

MICHAEL J. CHEYNE

1004 East Fourth Avenue • Ellensburg, Washington 98926 • (509) 925-7638 •
future@ellensburg.com

PROFESSIONAL EXPERIENCE

Seattle Tacoma International Airport, Seattle, Washington

1989 - Present

Director of Planning

3rd Runway Project Manager

Managing a full range planning department for a major airport and development of a comprehensive airfield development plan including planning and engineering for a third dependent air carrier runway.

Assisted Port of Seattle Executive with the planning for transition to a line of business organizational structure

Port of Edmonds, Edmonds, Washington

1986 - 1989

Port Executive Director

Controlled all functions of a working waterfront, marina and commercial properties including comprehensive planning, capital project administration, lease negotiations, promoting economic development, staff training and community and agency liaison.

Port of Friday Harbor, Friday Harbor, Washington

1982 - 1986

Port Executive Director

Managed a general aviation airport and recreational/commercial marina including comprehensive planning, capital project administration, commercial property development, and all aspects of administration including staff development, fiscal planing, and community and agency liaison.

Newport Yacht Club, Bellevue, Washington

1978 - 1981

Manager

Managed a marina, community center, and recreational facilities for private community organization.

EDUCATION

Master of Science in Public Administration, Western Illinois University, Macomb, Illinois
Bachelor of Science in Parks and Recreation, Western Illinois University, Macomb, Illinois

AR 037146

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Summary

Accomplished public-sector administrator with over 21 years of managerial, planning, program, and project experience with 17 years within the aviation industry. Experienced manager with the ability to work in complex organizational structures across multiple lines of business. Proven ability to handle multiple priorities, facilitate effective teamwork between disciplines, and negotiate solutions within politically charged and technically complex-situations.

AREAS OF EFFECTIVENESS

- Aviation Experience**
- Sea-Tac International Airport – Planning Director responsible for a full service planning department for a major airport. Program Manager directed the comprehensive airfield development plan, airport master plan, worked on two FAA capacity enhancement plans, cargo development planning, taxiway construction, runway rehabilitation, safety area expansion, industrial waste system improvements, basin planning, hangar soil remediation, NPDES permitting and citizen law suits, hotel site selection, secured federal funding through a letter of intent and AIP grants.
 - Port of Friday Harbor – directed operations of a general aviation airport with responsibilities including airport planning, environmental analysis, terminal expansion, hangar development, runway and taxiway development, fixed base operations lease, commercial development, navigational aid installation, and securing federal funding
 - American Association of Airport Executives – Accreditation Academy
 - Sea-Tac Airline Advisory Sub-Committee – coordinator
 - Green River Community College – Aviation Advisory Committee – Chair
 - Washington Airport Managers Association
- Finance and Economic Development**
- Conducted multi-jurisdictional industrial development planning for a 100-acre site at Sea-Tac International Airport.
 - Developed private/public partnerships for the commercial development along the Friday Harbor waterfront and at the Friday Harbor Airport.
 - Developed private/public partnerships for the commercial development of the City of Edmonds waterfront. Successfully renegotiated leases with Anthony's Homeport, Washington State Department of Transportation, and Harbor Mall.
 - Coordinated general and revenue bond financing and refinancing
 - Involved in economic development as vice-chair of the Washington Pubic Ports Association Economic Development Committee, chair of the City of Edmonds Tourism Committee, member of the Edmonds Main Street Project, and member of the State of Washington's Region IV Tourism Board.

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- Industry Involvement**
- FAA Regional Office – Management liaison with FAA Northwest Regional Office. Capital project liaison related to 3rd runway funding (letter of intent), navigational aid relocation and funding, and capital project development
 - Over 15 years of experience working with the Seattle Airport District Office related to project reimbursements, grant applications, and airfield planning.
 - Participation in the Airline Airport Affairs Committee and Airline Technical Committee
 - Developed and coordinated the Airport Advisory Sub-Committee – a committee of the Airline Technical Committee
- Planning**
- Director for a full service planning department and member of the Senior Aviation Management Team for Sea-Tac International Airport
 - Managed airport master plans at Sea-Tac International Airport (1995) and Friday Harbor Airport (1983)
 - Worked on two Federal Aviation Administration’s Capacity Enhancement Plans
 - Worked on the Port of Seattle’s Cargo Development Plan
 - Developed long-range comprehensive plans for the Ports of Friday Harbor and Port of Edmonds (as Executive Director)
 - Partner in Future Directions, Inc., a consultant firm that specializes in public sector comprehensive planning, public involvement, and grantsmanship. Directed the state-wide Outdoor Recreation Needs Assessment for the Interagency Committee for Outdoor Recreation.
- Environmental**
- Managed multiple complex environmental impact statements for airport, airfield, and capacity improvements
 - Obtained a U.S. Army Corps of Engineers Section 107 and 404 Permit (Port of Friday Harbor)
 - Negotiated a National Pollution Discharge Elimination System permit with the Department of Ecology
 - American Association of Airport Executives – Environmental Committee
 - Coordination of an Environmental Protection Agency air certification
 - Administered a regional multi-jurisdictional basin planning effort
 - Received and negotiated a settlement agreement for a Department of Ecology 401 Water Quality certificate and currently finalizing a Corps 404 permit at Sea-Tac International Airport
- Community Relations**
- Multiple public presentations at public meetings, Commission sessions, service groups, and open houses
 - Managed multiple video productions depicting an acquisition process and new technology in airfield nighttime construction management
 - Managed multiple public affairs design efforts including brochure development, implementation of a construction hot line, public displays, and web page.
 - Experienced with print and television media relations
 - Itasca Community Council – Chair
 - City of Edmonds 2020 Economic Committee, Tourism Committee, and Main Street Project member

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Project Management

- Directed the planning, environmental analysis, design and implementation of a \$766 million 3rd runway at Sea-Tac Airport
- Certified Project Management Professional (PMP) with Project Management International (PMI). Currently Vice-President of the Puget Sound Chapter, Executive Advisory Board
- Implemented an airfield re-development plan including runway rehabilitation/reconstruction at a major hub airport
- Expanded a general aviation airport including runways, taxiways, hangars, commercial development and terminal building
- Managed acquisition program including over 500 residential properties, an apartment complex, numerous commercial properties, and street vacations

MICHAEL J. BAILEY, P.E.
Sr. Principal Engineer, Hart Crowser, Inc.

EDUCATION

Purdue University, M.S. Civil Engineering, 1976
Michigan Technological University, B.S. Civil Engineering, with Honors, 1974

PROFESSIONAL REGISTRATION

Registered Professional Engineer: Washington & Alaska

PROFESSIONAL EXPERIENCE

Mr. Bailey has 25 years of geotechnical engineering experience, including the past 20 years with Hart Crowser, Inc. His work typically involves managing, and senior engineer responsibility for, subsurface explorations, analyses of stability and earth-structure interaction, development of plans and specifications, and construction oversight.

REPRESENTATIVE PROJECT EXPERIENCE

- **Earth Works.** Sea-Tac Third Runway (SeaTac); Mud Mountain Dam Right Abutment Stability Improvements (Enumclaw); Golf Club at Newcastle (Newcastle); Cannon Mine Closure (Wenatchee);
- **Site Development.** Millennium Tower (Seattle); Meadowview Park (Newcastle); METRO North Operating Base (King County); Summit School (Maple Valley).
- **Underground Utilities.** Boeing Vent Tunnel (Everett); Mud Mountain Dam Outlet Tunnel Replacement (Enumclaw); Swamp Creek Interceptor Sewer (Snohomish Co.); Diagonal Avenue CSO Control Project (Seattle); Skyline Conveyance Project (Anacortes); Lake Tapps Sewerage System (Bonney Lake).
- **Transportation Infrastructure.** Valley Avenue Bridge (Puyallup); West Valley Highway (Kent); Friday Harbor Airport Expansion; 64th Street Bridge (Pierce Co.); SR-5 NOB Dedicated Interchange.
- **Mine Closure & Reclamation.** Holden Mine RI/FS Oversight (WA); Eureka Slope & Cumberland Prospect (Calif.); Skookum Slope Mine (WA); Wilkeson / Fairfax Mines (WA); Rio Blanco (Colorado); Manhattan Canyon (Calif.); Coal Mines (Confidential Client, IL).

PROFESSIONAL AFFILIATIONS

Member, American Society of Civil Engineers
Member, Society of Mining Engineers

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RESUME

Jan L. Cassin

Wetland Ecology, Plant Community Ecology, Botany, Restoration Ecology

EDUCATION

Ph.D. (Ecology and Evolutionary Biology) 1997, **University of Michigan, Ann Arbor**.
Dissertation Title: 'Balancing Costs and Benefits in a Mutualism: Conditionality in the Interaction between the grass, *Hystrix patula* and its fungal endophyte'.

M.S. (Ecology and Evolutionary Biology) 1989, **University of Michigan, Ann Arbor**.
Thesis: 'Ecological Determinants of Host Plant Use in a Willow Flea Beetle (*Altica subplicata*)'.

B.A. (Environmental, Organismic and Population Biology) 1977, **University of Colorado, Boulder**.

QUALIFICATIONS

Dr. Cassin is a plant community ecologist and wetland scientist with over 17 years experience in applied conservation biology and wetland ecology. Jan has extensive experience conducting botanical and wetland inventories, and wetland/riverine functional assessments in the Pacific Northwest, California, Alaska, New England, the mid-Atlantic states, the Rocky Mountain states and in the upper Great Lakes region. Dr. Cassin specializes in the application of scientific principles to ecosystem assessment and restoration in wetland and riverine systems. She has focused on the development of ecological assessments for impact analysis, and in the design, construction and monitoring of wetland ecosystem restoration, with a particular emphasis on estuarine and riverine restoration. Dr. Cassin helped develop hydrogeomorphic (HGM) functional assessment models for riparian and wetland systems in Alaska, California, the Chesapeake Bay, and the Pacific Northwest.

In addition, Dr. Cassin is experienced in designing vegetation sampling protocols and conducting vegetation sampling to address changes in plant distribution and abundance at a range of spatial scales. Projects include: determining the effects of multiple environmental factors on plant population viability, persistence and distribution; addressing effects of spatial and temporal variation in environmental stressors on plant demographic parameters; linking plant parameters such as growth rates, biomass, productivity and seed production with trends in abundance and distribution; using a combination of historical records, satellite imaging, aerial photos and field surveys to map historic and current distributions of rare plants and communities to assess changes over time; and conducting vegetation sampling along environmental and anthropogenic disturbance gradients to determine conservation priorities as well as to set design and performance targets for ecosystem restoration projects.

As an environmental consultant, Dr. Cassin is experienced in providing the following services to governmental and non-governmental clients: regulatory assistance with

wetland permitting efforts at federal, state and local levels; conducting wetland delineations; conducting threatened and endangered species inventories and preparing conservation plans; designing, constructing and monitoring compensatory mitigation projects; monitoring and managing invasive plants; and ecosystem monitoring and management in both wetland and terrestrial systems. In addition, she has extensive experience in the design of protection and management strategies for the conservation and recovery of endangered species. Dr. Cassin has worked in both the public and private sectors, is an experienced teacher and lecturer, and has successfully worked on large multi-agency projects that involved coordination among numerous stakeholders and extensive public participation.

EXPERIENCE

Wetland Ecologist/Biologist, Parametrix, Inc.; Kirkland, WA. 1999 to present. As a Senior Scientist/Plant Ecologist at Parametrix, Dr. Cassin specializes in ecosystem restoration design, construction and monitoring; regulatory assistance; ecosystem functional assessment with a particular focus on riparian and estuarine systems; wetland delineation; and ESA compliance and conservation/recovery planning.

Senior Associate, L. C. Lee & Associates, Inc. (LCLA) and the National Wetland Science Training Cooperative (NWSTC), Seattle, WA. June 1997- December 1999. As a Senior Associate at LCLA, Dr. Cassin provided private, governmental and non-governmental clients with consulting services in wetlands science; regional wetlands inventories and functional assessments; wetlands permitting and regulatory assistance; ecosystem restoration design, construction and monitoring; and ecosystem monitoring and management.

Information Manager/Botanist, The Nature Conservancy. Michigan Natural Features Inventory (MNFI), Lansing, MI. 1990-1992. While at MNFI, Jan provided database/GIS management and botanical support for a state-wide biological inventory. She assisted with environmental reviews using database, conducted botanical and vegetation inventories, helped develop conservation priorities by mapping historic and current distributions of high priority plant community types, and writing natural areas management plans. Additional duties included working as a member of the team developing conservation and management strategies for state-wide natural areas program.

Regional Information Manager/Botanist, The Nature Conservancy (TNC), Eastern Regional Office, Boston, MA. 1982-1987. The regional office of TNC Jan provided database development/management for map and computer files documenting biological inventories for states in the eastern U.S. To support individual state inventories, she assisted with botanical and vegetation surveys, was a member of team developing conservation priorities and plans for rare species and threatened natural communities, assisted with the development of regional vegetation classifications, and prepared stewardship plans for rare species. Additional duties included assisting and training State Natural Heritage

data managers in database development and management, and working as a member of the team developing and implementing region-wide conservation and management strategies.

Senior Staff Assistant, Center for Policy Alternatives, Massachusetts Institute of Technology, Cambridge, MA. 1980-1982. Duties included working on multidisciplinary teams preparing technical and scientific review documents on a range of environmental policy issues.

Analyst: Environmental Permitting/Reclamation, Impact Environmental Consultants, Inc., Denver, CO. 1977-1980. Duties included regulatory assistance; air and water quality monitoring technician; Uranium and surface coal mine reclamation planning and assistance.

SELECTED PUBLICATIONS

Cassin, J. L. 2000. Filling the Gap in Conservation Strategies: A Mesoscale Tool for Biodiversity Assessment and Conservation. *Conservation Biology*, Vol. 14, No. 5, October, 2000.

Cassin, J. L., M. L. Louthier, and J. C. Kelley. 2000. *Implementation Addendum to the Natural Resource Mitigation Plan: Master Plan Update Improvements for the Seattle-Tacoma International Airport*. Port of Seattle. Parametrix, Inc. Kirkland, WA.

Lee, L. C., M. C. Rains, J. L. Cassin, S. R. Stewart, R. Post, M. Brinson, M. Clark, J. Hall, G. Hollands, D. LaPlant, W. Nutter, J. Powell, T. Rockwell, and D. Whigham. 1999. *Operational Draft Guidebook for Reference Based Functional Assessment of the Functions of Precipitation Driven Wetlands on Discontinuous Permafrost in Interior Alaska*. State of Alaska, Department of Environmental Conservation/U. S. Army Corps of Engineers Waterways Experiment Station Technical Report. Anchorage, AK.

L. C. Lee and Associates, Inc. 1998. *Newskah Creek Aquatic Ecosystem Restoration: Preliminary Restoration Plan for the Washington State Department of Corrections Stafford Creek Corrections Center, Grays Harbor County, Washington*. Prepared by J. L. Cassin and S. M. Winter for the Washington State Department of Corrections, Olympia, WA.

Lee, L.C., M. L. Butterwick, J. L. Cassin, R. A. Leidy, J. A. Mason, M.C. Rains, L.E. Shaw, E. G. White. 1997. *A Draft Guidebook for Assessment of the Functions of Waters of the U.S., Including Wetlands on the Borden Ranch, Sacramento and San Joaquin Counties, California*. Wetland Regulatory Office (WTR-8), United States Environmental Protection Agency /L.C. Lee & Associates, Inc. Seattle, Washington.

Lee, L. C., M. L. Butterwick, J. L. Cassin, R. A. Leidy, J. A. Mason, M. C. Rains, L. E. Shaw, E. G. White. 1997. *A Report on Assessment of the Functions of Waters of the United States, Including Wetlands, on the Borden Ranch, Sacramento and San Joaquin*

Counties, California. Wetland Regulatory Office (WTR-8), United States Environmental Protection Agency /L.C. Lee & Associates, Inc. Seattle, Washington.

