Steven J. Swenson

POLLUTION CONTROL HEARINGS BOARD
FOR THE STATE OF WASHINGTON

AIRPORT COMMUNITIES COALITION and CITIZENS AGAINST SEA-TAC EXPANSION, Appellants, v. STATE OF WASHINGTON DEPARTMENT OF ECOLOGY, and THE PORT OF SEATTLE, Respondents.	PCHB No. 01-160 **PREFILED DIRECT TESTIMONY OF STEVEN J. SWENSON**

AR 016792

Outline of Testimony

ORIGINAL

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INTRODUCTION

1. My name is Steven J. Swenson. I am over the age of 18, and this testimony is based on my own personal knowledge. I am testifying about the management of stormwater required at SeaTac International Airport (STIA) with a focus on how stormwater will be managed during construction and operation of Master Plan Update Improvement projects. Mr. Paul Fendt, at paragraphs 7-19 of his testimony, describes the physical facilities that will be used to manage Airport stormwater, and the measures that will be implemented to mitigate airport impacts. I will focus here on how stormwater management required at the airport compares with other stormwater management systems I am aware of and the consistency of the Port's management of stormwater with applicable regulatory requirements, including the Puget Sound Stormwater Manual.

EDUCATIONAL BACKGROUND

2. I received a Bachelor of Science degree from the University of Washington in 1977. My degree is in Civil engineering and I specialized in Environmental Engineering. I have taken a number of specialized training courses in hydrology, hydraulics, water supply, and wastewater treatment. I am a professional civil engineer licensed in the State of Washington. I have worked for R. W. Beck for over 25 years and lead the firm's storm water planning and design group in Seattle. A copy of my curriculum vitae is attached as Exhibit A.

PROFESSIONAL EXPERIENCE

3. I have a broad base of experience working on stormwater management projects in Washington, helping local permit applicants work with federal, state and local agencies to gain approval for stormwater management facilities and systems. These systems commonly include detention facilities, including vaults, lagoons and ponds, infiltration facilities designed to route runoff to groundwater, conveyance systems, including pipelines, ditches and constructed stream channels, and treatment systems. Recent clients include the cities of Bellevue, Lynnwood, Kent, Mount Vernon, Burlington, Des Moines, Bellingham, Kirkland, and Seattle, as well as King and Snohomish Counties.

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4. I also commonly work with local governments engaged in planning efforts focused on stormwater problems. I am currently working with the City of Seattle and Snohomish County on large stormwater management planning efforts designed to analyze hydrologic conditions and current hydraulic (stormwater infrastructure) systems to identify potential problem areas resulting from increased urbanization. The primary problems being scrutinized through these planning efforts are flooding, water quality degradation, and fish habitat problems. These types of planning efforts commonly involve implementing regulations for new development requiring construction of facilities such as detention vaults, ponds and lagoons, constructed wetlands, treatment facilities, and infiltration basins. These facilities are designed to address high flow and in some cases, low flow problems. Other communities where I have assisted with such planning efforts include: the cities of Bellingham, Burlington, Edmonds, Kent, Kirkland, Lynnwood, Renton, City of Snohomish, Mill Creek, Des Moines, Mount Vernon, North Bend, and Steilacoom.

HYDROLOGIC IMPACTS OF URBANIZATION

5. Increasing urbanization and associated increases in impervious surfaces typically cause changes in stormwater hydrology that can adversely impact surface waters in several ways. When precipitation occurs in an undeveloped area, most of the water infiltrates into the soil and migrates to groundwater. This groundwater moves slowly through the soil column and some or all of it will discharge to streams, rivers and other surface waters in the area. This hydrologic cycle is interrupted when impervious surfaces are constructed. Rainfall, which previously infiltrated into the soil, will instead run off the impervious surface and be routed directly to area surface waters. This process has a number of negative impacts. First, water running over impervious surfaces commonly picks up pollutants. Second, the volume and rate of water entering surface waters during precipitation events is increased, sometimes dramatically, causing high flows that can damage the stream channel, eliminate fish habitat and cause severe erosion. Finally, because recharge of groundwater is reduced, the volume of groundwater discharging to surface waters is decreased, with sometimes damaging decreases in low summer flows that can harm fish habitat.

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REGULATORY REQUIREMENTS FOR STORMWATER

6. I have worked on stormwater management issues for 25 years. In the early days of stormwater regulation the primary focus was to control damage to property from high flows. When the Clean Water Act was amended in 1987 to expressly require discharge (NPDES) permits for certain stormwater discharges, the focus shifted to controlling pollutant concentrations. A growing concern even in the late 1980s, however, was the impact of urbanization on stream flows. It was recognized then that increased wintertime high flows, and the corresponding problem of reduced summer flows, was a significant problem. Since 1987, certain municipal, industrial and construction related stormwater discharges have been subject to NPDES permits. These permits require development of a Stormwater Pollution Prevention Plan (SWPPP) that describes how storm water will be managed at a specific site. The SWPPP typically describes the so-called "best management practices" (BMPs) that will be used to ensure that stormwater discharges do not contain damaging concentrations of pollutants and that damaging hydrologic changes are avoided or minimized.

7. In addition to federal and state regulatory requirements, local governments actively regulate stormwater discharges. Like NPDES permits applicable to larger discharges, local ordinances typically apply similar BMP requirements to smaller stormwater discharges

8. As stormwater management regulatory requirements have matured, it has become commonplace for stormwater ordinances and permits to require the capture, detention and treatment of stormwater prior to discharge. The purpose of these systems is to reduce pollutant concentrations in the stormwater, and to reduce the adverse impacts of changes in flow rates and volumes. Today, there are literally thousands of operating stormwater management systems that involve the collection, detention, and slow release of stormwater. Historically, the focus has been on high flow impacts, but in some jurisdictions, stormwater management practices that address low flow impacts, e.g., infiltration, are being required where feasible.

9. I am familiar with earlier versions and the current version of the Stormwater Management Manual for Western Washington (August 2001) published by the Department of Ecology (Stormwater Manual). The first version of the Stormwater Manual was published in 1992.

