HISTORY

OF THE

SEATTLE DISTRICT

1896-1968

UNITED STATES ARMY ☆ CORPS OF ENGINEERS

72 YEARS IN PEACE AND WAR

Report Documentation Page

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--tain Harry Taylor, First Seattle District Engineer Photo. 1

FOREWORD

This story of Seattle District, Corps of Engineers, United States Army relates simply the major accomplishments, the critical turning points in public policy, and a little of the guiding personalities that have shaped the organization and its work. A great array of statistical, technical and biographical detail is quite beyond our resources and, probably, the interest of readers. Our purpose is to picture to the people we serve the "who, what and why" of our existence in the broad framework of 72 years' settlement and development in the Pacific Northwest. Statistical detail is largely relegated to pertinent appendices. A few anecdotes and comments, perhaps unimportant in themselves, are related merely to enliven the manuscript.

For the meticulous student who may wish to inquire more particularly into certain aspects, historical files are available in the offices of the District Engineer, Seattle; the Division Engineer, North Pacific, at Portland, Oregon; and the Chief of Engineers, Washington, D.C. Material is housed also in the National Archives' Regional and Central offices. Footnotes and the bibliography herein provide references to these sources and to others available outside the Government.

1 March 1969

RICHARD E. MC CONNELL
Colonel, Corps of Engineers,
United States Army
Seattle District Engineer

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(Bound at back of book)

PART I - THE CORPS OF ENGINEERS, U.S. ARMY

Origins and Missions

To place this account in historical perspective, we must reach back 223 years to Colonial days, whence the present Corps evolved from the commissioning of Engineer officers in the wars that preceded our independence. Exhibit 1 traces this and subsequent developments.1/ Throughout its history to the present day, the Corps has been a part of the United States Army, with all of its principal units commanded by Army officers. In fact, the United States Military Academy at West Point, the officers' training school of the Army, was established simultaneously and identically with the present Corps in 1802. West Point was the first engineering school in this country. Until 1866 the law required the superintendent of the military academy to be an officer of the Corps of Engineers. The commissioning of academically top-ranking graduates as Engineer officers became traditional. On their uniforms, these officers wear the distinctive turreted castle insignia of the Corps on their collars, and buttons bearing the shield and Engineers' motto "Essayons" (Let us try).

Beginning in Revolutionary days with the construction of simple earthworks and masonry fortifications, the military mission of the engineer has become the highly sophisticated complex of the modern space age in which the Corps has built satellite tracking stations that girdle the earth. Logistics--the techniques of arming, maneuvering, maintaining and supplying masses of men and materiel anywhere on, over or under the face of the earth--has become a decisive factor in warfare. Therefore, a major part of the Army's logistic mission has fallen to the technically trained men of the Corps. In World War I, the mission involved not only the construction of nationwide facilities for mobilization and training, but the support of an overseas force of two million troops. In World War II, Air Corps and Quartermaster Corps construction was added to the responsibilities of the Corps of Engineers. To illustrate the scope of its work, in 1945 at the close of World War II, Corps military construction amounted to $11-1/2 billion in seaports; facilities for processing, storing and maintaining all manner of war materials; training centers, camps, hospitals, harbor defenses, airports, and roads in the United States of America. More than 300 million square yards of runways and taxiways were built on more than a thousand airfields, and 27,000 miles of roads, all in the United States. The Corps built the ALCAN Highway to Alaska and, overseas, the Russian supply route through Iran, the Ledo-Burma Road, the XYZ Highway, the Red Ball Highway; thousands of airfields, railroads, and 11,000 miles of pipelines along 56,000 miles of supply routes leading to the fighting fronts, often under

1/Geneses of the Corps of Engineers, including portraits and profiles of its forty-three Chiefs and an introductory sketch of events from 1745 to 1966, as presented by the Corps of Engineers Museum, Fort Belvoir, Virginia. Copy in Seattle District historical files.