PRESENTATIONS AT PROFESSIONAL MEETINGS

- Ecological Society of America and Society of Conservation Biology, 1996 Annual Meeting. August 1996. Paper title: 'Conditionality in a fungal endophyte-grass mutualism: outcomes depend on light, soil nitrogen and herbivore densities'
- Ecological Society of America, 1997 Annual Meeting, August 1997. Paper title: 'Recruitment limitation in a perennial grass: the presence of a fungal mutualist determines whether seeds, sites or compensatory mortality limit recruitment'
- Society of Wetland Scientists, 1998 Annual Meeting. June 1998. Paper title: 'Using the Hydrogeomorphic Method (HGM) in Wetland Ecosystem Restoration in the Puget Sound Lowlands: The North Creek Aquatic Ecosystem Restoration'
- Society for Ecological Restoration, 1999 Annual Meeting. September 1999 (abstract accepted, March 1999). Paper title: 'Enhancing Biodiversity in Wetland Ecosystem Restorations: Restoring Biodiversity in an Urban Watershed in Puget Sound'
- Association of State Wetland Managers, 1999 Annual Symposium. October 1999. Restoration: Applying Restoration Science. Paper title: 'The Control of Invasive Weeds: Critical Design, Construction and Maintenance Issues in Riverine Ecosystem Restoration'

MEMBERSHIPS IN PROFESSIONAL SOCIETIES

- Ecological Society of America, 1991 to present
- Botanical Society of America, 1992 to present
- Society for Conservation Biology, 1991 to present
- Society of Wetland Scientists, 1996 to present
- Society for Ecological Restoration, 1992 to present

OTHER MEMBERSHIPS

- The Nature Conservancy, 1983 to present
- Washington Native Plant Society, 1997 to present
- California Native Plant Society, 1997 to present
- Oregon Native Plant Society, 1998 to present

REPRESENTATIVE PROJECTS

Parametrix Projects

Confidential Client, Southwestern U.S.

For this project Parametrix is conducting environmental studies to evaluate potential impacts of reservoir management on wetlands, native riparian plant communities and riparian wildlife habitat and species along an intermittent river in the southwestern U.S. As the technical lead for wetlands and plant communities studies, Dr. Cassin is responsible for designing and conducting studies to characterize the existing riparian ecosystems, inventory plant species, and monitor changes in the plant communities over

time related to changes in water management and groundwater elevations. Responsibilities also include recommending mitigation actions to protect and restore native riparian plant communities.

City of Kent, Covington Water District, King County Water District 111 – Pesticide Survey and Preparation of Integrated Pest Management Plan Dr. Cassin is the project manager on this study which will evaluate pesticide use within the wellhead protection area for several municipal water districts in King County. Based on the results of the pesticide survey, Parametrix is preparing integrated pest management plans for the management of parks, roadside and utility right of ways, and golf courses to reduce pesticide use within the wellhead protection areas.

Seattle-Tacoma International Airport Master Plan Update – Port of Seattle Dr. Cassin is a member of the consultant team conducting natural resource studies and environmental permitting for the Port's Master Plan Improvements including construction of a new third runway. To facilitate CWA Section 404 permitting, Dr. Cassin has reviewed and responded to comments on the EIS and Public Notice. She is also providing technical review and final design revisions for the preparation of the detailed wetland mitigation plans. This includes preparation of a final monitoring plan, as well as construction specifications. Key to these mitigation projects are the restoration of natural channel morphology, large woody debris and forested riparian buffers to a currently degraded urban stream, as well as restoring hydrology and native plant communities to forested, shrub and emergent wetlands. In addition, Dr. Cassin is assisting with coordination with Federal and State agencies to evaluate permit conditions and mitigation requirements. **Contact/Reference:** Elizabeth Leavitt, Port of Seattle,

Cross Base Highway EIS and Mitigation Planning – Pierce County, WA As a member of the consultant team preparing the EIS and CWA permitting and mitigation plans for this highway extension, Dr. Cassin is conducting studies to evaluate potential mitigation sites and preparing mitigation plans. The proposed highway route crosses an area containing oak woodlands - one of the highest priority habitats in the State of Washington, as well as habitat for the State-listed western gray squirrel. The restoration design includes restoring a stream which has been heavily degraded by grazing to a native Oregon white oak/Oregon ash gallery forest, one of the rarest habitat types in the Puget Sound lowlands. Development of the mitigation plans involves coordination with Federal and State agencies, as well as review and synthesis of the scientific literature on the technical requirements for restoring these rare habitats. Additional tasks include reviewing and responding to comments on the draft EIS for incorporation into the final EIS. **Contact/Reference:** Pat Baughman, Pierce County, (253) 798-3157.

Rare/Endangered/Threatened Plant Survey and Biological Assessment – Merlin Co-composting Facility, Grants Pass, Oregon Siting and environmental permitting for this co-composting facility required an evaluation of potential impacts on the Federally listed plant, Gentner's mission bells. Because a known location for the plant occurred within several miles of the project

location and apparently suitable habitat occurred on the project site. completing permits for the project required determining whether or not the plant occurred within the project site and would be impacted by the project. Dr. Cassin reviewed historic and current information on the plant's distribution and habitat requirements, developed an inventory protocol consistent with U. S. Fish and Wildlife Service requirements, conducted a plant survey of the project site and wrote a Biological Assessment. Although the plant was not found on the project site, a 'no effect' determination was not possible because Gentner's mission bells can remain dormant underground for several years. By carefully documenting habitat conditions at extant locations for the plant and comparing those to habitat conditions on the project site however, a 'not likely to adversely affect' determination was made and the project will be able to move forward without a formal consultation.

Additional Projects

Prior to joining Parametrix, Dr. Cassin worked on the development and implementation of several ecoregion or watershed based assessments and restoration projects conducted to support impact analysis or state and regional conservation priorities. Projects include:

Ecosystem Functional Assessment

As senior botanist on multi-agency teams, Dr. Cassin has participated in developing functional assessment models and conducting wetland functional assessments for a variety of Federal and State natural resource agencies in Alaska, the Pacific Northwest, California, and the eastern U.S. These models provide reference data and a rapid assessment method for conducting wetland functional assessments and impact assessments pursuant to NEPA, SEPA, CWA 404, and ESA requirements. These models use the Hydrogeomorphic approach to assessing wetland function, and include collection of reference data on systems representing a range of disturbance conditions, relating functional measurements to disturbance condition, and developing model parameters that can be used to rapidly evaluate wetland function in similar systems. Dr. Cassin has been responsible for model development, design of data collection protocols, collection of reference data, managing field teams, overseeing data analysis, development of model parameters, writing model guidebooks and review of guidebooks. Development and testing of models required close coordination with members of the multi-agency teams to ensure that the models can be effectively used to evaluate project impacts and conduct NEPA, SEPA, CWA and ESA reviews. Dr. Cassin participated in the development of two wetland functional assessment models in Alaska: depressionnal, slope and riverine wetlands associated with the Kenai River watershed, and precipitation driven wetlands on discontinuous permafrost in Interior Alaska. In addition, Dr. Cassin conducted reference sampling and data analysis to develop or refine models for riverine/estuarine wetlands in southwest Washington, Chesapeake Bay coastal plain depressionnal wetlands, and 3rd and 4th order riverine wetlands in the Puget Sound. **Contacts/References:** CA - Rob Leidy

(415-744-1970), USEPA; MD - Leander Brown, NRCS; AK - Jim Powell, Alaska Department of Environmental Conservation (AK).

Borden Ranch – U.S. EPA, Department of Justice

As a senior botanist on the L. C. Lee & Associates, Inc. team, Dr. Cassin participated in developing, testing and applying Hydrogeomorphic (HGM) functional assessment models for depressional (vernal pools), slope and riverine wetlands in the California's Central Valley. These functional assessment models were used to evaluate the impacts on vernal pools, and other wetlands, of deep ripping the soils for the purpose of converting grazed pasture land to cultivation for vineyards and orchards. Model development involved collection of reference data from approximately 90 sites, data analysis and synthesis, and the development of wetland functional indices related to a range of land use conditions. Dr. Cassin was responsible for botanical data collection, directing data quality assurance/quality control, overseeing data analysis, and development of model indices. In addition, Dr. Cassin participated in the field testing of the model and application of the model to wetlands on Borden Ranch. She was a co-author on both the Draft Guidebook and the Report on the Assessment of Wetland Functions that resulted from the development and implementation of functional assessment models to wetlands on the Borden Ranch. These reports were used by the U. S. EPA and the U. S. Justice Department to determine wetland impacts resulting from the deep ripping operation and to determine appropriate mitigation. **Contacts/References:** Rob Leidy, U.S. EPA; Mary Butterwick, U.S. EPA

Stafford Creek Corrections Center EIS, Wetland Permits and Mitigation Design – State of Washington Department of Corrections

As wetland ecologist/botanist on this project, Dr. Cassin investigated the potential impacts on freshwater tidal wetlands and streams of a utility line extension required for the construction of a new correctional facility. The approximately 20 mile-long utility extension crossed sensitive freshwater tidal wetlands as well as seven salmon-bearing streams adjacent to Grays Harbor estuary. Tasks included review and revision of the draft EIS, preparation of the FEIS sections on wetland and aquatic systems, delineating wetlands along the utility corridor, and preparing Federal, State and local permit applications required for the project. Additional tasks included participating in coordination with Federal and State natural resource agencies, as well as Grays Harbor County, to further evaluate project impacts, potential permitting conditions and mitigation requirements. As senior botanist, Dr. Cassin was responsible for designing the restoration of native freshwater and estuarine wetland, riparian and upland plant communities on the 10-acre mitigation site. Dr. Cassin conducted studies of estuarine and freshwater wetlands in Grays Harbor and Willapa Bay to identify plant communities and habitat features to be incorporated into the design. Additional duties included coordinating native plant procurement and performing construction observation for the Department of Corrections during the planting phase of mitigation construction. **Contact/Reference:** Linda Glasier, WA State Department of Corrections (360-753-6547)

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**North Creek Aquatic Ecosystem Restoration, Restoration Design and Construction
– Washington State Department of General Administration**

As senior botanist, Dr. Cassin was responsible for the design of native wetland and riparian plant communities on this approximately 60-acre aquatic ecosystem restoration site. As mitigation for impacts to wetlands from the construction of a co-located University of Washington-Bothell and Cascadia Community College campus, the restoration involved restoring natural channel morphology to approximately 4000 feet of the diked and channelized North Creek channel and reconnecting the stream to its floodplain. The restoration design included 20 native plant community types and over 100 native plant species. Additional tasks included completing construction specifications for plant procurement, weed management, and plant installation and maintenance. In addition, Dr. Cassin was responsible for the operation of an on-site nursery facility that propagated native plants for the restoration. Coordination with Federal and State natural resource agencies, as well as the City of Bothell was completed to evaluate project impacts, permitting conditions, and mitigation requirements. Participation in public meetings and presentations to community groups resulted in widespread public support for the restoration project and campus construction. Construction observation, including monitoring permit compliance, was completed for the first planting phase of the project. This phase consisted of planting the channel riparian zone and approximately 40 acres of floodplain wetlands and upland buffer.

Charles T. Ellingson, RPG, CGWP
Principal Hydrogeologist

Education and Other Qualifications

M.S. Hydrology, 1980, University of Arizona
B.S. Geology/Geophysics, 1978, University of Hawaii
Registered Professional Geologist, 1990, State of Oregon
Certified Groundwater Professional, 1990, Association of Groundwater
Scientists and Engineers

Professional Experience

Mr. Ellingson is a co-founder and principal hydrogeologist of Pacific Groundwater Group, bringing to the firm 22 years of consulting experience in aquifer protection, contaminant hydrogeology, basin hydrology, and water supply. His educational background in groundwater hydraulics complements his experience exploring, testing, and modeling a wide variety of groundwater regimes: single- and multi-aquifer systems, unsaturated soils, fractured aquifers, and two-phase flow systems. He has directed groundwater development projects that have involved evaluating regional aquifers, siting and designing wells and well fields, and analyzing impacts to surface water. Mr. Ellingson's other areas of expertise include groundwater management, contaminant assessment, design of remedial measures, and modeling the hydrologic effects of land development. He was an invited participant in the State's technical advisory committee on hydraulic continuity and co-authored *Report of the Technical Advisory Committee on the Capture of Surface Water by Wells*, produced for Ecology in 1998. Mr. Ellingson's recent activities involving land development include management of the multi-disciplinary team to independently assess hydrologic effects from construction of the SeaTac third runway, evaluating potential impacts to ground and surface water from a rezone proposal in Thurston County, and leading the groundwater efforts necessary to develop a basin plan focused on flood mitigation for Salmon Creek in Thurston County.

Representative Project Experience

- Predicted groundwater flooding severity and return periods as part of basin planning in the Salmon Creek Basin in Thurston County. Statistical methods and GIS were used to characterize the shallow groundwater regime and flooding potential on a detailed scale. Specified groundwater modeling requirements as part of land development standards used by Thurston County.
- Project manager of team of surface water, fisheries, wetlands, and groundwater specialists required to assess hydrologic impacts from construction of the SeaTac third runway. Worked closely with Port of Seattle, King County, public, and Ecology personnel to develop and implement this highly sensitive project. Assessed results of various existing surface water and groundwater models, and developed new models to complement the others.

- Identified water supply options and water right requirements for a proposed natural gas/ steam power plant in Wallula, Washington requiring up to 9,500 gpm of supply.
- Assisted with the planning and development of the City of Tumwater's groundwater supply. The project required wellhead protection planning and drilling multiple test and production wells.
- Completed the hydrogeologic portions of a RCRA Part B Permit application. Characterized the groundwater migration paths in an extremely variable glacial regime.
- Brought five solid-waste landfills into compliance with the Washington State groundwater monitoring regulations.
- Characterized the site of a proposed dangerous waste landfill in Grant County, Washington, for a RCRA Part B Proposed Permit. The project required evaluating tests conducted in hard-rock aquifers and soils.
- Analyzed regional hydrogeologic data to develop a groundwater-surface water model of Renton Cedar River aquifer. The model required short- and long-term transient calibrations that considered recharge from the river and influx from groundwater. It was used to optimize aquifer management despite groundwater contamination problems and required in-stream flows.
- Conducted a MTCA Remedial Investigation at a bulk petroleum plant in the Port of Tacoma.
- Analyzed regional hydrogeologic data to evaluate groundwater resources in Kitsap County, Washington. The project required assessing the impacts of development on other wells and surface waters and assessing the impacts of on-site septic drain fields on water quality.
- Conducted a Remedial Investigation/Feasibility Study for the Tacoma Landfill. The project required defining the groundwater flow regime, modeling contaminant transport, and designing and installing a groundwater extraction system.
- Assisted a municipal water purveyor in Pierce County, Washington, in developing its groundwater supplies. The project required evaluating groundwater resources, recommending well locations, and designing a 2,000-gpm well.
- Designed, installed, and tested wells for a 1,000-gpm water supply at uranium mill in Central Wyoming.
- Characterized the vadose zone beneath a proposed liquid waste impoundment in eastern Washington; modeled potential impacts to the vadose zone and aquifer under various release scenarios.
- Assessed the suitability of siting a landfill over an environmentally sensitive aquifer in Whidbey Island, Washington.

Publications and Presentations

- Invited speaker and participant in regional workshops addressing groundwater protection from land uses (storm water, septage) and industrial elements (pipes, tanks) in Renton, Washington.
- Invited by Ecology to participate in the Technical Advisory Committee on the Capture of Surface Water by Wells, a committee formed to help regulators evaluate impacts that may result from issuing additional water rights in Washington State. Key participant in Report.
- "Brine Reservoirs in the Castile Formation, Southeastern New Mexico", by R.S. Popielak, R.L. Beauheim, S.R. Black, W.E. Coons, C.T. Ellingson, and R.L. Olsen, TME 3153, Technical Support Contract to U.S. Department of Energy, Waste Isolation Pilot Plant, Albuquerque, New Mexico, 1983.
- "When is Modeling Necessary for Problem Solving?", by C.T. Ellingson; abstract and lecture for short course titled "Practical Applications of Groundwater Flow and Contaminant Transport Models", August, 1985, University of Washington, Seattle, Washington.
- "Grant County Waste Management Facility", by G.W. Smedes and C.T. Ellingson; abstract of presentation given at the 1985 Pacific Northwest Pollution Control Association Convention - Hazardous Waste Management Session, October, 1985.
- "Irrigation Impact Issues at the Proposed Grant County Dangerous Waste Management Site", by C.T. Ellingson; In: Proceedings of the Focus Conference on Northwestern Ground Water Issues, May 1987; National Water Well Association, 6375 Riverside Dr., Dublin, OH 43017.
- "Interesting Issues: Tacoma Landfill Hydrogeology", by Charles Ellingson and Russell Prior, at Washington Hydrologic Society Meeting, November 18, 1993.
- "Development and Implementation of a Comprehensive Aquifer Protection Program for the City of Renton", by Carolyn Boatsman, Michael Warfel, Charles Ellingson, and Geoff Clayton; In: First Symposium on the Hydrogeology of Washington State, August 1995.