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The Stormwater Manual is an important document that describes the adverse impacts of uncontrolled storm water and lists a menu of BMPs that can be tailored for use at a specific site. The current version of the Stormwater Manual explicitly recognizes the impacts of urbanization on stormwater, and the attendant high flow and low flow impacts, and states that the objectives of stormwater management include mitigating these hydrologic impacts. The Stormwater Manual contains the following requirements and statements:

> "Stormwater Controls for New Development and Redevelopment ... (must) seek to achieve no net detrimental change in natural surface runoff and infiltration." (Page 1-7);
>
> "...changes in natural hydrology ... (cause) reduced stream flows and wetlands water levels..." (Page 1-17);
>
> "Projects shall employ On-site Stormwater Management BMPs to infiltrate, disperse, and retain stormwater runoff onsite to the maximum extent feasible ... to reduce the hydrologic disruption of developed sites."(Page 2-25);
>
> "Based upon gross level applications of continuous runoff modeling and assumptions concerning minimum flows needed to maintain beneficial uses, watersheds must retain the majority of their natural vegetation cover and soils, and developments must meet the Flow Control Minimum Requirement of this chapter, in order to avoid significant natural resource degradation in lowland streams." (underline added) (Page 2-25);
>
> "Stormwater treatment facilities shall be selected in accordance with the process identified in Chapter 4 of Volume I" (Page 2-27)
>
> Step 1 under "Select Flow Control BMPs and Facilities" in Chapter 4 of Volume I requires that one should "determine whether you can infiltrate." (Page 4-2)

10. The manual recommends using infiltration where feasible to better maintain the natural hydrologic cycle and states "Reduction of [high stormwater] flows through infiltration decreases stream channel erosion and helps to maintain base flows throughout the summer months". Ecology Manual, pg. 2-32. The new Ecology Manual lists infiltration as the first option to consider for flow control BMPs. Ecology Manual, pg. 4-3.

11. Thus, to mitigate the impacts of development and to comply with state and federal regulations, jurisdictional entities have adopted requirements for new development to control the discharge rates of runoff to surface water bodies. This is typically done by construction of a detention or infiltration system.

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12. There are numerous examples of infiltration systems being used for stormwater management. These include the Meadowdale infiltration pond in Lynwood, Edwards Street Improvement project and storm water infiltration system in the City of Yelm, roof infiltration for single family residential homes for new development in King County, Chambers Creek storm drain facility in Pierce County, Panther Lake infiltration facilities in Federal Way, and numerous infiltration ponds in Thurston County. These systems were installed with the intent of managing stormwater in a manner that reduces impacts from development by replicating predevelopment runoff and stream flows. The goal of urban stormwater management has been to develop and require systems and methods to control the quality and rates of runoff to mimic predevelopment conditions to the extent it is technically and economically feasible. Numerous jurisdictions are providing incentives to developers to construct "low impact" projects that use technologies to manage both wet season high flows and dry season low flows. The jurisdictions that have adopted regulations promoting "low impact" development include: King County, Island County, and Kitsap County and the cities of Lacey, Seattle, and Olympia.

13. Where infiltration is not feasible or desirable, detention vaults or ponds are normally used to detain captured stormwater. Traditionally, these facilities are sized and designed to control only wet season high flows. However, they can be oversized to store a portion of the wet season runoff for summertime releases in a manner that would mimic year-round discharges to streams, i.e., the predevelopment hydrologic cycle. Such a stormwater detainment system would be similar in effect to infiltration. Both protect against reductions in summertime low flows by collecting surface water from the developed area, detaining or storing it, and then releasing it to the stream in a manner that would reflect natural conditions. Instead of using the storage capacity of a vault or pond, infiltration uses the storage capacity of the soil pore space to temporarily store collected storm water. Instead of discharging from a designed outlet in a vault, infiltrated stormwater discharges through the soil column to surface waters. Whatever the storage mechanism, the effect is the same: stormwater is captured, detained for a period of weeks or months and then returned to the stream during the dry season.

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14. I have reviewed several key documents describing how stormwater will be managed at STIA, including the Comprehensive Stormwater Management Plan -- Master Plan Update Improvements, Seattle-Tacoma International Airport Port of Seattle (SMP) (Parametrix, December 2000) and the Low Streamflow Analysis and Summer Low Flow Impact Offset Facility Proposal – Port of Seattle (Low Flow Analysis) (Parametrix, 2001). These documents describe the storm water management facilities and systems that are proposed for the airport redevelopment project.

15. The SMP describes the stormwater collection, conveyance, detention, and treatment facilities that currently exist, are under construction or are planned at STIA, all of which are required under the Port's NPDES permit and the Water Quality Certification issued for the proposed Master Plan Update developments. The Low Flow Analysis presents the methodology used to calculate the impacts to summertime stream flows in Miller, Walker, and Des Moines creeks. After reviewing these documents, I have a general understanding of the stormwater management system designed by the Port to comply with its NPDES permit and the water quality certification.

16. The required collection, conveyance, detainment, treatment and discharge system, while larger and more sophisticated than most stormwater management systems, employs the same technologies used by other projects in Western Washington. The Port is being required to infiltrate as much of its stormwater as possible given site soil and space constraints. As mentioned above, this is a common and preferred best management practice. Likewise, the vaults and ponds being used to detain collected stormwater, while large, are a common means for managing stormwater discharges.

17. I understand that the Airport Communities Coalition (ACC) contends that the stormwater management system required at STIA requires a water right permit because it "is not a typical stormwater detention project." Specifically, ACC argues that the required system "differs from traditional stormwater projects" in three ways, each of which I will address below.

18. First, ACC contends that the Port's stormwater management system will detain stormwater for a greater amount of time than a typical system. ACC is wrong when it contends that the detention times required at STIA are unusually long. For stormwater treatment purposes, it is common for many systems to use "wet" or "extended detention" ponds or vaults that may result in

stormwater runoff volumes being detained for weeks or months. My understanding is that the Port's system will store collected stormwater for up to several months at a time, but it is common for many stormwater treatment systems to store storm water for similar periods of time.

19. Second, ACC argues that the Port's stormwater system is atypical because of the type of treatment being utilized. The treatment methods required by Ecology at STIA consist of conventional treatment methods. The Port intends to use filter strips (vegetated migration pathways through which captured stormwater will pass), bioswales (vegetated swales designed to settle and filter collected stormwater) and settlement in ponds and vaults (this is probably the single most common method of treating stormwater). In my experience, these treatment methods are typical of stormwater management facilities.

20. Finally, ACC argues that the Port's stormwater system is unusual because of the "precise, prolonged and exacting release rates." No two stormwater management systems for large development projects are ever exactly the same. Each has its own specific hydrologic, water quality, and habitat mitigation requirements. The stormwater management system for STIA is unique given the size of many components, but the overall STIA project is also unique given its size. This project is somewhat unique in its sophistication, but its basic design and objectives are similar to other stormwater projects I am familiar with. With regard to ACC's specific allegations, it is not at all uncommon to design stormwater detention facilities to meet precise and exacting discharge rates. In fact, the Stormwater Manual contains very specific limits on allowable discharge rates from detention facilities. These requirements are very precise and require careful design and construction of all stormwater detention facilities. A second consequence of these new, more stringent discharge rate limitations is that detention times are greatly increased.

21. To my knowledge, no stormwater management system in this state has been required to obtain a water right permit to operate.

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I declare under penalty of perjury under the laws of the State of Washington that the foregoing is true and correct.

