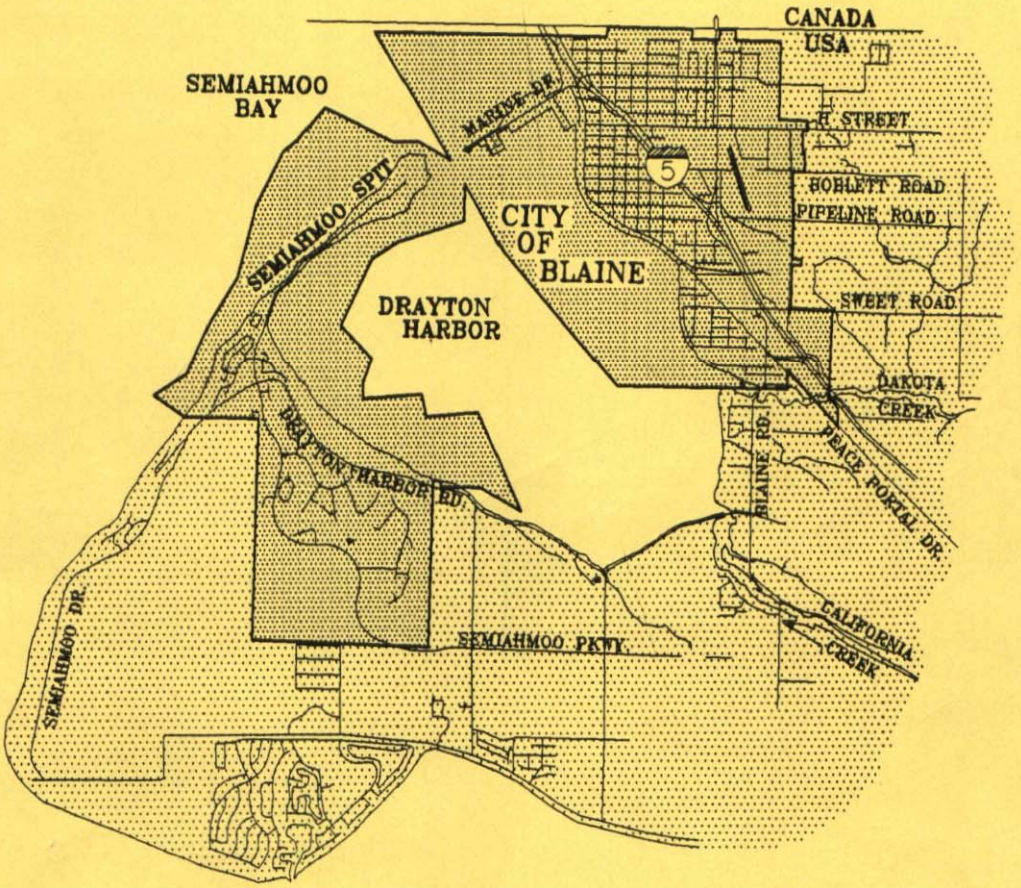
NOTE:
- No 4-8
- 4-3 not complete

Stormwater Management Plan

City of Blaine
Department of Public Works



Final Report
May 1995

Economic and Engineering Services, Inc.

P.O. Box 976
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STORMWATER MANAGEMENT PLAN

FOR THE CITY OF BLAINE

FINAL REPORT

May, 1995

City of Blaine

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Acknowledgments

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City of Blaine

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Preface

As part of its strategic planning process, the City of Blaine (City) has undertaken a management analysis of the City's stormwater program and developed the following Stormwater Management Plan. The Department of Public Works, being primarily responsible for the City's stormwater management functions, has developed a Stormwater Management Plan that is responsive to local drainage issues, ensures compliance with the Puget Sound Water Quality Authority Plan and supports the City's Growth Management Act planning process. In so doing, the Department of Public Works has also begun to prepare the City for the potential future regulatory requirements of the National Pollution Discharge Elimination System (NPDES) Stormwater Permit.

On a daily basis, the City's stormwater program is guided by the priorities and activities needed to provide for public welfare, protect the City's existing drainage infrastructure and preserve the City's ground and surface waters. Much of the programmatic guidance to protect water quality has been established in the Drayton Harbor Watershed Action Plan and the other supporting water quality documents for Drayton Harbor.

In light of the increasing role and obligations of the City's Stormwater Program, the City has deemed it prudent to undertake a review of the authority, funding activities, and regulatory compliance issues associated with the City's current stormwater program. The following document summarizes the present stormwater program and recommends changes or additions to meet minimum regulatory and program responsibilities. Higher levels of stormwater funding allow for an enhanced stormwater program to be developed. Priorities, staffing, and activities of higher "service levels" have been conceptually developed and are presented toward the end of this programmatic and management analysis. Information is presented to allow City Council, City staff, and the public to select the appropriate level of funding and staffing to meet the City's growing stormwater, water quality, and broader water resource obligations and responsibilities.

This is the 3rd Consolidated Plan

- City Water Supply - public safety < volume / quality
- Business/residential costs for Water
- Impact on Commercial interests using a working on harbor waters*
- attractiveness of city to business, residents and tourists (present or future)

* recreational fishing, boating etc.

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Stormwater Glossary

Acre-feet	A unit of measuring the volume of water, equal to the quantity of water required to cover 1 acre to a depth of 1 foot and equal to 43,560 cubic feet or 325,851 gallons.
Basic Stormwater Program	Required in the Puget Sound Water Quality Management Plan for all cities and counties.
Basin Plan	A plan and all implementing regulations and procedures including, but not limited to, land use management adopted by ordinance for managing surface and storm water quality and quantity facilities, and features within individual subbasins.
Biofiltration	The process of reducing pollutant concentrations in water by filtering the polluted water through biological materials.
BMP	Best Management Practice. Physical, structural, and/or managerial practices that, when used singly or in combination, prevent or reduce pollution of water.
Catch Basin	A basin combined with a storm-drain inlet to trap solids.
CCWF	Centennial Clean Water Fund
CED	The City of Blaine's Community and Economic Development Department
cfs	Cubic feet per second
Channel	(1) a natural or artificial watercourse of perceptible extent which periodically or continuously contains moving water or which forms a connecting link between two bodies of water. It has a definite bed and banks which were to confine the water. (2) The deep portion of a river or waterway which is used by watercraft.
CIP	Capital Improvement Plan
Class AA	A general water use and criteria class specified in WAC 173-201A-030.

Clean Water Act	Federal legislation with the objective of restoring and maintaining the chemical, physical, and biological integrity of the Nation's Waters.
CMP	Corrugated metal pipe.
Comprehensive Plan	Comprehensive Land Use, Growth, and Capital Facility Plan developed in response to the Growth Management Act.
Comprehensive Stormwater Program	Required in the Puget Sound Water Quality Management Plan for all large urban areas.
Computer Modeling	The use of a computer to determine the effect of a particular rainfall storm on a particular drainage system.
Constructed Wetlands	Those wetlands intentionally created on sites that are not wetlands, for the primary purpose of wastewater or stormwater treatment, and managed as such. Constructed wetlands are normally considered as part of the stormwater collection and treatment system.
Conveyance System	A system of drainage elements, ditches, gutters, pipes, culverts, drains, channels and lakes which, in combination, carry water from headwater to receiving waters.
CSDP	1989 Comprehensive Storm Drainage Plan by Associated Project Consultant, Inc.
CSO	Combined Sewer Overflow
Culverts	A man-made system that allows water to go under a road or landfill.
DCP	Drainage Control Plan - Part II of the City's new Stormwater Management Plan to control flooding.
Delta	Sediments deposited at the mouth of a stream or drainage system when the flow velocity is checked by a larger river, lake, or ocean.
Design Storm	A prescribed hyetograph and total precipitation amount (for a specific duration recurrence frequency) used to estimate runoff for a hypothetical storm of interest or concern for the purpose of analyzing existing drainage, designing new drainage facilities or assessing other

	impacts of a proposed project on the flow of surface water. (A hyetograph is a graph of percentages of total precipitation for a series of time steps representing the total time during which the precipitation occurs.)
Detention	The release of stormwater runoff from a site at a slower rate than it is collected by the stormwater facility system, the difference being held in temporary storage.
DHWAP	Drayton Harbor Watershed Action Plan
DHWMP	Drayton Harbor Watershed Management Plan in 1993.
Direct Runoff	Surface runoff and a substantial portion of interflow entering the storm drainage system during and/or immediately after a rainfall.
Discharge	Outfow; the flow of a stream, canal, pipeline, culvert or aquifer. One may also speak of the discharge of a canal or stream into a lake, river, or ocean. (Hydraulics) Rate of flow, specifically fluid flow; a volume of fluid passing a point per unit of time, commonly expressed a cubic feet per second, cubic meters per second, gallons per minute, gallons per day, or millions of gallons per day.
DOH	Department of Health
DOT	Department of Transportation
Drainage	Refers to the collection, conveyance, containment, and/or discharge of surface and storm water runoff.
Drainage Area	(1) The contributing area of a single drainage basin, expressed in acres, square miles or other unit area, also called watershed or basin. (2) The area served by a drainage system receiving storm and surface water or by a watercourse.
Easement	The legal right to use a parcel of land for a particular purpose. It does not include fee ownership, but may restrict the owners use of the land.
Ecology	Department of Ecology

Ecology's Guidance Manual	Stormwater Program Guidance Manual for the Puget Sound Basin Volumes 1 and 2, July 1992.
Ecology's Technical Manual	Stormwater Management Manual for the Puget Sound Basin (The Technical Manual), Volumes 1-4, July 1992.
Ecology Manual	Ecology Technical Manual, complete title is The 1992 Stormwater Management Manual for the Puget Sound.
EES	Economic and Engineering Services, Inc.
EPA	Environmental Protection Agency. A federal agency which administers many federal environmental laws. Region X, which includes Puget Sound, is headquartered in Seattle.
Erosion	The wearing away of the land surface by running water, wind, ice, or other geologic agents.
Flood	Water from a river, stream, watercourse, lake or other body of standing water that temporarily overflows or inundates adjacent lands and which may affect other lands and activities through stage elevation, backwater, and/or increased groundwater levels.
Flood Control	The elimination or reduction of flood losses by the construction of flood storage reservoirs, channel improvements, dikes and levees, bypass channels, or other engineering works.
Flood Fringe	That portion of the floodplain outside of the floodway which is covered by floodwater during the base flood; it is generally associated with standing water rather than rapidly flowing water.
Floodplain	The total area subject to inundation by the base flood including the flood fringe and the floodway.
Floodplain Regulations	A general term applied to the full range of codes, ordinances and other regulations relating to the use of land and construction as influenced by water. The term also encompasses zoning ordinances, subdivision regulations, building and housing codes, encroachment line status, open-area regulations, and other similar methods of control affecting the use and development of the area.

Floodway	That portion of the regulatory area required for the reasonable passage or conveyance of the design flood. This is the area of significant depths and velocities, and due consideration should be given to effects of fill, loss of cross-sectional flow areas, and resulting increased surface water elevations.
Frequency	The number of repetitions of a periodic process in a unit period of time.
FTE	Full Time Employee
GMA	Growth Management Act
Groundwater	Water in the ground that is within a saturated zone.
Habitat	The specific area or environment in which a particular type of plant or animal lives. An organism's habitat must provide all of the basic requirements for life and should be free of harmful contaminants. Puget Sound habitats includes streams, lakes, beaches, marshes, shorelines, mudflats, the water itself, etc.
Heavy Metals	Metals of high specific gravity, present in municipal and industrial wastes that pose long-term environmental hazards. Such metals include cadmium, chromium, cobalt, copper, lead, mercury, nickel, and zinc.
Hydraulics	A branch of science that deals with practical applications of the mechanics of water movement.
Hydrograph	A curve obtained by plotting discharge verses time that results from a particular rain storm.
Hydrologic Cycle	The circuit of water movement from the atmosphere to the earth and return to the atmosphere through various stages or processes as precipitation, interception, runoff, infiltration, percolation, storage, evaporation, and transpiration.
I/I	Inflow and Infiltration
Illicit Discharge	All non-stormwater discharges to stormwater drainage systems that cause or contribute to a violation of state water quality, sediment quality or groundwater quality standards, including but not limited to sanitary sewer

	connections, industrial process water, interior floor drains, car washing, and greywater systems.
Impervious Surfaces	Man-made or natural surface conditions that do not permit rainfall to soak into the ground.
In-Stream Storage	Storage ponds which are physically built in the channel area. This is in contrast to storage which is not physically in the main channel of a drainage system.
Infiltration	The entering of water through the interstices or pores of a soil or other porous medium.
Invert	The bottom or lowest portion of the internal cross section of a conduit. Used particularly with reference to sewers and drains.
LID	Local Improvement District
Metals	See heavy metals
MSL	Mean Sea Level
Non-Structural Control	Includes runoff control, land-use measures, modification, and flood-plain zoning.
NPDES	National Pollutant Discharge Elimination System. Part of the federal Clean Water Act, which requires point source discharges to obtain permits. These permits are referred to as NPDES permits and, in Washington State, are administered by the Washington State Department of Ecology.
Nutrients	Essential chemicals (e.g. nitrogen, phosphorus) needed by plants or animals for growth. Excessive amounts of nutrients can lead to degradation of water quality and the growth of excessive numbers of algae. Some nutrients can be toxic at high concentrations.
O/M	Operations and Maintenance

Pervious Surfaces	Surface conditions that permit rainfall to soak onto the ground.
Plat	A map or representation of a subdivision showing the division of a tract or parcel of land into lots, blocks, streets, or other divisions and dedications.
PSWQA	Puget Sound Water Quality Authority
PSWQMP	Puget Sound Water Quality Management Plan
Public Works	Department of Public Works
Puget Sound Water Quality Authority	Body created in 1985 by the Washington State Legislature to adopt and oversee implementation of a comprehensive strategy to protect Puget Sound.
Rate of Runoff	Runoff volume and rate expressed in cubic feet per second, gallons per minute, etc.
RCP	Reinforced concrete pipe.
Receiving Water	Main body of water receiving flow from tributary creeks and streams; for example, Lake Sammamish, Lake Washington, and Puget Sound.
Recurrence	To occur again after an interval.
Regional Detention Facility	A stormwater quantity control structure designed to correct existing excess surface water runoff problems of a basin or subbasin. The area downstream has been previously identified as having existing or predicted significant and regional flooding and/or erosion problems.
Release Rate	The computed peak rate of surface and stormwater runoff for a particular design storm event and drainage area conditions.
Riparian Corridor	A perennial or intermittent water body its lower banks and upper banks, and the vegetation that stabilized the slopes, protects the waterway from erosion and sedimentation, provides cover and shade, and maintains the fish and wildlife habitat.

Riprap	Armor-platting materials consisting of either rock or sand bags filled with sand and cement that are used to prevent erosion.
Runoff	That part of precipitation which reaches a stream, drain, sewer, etc. directly or indirectly.
Runoff Control	Physical devices which are used to limit runoff from an area.
Scour	Erosion of channel banks and bed due to excessive velocity of the flow of surface water and stormwater runoff.
Sediment	Fragmented material that originates from weathering and erosion of rocks or unconsolidated deposits, and is transported by, suspended in, or deposited by water. Certain contaminants tend to collect on and adhere to sediment particles.
Sedimentation	The depositing or formation of sediment.
SEPA	State Environmental Policy Act. The Washington State law intended to minimize environmental impacts.
Siltation	The process by which a river, lake, or other water body becomes clogged with sediment. Silt can clog gravel beds and prevent successful salmon spawning.
SMP	City's new Stormwater Management Plan has two parts: Part I = Water Quality Enhancement Plan Part II = Drainage Control Plan
Source Control	Refers to control of runoff waters before they enter the public storm water conveyance system.
Source Control BMP	A BMP that is intended to prevent pollutants from entering stormwater. A few examples of source control BMPs are erosion control practices, maintenance of stormwater facilities, constructing roofs over storage and working areas, and directing wash water and similar discharges to the sanitary sewer or a dead end sump.
Storage	Water artificially impounded in surface or underground reservoirs for future release.

Storm	A disturbance of the ordinary average conditions of the atmosphere, which may include any or all disturbances such as wind, rain, snow, hail, or thunder
Storm Drain	A closed conduit for conducting stormwater that has been collected by inlets or collected by other means. The various parts of a drainage system are defined as follows: (1) Lateral (Collection) Storm Drain. A drain that has inlets connected to it but has no other storm drain connected. (2) Trunk (Main) Storm Drain. A drain which receives the discharge from several laterals and generally serves a relatively large area, and may or may not have inlet connections. (3) Outfall Storm Drain. A drain which receives the runoff from a collecting system--such system being lateral or trunk storm drains, as are required--and carries such runoff to a point of final discharge.
Storm, 10-year	A rainfall storm that has a probability of occurrence on an average of once every ten years.
Storm, 100-year or Sooner	A rainfall storm that has a probability of occurrence on an average of once every 100 years.
Stormwater	That portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, channels or pipes into a defined surface water channel, or constructed infiltration facility.
Structural Control Measures	Includes placement of pipes, channel resizing, streambank protection and detention ponds to control runoff later.
Surface Runoff	That part of the runoff which travels over the soil surface to the nearest stream channel or conveyance system element.
Surface Water	Water on the surface of the earth.
Suspended Solids	Particles of organic and inorganic matter suspended in water. Toxicants may adhere to solid particles which can intensify chemical pollution problems.
SWMP	Stormwater Management Plan

Topography	General term to include characteristics of the ground surface such as plains, hill, mountains, degree of relief, steepness of slopes, and other physical features.
Treatment	Chemical, biological, or mechanical procedures applied to an industrial or municipal discharge or to other sources of contamination to remove, reduce or neutralize contaminants.
Turbidity	Dispersion or scattering of light in a liquid, caused by suspended solids and other factors; commonly used as a measure of suspended solids in a liquid. High levels of turbidity over extended periods are harmful to aquatic life.
UGA	Urban Growth Area
WADOT or DOT	Washington State Department of Transportation
Water Quality	A term used to describe the chemical, physical and biological characteristics of water, usually in respect to its suitability for a particular purpose.
Water Quality Storm	6-month, 24-hour storm event
Watercourse	A channel in which a flow of water occurs either continuously or intermittently, and if the latter, with some degree of regularity. Such flow must be in a definite direction. Watercourses may be either natural or artificial, and the former may occur either on the surface or underground. (1) Artificial: A surface watercourse constructed or modified by human agencies, usually referred to as a channel or ditch. (2) Natural: A surface watercourse created by natural agencies and conditions.
Watershed	The geographic region in which all the surface water flows toward a particular river or other body of water.
Watershed	The geographic region in which all the surface water flows toward a particular river or other body of water.
Wetlands	Those sensitive areas transitional between terrestrial and aquatic systems where the water table is usually at or

	near the surface or the land is covered with water. A wetland must have one or more of the following attributes: (1) At least periodically, the land supports predominantly hydrophytes. (2) The substrate is predominantly undrained hydric soil. (3) The substrate is non-soil and is saturated by water or covered shallow water at some time during the growing season each year.
Wetponds	Drainage facilities for water quality treatment that contain permanent pools of water that are filled during the initial runoff from a storm event. They are designed to optimize water quality by providing retention time in order to settle our particles of fine sediment to which pollutants such as heavy metal absorb, and to allow biologic activity to occur that metabolizes nutrients and organic pollutants.
WHPP	Wellhead Protection Plan
WQE Plan	Water Quality Enhancement Plan
WQE Plan	Water Quality Enhancement Plan - Part I of the City's new Stormwater Management Plan to improve water quality.
WQIDH	Water Quality in Drayton Harbor, 1990 by C.S. Cook.
WSP	Water Supply Plan

Executive Summary

1.0 Introduction and Background Information

1.1 Introduction

The City of Blaine (City) has recently undertaken a comprehensive effort to manage its water resources by conducting planning studies for water, sewer, and stormwater. Common management goals for the City have been identified and used to integrate these three resulting infrastructure plans through the City's Growth Management Act (GMA) planning processes. The following Stormwater Management Plan preserves and enhances the City's natural drainage system of lakes, streams, embayments, wetlands, and groundwater. At the same time it is responsive to local drainage problems and regulatory requirements and to promoting the enhanced development standards needed to guide future development.

1.2 Purpose

Management of the City's drainage system is one of many City responsibilities to provide for public safety and welfare. This responsibility includes the protection and preservation of the natural resources of the area that play such a large role in sustaining the City's quality of life. Within the City, the responsibility for storm and surface water management and protection of the groundwater have been entrusted to the Department of Public Works (Public Works). It is the mission of the Stormwater Program, within Public Works, to control flooding, enhance water quality, protect sensitive habitat areas, and optimize the recharge of local aquifers. The purpose of this study is to evaluate the present operation and staffing of the City's Stormwater Program, suggest improvements to enhance the performance of the Program, meet regulatory requirements of the Basic Stormwater Program of the Puget Sound Water Quality Management Plan, and present an approach to fund and implement needed improvements.

2.0 Water Quality and Enhancement Plan

2.1 Water Quality Assessment

There is little data available to define the quality of surface water runoff within the City. A few of the City's stormwater outfalls into Drayton Harbor have been monitored as part of the Drayton Harbor Watershed Action Plan (DHWAP). Results have shown elevated levels of coliforms, metals, nutrients, solids, turbidity, hydrocarbons, and low dissolved oxygen typical of urban areas. The separation of sewer and stormwater flows will reduce the

Difficult to est Base Line data ??

frequency of sewer overflows and substantially improve the water quality within Drayton Harbor and Semiahmoo Bay. Over the last five years the City has spent over $5 million to reduce stormwater and sewage discharges into Drayton Harbor.

2.2 Water Quality Enhancement Plan: Part I of the Recommended Stormwater Management Plan

Based on the data and recommendations presented in the DHWAP (1993) and the report of Water Quality in Drayton Harbor (C.S. Cook, 1990), a Water Quality Enhancement Plan (WQE Plan) has been developed for the City as one of the major elements of the following Stormwater Management Plan. The WQE Plan recommends a two part strategy to control contaminants and enhance water quality throughout the City. The first part is to use the source controls to prevent pollutants from entering stormwater runoff and/or to treat or remove pollutants at the source, as described in the following plan. The second part is to add treatment facilities at key locations within the City's drainage system to treat stormwater runoff prior to discharge to Drayton Harbor and Semiahmoo Bay. Both strategies need to be developed and implemented concurrently to achieve the City's water quality objectives. Needed treatment facilities are listed below.

(1) (2)

List of Treatment Control Projects and Costs
Needed to Provide Water Quality Treatment to the Existing Surface Water Runoff Within the City of Blaine

Drainage Area	Project Number	Location	Type of Improvement	Cost
1	1-1	* Ditch in state park along border	Settling/Biotreatment	$30,000
	1-2	Near I-5 and D Street	Settling/Biotreatment	$30,000
	1-3	Near 1st and B Streets	Settling/Biotreatment	$30,000
	1-4	I-5 right-of-way	Biofiltration	$ 4,000
2	--	No projects identified		
3	3-1	South of Pipeline and East of Yew	Apply Dev. Standards	
	3-2	South drainage from airport	Detention Basin	$135,000
	3-3	Truck Route and H Street	Biofiltration	$ 26,000
	3-4	Wet pond treatment facility near marina	Settling/Biotreatment	$ 70,000
4	--	No projects identified		
		Total for Infiltration/Vegetation Treatment Control Projects		$325,000

* Note: Most of the drainage in this facility is from Whatcom County (County).

See 2-4

3.0 Analysis of the City's Existing Drainage System

3.1 Overview of the City's Existing Drainage System

Existing Drainage Facilities

With the exception of a few more recent developments, the existing drainage system within the City consists of a series of earthen swales next to roads which collect and route drainage away from homes and businesses. In most of the commercial and business areas of the City these drainage swales have been put into culverts which carry the drainage directly to Semiahmoo Bay or Drayton Harbor. Due to the local topography, most drainage basins or catchment areas are small and consist of a small network of pipes and ditches which drain primarily to the west into nearby marine waters. All drainage from the City, except the Semiahmoo areas, must pass under the Burlington Northern Railroad grade prior to discharge into Drayton Harbor or Semiahmoo Bay.

Summary of Existing Drainage and Stormwater Issues

The City has historically had few major flooding problems. The City's drainage system also has a number of irregularities and inconsistencies (i.e., discontinuities) that either block drainage and/or reduce capacity and create localized ponding. This is especially true in the northern parts of the City. Generally, the capacity and effectiveness of the entire City system could be significantly increased by an upgraded, regular maintenance program. Water quality treatment does not exist for most stormwater drainage within the City. Recent road and sewer utility projects have added capacity and oil/water treatment to a few of the City's major discharges into Drayton Harbor. The City's sewer separation projects will also reduce combined sewer overflows in the Blaine Harbor area. Biotreatment is being added when projects and opportunity allow. However, much of the drainage receives little, if any, treatment prior to discharge.

Based on the field inventory of the City's drainage system, and an analysis of each major drainage area within the City, there are a number of important drainage related issues and challenges to be faced by the City and addressed in this Stormwater Management Plan. These issues include the need to:

- ❑ Improve water quality treatment throughout the City.
- ❑ Enhance maintenance.
- ❑ Protect and preserve wet areas and wetlands.
- ❑ Improve drainage standards for new development.

- ❑ Conduct water quality monitoring to evaluate treatment effectiveness and loadings.
- ❑ Develop a spill response program for highways, rail, airport, marinas, and harbor.
- ❑ Require source controls and treatment prior to discharge for manufacturers and industries.
- ❑ Reduce sewage discharge and combined sewer overflows.
- ❑ Sewer those areas with failing septic tanks.
- ❑ Provide for groundwater and wellhead protection.
- ❑ Work with businesses, homeowners, and public authorities to reduce the use and discharge from pollutants.

3.2 Drainage Control Plan: Part II of the Recommended Stormwater Management Plan

Based on the 1989 Blaine Comprehensive Storm Drainage Plan by Associated Project Consultants, Inc., and an inventory and analysis of the capital drainage problems within the City, a Drainage Control Plan has been developed, as the second major element of the following Stormwater Management Plan. The recommended Drainage Control Plan addresses flooding and capacity issues, while the above proposed Water Quality Enhancement Plan addresses the treatment and removal of pollutants within the City's stormwater runoff. Both of these planning elements need to be incorporated into the City's new Stormwater Management Plan to have an effective stormwater program.

The recommended drainage control plan has two elements: 1) maintenance of the City's existing drainage system to restore and maximize its original design capacity; and 2) construction of one new retention/detention facility and a series of new larger pipes and culverts to properly control the runoff from larger storms (greater than the 5-year event) and future development.

Recommended Drainage Control Operation and Maintenance Activities

The following lists the various maintenance activities and their relative priority, as presented in the 1989 Blaine Comprehensive Storm Drainage Plan.

Operations and Maintenance Plan for the City of Blaine from the 1989 Blaine Comprehensive Storm Drainage Plan

Priority	Activity	Drainage Area	Cost *
1	Inventory all drainage facilities and annually inspect, record results, and create an effective annual O/M work program.	All Areas	------
2	Conduct maintenance in order of priority on Cain Creek channel and all culverts and swales beginning with the largest diameter structures.	All Areas	------
3A	Conduct regular annual maintenance, as needed, to keep the system running effectively.	All Areas	------
	*Maintenance costs would be estimated based on the annual inspection program and facility needs.		Not Determined

Recommended Drainage Control Capital Activities

Presented below is the recommended capital facility plan for the City of Blaine from the 1989 Plan.

Capital Facility Plan for the City of Blaine from the 1989 Blaine Comprehensive Storm Drainage Plan

Priority	Activity	Drainage Area	Cost *
1	Clean main channel of Cain Creek	3	$6-10K
2	Repair the 60-inch box culvert under Peace Portal Drive	3	$50-75K
3A	Construct 5.1 acre foot detention facility, and	3	$62-100K
3B	Add a second 36-inch pipe west of the Truck Route	3	$70-90K
4A	Add a 36-inch culvert at Mitchell Street, and	4	$100-150K
4B	Add a 30-inch culvert under I-5	3	$30-50K
4C	Enlarge culverts discharging up and down the length of the main channel of Cain Creek	3	No costs presented
5	Construct an additional 5.3 acre feet of storage	3	$42-75K
	Total		$360K-$550K

* Note: A range of costs has been added to update the cost estimates presented in the 1989 Plan.

4.0 Evaluation of the City's Existing Stormwater Program and Activities Needed for Regulatory Compliance

4.1 The City's Existing Stormwater Program

Program Overview

The responsibilities of the City's Stormwater Program have expanded continuously over the last fifteen years. The City has been an active participant in regional watershed planning with Whatcom County, the Public Health Department, and other agencies. As the impacts of urbanization have increased, so have the regional and State regulatory requirements. Most recently, the critical interrelationships between stormwater, groundwater, and water supply have been documented in the Blaine Ground Water Management Plan and the City's recent draft Wellhead Protection Plan. These studies require the City to take a comprehensive look at all of its water resource programs.

Organization

The City's Stormwater Program is one of many services provided by Public Works. Under the direction of the City Engineer, the City's annual Stormwater Program is carried out by the two-person street, right-of-way maintenance crew under the supervision of a public works foreman. Beginning in 1995, the overall Stormwater Program will also be supported by the new water quality monitoring coordinator. An organizational chart for the Department of Public Works is shown in Exhibit 5-1.

Staffing

The City's Stormwater Program has no designated full-time staff. Day-to-day supervision and technical direction is provided by the City Engineer. Activities of the Stormwater Program are carried out by the two-person street maintenance crew under guidance of the Public Works foreman. Approximately 2,000 hours per year is allocated to the City's present Stormwater Program.

Funding

Financial support for the City's Stormwater Program comes from the City's Annual Engineering Division Budget (Funds 101 and 330). The Engineering Division is primarily funded from local option gas taxes, with supplemental funding from State motor fuel revenues, local option property tax levy, and an internal transfer of resources from the City's Current Expense Fund.

Funding for the City's Stormwater Program varies from year to year from about $50,000 to $150,000 depending on grants, capital projects, equipment needs, maintenance and repair needs, and the use of outside services. In 1992 and 1993, the operating budgets were $42,122 and $15,684, respectively. In 1994, the operating portion of the program, which is primarily catch basin cleaning and ditch mowing, was $43,287 (Requested 1994 Budget). This portion of the budget supports about 1,000 hours of a laborer's time (approximately $18,300), with $11,500 for supplies and about $13,500 for rentals and outside contractual services.

The capital portion of the stormwater budget also varies from year to year depending on the City's capital drainage needs. In 1994, the capital budget consisted of $80,000 for developing the City's Stormwater Program and $15,000 for drainage modifications along 9th and 10th Streets from "D" to "B" Streets. The City's total Stormwater Program costs for 1994 were $138,287 ($43,287 operating budget and $95,000 capital budget). Most of the City's capital stormwater projects have been included in other major road, sewer, water, and infrastructure projects, such as the $1,250,000 LID-27 drainage and the $1,600,000 sanitary sewer reconstruction projects for the City's central district, which were built in 1991 and 1992 from revenue bonds, a Public Works Trust Fund loan and a Community Development Block Grant. In addition, LID-14 paid for the construction of a new sanitary sewer system for South Blaine, costing $1,995,000.

Accomplishments

The staff of the City's Stormwater Program have routinely performed drainage services for the City with a very nominal amount of annual expenditure. They should be complimented for their work and dedication.

Accomplishments to-date include:

- ❑ Review and approval of all drainage plans for new development, including the Resort Semiahmoo.
- ❑ Input and guidance on the development of the Drayton Harbor Watershed Management Plan (DHWMP).
- ❑ Development of the City's Wellhead Protection Plan.
- ❑ Inflow/infiltration studies and major sewer separation to reduce combined sewer overflows and enhance water quality in Drayton Harbor.
- ❑ Stormwater treatment projects, such as LID-27 and the new biofiltration facility along Boblett Road.

what and where??

- Participation in regional water quality monitoring.
- Compliance with federal, State, and local regulations pertaining to stormwater.
- Establishment of working relationships and interlocal agreements with local and regional agencies to protect regional water resources.
- Development of new drainage design standards for the City.

Problems and Deficiencies

Overall Stormwater Program deficiencies include:

- Lack of timely and comprehensive maintenance.
- Little treatment of runoff prior to discharge.
- Pollution of outfall areas from urban discharges.
- Localized flooding due to discontinuities in the drainage system.
- No adopted criteria for new development.
- No clearing/erosion control ordinance.
- No maintenance ordinance for public and private systems.
- Septic tanks failing in some unserviced areas.
- Combined sewer overflows.
- Lack of appropriately trained staff.
- Lack of funding.

Needed Improvements

Enhancement of the City's Stormwater Program that would improve both its effectiveness and efficiency include:

- An enhanced annual maintenance program.
- Localized repairs/additions to the drainage system to remove discontinuities.
- Addition of treatment facilities to the existing system.

- Ordinances for stormwater/water quality, maintenance, inspection/ enforcement, and clearing/erosion control.
- Additional experienced stormwater staff.
- Additional financial resources.

Regulatory Compliance

Regulatory Requirements for Stormwater Management - The City of Blaine is affected by both existing State and possible future federal stormwater management requirements.

The City was required to comply with the terms of the State's Basic Stormwater Program by January 1, 1995. The Basic Stormwater Program requires the City to:

- Develop and adopt local ordinances for all new development and redevelopment.
- Develop and enforce the proper operation and maintenance program for all new and existing public and private stormwater systems (minimum standards are defined in The Department of Ecology's (Ecology) Stormwater Guidance Manual, July 1992).
- Develop and maintain a record keeping program for all new public and private drainage systems and facilities.
- Adopt Ecology's Stormwater Technical Manual or develop a manual with substantially equivalent technical standards (manuals other than the Ecology manual were to be pre-approved by Ecology by January 1, 1995).
- Develop and implement education programs to educate citizens about stormwater and its effects on water quality, flooding, and fish/wildlife habitat, and to discourage illicit dumping into storm drains.
- Coordinate the City's Stormwater Program with provisions of the GMA.
- Local enforcement of the above six stormwater controls.

Conclusion Regarding Compliance with the State's Basic Stormwater Plan

Because the January 1, 1995, due date has passed before the City had an opportunity to comply with all of the required elements of the Basic Stormwater Program, it is recommended that a "Letter of Compliance" be written to Ms. Nancy McKay, Executive Director of the Puget Sound Water Quality Authority (PSWQA), describing the City's existing Stormwater

Program and presenting a proposed schedule for full compliance. This letter will demonstrate the City's intent of making a "good faith" effort to comply with the State's Basic Program and may reduce or eliminate any future penalties, enforcement actions, or legal challenges.

A number of activities will need to be undertaken by the staff of Public Works to ensure future compliance with the State's Basic Stormwater Program, including:

- ❑ Adoption of a City-wide stormwater ordinance (January 1, 1996);
- ❑ Adoption of Ecology's model maintenance ordinance (January 1, 1996);
- ❑ Enhancement of the maintenance program, including increased annual funding, an annual maintenance management plan, a complete inventory of drainage facilities, annual inspection and improved maintenance data, and record keeping and the enforcement of the maintenance of private facilities (1996 - 1999);
- ❑ Adoption of the Ecology design manual (January 1, 1996);
- ❑ Development and implementation of a public awareness/education program (1996);
- ❑ Regional coordination with Whatcom County and other agencies (to be continued on an on-going basis); and
- ❑ Efforts to secure adequate funding for the program (to be continued on an on-going basis).

4.2 Programmatic Analysis

Overview of the Programmatic Analysis Process

A programmatic assessment was made of the City's existing program in order to identify stormwater activities needed to solve local problems and meet the above regulatory requirements. The programmatic analysis of the City's Stormwater Program was divided into three parts: assessment, analysis, and recommendations. In the first part, documentation and assessment of the various activities of the City's existing Stormwater Program was made. An analysis was provided in the second part that reviewed the existing program and staffing levels, presented regulatory and planning issues, and commented on management and financial alternatives. Programmatic recommendations in the third part included staffing, funding, management suggestions, and direction.

Summary of Programmatic Analysis

The City's Water Resources Program is emerging from planning into an implementation phase. As such, it is appropriate to review and update the Division's operations, as well as funding and staffing levels. Currently, the City's Stormwater Program is underfunded and understaffed. Each of the thirteen elements of the program analyzed above will require additional effort in the future. Staffing needs have been divided into short-term needs (0-2 years) and long-term needs (3-5 years), as shown in Table 5-3. In the short-term, the addition of 1.7 new FTE (3,400 hours) is recommended. In the long-term, as many as an additional 5.6 new FTE (11,200 hours) may be required as the City begins to address the needs of compliance with future regulatory requirements. Recommended short-term improvements will cost $138,500 annually. They should be implemented as soon as practicable. (It has been assumed that the existing level of stormwater funding and staffing would be maintained.) Long-term improvements will cost an additional $191,000 per year, for a total of $329,500 per year. In addition a future capital budget of $750,000 will be required.

Implementing both the recommended short- and long-term improvements will cost about $329,500 annually. It will effectively more than double the annual operating costs of the City's current Stormwater Program. Improvements will require new funding sources to be developed along with new outside funding sources for capital projects. Funding for the short-term improvements could come primarily from a new stormwater utility fee and creation of permit review and maintenance/inspection fees for private facilities. Long-term improvements could also be funded primarily from stormwater utility fees along with other revenue sources, including increased development fees, a new development inspection fee, grants, and support from the water utility. Capital improvements may be funded by grants, loans, stormwater utility fee revenues, local improvement districts, and revenue/councilmanic bonds.

5.0 Stormwater Management Plan

5.1 Overview

The following Stormwater Management Plan (Plan) presents activities and costs for the City to address local drainage needs and comply with the requirements of the State's Basic Stormwater Program, as defined in the 1994 PSWQA Management Plan. The various recommended administrative, regulatory, and programmatic activities have been prioritized with both short- and long-term improvements identified. Funding alternatives have been considered and recommendations made as to the most viable funding source.

5.2 Stormwater Management Strategy

The Stormwater Management Plan for the City is based upon two program directives: first, to solve local drainage problems, and, second, to develop a stormwater program that achieves regulatory compliance. One of the biggest challenges the City faces in regard to stormwater management is providing adequate treatment of the surface runoff before it is discharged into Drayton Harbor or Semiahmoo Bay. Most of the City's drainage system is older and in densely developed areas of the City, so there is limited opportunity to provide adequate treatment prior to discharge. Where sites are available, biofiltration/infiltration types of treatment facilities have been identified and are recommended.

To achieve the first goal, the existing City Stormwater Program and facilities were analyzed and evaluated. Capital needs were based on the 1989 Stormwater Management Plan, which identified the need for one new regional detention facility and a series of pipe capacity improvements. Because major flooding was not a problem, the analysis emphasized the gains to be realized by an enhanced maintenance program, which proved to be significant. A two to threefold increase in capacity can be realized within the existing system through regular maintenance and through a series of minor repairs to remove major discontinuities within the existing drainage system. Additional capacity improvements consisting primarily of larger or more pipes have been recommended to meet existing and future drainage needs.

Achieving the second program directive of regulatory compliance presents many challenges because the City does not have effective stormwater/water quality maintenance, enforcement/inspection, erosion control, or ordinances. Providing the City with these types of legal authority has been recommended, along with the adoption of a new set of drainage design standards for the City that are equivalent to Ecology's Technical Manual. Model Ecology stormwater and maintenance ordinances have been recommended as reference documents to guide the City's development of new ordinances.

5.3 Recommended Stormwater Management Plan

The recommended Stormwater Management Plan for the City has been divided into an annual operating program and a capital facilities plan. The annual operating plan is based on the regulatory and programmatic analysis presented in Section 5. In addition to program activities, it includes a listing of activities needed to achieve regulatory compliance and a list of prioritized maintenance needs. The capital facilities plan presents the treatment

projects identified in Section 3 and the major structural capital improvements presented in Section 4.

Annual Operating Program

Staffing and Funding Levels - The City needs to improve the staffing and level of funding of its existing Stormwater Program. Program enhancements are needed to meet the requirements of the State's Basic Stormwater Program, to improve the maintenance and capacity of the City's existing drainage system, to establish effective drainage controls for new development, and to improve water quality. By doing the above, they will meet many of the recommendations of the DHWAP.

Recommended staffing and funding levels are briefly summarized below.

In the short-term (0-2 years) the City should:

- Hire the equivalent of 1.7 new full-time employees (FTEs) which will provide the program with an additional 3,400 hours of internal technical support.
- Increase the level of annual funding to the program from $53,287 to $138,500.

In the long-term (3-5 years) the City should:

- Hire the equivalent of an additional 3.9 FTEs providing the Stormwater Program with an additional 7,800 hours of technical support.
- Increase the level of funding to the program from $138,500 per year to $329,500 per year.

Regulatory Compliance - Stormwater activities needed to be completed by the City to achieve compliance with the State's Basic Stormwater Program have been presented and discussed in Section 5.3. Individual costs for regulatory compliance have not been estimated. The identified short-term staffing and funding levels should be adequate to complete these various compliance activities within twelve to eighteen months.

List of Maintenance Needs and Priorities - One of the most significant stormwater enhancements needed is to improve the annual stormwater maintenance program. The City needs to substantially improve its legal authority, level of staffing, and level of funding in order to comply with the State's Basic Stormwater Management Plan. A partial listing of major City-wide maintenance needs and priorities is presented in Sections 3.0 and 4.0.

Priorities for the City's maintenance program are defined in the 1989 Stormwater Plan and presented in Section 4.5.2. They include the following activities in order of their priority.

1. Inventory and annually inspect all drainage facilities, record results, and create an effective annual record keeping work program;

2. Conduct maintenance in order of priority: Cain Creek Channel, then all culverts and swales, beginning with the largest diameter structures first; and

3. Perform regular annual maintenance as needed to keep the system operating effectively.

(Note: A complete inventory of facility maintenance needs would allow an accurate cost estimate to be developed. A short-term estimate of $85,000 per year has been proposed, with a long-term annual cost of $125,000, as presented in Table 5-3).

Capital Facilities Plan

A listing of capital facilities has been developed in Sections 3 and 4 of this report totaling $875,000. Major structural capital facilities totaling $360,000 to $550,000 have been presented in Section 4. This list consists of eight facilities and includes a regional detention facility to be built in two phases, just southeast of the City airport, and six pipe and repair projects to add capacity to the City's existing drainage system.

Seven additional stormwater treatment facilities have been proposed in Section 3 to improve the quality of the City's surface water runoff discharged into Drayton Harbor and Semiahmoo Bay. These facilities total an additional $325,000. It is recommended that a small projects program be developed for these facilities so they may be built as soon as funding allows.

The City's Capital Facilities Plan for stormwater improvements totals $685,000 to $875,000 for projects to be built over the next five years. Potential funding sources include local improvement district revenues, loans (Public Works Trust Fund), grants (Centennial Clean Water), current expense and/or road funds, or new revenues generated by formation of a stormwater utility, SEPA mitigations, and/or developer impact fees.

Scope and Effectiveness of the Proposed Plan

The Stormwater Management Plan allows the City to:

- ❑ Achieve regulatory compliance;

- Address effectively the City's maintenance needs;
- Present needed capital facilities for flood control;
- Add treatment facilities to improve water quality;
- Upgrade staffing and funding levels of the existing stormwater program;
- Be consistent with the results and seven recommendations of the Drayton Harbor Water Quality Study by S. Cook, 1990;
- Allow implementation of eleven of the nineteen recommendations of the DHWAP (Recommendations SW-29, SW-34, SW-36, SW-37, SW-41, and SW-43 have not been specifically included in this proposed plan); and
- Include eleven of the fifteen source controls and treatment controls recommended in the Water Quality Enhancement (WQE) Plan, presented in Section 3 of this report (source controls S1, S2, S6, and S7 have not been specifically address in this proposed plan).

Funding

Future Revenue Needs - The revenue needs of the Stormwater Management Program will more than double as the Division begins to implement the City's new stormwater program within the next three to five years. The short-term improvements will cost about $158,500, and long-term requirements an additional $104,000 per year. The cost of operating the City's Stormwater Program will be about $320,000 - $500,000 annually and will require additional outside revenues, such as bonding for capital projects, the creation of new maintenance and inspection fees.

Regulatory Compliance - The costs of compliance with the State's Basic Stormwater Program are included in the additional 1.7 FTEs and the $138,000 per year recommended for short-term enhancements of the program.

Future Funding Alternatives - Based on the preceeding analysis of the City's present water resources program and current and future regulatory requirements, it is clear that the City will need to consider and adopt one or more new sources of additional revenue to adequately support the City's Stormwater Program.

The funding options that are both realistic and will likely allow the City to realize the most new revenues include:

- ❑ Setting up a stormwater utility fee. This fee could add an additional $150,000 per year. (Please note that all future revenue amounts are estimates and subject to change as the program funding options are further defined).

- ❑ Setting up new fees or modifying existing fees for:

  - Development review, where actual costs incurred by the City would be reimbursed by hourly development review fees paid by the developer. This could add as much as $10,000 to $15,000 per year.

  - A new development inspection and enforcement fee, which could add about $10,000 to $15,000 per year, and help support one new inspector.

  - A new private facility inspection and enforcement fee which could add about $10,000 to $15,000 per year and help fund one new maintenance staff person.

- ❑ Requesting the City's Water Utility fund groundwater and wellhead protection within the Stormwater Program - $10,000 to $20,000 per year. (Funding costs for groundwater and wellhead programs are not well defined at this time. Intra-utility funding [i.e., water to stormwater] would likely need to be continually provided on an annual basis as the groundwater programs continue to be developed and implemented by the Stormwater Program.)

If only these most likely future revenue requirements were to be developed, the Water Resources Division could realize an additional $190,000 to $215,000 in operating revenues per year. These new funds could be used to supplement existing annual funding or "free up" funds that are now annually spent on stormwater (Current Expense and Road Funds).

Recommendations - The City should conduct, within the next six months, a review of potential future revenue sources. This review should address, as a minimum, establishing a utility fee, establishing new fees for development review, inspection, enforcement, securing outside bonding for capital needs, and increasing the internal support from the City's Water Utility for groundwater related activities. These new revenues could add as much as $190,000 to $215,000 per year to the operating budget of the City's annual Stormwater Program.

Implementation

Future Stormwater Program and Priorities - The responsibilities and services of the City's new Stormwater Program are conceptually displayed in Exhibit

6-1. Program priorities for the implementation of the recommended Stormwater Management Program for the City are as follows:

- Regulatory compliance
- Maintenance
- Establishing new funding sources
- Hiring needed staff and developing an effective program
- Funding and building capital projects

Schedule - The Blaine Stormwater Management Plan has been designed to be developed and implemented over approximately a five to seven-year period. Three phases of implementation are recommended.

- Phase I (zero to one years) Regulatory Compliance, Establishing Policies, and Securing Funding
- Phase II (one to two years) Developing the Stormwater Program
- Phase III (three to five years) Operating the Program and Building Facilities

6.0 Conclusions and Recommendations

6.1 Conclusions

- Groundwater and surface water quality are important to the quality of life for the citizens of the City and the region, making the Stormwater Program an important activity of the City.
- The program is presently underfunded to meet existing and future program and regulatory compliance responsibilities.
- The current budget of the City's Stormwater Program is not adequate to properly:
  - Staff the Stormwater Program;
  - Accomplish the City's responsibilities under the PSWQA Plan requirements;
  - Adequately address new development; or
  - Maintain the existing drainage system.
- The City does not have adequate legal authority to develop an effective stormwater program or meet regulatory requirements. A number of new

ordinances and the adoption of new drainage design standards (equivalent to the Ecology Technical Manual) is needed.

- New and additional staffing and funding alternatives should be considered for the City's Stormwater Program.
- The City is not in compliance with the State's Basic Stormwater Plan and should take immediate action to be in full compliance by January 1, 1995.
- A "Letter of Compliance" should be sent to the Director of the PSWQA prior to the January 1, 1995, date of compliance.

6.2 Recommendations

The City should:

- Enhance the existing Stormwater Program to reduce or eliminate local drainage problems by increasing annual funding for maintenance, regulatory compliance, and capital projects.
- Develop and implement a stormwater program that meets or exceeds the State's Basic Stormwater Program.
- Establish needed legal authority by adopting ordinances for stormwater, water quality, maintenance, inspection/enforcement, and erosion/ sedimentation (clearing/grading).
- Adopt drainage standards for new development that meet or exceed the design requirements presented in Ecology Technical Manuals, Volumes I and II.
- Reduce or eliminate combined sewer overflows into Drayton Harbor.
- Eliminate illicit connections to the City's sewer connection.
- Establish a City-wide source control program to reduce the amounts of pollutants entering the City's stormwater system.
- Investigate the establishment of new funding sources for stormwater management, including developer fees, connection charges, and the formation of a City-wide stormwater utility.
- Establish a regional, interagency agreement, including the Resort Semiahmoo, Whatcom County, and the Port of Bellingham (for the Blaine Harbor area), to improve the water quality of Drayton Harbor.

- ❑ Work with the Port of Bellingham and Semiahmoo to establish specific monitoring and source control programs for Blaine Harbor and the Semiahmoo Marina, respectively.

Section 1
Introduction

1.1 Background

The City of Blaine (City) has recently undertaken a comprehensive effort to manage its water resources by conducting planning studies for water, sewer, and stormwater. Common management goals for the City have been identified and used to integrate these three resulting infrastructure plans through the City's Growth Management Act (GMA) planning processes. The following Stormwater Management Plan will preserve and enhance the City's natural drainage system of lakes, streams, embayments, wetlands, and groundwater, while being responsive to local drainage problems and regulatory requirements and promoting the enhanced design standards needed to guide future development.

The City has become involved in a growing number of stormwater related planning and technical decisions. Many of these decisions have significant financial implications for the City and its residents. Whether it is surface water, water quality, wetlands, or groundwater; federal, State, and local regulations are requiring a greater level of local participation and funding. For the City, its stormwater program needs to be upgraded to be consistent with the Puget Sound Water Quality Authority Plan and be responsive to the technical requirements of the Department of Ecology's (Ecology) Basic Stormwater Program by January 1, 1995.

As the City has grown, increased development has changed the nature and quality of the City's water resources and natural drainage system. It is important that the City identify the role, level of involvement, and direction it wants to assume in preserving and utilizing the City's remaining natural drainage resources. The following Plan presents a management analysis of the City's present drainage related activities and level of funding. The role the City needs to assume in order to comply with present regulatory requirements has been identified. Short and long-term improvements, along with funding alternatives, have been presented in a recommended implementation plan.

1.2 Purpose and Authority

1.2.1 Purpose

The management of the City's drainage system is one of the many responsibilities of the City to provide for public safety and welfare. This responsibility includes the protection and preservation of the natural resources of the area that play such a large role in sustaining the City's

quality of life. Within the City, the responsibility for storm and surface water management and the protection of the groundwater have been entrusted to the Department of Public Works (Public Works). It is the mission of the Stormwater Program within Public Works to control flooding, enhance water quality, protect sensitive habitat areas, and optimize the recharge of local aquifers. The purpose of this Plan is to evaluate the present operation and staffing of the City's Stormwater Program, suggest improvements to enhance the performance of the Program to meet regulatory requirements, and present an approach to fund and implement needed improvements.

1.2.2 Project Authorization

The City of Blaine's Department of Public Works retained Economic and Engineering Services, Inc. (EES) to assist the Council and City staff in reviewing the role and services of the Public Works' Stormwater Program. Documentation of this review and its findings and recommendations have been presented in this final report entitled City of Blaine: Stormwater Management Plan.

The Project Team for this effort included:

- City staff, under the direction of William Duffy - Water/Wastewater Manager and John Hergesheimer - City Engineer.
- EES, under the co-direction of Project Managers Marc Horton and Joseph Simmler, Ph.D.

The agreement for these consulting services to develop a Stormwater Management Plan for the City consisted of the following tasks:

Phase I—Data Collection and Analysis
Phase II—Field Inventory and Interviews with Key Staff
Phase III—Program Evaluation and Assessment
Phase IV—Development of the Comprehensive Water Resources Plan

1.2.3 Authorized Study Area

The study area for the development of the Plan for the City included all natural and manmade drainage systems located within the present City limits.

1.3 Goals and Objectives

1.3.1 Goals and Objectives

In developing the Scope of Work for this Plan, it was important to characterize both the existing program and the current regulatory framework within which the program is operating. At the same time, the Plan needed to present a program to adequately protect surface water and groundwater, while effectively utilizing limited local resources. Keeping this guidance in mind, the following goals were established for this project:

- Document the activities and responsibilities of the City's Stormwater Program, with particular emphasis on surface water management and the regulatory elements of the program;
- Document and characterize the existing drainage system and water quality issues, identify capital and non-structural water quality improvements and costs;
- Recommend a minimum stormwater management program that addresses local problems and meets current regulatory requirements;
- Provide technical, programmatic, administrative, and financial guidance to allow the City to identify the future role, organization, responsibilities, and level of funding for the City's Stormwater Program.

1.4 Approach and Scope of Work

The above goals and objectives for the project were used to develop the approach and define the seven primary tasks (listed below) that were undertaken to complete the City's Plan. Exhibit 1-1, on the following page, presents a schematic overview of the planning process, and Appendix A contains a copy of the Scope of Work. Work was completed over a twelve month period beginning in October of 1993. This project was funded by the State's Centennial Clean Water Grant Program and the City of Blaine.

Task 1—Project Management
Task 2—Water Quality Assessment and Drainage Area Characterization
Task 3—Hydrological Analysis
Task 4—Problem Identification
Task 5—Development of Alternatives
Task 6—Stormwater Management Plan
Task 7—Public Informational Citizens' Advisory Committee

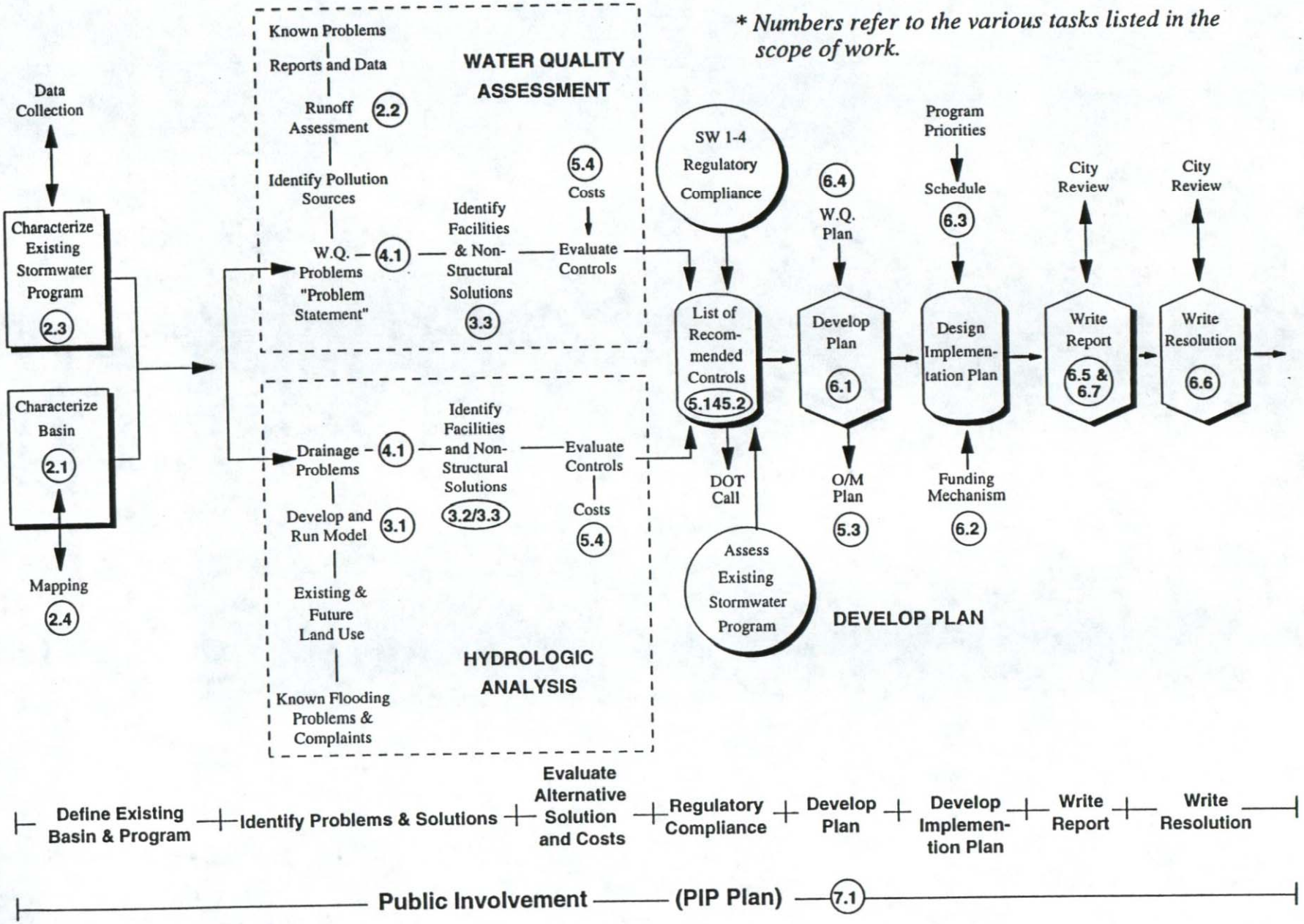


Exhibit 1-1
Planning Process and Scope of Work

1.5 Relationship to Other Plans

The proposed Plan has taken into account a number of other existing plans and ongoing planning activities sponsored by the City of Blaine, Whatcom County (County), the Whatcom County Council of Governments, and the State of Washington.

1.5.1 Planning within the City of Blaine

City of Blaine 1989 Comprehensive Storm Drainage Plan

In 1989, Associated Project Consultants, Inc. developed a drainage plan for the City. This plan included the 1984 Semiahmoo Company Drainage Plan and was an update to the City's previous 1973 drainage plan developed for the City by Hammond Collier Wade and Livingston, Inc.

