priority date of the effective date of their establishment. Only a few water rights have been issued since January, 1986, in WRIA 1 and most are subject to the established minimum instream flows. At present, an estimated 90 percent of decisions on new ground water permits are appealed--by the applicant if the permit is denied, or by third parties seeking to protect fish habitat if the permit is granted. There are approximately 570 pending water right applications in WRIA 1.

Several communities in the WRIA are seeking alternatives to obtain additional water to accommodate current needs and anticipated future growth. Many are facing problems related to closure and source water quality limitations.

Potential management options affecting streamflow for protection of fisheries resources, quantification of (and implementation of policies to recognize) reliable estimates of the Lummi Nation water rights for both instream and out-of-stream uses, changes in land use, and other actions in the WRIA will affect surface and ground water flows in both space and time. The implications of these hydrologic changes on current water rights holders and on the amount of water that might still be developable are of concern and must be analyzed.

Establishing an estimate of the streamflow conditions that would prevail in the absence of surface and ground water abstractions (i.e., surface water diversions and ground water withdrawals) is required to establish baseline conditions in WRIA 1. For purposes of this analysis, baseline conditions are defined as those hydrologic conditions that prevailed prior to significant use of water by Europeans, or approximately the conditions that were seen in the WRIA in about 1850. A depletion analysis is needed to provide this information.
Potential Water Management Measures

Various management measures and policies have been proposed for consideration in addressing present and future water resources problems in the WRIA. Data collection, analysis, and modeling work should be aimed at establishing the capability to evaluate the consequences of such measures. Both structural and nonstructural water management measures have been identified as potential actions to address water quantity related concerns.

Structural measures to increase water supply or provide physical controls on water flow include surface and ground water storage options, levees for flood control, trans-basin and inter-drainage water transfers, private sector hydropower development, options for modification of the Middle Fork-Lake Whatcom diversion, and modifications to wastewater treatment and distribution systems to enable water reclamation and reuse.

Possible non-structural actions to increase water supply or manage water demands include water conservation and water reuse strategies as well as more intensive management of surface and ground water permits in conjunction with investments in fish habitat rehabilitation, land management/land use controls, changes in crops and/or irrigation and fertilization technologies, more intensive management of ground water/soil moisture levels to provide subsurface irrigation of crops, water pricing, water metering in areas not presently metered, water banking and transfers, and zoning measures to manage population growth in light of water management objectives.

The following sections provide information on the objectives and scope of work proposed to address water quantity issues and evaluate water management alternatives in WRIA 1.

2.1.1 Surface Water Quantity

2.1.1.1 Objectives

The objectives for the surface water quantity component of the study.

1. Collect, compile, and assemble in the geodatabase all available pertinent surface water data needed to support analysis and modeling efforts and the evaluation of water management alternatives.

2. Evaluate the available streamflow and climatological database and design additional data collection efforts to address immediate analytic requirements and long-term strategic data needs.

3. In conjunction with the ground water quantity work and other WRIA 1 contractor efforts (such as the WRIA 1 estimated water use research being conducted by the Water Rights Review Team), prepare a water balance for each of the delineated drainages in the WRIA that estimates the surface and ground water present, available, and actually being used while taking into account seasonal and other variations.

4. Develop and implement appropriate analytic and modeling tools to provide the necessary capabilities to conduct a depletion analysis and evaluate alternative watershed management
strategies in the WRIA, including those for increasing water supplies in the WRIA as
described in RCW 90.82.070(2).

5. Provide support and guidance to the development of the database developed for this project
and the DSS.

6. Provide the necessary training and outreach services that will be required by the Initiating
Governments (IGs), Planning Unit (PU) caucuses, Technical Teams, and other affected
parties.

2.1.1.2 Detailed Work Plan

The following tasks provide a work plan for achieving the surface water quantity objectives.

Task 1: Evaluate Available Streamflow and Climatological Data

The available streamflow and climatological data will be evaluated to assess the need for
establishing new (or re-establishing old) gaging stations. The streamflow record for WRIA 1
leaves much to be desired. A record of at least 20 years is recommended to obtain a reasonable
estimate of average flows, and a longer period is recommended to estimate the variance in
streamflow. Of the approximately 45 stream gauges in the WRIA, fewer than half have a period
of record in excess of 10 years, and only 10 have a period of record longer than 20 years. Of
these, only three are currently in service (the gage on the mainstem at Ferndale, the gage on the
North Fork of the Nooksack River, and the lake water elevation gage at Lake Whatcom). The
existing streamflow data will be evaluated and recommendations will be formulated for
establishing new gages. These recommendations will be based on a stratification of the
drainages in the watershed in terms of land cover, climate, and geology into hydrologic regions,
or hydroclimatic regions. The stratification must ensure that there are measured watersheds
representative of all (or as many as possible) categories. The categories will have to be quite
course. A search will be made for Hydroclimatic Data Network (HCDN) data sets or benchmark
watersheds nearby with similar hydroclimatic attributes for comparison and use in calibration.
Additional criteria that will be considered for determining the need and assessing the location for
new gages include:

- upstream drainage area that is not gaged
- the types of drainages (e.g., size, location, land cover types, elevation) for which historic
gage data are and are not available
- the prior existence of a discontinued gage at a site (for which the period of record might be
strategically extended by installation of a new gage)
- requirements for calibration and validation data for surface water quantity and quality models
- locations of sites and portions of the year where streamflow data will and will not be
produced from the instream flow component of the project (and other on-going studies)
- the likelihood of future significant land use or other changes in areas that are not presently
gaged
- the location of outlet points of drainages
- information about historical streamflows, the impacts of vegetation (evapotranspiration) on
streamflows and channel geomorphology
Initially, emphasis will be placed on obtaining sufficient data for model calibration, which will likely require acquisition of additional streamflow data in specific drainages in the upper basin and in watersheds elsewhere that are selected for intensive study.

Climatological data are available from nearly 40 stations in and around the WRIA, with nearly 20 stations in Whatcom County. Most of these report precipitation, snow depth, and maximum and minimum temperature. Pan evaporation data exist, but are generally seasonal. These data will be evaluated for their usefulness in estimating areal precipitation, evapotranspiration, and surface model inputs at the drainage level.

As a result of the analysis of streamflow and climatological data, recommendations will be made for the installation of new streamflow and possibly meteorological gages to address long-term data needs and more immediate model calibration requirements.

Task 1 will be completed by November 30, 2000.

Task 2: *Obtain/Create Appropriate Gage Records for Use in Streamflow Modeling*

In conjunction with the review of streamflow data and evaluation of potential new gage locations, a streamflow database for use in water quantity analysis and model calibration and verification will be created. This effort will also entail a statistical analysis of the streamflow record to extend it to appropriate un-gaged locations for use in water balance calculations. Numerous tools have been developed for extending the period of record at a site and for estimating streamflow at an un-gaged location. These include the USGS GLSNET program, a regional hydrologic regression and network analysis that uses generalized least squares. GLSNET and/or other appropriate tools will be used to statistically extend the streamflow database at un-gaged locations required in assembling the water balance for Task 3.

Task 2 will be completed by November 30, 2000.

Task 3: *Estimate Components of the Annual and Monthly Water Balance*

Components of the annual and monthly water balance will be estimated at the drainage level if possible, or otherwise at the smallest geographical scale that can be supported by the database. This will include drainages within WRIA 1 that are outside the Nooksack River Basin. This will be done in conjunction with work in the ground water quantity portion of the project and other WRIA 1 contractors, such as the Water Rights Review Team. The results of this effort will yield information estimating the temporal and spatial distribution of surface water present, available, and actually in use in the WRIA. This will be used to support the information needs of the surface water modeling and depletion analysis (Tasks 5 and 6, below).

The information that will be assembled or estimated as a part of the water balance will include areal precipitation, diversions and withdrawals, evapotranspiration and consumptive use, return flows, surface and ground water inflows and outflows, and transbasin and trans-drainage diversions.
While the available point measurements of climatological information will provide fairly good
temporal coverage, it will be necessary to evaluate the spatial coverage in consideration of
differing meteorological conditions in the upper basin versus the lowlands. In order to estimate
precipitation at a non-gaged location, some form of interpolation is required. Two data sets have
become available that can potentially provide better ways to estimate spatially distributed
precipitation. One of these data sets is based on the climatic divisions prepared for the United
States by the National Climate Data Center (NCDC, available at
temperature and total precipitation are derived using all stations reporting both precipitation and
temperature within the division and are available for download from the Climate Diagnostics
Center (CDC, http://www.cdc.noaa.gov/Timeseries/). The other source of spatial precipitation
data is the Oregon Climate Center, which provides PRISM ("Parameter-elevation Regression on
Independent Slopes Method") generated gridded estimates of mean monthly precipitation maps
These two data sets, along with point precipitation data, will be used to estimate the spatial and
temporal precipitation fields for the WRIA.

Evapotranspiration (ET), which may account for a significant fraction of the water budget, is not
currently measured directly in the study area. This is the typical situation in most watersheds.
Standard engineering methods (see Jensen et al., 1990) will be used to estimate
evapotranspiration for use in the water budget calculations and in the water quantity modeling.
Where possible, these will be checked against annual rainfall-runoff estimates for specific
drainages/sub-watersheds. The ET calculations will draw upon available land use and land cover
data, as well as point measurements and interpolated climatological information. The Priestly-
Taylor method will be explored for estimating ET in drainages with forest cover or other natural
vegetation. In subsequent modeling efforts, sensitivity to estimates of evapotranspiration will be
evaluated and, as deemed necessary by the IGs/PU/Water Quantity Technical Team, programs
for collecting ET data in WRIA 1 and/or employing more sophisticated methods of estimating
ET for areas of natural vegetation will be designed and assessed.

Where available, historic records on diversions (within drainages, inter-drainage, and transbasin)
will be used to account for these components of the water budget.

Data on surface and ground water supplied for domestic and industrial use will be obtained from
water purveyors where available. Estimates of unmetered or otherwise unreported water use
(e.g., diversions for agricultural use, domestic supply to rural users) will be calculated on the
basis of type and location of use. For example, consumptive agricultural use will be estimated as
a part of the evapotranspiration calculations, and diversions (and implied return flows) will be
calculated from the consumptive use estimates by using appropriate irrigation system
efficiencies. Rural domestic use will be estimated by applying reasonable use rates to housing
densities in areas not served by water purveyors. Water use estimates will be compared against
available streamflow data to identify sub-watersheds or drainages that might be gaining/losing
from/to ground water. The PUD is conducting an analysis of actual water use based on tax
assessor land use codes and typical water use estimates by land use type. Estimation of water
use will be coordinated with these on-going efforts, especially with regard to basic statistics such
as use rates by type of use and land areas involved in particular uses.
Concerns have been expressed about an apparent climate shift that occurred in the Pacific Northwest in the 1970s. The shift seems to have resulted in warmer, drier winters and changed snowmelt and precipitation patterns in the upper reaches. It is unlikely that it will be possible to prove this shift from the WRIA 1 climatological and streamflow data, but it should be considered in evaluating water balance information and modeling the water quantity implications of alternative management options.

Task 3 will be completed by December 31, 2000.

Task 4: Review Available Surface Hydrologic Models and Select Appropriate Models

Surface water quantity modeling will be done at different levels of spatial detail, using different approaches for different drainages in the WRIA. In the upper reaches of the Nooksack River Basin and in other drainages in which water management issues are of relatively minor importance, simple distributed-parameter rainfall-runoff models will be developed. These will be based on digital elevation models (DEMs), distributed precipitation and other meteorological information, soil and geological data, and land use and land cover data. It is anticipated that there will be some grouping of drainages into larger hydrological units for purposes of surface water quantity modeling in these upper basin locations. Examples of readily available models that could be used in the uplands watersheds include HSFP (developed by the US Environmental Protection Agency), TOPMODEL (Beven and Kirkby, 1979; Beven et al., 1995), PRMS (Leavesley et al., 1983; Leavesley et al., 1996), and DHSVM (Wigmosta et al., 1994).

The emphasis for surface water quantity modeling will initially be placed in areas of the WRIA where the most significant water management issues are found and where aspects of the hydrologic cycle (e.g., withdrawals, evapotranspiration, surface water-ground water connectivity) are most complicated. For example, in the lowlands and other areas in the WRIA where significant water quantity problems exist and where development of water sources and changes in land management are occurring (or are expected in the future), a process-based surface water model will be constructed and implemented. This model(s) will be custom-built for the specific problems and issues presented in Section 3.1.4.5 of the WRIA 1 Watershed Management Project Final Scope of Work (March 27, 2000) and will interface with the upland models, drawing components from them where necessary. The model(s) will also be capable of being linked to the ground water quantity models that will be used in the same geographic areas. Such a physical/process-based model(s) will be able to forecast water availability for different water management and land use alternatives, for estimating amounts of surface water available and present, for conducting the depletion analysis, and for examining hypothetical pre-development conditions.

The model(s) will be capable of evaluating water management alternatives for increasing water availability through strategies that include but are not limited to: conservation, water reclamation and reuse, voluntary water transfers, additional water allocations, and additional water storage and water storage enhancements including aquifer storage and recovery.

Depending on the nature of the water management alternatives to be simulated in formulating the watershed management plan, it might also be necessary to obtain and apply a simpler water accounting model that is better suited to handle surface and ground water storage and transmission facilities and deal with constraints associated with meeting water demands,
satisfying water rights requirements, and operating reservoirs and diversion facilities. Numerous models have been developed over the past 30 years to simulate the management of storage and conveyance facilities at the river basin scale. These present a range in capabilities with regard to incorporation of ground water. Some have been institutionalized and are in use by state water management agencies. Most are link-node simulation models, and each offers a range of options for surface water routing and time steps. A few that might be of value to the project are IRAS (developed by D. P. Loucks at Cornell), MODSIM (by John Labadie at Colorado State University), WRAP (by R. A. Wurbs at Texas A&M), and PROSIM (used for simulation of operations in the Central Valley, California). Some of these models are designed to simulate the system so as to meet water demands. Others are designed to operate diversions and withdrawals to provide water to users on the basis of water rights quantities. If the management alternatives that are eventually developed require these capabilities, these and other such link-node water accounting models will be evaluated and an appropriate model will be selected and implemented. In any case, the surface water quantity models will be developed to address the level of spatial and temporal detail required in the watershed management plan.

Regardless of the suite of surface water quantity models eventually selected for use in the watershed management project, simulation results will be reported in terms of streamflows at the outlet of drainages (or aggregated sets of drainages, as appropriate) at 15-day intervals. Given the short travel times on the mainstem of the Nooksack River, it is probable that internal time steps will be less than this reporting interval, with daily time steps being likely. It will also be necessary to address the informational needs of flood control management in the WRIA, which require flow hydrographs at one-hour time steps. To do this, models and/or methodologies will be developed to assemble runoff hydrographs suitable for use in flood routing studies. These models/methodologies will be consistent with the surface water modeling efforts, and will provide the capability of using flood routing models to evaluate the hydraulic behavior resulting from a design storm.

Task 4 will be completed by November 30, 2001.

**Task 5: Implement Streamflow Models**

Implementation of the streamflow models selected and/or built in Task 4 will involve the following activities:

- Developing a database of model inputs needed to run a continuous simulation hydrologic model for a drainage-level disaggregation of the whole WRIA. This will consist of precipitation and snowfall data as well as temperature and radiation indicators for energy and snowmelt use.
- Implementing a continuous simulation model(s) that is parameterized using GIS methodology from DEM and land cover data.
- Calibrating and verifying the model(s) against streamflow data available from historic records and the extended streamflow information produced in Task 2.
- Using the model(s) to provide estimates of streamflow at required points and for alternative land cover and land management alternatives. This will require a sound mapping of management alternatives into model parameters. In some instances, relative uncertainty will be small while for other combinations of alternatives, data availability and modeling capabilities will result in higher uncertainty. These uncertainties will be evaluated using
sensitivity analysis and stochastic modeling techniques. This sensitivity analysis will identify opportunities where additional data collection will be cost-effective in reducing uncertainties. It will also allow a quantification of the risk associated with particular management decisions. In all cases, the level of uncertainty and recommendations for proactive actions to reduce uncertainties will be articulated.

- Developing a stochastic version of the model(s) for monthly or 15-day streamflow simulation, disaggregated to the drainage level.

Preliminary versions of the model(s) will be operational by the end of Phase II of the project. They will mainly serve to organize the data structures and interface for effective analysis of the data. During Phase III, the models will be iteratively refined and adjusted to meet the project needs. The refinement will also include uncertainty estimation and quantification through simulation of ranges of parameters using Bayesian or Generalized Likelihood Uncertainty Estimation (GLUE) methods.

Task 5 will be completed by September 30, 2001.

Task 6: Design and Conduct the Depletion Analysis

The water use estimates obtained in assembling the water balance in Task 3 will be used as a part of the depletion analysis.

The water quantity models (both surface and ground water) will provide the capability of estimating “undepleted” streamflows. The purpose of the depletion analysis is to estimate the spatial and temporal distribution of water use in WRIA 1 throughout the year and characterize the pre-European flow conditions in the WRIA. This will help define and understand the bounds of management options within the watershed planning process.

Conducting such an analysis of pre-European flow conditions is potentially more difficult than it sounds. The objective is to establish an estimate of the streamflow conditions that would prevail in the absence of surface and ground water abstractions (that will be estimated in Task 3, above) and the land uses that have driven them. However, model runs that simulate streamflow conditions that result from simple removal of abstractions will not capture the changes in hydrology created over the past 150 years. Simulation of conditions involving complete coverage of the WRIA with natural vegetation will provide a better approximation, but because of limitations in data availability it will be impossible to calibrate water quantity models to pristine, pre-European conditions of vegetative cover, stream morphology, infiltration, runoff, and other factors. Further, climatic conditions change at decadal and longer scales, and data are only available for WRIA 1 for about the past 40 years. In the face of these difficulties, the following work plan will be followed for conducting the depletion analysis:

- Use the assembled suite of calibrated surface (and ground water) models to simulate streamflows that would be expected under current hydrologic conditions if current surface and ground water were removed.

- Repeat the above analysis, but modify the data input to reflect reasonable assumptions about what the WRIA would look like under conditions of natural vegetative cover and, to the extent they can be determined or satisfactorily estimated, “natural” conditions of hydrology,
stream morphology, and other factors. This will be accomplished using the results of on-
go ing studies by Collins and Montgomery of the University of Washington if the results of
their work can be provided in a timely fashion.

Current climatic conditions will be assumed in both analyses. These analyses will provide an
approximate description of the undepleted condition in WRJA 1.

Task 6 will be completed by December 31, 2001.

Task 7: Analyze the Impact of Future Management Alternatives

The water quantity models will be assembled to provide the capability of exploring "what if"
questions regarding the ecological and economic implications of alternative land use and water
management throughout the entire WRJA 1 area. However, it will be some time before data
availability in the WRJA will become uniform enough to evaluate all water management
problems at a consistent degree of accuracy. For some drainage and/or sub-basins that have (or
will soon have) more complete databases, it will be possible to provide a clearer picture of water
management issues and alternatives. Initially, effort will be focused in the surface water quantity
work to address problems and potential in greater detail in such drainage and coordinated with
such area prioritization undertaken in the technical work for the ground water quantity, water
quality, instream flow, and fish habitat areas. Candidate areas where this might be possible,
especially considering the location of water quantity and quality problems, drainage that were
identified in the Phase I scoping meetings as having critical quality and/or quality problems,
and the areas where more intensive sampling will occur as a result of the instream flow and
other studies, are Dakota Creek, Fishtrap Creek, and Lake Whatcom. With the models
implemented in Task 5 and other work areas of the project, it will be possible in these drainage
to provide monitoring, analysis, and modeling directed at identifying more flexible—and
scientifically/legally justifiable—options for addressing fish habitat and rehabilitation
requirements and water supply alternatives such as those described in RCW 90.82.070(2).

An approach will be documented that recommends procedures to sequentially analyze the other
delineated areas in a like manner. Prioritization of these initial and subsequent areas will be
determined by the IGs and PU.

Task 7 will be completed by December 31, 2001.

Task 8: Assist in Training, Technology Transfer, and Implementation of the DSS

Meetings will be held between USU water quantity personnel and the water quantity Technical
Team during Phase II of the project to evaluate the direction and progress of the work and chart
future activities. During Phase III, a workshop will be held to provide training for designated
individuals in the WRJA in the formulation, content, data requirements, and use of all simulation
models.

Task 8 will be completed by June 30, 2002.
2.1.1.3  Deliverables

Task 1: Evaluate Available Streamflow and Climatological Data

The primary deliverable of Task 1 is a report documenting a set of recommendations for installation of new streamflow and, possibly, meteorological gages to address long-term, strategic data needs and, potentially, long-term model calibration requirements. The mechanism for the installation of these recommended stream or meteorological gages will be discussed in light of Phase III technical scoping actions.

Task 2: Obtain/Create Appropriate Gage Records for Use in Streamflow Modeling

The deliverable for Task 2 is a report documenting procedures and results of the construction of a streamflow database that can be used for surface water quantity model calibration and verification. This work product will include both existing data and statistically generated “data” to fill gaps in the present database.

Task 3: Estimate Components of the Annual and Monthly Water Balance

The principal deliverable for Task 3 is a report documenting an annual and monthly water balance at the smallest geographical scale that can be supported by the database. This will yield information describing initial rough estimates (to be refined in Phase III) of the amount of surface water present in the WRIA. The resulting information will be used to support the information needs of the surface water modeling and depletion analysis (Tasks 5 and 6, and coordinated with ground water quantity modeling tasks).

Task 4: Review Available Surface Hydrologic Models and Select Appropriate Models

In coordination with the ground water quantity activities, Task 4 will produce a report documenting the selection of surface water quantity models to be used in the study. The selected model(s) will be capable of integrating the principal information deliverables of Task 3 and producing forecasts of streamflows at the outlet of drainages (or aggregated sets of drainages, as appropriate) at 15-day intervals. Forecasts from these models will be based upon the simulation of hydrologic processes within the WRIA using both relatively simple distributed parameter rainfall-runoff modeling methods (in drainages for which data are limited and/or changes in demand and land use are not expected) and more sophisticated physical process-based methods (for drainages wherein water quantity issues and/or hydrologic complexity merit a more detailed approach).

Task 5: Implement Streamflow Models

The product of Task 5 is the implementation of the models identified in Task 4. Model implementation will include model calibration and verification. Preliminary versions of the model(s) will be operational by the end of Phase II of the project (December 31, 2000). These preliminary models will mainly serve to organize the data structures and interface for effective analysis of the data. During Phase III, the models will be iteratively refined and adjusted to meet the project needs.
Task 6: Design and Conduct the Depletion Analysis

The product of the depletion analysis will be a report that documents an approximate description of the undepleted streamflow condition in WRIA 1 at the drainage level or, otherwise, the smallest geographic scale that can be supported by the database. Production of the depletion analysis will be based upon an assumption of current climatic conditions.

Task 7: Analyze the Impact of Future Management Options

The deliverable for Task 7 will be an analysis of the surface water quantity issues for WRIA 1 as a whole and, at a greater level of specificity, for selected drainages where more complete data sets are available and where critical water and land use management issues must be resolved. The drainages selected for these analyses will be chosen in light of all quantity, quality, instream flow, and fish habitat issues present, as well as the availability of data.

Task 8: Assist in Training, Technology Transfer, and Implementation of the DSS

The product of Task 8 will be periodic and on-going communication with the Water Quantity Technical Team and, during Phase III, a workshop to provide training for designated individuals in the WRIA in the formulation, content, data requirements, and use of all simulation models.

2.1.1.4 Schedule

It is anticipated that work on the surface water quantity tasks will proceed according to the schedule illustrated in Table 2.1.
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### 2.1.2 Ground Water Quantity

#### 2.1.2.1 Objectives

In general terms, the ground water portion of this study will address the following objectives:

1. Estimate and evaluate the amount of ground water present in the aquifers of the lowland area and the area north of Kendall of WRIA 1, in terms of volume and the input and output discharges.

2. In conjunction with the surface water quantity work, estimate the spatial and temporal distributions of the ground water amounts being used.

3. Develop a model for estimating ground water available for further development.

4. Use the above-described models to provide the ground water component for the evaluation of predevelopment regime.

5. Determine and document the locations of aquifer recharge and discharge zones.

6. Evaluate the spatial and temporal stream-aquifer interactions, in terms of flow magnitude and direction, between the aquifers and surface water bodies including drains and ditches.

7. Evaluate the potential for further ground water recovery development at selected drainages of WRIA 1, taking into account the spatial and temporal distributions of ground water recovery activities, and the stream-aquifer interactions.
8. Perform Aquifer Storage and Recovery (ASR) feasibility analyses for selected WRIA 1 drainages.

9. Evaluate the ground water component of streamflow (baseflow) under the undepleted conditions.

2.1.2.2 Detailed Work Plan

The following tasks provide a work plan for achieving the ground water quantity objectives.

Task 1: Develop a Conceptual Model of the Aquifer System in the Lowland Area of WRIA 1

A conceptual model of the WRIA 1 aquifers in the lowland area and the aquifer near Kendall will be developed in this task. This task will include the horizontal delineation of the aquifers and definition of their vertical extent. Information from previous hydrogeologic studies and the existing well log data will be used to accomplish this task. Subsequent mathematical modeling related to ground water components, ASR, and stream-aquifer interactions will be based on the information available from this conceptual model. This task will also provide information related to missing information and some recommendation on future data gathering.

Task 1 will be completed by September 30, 2000.

Task 2: Develop a Database for Aquifer Hydrogeological Properties

The development of a database of the hydrogeological properties of aquifers will focus on defining properties such as hydraulic conductivity, transmissivity, porosity, and storativity. In this task, we will mainly utilize the USGS database, although other sources, such as consulting reports, will also be used when available. The database will be used in subsequent modeling activities.

Task 2 will be completed by October 31, 2000.

Task 3: Define Recharge and Discharge Zones and Stream-Aquifer Interactions

The principal percolation-type recharge zones for each of the WRIA 1 aquifers, including the coastal aquifers, will be defined in this task, and the locations of significant current and/or potential stream-aquifer exchange areas will be determined. For percolation recharge zones, soil maps, land-use maps, hydrogeologic property (transmissivity, hydraulic conductivity) information, and the potentiometric surface contour maps will be used. The stream-aquifer exchange will be quantified by direction and magnitude across the interface at selected locations. For the purpose of stream-aquifer interactions, the existing data from previous studies and future data from the proposed USGS seepage runs will be used. The principal investigators will collaborate with the USGS and WRIA 1 technical teams to coordinate the proposed seepage runs. This task will also focus on flow across localized drains and ditches to and from the aquifers to identify the impacts of these structural changes on water budget and flow processes.

Task 3 will be completed by December 31, 2000.
Task 4: Determine Spatial and Temporal Behavior of Water Budget Components

The spatial and temporal behavior of the water budget components for each of the WRIA 1 aquifers in the lowland will be estimated via data interpretation procedures and pre-modeling activities. The water budget components will include:

- Percolation recharge
- Discharge to surface water bodies
- Recharge from streams
- Discharge into tile drains and drain ditches
- Ground water withdrawals (pumping)
- Inter-aquifer flows
- Discharge to marine areas

The results of this task will be used to:

- Identify gaps in the database
- Define spatial and temporal patterns in ground water behavior
- Determine the locations of critical ground water recharge and discharge, and stream-aquifer interaction zones.

The pre-modeling activities may include statistical analysis, lumped-parameter models of ground water flow, or local-scale modeling for specific flow processes.

Task 4 will be completed by December 31, 2000.

Task 5: Develop Preliminary Model(s) for Stream-Aquifer Interactions

For selected areas, preliminary model(s) of stream-aquifer interactions will be developed to analyze the potential for ground water development. The model will be used to:

- Understand the dynamics (magnitude and timing) of stream-aquifer interactions
- Determine data gaps in the monitoring program (seepage runs, water table elevation, streamflow gaging)
- Identify potentially viable ground water development management options
- Guide in the selection of final stream-aquifer model(s)

Task 5 will be completed by March 31, 2001.

Task 6: Develop an Approach to Analyze Feasibility of ASR

The preliminary model developed in Task 5 will be used to develop an approach to model the feasibility of ASR at selected WRIA 1 drainages. This model will be subsequently used to:

- Select promising aquifer recharge technologies
- Determine data gaps in the monitoring program (infiltration potential [upper soil permeability], aquifer parameters, stream-aquifer interface resistivity)
739  • Provide information regarding the aquifer storage capacity
740  • Understand the temporal and spatial character of stream-aquifer interactions resulting from
741     ASR activities
742  • Guide in the selection of ASR model(s) for Phase III
743
744  Task 6 will be completed by June 30, 2001.
745
746  Task 7: Develop a Mathematical Model for Ground Water Component Analysis
747
748  The results of Tasks 4 and 5 will be used to develop an approach to estimate the ground water
749     component for the depletion analysis. This will include development, calibration, and validation
750     of an appropriate mathematical model, which will then be used to estimate the ground water
751     component for the analysis of the total amount of water available under the undepleted
752     conditions.
753
754  Task 7 will be completed by June 30, 2002.
755
756  Task 8: Develop a Mathematical Model for Stream-Aquifer Interactions
757
758  A model for simulating stream-aquifer interactions in selected areas of WRJA 1 will be chosen, 
759     calibrated, and validated. The mathematical model will then be used to analyze the impact of
760     future ground water development on streamflow at selected drainages. The areas that will be
761     considered for stream-aquifer interaction analyses include, but are not limited to:
762
763  • North Fork of the Nooksack River, north of Kendall. The aquifer in this area is considered to
764     be a good source of clean water. The City of Sumas is considering piping water from the
765     area. The major issue is the potential impact of ground water development on instream flow
766     and the potential effects of development on both ground water quantity and quality.
767
768  • Abbotsford-Sumas aquifer. It is understood that the ground water and surface water bodies in
769     this area are well connected. The Abbotsford-Sumas aquifer already supplies water to a large
770     area. In addition, this area is critical to instream flow and fish habitat. In conjunction with
771     area prioritization with surface water quantity work, a smaller drainage from this relatively
772     large area will be selected for modeling based on drainage importance, data availability, and
773     ground water quality and instream flow considerations. On this basis, Fishtrap Creek is a
774     likely initial drainage for consideration.
775
776  Task 8 will be completed by June 30, 2002.
777
778  Task 9: Develop a Mathematical Model for ASR Analysis
779
780  A mathematical model for analyzing the feasibility of ASR will be selected, calibrated, and
781     validated. The model will then be used to analyze the feasibility of this storage technology at
782     selected locations. The areas that will be considered for ASR analyses include, but are not
783     limited to:
- **North Fork of the Nooksack River, north of Kendall.** Again, this is a potential candidate area because it is a good potential source of clean water and is already under consideration by the City of Sumas.

- **Abbotsford-Sumas aquifer near Everson.** Everson is interested in development, but does not have enough water. The aquifer near Everson is characterized by relatively high permeability, and thus might be suitable for ASR.

Task 9 will be completed by June 30, 2002.

**2.1.2.3 Deliverables**

**Task 1: Develop a Conceptual Model of the Aquifer System in the Lowland Area of WRIA 1**

A report will be prepared that provides details related to the three-dimensional hydrogeologic model of the aquifer system in the lowland of WRIA 1. The report will include details of the hydrogeological conceptualization of the aquifer system and related properties obtained from existing data.

**Task 2: Develop a Database for Aquifer Hydrogeological Properties**

A detailed database of hydrogeological properties related to the aquifer system identified in Task 1 will be assembled and made available under this task.

**Task 3: Define Recharge and Discharge Zones and Stream-Aquifer Interactions**

A report will be submitted describing and mapping (at a scale to be determined in consultation with the Water Quality Technical Team) major recharge and discharge zones in the aquifer system of WRIA 1 and the areas with current and potential stream-aquifer interactions.

**Task 4: Determine Spatial and Temporal Behavior of Water Budget Components**

A report will be prepared that describes the results and conclusions derived from the pre-modeling activities to identify temporal and spatial behavior of water budget components.

**Task 5: Develop Preliminary Model(s) for Stream-Aquifer Interactions**

A report will be prepared describing the pre-modeling activities performed to identify stream-aquifer exchange for the purpose of subsequent model selection, management alternatives, and future data collection.

**Task 6: Develop an Approach to Analyze Feasibility of ASR**

A report will be submitted that documents information related to the proposed methodology to be used in ASR modeling.

**Task 7: Develop a Mathematical Model for Ground Water Component Analysis**
A report describing the proposed methodology for ground water component analysis to estimate ground water availability will be submitted. The report will include a description of the model selection process and subsequent calibration and verification of the selected ground water component model. The report will also include a description of the results obtained from ground water component modeling.

Task 8: Develop a Mathematical Model for Stream-Aquifer Interactions

This task will produce a report describing model selection, calibration, and verification, and results obtained from stream-aquifer interaction modeling at selected drainages.

Task 9: Develop a Mathematical Model for ASR Analysis

This task will develop a report describing the model selection and subsequent calibration and verification for stream-aquifer interactions. Included in the report will be a description of the ASR model selection and subsequent calibration and verification and the results obtained from ASR modeling at selected locations.

2.1.2.4 Schedule

It is anticipated that work on the ground water quantity tasks will proceed according the schedule illustrated in Table 2.3.

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2.2 Water Quality (SOW Section 3.1.4.6)

2.2.1 Surface Water Quality

2.2.1.1 Objectives

The central water quality goal of the WRRA 1 Watershed Management Project is to ensure that water quality in the Management Area is sufficient for current and future uses. Achieving this goal includes meeting the needs of salmon and shellfish; protecting people involved in water contact recreation; providing for cultural needs; protecting wildlife; providing a safe, affordable domestic water supply; and meeting the needs of other beneficial uses of water (e.g., agriculture, industry, commercial). The initial strategy to meet this goal will be focused on management activities to meet established water quality standards.

Work related to surface water quality in Phase II of the WMP (July to December 2000) will principally involve finding, collecting, analyzing, and summarizing existing water quality data. Conceptual models of water quality in WRRA 1 will be constructed and used as guides in determining where existing data and information may be insufficient to adequately inform water quality managers so that appropriate action may be taken to meet their goals. The USU team will work closely with the Water Quality Technical Team in carrying out the tasks described below for surface water quality, and for ground water quality described in Section 2.2.2. Collaboration is essential to ensure project deliverables are complete and on time. Early in Phase II, a detailed schedule of activities will be prepared so that collaborative activities can be planned.

2.2.1.2 Detailed Work Plan

The following tasks provide a work plan for achieving the surface water quantity objectives.

Task 1: Information Collection and Analysis

Information Collection:

It is anticipated that considerable amounts of historical and recent water quality data for the Management Area are available and that the majority of this data can be readily located and retrieved from traditional water quality management agencies in local, state, and federal governments. Finding and retrieving important, high quality information from non-governmental and non-traditional sources will be more challenging. Water quality data may be available from routine monitoring records from the Washington Department of Ecology, the Washington Department of Health, monitoring by drinking water purveyors, monitoring and special studies by the US Geological Survey, monitoring and special studies by the Lummi Nation and Nooksack Indian Tribe, monitoring and special studies by federal and state fish and wildlife management agencies, monitoring and special studies by the US Environmental Protection Agency, monitoring by wastewater treatment facilities, and monitoring and research conducted by colleges and universities.

For purposes of completeness, all available water quality measurements will be included in the database and reviewed under Task 2. For purposes of surface water quality analysis, particular
attention will be paid to those contaminants of primary concern in fish habitat, TMDLs, drinking water quality, and other identified beneficial uses. These parameters include stream temperature, air temperature, pH, alkalinity, nutrients (particularly nitrogen and phosphorus and their various forms), chlorophyll A (a measure of algal biomass), dissolved oxygen, specific conductance, dissolved and suspended solids, other sediment characteristics (e.g., scour, deposition, size distribution, embeddedness) fecal coliform bacteria, organic matter (i.e., total organic carbon (TOC), biochemical oxygen demand (BOD), ultraviolet absorbance at 254 nm (a measure of reactive organic matter), and measures of biological stream health such as macroinvertebrates (benthic and drift).

Identification of data sources includes querying Project technical team members about their knowledge and access to data and information about Area water quality. This approach was initiated in Phase I. National databases such as the USEPA’s STORET, USGS’ Hydrologic Benchmark Network and National Stream Quality Accounting Network that are available on CD-ROM will be queried for relevant water quality information. Washington Department of Ecology records will also be reviewed. Regional university, college, and research institution libraries will be searched for reports and other publications that include management area relevant water quality information. References made to other works that contain relevant data in reports located through these efforts will be retrieved and the data extracted. Data collection and analysis will be coordinated with similar efforts for ground water quality, and surface and ground water hydrology so that consistent information is available for time critical tasks.

Legally Established or Designated Characteristic uses:

The Washington Department of Ecology has classified all of the water bodies in the Management Area except for Reservation waters under the Clean Water Act. A search for other uses of area water bodies will be included in the data review. These uses may be independent of requirements usually considered under the Clean Water Act.

Water Quality Standards Compliance:

Available water quality data will be compared with all legally established water quality standards to evaluate the degree to which each water body is meeting or exceeding water quality standards. Where time-series data are available, the frequency of standards violation will be evaluated. For the case of permitted discharges, compliance history for dischargers permitted under the National Pollutant Discharge Elimination System (NPDES) will be reviewed to address those areas that are at risk and the practices that were modified in response to noncompliance actions. For permitted and unpermitted discharges, compliance with standards other than those used for NPDES permitting will also be reviewed. This task will necessarily interact with Task 2 for purposes of collecting information for compliance assessment.
Water Quality Sources of Concern:

Where violations of any applicable standards (e.g., Clean Water Act, Safe Drinking Water Act) are identified, the causes of the violations will be investigated during Phase III of the Project. Data availability to support this investigation will be evaluated in Phase II. This evaluation will include the identification of existing data relating to the causes of existing violations of water quality standards. Data will be needed that allows identification of the kinds of pollutants that are contributing to the problem, their possible point and nonpoint sources and their natural as well as their potential anthropogenic sources. Seasonal pollutant loading information, along with hydrologic data will be needed to support numerical modeling that will be used to estimate pollution carrying capacities for water bodies. Seasonal stream flow affects, and other natural events, will be included in this Phase III “assimilative capacity” and Total Maximum Daily Load (TMDL) analysis. Low flow and high flow hydrologic and pollutant loading information will be needed to provide adequate model calibration. Air-borne sources of contaminants will be considered in the context of likely sources and loading rates into water-bodies.

TMDLs:

Pathogen hazards, as indicated by concentrations of fecal coliforms that exceed standards, fine sediment concentrations, temperature, and nutrients are some of the surface water quality problems in the Management Area that are of concern. Other problems, as indicated by the frequency with which they impair beneficial uses, include biochemical oxygen demand (BOD) and pH. Oxygen deficit, temperature, fecal coliform, fine sediment, toxics, and pH are parameters for which water bodies have been listed on the Clean Water Act Section 303(d) list in the Management Area.

During Phase III of the project, the USU surface water quality team will cooperate with Washington Department of Ecology’s activities in performing technical studies and analysis required for TMDLs for 303(d) listed pollutants in the WRIA 1 region. This cooperation may take the form of detailed technical analyses of TMDL-related data and review of TMDL development progress. Toward the end of Phase III this effort will be oriented around developing the usefulness of the Decision Support System and its models in supporting Ecology’s efforts to establish TMDLs and in supporting efforts for designing water quality monitoring networks to determine whether water quality standards are being met through the implementation of the TMDL. As Stakeholder involvement is critical in the development and implementation of TMDLs, USU’s efforts will facilitate stakeholder access to TMDL-related data, models, and other technical information. The database and accompanying information developed under Task 1 will be very helpful in the scoping process Ecology will be conducting around the state in 2001, which will include WRIA 1. In addition, the models developed as part of the DSS will be useful tools for the stakeholders to use in collaborating with Ecology in developing the detailed implementation plans. Working groups of stakeholders will be solicited for inclusion in TMDL-related activities.
Fresh Water Quality Impacts on Marine Water Quality:

In Phase II, existing data will be reviewed to glean information that can be used to determine the impact of fresh water on marine water quality. Public health and economic viability associated with shellfish beds in both Portage Bay and Drayton Harbor are at risk due to fecal contamination (fecal coliforms), and evidence that this pollution, and other pollutants of concern, are of fresh water origin will be reviewed. In Phase III, estuarine current patterns available from nautical charts, existing current modeling studies, if any, soon-to-be performed dye studies, etc. will be used to assess the likelihood that fecal contamination is of terrestrial or non-marine surface water origin, the likely sources and pathways of fecal contamination to sensitive areas, the likelihood that non-marine source reduction will improve the viability of the shell fish beds, and the means of controlling the likely sources. Efforts related to shellfish beds will be coordinated with those of the existing shellfish protection districts.

Task 1 will be completed by December 31, 2001.

Task 2: Distillation and Incorporation of Existing Data into the Project Database

Compile, Analyze, and Summarize Existing Data:

As data become available, it will be entered into the project database. Various data displays including tables and graphs will be prepared to assist with data evaluation. Statistical analysis of the data may include descriptive statistics such as range, median, mean, and standard deviation. Exploratory statistical analysis may include cluster analysis, principle components analysis, and multiple linear regression analysis. The data, and the analysis of the data, will be organized and summarized according to the foci described above (water quality standards compliance, TMDLs, and fresh water quality impacts on marine water quality).

The output of the data review will be a synthesis describing the status of water quality in the Management Area. Emphasis will be placed on identifying where information is sufficient to make management decisions and where additional information is needed to support management decision-making. Identifying data needs for meeting modeling requirements is especially important. The conceptual (box diagram) water quality model of the Management Area will be an important tool in identifying these needs, and will be constructed on a Management Area water balance basis. It will, of necessity, be integrated with concepts on surface and ground water hydrology, ground water quality, and instream flow management.

In order for the data compilation and analysis process to be meaningful, quality assurance and quality control (QA/QC) protocols will be applied to ensure data integrity. These protocols will include hand checking of electronic data, bounds checking to ensure data fit within accepted norms, inclusion of QA/QC information that is provided with the data, maintenance of back up copies of all databases, and other standard procedures. Assessments of data quality will be included in the database so that data users understand the quality of the data prior to use. In addition, locations in the watershed for which no water quality data are found will be noted to ensure that it is understood that the absence of data is not mistaken for the absence of a water quality problem.

Data Gap Analysis:
A comparison of data availability to anticipated data needs (data gap analysis) will be performed relative to other Phase II and Phase III tasks and to more general information needs to inform water quality decision makers. Attention will be given to existing programs that may be of limited duration such as the fecal coliform monitoring work being conducted through the NWCC. Data needs associated with early action projects will also be included in the data gaps analysis. An approach to filling data gaps will be described. Potential long and short-term monitoring requirements will be delineated and, where possible, opportunities to fill data gaps with existing monitoring programs and/or resources will be identified during Phase II for implementation under Phase III.

Integration with Lake Whatcom Water Quality Study:

Recognizing on-going efforts to assess water quality and trophic status in Lake Whatcom, USU will coordinate data analysis activities with those efforts and lend support where helpful. Information will be shared freely with the Lake Whatcom study team and USU will be responsive to requests to integrate Lake Whatcom into the decision support system.

Task 2 will be completed by December 31, 2000.

Task 3: Surface Water Quality Monitoring

Surface water quality monitoring is an important element of the WRIA 1 process. Water quality monitoring will be ongoing throughout most of the project.

The primary effort during Phase II will be monitoring at sites identified for instream flow data collection to support fish habitat data collection efforts. A consistent suite of measurements will be made at each of these sites at the same time as the survey work is being done. The water quality measurements will include stream and air temperature (both continuous), dissolved oxygen, specific conductance, pH, turbidity, and alkalinity, nitrogen, and phosphorus, total suspended solids, and sediment scour/deposition. These measurements will be made using field methods using a Hydrolab, a Hach field turbidimeter, and a Hach field test kit. Phase II efforts will be carried out primarily by USU personnel involved in the instream flow assessment. The purpose of these measurements is to provide a snapshot of existing physical and chemical water quality conditions that pertain to habitat quality, and to provide a screening level assessment of chemical water quality to aid in planning for future, more focused, water quality collection efforts under Phase III. Although it is recognized that field test kits are less accurate than laboratory measurements, the quality is sufficient for this screening purpose, and the low cost and rapid results allow for a large number of measurements to be made.