Executed at Seattle, Washington, this 7th day of March 2002.

Steven J. Swenson

Since joining R. W. Beck in 1976, Mr. Swenson has specialized primarily in stormwater management planning and design; he has experience in wastewater and water system planning and design. His background includes strong project coordination and management skills and experience working with public interest groups and private citizens in developing surface water management projects. He is skilled in technical analysis of water resource hydrology, hydraulics, water quality, and aquatic habitat. He has applied these skills to a number of comprehensive planning efforts.

Much of Mr. Swenson's comprehensive planning experience originates with a strong background in design. Mr. Swenson has and continues to manage stormwater pumping, conveyance, storage, water quality improvement, and fish passage projects.

In addition to his stormwater technical and comprehensive planning skills, Mr. Swenson has been intimately involved in helping cities develop their overall stormwater programs. His stormwater program development experience includes CIP development, program financing, agency coordination and permitting, and public involvement.

University of Washington
B.S. in Civil Engineering

Relevant Project Experience

Drainage Needs Reports
Snohomish County, Washington

Mr. Swenson is the project manager overseeing the preparation of drainage needs reports that include analysis, planning, and design of solutions for existing and probable future drainage and surface water quality problems in rapidly urbanizing areas of Snohomish County. Close cooperation with county planners is required to ensure coordination between Drainage Needs Report preparation and the Urban Growth Area subarea planning process, as well as consistency with other county-wide planning efforts. Compliance with a tight schedule and working within a limited budget are critical aspects of this project.

Sea-Van Residential Development
City of Mount Vernon, Washington

Project Manager. Mr. Swenson is currently managing the technical review of a 670-acre, 800-unit residential development. The residential community is being developed in four separate phases over a period of several years. Mr. Swenson is responsible for reviewing each phase of the development. Aspects of the review include ensuring that the development is consistent with the City's development standards and that environmental resources are preserved to the greatest extent possible.

Ridgewood Design Memorandum and PS&E
Snohomish County, Washington

Project Manager. Mr. Swenson was responsible for creating a design memo to address solutions to a recurring flooding problem in Snohomish

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County. The problem resulted from additional surface water runoff being routed from a new subdivision into an existing subdivision's drainage system. Tasks involved in this project included a preliminary environmental assessment, development and presentation of two public meetings, and performance of a hydraulic and hydrologic analysis using the Waterworks computer program.

Comprehensive Flood Drainage Plan
City of Lynnwood, Washington

Project Manager. Mr. Swenson was responsible for the preparation of a comprehensive drainage plan for the City of Lynnwood. He determined specific capital improvements and regulatory requirements for minimizing stormwater-related flooding and water quality problems, and directed an extensive computer modeling effort using the U.S. EPA's HSPF and SWMM programs. R. W. Beck performed an inventory of the City's existing storm sewer network and associated facilities, including pipe sizes and material types, as well as elevations for selected pipe and channel systems. Data produced by the inventory were input to the model. Mr. Swenson also developed a capital improvement program and cost estimates that were used in a rate analysis. Based on this information, the City included the formation of a utility in its financial plan.

Squalicum Creek Floodplain Management Plan
City of Bellingham, Washington

Project Manager. Mr. Swenson was responsible for preparing a comprehensive floodplain management plan for a reach of the Squalicum Creek drainage basin located within the city limits of Bellingham. The new plan was developed to help city officials balance environmental issues with community development needs while meeting regulatory requirements. The project also involved updating a 1982 Federal Emergency Management Agency hydrology and hydraulic study. The plan included provisions to preserve fisheries, wildlife, and wetlands resources within the stream corridor.

Juanita Creek Regional Flow Control Facilities and Stream Restoration Project
King County, Washington

Project Engineer. Mr. Swenson was responsible for designing two regional detention facilities to reduce flooding, erosion, and sedimentation, and to enhance water quality in Juanita Creek. He also directed the design of a stream-channel restoration project along Juanita Creek to improve fisheries habitat and to repair bank failure areas using both traditionally engineered and "bio-engineered" techniques. Other key issues included flow control, safety (significant portions of the creek run through residential areas), maintenance and operation, and aesthetic appeal.

Scriber Creek Watershed Management Plan
Snohomish County, Washington

Project Engineer. Mr. Swenson was responsible for developing an action plan that recommended specific guidelines for preventing property damage and water quality degradation within the watershed. He used results derived from HSPF computer modeling to analyze existing conditions and problem areas. Using this information and other data, he helped develop structural and nonstructural solutions to flooding, drainage, and water quality problems as well as a capital improvement program for future construction.

Panther Creek Wetlands Improvement Project
City of Renton, Washington

Technical Reviewer. Mr. Swenson provided technical support in preparing data for use in a TR-20 hydrologic modeling effort. The TR-20 program was used to model a basin tributary to the Panther Creek wetland. He was also involved in analyzing the effects of backwater from the downstream East Side Green River system and making the decision that the predicted performance of any proposed improvements at the Panther Creek wetland could not be guaranteed unless the proposed improvements were incorporated into a model of the entire East Side Green River system. Mr. Swenson was also involved in the review and preparation of an interim predesign report that summarized findings and recommendations.

Massey Creek Drainage Basin Study
City of Des Moines, Washington

Project Engineer. Mr. Swenson was responsible for inventorying all of the basin's existing stormwater control facilities and developing design alternatives using the SCS TR-20 computer model. He was also responsible for analyzing tidal effects and backwater conditions using the U.S. Army Corps of Engineers' HEC-2 computer model. These models were used to determine both structural and nonstructural solutions to stormwater-related flooding and water quality problems. They were also used to prepare a capital improvement program. Mr. Swenson assisted the City in obtaining funding through the Washington Department of Ecology's Flood Control Assistance Account Program (FCAAP).

Smith Creek Drainage Study
City of Des Moines, Washington

Project Engineer. Mr. Swenson was responsible for preparing the Smith Creek drainage study, which identified long-range drainage improvements (regional detention, wetlands preservation, habitat enhancement, and regulations) for the Smith Creek basin. Mr. Swenson conducted hydrologic and hydraulic modeling to predict the two-, 25-, and 100-year storm events. A key aspect to the project was assessing the stormwater runoff impacts from the Midway Landfill, which abuts Smith Creek.

Whatcom Creek Flood Management Improvements
City of Bellingham, Washington

Project Engineer. Mr. Swenson was responsible for computer modeling of hydraulics using the U.S. Army Corps of Engineers' HEC-2 program to calculate water surface profiles during a design storm event. Based on this information, he developed design criteria, plans, and specifications for flood improvements to Whatcom Creek. During final design, he adhered to stringent environmental requirements for maintenance of fish habitat, mitigation of lost fisheries habitat, and development of erosion and sedimentation control schemes to minimize impacts to fisheries during construction.