GENESES OF THE CORPS OF ENGINEERS

RICHARD GRIDLEY
LIEUTENANT COLONEL: CHIEF OF ARTILLERY AND ENGINEERS
AT
SIEGE OF LOUISBURG
(1745)

MAJOR GENERAL: CHIEF ENGINEER NEW ENGLAND ARMY
(APRIL 1775)

COLONEL: CHIEF ENGINEER CONTINENTAL ARMY
(JULY 1775)

RUFUS PUTNAM - CHIEF ENGINEER
(AUGUST 1776)

LOUIS DUPORTAIL - CHIEF ENGINEER
(JULY 1777)

CONTINENTAL ARMY CORPS OF ENGINEERS ESTABLISHED - MARCH 1779
(DISSOLVED - 1783)

CORPS OF ARTILLERISTS AND ENGINEERS ESTABLISHED - MAY 1794
(DISSOLVED - MARCH 1802)

TWO CHIEFS: STEPHEN ROCHEFONTAINE (1795-1798); HENRY BURBECK (1798-1802)

PRESENT CORPS OF ENGINEERS ESTABLISHED - 16 MARCH 1802
JONATHAN WILLIAMS - CHIEF ENGINEER

CORPS OF TOPOGRAPHICAL ENGINEERS
ESTABLISHED -
5 JULY 1838

JOHN J. ABERT - CHIEF
(1838-1861)

STEPHEN H. LONG - CHIEF
(1861-1863)

CONSOLIDATED WITH CORPS OF ENGINEERS

3 MARCH 1863

WILLIAM F. CASSIDY
LIEUTENANT GENERAL: CHIEF OF ENGINEERS
(1 JULY 1965 to date)

enemy fire. The Corps of Engineers also built thousands of bridges, including crossings of every important stream, from Cherbourg to Austria; from Assam to Lashio; from Milne Bay to northern Luzon; from Casablanca to Bologna; and in Alberta, British Columbia, the Yukon Territory and Alaska. 1/

Engineer special brigades spearheaded invasions by American Forces in World War II, clearing harbors, demolishing obstructions, repairing ports, providing camouflage and technical intelligence. For the invasion of France only, they prepared some 116 million, or 5,625 tons, of maps. These and a host of other accomplishments are documented in the historical files of the Corps. Space does not permit the citation of individual sources, but the Congressional Record of 28 May 1945 contains a representative summary. Similar accomplishments have characterized later military work of the Engineers in Korea and Vietnam.

Meanwhile, at home, the Corps organized and supervised design and construction of the first atomic weapons plants at Hanford, Washington, and Oak Ridge, Tennessee (which brought World War II to conclusion), and the first nuclear reactor for peaceable applications of atomic energy. At its Fort Belvoir, Virginia, Research and Development Center, the Corps has engineered a permanent nuclear powerplant. Other stationary plants were installed at Fort Greely, Alaska, and Sundance, Wyoming. Portable nuclear plants for use in remote outposts or to supply emergency power in civilian disaster areas also have been developed. One has served in Greenland, another in the Antarctic.

Although the Corps of Engineers was established and continues as a professional military command, Engineer officers early were ordered into civil works. These began in the administration of George Washington, with passage of the Internal Improvement Act by the First Congress. Faced with the task of drawing together in one commonwealth the diverse economic and political interests of settlements scattered along a thousand miles of wilderness coast, the President knew that communication and commerce were first necessities. Only a few rough wagon roads between neighboring communities and footpaths or saddle trails following old Indian routes through the backwoods then existed. Other than these, only the Atlantic coastal and inland waterways offered means of travel among the 13 infant states that had cast their fortunes together.

President Washington requested and received from the First Congress authorization to hire two civilian engineers to survey means of navigation within and between the states and to recommend improvements. He added these men to his few military engineers, veterans of the War of Independence, and thus established a pattern of public policy that has continued throughout the settlement and development of the nation westward from the Atlantic. Much of the first exploration and mapping of the great Northwest territories was done by Army officers--Captains Merriwether Lewis and William Clark, 1804-06;

1/U.S. Army Engineers, 170th Anniversary Material, Office, Chief of Engineers, NY 176245.