Monitoring under Phase III will be more focused on filling the data gaps identified under the Phase II data collection and analysis tasks and in conjunction with WRIA 1 technical teams and stakeholders. These data will be used in conjunction with historical data records for assessment of overall watershed water quality, contaminant source identification and quantification, for water quality model population, calibration, and validation, for support of TMDL efforts ongoing through Ecology, and for support of the ongoing Lake Whatcom study efforts for lake water quality and drinking water supply improvement. In addition to the measurements listed above at locations decided under Phase II, laboratory measurements will be made for organic matter (e.g.
total organic carbon, biochemical oxygen demand, ultraviolet absorbance at 254 nm), algal biomass (e.g. chlorophyll A), nitrogen (total Kjeldahl, ammonia/ammonium, nitrite and nitrate) and phosphorus (organic, dissolved reactive phosphate, total reactive phosphate, dissolved total phosphorus, and total phosphorus), and specific target contaminants identified under Phase II. Biological indicators such as macroinvertebrate density and benthic fauna diversity will also be used to assess overall watershed water quality. The specific measures to be used and locations for data collection will be detailed under Phase II.

The majority of the water quality monitoring under Phase III will be carried out by local contractors and interested parties in the WRIA 1 WMP with assistance where needed by USU personnel, using Phase III funding. Prior to the Phase III water quality monitoring activities a detailed quality assurance/quality control (QA/QC) plan will be developed to ensure data integrity and quality.

Task 3 will be completed by March 31, 2001.

Task 4: Surface Water Quality Model Development (Phases II and III)

Any model of physical phenomena should be as simple as possible, but not simpler.
- Albert Einstein

Seek simplicity and distrust it.
- William of Occam

In the course of the data gathering, analysis, and distillation process, it will become apparent that many of the data gaps cannot be filled with short term water quality monitoring. A comprehensive long-term monitoring network and program will be required. However, an initial/preliminary estimate is needed so mathematical modeling will be used to fill the gaps. Phase II objectives under this task are to identify and refine surface water quality model needs, select mathematical models to meet specific needs, and gather and distill data to meet specific input requirements for selected models. Under Phase III, the models will be implemented in forms required in the decision support system, data filters will be constructed that connect the models with the database, models will be calibrated, validated, and verified in the Nooksack watershed, and linkages with other disciplinary models and the database will be completed.

Disciplinary Models:

During Phase II, we shall review existing surface water quality models for their suitability for the needs and system linkages indicated for decision making and adopt a strategy of adapting these models as parts of the integrative decision support framework. Through discussions among the multidisciplinary technical teams and Planning Unit, the USU research contingent, and interested stakeholders, we shall seek consensus in the needs and scales of analysis to populate a matrix of surface water quality models that will be brought to bear on filling the data gaps.
Due to the broad spectrum of water quality problems described above, there exists a spectrum of water quality model needs to address those problems. The models to be considered fall into a smaller number of categories based on the portion of the landscape they address. These categories include (but are not limited to) estuary models, steady- and unsteady state contaminant routing models for streams (including the water column, benthos, hyporheic zone, and the near surface atmosphere), mixing models for streams, models of fresh water lakes and reservoirs, models of the conjunctive interactions between ground- and surface waters for both temperature and physical water quality, consumptive use models for bioconcentration of key contaminants in crops and other vegetation via ground or surface water uptake, and contaminant generation and routing models for surface water flow not confined to stream courses – i.e. non-point source pollution models. Models in each of these categories exist in the public domain and in the private sector. Though some professional judgment will be exercised to exclude from consideration those models known to be deficient for a given purpose, every effort will be made to be inclusive in the approach to model selection. In cases where no suitable models exist for a specific problem, existing models may be adapted or it may be necessary to develop water quality model to address that problem. In all cases, conditions under which the models are developed and the bounds constraining the use of each model will be delineated within the DSS and in printed documentation. Where necessary, links between the surface and ground water flow and quality components of the modeling will be maintained (e.g. surface/ground water interactions are essential for understanding the temperature dynamics in the South Fork).

There are several foci for of the disciplinary modeling efforts. One focus is to provide quantitative technical guidance and support to the WRIA 1 watershed management project’s efforts related to the Washington Department of Ecology’s establishment of TMDLs to maintain and upgrade surface water quality. Toward this end, predictions, under management scenarios, of beneficial use-limiting water quality constituents (fecal coliform, temperature, nutrients, sediment, pH, dissolved oxygen, biochemical oxygen demand) will be made. A second focus is to provide other sub-elements in the project, such as instream flows, fish habitat, and ground water quality, with information needs at key locations in the watershed to set boundary conditions and enable simulation of variables that depend on surface water quality.

Once system and model choices have been made (i.e., a scenario has been built), an important next step is model calibration and parameter estimation. It is important that the model is calibrated for the range of management decisions for which there is a commitment to implement as well as those that are necessary to achieve compliance with water quality standards. We propose to develop and provide largely informal tools to aid in this process. These tools will be designed to provide rapid visual feedback to the user about the effects of parameter changes on decision outputs. Although formal optimization methods could also be included to determine superior parameter sets in the sense that the agreement between the model and data is as close as possible, the number of candidate parameters to be fitted is large, even in simple models, and the user is cautioned against indiscriminate use of automated methods.
Sensitivity and Uncertainty Analysis Models:

The purpose of the models is to allow the user to quantitatively assess the impact of watershed management on surface water quality, to be able to search, in an efficient way, for numerically superior management options and parameters relative to prescribed criteria, and to quantify the uncertainty and risk associated with different options in terms that are commonly accepted and are communicable to stakeholders and technical watershed managers. Both model parameter estimation, i.e. model calibration, and the development of management plans, e.g., best management practice, are viewed as decision problems characterized by uncertainty.

The capability for uncertainty analysis will be integrated into the system. The user will have the option of describing model inputs or outputs in terms of probability distributions (parametric or nonparametric), exploring conditional or unconditional relations between them, and generating univariate, multivariate, or spatial field realizations of parameters for scenario analysis. Both traditional Monte Carlo and bootstrap approaches will be provided to generate alternatives of interest.

Task 4 will be completed by December 31, 2001.

Task 5: Integration of Surface Water Quality Information with Other Portions of the Study (Phases II and III)

In the process of understanding and interpretation, part and whole are related in a circular way: in order to understand the whole, it is necessary to understand the parts; while to understand the parts it is necessary to have some comprehension of the whole.

- David Couzens Hoy

Integration is more than assembling and connecting relevant modules. It requires recognition of the key linkages across processes and actions that have positive and negative feedback to the whole from the part. As an example, a positive feedback effect could be: ground water withdrawals -> water table decline -> change in plant cover -> increased runoff, erosion, decreased infiltration -> more water table decline. The surface water quality component of this project requires input from most other components: water quantity, ground water quality, database and decision support, and instream flows. It will also supply information back to other components, e.g. fish habitat, ground water quality, and decision support. For this interaction to succeed, attention must be paid throughout Phases II and III to ensure that the information flow among components is facilitated. To this end, a thread that will continue throughout Phases II and III is the consistent interaction among technical team members for the USU team, and interaction of the USU team with the WRRA 1 Technical Teams and the Planning Unit to ensure that the integration process succeeds. This will be accomplished using software scoping sessions within the USU group to define data structures (including QA/QC), and regular meetings, on-site, via teleconference, and one-on-one phone and electronic mail, with the WRRA 1 Technical Teams and the Planning Unit to ensure compatibility and completeness. All components of the project, including surface water quality, will be tightly integrated within the Decision Support System described in 2.6 of this document.

Task 5 will be completed by December 31, 2001.
Task 6: Technical Team Training and Input: Model Functionality Design, Surface Water Quality Interface Design, Alpha and Beta Testing (Phases II and III)

Tasks are organized around the staged development of the elements described above in concert with the other activities proposed herein. Associated with each of these elements will be the solicitation of input and reviews from the technical teams. The first alpha version of the DSS will be delivered in July 2001 and will contain the majority of the data distillations, scenario building tools, and disciplinary models. Although some major components will likely be missing at this time, most major components will be represented at a defensible level of complexity, including the surface water quality component. A substantially complete beta version of the system with models and other analytical tools will be delivered in December 2001. This version will be capable of being implemented in the watershed planning process and will serve as the major shakedown version. Bugs and revisions will then be completed during the first and second quarters of 2002 and the final DSS will be delivered in June 2002.

Task 6 will be completed by December 31, 2001.

Task 7: Public Information and Education Forums: Surface Water Quality Modeling Demonstration and Instructional Sessions (Phase III)

During the alpha and beta testing periods, USU will provide two training sessions to the technical teams. On-going consultation on the use of the surface water quality and associated models will also be given during this period. Public forums presenting the DSS along with the posting of the high-level web-based version of the DSS will not occur until the first quarter of 2002.

Task 5 will be completed by June 30, 2002.

2.2.1.3 Deliverables

Task 1: Information Collection and Analysis

The primary deliverables for the Task 1 for the surface water quality portion of Phase II is an integrated database of surface water quality information with linkages to local, state, regional, and national information sources. Legally established or designated characteristic uses will be reported as GIS coverages on WRIA 1 WMA maps and in tables with detailed descriptions of those uses. Water quality standards compliance information will be identified as GIS coverages on WRIA 1 WMA maps and in tabular form showing standards, compliance status, frequency of violation, and constituents in violation. Water quality constituent sources of concern will, again, be identified on maps and in tabular form listing the constituent discharged, type of discharge (e.g. point source, non-point source), mass loading rate, and seasonal distribution of loadings. Information on TMDLs will be linked with Ecology’s 303(d) list of impaired water bodies, with the constituent causing impairment, appropriate standards, and status of the water body with regard to the TMDL process. Fresh water quality impacts on marine water quality will, again, be identified on maps and in tabular form listing the nature of the impact, the likely fresh-water related cause, and seasonal distribution of the impairment.
A repository for printed and electronic data sources will be identified and established in
conjunction with the technical teams and Planning Unit. An interim report detailing the methods
and results from Task 1 will be provided.

Task 2: Distillation and Incorporation of Existing Data into the Project Database

For Task 2, the surface water quality data will be integrated into and delivered with the project
database. Manuals in printed and electronic form will be included to guide users in accessing
information from the database. These manuals will be developed in parallel with stakeholders at
different levels of technical expertise in mind, so that all may have equal ability to use the
information.

Task 3: Surface Water Quality Monitoring (Phases II and III)

The Task 3 deliverables will include a printed data compilation and analysis report for surface
water quality measurements at ISF and other sites identified under Phase II, a QA/QC report for
the water quality monitoring efforts, and a database of water quality information for use under
Tasks 2, 4, and 5. Data analysis will be provided in the form of time series plots, frequency
plots, and other graphical means, tables of summary statistics, and narrative analysis of the
information collected. The QA/QC report will document data quality for both the field and
laboratory analysis. The database will be integrated with other WRIA 1 database construction
efforts and will be available for use by the technical teams, Planning Unit, and other authorized
users.

Task 4: Surface Water Quality Model Development (Phases II and III)

The Task 4, Phase II, deliverables will be a proposed suite of models for consideration for
inclusion, and a detailed work plan for integration of data and models with the decision support
system, surface water quality model calibration, validation, and verification in WRIA 1, and
demonstration version of the surface water quality model system for a simple sub-watershed in
WRIA 1. For Phase III, the primary deliverable will be a working suite of surface water quality
models linked to the database, model parameter sets that are suitable for use within WRIA 1
(subject to review by the technical teams), uncertainty and sensitivity analysis modules to enable
the user to quantify the risk associated with a management action, and user’s manuals and help
systems to provide guidance for the use of the model.

Task 5: Integration of Surface Water Quality Information with Other Portions of the Study
(Phases II and III)

The deliverable for Task 5 will be in conjunction with the deliverable Decision Support System
(DSS). The surface water quality component of the DSS elements will be tightly integrated with
other elements and the database so as to be indistinguishable with the other DSS elements.
Task 6: Technical Team Training and Input: Model Functionality Design, Surface Water Quality Interface Design, Alpha and Beta Testing (Phases II and III)

Deliverables for Task 6 are activities: those of coordination with the Technical Teams, Planning Units and interested stakeholders to provide (a) interaction toward the development of the surface water quality subsystem in the DSS to ensure that its functionality meets the needs of the WRIA 1 process, (b) interaction toward the development of user interface that will provide technical interaction with the surface water quality elements satisfying a broad spectrum of users, (c) technical guidance in the use of the surface water quality component of the DSS, and (d) testing support for alpha and beta versions of the systems.

Task 7: Public Information and Education Forums: Surface Water Quality Modeling Demonstration and Instructional Sessions (Phase III)

The deliverable under Task 7 will be a training package for three levels of user: high level decision makers, scientifically competent members of the Planning Unit and technical teams, and users that are highly competent in the science and in the use of computers to solve problems. The primary difference among these choices is in the time and effort the users are likely to have available to modify any but the core set of parameters in evaluating alternatives. This approach is consistent with that described in Section 2.6 Management Information Systems/Decision Support Systems.

2.2.1.4 Schedule

It is anticipated that work on the surface water quality tasks will proceed according the schedule illustrated in Table 2.5.

Table 2.5: Surface Water Quality Schedule of Work

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2.2.2 Ground Water Quality

The ground water quality issues that are important in the WRIA 1 water management plan are impacts on public health in areas with poor drinking water quality, and preservation of aquifers to maintain good water quality. In order to develop a management plan to address water quantity and quality concerns, water quality impacts on water flow need to be considered. The quality of ground water in the aquifers of WRIA 1 is controlled by seasonal stream-aquifer interactions, agricultural practices, land uses, and population growth. In order to better understand the implications of alternative management actions, water quantity and quality related processes and the corresponding impacts within the WRIA 1 study area need to be studied. This section, therefore, will focus on tasks related to ground water quality.

Previous discussions with WRIA 1 technical teams and other activities, such as field trips and literature review of previous studies, indicated the presence of three distinct geographical areas: (1) the Upper Watershed portion of the basin consisting of high elevation forest land that is primarily managed by the US Forest Service, the Washington Department of Natural Resources, and private timber companies, in which forestry is the principal source of contamination in the form of temperature and fine sediment; (2) the Rural Lowlands part of the basin that has low relief, where activities and failing septic systems are the principal sources of water quality problems in the form of ammonia-N, dissolved oxygen, temperature, pH, and fecal coliform: and (3) the Coastal Lowlands consisting of the most populated and industrialized areas, in which the principal sources of contamination are roads, construction, stormwater from residential and industrial areas, and direct discharge of industrial pollutants in the form of heat, turbidity, pH, dissolved oxygen, mercury, fecal coliform, pentachlorophenol, methylphenol, benzoic acid, phenol, phthalates, chlor dane, PAHs, lead, zinc, and copper. (Source: State of the Nooksack River Watershed, Department of Ecology, Nooksack Initiative, Nov. 1995) The Abbotsford-Sumas aquifer, located in the northern part of the lower basin, is the most water bearing aquifer of the region, and has high permeability. Due to the presence of large amounts of water in this aquifer, the northern part of the rural and coastal lowlands is used for industrial and agricultural activities. North of the US-Canada boundary and around cities such as Abbotsford and Sumas, large-scale berry farming and poultry industries are present. Much of the nitrogen-rich fertilizer and organic carbon-rich chicken manure from the poultry industry is used in berry farming in the Canadian side, and this practice by Canadian farmers has apparently produced high concentrations of nitrate in ground water in surrounding areas. Since the regional ground water gradient is from north to south towards the main stem of the Nooksack River, there is a strong possibility that some of the nitrogen species in ground water may be entering from the north. Other sources, such as landfills, are possible as well.

The western part of the lower basin, for example, areas close to Cherry Point and Blaine, has many industries and future expansion of the local economy requires good quality water. One of the key concerns in the area is identification of good water resources and allocation of water. Towards the south of the lower basin, agricultural activities are limited, but instream flows, salmon restoration, and fish habitat are of primary importance.

A detailed study of water quantity and quality issues in this basin requires a good understanding of surface and ground water issues. Due to soils with high runoff characteristics, and the high
recharge into the basin from rainfall during the winter, much of the land is poorly drained and has a shallow water table. During the summer months, the water table can be expected to fluctuate around six feet. This shallow water table has produced seasonal exchange of water between surface and ground water and therefore, corresponding mass fluxes of contaminants. Drainage ditches constructed by local farmers to lower the water table during farming seasons further complicate the drainage problem. The stream-aquifer interaction is especially important along the main stem of the Nooksack River where the ground water gradient is towards the river from either side. Excess contaminant loading from ground water to the Nooksack River may be causing harmful impacts on fish habitat. Previous discussions with stakeholders indicated the presence of high coliform counts in certain segments of the Nooksack River and associated tributaries that have forced the closure of shellfish beds. In order to properly understand water quality, this seasonal mass exchange between surface and ground water needs to be studied and quantified through field data and modeling, and future field monitoring. Such efforts need to be coordinated with those of the existing shellfish protection districts and other relevant groups.

The work performed during Phase I indicated the presence of many contaminants in ground water. These chemicals include nitrogen species, pesticides, heavy metals, inorganics such as phosphorous, iron, and manganese, pathogens including viruses and bacteria, and chlorides due to salinity, marine deposited sediment dissolution, and salt-water intrusion especially along the coastal aquifers. Since high nitrate concentration is the main ground water quality concern among stakeholders, the work proposed in this study will focus heavily on understanding the fate and transport of nitrogen species in ground water, and to a lesser extent on other chemicals. With this emphasis in mind, modeling tools and related analysis given by Tasks 1 through 10 will be developed to address nitrogen related concerns and diagnostic modeling activities given by Tasks 1 through 4 only will be performed for other constituents.

Since ground water quality is directly linked to corresponding ground water flow, data, results, and conclusions drawn from various stages of the ground water quantity analysis will be used in this work.

2.2.2.1 Objectives

The overall objective of the ground water quality study is to assist the decision-makers to select the best management alternative to address water quantity concerns without violation of water quality standards in the basin. The specific objectives of the study are as follows:

1. Evaluate the temporal and spatial trends of contaminant migration in ground water of different aquifers of the WRIA 1 study area using historical and current data.

2. Identify the chemicals of concern, sources of contamination, mass loadings from different sources, mass fluxes between surface and ground water, and background concentrations of contaminants using available data.

3. Using the information obtained from (1) and (2), identify and conceptualize the fate and transport processes including geochemical, biological, and physical mechanisms controlling contaminant migration through different aquifers.
4. Develop a system of modeling tools to predict the migration of contaminants of concern at regional- and local-scale of the aquifer system with calibration and verification performed using available data.

5. Evaluate the applicability of the proposed system of modeling tools in decision-making relevant to future water allocations, surface and ground water interactions, instream flows, land use changes, agriculture practices, and urban development. The modeling tools will be refined if necessary based upon the evaluation.

2.2.2.2 Detailed Work Plan

The following tasks provide a work plan for achieving the ground water quality objectives.

Task 1: Development of Ground Water Quality Database

A comprehensive database will be developed of all decision-relevant ground water quality constituents using available sources of data. The sources may include USGS, Washington State Department of Health, Washington State Department of Ecology, Conservation Districts, City and Municipality Offices, Tribal Offices, private sector, and individuals. The data will include areal locations of monitoring, depth of monitoring, type of soil, aquifer classification, related hydrogeological information obtained from ground water quantity analysis, time series data of the constituents, and additional remarks related to QA/QC. The parameters will include nitrogen species, heavy metals, pesticides, dissolved oxygen, other inorganic contaminants such as chlorides, iron, phosphorous, and manganese, coliforms, temperature, pH, specific conductance, and total dissolved solids.

Task 1 will be completed by October 31, 2000.

Task 2: Diagnostic Modeling of Ground Water Quality Data

A series of diagnostic modeling activities will be performed to determine the historical and current trends of contaminant migration in different aquifer systems and surface and groundwater interactions such that temporal and spatial trends can be determined. These pre-modeling activities may include simple statistical modeling, nonparametric statistics to evaluate seasonal behaviors, local-scale mass fluxes between surface and ground water at pre-determined areas, cumulative mass changes, analytical and semi-analytical physical modeling of selected processes, and geochemical interactions. Candidate sites to quantify mass fluxes between surface and ground water may include segments of the Nooksack River, Fishtrap Creek, and any other surface water tributaries with seepage data.

Diagnostic modeling activities will also provide information related to:

- Missing data gaps at different monitoring locations
- Locations where future monitoring is needed
- Information on water quality parameters that needs to be included in future monitoring
- Assessment, in conjunction with surface water quality data, of the connectivity between surface and ground water
Using the knowledge gathered from this task, a set of recommendations related to future field data collections and monitoring will be made to the WRIA 1 technical team.

Task 2 will be completed by December 31, 2000.

Task 3: Determine Baseline Concentrations of Ground Water Quality Constituent

Using the information obtained from Task (2), the baseline concentrations of individual constituents will be determined by geographic area and/or geological formation. This information can be readily used to identify the chemicals that are present due to natural occurrences versus those chemicals that are produced due to various land uses. Future decision-making related to preservation of ground water quality depends on sources of pollution and the mechanisms by which these sources can be controlled.

Task 3 will be completed by December 31, 2000.

Task 4: Determine Ground Water Constituents of Concern

Chemicals of concern in ground water will be identified using various water quality criteria such as drinking water standards or statewide beneficial-use standards and baseline concentrations identified through Task 3, sources of contamination, and implication of land use and agricultural practices on future loading of these chemicals of concern.

Task 4 will be completed by December 31, 2000.

Task 5: Perform Basin-wide Mass Balance for Selected Constituents

A basin-wide transient mass balance will be performed for chemicals of concern using existing data for a selected number of years to assess the cumulative changes of contaminant mass in the basin under existing land use and agricultural practices. If sufficient data are available, the analysis will also include predevelopment conditions of the basin as well.

Task 5 will be completed by March 31, 2001.

Task 6: Develop a Conceptual Model for Fate and Transport of Nitrogen Species

Using the information gathered from previous tasks, conceptual models will be developed for simulating the fate and transport of nitrogen species in ground water. The conceptual models will include a regional-scale model for the lowland area of the Nooksack Basin and a local-scale model(s) for a selected number of areas where nitrogen is of great concern. This model will necessarily include biogeochemical transformations of nitrogen among relevant species (nitrate, ammonia, organic nitrogen, nitrogen gas), and the interactions of the nitrogen species with aquifer materials and other subsurface chemical constituents that dictate nitrogen mobility and availability to microorganisms. These fate factors will be coupled with mass transport equations in the overall description.

Task 6 will be completed by March 31, 2001.
Task 7: Select Appropriate Local-scale Ground Water Mass Transport Model(s) for Nitrogen

An appropriate mathematical model will be selected to simulate local-scale fate and mass transport of nitrogen species. The model will be calibrated and verified for use in subsequent simulations. The local-scale modeling will include transient vertical two-dimensional cross-sections along transects at selected areas of interest. The model will be selected from a pool of well-accepted public domain computer models, and shall be able to accommodate the processes described in the conceptual model.

The objectives of local-scale modeling are to produce a simulation tool that can focus carefully on the processes at a more microscopic level, determine the relative importance of different fate and transport mechanisms under varying hydrogeological conditions, quantify mass fluxes and concentrations, and assess the sensitivity to input data and scenarios. The information gathered from this task over a set of local areas can be useful in subsequent regional-scale modeling. For example, if mass fluxes between surface and ground water can be calibrated and verified through these simulations, then this information can be used in regional-scale modeling with much less uncertainty. These models can also be used to compute the nitrogen loading to ground water via the unsaturated zone due to surface nitrogen sources; for example, the model will be able to simulate the nitrogen transport due to excess organic nitrogen and the results will produce travel times and loading rates to ground water. Another example will be to determine the nitrogen mass flux across the surface water-ground water interface in local ditches and drains to predict the mass loading to the shallow water table. Each model representing a given study area will be calibrated and verified using existing time-series data.

The areas to be simulated will be dependent on stakeholder concerns, data availability, and relative order of importance among competing sites. However, at least one study will be conducted in an area with drainage ditches and tile drains to assess the nitrogen mass exchange between surface and ground water, nitrogen loading rates, travel times, and natural attenuation potential of different nitrogen species.

Task 7 will be completed by September 30, 2001.

Task 8: Select Appropriate Regional-scale Ground Water Mass Transport Model(s) for Nitrogen

An appropriate mathematical model will be selected to simulate regional-scale fate and mass transport of nitrogen species based on the conceptual model developed in Task 6, and the necessary calibration and verification will be performed on the model. The objective of the regional-scale model is to develop a simulation tool for basin-wide applications that can be used to assess the long-term cumulative impacts that might result from a variety of competing management decisions related to water quantity.

The regional-scale transient fate and transport model may consist of a single layer vertically averaged model or a comprehensive three-dimensional model with multi-layers. The final selection of the model will depend on the conceptualization of the regional-scale problem and data availability for model calibration and verification. In addition, the information from previous tasks will be utilized to determine the dominant geochemical processes controlling the nitrogen cycle, and only the dominant species in ground water will be simulated. If data and
results from previous tasks suggest that nitrate and one or more of the other nitrogen species need to be simulated, then the model should be able to simulate reactive nonlinear mass transport. The candidate public domain numerical models for both non-reactive and reactive transport are SUTRA, MT3D, RT3D, and BIOPLUMEIII. These models can be readily used, with some modifications, to suit the WRIA 1 conditions.

Key input data needed for simulation include hydrogeological, mass transport, and reaction kinetic parameters. Hydrogeological information will be supplied through the ground water quantity analysis. Mass transport and reaction kinetic parameters may be obtained from pre-modeling activities, literature from sites with similar characteristics, or calibration. A part of the time-series data will be used for model calibration where site-specific information is not available, and the remaining portion will be used for verification. In addition, the model will be tested for parameter sensitivity. It should be noted that all modeling efforts related to ground water quality will be performed in close cooperation with ground water quantity analysis to ensure continuity of data and knowledge transfer between processes.

Task 8 will be completed by December 31, 2001.

Task 9: Integrate Ground Water Quality Models in the DSS

The local- and regional-scale fate and transport models and relevant databases will be integrated with the proposed GIS-based decision support system (DSS), and appropriate management scenarios will be developed for modeling. Since the key deliverable under the WRIA 1 water management plan is the DSS, it is important to transfer and test the linkage of ground water quality models within the DSS environment. Once the testing is completed, the models will be used to evaluate a variety of management scenarios in terms of their expected impacts on ground water quality. In order to develop these scenarios, the integrated approach to include water allocation, instream flow, fish habitat, land use, and growth will be considered and discussed with other project personnel and stakeholders. Based on the set of management alternatives selected to address water quantity issues, the corresponding ground water quality modeling scenarios will be developed.

Task 9 will be completed by March 31, 2002.

Task 10: Simulate Management Scenarios Related to Nitrogen Transport

The management scenarios developed for the watershed plan in Task 9 will be simulated to demonstrate the applicability of the ground water quality models. In order to perform these simulations, the data availability and data transfer between different GIS-based databases and modules will be checked and verified. Thereafter, the simulations will be performed and checked for accuracy and reliability using the site-specific knowledge gathered during data analysis and conceptual model development. In addition, the sensitivity of the simulation results to critical input parameters will be evaluated using appropriate statistical tools and the corresponding information will be incorporated in the DSS to assist the users.

Task 10 will be completed by June 30, 2002.
2.2.2.3 Deliverables

Task 1: Development of Ground Water Quality Database

A comprehensive database will be provided of all decision-relevant ground water quality parameters obtained from various sources. The information will include time-series data together with specific information related to each monitoring location.

Task 2: Diagnostic Modeling of Ground Water Quality Data

A detailed report will be developed of diagnostic modeling activities performed on ground water parameters. It will provide information on (a) current and historical variability of ground water quality, (b) seasonal trends and summary statistics, (c) relevant mass fluxes between surface and ground water, (d) cumulative mass loadings, (d) dominant geochemical processes controlling fate of chemicals, and (e) data gaps and recommendations for future field monitoring.

Task 3: Determine Baseline Concentrations of Ground Water Quality Constituent

Summary tables will be prepared of baseline concentrations of chemicals in various aquifers based on site-specific data and those reported in the literature for similar hydrogeological conditions.

Task 4: Determine Ground Water Constituents of Concern

A report will be provided that describes chemicals of concern present in ground water, sources of pollution, relevant contributions from various land uses, and the known and potential impacts on ground water quality due to current management practices.

Task 5: Perform Basin-wide Mass Balance for Selected Constituents

A report will be developed that provides information related to transient cumulative mass balance of chemicals of concern in the basin over a selected number of years. The information will also provide mass loading from various land use activities, mass flux exchanges between drainages and surface/ground water bodies, cumulative mass in different media, and cumulative mass degradation in ground water.

Task 6: Develop a Conceptual Model for Fate and Transport of Nitrogen Species

A report will be delivered that documents the details of conceptual models related to the regional-scale fate and transport model for the lowland area of the basin, and similar details on the local-scale models at selected areas of the basin.

Task 7: Select Appropriate Local-scale Ground Water Mass Transport Model(s) for Nitrogen

A set of calibrated and verified ground water models will be produced in Task 7 to simulate fate and transport of nitrogen species at selected areas of interest, especially in areas with drainage ditches and drains. It will include a user-guide for the models. The user-guide will provide information related to theoretical aspects of the conceptual models, model calibration and verification, example simulations, and model sensitivity to key input parameters.
**Task 8: Select Appropriate Regional-scale Ground Water Mass Transport Model(s) for Nitrogen**

A calibrated and verified ground water model will be provided in Task 8 to simulate nitrogen species at a regional-scale. A user-guide will provide information related to theoretical aspects of the conceptual models, model calibration and verification, example simulations, and model sensitivity to key input parameters.

**Task 9: Integrate Ground Water Quality Models in the DSS**

A report will be delivered that describes the links and modules of the DSS related to ground water quality databases and models, guidelines related to data selection and simulations, and information on different management scenarios that can be used in decision-making.

**Task 10: Simulate Management Scenarios Related to Nitrogen Transport**

A report will be provided that describes the simulation results of the management scenarios developed within the DSS, and guidelines to modify these scenarios with corresponding changes in other modules related to water quantity.

**2.2.2.4 Schedule**

It is anticipated that work on the ground water quality tasks will proceed according the schedule illustrated in Table 2.7.

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<td>Chemicals of Concerns</td>
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<td>Mass Balance Analysis</td>
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<td>7</td>
<td>Local-Scale Modeling</td>
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<td>DSS Integration and Mgmt. Scenarios</td>
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<td>10</td>
<td>Simulations</td>
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</table>
2.3 Instream Flow (SOW Section 3.1.4.7)

2.3.1 Objectives

The objective of the instream flow component of the WRIA 1 Watershed Management project is to estimate the relationship between streamflow and fish habitat quantity and quality for different fish life stages at selected locations throughout WRIA 1. Specifically, this effort will estimate ecological flow regimes necessary to sustain target fish species and life stages and other related flow dependent resources in WRIA 1. The effort will use the best available science, which will include the evaluation of the methods utilized, and development of a systematic framework to evaluate and estimate the instream flow requirements for the targeted fish species and life stages. Estimated flow regimes will consider sustainability issues.

The instream flow study locations listed below were selected by the Instream Flow Technical Team during the Phase I scoping efforts for the 2000 field season (i.e., Phase II). The selection process was conducted in coordination with Utah State University (USU), participants in the salmon recovery effort, participants in the Whatcom County Comprehensive Flood Management Program, and members of the water quantity and water quality technical teams. It is anticipated that after the stratification process, an additional 30 or more sites will be selected and studied during the 2001 field season (i.e., Phase III).

The criteria used to select these sites included: existing data on fish use (e.g., spawner survey results, electroshocking records), management implications, site representativeness, and the location of instream flow quantification sites established by the Washington Department of Ecology in 1986.

<table>
<thead>
<tr>
<th>Number</th>
<th>Stream Name</th>
<th>Reach Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Whatcom Creek</td>
<td>Woburn Street to Meador Street</td>
</tr>
<tr>
<td>2</td>
<td>Bertrand Creek</td>
<td>Badger Road to H Street</td>
</tr>
<tr>
<td>3</td>
<td>Fishtrap Creek</td>
<td>Bender Road to Badger Road</td>
</tr>
<tr>
<td>4</td>
<td>Tenmile Creek</td>
<td>Northwest Avenue to Hemmi Road</td>
</tr>
<tr>
<td>5</td>
<td>South Fork Nooksack R.</td>
<td>Acme (Highway 9) to Saxon Road</td>
</tr>
<tr>
<td>6</td>
<td>Anderson Creek</td>
<td>Smith Road to Kelly Road</td>
</tr>
<tr>
<td>7</td>
<td>Middle Fork Nooksack R.</td>
<td>Mosquito Lake Road to Confluence</td>
</tr>
<tr>
<td>8</td>
<td>North Fork Nooksack R.</td>
<td>Racehorse Creek to Kendall Creek Hatchery</td>
</tr>
<tr>
<td>9</td>
<td>Nooksack River Estuary</td>
<td>South of Marine Drive</td>
</tr>
<tr>
<td>10</td>
<td>Nooksack River Mainstem</td>
<td>North of Slater Road to PUD Intake</td>
</tr>
<tr>
<td>11</td>
<td>Nooksack River Mainstem</td>
<td>Northwood Road to Abbott/Noon roads</td>
</tr>
<tr>
<td>12</td>
<td>Nooksack River Mainstem</td>
<td>Upstream of Everson Bridge (Highway 544)</td>
</tr>
<tr>
<td>13</td>
<td>Nooksack River Mainstem</td>
<td>Downstream of confluence, Upstream of Deming</td>
</tr>
<tr>
<td>14</td>
<td>Dakota Creek</td>
<td>Delta Line Road to Burk Road</td>
</tr>
</tbody>
</table>

Previous efforts to define potential field collection strategies and analysis approaches based on best available science resulted in the development of a detailed scoping document: “A Conceptual Framework and Technical Approach For Assessing Instream Flow Needs In the Water Resources Inventory Area No. 1 (WRIA 1) in Washington State” (Hardy 2000).
following section outlines specific technical tasks necessary to meet the objectives of the
instream flow assessment component of the WRIA 1 Watershed Management Project based on
the implementation of the approaches outlined in Hardy (2000).

2.3.2 Detailed Work Plan

The following tasks provide a work plan for achieving the instream flow objectives.

Task 1: Delineation of Specific Study Site Locations

The delineation of specific study site locations task was initiated during the week of June 19th
and entailed site visits to each of the 14 study reach locations identified above to select the
specific study site location where intensive field data collection will be undertaken. Technical
Team members participated in this selection process.

Task 1 will be completed by July 31, 2000.

Task 2: Field Data Collection

Based on the specific study site locations and characteristics, the appropriate methodologies
outlined in Hardy (2000) will be implemented during the 2000 field season. These efforts will
include reach and site (meso- and micro-) level habitat mapping; physical characterization of the
stream channel topographies; measurement of water surface profiles and velocity distribution;
substrate characterization; riparian vegetation identification and delineation; woody debris
frequency, position, and size; invertebrate samples; water quality and temperature measurements
(as specified in the Water Quality Section); and related data. The objective of these data
collection efforts is to obtain a spatially accurate characterization of each study site (and reach)
to develop suitable hydraulic and habitat models necessary to evaluate the instream flow needs
for the site. The instream flow assessments will also include measuring water quality parameters
such as temperature. Three site visits are targeted for site characterization (see Hardy 2000).

During the 2000 field season appropriate study sites, parallel data collection efforts using
multiple field collection strategies will be implemented. As an example, the staff working on the
instream flow elements of the project will coordinate data collection efforts across water quality
and quantity data collection efforts. These data are needed for the instream flow element and the
water quality component and the coordination effort as a means of making efficient use of
available staff and financial resources. In addition, early in Phase III (i.e., winter 2001)
alternative modeling approaches will be evaluated to determine the most cost-effective means of
meeting study objectives in light of quantitative modeling results obtained in Phase II. In all
instances, the adopted QA/QC procedures for calibration of instrumentation, specific collection
methods, data recording, and data reduction will be followed.

Task 2 will be completed by December 31, 2001.

Task 3: Habitat Utilization Validation Data

The habitat utilization validation task will focus on the coordination of collection efforts at
intensive study sites. The goal of this effort is to obtain presence and absence data in a spatially
accurate manner in order to provide validation data for habitat suitability criteria and habitat
modeling. The anticipated level of effort will be determined through the coordination effort with existing management and monitoring programs already in place for the 2000 field season. In the event that ongoing efforts are deemed inadequate for the purposes of the WRIA 1 WMP and more focused and intensive efforts will be required during Phase III, specific recommendations for data collection efforts will be formulated.

Task 3 will be completed by December 31, 2001.

Task 4: Habitat Suitability Criteria Workshop

The technical scoping efforts identified the lack of site-specific Habitat Suitability Criteria (HSC) for target species and life stages for use in the modeling and evaluation of instream flows at each study reach. A HSC Workshop will be conducted during the early fall 2000 where existing Washington State Department of Ecology and Washington State Department of Fish and Wildlife and available literature-based HSC will be reviewed by local, state, and national species experts to reach consensus on species and life stage specific HSC for use in the instream flow evaluations in WRIA 1. The workshop dates, format, identification of specific technical experts, collation and distribution of literature-based HSC, and other necessary activities will be coordinated through the Instream Flow Technical Team. The result, which will be available by October 31, 2000, will be a report detailing the decisions made at the workshop.

Task 5: Updated Basin Stratification for Instream Flow Assessments

This task will rely on preliminary results from the Database Component efforts to evaluate the existing stratification of the WRIA in terms of instream flow assessment needs. This effort will focus on development of a stratification of drainages into homogeneous areas where stream systems have similar hydrologic, geomorphic, and biological characteristics as outlined in Hardy (2000). The purpose of this stratification is to assist in the selection of study sites during the Phase III 2001 field season to obtain representative assessment data throughout WRIA 1. Review of potential stratifications will be coordinated through both the Instream Flow and Fish Habitat Technical Teams during the fall of 2000 and in conjunction with Task 7. The updated basin stratification for instream flow assessments is scheduled for completion by November 30, 2000.

Task 6: Comparative Analysis of WDOE Instream Flow Requirements

The comparative analysis of Washington Department of Ecology (WDOE) instream flow requirements task will entail a critical evaluation of the current instream flow requirements developed by the WDOE based on the evaluation of the site-specific instream flow methods employed at selected "overlap" sites targeted for work both under Phase II and Phase III. The purpose of this evaluation, which will be completed by June 30, 2002, is to assess the relative level of existing protection afforded from flow levels developed from the WDOE approach in 1986 and those derived from existing techniques. This comparison will focus on technical modeling issues and not specifically in making alternative instream flow recommendations.
Task 7: Technical Evaluation of 2000 Field Studies and Phase III Study Site Selection

This task will focus on a critical evaluation of the data collection efforts employed across all 14 selected study sites completed during the 2000 field season. This evaluation will focus on determining what techniques worked adequately, which techniques need to be modified for specific types of systems, and how validation and verification of techniques will be implemented during Phase III activities. This task, which will be completed by March 31, 2001, will be implemented through technical coordination meetings with both the Instream Flow and Fish Habitat Technical Teams.

Task 8: Development of Estimated Ecological Flow Regimes

This task will focus on the development of an analysis and interpretation framework necessary to estimate optimal instream flows for fish species and life stages, and other flow dependent resources in the WRIA throughout the year. The analysis will focus on the integration and interpretation of physical habitat (i.e., micro-habitat), meso-habitat characteristics (i.e., water quality and temperature), hydrology, habitat and riparian maintenance flows, habitat time series (i.e., the time series of available habitat), and estimated growth rates. The integration of these factors is necessary to determine an ecologically based instream flow regime. This task, which will be completed by March 31, 2002, will also explicitly examine validation and verification of modeling results in light of known fish observations where suitable data are available.

Task 9: Development and Validation of Instream Flow Extrapolation Methodology

This task will focus on the development of an extrapolation methodology based on the generalization of site-specific modeling results for each stratum. The implicit assumption is that other similar streams contained within a particular stratum should respond in a similar fashion. This will be validated by collection of site-specific data of key system response variables (e.g., temperature, water quality, fish habitat) and compared to the generalized response based on the extrapolated predictions. The results of Task 9 will be available by March 31, 2002.

Task 10: Technical Training for Instream Flow Modeling Components

This task will provide a mechanism for technology transfer of field data collection methodologies, hydraulic and habitat modeling procedures, integration of physical, chemical, and biological modeling components, assessment of instream flows, and use of the instream flow extrapolation methodology. This technology transfer component is essential to ensure that the requisite quantitative and analytical foundation for these technical components is ‘transferred’ to personnel within WRIA 1. The results of Task 10 will be available by March 31, 2002.

2.3.3 Deliverables

Task 1: Delineation of Specific Study Site Locations

The primary deliverable for this task will be delineation and mapping of specific study site locations associated with each of the identified 14 study reaches for Phase II.
Task 2: Field Data Collection

The primary deliverables for this task will be: delineation of habitat availability within the study reaches, characterization of channel topographies, study site substrate and cover mapping, riparian vegetation elevation boundaries, water surface profiles at multiple discharges, velocity characterization at a minimum of two discharges, water quality and temperature parameters, macroinvertebrate benthic and drift characterization, site maps, photographs, and other field based parameters linked to the Fish Habitat Component of the study efforts.

Task 3: Habitat Utilization Validation Data

The deliverable for this task will be the site specific presence and absence data for target species and life stages at all intensive study reaches where coordinated field collections are possible during Phase II efforts. It is anticipated that this will be expanded under Phase III to include a broader range of sites and more seasonal collection efforts.

Task 4: Habitat Suitability Criteria Workshop

The primary product deliverable for this task will be the selection of species and life stage specific HSC for use in related WRJA 1 instream flow assessment modeling.

Task 5: Updated Basin Stratification for Instream Flow Assessments

The deliverable for this task will be an updated basin stratification scheme to guide field data collection and analyses under Phase III (Tasks 7 and 8) and serve as the basis for development of the extrapolation methodology discussed under Task 9. This will include close coordination under the Fish Habitat component of the study.

Task 6: Comparative Analysis of WDOE Instream Flow Requirements

The primary deliverable for this task will be a comparative analysis of the WDOE based instream flow requirements and those derived from application of the methodologies employed by the WRJA 1 process. Where appropriate, this will include the development of specific recommendations of how the current site-specific and the extrapolation methodology should be applied in developing instream flow recommendations. Evaluations and analyses will be conducted after the 2001 field season.

Task 7: Technical Evaluation of 2000 Field Studies and Phase III Study Site Selection

The deliverable for this task will be revised field sampling protocols for sites targeted for data collection during Phase III as well as the identification of the specific study reaches by strata. Field reconnaissance to select specific study sites for each study reach will be undertaken early in Phase III and follow the same (or revised) protocols used during the selection of sites in Phase II.
Task 8: Development of Estimated Ecological Flow Regimes for Fisheries Resources

The primary deliverables for this task will include the development of a consistent framework for the interpretation and application of site-specific and extrapolated methodologies to assess instream flow recommendations. This will include, but is not limited to, aquatic base flows, habitat and riparian maintenance, and general ecological flows (i.e., macroinvertebrates) that integrate physical, chemical, and biological processes. The deliverables will also include the calibrated hydraulic and habitat modeling components contained within the DSS.

Task 9: Development and Validation of Instream Flow Extrapolation Methodology

The deliverable for this task will include a report that details the developed extrapolation methodology and summary of the validation work, identification of uncertainty in the extrapolation method linked to specific strata, and recommendations for future efforts to reduce uncertainty where feasible.

Task 10: Technical Training for Instream Flow Modeling Components

This deliverable will entail three, one week technical training workshops for collaborators on the specific methods and modeling approaches used in the instream flow assessments. The first workshop will focus on the linkage between field data collection strategies and specific modeling approaches (e.g., one-dimensional versus two-dimensional modeling). This will include field data collection, data reduction, and QA/QC procedures. The second workshop will focus on hydraulic and habitat modeling and include model calibration and simulation procedures. The final workshop will focus on the integration of physical, chemical, and biological modeling components within the context of instream flow assessment and include use and evaluation of the instream flow extrapolation methodology. The technical training task will include written materials, videotapes, or other products to assist with ongoing technology transfer as local staff changes occur over time.