Regional Stormwater Detention Facilities
City of Bellevue, Washington

Project Engineer. Mr. Swenson performed a hydraulic analysis and hydrologic review of the Kelsey Creek stormwater drainage system and conducted a computer-aided hydraulic analysis of the drainage system. The data generated from this analysis were used as design criteria and operation parameters for the construction of eight regional detention facilities. Mr. Swenson coordinated with the Washington State Department of Ecology's Dam Safety Section while performing preliminary and final design of the facilities.

Maple Avenue Stormwater System Improvements
Town of La Conner, Washington

Project Engineer. Mr. Swenson designed and sized a stormwater collection system for the Maple Avenue trunk storm sewer in La Conner, Washington. He performed hydrologic and hydraulic analyses using the HYDRA modeling program.

Surface Water Runoff Analysis
TRA Bellevue, Washington

Project Engineer. Mr. Swenson was retained to perform a surface water runoff analysis for an EIS being prepared for a large development in Bellevue. A computer model using SCS methods was developed to predict runoff from the development area. The effects of runoff on the downstream stormwater drainage system were analyzed for the post-development condition, and detention systems were sized to keep post-development runoff from exceeding predevelopment conditions.

Infiltration/Inflow Study
Seattle Engineering Department/Washington

Project Manager. Mr. Swenson evaluated the causes of sewer backups and basement flooding, and suggested solutions for a 240-acre area in the Greenwood District of Seattle. Mr. Swenson monitored flows to determine the sources of excessive infiltration/inflow and supervised field investigations. The project team's recommendations included separating storm and sanitary flows by rerouting stormwater flows, reducing groundwater sources, or constructing new sewers.

Medvedjie Creek Fish Hatchery

Northern Southeast Regional Agriculture Association/Sitka, Alaska

Project Engineer. Mr. Swenson was responsible for performing a hydraulic analysis and determining flows and pipe sizes for the Medvedjie Creek Fish Hatchery. He also performed all mechanical design work for the hatchery, including pipelines, pump stations, ultraviolet disinfection equipment, and reservoir.

Neets Creek Fish Hatchery

Southern Southeast Agriculture Association/Ketchikan, Alaska

Project Engineer. Mr. Swenson was responsible for establishing the entire hydraulic water surface profile for the hatchery building and the exterior raceways as well as the hydraulic design of the hatchery pipelines to accommodate the hydraulic profile. His design responsibilities also included a 10,000-foot-long water supply pipeline.

Downtown Utility/Street Upgrade

City of Fairbanks, Alaska

Project Engineer. Mr. Swenson served as design engineer for water system improvements for the downtown utility/street upgrade project for Fairbanks, including responsibility for the hydraulic analysis for the water distribution network using a computer model. The modeling for this system posed a unique and difficult challenge because it was necessary to accommodate an existing water-circulating system with intermittent in-line pumps designed to prevent freezing. Mr. Swenson provided a design to improve water distribution and fire-flow capacity yet not adversely affect minimum-circulating velocity criteria. Water system improvements included the design of 2,200 feet of 14-inch-diameter water line with numerous 1- and 2-inch domestic connections and 6-inch fire services.

Wastewater Treatment Plant Improvements

City of Richland, Washington

Modeler. Mr. Swenson modeled wastewater loadings for the Richland Wastewater Treatment Plant and participated in pilot plant and water quality studies related to the treatment facility.

Comprehensive Sewer System Engineering Report

Tulalip Tribes of Washington

Project Engineer. Mr. Swenson was responsible for preparing a comprehensive sewer system engineering report that recommended improvements to the Tribes' sewer system. Using computer modeling techniques, field surveys, and desktop analyses, Mr. Swenson recommended treatment plant improvements, pumping requirements, and collection and conveyance system modifications.

Comprehensive Water System Plan
City of Anacortes, Washington

Project Engineer. Mr. Swenson developed a mathematical model of the City of Anacortes' supply and distribution systems, which was used as an analytical tool in developing its comprehensive water plan. His analysis of the system resulted in major improvements to the system, including increased capability to meet peak demands and provide fire protection.

Water System Improvements
Skagit County Public Utility District No. 1/Washington

Project Engineer. Mr. Swenson was responsible for water system analysis and design of improvements. The modeling effort for this system was very complex due to the vast amount of small-diameter pipeline, multiple pressure zones, and several booster pumps. Mr. Swenson's design responsibilities included design of chlorination improvements to the system.

Water System Modeling
Okanogan County, Washington

Project Engineer. Mr. Swenson conducted computer modeling, performed a hydraulic analysis, and prepared an abbreviated water system plan for the Lake Osoyoos North End water users in Okanogan County.

Inman Landfill Expansion Project
Skagit County, Washington

Design Engineer. Mr. Swenson was responsible for designing key landfill portions for the Inman Landfill, including the geomembrane liner, leachate collection system, leachate pumping units, and leachate pretreatment and storage lagoon. He assisted in designing the third phase expansion, which included converting an existing portion of the landfill to accept fly ash. This assignment involved designing a double-composite liner and expanding the leachate collection and pumping system. Mr. Swenson determined site preparation and excavation requirements and prepared construction cost estimates for design components.

Landfill Feasibility Study
Jefferson County, Washington

Engineer. Mr. Swenson participated in the study and evaluation of landfill development and closure alternatives as well as leachate management alternatives. The final report included a discussion of regulatory requirements and an evaluation of the economic effects of waste reduction from increased recycling. The study developed waste and site capacity projections for each alternative. The comparison of alternatives also included life-cycle cost analysis and annual operation and maintenance costs.

Solid Waste Landfill and Alternative Studies
City of Port Angeles, Washington

Engineer. Mr. Swenson assisted in the development of a landfill operation and closure plan and in the design of a new landfill under the state's Minimum Functional Standards for Solid Waste Handling. The design included an evaluation of recycling facilities to be located at the landfill. Mr. Swenson played an instrumental role in developing the excavation plan, determining contours, and accounting for projected waste quantities.

Solid Waste Disposal Alternatives Project
Thurston County, Washington

Computer Analyst. Mr. Swenson prepared a computer program to assist in identifying and evaluating options for solid waste disposal within Thurston County. The program was designed to analyze the feasibility of alternatives and to help select a long-range solid waste management system. Mr. Swenson developed an economic model that incorporated all costs for construction and operation of the system with a resulting tipping fee required for full recovery. In addition, he explored the environmental, public policy, economic, and operation-related issues of alternatives including recycling/landfill, recycling/incineration/ landfill, and composting/landfill.

County Resource Recovery Facility
Skagit County, Washington

Project Engineer. Mr. Swenson developed an ash-residue sampling/ testing and data-evaluation protocol. This protocol was the first to be developed in the state for bottom ash and fly ash from resource recovery facilities.