The 1989 Plan performed a visual inventory of the City's drainage system, modeled existing and future runoff using the SCS TR-55 model for the 5- and 25-year design storm, and presented a series of maintenance and capital improvements, including a 10 acre-foot regional detention facility near the airport.

City of Blaine 1984 Comprehensive Land Use Plan and 1994 Growth Management Act Plan

As part of the City's efforts to respond to the 1994 schedule of the State GMA, the City's 1984 land use and zoning map is being updated by the Planning Department and will be coordinated with needed infrastructure improvements being developed by Public Works. The County has been included in the GMA planning process. However, there are continuing discussions between the City and the County regarding the location of the final GMA boundaries.

EES has coordinated with City staff to acquire future land use designations as needed to model future drainage flows, identify problems, and size future drainage facilities.

City of Blaine 1994 General Sewer Plan (Draft)

The draft Blaine General Sewer Plan makes reference to the large amount of stormwater inflow and infiltration (I/I) that is entering the sewer system and consuming treatment capacity at the sewage treatment plant. Presently, the sewage treatment plant is at capacity. Efforts are underway, via smoke testing and other techniques, to reduce the I/I problem and limit the amount of stormwater entering the sewer system. The City's future stormwater

facilities, as presented in this Plan, have been sized to accept all drainage flows, including those stormwater flows presently entering the sewer system.

City of Blaine 1994 Water Supply Plan (Draft)

The draft Blaine Water Supply Plan makes little direct reference to the City's stormwater program. As the City continues to draw upon local aquifer resources, however, the non-point and source control activities of the City's Stormwater Program will play a significant role in protecting wellhead areas and enhancing groundwater recharge. An effective stormwater program will be essential to ensure the long-term quality and quantity of the City's water supply aquifers.

City of Blaine 1992 Ground Water Management Plan

The Groundwater Study report developed by Golder Associates, Inc., in 1992, defined six different hydrostratigraphic units within the 30 square mile Blaine Groundwater Management Area. Due to repeated glaciation advances and retreats, the soils are varied throughout the Blaine area. A number of discontinuous pockets of sand and gravel exist which contain some groundwater. Other areas contain primarily blue clay, silts, and sandy clay which are almost impervious to water. The City presently has six wells in both the shallow and deeper aquifer units. The shallow aquifer systems are perched above clay lenses with unknown and limited sources of recharge. Both the shallow and deeper aquifer systems are threatened by failing septic tanks, highway and residential runoff, underground storage tanks, City/County weed control programs, hobby farms, agricultural practices, and hazardous wastes/spills. The City should continue to pursue source control and pollution control programs to protect groundwater recharge areas.

City of Blaine 1992 Wellhead Protection Plan and Hydrogeologic Report

The City is in the process of completing a Wellhead Protection Plan to protect and ensure the recharge of its groundwater aquifers. Because 98 percent of the water used in the area is from groundwater and because these supplies are both limited in volume and easily contaminated, a well developed wellhead plan will be critical in preserving and sustaining the region's groundwater resources. Proper stormwater management practices and policies should be used in conjunction with the City Wellhead Plan to sustain the quality and quantity of the City's 1992 groundwater resources.

City of Blaine Resort Semiahmoo

A number of water quality and drainage studies have been developed in association with the planning and construction of the Resort Semiahmoo.

- The Preliminary Drainage Plan, by C. Roper in 1984, describes natural drainage patterns, sub-basins, and soils. A SCS TR-55 model was used to estimate current flows and predict future flows associated with the Resort Semiahmoo. In this study, little detention or water quality treatment (other than grass lined swales) was proposed in this study prior to its discharge to Drayton Harbor and the Strait of Georgia.

- The Master Development Plan for the Resort Semiahmoo presents a drainage plan for the site. The plan includes two discharges directly into Drayton Harbor. Most drainage is passed through detention ponds and/or biofiltration swales prior to discharge to Drayton Harbor or the Strait of Georgia.

- The Drayton Harbor Water Quality Study performed by S. Cook for the Semiahmoo Company documented that, with the exception of coliforms, the Drayton Harbor area was close to meeting the State Class A water quality standards. The harbor is nitrate limited, making the control of nutrients in the watershed, especially the Semiahmoo golf course, as important as the control of pollutants. Results of this study should be used by the City to design and prioritize stormwater source control programs within the City and the Blaine Harbor area (Port of Bellingham).

1.5.2 Whatcom County Council of Governments

Drayton Harbor 1993 Watershed Action Plan

The Whatcom County Council of Governments led the development of a Watershed Action Plan for Drayton Harbor drainage basin in 1993. This plan identified the non-point water quality problems in the Drayton Harbor watershed and recommended control strategies and activities based on the nature and source of the problem. There are numerous references to activities that the City needs to implement to improve water quality within the harbor including:

- Upgrade the sewer system,
- Monitor water quality,
- Plan for spill control,
- Improve enforcement,
- Develop an erosion, filling and grading ordinance,
- Adopt Ecology's design manual,
- Establish a critical areas ordinance,
- Provide citizen education, and
- Use Best Management Practices (BMPs).

1.5.3 Planning within Whatcom County

1994 Land Use and Growth Management Planning

Growth management planning has been occurring in the County over the past two years. Close coordination has occurred between the City and the County landuse planners. Comprehensive landuse plans and GMA boundaries have been established defining future City limits. Some areas within the GMA area are still being discussed by City and County planners, such as the land adjacent to and just south of Drayton Harbor.

Stormwater, Groundwater, and Watershed Planning

The County is actively involved in the land use planning and development processes outside of the City in the unincorporated areas of the Drayton Harbor Watershed. The County approves building permits based upon established zoning and building codes. The County sanitation engineer reviews and approves the sanitary systems which are primarily septic tank systems in the unincorporated County.

With relaxation of the past regional leadership role of the Whatcom County Council of Governments, there is a need for a governmental entity with regional jurisdiction and authority, such as the County, to lead and integrate the water resource planning, development, and protection processes throughout the County. Beginning with implementation and enforcement of the recommendations of the Drayton Harbor Watershed Action Plan, active regional leadership is needed to protect and guide the use of the area's surface, ground and drinking water supplies and resources. Regional water resource issues that need immediate attention include:

- ❑ Implementing the Drayton Harbor Watershed Action Plan.
- ❑ Adopting stormwater ordinances that include the Ecology drainage design standards and operation and maintenance (O&M) practices.
- ❑ Effective permitting, inspection, and enforcement of building regulations, including the siting of septic systems.
- ❑ Improving maintenance of existing facilities.
- ❑ Securing adequate funding, staffing, and technical expertise, including a county-wide stormwater utility.
- ❑ Updating and improving watershed planning, land use, and zoning decisions.

- Conducting stormwater, water quality monitoring, and habitat studies to establish effective source control programs, such as the reduction of coliform levels in Dakota and California Creek drainages.

- Improving education of developers, hobby farmers, marina operators, businesses, dairy and berry farmers, and foresters/loggers to protect water resources, preserve habitat, and reduce the release of pollutants to surface and groundwaters.

1.5.4 Planning and Monitoring by the State

Drayton Harbor Watershed Inventory

The State's Puget Sound Cooperative River Basin Team has participated in the regional planning for the Drayton Harbor Watershed by conducting a field inventory of the watershed in 1992 and writing a report on the status of land uses, wildlife, wetlands, riparian corridors, and water resources. The report from the River Basin Team was used to develop the Watershed Action Plan for Drayton Harbor in 1993.

Water Quality Monitoring

The State of Washington has been active in the Drayton Harbor area since the early 1950s. The Department of Health (DOH) has been monitoring Drayton Harbor and the commercial oyster rearing areas periodically over the last 45 years. More recently, their monitoring efforts have increased in conjunction with the de-certification of over 500 acres of commercial rearing areas due to increased bacterial levels from Dakota and California Creek discharge, failing septic systems, and to a lesser extent, releases of pollutants from Blaine and Semiahmoo marinas and occasional sewage discharges from the City's sewer system.

Ecology has recently monitored selected stormwater drainages in order to document illegal discharges from a few of the local manufacturers (metal platers) within the City. Improved notification and coordination of NPDES violations by Ecology is needed in the future.

1.6 Technical Guidance Used to Prepare the Plan

Substantial information exists regarding the design of stormwater programs and water quality treatment facilities within the State of Washington and particularly the Puget Sound Drainage basin. The two primary documents used in developing the Plan for the City were:

- The 1991 Puget Sound Water Quality Management Plan, adopted November 21, 1990, by the Washington State Legislature, with its 1992 and 1994 amendments; and

- The Stormwater Management Manual for the Puget Sound Basin, Volumes I and II, published by the Washington State Department of Ecology in February of 1992.

Other documents used for background information and additional technical guidance include the:

- United States Environmental Protection Agency's National Pollution Discharge Elimination System (NPDES) Regulations (Federal Register, November 16, 1990).

- Washington State Department of Transportation Hydraulics Manual.

- City of Blaine 1989 Comprehensive Storm Drainage Plan by Associated Project Consultants, Inc.

- City of Blaine 1984 Comprehensive Land Use Plan.

- City of Blaine 1994 Growth Management Act Plan (draft plan—internal communication with City staff).

- City of Blaine 1994 General Sewer Plan (internal draft).

- City of Blaine 1994 Water System Plan (internal draft).

- City of Blaine 1990 Groundwater Management Program: Background Report on Hydrogeology, Land Use and Water, by Golder Associates, Inc., Draft, November 6, 1990.

- Drayton Harbor Watershed Action Plan, Review Draft, August 1993, prepared by the Whatcom County Council of Governments.

- Technical Report: Water Quality in Drayton Harbor, Whatcom County, Washington 1989-1990 by Dr. S. Cook for the Semiahmoo Company.

- Technical Report: Semiahmoo Golf Course: Stormwater Drainage Study and Preliminary Drainage Plan, by C. Roper, P.E., March 1984.

- Technical Report: Water Balance and Hydrostratigraphy of the Dakota Creek Watershed, Whatcom County, Washington by M. Sandal, Masters Thesis, Western Washington University, June 1990.

- Technical Report: Semiahmoo Master Development Plan—Preliminary Drainage Plan, October 30, 1984.

1.7 Report Overview and Organization

The Stormwater Management Plan for the City is presented in terms of prioritized program recommendations. This format allows the City Council to select the optimum balance between protection of the City's extensive and diverse water resources and the appropriate scope of the water resources program and level of financial commitment.

A minimum level of service has been developed that allows the City to comply with existing regulations and reasonably address most local needs and services expected by the public. Higher levels of service allow the City to increase the level of resource protection and begin to allow the City's Stormwater Program to prevent problems and manage the resources rather than responding to problems once they have occurred.

The Plan presented in this final report is described in the following sections.

Section 1—Introduction
Section 2—Drainage Area Characterization
Section 3—Water Quality Assessment
Section 4—Existing Drainage System and Hydrologic Analysis
Section 5—Existing Stormwater Program and Regulatory Compliance
Section 6—Stormwater Management Plan
Section 7—Conclusions and Recommendations
Appendices

Section 1 describes the goals of this study and reviews the planning process used to develop the recommended Plan. Sections 2 and 3 present background and baseline water quality information for the various drainages within the study area. Section 4 uses the model and results of the 1989 Comprehensive Stormwater Drainage Plan to review and reprioritize drainage problems, management alternatives, and proposed solutions. In Section 5, an evaluation of the City's existing drainage program is compared with the various activities needed to achieve regulatory compliance. The recommended Stormwater Management Plan is presented in Section 6. Section 6 also presents an implementation schedule and reviews and recommends preferred financial alternatives to support new program initiatives and meet regulatory responsibilities.

The Technical Appendices Volume 2 of the Blaine Stormwater Management Plan, contain a number of documents important to the understanding of the City's stormwater program and key regulatory requirements. Of special importance are:

Appendix A - Scope of Work for the Blaine Stormwater Management Plan

Appendix B - Precipitation Data For the Blaine Study Area

Appendix C - Additional Information on Source and Treatment Controls

Appendix D - EES Site Visit and Field Inventory Results

Appendix E - 1989 Comprehensive Storm Drainage Plan for the City of Blaine

Appendix F - Preliminary Drainage Plan for the Resort Semiahmoo, 1984

Appendix G - City of Blaine 1994 Budget for the Transportation Division

Appendix H - Ecology Technical Manual

Appendix I - Puget Sound Water Quality Management Plan

Appendix J - Department of Ecology-"Guidance for Local Governments when Submitting Manuals and Associated Ordinances to Ecology for Equivalency Review," May 1984

Appendix K - Department of Ecology - letter from P. Birely regarding requirements and enforcement of the Puget Sound Water Quality Management Plan, July 1993.

Appendix L - Department of Ecology - Model Stormwater Ordinance, July 1992

Section 2
Drainage Area Characterization

2.1 Introduction

Section 2 describes the study area and summarizes existing data regarding land use, physical features, water quality, and the nature and extent of the City of Blaine's (City) drainage system. Findings from previous studies and reports are presented as they relate to stormwater and water quality issues, and allow for the identification and discussion of existing drainage problems. Primary reference documents include the Blaine 1994 Comprehensive Plan (July-August draft), the 1993 Watershed Action Plan, and the 1992 Blaine Groundwater Management Reports along with field investigations of the study area.

2.2 Description of the Study Area

The Drayton Harbor Estuary is just west of the central business section of the City of Blaine. It receives runoff from the City and the Resort Semiahmoo, combined sewer overflow discharges, and the drainage and wastes from the Blaine Harbor and Semiahmoo Marina. It also receives major inputs of freshwater drainage from unincorporated Whatcom County through the discharges from the Dakota Creek and California Creek watersheds.

The Drayton Harbor Watershed drains 54.8 square miles, or 35,102 acres, and contains 129 miles of streams and tributary drainage systems. Over 90 percent of the freshwater drainage into Drayton Harbor is from Dakota and California Creeks, with only 10 percent of the watershed, mostly within the City, draining directly into the Harbor. Wetlands and ponds cover about 7,300 acres, or 21 percent of the watershed. With each tidal cycle, about 50 percent of the water within Drayton Harbor is exchanged with marine water from Semiahmoo Bay and the Georgia Strait. (Note: This high level of tidal flushing helps maintain the water quality in Drayton Harbor and indicates that the estuary could quickly respond to a reduction in non-point pollution, including the direct discharges of surface water runoff and urban/commercial/ industrial/marine waste discharges.)

The estuary is very productive and environmentally sensitive. There is a commercial oyster farm located in the estuary just west of the mouth of Dakota Creek. Thousands of salmon pass through the estuary every year to spawn in Dakota and California Creek tributaries. Hundreds of thousands of small smelts and fry use the estuary area as a nursery and rearing area before entering their marine stage of life in Semiahmoo Bay and the Strait of Georgia. The estuary has a

healthy seal population, as well as eel grass areas and productive shellfish and crab habitat areas.

2.3 Location and Boundaries

The City is located in the northwestern corner of the State of Washington and has about 2,975 residents. Blaine is immediately south of the Canadian border and is the first city south of the border on Interstate I-5 (I-5), as shown in Exhibit 2-1. The City is located on both the east and the west sides of Drayton Harbor. On the west side of Drayton Harbor, the City boundaries include the Resort Semiahmoo (see location map, Exhibit 2-2). On the east side of Drayton Harbor, the study area includes the majority of the City's commercial and residential areas from the eastern City limits to the eastern shore of Drayton Harbor, including both sides of I-5.

2.4 Study Area and General Surface Hydrology

The study area for this stormwater plan is defined as the drainage areas within the City limits as shown in Exhibit 2-2. The western side of the City is located on Birch Point and includes the Semiahmoo Spit, an area of about 1.5 square miles. To the east, the study area extends about 3,000 lineal feet east of the City limits and includes an area of about 2.1 square miles. The study area has been divided into four drainage sub-basins which contain a total area of about 3.6 square miles. The drainage basin boundaries are shown in Exhibit 2-3. (Note: Since the western part of the City is the Resort Semiahmoo, which is owned and operated by the Semiahmoo Company, this stormwater planning effort focused primarily on the eastern part of the City, east of Drayton Harbor. The City's primary responsibilities in Semiahmoo related to drainage are maintaining water quality and reviewing and approving drainage plans.)

The City of Blaine is the only incorporated area within the Drayton Harbor Watershed, an area of about 54.8 square miles, as shown in Exhibit 2-4. This watershed parallels the international border with Canada and is located in the northwestern corner of Whatcom County (County). Two major freshwater drainage systems, Dakota and California Creeks, discharge directly into the Harbor from the southeast. The drainage from the eastern part of the City flows to the west into the Harbor and to the northwest into Semiahmoo Bay. The west side of the City, which includes the Resort Semiahmoo, flows directly into Semiahmoo Bay and the Strait of Georgia to the west, and Drayton Harbor to the east.

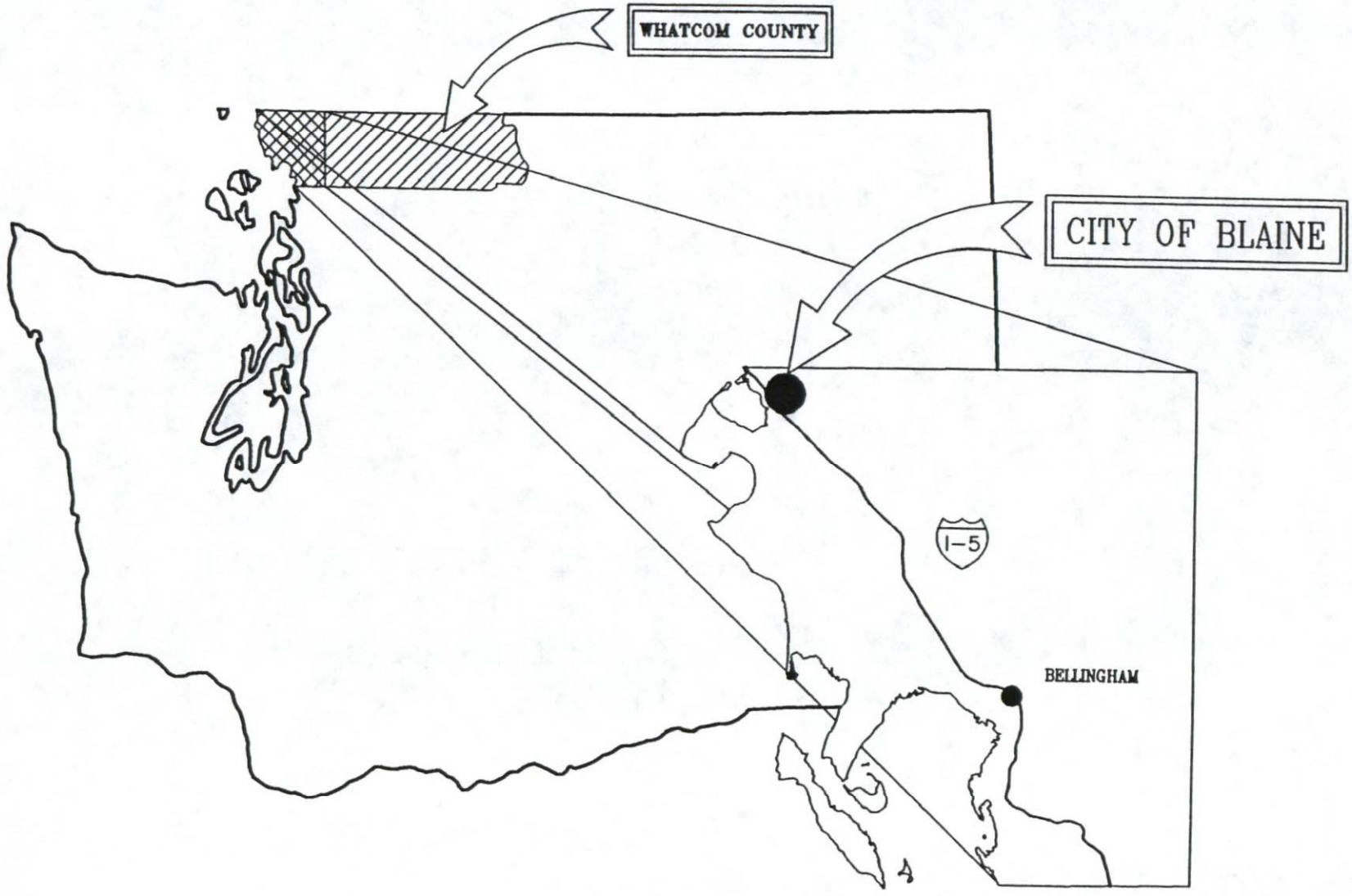
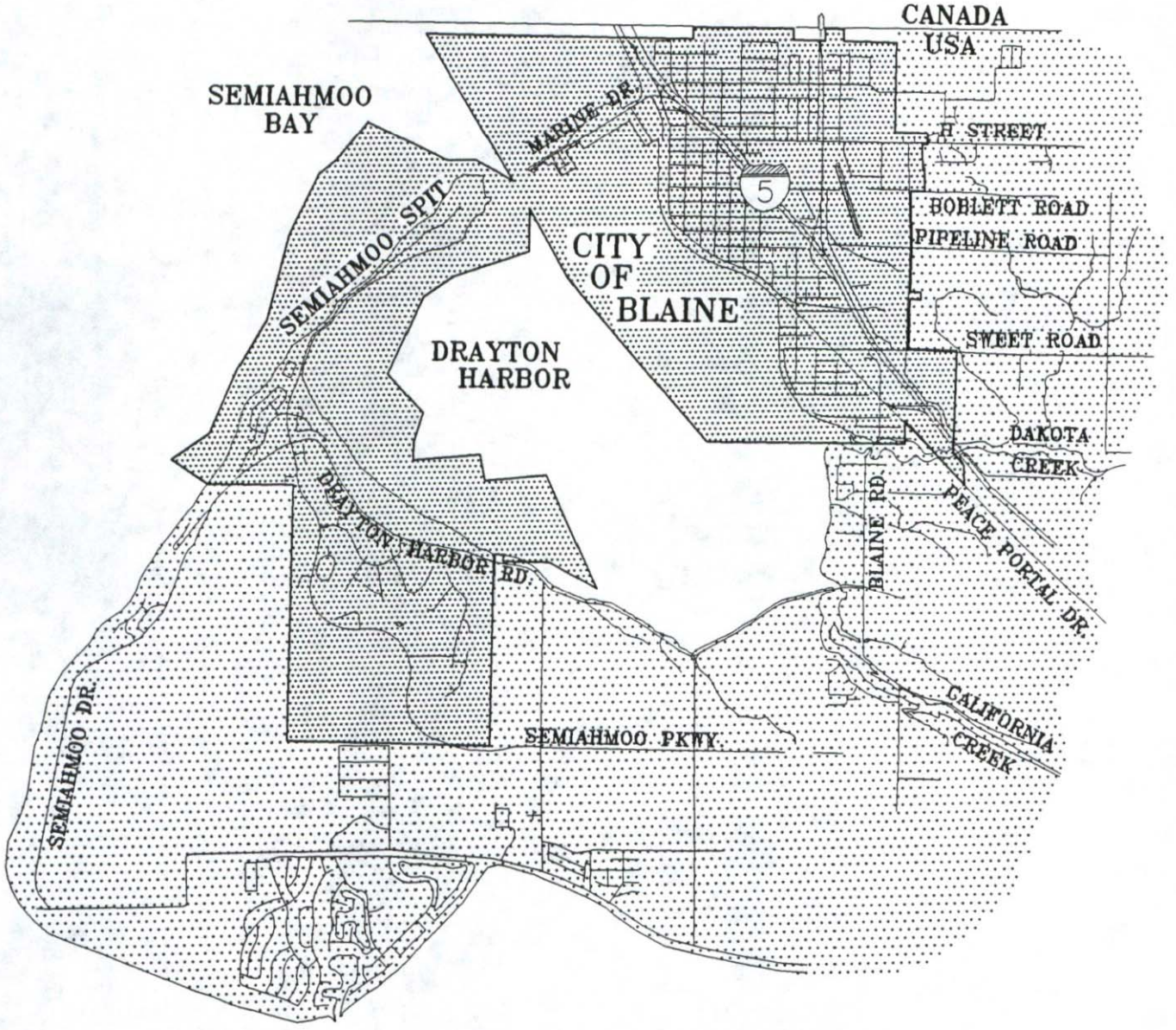


EXHIBIT 2-1 City of Blaine Location Map



Study Area
(incl county land adjacent to city)

EXHIBIT 2-2
Map of the City of Blaine

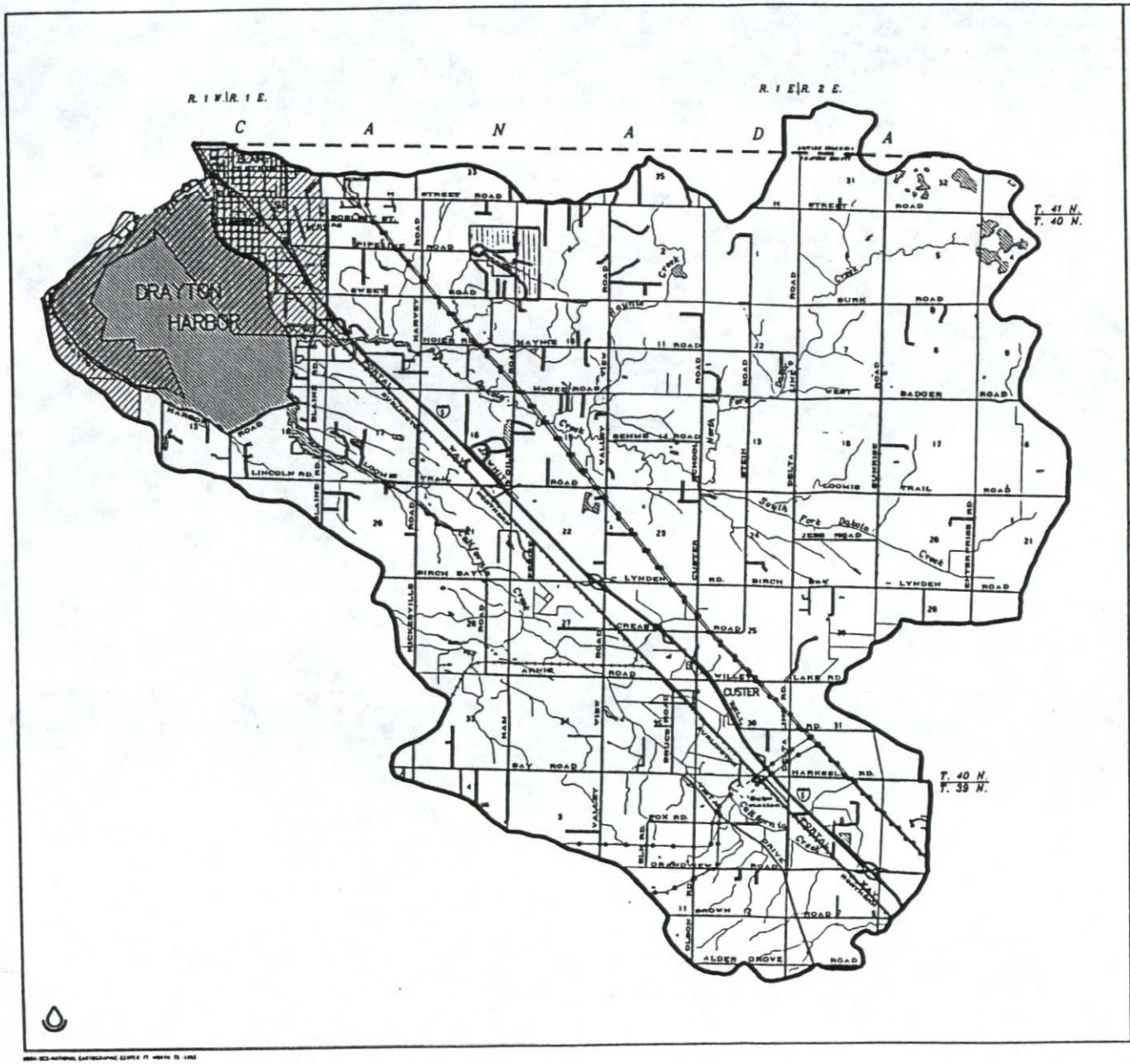


Exhibit 2-4
Map of Drayton Harbor Watershed

WHATCOM COUNTY, WASHINGTON

1991

LEGEND

- Watershed Boundary
- U.S./Canadian Border
- Interstate/State Highway
- Local Improved Roads
- Local Unimproved Roads
- Railroads
- Powerlines
- Major Streams
- Water Bodies
- City of Blaine
- City of Blaine Watershed

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2.5 Land Use

2.5.1 Existing Land Uses

Existing land uses within the City consist of a mix of open space and urban areas. The developed land includes only 13 percent residential, 6 percent commercial, and 10 percent parks and schools, as shown in Table 2-1. The majority of the land within the City, 70 percent, is either vacant (38 percent), public facilities (3 percent), or road right-of-way (29 percent). The unusually high amount of road right-of-way is associated with the extensive transportation network through the center of the City, which includes I-5 and associated truck routes.

Table 2-1
Existing Land Uses within the Blaine City Limits

Existing Land Use	Acres	% of City
Residential	312	13
Commercial	130	6
Manufacturing	20	1
Parks/Open Space*	229	10
Public Facilities	65	3
Roads Utility Rights-of-way	669	29
Vacant	903	38
Total Acres	2,328	100%

* Includes Semiahmoo Golf Course

The industrial, commercial, and residential land users have been classified as urban and are briefly discussed below. Reference has also been made to the two marinas within the study area which are a land use of special interest to this drainage study.

Urban

Several industries are located in the study area including manufacturers of molded computer components (Comptec, Inc.), fish nets (First Washington Net Factory, Inc.), signs and transfer letters (Geographics, Inc.), wire and screen mesh (Justesen Industries, Inc.), ship anchors and marine chains

(Lister Chain & Forge, Inc.), truck scales and aluminum ramps (Mantle Industries, Inc.), stainless and plastic valves (Tanaco Products), a commercial and pleasure boat builder (Fibercraft, Inc.), and four fish processing plants (Source: Fourth Corner Economic Development Group).

Commercial and retail establishments are concentrated primarily in the City's central area and marina, in and adjacent to the northern area of Drayton Harbor. The heavy concentration is the result of the City's proximity to the U.S./Canada border and the significant number of Canadians shopping across the border for groceries, gasoline, and other retail items. There are a number of motels located in Blaine along with a major destination resort (the Resort Semiahmoo). Restaurants and other commercial establishments are located in the area to serve both the local and transient populations.

Of the total 1,633 acres of residentially zoned land within the existing City limits (Blaine Planning Department), 918 acres of this land are located in the Resort Semiahmoo which is likely to develop to an average density of one housing unit per acre. The remaining 715 residential acres are located on the north and east side of Drayton Harbor. Zoning for this area ranges from four to six residential units per acre to 24 units per acre, with a current density of between two and four units per acre.

In addition to the current land use, the City has the potential for increased residential and commercial growth due to current zoning and available, undeveloped land. City staff has calculated that there are approximately 1,763 vacant residential sites within the current City limits available for infilling. The preliminary urban growth boundary proposed by the City indicates a significant increase in the level of urbanization surrounding Drayton Harbor.

Marinas

There are two marinas located in the study area. The Blaine Marina is located near downtown Blaine and is operated by the Port of Bellingham. It has docking facilities for 435 commercial fishing and pleasure boats and also includes four fish and crab processing operations. The Port of Bellingham has plans to expand the marina area to increase moorage by an additional 250-300 sites. The Semiahmoo Marina is located on the north end of the Semiahmoo Spit and is operated by the Semiahmoo Company. There are 300 pleasure boat slips at the Semiahmoo Marina. Both marinas generally operate at 100 percent capacity from March through November. During the winter months, capacity is generally at 80 percent.

2.5.2 Existing Zoning

For the purpose of guiding growth within the City, eleven different categories of land use zoning have been established, as shown in Exhibit 2-5. These eleven categories are summarized below by the three main types of land use, residential, commercial, and manufacturing:

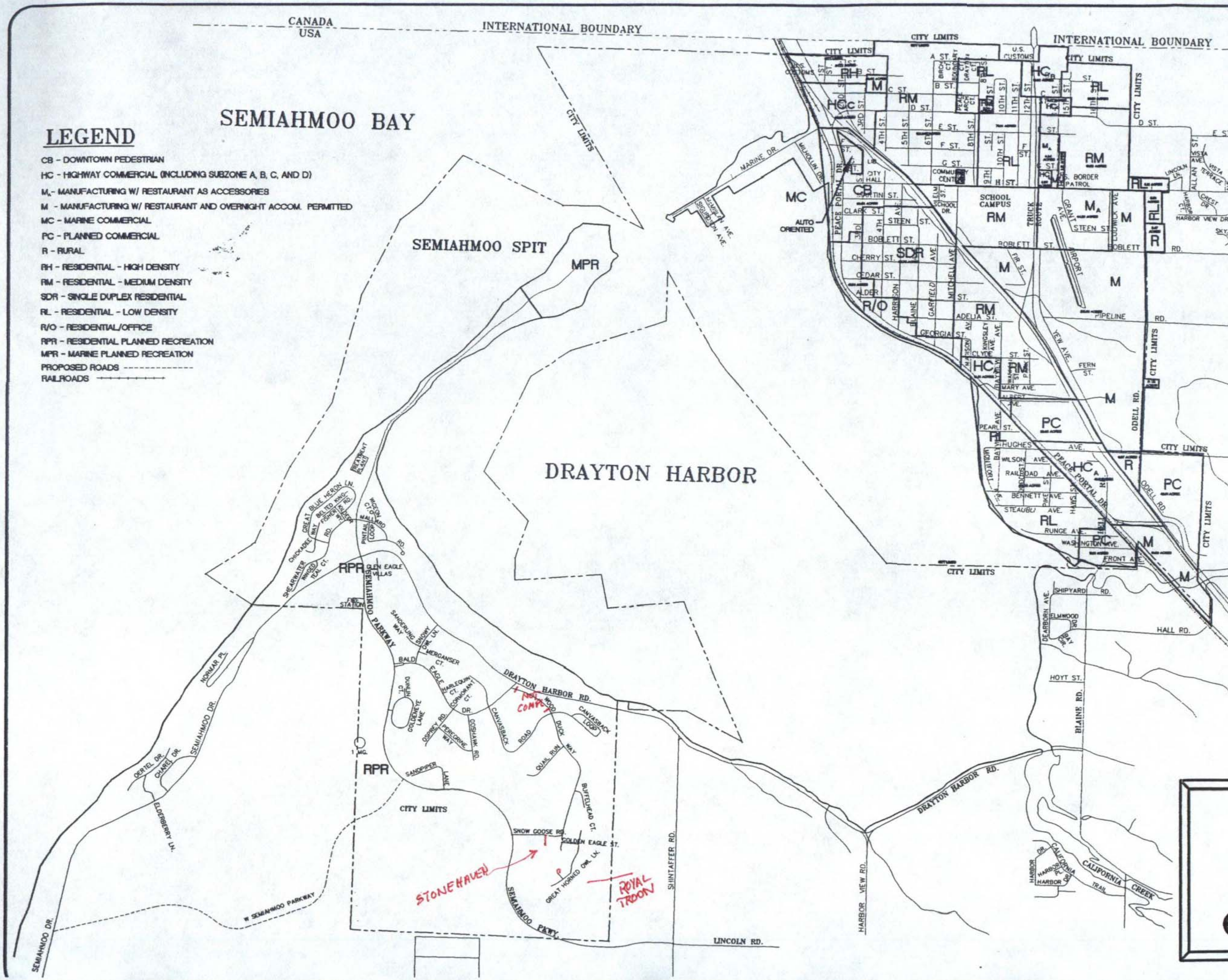
- In the City, there are 1,633 acres zoned for residential use, or 70 percent. Of this land, 1,151 acres are zoned for low density residential use, allowing an average density of up to six units per acres. An additional 420 acres are zoned for medium density residential use, allowing up to twelve units per acre. There are only 62 acres zoned for high density use, including the 42 acres zoned Residential/Office.

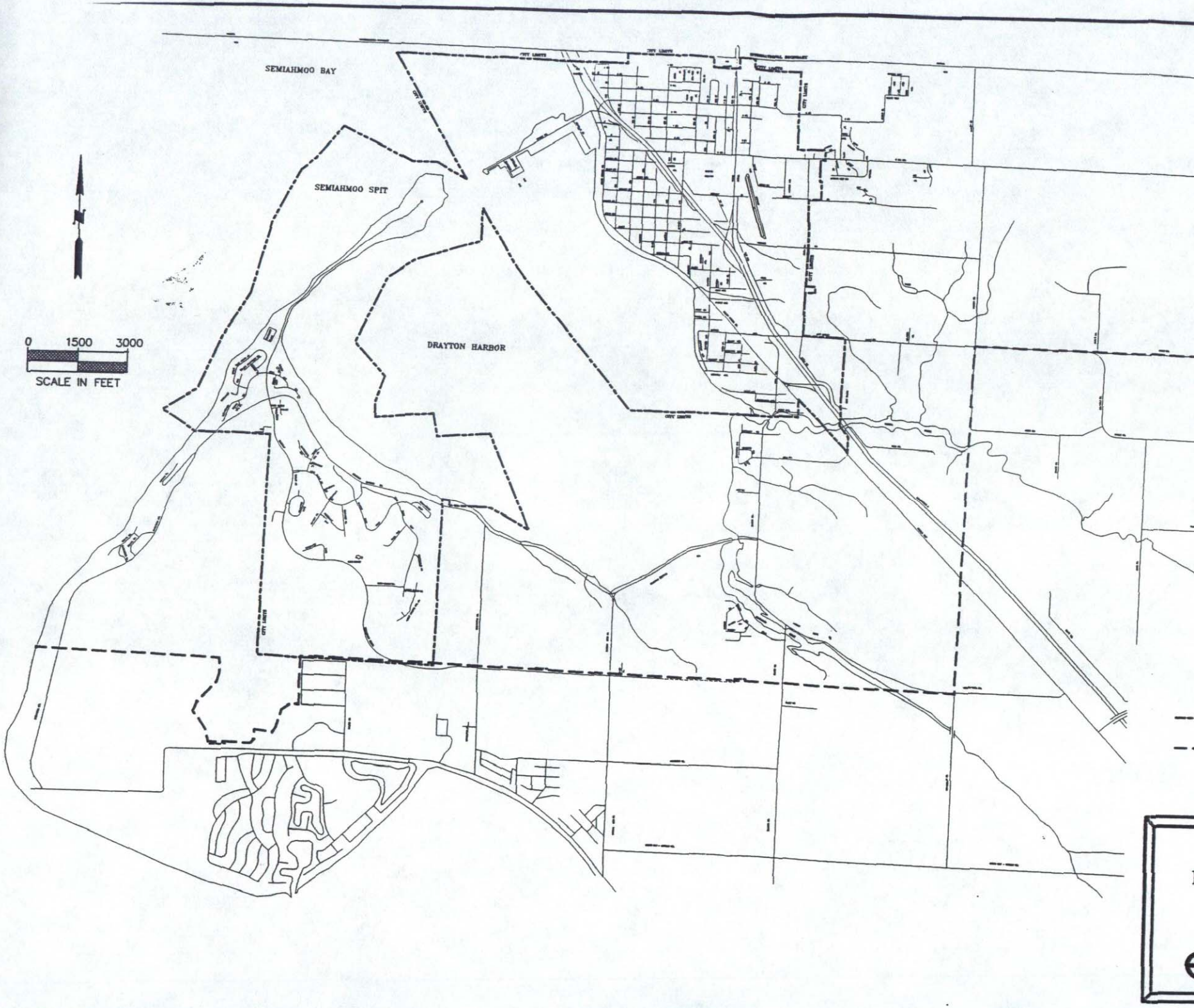
- Commercially zoned land comprises 342 acres, or 14 percent of the land in Blaine. Commercial zoning includes the Central Business zone located along Peace Portal Drive between Boblett and "E" Streets; the Highway Commercial zones along "D" Street, SR543, and Peace Portal Way, the Planned Commercial zone located along Peace Portal Way; Bell Road and Sweet Road; and the Marine Planned Recreation Zone located at the tip of the Semiahmoo Spit.

- The Manufacturing category includes 353 acres, or 15 percent of the land in the City. Included in the manufacturing category is the Marine Commercial zone, which includes approximately 50 acres located along Marine Drive. The rest of the manufacturing zoning is located on the east side of the City along the truck route and the southern edge of Central Blaine along Peace Portal Drive.

2.5.3 Blaine Growth Management Area

The Blaine Comprehensive Plan presents a proposed Urban Growth Area (UGA) that substantially increases the area of the City, as shown in Exhibit 2-6. The UGA shows considerable expansion to the east, particularly the northeast, along the Canadian Border and south just past the City's watershed area. Growth is also expected to move south around Drayton Harbor. A large portion of Birch Point, including the West Resort Semiahmoo, and the area east and north along Lincoln road, including the lower reaches and delta areas of Dakota and California Creeks, would be incorporated into the future City limits. (See City of Blaine 1994 Comprehensive Plan (July/August Draft) for a more detailed description of land use, zoning, and anticipated future development within the City of Blaine and the proposed Blaine Urban Growth Area.)


CANADA
USA
INTERNATIONAL BOUNDARY
SEMIAHMOO BAY
LEGEND
CB - DOWNTOWN PEDESTRIAN
HC - HIGHWAY COMMERCIAL (INCLUDING SUBZONE A, B, C, AND D)
M, - MANUFACTURING W/ RESTAURANT AS ACCESSORIES
M - MANUFACTURING W/ RESTAURANT AND OVERNIGHT ACCOM. PERMITTED
MC - MARINE COMMERCIAL
PC - PLANNED COMMERCIAL
R - RURAL
RH - RESIDENTIAL - HIGH DENSITY
RM - RESIDENTIAL - MEDIUM DENSITY
SDR - SINGLE DUPLEX RESIDENTIAL
RL - RESIDENTIAL - LOW DENSITY
R/O - RESIDENTIAL/OFFICE
RPR - RESIDENTIAL PLANNED RECREATION
MPR - MARINE PLANNED RECREATION
PROPOSED ROADS
RAILROADS
SEMIAHMOO SPIT
MPR
DRAYTON HARBOR
CITY LIMITS
U.S. CUSTOMS
SCHOOL CAMPUS
PEACE PORTAL DR.
MARINE DR.
DRAYTON HARBOR RD.
SEMIAHMOO PARKWAY
SEMIAHMOO DR.
W SEMIAHMOO PARKWAY
LINCOLN RD.
SHINTAFFER RD.
HARBOR VIEW RD.
BLAINE RD.
HALL RD.
HOYT ST.
ODELL RD.
PIPELINE RD.
CALIFORNIA CREEK
NOT COMPLETE
STONEHAVEN
ROYAL TROON


SEMIAHMOO BAY
SEMIAHMOO SPIT
DRAYTON HARBOR
0 1500 3000
SCALE IN FEET

2.5.4 Land Use in Drayton Harbor Watershed

In addition to the drainage and runoff from the City, the water quality of Drayton Harbor is significantly affected by the drainage and discharges from the Dakota and California watersheds, although only a small proportion of these watersheds are currently within the City Limits. These two drainage basins are the primary source of fresh water to Drayton Harbor. Over 90 percent of the fresh water charged into Drayton Harbor comes from these two drainages, while the remaining 10 percent is discharged directly into Drayton Harbor by the City.

The land use map of the Drayton Harbor Watershed is presented in Exhibit 2-7. About 50 percent of the land area has been converted to dairy and various agricultural uses. The remaining 50 percent of the land can be characterized as small stands of second and third growth forest areas and small wood lots. (See the 1993 Drayton Harbor Watershed Action Plan, and the 1992 report by the Puget Sound Cooperative River Basin Team for additional information on the of the Drayton Harbor Watershed).

2.6 Population

Between 1980 and 1990, Whatcom County has experienced a growth rate of about 20 percent, which is equivalent to an annual growth rate of about 2 percent per year. Future growth projections range from 1.5 percent to 2.5 percent annually creating the housing and population projections shown below in Table 2-2.

Table 2-2
Housing and Population Projections
(From 1993 Drayton Harbor Watershed Action Plan)

	Residential Units	Population
Current Conditions - 1990	3,207	8,300
Year 2001 at 1.5%	3,736	9,670
Year 2001 at 2.5%	4,089	10,582

Of the present population of 3,207 living in and around the Drayton Harbor Watershed, 2,975, or 93, percent currently live within the City of Blaine. Since 1990, the City has had a 5 percent per year rate of growth. Assuming population rates grow 2 to 5 percent by 2010, Blaine could have 3,859 to 6,691 residents and 4,260 to 8,539 citizens by the year 2015. (*Source: Blaine 1994 Growth Management Plan*)

2.7 Economy

Much of the recent economic activity and growth in and around the Blaine study area has been due to Canadian residents traveling south for a variety of goods and services which are relatively less expensive in the U.S. This Canadian influence has been apparent throughout northern Washington and has contributed to the

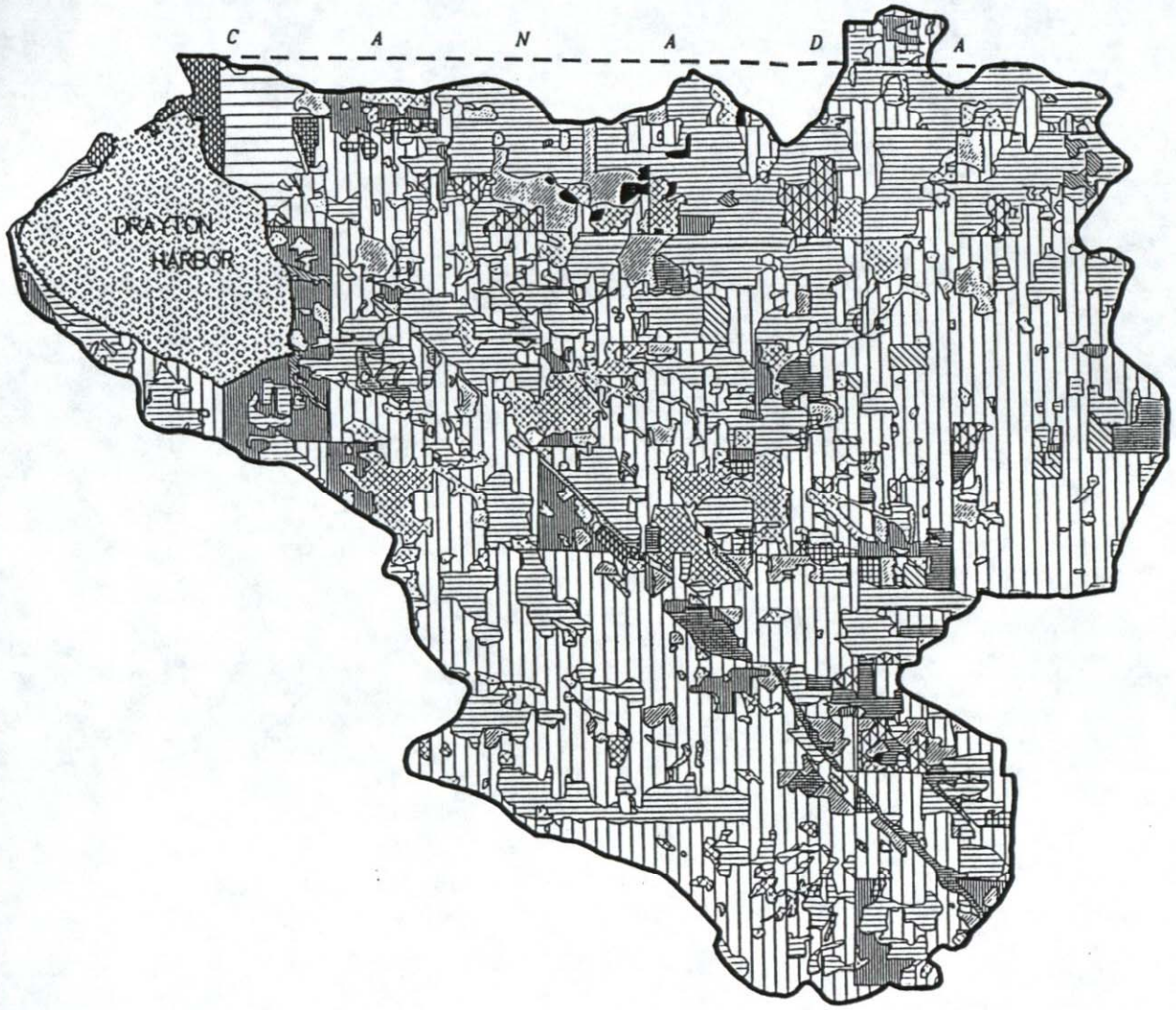


Exhibit 2-7
Generalized Land Use/Cover within the Blaine Study Area and Drayton Harbor Watershed

WHATCOM COUNTY, WASHINGTON

1991

SCALE 1:70,000

LEGEND

RURAL / AGRICULTURE
- High Density Residential*
- Low Density Residential**
- Berries
- Cropland
- Pasture/Hayland
- Grass/Scrub Shrub***

URBAN
- Residential
- Mixed Uses

FORESTLAND
- Conifers
- Hardwoods-Immature
- Hardwoods-Mature

OTHER
- Gravel Pits
- Water Bodies
- Drayton Harbor
- Miscellaneous Uses

Note:
*Less than or equal to 1.5 acres / Housing Unit.
**1.5 acres to 5 acres / Housing Unit.
***Crops and shrub cover grazing not ascertain.

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relatively recent construction of major shopping centers from Mount Vernon to Bellingham. The City also has shown a pronounced response to the Canadian influence, as expanded retail services have occurred throughout the area disproportionate to the needs of the resident population.

Blaine has also become recognized as an attractive and growing retirement and vacation area. The focus of this activity has been the Birch Bay area. The City's contribution to this type of economic development has been through development of the Resort Semiahmoo. Currently, the development on Semiahmoo Spit and the uplands of central Birch Point includes a 196 room resort hotel, a marina, a golf course, and associated residential homes and condominiums.

Tourism became an important part of the City's economy with the construction of the Inn at Semiahmoo, a destination resort located on Semiahmoo Spit. Development of this area has spurred residential growth along with plans for other resort residential projects, such as the Loomis Trail private golf course and planned unit developments, and the planned Cannery Hill proposal, adjacent to the Resort Semiahmoo property. Harbor Lights is another PUD (planned unit development) proposed on the south shore of Drayton Harbor west of California Creek.

Recreational opportunities currently include numerous golf courses. In addition, Semiahmoo Park, which is part of the County park system, provides the public with 6,700 feet of shoreline, a 22-acre dayuse site, and 300 acres of tidelands on the neck of Semiahmoo Spit. There are eight municipal parks within the City which provides picnic and open space areas.

Commercial agriculture provides a major economic base in the unincorporated areas of the Drayton Harbor Watershed. There are 29 commercial dairies which are capable of producing over 120,000,000 pounds of milk a year worth from $12 to $14 million. In addition, there are 54 other large livestock operations including 44 cattle ranches, four dairy replacement operations, one buffalo ranch, a commercial deer farm, and a sheep ranch. There are also seven commercial berry farms. The beef operations alone have the potential to generate $900,000 of gross returns.

Commercial fishing and crabbing fleets are based in the Blaine Marina which is operated by the Port of Bellingham. There is also a commercial oyster farm, operated by Drayton Harbor Oyster, Inc., on 150 acres of leased tideflats in Drayton Harbor. The importance of the commercial shellfish industry to the local economy has the potential to increase significantly if 500 acres of growing area can be reclassified from a prohibited to an approved status. The potential value of this area for commercial production of Pacific Oysters on an annual basis would be over $2 million.

2.8 Transportation

I-5 is the primary north-south interstate highway which interconnects the west coast states of the United States with Canada. It has its northern U.S. terminus within the City and traverses the center of the City. Within the City limits, there are three interchanges for Blaine access. The local reaches of this major freeway system greatly enhance surface transportation opportunities for businesses and industries in the Blaine area (See Exhibits 2-2 and 2-4).

The City is within 30 minutes of the major airports of Vancouver and Bellingham. In addition, Blaine also offers a municipal airport for small aircraft. The major north-south rail line from Seattle to Vancouver, B.C. passes through the area along the eastern shore of Drayton Harbor. The rail line parallels the I-5 highway and passes through the central district of the City. The track section is owned by Burlington Northern Railroad, and will likely see more traffic as the area and City continue to grow.

2.9 Climate

The area's climate is characterized by rainy winters and relatively cool, dry summers, and is similar to most areas along the northwestern Washington coast.

The area is predominantely maritime and experiences a small range of temperature extremes. This mild climate reflects the influence of winds from Puget Sound and the Pacific Ocean. The uplift of air masses moving from these large bodies of water produces rainfall which averages about 40 inches per year. The City receives 80 percent of its annual precipitation as rainfall between October and mid-June. Snowfall can occur in minor amounts in December, January, and February.

There are seven precipitation stations within a twenty mile radius of Blaine. The stations include: Blaine, Clearbrook, two near Bellingham in Whatcom County, and Langley and two near White Rock in British Columbia. Table 2-3 shows the precipitation statistics for the above stations. The mean annual precipitation for Blaine is 40.34 inches per year. There is some variation in precipitation between the individual stations, ranging from 35 inches per year at Bellingham to 57 inches per year at Langley. Precipitation increases eastward and northward as the Cascades and Coastal Mountains of British Columbia are approached. (Additional monthly precipitation data for 1989, 1990, and 1991 is presented in Technical Appendix A.)

The average annual temperature is 49.2 degrees Fahrenheit. The mean maximum temperature is 75.8 degrees Fahrenheit during late July and August. In January, the mean minimum temperature is 29.5 degrees. Although average temperatures indicate a very mild climate, severe winter weather can occur at any time during the winter season when the prevailing wind changes from southwesterly to

Table 2-3
Precipitation Data (in) for the Blaine Area

Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Blaine[1]	Total monthly													
(49d Om N 122d 45m W)	mean	5.54	4.20	3.39	2.51	1.98	1.81	1.16	1.55	2.34	3.97	5.57	6.32	40.34
	max	11.69	9.38	6.52	5.01	3.73	4.44	3.33	5.07	5.30	11.36	10.00	10.01	
Bellingham FAA Airport [2]	Total monthly													
(48d 48m N 122d 32m W)	mean	4.79	3.51	2.97	2.43	2.01	1.71	1.11	1.41	2.05	3.49	4.64	5.14	35.26
	max	10.58	7.59	5.37	4.56	4.81	4.78	2.75	4.77	4.71	7.93	8.73	9.99	
Bellingham 2 N[3]	Total monthly													
(48d 47m N 122d 29m W)	mean	4.69	3.49	2.97	2.58	2.08	1.74	1.15	1.45	2.18	3.47	4.61	5.05	35.46
Clearbrook[4]	Total monthly													
(48d 58m N 122d 20m W)	mean	5.57	4.65	3.96	3.39	2.85	2.32	1.50	2.07	3.23	4.68	5.83	6.47	46.52
White Rock, B.C.[5]*	Total monthly													
(49d 2m N 122d 50m W)	mean	6.10	4.30	3.70	2.60	2.20	1.90	1.20	1.80	2.50	4.40	5.80	6.70	43.20
	std	2.40	1.80	1.60	1.00	0.70	1.10	0.90	1.30	1.50	2.30	2.60	2.00	
White Rock, B.C.[6]**	Total monthly													
(49d 1m N 122d 46m W)	mean	5.80	4.20	3.60	2.40	2.00	1.80	1.20	1.80	2.60	4.20	5.70	6.30	41.60
	std	2.20	2.00	1.70	1.30	0.70	1.10	1.70	1.40	2.70	2.00	2.00	6.40	
Langley, B.C.[7]***	Total monthly													
(49d 3m N 122d 35m W)	mean	7.50	6.20	5.30	3.90	2.80	2.20	1.60	2.20	3.40	5.40	7.50	9.10	57.10
	std	3.00	2.90	2.20	1.30	0.90	1.20	1.40	1.60	2.20	2.80	2.20	2.90	

Note: Based on U.S. data from 1951 to 1980, from "Climate Normals for the U.S. (Base: 1951 - 80)", National Climatic Center, and Canadian data supplied by Environment Canada.

* 40 to 42 years of data
** 6 to 7 years of data
*** 22 to 24 years of data

Station Elevation:
[1] 60 ft
[2] 149 ft
[3] 140 ft
[4] 64 ft
[5] 200 ft
[6] 49 ft
[7] 331 ft

northeasterly. The entire climate changes from mild, maritime to brisk, cold continental weather. Temperature values for the region are shown in Table 2-4.

2.10 Topography

The City and its surrounding area can be characterized as gentle rolling terrain. The topography of the eastern portion of the City rises to only about 175 feet above sea level and gently slopes northeast toward Drayton Harbor. The western portion of the City rises to about 268 feet mean sea level (MSL) in height on the north portion of Birch Point, dropping down rapidly to include the Semiahmoo Spit, located just a few feet above sea level at the entrance to Drayton Harbor. Topography of the study area is shown in Exhibit 2-8.

2.11 Geology

The Blaine area has been shaped by the advance and retreat of many glacial systems. About 12,000 years ago, the Fraser Glaciation advanced at least three separate times over the area. Glacial outwash deposits, along with intervening marine deposits from periodic inland advances of the sea and substantial weathering and erosion, over the years have formed the present soils and geological features of the area.

Generally, the Drayton Harbor Watershed, including the area of Blaine in the most northwest corner of the Watershed, contains the following seven major geologic units, as shown in Exhibit 2-9.