2.3.4 Schedule

It is anticipated that work on the instream flow tasks will proceed according to the schedule illustrated in Table 2.9.
### Table 2.9: Instream Flow Schedule of Work

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<tr>
<th>Task</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
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<td>Jul</td>
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<td>Sep</td>
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<tr>
<td>Delineation of Specific Study Site Locations</td>
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<td>Field Data Collection</td>
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<td>Habitat Utilization</td>
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<td>Habitat Suitability Criteria Workshop</td>
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<td>Updated Basin Stratification</td>
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<td>Comparative Analysis of Instream Flow Recmdns</td>
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<tr>
<td>Technical Evaluation of Field Studies and Phase III Study Site Selection</td>
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<tr>
<td>Estimated Ecological Flow Regimes for Fisheries Resources</td>
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<tr>
<td>Development/Validation of Instream Flow Methodology</td>
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<td>10</td>
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<tr>
<td>Technical Training for Instream Flow Modeling Components</td>
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### 2.4 Fish Habitat (SOW Section 3.1.4.8)

#### 2.4.1 Objectives

The primary objective of the fish habitat component of the WRIA 1 Watershed Management Project is to ensure that all relevant activities are coordinated with salmon recovery efforts. This includes the development of information that summarizes current and historic fish habitat and populations, evaluation of physical, biological, and chemical processes in terms of delineating good habitat, and evaluates factors limiting current finfish and shellfish populations throughout WRIA 1. In order to achieve this objective, each study component should facilitate data and/or analyses that assess the conditions and identify any specific locations where corrective actions are needed, and the type and extent of the problems that need such corrective action. Therefore, the following tasks have been identified.

#### 2.4.2 Detailed Work Plan

The following tasks provide a work plan for achieving the fish habitat objectives.

**Task 1: Collate Existing Habitat and Fish Distribution Data throughout the WRIA**

In conjunction with salmon recovery and other similar efforts, this task will primarily focus on the collation of existing data on habitat mapping and fish distributions throughout the WRIA. This effort will help in the instream assessment component of the project (Task 3) to link...
analysis of instream flow needs to appropriate timing and distribution of target species and life stages by specific stream reaches. This data will be incorporated into the database and information management systems discussed under that study component.

1979

Task 1 will be completed by March 31, 2002.

1981 Task 2: Integrate Study Activities, Data Collection Methodologies, and Analyses

1982

This task will be facilitated through technical coordination with the Instream Flow and Fish Habitat Technical Teams and focus on optimizing data collection strategies at instream flow study sites that will be of mutual benefit to on-going efforts for salmon restoration programs. This will also include the use of collected data and subsequent analyses for instream flows that specifically target data and analysis needs for salmon restoration at all study sites.

1989 Task 2 will be completed by March 31, 2002.

1990

2.4.3 Deliverables

1993 Task 1: Collate Existing Habitat and Fish Distribution Data throughout the WRIA

1994

The primary deliverable for this task will be the inclusion of identified critical data linkages for data sets within the database and information management systems. For example, species and life stage periodicity charts linked to specific sites for use in habitat time series analysis or water quality standards thresholds. This will include data visualization capabilities as identified through the technical coordination efforts.

1998

Task 2: Integrate Study Activities, Data Collection Methodologies, and Analyses

2000

The main deliverable for this task will be a report demonstrating the integration of data collection efforts at the instream flow quantification sites in a manner such that results can be used within the salmon restoration program. It will also provide the better coordination of site selection activities where appropriate such that study reaches and study sites can be identified to meet dual purposes under WRIA 1 and salmon restoration efforts. Finally, analyses undertaken as part of the instream flow assessments will be conducted in a manner such that, where feasible, results will have direct applicability to planning, assessment and monitoring actions within the salmon restoration program.

2.4.4 Schedule

2014 It is anticipated that work on the fish habitat tasks will proceed according to the schedule illustrated in Table 2.11.
Table 2.11: Fish Habitat Schedule of Work

<table>
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<tr>
<th>Task</th>
<th>2000</th>
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<tr>
<td></td>
<td>Jul</td>
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<tr>
<td>1 Collate Existing Habitat and Fish Distribution Data</td>
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<td>throughout the WR1A</td>
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<tr>
<td>2 Integrate Study Activities, Data Collection, Methodologies, and</td>
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<td>Analyses</td>
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2.5 **Geodatabase Management System**

2.5.1 **Objectives**

The primary objective of the geodatabase management component is to provide spatial and non-spatial data collection, translation, quality control, and display services in support of the USU investigation team. This effort will facilitate the team's need for a central depository of scientifically validated data for analysis and modeling efforts.

This effort will also support the development of the decision support system (DSS). It is anticipated that the DSS will have three generic software components: (1) a database management system (DBMS) and geographical database, (2) a model-based management system (MBMS) and model base, and (3) a dialogue generation and management system (DGMS). The data subsystem of the DSS proposed in this section will perform all data management tasks. That is, it will store, maintain, and retrieve data from the database, extract data from various sources, and perform similar tasks (see Figure 2). It will provide access to data as well as the control of programs necessary to get the appropriate data in the proper format. It will also feed directly to the model subsystem and the user interface subsystem.

**Figure 2: Framework of the Database Component of the Decision Support System**

![Diagram of geodatabase management system](image-url)
As a service to the WRIA 1 stakeholders, we will facilitate the networking of our assembled data set with other WRIA 1 data holdings, thereby enabling a data depository of WRIA 1 that includes items not necessarily used by the DSS. It is anticipated that this depository will be a part of the larger depository in development by the WRIA 1 Watershed Planning Project. The extent to which this depository (including a library of paper reports and maps) is assembled by the end of the contract period will largely be determined by the resources and cooperation of the WRIA 1 participants. The database will probably include datasets with water resource components in them that will not be used by the DSS.

As data are collected and compiled throughout the course of this project, access to this data will be provided to the cooperating entities through the web, subject to appropriate security and approval requirements.

2.5.2 Detailed Work Plan

The following tasks provide a work plan for addressing the database management objectives to be achieved.

Task 1: Assemble Data Catalog

This task will initially focus on the collection of all relevant electronic data. Data available in other formats (e.g. paper maps, reports, and tables) will be indexed within the database. Metadata (data about data) will also be assembled, assessed for quality where possible, and then cataloged for all the data sets used in the DSS. Where older datasets are cataloged, the index number from the “Catalog of Existing Information” will be maintained. Of particular interest will be an assessment of the quality and relevance of the data in conjunction with the USU and WRIA 1 Technical Teams. Metadata for older datasets that have no metadata will be created where it becomes necessary to do so to address various tasks in the USU technical studies in support of the development of the watershed management plan.

Task 1 will be completed by December 31, 2001.

Task 2: Collect Data Relevant to Decision Support System

In support of the USU science team, all data relevant to the modeling system as well as the decision support system (DSS) will be assembled. Geographic data will be transformed to a common UTM Zone 10 NAD 83 projection and datum. Vertical (3D) data will be referenced to the NADV 84 datum where possible. Non-electronic data will also be assembled for USU technical use and digitized where necessary. USU hopes to assist WRIA 1 Watershed Management Project personnel with the establishment of a permanent repository for non-electronic watershed data.

Task 2 will be completed by December 31, 2001.

Task 3: Setup Computer Server

A Windows NT based computer server with approximately 500 GB of RAID 5 storage will be assembled. The server will have RAID 5 redundancy so as to ensure down-times of no more
than 24 hours in the event of a disk failure. An Environmental Systems Research Institute (ESRI) Spatial Database Engine (SDE) and Internet Map Server (IMS) system attached to a database will be loaded on the server. All DSS-relevant data sets will then be loaded on the server. Concurrent with the data assembly and loading, a web server will be established based on ESRI ArcSDE and ArcIMS software. Web links will be established with stakeholder dynamic data sets. ArcView Shape and Grid formats will be the primary geographic exchange format, but it is anticipated that other formats will be required in specific cases. Eventually, it is anticipated that geodatabase objects will be the preferred exchange format as the implementation of the “object” GIS paradigm is implemented in WRIA 1. However, the transition to a geodatabase implementation will likely be gradual.

Task 3 will be completed by December 31, 2001.

Task 4: Design and Implement Database Management System

The design and coding of the database management system DBMS system will parallel the design and coding of the model-based management system. The Sequential Query Language (SQL) queries and reports will be designed and developed along with data translation and data distillation modules. A program interface to the DSS will also be designed and implemented. Developer tools for the Windows 2000 platform will be used in this work and it is anticipated that a variety of programming languages will be employed such as Visual C++, Visual Basic, Java, and Fortran. The choice of an enterprise-level database engine will be made in conjunction with the WRIA 1 database technical team.

Task 4 will be completed by June 30, 2002.

Task 5: Design WRIA 1 Interfaces

Two levels of web interfaces will be built for the purposes of data exploration. The first will be intended for public information and education. Every effort will be made to design this interface to be simple, intuitive, and appropriate for the layperson. The second interface will be designed for the level of expertise of the decision analyst. Policies dictating access to either level will be determined in discussions with IGs, PU, and Technical Teams. These interfaces will be integrated with the DSS interactive interfaces that will also be presented at these same two levels.

Task 5 will be completed by December 31, 2001.

Task 6: Provide Educational Sessions

Two training seminars will be provided to appropriate WRIA 1 personnel. These seminars will concentrate on the understanding of the GIS database structure along with ways to extract, transform, and visualize the data. The geodatabase training will be a prerequisite to the DSS training, which will include data analysis, scenario building, and more. A separate seminar will also be provided for all agencies sharing data with the WRIA 1 database.

Task 7 will be completed by December 31, 2001.

A technical manual appropriate for a future WRIA 1 data manager will be prepared that discusses the geodatabase and the database management system (DBMS) that is a part of the
overall DSS. The training sessions will provide initial understanding of geodatabase architecture, DSS programming, and model variables.

Task 6 will be completed by December 31, 2001.

2.5.3 Deliverables

Deliverables during Phase II will include:

1. A draft of a comprehensive decision-relevant WRIA 1 metadata catalog. This will reside in an MS Access database.

2. A report will be submitted that details a high-level component software design for the database management subsystem of the decision support system.

3. A draft data exploration interface appropriate for public information and education will be posted on the web. Only officially approved data sets will be made available via the web interface.

4. A draft data exploration interface appropriate for WRIA 1 stakeholders will be posted on the web. This website will be password protected and will allow access to most data sets (again as approved by the stakeholders). This web interface will likely provide full access to the USU WRIA 1 dataserver.

5. A detailed outline of the geodatabase portion of the DSS technical manuals.

Deliverable during Phase III will include:

1. A final submission of a comprehensive decision-relevant WRIA 1 metadata catalog. This will reside in an MS Access database.

2. A finalized data exploration interface appropriate for public information and education will be posted on the web. Only officially approved data sets will be posted.

3. A finalized data exploration interface appropriate for WRIA 1 stakeholders will be posted on the web. This website will be password protected and will allow access to most data sets (again as approved by the stakeholders). This web interface will likely provide full access to the USU WRIA 1 dataserver.

4. The entire contents of the USU WRIA 1 database will be transferred to the permanent WRIA 1 DSS/database server.

5. Final drafts of the geodatabase portion of the DSS technical manuals.

2.5.4 Schedule

It is anticipated that work on the geodatabase management tasks will proceed according to the schedule illustrated in Table 2.13.
### Table 2.13: Geodatabase Management Schedule of Work

<table>
<thead>
<tr>
<th>TASK</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
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<tbody>
<tr>
<td></td>
<td>Jul</td>
<td>Aug</td>
<td>Sep</td>
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<tr>
<td>1 Data Catalog Development</td>
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<td></td>
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<tr>
<td>Compile metadata catalog</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Facilitate WRIA 1 library</td>
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<td></td>
<td></td>
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<tr>
<td>2 Collect DSS-relevant Data</td>
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<td></td>
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<tr>
<td>Data set conversion</td>
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<td></td>
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<tr>
<td>Data compilation/collation</td>
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<td></td>
<td></td>
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<tr>
<td>3 Setup Computer Server</td>
<td></td>
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<tr>
<td>Purchase computer system</td>
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<td></td>
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<tr>
<td>Setup ESRI SDE/IMS</td>
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<tr>
<td>Load DSS-relevant data sets</td>
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<tr>
<td>Establish web links</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>4 Design/Implement DBMS</td>
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<tr>
<td>Design queries/report</td>
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<tr>
<td>Design translation/distillation</td>
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<tr>
<td>Program DSS interfaces</td>
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<tr>
<td>5 Design WRIA 1 Interface</td>
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<tr>
<td>Design PIE Web Interface</td>
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<tr>
<td>Design WRIA 1 Interface</td>
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<tr>
<td>6 Education Sessions</td>
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<td>Training seminars</td>
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<tr>
<td>Data Stakeholders meetings</td>
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</table>

### 2.6 Management Information/Decision Support System (SOW 4.0)

#### 2.6.1 Objectives

The ultimate use of the MIS/DSS is to assist planners in the development of a management plan for WRIA 1. Planners will require the capability to easily identify and explore trade-offs among competing management alternatives and policies. This requires a tool that allow its users to easily navigate the complex of data, models, and analytic methods that will be assembled from the water quantity, quality, in-stream flow, and habitat components of the project, all within the
context of available decision relevant variables, constraints, and management options. The purpose of this portion of the project is to construct such a tool, called a decision support system (DSS). The DSS will be the primary technical instrument with which the WRJA 1 planners will examine the database to construct the management plan.

Figure 3 shows example computer screens (interfaces) for the three levels of a DSS: (1) data visualization and modeling, (2) designing various alternatives, and (3) comparing or weighing differences between alternatives. The actual interfaces will be custom designed in close consultation with the WRJA 1 technical team.
Figure 3: Three Basic Elements of the Decision Support System
(with example computer screens or interfaces)
This Decision Support System (DSS) element of the WRIA 1 Phase II and III project is to take place in two parts, approximately split into the two phases. Phase II activities will focus on the development of the computer screens or views that the stakeholders/system users will be using interactively. This activity is intended to elicit input from the users at an early stage. This type of interaction is needed to ensure that the DSS software delivered during Phase III of the WRIA 1 project reflects the needs of users as closely as possible, with an eye toward the elements described below. During Phase III, the actual ‘construction’ of the DSS will take place, again interactively with frequent input from the WRIA 1 planning unit and the technical teams to ensure that the actual product meets user requirements as closely as possible. This interaction and beta testing will provide a means for testing the DSS as it is developed so coding and other errors that will inevitably crop up can be minimized.

Any decision making process can be structured into three major phases: (1) where are the problems, why are they happening and is there an opportunity for change?, (2) what are the alternatives, and (3) which alternative is best? These three phases are expressed more formally in Figure 3 (Simon, 1960). These three stages do not necessarily follow a sequential path, as at any point in the decision-making process, it may be necessary to loop back to an earlier phase. For example, one might develop several alternative solutions during the design stage, then discover that there is not enough data to determine whether any of them will meet the requirements for the decision problem. In this case, one loops back to the initial data collection phase prior to going down to the choice stage. Each phase of the decision-making process requires different types of information and is supported in a different (though complimentary) way in a decision-support system DSS.

The DSS to be built by USU will form the interface between the technical teams and the decision analysts or decision-makers. This interface will need to support activities associated with the first two phases described above and to a lesser extent, the third phase as determined by the WRIA 1 stakeholders as shown in Figure 4. Phase II activities will focus on a preliminary specification of what the interface will look like, beginning with the “Data Explorer and Modeler”, and then continuing with the “Alternative Builder” (design phase). During this phase, only initial discussions regarding the potential form of the “Decision Analyst” interface will be explored.
The goal in Phase II is, through iteration with the Planning Unit and technical teams, to design the structure of a software system that provides users with the means to populate this framework and provide guidance in its use. The bulk of Phase II effort will be in the conceptual design process, the development of the overall flow diagram, creation of ‘mock-up’ user interface elements, description of information needs and data flow, and identification of technical analysis needs (e.g., models, statistical methods). Underlying and in parallel with conceptual design of the DSS function are the software engineering elements needed in the actual creation of the code during Phase III.

It is anticipated that the DSS will have three generic software components: (1) a database management system (DBMS) and geographical database, (2) a model-based management system (MBMS) and model base, and (3) a dialogue generation and management system (DGMS) (see Figure 5). The data subsystem performs all data management tasks, i.e., stores, maintains, and retrieves data from the database, extracts data from various sources, and so on. It provides access to data as well as the control of programs necessary to get the appropriate data in the
proper format. The model subsystem contains the library of models and routines to manage and maintain them. It keeps track of all possible models that might be run during the analysis, as well as controls for running the models. The MBMS component links the various models so that the output of one model can be input into another model. The DGMS contains the mechanisms whereby data and information are input to the system and output from the system at a level appropriate for the user.

These three components comprise the software portion of the DSS and are contained in a computer. In addition, the decision-maker or user is considered to be a part of the system. The unique contributions of the DSS are derived from the interaction between computer and user.

The fundamental elements envisioned in the DSS tool, consistent with Figure 5, are detailed in three units: Data Explorer and Modeler, Alternative Builder, and Decision Analyst.

Figure 5: Software Elements of the Proposed Spatial Decision Support System

2.6.2 Detailed Work Plan

The following tasks provide a work plan for addressing the decision support system objectives to be achieved.

Task 1: Develop "Data Explorer and Modeler"

This DSS module will facilitate a holistic, integrative modeling, data collection, data assimilation, and data visualization approach that is driven directly by a variety of stakeholder needs in the WRIA 1 watersheds. A model toolbox and user interface will be developed that will facilitate an understanding of the complex physical interaction of processes that relate to critical water issues both present and future. A systems analytical approach will be used that recognizes that water quantity, water quality, instream flow, and fish habitat in a watershed are intimately tied to climatic fluctuations, to ecological conditions, to land use and other economic activity.
This module will facilitate the translation of the problem statement into technical structural elements. The DSS will provide problem-relevant information from the database or other sources, and will aid the user in distilling this information into decision-relevant variables (input data needs) criteria maps, constraint maps (e.g. water quality standards, water rights, and jurisdictional wetland delineation), and management options (e.g. restoration of in-stream flows, improved manure management, urban storm water control, and enforcement against illegal water uses).

This task will entail more than the assembly and connection of relevant models. It will require recognition of the key linkages across processes and actions that have positive and negative feedback to the whole from the part. Connections that may lead to an unstable behavior of the watershed system will be of great interest. The models implemented in the DSS will, to the greatest extent possible, be practical, decision-relevant, responsive to disparate stakeholder needs, legally defensible, operational with limited existing data, and capable of representing uncertainty through various scenarios of retrospective and predictive reality. Thus, (1) diagnostic tools (e.g., space and time data visualization, exploratory statistical analysis, formal calibration), (2) carefully selected physical/numerical/ statistical/conceptual/behavioral and prognostic tools (e.g., a distributed model of rainfall-runoff generation, a conceptual water balance model, or an analytical solution for contaminant transport), (3) strong visualization capability, and (4) an effective user interface will be developed.

The variety of problems in a complex watershed is likely to be large. The DSS will need to anticipate the needs of these problems through collaboration among USU technical personnel, the IGs and PUs, and Technical Teams. The process of brainstorming lists of needs, as was begun during Phase I, will be expanded upon and formalized as the Phase II process continues.

Problem relevant information comes in a variety of forms, from electronic databases and reports, to paper copies of reports, to field notes, to anecdotal input from stakeholders. This portion of the DSS will strive to provide electronically available information immediately, and will provide pointers to non-electronic information identified in the database by identifying the repositories of such information such as offices of federal, state, tribal, and local agencies, university and public libraries, individuals at universities, consultants, and involved stakeholders. The DSS will also facilitate the conversion of this data into formats through which the database can be updated.

Task 1 will be completed by June 30, 2002.

Task 2: Develop the "Alternative Builder"

The software module developed with this task will facilitate the invention, development, and analysis of a set of possible solutions (alternative courses of action) to problems identified and framed in the previous stage. Alternatives may involve actions such as increasing water availability through strategies that include, but are not limited to: conservation, water reclamation and reuse, voluntary water transfers, additional water allocations, additional water storage and water storage enhancement including aquifer recharge and recovery, implementing TMDLs, enhancing fish habitat, etc. (see WRIA 1 SOW, section 4.1). However, these actions must comply with the goals of the Watershed Management Act, as well as the constraints imposed by existing water rights along with state, federal, and tribal laws.
The "Alternative Builder" portion of the DSS will be designed to integratively model the effects of solution alternatives on decision-relevant variables and decision constraints. It will represent the decision situation by structuring and formalizing the available data and information about the decision problem. An example of this would be the creation of a table where decision-relevant variables or criteria are listed by row and various alternatives listed by column, with the values of each variable tabulated by alternative. Another example would be the development of criteria maps (maps showing the important decision-relevant variables), constraint maps (maps showing areas in which certain management options are not allowed or possible), and management maps (maps giving project and/or land use locations for each alternative. As it is difficult to anticipate all alternatives that may be of interest to stakeholders, the DSS will be designed to facilitate users in defining alternatives in their own terms by anticipating elements (e.g., hydrological or water quality needs, analysis methods, models, etc.) and links (e.g., geospatial connections among elements, identification of unintended consequences) from which user's may build alternatives.

Task 2 will be completed by June 30, 2002.

Task 3: Initiate Design of "Decision Analyst"

The design of "Decision Analyst" will be initiated during this project but will not likely be complete by June 2002. This module will facilitate the application of decision criteria (determined by the decision-maker) to the results of the alternative analyses. While the generation of solution alternatives is purely a part of the previous stage, the evaluation of alternatives is mainly a part of this stage. Each alternative is evaluated and analyzed in relation to the others in terms of a specified decision rule, or decision criteria. The WRIA 1 SOW, Section 2.2 indicates that specific criteria including "effectiveness criteria" and "feasibility criteria" will be developed to assist in ranking and selecting the best alternatives. The key design element is to provide all results from the alternative analysis that are relevant to some degree to the decision maker in a form this is easily digested and free from extraneous detail. The emphasis is the provision of information in a framework conducive to decision making, not the provision of decision criteria, or the decisions themselves. Each decision-maker differs in the path taken from information to decision. Anticipation of all paths during the design stage would be impossible. A flexible system designed specifically for WRIA 1 issues and decision-makers is therefore necessary.

The Decision Analyst will provide a flexible means by which "preferences", "judgment of importance", or "values", related to evaluation criteria can be inserted into or combined with the model outputs. Some of the choices for interfaces could be simple maps, tables, and graphs that are distillation of relatively complex decision criteria, decision variables, constraints, probabilities, management alternatives, and decision rules. The actual form and nature of the decision interfaces needed in WRIA 1 will require education of and input from the Technical Teams, stakeholders, and decision-makers throughout the study. It is not anticipated that a "working" Decision Analyst module will be complete by June 2002 and will likely only entail decision-relevant products (i.e., maps, graphs or tables) generated specifically for the June 2002 watershed management plan. In a future phase, it is hoped that the most commonly used product will be coded into a Decision Analyst interface.

Task 3 will be completed by December 31, 2001.
Task 4: Software Engineering

The above three tasks will be accomplished using sound principals of software engineering. The stages of software development include: (1) interface design, (2) module coding, and (3) beta testing. Associated with each of these stages will be the solicitation of input and reviews from the technical teams. The first alpha version of the DSS will be delivered in July 2001. Some major components will likely be missing at this time. A substantially complete beta version will be delivered in December 2001. This version will be capable of being implemented in the watershed planning process and will serve as the major shakedown version. Bugs and revisions will then be completed during the first and second quarters of 2002 and the final DSS will be delivered in June 2002.

During the alpha and beta testing periods, USU will provide two training sessions to the technical teams. On-going consultation on the use of the DSS software and associated models will also be given during this period. Public forums presenting the DSS along with the posting of the high-level web-based version of the DSS will not occur until the first quarter of 2002.

Task 4 will be completed by November 30, 2000.

Task 5: Training and Documentation

DSS training will be provided that will include data analysis and visualization, scenario building, and decision making. A separate seminar will also be provided for all agencies sharing data with the WRIA 1 database.

A technical manual appropriate for a future WRIA 1 DSS users will be prepared that treats all components of the DSS including the model-base management system (MBMS), the database management system (DBMS), and the dialog generation and management system (DGMS).

Task 5 will be completed by June 30, 2002.

2.6.3 Deliverables

Task 1: Data Explorer and Modeler

Phase II: A report and skeletal software demonstrating a draft interface design of this module of the DSS. This interface design will be demonstrated in the first quarter of Phase III.

Phase III: Two beta test versions of this module (including draft user manuals) will be delivered for testing by WRIA personnel. The first will be delivered in July 2001 and the second in December 2001. A final version of this module with interactive help and a printed user's manual will delivered in June 2002 following six months of application in the WRIA 1 watershed management planning process.
Task 2: Alternative Builder

Phase II: A report and skeletal software demonstrating a draft interface design of this module of the DSS. This interface design will be demonstrated in the first quarter of Phase III.

Phase III: Two beta test versions of this module (including draft user manuals) will be delivered for testing by WRIA personnel. The first will be delivered in July 2001 and the second in December 2001. A final version of this module with interactive help and a printed user’s manual will delivered in June 2002 following six months of application to the WRIA watershed management planning process.

Task 3: Decision Analyst

Phase II: A report will be provided summarizing the feasibility of implementing a formal Decision Analyst module in the DSS. If possible, some preliminary alternative implementations will be presented for review.

Phase III: If Phase II results indicate more formal development of Decision Analyst is warranted, a report (user manual?) and skeletal software demonstrating a draft interface design of this module of the DSS will be delivered during Phase III.

Task 5. Documentation and Training

Phase II: An outline of the DSS documentation will be prepared for review and comments.

Phase III: DSS training will be provided to WRIA 1 designates.

A draft technical manual appropriate for a future WRIA 1 DSS users will be prepared for review by December, 2001. The final draft will be submitted in June, 2002.

2.6.4 Schedule

It is anticipated that work on the DSS tasks will proceed according the schedule illustrated in Table 2.15.

Table 2.15: DSS Schedule of Work

<table>
<thead>
<tr>
<th>TASK</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Jul</td>
<td>Aug</td>
<td>Sep</td>
</tr>
<tr>
<td>1 Data Explorer/Modeler</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Interface Development</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Interface Coding</td>
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<td></td>
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<tr>
<td>Beta Delivery &amp; Testing</td>
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<tr>
<td>2 Alternative Builder</td>
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<tr>
<td>Interface</td>
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</tbody>
</table>
2.7 Development of Watershed Management Plan (SOW Section 4.1-4.3)

2.7.1 Objectives

The Watershed Planning Act requires that a watershed management plan be written. The objective of this study component is to help develop a Watershed Management Plan for WRIA 1 as described in Section 4.3 of the SOW.

2.7.2 Detailed Work Plan

The following tasks provide a work plan for addressing the objectives of the development of the watershed management plan.

Task 1: Develop a Final Outline and Content of the WRIA 1 Watershed Management Plan

This task will involve technical assistance to the WRIA 1 Watershed Management Plan Process to facilitate the development of a final outline and specific contents for the required plan. This will be accomplished through technical coordination with the IG/PU and technical teams throughout the study.

Task 1 will be completed by March 31, 2001.

Task 2: Develop Specific Watershed Planning Scenarios to Be Evaluated in the Plan

This task will focus on the identification of specific watershed planning scenarios that can be identified for inclusion within the watershed management plan based on available data and modeling results obtainable within the time and cost constraints of this existing effort. This process will be facilitated through coordination with the IG/PU and technical teams. Specifically, issue driven planning needs will be discussed and evaluated in light of required data and analysis needs, proposed management options, and development of criteria by which the proposed actions can be evaluated. It is anticipated that this effort will focus on 4 to 6 site-specific (or regional) issues that can be used to establish near term (i.e., 2-3 year) planning
horizons as well as clearly defining the process or framework by which the Watershed Management Plan can be used to assess existing and potential management needs.

Task 2 will be completed by September 30, 2001.

Task 3: Produce the WRIA 1 Watershed Management Plan with Linkages to the DSS

This task will focus on the use of the DSS to evaluate the scenarios identified under Task 2 as ‘case studies’ in the development and presentation of the Watershed Management Plan. This effort is intended to clearly show the use of the DSS system within the framework of the plan as a means to evaluate and implement watershed management options as part of the planning process.

Task 3 will be completed by June 30, 2002.

2.7.3 Deliverables

Task 1: Provide Technical Assistance in the Development of a Final Outline and Content of the WRIA 1 Watershed Management Plan

The primary deliverable for this task will be a finalized outline and content for the watershed management plan.

Task 2: Develop Specific Watershed Planning Options to Be Evaluated in the Plan

The key deliverable for this effort will be the identification of 4 to 6 specific planning scenarios that address existing and future management scenarios for locations within the WRIA.

Task 3: Provide Technical Assistance for the Production of the WRIA 1 Watershed Management Plan with Linkages to the DSS

The primary product for this task will be to provide technical help in the development of the WRIA 1 Watershed Management Plan that incorporates the evaluation of the planning scenarios from Task 2 and demonstrates the use of the DSS as a tool to identify, evaluate, and then implement watershed management scenarios.

2.7.4 Schedule

It is anticipated that work on the watershed management plan tasks will proceed according the schedule illustrated in Table 2.17.
Table 2.17: Watershed Management Plan Schedule of Work

<table>
<thead>
<tr>
<th>Task</th>
<th>2000</th>
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<td>Jul</td>
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2.8 Project Management and Public Involvement/Education (SOW Section 2.6)

2.8.1 Objectives

The main objectives for this component are focused on overall technical coordination among all study elements and facilitating information exchange within the WRIA 1 Public Involvement and Education (PIE) process.

2.8.2 Detailed Work Plan

The following tasks provide a work plan for addressing the project management objectives.

Task 1: Technical Coordination for Study Components

The focus of this task will involve two separate levels of effort. At the project level, Dr. Hardy and Dr. McKee will have overall technical management responsibilities for all components of the project. As indicated in the Utah State University Personal Service Agreement approved by the Initiating Governments Administrative Decision Makers, Section 315 states, “The Joint Board hereby appoints and the contractor hereby accepts the Whatcom County Executive, and his or her designee as the Joint Board’s representative for the purposes of administering the provisions of this Agreement”. Bruce Roll and John Sproul are the designated representatives for administering the USU contract. This will involve direct coordination between USU and their counterparts on the WRIA 1 Project Team, Dr. Bruce Roll and Dr. John Sproul. At the technical level, USU has assigned one or more Technical Team Leaders associated with each study component to parallel the Technical Team Leaders on the WRIA 1 Staff. The Technical Team Leaders at USU will have overall responsibility to manage the technical implementation of each study component in close collaboration and coordination with their respective Technical Team Leaders for WRIA 1. Each Technical Team Leader will be responsible for coordinating efforts within their respective technical teams.

Task 1 will be on-going throughout the life of the project.
Task 2: Technical Coordination between USU, IG/PU, and Other Collaborators

This task will entail regular exchanges of technical information, technical discussions via phone and/or specific meetings necessary to address technical issues and decisions as they arise, and development of specific technical recommendations by the USU Technical Team Leaders. Recommendations made by USU will be reviewed, discussed, and revised as necessary by the respective technical teams of the WRIA in consultation with other participants of the IG/PU. Once technical issues have been resolved through this process, it will be the responsibility of the USU Technical Team Leader to ensure that the recommendations are implemented accordingly under Task 1.

Task 2 will be on-going throughout the life of the project.

Task 3: Public Involvement and Education Coordination

This task is focused on providing required support for PIE activities associated with the WRIA 1 Watershed Planning Process. Personnel from USU will participate in a variety of public meeting forums where public involvement and education are the focus during the entire development process. This task will also entail responses to public information dissemination requests from the PIE coordinator in support of that program within WRIA 1.

Task 3 will be on-going throughout the life of the project.

Task 4: Coordination of Independent Review Panel

USU will submit to the IG/PU a list of 3 to 4 qualified individuals within each major study component who may potentially serve on an independent review panel for the project. The qualifications of each potential reviewer will also be provided. In addition, the IG/PU will also submit other potential reviewers and evidence of their qualifications. In consultation with the USU Technical Team Leaders, the WRIA 1 Technical Team Leaders will evaluate the combined list. A final list of recommended reviewers will then be submitted for approval by the PU and IGs. This panel will be responsible for review of the draft Phase III scope of work when submitted to the IG/PU in the Fall of 2000, and will provide additional reviews during the Phase III study activities. The specific timing of these reviews will be finalized during the development of the Phase III study scope. However, it should be noted that in the event that a specific technical study component is identified that may need a more focused review, the project management team will facilitate these reviews.

Task 5: Project Tracking

This Task will involve short monthly progress reports submitted by USU to the WRIA 1 Project Managers. It will be their responsibility to disseminate this material. These reports will highlight activities undertaken for all tasks during the previous month, indicate the percent completion for each task, and include budget expenditures by major work area (i.e., surface water quantity, ground water quantity, surface water quality, ground water quality, instream flow, fish habitat, database management, DSS, watershed plan, project management) for that month. The intent of this effort is not only to communicate project status and progress but also...
to provide information that will facilitate the quarterly project reporting requirements by the WRIA 1 staff team.

Task 5 will be on-going throughout the life of the project.

2.8.3 Deliverables

Task 1: Technical Coordination for Study Components

The primary deliverable for this task will be the successful completion of the proposed study.

Task 2: Technical Coordination between USU, IG/PU, and Other Collaborators

The main deliverable for this effort will be a clear administrative record of the technical decision process across all study components.

Task 3: Public Involvement and Education Coordination

Although it is difficult to anticipate all potential deliverables for this effort at this time, it is anticipated that summary information in the form of press releases, web page materials, public presentations, and briefings to various administrative and political bodies will be required.

Task 4: Coordination of Independent Review Panel

The initial deliverable for this task will be a compiled list of potential qualified reviewers developed by USU and the IG/PU. USU will work collaboratively with the IG/PU in the evaluation of the candidates and the IG/PU will be responsible for the final selection of the review panel. The number and types of reviews will be determined as part of the Phase III scoping process.

Task 5: Project Tracking

The principal deliverable for this task will be short monthly progress reports provided to the WRIA 1 Project Managers and include previous month expenditure summaries and percent task completion.

2.8.4 Schedule

The schedule of work for overall project management is illustrated in Table 2.19. As shown in the table, reviews by the independent peer review panel will occur in the second and forth quarters of 2001 and the second quarter of 2002.
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Table 2.19: Project Management and PIE Schedule of Work
WRIA 01
INTERIM SALMON RECOVERY PROJECT PRIORITIZATION
For the
Salmon Recovery Funding Board Second Round 2000 Funding Cycle

Introduction

A local Chinook recovery plan, describing a strategy for restoring chinook salmon in Water Resource Inventory Area (WRIA) 01 is currently in development. WRIA 01 encompasses the Nooksack River watershed and the adjacent drainages that enter the Strait of Georgia, and Bellingham, Chuckanut, and Samish Bays (Figure 1). Specific strategies and priorities will be defined in the chinook recovery plan and will be consistent with the policy direction outlined in the "Wild Salmonid Policy" (FWWC, 1997) adopted by the Washington Fish and Wildlife Commission and approved by Lummi Nation and Nooksack Tribe. This interim strategy provides a local framework for salmon recovery pending completion and policy approval of the larger plan. The interim strategy contains two components: (1) an interim set of stock priorities as determined by the salmon co-managers (Lummi Nation, Nooksack Tribe, Washington Department of Fish and Wildlife); and, (2) an interim watershed restoration strategy. In addition, there are four attachments to assist in application preparation and ranking. Attachment A contains directions regarding Lead Entity supplemental questions. Attachment B presents the scoring matrix to be used by the Salmon Habitat Restoration Citizens Advisory Committee for project ranking. Attachment C contains a listing of WRIA 1 Information and Restoration Group Resources. Finally, Attachment D contains the Lead Entity (LE) meeting schedule for submission and review of applications for the Salmon Recovery Funding Board Second Round 2000 Funding Cycle.

This interim strategy will be applied until such time as the participating local governments and salmon co-managers adopt the Recovery Plan. The interim strategy is drawn in large part from draft sections of the Chinook Recovery Plan and it is the intent for the interim strategy to be consistent with the policy goals and objectives contained in the "Wild Salmonid Policy" and, for federal lands, the aquatic conservation strategy of the President's Northwest Forest Plan (USDA and USDI, 1994). Salmonid stock priorities are identified below. Projects will be ranked on the ability to protect and restore key habitats, prevent illegal take of listed species, and/or refine knowledge of key factors and habitat functions that limit salmonid production within WRIA 1. Geographic areas that correlate with known habitat limitations for key lifestages of North and South Forks stocks of listed Nooksack chinook stocks are identified in Table 1.

Background

The interim strategy presented below puts onto paper the essential approaches that have already been informally implemented in WRIA 1 since the early 1980's. The emphasis has been to protect habitat that is still working, prevent damage by treating source areas, and restore habitat

\FOREST-IVOLI\USERSWATER\SHARED\Salmon\Grant materials\Nooksack Interim Restoration Strategy.doc
functions where the physical or biological process causal mechanism is well enough understood to have some confidence in the result. The Whatcom Land Trust (WLT), Whatcom County, the Lummi Nation, Nooksack Tribe, and others have been instrumental in acquiring key land parcels to further watershed protection objectives. Examples include: the WLT and County Parks parcels along the critical chinook holding and spawning habitats within the Saxon reach of the South Fork; the Lummi Nation/The Nature Conservancy Arlecho Creek partnership, also in the South Fork; and the Washington Department of Fish and Wildlife Marietta Slough project in the Nooksack Estuary.

Road and landslide inventories from the "Peak Report" (PEAK, 1986) documented a correlation between land-management activities and increased sediment production to, and damage of, fish habitats and have been an essential tool in the prevention of further impacts. Study results produced specific corrective actions (road obliteration, abandonment, drainage upgrades, etc.) for problem roads on National Forest, state, and private timber lands. Subsequent road and landslide inventories for the Nooksack upstream of Deming (e.g. Watts, 1996, 1997; Zander, 1996, 1997; Zander and Watts, 1998) have provided a more complete picture and guided extensive road drainage improvement, landslide hazard reduction, and abandonment activities.

Fish and habitat studies conducted during the 1980's (e.g. Schuett-Hames and Schuett-Hames, 1987; Schuett-Hames et. al., 1988; Schuett-Hames, Schuett-Hames, and Mike, 1988) helped shape a basic understanding of habitat factors limiting the production of chinook and other species and guided some of the first habitat restoration projects in the basin. These and subsequent data provided a fact based set of issues and priorities for the Nooksack Recovery Team (NRT). The NRT was formed as a non-profit organization in 1994 to provide a restoration forum in which those interested in watershed recovery could coordinate and collaborate. The NRT has succeeded in bringing the full cross-section of groups working on restoration together on a regular basis to solve problems, share resources, and plan restoration activities and public education opportunities. Examples of NRT members active at the project level include: Bellingham, Crown Pacific, Lummi Nation, Nooksack Tribe, Nooksack Salmon Enhancement Association (NSEA), Northwest Ecosystem Alliance, Trillium Corp., U.S. Forest Service, Whatcom County, Washington Departments of Ecology, Fish and Wildlife, and Natural Resources, Washington Trout, and the U.S. Forest Service. These groups have proven effective in working together and provide an established structure to "get-the-job-done" for watershed restoration.

INTERIM STOCK PRIORITIES

The interim watershed restoration strategy assigns the highest priority to assessment of biological limiting factors, targeted regulatory enforcement, and habitat protection and restoration projects which positively impact the recovery and production of the affected species and populations in the following order: (1) South Fork native chinook salmon; (2) North Fork native chinook salmon (includes Middle Fork); and (3) Nooksack bull trout (native char); (4) Nooksack wild
spawning coho salmon; (5) Nooksack native fall chum salmon; and, (6) Nooksack pink salmon. Important to ecological restoration, but not prioritized at this time, are winter and summer run steelhead, sea-run cutthroat trout, native fall chinook (if present), sockeye, and other resident native salmonids. Project ranking criteria are designed to reflect these stock priorities.

INTERIM WATERSHED RESTORATION STRATEGY

Introduction
Restoration can be generally defined as the "reestablishment of the structure and function of an ecosystem, including its natural diversity" (Cairns 1988 and NRC 1992 as cited in Williams et al. 1997). To be effective, watershed-scale restoration must be long-term, comprehensive, process-oriented, guided by best available science, and adherent to the principles of ecological restoration and adaptive management. While modification and enforcement of land use regulations may halt or slow watershed decline, active restoration will be necessary to reverse the decline and redirect the trajectory towards historic ecosystem structure and function (Williams et al. 1997). The scope of this interim watershed restoration strategy is such active, voluntary restoration, which integrates and builds upon past and present salmon recovery projects and planning.

Goals
The primary goals of the interim WRIA 1 watershed restoration strategy are to assess biological limiting factors, protect properly functioning habitats, and restore and maintain the landscape processes that form habitats to which wild salmonid stocks are adapted. Since funding is limited, prioritization is necessary to focus and direct restoration efforts in the near term towards recovery of the species most at risk, i.e. ESA-listed species. Over the long term, prioritization merely alters the sequence, rather than the types, of restoration projects (Beechie and Bolton 1999). Further, adopting a process-oriented approach based on a sound scientific understanding of the biological and physical processes limiting salmonid production ensures benefits to multiple species, even while benefits to priority species are maximized.

Since restoration must be implemented and evaluated at the watershed scale and over long time frames, institutionalization of restoration into communities and agencies will be necessary (Williams et al. 1997). Thus, the secondary goal is to encourage the establishment of coordinated watershed restoration programs through: (1) encouraging partnerships of restoration practitioners, resource managers, landowners and community stakeholders (e.g. Nooksack Recovery Team); (2) increasing knowledge, information and tools for watershed restoration and management; and (3) providing opportunities for community-based employment, training, and stewardship.

Objectives
The objectives of this watershed restoration strategy are to: (1) identify the ecological principles that should guide restoration planning; (2) provide general guidelines for specific watershed
restoration activities; (3) provide the framework for the sequence of steps necessary to develop a watershed restoration plan, including development of the adaptive management mechanism; (4) identify appropriate funding mechanisms to meet community needs; (5) outline an early action watershed restoration strategy targeted at Nooksack native chinook and other salmonid stocks according to the stock priorities identified above.

**Principles of Watershed Restoration**

This strategy is built upon the following principles of ecological restoration:

*Focus on disruptions to habitat-forming processes.* Restore ecosystems upon which endangered species depend by addressing the root causes, rather than symptoms, of watershed degradation. By restoring the natural rates and magnitudes of habitat-forming processes, such as providing for natural side channel formation within the channel migration zone, habitat conditions will naturally tend to express the array of habitat conditions to which local stocks are adapted (Beechie and Bolton 1999). Historical reconstruction is key to identifying disruptions to habitat forming processes. Implicit in the process-oriented approach is the move away from managing for static habitat conditions, instead restoring natural ranges of temporal and spatial variability in habitat conditions. For instance, natural channel migration may cause degradation of a side channel in one location while allowing for creation of similar habitats in other locations.

*Provide for life history-stage specific refugia and connecting habitats throughout the watershed.* It is important to consider the effects of habitat fragmentation, where functional habitat patches decrease in size and become isolated from one another, reducing the value of remaining habitat. High quality (fully functional) habitat should be protected first, followed by protection and/or restoration of habitats contiguous or near to existing high quality habitats. In the short-term, presence of such refugia should help stabilize the population, while in the long-term, refugia can provide colonists to the rest of the basin (Beechie & Bolton 1999). Further, protection of fully functional habitat is both cheaper and more likely to succeed than restoring degraded habitats (Hoobyar 1999). For any specific acquisition, sufficient property should be acquired to adequately protect and restore natural stream functions (e.g. meander belts for floodplain reaches).

*Prioritize critical habitat to priority species.* Priorities: (1) habitat currently used during key life stages (i.e. holding, spawning, summer juvenile rearing and winter juvenile rearing for chinook, estuary areas used by smolts making the freshwater to marine transition); (2) reaches that are naturally inaccessible, but, physically and/or hydrologically connected to reaches which chinook actually use and which are important for critical watershed processes; (3) habitat formerly accessible but still in functional condition and for which access can be restored. Where bottlenecks are discovered at particular life history stages, restoration of such habitats is the highest priority (Beechie and Bolton 1999).