Enumclaw Landfill Closure
King County, Washington

Stormwater Design Engineer. Mr. Swenson supported the analyses, engineering, and design for the stormwater management and control system at the Enumclaw Landfill. Based on site-specific hydrologic and hydrogeologic conditions, the stormwater design for the second phase of the closure consisted of collection and disposal of runoff from the landfill cap to meet flow requirements. Design plans and construction specifications provided for temporary erosion and sediment control for protection of the soil cover until vegetation can be established.

Enumclaw Transfer/Recycling Station
King County, Washington

Stormwater Design Engineer. Mr. Swenson provided technical direction for the evaluations, engineering, and design for the drainage and stormwater control system at the new Enumclaw Transfer/Recycling Station. The design addressed the runoff from substantial amounts of roadway and paved areas, and included a stormwater collection system, a treatment bioswale, and an infiltration pond for disposal. To mitigate for

roadway fill in a wetland area, a wetland was created at a site. Some of the stormwater was diverted into a new wetland following treatment in a bioswale.

Bryant Landfill Closure
Snohomish County, Washington

Stormwater Design Engineer. Mr. Swenson reviewed design plans and specifications for the surface and stormwater controls necessary for this landfill closure. The site challenges included hydrologic analyses and hydraulic design of the conveyance system to transport runoff to an on-site infiltration recharge basin.

Development Review
City of Black Diamond, Washington

Project Manager. Mr. Swenson performed a development review of the Northwest Housing-Ridge Development in accordance with City standards. The review included evaluating proposed streets, water distribution, storm drainage, and sewer collection system improvements. He reviewed the proposed development for consistency with King County's road standards, the King County Surface Water Design Manual, the City's pending Stormwater Design Manual, and the Washington State Department of Ecology's Criteria for Sewer Works Design.

Mill and Springbrook Creeks Stormwater Management Analysis
City of Kent, Washington

Project Manager. Mr. Swenson is preparing a stormwater management analysis for Mill and Springbrook Creeks. The analysis includes hydraulic and hydrologic modeling of the creeks, both of which flow through Kent. Mr. Swenson is providing information to define and evaluate base-flood design criteria. The criteria will be used for the design of a 270-acre-foot regional detention and treatment facility in an area that was previously used as lagoons for sewage treatment. He is also evaluating several flooding problems and is developing conceptual designs of solutions to the problems.

Surface Water Management Plan
City of Mount Vernon, Washington

Project Manager. Mr. Swenson was responsible for preparing a surface water management plan for the Mount Vernon urban service area. He worked with the City to create a comprehensive surface water management program that provides guidance on stormwater control facilities, pollution source-control measures, resource-protection measures, operations and maintenance, financing, and compliance with existing and anticipated regulatory requirements. Mr. Swenson has also worked with the City to implement a surface water utility service charge. The service charge is based on a flat rate for single-family residences, and based on impervious surface area for commercial and multifamily

properties. Funding for this project was obtained through the Washington Department of Ecology's Centennial Clean Water Fund.

Wetland Environmental Permitting
City of Lynnwood, Washington

Project Manager. Mr. Swenson is responsible for preparing the necessary technical information and permit application to obtain a Section 404 permit from the U.S. Army Corps of Engineers for siting stormwater control facilities in wetlands. Mr. Swenson is facilitating close coordination with the City and jurisdictional agencies to involve all interested parties in the process. He is presenting the agencies with specific information regarding facility design and associated impacts, including a detailed assessment of current and proposed wetland hydrologic regimes, stormwater quality and its impact on the wetlands, and an overall assessment of the impact on the wetlands from the proposed detention facility.

Covington Master Drainage Plan
King County, Washington

Project Manager. Mr. Swenson was responsible for preparing a master drainage plan for the Covington community area within the Soos Creek watershed. The 1,237-acre area is designated as a regional urban activity center by the King County Comprehensive Land Use Plan. He developed a plan for surface water management control facilities, source control of possible pollutants, resource-protection measures, public education, operations and management, and monitoring of the drainage system. Mr. Swenson developed alternative conceptual designs, a final Master Drainage Plan, and a financial plan to fund the Drainage Plan's Implementation.

Surface Water Management Plan
City of Poulsbo, Washington

Project Manager. Mr. Swenson prepared a surface water management plan for the City of Poulsbo. The plan includes identifying existing surface water problems and alternative solutions, working with the City to comply with existing and anticipated regulatory requirements, and creating a comprehensive surface water management program. The program provides guidance on stormwater control facilities, pollution source-control measures, resource-protection measures, and operations and maintenance. The project received funding from the Washington State Department of Ecology's Flood Control Account Assistance Program.

Kulshan Creek Stormwater Pump Station
City of Mount Vernon, Washington

Project Manager. Mr. Swenson was responsible for the design of the Mount Vernon Kulshan Creek stormwater pump station, which handles high-flow periods in Kulshan Creek. The pump station construction was divided into two phases. During Phase I, a pump station, fish ladder,

automatically controlled gate, and new inlet 72-inch pipeline were constructed with a capacity of 150 cfs. Phase II added additional pumping equipment to provide an additional 50-cfs capacity to the pump station. For this $5 million project, Mr. Swenson also managed all the permitting and financing arrangements. Funding was obtained through the Hazard Mitigation Grant Program.

Squalicum Creek Capital Improvement Projects

City of Bellingham, Washington

Project Manager. Mr. Swenson directed the design of three capital improvement projects on Squalicum and Baker Creeks in Bellingham, Washington. The projects included the development of a Predesign report looking at the feasible alternatives for several large culvert undercrossings of major arterial roadways. Of primary concern was passing significant storm event flows while at the same time making provisions for fish passage. Mr. Swenson was also responsible for plans and specifications, and estimated construction costs. In order to prepare SEPA documents, he worked with numerous state and federal agencies, including the Washington State Department of Fish and Wildlife, City of Bellingham, Washington State Department of Transportation, Department of Ecology and the U.S. Army Corps of Engineers.

Whitman Lake Fish Hatchery

Southern Southeast Regional Aquaculture Association/Ketchikan, Alaska

Project Engineer. Mr. Swenson was responsible for performing a hydraulic analysis and determining flows and pipe sizes for the Whitman Lake Fish Hatchery. He also performed mechanical design work for the hatchery, including pipelines, pump stations, rearing ponds, and new reservoir intake.

Surface Water Management Plan

City of Snohomish, Washington

Project Manager. Mr. Swenson was responsible for coordination with the City of Snohomish, agencies, and public interest groups to develop a long-term management plan to reduce flooding, improve surface and groundwater quality, and protect environmental resources. Solutions to flooding problems are being combined with water quality and fish habitat improvements in an attempt to enhance salmon habitat in the area streams. Funding for this project was obtained through the Washington Department of Ecology's Centennial Clean Water Fund.

