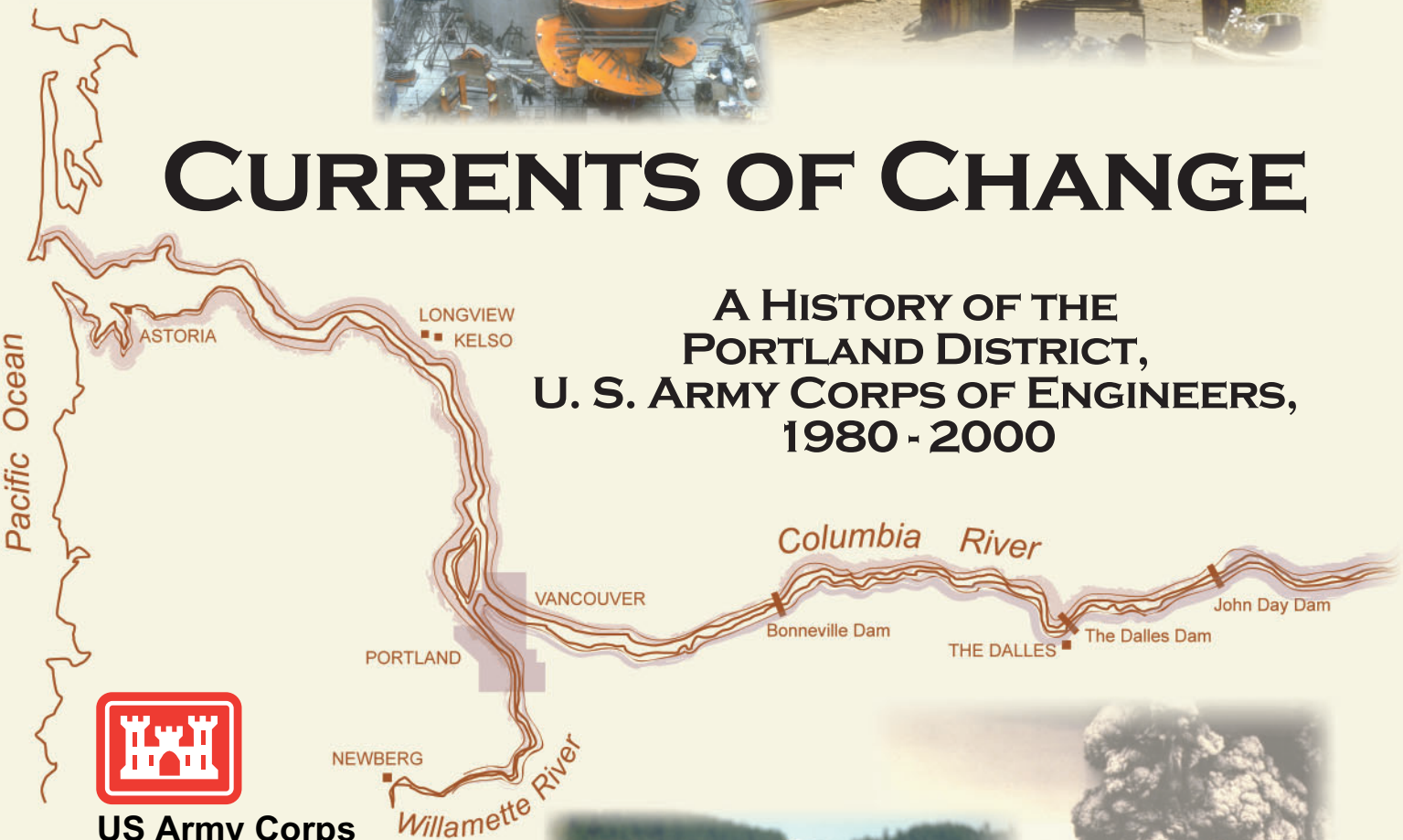
Currents of Change

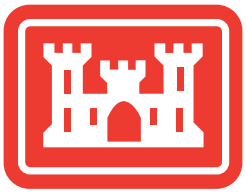
A History of the Portland District, U. S. Army Corps of Engineers, 1980 - 2000



US Army Corps of Engineers ®
Portland District

Currents of Change

A History of the Portland District, U.S. Army Corps of Engineers, 1980-2000



Todd Jennings
Lisa Mighetto
Jill Schnaiberg

Portland District
U.S. Army Corps of Engineers
2003

This book is dedicated to the Employees of the Portland District

Library of Congress Cataloging-in-Publication Data

Jennings, Todd, 1969-
Currents of change: a history of the Portland District, U.S. Army Corps of Engineers, 1980-2000 / Todd Jennings, Lisa Mighetto, Jill Schnaiberg.
p. cm.
Includes bibliographical references and index.
1. United States. Army. Corps of Engineers. Portland District--History--20th century. I. Mighetto, Lisa, 1955- II. Schnaiberg, Jill, 1973- III. United States. Army. Corps of Engineers. Portland District. IV. Title.

UG24.07J45 2003
363'.09795--dc21

2003045190

Acknowledgments

The authors are indebted to numerous current and retired employees of the Portland District, who provided their memories as well as photographs and documents. We also thank former District Commanders for sharing their perspective on the history of the district, including Colonel Randall J. Butler, Colonel Terence J. Connell, and Colonel Robert L. Friedenwald. We especially thank the members of the History Committee, which was led by Vickie Tomberlin. Members included Vickie L. Ashenbrenner, Diana C. Brimhall, Somphone P. Chanthabouasy, Howard B. Jones, Davis G. Moriuchi, and Thomas E. Savidge. We also thank William Baldwin and Martin Reuss of the Office in History in Washington, D.C. for their reviews and advice. Carol E. Hastings of the Portland District Visual Information Branch provided invaluable assistance in the production and design of this publication. We also appreciate the work of Carol A. Job, Administrative Officer, and Matt J. Rabe, Assistant Chief of Public Affairs, on this history. Outside of the Corps, we would like to thank historian William F. Willingham, for sharing his research and insights.

The staffs of various repositories provided assistance. These include the Portland District Technical Library; Portland District Public Affairs Office; Oregon History Center; National Archives and Federal Records Center, Pacific Alaska Region; University of Oregon; and University of Washington. We also appreciate the efforts of Vickie Tomberlin and George Rivard in obtaining interview tapes, videos, and printed records in storage for our use. Lastly, we are grateful for the assistance provided by S&K Technologies, Inc.

Todd Jennings
Lisa Mighetto
Jill Schnaiberg
Historical Research Associates, Inc., Seattle

U.S. Army Corps of Engineers

Milestones

1962 - Rogue River Basin Project Authorized, including Elk Creek Dam

1966 - National Historic Preservation Act

1970 - National Environmental Policy Act

1972 - Federal Water Pollution Control Act

1973 - Endangered Species Act

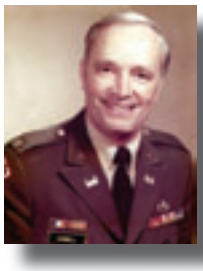
1974 - Archaeological and Historic Preservation Act

1977 - Clean Water Act

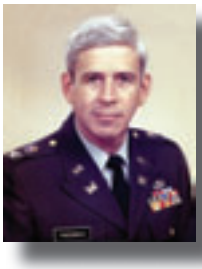
1978 - Public Law 95-269 establishes the Minimum Dredge Fleet

1980 - Mount St. Helens Erupts

1980 - Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)



Col Terence J. Connell
1979 - 1982



Col Robert L. Friedenwald
1982 - 1985

Elk Creek Dam project

Mountt St. Helens eruption
May 18th, 1980

Historical Timeline

1983 - Bonneville Second Powerhouse Completed

1985 - Tunnel at Spirit Lake Completed

1986 - Hamilton Island Cleanup Begins

1986 - Superfund Amendments and Reauthorization Act

1986 - Water Resources Development Act

1989 - Sediment Retention Structure Completed

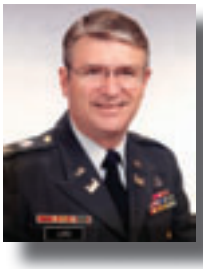
1989 - Alaska Oil Spill, Corps Dredges Assist with Clean-Up

1990 - Water Resources Development Act

1990 - Native American Graves and Repatriation Act

1991 - District Offices Move to New Site at RDP

1985



Col Gary R. Lord
1985 -1988

1990

Col Charles E. Cowan
1988 - 1991

TBM breaking through the Spirit Lake tunnel

Artist sketch of the Robert Duncan Plaza building, new office space for the Portland District

Dredge *YAQUINA* removing oil from the bay in Alaska

Bonneville Second Powerhouse completion

Mount St. Helens SRS completed

1991 - SEVERAL SPECIES OF PACIFIC SALMON LISTED AS THREATENED AND ENDANGERED IN COLUMBIA RIVER BASIN

1992 -HAMILTON ISLAND LISTED AS A SUPERFUND SITE

1993- DREDGED MATERIAL MANAGEMENT STUDY AUTHORIZED

1993 - BONNEVILLE NAVIGATION LOCK OPENS TO COMMERCIAL TRAFFIC

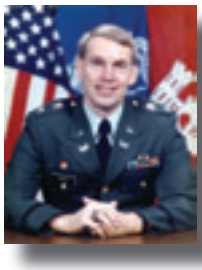
1993 - BONNEVILLE ORIGINAL POWERHOUSE REHABILITATION BEGINS

1994 - COLUMBIA RIVER CHANNEL DEEPENING STUDY INITIATED

1995 - HAMILTON ISLAND DELISTED AS A SUPERFUND SITE

1995

COL CHARLES A.W. HINES
1991 - 1994



COL. TIMOTHY L. WOOD
1994 - 1996

PACIFIC SALMON ON THE ENDANGERED SPECIES LIST

COHO

SOCKEYE

CHINOOK

HAMILTON ISLAND SUPERFUND SITE CLEANUP

BONNEVILLE NAVIGATION LOCK OPEN FOR TRAFFIC

BONNEVILLE POWERHOUSE REHABILITATION

Historical Timeline

1996 - Record Rainfalls; Willamette Floods and Threatens Portland

1996 - Water Resources Development Act

1997 - Corps and Department of Environmental Quality Sign Agreement Placing Bradford Island in the DEQ's Voluntary Cleanup Program

1999 - Additional Listings of Pacific Salmon Species as Threatened and Endangered

1999 - Work Begins on Amazon Creek Wetlands Project

2000 - EPA lists Portland Harbor on Willamette River, including U.S. Moorings, as Superfund Site

2000

Col. Robert T. Slusar
1996 - 1999

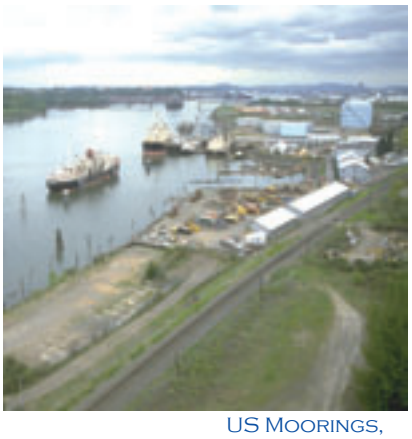
Col. Randall J. Butler
1999 - 2002

Flood of 1996

Salmon added to Endangered Species list

Chum

Steelhead



US Moorings, part of the Superfund site

Amazon Creek Wetlands Project

Table of contents

Foreword

The U.S. Army Corps of Engineers has been a strong presence in the Pacific Northwest since 1871. The Portland District's influence in the region is explained in William F. Willingham's book, *Army Engineers and the Development of Oregon: A History of the Portland District U.S. Army Corps of Engineers* (1983). It is my pleasure to introduce this update to the history of the Portland District, focusing on the years 1980–2000.

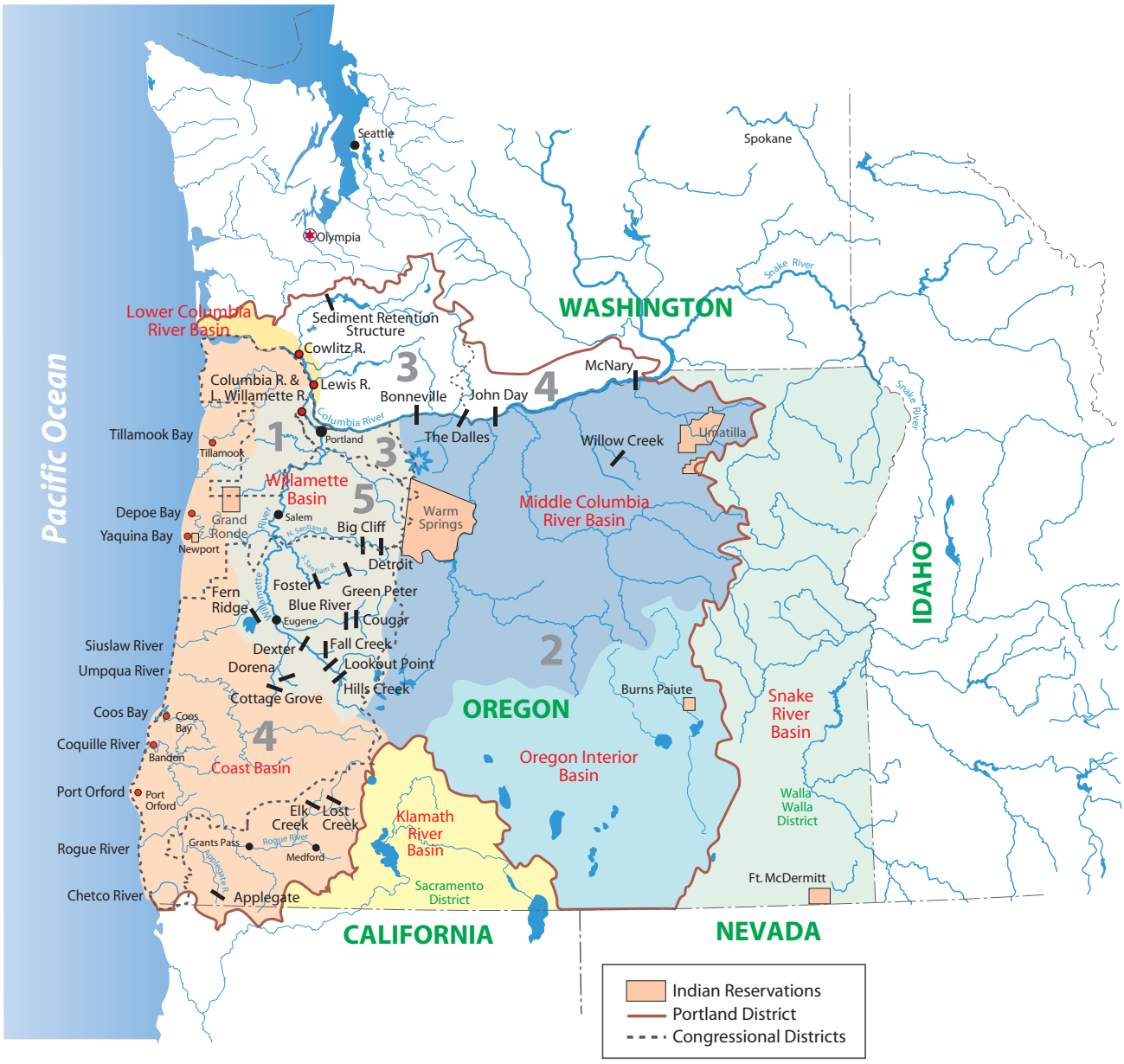
Currents of Change highlights the District's work in the traditional missions of navigation and hydropower. It also illustrates the Corps' newer missions, including recreation, responding to emergencies, regulating wetlands, and environmental restoration, while describing how the District incorporated new technologies and maintained a skilled and dedicated workforce.

A century ago residents in the Pacific Northwest would have been astonished at the region's current focus on environmental issues. Our nation's values and priorities have changed considerably during the last 20 years, requiring new responses from Congress, policy makers, and federal agencies. *Currents of Change* demonstrates how the Portland District adapted to these rapid changes, while continuing to serve the region's residents and an increasing number and diversity of interests.

It is difficult to imagine a more exciting period in our District's history. The years 1980-2000 include several monumental events – including the eruption of Mount St. Helens and the listings of endangered salmon under the Endangered Species Act – developments that will shape the region for years to come. As *Currents of Change* shows, the Portland District remains a very important force in the region's history.

The employees of the Portland District have played an essential role – and this is their story. *Currents of Change* reminds us of all we have accomplished during the last 20 years, as we look forward to the possibilities and opportunities that lie ahead in the 21st century.

Randall J. Butler
Colonel, U.S. Army Corps of Engineers
District Engineer
2002



Portland District

US Army Corps of Engineers®
Portland District

Introduction

"We're at the cutting edge of so many environmental issues, dealing with hydropower, fish, and tribal and treaty rights."
Colonel Eric T. Mogren, Deputy Division Engineer, Northwestern Division, 2001
"The rivers have made Portland."
Carl Abbott, Greater Portland: Urban Life and Landscape in the Pacific Northwest, 2001

Engineering in the Environmental Era

The story of the Portland District is closely linked to the rivers of Oregon and southwestern Washington. All of the U.S. Army Corps of Engineers' (Corps) districts have distinctive characters – and Portland's is shaped by its location in the Columbia River Basin, the largest river system in the West. As William F. Willingham demonstrated in his book, *Army Engineers and the Development of Oregon: A History of the Portland District U.S. Army Corps of Engineers* (1983), the Corps was instrumental in developing the early commerce of the Pacific Northwest, which depended heavily on the region's water routes. The Portland District, established in 1871, improved navigation on the Columbia and Willamette rivers during the late 19th century, allowing for passage of ships and barges. The Corps also strengthened maritime commerce by building jetties along the coast and by dredging, often in areas where rivers emptied into the sea. In the 20th century, the agency's missions expanded to include flood control, irrigation, hydropower, and recreation, and the Portland District constructed large multipurpose dams along the Columbia River, as well as a series of smaller dams along the Willamette River. These projects provided inexpensive electricity, spurring industrial development and population growth in the Pacific Northwest through the end of the century. The following history continues the story presented in Willingham's book, focusing on the period 1980-2000.

While the District's work remained centered on the region's rivers and coastlines, new themes emerged during this period. These included a growing national concern for environmental protection, which influenced every aspect

of the District's work in the late 20th century. During the last three decades, some Americans came to appreciate the importance of ecosystems, biodiversity, and water quality in a way that differed considerably from the nation's earlier interest in conservation. The environmental movement resulted in a growing number of regulations as well as directives from Congress in the 1970s and 1980s, many of which affected the Corps. Although the agency continued to serve older missions – such as navigation, flood control, irrigation, and hydropower – its emphasis gradually shifted to new initiatives during the years 1980-2000.

By the late 20th century, the Corps had adopted an environmental mission, and the rivers and coastlines of Oregon and southwestern Washington had become the focus of the District's new environmental work. The nature of this work developed throughout the decades, as the Corps moved from an initial mere compliance with the new regulations to becoming actively engaged in the protection of water quality, restoration of wetlands, and cleanup of hazardous waste sites. In some instances, the District began looking to non-structural solutions to traditional problems such as flooding.

While the environmental movement influenced all districts in the Corps, the issues that it sparked became especially significant in Portland. The most visible of these involved the endangered salmon and steelhead populations that depended on rivers and streams located in the District. As protection of endangered species became a concern of increasing prominence, the District devoted considerable resources to researching and updating fish-passage facilities at its dams. Few issues proved more controversial or more profoundly affected operations at Corps dams. A myriad of competing interests converged here, including tribes, federal and state agencies, commercial and recreational fishers, barge operators, farmers, environmental groups, and

a growing number of industries and residents that demanded electricity. "We're at the cutting edge of so many environmental issues," observed Colonel Eric T. Mogren, Deputy Division Engineer of the Northwestern Division, "dealing with hydropower, fish, and tribal and treaty rights."[1]

Colonel Mogren also pointed out that responding to environmental concerns brought a need for coordination among various interests, which quickly became a complex process. In his estimation, the Corps has been one of the leaders in collaboration and partnering with other agencies regarding environmental issues. "That's what the Corps is," he explained. "We are problem-solvers." While historically the problems confronting the agency had been technical and structural in nature, recent "key environmental challenges facing the nation and the region" have required the engineers to adopt new approaches.[2]

In describing the District's distinctive personality, many employees during the late 20th century noted the strong influence of the environmental movement.[3] Western Oregon has long been associated with environmental values, and popular portrayals have depicted the region as a place of natural beauty, abundant wildlife, and advocacy for protection.[4] District personnel were affected by their location – and many of them resided in Oregon and southwestern Washington by strong preference. "We live here as well as work here", explained Davis Moriuchi, Deputy District Engineer for Project Management, noting his attachment to his community.[5]

The Water Resources Development Act of 1986

The Water Resources Development Act of 1986 (WRDA-86) represented another significant trend affecting the District's work during the period 1980-2000. This legislation marked a major shift in the nation's attitude toward water resources planning. According to historian Martin Reuss, the statute directed non-federal interests to accept more of the financial and management burdens of water resources management and required water resources projects to have a sound economic basis. Furthermore, its passage reflected a widespread agreement that environmental considerations were integral to water resources planning.[6]

Although historically the federal government had responsibility for managing the nation's water resources, by the 1960s and 1970s that role had come under scrutiny.

During this period, Americans became increasingly skeptical toward the federal government, including the Corps. The public's suspicions were based on the belief that "the federal bureaucracy was bloated and inefficient, that ill-conceived government spending contributed to the nation's economic decline, that too much was being done at the national level, and, in the words of Ronald Reagan, that government was 'taxing away the American way of life.'"[7] The public was also influenced by the growing environmental movement, and, for the first time, many Americans were more interested in the recreation and environmental components of water resources projects than in irrigation, navigation, or flood control.[8]

In 1976, President Jimmy Carter based his campaign, in part, on a commitment to challenging traditional water resources projects. Already in July 1975, his campaign office issued a press release stating his position that "the Army Corps of Engineers ought to get out of the dam building business." Carter declared, "I personally believe that we have built enough dams in this country and will be extremely reluctant as president to build any more." On a larger scale, he vowed to protect the natural environment, asserting that "the federal government can and must play a significant role in the preservation of natural areas and resources."[9] Following up on his campaign pledge, President Carter reviewed hundreds of federal water resource projects, producing a "hit list" of proposed dams.[10]

During this period, Corps leaders became anxious about the agency's future. Federal funding of large reservoir projects had peaked in the 1960s, and, whereas in the 19th century states and localities had sought financial assistance for water resources projects from the federal government, it was now the federal government that sought economic aid from non-federal interests. In 1984, for the first time in the agency's history, operation and maintenance expenditures exceeded construction expenditures. [11]

While attitudes toward large federal water projects were shifting, there was a simultaneous need to rehabilitate or replace an aging water resources infrastructure. By the mid-1970s the nation was faced with approximately 3,000 dams in need of repair, and many navigation locks were deteriorated or were too small for modern shipping. The challenge was to find a way to eliminate questionable projects while still responding to legitimate water resources needs.[12] "The Corps' personnel, water resources mission, and very existence were brought into question," Reuss explained. "The agency needed a water resources bill, and cost sharing was the key."[13]

Eventually, Congress passed a water resources bill. On November 17, 1986, President Ronald Reagan passed the first major water resources legislation since 1970 – the WRDA-86. While President Carter had addressed both the environmental and economic impact of federal water resource projects, Reagan was concerned with cutting federal spending. Reducing the federal budget was part of Reagan's effort to incorporate federalist values into American government. The concept of federalism, which dated back to the earliest days of the republic, was reconceived in the second half of the 20th century as "new federalism." According to historian Samuel Beer, Reagan's version of federalism sought to cut back the welfare state and to restore the free market.[14] As President Reagan, in his first inaugural address, stated, "Government is not the solution to our problem. Government is the problem."[15] Later in the address he added that it was his intent "to curb the size and the influence of the federal establishment and to demand recognition of the distinction between the powers granted to the federal government and those reserved to the states or to the people."[16]

Reagan's election to the presidency reflected, in part, the public's desire to see reduced taxes and government spending. During the 1980s, there was an increasing emphasis on lowering the federal budget. The Corps was not immune to this trend, and the agency experienced considerable pressure to shrink its costs. It was during this period, for example, that the majority of the Corps' dredging work was transferred to private industry. The WRDA-86 was also part of the movement to decrease the federal government's costs.

The passage of the act had an immediate effect on the Corps' operations. Most significantly, the statute changed the funding of civil works projects. It established new cost-sharing requirements for the planning, construction, and operation and maintenance of projects for navigation, flood control, and other purposes. It also established national and local user fees, ensuring that non-federal interests would play a role in planning, financing, and maintaining water projects.[17]

The non-federal share of navigation project costs increased dramatically with WRDA-86. The act reflected a general agreement that non-federal interests – such as states, port authorities, commercial navigation companies, and local communities – should accept more of the financial and management burdens of projects. During the construction of navigation channels, for example, local interests were asked to pay from 10-50 percent of project costs, depending on the depth of the channel. To recover their share of the costs, the law allowed ports to levy port or harbor dues. In addition, non-federal sponsors were required to provide necessary lands, easements, rights-of-way, relocations, and dredged material disposal areas required for the project. WRDA-86 also authorized funding of specific modifications to the inland waterway system with one-half of the costs from the Inland Waterways Trust Fund. Furthermore, the statute imposed cost sharing on flood control projects. For the first time, local interests were required to contribute funds for reservoirs, levees, floodwalls, and channels, as the act mandated that they pay

at least 25 percent of the project's construction costs and 100 percent of the maintenance costs. [18]

WRDA-86 continued to de-emphasize the construction of federal water projects. Although work continued on projects authorized before passage of the act, Congress had authorized few new starts for Corps water resource projects in the 10-year period from 1976-1986. With the WRDA-86, Congress took a further step and deauthorized $11.3 billion worth of Corps' projects. Although the act called for the study or construction of 270 new projects, it subjected them to the new cost sharing rules and to more rigorous mitigation requirements.[19]

Ten years after the passage of the WRDA-86, President Bill Clinton signed the Water Resources Development Act of 1996 (WRDA-96). This legislation authorized new studies and construction projects for the Corps, as well as changed existing laws. Overall, however, the act continued the trend toward reducing federal costs through a variety of arrangements. WRDA-96, for example, raised the contribution of non-federal sponsors of Corps' flood control and environmental restoration projects, from 25 to 35 percent. It also increased the use of private industry hopper dredges, by requiring the agency to set aside an additional one million cubic yards of material for private dredging companies.[20]

The passage of the WRDA-86 expressed a tension between those who believed that an adequate transportation system was a national responsibility benefiting the nation's entire economy, and those who insisted that beneficiaries and users should bear a substantial portion of a project's cost. Many hoped that the cost-sharing provisions of the bill would give the Corps a new credibility by making local and state interests weigh the costs and benefits of a project more carefully. "The cost-sharing formulas can't guarantee that every new water project will be worth the price," *The New York Times* suggested. "But they will force state and local interests to weigh the costs against the benefits more conscientiously and to foot part of the bill for mistakes."[21] As Reuss pointed out, WRDA-86 challenged federal and non-federal interests as never before "to work together to develop projects that are economically, environmentally, and socially responsible."[22] This legislation brought a new context to the Portland District's work.

Changes in the Work Environment

By the 1980s, the era of large-scale water resources development had passed, and the Portland District's focus had moved to smaller environmental projects. This shift in the nature of the agency's work was also reflected in the workplace. One significant trend during the late 20th century was an increasing business orientation among District personnel and a new approach to customers. "We became more cost conscious," recalled David Beach, Operations Manager, "and more aware of time commitments."[23] The adoption of project management was part of this process. Historically, Corps districts functioned on a "stovepipe" model, with projects passing from one area – planning, engineering, construction, operations – to the next, each with its own manager. Under that system, no

single person assumed responsibility for budgets or delivery schedules. To increase efficiency, the Corps adopted the model of a single project manager who oversaw each job from concept through completion, much like a business model from the private sector. This new approach emphasized teamwork, cost control, and timeliness – and it signaled a major change for many long-term employees accustomed to the older system.

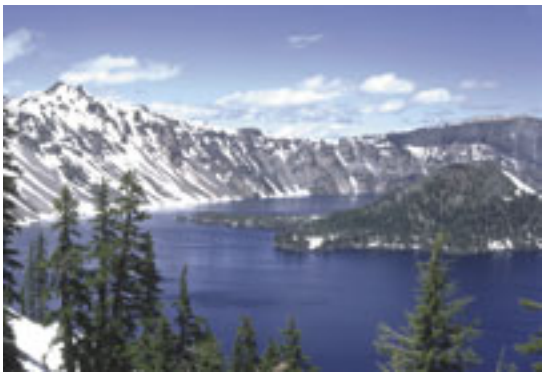
In addition to changes in business practices, the Corps recognized the need for reorganization during the 1980s. Proceeding on a piecemeal basis, this process extended into the 1990s – and it affected the Portland District in a number of ways. As a result of division realignment, for example, the Portland District became part of the new Northwestern Division, much larger in size and scope than the older North Pacific Division. The Portland District also closed some of its project and area offices during this period. While these changes demonstrated the Corps' longstanding ability to adapt to changing national and regional conditions, they affected the morale of District personnel.

An additional development included incorporation of new and rapidly changing technology, which proved to be a process with mixed results. Changes in technology affected the District's financial accounting systems and brought significant changes to the Engineering and Construction Division. Staffing and budgeting became increasing concerns, and like many businesses in the private sector, the District faced the challenge of recruiting and retaining new employees.

The Geography and Climate of the Portland District

The Portland District's boundaries cover 79,405 square miles in western and central Oregon and 8,740 square miles in southwestern Washington. The District encompasses five geographic regions: Coast Basin, Willamette Basin, Oregon Interior Basin, Middle Columbia River Basin, and Lower Columbia River Basin. This varied and complex landscape provides a unique set of challenges and opportunities for the District.

The first of these regions, the Coast Basin, draws thousands of visitors each year, who come for the scenery and recreational opportunities. This region encompasses a variety of natural features, including the watersheds



of the Umpqua, Coquille, and Rogue rivers, as well as several short coastal streams. On the coast, visitors encounter Oregon's beaches, estuaries, and bays. Moving inland, they discover the ridges, peaks, and river valleys of the interior. This region of the Coast Basin is also home to several mountain chains. These range from the rugged, hilly Coast Range to the massive Klamath Mountains, which attain heights of 7,500 feet. The region's climate is varied; annual precipitation fluctuates from 60 inches on the coast to more than 100 inches on the slopes of the Coast Range. The population of the Coast Basin is unevenly distributed, with the majority of the area's residents making their home along the coast or in one of the basin's towns or cities. The basin's economy is closely tied to the region's natural resources; logging, farming, fishing, and recreation are the dominant industries.[24]

Home to approximately two-thirds of Oregon's population, the Willamette Basin is a heavily populated region. It includes the eastern slope of the northern Coast Range, the Willamette Valley, and the western slope of the northern Cascade Range. Several natural features make this area attractive to residents. In the valley the moderate rainfall, mild temperatures, low elevations, gently undulating surfaces, and good soils are conducive to agriculture, and many types of crops are cultivated. Adding to the Basin's popularity, the valley is also a corridor that provides several transportation routes connecting Oregon with western Washington and California. Finally, both the Coast Range and the Cascades provide the valley with water, timber, and recreational opportunities.[25]

The Oregon Interior Basin is one of the driest parts of the state. Large areas of Harney County, for example, receive less than 10 inches of precipitation each year, and, with the exception of the higher elevations, the remainder of the region has less than 20 inches. While these lower areas are semiarid, the higher elevations are subhumid and can support many types of trees. Due to its aridity, the region is more thinly populated than other parts of the state. Most of the people live in clusters, based on the availability of water.[26]

Uniting the last two regions – the Middle and Lower Columbia River Basins – is the mighty Columbia River. The Columbia is the nation's second largest river, in terms of water flow, and its largest producer of hydropower. It is also the location of some of the District's most visible projects, including John Day, The Dalles, and Bonneville dams. Beginning in the Canadian Rockies, this river flows a distance of 1,270 miles to the Pacific Ocean and drains 258,000 square miles. Although it became the focal point of controversy and contention in the late

20th century, geographically it served as a unifying element. "More than any other physical feature it knits the disparate elements in the Pacific Northwest together," suggested historian Carlos Schwantes, "crossing desert, high plains, wheat fields, cattle ranges, and grassland as it threads its way between mountains to the sea." Over time, that this river has been "a vital transportation link and highway of history, a source of irrigation water and hydroelectric power," …and dramatic "regional symbol."[27]

The Middle Columbia River Basin encompasses a large section of the Columbia River, as well as lands both north and south of the river. The primary land use in the region is agriculture. The north side of the Columbia River supports one of the most productive fruit and vegetable regions in the United States, while directly south of the river, in Oregon, wheat production dominates.[28] The area also includes sections of the Blue Mountains, which consist of many small mountain ranges or ridges with intervening plateaus, canyons, and basins. Land uses in the Blue Mountains vary with altitude and water supply. The basins and lower valleys are generally irrigated, with hay being the primary crop. The lower foothills are grazed or dry-farmed, often for wheat. Logging occurs in the ponderosa pine forests, while recreation is the major land use in the highest elevations. The Middle Columbia River Basin's climate is semiarid to subhumid, with the heaviest precipitation – about 20 inches – occurring on the lower slopes of the Cascade Range and the Blue Mountains. The least rainfall is near the Columbia River, east of The Dalles, where the average is less than 10 inches.[29]

The Lower Columbia River Basin traces the Columbia River from east of Portland to its outlet in the Pacific Ocean. It also includes a small section of southwestern Washington and the Cascade Mountains. The region's forested slopes have made it home to a number of logging operations. While a good deal of the District's work focuses on the Columbia River, the Cascade Mountains have become one of the most prominent features of this region. The Cascades, which extend throughout much of Oregon and Washington, are volcanic in origin – a fact that was made prominent by the eruption of Mount St. Helens in 1980. The Cowlitz River, which originates on Mt. Rainier, drains an

area of approximately 2,480 square miles. Included in the Cowlitz River Basin is the Toutle River Basin, which drains 512 square miles and received the major impact from the eruption.[30]

While the physical landscape dictates much of the Corps' work, the District is also influenced by its location in Portland. As the only major river port in the western United States, Portland's position proved to be a crucial component of its success. "The rivers have made Portland," noted Carl Abbott, a professor of urban studies at Portland State University.[31] Situated near the confluence of the Willamette and the Columbia rivers, this was "the city that gravity built."[32] In addition to being an integral part of the city's economic life, local rivers also contribute to Portlanders' sense of place. Residents visit Portland's rivers to bird-watch, fish, and hike. City festivals congregate on the banks of rivers, and undeveloped riverside land has become "cherished open space."[33]

The importance of rivers and other natural spaces to city residents hints at one of Portland's most prominent characteristics – its "creative cohabitation of country and city." Abbott described how the city's use of two very different emblems symbolized its character as a community. One was the blue heron, adopted as an official city symbol in 1986. According to Abbott, "This graceful bird that thrives in the riverside marshes wending through the metropolis seemed a natural mascot to Mayor Bud Clark, who enjoyed early morning canoe trips along the Willamette River." The other emblem was a large copper statue of "Portlandia," which looks over the downtown bus mall and represents civic life and commerce. Thus, Portlanders cherish both their natural heritage as well as their urban accomplishments. Abbott asserts that, "this careful balance between environmentalism and urbanism introduces one of the several creative tensions that have shaped the character of Portland over the past generation."[34] Two additional icons associated with Portland – Mount Hood and the rose – further demonstrate the blending of the wild and the cultivated in the city.[35]

An additional characteristic identified by Abbott was the "small-town feel" of Portland. While Seattle was "frantic, congested, and fast paced" – a "New York with coffee" – Portland remained "comfortable, low key, willing to take some time to enjoy its surroundings." Portland's downtown featured inviting public spaces and short, walkable blocks, preserving a "human scale."[36] Many Corps employees agreed with this assessment of Portland, adding that the relaxed atmosphere extended to the District. While the District maintained more than 1,000 employees during the period 1980-

2000, many described a close-knit atmosphere and camaraderie with their co-workers.[37]

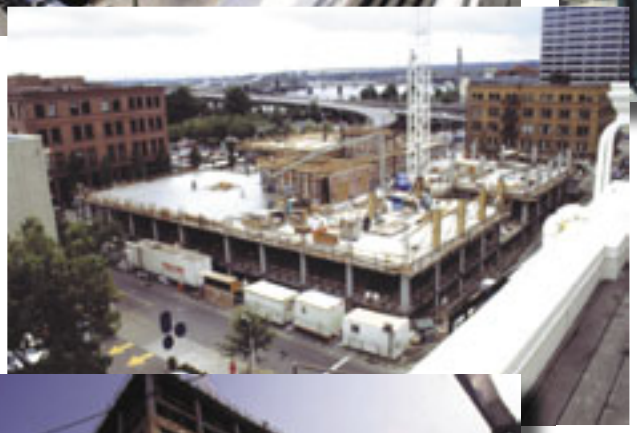
This book explains how the District responded to the physical landscape of Oregon and southwestern Washington, and how its personnel adapted to new values and a changing work environment during the period 1980-2000. It is organized into seven chapters. The first of these describes Civil Works, explaining how the District's missions regarding hydropower, flood control, and recreation continued into the late 20th century. Chapter Two concerns the District's navigational mission, including its dredging activities and channel deepening projects. Chapter Three addresses the District's environmental and regulatory work, analyzing the incorporation of new values into the Corps' mission, while Chapter Four discusses endangered species issues, particularly salmon, and how they brought significant changes to the District and the region. The readiness component of the Corps' mission is examined in Chapter Five, which describes the District's extensive efforts in the recovery following the Mount St. Helens eruption. This chapter also explores the District's response to the Alaska Oil Spill, Flood of 1996, and other disasters. Chapter Six details the considerable changes in the District's business practices and workplace, addressing the changing political environment, increased partnering and cost sharing, and Corps reorganization. This chapter also examines the District's leadership development programs and recruitment and retention programs. The final chapter discusses the District's adaptations to new technology.

The Multnomah Building, Portland, OR.

The headquarters for the Portland District moved to One Oak Plaza from the Multnomah Building in 1991. The name of the new building was later changed to Robert Duncan Plaza.

Artist's concept of the Robert Duncan Plaza building.

The construction of the Robert Duncan Plaza building, the new home for Portland District Corps of Engineers.



Endnotes

[1] Col. Eric T. Mogren, Interview with Lisa Mighetto, Portland, Oregon, May 7, 2001. Hereafter cited as Mogren Interview.

[2] Mogren Interview.

[3] See, for example, Davis Moriuchi, Interview with Lisa Mighetto, Portland, Oregon, June 15, 2001 and Doug A. Clarke, Interview with Lisa Mighetto, Portland, Oregon, June 15, 2001.

[4] See, for example, Ernest Callenbach, *Ecotopia* (Berkeley: Banyan Tree Books, 1975).

[5] Davis Moriuchi, Interview with Lisa Mighetto, Portland, Oregon, June 15, 2001.

[6] Martin Reuss, *Reshaping National Water Politics: The Emergence of the Water Resources Development Act of 1986* (Fort Belvoir, VA: U.S. Army Corps of Engineers, Institute for Water Resources, 1991), p. 1.

[7] Martin Reuss, *Reshaping National Water Politics: The Emergence of the Water Resources Development Act of 1986* (Fort Belvoir, VA: U.S. Army Corps of Engineers, Institute for Water Resources, 1991), p. 37.

[8] Martin Reuss, *Reshaping National Water Politics: The Emergence of the Water Resources Development Act of 1986* (Fort Belvoir, VA: U.S. Army Corps of Engineers, Institute for Water Resources, 1991), pp. 35-36.

[9] Jeffery K. Stine, "Environmental Policy During the Carter Presidency," in *The Carter Presidency: Policy Choices in the Post-New Deal Era* (Lawrence, Kansas: University Press of Kansas, 1998), p. 182.

[10] Stine, *The Carter Presidency: Policy Choices in the Post-New Deal Era*, p. 187.

[11] Martin Reuss, *Reshaping National Water Politics: The Emergence of the Water Resources Development Act of 1986* (Fort Belvoir, VA: U.S. Army Corps of Engineers, Institute for Water Resources, 1991), pp. 30, 36-37, 46.

[12] Martin Reuss, *Reshaping National Water Politics: The Emergence of the Water Resources Development Act of 1986* (Fort Belvoir, VA: U.S. Army Corps of Engineers, Institute for Water Resources, 1991), pp. 38-39.

[13] Martin Reuss, *Reshaping National Water Politics: The Emergence of the Water Resources Development Act of 1986* (Fort Belvoir, VA: U.S. Army Corps of Engineers, Institute for Water Resources, 1991), p. 46.

[14] Samuel Beer in Timothy Conlan, *New Federalism: Intergovernmental Reform from Nixon to Reagan* (Washington, D.C.: The Brookings Institution, 1988), p. xiii.

[15] Timothy Conlan, *New Federalism: Intergovernmental Reform from Nixon to Reagan* (Washington, D.C.: The Brookings Institution, 1988), p. 1.

[16] Conlan, *New Federalism: Intergovernmental Reform from Nixon to Reagan*, p. 97.

[17] Martin Reuss, *Reshaping National Water Politics: The Emergence of the Water Resources Development Act of 1986* (Fort Belvoir, VA: U.S. Army Corps of Engineers, Institute for Water Resources, 1991), pp. 196-199.

[18] United States Department of Interior web site, accessed at http://www.doi.gov/oepc/wetlands2/v2ch4.html, on June 1, 2001.

[19] United States Department of Interior web site, accessed at http://www.doi.gov/oepc/wetlands2/v2ch4.html, on June 1, 2001.

[20] U.S. Army Corps of Engineers, Portland District, "President Signs 1996 Water Resources Development Act," October 21, 1996, News Release, accessed at https://www.nwp.usace.army.mil/pa/info/wrda.html, on June 1, 2001.

[21] *New York Times*, November 22, 1986, p. 30 as quoted in Martin Reuss, *Reshaping National Water Politics: The Emergence of the Water Resources Development Act of 1986* (Fort Belvoir, VA: U.S. Army Corps of Engineers, Institute for Water Resources, 1991), p. 199.

[22] Martin Reuss, *Reshaping National Water Politics: The Emergence of the Water Resources Development Act of 1986* (Fort Belvoir, VA: U.S. Army Corps of Engineers, Institute for Water Resources, 1991), p. 199.

[23] David C. Beach, Interview with Lisa Mighetto, Portland, Oregon, June 12, 2001. Hereafter cited as Beach Interview.

[24] Samuel N. Dicken and Emily F. Dicken, *Oregon Divided: A Regional Geography* (Portland, Oregon: Oregon Historical Society, 1982), pp. 16, 39, 77.

[25] Dicken, *Oregon Divided: A Regional Geography*, p. 42.

[26] Dicken, *Oregon Divided: A Regional Geography*, p. 133.

ENDNOTES

[27] Carlos Arnaldo Schwantes, *The Pacific Northwest: An Interpretive History* (Lincoln, Nebraska: University of Nebraska Press, 1989), p. 13.

[28] *Virtual Atlas of the Pacific Northwest*, accessed at http://www.evergreen.edu/user/virtatpnw/SUBRGNS/columbia/gorge_body.html, on June 1, 2001.

[29] Dicken, *Oregon Divided: A Regional Geography*, pp. 98, 105, 115, 138.

[30] United States Geological Survey, accessed at http://vulcan.wr.usgs.gov/Volcanoes/MSH/Hydrology/Drainages/Cowlitz/description_cowlitz.html, on June 1, 2001.

[31] Carl Abbott, *Greater Portland: Urban Life and Landscape in the Pacific Northwest* (Philadelphia: University of Pennsylvania Press, 2001), p. 29.

[32] Schwantes, *The Pacific Northwest: An Interpretive History*, p. 236.

[33] Abbott, *Greater Portland: Urban Life and Landscape in the Pacific Northwest*, p. 61.

[34]Abbott, *Greater Portland: Urban Life and Landscape in the Pacific Northwest*, p. 3.

[35] Abbott, *Greater Portland: Urban Life and Landscape in the Pacific Northwest*, p. 17.

[36] Abbott, *Greater Portland: Urban Life and Landscape in the Pacific Northwest*, p. 39.

[37] Beach Interview; Miguel Jiminez, Interview with Lisa Mighetto, Portland, Oregon, June 13, 2001; Diana C. Brimhall, Interview with Lisa Mighetto, Portland, Oregon, June 13, 2001.

Civil Works

Chapter One
Civil Works

"Completion of the Bonneville second powerhouse is a major milestone in the effort begun half a century ago to fully and wisely utilize the Columbia River. The newest hydroelectric project on the Columbia reaffirms the principle firmly established by the original Bonneville Project – renewable energy resources are our region's most effective energy resources."
U.S. Senator Mark O. Hatfield, 1983

"Historically, the only questions we've asked is where and whether to build dams. And those questions are out of date."
Jim Bida, Oregon Natural Resources Council, 1994

"We realize these lakes are prime summer recreation spots. It's frustrating for us to not be able to meet the needs of all our customers all the time... we are dependent on Mother Nature."
Colonel Randall J. Butler, District Engineer, 2000

Bonneville second powerhouse

Lake recreation

Wetland restoration

Multipurpose Dams

When most people think of the Corps of Engineers they think of large dams. Yet the Portland District's work has been diverse, beginning in the 19th century with extensive hydrographic surveys and navigation improvements on the Columbia and Willamette rivers and along the coast. For the most part, the era of large dam-building lasted four decades in the Columbia Basin, spanning the 1930s through the 1970s. By 1980, this era had ended in the Pacific Northwest. After that time, the Corps became involved in restoring wetlands, expanding fish-passage facilities, and providing additional recreation facilities. Even so, as the Flood of 1996 and the power emergency of the early 21st century demonstrated, flood control and the generation of hydropower – made possible by large multipurpose dams – remained significant missions during the late 20th century.

The federal government funded construction of large multipurpose dams in the West, as individuals and private companies were unable to finance them. During the late 1920s, Congress authorized the Corps to compile information on stream flows, hydrography, topography, irrigable lands, and flood-prone areas, producing a comprehensive plan for developing the nation's water resources. The engineers began the plan for the Columbia River Basin in 1927, under the authority of that year's Rivers and Harbors Act, with the Seattle District surveying the Columbia River above the Snake and the Portland District studying the lower Columbia. The proposed large multipurpose projects provided hydropower, along with flood control, improvements in navigation, and irrigation.[1]

The District's large multipurpose dams represent a significant development in the Pacific Northwest. Few 20th-century projects brought greater economic benefits to the region than the dams along the Columbia River. Bonneville Dam, completed in 1938, ranked as "one of the major engineering and construction achievements of the century."[2] Located approximately 40 miles east of Portland, Bonneville was the first in a series of large multipurpose projects on the Columbia River. It

was followed by construction of The Dalles Dam, completed in 1957, and John Day Dam, completed in 1968. This system of dams provided inexpensive power to thousands of people, while also attracting industries to the region. Historically, the Pacific Northwest had depended on logging, mining, farming, and fishing – and the availability of affordable electricity diversified and expanded the region's economy, encouraging, for example, the location of aluminum industries in the area. Without the large multipurpose dams along the Columbia River, many residents would not live in Portland and Seattle today.[3]

The development of a system of dams along the Columbia River was in keeping with the ideals of the Progressive conservation movement, which emerged during the late 19th and early 20th centuries. Support for irrigation projects had been firmly rooted in the West since the early 20th century, with the passage of the Newlands Act in 1902 and the establishment of a Reclamation Service, which some early conservationists promoted. They were concerned that the nation's resources be used wisely and efficiently. Rivers, they believed, should be controlled to produce the maximum benefit to humans. Progressives in the early 20th century focused on eliminating waste, not on protecting habitat – and water that flowed down a river without being utilized to benefit humans was considered to be a wasted resource. By the 1920s and 1930s, this support had extended to generation of hydropower, and conservationists viewed the generation of electricity as an efficient use of water resources.[4] The environmental movement of the 1960s and 1970s brought new values and concerns that prompted many Americans to regard dams in a different light [See Chapter Four]. While this development discouraged new construction during the period 1980-2000 – affecting projects such as Elk Creek Dam – the District nevertheless continued to operate, maintain, and upgrade the large multipurpose projects built before this time.

Constructing a Second Powerhouse at Bonneville Lock and Dam

During the late 20th century, the populations of Oregon and Washington increased considerably. The number of people in Oregon expanded from approximately two million in 1970, to almost three-and-a-half million in 2000.[5] In Washington, the population surged from more than three million in 1970, to nearly six million in 2000.[6] With the growing population came increasing energy demands. On the Columbia River newly built dams in Canada and Montana were increasing the amount of flow. The existing system at Bonneville, however, could not utilize this additional flow, and much of the water was simply spilled. Recognizing this loss of potential hydropower, the Bonneville Power Administration in 1965 requested that the Corps begin planning work for a second powerhouse.[7]

In 1933 President Roosevelt had approved the Bonneville Project, and Congress authorized it in the Rivers and Harbors Act of August 30, 1935 (409 Stat 1028). The original Bonneville Project, completed in 1938, consisted of a spillway dam, powerhouse, and navigation lock. Authorization for completion, maintenance, and operation of Bonneville Dam was provided in Public Law 329, 75th Congress (50 Stat. 731, Approved August 20, 1937, 16 U.S.C. 832). The Bonneville Project Act authorized the construction of additional power facilities as requested by the Bonneville Power Administration.[8]

Before beginning construction, the Corps studied 11 potential sites for the new structure. Two were on the Oregon shore, one was on Bradford Island, and eight were on the Washington shore. Based on an analysis of the benefits and costs, and the requirement not to preempt a site for a future navigation lock, the Corps recommended the construction of a 558.2-megawatt powerhouse on the Washington shore of the Columbia River in 1971. In deciding on the plant's maximum capacity, the agency had to consider the presence of important anadromous fish runs and the heavy recreational use of the river [See Chapter Four].[9]

The site chosen for the new powerhouse presented a number of challenges. The area selected was located on the toe of an 800-year old landslide, the Cascade slide. This slide, which measures approximately three miles by five miles, originated on the Washington side of the Columbia River, forcing the river to the Oregon side of the gorge. Beginning in 1974, construction workers had to move sections of this slide, a possible source for the Native American legend of the "Bridge of the Gods," in order to build the powerhouse. Engineers also had to create a "dry" hole in which to construct the powerhouse. They built a two-foot-wide, 200-

Site of the new Bonneville Second Powerhouse showing the town of North Bonneville.

Concrete cut-off wall and the 40-acre excavation nicknamed the "bath tub"

Relocated highway bridge and railroad underpass

Archaeological excavation site of an Indian settlement

foot-deep, 5,360-foot-long, concrete cut-off wall around the powerhouse excavation. The cut-off wall was built to elevation 80 on three sides to protect up to the Bonneville pool elevation. On the tailrace side it reached elevation 30. This massive area, which extended over 40 acres and required the excavation of six million cubic yards, became nicknamed the "bath tub." [10]

During this time, archaeologists conducted their own excavations and unearthed a relatively undisturbed centuries-old Indian settlement that was first noted in the journals of explorers Lewis and Clark. Through their work, archeologists uncovered thousands of artifacts, and the site was nominated to the National Register of Historic Places. The work, which was completed in 1979, cost $1.2 million [See Chapter Three].[11]

Other physical challenges also awaited the contractors. The project required the relocation of three miles of Burlington Northern's main line railroad and four miles of Washington State Highway 14. Moving the rail line required contractors to construct a 22-foot-wide by 36-foot high, 1,400-foot-long tunnel through the Cascade slide debris. Relocation of the highway required moving three bridges and one underpass beneath the railroad. Costs for these relocation efforts totaled approximately $32 million.[12]

The largest controversy concerned the resettlement of the town of North Bonneville, which was located at the powerhouse site itself, to a location approximately two miles downstream. After several years of negotiations among town officials, citizens, and the Corps, the Corps agreed to fund and create a new community at a place to be selected by the residents. The relocation was largely completed by 1978.[13]

Despite both natural and social obstacles, the Corps carried on its work. In April 1978, the prime contract for the second powerhouse was awarded to a joint venture of S.J. Groves and Sons, Peter Kiewit and Sons, and Granite Construction. This contract, which was for more than $246 million, was the largest ever awarded to that time by the Corps for a water resource project – and various design changes during construction over the next four years would bring the cost to over $300 million. In the process of construction, workers excavated 23 million cubic yards of earth. This material was used to fill and contour the new North Bonneville townsite as well as Hamilton Island, which was adjacent to the new town. At the peak of the project, nearly 1,500 workers were employed. Furthermore, due to concerns about the pressing need for energy, the contract called for completion of the project in 54 months, instead of the eight years a project of this scope would have normally taken.

Relocation of the town of North Bonneville, downstream of the powerhouse construction.

To complete the powerhouse in 54 months it took round-the-clock construction. Workers started at both ends and worked toward the center

To speed construction, workers on the powerhouse started from both ends and moved toward the middle, working three shifts a day, seven days a week, for three years.[14]

Commercial operation of the first unit began in May 1981. On May 26, 1981, at a dedication ceremony, Lieutenant General J.K. Bratton, Chief of Engineers, called the project a "magnificent achievement." At the ceremony General Bratton also commented that he was "looking forward to its completion in the fall of 1982 and another full-power ceremony." The final unit was set in place in June 1982. Once completed, the second powerhouse measured 985 feet long, 221 feet wide, and 210 feet deep. The eight generators and two smaller fish water generators added 558,000 kilowatts of generating capacity, which more than doubled the project's previous capacity.[15] In 1983, the total cost of the project was estimated at $640 million.[16] A formal dedication ceremony was held on June 1, 1983 to celebrate the Bonneville second powerhouse, which was "probably the last dam of its type to be built on the mighty Columbia River." [17]

Although the powerhouse was essentially completed in 1983, several aspects of the project continued over the next two decades. Workers added finishing touches on landscaping and design work, for example, in the 1990s. In addition, the District enhanced amenities for visitors. These extensive facilities included a fish viewing building that allowed visitors to observe migrating salmon and steelhead and other species through viewing windows. The project also featured active displays explaining the geology and history of the area, as well as the workings of modern hydropower plant.[18]

The powerhouse also contained numerous fish facilities. While some of these dated to the project's original construction, many features were updated and modified. Migrating adult and juvenile salmon and steelhead traveled upstream and downstream of Bonneville Dam. Shad, lamprey, and other species also passed the project. The project featured fish ladders, a collection facility for tagging and monitoring adult fish, and a downstream fingerling bypass system [See Chapter Four].[19]

Corps officials also addressed mitigation issues for the second powerhouse. The construction of the structure altered the physical landscape considerably. According to a report by the Washington Department of Game, in the process of building the facility, approximately 1,000 acres of fish and wildlife habitat were destroyed. The bottomland affected by the powerhouse was once an area of abundant wildlife populations. As the Corps noted in its "Washington Environmental Atlas," this was "critical wildlife habitat." As a result of the construction of the second powerhouse, 45 acres of wetlands were filled or drained, large areas of Columbia River floodplain were covered with excavated materials, and elevations of lowland areas were changed.[20]

A U.S. Fish and Wildlife Service (USFWS) report detailed more specifically the ecological communities lost as a result of the powerhouse. The vegetation of the site before the project's construction consisted of a diverse mix of riparian areas, pasture, shrub, deciduous and coniferous forest, and wetland communities. The upland area around Bass and Greenleaf lakes was used by black-tailed deer, elk, bobcat, black bear, great horned owl, ruffed grouse, band-tailed pigeon, coyote, deer mouse, long-tailed vole, Beechy ground squirrel, Townsend mole, and other animals. Riparian areas in the project site provided habitat for waterfowl, furbearers, and many small birds and mammals. Several species of resident and anadromous fish made their home in the project's creeks and lakes.[21]

Second Powerhouse Visitor Center fish viewing and exhibits

Adult fish counting and tagging facility

The Washington Department of Game's report offered several recommendations to mitigate the loss of this habitat. One proposal included the development of Hamilton Island, situated downstream of Bonneville, for Canada geese and songbirds and refilling Bass Lake to replace fish losses. The USFWS also recommended several habitat improvement measures, which were primarily directed at Franz, Arthur, and Bass lakes – located along the Columbia River in Skamania County, Washington – and Hamilton Island.[22]

One of the wildlife mitigation projects that the Corps undertook was located at Cascade Island, Washington, which was formed during the construction of the second powerhouse. Following the powerhouse's completion, the engineers developed the island into a winter foraging area for geese. In 1992, they installed a permanent irrigation system on the island to make the area easier to maintain. New topsoil also was added along with reseeding. "This is a valuable gosling habitat," project manager Gail Lovell explained. "We'll continue to maintain the area as needs become more apparent." Unfortunately, the efforts to create new vegetation at Cascade Island were not very successful. While there are geese on the island, there has not been much new growth.[23]

The Steigerwald Lake wetlands became a prominent component of this mitigation. Located on a 1,500-acre floodplain along the Columbia River, the Steigerwald Lake wetland area sits adjacent to the city of Washougal, Washington. Throughout the 1980s, conservationists and various state and federal agencies discussed the future of the wetland. The debates focused on the price of the property, who would manage it, and how it would be restored. The Corps purchased the tract and transferred management of it to the USFWS, which incorporated it into the Steigerwald Lake National Wildlife Refuge. The refuge includes remnant and human-made wetlands, riparian community blocks, developed pastures, a remnant stand of white oak, and Gibbons Creek, which supports small remaining runs of coho salmon and steelhead as well as a variety of native, resident fish.[24]

The Bonneville second powerhouse was a major construction effort that considerably transformed the physical landscape. Built to ensure a steady supply of power to Pacific Northwest residents and industries, the structure symbolized the region's continued dependence on hydropower. As U.S. Senator Mark O. Hatfield observed at the plant's dedication, "Completion of the Bonneville second powerhouse is a major milestone in the effort begun half a century ago to fully and wisely utilize the Columbia River. The newest hydroelectric project on the Columbia reaffirms the principle firmly established by the original Bonneville Project – renewable energy resources are our region's most effective energy resources."[25]

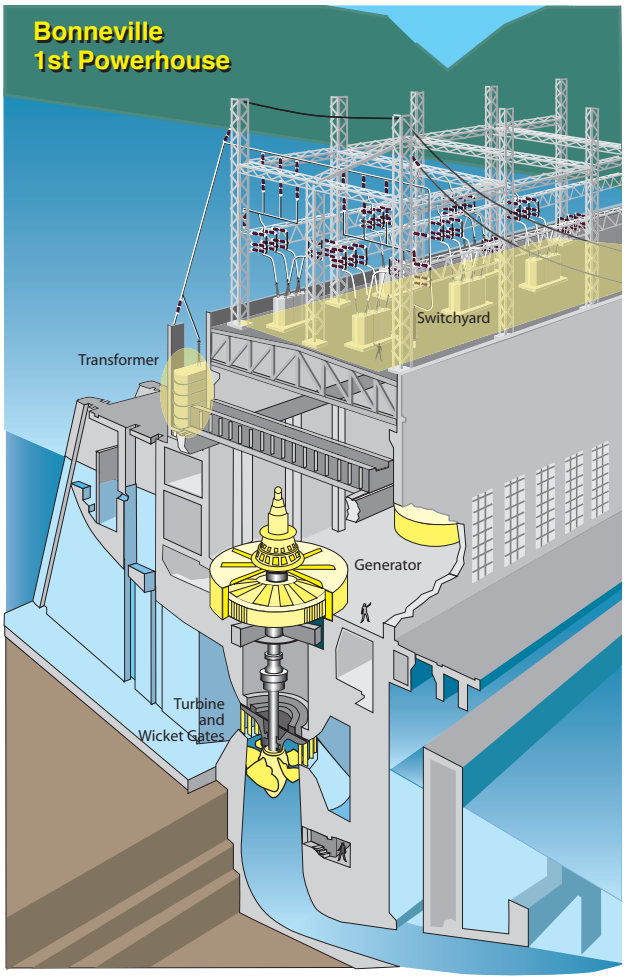
Rehabilitating the Original Powerhouse at Bonneville Lock and Dam

While constructing the second powerhouse was an important part of ensuring an adequate power supply in the Pacific Northwest, it was not enough to meet energy demands in the region. During the late 20th century, the original powerhouse at Bonneville, which had been in operation for over 50 years, showed signs of deterioration and declining reliability. Other Corps projects were also in need of rehabilitation during this period. Both John Day and The Dalles, for example, were updated and repaired, with work on The Dalles continuing into the 21st century. Some of the specific tasks included rewinding generators, refurbishing turbines, and replacing exciters.

At Bonneville, the Corps embarked on a major rehabilitation program for the powerhouse to ensure that the project would be capable of meeting power needs in the region. The rehabilitation of the original powerhouse, which began in 1993, included two phases. Phase I addressed issues concerning the powerhouse's transformers and switchyard. Phase II involved work on the turbines and generators. While work on phase II did not depend on completion of phase I, space limitations made it impossible to conduct the two phases simultaneously.[26] The goal of phase I was to replace the transformers and rehabilitate the switchyard. There were 21 main transformers at the powerhouse, 15 of which were installed between 1939 and 1941. Three additional transformers were added in 1945 and again in 1956. The transformers were an integral part of the powerhouse. They were the first link in connecting powerhouse generators to the Northwest power grid and converted the 13,800-volt output of the generators to the 115,00 and 230,000-volt levels used for cross-country transmission lines.[27]

Problems with the transformers appeared in the late 1980s. By the early 1990s, two of the original transformers had failed, and engineers suspected that the other ones were probably also nearing the end of their useful life. Furthermore, the original transformers employed an oil and water-cooling system that was worn out and also susceptible to breakdowns from internal leaks that allowed the water to contaminate the oil. This contamination would eventually lead to the failure of the transformer. In addition, the high-voltage connecting bushings on some of the original transformers contained insulation that had high concentrations of toxic Polychlorinated Biphenyls (PCBs). PCBs were commonly used in electrical insulation prior to the 1970s, because of the excellent fire-resistance.[28] These bushings measured 18 inches in diameter and six feet in length, and there was concern over potential PCB releases in the event of equipment failure. Finally, the original transformers posed maintenance difficulties. The transformers had five different manufacturers and vintages, making it hard to interchange spare parts and reducing the plant's versatility in the event of a failure.[29]

To address these issues, the Corps initiated a plan to replace the 21 original transformers with 15 larger ones. These new transformers would provide the same power capacity with renewed life expectancy, reduced maintenance requirements, greater operating flexibility, and no PCB hazards.



Phase I began in 1993 and was completed in the late 1990s. Asea Brown and Boveri of Hayward, California received the $27.1 million contract for the transformer work.[30]

The second component of phase I was to rehabilitate the 115 kV switchyard. The high-voltage switchyard at Bonneville carried huge amounts of electrical energy and contained the busses and switches that connected the main transformers to the transmission lines leaving Bonneville. It also housed the high voltage circuit breakers, which interrupted the full flow of transmission line power in an emergency.[31]

The aging switchyard at Bonneville increased fire, safety, and environmental dangers. The original circuit breakers, for example, were filled with large quantities of flammable insulating oil that frequently had to be transferred into the powerhouse for purification.

Work on the turbines in the First Powerouse

Leaks and contamination rendered unusable the piping system designed to deliver oil to the switchyard breakers, compelling Bonneville employees to transfer the oil using tanker trucks and hoses, which increased the risk of oil spills and fires. The presence of PCBs posed an additional hazard. The high-voltage bushings on the circuit breakers contained high concentrations of PCBs – some of which were more than 2,000 times over EPA standards. Corps officials worried that PCBs would be released if there were a catastrophic failure – and experience demonstrated that there was reason for concern. Between 1987 and 1993, two bushings exploded, damaging adjacent equipment and scattering PCB-contaminated insulating compound over a wide area. Agency officials worried that another explosion could expose workers or the public to PCB or that PCB-contaminated material would reach the Columbia River. In addition to safety concerns, maintenance of the 50-year-old breakers had become difficult due to the unavailability of parts. Custom made replacements were costly and caused long delays.[32]

The rehabilitation plan for the aging switchyard called for replacing the oil-filled circuit breakers with a newer design that allowed fewer breakers to be used, lowering the cost of rehabilitation. The updated breakers also used a non-flammable insulating material that allowed a less-expensive fire control system to be installed. Additionally, the new breakers were free of PCBs. By installing modern equipment, the Corps also ensured that spare parts for maintenance needs would be readily available, and, by installing uniform breakers, they reduced the costs of training and parts inventories. The Corps awarded a $1.72 million contract for this rehabilitation effort to Lamb Engineering and Construction Company of Salt Lake City, Utah.[33]

Phase II of the project, which continued into the early 21st century, improved the reliability of the powerhouse's 10 turbine-generator units. The turbines, which resembled enormous five-bladed fans, swept through a circle 23.5 feet in diameter, and each blade weighed nearly 13 tons. As water poured down over the blades it caused them to rotate, producing up to 74,000 HP per turbine. The power from the turning blades was then transferred to electrical generators through shafts more than three feet in diameter and over 50 feet long.[34]

Problems with this system emerged in the 1980s, when extensive fatigue cracks began to appear in the turbine blades of all powerhouse-generating units. Sections of the blades broke off, causing significant increases in total system power production costs. The

value of the lost power revenue from a 1984 turbine failure, for example, cost approximately $1.4 million. In addition to the problem of cracking blades, the total amount of energy that the powerhouse produced gradually declined. Surface erosion and repeated blade repairs caused a loss in efficiency of about 4.5 percent. Finally, there was evidence that deterioration in turbines might also result in significantly increased mortality in juvenile fish that passed through them.[35]

Phase II also addressed the generators at Bonneville's original powerhouse. The 10 synchronous generators converted rotating mechanical energy from the turbines into electrical energy. Each generator included a rotating field winding (rotor) and a stationary armature winding (stator). Over the years numerous stator coils suffered insulation failures that forced generators to be shut down. Heat, vibration, and expansion and contraction from thermal cycling and age all contributed to the insulation's breakdown. Some failed windings were repaired, while others required complete replacement. Without rehabilitation, however, stator reliability would have continued to deteriorate, causing more outages and unplanned repairs.[36]

To combat the decay, the Corps planned to replace the turbine hubs and blades in all 10 turbines. Replacing the turbine parts with modern fatigue-resistant designs and materials was the only long-term solution to the breakage problem. Newer turbine blades would also restore lost efficiency and add an additional one percent more power potential over the original capability. There was evidence to indicate that better efficiency would also positively impact fish passing through the dam. The Corps also intended to rewind the five generator stators that were in the worst condition.[37]

Phase II of the rehabilitation project was estimated to cost $89.1 million and would not be completed until 2010.[38] Voith Hydro Incorporated of York, Pennsylvania was awarded a $39.1 million contract to begin this phase of the project. The company's contract covered the design and supply of replacement parts and services for the powerhouse, including work on turbines and generators. The rehabilitation was expected to increase the output capacity of the 10 units by five percent, or 20,000 megawatt hours annually, each.[39] The Corps hoped that once the powerhouse was completely rehabilitated it would continue Bonneville's service in providing "stability to the power grid and reliable, economical hydropower to the western United States for decades to come."[40]

Building a New Navigation Lock

The new navigation lock at the Bonneville Lock and Dam was the District's last large-scale civil works project. While the original lock was still operable, after more than 50 years of service, it was clear to both river users and the Corps that a new lock was needed on the Columbia River. Construction on the new lock began in 1987, and by the spring of 1993, the lock opened to commercial traffic.

The Columbia and Snake rivers have long served as a vital transportation network for the Northwest. Together these rivers formed a water highway that ran 465 miles from the Pacific Ocean to Lewiston, Idaho. Keeping river traffic flowing smoothly and safely was of vital importance to the regional economy. It was crucial, therefore, that each of the locks on this river highway functioned appropriately. The original lock at Bonneville, completed in 1938, was the first of eight locks that stretched across the Columbia-Snake Inland Waterway. When first completed, it was the largest single lift lock in the world.[41] The farthest downstream, Bonneville handled the largest volume of commercial tonnage of all eight locks in the system. It was also, however, the smallest. Measuring 76 feet wide and 500 feet long, it had a water depth over the sill of 24 feet and a 66-foot maximum lift. To pass through this structure, tows with three or more standard-sized barges (42 feet by 220 feet) had to be separated and passed through the locks in smaller units and then recombined to continue their journey. As the years passed, the ability of the Bonneville lock to handle the growing amount of river traffic declined. Congestion delays were increasing, and the river's capacity as a transportation corridor was being constrained as the waterborne commerce through the lock neared its capacity.[42]

The project moved ahead when Congress authorized construction of a new navigation lock in the fiscal year 1985 Supplemental Appropriations Act, PL 99-88. Unlike many of the Corps' previous projects on the Columbia River, the

Site of the new navigation lock at Bonneville

Progress on the excavation site for the navigation lock. The Union Pacific railroad tracks were relocated and the "stealth wall" built.

Inland Waterway Trust Fund shared 50 percent of the project cost, in accordance with the Water Resources Development Act of 1986 (WRDA-86). A fuel tax on commercial vessels replenished the Inland Waterway Trust Fund.[43]

The new navigation lock was a major engineering project for the District, and its construction involved numerous contractors. The agency awarded the main lock construction contract in March 1990 to the joint venture of Kiewit Pacific Company of Vancouver, Washington and Al Johnson Construction Company of Minneapolis, Minnesota. This contract included construction of the upstream and downstream approach channels and the entire navigation lock. At $140.2 million, the contract was among the largest dollar bid offerings in the history of the District. The Corps also awarded a $34 million contract to the S.J. Groves Company (now Torno-America, Inc.) from El Dorado, California, for the construction of an upstream diaphragm wall. Other contracts were let for work on a guide wall, pontoons, water wells, and restoration of historic structures.[44]

Difficult site conditions challenged engineers and contractors throughout the project. Perhaps the biggest challenge was the fact that the site of the new lock was located in an area of historic landslide activity and variable underground geology. During the construction process, engineers checked plumbness and strictly controlled deflection to avoid starting landslides. An on-going program of instrument monitoring utilizing an Automatic Data Acquisition System (ADAS) continued to provide assurance that the ground was stable.[45]

The unique site conditions called for many innovative design solutions. Engineers had to plan, for example, a guard wall for site stabilization along the south bank of the upstream approach channel. The wall, completed in February 1991, required the relocation of roughly half a mile of the Union Pacific Railroad mainline. At 1,200 feet long, 135 feet high and 36 to 42 inches thick, it was a massive structure. Contractors built it using a slurry trench method because of the extremely limited workspace between the Columbia River and the railroad line on the Oregon shore. This method involved digging the trench for the wall, putting in reinforcing steel, and filling the trench with concrete. The wall was constructed entirely underground, and, as project manager David Brown joked, "It was called the 'Stealth Wall' during construction because it cost a lot, but you couldn't see it."[46]

Other creative engineering ideas were used in the construction of the guide walls. A unique floating guide wall was built at the upstream approach to assist traffic entering and leaving the lock. The guide wall included slots that allowed juvenile fish migrating downstream to pass through the wall and travel toward the fish bypass system.

Using RCC application on the downstream guide wall decreased the construction time on the navigation lock. These photos show working on the tunnels for filling and emptying conduits and designing the concrete swing bridge.

The downstream guide wall and wing wall were constructed of roller compacted concrete (RCC). When the wall was built it was the first application of RCC for a lock wall and was possibly the first soil foundation RCC wall. By permitting rapid construction, RCC decreased the length of the construction period and minimized the time required to have an open excavation at the toe of an ancient landslide.

In addition to the guard walls and guide walls, engineers incorporated other significant design features at the new navigation lock. Several drainage systems in and around the lock, for example, kept hydrostatic forces within design limits. The Corps developed a unique system beneath the lock floor using "popcorn" concrete that provided both the required foundation strength and eliminated the need for tiedown anchors to overcome uplift pressures. The lock chamber was formed within rock and used thin anchored concrete walls and tunnels for filling and emptying conduits – an economically efficient approach. Finally, the project included a concrete swing bridge at the downstream end of the lock. The bridge, which was mounted on a pedestal and swung out of the way to allow traffic through the lock, was only the third one of its kind in the world. Its unusual design included post tensioned, cast in place, concrete box girder construction. Unlike conventional swing bridges, which are made of steel, this one would not rust and required little maintenance.[47]

Designers of the new navigation lock relied extensively on modeling experiments conducted at the Corps' Waterways Experiment Station at Vicksburg, Mississippi. The station featured a large scale Columbia River model that enabled engineers to test numerous designs. Agency personnel used the model to design and locate the groins, which control currents. Columbia River towboat captains also traveled to Vicksburg to test concepts for approaches to the lock, using radio-controlled models.[48]

In the process of constructing the new lock, contractors excavated approximately 5.5 million cubic yards, enough rock and dirt to fill 687,500 standard-sized dump trucks. "Lined up end to end, these trucks would stretch 3,255 miles or clear across the United States!" noted a Corps public affairs publication.[49] So massive was this material that where to place it became an issue. At the request of several port authorities on the Bonneville pool, congressional action directed the Corps to provide excavated material, without cost, to upstream ports for use as fill material. Two Washington ports elected to receive the fill to make local municipal improvements; the Corps gave a combined total of 730,000 cubic yards of rock and dirt to the Ports of Klickitat and Skamania.[50] In addition to sending excavated material to various ports

in the area, the Corps also used it to create Canada goose habitat, some of which was destroyed during the project's construction. To mitigate the loss of nesting and brooding areas, the Corps constructed new habitat for the geese. The agency eliminated Bradford Island flat, for example, replacing it with a constructed island upstream of Eagle Creek.[51]

One of the biggest innovations of the project was the Corps' use of a management technique called "partnering." The new navigation lock was the District's first large project to use the partnering concept. This system employed a cooperative approach to contracting that, according to the Corps, was "an innovative, powerful management tool for transforming often negative, adversarial litigious construction relationships into positive cooperative morale- and profit-building experiences." After the award of a contract but before work began, the Corps and the contractor worked together to define long-term goals and objectives based on a commitment to a quality project, safety, timeliness, and cost-efficiency.[52]

Partnering played an important part in the construction of the new lock. It was used in the construction of the $34 million diaphragm wall, the replacement of fish hatchery wells, and the construction of the main lock.[53] The benefits of partnering on the navigation lock were immense. First, partnering dramatically reduced costs. According to David Brown, "With the project almost completed, through partnering, we have value engineered savings of $3.6 million." This amount of savings was unheard-of for a project this size. Second, partnering helped with safety concerns. "Since we started partnering with the contractors, we are not seeing the accidents like we have in the past," noted Chuck Galloway, resident engineer. "When we have an unsafe condition, we correct it together." Finally, partnering reduced the possibility of litigation on the project. "In the past, paperwork was done to support possible future claims and potential litigation," explained David Johnson, senior counsel for the Corps. "So far, we have not had any unresolved disputes."[54]

Tower, gates and navigation lock nearing completion. Earth removal opened the downstream to the Columbia River.

The benefits of partnering were a major theme of the various dedication speeches celebrating the new navigation lock. Lieutenant General Arthur Williams, Chief of Engineers, was especially appreciative of the role of partnering in the project. In his remarks on July 10, 1993, he thanked all the participants for taking a risk in trying a new approach. "I want to acknowledge all the individuals for their courage in undertaking this new style of working. None had done it before, nor had many others. There wasn't a track record they could point to. But it sounded like there might be a lot to gain, and there was." Later he added that, "Partnering on the new Bonneville lock is a success story not just for the team that built it, but for the Corps, the taxpayers, the construction industry, the users of the waterway, and the people of the Pacific Northwest. Everyone wins."[55]

In addition to highlighting the benefits of partnering, the new navigation lock also accomplished its goal of relieving the traffic bottleneck at Bonneville. On March 30, 1993, the lock, which cost approximately $331 million, opened to commercial traffic. Measuring 86 feet wide and 675 feet long, with

A double barge passes through the new navigation lock during the dedication ceremony. Completed lock with swing bridge and upstream floating guide wall. General Ernest Harrell, North Pacific Commander, dedicated the lock to the people of the United States of America.

an annual commercial shipping capacity of 30 million tons, the new lock corresponded to the seven locks upriver. The first upstream-bound commercial vessel through the lock was the tug *Clarkston*, operated by Brix Maritime of Portland, Oregon, with a tow of five barges. Heading downstream was the tug *Dauby*, operated by the SD & S Lumber Company of Bingen, Washington. Seventeen tows traveled through the new lock during the first 24 hours of operation. To pass the same number of tows through the original lock would have taken five 24-hour days. Furthermore, the new lock reduced the total amount of water use. Although it required 38 million gallons of water to fill, as compared to 17 million for the old lock, fewer trips through actually decreased the amount of water diverted for lock use. Major General Ernest J. Harrell, Commander of the North Pacific Division, spoke at the lock's dedication in 1993. "We in the Army Corps of Engineers are proud of this new navigation lock and the part we played ... in its construction," he remarked. "But make no mistake. This project doesn't belong to the Army Corps of Engineers. It belongs to all of us, the people of the United States of America. We pray it serves us well."[56]

The Battle for Elk Creek Dam

Elk Creek Dam marks a turning point in the District's history. While Bonneville represents an earlier era of big-dam construction, Elk Creek Dam signifies a shift in values and priorities in the Pacific Northwest. First proposed in the 1930s, this project has been embroiled in controversy since the 1980s. The debate over whether to build the structure reflected many of the new issues facing the Corps during the late 20th century. Located 1.7 miles above the confluence of Elk Creek and the Rogue River in Jackson County, Oregon, the dam is situated in the midst of critical salmon and trout habitat. Construction of the dam began in the mid-1980s, but was quickly halted by a federal injunction issued in response to environmentalists' concerns about its impact on the region's fish populations. Later, the debate shifted, focusing on whether the dam should be notched to allow fish passage. During the early 21st century, the partially completed structure stood as a monument to shifting environmental attitudes and values, reflecting the Corps' changing role in the 21st century.

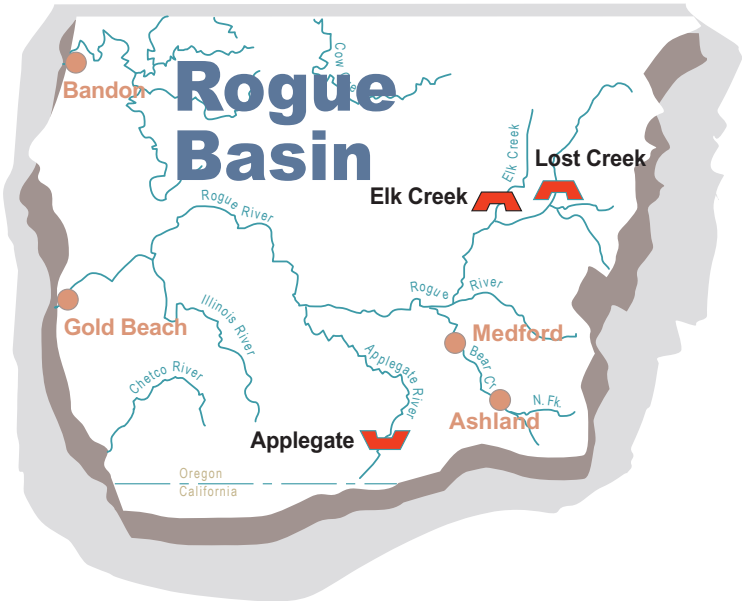
The Corps began planning for the Rogue River Basin in the 1930s in response to recurring floods in the basin. Sizable floods occurred in 1861, 1890, 1907, 1910, 1912, 1924, and 1927, washing away houses and barns, smashing bridges, and turning farm lands into enormous gravel beds. While these events created a widespread acceptance of the need for flood control measures, conservationists and anglers, who wanted to maintain the river's free running waters and healthy fish populations, resisted building dams or other flood control structures on the Rogue. Then in 1955 another flood wreaked havoc in the basin, causing an estimated four million dollars in damages and reigniting the movement toward flood control.[57]

Responding to pressure from local residents, Congress appropriated funds for flood control studies in fiscal year 1957. The challenge, however, was to provide flood control without destroying the Rogue's fisheries, and the solution came when the Corps included fish enhancements in the proposed project. Specifically, the Corps'

Rogue River Basin Project, which was authorized in 1962, included three multi purpose dams designed to operate as a system. The agency planned dams for Elk Creek, Lost Creek, and the Applegate River. In addition to its primary purpose of flood control, the dam at Elk Creek was also authorized to provide irrigation, a water supply for the area, recreation, fish and wildlife enhancement, and water quality control. By 1976 Lost Creek Dam was completed, and in 1980 Applegate Dam was completed.[58]

Both Lost Creek and Applegate dams presented numerous problems during their planning and construction phases – problems that also would plague Elk Creek. One issue was the economic viability of the projects. Critics questioned the benefit-to-cost ratio of the dams, accusing the Corps of using outdated interest rates in its calculations. When Congress authorized Lost Creek in 1962, for example, interest rates were three-and-one-eighth percent. But by the 1970s, when the Corps was conducting studies to build the dam, the rate had increased to five-and-one-eighth percent, and by 1972 the rate had reached seven percent. The District continued, though, to use the original, lower interest rate in its studies, admitting that the higher rate would diminish the benefit-to-cost ratio and make the project economically unjustifiable.

Another issue that arose was the Corps' preference for evaluating the projects using a systems approach. This meant that the agency measured the benefits of each individual project with total benefits divided among the projects. This method was called into question when the General Accounting Office (GAO) discovered on another project that while it was economically justified using a systems approach, it wasn't when evaluated on an incremental basis. Using an incremental approach meant that each individual component of a multi-system dam must be economically defensible without carry-over benefits from other projects. When the GAO asked the District to reevaluate Lost Creek on an incremental basis, the Corps refused.[59]



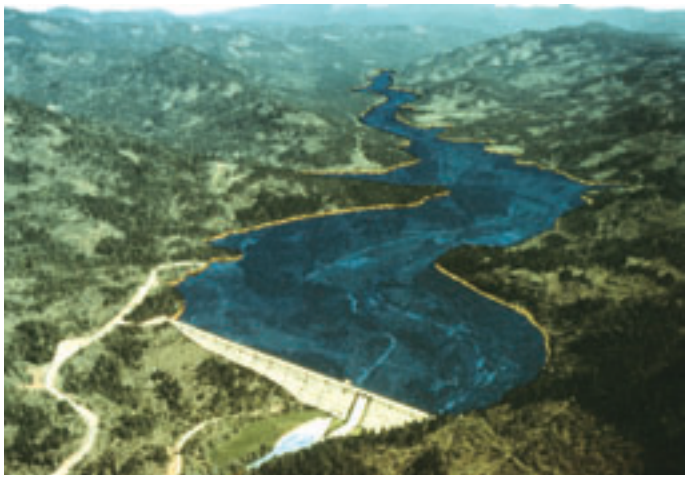
Elk Creek Dam site

In addition to economic considerations, environmental issues also haunted the Rogue River dams. In particular, opponents of the dams were concerned about increased turbidity, which threatened fish and other aquatic life. Many also feared the dams' impacts on wild fish runs. At one public meeting, an irate resident stated, "The concept that a magnificent species such as the steelhead can be replaced by pellet-fed, artificial trout that can be caught in Minnie's Trout Farm… is, I think, an idea that is grotesque to even the most casual observer."[60]

The debates over Elk Creek reflected many of the same concerns. In 1971, the District began construction of Elk Creek Dam by

Elk Creek Dam proposed site

Artist's concept of completed dam



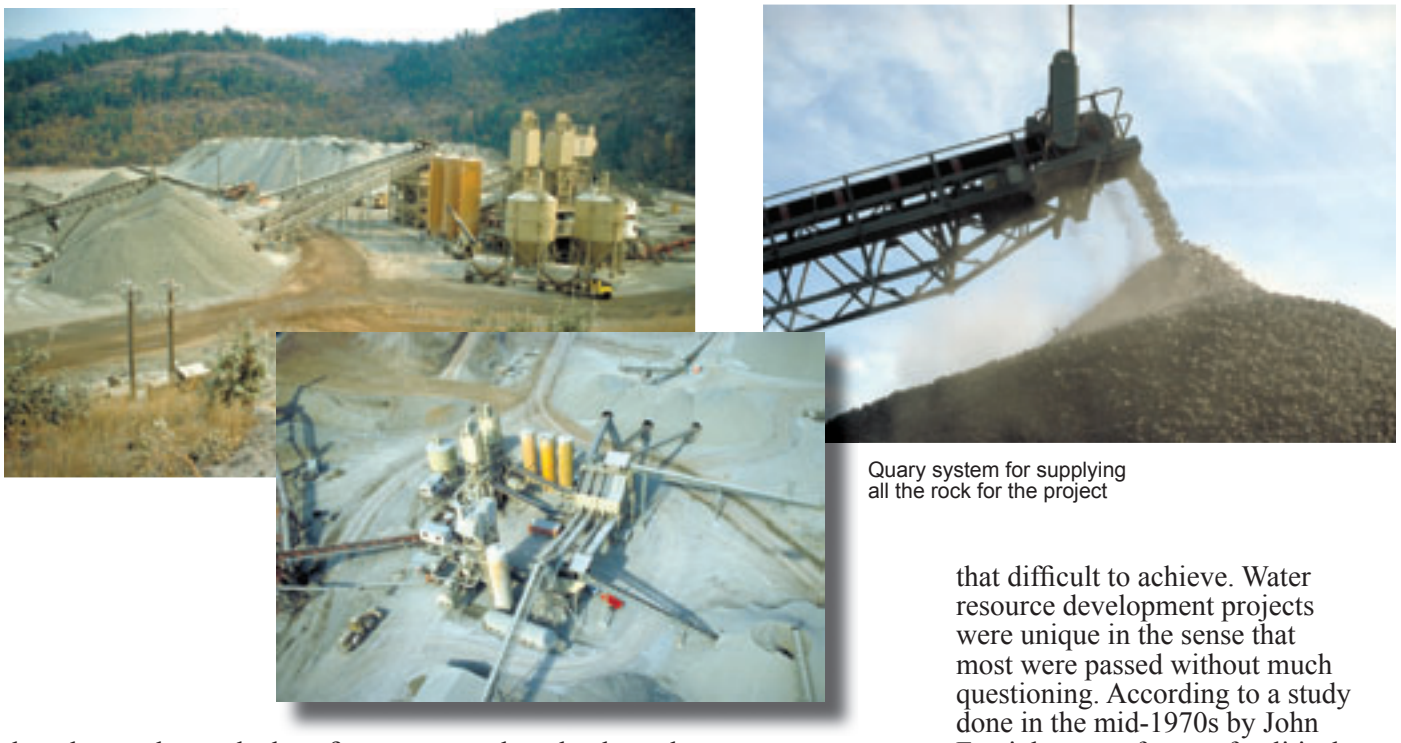
Early construction progress on the site of Elk Creek Dam

acquiring land, relocating residents, and moving various roads and utilities. The agency's plans called for a structure measuring 249-feet high and 2,580-feet wide, with three gated spillways to be built at an estimated cost of $77 million.[61] Over the next decade, however, the project did not progress much beyond this initial work due to environmental considerations. The biggest issue at the project was turbidity. The Corps outlined provisions to combat turbidity during construction, but did not believe it would be a problem after the project was completed. In July 1974, the District released its Rogue River Basin Water Temperature and Turbidity report, initiating a series of debates. The conflict over turbidity continued over the next year, culminating in the decision of the Oregon Water Policy Review Board to withdraw support of the project. The Board based its decision on several findings, primarily that the release of turbid water from the Elk Creek Reservoir would reduce the benefits of Lost Creek Dam and violate state water quality standards.[62]

Despite this strong blow against it, the project continued. The Corps announced that, while it could not meet the standards for a state discharge permit, it was still willing to work with the state to improve the situation. Oregon's two senators – Mark Hatfield and Bob Packwood – continued to support the dam, if turbidity could be controlled. The District began work on additional studies, and in 1979 it released Elk Creek Lake Water Quality Update Study. Like the 1974 report, this document continued to claim that turbidity would not be a problem at Elk Creek. Response to the Corps report was varied; many believed it was suspect due to the fact that studies for it had been done in 1977, a drought year. A Fish and Wildlife Service report found that turbidity levels would be much higher in normal flow years.[63]

Despite suspicions regarding the adequacy of the Corps' turbidity data, the Water Policy Review Board was convinced enough to reverse its 1975 decision, and, in April 1981, it voted to approve congressional funding. Although a final decision on the dam had not been made, in fiscal year 1982 Congress authorized $1.3 million to update and continue the project's design.[64] That same year the North Pacific Division Engineer signed a Record of Decision that read, "Decision is to proceed with construction of Elk Creek Lake Project subject to approval of funds by the U.S. Congress."[65]

Meanwhile, economic issues similar to those at Lost Creek Dam were cropping up at Elk Creek. According to the District's calculations, the project's benefits outweighed its cost. But not everyone agreed with the agency's method of analysis. U.S. Representative Jim Weaver, who had originally supported the dam, now opposed the project, questioning its economic merits. In 1980 Weaver asked the District to evaluate benefit-cost information for the dam using four different scenarios. Only when using a systems approach and a three-and-one quarter percent interest rate did the Corps find the project was economically justifiable. With



Quary system for supplying all the rock for the project

the other analyses, the benefit-to-cost ratio dropped to .80 to 1 and .32 to 1. Weaver then requested that the GAO evaluate Elk Creek on an economic basis. By March 1982, GAO had completed the study, questioning the Corps' estimates and recommending that the agency "reexamine the economic feasibility of the Elk Creek project and resolve the questions on project benefits and costs raised in our review."[66]

Given the project's shaky economic foundation and its potentially adverse environmental impacts, it is perhaps surprising that work on Elk Creek continued. In fact, by 1984 the Corps had moved to drop the project, and many in the District agreed with that decision, questioning the project's necessity.[67] "The Corps did not support it through the chain of command and all the way up," observed Tom White, a retired Corps economist. "There were a few people here and there who supported the project, but essentially the Corps' recommendation to Congress was that this was not a good idea."[68]

Yet, there were also powerful political forces at work in the Elk Creek debate that favored the project. The most prominent was Senator Hatfield, who was Governor when the three-dam system was conceived of in the early 1960s and a big champion of the project. Hatfield was not inclined to yield the project so readily. U.S. Representative Robert F. Smith, a Republican from Oregon who joined Weaver in representing the district where the dam was to be located, similarly continued to support the project. It was these two politicians – Hatfield in particular – that spearheaded the movement to kept Elk Creek Dam alive.[69]

While Elk Creek may have been unusual in terms of the controversy it generated, its intensely political nature was typical of most Corps water resource development projects, particularly during the period 1980-2000. "The Corps' mission is political," explained White. "Its priorities rise and fall with the political climate."[70] The process began with local interests seeking project funds by petitioning their senators and representatives, who in turn sought congressional appropriations for the project. Thus the success of a project often relied on the influence of an individual congressperson and his or her ability to garner support from fellow congressional members. Support was not, however, usually that difficult to achieve. Water resource development projects were unique in the sense that most were passed without much questioning. According to a study done in the mid-1970s by John Ferejohn, a professor of political science, members of Congress rarely debated the merits of water projects, preferring to allow funding of questionable works in other districts in exchange for reciprocal support when such projects came up for authorization in their areas.[71]

In the case of Elk Creek, Senator Hatfield was adamant that the project be built, and, through his efforts, in 1985 Congress appropriated $10 million construction dollars to build Elk Creek Dam over substantial environmental protest and congressional opposition. "Elk Creek is 'pork barrel,'" said White. "It just simply got added into the appropriations budget with the direction to the Corps, 'Here is the money, Corps, build the project.'" Despite its general lack of support for the project, once the money was appropriated, the Corps began construction. "The Corps operates under the Army for a reason; it knows how to take orders," observed White. "Once the Corps is given money, the Corps is reluctant to turn it down," he added. "There was a lot of pressure on units within the Corps to utilize or spend the money that they get. It's a serious sin to turn money back and say, 'Well, we didn't need this much money.'

Laying the outlet pipes and constructing the first core of the dam

Because if you didn't need it, then you don't get as much next time," said White.[72]

Further complicating the issues at Elk Creek was the relationship of Senator Hatfield to personnel in the District. "Hatfield wanted it," commented Tom Davis, the division's Chief of Planning, "and if Hatfield wanted it, Deb Olson, wanted it." According to Davis and White, Senator Hatfield managed to keep the project alive within the Division, despite opposition from the District and Corps Headquarters.[73]

Although Hatfield and certain individuals within the District supported the Elk Creek Dam, many other interests remained opposed to it, including Weaver. In the mid-1980s, this congressman made several attempts to stop the project. Opposing a development project in his own district, Weaver deviated from the typical "pork barrel" stereotype. In July 1985, for example, as the House considered H.R. 2959, an energy and water development appropriations bill, Weaver introduced an amendment to delete four million dollars that was slated for road construction at Elk Creek Dam. Elk Creek was "a $120 million dam that has no purpose," he stated. "It is a monument to nothing." In his arguments Weaver touched on a number of themes, including the fact that the Corps did not believe it a worthwhile project, finding it economically unsound. To support this claim he quoted a letter from Assistant Secretary of the Army William Gianelli. "Since the Elk project does not show current economic feasibility," Gianelli wrote, "the administration does not support inclusion of the project in the construction program." Weaver also stressed that Boise Cascade, a logging company and powerful economic force in the project area, opposed the dam because of restrictions on turbidity that would impact its ability to build roads and harvest timber. In a plea to fellow members of the house, Weaver argued that the dam was "a mind-boggling boondoggle" and reminded them that they could "kill it now with no ill effects." Smith, however, argued against the amendment, citing economic calculations that put the project in a favorable light and emphasizing that this road was "an economic necessity for logging in the Elk Creek Dam area…."[74] Perhaps due to fears about their own projects being questioned, members of the House rejected Weaver's amendment. Weaver attempted to stop the project on several other occasions, none of which were successful.[75]

Environmentalists also attempted to halt construction of Elk Creek. Following Congress' appropriations, several environmental organizations filed a lawsuit to stop the building of the dam, citing violations of the National Environmental Policy Act (NEPA). An initial court hearing on the lawsuit took place in the U.S. District Court for the District of Oregon, with Judge James M. Burns presiding. After hearing the case in March 1986, Judge Burns ruled to allow the Corps to proceed with work on the dam. Environmental groups, led by the Oregon Natural Resources Council (ONRC), appealed the court's decision and were granted a hearing before the Ninth Circuit Court of Appeals in San Francisco. In their appeal the ONRC cited concerns that increased turbidity and water temperatures would harm the Rogue's fishery. The Corps and dam proponents maintained that adequate measures had been taken to protect fish populations.[76]

After reviewing the case, the Ninth Circuit Court directed the Third District Court to issue an injunction to stop construction, and injunctive orders were issued

in September 1987. The court's decision was based upon their finding that the Corps' NEPA documentation was inadequate. The judge did allow work to continue until the dam reached one-third of its projected 249-foot height, which was attained early in 1988. The Ninth Circuit Court also directed the Corps to prepare a supplement to its Environmental Impact Statement (EIS). The court's decision to halt the dam was based on four major concerns. The first issue involved wildlife mitigation – opponents of the dam charged that the Corps' EIS failed to include a detailed analysis of wildlife mitigation measures or an explanation of the effectiveness of those measures. The second issue revolved around what was referred to as a "worst case" analysis. The court ruled that the Corps had failed to prepare a "worst case" analysis on the effects of Elk Creek Dam on Rogue River turbidity during high, average and normal-low rainwater run-off years. The third item raised by the court dealt with the "new information" issue. The court declared that the Corps had failed to analyze new information on the possible effects of turbidity and water warming on salmon and steelhead that came in after the District's EIS was completed. The court's fourth and final concern was that the Corps failed to consider the cumulative environmental impacts of all three Rogue Basin Projects – Elk Creek, Lost Creek, and Applegate dams.[77]

Following the Ninth Circuit Court's ruling, the District requested a rehearing, which was denied. They then requested a writ of certiorari (CERT), which essentially meant a Supreme Court review of a lower court's decision. That request was granted on June 27, 1988. In their hearing before the Supreme Court, which occurred on January 9, 1989, the District addressed the concerns raised by the Ninth Circuit Court. The first three issues were considered by the Supreme Court, but the fourth – cumulative impacts – was not reviewed. The Supreme Court reversed the Court of Appeals on all issues presented in the appeal, and the District commenced work on the supplemental EIS ordered by the Circuit Court.[78]

Over the next two years, the District conducted a series of environmental studies of Elk Creek Dam for the supplemental EIS. In their draft EIS, which was completed by November 1990, the Corps considered several operational options. They included the following: interim operation with a full pool, minimum flood control pool, and no conservation pool. Each of these interim alternatives would include flood control. A "no action" alternative was also examined. The District identified operation without a conservation pool – the "no pool" option as their preferred interim-operating alternative due to the lack

Roller compacted concrete (RCC) used on the surface of the structure

Aerial photo of Elk Creek Dam construction site as it reached the one-third height level. It would stay this way until the present day.

of demand for conservation storage. The cover letter to the supplement explained:

> The preferred interim-operating alternative is to initially operate the project without a conservation pool. Under this alternative there would be no conservation storage at the Elk Creek Lake project during the interim period: the reservoir would store water only during flood control operations. This alternative would minimize the impacts on fish and wildlife during the interim period until the need for conservation storage develops. This would have the least effect on flows, temperatures and turbidity levels in the Rogue River downstream of the project.