*Symptoms (rather than causes) of degradation should be treated only as interim measures.* Habitat modifications (e.g. placing log structures and constructing spawning riffles) have experienced high failure rates in the past (Frissell and Nawa 1992), likely due to failure to consider the ecological and landscape contexts of habitat degradation (Beechie and Bolton 1999). Instream projects (e.g. engineered debris jams, habitat structures) and side channels may be constructed as interim measures when stocks are critically low, but such projects should both
be preceded by detailed assessment and conducted in conjunction with treatment of long-term effects (e.g. riparian revegetation). These assessments should consider those biological and physical factors that are beyond the project scope and that may affect the ability to evaluate project effect on improved biological functions. Such habitat modifications may be more feasible in smaller streams and less so in streams with elevated sediment loads, high peak flows, or highly erodible bank materials (Frissell and Nawa 1992). Similarly, carcass deployment is an interim measure to return to stream ecosystems marine derived nutrients, which were historically high due to large anadromous salmonid runs.

Employ critical pathways methodology. Projects are typically designed and implemented over relatively small temporal and spatial scales, yet there is a need to understand the larger spatiotemporal context, especially if several projects are planned for a sub-basin. Therefore, assessment and restoration planning needs to be coordinated at least at the reach, and preferably at the sub-basin, scale. Assessment should focus on the biologic, hydrologic and geomorphic processes that may affect project success. For example, high summer stream temperatures in the south fork Nooksack River are a symptom of many factors including changes in channel morphology that resulted from land management-related sedimentation, harvest of mature riparian forests, and removal of in-channel large woody debris. Replanting riparian areas is an important step to re-establishing shade and lowering stream temperatures but may be ineffective if undertaken in isolation. The watershed restoration strategy employed must also address reducing the sediment-related disturbances to the system and restoring the tools (i.e. large woody debris) that support essential natural physical and biological processes.

Maintain, monitor, and adaptively manage. Use best available science to design, implement and maintain the project, monitor and evaluate project success, and employ adaptive management principles.

Activity Guidelines (NMFS 2000)

Information for conducting watershed restoration projects can be found in many sources including the technical peer review literature. The References Cited, Information Resources for SRFB Second Round 2000 Applicants and from the groups listed on the WRIA 1 Salmon Recovery Resource List are also available to help assist in project development. The latter two can be found in Attachment C.

In general, "hands on" active watershed restoration activities should follow the habitat restoration guidelines and technical manuals referenced in "A Citizen's Guide to the 4(d) Rule" (NMFS 2000). Assessment studies should use standardized methodologies where they exist, or be designed by qualified experts with appropriate technical background. The intent of this interim strategy is to encourage assessment and habitat restoration projects that are well designed and which provide appropriate technical documentation to demonstrate how the project will protect and restore priority species. Projects that are thorough in design and clearly linked to restoration objectives and priorities may also have the added advantage of successfully negotiating the local, state, and federal permitting processes. It will be essential that sufficient time for acquiring the necessary permits be provided for in project timelines. All instream work is likely to require Federal agency project review, and proposed timelines and designs need to anticipate this.
Sequencing of Watershed Restoration

The sequence of necessary steps outlined below are adapted from Williams et al. (1997) and Beechie and Bolton (1999).

**Early action strategy.** Use existing data and expert opinion to identify critical habitats for various life history stages of North and South Fork chinook stocks. Such habitats should be targeted for protection and restoration. The interim limiting factors map (WCD 2000) and fish distribution maps (NWIFC 2000) can be used as interim guides. Supporting material will be further developed and refined using data from ongoing studies.

**Establish historical (and/or pristine) processes and conditions.** “Evolutionary context is essential to defining objective restoration goals; historical data often reveal ecological conditions that now are rare or unrecognized, but that help establish restoration goals” (Angermeyer 1997). Pristine habitats in the watershed, where they exist, or other watersheds in the region may provide a surrogate where historical data are lacking. The objectives of this step are to determine the range of natural conditions to establish what is within the realm of natural variability, and to estimate natural rates of habitat-forming processes (Beechie and Bolton 1999).

**Understand Human impacts and Limiting Factors.** Understanding what processes are causing habitat degradation and how those processes can be reversed is key to any watershed strategy (Frisell 1997). The Chinook Recovery Plan (in preparation) will collate existing data on general physical and biological factors limiting chinook production, but quantification of critical habitat parameters is necessary to identify bottlenecks. Implicit in this step are basinwide inventories of current habitat condition and use. Assessment of changes in rates of habitat-forming processes due to land use activities is also necessary.

**Develop Final Watershed Restoration Plans (by Sub-Basin).** Identify actions required to restore habitat-forming processes and key biological functions. For example, inventory blockages to passage, inventory road failure hazards, map riparian areas to thin or replant, identify floodplain habitats that can be reconnected or areas where dikes/rip rap could be setback or removed to restore floodplain function, or areas where salmon carcass placement may be beneficial. The Interim sub-basin priorities are identified in Figure 2; priorities will be redefined as necessary pending completion of limiting factors analysis.

**Evaluate probable improvement in local biological indicators for each task.** Projects must be evaluated using the best mix of quantitative and qualitative methods available (best available science). It is essential that the evaluation identify those physical (e.g. large woody debris, substrate size, temperature) or biological attributes (e.g. benthic macroinvertebrate diversity, hatchery outplants) that the project will affect and those attributes beyond the project scope that may affect project success. For example, placement of designed historic scale log jams may produce measurable physical habitat benefits to pool volume and habitat complexity yet utilization by rearing juveniles may not increase if the system is chronically under-seeded. Specific analyses that demonstrate the cause/effect relationship for watershed restoration projects are essential information as the local salmon co-managers (Lummi Nation, Nooksack Tribe, and Washington Department of Fish and Wildlife) assess limitations to fish production.

**Prioritize actions based on costs and potential improvement in biological indicators.** Use either a cost-benefit ratio, or establish the sequence of actions that produce the shortest recovery time for the priority stock.
Estimate costs. Estimate the total costs of restoration package, identify appropriate cost shares and in-kind contributions, and seek funding sources.

Implementation. Implement watershed restoration projects after sufficient assessment and design and using best available science.

Monitor and evaluate restoration success (ongoing). Monitor and evaluate individual projects, input data into centralized database (NRT GIS database), incorporate lessons learned into new restoration projects.

Adaptive management feedback loop. The local chinook recovery plan will provide a framework for adaptive management monitoring integrated into a WRIA-scale decision support system. In the interim, the Joint Technical Advisory Committee (JTAG) operating under the auspices of the salmon co-managers and Whatcom County will review monitoring data. JTAG will use assessment data to make recommendations to modify methods, target specific geographic areas, and make refinements to the limiting factors analysis and the watershed restoration strategy. In addition, the Nooksack Recovery Team (NRT) holds monthly meetings of watershed restoration personnel and hosts a yearly watershed symposium (Salmon Summit) to both share information and tools for successful restoration and engage the community in salmon restoration.

Sources of Funding

The ability to provide project matching funds, in-kind services, and administrative support has been key to optimizing the scarce grant resources available for salmon recovery. The salmon recovery cooperators of WRIA 1 were able to provide an average match of 43 percent for the Early 2000 SRFB funding submissions. This large match reflects the high level of cooperation and collaboration among those working on salmon recovery in WRIA 1. The list below provides an overview of possible sources of funding and match available to project proponents.

- State/federal agencies and private grants (e.g. Salmon Recovery Funding Board, Department of Natural Resources' Jobs for the Environment, U.S. Fish & Wildlife Service's Jobs-in-the Woods, Centennial Clean Water Fund, Bureau of Indian Affairs, National Fish and Wildlife Foundation).
- Solicit volunteers in cooperation with skilled local groups such as the Nooksack Salmon Enhancement Association (WDFW's designated regional fisheries enhancement group).
- Use existing public and private infrastructure including technical and administrative staff time and heavy equipment resources.
- Landowners are able to provide project match through direct coverage of project costs, through designation of conservation easements, donations of materials, donations of equipment time etc.
- Whatcom County currently funds two Washington Conservation Corps crews targeting riparian replanting and plant maintenance and is assessing fish passage at County road culverts.
WRIA 01 Early Action Prioritization Strategy

This is an interim strategy designed to: (1) maximize benefits to the top two priority stocks, North Fork and South Fork native early chinook, using the best existing information available; and (2) to begin the transition from opportunistic towards strategic watershed restoration planning.

Required Elements
- Eligibility (i.e. ineligible if there is legal obligation to perform proposed work; subject to funding agency requirements?)
- Monitoring and evaluation of project success?
- Stewardship plan (site maintenance and management)?
- Benefits one of stocks listed in interim stock priorities?

Ranked Elements

Benefit to Priority Species. Projects conducted in areas identified in Table 1 must explicitly address interim habitat factors for decline and demonstrate clear linkages with species benefits.

Consistency with sequencing. Maximum points are assigned to those projects that protect and restore most functional habitats, followed in order of decreasing priority by projects involving (1) filling critical data gaps necessary to identify bottlenecks, (2) restoration of less functional habitats, (3) assessment as part of final watershed plan.

Consistency with strategy. How well does project address root causes of watershed degradation? To what extent has critical pathways methodology been employed? Is project contiguous to other functional/protected areas?

Time scale of benefits. Are benefits immediate or long term and what is the expected useful life? If intent of project is to protect, what are the assurances over time (i.e. 15-year lease or into perpetuity…)?

Likelihood of success. Does project use proven methods? What is the readiness to conduct the work (design complete, permits obtained)? Is the entity conducting restoration or assessment appropriately qualified? Is the conceptual design likely to enable permits?

Cost-Effectiveness. Is the project necessary, i.e. will benefits accrue if we do nothing? (i.e. if acquisition, what protection do current land use regulations afford?) Does applicant quantify benefit (i.e. miles of habitat upstream of culvert)? What is Cost/Benefit? Does applicant provide match/leveraging of additional funds?

Coordination with other efforts. Are assessments complete? What previous projects have been conducted in subwatershed? Is there a subbasin recovery plan in place, integrates well with other land management activities? To what extent does applicant incorporate existing technical information (e.g. watershed analyses)?
Social and political context. To what extent does project include community-based employment (especially dislocated natural resource workers), stakeholder partnerships, and public outreach and education?
References Cited


USDA and USDI. 1994. Record of Decision for the amendments to Forest Service and Bureau of Land Management planning documents within the range of the Northern spotted owl and Standards and Guidelines for the management of habitat for late-sucessional and old-
growth forest related species within the range of the Northern spotted owl. Washington D.C. 74pp."


ATTACHMENT A

WRIA 1 Lead Entity Supplemental Application Questions

The Ranked Elements section (pages 8-9) of the Interim Restoration Strategy contains additional questions that are necessary to evaluate project viability and relative priority. It should be noted that the questions under the Ranked Elements section overlap in part with the SRF Board 16a and b Evaluation Questions. In order to avoid redundant application questions, additional questions beyond the required SRFB questions are not required. However, applicants should read and incorporate the information required of the Ranked Elements into the six Evaluation questions required by the SRFB. These responses will serve as the basis for local scoring the of Ranked Elements. Failure to incorporate these elements into responses to Evaluation questions will result in a lowered score or no rank for the application.
ATTACHMENT B

WRJA 1 Lead Entity Screening Score Sheet and Instructions
To be used for the SRFB Second Round 2000 Grant Applications (see attached excel file)
Numerous non-profit and governmental organizations are currently engaged in watershed and salmon recovery within WRIA 1. The listing below is intended to help guide those engaged or interested in salmon recovery towards available resources and is not an endorsement of any group. May not include all groups.

**Non-profit Organizations**

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<tr>
<td>1.</td>
<td>Nooksack Recovery Team</td>
<td>P.O. Box 28598</td>
<td>Bellingham, WA 98228-0598</td>
<td>(360) 319-0628</td>
<td>Pat Smith, Board President</td>
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<td>2.</td>
<td>Nooksack Salmon Enhancement Association</td>
<td>P.O. Box 2535</td>
<td>Bellingham, WA 98227-2535</td>
<td>(360) 715-0283</td>
<td>(360) 715-0282 (fax)</td>
<td>Wendy Scherrer, Executive Director</td>
<td></td>
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<td>3.</td>
<td>People for Puget Sound</td>
<td>407 Main Street, Suite 201</td>
<td>Mt. Vernon, WA 98273</td>
<td>(360) 336-1931</td>
<td>(360) 336-5422 (fax)</td>
<td><a href="http://www.pugetsound.org">www.pugetsound.org</a></td>
<td>Britta Eschete, Outreach Coordinator</td>
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<td>4.</td>
<td>Skagit Watershed Council</td>
<td>407 Main St, Suite 205</td>
<td>Mt. Vernon, WA 98273</td>
<td>(360) 419-9326</td>
<td>Shirley Solomon, Executive Director</td>
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## Government Agencies

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<td>Natural Resource Department</td>
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<td>Environmental Resources Division</td>
<td>2616 Kwina Road</td>
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<tr>
<td>2221 Pacific Street</td>
<td>Bellingham, WA 98226</td>
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<tr>
<td>Bellingham, WA 98226</td>
<td>(360) 384-2267</td>
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<tr>
<td>(360) 676-6850</td>
<td>(360) 384-4737</td>
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<tr>
<td>(360) 676-7799 (fax)</td>
<td>Jim Hansen, Restoration Coordinator</td>
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<td>Clare Fogelsong, Superintendent</td>
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<td><strong>3. Nooksack Tribe</strong></td>
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<td>Mt. Baker District</td>
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<tr>
<td>Deming, WA 98244</td>
<td>2105 State Route 20</td>
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<tr>
<td>(360) 592-2632</td>
<td>Sedro Woolley, WA 98284-9393</td>
</tr>
<tr>
<td>(360) 592-5753 (fax)</td>
<td>(360) 856-5700</td>
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<tr>
<td>Treva Coe, Restoration Coordinator</td>
<td>Jon Vanderheyden, District Ranger</td>
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<tr>
<td>Nooksack Field Office</td>
<td>Watershed Stewardship Team</td>
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<tr>
<td>1204 Railroad Avenue, Suite 200</td>
<td>C/o Whatcom County Public Works</td>
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<tr>
<td>Bellingham, WA 98225</td>
<td>5280 Northwest Road, &quot;White House&quot;</td>
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<tr>
<td>(360) 738-6250</td>
<td>Bellingham, WA 98226</td>
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<tr>
<td>Mark Henderson, Water Quality Specialist</td>
<td>(360) 676-6730</td>
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<td>Steve Seymour, Fisheries Biologist</td>
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<td>7. Washington State University</td>
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<td>Cooperative Extension Service</td>
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<td>(360) 738-2458 (fax)</td>
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<td>Craig MacConnell, Extension Faculty, Chair</td>
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<td>6975 Hannegan Road</td>
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<tr>
<td>Lynden, WA 98264</td>
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<tr>
<td>(360) 354-2035</td>
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<tr>
<td>(360) 354-4678 (fax)</td>
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<td>George Boggs, District Manager</td>
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<td>John N. Thompson, ESA Coordinator</td>
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</table>
| 1. | Marine Resources Committee  
   | C/o Whatcom County Water Resources Division  
   | 1000 N. Forest Street, Suite 203  
   | Bellingham, WA 98226  
   | (360) 676-6876  
   | (360) 738-2468 (fax)  
   | Bruce Roll, Water Resource Division Manager/MRC Chair | 2. | Salmon Habitat Restoration Citizen Advisory Committee  
   | C/o Whatcom County Water Resources Division  
   | 1000 N. Forest Street, Suite 203  
   | Bellingham, WA 98226  
   | (360) 676-6876  
   | (360) 738-2468 (fax)  
   | John N. Thompson, ESA Coordinator |
ATTACHMENT D

Proposed
WRIA 1 Meeting Schedule for SRFB Second Round 2000

<table>
<thead>
<tr>
<th>Date</th>
<th>Item</th>
<th>Location (if applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>August 31, 2000</td>
<td>First rough draft of proposals due. Opportunity for Lead Entity to</td>
<td>Water Resources Meeting Room, 1000 N. Forest</td>
</tr>
<tr>
<td></td>
<td>provide feedback to applicants with assistance from members of</td>
<td></td>
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<tr>
<td></td>
<td>JTAG and the CHC.</td>
<td></td>
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<tr>
<td>September 15, 2000</td>
<td>- Final application packages due by 4:30 p.m.</td>
<td>Whatcom Conservation District, 6975 Hannegan</td>
</tr>
<tr>
<td></td>
<td>- Draft Lead Entity responses due</td>
<td>Rd., Lynden, WA 98264</td>
</tr>
<tr>
<td>September 22, 2000</td>
<td>JTAG meets for technical screen, projects sorting, and draft</td>
<td>Water Resources Meeting Room, 1000 N. Forest</td>
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<tr>
<td></td>
<td>recommendations. Provide technical review of and revisions to</td>
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<tr>
<td></td>
<td>Lead Entity Materials.</td>
<td></td>
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<tr>
<td>September 28, 2000</td>
<td>CHC meets to discuss applications and LE materials. Consults with</td>
<td>Water Resources Meeting Room, 1000 N. Forest</td>
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<td></td>
<td>JTAG members for technical questions and guidance if necessary.</td>
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<tr>
<td>October 5, 2000</td>
<td>If necessary, CHC meets to complete application review. Consults</td>
<td>Water Resources Meeting Room, 1000 N. Forest</td>
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<tr>
<td></td>
<td>with JTAG members for technical questions and guidance if necessary.</td>
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<tr>
<td></td>
<td>CHC produces ranked project list.</td>
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<tr>
<td>October 10, 2000</td>
<td>WRIA 1 Joint Board meets. Local process is reviewed and Board is</td>
<td>Water Resources Meeting Room, 1000 N. Forest</td>
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<tr>
<td></td>
<td>briefed on final rankings.</td>
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<tr>
<td>October 24, 2000</td>
<td>Final copies of applications due to the Whatcom Conservation District</td>
<td>Whatcom Conservation District, 6975 Hannegan</td>
</tr>
<tr>
<td></td>
<td>by 4:30 PM from the applicants.</td>
<td>Rd., Lynden, WA 98264</td>
</tr>
<tr>
<td>October 30, 2000</td>
<td>Application Package and Lead Entity materials due to SRFB.</td>
<td></td>
</tr>
</tbody>
</table>

Prepared by Christine Woodward, Wizards Consulting Services, Julie Hirsch, Hirsch Consulting Services and the Drayton Harbor Shellfish Protection District Advisory Committee
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Executive Summary

During this quarter of the grant cycle, several additional issues regarding pollution in Drayton Harbor and more particularly the Blaine Marina have been more specifically addressed. More cooperation has been forthcoming from some of the agencies involved. The Puget Sound Restoration Fund has joined in the efforts of the Drayton Harbor Shellfish Protection District Advisory Committees (DHSPDAC). Boundary Bay and Georgia Basin Ecological Initiative work groups are including DHSPDAC in their efforts to improve water quality in Boundary Bay/Semiahmoo Bay.

Whatcom County Health Department has with the exception of one or two units completed its upgrading of the OSS systems in the Drayton Harbor immediate drainage area.

The City of Blaine has made numerous improvements: (1) Infiltration of storm water from Blaine school district buildings and from an 8th Street improperly abandoned section of sewer pipe have been stopped. (2) A defective flap valve upstream of Lift Station # 1 has been replaced. (3) A standby tank has been installed and extra emergency storage units ordered for use in case of any future overflows. (4) A monitoring system has been installed to determine source of problems within the city's system. (5) The Interim City Manager has suggested a couple of back to back open educational Council meetings on just their storm water and sewer system situation. (6) A study is underway of the Corrosion Control system on the underwater sewer pipe to the STP. (7) Negotiations are ongoing with the Indians and conversations between Blaine and Birch Bay on possible solutions to watershed wastewater problems are embryonic.

The video project that was developed last year, is in the final stages of contract negotiations. (see attachment # 1). 8100 linear feet of gravity fed line will be video surveyed and problems captured by video will be identified and prioritized. With help from Betsy Peabody of the Puget Sound Restoration Fund, the bid process was completed and an independent contractor was located and a bid for survey work was completed. Gelco Services of Kent Washington, will be awarded the bid for an estimated $12,775.00 to complete the survey of the sewage lines. Nine thousand dollars from DOE that the City is to pay for an outstanding fine from overflows along with five thousand dollars from the City of Blaine will pay for the video project. All monies not used for the completion of this project will be put into a fund for Phase Two. This survey will help in determining which if any portions of the sewage collection system near to marine areas are likely contributing to fecal contamination of these waters. Problem areas will be identified and recommendations for further investigation and repair will be made. The Advisory Committee recommends that this project get under way as soon as possible.
Hirsch Consulting has established a water quality database and a Coordinated Water Quality Monitoring Plan for Drayton Harbor (see Report #1). A Report Card has also been developed that gives a ‘snap shot’ of water quality data collected by SDOH. (see attachment # 6&7) for latest update.

With the help of the WSU Cooperative Extension office, a Web site is being developed.

Work is progressing with the Boundary Bay and Georgia Basin Ecological Initiative work groups. A Cross- Boundary workshop tentatively called "Shared Waters", A Cooperative Approach to Restoration of Shellfish Growing Areas which will specifically deal with shellfish issues and downgrades involving Canada based Boundary Bay Workgroup and groups and agencies concerned with Drayton Harbor, is in the process of being developed. The date for the workshop is slated for the middle of September. This workshop is the first in a series that will provide an avenue for cooperative effort at solutions to potential pollution issues shared in common between the two countries regarding shellfish issues.

These projects, along with Implementing Agency progress towards the end goal, are beginning to make a difference in the serious water quality issues that have plagued Drayton Harbor. These agencies, along with the determined Advisory Committee, are beginning to see changes in attitude, responsibility and commitment towards improved water quality in and around Drayton Harbor.
Objective One: Establish Coordinated Water Quality Program for Drayton Harbor

Whatcom County Council, Department of Ecology, City of Blaine, Lummi Nation, Nooksack Indian Tribe, Whatcom County Health and Human Services, Port of Bellingham, Whatcom Conservation District, Puget Sound Water Quality Action Team, State Department of Health, Blaine Sewer Plant.

The Drayton Harbor Shellfish Protection District Advisory Committee (DHSPDAC) has been meeting on a monthly schedule. Through this dedicated work group of volunteers, issues that present themselves as threats to the water quality of Drayton Harbor have been first and foremost tasks. It is through this group that recommendations are made to the implementing agencies holding them accountable to their responsibility for the water quality of Drayton Harbor. These issues are then reported to the Natural Resource Committee on a quarterly basis.

It is the job of Whatcom County and Council to identify and pursue funding sources including grants and loans for program implementation.

Accomplishments:

Task 1: Update appointments, roles and responsibilities for Citizens Advisory Committee.

Ongoing meetings on a monthly basis. In January of 2000, a formal set of By Laws was adopted and formalized by the DHSPDAC. A set of signed documents was sent to County Council for formal adoption. (see attachment #2) Ten committee members are on board. (see attachment #3). In January of 2000, Geoff Menzies was elected as chairman and Jan Hansen as vice chairman.

Task 2: Convene an implementation work group consisting primarily of agencies with implementation responsibilities.

Two quarterly meetings have been held since the last reporting date in September. (See attachment #4 for member list).

Task 3:
Convene joint meetings of Citizen Advisory Committee and Implementation work group subcommittees to track progress and to resolve issues. Provide updates to council.
Ongoing.

Task 4: Identify and pursue grants and loans for program implementation.

A Public Involvement and Education grant (PIE) grant was prepared and submitted for the Shellfish Districts to adopt the Pledge Program which would have targeted shellfish protection districts in Whatcom County. This would have been the beginning of a great educational tool and raise awareness of the shellfish issues in the community. With help from The Conservation District the grant was written and submitted. Unfortunately, it was not accepted.

A grant from the Dept. of Ecology for $9,000.00 will be used for in-pipe camera survey of Blaine's sewer system from approximately the eastern end of Marine Drive to the western terminus of Marine Drive. Contracts are being finalized between the City of Blaine, the Dept. of
Ecology, and Puget Sound Restoration Fund. Puget Sound Restoration Fund will be administering monies for the project due to Blaine’s lack of staffing.

**Task 5: Secure dedicated funds for implementation using the Shellfish Protection District or other means.**

In 1999, the Whatcom County Flood fee was increased to 1993 level. The state and government have issued mandates that require the County to implement special water resource planning and programs. While the County seeks other funding, state law allows flood funds to be used for special projects that protect water quality. Under this umbrella, shellfish districts are included. Upon completion of the DHSPDAC Plan scheduled for May, 2000 the committee representatives will schedule a meeting with the Water Resources Division to discuss the Drayton Harbor Recovery Plan and funding options under the Flood Tax.

**Recommendation:**

1. **There is a need to establish a percentage of the flood fee for water quality improvement programs in the Drayton Harbor Watershed. The funds need to be directed to the appropriate agency. A reporting program for their use should be established.**

**Objective Two: Identify Pollution Sources & Monitor Water Quality**

Department of Ecology, DHSPDCAC, County staff, NWIC

A coordinated water quality-monitoring program must measure the effectiveness of the Drayton Harbor Closure Response Strategy. A monitoring plan should include indicators of water quality, shellfish health, land use, education, effectiveness of project and regulatory actions. It is expected that the Drayton Harbor strategy will be constantly evaluated and adjusted according to information yielded from an ongoing program. Without monitoring, there will be no way to measure the effectiveness of spending these resources on implementation. A coordinated monitoring strategy will be responsible for maintaining a database, interpreting and summarizing data of monitoring reports and evaluating trends.

**Task 1: Determine cost and evaluate benefits of conducting a TMDL study.**

**Expedite a TMDL study in Drayton Harbor**

Prior to this year, the earliest Drayton Harbor was being considered for a TMDL study was approximately 2004. This year, the Nooksack Indian Tribe is pursuing a job request to the Department of Ecology’s Washington State Environmental Assessment Program (EAP) which may move the TMDL process up in priority.

**Task 2: Develop a coordinated water quality-monitoring program to identify pollution sources and to track changes in water quality.**

The Northwest Indian College (NWIC) and State Department of Health (SDOH), continue to monitor in Drayton Harbor and the Drayton Harbor watershed, (see Report #2). This year, SDOH will cut back on sampling in Drayton Harbor from monthly sampling to every other month (See attachment #5). A Coordinated Water Quality Monitoring Plan has been developed for Drayton Harbor. (See Report #1). Beginning in July of 2000, the Port will enter into their long term water
quality monitoring plan as required by the permitting agencies for the Blaine Harbor expansion. This will add to the testing currently being done. The Dept. of Ecology will continue to monitor Drayton Harbor as part of their ambient monitoring plan for Puget Sound.

**Task 3: Develop Memorandum of Agreement for sampling agencies based on Coordinated Monitoring plan.**

The Memorandum of Agreement (MOA) was developed in the Coordinated Monitoring plan. Implementation of the MOA is expected to be completed Spring of 2000.

**Task 4: Review Drayton Harbor watershed studies since 1973 and creates an abstract bibliography, which will be available in hard copy and on the web site.**

**Task 5: Obtain a commitment for ongoing long-term water quality plan development and funding.**

**Objective Three: Control On-Site Sewage Sources.**

Many of the existing on-site sewage systems (OSS) on or near the Drayton Harbor shoreline and along California and Dakota Creeks, predate design and installation requirements. Fifty-four percent (54%) of the residences are greater than 20 years old. Previous survey work in this area has revealed that 38% of the systems evaluated did not meet current design standards. In 1995, an intensive survey of 252 OSS revealed 54 failures. This is a failure rate of 21%. To date, 53 OSS have been repaired.

**Task 1: Assure repair of failing On-Site Sewage Systems (OSS) in accordance with WCC 24.05.**

In 1999, 12 repair permits were issued for failing OSS in the Drayton Harbor Watershed. These failures have been repaired. These are based on routine complaint investigations. There is still one failure identified in the survey that is pending eviction/court action. The alternative system survey was a part of a Interlocal Agreement between Whatcom County and the City of Bellingham. Six alternative OSS were surveyed in the Drayton Harbor Watershed in 1999. All 6 systems were functioning adequately. $154,000 from a 1997 Special Onsite Shellfish Grant was spent on this project.

**Task 2: Develop county wide OSS Operation and Maintenance Program with initial implementation in sensitive areas such as Drayton Harbor.**

Regulatory changes necessary to implement OSS O&M Program approved by County Council in November 1999.

**Task 3: Pursue State Revolving Fund money to establish county wide low interest loan program for repair of failing OSS.**

Work plan developed, agreements with implementing agencies in process. Program implementation by end of 2nd quarter 2000.

**Task 4: Continue to enforce OSS regulations (from May 1995 Closure Response Strategy CRS)**
Task 5: Place a high priority on complaints to Whatcom County Health Department filed in the Drayton Harbor Watershed. (OS-23 from 1995 Watershed Plan) Report to DHSPDAC annually on complaints filed and actions taken in the watershed.

Task 6: To date, Drayton Harbor has not been designated under WCC 24.05 Sewage Regulation as an Area of Special Concern. Consider specific attention to development regulations (storm water management, limit percentage of impervious surface, cluster development) prior to formation of LID and delivery of sewer service. Designation of Drayton Harbor as Area of Special Concern will be discussed and proposed later this year.

Task 7: Require proof that functioning OSS as a prerequisite for all real estate transactions. (title transfer) (OS-29 from 1995 Watershed Plan).

Objective Four: Control Stormwater Sources

Stormwater runoff is a source of fecal coliform pollution. In urban areas, pet waste and other non-agricultural sources are the primary sources. In rural areas, stormwater can carry bacteria from agricultural operations, non-commercial farms or on-site septic systems.

Task 1: Investigate potential sources impacting priority storm water drainage around the entire shoreline of Drayton Harbor. Report findings to DHSPDAC and take prompt action to abate pollution sources when found. This task is based upon priority/problem drainage's as identified in the WWU 1995 Fecal Coliform Contamination Study of Drayton Harbor, by Cykler, Haggerty, and Matthews. No comprehensive shoreline monitoring is being be done by DOE, City of Blaine, Whatcom County or any other entity at this time.

Task 2: DNA testing to evaluate fecal coliform in Drayton Harbor. Testing is complete but fairly inconclusive. No final report has ever been received.

Task 3: Control pet waste within Blaine City limits with the introduction and installation of pooper scooper stations. Is proving to be very beneficial in collection in other watersheds.

Recommendations
1. The City of Blaine should create an ordinance requiring that pet waste be removed from city streets, alleys and parks.
2. The City of Blaine should enlist the services of a DHSPDAC member to advise the City in the development of a shoreline stormwater monitoring program.
Objective Five A: Control Municipal Sewage Sources.
City of Blaine, Department of Ecology (DOE)

Since the 1995 shellfish downgrade, Blaine has experienced numerous combined stormwater/sewer overflows along Marine Drive. Storm water entering the sewer system overloads the Blaine Sewage Treatment Plant (STP), resulting in design capacity being exceeded.

Shellfish Protection Progress Update from the City of Blaine
This Objective is a summary of City of Blaine progress toward the reduction of point and non-point-source fecal coliform contamination entering Drayton Harbor. Progress includes start up of the storm-water utility, the stepwise addition of offline storage resources, Lift Station No. 1 improvements, collection system inflow & infiltration reduction activities, flow monitoring, collection system modeling, and cathodic protection system evaluation for the Drayton Harbor force main crossing.

Stormwater Utility Start Up

Blaine adopted a series of enabling ordinances in the fall of 1999, and will send the first bills for storm-water utility service in March 2000. The monthly residential fee of $4.00 will provide capital reserve funding for construction of system improvements and operating funds to cover a greatly enhanced level of maintenance including catch basin cleaning, more frequent street sweeping, ditch cleaning, and detention pond/bio-swale inspection. The highest ranked capital project planned includes installation of storm drainage in areas of older Blaine that presently have an underdeveloped stormwater collection system and illicit sanitary sewer connections.

Offline Storage

In late January 1999, the City made piping modifications that enable the use of the adjacent 60,000-gallon clarifier/tank. On December 15, 1999 an additional 20,000-gallon portable storage tank was placed at Lift Station No. 1.

A purchase order was issued March 16, 2000 for four 50,000-gallon bladder tank storage units. The City will install and test these storage units and develop an operating procedure for their use in early May when they are installed.

Lift Station No. 1 improvements made in 1999 and early 2000:

1) Programmable Logic Controller (PLC) improvements included:
   a) Changed controller call for 100% pump power earlier during high flows. Previously, lines would surcharge before both pumps would operate at full power.
   b) Installed delay timer for power failure pump call. Prior to this installation, the controller would call for both pumps at 100% during power failure, resulting in extreme fluctuation of wet well level. This change also allows generator startup of pumps individually.
2) Installed pump seal failure relays and alarm lights, providing warning of impending motor failure.
3) Reset of warning lights and installation of transducer beam protector, enabling improved communication and facilitating staff investigation of high level alarms and drive failures.
4) Repaired flow meter, enabling instantaneous flow monitoring and continuous data recording.
5) Installed pressure indicator on pump discharge.

Additional repairs are planned for Lift Station No. 1 later this spring, including replacement of guide rails broken at the bottom of the wet well, inspection and possible replacement of discharge piping, and a general inspection of wet well integrity. Additional repairs may be deemed necessary after this inspection and consultation with CI2M HILL and DOE staff.

In order to accomplish repairs and inspection, the lift station must be taken off-line and wastewater must be pumped around the existing lift station to the treatment plant. In preparation for this pump around, staff has installed piping to enable a pump around, purchased inflatable plugs, and identified the source of a large rental pump. These preparations allow staff to pump around if both of our existing pumps fail at once.

The City will proceed with bidding and selection of a contractor to complete this work upon incorporation of DOE staff comments.

**Continue to reduce inflow & infiltration in the Blaine Sanitary sewer system.**
This spring, summer and fall, staff conducted smoke and dye testing of the older portions of the City’s wastewater collection system. Based on these results, 49 letters were sent illicitly connected addresses including homes, businesses, and schools. With staff assistance and occupant cooperation, 40 illicit connections were repaired, and three others are in progress. This program has educated residents about preventable causes of wastewater collection system overflows.

One highlight of smoke testing was the identification and disconnection of one source contributing almost an acre of impervious roof and parking lot runoff. This included 25,000 square feet of the Blaine Elementary School building, 7,500 s.f. of the Middle School building, and 3,750 s.f. of parking lot.

Staff recently discovered and plugged an improperly abandoned section of sewer piping on the north end of 8th Street that had been damaged during construction and was a major source of groundwater infiltration. Staff also recently replaced a defective flap valve upstream of Lift Station No. 1. In the Dec. 15, 1999 overflow event, this then-defective flap valve allowed up to 300 gpm of reverse flow to spill into Blaine Marina.

**Flow Monitoring**

The engineering firm CI2M Hill is assisting in the implementation of Blaine’s Wastewater Overflow Mitigation Program. The first task, wastewater collection system flow monitoring, began November 18, with 12 flowmeters and two rain gauges in place by November 25, 1999. Our first access to data was on December 28, 1999. This data allowed staff to quantify the December 15 wastewater overflow, and to identify the collection system reaches with the highest flow contribution during storms and during the recovery period between storms.

We have a significant quantity of rainfall data available after some early equipment problems. For the City Hall gauge, data is available since December 30. Rainfall data will help staff better understand the lag between heavy rain and heavy flow and the system flow response to storms of a known magnitude.
Public Works staff returned six of the meters March 7, 2000 per the contract agreement. To better understand the collection system trouble areas with high flow peaks during storms, staff will move the remaining six meters to isolate individual neighborhood drainage basins.

**Collection System Modeling**

On January 25, 2000, our consultant CH2M HILL installed the MIKESWMM collection system modeling software. This enabled staff to begin model creation. Model development is expected to require two months or more for completion of wet weather calibration and until late October for calibration to dry weather flow.

**Force Main Cathodic Protection System**

The December 21, 1999 Cathodic Protection System inspection report by Corrosion Control Specialists (CCS) of Kent, Washington on the Drayton Harbor submarine crossing of the Lift Station No. 1 force main indicates that we have a weakness in the pipe-to-soil potential. CCS recommends that we install an additional deep anode well on the Semiahmoo side of the crossing.

In a subsequent evaluation of the CCS report on January 31, 2000, CH2M HILL concludes:

1. From the data provided, we cannot determine if the lower levels of corrosion protection result from insufficient cathodic protection current provided from the existing cathodic protection station or from damaged joint bond wire(s).

2. The testing performed by CCS does not conclusively show that the pipelines are electrically continuous. However, we are not aware of other practical methods to perform this test without stringing wires across the mouth of Drayton Harbor.

Electrical continuity of the pipeline is important for a couple of reasons. The first is that an electrically continuous pipeline is required for effective cathodic protection. Broken bond wires will electrically “isolate” some portions of the buried pipelines from the cathodic protection current provided by the existing station on the Blaine side of the crossing. If more than one joint bond is damaged, it is possible that a section of the pipeline between Semiahmoo and Blaine could be isolated from cathodic protection current, even if an additional system is installed on the Semiahmoo side.

3. The information provided indicates that improvements to the cathodic protection system will be required to provide sufficient protection to the Semiahmoo side of the Drayton Harbor crossing. However, the information provided is not sufficient to enable us to comment on the arrangement and capacity of the proposed improvements.

The City will work with our consultants to prepare an inspection plan to complete our diagnosis of the corrosion protection system and to develop a repair plan when we have a firm grasp on how to proceed.

One time since September of 1999, the plant exceeded its 24-hour average design flow. An over flow on December 15 of 1999, allowed approximately 300,000 gallons of waste water to enter into Drayton Harbor and Semiahmoo Bay.

These overflows, caused by excessive inflow and infiltration (I&I) of storm water into the
sanitary sewer system, overwhelmed the system resulting in the discharge of untreated sewage into Semiahmoo Bay. This history of storm water I&I has caused exceedences in the average day design capacity of the Blaine STP.

Objective Five B: Blaine Sewage Treatment Plant Outfall

City of Blaine, DOE, DOH

Commercial shellfish harvesting north of Semiahmoo Spit in Semiahmoo Bay is prohibited due to the current location of the sewer treatment plant outfall pipe. Along with the closure of the commercial shellfish beds within Drayton Harbor, the Department of Health has suggested that Whatcom County Parks Department close recreational shellfish harvesting in this recreational area. Circulation studies conducted by Schwartz (1976) and by Menzies and Marcy (1998) show that under certain flood tide conditions, effluent from this sewer outfall pipe is capable of reaching the mouth of Drayton Harbor within five hours of discharge.

Effluent from the Blaine STP is chlorinated after treatment to disinfect the discharge. There have been events when the chlorination has not proved effective, and high fecal coliform counts have been found in the effluent. Under conditions of extremely high fecal coliform levels in effluent that could be discharged from the Blaine STP, the effluent may contribute to degraded water quality in the vicinity of the mouth of Drayton Harbor.

Task 1: Complete sewage treatment improvements.
Construction of new plant is pending due to negotiations with the Lummi Indian Nation.

Task 2: Investigate sewage treatment plant outfall location.
1. STP outfall was discounted by DOH Shellfish Division as significant source of fecal pollution to Drayton Harbor, F. Meriwether, 1998. In that letter from Frank Meriwether he states that “Improvements in either or both of these structures (STP and outfall) could result in a reclassification of these beaches, which may benefit recreational shellfish harvesters.”

2. Norm Glenn, DOE EILS Program Nov 98 (11/2/98 memo to Fricke, Abassi) subsequently suggested that extension of outfall and addition of diffuser to redirect effluent from shoreline might result in partial re-classification of portions of Semiahmoo Bay shoreline. What has Ecology or Blaine done about it? Rationale should be provided for whatever the decision is as requested in our Sept 98 Water Recovery Plan.

Task 3: Video project of Marine drive old sewer line and laterals to waterfront area and acknowledge funding sources: (see attachment #1)

Task 4: Enforcement by Ecology when Blaine is out of compliance with NPDES permit and when Marine Drive overflows occur (Initial CRS). Report violations, overflow events, enforcement actions to SPD as they occur.
In Dec. 1998 Blaine had a sewer overflow event. Part of the enforcement order given to Blaine specified that more off-line storage was required. It was agreed by both Ecology and the City of Blaine that the 60,000 gallon above ground tank located at pump station#1 should be sufficient since new telemetry for over-flow notification was also part of the enforcement. In Dec. 1999 another over-flow occurred and resulted in another enforcement action by Ecology. The City of
Blaine is in the process of obtaining 200,000 gallons of off-line storage in the form of bladder tanks.

**Objective Six: Control Agricultural Sources:**

**Whatcom Conservation District, Whatcom County Planning Department, EPA, DOE.**

Many livestock farms have animals in proximity to unfenced streams or drainage ditches. Pasture management, on many smaller farms with cattle or horses, is inadequate to control runoff and filter contaminants. Non-dairy livestock operations often have animal densities or stocking rates that exceed the vegetation’s capacity to utilize the nutrients in animal waste. Whatcom Conservation District (WCD) and Natural Resources Conservation Service (NRCS) works with these farmers to identify and eliminate impediments to good environmental practices, and to facilitate landowner adoption of environmental practices.

**Accomplishments:**

**Task 1: Provide financial assistance to 18 dairies to implement manure management plans.**

The Environmental Quality Incentive Program (EQIP) program funded $24,765 to one dairy in the watershed, and the producer partially matched that with $13,208. This funded water quality protection structures, as well as nutrient management services. This year, there are 4 signups for EQIP funding for farm improvements. $154,669 has been requested to make improvements to waste storage, transfer, and assessment facilities. There is also a State Cost Share Program, which these farms also signed up for, in case they don’t get the EQIP funding. Funding for either of these programs has not been issued yet this year.

EQIP is a federally funded program to fund improvements to farms, while requiring them to be at least concurrently working toward an approved farm plan. Farmers compete for funding, which is an incentive, to adopt fish and water quality improvement conservation practices, such as riparian restoration. To receive EQIP funds, farmers must compete on the basis of environmental improvement, and they must not be continuing practices harmful to water quality.

**Task 2: Provide technical assistance to 18 dairies to develop manure management plans.**

Two dairies have been certified as implemented to be compliant with standards in Substitute Senate Bill 6161. To date there are 11 dairies with plans compliant with SSB 6161 One of these has had a plan completed since September 1999. These plans must be implemented by 12/20/03. Four dairies have requested to develop plans compliant with SSB 6161, and five dairies have plans four to five years old. This describes all the dairies in the Drayton Harbor watershed.

**Task 3: Provide technical assistance to small/non-commercial farmers and landowners to develop resource management plans.**

Whatcom County is spending $15,000 for this activity in FY 2000; WCD secured a Centennial Clean Water grant for this activity that is funding $83,706 from 1999 until October 30, 2000. One small farm planner is currently employed at WCD through this grant.
Task 4: Conduct farm inspection program. Refer farms to Conservation District to develop conservation plans when required by the Critical Areas Ordinance (CAO). Refer BMP and farm plan violations to County enforcement officer when necessary. Enforce compliance with approved conservation plans. Enforce compliance with BMP's for small farms.

One hobby farmer is being assisted and enforced upon (Notice of Correction) by Mak Kautman DOE. Because of the recent listing of Chinook salmon as threatened, there is a likelihood further refinements will be required in the Critical Areas Ordinance so that all plans will be more fish friendly. The planning process with small farms has been limited, because of uncertainty about requirements in the near future, and there is a reluctance to impose too much or too little, and then have landowners have to revise their plan.

Task 5: Assist farmers to develop conservation plans consistent with CAO requirements. Approve, condition, disapprove plans.

The Whatcom Conservation District (WCD) small farm planner provided technical assistance to two small horse farm owners in the Dakota Creek watershed, and to a cattle farmer on an independent tributary to Drayton Harbor. Technical assistance has consisted of advising farmers on measures to make them compliant with Clean Water Act and the County Critical Areas Ordinance provisions, such as prohibiting animal access to streams, manure management, stream buffers, composting, and mud management. They have been advised about applying for federal Environmental Quality Incentive (EQIP) money to make improvements on their farm. The cattle farmer has requested $5,871 EQIP for a fence and cattle lane improvement, as well as 600 feet of a 35 foot wide woody riparian buffer on the independent tributary to Drayton Harbor. The farmer with horses is working currently with WCD on a conservation plan, and will be planting a riparian forest buffer averaging 30 feet width along approximately 200 feet of a South Fork Dakota Creek tributary this spring. She will also be leasing another acre to increase her land base in order to better sustain her pastures and reduce runoff, while maintaining the same number of horses. The other horse farmer has an approved farm plan, but got some technical assistance on composting. The cattle farmer will be getting an update on a previously completed plan, which will encompass cattle exclusion from a stream, cattle lane improvement, composting, and barn roof gutters and downspouts.