- Alluvial Deposits (Qa)—Silt, sand and mud deposited by streams (includes the Semiahmoo Spit).
- Bellingham Drift (Qb)—Unsorted, pebbly marine silts and clays of low permeability.
- Sumas Outwash Sand and Gravel (Qc)—Fine stratified deposits from melting ice with clay, weakly cemented.
- Sumas Silt and Clay (Qsc)—Poorly stratified deposits of finer silts and clays, of low permeability.
- Peat (Qp)—Partially decomposed organics which have accumulated in wetland depressions.
- Sand and Gravel Overlying Bellingham Drift (Qbg)—Sands and gravels deposited over the Bellingham Drift (Birch Bay Upland Area).
- Terrace Deposits (Qt)—Well sorted sands and gravels deposited by ancient streams and seas.

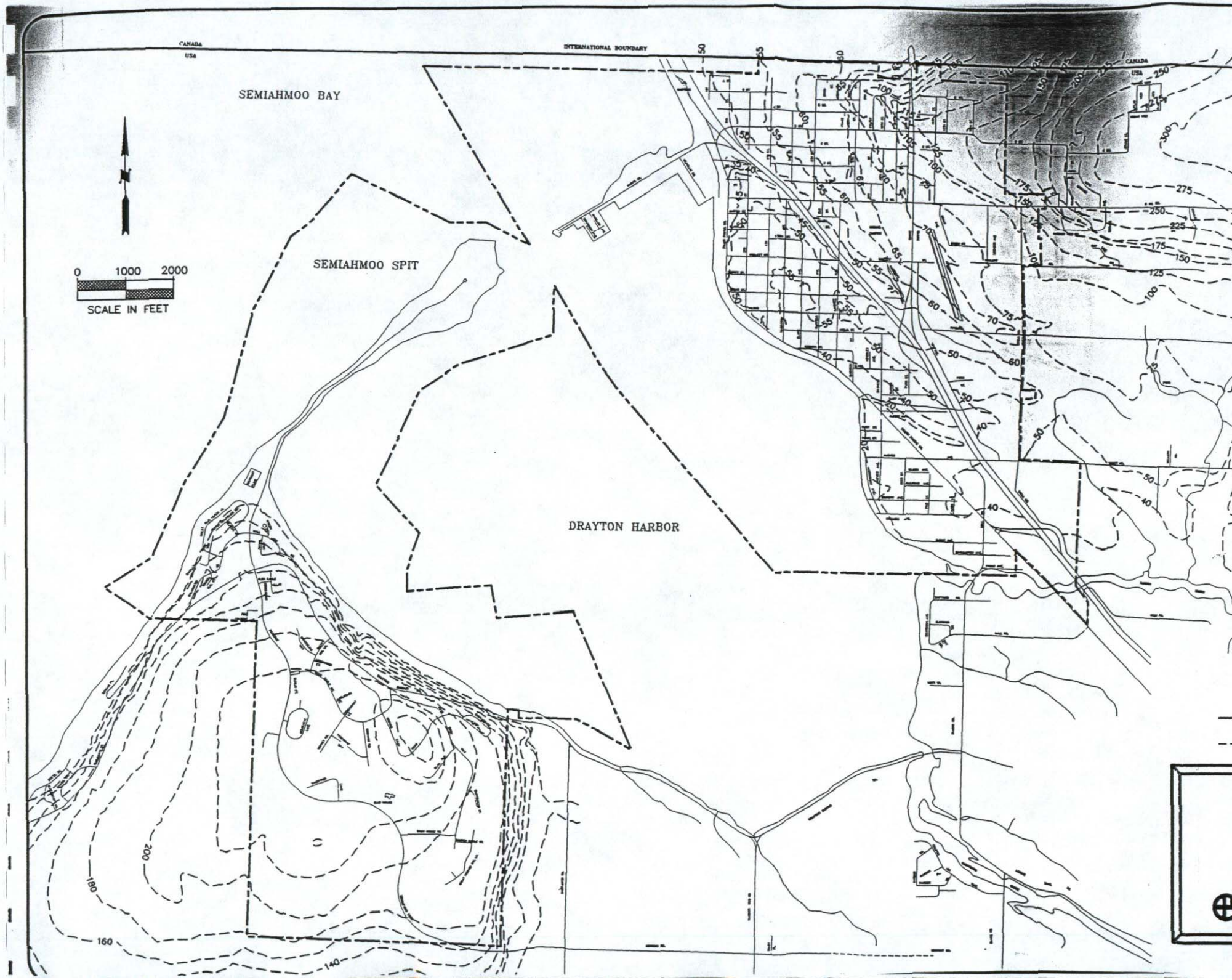
Table 2-4
Temperature Data (deg F) for the Blaine Area

Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Blaine[1]	max	41.7	47.3	50.6	56.7	63.4	67.9	72.6	72.1	67.0	58.1	49.1	44.1	57.6
(49d Om N 122d 45m W)	min	30.7	33.8	34.7	38.5	43.7	48.8	50.7	50.8	47.1	41.7	36.1	33.4	40.8
	mean	36.2	40.6	42.7	47.6	53.6	58.4	61.7	61.5	57.1	49.9	42.6	38.8	49.2
1989	mean	37.6	31.4	42.1	50.2	54.1	60.7	62.1	61.0	56.9	49.6	43.8	39.4	49.1
1990	mean	39.7	36.1	43.4	50.3	54.5	58.7	64.2	63.4	58.4	49.1	43.6	32.2	49.6
1991	mean	33.8	44.4	41.2	47.2	53.6	57.3	62.4	62.7	56.9	46.7	44.0	N/A	N/A
Bellingham FAA Airport[2]	max	42.3	47.5	50.1	56.0	62.4	66.7	71.5	71.1	66.9	58.6	49.8	44.8	57.3
(48d 48m N 122d 32m W)	min	30.9	34.0	35.1	39.1	44.6	50.0	52.6	52.7	47.9	41.8	36.3	33.5	41.5
	mean	36.6	40.8	42.6	47.6	53.5	58.4	62.1	61.9	57.4	50.2	43.1	39.2	49.5
Bellingham 2N[3]	max	43.4	48.9	51.5	57.8	64.8	69.0	74.2	73.4	69.3	61.2	50.7	45.8	59.1
(48d 47m N 122d W)	min	30.6	33.5	34.2	37.7	42.7	48.1	50.1	50.0	46.1	40.8	35.8	33.2	40.2
	mean	37.0	41.2	42.9	47.7	53.8	58.6	62.2	61.7	57.7	50.5	43.2	39.6	49.7
Clearbrook[4]	max	40.5	46.9	51.0	58.2	65.1	69.4	75.4	74.4	69.2	59.2	48.9	43.4	58.5
(48d 59mN 122d 20m W)	min	29.3	33.3	34.2	37.6	42.9	47.7	49.5	48.9	45.8	40.6	35.1	32.1	39.8
	mean	34.9	40.1	42.7	47.9	54.0	58.6	62.4	61.7	57.5	49.9	42.1	37.8	49.1
Whiterock, B.C.[5]*	max	41.5	46.2	48.7	54.9	60.8	64.3	69.3	68.7	64.6	56.8	48.6	44.4	55.8
(49d 2m N 122d 50m W)	min	31.8	34.3	35.1	39.7	44.8	49.8	52.5	52.7	48.9	43.3	37.2	34.7	42.1
	mean	36.9	40.3	41.9	47.1	52.9	57.2	61.0	60.6	56.7	50.0	42.8	39.4	48.9
Whiterock, B.C.[6]**	max	42.3	47.3	49.6	55.4	62.1	65.8	70.7	69.8	65.8	57.0	49.1	44.6	55.7
(49d 1m N 122d 46m W)	min	32.7	35.8	36.9	41.7	46.6	51.6	54.1	54.1	50.4	44.2	38.8	35.8	43.5
	mean	37.8	41.9	43.5	48.6	54.3	58.8	62.1	61.7	57.9	50.9	44.2	40.1	50.2
Langley, B.C.[7]***	max	40.5	46.2	50.0	55.8	62.8	67.6	73.4	73.0	67.5	58.1	47.5	42.8	57.0
	min	30.7	34.7	35.2	38.8	43.9	48.7	51.4	51.6	48.2	42.6	36.5	33.4	41.4
	mean	35.6	40.5	42.6	47.3	53.4	58.3	62.4	62.4	57.9	50.4	42.1	38.1	49.3

Note: Based on U.S. data from 1951 to 1980, from "Climate Normals for the U.S. (Base: 1951 - 80), National Climatic Center, and Canadian data supplied by Environment Canada.

* 40 to 42 years of data
** 6 to 7 years of data
*** 22 to 24 years of data

Station Elevation:
[1] 60 ft
[2] 149 ft
[3] 140 ft
[4] 64 ft
[5] 200 ft
[6] 49 ft
[7] 331 ft


CANADA
USA
INTERNATIONAL BOUNDARY
SEMIAHMOO BAY
SEMIAHMOO SPIT
DRAYTON HARBOR
0 1000 2000
SCALE IN FEET

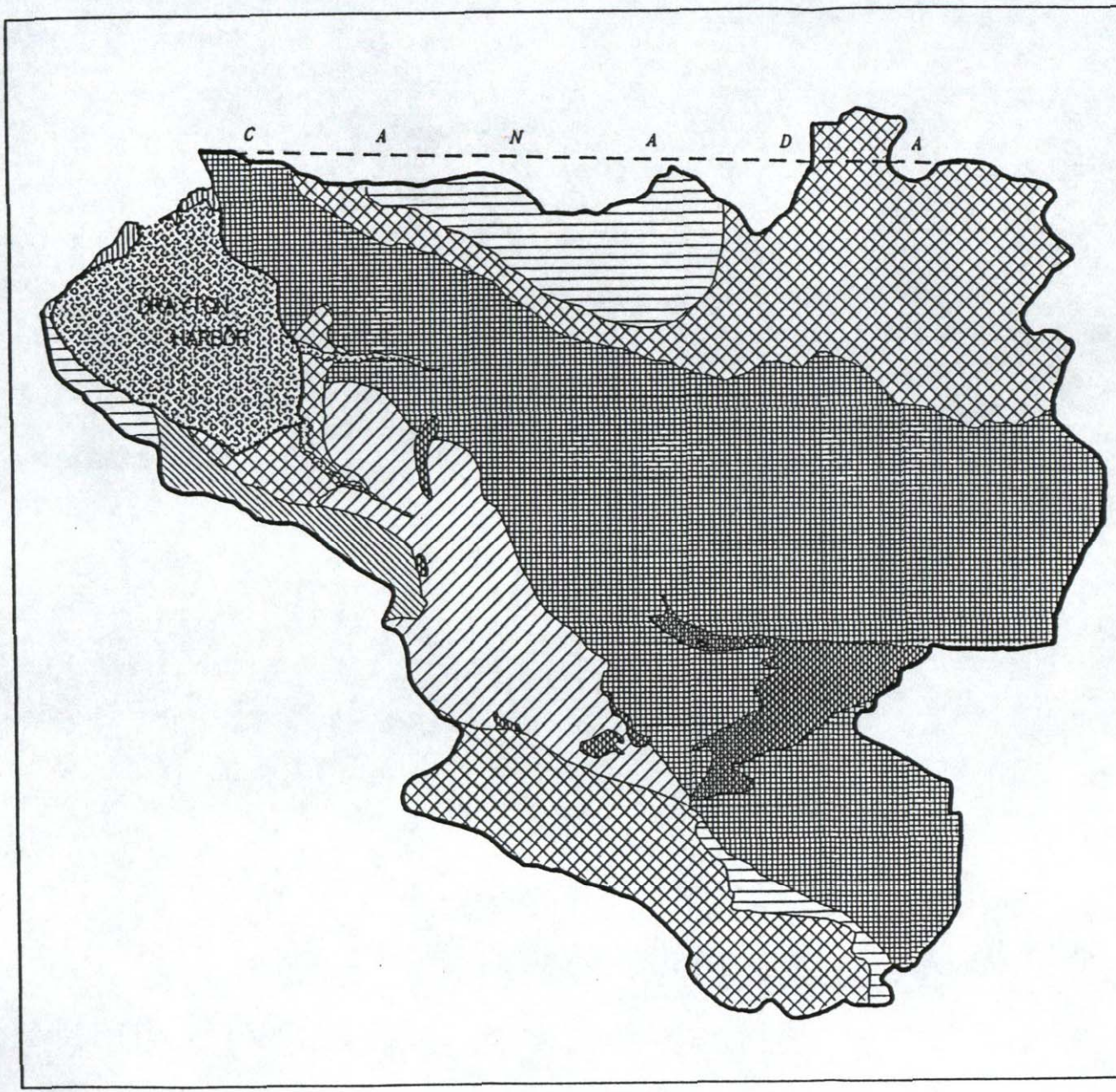


Exhibit 2-9
Primary Geologic Units within the Drayton Harbor Watershed

WHATCOM COUNTY, WASHINGTON

1991

SCALE 1:70,000

N

LEGEND

- Qal -Alluvial Deposits
- Qb -Bellingham Drift
- Qbg -Sand and Gravel Overlying Bellingham Drift
- Qp -Peat
- Qsc -Sumas Silt and Clay
- Qso - Sumas Outwash Sand and Gravel
- Qt -Terrace Deposits
- Water Bodies

USDA PUGET SOUND COOPERATIVE RIVER BASIN TEAM

2.12 Soils

There are over 55 different soils in the Drayton Harbor Watershed. These have been grouped into five major classifications, as shown in Exhibit 2-10. Of these five classifications, only three of these are located within the study area.

- Soils on Tidelands,
- Soils on Lacustrine Terraces, and
- Soils on Outwash Terraces.

Each of these general soil types is briefly discussed below, and to a large extent these determine the surface and groundwater drainage within the study area.

2.12.1 Soils on Tidelands

This soil unit covers 2 percent (680 acres) of the Drayton Harbor Watershed. It encompasses much of the tideland in Drayton Harbor and the coastal areas of the City. These soils are very deep and very poorly drained. A surface layer consists of six inches of sandy loam, lying on top of at least 60 inches of silt loam. Permeability is moderate, but it is limited by a water table that is at or above the surface during periods of high tides. These soils have a high potential for contributing to surface water pollution due to tidal action, low permeability, a high water table, and their close proximity to the bay.

2.12.2 Soils on Lacustrine Terraces

This map unit covers 14 percent (4,820 acres) of the Drayton Harbor Watershed. It consists of about 69 percent Skipopa-Blaingate soils. These soils occur on glaciolacustrine or estarine terraces. The slopes range from nearly level to moderate slopes.

These soil units are very deep and range from poorly to somewhat poorly drained. The surface layer is silt loam or silty clay about 8 or 9 inches thick. The subsoils are clay or silty clay. Permeability is very low. A seasonal high water table exists at the surface or to a depth of 1 or 2 feet from November to April. Surface runoff flows directly to area streams, ditches, and wetlands. Runoff may be ponded during winter months.

The main limitations of these soils for water quality purposes are a seasonally high water table and very slow permeability. Overall, these soils would rate as having a high potential for contributing to surface water pollution and would be only nominal for containing groundwater. Runoff is slow and there is no hazard of erosion.

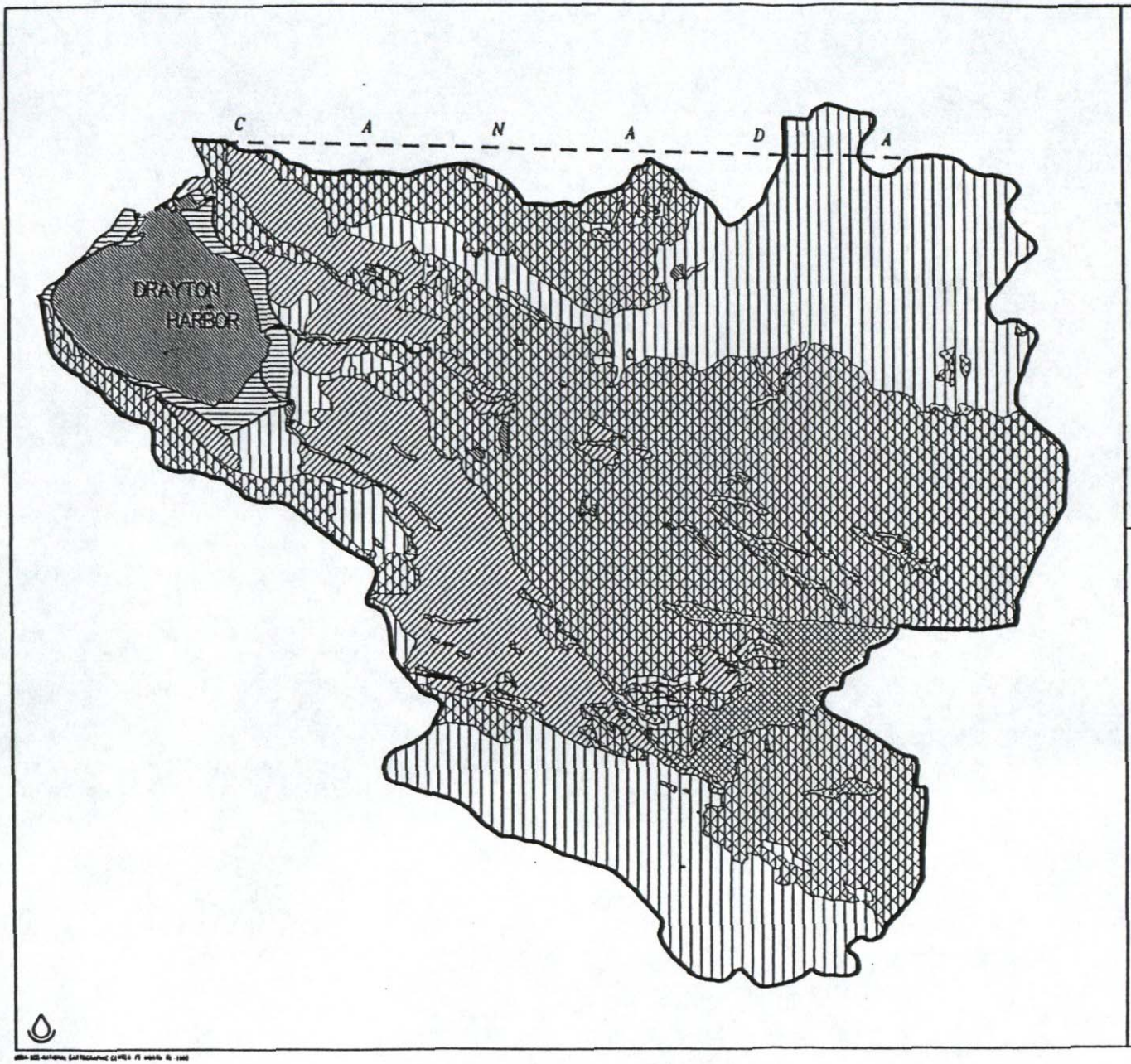


Exhibit 2-10
General Soils Maps of the City of Blaine and Drayton Harbor Watershed

WHATCOM COUNTY, WASHINGTON

1991

SCALE 1:70,000

LEGEND

- Soils on Outwash Terraces
- Soils on Marine Drift Plains
- Soils on Tidelands
- Organic Soils
- Soils on Lacustrine Terraces
- Water Bodies

Note: This map is meant for general planning purposes rather than decisions on the use of specific tracts of land.

USDA PUGET SOUND COOPERATIVE RIVER BASIN TEAM

2.12.3 Soils on Outwash Terraces

This soils unit covers 49 percent (17,340 acres) of the Drayton Harbor Watershed. It consists of about 36 percent Edmonds-Woodlyn soils, 19 percent Tromp soils, 10 percent Everett soils, 9 percent Lynden soils, and 6 percent Laxton soils. The remaining 20 percent consists of several soils of minor extent including Everson, Hale, Kickerville, Lynnwood, Pilchuck, Puyallup, Sehome, Squalicum, and Yelm soils. These soils occur on nearly level to steep landscapes.

The soils in this map unit range in depth from shallow to very deep and from moderately well drained to poorly drained. The surface layer is loam about 11 inches thick with moderate permeability. The subsoil is a discontinuous, sandy loam with some areas having a dense glacial till below 60 inches of soil depth. Permeability is rapid through the subsoil unless it encounters the till layer. These soils experience a seasonal high water table at a depth of 1 to 2.5 feet from November to April. Surface water runoff and lateral groundwater flow discharge to creeks and lowland wetland areas. The regional water table for most of this soil unit lies from near the surface to 50 feet below the surface.

The main limitations of these soils for water quality purposes are seasonally, high water tables and poor infiltration of the substratum. Overall these soils would rate as having a moderate to high potential for contributing to both surface and groundwater pollution because of the intermingling of groundwater with surface waters. Many domestic wells within this area are shallow and could be affected by poor water quality. Runoff is slow and there is no hazard of erosion.

2.12.4 Mapping of Soils within the City Limits

To gain a better understanding of the soils with the City limits, soils information was mapped from the 1992 SCS Soils Survey for Whatcom County. The resulting map is presented in Exhibit 2-11. Of the twelve soils classifications present within the City limits, over 80 percent of the area is characterized by five types of soils, No. 15, 16, 75, 149, and 192, as summarized in Table 2-5.

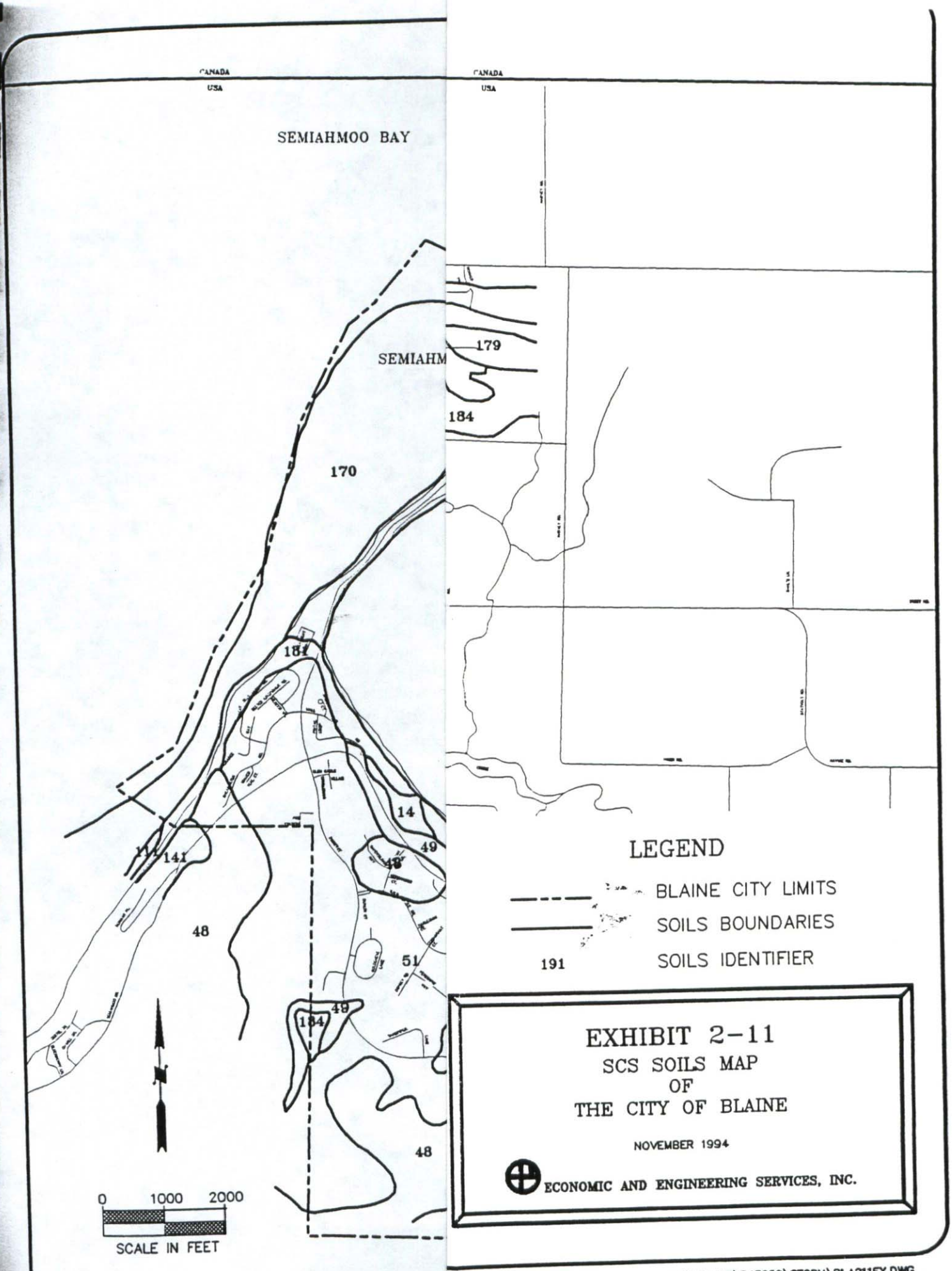


EXHIBIT 2-11

SCS SOILS MAP OF THE CITY OF BLAINE

NOVEMBER 1994

ECONOMIC AND ENGINEERING SERVICES, INC.

M:\BLAINE\P43650\STORM\BLA211EX.DWG

Table 2-5
Predominant Soil Classifications within the City of Blaine
(May 1992 Edition of Soil Survey of Whatcom County Area, Washington, USDA, Soil Conservation Service)

SCS Soil Type	Description of Soil Type
15	Blainegate silty clay on 0-1% slope deep, poorly drained marine deposit providing in winter Nov-June water table near surface, little erosion.
16	Blainegate - Urban land complex, 0-1 percent slope Blainegate (50%) and Urban (30%) intermixed, poorly drained marine deposit, slow permeability, urban land areas are generally impervious, similar to Blainegate soils.
75	Hydraquents, tidal, 0-1% slope, very deep, poorly drained soils on tidal flats sandy clay loam of 10-25% clay, moderate permeability.
149	S'Kipopa (50%) Blainegate (35%) complex, 0-8% slope deep, poorly drained, 50% silt loam with 35% silt clay, slow permeability, high water table, slow runoff little erosion.
192	Yelm - Urban land complex, 0-3% slope, 50% Yelm loam, 30% urban land, Yelm is deep and moderately well drained, moderately rapid permeability, high seasonal water table, slow runoff, little erosion.

From a drainage management perspective; the critical features that are common to many of these dominant soil types are:

- Deep, poorly drained (No. 192 is moderately draining),
- High seasonal groundwater table,
- Ponding in winter,
- Low permeability,
- Slow runoff, and
- Little erosion.

These soils would not be prone to erosion, but they also would not be effective for the infiltration of drainage, recharging of aquifers, or location of septic tanks or large structures or developments.

2.13 Groundwater

The hydrogeology of the study area is complex as a result of the continually changing geologic processes that were responsible for the deposition and reworking of the local sediments. In general, the outwash sands and gravels and deltaic sands represent excellent aquifers, but appear to have limited extent. The glaciomarine drift, lacustrine clays, and other similar relatively low-permeability deposits have a limited potential for groundwater supply purposes. Minor sand and gravely zones within the lower-permeability sediments may provide amounts of groundwater sufficient for individual domestic supplies or small community sources.

2.13.1 Blaine Hydrogeolgoic Units

In the 1992 Final Hydrogeologic Report, by Golder Associates, Inc., six different hydrogeologic units were identified within the City, as summarized in Table 2-6 and briefly discussed below. Of the six aquifer units, the deeper Unit D has the greatest potential to provide a significant source of water. Some domestic City wells presently exist within Unit C (most of the City's wells are located in Units C and D).

Unit A/B

Unit A/B includes two separate hydrostratigraphic units (A and B) within the City that include clay, peat, stony clay, and silty clays as well as sandy silts, and silty sands with marine shells. The units are similar, with the proportion of clay being about 10 to 50 percent. Silt content is 35 to 75 percent, and sand is from 5 to 60 percent. Unit A is differentiated from Unit B based on the number of shells. Only minor quantities of groundwater are available within the more permeable zones of Units A and B. The units as a whole are regarded as an aquitard with limited groundwater potential.

Unit C

Unit C consists mainly of glacio-fluvial sand and gravel deposited by streams. Where these streams entered the sea, large deltas formed, which have been elevated above present sea level. This unit forms confined and unconfined aquifers capable of yielding moderate to large quantities of water.

Unit D

Unit D includes tills together with sands and gravels deposited by a variety of glacial processes. Unit D is differentiated from Unit C by its association with sediments which appear to be glacial till, or other closely related glacial deposits. This unit has predominantly glacial outwash sediments in relation to the low permeability till-like materials. Consequently, the unit as a whole constitutes an aquifer which is one of the most productive in the area.

Unit E

Unit E is comprised of marine sediments interbedded with estuarine and fluvial deposits consisting of fine sand, silt, and clay-silts. This unit is the result of sediments deposited during the pre-Vashon times. Groundwater supply potential from this unit is low, and water quality is often poor (sodium chloride type with high levels of dissolved solids).

Table 2-6
Primary Hydrogeologic Units within the Blaine Study Area and the Drayton Harbor Watershed

U.S. Geologic Units*	Canadian Geologic Units**	Hydrostratigraphic Units***	General Geologic Description	Potential Groundwater Yields
Qal Alluvial Deposits Qp Peat Qt Terrace Deposits	Fraser River and Salish sediments	A/B [3]	Mainly fluvial and floodplain deposits consisting of silt, sand, gravel, and peat.	Limited quantities available as shallow unconfined aquifers.
Qs Till and Ice-contact Deposits Qsc Silt and Clay Qso Outwash Sand and Gravel	Sumas drift	C	Mainly till, glaciofluvial, and ice-contact deposits consisting of poorly sorted gravel in matrix of sand, silt, or clay; sand and gravel; and silt and clay.	Moderate quantities available in shallow-unconfined, and possibly semi-confined aquifers.
Qb Bellingham Drift [1] Qk Kulshan Drift	Fort Langley formation and Capilano sediments	A/B & C	Mainly glaciomarine deposits consisting of clay, stony clay, silty clay and sandy silts, silty sands sands, and marine shells.	Moderate quantities available in layers of sands and gravels (Hydrostratigraphic Unit C), limited quantities available in localized permeable zones.
Qvt Vashon Till	Vashon drift	D	Mainly till and ice-contact deposits consisting of poorly sorted gravel in a matrix of silt, clay, and sand.	Minor quantities available in localized permeable zones.
Qve Esperance Sand [2]	Quadra sand	C	Glaciofluvial deposits consisting of crossbedded sand and gravel.	Moderate quantities available in permeable zones.

Note:

* After Easterbrook, 1976

** After Armstrong, 1981

*** After Halstead, 1986

[1] Includes reworked sands and gravels of the Bellingham Drift.

[2] Member of Vashon Till (Qvt)

[3] These sediments are included in Hydrostratigraphic Unit A/B because they are generally thin and discontinuous in nature

Unit F

Unit F is consolidated bedrock. Little information is available on the potential yield from this unit, but it is expected to be low. Water quality is expected to be poor due to the weathering of the formation.

These hydrogeologic units are graphically displayed in Exhibits 2-12 and 2-13. The geologic cross-section A-A', shown in Exhibit 2-12, is representative of the area underlying the Blaine Watershed.

2.13.2 Groundwater Flow and Recharge

Groundwater flow occurs from the upland areas within the Drayton Harbor Watershed to the lower points of the watershed's surface water drainage system, as shown in Exhibit 2-14. In the study area, groundwater flows are primarily toward Drayton Harbor, generally following the contours of the land.

It appears that a portion of the precipitation falling on the Boundary Upland area, located just east of the City, seeps into the underlying soil and percolates downward to recharge Unit C and perhaps Unit D. Some discharge occurs as springs at the base of this upland area in the eastern areas of the City. The major area of recharge, however, occurs immediately north and east of the Blaine Watershed east of the City limits, as shown in Exhibit 2-15. The horizontal direction of groundwater flow within the deeper confined aquifers (Units C and D) is uncertain due to the lack of deep wells, but is likely directed toward the south and west toward Drayton Harbor where it may eventually discharge.

2.13.3 Groundwater Contamination and Supply

Groundwater is an important resource in the Drayton Harbor Watershed. It is the primary source of domestic water for the area's residents. Of the people residing within the Drayton Harbor Watershed, 98 percent of them use groundwater as their primary water supply. The City provides water to 98 percent of those residents that are supplied by public water systems.

The presence of unconfined aquifers, their seasonally high water table, and their recharge being from overlying land surfaces, make the groundwater in much of the watershed vulnerable to contamination, as shown in Exhibit 2-16. The watershed from which the City draws its drinking water will be able to meet the City's future needs. The City is currently involved in a Groundwater Management Area study to identify future sources of water and to develop a wellhead protection program.

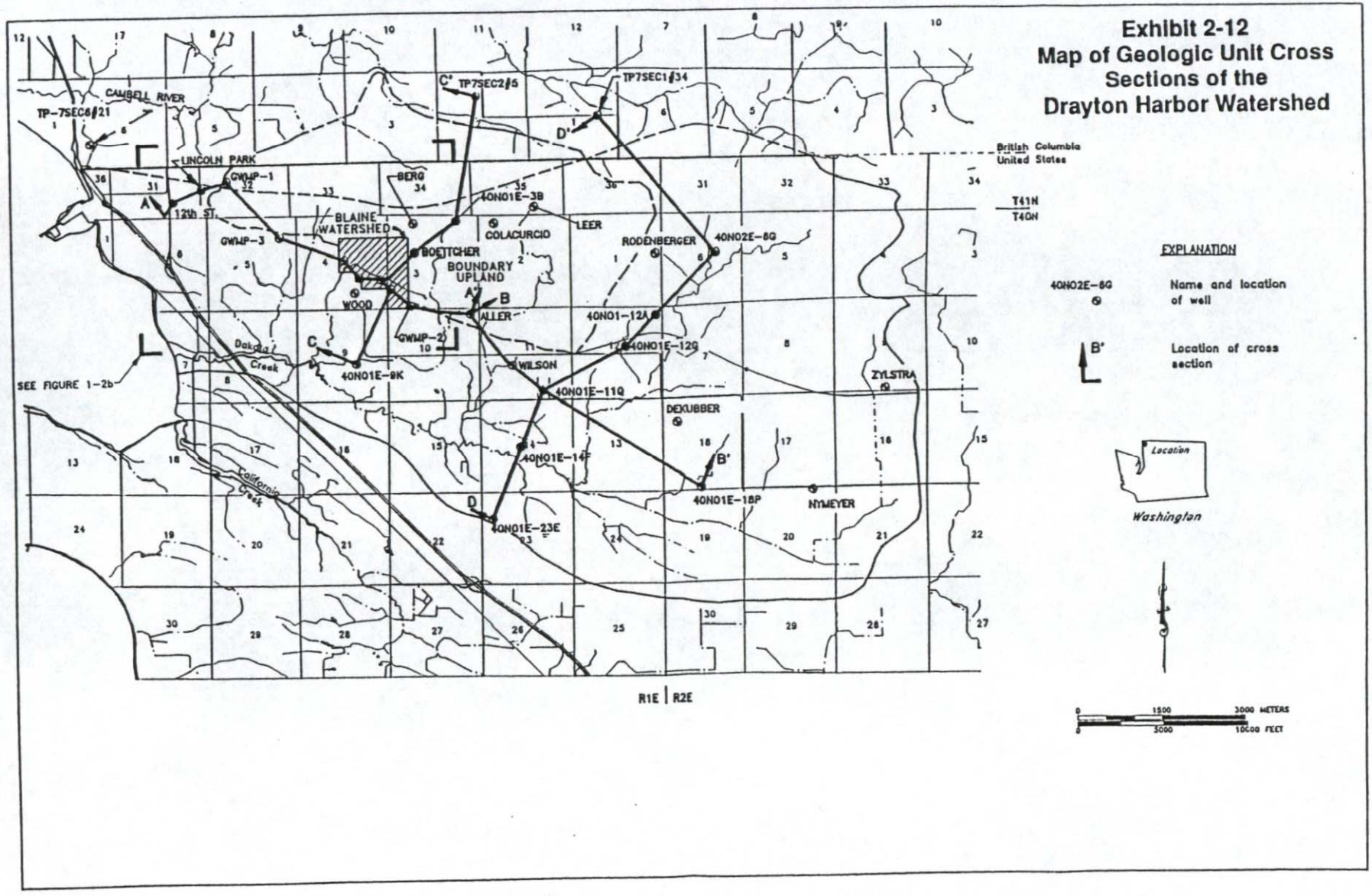


Exhibit 2-12
Map of Geologic Unit Cross Sections of the Drayton Harbor Watershed
British Columbia
United States
T41N
T40N
EXPLANATION
40N02E-8G
Name and location of well
B'
Location of cross section
Location
Washington
CAMPBELL RIVER
TP-7SEC6#21
LINCOLN PARK
GWMP-1
12th ST.
GWMP-3
BLAINE WATERSHED
BERG
C'
TP7SEC2#5
TP7SEC1#34
D'
40N01E-3B
COLACURCIO
LEER
RODENBERGER
40N02E-8G
BOETTCHER
BOUNDARY UPLAND
WOOD
A'
B
ALLER
40N01-12A
40N01E-12G
GWMP-2
C
Dakota Creek
40N01E-9K
WILSON
40N01E-11Q
ZYLSTRA
DEKUBBER
40N01E-14F
B'
40N01E-18P
NYMEYER
D
40N01E-23E
California Creek
SEE FIGURE 1-2b
R1E | R2E
0 1500 3000 METERS
0 5000 10000 FEET

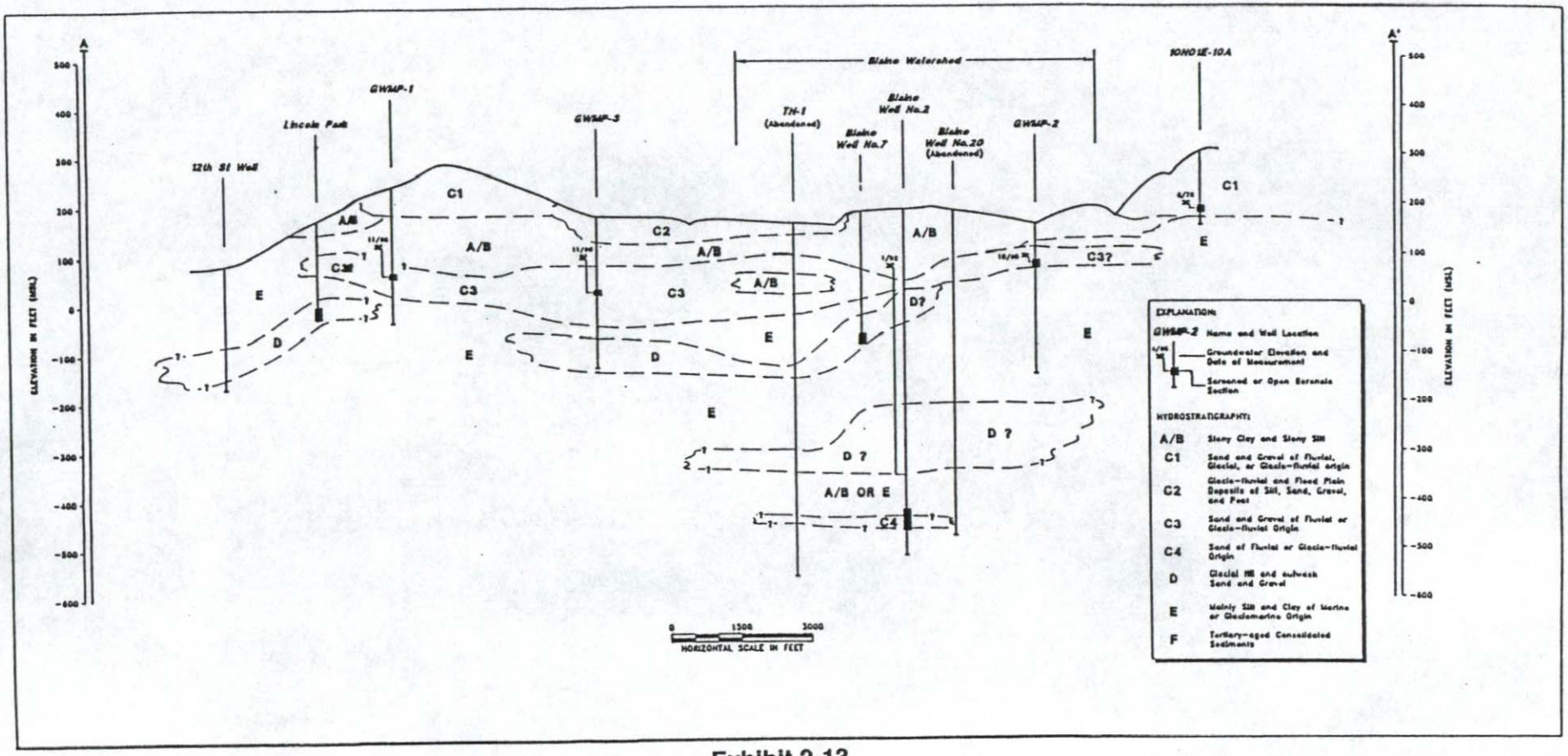


Exhibit 2-13
Schematic Diagram of the Major Geologic Units Underlying the City of Blaine Watershed

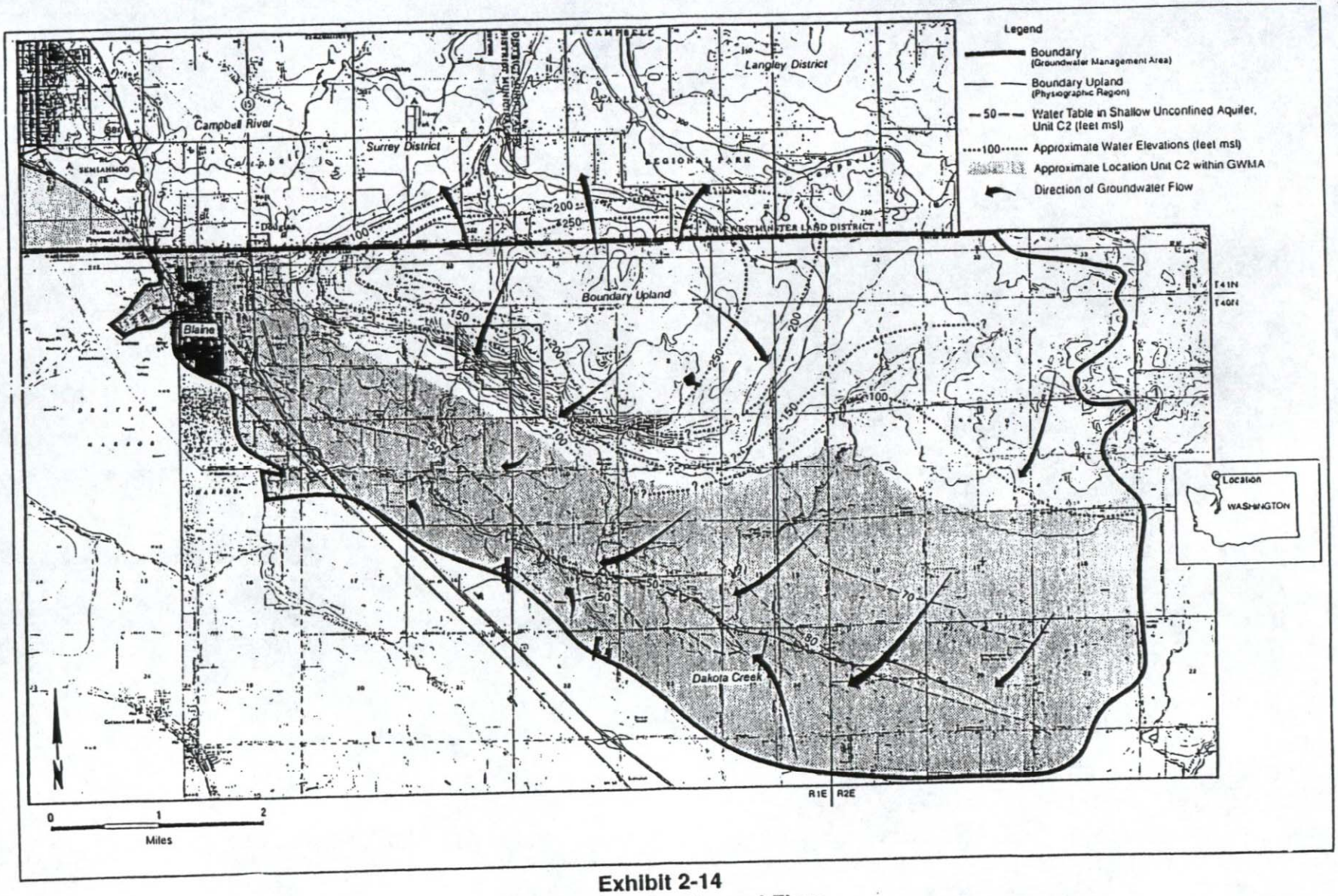


Exhibit 2-14
Groundwater Depths and Flow Patterns within the Blaine Groundwater Management Area

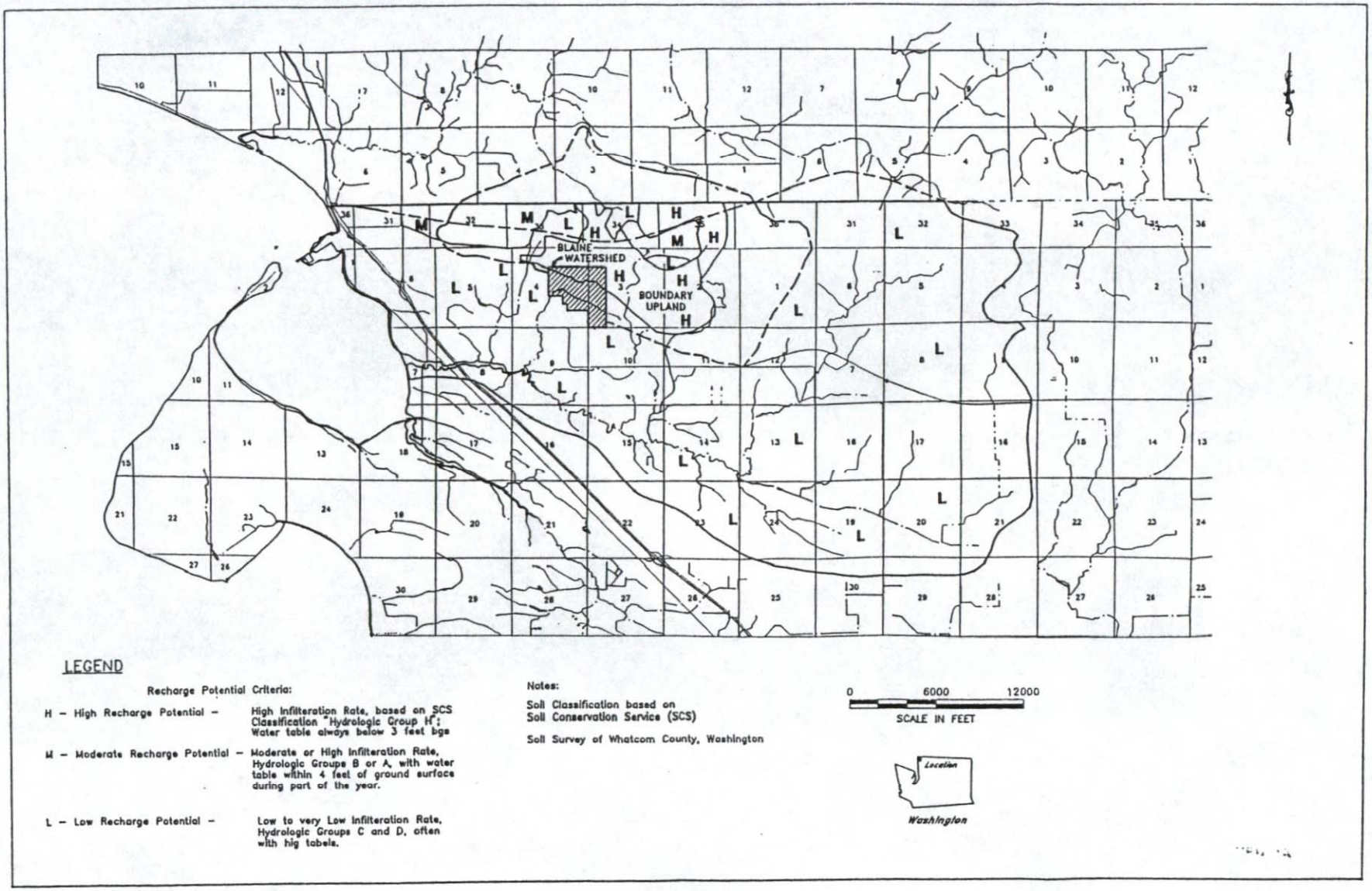


Exhibit 2-15
Groundwater Recharge Areas within the Blaine Groundwater Management Area

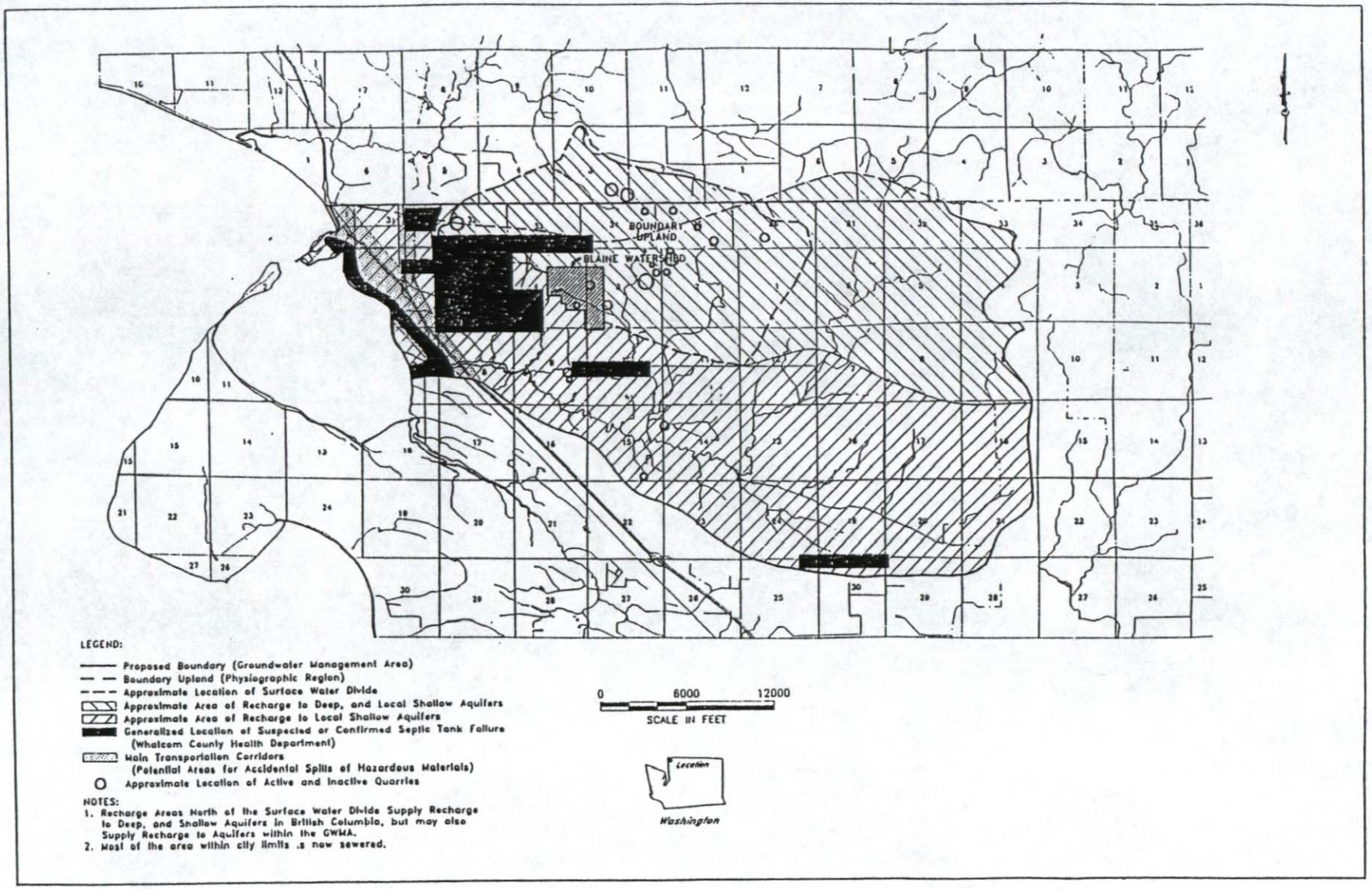


Exhibit 2-16
Areas in the Drayton Harbor Watershed Sensitive to Groundwater Contamination

Two City wells (No. 3 and 4) are located in C1 (at a shallow depth); one City well (No. 1) is located in C3 (at a shallow depth); four City wells (No. 5, 6, Lincoln Park, and 12th Street) are located in D (250-300 feet deep); and, two of the largest City wells (No. 1 and 2) are located in C4 (>600 feet deep).

The C Unit is unconfined making it possible for contaminated stormwater surface runoff to enter the aquifer at the shallow depths (<50 feet) and contaminate drinking water supplies at the lower depths.

2.14 Vegetation

Natural vegetation for the Blaine area was originally very similar to that in other communities around Puget Sound in regard to its original natural vegetation. Mature forests were dominated by Douglas Firs, Western and Red Cedar, and Western Hemlock with a host of understory shrubs and herbs, as listed in Table 2-7.

Today, vegetation in the study area is primarily a function of land use history, soil properties, and topographic characteristics. Native plant communities have been largely replaced by landscape plantings throughout most of the study area. In the relatively small portion of undeveloped land, second growth forest vegetation is composed of Big Leaf Maple, Douglas Fir, and Western Hemlock trees with a salal and word fern understory. In areas of more moisture, Western Red Cedar, Red Alder, and Black Cottonwood may be found, with salmonberry and other common understory plants.

2.15 Surface Water

Surface water and drainage patterns in the study area are largely dictated by local topography and underlying soils and geology. Generally, the northeastern part of the City is characterized by a gradually rising hill, which is about 175 feet in height, at the northeastern City limit. At the base of the hill are a series of small springs that combine with surface water drainage and flow directly into Cain Creek, which flows under and along I-5. Cain Creek then drains into Semiahmoo Bay, just to the north and outside of Drayton Harbor. This natural drainage way along I-5 is one of the predominant natural drainage features within the City, other than Drayton Harbor. It drains the central area of the City, which includes approximately 50 percent of the City's surface area on the east side of Drayton Harbor. Directly north of the City's central district, drainage sheet flows through residential areas directly into Semiahmoo Bay just south of the Canadian border. Remnants of the City's natural drainage system in these northern parts of the City include a number of wetlands located primarily to the north and east of the City.

Table 2-7
List of Plants Typical of Puget Sound Region

Common Name	Scientific Name
Trees:	
Big-leaf maple	Acer macrophyllum
Red alder	Alnus rubra
Black cottonwood	Populus trichocarpa
Douglas fir	Pseudotsuga menziesii
Cascara	Rhamnus purshiana
Willow	Salix spp
European mountain ash	Sorbus aucuparia
Western red cedar	Thuja plicata
Western hemlock	Tsuga heterophylla
Shrubs:	
Vine maple	Acer circinatum
Red-osier dogwood	Cornus stolonifera
Hazelnut	Corylus cornuta
Salal	Gaultheria shallon
Indian plum	Oemleria cerasiformis
Devil's club	Oplopanax horridum
Stink currant	Ribes bracteosum
Prickly current	Ribes lacustre
Evergreen blackberry	Rubus laciniatus
Thimbleberry	Rubus parviflorus
Salmonberry	Rubus spectabilis
Pacific blackberry	Rubus ursinus
Scouler's willow	Vaccinium parvifolium
Red elderberry	Sambucus racemosa
Red huckleberry	Vaccinium parvifolium
Herbs:	
Lady-fern	Athyriuim felix-femina
Deer-fern	Blechnum spicant
Enchanter's nightshade	Circaea alpina
Pacific bleeding-heart	Dicentra formosa
Foxglove	Digitalis purpurea
Bedstraw	Galium spp
Largeleaved avens	Geum macrophyllum
Tall mannagrass	Glyceria elata

In the western central regions of the City, urban and commercial drainages collect along streets and in culverts where they are discharged directly into Drayton Harbor through a series of outfalls after passing underneath the Burlington Northern rail line. The rail line parallels I-5 and runs along much of the City's

central downtown waterfront area along the eastern shoreline of Drayton Harbor. Drainage from the Blaine Marina, just west of the downtown area at the entrance to Drayton Harbor, drains directly into the harbor.

The south central and southern portions of the City are relatively flat and gradually slope toward Drayton Harbor and the mouth of Dakota Creek. The soils of this area are predominantly of glacial till. Where natural depressions occur, a series of more than two dozen wetlands have formed. Some of these wetlands are quite extensive and will ultimately limit the amount and type of future development that is able to be located in this area. Presently the area is relatively underdeveloped. Drainage from this southern area of the City sheet flows directly into Drayton Harbor or the lower reaches of Dakota Creek. Some localized infiltration of surface drainage and discharge of groundwater may also be occurring along the southeastern Drayton Harbor shoreline.

The Resort Semiahmoo is a major portion of the City, located on the west side of Drayton Harbor just north of Birch Point. It includes the Resort Semiahmoo and the Semiahmoo Spit and marina. Drainage in this area sheet flows off the top of the 250-foot hill within the Semiahmoo Golf Course and is collected in two large detention ponds and local roadside ditches before being discharged directly into either Drayton Harbor to the east, or Semiahmoo Bay and the Strait of Georgia to the west. The Semiahmoo Marina at the northeast end of the spit drains primarily to the east, directly into the entrance into Drayton Harbor. There are few remaining wetland areas within Semiahmoo. Much of the drainage not contained in ditches and culverts, sheet flows off the Semiahmoo area and likely infiltrates into sandy beach areas on the sand spit or along the base of the Semiahmoo hill, prior to discharge into Drayton Harbor and Semiahmoo Bay.