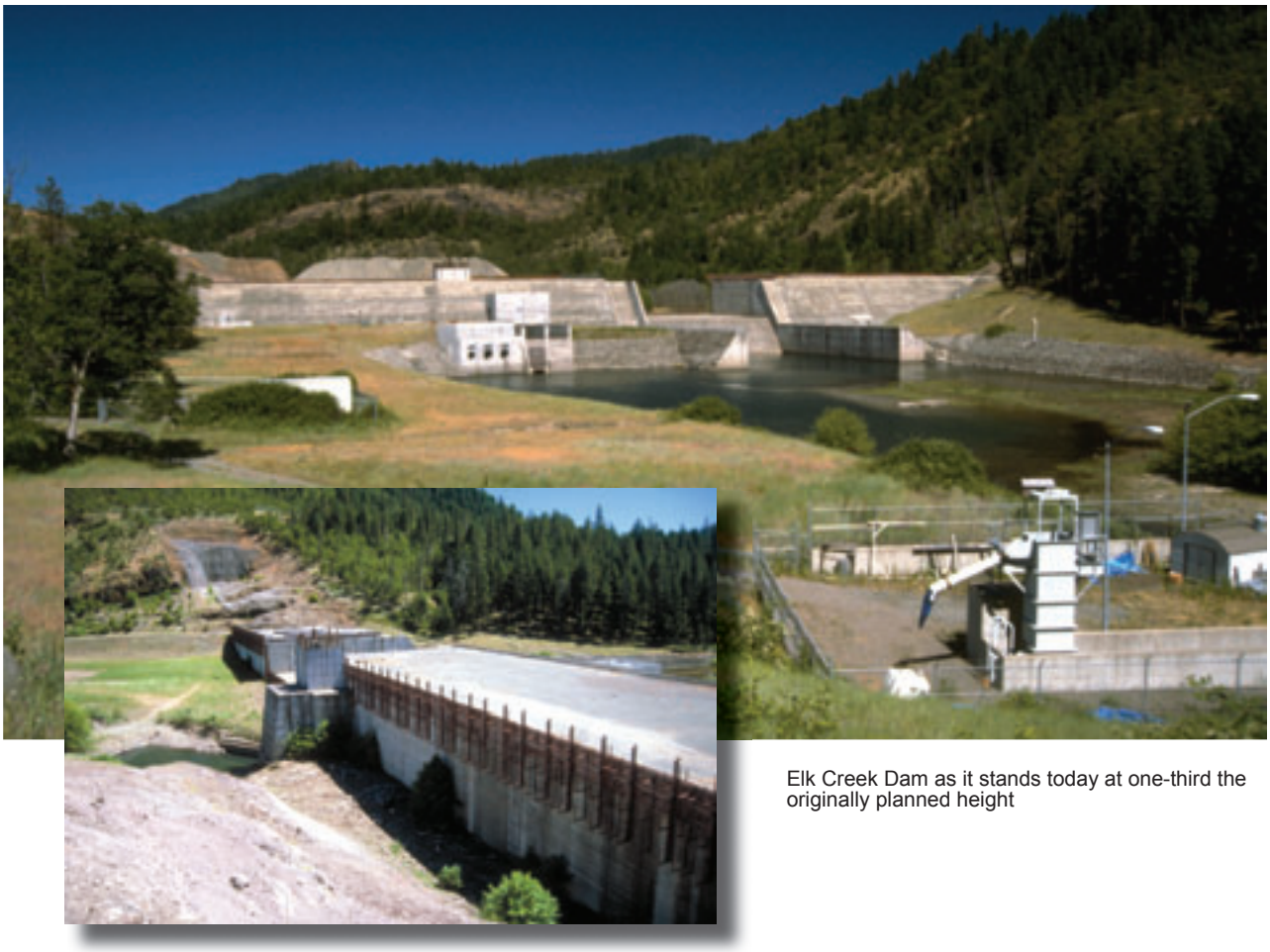
During the time that the EIS supplement was drafted, a Medford television station conducted an informal poll on the project. They found that 70 percent of respondents favored finishing the dam. Opinion split, however, when the issue of whether to operate it with or without a full reservoir was raised. Proponents of the full reservoir argued that it would increase recreational opportunities and would combat drought conditions.[79]

During the preparation of the draft EIS supplement, a confidential Corps' document was leaked regarding the future of the Elk Creek Dam. The document, which was written by Major General Pat M. Stevens, North Pacific Division Engineer, included a note about whether the dam should be terminated. It read, "Were that decision to be required today, I suspect I would recommend not resumption but termination in a mothball state." When contacted about the note, Stevens argued that the note was not a recommendation and was not binding.[80]

Despite this leak, work continued on the EIS and a final report was released in May 1991. During the review period the Corps received comments from federal, state, and local government agencies, as well as private citizens. One petition with 128 signatures and 755 letters were received during the review. None of the responses resulted in significant changes, however, to the agency's preferred alternative: construction and operation of the Elk Creek Project with no conservation storage. The Corps' selection of the "no pool" option did not rule out the possibility of conservation storage. As one report noted, "Ultimately the project could be operated using full conservation storage capacity to meet all authorized project purposes." The preferred alternative was to complete Elk Creek Dam, operating it for flood control only, with no conservation storage, until demand for conservation storage developed.[81]

Following the updated EIS, in 1993 the Elk Creek Dam project returned to the courts. Judge James M. Burns, U.S. District Court, District of Oregon, heard three motions related to the dam. The first was a July 1992 Corps motion to dissolve the 1987 injunction that stopped construction of the dam. The second motion studied by Judge Burns was a December 1992 ONRC motion to modify that 1987 injunction. The third motion, seeking to bar construction of the dam, was filed in January 1993 by the ONRC and other plaintiffs.[82]

During this period several stories about the dam appeared on the local television news. These detailed the history of the project and raised questions about the project's costs to taxpayers as well as its environmental impact. According to these stories, taxpayers had thus far spent $102 million on the dam. If the dam were completed it would cost an additional $70 million. Removing the dam and restoring Elk Creek to its natural state would cost approximately $10 million. At least six federal agencies lined up against the completion



Elk Creek Dam as it stands today at one-third the originally planned height

of the dam. The USFWS said that "removal of Elk Creek Dam" was the only way to save fish runs. Oregon Governor Barbara Roberts warned that the dam was a waste of money: "It's environmentally unsound, it's economically unsound. There is no way you can propose that dam today in 1993." Environmentalists also joined the debate, arguing that in addition to damaging fish populations, the flood control benefits of the project were overstated. "You can either spend $78 million to finish it and have this fish killer that has no need, or you can spend seven million to remove and restore," stated Andy Kerr of the ONRC. In another story he added that, "If the Congress of the United States continues to fund stupid projects like Elk Creek Dam, what it means is incremental continued environmental degradation. At the same time we're going deeper and deeper into debt."

The Corps, however, disagreed. "Our own internal biologists and engineers believe that we can in fact provide safe and effective passage for salmon through the project," Davis Moriuchi pointed out. Many of the residents of the town of Shady Cove, located near the dam, also wanted to see the dam completed – and they resented the intrusion of outsiders. One local woman, for example, complained at a town meeting that she was "fed up with southern Oregon being used as a scapegoat for those people sitting up in Salem telling us what we need and what we don't need before they check it out."[83]

In 1993, Judge Burns withdrew the three motions from submission, citing the Pacfish strategy endorsed by the Bureau of Land Management and the U.S. Forest Service. Burns stated that, "If adopted by the Departments of Agriculture and Interior, the Pacfish recommendations would restrict or prohibit many streamside activities..." Elements of the Pacfish plan, he said, "may have significant impact on the Elk Creek Dam project and the pending motions for injunctive relief...."[84] On February 1, 1994, the District received a decision and an order from Judge Burns. The judge dismissed the first lawsuit that had resulted in the 1987 injunction that stopped dam construction. He also withdrew the Corps' January 1992 Record of Decision, which explained that if the project was completed it would use the "no pool" alternative. Judge Burns also denied the ONRC motion to modify the 1987 injunction. Once again he ruled that the Corps could not continue with construction and directed them to consider new information on fish passage and the status of regional fisheries.[85]

The Judge's decision resonated deeply with both proponents of the dam and those who opposed it. It also left Corps officials in a

difficult situation. Bruce Bolme, Chief of Operations for the Rogue River Basin Project, explained the difficulties the agency faced in a television report on the dam. "Personally, it's quite frustrating because we haven't been given any people to maintain it and yet there's a substantial investment here already," he told reporters. "We've been told to preserve the assets. It costs about $30,000 a year to maintain the equipment and do other things that need to be done to make sure this place doesn't deteriorate. And there's no beneficial return from it."[86]

The ONRC remained equally adamant in its position on the dam. Spokesperson Jim Bida reminded the public that Elk Creek Dam "was proposed to control flooding on the Rogue River, but it was proposed with two other dams and both those dams are now complete. Flooding is controlled. So there is no real reason for Elk Creek Dam anymore. In addition to no need, the project is killing fish. And it's deteriorating the outstandingly remarkable Rogue River, which is known throughout the world for its recreation, scenic, and fishing values."[87]

Fish were at the center of many of the debates. Many dam proponents argued that the project would not injure salmon, and that, in fact, its ability to regulate the water flow would benefit fish. Opponents, however, did not agree and many congregated to protest the practice of transporting the fish in trucks around the dam. Other opponents of the dam focused on the economic aspects of the project, arguing that it represented a classic boondoggle. Bida asserted that the issues at stake went beyond just Elk Creek Dam. "It's time to start asking the question of whether or not existing dams should be allowed to remain," he explained. "Historically, the only questions we've asked is where and whether to build dams. And those questions are out of date." Even so, some local residents remained staunchly in favor of the dam. One man, clearly angered by the environmentalists' role in the process, remarked that, "You can't go by environmentalists ... why if you go by everything they say, why we wouldn't be able to do anything.

United Power Trades Organization

The United Power Trades Organization (UPTO) represents powerhouse trades and craftspeople throughout the Northwestern Division and is one of the few independent unions in the Corps. The union was formed in 1981 when a group of employees, frustrated by what they believed to be unfair wages and poor representation, decided to break away from the IBEW (International Brotherhood of Electrical Workers) and form their own union. The UPTO has 17 representatives with alternates, as well as an executive board consisting of seven members, which is elected every two years. The members of the executive board get a small stipend or salary.

As a federal employees union, the UPTO doesn't negotiate wages directly; instead they are set by wage surveys and a formula that averages the wages at the DOE (BPA) and BOR (Grand Coulee and other smaller Bureau projects in the region). Another difference between the UPTO and other unions is that the former is not technically allowed to strike. They also don't have as many benefits as some other unions. Conversely, one of the advantages of the UPTO for its members is that union dues are smaller. For this reason, the UPTO, unlike some other unions, does not give money to political candidates.

Since its establishment in 1981, the UPTO has accomplished several important tasks. In the late 1980s and early 1990s, for example, the Corps had attempted to contract out maintenance work at its powerhouses to supposedly save money. In response, the UPTO, with the help of other unions, got legislation passed through Congress, as part of the WRDA-1990, preventing this action. In 2000, the UPTO faced a similar struggle when the Corps once again tried to contract out work. This time the agency attempted a lighter version, where the work of running conduits, operating the heating and air conditioning system, and similar jobs would be contracted out. The union, however, feared that this measure would open the door to more contracting out and successfully opposed it.

According to Claud Leinbach, UPTO's Congressional Representative, the UPTO's success can be partially attributed to the backing it has received from Congress. "Congress understands the importance of our work," he said. Indeed, Corps projects supply 40 to 50 percent of the region's hydropower. Leinbach observed that another reason the UPTO has made significant achievements is because of the Division's highly skilled blue-collar workforce. These employees are dedicated to their work and place a good deal of importance on their job. "We're at the ground level," Leinbach explained. "We're the ones who do the actual work out here."

Wouldn't be able to walk in the woods even. 'Cause you might kill something crawling on the ground."[88]

In April 1995 the battle moved to the federal appeals court, where the Ninth Circuit Court ruled that the Corps' efforts were inadequate, specifically citing failure to examine water quality issues and the scarcity of wild coho salmon. The court required that the agency undertake a comprehensive review of a wide range of issues under NEPA before any further construction could occur. The Corps decided, however, not to perform the NEPA studies necessary to remove the injunction against completion of the project. This decision was based on the cost and time required to respond to the Ninth Circuit Court opinion without any certainty of success. Furthermore, the agency was facing a period of restrictive federal budgets. On November 6, 1995, the District notified the Congressional Appropriations Committee of its intention to evaluate options for long-term management of the project in its unfinished state. Congress made funds available for the Corps to manage the dam in its unfinished state in the Energy and Water Development Appropriations Act of fiscal year 1997. It also directed the Corps to take the necessary steps to provide passive (hands-off) fish passage through the project.[89]

The latter directive proved to be a formidable political challenge, and one that continued to be unresolved into the 21st century. Following Congress' request that the Corps provide passive fish passage at Elk Creek, the agency drew up plans to modify the dam and eliminate the trap-and-haul system in which fish were physically handled. This system was not designed for long-term use, nor was it meant to be used in the relatively uncontrolled flow and debris accumulating conditions that occurred with the unfinished project. One problem that arose was that adult fish were able to pass over the barrier weir at high flows (and the weir was knocked out by debris on several occasions), trapping the fish between the dam and the weir.

To provide passive fish passage, the Corps planned to remove a section of the dam. This action would include removing a portion of the dam's spillway and left abutment, realigning the stream above and below the dam, and placing features in the stream and streambank to maintain adequate flow velocities for fish passage. The cut through the dam would measure 150 feet wide at the base and 225 feet wide at the top of the dam. The size of the cut was based on the need to meet fish passage velocity criteria that were coordinated with and recommended by state and federal fishery resource agencies.

According to Elk Creek Project Manager Doug Clarke, the Corps proposal was the most cost-effective and biologically sound way to provide fish passage at the project. Furthermore, by notching the dam rather than completely removing it, the Corps was able to avoid making the decision that the dam would never be completed in the future. The Oregon Department of Fish and Wildlife (ODFW), the National Marine Fisheries Service (NMFS), and the USFWS all reviewed the plan and concurred that the trap-and-haul method should be eliminated and the dam physically modified. Furthermore, because the Corps would take steps to preserve the remaining portion of the structure, the work would not rule out completion of the project in the future. The agency had originally hoped to complete the work by the end of 1998, if funds were available. Modifying the dam was expected to cost seven million dollars.[90]

The Corps proposal to remove a portion of the dam – or notch it – was supported by numerous agencies at a series of congressional meetings held by the House of Representatives Agricultural Committee and overseen by Oregon Congressman Smith. A biologist at the ODFW explained that "Our agency supports the Corps of Engineers' proposal to do the work because it provides the most assured way to provide unobstructed fish passage within Elk Creek for migratory salmonid fishes, including coho salmon and steelhead."[91] Elizabeth Gaar of the NMFS also regarded the idea of notching the dam as the best option for fish passage. As she explained, "The proposed notch, or partial removal of Elk Creek Dam, will eliminate all of these fish passage problems, as well as restore the historically productive coho and steelhead habitat in the dam and pool area."[92] Corps officials reinforced the agency's position at the meeting, stating that the goal was "to provide passive fish passage and a balanced river system that requires minimal action and funding to maintain the stream channel and passive corridor on an annual basis."[93]

Dam proponents, however, remained steadfast in their opposition to the plan to notch the structure. One speaker at the meeting pointed out that "if we want to improve wild fish production and we have eight billion dollars to spend, why don't we spend it somewhere where we don't have to start by destroying an 180 million dollar investment that the American taxpayer has already made." Many of those who favored the dam feared that if the notch was approved, the project would never be completed. One protester remarked that, "We've wasted enough money. We could have done everything. Now this opposition, if they want Elk Creek to spawn salmon, they're going to have to bury a tunnel clear to the top, pump the water up there, and let her come back down." Martin Bauer of the Rogue River Basin Association expressed concerns over the future of water needs in the valley. "I feel absolutely passionate about this," he said. "We need to look to the future, what we need for water, in this valley and in the future. It's ridiculous to tear out this dam right at the time when we're showing more and more need for it."[94]

The dam proponents proved to be a powerful lobby. Their opposition to notching the dam resulted in a five-year effort to alter the half-built structure. The Corps' effort to notch the dam was blocked at the congressional level first by Representative Smith and later by Representative Greg Walden. Senator Hatfield also continued to push for

the project until he left the Congress in 1997. The two congressmen inserted language into Corps funding bills requiring the agency to continue trapping and hauling fish around the dam site.

In February 2001, however, proponents of the notching received a boost from the NMFS. The agency reported that cutting a 150-foot section out of the concrete dam and restoring the creek's channel was the only alternative that would not jeopardize threatened coho salmon and other species using upstream spawning grounds. The NMFS report also concluded that the current program of trucking and hauling the salmon and steelhead around the dam was not a viable long-term solution, even if facilities were upgraded. Clarke noted that the Corps has "always believed that notching is better biologically and cheaper than trapping and hauling. Now, we have a scientific opinion ... that will provide added justification for it."[95]

Not everyone was pleased with the findings of the report. Jackson County Commissioner Ric Holt spoke against the biological opinion, arguing that notching the dam would ruin the half-built structure, which he believed should be used to store water, avert floods, and even provide some hydroelectric power for Rogue Valley residents. "They'll have one hell of a fight on their hands," Holt warned. "You think chaining to log trucks was in vogue back when, you ain't seen nothing yet. There's ... a lot of people out there who will stand up for that dam at almost any cost." Environmentalists, however, planned to continue their struggle to reopen Elk Creek to in-stream fish passage. "That little basin is tremendously important for recovery of salmon and steelhead in the Rogue River," observed Wendell Wood of the ONRC. "It is the classic ... boondoggle, pork-barrel-type project. Some projects are real turkeys, and they should never have been built."[96]

When the initial plans for Elk Creek Dam were developed several decades ago, few suspected that the project would become such contested territory. At the time it was authorized in the 1960s, damming for flood control purposes was still an accepted practice throughout much of the country. But when construction began in the 1980s, public attitudes were shifting, and the environmental movement had helped create an awareness of the importance of fish and wildlife in the region. Citing violations to NEPA, environmental groups throughout Oregon banded together to fight Elk Creek Dam. Their efforts were aided by an unusual coalition, including the timber industry and a maverick U.S. Representative, Jim Weaver. In addition to environmental concerns, opponents of the project also argued that it was economically unjustifiable.

With strong environmental and economic evidence mounting against the dam, the Corps began to reconsider the project, and by the mid-1980s the agency had attempted to drop Elk Creek Dam altogether. Yet there were powerful interests at work who favored the completion of the dam, most notably Senator Hatfield. The fact that the project continued in spite of the Corps' majority opinion that the dam was not worthwhile illustrated the power of congressional politics to influence water resource development projects and the direction of the Corps. While Hatfield was helped in his efforts by an alliance with a senior Corps official, the agency's deference to Congress was by no means atypical.

Despite the backing of Hatfield, however, the project continued to be attacked by environmentalists and agencies concerned with ensuring the survival of salmon populations in the Rogue. In response to this increasing pressure and the listing of several species of fish, by the 1990s the Corps had decided that it would no longer pursue a dam at Elk Creek and proposed to notch the dam to allow passive fish passage. The fact that the fight over Elk Creek continued into the 21st century illustrated that a great divide still existed between various interest groups and reflected the diversity of stakeholders in the region. Less obvious to the casual observer, it also exposed the intricate connections between water resource projects and congressional politics. At stake was more than simply flood control and salmon, for Elk Creek had come to symbolize the tensions over how humans could coexist with a rapidly changing natural environment in the Pacific Northwest.

Recreation

During the mid-20th century, Congress expanded the Corps' missions to include recreation. While historically the agency focused on flood control, hydropower, and navigation needs, many of the Corps' water resource projects also offered recreational opportunities, such as boating, fishing, hiking, and camping. So prominent did these activities become that by the late 20th century they represented the Corps' most visible work to a large segment of the public. The increasing number of people using the District's facilities for recreational purposes brought new challenges, including funding cutbacks, conflicts among different user groups, and competing needs for recreation and fisheries. In response to these challenges, the agency identified creative solutions, including changes in funding, management, and construction. Some of these issues, however, did not present an easy solution. While not everyone was satisfied with these changes or the Corps' management of its facilities, recreation continued to be a significant component of the District's projects.

The growth in recreation in Portland and the Pacific Northwest was part of a larger phenomenon in the nation's tourism and recreation industry. Following World War II, the demand for recreational opportunities increased considerably. Travel for recreation had fallen sharply during the war. Gas rationing decreased the amount of automobile trips, and many resorts closed for the duration of the conflict. After 1945, resorts reopened and businesses along the nation's highways boomed. Not only did people have more money after the war, they also had more time for leisure activities due to shorter work weeks and longer vacation periods. In 1940 the average

work week was 44 hours. By 1950, however, it had fallen to 40 hours, and by 1960 it had dropped to 37.5 hours.[97]

Many of the people who traveled during the post World War II period wanted to spend their time enjoying the outdoors, as an increasingly urban population sought contact with nature.[98] Partly in response to the nation's desire for outdoor leisure opportunities, the Flood Control Act of 1944, as amended, authorized the Corps to construct, maintain, and operate public park and recreational facilities at its projects, and it directed that the water areas of these projects should be open to public use for boating, fishing, and other related purposes. The statute also permitted others to build, maintain, and operate these facilities. Subsequent legislation, such as the Federal Water Project Recreation Act of 1965 and specific project authorization acts, strengthened the agency's mandate to provide for recreation at its water resources projects.[99]

While the Flood Control Act of 1944 provided the authority necessary for the Corps to undertake recreation projects, the agency did not become closely associated with this activity until the mid-1960s.[100] Thereafter, the "recreation business" developed considerably over the next several decades and brought with it considerable public visibility to the agency. At Bonneville Lock and Dam, for example, the public had been visiting the project since it opened in the 1930s. Park rangers, however, were not hired until the late 1970s.[101] The concept of hiring personnel whose major responsibility was interacting with visitors was a relatively modern phenomenon.

The Corps first began counting visits to its sites in 1952, when there were 30 million days of use (a day of use is measured by the number of people visiting a site during a 24 hour period). That number steadily increased, and by 1980 more than 457 million people had visited the Corps' lakeside recreation areas. Throughout the 1980s and 1990s, the Corps was the nation's second largest federal provider of recreation, based on the number of visitor hours. The agency was second only to the United States Forest Service. Contributing to the popularity of the Corps' facilities was their accessibility; more than 80 percent of the sites were located within a 50-mile radius of urban areas with a population of more than 50,000.[102]

Within the North Pacific Division, Portland was second for the number of recreation visits. Nationally, out of more than 40 districts, the District ranked 21st. The number of visitors to the District's facilities may have been lower than other areas due to the wealth of outdoor recreational opportunities that abounded in the

Portland District recreation projects

Summer visitors to the Corps dams and lakes throughout the state enjoy various activities

Northwest. The region's numerous parks, forests, and lakes provide outdoor enthusiasts with a multitude of choices for boating, hiking, and camping. Even so, the District had nearly six million recreation visits in 1980 to its 16 recreational areas, and by 1999 that number had climbed to 10.7 million.[103]

As part of its recreation mission, the District developed outreach programs. Water safety, for example, remained an ongoing concern of the Corps. Rangers from many of the District's projects presented programs at schools, sports shows, and other events to promote safe boating. In 1998, for example, rangers spoke to more than 1,800 students at Willamette Valley schools about the subject. Using skits and props, they reminded students of the importance of wearing life jackets and the risks of hypothermia in Oregon lakes.[104] In 1995, rangers from the Bonneville Lock and Dam traveled to the annual sportsman's show in Portland, where they showed videos, presented computer games, and distributed posters, bumper stickers, and brochures addressing water safety issues at the project. One of the ranger's sub-themes at the show was "Don't anchor in the channel," addressing the conflict between anglers anchored below the downstream lock channel and commercial boat traffic.[105]

Some District facilities held public events related to their recreational resources. Each year at Foster Dam, for instance, project operators invited junior anglers to the site for a fishing derby. Foster Dam is located on the South Santiam near the town of Sweet Home, Oregon. The Corps built the dam in the 1960s to provide flood control, irrigation, power generation, downstream navigation improvement, and water-based recreation. Below the dam the Corps operated a park, featuring picnic areas and a boat ramp. In addition, Linn County Parks Department provided several day use areas and campgrounds surrounding Foster Lake.[106] The annual fishing derby, which was sponsored jointly by several agencies, promoted the message, "Get hooked on fishing, not on drugs." At the derby the District conducted tours of the fish hatchery and dam, held casting contests, and passed out various prizes. Conducted on the same day as the state of Oregon's free fishing day, anglers could cast their lines without a license in any Corps lake within the state on that day.[107] Other projects hosted similar functions. In 1993, Bonneville Lock and Dam rangers celebrated Earth Day activities with children from a local elementary school. Using puppets and songs, the employees discussed with the students how to protect the earth's resources.[108] The Corps also conducted more formal environmental education programs for the public. Park rangers at Bonneville, for example, held a three-day workshop at the Bass Lake natural area to advance better understanding of wildlife habitats.[109]

Water safety is a big concern at all the Corps projects

The District also led a workshop for teachers and youth leaders on Columbia River salmon and human impacts on their habitat. The workshop, which was jointly sponsored by several agencies, was designed to increase educators' awareness of educational resources and provide them with information that could be disseminated to their students.[110]

In addition to workshops and events, the Corps also created permanent amenities for environmental education. District employees worked with other federal agencies, state agencies, and the private sector to develop interpretive facilities in the Rogue River basin in southwestern Oregon. The goal of the project was to provide the public with enjoyable and educational experiences relating to the upper Rogue aquatic ecosystem. The development included exhibits at the Cole M. River hatchery, an education center at McGregor Park, and a wildlife observation and wetland area. The center at McGregor Park featured a warm water aquarium, interactive displays, classroom, laboratory, conference area, and outdoor amphitheater. The observation area allowed visitors to view otters, herons, muskrats, beavers, and other birds, mammals, and reptiles. They could also observe salmon and steelhead at a natural spawning area.[111]

While the Corps' environmental programs and other public events drew many visitors to the agency's sites, millions more came for more traditional outdoor activities, particularly water-based sports. Two of the District's most popular recreational spots were the Bonneville Lock and Dam and Fern Ridge. Bonneville, a National Historic Landmark located 40 miles east of Portland, was one of Oregon's top tourist attractions. At the site's main visitor center on Bradford Island, visitors examined historic displays, viewed the spillway, original powerhouse, and surrounding mountains of the Columbia River Gorge, and attended a variety of presentations in the center's theater. The project also featured viewing windows on the bottom floor, allowing visitors to observe salmon migrating up a fish ladder. Other activities at Bonneville included boating, fishing, bird-watching, and windsurfing. The sport of windsurfing was especially significant, growing considerably as both a recreation activity and a local economic resource. The strong wind, the number of windy days, and the height of the swells all contributed to the popularity of windsurfing in the Bonneville pool.[112]

Located just 12 miles west of Eugene, Fern Ridge Lake also proved to be a popular destination, drawing hundreds of thousands of visitors each year in the 1980s and 1990s. Constructed in the 1940s, the project originally consisted of a dam and a reservoir designed to provide flood control and irrigation. While recreation was not an authorized primary project purpose, it became increasingly popular at Fern Ridge. In 1971, the Willamette Basin Comprehensive Study recommended modifying the project to permit fuller use of its recreation potential. Since that time, the lake was heavily used for picnicking, swimming, sailing, water skiing, and fishing. It was surrounded by numerous parks operated by the Corps, with additional facilities managed by the Lane County Parks Department under lease agreements.[113]

Recreation at Corps facilities remained focused on water – and dependent on its availability. In the spring of 1988, for example, a drought lowered water levels at Fern Ridge, threatening the summer season. "We've got lots of things that are usually scheduled here, like sailboat regattas all summer long, but right now it's wait and see," explained Jim Beal, supervisory park ranger. "The lake's low right now so

Fern Ridge Dam, originally planned for flood control and irrigation, now hosts many summer recreational guests.

we'll just have to see what happens." Despite such setbacks, the site continued to entice water enthusiasts, and in 1996 approximately 845,700 recreation visits were made to Fern Ridge.[114]

Funding also became an important issue at District projects. As the number of visits to the Corps' water resource projects exploded, the agency faced funding cuts that severely hampered its ability to manage projects. In 1979, faced with projected budget reductions, the agency initiated a nationwide effort to increase the efficiency and quality of park management and to reduce recreation costs. A national study evaluated Corps recreation programs by comparing operation and maintenance costs with visitor use and uniqueness of the area. The impact on natural and social resources was also considered. By 1982, in an effort to "trim many less essential programs," the Corps had closed 15 recreation areas at lakes in Oregon and Washington and curtailed maintenance and recreation programs at another 24 sites. Through this action, the District hoped to save an estimated $340,000.[115]

The effort to cut costs continued throughout the 1980s. In 1989 the agency embarked on another nationwide study to find new ways to maintain and enhance recreation services at its water resources projects. "The Corps is the nation's second largest federal provider of recreation," explained District Commander Colonel Charles E. Cowan, " and we need to find new ways to make our limited funds go further in this era of budget constraints." Rather than closing facilities or deferring maintenance, the study examined possibilities for partnerships with non-federal agencies and the private sector in the development and operation of recreational facilities. This idea was not entirely new – many recreation areas were already being operated by state, county, and other local public entities under lease agreement with the Corps.[116]

While budget-deficit legislation in 1993 provided some resolution to funding problems, the District continued to search for innovative ways to manage its recreation program. In 1998 the agency's work was honored with Vice President Al Gore's Hammer Award, which was given to teams of federal employees who found new and better ways to accomplish their responsibilities. The Corps, Lane County Parks, and Oregon State Parks and Recreation received the award for their creative efforts to realign their park management systems on a team concept. These agencies successfully "swapped" management responsibilities of a number of parks in overlapping jurisdictional areas, creating clusters of parks under the same agencies. Together, the three organizations cut travel time to and from managed lands, provided quicker responses to public needs, improved communication, and better supervised operations and facilities. Each agency estimated a yearly savings of $100,000 for a total savings of $300,000. "If Lane County Parks, Oregon State Parks and the Corps had not joined efforts to develop the park realignment plan, public recreation areas would either close or would begin offering fewer and fewer amenities due to

The Hammer Award was presented to Portland District in 1998

Windsurfing, fishing, and fish viewing are some of the activities at Bonneville Lock and Dam.

budget constraints," explained Wade Stampe, Willamette Valley Project Manager.[117]

In addition to new management techniques, the Corps incorporated new values into its recreation program. Initially, the agency had focused on providing structures, such as boat ramps, picnic tables, and campsites used in traditional recreation. By the 1980s, however, the District had begun to incorporate non-structural projects into its recreation mission – a shift that related to the environmental movement and its values [See Chapter Three]. One such project was the Row River Trail at Dorena Lake. In 1994 this 6.2-mile pedestrian-bicycle-equestrian trail was developed along an abandoned railroad right-of-way on the north shore of the lake. Several agencies, together with the cities of Cottage Grove and Oakridge, cooperated to construct the project, which was hailed as both a positive economic development for the area and a wonderful recreation opportunity.[118] At Hills Creek Lake, a popular recreation area located in the Willamette National Forest, the Corps developed a 130-acre wildlife and wetland area below Hills Creek Dam. The restored area featured open fields, small ponds, and riverside habitat for wildlife.[119] Similarly, flora and fauna were the focus of a project at Fern Ridge Lake. With the help of students from Looking Glass Youth and Family Services, an organization that supports at-risk youth, the District constructed a three-and-a-half foot wide boardwalk and interpretive kiosk along the lake's south shoreline. The kiosk was designed to help identify plants and animals that visitors observed at the site, as well as explain the relationship between them and the surrounding wetlands.[120]

While these projects signaled a new approach to recreation, the District continued to construct traditional facilities as well. In 1993, for example, the Corps allowed Lane County to develop 86 overnight campsites at Richardson Park, located on the shore of Fern Ridge Lake. Lane County, which managed the park under a recreational lease from the Corps, hoped the expansion would booster the local economy. These campsites required the removal of numerous mature trees and featured fire rings, picnic tables, and paved camping pads with water and electric hook-ups. Each section of the campground offered visitors a comfort station complete with showers, a trailer dump station, play structure, and grey water disposal area.[121]

While the Corps' recreation program evolved during the late 20th century, one challenge remained constant – the need to balance competing interests. As at most recreation sites, the District's water resources projects attracted a diverse crowd. Some visitors came seeking solitude and wanted to canoe calm waters or hike trails rich with wildlife. Others wanted a chance to use their motorized boats and jet skis on the Corps' reservoirs. While at times such activities could coexist, they also held the potential for conflict. Balancing recreationists' needs remained a struggle for project managers.

Bonneville Lock and Dam exemplified the problem. The Bonneville Master Plan, produced in 1997, discussed the increasing demand for recreation, which was coupled with a decrease in the available supply of public land for recreation. "More people share limited water and land resources; this has led to increasing user conflicts. These conflicts arise from sheer user numbers, different perceptions of what is an appropriate setting, user etiquette and user impacts on the recreation resource."[122] Much of the tension at Bonneville involved some type of fishing. Sport fishers, for example, resented crowding at boat ramps. This frustration stemmed in part from the fact that the spring chinook salmon run could be fished from only two sites on the Columbia River in an area that stretched from Portland to the Idaho border, causing the boat launches at each of these

Hills Creek Lake wetland and wildlife area development below the dam

sites to become overcrowded during the open season. Rangers also faced conflicts between sturgeon anglers and bank anglers. Problems arose when sturgeon anglers parked at spots where bank anglers enjoyed casting their lines. Moreover, sturgeon anglers sometimes fished from the top of a high bank, casting a shadow over shad anglers who fished at water level. Indian fishers and windsurfers, who shared several access sites, also occasionally clashed, although arguments were usually avoided because Indian fishing was frequently done in the evening, night, or early morning hours when windsurfers were not present.[123]

In addition to conflicts among different types of recreational users, disputes also occurred among special interest groups, such as recreationists, farmers, and anglers, all of whom depended on Corps projects to meet their needs. Although the agency's water resources projects were designed to meet multiple objectives, sometimes these goals were not compatible. Discussing projects in the Rogue and Willamette River basins, the District explained that "The Corps is committed to serving its customers – the people of the region. Corps projects ... are operated to serve multiple needs: flood control, hydropower, irrigation, fisheries, water supply, water quality and recreation." The agency's goal was "to effectively balance these competing needs to serve the region and its people."[124]

Controversies among competing user groups were common to districts across the country, but they were particularly acute in the Pacific Northwest, where many species of salmon were threatened and endangered. In periods of low rainfall or drought, conflicts were considerably heightened. In 1988, for example, the Corps, in response to a forecasted summer drought, proposed to lower the reservoirs at Lost Creek and Applegate lakes to aid fish populations. By releasing water from the lakes, the agency hoped to protect the spring and fall chinook salmon runs. Recreational users and farmers, however, strongly objected to the plan, telling Corps officials that too much emphasis was being placed on the downstream fishery. "There are lots of people fishing that lake," said Beth Ness of the Lost Creek Marina. "We're there and we're not going to go away." The Lost Creek Recreation Association also was concerned about the availability of lake water for recreation and vowed that, "It's not all going to go down the canyon if we can help it." Farmers, who were faced with additional costs for purchasing supplemental water, also were dismayed by the proposal. "The cost of that water is way out of bounds," asserted one farmer from Grants Pass. Another asked the District, "In an extreme year, who has precedence, the fish or the farmer?" [125]

This situation could not be easily remedied, and other drought years followed. In the year 2000, the Corps reported that seven reservoirs in the Willamette Basin would not be full by Memorial Day. A lack of rain, combined with NMFS recommended minimum flows, prompted the agency to change water releases from several dams to support the passage of juvenile upper Willamette salmon and steelhead. The Corps was well aware of the potential impact this would have on recreation in the area. "We realize these lakes are prime summer recreation spots," said District Commander Colonel Randall J. Butler. "It's frustrating for us to not be able to meet the needs of all our customers all the time... we are dependent on Mother Nature."[126]

The following year the situation had only worsened as the region faced another dry year. Especially hard hit was Detroit Lake, a popular recreation area located 50 miles east of Salem. The Detroit Lake project, constructed in the 1950s, consisted of Detroit Dam, the principal facility, and Big Cliff Dam, a smaller reregulating dam three miles downstream from Detroit. These reservoirs stored waters of the North Santiam River, controlling runoff from approximately 438 square miles of drainage area. The authorized primary project purposes were flood control, irrigation, downstream navigation improvement, and power generation.[127] Detroit Lake, however, was best known for its recreational opportunities. Its proximity to Salem, along with its massive acreage, made it a favorite destination for water sports enthusiasts and anglers. "Water skiers, jet skiers, sailors, party barge skippers, and luxury

Low water at Applegate Lake, Lost Creek Lake, and Green Peter Lake

boat captains weave between patient anglers during the summer season," said the Oregon Outdoor Recreation Guide. "With so much splashing, sometimes the lake looks like a scene from the movie 'Meatballs.'"[128]

Complicating the situation at Detroit Lake were the four threatened and endangered fish species that inhabited the Willamette River Basin. Spring chinook, winter steelhead, bull trout, and Oregon chub all depended on certain levels of water flow for passage through the watershed.[129] To comply with the requirements of the ESA, the District was required to release water from its reservoirs to ensure no direct harm to the listed fish. While lowering the lake level was unavoidable, the agency recognized the impact it would have on the local community whose economic fate was closely tied to the lake. "It's a difficult situation because we know it is having a really tremendous impact on them and their livelihood," explained Diana Brimhall, Chief of Public Affairs. "It's just unfortunate that Mother Nature has not given us enough water this year."[130]

Many residents of the Detroit Lake area vehemently opposed the Corps' plan. Oregon Representative Tootie Smith understood that "water resources across the state will be stretched to the limit," but wondered why the Corps seemed "so intent on letting Detroit Lake go so low." She further explained that "it doesn't look like recreators who depend on water will have much of a season." Mike Lamont, a marina owner, worried that the town of Detroit would suffer severe economic losses if the lake was not filled for the season. "It rained for four days last week and I got so excited because the water level was up to the docks," he explained. "Then they let [it] all out again – it's stump city up here." In response to Corps' explanation about the need to protect salmon and steelhead smolts, Tootie Smith declared, "The Corps told me they have a legal requirement for endangered species and they don't have one for recreation. I think it's about time we have a legal requirement for people in the Endangered Species Act."[131]

As the situation at Detroit Lake escalated, the Corps faced mounting pressures from local residents. "Our lakes were authorized for multiple purposes and that's something the people in Detroit don't quite want to understand – that recreation is not the one main purpose for that lake," explained Brimhall. At times the pressure took its toll on agency employees. "Somehow they've gotten the idea that [lowering the lake] is an intentional thing against them and that we are not planning

on ever filling the lake again, which is not true," Brimhall added. This dilemma remained "very frustrating for our people ... who are not used to not being trusted and not being believed."[132] To combat some of the myths that were being circulated, the District's web site devoted considerable coverage to the situation at Detroit Lake and even included several pages of "Facts & Myths" to dispel misconceptions. The agency also released numerous news releases on the subject and spoke with reporters covering the story.[133]

By the early 21st century, the problem of increasing demands for recreation and conflicts among users had shown no signs of abating. Despite the challenges in balancing competing needs, however, the District's recreation program remained an important part of its mission. In the late 20th century, recreation was an integral component of the District's projects. Lakes, trails, and campgrounds drew millions of visitors, and, in many cases, provided them with their only exposure to the Corps and its mission. Furthermore, as the District shifted from structural to non-structural projects, it demonstrated its ability to incorporate the values and objectives of the environmental movement. Nature centers, bike paths, and wildlife observation areas joined the more traditional facilities of campgrounds and boat launches. Finally, despite budgetary restraints, the Corps' approach to park operations, such as park swapping, illustrated its ability to tackle important management issues creatively.

Conclusion

Historically, the Portland District focused on its civil works mission, particularly the building of large multipurpose dams. By the 1980s, however, the era of dam building had ended in the Pacific Northwest due in large part to pressure from the environmental movement. Simultaneously, the District expanded its mission to include restoring wetlands, expanding fish-passage facilities, and providing additional recreational opportunities. These new areas of work gained increasing attention, highlighting the changing nature of the agency's operations, but the Corps' multipurpose projects continued to be an important component of the District's work.

Endnotes

[1] Mary E. Reed, *A History of the North Pacific Division* (North Pacific Division, U.S. Army Corps of Engineers, 1991), p. 48.

[2] Rick Minor and Stephen Dow Beckham, *Cultural Resources Overview and Investigations for the Bonneville Navigation Lock Project, Oregon and Washington*, Portland District, U.S. Army Corps of Engineers, 1984, p. 61.

[3] Carlos Schwantes, *The Pacific Northwest: An Interpretive History*, revised edition (Lincoln: University of Nebraska Press, 1996). pp. 411-412.

[4] Samuel P. Hays, *Conservation and the Gospel of Efficiency: The Progressive Conservation Movement*, *1890-1920* (Cambridge: Harvard University Press, 1959).

[5] Oregon Blue Book, accessed at http://www.sos.state.or.us/BlueBook/1999_2000/local/populations/pop06.htm, on June 1, 2001.

[6] Office of Financial Management, State of Washington, accessed at http://www.ofm.wa.gov/pop189090/pop189000.xls, on June 1, 2001.

[7] U.S. Army Corps of Engineers, Portland District, *Bonneville Second Powerhouse*, September 1984, Portland District Technical Library; "Dedication of Bonneville II Powerhouse," Bonneville, Washington, June 1, 1983, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-91-0043, Box 2 of 2, Folder "Dedications – Bonneville Second Powerhouse."

[8] U.S. Army Engineer District, Portland Corps of Engineers, *Second Powerhouse Design Memorandum No. 22: Downstream Landscaping and Visitor Facilities*, September 1981, Portland District Technical Library.

[9] U.S. Army Corps of Engineers, Portland District, *Bonneville Second Powerhouse*, September 1984, Portland District Technical Library.

[10] U.S. Army Corps of Engineers, Portland District, *Bonneville Second Powerhouse*, September 1984, Portland District Technical Library.

[11] U.S. Army Corps of Engineers, Portland District, *Bonneville Second Powerhouse*, September 1984, Portland District Technical Library.

[12] U.S. Army Corps of Engineers, Portland District, *Bonneville Second Powerhouse*, September 1984, Portland District Technical Library.

[13] "Dedication of Bonneville II Powerhouse," Bonneville, Washington, June 1, 1983, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-91-0043, Box 2 of 2, Folder "Dedications – Bonneville Second Powerhouse."

[14] U.S. Army Corps of Engineers, Portland District, *Bonneville Second Powerhouse*, September 1984, Portland District Technical Library; "Dedication of Bonneville II Powerhouse," Bonneville, Washington, June 1, 1983, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-91-0043, Box 2 of 2, Folder "Dedications – Bonneville Second Powerhouse."

[15] U.S. Army Corps of Engineers, Portland District, "Powerhouse – Applegate ceremonies bring Bratton to Portland District," *Corps'pondent*, May 29, 1981; U.S. Army Corps of Engineers, Portland District, *Water Resources Development in Oregon, 1997*, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc 1950401, Binders and Books, Box 2.

[16] Dawn Mueller, "Thousands Find Work at Bonneville," *Corps'pondent*, June 1, 1983, Federal Records Center Pacific Alaska Region Pacific Alaska Region, RG 77, Accession 77-95-0183, Corps Newsletter, Box 1 of 2.

[17] "Dedication of Bonneville II Powerhouse," Bonneville, Washington, June 1, 1983, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-91-0043, Box 2 of 2, Folder "Dedications – Bonneville Second Powerhouse."

[18] U.S. Army Corps of Engineers, Portland District, *Bonneville Second Powerhouse*, September 1984, Portland District Technical Library.

[19] U.S. Army Corps of Engineers, Portland District, *Bonneville Second Powerhouse*, September 1984, Portland District Technical Library.

[20] Washington Department of Game, "Proposal for Wildlife Mitigation, Bonneville Second Powerhouse Project," October 15, 1980, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-95-0188, Box 2 of 2, Folder "Bonneville 2nd Mitigation."

[21] Sherry K. Horton, Portland Ecological Services Field Office, U.S. Fish and Wildlife Service, "Fish and Wildlife Impacts and Mitigation Recommendations, Bonneville Second Powerhouse Project, Skamania County, Washington," August 1982, Iron Mountain Records examined at Portland District Information Management Center, Location 6220106090304, Box 2 of 4, Unlabeled Folder.

Endnotes

[22] Washington Department of Game, "Proposal for Wildlife Mitigation, Bonneville Second Powerhouse Project," October 15, 1980, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-95-0188, Box 2 of 2, Folder "Bonneville 2nd Mitigation;" Sherry K. Horton, Portland Ecological Services Field Office, U.S. Fish and Wildlife Service, "Fish and Wildlife Impacts and Mitigation Recommendations, Bonneville Second Powerhouse Project, Skamania County, Washington," August 1982, Iron Mountain Records examined at Portland District Information Management Center, Location 6220106090304, Box 2 of 4, Unlabeled Folder.

[23] Beth A. Allen, "Portland District Looks Ahead," January 14, 1992, Iron Mountain Records examined at Portland District Information Management Center, Location 277BB34140108, Box 2 of 3, Folder "360-5b News Media and Releases; Media Contacts 1992;" Personal Communication with Park Manager James E. Runkles, August 13, 2001, Bonneville Dam, Cascade Locks, Oregon.

[24] U.S. Fish and Wildlife Service, accessed at http://www.r1.fws.gov/gorgefish/STEIGER/STEIGERW.HTM, on June 1, 2001; Memo from Commander, North Pacific Division, "Steigerwald Lake Wetland Acquisition, Bonneville Second Powerhouse, Oregon and Washington," November 27, 1984, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-95-0188, Box 2 of 2, Folder "Bonneville 2nd Mitigation;" Letter from R.L. Friedenwald, Colonel, Corps of Engineers to Jack Wayland, Director, Washington Department of Game, June 11, 1985, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-91-0028, Box 1 of 1, Folder "Bonneville Second Powerhouse, 1985."

[25] "Dedication of Bonneville II Powerhouse," Bonneville, Washington, June 1, 1983, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-91-0043, Box 2 of 2, Folder "Dedications – Bonneville Second Powerhouse."

[26] U.S. Army Corps of Engineers, Portland District, "Bonneville First Powerhouse Rehabilitation," January 1993.

[27] U.S. Army Corps of Engineers, Portland District, "Bonneville First Powerhouse Rehabilitation," January 1993.

[28] Personal Communication with Dave Shank, Assistant Operations Manager, Bonneville Lock and Dam, August 13, 2001, Bonneville Dam, Cascade Locks, Oregon.

[29] U.S. Army Corps of Engineers, Portland District, "Bonneville First Powerhouse Rehabilitation," January 1993.

[30] Mike Allegre, "Aging Corps of Engineers infrastructure getting needed facelifts," May 26, 1995, Portland District, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc 19150401, Box 1 of 4, Folder: "Fish 1995."

[31] U.S. Army Corps of Engineers, Portland District, "Bonneville First Powerhouse Rehabilitation," January 1993.

[32] U.S. Army Corps of Engineers, Portland District, "Bonneville First Powerhouse Rehabilitation," January 1993.

[33] U.S. Army Corps of Engineers, Portland District, "Bonneville First Powerhouse Rehabilitation," January 1993; Mike Allegre, "Aging Corps of Engineers infrastructure getting needed facelifts," May 26, 1995, Portland District, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc 19150401, Box 1 of 4, Folder: "Fish 1995."

[34] U.S. Army Corps of Engineers, Portland District, "Bonneville First Powerhouse Rehabilitation," January 1993.

[35] U.S. Army Corps of Engineers, Portland District, "Bonneville First Powerhouse Rehabilitation," January 1993.

[36] U.S. Army Corps of Engineers, Portland District, "Bonneville First Powerhouse Rehabilitation," January 1993.

[37] U.S. Army Corps of Engineers, Portland District, "Bonneville First Powerhouse Rehabilitation," January 1993.

[38] Army Corps of Engineers, Portland District, accessed at https://www.nwp.usace.army.mil/pm/projects/welcome.htm, on June 1, 2001.

[39] Army Corps of Engineers, Portland District, "Summary of Activities for Calendar Year 1995," Portland District, Public Affairs Office, 870-5a, Organizational Histories, 1990-1999.

[40] U.S. Army Corps of Engineers, Portland District, "Bonneville First Powerhouse Rehabilitation," January 1993.

[41] Personal Communication with Park Manager James E. Runkles, August 13, 2001, Bonneville Dam, Cascade Locks, Oregon.

[42] U.S. Army Corps of Engineers, Portland District, *Water Resources Development in Oregon, 1997*, Iron Mountain Records examined at Portland District

Endnotes

Information Management Center, Portland District, Location 277 cc 19150401, Box 2: Binders and Books.

[43] U.S. Army Corps of Engineers, Portland District, *Water Resources Development in Oregon, 1997*, Iron Mountain Records examined at Portland District Information Management Center, Portland District, Location 277 cc 19150401, Box 2: Binders and Books; "Bonneville New Navigation Lock Opens," Portland District, Army Corps of Engineers, March 26, 1993, Portland District, Public Affairs Office, 870-5b Installation Navigation Lock, Bonneville Navigation Lock, News Releases.

[44] Beth A. Allen, "Portland District Looks Ahead," January 14, 1992, Portland District, Iron Mountain Records examined at Portland District Information Management Center, Location 277 BB 34 14 01 08, Box 2 of 3, Folder: 360-5b News Media and Releases, Media Contacts 1992; "Corps Portland District Looks to New Year," January 15, 1991, Portland District, Iron Mountain Records examined at Portland District Information Management Center, Location 277 BB 34 14 01 08, Box 2 of 3, Folder: News Releases, 1991-1993.

[45] U.S. Army Corps of Engineers, *Annual Historical Report*, 1994, Portland District, Public Affairs Office, 870-5a, Organizational Histories, 1990-1999.

[46] Sara Walters, "Bonneville Navigation Lock Challenges Met," *Corps'pondent*, February 1989, Federal Records Center Pacific Alaska Region Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1 of 2, Corps Newsletter; "Bonneville New Navigation Lock Opens," Portland District, Army Corps of Engineers, March 26, 1993, Portland District, Public Affairs Office, 870-5b Installation Navigation Lock, Bonneville Navigation Lock, News Releases.

[47] "Bonneville New Navigation Lock Opens," Portland District, Army Corps of Engineers, March 26, 1993, Portland District, Public Affairs Office, 870-5b Installation Navigation Lock, Bonneville Navigation Lock, News Releases.

[48] "Bonneville New Navigation Lock Opens," Portland District, Army Corps of Engineers, March 26, 1993, Portland District, Public Affairs Office, 870-5b Installation Navigation Lock, Bonneville Navigation Lock, News Releases; "1995 Presidential Design Awards, Bonneville New Navigation Lock," Portland District, Public Affairs Office, 870-5b Installation Navigation Lock, Bonneville Navigation Lock, General.

[49] "Bonneville New Navigation Lock Opens," Portland District, Army Corps of Engineers, March 26, 1993, Portland District, Public Affairs Office, 870-5b Installation Navigation Lock, Bonneville Navigation Lock, News Releases.

[50] U.S. Army Corps of Engineers, Portland District, *Excavated Material Evaluation for Upland Disposal,* December 1993, Federal Records Center Pacific Alaska Region Pacific Alaska Region, RG 77, Accession 77-97-0051, Box 6 of 9; "Corps Portland District Looks to New Year," January 15, 1991, Portland District, Iron Mountain Records examined at Portland District Information Management Center, Location 277 BB 34 14 01 08, Box 2 of 3, Folder: News Releases, 1991-1993.

[51] Letter from Patrick J. Keough, Chief, Planning Division, December 2, 1986, Federal Records Center Pacific Alaska Region Pacific Alaska Region, RG 77, Accession 77-90-0008, Box 1 of 1, Folder: Fish and Wildlife #9; U.S. Army Corps of Engineers, Portland District, *Bonneville Master Plan*, March 1997, Portland District Technical Library.

[52] "Corps Portland District Looks to New Year," January 15, 1991, Portland District, Iron Mountain Records examined at Portland District Information Management Center, Location 277 BB 34 14 01 08, Box 2 of 3, Folder: News Releases, 1991-1993.

[53] "Corps Portland District Looks to New Year," January 15, 1991, Portland District, Iron Mountain Records examined at Portland District Information Management Center, Location 277 BB 34 14 01 08, Box 2 of 3, Folder: News Releases, 1991-1993.

[54] "Bonneville New Navigation Lock Opens," Portland District, Army Corps of Engineers, March 26, 1993, Portland District, Public Affairs Office, 870-5b Installation Navigation Lock, Bonneville Navigation Lock, News Releases.

[55] Arthur E. Williams, Bonneville Lock Dedication, July 10, 1993, Portland District, Public Affairs Office, 870-5b Installation History Files, Bonneville Navigation Lock, General.

[56] Major General Ernest J. Harrell, Bonneville Navigation Lock Dedication, July 10, 1993, Portland District, Public Affairs Office, 870-5b Installation Navigation Lock, Bonneville Navigation Lock, General.

[57] Keith Peterson, "The Army Corps of Engineers and the Environment in the Pacific Northwest," unpublished manuscript for the Army Corps of Engineers, Office of the Chief of Engineers, Historical Division, May 1982, pp. 32-38.

Endnotes

[58] U.S. Army Corps of Engineers, Portland District, *Elk Creek Lake: Master Plan for Resource Use*, December 1987, Portland District Technical Library; Keith Peterson, "The Army Corps of Engineers and the Environment in the Pacific Northwest," unpublished manuscript for the Army Corps of Engineers, Office of the Chief of Engineers, Historical Division, May 1982, pp. 32-38.

[59] Keith Peterson, "The Army Corps of Engineers and the Environment in the Pacific Northwest," unpublished manuscript for the Army Corps of Engineers, Office of the Chief of Engineers, Historical Division, May 1982, pp. 42-48.

[60] Keith Peterson, "The Army Corps of Engineers and the Environment in the Pacific Northwest," unpublished manuscript for the Army Corps of Engineers, Office of the Chief of Engineers, Historical Division, May 1982, pp. 42-48.

[61] U.S. Army Corps of Engineers, Portland District, *Elk Creek Lake, Design Memorandum No. 10, Supplement No. 2*, July 1985, Federal Records Center Pacific Alaska Region Pacific Alaska Region, RG 77, Accession 77-89-0085, Box 1 of 37.

[62] Keith Peterson, "The Army Corps of Engineers and the Environment in the Pacific Northwest," unpublished manuscript for the Army Corps of Engineers, Office of the Chief of Engineers, Historical Division, May 1982, pp. 53-54.

[63] Keith Peterson, "The Army Corps of Engineers and the Environment in the Pacific Northwest," unpublished manuscript for the Army Corps of Engineers, Office of the Chief of Engineers, Historical Division, May 1982, pp. 54-55.

[64] Keith Peterson, "The Army Corps of Engineers and the Environment in the Pacific Northwest," unpublished manuscript for the Army Corps of Engineers, Office of the Chief of Engineers, Historical Division, May 1982, p. 58.

[65] U.S. Army Corps of Engineers, Portland District, *Elk Creek Lake: Master Plan for Resource Use*, December 1987, Portland District Technical Library.

[66] Keith Peterson, "The Army Corps of Engineers and the Environment in the Pacific Northwest," unpublished manuscript for the Army Corps of Engineers, Office of the Chief of Engineers, Historical Division, May 1982, p. 57; Comptroller General, *Report to the Honorable James H. Weaver, House of Representatives of United States: Corps of Engineers Should Reevaluate the Elk Creek Project's Benefits and Costs*, March 15, 1982, United States General Accounting Office, p. 40.

[67] "Elk Creek: Supreme Court Weighs Future of District Project," April 1989, *Corps'pondent*, Federal Records Center Pacific Alaska Region Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1 of 2.

[68] Tom White, Interview with Lisa Mighetto, Portland, Oregon, October 18, 2001. Hereafter cited as White Interview.

[69] Martin Reuss, *Reshaping National Water Politics: The Emergence of the Water Resources Development Act of 1986* (Fort Belvoir, VA: U.S. Army Corps of Engineers, Institute for Water Resources, 1991), pp. 175-176.

[70] White Interview.

[71] John A. Ferejohn, *Pork Barrel Politics: Rivers and Harbors Legislation, 1947-1968* (Stanford University Press: Stanford, California, 1974).

[72] White Interview.

[73] Tom Davis, Interview with Lisa Mighetto, Portland, Oregon, October 18, 2001.

[74] *Congressional Record*. 99th cong., 1st sess., 1985, 131, no. 94.

[75] *Congressional Record*. 99th cong., 1st sess., 1985, 131, no. 156; *Congressional Record*. 99th cong., 1st sess., 132, no. 4.

[76] Paul Fattig, "Elk Creek Master Plan Released," July 22, 1988, *Daily Courier*, Portland District, Iron Mountain Records examined at Portland District Information Management Center, Location 6220106090304, Box 4 of 4, Folder: Elk Creek Lake Master Plan; U.S. Army Corps of Engineers, Portland District, "Elk Creek: Supreme Court Weighs Future of District Project," April 1989, *Corps'pondent*, Federal Records Center Pacific Alaska Region Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1 of 2.

[77] "Elk Creek: Supreme Court Weighs Future of District Project," April 1989, *Corps'pondent*, Federal Records Center Pacific Alaska Region Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1 of 2; Robert Sterling, "Corps Sets Elk Creek Timetable," *Corps'pondent*, February 1988, Federal Records Center Pacific Alaska Region Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1 of 2; U.S. House. Committee on Agriculture. *U.S. Army Corps of Engineers' Proposal to Restore a Fish Passage Corridor Through Elk Creek Dam*. Hearing, 13 November, 1997 (Serial no. 105-36). Washington, D.C.: Government Printing Office, 1998. (Y4. AG 8/1: 105-36), p. 164.

Endnotes

[78] "Elk Creek: Supreme Court Weighs Future of District Project," April 1989, *Corps'pondent*, Federal Records Center Pacific Alaska Region Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1 of 2; U.S. House. Committee on Agriculture. *U.S. Army Corps of Engineers' Proposal to Restore a Fish Passage Corridor Through Elk Creek Dam*. Hearing, 13 November, 1997 (Serial no. 105-36). Washington, D.C.: Government Printing Office, 1998. (Y4. AG 8/1: 105-36), p. 119.

[79] Dawn M. Edwards, "One Step Closer to Elk Creek Decision," January 1991, *Corps'pondent*, Federal Records Center Pacific Alaska Region Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1 of 2.

[80] Video Recording of February 15, 1990 newscast, Channel 8, 5 p.m. News, provided by Portland District Information Management Center.

[81] U.S. Army Corps of Engineers, Portland District, "Corps Releases Final Elk Creek Environmental Impact Statement," May 2, 1991, News Release, Iron Mountain Records examined at Portland District Information Management Center, Location 277 BB 34140108, Box 2 of 3, Folder: News Releases, 1991-1993.

[82] U.S. Army Corps of Engineers, Portland District, "Court Decision Issued on Injunctions," October 25, 1993, News Release, Iron Mountain Records examined at Portland District Information Management Center, Location 277 BB 34140108, Box 2 of 3, Folder: News Releases, 1991-1993.

[83] Video recording of May 17, 1993 newscast, "Elk Creek Dam at Issue," Portland news channel KATU 2, 5:02 p.m., provided by Portland District Information Management Center; Video recording of May 17, 1993 newscast, "Your Money, Your Choice: Elk Creek Dam," ABC World News report to Portland news channel KATU 2, 6:25 p.m., provided by Portland District Information Management Center.

[84] U.S. Army Corps of Engineers, Portland District, "Court Decision Issued on Injunctions," October 25, 1993, News Release, Iron Mountain Records examined at Portland District Information Management Center, Location 277 BB 34140108, Box 2 of 3, Folder: News Releases, 1991-1993.

[85] Dawn M. Edwards, "Elk Creek Dam Ruling Issued," March 1994, *Corps'pondent*, Iron Mountain Records examined at Portland District Information Management Center, Location 277 BB 34140108, Box 2 of 3.

[86] Video recording of June 21, 1994 newscast, "Northwest Reports: Elk Creek Dam," Portland news channel KPTV 12, 9:42 p.m., provided by Portland District Information Management Center.

[87] Video recording of June 21, 1994 newscast, "Northwest Reports: Elk Creek Dam," Portland news channel KPTV 12, 9:42 p.m., provided by Portland District Information Management Center.

[88] Video recording of June 21, 1994 newscast, "Northwest Reports: Elk Creek Dam," Portland news channel KPTV 12, 9:42 p.m., provided by Portland District Information Management Center.

[89] U.S. Army Corps of Engineers, Portland District, "Elk Creek Dam Modifications Most Successful Way of Providing Fish Passage," January 9, 1998, News Release, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc34060105, Folder: News Releases 1998.

[90] U.S. Army Corps of Engineers, Portland District, "Elk Creek Dam Modifications Most Successful Way of Providing Fish Passage," January 9, 1998, News Release, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc34060105, Folder: News Releases 1998.

[91] Video recording, "Elk Creek Dam Debate," November 12, 1997, Medford News channel KTVL 10, 5:03 p.m., provided by the Portland District Information Management Center.

[92] Video recording, "Elk Creek Dam Debate," November 12, 1997, Medford News channel KTVL 10, 5:03 p.m., provided by the Portland District Information Management Center.

[93] Video recording of "Elk Creek Dam Debate," November 13, 1997, Medford news channel KOBI 5, 11:06 p.m., provided by the Portland District Information Management Center.

[94] Video recording, "Elk Creek Dam Debate," November 12, 1997, Medford News channel KTVL 10, 5:03 p.m., provided by the Portland District Information Management Center.

[95] Mark Freeman, "Elk Creek Dam Battle Taken up a Notch: Fisheries Report Proposes Restoring Channel to Save Fish," February 2001, *Mail Tribune News*, accessed at http://www.mailtribune.com/archive/2001/february/020201n5.htm, on June 1, 2001.

[96] Beth Quinn, "Opinion adds ammo to foes: A report says breaching the Elk Creek Dam is vital to threatened coho in the Rogue River tributary."

Endnotes

February 1, 2001, *The Oregonian*, accessed at http://www.oregonlive.com/printer/printer.ssf??news/oregonian/01/02/nw_51dam01.frame, June 1, 2001.

[97] John A. Jakle, *The Tourist: Travel in Twentieth-Century North America* (Lincoln: University of Nebraska Press, 1985), pp. 185-186.

[98] Jakle, *The Tourist: Travel in Twentieth-Century North America*, p. 187. In his book Jakle discussed several recreational surveys conducted in the 1950s that reflect tourism's outdoor orientation. A survey of 1,600 tourists in Michigan in 1952, for example, revealed that 70 percent came for sightseeing, 55 percent to fish, 40 percent for the beaches, and 13 percent to camp. Of the major state attractions, scenery was mentioned by 62 percent of the respondents – more than any other single factor. A 1953 survey of 2,600 tourists in Colorado found similar results. Ninety-four percent were interested in general sightseeing, 77 percent in "taking it easy," 62 percent in visiting historic sites, 60 percent in picnicking, 49 percent in shopping, and approximately 40 percent in fishing, camping, and hiking.

[99] U.S. Army Corps of Engineers, Portland District, *Water Resources Development in Oregon, 1997*, p. 4, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc 19150401, Box 2 Binders and Books; U.S. Army Corps of Engineers, "Civil Works Overview," Portland District, Public Affairs Office, 870-5a, Organizational Histories, 1990-1999, p. 14.

[100] Civil Works Overview, Public Affairs Office, Fort Worth District, no date, p. 2.

[101] Personal Communication with Park Manager James E. Runkles, August 13, 2001, Bonneville Dam, Cascade Locks, Oregon.

[102] U.S. Army Corps of Engineers, Portland District, "Corps recreation site draws many," March 6, 1981, *Corps'pondent*, Federal Records Center Pacific Alaska Region, Pacific Alaska Region, RG 77 Accession 77-95-0183, Box 1, Corps Newsletter; U.S. Army Corps of Engineers, Portland District, "Millions visit Corps projects annually," April 8, 1983, *Corps'pondent*, Federal Records Center Pacific Alaska Region, Pacific Alaska Region, RG 77 Accession 77-95-0183, Box 1, Corps Newsletter.

[103] U.S. Army Corps of Engineers, Portland District, "Millions visit Corps projects annually," April 8, 1983, *Corps'pondent*, Federal Records Center Pacific Alaska Region, Pacific Alaska Region, RG 77 Accession 77-95-0183, Box 1, Corps Newsletter; U.S. Army Corps of Engineers, Portland District, "Corps of Engineers recreation season begins," May 17, 2000, News Release, accessed at https://www.nwp.usace.army.mil/pa/info/summer2000%5Frec.htm, on June 1, 2001.

[104] U.S. Army Corps of Engineers, *Annual Historical Report*, 1998, p. 1-14, Portland District, Public Affairs Office, 870-5a, Organizational Histories, 1990-1999.

[105] U.S. Army Corps of Engineers, *Annual Historical Report*, 1995, p. A-9, Portland District, Public Affairs Office, 870-5a, Organizational Histories, 1990-1999.

[106] U.S. Army Corps of Engineers, accessed at https://www.nwp.usace.army.mil/op/v/wvprjts.htm and http://www.nwp.usace.army.mil/pa/news/archive/1997/97%D47.htm, on June 1, 2001.

[107] U.S. Army Corps of Engineers, *Annual Historical Report*, 1997, p. C-12, Portland District, Public Affairs Office, 870-5a, Organizational Histories, 1990-1999; U.S. Army Corps of Engineers, *Annual Historical Report*, 1999, p. 1-16, Portland District, Public Affairs Office, 870-5a, Organizational Histories, 1990-1999.

[108] U.S. Army Corps of Engineers, *Annual Historical Report*, 1993, p. 7, Portland District, Public Affairs Office, 870-5a, Organizational Histories, 1990-1999.

[109] U.S. Army Corps of Engineers, *Annual Historical Report*, 1997, p. C-12, Portland District, Public Affairs Office, 870-5a, Organizational Histories, 1990-1999.

[110] U.S. Army Corps of Engineers, *Annual Historical Report*, 1997, p. C-10, Portland District, Public Affairs Office, 870-5a, Organizational Histories, 1990-1999.

[111] U.S. Army Corps of Engineers, *Annual Historical Report,* 1994, p. 10, Portland District, Public Affairs Office, 870-5a, Organizational Histories, 1990-1999.

[112] U.S. Army Corps of Engineers, Portland District, *Bonneville Master Plan, Final March 1997*, pp. 65-68, Portland District Technical Library.

[113] U.S. Army Corps of Engineers, Portland District, *Water Resources Development in Oregon, 1997*, pp. 24-25, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc 19150401, Box 2 Binders and Books; U.S. Army Corps of Engineers, Portland District, "When vacation rolls around, how about...Corps recreation areas?" May 1988, *Corps'pondent*, Federal Records Center Pacific Alaska Region, Pacific Alaska Region, RG 77 Accession 77-95-0183, Box 1, Corps Newsletter.

[114] U.S. Army Corps of Engineers, Portland District, *Water Resources Development in Oregon, 1997*, pp. 24-25, Iron Mountain Records examined at Portland District Information Management Center, Location

Endnotes

277 cc 19150401, Box 2 Binders and Books; U.S. Army Corps of Engineers, Portland District, "When vacation rolls around, how about...Corps recreation areas?" May 1988, *Corps'pondent*, Federal Records Center Pacific Alaska Region, Pacific Alaska Region, RG 77 Accession 77-95-0183, Box 1, Corps Newsletter.

[115] U.S. Army Corps of Engineers, Portland District, "Recreation cuts planned," February 26, 1982, *Corps'pondent*, Federal Records Center Pacific Alaska Region, Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1, Corps Newsletter.

[116] U.S. Army Corps of Engineers, Portland District, "Corps to Seek Recreation Alternatives," December 8, 1989, News Release, Federal Records Center Pacific Alaska Region, Pacific Alaska Region, RG 77, Installation History Files, Accession 77-98-0005, Box 24 of 51.

[117] U.S. Army Corps of Engineers, Portland District, "Willamette Valley's key parks providers hammered by Al Gore," March 31, 1998, News Release, accessed at https://www.nwp.usace.army.mil/pa/news/archive/1998/98%2D25.htm, on June 1, 2001.

[118] U.S. Army Corps of Engineers, *Annual Historical Report,* 1994, p. 10, Portland District, Public Affairs Office, 870-5a, Organizational Histories, 1990-1999.

[119] U.S. Army Corps of Engineers, Portland District, "Corps of Engineers recreation season begins," May 17, 2000, News Release, accessed at https://www.nwp.usace.army.mil/pa/info/summer2000%5Frec.htm, on June 1, 2001.

[120] U.S. Army Corps of Engineers, *Annual Historical Report*, 1997, p. C-9, Portland District, Public Affairs Office, 870-5a, Organizational Histories, 1990-1999.

[121] U.S. Army Corps of Engineers, Portland District, "Overnight Camping Facilities Proposed at Fern Ridge Lake," January 21, 1993, News Release, Iron Mountain Records examined at Portland District Information Management Center, Location 277 bb 34140108, Box 2 of 3, Folder: News releases, 1991-1993.

[122] U.S. Army Corps of Engineers, Portland District, *Bonneville Master Plan, Final March 1997*, pp. 68-69, Portland District Technical Library.

[123] U.S. Army Corps of Engineers, Portland District, *Bonneville Master Plan, Final March 1997*, p. 69, Portland District Technical Library.

[124] U.S. Army Corps of Engineers, Portland District, "Corps water regulation efforts reduced overall river levels," January 15, 1997, News Release, accessed at https://www.nwp.usace.army.mil/pa/news/archive/1997/97%2D13.htm, on June 1, 2001.

[125] Paul Fattig, "Corps hears outpouring of water woes: Users steam over proposals for reservoir outflows," May 5, 1988, *Daily Courier*, Portland District, Public Affairs Office, 870-5b Installation History Files, Rogue River Basin Correspondence.

[126] U.S. Army Corps of Engineers, Portland District, "Seven Willamette Basin reservoirs may not fill by Memorial Day," April 10, 2000, News Release, accessed at https://www.nwp.usace.army.mil/pa/news/archive/2000/00%2D47.htm, on June 1, 2001.

[127] U.S. Army Corps of Engineers, Portland District, *Water Resources Development in Oregon, 1997*, p. 29, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc 19150401, Box 2 Binders and Books.

[128] Oregon Outdoor Recreation Guide, accessed at http://ptopia.com/cascade/lakes/detroit.html, on June 1, 2001.

[129] U.S. Army Corps of Engineers, Portland District, "Willamette Low Water Situation," accessed at http://www.nwp.usace.army.mil/issues/lowwater/willamette/welcome.htm, on June 1, 2001.

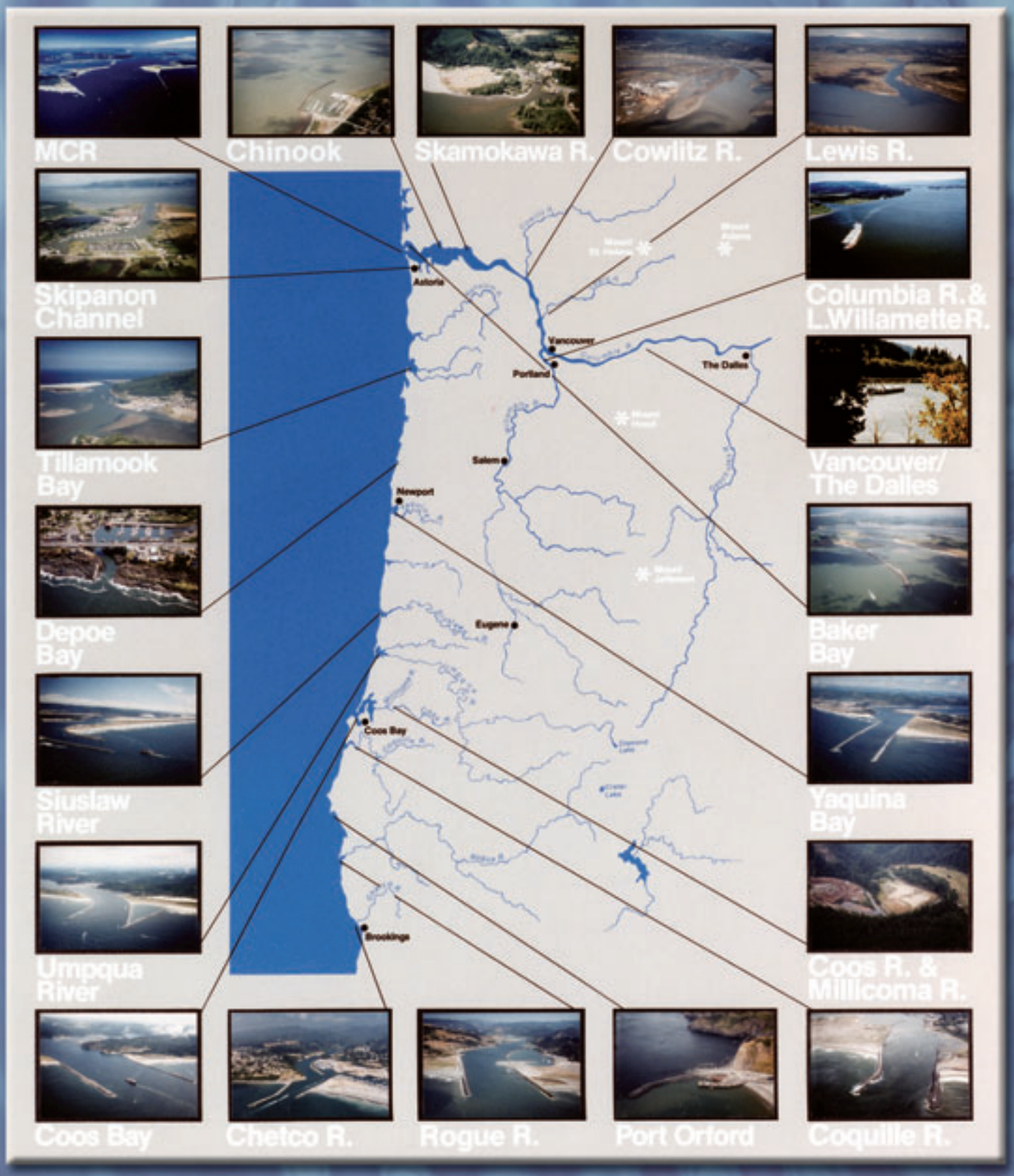
[130] Diana Brimhall, Interview with Lisa Mighetto, Portland, Oregon, June 13, 2001. Hereafter cited as Brimhall Interview.

[131] Representative Tootie Smith's column, accessed at http://www.leg.state.or.us/smitht/column4_20.htm, on June 1, 2001.

[132] Brimhall Interview.

[133] Brimhall Interview; U.S. Army Corps of Engineers, accessed at https://www.nwp.usace.army.mil/issues/lowwater/willamette/facts.htm, on June 1, 2001.

Navigation


MCR
Chinook
Skamokawa R.
Cowlitz R.
Lewis R.
Skipanon Channel
Columbia R.& L.Willamette R.
Tillamook Bay
Vancouver/ The Dalles
Depoe Bay
Baker Bay
Siuslaw River
Yaquina Bay
Umpqua River
Coos R. & Millicoma R.
Coos Bay
Chetco R.
Rogue R.
Port Orford
Coquille R.
Astoria
Portland
Vancouver
The Dalles
Salem
Newport
Eugene
Coos Bay
Brookings

Chapter Two
Navigation

"We realize that protecting fisheries and other endangered species can, and should, go hand in hand with managing and protecting our nation's infrastructure…. That includes our dredging mission."

David Beach, Chief, Navigation Branch, Operations Division, 2001

Dredging the channel at Coos Bay

Depot Bay boat basin and jetty

Coquille Lighthouse

In addition to providing for flood control and operating hydroelectric projects, the Corps also is charged with managing the nation's waterways for navigation. This is an especially important mission in the Portland District, which includes the Oregon coast, as well as the Columbia and Willamette rivers.

The Corps has a long history of navigation work on the Oregon and Washington coasts. Engineers began surveying and building jetties in the 19th century. During the late 20th century, engineers continued to meet the region's navigation needs, both undertaking new projects, as well as maintaining and operating existing ones. This work, which included channel deepening, dredging, and jetty construction, was vital to the economic health of the coastal communities. Many towns along the Oregon and Washington coasts depended on their ports, which drew both commercial and recreational users. "If you go to Newport," one employee observed, "you go there for ... the fishing boats and the waterfront and the beach." He noted that if the Corps did not maintain the jetties or dredge the channels "the towns would start drying up."[1]

The Corps' responsibilities extended throughout the Oregon Coast Basin, as well as a small section of southwestern Washington. The Oregon Coast Basin includes all streams south of the Columbia River that drain directly to the Pacific Ocean. It is comprised of three distinct sub-basins – the Rogue, Umpqua, and Coastal.[2]

In addition to managing coastal streams and harbors, the District maintains the Columbia and Willamette rivers, which are the Northwest's link to world markets, providing an essential trade corridor for the United States. Together they comprise the world's second largest grain export system, with only the Mississippi River exceeding them in size and importance. More than 40 percent of the wheat exports from the United States are shipped via ports on these Oregon rivers. Each year approximately $13 billion worth of freight is transported via oceangoing vessels on the Columbia and the

Willamette rivers. The commodities on these ships include millions of tons of mineral bulk cargoes (potash, soda ash, aluminum ore), breakbulk cargoes (steel and forest products), automobiles, and goods, ranging from clothing and groceries to animal feed and paper products. The rivers carry containerized cargo from more than 40 states, and more than 900 Oregon and southwest Washington companies ship their cargo via Portland.[3]

To operate and maintain this federal navigation channel, the District engaged in a variety of management activities, including dredging, diking, and building jetties. During the late 20th century, the agency's navigation work faced new issues. Larger ships, along with growing traffic volumes, placed additional pressure on the channel and resulted in a movement to deepen the rivers from 40 to 43 feet. As the agency dredged increasing amounts of material from the rivers, the issue of where to put this dredged material – some of which was contaminated – became a crucial question.

While the Columbia and Willamette rivers serve as corridors of commerce, they also provide habitat for fish and wildlife. Of particular significance is the fact that the Columbia River watershed is home to numerous stocks of salmon and other anadromous fish, many of which are threatened or endangered. The Endangered Species Act (ESA) and other environmental laws demanded that these rivers be managed for plants and animals, not just for cargo ships. In the period from 1980-2000, the District faced the task of balancing the river's economic and environmental role in the region.

Navigating the Pacific Coast

At Nehalem Bay, located 40 miles south of the Columbia, the Corps constructed two jetties in 1918 to stabilize the channel across the ocean bar at the bay's entrance. The purpose of a jetty is to concentrate and accelerate water flow at the

Nehalem Bay jetties

Rebuilding the north jetty at Yaquina Bay and Harbor

mouth of a river. This concentrated water flow scours out shallow sand deposits, stabilizing the river channel. As the decades passed, the jetties at Nehalem Bay began to show signs of deterioration. Strong water and wave action had removed large boulders, while underwater currents displaced smaller stones.[4]

In 1981, the Corps awarded a contract to joint venturers E.W. Eldridge, Inc. of Sandy, Oregon, and Marshal Associated Contractors of Tualatin, Oregon, to rehabilitate the aging structures. The project involved placing more than 347,000 tons of rock to extend the south jetty to 4,400 feet and the north jetty to 3,400 feet. Workers placed rocks, weighing more than 40 tons each, at the tip of both jetties – at the time the largest ever placed on an Oregon coast jetty. In November 1982, the work was completed at a cost of $12 million. A sign erected at the site read, "Dedicated to safer bar crossings and to all those who labored to obtain this restoration."[5]

A jetty restoration was also the major work done at Tillamook Bay in recent decades. The north jetty was originally built in 1914, and it was reconstructed and extended to its authorized length of 5,700 feet in 1931. Workers repaired it in 1946, 1955, and 1962, and it underwent more extensive rehabilitation from 1963-1965. Since the 1960s, however, roughly 374 feet of the jetty had receded, making it less effective. To combat the recession, the Corps awarded a $3,178,010 contract for rehabilitation to Aqua-Marine Constructors, Inc., a Portland firm. The firm completed the project in 1991.[6]

Yaquina Bay and Harbor was one of the oldest navigation projects on the Coast and included two jetties, numerous channels, turning and boat basins, and a breakwater. Yaquina's north jetty, which was severely damaged by wave action, was repaired numerous times throughout the late 20th century. In 1988 the Corps awarded contracts to rebuild the outer 450 feet and an additional 172 feet of the structure. In the process of repairing it, workers used approximately 85,000 tons of rock. The project was completed in 1989, at a cost of $6.4 million.[7] By the late 1990s the north jetty needed additional work, and the District awarded a $2.4 million contract to General Construction Company of Poulsbo, Washington. This company's work focused on removing displaced jetty stone to make the channel safer for users as they crossed the entrance bar. The rocks, some of which were the size of Volkswagen Beetles, had caused severe wave action conditions at the entrance, causing safety concerns between the U.S. Coast Guard and the local fishing community.[8]

The District also managed projects on the Yaquina and Siuslaw rivers. In 1981, the Energy and Water Development Appropriations Act authorized the extension of the Siuslaw north jetty by 1,900 feet and the south jetty by 2,300 feet, with 400-foot spur dikes to be built on the seaward side of each. Workers extended the jetties to reduce shoaling at the entrance and stabilize the river channel.[9] Contractors completed the work in 1986. On the Umpqua River the Corps extended the training jetty to join up with the south jetty, completing the work in 1980 at an estimated cost of $16 million. When contractors extended the training jetty, however, it allowed increased wave action to reach farther into the Umpqua River estuary, causing damage to existing facilities and shorelines on both sides. To mitigate the damage, workers lined portions of the affected shoreline with rock, completing the work in 1995. While this action protected the shoreline, it failed to stop the increased wave action. The Corps also responded to local interests at Umpqua who

The extended training jetty joined with the south jetty at Umpqua River. Dredging at Coos Bay to deepen the Coos-Millicoma channel for deeper draft ships allowing the Port to stay competitive.

requested that the navigation channel at Winchester Bay boat basin be deepened to 16 feet. Construction included deepening the existing access channel and turning basin, enlarging the turning basin, and establishing a new access channel. Workers finished this $1,616,400 project in 1984.[10]

At Coos Bay the Corps was involved in several different navigation projects. The north jetty, for example, was repaired in 1989. Also that year, the International Port of Coos Bay filed an application with the District to extend and deepen the navigation channel at Charleston to provide passage for the Coast Guard patrol boat, the *Orcas*, and large, commercial fishing vessels. The Port also requested that the permit include authorization for maintenance dredging of about 3,000 cubic yards per year for three years.[11] Responding to their request, workers provided deeper access and entrance channels and constructed a 180-foot by 900-foot turning basin, completing the job in 1985, with a total federal cost of $1.2 million.[12]

In the early 1990s, the Corps and the International Port of Coos Bay jointly sponsored a study at Coos Bay, which examined the feasibility of deepening 15 miles of the existing 35-mile Coos-Millicoma channel to accommodate newer, deeper draft ships and allow the Port to stay competitive in the shipping industry. In May 1996, the District and the Port signed a cost-sharing agreement for the project. The project cooperation agreement called for the Port to initially provide 25% of the cost, plus 10% more over the next 30 years, making the Port ultimately contribute 35%. Congress authorized the plan in the 1996 Energy and Water Development Appropriations Act, and work began that summer. The District awarded Manson Construction and Engineering Company of Seattle $8.9 million to deepen 15 miles of the Coos River and Bay, from 35 to 37 feet and from 45 to 47 feet at the entrance. The contract included both operation and maintenance and new construction, and it called for the removal of 2.6 million cubic yards of sand and 45,000 cubic yards of rock. The work was completed in 1998, at an estimated cost of $12 million, of which $9 million was federal and $3 million was non-federal.[13]

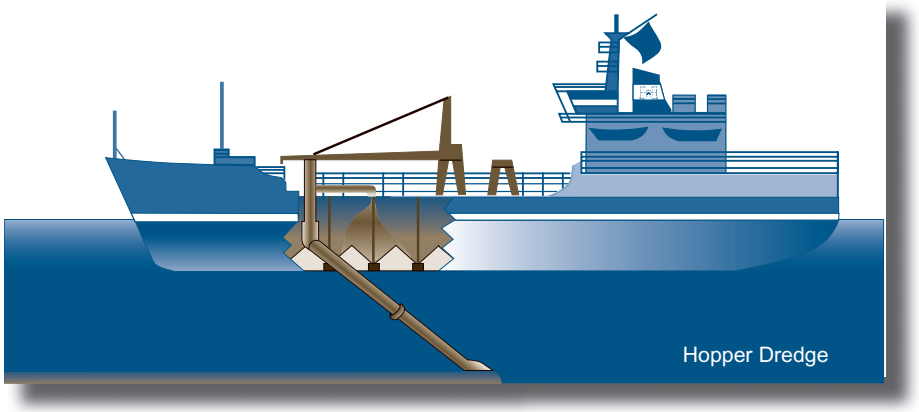
The Corps conducted other coastal projects on the Coquille River and at Astoria. On the Coquille, the Port of Bandon constructed a boat basin facility in conjunction with a

From the quarry, by truck and barge, the rocks are deposited at the jetty site. The Siuslaw north and south jetties were extended with spur dikes to reduce shoaling at the entrance and to stabalize the river channel.


Essayons


Yaquina


Sandwick

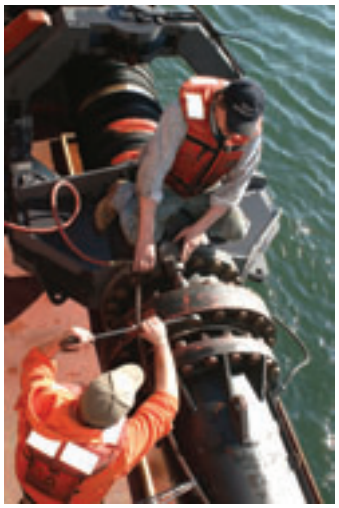


protective breakwater and entrance channel in 1985. The total federal cost of the project was $1,168,500.[14] At Astoria, the District worked on repairing the east boat basin breakwater in 1999. The agency refurbished a 400-foot section of the 2,000-foot long breakwater's eastern most end. They installed sheetpiling along the length of the section and filled in the areas between the new and outer walls with sand and gravel. The repairs cost roughly $5 million.[15]

Many of the Corps coastal projects required extensive dredging. While the District performed its own dredging operations, its dredging fleet was drastically reduced from its historic size. Beginning in the 1970s, Congress, in an effort to reduce costs and expand opportunities for the private sector, placed increasing pressure on the Corps to transfer its dredging operations to private contractors. Congress' push for private dredging was largely successful, and by the 1990s, the Corps' fleet of hopper dredges had been reduced from 22 to four. Of these four dredges, two were headquartered in Portland – the *Yaquina* and the *Essayons*.[16] These vessels worked the entire Pacific Coast, as well as the Columbia River, Hawaii, and Alaska.

The *Yaquina*, which measured 200-feet in length and had a 1,000 cubic yard holding capacity, was a hopper dredge designed to transport dredged material to open waters, where it was dumped. During a dredging operation, dragarms with dragheads were extended from the ship and lowered to the channel bottom where they worked like a massive vacuum cleaner. Pumps created suction in the dragarm, drawing up the silt or sand into hopper bins in the vessel's midsection. When the bins were full, the dredge moved to a designated relocation area and emptied the material through large hopper doors in the bottom of the hull. The District's other hopper dredge, the *Essayons*, essentially operated in the same manner. The only real difference between the two ships was size. The 350-feet long *Essayons*, with its bin capacity of 6,000 cubic yards, was often used for deeper entrances and extensive river dredging, while the *Yaquina's* smaller size made her well suited for dredging tighter, shallower coastal entrances.[17]

In addition to the two hopper dredges, the District also owned and operated the *Sandwick*, an 85-foot "sand bypasser" dredge. The *Sandwick* removed sand and silt by positioning itself over a shoal and eroding the material by



Life on board the dredge *Yaquina*

the concentrated force of propeller action. Its ability to work in water as shallow as six feet enabled it to operate in conjunction with the *Yaquina* in areas that were too shallow for the *Yaquina* to dredge.[18]

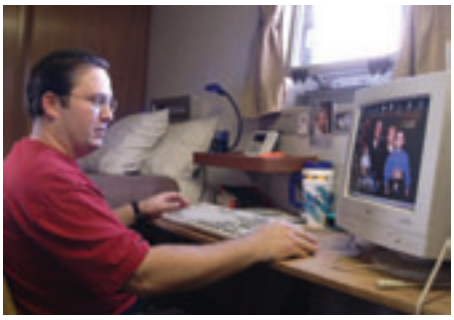
Working aboard these dredges proved to be a unique experience. The majority of dredging activity occurred between March and early November, slowing during the winter months. When operating, the two hopper dredges worked 24 hours a day, stopping only eight hours or less per week for fuel, water, supplies, and maintenance. Crewmembers of the *Essayons* worked for eight days straight, followed by six days on shore. This schedule could be difficult. "You either have the temperament for it or you don't," explained Miguel Jiminez, one of the captains of the *Yaquina*.[19] Working on a dredge also entailed regular periods of separation from families. "My wife is kind of used to this, [she's] been married into this type of system for 36 years and she's used to me being gone," commented Al Short, Chief Electrician on the *Essayons*.

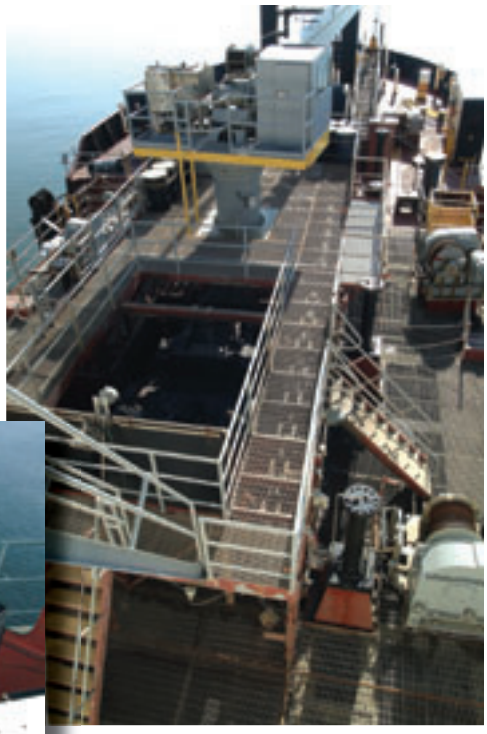
On the other hand, because they were together for eight days at a time, crewmembers formed close relationships with one another. "You find out when their birthday is and surprise them with a birthday cake," explained Ship's Steward Albert Castillo. "We have a lot of fun." Many crewmembers also found a good deal of pleasure in the work itself. Jan Bemetz, one of three women crewmembers, started as a typist and soon advanced to the position of administrative technician. "The pay is good and ... I have lots of different things I do, so it's interesting work," she remarked.[20]

For the most part, work on the ships was generally routine – and that was the preference of the crews. "There is an old saying in the shipping world that most things like shipping are 95 percent boredom and five percent terror. And that is pretty much what it is out here," explained one member of the *Essayons*' crew. "When things are going well, which is the way we like it, it's boring. And that's the way we want to keep it."[21]

Given the intense demands placed on them, the ships required regular maintenance, and they often needed extensive repairs following a working season. In 1994, for example, the Corps awarded a $744,884 contract to repair the *Yaquina*. The work included cleaning and painting the dredge's bottom to protect it against corrosion, barnacles, and other marine growth. The contractor also installed new propellers and rudders, replaced valves, changed underwater gear, pipe-fitted and welded, and performed electrical services for the boat.[22]

While dredging ensured that ships could safely navigate the coastal waterways, it came with environmental costs. Much of the marine life affected by dredging was commercially important, including clams, shrimp, crab, and salmon – and fishermen sometimes joined environmentalists in their protests against dredging.[23] According to Stewart Schultz's study, *The Northwest Coast*, the act of digging in an estuary sent billowing clouds of sediment into the water column, causing an abrupt rise in turbidity. Increased turbidity stunted the growth of estuarine plants, buried





submerged rocks and the plants and animals that lived on them, and clogged and injured the breathing and feeding mechanisms of fish and invertebrates. The physical force of digging also affected animals. Dredges in Grays Harbor, for example, consumed one to three crabs with every seven cubic yards of sediments for a total of roughly 100,000 to 300,000 every year, depending on the type of dredge. Furthermore, when dredges disposed of their material, they often buried plants and animals under tons of sediment. At one disposal site, only 70 out of 200 invertebrate species survived the dump.[24]

Due in part to pressure from the growing environmental movement and to the concerns of commercial fishers and crabbers, the Corps became increasingly aware of the tensions between ensuring safe navigation and protecting the natural environment. "We realize that protecting fisheries and other endangered species can, and should, go hand in hand with managing and protecting our nation's infrastructure," David Beach, Chief of Navigation Branch, explained. "That includes our dredging mission." As a result, the agency adjusted its dredging operations around anadromous fish runs and other biological concerns. It also prepared biological assessments for dredging work that were submitted to the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) for review and approval.[25]

Another issue concerned the chemical composition of the dredged sediments. At times the sand and silt that the Corps' dredging operations removed were laden with metals and other contaminants, creating problems in disposing of the dredged material. To address this issue, the Corps tested sediments in the federal navigation channel every five years. This testing ensured that dredge material could be safely relocated in accordance with the Clean Water Act and the Marine Protection and Sanctuaries Act. Fortunately for the District, most of the dredged material on the West Coast is comprised of coarse-grained sand, which does not hold contaminants.[26]

Corps Dredges Provide Excellent Training for Maritime Cadets

Each year, cadets from maritime academies in the U.S. look for opportunities to earn their sea-time on a variety of ocean-going vessels. The top performers get to choose from huge tankers, container cargo vessels, Military Sealift Command ships, and other opportunities to complete 60-day periods of sea duty. Many cadets choose to work on Corps dredges, including the Portland District's ***Essayons*** *and* ***Yaquina****. During the 2000 season, for example, two cadets came aboard the* ***Yaquina****, while the* ***Esssayons*** *had four.*

For these cadets, working on a dredge offered many distinct advantages. "We get a lot of hands-on experience in ship handling on the dredges," said Mary O'Brien, a midshipman 2nd class assigned to the ***Essayons****. "With a tanker, you're talking a lot of sea voyages, and very little turning and maneuvering. Working on a dredge, we are handling the ship all the time, calculating tides, currents, and all that. We might spin the ship on a dime at times. You just don't get that on a tanker." Casey O'Donnel, a midshipman 2nd class aboard the* ***Yaquina****, agreed. "We get to handle a lot of close-quarter work, and there is nothing like that experience anywhere else." James Dalske, a midshipman 2nd class, also "chose the* ***Yaquina*** *for the piloting experience."*

Many cadets appreciated the depth of knowledge that dredge crew members possessed. "There are some good teachers here and I've learned a lot from them," said Mathew Lazarski, a midshipman 1st class in the Naval Reserve. "I plan on being an officer in the Navy, and some of the valuable lessons they taught me are how to approach problems in everyday life on the ship." Brian Leet, a midshipman 2nd class on the ***Essayons****, agreed. "I've talked to a lot of other guys in the engine room and have learned a lot just from them telling me about where they worked before coming to the Corps. I was surprised at how many hawsepipers work here." [A hawsepiper is one who worked his or her way up the ranks in the maritime services, rather than graduating from an academy.] "There's just a lot of experience," Leet concluded.*

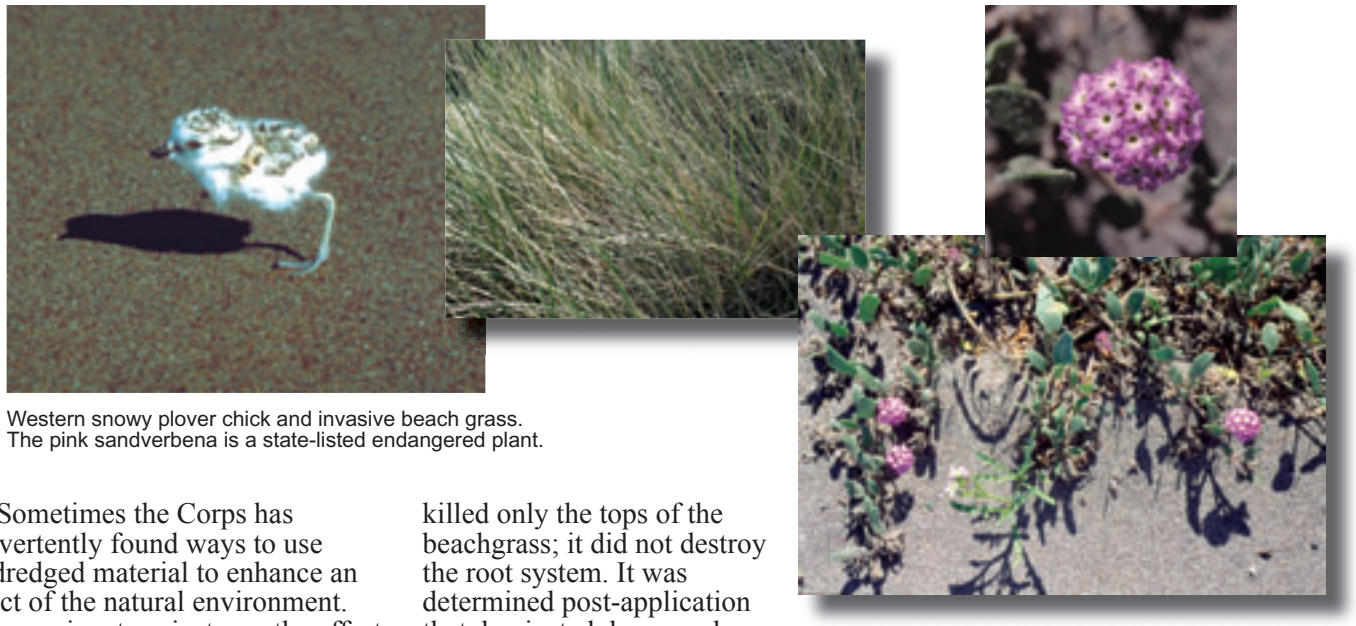
The range of work aboard a dredge also impressed cadets. "I'm a cadet, a welder, a dredge helper and a cook – and that was just today," commented Dalske. "We're constantly fabricating stuff. We made fire hose racks, repaired a bulkhead from angle iron, and I welded a hole that wore through a dredge pipe."