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EDUCATION

Ph.D. (Aquatic Toxicology) University of Wyoming, 1987.
M.S. (Toxicology/Toxicodynamics) University of Kentucky, 1979.
B.S. (Biological Sciences/Chemistry) Eastern Kentucky University, 1977.

SCIENTIFIC SOCIETY AFFILIATIONS

Society of Environmental Toxicology and Chemistry
Society of Toxicology
American Society of Testing and Materials
American Chemical Society
Rocky Mountain Regional Chapter of the Society of Environmental Toxicology and Chemistry

PROFESSIONAL HISTORY

1987-Present ENSR Consulting and Engineering
1998-Present Colorado State University Department of Environmental Health, Affiliate Faculty
1990-Present Colorado State University Department of Fisheries and Wildlife Biology, Affiliate Faculty
1985-1987 Mobay Corporation; Health, Environment, and Safety Division
1983-1985 University of Wyoming, Fish Physiology and Toxicology Laboratory
1979-1983 Exxon Corporation, Research and Environmental Health Division

PROJECT EXPERIENCE

- *Exxon Company USA - Evaluation of the Toxicological Effects of the Exxon Valdez Crude Oil Spill.* Designed and supervised a toxicology testing program to assess the toxicity of spilled crude oil in Prince William Sound, Alaska. This program included evaluation of potential effects to both sediment and water-column dwelling organisms as well as a characterization of the toxicity of weathered crude on terrestrial and avian species. These efforts were conducted in support of a natural resource damage assessment.
- *Confidential Client - Evaluation of the Fate and Effects of Chlorinated Hydrocarbon Contaminants Associated with a Metals Processing Facility.* Designed and implemented a quantitative program to evaluate the extent of contamination and potential environmental effects associated with release of chlorinated hydrocarbon contaminants from a metals processing facility. Contaminants of concern included dioxin and related compounds; potential effects on both aquatic and terrestrial species were considered.
- *ARCO - Evaluation of Metals Toxicity on Aquatic Organisms in Montana's Clark Fork River.* Project manager to evaluate potential effects of metals exposure on aquatic organisms in Montana's Clark Fork River and to support natural resource damage injury claims. This river has received input of heavy metals (e.g., copper, zinc) derived from old mining wastes. The project required the design and conduct of several types of laboratory studies to evaluate the roles of: metals bioavailability,

potential metals interactive effects, site-specific water quality, and metal sensitivity of resident fish species in determining the expected environmental effects of metals contamination.

- **American Petroleum Institute - Evaluation of the Aquatic Toxicity of the Gasoline Additive, Methyl Tertiary-butyl Ether (MTBE).** Designed and conducted a series of toxicity tests to determine the toxicity of MTBE to a range of freshwater aquatic organisms. The goal of this effort was to develop the information necessary to derive an ambient water quality criteria (AWQC) and to work, in conjunction with USEPA scientists, to develop a MTBE AWQC document.
- **Confidential Client - Evaluation of the Aquatic Toxicological Effects of a Variety of Crude Oils and Petroleum-Derived Products.** Designed and supervised an aquatic toxicology testing program to assess the toxicity of various crude oils and petroleum-derived products to freshwater and marine organisms. Testing was conducted in accordance with U.S. EPA Good Laboratory Practices using both static and flow-through methods.
- **Sante Fe Southern Pacific, Inc. - Salem, Oregon, Gasoline Spill Impact Assessment.** Designed and supervised an evaluation of impacts to a lotic environment as a result of a gasoline spill. The client desired a scientifically accurate evaluation of the short- and long-term impacts to exposed organisms in a freshwater stream. This program consisted of stream sampling for fish, water quality, and stream benthic invertebrates as well as toxicity testing of site waters.
- **Confidential Client - Drilling Mud Reserve Pit Wastes Risk Assessment.** Project manager for a risk assessment of the potential adverse environmental effects that may come about as a result of drilling mud reserve pit waste disposal practices. Overall project approach included estimations of the environmental fate of waste components and estimations of toxicologic consequences of waste exposure.
- **ASARCO, Inc. - Evaluation of Heavy Metal Contamination in the Arkansas River, Colorado.** Project manager for several types of investigations aimed at evaluating the potential impact of mining-related, heavy metal discharges on the Arkansas River. Studies included a comparison of instream fish population data with those of other rivers in the state, ambient water toxicity studies to evaluate the effect of the discharges on the existing metal contamination, and site-specific water quality criteria evaluations for possible application to the Arkansas River.
- **BP Exploration - Evaluation of Bioaccumulation Potential of Drilling Mud Reserve Pit Wastes.** Project manager for investigations to evaluate the bioaccumulation potential of drilling reserve pit constituents in tundra on Alaska's North Slope. Contaminant concentrations in water, soil, phytoplankton, zooplankton, and terrestrial plants were evaluated, and the ecological hazard associated with oil drilling waste disposal/storage was assessed. Subsequent studies addressed issues associated with consumption of reserve pit constituents by caribou using pit areas as refuge from insect irritation.
- **Arizona Dept. of Environmental Quality - Surface Water Quality Standards Review Committee.** Member of a state-sponsored expert review panel to oversee scientific development of surface water quality standards for the State of Arizona.
- **Ashland Oil - Evaluation of the Toxicological Effects of a Large Diesel Fuel Spill.** Designed and supervised a large monitoring/laboratory testing program to assess the toxicity and impacts of spilled diesel fuel in the Monongahela and Ohio Rivers. Studies conducted included acute toxicity tests with collected river water samples and detailed analytical evaluation of contaminant concentrations.

- *Mercury Marine - Toxicity Identification, Confirmation, and Mitigation.* Identified carbon monoxide in toxic concentrations in a receiving stream and confirmed it as the cause of mortalities during *in situ* bioassays and as a contributing factor to fish die-offs in the receiving water. Mapped carbon monoxide concentrations on a lake/riverine system. Assisted Mercury Marine with the design and implementation of mitigative measures.
- *ARCO - Ecological Risk Assessment for a Sediments Superfund Site.* Evaluated ecological risk associated with exposure of water column, benthic, and soil dwelling organisms to mining-related heavy metals contamination of reservoir sediments. Environmental exposure concentrations were determined and compared against literature-based, regulatory-based, and empirically based benchmarks of toxicity to provide a comprehensive risk characterization for the site. A multitiered approach was taken to identify potential chemicals of concern, screen them for toxicity, and make recommendations about site remediation. Results of the assessment were used to respond to a parallel ecological risk assessment prepared by the USEPA as part of the Remedial Investigation/Feasibility Study for the site.
- *ARCO - Development of Site-Specific Water Quality Criteria for Metals in the Upper Clark Fork River, Montana.* Developed and conducted a comprehensive testing and analysis program to derive unique water quality criteria for metals in the Clark Fork River that took into account the potential attenuating effects of site-specific water quality characteristics on the toxicity of metals. In accordance with the USEPA's Indicator Species Approach, acute and chronic toxicity tests were conducted in site and laboratory-reconstituted waters with invertebrates and cold/warm water fish species. The relative toxicity of metals in the two water types was evaluated to derive Water-Effect Ratios to be used in criteria development. Results of the studies indicated significantly reduced metals toxicity in site waters and provided the justification for site-specific criteria modification.
- *Burlington Northern, Inc. - Evaluation of Natural Resource Injury as a Result of the Nemadji River Derailment.* As part of a project investigating potential effects from the spill of a refined petroleum product into the Nemadji River, Wisconsin, developed and conducted a testing program to evaluate possible toxicity stemming from exposure of benthic organisms to elevated sediment hydrocarbon concentrations. Also evaluated the environmental fate of the spilled product and contributed to a testing program investigating the toxicity of the Water-Soluble Fraction of the spilled product to warm water fish species. Results of these studies were used in the Natural Resources Damage Assessment associated with the incident.
- *Aluminum Company of America - Review of Terrestrial Toxicity Testing Methods and Regulatory Status.* Conducted a comprehensive literature review and prepared a white paper highlighting the advantages associated with including terrestrial toxicity testing strategies in site assessments and hazardous waste cleanup operations. Demonstrated the utility of substituting toxicity endpoints for chemical standards when setting site cleanup guidelines.
- *ARCO - Warm Springs Ponds Biomonitoring.* Prepared the work plan and oversaw the ensuing field efforts associated with an evaluation of the chemical, toxicological, and ecological status of former metals tailings settling ponds now undergoing closure and conversion to wildlife refuge habitat. Sediment, water, and tissue (fish, invertebrates, waterfowl) metals concentrations were surveyed. Sediment Toxicity and benthic community structure were also evaluated.

PUBLICATIONS

- Stubblefield WA. 1979. *Quantitative administration of insecticide vapors to rats*. M.S. thesis. University of Kentucky, Lexington, KY.
- Stubblefield WA, Maki AW. 1985. Environmental hazard assessment of refinery effluents. In Bergman HL, Kimerle RA, Maki AW, eds, *Environmental Hazard Assessment of Effluents*. Pergamon Press, Elmsford, NY.
- Johnson HE, Behrens DW, Dickson KL, Gullledge WP, Hamelink JL, Lee GF, Miller TG, Peltier WH, Stubblefield WA. 1985. Discussion Synopsis: Hazard Assessment Case Histories. In Bergman HL, Kimerle RA, Maki AW, eds, *Environmental Hazard Assessment of Effluents*. Pergamon Press, Elmsford, NY.
- McKee RH, Stubblefield WA, Lewis SC, Scala RA, Simon GS, DePass LR. 1986. Evaluation of the dermal carcinogenic potential of tar sands bitumen-derived liquids. *Fund. Appl. Toxicol.* 7(2):228-235.
- Bergman HL, Middaugh CR, LaPoint TW, Steadman BL, Stubblefield WA. 1986. *Development of procedures for the derivation of site-specific water quality criteria for complex discharges*. Final report to the American Petroleum Institute; December 1986.
- Stubblefield WA. 1987. *Acclimation-induced changes in the toxicity of xenobiotics in rainbow trout*. Ph.D. dissertation. University of Wyoming, Laramie, WY.
- Stubblefield WA, McKee RH, Kapp RW, Hinz JP. 1989. An evaluation of the acute toxic properties of tar sands-derived oils. *Fund. Appl. Toxicol.* 9(1):59-65.
- Steadman BL, Stubblefield WA, LaPoint TW, Bergman HL. 1991. Decreased survival of rainbow trout exposed to No. 2 fuel oil caused by sublethal pre-exposure. *Environ. Toxicol. Chem.* 10(3):355-363.
- Stubblefield WA, Toll, PA. 1993. Effects of incubation temperature and warm-water misting on hatching success in artificially incubated mallard duck eggs. *Environ. Toxicol. Chem.* (12)10: 695-700.
- Stubblefield WA, Hancock GA, Ford WH, Prince HH, Ringer RK. 1995. Evaluation of the toxic properties of naturally weathered *Exxon Valdez* crude oil to surrogate wildlife species. In Wells PG, Butler J, Hughes JS, eds, *Exxon Valdez: Environmental Impact and Recovery Assessment*, ASTM STP 1219, American Society for Testing and Materials, Philadelphia, Pennsylvania. Pp. 665-692.
- Boehm PD, Page DS, Gilfillian ES, Stubblefield WA, Harner EJ. 1995. Shoreline ecology program for Prince William Sound following the *Exxon Valdez* oil spill: Part 2 - Chemistry and toxicology. In Wells PG, Butler J, Hughes JS, eds, *Exxon Valdez: Environmental Impact and Recovery Assessment*, ASTM STP 1219, American Society for Testing and Materials, Philadelphia, Pennsylvania. Pp. 347-397.
- Neff JM, Stubblefield WA. 1995. Chemical and toxicological evaluation of water quality following the *Exxon Valdez* oil spill. In Wells PG, Butler J, Hughes JS, eds, *Exxon Valdez: Environmental Impact and Recovery Assessment*, ASTM STP 1219, American Society for Testing and Materials, Philadelphia, Pennsylvania. Pp. 141-177.

- Stubblefield WA, Hancock GA, Ford WH, Ringer RK. 1995. Acute and subchronic toxicity of naturally weathered *Exxon Valdez* crude oil to mallards and ferrets. *Environ. Toxicol. Chem.* 14(11):1941-1950.
- Stubblefield WA, Hancock GA, Ford WH, Ringer RK. 1995. Effects of naturally weathered *Exxon Valdez* crude oil on mallard reproduction. *Environ. Toxicol. Chem.* 14(11):1951-1960.
- Gerath M, Daggett R, Stubblefield WA. 1995. Estimation of water quality and toxicological impacts of large volume ammonia spills into a river. In: *Proceedings of Water Environment Federation Specialty Conference on Toxic Substances*. Cincinnati, Ohio, 14-17 May 1995.
- Wood CM, Adams WJ, Ankley GT, DiBona DR, Luoma SN, Playle RC, Stubblefield WA, Bergman HL, Erickson RJ, Mattice JS, Schlekot CE. 1997. Environmental toxicology of metals. In Bergman HL, Dorward-King, EJ, eds, *Reassessment of Metals Criteria for Aquatic Life Protection*, SETAC Press, Pensacola, Florida. Pp. 31-56.
- Lington AW, Bird MG, Plutnick RT, Stubblefield WA, Scala RA. 1997. Chronic toxicity and carcinogenic evaluation of diisonoyl phthalate in rats. *Fund. Appl. Toxicol.* 36:79-89.
- Stubblefield WA, Brinkman S, Davies P, Hockett JR, Garrison T. 1997. Effects of water hardness on the toxicity of manganese to developing brown trout (*Salmo trutta*). *Environ. Toxicol. Chem.* 16(10):2082-2089.
- Steen A, Fritz D, Stubblefield W, Giddings J. 1999. Environmental effects of freshwater spills. In *Proceedings of the 1999 International Oil Spills Conference*. American Petroleum Institute. Washington DC.
- Stubblefield WA, Steadman BL, LaPoint TW, Bergman HL. 1999. Acclimation-induced changes in the toxicity of zinc and cadmium in adult and juvenile rainbow trout (*Oncorhynchus mykiss*). *Environ. Toxicol. Chem.* 18(12):2875-2881.
- Mancini ER, Steen A, Rausina GA, Wong DCL, Arnold WR, Gostomski FE, Davies T, Hockett JR, Stubblefield WA, Drottar KR, Springer TA, Errico P. 2001. MTBE ambient water quality criteria development: a public/private partnership. *Environ. Science Tech.* (In press).
- Adams W, Hodson P, Reiley M, Stubblefield W. 2001. *Re-evaluation of the State of the Science for Water Quality Criteria Development*. SETAC Press. Pensacola, FL (In press)
- Benson WH, Allen HE, Connolly JP, Delos CG, Hall LW, Luoma SN, Maschwitz D, Meyer JS, Nichols JW, Stubblefield WA. 2001. Re-evaluation of the State of the Science for Water Quality Criteria Development: Exposure Analysis. In Adams W, Hodson P, Reiley M, Stubblefield W, eds. *Re-evaluation of the State of the Science for Water Quality Criteria Development*. SETAC Press. Pensacola, FL (In press)
- Page DS, Boehm PD, Stubblefield WA, Parker KR, Maki AW. 2001. Hydrocarbon composition and toxicity of sediments following the *Exxon Valdez* oil spill in Prince William Sound, Alaska. (Submitted to *Environ. Toxicol. Chem.*)
- Stubblefield WA. 200*. Derivation of a manganese ambient water quality threshold for the protection of aquatic life. (In preparation)

Naddy R, Cohen AS, Hockett JR, Stubblefield WA. 200*. The interactive toxicity of cadmium, copper, and zinc to *Ceriodaphnia* and rainbow trout (*Oncorhynchus mykiss*). (In preparation)

Stubblefield WA, Cohen AS, Hockett JR. 200*. Development of a site-specific water quality criteria for copper in the Clark Fork River, Montana. (In preparation).