2.16 Water Quality

2.16.1 Within Drayton Harbor

Water quality in Drayton Harbor has been monitored sporadically since the early 1950s by the Washington State Department of Health (DOH). The emphasis of this early monitoring was to document bacterial levels in and around the harbor area, to determine the areas within the harbor that were safe for shellfish rearing in order to certify commercial shellfish operations.

Since the early 1950s, a number of other agencies have monitored the water quality of Drayton Harbor, including the Department of Ecology (Ecology), the City of Blaine, the Semiahmoo Company, Whatcom County Health Department, Port of Bellingham (sediments), and the Whatcom County Council of Governments, who retained the services of the Institute for Watershed Studies at Western Washington University. Although each of these efforts had its own set of objectives, general conclusions were that the water quality within the Harbor almost meets Class A water quality

standards, as listed in Table 2-8. Based on these studies, collective water quality concerns include high bacteria, occasional low dissolved oxygen, elevated nutrients, and turbidity. Monitoring to-date indicates that the Harbor is being polluted by:

- Bacteria and nutrients from agricultural practices and failing septic tanks in Dakota and California Creeks drainages;
- Bacteria from failing septic tanks within the City and County along the shores of Drayton Harbor;
- Runoff and discharges from the Semiahmoo and Blaine marinas;
- Industrial and commercial discharges within the Blaine Harbor and surrounding area, including fish processing wastes, boat repair wastes and byproducts, and metal finishing operations;
- Sewage and combined sewer overflows from the City; and
- Non-point pollutant discharges, primarily from the City's urban/ commercial impervious areas.
- Local and wildlife populations are also contributing to the elevated coliforms in the Harbor.

Table 2-8
Class A Water Quality Standards for Surface Waters of the State of Washington*

Marine Waters	❑ Fecal coliform shall not exceed a geometric mean value of 14 organisms/100 milliliters (mL), with not more than 10% of samples exceeding 43 organisms/100 mL.
	❑ Dissolved oxygen levels shall exceed 6.0 milligrams (mg)/liter (L).
	❑ Temperature shall not exceed 16.0°C due to human activities. When natural conditions exceed 16.0°C, no temperature increase will be allowed which will raise the receiving water temperature by more than 0.3°C.
	❑ pH shall be within the range of 7.0 to 8.5 with a variation within a range of less than 0.5 units due to human activities.
Fresh Waters	❑ Fecal coliform shall not exceed a geometric mean value of 100 organisms/100 mL, with not more than 10 percent of samples exceeding 200 organisms/100 mL.
	❑ Dissolved oxygen levels shall exceed 8.0 mg/L.
	❑ Temperature shall not exceed 18.0°C due to human activities. When natural conditions exceed 18.0°C, no temperature increase will be allowed which will raise the receiving water temperature by more than 0.3°C.
	❑ pH shall be within the range of 6.5 to 8.5 with a variation within a range of less than 0.5 unless due to human activities.

(*Note also that applicable standards include the April 1991, Chapter 173-204-320 which establishes marine surface sediment management standards for the State of Washington.)

2.16.2 Within the City of Blaine

In spite of the extensive water quality monitoring within Drayton Harbor, there is little water quality information available within the City. Water quality issues throughout most of the City are thought to be typical of most urban and commercial areas. Pollutants commonly associated with urban runoff are listed in Table 2-9. Additional monitoring within the City, however, will be necessary to characterize nonpoint urban sources and establish an effective water quality source control program.

Ecology has taken some grab samples for cadmium in the Yew Street drainage ditch by the airport as part of an investigation of an illegal discharge from a metal plating operation. Other than this single sampling event, little data has been collected within the City by any agency.

The City has recently monitored sewage, roof drains, illegal connections, and sewer overflow discharges into Blaine Harbor and along the western shoreline of Drayton Harbor as part of its sewer plan and the expansion of the sewage treatment plant.

2.17 Sensitive Areas

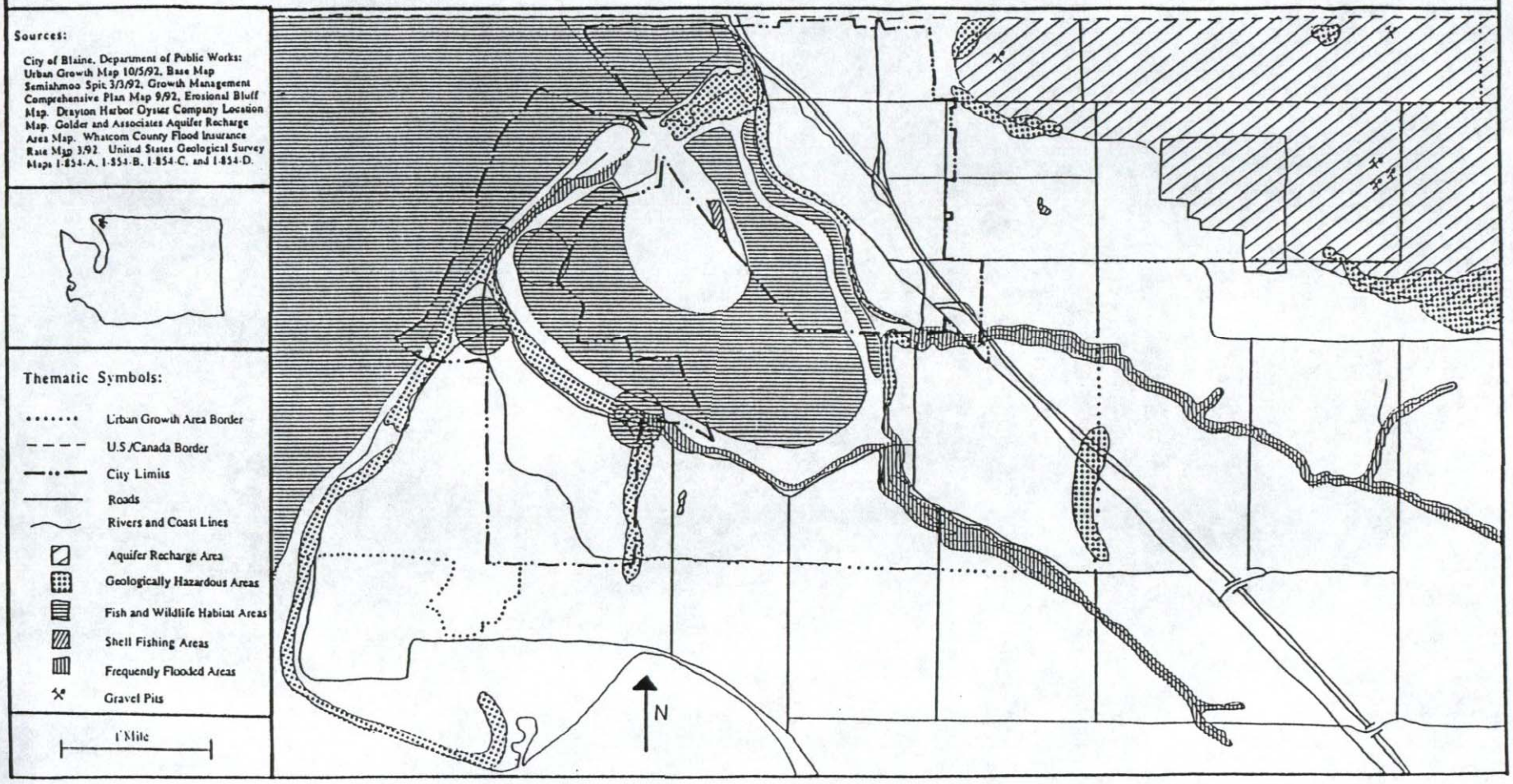
Sensitive areas within the City are shown in Exhibit 2-17 and include steep slopes, wetlands, drainage corridors, and habitat areas, as listed below.

- The steep slopes on the west and northeast sides of the Resort Semiahmoo on Birch Point,
- The Cain Creek drainage corridor and associated flood plain west of and parallel to I-5 that drains most of the interior of the City,
- The wetlands and adjacent buffer areas located throughout the City,
- Drayton Harbor and the shoreline areas that are within the City limits,
- Eel grass beds within Drayton Harbor,
- Shellfish rearing areas within Drayton Harbor just south of the City limits,
- Shallow aquifers and groundwater recharge areas located throughout the City, but primarily along the Drayton Harbor shoreline,
- Shoreline and associated beaches,
- Groundwater recharge and wellhead protection areas,
- The flood plain located at the mouth of Dakota Creek within the City limits, and
- Other critical habitat and/or wildlife areas located throughout the City, including natural fish rearing areas within the harbor adjacent to the City.

Table 2-9
Pollutants Associated With Urban Stormwater Runoff

Pollutant Category	Sources	Potential Impacts	Forms/Measurements
Sediment	Construction sites Stream channel erosion Poorly vegetated lands Slumping on steep slopes Vehicular deposition	Tissue abrasion Gill clogging Light reduction Benthic siltation Transport of other pollutants	Total suspended solids (a mass measure. Turbidity (a light scattering measure)
Nutrients	Sediments Fertilizers Petroleum products Domestic animals Septic systems Vegetative matter	Eutrophication (enrichment) Nuisance algal blooms Reduced clarity Odors Oxygen depletion (algal decomposition) Reduced drinking water quality	Phosphorus Soluble and Particulate Nitrogen: Ammonia Nitrate and nitrite Organic
Oxygen-demanding organics	Sediments Vegetative matter Domestic animals Petroleum products	Oxygen depletion	Biochemical oxygen demand Chemical oxygen demand
Metals	Sediments Vegetative mater Domestic animals Petroleum products	Toxicity	Lead Copper Zinc Cadmium Others
Organic toxins	Sediments Pesticides Combustion products Petroleum products Paints and preservatives Plasticizers Solvents	Toxicity	Many specific chemicals
Bacteria	Sediments Animal and manure transport Domestic animals Septic systems	Shellfish bed contamination Drinking water contamination Contact recreation impacts	Coliform indicators Total Fecal Specific pathogens
Oil and grease	Petroleum product leakage and systems	Benthic accumulation Toxicity	Oil and grease
Chlorides	Roadway deicing	Osmotic effects on freshwater animals Reduced drinking water quality	Chlorides
Heat	Pavement runoff Loss of shading	Reduced ability to support temperature-sensitive fish and invertebrates	Temperature

Exhibit 2-17
Map of the Critical and Sensitive Areas within the City of Blaine



Most of these areas have been identified directly or indirectly through the City's Critical Areas Ordinance adopted on an interim basis in July 1994 or will be included in the City's SEPA review process as new development projects are brought before the City for review prior to construction.

2.18 Wetlands

The City is blessed with a myriad of wetland areas, as shown in Exhibit 2-18. Most of these wetlands are located in the southern, eastern, and northern portions of the City. These wetlands are primarily Class 3 wetlands, indicating that they have been altered from their natural state and are receiving stormwater runoff or are of low natural functional value.

A large Class 2 wetland is located just south of the airport. Its boundaries cross both Pipeline and Odell Roads. The only Class 1 wetland located within the City limits consists of the mouth and intertidal areas of Dakota Creek.

There are a series of 8-12 wetlands along the west side of I-5 in the Cain Creek drainage corridor that are acting as a series of effective regional flow control and water quality treatment facilities. These wetlands receive stormwater runoff from I-5 and the central urbanized area facilities of the City on both sides of the freeway. The wetlands located throughout the City and their natural drainage functions should be actively protected and maintained as the City continues to grow. These are natural cost-effective drainage devices that are usually relatively easy to purchase or secure the development rights for, and also require little or no maintenance.

2.19 Fish and Wildlife

Much of the original habitat areas in and around the City have been substantially altered from their natural state. Dakota Creek, however, is still one of the most productive salmonid streams in the State and should be protected along with a number of the City's other valuable natural features. Of the areas that remain, it is important that the City continue to protect and maintain the habitat functions of:

- The Drayton Harbor shoreline area and associated eel grass beds, seal resting areas, water quality, shellfish growing, and natural fish rearing areas within Drayton Harbor;
- The water quality, flood plain, and riparian corridor of Dakota Creek that is within the City Limits;
- The wetland areas and adjacent buffer areas located throughout the City;

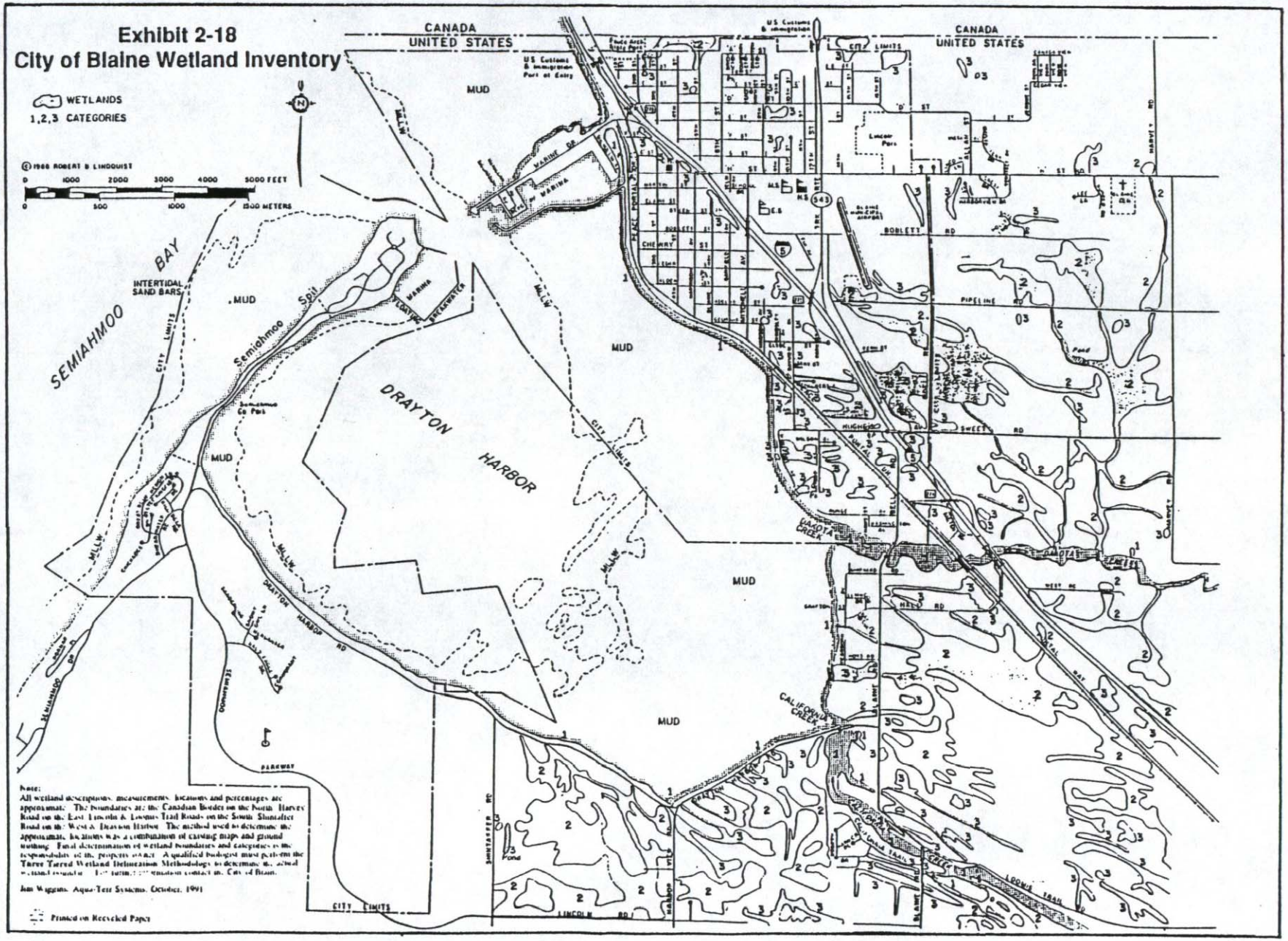


Exhibit 2-18
City of Blaine Wetland Inventory
WETLANDS
1,2,3 CATEGORIES
CANADA
UNITED STATES
MUD
SEMIAHMOO BAY
INTERTIDAL SAND BARS
Semiahmoo Spit
DRAYTON HARBOR
CITY LIMITS
MLLW
MARINA
PARKWAY
LINCOLN RD
BOBLETT RD
SWEET RD
PIPELINE
Printed on Recycled Paper

- The sensitive ecology and geology of the Semiahmoo Spit and adjacent upland and steep slope areas of Birch Point, and
- The remaining water quality, flood plain, and riparian features of the Cain Creek drainage corridor that flows northwest through the City parallel to I-5.

Many of these habitat areas have already been protected through the City's Critical Areas Ordinance and are identified on the City's Critical Areas map, shown previously in Exhibit 2-17.

2.20 Steep Slopes

The only steep slope areas within the City are along the west and east slopes of Birch Point within the Resort Semiahmoo. These areas have been protected through the City's on-going master planning process that has been guiding the phased construction of the Resort Semiahmoo. Steep Slope areas have been included in the City's inventory of geologic hazards and are included in the Critical Areas map presented in Exhibit 2-17.

2.21 Flood Plains

Three drainage corridors and associated flood plains exist within the City. They include:

- The Drayton Harbor shoreline and adjacent upland flood plain areas,
- The mouth and lower reaches of Dakota Creek that lie within the City limits, and
- The drainage corridor and flood plain associated with Cain Creek that flows northwest through the central area of the City.

The Dakota Creek flood plain is noted on the flood maps of the Federal Emergency Management Agency (FEMA).

Although not usually considered flood plains, the buffers and riparian areas adjacent to the City's 30 or more wetlands also act as flood plains by providing localized regional detention for each of their associated drainage subbasins. These flood plain functions are valuable to the City in minimizing localized flooding throughout the City and have been protected by the City, as shown in the Wetlands Inventory Map show in Exhibit 2-18.

2.22 Summary of Study Area Drainage Characterization

The Blaine Drainage Study Area includes a unique combination of natural drainage, ecological, and geological features. Although altered from its natural

state by the various developments that make up the City of Blaine, significant elements of the natural system remain. These remaining elements of the natural system have been accepting increased drainage flows and treating increased pollutant loadings while at the same time treating the water, maintaining aquifer recharge, and sustaining habitat areas. These remaining features need to be protected by the City in order to ensure their long-term performance.

From a review of this information, it was learned that:

- ❑ The natural drainage systems and water quality have been degraded by development.
- ❑ The City's relatively flat topography, impermeable soils, and seasonally high groundwater tables create the local ponding of surface water runoff which is responsible for the large number of wetlands and localized drainage problems throughout the City.
- ❑ Groundwater is the primary source of drinking water in the City; many wells are shallow and can be easily contaminated by stormwater due to the types of soils; seasonal high groundwater levels and interties between the various smaller aquifers.
- ❑ Water quality has been impacted and needs to be monitored and improved. The restoration and long-term health of Drayton Harbor and Cain Creek habitat areas are directly dependent on an effective stormwater management program being developed by the City and being supported and implemented by the Resort Semiahmoo, the public authorities, and the Blaine business community.

An effective stormwater program for the City needs to:

- ❑ Emphasize water quality treatment;
- ❑ Discourage direct infiltration of surface water runoff prior to treatment;
- ❑ Protect remaining habitat and natural drainage features, as defined in the City's Critical Areas Ordinance;
- ❑ Identify critical wellhead protection areas and develop a corresponding source control program as defined in the City's Groundwater Management Plan;
- ❑ Adopt effective on-site drainage controls from highway runoff and new developments (as defined in Ecology's Technical Manual);
- ❑ Establish common development and land use standards with the County as defined in the Drayton Harbor Watershed Action Plan and the City's Comprehensive Plan;

- ❑ Establish a water quality monitoring program; and
- ❑ Develop an on-going public education program for businesses and residential homeowners to reduce pollutant loadings and encourage proper handling and disposal of toxic materials.

Section 3
Water Quality Assessment

3.1 Introduction

Assessment of water quality programs and development of solutions are critical to the development of an effective Stormwater Program for the City of Blaine (City). This water quality assessment will be combined with the recommended drainage controls from Section 4, and the local programmatic enhancements and regulatory compliance activities presented in Section 6, to form the City's Comprehensive Stormwater Management Plan.

The following water quality assessment reviews existing data and reports to identify water quality problems and their sources. A stormwater runoff assessment has been made from available literature to identify possible sources and impacts of pollution carried by surface water runoff. Receiving waters and their beneficial uses are discussed, along with measures to control both existing and future sources of non-point pollution. Various controls have been evaluated for their ability to reduce impacts of stormwater runoff and cost and feasibility. Recommended controls have been selected for consistency with the regulatory requirements of the Puget Sound Water Quality Management Plan. Implementation priorities are presented along with a long-term monitoring plan to track baseline water quality conditions and record the improvements achieved from implementation of the City's enhanced Stormwater Program.

3.2 Existing Water Quality Data

The two primary documents used to develop this Water Quality Assessment included:

- "Water Quality in Drayton Harbor, Whatcom County, Washington, 1989-1990," by Dr. Susan Cook of Freshwater Assessments, founded by the Semiahmoo Company, and
- "Drayton Harbor Watershed Action Plan," published in August 1995 by the Drayton Harbor Watershed Management Committee, sponsored by the Whatcom County Council of Governments, and funded by the Washington State Department of Ecology, Water Quality Financial Assistance Program.

The City has collected very little water quality monitoring data from the different areas and land uses within the City. Therefore, most of the following statements are based upon interpretation of the water quality monitoring data

from within the two above documents, as well as regional and national information about urban runoff, its impacts, and various control measures.

3.3 Identification of Receiving Waters and Beneficial Uses

3.3.1 Overview

The City has been blessed with a myriad of freshwater and marine water resources. Freshwater systems include surface streams and natural drainage swales, springs and wetlands, and groundwater aquifers. Marine systems include the estuary of Drayton Harbor which receives drainage from Dakota and California Creeks, embayments such as Semiahmoo Bay, and also the parent marine system of the Strait of Georgia and Puget Sound.

3.3.2 Freshwater Systems - Streams and Natural Drainage Swales

Cain Creek

Cain Creek is the single largest natural drainage feature in the City, other than Drayton Harbor. The Cain Creek Watershed encompasses about 50 percent of the land area within the City limits and is one of the most diverse and developed of the major drainage areas within the City. The lower reaches include a major part of the marine/ commercial center of the City, while the central part has medium density residential and commercial/business offices. The upper reaches consist of a series of interconnected wetlands in a sparsely developed area just south of the City airport. Cain Creek discharges directly into Semiahmoo Bay under Peace Portal Drive just east and north of the Blaine Harbor, crossing and parallel to the main drainage channel of Cain Creek in the I-5 freeway system with multiple stormwater discharges up and down the length of the channel. There are also multiple urban discharges from the central and eastern areas of the City down the length of Cain Creek. At one time, this drainage system may have had fish habitat. However, the development of the City and construction of the I-5 freeway have had major impacts on this drainage system. Other than the wetlands in the headwaters, the main channel is functioning as a series of regional stormwater detention treatment ponds connected by small lengths of culvert. This system also receives considerable drainage from the County down "H" and "D" Streets, Boblett Road, and some drainage down Pipeline and Odell Roads.

- Beneficial Uses
  - Headwater Area
    - Natural storage of peak runoff/flood control,

- Surface water collection and treatment,
- Conveyance of natural and urban runoff,
- Urban wetland habitat areas,
- Open space/aesthetics,
- Probable shallow aquifer recharging, and
- Natural storage and infiltration to help maintain summer low flows in the creek.

■ Main Channel to Point of Discharge
- Urban stormwater conveyance,
- Surface water runoff detention, and
- Provides some natural setting and pretreatment of stormwater runoff and highway and urban drainages.
- Fish passage and spawning grounds.

Albert Avenue Drainage Swale

Originally, the drainage swale down Albert Avenue was a small, probably seasonal intermittent stream channel. With the construction of Albert Avenue, this natural drainage has been partially replaced by a pipe/culvert system that drains due west directly into Drayton Harbor.

❑ Beneficial Uses
- ■ Catchment and conveyance of urban surface water runoff.
- ■ Aesthetics and open space.

Other Small Swales, Subbasins, and Drainage Catchments

Located throughout the City (including the Resort Semiahmoo on Birch Point) are numerous small natural and man-made drainage subbasins that collect surface water runoff and directly discharge to the marine systems of either Drayton Harbor or Semiahmoo Bay. Most of these systems have been significantly altered and contain few remaining natural features or functions. They provide little storage, flood control, habitat, or water quality treatment functions. They do, however, help maintain the estuary characteristics of Drayton Harbor surface water by continuously contributing freshwater discharges.

❑ Beneficial Uses
- ■ Catchment and conveyance of urban runoff, and
- ■ Discharges of freshwater into Drayton Harbor estuary.

Springs

There are numerous springs in the eastern, central area of Blaine by the airport and east to the City Limits. The springs feed local wetlands, and

help maintain the summer base flow in Cain Creek. They appear to have little habitat or groundwater recharge potential. However, some of this water may infiltrate to shallow groundwater aquifers as local soils allow.

- ❑ Beneficial Uses
  - ■ Feed and maintain local wetlands,
  - ■ May provide some limited recharge of shallow aquifers, and
  - ■ Help maintain summer base flows in Cain Creek.

Wetlands

The City contains many wetland areas due to poorly draining soils and relatively flat topography. The October 1991 inventory of wetlands in the City identified numerous wetland areas throughout the City. Almost all of these wetlands were classified as Category 3 wetlands which have been significantly impacted by local development and primarily act as recipients of local surface water runoff. A large Category 2 wetland, however, is located on the eastern boundary of the City and intersects both Odell and Pipeline Roads. These wetland areas also provide some urban habitat areas for local wildlife and may contribute minimally to groundwater recharge.

- ❑ Beneficial Uses
  - ■ Natural storage of peak runoff/flood control,
  - ■ Surface water collection and treatment,
  - ■ Conveyance of natural and urban runoff,
  - ■ Urban wetland habitat areas,
  - ■ Open space and aesthetics,
  - ■ Possibly some local shallow aquifer recharge, and
  - ■ Habitat, feed, and protection for migrating salmon, depending on location.

Groundwater Aquifers

As described in Section 2, the Blaine area and the Drayton Harbor Watershed, including both Dakota and California Creeks, contain substantial groundwater aquifer resources. Presently, these aquifers are the sole source of drinking water for the citizens of Blaine and most of the residents of unincorporated Whatcom County (County). There are three to four layers of aquifers under the City. The shallowest, 50 to 150 feet deep, are thought to be unconfined and readily susceptible to contamination from infiltrating/percolating surface water runoff. The shallower aquifers may feed springs and wetlands and help maintain summer base flows in local streams.

- Beneficial Uses
  - Water supply,
  - Filtration of surface water runoff,
  - Collection of surface water runoff,
  - Water supply for local springs and wetlands, and
  - Maintenance of summer base flows in local streams.
  - Aesthetics and open space.

3.3.2 Marine Systems

Drayton Harbor Estuary

The Drayton Harbor Estuary is just west of the central business section of the City. It receives runoff from the City and the Resort Semiahmoo and drainage and wastes from the Blaine Harbor and Semiahmoo Marina. It also receives major inputs of freshwater drainage from unincorporated County through discharges from the Dakota Creek and California Creek watersheds.

The Drayton Harbor Watershed drains 54.8 square miles, or 35,102 acres, and contains 129 miles of streams and tributary drainage systems. Over 90 percent of the freshwater drainage into Drayton Harbor is from Dakota and California Creeks, with only 10 percent of the watershed, mostly within the City, draining directly into the Harbor. Wetlands and ponds cover about 7,300 acres, or 21 percent of the watershed. With each tidal cycle, about 50 percent of the water within Drayton Harbor is exchanged with marine water from Semiahmoo Bay and the Georgia Strait. (Note: This high level of tidal flushing helps maintain water quality in Drayton Harbor and indicates that the estuary could quickly respond to a reduction in non-point pollution, including direct discharges of surface water runoff and urban/commercial/ industrial/marine waste discharges.)

The estuary is very productive and environmentally sensitive. There is a commercial oyster farm located in the estuary just west of the mouth of Dakota Creek. Thousands of salmon pass through the estuary every year to spawn in Dakota and California Creek tributaries. Hundreds of thousands of small smelts and fry use the estuary area as a nursery and rearing area before entering their marine stage of life in Semiahmoo Bay and the Strait of Georgia. The estuary has a large seal population, as well as eel grass areas and productive shellfish and crab habitat areas.

- Beneficial Uses
  - Receiving waters for freshwater discharges and urban surface water runoff,

- Harbor and marina areas for the commercial fleet and recreational boating,
- Recipient of industrial processing and manufacturing wastes;
- Rich environmental and habitat areas for a myriad of shore birds, seals, and fish; shellfish, crabs, eel grass beds, and other elements of a complex productive estuary ecosystem;
- Oyster and shellfish farming; and,
- Aesthetics and recreation.

Semiahmoo Bay/Strait of Georgia

Both of these large marine receiving waters receive urban runoff and support a rich and diverse ecosystem. The Bay accepts major urban discharges from Cain Creek within the City and from the various land use activities within the Resort Semiahmoo and Birch Point.

❑ Beneficial Uses

- Receives, treats, and assimilates urban wastes and surface water discharges;
- Provides food, habitats, and rearing areas for a healthy population of shore birds, clams, crabs, salmon, bottom fish, seals, and numerous other plant and animal species;
- Receives estuary discharges from Drayton Harbor;
- Crab rearing, harvesting, and processing; and,
- Aethetics and recreation.

Semiahmoo Spit and Birch Point

The Semiahmoo Spit and adjacent upland areas of Birch Point are unique features of the marine system that should always be valued and protected. The sand spit creates unique hydraulic and habitat features that create the special localized features of Drayton Harbor and Semiahmoo Bay.

The Semiahmoo Spit is home to a multitude of shore birds and provides productive habitat areas for crabs, shellfish, eel grass, and a diversity of fisheries. It is also the recipient and assimilator of stormwater runoff, urban discharges and wastes, and provides safe moorage for the Blaine Harbor and Semiahmoo Marina.

- Beneficial Uses
  - Receives, treats, and assimilates urban water and surface water discharges;
  - Provides for and supports a great diversity of marine life and a complex and diverse estuary ecosystem;
  - Provides safe harbor and marina areas that support the economy and quality of life in the area; and,
  - Aesthetics and recreation.

3.4 Stormwater Runoff Assessment

3.4.1 Overview

The following Stormwater Runoff Assessment identifies existing and future water quality problems in the City. It lists and characterizes the various potential sources of both point and non-point pollution by reviewing the data and results of the 1993 ""Drayton Harbor Watershed Action Plan"" and the 1991 "Report of Water Quality Analysis-Drayton Harbor." Observed water quality problems are correlated with their potential sources in order to recommend an appropriate source control program for the City. The goal is to enhance the quality of water being discharged from the City into Drayton Harbor and Semiahmoo Bay.

3.4.2 The Report of Water Quality in Drayton Harbor

Introduction

The report entitled "Water Quality in Drayton Harbor" is perhaps the single most complete documentation of baseline water quality conditions in and around Drayton Harbor. It covers a twelve-month period (1989-1990) and involves repeated sampling at established permanent monitoring sites. All other samples taken of Blaine outfalls, Semiahmoo discharges, harbor/marina inputs, and at other sites in Drayton Harbor have been "grab" samples. These "grab" samples may not accurately reflect average annual conditions, pollutant levels, or loadings. This Water Quality Study was conducted by Dr. Susan Cook, of Freshwater Assessments for the Semiahmoo Company, and published in 1991. The Study focused on the possible effects of the Resort Semiahmoo on ambient water quality and shellfish harvesting.

Approach and Methodology

Seventeen sampling sites were located around Drayton Harbor to monitor the runoff from the City, the Resort Semiahmoo, Blaine Harbor,

Semiahmoo Marina, City combined sewer overflows, the oyster rearing area, Dakota Creek discharges, and the background conditions outside Drayton Harbor in Semiahmoo Bay. These monitoring stations are shown in Exhibit 3-1.

Water quality parameters included temperature, conductivity, pH, dissolved oxygen, turbidity, nutrients (ammonia, nitrate, and phosphate), total fecal coliforms and fecal streptococcus. All samples were collected at ebb tide just below the surface of the water. Monthly samples were collected just after typical spring, summer, fall, and winter storm events. Fecal coliform loadings were estimated along with the ratio of fecal coliforms to fecal streptococcus.

3.4.3 The ""Drayton Harbor Watershed Action Plan""

Introduction

In 1988, the "Drayton Harbor Watershed Action Plan" (DHWAP) was identified as the watershed of highest priority within County, as defined by the criteria of the Puget Sound Water Quality Management Plan. In 1989, the City requested the County Council of Governments to apply for Centennial Grant Funding to establish a watershed action plan. In 1990, this effort was funded by the Department of Ecology (Ecology) and the planning process was initiated by the Drayton Harbor Watershed Management Committee. The Puget Sound Cooperative River Basin Team performed the watershed characterization and produced the maps for this watershed plan.

The Planning Process

The DHWAP was specifically written to address the sources and impacts of non-point pollution on surface waters and their associated beneficial uses, as defined in the State of Washington WAC 400-12.

- ❑ The "Drayton Harbor Watershed Action Plan"
  - ■ Characterized the watershed,
  - ■ Assessed water quality,
  - ■ Identified beneficial uses,
  - ■ Developed goals and objectives,
  - ■ Listed sources of non-point pollution, and
  - ■ Defined controls to limit the sources and release of non-point pollution.

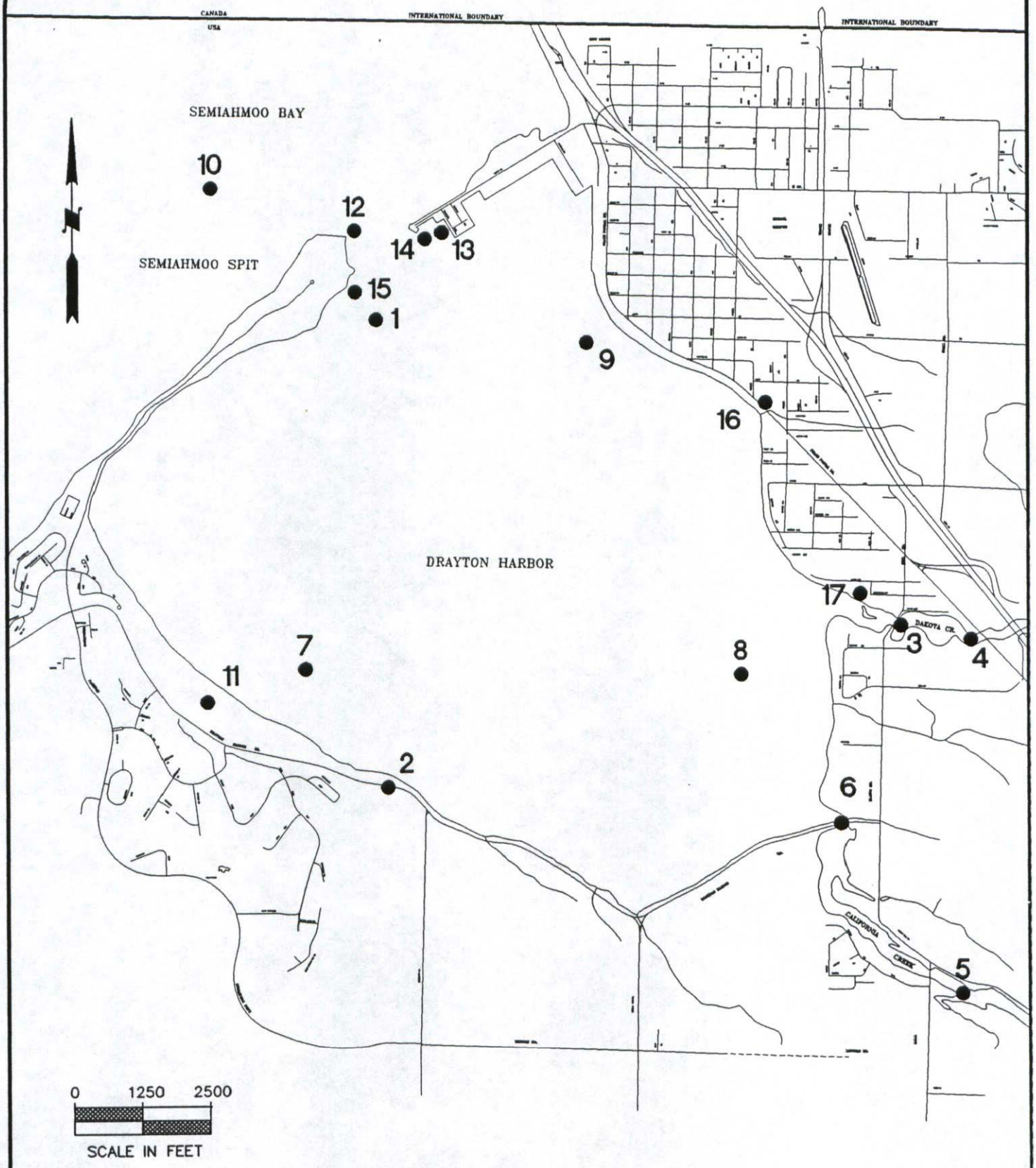


EXHIBIT 3-1

MAP OF DRAYTON HARBOR AND VICINITY SHOWING APPROXIMATE LOCATIONS OF THE TWELVE WATER QUALITY MONITORING SITES

NOTE:
SITE 4 AND 5 ARE UPSTREAM ABOVE TIDAL INFLUENCE

- Sources of non-point pollution included in the development of the "Drayton Harbor Watershed Action Plan" included:
  - Agriculture,
  - Boats and marina,
  - Forest practices,
  - On-site septic systems,
  - Stormwater and erosion, and
  - Other watershed specific sources.
- Roles and responsibilities were defined as follows:
  - The Management Committee identified goals, objectives, beneficial uses, and selected source control options;
  - The Western Washington University Institute for Watershed Studies conducted a one-year ambient water quality monitoring program; and,
  - The Puget Sound Cooperative River Basin Team performed the Watershed characterization and mapping.
- The goals of the project included:
  - Protection of beneficial uses,
  - Development of a feasible plan,
  - Increased awareness of the sources and effects of non-point pollution, and
  - Identification of an appropriate agency to implement the resulting plan.

Basin Characterization

See Section 2 for a description of the drainage areas within the City (See the 1993 Drayton Harbor Plan Watershed Action Plan for a discussion of the natural features and various land uses within the Drayton Harbor Watershed.).

Water Quality Assessment

Background Information - Drayton Harbor and all the streams draining into it are classified under the State of Washington WAC 173-201 as Class A water. See Table 2-7 in Section 2.14 for the Water Quality Standards of Class A waters within the State of Washington (The high quality of Class

A waters is required for water supplies, stock watering, fish habitat, shellfish habitat, wildlife habitat, recreation and commerce/ navigation).

Water Quality Parameters of Interest - The water quality standards of Class A waters include coliform bacteria, sediment, nutrients (nitrogen and phosphorous), dissolved oxygen, temperature, and pH (i.e., the acidity of the water).

Monitoring Programs in Drayton Harbor - The water quality of Drayton Harbor has been monitored periodically since the early 1950's. The primary emphasis was on coliform measurements taken by the Washington State Department of Health (DOH) to regularly certify commercial shellfish rearing activities. Separate monitoring has also been performed by Ecology, County Health Department, the Port of Bellingham, the Semiahmoo Company, and the Soil Conservation Services.

More recent water quality monitoring in Drayton Harbor has been performed by DOH, County Council of Governments (Western Washington University, Institute of Watershed Studies), City of Blaine, and Ecology.

Status of Water Quality in Drayton Harbor - Although considerable monitoring has occurred in Drayton Harbor, there are significant gaps in the data and little data that characterizes the freshwater inputs, including urban discharges from the City. Almost all current and historical data involves primarily fecal coliform monitoring. Listed below is a summary of data collected to date within Drayton Harbor for key water quality parameters, as current data allows. A much more thorough assessment of water quality is recommended.

- Sediment Quality

  Selected samples have been taken of metals, volatile organics, and other parameters from isolated areas within the Harbor. Results show that all parameters were elevated, but were within the State's new sediment standards as defined by WAC 173-204.

- Water Quality

  - Fecal coliforms

  Frequent water quality violations were recorded within and around the Drayton Harbor shoreline. Most of the coliforms are associated with, and caused by, surface water runoff. Sources include a multitude of failing septic tank systems, agricultural practices

(particularly in Dakota and California Creek drainages), City combined sewer overflows (some of which have now been corrected), and runoff from the Resort Semiahmoo. Coliforms are the most significant documented threat to the water quality of Drayton Harbor.

- Dissolved Oxygen

  The State standards for dissolved oxygen of 8.0 mg/L have been met by all marine sampling stations. However, freshwater discharges from within California Creek and storm culvert discharges from within the City have often been below the standard 8.0 mg/L.

- Nutrients

  Ammonia, nitrogen, and phosphorous were monitored by the Institute of Watershed Studies; samples from California Creek were acutely toxic (0.083-1.09 mg/L NH3) to salmonids 30 percent of the time, Dakota Creek samples were toxic only once. Nutrients were also elevated in Blaine storm sewer discharges.

- Metals and Organic Constituents

  No data was presented in the "Drayton Harbor Watershed Action Plan" for these parameters.

❑ Summary of Water Quality Data

- Drayton Harbor occasionally violates water quality Class A standards for fecal coliforms.
- California Creek frequently violates fecal coliform standards and occasionally dissolved oxygen standards. (There are presently no State standards for nutrients.)
- Dakota Creek occasionally violates State fecal coliform standards.
- Nutrient concentrations were elevated in both Dakota and California Creeks, and are impairing beneficial uses.
- Land use activities within the watershed are adversely affecting water quality in the Drayton Harbor Watershed.
- Much of the water quality data collected in 1990 and 1991 does not reflect the recent $5 million of capital improvements completed by the City in 1991 and 1993.

❑ Beneficial Uses

Beneficial uses within the Drayton Harbor Watershed include:

- Public and domestic water supply,

- Irrigation and livestock watering,
- Fish resources,
- Shellfish resources,
- Marine habitat,
- Wildlife habitat, and
- Recreational resources (boating, parks, aesthetics).

With the exception of the shellfish beds, the extent of impairment to beneficial uses of the watershed has limited documentation.

General impairment has been documented by:

- Nutrient enrichment data,
- Dissolved oxygen and fecal coliform standard violations,
- Impairments to fish migration and decreased survival rates due to low dissolved oxygen and high ammonia levels,
- Loss of riparian cover and increased water temperature,
- Impairment of commercial shellfish beds,
- Reduction of wildlife habitat,
- Wetland degradation from runoff and development, and
- Groundwater supply impairment from poor animal waste practices, failing septic tanks, and urban runoff. The full extent of this type of impairment in the Drayton Harbor Watershed is unknown.

3.4.4 Non-Point Pollution Assessment and Conclusions

Introduction

Typical non-point pollution sources include wastewater from failing septic tanks, animal wastes from farms, sewage/paints/oils from boats and marinas, debris and sediment from forest practices, and urban runoff. Sources of non-point pollution within a watershed vary depending on land use and the physical characteristics of the watershed. Impairment to water and associated beneficial uses is dependent upon the amount and types of pollutants carried with the surface water runoff.

Conclusions

Conclusions from the non-point pollution assessment of the Drayton Harbor Watershed include the following:

Agriculture - Agricultural practices, particularly hobby farms, contribute to elevated levels of fecal coliforms, nutrients, and low dissolved oxygen levels in freshwater streams. These are from:

- Fecal coliforms from human and animal wastes,
- Nutrients from fertilizers, human and animal wastes, and the degradation of plant materials, and
- Low oxygen levels from algal blooms, high water temperatures, and the presence/decay of organic matter.

Boats and Marinas - Boat users and marinas contribute coliforms, fuel/oil, and boat repair wastes; both the Semiahmoo Marina and Blaine Harbor have exceeded the State fecal coliform standards on numerous occasions. The coliform levels likely originate from the lack of use of the sewage pump out facilities located at both marinas.

Forest Practices/Logging - Forestry practices increase runoff, increase debris and sediment accumulations, contribute chemical contaminants (nutrient and herbicides), and significantly degrade salmonid habitat areas. Because most of the original forests within the watershed have been removed and only a few stands of second or third growth remain, commercial logging was determined not to be a significant source of non-point pollution.

Septic Tanks - Failing septic tanks contribute pathogenic bacteria, nitrates, and phosphates to both surface and groundwater. Over 70 percent of the homes in the watershed on septic tanks are located on poorly draining, inadequate soils, and over 1,500 of these systems are older and predated the 1980 septic system regulations. Historically a major contributor of septic leachate, the City has taken steps to provide sewer extensions. However, even with these improvements, failing septic tanks throughout the watershed are a significant source of non-point pollution.

Stormwater and Erosion - Stormwater and erosion increase as an area is developed. Rates and volumes of stormwater runoff increase which pick up and transport numerous contaminants including petroleum hydrocarbons, coliform bacteria, nutrients, particulates and heavy metals. The result is stream bank erosion, scour, and destruction of habitat areas. Road runoff is a significant portion of this runoff and is a major source of solids, hydrocarbons, and metals. Urban runoff from Blaine can be contaminated by metals, coliforms, and nutrients. Future growth will have a significant impact on the water quality of Drayton Harbor. This will emphasize the requirement to pretreat stormwater prior to discharge.

While the City has reduced sewer discharges into the harbor, the physical vulnerability of main sewer line across the entrance of the harbor is of considerable concern. It was concluded that stormwater and erosion are a significant source of pollution to Drayton Harbor.

- Other Non-Point Sources

  - Land Conversions

    Land conversions increase erosion and sediment loading, can destroy habitat areas, and have significant water quality impacts. Blaine is rapidly growing, and because development significantly contributes to the long-term pollutant loading and creates significant site disturbances, the harbor land conversions were considered to be a significant source of pollution within the watershed.

  - Golf Courses

    Golf courses use and contribute loading of fertilizers and pesticides to local receiving waters. There are four (soon to be five) golf courses in the watershed which have the potential to significantly impact water quality in Drayton Harbor and the Watershed. The present lack of data does not allow an accurate assessment of this source of non-point pollution.

Source Control Program - A non-point source control plan was recommended by the Watershed Management Committee that identified 58 individual recommendations to address the above water quality problems and their respective sources of non-point pollution. The rationale for each recommendation, and agency responsible for implementing each recommendation, have been identified on pages 74-104 of the "Drayton Harbor Watershed Action Plan" to which the reader is referred to for additional information.

Plan Evaluation and Implementation - Due to cost and feasibility considerations, the Watershed Management Committee concluded that the effectiveness of the "Drayton Harbor Watershed Action Plan" would be documented by monitoring the successful implementation of the 58 elements of the recommended Source Control Plan and not by additional water quality sampling and data collection (See Appendix to the Drayton Harbor Watershed Actin Plan). The County Council of Governments was designated as the lead agency to implement the resulting "Drayton Harbor Watershed Action Plan". Costs and sources of funding were not presented in the Drayton Harbor Action Plan.

Implementation of the Source Control Program

Those elements of the Source Control Program, which are the responsibility of the City to implement, include sewage disposal, stormwater runoff, and land conversion regulations, as listed below.

- ❑ On-Site Sewage Disposal Systems

  OS-26 To send out educational information on septic tank maintenance.

- ❑ Stormwater Runoff/Erosion

  SW-29 To identify reasonable alternatives to non-permeable surfacing materials in appropriate regulatory documents (i.e., zoning and development standards) and encourage their use. Recommend incentives to have developers incorporate these materials into their projects.

  SW-30 Adopt development standards which will require erosion control and stormwater detention, control, and treatment on all sites (equivalent to the Ecology Stormwater Technical Manual). Prescribe appropriate on-site management practices for all types of land uses and remediate existing stormwater controls to protect water quality.

  SW-31 Adopt a filling, clearing, and grading ordinance.

  SW-32 Develop an effective inspection and enforcement process for the development standards defined in SW-30 and SW-31. (Two alternatives were presented for implementation.)

  SW-33 Review stormwater plans and inspect major facilities during the wet season in the first year, and every two years thereafter, to ensure compliance and effectiveness.

  SW-34 Have the Management Committee participate in development of the City's Stormwater Management Plan through membership on the citizen advisory committee.

  SW-36 Participate in developing a spill response plan.

  SW-37 Conduct workshops for City staff on best management practices (BMPs) for controlling erosion and stormwater runoff.

SW-39 Retrofit existing structures and all new treatment facilities for runoff into Semiahmoo Bay. Coordinate with the spill response plan in SW-36.

SW-41 Replace culverts identified by Department of Fisheries as being barriers to fish passage.

SW-42 Review short plat requirements to promote clustering and protect environmentally sensitive areas.

SW-43 Include all lands within the City's Urban Growth Area in the Blaine Stormwater Plan.

- Land Conversions

LC-45 Encourage timely establishment of ground cover to reduce erosion from site preparations and road construction.

LC-47 Delay land disturbances until a building permit has been applied for.

LC-48 Encourage dry season land conversions and phasing of new development during the wet season; include inspection and enforcement during the wet season.

LC-51 Consider zoning changes and incentives for developers to encourage cluster development and take into account the natural limitations of the site.

LC-52 Adopt a filling, grading, and clearing ordinance.

Results

Major findings included the following:

- The State standard 16°C was exceeded in July and August in Drayton Harbor, and also in September in the both marinas and the harbor.
- Dissolved oxygen levels never dropped below the fish standard of 5.0 mg/L.
- Summer months had low dissolved oxygen levels at some stations in both fresh and marine waters that exceeded the 8.0 and 6.0 mg/L standards, respectively.

- ❑ pH was within Class A standards for both fresh and marine waters almost all the time.
- ❑ Turbidity levels were always below the EPA level of 2.5 NTU (the State standard is 5 NTU over background levels).
- ❑ Flow discharges from Dakota and California Creeks varied seasonally, with Dakota Creek discharging twice the volume of California Creek.
- ❑ Marine phosphate levels were higher in the winter; freshwater phosphate levels were higher in the summer.
- ❑ Ammonia and nitrate levels were highest during the winter months.
- ❑ Open water marine sites had lower average nitrogen levels, but higher levels of phosphates than freshwater sites.
- ❑ Fecal coliforms exceeded State standards at all sites, with California Creek exceeding Dakota Creek levels on an annual basis, even though California Creek had only about half the volume.
- ❑ Fecal coliform/fecal streptococcus ratios in Blaine Harbor indicated human fecal contamination.

Discussion

The discussion section of the "Drayton Harbor Watershed Action Plan" has been summarized according to key water quality findings, as listed below.

Discharges	The discharge of California Creek was routinely about one-half the flow of Dakota Creek.
Temperature	All marine sites exceeded the State standard of 16°C maximum during the summer months. The two creeks exceed the 18°C maximum standard during July and August.
Conductivity	Higher values in the summer, lower values in the winter. The EPA standard of 750 maximum units was never exceeded at any station.
Dissolved Oxygen	There was sufficient dissolved oxygen year round for fish (>5 mg/L).

pH	Standards for Class A fresh and marine waters were never exceeded.
Turbidity	All levels were below the EPA standard of 25 NTU.
Nitrogen	Ammonia indicates organic wastes, nitrates indicate pollution and enrichment, and nitrates are usually present in all water in low levels; ammonia and nitrates showed failing septic tanks draining under Portal Way and enrichment in Blaine Harbor from boat wastes and fish processors.
Phosphorous	Blaine Harbor and drains under Portal Way had the highest phosphate levels, from fish processors and sewage/septic drainage, respectively.
Nutrient Seasonal Variability	Low concentrations in the summer, high in the fall and winter. Algal growth in Drayton Harbor appears to be nitrate limited.
Bacteria	Monitoring detected human waste in Blaine Harbor, and failing septic tanks in the south Drayton Harbor Area. The fecal coliform/fecal streptococcus ratios demonstrated the source was human wastes; however, the two creeks also contribute high annual loadings of coliforms from livestock.

Conclusions and Recommendations

- Conclusions
  - All water quality parameters were close to meeting Class A standards, except bacterial levels.
  - Storms significantly increase the loadings of nutrients and bacteria.
    - The two streams (Dakota and California Creeks) contribute the most, followed by Blaine Harbor and the Peace Portal Drive drain.
    - Human waste is a problem in Blaine Harbor.
    - The City's recently completed sewer separation project should reduce the loadings draining under Peace Portal Drive.

- Recommendations
  - Land use and water quality need to be further investigated in Dakota and California Creek watersheds.
  - Dairy practices need to be changed to reduce coliforms.
  - Streams should be revegetated, and reiparian areas fenced.
  - Boats need to use the sewage pump out facilities.
  - Failing septic tanks need to be fixed and pumped out every 5 years.
  - The amount of fish processing wastes discharged into Blaine Harbor needs to be reduced.
  - Nitrate loadings should be reduced into Drayton Harbor to reduce algal blooms.

3.4.5 Summary of Water Quality Data and Sources of Point and Non-Point Pollution

Summary of Preceding Data and Reports

The Drayton Harbor Plan and the Report of Water Quality in Drayton Harbor were similar in their discussions of impacts on beneficial uses, water quality problems, and potential sources of point and non-point pollution. An assessment of the beneficial uses is presented in Table 3-1, along with identified sources of pollution and proposed solutions for enhancement and/or restoration of lost uses. Table 3-2 summarizes the results of the two reports by correlating water quality data and impacts with potential sources of pollution and proposed solutions for water quality control and enhancement.

Summary of Pollution Sources

In general, the sources of water quality degradation within the City are:

- Occasional releases of sewage from hydraulic overloading of the conveyance system during storm events,
- Failing and poorly maintained septic systems,
- Untreated urban runoff,
- Industrial and commercial waste discharges (especially fish processing wastes and discharges from marina/boat operation and repair),

Table 3-1
Correlation of Beneficial Use Impacts with Potential Pollution Sources and Proposed Solutions in the Drayton Harbor Watershed

Receiving Water Body	Beneficial Use Assessment, Explanation, and Potential	Potential Sources and Solutions
❑ Freshwater Systems		
■ Streams and Natural Drainage Swales, including: • Cain Creek • Albert Avenue • Small Subbasins	In City - natural drainage system has been significantly altered and/or destroyed causing loss of habitat, high rates of flow, flooding, loss of water quality; most systems have been reduced to urban drainage conveyance systems.	- Detention is needed to reduce flows and flooding - Maintenance of the existing drainage system is needed - Protection is needed of the remaining natural system (i.e., wetlands) - BMPs are needed to treat water - On-site controls are needed for future development
■ Springs	In City - limited data exists, needed to maintain wetlands and summer base flows, if contaminated, could effect shallow aquifers.	- Need protection - Keep these clean natural flows separated from polluted urban runoff, if possible
■ Wetlands	In City - many wetlands exist which have been degraded to Category 3 by urban runoff and development, they are needed for flood control, habitat and water quality treatment.	- Protect remaining wetlands by proper drainage and land use standards for new development
■ Groundwater Aquifers	In City - limited data exists, there is a high potential for urban runoff to contaminate shallow local aquifers, not likely to be a threat to deeper aquifers (i.e., City Wells Nos. 1 and 2).	- Identify and protect aquifer recharge and wellhead areas - Treat surface water runoff - Wellhead Protection Plan
❑ Marine Systems		
■ Drayton Harbor Estuary • Water Quality	General water quality is good, meets all Class A standards, except bacteria; stressed by dairy and human wastes, urban runoff, marina waste, and industrial discharges	- control sewer overflows - fix failing septic systems - improve dairy practices - use boat pump out facilities - reduce marina discharges and wastes
• Shellfish Rearing	Marina recreational areas are threatened, commercial rearing is marginally approved; stressed primarily by dairy wastes, but also human wastes and urban runoff	- improve dairy waste practices - reduce sewer outflows - fix and maintain septic systems - treat runoff prior to discharge

Table 3-1 (cont)

• Habitat, Ecosystem and Fisheries	- Marine waters are of good water quality and few documented habitat impacts are identified. - Freshwater fisheries are being stressed by low dissolved oxygen, high rates of runoff, and high ammonia levels in Dakota and California Creeks	- Marine system - no proposed habitat improvements - Freshwater system Revegetate and protect streams and riparian areas Fix and maintain septic systems Change animal waste practices
■ Semiahmoo Spit and Birch Bay (limited data exists)	- Likely elevated coliforms, nutrients, and urban pollutants - Some dilution occurs on west shore, but east shore discharges directly into Drayton Harbor are a problem	--Semiahmoo Marina needs a water pollution control plan - Use of pump out facilities needs to be enforced - City needs to protect and replace main sewer interceptor and force main to treatment plant - Fish processing wastes are causing localized problems in the area. These waste loadings need to be reduced
■ Semiahmoo Bay and Georgia Strait • Water Quality • Shellfish/Crabs • Habitat, Ecosystem and Fisheries (limited data exists)	- Likely elevated coliforms, nutrients, and urban pollutants - Dilution is good and helps prevent major problems - Likely to find localized "hot spots" near urban outfalls and marinas	- No documented problem areas - Urban runoff from City (Cain Creek) and Semiahmoo could be a problem, along with, - Boating and marina wastes, - Lack of using pump out facilities, and - Fish processing waste discharges

Table 3-2
Correlation of Observed Sediment and Water Quality Problems with Potential Pollution Sources and Proposed Solutions in the Drayton Harbor Watershed

Sediment and Water Quality and Quantity Assessment	Potential Sources	Potential Solutions
❑ Sediment Quality		
■ All sediment samples to date have met State sediment standards	(no recorded problems; however, sampling to date has been very limited and localized)	- clearing/grading ordinance
❑ Water Quality		
■ Fecal Coliforms • frequent violations in both streams and Drayton Harbor of Class A standards • routinely exceed State standards	the discharge of human and animal wastes - Blaine sewer overflows - failing septic tanks - poor drainage practices - lack of use of boat pump out facilities	- improve dairy and agricultural practices - fix and maintain septic systems - reduce Blaine sewage discharges - boaters need to use sewage pump out facilities
■ Dissolved Oxygen • marine standards routinely met • Blaine runoff and freshwater streams often below 8 mg/L.	freshwater violations due to dairy and human wastes and organic loadings, fisheries are being stressed occasionally	- improve dairy and agricultural practices - reduce nutrient loading - reduce organic loadings especially human wastes from sewage and failing septic systems
❑ Temperature		
■ High summer water temperatures exceeded State standards in the Harbor ■ In stream high levels stressed fish in July and August	likely a combination of both natural and human influences; in Drayton Harbor, high temperatures are primarily natural; in streams, it is primarily due to land use changes and activities Sources include: - shallow harbor area - poor mixing in Blaine Harbor/Semiahmoo Marina - deforestation of streams and watershed	- preserve riparian areas - revegetate stream banks
❑ Conductivity		
■ higher summer values ■ lower winter values ■ EPA standard of 750 uhoms was never exceeded	natural dilution occurs during the winter due to greater levels of precipitation and runoff	- improve agricultural practices - reduce urban discharge - reduce sewage and failing septic tank discharge

Table 3-2 (cont)

❑ pH ■ met Class A standards	no problems	- no controls proposed
❑ Turbidity ■ EPA standard of 25 NTU	no problems	- clearing/grading ordinance
❑ Nutrients ■ High nitrogen and phosphate loadings ■ Concentrations elevated throughout the study area, both marine and freshwater ■ Toxic levels of ammonia in California Creek (no State nutrient standards)	primarily due to organic human, dairy, and fish processing wastes	- eliminate Blaine sewage overflows - fix failing septic systems and/or convert to sanitary sewer - reduce fish processing waste discharges - control use of fertilizers - educate dairy and non-commercial farmers, change animal management practices - boaters need to use pump out facilities
❑ Metals - Unknown (likely to be universally elevated, especially in urban discharges, and marina/harbor areas)	limited data, mentioned only briefly in Drayton Harbor Watershed Management Plan	- multitude of urban sources - freeway and street runoff have especially high metal loadings - sewage discharges - Blaine and Semiahmoo Harbor discharges and urban runoff need to be controlled
❑ Hydrocarbons - Unknown (likely to be elevated in urban discharges and in the marina areas)	not included in either of the reports	- combustion of fuels - oil/fuel spills and runoff - boat/car operation and maintenance - use of pesticides solvents and other hazardous materials
❑ Water Quantity ■ Rates/volumes of runoff elevated through the developed areas causing pollution, flooding, and habitat destruction	- reduction of natural vegetation - land development and conversions - increase in impervious surface areas - lack of adequate controls - destruction of natural drainage system	- adequately maintain existing system - fix flooding problems - put in place effective designs/controls for new development

- Lack of use of sewage pump out facilities by boaters,
- Degradation and loss of the natural drainage system, and
- Impacts of development and construction.