Corps crewmembers believed having the cadets aboard was mutually beneficial. "We love it," said Miguel Jiminez, captain of the ***Yaquina****. "They [the cadets] were like a breath of fresh air. They were full of energy and enthusiasm, and always eager to learn. ...We all benefit from their presence." Jiminez also observed that having the cadets on the ship improved the work of the permanent crewmembers. "I think one of the little realized side benefits to the program is that it makes the crew act as instructors, which in turn sharpens their skills. The constant questions and our answers to those questions make us reexamine some of the ways we do things. A cadet might ask a question and as I answer it I might say to myself, 'I don't like the way that explanation sounded.' So we may decide to re-look the way we do this."*

Neal Nyberg, captain of the ***Essayons****, felt that the advantages of the program extended beyond the Corps. "There are sound reasons why we participate. We have the chance to train new officers for the industry. Whether we (the Corps) get them or not, it's a benefit for the whole industry," he explained. "Global competition is a fact of life for the merchant marine. We forget that 95 percent of the cargo and equipment for Desert Storm was brought by ship. Right now we're training the best and brightest to be the future mates on our ships, and that's good for everyone."*[1]

Endnotes

[1] Jim Edwards, "Maritime Cadets Make Summer Voyages on Dredges," October 2000, Engineer Update.



Western snowy plover chick and invasive beach grass.
The pink sandverbena is a state-listed endangered plant.

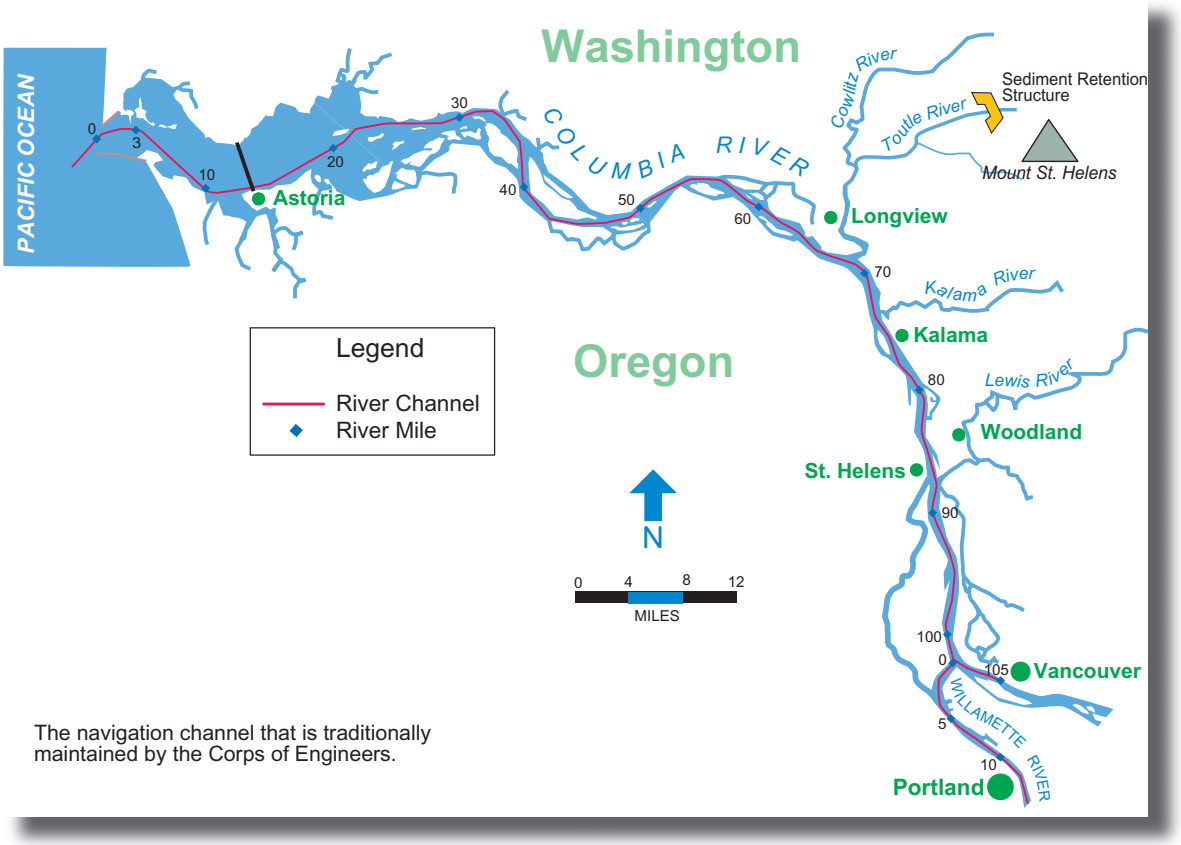
Sometimes the Corps has inadvertently found ways to use the dredged material to enhance an aspect of the natural environment. One prominent project was the effort to restore western snowy plover habitat on the north spit of Coos Bay. This project was sponsored by the International Port of Coos Bay with funding from the Corps, the Port, and the Coos County Urban Renewal Agency. The western snowy plover is a federally listed threatened species that nests in coastal areas. Habitat destruction, along with the introduction of European beachgrass that is used to stabilize sand, had substantially reduced the bird's nesting habitat to just a few areas along the entire Oregon coast.[27]

Coos Bay's North Spit contained a 26-acre section of dredged material which, due to its higher salt concentrations, remained free of European beachgrass and thus provided suitable habitat for the plover for many years. To rid the site of invasive beachgrass and restore 45 additional acres of plover nesting habitat, workers irrigated the area with salt water during the summer growing season. The salt water irrigation method was found to be a less expensive and more flexible means of creating habitat than relying on dredged material disposal, which is costly to implement and driven by the availability of material and proximity to the site. The estimated total project cost was $224,000, of which $168,000 was federal and $56,000 was non-federal.[28] The Corps' irrigation efforts, however, killed only the tops of the beachgrass; it did not destroy the root system. It was determined post-application that dessicated dune sand repels water thus precluding salt water contact with soil moisture in the root zone. Realizing that beachgrass remained on the site, workers turned the soil with a disc, which succeeded in reducing the vegetative cover and maintaining nesting habitat for plover. Discing has proven to be an effective means of keeping the beachgrass in control at the site and continues to be the primary treatment for the invasive species. However, it has not eradicated European beachgrass and annual implementation is required to maintain plover nesting habitat.[29]

In addition to working on restoring bird habitat, the District also worked to restore a native oyster species – *Ostrea luida* – whose numbers were in decline since the turn of the century due to over harvesting and water pollution. This particular type of oyster tends to inhabit areas with high concentrations of empty oyster shells. Thus to enhance its habitat in Yaquina Bay, the District dredged 2,400 cubic yards of sandy sediment and clamshells mixture from another location in the bay and deposited it over an existing oyster bed. The project was a coordinated effort between the Corps, Oregon Department of Fish and Wildlife (ODFW), and the Environmental Protection Agency (EPA). Once the project was completed, the ODFW monitored and maintained the oyster bed.[30]

Similarly, the pink sandverbena, a state-listed endangered plant, received a helping hand from the Corps at Port Orford. The plant was found thriving on an area of the Port Orford beach covered with dredged sand material. To protect the plant and expand its population, the District modified its disposal operation and deposited additional dredge material further down the beach.[31]

These projects reflected the District's changing role on the Oregon and Washington coast. While traditionally the agency's work was limited to ensuring navigation and bolstering coastal commerce, in more recent years projects have been influenced by the environmental movement and its objectives [see Chapter Three]. Projects such as dredging and repairing jetties have continued in the late 20th century, but they also have been joined by habitat restoration and protection of the region's threatened and endangered species. While their historical navigation mission has often been at odds with natural resource concerns, the period from 1980-2000 does demonstrate that providing safe passage for ships and protecting plants and wildlife were not always mutually exclusive goals.



The navigation channel that is traditionally maintained by the Corps of Engineers.

Dredging the Columbia and Willamette Rivers

The federal government first authorized the Columbia and Lower Willamette River Navigation Project in 1878, and the Corps has deepened the channel at intervals since that time. The project authorization, as modified by Congress in 1962, covers 14.6 miles of the Willamette River below Portland and 103.5 miles of the Columbia River below Vancouver, Washington. The Corps completed work on the authorized 40-foot deep channel from Portland and Vancouver to the sea in 1976.[32]

The Corps has traditionally maintained the navigation channel through a combination of dredging and hydraulic control works, such as pile dikes, inwater fills, and island creation. Pile dikes constructed of logs are used to control channel alignment for navigation, focus flow in navigation channels, provide bank protection, reduce erosion, and provide disposal areas. The Corps also used inwater fills to reduce channel cross-section and control channel alignment. This entailed placing material, such as sand or rock, along the edge of the channel to focus the water into the center of the channel, where it flowed at a higher velocity. The agency also deposited dredged material to create islands to control channel alignment. At these sites, pile dike fields were used to prevent erosion.[33]

The Corps used three types of dredges – hopper, pipeline, and clamshell – to deepen the river channel. Hopper dredges dispose inwater, clamshell dredges are used for inwater and ocean disposal, and pipeline dredges are employed primarily for shoreline disposal with some inwater and upland disposal. In addition, dredged material removed with both a clamshell dredge and hopper dredge from the Willamette River was disposed inwater in the Columbia River. The type of dredge used depended on dredge availability, size and location of the shoal, and available disposal sites.[34]

By the 1990s, hopper dredges removed four to five million cubic yards of material annually from the Columbia and Willamette rivers. Crews disposed of sediments from these dredges in deep water or alongside the navigation channel, which was generally termed flowlane disposal. Hopper dredges were most often used on small volume "sandwave" shoals in the river and on larger shoals in the estuary. Sandwave shoals are the valleys and peaks on a river bottom formed by the river's current. Pipeline dredges, on the other hand, were applied to large cutline shoals – a shoal on the edge of a channel – and areas with multiple adjacent sandwave shoals. Approximately two million cubic yards of material a year were removed by these dredges and disposed of along the shoreline or upland. One problem, however, with pipeline dredge disposal was that many of the shoreline sites eroded sand back into the navigation


Hopper dredge


Clamshell dredge


Pipeline dredge

channel. Clamshell dredging on the federal navigation channel used a bucket operated from a crane or derrick and was well suited to work in tight quarters, such as around docks and piers. Sediment removed by clamshell dredges was generally placed on a barge and disposed of at either an upland or inwater site. The District used this method of dredging for side channel projects in both the Columbia and Willamette rivers.[35]

Historically, the Corps disposed of dredged material from the navigation channel in a combination of shoreline, upland, and inwater sites. Shoreline disposal done primarily with pipeline dredges, involved pumping dredged material through a floating discharge pipe to an existing beach. The material was pumped in a sand and water slurry, allowing the sand to settle out on the beach while the water returned to the river. After sufficient sand settled out, bulldozers moved the sand to match the elevation of the "pre-eroded" beach. While between 1975 and 1995, 62 shoreline sites were used for dredged material, the ESA listing of Snake River salmonids reduced the number of sites approved by the NMFS. In its study, the Corps proposed that no more than 12 shoreline sites be used in any one alternative.[36]

Upland disposal involved both clamshell and pipeline dredges. The Corps did not need to use every upland disposal site annually. Annually, the average quantity of dredged material placed in upland areas was approximately 750,000 cubic yards. Once the material was deposited, it was completely removed from the river system and did not reenter it.[37]

The District employed all three dredge types for inwater flowlane disposal, which occurred throughout the Columbia River navigation channel, where depths ranged between 35 and 65 feet. Like all river channels, the Columbia's depth varied naturally, with pockets and holes – some as deep as 100 feet.[38] Unlike ocean disposal sites, which were designated and approved according to the Marine Protection, Research, and Sanctuaries Act, these inwater disposal sites were regulated by the National Environmental Policy Act (NEPA) and varied depending on the condition of the channel each year. As flowlane areas filled, new deep areas formed elsewhere as a result of river processes.[39]

Over the past several decades, the issue of where to place dredged materials has become increasingly important due to concerns raised by environmentalists and biologists about the impact of the material on terrestrial and aquatic ecosystems. Partly in response to mounting concerns about the toxicity of dredged material, in 1993 the Corps initiated a study of its dredging practices on the Columbia and Willamette rivers. While pollution problems in some Northwest rivers certainly existed, the problem of hazardous dredge materials was particularly acute on the eastern seaboard, where contaminated sediments had been released into rivers and ports. In fact, concern over the state of dredging in states like New York and New Jersey prompted the Corps to undertake the dredging studies, including one for the Columbia River. As David Beach explained, the District's five-year study was proposed "partly because of the East Coast experience and partly because of disposal siting problems we had out here."[40]

The authority for the District study came from a memorandum dated October 26, 1993, in which the Corps' North Pacific Division directed the District to prepare a Dredged Material Management Study (DMMS) for the navigation channel using operation and maintenance funds; the study was entirely funded by the federal government. The area encompassed in the DMMS included the 103.5 mile stretch of the channel from the mouth of the Columbia River to the

Deepening the channel of the Columbia River would allow larger ships to travel to the ports of Oregon and Washington, allowing them to stay competitive with other major shipping centers.

Port of Vancouver upper turning basin, and the 11.6 miles from the mouth of the Willamette River to the grain terminal at the Broadway Bridge. In accordance with the Water Resources Development Act of 1986 (WRDA-86), several local sponsors, including the Port of Portland in Oregon and the Ports of Vancouver, Woodland, Kalama, and Longview in Washington, shared the costs of maintaining the federal navigation channel. Specifically, they were responsible for purchasing or acquiring easements on upland disposal sites. Washington State's Department of Natural Resources and Wahkiakum County also shared in the channel's maintenance costs.[41]

The purpose of the Corps' DMMS was to develop a Dredged Material Management Plan (DMMP) that would guide navigation work on the Columbia and Willamette rivers through the first two decades of the 21st century. During this period, the Corps also examined the possibility of deepening the Columbia River from 40 to 43 feet, in its Columbia River Channel Deepening feasibility study [see following section]. The DMMS helped determine the optimum maintenance plan without the channel deepening project.[42]

As part of the DMMS, the Corps also prepared a Supplemental Environmental Impact Statement (SEIS) that considered the effects of proposed changes, such as increased upland disposal and construction of new pile dike fields. This document supplemented an Environmental Impact Statement (EIS) formulated in 1975, which addressed the environmental effects of the 40-foot channel, the impacts of dredging and disposal practices, impacts at specific upland and beach placement disposal sites, and indirect and cumulative effects. Following that original EIS, changes in maintenance practices and environmental conditions warranted additional NEPA documentation. The Corps conducted Environmental Assessments in 1983, 1989, and 1994 to address minor changes in the project and to consider environmental statues implemented after 1975, such as the Clean Water Act and the Coastal Zone Management Act. All these studies resulted in findings of no significant impact. However, a separate EIS was necessary for the DMMS because of the extensive geographic scope of the project area, the endangered salmon species that could be impacted, and the potential changes in maintenance practices.[43]

The DMMS examined numerous combinations of dredging equipment and disposal sites in an effort to more efficiently maintain the authorized channel. In particular, the study looked closely at increasing the use of upland disposal sites, which held the potential to reduce future dredging requirements and costs. As a result of these investigations, the plan identified four long-term alternatives for disposing of material dredged from the rivers. The alternatives considered included the following: alternative one, "no action," which reflected the minimum disposal site requirements to continue the normal dredging and disposal practices on the rivers; alternative two, "least cost plan," which minimized the overall cost of maintaining the channel; alternative three, "operational plan," which was a variant of the no action plan and provided additional disposal sites to create more options; and alternative four, the "proposed plan," which was a composite of alternatives two and three and expanded the least cost plan to allow for periodic pipeline dredging and upland disposal in areas traditionally maintained by hopper dredge.[44]

Alternative four included several significant differences from the Corps' usual maintenance practices on the Columbia and Willamette rivers. These included the following: eliminating most shoreline disposal, increasing disposal at existing upland disposal sites, limiting flowlane disposal to the 45-65 foot depth range, constructing new pile dike fields for beach stabilization, and disposing Columbia River sediments in the ocean, pending EPA designation of permanent ocean disposal sites. As part of its assessment of dredged material disposal, the DMMS also evaluated potential beneficial uses of the sand for non-navigation purposes. These included fish and wildlife habitat restoration, hurricane and storm reduction, industrial/commercial development, and recreation.[45]

During the review of the SEIS, the Corps received numerous comments from agencies and the general public on the document. One of their primary concerns was the impact of the project on riparian habitat and wildlife, particularly the effects on endangered salmon species. These groups and

individuals also raised questions about the practice of disposing dredged materials to enhance beaches, the impact of channel and pile dike structures on river hydraulics and fisheries, the potential for contaminants in dredged material, and the effects of ship wakes on shoreline erosion. In response to these concerns, the Corps' environmental coordinator, Steve Stevens, stated that no threatened or endangered species would likely be affected by the preferred plan.[46]

The DMMP signaled the continuing economic importance of the Columbia and Willamette rivers to the regional economy. Management of this water highway had been a Corps responsibility since the turn of the century. In the period since the agency had first dredged and altered the channel, however, new environmental concerns had arisen. Across the country there was an increased awareness of the toxic content of some dredged material; in the Northwest there was the added issue of endangered and threatened salmon species that inhabited these rivers. Throughout the DMMP and the resulting supplemental EIS, the Corps attempted to incorporate the concerns of biologists and environmentalists. It also remained committed to dredging the rivers. "When we dredge the channels ... that's what keeps the ships moving up and down the river," said David Beach. After all, he explained, "these channels are the [lifeblood] of the country."[47]

Proposed channel improvement project would go from the mouth of the Columbia River to the Willamette River ports.

Deepening the Columbia River:

The Columbia River Channel Improvement Project

The Columbia and Willamette rivers are a vital transportation corridor in the Northwest. For more than a century, boats of various shapes and sizes have traversed these water highways, carrying their products to markets. In recent years, however, ships on the Columbia and Willamette rivers have increased in size. To accommodate these new, larger ships, deeper navigation channels were needed. Recognizing this fact, in the 1980s several Northwest ports requested that the Corps study the need to deepen the channel. While deepening the channel would allow ports in Oregon and Washington to stay competitive with other major shipping centers, the project also had significant environmental impacts. Both the process of dredging, as well as the placement of dredge materials, had the potential to affect fish and wildlife populations in the watershed. Especially vulnerable were the salmon that inhabited the rivers, many of which were protected under the ESA. Congress authorized the project in 1999, with the contingency that an approved Chief of Engineers report would be needed by the end of the calendar year – which was accomplished. Thus, the Corps remains authorized for the channel deepening project, but construction has not yet begun and many issues still need to be resolved.[48]

The purpose of the proposed channel deepening project was "to improve transport of goods on the navigation channel by improving the channel's ability to handle deep-draft loads, and also to provide ecosystem restoration for fish and wildlife habitats." The Corps pointed out that the existing 40-foot channel posed many limitations to navigation and in particular prevented "many of the larger vessels from transiting the river at full capacity." The study boundaries extended from the mouth of the Columbia River upstream to the Interstate 5 Bridge between Portland and Vancouver, and from the mouth of the Willamette River upstream to the Broadway Bridge in Portland.[49]

The Corps' first step toward deepening the Columbia and Willamette rivers was taken in December 1989, with the initiation of a reconnaissance study. The study, which was completed in October 1991, indicated that deepening the channel would benefit the surrounding ports by

allowing vessels to carry greater loads. Furthermore, shipping delays would be decreased because larger shipments would no longer be required to follow the tidal cycle. In the study the Corps found that each additional foot of draft created by deepening the rivers would allow an additional 2,000 metric tons of grain to be shipped per cargo vessel.[50]

Following the reconnaissance study, the Corps initiated a five-year Columbia River Channel Deepening feasibility study in 1994. In accordance with cost sharing requirements, the study was funded in part by seven local sponsors. The non-federal sponsors included the Ports of Portland, St. Helens, and Astoria in Oregon, and the Ports of Longview, Kalama, Woodland, and Vancouver in Washington. The cost sharing agreement signed by the ports required that they pay 50 percent of the feasibility study and 25 percent of the potential construction costs.[51] By 2000, however, the Port of Astoria had pulled out of the study, no longer endorsing the project.[52]

The purpose of the study, which was part of the federal government's required EIS, was to evaluate a variety of alternatives to meet the demand for deeper draft vessels. The first phase of the channel deepening study identified the least-cost, environmentally-acceptable dredge material plans for each of the various reaches of the river. The second phase concentrated on determining which plan maximized the net benefits, due to reduced transportation costs and reduced delays.[53]

In addition to the option of deepening the channel to 41, 42, or 43 feet, the Corps also examined two other alternatives. The first option was to improve the water level reporting system that guided river pilots from Portland to Astoria. The system of computerized gauges told pilots when water was highest, allowing them to time a ship's exit downriver with the highest tides, dam releases, or storm surges. The second option was to establish one regional port for the entire lower Columbia. The Corps considered two locations for the regional port – Astoria and Longview. Creating a regional port, however, would have considerable environmental and economic impacts. At Astoria, for example, it would have impacted critical estuary habitat and required additional infrastructure, such as roads and railroad lines, to handle large container vessels. Furthermore, local sponsors would be entirely responsible for establishing any additional infrastructure – the federal government's financial involvement remained limited to work within the channel itself. In the end, no local sponsor stepped forward, and the Corps dismissed the regional port concept as a viable alternative. Apparently, some of the local sponsors of the project never seriously considered this latter choice, with one port director calling it "ridiculous."[54]

An alternative proposal was to establish one regional port at Astoria. The port would require infrastructure changes to be able to handle large container vessels. These would adversely impact critical estuary habitat.

In October 1998, with approximately six months left of the five-year long study, the Corps released its *Draft Integrated Feasibility Report for Channel Improvements and Environmental Impact Statement: Columbia and Lower Willamette River Federal Navigation Channel* for public comment. Alternatives evaluated during the study and presented in the draft report included the following: the regional port concept, non-structural alternatives, structural alternatives (41-, 42-, and 43-foot dredged channel), and no action. Each of those alternatives, as well as dredging and disposal needs that would arise as a result of construction and maintenance of the project, were evaluated on the basis of technical, economic, social, and environmental criteria. The Corps reviewed potential impacts to both natural and cultural resources in accordance with NEPA, Clean Water Act, ESA, Coastal Zone Management Act, and the Marine Protection Research and Sanctuaries Act. The draft report included two proposals – the government's proposed "Least Cost Alternative" and the "Sponsor's Preferred Alternative." Following public comment, the Corps planned to select and recommend one alternative in its final report.[55]

The plan to deepen the channel provoked a variety of responses. Those who depended on the rivers for transport generally favored the plan and its potential economic benefits. Darrel Buttice of the Port of Portland pointed out that if the federal navigation channel was not deepened "those ships are going to go elsewhere."[56] Jon Krebs, Port of Astoria, agreed that, "The last thing the states of Oregon, Washington, and Idaho want to do

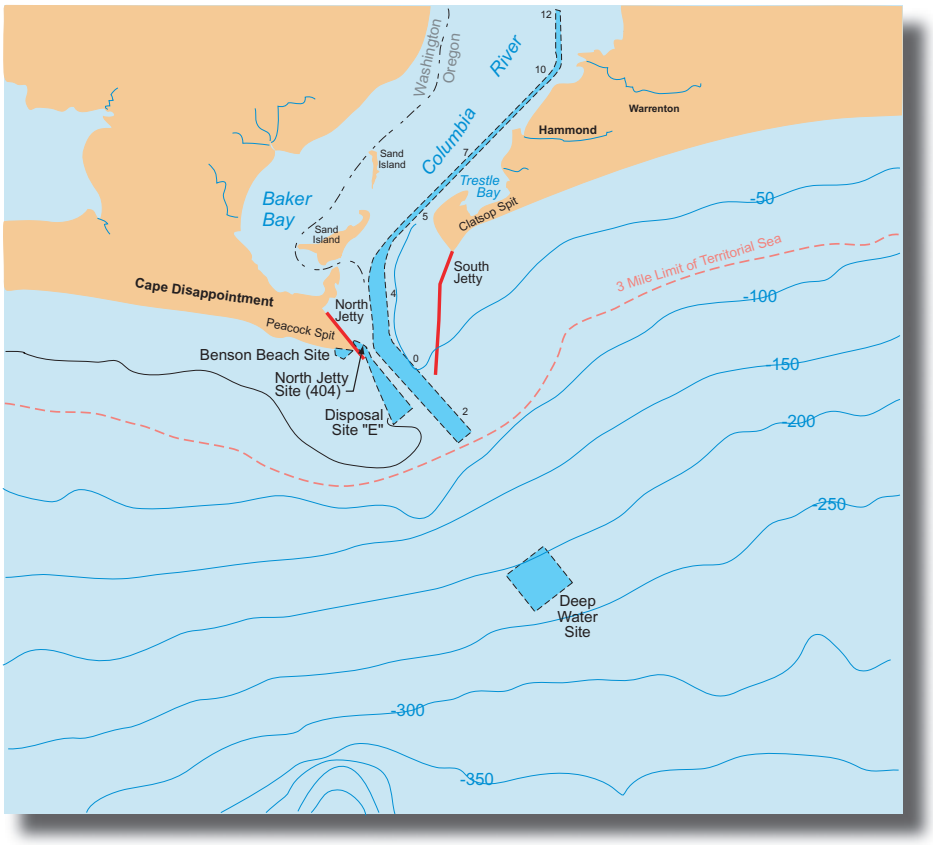
is give the shipping industry another reason to go to California or Puget Sound."[57] River bar pilot Captain Robert Johnson tried to make the case that "Having a deeper channel, making the Columbia River more competitive, will benefit all of us."[58]

Others questioned the project's impact on the environment. Dredging raised particular concern – both the process itself and the disposal of dredged material. River advocates pointed out that stirring up additional sediments in the two rivers posed problems. "Both the Willamette and the Columbia have some fairly hazardous and toxic material in them," remarked Hilary Abraham of the Oregon Environmental Council. "We're worried that the dredging is going to encourage greater sedimentation and toxicity."[59] Perhaps an even larger question was the disposal site. If the material was deposited in the water it could harm fish and other aquatic life, while disposing of it on land could force wildlife from its habitat. At a 1997 public meeting held in Astoria to discuss the project, conservationists, crab fishermen, sports fishermen, and property owners whose land would be affected by the project, all expressed reservations. According to a journalist covering the event, critics of the project warned that it could "take low-lying farmland out of production, bury fishing grounds and juvenile fish, and run counter to biologists' recommendations for salmon recovery." As frustration levels rose at the meeting, one attendee remarked that, "They [the Corps] held a meeting just to fill in the box that said they held a meeting."[60] In fact, the Port of Astoria withdrew its sponsorship from the project following the release of the feasibility study. Apparently, the Port no longer believed that the deepening of the Columbia River would benefit them.[61]

The Corps released the final report in August 1999, amidst this controversy. In the report the agency outlined its recommended alternative, which was to deepen the 40-foot channel by three feet. To accomplish this, workers would have to dredge 20 million cubic yards of sandy material, as well as remove 220,000 cubic yards of hard basalt rock and 450,000 cubic yards of cemented sand, gravel, and boulders. In terms of placement of this dredged material, the report noted that the amount of in-water disposal for the deepened channel would actually be less than the existing channel because more disposal sites would be placed on land. The plan called for a total of 20 land sites – primarily agricultural and industrial – to be used. More than 1,600 acres would be needed for disposal sites; the Corps planned to address the loss of 67 acres of riparian habitat and 20 acres of wetland habitat through compensatory mitigation actions.[62] Compensatory mitigation involves the restoration or development of wildlife habitat to replace those wildlife values lost due to project related actions. For the channel deepening project, compensatory mitigation would be addressed through the USFWS's Habitat Evaluation Procedures (HEP) process. Furthermore, representatives from the Corps, USFWS, ODFW, Washington Department of Fish and Wildlife, Washington Department of Ecology, and the ports formed an interagency wildlife mitigation team to determine compensatory levels.[63] In addition to land sites, the Corps, in conjunction with other government agencies, area fishermen, and members of the Columbia River Estuary Study Taskforce (CREST) – a council of governments representing local jurisdictions, including cities, counties, and ports, surrounding the Columbia River estuary in both Oregon and Washington – selected two ocean disposal sites to deal with the dredged material. One was a deepwater site; the other was Site E by the north jetty at the mouth of the Columbia River.[64] The Corps' idea was to use these sites for both construction material from the channel deepening and routine maintenance.[65]

The report also outlined an environmental restoration component, which was one of the stated purposes of the project. It

Some of the proposed ocean disposal sites for the dredged material at the Columbia River estuary



The EPA listed Portland Harbor on the Willamette River as a Superfund site, prohibiting the Corps from dredging the area.

included reestablishing the hydraulic connection between the Columbia River and Shillapoo Lake near Vancouver, Washington and restoring 250 acres in the Columbia estuary. The District planned to conduct additional restoration work over the next several years. Specifically, they intended to create more shallow water habitat, such as wetlands and estuaries. Part of this entailed removing dikes located along the tidal-freshwater floodplain and reconnecting backwater channels, sloughs, and oxbows to the main river. The Corps also contemplated retrofitting tide gates to open salmon spawning habitat.[66] The Corps estimated the cost of the proposed 43-foot channel, including restoration efforts, at $196 million.[67]

Environmental concerns put one aspect of the project on hold. Contaminated sediments in Portland Harbor delayed the deepening of the Willamette River portion of the channel. The material dredged from that section of the river was suitable for in-water disposal, but the additional material that would be removed for a deeper channel was potentially not suitable. Further biological tests were needed. Because of these complications, the sponsoring ports requested that the Corps delay that aspect of the project until the Oregon Department of Environmental Quality could investigate the situation and make plans for remediation.[68] In April of 2000, the EPA listed Portland Harbor on the Willamette River as a Superfund site, prohibiting the Corps from dredging the area. Furthermore, listing the site added to the controversy surrounding the channel deepening project.[69]

After the final report was released, CREST sent a letter outlining their concerns about the project. Worried about the impacts to aquatic resources, these local governments directed the council to analyze the final EIS for impacts to the estuary. Following a preliminary review of the final EIS, CREST found that the "project can not be done as proposed in the final EIS without resulting in extreme negative impacts to the natural resources and the economy of the communities surrounding the Columbia River estuary." The council argued that the plan failed to protect salmon and their habitat, that the Willamette portion of the project violated the Clean Water Act, and that the Corps did not provide mitigation for any aquatic impacts to species or habitats in the estuary or ocean. The council pointed out that many of these issues had been raised by a wide assortment of organizations and governments following the draft EIS, yet they had not been adequately addressed in the final version of the EIS.[70]

Throughout the planning process, the Corps was directed to consider potential impacts on fish and wildlife, particularly for endangered or threatened species. The agency's April 1999 biological assessment did not identify any significant habitat impacts as part of the channel improvement project. To ensure that channel deepening did not cause significant impacts and to evaluate the effectiveness of restoration efforts, the Corps planned, in conjunction with the NMFS, to do extensive monitoring both during and after construction.[71]

Initially, NMFS agreed with the Corps' biological assessment that there would be no significant impacts. In December 1999, the agency issued a non-jeopardy biological opinion, allowing the Corps to proceed with the action as proposed, as the channel project did not significantly impact the long-term survival of the twelve listed fish species.[72] A fisheries service biological opinion is required whenever any proposed federal action might adversely affect species protected under the ESA.[73] Laura Hicks, Columbia River Channel Improvement Project Manager, commented that the Fisheries Service's finding allowed the Corps "to pursue our long-term goal of ecosystem restoration in the estuary more expeditiously than we could have done without NMFS added emphasis on its importance."[74] Shortly thereafter, the final step in the five-year process was completed when Lieutenant General Joe N. Ballard signed the Chief of Engineers' Report on the Columbia River Channel Improvement Study. "We met the deadline established in congressional language which stated that this report had to be signed by December 31, 1999, to maintain congressional authorization to construct the project," said Hicks.[75]

The project received a setback, however, when in August 2000 the NMFS withdrew its biological opinion. This agency withdrew its opinion because its representatives

had not reached agreement with the Corps on needed studies. In the new consultation, the Corps and NMFS intend to identify what studies are needed and evaluate the information to assure the project will not impede the recovery of ESA-listed salmon populations. Another reason the NMFS withdrew its opinion was because of new information that had not been considered. In the interim since the first opinion, the Northwest Fisheries Science Center completed further studies on the effect of flow and the configuration of the estuary bottom as it relates to shallow water habitat. Scientists learned that shallow water habitat plays a key role in the estuary's ability to support fish. New information also suggested that salmon may be susceptible to a wider range of impacts, such as reduced growth and impaired disease resistance, from certain contaminants.[76] In September of 2000, the Oregon Department of Environmental Quality and the Washington Department of Ecology denied the Corps a water quality permit for the project, creating additional obstacles for the agency.[77]

Both the Corps and the NMFS agreed that this new information required careful consideration. "In the new consultation, we will work closely with the Corps to reach agreement on the specific details and schedule of required studies and monitoring, thoroughly assess the implications of any relevant new information, clarify expectations for the completion of restoration work and make any necessary refinements in the conservation measures," explained Brian Gorman, NMFS spokesperson. Laura Hicks also supported the consultation process. "The Corps agrees with this cautious approach and is committed to work with NMFS to assure there will not be any impact to ESA-listed stocks," she explained. Once the two agencies agree on the required studies and measures to ensure no harm to listed stocks, a biological opinion will be reissued.[78]

The movement to deepen the Columbia River illustrates the increasing tension that surrounds the Corps' work in the Pacific Northwest. On the one hand, the District is charged to manage navigation, which includes altering waterways for the passage of ships. Yet, at the same time they must consider a wide range of environmental concerns, particularly the region's rapidly diminishing salmon populations. While in recent years the District has attempted to integrate environmental restoration and mitigation into its navigation work, there is no question that at times the two goals have not been reconcilable. Perhaps this is no truer than on the coursing Columbia River – which has long been heralded as both a symbol of nature and commerce in the region.

Crafting a Minimum Dredge Fleet

The Corps has been dredging Oregon's rivers and streams since the late 19th century, as required by its navigation mission. From 1906 through the 1970s, the Corps remained the only significant owner and operator of hopper dredges in the United States. Historically, the agency owned and operated its own fleet of dredges that were distributed across the coastal United States. In the 1970s, however, the federal government came under pressure to transfer most of the dredging work to private industries. The result was the passage of Public Law 95-269 on April 26, 1978, which established the Minimum Dredge Fleet (MDF) and shifted the majority of the work to private contractors. By the late 20th century, the Corps maintained 12 dredges in the MDF, two of which were hopper dredges operated by the Portland District.

The Corps' dredge fleet evolved gradually over the early 20th century. By the 1950s, the agency owned and operated 20 hopper dredges. Six of these were located on the West Coast, eight on the East Coast, three were stationed on the Gulf Coast, and three were assigned to the Great Lakes. Hopper dredges were the primary mechanisms used in most Corps' coastal dredging operations. These vessels are usually configured with two drag arms, one on each side. During dredging, bottom sediments are sucked into the drag arm by hydraulic pumps and deposited into the dredge's hoppers. Once the hoppers are full, the drag arms are lifted, and the dredge sails to the disposal area, where the material is normally dumped through doors located at the bottom of the hoppers.[79]

Throughout the 1960s, the Corps had unsuccessfully petitioned Congress for additional funds to update its fleet, arguing that it was in need of modernization. The agency's fleet consisted of 16 hopper dredges, 14 of which had been constructed and put into service prior to 1949. Congress denied the Corps funds, aware that private dredging contractors, who had already established themselves in the field of pipeline and mechanical dredging, believed they were capable of supplying hopper dredging as well. In 1973, Congress directed the Corps to conduct an in-depth national dredging study to evaluate national dredging needs, survey the physical condition of both the Corps and private fleets, and assess the government's bidding procedures. Congress also directed that the study "must include consultation with the dredging industry, including their views and recommendations on various alternatives for meeting the national dredging requirements."[80]

After a management consulting firm completed the national dredging study, Congress initiated an industry capability program, which placed industry dredges in competition with government hopper dredges on selected projects for a "testing of the market." The Corps and private industry contractors essentially bid on the same projects from the same bid documents, plans and specifications. The Corps prepared a hired labor estimate for each project and contractors were told which hopper dredge and disposal method were being used for the estimate. One major difference was that the Corps' estimate did not allow for profit. Congress awarded the job to an industry contractor if its bid was not more than 125 percent of the hired labor estimate; if industry

bids all exceeded 125 percent of the hired labor estimate, the Corps received the jobs. When the industry capability program ended in fiscal year 1981, 149 dredging jobs had been advertised, 83 of which were awarded to industry. Of the 93 hopper-dredge jobs, 50 went to industry. During this period, private industry had acquired eight hopper dredges and another two were "on-line." These results satisfied Congress that private contractors could meet the demand for hopper dredging.[81]

Meanwhile, as the market testing program proceeded, Congress went forward with legislation to ensure industry's participation in dredging projects. The result of their efforts was the passage of Public Law (PL) 95-269. PL 95-269, the Minimum Fleet Legislation, applied to all types of dredges and remains the landmark legislation for the dredging industry. Key provisions of the law included the following:

- ❖ The Corps has dredging and related work done by contract if it is determined that private industry has the capability to do such work at reasonable prices and in a timely manner.
- ❖ The federally owned fleet is reduced in an orderly manner by retirement of plant. The Corps retains a minimum federally owned fleet required to carry out emergency and national defense work.
- ❖ Work necessary to keep the minimum fleet operational can be set aside from those projects to be bid by industry.
- ❖ The Secretary of the Army submits to Congress within 2 years a minimum fleet study that defines the minimum fleet dredges.
- ❖ The government, when estimating its dredging costs, considers depreciation, supervision, overhead expenses, interest on capital investment, and other appropriate charges.[82]

This legislation required the Corps to establish a minimum fleet of both hopper and nonhopper dredges to meet emergency and defense needs. As David Beach explained, the point of the law was "to turn over all the dredging in the country of federal channels ... to private industry. Except the U.S. wanted to retain ... a minimum number of dredges so that if contractors couldn't get the work done, the federal government would go in and do it." Beach added that having the federal government retain a certain number of its own dredges was important in case private contractors weren't available or their costs were too high.[83] The law itself mandated that the federally-owned fleet be reduced in an orderly manner, while retaining enough vessels to carry out emergency and national defense work, including wartime requirements. Furthermore, the statute allowed enough vessels to be retained by the government "to insure the capability of the Federal government and private industry together to carry out projects for improvements of rivers and harbors."[84]


Essayons


Yaquina


The *Essayons*, *Wheeler*, and *McFarland* dredge the Mississippi River in high water.

Under this legislation, Congress directed the Corps to conduct a Minimum Fleet Study, which the agency completed in 1978. In the study the Corps recommended a minimum fleet of eight hopper dredges – two each for the Gulf and Great Lakes and the east and west coasts of the United States. This recommendation received mixed responses. Industry, which was facing a smaller workload than predicted by the national dredging study, opposed the Corps' recommendation. Fearing that their new equipment would stand idle, they argued for a fleet in the range of two to five vessels. Conversely, port operators on the Oregon Coast worried that turning dredging projects over to private industry would result in increased costs and cause projects to be delayed or eliminated. The American Association of Port Authorities pushed for ten hopper dredges rather than the eight proposed by the Corps.[85] As Representative Peter DeFazio pointed out 20 years later, "Without the federal dredge fleet, smaller ports like those on the Oregon coast risk losing access to affordable and timely navigation dredging."[86]

Despite these conflicting responses, in 1979 the Corps forwarded their minimum fleet recommendations for eight hopper dredges to the Assistant Secretary of the Army for Civil Works (ASACW). The Office of Management and Budget requested that the agency provide additional information to justify the size of the minimum fleet. The Corps reassessment of the issue reaffirmed their initial findings. During this period, the agency had begun to retire its existing hopper fleet. By the end of fiscal year 1981, the Corps had retired five hopper dredges; the following year four more were taken out of service. In 1982 the Corps made a final appeal to the ASACW for maintaining


McFarland

a minimum fleet of eight hopper dredges. The political climate, however, was not conducive to this plan. Amidst intense lobbying from industry to increase their share of the dredging load and pressure to reduce costs, the ASACW decided in 1983 to allow the Corps a minimum fleet of four hopper dredges and six nonhopper dredges.[87]

To augment dredging capability for national defense and emergency purposes, the Corps initiated a Corps of Engineers' Reserve Fleet (CERF) in partnership with industry. The CERF program proposed a guaranteed response by private industry to emergency and defense situations. It called for a reserve fleet consisting of the Corps' four hopper dredges – the *Essayons*, the *Yaquina*, the *Wheeler*, and the *McFarland* with additional support from private vessels. By 1985, 15 private industry hopper dredges had joined CERF.[88]

In 1987 the U.S. Army Audit Agency recommended that the composition of the minimum fleet be reassessed to "include current defense requirements and private industry capability." In response, the Corps agreed to reassess the fleet every five years. In a related task, in 1990 the Chief of Engineers directed the U.S. Army Engineer Study Center (ESC) to assess two specific issues. First, the Corps wanted to know what type of a Corps dredge fleet was necessary to meet navigation, emergency, and military requirements. Second, the ESC was asked to examine the military need for a minimum fleet, independent of other issues. The ESC reports, which were released in 1991, concluded that the United States needed hopper-dredging capability, but it should not necessarily be the Corps' responsibility to provide it. In


Wheeler

terms of the second issue, the report found that existing military needs by themselves did not require a Corps minimum fleet.[89]

The discussions over the size and configuration of the MDF continued throughout the 1990s. As part of the process of periodic review mandated by the Minimum Fleet Legislation, in 1992 the Corps initiated a study focused on hopper dredges. Five years later, in October 1997, the Corps released information from that study for public comment. The study described eight options for the use of the four hopper dredges that constituted the government fleet. "The options range at one end of the spectrum with maximum use of the four Corps hopper dredges, to the other end, with all Corps hopper dredges being placed in a standby/support status and all hopper dredging work offered by industry to bid," announced General Ballard. The agency developed these options based on comments and concerns expressed by the ports, maritime users and the dredging industry. General Ballard explained that the Corps "attempted to focus the options on the varying degrees of risk to the viability of navigation projects and the investment and income risk to the dredging industry, and to balance those risks with costs considerations and improved competition, the long-term viability of the industry, and the ability to respond to time-sensitive and emergency dredging needs." Once comments were received, the agency planned to recommend a final configuration for the fleet.[90]

No final plans were made, however, due to new legislation included in the Water Resources Development Act of 1996 (WRDA-96). The passage of this act supplanted the Corps study and was the second major piece of legislation to affect the government's fleet of dredges.[91] In particular, the act directed the Corps to increase the use of private industry hopper dredges. Based on annual appropriations bills, beginning in 1992, the agency had allocated 7.5 million cubic yards, nationwide, to private dredging companies. WRDA-96 increased that amount by another million cubic yards. It also placed the *Wheeler* on standby and restricted the use of the MDF hopper dredges to 180 days a year. While it further reduced the Corps' direct role in dredging, the agency retained responsibility for maintaining the region's ports and harbors with either federal or private dredges.[92]

Conclusion

The issue of the Corps' role in dredging was crucial to the District, which encompassed numerous ports on the West Coast, as well as the Columbia and Willamette rivers. While it remained responsible for ensuring safe navigation, the agency's role in dredging projects evolved during the late 20th century. Historically the Corps dredge fleet participated in most dredging operations across the country. The trend over the past two decades, however, was to shift dredging work toward private industry. Given industry's general success in completing dredging projects and a political climate that favors increasing privatization, it is unlikely that this trend will be reversed. Furthermore, at the end of the 20th century, environmental issues heightened the complexity of the mix of public and private dredging by generally reducing the amount of dredge work performed by any hoppers. Despite its reduced fleet, the Corps remained the leader in managing navigation on our nation's rivers and streams.

Endnotes

[1] David C. Beach, Interview with Lisa Mighetto, Portland, Oregon, June 12, 2001. Hereafter cited as Beach Interview.

[2] U.S. Army Corps of Engineers, Portland District, Water Resources Development in Oregon, 1997, p. 65, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc19150401, Binders and Books Box 2.

[3] Port of Portland, accessed at http://www.portofportland.com/marine/chandeep/CHANDEEP.HTM, on June 1, 2001.

[4] U.S. Army Corps of Engineers, Portland District, "Yaquina Bay North Jetty Work Beginning," July 8, 1999, news release, Iron Mountain Records examined at Portland District Information Management Center, Location 277 CC 34060105, Folder: News Releases 1999.

[5] U.S. Army Corps of Engineers, Portland District, "Senator Mark O. Hatfield keynotes dual dedications – September 22," October 5, 1983, Corps'pondent.

[6] U.S. Army Corps of Engineers, Portland District, Water Resources Development in Oregon, 1997, p. 69, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc19150401, Binders and Books Box 2; U.S. Army Corps of Engineers, Portland District, "Corps Awards Contract for Tillamook North Jetty Rehabilitation," March 4, 1991, News Release, Iron Mountain Records Examined at Portland District Information Management Center, Location 277 BB 34140108, Box 2 of 3, Folder: News releases, 1991-1993.

[7] U.S. Army Corps of Engineers, Annual Historical Report, 1989, Portland District, Public Affairs Office, 870-5a, Organizational Histories, 1990-1999; U.S. Army Corps of Engineers, Portland District, "Special to Portland Daily Journal of Commerce," January 18, 1989, News Release, Federal Records Center Pacific Alaska Region Pacific Alaska Region, RG 77, Accession 77-98-0005, Box 26 of 51, Installation History Files; U.S. Army Corps of Engineers, Portland District, "Corps Announces Coastal Dredging Plans," April 18, 1988, News Release, Federal Records Center Pacific Alaska Region Pacific Alaska Region, RG 77, Accession 77-98-0005, Box 26 of 51, Installation History Files.

[8] U.S. Army Corps of Engineers, *Annual Historical Report*, 1999, Portland District, Public Affairs Office, 870-5a, Organizational Histories, 2000-present.

[9] Personal Communication with David Beach, February 12, 2002.

[10] U.S. Army Corps of Engineers, Portland District, Water Resources Development in Oregon, 1997, pp. 69-71, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc19150401, Binders and Books Box 2.

[11] U.S. Army Corps of Engineers, Portland District, "Application to Extend Channel," August 3, 1989, News Release, Federal Records Center Pacific Alaska Region Pacific Alaska Region, RG 77, Accession 77-98-0005, Box 24 of 51, Installation History Files.

[12] U.S. Army Corps of Engineers, Portland District, Water Resources Development in Oregon, 1991, p. 60, Iron Mountain Records Examined at Portland District Information Management Center, Location 277 cc19150401, Binders and Books Box 2; U.S. Army Corps of Engineers, Portland District, Water Resources Development in Oregon, 1997, p. 71, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc19150401, Binders and Books Box 2.

[13] U.S. Army Corps of Engineers, Portland District, Water Resources Development in Oregon, 1997, p. 71, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc19150401, Binders and Books Box 2; U.S. Army Corps of Engineers, Annual Historical Report, 1996, Portland District, Public Affairs Office, 870-5a, Organizational Histories, 1990-1999; U.S. Army Corps of Engineers, Annual Historical Report, 1997, Portland District, Public Affairs Office, 870-5a, Organizational Histories, 1990-1999; Heidi Y. Helwig, "Coos Bay channel deepening contract awarded," July 1996, Corps'pondent, Iron Mountain Records examined at Portland District Information Management Center, Location 277 CC 20150409, Binders and Books Box 1, Corps'pondent 1995, 1996; U.S. Army Corps of Engineers, Portland District, "Corps Portland District Looks to New Year," January 15, 1991, News Release, Iron Mountain Records examined at Portland District Information Management Center, Location 277 BB 34140108, Box 2 of 3, Folder: News releases, 1991-1993; Beth A. Allen, "Portland District Looks Ahead," January 14, 1992, Iron Mountain Records examined at Portland District Information Management Center, Location 277 BB 34140108, Box 2 of 3, Folder: 360-5b News Media and Releases, Media Contacts 1992.

[14] U.S. Army Corps of Engineers, Portland District, Water Resources Development in Oregon, 1991, p. 60, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc19150401, Binders and Books Box 2; U.S. Army Corps of Engineers, Portland District, Water Resources Development in Oregon, 1997, p. 72, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc19150401, Binders and Books Box 2.

Endnotes

[15] U.S. Army Corps of Engineers, *Annual Historical Report*, 1999, Portland District, Public Affairs Office, 870-5a, Organizational Histories, 2000-present.

[16] Video recording of Oregon Field Guide, "Dredging the Columbia River," OPB News, November 1995, provided by the Portland District Information Management Center.

[17] Heidi Y. Brown, "Dredges ready for busy season of work," March 1994, *Corps'pondent*, Iron Mountain Records examined at Portland District Information Management Center, Location 277 BB 34140108, Box 2 of 3.

[18] U.S. Army Corps of Engineers, Portland District, "1991 Dredging Season in Full Swing," June 24, 1991, News Release, Iron Mountain Records examined at Portland District Information Management Center, Location 277 BB 34140108, Box 2 of 3, Folder: News releases, 1991-1993; Heidi Y. Brown, "Dredges ready for busy season of work," March 1994, Corps'pondent, Iron Mountain Records examined at Portland District Information Management Center, Location 277 BB 34140108, Box 2 of 3.

[19] Miguel Jiminez, Interview with Lisa Mighetto, Portland, Oregon, June 13, 2001.

[20] Video recording of "Corps Dredge in Town," June 6, 1996, KOIN 6, 5:26 p.m., provided by the Portland District Information Management Center.

[21] Video recording of Oregon Field Guide, "Dredging the Columbia River," OPB News, November 1995, provided by the Portland District Information Management Center.

[22] Heidi Y. Brown, "Dredges ready for busy season of work," March 1994, Corps'pondent, Iron Mountain Records examined at Portland District Information Management Center, Location 277 BB 34140108, Box 2 of 3.

[23] C.V. Hollander, "Channel-deepening plan draws fire from Astoria Crowd," Portland District, Iron Mountain records examined at Portland District Information Management Center, Location 277 cc20150409, Box 1: Binders and Books, Binder: Col. Wood and Maj. Cottrell.

[24] Stewart T. Schultz, *The Northwest Coast, A Natural History* (Portland, Oregon: Timber Press, 1990), pp. 318-321.

[25] Heidi Y. Brown, "Dredges ready for busy season of work," March 1994, *Corps'pondent*, Iron Mountain Records examined at Portland District Information Management Center, Location 277 BB 34140108, Box 2 of 3; Personal communication with David Beach, February 12, 2002.

[26] Heidi Y. Brown, "Dredges ready for busy season of work," March 1994, *Corps'pondent*, Iron Mountain Records examined at Portland District Information Management Center, Location 277 BB 34140108, Box 2 of 3.

[27] U.S. Army Corps of Engineers, accessed at http://www.nwp.usace.army.mil/pm/e/ENPLAN.htm#trestle, on June 1, 2001.

[28] U.S. Army Corps of Engineers, accessed at http://www.nwp.usace.army.mil/pm/e/ENPLAN.htm#trestle on June 1, 2001;U.S. Army Corps of Engineers, Portland District, Water Resources Development in Oregon, 1997, p. 73, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc19150401, Binders and Books Box 2.

[29] Geoff Dorsey, Interview with Jill Schnaiberg, Portland, Oregon, January 17, 2002.

[30] U.S. Army Corps of Engineers, Annual Historical Report, 1995, Portland District, Public Affairs Office, 870-5a, Organizational Histories, 1990-1999.

[31] Heidi Y. Brown, "Dredges ready for busy season of work," March 1994, *Corps'pondent*, Iron Mountain Records examined at Portland District Information Management Center, Location 277 BB 34140108, Box 2 of 3.

[32] U.S. Army Corps of Engineers, Portland District, *Integrated Feasibility Report for Channel Improvements and Environmental Impact Statement, Columbia & Lower Willamette River Federal Navigation Channel, Appendix G: Wildlife Mitigation*, August 1999, p. 5, Portland District Technical Library.

[33] U.S. Army Corps of Engineers, Portland District, "Corps Seeks Public Review, Comment on Dredge Material Management Study," January 20, 1998, News Release, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc 34060105, Folder: News Releases 1998; U.S. Army Corps of Engineers, Portland District, Dredged Material Management Plan & Supplemental Environmental Impact Statement: Columbia and Lower Willamette River Federal Navigation Channel, Final June 1998, Portland District Technical Library, pp. 9-10.

[34] U.S. Army Corps of Engineers, Portland District, Dredged Material Management Plan & Supplemental Environmental Impact Statement: Columbia and

Endnotes

Lower Willamette River Federal Navigation Channel, Final June 1998, Portland District Technical Library, p. 10.

[35] U.S. Army Corps of Engineers, Portland District, Dredged Material Management Plan & Supplemental Environmental Impact Statement: Columbia and Lower Willamette River Federal Navigation Channel, Final June 1998, Portland District Technical Library, pp. 10-11.

[36] U.S. Army Corps of Engineers, Portland District, Dredged Material Management Plan & Supplemental Environmental Impact Statement: Columbia and Lower Willamette River Federal Navigation Channel, Final June 1998, Portland District Technical Library, p. 12.

[37] U.S. Army Corps of Engineers, Portland District, Dredged Material Management Plan & Supplemental Environmental Impact Statement: Columbia and Lower Willamette River Federal Navigation Channel, Final June 1998, Portland District Technical Library, pp. 12-13.

[38] Personal communication with David Beach, February 12, 2002.

[39] U.S. Army Corps of Engineers, Portland District, Dredged Material Management Plan & Supplemental Environmental Impact Statement: Columbia and Lower Willamette River Federal Navigation Channel, Final June 1998, Portland District Technical Library, p. 13; Personal communication with David Beach, February 12, 2002.

[40] Beach Interview.

[41] U.S. Army Corps of Engineers, Portland District, "Corps Seeks Public Review, Comment on Dredge Material Management Study," January 20, 1998, News Release, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc 34060105, Folder: News Releases 1998; U.S. Army Corps of Engineers, Portland District, "Corps' dredged material management plan hits the street," June 24, 1998, News Release, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc 34060105, Folder: News Releases 1998; Personal communication with David Beach, February 12, 2002.

[42] U.S. Army Corps of Engineers, Portland District, Dredged Material Management Plan & Supplemental Environmental Impact Statement: Columbia and Lower Willamette River Federal Navigation Channel, Final June 1998, Portland District Technical Library, p. 1.

[43] U.S. Army Corps of Engineers, Portland District, Dredged Material Management Plan & Supplemental Environmental Impact Statement: Columbia and Lower Willamette River Federal Navigation Channel, Final June 1998, Portland District Technical Library, pp. 1,8.

[44] U.S. Army Corps of Engineers, Portland District, "Corps' dredged material management plan hits the street," June 24, 1998, News Release, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc 34060105, Folder: News Releases 1998.

[45] U.S. Army Corps of Engineers, Portland District, Dredged Material Management Plan & Supplemental Environmental Impact Statement: Columbia and Lower Willamette River Federal Navigation Channel, Final June 1998, Portland District Technical Library, pp. iii, 3; U.S. Army Corps of Engineers, Portland District, "Columbia River Federal Navigation Channel dredging document available to public," June 19, 2000, News Release, accessed at https://www.nwp.usace.army.mil/pa/news/archive/2000/00%2D107.htm, on June 1, 2001.

[46] U.S. Army Corps of Engineers, Portland District, Dredged Material Management Plan & Supplemental Environmental Impact Statement: Columbia and Lower Willamette River Federal Navigation Channel, Final June 1998, Portland District Technical Library, pp. iii; U.S. Army Corps of Engineers, Portland District, "Corps' dredged material management plan hits the street," June 24, 1998, News Release, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc 34060105, Folder: News Releases 1998.

[47] Beach Interview.

[48] Laura Hicks, Interview with Jill Schnaiberg, Portland, Oregon, January 17, 2002, Hereafter cited as Hicks Interview; U.S. Army Corps of Engineers, Portland District, "Draft Columbia River Channel Improvement Feasibility Study/Environmental Impact Statement to be Released," October 22, 1998, News Release, Portland District, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc34060105, Folder: News Releases, 1998.

[49] U.S. Army Corps of Engineers, Portland District, "Draft Columbia River Channel Improvement Feasibility Study/Environmental Impact Statement to be Released," October 22, 1998, News Release, Portland District, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc34060105, Folder: News Releases, 1998.

Endnotes

[50] U.S. Army Corps of Engineers, Portland District, "Feasibility phase of channel deepening study begins," October 1994, *Corps'pondent*, Portland District, Iron Mountain Records examined at Portland District Information Management Center, Location 277 bb 34140108, Box 2 of 3.

[51] U.S. Army Corps of Engineers, Portland District, "Columbia River Channel Improvement Study," January 1997, Information Paper, Portland District, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc20150409, Box 1: Binders and Books, Binder: Col. Wood and Maj. Cottrell.

[52] Shelly Strom, "Army Corps Delays Channel-Deepening Decision," *The Business Journal*, May 12, 2000, accessed at http://www.northwestenvironmentaladvocates.org/resources/docs.html#3L, on November 20, 2001.

[53] U.S. Army Corps of Engineers, Portland District, "Feasibility phase of channel deepening study begins," October 1994, *Corps'pondent*, Portland District, Iron Mountain Records examined at Portland District Information Management Center, Location 277 bb 34140108, Box 2 of 3.

[54] C.V. Hollander, "Ports see channel-deepening study as good investment," October 24, 1995, *Daily Astorian*, Portland District, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc 19150401, Box 1 of 4, Folder: Fish 1995; Hicks Interview.

[55] U.S. Army Corps of Engineers, Portland District, "Draft Columbia River Channel Improvement Feasibility Study/Environmental Impact Statement to be Released," October 22, 1998, News Release, Portland District, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc34060105, Folder: News Releases, 1998; U.S. Army Corps of Engineers, Portland District, "Public Meeting – Columbia River Channel Improvement Feasibility Study," November 5, 1998, News Release, Portland District, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc34060105, Folder: News Releases, 1998.

[56] Video tape of news clip, "Dredging Plans," October 22, 1998, Portland News, KGW Channel 8, 5:24p.m., provided by the Portland District Information Management Center.

[57] C.V. Hollander, "Ports see Channel-Deepening Study as Good Investment," October 24, 1995, *Daily Astorian*, Portland District, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc 19150401, Box 1 of 4, Folder: Fish 1995.

[58] C.V. Hollander, "Channel-Deepening Plan Draws Fire from Astoria Crowd," Portland District, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc20150409, Box 1: Binders and Books, Binder: Col. Wood and Maj. Cottrell.

[59] Video tape of news clip, "Dredging Plans," October 22, 1998, Portland News, KGW Channel 8, 5: 24p.m., provided by the Portland District Information Management Center.

[60] C.V. Hollander, "Channel-deepening plan draws fire from Astoria Crowd," Portland District, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc20150409, Box 1: Binders and Books, Binder: Col. Wood and Maj. Cottrell.

[61] Hicks Interview.

[62] U.S. Army Corps of Engineers, Portland District, "Final Columbia River Channel Improvement Feasibility Study/Environmental Impact Statement Released to Public," August 17, 1999, News Release, Portland District, Iron Mountain records Examined at Portland District Information Management Center, Location 277 cc 34060105, Folder: News Releases, 1999.

[63] U.S. Army Corps of Engineers, Portland District, Integrated Feasibility Report for Channel Improvements and Environmental Impact Statement, Columbia & Lower Willamette River Federal Navigation Channel, Appendix G: Wildlife Mitigation, August 1999, p. 19, Portland District Technical Library.

[64] U.S. Army Corps of Engineers, Portland District, "Final Columbia River Channel Improvement Feasibility Study/Environmental Impact Statement Released to Public," August 17, 1999, News Release, Portland District, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc 34060105, Folder: News Releases, 1999.

[65] Hicks Interview.

[66] U.S. Army Corps of Engineers, Portland District, "Restoration Goals Benefit Columbia River Estuary," December 15, 1999, News Release, Portland District, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc 34060105, Folder: News Releases, 1999.

Endnotes

[67] U.S. Army Corps of Engineers, Portland District, "Final Columbia River Channel Improvement Feasibility Study/Environmental Impact Statement Released to Public," August 17, 1999, News Release, Portland District, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc 34060105, Folder: News Releases, 1999.

[68] U.S. Army Corps of Engineers, Portland District, "Final Columbia River Channel Improvement Feasibility Study/Environmental Impact Statement Released to Public," August 17, 1999, News Release, Portland District, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc 34060105, Folder: News Releases, 1999.

[69] Jim Barnett, "Panel Will Reject Dredging Funds," The Oregonian, June 20, 2000, as accessed at http://www.northwestenvironmentaladvocates.org/resources/docs.html#3L, on November 20, 2001.

[70] Letter from Columbia River Estuary Study Taskforce (CREST) to Northwest Power Planning Council, September 29, 1999, accessed at http://www.columbiaestuary.org/channel/NWPPC.htm, on June 1, 2001.

[71] U.S. Army Corps of Engineers, Portland District, "Restoration Goals Benefit Columbia River Estuary," December 15, 1999, News Release, Portland District, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc 34060105, Folder: News Releases, 1999.

[72] Columbia River Channel Improvement Reconsultation Project (CRCIRP), "Consultation underway to resolve biological opinion issues," February 8, 2001, News Release, accessed at http://www.sei.org/columbia/home.html, on June 1, 2001.

[73] U.S. Army Corps of Engineers, Portland District, "Corps and NMFS renew discussions over Columbia River Channel Improvements Project," August 25, 2000, News Release, accessed at https://www.nwp.usace.army.mil/pa/news/archive/2000/0052D152.htm, on June 1, 2001.

[74] U.S. Army Corps of Engineers, Portland District, "Army Corps of Engineers receives NMFS' Biological Opinion on Columbia River Channel Improvement Study," December 17, 1999, News Release, Portland District, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc 34060105, Folder: News Releases, 1999.

[75] U.S. Army Corps of Engineers, Portland District, "U.S. Army Corps of Engineers signs Chief's Report on Columbia River Channel Improvement Study," December 23, 1999, News Release, Portland District, Iron Mountain Records examined at Portland District Information Management Center, Location 277 cc 34060105, Folder: News Releases, 1999.

[76] U.S. Army Corps of Engineers, Portland District, "Corps and NMFS renew discussions over Columbia River Channel Improvements Project," August 25, 2000, News Release, accessed at https://www.nwp.usace.army.mil/pa/news/archive/2000/0052D152.htm, on June 1, 2001.

[77] Letter from Michael T. Llewelyn to Colonel Randall J. Butler, September 29, 2000, accessed at http://www.columbiaestuary.org/channel/channel.html, on November 20, 2001; Letter from Gordon White to Colonel Randall J. Butler and Mr. Lee Daneker, September 29, 2000, accessed at http://www.columbiaestuary.org/channel/channel.html, on November 20, 2001.

[78] U.S. Army Corps of Engineers, Portland District, "Corps and NMFS renew discussions over Columbia River Channel Improvements Project," August 25, 2000, News Release, accessed at https://www.nwp.usace.army.mil/pa/news/archive/2000/0052D152.htm, on June 1, 2001.

[79] U.S. Army Corps of Engineers, Management of Dredging Projects; Summary Report for Technical Area 5, February 1996, pp. 29, 30, 42, Portland District Technical Library.

[80] U.S. Army Corps of Engineers, Management of Dredging Projects; Summary Report for Technical Area 5, February 1996, p. 42, Portland District Technical Library.

[81] U.S. Army Corps of Engineers, Management of Dredging Projects; Summary Report for Technical Area 5, February 1996, pp. 42-43, Portland District Technical Library.

[82] U.S. Army Corps of Engineers, Management of Dredging Projects; Summary Report for Technical Area 5, February 1996, p. 43, Portland District Technical Library.

[83] Beach Interview.

[84] U.S. Army Corps of Engineers, Management of Dredging Projects; Summary Report for Technical Area 5, February 1996, p. 44, Portland District Technical Library.

Endnotes

[85] U.S. Army Corps of Engineers, Management of Dredging Projects; Summary Report for Technical Area 5, February 1996, pp. 43-44, Portland District Technical Library.

[86] "DeFazio Blasts Corps Study on Minimum Dredge Fleet," June 12, 2000, Press Release, accessed at http://www.house.gov/defazio/pf_061200TNRelease.htm, June 1, 2001.

[87] U.S. Army Corps of Engineers, Management of Dredging Projects; Summary Report for Technical Area 5, February 1996, pp. 44-45, Portland District Technical Library.

[88] U.S. Army Corps of Engineers, Management of Dredging Projects; Summary Report for Technical Area 5, February 1996, p. 45, Portland District Technical Library.

[89] U.S. Army Corps of Engineers, Management of Dredging Projects; Summary Report for Technical Area 5, February 1996, p. 45, Portland District Technical Library.

[90] U.S. Army Corps of Engineers, "Minimum Dredge Fleet information released for comment," October 8, 1997, News release, accessed at http://www.nwp.usace.army.mil/pa/news/archive/1997/97%2D106.htm, on June 1, 2001.

[91] Beach Interview.

[92] U.S. Army Corps of Engineers, Portland District, "President signs 1996 Water Resources Development Act," October 21, 1996, News Release, accessed at https://www.nwp.usace.army.mil/pa/info/wrda.htm, on June 1, 2001.

Environmental Work

Chapter Three
Environmental Work

"There is a heightened environmental ethic here [in Portland] and has been for sometime; it has maybe put us in the forefront in dealing with environmental issues."

Davis Moriuchi, Deputy District Engineer for Project Management, 2001

Redirecting water flow at a wetland restoration area.

The U.S. Government Moorings becomes part of a Superfund site.

Testing soil samples at a cleanup site for hazardous material.

New Directions for the Corps

The environmental movement profoundly influenced federal water resources development in the late 20th century, resulting in major changes in the Corps' work and in the agency's public image. Few forces were more influential in the Portland District during the period 1980-2000. While the Corps' navigation, flood control, and hydropower missions continued, the era of big-dam building had ended in the Pacific Northwest. In the late 20th century, Congress began moving away from structural solutions to water resources problems, in favor of managing watersheds, restoring wetlands, and cleaning up hazardous waste sites. It is important to recognize that these concerns emerged recently. Throughout much of the 20th century, the United States focused on technological and economic advancement, and federal policy reflected those objectives. The story of the Portland District exemplifies how the Corps responded to the new concerns that environmentalism introduced, and how the agency incorporated them into its mission.

The environmental movement, which emerged during the 1960s and 1970s, was very different from Progressive-Era conservation, which dated back to the late 19th and early 20th centuries. Unchecked exploitation of the nation's resources in part prompted the conservation movement a century ago. So rampant were the logging, fishing, hunting, and mining activities during this period that historians have dubbed it "the Great Barbecue."[1] Stands of timber and populations of fish and wildlife declined with alarming rapidity, prompting some Americans to advocate protection of the nation's natural resources. The extinction of the passenger pigeon and the near-extinction of the buffalo – both targets of commercial hunting – served to point out the need for regulations. The early conservationists that advocated state and federal legislation had little appreciation of complex ecosystems or habitat requirements; their objective was to protect natural resources for efficient use and continued productivity. Conservation legislation ensured that the nation's water, timber, fish, and wildlife resources would not be destroyed by unchecked harvesting.[2]

Many conservationists also promoted wise use of the nation's waterways. They advocated reclamation projects that promised to harness rivers and streams, providing flood control, irrigation, navigation, and electricity. The Reclamation Act of 1902 was a product of the conservation movement, and the Corps and the Bureau of Reclamation became the primary agencies for carrying out federal water resources responsibilities. Dams constructed in the Pacific Northwest during the early 20th century allowed for efficient utilization of the region's resources, in keeping with the principles of conservation.[3]

Environmentalism had a very different philosophical basis, representing new intellectual forces that developed rapidly in the late 20th century. As Chief of Engineers Lieutenant General John W. Morris observed in 1978, "environmentalism has become a truly powerful force in the United States only in relatively recent times."[4] The environmental movement developed during a period of social unrest, drawing inspiration from the counterculture's questioning of traditional values. It emerged during an era of political activism, and proponents became adept at publicizing their concerns and mobilizing citizens to work for changes in federal laws and policies.[5]

In addition to its political underpinnings, environmentalism had a scientific basis. While conservationists emphasized efficient use of resources and the need for outdoor recreation, environmentalists initially focused on concern about the effects of pollutants and hazardous materials. Rachel Carson vocalized this issue during the early 1960s, alerting the nation to the potential threat of radiation fallout and toxic chemicals – a threat that had proliferated since World War II. Her popular book, *Silent Spring,* published in 1962, outlined the effects of contamination on the country's fish and wildlife species, and, by implication, on human health. Carson's lyrical writing style reached a generation of readers and the appearance of her book marked the beginning of an era of concern about pollution as well as political activism promoting cleanup of the nation's air, land, and waterways.[6]

During the 1970s, the environmental movement evolved with changing scientific precepts. These included a recognition of the complexity of ecosystems and the need to manage resources in relation to the surrounding environment. Whereas conservationists called for the wise use of resources, often focusing on a single resource or a single species, environmentalists promoted a holistic approach to protecting the natural world.[7] Ecosystem management was a new concept – one that might have astonished natural resource managers 50 years earlier.

To be sure, environmentalists were not single-minded and not all Americans considered themselves to be environmentalists. Even so, the concerns of the movement became pervasive in American culture and politics. As Lieutenant General Morris explained in 1978, "In the United States today most of our citizens have developed at least a degree of concern for environmental quality." Terms like "environment," "habitat," and "ecosystem" became household words, and Congress responded to this new awareness with legislation that established new procedures for projects.[8]

The National Environmental Policy Act (NEPA) was one of the most prominent statutes, bringing the protection of natural and cultural resources into the forefront of the federal planning process. Signed into law in 1970, NEPA required federal agencies to employ an interdisciplinary approach to project evaluation, which resulted in the hiring of new staff, including fisheries and wildlife biologists as well as archaeologists. It also required agencies to complete an Environmental Impact Statement (EIS), which included public input into the decision-making process. Moreover, the act was retroactive, directing agencies to prepare environmental impact statements for then current projects, regardless of the stage of planning, design, or construction. In addition to NEPA, Congress passed the Federal Water Pollution Control Act amendments (FWPCA) of 1972.[9]

The Endangered Species Act (ESA) of 1973 was another landmark statute that affected the Corps and other federal agencies. Although Congress passed endangered species legislation in 1966 and 1969, these earlier acts were weak and ineffective, while the amended statute of 1973 proved to be one of the nation's strongest (and most controversial) environmental measures. The ESA resulted from a growing awareness of the importance of biodiversity – and it was the nation's first comprehensive attempt to protect fisheries, wildlife, and plant species from extinction.[10] The ESA directed the U.S. Fish and Wildlife Service and the National Marine Fisheries Service (NMFS) to list species as endangered or threatened, and to identify critical habitat necessary for continued survival. The ESA brought considerable changes to the Portland District's work.

The ESA greatly affected the Corps and other federal agencies charged with managing the nation's natural resources. The Corps had entered the 1970s "as an agency steeped in tradition."[11] Its original water resources development mission dated back to the early 19th century – long before the environmental movement. Historically, the Corps has proven to be a resilient agency, adapting to the nation's changing needs. During the early 20th century, the Corps had adopted the "wise use" philosophy of the conservation movement, which emphasized efficient utilization of the nation's natural resources. In the late 20th century, the Corps' leaders similarly understood the need to continue adapting.[12]

Change, however, was not immediately apparent among many federal agencies, including the Corps. One initial, highly visible result of the new environmental legislation was that it embroiled agencies in litigation throughout the nation. If an agency failed to consider the impact on the environment in the planning process, the courts had

the power to stop the project. The Corps, like other federal agencies, soon became the target of lawsuits largely initiated by environmental groups. As litigation increased, the Corps' public image eroded, and the agency found itself caught between competing interests, especially environmentalists and developers.[13] Environmentalists proved to be vocal, persistent critics, concerned about the impact of the "hard Corps" on our "soft environment."[14]

The Corps' response to environmental directives evolved over time. Initially, the District complied with the new regulations but showed little initiative or innovation in its approach, continuing to view itself primarily as a dam-building agency.[15] An influx of new staff helped change this perspective, as the Corps began to attract a more culturally and technically diverse workforce, adding fisheries and wildlife biologists and other personnel from disciplines outside engineering. The Water Resources Development Act of 1990 further helped changed perceptions, marking a new policy direction for the Corps. This legislation established environmental protection "as one of the primary missions of the Corps of Engineers in planning, designing, constructing, operating, and maintaining water resources projects." In October of 1990 Lieutenant General Henry Hatch explained the Corps' new mission as follows: "No public works project should be undertaken that is not environmentally sustainable. If a particular project has avoidable impacts, they must be avoided. Then, in turn all *un*avoidable impacts need to be minimized, mitigated, or compensated for. This *must* be included as part of the cost of doing business."[16]

Responding to these changes required a philosophical shift in the Corps. "The Corps thinks of itself as a 'nation-building' organization," Lieutenant General Hatch explained in 1991, "But nation building means something quite different today than it did 150 years or even 50 years ago. Nation building no longer automatically means large construction and maintenance projects."[17] The Portland District exemplified this change in mindset. As Davis Moriuchi, Deputy District Engineer for Project Management, observed, the District faced the challenge of "trying to figure out how to transform ourselves from an organization that is used to doing huge multi-million dollar projects down to one that does smaller scale projects." To his mind, the transition might have been easier for Portland than other districts. "I think there is a heightened environmental ethic here and has been for sometime," he explained. "It has maybe put us in the forefront in dealing with environmental issues."[18]

Accordingly, the District adopted new approaches to environmental issues, including building alliances between the Corps and environmental organizations. Portland District personnel met with staff from American Rivers and River Networks, for example, "to talk about legislative strategies." Moriuchi also encouraged District employees to represent the Corps at meetings of local civic and environmental organizations, where they could interact with people outside the agency. He believed this approach had a positive effect on the relations between the Corps and local communities, including environmentalists. "Once they know about our willingness and interest in working in this area and our technical abilities," he commented, "and once they stop thinking of us only as the dam builders and fish killers, they see all sorts of opportunities."[19]

By the early 21st century, the Corps had adapted its engineering expertise to new directions in federal policy, and the Portland District had evolved into an environmental engineering organization. As Moriuchi concluded, "the changes we've gone through are really phenomenal."[20] The following chapter describes how environmental concerns permeated nearly all aspects of the agency's work in the Portland District.

The Corps' Regulatory Program

Introduction

Over the last two decades of the 20th century, the Corps' regulatory program underwent significant changes. The agency spent most of the 1980s attempting to refine

its understanding of its regulatory responsibilities, particularly the extent of its jurisdiction and its obligations to wetlands protection. During this period, the Corps Institute for Water Resources developed a manual titled *Wetland Values: Concepts and Methods for Wetland Evaluation*, defining wetlands and procedures that field offices could use for delineating them. In addition to growing concerns over wetland protection, the agency experienced significant pressure from increased numbers of applications for Section 404 permits, described below, and the growing complexity of the permitting process. Despite these challenges, by the end of the decade the Corps had transformed from an agency unsure of its role in the regulatory field to one more confident about its regulatory mission, particularly in the area of wetlands protection. No longer seen as being on the defensive, the Corps was more proactive in environmental matters pertaining to regulation.[21]

In the 1990s, the Corps' regulatory program maintained a heavy workload. The agency increasingly focused on enforcement activities, while still working to administer the program in a balanced manner. The goal remained to protect the aquatic environment and still provide a fair and efficient process for applicants. It was during this period that the agency made considerable strides in the area of mitigation, especially in the development of mitigation banks for wetlands. The Corps also refined the operation and management of the Section 404 program and worked to improve its relationship with other federal resource agencies involved in the regulatory program. Despite a series of court decisions in the late 1990s challenging the Corps, the agency's regulatory program continued to play a key role in balancing the interests of those seeking environmental protection for wetlands and other natural areas and those pursuing development.[22]

Developing a Regulatory Program

The Corps' regulatory program is one of the oldest in the federal government. Initially created to protect and maintain the navigable waters of the United States, it derived authority from the River and Harbors Act of 1890 and 1899. The Act of 1899 authorized the Corps to regulate activities that could obstruct navigable waterways, defined as those waters below the ordinary or mean high-water level or tide level. Discharges of refuse were prohibited without a permit from the Corps.[23]

Until the late 1960s, the Corps made its permitting decisions based on the potential impact of proposed activities on navigation. As the environmental movement and its new values began to permeate the nation's consciousness, the Corps expanded the factors it considered in evaluating permit requests. In 1968 permit criteria were broadened to include evaluation of fish and wildlife, conservation, pollution, aesthetics, ecology, and the general public interest. Later these criteria were extended to address additional factors such as economics, historical values, flood damage prevention, recreation, energy needs, and food production.[24]

The passage of the Federal Water Polution Control Act (FWPCA) of 1972 continued to expand the scope of the Corps' regulatory program. This legislation added to the Secretary's authority what is commonly referred to as Section 404 authority. Section 404 prohibited the discharge of any dredged or fill materials into waters of the United States without a permit from the Corps.[25] The Clean Water Act (CWA) of 1977 amended the FWPCA to strengthen the federal commitment to "restore and maintain the chemical, physical, and biological integrity of the nation's waters."[26]

Over time, the regulatory jurisdiction of the Corps evolved under Section 404. Originally its jurisdiction was limited to navigable waters. A series of court decisions, however, expanded the scope of coverage to encompass all waters of the United States, including most wetlands. While the legislation was not a comprehensive wetlands program, it was the major authority for the federal government to halt the loss of wetlands.[27]

Congressional amendments to the CWA, and Corps regulations for implementing the act, set limits to the jurisdiction of the 404 program. The 1977 amendments to the CWA exempted a number of activities, including farming, silviculture, and ranching activities. It also exempted emergency repairs to dikes, dams, and other related structures; construction or maintenance of farm, stock ponds, or irrigation/drainage ditches; construction of temporary sedimentation basins on a construction site; construction or maintenance of farm or forest roads; and congressionally approved projects that had filed an EIS.[28]

While Congress assigned the Corps primary administrative responsibility for carrying out the program, several other federal agencies also were involved with

Section 404. The Environmental Protection Agency (EPA), NMFS, and U.S. Fish and Wildlife Service (USFWS) reviewed permit applications and provided comments and recommendations on whether permits should be issued by the Corps. Both USFWS and NMFS also had agreements with the Corps that allowed them to request that district engineer permit decisions be reviewed at upper levels in the agency if there was disagreement. The Assistant Secretary of the Army for Civil Works could, however, refuse the request. The EPA had the authority to veto any application or overrule any disposal site designated on a permit reviewed by the Corps if it found the project impacts unacceptable. The agency also developed criteria for discharges and State assumption of the 404 program.[29]

States also had a role in the 404 program. Section 401 of the CWA required state water quality certification before issuing a Section 404 permit, essentially enabling states to veto permit applications. States were also able to administer portions of the 404 program if they met criteria established by the EPA. In general, however, most states lacked both the capability and desire to assume sole responsibility for regulating wetland use without additional resources from the federal government.[30]

The primary objective in the permitting process was to reduce the potential impacts of projects on the aquatic environment. Within the Corps, the processing of permit applications varied depending on the type of permit. The major types included individual, general, and letters of permission. Individual permits covered unique projects or those with larger impacts and were the basic form of authorization used by the Corps' districts. Processing individual permits involved three steps: pre-application consultation, formal project evaluation after a completed application was received, and decision-making by a district engineer. The formal project evaluation step included a public notice and comment period, preparation of permit decision documents including a discussion of the environmental impacts of the project, the findings of the public interest review process, and any special evaluation required by the type of activity.[31]

During the public interest review stage, the Corps considered many factors, such as conservation, economics, aesthetics, cultural resources, fish and wildlife values, and water supply. A permit was generally granted unless it was found to be contrary to the public interest. In evaluating individual applications, the Corps used three general criteria. These included the following: the relative extent of the public and private need for the proposed structure or work; the desirability of using appropriate alternative locations and methods to accomplish the objective of the proposed

Permit Actions

The following numbers represent the number of permits issued by the Portland District. (The anomaly in 1996 - 97 reflect actions taken in response to the flood impacts during that period.)

Year	*Permit Actions*	*Year*	*Permit Actions*
1980	*349*	*1991*	*410*
1981	*218*	*1992*	*496*
1982	*275*	*1993*	*509*
1983	*259*	*1994*	*671*
1984	*173*	*1995*	*586*
1985	*333*	*1996*	*1227*
1986	*456*	*1997*	*1232*
1987	*454*	*1998*	*899*
1988	*437*	*1999*	*789*
1989	*392*	*2000*	*762*
1990	*495*	*2001*	*843*

"In the Pacific Northwest, our biggest challenge has been changes brought on by the Endangered Species Act (ESA). The Corps is prohibited from issuing a permit before we complete consultation with either of the federal resource agencies whenever a proposed activity might affect a listed species or its habitat. In this region most or our project evaluations involve this ESA review. When the Act was first passed and listings took effect, our average processing time went up significantly (for even minor project activities). In the last few years our efforts have been focused on working with our federal resource agency partners to develop new, and more efficient, procedures that allow us to meet our ESA responsibilities while still providing a timely review for our customers. An example of this partnering relationship is the Programmatic Biological Opinion the Portland District developed in collaboration with the NMFS, Portland. This document allows efficient evaluations to be completed by Corps regulatory staff for projects that fall into any one of 16 categories of work, i.e. shoreline stabilization. Our challenge in the next few years will be to expand on these types of process initiatives, e.g. General Fastabend's regional regulatory initiative, and continue to improve our service to the public.

-Lawrence Evans

structure or work; and the extent and permanence of the beneficial or detrimental effects that the proposed structure or work may have on the public and private uses to which the area is suited.[32]

One of the primary concerns of the Section 404 program was the need to streamline the permitting process to minimize regulatory burdens. Developers, in particular, complained about delays in their project schedules. In response, the Corps developed several types of general permits. Nationwide permits, for example, were issued at the national level by the Chief of Engineers. They were the most commonly used form of authorization; by 1997, 65 percent of all Corps permit actions were authorized under nationwide permits.[33] These permits covered activities the Corps identified as substantially similar in nature and causing only minimal individual and cumulative impacts. Nationwide permits were issued for projects such as utility line installations, bridges, and agricultural activities. Another type were regional general permits, which covered projects that were similar in nature and subject to specific regional conditions. A number of stream and habitat restoration projects fell into this category. All permits, whether individual or general, initially required public notice and the opportunity for comment.[34]

For projects involving a minor amount of work, the Corps used letters of permission. These were projects that resulted in no significant environmental impacts, and no appreciable opposition was expected. For this type of permit the proposal was coordinated with all concerned resource agencies and adjoining property owners who may have been impacted, but the public at large was not notified.[35]

Many of the permits approved by the Corps entailed some form of compensatory mitigation to replace ecosystems that were destroyed or impaired by an authorized activity. The loss of wetlands and other aquatic ecosystems was mitigated through a variety of actions, including restoration, enhancement, creation, and preservation. The regulations for wetlands mitigation provided no established national ratio that set the amount of mitigation required. Instead, agency officials considered many site specific and watershed factors, including the type of wetland impacted and its relative values, the extent of temporal losses, and historic wetland losses in the watershed.[36] "If you're going to be destroying a wetland, or part of it," explained Dave Kurkoski, a water resources planner in the Regulatory Branch, "you need to determine what function that wetland serves, what values it has, and try to replace those functions and values somewhere else, preferably at the site, at a nearby site, or at least in the same watershed." A wetland's function was determined by what the ecosystem contributed to the environment, such as floodwater retention, groundwater recharge, wildlife habitat, aquatic habitat, and water quality. The value of a wetland was established by the wetland's contributions to human activities and interests, including aesthetics, recreation, bird and wildlife watching, hiking, and open space.[37]

Regulatory tools, guides and resources

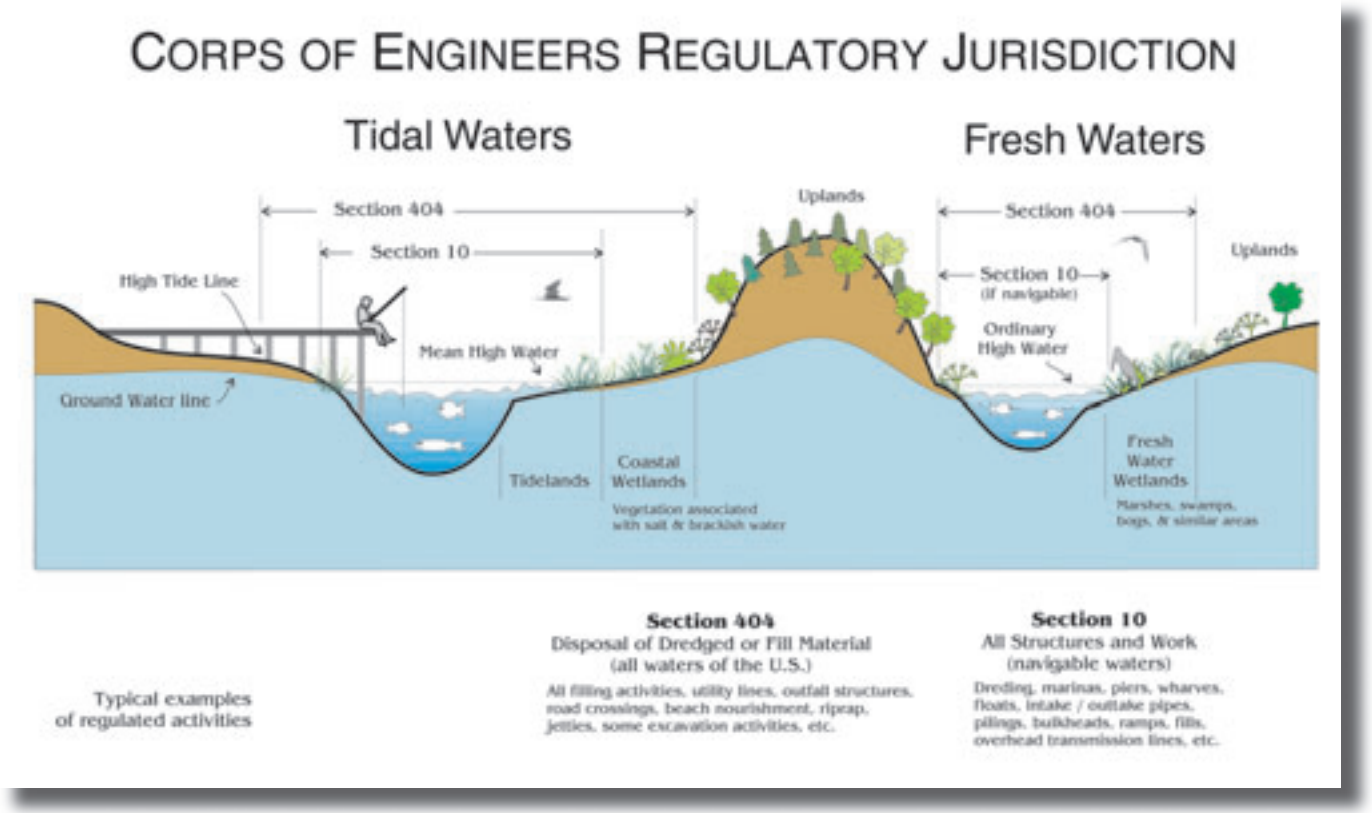
Under certain conditions, mitigation banking could also be used. Mitigation banking was designed to coordinate mitigation at one location for habitat losses allowed under federal programs at other sites. Essentially mitigation banking occurred when a client was required to obtain wetland units with similar functions and values at a nearby site to satisfy federal permit or program requirements. The process began when a bank sponsor created a mitigation bank – any private land where wetlands were saved, restored, or created. Sponsors were corporate, non-profit, or government entities. A bank sponsor then created credits by restoring, enhancing, or creating wetlands at the bank site. These credits were either debited or purchased by clients who were required to compensate for wetland losses. When clients obtained these credits they were withdrawn from the bank, becoming unavailable for future transactions. Mitigation banking differed from the normal wetland permitting process in two significant ways. First, it provided compensation in advance of projects that would adversely impact

wetlands, in theory allowing a simple one-to-one acreage and functional trade in "real time." Second, banks were typically large enough in area to provide this trading service for numerous potential impacts, as opposed to the typical impact-by-impact process associated with regular permitting.[38]

Critics of the practice argued that natural and manmade wetlands were not equal in biological richness. "They may have an emergent wetland that's a wet area with a lot of plants and they want to scoop it out and make it a pond," said Kurkoski. "They like to have ducks come and land on their pond. But it's not the same thing."[39] Michael Bowen, a Corps ecologist, asserted that mitigation banking was not a solution when it merely reduced wetlands to equivalent acres. Even when the equivalent acres of habitat were located near the project site, local animal populations usually failed to populate the new area. "All we will build," Bowen wrote, "are large, wet, 'dead' areas containing fewer species than the original 'protected' wetland." He contended that acreage figures were useful only for justifying projects. From an environmental standpoint they were "largely meaningless."[40] Yet, mitigation banking still offered some hope, even to its critics. If used properly it offered the promise of environmental protection, and in most cases it was preferable to mitigation efforts by the local landowner or developer, which were often ineffective and costly. As EPA's Robert H. Wayland testified before a congressional subcommittee, mitigation banks were "an innovative, market-based way for landowners to effectively and efficiently compensate for unavoidable wetland impacts…. Through mitigation banking, the responsibility for providing mitigation is transferred to an entity that has the financial resources, scientific expertise, and incentives necessary to ensure that the mitigation will be ecologically successful."[41]

One successful example of mitigation banking was found in West Eugene, Oregon. The West Eugene Wetland Mitigation Bank, operated by the City of Eugene, funded and implemented wetland mitigation projects in combination with the *West Eugene Wetlands Plan*. The plan, which was adopted locally in 1992 and formally in 1994, was Oregon's first wetland conservation plan. It established standards for preservation, restoration, and fill of wetlands and described the processes required for implementation. This revolutionary plan relied on a partnership between federal, state, and local agencies, including the Corps, as well as non-profit organizations. In essence, the plan marked the city of Eugene as the first in the United States to receive local authority to issue state wetland permits for developmental proposals. Additionally, the Corps authorized the city to use an abbreviated permit process, or Letter of Permission, that relied on local review of applications to ensure they met the local wetland plan requirements.[42]

The plan also called for the creation of a mitigation bank to help fund restoration and enhancement in conjunction with a program to protect valuable wetlands. Bank sites were located within a connected system



One of the public meetings held by the Corps of Engineers in Eugene, Oregon to discuss the proposed construction of the Hyundai Semiconductor plant.

of existing wetlands managed by the West Eugene Wetland Partnership, of which the Corps was a member. The mitigation bank had three major goals: lead the implementation of plans to restore and enhance wetland communities, provide certified mitigation credits to the development community seeking to develop wetlands located within the bank's service area, and collect fees generated from the sale of mitigation credit. Unlike traditional mitigation, which often resulted in incremental and disconnected wetland pockets, the West Eugene Wetland Bank allowed the protection of a broader ecological community by restoring the functions and values of an entire wetland system. Furthermore, by making the wetland permitting process easier and relieving developers of the responsibilities associated with mitigation, the bank proved to be a tremendous benefit to the development community.[43]

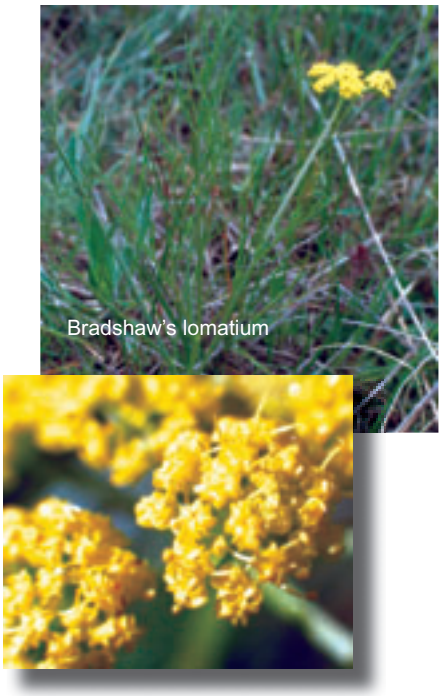
In addition to working as a partner on mitigation banking projects, the District's Regulatory Branch identified additional ways to help restore and enhance wetlands in Oregon. In 1995, for example, the District proposed a new regional permit to authorize most restoration projects. The regional permit avoided unnecessary duplication of regulatory control exercised by the Oregon Division of State Lands (ODSL), which has regulatory authority over waters in Oregon under the state's Fill and Restoration Law. Under the new permit, information about proposed work was supplied to ODSL. Within 15 days, ODSL would determine whether the project qualified for the regional permit and notify the project's proponents and the Corps.[44]

Once a permit was approved, the next task became monitoring and enforcing its requirements. The Corps and the EPA were jointly responsible for this work. While they could take criminal or civil action, the Corps preferred to seek administrative remedies. The agency's basic policy was, "Strive to gain compliance with the least amount of conflict and seek stronger enforcement options only when a violator is willful, flagrant or knowing, or the violation is severe." In FY 94, for example, the Corps resolved permit problems using civil and criminal penalties in only 1.5 percent of the cases. Thus, the Corps settled the vast majority of violations without litigation or penalties, relying instead on voluntary actions by the landowner, such as restoration or mitigation, or issuing after-the-fact permits.[45]

In the District, enforcement was an ongoing component of the regulatory program. Regulatory personnel in the District continually inspected and evaluated permit holders. In 1993, for example, the Regulatory Enforcement Team suspended a 1985 permit of the Coos Bay Water Board because operations were interfering with the salmonid fish passage. That same year, the team also began inspection and evaluation of irrigation pump intakes and effectiveness of fish passage screens. District personnel sent questionnaires to permit holders, requesting information on the type and condition of their fish screens.[46]

Nationwide, the Corps regulatory program annually processed approximately 70,000 permits of all kinds, involving both section 10 and 404 approval. In 1988 the cost of administering this program was $106 million and took roughly 1,100 employees.[47] That year, the Portland District's regulatory program included 17 people and a budget of $1.2 million. Regulatory personnel processed individual permits in 84 days on the average. Furthermore, 86 percent of the permit applications were processed within 60 days.[48]

A single month in the Portland District exemplified the vast number of permits and the broad scope of



the regulatory program's work. In November of 2000, the Corps approved 40 wetland and waterway applications for Oregon. Of those 40 permits, 36 were issued under existing nationwide permits. The agency also issued one individual permit, one general permit, one after-the-fact permit, and approved modifications to an existing project.[49]

The type of projects approved by the District generally included road improvements, bank stabilization efforts, endangered species habitat improvement, commercial and residential developments, and other activities. In April 2000, for example, the District evaluated a permit application from the City of Rainier to construct a new public boating access facility on the Columbia River. The proposed ramp would be built on a former Corps dredge disposal site near the City's River Front Park. Another project in the Rainier area was a permit application to perform annual dredging in the Columbia River near Goble.[50] In Springfield, the agency examined an application to build a high-density housing development, which would negatively impact wetlands in the area. Accordingly, the developer proposed creating an equal amount of wetlands in another portion of the site.[51]

While many of the permits were processed without much debate, occasionally an application would become contentious. In the city of Eugene, for example, plans by Hyundai Electronics to build a large computer memory chip factory sparked heated arguments in the community. The issue centered around the fate of wetlands on the proposed site. In 1995 Hyundai submitted a three-phase plan for constructing a plant and related structures. Phase one of the plan would entail filling approximately 34 acres of wetlands. Phases two and three would require additional wetland conversion. Located on the wetlands were two rare plant species – Bradshaw's lomatium, an endangered plant found only in the Willamette Valley, and Kincaid's lupine.[52]

Opponents of the plan argued that the factory should not be built on wetlands that supported endangered or threatened plant species. "The plant is going to cause a lot of environmental damage," said Anne Olsen, a student at the University of Oregon. "If you really care about our future, that doesn't mean pure jobs."[53] Others expressed concerns about the factory's impact on the community's small-town atmosphere, as well as its potential to discharge toxins and other chemicals into on-site streams flowing directly into some of the Willamette Valley's most valuable wetlands.[54] Meanwhile, supporters of the project cited the plant's economic benefits to the region. Hyundai officials projected that the project would generate 1,000 jobs.[55]

The EPA also weighed in on the project. In a letter sent to the Corps, the agency recommended a study of the plant's environmental impact and questioned whether the developers examined enough alternatives to building the factory in a wetland. Although the Corps had agreed to limit the search for alternative sites to Eugene, the EPA pushed for consideration of a broader geographic area. Diana Brimhall, Chief of Public Affairs, assured the public that the Corps would look at the EPA's letter "very seriously."[56]

In December 1995, the Corps approved the permit, with several modifications. Instead of the 34 acres originally proposed, Hyundai would be allowed to fill 10.4 acres of wetlands. Hyundai also agreed to remove the third development phase from the permit. Because the company reduced the amount of wetlands to be filled and agreed to mitigate against the loss, the Corps did not require Hyundai to complete an EIS. Colonel Tim Wood, Portland District Commander, explained that, "We considered all the comments and looked at the information before drafting the conditions we felt would best protect the resources affected." Environmentalists, however, threatened to file lawsuits in federal court to block the project. "This is our home here," said Tom Pringle, a Eugene wetlands consultant. "We won't spare the horses in defending it. All of the agencies, in my view, have made tremendous procedural errors in approving this."[57]

Protests continued throughout the construction phase of the project, with members of Earth First, an environmental group, attempting to physically block construction workers. "We're willing to put our bodies on the line to stop this project," said one woman. "Over my dead body this plant will get built."[58]

Despite attempts to block the project both on the ground and in the courts, the $1.4 billion plant officially opened in May 1998. The massive structure, which was the single largest private construction project in Lane County history, employed 660 people.[59]

Critics of the project, who were deeply disappointed in not halting the project in its initial stages, vowed to press ahead with appeals that would deny Hyundai the redesignation of wetlands on the site it would need to gain clearance for its third phase, which would necessitate filling more wetlands. "We have no intention of cutting them any slack," said Pringle in 1997. "This thing is a fish out of water and it should never have been allowed."[60]

Supporters of the expansion were equally adamant that the third phase of the project be approved. Many argued that the filling of a portion of the wetlands was worth the estimated 1,200 jobs and $5 billion in capital investments associated with Hyundai's phases two and three. Furthermore, some workers feared that the jobs of the employees at the company's phase one factory were at stake if Hyundai was not allowed to expand. One Hyundai employee wrote that before working for the company he carried his six-year old son, who had diabetes, on an individual health insurance policy, costing him hundreds of dollars a month to cover medical costs. After being hired at Hyundai, he wrote that, "my income doubled, I immediately received insurance and my family was taken care of." Tammy Reynolds, a manufacturing technician, thanked Hyundai for taking care of her and her family "like no other company could." She wrote that, "I plan to make my career here. I plan to retire from Hyundai Semiconductor America. I owe them my loyalty – and so will this community!"[61]

In the fight over the Hyundai plant in Eugene, the Corps found itself in the middle of a debate not just about wetlands, but about larger issues, such as balancing economic development with environmental protection and preserving a community's character. Many critics of the project attacked the Corps for allowing the development to proceed – especially without an EIS. On a broader level, many federal agencies, such as USFWS, NMFS, and EPA, as well as environmental organizations have long felt that the Corps viewed its primary function, in administering the Section 404 program, as protecting the quality of the water. They argued that habitat and other wetland values, although considered in the agency's decisions, were usually of secondary concern. These groups felt that the mandate of the CWA obliged the Corps to protect the integrity of wetlands, including their habitat.[62]

Yet, in deciding whether to approve permits, the Corps found itself in the unenviable position of attempting to balance development pressures with environmental concerns about habitat, endangered species, and clean water. Not all of the Corps projects, however, were so contentious. In fact, over the last several decades, the agency has become increasingly involved in a number of restoration and enhancement projects, including work on wetlands. Ushered in by Section 1135 of the Water Resources Development Act, these environmental improvement projects provided the Corps an opportunity to use its skills and expertise in exciting new ways.