A small farm planning guide is being developed within the context of the Endangered Species Act. This will assist small farm owners in working on their own plan, and help them be more involved in the process. It is projected that this guide will speed up the time frame in which plans get completed and implemented. An initial draft has been reviewed by NRCS, NSEA, DOE, WDFW, and Whatcom County. It will be reviewed in light of the anticipated revised 4d rules to be announced by the NMFS by June 30.

Conservation Reserve Enhancement Program (CREP)

CREP is a U.S. Department of Agriculture program that pays landowners cost sharing and annual payments to establish trees, shrubs, and other components necessary for developing riparian habitat. Fencing and bringing livestock water through the habitat are other items that can be included in cost sharing. Cost sharing from USDA plus Washington State pays for 87.5% of the project, plus allowances for the landowner's labor and/or equipment. Land enrolled in CREP will earn an annual payment based on the county's average dryland rental for agricultural land. Depending on soil type and site potential tree height, the width of the riparian habitat will be 50 - 150 feet. Among other benefits, this would create effective filtering for fecal coliform bacteria, contributing to decreases in fecal coliform.
WCD expanded the program in 2000 to include a significant area of the Drayton Harbor watershed through cooperation with the Tribes and WDFW. Currently, there are two CREP projects that WCD is working on, in the development stages in the Drayton Harbor Watershed. One project, at a cattle farm on the North Fork of Dakota Creek, will generate 3,330 lineal feet and 21.34 acres of riparian buffer. Another project, at a hayfield on California Creek, would develop 979 lineal feet, and 2.33 acres of riparian buffer.

The WCD education coordinator worked with an educator from Horses for Clean Water to secure a PIE grant, that Whatcom and Skagit WCD's are partnering. The program addresses many aspects of environmentally sound horsekeeping, and will be offered free of charge to horse owners in the two counties, beginning Fall 2000. In August 1999 WCD sponsored a workshop on Manure Management for Horse Owners. Composting was focused on, and the importance of returning nutrients to the earth. Twelve people attended the workshop.

A Small Farm Compost Workshop was held also in August 1999. A grant was applied for and awarded, which funded transportation and compost guides for the attendees. Two farms in Blaine and Custer were toured that are currently composting, a cattle farm and horse farm. Speakers were from NRCS, WCD, and WSU Cooperative Extension, as well as the farm owners. The farmer in Blaine became an avid composter in the course of preparing for this tour. Twenty-five landowners attended.

The WCD small farm technicians have assisted Washington Department of Health in water quality sampling of Drayton Harbor several times.

**Task 6: Reach a cooperative agreement between the EPA, DOE and Whatcom County.** An agreement was reached this past summer between all parties regarding their respective enforcement activities.

**Task 7: Report violations and enforcement actions taken to DHSPDAC on a regular basis.**

**Task 8: Work with NSEA, Tribes, schools and the Ag/Forestry Class, to annually update stream enhancement projects in watershed.** Under contract with the County, the District is capturing all salmonid restoration/culvert projects within the WRIA. All Nooksack Recovery Team members) report on this.

**Recommendations:**
1. Continue working with dairies and small farms to give technical and financial assistance for fish habitat and water quality improvements
2. Whenever possible, refer interested landowners to groups engaging in riparian restoration projects.
3. Continue to develop CREP projects in the watershed.

**Objective Seven: Control Marina and Boating Sources.**
Port of Bellingham, DOE, City of Blaine, Seafood Processor's.

Two marinas operate at the entrance of Drayton Harbor. The Semiahmoo Marina Condominium Association operates a 300-slip marina for pleasure boats. The Semiahmoo marina operates a marine repair and fuel facility and currently has thirty live-aboards. The Port of Bellingham
maintains Blaine Harbor, which currently has 400-700 slips. Blaine Harbor supports commercial fishing vessels, fish processing facilities, and pleasure boats, including 3 live-aboards. Due to the number and variety of vessels that actively use the Blaine harbor, this marina represents a greater possible source of pollution to Drayton Harbor than the Semiahmoo Marina. (SDOH Sanitary Survey 1995).

The State Health Department’s ambient water quality data, Western Washington University’s oyster tissue sampling, and current water quality monitoring conducted by the Port of Bellingham all show higher fecal coliform levels recorded in the commercial section of Blaine Harbor. This indicates that there are significant sources in Blaine Harbor. Washington State ambient sampling from March 1995 through September 1997 (43 samples) show repeated violations of fecal coliform. Seventy-five per cent of the samples taken exceeded the standard. Although high fecal coliform levels have been recorded in Blaine Harbor no known point sources have been recorded. The Port’s continued and focused monitoring will hopefully provide more information about sources. Once that information is known, it is crucial that a mechanism for correcting the identified problems be put in place.

Accomplishments

Task 1: Monitor commercial activity while taking surface samples for water quality monitoring and report to all interested parties.

The Port is currently monitoring all commercial activities, recreational boating, seals, otters etc.. The Port is compiling data with an ongoing surface water monitoring program. The Port has increased from 12 sampling stations on a monthly basis to 16 stations sampled bi-weekly. In addition to the 9 stations within Blaine Harbor and one inside Semiahmoo Harbor, the Port began sampling 6 stations “outside” in both Drayton Harbor (2) and Semiahmoo Bay (4) as requested by the Whatcom County Council and DHSPDAC.

Task 2: Report on number and types of Marine Sanitation Devices (MSD) in Blaine Harbor and report to DHSPDAC.

Phase I moorage facilities are completed—including the installation of four state-of-the-art portable sewage pump-out stations plus a fixed station. All stations include a dump station as well. Phase II will add two more portable sewage pump-out stations plus a fixed station.

Task 3: Port of Bellingham, and Blaine Seafood Processors should exchange water quality data to help identify and control possible fecal sources.

Task 4: Department of Ecology should insure Blaine Seafood Processors are meeting their NPDES permit requirements. And that regular biennial inspections are carried out by DOE. Permit inspection is 7 months overdue. TREE inspection has been postponed with no timeline offered. Request for complete inspection ASAP. What is the status of the violation marking component of DOE? Ecology makes enforcement actions public when they are final.

Task 5: Coordinate water quality sampling with the State Department of Health. Coordinated efforts between SDOH and the Port were agreed upon on August 16, 1999. A Plan was to be submitted before Sept 1. No formal plan has been received.
Task 6: Compliance with the 401 Water Quality Certification including Enclosures 1 and COE Permit # 97-2-00960. Actions include dye testing of various sewer and waste lines servicing the Blaine Harbor fish processors, fecal coliform study of the sump pumps, inspection of all floor drains, bird exclusion systems, investigation of sediments for fecal coliform, inspect old on-site systems, and conduct fecal coliform testing at several locations in Boundary Bay.
Compliance complete? Last dye test was completed on March 30, 1999.

Task 7: Distribute educational materials regarding water quality specific to Drayton harbor via “Marina Update” newsletter. (adapted from initial CRS) What has been communicated about water quality in DH in this newsletter since Sept 1998? Provide documentation to DHSPDAC.

Task 8: Use moorage agreements to educate lessees and promote environmental regulations (initial CRS). Update: March 7 ’98 Harbor Rules and Regs updated showing Drayton Harbor as a zero discharge harbor.

Task 9: Blaine Seafood Processors: The Blaine Seafood Processors (BSP) have been working on elimination of fecal coliform from the outfall waste water.
(Recommendations were made for chlorinator spray for sump and for a fecal monitoring plan.)
BSP is actively working on the problem of a plugged outfall line under the tide flats. This line discharges fish waste. A contractor has been contacted and the plan is to clean out the line as soon as they are able to get the work done. The access is under water at high tide and can only be opened at low tide. As tides are not low enough during daylight hours, the project is on hold until daytime tides are convenient. It is unknown what the condition of the outfall pipe is at this time. BSP will be responsible for all costs incurred with this project.

Task 10: Review Blaine Seafood Processor (BSP) NPDES permit. It is up for renewal this year.
Washington Administrative Code 173-220-080 Public access to information. “the department shall make records relating to NPDES permits available to the public for inspection and copying.”
There is no mention of drafts. Drafts connotes to local DOE office a work in progress not a record.

Recommendations:
1. Need for an update on trends inside the Blaine marina.
2. The Port to continue water quality monitoring in the designated areas.
Objective 8: General Recommendations.

Task 1: As recommendations are implemented, critical areas such as stream sections in need of restoration work and pristine areas should be identified and mapped. (page 124 from 1995 Watershed Plan).

Task 2: Identify and communicate current public land acquisition programs to encourage public acquisition, conservation easements, open space programs, and other tax incentive programs for riparian and wetland areas. Focus on critical areas as identified in Task #1. (GR-57 from 1995 Watershed Plan).

Task 3: Make Drayton Harbor Shellfish Protection District Advisory Committee a party of record on all NPDES permits within the Drayton Harbor watershed.

Task 4: The State Department of Health should conduct a circulation study of Drayton Harbor. The National Shellfish Sanitation Program Manual, section C requires "a review of hydrographic factors that may affect distribution of pollutants". Due to lack of information of hydrographic studies in Drayton Harbor, DHSPDAC recommends that a field circulation study be completed by SDOH.

Task 5: Maintain webpage and make it more user friendly. Add map/data links that are more easily understood by the community.

Task 6: Increase efforts regarding community involvement and education primarily through newsletter and volunteer water quality monitoring efforts in priority drainage's.

Task 7: The Boundary Bay and Georgia Basin Ecological Initiative work groups along with the Drayton Harbor group are working on a Cross- Boundary workshop tentatively called "Shared Waters", A Cooperative Approach to Restoration of Shellfish Growing Areas. This workshop will specifically deal with shellfish issues and downgrades involving Canada based Boundary Bay Workgroup and Drayton Harbor, and is in the process of being developed. The date for the workshop is slated for the middle of September. This workshop is the first in a series that will provide an avenue for cooperative effort at solutions to potential pollution issues shared in common between the two countries as they affect shellfish issues.

Task 8: It is the committee's desire that Drayton Harbor be designated as an Area of Special Concern.
ATTACHMENTS
ATTACHMENT #1

SCOPE OF WORK FOR DRAYTON HARBOR SEWAGE LINE INTEGRITY TESTING

HISTORY

In January of 1995, The Washington State Department of Health downgraded the classification of commercial shellfish growing areas in most of Drayton Harbor from an approved status to either a restricted or prohibited status. In July of 1995, the Whatcom County Council established a Shellfish Protection District, which in turn created the Citizens Advisory Committee. Drayton Harbor Shellfish Protection District encompasses the entire Drayton Harbor Watershed. There is no current active oyster growing operation in Drayton Harbor due to fecal coliform pollution problems, which caused this downgrade and continues to degrade Drayton Harbor. According to the June 1999, Draft Sanitary Survey by the State Department of Health, shellfish growing and harvesting is now prohibited in the entire harbor. As of January 2000, State Department of Health will no longer collect monthly samples in Drayton Harbor until physical work towards improvement of water quality in the Shellfish District is shown implemented.

According to the most recent State Department of Health Drayton Harbor Sanitary Survey, flood tide as opposed to ebb tide is the adverse tidal condition for pollution problems in Drayton Harbor. Water quality data shows that testing stations within the Blaine Marina and near the entrance to the harbor have consistently high fecal coliform bacteria counts indicating that the source is potentially located in this proximity. During a priority setting meeting with the Drayton Harbor Citizens Advisory Committee, several issues regarding this occurrence were brought to the table. After investigative work regarding this issue, it was found that the businesses that are located in the marina with the exception of the new Port buildings, are still connected to an older cement line and not the new sewer line (21") that runs along Marine Drive from the railroad tracks to Lift Station #1. This line also acts as an overflow line for the main sewer system and actively drains the north area in Blaine. It is an active collection system. The Advisory Committee, after reviewing all potential pollution sources and data involving this issue, voted that the old cement line as well as the laterals that connect businesses to Lift Station #1 could possibly be leaking raw sewage to the Blaine Marina area. The committee recommended as a top priority constructing a video survey to evaluate the integrity of the cement line sewer collection system along Marine Drive.
**SCOPE OF WORK**

The Citizens Advisory Committee recommends that due to the high fecal coliform bacteria counts that have been consistently recorded in the Blaine Marina, this project should begin with the integrity testing of the old cement line and laterals located in the Blaine Marina area.

8100 linear feet of gravity fed line will be video surveyed for an estimated cost of $12,775. Problems captured by video will be identified and prioritized. The survey will include the cement line and laterals beginning from the manhole cover located above the railroad tracks at the marina entrance and will include all main laterals in the marina area including the Fish Processor area but not the Processor outfall pipe (see map).

With help from Betsy Peabody of the Puget Sound Restoration Fund, an independent contractor was located and a bid for survey work was completed. Gelco Services of Kent Washington, has submitted a bid for an estimated $12,775.00 to complete the survey of the sewage lines (see attached bid and references). Nine thousand dollars from DOE that the City is to pay for an outstanding fine from overflows along with five thousand dollars from the City of Blaine will pay for the video project. All monies not used for the completion of this project will be put into a fund for Phase Two.

Gelco will provide the labor, materials and equipment necessary to complete the investigative work involved with this project. They will clean lines, use television inspection and produce a written assessment in the form of a report using a priority driven information system for any problems that may be found.

This survey will help in determining once and for all which if any portions of the sewage collection system near to marine areas are likely contributing to fecal contamination of these waters. Problem areas will be identified and recommendations for further investigation and repair will be made. The Citizens Advisory Group recommends that this project get under way as soon as possible.
SCOPE FOR VIDEO SURVEY WORK

This proposal is for the work plan to be completed by Gelco regarding the Blaine Marina video inspection of the 15" cement line and laterals.

SITE LOCATION

Section #1
With the maps available, the location of the project will include video inspection of the following:

- Beginning at manhole # D3-2 located just east of the RR tracks that shows the cement line and the new 21” line as they form a Y junction, the camera will begin the inspection towards the west and the Marina area. The 21” line veers to the south side of Marine Drive while the cement line continues on the north side. At this juncture is where the cement line serves as an overflow line for the main 21” line if it exceeds a flow of 6”. At physical inspection of this manhole cover on January 15, the cement line was basically dry.
- Moving in a westerly direction, to manhole #C3-5 that is located approximately over the Cain Creek outfall. It is between these two manholes that the lateral 8” line that services North Blaine enters into the main cement line (now afterwards referred to the 15” line). During inspection, there was considerable flow in this pipe.
- Manhole # C3-3 is located at the juncture of Marine Drive and Milhollin Dr. A 10” lateral PVC pipe runs the length of Milhollin Dr from the public restrooms to the manhole at Marine Drive. These include manhole #’s C3-3, C3-4, Cr-1 and B4-1.
- Continuing west to manhole # C3-1 on the 15” line.
- On to manhole # B3-1.
- West to B3-2
- Manhole B4-2
- At the next manhole # B4-1, is where the 15” line meets with the 21” line and enters into Lift Station #1.

For this section of work, there appears from the maps that the only lateral line that attaches to the 15” line is at Milhollin Dr.

Section #2
This area includes the commercial marina area along with the Fish Processor buildings.

- Several 8” laterals connect to a 12” line that then returns east to Lift Station #1.
- From Lift Station #1 to Old lift Station #2 where a new manhole cover has been placed. (no manhole # for this)
- Heading west to manhole #A4-5 on Marine Drive. Connected to this manhole is an 8” line on McMillan Ave. On McMillan are two manholes #A4-3 and A5-2. The lateral 8” line that heads east from A4-3 has been removed from service.
- From a4-5 on Marine Drive to A4-1. An 8” lateral connects businesses on Sigurdson Ave to the main 12” line at A4-1.
• 8" laterals heading in a southerly direction. Include Manhole #’s A4-2, A5-1 and A5-2.

This concludes the physical site description of the video camera survey site location.

WORK AND EQUIPMENT

Initial Pipeline Service Prior to Video Inspection
Gelco will provide and perform the necessary cleaning of the approximate 8100 linear feet of 8, 10 and 15" sanitary sewer lines and 25 manholes prior to video work. With their vacuum truck, they will collect all solids and, with the City of Blaines direction, will dispose of the material at either the City’s landfill site or another designated location within reasonable distance of the job site.

The following information is from the NASCO specifications for Sewer Cleaning and Television Inspections. They are used state wide as standards. The cleaning equipment to be used will be the following:

Hydraulically Propelled Equipment: The equipment used shall be of a movable dam type and be constructed in such a way that a portion of the dam may be collapsed at any time during the cleaning operation to protect against flooding of the sewer. The movable dam shall be equal in diameter to the pipe being cleaned and shall provide a flexible scraper around the outer periphery to insure removal of grease. If sewer cleaning balls or other equipment’s which cannot be collapsed is used, special precautions to prevent flooding of the sewers and public or private property shall be taken.

High-Velocity Jet (Hydro Cleaning) Equipment: All high-velocity sewer cleaning equipment shall be constructed for ease and safety of operation. The equipment shall have a selection of two or more high-velocity nozzles. The nozzles shall be capable of producing a scouring action from 15 to 45 degrees in all size lines designated to be cleaned. Equipment shall include a high-velocity gun for washing and scouring manhole walls and floor. The gun shall be capable of producing flows from a fine spray to a solid stream. The equipment shall carry its own water tank, auxiliary engines, pumps and hydraulically driven hose reel.

Cleaning Precautions: During sewer cleaning operations, satisfactory precautions shall be taken in the use of cleaning equipment. When hydraulically propelled cleaning tools (which depend upon water pressure to provide their cleaning force) or tools which retard the flow in the sewer line are used, precautions shall be taken to insure that the water pressure created does not damage or cause flooding of public or private property being served by the sewer. When possible, the flow of sewage in the sewer shall be utilized to provide the necessary pressure for hydraulic cleaning devices. When additional water from fire hydrants is necessary to avoid delay in normal work procedures, the water shall be conserved and not used unnecessarily. No fire hydrant shall be obstructed in case of a fire in the area served by the hydrant.

Sewer Cleaning: The designated sewer manhole sections shall be cleaned using hydraulically propelled, high-velocity jet, or mechanical powered equipment. Selection of
the equipment used shall be based on the conditions of the lines at the time the work commences. The equipment and methods selected shall be satisfactory to the Owners Representative. The equipment shall be capable of removing dirt, grease, rocks, sand and other materials and obstructions from the sewer lines and manholes. If cleaning of an entire section cannot be successfully performed from one manhole, the equipment shall be set up on the other manhole and cleaning again attempted. If, again, successful cleaning cannot be performed or the equipment fails to traverse the entire manhole section, it will be assumed that a major blockage exists and the cleaning effort shall be abandoned.

**Television Inspection**

After cleaning, the manhole sections shall be visually inspected by means of a closed-circuit television. The inspection will be done from the center of manhole to center allowing for a 4” variance per 300-foot segment. The inspection will be done one manhole section at a time and the flow in the section being inspected will be suitably controlled as required.

The camera used for the inspection shall be one specifically designed and constructed for such inspection. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe. The camera shall be operative in 100% humidity conditions. The television monitor and other component of the video system shall be capable of producing picture quality to the satisfaction of the owners representative; and if unsatisfactory, equipment shall be removed and not payment will be made for an unsatisfactory inspection.

The camera used for television inspection shall be self-propelled, crawler type units having 360 degree pan and tilt capabilities. No hand winching units shall be allowed. The camera shall move through the line in either direction at a moderate rate, topping when necessary to permit proper documentation of the sewer condition. In no case will the television camera travel at a speed greater than 30 feet per minute. If, during the inspection operation the camera will not pass through the entire manhole section, the Contractor shall set up his equipment so that the inspection can be performed from the opposite manhole. If again, the camera fails to pass through the entire manhole section, the inspection shall be considered compete and no additional inspection will be required.

The camera used on this job will be a *Pan and Tilt Low Light Sensitive Color Radial Viewing Camera System* (see attachment for specs.) The camera will be used for all main and lateral lines but will not include the inspection of the laterals leading from the business location to the lateral line. The camera will be able to turn and visually check the smaller laterals from the main lateral.
Documentation of the Television Inspection

**Television Inspection Logs:** Printed location records shall be kept by the Contractor and will clearly show the location in relation to an adjacent manhole of each infiltration point observed during inspection (see attached). In addition, other points of significance such as locations of building sewers, unusual conditions, roots, storm sewer connections, broken pipe, presence of scale an corrosion, and other bound report.

**Video Tape Recordings:** The purpose of tape recordings shall be to supply a visual and audio record of problem areas of the lines that may be replayed. Videotape recording playback shall be at the same speed that it was recorded. Slow motion or stop-motion playback features may be supplied at the option of the Contractor. Color VHS tapes of the televisions inspection shall be provided by the Owner.

**Written documentation Report:** A written report will provided as requested by the City of the findings of the videotape.
Drayton Harbor Shellfish District Advisory Committee  
C/O Whatcom County Council Office  
311 Grand Ave., Bellingham, WA 98225  

Members: Margaret Kardell  Martin De Lange  Bonnie Onyon  
Art Choat  Bjorn Hrutfiord  William Goff  
Chairman: Geoff Menzies  Charles Hawkins  Richard Neily  
Vice Chairman: Janet Hansen  

To City of Blaine:  
February 7, 2000  

Re: Video Camera proposal  

Enclosed is the Project Proposal for the Video Camera Project of the 15” cement sewer line  
located in the Blaine Marina area. This proposal is complete with site locations, map and a  
complete write-up of work to be performed. The Committee is in the process of finding the lead  
agency in which to move this project through with. We hope to have an answer by Wednesday,  
February 9.  
We hope this fulfills the City’s request so that the work can begin ASAP.  

Thank you,  

Christine Woodward  
Project Manager for the Shellfish Protection Districts  

Cc:  Chris Chesson  Whatcom County Health and Human Services  
Mark Henderson, Bellingham Field Office DOE  
Art Choat, Port of Bellingham  
Jeremy Freimund, Lummi Natural Resources  
Claire CeDebaca, Nooksack Indian Tribe  
Betsy Peabody, Puget Sound Restoration Fund  
Don Lennartson, State Department of Health
ATTACHMENT #2
BYLAWS

Drayton Harbor Shellfish Protection District Advisory Committee (DHSPDAC)

Bylaws

January 11, 2000

I. Composition

A. Members: The Drayton Harbor Shellfish Protection District, (DHSPDAC) shall be composed of nine members, as outlined in Whatcom County's ordinance, #95-197C. Members must be a property owner that resides within the Shellfish Protection District, or have a direct interest from Commercial Shellfishing, Agriculture, Ports, Fish Processing, Recreational Boating, Blaine City Council, or Drayton Harbor Management Committee.

B. Appointment: Members shall be appointed to DHSPDAC as provided for in the ordinance.

C. Term of office: Each member will serve until the sunset date of December 31, 2000, or upon removal of the Drayton Harbor downgrade of January 1995, or the district is dissolved by legislative ordinance.

D. Officers: The officers of the committee shall include a chairperson and vice-chairperson who shall be elected by the voting membership of the Committee. Elections shall be held at the first regularly scheduled meeting after January 1st of each year. The term of those offices shall be one year. Chairperson and vice-chairperson may serve more than one term, but not more than three years consecutively. The chairperson shall preside over all meetings. The vice-chairperson assumes the responsibilities of the chairperson in his/her absence or disability. In the event the chairperson and vice-chairperson are absent, the meeting shall either be presided over by an acting chairperson, elected by the members present, or be postponed. In the event of a vacancy in the office of chairperson, the vice-chairperson automatically succeeds to the chair. If a vacancy occurs in the office of vice-chairperson for any reason, the committee shall elect another to serve the unexpired portion of the term.

E. Vacancies: Vacancies shall be filled as provided for in the ordinance.

F. Attendance: A member unable to attend a meeting should notify the Facilitator, the committee chairperson, or another member. If a member of DHSPDAC has excessive unexcused absences from meetings in any twelve- (12) month period, the other committee members may recommend to the Whatcom County Council that he or she be replaced.
II. Staff

The efforts of DHSPDAC shall be supported by the Whatcom County Council staff, or by a contractor specified by the Council. The person specified as Facilitator shall be responsible for these items, listed in the Scope of Work:

Schedule quarterly Implementation Work Group meetings and monthly DHSPDAC meetings to include, but not be limited to: time, location, agenda development and distribution.
Facilitate meetings, take notes at meetings, and distribute minutes.

Produce written progress reports detailing each agency’s budget and funding sources. Make progress assessments and determine future needs.
Work with DHSPDAC and Implementation Work Groups to resolve conflicts.
Present regular updates in the form of progress reports and future needs assessments to Shellfish Advisory Committees, Whatcom County Council, and participating agencies and organizations. These reports shall be submitted to and approved by the Committee before they are provided to other agencies.
However, if events require it, the Facilitator may modify these reports before they are presented.
Track and document the progress of each agency’s individual tasks identified in the closure response strategies.
Schedule and facilitate interagency meetings to resolve work plan issues.
Research any questions that arise during shellfish Advisory meetings, and draft correspondence for the committee.

III. Communication

Paper copies of official minutes and other official documents shall be submitted to the Office of the Whatcom County Council, and other agencies that request them.
Committee members shall notify the Facilitator of their preference for mailed paper copies or electronic copies.

IV. Meetings

A. DHSPDAC shall meet regularly as required to carry out the purposes of the Committee. Meetings shall be held at the Blaine Library on Wednesdays, from 5-7 p.m., unless otherwise specified. If the meeting location or time is changed, staff shall notify the chairperson, members, and the local media.

B. The facilitator may call meetings of the agencies involved, at a time and place convenient for those attending. The Chair of DHSPDAC, or his/her designee shall attend as a representative. Other members may attend to listen. Reports of agency meetings shall be sent to members of DHSPDAC. Meetings with a single agency will not require notification or attendance of the Chair.

C. Minutes/Agendas: Minutes of all meetings shall be kept by staff, and distributed to the members prior to the next regularly scheduled meeting.
Meeting minutes shall be approved by a majority vote of members present. Agendas shall be prepared by staff, with verbal approval of the Chairperson, and distributed to the members at least seven (7) days in advance of any regularly scheduled meeting.

D. Public Access: All meetings shall be open to the public. Approved meeting minutes shall be filed on record with the Whatcom County Council’s Office and shall be made available to the public as a matter of public record. The public can access all pertinent information at the Shellfish Protection District’s website at whatcomshellfish.wsu.edu.

E. Quorum: A majority of the voting members of the committee (5) shall constitute a quorum and shall have authority to transact Committee business within the constraints of voting as defined in Subsection G.

E. Order of Business
1. Call to order
2. Members sign in; the chair determines quorum. If there is no quorum, the meeting may continue, but no formal action may be taken.
3. Introduction and identification of guests
4. Reading, correction, and approval of minutes.
5. Reading and disposition of any correspondence
6. Introduction and disposition of business listed on the agenda
7. Other business
8. Open session
9. Announcements:
   a. Agenda for next meeting
   b. Time and place of next meeting
   c. Other announcements
10. Adjournment

F. Rules of Order: The Committee shall be as clear and simple in its procedure as possible, and therefore should avoid the finer points of parliamentary rules. If necessary, however, Roberts Rules of Order, Revised, shall be followed.

G. Voting: An affirmative vote of a majority of the quorum is required for transaction of business. Votes on recommendations to the County council or County Executive will only take place if background information has been given to DHSPDAC at previous DHSPDAC meetings, or if background information is included with the meeting agenda. All policy or contract negotiations forwarded to the Council or Executive, that do not pass unanimously, will include a description of the arguments for and against the motions.

V. Amendments

To the extent that such an amendment would not conflict with the ordinance, any of the Bylaws may be amended or repealed, and new Bylaws may be adopted, by majority vote of the entire DHSPDAC.
VI. Savings Clause

Should any portion of these Bylaws be declared unconstitutional or otherwise contrary to law, such decisions shall not affect the validity of the remaining portions of these Bylaws.

These Bylaws are hereby adopted in a duly noticed meeting held on January 11, 2000 by an affirmative vote of Committee members.
ATTACHMENT #3

DRAYTON HARBOR ADVISORY COMMITTEE LIST

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bgnw@earthlink.net

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P.O. BOX 922
BLAINE, WA 98231

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cnhawkins@juno.com

ART CHOAT
PORT
ArtC@PortofBellingham.com

Bonnie Onyon
City Council of Blaine
bonyon@naturespath.com
ATTACHMENT #4

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COUNTY PLANNING
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jthomps@cmwinternet.com
ATTACHMENT #5
State Department of Health Monitoring Change

April 4, 2000

Christine Woodward
Wizards Consulting Services
5893 Malloy
Ferndale, WA 98248

Dear Ms. Woodward,

This is to advise you, and the members of the Drayton Harbor Watershed Committee, of the decision by the Washington State Department of Health, Office of Food Safety and Shellfish Programs to decrease the frequency of water quality sampling in Drayton Harbor from twelve times a year to six times a year.

This decision is based on the results of months of water quality monitoring in which no significant improvements have been noted. Drayton Harbor has been re-classified as Prohibited and no active shellfish harvest is taking place. In most downgrades to Prohibited, until pollution sources are found and corrected, water quality sampling is suspended entirely in an effort to spend Office resources most efficiently and economically.

Although this Office is fully committed to the restoration of downgraded shellfish growing areas, we do not have any regulatory authority except in the classification process in order to protect the public health. The process of finding and correcting pollution sources lies with local agencies. When we receive documented notification that actual pollution sources have been found and corrected in the watershed, we will then re-evaluate our sampling policy regarding Drayton Harbor.

If you need amplification or clarification of this situation, please contact me by phone (360-236-3318) or e-mail (don.lennartson@rdoh.wa.gov)

Sincerely,

Don Lennartson
Office of Food Safety & Shellfish Programs
Washington State Department of Health
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It is a statistic that accounts for the variability among data points. The logarithmic mean is calculated as follows:

logarithmic mean = \( \log_{10} \left( \frac{\sum_x \log_{10}(x)}{n} \right) \)

where \( x \) is each data point and \( n \) is the number of data points.

Because microbiological data is not normally distributed, the geometric mean of the sample results is used. The geometric mean is calculated as follows:

geometric mean = \( \exp \left( \frac{\sum_x \log_{10}(x)}{n} \right) \)

where \( x \) is each data point and \( n \) is the number of data points.

Geometric mean is the geometric mean, defined by the National Shellfish Sanitation Model Ordinance (1967), as the arithmetic mean (base 10) of the arithmetic mean of the sample results logarithmically (base 10).

Previous data from DOH Draft Survey of Drayton Harbor (June 1999), which includes data up to 12/2/98.
ATTACHMENT #8

SUMMARY OF RECOMMENDATIONS

Objective One: Establish Coordinated Water Quality Program for Drayton Harbor
There is a need to establish a percentage of the flood fee for water quality improvement programs in the Drayton Harbor Watershed. The funds need to be directed to the appropriate agency. A reporting program for their use should be established.

Objective Four: Control Stormwater Sources
The City of Blaine should create an ordinance requiring that pet waste be removed from city streets, alleys and parks. The City of Blaine should enlist the services of a DHSPDAC member to advise the City in the development of a shoreline stormwater-monitoring program.

Objective Six: Control Agricultural Sources
1. Continue working with dairies and small farms to give technical and financial assistance for fish habitat and water quality improvements
2. Whenever possible, refer interested landowners to groups engaging in riparian restoration projects
3. Continue to develop CREP projects in the watershed.

Objective 8: General Recommendations
1. As recommendations are implemented, critical areas such as stream sections in need of restoration work and pristine areas should be identified and mapped. (page 124 from 1995 Watershed Plan).

2. Identify and communicate current public land acquisition programs to encourage public acquisition, conservation easements, open space programs, and other tax incentive programs for riparian and wetland areas. Focus on critical areas as identified in Task #1. (GR-57 from 1995 Watershed Plan).

3. Make Drayton Harbor Shellfish Protection District Advisory Committee a party of record on all NPDES permits within the Drayton Harbor watershed.

4. The State Department of Health should conduct a circulation study of Drayton Harbor. The National Shellfish Sanitation Program Manual, section C requires “a review of hydrographic factors that may affect distribution of pollutants”. Due to lack of
information of hydrographic studies in Drayton Harbor. DHSPDAC recommends that a field circulation study be completed by SDOH.

5. Maintain webpage and make it more user friendly, Add map/data links that are more easily understood by community

6. Increase efforts regarding community involvement and education primarily through newsletter and volunteer water quality monitoring efforts in priority drainage’s.

7. The Boundary Bay and Georgia Basin Ecological Initiative work groups along with the Drayton Harbor group are working on a Cross-Boundary workshop tentatively called “Shared Waters”, *A Cooperative Approach to Restoration of Shellfish Growing Areas*. This workshop will specifically deal with shellfish issues and downgrades involving Canada based Boundary Bay Workgroup and Drayton Harbor, and is in the process of being developed. The date for the workshop is slated for the middle of September. This workshop is the first in a series that will provide an avenue for cooperative effort at solutions to potential pollution issues shared in common between the two countries as they affect shellfish issues.

8. It is the committee’s desire that Drayton Harbor be designated as an Area of Special Concern.
UPDATES AND REPORTS
March 31, 2000

TO: Whatcom County Council and Drayton Harbor Shellfish Advisory Committee
FROM: Julie Hirsch, Hirsch Consulting Services
RE: Whatcom County Shellfish Closure Response Implementation Progress Report for Data Management
CC: Christine Woodward, Wizards Environmental Consulting

Dear Council and Committee Members,

This report outlines progress on tasks specified in the scope of work for Whatcom County professional services contract #9903010.

DATA MANAGEMENT TASK PROGRESS SUMMARY

Task – Facilitate the formation of a Data Management Subcommittee consisting of all agencies that collect water quality monitoring data.

The Data Management Work Group (DMWG) was formed and has met three times. The DMWG has:
- Facilitated coordination among sampling agencies (especially the Port and DOH)
- Provided recommendations for coordinated monitoring strategies which have been incorporated into the Drayton Harbor Coordinated Water Quality Monitoring Framework.
- Provided recommendations for implementation of the Coordinated Monitoring Framework.

Examples of improved coordination of water quality sampling among agencies include:
- At the request of the Drayton Harbor SPD, Ecology has agreed to continue sampling Drayton Harbor as part of their ambient marine water quality program in 2000.
- DOH and the Port of Bellingham (Port) have sampled together several times and have coordinated sampling locations inside the Blaine commercial marina.
- DOH and NWIC sample together regularly as part of NWIC quality control procedures.
- As part of the Coordinated Water Quality Monitoring Framework implementation, the Port has submitted their sampling protocol to DOH for review and approval.
- DOH has provided their historical data to the Port to be used in the data analysis which is being conducted by Pacific International Engineering for the Port. Art Choot has indicated that Port’s data analysis should be available in March.

Task – Develop a coordinated water quality monitoring plan, which incorporates existing work plans by January 1, 2000.

Drayton Harbor Coordinated Water Quality Monitoring Framework (attached) was submitted to the Whatcom County Health Department in January, 2000 and sets forth:
- Quality assurance and Quality Control (QA/QC) and methods recommendations for all agencies that collected water quality data that is submitted to the Shellfish Protection District Database

1537 Iron Street
Bellingham, WA 98225
Phone: (360) 671-4273
Fax: (360) 738-7929
e-mail HirschServ@aol.com
Recommendations for coordinated monitoring strategies and targeted monitoring projects that were generated in brainstorming sessions with the DMWG.
Recommendations for coordination and cooperation among agencies including a memorandum of agreement among agencies to follow recommendations set forth in the Coordinated Monitoring Framework.
The Drayton Harbor Coordinated Water Quality Monitoring Framework is posted on the SPD website in the What’s new section (www.whatcomshellfish.wsu.edu).

Task – Develop a database for management of existing and future water quality monitoring data by April 2000.

Progress on elements of the Whatcom County Shellfish Protection District Database includes:
- The creation and updating of SPD maps including sampling sites for all participating agencies and details of key areas.
- The creation of a data collection matrix including relevant information for all sample stations.
- Gathering of datasets from all participating agencies for inclusion in the Whatcom County SPD database.
- The Whatcom County Shellfish Protection Districts water quality database was submitted to Whatcom County Department of health and Human Services on March 31, 2000 for management of existing and future water quality data. The database was developed in Microsoft Access/Office 2000. The database design and structure are presented in the attached tables. The SPD database will be made available on the Whatcom County SPD website for downloading. The database will be used for the water quality assessment phase of the project and it will be updated as current and future data are submitted by Implementing Agencies.

Task – Public Involvement

Website - Data management sections were developed for the Whatcom County Shellfish Protection Districts website (www.whatcomshellfish.wsu.edu). Data management products displayed on the website include:
- DMWG meeting announcements, agendas and minutes
- Data collection matrix
- GIS maps
- Current summaries of DOH sampling data
- Coordinated Water Quality Monitoring Frameworks

Please feel free to contact me or Christine Woodward if you have questions about the attached materials. I appreciate the opportunity to contribute to reopening the Whatcom County shellfish beds.

Sincerely,  

Julie Hirsch  
Principal  

Enclosures
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<td>Point source discharge</td>
<td>Is this station a point source discharge?</td>
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<td>Description of the location of this station</td>
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<tr>
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<td>Name of waterbody or watershed</td>
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<td>Subbasin</td>
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<tr>
<td>Parameters</td>
<td>List of water quality parameters measured at this station</td>
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<tr>
<td>Comments</td>
<td>Additional comments regarding this station</td>
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Coordinated Water Quality Monitoring Framework for Drayton Harbor Shellfish Protection District

January 2000

Prepared for
The Whatcom County
Drayton Harbor Shellfish Protection District

Prepared by
Hirsch Consulting Services
Bellingham, Washington
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Executive Summary

In response to the January of 1995 shellfish bed closure, Whatcom County established the Drayton Harbor Shellfish Protection District (SPD) in July of the same year and the Initial Closure Response Strategy was set forth. In March 1999 consultants were contracted using Department of Ecology, Centennial Clean Water funds obtained by the Whatcom Conservation District and the Whatcom County Department of Health and Human Services to assist with implementation of the Drayton Harbor Implementation and Water Recovery Plan.

In September, 1999 all remaining Approved shellfish growing area in Drayton Harbor was reclassified to Prohibited status by the Washington State Department of Health Office of Shellfish Programs. Pollution sources with the potential to impact affected shellfish growing areas that were identified in the September 1999 Sanitary Survey of Drayton Harbor (Meriwether, 1999) include:

- Bypasses and possible leaks of raw sewage from the force main of the Blaine sewage collection system near the commercial marina and harbor mouth
- Storm water runoff from urbanized areas
- Blaine and Semiahmoo marinas
- Agricultural runoff in California and Dakota Creek watersheds
- Seafood processing wastewater
- Birds, waterfowl and marine animals

There are many potential and known sources of fecal coliform loading to Drayton Harbor shellfish beds, however, which one(s) are the primary cause(s) of fecal contamination of shellfish beds remains unknown. Due to consistent and extremely high fecal coliform counts, the area in the vicinity of the Blaine commercial marina has become the focus of sampling activities and of investigations of the sewage collection system near the marina.

The Initial Response Strategy and the Whatcom County Comprehensive Plan calls for coordination of a long term water quality monitoring program among stakeholder organizations. The primary goal of the monitoring plan as stated in the 1998 Drayton Harbor Shellfish Protection District Recovery Plan, the Whatcom County Comprehensive Plan, and the 1995 Drayton Harbor Watershed Action Plan is:

"The development of a coordinated, comprehensive, long term monitoring scheme for guiding pollution control projects and activities and for assessing progress toward meeting water quality standards."

This plan describes the efforts of all organizations currently collecting water quality data related to fecal coliform loading in the Drayton Harbor SPD and submits strategies for monitoring water quality changes with coordination among participating organizations. Strategies were developed with the input of a data management work group consisting of representatives from each Implementing Agency that currently conducts water quality
monitoring activities within the Drayton Harbor Shellfish Protection District. A representative from the Drayton Harbor Citizen's Advisory Group is also included in the data management work group.

The Drayton Harbor Shellfish Protection District, Data Management Work Group includes:

- Blaine Seafood Processors, Bill Charles
- City of Blaine, Public Works Department, Grant Stewart
- Department of Ecology, Bellingham Field Office, Mark Henderson
- Drayton Harbor Shellfish Protection District, Citizen's Advisory Group, Margaret Kardell
- Northwest Indian College, Michael Cochrane
- Port of Bellingham, Art Choat, Marinas Director
- Washington State Department of Health, Office of Shellfish Programs, Don Lennartson

Recommended Coordinated Monitoring Program Strategies are intended to be used to guide implementation of a long term monitoring program by the Drayton Harbor Shellfish Protection District Advisory Committee. While the strategies are too numerous to list in an executive summary, some highlights include:

- Obtaining ongoing funding for a long term coordinated Shellfish Protection District monitoring program administered by a lead agency.

- Development of a quality assurance plan to ensure that data collected by various entities which is utilized for planning and decision making purposes meets generally accepted standards.

- Establishing partnerships in the form of a memorandum of understanding where participating agencies make a commitment to data sharing, sampling coordination, and reporting of requested relevant information.

Implementation of a long term coordinated monitoring strategy will require the continued commitment and cooperation from each Implementing Agency and elected officials.
Acknowledgements
We would like to thank the following members of the Drayton Harbor Shellfish Protection District Advisory Committee for their review of this document:

- Mark Henderson, Department of Ecology, Bellingham Field Office
- Margaret Kardell, Drayton Harbor Shellfish Protection District, Citizen's Advisory Group
- Michael Cochrane, Northwest Indian College
- Don Lennartson, Washington State Department of Health
Project Description

This plan fulfills, in part, the Whatcom County Shellfish Protection Plan; Implementation of Shellfish Closure Response Strategies for Drayton Harbor. Funding for this project was obtained by Whatcom County in partnership with the Whatcom Conservation District through a Department of Ecology (Ecology) Centennial Clean Water Fund Grant. Commercial shellfish beds in Drayton Harbor have a history of closure to harvest due to fecal contamination. There are many jurisdictions and affected parties with a stake in the classification of the Drayton Harbor shellfish beds by the Washington State Department of Health. In response to the January of 1995 shellfish bed closure, Whatcom County established the Drayton Harbor Shellfish Protection District in July of the same year and an Initial Closure Response Strategy was set forth as required by state law (RCW 90.72). The shellfish district includes the Drayton Harbor watershed in its entirety. The Drayton Harbor Shellfish Protection District Status Report and Water Recovery Plan (DHSPD Advisory Committee, 1998 and Whatcom County, 1999) listed agencies and organizations that have conducted fecal coliform sampling in Drayton Harbor and its watershed and called for coordination of a long term water quality monitoring program among stakeholder organizations. This plan describes the efforts of all organizations currently collecting water quality data related to fecal coliform loading in the Drayton Harbor watershed and submits strategies for monitoring water quality changes with coordination among participating organizations.

Drayton Harbor Watershed

The Drayton Harbor watershed is located in the northwest corner of Whatcom County, Washington and straddles the international border with Canada. The watershed encompasses 35,102 acres including 256 acres in British Columbia. There are 129 miles of tributary streams contained within the Drayton Harbor Watershed. California and Dakota Creeks constitute the primary freshwater inputs to the Harbor draining over 90% of the watershed area (Peterson, 1995). The remaining portion of the watershed drains directly into Drayton Harbor. The mouth of Drayton Harbor lies just south of Semiahmoo Bay which is bisected by the international border with Canada. Figure 1 shows the boundaries of the Drayton Harbor watershed and the shellfish protection district. The Drayton Harbor Watershed Management Plan (Peterson, 1995) provides a comprehensive watershed characterization. Total annual rainfall recorded at Blaine averaged 41 inches per year between 1948-1998 with about 68% in the fall and winter and ranged from 24.8 inches in 1952 to 52.7 inches recorded in 1997. The highest daily rainfall value was 3.4 inches in November 1955 (Determan, 1999).

Land Use

Land use in the Drayton Harbor watershed is diverse. Urban, residential, agriculture (commercial and hobby farms), surface mining, forestry, and marinas including industry are all identified as significant land uses in the watershed by the 1995 Drayton Harbor Management Plan. The incorporated city of Blaine flanks the eastern shore of Drayton Harbor just south of the Canadian border. The Resort Semiahmoo and residential development borders the western shore of the harbor. California and Dakota creeks
1999 is 3,640 (OFM, 1999). The recent growth rate increase in Blaine to 4.8% per year is attributed primarily to the development of Resort Semiahmoo (City of Blaine, 1999). Custer is an unincorporated town located in the California Creek drainage. As of 1991 54% of land was in rural/agricultural use with the majority used as pastureland. Two and a half percent of the watershed area was occupied by urban uses, mostly residential, with 40% in forestry (Puget Sound Cooperative River Basin Team, 1991). In 1998 Whatcom County passed the Agricultural Nutrient Management ordinance (WCC 16.28) regulating ground application of liquid manure (Whatcom County, 1998). Whatcom County and Ecology have hired inspectors to enforce manure application regulations.