PRESENTATIONS AT PROFESSIONAL MEETINGS

Stubblefield WA, Dorough HW. 1979. Quantitative administration of insecticide vapors to rats. Society of Toxicology Annual Meeting. March 1979.

Stubblefield WA, Maki AW. 1982. Environmental risk assessment of refinery effluents. Cody Conference on Complex Effluents. August 1982.

Stubblefield WA, Foster RB, Howard PH. 1983. An environmental toxicological assessment of phthalate esters. Society of Environmental Toxicology and Chemistry Annual Meeting. November 1983.

Phillips RD, Stubblefield WA, Dodd DE, Grice HC. 1984. Acute and subchronic inhalation of methyl-DBCP. Society of Toxicology Annual Meeting. March 1984.

McKee RH, Stubblefield WA, Scala RA. 1985. Evaluation of the carcinogenic activity of bitumen-derived liquids. Society of Toxicology Annual Meeting. March 1985.

Biles RW, Stubblefield WA. 1985. Acute toxicity battery of tar sands products and intermediates. Society of Toxicology Annual Meeting. March 1985.

Bergman HL, Crossey MC, Steadman BL, Stubblefield WA, LaPoint TW. 1985. Water quality concerns: Organic pollutants. American Fisheries Society Annual Meeting. September 1985.

Stubblefield WA, Steadman BL, LaPoint TW, Bergman HL. 1985. Acclimation-induced changes in the toxicity of zinc, cadmium, and phenol in adult and fry rainbow trout. American Fisheries Society Annual Meeting. September 1985.

Stubblefield WA, Steadman BL, LaPoint TW, Bergman HL. 1985. Acclimation-induced changes in the toxicity of zinc and cadmium in adult and fry rainbow trout (*Salmo gairdneri*). Society of Environmental Toxicology and Chemistry Annual Meeting. November 1985.

LaPoint TW, Stubblefield WA, Steadman BL, and Bergman HL. 1985. Acclimation-induced changes in the toxicity of petroleum refinery wastewaters under laboratory and field conditions. Society of Environmental Toxicology and Chemistry Annual Meeting. November 1985.

Steadman BL, Farag A, Stubblefield WA, Bergman HL. 1986. Interactions of organic and metal detoxification pathways in rainbow trout. Society of Environmental Toxicology and Chemistry Annual Meeting. November 1986.

Stubblefield WA, Toll PA. 1987. Evaluation of temperature and warm water-misting on hatching success in artificially incubated mallard duck eggs. Society of Environmental Toxicology and Chemistry Annual Meeting. November 1987.

- Toll PA, Stubblefield WA, Nicolich MJ. 1987. Evaluation of methods for the determination of avian eggshell strength. Society of Environmental Toxicology and Chemistry Annual Meeting. November 1987.
- Stubblefield, WA, Giddings JM, deNoyelles F. 1989. Mesocosms: their utility in the hazard assessment process. American Society of Testing and Materials Annual Meeting. April 1989.
- Stubblefield WA, Capps SW, Patti SJ. 1990. Toxicity of manganese to freshwater aquatic species. Society of Environmental Toxicology and Chemistry Annual Meeting. November 1990.
- Pillard DA, Stubblefield WA. 1990. Community structure analysis of benthic communities subjected to metal-laden mine drainage. Society of Environmental Toxicological Chemistry Annual Meeting. November 1990.
- Cohen AS, Stubblefield WA. 1991. Toxicity of bromide to freshwater aquatic species. Society of Environmental Toxicological Chemistry Annual Meeting. November 1991.
- Stubblefield WA. 1991. Potential bioaccumulation of reserve pit constituents in tundra biota on Alaska's North Slope oil fields. Society of Environmental Toxicological Chemistry Annual Meeting. November 1991.
- Lawhead BE, Bishop SC, Stubblefield WA. 1992. Evaluating the exposure of caribou to toxic substance and North Slope drilling muds. North Slope Terrestrial Studies Workshop, February 1992. Anchorage, Alaska.
- Stubblefield WA, Cohen AS, Gulley DD, Colonell J, Fortdam CL, Klima KE, Hampton P, Jakubczak R. 1992. Potential bioaccumulation of reserve pit constituents in tundra biota on Alaska's North Slope. North Slope Terrestrial Studies Workshop, February 1992. Anchorage, Alaska.
- Cohen AS, Stubblefield WA. 1992. Bioaccumulation: Field evaluation and application in the ecological risk assessment framework. Society of Risk Analysis Annual Meeting. December 1992.
- Brumbaugh WG, Wiedmeyer RH, Ingersoll CG, Mount DR, Stubblefield WA. 1992. Milltown Reservoir - Clark Fork River, Montana: Chemical characterization of metals in sediments and pore water. Society of Environmental Toxicology and Chemistry Annual Meeting, Cincinnati, Ohio. November 1992.
- Ringer RK, Prince HH, Hancock GA, Stubblefield WA. 1993. An ecological risk assessment of weathered North Slope crude oil to avian wildlife following the *Exxon Valdez* oil spill. Society of Environmental Toxicology and Chemistry Annual Meeting, Houston, Texas. November 1993.
- Stubblefield WA, Cohen AS. 1993. Application of the water effects ratio (WER) for site-specific water quality criteria development for copper in the Clark Fork River (CFR). Society of Environmental Toxicology and Chemistry Annual Meeting, Houston, Texas. November 1993.
- Cohen AS, Stubblefield WA, Hockett JR, Mount DR. 1993. Comparison of the sensitivity of three salmonid species during separate acute exposures to copper, cadmium, and zinc. Society of Environmental Toxicology and Chemistry Annual Meeting, Houston, Texas. November 1993.

- Stubblefield WA, Cohen AS, Hockett JR, Mount DR. 1993. Acute and chronic interactive effects of copper, zinc, and cadmium to rainbow trout and *Ceriodaphnia*. Society of Environmental Toxicology and Chemistry Annual Meeting, Houston, Texas. November 1993.
- Stubblefield WA, Pillard DA. 1993. Evaluation of the fate and toxicity of oil residues in shoreline sediments following the *Exxon Valdez* oil spill. Society of Environmental Toxicology and Chemistry Annual Meeting, Houston, Texas. November 1993.
- Stubblefield WA, Pillard DA. 1993. Evaluation of toxicity oil residues in shoreline sediments following the *Exxon Valdez* oil spill. Society of Environmental Toxicology and Chemistry Annual Meeting, Houston, Texas. November 1993.
- Boehm PD, Gifillian ES, Page DS, Stubblefield WA. 1993. Application of sediment "triad" approach to a major oil spill assessment. The *Exxon Valdez* spill. Society of Environmental Toxicology and Chemistry Annual Meeting, Houston, Texas. November 1993.
- Pillard DA, Stubblefield WA. 1993. An evaluation of sediment grain size as a confounding factor in assessing toxicity in shoreline sediment samples. Society of Environmental Toxicology and Chemistry Annual Meeting, Houston, Texas. November 1993.
- Cohen AS, Stubblefield WA. 1994. Chronic toxicity of Clark Fort River sediment interstitial water to *Ceriodaphnia dubia* and rainbow trout. Society of Environmental Toxicology and Chemistry Annual Meeting, Denver, Colorado. November 1994.
- Cohen AS, Hockett JR, Stubblefield WA. 1994. Toxicity of pulse exposures of zinc, cadmium, and copper to pre-exposed trout and daphnia. Society of Environmental Toxicology and Chemistry Annual Meeting, Denver, Colorado. November 1994.
- Stubblefield, WA, Cohen AS. 1995. Application of the water-effects ratio (WER) for site-specific water quality criteria development for copper in the Clark Fork River (CFR). Society of Environmental Toxicology and Chemistry Annual Meeting, Vancouver, BC. November 1995.
- Cohen AS, Brady MD, Stubblefield WA. 1995. Changes in copper water-effect ratios in toxicity tests conducted at varying water hardness levels. Society of Environmental Toxicology and Chemistry Annual Meeting, Vancouver, BC. November 1995.
- Cohen AS, Stubblefield WA. 1995. Comparison of the water-effects ratios for species ranging in copper sensitivity. Society of Environmental Toxicology and Chemistry Annual Meeting, Vancouver, BC. November 1995.
- Barth A, Cohen AS, Stubblefield WA. 1995. Chronic Toxicity of Clark Fork River invertebrates to rainbow trout when administered via the diet. Society of Environmental Toxicology and Chemistry Annual Meeting, Vancouver, BC. November 1995.
- Brannon EL, Neff JM, Pearson WH, Stubblefield WA, Maki AW. 1996. Application of ecological risk assessment principles to evaluation of oil spill impacts. Society of Environmental Toxicology and Chemistry Annual Meeting, Washington, D.C. November 1996.

- Stubblefield WA, Garrison TD, Hockett JR, Brinkman SF, Davies PH, McIntyre MW. 1996. Effects of water hardness on the toxicity of manganese to developing brown trout (*Salmo trutta*). Society of Environmental Toxicology and Chemistry Annual Meeting, Washington, D.C. November 1996.
- Hopkins K, Kangaonkar T, Parsons A, Stubblefield WA. 1996. Assessment of baseline sediment risks in the Tongass Narrows Waterway, Alaska. Society of Environmental Toxicology and Chemistry Annual Meeting, Washington, D.C. November 1996.
- Stubblefield WA, Burnett SL, Hockett JR, Naddy RB, Mancini ER. 1997. Evaluation of the aquatic toxicity of methyl tertiary-butyl ether (MTBE): Implications to refinery operations. American Petroleum Institute Spring Refining Meeting. San Diego, California. April 1997.
- Stubblefield WA, Burnett SL, Hockett JR, Naddy RB, Mancini ER. 1997. Evaluation of the acute and chronic aquatic toxicity of methyl tertiary-butyl ether (MTBE). American Chemical Society Annual Meeting. San Francisco, California. April 1997.
- Stubblefield WA, Baroch J, Dressen P, Spraker T, Getzy D. 1997. Evaluation of the toxic properties of acid mine drainage water to Snow Geese. Society of Environmental Toxicology and Chemistry Annual Meeting, San Francisco, CA. November 1997.
- Naddy RB, Barten K, Garrison T, Tucker S, Vertucci F, Stubblefield WA. 1997. Evaluation of benthic macroinvertebrate community composition and tissue residues in the Clark Fork River, Montana. Society of Environmental Toxicology and Chemistry Annual Meeting, San Francisco, CA. November 1997.
- Stubblefield WA, Naddy RB, Tucker S, Barten K, Christensen K, Hockett JR. 1997. Evaluation of metals contaminated sediments within depositional and riffle habitats in the Clark Fork River. Society of Environmental Toxicology and Chemistry Annual Meeting, San Francisco, CA. November 1997.
- Naddy RB, Cohen AS, Pillard D, Tucker S, Vertucci F, Stubblefield WA. 1997. Biomonitoring as a strategy for evaluating the effectiveness of wetlands remediation: Case study Warm Springs Ponds. Society of Environmental Toxicology and Chemistry Annual Meeting, San Francisco, CA. November 1997.
- Mancini ER, Stubblefield WA. 1997. Physiochemical and ecotoxicological properties of gasoline oxygenates. Society of Environmental Toxicology and Chemistry Annual Meeting, San Francisco, CA. November 1997.
- Christensen K, Stubblefield WA, Naddy RB, Rehner A. 1997. Use of water effect ratios in development of site-specific water quality criteria. Society of Environmental Toxicology and Chemistry Annual Meeting, San Francisco, CA. November 1997.
- Stubblefield WA, Naddy RB, Tucker S, R Hockett JR. 1998. *In situ* evaluation of porewater metal concentrations in aquatic sediments. Society of Environmental Toxicology and Chemistry - Europe Annual Meeting, Bordeaux, France. April 1998.
- Naddy RB, Stubblefield WA, Christensen KP, Pillard DA, Tucker SA, Hockett JR. 1998. Evaluating the bioavailability of metals mixtures in sediments from the Clark Fork River basin. Society of Environmental Toxicology and Chemistry Annual Meeting, Charlotte, SC. November 1998.

- Greenberg M, Rowland C, Burton GA, Hickey C, Stubblefield W, Clements W, Landrum P. 1998. Isolating individual stressor effects at sites with contaminated sediments and waters. Society of Environmental Toxicology and Chemistry Annual Meeting, Charlotte, SC. November 1998.
- Stubblefield WA, Christensen KP, Hockett JR, Steen A, Grindstaff J, Wong DCI, Arnold WR, Rausina G. 1998. Derivation of ambient water quality criteria for MTBE: Toxicity to selected freshwater organisms. Society of Environmental Toxicology and Chemistry Annual Meeting, Charlotte, SC. November 1998.
- Mancini ER, Steen A, Arnold WR, Rausina GA, Wong DCL, Gostomski FE, Davies T, Hockett JR, Stubblefield WA, Drottar KR, Springer TA, Errico P. Preliminary calculations of freshwater and marine water quality criteria for MTBE. Society of Environmental Toxicology and Chemistry Annual Meeting, Philadelphia, PA. November 1999.
- Naddy RB, Stubblefield WA, May JR, Tucker SA, Hockett JR. The effect of calcium:magnesium ratios on the acute copper toxicity to five aquatic species in laboratory waters. Society of Environmental Toxicology and Chemistry Annual Meeting, Philadelphia, PA. November 1999.
- Naddy RB, Vertucci FA, Stubblefield WA. Evaluation of exposure-effects relationships of metals in the benthic macroinvertebrate community in the Upper Clark Fork River, Montana. Society of Environmental Toxicology and Chemistry Annual Meeting, Philadelphia, PA. November 1999.
- Pillard DA, Naddy RB, Stubblefield WA. Trends in tissue burdens, media concentrations, and toxicity at Warm Spring Pond, Anaconda, Montana. Society of Environmental Toxicology and Chemistry Annual Meeting, Philadelphia, PA. November 1999.
- Long K, Ryan A, Van Genderen E, Karen DJ, Stubblefield WA, Naddy RB, Klaine SJ. Does the hardness-based water quality criteria accurately reflect response of aquatic organisms to copper in the soft waters of the southeastern US. Society of Environmental Toxicology and Chemistry Annual Meeting, Philadelphia, PA. November 1999.
- Stubblefield WA, Hockett JR, Pillard DA, Herbst DB. Application of a triad-based approach for evaluating the effects of acid mine drainage (AMD) in a high-mountain stream. Society of Environmental Toxicology and Chemistry Annual Meeting, Philadelphia, PA. November 1999.
- Gensemer RW, Playle RC, Stubblefield WA, Hockett JR. Aluminum bioavailability and toxicity of freshwater biota at circumneutral and higher pH. Society of Environmental Toxicology and Chemistry Annual Meeting, Philadelphia, PA. November 1999.
- Stubblefield WA, Hockett JR, Kramer JR, Wood CM, Paquin PR, and Gorsuch JW. Chronic silver toxicity: water quality parameters as modifying factors. Society of Environmental Toxicology and Chemistry Annual Meeting, Nashville, TN. November 2000.
- Page D, Gilfillian E, Boehm P, Burns W, Maki A, Stubblefield W, and Parker K. Sediment toxicity values for a field study compared with sediment quality criteria for total PAH. Society of Environmental Toxicology and Chemistry Annual Meeting, Nashville, TN. November 2000.

PROFESSIONAL ACTIVITIES

Scientific Society Service

Society of Environmental Toxicology and Chemistry

- Board of Directors (1995-1998)
- Program Chairman 1994 and 2002 annual meetings
- Chairman Publications Advisory Council (1995-2002)
- Member of *Environmental Toxicology and Chemistry* Editorial Board (1994-1997)
- Chairman Professional Opportunities Committee (1992-1995)
- Committee member Publications Committee (1989-1992) and the Nominations Committee (1985-1987)
- Assistant Editor of the Society of Environmental Toxicology and Chemistry Newsletter
- Associate Editor Society of Environmental Toxicology and Chemistry Special Publications.

Invited Conferences and Program Reviews

Surface Water Quality Standards Review Committee for the Arizona Department of Environmental Quality (1989-1990).

U.S. Environmental Protection Agency Workshop on Mesocosms. Duluth, Minnesota, September 14-17, 1987.

U.S. Environmental Protection Agency Complex Effluent Program Review. September 1990.