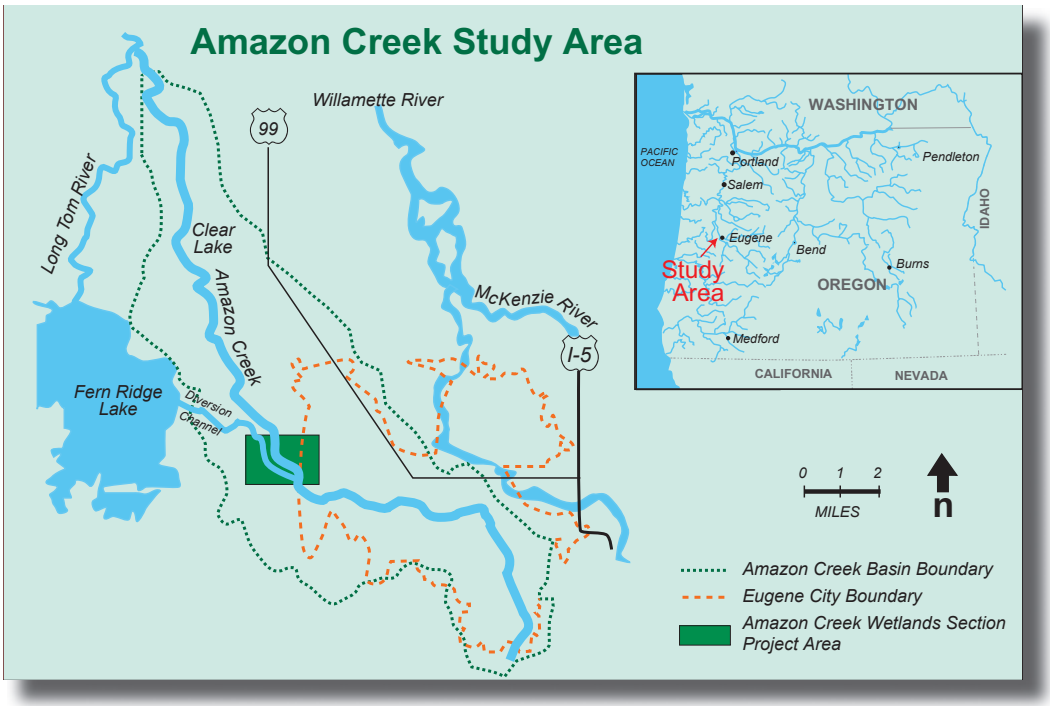
Enhancing Wetlands

While flood control, hydropower, and navigation have long been central components of the Corps' mission, environmental improvements were not part of the agency's work until the 1980s, reflecting a major philosophical shift. Congress gave the Corps authority for environmental restoration through the Water Resources Development Acts of 1986 and 1996, as amended. Section 1135 of the 1986 act enabled the agency to modify existing structures to restore the environment and construct new projects to restore areas degraded by Corps projects. Section 206 of the 1996 act gave the agency the authority to restore aquatic ecosystems. Under these authorities, the Corps oversaw a number of projects to benefit or improve wetlands, fisheries, wildlife habitat, endangered species, and rivers and streams.[63]

Both Section 1135 and Section 206 relied on cost-sharing measures through local sponsorship of projects. Local sponsors included local or state governments, associations, service districts, or, for 1135 projects only, non-profit organizations. These local sponsors had to fund 25 percent of Section 1135 projects and 35 percent of Section 206 projects. In addition, the local sponsor acquired lands, easements, and rights-of-way and paid for "in kind" services. After completion of the project, the local sponsor assumed operation and maintenance responsibilities. In both programs the federal expenditure was limited to $5 million per project.[64]

Environmental restoration projects through Section 1135 and 206 were initiated in response to local interests. Once a local sponsor requested a potential project, the Corps conducted a preliminary study – at the expense of the federal government – to determine if a federal interest existed. If the agency determined a federal interest, and if funds were available, the local office began a feasibility study to define the problem, identify possible solutions, and determine the costs, benefits, and environmental impacts of the alternatives. Following the completion of the feasibility study, the Corps selected a final plan.[65]

Once a plan was chosen, the Corps designed the plans and specifications for the construction phase of the project. Implementing Section 1135 and 206 projects required an entirely different time scale and pace of operations. Unlike traditional large Corps projects, 1135 and 206 activities had a far quicker turn around time and were not required to follow the same elaborate steps to completion. The target time frame from start to completion for these projects was two years.[66] Furthermore, projects with an estimated federal cost of less than $300,000 could be expedited,



Amazon Creek wetlands restoration project was designed also to maintain flood control in the area.

allowing them to be completed in 18 months or less. Both the feasibility study and the construction phase of the projects were covered under the partner cost-share agreement, and construction would not begin until local sponsors met their required contribution amount.[67]

Since the mid-1980s, the Corps has undertaken a variety of Section 1135 projects. One of these, the Amazon Creek Wetlands Project, entered its final phase in 2001. Located just west of Eugene, it was one of the Corps' largest environmental restoration projects outside of the Florida Everglades. The project was part of a larger effort by the City of Eugene to manage the Amazon Creek drainage basin. Oregon's second largest city, Eugene is located in the heart of the Willamette Valley, with access to major highways and rail lines. Businesses and residential developments increased rapidly in the 1970s, causing increased pressure on sensitive wetlands west of Eugene.[68]

With approximately 62 square miles of drainage area, the Amazon Creek Basin is located in the Long Tom River Subbasin of the Willamette River Basin. The waterway originates in the steep, wooded hillsides surrounding Eugene on the east and south sides and flows through residential, commercial, and industrial sections of Eugene and across the Willamette Valley. The 24-mile Amazon Creek eventually joins the Long Tom River near Junction City, Oregon. Before joining the Long Tom River, the creek widens to form Clear Lake, a narrow lake about one mile long. A low ridge from its mouth to a point approximately 12 miles upstream, separates the Amazon from the Long Tom River and Fern Ridge Lake. Fern Ridge Lake is a multi purpose flood control project, constructed by the Corps in 1941.[69]

During the 1950s, the Corps dramatically altered a series of natural streams and wetlands when it constructed the Amazon Canal to provide flood control for local farms and homes. Levees were built on both sides of the creek, and the channel was deepened to prevent overflow. More than five miles of the channel flowing through Eugene were lined with concrete, and an additional two-and-a-half mile channel was created, which

Drainage channels were graded and new culverts were installed to help maintain wetland conditions and natural stream flows.

flowed from Eugene to a diversion structure.[70] While these changes prevented floods, they also cut off water from areas that had previously supported a rich mix of native plants and animals. As these areas began to dry out, wetland flora and fauna disappeared.[71]

As part of the larger effort to restore wetlands to the area, local interests began lobbying the Corps to modify the project under Section 1135. Corps studies showed the creek had good potential for restoration, and a project cooperation agreement was signed with the City of Eugene in 1998. Under the agreement, the City was responsible for 25 percent of the project's $5.32 million cost, with the Corps paying the remainder.[72]

The modification project was designed to restore these wetlands, while maintaining flood control. It consisted of three phases. The first phase, construction, began in the summer of 1999. The Corps removed levees along approximately 10,000 feet of Amazon Canal and several smaller drainage channels, and it graded these channels to mimic a more natural stream configuration. To protect nearby developments from flooding, workers relocated the levees farther away from the channels. They also replaced an existing diversion weir and added other structures. The new weir was slotted and could divert water based on the level of flow. Other weirs and culverts provided greater flexibility to help maintain wetland conditions.[73]

The second phase of the project, which began in the summer of 2000 and continued through 2002, restored wet prairie habitat. Native plants replaced non-native plants and seeds on the 45 acres directly impacted by construction, as well as 96 acres that will be occasionally flooded once the creek returns to its natural pattern. The planting required more than 350,000 native plants and thousands of seeds – a far greater number than in any other prior District project. Biologists and botanists collected these plants and seeds at nearby sites – most within five miles of the project – to maintain the genetic integrity of the plants. The third phase brought recreational facilities to the project and was added under a new Corps cost-sharing agreement, which split costs 50-50 between sponsors. During the summer of 2001, workers began constructing a project overlook and viewing station, parking, restrooms, interpretive displays, and trails linking the project to a regional bike system.[74]

The success of the project was due in large part to the formation of remarkable partnerships. In addition to the City of Eugene and the Corps, other primary partners included the Bureau of Land Management, the Nature Conservancy, Lane Council of Governments, and local Youth Corps agencies. The Natural Resources Conservation Service, USFWS, and Oregon Department of Fish and Wildlife (ODFW) also provided assistance. "A project like this – one that deals with the environment, water quality, science, animals and plants – depends on people at the federal, state, and local level working together," observed Steve Gordon, natural resources program manager at Lane Council of Governments. "At Amazon Creek, everyone has worked hard to avoid turf battles and maintain a positive focus."[75] Matt Rea of the Corps also expressed enthusiasm for the project, stating that the benefits of the project "are great both for the environment and the local population."[76]

The Fern Ridge Marsh project converted a reed canary grass dominated marsh area into a habitat where native emergent plants are the primary vegetative cover. This allows water from the flood control reservoir to follow a more natural cycle.

In addition to Amazon Creek, the District was involved in a number of other Section 1135 projects. On the Long Tom River in the southern Willamette Valley, for example, a Corps project provided improved habitat for ducks, shorebirds, and other wetland species. The District also jointly sponsored the Fisher Butte Waterfowl Impoundments Project with the ODFW, who paid 25 percent of the project's $537,600 cost.[77] In 1993 these agencies had initiated a project to counteract habitat loss in the Willamette Valley. Over the last century, agricultural conversion and urban/industrial development significantly reduced both the quantity and quality of waterfowl habitat in the region. In addition, the Corps' flood control projects almost completely reversed the natural wetland cycle. "We run our reservoirs opposite of the time you would expect to find wetlands," said Rick Hayes, a park ranger at the Fern Ridge Project office. He noted that valley bottomlands were historically drier in the summer and wetter in the winter. District-operated lakes, however, were kept high in the summer and low in the winter for flood control and other purposes. As Hayes explained, by creating wetlands during the winter – the peak time of arrival for migrating waterfowl – the impoundments on the Long Tom River "provide the opportunity to turn that around."[78]

Protecting the Fisher Butte impoundments was a significant step toward counteracting habitat loss in the Willamette Valley. Located along the Pacific Flyway, the impoundments provide critical habitat for migrating waterfowl. Spread across 155 acres of land, the area is an important transition point for waterfowl and acts "like an airline hub" for migrating birds. Wetlands were created by flooding the impoundments with water from Fern Ridge Lake. Water dikes, levees, and ditches, plus a water supply pump and pipeline from the lake to the ponds, made this possible. When the impoundments were completed in 1994, project leaders hoped that ultimately the project would result in up to 2.25 million waterfowl use days.[79]

Section 1135 and 206 projects signaled a substantial change in the Corps' mission and philosophy. While local sponsors also contributed funds toward restoration, these programs were established specifically to accomplish environmental improvements and modifications to Corps projects. The Amazon Creek project, for example, showed just how much the agency evolved in the second half of the 20th century. When the project was originally conceived in the 1950s, flood control was of the utmost importance to both the Corps and the public. Little or no thought was given to rich and complex wetlands that were destroyed by the project. In fact, appreciation of the role of wetlands as both productive habitat and providing clean water is a very recent phenomenon. Today the almost 400 acres of restored wetlands and gently meandering waterway exemplify the nation's incorporation of the environmental values and the Corps' response and adaptation.

Cultural Resources Management

The Portland District's Cultural Resources Management (CRM) represented another non-traditional component of the Corps' work that emerged during the environmental era. In 1966, the National Historic Preservation Act sought to protect, restore, and maintain historical and archaeological resources affected by federal projects. This legislation created a federal-state partnership to identify districts, sites, objects, buildings, and structures significant

North Bonneville excavation site

in American history, archaeology, and culture. It also established the Advisory Council on Historic Preservation, requiring federal agencies that had direct and indirect jurisdiction over proposed federal projects to take into account the effect of those projects on cultural resources eligible for listing in the National Register of Historic Places. Congress provided funding for CRM projects through the Archaeological and Historic Preservation Act of 1974, which granted federal agencies the authority to devote up to one percent of a project's total construction cost to archaeology.[80]

Legislation in 1979 further expanded the federal government's role in evaluating and protecting cultural resources. That year, the Archaeological Resources Protection Act established a permit procedure for investigations of archaeological resources on public lands, prohibiting the removal, sale, receipt, and interstate transportation of these resources obtained without a permit from public or Indian lands. This legislation ensured that individuals and organizations wishing to investigate or excavate and remove archaeological resources from federal lands had the necessary professional qualifications, and that federal guidelines for research and curation were followed. Congress also passed the Native American Graves Protection and Repatriation Act (NAGPRA) in 1990, in response to Native Americans' concern about the loss of human remains and cultural items. This legislation directed federal agencies to inventory their collections of human remains and associated funerary objects and to identify the descendants entitled to claim them.[81]

These new laws drew the Corps into cultural resources management work during the late 20th century. The Portland District began hiring archaeologists during the 1970s, and by the late 1990s, the staff included five of these professionals. Many of the District's proposed hydrological projects included assessments of the archaeological and historical resources affected by water resources development. Two prominent examples are provided below.

Excavating and Documenting the North Bonneville Site

The District's construction of the second powerhouse at Bonneville resulted in significant archaeological finds. The aboriginal village that archaeologists excavated for the project revealed exciting new information for many avenues of scientific research. Furthermore, the large number of artifacts found at the site resulted in the creation of a state-of-the-art curation facility for the North Pacific Division.

When Congress approved the construction of a second powerhouse at Bonneville, the Corps asked the National Park Service (NPS) to conduct surveys to identify any valuable archaeological sites in the affected area. In 1974 archaeologists from the University of Washington, who were working under contract with the NPS, located five sites that they considered archaeologically significant. Four of those sites could be avoided by a change of construction plans, but one site on the Columbia River at North Bonneville would be covered by water. In 1976, University researchers organized an archaeological testing program at the site that was to be flooded. Based on the results of the testing program, the Corps, along with the Advisory Council on Historic Preservation, the Washington State Historic Preservation Officer, and the NPS, agreed to sponsor large-scale archaeological investigations to recover scientific information contained in the site before it was destroyed.[82]

To begin the process of investigation, the Corps hired Environmental Consultants, Inc., from Dallas, Texas, to excavate the site. With a crew of 30 excavators, the contractors worked from December 1977 through May 1979, unearthing more than half-a-million artifacts.[83] More than 600,000 artifacts recovered at the site documented the remains of a major aboriginal village once visited by explorers Lewis and Clark in 1805-1806. Archaeologists categorized the artifacts into groups, including stone, wood, bone, metal, glass, floral and faunal remains, and perishable items (leather, cloth, and wood). They also discovered remnants of two types of Indian homes – pit houses and plank houses. William Clark had described these structures in his journal. "Usually a pit was dug one

Large numbers of artifacts were studied and catalogued, then stored in the curation center at the Administration building of Bonneville Dam until being turned over to the Yakama Nation.

to four feet deep," he wrote in 1805, "the wall planks set vertically to the eves, a small hole left in one end for a door, and an opening in the roof for the smoke to escape – several families occupied one house." Researchers believed that the house pits located at the North Bonneville site were the same ones that the Lewis and Clark Expedition observed in their trip down the Columbia River. "I passed four large houses on the Star side a little above the last rapid and opposite a large Island which is situated near the Lar side," wrote William Clark in October of 1805. "The [inhabitants] of those houses had left them closely shut up. They appeared to contain a great deel of property and Provisions such as those people use… The bottom is high stoney and about two miles wide covered with grass, here is the head of a large Island [Hamilton Island] in high water, at this time no water passes on the Star Side." [84]

The large number of artifacts preserved at the site was unique. "Artifact collectors … were unable to get to the site because in constructing the Bonneville Dam, the area was covered with a great deal of fill and that preserved it until it was excavated for construction of the second powerhouse in the late 1970s," explained Bill Willingham, North Pacific Division historian. "So, the fact that all of these material remains were kept undisturbed is what is significant because most other sites in the Northwest have been pillaged by pot hunters [or] artifact collectors." While occasional looting, erosion from the river, and construction from the original dam did affect the site, the impacts were minimal.[85]

The site at North Bonneville was also special because of its size and location. "The collection at Bonneville is one of the largest ever uncovered in the Northwest," observed Willingham.[86] Typically archaeologists and anthropologists dug up only a section of a site, but at North Bonneville they excavated most of the two-acre site, resulting in an "ideal data bank."[87] Furthermore, being situated on the Columbia River, the site was a major fishing village and a critical link on the Columbia River trade route. "During the fur trading days, the Chinook and the Cascade Indians actually had a toll road there, [they] collected a fee for people passing over their site or around their avenues, and prior to that, they used the area as a major fishing location," explained John Fagan, a Corps archaeologist who supervised the dig.[88]

As the only known undisturbed site on the lower Columbia that contained evidence of occupation from prehistoric to recent historic times, the North Bonneville dig had the potential "to provide broad insights into the cultural uses of the area."[89] Relics from the site dated back 700 years to the prehistoric period and continued through the recent historic past. Scientists focused their excavation efforts on the 17th through 19th centuries, a period when Euroamerican culture began to influence Native Americans in the Northwest. Indeed, the primary importance of the site was that it spanned the period of early cultural contact without interruption, providing an opportunity to study the process of acculturation along the Columbia River. "It's going to give a better understanding," said Richard Pettigrew, an associate researcher at the University of Oregon specializing in anthropology and archaeology. "The record at that time is totally biased because it was written by one side." At this site, however, the contact period was "very well represented."[90]

Before researchers could interpret the artifacts, they needed to go through a process of initial curation. For the North Bonneville site, the Corps contracted with

Elk Creek excavations found pottery and projectile points.

Heritage Research Associates of Eugene, Oregon to prepare the artifacts – a process that took approximately two-and-a-half years and required a number of labor- intensive, delicate tasks.[91] "The whole point of the initial curation process is to get the materials in a position where they can be researched. And this is a very painstaking and time consuming process in which all the materials are … cleaned and stabilized and packaged and described and catalogued. And then [they are] placed in a facility where researchers can go and study them over time," explained Willingham.[92]

Following the initial curation stage, the Corps had to decide where the artifacts would be housed. The agency usually made arrangements with public and private institutions, such as museums and universities, to store relics obtained on Corps sites. In the case of the North Bonneville site, which revealed an enormous quantity of artifacts, the Corps determined that no adequate facilities were available. Furthermore, other districts within the North Pacific Division faced similar problems.[93]

North Bonneville provided the impetus for the Corps to establish a division-wide curation facility dedicated to preserving and maintaining regional resources. Rather than creating a new facility, however, the agency chose to retrofit an existing structure – the Bonneville auditorium. Located on the grounds of the Bonneville Lock and Dam project, this single-story brick structure was built in 1934, and subsequently it was listed on the National Register of Historic Places in 1987 and declared a national landmark. In addition to furnishing a home for artifacts, reusing the auditorium for curation "assured continued life for a significant historic, architectural and visual resource of the Bonneville project."[94]

The Corps dedicated the curation center on April 24, 1989. "We're here to dedicate ourselves to preserving the past," stated Lieutenant Colonel Richard Goodell, Deputy District Engineer, in his opening remarks.[95] Described as a "state-of-the-art" facility, architects converted the auditorium's basement into three secure rooms for general storage and research. High-density mobile storage units with open shelving provided space for the hundreds of thousands of artifacts. To access these artifacts, researchers used a computerized catalog that divided the collection by major material categories and then into subcategories by artifact type for each excavation unit. The innovative use of space at the auditorium resulted in several awards, including the Chief of Engineers Environmental Design Award (1989) and the 1991 Government Workplace Benchmark Honoree Award. The Portland District operated the center, and Bonneville park rangers experienced in collection care and management oversaw the site's daily operational needs.[96]

The artifacts, however, did not remain in the curation center. In the 1990s, the Corps turned them over to the Yakama Nation in south central Washington, as a result of a cooperative agreement between the District and the Nation. The agreement called for the Yakamas to curate the artifacts, with the Corps continuing to pay for any general management costs. The Yakama Nation continued to allow researchers to access the artifacts for their work. According to Michael Martin, a community planner in the Environmental Resources Branch, the arrangement was a natural fit because the Yakama Nation had the staff and facilities that met National Park Service standards and the Bonneville Lock and Dam project was located on lands ceded by the Yakama.[97] Through its mitigation work for the second powerhouse, the Corps revealed an exciting glimpse into the material culture of these groups.

Examining Cultural Resources at Elk Creek Lake

When the Portland District began moving ahead with construction plans for a dam at Elk Creek in the 1970s, it initiated a series of field investigations of cultural resources in the project area. Although the Corps did not complete Elk Creek Dam [See Chapter One], in the planning process it evaluated a number of historical sites in the region. The project area is located in southwestern Oregon, approximately one mile above the confluence of the Rogue River and Elk Creek, extending five miles to the mouth of Flat Creek.

The NPS conducted the initial investigations of cultural resources in the Elk Creek project area. In 1979 and 1982 the Corps contracted with the Department of Anthropology at

Oregon State University (OSU) to obtain a more thorough appraisal. The objective of the second phase of this investigation, which occurred in 1982, was to acquire sufficient data to determine eligibility for the National Register of Historic Places and to recommend site management options for the significant archaeological sites. To accomplish this work, researchers from OSU designed a testing program to determine horizontal and vertical site parameters, site content (function and antiquity), and contextual integrity.[98]

After completing the 1979 and 1982 field investigations, researchers determined that 13 of the 23 sites they examined were significant. Because the 13 sites were situated in close proximity to one another and were all temporally and/or functionally interrelated, scientists recommended that the Corps nominate the entire area as a district to the National Register. The sites at the Elk Creek Lake project area spanned the last 7,000-8,000 years and presented a picture of human adaptive strategies in the lower eight miles of Elk Creek drainage. Taken together, the 13 sites were well integrated and provided the basic data for a working chronology.[99]

Researchers also identified changes in the cultural patterns through artifacts on the sites. One of the major changes in the Elk Creek drainage was the introduction of new projectile point forms and pottery around 500 B.P (before present). Archaeologists and anthropologists believed that changes in projectile point styles may have implied changes in the weapon system and hunting strategies and/or changes in trade networks.[100] Thus the archaeological work at Elk Creek revealed interesting findings about early settlement patterns and documented the material remains of early human inhabitants of southern Oregon.

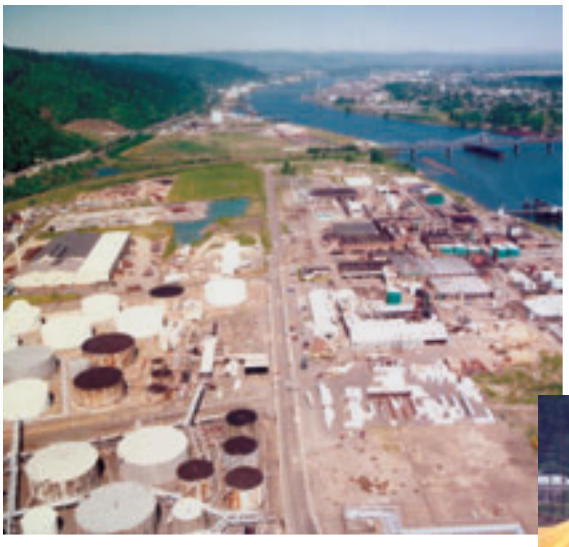
HTRW work through Support for Others program

Addressing Hazardous, Toxic, and Radioactive Waste

No one could have predicted 50 years ago that the Corps would have an entire program dedicated to the removal and treatment of hazardous and contaminated materials. Historically, the nation gave little thought to the disposal of waste or industrial discharges. These products were often dumped into landfills or directly into waterways with few regulations. As understanding of the impacts these materials had on human health and the environment grew, the public pushed for legislation to control future disposals and address contaminated sites, resulting in the passage in 1980 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

Congress intended CERCLA, which was administered by the EPA, to deliver comprehensive coverage, encompassing both prevention of and response to uncontrolled hazardous substance releases. This legislation provided the necessary authority and a funding mechanism for reacting to both emergency situations and to chronic hazardous materials releases. CERCLA identified two types of responses – removal actions and remedial actions. Removal actions stabilized or cleaned up a hazardous site that posed an immediate threat to human health or the environment; remedial actions provided permanent remedies. In many cases, removal actions did not eliminate the need for remedial actions because, while immediate protection was furnished, chronic problems were ignored.[101]

Determining appropriate funding sources was a major challenge associated with this program. As part of the 1980 legislation, Congress established the Hazardous Substances Response Trust Fund, or Superfund, to finance its emergency response and remedial activities and recover costs. The fund itself totaled $1.6 billion, of which 87.5 percent came from a tax on the chemical and petroleum industries. General federal revenues generated the remaining 12.5 percent. The EPA was allowed to use these funds to cover its own costs or the costs involved with



The Gould, Inc. site on the Willamette River in northwest Portland.

work it ordered in response to an immediate threat. The fund, however, was intended to be rotating; the idea was to recover cleanup costs from the responsible parties. In 1986, Congress increased the Superfund to $8.5 billion as part of the Superfund Amendments and Reauthorization Act (SARA). While the petroleum and chemical industries continued to finance the bulk of this fund, corporate income taxes also contributed a significant amount. The remainder of the fund came from general federal revenues, interest, and recovery of cleanup costs.[102]

Additional important features of CERCLA included the following: it established prohibitions and requirements concerning closed and abandoned hazardous waste sites; it provided for liability of persons responsible for releases of hazardous waste at these sites; and it allowed the National Contingency Plan (NCP), which provided guidelines and procedures for responding to releases of contaminants, to be revised. The NCP also established the National Priorities List (NPL). The NPL was a system whereby the EPA could prioritize among sites potentially needing remediation. To create the list, the EPA had a Hazard Ranking System (HRS) that evaluated sites on the basis of relative risk to human health and the environment. In the process the EPA determined four scores based upon potential exposure via the four major exposure routes: surface water, groundwater, air, and soil contamination. The agency placed sites scoring above a certain level on the NPL. The EPA could only take remedial action for sites listed on the NPL, but the act did not require the agency to pursue sites on the list in any particular order. Thus the EPA's site selection process was as much a political debate as a technical one.[103]

Once a site was listed on the NPL, the EPA generally followed several subsequent steps. First, the agency conducted a Remedial Investigation/Feasibility Study (RI/FS) to determine the nature and extent of contamination. Then came a Record of Decision, explaining the various cleanup alternatives to be used at the site. Next, the agency prepared and implemented plans and specifications for applying site remedies through a Remedial Design/Remedial Action (RD/RA). The following step was construction completion and identifying completed cleanup activities. Operation and Maintenance personnel then conducted investigations to ensure that all actions were effective and properly operating. In the final step, the EPA deleted the site from the NPL.[104]

Today CERCLA forms the legislative backbone of the Corps' Hazardous, Toxic, and Radioactive Waste (HTRW) program. The Corps initially developed the HTRW program to support the EPA's work; later the program's mission expanded. In the 1980s, when the Corps began the program, the District's role in dealing with hazardous waste at its own facilities "was pretty low," according to Michael Gross, Portland District environmental engineer. Over the next several decades, the Corps instituted several measures to increase awareness of hazardous and toxic waste issues. In the early 1990s, for example, the agency began an environmental compliance program and developed a review guide to evaluate Corps projects. The agency also established environmental compliance coordinator positions to help the Corps "get into compliance and identify the problem."[105]

The HTRW program recognized that there was a limited amount of expertise in the field of hazardous waste. Accordingly, the Corps designated centers of expertise throughout the nation for HTRW work. In the North Pacific Division, the agency established the Seattle District as the regional center. The Portland District, therefore, often turned to Seattle District for assistance on some of its larger projects. The Corps also relied heavily on contractors to investigate a site and clean it up.[106]

Since 1985, when the Corps began working on the EPA Superfund sites, the District's HTRW program has been involved in a variety of projects. The District, for example, helped the EPA with remediation at three Superfund sites in Oregon, including the Gould, Inc. site in northwest Portland. Covering ten acres, this area housed a secondary lead smelter and lead oxide production facility from the 1940s

Location map of the Hamilton Island site for hazardous waste removal.

through the 1980s. Workers at these facilities disposed of smelter waste and battery casings on the site, and they also discharged acid to a lake remnant adjacent to the property. To clean up the property, hazardous waste experts processed batteries that had been tossed into landfills and created stabilized blocks of hazardous material. The District's role in the project was to provide on-site technical services and monitor compliance with requirements stated in approved workplans.[107]

The District's work on contaminated sites that were not owned by the Corps was accomplished through the Corps' Support for Others (SFO) program. Through the SFO program the Corps assisted federal agencies by providing them with engineering and related services. The SFO program was divided between environmental work and facilities/infrastructure work. The Corps' goal with the program was to "apply our capabilities to assist federal agencies in the execution of their missions and not to take away missions from those agencies." The Corps recognized that its engineering and technical knowledge could aid many agencies that lacked such expertise. The agencies that the Corps supported still provided full funding for the effort and retained control and legal responsibility for their program. In return for offering support, the Corps was able "to maintain and enhance its capabilities."[108]

In addition to its work with the EPA, the Corps assisted other agencies through its HTRW program. The District assisted the Farmers Home Administration, for example, in the cleanup of contaminated properties that the agency acquired through foreclosures and bankruptcies in the early 1990s. Specifically, the Corps worked on preliminary assessments and site investigations, remedial designs and remedial actions, and other environmental restoration services. In FY 1994, for example, the District completed remedial design and actions on seven properties.[109]

The Corps also performed HTRW work through its Defense Environmental Restoration Project – Formerly Used Defense Sites (DERP-FUDS) program. This program was designed to reduce the risks to human health, public safety, and the environment from contamination resulting from past sites that were owned, leased, or used by the Department of Defense. By 2000, the FUDS program had more than 9,800 properties in its national inventory. These properties included privately-owned farms, National Parks, residential areas, schools, airports, and industrial sites.[110] The Portland District was responsible for site assessment

Soil samples were taken over a two-year period from Hamilton Island and tested for contaminants.

and clean up of FUDS in Oregon until the mid 1990s, when the assessments were completed. From approximately 1986 to 1994, the District evaluated many former defense sites, including Fort Stevens, Camp Adair, and Tongue Point. In the process, Corps engineers identified problems and either cleaned them up themselves or forwarded them to the Seattle District. Once the District finished all of the site investigations, it forwarded its findings to the Seattle District to complete.[111]

The District's HTRW work eventually expanded to include remediation at its own sites. In particular, Hamilton Island and Bradford Island, located at Bonneville Lock and Dam, and the U.S. Government Moorings site on the Willamette River required the Corps' attention. The EPA eventually delisted Hamilton Island from the NPL in 1995, but work at Bradford Island and the U.S. Government Moorings continued into the 21st century. At all of these sites, Corps employees faced a number of technical and political challenges in their clean-up efforts.

Evaluating Contamination at Hamilton Island

Hamilton Island, which measures 240 acres, is located on the Columbia River, approximately 40 miles east of Portland. During the construction phase of the Bonneville second powerhouse, workers used the island, as well as a river slough separating the island and the Washington shore, to dispose of soil and rock that had been excavated for the powerhouse. Between the years of 1976 and 1981, the Corps' contractors deposited 19 million cubic yards of material on the site. In addition, they buried debris from the old town of North Bonneville and excess material from construction operations.[112]

Once the Corps completed the construction of the second powerhouse, the site was managed as part of an overall plan to maximize use of Corps land for wildlife. Specifically, the agency used it to fulfill a portion of the mitigation requirements for wildlife habitat that had been destroyed as a result of the second powerhouse construction. Hamilton Island also provided access for fishing and was a popular recreation spot.[113]

Concern at Hamilton Island first surfaced in 1986, when Bonneville project personnel discovered oily water in small pools on the site. Of special interest was one 12-acre parcel, referred to as the "knoll," where workers placed debris from the last stages of excavation. In December 1986, District personnel took a water sample from the area and subsequent test results identified some metals and organics in runoff from the site. As a precautionary measure, the Corps erected a fence around 20 percent of the island in September 1987. The fence was intended to prevent anyone from entering the knoll area and the lands immediately surrounding it until further studies were completed.[114]

Drilling for soil samples and testing water samples

In many ways Hamilton Island "became a catalyst" for the Corps' hazardous waste program. It was, in fact, the first civil works project in the nation to become a Superfund site. When personnel discovered the oily water, the only Corps staff experienced in dealing with hazardous waste were located in the construction branch. The situation at Hamilton Island prompted the District to develop expertise in environmental engineering and to establish a committee to deal with hazardous waste issues. Out of this effort came a compliance review guide to assist Corps personnel in this emerging area of work.[115]

As the story of Hamilton Island spread, local residents and users of the site had a variety of reactions to the news of possible contamination. One fisherman, for example, did not appear concerned. "I don't feel threatened," he explained. He added that if he saw "a bunch of guys around in hygienic suits and masks and gloves," he would then "worry about it." In contrast, many residents of the town of North Bonneville, which was adjacent to the site, were quite worried. One woman said that she had "seen tires sticking up in the landfill before they were covered and houses built on top of them, and the children play on the berms."[116]

The potential impact on fish and wildlife was a major concern shared by both federal and state agencies and the public. In 1987 William Renfroe, an environmental engineer with the Corps, observed that while "The human impacts are pretty low … impacts on wildlife might be quite high."[117] Following the installation of the fence on the island, a member of the public wrote in an opinion piece that, "Canada geese, robins and other birds are not likely to be stopped by a fence. Nor are rabbits. Yet just two or three feet from the fence, coyote scat with feathers and fur was found last week. The food chain respects no boundaries."[118]

Others questioned how the situation could have occurred in the first place. Reporter Eric Olson observed that many had asked, "How could contractors dump toxic waste on the Columbia River, right under Uncle Sam's nose, if that's what happened, and get away with it?" Renfroe responded by explaining that, "The Corps' activities were focused on the actual construction of the dam, the powerhouse itself…." He added that once contractors load the material and indicate that they are going to transport it to the waste site, that is typically the extent of Corps inspectors' involvement.[119]

The Corps conducted tests and other investigations on the site. The agency completed sampling and drilling in 1988 and 1989. A total of 54 surface and subsurface soil samples and 51 water samples were taken in this two-year period. During these investigations, workers found miscellaneous metal objects, low concentrations of a heavy oil, low-grade concentrations of some heavy metals, and organic solvents scattered throughout the site. They also identified a small amount (3,000 cubic yards) of oil-stained soil in the knoll area. By February 1990, the Corps completed a site investigation report, sending it to the EPA.[120]

Based on the guidelines for analysis of potentially hazardous sites, Corps personnel didn't feel that Hamilton Island would be nominated for inclusion on the NPL. Using revised scoring methods, however, the EPA reviewed the site investigation report and calculated a score of 51.92 for the site. At that time, a site needed a hazard score of 28.5 to qualify for the NPL. On July 29, 1991, the EPA nominated the site for listing on the NPL. The agency's primary concerns behind the proposed listing were environmental in nature. In particular, the EPA noted that the site was intended as mitigation for lost wildlife habitat.

Colonel Wood speaking at the ceremony to reopen Hamilton Island to the public

Bald eagles and peregrine falcons resided in the area. Runoff from Hamilton Island drained directly into the Columbia River, and, as noted, the site was a favored fishing area.[121]

Following a public comment period, the EPA placed Hamilton Island on the NPL in October 1992. The Washington Department of Ecology also placed the island on the state's Hazardous Sites List. As a result, on July 26, 1993, the Corps began field investigations as the first of several studies required by the Superfund process. The field testing initiated the RI/FS, which was accomplished through a contract with Woodward-Clyde Consultants of Seattle. The purpose of this study was to learn the nature and extent of contamination, find potential risks to human health and the environment, and develop cleanup alternatives.[122]

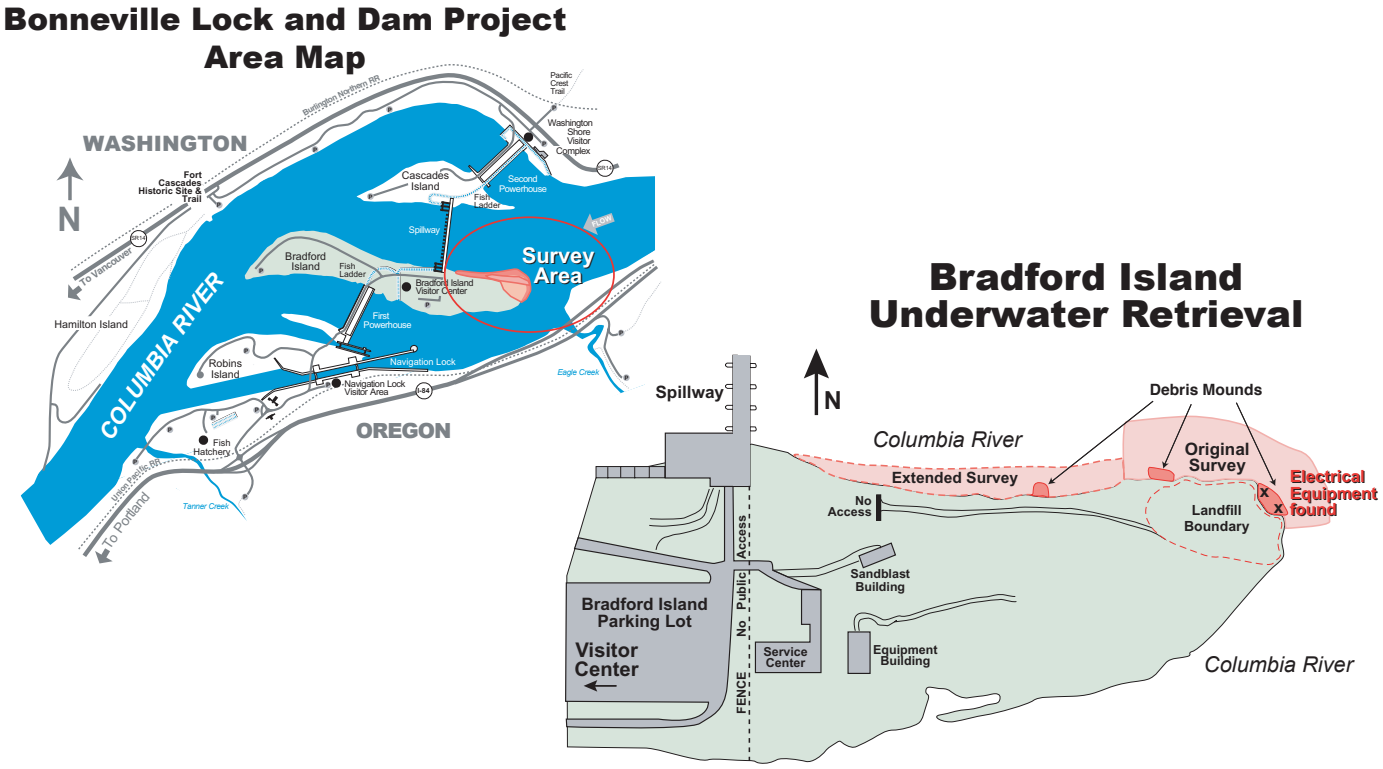
By January 1994, the Corps completed the initial phase of soil, sediment, and water sampling. Environmental engineers took approximately 170 soil samples from soil borings, test pits, and trenches on the island. They also gathered 50 water samples from on-site monitoring wells, off-site wells, and seeps. The results of lab analyses on these samples found no contaminants exceeding screening levels in the surface water. The only contaminant found above screening levels in groundwater was manganese. Manganese was found in wells throughout the area, however, and was probably related to local geologic conditions, not to human activities at Hamilton. Furthermore, no volatile or semi-volatile compounds, Polychlorinated Biphenyls (PCBs), or pesticides were discovered above screening levels in soils or sediments. Nor did the lab results identify any metals that exceeded natural background levels in the soils or sediments. Field crews found petroleum hydrocarbons in samples at two locations in the knoll area that were above Washington state screening levels. This was the only substance of concern, and, after further investigations, the Corps and the state decided that it was not pervasive enough to merit any remediation work.[123]

On October 18, 1994, the Corps released the final results of a year-long study of the site, which focused on areas of contamination and routes of exposure. Woodward-Clyde's report found no threat to human health or the environment. Typically a remedial investigation was followed by a feasibility study. Because no contamination exceeded levels considered by the regulating agencies to be hazardous to people or the environment, no feasibility study was required.

In February 1995, the Washington Department of Ecology delisted Hamilton Island from the state's Hazardous Sites List and the Corps expected delisting from the federal NPL to occur by the summer. While normally it took an average of 11 years to go through the federal Superfund process – from the date listed to the date investigations were completed – Hamilton Island was concluded in just two years. The Corps, EPA, and Ecology attributed the speedy resolution to agency cooperation. "We each made a commitment to concentrate on big picture issues to avoid jurisdictional disputes that sometimes occur," commented Chris Cora, EPA project manager. Norm Tolonen, Corps District project manager, observed that each agency worked to simplify regulatory standards that sometimes conflicted. "It worked," he said. "We were offered choices, rather than hard and fast rulings. That let us respond effectively and fulfill requirements with very few conflicts – it let us keep moving instead of stalling out."[124]

Two months after Ecology delisted the site, the Corps, EPA, and Ecology all concluded that no cleanup was necessary at Hamilton Island, and they developed a proposed plan for the site that recommended No Action. Public comments supported their No Action approach. Based on their own findings and public support, these three agencies drafted a final plan for Hamilton Island (also called a Record of Decision), reiterating the No Action recommendation. Following the signing of the Record of Decision, the EPA published a "Notice of Intent to Delete," for delisting the site from the NPL. After a 30-day comment period, where no comments were received, the agency officially removed Hamilton Island from the NPL on May 25, 1995 – just three years after listing.[125]

On June 15, 1995, the District reopened Hamilton Island to the public. Personnel from Ecology, EPA, and the Corps were joined by elected officials and residents of the town of North Bonneville at the ceremony. The site removal was



particularly poignant for those people who lived in North Bonneville. "The stigma of a Superfund site next door to your city is gone," Colonel Wood said at the ceremony. "Tentative plans are to use the area primarily as wildlife habitat, and it will be open for the public to use and enjoy." In his remarks Colonel Wood also stressed his appreciation for the cooperation on the part of federal and state agencies and the townspeople. "What we've achieved could be used as a case study for future issues of Vice President Al Gore's National Performance Review. It fits his goals of government efficiency, cooperation, and good practices. It is an example of what government bodies and private citizens can accomplish when they work as partners."[126]

Cleaning up Bradford Island

Like Hamilton Island, Bradford Island is located on the Columbia River adjacent to Bonneville Lock and Dam. In the 1930s, when the dam was being constructed, a small community of single-family homes was built on the project to house Corps' personnel and their families. In the 1950s, apartments were added to accommodate the growing number of people working on the project. These units were occupied until the 1970s, when they were removed. From 1942 to 1982, Corps employees used a landfill site on Bradford Island to dispose of household garbage and some project waste materials, such as oil and grease, paint, solvents, scrap metals, mercury vapor lamps, pesticide residues, sand blast grit, and electrical components, including switchgear, cables, light ballasts, and possibly insulators. The total size of the landfill was approximately one-half acre and was located on a forested section of the island, which was managed for wildlife habitat. The area was not open to the public.[127]

Since the late 1980s, as hazardous waste disposal and compliance requirements were implemented on a national basis, the District became involved in a Corps-wide effort to bring all projects into compliance using a comprehensive self-evaluation program management system called ERGO (Environmental Review Guide for Operations). ERGO required a team of Corps personnel or a contractor to assess potential hazardous problems at each district project every five years. Bonneville's first ERGO audit was in 1992. At that time, the Bradford Island landfill was a minor finding, due to a lack of information about contaminated items at the site. Between 1992-1995, all 31 items identified for corrective action in the 1992 audit were completed. But as the years passed and new information became available, concern about the landfill grew.[128]

In June 1996, the Corps notified the Oregon Department of Environmental Quality (DEQ) and the EPA about its intent to begin an investigation and potential remediation of the site. Before work could begin, the Corps needed to clarify requirements and obtain funds. In February 1997, the Corps and DEQ signed a voluntary cleanup agreement that put the site into the DEQ's Voluntary Cleanup Program (VCP). The VCP was a program designed to forge cooperative relationships between DEQ and the responsible landowner or operator, in this case the Corps. It allowed DEQ

Landfill site and contaminated material brought up by divers

to dedicate staff to researching a particular site and recommending the most responsible and cost-effective remediation alternatives.[129]

Upon signing the voluntary cleanup agreement, scientists conducted a series of studies beginning in mid-1997. These phased studies found the landfill contained hazardous materials and that some nearby areas in the Columbia River were contaminated. An initial site investigation included soil and groundwater testing. It was also supposed to include sediment testing in the Columbia River, but the rocky river bottom prevented contractors from obtaining samples. In the groundwater, analysts detected Volatile Organic Compounds (VOCs), which are substances that contain carbon and evaporate at room temperature; they also found petroleum, metals, PCBs, and pesticides in soil samples. The second phase of investigations included the following work: taking samples of surface soil and groundwater, conducting a survey to find any areas where groundwater was seeping to the surface, creating a systemic grid survey of the landfill to locate water pockets, evaluating the stability of the slope below the landfill and its potential for erosion, and making hydrosurveys of the river floor to identify any materials below the water level in areas adjacent to the landfill.[130]

One of the primary concerns during these investigations was the extent of contamination in the river. In March of 2000, two ballasts from old streetlamps were recovered from the riverbank adjacent to the landfill. Both contained PCBs up to 537 parts per million (ppm). Regulations required electrical equipment with PCBs over 50 ppm to be disposed of in an approved facility in accordance with the Toxic Substance Control Act. Accordingly, the ballasts were tested and sent to ChemWaste in Arlington, Oregon. The Corps continued to investigate the potential contamination of the river, and over the next year divers identified various power transmission system components. They were able to retrieve some of the equipment (two capacitators, lightning arresters, ballasts, relays, and miscellaneous porcelain and metal pieces), and these objects were tested for asbestos and PCBs. While scientists did not find any asbestos, two of the samples had PCB amounts above 50 ppm. One of those, an oily material from a damaged capacitor, had a PCB level of 200,000 ppm.[131] Diving continued through May 2001, and the Corps expected a report, including final analyses of sediment and tissue samples plus debris mound mapping and quantifying work, by July of 2001.[132]

In addition to its river research, the District also continued its work on the landfill. In the summer of 2001, the Corps and its contractors identified priorities and set schedules for the landfill investigations. The work was expected to include the following:

- slope stabilization


U.S. Government Moorings.

- a seismic survey to determine the depth to bedrock and flow paths within the landfill
- investigation of a gully and potential removal of mercury vapor lamps reported at that site
- installation of new monitoring wells
- groundwater sampling at the new and old wells
- a water budget analysis to determine how much water is unaccounted for given rainfall levels, evaporation, and uptake from plants and trees
- a "hot-spot" analysis
- a final report
- a groundwater beneficial use analysis, including land and water considerations
- an update to the Environmental Risk/Human Risk Assessment.

The District expected a final evaluation report by spring 2002. When the investigation is completed, the Corps, along with the DEQ and EPA, will decide if remedial actions are needed. Possible alternatives include: total removal of materials in the river and/or the landfill, a cap on the landfill and/or some type of cap in the river, or no action.[133]

The Corps faced several challenges in its work to address the problems at the Bradford Island landfill. While some of these were unique to the site, several applied to the HTRW program in general. First, this type of work was expensive. The federal government operated on a two-year budget cycle, resulting in a lag period with funding requests, and a problem had to be clearly identified before money could be requested. Second, many of these sites had overlapping jurisdictions and involved a number of agencies, each of which had different priorities. The Bradford Island site, for example, was located on Corps land, but included the Columbia River – a migratory pathway for endangered species. Therefore, in addition to the Corps and the DEQ, the USFWS and NMFS were consulted. According to Mark Dasso, program manager for the site, "The plan which the Corps and DEQ devised to remove the components from the river has caused concern for NMFS and USFWS, who are worried that sediments would be flushed downriver. Right now, I'm not sure how we're going to work that out."[134]

Another difficulty concerned the dissemination of information for the public. In the case of Bradford Island, there was a lot of inaccurate or incomplete information that circulated about the historic landfill. With this project, the District struggled to explain to the public "that the Corps is doing the right thing." To aid communication, Dasso held monthly meetings with the District's senior leaders, and the public affairs office sent out news releases and responded to media inquiries on a regular basis. Public Affairs also created a web site to provide information to the public.[135]

The landfill at Bradford Island illustrates the nation's changing attitudes toward the disposal of waste. In the 1930s, little thought was given to the practice of dumping materials of all kinds directly into a landfill. As awareness of the dangers of hazardous materials increased, particularly after World War II, the American public grew concerned about the impacts of dumping contaminated substances and the effects on human health and the environment. The Corps acknowledged that, "we as a culture made a lot of mistakes in our past. The Bradford Island Landfill is one of those long-ago mistakes."[136]

Determining the Future of U.S. Government Moorings

Unlike Bradford and Hamilton islands, where hazardous waste was relatively contained, the Corps-operated U.S. Government Moorings facility was linked to a more pervasive contamination problem along the lower Willamette River – one that involved numerous potentially responsible parties. Due to hazardous sediments, the Corps had been unable to dredge at the site since 1981, and the EPA's designation of a six-mile stretch of the Willamette as a Superfund site in 2000 halted the agency's dredging work on that portion of the river. Accordingly, the Corps proposed to deepen and restore the river through a program of environmental dredging, which was allowed under Section 312 of the Water Resources Development Act of 1990 and was typically done for environmental restoration, not navigational purposes. The issue, however, remained unsettled in the early years of the 21st century. The struggle to determine a solution was due, in part,

The *Essayons* and *Yaquina* dredges docked at the Moorings

to the number of interested parties, each of whom held their own goals and values in regards to the future of the river.

Situated six miles northeast of downtown Portland and encompassing approximately 13 acres, U.S. Government Moorings is located on the Willamette River. The Corps began constructing the site after acquiring the first parcel of land in 1903. By 1904, the District operated the site as a facility to provide port, supply, and repairs for its dredges, hydrosurvey vessels, and other support ships. The site also housed warehousing facilities for the agency. To repair and maintain the vessels, District personnel historically engaged in a variety of activities, including sandblasting, paint removal, oil and petroleum usage, painting, overhaul of equipment, steam cleaning, welding and cutting, stockpiling, and storage of fittings, dredge equipment, and other materials. In 1986 the Corps turned over a portion of the facility to the District's Logistics Management Office, who used it primarily as a warehouse and storage space. By the 1990s, the Corps had terminated several of these activities at the site, such as fueling the dredges, sandblasting, and vehicle maintenance.[137]

In 1989, the agency contracted with Battelle-Northwest from Sequim, Washington to conduct sediment analysis in preparation for lowering the berth depth of the *Essayons*, a hopper dredge moored at the site. Chemical and physical tests revealed that heavy metals, pesticides, and Polyaromatic Hydrocarbon (PAH) exceeded the District's levels of concern. Corps and EPA criteria characterized the mean lead concentrations as heavy pollution. EPA guidelines classified the levels of chromium, copper, mercury and nickel at the site as moderately polluting. Scientists also found elevated levels of the pesticides DDD, DDT, and dieldren. In a preliminary report discussing the results of the analyses, the Corps concluded that sediment dredged from the U.S. Government Moorings should not be placed in unconfined in-water sites.[138]

Following the sediment analysis, Geotechnical Resources, Inc. conducted a preliminary site assessment at U.S. Government Moorings for the Corps. The purpose of the study was to evaluate, on a preliminary basis, whether contamination due to hazardous substances was present at the project area and to determine whether additional investigations were appropriate. The consulting firm based its assessment on a visual examination of the site and a review of available information, files, and documented past uses of the site. The company concluded that the most likely sources that contributed to contamination of the U.S. Government Moorings site came from activities in the Doane Lake area, adjacent to and upstream from the site.[139]

Doane Lake is an area of roughly 360 acres that once consisted of marshes and shallow lakes. Since the early 1900s, it gradually filled in with a variety of industries, and by the 1990s only small remnants of Doane Lake existed. Past industrial activities at the site included oil gasification, wood treatment, recovery of lead from batteries, and the manufacturing of pesticides. In the late 20th century, the site housed the manufacturing of herbicides, chlor-alkali operations, production of acetylene gas, recycling of construction debris, silicon chip manufacturing, and storage and distribution of liquefied natural gas, petroleum products, and creosote. Multiple studies of the area documented extensive soil and groundwater contamination.[140]

Geotechnical Resources, Inc. attributed the Corps' 1989 findings of metals, pesticides, and PAH to the agrochemical industry in the Doane Lake area. Specifically, they believed that the PAH compounds probably came from the old gasification work. The metals were most likely due to a combination of industrial activities in the Doane Lake area and the flaking and scaling of bottom paint on the dredges and other craft anchored at U.S. Government Moorings. Perhaps further contributing to contamination at the Corps site was the old General Construction Company yard, located west of the property.[141]

In 1992 and 1993, InterMountain West, Inc. performed another round of investigations for the District at the U.S. Government Moorings facility. The company completed soil surveys, and site characterizations, which focused on past facility waste management activities, and found three discrete areas of concern. Workers at the site had sandblasted

machinery and equipment parts at two areas within the site, resulting in piled accumulations of chrome and lead contaminated spent sand blast residue. At a third spot, District personnel stored leaking oil-filled equipment, causing limited shallow surface contamination.[142]

To address those areas that had been contaminated with sand blast grit the District contracted with InterMountain West, Inc. in August of 1993 to excavate and clean up portions of the site. In the process workers removed 400 tons of soil containing low concentrations of metals, which they transported and disposed of at the Columbia Ridge Landfill near Arlington, Oregon. Most of the metal deposits resulted from the removal of paint on metal surfaces and were not classified as hazardous, according to Jeff Hepler, the District's environmental compliance coordinator. The District worried, however, that they could become a health risk to nearby workers if inhaled over an extended period. Following the cleanup, the Corps cleared these areas for normal use.[143]

During the same year as the soil clean up, the EPA required the Corps to conduct a preliminary assessment report on the U.S. Government Moorings site. The EPA's authority for requesting the report came from CERCLA, as amended by SARA. The purpose of the report was to describe any potentially hazardous waste spills or releases that occurred at the site, document waste handling and disposal, provide information on current practices, and record known site conditions. The information in the report provided the EPA with data to use in the HRS, which ranked the site relative to other sites. In the preliminary assessment, the Corps evaluated the risk of exposure to contaminants at U.S. Government Moorings through four pathways – surface water, groundwater, air, and soil. The agency concluded that exposure through these four pathways was low.[144]

Meanwhile District personnel continued to struggle with an ongoing challenge at U.S. Government Moorings. "The biggest problem we have with the Moorings right now is we have too many sediments," said Michael Gross in 2001. Underneath the Mooring's dock, sediment regularly accumulated, requiring dredging. Without dredging there was not enough depth for the large dredges, such as the *Yaquina* and the *Essayons*, which the Corps housed at the facility. Yet the District had not dredged the area since 1981. Despite several attempts to dredge since then, elevated contaminant levels – especially PAHs – prevented any such efforts.[145]

The situation at the U.S. Government Moorings became more complicated when the EPA declared an entire stretch of the Willamette River a Superfund site in 2000. As a result of this designation, U.S. Government Moorings was no longer an isolated site, but was part of a much larger area of contamination – one that involved many government agencies and potentially responsible parties. Inevitably the process was "going to be protracted because of all the responsible parties out there," explained Gross. "It's a large, complicated project." In fact, by 2001 the EPA had identified 90 responsible parties, and Gross expected them to name several hundred by the time the agency completed its research.[146]

A view of the contaminated Doane Lake area upstream of the Moorings

The navigation channel of the Port of Portland supports a thriving shipping trade for grain, minerals, and manufactured products.

The process of listing a portion of the river as a Superfund site began in 1997, when the DEQ requested that the EPA sample sediments in the Portland Harbor. The EPA found elevated levels of pesticides, PCBs, and heavy metals throughout the harbor area.[147] Based on the results of this investigation, this agency made an initial determination that Portland Harbor might qualify for listing on the NPL. Despite requests by the state that the site be deferred from listing and cleaned up under state authority, the EPA continued to pursue NPL listing, and by December of 2000, the agency finalized the Superfund listing. The area included in the Superfund site was a six-mile stretch of the Willamette River, between Sauvie Island and Swan Island. This area encompassed 17 active cleanup sites and 74 industrial sites, including U.S. Government Moorings.[148]

The stretch of the lower Willamette designated as a Superfund site was environmentally and economically important to the region. The lower Willamette was a popular recreational fishing area for spring chinook, steelhead, coho, shad, and white sturgeon. All of these fish, plus the Pacific lamprey, depended on the lower Willamette for spawning grounds.[149] Furthermore, within the lower Willamette River basin there were several species of fish listed under the ESA, with several more proposed for listing. Chinook, chum, steelhead, bull trout, and Oregon chub were all either threatened or endangered; the NMFS was also considering listing coastal cutthroat trout and coho salmon.[150]

In addition to serving as crucial habitat for these fish species, the Willamette River backed a thriving shipping trade. As part of the federal navigation channel, the Willamette River supported the transport of grain, minerals, and manufactured products through Portland Harbor. In 1996, for example, Portland Harbor's marine facilities produced a total of more than 7,000 jobs and $723 million in business revenue.[151]

The problem was that to ensure the continued existence of the shipping business, the Corps needed to maintain the federal navigation channel through dredging. Since the late 1980s, the Corps had pushed to deepen the channel from 40 to 43 feet to accommodate modern, larger ships [See Chapter Two]. The contaminated sediments in the lower Willamette and the resulting Superfund listing, however, prevented maintenance dredging in the river. To address this dilemma, the Corps prepared a reconnaissance study of the Willamette River in December of 2000 that proposed a program of environmental dredging.

Corps policy prohibited the agency from using civil works funds in a site being remediated under CERCLA authority. Under this policy, continued channel maintenance, potential deepening, or dredging for maintenance at the U.S. Government Moorings would not be done until cleanup of the harbor was completed. Without a policy change, exception or waiver, adjustment or hold harmless agreement with agencies and responsible parties, Corps activity would be limited to issues where the agency was a responsible party.

Because of this probable impasse, the Corps looked to a separate policy that existed for environmental dredging projects. Under Section 312 of the Water Resources Development Act of 1990, the Corps was able to perform environmental dredging in conjunction with a CERCLA cleanup under the following conditions: the polluter paid for allocable contamination, the Corps was shielded from liability for its actions, and the project was coordinated with the EPA cleanup. This policy existed for environmental dredging, but it could be extended to maintenance dredging if the agency addressed coordination and liability issues.[152]

As long as the Corps met the conditions listed above, Section 312 provided a means for the District to continue its dredging work in the Willamette River. Essentially, the agency sought to combine its environmental restoration and

dredging work. Recognizing the potential of Section 312, the District drafted a proposal for environmental dredging. This proposal was the first one in the Corps to attempt attaching the civil works authority to another agency's authority – the EPA.[153] The Corps' broad goals were to coordinate the cleanup and environmental dredging work with the navigation maintenance dredging, allowing continued use of the navigation channel and restoring the lower Willamette aquatic ecosystem.[154]

In the process of preparing the reconnaissance study, the District considered several options related to sediment remediation, including taking no action, monitoring natural attenuation, capping sediments in place, and dredging sediments. The agency also discussed alternatives for managing dredged sediments, such as confined aquatic disposal, near-shore confined disposal, and upland confined disposal. After considering these various options, the Corps selected as its preferred alternative a program where all sediments requiring remediation would be dredged and placed in a single confined aquatic disposal facility. Ideally the disposal site would be located in the Willamette River to reduce transport costs.[155]

The Corps' plan to combine the environmental restoration and dredging program elicited a variety of responses. Some environmentalists worried that in its quest to dredge the river, the agency might overlook other types of restoration plans, such as capping the river bottom with a fresh layer of sediments, which they believed might be less risky for endangered fish. "As an agency on a whole, they are not known for environmental protection," said Nina Bell, a lawyer for Northwest Environmental Advocates. "They are proponents of dredging … and putting alleged economic interests over environmental concerns." Others pointed out that the Corps' presence as a potentially responsible party and cleanup partner raised conflict-of-interest questions that DEQ officials "really haven't even investigated." Opponents of the channel-deepening project specifically questioned whether the Corps would pursue polluters aggressively because the agency itself was responsible for a portion of the contaminants in the harbor.[156]

Some also questioned the EPA's interest in handling the Portland Harbor. While the 1980 Superfund law levied taxes on oil and chemical companies to pay for cleanups where responsibility could not be assigned, taxing authority expired in 1995, resulting in a dwindling fund. Facing serious budget concerns, the EPA had to decide whether to undertake a new project that might spawn numerous lawsuits and take decades to complete. Officials at the EPA's regional office in Seattle said they would scrupulously follow the Superfund law. Yet one employee added that the agency welcomed the chance to work with the Corps and its cleanup resources. "I look at it more from getting the right people together to work on a really difficult and complex problem," noted Sally Thomas, Portland Harbor project manager for the EPA. "The Corps has a lot of expertise to offer."[157]

The District recognized the challenge it faced in combining environmental restoration and maintenance dredging on the lower Willamette. "For me, getting that little stretch of …Willamette River… resolved and maintaining it without concerns for future liability is my biggest challenge," explained Gross. While it took "a lot of coordination" and could "be a headache at times," it was also "real interesting to try to resolve everybody's interest and make a project that works."[158]

Cleaning up hazardous waste represents a new direction for the Corps, and this work will continue into the 21st century. By 2001, more than 1,200 sites had made the EPA's National Priorities List.[159] Of these 1,200 sites, a number were located in Oregon and involved the Portland District. As an agency comprised largely of engineers and scientists, the Corps was ideally suited to addressing hazardous waste issues, and the HTRW program utilized the Corps' technical expertise in a variety of challenging situations.

Conclusion

By the late 20th century, environmental concerns touched nearly all aspects of the Corps' work. Whether issuing permits for wetland development, documenting cultural resources, or cleaning up hazardous waste, the District had to conform to a wide range of environmental laws and policies, such as NEPA, FWPCA, and ESA. Furthermore, the agency had to balance the region's diverse interests. Developers, environmentalists, Indian tribes, and local citizens – all wanted their voices to be heard. While it was not always possible to satisfy everyone's needs, the District's scientific and engineering expertise made it capable of carrying out its mission in an increasingly complex arena.

Endnotes

[1] V.L. Parrington characterized the late 19th century as the Great Barbecue for its excessive rate of resource consumption. See Stephen J. Pyne, *America's Fires: Management on Wildlands and Forests* (Durham, North Carolina: Forest History Society, 1997), p. 4. See also William G. Robbins, *Lumberjacks and Legislators: Political Economy of the U.S. Lumber Industry, 1890-1941* (College Station: Texas A&M Press, 1982), p. 16.

[2] Samuel P. Hays, *Conservation and the Gospel of Efficiency: The Progressive Conservation Movement, 1890-1920* (Cambridge: Harvard University Press, 1959); John F. Reiger, *American Sportsmen and the Origin of Conservation*, third edition (Corvallis: Oregon State University Press, 2001).

[3] Joseph M. Petulla, *American Environmental History: The Exploitation and Conservation of Natural Resources* (San Francisco: Boyd & Fraser Publishing Company, 1977).

[4] Lieutenant General J.W. Morris, "The Corps of Engineers and the American Environment: Past, Present, and Future," Federal Records Center, Pacific Alaska Region, RG 77, Installation History Files, # 77980005, Box 45.

[5] Thomas M. Clement, Jr., Glenn Lopez, and Pamela T. Mountain, "Engineering a Victory for Our Environment: A Citizens' Guide to the U.S. Army Corps of Engineers," Washington, D.C., Institute for the Study of Health and Society, 1971.

[6] Rachel Carson, *Silent Spring* (Boston: Houghton Mifflin Co. [1987] 1962).

[7] Petulla, *American Environmental History: The Exploitation and Conservation of Natural Resources.*

[8] Lieutenant General J.W. Morris, "The Corps of Engineers and the American Environment: Past, Present, and Future," Federal Records Center, Pacific Alaska Region, RG 77, Installation History Files, # 77980005, Box 45.

[9] Petulla, *American Environmental History: The Exploitation and Conservation of Natural Resources*.

[10] Lisa Mighetto, *Wild Animals and American Environmental Ethics* (Tucson: University of Arizona Press, 1991).

[11] Jeffrey K. Stine, "Environmental Politics and Water Resources Development: The Case of the Army Corps of Engineers During the 1970s," Ph.D. Dissertation, University of California, Santa Barbara, 1984, p. 2.

[12] Jeanne Nienaber Clarke and Daniel C. McCool, *Staking Out the Terrain: Power and Performance Among Natural Resource Agencies* (Albany: State University of New York Press, 1996), pp. 17-68.

[13] Becky Hanson, Interview with Lisa Mighetto, Portland, Oregon, May 8, 2001.

[14] Thomas M. Clement, Jr., Glenn Lopez, and Pamela T. Mountain, "Engineering a Victory for Our Environment: A Citizens' Guide to the U.S. Army Corps of Engineers," Washington, D.C., Institute for the Study of Health and Society, 1971, Section 3.

[15] Davis Moriuchi, Interview with Lisa Mighetto, June 15, 2001, Portland, Oregon. Hereafter cited as Moriuchi Interview.

[16] Alan B. Nichols, "Corps of Engineers Charts New Course," *Water Environment & Technology*, January 1991, p. 44.

[17] Nichols, "Corps of Engineers Charts New Course," p. 46.

[18] Moriuchi Interview.

[19] Moriuchi Interview.

[20] Moriuchi Interview.

[21] Willingham, William F. and John Carroll, "Protecting the Nation's Waters: A History of the US Army Corps of Engineers Regulatory Responsibilities, 1899-1999," pp. 91-92, 128-129, 155, 180. Unpublished manuscript, U.S. Army Corps of Engineers, Office of History, Washington, D.C.

[22] Willingham, William F. and John Carroll, "Protecting the Nation's Waters: A History of the US Army Corps of Engineers Regulatory Responsibilities, 1899-1999," pp. 91-92, 128-129, 155, 180. Unpublished manuscript, U.S. Army Corps of Engineers, Office of History, Washington, D.C.

[23] Albert E. Cowdry, "Pioneering Environmental Law: The Army Corps of Engineers and the Refuse Act," *Pacific Historical Review* 46 (August 1975).

[24] Wetlands: Their Use and Regulation (Washington, D.C.: U.S. Congress, Office of Technology Assessment, OTA-0-206, March 1984), p. 72.

[25] U.S. Army Corps of Engineers, Regulatory Branch, *Section 404 of the Clean Water Act and Wetlands: Special Statistical Report*, July 1995, p. 3.

[26] "Federal Water Pollution Control Act" as cited in Environmental Statutes (Rockville, Maryland: Government Institutes, 2000), p. 643.

Endnotes

[27] Jeffrey K. Stine, "Regulating Wetlands in the 1970s: U.S. Army Corps of Engineers and the Environmental Organizations," *Journal of Forest History* 27 (April 1983); Wetlands: Their Use and Regulation (Washington, D.C.: U.S. Congress, Office of Technology Assessment, OTA-0-206, March 1984), p. 70.

[28] Wetlands: Their Use and Regulation (Washington, D.C.: U.S. Congress, Office of Technology Assessment, OTA-0-206, March 1984), pp. 70-71.

[29] Wetlands: Their Use and Regulation (Washington, D.C.: U.S. Congress, Office of Technology Assessment, OTA-0-206, March 1984), p. 71.

[30] Wetlands: Their Use and Regulation (Washington, D.C.: U.S. Congress, Office of Technology Assessment, OTA-0-206, March 1984), p. 71.

[31] U.S. Army Corps of Engineers, Regulatory Branch, *Section 404 of the Clean Water Act and Wetlands: Special Statistical Report*, July 1995, p. 4.

[32] Wetlands: Their Use and Regulation (Washington, D.C.: U.S. Congress, Office of Technology Assessment, OTA-0-206, March 1984), p. 70.

[33] Senate Subcommittee on Clean Air, Wetlands, Private Property and Nuclear Safety of the Committee on Environment and Public Works, *Wetlands: Review of Regulatory Changes*, 105th Cong., 1st sess., 1997, pp. 58-59.

[34] U.S. Army Corps of Engineers, Portland District, "Corps issues 40 permits in November for Oregon projects," News Release, December 6, 2000, Portland District, Public Affairs Office, Folder: 1145 General COE Regulatory, permits 2000; U.S. Army Corps of Engineers, Regulatory Branch, *Section 404 of the Clean Water Act and Wetlands: Special Statistical Report*, July 1995, p. 4.

[35] U.S. Army Corps of Engineers, Regulatory Branch, *Section 404 of the Clean Water Act and Wetlands: Special Statistical Report*, July 1995, p. 4.

[36] U.S. Army Corps of Engineers, Regulatory Branch, *Section 404 of the Clean Water Act and Wetlands: Special Statistical Report*, July 1995, p. 11.

[37] Jerry Rhodes, "Wetlands mitigation," July 1995, Corps'pondent, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 20150409, Box 1: Binders and Books.

[38] Jeffrey Zinn, Wetland Mitigation Banking: Status and Prospects, September 12, 1997, Congressional Research Service, Report for Congress, accessed at http://www.cnie.org/nle/wet-8.html, on August 1, 2001; NC State University Water Quality Group, accessed at http://h20sparc.wq.ncsu.edu/info/wetlands/mitbank.html, on August 1, 2001.

[39] Jerry Rhodes, "Wetlands mitigation," July 1995, Corps'pondent, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 20150409, Box 1: Binders and Books.

[40] Michael Bowen, "What's Wrong with Mitigation Banks?" *The Military Engineer*, NO. 573, October/November 1995, p. 20.

[41] Senate Subcommittee on Clean Air, Wetlands, Private Property and Nuclear Safety of the Committee on Environment and Public Works, *Wetlands: Review of Regulatory Changes*, 105th Congress, 1st Session, 1997, p. 55.

[42] City of Eugene, "West Eugene Wetlands Mitigation Bank," accessed at http://www.ci.eugene.or.us/wewetlands/mitigation.htm, on August 27, 2002; U.S. Army Corps of Engineers, *Annual Historical Report*, 1994, p. 3, Portland District, Public Affairs Office, 870-5a, Organizational Histories, 1990-1999.

[43] City of Eugene, "West Eugene Wetlands Mitigation Bank," accessed at http://www.ci.eugene.or.us/wewetlands/mitigation.htm, on August 27, 2002.

[44] U.S. Army Corps of Engineers, *Annual Historical Report*, 1995, p. A-1, Portland District, Public Affairs Office, 870-5a, Organizational Histories, 1990-1999.

[45] U.S. Army Corps of Engineers, Regulatory Branch, *Section 404 of the Clean Water Act and Wetlands: Special Statistical Report*, July 1995, pp. 2, 13.

[46] U.S. Army Corps of Engineers, *Annual Historical Report*, 1993, p. 11, Portland District, Public Affairs Office, 870-5a, Organizational Histories, 1990-1999.

[47] U.S. Army Corps of Engineers, Regulatory Branch, *Section 404 of the Clean Water Act and Wetlands: Special Statistical Report*, July 1995; Information Paper: Civil Works Program Statistics, January 8, 1998, Civil Works/General, Reading Files, Office of History Archives.

[48] U.S. Army Corps of Engineers, *Annual Historical Report*, 1988, p. 5, Portland District, Public Affairs Office, 870-5a, Organizational Histories, 1990-1999.

Endnotes

[49] U.S. Army Corps of Engineers, Portland District, "Corps issues 40 permits in November for Oregon projects," News Release, December 6, 2000, Portland District, Public Affairs Office, Folder: 1145 General COE Regulatory, permits 2000.

[50] "Corps Seeks Comments on Rainier Boat Ramp Project," April 20, 2000, *The Clatskanie Chief*, Portland District, Public Affairs Office, Folder: 1145 General COE Regulatory, permits 2000.

[51] "Army Corps seeking input on development," May 15, 2000, *Eugene Register-Guard*, Portland District, Public Affairs Office, Folder: 1145 General COE Regulatory, permits 2000.

[52] Richard Read, "Hyundai & Eugene: A Clash of Cultures," November 19, 1995, *The Oregonian*, p. G01; "Agency Rules Eugene Plant Will Not Harm Endangered Plant," December 5, 1995, *The Oregonian*, p. B01.

[53] Read, "Hyundai & Eugene: A Clash of Cultures," p. G01.

[54] Dana Tims, "Hyundai Faces Wetlands Hurdle," March 28, 1997, *The Oregonian*, p. D01.

[55] Dana Tims, "Hyundai's Site Preference Had Eugene Gulping," May 25, 1995, *The Oregonian*, p. B02.

[56] Kathleen Monje, "EPA Worries May Delay Hyundai Plant in Eugene," August 23, 1995, *The Oregonian*, p. B01.

[57] "Corps Gives Green Light to Hyundai," December 21, 1995, *The Oregonian*, p. D01.

[58] "Hyundai Pushes on With Plant at Eugene," December 22, 1995, *The Oregonian*, p. E01

[59] Tims, "Hyundai Faces Wetlands Hurdle," p. D01; Janet Filips, "Hyundai Opens Controversial $1.4 Billion Semiconductor Plant," May 9, 1998, *The Oregonian*, p. D06.

[60] Tims, "Hyundai Faces Wetlands Hurdle," p. D01.

[61] Sherri Buri McDonald, "Hyundai boosters back," May 23, 2000, *The Eugene Register-Guard*, Portland District, Public Affairs Office, Folder: 1145 General COE Regulatory, permits 2000.

[62] Wetlands: Their Use and Regulation (Washington, D.C.: U.S. Congress, Office of Technology Assessment, OTA-0-206, March 1984), pp. 69-70.

[63] Matt Rabe, "Army Corps of Engineers: Stewards of the environment," October 8, 1998, News Release, U.S. Army Corps of Engineers, Portland District; Carrie Fox and Heidi Y. Helwig, "Corps strengthens commitment to environmental stewardship," May 1995, *Corps'pondent*, U.S. Army Corps of Engineers, Portland District.

[64] Matt Rabe, "Army Corps of Engineers: Stewards of the environment," October 8, 1998, News Release, U.S. Army Corps of Engineers, Portland District.

[65] Matt Rabe, "Army Corps of Engineers: Stewards of the environment," October 8, 1998, News Release, U.S. Army Corps of Engineers, Portland District.

[66] Carrie Fox and Heidi Y. Helwig, "Corps strengthens commitment to environmental stewardship," May 1995, *Corps'pondent*, U.S. Army Corps of Engineers, Portland District.

[67] Matt Rabe, "Army Corps of Engineers: Stewards of the environment," October 8, 1998, News Release, U.S. Army Corps of Engineers, Portland District.

[68] Chris Moore, "Corps wetlands project nears completion," March 6, 2001, News Release, U.S. Army Corps of Engineers, Portland District.

[69] U.S. Army Corps of Engineers, Portland District, "Corps to study Amazon Creek wetlands," October 28, 1992, News Release.

[70] U.S. Army Corps of Engineers, Portland District, "Corps to study Amazon Creek wetlands," October 28, 1992, News Release.

[71] Chris Moore, "Corps wetlands project nears completion," March 6, 2001, News Release, U.S. Army Corps of Engineers, Portland District.

[72] Chris Moore, "Corps wetlands project nears completion," March 6, 2001, News Release, U.S. Army Corps of Engineers, Portland District.

[73] Chris Moore, "Corps wetlands project nears completion," March 6, 2001, News Release, U.S. Army Corps of Engineers, Portland District.

[74] Chris Moore, "Corps wetlands project nears completion," March 6, 2001, News Release, U.S. Army Corps of Engineers, Portland District.

[75] Chris Moore, "Corps wetlands project nears completion," March 6, 2001, News Release, U.S. Army Corps of Engineers, Portland District.

[76] Lance Robertson, "Amazon to wander like creek, again," October 31, 1998, p. 1B, *Eugene Register-Guard*.

Endnotes

[77] "Corps projects reshape Amazon Creek, Fern Ridge wetlands," December 1999, *Oregon Wetlands*.

[78] Heidi Y. Helwig, "Wintering waterfowl find relief," April 1994, Corps'pondent, U.S. Army Corps of Engineers, Portland District; U.S. Army Corps of Engineers, Portland District, "Corps joins effort to build duck ponds," September 1993, *Corps'pondent*.

[79] Heidi Y. Helwig, "Wintering waterfowl find relief," April 1994, *Corps'pondent*, U.S. Army Corps of Engineers, Portland District.

[80] National Park Service, Cultural Resources Programs, *Federal Historic Preservation Laws*, Washington, D.C., 1993.

[81] National Park Service, Cultural Resources Programs, *Federal Historic Preservation Laws*, Washington, D.C., 1993.

[82] U.S. Army Corps of Engineers, "North Pacific Division Curation Facility," no date, Portland District, Public Affairs Office, 870-5b, Bonneville Dam, Archeological; U.S. Army Corps of Engineers, Portland District, "An Overview of Investigations at 45SA11: Archaeology in the Columbia River Gorge," February 1986, Oregon History Center; U.S. Army Corps of Engineers, Portland District, "Archeological Discoveries at Bonneville," April 21, 1983, News Release, National Archives Pacific Alaska Region, RG 77, Accession 77-91-0043, Box 2, Folder: Dedications – Bonneville Second Powerhouse.

[83] U.S. Army Corps of Engineers, Portland District, "Archeological Excavation at North Bonneville, Washington," August 2, 1978, News Release, Portland District, Public Affairs Office, 870-5b, Bonneville Dam, Archeological.

[84] Clare Perry, "Making a Case for History," circa early 1990s, *Nor'wester*, Portland District Technical Library; U.S. Army Corps of Engineers, Portland District, "Archeological Discoveries at Bonneville," April 21, 1983, News Release, National Archives Pacific Alaska Region, RG 77, Accession 77-91-0043, Box 2, Folder: Dedications – Bonneville Second Powerhouse.

[85] "Village of Time, Part I," March 2, 1987, KXL Radio, 8:18 A.M., Portland District, Public Affairs Office, 870-5b, Bonneville Dam, Archeological; Andrew MacLeod, "Artifacts may yield clues to Indians' decline," July 13, 1983, *Mail Tribune*, National Archives Pacific Alaska Region, RG 77, Accession 77-90-0020, Box 1, Folder: Bonneville Lock and Dam.

[86] U.S. Army Corps of Engineers, Portland District, "Ancient Cultures – Our Heritage," May-June 1989, *Corps'pondent*, Portland District, Public Affairs Office, 870-5b, Bonneville Dam, Archeological.

[87] MacLeod, "Artifacts may yield clues to Indians' decline."

[88] "Village of Time, Part II," March 3, 1987, KXL Radio, 8:18 P.M., Portland District, Public Affairs Office, 870-5b, Bonneville Dam, Archeological.

[89] U.S. Army Corps of Engineers, Portland District, "Archeological Discoveries at Bonneville," April 21, 1983, News Release, National Archives Pacific Alaska Region, RG 77, Accession 77-91-0043, Box 2, Folder: Dedications – Bonneville Second Powerhouse; U.S. Army Corps of Engineers, Portland District, "Ancient Cultures – Our Heritage," May-June 1989, *Corps'pondent*, Portland District, Public Affairs Office, 870-5b, Bonneville Dam, Archeological.

[90] U.S. Army Corps of Engineers, Portland District, "Archeological Excavation at North Bonneville, Washington," August 2, 1978, News Release, Portland District, Public Affairs Office, 870-5b, Bonneville Dam, Archeological; MacLeod, "Artifacts may yield clues to Indians' decline."

[91] U.S. Army Corps of Engineers, "North Pacific Division Curation Facility," no date, Portland District, Public Affairs Office, 870-5b, Bonneville Dam, Archeological.

[92] "Village of Time, Part V," March 6, 1987, KXL Radio, 12:51 P.M., Portland District, Public Affairs Office, 870-5b, Bonneville Dam, Archeological.

[93] U.S. Army Corps of Engineers, "North Pacific Division Curation Facility," no date, Portland District, Public Affairs Office, 870-5b, Bonneville Dam, Archeological; Clare Perry, "Making a Case for History," circa early 1990s, *Nor'wester*, Portland District Technical Library; U.S. Army Corps of Engineers, Portland District, "Ancient Cultures – Our Heritage," May-June 1989, *Corps'pondent*, Portland District, Public Affairs Office, 870-5b, Bonneville Dam, Archeological.

[94] Clare Perry, "Making a Case for History," circa early 1990s, *Nor'wester*, Portland District Technical Library.

[95] "Curation center dedicated April 24," April 26, 1989, Portland District, Public Affairs Office, 870-5b, Bonneville Dam, Archeological.

[96] Clare Perry, "Making a Case for History," circa early 1990s, *Nor'wester*, Portland District Technical Library.

Endnotes

[97] Personal communication with Bert Rader, Portland District Cultural Resource Team Leader, September 28, 2001; Michael Martin, Interview with Jill Schnaiberg, Portland, Oregon, January 17, 2002.

[98] David Brauner and Clayton Lebow, *A Reevaluation of Cultural Resources Within the Proposed Elk Creek Lake Project Area, Jackson County, Oregon, Phase II: Site Evaluation*, 1983, Department of Anthropology, Oregon State University, Portland District Technical Library, pp. 1-4.

[99] David Brauner and Clayton Lebow, *A Reevaluation of Cultural Resources Within the Proposed Elk Creek Lake Project Area, Jackson County, Oregon, Phase II: Site Evaluation*, 1983, Department of Anthropology, Oregon State University, Portland District Technical Library, pp. 1-2, 172.

[100] David Brauner and Clayton Lebow, *A Reevaluation of Cultural Resources Within the Proposed Elk Creek Lake Project Area, Jackson County, Oregon, Phase II: Site Evaluation*, 1983, Department of Anthropology, Oregon State University, Portland District Technical Library, p. 177.

[101] Nancy K. Kubasek and Gary S. Silverman, *Environmental Law* (Upper Saddle River, New Jersey: Prentice Hall, 2000), p. 255.

[102] Kubasek and Silverman, *Environmental Law*, pp. 255-256.

[103] Kubasek and Silverman, *Environmental Law*, pp. 257-258; U.S. Environmental Protection Agency, accessed at http://www.epa.gov/superfund/action/law/cercla.htm, on August 1, 2001.

[104] U.S. Environmental Protection Agency, accessed at http://www.epa.gov/superfund/action/process/sfproces.htm, on August 1, 2001.

[105] Michael Gross, Interview with Lisa Mighetto and Jill Schnaiberg, Portland, Oregon, August 15, 2001. Hereafter cited as Gross Interview.

[106] Gross Interview.

[107] Gross Interview; U.S. Army Corps of Engineers, Portland District, "FY 1995 SFO Annual Report," October 25, 1994, Portland District, Public Affairs Office, 360 – General Army Information Correspondent Files, Support for Others; "NPL Site Narrative: Gould, Inc.," September 8, 1983, accessed at http://www.epa.gov/superfund/sites/npl/nar986.htm, on August 1, 2001.

[108] U.S. Department of the Army, Corps of Engineers, "Support for Others Program, Annual Report, 1995," April 1995, Portland District, Public Affairs Office, 360 – General Army Information Correspondent Files, Support for Others.

[109] U.S. Army Corps of Engineers, Portland District, "FY 1995 SFO Annual Report," October 25, 1994, Portland District, Public Affairs Office, 360 – General Army Information Correspondent Files, Support for Others.

[110] U.S. Army Corps of Engineers, "Formerly Used Defense Sites Program Realigns to Improve Property Cleanup," August 7, 2000, News Release, Portland District, Public Affairs Office, 360 – General Army Information Correspondent Files, Formally Used Defense Sites (FUDS).

[111] Gross Interview.

[112] U.S. Army Corps of Engineers, Portland District, "Hamilton Island Possible Superfund Cleanup Site," July 25, 1991, Portland District, Public Affairs Office, 870-5b, Bonneville Dam, Hamilton Island; U.S. Army Corps of Engineers, Portland District, "Hamilton Island, North Bonneville, Washington," Information Paper, August 13, 1991.

[113] U.S. Army Corps of Engineers, Portland District, "Hamilton Island Possible Superfund Cleanup Site," July 25, 1991, Portland District, Public Affairs Office, 870-5b, Bonneville Dam, Hamilton Island.

[114] U.S. Army Corps of Engineers, Portland District, "Hamilton Island Possible Superfund Cleanup Site," July 25, 1991, Portland District, Public Affairs Office, 870-5b, Bonneville Dam, Hamilton Island.

[115] Gross Interview.

[116] "Dumpsite Polluting Water," KATU TV CH 2, April 7, 1987, 5:14 P.M., provided by Moba Media Inc., Portland District, Public Affairs Office, 870-5b, Bonneville Dam, Hamilton Island.

[117] Sverre Bakke, "Bonneville contamination cleanup could take years," April 16, 1987, *The Enterprise*, Portland District, Public Affairs Office, 870-5b, Bonneville Dam, Hamilton Island.

[118] "Two years later: studies of Hamilton ooze still proceed," March 23, 1988, *The Skamania County Pioneer*, Portland District, Public Affairs Office, 870-5b, Bonneville Dam, Hamilton Island.

[119] "Columbia Project Haunts Corps," KOIN TV CH 6, April 7, 1987, 5:27 P.M., provided by Moba Media Inc., Portland District, Public Affairs Office, 870-5b, Bonneville Dam, Hamilton Island.

Endnotes

[120] U.S. Army Corps of Engineers, Portland District, "Hamilton Island, North Bonneville, Washington," Information Paper, August 13, 1991.

[121] U.S. Army Corps of Engineers, Portland District, "Hamilton Island, North Bonneville, Washington," Information Paper, August 13, 1991.

[122] U.S. Army Corps of Engineers, Portland District, "Testing to Begin on Hamilton Island Superfund Site," July 23, 1993, News Release, Portland District, Public Affairs Office, 870-5b, Bonneville Dam, Hamilton Island; U.S. Army Corps of Engineers, Portland District, "Superfund Investigation Begins on Hamilton Island," September 3, 1993, News Release, Portland District, Public Affairs Office, 870-5b, Bonneville Dam, Hamilton Island; U.S. Army Corps of Engineers, Portland District, "Hamilton Island, North Bonneville, Washington," February 1994, Information Paper, Portland District, Public Affairs Office, 870-5b, Bonneville Dam, Hamilton Island.

[123] U.S. Army Corps of Engineers, Portland District, "Hamilton Island, North Bonneville, Washington," February 1994, Information Paper, Portland District, Public Affairs Office, 870-5b, Bonneville Dam, Hamilton Island; U.S. Army Corps of Engineers, Portland District, "Hamilton Island, North Bonneville, Washington," April 1994, Information Paper, Portland District, Public Affairs Office, 870-5b, Bonneville Dam, Hamilton Island; Proceedings from Public Meeting on the Proposed Plan for the Hamilton Island Superfund Site, November 29, 1994, p. 23, North Bonneville City Hall, Portland District, Public Affairs Office, 870-5b, Bonneville Dam, Hamilton Island.

[124] Washington State Department of Ecology, "Ecology Delists Superfund Site from State Hazardous Sites List," March 14, 1995, Portland District, Public Affairs Office, 870-5b, Bonneville Dam, Hamilton Island.

[125] U.S. Army Corps of Engineers, Portland District, "Hamilton Island Superfund Site, North Bonneville, Washington," April 1995, Information Paper, Portland District, Public Affairs Office, 870-5b, Bonneville Dam, Hamilton Island; EPA Superfund Fact Sheet "Hamilton Island Superfund Site, North Bonneville, Washington," May 31, 1995, Portland District, Public Affairs Office, 870-5b, Bonneville Dam, Hamilton Island.

[126] U.S. Army Corps of Engineers, Portland District, "Ceremony marks Superfund site removal," August 1995, *Corps'pondent*, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 20150409, Box 1, Binders and Books.

[127] U.S. Army Corps of Engineers, Portland District, "Bradford Island Historic Landfill, Bonneville Lock and Dam," December 19, 2000, Portland District, Public Affairs Office, 360- Information Papers, 2000.

[128] Gay Monteverde, "District tackles landfill at Bonneville Lock & Dam," April 2001, *Engineer Update*.

[129] U.S. Army Corps of Engineers, Portland District, "Cooperation between DEQ and Corps of Engineers will resolve landfill concerns," August 13, 1998, News Release, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 34060105, Folder: News Releases, 1998.

[130] U.S. Army Corps of Engineers, Portland District, "Bradford Island Historic Landfill, Bonneville Lock and Dam," December 19, 2000, Portland District, Public Affairs Office, 360- Information Papers, 2000.

[131] U.S. Army Corps of Engineers, Portland District, "Bradford Island Historic Landfill, Bonneville Lock and Dam," December 19, 2000, Portland District, Public Affairs Office, 360- Information Papers, 2000.

[132] U.S. Army Corps of Engineers, Portland District, "Bradford Island Historic Landfill: The Next Steps," accessed at https://www.nwp.usace.army.mil/issues/bradford/next.htm, on August 1, 2001.

[133] U.S. Army Corps of Engineers, Portland District, "Bradford Island Historic Landfill: The Next Steps," accessed at https://www.nwp.usace.army.mil/issues/bradford/next.htm, on August 1, 2001.

[134] Gay Monteverde, "District tackles landfill at Bonneville Lock & Dam," April 2001, *Engineer Update*.

[135] Gay Monteverde, "District tackles landfill at Bonneville Lock & Dam," April 2001, *Engineer Update*.

[136] U.S. Army Corps of Engineers, Portland District, "Bradford Island Historic Landfill: Frequently Asked Questions," accessed at https://www.nwp.usace.army.mil/issues/bradford/faq.htm, on August 1, 2001.

[137] U.S. Army Corps of Engineers, Portland District, "General Investigation Reconnaissance Study Willamette River Environmental Dredging, Oregon," December 26, 2000, p. 6, from Michael Gross' files.

[138] U.S. Army Corps of Engineers, Portland District, "Results of 1989 U.S. Moorings Sediment Quality Evaluation, no date, accessed at, https://www.nwp.usace.army.mil/ec/h/hr/Reports/Moorings/us_moorings_89.pdf, on August 1, 2001.

Endnotes

[139] Geotechnical Resources, Inc., "Level 1 Preliminary Site Assessment for the U.S. Moorings Facility, Portland, Oregon," Draft, June 20, 1990, National Archives Pacific Alaska Region, RG 77, Accession 77-97-0051, Box 6, Folder: U.S. Moorings – Preliminary Assessment (PA) File – 1994.

[140] Geotechnical Resources, Inc., "Level 1 Preliminary Site Assessment for the U.S. Moorings Facility, Portland, Oregon," Draft, June 20, 1990, National Archives Pacific Alaska Region, RG 77, Accession 77-97-0051, Box 6, Folder: U.S. Moorings – Preliminary Assessment (PA) File – 1994.

[141] Geotechnical Resources, Inc., "Level 1 Preliminary Site Assessment for the U.S. Moorings Facility, Portland, Oregon," Draft, June 20, 1990, National Archives Pacific Alaska Region, RG 77, Accession 77-97-0051, Box 6, Folder: U.S. Moorings – Preliminary Assessment (PA) File – 1994.

[142] InterMountain West, Inc., "Final Report for On Site Cleanup of Contaminated Soils, U.S. Moorings Facility, Portland, Oregon," September 9, 1993, p. 1, Portland District Technical Library.

[143] U.S. Army Corps of Engineers, Portland District, "Cleanup Crews Working at U.S. Moorings Facility on St. Helens Road," August 20, 1993, News Release, Portland District, Public Affairs Office, 360 – Hazardous & Toxic Waste; "Corps of Engineers ship mooring facility gets cleanup of metal-contaminated soils," September 2, 1993, St. Johns Review, Portland District, Public Affairs Office, 360 – Hazardous & Toxic Waste.

[144] U.S. Army Corps of Engineers, "Preliminary Assessment Report: The U.S. Government Moorings Facility, Portland, Oregon," April 1994, Portland District Technical Library.

[145] U.S. Army Corps of Engineers, Portland District, "General Investigation Reconnaissance Study Willamette River Environmental Dredging, Oregon," December 26, 2000, p. 7, from Michael Gross' files.

[146] Gross Interview.

[147] EPA, "Fact Sheet, Portland Harbor, Portland, Oregon," April 1999, Portland District, Public Affairs Office, 870-5b, Willamette River, Hazardous & Toxic Waste.

[148] U.S. Army Corps of Engineers, Portland District, "Portland Harbor (Superfund) Site," December 2000, Information Paper, Portland District, Public Affairs Office, 870-5b, Willamette River, Hazardous & Toxic Waste; accessed at http://www.deq.state.or.us/wmc/ECSI/ecsidetail.asp?seqnbr=2068, on August 1, 2001.

[149] U.S. Army Corps of Engineers, Portland District, "Portland Harbor National Priorities List (Superfund) Site," December 2000, Information Paper, Portland District, Public Affairs Office, 870-5b, Willamette River, Hazardous & Toxic Waste.

[150] U.S. Army Corps of Engineers, Portland District, "General Investigation Reconnaissance Study Willamette River Environmental Dredging, Oregon," December 26, 2000, p. 4, from Michael Gross' files.

[151] U.S. Army Corps of Engineers, Portland District, "General Investigation Reconnaissance Study Willamette River Environmental Dredging, Oregon," December 26, 2000, p. 12, from Michael Gross' files.

[152] U.S. Army Corps of Engineers, Portland District, "General Investigation Reconnaissance Study Willamette River Environmental Dredging, Oregon," December 26, 2000, pp. 14-19, from Michael Gross' files.

[153] Gross Interview.

[154] U.S. Army Corps of Engineers, Portland District, "General Investigation Reconnaissance Study Willamette River Environmental Dredging, Oregon," December 26, 2000, pp. 14-19, from Michael Gross' files.

[155] U.S. Army Corps of Engineers, Portland District, "General Investigation Reconnaissance Study Willamette River Environmental Dredging, Oregon," December 26, 2000, pp. 14-19, from Michael Gross' files.

[156] Jim Barnett and Brent Hunsberger, "Harbor cleanup may dredge taxpayers' pockets," March 20, 2000, *The Oregonian*, Portland District, Public Affairs Office, 870-5b, Willamette River, Hazardous & Toxic Waste.

[157] Jim Barnett and Brent Hunsberger, "Harbor cleanup may dredge taxpayers' pockets," March 20, 2000, *The Oregonian*, Portland District, Public Affairs Office, 870-5b, Willamette River, Hazardous & Toxic Waste.

[158] Gross Interview.

[159] Environmental Protection Agency, accessed at http://www.epa.gov/superfund/sites/query/query.htm/nplfin.htm#0regon, on August 1, 2001.

Salmon and Endangered Species

Chapter Four
Salmon and Endangered Species

["The salmon listings] may be the biggest hammer ever brought down in the 26 years of the Endangered Species Act."
National Audubon Society, 1999

"No one will escape, unaffected, by any meaningful process to recover salmon."
Brian Gorman, National Marine Fisheries Service, 1999

"The Endangered Species Act has altered the way the Corps does business."
Tom Davis, former Chief of Planning, North Pacific Division, 2001

Spawning Sockeye salmon.

Extended length traveling screens are installed to help juvenile fish safely pass the dams.

Salmon raised by hatcheries are trucked and barged past the dams and released in the rivers.