Beneficial Uses

Drayton Harbor is classified by the Department of Ecology as a Class A waterbody, (WAC-173-201A-140). Tributaries of Drayton Harbor are given the same classification as the waterbody into which they merge. Class A waters are considered excellent where water quality shall meet or exceed the requirements for all or substantially all uses. Characteristic uses for Class A waters and include:

- Water supply (domestic, industrial and agricultural)
- Stock watering
- Fish (including salmonid) and shellfish spawning, rearing, migrating, and harvesting
- Wildlife habitat
- Recreation including primary contact, sport fishing, boating, and aesthetic enjoyment
- Commerce and navigation

Fecal coliform standards for Class A waters are:

<table>
<thead>
<tr>
<th>Class</th>
<th>Water Type</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Freshwater</td>
<td>Geometric mean shall not exceed 100 colonies/100mL and not more than 10% of all samples shall exceed 200 colonies/100mL.</td>
</tr>
<tr>
<td>A</td>
<td>Marine</td>
<td>Geometric mean shall not exceed 14 colonies/100mL and not more than 10% of all samples shall exceed 43 colonies/100mL. This is also the NSSP criteria for approved shellfish growing waters except that NSSP uses the estimated 90th percentile calculation (NSSP, 1997).</td>
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Drayton Harbor watershed provides groundwater for the city of Blaine’s public drinking water supply, small community water supplies, and individual wells. The watershed provides habitat for a variety of marine and freshwater fishes. Drayton Harbor and its
tributaries, including ditches, support migration, rearing, and spawning of native resident and anadromous salmonids. The predominant species are coho and chum salmon, steelhead, and cutthroat trout. Chinook salmon also utilize the Drayton Harbor watershed (Peterson, 1995). The native spring chinook is listed as threatened under the federal Endangered Species Act. Pacific herring is an important marine fish in Drayton Harbor that provides the primary food source for salmon. The intertidal shoreline of Drayton Harbor and subtidal areas possess extensive eelgrass beds that are sensitive spawning habitat for herring, pacific sand lance, and surf smelt. Out migrating juvenile salmon and Dungeness crab also utilize these nearshore areas (Puget Sound Cooperative River Basin Team, 1991). Drayton Harbor is a popular destination for contact recreation, sport fishing, boating, and shellfish harvest. The Resort Semiahmoo and housing development is a destination location on Semiahmoo Spit offering proximity to a county park, beaches, recreational shellfish beds, and a 300 slip marina for pleasure craft. The Port of Bellingham operates a marina for commercial and pleasure craft that is being expanded from 400 to 681 slips.

Shellfish Beds

Historically, Drayton Harbor has been a significant shellfish resource for several user groups. Environmental conditions were ideal for the harvest and farming of several species of clams and oysters. The Lummi Nation and the Nooksack Tribe hold ceremonial and subsistence rights to shellfish harvesting in the Harbor. Commercial shellfish growing began in 1905 when the Drayton Harbor Oyster Company seeded 500 acres in the southern portion of Drayton Harbor. Neptune Aquafarms grew shellfish for commercial markets on 400 acres in the 1970s and 1980s until their assets were purchased by the Drayton Harbor Oyster Company in 1992 (Menzies, 1999). Commercial shellfish harvest by Drayton Harbor Oyster Company continued until 1997 after their shellfish growing area was downgraded. In past years, Semiahmoo Spit and the west side of Drayton harbor have produced 10-20% of the Lummi Nation shellfish harvest (Cochrane, 1999). Recreational harvest of shellfish has been popular at public and private beaches. Recreational harvest includes hard-shell clams, butter clams, and Dungeness crab.

The State Department of Health (DOH) is charged by the Federal Food & Drug Administration (FDA) with responsibility for classifying shellfish growing areas for the protection of public health. Drayton Harbor was first restricted to shellfish harvest in 1952 due to the discharge of raw sewage by the City of Blaine. Later that year the Blaine sewage treatment plant (STP) was built at the south end of Semiahmoo Spit. The city of Blaine's raw sewage is pumped through a submarine force main to the STP. Again in the 1970s it was necessary for a commercial shellfish operation to relay oysters to Semilk Bay due to water quality degradation (Menzies, 1999). In 1988, 680 acres of shellfish growing area in Drayton Harbor were downgraded from Approved to Prohibited classification as a result of contamination by fecal runoff from rural non-point sources (Determan, 1999). A 1988 Department of Health and Human Services report recommended that Approved portions of Drayton Harbor remain Approved even though elevated fecal coliform levels in other areas in the bay represented a potential contamination threat to the commercial shellfishery (DSHS, 1988). The commercial
value of the shellfish growing area downgraded in 1988 was estimated at $2 million (Peterson, 1995). The most recent closure in 1995 downgraded approximately 1,000 acres of Approved growing area to Prohibited status with 30 acres classified as Restricted to allow relay operations for the Drayton Harbor Oyster Company (Determan, 1999). The Restricted area was downgraded to Prohibited status by default when relay operations ceased in 1998. The 1995 downgrade left only the Approved growing area for tribal commercial harvest in the western portion of Drayton Harbor along the inside of Semiahmoo Spit. In January 1999, after overflows and breaks in the raw sewage force main crossing under the mouth of Drayton Harbor, DOH placed an emergency closure on the remaining Approved area. The most recent sanitary survey report-published by the DOH in September 1999 announced the closure of all remaining approved shellfish growing area to Prohibited classification (Meriwether, 1999).

**Potential Pollution Sources**

Pollution sources identified by DOH with the potential to impact affected growing areas include:

- Bypasses and possible leaks of raw sewage from the force main of the Blaine sewage collection system near the commercial marina and harbor mouth
- Storm water runoff from urbanized areas
- Blaine and Semiahmoo marinas
- Agricultural runoff in California and Dakota Creek watersheds
- Seafood processing wastewater.
- Birds, waterfowl and marine animals

There are many potential and known sources of fecal coliform loading to Drayton Harbor shellfish beds, however, which one(s) are the primary cause(s) of fecal contamination of shellfish beds is unknown. While fresh water tributaries routinely exceed freshwater fecal coliform standards, flows are cited as being too low to constitute the primary source of loading to shellfish growing areas (Meriwether, 1999 and Cochrane, 1999). Tidal input is the most significant in terms of volume. Flood tide is the adverse condition in Drayton Harbor (Meriwether, 1999) when fecal coliform water quality standards are most frequently exceeded. If California and Dakota Creeks were the primary contributors of fecal coliform then high fecal coliform concentrations would be observed predominantly during ebb tide. Fecal coliform sampling at two stations in Semiahmoo Bay by the Port of Bellingham began in July 1999 and might answer questions regarding loading from Canadian waters on flood tide. Due to consistent and extremely high fecal coliform counts, the Blaine commercial marina has become the focus of special sampling by the DOH. The DOH sampling station #8, is situated just outside of the Blaine marina entrance and demonstrates higher fecal coliform levels than any other monitoring station in Drayton Harbor, except those located inside the Blaine commercial marina.

Questions have been raised among shellfish protection district members in regard to factors that may influence fecal coliform levels in Drayton harbor, such as water
circulation patterns, rainfall, stormwater runoff, potential and actual point source inputs, and water quality conditions within the Blaine marina and Drayton Harbor.

Circulation and Transport Studies
A 1976 circulation study conducted by Western Washington University using drogues demonstrated the possibility of transport from the Blaine STP outfall through the mouth of Drayton Harbor on an extreme high tide. Similar results were shown by a drogue study conducted by Geoff Menzies in 1997. However, modeling of the STP effluent plume by DOH in 1994 indicates that without disinfection, and during a plant upset and a major flood tide, fecal coliform concentrations would fall below the marine fecal coliform standard due to dilution and dispersion alone prior to entering Drayton Harbor (Meriwether, 1999).

Floats released from inside the entrance of the Blaine marina by Geoff Menzies and Don Lennartson (DOH) in 1995 traveled to the vicinity of DOH sampling station #6 and #4, a growing area previously harvested by the Drayton Harbor Oyster Company. Some of the drogues released at the entrance to Drayton Harbor near the end of Marine Drive also traveled over DOH stations 6 and 4 on a flood tide (Meriwether, 1999). The force main to the Blaine STP crosses under the mouth of Drayton Harbor from lift station #1. The Blaine Seafood Processor outfall is located under the dock at the end of Marine Drive. Drogues released at the mouths of California and Dakota Creeks on an ebb tide traveled over the general vicinity of DOH station 1 and 3.

While past hydrographic studies are helpful in illuminating potential fecal coliform transport to Drayton Harbor shellfish growing areas, questions remain. Fecal coliform sampling has revealed little information regarding circulation within the Blaine Marina. With high fecal counts distributed throughout the marina during both ebb and flood tides, contamination sources have not yet been pinpointed. An understanding of circulation patterns within the Blaine Marina could facilitate pollution source identification. Questions in regard to exchange between Boundary Bay and Semiahmoo Bay are being asked by agencies in Whatcom County and British Columbia alike. Some shellfish protection district members have voiced questions about the model for the Blaine STP outfall generated by DOH and have asked for continued sampling at the western entrance to Drayton Harbor.

Stormwater and Sewer Overflows
Combined sewer overflows from Blaine’s collection system at lift stations near the mouth of Drayton Harbor have been an ongoing problem due to inflow and infiltration (I&I). Blaine Public Works has replaced portions of their sewage collection system to separate storm water from sewage and recently several illicit stormwater discharges to their collection system were identified. While the submarine force main was replaced in 1997, overflows from Blaine’s collection system due to I&I have continued. Investigation of
older concrete sewer lines suspected of leakage near the Blaine commercial marina is planned in 2000. Records from 1995 through 1997 compiled by Margaret Kardell and Bill Goff do not show that samples for fecal coliforms in Drayton Harbor have been collected specifically during or immediately after overflow events. Elevated fecal coliform levels have occurred at storm drains at Cain Creek and Portal Way Viaduct. Targeted sampling during and immediately after storm events could assist in the determination of stormwater contributions to fecal coliform loading and in tracking water quality effects from Blaine’s collection system improvements.

Point & Non-Point Sources

Known or potential fecal coliform sources that may impact Drayton Harbor shellfish beds include; Blaine and Semiahmoo marinas, leakage from the City of Blaine’s sewage collection system, process wastewater from the Blaine Seafood Processor outfall, agricultural inputs to California and Dakota Creeks, birds, and marine mammals. Fecal coliform concentrations inside the Blaine marina at stations sampled by DOH and the Port of Bellingham are consistently higher than other stations in Drayton Harbor with numbers in the hundreds and often above 1,000 organisms/100 mls.

Raw sewage collection lines run adjacent to Blaine Marina along Portal Way, down Marine Drive and along the seafood processors docks. Several discharges were corrected as the result of a dye test conducted by the Port of Bellingham during March, 1999 however fecal coliform concentrations remain unchanged. The dye study will be repeated during active fish processor operation as requested by Frank Meriwether (DOH) in 1999 or 2000.

Blaine Seafood Processors (BSP) discharge process water from an outfall located at the mouth of Drayton Harbor at the end of the Marine Drive dock. Sampling of process effluent by Sea-K-Seafoods shows fecal coliform concentrations ranging from 20-16,000 fecal coliforms/100 mls from an unknown source. The sump for screened process water is suspected of incubating fecal coliform bacteria. While fish do not harbor an indigenous bacterial flora, they may become carriers of pollution from warm-blooded animals. Microbiological studies have found fecal coliform bacteria in the guts of freshwater fish at concentrations up to 1 million per gram of tissue (Geldreich, 1966). Based on further study, the author hypothesized that the source of fecal coliforms in fish guts was related to ingestion of contaminated food. He found that multiplication of fecal coliforms in the fish gut can occur under certain temperature conditions (Geldreich, 1966). Bird feces introduced on the shoes of workers have also been mentioned as a possible source of fecal coliforms in fish process effluent at BSP (Grette, 1999). Process water discharge from BSP is also fairly high in BOD, oil & grease, and suspended solids (Bellingham Seafood Processors, 1999).

Discharges from commercial and recreational craft in the two marinas may also contribute to fecal loading. The Port of Bellingham began sampling station N inside the
Semiahmoo marina during July 1999, which should indicate whether fecal contribution from this area is a problem.

Large numbers of birds and seals are often observed in the Blaine Marina vicinity and on the Semiahmoo marina floating breakwater. Sampling prior to and after gull activity near the Sea-K dock was conducted by Pacific International Engineering (PIE) to fulfill Enclosure 1 requirements of the Blaine Harbor Moorage Expansion Project in March 1999. No increase in fecal coliform concentration was found after bird activity (Grette, 1999). Results of sampling by Don Lennartson (DOH) from 1996-1998 near the Semiahmoo breakwater during periods of seal or bird congregation demonstrate low fecal coliform levels from 1.7-7.8 organisms/100mls. In an RNA study conducted for the City of Blaine, animal and human strains of E. coli were identified in Drayton Harbor and tributary samples but between 53 and 71% of the E.coli samples could not be identified (Hererra Environmental Consultants, 1998). Well targeted investigations might reveal whether any of the many fecal coliform sources is (are) primarily responsible for shellfish bed downgrades however there is no cost effective and well tested method that can reliably differentiate among fecal pollution sources.

Water Quality Conditions
Water quality analysis can provide information about the estuarine environment indicating circulation patterns, sewage inputs, and the likelihood of bacterial survival as well as the ability of a waterbody to support beneficial uses.

Several previous studies include collection of chemical and physical data from Drayton Harbor, its tributaries, and storm drains. Investigations conducted by Cook in 1987 and 1991 for the Semiahmoo Company documented elevated nutrient inputs from freshwater tributaries during storm events (Vasey Engineering, 1995). The Department of Ecology monitored a site at the mouth to Drayton Harbor between 1973 and 1987 and determined that the site was probably not sensitive to nutrient enrichment (Vasey Engineering, 1995). At a site inside Drayton Harbor during a 1997 study, DOE found seasonal stratification with depressed dissolved oxygen levels, elevated ammonium, and elevated fecal coliforms. Their conclusion stated that due to the enclosed nature of the harbor, it is sensitive to human activity that can alter dissolved oxygen. Ammonium detected in marine waters can indicate input of sewage or other anthropogenic sources (Newton et al., 1998). In a study conducted for the Semiahmoo Company, Vasey Engineering found relatively elevated nutrient concentrations in the southwest portion of Drayton Harbor (Vasey Engineering, 1995). Taken together results from these studies indicate that Drayton Harbor could be showing effects of human activity.

Algae blooms have been reported in the Blaine Marina near the seafood processing docks. Fish processors’ screened effluent lines pass under the docks to an outfall at the mouth of Drayton Harbor. Reported effluent concentrations of BOD range from 190-1300 mg/L with total suspended solids up to 500 mg/L and oil & grease up to 130 mg/L.
(Charles, 1999). Samples collected at the fish processor docks during April, 1999 did not appear to have elevated nutrients (Grette, 1999) however seasonal sampling would be necessary to determine the nutrient status of waters within the Blaine commercial marina. Dissolved oxygen, temperature, salinity, and fecal coliforms will be measured at five stations within Blaine marina over 10 years as a requirement for moorage expansion. Dissolved oxygen and temperature will be measured at the surface and at the bottom of the water column (Pacific International Engineering, 1998). Measurement of nutrient parameters and BOD in the marinas could contribute valuable information regarding inputs to Drayton Harbor. Drayton Harbor has been studied sporadically for indicators of eutrophication over the years however a more comprehensive and longer term investigation would be needed to identify trends.

Existing Water Quality Monitoring Data and Current Data Collection

The Washington State Department of Health has been the primary source of fecal coliform data for shellfish growing areas in Drayton Harbor. The Department of Ecology also sampled a site at the mouth of Drayton Harbor as part of their ambient monitoring program in 1997. Many past studies have documented violations of fecal coliform water quality criteria in freshwater tributaries and nearshore marine waters in Drayton Harbor (Cook, 1987; Dicke, 1992; Matthews and Saban, 1992; Cykler, et al., 1995; Vasey Engineering, 1995 and Matthews et al., 1997. The Northwest Indian College and the Port of Bellingham currently collect fecal coliform samples in the Drayton Harbor Watershed and in the Blaine marina. The City of Blaine and the Blaine Seafood Processors sample their effluent discharge under NPDES permit requirements.

Water quality data residing in the DOH database, along with other federal criteria, is used to classify Drayton Harbor shellfish growing areas where the other studies are aimed at identification and documentation of fecal pollution sources. Table 1 indicates parameters, accessible period of record, and location coordinates for sampling agencies. The table includes only fecal coliforms and parameters that might influence fecal coliform distribution. Table 2 summarizes fecal coliform sampling for each agency. Figures 2-4 show the locations of sampling sites for each agency.

State Department of Health

The DOH has monitored shellfish growing operations in Drayton Harbor since 1952 for the purpose of classifying shellfish beds for commercial harvest. The DOH is required by the FDA to follow guidance set forth by the Interstate Shellfish Sanitation Conference (ISSC) in the context of the National Shellfish Sanitation Program (NSSP) to provide public health protection to consumers. The Guide for the Control of Molluscan Shellfish and the Molluscan Shellfish Model Ordinance provides protocols for sanitary control of all phases of commercial shellfish operations including classification of growing areas (NSSP, 1997). Commercial growing areas are classified using periodic sanitary surveys. The 3 components of a sanitary survey include:
1. A pollution source survey of the shoreline area and watershed which identifies point and non-point discharges that may affect the growing area(s)

2. An evaluation of local meteorologic and hydrographic factors such as tidal characteristics, water circulation patterns, depth, salinity, stratification characteristics, rainfall patterns and intensity, and prevailing winds

3. A water quality assessment based on analysis of sample data collected from growing area sample stations. Fecal coliform is the indicator used by the NSSP and DOH for growing area classification

Growing area classifications include Approved, Conditionally Approved, Restricted, and Prohibited. A growing area can be classified as Conditionally Approved only if the growing area is affected by a predictable pollution event. An area may be classified as Restricted when a sanitary survey indicates a limited degree of pollution and requires relaying and depuration in an Approved growing area. An area must be Prohibited if the sanitary survey or other monitoring program indicates excessive contamination is reaching the growing area or there is no current sanitary survey. In order for a growing area to be classified Approved for commercial shellfish harvest all sample stations must meet both parts of the fecal coliform standard where:

The fecal coliform geometric mean or median Most Probable Number (MPN) of sample results shall not exceed 14 organisms per 100 milliliters (mL).

and

The estimated 90th percentile shall not exceed 43 MPN/100 mL. The 90th percentile estimate shall be calculated using the procedure outlined in the NSSP Model Ordinance, Chapter IV, page 26, section F5 (NSSP, 1997)

Approved areas are sampled 6 times per year using the systematic random sampling method representing a range of environmental conditions and referred to as ambient sampling protocol. In areas impacted by point source pollution or predictable pollution events, a minimum of 30 samples collected under adverse pollution conditions must be utilized to determine classification. In areas that have been downgraded this type of sampling is usually conducted monthly and referred to as restoration protocol.

Regular fecal coliform sampling data is available for various stations in and near shellfish growing areas in Drayton Harbor dating back to 1990 (Meriwether, 1999). Sampling frequency and stations have changed over time reflecting changes in station classification. Figure 5 shows historical DOH sample stations. Currently samples are
collected on a monthly basis at six stations within Drayton Harbor and one station near the mouth of the Harbor in Semiahmoo Bay as shown in Figure 3. Special sampling is also conducted monthly at selected sites within the Blaine marina in an effort to identify pollution sources. Beginning in January 2000, DOH will reduce sampling frequency in Drayton Harbor to once every other month.

In September 1999 the remaining Approved growing area was downgraded to Prohibited status eliminating all commercial growing from Drayton Harbor shellfish beds. The Sanitary Survey of Drayton Harbor has identified flood tide as the adverse tidal condition (Meriwether, 1999).

Special sampling by DOH within the Blaine marina shows exceptionally high fecal coliform concentrations throughout the marina which do not appear related to tidal conditions (Meriwether, 1999; Cykler et al., 1995, Cochrane, 1999). The Blaine Marina vicinity has several potential pollution sources and has become the primary focus of concern. An oyster tissue sampling study (Cykler, et al., 1995) indicated sources of fecal contamination within the Blaine Marina in the area of commercial fish processing operations and commercial boat moorage.

Department of Ecology
The Department of Ecology, Environmental Assessment Program (EAP) conducts the statewide Marine Water Column Ambient Monitoring Program with sites throughout Puget Sound. A station in Drayton Harbor (DRA002) was sampled monthly during 1997 from January to September. This station was only sampled in 1997. Parameters sampled at 0m, 10m, and 30m depths included; salinity, temperature, dissolved oxygen, light transmission, secchi depth, pH, dissolved nutrients, and pigments. Dissolved nutrient parameters included; ammonium, nitrate-nitrite, and orthophosphate. Fecal coliform samples were collected at a depth of 0.1 meters. Sampling results are presented in Washington State Marine Water Quality in 1996 and 1997 (Newton et. al, 1998). It is uncertain whether Ecology will continue sampling Drayton Harbor in the next round of sampling in 2000.

Northwest Indian College
The Northwest Indian College received funding through a Centennial Clean Water Fund grant to sample freshwater tributaries of Drayton Harbor for fecal coliforms to augment DOH sampling. Ten sample sites are distributed in the California and Dakota Creek subbasins and smaller drainages that discharge near the Blaine Marina. Some special studies inside the Blaine marina have been conducted. The study period is from April 1998 through September 2000.
Port of Bellingham

The Port of Bellingham (POB) has sampled 9 stations within the Blaine marina for fecal coliforms and fecal streptococcus since October 1997. Additional water quality monitoring in the Blaine Marina that was required by permitting agencies for the Blaine Harbor Moorage Expansion Project began in July 1999. Additional fecal coliform samples are now collected at DOH station #8, at two stations in Semiahmoo Bay, near the international boundary, and at 1 station inside the Semiahmoo Marina. The Port also began sampling 2 stations near the southwest entrance to Drayton Harbor in October 1999 at the request of the Whatcom County Council Natural Resources Committee.

Water quality certification requirements for the Blaine marina moorage expansion include a study comparing fecal coliform levels in the fish processor waste streams, monitoring of bird and seal activity, and fecal coliform sampling during (fish product) offloading, investigation of sediment fecal coliform levels, and assessment of sediment conditions. An inspection of the area under the fish-processing pier was required for the presence of indicators of nutrient enrichment. Long term monitoring requirements described under Condition S8 of the Water Quality Certification include a 10-year plan with monthly sampling on years 1, 3, 5 and 10 after occupancy of Phase II. The Long-Term Water Quality Monitoring Plan describes the sampling program and protocol to be followed (PEI, 1998). Long term studies will be performed by Pacific International Engineering under contract to the POB. Five stations inside the Blaine Marina will be sampled for fecal coliform, dissolved oxygen, and temperature.

Blaine Seafood Processors

Sea-K-Fisheries operates a point source discharge for the Blaine Seafood Processors at the mouth of Drayton Harbor. Current state discharge requirements include monthly monitoring of effluent flow, biochemical oxygen demand (BOD), total suspended solids (TSS), and pH. Samples for oil and grease are collected quarterly. In addition a plan was required in June 1998 for identification of fecal coliform bacteria in process wastewater. Fecal coliform samples have been collected monthly by BSF since January 1998 and are currently sampled from the combined fish processor discharge line as it discharges into the solids removal sump. Samples for other parameters are collected from the effluent line after solids removal (Charles, 1999).

Blaine Sewage Treatment Plant

The City of Blaine discharges treated municipal wastewater from its sewage treatment plant on the west side of Semiahmoo Spit into Semiahmoo Bay. Current state discharge requirements include regular effluent monitoring of flow by continuous recording, weekly BOD and TSS sampling, daily residual chlorine and pH testing and fecal coliform sampling 3 times per week. The Blaine STP also operates a weather station and collects daily rainfall data.
South Fraser Health Region
The South Fraser Health Region monitors water quality at recreational use areas. Monthly fecal coliform sampling is conducted at beaches in White Rock B.C. during the summer months. The Georgia Basin Ecosystem Initiative began a three-year intensive sampling program in June 1999 that will focus on identifying non-point source contaminants that may affect shellfish harvesting in Semiahmoo Bay. Drainage systems that will be sampled for fecal coliforms include rivers, outfalls, and beaches that feed into Semiahmoo Bay. Beaches are sampled during ebb tides in this study (Gobles, 1999).

Project Objectives
The primary goal of the monitoring plan as stated in the 1998 Drayton Harbor Shellfish Protection District Recovery Plan, the Whatcom County Comprehensive Plan, and the 1995 Drayton Harbor Watershed Action Plan is:

*The development of a coordinated, comprehensive, long term monitoring scheme for guiding pollution control projects and activities and for assessing progress toward meeting water quality standards.*

Objectives in support of this goal include;

- Development of a framework for the coordination of existing and future monitoring programs by participating implementing agencies in order to maximize resources and avoid duplication of effort.

- Development of strategies for a long term monitoring program which can be used to assess the effectiveness of implemented source control programs and promote the ability of these waters to meet their respective marine and freshwater water quality standards.

Coordinated Monitoring Program Strategies:
Strategies were developed using a brainstorming and rating process by the Drayton Harbor Data Management Work Group (DMWG) (Appendix A).

Program Framework

- Ongoing funding will be needed for any long term monitoring program. Even if sampling could be accomplished under existing programs there will still be a need to maintain the database, disseminate information, and coordinate agencies.
Ongoing funding for a shellfish protection district monitoring program by a lead agency was the number one priority identified by the Drayton Harbor Data Management Work Group.

- Development of a quality assurance plan to ensure that data collected by various entities which are utilized for planning and decision making purposes meets generally accepted standards. Coordinate quality control sampling so that data can be compared among agency monitoring programs.

- Establish partnerships where participating agencies make a commitment to data sharing, sampling coordination, and reporting of requested relevant information.

- Establish a centralized database with free exchange of data.

- Periodic analysis of water quality data brought to the attention of elected officials.

- Periodic re-evaluation of the coordinated monitoring plan.

- Define a time frame for coordinated monitoring. Continue coordinated sampling at a level sufficient to indicate fecal coliform trends until shellfish growing areas are upgraded and Approved classification is maintained for at least 2 years.

- Accompany potentially polluting activities (such as development) and pollution control activities by water quality monitoring plans to track resulting water quality changes. (The entity proposing a given project would be asked to address water quality monitoring and expected impacts or improvements).

Sampling Strategies

- Use of a systematic random sampling approach to identify adverse pollution conditions and to identify “hot spots” for targeted sampling.

- Continue sampling with coverage of Drayton Harbor, the marinas, freshwater tributaries, and storm drains with an emphasis on spatial and temporal distribution of sampling to maximize coverage among agency programs.

- Identify a list of long term sampling sites. The DOH and NWIC should recommend sites to be sampled at a decreased frequency to maintain monitoring at a base level if and when current sampling is modified and/or discontinued.

- Include an urban stormwater component in coordination with municipalities (Blaine) and the County as they develop stormwater monitoring programs to
comply with upcoming implementation of state stormwater NPDES requirements (2000).

> Coordinate sampling parameters. Agencies sampling, for fecal coliforms in marine waters and in tributaries with marine influence would also test for additional field parameters as collected by DOH (salinity and temperature).

> Coordinate sampling schedules. The Blaine Harbor Moorage Expansion Permit requires the Port to sample certain sites during DOH sampling and it requires that samples collected at Semiahmoo and Boundary Bay be taken on flooding tides (Department of the Army, Permit for Blaine Harbor Moorage Expansion, 1998).

> Make a request to Ecology for continued sampling by the Marine Ambient Program in Drayton Harbor. Ecology will also take requests to change the sampling location.

**Recommendations for Targeted Projects**

> Stormwater sampling to evaluate the contribution of storm events to fecal coliform loading. Include sampling of Drayton Harbor during or immediately after sewer overflows and include a stormwater sampling station at the viaduct near Nikki’s Restaurant.

> Blaine marina circulation study to evaluate movement of fecal contaminants within the marina. A marina circulation study should include monitoring the effects of a new breakwater on fecal coliform distributions inside the marina. The Port plans to install a new breakwater in 2000.

> Sampling inside both marinas for parameters such as BOD, nutrients (including ammonia as an indicator of waste discharge), light extinction measured as secchi depth, and dissolved oxygen profiles. Coordinate with the Phase II monitoring by the Port.

> Monitoring the presence birds and seals, and sampling to determine their influence on fecal coliform loading.

> Evaluate need for follow-up sampling to the Blaine sewage collection system video inspection and integrity test in the area of the Blaine marina and the force main.

> Should Ecology indicate that the fecal coliform standard will be changed to *E.coli* or *enterococcus*, additional samples should be collected for the selected organism.

> In certain situations special techniques may be useful in fecal coliform source identification. *Clostridium perfringens* is a sporeforming bacterium which is
primarily associated with human wastes and demonstrates relatively constant survival in marine environments over time (Davies et al., 1995 and Sargeant, 1999). Clostridium perfringens is used to distinguish fecal contamination in both marine and freshwater environments (Edwards et al., 1998). Chemical indicators such as human sterols have been used to distinguish fecal contamination of human and herbivore sources (Leeming et al., 1996). Where fecal coliforms are associated with sediment, bacteria can adhere to particles and settle out of the water column, persisting in bottom sediments longer than in the water column (Davies, et al., 1995; Gerba and McLeod, 1976). Coprostanol has been used as a tracer for human wastes in coastal sediments (Edwards et al., 1998). A study of fecal chemical indicators including coprostanol, and viral and bacterial indicators was recently conducted by USGS on Kamm Creek, however, the results are not yet available (Embrey, 1999). It may be useful to conduct a demonstration project using sediment samples for chemical and microbiological indicators to determine the utility of these techniques for source identification in Drayton Harbor. A report has just come out from the Ecology Environmental Assessment Program entitled, Fecal Contaminant Source Identification Methods, which may provide additional guidance for pilot study selection (Sargeant, 1999).

Sampling Locations

Current sampling locations for all agencies collecting water quality data within Drayton Harbor SPD boundaries are shown in Figures 2-4. Mapping coordinates for all sites are listed in Table 1, along with parameters sampled at each sample station. Only fecal coliforms and other parameters which might influence or have a relationship to fecal coliform distribution are included. Stations for use in long term tracking of fecal coliform trends in the Drayton Harbor SPD will include sites that are monitored as part of existing long term programs. Drayton Harbor SPD advisory committees should select additional sites to be sampled at a decreased frequency to maintain monitoring at a base level if and when current sampling is modified and/or discontinued.

Long term historical stations sampled for fecal coliforms by agencies as part of ongoing regulatory programs include:

<table>
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<tr>
<th>Drayton Harbor</th>
<th>DOH-3</th>
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<td>DOH-4</td>
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<td>DOH-6</td>
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<td>DOH-8</td>
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<td>DOH-12</td>
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<tr>
<td>Point Source Discharge, Semiahmoo Bay</td>
<td>BLN-STP</td>
</tr>
</tbody>
</table>
The DOH has conducted special restoration sampling inside the marina since 1996, however, sampling by DOH will be reduced from a monthly basis to every other month beginning in January 2000. Future long term monitoring will be conducted by the POB inside the Blaine marina to fulfill water quality certification requirements for the moorage expansion. Port contractors will monitor five sites, three of which coincide with sites that have been sampled by the Port or others since 1997. Samples will be collected monthly on years 1, 3, 5, and 10 after marina occupation and during June and September in years 2, 4, 6, 7, 8, and 9 (Pacific International Engineering, 1998). Blaine Marina long-term monitoring sites are shown in Figure 6 and include:

**Blaine Marina**

<table>
<thead>
<tr>
<th>Site</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>POB-L-A</td>
<td>This is the same site currently sampled by DOH, POB, and NWIC near Sea-K Fisheries as shown in Figure 4.</td>
</tr>
<tr>
<td>POB-L-F</td>
<td>This is the same site currently sampled by DOH, as shown near the commercial sawtooth dock in Figure 4 and labeled as DOH-CD.</td>
</tr>
<tr>
<td>POB-L-G</td>
<td>This site is located at the end of dock C and does not appear to coincide with any current sampling station.</td>
</tr>
<tr>
<td>POB-L-I</td>
<td>This is the same site currently sampled by the POB, shown as station POB-I in Figure 4.</td>
</tr>
<tr>
<td>POB-L-N</td>
<td>This site is located in the new docks and does not coincide with any current sampling station.</td>
</tr>
</tbody>
</table>

Additional sites currently monitored as part of short term programs, which should be considered as candidates for long term monitoring include:

<table>
<thead>
<tr>
<th>Site</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>POB-N</td>
<td>Inside the Semiahmoo marina. This site provides data for comparison between the two marinas.</td>
</tr>
<tr>
<td>DOE-DRAOO2</td>
<td>This site in Drayton Harbor has was sampled for parameters in addition to fecal coliforms which assess the general health of the harbor.</td>
</tr>
</tbody>
</table>

The NWIC should recommend sites for sampling at a decreased frequency to maintain monitoring at a base level sufficient to indicate fecal coliform loading to Drayton Harbor from California and Dakota creeks after September 2000.
Methods

Because data generated by many agencies and other groups will be collectively used to make management decisions in the SPD it is necessary that standard and accepted practices be used for sample collection and analysis. One of the challenges of a coordinated monitoring program is the generation of high quality data of adequate comparability. Participants must have confidence that data used in decision making are reliable.

Sampling Methods

Bacteriological sampling must be conducted according to Standard Methods, 9060A (APHA, 1992) or the marine water sampling protocol detailed by the DOH (see Appendix B). Samples are collected in presterilized bottles and cooled to 4°C immediately. Fecal coliform samples are collected near the surface of the water column by plunging the bottle, opening down, 6 inches below the surface and sweeping forward to avoid contamination from the outside of the bottle or from sampling apparatus. Stations should be located where samples will be representative of the water body of interest. For instance, river or creek samples should be collected in midstream to avoid near shore effects. It is critical that aseptic techniques are used at all times to avoid sample contamination. In addition, agencies are encouraged to take steps to protect sample integrity as outlined in the DOH sampling protocol such as use of a temperature control bottle to ensure sample temperatures below 10°C (DOH, 1996). Samples must be accompanied by complete identifiers and chain of custody documentation upon transport to an accredited laboratory. Analysis should be performed as soon as possible after sample collection, ideally within 6 hours. Holding time prior to analysis should not exceed 24 hours (APHA, 1992).

For marine sampling, tidal data must be recorded. Ebb or flood tides are considered by DOH to occur 30 minutes after the time in tide tables for the given high or low tide. It is also suggested that salinity and temperature data routinely collected by DOH, be recorded by other agencies sampling marine waters because it can provide valuable information as to the source of the water sampled. A mercury thermometer and hand held refractometer or electronic meters can be used.

Accepted techniques should be used to collect samples for parameters other than bacteria as described in Standard Methods or other accepted protocol. Sampling protocols for all parameters should be described in the Quality Assurance Project Plan (QAPP) for each sampling project.
Analytical Methods

Although other microbial indicators have been investigated, use of fecal coliform is still used in Washington State. Fecal coliform is the indicator selected by the NSSP to monitor shellfish growing areas for classification purposes. It is also the indicator used by regulatory agencies and utilities to monitor the quality of drinking water and wastewater. The Most Probable Number or MPN (SM 9221 E) and membrane filtration (SM 9222 D) are the two methods used to analyze water samples for fecal coliforms (APHA, 1992). The DOH uses the MPN method with A-1 medium. Because the MPN method takes considerably more preparation most laboratories operated by utilities use membrane filtration (M-FC). Most commercial laboratories offer both methods. All analyses must be performed by a laboratory accredited by the DOH or Ecology for each method. A summary of fecal coliform analytical methods is shown for participating agencies in Table 2.

The M-FC method may produce lower results than the MPN method especially for organisms exposed to environmental stress such as chlorination or marine salinities (EPA, 1978). High sediment concentrations can interfere with M-FC. The M-FC method yields a fecal coliform density where the MPN method provides an estimate of density within the 95% confidence limits of the test. In addition, higher results can be expected for the MPN method due to statistical bias (APHA, 1992). In a comparison of methods used during the Lower Nooksack TMDL study, MF and MPN results were not highly correlated (Joy, 1999). However, field replicates collected by DOH and NWIC are analyzed by both methods and have consistently fallen within the 95% confidence limits for the MPN test (Cochrane, 1999a). Simple steps can be taken to enhance recovery for stressed organisms in the M-FC method as described in Standard Methods 9212 (APHA, 1992). Temperature acclimation calls for pre-incubation of M-FC plates for 5 hours at 35°C followed by 18 hours of incubation at 44.5°C. The addition of rosoic acid which is sometimes used to suppress background growth can be eliminated and filters designed to enhance recovery can be used such as the Millipore HC filter (APHA, 1992).

Accepted analytical methods must be used for parameters other than fecal coliforms as described in Standard Methods or other accepted protocols. Analytical methods for all parameters should be described in the QAPP for each sampling project.
Quality Assurance and Quality Control

Each participating agency should provide a Quality Assurance Project Plan approved by
the DOH, Ecology, EPA or equivalent agency for each water quality monitoring program
or project. The current status of agency QAPPs is shown below:

<table>
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<tr>
<th>Program</th>
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<td>NWIC</td>
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<tr>
<td>Ecology</td>
<td>Yes</td>
<td>EPA</td>
</tr>
<tr>
<td>Blaine STP</td>
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<tr>
<td>POB</td>
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<td>POB Phase II</td>
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<tr>
<td>Blaine Seafood Processors</td>
<td>unknown</td>
<td>Ecology</td>
</tr>
<tr>
<td>South Fraser Health (B.C.)</td>
<td>unknown</td>
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</tr>
</tbody>
</table>

* There is an existing monitoring plan, however, because the sampling program is voluntary, there has been no regulatory approval.

The QAPP is the primary source of documentation for use by participating agencies and
SPDs for coordination purposes. Review and approval of plans by DOH, Ecology, or
EPA will provide confidence in methods used to generate the data, which are used for
decision making. At a minimum, each plan should include the following eight elements

- Title page
- Project description
- Project organization and responsibility
- Data quality objectives
- Sampling procedures
- Analytical procedures
- Quality control procedures
- Data assessment procedures

Data generated by participating agencies will be used among agencies and by the SPD to
evaluate fecal coliform trends and to identify sources. Data sets generated by agencies
may be pooled to provide comprehensive spatial and temporal coverage of the district.
Variability in microbiological samples and analysis is high. The Nooksack TMDL study
and the NWIC sampling program use(d) field duplicate analysis to estimate total
variance. The NWIC sampling program collects field duplicates for 10–12% of samples
collected which are analyzed by an independent laboratory (NWIC 1999). Occasionally
samples are collected side by side with the DOH. It is suggested that each participating
agency collect and analyze field replicates for 10–15% of samples collected and that
agencies occasionally sample side by side to provide an estimate of variance among data sets generated by different agencies. Results for replicates (split samples) should fall within the 95% confidence limits for the analytical method used. When duplicates are analyzed by both MPN and M-FC methods, 80% of the results obtained by membrane filtration should fall within the 95% confidence interval for the MPN index. The lower limit of sensitivity for the five tube MPN test is an index value of 2 organisms/100 mL and 1 organism/100 mL for the M-FC method (APHA, 1992).

Additional quality control procedures suggested for fecal coliform samples include use of temperature control bottles to ensure sample temperatures below 10°C and use of transfer blanks. Accreditation for microbiological laboratories requires stringent quality control (QC) procedures for each step of analysis. Laboratory blanks are analyzed as part of routine laboratory QC during M-FC analysis.

Accepted quality control procedures should be used for field and analytical water quality parameters in addition to fecal coliform as described in Standard Methods or other accepted protocols. All quality assurance and quality control (QA/QC) procedures should be documented in the QAPP for each agency. Field instruments should be calibrated according to manufacturer’s specifications. Chain of custody procedures must be followed by all participating agencies to ensure sample integrity.

**Data Reduction, Review, and Reporting**

Each participating agency should have a data review procedure in place to ensure the correctness of data contributed for use in a central SPD database. When results are returned from the laboratory, they should be checked against field identification information to match sample times and locations. In order to make data sets accessible to most agencies each agency should maintain their data in Microsoft Excel spreadsheets or in a Microsoft Access database. Data returned from the laboratory should be entered into electronic format and then independently confirmed against the original laboratory data. Quality control results from duplicates and blanks should be included along with data qualifiers. It is suggested that each agency analyzes their own QC data periodically and takes necessary corrective action based on the results. Data sets and QC reports should be reviewed by a project manager before submittal to the SPD central database in electronic format. While the central database is being built, data submittal will be monthly. Frequency of data submittal may be reevaluated after September 2000.

The central database will be made accessible to all participating agencies on the Whatcom County Shellfish Protection District website (www.whatcomshellfish.wsu.edu) or upon request. The DHSPD or lead agency will prepare maps and reports summarizing compilation of data, identifying water quality trends and assessing progress toward meeting water quality goals. Participating agencies are encouraged to perform analysis of their own data. The first water quality assessment will be completed in June 2000. It is suggested that subsequent reports be prepared at least annually by a lead agency to provide supplemental information between DOH triennial sanitary surveys.
Coordination and Cooperation Among Agencies

The key to a coordinated water quality monitoring program is participation and cooperation of all agencies that collect fecal coliform data in the SPD. Coordination of sample site selection and timing of sampling will result in the maximization of resources and temporal and spatial coverage of the district. Occasional concurrent sampling among agencies can be used for quality control purposes or to aid in identification of adverse conditions or pollution sources. It is critical that each agency make a commitment to share their data in a timely manner and in a common electronic format to facilitate incorporation into a centralized database. All relevant information should be included. For instance, the need to record days of seafood processing operations was identified as a high priority by the Data Management Work Group. Participating agencies should also agree to meet minimum QA/QC standards as represented in this plan. To this end, participating agencies should enter into data sharing partnerships embodied by a memorandum of understanding.
References


DOH, 1999. Docket #99-07-C-1030SF. Washington State Department of Health, Office of Shellfish Programs, Olympia, WA.


Figure 1. Drayton Harbor Shellfish Protection District area map.
Figure 2. Map of Drayton Harbor Shellfish Protection District sample stations.
Figure 3. Map of Drayton Harbor sample stations, harbor detail.
Figure 4. Map of Drayton Harbor Shellfish Protection District sample stations, Blaine Marina detail.
Figure 5. Past DOH sampling stations in Drayton Harbor.
(From DOH)
Figure 6. Port of Bellingham long-term monitoring sites inside the Blaine marina.
(From Port of Bellingham, 1998)
<table>
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<th>Source</th>
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<th>Y</th>
<th>Date Range</th>
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<th>FC/100gal</th>
<th>Flow</th>
<th>Sal %</th>
<th>Tide</th>
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Source Agency Abbreviation Key:
- DOH - Washington State Department of Health
- NWIC - Northwest Indian College
- POB - Port of Bellingham
- Ecology - Department of Ecology
- WWU - Western Washington University
- STP - Sewage Treatment Plant
- BOD - Biochemical Oxygen Demand
- TSS - Total Suspended Solids
- D.O. - Dissolved Oxygen
Table 2. Summary of fecal coliform sampling and analytical methods for organizations sampling within and surrounding the Drayton Harbor Shellfish Protection District.