Within the Drayton Harbor Watershed, the major sources of point and non-point pollution are:

- Human wastes from failing on-site sewage systems, sewage discharges, and lack of using pump out facilities.
- Animal wastes from improper agricultural and waste management practices.
- Boat and marina wastes, especially fish processing wastes and pollution from marina operation.
- Urban stormwater and erosion from inadequate treatment and control of development runoff.
- Land conversions, due to improper runoff and sediment controls.
- Golf courses, due to use of fertilizers and pesticides.

3.5 Water Quality Problems, Alternatives, and Solutions

3.5.1 Overview

Results of the Stormwater Runoff Assessment are used in this Section to identify, evaluate, and recommend effective water quality activities and controls to improve the quality of the surface water runoff within the City. In this section, documented contaminants and loadings are correlated with potential sources. Treatment and source control alternatives are presented to address the observed water quality problems. Alternatives are evaluated and a series of recommended source and treatment controls are presented in the proposed Water Quality Enhancement Plan for the City.

3.5.2 Results of the Stormwater Runoff Assessment

Water Quality Within the City of Blaine

The preceding Stormwater Runoff Assessment defined the general water quality of Drayton Harbor as good, because it met all of the State's Class A Water Quality Standards with the exception of bacterial levels. It

should be noted that the freshwater discharge to Drayton Harbor from the City amounts to only 5-10 percent of the total freshwater input into the harbor, however, it was one of the more significant contributors of coliforms, nutrients, metals and low dissolved oxygen levels from fish processing wastes, sewage (boats, sewage overflows and failing septic tanks), marina and harbor operations, and general urban runoff.

Most of the runoff from the City flows into Cain Creek and then into Semiahmoo Bay. No water quality data or source studies have been performed on water quality in Semiahmoo Bay. For the purposes of this study, it has been assumed that all urban runoff within and from the City has about the same general water quality characteristics (except sewage discharge) as that sampled in the report on Water Quality in Drayton Harbor by Susan Cook. In reality, there is inadequate water quality data to develop a data based source control for the City. General knowledge, other studies, and literature information (such as the Ecology Technical Manual) were used to develop the recommended water quality enhancement and source control plan for the City.

List and Location of Water Quality Problems

Water quality pollutants found in stormwater runoff from the City include:

- High suspended solids and turbidity 100-200 mg/L,
- Oxygen demanding substances 60-80 mg/L, COD,
- Toxic metals and trace elements (especially lead, copper, and zinc) to 20-200 mg/L,
- Organic contaminants 5-10 mg/L,
- Nutrients 1-2 mg/L, and
- Pathogenic bacteria 400-50000/100 mL.

(Note: Approximate concentration levels have been taken from Urban Runoff Quality and Treatment: A Comprehensive Review, British Columbia Research Corporation March, 1991, page 15.)

These pollutants originate from a host of urban sources. Common sources for each pollutant are shown in Table 3-3.

Table 3-3
Sources of Urban Non-Point Pollution

Water Quality Pollutant	Common Urban Sources
Suspended Solids	• eroded soil from construction • highway runoff
Oxygen Demanding Substances	• illicit storm sewer connections • combined sewer overflows • failing septic systems • pet droppings, plant waste, household waste
Toxic Metals and Trace Substances	• fossil fuel combustion • corrosion of metal alloys • automobile related activities
Organic Contaminants	• use of pesticides • fossil fuel combustion • plastic products • automobile related activities
Nutrients	• intensively landscaped areas • golf courses, cemeteries • decaying vegetation • animal/pet wastes
Pathogenic Bacteria	• human sewage • pets • wildlife • construction erosion • highway runoff • illicit sewer connections • failing septic systems • combustion of fossil fuel • automobile related activities • corroding metal alloys • use of plastics • pesticide use • fertilizer use • natural degradation of vegetation

Areas within the City which would tend to have greater releases of non-point pollutants would include:

- ❑ Storm sewer outfalls, including the discharge from Cain Creek,
- ❑ Freeway discharges, especially I-5 and the Truck Route,
- ❑ Street runoff,
- ❑ Commercial, manufacturing, and industrial areas, including
  - ■ City airport
  - ■ Marine manufacturing area
  - ■ Blaine Harbor
  - ■ Semiahmoo Marina
  - ■ Shopping center

- Automotive service, repair, restoration sites
- Golf courses and cemetery, and
- Failing septic systems.

3.5.3 Alternative Analysis

Approach to Solving Non-Point Water Quality Problems

There are generally two commonly used approaches for reducing non-point pollution. They include: 1) Source Control - Treating and removing the specific pollutants at the source, before they enter surface water runoff; and 2) Treatment - Treating the surface water runoff to reduce overall pollutant loadings once it has entered the stormwater runoff.

To have an effective control program, both approaches usually need to be in effect at the same time. This is especially true for a city such as Blaine, with so many different land uses and such a diversity of activities that could potentially contribute pollutants.

Alternatives to Reduce and/or Treat Non-Point Pollution

Alternative controls are presented to reduce and/or treat non-point pollution within the City. Controls include both source controls and treatment controls. Source controls are institutional in nature and are usually the first practical step to enhance water quality. They are usually preferred because of the high costs and operational problems in constructing new treatment facilities. Source controls are often referred to as non-structural BMPs. Source controls appropriate for the City include:

S1 Elimination of illicit connections to the storm drain system (through testing, education, and enforcement).

S2 Fixing and maintaining failing septic systems (through education, inspection, and enforcement).

S3 Properly maintaining the public drainage system (through an enhanced city maintenance program).

S4 Properly maintaining private drainage facilities (through a new ordinance, education, inspection, and enforcement).

S5 Monitoring and controlling construction sites (through education, a new stormwater ordinance, new design standards, enhanced plan review, and site requirements (including a new clearing, grading, and erosion control ordinance), inspection and enforcement).

S6 Reducing the use of household hazardous materials including the use of pesticides and fertilizers, and properly managing yard, pet, and kitchen wastes (through education and recycling programs).

S7 Reducing industrial, manufacturing, and commercial release of pollutants by changing manufacturing processes, proper waste disposal, and on-site water quality and spill response plans (through education, inspection, and enforcement).

S8 Replacing salt with sand to de-ice roads (City has already done this).

S9 Educating City staff and maintenance crews about BMPs for controlling erosion, stormwater runoff, and enhancing water quality.

S10 Retrofitting existing City drainage structures and adding water quality treatment to enhance the City's runoff and reduce pollutant loadings into local receiving waters, particularly the Cain Creek systems (by adopting, funding and implementing the recommendations in this plan).

S11 Setting up and monitoring a complete inventory of drainage facilities, including a mapping system, as-built drawings, and process to update this system as new developments occur.

S12 Effectively coordinating drainage infrastructure needs with the City and County Growth Management Act planning processes.

S13 Developing and enforcing effective stormwater, design, water quality, construction, maintenance, and inspection ordinances; processes and programs to appropriately implement the City's stormwater management program.

S14 Routinely conducting public and business education on stormwater management and water quality.

S15 Funding, staffing, and implementing the City's Stormwater Program.

Many of the above source controls are either required for regulatory compliance with the State's Basic Stormwater Program, (as defined in the 1991 Puget Sound Water Quality Management Plan, as amended in 1994), or are required to implement the terms and conditions of the 1993 "Drayton Harbor Watershed Action Plan". Source controls and non-structural BMPs are further described in Technical Appendix C.

Treatment Controls: The Use of Best Management Practices

Treatment BMPs are used in those situations within the urban environment where source controls are likely to be insufficient or impractical. The control and treatment of runoff from urban freeways and roads is a good example of where the pollutants have already been combined with surface water runoff and the contaminated runoff (drainage plus pollutants) needs to be treated. The cost and nature of treatment BMPs can vary greatly with the particular drainage problem and location where additional treatment is needed. Treatment controls are often referred to as structural BMPs.

There are at least seven different types or classes of structural BMPs including:

T1 - wet pond detention basins
T2 - dry pond detention basins
T3 - artificial wetlands
T4 - oil/grease trap catch basins
T5 - infiltration practices
T6 - vegative practices, and
T7 - erosion and sediment control practice during construction.

To be effective, structural controls need to be specifically designed for the site and the type of water quality problem to be addressed. Many designs combine one or more of these structural controls together with the same overall design, in order to improve the total performance of the facility. Combing one or more of these treatment techniques is usually recommended because rarely will one type of control remove all the different types of pollutants typically found in urban stormwater runoff. Please refer to Technical Appendix C for additional information about these structural BMPs.

The structural BMPs likely to be most effective for the City include:

- ❑ Wet/dry pond detention basins (such as the pond near Grant Avenue at the airport shopping center).

- A combination of infiltration and vegetative practices (such as the biofiltration ditch facility the City is installing along Boblett Road).

- Various erosion and sediment control practices during construction. (Note: the City needs a new stormwater ordinance, maintenance ordinance, clearing/grading ordinance, design standards, and inspection/enforcement programs for this BMP to be effectively implemented).

Alternative Evaluation

Both source and treatment control alternatives have been listed and evaluated in Tables 3-4 and 3-5, respectively, using the following evaluation criteria:

- Cost effectiveness,
- Environmental impacts,
- Practicality,
- Effectiveness,
- Redundancy,
- Political feasibility, and
- Agency willingness to implement.

Evaluation of Source Controls/Non-Structural BMPs

Of the fifteen different source control alternatives evaluation in Table 3-4, maintenance, fixing septic systems, controlling development, and reducing waste loadings are always cost effective. Education and enforcement can also bring good returns for limited financial investments. One of the most effective investments, although often costly, is to properly staff and fund the City's Stormwater Program so the various stormwater processes and activities can be properly developed and effectively implemented. Often, the political will is hesitant to properly control new development or to provide the proper funding or staffing needed to have a viable stormwater management program. In the State of Washington, State laws require municipalities, to develop, properly fund, and maintain an effective stormwater program.

Table 3-4

Evaluation of Source Controls/Non-Structural Best Management Practices

Source Control Alternative	Evaluation Criteria						
	Cost Effective	Environmental Impacts	Practicality	Effectiveness	Redundancy	Political Feasibility	Agency Willingness to Implement
S1 Eliminate illicit connections	Sometimes	Minor	High	High	None	Can be difficult	Can be difficult to implement
S2 Fix failing septic systems	Always	None	High	High	None	Good	High
S3 Maintenance - public facilities	Always	Minor	High	Medium	None	Good	Can be difficult to fund
S4 Maintenance - private facilities	Usually	Minor	High	Medium	None	Usually Good	Can be difficult to fund
S5 Monitor/control construction	Always	Some (major if uncontrolled)	High	High	None	High usually	Sometimes hard to fund adequately
S6 Reduce household wastes	Usually	None	High	Medium	None	High	High usually
S7 Reduce industrial/commercial manufacturing wastes	Always	Minor (major if uncontrolled)	High	High	None	Good usually	Good usually
S8 Use sand to de-ice	Usually	Minor	High	Good	None	High	High usually
S9 Educate City staff	Usually	None	Good	Good	None	High usually	High usually
S10 Retrofit existing facilities	Sometimes	Can be significant	Good usually	High	None	Low usually	Difficult to fund
S11 Set-up and maintain record keeping	Usually	None	High	Good	None	Good usually	Medium
S12 Coordinate with GMA Plan	Always	None	High	High	None	High	High
S13 Develop and enforce stormwater, O/M, construction, water quality, inspection, and enforcement, ordinances, processes, and programs	Always	Minor	High	High	None	Medium to high	Often Difficult to fund
S14 Educate public and businesses	Always	None	High	Medium	Sometimes	High usually	May be hard to fund
S15 Fund staff and implement City Stormwater Management Program	Always (expensive, but required by law)	Some (major if not implemented	High	Can be High (depending on level of funding)	None	Good usually	Often difficult to fund and staff to operate properly

Table 3-5
Evaluation of Treatment Controls/Structural Best Management Practices

Treatment Control Alternative	Evaluation Criteria						
	Cost Effective	Environmental Impacts	Practicality	Effectiveness	Redundancy	Political Feasibility	Agency Willingness to Implement
T1 Wet Detention Ponds	Usually	Some	Usually	Good Usually	None	Good usually	Good, but hard to fund
T2 Dry Detention Ponds	Usually	Some	Good Usually	Good Usually	None	Good usually	Good, but hard to fund
T3 Artificial Wetlands	Sometime	Some	Medium	Good Sometimes	Some	Good usually	Good, but hard to fund
T4 Oil/Grease Catch Basin	Occasionally	None	Medium (depends on site)	Medium	None	Good usually	Good Usually
T5 Infiltration Practice	Always	Minor	High	High	None	High	Good usually
T6 Vegetative Practices	Always	Minor	High	High	None	High	Good usually
T7 Construction Drainage, Erosion & Sediment Control	Always	Minor (major if uncontrolled)	High	High	None	High usually	High usually

Evaluation of Treatment Controls/Structural BMPs

Treatment controls were evaluated according to the seven evaluation criteria listed above and presented in Table 3-5. Generally, the best water quality returns for the dollars invested are in the use of infiltration (T5) and vegetative practices (T6). These two treatment controls are usually inexpensive, relatively effective, and can be placed almost anywhere. They present excellent opportunities, as the City has currently begun to demonstrate, to add new treatment facilities to older, established areas of the City's existing drainage system.

The control of construction (T7) is always worth the investment because it is always easier and cheaper to prevent a problem from occurring than to fix a problem once it has already occurred, and this is especially true of drainage control and water quality treatment. The other four treatment controls involving wet and dry ponds (T1/T2), artificial wetlands (T3) and oil/grease catch basins (T4) can be effective for solving certain types of drainage problems, but are usually more costly and difficult to fund and construct.

3.5.4 Proposed Water Quality Solutions

Source Controls/Non-Structural BMPs

Each of the source control alternatives is a viable control technique. Many, if not all, of these source controls will eventually need to be adopted and implemented by the City. Due to the shortage of available funding, a three phase approach with short- and long-term priorities has been identified. Those that would be the least expensive and most effective in the short-term include the following ten, Priority No. 1 Control Techniques:

Phase I-Priority No. 1: Short-Term Source Controls

S3	Properly maintaining public facilities.
S4	Properly maintaining private facilities.
S5	Monitoring and controlling new construction.
S8	Using sand for de-icing.
S9	Educating City staff.
S11	Setting up an effective recordkeeping program.

S12 Coordinating with GMA planning process.

S13 Developing and enforcing stormwater and maintenance ordinances and adopting design standards, as defined in the Ecology Manual.

S14 Educating the public and businesses about stormwater.

S15 Properly funding and implementing the City's Stormwater Management Program.

It should be noted that these are also the same elements needed for the City to be in compliance with the State's Basic Stormwater Program requirements. (Regulatory requirements for the City are discussed in Section 5 of this report.)

The other five source controls can be implemented as funding allows and local program priorities dictate. A suggested order of priority for the future adoption and implementation of these remaining five, Priority No. 2 source controls is presented below.

Phase II - Priority No. 1: Long-Term Source Controls

S1 Eliminate illicit connections.
S2 Fix and maintain septic systems.

Phase II - Priority No. 2: Long-Term Source Controls

S6 Reduce household wastes.
S7 Reduce industrial, commercial, manufacturing wastes.
S9 Retrofit existing facilities.

Treatment Controls/Structural BMPs

Structural BMPs, presented and evaluated in Table 3-5, to treat existing or future stormwater runoff are site specific and are to be selected, designed, and built as needed to meet the City's water quality goals. Based on the site visit, field inventory, and knowledge of the City's drainage system, the City should:

- Control drainage erosion and sedimentation from new construction (T7). The City's construction/development review practices need to be improved and upgraded with new ordinances, standards, and inspection/enforcement procedures.

- Use wet (T1) and dry (T2) detention ponds to provide regional storage and add treatment to those areas of the City where no treatment presently exists, as sites allow.

- Use a combination of infiltration (T5) and vegetative practices (T6) to provide treatment to the more developed areas of the City where adding regional storage and treatment systems is not feasible due to lack of available space/sites.

Additional wetlands (T3) are not recommended at this time. Oil/grease catch basins (T4) may prove effective and may not be needed in the various industrial/commercial developments located throughout the City, as local site conditions require.

Priorities for the adoption and implementation of treatment control structural BMPs are:

Phase I-Priority No. 1: Short-Term Treatment Controls

- Control drainage erosion and sedimentation from new construction (T7).

- Add treatment to the existing system using a combination of infiltration (T5) and vegetative practices (T6), particularly the highly developed Cain Creek Basin, Drainage Area No. 3.

Phase II-Priority No. 1: Long-Term Treatment Controls

- Add oil/grease catch basins (T4) where needed.

Phase II-Priority No. 2: Long-Term Treatment Controls

- Add regional detention and wet (T1) and dry (T2) water quality treatment facilities, as needed (future monitoring will likely be needed to correctly locate these facilities).

3.6 Facilities, Solutions, and Costs for Water Quality Enhancement

3.6.1 Overview

The following Water Quality Enhancement Plan is based on existing water quality data, documented water quality problems, and impaired beneficial uses. Identified sources have been combined with regional monitoring results and source and loading information. Established national and regional stormwater management practices consistent with and including those presented in the Ecology Technical Manual, have

been selected and recommended, as appropriate, to solve both existing and future water quality problems within the City.

Short and long-term implementation phases and priorities are presented in the recommended Water Quality Enhancement Plan. Costs have been developed to construct treatment controls (structural BMPs) at seven different locations throughout the City. These proposed facilities will provide treatment and enhance the water quality of stormwater runoff within many of the older, developed areas of the City. The estimated costs for these improvements is $325,000. Financial information relative to implementing the various programmatic source controls (non-structural BMPs) is presented in Section 5.

(Note that the costs for water quality enhancement have been combined with the costs for regulatory compliance and staffing costs to enhance the City's overall stormwater management program, and are presented in Section 6. See Section 6 for a more complete presentation of all future stormwater program costs. Financial alternatives and funding recommendations are also included in Section 6.)

3.6.2 Recommended Water Quality Enhancement Plan

The recommended Water Quality Enhancement Plan for the City has two elements. Element No. 1 includes the recommended Source Control Program. Element No. 2 involves the implementation of the recommended Treatment Control Program. Both are to be developed and implemented concurrently to achieve the City's water quality objectives. Element No. 1 is shown in Table 3-6.

Table 3-6
Element No. 1 Source Control Program

	Activity	Priority	Cost
	Priority No. 1: Short-Term		
S3	Maintain public drainage facilities	#1-3	$
S4	Maintain private drainage facilities	#1-7	
S5	Monitor and control new construction	#1-4	
S8	Use sand for de-icing	#1-10	
S9	Educate City staff	#1-9	
S11	Set up record keeping program	#1-8	
S12	Coordinate with GMA planning	#1-5	
S13	Develop and enforce stormwater ordinance and design standards	#1-2	
S14	Educating public and businesses	#1-6	
S15	Proper funding and staffing of City stormwater program	#1-1	
	Phase I Sub Total		$ *1
	Priority No 2: Long-Term		
S1	Eliminate illicit connections	#2	
S2	Fix and maintain septic systems		
	Priority No 2: Long-Term		
S6	Reduce household wastes	#3	
S7	Reduce industrial, commercial, manufacturing wastes		
S9	Retrofit existing facilities		
	Phase II Sub Total		$ *2
	Total Source Control Program		

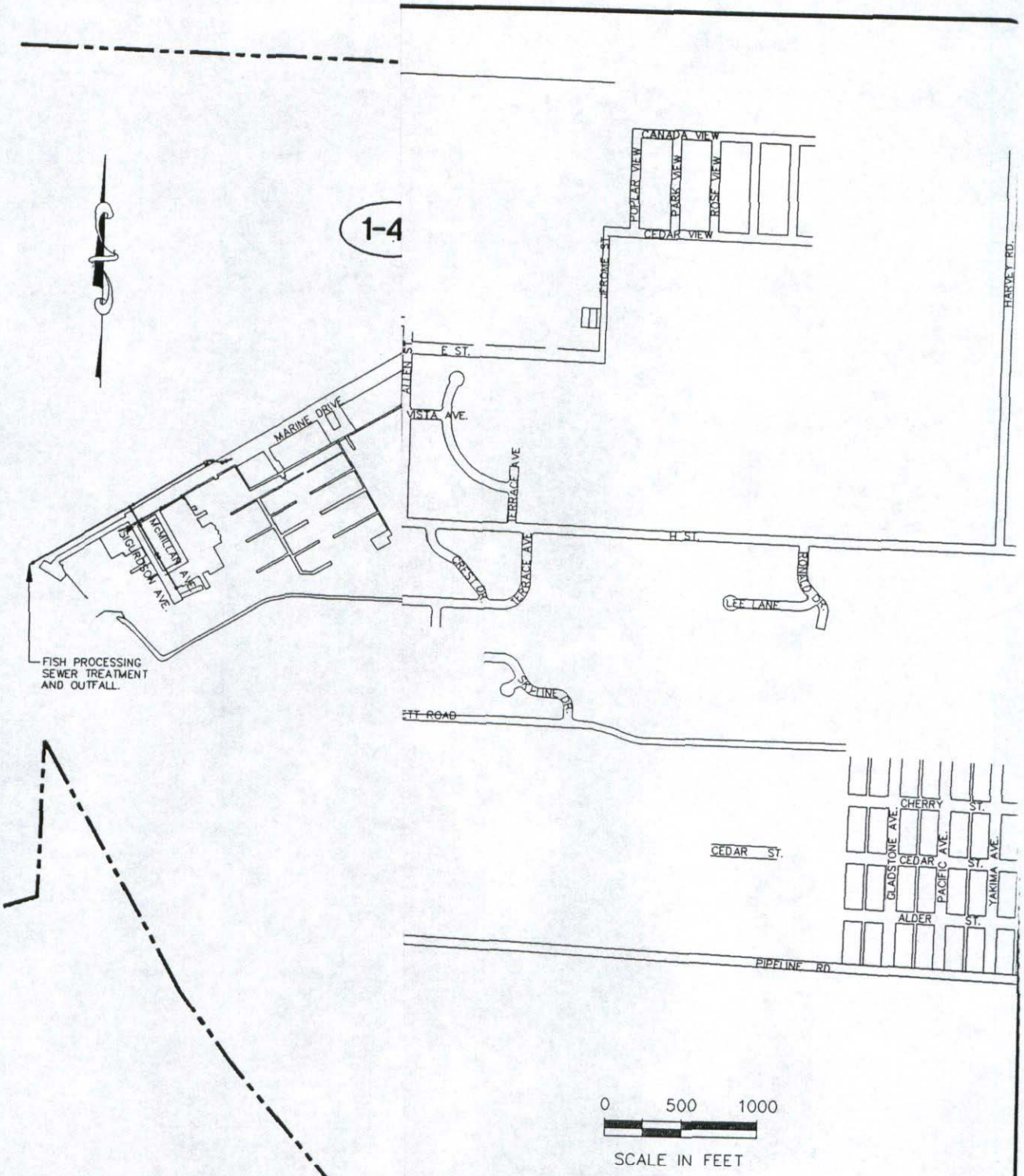
*1 An estimate of the Phase I Source Control Program costs is presented in Section 5 as part of the costs of implementing the City's enhanced stormwater program.

*2 The cost estimates for the Phase II Source Control Program will be estimated by City staff at a later date.

The Source Control Program; Element No. 1, summarized in Table 3-6, includes both Priority No. 1 and Priority No. 2 recommended source alternatives, as previously discussed in Section 3.5.4.

Of particular importance for the City of Blaine is maintenance of the City's public drainage facilities. Based on the site visit and field inventory of needs and facilities, a list of ten high priority areas has been identified for improvement and routine annual maintenance. The list of maintenance sites is presented in Table 3-1 and graphically located in Exhibit 3-2.

The short-term Priority No. 1 source control activities will be completed as part of the City's efforts to achieve regulatory compliance and improve local stormwater service. No separate costs have been identified for these individual Priority No. 1 short-term controls. The costs to complete the



LEGEND

DRAINAGE CHANNEL - - - - - -

STORM DRAIN ———

LOCATION IDENTIFIER 4-1M

- Drainage Area #
- O/M Priority Location
- Type of St
  M = Main

EXHIBIT 3-2

BLAINE STORMWATER MANAGEMENT PLAN
FIELD INVENTORY:
LOCATION OF MAINTENANCE NEEDS
BY DRAINAGE BASINS

NOVEMBER 1994

ECONOMIC AND ENGINEERING SERVICES, INC.

Priority No. 2 source controls have not been presented in this plan. It is anticipated that Priority No. 2 costs will be estimated by City staff at a future date, as future needs and stormwater data allow.

The Treatment Control Program: Element No. 2 is presented in Table 3-7. It includes those new water quality treatment facilities to be built by future developers and the seven recommended infiltration/vegetative treatment controls previously presented in Section 3.5.4. The developers will pay the costs of water quality treatment related to new construction, which have not been estimated as part of this plan. The seven new treatment facilities to be built by the City to treat runoff from within the older, established areas of the City have been estimated to cost $325,000, as shown in Table 3-8. Exhibit 3-3 shows the locations of the proposed treatment control facilities.

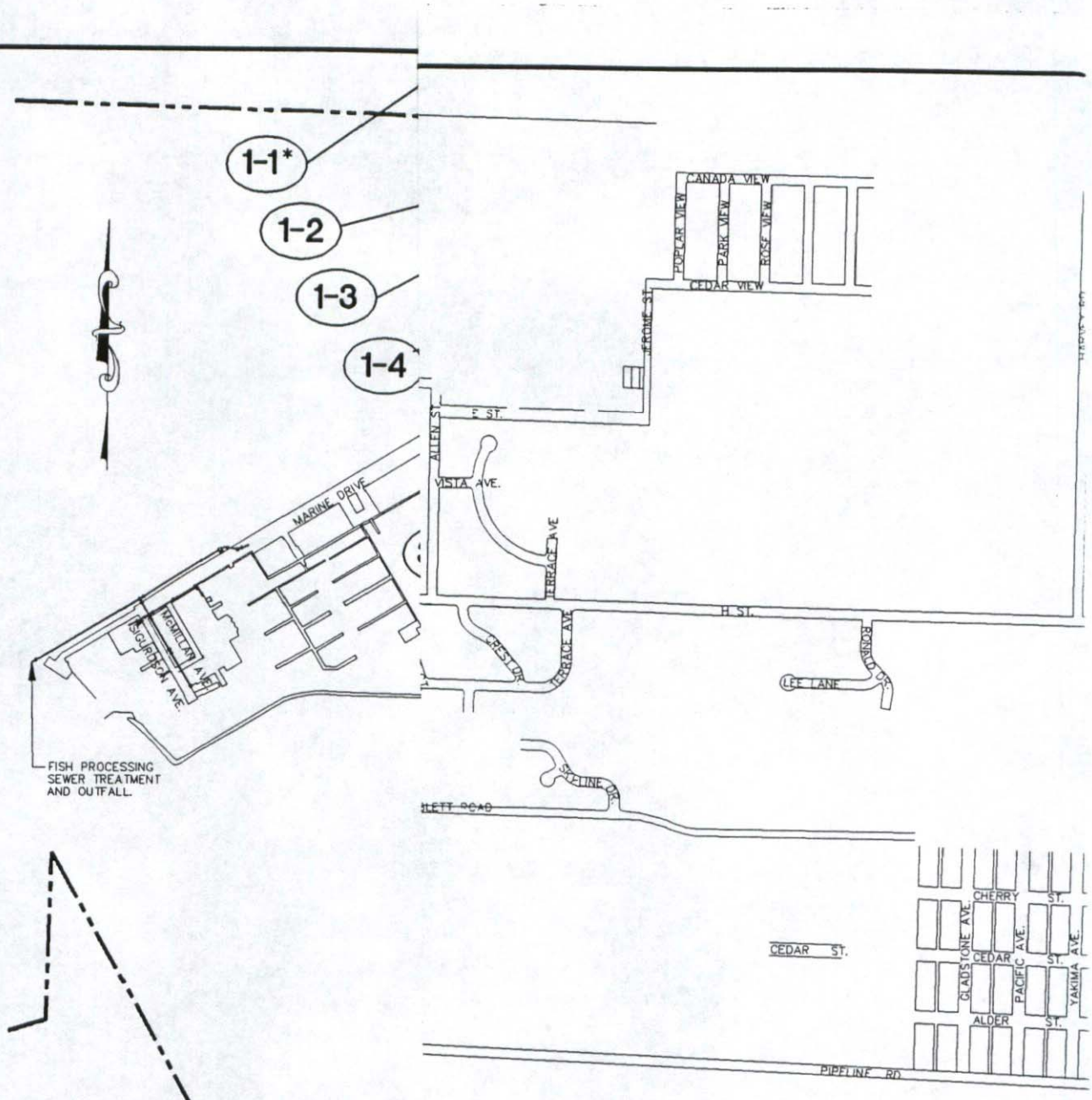
Table 3-7
Element No. 2 Treatment Control Program

	Activity	Priority	Cost
	Priority No. 1: Short Term		
T7	Control drainage, erosion, and sementation from new construction (This is the facility/treatment part of the S5 source control element listed above)	#1	*1
T5/6	Treatment Controls: Infiltration (T5)/ vegetative (T6) projects. (Individual project cost information is presented in Appendix D.)	#1	$325,000
	Priority No. 2: Long-Term		
T4	Add oil/grease catch basins as needed		*2
T 1/2	Add wet/dry detention ponds as needed		*2
	Initial City Treatment Control Program		

*1 These costs will be the responsibility of the developer.

*2 To be estimated by the City staff at a later date. These costs are dependent upon the number of future water quality problems identified, the nature of the problem, and the location and type of required treatment control facility.

The Priority No. 2 long-term treatment controls will be constructed as needed to solve localized water quality problems. Again, it is anticipated that City staff will identify the need, location, and cost of these controls to address specific water quality problem areas throughout the City. These costs have not been estimated at this time and have not been included in this plan.



LEGEND

DRAINAGE CHANNEL ------

STORM DRAIN ——————

LOCATION IDENTIFIER 3-1

- Drainage Area #
- Treatment Control Facility #

* Inconjunction with County

EXHIBIT 3-3

BLAINE STORMWATER MANAGEMENT PLAN FIELD INVENTORY: LOCATION OF PROPOSED TREATMENT CONTROL FACILITIES

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Table 3-8
List of Treatment Control Projects and Costs
Needed to Provide Water Quality Treatment to the Existing Surface Water Runoff Within the City of Blaine

Drainage Area	Project Number	Location	Cost
1	1-1	Ditch in state park along border	$30,000
	1-2	Near I-5 and D Street	30,000
	1-3	Near 1st and B Streets	30,000
	1-4	I-5 right-of-way	4,000
2		No projects identified	
3	3-1	South of Pipeline and East of Yew	
	3-2	South drainage from airport	135,000
	3-3	Truck Route and H Street	26,000
	3-4	Wet pond treatment facility near marina	70,000
4		No projects identified	
		Total for Infiltration/Vegetation Treatment Control Projects	$325,000

In summary, it is again important to realize that no one source control or treatment control technique will be adequate by itself to enhance the quality of stormwater within the City. Due to the different physical forms, numerous sources, and complex chemical natures of the various pollutants within urban stormwater runoff, both source controls and treatment controls need to be implemented concurrently. By controlling or eliminating new sources before they are discharged, as well as by treating the runoff that has already become contaminated, an effective Water Quality Enhancement Plan can be established within the City.

Section 4
Existing Drainage System and Hydrologic Analysis

4.1 Introduction

The City of Blaine's (City) stormwater drainage system was analyzed using both a field inventory of existing facilities and problem areas, and a computerized modeling technique to confirm existing problems, and project future problems and sizes of needed facilities. The analysis of existing conditions was conducted via a field inventory. The field inventory identified problem area locations from both a water quantity (flooding, property damage, and habitat degradation); and a water quality (erosion, contamination, and pollutant loading) perspective. The computerized modeling analysis utilized results of the hydrologic/hydraulic study presented in the City's 1989 Comprehensive Stormwater Management Plan. Design storm hydrographs, runoff coefficients, and existing and future land use projections allowed modeling flow sequences to be developed. Estimates were made of peak flow rates, volumes, and runoff hydrographs. Computer analysis, site visit, and field inventory allowed the identification of existing problem areas and future potential "hot spots." Capital facilities and a list of prioritized maintenance needs have been identified to solve both existing and future water quantity and system capacity problems. The methodology, system evaluations, criteria, and description of the field and computer modeling processes are presented below.

4.2 Data Collection, Mapping, and Field Investigation

4.2.1 Data Collection

A substantial amount of reports, ordinances, maps, and related budgets and drainage program information was obtained from the City throughout this study. Considerable input was also received from the City's planners as part of the City's Growth Management Act (GMA) planning process.

The site visit of the study area confirmed existing data and allowed inspection of the various elements of the existing drainage system. Drainage patterns and problems were confirmed and the status of the operation and maintenance of the existing drainage facilities was examined. This site visit helped to create a visual inventory of the City's drainage facilities and confirm the computerized mapping of the drainage system which was developed as part of this study.

Modeling for the Blaine drainage system was based on the modeling analysis performed in the "City of Blaine Comprehensive Storm Drainage Plan Report," prepared by Associated Project Consultants, Inc., of Bellingham, in February 1989. The 1989 plan presented drainage basin boundaries for the City as well as input parameter values, including land use assumptions necessary to model the system. The results, presented in this capital facility and maintenance plan, have been included in this review of the adequacy of the City's existing drainage system.

4.2.2 Mapping

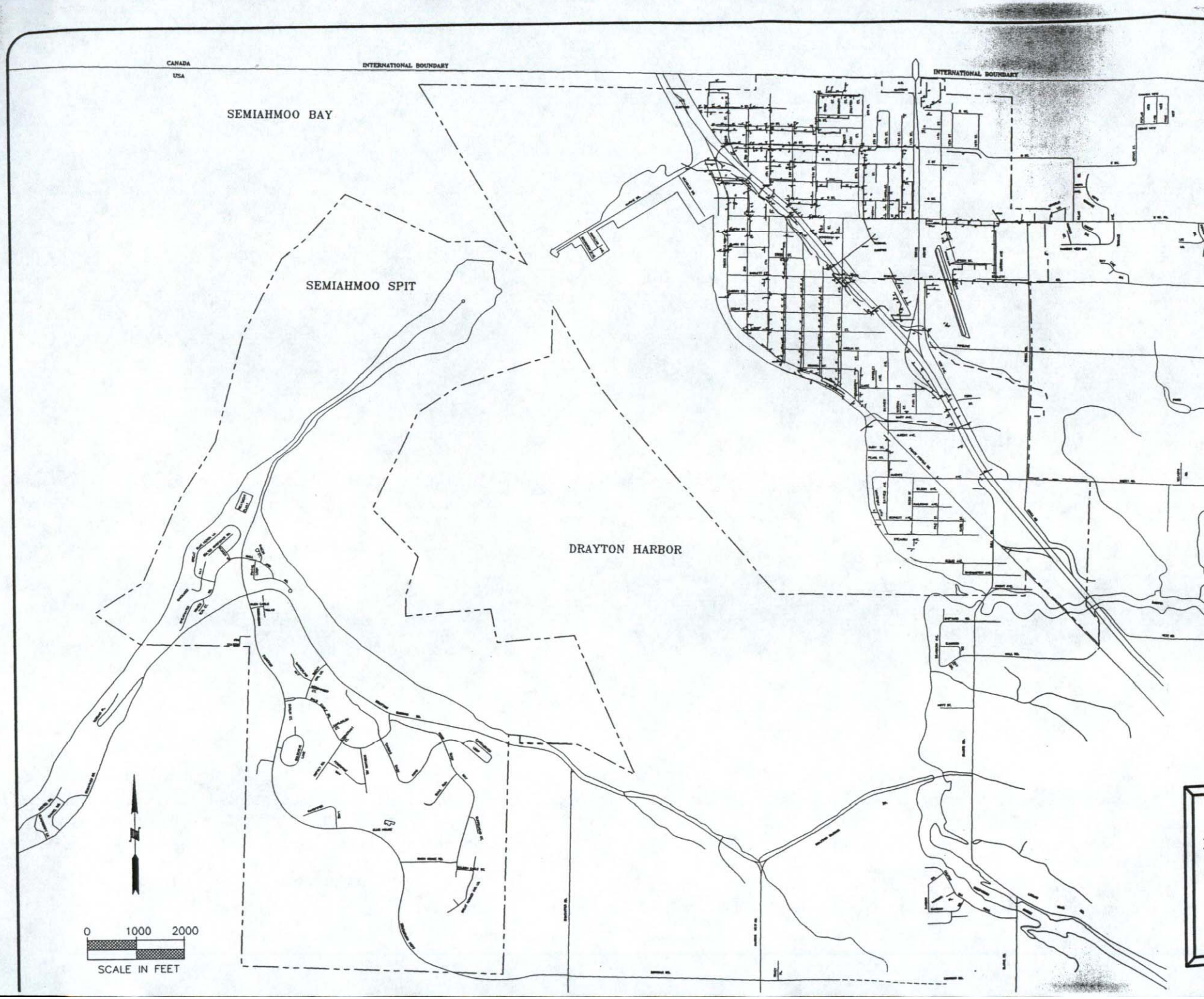
A map of the Blaine drainage system was provided by the City. This information was converted into a digitized AutoCAD system of drawings showing locations of pipes and retention/detention facilities. The drainage basin boundaries from the 1989 Drainage Plan were also mapped digitally on this AutoCAD database. Soil types from the Soil Conservation Service (SCS) were mapped along with the land use and zoning boundaries provided by the City. Topographic contour lines were included on one of the layers of the drawing. All of these layers of digitized data merged onto one AutoCAD map for use in calculating drainage basin areas and determining other important parameters used to confirm the computer modeling of the system.

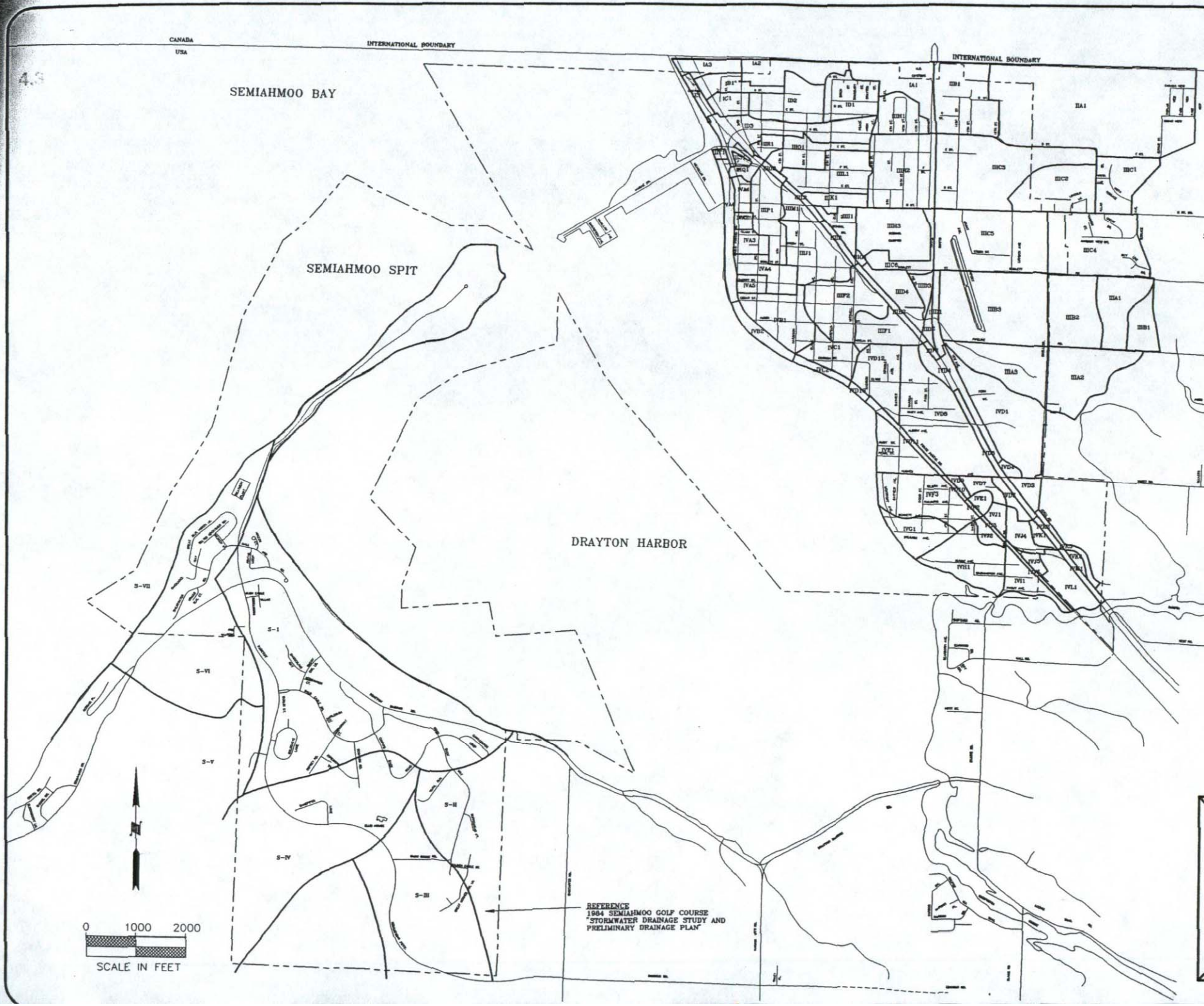
Digitized maps developed as part of this study include the following:

- Drainage Basin Boundary Map, presented in Exhibit 2-3
- Land Use/Zoning Map, presented in Exhibit 2-5
- Growth Management Area Map, presented in Exhibit 2-6
- Topography of the Study Area, presented in Exhibit 2-8
- SCS Soils Map, presented in Exhibit 2-11
- Stormwater Facility Base Map, presented in Exhibit 4-1
- Drainage Basin Subbasin Map, presented in Exhibit 4-2

4.2.3 Site Visit and Field Inventory

A site visit and field inventory of existing drainage facilities was conducted in the spring of 1994. This timing allowed on inspection of the facilities after a series of winter storm events and before any annual maintenance had taken place. The results of the field inventory are presented below. Information has been summarized for each of the major drainage areas according to predominant land use, existing drainage facilities, outstanding drainage issues, and water quality problems.


CANADA
USA
INTERNATIONAL BOUNDARY
INTERNATIONAL BOUNDARY
SEMIAHMOO BAY
SEMIAHMOO SPIT
DRAYTON HARBOR
0 1000 2000
SCALE IN FEET


CANADA
USA
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INTERNATIONAL BOUNDARY
SEMIAHMOO BAY
SEMIAHMOO SPIT
DRAYTON HARBOR
S-I
S-II
S-III
S-IV
S-V
S-VI
S-VII
0 1000 2000
SCALE IN FEET
REFERENCE
1984 SEMIAHMOO GOLF COURSE
"STORMWATER DRAINAGE STUDY AND
PRELIMINARY DRAINAGE PLAN"

An extensive complex of both isolated and interconnected wetland systems, as shown in Exhibit 2-16, exist within the City. Due to the City's relatively flat topography and almost impervious glacial till and blue clay soils, wetlands have developed throughout the Blaine area and in almost any undisturbed natural depression. Six to eight wetland areas exist within the City north of "H" Street and I-5 to the Canadian border. The Cain Creek drainage system within the central area of the City contains another 10-12 major wetland areas, including the large complex of wetlands just southeast of the airport (and beyond the eastern City limits due west of Albert Avenue and I-5). The area south of the Cain Creek Watershed, from Albert Avenue and I-5 south to the mouth of Dakota Creek, is an almost continuous series of over sixteen different wetland systems, as identified in the City's 1991 Wetlands Inventory.

Drainage Related Issues

Other elements of the City's drainage system include:

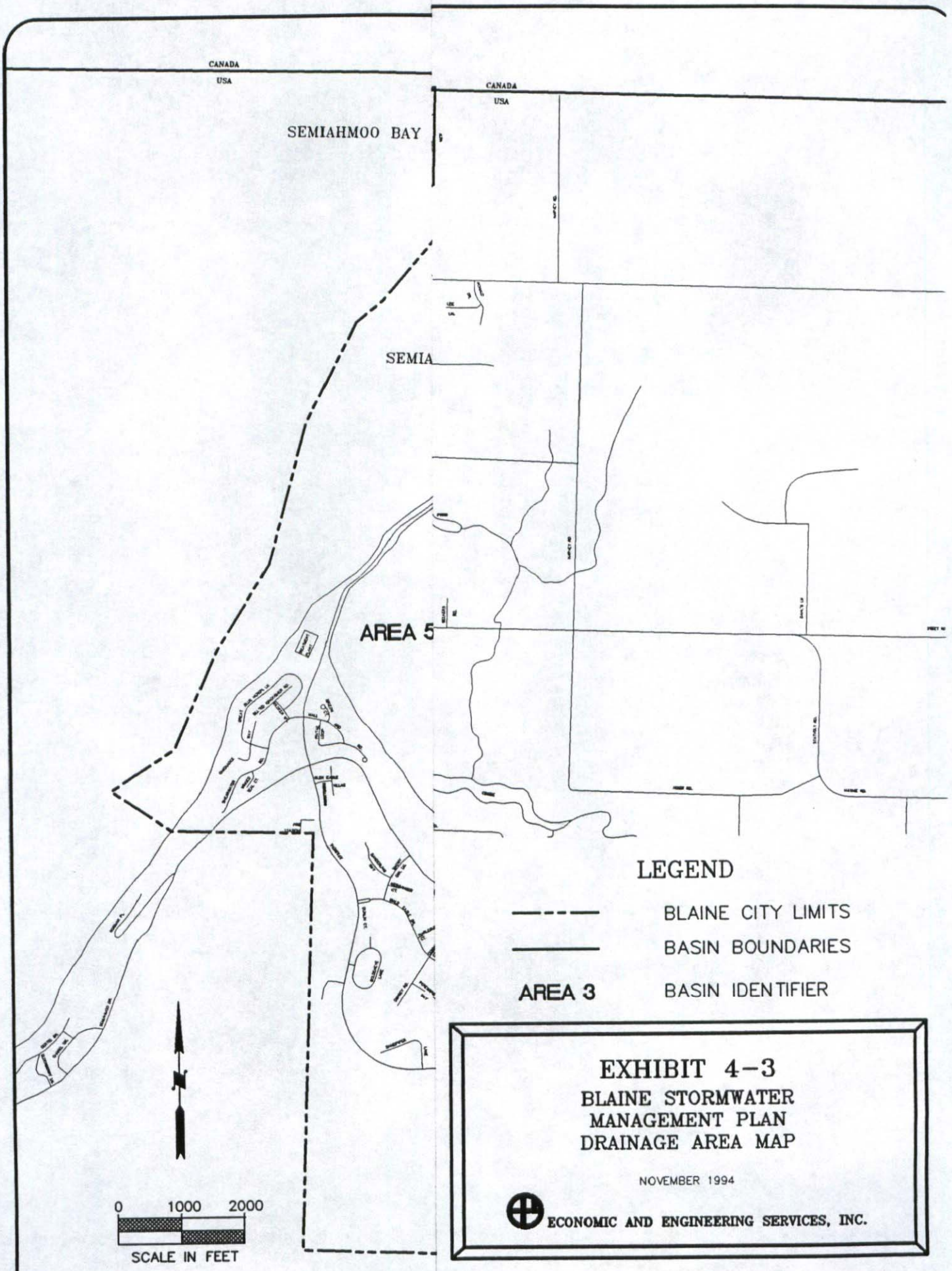
- The Blaine Marina, operated by the Port of Bellingham, which discharges stormwater, marina wastes, and a host of other commercial and manufacturing wastes directly into Drayton Harbor at the base of "D" and "H" Streets.

- The Semiahmoo Marina operated by the Semiahmoo Company, which discharges runoff and marina wastes directly into Drayton Harbor at the north end of the Semiahmoo Spit.

- The Semiahmoo Golf Course and residential developments which discharge urban runoff into Drayton Harbor to the east and to the Strait of Georgia to the west.

- The City sewer collection, conveyance, and treatment system which has had significant stormwater inflow/infiltration problems and has experienced numerous combined sewer overflows into Drayton Harbor during larger storm events. The sewage from the City is pumped through a 14-inch buried fiberglass line to the City's secondary sewage treatment plant located on the southwest side of the Semiahmoo Spit. The discharge from this secondary treatment system is conveyed via a deep water outfall into the Strait of Georgia.

(Note: Because the Semiahmoo Company owns and operates the drainage systems of the entire Resort Semiahmoo and Marina, this stormwater Management Plan has emphasized the drainage and water quality problems primarily associated with that portion of the City located on the eastern side of Drayton Harbor. The Semiahmoo Company is directly responsible to the City for the correct design, construction, operation, and maintenance of all



LEGEND

----	BLAINE CITY LIMITS
———	BASIN BOUNDARIES
AREA 3	BASIN IDENTIFIER

EXHIBIT 4-3

BLAINE STORMWATER MANAGEMENT PLAN DRAINAGE AREA MAP

NOVEMBER 1994

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Semiahmoo drainage facilities, including water quality and regulatory compliance.)

In a similar manner, the Port of Bellingham is directly responsible to the City for all drainage and water quality problems associated with the presence and operation of the Blaine Harbor.

4.3.2 Description and Inventory of the City's Drainage System by Sub-basin

In this section of the report, the results of the site visit have been combined with the visual field inventory and discussion of the various drainage systems within the City. Six major drainage areas have been identified, including the four shown in Exhibit 4-3, as well as Blaine Harbor and the Resort Semiahmoo. (Note: Exhibit 4-3 is the same as Exhibit 2-3 and has been included for the convenience of the reader). The Blaine Harbor area has been shown as Drainage Area No. 5 and the Resort Semiahmoo is presented as Drainage Area No. 6. Within each drainage area, drainage flow patterns and facilities are discussed along with predominant land uses, major drainage facilities and problems, and a list of outstanding drainage related issues and concerns as presented in the various subsections below.

Drainage Area No. 1 - North

The North Drainage Area (Drainage Area No. 1) is relatively small and runs from Semiahmoo Bay along the Canadian Border to 12th Street then south to just south of "D" Street and directly along "D" Street back to the Semiahmoo Bay shoreline, just north of Marine Drive and the Blaine Marina. The area is primarily residential with some highway commercial areas associated with U.S. Customs buildings and the Peace Arch Park. The area slopes downward to the west from 12th Street and continues to be relatively flat with a gentle slope to the west until it reaches the shoreline, where it drops about 50 feet to the water. Soils are poor to moderately draining with a high seasonal groundwater table and considerable developed impervious areas.

There are no major drainage facilities in this area. Drainage is collected along roadside depressions and ditches in the residential areas and in pipes and culverts in the commercial areas. Continuous piping systems occur along "B", "C", and "D" Streets which drain directly to the west and discharge under I-5 into Semiahmoo Bay. Some drainage is also passing into this drainage area from the northwest from adjacent Drainage Area No. 2 via

piping along "D" Street. Drainage from Area No. 2 will increase as the area continues to be developed and annexed into the City. There are local ponding problems during heavy rains which may be reduced or eliminated by enhanced maintenance. There are no major flooding problems. There is little to no treatment of the surface water runoff prior to direct discharge to the marine receiving waters of Semiahmoo Bay. Portions of the drainage system are discontinuous, which also contributes to occasional localized nuisance ponding.

- Results of Field Inventory
  - Predominant Land Uses
    - Mostly older residential development of moderate density.
    - About 33 percent commercial land uses related to highway traffic and businesses.
    - High level of development and impervious surfaces.
  - Drainage Facilities and Problems
    - Mostly open ditches along roads and culvert conveyance systems through commercial areas.
    - Some localized ponding during larger storm events.
    - Poor soils, little direct infiltration.
    - Discharges directly to Semiahmoo Bay just south of Canadian border.
    - Facilities currently have adequate capacity, but lack maintenance.
    - Little detention.
    - Little water quality treatment.
    - In many areas, the drainage system is discontinuous which cause localized flooding problems.

- Drainage Issues and Opportunities
  - Lack of maintenance in catch basins, culvert, and ditches (See Table 3-7, Exhibit 3-2, and Technical Appendix D for list of O&M need).
  - No detention or water quality treatment
  - At least two sites available for water quality treatment:
    No. 1 - Right-of-Way at West end of "C" Street
    No. 2 - Small triangular lot on corner of 1st and "B" streets
- Field Notes
  - Field Note 1-1: Potential Biofiltration Sites

    Extensive time was spent studying the flows in the northwest portion of Blaine in the vicinity of "B" and "C" Streets and 3rd and 4th Streets, which presently has no treatment to enhance water quality. These flows can be treated in swales located along the I-5 right-of-way, and in a bioswale located at 1st and "B" Streets. This site appears to be City property which can be readily expanded/ converted in order to provide additional treatment and detention, as required.
  - Field Note 1-2: Treatment for Peace Arch Park Drainage

    The drainage system at Peace Arch State Park was also studied. Drainage from the park combines with the flow in the ditch along the border and outfalls near the Peace Arch. The potential exists for some of the northern City flows to be treated in swales in the I-5 right-of-way, then discharged into this system, as needed.
  - Field Note 1-3: Catch Basin Maintenance

    Numerous catch basins throughout Drainage Area No. 1 are in desperate need of maintenance and cleaning. There was little evidence of any past routine maintenance or debris removal.

Drainage Area No. 2 - Northeast

The Northeast Drainage Area (Drainage Area No. 2) is also small and is about the same size as the North Drainage Area No. 1, just to the west. Approximately one-third of the area is within the City Limits with the remainder of the area lying within unincorporated Whatcom County (County). The area within the City is bounded by 12th Street to the west,

runs along the Canadian border to the north, east to the City limits about three or four blocks past 16th Street, and then down to "D" Street and back over to 12th Street. Development in this area of the City is relatively sparse and would be classified as low density residential within the City limits and rural within the areas of the unincorporated County. There is a little highway commercial activity along 12th Street and the Truck Route in the vicinity of the U.S. Customs facilities. Soils are moderate to rapidly draining with a seasonally high groundwater table which contributes to seasonal ponding throughout the area. Topography within the City gently slopes to the northeast into Canada.

There are no major drainage facilities within this area. Drainage is collected primarily in open roadside ditches and depressions, even within the residential areas. A small portion of the drainage system has been placed in pipes along "D" Street. Within the City, a portion of the surface water runoff is collected and directed to "D" Street culvert where it continues to flow down "D" Street into Drainage Area No. 1 and ultimately into Semiahmoo Bay. The rest of the drainage within the area appears to flow to the northeast into Canada, using the relatively unaltered natural drainage system.