New Legislation and New Values

Salmon have long been important to the identity of this region, but attitudes toward these fish and the natural world in general have evolved considerably over the last 150 years. If the Euroamericans who arrived on the Columbia and Snake rivers during the mid-19th century could witness the debates regarding Pacific salmon in the late 20th century, they might be astonished at the contrast in priorities and values. The first white settlers viewed salmon as an inexhaustible resource, and they devoted their energies to increasing the efficiency of harvest methods and transportation systems, not to protecting the region's fisheries. At the same time, the federal government encouraged the perception that the nation could enjoy the fruits of development and continue to have fish, too – and conservationists advocated using the region's water, timber, and fisheries resources to the fullest extent. By the late 19th century, far-sighted individuals had warned that some salmon species were headed for extinction; in the late 1880s Congress directed the Corps to investigate the alarming reduction in the numbers of Columbia River salmon.[1] Not until the environmental era of the 1960s and 1970s, however, did the region recognize the limitations of its resources, prompting dramatic changes in fisheries policy and management, as well as changes in the operations and management of the Portland District's dams.

Salmon decline was a highly visible, politicized issue that reflected a larger historical trend: the realization that the Pacific Northwest's natural resources were finite. No longer did the rivers run thick with the inconceivable quantities of salmon encountered by Lewis and Clark. By the end of the 20th century, a number of salmon species that passed through Columbia and Snake river dams were listed as threatened and endangered. The perception of the Pacific Northwest as a place offering nature's bounty in unlimited quantities had come to an end – and scientists, economists, and policy makers faced the monumental task of managing the resource in this new reality. "Our time of having it all is over," explained a reporter in 1991. "The choices must be made."[2]

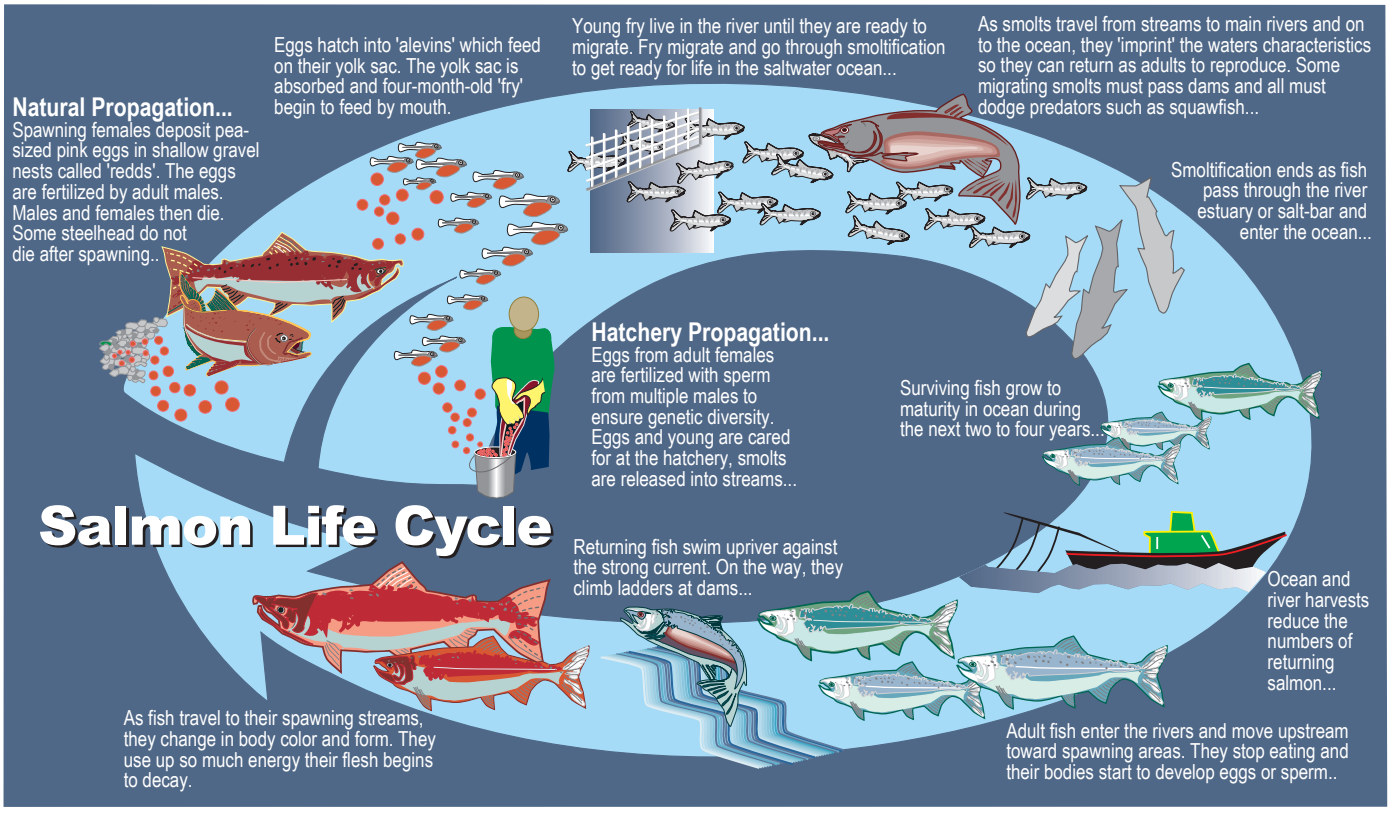
Dams in particular came under scrutiny. When they were originally constructed many Americans applauded them for turning desert into orchards, providing jobs during the Depression, and supplying inexpensive electricity. By the 1960s, though, many no longer viewed dams as humans harnessing nature for the public good, but as attempts to engineer nature. Turbines were viewed as blenders, and bypass flumes became tunnels of death.[3]

The Endangered Species Act (ESA) reflected this shift in attitudes toward the environment in general, and dams in particular. Although Congress passed endangered species legislation in 1966 and 1969, these earlier acts were weak and ineffective, while the amended statute of 1973 proved to be one of the nation's strongest environmental measures. Called the "pit bull of environmental law," this landmark legislation established a set of rules that provided special protection to threatened and endangered species. Because salmon are anadromous fish, the ESA granted the National Marine Fisheries Service (NMFS) regulatory authority over the fish; the U.S. Fish and Wildlife Service (USFWS) held responsibility for freshwater, resident species. Under the ESA, NMFS designated the Corps, Bonneville Power Administration (BPA), and the Bureau of Reclamation as Action Agencies responsible for implementing listing recommendations in cooperation with NMFS. Specifically, NMFS directed these Action Agencies to conduct studies, alter operations, modify structures, provide supplemental water to assist migrating fish, and participate in recovery activities. The statute required NMFS to write a recovery prescription – known as a 4(d) rule – which could be applied to each salmon run listed.[4]

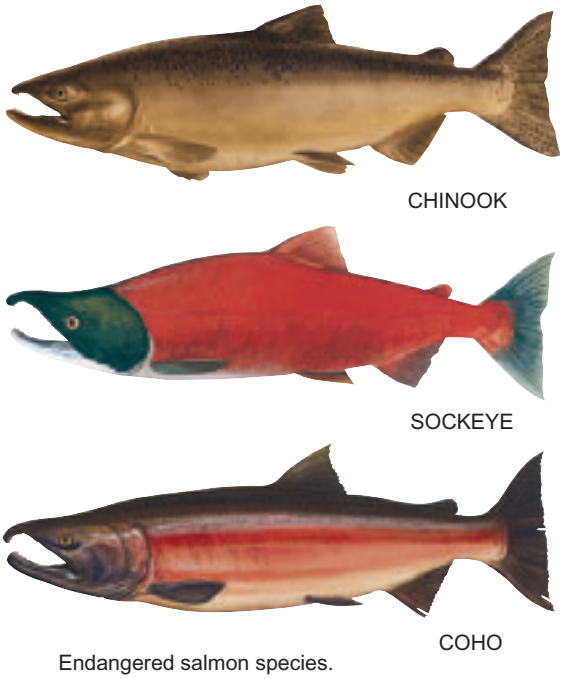
In the early 1990s, NMFS had received petitions to list five salmon populations under the ESA. The five populations included Snake River spring, summer, and fall chinook, Snake River sockeye, and

PACIFIC SALMON

Salmon are anadromous fish that hatch in freshwater, swim to the ocean, and then return as adults to freshwater to spawn. The Greek term "anadromous," which means "running upward," refers to this migratory behavior. Salmon start out as pea-sized eggs buried in the gravel of cold, swiftly running water. After hatching, juvenile salmon undergo smoltification – a process that enables them to adapt to saltwater. As they move downriver, smolts imprint on the sequence of odors they encounter. After maturing in the ocean, they find their way back to the waters of their birth, where they spawn, by following the reverse sequence. Once they enter freshwater, they do not feed extensively. Salmon generally die after spawning, while steelhead can live to repeat the spawning cycle. The five species of Pacific Salmon include Chinook, sockeye, coho, chum, and pink.



lower Columbia River coho. In December 1991, the agency listed the Snake River sockeye as endangered; the following spring NMFS listed Snake River chinook populations as threatened. Regional observers understood that the impact would be significant – particularly to the Pacific Northwest's economy. ESA listings threatened a wide range of economic activities, including hydroelectric generation, agriculture, commercial and recreational fisheries, and Native American treaty fisheries. "Every man, woman and child in the Northwest will be shaken as if by an earthquake," predicted Oregon Senator Mark Hatfield in 1991.[5]



Endangered salmon species.

In March of 1999, in a bold application of the act, NMFS named nine additional species of salmon as threatened or endangered. This ruling affected 72,000 square miles of watersheds in Oregon and Washington, including the urban areas of Portland and Seattle. As predicted in the early 1990s, the impact of the listing on the economy was felt almost immediately. This federal action restricted a number of projects, ranging from highway construction to building new housing developments. These listings also curtailed logging, grazing, and farming in salmon habitat. Never before had the ESA resulted in such far-reaching impacts in a heavily urbanized area. "As far as the impact of ESA listings on the human population, this was simply unprecedented," observed Curt Smith, salmon advisor to Washington Governor Gary Locke.[6] Similarly, in 1999, representatives of the National Audubon Society commented that the salmon listings "may be the biggest hammer ever brought down in the 26 years of the Endangered Species Act."[7] That year, Brian Gorman, NMFS spokesman, warned, "No one will escape, unaffected, by any meaningful process to recover salmon."[8]

The region had experienced endangered species listings before – most notably the spotted owl that pitted the timber industry against environmentalists – but the reverberations were not nearly as widespread. "The consequences [of the listings] could far surpass those that followed similar action to safeguard the northern spotted owl," observed *The Seattle Times/ Post-Intelligencer*.[9] While spotted owls ranged for thousands of acres, salmon ranged for thousands of miles, swimming through a number of borders and jurisdictions. Listings of salmon stocks created considerable alarm among the region's residents and policy makers.

So momentous was the impact of this legislation that the Portland District's history could best be understood as constituting two eras: before and after the ESA. The legislation's full effect wasn't immediately felt by the agency, but the listings of Pacific salmon species changed that. "The Corps' awareness and sensitivity to environmental issues … hit hard with the listing of endangered species on the Columbia River," explained Jerry Weaver, former Chief of Plan Formulation for the North Pacific Division, in 2001.[10] Tom Davis, former Chief of Planning for the North Pacific Division, agreed. "Since the early 1990s the Endangered Species Act has altered the way the Corps does business," he declared in 2001, "and today it's the most significant thing we deal with."[11]

With its diverse missions of flood control, navigation, hydropower, and environmental activities, the Corps often found itself embroiled in the salmon controversy. For example, calls to increase spill because of salmon and water temperature concerns meant a decrease in power output and an increase in the likelihood of fish suffering from gas bubble disease. Decreasing spill resulted in another trade-off: more power but also more salmon going through turbine passage routes. "You can't have an agency with such a widespread mission that touches so many people that is not going to get criticism," commented Colonel Eric T. Mogren, Deputy Commander, Northwestern Division.[12]

Managing salmon, however, was not a simple task. The large number of agencies and tribes

operating on the Columbia River system presented an enormous challenge, and salmon migrations further complicated management. Salmon swim through a maze of federal jurisdictions: BPA, NMFS, Corps of Engineers, USFWS, Bureau of Land Management, Bureau of Reclamation, USDA Forest Service, and the Environmental Protection Agency (EPA).[13] Additional interests include state agencies, tribes, and environmental, economic, and recreational groups, reflecting an increasing level of public involvement at the end of the 20th century. "The level of institutional cooperation between state agencies, tribes, federal agencies, and private landowners needed to achieve salmon recovery in the Columbia River Basin is unprecedented," explained a report produced by the Northwest Power Planning Council.[14] Ultimately, the fight for salmon is a fight over control of the river, explained Colonel Mogren in 2001: "It's about whether it's going to be state controlled, tribal controlled, local controlled, or federal controlled. Whether you're going to give the use to agriculture or business or navigation or flood control or hydropower or tribal, environmental protection. That's what this is fundamentally about; it's about who gets to control the water."[15]

The District increasingly found itself having to balance often opposing interests, and it was required to consult and coordinate with state and federal fisheries agencies, as well as with the tribes. The Nez Perce, Umatilla, Warm Springs, and Yakama reserved the rights to harvest salmon in perpetuity in exchange for ceding millions of acres of lands to the United States in 1855, and the tribal perspective was sometimes different from that of other interests operating along the region's rivers. "The ESA must do more than merely prevent extinction of fish, wildlife, and plants," explained one tribal publication in 2000. "The ESA must restore these populations to healthy levels that may again support harvest."[16] As Colonel Mogren explained, salmon were a crucial focal point in consultation with the tribes. "You can't talk fish without talking hydropower," he observed, "and you can't talk hydropower without talking fish, and you can't talk about either one without talking about Indians." He viewed coordination with the tribes as being an essential component of the Northwestern Division's and the Portland District's operations. "It's important to meet their elders and go to their ceremonies and listen," Colonel Mogren recalled. "They don't care about the Corps of Engineers; they care about the character of the people that they are dealing with. They want to know as a person who you are, and what your beliefs and values are. If you get that rapport going, you can make headway."[17]

While establishing personal relationships may have fostered rapport, responding to environmental concerns proved to be a continuing challenge for the Corps. The agency adapted its focus, evolving from massive engineering projects to responding to new environmental requirements, but the need to balance a diversity of interests continued to create conflict. "Anything we've done in the last three years, there's been an issue associated with it," said Douglas Arndt, a fisheries biologist with the Northwestern Division, in 1999.[18] Furthermore, the Corps' new environmental role met with some skepticism. As one participant at a public hearing complained, "You're the Corps of Engineers, not the Corps of Biologists."[19] The following sections describe the causes of fish loss, as well as how the District responded to the salmon crisis, completing research and updating fish-passage facilities.

The Five "H"s

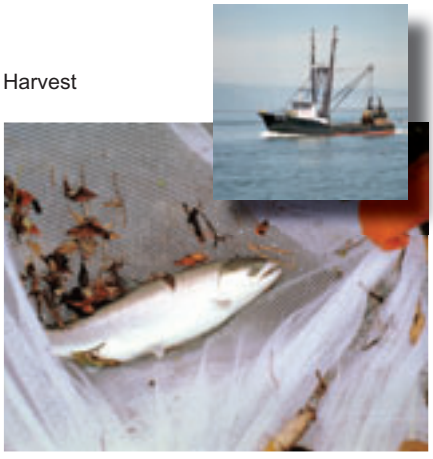
In the search for the causes of diminishing salmon runs, dams provide an easy target. They are enormous, highly visible structures and have a history of disrupting the migrations of anadromous fish. But the dams on the Columbia and Snake rivers were only one piece in the complex puzzle of salmon decline. The listing of Pacific Northwest salmon species in the 1990s rekindled a serious investigation into human-made and natural causes of salmon decline. Toward the end of the 20th century, scientists generally attributed human-caused fish loss to four primary areas, dubbed the four "H's": habitat, harvest, hatcheries, and hydropower. Some suggested that a fifth "H," high seas, had a significant – but largely unknown – impact on salmon populations.

As a cause of salmon decline, habitat is especially complex in terms of historical attitudes and practices. "Habitat" is a modern concept – newspapers and other popular publications rarely used the term until the 1960s and 1970s. During the 19th century, settlers in the Columbia River Basin did not view their surroundings as a habitat or as an ecosystem. Moreover, changes to habitat were sometimes incremental and difficult to detect. When advocates for salmon searched for causes for the decline of the region's fisheries, they tended to focus on visible, easily identified causes such

The Five "H"s

Habitat

Harvest

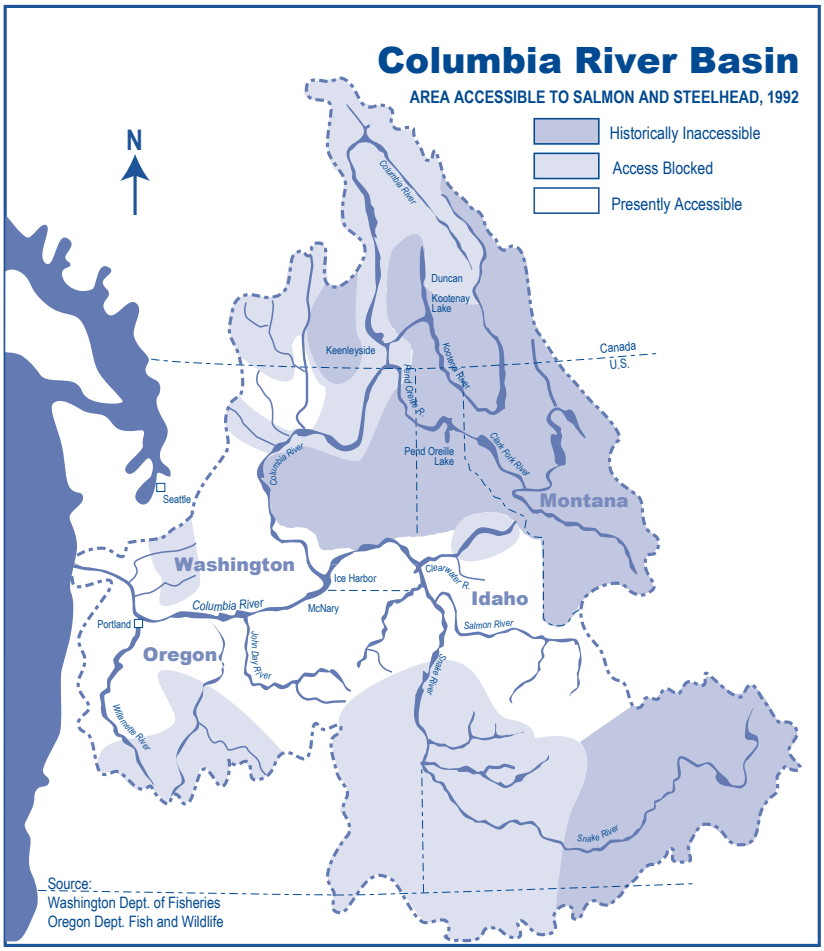


as harvest and dams. Incorporating habitat concerns into research and policies is a recent practice, part of the bigger picture of biodiversity and ecosystems that emerged during the environmental movement.

By the end of the 20th century, threats to salmon habitat were better understood. Logging, agriculture, mining, development, and recreation dramatically altered water quality and temperature, while reduced food supply, introduced animal waste, pesticides, and industrial pollution further harmed anadromous fish.[20] NMFS, in listing the Puget Sound Chinook salmon as threatened under the ESA in 1999, identified widespread habitat modification as one factor contributing to its decline.[21]

Hatcheries are another cause of salmon decline. In addition to regulating seasons and methods of harvest, early state and federal authorities turned to hatcheries and fish culture as a means to perpetuate salmon and steelhead populations. During the early 1870s, cannery interests in the Pacific Northwest experimented with artificial propagation, and for the next century the Oregon Fish Commission, Washington Department of Fisheries and Game, the U.S. Fish Commission, and their successor agencies constructed hatcheries throughout the Columbia River Basin and Puget Sound. Some fisheries authorities placed substantial faith in hatcheries. The U.S. Bureau of Fisheries, for example, claimed in 1913 that "the possibilities for fish-cultural work are practically unlimited," particularly "with reference to the Pacific Coast salmon."[22] Similarly, fisheries expert John N. Cobb noted in 1917 that "the consensus of opinion is that artificial culture does considerable good."[23]

This faith in hatcheries reflects an early 20th century belief that science and technology combined could sustain a critical resource, allowing continued use and harvests.[24] Modest successes in artificial propagation replaced initial failures and led biologists to believe that anadromous fish populations could be sustained with this method, which became "the only recognized tool of fishery management."[25] Increasingly, hatcheries were seen as the solution to declining salmon runs. The region's earlier reliance on hatcheries, however, came under scrutiny during the environmental era. By the 1980s, an increasing number of fisheries biologists had pointed out that reliance on hatcheries had weakened wild stocks.



Hatcheries

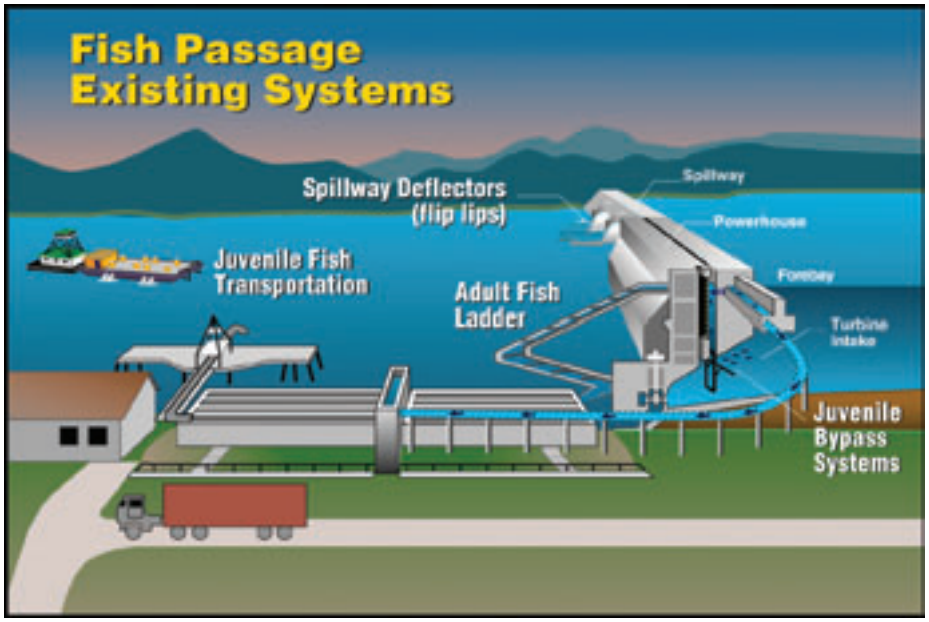
Hydropower

High Seas

Concerns included competition for food, space, and cover, and vulnerability to disease. Hatchery fish can infect wild ones with bacterial kidney disease, weakening them during the smoltification process, the demanding physiological transition from fresh to salt water.[26]

Harvesting also affected salmon populations on the rivers and the ocean. During the 20th century, commercial catches of salmon and steelhead on the Columbia River varied. In the late 1930s, they averaged about 18 million pounds annually, which was a substantial drop from the 40 million pounds averaged during World War I and a decline of 50 percent from their 1911 peak. Catches dropped steadily in the post World War II era.[27] During the 1940s, ocean trollers hauled a large percentage of the catch, and advances in technology improved navigational aids, netting materials, and fish-hauling equipment.

The 1940s also saw an increase in regulations. The Pacific Marine Fisheries Commission, for example, was established in 1947 to oversee ocean fisheries along the West Coast. This interstate commission reviewed fisheries research data and tried to develop unified positions on regional fisheries issues. In later decades, fishing seasons were shortened, and the number of fishing fleets was restricted.[28]



After World War II, population growth as well as increased affluence and leisure time considerably augmented the number of recreational anglers. The interest in sports fishing grew rapidly in the 1960s and 1970s. Almost a million anglers fished for salmon and steelhead in the rivers in 1976 and 1977 in Oregon, Washington, and Idaho. In 1976, their coho catch was 1.7 million, and in 1977, a drought year, it was 900,000. Sport fishers' chinook harvest totaled 631,000 in 1976 and 553,000 in 1977, while the steelhead catch increased from 210,000 to 258,000.[29]

Better technology and equipment and a record number of river users led to increased pressure on the salmon resource. Together with widespread habitat degradation and other causes mentioned in this section, salmon populations plummeted and by the early 1990s, several species had been listed as threatened or endangered. Salmon forecasts in 1994 were so bleak that for the first time in history fisheries agencies shut down all offshore coho and most chinook salmon fishing in Oregon and Washington.[30] Along the Columbia River, controversy remains over Indian gillnets, while up north Canadians claim U.S. fishers continue to intercept millions of Canadian salmon – fish that don't have to negotiate mainstem dams like their American counterparts.

Although salmon spend most of their lives in salt water, most habitat, hatchery, and harvest remedies have focused on threats in fresh water. However, in addition to the impact of the fourth "H," hydropower, described below, there is increasing consensus that the causes of fish loss – and the need for additional knowledge – extend well into the open ocean. This fifth "H," high seas, adds a host of variables to an already complex puzzle. "The ocean is the big black box that's really the determining factor in run size," explained John Kranda, Portland District project manager.[31] Conditions that might play a very significant role include climatic shifts over decades that impact ocean productivity, and ocean currents and temperatures in the North Pacific, particularly El Niño and La Niña events. An ocean dynamic adds even more uncertainty to a system fraught with uncertainty, and makes mitigation efforts all the more difficult, admitted Brigadier General Robert H. Griffin, Northwestern Division Commander. "The truth is there's a lot going on out there in the

THE CORPS AND COLUMBIA RIVER SALMON

The Corps' interest in Columbia River salmon is longstanding. As early as 1887, Major William A. Jones, Portland Engineer Officer, investigated salmon catch methods, artificial propagation, life cycle, and the depletion of runs. The Corps' responsibilities for navigation prompted this report, which examined the danger posed to vessel traffic by dams and fish traps. By the 1930s, Congress had recognized the importance of providing fish passage over dams and included "fishways" (ladders) in dam cost estimates, noting, "the salmon industry is of great importance to the states of Oregon and Washington, and should not be endangered."

Northern pike minnow caught with several juvenile salmon in its belly. Photo courtesy of National Marine Fisheries Service, Seattle, WA.

ocean that isn't being blamed simply because if you blame the ocean there's nobody who can be held accountable."[32]

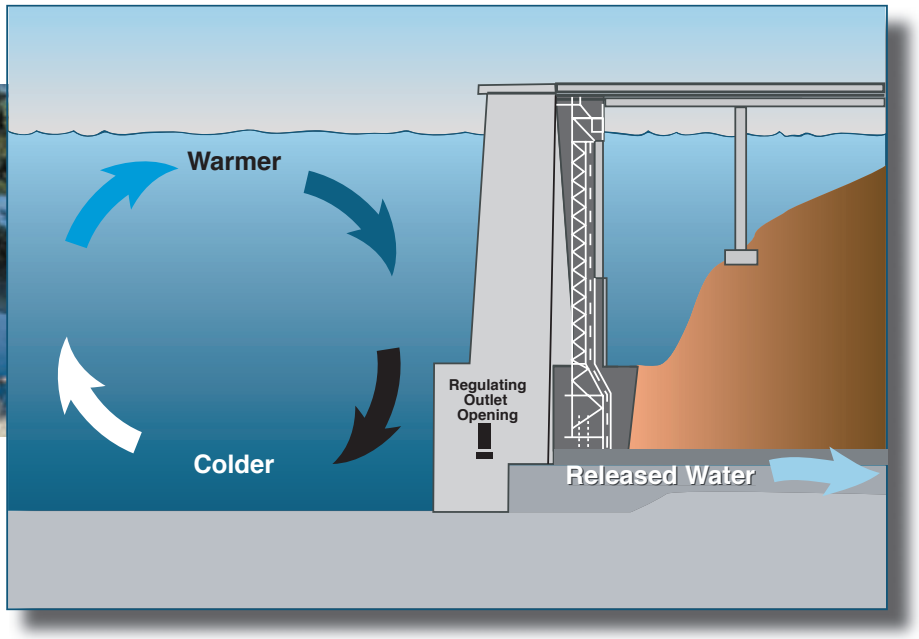
Hydropower, the most visible of the "H's," became the focus of blame when salmon populations were in jeopardy. Dams introduced a number of threats to migrating salmon, including delays caused by the blocking of the migratory journey. Juvenile salmon evolved under seasonal flooding; spring freshets rushed young salmon to the sea. Water slowed by dams – and the time spent navigating over, around, and through them – added as much as one month to the migration. Other hydropower-related threats included increased predation, mainly by northern pike minnow (formerly "squawfish"), and the stresses of tagging and bypass collection and transportation by barge, truck, or flume. The biggest hazards, however, were from turbines, Total Dissolved Gas (TDG), and temperature.

The turbine intake system is probably the most dangerous path a young salmon can take through a dam. While this is the prevailing view, over the years it has not been shared by all. In 1941, the assistant chief of engineers for the Corps, Thomas Robins, testified before Congress that dam turbines were "absolutely incapable of hurting the fish. If you could put a mule through there, and keep him from drowning, he would go through without being hurt. Before we put the wheels in, we carried on experiments with fish, and proved conclusively that the pressure of the turbines will not injure fish."[33] While this statement is exaggerated and inaccurate, recent claims that turbines are large blenders, dicing young salmon on their journey to the sea, are also misleading. Because the force of rushing water drives the turbine blades they rotate 70 to 90 times per minute, not the thousands per minute found in a blender. Still, the turbine intake system subjects young salmon to a number of dangers that can cause injury or death: pressure from diving to low depths (juveniles prefer to stay in the upper water column), striking (hitting solid parts of the turbine machinery), gill tearing (from jets of water streaming at different velocities), cavitation (sudden changes in pressure, low to high, from the blade action), and predation (disorientation or injury from transiting the system makes them more susceptible to feeding by opportunistic fish or birds).[34]

High levels of Total Dissolved Gas, or TDG, can lead to gas bubble disease, one of the most serious threats to migrating smolts. Water plunging down the spillway injects air bubbles, composed of oxygen and nitrogen, into the water. While the bubbles disappear, the gas is incorporated into the water – and fish absorb the extra oxygen and nitrogen when they pass the gas-saturated water over their gills to breathe. As fish return to shallower water, the pressure lessens and the gasses bubble out of solution inside the fish. Gas bubble trauma in fish is akin to the nitrogen narcosis – better known as caisson disease or the "bends" – experienced by scuba divers who ascend too quickly. Symptoms include tiny blisters on fins or scales, and swollen or ruptured eyes.[35] "By the time you see bubbles on the outside of a fish," said one fish farm operator, "it's toast."[36]

Even with reduced spillway flow it was difficult to keep TDG levels at or below the 110 percent threshold required by state water quality standards in Washington and Oregon. These states sometimes gave the NMFS permission to allow levels to reach 120 percent because of spring runoff and calls for increased spill.[37] In 1996, 4.2 percent of nearly 40,000 smolts examined near dams showed signs of gas bubble disease; of those, 37 were severe cases with possible lethal concentrations of nitrogen. And like the young salmon that emerged from the turbines, smolts that lingered at the bottom of the spillway could become disoriented by the churning water or disabled by high levels of TDG which increased their vulnerability to predation and disease.[38]

High levels of Total Dissolved Gas in the water can result in gas bubble disease in salmon. Photos courtesy of National Marine Fisheries Service, Seattle, WA.



Cougar Dam reservoir water temperatures will be regulated through a temperature control tower.

Columbia River water temperatures also presented problems for salmon. Temperatures were raised in a number of ways: farm runoff, logging that removed cooling shade, pumping water from wells for homes, farms, industry, and hydropower structures. Dams raised water temperatures by slowing and pooling water that was then warmed by the summer sun. Dams also disrupted seasonal flows, making the river warmer than usual in autumn and cooler than usual in spring. The risk posed to salmon by temperature fluctuations was very real but largely unstudied. "We've spent a lot of energy on helping fish get past dams, on barges and other things but we haven't looked much at temperature," said Charles C. Coutant, a research ecologist with the Independent Scientific Advisory Board. "Maybe we've made a mistake."[39]

Scientists found that temperature change greatly impacts a salmon's ability to survive. Salmon are cold-blooded creatures and unusually warm water speeds up their system, forcing them to consume the fat reserves that are needed to make the long journey to their spawning grounds; because of raised metabolic rates some salmon are too exhausted to spawn. Higher temperatures also drive smolts from the edges of the river to the main reservoir where there is less to eat and a greater chance of being eaten.[40] And because warmer water holds less gas, including oxygen, respiratory problems can develop as fish struggle to breathe.[41]

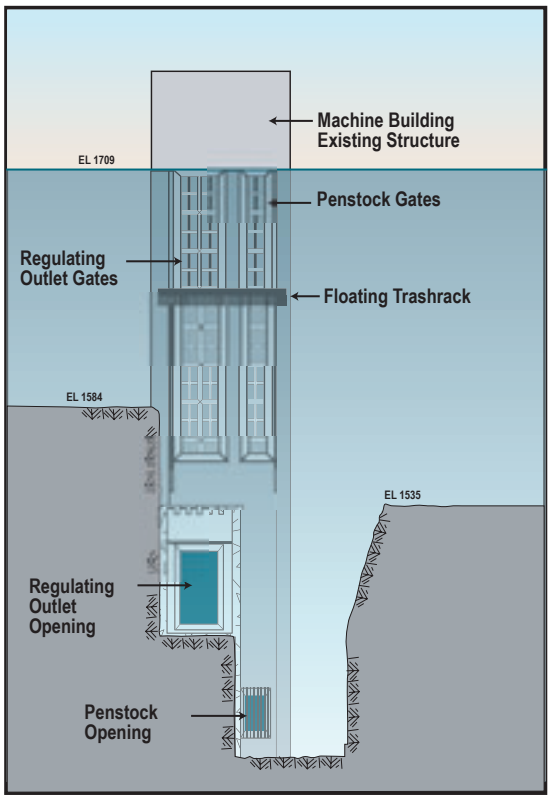
State and federal agencies maintained that river temperature levels above 68 degrees could be harmful to fish; summer temperatures in the Columbia River occasionally climbed as high as 80 degrees. In July of 1998, abnormally warm waters were blamed for the deaths of more than 40,000 smolts at McNary Dam.[42] The EPA recommended increased spills to stay within the levels required by the Clean Water Act, but this action entrained more air and pushed TDG levels beyond the 110 percent level required by the ESA. This recommendation put the EPA at odds with the Portland District and complicated salmon recovery efforts.[43]

It was not just the Columbia River dams that posed a temperature threat to anadromous fish. In the 1960s, the Corps erected dams on the Willamette River system to control floods, generate power, and to supply water for irrigation and domestic use, low flow augmentation, and recreation.[44] The Corps incorporated fish facilities in these dams. However, toward the end of the 20th century, unnatural temperatures became the primary concern, particularly at Cougar Dam on the South Fork of the McKenzie River and the Blue River Dam on the Blue River. The Corps launched the Willamette Temperature Control Project to address this hazard.

The impact of hydropower facilities on Willamette River temperatures was not a new consideration. A report by USFWS in 1952 noted that development of water-use and flood-control projects on the Willamette River System changed the ecology of many of the Willamette streams. Changes in temperature and chemical composition of the water affected fish populations in the system. The report further recommended planning a fishery-management program.[45] When the Cougar and Blue River dams were constructed, however, upstream habitat loss was the focus of salmon runs, and a hatchery sited at Leaburg was intended to compensate for the degradation. Biologists and engineers failed to anticipate the temperature problem.[46]

By the 1990s, scientists had identified temperature as the major cause of salmon decline on the Willamette. In the fall, water as much as 10 degrees higher than normal was flushed from a single outlet near the top of the reservoir, triggering eggs to hatch off schedule in December or January – months ahead of time – when food supplies are low. The smolts that did survive

often couldn't find their way out of the reservoir and through the specially designed "fish horn" – a system that never worked properly. Temperature also disrupted the crucial timing of salmon migrating upriver. Originally, returning adults were to be trapped near the base of the dam and trucked above. In the spring and summer, however, only a few adults congregated near the base of the dams because the water released was too cold.[47] "The water's just too cold sometimes and too warm other times. It's just the opposite of what the natural river temperatures should be," explained Nancy MacHugh, Oregon Department of Fish and Wildlife (ODFW) interagency coordinator.[48] By 1998, native chinook runs numbered 1,000 to 2,000 fish, less than one percent of their historic size, and on March 24, 1999, NMFS listed the Upper Willamette River Chinook Evolutionary Significant Unit (ESU) as threatened.



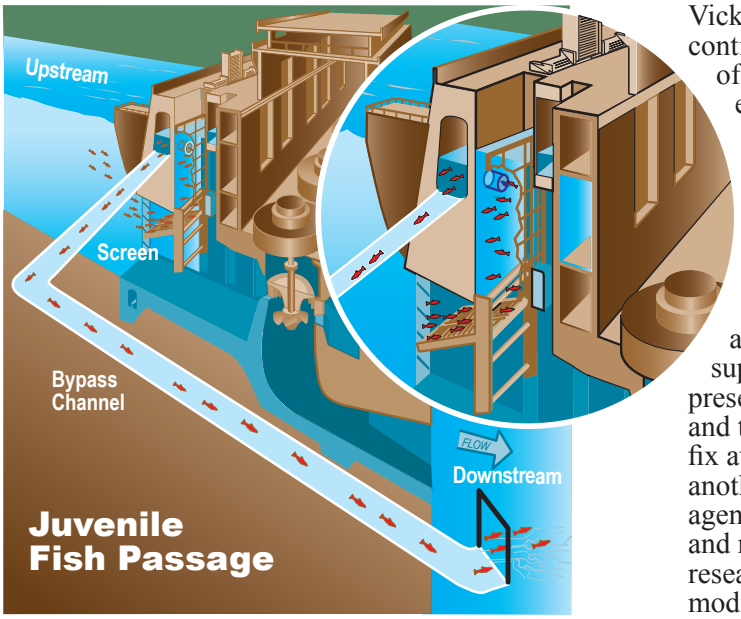
Modifications to the Cougar Dam temperature control tower began in 2002 with the drawdown of the reservoir. New outlet gates will be added to the tower to allow better water temperature regulation of water released from the reservoir.

To mitigate the harmful temperature fluctuations, the District proposed large control towers at Blue River (257 feet) and Cougar (302 feet) dams in 1995. Through a series of ports on each tower water could be released from varying depths in the reservoir, depending on downstream temperature needs. "We're trying to restore the temperature to what it was before the dams were built," said Doug Clarke, project manager. And unlike other Corps salmon recovery efforts, the towers had broad support from fishing groups, environmentalists, and state and federal officials. "Temperature regulation is going to be very beneficial, especially to spring chinook," remarked Bob Bumstead, conservation chairman for the McKenzie Flyfishers.[49]

The District estimated that temperature control modifications to the Cougar and Blue River dams would take eight years and cost $42 million. While interested parties agreed the project needed to move forward, concerns about the impact of construction on water quality, recreation, hydropower losses, and fish populations remained. Plans called for draining the Blue River reservoir, but a pool was needed at Cougar reservoir for bull trout, a threatened species under the ESA. An ODFW fisheries biologist worried that the proposed 80-acre pool wouldn't be enough to sustain a bull trout population "hanging on by its toenails." In the early 21st century, the District worked with USFWS and ODFW to develop a plan to collect adult bull trout below the dam and transport them to release sites above the reservoir in the South Fork McKenzie River.[50]

Although the District released a final EIS for the construction of the project in 1995, fisheries biologists modified its design to include a larger temporary pool, an unscreened opening for the diversion tunnel, and placement of two cofferdams to manage water flows during construction. The Cougar reservoir is to be lowered each summer for up to five years beginning in April of 2002, while workers complete the temperature control structure; construction will render unusable the reservoir's three boat ramps. The Corps will begin work at the Blue River Dam when the Cougar

Dam intake tower is completed.[51] Fisheries biologists predicted that improved salmon conditions in the lower McKenzie could rebuild the chinook run by 16,700 a year.[52] A fish passage report at the close of the 20th century recommended that an upstream adult trap be built immediately. For downstream migrants, it concluded, the only practical solution is trapping and hauling the fish, and more research is required about reservoir hydraulics and fish behavior.[53]



In addition to the perils of turbines, TDG, and temperature, hydropower raised the issue of techno-fixes versus more natural ways of routing juvenile salmon through dams. "If you understand how a bypass system works it's not the most natural thing," said John Kranda. "With the fish having to sound into a turbine intake and get screened up into a gate well and shoot through an orifice and into a channel that runs the length of the dam; it's dewatered while they're doing that, eight hundred CFS (cubic feet per second) down to thirty, and into a pipe and then back out to the river. Pressure changes and all these mechanical systems – even the average person would think that's not very natural."[54] Other fish passage techniques had drawbacks as well. Barging and trucking smolts stressed and crowded them, and more passive methods like water slide flumes deposited dazed fish into the waiting jaws of northern pike minnows, an over-sized minnow that consumed millions of young salmon and steelhead every year.[55]

Finding Solutions

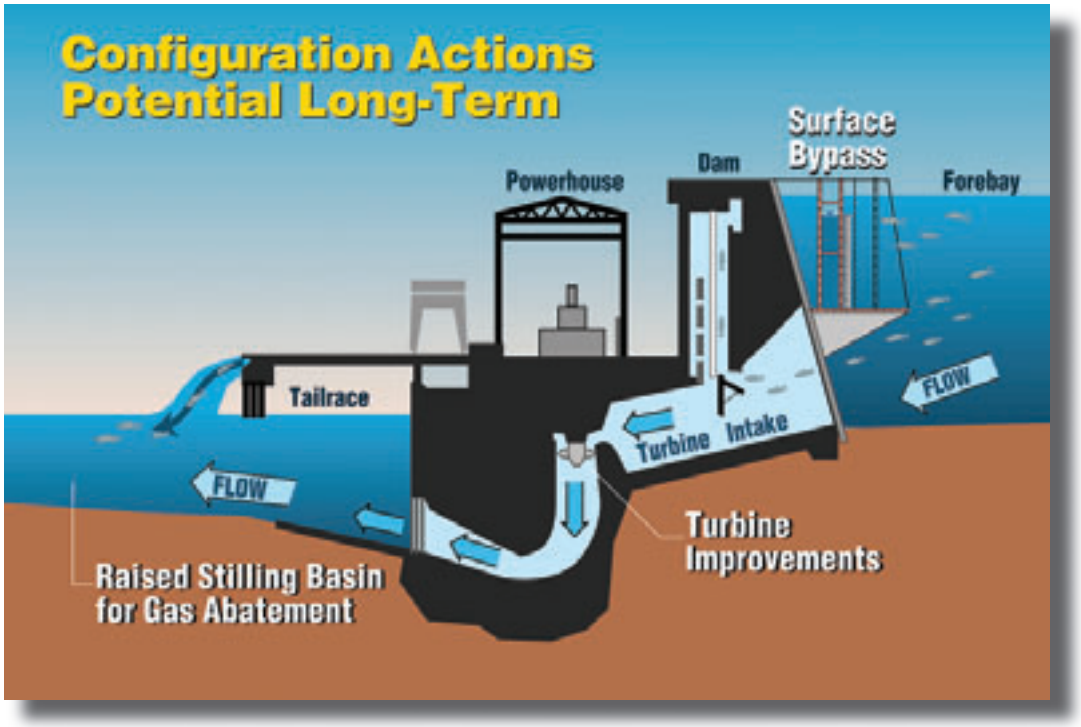
"We are extremely interested in providing safe fish passage," Corps biologist Gary Johnson explained in 1989. "But we also feel a strong obligation to the region's ratepayers to operate our projects in a way that will balance all of our resources."[56] For much of the 20th century Americans believed they could have dams and salmon, too – a perception that Congress encouraged. Later in the century, with the emergence of the environmental movement, that balance became harder to maintain as salmon moved to the forefront. This shift prompted changes in fisheries management as well. While the early focus had been on adult fish, juveniles received an increasing amount of attention during the period 1980-2000.

Although Pacific salmon have been probed, tagged, and monitored for decades, many uncertainties remained. During the environmental era, research projects replaced construction as the District's primary mission on the Columbia. In 1980, the District lost the Fisheries Engineering Research Laboratory at Bonneville Dam when a heavy snowfall collapsed the building. While the laboratory's functions were transferred to the Corps' Waterways Experiment Station (WES) in Vicksburg, Mississippi, the District continued to initiate a large number of new research and monitoring efforts in the Pacific Northwest.[57] In the early 1990s alone, its Fish Passage Development and Evaluation Program conducted approximately 50 studies of fish passage issues including transportation, spill effect, bypass effectiveness, adult migration, and gas supersaturation.[58] Each dam presented a different challenge, and the Corps soon realized that a fix at one dam might not work on another. This section examines the agency's response to new regulations and new realities, and its extensive research and monitoring and facility modifications.

The Pacific Northwest Electric Power Planning and Conservation Act, signed into law in 1980, significantly influenced the Corps' research and construction efforts to improve salmon passage. The act created the Northwest Power Planning Council (NWPPC), which had two objectives: to assure the region of adequate, reliable, economical power supply, and to "protect, mitigate, and enhance fish and wildlife" and their habitats in the Columbia Basin. Governors from four states – Idaho, Montana, Oregon, and Washington – appointed two members to sit on the Council. The Power Act contained three principal mandates for the Council:

- ❖ Develop a 20-year electric power plan to guarantee adequate and reliable energy at the lowest economic and environmental cost;
- ❖ Develop a program to protect and rebuild fish and wildlife populations affected by hydropower development; and
- ❖ Educate and involve the public in the Council's decision-making process.[59]

Hydroelectric dams greatly altered natural flows, regulating the river to produce more electricity in the fall and winter, in turn, reducing river flows in the spring when juvenile salmon and steelhead migrate.[60] To increase spring flows, the NWPPC established a "water budget" in 1982 to be used between



Potential long-term actions at the dams to benefit juvenile fish passage

April 15th and June 15th, the period when most young salmonids journey downriver. The water budget, which replaced the Committee on Fisheries Operations, represented a volume of water earmarked to improve smolt survival. The Council's goal was to simulate the effects of a spring freshet, augmenting the flow and flushing the fish to the open ocean and thereby reducing their exposure to predation and other hazards. By the 1980s the NWPPC, under its Columbia River Basin Fish & Wildlife Program, had called for spill at dams without adequate bypass systems.[61]

NWPPC encouraged the preparation of interim juvenile passage plans while developing permanent solutions to passage problems at John Day, The Dalles, Bonneville, and other dams that lacked mechanical juvenile bypass systems. Interim fish passage plans called for spilling water at these dams when significant numbers of juvenile migrants were present. Fisheries agencies and tribes determined what constituted a significant number, which varied from a few hundred to tens of thousands, depending on the dam and the season.[62] The NWPPC Program created a Fish Passage Center (FPC), located in Portland, which provided fish passage management recommendations regarding spill, flow, and fish facilities operations.[63] In large part the FPC was formed to monitor the effectiveness of programs undertaken in response to the 1980 Power Act.[64]

Biological Opinions issued by the NMFS added a new dynamic to the Corps' short and long-term planning. In its 1995 Opinion, for example, the NMFS called for significant changes in the way federal dams were operated on the Columbia River system. Among the options considered by the Corps – ranging from the status quo to partial breaching – were major system improvements, including surface bypass systems, fish friendly turbine blades, and increased spill.[65] The 1995 Opinion called for increased river flows from April to September to simulate more natural river conditions during the time when endangered smolts are migrating downriver. It required the unscreened Dalles Dam to spill nearly two-thirds of the total volume or river flow, leaving only 36 percent available for power generation.[66]

The Corps' emphasis on research reflected the need for more knowledge about riverine systems and human impacts. "We're still in our infancy in terms of understanding," explained Johnson.[67] In the Columbia River Basin, the magnitude of scientific research undertaken remained staggering throughout the period 1980-2000.[68] Even so, there was a significant gap in information on juvenile salmon – how they migrated, why they migrated, and why their numbers were declining. Adding to this was a hydropower system comprised of non-uniform structures. "Fish need to be evaluated system-wide to give us a better feel for where the system is working best and where improvements should be made. Each project on the Columbia River is different. Differing site conditions, plus structural or placement variations make them unique," said Stuart Stanger, Corps project manager. "This means there is no 'one-size-fits-all' solution to the fisheries issue, making finding answers that much more complex."[69]

A noteworthy indication of the District's development during the environmental era was the sizeable increase in the number of biologists employed. As Johnson put it, "It's an exciting time to be a fish biologist."[70] Engineers had to adapt to the new emphasis. "I'm not a biologist myself, I'm an engineer," explained Kranda. "It gets kind of frustrating to me because as engineers we're kind of black and white, concrete and steel, yes or no. You can take a research study and, given all the variables that you can imagine for why a fish survives or doesn't survive as it passes through a complex system, if you want to you can shoot holes in [the study]."[71] To improve fish passage, the District undertook four innovative areas of

research including surface bypass, fish friendly turbines, passive integrated transponder (PIT) tags, and the Project Improvements for Endangered Species (PIES).

Surface bypass was a strategy that sought to pass young salmon safely around a dam powerhouse by taking advantage of specific migrational behaviors of salmonids. Juvenile salmon naturally swim in the top 20 to 30 feet of the river, and they follow attraction flows – water volumes they're pre-programmed to follow – as they travel. Turbine flows draw them down into the bypass systems. Because smolts prefer to swim in the upper part of the water column, researchers argued, surface bypass would guide more fish with less delay and stress than screened bypass systems. Corps engineer Patty Etzel compared surface bypass design to a box of tissue: "There is a narrow slot we call a 'vertical slot' that fish move into. Then it opens up like the inside of a Kleenex box, and the fish spread out and travel through the project with the flow."[72]

The 1995-98 NMFS biological opinion stressed bypass studies; Congress also asked the Corps to test surface bypass or "skimming" at The Dalles by 1996. The Corps responded quickly to the interest in surface bypass with a study of all eight dams on the Columbia-Snake river system. A collaborative effort involving the Portland District, Walla Walla District, and the WES sped modeling, design, and construction of test vertical slots.[73]

The NMFS and other regional interests still considered spill to be the best method to pass fish by dams, and surface collection worked in conjunction with spill.[74] Corps projects have powerhouses and spillways in a side-by-side design. However, water that flows to the turbines attracts fish to the turbine bays and directs them down the turbine intakes, not the spillways. The challenge was to find the best surface bypass system for the Corps' dams.

Since no two dams were the same, this was a tough, but essential task. "Because each dam is different, it's important we understand how the migrating juvenile salmon respond to the varying hydraulic conditions that we create around these structures, " said Mark Lindgren, Corps engineer.[75] Accordingly, research began with what was known. "At The Dalles is a base level of knowledge of hydraulic characteristics and fish behavior because of the extensive research already done for screen systems and on design of a new juvenile bypass system with a mile-long bypass channel," described Corps biologist John Ferguson. "Those studies have taught us how fish behave as they approach and move through the project. For instance, the fish tend to concentrate at the west end of the powerhouse before they pass through the structure. Because we know a lot about The Dalles, we'll start testing there."[76] The Dalles Dam research demonstrated that approximately 43 percent of the fish used the sluiceway to bypass the dam and the sluiceway used only three percent of the water flow. "This is a highly efficient rate of fish passage for the volume of water used," remarked Ferguson.[77]

Hydroacoustic monitoring and radio tagging measured the effectiveness of surface bypass at The Dalles. Using that data, the Corps could better design facilities that fit the behavior of the fish. "The key to all our work on the river is adaptive management," said Ferguson. "Our plans for surface bypass, for instance, are not set in concrete. Two years from now things may change as we learn and adapt to what we've learned. The fisheries program is not meant to be rigid. We have to be flexible and design the program in such a way that it adjusts with our growing knowledge base."[78]

Turbines presented another challenge. Although these devices are not the blenders described by some river users, they can injure

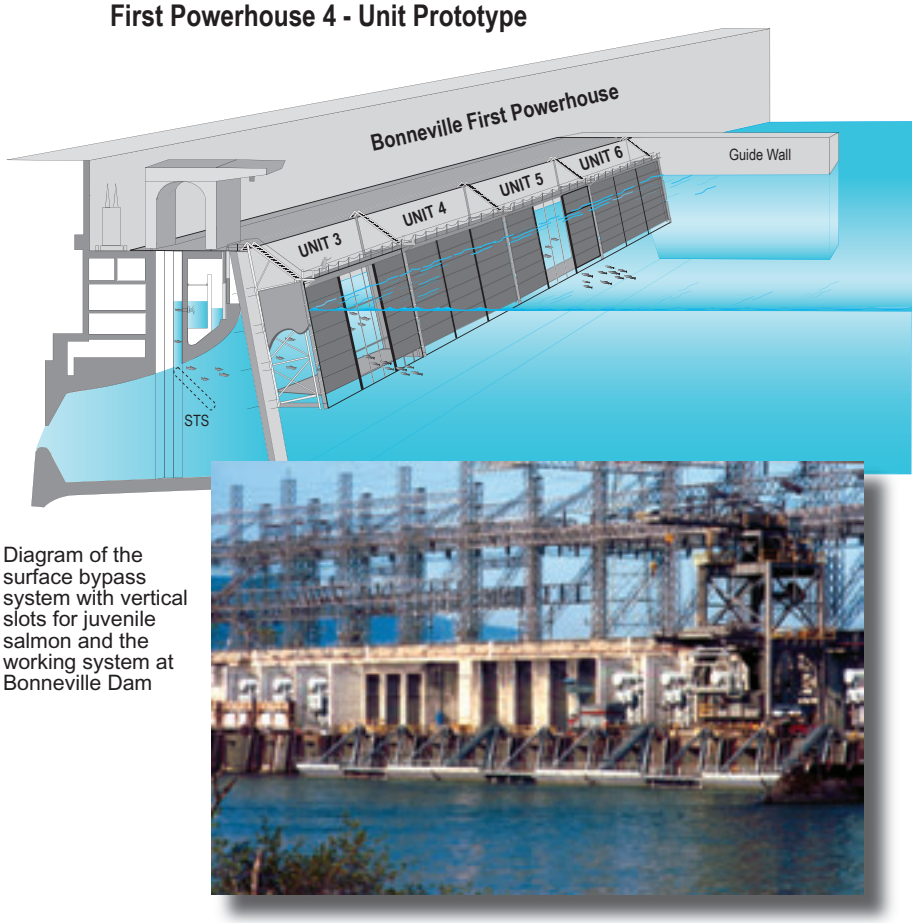


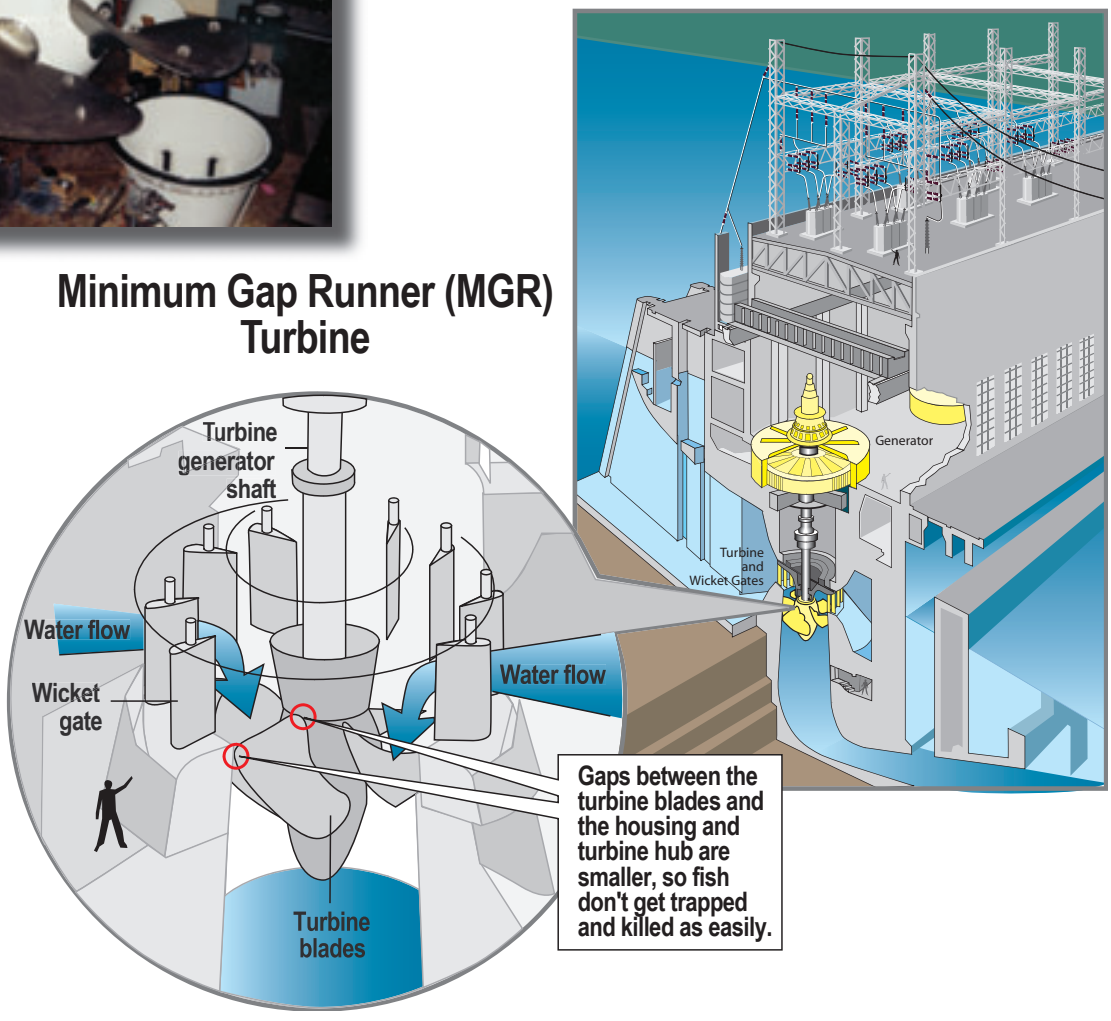
Diagram of the surface bypass system with vertical slots for juvenile salmon and the working system at Bonneville Dam

or kill fish. To get a better idea of what a fish undergoes when passing through the turbine intake system, the Corps conducted extensive safer turbine trials at the WES in Vicksburg, Mississippi. A scale model of a McNary turbine behind Plexiglas allowed researchers to get a fish-eye view. "The big picture from our initial work," explained Ferguson, "is that if you think rotating turbine blades are a problem – they aren't…. We have been so focused on the blades being the problem. But it looks to us now that the fixed members are more of a problem than the blades. We never would have thought that."[79]

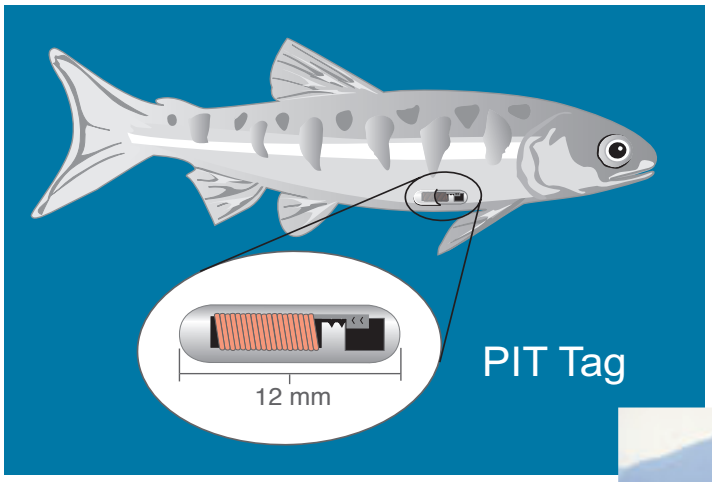
Armed with this information, researchers tested a new design called Minimum Gap Runner, or MGR. As a turbine blade changes operational angles, gaps form between the hub and blade, and between the blades and the outer casing of the turbine. One study indicated a two to three percent injury rate from fish getting caught in those gaps. An MGR would eliminate the gaps by making the corner of the blades longer and by milling out notches in the hub to accommodate the longer corners when the blades are tilted at a steep angle. In addition to being biologically favorable, research showed that power generation might be increased. Each new MGR, researchers estimated, would produce enough additional power to fuel about 15,000 homes in an average year.[80]

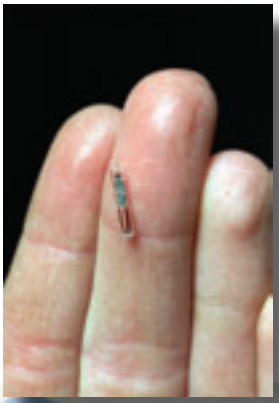
Bonneville's first powerhouse, built in 1938 and undergoing rehabilitation in the late 1990s, was a candidate for this pioneering design. MGR technology could be beneficial at Bonneville because there were fish distributed lower in the turbine intake systems, particularly at night and particularly in the summer, so more fish went under the bypass screens and through the turbines. Due to funding issues, the Corps could replace only one original powerhouse turbine per year, with full powerhouse conversion anticipated by 2007.[81]

Minimum Gap Runner (MGR) Turbine



A 16-member Turbine Working Group (TWG) was assembled to study turbine passage problems. In its ranks were biologists and engineers from NMFS, Corps, Department of Energy, BPA, public utility districts, Idaho National Engineering Laboratory and the Electric Power Research Institute. The Corps also developed a Turbine Passage Survival Program in coordination with the TWG. This four-year program, with a projected cost of $8.72 million, investigated short-term improvements to juvenile passage via the turbine route.[82]





Juvenile Pit Tag and radio monitor

One of the best data collection devices developed during this time period was the PIT tag, or passive integrated transponder. Scientists implanted these small coils of wire, comparable in size to a grain of rice, in smolts. PIT tags were inactive until the fish passed through detectors located at monitoring facilities along the Columbia and Snake rivers. The detectors triggered each tag to send a coded message to a 24 hour-a-day computer database maintained by the Pacific Marine Fisheries Commission.[83]

This remarkable electronic capsule enabled biologists to track a fish during its journey to the ocean and back, providing important information for in-season and long-term management decisions. A benefit to this monitoring method is that each PIT tag is unique, like a fingerprint, and once it's inserted, it's truly passive. "All the information on the fish can be read as the fish passes a detector," said Stanger, "much like a clerk can determine the cost or category of a grocery item as it passes a barcode reader."[84]

In a direct response to the listing of Columbia River salmon, the Portland District developed the Project Improvements for Endangered Species program or "PIES." From 1991 to 1996, a series of 19 items were addressed at Bonneville, The Dalles, and John Day dams. "Individual PIES projects range in cost from $40,000 to $4 million for engineering, design and construction," said Steven Wabnitz, PIES project manager. "There's a wide range, but whatever the cost, they are all being done for the same reason: to make passage conditions better for the salmon."[85]

Projects included placing netting over the adult fish ladder at John Day to prevent fish from jumping out of the ladder; a sonar inspection of the Bradford Island fish ladder at Bonneville that detected obstructions in the outlet; fishway water quality improvements at all three dams to ensure contaminated water did not discharge into the fish passage facilities; a spill modification study at Bonneville; installation of a camera monitoring system at Bonneville and John Day that simplified monthly inspections of submerged traveling screens, vertical barrier screens, and juvenile bypass system orifices; and adding an electronic device at all three dams that adjusted turbine blades to river conditions (this maintained optimum efficiency and reduced harmful pressure to the smolts). The PIES program represented a serious commitment by the Corps to incorporate the ESA into its operations. "What we are doing is the best we can do for the survival of the fish," said Wabnitz. "It's a balancing act."[86]

The Corps received considerable criticism for its handling – or too much handling – of fish passage through its hydroelectric facilities. However, the agency has a long history of fish management. "The Corps has gotten a lot of flack lately about the harm our projects do to the region's migratory fish runs," noted Colonel Charles A.W. Hines, District Commander, in 1992. "But what many people don't know is that the Corps of Engineers has been concerned about fish runs for more than 100 years."[87] The early dams indeed were outfitted – ladders for adult salmon passage – but little attention was given to juvenile bypass. As the "H's" of fish loss became more visible, the District's salmon work shifted in focus from adult passage to juvenile passage.

Facility redesign and improvements underscored the differences between the dams. "Back in our naïve days in the 1980's we just thought if that design worked

there it would work here and so we put it on the second powerhouse and it didn't work for beans. We spent a lot of years after the second powerhouse was constructed trying to tweak it and make it work," observed Kranda.[88] It was difficult to remain flexible when confronted with changing conditions. "We've been relying on this spill as a primary passage route at The Dalles. However, we're now finding problems with high spill causing injury to fish and we are constantly chasing our tail on all this stuff."[89]

To be responsive, the District practiced adaptive management, requiring continual fixes as the information evolved – an approach that required more time and money spent on salmon recovery efforts. "If you're a taxpayer or ratepayer on the outside paying for all this stuff," commented Ken Casavant, NWPPC economist, "each new thing" looks very alarming. "But it's essential because what we know about salmon is in flux." [90] For the Portland District, this work included a number of project improvements: Bonneville second powerhouse Juvenile Bypass System, John Day Dam Juvenile Fish Sampling and Monitoring Facility, and the installation of traveling screens and spill deflectors (flip lips) to reduce turbine passage and gas supersaturation.

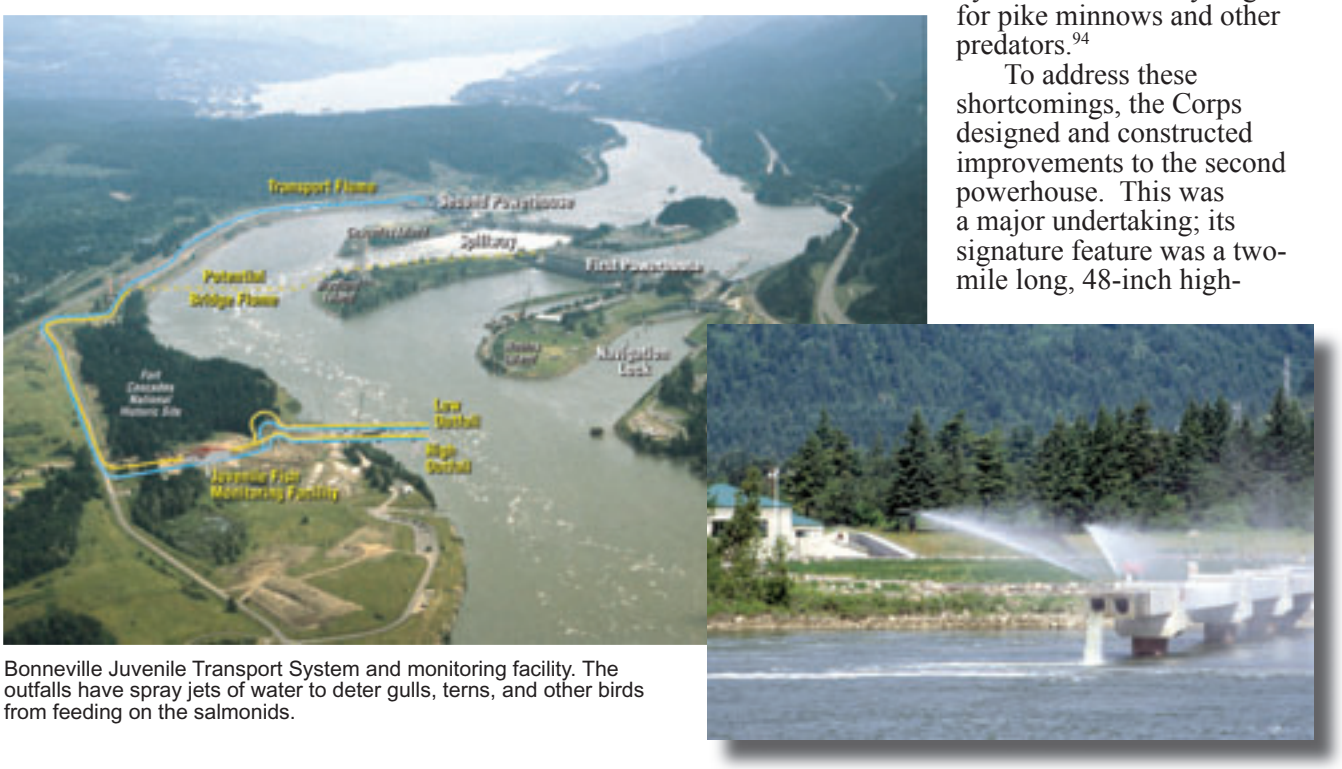
Improving fish passage for juveniles proved more difficult than for adults. Bonneville Dam, the last hydropower obstacle between smolts and the open sea, exemplified this point. Like Lower Granite Dam, the Corps designed the Bonneville second powerhouse with a juvenile bypass facility. During construction of the second powerhouse, the Corps modified the first powerhouse to include a juvenile bypass system.[91]

Bonneville's second powerhouse included the following components: submersible traveling screens that guided fish out of the turbine intakes and into the gatewells; vertical barrier screens that prevented juveniles from returning to the turbine intakes; orifices that allowed fish to travel from gatewells into the bypass area; a bypass downwell; a sampler that automatically collected up to 10 percent of juvenile migrants passing through the system; a dry separator connected to a wet separator in the migrant observation room; and four raceways to hold fish from the wet separator. The Corps modified the first powerhouse by drilling orifices in the bulkhead slots to permit passage from the gatewell slots, constructed a bypass and juvenile sampler, and installed submersible traveling screens to divert migrants from turbine intakes.[92]

Evaluating the downstream migrant systems began in 1982, the first year of operation of the second powerhouse. Researchers limited their observation to the migrant facility in the second powerhouse because construction was in progress and traveling screens were not yet installed. Fish guidance tests in 1983 yielded disappointing results – less than 30 percent of the fish entering the turbine intakes were guided into the gatewells.[93]

Though an improvement, this system still posed a number of stresses to migrating salmon. Juveniles were required to sound 70 feet or more before being guided by the submerged screens back up into the bypass channel (because they preferred not to sound they lingered and were more vulnerable to predation); some smolts continued to dive and entered the turbine intake system; submerged screens caused high water velocities and significant pressure changes; and disoriented fish were released into relatively calm water – easy targets for pike minnows and other predators.[94]

To address these shortcomings, the Corps designed and constructed improvements to the second powerhouse. This was a major undertaking; its signature feature was a two-mile long, 48-inch high-



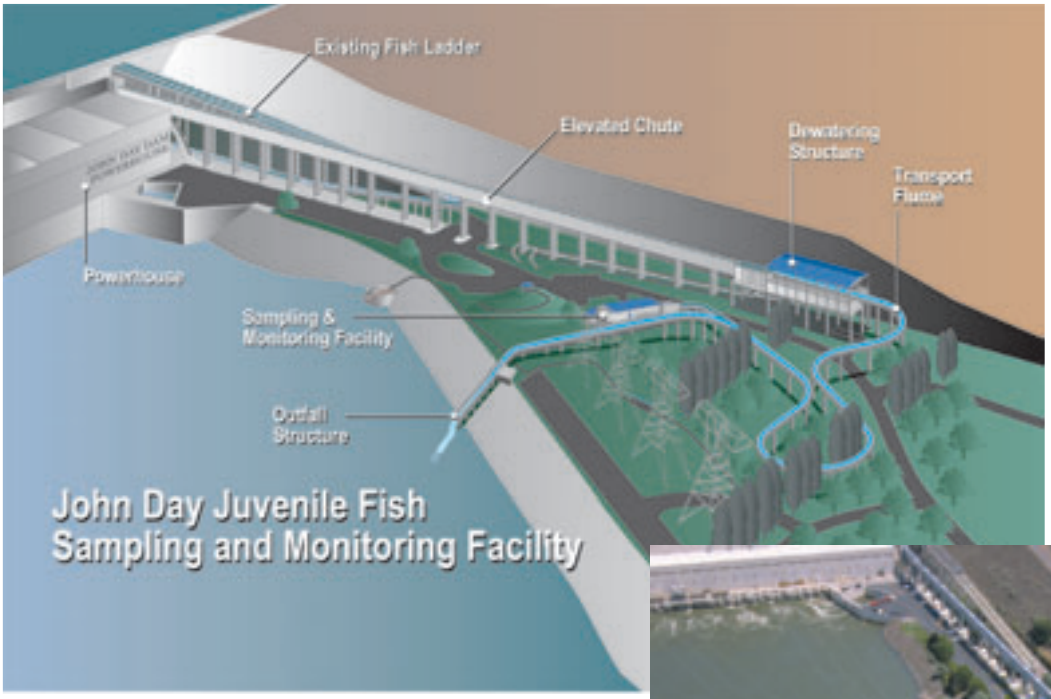
Bonneville Juvenile Transport System and monitoring facility. The outfalls have spray jets of water to deter gulls, terns, and other birds from feeding on the salmonids.

density polyethylene pipe running along the Washington shore. "This cost something on the order of $60 million," said Douglas Arndt. "It was a major engineering feat to build that, particularly in the conditions and the flows that it had to be put in."[95] To minimize maintenance and visual impacts, and to maintain river water temperatures in all seasons, the flume was buried for much of its length.[96] "I don't know of any other place where we have any bypass quite like this," said Heidi Helwig, of Portland District's Public Affairs Office.[97]

Other elements of Bonneville's second powerhouse bypass included a sample flume that directs the flow toward the monitoring facility where PIT tag monitors record fish data. Fish lifts then carry them up to an examination lab where they are anesthetized with a mild relaxant (Tricaine), identified (hatchery or wild origin), and inspected (for disease or injury). The outfalls are located in swift water to give smolts an edge over fish predators. Hydro cannons, located on each outfall, can spray jets of water 150 feet to deter gulls, terns, and other predatory birds from feeding on the salmonids. Samples from 1999 showed promise for fish condition and travel time. A projection for the improved system estimated a survival rate increase of juveniles by 6 percent to 13 percent.[98]

In June 1998, an independent scientific report to the NWPPC declared the new bypass system would be an improvement, but not a long-term solution. Mechanical bypass systems can be as lethal to young fish as passing through turbines, it stated, because they funnel large numbers of fish into a narrow space. The report recommended passage over spillways, a controversial position because more spill results in less water available to generate electricity (and a greater chance of gas entrainment). If fish are to be restored, the scientific panel said, dam operations on both rivers should be adjusted to better mimic natural river conditions.[99]

In August of 1997 the District unveiled a state-of-the-art fish sampling and monitoring facility at John Day Dam. It featured a 1,200 foot-long, 3-foot wide elevated transport flume – 50 feet above ground at its highest point – that carried fish from the upriver side of the dam to a dewatering facility and monitoring building and back into the river below the dam. The focus of its operations was twofold: (1) passive monitoring, described in the PIT tag technology above, and (2) physical monitoring, moving a sample number of migrating fish from the flume to inspect for injuries and disease. Through the monitoring process, scientists were able to collect data to help:



John Day juvenile fish monitoring and sampling facility.

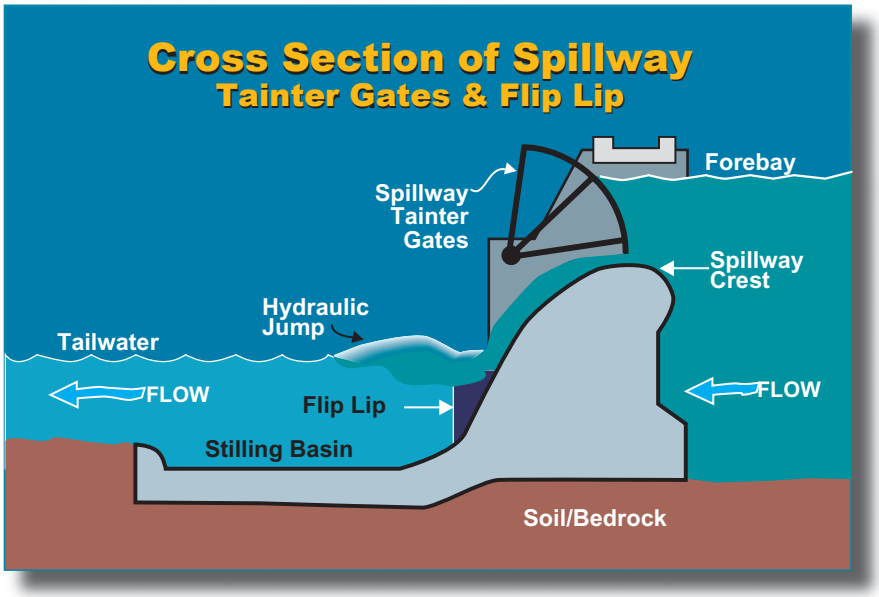
- Assess the physical condition of the fish (disease, descaling)
- Determine travel times between dams
- Develop survival studies
- Determine run sizes and
- Evaluate the operation of the river system.[100]

The smolt monitoring project was a priority of the NWPPC and fisheries agencies as they sought to improve the survival rate of anadromous fish in the Columbia-Snake river system.

Submersible Traveling Screens (STS) were an important part of engineering solutions to steer migrating salmon into bypass systems and away from turbine intake systems. At Bonneville's second powerhouse, for example, these devices were extended into the gatewell slots on the intake deck of the powerhouse to guide the fish. Suspended at a 55-degree angle from the Vertical Barrier Screen, an STS was a 20-foot long frame with motorized screens that traveled along a track. Juveniles were guided by the flow of water along the face of the STS into the gatewell. Debris impinged on the STS traveled up to the top of the STS, then down the backside of it, where the water flowing through the STS washed the debris off. The debris then continued through the unit, with a small portion of it entering the intake and going into the gatewell.[101] The Dalles Dam remained the only major mainstem dam without fish screens over its turbines at the end of the 20th century. Nearly two-thirds of its flow from April through August was spilled rather than passed through generators.[102]

Prototype tests of 40 foot-long screens at John Day showed that more migrating juvenile fish were guided into the bypass system (existing screens were 23 feet long). However, mortality rates were higher with the new screens in place. Mortality could result from increased turbulence – longer screens have a larger surface area and therefore higher velocities – or from debris caught on the screens. Even so, NMFS engineer Steve Rainey cautioned that it was premature to give up on them: "The screens need to be judged on their overall passage survival benefit and the jury is still out."[103]

Extended fish screens



Flip Lip spill deflectors helped to move spill water in a more horizontal pattern to keep water from plunging deeply and to reduce the effects of gas supersaturation on fish.

The higher mortality rate troubled some river users, tribal members in particular. "The extended screens are more finicky than standard screens," said Tom Lorz, Columbia River Inter-Tribal Fish Commission (CRITFC) hydraulic engineer. "Due to the increased flow and debris diverted by these new screens, gatewell openings become clogged more often than with standard screens. And when they become clogged, the system doesn't operate very well. And when it doesn't operate very well, salmon pay the price." Tribal biologists also expressed concern about lamprey eels, which are not strong swimmers and were easily caught on screens. Cleaning brushes that scour the screens every four to six hours were killing eels, the biologists claimed.[104]

Another dam modification to improve fish passage was the introduction of spill deflectors, or "flip lips," to Corps' dams. These devices attached to the downstream face of the spillway and deflected water in a more horizontal pattern. The logic of this design was to keep water from plunging deeply and therefore reduce the effects of gas supersaturation. The Corps undertook a Dissolved Gas Abatement Study to identify ways to reduce TDG levels. A collateral goal was to meet state and federal water quality criteria: TDG should not exceed 110 percent, except when discharges surpass 475,000 cubic feet per second on the Columbia River. The District's primary goal here was

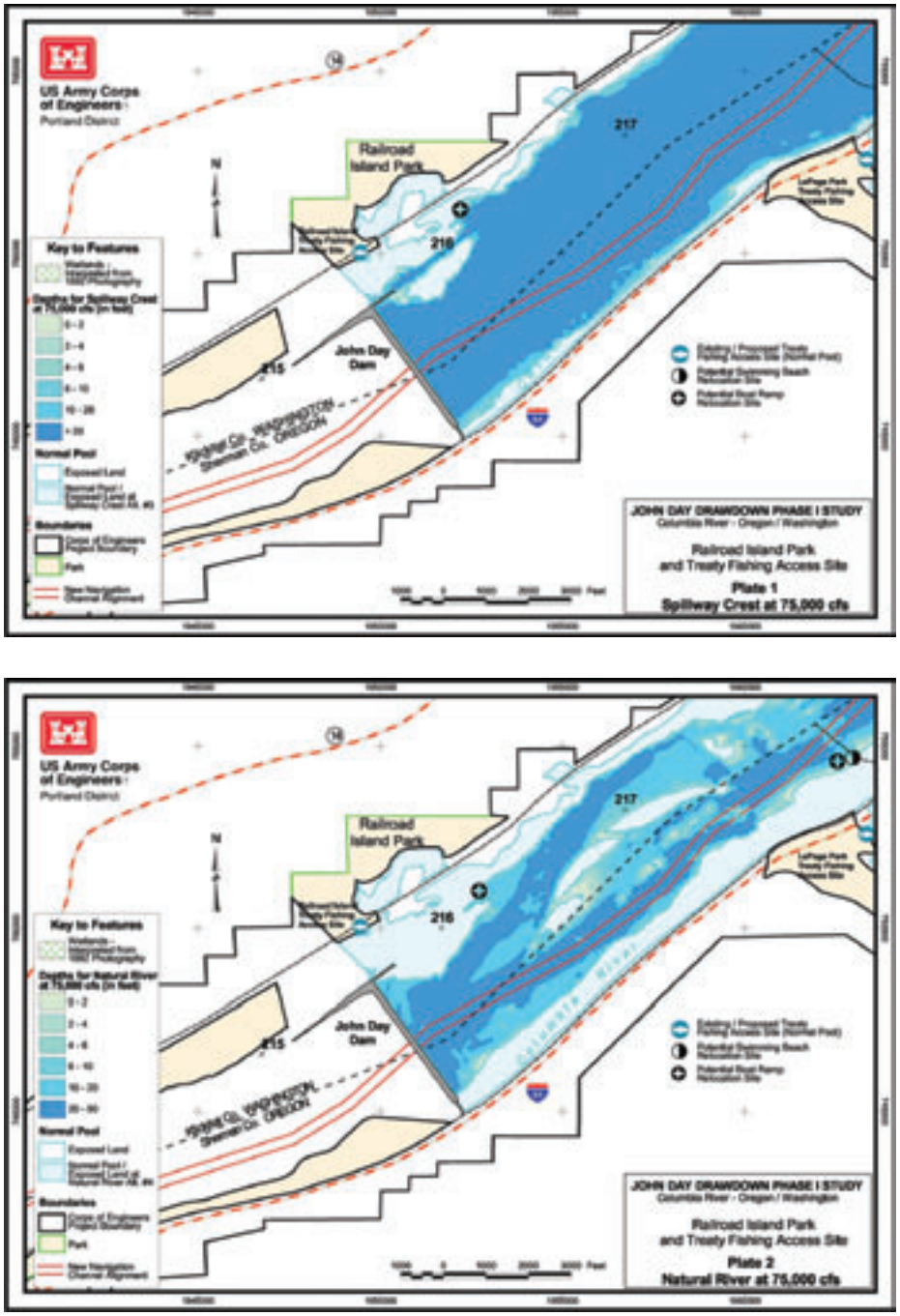
to "reduce gas levels as much as possible, to the extent economically, technically and biologically feasible." In addition to flip lips, Phase I of the study recommended four other alternatives to reduce TDG supersaturation: raised stilling basin, raised tailrace, flip bucket, and revised spillway shape. Physical model studies were underway to investigate hydraulic conditions, and biological concerns were to be addressed by an expert panel.[105]

At John Day, juvenile fish used three methods to bypass the dam: through the turbines, through the juvenile bypass channel, or through the spillway. The spillway was considered safe – about 98 percent survived compared to 85 percent for turbines and 98 percent for bypass facilities. The threat of gas bubble disease from spill passage, however, prompted the installation of flip lips at John Day.[106]

Debating the John Day Drawdown

The ESA listings of Columbia and Snake river salmon stocks during the 1990s prompted a debate over whether the reservoir behind John Day Dam should be lowered or drawn down. In general, plans to restore migratory fish populations garnered attention, but the discussion surrounding the John Day drawdown was especially controversial due to its potential impact on a wide range of economic activities in the Columbia River Basin. The arguments that emerged – both for and against the drawdown – reflected the diversity of interests in the region, emphasizing the inherent challenges in crafting a solution to declining salmon populations.

The John Day Dam, which spans the Columbia River 215 miles upstream from the Pacific Ocean, creates a 76-mile long reservoir – Lake Umatilla. Historically, the area supported some of the most productive fall chinook spawning grounds on the Columbia. The deep waters of the John Day pool covered this habitat, slowing the flow of water down the Columbia.



John Day reservoir maps for Phase I drawdown study based on 1994 hydrosurveys produced by GIS, Survey and Mapping Section of the US Army Corps of Engineers, Portland District.

The migration time of juvenile fish traveling to the ocean increased, leaving salmon more susceptible to disease, predators, and other problems. All reservoirs impede fish migration, but the problem at John Day – the slowest flowing of the river's pools – was particularly acute.[107]

One possible solution to increasing the flow on the Columbia involved lowering the reservoir behind John Day Dam below its normal operating range. Referred to as a "drawdown," this technique decreased the reservoir's width and depth, thereby increasing water velocity and creating a faster journey downriver for salmon. Additional

goals of drawdowns included improving rearing conditions, reducing water temperature and dissolved gas, and restoring spawning habitat.[108]

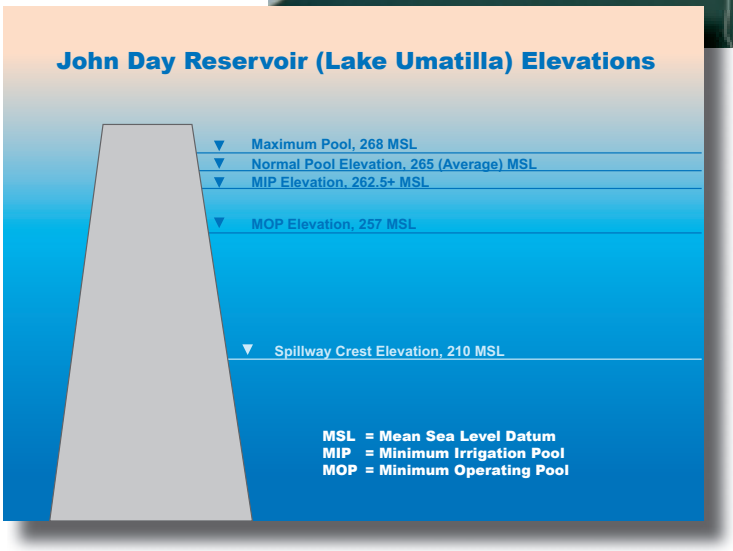
A number of major salmon recovery plans emerged in the 1990s, many of them recommending drawdowns. In 1994, for example, the District prepared a draft study, which included an evaluation of lowering the John Day pool by six feet to an elevation of 257 feet. The District found that even at 257 feet, fish survival would not be enhanced significantly. After reviewing the study, Harza Engineering, an independent consulting group, recommended that the District consider a deep drawdown. The consultants determined that drawing down the elevation to 210 feet would be equivalent to four 33-foot Snake River reservoir drawdowns and would triple the fishery benefits compared to Snake River-only drawdowns.[109]

The NWPPC's salmon recovery plans also considered drawing down the reservoir. In 1994, for example, the agency proposed a modest drawdown of the John Day pool in its fish and wildlife program. Two years later the NWPPC appointed an Independent Science Group to analyze options for enhancing salmon recovery, including drawdowns. As part of its research, the group studied Hanford Reach, a free flowing stretch of the Columbia where chinook populations were thriving. After examining this area and reviewing more than 4,000 scientific studies, the group reached its primary conclusion – salmon need a river. Specifically, they argued that regulating the river's flow and draining reservoirs to establish a network of more natural river segments would increase salmon populations substantially.[110]

To achieve more natural river segments, the group proposed lowering the reservoirs behind John Day and McNary dams, both of which are located below the Hanford Reach. "Before flooding, the area behind John Day was a huge spawning area," explained Jack Stanford, a University of Montana ecologist and member of the team. Furthermore, Stanford explained a drawdown would allow the Hanford Reach riverbed to be flushed clean by the river and begin attracting salmon. "You give these fish half a chance and they'll take it," he said. The scientists also explained that it was important to recreate the river's natural flow patterns as closely as possible. Historically, the spring freshets that swept through the river sustained salmon habitat, replenishing gravel bars and boosting populations of insects that young salmon eat. During the rest of the year, stable flows maintained salmon eggs buried in gravel, as well as insects and plants at the base of the food chain. While the federal government changed the river's

John Day Lock and Dam and Lake Umatilla

Proposed breaching of the dam would allow the natural river to flow and the river level to decrease.



flow in response to the listing of Snake River salmon as endangered, unnatural fluctuations persisted.[111]

The scientific panel emphasized that drawing down reservoirs would create spawning grounds and salmon habitat, but objections to drawdown remained. Throughout the 1990s, a variety of arguments – mostly economic – emerged to counter proponents of drawdown. In particular, drawdown threatened farmers who relied on irrigation and barge and shipping operators who needed a deep river channel for navigation. Dixon Shaver, of Shaver Transportation Company, worried that water levels would become so low that modern barges would not be able to operate on the John Day stretch of the river. "We can't go back to pre-John Day equipment," he explained. "Today's vessels are too big and too long to be shooting the bends and rapids of the old river." Grain growers were also upset by the proposal to lower the reservoir. Jonathan Schlueter, the executive vice president of the Pacific Northwest Grain and Feed Association, said that shipping restrictions would have major impacts on the region. "Five hundred million bushels of wheat a year are exported out of the Columbia," he stated, "and 40 percent of that volume comes by barge." Opponents also expressed concerns about hydropower production and the elimination of recreational areas.[112]

In addition to these general concerns, opponents of drawdown specifically critiqued the Independent Scientific Group's report. In January 1997, the Tri-Cities-Hermiston Group, composed of seven regional utilities and irrigators, had released a report responding to the science team's study. "We do want to support saving the salmon," explained Pamela Harrington, director of communications and marketing for Umatilla Electric Cooperative, "but we don't want to change our lifestyle to the degree that we don't have irrigated agriculture." Russell George, a former manager of the Corps' Reservoir Control Center and the author of the report, argued that a drawdown would decrease power generation and pose a threat to the electrical system's stability. He also discussed drawdown's adverse affects on irrigated agricultural lands, barge traffic, and flood control. "Returning the Columbia River … to the natural river level would have significant economic and environmental impacts on the people of the Pacific Northwest and beyond," George wrote. "[Drawdown] would be a major natural resource policy decision, and such action should be approached with great caution."[113]

Despite these objections, the drawdown debate continued. Following the listings of several species of Snake River fish in the early 1990s, the NMFS Biological Opinion called for a study evaluating the role of a John Day drawdown in salmon recovery. In response, in October 1998 Congress directed the Corps to examine the issue and appropriated $3.7 million for the first phase of the study. Congress ordered the agency to limit phase I to two options for lowering the reservoir: spillway crest level and natural river level. The purpose of the study was to evaluate the potential benefits for fish and wildlife of these two drawdown scenarios and to analyze the social and economic affects of these actions. Congress also told the Corps to recommend whether to proceed to phase II of the study. "As we began this study," explained Stuart Stanger, "our goal was to gather enough facts on effects, both biological and economic, to make a sound recommendation to Congress. We wanted to either be able to recommend dropping all further study of lowering the John Day reservoir off the regional agenda because of what we learned, or recommend further study of drawdown, which would include evaluating an expanded list of drawdown alternatives."[114]

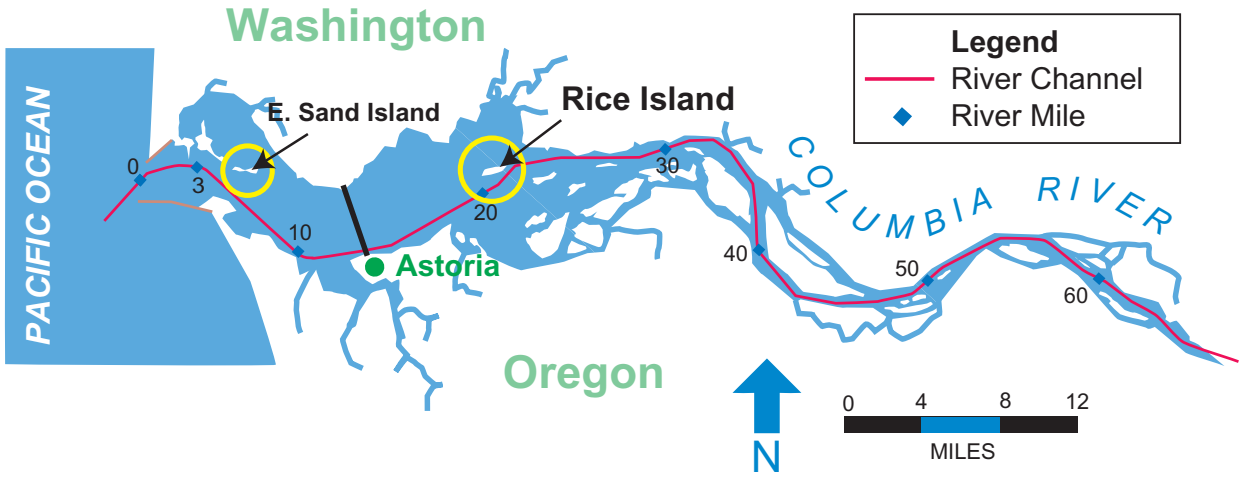
On September 18, 2000 the District released its John Day Drawdown Phase I Study Final Report. As directed, the agency's study evaluated spillway crest level and natural river level (breaching), each with and without flood control measures. After analyzing biological, economic, and social affects, the District's "biological studies show that drawdown would contribute little to the survival and recovery of listed Snake River fish." It therefore recommended to Congress that "no further study is necessary to allow Congress and the Region to make a decision regarding drawdown of the John Day reservoir, or removal of the John Day Dam." This recommendation eliminated John Day drawdown from further consideration.

While the Corps study recommended against drawdown as an option, the question remained of how to best revive salmon populations in the Columbia River Basin. Amidst the complexity of the salmon debate one thing remained clear – there would be no quick and easy answers. "All the tweaking and fixes in technology won't get us near the goals for salmon recovery we've set," observed Witt Anderson, the District's manager for salmon recovery plans. "So the decision is this: Do we do something dramatic or do we give up on significantly reversing the decline of salmon runs? We probably are running out of middle ground."[115]

The Trouble With Terns

While hydropower and salmon facilities dominated Portland District operations, the District was also active in other areas during the years 1980-2000, most notably its ongoing navigation mission on the Columbia River. As Chapter Two detailed, dredging was a large undertaking -- and one that attracted considerable controversy. Since the 1960s, dredge spoil has been deposited on Rice Island, a Corps-made sand spit located 21 miles upriver from the mouth of the Columbia. This barren island attracted Caspian Terns and became an example of an unintended consequence.

Caspian terns – seabirds that consume large numbers of salmon smolts – first arrived on Rice Island in 1986, drawn to the easy food supply, a lack of predators, and favorable nesting conditions



(terns prefer sandy areas free of vegetation). By the late 1990s, nearly 20,000 terns called the island home during the nesting season, making it the largest Caspian tern colony in the world.[116] Terns "jammed in there like cord wood" became a serious concern because their significant numbers required a large food supply of young salmon.[117] During the smoltification process, the transition from fresh to saltwater, young salmon prefer the upper water column. They are even more concentrated in estuaries where the lens of freshwater rides on top of the incoming saltwater.

This schooling behavior, together with thousands of birds looking for a meal, resulted in the consumption of staggering numbers of smolts. Researchers estimated that the colony used Rice Island as a staging area to consume 6 to 25 million young salmon annually, or as many as 25 percent of salmonids that reach the Columbia River estuary. The tern problem was first discovered by birders who noticed PIT tags strewn over the island. The tags had been implanted in juvenile hatchery salmon.[118]

A number of agencies and fishing groups, including the Corps, wanted to remove the salmon-decimating birds from Rice Island. The USFWS and the Audubon Society, however, defended the tern's presence in the area, citing the International Migratory Bird Treaty Act. Despite agency differences, in February 1999 an interagency team launched a compromise plan that tried, within the limits of environmental law, to make the island inhospitable to terns. It was an unprecedented seabird relocation effort. Decoys and recorded tern calls played over loudspeakers, attempting to lure returning terns to East Sand Island, their former nesting site located 17 miles downstream from Rice Island. District personnel hoped a colony situated nearer the ocean would expand the terns' diet to include perch and herring. The District tried a number of methods to dissuade terns from returning to Rice: erecting bald eagle scarecrows, sowing winter wheat to establish dense vegetation cover, plastic mesh fencing to discourage nesting, and simply running them off. It was "comparable

Nesting Caspian Terns

Terns consume large numbers of smolts.