<table>
<thead>
<tr>
<th>Organization</th>
<th>Sampling Frequency</th>
<th>Description</th>
<th>Method</th>
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<td>DOE</td>
<td>Rotational/monthly</td>
<td>MF</td>
<td>SM 9222D</td>
<td>DOE/Manchester</td>
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<td>MF</td>
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<td>POB</td>
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<td>POB(^2)</td>
<td>Monthly/Seasonal</td>
<td>MPN</td>
<td>SM 9221E</td>
<td>Unknown</td>
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<td>BSP</td>
<td>Monthly</td>
<td>MPN</td>
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<td>SFHD</td>
<td>Seasonal/weekly</td>
<td>MF</td>
<td>3</td>
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1. DOH will reduce sampling frequency from monthly to every other month beginning January 2000.
2. POB, Phase II long-term studies
3. Canadian Guidelines for Recreational Water Quality

**Abbreviation Key**

MPN - Most Probable Number  
MF - Membrane filtration  
DOH - Washington State Department of Health  
NWIC - Northwest Indian College  
POB - Port of Bellingham  
BSP - Blaine Seafood Processors  
SFHD - South Fraser Health District, BC  
BCCDC - B.C. Centre for Disease Control, Provincial Laboratory  
STP - Sewage Treatment Plant
Appendix A: Data management work group priorities list
Drayton Harbor Shellfish Protection District Data Management Work Group
- Brainstorming Session 9/13/99

Micheal Cochrane, NWIC; Don Lennartson, DOH; Bill Charles, BSP; Margaret Kardell, DHSPD
CAG; Art Choat, Port of Bellingham; Grant Stewart, City of Blaine; Julie Hirsch, Facilitator and
DHSPD Consultant.

GOAL: Reopen Shellfish Growing Areas in Drayton Harbor

OBJECTIVE: Develop a coordinated, comprehensive long term monitoring scheme for
guiding pollution control projects and activities, and for assessing progress toward meeting water
quality standards – From the DHSPD Water Recovery Plan (1998) and the Whatcom County
Comprehensive Plan.

IDEAS GENERATED BY THE WORK GROUP WERE PRIORITIZED USING THE FOLLOWING
RATING SYSTEM. (The rating table is attached at the bottom of this document)
1 = Highest priority for implementation as soon as possible
2 = Mid priority, needed but not urgent
3= Low priority item
W = Wish list item, would be useful but may not be realistic before September 2000 possibly in the
future

BRAINSTORM QUESTION 1:
What elements are needed to provide a framework for an effective DHSPD long term
monitoring scheme?

In the category of highest priority for implementation as soon as possible

- The #1 priority item under brainstorm question #1 is to maintain a regular water quality
  monitoring program in the Drayton Harbor SPD and to obtain an ongoing source of funding
  for a lead agency to operate this program.
  - A quality assurance and quality control component was identified as a top priority for
    the program.
  - Include an ambient monitoring component that uses a systematic random sampling
    approach.

- The #2 priority is to establish a data sharing agreement among participation agencies.

- Tied for # 3 priority are:
  - The need for recognition of water quality problems by elected officials
  - Periodic analysis of water quality data and periodic dialog about conclusions.
  - Continuation of sampling at current levels.
  - A defined time frame for a long term monitoring program.

- Tied for # 4 priority are:
  - The need for periodic re-evaluation of a long term coordinated monitoring plan/program.
  - Accompaniment of potentially polluting activities (such as development) and pollution
    control activities by water quality monitoring plans to track water quality changes.
  - Identify a list of long term sampling sites.

In the category of mid-priority, needed but not urgent:

- The #1 priority is to include an event driven sampling component for known or potentially
  adverse conditions. An example of event driven monitoring is the Adverse Pollution
  Condition sampling of Drayton Harbor by DOH primarily during flood tide.
Tied for #2 priority are:

- Obtain a statement of commitment to a long term coordinated monitoring program from participating agencies.
- Include a sampling component targeted to specific problems or locations. These studies might take the form of special projects or pilot projects. An example of targeted sampling is intensive sampling by the Port and DOH inside the Blaine Marina.

BRAINSTORM QUESTION 2:
What data are needed to promote progress in fecal coliform source identification and actions that will result in reduced (fecal coliform) loading to shellfish beds, and to assess progress toward meeting water quality standards?

In the category of highest priority for implementation as soon as possible:

- Tied for #1 priority under brainstorm question #2 are:
  
  - Include sampling coverage of Drayton Harbor, the marinas and tributaries. Emphasize spatial and temporal distribution of stations to maximize coverage among agency sampling programs.
  
  - Record days when fish processors are operating in the Blaine Marina.

The #2 priority identified was the need for a stormwater sampling component which would include sampling of Drayton Harbor during or immediately after sewer overflows and include a stormwater sampling station at the viaduct near Nikki’s Restaurant.

- The #3 priority identified was “better” data analysis. (Currently data analysis is provided separately by DOH with sanitary surveys and quarterly by NWIC for their respective programs. Construction of a coordinated database and a water quality assessment are tasks scheduled in the year 2000 in the consultant implementation contract for data management.)

- The #4 priority item is for the Blaine STP to continue reporting 4 day accumulated rain data.

In the category of mid-priority, needed but not urgent:

- The #1 priority identified was to evaluate fecal coliform source contributions by the process of elimination whenever possible.

- Tied for #2 priority are:
  
  - A circulation study of the Blaine Marina
  
  - For agencies sampling marine waters for fecal coliform to test for additional parameters collected by DOH (salinity and temperature).
  
  - Request that Ecology’s Marine Ambient Sampling Program continue sampling Drayton Harbor at a higher frequency.

- The #3 priority identified was special sampling inside both marinas for parameters such as BOD, nutrients (including ammonia as an indicator of waste discharge), secchi depth, and dissolved oxygen profiles.

- The #4 priority was monitoring the presence birds and seals, and sampling to determine their influence on fecal coliform loading.
BRAINSTORM QUESTION 3:
What measures are needed to effectively coordinate sampling activities among agencies/organizations sampling in the Drayton Harbor watershed?

In the category of highest priority for implementation as soon as possible:
- Priority #1 was that agencies coordinate quality control procedures by collecting duplicates and occasional side by side sampling to document variation among sampling programs.

- Tied for priority #2 were:
  - Commitment to communicate information and coordinate sampling schedules among participating agencies
  - Recognition of logistical constraints on sampling

In the category of mid-priority, needed but not urgent:
- Tied for priority #1 were:
  - A centralized database with free exchange of data.
  - The establishment of a coordinated sampling schedule for sampling agencies.
  - Local agency efforts provide sampling for special projects (such as stormwater sampling).

- The #2 priority is that agencies commit to providing e-mail for electronic communication and data transmission.

SEE NEXT PAGE FOR RATING TABLE
### BRAINSTORM QUESTION 1:
What elements are needed to provide a framework for an effective DHSPD long term monitoring scheme?

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<td>Include 3 types of sampling:</td>
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**BRAINSTORM QUESTION 2:**

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<td>Marina circulation study</td>
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<td>Record days that industries operate, e.g. fish processors</td>
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<td>Distribute data collection spatially and temporal</td>
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<td>Better data analysis by qualified person</td>
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<td>Evaluate source contributions by process of elimination</td>
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<td>Sample or record additional relevant parameters: As selected by Blue Ribbon Panel (e.g. Color, turbidity, total suspended solids, total Organic carbon, effects of siltation on harbor volume, dissolved oxygen, boat waste volume &amp; activity, understand the effects on fecal coliform mortality, predation assay, algae, foam, and oil)</td>
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<td>Monitor effects of new breakwater(s) on water quality</td>
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<td>Sample for BOD, nutrients (including ammonium, Secchi depth, chlorophyll A, dissolved oxygen profile inside both marinas</td>
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<td>Sample shallow front wave of incoming tide @ tributaries</td>
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**BRAINSTORM QUESTION 3:**

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<th>Rating 2 (votes/6)</th>
<th>Rating 3 (votes/6)</th>
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<td>A coordinated sampling schedule for sampling agencies, (DOH, NWIC, Port, Blaine Seafood Processors)</td>
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<tr>
<td>A commitment from agencies to communicate and agree on sampling coordination scheduling</td>
<td>3</td>
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<td>A centralized database with free exchange of data</td>
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<td>Sampling coverage of the whole watershed, and tributaries) on the same days</td>
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<td>Record and communicate dates of fish processing and industrial activity</td>
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<td>Occasional duplicates for quality control purposes</td>
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<td>Occasional split samples for quality control purposes</td>
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<td>Financial commitment by agencies</td>
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<td>Local efforts (Vs DOH in Olympia) for special sampling i.e. stormwater sampling</td>
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<td>Agreement on what constitutes a storm for sampling purposes</td>
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<td>Finalize a list of sites that will be sampled over the timeframe of the long term monitoring scheme</td>
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<td>E-mail provided for the Blaine STP By the City of Blaine</td>
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<td>Use logarithm or natural log for presentation of fecal coliform data</td>
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<td>Regular dock inspections by a lead agency</td>
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<td>Financial commitment from cooperating agencies</td>
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<td>Each time Semiahmoo Bay is sampled, sample it on the flood tide first,</td>
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<td>followed by sampling in the Blaine Marina</td>
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<td>Recognize sampling constraints based on logistics</td>
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<td>City of Blaine report CSOs to coordinating sampling agencies for sampling purposes</td>
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Appendix B  

Marine water sampling protocol; Washington State Department of Health Office of Shellfish Programs.
MARINE WATER SAMPLING

Department of Health, Office of Shellfish Programs

Collecting Marine Water Samples for Shellfish Area Classification and Monitoring

SUPPLIES
- Sterile 100ml sample bottles
- Long handled sampling wand
- Salinometer or refractometer
- Thermometer (centigrade)
- Wristwatch or clock
- Paper towels or hand towel
- Insulated ice chest / crushed ice
- Insulated shipping carton
- Newspapers (for packing samples)
- Shipping invoice
- Frozen ice packs
- DOH/Shellfish data sheets
- Sample station location map
- Waterproof marking pen
- Waterproof ballpoint pen
- Sealable plastic bags
- Packing Tape

PROCEDURES

I. Before water sample collection, perform the following tasks

Prepare the data sheet(s): Enter the following information using only the DOH/Shellfish data sheets (see the attached examples).

1. In the space marked "Date", enter the sampling date.

2. In the space marked "Samplers", enter the names of the sampling crew.

3. In the space marked "Area", enter the complete, official DOH/Shellfish name of the sample area.

4. In the space marked "Monitoring", enter the DOH/Shellfish monitoring program type (Ambient, Conditional, Recreational, or Restoration).

➢ Use a separate data sheet for each area that is sampled.
5. In the space marked "Tide", enter the name of the tide correction location closest to the sample area.

6. In the space marked "Low Tide: Time", enter the low tide time listed for the tide correction location.

7. In the spare marked "Height" following the Low Tide: Time space, enter the low tide height for the tide correction location.

8. In the space marked "High Tide: Time", enter the high tide time listed for the tide correction location.

9. In the space marked "Height" following the High Tide: Time space, enter the high tide height for the tide correction location.

➤ Choose high and low tides that bracket the times that samples will be collected.

Prepare the sample bottles: Mark the sample bottles, using only DOH/Shellfish sterile 100ml sample bottles.

1. Use a waterproof marking pen to consecutively number each of the bottles. Mark the bottle number both on the side of the bottle and on the top of the bottle cap. Start the numbering with "1" and end with the number that equals the total number of samples collected from all areas sampled during the day.

➤ The bottle number is NOT the same as the sampling station number. Do NOT write the sampling station number on the sample bottle.

2. Mark a separate bottle with the letters "TC" (temperature control). Fill this bottle with water when the first sample of the day is collected and place it in the cooler with the rest of the samples. If more than one shipping carton is going to be used make sure that each shipping carton contains a TC bottle.

➤ The "TC" bottle is used to determine the temperature of the samples in each shipping carton upon arrival at the DOH Public Health Laboratory in Seattle. If the temperature of the water in the "TC" bottle is greater than 10°C., the samples will not be processed!

II. During Sample collection: Enter the following information on the data sheet:

1. In the column marked "Sample Number", enter the number written on the side of the sample bottle, and on the cap.
The numbers in the "Sample Number" column must be in consecutive order on each data sheet. This requires some planning when two samples are being collected from two or more areas in the same day.

2. In the column marked "Station Number", enter the number of the sampling station indicated on the station map.

3. In the column marked "Time: 24 hr.", enter the sample collection time using 24 hour time notation (0821, 1037, 1403, etc).

4. In the column marked "Tide: Eb/FI", enter the tidal phase at the time of sample collection; "EB" for ebb or "FL" for flood.

Enter an "EB" in the Tide column for all samples collected up to and including 30 minutes after the indicated low tide. Enter a "FL" in the Tide column for all samples collected up to and including 30 minutes after the indicated high tide.

5. In the column marked "Surface Temp.", enter the water temperature (to the nearest whole degree C.) registered at the sampling station when the water sample is collected.

6. In the column marked "Surface Salinity", enter the salinity (to the nearest one part per thousand) registered at the sampling station when the water sample is collected.

When sampling an area that contains subareas, indicate the subarea names on the data sheet as follows:

- Under the column marked "Subarea/Station Description/Remarks/BIDN", write the subarea name on a blank line (no other entries on the line). More than one subarea may be entered on one data sheet.

- Enter all information as described above for each station in the subarea on the lines below the subarea name.

Perform the following tasks while collecting water samples:

1. Collect samples at the sites designated on the sample station map.

2. Do not collect a water sample from a silt plume produced by the boat wake, or use reverse to slow the boat at the sample location in shallow water. Approach the sample location slowly in order to disturb the sediments as little as possible.
3. When collecting samples from shore, wade far enough away from the shore to avoid silt stirred up by shoreline wave action. Use a long handled sampling wand to collect samples well away from sediments stirred up by wading.

4. Avoid collecting samples from areas of the sample site with obvious surface scum, vegetation, or floating debris. In the "Remarks." column of the data sheet, describe any unusual aspect of the water being sampled, as above.

Remove the cap from the sample bottle with care not to touch the inside of the cap, the lip, or inside of the bottle. If you feel that the bottle has been contaminated discard it and prepare a new one.

6. Collect samples by sweeping the bottle smoothly through the water, approximately six inches below the surface. The bottle must enter and leave the water without stopping the sweeping, forward motion. This is done to prevent any contaminants on the outside of the bottle, or the sampling wand, from entering the sample bottle.

7. Do not fill the sample bottle completely. Pour out enough of the sample so that the liquid level reaches approximately to the 100ml line marked just below the neck of the bottle. This is done to allow enough air space in the bottle so that the sample can be shaken before it is processed.

8. Replace the cap without touching the lip of the bottle or the inside of the cap and place the sample upright in the cooler surrounded by crushed ice as soon after collection as possible. Do not submerge the sample in ice or melted ice water as this may contaminate the sample.

➢ Exposure to ultraviolet light can kill fecal coliform bacteria. It is critically important not to expose the sample to direct sunlight, and to place the sample in crushed ice in a light-tight cooler immediately after collection.

9. If a refractometer is used to measure salinity, dry the instrument with a clean paper towel or a clean hand towel after each reading.

10. The refractometers used by DOH Shellfish staff are most accurate at temperatures between 70°F and 85°F. In cold weather the refractometer should be wiped dry and placed inside your jacket between readings.

III. After Sample Collection: Ship the collected samples to the D014 Public Health Laboratory.
The samples must be received in the Laboratory in Seattle within 30 hours of being collected or the samples will not be processed.

1. Use insulated shipping cartons (with styrofoam liners) to ship the collected samples to the DOH Public Health Laboratory.

2. Place one or two frozen ice packs in the bottom of the shipping carton and arrange no more than two layers of sample bottles on their sides on top of the ice packs. Make sure that each shipping carton contains a temperature control (TC) bottle. The bottles must be arranged so that each bottle is in contact with an ice pack. Place a second layer of frozen ice packs on top of the bottles and fill any empty spaces with crumpled newspaper.

Temperature of the water samples is a critical factor in shipping, especially during the summer months. The temperature of the water in the "TC" bottle must be less than 10°C when it reaches the laboratory, or the samples will not be processed.

3. Place the data sheet(s) in a large sealable plastic bag inside the cardboard carton and on top of the styrofoam lid.

4. Seal the cardboard shipping carton with sufficient tape to secure the integrity of the carton during shipment.

5. Carefully observe the check-in process at the shipping service counter, check the receipt for accuracy, turn in the receipt at the Shellfish Office for recordkeeping and for package tracing, should this become necessary.

References:


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PORTAGE BAY SHELLFISH PROTECTION
DISTRICT PROGRESS REPORT

November 2, 2000

Prepared by:
Christine Woodward
Wizards Consulting Services, Julie Hirsch, Hirsch Consulting Services and the Portage Bay Citizens Advisory Group

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**MAPS**

#1 Border Monitoring Project

#2 Portage Bay Ambient Monitoring Stations

**SEPARATE REPORT**

Portage Bay Shellfish Protection District Water Quality Summary
BACKGROUND HISTORY OF PORTAGE BAY

Portage is located at the terminal end of the Lummi Peninsula and approximately three miles down the shore from the mouth of the Nooksack River. The intertidal area of Portage is a major commercial shellfish harvesting area owned and operated by the Lummi Nation. Until recently, all of Portage held an Approved commercial shellfish growing area designation.


Results from WDOH sampling lead to a downgrade in August of 1997 of a portion of Portage. The downgrade derived from the failure of WDOH stations 11 and 12 (see map # 2) to meet the standard for Approved commercial shellfish growing water. In 1999, station 13 and 30 were added to the restricted list. In response to this downgrade, the Whatcom County Council formed a Portage Closure Response Team in order to develop a strategy to reopen the closed beds by December 1999.

The linkage between the Nooksack River fecal coliform counts and Portage is generally established by the incidence of low salinity recorded by WDOH while sampling for fecal coliform. In general, the incidence of high fecal coliform concentrations in Portage coincides with lowered salinity values that are indicative of freshwater influence. The primary source of freshwater to Portage is the Nooksack River.

Results from inspection of the WDOH database reveal that increased fecal coliform concentrations normally occur when Nooksack River flow is over 7,000 cfs or when river discharge is over 3,000 cfs AND precipitation was greater than 0.7 in during the previous 2 days. River discharge below 2,500 cfs rarely yields violations of the standard. Violations of the standard also appear to be seasonally related. Most of the violations for Stations 11 and 12 occur in the months of October and April, while most of the violations for Station 13 occur in the summer months as well as October and April. The predominant mechanism for transport of excessive fecal coliform concentrations to Portage seems to occur when rainstorms wash excessive fecal coliform by overland flow and river channels into the Nooksack River. As a result of storm runoff, river flow increases. The high river flow, combined with the southerly winds associated with rainstorms, can serve to direct this concentrated discharge along the shoreline and into both inner Bellingham Bay and Portage. This mechanism seems to be predominant during fall and spring months. Another mechanism can occur to a lesser extent during dry summer months and during periods of low river flow. In this scenario a relatively thin layer of Nooksack River freshwater can flow directly from the Nooksack River mouth along Brant Island and out Bellingham Bay past Portage Island. As summer months are
typically times of lower fecal coliform concentrations in the Nooksack River, the magnitude of water quality violations at WDOH stations in Portage tends to be lower as well.

**Executive Summary**

The time frame from November of 1999 to November of 2000 has been a period of increased water quality related activities in the Portage Bay Shellfish Protection District/Nooksack watershed. One of the most important of these activities has been the continuing work by Department of Ecology on the Total Maximum Daily Load (TMDL) project. In 1997-1998, DOE conducted a TMDL of the lower Nooksack River. Because the lower river basin has a history of bacteria standards violations, the TMDL focused on fecal coliform bacteria loading on the river from tributaries, sewage treatment plants and other sources. Nooksack river bacteria sources were implicated as a significant reason for the downgrades of shellfish beds in Portage Bay.

In April of 2000, DOE, with the help of many agencies most of whom also now sit on the Portage Shellfish Advisory group, developed a Summary Implementation Strategy for the TMDL. The strategy to implement the Nooksack Bacteria TMDL is based upon many existing efforts underway to reduce and eliminate fecal coliform contributions to the Nooksack River. The Portage Bay Shellfish Protection District Advisory Committee fully supports the DOE bacteria reduction plan. This plan will comply with federal mandates required by the Clean Water Act and Section 6217 of the Coastal Zone Management Act Reauthorization Amendments of 1990, state laws to control point and non point pollution, and the 1997 Memorandum of Agreement between the EPA and DOE.

Water quality sampling conducted by the Northwest Indian College continuing the TMDL work completed its seventh quarter on September 2000. Through this work along with additional funding through EPA for additional sampling along the Canadian border and northern Lynden area, (see map #1) areas of concern have been located and additional sampling by DOE to pin point problem locations has taken place. With this data, DOE and Whatcom County Health have begun a priority On Site Septic Survey (OSS) in those selected areas that continue to violate standards even during dry times of the year. DOE is also re-inspecting those dairies in the vicinity of areas of concern. The sampling program for the NWIC in the Nooksack Basin has been funded for another year. Future funding needs to be more stable.
UPDATE ON STATUS ACCOMPLISHMENTS FOR THE TIME PERIOD FROM NOVEMBER OF 1999 TO NOVEMBER OF 2000

Objective 1: Control Agricultural Sources:
Natural Resource Conservation Service, Whatcom County Conservation District, Whatcom County Planning and Development Department.

Whatcom County Conservation District, Natural Resource Conservation Service:

- The Conservation Reserve Enhancement Program (CREP) is a relatively new program for which the Farm Service Agency (FSA) leases farmed land for 10-14 years for the purpose of establishing conservation buffers of native conifers and hardwoods along salmonid-bearing streams. To date, 57 acres in the Portage Bay watershed have been planted in this program, and the number of contracts to plant is growing.
- The Whatcom Conservation District’s Dairy Program started out the year with a 4 member team that at one point was down to a single individual. In May, Chris Clark, and in October, Bill Sickner joined the staff, bringing the team back up to 3. Over the past year the dairy team accomplished the following:
  - 58 total nutrient management plans are completed and approved that met the requirements of the states Dairy Nutrient Management Law (SB 6161, Chapter 90.64 RCW). This is 21 more than last year. Of those, 13 are certified, which means that practices have been implemented. By 2002 51 more dairies need to have a dairy plan compliant with SB 6161 and all must be implemented by 2003.
  - The Washington Conservation Commission provided approximately about $269,358 in the watershed, targeting livestock waste storage and control facilities. The Farm Service Agency provided approximately $425,000 for similar facilities.
  - One small farm planner is currently working on one conservation plan for a small horse farm in the watershed, which includes financial assistance for a dry stack facility and fencing. Three small farm conservation plans were completed since the last update. One was for an 80 acre llama farm, which has implemented most of the planned 8.6 acres of riparian buffer of native trees and shrubs along a headwater reach of Deer Creek and a tributary. The other two were on cattle farms. One had a 30’ wide riparian woody buffer planted along 1800’ of Kimm Creek.
  - The WCD small farm planner made three site visits to small farms during the last year, one with cattle and two with horses. She provided technical assistance by providing information about complying with CAO, and keeping animals and manure runoff out of streams. One of the horse farms was referred by Department of Ecology.
  - The small farm planner is currently working cooperatively with Whatcom County Planning and Department of Ecology to provide assistance to violators of the Critical Areas Ordinance and RCW.90.48 to prevent further degradation of resources.
  - Whatcom Conservation District has worked with dairies and small farms to develop conservation plans and implement NRCS filter strip or riparian forest specifications
next to streams which are based on soil types and slope: these are exemptions to CAO stream buffers that still enable water quality protection.

**Whatcom County Planning and Development Department:**
No report

**Objective 2: Control Stormwater Sources:**
Whatcom County Planning Department
No report.

**Objective 3: Control STP's and OSS's Sources.**
Whatcom County Health and Human Services, Lummi Indian Nation, City of Ferndale, City of Lynden, Lummi Water and Sewer, Department of Ecology.

**Whatcom County Health and Human Services:**
- An Interagency agreement with Whatcom Conservation District for Loan Administration for low interest loan programs to assist homeowners with repair of failing On Site Septic Systems (OSS) has been approved. Health is currently finalizing Agreements for Title services and preparing Loan Application packets.
- A formal OSS enforcement policy to ensure adequate enforcement of regulations regarding repairs of failing OSS was approved by Board of Health and has been in effect since December of 1998.
- On November of 1999, Council approved necessary changes to WCC 24.05 which insures that consideration is given to special areas such as the Nooksack drainage which may have a potential impact on shellfish resources so that the resulting program ensures preventive Operation and Maintenance in these areas.
- Consideration of the Nooksack drainage as an Area of Special Concern discussions will begin in November of 2000.
- A formal letter was written to the Lummi Nation offering any resources that may be needed in evaluating OSS on the Nations land.
- A database of listed sites for all residences within public sewer service areas that are either connected to public sewer or that their OSS are adequately functioning has been update.
- Cooperative effort with DOE in completing 21 OSS surveys in the Double Ditch area. Through water quality sampling in the Double Ditch area by NWIC and DOE, fecal coliform levels were shown as consistently high even during dry months. Results of the testing has found that to date (11/2/00) 17 inspections completed, 3 failures identified and in process of obtaining permits, financing, etc. for repairs. 3 inspections remain to be completed. If needed, Health will write a letter with DOE to get on these sites.
City of Ferndale:
No response.

City of Lynden:
- The UV system installed in July of 1999 to help eliminate the presence of high bacteria counts is working as it is suppose to. There have been no problems and/or violations.

Lummi Indian Nation:
- A Memorandum of Agreement between United States Environmental Protection Agency, (EPA) Lummi Nation, Washington Department of Ecology (DOE) and State Department of Health, (SDOH) was agreed to in August of 2000, (see attachment 4#).
- Lummi is working with EPA and SDOH to conduct a dye study to demonstrate how, if at all, the Wastewater Treatment Plant discharge affects Portage Bay.
- Lummi Natural resources is collecting fecal coliform samples along-side with Sewage Treatment Plant (STP) staff from the STP’s as an independent check of their lab.
- In cooperation with the Lummi Natural Resources Department and the Lummi Sewer District, the SDOH has been investigating the pup stations along Lummi Shore Road.

Department of Ecology:
- NPDES permits for Everson, Lynden and Ferndale Treatment plants are in the process of being transferred to the Bellingham office.

Objective 4: Monitor Water Quality:
Northwest Indian College, State Department of Health, Nooksack Indian Tribe, Lummi Indian Nation, Department of Ecology

Northwest Indian College:
The Northwest Indian College (NWIC) Water Quality Monitoring program, was developed to provide technical data about location, concentration, and pattern of fecal coliform contribution. This monitoring is to provide Drayton Harbor and Portage Shellfish Protection Districts with the technical data needed so that resources are used effectively towards correcting nonpoint pollution sources. This monitoring program augments the Department of Ecology’s (DOE) Nooksack TMDL study that conducted fecal coliform monitoring in the Nooksack River from March 1997 to February 1998 and Washington Department of Health (WDOH) monthly ambient monitoring in Portage. Additional fecal coliform monitoring results utilized by this task come from an EPA River Watch grant that monitored Nooksack River concentrations monthly between the end of the TMDL field sampling and the start of this project and will continue to provide data primarily from Portage. (See attachment # 2 for seventh quarter data results.)
State Department of Health:
See attachment # 3 and map #2 for classification map.

Julie Hirsch, Shellfish Consultant:
The Coordinated Water Quality Monitoring Framework for Portage Bay Shellfish Protection District and the Water Quality Summary has been completed (see attachment #1 and item marked report.)

Department of Ecology:
Ecology is continuing to monitor and sample various areas in the Double Ditch and Bender Road areas, as well as Fishtrap Creek area. Fecal coliform bacteria sources are “being narrowed down” according to Mak Kaufman, Dairy waste inspector. Ecology has been denied access to an area which it was previously permitted access too which has caused the sampling regime to be altered.

Objective 5: Establish Education/Outreach Program
WSU Cooperative Extension, Whatcom Conservation District

WSU Cooperative Extension:
- WSU Extension conducted Dairy Nutrient Management Plan workshops in Dec. 1999 in NW Washington for dairy producers and planning consultants on plan elements as per RCW 90.64. General topics covered included: legal matters, Soil & Manure Sampling, Whole-farm nutrient management, nutrient management case study, and general planning requirements.
- In February 2000, the WCD held a workshop targeted for EQIP participants specifically on the Nutrient Management Specification 590 requirements in the NRCS Field Office Technical Guide. WSU Extension co-partnered in presenting this information.
- WSU Extension held 2 grazing management workshops directed to teaching livestock owners about the advantages of grazing systems, including implications for nutrient management.
- Robert Dyk, WSU Area Extension Agent, has established an advisory system on local research and educational needs with Whatcom County dairy producers and consultants. Meetings have so far generated interest in prioritizing local research issues in nutrient management. Grants applications are underway to facilitate those needs. Future advisory system meetings will continue to direct efforts towards establishing a nutrient management research program on farms in Whatcom County. Demonstration and workshops on management practices are the key products to be generated for NW Washington dairy producers.
Whatcom Conservation District:

- WCD is partnering in sponsoring the Horses for Clean Water educational series for Horse Owners. It is a 4 part classroom series held this fall in Bow, WA for a small fee, and focuses on manure and mud management, pasture productivity, and composting, in the context of water quality protection. A model horse farm tour is being offered as part of the program that addresses water quality protection practices.

- Have two part-time employees for information and education for small farm owners and public schools. The program includes: landowner workshops on environmentally sensitive horse keeping, educational displays at Farmers’ Market, NW Washington Fair, Cattlemen’s Winterschool, a benefit for the Northwest Ecosystem Alliance salmon program and Salmon Summit; newsletter articles highlighting water quality issues, concerns, and solutions for farmers; school presentations and workshops.

- One part-time employee has established the Bertrand Creek Stream Team, an educational program which involves landowners and the general public in stream restoration and environmental education activities, and provides lectures on stream ecology, water quality, and fisheries.

- As a way of keeping local dairy producers informed about its programs as well as updating them on the latest in developments in Nutrient Management practices and technology the Dairy Team contributed articles to the District’s quarterly newsletter (WHATCOM Conservation News) and in the spring it joined with NRCS and WSU Cooperative Extension in presenting a 6 hour nutrient management workshop to dairy producers. This is current.

Objective 6: Establish Funding District and Program
No report
ATTACHMENT #1

TO: Whatcom County Council and Portage Bay Shellfish Advisory Committee
FROM: Julie Hirsch, Hirsch Consulting Services
RE: Whatcom County Shellfish Closure Response Implementation: Progress Report for Data Management
CC: Christine Woodward, Wizards Environmental Consulting

Dear Council and Committee Members,

This report outlines progress on Data Management tasks specified in the scope of work for Whatcom County professional services contract #9903010.

Portage Bay Shellfish Protection District Water Quality Summary
The Portage Bay Shellfish Protection District Water Quality Summary was submitted to Whatcom County Health on October 25, 2000. The document summarizes fecal coliform trends at all stations monitored by implementing agencies and provides recommendations for pollution reduction and updated GIS maps. The report is submitted to the Council with this packet.

Whatcom County Shellfish Protection District Database
The database was submitted to Whatcom County Health on April 1, 2000, with data through 1999. The database contains contact information for all implementing agencies that collect water quality data, information about each sampling station, and available data from each implementing agency. It is now in the process of being updated to June 2000. The database was requested by and has been provided to the WRIA 1 project consultants for their use.

Data Management Work Group
The data management work group will meet once more this year.

Web site
The Portage Bay Coordinated Monitoring Framework is available on the County’s Shellfish Protection District Web site. The water quality summary is available in the What’s New section of the web site. The database will be posted before the end of the year.

Please feel free to contact me or Christine Woodward if you have questions about the attached materials. I appreciate the opportunity to contribute to reopening the Whatcom County shellfish beds.

Sincerely,

Julie Hirsch
Principal
ATTACHMENT #2
WHATCOM COUNTY SHELLFISH PROTECTION PLAN

TASK 2.
NORTHWEST INDIAN COLLEGE WATER QUALITY MONITORING
SEVENTH QUARTER REPORT
JULY-SEPTEMBER 2000

NOOKSACK WATERSHED

Introduction
Fecal coliform concentration data gathered under the Centennial Clean Water Act (CCW) grant for the seventh quarter (July-September 2000) are compared to data gathered during the previous quarters and to appropriate fecal coliform data from the Washington Department of Ecology Total Maximum Daily Load (TMDL) study. The purpose is to address the 'Is it getting better or worse?' question. Also included are data from an additional Environmental Protection Agency (EPA) contract that was initiated this quarter (in Italics). Supplemental EPA sampling includes Duffner Ditch and the upper watersheds of Bertrand and Fishtrap Creeks. The state Class A surface water quality standard is a geometric mean of 100 fecal coliform per 100 milliliters (fc/100ml) with no more than 10% of the samples exceeding a value of 200 fc/100ml. This is the final quarter of sampling for this Centennial Clean Water Act grant. Limited sampling of the Nooksack watershed will continue, however, under contracts with Lummi Natural Resources and EPA Region 10.

Fecal coliform geometric mean values for tributary stations were generally about the same or lower during the seventh quarter (Summer00) than the sixth quarter (Spring00).

Elevated fecal coliform values for Bertrand and Doubleditch appear to have significant contributions from Canada.

Water quality at the mouth of the Nooksack River during Summer00 improved considerably.

Water quality in Portage Bay continued to violate the Approved shellfish growing water standard of 43fc/100ml in more than ten percent of samples.

EVERSON (M5)

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The Everson sample station serves as a baseline for fecal coliform input to the study area from the North and South Forks. One high sample (300 fc/100ml) on 9/19 served to increase counts for this station above the Class AA water quality standards. All Nooksack mainstem stations recorded high counts on this day, increasing to a count of 600fc/100ml at the mouth.

Kamm Creek enters the Nooksack River just above Lynden. Results from the Summer00 sampling show a slight decrease in fecal coliform values at the mouth (K1) and a slight increase at K2 (Northwood Rd) over Spring00 samples.

Summer00 sampling along the mainstem Nooksack River at Lynden (M4) maintained a low fecal coliform concentration with the exception of the one high count on 9/19.
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Scott Ditch showed radically decreased fecal coliform concentrations during the Summer00 sampling over those of Spring00.

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### F2

|          | Winter99     | Spring        | Summer | Fall   | Winter00 | Spring00 | Summer00 |         |         |         |         |         |
| GEOMEAN  | 251         | 503           | 549    | 374    | 377     | 614     | 377     |         |         |         |         |         |
| %>200    | 79%         | 83%           | 100%   | 80%    | 73%     | 100%    | 76%     |         |         |         |         |         |
| N=       | 14          | 6             | 9      | 10     | 11      | 8       | 4       |         |         |         |         |         |

### F3

<p>|          | Winter99    | Spring       | Summer | Fall   | Winter00 | Spring00 | Summer00 |         |         |         |         |         |
| GEOMEAN  | 513         | 488          | 304    | 208    | 369     | 903     | 259     |         |         |         |         |         |
| %&gt;200    | 69%         | 83%          | 89%    | 50%    | 73%     | 88%     | 80%     |         |         |         |         |         |
| N=       | 16          | 6            | 9      | 10     | 11      | 8       | 5       |         |         |         |         |         |</p>
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Fishtrap Creek showed counts during Summer00 that were within the range one would nominally expect for Fishtrap. The lower sample numbers for F1 and F2 are due to lab errors encountered during analysis that resulted in 0 results. A zero result with the already minimal number of samples taken this quarter had such a large effect on the geometric mean calculations that they were removed from the database. The 0 results were determined to be lab error when the adjacent station had a significant count on the same day. The principle tributary with the highest counts during Summer00 remains F4.

Both sides of Doubleditch were sampled under the EPA contract. Odd number samples are the west side, even numbers the east side. DD5 and DD6 are border stations. The west side of Doubleditch increased progressively from 83 at the border to over 400 where it combined with the east side. The east side of Doubleditch began with 32 at the border, went up to 313 in the middle, and dropped to just over 200 at the confluence with the west side. Chronically high counts in the middle of a reach argue for a local point source. Additional sampling was undertaken by Dept of Ecology during Summer00 to document and investigate this possibility.

Drainages that feed into F4 include FT1 (Benson Rd), FT2 & FT5 (Depot Rd), FT3 & FT6 (Bender Rd.), FT4 & FT7 (Assink Rd) and FT8 (Border). These were also sampled under the EPA contract. It appears that the Canadian contribution for this side of Fishtrap Creek is minimal as the concentrations coming across the border have little effect on the concentrations recorded at F4. Values recorded during Summer00 for the border station (FT8) were substantially lower than those during Spring00, while values at F4 were essentially the same. It appears that the majority of loading to F4 does not come from across the border.

**DUFFNER DITCH**

**DUFFNER**

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**DF2**

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Duffner Ditch was sampled under the EPA contract. It runs along the Guide Meridian, then crosses above Fishtrap Creek to discharge into Bertrand Creek between the current sampling station at B1 and the Nooksack River. While not a direct tributary to the Nooksack River, it is a tributary to Bertrand Creek. Summer00 concentrations decreased over Spring00. DF1 has the dubious distinction of the highest count recorded during Summer00 sampling – 13,900 fc/100ml on 8/8/00. DF3 had more than one sample taken, but it was dry a lot this summer. While concentrations are extremely high, flow is unknown, consequently the actual loading to Bertrand Creek is unknown.

### BERTRAND

#### BERTRAND B1

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</tr>
</tbody>
</table>

#### BJB

<table>
<thead>
<tr>
<th>Spring00</th>
<th>Summer00</th>
</tr>
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</table>

Bertrand Creek decreased fecal coliform concentrations during the Summer00 sampling. EPA contract stations at the border H St (BH) and Jackman Rd (BJ) indicate that most fecal coliform loading to Bertrand Creek is likely coming from Canada. Canadian concentration contributions appear to be about equal for BH and BJ this quarter.

### TENMILE

<table>
<thead>
<tr>
<th>TENMILE</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
</tr>
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<tr>
<td>GEOMEAN</td>
<td>Winter99</td>
<td>Spring</td>
<td>Summer</td>
<td>Fall</td>
</tr>
<tr>
<td>275</td>
<td>86</td>
<td>366</td>
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<tr>
<td>378</td>
<td>750</td>
<td>468</td>
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<td>194</td>
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<tr>
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<td>100%</td>
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<td>55%</td>
</tr>
<tr>
<td>N= 14</td>
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</tr>
<tr>
<td>175</td>
<td>666</td>
<td>219</td>
<td>249</td>
<td>255</td>
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<tr>
<td>33%</td>
<td>100%</td>
<td>78%</td>
<td>50%</td>
<td>55%</td>
</tr>
<tr>
<td>N= 12</td>
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<td>62</td>
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<tr>
<td>8%</td>
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<td>78%</td>
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<td>18%</td>
</tr>
<tr>
<td>N= 13</td>
<td>6</td>
<td>9</td>
<td>10</td>
<td>11</td>
</tr>
</tbody>
</table>

Tenmile Creek fecal coliform concentrations decreased at all stations during Summer00 sampling. Counts at T4 are maintaining their relatively low level.

### FERNDALE (M2)

<table>
<thead>
<tr>
<th>FERNDALE</th>
<th>M2</th>
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<th>Winter99</th>
<th>Spring</th>
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<td>67</td>
<td>80</td>
<td>71</td>
<td>58</td>
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<tr>
<td>%&gt;200</td>
<td></td>
<td>27%</td>
<td>13%</td>
<td>20%</td>
<td>0%</td>
<td>0%</td>
<td>18%</td>
<td>13%</td>
<td>20%</td>
</tr>
<tr>
<td>N=</td>
<td></td>
<td>33</td>
<td>23</td>
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<td>9</td>
<td>10</td>
<td>11</td>
<td>8</td>
<td>6</td>
</tr>
</tbody>
</table>

The Ferndale sample site showed a slight decrease during the Summer00 sampling.
MARIETTA (M1)

<table>
<thead>
<tr>
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<th>Winter99</th>
<th>Spring</th>
<th>Summer</th>
<th>Fall</th>
<th>Winter00</th>
<th>Spring00</th>
<th>Summer00</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOMEAN</td>
<td>62</td>
<td>49</td>
<td>103</td>
<td>63</td>
<td>69</td>
<td>66</td>
<td>66</td>
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<tr>
<td>N=</td>
<td>46</td>
<td>43</td>
<td>10</td>
<td>9</td>
<td>11</td>
<td>13</td>
<td>12</td>
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</tr>
<tr>
<td>%&gt;200</td>
<td>17%</td>
<td>14%</td>
<td>20%</td>
<td>0%</td>
<td>0%</td>
<td>15%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>%&gt;43</td>
<td>59%</td>
<td>65%</td>
<td>90%</td>
<td>86%</td>
<td>73%</td>
<td>62%</td>
<td>67%</td>
<td>33%</td>
</tr>
<tr>
<td>%&gt;100</td>
<td>30%</td>
<td>16%</td>
<td>40%</td>
<td>29%</td>
<td>45%</td>
<td>31%</td>
<td>8%</td>
<td>33%</td>
</tr>
</tbody>
</table>

The sample site at the mouth (M1) showed a decrease during Summer00 sampling. While the mouth of the Nooksack did violate the 10% not to exceed 200cf/100ml part of the state standard, this was due solely to one high sample on 9/19/00. The percentage of samples likely to cause violation of shellfish growing water standards in Portage Bay (%>100) as well as the percentage of samples that could possibly affect shellfish growing water quality (%>43) were 33%.

PORTAGE BAY

<table>
<thead>
<tr>
<th></th>
<th>TMDL</th>
<th>Winter99</th>
<th>Spring</th>
<th>Summer</th>
<th>Fall</th>
<th>Winter00</th>
<th>Spring00</th>
<th>Summer00</th>
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</thead>
<tbody>
<tr>
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<td>18</td>
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<tr>
<td>N=</td>
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<td>9</td>
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<td>13</td>
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<table>
<thead>
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<th></th>
<th>Winter99</th>
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<th>Summer</th>
<th>Fall</th>
<th>Winter00</th>
<th>Spring00</th>
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<td>24</td>
<td>9</td>
<td>10</td>
<td>12</td>
<td>13</td>
<td>13</td>
<td>26%</td>
</tr>
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</table>

Portage Bay sampling data are again included as reference only. Summer00 CCW sampling documents slightly poorer water quality compared to Spring00. The frequency at which the Approved shellfish growing water standard (<10% exceed 43) is violated was 25%. When the Nooksack had a fecal coliform concentration of 600 cf/100ml on 9/19, it went to Bellingham. Portage Bay experienced full salinity and low fecal counts on 9/19/00.
**ATTACHMENT #3**

**SUMMARY OF MARINE WATER DATA (SRS)**

Growing Area: PORTAGE BAY
Classifications: Approved, Restricted

From: 01/01/1998 To: 11/01/2000
Fecal Coliform Organisms/100 ml

<table>
<thead>
<tr>
<th>Station Number</th>
<th>Classification</th>
<th>Number of Samples</th>
<th>Range</th>
<th>Geometric Mean</th>
<th>Est. 90th Percentile</th>
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<tr>
<td>49</td>
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<td>1.7 - 79</td>
<td>6.6</td>
<td>39</td>
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<td>Approved</td>
<td>30</td>
<td>1.7 - 79</td>
<td>3.8</td>
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<tr>
<td>54</td>
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<td>30</td>
<td>1.7 - 110</td>
<td>5.4</td>
<td>29</td>
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<tr>
<td>55</td>
<td>Approved</td>
<td>30</td>
<td>1.7 - 240</td>
<td>5.7</td>
<td>34</td>
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<tr>
<td>50</td>
<td>Restricted</td>
<td>32</td>
<td>1.7 - 240</td>
<td>9.9</td>
<td>66</td>
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<td>Restricted</td>
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<td>1.7 - 540</td>
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<td>1.7 - 110</td>
<td>8.7</td>
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</tr>
<tr>
<td>57</td>
<td>Restricted</td>
<td>25</td>
<td>1.7 - 220</td>
<td>5.7</td>
<td>34</td>
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</table>

*Fails Standard
PASSES, but threatened
Passes Standard*
MEMORANDUM OF AGREEMENT
Between

PURPOSE: The purpose of this agreement is to define the roles and responsibilities of federal, tribal, and state agencies in the effort to reclassify the shellfish beds within and adjacent to Portage Bay on the Lummi Indian Reservation as "Approved" for commercial harvest.

TERM OF AGREEMENT: From date of execution until terminated as provided herein.

OBJECTIVE: The objective of this cooperative effort is to achieve an "Approved" classification status for shellfish beds within and adjacent to Portage Bay by December 31, 2001. An Approved classification will have been achieved if the water quality bacterial standard defined under the National Shellfish Sanitation Program (NSSP) are achieved and the results of a sanitary survey show that the area is not subject to fecal contamination from human or animal sources at levels that present a public health hazard.

In addition to routine communication necessary to accomplish the purpose of this agreement, the parties will participate in a management level meeting at a time near the above target date to discuss the status of this joint effort and/or other actions necessary to fully restore and protect Portage Bay shellfish beds.