Comprehensive Flood and Drainage Plan Update

City of Lynnwood, Washington

Project Manager. Mr. Swenson directed the preparation of an update to the City of Lynnwood's Comprehensive Flood and Drainage Plan. Mr. Swenson was also instrumental in developing the original plan. The purpose of the update was to analyze the effect of roadway improvements and wetlands regulations, and to evaluate and recommend

solutions to specific stormwater-related water quality problems. Work for the update included additional hydraulic computer modeling of Scriber Creek, a review of the existing stormwater utility operation and maintenance plan, a review and update of the proposed capital improvement program, and an update to recommended solutions to flooding, water quality, fish habitat, and wetlands preservation problems.

Redmond Town Center Sanitary Sewer Lift Station

The Winmar Company/Redmond, Washington

Project Engineer. For a proposed 110 acre commercial/retail development located in Redmond, Mr. Swenson is responsible for the design of a new sanitary sewer lift station with a maximum capacity of 1,000 gpm. The new pump station structure will be constructed using sunken caisson methods because of high groundwater level due to adjacent river. The caisson structure is divided into wet and dry wells by a separating wall. Mr. Swenson is directing civil mechanical, structural, electrical, and CADD design services for the project. He is also responsible for obtaining project approval from the City of Redmond, as well as coordination with the pump station building and landscape architects, and the Winmar Company staff.

Redmond Town Center Construction Site Runoff Stormwater Treatment System

The Winmar Company/Redmond, Washington

Project Manager. Mr. Swenson is responsible for developing a stormwater treatment process for construction site runoff from a proposed 110-acre commercial/retail development located in Redmond. The work involves design of a chemical feed system to promote settling and reduce turbidity as the stormwater passes through treatment areas. Mr. Swenson is also responsible for coordination with state and local agencies.

Comprehensive Surface Water Management Plan Update and Facility Predesign

City of Burlington, Washington

Project Manager. Mr. Swenson is preparing an update to the City of Burlington's existing Comprehensive Surface Water Management Plan. The focus of this update is to perform a predesign of a new stormwater pump station, forcemain, and gravity storm drain system on the west side of the City.

Predesign of the west-side system includes reviewing the existing hydrologic analysis to determine the system design flows, performing a hydraulic analysis of the proposed pump station/forcemain/gravity system, optimizing stormwater detention to minimize required system capacity, developing preliminary plan and profile drawings, and preparing construction cost estimates.

This project also included an evaluation of the required design flows for the Gages Slough Stormwater Pump Station.

Stormwater Management Funding Program
City of Burlington, Washington

Project Manager. Mr. Swenson managed the development of a funding mechanism to implement a stormwater program which includes capital projects, operation and maintenance, engineering, administration, and public education costs. The funding mechanism must generate the necessary revenues and be politically acceptable. Mr. Swenson was instrumental in establishing a public involvement process to involve key stakeholders in decision making. As a result, the City adopted a utility service charge to fund its program.

Riverbend Road Stormwater Pump Station
City of Mount Vernon, Washington

Project Manager. A large area proposed for commercial development within the City of Mount Vernon is faced with development restrictions because of inadequate drainage facilities. Previous planning work performed by Mr. Swenson for Mount Vernon recommended a stormdrain/pump station project that could provide adequate service to this area. Mr. Swenson is responsible for the design of this new pump station and stormdrain pipeline for the City of Mount Vernon. Mr. Swenson is directing the hydraulic analysis, civil, mechanical, structural, electrical, and CADD design services for the project. He is also managing all the necessary permitting, as well as assisting the City with a $2.1 million revenue bond sale to finance the project.

On-Call Surface Water Management Services
Snohomish County, Washington

Project Manager. Mr. Swenson is responsible for providing on-call surface water management engineering services to Snohomish County. Tasks completed to date include several designs to solve localized flooding problems associated with inadequate pipe systems, culverts, and infiltration systems. Hydrologic and hydraulic analysis was also provided to establish design criteria for County engineers to perform the actual design.

Other projects include hydraulic studies to prevent lake flooding, and analysis of lake aeration systems. Mr. Swenson is currently providing drainage-related engineering and preliminary design for several large road improvement projects. This includes siting and sizing detention and stormwater quality treatment systems, conveyance systems and roadway stream crossings. This work must be in compliance with the new Title 24 county ordinance, and must be coordinated with other permitting processes such as obtaining Hydraulic Project Approvals from the Washington State Department of Fish and Wildlife.

Mill Creek Phase 2 Flood Control Plan
King County, Washington

Project Manager. Mr. Swenson is managing the preparation of a flood control plan for the Mill Creek Basin. He directed subconsultant

activities during Phase 2 of the work, which involved a feasibility analysis of flood control alternatives using HSPF and FEQ models, a public involvement program, and an alternatives evaluation process that included the public, in order to select a preferred flood control alternative. Mr. Swenson is currently managing Phase 3 of the project, which includes engineering design and environmental review of the preferred flood control alternative. Mr. Swenson's responsibilities also include development of a funding approach for the selected flood control plan, and coordination with King County and the Cities of Auburn and Kent.

SeaTac Business Park Master Drainage Plan
King County, Washington

Technical Reviewer. Mr. Swenson closely reviewed the development of a master drainage plan for a 200-acre area in King County. The plan recommended structural and nonstructural methods to control runoff, and the County specified that the plan would be used as a model for all future business park developments within King County. Work on the project included hydrologic and hydraulic computer modeling of the area's drainage basin, a system inventory, and the formulation of recommendations to serve a proposed new business park.

Springwood Apartments Regional Wetland Design
King County, Washington

Project Engineer. Mr. Swenson helped prepare the preliminary and final design of a regional stormwater detention facility and culvert improvements near the Springwood Apartments in King County. His work included hydrologic computer modeling and a siting study for a detention facility that could meet downstream peak flow control requirements with minimum impacts to area wetlands. Mr. Swenson was also involved in the design of an adjustable release flow control structure, embankment structure, armored overflow spillway, sediment retention facility, access roads for operations and maintenance, and downstream culvert replacements. In addition, his responsibilities included a detailed wetland analysis, preparation of a construction mitigation plan, and SEPA environmental review.

Stormwater Pump Station Nos. 1 and 4 Design
Consolidated Diking Improvement District #2 of Cowlitz County/ Washington

Project Manager. Mr. Swenson is responsible for the preliminary and final design for pump stations Nos. 1 and 4. During predesign, the pump stations' capacities and the operational capabilities of existing pump station No. 1 were established. The configuration of pump station No. 1 was evaluated and the best location for new pump station No. 4 was determined. Forebay volume requirements were calculated to ensure that overflows from pump station No. 2 can be intercepted by pump station No. 4. Mr. Swenson determined pumping equipment required and evaluated emergency power supply options in the event of power

outages. In addition, he determined what environmental permits are required for the project. The project is currently in the final design phase.