Captain Benjamin L. E. Bonneville, 1832 and 1852; Lieutenant Warren, 1854-57; Lieutenant Thomas W. Symons, 1881; and others--a pioneering tradition that endures to this day in the work of the Army Engineers. Appendix G is a reprint of some pages from the Symons report that suggest the wide range of his investigations during his trip down the Columbia River.

In the course of time, the civil works assignments of the Corps have tended mainly toward water resource developments, the numbers and magnitudes of which have grown mightily with the population and economy of the nation. Beginning with the first River and Harbor Act of 1824 for the improvement of navigation, successive Congresses have expanded the activities of the Corps of Engineers in the development of public civil works. These activities now include flood control, drainage, domestic and industrial water supply, shore protection, pollution abatement, fish and wildlife conservation, hydroelectric power, recreation facilities, surface transportation, public buildings and disaster relief. The combined military and civil functions of the Corps of Engineers are so numerous, varied, and worldwide that the Corps is the largest, most versatile organization of professionally trained and experienced engineers in the world. Most of these functions will be described more particularly hereafter, as exemplified in the work of the Seattle District.

Seattle District

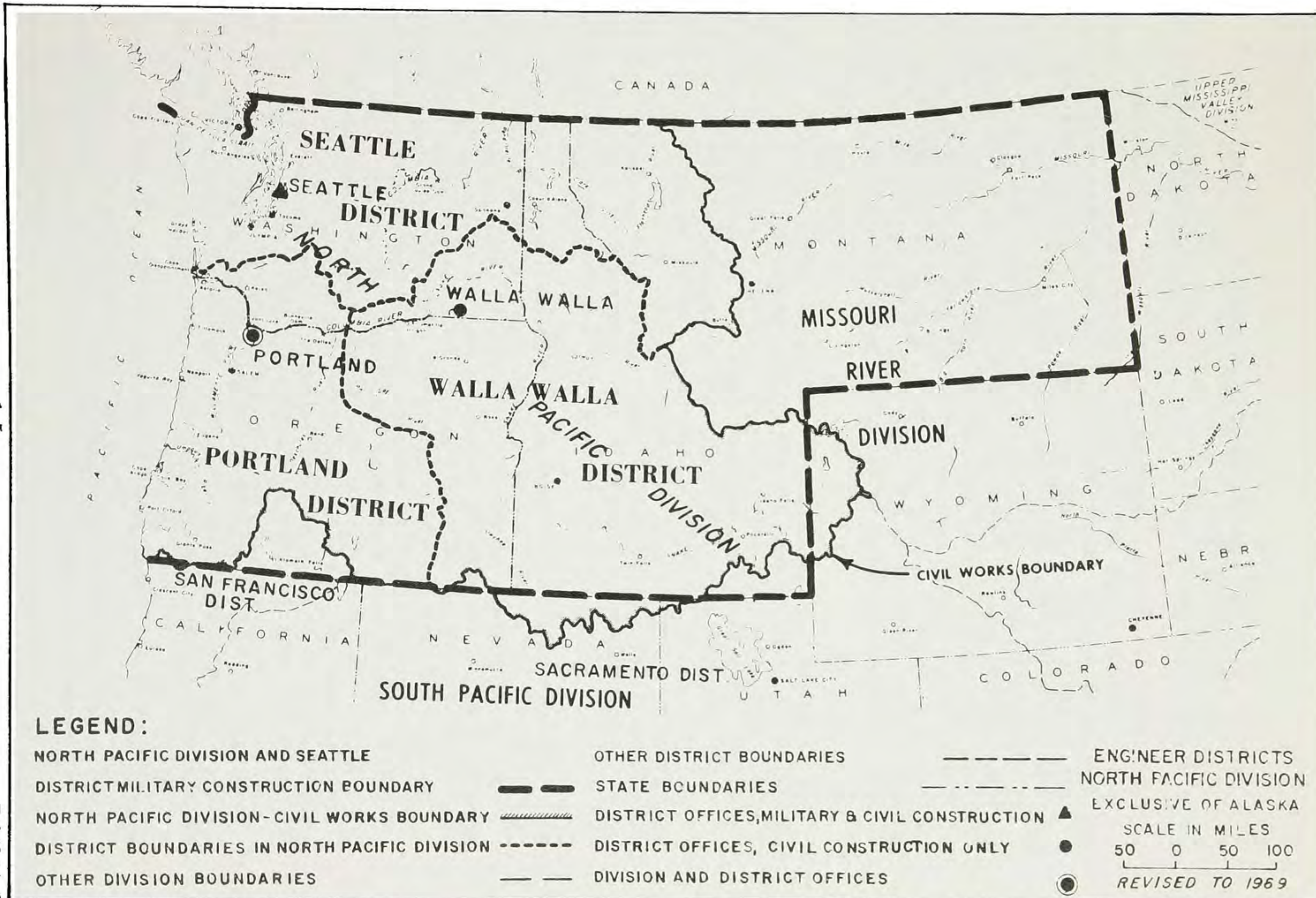
The place of Seattle District in the organization is illustrated in exhibit 2. The assigned duties and the areas now normally served by the District are:

Military work throughout the States of Washington, Oregon, Idaho, and Montana. Thus, Seattle District now does all military work of the North Pacific Division except Alaska. However, Alaska also has been a part of Seattle's territory at times, most importantly during World War II.

Civil works in all of Washington, except the main stem of the Columbia River below the mouth of the Yakima River; northern Idaho; and Montana west of the Continental Divide.

Four Army Engineer District Offices, at Anchorage, Alaska; Walla Walla and Seattle, Washington; and Portland, Oregon, comprise the 5-state area of the Corps' North Pacific Division headquartered in Portland. Present military and civil boundaries also are shown on exhibit 2. These district assignments have varied from time to time with geographical shifts in military or civil workloads. Alaska and Walla Walla are the youngest districts in the Division. There have, at times, been others established for short-term exigencies or special purposes.

Exhibit 2


CANADA
UPPER MISSISSIPPI VALLEY DIVISION
SEATTLE
SEATTLE
DISTRICT
WASHINGTON
NORTH
WALLA WALLA
COLUMBIA RIVER
PORTLAND
WALLA WALLA
PACIFIC
OREGON
PORTLAND
DISTRICT
IDAHO
DISTRICT
DIVISION
MONTANA
MISSOURI
RIVER
DIVISION
NORTH DAKOTA
SOUTH DAKOTA
WYOMING
NEBR
CIVIL WORKS BOUNDARY
SAN FRANCISCO DIST
CALIFORNIA
NEVADA
SACRAMENTO DIST
UTAH
COLORADO
PACIFIC OCEAN
SOUTH PACIFIC DIVISION
LEGEND:
NORTH PACIFIC DIVISION AND SEATTLE
DISTRICT MILITARY CONSTRUCTION BOUNDARY
NORTH PACIFIC DIVISION - CIVIL WORKS BOUNDARY
DISTRICT BOUNDARIES IN NORTH PACIFIC DIVISION
OTHER DIVISION BOUNDARIES
OTHER DISTRICT BOUNDARIES
STATE BOUNDARIES
DISTRICT OFFICES, MILITARY & CIVIL CONSTRUCTION
DISTRICT OFFICES, CIVIL CONSTRUCTION ONLY
DIVISION AND DISTRICT OFFICES
ENGINEER DISTRICTS
NORTH PACIFIC DIVISION
EXCLUSIVE OF ALASKA
SCALE IN MILES
50 0 50 100
REVISED TO 1969

PART 2 - A GENERATION OF ENGINEERS, 1896-1940

The Pacific Northwest, 1896

Seattle was a frontier waterfront town of about 43,000 people,1/ only 45 years settled and being rebuilt after the fire that, seven years earlier, had wiped out most of the wooden business buildings and piers. Seattle was the principal port and largest of about a dozen towns in a state that had emerged from territorial status the same year as the fire. The population of the new State was about 360,000, an increase of 375 percent in the 10 years which brought statehood and transcontinental rail service to the Territory. The Northern Pacific Railway main line had reached Tacoma in 1887. Six years later the Great Northern was completed to Seattle, giving the State its second transcontinental rail system.2/ These and other great transcontinental railway locations largely were laid out or based on surveys by Army Engineers.