Most terns did nest on East Sand Island in 2000, due to habitat modification conducted on Rice Island.

to chasing a chicken around in the old barn yard," recalled Geoff Dorsey of the Corps.[119]

Early relocation efforts were largely unsuccessful, and the controversy intensified. "Rice Island has been there since the early 1960s and will likely be there forever," said Al Clark, NMFS wildlife biologist. "Terns don't like vegetation where they nest and a dredge spoil island is perfect for that. If the Corps stopped dumping there, vegetation would grow and there'd be no more nest."[120] A commercial fisherman expressed a sentiment felt by many river users: "Get some raccoons, or possums, or anything, and put them right on the island, and that would take care of it, instead of spending all this money trying to move them from A to B." Accordingly, some frustrated members of the public released rodents on the island to encourage the terns to relocate.[121]

Some observers saw absurdity and humor in this unprecedented situation. "Feed the tern pellets of fish laced liberally with marijuana," suggested one letter to the editor, because "the terns would no longer be interested in work, which for a tern is catching fish. The road to salmon recovery is a rocky one but along that road we should leave no tern unstoned."[122] Another opinion piece suggested an alternate remedy: "If the Corps of Engineers can create an island, why can't they lower one a few feet? Let the terns nest under water for a few years. That should discourage them."[123]

Work on the tern issue continued. In 1998 the Caspian Tern Working Group (CTWG) had been formed to develop short and long-term goals for reducing predation. The CTWG included a host of agencies: Corps, NMFS, USFWS, BPA, Oregon State University, CRITFC, Oregon Fish and Wildlife, Washington Fish and Wildlife, and Idaho Fish and Game. In April of 1999, before the juvenile fish out-migration, the CTWG had implemented a pilot study, intended to increase juvenile salmonid survival and provide information for development of a long-term management plan. The study was partially successful – 1,400 pairs of Caspian terns nested on East Sand Island.[124]

On September 5, 1999, the NMFS issued a Biological Opinion requiring the Corps to prevent Caspian terns from nesting on Rice Island in 2000. The CTWG continued to meet and discuss the relocation of the Caspian tern colony in 1999 and 2000. The result of these discussions was the FY 2000 Tern Management Plan. The District prepared a draft Environmental Assessment (EA) on a proposed action to implement this plan. The Corps proposed preventing terns from nesting on Rice Island through active and passive discouragement, including the taking of up to 300 tern eggs and maintaining approximately four acres of Caspian tern nesting habitat at East Sand Island. After circulating the draft EA for public and agency review, a Finding of No Significant Impact was signed on March 17, 2000. Workers undertook plans on East Sand Island, and research activities, supported by the BPA, began on Rice Island.[125]

Meanwhile, the National Audubon Society and three other groups had sued the Corps and the USFWS on behalf of the terns, saying the United States was harassing the birds in violation of the Migratory Bird Act. A federal judge in Seattle first issued a temporary restraining order in April of 2000, forbidding any harassment of the birds. She then issued a permanent injunction in August of 2001, prohibiting both tern harassment and efforts to make East Sand Island tern-friendly.[126]

Most terns did nest on East Sand Island in 2000, apparently due to habitat modification conducted on Rice and East Sand islands prior to

the injunction. An estimated 9,100 breeding pairs nested on East Sand; on Rice there were approximately 580 pairs. Preliminary research showed salmonids made up 44 percent of the diet of East Sand Island tern; salmonids composed 91 percent of the diet of Rice Island terns. Total consumption by terns was about 7.3 million smolts, or 6.4 percent of the estimated 115 million ocean-bound smolts that reached the estuary. Relocation of terns in FY 2000, therefore, resulted in six million fewer salmon being consumed than if all the terns had returned to Rice Island. The result of this effort was that Caspian terns could be moved successfully from Rice Island to East Sand Island without adverse impacts to the terns, while significantly reducing consumption of juvenile salmonids.[127]

The CTWG continued to meet periodically, urging the preparation of a long-term management plan for Caspian terns and other piscivorous birds in the Columbia River. No agency, however, stepped forward to prepare such a plan. In 2001, therefore, the Corps again prepared an EA for management of Caspian Terns in order to respond to the NMFS 1999 Biological Opinion. The Corps' proposed action covered two years in the hope that an appropriate agency would prepare a long-term plan, with required environmental documents, in the interim. The major actions proposed by the Corps included preparation of a minimum of four acres of Caspian tern nesting habitat on East Sand Island and passive and active harassment on the former tern nesting area on Rice Island. Because these types of activities had been described and commented on in previous EAs, the Corps did not issue a draft EA but proceeded to a Finding of No Significant Impact with 30-day notification. The Corps' EA acknowledged that unless the restraining order was rescinded, the agency could take no action on Rice Island.[128]

Conclusion

The controversy surrounding the terns demonstrated the complexities facing the District during the late 20th and early 21st centuries. This issue, along with the question of how to save declining runs of salmon, reflected the nation's changing values as well as the increasing number of interests involved in the region's rivers during the years 1980-2000.

Balancing these interests became one of the District's most consuming tasks, and its personnel devoted considerable resources to saving endangered salmon. Not everyone viewed this effort as successful. According to historian Joseph Taylor, "Since 1981, when Congress made the Bonneville Power Administration give salmon equal consideration when managing Columbia River dams, the region has invested three billion dollars to save these fish, and the only thing everyone can agree upon is that the effort has largely failed."[129] The Corps viewed the situation differently. "We spent over a billion dollars, or two billion dollars, and what do we have to show for it? Nothing. Well, that's bunk," said Brigadier General Griffin in 1999. "You know, we've doubled fish passage efficiency. We have more than cut in half the lethality of these dams that these fish go through. What's the cost benefit? Well, if this was a cost benefit business, we probably wouldn't be doing a lot of this, but that's not what recovering endangered species is about. I mean, it's something beyond just dollars and cents here."[130]

Endnotes

[1] William A. Jones, Salmon Fisheries of the Columbia River, 50th Cong., 1st sess., 1888, S. Exec. Doc. 123, SS 2510, p. 32.

[2] Marla Williams and Jon Simon, "Last Chance for Salmon," *The Seattle Times/Post Intelligencer*, March 31, 1991, p. A1.

[3] Jon Savelle, "It's not easy sorting out salmon puzzle," *Seattle Daily Journal of Commerce*, November 2, 1999.

[4] U.S. Bureau of Reclamation, Pacific Northwest Region, "Columbia/Snake River Salmon and Steelhead," accessed at http://www.pn.usbr.gov/project/esa.shtml, on August 15, 2002.

[5] Williams and Simon, "Last Chance for Salmon," p. A1.

[6] Hal Spencer, "ESA Listing Means Massive Changes Ahead for State," *Seattle Daily Journal of Commerce*, March 16, 1999.

[7] Bruce Barcott and Keith Kloor, "Saved by Salmon?" *Audubon*, May/June 1999, p. 14.

[8] John Hughes, "Snake dam report joins salmon debate," *Seattle Daily Journal of Commerce*, December 20, 1999.

[9] Williams and Simon, "Last Chance for Salmon," p. A1.

[10] Jerry Weaver, Interview with Lisa Mighetto, Portland, Oregon, October 18, 2001.

[11] Tom Davis, Interview with Lisa Mighetto, Portland, Oregon, October 18, 2001.

[12] Colonel Eric T. Mogren, Interview with Lisa Mighetto, Portland, Oregon, May 7, 2001. Hereafter cited as Mogren Interview.

[13] Bill Crampton, "Dysfunctional Feds Must Get Salmon Act Together," *Seattle Times Editorial*, November 25, 1998.

[14] Recovery Strategies Review, Executive Summary, NWPPC website.

[15] Mogren Interview.

[16] "Treaty Tribes and the ESA," 2000.

[17] Mogren Interview.

[18] Supplementary interview with Douglas Arndt, Oral History of Brigadier General Robert H. Griffin, by Michael O'Rourke for the Oregon Historical Society, July 12, 1999, p. 4.

[19] Bruce Allen, "Dubious audience grills corps over fish management," *The Dalles Chronicle*, September 29, 1997, U.S. Army Corps of Engineers, Portland District, Iron Mountain Records, Information Management Center, Location 277, cc 19150401, Box 1 of 4, Folder Fish 1997.

[20] "Major Threats and Impacts to Pacific Salmonids," Office of Protected Resources, National Marine Fisheries Service website, accessed October 12, 2001.

[21] Connie Sue Manos Martin, "Threatened Species in an Urban Environment: Chinook salmon and the 4(d) Rule," *Seattle Daily Journal of Commerce*, June 29, 2000.

[22] U.S. Bureau of Fisheries, *Annual Report*, 1913, p. 5.

[23] John N. Cobb, Pacific Salmon Fisheries (Washington, D.C.: Government Printing Office, 1917), p. 94.

[24] Joseph E. Taylor III, *Making Salmon: An Environmental History of the Northwest Fisheries Crisis* (Seattle: University of Washington Press, 1999).

[25] Fisheries Steering Committee of the Columbia Basin Inter-Agency Committee, "The Fisheries and Multipurpose Development of the Columbia River," Columbia Basin Inter-Agency Committee, University of Washington Archives, January 3, 1955, Accession # 1659-2, Box 26, Folder 6, pp. 18-19.

[26] William Dietrich, Northwest Passage, *The Great Columbia River* (New York: Simon & Schuster, 1995), p. 331.

[27] Anthony Netboy, *The Columbia River Salmon and Steelhead Trout: Their Fight for Survival* (Seattle: University of Washington Press, 1980), p. 116; Richard White, The Organic Machine (New York: Hill and Wang, 1995), p. 88.

[28] Lisa Mighetto and Wesley J. Ebel, *Saving the Salmon: A History of the U.S. Army Corps of Engineers' Efforts to Protect Anadromous Fish on the Columbia and Snake Rivers* (Portland: U.S. Army Corps of Engineers, 1994), pp. 152-153.

[29] Netboy, The Columbia River Salmon and Steelhead Trout: Their Fight for Survival, p. 123.

[30] Jessica Maxwell, "How to Save a Salmon," *Audubon* 96 (July/August 1994): 28-33, p. 114.

Endnotes

[31] John Kranda, Interview with Lisa Mighetto and Jill Schnaiberg, Portland, Oregon, August 16, 2001.

[32] Oral History of Brigadier General Robert H. Griffin Commander, US Army Corps of Engineers, NWD (1996-1999), Interview by Michael O'Rourke for the Oregon Historical Society, July 12, 1999, p. 51.

[33] Dietrich, *Northwest Passage, The Great Columbia River*, pp. 337-338.

[34] Sarah Thomas, "Evaluating Technologies for Improved Fish Passage," *Salmon Passage Notes*, January 1998.

[35] Jonathan Brinckman, "Churning up Trouble for Fish Below Dams," *The Oregonian*, March 7, 1997, U.S. Corps of Engineers, Portland District, Iron Mountain Records, Information Management Center, Location 277, cc 20150409, Box 2 of 4, Folder Fish 97.

[36] Dan Spatz, "Gas Poisoning Blamed for John Day Fish Kill," The Chronicle, June 27, 1997, U.S. Corps of Engineers, Portland District, Iron Mountain Records, Information Management Center, Location 277, cc 20150409, Box 2 of 4, Folder Fish 97.

[37] Joan Laatz and Roberta Ulrich, "Spillway plan Aims to Save Salmon," *The Oregonian*, May 10, 1994, p. 1, U.S. Corps of Engineers, Portland District, Iron Mountain Records, Information Management Center, Location 277, cc 19150401, Box 1 of 4, Folder Fish 1994 Jan–May.

[38] Brinckman, "Churning up Trouble for fish below dams."

[39] Jonathan Brinckman, "EPA adds new twist to dispute on salmon," *The Oregonian*, November 7, 1997, p. D1, U.S. Corps of Engineers, Portland District, Iron Mountain Records, Information Management Center, Location 277, cc 19150401, Box 1 of 4, Folder Fish 1997.

[40] Brinckman, "EPA Adds New Twist to Dispute on Salmon."

[41] Thomas Bennett, "Heat has Fish Frying in Columbia River," *Hood River News*, August 1, 1998, U.S. Corps of Engineers, Portland District, Iron Mountain Records, Information Management Center, Location 277, cc 20150409, Box 2 of 4, no Folder.

[42] Bennett, "Heat has fish frying in Columbia River."

[43] "River Temperatures Hit Fatal Level for Fish," *Daily Journal of Commerce*, July 31, 1998, U.S. Corps of Engineers, Portland District, Iron Mountain Records, Information Management Center, Location 277, cc 19150401, Box 1 of 4, Folder Fish 1998; see also Mogren Interview.

[44] "Cougar Lake WTC Project, Final Alternatives Report for Fish Passage," Task Order No. 15, August 4, 2000, CH2M Hill/Montgomery Watson Joint Venture, U.S. Army Corps of Engineers, Portland District, Technical Library.

[45] Kingsley G. Weber and Lyle G. Schedin, "Water Temperatures of the Willamette River System, 1950," Special Scientific Report: Fisheries No. 69, U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, Portland District, Technical Library.

[46] "Salmon need Corps' help: Control temperature in McKenzie," *Eugene Register-Guard Editorial*, April 1998 News, Willamette Riverkeeper, accessed at www.willamette-riverkeeper.org/apr98.html, on November 1, 2001.

[47] "Salmon need Corps' help: Control temperature in McKenzie," *Eugene Register-Guard Editorial*.

[48] Lance Robertson, "Dam Towers Could Aid Salmon," *Eugene Register-Guard*, January 16, 1995, PAO, 1105 General COE Planning Correspondence, Willamette Temperature Studies.

[49] Associated Press, "Corps Plans Towers on McKenzie Dams," *The Oregonian*, January 17, 1995, U.S. Army Corps of Engineers, Portland District, 1105 General COE planning correspondence, Willamette Temperature Studies.

[50] Associated Press, "Corps plans towers on McKenzie dams."

[51] "Construction contract awarded for Cougar Dam," News Release, June 22, 2000, Portland District, U.S. Army Corps of Engineers, accessed at https://www.nwp.usace.army/mil/pa/news/archive/2000/00-114.htm, on November 1, 2001.

[52] Lance Robertson, "Towers May Be Chinook's Best Hope."

[53] "Cougar Lake WTC Project, Final Alternatives Report for Fish Passage," Task Order No. 15, August 4, 2000, CH2M Hill/Montgomery Watson Joint Venture, U.S. Army Corps of Engineers, Portland District, Technical Library.

[54] John Kranda, Interview with Lisa Mighetto and Jill Schnaiberg, Portland, Oregon, August 16, 2001. Hereafter cited as Kranda Interview.

Endnotes

[55] Steve Myers, "Salmon Center Dedication Draws Protestors," East Oregonian, September 2, 1994, U.S. Army Corps of Engineers, Portland District, Iron Mountain Records, Information Management Center, Location 277, cc 19150401, Box 1 of 4, Folder Fish 1994 June-Dec.

[56] U.S. Army Corps of Engineers, News Release, March 10, 1989, Federal Records Center, Pacific Alaska Region, RG 77, Installation History Files, Accession 77980005, Box 24 of 51.

[57] Gerald Collins, Interview with Wesley J. Ebel and Lisa Mighetto, Seattle, August 31, 1993.

[58] Gay Monteverde, "Saving Salmon: The Role of Research," *Salmon Passage Notes*, U.S. Army Corps of Engineers, North Pacific Division, June 1993, p. 1.

[59] Northwest Power Planning Council Background, NWPPC website, accessed at www.nwcouncil.org/about/background.htm, on October 11, 2001.

[60] Northwest Power Planning Council, Columbia River Basin Fish and Wildlife Program, Portland, 1987, p. 19.

[61] "The Water Budget and Flow Augmentation," *Salmon Passage Notes*, U.S. Army Corps of Engineers, North Pacific Division, March 1993, pp. 1-2.

[62] Fish Passage Center of the Columbia Basin Fish and Wildlife Authority, *Fish Passage Center Annual Report*, Portland, 1984.

[63] Fish Passage Center website, accessed at http://www.fpc.org/Biography.html, on October 12, 2001.

[64] Fish Passage Technologies: Protection at Hydropower Facilities, OTA-ENV-641, Washington, D.C., U.S. Government Printing Office, September 1995, accessed at http://govinfo.library.unt.edu/ota/Ota_1/DATA/1995/9519.PDF, on October 30, 2001.

[65] John Hughes, "Snake Dam Report Joins Salmon Debate," *Seattle Daily Journal of Commerce* online edition, December 20, 1999, accessed at www.djc.com/news/enviro/11001897.html, on October 24, 2001.

[66] Bruce Allen, "Bpa Defends Consideration Of Low-Flow" *The Dalles Chronicle*, February 1, 1998, U.S. Army Corps of Engineers, Portland District, Iron Mountain Records, Information Management Center, Location 277, cc 20150409, Box 2 of 4, no Folder.

[67] Gary Johnson, Interview with Lisa Mighetto, Portland, April 17, 2002. Hereafter cited as Johnson Interview.

[68] Independent Scientific Review Panel Background, Northwest Power Planning Council website, accessed at www.nwcouncil.org/fw/isrp_background.htm, on October 11, 2001.

[69] U.S. Army Corps of Engineers, "Corps Works to Find Answers to Improved Fish Passage Through New Smolt Sampling and Monitoring Facility at John Day Dam," News Release, August 19, 1997, U.S. Army Corps of Engineers, Portland District, PAO, 870-5b, Installation History Files, John Day Lock and Dam, Correspondence.

[70] Johnson Interview.

[71] Kranda Interview.

[72] Dawn M. Edwards, "Fish passage may be aided by surface bypass system," *Corps'pondent*, April 1995, Portland District, Iron Mountain Records, information Management Center, Location 277 cc 20150409, Box 1 – Binders and Books, Corps'pondent 1995, 1996.

[73] Dawn M. Edwards, "Fish Passage May be Aided by Surface Bypass System," *Corps'pondent*, April 1995, Portland District, Iron Mountain Records, Information Management Center, Location 277 cc 20150409, Box 1 – Binders and Books, *Corps'pondent* 1995, 1996.

[74] At John Day, for example, selective spills were used to pass juvenile salmon over the dam. Sonar monitoring equipment indicated the movement of large numbers of smolts; this eliminated the waste of water, and therefore power, that would occur with constant spilling. See Gretchen Starke, "Project Designed with Fish in Mind," n.d., Federal Records Center Pacific Alaska Region, RG 77, Accession 77-95-0185, Corps Newsletter, Box 1 of 2.

[75] Sarah Thomas, "Evaluating Technologies for Improved Fish Passage," *Salmon Passage Notes*, January 1998, accessed at www.nwd.usace.army.mil/ps/notes/Jan98.pdf on October 5, 2001. See also Edwards, "Fish passage may be aided by surface bypass system."

[76] Dawn M. Edwards, "Fish Passage May be Aided by Surface Bypass System," *Corps'pondent*, April 1995, Portland District, Iron Mountain Records, Information Management Center, Location 277 cc 20150409, Box 1 – Binders and Books, Corps'pondent 1995, 1996.

[77] Sarah Thomas, "Evaluating Technologies for Improved Fish Passage," *Salmon Passage Notes*, January 1998, accessed at www.nwd.usace.army.mil/ps/notes/Jan98.pdf on October 5, 2001. See also

Endnotes

Edwards, "Fish Passage May be Aided by Surface Bypass System."

[78] Dawn M. Edwards, "Fish Passage May be Aided by Surface Bypass System," *Corps'pondent*, April 1995, Portland District, Iron Mountain Records, Information Management Center, Location 277 cc 20150409, Box 1 – Binders and Books, *Corps'pondent* 1995, 1996.

[79] Sarah Thomas, "Evaluating Technologies for Improved Fish Passage," *Salmon Passage Notes*, January 1998, accessed at www.nwd.usace.army.mil/ps/notes/Jan98.pdf on October 5, 2001. See also Edwards, "Fish Passage May be Aided by Surface Bypass System."

[80] "Minimum Gap Runner Technology," Information Paper, July 1999, U.S. Army Corps of Engineers, Portland District, PAO, 360 – Surface Bypass Information Papers.

[81] Sarah Thomas, "Evaluating Technologies for Improved Fish Passage," *Salmon Passage Notes*, January 1998, accessed at www.nwd.usace.army.mil/ps/notes/Jan98.pdf on October 5, 2001. See also Edwards, "Fish Passage May be Aided by Surface Bypass System."

[82] "Minimum Gap Runner Technology," Information Paper, July 1999, U.S. Army Corps of Engineers, Portland District, PAO, 360 – Surface Bypass Information Papers.

[83] Bruce Allen, "Monitoring station based at John Day," *The Dalles Chronicle*, August 26, 1997, Portland District, Iron Mountain Records, Information Management Center, Location 277 cc 19150401, Box 1 of 4, Folder Fish 1997.

[84] "John Day Facility May Hold Answers to Declining Salmon," *Hood River News*, August 27, 1997, p. C12, Portland District, Iron Mountain Records, Information Management Center, Location277, cc 19150401, Box 1 of 4, Folder Fish 1997.

[85] Dawn M. Edwards, "Corps Projects Save Endangered Species," *Corps'pondent*, June 1994, U.S. Army Corps of Engineers, Portland District, Iron Mountain Records, Information Management Center, Location 277, BB 34140108, Box 2 of 3, Copies of *Corps'pondent.*

[86] Sandra Walters, "Restructuring to Save Fish," Camas-Washougal Record, April 19, 1994, Portland District, Iron Mountain Records, Information Management Center, Location 277, cc 19150409, Box 1 of 4, Folder Fish 1994 Jan-May.

[87] Dawn M. Edwards and Heidi Y. Brown, "Hines explains fisheries involvement," *Corps'pondent*, September, 1992, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-95-0183, Corps Newsletter, Box 1 of 2.

[88] Kranda Interview.

[89] Kranda Interview.

[90] Jim Simon, "Do endangered salmon equal endangered dams?" *Seattle Times*, April 20, 1997, accessed at http://archives.seattletimes.nwsource.com/, on October 12, 2001.

[91] Mighetto, Lisa and Wesley J. Ebel, *Saving the Salmon: a History of the U.S. Army Corps of Engineers' efforts to protect anadromous fish on the Columbia and Snake Rivers*.

[92] Mighetto and Ebel, *Saving the Salmon: a History of the U.S. Army Corps of Engineers' efforts to protect anadromous fish on the Columbia and Snake Rivers*.

[93] National Marine Fisheries Service, Preliminary Evaluation of the Bonneville Juvenile Bypass System – Second Powerhouse, Seattle: U.S. Army Corps of Engineers, 1992.

[94] Sarah Thomas, "Evaluating Technologies for Improved Fish Passage," *Salmon Passage Notes*, January 1998, accessed at www.nwd.usace.army.mil/ps/notes/Jan98.pdf on October 5, 2001. See also Edwards, "Fish Passage May be Aided by Surface Bypass System."

[95] Arndt Interview, p. 3.

[96] U.S. Army Corps of Engineers, "Juvenile Fish Bypass Improvements, Bonneville Lock and Dam," Information Paper, April 2000, U.S. Army Corps of Engineers, Portland District, PAO, 360 – Information Papers, 2000.

[97] Joan Laatz Jewett, "Bypass Will Pipe Young Fish Past Dam," *The Oregonian*, June 26, 1998, Portland District, Iron Mountain Records, Information Mnagement Center, Location 277, cc 20150409, Box 2 of 4, no Folder.

[98] U.S. Army Corps of Engineers, "Juvenile Fish Bypass Improvements, Bonneville Lock and Dam," Information Paper, April 2000, U.S. Army Corps of Engineers, Portland District, PAO, 360 – Information Papers, 2000.

[99] Jewett, "Bypass Will Pipe Young Fish Past Dam."

Endnotes

[100] Bruce Allen, "Monitoring station based at John Day," *The Dalles Chronicle,* August 26, 1997, Portland District, Iron Mountain Records, Information Management Center, Location 277 cc 19150401, Box 1 of 4, Folder Fish 1997.

[101] U.S. Army Corps of Engineers, "Juvenile Fish Bypass Improvements, Bonneville Lock and Dam," Information Paper, April 2000, U.S. Army Corps of Engineers, Portland District, PAO, 360 – Information Papers, 2000.

[102] Bruce Allen, "Corps Tests Artificial Shore to Guide Fish," *The Dalles Chronicle*, April 1, 1998, p. A1, Portland District, Iron Mountain Records, Information Management Center, Location 277, cc 20150409, Box 2 of 4, no Folder.

[103] U.S. Army Corps of Engineers, "Corps and National Marine Fisheries Service Test Screens at John Day," *News Release*, May 27, 1999, U.S. Army Corps of Engineers, Portland District, PAO, 870-5b, Installation History Files, John Day Lock and Dam, Fish.

[104] Bruce Allen, "Dam Screen Tests Gets Poor Marks," *The Dalles Chronicle*, June 16, 1998, Portland District, Iron Mountain Records, Information Management Center, Location 277, cc 20150409, Box 2 of 4, no Folder.

[105] U.S. Army Corps of Engineers, "'Flip Lips' to help reduce gas levels in water at John Day Dam," Information Paper, July 1997, U.S. Army Corps of Engineers, Portland District, PAO, 870-5b, Installation History Files, John Day Lock and Dam, Correspondence.

[106] U.S. Army Corps of Engineers, "'Flip Lips' to help reduce gas levels in water at John Day Dam," Information Paper, July 1997, U.S. Army Corps of Engineers, Portland District, PAO, 870-5b, Installation History Files, John Day Lock and Dam, Correspondence.

[107] Thomas Bennett, "Barge Firms, Conservationists at Odds Over Dam Drawdown," *Hood River News*, April 5, 1997, Portland District, Public Affairs Office, 870-5b John Day Lock and Dam, clips; U.S. Army Corps of Engineers, Portland District, "Corps Recommends no Further Study of Drawdown," News Release, September 18, 2000, accessed at https://www.nwp.usace.army.mil/pa/news/archive/2000/00%D168.htm, on July 3, 2001.

[108] Bruce Allen, "Officials Eye John Day Drawdown Cost to Region," Chronicle, March 11, 1998, Portland District, Public Affairs Office, 870-5b John Day Lock and Dam, clips; U.S. Army Corps of Engineers, Portland District, "Corps Recommends no Further Study of Drawdown," News Release, September 18, 2000, accessed at https://www.nwp.usace.army.mil/pa/news/archive/2000/00%D168.htm, on July 3, 2001.

[109] Associated Press, "Drawdown Proposal Alarms River Users," *The Mail Tribune*, April 20, 1994, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 19150401, Box 1, Folder: Fish 1994 Jan-May.

[110] Sandi Doughton, "Return to the River," Tacoma News Tribune, December 19, 1996, Portland District, Public Affairs Office, 870-5b John Day Lock and Dam, clips.

[111] Doughton, "Return to the River."

[112] Doughton, "Return to the River"; Thomas Bennett, "Barge Firms, Conservationists at Odds Over Dam Drawdown," *Hood River News*, April 5, 1997, Portland District, Public Affairs Office, 870-5b John Day Lock and Dam, clips.

[113] Theresa Goffredo, "Utilities, Irrigators Rebuke Drawdown Idea," *Tri-City Herald*, January 9, 1997, Portland District, Public Affairs Office, 870-5b, Installation History Files, John Day Lock and Dam, Fish.

[114] U.S. Army Corps of Engineers, Portland District, "Corps Recommends no Further Study of Drawdown," *News Release*, September 18, 2000, accessed at https://www.nwp.usace.army.mil/pa/news/archive/2000/00%D168.htm, on July 3, 2001; U.S. Army Corps of Engineers, Portland District, "John Day Drawdown Phase 1 Study," Information Paper, March 2000, Public Affairs Office, 1105 General COE Planning Correspondence John Day Drawdown, John Day Drawdown Phase 1 Study – Info. Paper.

[115] Jim Simon, "Do Endangered Salmon Equal Endangered Dams?" *Seattle Times*, April 20, 1997, accessed at http://archives.seattletimes.nwsource.com/, on October 12, 2001.

[116] Rob Taylor, "Terns Defy Efforts to Protect Salmon," *Seattle Post-Intelligencer,* May 24, 1999, p. 1, U.S. Corps of Engineers, Portland District, PAO, 870-5b, History Installation Files, Caspian Terns.

[117] Jonathan Nelson, "Salmon-Devouring Terns Prove Tough Opponents for Biologists," *The Oregonian*, June 1, 1999, U.S. Corps of Engineers, Portland District, PAO, 870-5b, History Installation Files, Caspian Terns.

Endnotes

[118] Andre Stepankowsky, "200 Terns Take Biologists' Bait," *The Daily News,* April 12, 1999, U.S. Corps of Engineers, Portland District, PAO, 870-5b, History Installation Files, Caspian Terns.

[119] KATU-TV Channel 2 Portland, "Human Scarecrows for Army Corps," Moba Media, March 1, 2000, U.S. Corps of Engineers, Portland District, PAO, 870-5b, History Installation Files, Caspian Terns. See also Stepankowsky, "200 Terns Take Biologists' Bait," and Taylor, "Terns Defy Efforts to Protect Salmon."

[120] Ed Hunt, "Seabirds Take Big Bite out of Salmon, Scientists Discover," *The Chinook Observer*, May 13, 1997, p. 1, U.S. Corps of Engineers, Portland District, Iron Mountain Records, Information Management Center, Location 277, cc 20150409, Box 2 of 4, Folder Fish 97.

[121] Oregon Public Broadcasting Radio, "Future of Dams Unclear," Moba Media, December 29, 1999, U.S. Corps of Engineers, Portland District, PAO, 870-5b, History Installation Files, Caspian Terns.

[122] Art L. Seamans, "To Save Salmon, Get Birds High," Letter to the Editor, *Spokesman Review*, December 16, 1999, U.S. Corps of Engineers, Portland District, PAO, 870-5b, History Installation Files, Caspian Terns.

[123] Roger Pond, "A Tern for the Worse," *Agri-Times* NW, June 18, 1999, U.S. Corps of Engineers, Portland District, PAO, 870-5b, History Installation Files, Caspian Terns.

[124] Randall J. Butler, "Caspian Tern Relocation FY2001-2002 Management Plan, Lower Columbia River, Oregon," Decision Document, U.S. Army Corps of Engineers, Portland District, accessed at https://www.nwp.usace.army.mil/pm/e/images/CT2001_dec_doc.pdf on October 19, 2001.

[125] Randall J. Butler, "Caspian Tern Relocation FY2001-2002 Management Plan, Lower Columbia River, Oregon," Decision Document, U.S. Army Corps of Engineers, Portland District, accessed at https://www.nwp.usace.army.mil/pm/e/images/CT2001_dec_doc.pdf on October 19, 2001.

[126] Brinckman, Jonathan, "Tern Relocation Turns Out Popular," *The Oregonian*, May 16, 2002.

[127] Randall J. Butler, "Caspian Tern Relocation FY2001-2002 Management Plan, Lower Columbia River, Oregon," Decision Document, U.S. Army Corps of Engineers, Portland District, accessed at https://www.nwp.usace.army.mil/pm/e/images/CT2001_dec_doc.pdf on October 19, 2001.

[128] Randall J. Butler, "Caspian Tern Relocation FY2001-2002 Management Plan, Lower Columbia River, Oregon," Decision Document, U.S. Army Corps of Engineers, Portland District, accessed at https://www.nwp.usace.army.mil/pm/e/images/CT2001_dec_doc.pdf on October 19, 2001.

[129] Taylor, *Making Salmon: An Environmental History of the Northwest Fisheries Crisis,* p. 3.

[130] Griffin Interview, p. 50.

Responding to Emergencies

U.S. Geological Survey photo by Robert Krimmel

Chapter Five
Responding to Emergencies

"While it is hoped that the mountain will again become dormant, it is impossible to predict what it might do. In the meantime, it is hoped that good engineering practices and common sense will prevail to permit us to stay one step ahead of being caught by surprise."
Colonel Terence J. Connell, 1980

Crude oil from the 1989 Alaska oil spill in Prudhoe Bay

Working the 1996 flood

Surveying at Spirit Lake after the Mount St. Helens eruption in 1980

Disaster Relief

Disaster relief has been a part of the Corps' civil works responsibilities since the 19th century. Public Law 84-99 (1955) authorized the agency to provide flood assistance, and Public Law 93-288 (1974) authorized it to assist the Federal Emergency Management Authority (FEMA) for other disasters. As part of this work, districts across the nation prepared emergency management plans, detailing how the agency would aid communities struck by a disaster. In 1983, the duties of the Corps' Emergency Management Branch expanded to include coordination with the FEMA for flood hazard mitigation and participation in Regional Response Committees. The following year, Executive Order 11490 added emergency water preparedness to the branch's responsibilities.[1]

From 1980 to 2000, the Portland District responded to a wide range of disasters, results of both natural phenomenon and human error. Agency personnel combated volcanic eruptions, floods, earthquakes, hurricanes, and oil spills, both within the United States and abroad. The District's combination of technical expertise, heavy-duty engineering equipment, and the ability to mobilize quickly and efficiently proved essential in many emergency situations, such as the eruptions of Mount St. Helens and Mount Pinatubo, the Alaska Oil Spill, and the Flood of 1996.

In responding to disasters, Portland District personnel became heroes to the public. Unlike many water resource development projects, which were often controversial, the Corps' emergency relief work was generally applauded. Following the Mount St. Helens eruption, for example, Patrick Keough, Chief of Planning Branch, directed the Cowlitz-Toutle River Restoration effort. At one point he discovered just one hour before a public meeting that the "USGS had told the media they expected 400,000,000 cubic yards of material to come into the Cowlitz during the 1980-81 water year." The moment stood out in his mind because, rather than being alarmed, locals had confidence in the Corps, believing that the agency "would do the job." This experience was "a treasured change from the stereotypic bad guy image we often hear."[2]

Mount St. Helens before May 18, 1980

Mount St. Helens Erupts

The May 18, 1980 eruption of Mount St. Helens was one of the largest natural disasters to strike the Pacific Northwest in the 20th century. While the mountain had displayed warning signs of volcanic activity and had erupted in previous centuries, few were prepared for the events that unfolded that day. The Corps, with its experience in navigation and flood control, played a vital role in the earliest phases of the emergency. In particular, the Portland District successfully combated the massive amounts of sediments Mount St. Helens had released into the Toutle, Cowlitz, and Columbia rivers.

Prior to its eruption, Mount St. Helens was part of a recreational landscape that included state, private, and national forest lands. On the north side of the mountain was Spirit Lake, a focal point for camping, fishing, and boating. The area provided habitat for a wide variety of wildlife, including large game animals and small mammals and birds. The Toutle River and its tributaries, along with Spirit Lake and the Lower Cowlitz, supported large populations of resident and migratory fish. The Toutle River, which originated on the slopes of the mountain, was a spawning ground for winter and summer run steelhead, chinook, and coho salmon, and sea-run cutthroat trout; the Lower Cowlitz provided spawning area for Columbia River smelt, whose spring runs supported a large dip-net fishery.[3]

For most people in the region, Mount St. Helens was a scenic landmark, a reminder of the grandeur of the Pacific Northwest. "You could not miss Mount St. Helens' beauty on cloudless days en route between Seattle and Portland up Interstate 5," recalled one writer. "Even at sixty miles per hour, Mount St. Helens looked as delectable as a scoop of vanilla perched atop a sugar cone. Few freeway motorists thought 'volcanic cone' until now, that is."[4]

The mountain, however, was more than a pleasant vista – it was also a geologically active volcano. As part of the Cascade Range, Mount St. Helens is one of a series of active volcanoes that are part of the "Ring of Fire," a circle of volcanic and earthquake activity rimming the Pacific Ocean. Located 45 miles northeast of Portland, the mountain is a relatively young volcanic cone formed within the last 2,500 years, which sits on the remains of an older volcano, some 37,000 years old. Geologic evidence revealed numerous past explosive eruptions of the older volcano, and there were ample signs of more recent activity as well. After a dormant period of approximately 150 years, in 1800 there was a large pumice eruption. Over the next 50 years the volcano was intermittently active, until it settled into dormancy for almost 130 years.[5]

Series of 6 eruption photos taken by Vern Hodgson on May 18th, 1980.

Mount St. Helens after May 18, 1980

Because of the mountain's active and violent history, geologists had predicted for several years that a major eruption could occur, but most people discounted these warnings. Even after earthquakes began in March 1980, sightseers crowded the area, ignoring barricades and refusing to recognize the potential for disaster. Early on May 18, 1980, a 5.1 magnitude earthquake precipitated a colossal landslide – the largest ever witnessed in human history – on Mount St. Helens' north flank.[6] "About 8:20 we were overcome by a strange feeling," one eyewitness recalled. "Everything was quiet. It felt like something was going to happen. There was no noise, no animals chattering, it felt like a surrealistic dream."[7] According to one report by the Corps, "The effect was much like that of removing the lid from a pressure cooker: billions of gallons of superheated groundwater trapped inside the mountain flashed into steam; explosions sent material almost 14 miles straight up; pyroclastic flows moved down the mountain at nearly 100 miles an hour. Almost every living thing within a wide arc up to 16 miles from the mountain was killed."[8]

As the landslide careened down the mountain, it incorporated debris, rock, trees, and glacial ice, eventually plunging into the North Fork of the Toutle River Valley. Water from lakes and melting snow mixed with the debris, causing mudflows that coursed down stream and river valleys. Salmon in the Toutle and Lower Cowlitz leapt from the rivers to the banks to avoid the searing conditions. Witnesses described these mudflows, carrying over 50 percent solids by volume, as the consistency of pancake batter.[9]

The blast affected an area of 150 square miles around the mountain. The toll on people, wildlife, and resources was extremely heavy: 59 people, 2,300 big game animals, millions of juvenile salmon and steelhead, 1.6 billion board feet of lumber, and thousands of acres of forest were killed and destroyed.[10] "I've never seen anything like it," commented President Carter on a flight over the area. "The moon looks like a golf course compared to what's up there."[11] Larry Magura, Emergency Management Coordinator, was also moved by the scene of destruction. He recalled the event a year after his helicopter flight: "We flew into the clouds and then we saw the entire North Toutle Valley through the clouds and it was a vast panorama of utter devastation – just awesome, mind boggling. And I remember standing by a stump that was just toothpicks, and we were like five miles away from the mountain."[12]

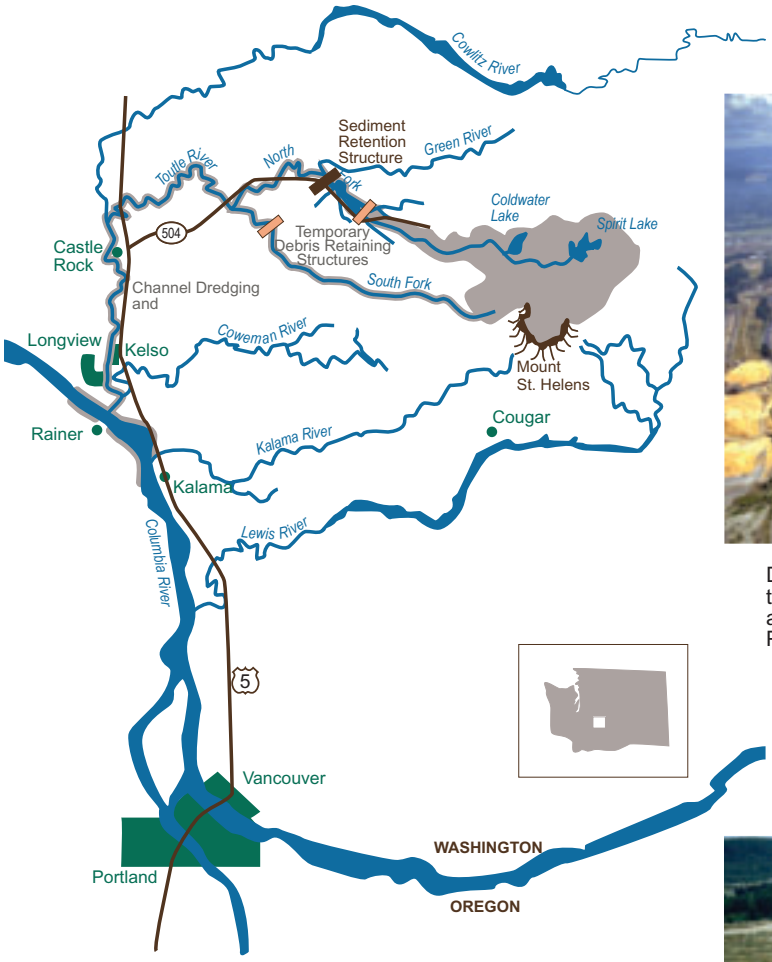
Recognizing the magnitude of this event, on May 19, the Corps and other federal, state, and local agencies established a communications system from a temporary FEMA headquarters, located in Vancouver, Washington, to coordinate the recovery effort.

Surveying the Mount St. Helens eruption damage

These agencies evaluated the impacts to general populations, public utilities, and other public and private facilities, as they formulated plans for both immediate action and longer-range considerations. In these early days of the crisis, one obstacle was simply determining what issues needed to be addressed. "You weren't quite sure what was going to happen one way or another," recalled Jerry Christensen, Section Chief for civil and environmental engineering, "so you spent a lot of time just monitoring and looking at things and seeing what was evolving and developing…." Christensen further explained that "The biggest problem we had was defining what the problem was. It wasn't defining what the solution could be. We had lots of solutions."[13] Three Corps districts – Seattle, Walla Walla, and Portland – were involved in the response effort. Seattle, with assistance from Walla Walla, led damage survey assessment teams and reported on ash cleanup. Portland had three major tasks: clearing the Columbia River channel, restoring the flood-carrying capacity of the Cowlitz and Toutle rivers, and constructing several small debris retaining structures on the north and south forks of the Toutle.[14]

As a water resource agency, the Corps took charge in the effort to provide flood control and navigation on the impacted rivers. The eruption had released large amounts of sediments in the Toutle and Cowlitz rivers, depositing 50 million cubic yards (mcy) of sediment in the Lower Cowlitz River flood plain and another 50 mcy in the Columbia River, including 15 mcy in the navigation channel.[15] Sediments in the Columbia had formed a shoal, large enough to halt ocean vessel traffic, in the river opposite the mouth of the Cowlitz. These deposits substantially reduced the flow capacity of the rivers to a point where normal winter rains could have caused severe flooding. After the mudflows, the District began dredging to reopen channels and initiated construction of levees to reduce potential flooding.[16]

Perhaps the District's most impressive dredging effort occurred on the Columbia. Before the explosion, the Columbia River navigation channel was an important contributor to the regional economy. In fact, the Port of Portland was one of the fastest growing ports in the country and a vital link in the grain export chain. The eruption severed this "economic lifeline," reducing the depth of the normally 40-foot channel to as little as 15 feet. In the days following the event, the District quickly mobilized its dredges, operating its vessels around the clock to clear the sediment. "I don't think anyone will ever again ask why the Port of Portland and the U.S. Army Corps of Engineers are



Dredging on the Columbia at the Port of Portland

Pipeline dredges working on the Cowlitz River

in the dredging business," predicted Dave Neset, Port Director of Marine Services. "Ships couldn't have gotten into or out of Portland as fast as they did, if the *Oregon* and the Corps' three dredges hadn't started digging immediately. You just couldn't expect a private contractor to drop everything and pick up and go like that."[17]

The work was tough, both on the workers and equipment. "What worries me is the strain it's putting on our people," stated Larry Patella manager of the dredge *Oregon*. "The material is murder to handle…just like concrete… and it's tearing up our equipment. Then there's the ash to contend with…. I've commanded three ships – in the Navy 31 years – but I've never seen a bunch with this much dedication." When asked when he had last seen his family, one crewmember responded, "I don't know, maybe a week, I'm a little foggy. We have a daughter 27 and another 8 years old. That spread out should tell you something about family life when you work on the *Oregon*."[18]

Through the intensive efforts of the Corps' dredges, along with dredges from private industries, deep-draft shipping was restored in just five days. This accomplishment was testimony to "remarkable teamwork" and the "quick action and unflagging efforts of the U.S.

Temporary debris dams on the south and north forks of the Toutle River

Army Corps of Engineers." To alert customers that the Port was open and ready for business, the Port of Portland launched a campaign in which it reminded customers that, "If we can move a mountain, we can move your cargo."[19]

In addition to its dredging work on the Columbia, the District also used pipeline dredges on the Cowlitz, which had lost 85 percent of its flow capacity as a result of the eruption. In a massive restoration effort lasting 16 months, the District and its contractors dredged and excavated more than 21 mcy from the Toutle, 54 mcy from the Cowlitz, and another 28 mcy from the Columbia. The District's normal dredging program for Oregon coastal harbors and the Columbia River amounted to about 16 mcy annually.[20]

Dredging was only one component of the District's plan to combat sediments. On the north and south forks of the Toutle, for example, the agency built debris dams. Contractors constructed a 1.5 mile long debris dam immediately downstream of the main mudflow deposit on the north fork and a smaller dam at the lower end of the south fork. The purpose of the structures was to restrain and impound the material eroded from the mudfills upstream, allowing it to be excavated and removed to nearby spoils area. The south fork debris dam also featured a fish trap facility designed to trap and transport steelhead either upriver or to more suitable streams. Workers completed the dams in October 1980, in time for the fall rainy season.[21]

In the days and months and years that followed the eruption of Mount St. Helens the District mobilized a wide variety of resources – both in terms of personnel and equipment. Agency staff worked long hours to meet the challenge of stabilizing the region. "We were working 10 to 12 hour days and six or seven days a week for the first two years," recalled Christensen.[22] By fiscal year 1983, the Corps had spent $327 million on emergency activities, including improvements to levees, construction of two debris dams and excavation of sediment stabilization basins in the Toutle River, dredging of the Columbia River, and pumping at Spirit Lake. Throughout this period, the District demonstrated its ability to utilize its vast engineering expertise to address a range of navigation and flood control issues, in the process expanding its knowledge of how to deal with related emergencies in the future. The agency's efforts were well recognized, and in 1981 the District received an engineering Award of Merit in the Corps of Engineers Design and Environmental Awards program.[23] Reflecting on the 1980 eruption of Mount St. Helens, Senator Slade Gorton expressed appreciation for the Corps' role in the event. "The 1980 eruption unleashed massive destruction on the Pacific Northwest," he observed. "The volcano ejected billions of cubic yards of debris, rock, mud, and ash; but this was only the beginning. The Corps responded immediately to the challenge of maintaining control in an uncontrollable time and region."[24]

While the Mount St. Helens eruption highlighted the agency's strengths, the District recognized that the work was far from over and appreciated the volatility of the situation. "The biggest question mark in the cleanup operation is Mount St. Helens itself," remarked District Commander Terence J. Connell in September 1980. "While it is hoped that the mountain will again become dormant, it is impossible to predict what it might do. In the meantime, it is hoped that good engineering practices and common sense will prevail to permit us to stay one step ahead of being caught by surprise."[25] In the years following the eruption, the District worked to address the long-term consequences of the eruption. In particular, the agency undertook two significant projects – stabilizing Spirit Lake and constructing a sediment retention structure on the Toutle River.

Mount St. Helens

The impacts of the eruption were immediate. Avalanches sent water 20 feet high surging down the Toutle River Valley, uprooting trees and washing out roads and bridges. Elsie Calvert, a resident of the valley, said that she knew it was time to leave her home when she saw a house and several cars floating downstream. "You could hear the river just roaring," she reported. A U.S. Coast Guard helicopter evacuated her, along with her husband and four children. Also rescued was Patrick Killgore, who boarded the helicopter with Josephine, his pet boa constrictor. "I tried to get out by car," he explained, "but trees were blocking the road." Larry Magura, the Corps' Emergency Management Coordinator, described the North Toutle Valley as "a vast panorama of utter devastation – just awesome, mind boggling."

-The Oregonian, May 19, 1980

Stabilizing Spirit Lake

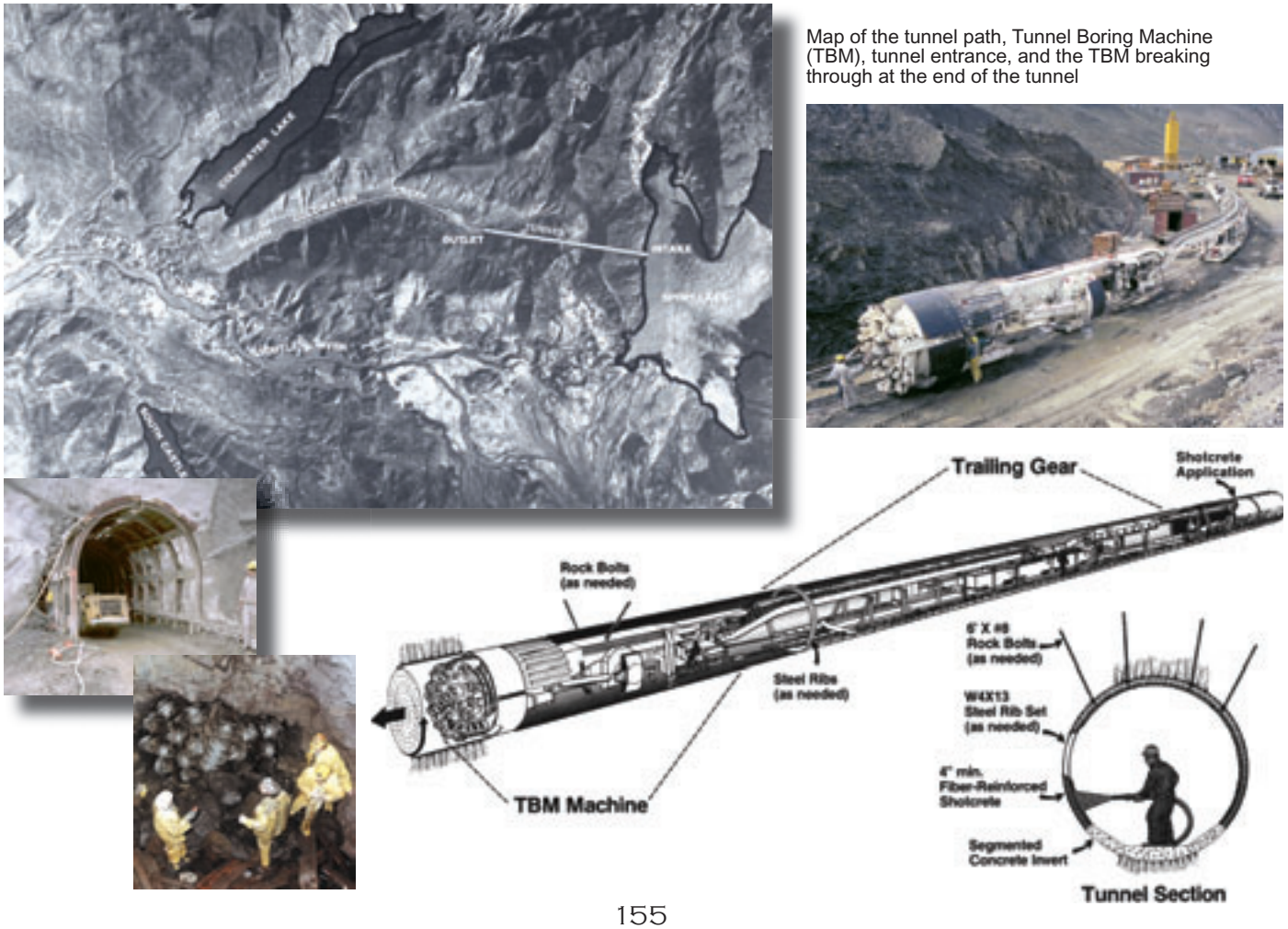
In the period immediately following the eruption, the Corps stabilized the region's waterways through a variety of emergency measures. Agency officials recognized, however, that the continual movement of debris and volcanic sediment posed a long-term threat to existing flood protection measures and had the potential to impair future navigation. In response, in June 1982, President Reagan requested that the Corps prepare a comprehensive plan to address flood control and navigation problems brought about by the huge deposition of sediment from Mount St. Helens. During the planning process, the District considered a number of alternative strategies, evaluating them on the basis of engineering feasibility, economic merit, and environmental sensitivity.[26]

Spirit Lake filled with logs and debris after the eruption

Pump barge maintains the lake level at the debris dam on Spirit Lake

Unlike many Corps projects, planning in the wake of the eruption occurred under crisis conditions with few economic or environmental precedents. Sedimentation and erosion rates and volumes had to be estimated with complex data-gathering and analytical methods. For the first time, the Corps included a "design mudflow" for a large dam. Planning for long-term solutions focused on two major areas: the unstable debris dam that had been formed at Spirit Lake and continuing sedimentation of the Cowlitz River. These problems were connected, in that releasing water from Spirit Lake to avoid dam failure would move more sediment down the Coldwater to the Toutle North Fork and into the Cowlitz. If the dam failed altogether, the situation would be worse.[27]

Spirit Lake is located at the base of Mount St. Helens near the headwaters of the North Fork Toutle River. When the mountain erupted



Map of the tunnel path, Tunnel Boring Machine (TBM), tunnel entrance, and the TBM breaking through at the end of the tunnel

it precipitated a massive debris avalanche that formed a ridge of volcanic material up to 600 feet deep at the lake's outlet to the North Fork Toutle. This material blocked the lake's natural drainage outlet and raised the lake's surface elevation approximately 200 feet. With no outlet the lake could rise until the water overtopped or breached the blockage, causing catastrophic flooding downstream. By 1982 Spirit Lake had risen almost 60 feet higher, increasing the volume of water held back by the debris dam from 126,000 acre-feet to nearly 275,000 acre-feet.[28]

In July of 1982, a United States Forest Service task force report stated that the natural dam barrier at Spirit Lake was unstable and warned of the risk to downstream communities from an uncontrolled breach. In August that year, President Reagan declared a state of emergency, activating FEMA to coordinate a federal response. FEMA requested that the Corps develop an interim solution to stabilize the lake over the winter. The District installed a barge-mounted pumping system that began operating in November of 1982. This system pumped water at a rate of 1,350 gallons per second from the lake through a 3,650-foot-long, five-foot-diameter pipe across the debris plug to a stilling basin, and from there to the North Fork of the Toutle River.[29]

The barge-mounted pumps proved to be only a temporary solution to the problem of sedimentation. In October of 1983, the Corps completed a comprehensive plan for Mount St. Helens that examined six long-term solutions for Spirit Lake. Following a series of technical studies and public debate, the Corps decided in 1984 to provide an outlet for Spirit Lake via a tunnel, which was to be constructed through solid rock.[30] By July of that year, contractor Kiewit-Groves began work on the 8,460-foot tunnel at a cost of $13.5 million. Measuring 11-feet in diameter, the tunnel was created by a tunnel boring machine, often referred to as the "mole."[31] By May of 1985, the tunnel began operating, eventually lowering the lake by about 20 feet to its design elevation of 3,440 feet. As expected, the high flows of the initial drawdown period resulted in significant erosion along South Coldwater Creek. Since that time, the system has operated "flawlessly."[32]

The SRS was created to trap sediment from the water before it could move downstream and cause flooding and impede navigation.

The tunnel at Spirit Lake was a major engineering feat that was accomplished through the cooperation of many agencies and contractors. The 11-foot-diameter tunnel that stretched a mile-and-a-half through solid rock was "created by a modern-day mechanical monster" in "a task that was worthy of the volcano," remarked Chief of Engineers Lieutenant General Elvin R. Heiberg III at the structure's dedication in April of 1985. "It was not the result of the somewhat mysterious forces of nature" that this tunnel was built, he explained, but through "real team work" and by "very real people."[33] Perhaps most importantly, the tunnel was a source of comfort to local residents who feared flooding. "This is something that gives us safety," explained Ethel Mayclin of Longview.[34]

Constructing a Sediment Retention Structure

In addition to discussing alternatives for sediment blockage at Spirit Lake, the Corps' comprehensive plan for Mount St. Helens also proposed five solutions for keeping sedimentation out of the Cowlitz River. In 1984, the agency's feasibility report recommended that the most cost effective solution was a single retention structure, to be built on the North Fork of the Toutle River. Other parts of the sediment prevention project included levee improvements at the town of Kelso and the dredging of the Cowlitz. The following year, Congress authorized the sediment retention structure (SRS), and contractors completed construction by December of 1989 at a cost of $73.2 million.[35]

The SRS was a creative solution to a unique environmental problem. The structure's purpose was to trap sediment from the water before it could move downstream, causing

Completed Sediment Retention Structure (SRS)

flooding and impeding navigation. Essentially, it worked with nature to slow down the flow of water, allowing sediment to drop out and build behind the SRS in a single, large manageable deposit. The facility consisted of an 1,800-foot long embankment that rose 184 feet above the post-eruption streambed, a concrete outlet work, and an unlined spillway at one end. The embankment was made from fractured rock with a tapered core of impervious clay that workers had excavated from the site. The entire structure rested on ancient river gravels, allowing water to pass underneath and rise inside the embankment when lake levels were high. Drainage pipes set into the embankment faced between layers of roller compacted concrete, enabling the water to run back into the lake when the level receded.[36]

Upstream from the SRS, where the North Fork Toutle entered the lake, the stilling action of the impounded water caused sediment to drop to the bottom. The sandbar behind the structure was the natural collection point for the material. Engineers envisioned the bar gradually building downstream toward the embankment as the 3,200-acre lake filled over the 50 year life of the project.[37]

The outlet works consisted of a concrete gravity monolith that featured six rows of five outlet pipes through which water and fish passed into the plunge pool and outlet channel below. The Corps' plan was to close each row of outlet pipes gradually, until the river flowed continuously over the spillway.[38] In 1998, when the last row was closed, the SRS still had room for roughly 190 mcy of sediment to be stored behind it.[39]

The spillway ran along the far north end of the SRS. It was an unlined, ungated structure whose approach channel sloped up from the lake towards the chute, narrowing from about 1,000 feet to 400 feet at the crest. The water was then carried about 2,000 feet down to an exit channel, some 140 feet lower than the crest.[40]

Building the SRS was a challenging task. The entire site was blasted out of solid rock, and during construction the course of the river was changed three times: first, to the north while a diversion pipe was buried at the south side of the valley, then south through the pipe, and then north again through the outlet works. At that point, two years before the project was completed, the SRS began forming a lake and retaining sediment.[41]

One of the Corps' considerations in building the dam was the juvenile and adult fish whose migration would be affected by the structure. As salmon runs declined and many species were threatened or endangered, the agency had to incorporate fish protection measures into every aspect of its work. When dredging the Toutle River, for example, the District had to adapt its methods to accommodate the adult salmon and steelhead that were spawning in tributaries. Specifically, the Corps diverted the river to one side of the channel by means of temporary dikes and prohibited excavation within the fish passage channel.[42] Constructing the SRS also posed challenges in terms of fish passage. With its experience in building fish passage facilities in its dams on the Columbia River [See Chapter Four], the District was technically well prepared to meet this challenge.

Since the mid-1980s, when the Corps began planning the SRS, biologists from state and federal agencies as well as environmental groups expressed concerns about how the project would affect the movement of fish. Specifically, they worried that the sediments behind the SRS would harm the fish and that accumulated debris would impede the downstream passage of juveniles. To address these concerns the District built a trap-and-haul facility downstream from the outlet works. The facility was designed to collect salmon and steelhead and truck them to spawning areas above the dam. The Corps also installed temporary log booms to keep debris away from the structure and enhance fish passage through it.[43]

The trap-and-haul facility was not, however, intended to be a permanent fish passage facility,

according to Jerry Christensen. In fact, the Corps' original plan was for the entire SRS to be a temporary structure; once the pool filled up with enough sediment and the outlet pipes closed, water would flow over the spillway and fish would travel up the spillway and through the system. Eventually, the agency envisioned the spillway naturally eroding, allowing sediment to be slowly released downstream. "We tried to produce a system that was fairly natural, even though it is a dam," Christensen explained. The problem was that once the Corps constructed the SRS, "nobody really wants to let the stuff go, now that it's trapped there," he said. The District therefore retained the trap-and-haul facility into the 21st century, causing concern among proponents of passive fish passage. The Corps, too, recognized the limitations of the current system. "It probably isn't the best for fish," remarked Christensen.[44]

A primary concern for the SRS was the outlet pipes, which carried water and fish. The District began closing the pipes in 1991, shutting down the final row in 1998. Both the National Marine Fisheries Service and Washington Department of Fish and Wildlife supported the closures, believing that migrating juvenile fish were better off traveling over the spillway. A number of environmental groups, including American Rivers and Friends of the Cowlitz, applauded the action. "The continuous release of sediment from a retention dam built to capture debris generated by the eruption of Mount St. Helens has wreaked havoc on Toutle River coho and chinook salmon and steelhead," stated a spokesman for American Rivers. "The heavy sediment loads have killed migrating juvenile and adult fish, and prevented operation of the fish trap that returns adult fish to the upper river to spawn." Closing the pipes on the dam allowed sediment to move downstream on a continual basis, which meant that sediment was transported through the rivers primarily during periods of high flow in the winter and early spring. According to Rob Masonis of American Rivers,

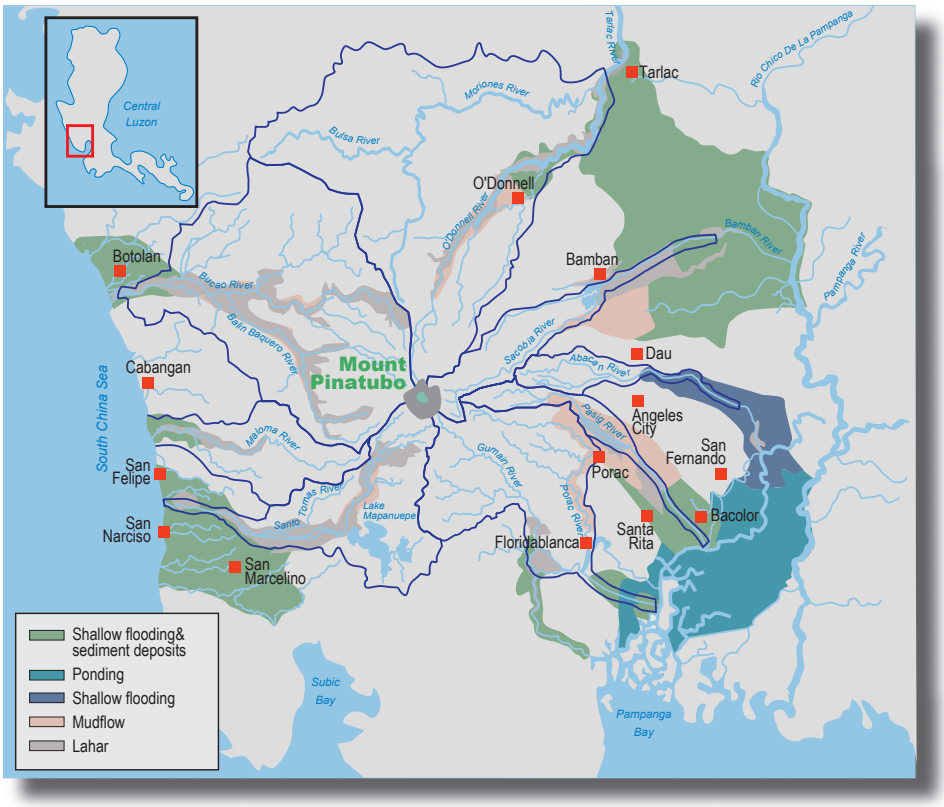
Mt Pinatubo crater and lava flows, 1991

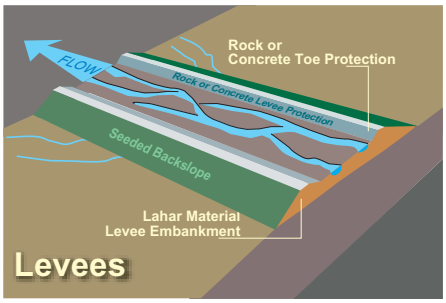
Flooded areas and bridge rebuilding, 1992

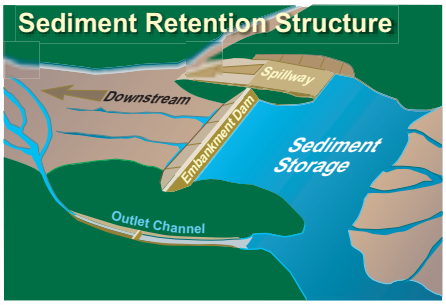
occasional high sediment loads are part of natural river conditions, but the constant turbidity caused by continual sediment loading is not. Both conservation groups credited the District for its response to the problem. "The Corps has responded to our recommendations openly and timely," said Friends of the Cowlitz. "We look forward to working with the Portland District on other habitat restoration projects in the basin."[45]

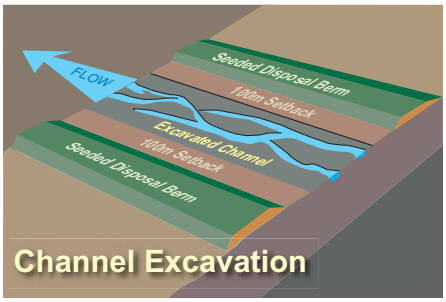
While the SRS posed risks to fish populations, it was an important component of the Corps' plan for meeting the Mount St. Helens emergency. "The sediment retention structure is the final piece of the solution," said Brigadier General Pat M. Stevens, Commander of the Corps' North Pacific Division. Furthermore, both the tunnel at Spirit Lake and the SRS were major engineering accomplishments, winning the national ASCE Outstanding Civil Engineering Achievement Award for 1991.[46] While no one wished for another Mount St. Helens, the eruption provided valuable experience for the District. "Mount St. Helens was truly a unique event," stated Keough. "Ready-made answers did not exist. Answers had to be developed quickly, creatively and diligently in response to immediate and long-term needs. The knowledge and expertise from this response will serve the nation well for generations to come."[47]

Looking back on the eruption of Mount St. Helens and on the District's response to this disaster, Colonel Connell recalled in 2001 that the public generally responded very favorably to the Corps' emergency-operations efforts. "Morale was absolutely phenomenal," he noted. "It was a major team effort in the World Series and we were winning."[48]









Mt. Pinatubo devastation area map and Corps of Engineers recovery plans for sediment retention, channel excavation, and levees

Assisting at Mt. Pinatubo

Through its involvement in the Mount St. Helens recovery work, the District acquired experience in large-scale disaster relief. Eleven years after Mount St. Helens erupted, this knowledge was put to the test at the site of another volcanic eruption – Mt. Pinatubo in the Philippines. When this volcano erupted in the summer of 1991, the State Department requested that the Portland District investigate. Ordinarily, the Corps' Hawaii and Pacific districts would have taken the lead, but Mount St. Helens had made Portland uniquely prepared.[49] "The Portland District was actually requested by the Government of the Philippines to work on it based on our Mount St. Helens experience," recalled Christensen.[50]

Mt. Pinatubo had been silent for nearly 600 years, but in April of 1991 a series of small earthquakes began, emitting steam clouds and bits of ash. This activity continued intermittently until mid-June, with each shake increasing in intensity. Finally, on June 14 and 15, Pinatubo erupted, ejecting huge amounts of volcanic ash, pumice, and pyroclastic flows down its slopes and into the surrounding area. The geographic extent of the volcano was impressive, covering a 40 to 80 kilometer radius. According to Philippine Institute of Volcanology and Seismology officials, "The ejecta covered more extensive areas and were carried by the winds of Typhoon Diding to as far as metro Manila and Palawan to the south and Cambodia to the east."[51]

In September of 1991, the State Department requested a team from the Corps to go to the site to conduct field investigations and prepare a report on the damages. The agency sent four engineers to the scene – two from the Portland District, Steve Stockton and Karl Eriksen, and two from the North Pacific Division Headquarters, John Oliver and Duane Bankofier.[52] During their September trip, the team met with representatives of the U.S. Agency for International Development (USAID), the Philippines Department of Public Works and Highways, and Mt. Pinatubo emergency officials to discuss possible solutions to the threats posed by the eruption. Many of the team members were struck by the devastation they found upon arriving. "It's almost mind boggling, it's so big," said Stockton, Chief, Planning and Engineering Division. "It's really humbling when you look at something like that, you realize how insignificant you are."[53]

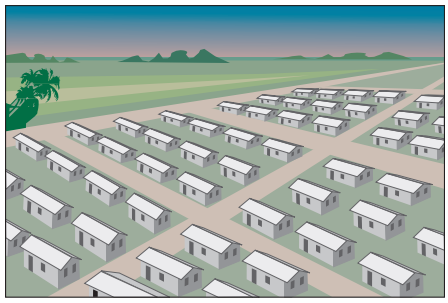


Diagram of flow damage and the Relocation Plan for new homes on safer land areas

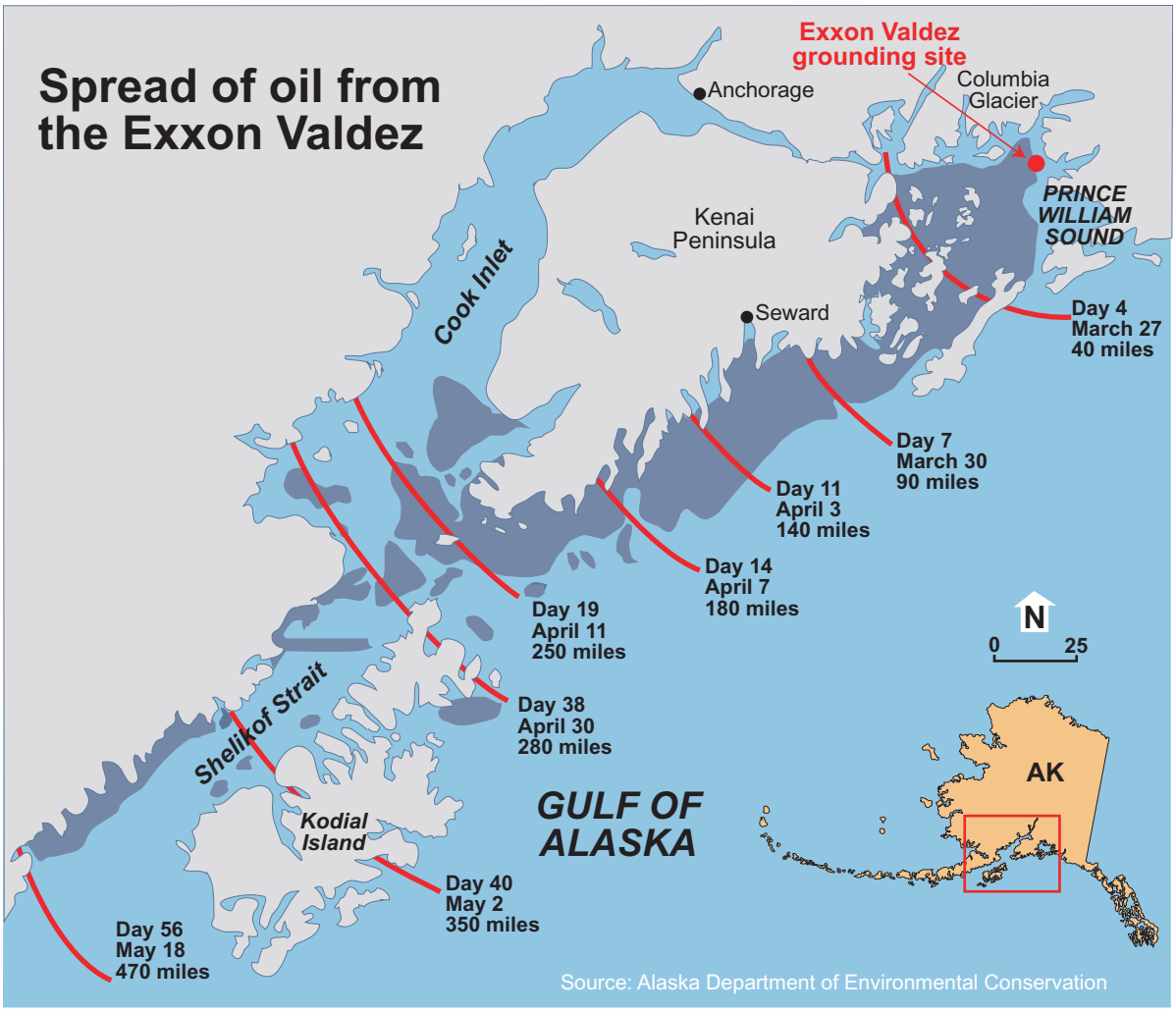
The volcanic eruption took a heavy toll on both people and natural resources in the region. The impacted area was home to more than 500 families of the Aeta tribe, as well as thousands of villagers who lived in the delta land. The eruption, with its accompanying mudflows, displaced thousands of villagers and more than 350 people lost their lives. Many more died in the evacuation centers due to unsanitary conditions. The eruption also created pyroclastic flows, which are extremely hot blasts of volcanic fragments, pebbles, boulders, sand, and hot gases that sweep along the ground at hurricane speed. These pyroclastic flows left deposits all along the slopes of Pinatubo. When rainwater mixed with the deposits and began traveling downhill, it resulted in mudflows with the consistency of cement and left deposits in the river channel, causing them to flood their banks into rice paddies and villages. Overflowing rivers filled with volcanic debris also ruined habitat that supported a considerable fish-rearing industry.[54] These flows were "a nightmare for the farmers out there with their rice crops and the engineers trying to keep the rivers open," observed Duane Bankofier, Chief, Geotechnical and Hazardous, Toxic and Radiological Waste Branch. "It's a monumental task."[55]

The area affected by Mt. Pinatubo's eruption covered nearly 62,000 acres and eight river basins. Although the volcanic ejections and mountain surface of Mt. Pinatubo looked similar to Mount St. Helens, the destruction far exceeded it.[56] "Mount Pinatubo devastated the Philippine countryside much more than Mount St. Helens did," explained Bankofier. "There isn't just one Toutle River … there are six, seven, or eight Toutle rivers." The intensity of the impact was partially due to the fact that unlike the Mount St. Helens eruption, which primarily damaged the northern and western sides of the mountain, Pinatubo "blasted away" at all sides. "In terms of damage, numbers of people killed, acres of land damaged, and other general factors it's many times larger," said Stockton. "The amount of land impacted is not in one area. It is 360 degrees around the mountain, and eight major drainages have been affected by the volcanic sediments. Also, the rainy season in the Philippines has magnified the sedimentation's damage."[57]

In addition to the technical challenges of addressing such a heavily hit area, working with the Philippine government wasn't necessarily easy. "There's a challenge in dealing with a government that does not have an organized emergency management structure in place," explained Mike Roll of the Planning and Engineering Division and technical manager for the Mt. Pinatubo study. "There's also limited money, limited equipment, limited resources." Furthermore, the work could be dangerous. "There's an active volcano over there…. It could spout when you are flying around it or over it," said Roll. "The torrential rains that they get are bad enough, but you throw in 23 typhoons a year and there's always the risk there's going to be a significant mud flow that comes down that hill. Sometimes out walking along the river bank, you can hear the sound of banks caving in – big thumps and booms."[58]

Following their initial visit in September to the Philippines, the Corps team submitted a report to the Department of State, focusing on possible repair measures and the protection of remaining systems.[59] In August of 1992, representatives from the Corps, along with private consultants, left for the Philippines to meet with Filipino engineers and collect material samples to better analyze site conditions and recommend recovery measures. Some of the specific methods considered by the team included building retaining dams, levees, and retaining walls for water and sediment retention. USAID provided six million dollars toward funding these recovery studies.[60]

By the mid-1990s, the Corps had completed a long-term recovery plan for all eight basins impacted by the eruption. The study cost a total of $6 million and outlined procedures to control sediments and protect residents.[61] The report specifically focused on implementing land-use strategies to reduce the level of risk. Due to the relatively inexpensive cost of land in the Philippines, the Corps recommended that the government buy parcels of vulnerable land and relocate people to safer areas.[62] The study was officially managed by the Pacific Ocean Division. Following the completion of the report, the next step was for the Philippine government to initiate recovery efforts. To support that effort, seven representatives from the Philippine government underwent five days of training in a design workshop led by the Portland District's Mt. Pinatubo study team. During the workshop the District went through the alternatives and recommended solutions on a basin-by-basin basis. Participants also went on field trips to Mount St. Helens and other operating units to view some examples of related work firsthand. One member of the visiting group expressed appreciation for the Corps' effort. "I guess the benefit



of the trip is really more than what we actually paid for it," she noted. "I think the Corps has done a great job."[63]

Despite the numerous challenges of the work, for the Corps team involved in the Mt. Pinatubo recovery efforts there were also many rewards. "It's a professional challenge, a prime opportunity to see personally how good they are," said Roll. The personal dimension was also satisfying. "When the helicopter lands in a local school yard and all the kids come out, you really get a feel for who you are responding to. It's their lives, their families, their homes that are going to be potentially impacted by this. If we can do something to alleviate some of the pain or problems that they're going to have, then we're doing what we all wanted to do when we got involved in this career."[64]

Combating the Alaska Oil Spill

Disaster Strikes Alaska

On March 24, 1989, nearly 11 million gallons of crude oil from Prudhoe Bay gushed from the *Exxon Valdez*, causing the worst oil spill in American history and the world's tenth worst oil spill. In an effort to avoid pieces of glacial ice in the outbound lane of the Valdez Narrows in Prince William Sound, the boat's captain changed his route to the inbound lane and then veered three miles off course, hitting Bligh Reef at a speed of over 10 knots and rupturing eight cargo tanks. These tanks began leaking oil at the rate of 1,000 gallons per second, creating black waves measuring three feet high.[65]

Prudhoe Bay, Alaska

Prince William Sound was one of Alaska's most treasured wilderness areas and home to hundreds of thousands of birds, fish, and mammals. The islands of the Sound provided nesting sites

Oil on the water in the sound

for marine birds, such as the black-legged kittewake and tufted and horned puffins. Numerous shore birds used the Sound as a resting and feeding area. Black and brown bear and bald eagles feasted on the rich supply of fish that inhabited the marine and fresh waters. Visitors marveled at the whales, sea otters, porpoises, and seals that they spotted from their boats.[66]

The March 24 oil spill killed more wildlife than any spill in history, including an estimated 100,000 to 300,000 sea birds, thousands of marine mammals, and hundreds of bald eagles. The spill also disrupted the herring and salmon harvests that supported fishing communities in the region, hurt local recreation and tourism businesses, and devastated subsistence hunting, fishing, and gathering in many coastal villages.[67] It was an area rich in natural resources and natural beauty, but its inviting blue green waters were now washed in a wave of thick oil. "I referred to Prince William Sound as one of the most beautiful places on earth," said Don Moore, Cordova city manager, in an appeal to the nation. "I leave it to each of you individually to decide what the other one is. We all have a special Shangri-La in our hearts and minds. Think of yours when you contemplate what has happened to ours."[68] Other citizens were also emotionally affected by the spill. "When you see birds pulling their feathers out until they make holes in their necks and oiled otters that show no resistance when you pick them up, it brings home to you what an oil spill really means," said Dan Lawn of Alaska's Department of Environmental Conservation.[69]

The geographic extent of the spill was staggering. Eventually, oil from the *Valdez* found its way to 2,000 miles of shoreline, and oil patches were sighted in the Shelikof Straits over 300 miles from Bligh Reef.[70] "It's amazing when you look at the tiny spot on the map that is the tanker and think how much it can hold, and then look at how far that tiny amount spread," observed Ted Cooney, an oceanographer at the University of Alaska in Fairbanks.[71]

Part of the reason the oil spill spread so far was the inadequate and confused initial response effort. Alyeska Pipeline Service Company, Exxon, and federal and state agencies lost valuable time trying to mobilize resources and deciding who should take charge of the cleanup. Weather conditions in the first two days following the spill were ideal for mechanical cleanup operations – the wind velocity was less than 5 knots, visibility was excellent, and the seas were calm. Alyeska, whose job it was to contain any spill, failed, however, to mobilize its equipment and crew. Although the company had developed a state-approved oil spill contingency plan, vital components were missing. Much of the necessary equipment, for example, was out of order, buried under deep snow, or simply gone. Alyeska's plan said that containment booms were supposed to go in five hours after a spill, but it took 12 to 17 hours just to deploy the booms. Thirty-six more hours passed before the booms surrounded the Valdez. After 70 hours had passed – the point at which Alyeska's plan had guaranteed that a spill of 200,000 barrels would be picked up – only 3,000 barrels had been recovered.[72]

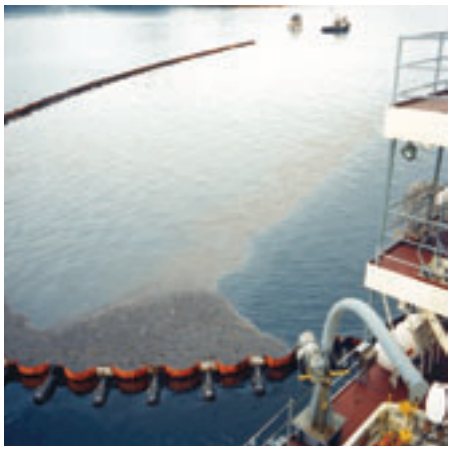
In addition to mechanically collecting the oil, one of the technologies that Alyeska identified in the oil spill contingency plan for Prince William Sound was the use of chemical dispersants. The calm weather of the first few days after the spill limited the use of this treatment, which relied on wave action to mix and distribute the dispersant. Even when the weather began to shift on the third day, however, dispersants didn't substantially contribute to the response, largely because Exxon and Alyeska lacked adequate quantities of dispersant and application equipment.[73] Another procedure used for large spills – the burning of the oil – was also not effectively used in this disaster. Attempts to use fire had failed because, in the days that had lapsed since the spill, volatiles had evaporated and water had diluted the mixture to a point where it would not combust.[74]

Once it was clear that Alyeska's plan was not working, both Exxon and the Coast Guard began to mobilize personnel and equipment to address the spill. From the start of cleanup operations, a lack of clarity about the chain of command and who was in charge hampered the response. Part of the difficulty lay in the number of parties involved: the Clean Water Act had designated the Coast Guard's jurisdiction in the Coastal Zone as part of the National Contingency Plan for serious oil or hazardous material spills; Alyeska was responsible for immediate spill response under the Oil Spill Emergency Response Plan; Exxon was in charge of directing and paying for the cleanup; and the Alaska Department of Environmental Conservation, in conformance with state law, had jurisdiction over water quality and fisheries. "The spill tested the ability of government and industry to cooperate on a scale rarely encountered in the United States and required a tremendous amount of resources," explained one writer who visited the scene.[75]

Also challenging was the relationship between Exxon, as the responsible party and financial backer of cleanup operations, and the Coast Guard, as overseer of the response effort. The Interior Department, the Environmental Protection Agency, and Alaska's congressional delegation all wanted the federal government to assume control. An official from the Alaska Department of Environmental Conservation argued that, "Exxon has not demonstrated an ability to manage a big cleanup properly. They have a lot of people, a lot of equipment, and a lot of oil, but getting them together is a problem. It's very slow, very frustrating, and not very successful."[76] President George H.W. Bush settled the debate when he announced a partial federalization on April 7, in which Exxon would direct operations and the Coast Guard would monitor and supervise all procedures. Furthermore, the plan called for the Defense Department, including the Corps, to assist the Coast Guard and Exxon by providing personnel, equipment, and facilities.[77]

Another obstacle in the cleanup process was the remoteness of the spill, which made logistics and communication difficult. Most of the area targeted for cleanup was uninhabited, with few roads and means of communication. "The logistics to get a man on the beach are awesome," said Allen Smith of the Wilderness Society. "You need a boat to carry men, barges for gas, barges for food, and barges just for garbage. It looks like the logistical support for the invasion of Normandy."[78]

The arrival of the dredge *Yaquina*



While the fishing ships corralled the oil, the dredge drag head was turned over to suction the oil swiftly into the hopper.

Meanwhile, the oil continued to spread. By March 27, the calm weather had ended. Heavy storms blasted the Sound until the morning of the fifth day of the spill, preventing boat operations and grounding aircraft. By the time the storm had passed, the oil covered more than 175 square miles and had been transformed into the consistency of a thick, gelatinous mousse. When calm seas returned, large amounts of oil had polluted the shores of Smith, Green, Knight, Naked, and Eleanor islands. Between March 31 and April 6, currents and winds carried about two million gallons of oil into the Gulf of Alaska, and by mid-May the spill had reached the outer coast of the Kenai Peninsula and was entering

Motor launch pushed the oil boom close to the dredge for oil removal. The cage system for the drag head helped keep large debris away from the suction head. Oil in the hold of the dredge was taken to the dock for transfer to awaiting trucks.

Resurrection Bay. Later the oil flowed into the mouth of Cook Inlet and as far away as Kodiak Island and parts of the Alaska Peninsula.[79]

Corps' Response

The Corps responded to the Alaska oil spill in five key ways: providing and operating dredges for oil recovery, participating in the Department of Defense's contingency planning, providing technical assessment, producing pollution reports and disseminating information, and offering the services of Corps labs in various support capacities. All of these areas were important to fighting the spreading oil, but it was the work of the Portland District dredges Yaquina and Essayons that made the most visible contribution to the remediation effort.

At first, neither Exxon nor the Coast Guard welcomed the arrival of the Corps dredges. The Corps vessels were designed to clear channels in harbors and riverbeds along the Pacific Northwest coast and had never been used in a cleanup capacity. When the Corps offered the dredges to combat the spill, cleanup managers couldn't see any use for them. Almost three weeks passed before the Corps dispatched the *Yaquina* from Oregon on the orders of Brigadier General Patrick J. Kelly, Director of Civil Works. Just a few days later the Corps sent the *Essayons* along as well. Even when the arrival of the *Yaquina* was imminent, cleanup officials in Valdez were still searching for a way to use the dredge. It wasn't until the boat's crew removed 1,500 barrels in only 15 minutes that the critics were silenced.[80]

It was only through the crewmembers' innovative thinking that the Corps dredges were able to remove oil effectively. When the *Yaquina* entered Prince William Sound on April 19, two fishing boats had boomed a circle of oil, measuring 200 feet in diameter and 10 inches thick. Initially, the crew tried both of the small pumps that were aboard the boat, but neither could handle the oil, which had thickened into a mousse-like substance; thus, the dredge pumps were the only option. At first, the dredge crew attempted to use the drag line in its usual position of vacuuming material up from the river bottom. This method did pump some oil, but the percentage of water that came with it was too high. After trying this for a while, the crew decided to modify the drag arm by turning the drag head completely over. Once reversed, the drag head pulled in oil from just beneath the surface, allowing the suction portion to lie above the water line while remaining firmly in the layer of oil. With this change, more oil was being sucked into the hoppers in seconds than had been taken in all day.[81]

The other dredges on the scene, including the *Essayons* and the Russian vessel *Vaydaghubsky*, heeded the *Yaquina's* example and inverted their drag arms as well. Thus, the rest of the dredges' work in Alaska followed a pattern in which fishing boats collected the oil and circled the booms into "donuts" to be picked up by the dredges. Motor launches helped by pushing the boomed oil toward the ship as it was sucked into the hoppers.[82]

One of the challenges in this process was the oil itself. In the weeks that followed the spill, the oil had been transformed from a liquid substance into a material that workers compared to cow patties, peanut butter, and lacquer. "The mousse just lays there in a broad sheet 100 feet square," said Ted Hunt, captain of the *Yaquina*. "You can take a handful of it and flip it over like a fish. It's an amorphous mess – God, what a mess."[83] The oil was so viscous that as the suction pumped it, a hole would be created that the oil would not fill. Therefore the suction had to constantly move around the surface of the oil, a very labor-intensive and physically

demanding task. One crewmember compared it to taking "a piece of chocolate pudding" and scooping "a bite out of it."[84]

In addition to inverting the drag heads, Corps crewmembers came up with other creative solutions to the oil spill work. As they collected the oil, for example, debris and kelp continually clogged the drag heads. Crewmembers therefore designed a cage that fit over the drag head and filtered out large pieces of debris. Another challenge was offloading the oil from the dredges onto trucks that were positioned on barges. Normally, the oil was transported via a pump onto the waiting trucks, but the coagulated oil tended to clog the pump, making the process extremely slow and tedious. In response, crewmembers devised a trough that allowed the oily mass to be directly dumped into the truck. This innovation cut the time involved by 20 percent.[85]

The dredges and their crews worked long hours and covered many nautical miles in their effort to contain the oil. Rather than their usual tour of eight days, some crewmembers worked for two weeks without stopping, and the vessels were operated on a 24-hour basis.[86] The *Essayons* began at Gore Rock and worked as far north as Resurrection Bay to as far south as Sutwik Island in the Shelikof Strait west of Kodiak Island. The *Yaquina* began its work around Knight Island in Prince William Sound and at one point traveled as far south as Kukak Bay. Generally, however, the smaller *Yaquina* remained in more sheltered island areas of the Sound and in the fragile environment of the Kenai Fjords National Park, while the *Essayons* worked in the rougher open waters.[87] The *Essayons* also participated in shoreline cleanup operations, by collecting sacks of contaminated sand and oil.[88]

In addition to removing oil, the dredges assisted the effort in other ways. They provided logistical support services, for example, to fishing and skimming vessels in the area. Fishing boats low on supplies called on the Corps for gas and fresh water. Crewmembers occasionally shared meals with the dredge crews or took hot showers on board.[89]

In late May, cleanup managers decided to withdraw Corps dredges from the cleanup area because the oil was no longer on the open water where the dredges could be of use, greatly diminishing productivity. The dredges were sent to Seward, where contractors cleaned the vessels. The *Essayons* proved particularly difficult to clean because the beach waste and sand had mixed with recovered oil, turning it into asphalt. During the time that they worked the Alaskan waters, the two dredges combined had recovered over 379,720 gallons of oil, proving that hopper dredges could play a crucial role in oil spills.[90]

Wildlife covered with oil

Reaction to the Corps' dredges efforts was overwhelmingly positive. "An Army Corps of Engineers dredge near Katmai National Park has proved to be one of the most effective machines at collecting oil," said John Quinley, Regional Public Affairs Chief, National Park Service.[91] "All of a sudden we were heroes," recalled Miguel Jiminez, captain of the *Yaquina*. The cleanup effort was the vessel's "crowning glory."[92] Yet, despite the excitement generated by their vital contribution, some crewmembers also expressed distress over what they experienced while working in Alaska. "I was awed by the beauty of what I saw," said Ernie Wait of the *Yaquina*. "And I hated to see what was going on up there."[93]

While not every aspect of the Corps' involvement was as visible as the work of the *Yaquina* and *Essayons*, the agency made other important contributions to the cleanup operations. The Alaska District formed a Crisis Management Team (CMT) and opened an Emergency Operations Center (EOC), which stayed open for 65 days, most of that on a 24-hour basis. Part of the CMT responsibilities was planning with Defense Department officials in the event that Exxon failed to continue to meet its obligations. In the 65 days that it operated, the EOC maintained liaisons with state, federal, and local agencies and coordinated support activities for the two dredges.[94]

In addition to providing daily information on the spill and participating in contingency planning, the Corps analyzed Exxon's shoreline cleanup methods and assessed other methods of shoreline restoration at the request of the Joint Task Force. Scientists from the Alaska District, North Pacific Division, and the Waterways Experiment Station in Vicksburg, Mississippi, produced papers on a variety of topics related to shoreline remediation. Alaska District staff also conducted research on incineration techniques, examining different types of incinerators and methods for burning oil-soaked materials.[95]

The effort to clean up contaminated shorelines, however, was ultimately not very successful. By the end of May 1989, almost 9,000 workers had become involved in shoreline cleanup. The most prevalent method pumped vast quantities of cold seawater onto the beaches. This technique failed, however, to remove the oil that had seeped into the rocky crevices. Furthermore, each night brought

tides that usually lifted the oil to the surface or returned oil that had previously been washed off back ashore.[96]

In mid-September, Exxon halted its shoreline operations for the winter. By this point, Coast Guard Commandant Paul Yost had given up hope that the Smith Island beaches could ever be restored by human effort. "I can't see when it will be clean again," he said. "Restoration will have to be done over the next few years by the Lord."[97] Port Graham Village Chief, Walter Megananck expressed his community's distress over the devastation. "Never in the millennium of our tradition have we thought it possible for the water to die," he observed. "But it is true. We walk our beaches. But the snails and barnacles and the chitons are falling off the rocks. Dead. Dead water…. We walk our beaches. But instead of gathering life, we gather death. Dead birds. Dead otters, Dead seaweed…. We are in shock. We need to clean the oil, get it out of our water, bring death back to life. We are intoxicated with desperation."[98]

Despite the heroic efforts of many agencies and individuals, only one-quarter of the oil spilled from the *Exxon Valdez* was directly recovered, leaving 114,000 barrels adrift in Alaska's waters.[99] Perhaps the most obvious lesson from the spill was the need for prevention. The spill also highlighted the need for better spill preparation, more clearly delineated command and control procedures, and more research into increasing the effectiveness of hopper dredges. While no one wanted to experience another such human-caused disaster, the Alaska oil spill demonstrated the Corps' ability to utilize its equipment and personnel in a highly effective manner.

Flooding at Oregon City and south on the Willamette River

Containing the Flood of 1996

As with volcanic eruptions and other natural events, the Corps responded to flooding as part of its disaster relief work. One of the biggest floods the Portland District faced in the late 20th century occurred in February 1996 and caused millions of dollars in damage to the region. The District played a crucial role in combating this flood's impact through a variety of short-term and long-term activities. Once the immediate danger had subsided, the flood prompted environmentalists, concerned citizens, and government agencies to reexamine how human development patterns, such as logging and agriculture, contributed to the intensity of flooding.

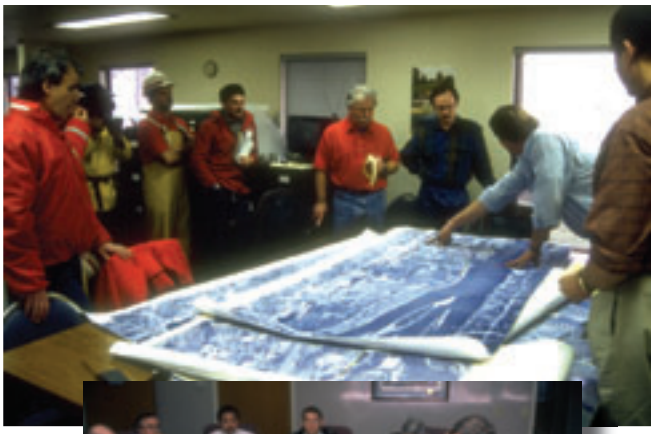
Flooding in the farmlands and residential areas

High water at Willamette Falls Locks

The Pacific Northwest has a history of flooding. Winters in the region sometimes bring a sudden influx of warm westerly winds, referred to locally as chinooks, which rapidly melt the snow pack, causing runoff over the still frozen ground. The first snowmelt, which is often accompanied by warm rain, swells tributaries and major rivers, resulting in floods of various intensities. In the late 19th and early 20th centuries a series of floods transpired on the Willamette and Columbia rivers. More recently, major floods struck western Oregon in 1948 and 1964. Thirty-two years later, another flood of similar intensity struck the region.[100]

The flood of 1996 began in much the same way as previous floods. In the months prior to February, record snowfall had been accumulating, saturating the soil. In January, the snowfall doubled and tripled the snow pack in some locations. Then in early February, a storm began near Java in the western Pacific. This "pineapple express" storm gathered moisture and power as it raced across the subtropical Pacific and veered northward. Typically such storms struck California, but because of La Nina, a powerful west-east jet stream, the storm worked its way northward, across Washington and Oregon. The storm's heavy rains mixed with the snow in the mountains; rainfall in some locations reached half an inch an hour.[101]

Ships in the swollen Columbia River waiting to sail upriver to ports



Portland seawall and Emergency Management strategy meetings

From February fifth through the eighth, heavy rain fell on the Northwest. Combined with melted snow, the rain transformed streams into raging torrents and caused rivers to surge over their banks. "I've never seen anything like this before and I have been in Oregon for 25 years," said a resident of Oregon City. "Last night, the water had not reached the McDonald's parking lot. Now McDonald's looks like it's in the middle of the lake." Flooding hit communities from Puget Sound to central Oregon, killing four people and forcing thousands of others to evacuate. In the countryside, flooding destroyed winter wheat crops in southeastern Washington and damaged many farms and ranches. At least 1,000 dairy cows drowned in Tillamook County, and two farmers lost their entire herds. Rising water and mudslides – more than 100 in the Portland area alone – shut down transportation networks and isolated some towns. Interstate 5 – the north-south artery across Oregon and Washington – was cut off in two places, buried under a landslide and several hundred feet of water. Freight trains in eastern Oregon were backed up, unable to cross through the Columbia Gorge, where a massive slide had buried the railroad tracks and most lanes of the interstate. "This is a very, very damaging flood," Washington Governor Mike Lowry told reporters. "It is way too early to make assessments, but I've seen numerous comments that this might be the worst in 50 years." At the national level, President Clinton issued a federal disaster declaration, clearing the way for providing temporary housing, family grants, and low-interest loans for flood victims.[102]

The Corps took a number of immediate steps to lessen the flood's impact. Before the rain intensified in early February, the Corps had been releasing water from its hydro projects to make room for spring runoff. Once the heavy rains began, it immediately started cutting back flows and storing water in its storage projects. Engineers and technicians at the North Pacific Division Reservoir Control Center (RCC) in Portland worked around the clock to manipulate more than 60 dams in the Columbia River system to minimize flooding. Managing river flows during the flood was a delicate balancing act, according to Cindy Henriksen, Chief of the RCC. "There is a complex system of dams on Northwest rivers and streams," she explained. "But not all of these dams are designed for flood control. Only one dam on the lower Columbia, the John Day, has significant storage capacity."[103]

Despite the challenges in regulating water flow, Corps dams were successful in holding back the flow of water and reducing flooding. Perhaps their most visible success was in downtown Portland, which, because of its location at the confluence of the Columbia and the Willamette, was especially vulnerable. A number of uncontrolled tributaries entered the Willamette upstream of the city, and many experts predicted that the crest would top Portland's floodwall, which protected the downtown area. In response to this threat, Portland's mayor Vera Katz requested technical assistance from the Corps and asked for volunteers to help city crews reinforce the wall. In a matter of hours, the riverfront teemed with people filling sandbags, building a higher plywood wall, and reinforcing the plywood with concrete road slabs.[104] "You essentially had this miniature levee built all along the seawall," explained Jerry Christensen.[105] Crews worked into the night as the river edged up the wall, lapping over it at times. When the crest finally arrived, it was lower than predicted due to waning rainfall, and the city was spared

Sand bagging at Willamette Falls and dike rebuilding in Clatskanie

major flooding. "It could have been a terrible nightmare for Portland if those dams weren't there," said Tom Worden, spokesman for Oregon's state emergency management office.[106] Mayor Katz was also grateful, calling the effort by the Corps and volunteers "a heroic, heroic public works project."[107] *The Oregonian* applauded the District as well, summarizing the effort in a dramatic headline reading, "How They Saved Downtown."[108]

The Corps contributed to the flood relief efforts in other ways as well. At The Dalles-John Day project, for example, the agency distributed more than 100,000 sandbags to outlying communities in four counties. At Mill Creek, Corps' personnel worked to keep the rising waters at bay. When debris began backing up the creek on February 7, crews worked until midnight for many consecutive nights to clear the material. "They were great," exclaimed Kim Fisher of The Dalles Chamber of Commerce. "The guys worked very hard and were soaked from the rain." In addition to directly battling the flood, the Corps also provided less traditional assistance. At the Bonneville project, for example, the District allowed 11 students from a nearby school to use the second powerhouse visitors' theater as a makeshift classroom after a mudslide threatened their own facility. "They're on the project from 8 a.m. until 2 p.m. and we've reserved the gymnasium in the project auditorium for their physical education classes," explained Jim Runkles, park manager.[109]

When the initial threat of flooding was over, the District shifted to recovery work. The agency's primary work involved repairing both federal and non-federal dikes, levees, and flood protection embankments in numerous counties throughout the region. The floods also had produced heavy shoaling in the Columbia River navigation channel, prompting the *Essayons* and its crew to undertake dredging work. Through its immediate response and longer-term efforts, the Corps substantially reduced the economic impact of the flood. Altogether, Corps projects in the Pacific Northwest prevented flood damages totaling more than $3.2 billion, with savings of $1.1 million at Portland.[110]

In addition to impacting human communities, the February floods also affected salmon populations in the Northwest. Raging river currents swept away banks, took out trees, and destroyed streamside vegetation; clear waters became choked with debris. The floods, however, also benefited fish populations by forming new side channels, depositing protective woody debris, scouring out pools, and bringing in new clean gravel. To the general public the flood was a catastrophe, but for fish and other aquatic species, floods are a part of nature's cycle. "These fish have lived with flooding for thousands, even millions of years, and they've done quite well without us," explained Stan Gregory, a professor at Oregon State University. Dave Heller compared floods to forest fires, another natural phenomenon whose role in promoting healthy ecosystems has historically been unappreciated. "Floods are analogous to fire in a forest: It may not be pretty, but it surely plays a critical role," he said.