U.S. Environmental Protection Agency, ECOTOX Database Review, Duluth, Minnesota. August 1994.

U.S. Environmental Protection Agency, Science to Achieve Results (STAR) Fellowship Review, Washington D.C. 1996, 1997, 1998, 1999, 2000, 2001.

SETAC Pellston Conference on Environmental Hazard Assessment of Effluents. Cody, Wyoming. August 1982.

SETAC Pellston Conference on Avian Toxicity Testing Methods. Pensacola, Florida, December 1994.

SETAC Pellston Conference on Sediment Risk Assessment, Pacific Grove, California, April 1995.

SETAC Pellston Conference on Reassessment of Metals Criteria for Aquatic Life Protection, Pensacola, Florida, February 1996.

SETAC Pellston Conference on Reevaluation of the State of the Science for Water Quality Criteria Development; Gregson, Montana, June 1998.

SETAC Pellston Conference on Predicting Ecological Impacts from Laboratory Toxicity Tests; Cornwall, Quebec, Canada, May 1999.

Academic Courses or Professional Continuing Education

University of Wisconsin, Madison - Department of Engineering Professional Development Program.

Understanding Aquatic Toxicity Testing, October 1992, Anchorage, Alaska.

Colorado State University - Department of Fisheries and Wildlife, *Environmental Toxicology*, Spring 1990.

Colorado State University - Department of Environmental Health, *Environmental Risk Assessment*, Spring 1996/1998/2000.

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.

Relevant Project Experience

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 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.

Pre-design 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. The plan will characterize existing area receiving-water body water quality problems using existing data, and supplement that information with a simplified pollutant loading analysis based on land use in order to identify basin-specific water quality problems, and sources of these problems. 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.

KEITH R. SMITH, P.G.

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Seattle, WA 98188
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SUMMARY OF QUALIFICATIONS

Twenty years experience in a variety of water resource and environmental fields, including eleven years at the management/supervisory level. Areas of expertise include regulatory programs, research programs, planning, inter-agency coordination, and policy development. Technical/management experience includes water supply/water use, water quality, stormwater management, public water supply systems, wastewater, noise, land use, solid waste, hazardous waste, and capital construction programs. Extensive experience working with elected and appointed officials at local, state, and federal levels. Licensed Professional Geologist (Florida PG No. 501).

Extensive management and supervisory experience in both union and non-union environments. Managed interdisciplinary groups of up to 54 professional, technical, and administrative personnel. Participated in management teams responsible for formulating and implementing policy on a wide variety of technical, administrative, and procedural issues. Worked directly with federal, state, and local agencies on projects and programs of local, regional, and national significance. Worked with legislative committees on statewide environmental and water policy matters. Served on many state and local advisory committees. Managed and administered grants and cooperative funding programs. Extensive experience in budget development and management. Extensive experience in contract management. Book and manuscript reviewer for professional journals.

PROFESSIONAL EMPLOYMENT HISTORY

Port of Seattle, Seattle, Washington

Manager, Water Resources (1999 - present)

Responsible for the development and management of a comprehensive water resources management program for Seattle-Tacoma International Airport. Responsibilities include supervising research programs, monitoring programs, regulatory requirements, construction projects, utility programs, and inter-agency coordination. Specific accomplishments include:

- Managing the Port's Water Resources team and coordinating operation of the Port's water utility programs (public water supply, sanitary sewer, industrial wastewater, and stormwater).
- Managing the Port's water resources research and monitoring programs, including water quality studies, watershed assessment studies, and other studies associated with the Port's water resources management program.
- Developing a ten-year, 150 million-dollar capital construction program to expand and retrofit the airport's stormwater management system in order to meet current regulatory standards.
- Managing the Port's participation on two watershed management committees, including funding of research/monitoring programs and the construction of water management facilities (regional detention facilities, low flow augmentation facilities, high flow bypass facilities, restoration of stream habitats, and removal of barriers to fish passage).
- Managing and negotiating regulatory requirements associated with the airport's water resources activities. Elements include an individual NPDES permit covering the airport's Industrial Wastewater Treatment Plant and stormwater discharges. Additional elements include state and federal regulatory requirements associated with the airport's eight-year, six billion-dollar Capital Improvement Plan (Clean Water Act Section 401/404 permits), and Endangered Species Act

- requirements.
- Managing inter-agency coordination associated with the Port's water resources activities. Elements include managing agreements with water supply utilities and wastewater treatment facilities, and coordinating stormwater management activities with adjacent jurisdictions.
 - Negotiating disputed water rights, claims, transfers, and relinquishments with the Washington Department of Ecology. Also involved in negotiating disputed utility fees with a local jurisdiction and an agreement with a regional wastewater utility to accept discharge from the airport's Industrial Wastewater Treatment Plant. Worked with Washington Water Trust to return unused water rights to instream flows.
 - Managing contracts with a variety of consultants working on water resource issues, including the development and implementation of the airport's Comprehensive Stormwater Management Plan, expansion/upgrades to water supply/wastewater/stormwater infrastructure, and water resources research studies.
 - Managing an emergency response team providing 24-hour coverage to Seattle-Tacoma International Airport.
 - Representing the Port of Seattle and the Washington Public Ports Association on several statewide advisory committees, including the Stormwater Policy Advisory Committee and the Water Resources Advisory Committee.

Thurston County, Olympia, Washington

Director, Environmental Health Division (1998-1999)

Directed Thurston County's environmental management programs. Managed environmental regulatory programs (drinking water, wastewater, well construction, land use, solid waste, noise, food safety), and environmental resource protection programs (groundwater, surface water, water quality, water chemistry laboratory, hazardous waste, environmental education/outreach). Specific accomplishments include:

- Supervised an interdisciplinary staff of 47 professional, technical, and administrative personnel.
- Developed and managed a multi-million dollar annual budget funded by utility fees, revenues generated by divisional programs, and grants.
- Managed the county's participation on three regional watershed management committees (Nisqually River, Deschutes River, Chehalis River). Coordinated state and local funding for development and implementation of watershed management plans.
- Managed county's participation in programs to manage/restore several Puget Sound estuaries, particularly those with extensive shellfish habitats.
- Managed agreements with several state agencies governing and funding delegated regulatory programs.
- Served as Administrative Hearings Officer for appeals of environmental regulatory decisions.
- Managed rule development activities associated with environmental regulatory programs.
- Worked with the County Commission and Board of Health on policy and management issues.
- Coordinated Divisional activities with the county's Water and Waste Management Department. Elements included participating in planning and policy issues associated with operation and expansion of county-owned water supply and wastewater systems, and the development of a regional water utility to fund all water related programs and services.
- Represented the county on local and statewide advisory committees, including the Drinking Water Advisory Committee and the Groundwater Policy Advisory Committee. Chaired the Drinking Water/Legislative committee of the state Environmental Health Directors Organization.
- Managed the development of radio and television public service advertisements for environmental programs.

Oregon Department of Transportation, Salem, Oregon

Manager, Geo/Hydro Services Division (1997)

Managed a division providing hydrologic and geotechnical services to a state transportation agency.

Services included drainage design/management, bridge hydraulics/foundation design, erosion control, site assessment/remediation, and identification/response to geologic hazards. Accomplishments include:

- Managed an interdisciplinary group of 54 professional and technical personnel in four offices throughout the state (Salem, Portland, Roseburg, Bend).
- Developed and managed a multi-million dollar divisional budget.
- Initiated discussion/negotiations with Oregon Department of Environmental Quality for coverage of agency's stormwater management activities under an NPDES permit.
- Participated in inter-agency management teams developing a statewide strategy in response to the listing of numerous salmon runs as threatened or endangered.
- Developed the Geo/Hydro Division from its inception. Successfully brought together several previously distinct units into one group providing seamless technical and professional support throughout the agency.
- Participated in management teams addressing agency organization in response to changing responsibilities and priorities. Projects included redesigning internal processes and project management in order to achieve a mandated 80% reduction in project delivery time.

South Florida Water Management District, West Palm Beach, Florida
Director, Hydrogeology Division (1991-1997)

Managed and coordinated water resources technical support for a regional water management agency. Activities included water resource assessment studies, model development and application, water quality and quantity monitoring, database services, and field support. Lines of business supported included environmental, regulatory, planning, operations, and construction. Specific accomplishments include:

- Supervised an interdisciplinary group of 29 professional, technical, and administrative personnel.
- Developed, defended, and managed a multi-million dollar budget which included funds for personnel, contracts, intergovernmental agreements, and capital projects and equipment.
- Managed contracts, grants, and intergovernmental funding agreements covering a variety of water management issues.
- Represented the District on inter-agency committees working to coordinate regional and statewide water management activities. Served on a team that developed an MOU with another state water management district to coordinate regulatory, research, and monitoring activities in the central Florida area.
- Served on Land Selection Committee, which provided direction on purchase and management of environmentally sensitive lands. Provided staff support for Utility Advisory Committee.
- Worked with other state and federal agencies on projects and programs governing water use, water quality, underground injection control, and other programs.
- Managed an individual NPDES permit covering discharge from an aquifer storage and recovery pilot project.
- Worked closely with the District's Governing Board on policy and management issues.
- Served as Technical Coordinator of the District's Water Shortage Team.
- Participated in agency management teams guiding the development and implementation of regional water management/water supply plans.
- Coordinated cooperative projects with local governments to develop pilot projects for innovative water supply and management technologies. Worked with legislative committees on statewide water policy matters.
- Served on teams revising policies/procedures on administrative issues, including the revision of the agency's contracting and procurement activities.

Senior Supervising Hydrogeologist (1991)

Supervised a unit responsible for water resources assessment studies and field data acquisition programs. Specific accomplishments include:

- Supervised a staff of nine professional and technical personnel.
- Responsible for planning water resource program/project requirements, including coordinating research and monitoring programs with the needs of planning, regulatory, operations, and construction groups.
- Supervised the review and editing of Technical Publications.

Senior Hydrogeologist (1989 - 1991)

Developed and applied hydrologic models to support the development of regional Water Supply/Water Management Plans, including:

- Developed various supply and demand scenarios for a twenty year planning horizon, as well as resource constraints (minimum flows and levels) to determine areas of deficit.
- Recommended management options to meet water supply demands, including development of alternative sources, changes in operating schedules of regional water management systems, construction of additional water control structures and water storage facilities, conservation, reuse, and aquifer storage and recovery.
- Developed and applied site-specific hydrologic models. Applications included estimating canal seepage in the northeast Shark River Slough area (Everglades National Park) to support design and construction of water management facilities.

Staff Hydrogeologist (1986 - 1989)

Conducted regional water resource assessment studies. Specific responsibilities include:

- Designed and supervised field data acquisition programs including an exploratory drilling program, collection and interpretation of geophysical logs and well cuttings, design and implementation of aquifer performance tests, and design and installation of monitor networks for both water levels and water quality.
- Authored Technical Publications for the dissemination of data and results from water resource studies.

St. Johns River Water Management District, Palatka, Florida

Hydrologist II (1983 - 1984)

Responsible for rule development for the agency's water resources regulatory programs. Specific accomplishments include:

- Co-authored the agency's first district-wide water use regulatory rule. Coordinated public hearings during the rule development process. Developed the required forms, databases, and administrative procedures. Co-authored Applicant's Handbook and Basis of Review for the Water Use Program.
- Managed the public education program for the water use program. Developed and coordinated technical workshops for a variety of audiences including industry representatives, engineering firms, trade groups, elected officials, and the general public.
- Participated in other rule development programs, including well construction, surface water management, and water shortage management.

Hydrologist I (1981 - 1983)

Worked in water resource regulatory programs. Specific accomplishments include:

- Reviewed applications for water use, well construction, and surface water management permits.
- Developed technical reports recommending approval or denial of applications for Governing Board

action. Projects reviewed included agricultural uses, public water supplies, and industrial uses.

EDUCATION

- M.S., Water Resources Management, University of Wisconsin - Madison
- B.S. (Honors), Geology (Geography minor), University of Wisconsin - Oshkosh

REGISTRATIONS AND AFFILIATIONS

- Florida Professional Geologist No. 501
- American Water Resources Association (national and local chapters)
- Book and manuscript reviewer for *Journal of Ground Water* and *Journal of the American Water Resources Association*.

PUBLICATIONS

Yan, Jiansheng, Keith R. Smith, Robert M. Greenwald, P. Srinivansan, and David S. Ward, 1998. A Modular Ground Water Modeling System. In *GIS in Natural Resource Management: Balancing the Technical-Political Equation*, High Mountain Press, Stan Martin, Editor.

Yan, Jiansheng, Keith R. Smith, Robert M. Greenwald, P. Srinivansan, and David S. Ward, 1995. A Modular Ground Water Modeling System (GWZOOM): 1. Concept and System. *Advances in Model Use and Development - Proceedings of 1995 AWRA Annual Conference and Symposium*.

Yan, Jiansheng, Keith R. Smith, 1995. A Modular Ground Water Modeling System (GWZOOM): 2. System Implementation. *Advances in Model Use and Development for Water Resources - Proceedings of 1995 AWRA Annual Conference and Symposium*.

Yan, Jiansheng and Keith R. Smith, 1994. Simulation of Integrated Surface Water and Groundwater Systems-Model Formulation. *Water Resources Bulletin*, Vol. 30, No. 5.

Yan, Jiansheng and Keith R. Smith, 1993. GIS Application in Ground Water Model Development. *Proceedings of the 3rd International Workshop on Geographic Information Systems*, Vol. 1.

Smith, Keith R., 1990. A Three-Dimensional Groundwater Flow Model of Hendry County, Florida. *South Florida Water Management District Technical Publication No. 90-08*.

Smith, Keith R., and Karin M. Adams, 1988. A Groundwater Resource Assessment of Hendry County, Florida. *South Florida Water Management District Technical Publication No. 88-12*.

Smith, Keith R. and others. An Assessment of the Floridan Aquifer System in Brevard County, Florida, November 1988. *South Florida Water Management District Technical Memorandum*.

Smith, Keith R., Timothy S. Sharp, and George S. Shih, March 1988. Investigation of Water Use, Land Use, and the Groundwater Monitoring Network in Hendry County, Florida. *South Florida Water Management District Technical Memorandum*.

Multiple Authors, March 1985. Black Earth Creek: A Watershed Study With Management Options. *University of Wisconsin-Madison Institute for Environmental Studies Report No. IES 129*.

RESUME

Jan L. Cassin

Wetland Ecology, Plant Community Ecology, Botany, Restoration Ecology

EDUCATION

- Ph.D. (Ecology and Evolutionary Biology) 1997, **University of Michigan, Ann Arbor**.
Dissertation Title: 'Balancing Costs and Benefits in a Mutualism: Conditionality in the Interaction between the grass, *Hystrix patula* and its fungal endophyte'.
- M.S. (Ecology and Evolutionary Biology) 1989, **University of Michigan, Ann Arbor**.
Thesis: 'Ecological Determinants of Host Plant Use in a Willow Flea Beetle (*Altica subplicata*)'.
- B.A. (Environmental, Organismic and Population Biology) 1977, **University of Colorado, Boulder**.

QUALIFICATIONS

Dr. Cassin is a plant community ecologist and wetland scientist with over 17 years experience in applied conservation biology and wetland ecology. Jan has extensive experience conducting botanical and wetland inventories, and wetland/riverine functional assessments in the Pacific Northwest, California, Alaska, New England, the mid-Atlantic states, the Rocky Mountain states and in the upper Great Lakes region. Dr. Cassin specializes in the application of scientific principles to ecosystem assessment and restoration in wetland and riverine systems. She has focused on the development of ecological assessments for impact analysis, and in the design, construction and monitoring of wetland ecosystem restoration, with a particular emphasis on estuarine and riverine restoration. Dr. Cassin helped develop hydrogeomorphic (HGM) functional assessment models for riparian and wetland systems in Alaska, California, the Chesapeake Bay, and the Pacific Northwest.

In addition, Dr. Cassin is experienced in designing vegetation sampling protocols and conducting vegetation sampling to address changes in plant distribution and abundance at a range of spatial scales. Projects include: determining the effects of multiple environmental factors on plant population viability, persistence and distribution; addressing effects of spatial and temporal variation in environmental stressors on plant demographic parameters; linking plant parameters such as growth rates, biomass, productivity and seed production with trends in abundance and distribution; using a combination of historical records, satellite imaging, aerial photos and field surveys to map historic and current distributions of rare plants and communities to assess changes over time; and conducting vegetation sampling along environmental and anthropogenic disturbance gradients to determine conservation priorities as well as to set design and performance targets for ecosystem restoration projects.