PARTIES: The federal, tribal, and state agencies with regulatory authority to ensure that the objectives of this effort are achieved or have direct authority to classify commercial shellfish growing areas are the parties to this agreement. The parties to this agreement are the United States Environmental Protection Agency (EPA), the Lummi Natural Resources Department, the Washington Department of Ecology, and the Washington Department of Health. The parties to this agreement will work with political subdivisions of the state including the Initiating Governments conducting watershed planning under RCW 90.82 and the Portage Bay Shellfish Protection District to achieve the objective.

ROLES AND RESPONSIBILITIES: The roles and responsibilities of each of the parties to this agreement are the following:

U.S. Environmental Protection Agency
The EPA will, subject to existing resource constraints and the availability of appropriated funds:
1. Continue to provide financial support for the surface water quality monitoring programs currently underway in response to the shellfish bed closure. The Lummi Nation, Washington Department of Health, and other institutions and private contractors are implementing these monitoring programs.
2. Maintain a lead contact with the responsibility and authority necessary to interact effectively with the other parties of this agreement. Continue to provide technical...
support in the review and approval of quality assurance/quality control plans of the surface water quality monitoring programs.

3. Provide financial and technical support in the design and implementation of dye studies to define the travel time and dilution of Nooksack River waters from the estuary to Portage Bay as well as from Nooksack River tributaries to Portage Bay.

4. Provide technical support for research directed toward understanding the response of fecal coliform populations to salinity, temperature, and sediment. The research will also include an examination of fecal coliform survival in sediments.

5. Continue to conduct compliance and enforcement inspections of the Gooseberry Point wastewater treatment plant, dairy farms, and other potential sources of fecal contamination throughout the watershed.

6. Continue to conduct source-specific monitoring of streams and other waters of the United States to determine the spatial and temporal distribution of fecal contamination in the Nooksack River basin.

7. Pursue legal actions against concentrated animal feeding operations whose operations are in violation of the Clean Water Act, as deemed appropriate by EPA in consultation and coordination with the Washington Department of Ecology.

8. Continue to actively monitor the development and implementation of the fecal coliform total maximum daily load (TMDL) for the Nooksack River basin and ensure effective implementation of the TMDL.

9. Continue to assist the Lummi Nation in developing a water quality standards program that meets the requirements of the Clean Water Act.

10. Continue to coordinate actions in the Nooksack and certain adjacent watersheds with the other parties to this agreement.

Lummi Natural Resources Department
The Lummi Natural Resources Department will:

1. Continue to implement the surface water quality monitoring program on-Reservation with particular focus on the uplands adjacent to Portage Bay and the marine waters within and adjacent to Portage Bay.

2. Collect monthly samples of the Gooseberry Point wastewater treatment plant effluent to provide an independent review of plant operations. Samples will be collected and analyzed pursuant to the EPA/Lummi Nation Water Quality Monitoring Quality Assurance Plan.

3. Improve coordination with the Lummi Sewer District to ensure that all overflows or spills from the collection and/or treatment system are reported to the Lummi Natural Resources Department within one hour after their occurrence. Appropriate Lummi Natural Resources staff members will ensure that water quality samples are collected at the site of the overflow/spill, upstream and downstream from the spill location, and from any adjacent waters where shellfish beds could be impacted. Pursuant to the Shellfish Consent Decree (Order Regarding Shellfish Sanitation, United States v. Washington [Shellfish], Civil Number 9213, Subproceeding 89-3, Western District of Washington, 1994), the Lummi Natural Resources Department will notify the Washington Department of Health Office of Shellfish Programs if it is determined that the spill discharges to shellfish beds.

August 18, 2000
4. Provide necessary coordination and support to implement dye studies designed to evaluate fetal coliform dilution and travel time from potential pollutant sources.
5. Conduct a literature review on the survival of fetal coliform in fresh and saline waters.
6. Continue to support the fetal coliform TMDL development and implementation in the Nooksack River basin.
7. Continue to develop water quality standards for the Reservation.
8. Continue to coordinate actions in the watershed with the other parties to this agreement.

**Washington Department of Ecology**

The Washington Department of Ecology will:
1. Continue to conduct compliance inspections of dairy farms and other potential sources of fetal contamination throughout the watershed. Timely and appropriate formal enforcement action will be initiated against operators determined to be discharging illegally.
2. Pursue as a top priority of the Bellingham Field Office the development and implementation of the fetal coliform TMDL for the Nooksack River basin.
3. Pursue enforcement against operations not implementing farm plans in accordance with the timeframes established in RCW 90.64.026.
4. Take corrective action(s) where it is demonstrated that nutrient management plans are either not effective and/or not being effectively implemented.
5. Continue to coordinate actions in the watershed with the other parties to this agreement.

**Washington Department of Health**

The Washington Department of Health will:
1. In consultation with the Lummi Nation and under the Shellfish Consent Decree (Order Regarding Shellfish Sanitation, *United States v. Washington (Shellfish)*, Civil Number 9213, Subproceeding 89-3, Western District of Washington, 1994), continue to be responsible to the federal Food and Drug Administration (FDA) to ensure that the National Shellfish Sanitation Program (NSSP) standards for certification of shellfish growing waters are met on the Reservation.
2. Conduct a dye study of the Gooseberry Point Wastewater Treatment Plant outfall during pertinent tidal conditions with at least one event when the tidal elevation at Portage Point is +9 MLLW.
3. Continue to coordinate actions in the watershed with the other parties to this agreement.

**TERMINATION:**

- Any parties to this agreement may terminate their participation with 30 days written notice of intent to terminate to each participant followed by a formal termination letter.
- No amendment or alteration of this agreement shall arise by implication, course of conduct, or change in state law. This agreement may be altered only by a subsequent
written document, signed by the parties, expressly stating the parties’ intention to amend their agreement.

Lummi Nation

Merle Jefferson, Executive Director
Lummi Natural Resources Department

Date: 8/18/00

Environmental Protection Agency

Charles E. Findley, Acting Regional Administrator, Region 10

Date: 8-31-00

Washington Department of Ecology

Tom F. Simmons, Director
Washington Department of Ecology

Date: 8-23-00

Washington Department of Health

Mary Selecky, Secretary
Washington Department of Health

Date: 8-31-00

August 18, 2000
Enclosed for signature by the acting Regional Administrator are four copies of a MOA between the Lummi Nation, Washington Department of Ecology, Washington Department of Health and EPA. Ecology, DOH and the Tribe have already signed the agreement. The MOA outlines activities that each party will conduct to help restore water quality in the Nooksack River and Portage Bay (located in southwest part of Bellingham Bay).

Degraded water quality has caused closure and downgraded certification of the shellfish beds in Portage Bay. These shellfish beds are an important economic and cultural resource for the Lummi Nation. Fecal coliform contamination of the Nooksack River from dairy industry wastes has been identified as the principle cause of closure of shellfish beds in the Portage Bay area. Several years ago the Lummi approached EPA to take action to help stop the poor dairy animal waste management practices that were destroying their shellfish resources. This plea was one of the several factors that helped launch our Regional CAPO inspection/enforcement initiative. Since that time, EPA and Ecology have initiated numerous enforcement actions in the Nooksack watershed and supported efforts to educate operators about improved animal waste management practices.

EPA recently approved a TMDL for fecal coliform in the Nooksack River that was developed with significant local, tribal and dairy industry participation. This TMDL established specific targets for reduced pollutant loading for each of the tributaries to the Nooksack River. Achieving the large load reductions called for in the TMDL will take time and will only occur if all of the MOA participants work cooperatively and inclusively with local efforts to restore water quality.

Finally, the MOA specifies certain commitments for each party that will be carried out as available resources allow. For EPA, the MOA establishes commitments:

- to maintain a federal regulatory presence to supplement the state's dairy program;
- to continue funding (again, as resources allow) of monitoring in the Nooksack watershed directed at determining sources of fecal bacteria pollution;
- to continue participation in efforts to restore water quality in the Nooksack River and harvesting of Portage Bay shellfish beds in as short a time as possible.

<table>
<thead>
<tr>
<th>name</th>
<th>Ragsdale</th>
<th>Psyk</th>
<th>Smith</th>
<th>Findley (for signature)</th>
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</thead>
<tbody>
<tr>
<td>date</td>
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<td>L.Mann for</td>
<td>RES</td>
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<td>08/30/00</td>
<td>08/31/00</td>
<td>08/31/00</td>
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</tr>
</tbody>
</table>
written document, signed by the parties, expressly stating the parties' intention to amend their agreement.

Lummi Nation

Merle Jefferson, Executive Director
Lummi Natural Resources Department

Date: 8/18/00

Environmental Protection Agency

Charles E. Findley, Acting Regional Administrator, Region 10

Date: 8-31-00

Washington Department of Ecology

Tom Fitzsimmons, Director
Washington Department of Ecology

Date: 8/23/00

Washington Department of Health

Mary Selecky, Secretary
Washington Department of Health

Date: 8/30/00

August 18, 2000
PORTAGE BAY SHELLFISH PROTECTION DISTRICT ADVISORY COMMITTEE AS OF
10/10/2000

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scarlet3046@yahoo.net
Water Resources Proposal

Lake Whatcom Management Structure
MEMO

TO: The Honorable Pete Kremen, Executive
    The Honorable Members of the Whatcom County Council

FROM: Richard Prievé, P.E.
       Assistant Director

SUBJECT: FCZD 2001 Budget Priorities

At the June 13th Public Works Committee, members of the Flood Control Zone District Advisory Committee (FCZDAC) discussed the various demands facing the district and requested direction from the Board of Supervisors on how to prioritize these competing demands. The Public Works Committee requested that the FCZD develop a recommended prioritization and bring it back to the Board of Supervisors.

Members of the FCZDAC met on June 29th in a work session to develop a prioritized list of the district's current and future activities. Attached is a document summarizing the priorities resulting from this meeting. Six members of the FCZDAC were present and this list reflects the consensus of those present. The attached document includes:

- Page 1: FCZD general program area priorities
- Pages 2-3: Detailed tasks within the general program areas
- Pages 4-7: Prioritized list of detailed tasks with an estimate of the number of full time equivalents (FTE) needed to accomplish each task

Representatives of the FCZDAC and staff will be present at the Committee meeting to discuss the prioritized tasks and the resources required to accomplish them.

Thank you.

Cc: Paula Cooper, P.E., Special Projects Manager
FCZD 2001 General Budget Priorities for major program areas:

1 Coordination of the County Flood Response and Damage Recovery Program
   This activity is only conducted in direct response to a flood event and supercedes all
   other activities. It includes both sector watch coordination and flood fighting during
   the event and damage assessment and repair after the event.

2 Operation and maintenance of the Early Flood Warning System
   This is primarily coordination with NRCS and evaluation of future forecasting needs.

3 Administration of the National Flood Insurance Program (NFIP)
   This includes flood review of building permit applications, as well as response to flood
   inquiries and coordination of the CRS program.

4 Completion of past project permit requirements (monitoring / maintenance)
   The activities within this task are a direct result of project requirements placed by
   permitting agencies at the time of permit issuance. We must complete these items.

5 Implementation of programmatic elements of adopted plans
   Items in this category include studies and analysis aimed at developing long-term
   programs or specific capital projects.

6 Implementation and administration of the Flood Control Maintenance Program
   This is the annual repair and maintenance program (also known as 80/20 program).

7 Development and refinement of comprehensive flood hazard management plans
   This includes the up-front planning tasks to develop an overall plan.

8 Implementation of capital elements of adopted plans
   This includes capital projects, primarily construction projects, but also individual
   buyout projects.

9 Technical and administrative assistance to diking and drainage districts,
   subzones, individuals, etc.
   This includes all of the miscellaneous technical support we provide to districts, County
   departments, individuals, etc. (maintain rolls, process district invoices, etc.)
FCZD 2001 Budget - DETAILS of tasks within each major program area:

1 Coordination of the County Flood Response and Damage Recovery Program

2 Operation and maintenance of the Early Flood Warning System

3 Administration of the National Flood Insurance Program (NFIP)
   - Flood permit review
   - Flood inquiries/determinations
   - Community Rating System

4 Project permit requirements (monitoring / maintenance)
   - Swift Creek Plan implementation
   - Riverberry / Van Dellen / Davis monitoring
   - Lighthouse Park monitoring
   - Truck Road Shorelines permit (after-construction under emergency exemption)
   - Truck Road monitoring
   - Misc. revegetation monitoring and maintenance

5 Implementation of programmatic elements of adopted plans (Lower Nooksack)
   5A Hydraulic Modeling
   5B Development of capital project plan for flood hazard reduction
   5C Floodplain mapping
   5D Meander Limits
   5E Sediment management strategy

6 Implementation and administration of the Flood Control Maintenance Program
   6A Permits in-hand
      - Bertrand Creek Levee Repair
   6B Permits imminent
      - Saxon Bank Stabilization??
      - Duffner Ditch Scour Hole Repair
   6C Permits likely within one-year
      - Sudden Valley, Burke
      - Sudden Valley, Landeck
      - Sudden Valley, Parker
      - Point Roberts Bulkhead
6D Design / Permits Unknown
- Ritter Road
- Deming Dike Raise
- Acme – Rothenbuehler Stabilization
- Mosquito Lake Road Bank Stabilization
- DD#3 Floodgate and Pipe Installation
- Johnson / Sumas Creek Maintenance
- Nolte Road / Stickney Island Road Bank Stabilization

7 Development comprehensive flood hazard management plans
  7A Coastal Areas Floodplain Mapping
  7B Canyon Creek Alternatives Analysis
  7C Saar Creek Management Plan
  7D South Fork CFHMP
  7E North Fork Nooksack CFHMP
  7F Middle Fork Nooksack CFHMP

8 Implementation of capital elements of adopted plans
  8A Buyout Program
  8B Swift Creek construction

9 Technical and administrative assistance to diking and drainage districts, subzones, individuals, etc.
  9A Administrative support for districts
  9B Create levee maintenance program / PL99
  9C Develop / compile miscellaneous data and reports
  9D Technical support for WRJA 1 watershed project
  9E Establishment of special districts
Tasks ordered by priority:

1 Coordination of County Flood Response/Damage Recovery Program  All Staff

2 Operation and maintenance of the Early Flood Warning System  0.1 FTE

3 Administration of the National Flood Insurance Program (NFIP)  1.0 FTE
   - Flood permit review
   - Flood inquiries/determinations
   - Community Rating System

4 Completion of past project permit requirements (monitoring / maintenance)  0.5 FTE
   - Swift Creek Plan implementation
   - Riverberry / Van Dellen / Davis monitoring
   - Lighthouse Park monitoring
   - Truck Road Shorelines permit (after-construction under emergency exemption)
   - Truck Road monitoring
   - Misc. revegetation monitoring and maintenance

5A-C  1.0 FTE
5A. Hydraulic Modeling
5B. Development of capital project plan for flood hazard reduction
5C. Floodplain mapping

9A Administrative support for districts  0.2 FTE

9B Create levee maintenance program / PL.99  0.1 FTE
<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>FTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>6A</td>
<td>Permits in-hand</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>- Bertrand Creek Levee Repair</td>
<td></td>
</tr>
<tr>
<td>6B</td>
<td>Permits imminent</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td>- Saxon Bank Stabilization??</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Duffner Ditch Scour Hole Repair</td>
<td></td>
</tr>
<tr>
<td>6C</td>
<td>Permits likely within one-year</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td>- Sudden Valley, Burke</td>
<td></td>
</tr>
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<td></td>
<td>- Sudden Valley, Landeck</td>
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<tr>
<td></td>
<td>- Sudden Valley, Parker</td>
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<tr>
<td></td>
<td>- Point Roberts Bulkhead</td>
<td></td>
</tr>
<tr>
<td>7A</td>
<td>Coastal Areas Floodplain Mapping</td>
<td>0.1</td>
</tr>
<tr>
<td>7B</td>
<td>Canyon Creek Alternatives Analysis</td>
<td>0.2</td>
</tr>
<tr>
<td>7C</td>
<td>Saar Creek Management Plan</td>
<td>0.2</td>
</tr>
<tr>
<td>8A</td>
<td>Buyout Program</td>
<td>0.1</td>
</tr>
</tbody>
</table>
7D South Fork CFHMP  
0.5 - 1.0 FTE

8B Swift Creek construction  
0.1 FTE

6D Design / Permits Unknown  
1.1 FTE
- Ritter Road
- Deming Dike Raise
- Acme – Rothenbuehler Stabilization
- Mosquito Lake Road Bank Stabilization
- DD#3 Floodgate and Pipe Installation
- Johnson / Sumas Creek Maintenance
- Nolte Road / Stickney Island Road Bank Stabilization

9C Develop / compile miscellaneous data and reports  
0.2 FTE

9D Technical support for WRIA 1 watershed project  
0.1 FTE
PARKING LOT
(As projects are completed, these tasks can be initiated)

5D
Meander Limits
0.5 FTE

5E
Sediment management strategy
1 FTE

9E
Establishment of special districts
0.2 FTE

7E
North Fork Nooksack CFHMP
0.5 - 1.0 FTE

7F
Middle Fork Nooksack CFHMP
0.5 FTE
We invite your comments. This plan is Washington State's long-term strategy for protecting and restoring Puget Sound. It provides the framework for coordinating the roles and responsibilities of federal, state, tribal and local governments.

To submit your comments by mail, send them to:
Puget Sound Water Quality Action Team
Attn: Steve Tilley, Planning Manger
P.O. Box 40900 Olympia, WA 98504-0900

To submit your comments electronically, follow this link to the Comments Electronic Form.

The deadline for submitting your comments is November 6. The plan is available here in PDF. If you'd prefer a printed copy, contact Gigi Williams at gwilliams@psat.wa.gov.

- **Summary of proposed edits to the 2000 Management Plan** (532 KB)
  A quick overview (in chart form) of changes to the existing management plan.
- **2000 Puget Sound Management Plan-The full version** (1,729 KB)
  The entire management plan, including easy-to-use bookmarks to the different programs.

**2000 Management Plan by sections:**

- **Letter from chair of Puget Sound Water Quality Action Team, Determination of Nonsignificance, Action Team/Council members.** (92 KB)
- Table of Contents (26 KB)

Programs:
- Introduction (148 KB)
- Estuary Management and Plan Implementation (79 KB)
- Puget Sound/Georgia Basin Shared Waters (34 KB)
- Aquatic Nuisance Species (51 KB)
- Contaminated Sediments and Dredging (62 KB)
- Marine and Freshwater Habitat Protection Program (94 KB)
- Municipal and Industrial Discharges (91 KB)
- Nonpoint Source Pollution (42 KB)
  o Agricultural Practices (42 KB)
  o Forest Practices (37 KB)
  o Household Hazardous Waste (37 KB)
  o Local Watershed Action (73 KB)
  o Marinas and Recreational Boaters (59 KB)
  o On-Site Sewage Systems (45 KB)
  o Pest Management (37 KB)
- Shellfish Protection (72 KB)
- Spill Prevention and Response (49 KB)
- Stormwater and Combined Sewer Overflows (100 KB)
- Education and Public Involvement (83 KB)
- Laboratory Support (45 KB)
- Monitoring (47 KB)
- Research (45 KB)

Appendices:
- Appendix A: Chapter R 90.71 RCW-Puget Sound Water Quality Protection (49 KB)
- Appendix B: Acronyms (34 KB)
- Appendix C: Glossary (71 KB)
- Appendix D: The Unfinished Agenda (30 KB)
TO: DOE Stormwater Policy Advisory Committee Members

FROM: Willy O’Neil

SUBJECT: Process for Committee Recommendation Development

BACKGROUND

The 1999-2001 State Operating Budget included the following proviso under Section 302 (Department of Ecology):

“(11) $100,000 of the general fund–state appropriation for fiscal year 2000 is provided solely for the department to form an advisory committee for the purpose of updating the department's storm water management plan and the Puget Sound storm water management manual. The advisory committee shall be appointed no later than September 1, 1999, and it shall provide its recommendations on storm water management to the legislature by December 31, 2000.”

As a result, the Department created the Stormwater Policy Advisory Committee (SPAC) members to assist with meeting the above stated requirements, which are to:

1. Advise the department on the update of the state's stormwater management plan and the Puget Sound stormwater manual; and,

It should be noted that this roughly concurs with the blue memo titled “Committee Process and Recommendations to the Legislature” that was included in the latest meeting packet. The purpose of this memo is to recommend a specific process for ensuring that the SPAC, and therefore the Department, meet the timelines set out in the proviso in an orderly, fair manner.

KEY RECOMMENDATIONS

In order to allow the SPAC and the Department to efficiently and effectively carry out the requirements of Section 302 (11) Chapter 309, Session Laws of 1999, the following administrative procedures are proposed for adoption by the Committee:

1. Selection of a presiding officer for the Committee to conduct the meetings
2. Selection of a secretariat for recording Committee meeting minutes and developing Committee meeting agendas
3. Adopt the process used by the Washington State Building Code Council (RCW 19.27) for developing building code changes in order to develop Committee recommendations and to fairly identify disputed policies and recommendations (Council By Laws, 1998).
DISCUSSION

Presiding Officer and Secretariat

Roberts Rules of order finds that "the minimum essential officers for the conduct of business in a deliberative assembly are a presiding officer, who conducts the meeting and sees that the rules are observed, and a secretary, or clerk, who makes a written record of what is done."

The Committee should establish each of the positions to ensure that meetings are well run and efficient, and that decisions are properly documented.

Process for Developing Recommendations

The draft "Interim Report to the Legislature" that was presented to the SPAC at their December meeting, included the following phrase on Page one, 4th paragraph:

"Consensus building will be a desirable goal, but not required for final stormwater management plan."

Although consensus is a worthy goal, there will inevitably be disagreements regarding policy issues and recommendations. In order to ensure that such disagreements are fairly considered and dealt with, it is recommended that the Committee consider adoption of a process similar to the Technical Advisory Group (TAG) process used by the Washington State Building Code Council. Under the Council’s By Laws, TAG recommendations are developed by consensus. When a recommendation is disputed, the TAG is required to present the recommendation:

"in the form of an issue paper, outlining all issues related to the subject."

The issue paper is in many instances, included in the body of the TAG report as a series of options with a brief discussion outlining the reasons for each option. This allows policy makers (the Council) to receive a thorough analysis of all the relevant areas of disagreement, as well as recommendations for all of those areas where consensus was achieved. This ensures that the process for developing recommendations is reasonable, certain, and fair for all participants.

Conclusion

By adopting the recommendations listed above, the SPAC will ensure that the process for developing recommendations to improve the state’s stormwater management plan and the Puget Sound stormwater manual is fair, certain, and productive. If you have any questions about this recommendation, please contact Willy O’Neil at 360-352-5000. Thank you for your consideration.
Ecology’s Revised Stormwater Activities and Priorities

At last December’s meeting of the Stormwater Policy Advisory Committee, Ecology presented an overview of Ecology’s stormwater related activities and relative priorities. Since that meeting we have heard back from several interest groups that Ecology’s priorities and schedules should be re-evaluated. Specifically some felt that Ecology should slow down the renewal of the phase I municipal stormwater permit in favor of devoting more effort to the development of the phase II municipal stormwater permit(s). Ecology also received numerous comments that the timeline for the development of the Stormwater Technical manual for Eastern Washington should be slowed down.

Also at last December’s meeting there was some discussion and a recommendation was made that Ecology should devote or re-assign more resources to stormwater related activities. As we noted at the December meeting it is not possible to increase the level of resources being devoted to stormwater without re-evaluating all of the Water Quality Programs priorities. Re-evaluation of the Program’s priorities will take place in developing our next biennial budget. However changes will not go into effect until July 2001. Until then we must work within our current resources.

Stormwater Technical Manual

Original Proposal and Schedule:


New Proposal and Schedule:


Ecology will publish a final draft of the Stormwater Technical Manual and provide a minimum of a 90-day public comment period before publishing a final Technical Manual for Western Washington. We currently anticipate completing a final draft of the Technical Manual along with a response to the comments we have received in late June.

Reasons for the Change:

Completion of the revised manual has been delayed due to the large volume of comments received on the preliminary draft of the Manual that was published last fall. Many of the comments we received requested that Ecology slow down the development of the Manual for Eastern Washington and to do a better job of coordinating the Manual development for Eastern Washington with phase II stormwater requirements for Eastern Washington.

The need for a revised and updated Stormwater Technical Manual for Western Washington remains. The expiration and renewal of the Phase I municipal stormwater permits is contingent upon, and can not be completed without a revised Technical Manual. As a consequence Ecology is proposing to continue with the development of a revised stormwater Technical Manual for Western Washington and delay the completion of a Manual for Eastern Washington.
Implications:


Phase I Municipal Stormwater Permit Renewal

Original Proposal and Schedule:

With the exception of Clark County, the current phase I municipal stormwater permits expire on July 5, 2000. Under Ecology's original proposal the Stormwater Technical Manual was scheduled to be completed in June, 2000, and the phase I municipal stormwater permits were to be completed by September 2000.

New Proposal and Schedule:

The Stormwater Technical Manual needs to be completed before the phase I permits can be renewed. The delay in completing the Stormwater Technical Manual will mean a delay in the completion of the phase I permit renewal until at least January 2001. Because the current permits expire on July 5, 2000, Ecology would administratively extend the current permits until the permits could be renewed.

Proposal from the Phase I Permittees:

Ecology was approached by the phase I municipal permittees with a proposal to either delay the phase I permit renewal or do very minimal tweaking to the existing permits and re-issue them. The rational for the proposal was to coordinate the substantive changes to the phase I municipal permits with the development of the phase II municipal stormwater permits.

Concern was also expressed that Ecology should be working on the phase II municipal stormwater implementation rather than waiting. The phase I permittees feel that a delay in the phase II stormwater program would jeopardize the phase I permittees' ability to solve stormwater problems on a watershed basis due to the continued problem of trying to coordinate with non-permitted jurisdictions.

Ecology's Response to the Phase I Permittees Proposal:

While we agree that the phase II municipal stormwater permit would facilitate watershed based solutions, the phase I permittees did not propose to issue the phase II permits before the December 2002 EPA deadline. The current permits will expire on July 5, 2000, as a result they must either be renewed or administratively extended in order to provide continued permit coverage for the phase I permittees. Administratively extending the permits is a viable option for the short term, i.e. six to twelve months. Administratively
extending the permit for a longer period is problematic given that the permit does not address the development and refinement of stormwater programs beyond the year 2000.

The alternative proposal was to renew the current permit making minor changes. The renewed permit would remain in effect either for a full permit term or would be re-opened and modified at the time that the Western Washington phase II permit was issued. Ecology requested information on what minor changes to the current permit were required if this approach were to be taken. The scope and nature of the minor changes to the current permit that were identified indicate that there is little agreement and that the effort necessary to renew the permit with minor changes could be very significant. This means renewing the permit with ‘minor changes’ now and then doing the whole effort over again with the Western Washington phase II permit.

Rather than repeat the phase I permit renewal twice over the next three years it is more efficient to administratively extend the current permit for 6-12 months, followed by the renewal of the phase I permit. This will allow time to complete the Stormwater Technical Manual for Western Washington. This schedule will also allow for the timely incorporation into the phase I municipal stormwater permit conditions that may be necessary to satisfy ESA 4(d) requirements. This approach could also serve to coordinate ESA and CWA compliance for phase I and phase II communities that want to combine their stormwater actions into a single program.

Implications:

Administratively extending the current phase I stormwater permit will allow for the completion of the Stormwater Technical Manual for Western Washington. Administratively extending the current phase I permit until the permit can be renewed later this year, rather than writing an interim permit with ‘minor’ changes avoids having to write and issue the permit twice over the next 2-3 years.

Initially focusing Ecology’s stormwater efforts on Western Washington will make it possible to complete a phase II municipal stormwater permit by the EPA December 2002 deadline.

Phase II Municipal Stormwater Permit/Program Development

Original Proposal and Schedule:

In December Ecology indicated that the level of effort devoted to phase II program development and implementation was zero.

New Proposal and Schedule:

Ecology proposes to split phase II program development and implementation into two tracks, Western Washington and Eastern Washington. Initially phase II program development and implementation efforts will be focused on developing a phase II municipal stormwater permit for Western Washington.

The target is to have a phase II municipal stormwater permit and program completed and in place for Western Washington in time to meet the EPA permit deadline of March 2003. This means the Western Washington phase II municipal stormwater permit would need to be completed no later than March 2002 to allow time for local jurisdictions to develop their stormwater programs in time to meet the March 2003 permit deadline.
Between now and December 2002 Ecology will continue to work with local governments in Eastern Washington to identify stormwater issues and concerns. However, work on a phase II municipal stormwater permit for Eastern Washington would not begin in earnest until the Western Washington phase II permit is completed sometime in late 2002. A phase II municipal stormwater permit for Eastern Washington would not be completed until sometime late in 2003, and would be coordinated with the completion of the Stormwater Technical Manual for Eastern Washington.

**Reasons for the Change:**

The time-lines for a phase II municipal stormwater permit need to be staggered for Eastern and Western Washington. The majority of Western Washington communities that will be affected by the phase II rules, already have stormwater programs in place as a result of the Puget Sound Water Quality Management Plan. This is not the case for the communities in Eastern Washington that will be subject to phase II requirements.

There are several initiatives currently underway that are affecting or will affect stormwater management in Western Washington. Two of the more notable are the revision of PSWQMP and the on-going negotiations between the Tri-County parties and NMFS over the stormwater requirements in the 4(d) rule. Further, there is a need to integrate and coordinate the phase II municipal stormwater programs with the phase I municipal stormwater programs.

The environmental impacts due to urban stormwater are less significant in the dryer areas of the State, principally Eastern Washington. One of the reoccurring comments on the Stormwater Technical Manual, that Ecology received from local governments from Eastern Washington was that Ecology needed to slow down the Technical Manual and the phase II stormwater requirements for Eastern Washington. In contrast, the larger phase I municipalities in Western Washington all wanted phase II accelerated to facilitate watershed based urban stormwater coordination.

**Implications:**

Focusing Ecology’s efforts on the development of the phase II municipal permit for Western Washington would allow the completion of the Western Washington phase II permit by December 2002. This allows the phase I and phase II municipal stormwater permits and programs to be coordinated earlier. Delaying the development of the Eastern Washington phase II permits until later will allow Ecology to coordinate the completion of the Stormwater Technical Manual for Eastern Washington with the phase II permits.

One disadvantage of delaying the completion of the phase II municipal stormwater permits for Eastern Washington until after December 2002 will be that permits will not be completed in time to meet the EPA’s March 2003 regulatory deadline for permit coverage. The EPA phase II stormwater regulations allow for the phasing of permits based on an approved watershed permitting strategy. The allowance for phasing in the permit is not applicable to communities with a population of over 10,000.

Another concern results from Western Washington phase II permit development preceding Eastern Washington phase II permit development. The concern is that the Western Washington phase II permit will set a precedent for the Eastern Washington phase II permit.
Tri-County 4(d) Discussions and Ecology Certification

Background

Under Section 4(d) of the Endangered Species Act (ESA), the National Marine Fisheries Service (NMFS) must promulgate a rule that identifies actions that constitute a "take" of threatened species. NMFS published a proposed 4(d) rule in December, governing take of salmonids in 7 Evolutionarily Significant Units (ESUs), including large parts of Washington.

The proposed rule broadly applies the take prohibitions, and goes on to propose exceptions to the take prohibitions, where entities are performing actions in accordance with the standards in the rule. A group of entities from King, Pierce and Snohomish Counties are making a proposal to NMFS to specify a stormwater management program that will be incorporated into the 4(d) rule. Municipalities that can demonstrate that they have a stormwater program which meets the provisions in the 4(d) rule can be granted an exception from the take prohibition.

Ecology’s Role in the Tri-County Stormwater Negotiations

Ecology stormwater staff have recently become involved in the negotiations between the Tri-County group and NMFS after being asked to "certify" stormwater programs as a part of determining compliance with the 4(d) rule.

We have participated in negotiations with the following objectives:

- Maintain consistency/coordination between ESA and CWA requirements, including the update of the stormwater manual, and municipal stormwater permits.
- Provide a statewide perspective, since the outcome of the negotiations could affect other municipalities.
- As a matter of governance, review of stormwater programs by Ecology may be preferable to federal agencies reviewing stormwater programs. Ecology is closer to local governments, and has greater stormwater expertise. Staff participated to help develop workable criteria and certification process.

Questions:

- Should Ecology have a role in certifying local stormwater programs under ESA?
- Should Ecology only consider certification within the context of NPDES permits, or should we consider certification outside of permits?
- If certification is only within the context of NPDES permits, do we write a phase 1 permit that is ESA compliant, and anyone desiring certification under ESA must get coverage under that permit?
- If elements of the final stormwater program agreed to by NMFS and the Tri-County group are not consistent with CWA requirements, should Ecology take on a certification role?
Renewal of Construction and Industrial Stormwater General Permit

The construction stormwater general permit and the industrial stormwater general permit expire on November 18, 2000. It is very important that Ecology renew these permits in a timely fashion but there are challenges to accomplishing a thorough rewrite of these permits.

- As a result of competing stormwater activities and limited staff, Ecology has not yet begun the renewal process.
- A typical permit renewal cycle would take twelve to eighteen months.
- Existing stormwater requirements apply only to construction sites of 5 acres or more.
- Phase II stormwater regulations will also require construction sites of one acre or more to obtain NPDES coverage by March 2003.

Timely renewal and full consideration of permit issues appear to be mutually exclusive objectives at this time. Therefore, Ecology is proposing a process that will reissue the existing construction and industrial stormwater permits "As-Is" by November 18, 2000 and then follow that up with a full consideration of stormwater issues associated with these activities. Major milestones and target dates for this process are described below:

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<tr>
<th>Announce the Reissue/Renewal of Construct and Industrial GPs</th>
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<tr>
<td>Develop a List of Interested Parties</td>
<td>Ongoing</td>
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<tr>
<td>Hold Public Workshops/Hearings on Reissue</td>
<td>August 2000</td>
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<tr>
<td>Reissue Both Permits &quot;As-Is&quot; (Expr. Date November 2005)</td>
<td>November 18, 2000</td>
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<table>
<thead>
<tr>
<th>Industrial General Permit</th>
<th>Full Consideration Renewal</th>
<th>Construction General Permit</th>
<th>Full Consideration Renewal</th>
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</thead>
<tbody>
<tr>
<td>Conduct Workshops/ Collect Comments on Industrial General Permit</td>
<td>May 2001</td>
<td>Conduct Workshops/ Collect Comments on Construction GP</td>
<td>November 2001</td>
</tr>
<tr>
<td>Prepare First Draft of Revised Industrial General Permit</td>
<td>August 2001</td>
<td>Prepare First Draft of Revised Construction General Permit</td>
<td>March 2002</td>
</tr>
<tr>
<td>Prepare Second Draft of Industrial General Permit</td>
<td>December 2001</td>
<td>Prepare Second Draft of Construction General Permit</td>
<td>July 2002</td>
</tr>
<tr>
<td>Final Draft of Industrial General Permit</td>
<td>March 2002</td>
<td>Final Draft of Construction General Permit</td>
<td>October 2002</td>
</tr>
<tr>
<td>Public Workshops/Hearings on Industrial GP</td>
<td>May 2002</td>
<td>Public Workshops/Hearings on Construction GP</td>
<td>December 2002</td>
</tr>
</tbody>
</table>

The "As-Is" reissue will not make any changes to the existing permits other than to correct dates to be consistent with reissuing the permits. The expiration date is the full five years from the
effective date of the reissued permit (statutory limit) but the intent is to renew these permits prior to that time after full consideration of the issues.

**Question 1**: How comfortable are you with this approach? Do you have suggestions for change?

**Question 2**: How do you want to be involved with this process?
Timeframe for Completing Stormwater Management Plan

Ecology committed to developing a statewide stormwater management plan and delivering this product by December 2000. The plan was expected to answer the significant stormwater policy issues and define how stormwater will be managed, at least within Ecology's authorization. We have come to the conclusion that we cannot deliver a comprehensive plan by December 2000. The alternatives appear to be:

- Scale back the scope of the plan and provide only the framework for how stormwater management issues will be defined and resolved, or
- Extend the date for completion to allow more time to develop a comprehensive stormwater management plan.

There are a number of initiatives both within and outside of Ecology's control that are currently underway and will have a significant impact on stormwater management. These initiatives were not timed to coincide with Ecology's stormwater management plan effort, making the December 2000 delivery date problematic. Some of these initiatives include:

Revision of the Puget Sound Plan - completion in November 2000

The Puget Sound Plan applies to those communities in the Puget Sound Basin and stormwater management is a significant component in the Plan revision. A comprehensive statewide stormwater management plan should reconcile Puget Sound Plan requirements with requirements for jurisdictions outside of the Puget Sound Basin.

Revision of the Stormwater Manual - completion by October 2000

The stormwater manual is an integral component of stormwater management requirements and implementation. The stormwater manual revision expands the scope of the manual from just the Puget Sound basin to cover the entire state. This is a major effort and the first draft received a large number of public comments. There are significant issues still to be resolved making the delivery date uncertain. October is only a likely date if the first release of the manual applies just to western Washington.

Phase I Permit Reissuance - completion by January 2001

The Phase I permits impact about 33% of the total state population. The decisions associated with this permitting process will impact the overall stormwater management plan.

Phase II Permit Issuance - completion by December 2002

Phase II permits are likely to be the most significant piece to implementing stormwater management requirements outside of Phase I communities. This is a major effort and the preponderance of this effort is yet to begin. Issues include the relationship of Phase I permits and permittees to Phase II permits and permittees, "criteria" for including/excluding municipalities outside of "urbanized areas", coordination with PSWQMP and tri-county ESA, BMP lists for the 6 minimum measures, and responding to a host of flexibility issues contained in the Phase II rule. Completion by December 2002 is only applicable to western Washington. Time frame for eastern Washington is uncertain.
Additional Public Participation

Phase II implementation affects a large number of constituencies in the state. Although representation on the SWPAC is broad based, it is not sufficient to fully address public participation concerns. Two probable groups that would require additional attention are:

**Eastern Washington:** It is difficult for representatives from eastern Washington to participate in meetings held consistently in western Washington. Some of the issues for Phase II implementation and the stormwater manual require attention based on considerations unique to eastern Washington. Ecology recognizes that meetings must be conducted in eastern Washington in order to provide reasonable opportunity for participation by concerned parties and to address the issues.

**Small Municipalities (western Washington):** Phase II targets stormwater management in small municipal separate storm sewer systems (small MS4s) within urbanized areas and designated MS4s. This is a fairly large and diverse group, sometimes represented by a city manager and others times by a consultant. There may also be individuals and organized citizen groups with an interest in the outcome. Ecology recognizes that an additional effort must be made to provide this group access to the process.

Ecology is therefore proposing that rather than add additional members to the SWPAC, that we establish either a formal or informal process to inform and encourage participation by the larger constituency. A formal process could be the formation of subcommittees or workgroups under the SWPAC. They would potentially consider more detailed issues associated with stormwater management as well as the broader policy issues. At least one member on each group would be a member of the SWPAC and would provide the link between the two. An informal option could be a number of activities ranging from one-on-one meetings with local officials to meeting with associations and other organized groups concerned about stormwater management.

**Question:** Ecology believes it is necessary to expand participation as we address Phase II implementation and that a formal process would be more effective. Do you agree? Can you identify specific parties or groups that should be brought into the process?
Committee Process and Recommendations to the Legislature:

Ecology envisions two separate committee activities:

1. Advising Ecology on policy issues related to developing a stormwater management plan (including stormwater technical manual).

2. Making recommendations to the Legislature on stormwater management.

We are proposing the split because we believe there should be different processes and responsibilities for these two activities. Under this approach, Ecology has the primary responsibility for the content of the stormwater management plan. We believe this provides efficiency for developing plan options without sacrificing the ability of the committee to influence the outcome and it also makes sense because Ecology will be responsible for implementing the stormwater management plan, at least for those elements within Ecology's jurisdiction. However, we believe the recommendations to the Legislature should represent the collective thinking of the committee. Ecology would facilitate the committee's work on recommendations but only at the direction of the committee. Therefore we are proposing the following processes:

1. Developing the Stormwater Management Plan
   - Ecology identifies the major issues based on internal analysis or recommendation by interested party.
   - Ecology describes the issue and identifies one or more options for resolution and distributes this information to the committee.
   - Ecology convenes a meeting and facilitates the discussion of issues.
   - Committee responds to issue and options, agreeing/disagreeing, making suggestions for change, providing additional options.
   - Ecology comes to conclusion on the issue or reworks option(s) for additional discussion.

2. Making Recommendations to the Legislature
   - Volunteers from the committee assume the responsibility for identifying and proposing recommendation to the full committee.
   - Ecology convenes meeting of full committee with recommendations on agenda.
   - Committee member leads discussion.
   - Committee determines content of recommendations including a minority report if desired.
   - Ecology writes up outcome.

There would also be WebPage support for these activities. This would include posting meeting dates, agenda, and support information. Email addresses for committee members would be available on the WebPage by clicking. We are considering adding a list service that would allow easy distribution of materials to all members and to interested parties. This would provide another avenue by which the committee could actively participate in and influence the development of the stormwater management plan and develop recommendations to the Legislature.

Question 1: Is the committee willing to assume responsibility for recommendations to the Legislature?

Question 2: Is the proposed process acceptable? Volunteers for developing recommendations?
Volunteers scour shoreline for data

COMMUNITY: Group covered 4 miles to record information for maps.

BY KARI THORENE
THE BELLINGHAM HERALD

BLAINE — Armed with pens and clipboards, about 40 Bellingham-area volunteers hit the beaches of Drayton Harbor on Saturday morning to find what grows, what lives and what stinks along the Blaine shoreline.

“We found a few outfalls that have a real odor to them,” said Lisa Younger, volunteer coordinator for People for Puget Sound.

The volunteers, separated into two groups to cover a 4-mile stretch of shoreline, recorded data that will eventually be used to make detailed maps. The information fills gaps in the county’s data on its fragile tidelands, information used to preserve it and interpret impacts of neighboring development.

Younger’s organization, along with the county Marine Resources Committee and the local volunteer group ReSources, worked on the Drayton Harbor tidelands courtesy of a federal grant to shape up Northwest tidal areas, said Amy Krahm, a representative of the county Marine Resources Committee.

Gibb Fletcher, who works for the nonprofit National Association for the Mentally Ill in Bellingham, volunteered for the weekend out of concern for the environment. He said he knew little about shorelines before the two intensive three-hour courses required before the volunteer weekend.

“The program is pretty neat,” Fletcher said. “I used to walk the beaches a lot so I know about the critters. But I didn’t know as much about the environmental impacts.”

Kathleen Fragles helped Fletcher unroll a tape measure to determine the width of brushy areas bordering the sandy tidelands. “I’m retired,” Fletcher said. “I just thought I’d enjoy learning about the tidelands.”

Although much of the data collected will be used for descriptive purposes, some of it will set off red flags.

TAKING STOCK: ReSources enviromental educator Crina Hoyer checks measurements Saturday at Drayton Harbor in a volunteer effort to document the state of the shoreline at Semiahmoo. About 40 people gathered information, which will fill gaps in the county’s data on fragile tidelands.

See SHORELINE, Page B2, Col. 3

Council to consider Civic Field, water rate

GOVERNMENT: 2 proposals to approve a maximum $5 monthly

Man shot in car ID’d

CRIME: 23-year-old Whidbey serviceman killed while driving car.

THE ASSOCIATED PRESS
MOUNT VERNON
Whidbey Island Naval Station serviceman died in Thursday’s shooting.

Scott W. Kinkele died in Thursday’s shooting, authorities said.

It was unclear what kind of weapon used, Orland Free, the deputy Skagit County coroner, said late Friday.

“The evidence points to the shot was fired from an automobile,” said Skagit County Sheriff’s Chief Deputy Harry Hemphill.

Deputies say King apparently had been westbound when shots were fired.

His car was found.

Died instantly.
Marine Resources of Whatcom County

Prepared for:

Whatcom County
Marine Resources Committee

Prepared by:

ANCHOR ENVIRONMENTAL, L.L.C.

May 2000
Rapid Shoreline Inventory
Drayton Harbor
Whatcom County

People for Puget Sound
August 2000

Legend
- Beach Access
- Outfalls
- Rip Rap
- Shoreline Survey
- Mean High Water
- Mud Flats
- Rivers
- Lakes
- Puget Sound
- Roads
- Contour Interval 50 feet
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