The coming of the railroads and their telegraph systems to the shores of the great inland ocean waterways, now collectively referred to as the Puget Sound Country, gave the principal settlements of the Northwest better means of travel, commerce, and communication with the older, established regions of the nation that were essential to economic growth and unity. Heretofore, vital connections with the East required arduous voyages around Cape Horn or months of dangerous travel by saddle, coach, wagon, and river craft, to span great plains and deserts, cross the Rockies and the Cascades, and hew a track through the dense forests of the seaward slopes.

Coastwise travel was much easier between the early settlements and, from the first of these outposts at Fort Vancouver (1824) on the lower Columbia, travel by water facilitated the establishment and support of others to the north. Tacoma, in 1896 nearly the same size as Seattle, was founded about the same time on the splendid harbor of Commencement Bay. Olympia, the present State Capitol; Steilacoom, with its frontier fort and two companies of regulars; and several other small settlements around Budd Inlet date from about 1848. Bellingham, Everett, Port Angeles and Port Townsend, all on fine harbors of Puget Sound and the Strait of Juan de Fuca, were started only a few years later, as were Aberdeen and Hoquiam on Grays Harbor on the Pacific Coast. Of significance is that, in 1896, 14 of the 17 Northwest towns with a population of 1,000 or more were located on, or readily accessible by water to, the Pacific Ocean. The discovery, settlement and development of the Pacific Northwest by peoples of European origin followed the pattern established everywhere in the New

1/Schmid, Calvin F. et al, Washington State Census Board; Population Trends State of Washington, 1900-1967.

2/Washington, A Guide to the Evergreen State. Writers Program, WPA and State Historical Society. Binfords & Mort, Publishers, Portland, Oregon.

World - first, landings on the coasts; second, the establishment of pioneer communities on sheltered harbors and river estuaries; then the gradual extension of settlement along the coasts and inland waters. Thus, much of Northwest history has been closely associated with, or indeed primarily shaped by, water transportation.

Arrival at Seattle in 1897 of the Steamer PORTLAND with gold from the Yukon and the resultant rush of prospectors through the city, bound northward on any craft that would float (and some that would not) dramatized the mutual reliance of Pacific Northwest communities on water transportation. Through the ensuing decade, great quantities of supplies flowed northward to the gold camps while some $200 million dollars' worth of the precious metal was cashed in Seattle. This commerce established a bond between the Northwest States and Alaska that has endured and grown through the years. The loss of 36 vessels in 1897 and 1898, among the 150 or more that were hastily mobilized for the voyage north,3/ also emphasized the need for navigational improvements along the route and launched the new Seattle Engineer District on its active career of river and harbor work.

The Army always has accompanied the early settlements, to make good the territorial claims, to protect the pioneers from native resistance, and to establish order on the frontier. Advance elements of the Army traditionally have been the Engineers--exploring, mapping, and establishing routes and means of transportation among the new communities. So it was in the Oregon Country4/ and Washington Territory.5/ The coasts and inland rivers were studied by Army Engineers, with particular attention to their potentialities for navigation. Maps and reports of some of the early surveys made in the 1870's and 1880's are preserved in Seattle District files.

Lieutenant Harry J. Taylor was one Engineer officer who did such work in the Northwest prior to his timely appointment as a District Engineer of the Corps, with headquarters at Seattle.

Early Years - River and Harbor Work

In 1896, Lieutenant Harry J. Taylor, Corps of Engineers, received orders to establish the Seattle District Office. He had graduated from West Point in the Class of '84, spent 10 years on East Coast fortifications and harbors, then worked out of San Francisco and Portland Engineer Offices on coastal river and harbor surveys and construction. The Seattle office was established 1 May 1896. Taylor was

3/Speidel, William C., Sons of the Profits. Nettle Creek Publishing Co., Seattle, 1967.