As an environmental consultant, Dr. Cassin is experienced in providing the following services to governmental and non-governmental clients: regulatory assistance with

wetland permitting efforts at federal, state and local levels; conducting wetland delineations; conducting threatened and endangered species inventories and preparing conservation plans; designing, constructing and monitoring compensatory mitigation projects; monitoring and managing invasive plants; and ecosystem monitoring and management in both wetland and terrestrial systems. In addition, she has extensive experience in the design of protection and management strategies for the conservation and recovery of endangered species. Dr. Cassin has worked in both the public and private sectors, is an experienced teacher and lecturer, and has successfully worked on large multi-agency projects that involved coordination among numerous stakeholders and extensive public participation.

EXPERIENCE

Wetland Ecologist/Biologist, Parametrix, Inc.; Kirkland, WA. 1999 to present. As a Senior Scientist/Plant Ecologist at Parametrix, Dr. Cassin specializes in ecosystem restoration design, construction and monitoring; regulatory assistance; ecosystem functional assessment with a particular focus on riparian and estuarine systems; wetland delineation; and ESA compliance and conservation/recovery planning.

Senior Associate, L. C. Lee & Associates, Inc. (LCLA) and the National Wetland Science Training Cooperative (NWSTC), Seattle, WA. June 1997- December 1999. As a Senior Associate at LCLA, Dr. Cassin provided private, governmental and non-governmental clients with consulting services in wetlands science; regional wetlands inventories and functional assessments; wetlands permitting and regulatory assistance; ecosystem restoration design, construction and monitoring; and ecosystem monitoring and management.

Information Manager/Botanist, The Nature Conservancy. Michigan Natural Features Inventory (MNFI), Lansing, MI. 1990-1992. While at MNFI, Jan provided database/GIS management and botanical support for a state-wide biological inventory. She assisted with environmental reviews using database, conducted botanical and vegetation inventories, helped develop conservation priorities by mapping historic and current distributions of high priority plant community types, and writing natural areas management plans. Additional duties included working as a member of the team developing conservation and management strategies for state-wide natural areas program.

Regional Information Manager/Botanist, The Nature Conservancy (TNC), Eastern Regional Office, Boston, MA. 1982-1987. The regional office of TNC Jan provided database development/management for map and computer files documenting biological inventories for states in the eastern U.S. To support individual state inventories, she assisted with botanical and vegetation surveys, was a member of team developing conservation priorities and plans for rare species and threatened natural communities, assisted with the development of regional vegetation classifications, and prepared stewardship plans for rare species. Additional duties included assisting and training State Natural Heritage

data managers in database development and management, and working as a member of the team developing and implementing region-wide conservation and management strategies.

Senior Staff Assistant, Center for Policy Alternatives, Massachusetts Institute of Technology, Cambridge, MA. 1980-1982. Duties included working on multidisciplinary teams preparing technical and scientific review documents on a range of environmental policy issues.

Analyst: Environmental Permitting/Reclamation, Impact Environmental Consultants, Inc., Denver, CO. 1977-1980. Duties included regulatory assistance; air and water quality monitoring technician; Uranium and surface coal mine reclamation planning and assistance.

SELECTED PUBLICATIONS

Cassin, J. L. 2000. Filling the Gap in Conservation Strategies: A Mesoscale Tool for Biodiversity Assessment and Conservation. *Conservation Biology*, Vol. 14, No. 5, October, 2000.

Cassin, J. L., M. L. Louther, and J. C. Kelley. 2000. *Implementation Addendum to the Natural Resource Mitigation Plan: Master Plan Update Improvements for the Seattle-Tacoma International Airport*. Port of Seattle. Parametrix, Inc. Kirkland, WA.

Lee, L. C., M. C. Rains, J. L. Cassin, S. R. Stewart, R. Post, M. Brinson, M. Clark, J. Hall, G. Hollands, D. LaPlant, W. Nutter, J. Powell, T. Rockwell, and D. Whigham. 1999. *Operational Draft Guidebook for Reference Based Functional Assessment of the Functions of Precipitation Driven Wetlands on Discontinuous Permafrost in Interior Alaska*. State of Alaska, Department of Environmental Conservation/U. S. Army Corps of Engineers Waterways Experiment Station Technical Report. Anchorage, AK.

L. C. Lee and Associates, Inc. 1998. *Newskah Creek Aquatic Ecosystem Restoration: Preliminary Restoration Plan for the Washington State Department of Corrections Stafford Creek Corrections Center, Grays Harbor County, Washington*. Prepared by J. L. Cassin and S. M. Winter for the Washington State Department of Corrections, Olympia, WA.

Lee, L.C., M. L. Butterwick, J. L. Cassin, R. A. Leidy, J. A. Mason, M.C. Rains, L.E. Shaw, E. G. White. 1997. *A Draft Guidebook for Assessment of the Functions of Waters of the U.S., Including Wetlands on the Borden Ranch, Sacramento and San Joaquin Counties, California*. Wetland Regulatory Office (WTR-8), United States Environmental Protection Agency /L.C. Lee & Associates, Inc. Seattle, Washington.

Lee, L. C., M. L. Butterwick, J. L. Cassin, R. A. Leidy, J. A. Mason, M. C. Rains, L. E. Shaw, E. G. White. 1997. *A Report on Assessment of the Functions of Waters of the United States, Including Wetlands, on the Borden Ranch, Sacramento and San Joaquin*

AR 037200

Counties, California. Wetland Regulatory Office (WTR-8), United States Environmental Protection Agency /L.C. Lee & Associates, Inc. Seattle, Washington.

PRESENTATIONS AT PROFESSIONAL MEETINGS

Ecological Society of America and Society of Conservation Biology, 1996 Annual Meeting. August 1996. Paper title: 'Conditionality in a fungal endophyte-grass mutualism: outcomes depend on light, soil nitrogen and herbivore densities'

Ecological Society of America, 1997 Annual Meeting, August 1997. Paper title: 'Recruitment limitation in a perennial grass: the presence of a fungal mutualist determines whether seeds, sites or compensatory mortality limit recruitment'

Society of Wetland Scientists, 1998 Annual Meeting. June 1998. Paper title: 'Using the Hydrogeomorphic Method (HGM) in Wetland Ecosystem Restoration in the Puget Sound Lowlands: The North Creek Aquatic Ecosystem Restoration'

Society for Ecological Restoration, 1999 Annual Meeting. September 1999 (abstract accepted, March 1999). Paper title: 'Enhancing Biodiversity in Wetland Ecosystem Restorations: Restoring Biodiversity in an Urban Watershed in Puget Sound'

Association of State Wetland Managers, 1999 Annual Symposium. October 1999. Restoration: Applying Restoration Science. Paper title: 'The Control of Invasive Weeds: Critical Design, Construction and Maintenance Issues in Riverine Ecosystem Restoration'

MEMBERSHIPS IN PROFESSIONAL SOCIETIES

Ecological Society of America, 1991 to present
Botanical Society of America, 1992 to present
Society for Conservation Biology, 1991 to present
Society of Wetland Scientists, 1996 to present
Society for Ecological Restoration, 1992 to present

OTHER MEMBERSHIPS

The Nature Conservancy, 1983 to present
Washington Native Plant Society, 1997 to present
California Native Plant Society, 1997 to present
Oregon Native Plant Society, 1998 to present

REPRESENTATIVE PROJECTS

Parametrix Projects

Confidential Client, Southwestern U.S.

For this project Parametrix is conducting environmental studies to evaluate potential impacts of reservoir management on wetlands, native riparian plant communities and riparian wildlife habitat and species along an intermittent river in the southwestern U.S. As the technical lead for wetlands and plant communities studies, Dr. Cassin is responsible for designing and conducting studies to characterize the existing riparian ecosystems, inventory plant species, and monitor changes in the plant communities over

time related to changes in water management and groundwater elevations. Responsibilities also include recommending mitigation actions to protect and restore native riparian plant communities.

City of Kent, Covington Water District, King County Water District 111 – Pesticide Survey and Preparation of Integrated Pest Management Plan Dr. Cassin is the project manager on this study which will evaluate pesticide use within the wellhead protection area for several municipal water districts in King County. Based on the results of the pesticide survey, Parametrix is preparing integrated pest management plans for the management of parks, roadside and utility right of ways, and golf courses to reduce pesticide use within the wellhead protection areas.

Seattle-Tacoma International Airport Master Plan Update – Port of Seattle Dr. Cassin is a member of the consultant team conducting natural resource studies and environmental permitting for the Port's Master Plan Improvements including construction of a new third runway. To facilitate CWA Section 404 permitting, Dr. Cassin has reviewed and responded to comments on the EIS and Public Notice. She is also providing technical review and final design revisions for the preparation of the detailed wetland mitigation plans. This includes preparation of a final monitoring plan, as well as construction specifications. Key to these mitigation projects are the restoration of natural channel morphology, large woody debris and forested riparian buffers to a currently degraded urban stream, as well as restoring hydrology and native plant communities to forested, shrub and emergent wetlands. In addition, Dr. Cassin is assisting with coordination with Federal and State agencies to evaluate permit conditions and mitigation requirements. **Contact/Reference:** Elizabeth Leavitt, Port of Seattle,

Cross Base Highway EIS and Mitigation Planning – Pierce County, WA As a member of the consultant team preparing the EIS and CWA permitting and mitigation plans for this highway extension, Dr. Cassin is conducting studies to evaluate potential mitigation sites and preparing mitigation plans. The proposed highway route crosses an area containing oak woodlands - one of the highest priority habitats in the State of Washington, as well as habitat for the State-listed western gray squirrel. The restoration design includes restoring a stream which has been heavily degraded by grazing to a native Oregon white oak/Oregon ash gallery forest, one of the rarest habitat types in the Puget Sound lowlands. Development of the mitigation plans involves coordination with Federal and State agencies, as well as review and synthesis of the scientific literature on the technical requirements for restoring these rare habitats. Additional tasks include reviewing and responding to comments on the draft EIS for incorporation into the final EIS. **Contact/Reference:** Pat Baughman, Pierce County, (253) 798-3157.

Rare/Endangered/Threatened Plant Survey and Biological Assessment – Merlin Co-composting Facility, Grants Pass, Oregon Siting and environmental permitting for this co-composting facility required an evaluation of potential impacts on the Federally listed plant, Gentner's mission bells. Because a known location for the plant occurred within several miles of the project

location and apparently suitable habitat occurred on the project site, completing permits for the project required determining whether or not the plant occurred within the project site and would be impacted by the project. Dr. Cassin reviewed historic and current information on the plant's distribution and habitat requirements, developed an inventory protocol consistent with U. S. Fish and Wildlife Service requirements, conducted a plant survey of the project site and wrote a Biological Assessment. Although the plant was not found on the project site, a 'no effect' determination was not possible because Gentner's mission bells can remain dormant underground for several years. By carefully documenting habitat conditions at extant locations for the plant and comparing those to habitat conditions on the project site however, a 'not likely to adversely affect' determination was made and the project will be able to move forward without a formal consultation.

Additional Projects

Prior to joining Parametrix, Dr. Cassin worked on the development and implementation of several ecoregion or watershed based assessments and restoration projects conducted to support impact analysis or state and regional conservation priorities. Projects include:

Ecosystem Functional Assessment

As senior botanist on multi-agency teams, Dr. Cassin has participated in developing functional assessment models and conducting wetland functional assessments for a variety of Federal and State natural resource agencies in Alaska, the Pacific Northwest, California, and the eastern U.S. These models provide reference data and a rapid assessment method for conducting wetland functional assessments and impact assessments pursuant to NEPA, SEPA, CWA 404, and ESA requirements. These models use the Hydrogeomorphic approach to assessing wetland function, and include collection of reference data on systems representing a range of disturbance conditions, relating functional measurements to disturbance condition, and developing model parameters that can be used to rapidly evaluate wetland function in similar systems. Dr. Cassin has been responsible for model development, design of data collection protocols, collection of reference data, managing field teams, overseeing data analysis, development of model parameters, writing model guidebooks and review of guidebooks. Development and testing of models required close coordination with members of the multi-agency teams to ensure that the models can be effectively used to evaluate project impacts and conduct NEPA, SEPA, CWA and ESA reviews. Dr. Cassin participated in the development of two wetland functional assessment models in Alaska: depressionnal, slope and riverine wetlands associated with the Kenai River watershed, and precipitation driven wetlands on discontinuous permafrost in Interior Alaska. In addition, Dr. Cassin conducted reference sampling and data analysis to develop or refine models for riverine/estuarine wetlands in southwest Washington, Chesapeake Bay coastal plain depressionnal wetlands, and 3rd and 4th order riverine wetlands in the Puget Sound. **Contacts/References:** CA - Rob Leidy

(415-744-1970), USEPA; MD - Leander Brown, NRCS; AK - Jim Powell, Alaska Department of Environmental Conservation (AK).

Borden Ranch – U.S. EPA, Department of Justice

As a senior botanist on the L. C. Lee & Associates, Inc. team, Dr. Cassin participated in developing, testing and applying Hydrogeomorphic (HGM) functional assessment models for depressional (vernal pools), slope and riverine wetlands in the California's Central Valley. These functional assessment models were used to evaluate the impacts on vernal pools, and other wetlands, of deep ripping the soils for the purpose of converting grazed pasture land to cultivation for vineyards and orchards. Model development involved collection of reference data from approximately 90 sites, data analysis and synthesis, and the development of wetland functional indices related to a range of land use conditions. Dr. Cassin was responsible for botanical data collection, directing data quality assurance/quality control, overseeing data analysis, and development of model indices. In addition, Dr. Cassin participated in the field testing of the model and application of the model to wetlands on Borden Ranch. She was a co-author on both the Draft Guidebook and the Report on the Assessment of Wetland Functions that resulted from the development and implementation of functional assessment models to wetlands on the Borden Ranch. These reports were used by the U. S. EPA and the U. S. Justice Department to determine wetland impacts resulting from the deep ripping operation and to determine appropriate mitigation. **Contacts/References:** Rob Leidy, U.S. EPA; Mary Butterwick, U.S. EPA

Stafford Creek Corrections Center EIS, Wetland Permits and Mitigation Design – State of Washington Department of Corrections

As wetland ecologist/botanist on this project, Dr. Cassin investigated the potential impacts on freshwater tidal wetlands and streams of a utility line extension required for the construction of a new correctional facility. The approximately 20 mile-long utility extension crossed sensitive freshwater tidal wetlands as well as seven salmon-bearing streams adjacent to Grays Harbor estuary. Tasks included review and revision of the draft EIS, preparation of the FEIS sections on wetland and aquatic systems, delineating wetlands along the utility corridor, and preparing Federal, State and local permit applications required for the project. Additional tasks included participating in coordination with Federal and State natural resource agencies, as well as Grays Harbor County, to further evaluate project impacts, potential permitting conditions and mitigation requirements. As senior botanist, Dr. Cassin was responsible for designing the restoration of native freshwater and estuarine wetland, riparian and upland plant communities on the 10-acre mitigation site. Dr. Cassin conducted studies of estuarine and freshwater wetlands in Grays Harbor and Willapa Bay to identify plant communities and habitat features to be incorporated into the design. Additional duties included coordinating native plant procurement and performing construction observation for the Department of Corrections during the planting phase of mitigation construction. **Contact/Reference:** Linda Glasier, WA State Department of Corrections (360-753-6547)

**North Creek Aquatic Ecosystem Restoration, Restoration Design and Construction
– Washington State Department of General Administration**

As senior botanist, Dr. Cassin was responsible for the design of native wetland and riparian plant communities on this approximately 60-acre aquatic ecosystem restoration site. As mitigation for impacts to wetlands from the construction of a co-located University of Washington-Bothell and Cascadia Community College campus, the restoration involved restoring natural channel morphology to approximately 4000 feet of the diked and channelized North Creek channel and reconnecting the stream to its floodplain. The restoration design included 20 native plant community types and over 100 native plant species. Additional tasks included completing construction specifications for plant procurement, weed management, and plant installation and maintenance. In addition, Dr. Cassin was responsible for the operation of an on-site nursery facility that propagated native plants for the restoration. Coordination with Federal and State natural resource agencies, as well as the City of Bothell was completed to evaluate project impacts, permitting conditions, and mitigation requirements. Participation in public meetings and presentations to community groups resulted in widespread public support for the restoration project and campus construction. Construction observation, including monitoring permit compliance, was completed for the first planting phase of the project. This phase consisted of planting the channel riparian zone and approximately 40 acres of floodplain wetlands and upland buffer.