10th Avenue South Culvert Replacement and Intersection Improvement
City of Des Moines, Washington

Project Manager. Mr. Swenson was responsible for designing two three-sided box culverts and 140 feet of new channel to replace the existing under-sized culvert beneath 10th Avenue South. The project included updating the hydraulic model to size the culverts; providing for fish passage in the culverts and fish habitat in the new channel; preparing the civil design; coordinating the civil, structural, roadway and utility design; and preparing the construction cost estimate and contract documents for bid.

Community Workbook, Curriculum, and Workshop Development; EPA NPDES Phase II Stormwater Regulations
American Public Works Association

Author/Presenter. To educate smaller communities on compliance with new Phase II NPDES stormwater requirements being implemented by EPA, Mr. Swenson participated in development of a workbook and curriculum, and is helping conduct workshops across the country for the APWA. The program discusses the proposed new regulations and how communities can implement stormwater programs to comply with these regulations, get public support, and fund their programs.

Surface Water Management Action Program
City of Mill Creek, Washington

Project Manager. Mr. Swenson led the R. W. Beck team that developed a surface water program and program costs for the City of Mill Creek. The team then assisted the City in implementing a surface water utility to fund the program. The program includes capital projects, operation and maintenance, and public education costs. During the project, Mr. Swenson met with a committee of citizens and stakeholder groups to review the overall program costs and different options for creating a utility service charge for stormwater. He also worked with the City to implement a utility service charge recommended by the committee. The utility was subsequently approved by the City Council.

Drainage Manual Revision
Snohomish County, Washington

Project Manager. Mr. Swenson is responsible for preparing the Snohomish County Drainage Manual pursuant to the new Snohomish County Drainage Code (SCC Title 24) adopted in 1998. The manual contains guidance for complying with the code, including review and submittal requirements, detention facility performance standards, water quality treatment BMP requirements, required source control measures, and a protocol for obtaining approval for alternative BMPs. His contributions to the manual also include technical information on

engineering design for drainage facilities and other drainage control measures. Mr. Swenson participates in discussions with an advisory committee consisting of professional consultants, developers, and county planning and public works staff.

Surface Water Design Manual Update
King County, Washington

Project Engineer. R. W. Beck provided engineering services to update the existing King County surface water design manual and to develop an ongoing training program. Mr. Swenson was involved with preparing immediate corrections and clarifications; addressing substantive technical and policy amendments that required further development, research, and public review; and incorporating water quality controls into the manual. As part of the final phase, he participated in a regulatory analysis for the County's legal authority to implement and enforce water quality requirements. The design manual is a nationally recognized publication and is acknowledged by municipalities throughout the Northwest and across the United States as a model document. The manual is also the basis for large portions of the Washington State Department of Ecology's Stormwater Management Manual for the Puget Sound Basin.

Managed Competition for Stormwater System Maintenance
City of Kirkland, Washington

Project Engineer. Mr. Swenson performed work to conduct a managed competition for the operation and maintenance of portions of the City of Kirkland's stormwater system. He reviewed the City's current maintenance practices and developed performance standards that were used to prepare the RFP for outsourcing.

Comprehensive Stormwater Management Plan
Town of Eatonville, Washington

Project Manager. Mr. Swenson is currently managing preparation of a comprehensive stormwater plan that includes a capital improvement program, operation and maintenance program, inventory and mapping, water quality and fish habitat assessment, public involvement, and program administration. Mr. Swenson will present alternative program levels of service and the results of a financial analysis for each alternative. The financial analysis will be reconciled with a new utility service charge that will fund the program.

Stormwater Management Program
City of North Bend, Washington

Project Manager. Mr. Swenson is currently managing preparation of a comprehensive stormwater plan that includes a capital improvement program, operation and maintenance program, inventory and mapping, water quality and fish habitat assessment, public involvement, and program administration. The comprehensive plan is being integrated with a floodplain management plan, since much of the city lies in a

FEMA-designated floodplain. Mr. Swenson will review program costs identified in the comprehensive plan with a citizens committee and other key stakeholder groups as part of a process to develop a recommended program. He will also present alternative program levels of service and results of a financial analysis for each alternative. The financial analysis assumes that the City would fund the program through a new utility service charge. Once a recommended level of service and associated funding are approved, he will assist the City in adopting the new utility.

Padden Creek Daylighting Project

City of Bellingham, Washington

Project Manager. Mr. Swenson is managing a preliminary draft for a project that would create a new open channel for Padden Creek. A section of the Creek has flowed in an underground tunnel since the 1890s. The purpose of the project is to provide fish passage, since the existing tunnel blocks fish, as well as provide added conveyance capacity to eliminate a flooding problem. The work involves sizing and locating alternative alignments for the channel that will provide adequate flow conveyance, fish passage, and fish habitat. Alternative alignments involve several road crossings, and space is limited along existing rights-of-way. In addition to technical challenges, selection of the preferred alternative will be affected by permitting scenarios and acceptance by the community. The aggressive predesign schedule is driven by grant application funding cycles, as the construction phase of the project will depend on obtaining grant funding.

Martha Lake Drainage Improvements

Snohomish County/Washington

Project Manager. Mr. Swenson directed a study to analyze and propose solutions to flooding problems at Martha Lake. The lake flooding was attributed to conveyance problems with the lake outlet. An HEC-RAS backwater hydraulic model was created to analyze the Lake outlet capacity. Downstream improvements from the lake were sized using this model. Many of the recommendations to prevent lake flooding included improved maintenance of the outlet channel to prevent clogging with debris and trash.

196TH Street-Filbert Road (SR 524) Drainage Analysis and Preliminary Design

Snohomish County, Washington

Project Manager. Mr. Swenson directed the R. W. Beck team that prepared the preliminary design for stormwater, detention, water quality, and conveyance facilities for the widening of 196th Street/Filbert Road (SR 524) in Bothell. It was necessary to design these improvements to comply with new County standards for stormwater detention and treatment. The work involved the location of new facilities along the roadway corridor amongst existing development. Preliminary designs for five stream crossings were included in the project, requiring

hydrologic and hydraulic analysis such as bridge scour evaluation. The facilities were sized to meet fish passage standards.

112th Street SW Detention Systems and Culvert Crossings
Snohomish County, Washington

Project Manager. Mr. Swenson directed the R. W. Beck team that prepared the preliminary design for stormwater, detention, water quality, and conveyance facilities for the widening of 112th Street SW. It was necessary to design these improvements to comply with new County standards for stormwater detention and treatment. The work involved locating new facilities along the roadway corridor amongst existing development. Preliminary designs for five stream crossings were included in the project, requiring hydrologic and hydraulic analysis such as bridge scour evaluation. The facilities were sized to meet fish passage standards.