The Oregonian recognized the Corps' efforts to save the downtown area from the flooding.

In fact, while "postcard-perfect, uncluttered streams" are visually appealing, they offer little food and shelter for fish. By depositing woody debris and creating new deep pools and gravel bars, the floods actually improved the habitat of some streams.[111]

The impact of the 1996 floods on salmon streams was uneven: some suffered extreme damage, while others appeared to be recovering well and even prospering. Some of the disparity could be attributed to differences in terrain and local storm intensity, but the primary factor was the extent of human influences on the landscape. Scientists generally found that areas that were heavily altered by human development suffered more than those that were relatively untouched. Logging, for example, created clearcuts and logging roads, both of which increased the rate of slides. Agricultural development converted wetlands and floodplains, reducing a river's natural flood control system.[112]

The Corps, through its attempts to provide navigation, also contributed to the problem of flooding. In the Willamette River watershed, for example, the agency cut off secondary channels with debris dams, filled in sloughs to increase water volume in the main channel, and performed clearing and snagging activities. Over time, these activities transformed the historic multiple channel configuration of the river to a simplified single channel system that could no longer handle the same volume of water – particularly in an area that had become heavily urbanized.[113]

Prompted by the February flood and several others that followed it, environmentalists, scientists, and government officials in the Pacific Northwest questioned traditional land use practices, seeking a variety of solutions to lessen the impacts of flooding. Despite their success in controlling the water flow, few believed it was feasible or desirable to build new dams. Instead, they pushed to revamp and better enforce land use policies to limit development in flood zones, restrict clear-cutting of forests on steep slopes, and restore wetland areas. "We need long-term changes in policies over the next 40 years," said John Baldwin, a University of Oregon professor and specialist on environmental public policy. "We have to realize that we're looking at problems that building one dam on a river won't change. We need to change the whole way we do business." Later he added, "What we really need to do is develop human systems that recognize the primacy of physical systems." Environmentalists and scientists joined in the debate, arguing for a moratorium on steep-slope logging on both private and public lands until other forest practices could be enacted to reduce the number of landslides. Some environmentalists supported returning the Willamette River to a more "natural" state. "The main thing we can do to alleviate flooding in this valley is to give the flood plain back to the river, to give it room to roam and stay out of its way as best we can," said Phil Wallin of River Networks, a national river conservation group.[114]

In a further step toward river restoration, River Networks proposed restoring flood plain functions through a voluntary wetlands restoration program along the Willamette. The group, who had been exploring the idea prior to the Flood of 1996, released its preliminary report during the February flooding. The River Networks report, along with the support of Congressman Peter DeFazio, led Congress to authorize the Portland District to study the issue. After obtaining study authority, the Corps completed a reconnaissance study and proceeded to begin work on the feasibility study.[115]

President Clinton visited the area to praise the Corps and city for successful prevention and recovery efforts from the flood.

The Corps expects the feasibility study, which generally takes two to three years, to be completed in the early 21st century. The major challenge facing the District at this stage is finding a local sponsor to satisfy the cost-sharing requirements of the project. Identifying an appropriate sponsor will be difficult given the considerable costs of the project, but the Corps remains optimistic about the benefits of this type of voluntary restoration work. "It's clear that the Corps needs to look at new options for flood control in the Willamette Basin," remarked Project Manager Matt Rea. Furthermore, Rea believed that the voluntary nature of the program heightened its potential for success. Much of the land along the Willamette River is privately owned and divided into small parcels. Attempting to implement a mandatory program would likely meet with a great deal of resistance from private landowners, whereas a voluntary program, including tax incentives, easements, and other real estate agreements, would be less politically volatile.[116]

The February 1996 flood brought extensive damages to communities throughout the Pacific Northwest. Using its ability to quickly mobilize, its technical expertise, and its intricate systems of dams, the Corps contributed greatly to relief efforts by lessening the impacts of the flood. The agency's hard work did not go unnoticed; after reviewing flood damages President Clinton stated that he was "very impressed with…the work the Corps of Engineers has done to try to get the water down as much as possible, as quickly as possible."[117] More formal recognition was given in February of 1997, on the one-year anniversary of the flood, when Vice President Gore presented his National Performance Review Hammer Award to the Portland District and the North Pacific Division. The Bonneville Power Administration, Bureau of Reclamation, and City of Portland also received Hammer Awards, which are given to teams of federal, state, and local employees and citizens working together to build a better government.[118]

Yet the story of the flood extended beyond the immediate crisis, prompting environmentalists, scientists, and concerned citizens in the region to reexamine land use practices and beliefs. Logging practices, wetland conversion, and development in flood plains were all called into question in the wake of the event. Not immune to the shifting values, the Corps also reevaluated its position, looking beyond dams to other non-structural approaches to flood control. "The Corps has changed the way it approaches the environment," said Robert Willis, Chief, Environmental Resources Branch. "We used to focus only on flood control and navigation work. Now our emphasis has shifted to include ecosystem restoration and fish and wildlife management."[119]

Participating in Recovery Operations for Hurricanes and Earthquakes

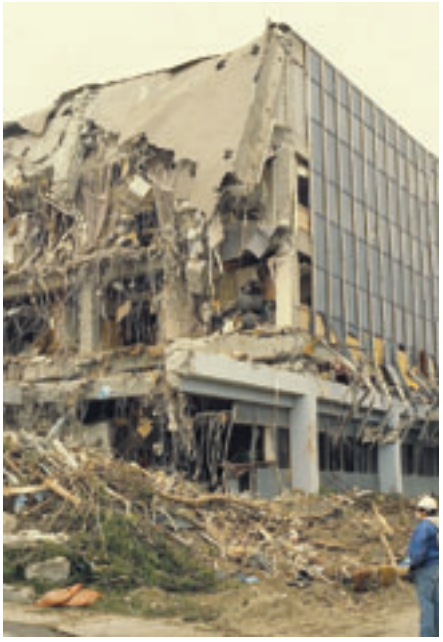
As demonstrated by its role in cleaning up the Alaska oil spill, the District's disaster recovery mission extended beyond its own boundaries to helping other regions with relief work. In the late 20th century, Portland District aided other districts in response to two major events – the California earthquake and Hurricane Andrew. In both of these efforts, Portland employees offered valuable assistance, drawing on their experience with previous disaster work, including the Mount St. Helens recovery work.

California earthquake recovery, 1989

When an earthquake struck central California on October 12, 1989, the Corps was one of the first agencies on the scene. More than 100 people from Portland volunteered to help in the relief work; the 30 selected joined 300 Corps professionals from around the country. Once again, the agency demonstrated its ability to rapidly mobilize. "The fact that 300 people were out there working the next day shows you how quickly you can get out if you need to," said Hank Annus, a civil engineer with the District. "I was very impressed by Sacramento's handling of such a large group of people." Lou Smith, another civil engineer from Portland was also inspired by the Corps' highly organized response. "I arrived in Sacramento on October 22 and by early the 23rd I was in a briefing with 300 people," he recalled. "The Sacramento District Engineer, a very dynamic colonel, was ready to dispatch teams all over the earthquake area."[120]

One of the major tasks of the recovery effort was evaluating damage to residential properties. People whose homes had been impacted by the earthquake submitted special forms to FEMA requesting help. Those forms were then given to the disaster center, where California state emergency management staff members prioritized the requests and dispatched teams to inspect the damage and fill out Damage Report Surveys (DRS). Drawing on their engineering knowledge, many District employees worked on various stages of the DRS. Smith explained his group's role in the process. "We verified [the home] was damaged and the estimated cost to fix it. We looked to see where the cracks were, if the foundation was off," he said. To process the constant stream of applications coming in – in just one day FEMA received more than 800 DRS – Corps members worked six days a week, 10 hours a day.[121]

Many of the District volunteers were surprised by the extent of the earthquake damage and struck by the toll it took on people's lives. "I didn't realize," said Carol Hudson, an emergency operations assistant. "I had seen it previously (on TV) but unless you see it yourself, you never realize how terrible it must have been. People's whole lives were gone, their homes, possessions. It's something I don't ever want to go through."[122]



Despite the shock of the devastation, most District personnel felt that the experience was rewarding as well as beneficial. "I met a bunch of wonderful people, learned about the Corps and learned a new software program," said Jeanette Morden, personnel assistant. Many others agreed that the best aspect of the experience was "working with people." Furthermore, District employees expressed admiration for the tenacious nature of the earthquake victims. "It's amazing how people band together," said Annus. "It's a good feeling to see that people really do care. It's been a positive experience. Every

Hurricane Andrew recovery, 1992

time you go to a disaster there is some positive. You see human suffering but you see people do care."[123]

The Corps was once again called to action when Hurricane Andrew hit South Florida on August 24, 1992. The hurricane damaged $20 billion in property, destroyed or damaged 82,000 businesses, and left 160,000 people homeless. In fact, Hurricane Andrew turned out to be the costliest disaster in American history and the largest disaster recovery effort ever undertaken by the Corps.[124]

More than 1,150 Corps members from all over the country, including the Portland District, traveled to Florida to clean up the ravaged state and help the thousands of victims. "The hundreds of Corps team members deployed to the disaster scene from throughout the Corps are the key to recovery efforts," said Commander Colonel Terrence Salt of the Jacksonville District.[125] Portland sent four people to assist with relief and cleanup and placed 38 emergency response team members on standby. The Portland team was comprised of engineers and specialists in damage assessment, structural inspection, radio and computer communications support, and administrative and logistical support. Furthermore, many of the team members had practical experience working on disasters ranging from Mount St. Helens to floods and hurricanes.[126]

The Corps response effort was comprised of many different tasks. FEMA assigned more than $380 million in recovery missions to the agency, including the following projects: roofing, water supply, providing ice, technical assistance, debris removal, emergency generator and pumps, portable toilets, schools, garbage removal, showers and laundry services, temporary housing, and damage survey reporting. Of these missions, providing temporary roofing and collecting storm debris were the major tasks, utilizing the majority of Corps members engaged in the relief work. Corps contractors and volunteer organizations covered 43,000 damaged roofs with plastic sheeting and collected 11 mcy of storm debris.[127]

Through its dedication and teamwork the Corps greatly contributed to the disaster relief work at Hurricane Andrew. "The performance of all Corps elements in response to Hurricane Andrew has

been simply magnificent," observed Colonel Salt. "Time and time again, Corps elements are singled out for the importance of their contribution and the quality of their response."[128]

Conclusion

Disaster relief is one of the Corps' long-standing missions. The Portland District has responded to many emergencies in the late 20th century, including volcanic eruptions, floods, earthquakes, hurricanes, and oil spills. With its extensive technical knowledge, heavy equipment, and quick response time, the District is prepared to combat a variety of disasters. In addition, District employees have often provided creative techniques to solving serious problems. During the Alaska oil spill, for example, crewmembers of the *Yaquina* inverted the vessel's drag head to suck up oil, providing the first significant success in this area. Disaster relief is one of the Corps' most visible areas of work, and the agency's efforts are generally appreciated throughout the country.

Endnotes

[1] D. Clayton Brown, *The Southwestern Division: 50 years of Service*, Southwestern Division, U.S. Army Corps of Engineers, 1987, pp. 60-62.

[2] Dawn Mueller, "Excitement…confidence…pride," May 15, 1981, *Corps'pondent*, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1, Corps Newsletters.

[3] Department of the Army, "A Comprehensive Plan for Responding to the Long-Term Threat Created by the Eruption of Mount St. Helens, Washington," November 3, 1983, p. I-8, Portland District, Iron Mountain Records examined at Information Management Center, Location 6220106090304, Box 8.

[4] Alan Guggenheim, *Spirit Lake People: Memories of Mount St. Helens* (Gresham, Oregon: Salem Press, 1986), p. 133.

[5] Department of the Army, "A Comprehensive Plan for Responding to the Long-Term Threat Created by the Eruption of Mount St. Helens, Washington," November 3, 1983, p. I-8, Portland District, Iron Mountain Records examined at Information Management Center, Location 6220106090304, Box 8.

[6] Department of the Army, "A Comprehensive Plan for Responding to the Long-Term Threat Created by the Eruption of Mount St. Helens, Washington," November 3, 1983, pp. I-10-I-12, Portland District, Iron Mountain Records examined at Information Management Center, Location 6220106090304, Box 8; U.S. Forest Service, "Mount St. Helens Fact Sheet – March 1990," Portland District, Public Affairs Office, 870-5b Installation History Files, Mt. St. Helens, News Releases.

[7] Mount St. Helens National Volcanic Monument, Public Affairs Office, "Notes from Eyewitnesses, Mount St. Helens Eruption, May 18, 1980," Portland District, Public Affairs Office, 870-5b Installation History Files, Mt. St. Helens, News Releases.

[8] Department of the Army, "A Comprehensive Plan for Responding to the Long-Term Threat Created by the Eruption of Mount St. Helens, Washington," November 3, 1983, p. I-10, Portland District, Iron Mountain Records examined at Information Management Center, Location 6220106090304, Box 8.

[9] Department of the Army, "A Comprehensive Plan for Responding to the Long-Term Threat Created by the Eruption of Mount St. Helens, Washington," November 3, 1983, p. I-12, Portland District, Iron Mountain Records examined at Information Management Center, Location 6220106090304, Box 8.

[10] Department of the Army, "A Comprehensive Plan for Responding to the Long-Term Threat Created by the Eruption of Mount St. Helens, Washington," November 3, 1983, p. I-12, Portland District, Iron Mountain Records examined at Information Management Center, Location 6220106090304, Box 8.

[11] Don and Diana Roberts, *Mount St. Helens, The Volcano of Our Time* (Portland, Oregon: Frank Amato Publications, 1980), p. 7.

[12] Dawn Mueller, "Excitement…confidence…pride," May 15, 1981, *Corps'pondent*, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1, Corps Newsletter.

[13] Jerry Christensen, Interview with Lisa Mighetto, Portland, Oregon, October 16, 2001. Hereafter cited as Christensen Interview.

[14] Colonel Terrence J. Connell, "The Mount St. Helens Emergency," September-October 1980, The Military Engineer, No. 469, pp. 311-315, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-98-0005, Box 45.

[15] Department of the Army, "A Comprehensive Plan for Responding to the Long-Term Threat Created by the Eruption of Mount St. Helens, Washington," November 3, 1983, p. I-12, Portland District, Iron Mountain Records examined at Information Management Center, Location 6220106090304, Box 8.

[16] U.S. Army Corps of Engineers, Portland District, *Mount St. Helens Eruption: Impacts on the Toutle, Cowlitz and Columbia River System*, December 1980, Portland District, Iron Mountain Records examined at Information Management Center, Location 622010609304, Box 8.

[17] Port of Portland, "Working Around-The-Clock to Open Portland's River Highway," June 5, 1980, News Release, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-98-0005, Box 45.

[18] Port of Portland, "Working Around-The-Clock to Open Portland's River Highway," June 5, 1980, News Release, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-98-0005, Box 45.

[19] Port of Portland, "Team Effort Moves a Mountain to Put Ports Back in Business," June 3, 1980, News Release, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-98-0005, Box 45.

Endnotes

[20] U.S. Army Corps of Engineers, Portland District, News Release, May 18, 1982, Portland District, Public Affairs Office, 870-5b Installation History Files, Mt. St. Helens, News Releases.

[21] U.S. Army Corps of Engineers, Portland District, *Mount St. Helens Eruption: The Challenge to Restore and Protect*, October 1981, p. 63, Portland District, Iron Mountain Records examined at Information Management Center, Location 6220106090304, Box 8.

[22] Christensen Interview.

[23] U.S. Army Corps of Engineers, Portland District, "Design Awards announced: Mount St. Helens work honored," January 15, 1982, *Corps'pondent*, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1, Corps Newsletter.

[24] "Congress and ASCE honor the Corps," July 1991, *Corps'pondent*, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1, Corps Newsletters.

[25] Colonel Terrence J. Connell, "The Mount St. Helens Emergency," September-October 1980, The Military Engineer, No. 469, pp. 311-315, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-98-0005, Box 45.

[26] U.S. Army Corps of Engineers, Portland District, "President Reagan Asks Corps to Prepare Mount St. Helens Comprehensive Plan," June 15, 1982, News Release, Portland District, Public Affairs Office, 870-5b Installation History Files, Mt. St. Helens, News Releases.

[27] Rita Robison, "A Decade of Recovery," *Civil Engineering*, July 1991, pp. 40-43, Portland District, Public Affairs Office, 870-5b Installation History Files, Mt. St. Helens.

[28] U.S. Army Corps of Engineers, Portland District, *Mount St. Helens*, October 1986, p. 9, Portland District Technical Library.

[29] U.S. Army Corps of Engineers, Portland District, *Mount St. Helens*, October 1986, p. 9, Portland District Technical Library.

[30] Rita Robison, "A Decade of Recovery," *Civil Engineering*, July 1991, pp. 40-43, Portland District, Public Affairs Office, 870-5b Installation History Files, Mt. St. Helens.

[31] U.S. Army Corps of Engineers, Portland District, "With Pumps and a Tunnel, The U.S. Army Corps of Engineers Keeps Spirit Lake Safe," September 6, 1984, News Release, Portland District, Public Affairs Office, 870-5b Installation History Files, Mt. St. Helens, News Releases.

[32] U.S. Army Corps of Engineers, Portland District, *Mount St. Helens*, October 1986, p. 9, Portland District Technical Library.

[33] General Heiberg, Tunnel Dedication, Longview, Washington, Saturday, April 27, 1985, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-91-0043, Box 1, Folder: Dedications – Spirit Lake Tunnel.

[34] Andre Stepankowsky, "Red carpet rolls out for tunnel's premiere," April 27, 1985, *Longview Daily News*, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-91-0043, Box 1, Folder: Dedications – Spirit Lake Tunnel.

[35] Rita Robison, "A Decade of Recovery," *Civil Engineering*, July 1991, pp. 40-43, Portland District, Public Affairs Office, 870-5b Installation History Files, Mt. St. Helens; U.S. Army Corps of Engineers, Portland District, "Mount St. Helens," April 1990, Information Paper, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-91-0043, Box 1, Folder: Dedications – Spirit Lake Tunnel.

[36] U.S. Army Corps of Engineers, Portland District, "Sediment Retention Structure," April 17, 1990, News Release, Portland District, Public Affairs Office, 870-5b Installation History Files, Mt. St. Helens, News Releases.

[37] U.S. Army Corps of Engineers, Portland District, "Sediment Retention Structure," April 17, 1990, News Release, Portland District, Public Affairs Office, 870-5b Installation History Files, Mt. St. Helens, News Releases.

[38] Rita Robison, "A Decade of Recovery," *Civil Engineering*, July 1991, pp. 40-43, Portland District, Public Affairs Office, 870-5b Installation History Files, Mt. St. Helens.

[39] U.S. Army Corps of Engineers, Portland District, "Corps to close last row of pipes at sediment structure," April 20, 1998, News Release, Portland District, Public Affairs Office, 870-5b Installation History Files, Mt. St. Helens.

[40] Rita Robison, "A Decade of Recovery," *Civil Engineering*, July 1991, pp. 40-43, Portland District, Public Affairs Office, 870-5b Installation History Files, Mt. St. Helens.

Endnotes

[41] U.S. Army Corps of Engineers, Portland District, "Sediment Retention Structure," April 17, 1990, News Release, Portland District, Public Affairs Office, 870-5b Installation History Files, Mt. St. Helens, News Releases.

[42] U.S. Army Corps of Engineers, Portland District, "Environmental Assessment Available for Sediment Stabilization Basin Dredging," August 8, 1986, News Release, Portland District, Public Affairs Office, 870-5b Installation History Files, Mt. St. Helens, News Releases.

[43] Letter from Davis G. Moriuchi, Deputy District Engineer for Project Management, to Paul Koberstein of *The Oregonian*, May 24, 1990, Portland District, Public Affairs Office, 870-5b Installation History Files, Mt. St. Helens; U.S. Army Corps of Engineers, Portland District, "Corps Awards Contract for Mount St. Helens SRS Log Boom," July 30, 1991, News Release, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 BB 34 14 01 08, Box 2, News Releases 1991-1993; Andre Stepankowsky, "Uncertain era ends with new sediment dam," May 19, 1990, *The Daily News*, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-91-0043, Box 1, Folder: Dedications – Spirit Lake Tunnel.

[44] Christensen Interview.

[45] American Rivers, "Army Corps Stops Sediment Flow at Toutle River Dam to Aid Salmon and Steelhead," April 21, 1998, Portland District, Public Affairs Office, 870-5b Installation History Files, Mt. St. Helens, SRS Correspondence.

[46] American Society of Civil Engineers, "Decade of Recovery from Volanic Eruption Cited as 1991 CE Achievement," *ASCE News*, May 1991, Vol. 16, No. 5, Portland District, Public Affairs Office, 870-5b Installation History Files, Mt. St. Helens.

[47] Stepankowsky, "Uncertain era ends with new sediment dam."

[48] Terence J. Connell, Interview with Lisa Mighetto, Portland, Oregon, October 17, 2001.

[49] U.S. Army Corps of Engineers, Portland District, "Corps Emergency Response Team Heads for Philippines," News Release, September 9, 1991,Portland District, Iron Mountain Records, examined at Information Management Center, Location 277 BB 34 14 01 08, Box 2, News Releases, 1991-1993.

[50] Christensen Interview.

[51] Heidi Brown, "Volcano Disaster Report," *Corps'pondent*, November 1991, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1, Corps Newsletters.

[52] U.S. Army Corps of Engineers, Portland District, "Corps Emergency Response Team Heads for Philippines," News Release, September 9, 1991, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 BB 34 14 01 08, Box 2, News Releases, 1991-1993.

[53] Heidi Brown, "Volcano disaster report," *Corps'pondent*, November 1991, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1, Corps Newsletters.

[54] Heidi Brown, "Volcano disaster report," *Corps'pondent*, November 1991, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1, Corps Newsletters.

[55] Andre Stepankowsky, "Mount St. Helens veterans may help in the Philippines," *The Daily News*, February 8, 1992, Portland District, Public Affairs Office, 870-5b Installation History Files, Mt. St. Helens.

[56] U.S. Army Corps of Engineers, Portland District, "Corps Emergency Response Team Heads for Philippines," News Release, September 9, 1991, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 BB 34 14 01 08, Box 2, News Releases, 1991-1993; Heidi Brown, "Volcano disaster report," *Corps'pondent*, November 1991, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1, Corps Newsletters.

[57] Stepankowsky, "Mount St. Helens veterans may help in the Philippines."

[58] Gay Monteverde, "Mount Pinatubo: the inside story," *Corps'pondent*, May 1993, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1, Corps Newsletters.

[59] U.S. Army Corps of Engineers, Portland District, "Corps Emergency Response Team Heads for Philippines," News Release, September 9, 1991,Portland District, Iron Mountain Records examined at Information Management Center, Location 277 BB 34 14 01 08, Box 2, News Releases, 1991-1993.

[60] U.S. Army Corps of Engineers, Portland District, "Engineers Study Mt. Pinatubo Recovery Efforts," News Release, August 19, 1992, Portland District,

Endnotes

Iron Mountain Records examined at Information Management Center, Location 277 BB 34 14 01 08, Box 2, News Releases, 1991-1993.

[61] U.S. Army Corps of Engineers, Portland District, *Mt. Pinatubo Recovery Action Plan – Long Term Action Report Environmental Scoping Report*, June 1993; U.S. Army Corps of Engineers, Portland District, *Mt. Pinatubo Interim Action Report, Pasig-Potrero River Basin, Final Report, Volume 1,* June 1993, *and Environmental Assessment, Volume 2*, August 1993; U.S. Army Corps of Engineers, Portland District, *Mt. Pinatubo Recovery Action Plan – Long Term Report Environmental Scoping Report, Five Eastern River Basins*, October 1993; U.S. Army Corps of Engineers, Portland District, *Mt. Pinatubo Recovery Action Plan – Long Term Report, Eight River Basins, Republic of the Philippines*, Volumes I-III, March 1994.

[62] Christensen Interview; U.S. Army Corps of Engineers, Portland District, *Mount Pinatubo Recovery Action Plan Long Term Report*, March 1994.

[63] Heidi Y. Brown, "District aids Mount Pinatubo team," *Corps'pondent*, January 1994, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 BB 34 14 01 08, Box 2, News Releases, 1991-1993.

[64] Gay Monteverde, "Mount Pinatubo: the inside story," *Corps'pondent*, May 1993, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1, Corps Newsletters.

[65] U.S. Army Corps of Engineers, Alaska District, "Alaska 1989 Oil Spill," After Action Report, Captain Charles Heaton, Report Coordinator, 1990, p. 2, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 34060105, Folder: Alaskan Oil Spill Clips; U.S. Army Corps of Engineers, Alaska District, "Oil spill events lead to Corps involvement," Oil Spill Special Edition, Esprit de Corps, January 1990, p. 2, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 34060105, Folder: Alaskan Oil Spill Clips.

[66] U.S. Army Corps of Engineers, Alaska District, "Alaska 1989 Oil Spill," After Action Report, Captain Charles Heaton, Report Coordinator, 1990, p. 2, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 34060105, Folder: Alaskan Oil Spill Clips.

[67]Dennis De. Kelso and Marshal Kendziorek, "Alaska's Response to the *Exxon Valdez* Oil Spill," *Environmental Science & Technology*, January 1991, p. 16.

[68]Quoted by John Keeble, *Out of the Channel: The "Exxon Valdez" Oil Spill in Prince William Sound* (Eastern Washington Press: 1999), p. 101.

[69] Quoted by Stephanie Pain, "Alaska Has Its Fill of Oil," *New Scientist*, August 12, 1989, p. 40.

[70] U.S. Army Corps of Engineers, Alaska District, "Alaska 1989 Oil Spill," After Action Report, Captain Charles Heaton, Report Coordinator, 1990, p. 3, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 34060105, Folder: Alaskan Oil Spill Clips

[71] Pain, "Alaska Has Its Fill of Oil," p. 35.

[72] Janet McDonnell, *The U.S. Army Corps of Engineers Response to the "Exxon Valdez" Oil Spill* (Fort Belvoir, VA: U.S. Army Corps of Engineers, 1992), pp. 4-5; Keeble, *Out of the Channel: The "Exxon Valdez" Oil Spill in Prince William Sound*, pp. 19-20; Pain, "Alaska Has Its Fill of Oil," p. 35; Stanton S. Miller, "In a Faraway State," *Environmental Science & Technology*, September 1990, p. 1287.

[73] De. Kelso and Kendziorek, "Alaska's Response to the *Exxon Valdez* Oil Spill," p. 17.

[74] U.S. Army Corps of Engineers, Alaska District, "Oil spill events lead to Corps involvement," Oil Spill Special Edition, Esprit de Corps, January 1990, p. 2, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 34060105, Folder: Alaskan Oil Spill Clips.

[75] Jerald L. Schnoor, "The Alaska Oil Spill: Its Effects and Lessons," *Environmental Science & Technology*, January 1991, p. 14.

[76] Pain, "Alaska Has Its Fill of Oil," p. 39.

[77] Janet McDonnell, *The U.S. Army Corps of Engineers Response to the "Exxon Valdez" Oil Spill* (Fort Belvoir, VA: U.S. Army Corps of Engineers, 1992), p. 16.

[78] Pain, "Alaska Has Its Fill of Oil," p. 39.

[79] De. Kelso and Kendziorek, "Alaska's Response to the *Exxon Valdez* Oil Spill," p. 17; Janet McDonnell, *The U.S. Army Corps of Engineers Response to the "Exxon Valdez" Oil Spill* (Fort Belvoir, VA: U.S. Army Corps of Engineers, 1992), pp. 6-7; Miller, "In a Faraway State," p. 1287.

[80] John Killoran, "Dredges prove their worth in frigid Alaskan waters," Oil Spill Special Edition, *Esprit de Corps*, January 1990, p. 5, Portland District,

Endnotes

Iron Mountain Records examined at Information Management Center, Location 277 cc 34060105, Folder: Alaskan Oil Spill Clips.

[81] Dawn M. Edwards, "Dredge Success in Alaska Noted by Corps Leadership and Industry Leaders … May Mean New Corps Mission in Future," Special Edition Alaska Oil Spill Response, *Corps'pondent*, July 1989, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1, Corps Newsletters.

[82] John Killoran, "Dredges prove their worth in frigid Alaskan waters," Oil Spill Special Edition, *Esprit de Corps*, January 1990, p. 5, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 34060105, Folder: Alaskan Oil Spill Clips; Dawn M. Edwards, "Dredge Success in Alaska Noted by Corps Leadership and Industry Leaders … May Mean New Corps Mission in Future," Special Edition Alaska Oil Spill Response, *Corps'pondent*, July 1989, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1, Corps Newsletters.

[83] Paul Koberstein, "Sea Whips Oil into 'Chocolate' Mess," *The Oregonian*, May 8, 1989, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 34060105, Folder: Alaskan Oil Spill Clips.

[84] Paul Apfelbeck, "The Oil Spill Observed," *Polk County Itemizer Observer*, May 17, 1989, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 34060105, Folder: Alaskan Oil Spill Clips.

[85] Dawn M. Edwards, "Dredge Success in Alaska Noted by Corps Leadership and Industry Leaders … May Mean New Corps Mission in Future," Special Edition Alaska Oil Spill Response, *Corps'pondent*, July 1989, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1, Corps Newsletters.

[86] Apfelbeck, "The Oil Spill Observed"; Dawn M. Edwards, "Dredge Success in Alaska Noted by Corps Leadership and Industry Leaders … May Mean New Corps Mission in Future," Special Edition Alaska Oil Spill Response, *Corps'pondent*, July 1989, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1, Corps Newsletters.

[87] Dawn Edwards, "Innovations Turn Dredges into Successful Oil Skimmers," Oil Spill Special Edition, *Esprit de Corps*, January 1990, p. 4, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 34060105, Folder: Alaskan Oil Spill Clips.

[88] Dawn M. Edwards, "Dredge Success in Alaska Noted by Corps Leadership and Industry Leaders … May Mean New Corps Mission in Future," Special Edition Alaska Oil Spill Response, *Corps'pondent*, July 1989, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1, Corps Newsletters.

[89] Dawn M. Edwards, "Dredge Success in Alaska Noted by Corps Leadership and Industry Leaders … May Mean New Corps Mission in Future," Special Edition Alaska Oil Spill Response, *Corps'pondent*, July 1989, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1, Corps Newsletters; Dawn Edwards, "Innovations Turn Dredges into Successful Oil Skimmers," Oil Spill Special Edition, *Esprit de Corps*, January 1990, p. 4, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 34060105, Folder: Alaskan Oil Spill Clips.

[90] U.S. Army Corps of Engineers, Alaska District, "Alaska 1989 Oil Spill," After Action Report, Captain Charles Heaton, Report Coordinator, 1990, pp. 1-2, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 34060105, Folder: Alaskan Oil Spill Clips.

[91] John Killoran, "Dredges prove their worth in frigid Alaskan waters," Oil Spill Special Edition, *Esprit de Corps*, January 1990, p. 5, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 34060105, Folder: Alaskan Oil Spill Clips.

[92] Miguel Jiminez, Interview with Lisa Mighetto, Aboard the *Yaquina*, Portland, Oregon, June 13, 2001.

[93] Apfelbeck, "The Oil Spill Observed."

[94] Janet McDonnell, *The U.S. Army Corps of Engineers Response to the "Exxon Valdez" Oil Spill* (Fort Belvoir, VA: U.S. Army Corps of Engineers, 1992), pp. 20-21, 43-48; Pat Richardson, "'Un-natural' disaster triggers longest emergency operation," Oil Spill Special Edition, *Esprit de Corps*, January 1990, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 34060105, Folder: Alaskan Oil Spill Clips.

[95] Janet McDonnell, *The U.S. Army Corps of Engineers Response to the "Exxon Valdez" Oil Spill* (Fort Belvoir, VA: U.S. Army Corps of Engineers, 1992), pp. 47-48; U.S. Army Corps of Engineers, Alaska District, "Engineers Assess Beach Cleaning, Oil Incinerating Methods," Oil Spill Special Edition, *Esprit de Corps*, January 1990, p. 13, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 34060105, Folder: Alaskan Oil Spill Clips.

Endnotes

[96] Janet McDonnell, *The U.S. Army Corps of Engineers Response to the "Exxon Valdez" Oil Spill* (Fort Belvoir, VA: U.S. Army Corps of Engineers, 1992), pp. 90-91.

[97] Koberstein, "Sea Whips Oil into 'Chocolate' Mess."

[98] Keeble, *Out of the Channel: The "Exxon Valdez" Oil Spill in Prince William Sound*, p. 227.

[99] Miller, "In a Faraway State," p. 1288.

[100] Mary E. Reed, *A History of the North Pacific Division*, for U.S. Army Corps of Engineers, North Pacific Division, 1991, pp. 84-89; William F. Willingham*, Army Engineers and the Development of Oregon: A History of the Portland District, U.S. Army Corps of Engineers* (Government Printing Office, 1983), p. 170; Paul Neville and Lance Robertson, "Opening the Flood Gates," *The Register-Guard*, December 15, 1996, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 20150409, Box 2, Folder: Flood December 1996.

[101] Neville and Robertson, "Opening the Flood Gates"; Jerry Schmunk, "Corps battles Pacific Northwest floods," *Engineer Update*, March 1996, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 20150409, Box 2, Folder: Flood 97.

[102] Jerry Schmunk, "Corps battles Pacific Northwest floods," *Engineer Update*, March 1996, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 20150409, Box 2, Folder: Flood 97; Bob Baum, "Worst of flooding over in Northwest," *Press Telegram*, February 10 1996, Portland District, Iron Mountain Records examined at Information Management center, Location 277 cc 20150409, Box 2, Folder: Flood 97; Kim Murphy, "In Northwest: Flooding Eases, Work Begins," *Los Angeles Times*, February 10, 1996, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 20150409, Box 2, Folder: Flood 97.

[103] Jerry Schmunk, "Corps battles Pacific Northwest floods," *Engineer Update*, March 1996, Portland District, Iron Mountain Records examined at Information Management center, Location 277 cc 20150409, Box 2, Folder: Flood 97; U.S. Army Corps of Engineers, Portland District, "Region's Dams Provide Vital Flood Control," News Release, January 27, 1997, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 20150409, Box 2, Folder: 1997 Floods.

[104] Jerry Schmunk, "Corps battles Pacific Northwest floods," *Engineer Update*, March 1996, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 20150409, Box 2, Folder: Flood 97.

[105] Christensen Interview.

[106] Jerry Schmunk, "Corps battles Pacific Northwest floods," *Engineer Update*, March 1996, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 20150409, Box 2, Folder: Flood 97.

[107] Murphy, "In Northwest: Flooding Eases, Work Begins."

[108] Jerry Schmunk, "Corps battles Pacific Northwest floods," *Engineer Update*, March 1996, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 20150409, Box 2, Folder: Flood 97.

[109] Mike Allegre, "Corps helps communities as waters rise," *Corps'pondent*, Special Issue: The 1996 Flood, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 20150409, Box 1, Corps'pondent 1995, 1996.

[110] Jerry Schmunk, "Corps battles Pacific Northwest floods," *Engineer Update*, March 1996, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 20150409, Box 2, Folder: Flood 97; U.S. Army Corps of Engineers, Portland District, "Corps Continues Flood Recovery Work 1 Year after Great Flood of 1996," News Release, February 7, 1997, accessed at https://www.nwp.usace.army.mil/pa/news/archive/1997/97-21.htm, on October 1, 2001.

[111] Joan Laatz Jewett, "Floods carry undercurrent of rebirth," *The Oregonian*, September 4, 1996, Portland District, Iron Mountain Records examined at Information Management center, Location 277 cc 20150409, Box 2, Folder: Flood 97; Chris Moore, "Surviving the flood: the impact on Northwest fish habitat," *Corps'pondent*, October 1996, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 20150409, Box 1, Corps'pondent 1995, 1996.

[112] Jewett, "Floods carry undercurrent of rebirth"; Chris Moore, "Surviving the flood: the impact on Northwest fish habitat," *Corps'pondent*, October 1996, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 20150409, Box 1, Corps'pondent 1995, 1996.

Endnotes

[113] Jewett, "Floods carry undercurrent of rebirth"; Chris Moore, "Surviving the flood: the impact on Northwest fish habitat," *Corps'pondent*, October 1996, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 20150409, Box 1, Corps'pondent 1995, 1996; Colonel Robert Friedenwald, Interview with Lisa Mighetto, Portland, Oregon, October 15, 2001.

[114] Neville and Robertson, "Opening the Flood Gates."

[115] Matt Rea, Interview with Jill Schnaiberg, Portland, Oregon, January 16, 2002, Hereafter cited as Rea Interview; U.S. Army Corps of Engineers, Portland District, *Willamette River Basin, Oregon Floodplain Restoration Project, Section 905(b) Analysis*, April 1999.

[116] Rea Interview; U.S. Army Corps of Engineers, Portland District, *Willamette River Basin, Oregon Floodplain Restoration Project, Section 905(b) Analysis*, April 1999; Jewett, "Floods carry undercurrent of rebirth"; Chris Moore, "Surviving the flood: the impact on Northwest fish habitat," *Corps'pondent*, October 1996, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 20150409, Box 1, Corps'pondent 1995, 1996.

[117] Jerry Schmunk, "Corps battles Pacific Northwest floods," *Engineer Update*, March 1996, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 20150409, Box 2, Folder: Flood 97.

[118] U.S. Army Corps of Engineers, *Annual Historical Report*, 1997, p. C-2, Portland District, Public Affairs Office, 870-5a, Organizational Histories, 1990-1999.

[119] Chris Moore, "Surviving the flood: the impact on Northwest fish habitat," *Corps'pondent*, October 1996, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 20150409, Box 1, Corps'pondent 1995, 1996.

[120] Beth A. Allen, "District Employees Show True Colors in Earthquake Response Efforts: More Than 100 Offer to help," *Corps'pondent*, January-February 1990, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1.

[121] Beth A. Allen, "District Employees Show True Colors in Earthquake Response Efforts: More Than 100 Offer to help," *Corps'pondent*, January-February 1990, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1.

[122] Beth A. Allen, "District Employees Show True Colors in Earthquake Response Efforts: More Than 100 Offer to help," *Corps'pondent*, January-February 1990, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1.

[123] Beth A. Allen, "District Employees Show True Colors in Earthquake Response Efforts: More Than 100 Offer to help," *Corps'pondent*, January-February 1990, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1.

[124] U.S. Army Corps of Engineers, Portland District, "Corps team helps hurricane relief effort," *Corps'pondent*, January 1993, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1.

[125] U.S. Army Corps of Engineers, Portland District, "Corps team helps hurricane relief effort," *Corps'pondent*, January 1993, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1.

[126] U.S. Army Corps of Engineers, Portland District, "Local Response to Hurricane Andrew," News Release, September 4, 1992, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 cc 19150401, Box 1, Folder: Emergency and Disasters, 1989-1994.

[127] U.S. Army Corps of Engineers, Portland District, "Corps team helps hurricane relief effort," *Corps'pondent*, January 1993, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1.

[128] U.S. Army Corps of Engineers, Portland District, "Corps team helps hurricane relief effort," *Corps'pondent*, January 1993, Federal Records Center Pacific Alaska Region, RG 77, Accession 77-95-0183, Box 1.

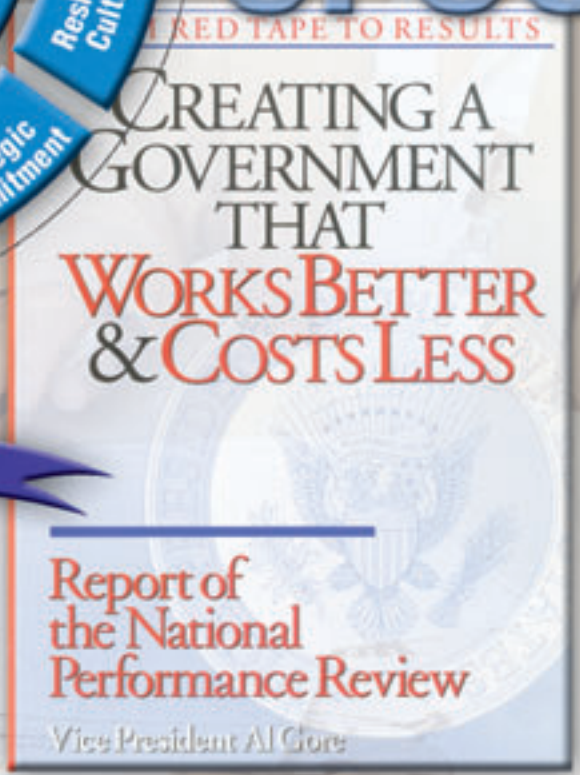
Changing the Way the District does Business

PMBP

CPAC
CPOC

Portland District
US Army Corps of Engineers
STRATEGIC PLAN

LDP



Chapter Six

Changing the Way the District Does Business

"This decade is not a time for business as usual and the Corps must be in the forefront of organizations which can adjust to changing political considerations, fiscal policies, socio-economic developments and new technologies."

Lieutenant General J.K. Bratton, "Challenges for the 1980s in Serving the Army and the Nation," 1982

Portland District's workforce faced the National Performance Review, which called for organization downsizing.

Corps engineers in the field with contractors

Deputy District Engineer Davis Moriuchi

Adapting to Changing Conditions

The late 20th century marked a period of significant transformation for the Corps. Fluctuating workloads, agency-wide downsizing movements, and personnel issues all impacted the agency. In response, during the period from 1980-2000, the Corps incorporated considerable changes to its operations, as it sought to function more like a business, guided by the same principles affecting the private sector.

Reduced workloads challenged districts throughout the Corps. By the early 1980s, the era of large-scale water development had ended, due to economic and environmental concerns [See Chapter One]. Deputy District Engineer Davis Moriuchi witnessed this period of transition. "The nature of our work is changing," he explained. "When I got here in the mid 1970's, [we were] toward the end of a period of several decades when … the demands of the country were nation building and infrastructure development." The passage of environmental legislation, however, altered the Corps' work, marking "the beginning of changes."[1] The future of the agency's civil works remained uncertain until the passage of the Water Resources Development Act of 1986 (WRDA-86) made possible a steady flow of small-scale water projects.[2]

WRDA-86 profoundly influenced the Corps, prompting the agency to increase efficiency and operate more like a business. This legislation directed the Corps to implement greater cost sharing with non-federal sponsors and to expedite the planning process for civil works projects.[3] Cost sharing in particular brought a new level of accountability to the Corps. "Before cost sharing … we had these large-scale projects that came with these rough estimates,

and, if we needed more money, we would get our knuckles rapped and go back and ask Congress for more," said Moriuchi. "So I don't think we had quite the same accountability and discipline, in terms of being cost effective and serving customers." Now, he explained, the Corps' customers "want us to deliver things on time and meet the budget, and we have to open our books up to them."[4]

Combined with the movement away from large construction projects, the Clinton administration's National Performance Review (NPR) further affected the agency – particularly in terms of staffing needs. Enacted in the mid-1990s, the NPR called for an intensive, six-month study of the federal government, including agencies such as the Corps. NPR and the "Reinventing Government" initiative aimed to make government "work better and cost less." Some of the campaign's objectives included the following: streamlining bureaucracy, cutting unnecessary regulations, and improving civil service personnel practices and federal procurement procedures. According to Donald Kettl, a professor of Public Affairs at the University of Wisconsin-Madison, what most preoccupied government managers was NPR's call for reducing federal employment by 272,900 workers. This quickly became "the defining reality of NPR for many government workers," and it brought significant changes to the Corps' employees.[5]

Personnel issues became prominent during this period as well. The nation's workforce was aging, and the Corps was not immune from this trend. Astounding numbers of Corps employees were eligible to retire, potentially undermining the agency's knowledge base and expertise. Furthermore, the Corps had to compete with the private sector to recruit and retain its staff.

Struggling with an ever-changing work environment, districts throughout the Corps developed institutional and administrative responses to ensure organizational survival. In particular, the Corps adopted strategies to become more like a competitive business than a government office. These included the adoption of project management, downsizing through agency-wide reorganization, the inception of regional business centers, the regionalization of personnel services, and other related measures.

"We're asking, what skill sets do we need that we don't currently have, because these environmental skills aren't the same skills that these big structural dam building engineers have had prior….So what we want to do is … hire in some people with new skill sets for the future."
-Colonel Randall J. Butler, District Commander

Adopting Project Management

Following the passage of WRDA-86, the Corps adopted a new project management system. Traditionally, a district managed its civil works project by passing it from one functional area – planning, engineering, construction, and operations – to the next as it progressed from concept through completion. Each functional area assigned a different manager to the project, causing a break in continuity as the project moved from one manager to the next. Furthermore, no single person was responsible for delivery time or cost control.[6] WRDA-86's establishment of cost sharing measures, however, placed new pressures on the Corps to more effectively manage projects. "In a cost sharing environment we had to get a lot more efficient and unified as a Corps team," explained Moriuchi. "So project management was set up to try and horizontally integrate the organizations and to try to make them one."[7] In contrast to the Corps' approach to project management, the private sector employed one person – the project manager – to oversee all project costs and schedules throughout the life of the project. This system eliminated the necessity of transferring the project between managers. It also emphasized teamwork above loyalty to a functional specialty and stressed cost controls and timelines throughout the life of the project.[8]

In July 1988, the Corps adopted the project management concept, issuing an engineering circular to guide implementation. The circular instructed districts to take the following four steps. First, each district was to designate a civilian as a Deputy District Engineer for Project Management (DDE [PM]). Second, districts were to assign a project manager for each large civil works project and a team of project managers for projects too small to be individually managed. Third, the circular established a board chaired by the DDE [PM] to meet on a monthly basis to review and evaluate projects' status. Finally, a Program Management Office would provide technical advice to the DDE [PM]. The chiefs of the functional areas retained responsibility for providing traditional projects, including developing schedules, budgets, and manpower requirements for accomplishing their work. New project managers were accountable for overall project schedule, cost, and coordination and reported directly to the DDE [PM]. Corps Headquarters ordered that no additional personnel positions be created to achieve the new structure.[9]

Over the next four years, senior leaders at Headquarters worked to execute the new project management system. The process did not proceed smoothly. Even before issuing the engineering circular, Chief of Engineers Lieutenant General Henry Hatch anticipated opposition, observing that "people resist change, particularly change that disturbs their turf." Some Corps

employees were reluctant to give up their authority or personnel to a project manager or civilian DDE. According to Moriuchi, "historically the Corps has been very stovepipe-oriented," with the organization "pretty much self-contained … in the Division Headquarters" – which made implementation of project management challenging. In general, Corps employees in the field thought the new system added a layer of management and reporting requirements with few benefits. Some even questioned the underlying belief that the Corps needed to increase its efficiency and reduce costs. A participant in a planning meeting asked, "Why should we worry about the cost of doing business?" The fact that each district initially tended to interpret and implement guidelines differently further hindered the process.[10]

Despite internal resistance, General Hatch pushed ahead, clarifying that the DDE [PM] shared equal rank with chiefs of engineering and construction. He also restructured Corps Headquarters to demonstrate the agency's commitment at the top to the project management system. The key change, made in July 1989, involved establishing two program directorates – civil works and military programs. While each directorate had its own engineering and construction division, civil works contained divisions of project management, programs, and policy and planning. Military programs had new project management and environmental restoration divisions. In the field, each district and division combined programs and project management. By 1990 project managers existed at every level of the Corps.[11]

Between 1990 and the end of his term as Chief of Engineers in 1992, General Hatch continued the movement to establish project and program management. In March 1991, the Corps issued a regulation for project management, establishing a project team led by a project manager and including technical personnel from functional elements. Field surveys conducted by Headquarters revealed that resistance to the new approach persisted. Field personnel complained about conflicting guidance, complicated reporting requirements, duplication of efforts, and micromanagement. Despite these challenges, General Hatch maintained his support for project management. While he acknowledged that "differing perspectives among our functional elements and project management are inherent" to the system, he also made clear the leadership's ongoing commitment to the full implementation of project management. "We believe that developing quality projects on schedule and within budget can best be accomplished by combining the strength of our existing functional elements with a strong PM organization," explained General Hatch. Gradually, the system took hold as new leaders who embraced project management emerged in district and division offices.[12]

The Portland District initiated project management in 1988. That year, a new civilian deputy district engineer position – filled by Moriuchi – was established to oversee the project management program.[13] Initially, many in the District were reluctant to embrace the new system. "No one thought this was going to last very long," observed Moriuchi, "a lot of folks thought it was a foolish idea." The District's project management concept started with four people – Moriuchi, a personnel specialist, and two project managers from engineering. Gradually, the agency expanded the program, adding a number of different project managers.[14]

In a related move, the District incorporated the Project Management Business Process (PMBP) in 1998. The principal focus of PMBP was on clear project definition, agreement on project direction, completion within time and budget constraints, and excellent customer satisfaction. PMBP applied to all District projects and included the following major components: marketing as a District strategy, consistent project identification, projects led and

Project managers were empowered to be creative.

Row 1: Howard Jones, Brent Mahan, Col Hobernicht, LTC Markham, Dave Brown
Row 2: Mike Gross, George Miller, Doris McKillip, Laura Hicks, Sandra Takabayashi, Steve Perkins, Curt Locp
Row 3: Gil Fletcher, Taunja Berquam, Doug Craner, Harley Grosvenor, Doug Putman, Brian Schmidtke, Mark Dasso, Matt Rea
Row 4: Rick Goodell, Geoff Dorsey, Sheryl Carrubba, Greg Bertrand, Norm Tolonen, Doug Clarke, Don Erickson, Maurice Secrest, Bob vanderBorg, Eric Bluhm, John Kranda, and George Medina

Project Managers

managed by a single PM, projects managed in accordance with a management plan, regular review of resource issues and oversight of the project team formation by project review teams, and project information managed using automated information systems. As with other aspects of project management, PMBP strove to ensure "excellent end results" for District projects.[15]

In 1999, the District combined the Programs and Project Management Division (PPMD) with the planning division to form the Planning, Programs and Project Management Division (PPPMD). According to Moriuchi, the two were merged "because there was a kind of natural alliance there." There was, however, organizational resistance to the merger. "We may have been one of the first districts to push that idea," observed Moriuchi, "now it's more accepted."[16] In that same year the District also established an environmental resources branch in the PPPMD.[17]

As a DDE [PM], Moriuchi believes that one of the greatest benefits of project management has been the personal development and empowerment of District employees. "Watching the project managers and the entire staff grow when they used to ask me for permission is satisfying," he said. "This whole notion of empowerment was one of our basic management philosophies when we began," Moriuchi explained. "Project managers needed a total sense of ownership and responsibility for their projects and, because we were a very flat organization, I was often unavailable to provide that insight." So he urged his staff to "keep pushing and pushing until you find out you pushed too far." In the process of testing the organization's boundaries, Moriuchi was gratified "to see those folks who were brought up in a very traditional, rigid, hierarchical organization … have their creative juices start flowing. They've grown tremendously."[18]

Compared to other districts, Portland's project management team grew slowly. By limiting the system's expansion, Moriuchi and others hoped to avoid establishing another level of hierarchy within the organization. "My vision all along though was that we have not won if we try and create still another stovepipe, if you will, called PPPMD," he explained. "In fact, I think that we need to continue to blur the lines that divide engineering and construction and planning and programs and project management and operations."[19] According to Howard Jones, Chief of Engineering and Construction Division, project management has benefited the District. "I think right now we have a much more corporate mindset," he explained. "I see very little functional or stovepipe mentality anymore. I think all of us realize that in order to be successful, we have to work together very closely."[20]

Restructuring the Corps

By the late 1980s, Corps leadership recognized that, in addition to changes in business practices, a reorganization of the agency was necessary. Several factors pushed the agency to consider reorganization, including the shift from a workload heavy with design and construction to one weighted toward operations, maintenance, and regulatory and environmental restoration activities, and the need to reduce overhead. The cost sharing features of WRDA-86 and a decline in military work due to the Cold War also influenced the decision to reorganize. Appropriations for military construction peaked in the mid 1980s, dwindling thereafter. A mandate to reduce manpower throughout the Department of Defense, combined with the requirement to maintain specific administrative and management positions in each division and district office, forced the Corps to cut technical staff. The erosion of the workforce and the loss of engineering expertise worried many in the agency. A reorganization that reduced the number of divisions and districts offered the potential to distribute the workload more evenly among the remaining field offices, cut nontechnical personnel, and reduce overhead. It appeared to be time for the Corps to reevaluate its mission, goals, and structure, as well as its management procedures.[21]

Prompted by a congressional directive in the Energy and Water Development Appropriations Act for Fiscal Year 1990-91, the Corps formed a study group to identify the most effective means for reorganizing the agency. Chief of Engineering for the Vicksburg District Fred H. Bayley III headed the Bayley Task Force, which included a group of senior representatives from Headquarters and the field. The task force identified three factors – cost effectiveness, flexibility, and competence – to be considered in the planning phase and determined criteria by which to weigh the factors. Based on these objectives, the Bayley Task Force laid out five organizational alternatives: realignment, regionalization, decentralization, elimination of division offices, and a combination of all structures.[22]

As the Bayley Task force completed its report in October 1990, the Bush administration attempted to insulate the Corps reorganization from politics by including the plan in the larger Base Realignment and Closure (BRAC) process. In 1988, the Secretary of Defense chartered the BRAC commission to review Department of Defense installations and to recommend facilities to be realigned, consolidated or closed free of congressional interference. Congress, however, did not feel that the BRAC process was appropriate for evaluating the civil works aspects of the Corps. Subsequently, in November 1991, Congress passed the "Nunn Amendment," withdrawing the Corps from BRAC and ordering the Defense Department not to spend funds to close any district or division office.[23]

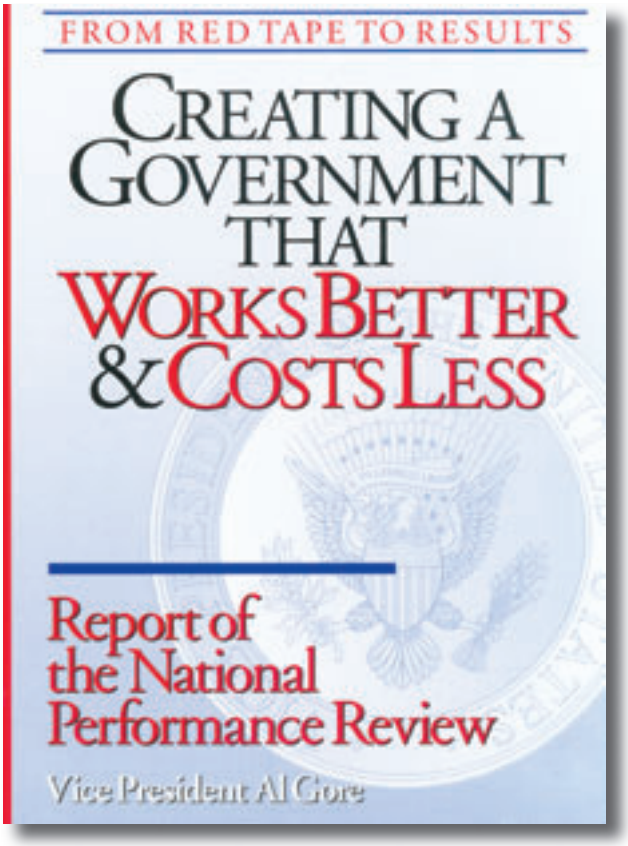
Following passage of the Nunn Amendment, the Corps created two additional study groups: a Headquarters Reorganization Office assisted by a Field Advisory Committee (FAC) and a task force led by Brigadier General Albert Genetti, former District Engineer. The Genetti Task Force proposed an organizational structure consisting of divisions, districts, and technical and administrative centers, and the Corps directed the FAC to develop site-selection criteria for these structures. In July 1992, the Genetti Task Force recommended reducing the number of divisions from 11 to 5 and basing district management on the concept of 15 technical centers – designed to provide greater concentration of planning, design, and review expertise – and 10 military construction centers, with two districts per division having responsibility for all military work. Five administrative centers would provide regional human resources, audio-visual, library, and audit functions. As part of its plan, the Genetti Task Force did not name the divisions or districts targeted for closure, causing a great deal of anxiety among Corps employees throughout the organization. Instead, it provided a list of site-selection criteria by which the organizations would be evaluated. These criteria included items such as the cost of living, education, transportation, labor, office space availability, number of current personnel, and geographic distribution. The selection of sites to be closed was further complicated when Congress, on September 24, 1992, funded Corps reorganization planning while specifically ordering the agency not to close any district offices. Finally, on November 19, 1992, Chief of Engineers Lieutenant General Arthur E. Williams and Assistant Secretary of the Army for Civil Works Nancy Dorn held a joint news conference to announce the final reorganization strategy.[24]

The 1992 reorganization plan proposed closing five divisions and altering the responsibilities and workload of all 38 districts. As a result, approximately 2,600 positions in Corps offices across the country would be eliminated, with a projected annual savings of $115

million. The Corps planned to close divisions in Chicago, New York, San Francisco, Dallas, and Omaha. In addition to reducing the number of divisions, the plan also changed their responsibilities. The remaining divisions lost their technical and policy review functions, which were now assumed by a Washington Level Review Center at Headquarters. Commenting on the reorganization, General Williams explained that, "the Corps needs to reorganize if it is to continue its rich tradition of responsive, efficient and economical engineering services to the Nation."[25]

Understandably, the reorganization plan caused concern among Corps personnel. To address questions and rumors about the impact of the plan on individuals, some divisions set up a Reorganization Information Center. They also established hotlines and published special newsletters with information about the reorganization process and individual options. Portland's Public Affairs Office distributed 24 special issues of a publication, named "Reorganization Update," to all district employees. The publication featured the most recent information available and found answers to all questions submitted by employees. In addition, several town hall meetings were held for those employees who wanted to discuss the reorganization or their feelings about it with the Commander.[26] Many employees refused to accept the reorganization plan, however, turning to their local congressmen for help in halting it. Both Congress and the Clinton administration responded sympathetically to these concerns.[27]

In January 1993, President Clinton instructed the Secretary of Defense to review the 1992 reorganization process and ordered Vice President Al Gore to examine the Corps as part of the NPR campaign. These actions essentially killed the plan. Over



President Clinton instructed the Secretary of Defense to review the 1992 reorganization process. He ordered Vice President Al Gore to examine the Corps as part of the NPR campaign.

the next several years, the Corps' reorganization was absorbed by the "Reinventing Government" initiative and was heavily influenced by the Republican-controlled House of Representatives move to cut congressional budgets. Thus, reorganization proceeded on a piecemeal basis, with a reduction of approximately 1,770 full-time jobs between Fiscal Years 1990 and 1995. The movement to reduce the workforce was painful for the agency, and discussions of reorganization permeated the Corps during the 1990s.[28]

In May 1994, the Corps initiated a new effort to reorganize. To that end, the Corps leadership convened a restructuring workshop, comprised of representatives from Headquarters and the field as well as project sponsors and partners, to search for ideas on how the agency could function more efficiently. In his remarks, General Williams openly expressed that the agency had "been through a period of frustration and uncertainty because of project reorganizations, hiring freezes, high-grade ceilings, changes in workloads, and personnel reductions…. We have 40,000 civilians in the Corps who have been on a bungee cord," he observed. "We now have the opportunity to move forward."[29]

At the workshop, participants addressed a number of serious issues, including the future roles and missions of the Corps, the definitions of technical and policy review and the level at which they should occur, and the implementation of new Civil Works Standard Organization Structure. After intense debate, the workshop produced a draft statement outlining revised roles and missions for comment throughout the Corps. As part of the restructuring process, the agency had to eliminate a number of positions; fortunately the majority of these were accomplished on a voluntary basis.[30]

Lacking an overarching plan, the process of restructuring the Corps proceeded on a piecemeal basis. Initial efforts to improve efficiency focused at the Headquarters and division levels. During 1994, for example, the new technical review procedures removed divisions from the process, focusing reviews at the district level. The Corps also revised many of its business processes, including the continuing authorities program, the feasibility study process, and the Operations and Maintenance performance measurement system. The objective remained the delivery of quality products at less cost. Not surprisingly, restructuring proved painful due to continuing pressure to downsize. By August 1995, the Corps had achieved roughly 1,800 of the 4,500 reductions required by 1999. These reductions challenged the agency's ability to maintain a

Restructuring the Corps from 13 to 8 Divisions.

viable engineering and technical expertise.[31]

The next phase of restructuring focused at the district level. This process involved developing Corps-wide guidelines and then allowing division commanders to ensure that all specific district restructuring actions were in compliance with the guidelines. No district would close and all would continue to maintain engineering, planning, operations, and construction capability. The difference, however, was that the level of competency in each functional element would vary across districts. The goal, according to the guidelines, was not to "do more with less," but "to identify how to accomplish the realistically projected workload in an era of declining resources."[32]

After gathering comments from the field, customers, and congressional elements, the Corps issued guidance, allowing district restructuring to begin in the spring of 1996. While the district reorganization moved slowly ahead, the Corps implemented a revised division-restructuring plan in 1997.[33] Earlier, Congress had passed the 1996 Appropriations Act, requiring the Corps to downsize. The appropriations act required the agency to reduce the number of divisions from 13 to 6, 7, or 8 and mandated that each division must have at least four districts.[34] In response, the Corps' final plan reduced the number of divisions from 13 to 8 and reassigned some districts to new divisions.[35]

Reducing the divisions was a complicated process. Three of the divisions were divisions in name only and were easily reassigned. The New England Division, for example, had no districts. The Corps therefore told the office to report to the North Atlantic Division. Similarly, the Huntsville Division was an operating center and also had no districts; it became a support center, providing assistance to specialized missions requiring unique technical expertise. At this point the Corps had ten divisions – two more still needed to be eliminated. By restructuring the agency to form one division for the Mississippi River Basin, the Corps reduced the number of divisions to 9. The Corps then attempted to eliminate the Pacific Ocean Division (POD) by adding it to the South Pacific Division (SPD), but senators from Alaska and Hawaii protested the closure. According to Colonel Eric T. Mogren, Deputy Division Engineer of the Northwestern Division, while Congress has always expressed interest in reducing the number of districts and altering the Corps' structure, when it comes to the specifics of what gets closed, local interests go "up in arms." Thus, restructuring the agency "has historically been extremely tough." Rather than eliminate the POD, the Corps combined the North Pacific Division (minus Alaska, which was transferred to the POD) and the Missouri River Division to form the Northwestern Division (NWD). The new division, which covered the largest land area of any division, encompassed the Portland, Seattle, Walla Walla, Omaha, and Kansas City districts. Colonel Mogren recalled that there were several reasons why the two divisions fit together. "There were a lot of similarities in the issues facing those divisions," he explained. "So it made sense to put those folks together." Specifically the divisions both encompassed major river systems with hydropower, navigation, and environmental issues.[36]

Merging the North Pacific Division and the Missouri River Division was not an easy task. The new division encompassed

an expansive geographic area, faced complex environmental and economic issues on the Missouri and the Columbia rivers, and included both military and civil projects. Furthermore, Corps leaders had to combine two separate staffs into one and "bring that down to where it was just one division's worth of resources." In fact, when asked which of his many responsibilities took the most time, Colonel Mogren replied that what had occupied him most during his tenure in Portland was "the restructuring and making sure that worked with the downsizing of the workforce and the melding of the two cultures." Downsizing proved particularly demanding. Amazingly, in the process of combining the two divisions, the Corps managed to avoid a Reduction in Force (RIF). "The most challenging piece was the downsizing aspect," explained Colonel Mogren in 2001. "We had 160 … plus people when I got here four years ago, with an end strength of going down to 94 by October 1st of this year. And we've been able to do that without any adverse impacts, such as RIFing anybody." Instead the Corps relied on techniques such as voluntary departures and lateral assignments. The goal was to "minimize the adverse impact on people."[37]

Employee morale tended to suffer throughout the reorganization process. In addition to the turmoil associated with changes in leadership, Colonel Mogren acknowledged that there was uncertainty among staff. According to him, people wondered, "Will my job be eliminated, won't it be eliminated? Will I be moved to Portland, won't I be moved to Portland?" Overall personnel in the two divisions experienced "tremendous personal stress." Colonel Mogren emphasized that to bolster morale it was important to provide employees with as much accurate information as possible. "I think the most important thing you can do," he explained, "is … keep people informed. Because when your morale starts tanking … people have questions and are making up the answers themselves." Furthermore, Colonel Mogren believed that people "will always make up the worst possible scenario, internalize it, and convince themselves or their peers that it has a high likelihood of occurrence."[38] Diana Brimhall, Chief of Public Affairs for the Portland District, agreed that keeping people informed was essential during the restructuring process. "That's what we were trying to do," she said. "We tried to keep people informed regularly. We tried to be open with what we knew." According to Brimhall, this was not always an easy task. "The problem that we faced at this level is frequently that nothing comes from Headquarters," she explained. "Even when you ask questions or ask for information that you really need to get out to your people, … nobody wants to put it down in writing."[39]

Despite the challenges inherent to restructuring the districts, there were benefits. Howard Jones observed that the restructuring prompted work to be shared among the districts. "There's a lot more understanding of who may need … help and a lot more willingness across the Corps to work back and forth across district lines," he explained. Because of its design experience with the Bonneville navigation lock, Portland, for example, worked on lock design for the Louisville and Huntington districts. Conversely, Omaha created a design for The Dalles Dam, and Walla Walla worked on a variety of fish-related projects for Portland.[40]

Reflecting on the restructuring process, Colonel Mogren noted that it was both among his most important accomplishments as well as an area for improvement. "The thing I'm most proud of, number one, is the restructure. I'm proud of bringing in restructuring without anybody getting hurt professionally, without adverse reactions. We've had some very disgruntled people, and I guess I'm very proud of the way that came out. At the same time, the thing I'm least satisfied with is the fact that we do have some people with some very hard feelings over how they got treated in this process. I think they tend to be the minority, but they are there, and I think we could have done a better job with that. So that cuts both ways."[41]

Becoming a Regional Business Center

In an effort to increase its competitive edge and as part of its restructuring process, in 1998 the Corps formally initiated the concept of regional business centers. Since then the agency has worked to transform each of its eight divisions into a Regional Business Center (RBC) and bring a broader perspective to Corps operations and business practices. The Northwestern Division's goal in implementing the RBC concept was "to provide a strategic framework to transition the Division to corporate processes that will optimize the use of available resources and improve internal procedures to better serve our customers, the Army, and the Nation." In particular, the NWD hoped to provide high quality, cost effective, and timely products to its customers and the public.[42]

The Corps had five major operating principles guiding the RBC. These included the following: building corporate procedures; facilitating the ability to meet the nation's needs in water resources, military construction and installation support, environmental, and support to others; developing a capable and sustainable workforce; instituting a peer review process; and assuring that lessons learned are recorded and developed into better business practices to improve the agency's service. The RBCs operate through a regional management board (RMB). According to Corps' policy, the RMB includes three representatives from the division and two from each district; in practice, however, membership varies widely. The RMBs report either directly to the division commander or to a board configured and chaired by the division commander.[43]

The need for RBCs grew out of recognition that districts tended to operate too independently of one another. Davis Moriuchi recalled how Lieutenant General Joe N. Ballard, the former Chief of Engineers and a onetime customer of the Corps, had been instrumental in identifying the need for cooperation. "One of his observations was very correct even though it was painful to hear," Moriuchi explained. "He said, 'I can't tolerate having 41 independent fiefdoms, doing your own things." Indeed, Moriuchi observed that each of the districts had in fact created their own interpretation of regulations and their own business processes. General Ballard continued that while having 41 entities was not workable, he could "control eight regional business centers." The challenge, according to Moriuchi, was incorporating standards while allowing districts to retain some of their individuality: "We don't necessarily want to make us look like we're cut by the same cookie cutter," he said, "because there are legitimate differences that reflect our working flavor. But there ought to be standard business processes. We don't have to be exactly like McDonalds, but we should be less like 41 independent fiefdoms and not have 20 separate ways of doing things."[44]

Having uniform standards was important for the Corps' customers. In particular, it benefited states, which would often work with multiple districts. Corps' districts followed watershed lines, not state boundaries; if each district had its own set of rules and procedures it had the potential to produce a good deal of confusion and stress. "In the state of Oregon you've got Portland District, Walla Walla District, and way down south by the Klamath Basin you've got the San Francisco and Sacramento districts," Moriuchi explained. By introducing RBCs the Corps hoped to work "in a more collaborative manner."[45]

While many believed the RBC concept was "cutting edge," the Corps encountered some resistance to the idea.[46] Part of the opposition came from the fact that historically Corps districts have been very self-contained. "Portland District has loved to do work for others, but we don't like sharing our work with outside hands," observed Moriuchi. "If we do, we like to pick the interesting stuff and pass the rest of the stuff on." Yet Moriuchi expressed pleasure that the concept was gaining acceptance within the District. "I've been surprised – though it is taking a while – that just by getting people to meet members from other districts and talk to them you realize that they are also very professional and highly technically competent…. People realize that they don't have to just look to the people around them; if they don't have the resources now they know someone they can call and go get some help."[47] Thus, Portland, like other districts throughout the Corps, gradually incorporated the RBC concept into their workloads, ushering in a new era of customer service and bolstering the agency's competitive edge.

Forging a New Funding Agreement with BPA

The Corps' efficiency further increased during the late 1990s, with a new funding agreement with the Bonneville Power Administration (BPA). As the operator of 21 hydropower plants in the Pacific Northwest, the Corps shared a close relationship with the BPA, which marketed and sold the electricity from the Corps and other federal hydro projects in the Columbia Basin. The BPA was also accountable for covering repair and maintenance costs at the Corps plants. Historically, these costs were funded through the federal budget process and then repaid by BPA at the year's end to the U.S. Treasury. In October of 1998, however, a new agreement went into effect in which the BPA agreed to fund repair and maintenance costs directly. Eliminating the congressional appropriations loop allowed the Corps to make power plant repairs that otherwise would have been delayed because of budget limitations and inflexible schedules inherent in the annual appropriations process.[48]

The new agreement promised to increase the efficiency and reliability of the Federal Columbia River Power System. "Without a doubt, the direct funding agreements will improve the overall value of the federal hydro system by generating more energy and providing greater system reliability," said Elizabeth Moler, deputy secretary of the U.S. Department of Energy. By shortening the time to secure funding for repairs and maintenance, the agreement provided greater assurance that generators would keep running. It also removed maintenance as a funding item, eliminating competition with other federal budget priorities. Furthermore, the agreement had the potential to improve cost efficiency of the projects. Now BPA could, for example, fund off-shift maintenance work, allowing plants to run during peak generation hours. "This agreement is a major improvement," explained acting BPA Administrator Jack Robertson. "Before now, delays and uncertainty in funding maintenance on turbines and other power-related facilities disrupted operations that are critical to generating the revenues needed to pay for the projects."[49]

The direct funding agreement between the Corps and BPA covered a ten-year period, ending in 2008. The terms of the agreement called for the Corps to secure funding certainty for plant operations and maintenance for the first five years, ensuring that BPA would know its financial obligations related to the plants. Both the BPA and the Corps expected direct funding to improve business relationships between agencies and foster a greater understanding of regional priorities. According to Tom Savidge, Chief of the Operations Division, the agreement marked a watershed in the relationship of the organizations. "We have a 60-plus year relationship," he explained. "Over that time there was a lot of opportunity for emotional baggage to build up – perceptions of one agency over the other, jealousies,

and whatever else." Direct funding heralded "a major sea change." Overall, Savidge believed that the new agreement was working, prompting the BPA and the Corps to cooperate and work together. "Now we're operating as much as we can as one unit," he observed. "They're the funding component, but we are learning a lot more about what's important to Bonneville Power, and they are learning a lot more about what's important to us. That's been a very large learning process. We're creating business processes that didn't exist before on how we interact with one another."[50] While the process involved a major effort from both parties, it had the potential to bring great benefits as well. "Direct funding will provide for a true partnership between the Corps, which is the fourth largest power generator in the country, and BPA," observed John Zirschky, Assistant Secretary of the Army for Civil Works. "This strengthened relationship will improve the efficiency and reliability of the power supply in the Northwest region."[51]

Regionalizing Personnel Services

Beginning in the mid-1990s, the Department of Defense's (DoD) effort to downsize its civilian and military force led to a series of changes to the Corps' personnel system. The goal was to streamline human resources functions, thereby increasing efficiency. The end of the Cold War, along with Vice President Al Gore's "Reinventing Government" initiative, contributed to the DoD's endeavor to reduce the size of its human resources staff. As a result, on November 14, 1993, the Office of the Secretary of Defense directed the Army to regionalize civilian personnel servicing functions and to reach a ratio of one employee providing personnel services to every 88 customers by the end of FY 1998.[52]

Traditionally, human resources functions in the Corps resided in a Civilian Personnel Office (CPO). The Army instituted the regionalization process through the establishment of ten regional Civilian Personnel Operations Centers (CPOCs), seven of which were located in the continental United States and three overseas. The plan also restructured the CPOs to become Civilian Personnel Advisory Centers (CPACs) at the various districts and installations. The Army implemented regionalization in stages to ease some of the hardships associated with the effort and to apply lessons learned to those regions that were slated for transition later in the sequence. Generally, the process occurred in the following manner: as a CPOC became operational, three CPOs in the region transitioned to CPACs. Approximately every three months thereafter, three additional CPOs transitioned to CPACs until the process was complete. In addition, the Army installed new automation tools and equipment in the CPAC at the time of transition. The schedule varied slightly, depending on factors such as size and mission requirements.[53] Portland was the last district in the country scheduled to make the switch from a CPO to a CPAC, completing the transition in 1999. It was one of 13 CPACs to join the West Civilian Personnel Operation Center (WCPOC), located in Fort Huachuca, Arizona.[54]

The largest human-resources information system in the world, the DCPDS linked all military branches under the same personnel system and replaced all DoD personnel information management systems with one information system to manage civilian human resources.

The Army's plan to split functions between the CPACs and CPOCs attempted to achieve economies of scale through standardized operations, state-of-the-art automation tools, communication enhancements, and streamlined, customer-oriented business processes. Under the new system, CPOCs had the following functions: recruitment, training management, automation management, classification of jobs, personnel actions processing, maintenance of personnel records, and processing employee benefits. In general, the CPOC performed tasks that did not require face-to-face contact with customers. Conversely, CPACs provided advice and assistance to managers, supervisors, and employees about various personnel functions. "We're supposed to take care of the human factor," explained Daniel Majerus, Director of Portland's CPAC. The split of CPOC/CPAC functions was made in accordance with an Integrated Definition study of personnel functions, developed by the Department of Army. As a result, approximately 60 percent of personnel functions were moved to the CPOC, with the remaining 40 percent performed at the CPAC.[55]

According to Majerus, Portland's predecessor to CPAC – the CPO – was a stand-alone organization that was largely independent from other districts' human resources offices. Regionalization changed that dynamic. Under the new system, the District's CPAC served as an intermediary between the CPOC and District staff. In the process it lost many of the functions it once held, such as determining salaries, managing Official Personnel Files, and distributing wages. Regionalization also shifted some work back on District managers, who in some cases had to hire additional administrative staff to help them with their new responsibilities. CPACs retained some functions independently of CPOCs. These included labor relations, manager/employee relations, and some local student recruitment. Originally, the Army had given these duties to the CPOCs, but, after reviewing the

situation in their European CPOCs, it found this arrangement was not working. Apparently, these functions were better achieved on a local level.[56]

In addition to dividing work between the CPAC and CPOC, regionalization affected human resources within the District by shifting the majority of positions from specialists to generalists. In accordance with the Army's plan, those who remained at the installation level in the CPAC would "likely transition from a functional specialist to a generalist providing advice and assistance to managers on how to affect organizational and personnel actions."[57] Traditionally, the District's human resources staff specialized in a particular area, such as civilian training, classifying positions, staffing and recruiting, and labor relations. Each person was an expert in his or her field. Regionalization forced these employees to become generalists. Specialists, however, remained at the CPOCs. To accomplish the switch from specialists to generalists required a substantial knowledge transfer, which was done through a formal training center, self-training, and with the assistance of CPOC staff. Officially CPAC staff were no longer specialists, but in reality many retained their specializations, and District employees continued to route questions to various individuals, depending on their area of expertise.[58]

Not only did the roles of the District's human resources staff change, the actual number of employees underwent a dramatic reduction. In the 1990s, Portland had 30-35 human resources staff. To meet the Army's goal of having a service ratio of 1:88, by May of 2000, that number had dropped to 16; by 2001 the District's CPAC employed 12 people. The majority of individuals either retired or found another position within the District; very few Reduction-In-Forces or RIFs were necessary.[59] The elimination of human resources positions occurred throughout the Army. In fact, by 2000 the personnel workforce had been reduced by 41 percent.[60]

One of the ways the Army proposed to meets its personnel goals with a reduced staff was through the use of automated systems, which were constantly being developed. In fact, according to Majerus, in one year alone the Army introduced six new systems. These systems were developed to simplify and standardize processes, but they were also hard to adapt to and necessitated substantial training. In particular, many managers found learning so many new systems challenging, and training occupied a considerable amount of the CPAC staff's time.[61]

One such automated system was the modern Defense Civilian Personnel Data System (DCPDS). In 2000, the Department of Defense began preparing for the release of this new civilian personnel system. The largest human-resources information system in the world, the DCPDS linked all military branches under the same personnel system and replaced all DoD personnel information management systems with one information system to manage civilian human resources. The DCPDS was designed to streamline personnel paperwork and services and support appropriated and non-appropriated fund and local national civilian personnel operations.[62]

The DCPDS offered several benefits, including increased access to information, enhanced productivity, reduced redundancy, and improved operations. The new system, for example, would enable managers to initiate and track the status of personnel actions from their desktops, as well as access and retrieve information on their subordinates. It would also allow employees to take a more hands-on role in completing and monitoring their own personnel transactions. Overall, the DCPDS promised to improve communication between managers, CPACs, and CPOCs. "One of the advantages of the new system is that everyone involved in the civilian personnel process (managers, supervisors, resource managers, and human-resource personnel) can access the system, and data will flow quickly and efficiently to organizations and geographic locations," explained Denise Copeland, a personnel management specialist at the Civilian Personnel Operations Center Management Agency (CPOCMA).[63]

The DCPDS also presented new challenges for the Corps' personnel system. The major obstacles were the time and training involved in establishing the system, mastering the enormous amount of information regarding the DCPDS, and overcoming customers' fears about the change to the new system. In response, CPOC staff designated a project officer for the DCPDS, established a deployment committee, and trained customers.[64]

The Army's regionalization plan substantially altered the District's human resources component. It reduced the size of the staff, transformed individual positions, established new functions and eliminated others, and introduced a series of new automation systems. As far as its ability to reduce costs and standardize procedures, regionalization was a success. Even so, it took a toll on human resources personnel, who watched their staff cut and struggled to adopt new automated systems. Furthermore, the transition to CPAC and CPOC diminished the roles and responsibilities of many personnel staff, according to Majerus. Most importantly perhaps, he explained, under the new system where most interactions are done remotely, "You lose the personal contact."[65]

Closing the Troutdale Lab and Combining Willamette Valley Project Offices

In response to its changing workload and reduced federal expenditures, the District made several changes to its field offices during the 1990s. In 1991, for example, the agency consolidated

its Willamette Valley project offices. Six years later, the District closed its materials laboratory at Troutdale.

Following a Commercial Activities study, in January 1991 the District consolidated administrative support for its Willamette Valley dams at Lowell, Oregon.[66] The new organization, called Willamette Valley Projects, combined the former Upper and Mid Willamette Valley Projects offices with offices at Lowell and Foster, Oregon, into one administrative support office in Lowell. According to the District's Public Affairs Office, the action "was prompted by the nationwide focus on reducing federal expenditures while making the federal workforce more efficient and effective in serving the public needs."[67]

Under the new arrangement, administrative support, such as supplies, time and attendance reporting, travel arrangements, and personnel record keeping, was provided from the office at Lowell to Cougar, Blue River, Detroit, Big Cliff, Green Peter, Foster, Cottage Grove, Lookout Point, Dexter, Fall Creek, Fern Ridge, Hills Creek, and Dorena dams. The Foster office was not closed, but instead housed resource management staff. The District phased in the consolidation effort throughout 1991, allowing employees who were directly affected time to plan for the move. While the move impacted District personnel, the public saw little effect of the reorganization, as crews continued to handle maintenance and operation functions at the various dam locations, while parks and recreation facilities remained open, managed by resources staff throughout the Willamette Valley.[68]

In addition to the restructuring in the Willamette Valley, in April 1997, District Commander Colonel Robert T. Slusar announced to staff that the North Pacific Division Materials Laboratory at Troutdale, Oregon, would be closed. According to the District, the lab was closed with the agreement of Headquarters due to "severe financial deficits and reduced workload." Positions elsewhere within the District were not available for all the displaced workers, but the agency placed most employees in jobs within the organization.[69] The combining of the Willamette Valley offices and the closing of the Troutdale lab reflected the nationwide effort to trim spending and downsize federal agencies.

Closing the Astoria Field Office

In addition to economic concerns, technological advances also impacted the District's field offices. In 2000, the District closed its Astoria field office, located on the Oregon Coast, near the mouth of the Columbia River. The primary reason for the closure was the implementation of Global Positioning System (GPS) technology.

Since the 1970s, the Astoria office had assisted the Corps with its daily operations on the Oregon coast and the lower Columbia River. Staff supported Corps dredges and survey boats, and departing dredge crews left their vehicles in the office's parking lot. Personnel at the office also helped administer the Corps' regulatory program for the area, including Section 404 compliance, investigating reported violations of the Clean Water Act [See Chapter Three].[70]

Another major function of the office was establishing navigational aids. Over the years, however, dredging operations became increasingly automated, diminishing the need for the facility in Astoria. "One of the main duties of the crew [in Astoria] was to maintain the dredge range markers on the coastal entrances and the Columbia River channel," explained Sheryl Carrubba of the Operation Division. "Now that dredges use GPS technology, the visual aids are no longer needed."[71]

Following the closure, Portland took over the Columbia River estuary regulatory issues. The four employees at the field office were all offered other jobs within the Corps. Two chose to retire, and two others relocated to The Dalles and Eugene. In terms of the physical structure, the District's plan called for the property to be evaluated for contamination, cleaned up (if found to be contaminated), and turned over to the General Services Administration.[72]

Leadership Development Programs

Adding to the challenges associated with an increasingly competitive business environment, in the late 20th century the Corps faced new demands in recruiting and retaining its workforce. During this period, the nation's workforce was aging. In the Corps, dramatic numbers of employees were nearing retirement, potentially undermining the Corps' knowledge base and expertise. Furthermore, downsizing threatened to reduce the number of staff throughout the agency. Adding to the pressure, the Corps faced stiff competition from the private sector for work. In response to these challenges, the District implemented its Leadership Development Program (LDP) in 1994 to help foster employee leadership skills.

The intensive, year-long program provided an opportunity for personnel interested in higher education, self development, and career advancement. "We're trying to give people of the District background and training so they can be leaders of groups, teams or larger parts of the organization," explained Robert Couch, Chief of Construction Branch and one of the facilitators for the 2002 program. "People need skills and they need to have background in how we work," he added. Toward that end, each year's LDP participants took a series of graduate level courses – which could be applied toward a master's degree – in a variety of subject areas. The District paid for the entire cost of the program, including tuition, books, travel, and labor costs while in class.[73]

District employees entered the LDP for a number of reasons. Some of the most common ones were the opportunity to meet their coworkers in other areas of the District, gaining insight into how the Corps and the District operated, understanding processes within the

A Leadership Development class at the National Policy Process Seminar in Washington, DC.

federal government, developing communication skills, and preparing for possible future career changes. In general, participants in the LDP shared an awareness that the Corps faced substantial changes in the late 20th century; if they wanted to be prepared – both as individuals and as an agency – they needed new tools and skills.[74] George Medina, Chief of the Logistics Management Office, for example, joined the program to gain exposure to the inner, corporate workings of the organization. "It is common knowledge that as an organization (both nationally and regionally) we are in the midst of change," he explained. "Shrinking dollars and an eye on the bottom line is fostering a new mind-set and approach to doing business. Being acutely competitive and efficient is no longer enough – that is the norm. Rather, there is a need for creative thinking, coupled with resolve and commitment."[75]

Others expressed similar concerns about the changing nature of the Corps' work and hoped that the program would better prepare them to meet these challenges. The District's transition from large civil works project to many smaller projects, for example, increased the number of projects employees were responsible for, requiring greater organizational and communication skills. "The number of customers has proportionally increased and the job requires more coordination and interaction with other government and state agencies," explained Chris Budia, a geologist in the Planning and Engineering Division. "Participation in the LDP will provide me with the opportunity to learn more about how our government works and to acquire human-resource and time-management skills … to manage a changing workload."[76] Jim Barton, a hydraulic engineer, also appreciated the "many changes occurring in the Corps." Energy deregulation and a new emphasis on customer funding, for example, affected his work in the hydropower field. "These types of changes make it very important to have a sound understanding of the national policy process," he explained, "and how agencies such as the Corps function within this process."[77]

The framework for the program changed periodically, reflecting the evolving needs of employees. Since 1999, the LDP has covered four subject areas: professional development, administration in government, the national policy process, and speechcraft. To integrate theory with applied work experiences, each of these components were coordinated with Portland State University (PSU) faculty, Portland District facilitators, and Toastmasters. The facilitators, senior staff selected to act as in-house resources, played a unique role in the LDP. Working with PSU staff to plan and coordinate classes and activities, the facilitators offered students the Corps perspective and provided real-world examples.[78] "As a facilitator … my main objective is to help them make this learning relevant to their work with the Corps," said Couch.[79]

The professional development component of the LDP linked the individual skills needed for leadership succession at the District with the strategic business campaigns of the Corps. The component was multi-faceted, consisting of classroom sessions, mentoring sessions, field trips, assigned reading, informational interviews and networking, and strategic career

management plans. The strategic career management plans were especially important, and students developed them from a range of sources, such as the Corps' campaign plan, District goals, individual leadership assessments, career research, and interviews. The goal was to provide participants with the resources to successfully manage their career in public service.[80]

The "administration in government" component of LDP acknowledged that many administrators in public organizations experienced their work roles as "trying to do good in the face of conflicting demands." PSU faculty taught this course, in conjunction with District facilitators, and it included six issues: 1) the multiple purposes of the "Reinvention of Government" initiative and the transferability of private sector experience to the public setting, 2) the history and development of the core administrative functions of modern complex organizations, 3) the interactive relationship among administrative functions, 4) the tension between administrative control and flexibility, 5) the multiple purposes or ends served by core administrative functions, and 6) the various contextual factors that influence the exercise of administrative functions, such as economic forces, political interest groups, legal principles and practices, and interorganizational and jurisdictional relationships.[81]

The "national policy process" component of LDP operated from the belief that mid-level supervisors and project managers increasingly needed to understand the "larger political, legal, interorganizational, and interjurisdictional environment within which they undertake leadership initiatives." To meet that goal, instructors provided case studies drawn from the Columbia River Basin and the Pacific Northwest. The capstone of the course was a field trip to Washington, D.C., where participants had the opportunity to study the national policy process on-site and meet with many policy-makers and lobbyists. Vickie Ashenbrenner, an executive assistant who oversees the LDP and participated in the program, expressed great enthusiasm for the trip. "It's phenomenal," she said. "You don't realize how complicated the issues are until you see them on a national level. It's fascinating to see how the process works."[82]

One of the Certificates of Achievement for the Portland District's Leadership Development Class

The final component of the LDP was the speechcraft class. Taught by Corps staff who had completed a class in speechcraft through the Essayons Toastmasters Club, the ten-session workshop aimed to develop oral-communication skills. Participants received training in various communication techniques and processes, such as organization, word use, vocal variety, and body language.[83] For many LDP students, speechcraft presented new challenges. "The Toastmasters course was terrifying," recalled John Entwistle, Chief of Customer Support. Fortunately, he also found it "a wonderful and extremely valuable experience." Others agreed that it provided a solid foundation in public speaking. "I really enjoyed the Toastmasters speechcraft course," said Pamela Hertzberg, an environmental protection specialist. "It was helpful to learn how to organize my thoughts and articulate them more clearly during public speaking."[84]

The LDP program offered participants a variety of benefits, and many District employees applied to the program. By 2000, 72 of them had participated in LDP. Generally, LDP administrators sought to restrict the size of each class to approximately 10-12 students, although occasionally classes would include as many as 16 participants. The District's selection criteria for the program focused on years of service, grade level, and gathering a wide spectrum of representatives from throughout the agency. Ideal candidates volunteered, held career

status in GS levels 9-14, were able to demonstrate individual commitment and explain how training would benefit the individual and the Corps, supported Corps values, and sought career advancement.[85]

Participating in the LDP in addition to normal workday responsibilities proved challenging for many employees. Overall, however, the majority of those involved with the program found it a worthwhile endeavor, despite the added stress. On an individual level, the program developed employees' leadership and communication skills, helping prepare them for current and future career objectives. By forging new relationships with personnel in various other parts of the agency, it also enriched people's work life. Furthermore, it allowed staff the opportunity to consider ideas outside of their daily routine, engaging them in new and creative ways.

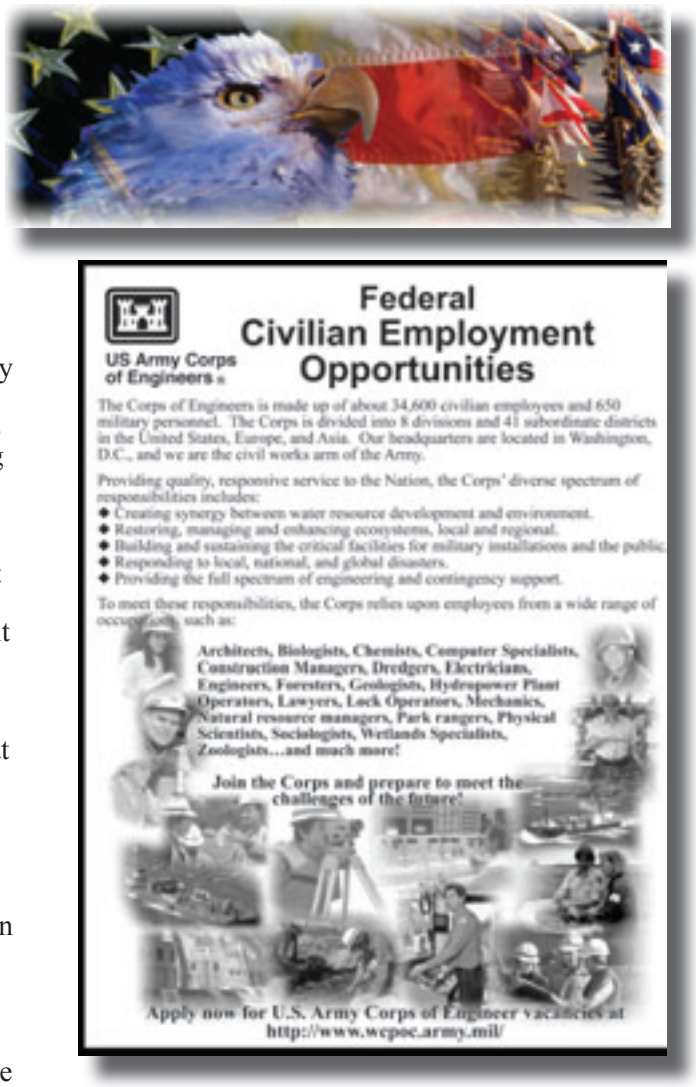
As an agency facing considerable changes to its workload, the LDP made the District more competitive by enhancing and expanding the skills of its personnel. Graduates of the program were better equipped to meet the demands of the evolving organization. "To be effective, we must be willing to accept our changing mission and the inevitable downsizing," observed Jim Anderson, a regulatory specialist and a 1998 LDP participant. "Strategic personnel management is a 'must' for top and middle managers in the near future, but it is [also] for all of us to understand."[86]

Recruitment and Retention

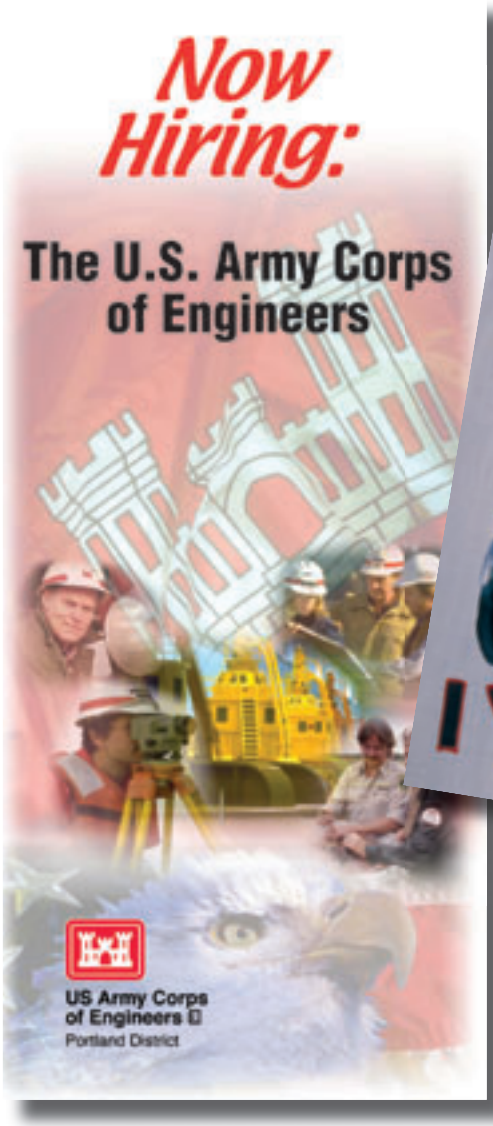
In addition to the Leadership Development Program, the Corps undertook several other measures to address personnel needs. The Capable Workforce Initiative, for example, sought to maintain and enhance the capability of the workforce. The initiative consisted of three general strategic objectives: recruitment, retention, and employee development. Together, these three areas provided a comprehensive framework for maximizing job opportunities and employee satisfaction, providing "the skilled and motivated workforce essential to the future of the District."[87]

During the last two decades, the average age of Corps employees has risen, with many nearing retirement. According to Davis Moriuchi, the aging workforce problem dates back to the Reagan years of downsizing, budget cuts, and hiring freezes.[88] As a result of these trends, District Engineer Colonel Randall J. Butler observed that the Corps "had lost the skills to recruit. We've always been cutting."[89] Moriuchi, who joined the District in 1974, recalled that the Corps ceased hiring new and younger employees at approximately the same time he began working for the organization. "There used to be a pretty good gradation of age cohorts, from entry level to retirement age," he explained. "If you look at it right now, there are frightening figures of what percent of the workforce is eligible to retire in the next five years." Furthermore, the age cohorts across the District had become heavily skewed, with an average age of 47 or 48 years old.[90]

In fact, the numbers of personnel reaching retirement age were staggering. According to Colonel Butler, as of 2001 approximately 14 percent of the workforce had reached retirement eligibility. In five years, that number would climb to 38 percent, and in ten years it would reach 67 percent. One of the great costs associated with the retirement trend was the loss of expertise and knowledge. To address this challenge, the Corps instituted the concept of knowledge transfer. "When you have an engineer who has all this great knowledge, you can't sit down and have a new engineer come in and say let me dump all my knowledge to you; … it takes years to bring somebody new in and sit them down with a more experienced person," explained Colonel Butler. The loss of knowledge cut across all disciplines within the Corps, posing serious difficulties. "To learn the ins and outs of the region, the personalities you deal with and do a knowledge transfer is a tremendous challenge,"



One of the Recruitment ads for the Army Corps of Engineers.



said Colonel Butler. "But it is going to overtake us here within the next five to ten years."[91]

To address its workforce issues, the District undertook steps to ensure it would continue to have qualified employees. The District's capable workforce group, for example, devised a system whereby it tracked individuals nearing retirement, noting their skills and expertise. By anticipating personnel losses, the agency hoped to find adequate replacements. At the same time, it also tried to recruit employees with new skills, reflecting the changing nature of the District's work. "We're asking, what skill sets do we need that we don't currently have, because these environmental skills aren't the same skills that these big structural dam building engineers have had prior," explained Colonel Butler. "So what we want to do is … hire in some people with new skill sets for the future."[92]

The District implemented a number of programs designed to train and recruit new personnel. The power plant training program, for example, was a four-year training program that combined formal education, on-the-job training, and mentoring by existing journeymen.[93] Being a power plant operator required specialized skills – skills that took years to develop. The District's operators "have the expertise to walk by a generator, listen to it hum, and tell you if it's working right or not," observed Colonel Butler. "That's not something you learn from a book. That's something you learn from experience," he added. Following the training program, the operators received certification from both the Corps and the Department of Labor as journeymen. While graduates were free to find employment anywhere, the Corps attempted to find places for them within the organization. "What we're doing is growing our own," said Colonel Butler.[94]

The District also featured an Engineer In Training (EIT) program and an intern program designed to bring qualified engineers to the Corps. After receiving an engineering degree, program participants came to work for the Corps, where they obtained training in multiple areas of the District and got "a tasting of whether they want to stay" with the agency. One obvious benefit of joining the programs was the Corps' promise to employ these engineers. "What's enticing to them," explained Colonel Butler, "is we will place them within the Corps of Engineers, not always this District, but within the Corps upon graduation from this program." In exchange for helping them find jobs, the Corps got highly trained engineers who understood "how the whole organization works."[95]

For students, the Corps hosted two programs: the Student Career Experience Program (SCEP) and the Student Training Employment Program (STEP). SCEP provided work experience directly related to the student's educational and career goals and allowed students to work part time for the Corps while attending school. In some cases the District partnered with the school, enabling students to receive college credit for their work at the Corps, while receiving an income. "Here's a way that they [students] can work within their discipline and earn dollars," explained Colonel Butler. "I get benefits and at the same time I do my recruiting." STEP also employed college students, but the majority of the positions were clerical in nature. According to Colonel Butler, STEP provided students with an income and introduced them to the federal workforce. In some cases, after completing the STEP program, students would then enter the SCEP

program, gaining additional work experience and further exposure to the Corps.[96]

Through its Capable Workforce Initiative, the Corps managed to address many of its personnel issues. Several obstacles, however, remained. One of the biggest challenges to recruiting new workers was the agency's hiring process. Unlike the private sector, the Corps' hiring process followed strict guidelines. "You cannot just go out and put an ad in *The Oregonian*," said Operations Manager David Beach. "You don't get to do things like that." Whereas once the District's human resources office had handled hiring, by the late 1990s hiring was handled by Fort Huachuca, Arizona. Many felt that the agency's centralized office, computerized system, rules for federal hiring, and the time it took to hire someone failed to result in the best candidates being selected for a position. "You do it all with computers," explained Beach. "You try to pick names off a list, but if there are people in the federal government who've been bumped out of their job for some reason, and if they are qualified for the position, … they get first crack at it, whether you want them or not." Unlike the private sector, supervisors in the Corps had little input into who was selected for a particular position. "You can get someone whom you had no choice in selecting," commented Beach. Furthermore, the widespread military base closures over the last decade displaced many people, adding them to the Priority Placement Program and giving them special consideration in the Corps hiring process. "It's a crapshoot," said Beach of the process. "We've done really well sometimes and other times we've not done well."[97] In general, the Corps' hiring process was "a source of tremendous frustration," according to Davis Moriuchi. "Going through the normal route, for a variety of reasons, we're not getting the kind of qualified folks that we know are out there on some of the lists."[98]

Colonel Butler speaking at a yearly Engineer Day that introduces students to the Corps of Engineers.