4/Extended from the Rocky Mountain Divide to the Pacific Ocean and from Latitude 42° North to 49° North by Treaty of 15 June 1846 with Great Britain. Oregon was separated as a Territory 14 August 1848 and as a State 14 February 1859.

5/Created 2 March 1853, including the present state, northern Idaho and western Montana. Idaho became a separate territory 3 March 1863 and a state 3 July 1890; Montana a territory 26 May 1864 and a state 8 November 1889. Washington was admitted as a state 11 November 1889.

promoted to Captain the same month and served until 30 November 1900. During this four-and-one-half-year tour his duties included the development of defense works for Puget Sound, where none then existed. A military allotment of 6 June 1896 called for two 12-inch and four 10-inch gun emplacements at Fort Lawton, which was established north of Seattle overlooking Puget Sound in 1897. He also had the duty of procuring equipment for Army troops garrisoned within the district.

In characteristic dual military-civil role, the Seattle District assignments included surveys, construction, channel clearing and maintenance on coastal rivers and harbors, among which were Willapa River and Harbor, Grays Harbor and Chehalis River, Olympia Harbor and Swinomish Slough in Washington, and Portland Channel in Alaska. Inland river reconnaissance surveys for navigation were made of the Upper Columbia from Rock Island Rapids to Foster Creek Rapids; the Kootenai, Clark Fork, and Pend Oreille Rivers in Idaho and Montana; the Snake River in Washington, the Clearwater in Idaho, and the Flathead in Montana. Of incidental interest, exhibit 3 shows a survey of Albeni Falls on Pend Oreille River, Idaho, made by Captain Taylor in 1897. His soundings of water depth showed "40-plus feet," apparently the limiting length of his line, but surely enough water for any vessel of his time. Today a dam and powerplant stand on this site. In making the surveys for that project, Taylor's successors found the hole below the north side of the falls to be 40-plus-130 feet deep!