Mount Vernon Flood Control Wall
City of Mount Vernon, Washington

Project Manager. Mr. Swenson managed a team of engineers and architects to design a portable wall that would prevent high water levels during flood conditions in the Skagit River from entering the downtown area. To protect the City from severe flooding during these events, sandbag walls have been constructed along the top of the Skagit River dike. To provide a more reliable flood barrier, the City wanted to construct a portable wall system that is easier and faster to erect in an emergency than the sandbag walls.

The criteria for the design required minimal loss of parking and no loss of views of the Skagit River from the downtown business district. Mr. Swenson helped facilitate the development of the design solution in meetings with the businesses and environmental interests affected by the project.

Gages Slough Pump Station
City of Burlington, Washington

Project Manager. Mr. Swenson managed the design for a new stormwater pump station for the City of Burlington. The pump station will provide an outlet into the Skagit River for Gages Slough when the river is at high water levels. A hydraulic model was used to confirm that the new pump station could control the depth and duration of flooding to properties as well as maintain existing wetland resources along the Gages Slough riparian corridor. The R. W. Beck team was also responsible for all of the necessary permitting for the project.

Design tasks included sizing the upstream culvert and channel system; choosing pumping equipment; designing the pump station to prevent vortices and pre-rotation of the pumps; and designing a new force main penetration for the Skagit River dike.

Squalicum Creek Floodplain Flood Control Berm
City of Bellingham, Washington

Project Manager. Mr. Swenson is directing the design of a flood control berm that is set back from Squalicum Creek in the City of Bellingham. The berm was recommended as part of a separate planning effort also managed by Mr. Swenson. The purpose of the berm is to prevent creek flows from entering commercial buildings that are threatened by flooding. The design of the berm is being coordinated with permitting agencies to comply with shoreline and wetland setback and buffer requirements

NE 120th Place Culvert Replacement
City of Kirkland, Washington

Project Manager. Mr. Swenson supervised the design of a large corrugated metal pipe arch to replace an undersized culvert, in order to prevent roadway flooding and to allow for fish passage at NE 120th Place and Juanita Creek in Kirkland. Work included surveying, hydraulic analysis, permitting, plans and specifications, cost estimates, construction management assistance, and public involvement. Permits were obtained, including Hydraulic Project Approval from the Washington Department of Fish and Wildlife, and a Section 401 Water Quality Certification from the Washington State Department of Ecology.

Comprehensive Stormwater Management Plan
City of Des Moines, Washington

Project Manager. Mr. Swenson is preparing an update to the City of Des Moines' Comprehensive Stormwater Management Plan. The focus of this update is to gather information developed on individual basin studies and integrate the information into an overall program, with a new capital improvement program, changes to policies and regulations, changes to the current maintenance program, and public education elements. The study includes financial rate analysis and recommendations for new stormwater utility rates that were implemented to fund the recommended program. Also included is the development of a strategy to meet the Puget Sound Basin Plan requirements.

Lake Meridian/Soosette Creek Watershed Study
City of Kent, Washington

Project Manager. Mr. Swenson managed this project for the City of Kent to determine required stormwater capital expenditures in a recently annexed area in the Soosette Creek, Lake Meridian, Clark Lake, and Meridian Valley Creek watersheds. The City was interested in capital costs for a stormwater system for this newly annexed area, in order to determine the capital component of the stormwater utility service charge. The City's stormwater utility service charge varies between the different drainage basins depending upon the capital needs in those areas. To support flood reduction and fish habitat improvements to the area, a watershed study was conducted that included development of a capital

improvement program for these basins that enabled the City to establish a basin-specific utility service charge.

35th Avenue SE Roadway Improvement Project
Snohomish County, Washington

Project Manager. Mr. Swenson managed an analysis to locate and prepare conceptual site layouts for stormwater control facilities in connection with the design and construction of 4.2 miles of street improvements for 35th Avenue SE, from 116th Street SE to Seattle Hill Road. He incorporated individual drainage quality and quantity control facilities, designed by the County and by the roadway design consultant, into an overall drainage control concept plan for approval by permitting agencies. For a major portion of the project, Mr. Swenson successfully implemented an innovative approach to provide the required stormwater storage at an off-site wetland enhancement area, rather than using a conventional stormwater pond. This was necessary because the existing road was very low and flat in relation to an existing stream crossing, and lacked the grade needed to construct a conventional pond.

South Mount Vernon Stream Gaging
Skagit County and City Of Mount Vernon, Washington

Principal-in-Charge. Under two parallel projects, R. W. Beck is providing stream gaging services on Bulson Creek and Carpenter Creek for Skagit County, and on Maddox Creek for the City of Mount Vernon. The data obtained from the two projects will be used to quantify streamflow and the effects of pump stations and tide gates, and will also be used to characterize the basin and calibrate future hydrologic and hydraulic models in the area. R. W. Beck will conduct field reconnaissance and select appropriate stream gaging instrumentation (area/velocity meters and stage-only meters), install the equipment, make streamflow measurements for instrumentation calibration, and provide a technical memorandum to describe the methodologies used and present data from the analysis.

Sturtevant Creek Watershed Analysis
City of Bellevue

Project Manager. Mr. Swenson worked with the City of Bellevue to evaluate several alternatives for managing stormwater within the Central Business District (CBD) portion of the Sturtevant Creek basin. These alternatives presented different methods for providing flow control for areas within the Sturtevant Creek portion of the CBD that will be re-developed in the future. These alternatives included on-site detention, regional detention, and a high flow storm drain that would transport undetained peak flows directly to Lake Washington. An abbreviated hydrologic/hydraulic analysis was performed to size facilities and determine capital costs for each alternative. The results of this analysis and a recommended stormwater management strategy were provided to the City.

Stormwater Management Planning

Seattle Public Utilities/Washington

Project Manager. Steve Swenson is leading a team that was recently selected to assist SPU with development of a strategy to address renewal of the City's NPDES Phase I stormwater permit. In order to identify basin-specific water quality problems and their sources, the plan will characterize existing water quality problems in receiving water bodies using existing data supplemented with a simplified pollutant loading analysis based on land use. GIS will be used extensively as a data management tool so that existing water quality data and pollutant loading information can be referenced geographically as well as numerically. The plan will also evaluate different stormwater treatment BMPs and store this information in the GIS database in the form of relationship tables that describe BMP removal efficiencies for different pollutant parameters as well as other factors such as cost, maintenance considerations, and land area requirements. Once all this information is input into the GIS database, the GIS model can be queried to evaluate the most appropriate BMPs to use in specific drainage basins throughout the City with the end product being the development of basin-specific water quality control strategies. This information will be used as the basis for a stormwater quality management plan that will be incorporated into the City's NPDES permit renewal.