Students touring the different branches of the Corps at Robert Duncan Plaza.

In addition to the inflexibility of the hiring process, the Corps also faced retention issues. Competition from the private sector and other government agencies made retaining qualified workers difficult. Moriuchi found that competent and professional federal employees could sometimes "double their salaries by going to the outside." While salary discrepancies were less of a problem in Oregon than in markets like New York and Los Angeles, the Portland District faced additional competition from other government agencies, such as the Bonneville Power Administration. Furthermore, the Corps was not the only employer confronting workforce shortages. "This capable workforce initiative isn't just facing the federal government," observed Colonel Butler, "it's facing society as a whole. So we're competing with the

Nikes and the Intels and all the big firms around here in the Portland area for that young talent coming in."[99]

In addition to the competitive market, many young people had different attitudes about work than their predecessors. Moriuchi observed, for example, that younger recruits had a different approach to their careers than people from his generation:

"I doubt that we're going to see very many folks like me 20 years from now. We won't see folks who … spend their entire career with one organization. The retirement system is more flexible. There are mobile 401(k)s. I think all my relatives, such as my nephews, who are in their twenties have no intention of staying with a firm for very long. They are looking for what they want, and they'll go shopping as long as they can market their skills. I think it's great. But as we see that happen, we need to be prepared to deal with it. That means being prepared for turnover."[100]

Colonel Butler also saw a shift in career approaches. "The mentality right now is no longer loyalty to the organization as much as loyalty to one person," he said. Younger employees, he felt, were "going to come in and learn as much as they can, get trained as much as they can, and then they will go look for the next opportunity." Fortunately, the Corps offered its workers numerous opportunities for progression through its ranks.[101]

The Corps had to contend with an array of recruitment and retention issues, but it also offered employees several distinct advantages. First, due to the massive wave of retirements and the continuing demand for the District's environmental services, new employees had tremendous opportunities for career advancement. Second, compared to the private sector, the Corps' workforce was secure. "We are a stable workforce," said Colonel Butler. "It's not as cutthroat out there as in private industry, and they [employees] do not have to move around." Finally, the Corps presented personnel with interesting projects and work assignments, which, according to Moriuchi, was the agency's "competitive edge." "We do … fascinating stuff," he stated. "Some of my buddies here, senior VP's for insurance companies and manufacturing firms, make a tremendous amount of money. But when we talk, I wouldn't trade my job for theirs any day," concluded Moriuchi. "I get to deal with everything from Native American issues to archeological issues to fish issues to politics, and that all happened in the first part of the day."[102]

Faced with widespread retirements and the loss of institutional knowledge, the District responded positively, instituting a number of programs and efforts to address the challenge of bringing in new, qualified workers. Through the Capable Workforce Initiative the District acknowledged the upcoming changes, and its worker training programs attempted to ensure that the agency's expertise would be passed to the next generation. Securing a competent workforce was essential to the District's success as it entered the next century. As Colonel Butler succinctly stated, "The District is people."[103]

Conclusion

During the late 20th century, the Corps underwent significant transitions. The nature of the agency's work shifted, from large civil works construction projects to a series of smaller projects, many of which had an environmental restoration component. Several nationwide trends also affected the Corps. Vice President Al Gore's "Reinventing Government" initiative attempted to downsize the staff of federal agencies, including the Corps, and the country's aging workforce threatened the agency with the loss of institutional knowledge and expertise. Increasing competition with the private sector added further stress. To remain competitive, the Corps implemented considerable changes to its operations. Essentially, this federal agency needed to operate more like a business if it was to retain its prominence in the engineering and design fields.

Demonstrating its considerable adaptability, the Corps ushered in a series of changes designed to increase efficiency and streamline its operations. The District, for example, replaced its traditional stovepipe style of management with project management. The agency also adopted Regional Business Centers, regionalized its personnel services, and the Portland District closed and consolidated several field offices. Senior staff carried out a series of restructuring efforts throughout the entire Corps – with considerable downsizing occurring in some areas – to reflect the new realities of its workload and the mandates of cost sharing. To meet the challenges of retaining its employees and recruiting qualified personnel, the District developed several programs and initiatives, such as the Leadership Development Program and the Capable Workforce Initiative.

These changes helped the Corps retain its competitive edge, but they also came with costs. In many ways, Portland, as one of the larger districts in the Corps, was less affected by the reorganization than other smaller districts. Nevertheless, the restructuring and downsizing trends created stress among District employees, who worried about job security and their future in the agency. Those who stayed on often had to adapt to greatly revised roles and learn new skills to accomplish their work. To survive these changes, personnel had to be flexible and willing to take on new tasks. Overall, the Corps ability to weather these changes and stay a viable agency was remarkable. In the Portland District, employees' success at adapting to new workloads and new roles shows a commitment to the agency's missions that bodes well for the future.

Endnotes

[1] Davis Moriuchi, Interview with Lisa Mighetto, Portland, Oregon, June 15, 2001. Hereafter cited as Moriuchi Interview.

[2] Martin Reuss, *Reshaping National Water Politics: The Emergence of the Water Resources Development Act of 1986* (Fort Belvoir, VA: U.S. Army Corps of Engineers, Institute for Water Resources, 1991), pp. 1-2, 80-92, 145-46, 197-99.

[3] Martin Reuss, *Reshaping National Water Politics: The Emergence of the Water Resources Development Act of 1986*, pp. 1-2, 80-92, 145-46, 197-99.

[4] Moriuchi Interview.

[5] Donald F. Kettl and John J. DiIulio (eds.), *Inside the Reinvention Machine: Appraising Governmental Reform*, 1995, Washington, D.C., The Brookings Institution; Donald F. Kettl, *Reinventing Government? Appraising the National Performance Review*, August 1994, Center for Public Management, The Brookings Institution, pp. v-ix.

[6] Donita Moorhus and Gregory Graves, "The Limits of Vision: A History of the United States Army Corps of Engineers, 1988-1992," unpublished manuscript August, 1998, Office of the Chief of Engineers, Office of History, p. 17.

[7] Donita Moorhus and Gregory Graves, "The Limits of Vision: A History of the United States Army Corps of Engineers, 1988-1992," unpublished manuscript August, 1998, Office of the Chief of Engineers, Office of History, p. 17.

[8] Moriuchi Interview.

[9] Donita Moorhus and Gregory Graves, "The Limits of Vision: A History of the United States Army Corps of Engineers, 1988-1992," unpublished manuscript August, 1998, Office of the Chief of Engineers, Office of History, p. 19.

[10] Donita Moorhus and Gregory Graves, "The Limits of Vision: A History of the United States Army Corps of Engineers, 1988-1992," unpublished manuscript August, 1998, Office of the Chief of Engineers, Office of History, pp. 21-22.

[11]Donita Moorhus and Gregory Graves, "The Limits of Vision: A History of the United States Army Corps of Engineers, 1988-1992," unpublished manuscript August, 1998, Office of the Chief of Engineers, Office of History, pp. 21-25.

[12] Donita Moorhus and Gregory Graves, "The Limits of Vision: A History of the United States Army Corps of Engineers, 1988-1992," unpublished manuscript August, 1998, Office of the Chief of Engineers, Office of History, pp. 25-28; Lieutenant General H.J. Hatch, "Implementation of Project Management," Memo, October 1991, Public Affairs Office, File 360, Project Management.

[13] U.S. Army Corps of Engineers, *Annual Historical Report*, 1988, p. 2, Portland District, Public Affairs Office, 870-5a, Organizational Histories, 1990-1999.

[14] Moriuchi Interview.

[15] US Army Corps of Engineers, Portland District, "ER 5-1-11 Implementation Plan," June 12, 1998, Public Affairs Office, File 360, Project Management.

[16] Moriuchi Interview.

[17] U.S. Army Corps of Engineers, *Annual Historical Report*, 1999, p. 1-17, Portland District, Public Affairs Office, 870-5a, Organizational Histories, 1990-1999.

[18] Moriuchi Interview.

[19] Moriuchi Interview.

[20] Howard Jones, Interview with Lisa Mighetto, Portland, Oregon, June 14, 2001. Hereafter cited as Jones Interview.

[21] Donita Moorhus and Gregory Graves, "The Limits of Vision: A History of the United States Army Corps of Engineers, 1988-1992," unpublished manuscript August, 1998, Office of the Chief of Engineers, Office of History, p. 29.

[22] Donita Moorhus and Gregory Graves, "The Limits of Vision: A History of the United States Army Corps of Engineers, 1988-1992," unpublished manuscript August, 1998, Office of the Chief of Engineers, Office of History, pp. 30-31.

[23] Donita Moorhus and Gregory Graves, "The Limits of Vision: A History of the United States Army Corps of Engineers, 1988-1992," unpublished manuscript August, 1998, Office of the Chief of Engineers, Office of History, pp. 30-37; Lisa Mighetto and William F. Willingham, *Service – Tradition – Change: A History of the Fort Worth District, U.S. Army Corps of Engineers, 1975-1999* (Fort Worth District, 2000), p. 100.

[24] Donita Moorhus and Gregory Graves, "The Limits of Vision: A History of the United States Army Corps of Engineers, 1988-1992," unpublished manuscript August, 1998, Office of the Chief of Engineers, Office of History, pp. 30-37; Lisa Mighetto and William F. Willingham, *Service – Tradition – Change: A History of the Fort Worth District, U.S. Army Corps of Engineers, 1975-1999*, pp. 100-101.

Endnotes

[25] Donita Moorhus and Gregory Graves, "The Limits of Vision: A History of the United States Army Corps of Engineers, 1988-1992," unpublished manuscript August, 1998, Office of the Chief of Engineers, Office of History, pp. 30-37; Lisa Mighetto and William F. Willingham, *Service – Tradition – Change: A History of the Fort Worth District, U.S. Army Corps of Engineers, 1975-1999*, pp. 100-101; U.S. Army Corps of Engineers, Portland District, "Army Corps of Engineers to Streamline," News Release, November 19, 1992, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 BB 34140108, Box 2, News Releases, 1991-1993.

[26] Diana Brimhall, Interview with Lisa Mighetto, Portland, Oregon, June 13, 2001; U.S. Army Corps of Engineers, *Annual Historical Report*, 1993, p. 12, Portland District, Public Affairs Office, 870-5a, Organizational Histories, 1990-1999.

[27] Donita Moorhus and Gregory Graves, "The Limits of Vision: A History of the United States Army Corps of Engineers, 1988-1992," unpublished manuscript August, 1998, Office of the Chief of Engineers, Office of History, pp. 30-37; Lisa Mighetto and William F. Willingham, *Service – Tradition – Change: A History of the Fort Worth District, U.S. Army Corps of Engineers, 1975-1999*, pp. 100-101.

[28] Donita Moorhus and Gregory Graves, "The Limits of Vision: A History of the United States Army Corps of Engineers, 1988-1992," unpublished manuscript August, 1998, Office of the Chief of Engineers, Office of History, pp. 30-37; Lisa Mighetto and William F. Willingham, *Service – Tradition – Change: A History of the Fort Worth District, U.S. Army Corps of Engineers, 1975-1999*, pp. 101-102.

[29] Donita Moorhus and Gregory Graves, "The Limits of Vision: A History of the United States Army Corps of Engineers, 1988-1992," unpublished manuscript August, 1998, Office of the Chief of Engineers, Office of History, pp. 30-37; Lisa Mighetto and William F. Willingham, *Service – Tradition – Change: A History of the Fort Worth District, U.S. Army Corps of Engineers, 1975-1999*, p. 102.

[30] Donita Moorhus and Gregory Graves, "The Limits of Vision: A History of the United States Army Corps of Engineers, 1988-1992," unpublished manuscript August, 1998, Office of the Chief of Engineers, Office of History, pp. 30-37; Lisa Mighetto and William F. Willingham, *Service – Tradition – Change: A History of the Fort Worth District, U.S. Army Corps of Engineers, 1975-1999*, p. 102.

[31] Donita Moorhus and Gregory Graves, "The Limits of Vision: A History of the United States Army Corps of Engineers, 1988-1992," unpublished manuscript August, 1998, Office of the Chief of Engineers, Office of History, pp. 30-37; Lisa Mighetto and William F. Willingham, *Service – Tradition – Change: A History of the Fort Worth District, U.S. Army Corps of Engineers, 1975-1999*, p. 102.

[32] Donita Moorhus and Gregory Graves, "The Limits of Vision: A History of the United States Army Corps of Engineers, 1988-1992," unpublished manuscript August, 1998, Office of the Chief of Engineers, Office of History, pp. 30-37; Lisa Mighetto and William F. Willingham, *Service – Tradition – Change: A History of the Fort Worth District, U.S. Army Corps of Engineers, 1975-1999*, pp. 102-103.

[33] Donita Moorhus and Gregory Graves, "The Limits of Vision: A History of the United States Army Corps of Engineers, 1988-1992," unpublished manuscript August, 1998, Office of the Chief of Engineers, Office of History, pp. 30-37; Lisa Mighetto and William F. Willingham, *Service – Tradition – Change: A History of the Fort Worth District, U.S. Army Corps of Engineers, 1975-1999*, p. 103.

[34] Colonel Eric T. Mogren, Interview with Lisa Mighetto, Portland, Oregon, May 7, 2001. Hereafter cited as Mogren Interview.

[35] Donita Moorhus and Gregory Graves, "The Limits of Vision: A History of the United States Army Corps of Engineers, 1988-1992," unpublished manuscript August, 1998, Office of the Chief of Engineers, Office of History, pp. 30-37; Lisa Mighetto and William F. Willingham, *Service – Tradition – Change: A History of the Fort Worth District, U.S. Army Corps of Engineers, 1975-1999*, p. 103.

[36] Mogren Interview.

[37] Mogren Interview.

[38] Mogren Interview.

[39] Brimhall Interview.

[40] Jones Interview.

[41] Mogren Interview.

[42] Department of the Army, Northwestern Division, Corps of Engineers, Memorandum: Northwestern Division Regional Business Center, Concept and Guidelines, May 23, 2000; U.S. Army Corps of Engineers, Engineer Inspector, *General Inspection Report*, Regional Business Centers, May 2000.

[43] Department of the Army, Northwestern Division, Corps of Engineers, Memorandum: Northwestern Division Regional Business Center, Concept and

Endnotes

Guidelines, May 23, 2000; U.S. Army Corps of Engineers, Engineer Inspector, *General Inspection Report*, Regional Business Centers, May 2000.

[44] Moriuchi Interview.

[45] Moriuchi Interview.

[46] Mogren Interview.

[47] Moriuchi Interview.

[48] Bonneville Power Administration and U.S. Army Corps of Engineers, "BPA, Corps applauded for cutting red tape," Joint News Release, January 27, 1998, accessed at http://www.bpa.gov/Corporate/KCC/nr/98nr/nr012798x.shtml, on November 28, 2001; U.S. Army Corps of Engineers, Portland District, "U.S. Army Corps of Engineers funded for a number of projects," News Release, December 3, 1998, accessed at https://www.nwp.usace.army.mil/pa/news/archive/1998/98-100.htm,, on November 28, 2001.

[49] Bonneville Power Administration and U.S. Army Corps of Engineers, "BPA, Corps applauded for cutting red tape," Joint News Release, January 27, 1998, accessed at http://www.bpa.gov/Corporate/KCC/nr/98nr/nr012798x.shtml, on November 28, 2001.

[50] Thomas Savidge, Interview with Lisa Mighetto, Portland, Oregon, June 12, 2001. Hereafter cited as Savidge Interview.

[51] Bonneville Power Administration and U.S. Army Corps of Engineers, "BPA, Corps applauded for cutting red tape," Joint News Release, January 27, 1998, accessed at http://www.bpa.gov/Corporate/KCC/nr/98nr/nr012798x.shtml, on November 28, 2001.

[52] "Frequently Asked Questions and Answers about the Army Regionalization Project," accessed at http://www.cpol.army.mil/regionalization/regfaq.html, on December 21, 2001; Daniel Majerus, Telephone Interview with Jill Schnaiberg, December 20, 2001, hereafter cited as Majerus Interview.

[53] "Frequently Asked Questions and Answers about the Army Regionalization Project," accessed at http://www.cpol.army.mil/regionalization/regfaq.html, on December 21, 2001.

[54] Majerus Interview.

[55] "Frequently Asked Questions and Answers about the Army Regionalization Project," accessed at http://www.cpol.army.mil/regionalization/regfaq.html, on December 21, 2001; Majerus Interview.

[56] Majerus Interview.

[57] "Frequently Asked Questions and Answers about the Army Regionalization Project," accessed at http://www.cpol.army.mil/regionalization/regfaq.html, on December 21, 2001.

[58] Majerus Interview.

[59] Majerus Interview.

[60] Gary Sheftick, "DoD to field new civilian personnel system," ArmyLINK News, June 30, 2000, accessed at http://www.dtic.mil/armylink/news/Jun2000/a20000630moderndcpds.html, on December 21, 2001.

[61]Majerus Interview.

[62] Gary Sheftick, "DoD to field new civilian personnel system," ArmyLINK News, June 30, 2000, accessed at http://www.dtic.mil/armylink/news/Jun2000/a20000630moderndcpds.html, on December 21, 2001; Barbara K. Filbert, "Personnel actions made easier with modern computer system," News Release, CPOCMA, October 5, 2000.

[63] Gary Sheftick, "DoD to field new civilian personnel system," ArmyLINK News, June 30, 2000, accessed at http://www.dtic.mil/armylink/news/Jun2000/a20000630moderndcpds.html, on December 21, 2001; Barbara K. Filbert, "Personnel actions made easier with modern computer system," News Release, CPOCMA, October 5, 2000.

[64] Barbara K. Filbert, "Personnel actions made easier with modern computer system," News Release, CPOCMA, October 5, 2000.

[65] Majerus Interview.

[66] U.S. Army Corps of Engineers, *Annual Historical Report*, 1990, p. 5, Portland District, Public Affairs Office, 870-5a, Organizational Histories, 1990-1999.

[67] U.S. Army Corps of Engineers, Portland District, "Corps Reorganizes Willamette Valley Projects Management," News Release, January 18, 1991, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 BB 34140108, Box 2, News Releases, 1991-1993.

[68] U.S. Army Corps of Engineers, Portland District, "Corps Reorganizes Willamette Valley Projects Management," News Release, January 18, 1991, Portland District, Iron Mountain Records examined at Information Management Center, Location 277 BB 34140108, Box 2, News Releases, 1991-1993.

Endnotes

[69] U.S. Army Corps of Engineers, *Annual Historical Report*, 1997, p. C-15, Portland District, Public Affairs Office, 870-5a, Organizational Histories, 1990-1999.

[70] Jerry Christensen, Interview with Lisa Mighetto, Portland, Oregon, October 16, 2001, hereafter cited as Christensen Interview; U.S. Army Corps of Engineers, Portland District, "Corps of Engineers Closing Astoria Office," News Release, September 18, 2000, accessed at https://www.nwp.usace.army.mil/pa/news/archive/2000/00-169.htm, on January 4, 2002.

[71] Christensen Interview; U.S. Army Corps of Engineers, Portland District, "Corps of Engineers Closing Astoria Office," News Release, September 18, 2000, accessed at https://www.nwp.usace.army.mil/pa/news/archive/2000/00-169.htm, on January 4, 2002.

[72] U.S. Army Corps of Engineers, Portland District, "Corps of Engineers Closing Astoria Office," News Release, September 18, 2000, accessed at https://www.nwp.usace.army.mil/pa/news/archive/2000/00-169.htm, on January 4, 2002.

[73] Heidi Y. Helwig, Portland District, Public Affairs Office, "School starts for the LDP class of 2002," *Corps'pondent*, November 2001; U.S. Army Corps of Engineers, Portland District, "Leadership Development Program," accessed at https://www.nwp.usace.army.mil/de/leadership/program.html, on December 7, 2001; Vickie Ashenbrenner, Telephone Interview with Jill Schnaiberg, December 14, 2001. Hereafter cited as Ashenbrenner Interview.

[74] LDP Participants, 1994-2001, provided by Vickie Ashenbrenner, Executive Assistant, December 14, 2001.

[75] LDP Participants, April 1998, provided by Vickie Ashenbrenner, Executive Assistant, December 14, 2001.

[76] LDP Participants, June 1996, provided by Vickie Ashenbrenner, Executive Assistant, December 14, 2001.

[77] LDP Participants, October 1999, provided by Vickie Ashenbrenner, Executive Assistant, December 14, 2001.

[78] U.S. Army Corps of Engineers, Portland District, "Leadership Development Program," accessed at https://www.nwp.usace.army.mil/de/leadership/program.html, on December 7, 2001; Ashenbrenner Interview.

[79] LDP Participants, August 2001, provided by Vickie Ashenbrenner, Executive Assistant, December 14, 2001.

[80] U.S. Army Corps of Engineers, Portland District, "Leadership Development Program," accessed at https://www.nwp.usace.army.mil/de/leadership/profdev.html, on December 7, 2001.

[81] U.S. Army Corps of Engineers, Portland District, "Leadership Development Program," accessed at https://www.nwp.usace.army.mil/de/leadership/admin.html, on December 7, 2001.

[82] U.S. Army Corps of Engineers, Portland District, "Leadership Development Program," accessed at https://www.nwp.usace.army.mil/de/leadership/policy.html, on December 7, 2001; Ashenbrenner Interview.

[83] U.S. Army Corps of Engineers, Portland District, "Leadership Development Program," accessed at https://www.nwp.usace.army.mil/de/leadership/speech.html, on December 7, 2001; Ashenbrenner Interview.

[84] LDP Participants, October 1999, provided by Vickie Ashenbrenner, Executive Assistant, December 14, 2001.

[85] U.S. Army Corps of Engineers, Portland District, "Leadership Development Program," accessed at https://www.nwp.usace.army.mil/de/leadership/apply.html, on December 7, 2001; Portland District Leadership Development Program, Class List, 1994-2000, provided by Vickie Ashenbrenner, Executive Assistant, December 14, 2001.

[86] LDP Participants, April 1998, provided by Vickie Ashenbrenner, Executive Assistant, December 14, 2001.

[87] U.S. Army Corps of Engineers, NWP Executive Office Plan, "People," accessed at https://www.nwp.usace.army.mil/de/oplan/oplan20002-6.asp, on December 7, 2001.

[88] Moriuchi Interview.

[89] Colonel Randall Butler, Interview with Lisa Mighetto and Jill Schnaiberg, Portland, Oregon, August 15, 2001. Hereafter cited as Butler Interview.

[90] Moriuchi Interview.

[91] Butler Interview.

[92] Butler Interview.

[93] Savidge Interview.

Endnotes

[94] Butler Interview.

[95] Butler Interview.

[96] Butler Interview.

[97] David Beach, Interview with Lisa Mighetto, Portland, Oregon, June 12, 2001.

[98] Moriuchi Interview.

[99] Moriuchi Interview; Butler Interview.

[100] Moriuchi Interview.

[101] Butler Interview.

[102] Moriuchi Interview; Butler Interview.

[103] Butler Interview.

Changes in Technology

CADD

CEFMS

Value Engineering

GIS

ISO 9000

VE

Serving the Army and the Nation
U.S. ARMY CORPS OF ENGINEERS
PEOPLE
PROCESS
COMMUNICATION

WWW

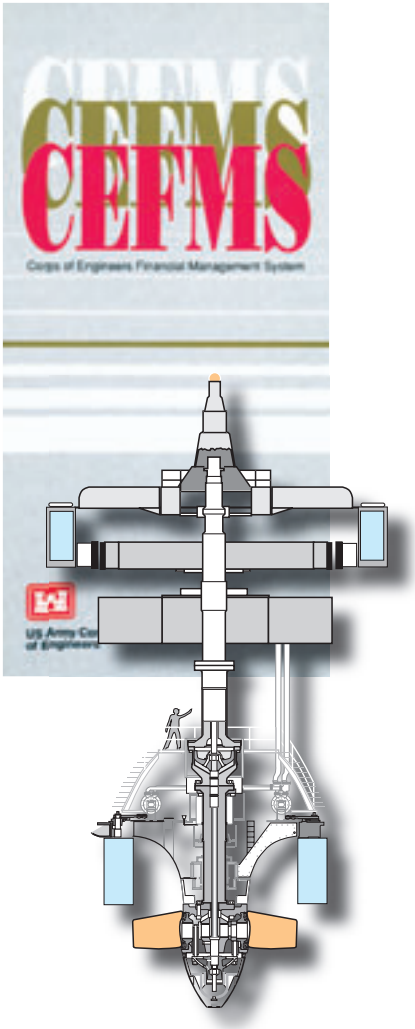
Pillars of TQM
Customer
Quality
Cont Imprvmt
Empowerment

NRRS

Chapter Seven
Changes in Technology

"We're not where we want to be yet, but we're putting the tools in place."
Howard Jones, Chief of Engineering and Construction, 2001

The CADD system produces drawings for the Corps' large civil works projects.



Technological advances in the late 20th century impacted the public and private sector, including the Corps. To increase efficiency and remain competitive, the District adopted a series of new technologies and standards, including the Internet, Geographic Information Systems (GIS), and Computer Aided Design and Drafting (CADD). Learning how to utilize these new tools required additional training and new expertise, but it also had the potential to revolutionize many aspects of the Corps' work and ensure that it remained at the forefront of the engineering and environmental fields.

Incorporating ISO 9000 Standards

Responding to an increasingly competitive work environment, the Corps integrated new standards for its operations. In the 1990s, for example, Corps Headquarters selected the Portland District as one of four districts to implement ISO 9000, an internationally accepted set of management criteria establishing minimum requirements for a quality management system. By using ISO 9000, the agency hoped to improve its business practices, work processes, and employee empowerment.[1] Adopting ISO 9000 offered the Portland District the following benefits: it established clear, consistent processes by reviewing and revising existing written operation procedures, many of which were outdated, redundant, or conflicting; it instituted measurements to gauge improvements; and it introduced more effective customer contact, such as customer satisfaction surveys.[2]

The ISO 9000 is a product of the International Organization for Standardization (ISO), a non-governmental organization established in 1947. The ISO's mission is to "promote the development of standardization and related activities in the world with a

view to facilitating the international exchange of goods and services, and to developing cooperation in the spheres of intellectual, scientific, technological, and economic activity." With some 140 countries involved, this international federation creates agreements that are then published as international standards.[3] These standards contain technical specifications or other precise criteria that are used as rules, guidelines, or definitions of characteristics, to ensure that materials, products, processes, and services fulfill their purpose. While creating a good product is important, standards focus on the quality of the process, not the quality of the product.[4]

In addition to the Corps, numerous types of companies and agencies use ISO, including both product and service oriented organizations. There are multiple reasons why a group would choose to implement ISO standards. A company may feel the need to control the quality of its products and services, reduce costs, or become more competitive. Other times a regulatory body may mandate the use of these standards. Once an organization decides to engage the ISO standards, it then develops a system that meets the quality requirements specified by one of four standards – ISO 9000, 9001, 9002, or 9003. A characteristic that distinguishes an ISO-based business process from other business processes is that management is required (in order to maintain certified status) to periodically review the effectiveness of its quality management system and to conduct internal audits of the system on a periodic basis using in-house resources. This is complemented by ISO-certified, independent, third-party assessor audits conducted on a semi-annual basis to assure that ISO certification remains intact.[5]

The Corps began investigating the use of ISO in the l990s. By 1995, the Logistics Management Institute (LMI) – a consulting company helping to improve public sector management – had completed a report analyzing how the Corps could incorporate ISO 9000 standards into its engineering and design programs. According to LMI, "In the face of military downsizing and spending cutbacks, the U.S. Army Corps of Engineers (USACE) must uphold its reputation as this country's preeminent engineering enterprise and be poised to enter the 21st century as its customers' first choice for engineering and design services." To survive in an increasingly competitive business climate, LMI explained that the agency must meet its customers' requirements on time, within budget, and with excellent service, while simultaneously satisfying industry engineering, safety, and environmental standards.[6]

LMI urged the Corps to incorporate the ISO 9000 quality system model into its engineering operations. The ISO 9000 offered the agency the systematic and structured methodology it needed for establishing a total quality management philosophy, while the system's standards formed the foundation "that will enable the USACE to establish itself as a world-class engineering organization." By using ISO 9000, LMI believed that the Corps could improve its organizational productivity, product quality, competitiveness, and employee motivation, while also lowering its supervision and review rates and reducing lost design efforts.[7]

Responding to LMI's report, the Corps selected four districts, including Portland, for a Headquarters pilot program to implement ISO 9000. By August of 1997, following a two-year internal analysis, the Portland District's Planning and Engineering Division had achieved certification under ISO 9001 criteria (development/ design, production, installation, and servicing). The District was only the second Corps office to achieve this certification. During the process of adopting the ISO system, the Planning and Engineering Division instituted an action plan to review, revise, enhance, and measure internal work processes and documentation procedures to improve communication links with internal and external customers, eliminate unnecessary paper work, and streamline the work process. The Division's goal was to achieve results on time, within budget, and to meet the customers needs "the first time, every time."[8]

In 1998 the Planning and Engineering Division was reorganized as the Engineering and Construction Division. The opportunity availed itself to expand the scope of ISO certification to include construction activities and efforts were taken to incorporate the Construction Branch as part of

The Information Age

The work environment at the Portland District has changed a great deal since 1980, mostly owing to the increasing prevalence of personal computers. When Lester Lynch arrived in Information Management during the early 1980s, "most people still used typewriters." The District had only a few computers – each with 640k of memory. "They were made in a guy's garage in Portland," Lynch recalled. By the late 1980s, Lynch had assisted the District with installing Local Area Networks, and within several years nearly every employee in the Portland District had access to a personal computer. "It's changed the way we communicate," he explained – inside and outside the Corps. District employees quickly recognized the potential of the World Wide Web to enhance communications. Portland was one of the first districts in the Corps with its own website, and fish counts were among the first topics posted.

the overall business process. The culmination of this effort solidified and brought closure to design verification and validation with physical product delivery to the customer.[9]

The ISO system affected the daily operations of the District in several important ways. As one employee explained it, the system had three major requirements. First, you have to "say what you do." In other words, workers have a manual of policies and procedures describing what the agency does to plan and manage the quality of its products. Second, you have to "do what you say." This means applying the written policies and procedures in daily work activities, such as work scope development, review, and approval. Finally, you have to "prove it," which requires subjecting your Quality Management System to an external audit every six months.[10]

The adoption of ISO 9001 was part of a larger trend within the Corps to increase the agency's efficiency and competitiveness. Since 1980, several national trends, such as a greater reliance on the marketplace and a smaller role for the federal government, placed increasing pressure on the agency, both reducing and transforming its workload. By instituting a set of international standards, Portland's Planning and Engineering Division took a step toward ensuring that its products would meet its customers' needs into the 21st century.

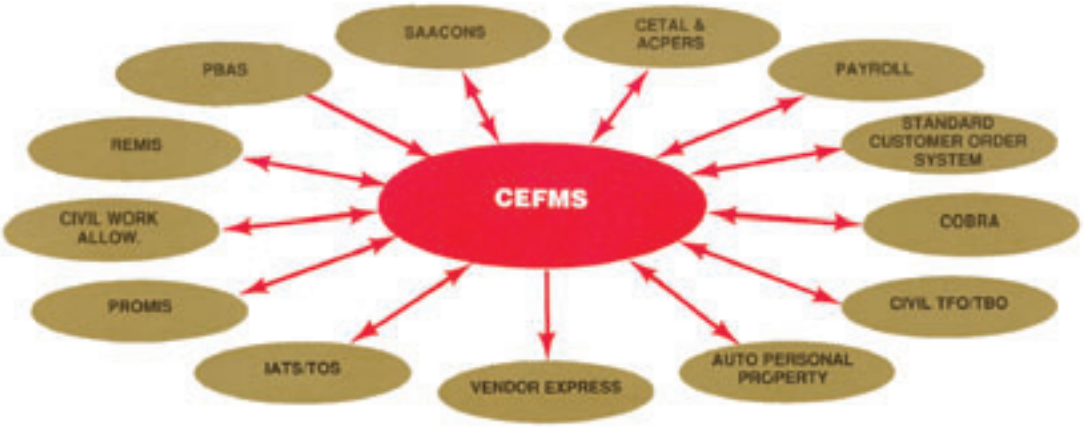
Corps of Engineers Management Information Systems (CEFMS)

In the early 1970s, the private sector and government agencies began to face the challenge of how to incorporate rapid advances in computer technology into their business practices. Many agencies, including the Corps, had to modify aging, clumsy systems and procedures. In the mid-1980s, for example, key-punch operations in divisions and districts prepared data cards for an array of systems, such as COEMIS (Corps of Engineers Management Information Systems) and AMPRS (Automated Management Project Reporting Systems). In addition to these Corps-wide systems, personal computers, connected through a local area network within the district or division, ran numerous commercial software packages for word processing, spreadsheets, or graphics. Responding to technological advances, Headquarters initiated the Corps of Engineers Automation Program (CEAP) and launched an information systems planning study.[11]

One of the areas in need of updating was the Corps' finance and accounting system. In the early 1980s when a Corps study team for Information Systems Modernization Program (ISMP) considered the agency's automated systems, the finance and accounting module of COEMIS – in place since 1972 – received the sharpest criticism. In January of 1988, the group assigned to work on the system concluded that the agency should move toward a financial management system, rather than designing a new accounting system that would only record how funds were spent after the fact. As a result, planners in Headquarters searched for a system to purchase. Unable to find one, they determined that the Corps needed to design a system specifically to fit its needs.[12]

To create the system the Corps used a technique called rapid prototyping in which developers writing computer code received nearly instant feedback on how the system satisfied users' functional and regulatory requirements. This initial development phase was conducted at the Huntsville District; the Fort Worth District was in charge of testing the program prior to full-scale implementation. By the mid 1990s the new software application was formally named CEFMS – Corps of Engineers Financial Management System.[13]

As a complete financial management system, the Corps designed CEFMS to allow employees to conduct all their financial business through the computer. CEFMS maintained virtually every financial transaction, including travel orders, payments to contractors, labor time and attendance, and civilian



CEFMS provided a complete financial system that consolidated numerous fiscal applications.

pay. Developed during the same period as the agency adopted project management, the Corps intended the new financial system to benefit project managers by enabling them to monitor their projects' financial status. "The idea … was that it was supposed to supply managers with more readily available financial information," explained David Beach, Operations Manager. In particular, the system's ability to provide financial information in real time (as funds were expended), rather than 30, 60, or even 90 days later, and its electronic signature capability to authorize transactions on a computer, promised to aid managers. CEFMS also integrated information from other automated systems in the district. The Corps hoped that ultimately the new system would save time and money by streamlining business processes, projecting savings of $270 million over ten years.[14]

Geographic Information Systems (GIS) include remote sensing/image processing, imagery, land surveying, photogrammetric mapping, and cartographic mapping.

Despite the Corps' intent to improve its handling of financial information, when the Fort Worth District began testing CEFMS in June of 1995, many initially found the system complicated and not very user-friendly. "At first, it was a total disaster," recalled Texas engineer John Riddle. Produced for civilian needs, it did not incorporate forms, such as purchase orders, required for military projects. Over the course of a year, the Fort Worth District helped the development team make essential improvements to the new system. Besides the human issues, problems the District had to overcome in adapting CEFMS to district business centered on fine-tuning the interactions with other project systems involving contracting personnel, logistics, and real estate.[15]

Even after Fort Worth's input, the system continued to challenge Corps' users. Carol Ann Job, an administrative officer in the Engineering and Construction Division, explained that one of the problems was that the system was fielded before many of the bugs were worked out due to political pressure to get it up and running. Different programmers, for example, worked on each module, which meant that commands and instructions were not standardized. This made training and use of the system challenging.[16] Others in the District agreed that the software was difficult to use. "After being used to being able to point and click and work Microsoft's array of software it was difficult," said Beach. "Most software is neutral, friendly, and intuitive," he added, but CEFMS is "very cumbersome." Beach also wondered if perhaps a commercial system would have been better and felt disappointed that a more intuitive system was not developed. [17]

Diana Brimhall, Chief of Public Affairs, acknowledged that District personnel had mixed feelings about the system. She explained that one of the reasons for the resistance may have been due to the fact that the District's financial and accounting staff was already extremely familiar with the existing system and the financial terminology required to work with it. The new CEFMS users, however, were not well-acquainted with the financial vocabulary, which took a good deal of time to remedy. Another reason for the system's lukewarm reception was that in the process of creating a centralized financial management structure, the Corps made it harder for smaller offices, such as Public Affairs, to conduct some of its business. Whereas once employees in Public Affairs simply had to type up a requisition form and take it to contracting, they now had to "do multiple strains of these different codes and things that don't really mean a whole lot to us." Furthermore, according to Brimhall, "Then somebody else has got to verify it, and I have to go in personally and approve it; I can't just sign my name on a piece of paper." The result was a more time-consuming process. One positive result of CEFMS was that it allowed for closer tracking of funds; however, many of the reports it generated were not user-friendly and were difficult to interpret. CEFMS continues to be used at the District, but, according to Job, training for new employees on

the system remains inadequate and is up to the individual offices.[18] While CEFMS posed many obstacles for Corps personnel, other technological advances proved far easier to incorporate into the agency.

Using GIS and CADD

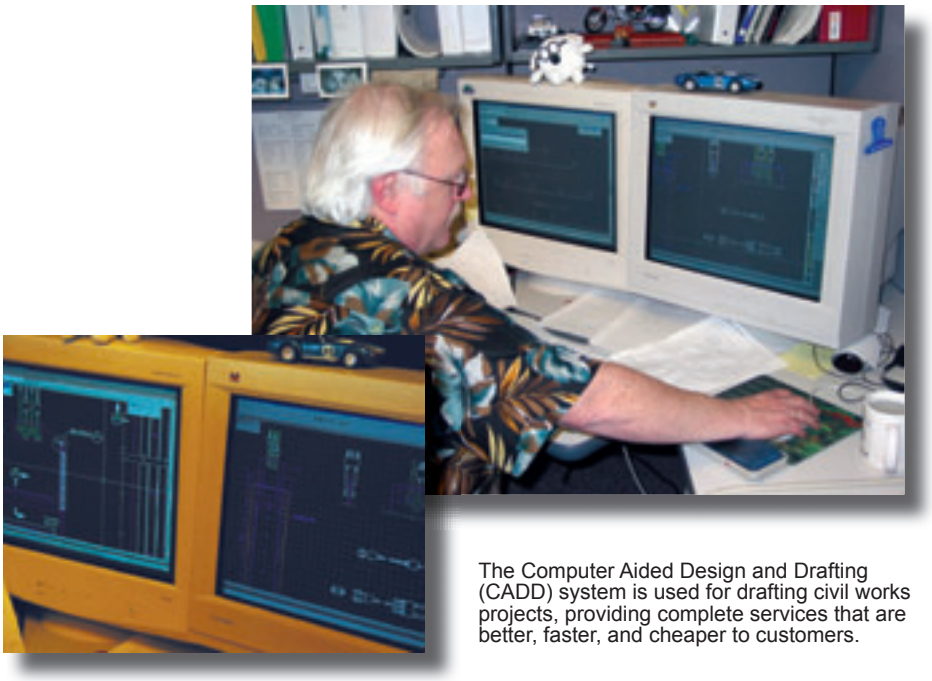
In the late 20th century the Corps adopted Geographic Information Systems (GIS) and Computer Aided Design and Drafting (CADD) into its operations. Portland's GIS program is operated out of the GIS, Survey and Mapping Section, which provides support services to all technical offices in the District and to other agencies through partnerships in six distinct technical areas. These include the following: GIS, remote sensing/image processing, imagery, land surveying, photogrammetric mapping, and cartographic mapping. The merger of these technical components into one section provided a number of benefits, such as cross training, improved coordination and communication, and efficient management of the digital data collection process. Over the years, GIS has become an integral component of all these technical functions.[19]

GIS technology is based on referencing objects to a spatial coordinate system and attaching a rich database of attributes. GIS enables a user to query the database to obtain specific information and is helpful in many types of land management activities.[20] Portland has been actively involved in the georeferenced digital data collection process since 1976. It was not until 1983, however, that it acquired its first true GIS software, ERDAS (Earth Resource Data Analysis System). The ERDAS system, with its image processing component, provided an ideal match to the geotechnical, hydrologic, and environmental focus of district projects.[21]

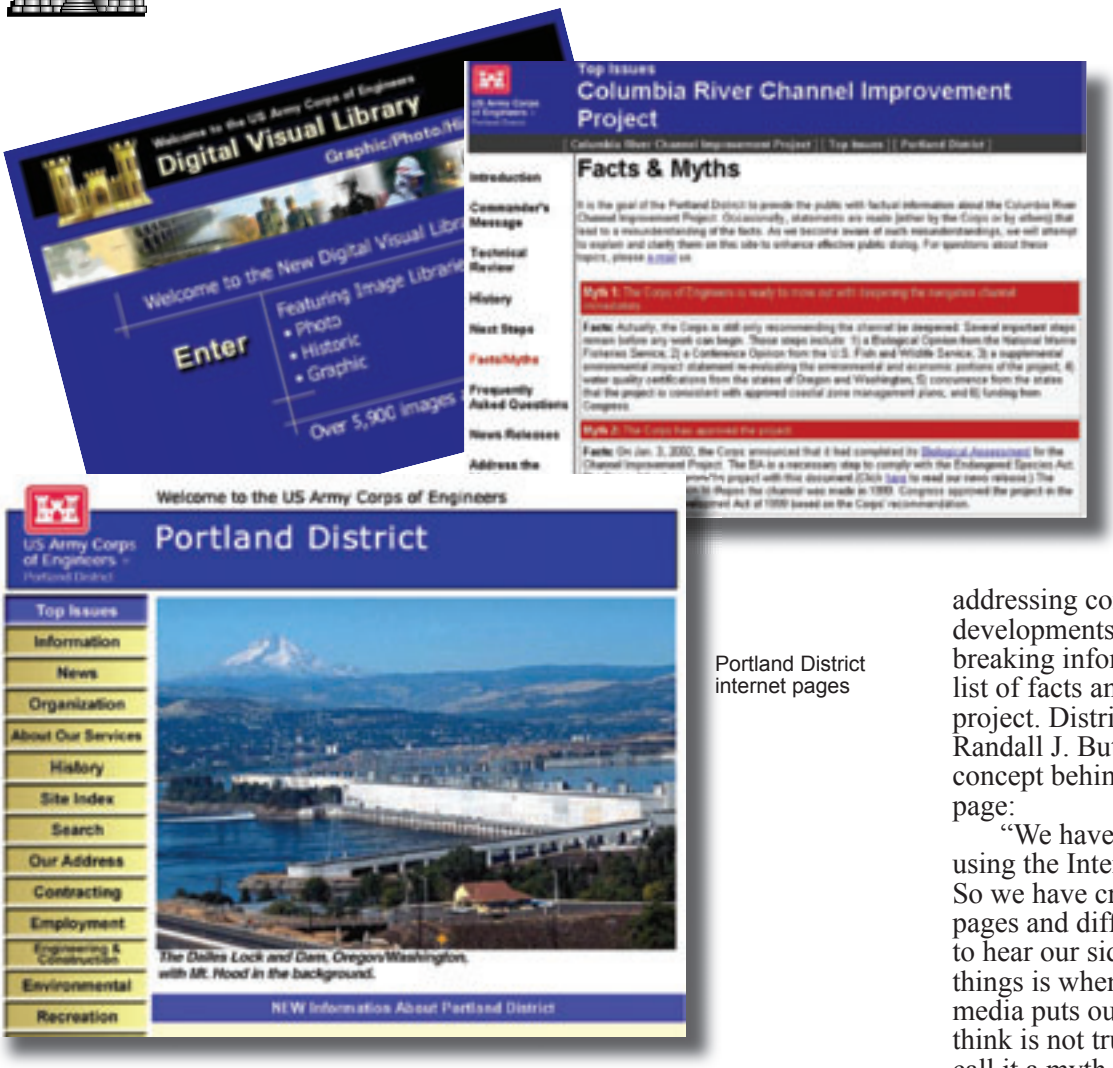
In 1985 the District purchased an Intergraph system to support its cartographic and photogrammetric operations. The development of certain software eventually enabled Portland to acquire and implement Intergraph GIS software. In 1989, the District added Arc/Info software to its GIS operations to facilitate communications and data transfer with other agencies. Later, the agency supplemented the software with ArcView; both have been integrated with the Intergraph system and are used extensively.[22] While GIS expanded the District's capabilities, a fair amount of work remained. "We now have the capability to essentially put all of our information on all of our projects, such as cultural resources, into a GIS data base," explained Howard Jones, Chief of Engineering and Construction. "We're not where we want to be yet, but we're putting the tools in place."[23] In the future the District plans to continue its expansion of its GIS capabilities by implementing an "Enterprise GIS system, which would improve corporate database and development, storage, and access as well as facilitate the growth of GIS."[24]

The District's GIS program maintains close links with its CADD system. CADD vendors define CADD as a "system of primitive graphic elements incrementally placed to create an engineering graphic." Commands are strung together through computer programs to generate elaborate graphical products, such as two-dimensional or three-dimensional drawings. Within the Corps, CADD has generally been used to represent a building and its elements. For civil works projects it is also used for large scale site work, such as channels and levees, surveying and coordinate geometry packages for site and transportation, and geotechnical subsurface modeling. In using CADD, the Corps aimed to "provide optimum products and services to our customers, delivering completed projects 'better, faster, and cheaper.'"[25]

The Corps has relied on some form of CADD in its design work for almost two decades. Computer-Aided Drafting (CAD) has been used in the Corps to produce production drawings since the mid 1980s, and resulted in a three to one savings over manual drafting methods. With the advent of work stations and the availability of computer programs from the CAD vendors for all phases of the life cycle of a project, an additional 'D' was added to CAD, making it Computer-Aided Design and Drafting (CADD).[26]



The Computer Aided Design and Drafting (CADD) system is used for drafting civil works projects, providing complete services that are better, faster, and cheaper to customers.



Portland District internet pages

Over the last decade, CADD users in the Corps have expressed interest in integrating engineering software programs into CADD programs. Industry has produced some powerful programs, but they have not been well accepted by users, perhaps due to issues such as cost, the learning curve required, and adaptability. While exceptions do exist, the primary usage of CADD remains as a drafting tool.[27]

Taken together, GIS and CADD are essential tools for the District's civil works projects, and, in fact, the Corps continues to work on integrating the two technologies. Recognizing the downsizing trend of the past two decades, the agency has also begun considering ways to "adopt a different business paradigm." According to the Corps, "the days when every design office had several engineers of one kind … has gone; now they only have a few engineers specializing in one area." Therefore experts and resources now need to be pooled between offices. With the advent of the Internet, CADD and GIS knowledge and products can be shared throughout the Corps, creating a "true enterprise-wide virtual office."[28]

The Internet

The development of the Internet transformed the way the Corps conducted its business in the late 20th century. The agency used the new technology in numerous ways, including storing and retrieving documents, communicating internally, and interacting with customers and the public. Perhaps the most visible impact of the Internet on the Corps has been in this last category – public relations.

Communicating with the public is an ongoing task at the District. Portland's Public Affairs Office relies on a variety of tools, such as news releases, interviews, and workshops, to provide information about its projects to the public and the media. The creation of the Internet added an additional tool. Following the lead of the Vicksburg District, one of the ways Public Affairs incorporated the new technology was by generating a "top issues" web page, addressing controversial projects or developments. This page included breaking information, as well as a list of facts and myths about each project. District Commander Colonel Randall J. Butler described the concept behind the facts and myths page:

"We have found that folks are using the Internet for information. So we have created different web pages and different ways for folks to hear our side…. One of the key things is when a newspaper or other media puts out something that we think is not truly the facts, we will call it a myth. … What we will then do on our web site is say, here are some of the myths that have been put out there, and here are our facts. We actually give them counter points."

When Vicksburg created its "facts and myths" page, district personnel apparently received criticism from various organizations. "They got calls back from groups saying that you can't do that, you can't counter our story," recalled Colonel Butler. "Basically, Vicksburg said why? These are the facts, and you can tell the facts like they should be told and let people make their own decision."[29]

Brimhall found the top issues page extremely helpful in dealing with questions both from the public and the media. During, for example, the controversy over releasing water from Detroit Lake [See Chapter One], the web page enabled the office to "directly address some of these pieces of information that are

out there." The web page informed the public, while reducing the number of people calling and writing to Public Affairs, saving the office a good deal of time and energy. "It helped drastically because Detroit was having a 'Save our Lake' rally," explained Brimhall. "Matt [Rabe] was getting calls from news media people wanting to know our view on that, or our take. He said, 'Well, as a matter of fact, why don't you check out this web site, we just posted the box of myths.'" Many of the callers responded enthusiastically, and, according to Brimhall, the web site "saved him a lot of time and effort as well."[30] Colonel Butler also observed that information presented on the site could help diffuse contentious situations. Furthermore, he noted that reporters who visited the site were more informed. "What we found is that reporters … go to the web site first before they ask the questions," he explained. "I think that's great because then they are able to at least see what we've put there" and "can tailor their questions and ask the specifics that they want."[31]

Additionally, the top issues web site helped inform District employees outside of Public Affairs. "We're also letting our own people know that those pages are there," explained Brimhall. "Frequently they get asked questions by their neighbors and other folks, and they know where they can go to get information if they need it." Another benefit of the web site was that it offered visitors a chance to be added to a mailing list, further strengthening communication between the agency and the public.[32]

A related technological advance was the adoption of electronic mail (email) by the District. The Corps of Engineers Headquarters encouraged access to email for all employees, and in the mid-1990s email became standardized throughout the agency. At the District, email was primarily used at Headquarters and on larger projects. To meet the Corps' goal of email for all employees, the Portland District Information Management formed a 'traveling road show' installation team that installed Microsoft Outlook and Internet Explorer at all the Portland District projects over one summer. The team included software configuration and installation on all the computers at a project and also delivered classroom teaching on how to use email and the Internet. A community college was used for multiple weeks in The Dalles to teach project staff from Bonneville and the The Dalles/John Day. This concentrated effort made email available to all the Portland District staff.[33]

The Internet and email benefited the District's communication efforts with the public, but, as Brimhall cautioned, it could not replace more traditional tools. "I think the Internet is great … we're making

You've Got Mail!

The introduction of electronic mail (email) had an immediate impact on the Portland District. This new communications tool, which gained widespread use in the district during the 1990s, brought advantages and disadvantages. Email greatly increased the Corps' ability to interact with the public and media – and the Public Affairs Office was quick to recognize the possibilities. The Public Affairs Office created electronic mailing lists to keep people informed of the latest news regarding a particular issue. "We're trying to be more proactive than the Corps traditionally has been," explained Diana Brimhall, Chief of Public Affairs. Email also made exchanging information within the District easier – a particularly important factor for an agency whose project personnel were located across the Pacific Northwest.

The very ease with which people could send emails, however, also created difficulties. The sheer volume of emails could be overwhelming at times. Brimhall regularly received between 50 and 60 messages a day, while Deborah Chenoweth, Operations Manager at Bonneville Lock and Dam, spent "a minimum of two hours a day just dealing with my email." With so many messages coming in, district employees also faced the difficult task of deciding which messages were important and which could be deleted. "People … are inundated with so much information that they don't know what's important," said Brimhall. An additional frustration was that the increased dependence on email meant less face-to-face communication.

To avoid overloading the system, electronic mailboxes required regular sorting and cleaning. This could be accomplished if a person was in the office, but weekends and vacations posed a problem. "If I don't keep up with my email over the weekend, Mondays are a nightmare," reported Chenoweth. "The problem is there are a lot of folks that do their email at night, so you can't clean out your box and go home and come back the next morning, because there is stuff as soon as you walk in the door." The challenge became even more pronounced with an extended absence from the office. "Some people take their laptops with them on vacation so they can check their email," explained Brimhall. "You … go on a two-week vacation, and you get relaxed, refreshed, and ready to come back to work. You walk in and you've got 200 email messages and … it undoes all of the good that the vacation did." To avoid such a scenario, many employees took laptops on vacation, periodically sorting through their emails.

a lot of information accessible to people," she said. But she added, "What we have to remember is not everybody has access to the Internet. Not everybody wants to get their information that way." Even within the District, employees felt that there were some negative impacts associated with the emerging technology. Surveys and discussions revealed that employees wanted more face-to-face communication. "There is too much dependence on sending an email or giving out [information] electronically," Brimhall explained. "People are overwhelmed … with so much information that they don't know what's important, what's not, and how does it affect them?" Furthermore, some employees felt that staying on top of their email correspondence had the potential to prevent them from accomplishing other work. "Am I going to read through email or am I going to try to get some more work done?" was a question that Brimhall often asked herself.[34] Overall, however, District employees remained enthused about the technology's possibilities. Beach – whose channels and harbors projects were one of the first in the District to have a web site – expressed excitement about the new communication tool. "The Internet is fantastic," he said. "We've been able to do a lot there with communicating with the public and telling them what we do. It greatly increased our accessibility."[35]

Becoming Part of the National Recreation Reservation System

Further enhancing its strength as a communications tool, the emergence of the Internet also transformed the public's ability to access Corps recreation sites. As part of an effort to make the nation's recreation sites more accessible, in October of 1998, the National Recreation Reservation System (NRRS) began taking reservations at Corps and National Forest Service campgrounds. This system allowed

campers to make reservations either through a toll-free number or on the Internet. As of May 2000, four Corps-managed campgrounds in Oregon and Washington were part of this directory: Pine Meadows at Cottage Grove Lake, Schwarz at Dorena Lake, and LePage and Plymouth, both of which are located upstream of John Day Dam. The Corps still reserved a limited number of sites available on a first-come, first-serve walk up basis.[36]

The Portland District's Integration and Implementation Branch (IM-I) played a crucial role in implementing the NRRS. The branch established the Interagency Contract Management Office (ICMO) to perform the contract-related startup activities and NRRS program activities, such as financial management and contractor performance monitoring. The IM-I Branch developed the inventory data collection system, which was distributed Corps-wide. After personnel entered the data for each campsite and reservable facility, the files were returned to Portland for consolidation and subsequent transfer to the contractor's center.[37]

Meanwhile, the IM-I Branch established the office automation infrastructure for ICMO, and the Telecommunications Branch developed the communication links from the contractor to the CEAP network and the Internet. The IM-I Branch also assisted in the configuration of personal computers to be placed at campgrounds and installed a modem bank, allowing all campground locations to communicate with the central reservation system. Furthermore, IM-I personnel provided leadership in the design of the financial models required to support the agencies, developed management tools, and worked with the contractor to implement the NRRS. The District's Information Management Office also had a role in the campground reservation system. The office supported the NRRS infrastructure, monitored various aspects of contractor performance, and refined the Financial Management System.[38]

Conclusion

During the late 20th century the Corps faced a number of challenges. As both its workload and workforce underwent significant changes, the agency struggled to stay competitive. The District's adoption of a wide range of new technologies and standards demonstrated its ability to adapt to changing conditions and helped ensure its continued presence in the areas of engineering and design. Furthermore, technological advances, such as the Internet, transformed not only the agency's internal operations and work products, but also its interactions with the public. Web sites provided information on controversial issues, for example, and the National Recreation Reservation System made the Corps' recreation sites more accessible. While the transition to new technologies could be difficult, the Corps generally embraced these new tools, finding innovative ways to incorporate them into its work.

Endnotes

[1] U.S. Army Corps of Engineers, Portland District, "ISO 9000," accessed at https://www.nwp.usace.army.mil/ec/ts/iso9000old.htm, on November 21, 2001.

[2] Personal Communication with Mike Roll, Portland, Oregon, June 6, 2002,

[3] International Organization for Standardization, "What is ISO?" accessed at http://www.iso.ch/iso/en/aboutiso/introduction/whatisISO.html?printable=true , on November 21, 2001.

[4] International Organization for Standardization, "What are standards?" accessed at http://www.iso.ch/iso/en/aboutiso/introduction/index.html?printable=true, on November 21, 2001; Jeffrey Hawkins, Logistics Management Institute, *Road to Engineering Excellence: ISO 9000 Blueprint to Success*, April 1995, p. I-3.

[5] Praxiom Research Group Limited, "Introduction," accessed at http://ww.connect.ab.ca/~praxiom/, on November 21, 2001.

[6] Jeffrey Hawkins, Logistics Management Institute, *Road to Engineering Excellence: ISO 9000 Blueprint to Success*, April 1995, p. I-1.

[7] Jeffrey Hawkins, Logistics Management Institute, *Road to Engineering Excellence: ISO 9000 Blueprint to Success*, April 1995, p. I-2.

[8] U.S. Army Corps of Engineers, Portland District, "ISO 9000," accessed at https://www.nwp.usace.army.mil/ec/ts/iso9000old.htm, on November 21, 2001; U.S. Army Corps of Engineers, *Annual Historical Report*, 1997, p. C-14, Portland District, Public Affairs Office, 870-5a, Organizational Histories, 1990-1999.

[9] Personal Communication with Larry Greep, Portland, Oregon, July 31, 2002.

[10] Personal Communication with Mike Roll, Portland, Oregon, June 6, 2002.

[11] Donita Moorhus and Gregory Graves, "The Limits of Vision: A History of the United States Army Corps of Engineers, 1988-1992," unpublished manuscript August, 1998, Office of the Chief of Engineers, Office of History, pp. 155-156.

[12] Donita Moorhus and Gregory Graves, "The Limits of Vision: A History of the United States Army Corps of Engineers, 1988-1992," pp. 159-161.

[13] Donita Moorhus and Gregory Graves, "The Limits of Vision: A History of the United States Army Corps of Engineers, 1988-1992," pp. 159-161.

[14] Lisa Mighetto and William F. Willingham, *Service – Tradition – Change: A History of the Fort Worth District, U.S. Army Corps of Engineers, 1975-1999*, pp. 107-108; Donita Moorhus and Gregory Graves, "The Limits of Vision: A History of the United States Army Corps of Engineers, 1988-1992," unpublished manuscript August, 1998, Office of the Chief of Engineers, Office of History, pp. 159-161; David Beach, Interview with Lisa Mighetto, Portland, Oregon, June 12, 2001. Hereafter cited as Beach Interview.

[15] Lisa Mighetto and William F. Willingham, *Service – Tradition – Change: A History of the Fort Worth District, U.S. Army Corps of Engineers, 1975-1999*, p. 108.

[16] Personal Communication with Carol Ann Job, Portland, Oregon, May 20, 2002.

[17] Beach Interview.

[18] Diana Brimhall, Interview with Lisa Mighetto, Portland, Oregon, June 13, 2001, hereafter cited as Brimhall Interview; Personal Communication with Carol Ann Job, Portland, Oregon, May 20, 2002.

[19] U.S. Army Corps of Engineers, Portland District, "History of GIS at NWP," accessed at https://www.nwp.usace.army.mil/ec/g/gis_hist.htm, on December 3, 2001.

[20] U.S. Army Corps of Engineers, "Computer Aided Design and Drafting (CADD) in USACE: Perspective & Direction," accessed at http://ckb.wes.army.mil/perspective.htm, on December 4, 2001.

[21] U.S. Army Corps of Engineers, Portland District, "History of GIS at NWP," accessed at https://www.nwp.usace.army.mil/ec/g/gis_hist.htm, on December 3, 2001.

[22] U.S. Army Corps of Engineers, Portland District, "History of GIS at NWP," accessed at https://www.nwp.usace.army.mil/ec/g/gis_hist.htm, on December 3, 2001.

[23] Howard Jones, Interview with Lisa Mighetto, Portland, Oregon, June 14, 2001.

[24] U.S. Army Corps of Engineers, Portland District, Hydraulics, Hydrology & Geotechnical Design Branch, "GIS, Survey & Mapping Section Functions," accessed at https://www.nwp.usace.army.mil/ec/h/hm/gis_outline.htm, on November 28, 2001.

[25] U.S. Army Corps of Engineers, "Computer Aided Design and Drafting (CADD) in USACE: Perspective & Direction," accessed at http://ckb.wes.army.mil/perspective.htm, on December 4, 2001.

Endnotes

[26] U.S. Army Corps of Engineers, "Computer Aided Design and Drafting (CADD) in USACE: Perspective & Direction," accessed at http://ckb.wes.army.mil/perspective.htm, on December 4, 2001.

[27] U.S. Army Corps of Engineers, "Computer Aided Design and Drafting (CADD) in USACE: Perspective & Direction," accessed at http://ckb.wes.army.mil/perspective.htm, on December 4, 2001.

[28] U.S. Army Corps of Engineers, "Computer Aided Design and Drafting (CADD) in USACE: Perspective & Direction," accessed at http://ckb.wes.army.mil/perspective.htm, on December 4, 2001.

[29] Colonel Randall Butler, Interview with Lisa Mighetto and Jill Schnaiberg, Portland, Oregon, August 13, 2001. Hereafter cited as Butler Interview.

[30] Brimhall Interview.

[31] Butler Interview.

[32] Brimhall Interview.

[33] Personal communication with John Entwistle, Portland, Oregon, August 7, 2002.

[34] Brimhall Interview.

[35] Beach Interview.

[36] U.S. Army Corps of Engineers, Portland District, "Corps of Engineers Recreation Season Begins," News Release, April 26, 1999, accessed at https://www.nwp.usace.army.mil/pa/info/summer99_rec.htm, on November 27, 2001; U.S. Army Corps of Engineers, Portland District, "Corps of Engineers Recreation Season Begins," News Release, April 26, 1999, accessed at https://www.nwp.usace.army.mil/pa/news/archive/2000/00-82.htm, on November 27, 2001.

[37] U.S. Army Corps of Engineers, *Annual Historical Report*, 1997, p. 1-11, Portland District, Public Affairs Office, 870-5a, Organizational Histories, 1990-1999.

[38] U.S. Army Corps of Engineers, *Annual Historical Report*, 1997, p. 1-11, Portland District, Public Affairs Office, 870-5a, Organizational Histories, 1990-1999.

Conclusion

By the end of the 20th century, the Portland District had adapted to considerable changes, particularly in the environmental arena. While the District continued its longstanding commitment to navigation and hydropower, it also devoted many resources to the Corps' newer missions, including regulating wetlands and environmental restoration. At the same time, the District responded to new congressional mandates. Legislation, such as the Endangered Species Act of 1973, notably influenced navigation and hydropower during the period 1980-2000.

So significant did endangered species become that this could be called the "salmon era" for the Portland District. Consideration of endangered salmon affected almost every action of the District – and the Corps' efforts to save these fish while also providing navigation, hydropower, and other services highlighted an important theme of the era: the need to balance a growing diversity of interests with the increasing demands on the region's limited natural resources. The controversy surrounding Elk Creek Dam exemplified the magnitude of changes that had occurred during this period. A half a century earlier, this project likely would have been completed with little, if any, opposition. Another significant development included the Corps' research on salmon and its construction of fish-passage facilities, which illustrated adaptive and innovative approaches to saving salmon.

The period 1980-2000 was also characterized by the District's response to emergencies. The eruption of Mount St. Helens was a monumental event in the District's history as well as that of the region. The Corps' quick mobilization and response to that disaster, along with the assistance provided during the Alaska Oil Spill in 1989 and the Flood of 1996, demonstrated the District's connection to Pacific Northwest communities, marking a high point in the public's reaction to the agency. As one dredge captain commented, the Corps' aid during disasters represented the District's "glory" days.[1]

The last decades of the 20th century also marked a turning point in water resources planning and management. The Water Resources Development Act of 1986 directed non-federal interests to share the costs for navigation, flood control, and other projects. From that point, the Corps worked with non-federal interests to develop projects that were environmentally and socially responsible as well as economically sound.

Changes in congressional appropriations and funding led the Corps to modify the way it conducted business during the end of the 20th century. The agency adopted concepts from private industry during this period, attempting to improve efficiency and competitiveness. Project management, which emphasized teamwork, cost control, and timeliness, proved to be a significant development in Portland as well as other districts – one that is likely to persist.

Many of the major trends of the late 20th century will continue into the 21st century. Projects such as the Columbia River Channel Deepening, for instance, will require ongoing consideration of endangered species and environmental impacts as well as the need to balance a diversity of interests. The Willamette River restoration initiative and the Lower Columbia River Estuary Program highlight the continued importance of the Corps' environmental work.

The story of the Portland District demonstrates the adaptability, innovation, and determination of its employees – and it reveals how their work has helped shape the history of the region. As a new generation of employees face new challenges, they can draw from the legacy and the tradition of service of their predecessors. As the new District Engineer, Colonel Richard W. Hobernicht aptly observed shortly after taking command in July of 2002, "It's the people that make the District."[2]

Endnotes

[1] Miguel Jiminez, Interview with Lisa Mighetto, Aboard the Yaquina, Portland, Oregon, June 13, 2001.

[2] "The People of the Portland District." Video Produced for Portland District Public Affairs by Historical Research Associates, 2002.

Register of Dams in Oregon from The World Register of Dams 1984 - 1988

Name of Dam	Year of Completion	River	Nearest City	State	Type	Foundation	Foundation Height above Lowest Foundation (m)	Length of Crest (m)	Volume Content of Dam ($10^3/m^3$)	Reservoir Area ($10^3/m^3$)	Destination Purpose	Maximum Discharge Capacity of Spillways (m^3/s)	Type of Spillways	Owner	Engineering By	Construction By
Applegate	1980	Applegate	Applegate	OR	TE	R/S	74	366	2150	101377	ICR	2656	V	COE	COE	Peter Kewit
Bonneville	1937	Columbia	Bonneville	OR	PG	R	60	755	893	696815	HNR	45307	V	COE	COE	Columbia Const. Co.
Big Cliff	1953	N. Santiam	Mill City	OR	PG	R	58	85	68	7955	H	4984	V	COE	COE	Columbia Const. Co./ Consolidated Builders
Blue River	1968	Blue	Springfield	OR	TE	R/S	95	381	3726	110380	CR	1501	V	COE	COE	Lockheed Ship Building & Const. Co
Cottage Grove	1942	C.F. Willamette	Cottage Grove	OR	TE	R/S	31	643	581	40625	CINR	1155	L	COE	COE	T.E.Connelly Co.
Cougar	1964	S F. McKenzie	Springfield	OR	ER	R/S	158	488	9939	270463	HCIR	2152	V	COE	COE	Merritt-Chapman-Scott
Detroit	1953	N. Santiam	Mill City	OR	PG	R	141	482	1147	561152	HCRI	4984	V	COE	COE	Consolidated Builders
Dexter	1955	M.F. Willamette	Eugene	OR	TE	R/S	36	843	600	33916	HR	7646	V	COE	COE	McNutt Bros. & C.J. Montag & Sons
Dorena	1949	Row	Cottage Grove	OR	TE	R/S	47	1006	2312	95580	CINR	2761	L	COE	COE	Doena Const. Co.
Fall Creek	1965	Fall Creek	Springfield	OR	ER	R/S	62	1539	3802	154163	CNIR	2333	V	COE	COE	Montag-Halvorson-McLoughlin
Foster	1967	S. Santium	Sweethome	OR	ER	R/S	38	1391	609	75231	HCRI	5522	V	COE	COE	Paul Hardman, Inc.
Green Peter	1967	M. Santiam	Sweethome	OR	PG	R	115	462	873	530319	CHRI	3115	V	COE	COE	Paul Hardman, Inc.
Hills Creek	1962	M.F. Willamette	Oakridge	OR	TE	R/S	104	703	8257	439055	CHIS	4010	V	COE	COE	Shed Construction
John Day	1968	Columbia	Rufus	OR	PG/ER	R	70	1798	2164	616505	HRNC	63713	V	COE	COE	Montag-Halverson-McLoughlin; Morrison-Knudsen; Others
McNary	1957	Columbia	Umatilla	OR	PG/ER	R	67	2245	3668	1665200	HSRI	62297	V	COE	COE	Atkinson, Ostrander & Jones
Lookout Point	1953	M.F. Wilamette	Eugene	OR	TE	R/S	84	968	5892	562385	CINH	7646	V	COE	COE	Macco Corp.; Morrison-Knudsen, Peter Kewit
Lost Creek	1976	Rogue	Shady Grove	OR	ER	R/S	105	1097	8257	573485	CHSR	4474	V	COE	COE	Umpqua Navigation
The Dalles	1957	Columbia	The Dalles	OR	PG/ER	R	61	2662	2340	410073	HNRI	64845	V	COE	COE	Guy Atkenson; Ostrander; S.A. Healy, Dalles Powerhouse
Willow Creek	C	Willow Creek	Heppner	OR	PG	R	47	543	308	5116	CR	2595	L	COE	COE	Eucon Corp.

Legends:

Types of dams: Earth = TE; Rockfill = ER; Gravity = PG; Buttreess = CB; Arch = VA; Multi-arch = MV

Foundation: Rock = R; Soil = S; Part of dam is on rock = R/S

Legends:

Destination Purpose: Irrigation = I; Hydroelectric = H; Flood Control = C; Navigtion = N; Water Supply = S; Recreational = R

Type of Spillway: Uncontrolled = L; Controlled = V

Bibliography

Archival Sources

Federal Records Center Pacific Alaska Region (Record Group 77), Seattle

Installation Historical Files, Accession Number 77-98-0005. Boxes 18, 23, 24, 25, 26, 31, 37, 44, 45, 46, 47, 48.
Accession Number 77-90-0028, Box 1.
Accession Number 77-90-0034, Boxes 1-3.
Accession Number 77-00-0020, Boxes 1, 4, 7, and 8.
Accession Number 77-98-0001, Box 1.
Accession Number 77-00-0015, Box 2.
Accession Number 77-95-0188, Boxes 1, 2.
Accession Number 77-96-0021, Box 1.
Accession Number 77-91-0027, Box 1.
Accession Number 77-90-0027, Box 1.
Accession Number 77-98-0003, Box 1.
Accession Number 77-92-0047, Box 1.
Accession Number 77-91-0018, Box 1.
Accession Number 77-92-0031, Boxes 1, 2.
Accession Number 77-95-0183, Box 2.
Accession Number 77-91-0043, Boxes 1, 2.
Accession Number 77-90-0020, Boxes 1, 2
Accession Number 77-91-0028, Box 1.
Accession Number 77-97-0051, Boxes 5, 6, 7, 8, and 9.
Accession Number 77-98-0002, Boxes 1-4.
Accession Number 77-97-0041, Boxes 1, 3.
Accession Number 77-89-0085, Boxes 1, 19, 29, and 36.
Accession Number 77-89-0021, Box 1.
Accession Number 77-93-0037, Box 1.
Accession Number 77-87-0056, Box 3.
Accession Number 77-94-0021, Box 4.
Accession Number 77-89-0084, Box 2.
Accession Number 77-95-0158, Boxes 1-4.

Oregon History Center, Portland

Books and Articles
Oral Histories
Photographs
Vertical Files

Newspapers

The Oregonian
The Seattle Post-Intelligencer
The Seattle Times
The Seattle Daily Journal of Commerce
The Register-Guard

Portland District Office

U.S. Army Corps of Engineers, *Corps'pondent*, 1980-2000.

Information Management Center

Videotapes relating to Corps' projects provided by Information Management Center.
18 unmarked boxes from Iron Mountain Records.

Visual Information Branch, Portland District

Photo Notebook, Disks 1-24.
"Flood of '96 CD and slideshow" notebook
"Elk Creek" Notebook #1, contact prints
"Elk Creek" Notebook #2, contact prints
Artwork Notebook
New Photo CDs, Cougar, Blue River, Detroit, Foster
Maps archive Notebook

Public Affairs Office (PAO)
Installation History Files, 870-5a and 870-5b.
Files 360, 25-1pp, 1jj, 1105, 1145

Technical Library
Government Reports
Books and Articles

HRA Interviews

Ashenbrenner, Vickie, Telephone Interview with Jill Schnaiberg, December 14, 2001.
Ashley, Ed, Interview with Lisa Mighetto, Portland, Oregon, June 14, 2001.
Beach, David C., Interview with Lisa Mighetto, Portland, Oregon, June 12, 2001.
Brimhall, Diana C., Interview with Lisa Mighetto, Portland, Oregon, June 13, 2001.
Butler, Colonel Randall J., Interview with Lisa Mighetto and Jill Schnaiberg, Portland, Oregon, August 15, 2001.
Chenoweth, Deborah, Interview with Lisa Mighetto, Bonneville Dam, January 30, 2002 and March 26, 2002.
Christensen, Jerry, Interview with Lisa Mighetto, Portland, Oregon, October 16, 2001.
Clarke, Doug, Interview with Lisa Mighetto, Portland, Oregon, June 15, 2001.
Connell, Colonel Terence J., Colonel Robert Friedenwald, and Patrick Keough, Interview with Lisa Mighetto, Portland, Oregon, October 17, 2001.
Collins, Gerald. Interview with Wesley J. Ebel and Lisa Mighetto, Seattle, Washington, August 31, 1993.
Davis, Tom, Tom White, and Jerry Weaver, Interview with Lisa Mighetto, Portland, Oregon, October 18, 2001.
Dorsey, Geoff, Interview with Jill Schnaiberg, Portland, Oregon, January 17, 2002.
Friedenwald, Colonel Robert, Interview with Lisa Mighetto, Portland, Oregon, October 15, 2001.
Gross, Michael, Interview with Lisa Mighetto and Jill Schnaiberg, Portland, Oregon, August 15, 2001.
Hanson, Becky, Interview with Lisa Mighetto, Portland, Oregon, May 8, 2001
Hicks, Laura, Interview with Jill Schnaiberg, Portland, Oregon, January 17, 2002.
Jacques, Alene, Telephone Interview with Jill Schnaiberg, May 22, 2002.
Jiminez, Miguel, Interview with Lisa Mighetto, Portland, Oregon, June 13, 2001.
Johnson, Gary, Interview with Lisa Mighetto, Portland, Oregon, April 17, 2002.
Jones, Howard, Interview with Lisa Mighetto, Portland, Oregon, June 14, 2001.
Kranda, John, Interview with Lisa Mighetto and Jill Schnaiberg, Portland, Oregon, August 16, 2001.
Leinbach, Claud, Telephone Interview with Jill Schnaiberg, May 21, 2002.
Lynch, Lester. Telephone Interview with Lisa Mighetto, April 11, 2003.
Majerus, Daniel, Telephone Interview with Jill Schnaiberg, December 20, 2001.
Martin, Michael, Interview with Jill Schnaiberg, Portland, Oregon, January 17, 2002.
Mogren, Colonel Eric T., Interview with Lisa Mighetto, Portland, Oregon, May 7, May 10, and June 11, 2001.
Moriuchi, Davis, Interview with Lisa Mighetto, Portland, Oregon, June 15, 2001.
Nyberg, Neal, Interview with Lisa Mighetto, Portland, Oregon, January 18, 2002.
Rea, Matt, Interview with Jill Schnaiberg, Portland, Oregon, January 16, 2002.
Savidge, Thomas, Interview with Lisa Mighetto, Portland, Oregon, June 12, 2001.
Strock, General Carl A., Interview with Lisa Mighetto, Portland, Oregon, July 6, 2001.
Takabayashi , Sandra, Interview with Lisa Mighetto, Portland, Oregon, June 14, 2001.
Walker, Lynda, Interview with Lisa Mighetto, Portland, Oregon, May 8, 2001.

Miscellaneous Interviews

Arndt, Douglas, Oral History of Brigadier General Robert H. Griffin Commander, US Army Corps of Engineers, Supplementary Interview, Interview by Michael O'Rourke for the Oregon Historical Society, July 12, 1999.
Connell, Colonel Terence J., Interview with William F. Willingham, Portland, Oregon, June 26, 1985.
Cowan, Colonel Charles E., Interview with William F. Willingham, Portland, Oregon, September 8, 1988, October 20 and 30, 1989, and November 1, 1990.

Friedenwald, Colonel Robert L., Interview with William F. Willingham, Portland, Oregon, June 11, 1985.
Griffin, Robert H., Oral History of Brigadier General Robert H. Griffin Commander, US Army Corps of Engineers, NWD (1996-1999), Interview by Michael O'Rourke for the Oregon Historical Society, July 12, 1999.
Keough, Patrick, Interview with William F. Willingham, Portland, Oregon, June 2, 1983 and March 8, 1985.
Lord, Colonel Gary R., Interview with William F. Willingham, Portland, Oregon, June 10, 1987.

Dissertations

Stine, Jeffrey K. *Environmental Politics and Water Resources Development: The Case of the Army Corps of Engineers During the 1970s*. Ph.D. Dissertation. University of California, Santa Barbara, 1984.

Government Publications and Reports

Bowen, Michael, "What's Wrong with Mitigation Banks?" *The Military Engineer*. October/November 1995.
Brauner, David and Clayton Lebow. *A Reevaluation of Cultural Resources Within the Proposed Elk Creek Lake Project Area, Jackson County, Oregon, Phase II: Site Evaluation*. Corvallis, Oregon: Oregon State University, 1983.
Brown, Clayton D. *The Southwestern Division: 50 Years of Service*. U.S. Army Corps of Engineers, Southwestern Division, 1987.
CH2M Hill/Montgomery Watson Joint Venture. *Cougar Lake WTC Project, Final Alternatives Report for Fish Passage*. Task Order No. 15, August 4, 2000.
City of Portland, Bureau of Planning. *Portland Environmental Handbook.* Portland, The Bureau, 1977.
Clement, Thomas M., Jr., Glenn Lopez, and Pamela T. Mountain. *Engineering a Victory for Our Environment: A Citizens' Guide to the U.S. Army Corps of Engineers*. Washington, D.C.: Institute for the Study of Health and Society, 1971.
Cobb, John N. *Pacific Salmon Fisheries*. Washington, D.C.: Government Printing Office, 1917.
Columbia River System Operation Review. *Final Environmental Impact Statement / Bonneville Power Administration, U.S. Army Corps of Engineers, North Pacific Division; U.S. Department of the Interior, Bureau of Reclamation*. Portland: SOR Interagency Team, 1995.
Department of the Army. *A Comprehensive Plan for Responding to the Long-Term Threat Created by the Eruption of Mount St. Helens, Washington*. November 3, 1983.
Geotechnical Resources, Inc. *Level 1 Preliminary Site Assessment for the U.S. Moorings Facility, Portland, Oregon*. Draft. June 20, 1990.
Government Institutes. *Environmental Statues*. Rockville, Maryland: Government Institutes, 2000.
Hawkins, Jeffrey, "Road to Engineering Excellence: ISO 9000 Blueprint to Success," McLean Virginia, Logistics Management Institute, 1995.
Heaton, Charles. *Alaska 1989 Oil Spill, After Action Report*. Alaska, 1990.
InterMountain West, Inc. *Final Report for On Site Clean Up of Contaminated Soils, U.S. Moorings Facility, Portland, Oregon*. September 9, 1993.
Jones, William A. *Salmon Fisheries of the Columbia River*, 50th Cong. 1st sess., 1888, S. Exec. Doc. 123, SS 2510.
McDonnell, Janet. *The U.S. Army Corps of Engineers Response to the Exxon Valdez Oil Spill*. Fort Belvoir, VA: U.S. Army Corps of Engineers, 1992.
Minor, Rick and Stephen Dow Beckham. *Cultural Resources Overview and Investigations for the Bonneville Navigation Lock Project, Oregon and Washington*. Portland District, U.S. Army Corps of Engineers, 1984.
Mighetto, Lisa and Wesley J. Ebel. *Saving the Salmon: a History of the U.S. Army Corps of Engineers' Efforts to Protect Anadromous Fish on the Columbia and Snake Rivers*. U.S. Army Corps of Engineers, 1994.

Moorhus, Donita and Gregory Graves, "The Limits of Vision: A History of the United States Army Corps of Engineers, 1988-1992." Unpublished manuscript, August 1998.

National Park Service, Cultural Resources Programs. *Federal Historic Preservation Laws*. Washington, D.C., 1993.

Office of Technology Assessment. *Wetlands: Their Use and Regulation*. Washington, D.C.: U.S. Congress, Office of Technology Assessment, March 1984.

Peterson, Keith. "The Army Corps of Engineers and the Environment in the Pacific Northwest." Unpublished manuscript, U.S. Army Corps of Engineers, Office of the Chief of Engineers, Historical Division, May 1982.

Reed, Mary E. *A History of the North Pacific Division.* Portland: U.S. Army Corps of Engineers, 1991.

Reuss, Martin. *Reshaping National Water Politics: The Emergence of the Water Resources Development Act of 1986*. Washington, D.C.: U.S. Army Corps of Engineers, Institute for Water Resources, 1991.

Richmond, Henry R. III, *The History of the Portland District Corps of Engineers 1871-1969*, U.S. Army Corps of Engineers Portland District, n.d.

U.S. Army Corps of Engineers. *Corps of Engineers' Action to Assist Salmon in the Columbia River Basin: report to congressional requesters / United States General Office*, 1998.

U.S. Army Corps of Engineers, Regulatory Branch. *Section 404 of the Clean Water Act and Wetlands: Special Statistical Report*. July 1995.

U.S. Army Corps of Engineers, Portland District. *An Environmental Impact Statement on Operations and Maintenance of the Willamette Reservoir System.* Portland, 1980.

U.S. Army Corps of Engineers, Portland District. *Bonneville Master Plan*. Portland, March 1997.

U.S. Army Corps of Engineers, Portland District. *Bonneville Second Powerhouse*. Portland, September 1984.

U.S. Army Corps of Engineers, Portland District. *Cultural Resource Overview and Investigations for the Bonneville Navigation Lock Project*. Portland, 1984.

U.S. Army Corps of Engineers, Portland District. *Dredged Material Management Plan & Supplemental Environmental Impact Statement: Columbia and Lower Willamette River Federal Navigation Channel*. Portland, June 1998.

U.S. Army Corps of Engineers, Portland District. *Elk Creek Lake, Design Memorandum No. 10, Supplement No. 2*. Portland, July 1985.

U.S. Army Corps of Engineers, Portland District. *Elk Creek Lake: Master Plan for Resource Use*. Portland, December 1987.

U.S. Army Corps of Engineers, Portland District. *Excavated Material Evaluation for Upland Disposal*. Portland, December 1993.

U.S. Army Corps of Engineers, Portland District. *General Investigation Reconnaissance Study Willamette River Environmental Dredging, Oregon*. Portland, December 26, 2000.

U.S. Army Corps of Engineers, Portland District. *Management of Dredging Projects: Summary Report for Technical Area 5*. Portland, February 1996.

U.S. Army Corps of Engineers, Portland District. *Mount St. Helens Eruption: Impacts on the Toutle, Cowlitz and Columbia River System*. Portland, December 1980.

U.S. Army Corps of Engineers, Portland District. *Mount St. Helens Eruption: The Challenge to Restore and Protect.* October 1981.

U.S. Army Corps of Engineers, Portland District. *Preliminary Assessment Report: The U.S. Government Moorings Facility, Portland, Oregon*. Portland, April 1994.

U.S. Army Corps of Engineers, Portland District. *Water Resources Development in Oregon, 1991*. Portland, 1991.

U.S. Army Corps of Engineers, Portland District. *Water Resources Development in Oregon, 1997*. Portland, 1997.

U.S. Army Corps of Engineers, Water Resources Support Center. *Port of Portland, Oregon and Ports on the Columbia-Snake River System: Deep Draft, Upper Columbia River,* 1996.

U.S. Bureau of Fisheries, *Annual Report*. 1913.

United States, General Accounting Office. *Water Resources (microform): Corps of Engineers' Actions to Assist Salmon in the Columbia River Basin: report to congressional requesters,* 1998.
Willingham, William F. *Army Engineers and the Development of Oregon: A History of the Portland District*, U.S. Army Corps of Engineers. Washington, D.C., 1983.
Willingham, William F. and John Carroll. "Protecting the Nation's Waters: A History of the US Army Corps of Engineers Regulatory Responsibilities, 1899-1999." Unpublished manuscript, U.S. Army Corps of Engineers, Office of History, Washington, D.C.
Willingham, William F. *Water Power in the Wilderness: The History of Bonneville Lock and Dam*. U.S. Army Corps of Engineers, c. 1988.
Willingham, William F and Lisa Mighetto. *Service – Tradition – Change: A History of the Fort Worth District, U.S. Army Corps of Engineers, 1975-1999*. Fort Worth: U.S. Army Corps of Engineers, 2000.

Books and Articles

Abbott, Carl. *Greater Portland: Urban Life and Landscape in the Pacific Northwest*. Philadelphia: University of Pennsylvania Press, 2001.
Bullard, Oral. *Crisis on the Columbia.* Portland: Touchstone Press, 1968.
Carson, Rachel. *Silent Spring*. Boston: Houghton Mifflin Co., 1962.
Conlan, Timothy. *New Federalism: Intergovernmental Reform from Nixon to Reagan*. Washington, D.C.: The Brookings Institution, 1988.
Cowdry, Albert E. "Pioneering Environmental Law: The Army Corps of Engineers and the Refuse Act." *Pacific Historical Review* 46 (August 1975).
DeMarco, Gordon. *A Short History of Portland*. San Francisco: Lexikos, 1990.
Dicken, Samuel N. and Emily F. *The Making of Oregon: A Study in Historical Geography.* Portland: Oregon Historical Society, 1979.
Dietrich, William. *Northwest Passage: The Great Columbia River*. New York: Simon & Schuster, 1995.
Dodds, Gordon. *The American Northwest: A History of Oregon and Washington*. Arlington Heights, Ill.: Forum Press, 1986.
Ferejohn, John A. *Pork Barrel Politics: Rivers and Harbors Legislation, 1947-1968*. Stanford: Stanford University Press, 1974.
Fink, Gary M. and Hugh Davis Graham. *The Carter Presidency: Policy Choices in the Post-New Deal Era*. University Press of Kansas, 1998.
Fisher, Lorena. *The Bonneville Dream*. L.S. Fisher, 1991.
Guggenheim, Alan. *Spirit Lake People: Memories of Mount St. Helens*. Gresham, Oregon: Salem Press, 1986.
Hays, Samuel. *Conservation and the Gospel of Efficiency: The Progressive Conservation Movement, 1980-1920*. Cambridge: Harvard University Press, 1959.
Jakle, John A. *The Tourist: Travel in Twentieth-Century North America*. Lincoln: University of Nebraska Press, 1985.
Keeble, John. *Out of the Channel: The Exxon Valdez Oil Spill in Prince William Sound*. Eastern Washington Press, 1999.
Kelso, Dennis D. and Marshal Kendziorek, "Alaska's Response to the *Exxon Valdez* Oil Spill," *Environmental Science & Technology*, January 1991.
Kettl, Donald F. and John J. DiIulio. *Inside the Reinvention Machine: Appraising Governmental Reform*. Washington, D.C.: The Brookings Institution, 1995.
Kettl, Donald F. *Reinventing Government? Appraising the National Performance Review*. Center for Public Management, The Brookings Institution, August 1994.
Kubasek, Nancy K. and Gary S. Silverman. *Environmental Law*. Upper Saddle River, New Jersey: Prentice Hall, 2000.
Lang, William L. and Robert C. Carriker (eds.). *Great River of the West: Essays on the Columbia River*. Seattle: University of Washington Press, 1999.
Lichatowich, Jim. *Salmon Without Rivers: A History of the Pacific Salmon Crisis*. Washington, D.C.: Island Press, 1999.
Mighetto, Lisa. *Wild Animals and American Environmental Ethics*. Tucson: University of Arizona Press, 1991.

Miller, Stanton S, "In a Faraway State," *Environmental Science & Technology*, September 1990.
Netboy, Anthony. *The Columbia River Salmon and Steelhead Trout: Their Fight for Survival*. Seattle: University of Washington Press, 1980.
Nichols, Alan B, "Corps of Engineers Charts New Course," *Water Environment & Technology*, January 1991.
Nienaber, Jeanne Clarke and Daniel C. McCool. *Staking Out the Terrain: Power and Performance Among Natural Resource Agencies*. Albany: State University of New York Press, 1996.
Pain, Stephanie, "Alaska Has Its Fill of Oil," *New Scientist*, August 12, 1989.
Petulla, Joseph M. *American Environmental History: The Exploitation and Conservation of Natural Resources*. San Francisco: Boyd & Fraser Publishing Company, 1977.
Price, Larry W. *Portland's Changing Landscape*. Department of Geography, Portland State University, 1987.
Pyne, Stephen J. *America's Fires: Management on Wildlands and Forests*. Durham, North Carolina: Forest History Society, 1997.
Reiger, John F. *American Sportsmen and the Origin of Conservation*. Corvallis, Oregon: Oregon State University Press, 2001.
Robbins, William G. *Landscapes of Promise: The Oregon Story, 1800-1940.* Seattle: University of Washington Press, 1997.
Robbins, William G. *Lumberjacks and Legislators: Political Economy of the U.S. Lumber Industry, 1890-1941*. College Station: Texas A&M Press, 1982.
Roberts, Don and Diana Roberts. *Mount St. Helens: The Volcano of our Time*. Portland, Oregon: Frank Amato Publications, 1980.
Schnoor, Jerald L, "The Alaska Oil Spill: Its Effects and Lessons," *Environmental Science & Technology*, January 1991.
Schultz, Stewart T. *The Northwest Coast, A Natural History*. Portland, Oregon: Timber Press, 1990.
Schwantes, Carlos A. *The Pacific Northwest: An Interpretive History*. Revised Edition. Lincoln: University of Nebraska Press, 1996.
Shallat, Todd. *Structures in the Stream: Water, Science, and the Rise of the U.S. Army Corps of Engineers*. Austin: University of Texas Press, 1994.
Smith, Cortland. *Salmon Fishers of the Columbia.* Corvallis: Oregon State University, 1979.
Stine, Jeffrey K. "Regulating Wetlands in the 1970s: U.S. Army Corps of Engineers and the Engineering Organizations." *Journal of Forest History* 27 (April 1983).
Taylor, Joseph E. III. *Making Salmon: An Environmental History of the Northwest Fisheries Crisis*. Seattle: University of Washington Press, 1999.
Weatherford, Gary D., ed. *Water and Agriculture in the Western U.S.: Conservation, Reallocation, and Markets*. Studies in Water Policy and Management, No. 2. Boulder, Colorado: Westview Press, 1982.
White, Richard. *The Organic Machine.* New York: Hill and Wang, 1995.

SUBJECT INDEX

CODE: 99 (mentioned on this page)
99f (mentioned on this and consecutive following pages)

C

D

G

P

T

XYZ

List of Acronyms

ADAS	Automatic Data Acquisition System
AMPRS	Automated Management Project Reporting Systems
ASACW	Assistant Secretary of the Army for Civil Works
BPA	Bonneville Power Administration
BRAC	Base Realignment and Closure
CADD	Computer Aided Design and Drafting
CEAP	Corps of Engineers Automation Program
CEFMS	Corps of Engineers Financial Management System
CERCLA	Comprehensive Environmental Response, Compensation and Liability
CERF	Corps of Engineers Reserve Fleet
CFS	Cubic Feet per Second
CMT	Crisis Management Team
COEMIS	Corps of Engineers Management Information System
CPAC	Civilian Personnel Advisory Center
CPO	Civilian Personnel Office
CPOC	Civilian Personnel Operations Center
CPOCMA	Civilian Personnel Operations Center Management Agency
CREST	Columbia River Estuary Study Taskforce
CRITFC	Columbia River Inter-Tribal Fish Commission
CRM	Cultural Resources Management
CTWG	Caspian Tern Working Group
CWA	Clean Water Act
DCPDS	Defense Civilian Personnel Data System
DDE	Deputy District Engineer
DDE [PM]	Deputy District Engineer for Project Management
DE	District Engineer
DEQ	Department of Environmental Quality
DERP	Defense Environmental Restoration Project
DMMP	Dredged Material Management Plan
DMSP	Dredge Management Sediment Program
DMMS	Dredge Material Management Study
DoD	Department of Defense
DOE	Department of Energy
DRS	Damage Report Surveys
EA	Environmental Assessment
EIS	Environmental Impact Statement
EIT	Engineer in Training
EOC	Emergency Operations Center
EPA	Environmental Protection Agency
ERDAS	Earth Resource Data Analysis
ERDC	Engineer Research and Development Center
ERGO	Environmental Review Guide for Operations
ESA	Endangered Species Act
ESC	Engineer Study Center
ESU	Evolutionary Significant Unit
FAC	Field Advisory Committee
FEMA	Federal Emergency Management Act
FONSI	Finding of No Significant Impact

FPC	Fish Passage Center
FUDS	Formally Used Defense Sites
FWPCA	Federal Water Pollution Control Act
GAO	General Accounting Office
GIS	Geographic Information Systems
GPS	Global Positioning System
HRS	Hazard Ranking System
HTRW	Hazardous, Toxic and Radioactive Waste
ICMO	Interagency Contract Management Office
IM-I	Integration and Implementation Branch
ISMP	Information Systems Modernization Program
ISO	International Organization for Standardization
JBS	Juvenile Bypass System
LDP	Leadership Development Program
LMI	Logistics Management Institute
MCY	Million Cubic Yards
MDF	Minimum Dredge Fleet
MGR	Minimum Gap Runner
MOP	Minimum Operating Pool
NAGPRA	Native American Graves Protection and Repatriation Act
NCP	National Contingency Plan
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
NPR	National Performance Review
NPS	National Park Service
NRRS	National Recreation Reservation System
NWD	Northwestern Division
NWPPC	Northwest Power Planning Council
ODFW	Oregon Department of Fish and Wildlife
ODLS	Oregon Division of State Lands
OEC	Oregon Environmental Council
ONRC	Oregon Natural Resources Council
OSU	Oregon State University
PAH	Polyaromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PIES	Project Improvements for Endangered Species
PIT	Passive Integrated Transponder
PMBP	Project Management Business Process
POD	Pacific Ocean Division
PPM	Programs and Project Management
PPMD	Programs and Project Management Division
PPPMD	Planning, Programs and Project Management Division
PSU	Portland State University
RBC	Regional Business Center
RCC	Roller Compacted Concrete
RCC	Reservoir Control Center
RD/RA	Remedial Design/Remedial Action
RIF	Reduction in Force

RI/FS	Remedial Investigation/Feasibility Study
RMB	Regional Management Board
SARA	Superfund Amendments and Reauthorization Act
SCEP	Student Career Experience Program
SEIS	Supplemental Environmental Impact Statement
SFO	Support for Others
SHPO	State Historic Preservation Office
SPD	South Pacific Division
SRS	Sediment Retention Structure
STEP	Student Training Employment Program
STS	Submersible Traveling Screen
TAQ	Total Army Quality
TDG	Total Dissolved Gas
TWG	Turbine Working Group
USACE	United States Army Corps of Engineers
USAID	U.S. Agency for International Development
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
USFWS	U.S. Fish and Wildlife Service
VOC	Volatile Organic Compound
VCP	Voluntary Cleanup Program
WCPOC	West Civilian Personnel Operation Center
WES	Waterways Experiment Station
WRDA	Water Resources Development Act