Similar to Area No. 1, Drainage Area No. 2 has seasonal local ponding problems, but no major flooding problems. Parts of the drainage system in this area have minor blockages, slope in the wrong direction, and/or are discontinuous. These features combined with seasonal rains and seasonal high groundwater contribute to localized and seasonal ponding problems.

There is little treatment of the surface water runoff prior to collection. City runoff flows directly to the piping system along "D" Street, while the rest "sheet-flows" into Canada. However, in the deeper, more vegetated ditches some bio-filtration is likely occurring. The amount of runoff within this area will greatly increase as development continues to occur. Special drainage design criteria should be considered for all new development in this area; including on-site retention/detention.

- ❑ Results of Field Inventory
  - ■ Predominant Land Uses
    - Sparsely developed, one and five acre lots are common.
    - Residential area of moderate to light density (70 percent).
    - Includes some commercial development along highway truck route (30 percent).

- Drainage Facilities
  - Road side ditches and drainage swales.
  - No continuous drainage system - major drainage is in a pipe along "D" Street which collects drainage from side streets.
  - A number of culverts have been installed to relieve local drainage.
  - A number of wet areas and large wetlands.
  - No major flooding problems.
  - No citizen complaints.
  - Poor soils for infiltration.
  - City runoff discharges down "D" Street into Area 1 and ultimately into Semiahmoo Bay.
  - Some discharges believed to flow northward into Canada or into east-west ditch along the border.
- Drainage Issues and Opportunities
  - Little maintenance of catch basins, culverts, or ditches (See Appendix D for list of O/M needs).
  - No detention.
  - No water quality treatment.
  - Land is available for treatment - need to identify sites and types of facilities.
  - Much of new development pressures will substantially increase volumes of runoff with this area; on-site best management practices (BMPs) and detention will be needed.
- Field Notes
  - Field Note 2-1:

    The area north and east of the ridge near "D" Street appears to flow into Canada. Runoff from this area will likely best be served by BMPs and road cross-sections with bioswales as the area develops.

Drainage Area No. 3 - North-Central

The North Central Drainage Area (Drainage Area No. 3) is the largest, most diverse and most developed of the City's drainage areas. It includes the City business center, manufacturing, offices, schools, the City airport, highways (I-5), and moderate density residential land uses. It also includes a less developed unincorporated area of the County just to the east of the City's eastern City limits. The drainage basin begins at the mouth of Cain Creek, just east of the Blaine Marina, goes east along "D" Street across the City limits to Jerome Street. From there it follows the natural drainage contours south to where it crosses the City Limits about half a mile south of Pipeline Road. The southern boundary extends from the eastern City limit crossing at Pipeline Road north westerly to the intersection of I-5 and the Truck Route, then westerly along Adelia Street to Garfield, then in a northwest direction all the way up to Peace Portal Drive and the 60-inch culvert which carries the Cain Creek discharge into Semiahmoo Bay, just east of the Blaine Marina. The soils of the area are naturally poorly draining with little infiltration. What natural drainage qualities these soils may have had originally have now been substantially altered by high density development and its associated impervious area. Topography is flat to gently sloping and includes the entire watershed area of Cain Creek which originates in a series of wetlands just south of the airport. The Creek crosses under I-5 at about Cedar Street and parallels the path of the I-5 freeway to its point of discharge into Semiahmoo Bay just west of "D" Street and just east and north of the Blaine Marina.

The drainage facilities in Drainage Area No. 3 consist primarily of medium to large networks of culverts and pipes with some open ditches. Almost all drainage, including the discharges from these networks of culverts and the I-5 freeway, discharge up and down into the various reaches of Cain Creek. The channel of Cain Creek is a series of natural retention/ detention ponds which appear to be providing some biotreatment of almost all drainage leaving this watershed (Although there is no water quality data to confirm this). The upper reaches of the watershed, just south of the airport, are relatively undeveloped and consist of a series of moderate to large interconnected wetlands. Man-made drainage improvements include on-site detention on the newer developments. However, much of this area is older with few drainage improvements. The City is beginning to include a few state-of-the-art treatment facilities in ditches along Boblett Road and other areas as opportunities allow.

As with other areas of the City, there are no major flooding problems in Drainage Area No. 3, but there are numerous localized nuisance ponding problems that occur seasonally with the heavier rain events. The existing drainage system would benefit from an enhanced maintenance program.

Characteristic of other parts of the City, minor blockages, inappropriate ditch and pipe slopes, and discontinuous reaches of the drainage system are also contributing to the localized problem areas.

Other than a few on-site systems, the City's facility on Boblett Road, and the "natural" treatment occurring in Cain Creek, little water quality treatment has been put in place relative to the large amount of development that has occurred in this area. Regional detention and biotreatment facilities should be considered for this area as recommended in the 1989 Stormwater Plan. Potential sites may be available, just below the Boblett Street discharge, both upstream and downstream along Cain Creek, just off of Peace Portal Drive, before Cain Creek enters into a 60-inch pipe and discharges into Semiahmoo Bay.

Of major concern in Drainage Area No. 3 is pollution from the numerous manufacturing, commercial, airport, and highway areas. Pollutant loadings should be kept to a minimum, and the entire area would benefit from a source control program, on-site water pollution control plans, and spill response programs. These controls are required by Ecology under the State's NPDES Stormwater Permitting Program and should already be in place by the various property owners. It should be noted that the City routinely cooperates with Ecology in administering short-term industrial NPDES Stormwater permits for erosion control on those developments of 5 acres or more.)

- ❑ Results of Field Inventory

  - ■ Predominant Land Uses
    - Drains about 50 percent of the City's present land area.
    - About 50 percent older, high to medium density residential developments.
    - About 50 percent manufacturing, commercial, and public uses, includes the Blaine airport, I-5, truck routes, school campus, and adjacent shopping mall.

  - ■ Drainage Facilities
    - All drainage in this subbasin goes into Cain Creek, which discharges into Semiahmoo Bay.
    - Well established drainage system with many small impervious lots.
    - Area around airport is primarily ditches with some piping.
    - There is a large detention facility for drainage from the airport shopping mall area adjacent to Grant Avenue.

- New school development is adding detention and a large biotreatment swale that will treat all airport area drainage.
- Historically, some manufacturers have discharged directly into ditch drainage system and caused localized pollution of stormwater system. (The Department of Ecology sent a crew to monitor the "spill").
- There are a number of culverts directed into Cain Creek up and down the length of the drainage channel, including drainage from I-5 which discharges directly into Cain Creek.
- About 50 percent of the Cain Creek drainage channel has been put into a pipe; a number of the segments of the remaining stream channel are large wet areas, functioning as regional treatment and detention facilities, which are interconnected with the piped segments of the channel.
- Major flooding was reported in 1980 when the 60-inch culvert underneath the present Volume Shoe Store was blocked with debris.
- Large number of wet soil areas and wetlands.
- No routine flooding or citizen complaints.
- Poor soils for infiltration.

■ Drainage Issues and Opportunities

- Little maintenance: catch basins and ditches need clearing (See Table 3-7, Exhibit 3-2, and Technical Appendix D for a list of O&M needs).
- Main drainage corridor needs debris and vegetation removal, channel needs to be "opened-up," a number of trash racks are needed to catch debris and prevent flooding.
- Some detention provided in newer developments.
- Some water quality treatment being put in with new developments.
- Needs more water quality treatment.
- Education and source control may be needed in manufacturing areas.

- Spill response planning for freeway and manufacturing areas needed.
- Some water quality monitoring is needed to identify non-point source.
- Wetlands south of airport, functioning as a large detention and treatment system, need to be protected.
- Amount of detention and water quality treatment need to be increased; sites and facilities need to be identified, designed, and constructed; possible site at Boblett and "H" Streets.

■ Field Notes

- Field Note 3-1: Treatment of "D" Street Drainage

  Flows from "D" Street do not appear to have adequate treatment. These flows collect locally and ultimately combine with flows from the northeast and southeast portions of Blaine in the channel of Cain Creek west of I-5. All of these combined flows then travel through a 60-inch diameter and outfall into Semiahmoo Bay. A location was noticed near the 60-inch pipe along the railroad tracks near the marina just west of Peace Portal Drive, which should be investigated for potential biofiltration or a pond-type facility to treat the runoff from these areas prior to discharge into the bay.

- Field Note 3-2: Treatment of 8th and "H" Street Drainage

  Flows, from the piped system bordered by 8th Street on the west, "H" Street on the south, Truck Route on the east, and "D" Street on the north, go under the school property, and can be treated on the west side of I-5 in the existing channels of Cain Creek, after it combines with flows from the Grant Avenue and Boblett Street areas.

- Field Note 3-3: Treatment of "H" Street and County Drainage

  The north/south ditch on northeast corner of "H" Street and the Truck Route is an ideal location for a biofiltration swale. This is a Washington State Department of Transportation (DOT) right-of-way and needs DOT concurrence. The ditch needs some shaping and/or minor redesign. Heavy maintenance, mostly trash removal, but also some vegetation management is needed. The north/south ditch on the southeast corner of "H" Street and Truck Route is also an ideal location for a biofiltration swale. This ditch also needs

heavy trash maintenance and some vegetation management. Both of these two ditches would be able to treat the drainage from the area northeast of "H" Street and the Truck Route up to the top of the ridge (including flows from the County which are outside of the City limits). (DOT right-of-way needs State approval)

- Field Note 3-5: Grant Avenue/Airport Shopping Mall Detention Basin

  The facility denoted as "Detention Basin" on Grant Avenue is a constructed wetland/bioswale which collects drainage from Grant Avenue and the adjacent shopping center. The facility appears to be appropriately designed. However, it is badly in need of maintenance, particularly litter clean-up. Two private oil water seperators which discharge near the shopping center were observed flowing into the pond (maintenance and/or repair of these oil separators is a private, not City, responsibility). This pond should be adequate to treat the shopping center and Grant Avenue runoff if maintained properly. Downstream, this runoff will receive further treatment in the future swale presently under construction on Boblett Street just south of the school.

- Field Note 3-6: 12th Street Biotreatment Site

  The north/south ditch located on the east side of 12th Street, between "H" and "D" Streets, also could be used for biofiltration. The ditch needs minor redesign and/or some shaping along with vegetation and maintenance. There is a culvert running east/west beneath the Truck Route which drains into this ditch. The origin of this culvert is unknown as no ditch was found on the east side of the Truck Route. This 12th Street ditch will treat part of the Truck Route up to "D" Street (Port of this site is owned by the WSDOT).

- Field Note 3-7: Treatment for Boblett Street Area Drainage

  The southeast portion of the City down by the City shops is of relatively low density and generally undeveloped. A significant portion of the area is wetlands and has numerous existing channels which are currently providing effective treatment. These flows eventually combine with flows from the northeast portion of Blaine, in the drainage channel of Cain Creek, located on the west side of I-5 near Boblett Street. Additional treatment can be attained in the channels of Cain Creek west of I-5 in addition to on-site BMPs installed as the area develops.

Drainage Area No. 4 - West and South

Drainage Area No. 4 lies along the eastern shore of Drayton Harbor and runs almost the entire north/south length of the City. It is a relatively long and narrow area of land that includes a portion of the commercial area of the City and medium to low density residential use with smaller amounts of marine commercial, highway/commercial, and manufacturing uses. A large portion of the I-5 freeway system is located within this drainage area which extends from the City's southern limits to the Truck Route turnoff. The area also has a continuous section of the Burlington Northern rail line which generally parallels I-5 and a major length of the shoreline along Drayton Harbor. Soils within this area are poor to moderately draining and have been substantially altered by development and the creation of numerous impervious surfaces. The topographic relief of this area is minor, with no point above 50 feet, and most areas relatively flat or gently sloping west towards Drayton Harbor. The southern portion of this area is particularly flat and contains numerous wetlands. The north half of this area is densely developed while the southern portion of the area is only sparsely developed.

There are no major drainage facilities present in this Drainage Area No. 4. The existing drainage system consists of a series of roadside ditches and culverts. Generally, the drainage system in the northern more commercial area consists of culverts running south down Harrison, Blaine, Garfield, and Mitchell Avenues which go underneath Peace Portal Drive and the railroad, and discharge directly into Drayton Harbor. Smaller and discontinuous pipe and ditch drainage systems exist along 4th and 3rd Streets, Peace Portal Drive, and Madison Avenue which also directly discharge into Drayton Harbor. A small piped system has been placed along Albert Avenue in a natural drainage swale that flows west, discharging under Peace Portal Drive and the railroad tracks into Drayton Harbor. The remaining portions of this drainage area, south of Albert Avenue, have few piped systems and consist of shallow roadside ditches and naturally occurring wetlands and drainage areas which flow to the west and south into Drayton Harbor.

Drainage problems are localized and seasonal. There are no major flooding problems. Parts of the drainage system in this area have minor blockages, inappropriate slopes, and in places discontinuities. Similar to other areas within the City, these drainage system irregularities, combined with seasonal rains and a high groundwater table, contribute to the area's localized ponding problems. Little water quality treatment occurs within this drainage area. Most pollutants are picked up by the surface water runoff and carried directly into Drayton Harbor. Historically, this area has been subject to sewer overflows, which have been recently eliminated by the City (1993). The City has recognized these water quality problems and has begun to include water quality treatment facilities in the design and restoration of

the City's road, sewer, and utility improvement projects. Sewer overflows are being reduced as part of upgrades to the City sewer treatment plant. Improvement District No. 27 (LID-27) has recently installed two oil/water separators at the end of the drainage pipes that drain Boblett Street, Mitchell Avenue, and Peace Portal Drive, just prior to discharge to Drayton Harbor.

- ❑ Results of Field Inventory
  - ■ Predominant Land Uses
    - Marine commercial (5 percent).
    - Commercial and offices (30 percent).
    - Residential–medium density (30 percent).
    - Residential–low density (25 percent).
    - Manufacturing (10 percent).
    - Burlington Northern rail line all along the shoreline of Drayton Harbor.
  - ■ Drainage Facilities
    - Mostly older piped systems with some ditches.
    - All drainage goes directly into Drayton Harbor.
    - Area is characterized by a number of small impervious drainage subbasins and catchment areas which flow through pipes into the harbor, all along the shoreline from the month of Dakota Creek north to the Blaine Marina.
    - Receives some I-5 drainage and a lot of road runoff from residential streets and Peace Portal Drive.
    - Numerous drainage culverts pass underneath the Burlington Northern rail-line.
    - Most of the shoreline is rip-rapped to protect the railroad grade.
    - Numerous wet areas and wetlands South of Albert Avenue.
    - Southern portion of the basin is rural and only sparsely developed.
    - North and central portions of the basin are residential and contain the central business area.
    - Poor soils for infiltration.
    - No major flooding, no citizen complaints.
    - LID-27 has put in a new drainage system with water quality treatment and two oil/water separators.
    - Sewer Overflows are being reduced.

- Drainage Issues and Opportunities

  - Catch basins, culverts, and ditches need maintenance (See Technical Appendix D for a list of Operation and Maintenance needs).
  - Spill response is needed for roadways and especially for the highway and rail line.
  - Little to no water quality treatment (except LID-27).
  - Commercial areas need source control program.
  - Residential areas need water quality education.
  - Water quality monitoring needed.
  - LID-27 improvements have substantially upgraded the drainage system throughout a significant portion of this subbasin, by both reducing sewer overflows and treating stormwater prior to discharge into Drayton Harbor.

- Field Notes

  - Field Note 4-1: LID-27 Drainage/Treatment System

    For the south/central part of Blaine, near Boblett Street, Peace Portal Drive, and Mitchell Avenue, the new stormwater system installed by LID-27 appears appropriate for both flow control and treatment. This new drainage system has also eliminated a majority of the groundwater inflow and infiltration problems that have historically occurred in this area. The oil/water separators located at the downstream end of the streets (along Peace Portal Drive) will treat the "water quality storm" (6-month, 24-hour event) and are equipped with bypasses for the larger storm events. Flows from the oil/water separators discharge down a steep slope, then under the railroad tracks and into Drayton Harbor. (A preliminary idea was to treat the area's runoff near the tracks, between the tracks and the shoreline, but steep slopes and limited space may limit the use of this alternative.)

  - Field Note 4-2: Drainage South of Mary Avenue

    The southern portion of town (south of Mary Avenue and west of I-5) is relatively flat with low density development. Actual

stormwater flow routing is difficult to determine without extensive analysis. This area is likely best served by on-site BMPs as the area develops.

Drainage Area No. 5 - Blaine Harbor

The Blaine Harbor area has been included in this study and identified as Drainage Area No. 5. A detailed site inspection of this area was not performed. However, a number of issues regarding drainage discharges and, particularly, water quality enhancement are relevant to this study. It is critical that Blaine Harbor, which is owned and operated by the Port of Bellingham, is operated in a manner consistent with the City's Stormwater Management Plan and the Puget Sound Water Quality Management Plan.

The Blaine Harbor area is one of the most densely developed areas within the City. The level of development, as well as its manufacturing and industrial land uses, make it potentially one of the greatest sources of pollutant loading to Drayton Harbor. The area has little land area available for biotreatment, so all water quality and drainage controls must occur on-site in the form of effective source control, spill control and prevention. Water pollution control plans should be developed both for the Harbor as a whole and for every major manufacturer that discharges, handles, or stores toxic and/or hazardous materials. It is the responsibility of the Port of Bellingham and the Washington State Department of Ecology (Ecology) to develop, implement, effectively monitor and enforce such environmental controls.

- ❑ Summary of Drainage/Water Quality Comments
  - ■ Predominant Land Use
    - Marine commercial/recreational (50 percent).
    - Marine industrial (50 percent).
  - ■ Drainage Facilities
    - A few culverts.
    - Most drainage runs off directly into the harbor.
    - Lots of industrial activities (i.e., fish processing, ship building/ refinishing, center for fishing industry and fleet, industrial marine suppliers etc.).
    - Site of sewage pump station and occasional combined sewer overflows, sewer system is being required to be upgraded.

- Drainage Issues
  - No water quality treatment and little land area available for future treatment facilities.
  - Source controls and treatment prior to discharge needed for manufacturers.
  - Spill containment program needed.
  - The City needs to work cooperatively with the Port of Bellingham.
  - On-site water quality monitoring needed.
- Field Notes - None
  (No site visit was undertaken of the marina area)

Drainage Area No. 6 - Resort Semiahmoo

Drainage from the Resort Semiahmoo is the responsibility of the Semiahmoo Company; however, the quality of the runoff leaving the Resort Semiahmoo is the responsibility of the City and has therefore been included in this Comprehensive Stormwater Management Plan.

The drainage from the Resort Semiahmoo takes the form of three different types of runoff and originates from three very different types of land use: 1) golf course operation and maintenance; 2) residential and commercial construction and development; and 3) recreational marina operation.

Golf Course Operation and Maintenance - The golf course appears to have adequate drainage controls and utilizes two regional collection facilities to intercept excessive runoff and provide seasonal irrigation. Some settling and biotreatment is also likely occurring in this system of vegetated drainage swales and ponds. Overflow from one pond goes through a vegetated area into Semiahmoo Bay, while the other pond flows to the east into the residential and road side drainage system that ends in Drayton Harbor.

The use of pesticides, herbicides, and fertilizers is largely unknown for the Resort Semiahmoo. Of particular concern is the drainage from the second pond that also collects residential and road runoff and is discharged without any additional treatment directly into Drayton Harbor. Drayton Harbor, like most of Puget Sound, is nitrogen limited. Nutrients such as nitrates are difficult to effectively treat and could negatively impact Drayton Harbor along with other pollutant loadings carried in with this type of urban runoff.

Residential/Commercial Construction and Development - Residential and commercial land uses have initial construction related erosion, drainage, and habitat impacts, as well as long-term impacts from urban runoff. The Resort Semiahmoo has attempted to take both types of drainage impacts into account as it built and currently operates its facilities. Because of the sensitive nature of Drayton Harbor, it would be very beneficial to monitor pollutant loadings draining from these various development sites and to monitor the effectiveness of the various existing drainage and treatment facilities and on-site BMPs.

Marina - Perhaps the area that has the greatest potential for drainage and water quality impacts is the construction and operation of the various marina restaurant facilities. The restaurant/hotel area has waste, maintenance, and parking lot pollutant-related issues. The marina has significant potential drainage impacts including the use of sewage pump-out facilities by boaters, boat and fuel/oil operational issues, spill and emergency response protection, boat maintenance and restoration impacts, and fish cleaning and waste disposal related concerns.

Conclusion/Recommendations - The Resort Semiahmoo should develop and submit to the City drainage and water pollution control plans for each of these three different types of land uses.

The following comments are estimates only. Complete drainage plans were not available from the Resort Semiahmoo for this study.

- Summary of Drainage/Data Quality Concerns
  - Predominant Land Use (estimates)
    - Residential - 30 percent.
    - Commercial - 20 percent.
    - Golf Course - 40 percent.
    - Marina - 10 percent.
  - Drainage Facilities
    - Golf Course - two detention ponds and a series of pipes and vegetated drainage swales.
    - Residential/Commercial Developments - roadside ditches and pipes. Some biotreatment may be occurring in roadside ditches; regional detention; limited on-site detention.

- Marina - Series of pipes and ditches and/or runoff, and direct discharges into Drayton Harbor and Semiahmoo Bay with little to no treatment, spill response, or water pollution control plans.

■ Drainage Issues

- Need complete set of digitized as-built drawings for all developed Semiahmoo areas and drainage facilities.
- Need operation and maintenance plan submitted to, and approved by, the City on an annual basis.
- Need on-site monitoring to verify the effectiveness of drainage and treatment controls.
- From outfall data from Semiahmoo, additional treatment and/or detention are needed, existing treatment is not adequate.
- Marina should have a water pollution control plan that includes spills, emergency response, sewage pumpout, boat/fuel operation, maintenance and repair procedures, etc.

■ Field Notes
None (No site visit was made of the Resort Semiahmoo area)

Summary of Existing Drainage Problems and Stormwater Issues

❑ Drainage Issues

Based on the field inventory of the City's drainage system and the above analysis by each major drainage areas, there are a number of important drainage related issues and challenges to be faced by the City and addressed in this Stormwater Management Plan. These issues include the need to:

- Improve water quality treatment throughout the City.
- Enhance maintenance (see Technical Appendix D for a map and list of Operation and Maintenance needs).
- Protect and preserve wet areas and wetlands.
- Improve drainage standards for new development.
- Develop a spill response program for road, highway, rail, marina, and harbor.
- Require source controls and treatment by manufactures and industries prior to discharge.
- Reduce sewage discharges and combined sewer overflows.

- Sewer those areas with failing septic tanks.
- Provide for groundwater and wellhead protection.
- Work with businesses and homeowners to reduce the use and discharge of pollutants, especially the Port of Bellingham and the Resort Semiahmoo.

These problems will be addressed in the following Stormwater Management Plan by developing a comprehensive Stormwater Program for the City that adopts the City's first stormwater ordinance, improves maintenance of public and private facilities, achieves regulatory compliance, and realizes new sources of revenue which will allow the City to improve water quality, protect the remaining elements of the natural drainage system, and begin source control and public education programs.

4.4 Engineering and Hydraulic/Hydrologic Analysis

4.4.1 Overview

The 1989 Comprehensive Storm Drainage Plan (1989 Plan) provided an engineering and hydrologic modeling assessment of the City which was not duplicated as part of this study and development of the City's Stormwater Management Plan. Rather, the results of this flow and capital facilities analysis were used to complement the water quality and regulatory compliance reviews performed under this study to form a comprehensive Stormwater Management Plan. The recommended Stormwater Management Plan, presented in this document, also presents program costs and financial alternatives for long-term funding the City's emerging Stormwater Management Program.

Presented below, in Sections 4.4 through 4.6, are the pertinent findings of the 1989 Plan and a discussion of the costs of the recommended capital facilities. Major maintenance improvements have been identified in the 1989 Plan along with their relative priority for implementation. The 1989 Plan has been presented in its entirety in Technical Appendix E.

4.4.2 Approach

The 1989 Plan divided the City (excluding the Blaine Harbor and Resort Semiahmoo) into four major drainage areas based on where the surface water runoff was ultimately discharged. These same drainage areas, as shown in Exhibit 4-3, have been generally maintained in the present stormwater planning effort in order to ensure compatibility with the 1989 Drainage Capital Facility Plan. (Note: This 1989 Plan did not include the Resort Semiahmoo (Drainage Area No. 5).

Drainage Area 1: North - discharges directly into Semiahmoo Bay

Drainage Area 2: Northeast - discharges primarily north into Canada

Drainage Area 3: Central - consists of the Cain Creek drainage basin that discharges into Semiahmoo Bay.

Drainage Area 4: West and South - contains numerous small subbasins that discharge directly into Drayton Harbor.

The average annual rainfall was documented to be 32 inches per year and the majority of the City's drainage problems were largely the result of poorly draining silts, blue clay, and glacial till. The geographic areas of each of the above four drainage areas was expanded outside the City limits in the 1989 Plan to more accurately reflect the natural boundaries of the four drainage areas.

The 1989 Plan undertook four main tasks:

Task 1 Gathering data/documents and reviewing past priorities and recommended solutions.

Task 2 Hydrologic modeling and engineering of flows, problems, solutions, priorities, and costs.

Task 3 Preparation of drainage maps of the City and of each of the four major drainage areas.

4.4.3 Hydraulic/Hydrologic Analysis

The 1986 Technical Release No. 55 (TR55), published by the Soil Conservation Service, was used to estimate peak discharges for the 5-year (2.5 inches) and 25-year (3.5 inches) year 24-hour storm events under both existing and future land use conditions. (Note: The 6-month (1/2 of the 2-year event) water quality storm, and the 100-year event often used to size downstream conveyance facilities were not calculated.) Using this TR55 methodology, each major drainage area was divided into numerous sub-basins or catchment areas based on soils, land use, topography, and drainage patterns. Flows for each subbasin were estimated and total to create flow rates and volumes representative of the entire drainage area.

The drainage design goal was to release no more than the 5-year, predeveloped, storm event. The amount of required stormwater detention volume was based on the difference of a 5-year predevelopment storm and a 25-year post development storm under both existing and future land use conditions. A planning period of 15 years was identified, although little new

development was expected to occur in Drainage Area Nos. 1, 2, and 4. Two different future land use assumptions were used for the eastern part of Drainage Area No. 3 to reflect different rates of potential development. A data log was established that contained a summary of discharge data for single and composite hydrographs within each of the four major drainage areas and their respective sub-basins.

4.4.4 Drainage Problems, Alternatives, and Solutions

Results of the Hydraulic/Hydrologic Analysis

Existing and Future Discharge Quantities - The peak stormwater runoff for existing and future land conditions was calculated for each of the four major drainage areas for both the 5- and 25-year storm events. Results for the largest and most significant drainage area, Drainage Area No. 3, are presented in Table 4-1.

Table 4-1
Calculated Peak Flow Rates for Drainage Area No. 3

Area 3 Figure No.	*Peak Flows (CFS) 5-Year Storm	*Peak Flows (CFS) 25-Year Storm	**Peak Flows (CFS) 5-Year Storm	**Peak Flows (CFS) 25-Year Storm	Detention Basin
Figure 1 (Existing)	18	44	88	186	None
Figure 2 (Existing)	35	69	121	235	None
Figure (Existing-Revised)	23	50	86	166	5.1 Ac-Ft
Figure 4 (Future-Revised)	37	65	104	192	10.4 Ac-Ft

* Peak flows at 48" diameter culvert under truck route by City shop.

** Peak flows discharged into Semiahmoo Bay.

Figure 1 Shows the peak flows along the main drainage route for existing storm runoff conditions.

Figure 2 Shows the peak flows along the main drainage route for future storm runoff conditions.

Figure 3 Shows the peak flows along the main drainage route for existing storm runoff conditions with storm drainage runoff revised in Zone 2 and Zone 4 flow into a detention basin as shown. For Phase 1, the detention basin is designed to handle the difference between a 5-year frequency storm and 25-year frequency storm for the revised (R) Zone.

Figure 4 Shows the peak flows along the main drainage route for future storm runoff conditions with storm drainage runoff revised to flow into a detention basin as shown. For Phase 2, the detention basin is designed to handle the difference between a 5-year frequency storm at the predevelopment (existing) condition and the 25-year frequency storm at the future development condition for the revised (R) zone.

List and Location of Drainage Problems

Flows were routed through the existing drainage system for both the 5- and 25-year storm events under existing and future land use conditions. Few capacity or flooding problems were identified under existing land use conditions for either the 5- or 25-year event, except in Drainage Area No. 3. Drainage Area No. 3 had some capacity problems with the pipes under I-5 in the upper reaches of the watershed which caused water to back up on the east side of I-5 into a series of wetlands just south of the airport, which has caused some localized flooding in the past. Table 4-1 shows the need for and effect of, providing 5.1 acre-feet and 10.4 acre-feet of storage in a regional detention basin, just south of the airport.

All drainage areas demonstrated capacity and flooding problems with the 25-year storm event under both the existing and future land use conditions.

Drainage Area No. 1 - Has ponding and backwater effects in the Peace Arch Park Area.

Drainage Area No. 2 - Has substantial sheet flow which is directed toward Canada; future detention will be needed as the area develops.

Drainage Area No. 3 - Needs regional detention now and even more on-site and regional detention in the future; this area has the most significant existing and future drainage problems.

Drainage Area No. 4 - A number of culverts under Peace Portal Drive need to be upgraded. (Note: A number of these improvements, such as those associated with LID-27, have been made by the City since 1989 when this drainage analysis was performed.)

Alternatives to Reduce and/or Control Non-Point Drainage

Potential alternatives to reduce and/or control non-point urban drainage include both structural and non-structural approaches.

Non-structural approaches include:

- Inspect and maintain the existing drainage system to realize its full capacity,
- Control new construction in designing and sizing new drainage facilities, and

- Reduce flows through the drainage flow reductions that may occur when non-structural BMPs/source controls are installed (as presented in Section 3 - Water Quality Assessment of this report).

Structural approaches include:

- Fix small local ponding problems,
- Add regional detention to the existing drainage system, where needed,
- Retrofit and upgrade downstream facilities to add additional storage and conveyance capacity, and
- Reduce flows through the drainage flow reductions that may occur when treatment controls (i.e., structural BMPs) are added to an existing or new drainage system as discussed in Section 3, Water Quality Assessment.

(Note: Source Controls (non-structural BMPs) and Treatment Controls (structural BMPs) are usually designed for the 6-month to 2-year design storm. They are developed to bypass flows from larger storm events and are usually not effective for flow and volume control. Because of the way they are designed to operate, these types of facilities normally provide little flow/flood control capabilities and are not considered viable "stand-alone" solutions to control existing or future flooding or capacity problems.)

To control existing flooding problems, it is always easier and more cost-effective to perform maintenance and fix local problem areas than it is to fund and build large regional facilities. However, if needed, adding regional detention can be an effective way to upgrade an older drainage system. Retrofitting an existing drainage system is almost always cost prohibitive.

To control future flooding problems, the best approach is to adequately control future development. To do this, appropriate design standards need to be developed and enforced, and all new construction closely inspected. Providing adequate on-site detention and proper routine maintenance should also be required. If new development is designed and constructed properly, additional regional detention and/or retrofit of the existing drainage system should not be needed in the future.

Alternative Analysis

Alternative to Regional Detention - In the 1989 Plan, regional detention was compared to upgrading the sizing of all Drainage Area No. 3 drainage facilities to accommodate the future 25-year storm event. The second alternative was determined to be cost prohibitive and not given further consideration.

Approach to Solving Drainage Problems - The same rationale discussed above for Drainage Area No. 3, can be applied to the other three major drainage areas within the City, Drainage Areas Nos. 1, 2, and 4. It is usually best to first repair and adequately maintain the existing drainage infrastructure to realize its full design capacity. Secondly, regional detention and storage should be provided as needed to add additional storage capacity to the system. Adding storage to provide detention is almost always less expensive and more realistic to implement than removing and/or upgrading all downstream drainage facilities. Small facility improvements should be used to solve or reduce localized flooding problems.

The above activities should provide adequate capacity to solve existing drainage problems and meet the drainage needs of the existing land uses. To prevent drainage from future development from contributing to existing drainage problems, adequate on-site detention should be required. Additional future regional detention can also be added on an as needed basis if future on-site controls are not adequate.

Alternative to Reduce and/or Control Non-Point Drainage

The above drainage alternatives are reviewed below in Table 4-2 matrix format.

Proposed Drainage Solutions

- Drainage Areas No. 1, 2, and 4
  - Future drainage facilities should be sized and built as development occurs to accommodate ultimate land use development as defined by the present City zoning map.
  - Existing facilities and drainage systems should be reviewed and inspected with regard to capacity, and upgraded as required using the nomographs provided in the 1989 report.
  - No regional detention facilities are recommended.
  - On-site detention will be needed as future development occurs.
  - Maintenance of the existing drainage system in each of these three major drainage areas is needed.
- Drainage Area No. 3
  - Removal of restrictions that cause flooding and localized ponding throughout the area.

Table 4-2
Evaluation of Drainage Alternatives

Drainage Improvement Alternative	Evaluation Criteria: Cost Efficiency	Environmental Impact	Practicality	Effectiveness	Redundancy	Agency Willingness Implement
For Existing Problems:						
Repair and maintain existing facilities	High	Low	High	Medium	None	High
Fix small local flooding problems	High	Low	High	High	None	High
Add regional detention	High	Medium	High	High	Low	Medium
Retrofit and upgrade all down stream facilities	Low	High	Low	High	High	Low
For Future Drainage Problems:						
Provide on-site detention	High	Low	High	High	None	Medium
Adequately maintain	High	Low	High	High	None	High
Add regional detention	High	Medium	High	High	Low	Medium
Retrofit downstream facility	Low	High	Low	High	High	Low

- A major ditch cleaning program is recommended. The single largest factor contributing to the lack of capacity of the existing drainage system is the lack of maintenance, particularly of the main channel of Cain Creek where it goes under I-5 near the I-5/Truck Route intersection to where Cain Creek discharges into a 60-inch culvert that goes under Peace Portal Drive. Vegetative growth and debris are significantly reducing available existing drainage flow capacity; backwater effects are evident for the 5-year storm event under present land uses.

- Repair and add a trash rack to the box culvert under Peace Portal Drive; flow restrictions are presently occurring in the facility.

- Construct a 5.1 acre-feet detention pond, just southeast of the airport when growth in the eastern part of Drainage Area No. 3 reaches about 25 percent; increase the size of this facility to 10.4 acre-feet when development reaches over 50 percent. The 10.4 acre-feet of storage would be adequate to accommodate all future drainages when this area is fully developed.

- Require adequate on-site detention for all new development.

- Under the 25-year future land use conditions, a second 36-inch line will be needed, at 25 percent development, under I-5 just west of the I-5/Truck Route intersection to pass the regional drainage coming down Boblett Street and flowing into Cain Creek.

- Additional culvert upgrades will be needed, at 25 percent buildout, under I-5 and Mitchell Street to handle the 25-year future storm event.

(Note: The 1989 Plan recommended eventually putting the entire Cain Creek drainage channel into a large culvert. This is not recommended because it removes any opportunity for water quality treatment presently occurring with the system of regional detention ponds interconnected by short sections of culvert. This present system is in effect a multi-celled water quality treatment facility and should not be modified other than by routine maintenance and repairs, on an as-needed bases.)

4.5 Facilities, Solutions, and Costs for Drainage Control

4.5.1 Overview

The 1989 Plan concluded that the City needed to implement a series of capital improvements over a 15-year planning period and develop, and annually conduct, an effective City-wide inspection and maintenance

program. The timing and priority of the needed capital improvements, which were primarily located in Drainage Area No. 3, were based on the rate of development east of the Truck Route and in the area around the City airport. The priority and cost of the recommended improvements are presented in the Capital Facility Plan below. Total capital costs range from $710,000 to $800,000. Priorities and activities for the recommended Operations and Maintenance Plan are also listed below. Annual costs of maintenance would be estimated following a more complete inspection and inventory of the City's various drainage facilities.

4.5.2 Recommended Drainage Capital Facilities Plan and Costs

Presented below in Table 4-3 is the recommended Capital Facility Plan for the City for the 1989 Plan.

Table 4-3
Capital Facility Plan for the City of Blaine

Priority	Activity	Drainage Area	Cost *
1	Clean main channel of Cain Creek	3	$10-20K
2	Repair the 60-inch box culvert under Peace Portal Drive	3	$100-150K
3A	Construct 5.1 acre foot detention facility, and	3	$120-200K
3B	Add a second 36-inch pipe west of the Truck Route	3	$140-180K
4A	Add a 36-inch culvert at Mitchell Street, and	4	$200-300K
4B	Add a 30-inch culvert under I-5	3	$60-100K
4C	Enlarge culverts discharging up and down the length of the main channel of Cain Creek	3	No costs presented
5	Construct an additional 5.3 acre feet of storage	3	$80-150K
	Total		$710K-$800K

* Note a range of costs have been added to update the cost estimates presented in the 1989 Plan.

4.5.3 Recommended Drainage and Operation and Maintenance Plan

The following Table 4-4, lists the various maintenance activities and their relative priority, as presented in the 1989 Plan.

Table 4-4
Operations and Maintenance Plan for the City of Blaine

Priority	Activity	Drainage Area	Cost *
1	Inventory all drainage facilities and annually inspect, record results, and create an effective annual O/M work program.	All Areas	------
2	Conduct maintenance in order of priority on Cain Creek channel and all culverts and swales beginning with the largest diameter structures first.	All Areas	------
3A	Conduct regular annual maintenance as needed to keep the system running effectively.	All Areas	------
	Maintenance cost would be estimated based on the annual inspection program and facility needs.		Not Determined

4.5.4 Hydraulic/Hydrologic Analysis and Recommendations for the Resort Semiahmoo and Blaine Harbor

Hydraulic/Hydrologic Analysis for the Resort Semiahmoo

Analysis of the Semiahmoo area was not included in the City's 1989 Plan.

A separate Preliminary Drainage Plan was developed for the Resort Semiahmoo in 1984 and has been included in this plan as Technical Appendix F. The plan used the SCS TR55 model, similar to the City's 1989 Plan, for the 25-year, 24-hour storm event to estimate existing and future flow rates. (Note: The runoff from the 6-month 24-hour, and 100-year 24-hour, storms for water quality and conveyance were not calculated).

Seven drainage sub-basins were identified. Four of the largest, which include almost all of the upland areas of the Resort Semiahmoo on top of Birch Point, drain into Drayton Harbor. The other three are much smaller steep drainages that flow into Semiahmoo Bay. Drainage from existing and proposed future land use conditions were estimated.

The proposed drainage plan was to capture the drainage that flows to the southwest, retain it in a pond, and discharge it at a rate no greater than the predevelopment rate. Discharges to the north and west were to be collected in pipes and discharged into a road ditch and existing drainage gully that flows directly into Drayton Harbor. Most of the drainage was to be carried in pipes. However, some biofiltration was to occur in the drainage swales of the golf course. The drainage schematic from the October 1984 Master Plan for Semiahmoo shows no detention or treatment of the drainage that enters

Drayton Harbor. This 1984 Drainage Plan and the drainage excerpt from the 1994 Master Plan are included in Technical Appendix F.

While the Semiahmoo Drainage and Master Plans took the water quality of Drayton Harbor into account, it is now time to review the original drainage assumptions, model the hydraulics of the actual drainage system, and use the results of outfall monitoring from the development to improve and add additional water quality treatment facilities and land use practices.

Hydraulic/Hydrologic Analysis for the Blaine Harbor

No drainage plan has ever been prepared for the Blaine Harbor area. While drainage considerations were taken into account as the harbor developed in an incremental manner, it is now time to model and assess the adequacy of the harbor's existing drainage and water quality treatment facilities. It is also time for the Port of Bellingham to inventory and map its drainage system, monitor outfalls and waste discharges, and add the water quality treatment facilities needed to realize the objectives of the Drayton Harbor Watershed Action Plan.

Stormwater Assessment and Recommendations

Based on information made available by the City and the Resort Semiahmoo it is recommended that:

- ❑ The existing drainage system be inventoried, mapped, and digitized into a GIS/CADD system and transmitted to the City;
- ❑ Hydraulic modeling be performed on the existing facilities and new proposed developments and compared to the original drainage plan;
- ❑ A new drainage master plan be developed for complete buildout of the site, marina, and spit areas;
- ❑ Discharge flows and water quality monitoring be performed for all major drainages leaving the site and being discharged into the Semiahmoo Marina;
- ❑ Additional treatment be added to treat all drainage leaving the site;
- ❑ A pollution prevention plan and spill response plan be developed and implemented for the Semiahmoo Marina; and
- ❑ The Resort Semiahmoo comply with the seven elements required for compliance with the State's Basic Stormwater Program, by developing and submitting a regulatory compliance document for the entire Semiahmoo development for the City to submit to Ecology for review and approval.

Section 5
Existing Stormwater Program and Regulatory Compliance

5.1 Overview

Section 5 reviews both the City of Blaine's (City) existing Stormwater Program and the requirements for compliance with the State's Basic Stormwater Program. An analysis of the existing program identifies what changes and enhancements are needed in order to either improve local services and/or comply with the various regulatory requirements. Each element of the Stormwater Program is reviewed and separately compared with each of the regulatory requirements. A list of improvements is presented to enhance both the City's existing Stormwater Program and to meet the existing Stormwater regulations. Short- and long-term implementation activities and priorities are identified for inclusion in the Stormwater Management Plan and are presented in Section 6. This section parts on administrative/management analysis, regulatory compliance, and programmatic evaluation.

5.2 Administrative/Management Analysis of the City's Existing Stormwater Program

5.2.1 Introduction

The following section discusses the need for and evolution of, stormwater management within the City of Blaine. The existing authority and present scope of services of the City's Stormwater Program are reviewed. Stormwater goals and objectives are presented along with activities for their effective implementation. A summary of the program's current funding, organization, and staffing is presented along with a list of the program's recent accomplishments.

5.2.2 Need For and Role of the City's Stormwater Program

Most local governments in the Northwest were first introduced to the need for stormwater management to control flooding, protect roads and structures, and generally provide for public safety and welfare. In the 1960s and 1970s, the scope of stormwater management began to expand to control the increasing impacts of urban development. The increased runoff from developments throughout the region caused erosion, scoured our streams,

transported pollutants, and deposited sediment into our lakes, wetlands, and estuaries.

To control the impacts of urbanization, most larger cities and counties developed design standards to reduce runoff from new development and to protect urban streams. Some governments, including the Cities of Seattle, Bellevue, and Olympia, and the Counties of King, Snohomish, and Thurston, set up separate divisions for stormwater management, usually within their engineering or public works departments.

As a result of amendments to the federal Clean Water Act in 1985, and the formation of the Puget Sound Water Quality Authority (PSWQA) by the State Legislature in 1986, the scope of stormwater management services has expanded from development control and fish habitat protection, to include non-point source pollution control, public education, water quality monitoring, wetland preservation, and groundwater/wellhead protection as well. Local governments that have established stormwater utilities are using these programs to form and fund comprehensive and integrated water resource management programs to meet the requirements of the PSWQA Management Plan and to comply with the new National Pollution Discharge Elimination System (NPDES) Stormwater Permits. Those governments that are also water supply purveyors, are beginning to realize the direct relationship between stormwater management, wellhead protection, and the preservation and usage of local groundwater aquifers. The needs and services of comprehensive stormwater management for these agencies have evolved into integrated water resource management programs.

Today, most local governments could not effectively oversee the area's water resources without dedicated funding sources, qualified technical staff, and an integrated water resource management program. The services provided by most of these comprehensive stormwater/water resource programs include:

- ❑ Developing design standards for new developments,
- ❑ Conducting plan reviews of new building permits,
- ❑ Maintaining drainage infrastructure,
- ❑ Performing basin watershed studies,
- ❑ Designing, funding, and building needed capital facilities,
- ❑ Undertaking wellhead plans and protecting groundwater resources,

- Protecting and enhancing water quality, wetlands, streams, lakes, and habitat areas through comprehensive basin and watershed planning and public education and involvement;
- Establishing appropriate legal authority, and developing and enforcing ordinances, design standards, and policies;
- Providing for public education and information to businesses and residents to reduce pollutants and facilitate maintenance of private stormwater facilities;
- Complying with all relevant regulatory standards; and,
- Coordinating effectively with other local governments to develop common use of regional water resources.

The City is faced with the same obligations and responsibilities as other local governments around Puget Sound. Stormwater and water resource management have become a service of considerable prominence and importance, expected by local citizens and required by a host of federal, State, and local regulations. Clearly, there is a significant need for an integrated stormwater management program within the City. The City has an obligation to solve local drainage problems and preserve the area's natural resources, as well as to meet stormwater, groundwater, and water quality requirements. The focus of these services, sources of revenue and level of funding shall be determined by the public, City Council, and City staff.

5.2.3 History of the Program

Historically, water resource obligations of the City have consisted almost exclusively of drainage facility design and flood control. These obligations were the responsibility of the City's Public Works Engineering Department. No special staffing or operating unit was required. Generally, the same engineers who reviewed building permits and designed roads, also addressed drainage design needs as part of the City's review process for the proposed project or building permit. This level of priority and staffing has been typical of most small local governments in the Northwest throughout the 1970s and 1980s.

Today, the City's program is staffed at a level of about 1,000 to 2,000 hours per year, the equivalent of 0.5 - 1.0 staff positions. There is no dedicated stormwater staff. Most of the policy, planning, capital, and technical decisions are made by the City's Water/Wastewater Division Manager and the City Engineer. Annual maintenance, equivalent to about 1,000 hours, is provided by within the existing two-person street maintenance crew.

Stormwater maintenance, consisting primarily of catchbasin cleaning and ditch mowing, uses the vactor truck of the City's Street Maintenance Section.

Funding for the program varies from about $50,000 to $150,000 per year, depending on grants and outside funding for capital projects. Financial resources for stormwater come from the City's Street Maintenance Division which is funded by a combination of local option gas tax revenues, local option property excess tax levy revenues, State motor fuel revenues, a transfer from the Current Expense Fund, and a host of other smaller revenue sources.

5.2.4 Authority and Scope of Services

Authority

The authority for stormwater management lies within the City's general authority to protect the public and structures from flooding, provide for public welfare, and preserve and protect the area's natural environment and resources, including the various elements of the natural drainage system. (i.e., streams, drainage swales, lakes, wetlands, estuaries, wellhead recharge areas, flood plains, and local fresh and marine receiving waters).

The City implements this authority in the services, activities, and programs initiated by the City's Engineering Operations Division (Division) within the Public Works Department. The Stormwater Program is carried out under the direction of the City Engineer Manager who operates under the supervision of the Public Works Director, who in turn, reports directly to the City Manager.

Presented below is a listing of six of the major City codes and ordinances that have been developed by the City to form, fund, implement, and enforce the various aspects of the City's existing Stormwater Program.

Table 5-1
City Codes and Ordinances Related to the Authority and Implementation of the City's Stormwater Program

City of Blaine Municipal Code	Description	Date
Title 15.12	Flood hazard regulations (Ordinance 1535)	1979
Title 17.16	Storm drainage standards for new development (17.16.120) (Ordinance 1712)	1984
Title 16.12	Critical areas ordinances (Ordinances 2066)	1992
Title 16.16	Wetland management and protection (Ordinance 2068)	1992
Title 16.04	SEPA guidelines (Ordinance 1733)	1984
Title 16.08	Shorelines Regulations (Ordinanace 216)	1994

Scope of Services

The range of services and responsibilities of the City's existing Stormwater Program has substantially expanded from its original mission of primarily providing flood control. Today, in addition to its historical drainage design responsibilities, the Division performs a host of planning, maintenance, construction, public education, and response services, including:

- ❑ Review of drainage plans for new development;
- ❑ Development and update of drainage design standards;
- ❑ Design and construction of capital facilities;
- ❑ Implementation of the City's watershed, stormwater, and groundwater management related plans;
- ❑ Maintenance of drainage facilities;
- ❑ Groundwater management through wellhead protection of groundwater aquifers, and implementation of the Blaine Groundwater Management Plan;
- ❑ Water quality monitoring and source control programs (as funding allows);
- ❑ Regulatory compliance as defined by the
  - Puget Sound Management Plan, and the
  - State NPDES Stormwater Permit (when applicable);
- ❑ Wetland and habitat protection and fisheries enhancement/restoration;
- ❑ Formation and administration of stormwater, water quality, and water resource policies;
- ❑ Financial and program management, administration, and implementation;
- ❑ Public education and involvement, as needed; and
- ❑ Complaint and emergency response services.

5.3 Goals and Objectives

5.3.1 Water Resource Goals

The goal of the stormwater section of the PSWQA Management Plan, as described in Ecology's Puget Sound Stormwater Program Guidance Manual for the Puget Sound Basin (p. 10, July 1992) is:

> "to protect shellfish beds, fish habitat, and other resources to prevent the contamination of sediments from urban runoff, and to achieve standards for water and sediment quality by reducing and eventually eliminating harm from pollution discharges from stormwater throughout Puget Sound."

Consistent with the Washington State Department of Ecology's (Ecology) stated stormwater goal, the Public Works Department has established the following five water resource goals, as reflected in the City's 1994 Growth Management Plan (GMA).

- Goal No. 1

  To protect the scenic beauty, water quality, wildlife habitat areas and open spaces which contribute to the quality of life and give the Blaine area and its rural character. (Land use Goal No. 4 - 1994 GMA Plan)

  To be achieved by:

  - Implementing the Drayton Harbor Watershed Action Plan.
  - Developing and adopting a clearing and grading ordinance.
  - By regional coordination and interlocal agreements with the County.
  - Other activities, as defined in the GMA Plan.

- Goal No. 2

  To recognize private property rights and balance the protection of these rights with protection of the environment and greater public welfare. (Land Use Goal No. 5 - 1994 GMA Plan)

  To be achieved by:

  - Reviewing City codes and improvement standards to insure that they are not overly restrictive and are consistent with all federal, State, and local requirements.
  - Other activities as defined in the GMA Plan.

❑ Goal No. 3

To provide the citizens of the City of Blaine and the surrounding communities with quality water service in concert with federal, State, and local requirements. (Utilities Goal No. 1 - 1994 GMA Plan)

To be implemented by:

- Developing a wellhead protection program.
- Implementing a cross-connection control program.
- Other activities, as defined in the GMA Plan.

❑ Goal No. 4

To provide efficient and affordable wastewater collection and treatment facilities which meet the needs of existing and future residents, protect the environment and water quality in Drayton Harbor and Semiahmoo Bay, and comply with State and federal requirements. (Utilities Goal No. 2 - 1994 GMA Plan)

- Eliminating leaks and illicit connections, requiring a separate stormwater collection system for all new development.

- Other activities, as defined in the GMA Plan.

❑ Goal No. 5

To develop and maintain a stormwater retention, collection, and treatment system which provides adequate drainage for land with the City of Blaine and meets applicable state and federal standards. (Utilities Goal No. 3 - 1994 GMA Plan)

To be implemented by:

- Requiring all new development within the City to design and install stormwater collection and treatment systems which comply with the Puget Sound Water Quality Standards Best Management Practices, recommended by Ecology.

- Upgrading existing City stormwater collection and treatment systems to meet applicable State and federal laws.

- Reducing stormwater inflow and infiltration into the City's sanitary sewers by smoke testing and reconstructing sanitary sewers as needed.

- Completing and adopting a stormwater management plan and implementation ordinances consistent with Puget Sound Water Quality Standards.

5.3.2 Water Resource Implementation Policies

From a management perspective, the City's Stormwater Program continuously attempts to achieve the above goals by routinely striving toward the following five main implementation policies:

- Continue to develop and implement a comprehensive stormwater management program consistent with requirements of the municipal stormwater NPDES permit program, as mandated under the federal Clean Water Act, the Puget Sound Water Quality Management Plan, and the Urban Growth Area Plan.

- Continue to work cooperatively with other local governments through joint basin planning in shared drainage basins in order to provide regionally coordinated planning, construction, and maintenance for regional stormwater facilities and stormwater management.

- Continue to encourage public involvement in and support for the City's water resource management program activities.

- Continue to utilize a variety of funding sources for planning, acquisition, and construction projects, in order to minimize program expenditures.

- Continue to achieve the City's Stormwater Program goals in a manner that makes efficient use of limited resources so that the most critical problems are addressed first.

5.3.3 Local Stormwater Program Objectives

On a daily basis, the staff of the City's Stormwater Program:

- Protect and conserve the City's water resources, preserve, and enhance surface and groundwater quality and in so doing, protect the uses of water, the pleasure it provides, and the livelihoods that it supports;

- Eliminate or reduce chronic flooding and erosion to ensure the protection of the public's safety, health, and property;

- Protect, preserve, and enhance shellfish beds, wildlife, and fish habitat, and other resources; and,

- Meet federal and State standards for water and sediment quality by reducing and eventually eliminating harmful pollutant discharges from stormwater.

5.4 Funding, Organization, and Staffing

5.4.1 Funding

The financial support of the City's Stormwater Program comes from the City's Annual Transportation Division Budget (Funds 101 and 330). The City's Transportation Division is primarily funded from local option gas taxes with supplemental funding from State motor fuel revenues, local option property tax levy, and an internal transfer of resources from the City's Current Expense Fund.

The funding of the City's Stormwater Program varies from year to year from about $50,000 to $150,000 depending upon grants, capital projects, equipment needs, maintenance and repair needs, and the use of outside services. In 1992 and 1993, the operating budgets were $42,122 and $15,684, respectively, as shown in Table 5-2. In 1994, the operating portion of the program, which is primarily catch basin cleaning and ditch mowing, was $43,287 (Requested 1994 Budget). This portion of the budget supports about 1,000 hours of a laborer's time (costing approximately $18,300), with $11,500 for supplies and about $13,500 for rentals and outside contractual services.

The capital portion of the stormwater budget also varies from year to year depending upon the City's capital drainage needs. In 1994, the capital budget consisted of $80,000 for developing the City's Stormwater Management Plan and $15,000 for drainage modifications along 9th and 10th Streets from D to B Streets. The City's total Stormwater Program costs were $138,287 ($43,287 operating budget and $95,000 capital budget). (See Technical Appendix G for additional 1994 budget information for funds 101 and 330 for the Transportation Division.)

Table 5-2
Stormwater Program Expenditures 1992-1994

	1992 (Actual)	1993 (Estimate)	1994 (Request)
Operating			
Salaries	6,618	5,718	13,822
Benefits	2,375	1,880	4,465
Supplies	1,175	740	11,500
Other Services & Charges	1,219	900	13,500
Capital Outlay	0	0	0
Total Equipment Rental	30,735	6,446	0
Total Storm Drainage Operating Expenditures	$42,122	$15,684	$43,287
Capital			
Stormwater Plan			$80,000
9th Street Drainage Repair			7,500
10th Street Drainage Repair			7,500
Total Storm Drainage Capital Expenditures	*	*	$95,000
Total Annual Stormwater Expenditures	$42,122*	$15,684*	$138,287

*Note: Most of the City's capital stormwater projects have been included in other major road, sewer, water, and infrastructure projects, such as the $750,000 LID-27 drainage and sewer separation project for the Blaine central district which was built in 1991 and 1992 using revenue bonds and a Public Works Trust Fund loan.

5.4.2 Organization

The City's Stormwater Program is one of many services provided by the Public Works Department. Under the direction of the City Engineer, the City's annual Stormwater Program is carried out by the two-person street, right-of-way maintenance crew under the supervision of a lead Public Works foreman. Beginning in 1994, the overall Stormwater Program will also be assisted, as needed, by the new water quality monitoring coordinator. An organizational chart for the Department of Public Works is shown in Exhibit 5-1.

5.4.3 Staffing

The City's Stormwater Program has no designated full-time staff. Day to day supervision is provided by the City Engineer. Activities of the Stormwater Program are carried out by the two person street maintenance crew under the guidance of the lead maintenance worker.