S. S. PAPADOPULOS & ASSOCIATES, INC.
ENVIRONMENTAL & WATER-RESOURCE CONSULTANTS

MICHAEL RILEY

Water Resource Engineer

Education

PhD in Civil Engineering, 1988, University of Minnesota, Minneapolis.

BS in Civil Engineering, 1980, University of Minnesota, Minneapolis.

BA in History, 1977, Marquette University, Milwaukee, Wisconsin.

Specialized Training:

- Course work in hydrology, 1981-82, University of Maryland, College Park.
- EPA Training, 1991(Use of WASP4 water- and sediment-quality fate-and-transport model).
- Short Courses in Groundwater Modeling, 1991, 1994, 1996

Professional History

S.S. Papadopoulos & Associates, Inc., Olympia Washington: Vice President, 1997 to present; Boulder, Colorado: Senior Water Resource Engineer/Hydrologist, 1994-1997.

Converse Consultants NW, Seattle, Washington: Associate Scientist/Engineer, 1993-1994.

S.S. Papadopoulos & Associates, Bethesda, Maryland: Senior Water Resources Engineer/Hydrologist, 1992-1993.

Parametrix, Inc., Environmental Consulting and Engineering, Kirkland, Washington: Water Resources Engineer and Director of Water Resource Division, 1988-1992.

St. Anthony Falls Hydraulic Laboratory, University of Minnesota, Minneapolis, Minnesota, 1983-1988.

University of Maryland, Water Resources Research Assistant, College Park, Maryland, 1981-1983.

Greenhorne & O'Mara, Engineering and Environmental Consulting, Riverdale, Maryland. Water Resource Engineer, 1980-1981.

Summary of Qualifications

Dr. Riley has over 15 years of experience in investigating contaminant transport in groundwater, surface water, and sediments. His special interests are risk assessments and analysis of exposure pathways, identification of effective innovative technologies for remediation of groundwater, hydrology of coastal environments, groundwater/surface-water interactions, and remediation of contaminated sediments. He has applied numerical models related to groundwater hydrology (*MODFLOW*), surface-water hydrology (*HEC-1*, *SWMM*, *TR-20*, *HSPF*), hydraulics (*HEC-2*, *DYNFLOW*), and contaminant transport in groundwater and surface water (*SUTRA*, *MT3D*, *WASP4*) for numerous site investigations located throughout the United States. In addition, Dr. Riley has developed computer programs to address lake and reservoir dynamics, density stratified flow, sedimentation, and oil-spill impacts to coastal environs. Dr. Riley is Office Manager of the Olympia, Washington office

Awards & Honors

Sommerfeld Fellowship, University of Minnesota

AR 037206



**Representative
Project
Experience**

S.S. Papadopoulos & Associates, Inc., Environmental & Water-Resource Consultants, Olympia, Washington.

Dr. Riley conducts data analysis; identifies remedial alternatives and feasibility studies for groundwater, soil and sediment contamination, and applies and develops numerical models and computer programs for these investigations. Examples of project work include:

- **Kalama Chemical, Kalama, Washington.** Served as project manager for remediation of this chemical manufacturing facility. Assisted in negotiations for termination of a RCRA order under EPA and implementation of a MTCA order under the Washington Department of Ecology. Provided oversight to other contractors including: development of the MTCA RI Work Plan and implementation of the plan, development of revised monitoring program for the site, implementation and interpretation of studies of the effect of tides and river stage on groundwater flow dynamics, and preparation of annual reports for Interim Corrective Measures in operation on the site.
- **Seattle-Tacoma International Airport Groundwater Model Study, Seattle, Washington:** Prepared a groundwater model of the airport and surrounding areas to predict the potential for contaminants in selected areas of the airport to migrate to off-site water users. A model area of approximately 60 sq. mi. includes five aquifers and two surface water basins. HSPF modeling of the basins provided estimates of recharge to the groundwater system and groundwater discharge to creeks, springs, and seeps was used as base flow additions in the surface water models. Based on model results, a groundwater monitoring network will be developed to verify model results and to measure concentrations in groundwater along the migration pathways.
- **McCormick & Baxter Site, Portland, Oregon:** Assisted the Oregon Department of Ecology in evaluating groundwater flow, dissolved-phase contaminant transport, and non-aqueous-phase contaminant transport from upland areas to the Willamette River. The long-term study objectives are to evaluate upland remedial actions that would be protective of surface water and sediments.
- **East Multnomah Groundwater and Database Project, Portland, Oregon:** Served as Project Manager for this model study that included a regional-scale model and a smaller detail model of the area of a TCE groundwater plume. The detail model, which was the main focus of the study, was used initially to identify parties potentially responsible for the TCE contamination. The model was later used to develop remedial action plans for two sites and to address questions of potential migration of contaminants to a down-gradient municipal well field.
- **Hytek Site, Kent, Washington:** Conducted an annual review of the performance of a groundwater containment system at this RCRA site. A MODFLOW groundwater model was developed by SSP&A for the site. The model is applied annually to existing water level data and meteorological conditions. The model is used to evaluate the effectiveness of the containment system in capturing contaminated groundwater and to set pumping rates for the coming year. The model was also used with the MT3D transport model to simulate concentrations at selected wells and concentrations from the extraction wells as a means of further evaluating the actual and expected response of the system.



**Representative
Project
Experience**
– continued

- **Tarpits Superfund Site, Tacoma, Washington:** Provided technical assistance in support of litigation at this former manufactured gas plant site. Technical support included data review of groundwater chemistry and water levels, analysis of surface-water flows, and evaluation of the hydrogeology of the site.
- **Harbor Avenue Pump Station, Seattle, Washington:** Provided senior overview for this groundwater model study of a construction site located across Harbor Avenue from a landfill. The model was used to simulate groundwater flow and to design a slurry wall between the landfill and the construction site that would prevent the migration of landfill leachate to the construction site.
- **Pasco Bulk Fuel Terminal, Pasco, Washington:** Provided oversight and technical direction on this investigation of a bulk fuel terminal on the Columbia River. The investigation included groundwater and surface-water monitoring at a down-gradient drainage channel and pond, and sediment sampling in the Columbia River. Provided an extensive review of the Phase I report and development of the Phase II scope of work. Negotiated changes in the long-term monitoring plan that allowed for reduced sampling over time.
- **Pacific Sound Resources Superfund Site, Seattle, Washington:** Provided technical oversight and data analysis on this near-shore former wood treatment site. Assisted with design and data analysis of two tidal studies to determine changes in groundwater flow patterns over the tidal cycle and the net gradients and flow directions from the site. Assisted in the design of a slurry containment wall between the main process areas and the shoreline. Analyzed tidal effects on the slurry wall and the effect of the slurry wall in reducing tidally-induced groundwater level fluctuations behind the slurry wall.
- **Heleva Superfund Site, Whitehall Township, Pennsylvania:** Conducted groundwater model studies to support the design of remedial actions at the site. The MODFLOW model was used to design a groundwater containment system and allowed optimization of the extraction system from a network of five wells operating at a total rate of 900 gpm to three wells operating at a total rate of 450 gpm. The model was calibrated to steady-state flow rates and to three large-scale, multi-day pump tests. The model was used in conjunction with the MT3D transport code to estimate the contaminant concentration in the pump effluent for design of a groundwater treatment system.
- **ReSolve Chemicals Superfund Site, North Dartmouth, Massachusetts:** Assisted in the evaluation of alternative extraction well placement in response to EPA comments on a 35% design report. A groundwater model was developed for the design process to test alternate locations of extraction wells requested by EPA and to test location changes necessitated by easements and utilities. The model allowed optimization of well locations and capture of contaminated groundwater while holding pumping rates to a minimum design level.
- **American Barrel Yard Site, Salt Lake City, Utah:** For this site of previous creosote and manufactured gas plant operations, provided litigation support on the extent of contamination, the type of contamination associated with different operations, the history of different operations, and the fate of contaminants generated at different times and under different operations on the site.



**Representative
Project
Experience**
– continued

- **Jordan East Site, Salt Lake City, Utah:** For this former coal tar manufacturing facility where roofing pitch, creosote, and coal tar products were produced, provided litigation support on the potential migration of complex organics from coal tar wastes to groundwater and timing of waste disposal relative to the magnitude and extent of contaminant migration in groundwater.

Sediment/Groundwater/Surface-water Investigations

- **Thea Foss/Tacoma Coal Gas Site Groundwater Model, Tacoma, Washington:** Conducted a groundwater model study of a former manufactured gas facility located on the shore of Thea Foss Waterway. The project objectives were to quantify contaminant loading to the waterway and, following remedial actions, to predict the potential for re-contamination of sediments from continuing sources of contaminants. The groundwater model incorporated the effect of tides, aquifer compression, and saline boundary conditions on groundwater flow.
- **Southwest Harbor Project Soil Remediation Analysis, Seattle, Washington:** Assisted in the development of a strategy to determine site-specific soil concentrations suitable for on-site disposal. The study involved designation of site groundwater as non-potable, analysis of tides to identify groundwater flow pathways and exposure routes, chemical sampling of surface water and groundwater, and development of a conceptual model of groundwater/surface-water interaction. From the conceptual model, a multi-step partitioning and mixing model was developed to identify soil concentrations suitable for on-site disposal. The modeling effort involved surface water criteria, allowable changes up the groundwater flow path taking into account a surface-water mixing zone, tidal mixing in a discharge line, infiltration under different post-development caps, mixing of infiltrate with ambient groundwater flow, and soil/groundwater partitioning of contaminants. This modeling analysis resulted in over 90% of contaminated soils remaining onsite.
- **Port Quendall Terminal, Renton, Washington:** Performed a model analysis of groundwater flow and contaminant transport from a former wood treatment site on Lake Washington. The purpose was to predict allowable concentrations in groundwater that would be protective of surface water, estimate the potential for groundwater flux to re-contaminate near-shore remediated sediments, and evaluate remedial actions for protecting surface water and near-shore sediments.
- **Salmon-Rearing Netpen Studies, Puget Sound, Washington:** Conducted model studies on a series of proposed salmon netpens. One of the issues involved possible nutrient enrichment of sediments due to settlement of feces and uningested food. A discrete particle settling model was developed to simulate the movement of suspended particles representing feces and fish food. The model operated with tidal current measurements to predict an area of impact from the salmon net pen based on mass loading to the sediments.



**Representative
Project
Experience**
— continued

- **Southwest Harbor Project, Lockheed Site, Seattle, Washington:** Part of a team investigating contaminant movement from proposed contaminated sediment disposal sites to Elliott Bay. Investigation included installation of upland and offshore wells, groundwater sampling, tidal studies, and sediment pore-water flux studies. Primarily responsible for implementation of a contaminant transport model that used the results of the field investigations. This model was used to evaluate the potential for migration of contaminants from the proposed disposal alternatives, estimate the concentrations of selected compounds in groundwater reaching Elliott Bay (for use in a risk assessment of different alternatives), and make recommendations on design of the contaminated fill and containment cap to minimize contaminant migration.
- **Lake Union Capping Feasibility Study, Seattle, Washington:** Conducted sediment investigation and groundwater model analysis to evaluate the feasibility of sediment remediation along Gas Works Park on Lake Union. Samples of sediment core were analyzed for chemistry and sediment pore-water to develop sediment-to-groundwater exchange rates. The purpose of this groundwater model study of upland groundwater and contaminant transport was to estimate the potential for sediment contamination due to movement of contaminated groundwater through off-shore sediments.
- **University Regulator CSO Control Project, Seattle, Washington:** Served as Project Manager to evaluate the sediment and water-quality impacts of a stormwater diversion and combined sewer overflow. Near-field and far-field models were developed. The near-field model was used to design the outfall structure and evaluate the mixing zone close to the outfall. The far-field model was used to predict concentrations in the effluent plume away from the outfall. The models were used to compare differences in concentration of conservative and non-conservative constituents. The non-conservative constituents, represented by particles with a decay rate related to the settling velocity, allowed a prediction of settling areas for different size particles and identification of areas of potential sediment contamination from the CSO effluent.

**Previous
Experience**

Converse Consultants NW, Seattle, Washington.

Worked on projects related to site cleanup under CERCLA and the Washington State Model Toxics Control Act. Site investigations focused on groundwater contamination and soil and surface-water contamination for development of consistent cleanup levels for each media. Actively involved in negotiations with EPA and the Washington Department of Ecology on cleanup levels for soils and groundwater. Worked on developing cleanup criteria, risk assessments, and remedies consistent with redevelopment of sites. Assisted in development of presumptive remedies, early actions, and Engineering Evaluation/Cost Analysis (EECA) under the Superfund Accelerated Cleanup Model.

Parametrix, Inc., Environmental Consulting and Engineering, Kirkland, Washington.

Worked on numerous projects including: (1) environmental impact studies involving water-quality assessments of oil-spill impacts from U.S. Navy base operations, dispersions and tidal flushing analysis of outfalls from wastewater treatment plants, and circulation impacts from shoreline development; (2) remedial investigations and feasibility studies at pulp and paper plants, mining and smelter



**Previous
Experience**
— *continued*

operations, and municipal outfalls; (3) NPDES permitting investigations for both outfall and stormwater that included hydrologic analysis, identification of runoff paths, and evaluation of the water quality of the storm runoff; and (4) sediment cleanup in the Pacific Northwest.

St. Anthony Falls Hydraulic Laboratory, University of Minnesota, Minneapolis.

Provided support on research projects that included development of dynamic flow-nutrient-biological interaction models for prediction of lake eutrophication and the effect of treatment strategies on density stratified plumes in lakes and rivers, and the effect of barge traffic on mixing dynamics in rivers.

Greenhorne & O'Mara, Engineering and Environmental Consulting, Riverdale, Maryland.

Performed and reviewed flood studies for the FEMA flood insurance program. Project experience included review and implementation of hydrology programs (SWMM, HEC-1, TR-20) and hydraulic programs (HEC-2) to identify and delineate floodplain boundaries.

**Professional
Societies**

American Geophysical Union
National Ground Water Association
Geological Society of America



PUBLICATIONS

- Riley, M. and C.J. Neville, 2001, **Natural Attenuation in Tidal Zones**. National Ground Water Association Northwest Focus Conference, February 2001. (Accepted)
- Ford, B. and M. Riley, 1998, **A Practical Application of MODFLOW and UCODE (Universal Inverse Code) for Design of a Recovery Well System and Evaluation Well System Performance**. *Proceedings of the MODFLOW >98 Conference*, October 1998, International Ground Water Modeling Center, Colorado School of Mines, Golden, Colorado.
- Neville, C.J., M. Riley, and C. Zheng, 1998, **Implicit Modeling of Low-Permeability Features: An Appraisal for Solute Transport**. *Proceedings of the MODFLOW >98 Conference*, October 1998, International Ground Water Modeling Center, Colorado School of Mines, Golden, Colorado
- Pascoe, G.A., M.J. Riley, T.A. Floyd, C.L. Gould, 1998, **Use of a Risk-Based Hydrogeologic Model to Set Remedial Goals for PCBs, PAHs, and TPH in Soils during Redevelopment of an Industrial Site**. *Environmental Science and Toxicology*, v. 32, no. 6, pp. 813-820.
- Riley, M., G. Biswas, C. Boatman, M. Utting, R. Brockhaus, and D. Hotchkiss, 1994, **Groundwater Model Simulation of Chemical Transport from a Nearshore Confined Sediment Disposal Facility**. *In: Dredging '94, Proceedings of the Second International Conference on Dredging and Dredge Material Placement, 1994*. E.C. McNair, Jr., (ed.). American Society of Civil Engineers, New York, New York.
- Riley, M.J., and H.G. Stefan, 1988, **Development of the Minnesota Lake Water Quality Management Model. MINLAKE**. *Lake and Reservoir Management*, North American Lake Management Society, v. 4, no. 2, pp. 73-83.
- Riley, M.J., and H.G. Stefan, 1988, **MINLAKE: A Lake Water Quality Simulation Model**. *Ecological Modeling*, v. 43, no. 3/4, pp. 155-182.
- Hanson, M., M. Riley, and H. Stefan, 1987, **An Introduction to Mathematical Modeling of Lake Processes for Management Decisions**. Project Report 249, St. Anthony Falls Hydraulic Laboratory, University of Minnesota, Minneapolis.
- Riley, M.J., and H.G. Stefan, 1987, **Dynamic Lake Water Quality Simulation Model MINLAKE**. Project Report 263, St. Anthony Falls Hydraulic Laboratory, University of Minnesota, Minneapolis.
- Stefan, H.G., and M.J. Riley, 1985, **Mixing of a Stratified River by Barge Tows**. *Water Resources Research*, v. 21, no. 8.
- Stefan, H., G. Farrell, M. Riley, K. Lindquist, and G. Horsch, 1984, **Mixing of the Seneca and Blue Lake Waste Water Treatment Plant Effluents with the Minnesota River**. Project Report 277, St. Anthony Falls Hydraulic Laboratory, University of Minnesota, Minneapolis.



Stefan, H., M. Riley, G. Farrell, and Y. Chen, 1984, **Near-field Water Quality of the Metro WWTP Effluent Mixing Zone in the Mississippi River Under Summer Conditions.** Project Report 231, St. Anthony Falls Hydraulic Laboratory, University of Minnesota, Minneapolis.

PRESENTATIONS

- Riley, M., G. Bennett, and W. Guo, 1998, **Comparison of MODFLOW/SEAWAT to Other Model Applications in Coastal Areas.** Presented at the MODFLOW '98 Conference, International Ground Water Modeling Center and Colorado School of Mines, Golden, Colorado, October 4-7, 1998.
- Pascoe, G., L. Gould, J. Martin, M. Riley, and T. Floyd, 1995, **Use of a Hydrogeologic Model to set Remedial Goals for Subsurface Soils in a Puget Sound Basin Watershed.** Presented at the Society of Environmental Toxicology and Chemistry annual meeting, Vancouver, British Columbia, Canada, November 6, 1995.
- Hathaway, D.L. and M.J. Riley, 1995, **Evaluating the Performance of Hydraulic Containment Systems.** Presented at the American Institute of Hydrology Annual Meeting, Denver, Colorado, May 14-18, 1995.
- Riley, M.J., R. Matsuda, et al., 1991, **A Risk Approach to Classifying Contaminated Sediments in Elliott Bay.** Presented at the Puget Sound Research Conference, Seattle, Washington.
- Hinckley, D., B. Maier, R. Cardwell, M. Riley, R. Matsuda, et al., 1991, **Rapid Methods for Quantitatively Assessing Ecological and Human Health Risks in Contaminated Sediments.** Presented at the Puget Sound Research Conference, 1991, Seattle, Washington.
- Lindquist, K., M. Riley, and H. Stefan, 1987, **Sinking Flow into a Shallow Cross Current.** Presented at the Third International Symposium of Density Stratified Flows, February 1987, IAHF, American Geophysical Union, and the American Society of Civil Engineers.
- Hanson, M., H. Stefan, and M. Riley, 1986, **Dynamic (Mathematical) Modeling of Lake Processes for Management Decisions.** Presented at the International Symposium on Lake and Watershed Management, November 13-16, 1985, North American Lake Management Society.
- Stefan, H.G., and M.J. Riley, 1986, **Dynamic Lake Water Quality Modeling.** Presented at the Eastern Simulation Conference, March 10-12, 1986, Norfolk, Virginia, Society of Computer Simulation.

Charles S. Wisdom, Ph.D.

*Ph.D., Chemical Ecology
Bachelor of Arts, Biology
Associate of Arts, Biology*

Charles Wisdom is an ecologist with 19 years of experience investigating the impacts of human activities on aquatic and terrestrial ecosystems using a risk assessment approach. Dr. Wisdom has assessed the environmental impacts of current and future mining activities and discharges from sewage treatment plants to aquatic life, wildlife, and humans. He has assessed the potential for exposure of fish, birds, mammals, and humans to chemicals, physical effects, and habitat modifications, and predicted the level of adverse impact (if any) on these organisms from their exposure. Additionally, he has been active in the use of risk assessments to determine the impacts of human activities on aquatic endangered species and establishing the relationships between of the Clean Water Act and the Endangered Species Act. Dr. Wisdom's research career has included field and laboratory evaluations of plant biochemical and ecophysiological responses to ozone exposure and aerosol deposition of nitrogenous compounds. He has conducted comparative studies on responses of various plant species (e.g., photosynthesis and water relations) to patterns of water availability in the environment.

Project Experience

Parametrix (1995-Present)

Sammamish-Washington Analysis and Modeling Program (SWAMP). King County Department of Natural Resources – Washington

Currently assisting wastewater capital planning, habitat conservation planning, and salmon recovery and watershed planning efforts by developing a set of scientific tools to better understand the Sammamish/Washington watershed system, and using the tools to explore resource management options.

These tools and information include water and sediment quality monitoring results, water quality and quantity modeling, ecological and human health risk assessment, and habitat and biological assessments.

The SWAMP project is seeking to (1) understand existing conditions in the study area and identify any associated risks to aquatic life, wildlife, and people and as well as under buildout conditions; and (2) understand the effects of using reclaimed water in the watershed on existing and future conditions and resulting potential risks. Technical studies are supporting wastewater reuse planning, wastewater treatment plant siting, wastewater habitat conservation planning for endangered species act compliance, and watershed basin planning for endangered species recovery. These studies include water and sediment quality analysis, water quality modeling, human site use surveys, human health and ecological risk assessment, and habitat and biological surveys. Water quality studies include field sampling, modeling, and ecological and human health risk assessment in the major lakes in the study area. Various biological and habitat surveys are being conducted in areas where a potential treatment plant and/or reuse project may be located.

Seattle Tacoma International Airport Master Plan Update Improvements Biological Assessment. Port of Seattle, Seattle, Washington.

Managed the preparation of a Biological Assessment (BA) to fulfill the ESA Section 7 Consultation requirements of the Federal Aviation Authority (FAA) for the proposed Master Plan Update (MPU) Improvements at Seattle Tacoma International Airport. This BA assessed the impacts of construction and operation of the proposed MPU Improvements on chinook salmon and bull trout in Miller and Des

Moines Creek watersheds and the Green River. Additionally evaluated were potential effects on marbled murrelets and bald eagles. Both potential water quality and hydrologic impacts were evaluated in this process, as well as proposed mitigation efforts for the overall project. The determinations of the BA were concurred with by both the National Marine Fisheries Service (NMFS) and the United States Fish and Wildlife Service (USFWS).

Link Light Rail Biological Assessment. Sound Transit – Seattle, Washington

Managed the preparation of a Biological Assessment to fulfill the ESA Section 7 Consultation requirements of the Federal Transit Authority (FTA) for the proposed Link Light Rail system to be constructed in the City of Seattle. This BA assessed the impacts of construction and operation of the proposed Link Light Rail system on chinook salmon and bull trout in the Duwamish River and associated tributaries. Additionally evaluated were potential effects on bald eagles. Both potential water quality and hydrologic impacts were evaluated in this process, as well as proposed mitigation efforts for the overall project. The determinations of the BA were concurred with by both the National Marine Fisheries Service (NMFS) and the United States Fish and Wildlife Service (USFWS).

North Treatment Facility (NTF) – Marine Outfall Siting Study (MOSS). King County Department of Natural Resources – Seattle, WA

Parametrix is assisting King County to site a new marine outfall as part of the siting and construction of their proposed North Treatment Facility and conveyance system. The Parametrix team will evaluate the human health, aquatic life and wildlife impacts and risks posed by existing physical, biological and chemical conditions and how those impacts and risks could potentially change during construction and operation of the new outfall. Additionally, the Parametrix team will evaluate potential risks to chinook salmon and other potentially threatened and endangered species and their habitat from existing and proposed County discharges to Puget Sound in support of the County's efforts to develop and implement a Habitat Conservation Plan. Both of these evaluations will require an assessment of the physical, biological and chemical conditions of the outfall and Wastewater Habitat Conservation Plan (HCP) marine study areas.

NEPA Environmental Assessments – United States Navy, EFA Northwest – Poulsbo, WA

Assisted in the preparation of an Environmental Assessment for the Navy Limited Partnership Housing project near Marysville (Everett II). Provided evaluations used in the selection of the final site for this housing complex from three proposed sites. Completed a Biological Assessment of potential impacts on endangered species required for this project. Currently assisting in the preparation of an Environmental Assessment of the proposed redevelopment of the 1942 Victory Housing complex located at Naval Air Station, Whidbey Island.

Water Quality Assessment – King County Department of Natural Resources, WA

Assessed the risks to aquatic life, wildlife, and human health from baseline conditions with and without Combined Sewer Overflow contributions to the Duwamish River and Elliott Bay. Risks were assessed to fish, benthic organisms, wildlife, and people working and recreating on the river and bay from exposure to metals and organics, physical stressors, and human pathogens that are present in both freshwater and marine ecosystems in the Duwamish Estuary.

Aquatic Life Risk Assessment Sydney – Water Corporation, Sydney, Australia

Assessed the risks to aquatic life from wet-weather discharges from three Sewage Treatment Plants operated by the Sydney Water Corporation. Risks were assessed to fish and benthic organisms from

exposure to dissolved metals that would be present in both freshwater and marine ecosystems in the greater Sydney metropolitan area.

Environmental Impact Statement – Bureau of Land Management, Nevada

Conducted a third party review of an aquatic life risk assessment of the proposed Cortez South Pipeline project for a Bureau of Land Management EIS. The review involved critiquing the scientific validity of the risk assessment and summarizing the risk assessment for the draft EIS.

Environmental Risk Assessment – P.T. Freeport Indonesia, Irian Jaya, Indonesia

Assessed the risks to aquatic life, human health, and a tropical mangrove ecosystem for metals present surface water resulting from increased operations of a combined gold and copper mine. Risks were assessed to humans, fish, benthos, and plants from exposure to dissolved metals present in the Ajkwa River.

Aquatic Life and Human Health Risk Assessment – Phelps Dodge Corporation, Montana

Managed an aquatic life and human health risk assessment for metals present in groundwater and surface water at a site of a proposed gold pit mine. Risks were assessed to humans and fish from exposure to dissolved metals that would be present in the Blackfoot River once the mine begins operation.

Human Health and Wildlife Risk Assessment – Sante Fe Pacific Gold Corporation, Nevada

Managed a human health and wildlife risk assessment for a future pit mine lake. Risks were assessed to humans, birds and mammals from exposure to dissolved metals that will be present the lake once it forms, including mercury, methylmercury, arsenic, cadmium, and zinc.

Human Health and Wildlife Ecological Risk Assessment – Aluminum Company of America, Texas

Directed the identification of background sites for use in human health and wildlife risk assessments from elevated metal (e.g., mercury, lead and cadmium) and organic (e.g., PCBs and PAHs) concentrations related to Alcoa's Point Comfort Operation in Lavaca Bay, Texas. Background sites are being used in the identification of Chemicals of Potential Concern and the establishment of future Remedial Action Levels.

Wildlife Risk Assessment – Kennecott Utah Copper, Utah

Managed a wildlife risk assessment in wetlands properties adjacent to the Kennecott mining operations in Salt Lake City, Utah. Risks were assessed to birds from exposure to metals present in sediments, water and invertebrate prey in these wetlands, including arsenic, cadmium, copper, lead, selenium and zinc.

Wildlife Risk Assessment – Asarco, Inc., Nebraska

Managed an aquatic risk assessment from metals and organics present groundwater seeping into the Missouri river. Chemical concentrations were compared to EPA Ambient Water Quality Criteria to determine whether aquatic life were at risk from exposure to these chemicals.

Housing Demolition Environmental Assessment - EFA NW, Poulsbo, Washington

Parametrix prepared sections of an Environmental Assessment of the proposed demolition of the existing Victory Housing at the Whidbey Island Naval Air Station and the construction of new housing on the same location.

Beak Consultants (1992-1995)

Guidelines for Development and Operation Manual – King County, WA

Assisted in the preparation of toxicological guidelines for King County's Best Management Practices for Golf Course Development and Operation manual. Designed guidelines for the seasonal use and application of pesticides.

Toxicity Evaluations to Support NPDES Permit Requirements – Various Clients in Washington State

Managed the determination of acute and chronic toxicity of wastewater discharges at treatment plants for the following municipal clients: Edmonds, Duvall, Lynnwood, Spokane, Goldendale, Othello, Pasco, and Bellingham. Dr. Wisdom managed similar projects for the Department of Ecology/Manchester Laboratory, and the Department of Corrections at the Cedar Creek Corrections Center and the Clallum Bay Corrections Center.

Toxicity Evaluations to Support NPDES Permit Requirements – Various Industrial Clients in Washington State

Managed the determination of acute and chronic toxicity of freshwater and marine discharges at treatment plants for the following industrial clients: Texaco Refining & Marketing, Shell Oil/801 Division, Longview Fibre Company, Foss Shipyard, and Jorgenson Forge.

Wisdom Associates (1991)

Environmental Technologies Consultant. Dr. Wisdom evaluated control technologies and market trends in the waste management industry (air quality, groundwater contamination, plastics recycling and noise and vibration control) for a confidential client. This involved the assessment of technology feasibilities, impacts of governmental regulations on environmental technologies and the analysis of market directions.

University of New Mexico, Department of Biology (1986-1992)

Assistant Professor. Responsible for conducting a grant-supported research program, teaching undergraduate and graduate students (classes in botany, plant ecology, plant physiology, plant-herbivore interactions and spatial statistics) and participating in university administrative committees. Dr. Wisdom designed and conducted research to investigate plant chemistry, toxicity of chemicals to insects, brine shrimp and bacteria and environmental influences on plant chemical production. He also investigated the biodegradation of chemicals in soils, performed chemical analyses by chromatography (HPLC, GC, TLC) and identified structures by spectroscopy (UV, MS, NMR). In addition, Dr. Wisdom performed multivariate statistical analyses of experimental data by computer software (LOTUS, SAS, SPSSX) and programmed computers in FORTRAN and PASCAL to aid data analyses. Specific research activities conducted by Dr. Wisdom at UNM included:

USDA Forest Service, Rocky Mountain Experimental Station Sponsored Research

Herbivorous arthropods on snakeweed: Influence of associated plants on arthropod distributions and of the environment on snakeweed terpene chemistry.

NSF Biological Systems and Resources Division Sponsored Research

Long-term ecological research on climatic and ecological gradients: Sevilleta National Wildlife Refuge.
Co-principal Investigator with Dr. James R. Gosz and many other members of the Department of Biology.

Biomedical Research Support Grant, University of New Mexico Sponsored Research

Chemical surveys of medicinally used plants of the arid Southwest.

USDA Forest Service, Rocky Mountain Experimental Station Sponsored Research

Impact of a Southwestern semi-arid rangeland plant invader on soil biology and chemistry.

USDA Forest Service, Rocky Mountain Experimental Station Sponsored Research

Ecophysiology and herbivory of *Gutierrezia* in disturbed and undisturbed sites.

***University of California, Los Angeles, Laboratory of Biomedical and Environmental Sciences
(1983-1986)***

Postdoctoral Scholar. Responsible for the development of organic analyses laboratory and planning/conducting/analyzing field research on the interaction of native herbivorous insects on *Prosopis glandulosa* (mesquite trees) in the Mojave Desert of California. Determined the toxicity of mesquite chemicals in bioassays using native herbivorous insects.

***University of California, Irvine, Department of Ecology and Evolutionary Biology
(1977-1982)***

Research Assistant/Teaching Assistant. Dr. Wisdom assisted his dissertation advisor in ecological research, conducting laboratory analyses of plant chemical content and field collection of plant and insect distributions. Planned, conducted and analyzed dissertation research on the interaction of desert plant chemicals and herbivorous insects. Developed culturing techniques for insects involved in this research.

NSF Doctoral Dissertation Improvement Grant, Sponsored Research

The multiple-component defense system of *Encelia farinosa*: Ecology and evolution. Dissertation advisor – Dr. Eloy Rodriguez.