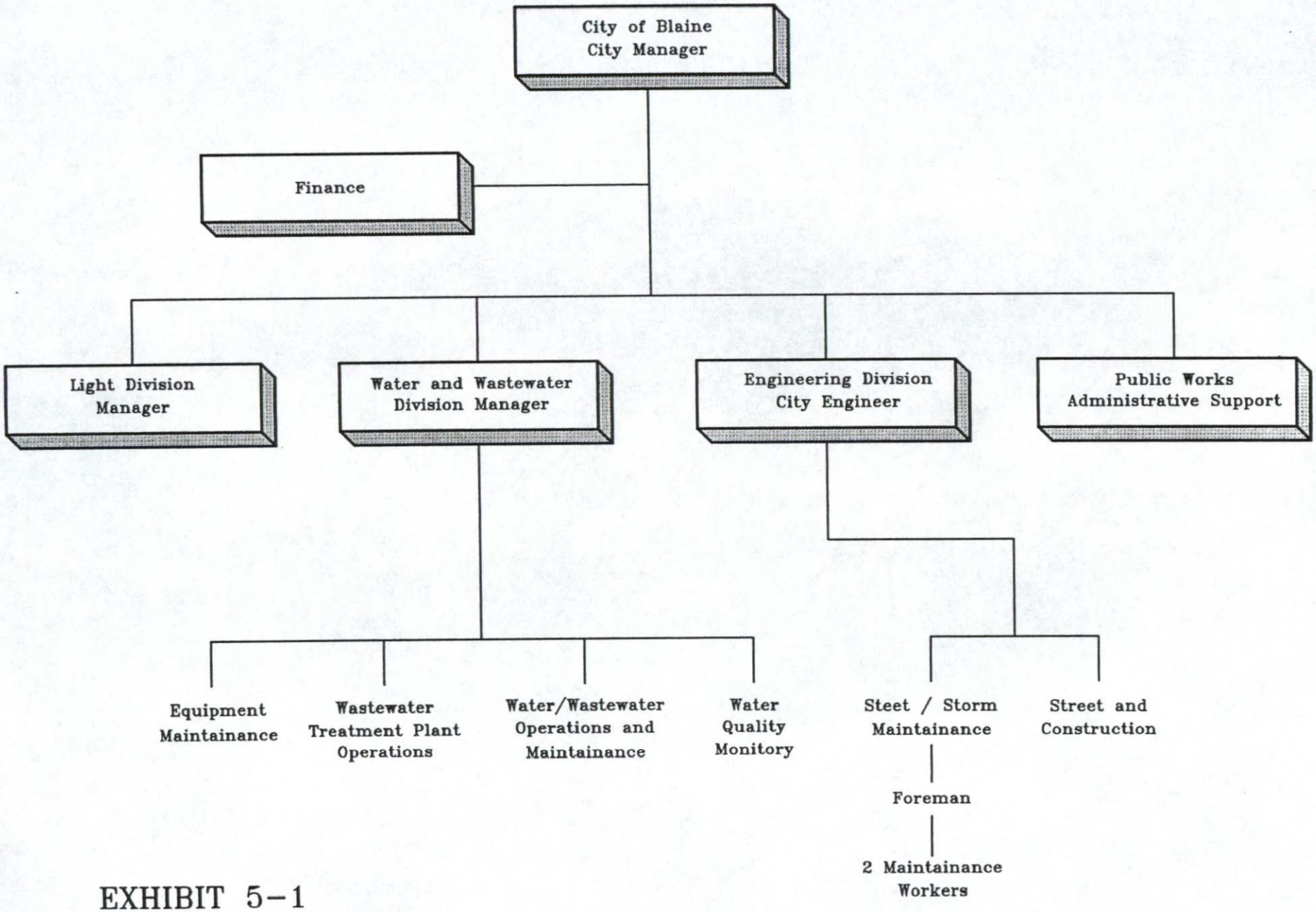


EXHIBIT 5-1
Department of Public Works
Organization Chart

5.5 Accomplishments

Accomplishments include:

- Review and approval of all drainage plans for new development, including the Resort Semiahmoo.
- Input and guidance on the development of the Drayton Harbor Watershed Action Plan.
- Development of the City's Wellhead Protection Plan.
- Inflow/infiltration studies and major sewer separation construction resulting in reduced combined sewer overflow and enhanced water quality in Drayton Harbor.
- Sewer extension service for South Blaine by forming LID-14.
- Stormwater treatment projects, such as LID-27 and the new biofiltration facility along Boblett Road.
- Control Blaine sanitary sewer rehabilitation.
- Participate in regional water quality monitoring.
- Regulatory compliance.
- Establish effective working relationships and interlocal agreements with local and regional agencies to protect regional water resources.
- Direction of the development and adoption of new drainage design standards for the City.

5.6 Overview of the Effectiveness of the City's Existing Stormwater Program

5.6.1 City's Existing Stormwater Program

The City has historically had few major flooding problems. In recent history, the most significant problem occurred when the 60-inch pipe carrying the discharge from Cain Creek to Semiahmoo Bay became blocked with debris and caused localized flooding in the downtown central business district. This occurred primarily due to the lack of maintenance, not the lack of capacity. Generally, the capacity and effectiveness of the entire City system could be significantly increased by an upgraded, regular maintenance program. The City's drainage system also has a number of irregularities and

capacity and create localized ponding. This is especially true in the northern parts of the City. Water quality treatment does not exist for most stormwater drainage within the City. Recent road and sewer utility projects have added capacity and oil/water treatment to a few of the City's major discharges into Drayton Harbor. The City's sewer separation projects will also reduce sewer overflows in the Drayton Harbor area. Biotreatment is being added when projects and opportunity allow, however, much of the drainage receives little if any treatment prior to discharge.

5.6.2 Problems and Deficiencies

Overall Stormwater Program deficiencies include:

- ❑ Lack of maintenance.
- ❑ Little treatment of runoff prior to discharge.
- ❑ Pollution of outfall areas from urban discharges.
- ❑ Widespread localized flooding due to discontinuities in the drainage system.
- ❑ No adopted criteria for new development.
- ❑ No clearing/erosion control ordinance.
- ❑ No maintenance ordinance.
- ❑ Failing septic tanks in some unserviced areas.
- ❑ Sewer overflows.
- ❑ Lack of appropriately trained staff.
- ❑ Lack of funding.

5.6.3 Needed Improvements

Enhancements to the City's Stormwater Program that would improve both its effectiveness and efficiency include:

- ❑ An enhanced annual maintenance program.
- ❑ Localized repairs/additions to the drainage system to remove discontinuities.
- ❑ The addition of treatment facilities to the existing system.

- ❑ Ordinances for stormwater/water quality, maintenance, inspection/ enforcement, and clearing/erosion control.
- ❑ Additional experienced stormwater staff.
- ❑ Additional financial resources.

5.7 Regulatory Compliance

5.7.1 Regulatory Requirements for Stormwater Management

Introduction

The City of Blaine is affected both by existing State and possible future federal stormwater management requirements. At present, the City is required to comply with the State's Puget Sound Basic Stormwater Program as defined in the 1991 Puget Sound Water Quality Management Plan (as amended in 1994). The Basic Stormwater Program emphasizes the establishment of appropriate legal authority, standards for new development and redevelopment, and maintenance of the existing drainage system. Due to its small size (and location), the City is not currently required to comply with the State's Comprehensive Stormwater Program which requires monitoring, source controls, and the elimination of water quality problems.

In the future, the City may be issued a Stormwater NPDES by Ecology. This permit has currently been issued to eight of the larger urban areas within the State with populations of 100,000 or more. NPDES Stormwater Permits, for moderately sized and even small cities, are being considered by the federal Environmental Protection Agency (EPA) and Ecology. Although the City is both small and remote in location, Ecology may elect to issue future NPDES Stormwater Permits on either a watershed or "urban center" basis. If the latter approach is used, the City and adjacent urban areas within Whatcom County (County) would be issued a joint permit. Discussions to-date with Ecology indicate that if an NPDES Stormwater Permit is issued to the City in the future, the terms and conditions of the permit would be very similar, if not identical, to the conditions of compliance with the State's present Comprehensive Stormwater Management Program. Because Ecology does not currently have adequate authority under State law to enforce the PSWQA Management Plan, they will likely be using the enforcement powers granted to them under the federal NPDES permitting program to ensure compliance.

Background Information

The most important stormwater requirements the City is presently facing are those of the State's PSWQA Management Plan. This section presents

background information on the State PSWQA Management Plan and an overview of the federal NPDES stormwater permitting process. The City needs to immediately address the requirements of the State's PSWQA Management Plan, even though it may never be required to have an NPDES Stormwater Permit.

State of Washington PSWQA Management Plan for the Puget Sound Basin

The Washington State Legislature Formed the PSWQA in 1985 to "restore and protect the biological health and diversity of Puget Sound, by:

- Preserving and restoring wetlands and aquatic habits,
- Preventing increases in the introduction of pollutants to the Sound, and
- Reducing and ultimately eliminating harm from the entry of pollutants to the water, sediments, and shorelines of Puget Sound."

The first Management Plan for Puget Sound was established in 1987, and updated in 1991 and 1994.

The proposed 1994 amendments to the 1991 PSWQA Management Plan were made public February 14, 1994, and do not require major changes to the stormwater program presented and approved in the 1991 plan. As a result, this management analysis is based primarily on the plan, the draft 1994 amendments, and the Technical and Program Guidance Documents (Volumes I and II) issued by Ecology in February and July of 1992, respectively, for implementation of the PSWQA Monitoring Plan.

The Puget Sound Stormwater Management Program is divided into the Basic Stormwater Program which applies to all cities and counties in the Puget Sound Basin, and the Comprehensive Stormwater Program which applies to designated urban areas based on population. The City does not need to comply with the Comprehensive Stormwater Program which was developed for larger urban cities.

All cities and counties in the Puget Sound Basin, including the City of Blaine, were to comply with the State's Basic Stormwater Program by January 1, 1995, as approved by the PSWQA on May 26, 1994. Large urban areas within Puget Sound are also to be in compliance with the Comprehensive Stormwater Program by the year 2000. The 2000 date may be moved up to 1997 or 1998, because Ecology has chosen to implement the Comprehensive Plan requirements as part of the Phase I NPDES Stormwater Permit, which could be implemented as soon as 1996 or 1997 for the large urban areas around the Puget Sound Basin.

- ❑ Controlling stormwater quality from all new development and redevelopment, and

- ❑ Developing and operating maintenance programs for all public and private stormwater facilities.

The Basic Stormwater Program requires the City to:

- ❑ Develop and adopt local ordinances for all new development and redevelopment which address:

  - The control of off-site water quality,
  - The use of source control Best Management Practices (BMPs),
  - The effective treatment of the water quality design storm (6-month, 24-hour event),
  - The use of infiltration (where appropriate),
  - The protection of stream channels and wetlands, and
  - The prevention of erosion and sedimentation control.

- ❑ Develop and enforce a proper operation and maintenance program for all new and existing public and private stormwater systems (minimum standards are defined in Ecology's Stormwater Management Manual).

- ❑ Develop and maintain a recordkeeping program for all new public and private drainage systems and facilities.

- ❑ Adopt Ecology's Technical Manual or develop a manual with substantially equivalent technical standards (manuals other than the Ecology manual were to be pre-approved by Ecology by January 1, 1995).

- ❑ Develop and implement programs to educate citizens about stormwater and its effects on water quality, flooding, and fish/wildlife habitat, and to discourage illicit dumping into storm drains.

- ❑ Coordinate the City's Stormwater Program with provisions of the GMA, where appropriate.

The Ecology Stormwater Program Guidance Manual Volumes I and II (July 1992) contains additional explanation and clarification of the above six requirements. (See Technical Appendix H). A seventh enforcement element has also been added in the 1994 amendments to the 1991 Puget Sound Stormwater Management Plan that the City will need to comply with.

- ❑ Local enforcement of these (the above six) stormwater controls.

The main elements of the State's Basic Stormwater Program include the stormwater ordinance, technical manual, the maintenance ordinance, and the maintenance program. Each of these elements is summarized below.

- ❑ The stormwater ordinance and stormwater management manual that are to be adopted by the City as part of the State's Basic Stormwater Program must:
  - Control off-site water quality and water quantity,
  - Use both source control and treatment BMPs,
  - Provide effective treatment using BMPs for the storm size and frequency as defined in the manual for the proposed development,
  - Use infiltration wherever possible, and
  - Control erosion and sedimentation for both new developments and redevelopment.
- ❑ The maintenance ordinance that needs to be adopted to comply with the required maintenance program must:
  - Provide for inspection (including right of entry) for all public and private stormwater facilities,
  - Define inspection procedures and criteria,
  - Identify the parties responsible for maintenance,
  - Include enforcement provisions, and
  - Provide for the proper disposal of maintenance wastes.
- ❑ The City's maintenance program, as defined in the Ecology Program Manual, requires:
  - The annual inspection and removal of all debris,
  - The monthly inspection, cleaning, and mowing of all grassy swales and biofilters,
  - The immediate corrections of water quality criteria violations,
  - The creation and use of a Master Maintenance schedule (the maintenance program standards, frequencies, and technologies should

ultimately be tailored to each type of stormwater facility, their location, the nature of discharge/runoff and its water quality), and

- Adequate record keeping, which should include as-built drawings, location maps, Operation and Maintenance (O&M) requirements, records of inspections, O&M activities and their frequency and any engineering reports.

1994 Amended Puget Sound Water Quality Management Plan

The 1994 PSWQA Management Plan required the State's Basic Stormwater Program to be complied with by January 1, 1995. SW-1 describes the requirement for the Basic Program to be implemented by all cities and counties within the Puget Sound basin including the City of Blaine. A copy of the 1994 Stormwater section of the 1994 PSWQA Management Plan has been appended to this report and is presented in Technical Appendix I.

Ecology Review(s) and Non-Compliance

The City's responses to the elements of the State's Basic Stormwater Program are to be submitted to Ecology for review and a determination of compliance. This review is to include the City's stormwater and maintenance ordinances and a description of the City's overall Stormwater Program. (The criteria Ecology will use to evaluate the City's stormwater design standards are presented in Technical Appendix J.)

Many local governments around the Puget Sound have asked how Ecology plans to enforce these stormwater requirements and the penalties for non-compliance. An opinion issued last year by the State Attorney General stated that Ecology has little to no enforcement authority for stormwater and must rely on the PSWQA's powers of enforcement, granted directly to that agency by the State Legislature when the Authority was formed. It is for this reason that Ecology has combined the requirements for compliance of the State's Comprehensive Plan with that of the NPDES Stormwater Permits, and may do the same to ensure compliance with the State's Basic Stormwater Program as well.

The consequences of non-compliance with the State's Basic Stormwater Program of the PSWQA Management Plan are unclear at this time. A formal public accounting to the PSWQA would be the first consequences of non-compliance. Other penalties could include denial of future grant funds, daily fines of up to $10,000 per day, and potential legal action by the State. Non-compliance also may make violators vulnerable to third party lawsuits.

A recent letter to the City of Lynnwood from Ecology's Stormwater Program Supervisor, Dr. Peter Birch, clarifies the follow-up review and enforcement

processes. This letter has been included as Technical Appendix K to this report.

5.7.3 Assessment of Compliance with the State's Basic Stormwater Program

According to the 1991 PSWQA Management Plan (as amended in 1994), all cities and counties within the Puget Sound Basin were to be in compliance with the requirements of the State's Basic Stormwater Program by January 1, 1995. The City will meet some, but not all, of the requirements of the Basic Stormwater Program by that date.

To be in compliance with the State's Basic Stormwater Program, the City will need to undertake additional stormwater related activities. Each of the seven elements (No. B1-B7) of the State's Basic Stormwater Program is presented below along with a preliminary assessment of the City's present status of compliance and recommended improvements needed to achieve full compliance.

Element No. B1

Adopt local drainage ordinances for all new development and redevelopment that address the seven technical requirements listed on page 126 of the 1994 Draft Amendments to the Puget Sound Stormwater Management Plan published on February 14, 1994.

Assessment - The City has flood control ordinance (Title 15.12) and an ordinance that requires new development to adopt and use the City's local drainage standards (Title 17.16.120). However, the City does not have an adopted drainage ordinance to address the water quality storm (the 6-month, 24-hour event), the use of BMPs for source and treatment controls, the use of infiltration, the protection stream channels, the control of erosion/ sedimentation, or local enforcement of the above stormwater controls.

The City's existing ordinance meets the intent, but not all of the technical requirements, needed for compliance with the State's Basic Stormwater Program.

A separate new ordinance, however, is not needed. The City needs to modify the existing drainage ordinance to add sections on the use of the water quality design storm, the use of BMPs and on-site infiltration, and enforcement.

Recommendations - The City should:

- ❑ Make a more detailed comparison of the City's existing drainage ordinance to the Ecology model stormwater ordinance in order to ensure consistency with the ordinance.
- ❑ Draft new language as needed, particularly for inspection/enforcement and water quality related issues.
- ❑ Develop a revised City stormwater ordinance.
- ❑ Include clearing, grading, and erosion control elements in the new stormwater ordinance.
- ❑ Receive City Attorney review and approval.
- ❑ Present to City Council for approval.

Element No. B2

Develop and enforce a proper operation and maintenance program for all new and existing public and private stormwater systems.

Assessment - the City operates an annual maintenance program for its public stormwater facilities funded through the Street Fund.

- ❑ Each year the maintenance of the City's catch basins, and some ditches, is routinely performed.
- ❑ For new commercial facilities, the owner is required to assume long-term maintenance responsibilities.
- ❑ For new residential facilities, the home owners usually dedicate the stormwater facilities over to the City for long-term maintenance.
- ❑ Most major public and private drainage facilities within the City have been mapped on the City's GIS/CADD system. New structures are added to this recordkeeping system and to the City's annual maintenance program as new drainage facilities are approved and accepted by the City.

The City is in compliance with many of the conditions of Requirement No. 2; however, to be in full compliance, an inspection and enforcement element needs to be added, and the frequency of various O&M activities may need to be increased to keep the City's drainage system at an optimum level of performance. Record keeping and mapping should be enhanced, and the inspection of both public and private facilities should be performed on an

annual basis. The existing O&M program, priorities, and activities should also be documented.

Recommendations - The City should:

- ❑ Do a final comparison of the City's maintenance ordinances and program with those proposed by Ecology. Ensure consistency with the model Ecology maintenance ordinance and the recommended types and level of maintenance as suggested in the Ecology Stormwater Program Guidance Manual (Volumes I and II).
- ❑ Develop and adopt a new maintenance ordinance for public and private facilities consistent with Ecology requirements.
- ❑ Do a complete inventory of City drainage facilities and maintenance needs. Update this inventory with biannual inspections.
- ❑ As necessary, modify existing ordinances so that the City has the authority needed for site inspections of private facilities, enforcement actions, emergency response, and cost reimbursement.
- ❑ Develop an annual maintenance program based on biannual inspections.
- ❑ Increase the level of funding to the annual maintenance program to increase the level and frequency of service as recommended by City's maintenance crew and as required by the State's Basic Stormwater Program.

Element No. B3

Develop and maintain a recordkeeping program for all new public and private drainage systems and facilities.

Assessment - The City has the beginnings of a good inventory and record keeping system. The process of adding new drainage facilities to the system needs to be formalized. The City's present recordkeeping program should be documented in order to respond to Ecology's regulations.

Recommendations - The City should:

- ❑ Refine the existing record keeping process as needed to comply with the regulatory requirements.
- ❑ Document the City's existing drainage recordkeeping program.

Element No. B4

Adopt Ecology's Technical Manual or develop a manual with substantially equivalent technical standards.

Assessment - The City has been, by policy, routinely using the 1991 Ecology drainage design standards for new developments throughout the City. The City needs to officially adopt the Ecology Drainage Design Standards by ordinance. The adoption and use of the required Ecology standards is not expected to substantially change the City's drainage policies, planning, or review time, but will increase the cost of new construction within the City.

Recommendations - The City should:

- ❑ Review and adopt the drainage design standards as described in the Ecology Technical Manual (Volumes III and IV).
- ❑ Develop new standard drainage handouts for developers to be consistent with the newly adopted Ecology design manual.

Element No. B5

Develop and implement education programs to educate the citizens about stormwater and its effects on water quality, flooding, and fish/wildlife habitat, and to discourage dumping into storm drains.

Assessment

The City has historically complied with the intent of this requirement, but has not established a regular stormwater public awareness/ education program, funded on an annual basis and implemented over a longer period of time, toward stated goals.

Recommendations - The City should:

- ❑ Develop one or more stormwater brochures and a long-term public education/awareness program with public input.
- ❑ Annually fund public awareness activities related to stormwater and water quality.

Element No. B6

Coordinate the City's Stormwater Program with provisions of the GMA, where appropriate.

Assessment - Generally, the City has complied with this requirement as described in the Ecology's Guidance Manual. The City has coordinated regionally on water resources management issues and has established an interim Growth Management Plan and boundaries.

Recommendations - The City should:

- ❑ Continue regional coordination to help fund and implement its Growth Management Plan and implement the Blaine Stormwater Management Plan.

Element No. B7

The City should provide local enforcement of its stormwater controls.

Assessment - The City does not appear to have legal authority for inspection and enforcement of its various inspection/drainage related ordinances and has not historically been very active in the area of enforcement due to resource and funding limitations. The City should review its legal authority for inspections and enforcement and increase inspection and enforcement activities as local resources allow.

Recommendations - The City should:

- ❑ Review existing ordinances to ensure appropriate legal authority exists.
- ❑ Enhance the City's existing inspection/enforcement procedures.
- ❑ Elevate the priority of enforcement in order to ensure adequate annual funding.

5.7.4 Conclusion Regarding Compliance with the State's Basic Stormwater Program

Because the January 1, 1995, due date has passed before the City has an opportunity to comply with all of the required elements of the State's Basic Stormwater Program, it is recommended that a "Letter of Compliance" be written to Ms. Nancy McKay, Executive Director of the PSWQA, describing the City's existing Stormwater Program and presenting a proposed schedule for full compliance. This letter will demonstrate the City's intent of making a "good faith" effort to comply with the State's Basic Stormwater Program and may reduce or eliminate any future penalties, enforcement actions, or legal challenges.

A number of activities need to be undertaken by the staff of Public Works to ensure future compliance with the State's Basic Stormwater Program, including:

- ❑ Review and refinement of the City's stormwater ordinance;
- ❑ Adopt Ecology's model maintenance ordinance;
- ❑ Enhance the maintenance program, including increased annual funding, an annual maintenance management plan, a complete inventory of drainage facilities, improved maintenance data, and record keeping and enforcement of the maintenance of private facilities;
- ❑ Adopt of the Ecology Technical Manual;
- ❑ Develop and implement a public awareness/education program;
- ❑ Continue regional coordination with the County and other agencies;
- ❑ Continue efforts to secure adequate funding for the program; and
- ❑ Enhance, fund, and implement inspection and enforcement procedures.

5.8 Programmatic Analysis of the City's Existing Stormwater Program

5.8.1 Background

The purpose of this section is to review the City's present Stormwater Program. This management analysis reviews the City's programmatic stormwater obligations in order to define responsibilities, set priorities, and allocate available resources for the Stormwater Management Plan for the City which will be presented in Section 6 of this report.

5.8.2 Overview of the Programmatic Analysis Process

The following programmatic analysis of the City's Stormwater Program has been divided into three parts: assessment, analysis, and recommendations. The first part is the documentation and assessment of the various activities of the City's Stormwater Program. An analysis is provided in the second part that reviews the existing program and staffing levels, presents regulatory and planning issues, and comments on management and financial alternatives. Programmatic recommendations are included in Section 3 where suggestions and direction are provided.

From a programmatic perspective, the operation of the City's Stormwater Program involves at least thirteen different activities as listed below.

1. Management and technical direction of the Stormwater Program
2. Basin and Watershed Planning

3. Capital Improvements
4. Maintenance
5. Development Review
6. Engineering Support to Other City Programs
7. Water Quality, Wetlands, and Habitat Protection
8. Groundwater and Wellhead Protection
9. Inspection and Enforcement
10. Complaint and Emergency Response
11. Public Education and Involvement
12. Regional Coordination
13. Regulatory Compliance

Each of these elements of the existing Stormwater Program are discussed below.

5.8.3 Programmatic Analysis

Element No. 1 - Management and Technical Direction of the City's Stormwater Program

Assessment - Any City program must have direction and administrative support if it is to accomplish its assigned responsibilities. This is especially true of today's stormwater and water resource programs.

The City's Stormwater Program is responsible for managing the City's stormwater and groundwater protection activities and integrating their common planning, capital, and maintenance responsibilities. All three of these functions are closely related and their coordination within a common management structure is both logical and efficient.

Program Management and Technical Direction also includes such activities as:

- ❑ Develop budget and management,
- ❑ Assess workload and staffing,
- ❑ Develop ordinances, policies, and design standards for new development,
- ❑ Oversee inspection and enforcement activities and proceedings;
- ❑ Oversee regulatory compliance and permit negotiations,
- ❑ Identify and secure funding sources including grants, loans, developer fees, and bonds,

- Set priorities and define performance standards (design, permit review, O&M, etc. for the Program),
- Direct regional coordination with other agencies,
- Provide interdepartmental coordination and technical assistance within the City for roads, water, and landuse,
- Develop programs and management practices to protect the City's water resources,
- Develop and lead public education and involvement programs, and
- Ensure regulatory compliance.

Analysis - Management of the City's existing program is the responsibility between of the City Engineer. Day-to-day direction is provided by the Operations Manager, while the technical direction is provided by the City Engineer.

Current level of staffing is estimated to be 100 hours (0.05 FTE, $3,500) per year for the City Engineer.

Required for Regulatory Compliance - There is no specific regulatory requirement that the City's Stormwater Program have a program manager. How the Program is managed and directed, and to what level the program is staffed are to be determined by the City.

Required by the Drayton Harbor Watershed Action Plan - There is no specific requirement in the DHWAP for the City to increase the management or technical direction of its Stormwater Program. (The City Engineer has been performing as the lead for the City in developing the DHWAP.)

Management Alternatives - listed below are several different alternatives for the City's consideration.

- Maintain existing staffing and funding level of about 100 hours per year.
- Increase program management and technical direction on an as-needed basis using existing staff and existing levels of funding, i.e., change internal priorities to free-up needed staff.
- Increase staffing as the program grows. This will likely involve securing additional funding.
- Use outside contract technical services as needed.

Recommendations

Program	An increased level of both management and technical direction is needed now and in the near future to implement new program and regulatory compliance activities.
Staffing Level	In the short-term, double the existing staffing level to 200 hours/year, 0.10 FTE. Use existing staff. No new staff recommended. In the long-term, continue to staff at 200 hours/year (0.10 FTE).
Management Alternative	Continue to use existing staff. Double their level of effort on stormwater by reprioritizing their other activities and responsibilities. Begin to identify future internal City resources to develop and support the City's Stormwater Program in the long-term. Use outside contract services, as needed, until additional internal City resources are realized.
Costs/Funding Sources	Costs: Short-term costs will double from $3,500 for 100 hours to about $7,000 for 200 hours per year. Long-term costs are the same as short-term costs, about $7,000 per year for 200 hours. Funding Sources: New funding source(s) will likely be needed in the future such as a stormwater utility, or greater annual appropriations from the City's Current Expense and/or Road Funds.
Legal Authority	The City has the needed legal authority to manage and direct its Stormwater Program. No new legal authority is required.

Element No. 2 - Basin and Watershed Planning

Assessment - Water Resources Management requires an understanding of the hydrology, hydraulics, water quality, and environmental conditions of each of the major drainage areas within the City. The City drains primarily into two major water bodies, Drayton Harbor and Semiahmoo Bay, with discharge

directly into Georgia Strait. The City has been active in developing basin plans for these watersheds by:

- Completing the 1989 Comprehensive Drainage Study of the City,
- Participating in development of the Drayton Harbor Watershed Action Plan, and
- Sponsoring and funding the development of this comprehensive Stormwater Management Plan for all main drainage areas within the City.

The above three basin planning efforts have completed the City's primary stormwater planning responsibilities. These basin plans and special stormwater studies have identified a number of capital and non-structural improvements that are needed to improve the major drainages throughout the City. The capital improvements have been incorporated into the Stormwater Capital Improvement Plan (CIP), presented in Element No. 3.

Some smaller watershed plans may still remain to be done and additional studies in all subbasins will likely be needed from time to time to solve specific problems. There is also the on-going need to update each of these plans on about a 5-year cycle as well as to continuously monitor their implementation. Also, more detailed water quality studies within each basin may eventually be needed to comply with NPDES permits and the requirements of the PSWQA Management Plan.

Analysis - Most of the major basin planning for the City has been, or is about to be, completed with the adoption of this Stormwater Management Plan. Some smaller subbasin and catchment areas may need to be studied to solve specific drainage problems in the future. Depending on the growth rate within the City, an update to this comprehensive management plan may be needed in about 5-10 years to assess the impacts of development and review and reassess drainage and environmental problems and priorities.

The most significant problem of the City's present basin/watershed planning process relates to funding. Additional funding will be needed to implement the resultant plans and their recommended capital facilities and control programs.

Current Level of Staffing - Estimated to be about 100 hours (0.05 FTE and $2,000) per year. Current staffing is provided by the City's existing staff, including the City Engineer and City Planners on an as-needed basis.

Required for Regulatory Compliance - The emphasis of the State's Basic Stormwater Program is on controlling the quality of runoff from new

development and properly operating and maintaining existing stormwater facilities. Basin planning is also required to coordinate the City's Stormwater infrastructure needs with the City's GMA planning processes. Land use policies and infrastructure needs, including drainage, are to be integrated by each public agency as guided by the GMA.

Basin planning is needed to identify and correct sources of stormwater pollution. (It is also possible that the City may be required to perform basin planning as part of a future NPDES Stormwater Permit, which may be issued to the City at some time in the future.)

Required by the Drayton Harbor Watershed Action Plan - Basin planning is needed to address recommendation SW-39 of the DHWAP and address existing and future water quality issues and source control planning for Drayton Harbor and Semiahmoo Bay.

Management Alternatives - listed below are several different alternatives for the City's consideration.

- ❑ Maintain existing staffing and funding level by continuing to have the basin planning tasks assumed by existing engineering staff.
- ❑ Have the basin planning work incorporated into the existing community planning process which is routinely performed by the Community and Economic Development Department (CED).
- ❑ Require new developments to perform basin planning studies as a condition of their building permit.
- ❑ Use outside consultants on an as needed basis to perform basin planning, including updating existing basin plans.

Recommendations

Program	Perform future basin planning only on an as needed basis (i.e., for small drainage projects), updating this comprehensive plan in about 5 years.
Staffing Level	Short- and long-term: maintain the existing level of staffing and funding (100 hours, 0.05 FTE, $2,000). No new staff recommended.
Management Alternative	Hire consultants on an as-needed basis to develop or update the City's basin and watershed action plans. Have the City's senior engineers and planners assume

the direction of future basin planning by hiring and managing the work of these outside consultants.

Cost/Funding Sources

Costs

Short-term: no new expenditures ($2,000 per year).

Long-term: $100,000 to update SWM Plan.

Funding Sources

New funding source will be needed to address future basin planning needs. Either fund as needed from the City's Current Expense Fund or set up a permanent funding source for stormwater, such as a stormwater utility. Grants, and/or loans could also be used as interim short-term funding sources.)

Legal Authority

The City has the needed legal authority to conduct basin and watershed management. No new legal authority is required.

Element No. 3 - Capital Facilities

Assessment - Because the City has taken the initiative to conduct basin plans and stormwater studies, the capital needs of the City's Stormwater Program are well defined. Fortunately, the City's existing basin plans and stormwater studies have identified the need for only a few major capital stormwater facilities. One 10.4 acre-feet regional detention/retention facility has been proposed in the 1989 Stormwater Plan to be built just southeast of the City airport. Phase I for 5.1 acre-feet of storage is estimated to cost $120K-200K. Phase II of this project adds another 5.3 acre-feet of storage and costs an additional $80-150K, for a total project cost of $200-350K. The timing and size of these facilities are growth dependent.

Other capital needs consist primarily of upgrading pipe sizes to handle existing and future flows and constructing water quality treatment facilities. The cost of pipe and related channel and culvert repairs total $501-750K. Water quality treatment facilities have been estimated to cost $325K. Total existing capital needs are estimated to be $1,035-1,425K. (See Section 4.5.1 for a complete list of needed capital improvements.)

The DHWAP adopted January 1995, and the 1989 Stormwater Plan have not been officially adopted by the City. These planning efforts, along with the implementation of the Blaine Ground Water Management Plan, will likely add additional capital projects to the above list.

The City presently funds its stormwater capital program through a mixture of Current Expense funding, Street funding, local improvement district revenues, and Public Works Trust Fund loans.

Analysis - To accomplish the City's Stormwater CIP, it is necessary to have staff engineers work with design consultants to design, construct, and inspect new CIP projects. The amount of staff effort that will be required is directly related to the number of projects undertaken, timing of construction, and how the projects are funded. Fewer staff are needed if the projects are designed and built over a longer period of time and funded by the City internally. If the City decides to use revenue bonds to fund the CIP program, more staff will be required over a shorter period of time. Much of the staff costs associated with implementing the CIP program can, however, be funded from the CIP budget, whether the CIP funding is from bonds or cash.

Due to the heavy workload of the City's engineering staff, little staff time is presently available to implement the City's capital program. Given the number of capital projects identified for design and construction, the City may want to make some staffing improvements if the City's CIP program is to be constructed within a short period of time (i.e., one to three years).

Current Level of Staffing - Existing CIP responsibilities are the responsibility of the City Engineer. Estimated level of staffing is about 100 hours (0.05 FTE, $3,000) per year.

Required for Regulatory Compliance - The design and construction of capital projects to reduce flooding or treat stormwater to improve its water quality are not required for compliance with the State's Basic Stormwater Program. A capital program for drainage, however, is required under the Federal Clean Water Act and the State's water pollution control laws to achieve both national and regional water quality goals.

Required by the Drayton Harbor Watershed Action Plan - The construction of capital facilities by the City is suggested in Recommendations No. SW-39 and SW-41 of the DHWAP.

Management Alternatives - listed below are several different alternatives for the City's consideration.

- ❑ Maintain existing level of staffing by continuing to use the Operations Manager and City Engineer).
- ❑ Hire one additional engineer to lead the City's new Stormwater CIP efforts.

- ❑ Use outside contract resources to design, manage, and build the City's future CIP projects for stormwater.

Recommendations

Program	Secure about $975,000 and implement most of the stormwater CIP projects ($650K) and water quality treatment projects ($325K) over the next three to five years.
Staffing Level	Short-term: Maintain the existing level of staffing of 100 hours per year (0.5 FTE). No new staff are recommended. Long-term: Hire a senior engineer for 1,000 hours per year (0.5 FTE, $30,000), share this position with Element No. 6.
Management Alternative	Continue to use existing staff to direct and oversee implementation of the City's CIP program. Identify needed financial resources to build the needed facilities within the next three to five years. Use outside contract services as needed, and as funding allows.
Costs/Funding Source	<u>Costs</u> Short-term: $3,000 per year for 0.05 FTE. Long-term: CIP Cost is about $975,000 for projects over the next three to five years. (See list of capital projects presented in Section 4.5.1) An additional $30,000 per year for 1,000 hours (0.5 FTE) of a senior engineer. <u>Funding Source(s)</u> Include State Centennial Grant, Current Expense Fund, local improvement districts, Public Works Trust Fund; a stormwater utility within the City.
Legal Authority	City has authority to design and construct public capital drainage facilities. No new legal authority required.

Element No. 4 - Maintenance

Assessment - One of the most important elements of surface water management and the protection of groundwater is maintenance of the City's drainage system. As urbanization increases, the volume of surface water runoff increases, taxing the capacities of both the natural and manmade drainage features and facilities. If these systems are not maintained or designed to have enough capacity, there will be little removal of pollutants prior to entering the natural surface or groundwater drainage system. The resulting risks of groundwater contamination, localized flooding, and receiving water impacts are substantially increased.

Generally, constructed stormwater drainage systems require more maintenance than sewer or water facilities. Surface water systems are often more complex in that maintenance of these systems involves not only catch basins, retention ponds, and culverts, but also street and impervious surface cleaning, and ditch and natural drainage system enhancements. Proper stormwater maintenance also includes the inspection and maintenance of drainage facilities on private property.

Analysis - The maintenance of stormwater facilities within the City is performed by the Street Division of the Public Works Department. In 1994, the Division was provided an annual budget of $43,287, which allows the cleaning of catch basins and mowing of vegetation in some of the major drainage swales. This funding supports the equivalent of about 1,000 hours of time provided by a two-person maintenance crew. Over the last three years, the City's drainage maintenance program has varied from an annual appropriation of $15,684 in 1993, to $43,287 in 1994 ($42,122 in 1992). The direction and day-to-day supervision of drainage maintenance is provided by a lead maintenance worker.

There are many drainage features that are not being properly maintained and the City presently has no program to inspect or enforce the maintenance of stormwater facilities on private property. Maintenance of public facilities not being performed adequately include:

- ❑ Catch basins,
- ❑ Ditches-vegetation, debris, and sediment removal
- ❑ Structural repairs,
- ❑ Ditch, swale, and culvert semi-annual inventory and maintenance,
- ❑ Semi-annual inspection and enforcement of the maintenance of private facilities,

- Development and funding of an annual maintenance management plan, and
- Formal inventory and record keeping process of existing and new drainage facilities.

Other observations of the existing maintenance program include:

- The City does not have vacuum street sweeping equipment. This means that their ability to improve water quality by eliminating small particulates on the surface of the road is very limited. Existing "brush" street sweeping is primarily for aesthetics and does little to improve water quality. The City has two vactor trucks used for catch basin cleaning. However, there is not enough crew to keep the vactor operating on a regular schedule.
- The City's stormwater maps and inventory of facilities need to be completed and updated periodically. This is particularly important maintenance since many of the facilities were installed a long time ago and are difficult to find and/or maintain to function properly. Documenting pipe and ditch sizes, locations, and slopes will also assist the City in identifying and removing the many drainage discontinuities within the existing City's drainage system. (It is also needed for the City to be in compliance with Ecology's Basic Stormwater Program requirements.)
- There is a limited preventive maintenance program. Available staffing is insufficient to perform a complete preventative maintenance program for the City's entire surface water system.

There are few City-owned on-site or regional detention facilities (except the one along Grant Avenue). However, as development continues, the City will need to develop a policy on ownership and long-term maintenance responsibilities of such facilities. Although maintenance of future residential systems could be assigned to Home Owners Associations, the City should always retain the right to properly maintain neglected facilities and bill the owners in order to prevent flooding, water quality, and liability problems.

The City maintenance crew is the primary emergency response team, along with the fire department, for all hazardous material spills or illicit dumping responses within the City. The crew is also involved in many of the Division's responses to citizen complaints concerning either ponding water quality problems.

In general, the storm drainage maintenance activities of the City are understaffed and underfunded at this time.

Current Level of Staffing - Approximately 1,000 hours per year, performed by a two-person maintenance crew. The two-person crew performs stormwater maintenance for 25% of their time. Their time and responsibilities are shared with the Streets Maintenance Program.

Required for Regulatory Compliance - There is a regulatory requirement. The State's Basic Stormwater Program requires the City to develop and operate an effective maintenance program for all public and private drainage facilities. This will require the City to draft and adopt a new maintenance ordinance and increase the level of staffing and funding to the maintenance programs administered by the City's Stormwater Program. Inventory and mapping of existing facilities is required along with a process to keep and update records of all new public and private drainage systems and facilities.

Under the State Comprehensive Stormwater Program or future NPDES Stormwater Permit, additional maintenance related activities, such as monitoring, eliminating illicit connections, spill response, illegal hookups, complaints, dumping, and enforcement may also be required to be assumed by the City.

Required by the Drayton Harbor Watershed Action Plan - The funding and operation of an effective stormwater maintenance program by the City is suggested in Recommendations No. SW-36, SW-37, and SW-39 of the DHWAP.

Management Alternatives - listed below are several different alternatives for the City's consideration.

- ❑ Continue with the present drainage maintenance program, level of staffing, maintenance activities, priorities, level of funding, and funding sources.
- ❑ Adopt the new required maintenance ordinance for drainage facilities and staff up internally, within the Operations Division, to perform the expanded maintenance program. Secure additional financial and staff resources as needed.
- ❑ Adopt the new maintenance ordinance and contract out the management and maintenance activities with an outside contractor.

Recommendations

Program	Enhance the City's stormwater maintenance and activities to meet the needs of the City and address the requirements of the State's Basic Stormwater

	Program.
Staffing Level	Short-term: Hire one full-time stormwater maintenance laborer 2,000 hours, 1.0 FTE. Long-term: Hire a second full-time stormwater maintenance laborer, 2,000 hours, 1.0 FTE.
Management Alternative	Adopt a new maintenance ordinance, hire two full time staff, secure needed funding, and comply with the State's Basic Stormwater Program maintenance requirements.
Costs/Funding Source	<u>Costs</u> Short-term: Estimated to be about $95,000 per year. Long-term: Estimated to be about $125,000 per year. <u>Funding Source(s)</u> City Current Expense Fund, or from a new City stormwater utility which supports annual maintenance funds capital projects, and allows the City to be in compliance with regulatory requirements. (Local improvement district revenues are also a possibility. Grants, loans, and bonds are usually not viable options to fund maintenance programs.)
Legal Authority	The City needs a new maintenance ordinance for public and private facilities, which includes inspection/enforcement, semiannual inspections, and cost recovery and is equivalent to the Ecology "model" maintenance ordinance. (The Ecology model maintenance ordinance is presented in Technical Appendix L.)

Element No. 5 - Development Review

Assessment - Development review is one of the most critical functions of any municipal stormwater program because through the development review process future flooding, drainage, maintenance, water quality, and other environmental problems may be reduced or even eliminated. This function must be done properly by the City.

If new drainage facilities are undersized, do not address water quality, or do not work properly, the City may have to rebuild or incur the costs of increased maintenance when these new drainage facilities are accepted by

the City for ownership and long-term maintenance. It is important that the developer construct these new facilities correctly to keep City maintenance and retrofit costs to a minimum.

In the City of Blaine, regulation of new development is the joint responsibility of the City's CED and Public Works Departments. Most of the drainage reviews required for new developments are performed by the City Engineer within the Public Works Department. With the exception of developments like Resort Semiahmoo, most new developments are single lot commercial or residential.

Analysis - The Public Works Department routinely reviews all drainage plans for the City. The drainage plans are usually sent to the City Engineer for technical review. Technical reviews are performed as time allows and new development projects dictate. Presently, the City has no adopted drainage design standards, stormwater ordinance or clearing/grading ordinance. The Ecology Technical Manual, however, has been adopted "by policy" and has been required by the City plan reviewers since 1991.

There are three issues involved with the City's development review activity:

1. Ordinance,
2. Development standards for drainage facilities, and
3. Funding.

The City has little choice in the first two issues. The City is required to write and adopt new local drainage ordinances and accept the legal authority to review and approve drainage facilities for new development and re-development within the City. The City was required, in the State's Basic Stormwater Program, to adopt the Ecology Technical Manual or equivalent drainage design criteria for new development by January 1, 1995. How the City chooses to staff and fund the development review functions in order to meet the above two requirements is to be determined by the City.

To be done properly, trained drainage engineers must be able to spend the time necessary to review and approve effective drainage plans. To do this, the activity must be adequately staffed and funded. Development review is one of the few City functions that can and should be entirely fee supported by charging developers the staff time it takes to review and approve their drainage plans. The City currently substantially subsidizes the drainage review process from the City's Current Expense Fund and Street Fund.

One option that many Puget Sound municipalities have successfully exercised is to hire outside drainage consultants on an as-needed basis under an open annual contract. This works very well because there are many drainage consultants that have the required technical expertise and first-

hand development experience to interpret and apply the City's drainage design criteria and related environmental policies. This process requires little administrative work on the part of the City, other than billing for the time incurred by the consultant to review and approve the plans. Even City staff administrative time may be billed to the developer so the City incurs no net costs.

Current Level Staffing - Estimated to be 100 hours per year provided on an as-needed basis by primarily the City Engineer.

Required for Regulatory Compliance

The requirements of the State's Basic Stormwater Program do not specifically stipulate how the local agency is to properly conduct development review. However, a specified requirement of the State's Basic Stormwater Program requires that the City control the quality of water from all new development and redevelopment by:

- ❑ Adopting the Ecology Technical Manual.
- ❑ Developing and adopting local drainage ordinances for all new development and redevelopment to address:
  - The control of off-site water quality,
  - The use of BMPs for water quality,
  - The effective treatment of the water quality design storm,
  - The use of infiltration,
  - The protection of stream channels and wetlands, and
  - The prevention of erosion and the control of sedimentation.

Required by the Drayton Harbor Watershed Action Plan - The adoption of effective design standards and proper review of drainage plans for new developments by the City is suggested in Recommendations No. SW-29, SW-30, SW-31, SW-32, SW-33, SW-42, LC-45, LC-47, LC-48, LC-51, and LC-52 of the DHWAP.

Management Alternatives - listed below are several different alternatives for the City's consideration.

- ❑ Maintain the existing level of staffing and funding by continuing to have the City Engineer perform plan reviews, as time and priorities allow.
- ❑ Hire and train one new engineer to perform reviews internally for Public Works.
- ❑ Contract out the drainage review.

Recommendations

Program	Write and adopt new stormwater and clearing/ grading ordinances, and drainage design standards to be implemented in order to comply with the State's Basic Stormwater Program.
Staffing Level	Short- and long-term: maintain the existing level of staffing and funding, no new staffing recommended unless the number of new permits requests increases substantially. Then one new engineer may be justified.
Management Alternative	Continue to perform permit reviews internally using the joint CED/Public Works internal technical review committee. Continue to use the City Engineer for these reviews, as time and priorities allow.
Cost/Funding Source(s)	Cost: Estimated to be $3,000 for 100 hours annually Funding Source(s): The City should impose a developer review fee to reimburse the City for all of the expenses related to reviewing and approving plans for any proposed new development or redevelopment. Continued use of the City Current Expense and Street Funds is also a viable financial options.
Legal Authority	The City needs its existing drainage ordinance to be revised and upgraded to be consistent with the Ecology model ordinance. (Note: The Ecology model Stormwater Ordinance is presented in Technical Appendix M). The City needs its existing drainage design standards to be revised and upgraded to be consistent with the Ecology Technical Manual. A new clearing/grading ordinance, zoning amendments, and land conversion controls are recommended in the DHWAP.

Element No. 6 - Internal Engineering and Technical Support

Assessment - The control, conveyance, and treatment of surface water runoff is a technical process that involves engineering judgment and decisions. A strong engineering capability is needed in all aspects of water resource management, including the development of design standards and effective maintenance programs, regulatory compliance, watershed planning, and CIP implementation.

At this time, the City's Public Works Department does not maintain a separate stormwater engineering staff. The City Engineer provides the engineering direction for basin planning, regulatory compliance, maintenance, development review, and the CIP process, as their time allows.

Technical assistance is also provided by Public Works to the CED, as well as the City Managers office, as time is available from existing staff within Public Works.

Analysis - The City Engineer provides engineering input to stormwater and groundwater management as his time allows. Occasionally, other Public Works staff are used to support stormwater and groundwater management technical functions.

Because there are few stormwater staff presently in the Public Works Department, many existing City services cannot be adequately performed. These include:

- ❑ Technical support to the water utility for groundwater, wellhead, and aquifer protection,
- ❑ Development review and land use controls,
- ❑ Policy and design standard development,
- ❑ Regional planning and coordination,
- ❑ Inspection and enforcement,
- ❑ Development of additional funding sources,
- ❑ Public education,
- ❑ Regulatory tracking and compliance,
- ❑ Complaint response,
- ❑ Program management and direction, and

- Regulatory compliance.

Having the appropriate types of technical expertise and adequate levels of staffing is critical to the success of the City's Stormwater Program. To continue as is, is not realistic because additional internal technical resources are needed right now within Public Works to achieve regulatory compliance. Hiring additional staff is expensive and highly visible, but it is inappropriate to contract this type of work out to one or more outside consultants or agencies who are unfamiliar with the City's way of doing business and the City's drainage system.

An effective and cost-effective way to develop and provide this type of function within the City is to first create a new senior engineer position and include technical assistance within the responsibilities assigned to this new position. Technical assistance responsibilities could also include plan review, implementation of the City's Stormwater CIP program, and other assigned tasks. This should help address the immediate short-term technical assistance needs as well as plan review, stormwater regulatory compliance, and groundwater management.

Specialized areas of expertise such as wetlands, fisheries, soils, and water quality could also be acquired on an as needed basis from other agencies or outside consultants to supplement the City's internal technical expertise.

Current Level of Staffing - Estimated to be 100 hours per year as provided primarily by the City Engineer.

Required for Regulatory Compliance - There is no specific regulatory requirement to provide engineering and technical assistance to the City's Stormwater Program. It is understood, however, that the City would use good judgment to select and staff its Stormwater Program with an adequate number of capable, technically competent individuals.

Required by the Drayton Harbor Watershed Action Plan - There is no specific requirement for the City to hire and support specialized engineering stormwater expertise. However, adequate City technical staffing and capabilities are implied in Recommendations No. SW-29, SW-30, SW-31, SW-32, SW-33, SW-36, SW-37, SW-39, SW-41, SW-42, and LC-52.

Management Alternatives - listed below are several different alternatives for the City's consideration.

- Continue as is, with the existing engineers (the Operations Manager and the City Engineer) providing technical direction and assistance as their time allows.

- ❑ Add additional technical capabilities to the City's Stormwater Program by hiring one senior engineer in the short-term and additional specialized staff in the future as needed for internal technical expertise.
- ❑ Contract the work out to another local agency, such as Whatcom County or the City of Bellingham through an interlocal agreement.
- ❑ Contract the work out to an outside consultant on an as needed basis.

Recommendations

Program	Develop the internal engineering and technical expertise as-needed to effectively implement the City's Stormwater Program compliance with the State's Basic Stormwater Program and recommendations of the DHWAP.
Staffing Level	Short-term: Add the equivalent of 1,000 hours (0.5 FTE) of a senior stormwater engineer's time. Long-term: Maintain the 1,000 hours of the senior engineer' time and add water quality expertise as program dictates and funding allows.
Management Alternative	Hire an additional senior engineer, within Public Works to address the immediate short-term technical assistance needs. Other duties assigned to this position would include development review, regulatory compliance, and direction of the City's new stormwater CIP program. To address the long-term needs, create an internal pool of expertise within the City by developing technical expertise in other divisions and departments within the City. Hire outside consultants and/or contract with other agencies to acquire additional or very specialized areas of expertise on an as-needed basis, $20,000 per year. These outside experts could also be used to provide a senior level of review to the City's internal pool of technical personnel.
Costs/Funding Source(s)	<u>Costs</u> Short-term: Estimated to be $20,000 per year. Long-term: Estimated to be $40,000 per year.

	Funding Sources
	Current Expense Fund, Street Fund, or revenue from a new City-wide stormwater utility.
Legal Authority	The City has the needed legal authority to technically support the City's Stormwater Program. No new legal authority required.

Element No. 7 - Water Quality, Wetlands, Streams, and Habitats

Assessment - The proper management and protection of surface water involves the use of natural systems. The management and integration of these natural systems goes beyond engineering judgments, and includes such areas of expertise as biology, water chemistry, fisheries, geology, hydrology, and ecology. Viable streams, fisheries, wetlands, and estuaries are the visible products of an effective stormwater program.

In order to have a proper understanding of these systems, it is important for the City to have qualified staff to assess and guide these aspects of the water resources program. At this time, the City has no specially trained staff in the areas of freshwater, ecology, fisheries, or water quality. The City Engineer and Division Manager and City Planner use their best judgment, with input from the County, State resource agencies, and consultants, to make these natural resource decisions.

Some of this type of work is done cooperatively with the County, and through the use of consultants. However, the day-to-day involvement of these types of personnel is important to the long-term success of the program.

Water quality expertise would be especially helpful to the City when developing monitoring and source control programs to meet regulatory requirements and implement the wellhead protection program. Habitat, water quality, land use, and watershed planning skills can often be found in the same person, which may also help the City realize any future basin planning objectives, as described above in Element No. 2.

Analysis - Water quality, wetlands, and stream habitat expertise are vital to the long-term success of the City's Water Resources Program. However, these fields of expertise are not required by regulation, and could easily be provided by internal or external experts.

Immediate staffing is not recommended because it is not needed for compliance with the State's Basic Stormwater Program. If this expertise is needed in the short-term, it might best be served by using outside consultants.

Because there is a long-term need to have this expertise to comply with the DHWAP and possible future NPDES permits, the City should anticipate acquiring this expertise within one to three years (or developing it internally as suggested in Element No. 6.) Existing staff cannot meet this long-term need. Acquiring this expertise with the hiring of a senior engineer would be the most convenient and cost-effective way to proceed, if possible.

If this is not possible, the City has a number of options:

- ❑ Develop the expertise "in-house", i.e., within CED, Public Works, or the Water Utility.
- ❑ Contract out to the County or City of Bellingham.
- ❑ Contract out to consultants.

The best option, in this case, is to do all three. Develop enough of this type of expertise "in-house" to answer day-to-day questions. Use the County or other agency expertise when doing large scale basin studies or conducting regional water quality monitoring. Continue to use consultants, as needed, to confer with City staff and/or conduct specialized studies or meet specific permit or regulatory requirements.

Current Level of Staff - Estimated to be approximately 100 hours per year, as provided by City Engineer, City Planner, and Division Manager.

Required for Regulatory Compliance - Retaining water quality, wetlands, and stream habitat specialists is not required in the State's Basic Stormwater Program.

Required by the Drayton Harbor Watershed Action Plan - There is no specific requirement for the City to hire and maintain water quality, Wetlands, streams, and habitat expertise on staff, However, having this expertise in-house would allow the City to implement suggested DHWAP Recommendations: SW-30, SW-36, SW-41, SW-42, LC-51, and LC-45.

Management Alternatives - listed below are several different alternatives for the City's consideration.

- ❑ Continue using existing staff for this function and continue to use County personnel or outside consultants on an as-needed basis.
- ❑ Hire a second senior engineer who also has water quality, wetlands, and stream habitat expertise. Share this position with the staffing needs identified in Element No. 6.

- ❑ Hire a water quality expert and share the position with groundwater management responsibilities.
- ❑ Develop this environmental expertise within other departments or divisions within the City.
- ❑ Contract out to the County or neighboring cities to acquire these areas of expertise.
- ❑ Contract out to an outside consultant, on an as needed basis.

Recommendations

Program	Water quality, wetlands, and stream habitat expertise are not needed immediately, but will be needed to implement the DHWAP. (Note: This expertise is similar to that needed for groundwater protection (Element No. 8), and the two responsibilities could be combined with the hiring of one FTE in the City's Stormwater Program in the long-term.)
Staffing Level	Short-term: Continue to use existing staff. No new staffing recommended. Long-term: Develop the needed expertise in-house with existing planning staff (or hire 0.5 FTE water quality specialist).
Management Alternative	Try to acquire some of this expertise with the new senior engineer position or groundwater specialist to be hired. Work with CED and other City departments to develop an in-house pool of expertise. Continue to use County, other cities and resource agency staff as appropriate. Use outside contract expertise only to supplement the above three options, on an as-needed basis.
Cost/Funding Source(s)	<u>Costs</u> Short-term: No new costs. Long-term: Costs of hiring an out-of-house water quality specialist (or adding 0.5 FTE in-house) are

estimated to be $20,000 per year and an additional $20,000 for outside experts per year.

Funding Source(s)

Current Expense Fund, new stormwater utility fund, and/or the City's Water Utility.

Legal Authority — The City has legal authority to perform water quality and other environment services.

Element No. 8 - Groundwater and Wellhead Protection

Assessment - A major emphasis of the City's Stormwater Program is on groundwater, aquifer, and wellhead protection. This emphasis on groundwater will continue to grow as the City implements its new Wellhead Protection Plan and begins to implement the Blaine Ground Water Management Plan. The Water Utility has been using the expertise of the Stormwater Management Program to conduct wellhead protection planning and to coordinate regionally for the City on groundwater issues.

The City's groundwater resources supply drinking water to over 5,000 citizens of Blaine and adjacent areas. These underground aquifers are very susceptible to contamination from stormwater and surface land uses through local aquifer recharge and stormwater infiltration.

The City Engineer has developed the Blaine Ground Water Management Plan. Public Works has also taken a leadership role in protecting the City's groundwater resources through development of the City's Wellhead Protection Plan. The proposed wellhead program advances the goals of the Blaine Ground Water Management Plan by establishing pollution source control programs within the 1- to 10-year pollutant travel times for each of the City's major well fields.

Much of this groundwater planning work has been accomplished through State grants and inter-jurisdictional financial support. As these plans are implemented by the City, staffing and program priorities will need to be established as well as the possible identification of new and additional funding sources.

Analysis - The specific role the City needs to assume in regard to groundwater protection, both now and in the future is unclear. The City has recently developed a Draft Wellhead Protection Plan to protect the City's system of water supply aquifers. This was done using an outside consultant and existing staff within the City's Stormwater Program. This type and level of staffing seems appropriate to address both current and short-term needs.

In the long-term additional groundwater expertise and protection will likely be needed. This is particularly true if the City Council officially adopts the draft Wellhead Protection Plan.

Because groundwater and wellhead protection involve monitoring and control of both point and non-point sources of pollution, usually transported via stormwater runoff, it would be appropriate to locate this function within close proximity to the City's water quality specialist. In fact, due to their technical similarities, the water quality person within the City could also perform or guide the wellhead protection activities. Based on the discussion above in Element No. 7 regarding water quality, wetlands, and stream habitat expertise, the City may be best served by developing the in-house groundwater protection expertise within the City's Stormwater Program. This same position could also perform surface water quality functions and help the City meet its future stormwater regulatory requirements. Funding for this position could be provided by the Water Utility and expanded as needed to meet future enhancements of the City's groundwater protection program.

Current Level of Staffing - Estimated to be 100 hours per year, as provided by City Engineer and Operations Manager.

Required for Regulatory Compliance - Groundwater and wellhead protection are highly desirable goals for the City to achieve, but they are not specifically required to meet the requirements of the State's Basic Stormwater Program.

Required by the Drayton Harbor Watershed Action Plan - Groundwater/wellhead expertise would be helpful to the City to address City Responsibilities No. SW-36 and SW-37 as defined in the DHWAP.

Management Alternatives - listed below are several different alternative for the City's consideration:

- ❑ Continue the existing level of expertise, staffing, and funding.
- ❑ Develop or use existing expertise within the City's Water Utility.
- ❑ Contract with the County and/or adjacent cities.
- ❑ Contract out to consultants.

Recommendations

Program	Additional groundwater expertise is needed to complete and implement the Blaine Wellhead Protection Plan
Staffing Level	Short-term: A senior level position (equivalent to 1,000 hours and $20,000) should be hired to lead the

City's groundwater and wellhead protection activities. (Note: Position responsibility could be shared with water quality specialist needs presented in Element 6.)

Long-term: It is likely that the need for groundwater protection expertise will increase as the groundwater, wellhead, water supply, and conservation plans are implemented. Continued and expanded funding from the water utility will be critical to the City's ability to sustain groundwater expertise within the City's Stormwater Program. The future level of staffing for this element is estimated to be 2,000 hours (1.0 FTE) and $40,000 per year. When existing groundwater plans are adopted and begin to be implemented, another review of staffing and workload levels is recommended.

Management Alternative

Increase support to Public Works from the Water Utility to 1,000 hours per year (0.5 FTE) and begin to develop in-house expertise for both water quality (0.5 FTE) and groundwater protection (0.5 FTE) within the same staff person located within the City's Stormwater Program. (See Element No. 6)

Continue using existing City staff, other agency staff and outside consultants in the short-term, as appropriate.

In the long-term, acquire the additional expertise as needed by:

- Continuing to expand the use of this new position from 1,000 hours to 2,000 per year for groundwater related work. Locate this position in Public Works to assist the City in the implementation of the Groundwater Management Plan, and
- Supplementing in-house expertise with outside consultants on an as needed basis. (No budget has been estimated for these possible future services.)

Cost/Funding Source(s)	Costs Short-term: Estimated to be $20,000 per year for 1,000 hours for 0.5 FTE. Long-term: Estimated to be $40,000 for 2,000 hours for 1.0 FTE Funding Source(s) Water Utility. Other options are Current Expense and/or new stormwater utility fund.
Legal Authority	The City has the needed legal authority to implement its groundwater management and planning services. No new legal authority is needed.

Element No. 9 - Inspection and Enforcement

Assessment - Inspection and enforcement of development design standards and the protection of City's sensitive wetlands, aquifer recharge areas, streams, lakes, and flood plains are critical to the protection, preservation, and enhancement of the region's natural drainage features and related resources.

Because the City has the responsibility of providing adequate drainage controls throughout the City, it is important that all new drainage systems installed by developers be properly designed and built. The City accepts ownership of these public drainage facilities and is responsible for their proper long-term maintenance. Some facilities may, in the future, be maintained by residential home owner associations. An inspection program of new stormwater facilities ensures that both public and private facilities are properly constructed in the field. It also ensures that proper long-term maintenance is provided for the City's private drainage facilities.

Analysis - The Engineering Division has assigned staff (0.25 FTE) to inspection and enforcement of the City's drainage requirements for new development. Some inspection of new development is occurring through the City's Building Office. The staff often does not have the time or expertise in stormwater management to ensure the City's drainage facilities are built and operating according to the proposed plans and specifications approved by the Engineering Division. This is of concern to the City for two reasons. First, the City ultimately has the responsibility and liability if the facilities are not operating correctly or are causing localized flooding and/or water quality problems. Secondly, many of these systems built by developers may be deeded to the City and may ultimately be taken over by the City for long-term maintenance and repair. (See above discussion in Maintenance Element No. 4.) If these facilities are not built or maintained properly by the

developer, the City may have to retrofit and reconstruct them, or incur a large operating cost in maintaining them for the developer, in order to bring the system up to the City's operating standards.

Future drainage inspectors should have the authority, as defined in City ordinances, to enforce the City's drainage codes by "red tagging" a site, and halting all construction on the site until the drainage, erosion, or water quality problems have been corrected. Many cities require maintenance or stormwater cash bonds to be secured by a developer before work begins at a site. In this way, if a drainage emergency or other related problem occurs, the city crews can fix it immediately in order to minimize its environmental impacts, and be reimbursed directly by the developer through the pre-established cash bond.

An inspection/enforcement program is normally not needed if developers, businesses, and the public do what they are supposed to do with regard to the design, operation, and maintenance of the drainage facilities. However, because this is not always the case, and because the City assumes ownership and the liability of the City's drainage facilities, and because it is required by the State, the City should improve its existing inspection and enforcement program of both private and public drainage systems.

Existing Level of Staffing - Estimated to be 100 hours per year, as performed by City Engineer and City Building Inspector.

Required for Regulatory Compliance - Inspection and enforcement of the City's stormwater and maintenance ordinances and design criteria are a requirement of the State's Basic Stormwater Program. Under the State's Basic Stormwater Program, the City is to:

- ❑ Control stormwater quality from all development by inspection and approval of all new drainage facilities acquired by the City.
- ❑ Maintaining all stormwater facilities within the City, both public and private, by developing and enforcing the proper operation and maintenance program.

Required by the Drayton Harbor Watershed Action Plan - An inspection/enforcement program is needed by the City to effectively address implementation Requirements No. SW-30, SW-32, SW-33, LC-45, LC-47, and LC-52.

Management Alternatives - listed below are several different alternatives for the City's consideration.

- ❑ Continue as is, with the existing level of inspection and enforcement.

- ❑ Have staff inspectors in the CED receive training and assume the drainage enforcement inspection requirements.
- ❑ Staff up and train one of the drainage maintenance crew (in the Operations Division) to provide inspection and enforcement services.
- ❑ Have existing (and/or future) Stormwater staff assume the enforcement/ inspection function.
- ❑ Contract with the County or adjacent cities to perform inspection and enforcement.
- ❑ Contract the work out to consultants.

Recommendation

Program	The City needs to enhance its present inspection/ enforcement program.
Staffing Level	Short-term: Existing funding and staffing levels should be maintained, and the City's inspection and enforcement procedures and authority should be reviewed and updated as-needed. A proposal should be developed and adopted by the City so that a drainage enforcement/inspection program for new development and existing private drainage facilities is developed that is primarily fee supported. Long-term: The City should develop an inspection enforcement capability with at least one almost full-time drainage inspector (1,500 hours, 0.75 FTE, $30,000 per year). Because of the similarity of the technical expertise needed, the position should work in close association with the drainage maintenance crew and may also be used to lead the City's spill response program which will be needed as part of the Wellhead Protection Program. This position is to be shared with Element No. 10. (Could also be incorporated into the responsibilities of the two person Stormwater maintenance crew discussed in Element No. 4.)
Management Alternatives	In the short-term the City needs to meet its existing inspection/enforcement needs by: ❑ Using existing staff within Community Development to improve the review of new construct sites and new drainage facilities, (by adding 100 hours per year) and

- ❑ Developing an inspection/enforcement program for private drainage facilities. (This is needed to comply with the State's Basic Stormwater Program.)

In the long-term, continue the two short-term staffing inspection/enforcement activities listed above and add water quality inspection/enforcement expertise. As work load increases and responsibilities are defined, a new position (equivalent to 1,500 hours, 0.75 FTE, $30,000) may be needed.

(Note: Using outside consultants for inspection/ enforcement of City drainage code is not an effective management option due to legal, logistical, and technical challenges and issues.)

Cost/Funding Source(s)

Costs

Short-term: No new expenditures.

Long-term: Estimated to be $30,000 per year.

Funding Source(s)

Current Expense Fund, new developer inspection fees, new permit review fees, new private facility inspection fees, or from revenues from a new stormwater utility.

Legal Authority

The City does not have the ordinance to implement its inspection enforcement program. New ordinance language is needed. The inspection/enforcement ordinance and the new maintenance ordinance could be combined.

Element No. 10 - Complaint Response

Assessment - Most Northwest cities have found it very important to be responsive to the needs of their citizen clientele, particularly when programs are being publicly funded and require public approval of any new fee increases. Public perception is critical to the long-term success of any stormwater program. Local citizens will judge the effectiveness of the City's Stormwater Program by how politely and effectively their complaints are addressed. Most people do not expect their problem to be fixed immediately, but they do expect a professional and timely response to their complaint and a general idea of how and when their local problem will be addressed. Often

these complaints can be used by the City's drainage engineers as an early warning system, alerting them to capacity and/or water quality problems.

At this time, public complaints are handled on a case-by-case basis. A list of drainage complaints is maintained by the Public Works. Complaints are carefully tracked, but the ability of the Division to respond to these complaints in a timely manner is hindered by limited staff resources.

Analysis - The City's Stormwater Program receives about ten to twenty drainage-related complaints per year. Each complaint is recorded and a master list is maintained by Public Works. Generally, a City employee does not immediately or personally respond to a drainage complaint unless it is a life-threatening situation. Complaints are responded to as part of the annual maintenance program. Solutions may be addressed as regional capital projects are designed and built.

Due to the sporadic and seasonal nature of most public complaints, it is difficult to determine in advance how many and what types of complaints the City may experience. Because the work load is difficult to define, hiring new staff or dedicating existing staff just to respond to public complaints is difficult to justify.

The City should have an established procedure to record, document, map, and respond to complaints. Once this process has been established, it can be carried out by any staff person familiar with the procedures. All drainage related complaints, however, should be reported to the staff of the City's Stormwater Program, with the drainage complaint response forms filed and stored within the Division.

One of the best approaches to staff this type of sporadic work load is to divide the effort among existing staff. CED would respond to any development related drainage complaints, the Transportation Division's Stormwater Maintenance Crew to maintenance and flooding related complaints, and Stormwater Staff to water quality-related complaints.

The City's Stormwater Program needs to set up a standardized and responsive public complaint process. All of the City's staff, including inspectors, maintenance staff, and engineers, should be trained to respond to citizen complaints.

Because of the issue of public perception, it is not recommended that response to public complaints be contracted out to consultants or other local agency.

Current Staffing Level - Estimated to be 50 hours per year, generally performed by City Engineer and/or maintenance crew.

Required for Regulatory Compliance - There is no specific regulatory requirement to respond to public complaints.

Required by the Drayton Harbor Watershed Action Plan - There is no recommendation for complaint response in the DHWAP.

Management Alternatives - listed below are several different alternatives for the City's consideration.

- ❑ Continue as is responding as staff time and situations dictate.
- ❑ Improve responses to the public by assigning existing staff in Stormwater Maintenance, Operations, and CED.
- ❑ Add staff within either Stormwater Maintenance, Operations, or CED to improve the response program.
- ❑ Contract with the County and/or adjacent cities to provide this service.
- ❑ Contract out to consultants.

Recommendations

Program	The City needs to enhance its complaint response processes.
Staffing Level	Short-term: The City's Stormwater Program should develop and begin to implement a more responsive and informative process to address public drainage complaints. The number of calls and response time should be recorded to prioritize corrective actions and allocate resources. No immediate new staffing is recommended; maintain existing funding and staffing levels. Long-term: This element of the City's stormwater work load should be documented and taken into account when hiring new staff and making work assignments. Because of the sporadic nature of this element, dedicating staff to respond just to public complaints is not recommended; however, once the work load is documented, this element could account for as much as 500 hours, $10,000 per year (0.25 FTE), as the City's Stormwater Program continues to grow and expand its responsibilities.

Management Alternatives	Improve City response to public complaints by: ❑ Establishing a uniform process to document, contract, and record public complaints, and ❑ Use existing staff within CED, Stormwater Maintenance, and Operations to respond to individual complaints based on the type and nature of the complaint. ❑ No additional staffing is recommended at this time.
Costs/Funding Source(s)	Costs Short-term: No additional expenditures recommended. Long-term: $10,000 needed for 500 hours (0.25 FTE) of response time per year. Funding Source(s) Short-term: No new or additional funding needed. Long-term: Recommend forming a stormwater utility.
Legal Authority	City has legal authority to respond to public complaints. No new legal authority required.

Element No. 11 - Public Education

Assessment - One of the major components of any future regulatory compliance program will be a significant effort to educate the public so as to prevent pollutants from entering the surface water and groundwater systems. Such a public information education program does not just happen, it needs to have direction and it needs to be coordinated with the activities of other agencies, both within the State and the local region. Producing the corresponding informational and educational materials can often require considerable financial and staff resources.

Education and public involvement help foster recognition and stewardship of natural resources. Recognizing that education is an effective, long-term resource management tool, and that education is necessary as both a supplement and an alternative to enforcement programs, the City's Stormwater Program should be making the effort to inform and involve the public in pollution prevention and resource protection.

An ongoing public involvement program will be critical to the City in achieving its water resource goals. The non-point source control programs needed for the enhancement of the City's surface water quality are primarily realized through public education. Public education is also especially important to an effective wellhead protection program which can only be realized through continuous public education and awareness. Often a good place to begin such programs is by sponsoring the development of local school curricula, which tend to reach out to most families and generally reaches the entire community.

Through its basin planning projects, the City's Stormwater Program has targeted education and involvement efforts to many of the City's citizens. By direct participation on project advisory committees, the City has made a good effort to change the habits and practices of some of the citizens of Blaine to protect the area's water resources.

Analysis - Much of the progress made by the City in the areas of public involvement and education has been made possible through grant funding obtained from the State, primarily through the Centennial Clean Water Fund program. Because public involvement and education activities have primarily been grant-funded it has been difficult to maintain a consistent ongoing effort to educate and involve the public and work with specific commercial activities or special interest groups, such as the business community.

The City's Stormwater Program should develop a long-term, dedicated public involvement and education program. The focus of this effort should be on source control, i.e., stopping the discharge of pollutants into the natural drainage system. This is one of the most effective BMPs for the reduction of pollutants and is stressed by both Ecology and the PSWQA. This type of activity must be an ongoing effort to be successful because the City is requesting its citizens to change their lifestyle and their daily habits. To change people's habits takes time and continuous education. It will also require opportunities and programs created/sponsored by the City that allow the public to act correctly (i.e., oil recycling, collection of household hazardous wastes, and the correct selection and use of pesticides, etc.).

Public education is a good preventive tool that plays an effective role in reducing or eliminating stormwater, habitat, and water quality problems. Experience with other agencies throughout Puget Sound and the nation indicate this is true, and that the long-term benefits of public education usually more than pay for their short-term costs. It is for these reasons that the existing level of effort for public education within the City's Stormwater Program should be enhanced. Where appropriate, additional opportunities for regionally sponsored public education activities should also be pursued.

Contracting out an ongoing public program is not encouraged unless a new level of effort and/or specialized public relations campaign is being initiated, such as developing a stormwater brochure. The City's ongoing program may need to be expanded in the future, requiring additional staff to meet possible future regulatory requirements.

Current Level of Staffing - Estimated to be 50 hours per year, as provided by the staff of Public Works and/or CED.

Required for Regulatory Compliance - The State's Basic Stormwater Program requires the City to "develop and implement education programs to educate citizens about stormwater and its effects..."

Required by the Drayton Harbor Watershed Action Plan - The DHWAP requires the City to educate septic tank owners (Recommendation No. LS-26).

Management Alternative - listed below are several alternatives for the City's consideration.

- ❑ Continue as is to allocate Transportation and Engineering Division staff time on a project specific basis.
- ❑ Meet the minimum requirements of the State's Basic Stormwater Program by establishing a public education program, beginning with the development of a Blaine Stormwater brochure.
- ❑ Expand the existing City public education plan by allocating additional funding and staff time, and create an ongoing, annually funded public education program.
- ❑ Coordinate regionally with the County and adjacent cities to perform public education for stormwater.
- ❑ Contract public involvement program work out to a consultant (perhaps even creating a new stormwater public relations campaign) to support the City's existing stormwater, groundwater, and future stormwater utility.

Recommendations

Program

The City needs to develop a public education program to meet the requirements of the State's Basic Stormwater Program.

Staffing Level

Short-term: The City should continue to educate its citizens and participate in the regional awareness campaign as opportunities present themselves. It is recommended that the City continue to budget funds to work cooperatively with the other agencies in the area in developing regional public involvement and education programs. No additional staffing is recommended at this time. Maintain current levels of staffing and funding (50 hours per year.)

Long-term: The Division should establish an ongoing public involvement and education program. Public involvement and education, including volunteer and regional coordination, require additional staff resources. To ensure a consistent high quality program and continued regional coordination, it is envisioned that designated staff may be required in the future, however, none are recommended at this time.

Management Alternative

- ❑ Increase the City's support of public education activities for stormwater as needed to meet the requirements of the State's Basic Stormwater Program.
- ❑ Pursue new regionally supported and funded public education activities, as opportunities allow. (This is a cost-effective way to enhance the existing public education program without incurring significant new expenditures or staffing requirements.)

Costs/Funding Source(s)

Costs

Short-term: Maintain existing levels of staffing and funding. About $5,000 will be needed to develop a Blaine Stormwater brochure. Long-term: Maintain existing level of support.

Funding Source(s)

Current Expense Fund or future stormwater utility.

Legal Authority	The City has the legal authority to implement an enhanced public involvement program. No new authority is needed.

Element No. 12 - Regional Coordination

Assessment - The City is fortunate in many ways to be a part of a larger regional water resources management group which includes Whatcom County, the County Public Health Department, and other resource agencies. Over the past several years, substantial coordination has occurred between various agencies in the Drayton Harbor area, allowing the City's water resources program to grow rapidly and implement state-of-the-art management practices, such as effective drainage standards and the local use of BMPs.

This type of effective regional coordination takes time and has not been assigned to any one specific person within the City's Stormwater Program. Most of the coordination efforts have been shared by the Division's Manager and the City Engineer.

It is important, especially for the City's emerging groundwater management effort, to continue this type of regional coordination in order to continue to save money and take advantage of regional technical expertise.

Analysis - Regional coordination of the various activities of the City's Stormwater Program should continuously be pursued. The City has used regional coordination to develop its existing Stormwater Program, and to keep costs and staffing levels to a minimum. These efforts should be maintained by the City, and perhaps even increased, to keep the City's stormwater costs to a minimum. Interlocal agreements and regional coordination will likely be needed over time to effectively implement the City's numerous stormwater and watershed action plans.

The City should continue to maintain and expand its good working relationship with other local agencies. However, no additional staffing in either the short- or long-term is recommended at this time. Existing efforts and staffing may need to be increased as part of a future NPDES Stormwater Permit, but cannot be justified at this time. Contracting with an outside consultant to perform the regional coordination function is usually not needed or even appropriate. Consultants may be helpful, however, on a project specific or issue specific basis for technical advice or evaluation of alternatives.

Current Level of Staffing - Estimated to be 50 hours per year, as performed by the City Engineer.

Required for Regulatory Compliance - Regulatory requirements for regional coordination are not specifically defined at this time.

The State's Basic Stormwater Program, however, states that the City shall "conduct the City's Stormwater Program with the provisions of the Growth Management Act, where appropriate."

Required by the Drayton Harbor Watershed Action Plan - Regional coordination is specified in the DHWAP for the City in Recommendation SW-34.

Management Alternatives - listed below are several different alternatives for the City's consideration.

- ❑ Continue the existing level of regional coordination using existing staff within Public Works, Engineering, the CED, and the Water Utility.
- ❑ Increase the level of regional coordination in an effort to reduce the City's Stormwater Program costs, keeping staffing levels to a minimum, and taking advantage of specialized expertise within other local agencies.
- ❑ Decrease the existing level of regional coordination in order to develop special policies and practices for stormwater management that are uniquely tailored to the City's land use plans, environmental conditions, or internal polices favored by the City.
- ❑ Contract out regional coordination activities to a consultant.

Recommendations

Program	Continue to maintain the existing level of regional coordination
Staffing Level	Short-term: No additional staff should be hired specifically for regional water resources program coordination for either the City's stormwater activities or the evolving groundwater program. Assign the new staff positions recommended in Element No. 6 and No. 8. Long-term: Regional coordination responsibilities should be assigned to each of the new senior engineers and water quality/groundwater person when they are hired. See Elements No. 6 and No. 8.
Management	❑ Continue the existing level of regional

Alternatives	coordination by having the existing staff of Public Works, Planning/CED, and the Water Utility contact local agencies, establish agreements and working relationships and coordinate as needed among themselves. ❑ Continuously pursue interagency working relationships to reduce stormwater costs and staffing levels, and establish a friendly basis for future agreements which will be needed to implement the DHWAP.
Costs/Funding Source(s)	Costs - No new expenditures recommended. Funding Source(s) - No new funding required.
Legal Authority	The City has the authority to implement its regional coordination activities. No new legal authority required.

Element No. 13 - Regulatory Compliance

Assessment - The City will come under increasing regulatory pressure from Ecology, through the PSWQA Management Plan and through implementation of the NPDES stormwater permitting process, to comply with certain activity levels and standards related to water quality of both groundwater and surface water. The City will need to have a person who can remain up-to-date on the latest regulatory requirements, participate in their negotiation, and prepare the appropriate reports and compliance documentation. This will be especially true if an NPDES Stormwater Permit is issued to the City by Ecology.

It is neither appropriate nor responsible for the City to ignore these requirements. As discussed earlier, the penalties for non-compliance would include significant political, financial, and legal ramifications.

Analysis - All regulatory compliance to-date has been handled by the City Engineer and the Operations Manager. The City's Stormwater Program has no staff specifically assigned to this task. It is anticipated that the requirements for regulatory compliance will increase substantially over the next several years, particularly if the State issues the City a NPDES Stormwater Permit and/or begins to enforce compliance with the PSWQA Management Plan.

Although the City will have to document compliance with State and federal regulations, this is not such an onerous job as to require a major staffing

effort. What is required, is to have someone responsible for this activity who can take the time to meet with the regulatory agencies, compile the various reports and studies prepared by other parts of the City's Stormwater Program, and see that all reports and regulatory requirements are submitted promptly.

The short- and long-term regulatory responsibilities of the City's Stormwater Program should reside with the City Engineer. The City Engineer will need assistance, however, from a number of City staff from different departments to meet the diverse regulatory requirements for stormwater.

Existing staff within the City's Stormwater Program should be adequate to continue to meet the short-term regulatory needs of the City. Current regulatory needs include compliance with the State's Basic Stormwater Program. The actual work of developing and responding to the various regulatory requirements would be performed by Stormwater staff, Operations staff, CED staff, and outside consultants, as required. Regulatory compliance work, particularly the management and direction of the program, is best done internally by City staff. Special studies, water quality monitoring, and other specific assignments to meet these requirements can, and perhaps should, be contracted out to keep internal staffing levels to a minimum.

Current Level of Staffing - Estimated to be 50 hours per year as conducted by the Operations Manger and City Engineer.

Required for Regulatory Compliance - The City is obligated under State laws to comply with the State's Basic Stormwater Program, and any future NPDES Stormwater Permits.

Compliance with these regulations require the City to undertake many stormwater related activities, including:

- ❑ Adopting new ordinances,
- ❑ Conducting effective stormwater and water quality management for new developments,
- ❑ Proper operation and maintenance, including annual O&M planning, inventory of facilities, and record keeping,
- ❑ Public education,
- ❑ Regional coordination,
- ❑ Dedicated, adequate local funding,

- Inspection and enforcement,
- Water quality monitoring and response program,
- Fixing problem areas, including illicit connections, and
- Developing and implementing a source control program.

Future stormwater NPDES Stormwater Permits may include additional stormwater activities, including watershed action plans, additional monitoring, and groundwater protection.

Required by the Drayton Harbor Watershed Action Plan - Regulatory compliance for the City is not specifically defined in the DHWAP, however, each agency responsible for implementing the DHWAP is expected to meet or exceed all stormwater regulatory requirements.

Management Alternatives - listed below are several different alternatives for the City's consideration.

- Ignore the regulatory requirements.
- Continue to have the City Engineer in the Public Works assume these responsibilities, as required.
- Have some other division or department within the City assume these additional responsibilities with existing staff.
- Add new staff within the City's Stormwater Program, when needed, to assume the increasing level of regulatory compliance responsibilities.
- Hire new staff, when needed, within other divisions or departments to meet these responsibilities.
- Keep internal staffing to a minimum (using existing City Stormwater staff in the short-term and hiring 1.0 FTE in the City's Stormwater Program in the long-term). Hire out to consultants or contract with the County or other local agencies to meet specialized regulatory requirements and provide technical/programmatic advice.

Recommendations

Program	The City should meet the regulatory requirements of the State's Basic Stormwater Program.
Staffing Level	Short-term: The Public Works City Engineer should

continue to track regulatory changes and be the primary contact for the City on regulatory issues, including either stormwater, groundwater, and wellhead protection.

Long-term: A full-time person may be needed to coordinate internally and externally for the City. This position would become responsible for coordinating all permit-related monitoring, data collection, reporting, and regional coordination, and would continue to assist the or City Engineer in future permitting negotiations.

Management Alternatives

- ❑ Continue to use existing City Stormwater staff to monitor and ensure compliance with the various stormwater regulations.
- ❑ Hire up to one new staff person (2,000 hours, $40,000 per year, 1.0 FTE) to assist in regulatory compliance as needed in the future.
- ❑ Use consultants, as-needed, for special/specific regulatory compliance assignments in order to keep staffing and compliance costs to a minimum.
- ❑ Where appropriate, contract with other local agencies to reduce financial and staffing burden upon the City. Economies of scale may be possible on similar or repetitive compliance requirements; these should be pursued by the City before any additional staff are hired.

Cost/Funding Source(s)

Costs

Short-term: No new expenditures. Long-term: One new position (2,000 hours) costing $40,000 per year.

Funding Source(s)

City Current Expense Fund, or new stormwater utility.

Legal Authority

City has required legal authority to implement regulatory compliance related activities except as defined in Elements Nos. 1-12 above. No new legal authority is required.

5.8.4 Summary of Programmatic Analysis

The City's Stormwater Program is emerging from a planning into an implementation phase, so such, it is appropriate to review and update the Division's operations, as well as funding and staffing levels. The City's

Stormwater Program, at this time, is underfunded and understaffed. Each of the thirteen elements of the program analyzed above will require additional effort in the future. Staffing needs have been divided into short-term needs (0-2 years) and long-term needs (3-5 years), as shown in Table 5-3. In the short-term, the addition of 1.4 new FTE (2,800 hours) is recommended. In the long-term, as many as an additional 6.7 new FTE (13,450 hours) may be required as the City begins to address the needs of compliance with future regulatory requirements. Recommended short-term improvements will cost $158,500 annually and should begin to be implemented as soon as practicable. (It has been assumed that the existing level of stormwater funding and staffing would be maintained.) Long-term improvements will cost an additional $189,500 for a total of $348,000 per year. In addition, a future capital budget of $1,525,000 will also be required.

Implementing both the recommended short- and long-term improvements will cost about $348,000, annually and effectively more than double the annual operating costs of the City's current Stormwater Program. Improvements will require new funding sources to be developed along with a new outside funding source for capital projects. Funding for the short-term improvements could be primarily from a new stormwater utility fee and the creation of permit review and maintenance/ inspection fees for private facilities. Long-term improvements could also be funded primarily from the stormwater utility fees along with other revenue sources, including increased developer fees, a new development inspection fee, grants, and support from the water utility. Capital improvements may be funded by grants, loans, stormwater utility fee revenues, local improvement districts, and revenue/councilmanic bonds.

(Please note: All budget and cost estimates presented in this report are estimates and need additional financial analysis before funding is appropriated. The numbers are presented to provide perspective to the planning concepts and alternatives discussed as part of this management analysis.)

One of the difficulties in accurately assessing future funding and staffing levels is that the City has a number of draft stormwater related plans which have identified many new tasks and thousands of dollars worth of capital and operational obligations. Few of these plans have yet been adopted and funded by the City. Financial resources and future funding alternatives are discussed further in Section 6. (Note: It is the intent of the City to adopt this Stormwater Management Plan before, or at the same time as, the various comprehensive plans associated with the Growth Management Act later this summer.)

Table 5-3
Programmatic Analysis: Estimate of Existing and Future Costs and Levels of Staffing
To Operate the City's Stormwater Management Program

No.	Element/Activity	Staffing Level (hours)					Annual Program Costs ($1,000) (Except for CIP $s)				
		Existing Staff	Short-Term Needs		Long-Term Needs		Existing Labor &	Short-Term	Long-Term	Funding Sources	
		PWK	PWK	Other	PWK	Other	Equipment	(0-2 yrs)	(3-5 yrs)	Existing	Future
1	Program Management Technical Direction	100	200	-	200	-	$3,500	$3,500	$7,000	CEF, FR	SWU
2	Basin Planning	100	100	0	100	0	$2,000	$2,000	$2,000 $100,000 (plan update)	CEF, Grant	Grants, SWU
3	Capital Improvements	100	100	0	1,000 (0.5 FTE)	0	$3,000	$3,000	$30,000 $1,425,000 (CIP)	CEF	Grants, LID
4	Maintenance	1,000	2,000 (1.0 FTE)	0	4,000 (2 FTE)	0	$43,287	$95,000	$125,000	RF	SWU
5	Development Review	100	100	100	100	100	$3,000	$3,000	$3,000	CEF, RF	F
6	Eng. and Tech. Support	100	1,000 (0.5 FTE)	0	1,000 (0.5 FTE)	0	$2,000	$20,000	$20,000 + $20,000	CEF, RF	SWU
7	Water Quality, Streams, and Habitats	100	100	0	1,000 (0.5 FTE)	0	$2,000	$2,000	$20,000	CEF, RF	SWU, WU
8	Groundwater and Wellhead	100	1,000 (0.5 FTE)	0	2,000 (1.0 FTE)	0	$2,000	$20,000	$40,000	CEF, RF	WU
9	Inspection and Enforcement	100	100	100	1,500 (0.75 FTE)	0	$2,000	$2,000	$30,000	CEF, RF	F, SWU
10	Complaint Response	50	50	0	500 (0.25 FTE)	0	$1,000	$1,000	$10,000	CEF, RF	SWU
11	Public Education	50	50	0	50	0	$1,000	$1,000 $5,000 (Brochure)	$1,000	CEF, RF	SWU
12	Regional Coordination	50	0 (#6&8)	0	0 (#6&8)	0	$1,000	$0 (#6&8)	$0 (#6&8)	CEF, RF	-
13	Regulatory Compliance	50	50	0	2,000 (1.0 FTE)	0	$1,000	$1,000	$40,000	CEF, RF	SWU
	Total	2,000 (1.0 FTE)	4,850 (2.4 FTE)	200 (0.05 FTE)	13,450 (6.7 FTE)	100	$66,787 w/$95K of CIP	$158,500 w/no CIP	$348,000 $1,525,000K of CIP	CEF, RF	SWU, WU, F Grants

PWK = Public Works Dept.
Other = Other City Depts.

1.4 New FTE

4.3 New FTE

CEF = Current Expense Fund
RF = Road Fund
SWU=Stormwater Utilities

F = Fee
LID = Local Improvement Dis
WU=Water Utility

Section 6
Stormwater Management Plan

6.1 Overview

The following Stormwater Management Plan (Plan) presents activities and costs for the City of Blaine (City) to address local drainage needs and comply with the requirements of the State's Basic Stormwater Program, as defined in the 1994 Puget Sound Water Quality Management Plan. The various recommended administrative, regulatory, and programmatic activities have been prioritized with both short and long-term improvements identified. Funding alternatives have been considered and recommendations made as to the most viable funding source. Suggested staffing levels and costs for each element of the City's Stormwater Program have been presented, along with identified capital and maintenance programs and priorities. An implementation plan is presented along with a proposed schedule, and staffing and funding plans. Note that a Letter of Compliance to the Puget Sound Water Quality Authority has also been suggested to demonstrate the City's acknowledgment and compliance with the January 1, 1995, requirements of the State's Basic Stormwater Program.

6.2 Stormwater Management Strategy and Formation of the Stormwater Management Plan

The Plan for the City is based upon two program directives: first, to solve local drainage problems; and second, to develop a stormwater program that achieves regulatory compliance. One of the biggest challenges the City faces in regard to stormwater management is providing adequate treatment of the surface runoff before it is discharged into Drayton Harbor or Semiahmoo Bay. Most of the City's drainage system is older and is in densely developed areas of the City so there is limited opportunity to provide adequate treatment prior to discharge. Where sites are available, biofiltration/ infiltration types of treatment facilities have been identified and are recommended.

To achieve the first goal, the existing City Stormwater Program and facilities were analyzed and evaluated. Capital needs were based on the 1989 Stormwater Management Plan, which identified the need for one new regional detention facility and a series of pipe capacity improvements. Because major flooding was not a problem, the analysis emphasized the gains to be realized by an enhanced maintenance program, which proved to be significant. Approximately a two to three fold increase in capacity can be

realized within the existing system through regular maintenance and through a series of minor repairs to remove major discontinuities within the existing drainage system. Where needed, additional capacity improvements consisting primarily of larger or more pipes have been recommended to meet existing and future drainage needs.

Achieving the second Stormwater Program directive, regulatory compliance, presents many challenges because the City does not have an effective stormwater/water quality, maintenance, enforcement/inspection and erosion control or other ordinance. Providing the City with these types of legal authority has been recommended along with the adoption of a new set of drainage design standards for the City that are equivalent with the Department of Ecology's (Ecology) Technical Manual. Model stormwater and maintenance ordinances have been included in the Technical Appendix and are recommended as reference documents to guide the City's development of new ordinances. Funding alternatives have been evaluated for both local and political feasibility as well as funding potential. Without new and additional sources of funding, the City's new Stormwater Program will not be able to be implement the additional staffing and financial resources that are needed for almost every element of the City's present Stormwater Program. The current use of Street Funds can not be expected to fund the enhanced and expanded Stormwater Program to meet even the regulatory requirements. Future viable funding sources have been identified and are recommended, to include forming a City-wide stormwater utility, new fees for development review, enforcement/inspection and maintenance fees, and outside grants and loans. Capital projects may be most effectively financed through grants, loans, and local improvement districts, and revenue or councilmanic bonds.

To achieve the above stormwater management goals for sustaining the quality of life within the City and surrounding area, the City needs to renew its commitment to fund, staff, and implement its enhanced comprehensive stormwater, groundwater, and land use/management plans.

6.2.2 Formation Of The City's Stormwater Management Plan

The following Stormwater Management Plan for the City is based on the administrative, regulatory, and programmatic analyses performed as part of this project and presented in this report. The primary sources of input for developing the plan included:

Treatment and Source Controls

The treatment and source controls developed in the Water Quality Assessment presented in Section 3, which were based on available water quality data.

Watershed Plan Recommendations

The recommendations identified for implementation by the City, as presented in the Drayton Harbor Watershed Management Plan and summarized in Section 3 - Water Quality Assessment.

Capital Needs

The capital needs listed and prioritized in the Citys 1989 Stormwater Drainage Plan, as presented in Section 4 of this report.

Maintenance Needs

The maintenance needs listed in the City's 1989 Stormwater Drainage Plan and identified by site visit and field inventory of the drainage facilities and problems which was performed as part of this project in Sections 3 and 4.

Administrative Needs

The administrative program analysis which identified existing legal authorities, program priorities and financial support, and evaluated the overall effectiveness of the City's stormwater program, as presented in Section 5.

Regulatory Compliance Requirements

The regulatory analysis in Section 5, which compared the City's existing stormwater program with compliance requirements of the State's Basic Stormwater Program, identified areas needed for compliance.

Program Needs Assessment

The detailed programmatic analysis, presented in Section 5, of each of the thirteen elements of the City's existing Stormwater Program. These elements resulted in recommended program initiatives, management approaches, staffing and funding levels, and recommended funding sources.

The resulting Plan for the City is presented below.

6.3 Recommended Stormwater Management Plan

The recommended Plan for the City has been divided into an annual operating program and a capital facility plan. The annual operating plan is based on the regulatory and programmatic analysis presented in Section 5.

In addition to the program activities, it includes a listing of activities needed to achieve regulatory compliance and a list of prioritized maintenance needs. The capital facilities plan presents the treatment projects identified in Section 3 and the major structural capital improvements presented in Section 4.

6.3.1 Annual Operating Program

Staffing and Funding Levels

The City needs to improve the staffing and level of funding of its existing stormwater program. Program enhancements are needed to meet requirements of the State's Basic Stormwater Program, to improve maintenance and capacity of the City's existing drainage system, to establish effective drainage controls for new development, to improve water quality, and in doing so meet to many of the recommendations of the Drayton Harbor Watershed Action Plan (DHWAP).

Recommended staffing and funding levels have been previously summarized in Table 5-3, and are briefly summarized below.

In the short-term (0-2 years) the City should:

- Hire the equivalent of 1.4 new full-time employees (FTEs) which will provide the program with an additional 2,800 hours of internal technical support.
- Increase the level of annual funding to the program from $66,787 to $158,500 an increase of $91,713 per year. Potential sources of funding include City Current Expense Fund, Street Fund and grants.

In the long-term (3-5 years) the City should:

- Hire the equivalent of an additional 4.3 new staff providing the program with an additional 8,600 hours of technical support.
- Increase the level of funding to the program from $158,500 per year to $348,000 per year, an annual increase of $189,500. Potential funding sources include the formation of a stormwater utility and/or Current Expense and Street Funds, and grants.

Regulatory Compliance

Stormwater activities needed to be completed by the City to achieve compliance with the State's Basic Stormwater Program (by January 1, 1995) have been presented and discussed in Section 5.3. They include:

- ❑ Write and transmit a Letter of Compliance prior to January 1, 1995, in addition to the following technical requirements;
  - ■ Revise and adopt a new stormwater ordinance including clearing and grading (equivalent to the Ecology model ordinance);
  - ■ Revise and adopt new drainage design standards (equivalent to the Ecology Technical Manual);
  - ■ Improve the City's annual maintenance program, as required, by:
    - writing and adopting a new maintenance ordinance for both public and private facilities (the ordinance should also include inspection and enforcement),
    - inventorying and mapping all drainage facilities and setting up a record keeping process for existing and new drainage facilities,
    - inspecting the City's drainage system semiannually and developing an annual maintenance management plan,
    - increasing the frequency of maintenance (equivalent to Ecology guidelines), and
    - establishing a maintenance enforcement program for private facilities.
- ❑ Develop and distribute a stormwater management/water quality brochure to educate the public;
- ❑ Continue to integrate the City's Stormwater Management program with the City's Growth Management Act (GMA) planning process; and
- ❑ Enforce the City's stormwater management policies, practices, and standards.

(Note: Individual costs for regulatory compliance have not been estimated. The identified short-term staffing and funding levels should be adequate to complete these various compliance activities within twelve to eighteen months.)

List of Maintenance Needs and Priorities

One of the most significant stormwater enhancements needed within the City is to improve the annual stormwater maintenance program. The City needs to substantially improve its legal authority, level of staffing, and level of funding in order to comply with the State's Basic Stormwater Management Plan. A partial listing of major City-wide maintenance needs and priorities has been developed and presented in Section 5.2. This listing is based on the field inventory of major drainage areas presented in Section 3, and graphically displayed in Exhibit 3-21.

Priorities for the City's maintenance program are defined in the 1989 Stormwater Plan and presented in Section 4.5.2. They include the following activities in order of their priority.

1. Inventory and annually inspect all drainage facilities, record results, and create an effective annual recordkeeping work program;

2. Conduct maintenance in order of priority: Cain Creek Channel, then all culverts and swales, beginning with the largest diameter structures first; and

3. Perform regular annual maintenance as needed to keep the system operating effectively.

(Note: A complete inventory of facility maintenance needs would allow an accurate cost estimate to be developed. A short-term estimate of $95,000 per year has been proposed, with a long-term annual cost of $125,000, as presented in Table 5-3.

6.3.2 Capital Facilities Plan

A listing of capital facilities has been developed in Sections 3 and 4 of this report which totals up to $1,200,000. Major structural capital facilities totaling $710,000 have been presented in Section 4.5.1. This list consists of eight facilities, as displayed in Exhibit 4-3. It includes a regional detention facility to be built in two phases, just southeast of the City airport, and six pipe and repair projects to add capacity to the City's existing drainage system.

Seven additional stormwater treatment facilities have been presented in Table 3-6 to improve the quality of the City's surface water runoff being discharged into Drayton Harbor and Semiahmoo Bay. These facilities total an additional $325,000. It is recommended that a small projects program be developed for these facilities so they may be built as soon as funding allows.

The City's Capital Facilities Projects total $1,525,000 recommended to be built over the next five years. Potential funding sources include local improvement district revenues, loans (Public Works Trust Fund), grants (Centennial Clean Water), Current Expense and/or Street Funds, or new revenues generated by formation of a stormwater utility.

6.3.3 Scope and Effectiveness of the Proposed Plan

The preceding stormwater management plan allows the City to:

- ❑ Achieve regulatory compliance;
- ❑ Effectively address the City's maintenance needs;
- ❑ Present needed capital facilities for flood control;
- ❑ Add treatment facilities to improve water quality;
- ❑ Upgrade staffing and funding levels of the existing stormwater program;
- ❑ Be consistent with the results and seven recommendations of the Drayton Harbor Water Quality Study;
- ❑ Allow the City to implement thirteen of the nineteen recommendations of the Drayton Harbor Watershed Action Plan (Recommendations SW-29, SW-34, SW-36, SW-37, SW-41, and SW-43 have not been specifically included in this proposed plan), and
- ❑ Include 10 of the fifteen source controls and treatment controls recommended in the Water Quality Enhancement Plan, presented in Section 3 of this report (source controls S1, S2, S6, and S7 have not been specifically addressed in this proposed plan). (Priorities for the 10 recommended source controls have been presented in Table 3-6, page 3-38.)

(Note: Due to the high costs of an annual City-wide water quality monitoring program, a specific monitoring plan has not been developed as part of this study and is not recommended at this time. This recommendation is also consistent with the discussion and

recommendation regarding monitoring presented in the Drayton Harbor Watershed Management Action Plan.)

6.4 Funding

6.4.1 Existing Stormwater Program

Revenues

The City's Stormwater Program has no independent revenues. It receives its normal annual appropriation of $50,000 - $150,000 from a combination of funding sources including Current Expense Fund, Road Fund, grants, loans, and in the past, revenues from a local improvement district. In some years, it is higher due to special capital projects, such as the LID No. 27 drainage project.

Expenditures

Annual expenditures are usually close to annual appropriations with any overruns reimbursed from the Street Fund balance. Annual expenditures for 1992 - 1994 are listed below.

	1992	1993	1994
Operating Costs	42,122	15,864	43,289
Capital Costs	0	0	95,000
Total	$42,122	$15,684	$138,289

Additional Stormwater financial information is presented in Technical Appendix G.

Program Financial Priorities

Annual appropriations are used primarily to fund maintenance activities. Capital funding is added to the annual stormwater budget on a project specific basis and is not provided on an annual basis.

Adequacy of Existing Funding and Future Needs

The existing funding level for stormwater management by the City is not adequate to address existing operating needs, comply with regulatory mandates, or fund needed capital improvements.

General observations about the existing budget are:

- Maintenance is understaffed and underfunded; most of the City's drainage facilities are not maintained on a regular basis;

- Operating and staffing responsibilities greatly exceed the time, and occasionally the technical expertise, of existing staff;
- Grants cannot be expected to play a significant role in meeting future operating and capital needs;
- Development review does not pay for itself like it could;
- The groundwater, wellhead protection program needs designated staff;
- There is little or no funding available to meet existing and future regulatory requirements;
- There are little or no financial resources available to implement the City's stormwater, watershed, or groundwater management plans; and
- The existing program is not being adequately staffed or funded, many stormwater services can only be provided now on an as-needed basis, as available staff time allows.

It will be important to the future success of the City's Stormwater Program that additional revenue sources be identified to meet the level of services that the City's water resources program is presently attempting to provide. Future funding options, and additional revenues that may be able to be realized for the City's Water Resources Program, are presented below.

6.4.2 Developing Adequate Funding for Stormwater Management

Based on the preceding analysis of the City's present water resources program and current and future regulatory requirements, it is clear that the City will need to consider and adopt one or more new sources of additional revenue to adequately support the City's Stormwater Program.

Presented below is a listing of possible revenue opportunities and an assessment of how much new revenue may be obtained from a few of the most promising new sources.

Future Funding Alternatives

Assessment of Alternatives - As shown in Table 6-1, there are at least eighteen different ways to fund water resource programs in the State of Washington.

Table 6-1
Stormwater Program Funding Alternatives

General Current Expense Fund
Street/Road Funds
Water Utility Fund
Sewer Utility Fund
State/Federal Grants and Loans (six financial programs available from the State of Washington for Water Resources)

- ❑ Flood Control Assistance Account Program
- ❑ Centennial Clean Water Program
- ❑ Water Pollution Control Revolving Fund
- ❑ Public Works Trust Fund
- ❑ Public Involvement Education Fund
- ❑ HUD Block Grant Program

Debt Financing (via General Obligation and Revenue Bonds)
Drainage Districts
Flood Control Zone Districts
Special Assessment/Improvement District (UDs and ULIDs)
System Development Fees
Fees-in-Lieu of Construction
Developer Extension/Latecomer Fees and Agreements
Plan Review and Inspection Fees
Shellfish Protection Districts
Aquifer Protection Areas
Connection Fees
Development Impact Fees
Street Utility
Stormwater Utility Service Charges

To-date, the City has used four of these alternatives: Current Expense Fund, Street Fund, grants/loans, and local improvement district revenues. Most funding, however, comes from the Current Expense and Street Funds.

Future Revenue Needs

The revenue needs of the City's Stormwater Program will more than double as the City begins to implement its emerging stormwater program within the next three to five years, as shown in Table 5-3. The short-term improvements will cost about $158,500, and long-term requirements an additional $784,500 per year. The cost of operating the City's Stormwater Program will be about $348,000 - $500,000 annually and will require additional outside revenues, such as bonding for capital projects, the creation of new maintenance and inspection fees, and additional support of the water utility for groundwater management.

Regulatory Compliance

The costs of compliance with the State's Basic Stormwater Plan have been incorporated into the responsibilities of the additional 1.4 FTEs and the $158,500 per year recommended for short-term enhancements of the program.

Developing Adequate Funding

There are real costs associated with the creation of new programs, fees, ordinances, and funding sources. Because these are normally the responsibility of the Stormwater Program management, no additional costs have been identified to establish adequate funding. However, because of the time requirements, these tasks and activities will have an impact on the management of the Operations Manager and the City Engineer, and completion of their activities and responsibilities.

From the review of the City's current and future Stormwater Program obligations, the Stormwater Program will need to consider additional funding sources or elect to assume few, if any, additional program responsibilities, including regulatory compliance. Even maintaining the existing level of funding will be difficult to do, since many of these new responsibilities are mandated in State regulatory compliance requirements. The City, through its various basin planning processes, has also identified many unfunded capital and planning activities which presently need funding and implementation.

Common Financial Alternatives for Stormwater Management

Funding options that the City may wish to consider include:

- ❑ Establish a stormwater utility fee;
- ❑ Establish development plan review fees to cover actual City costs on an hourly basis;
- ❑ Continue to use the Street Fund to maintain drainage facilities within the road right-of-way;
- ❑ Request that the City's Water Utility support more of the Division's groundwater/wellhead protection activities;
- ❑ Set up fee-supported inspection and enforcement programs for new development;
- ❑ Set up a fee-supported inspection and enforcement program for the maintenance of stormwater facilities on private property;

- Fund capital expenses through bonding;
- Consider the establishment of a developer extension/latecomer fee; and
- Increase the City's connection fees for hooking up to the City's stormwater system.

The funding options that are both realistic and will likely allow the City to realize that most new revenues include:

- Setting up a stormwater utility fee. This fee could add an additional $150,000 per year. (Please note that all future revenue amounts are estimates and subject to change as the program funding options are further defined).
- Setting up new fees or modifying existing fees for:
  - Development review, where actual costs incurred by the City would be reimbursed by hourly development review fees paid by the developer. This could add as much as $10,000 to $15,000 per year.
  - A new development inspection and enforcement fee, which could add about $10,000 to $15,000 per year, and help support one new inspector.
  - A new private facility inspection and enforcement fee which could add about $10,000 to $15,000 per year and help fund one new maintenance staff person.
- Requesting that the City's Water Utility fund groundwater and wellhead protection within the stormwater program - $10,000 to $20,000 per year. (Funding costs for groundwater and wellhead programs are not well defined at this time. Intra-utility funding [i.e., water to stormwater] would likely need to be provided on an annual basis as the groundwater programs continue to be developed and implemented by the Stormwater Program.)

If only these most likely future revenue requirements were to be developed, the City could realize an additional $190,000 to $215,000 in operating revenues per year. These new funds could be used to supplement existing annual funding or free up funds that are now annually spent on stormwater (Current Expense and Street Funds).

Recommendations

The City should conduct, within the next six months, a review of potential future revenue sources. This review should address, as a minimum, establishing a utility fee, establishing new fees for development review, inspection, and enforcement, securing outside bonding for capital needs, and increasing internal support from the City's Water Utility for groundwater-related activities. These new revenues could add $190,000 to $215,000 per year to the operating budget of the City's annual Stormwater Program.

Funding Conclusion

The City's Stormwater Program (1994) has a budget of $138,278 annually. Most of these revenues are from the Street Fund. The current funding level is not adequate to meet existing Stormwater Program needs, nor future regulatory or water resources plan implementation requirements. Because the preferred management approach is to have these new services self-supporting, a number of additional revenue options have been presented that will allow the City to meet its future monetary responsibilities. The additional revenue sources include bonding, forming a utility fee, setting up new fees for new services, and increasing Water Utility support. If all of the five most likely revenue options discussed above were implemented, additional annual operating revenues could be increased by $190,000 to $215,000 per year. This would be more than enough to meet the short-term staffing, program, and regulatory recommendations. Future obligations of the City to implement the three draft surface water, watershed, and groundwater management plans are not well defined at this time and could require additional staffing and financial resources in addition to those discussed in the management review.

6.5 Implementation

6.5.1 Future Stormwater Program and Priorities

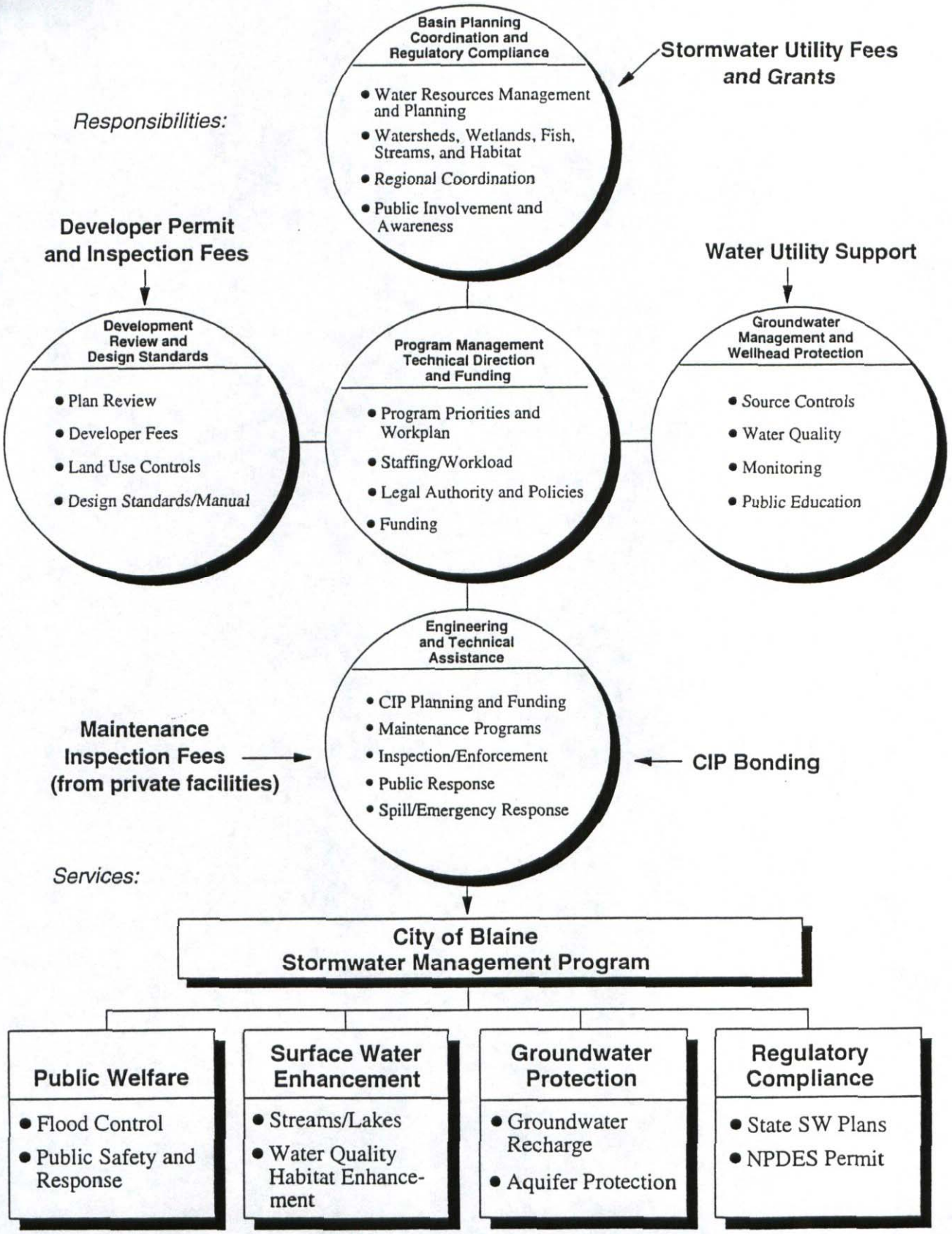
The responsibilities and services of the City's new stormwater program are conceptually displayed in Exhibit 6-1. Program priorities for implementation of the recommended Stormwater Management Program for the City are as follows:

1. Regulatory compliance.
2. Maintenance.
3. Establishing new funding sources.
4. Hiring needed staff and developing an effective program.
5. Funding and building capital projects.
6. Water quality monitoring.

Exhibit 6-1

May 4, 1995

Conceptual Schematic of the Responsibilities and Services of the Blaine Stormwater Program



Schedule

The Blaine Stormwater Management Plan has been designed to be developed and implemented over approximately five to seven years as shown in Exhibit 6-2. Three phases of implementation are recommended and are shown in Table 6-2.

Table 6-2

Phase I (0-1 years) Regulatory Compliance, Establishing Policies, and Securing Funding

- ❑ Establish Policies, Standards and Controls including Council adoption of the plan and new legal authority as defined in:
  - new stormwater ordinance,
  - new maintenance ordinance,
  - new clearing and grading ordinance,
  - new drainage design standards, and
  - inspection/enforcement ordinance (if needed).
- ❑ Identifying and Securing Needed Financial Support, including such financial options as:
  - new developer fees,
  - new maintenance fees,
  - new inspection/enforcement fees,
  - forming a stormwater utility,
  - forming local improvement districts,
  - grants and loans, and
  - revenue bonds.
- ❑ Developing and Implementing An Effective Maintenance Program, including
  - inventorying and mapping facilities,
  - identifying needs, and
  - performing O/M as priorities and funding allow.
- ❑ Achieve Regulatory Compliance by completing the above 3 activities

Phase II (1-2 years) Developing the Stormwater Program

- ❑ Developing Internal Program by hiring identified short-term staff (1.4 FTE).
- ❑ Continuing to Perform Annual Inspections and Maintenance.
- ❑ Securing Funding for Capital Projects.
- ❑ Establishing Inspection/Enforcement Programs.

Phase III (3-5 years) Operating the Program and Building Facilities

- ❑ Designing and Building Capital and Treatment Facility Improvements.
- ❑ Hiring Long-Term Staff, as identified in the Plan (4.3 FTE).
- ❑ Continuing the Annual Maintenance Program.
- ❑ Continuing the Established Inspection/Enforcement Programs.
- ❑ Securing Grants and Loans, as appropriate.

Exhibit 6-2
Schedule for Implementation for the Blaine Stormwater Management Plan

Phase/Activity for the Stormwater Management Plan	Schedule (years) 1	2	3	4	5	6	7
Phase I - Policies, Funding, Compliance							
- Establish policies, standards, and controls							
- Identify and secure financial support for operating program	Program Funding						
- Develop annual maintenance program							
- Achieve regulatory compliance	*						
- Form a stormwater utility	Letter of compliance						
Phase II - Stormwater Program Development	(1.4 FTE)						
- Develop Internal Stormwater Program (i.e. staffing)	Hire staff						
- Perform Annual Maintenance							
- Secure Capital Funding	0						
- Establish inspection/enforcement program	Fund CIP						
- Send out utility bills (January 1, 1986)	*						
Phase 3 - Operation and Construction			(4.3 FTE)				
- Design and build capital and treatment facilities			Design CIP				
- Hire long-term staff			Hire staff (5.4 FTE)				
- Continue and enhance annual maintenance							
- Continue inspection/enforcement							
- Secure grants and loans							

Section 7
Conclusions and Recommendations

7.1 Conclusions

- Groundwater and surface water quality are important to the quality of life for the citizens of the City of Blaine (City) and the region, making the Stormwater Program an important activity.
- The Stormwater Program is presently underfunded to meet existing and future Stormwater Program and regulatory compliance responsibilities.
- The current budget of the City's Stormwater Program is not adequate to properly:
  - Staff the Stormwater Program,
  - Accomplish the City's responsibilities under the Puget Sound Water Quality Authority (PSWQA) Management Plan requirements,
  - Adequately address new development, or
  - Maintain the existing drainage system.
- The City does not have adequate legal authority to develop an effective stormwater program or meet regulatory requirements. The adoption of new drainage design standards and a number of new ordinances (equivalent to the Department of Ecology Technical Manual) are needed.
- New and additional staffing and funding alternatives should be considered for the Stormwater Program.
- The City is not in compliance with the State's Basic Stormwater Program and should develop and adopt a schedule to be in full compliance as funding allows.

7.2 Recommendations

The City should: Public Awareness Campaign

- Enhance the existing Stormwater Program to reduce or eliminate local drainage problems by increasing annual funding for maintenance, regulatory compliance, and capital projects.
- Develop and implement a stormwater program that meets or exceeds the State's Basic Stormwater Program.
- Establish needed legal authority by adopting ordinances for stormwater, water quality, maintenance, inspection/enforcement, and erosion/sedimentation (clearing/grading).
- Adopt drainage standards for new development that meet or exceed the design requirements presented in Ecology Technical Manuals, Volumes I and II.
- Eliminate sewer overflows into Drayton Harbor.
- Eliminate illicit connections to the City's sewer connection.
- Establish a City-wide source control program to reduce the amounts of pollutants entering the City's stormwater system.
- Investigate the establishment of new funding sources for stormwater management, including developer fees, connection charges, and the formation of a City-wide stormwater utility. / facility
- Establish a regional interagency agreement, including the Semiahmoo Company, Whatcom County, and other public authorities, to improve the water quality of Drayton Harbor.
- Work with the Port of Bellingham and Semiahmoo Company to establish specific monitoring and source control programs for Blaine Harbor and the Semiahmoo Marina, respectively.