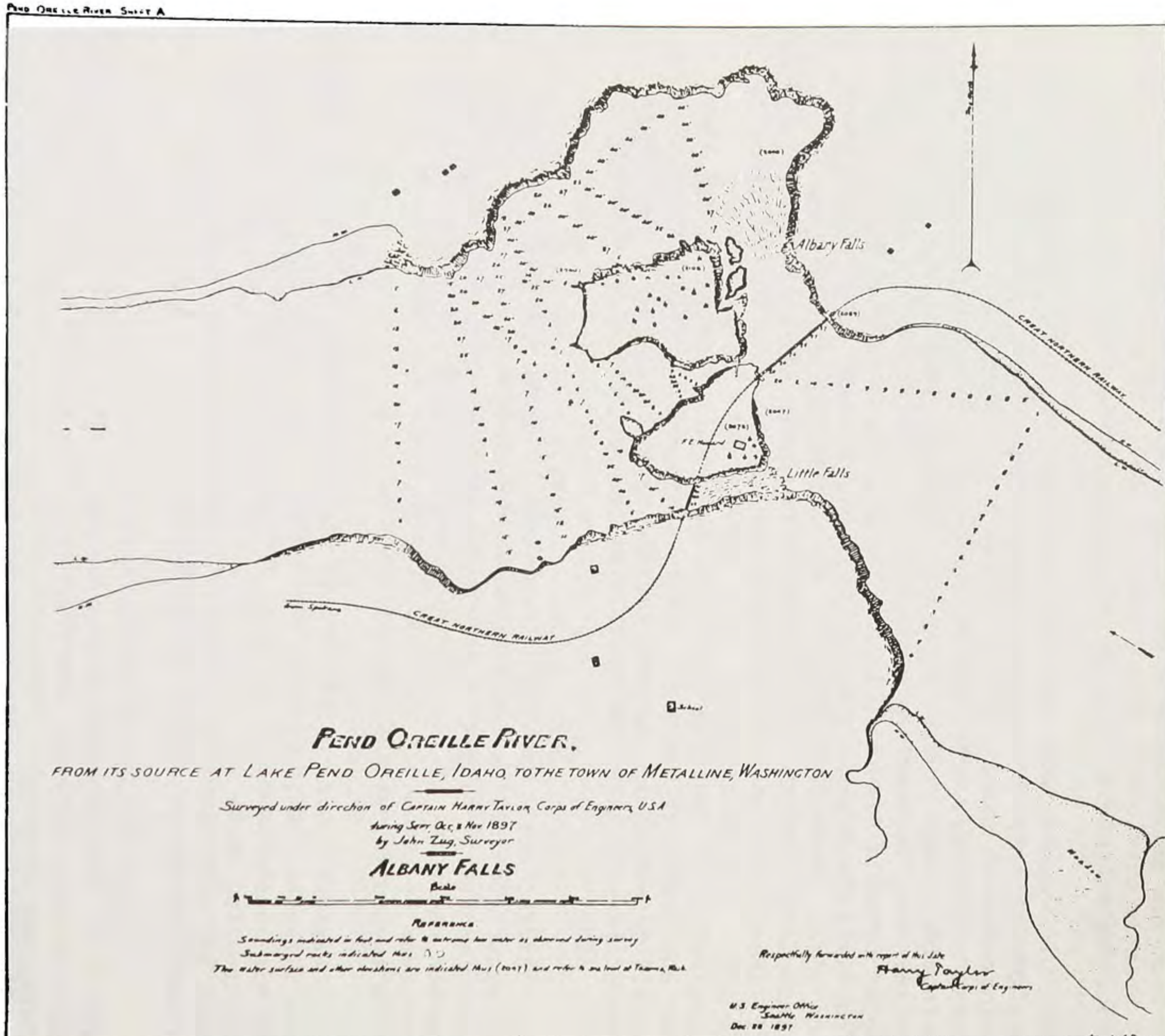
Albeni Falls was named for Albeni Poirier, a French-Canadian voyageur who built a log tavern and way station at the falls, which were impassable by boat. Before the railroad came, Poirier's place marked the point of transfer from land to water for travelers bound upstream by steamboat via Pend Oreille River and Lake and the Clark Fork toward the gold fields of Montana.

Captain Taylor's interest in all these inland rivers, of course, was directed toward channel improvements for navigation. What would be his astonishment if he could revisit them today and find that the obstructing rocks and rapids had been replaced or submerged by great dams and hydroelectric powerplants that form navigable lakes of the rivers and support a way of life unimaginable to the pioneers!

Captain Taylor was succeeded by Major John Millis, and Lt. F. A. Pope, who had served and later continued as principal assistant to four different District Engineers, including Majors Chittenden, Kutz, and Cavanaugh. These men continued the work begun by Taylor on river and harbor improvements and Puget Sound defenses. Illuminating references to their activities appear in correspondence of the period.6/

A letter written by Major Chittenden referred to an Executive Order of President Theodore Roosevelt dated 4 April 1907, mentioning the "Engineer Department at Large." His letter, under the heading

6/Orders and Circulars, Misc. Doc. File 9050, Folder 1, 1907-1912.



Albany Falls
Little Falls
Great Northern Railway
Great Northern Railway
from Spokane
School
Pend Oreille River.
From its source at Lake Pend Oreille, Idaho, to the town of Metalline, Washington
Surveyed under direction of Captain Harry Taylor, Corps of Engineers, U.S.A.
during Sept., Oct., & Nov. 1897
by John Zug, Surveyor
Albany Falls
Scale
Reference
Submerged rocks indicated thus
Respectfully forwarded with report of this date
Harry Taylor
Captain Corps of Engineers
U.S. Engineer Office
Seattle Washington
Dec. 28 1897

H Doc 235 55 2

"U.S. Engineer Office, Seattle," was addressed to his entire staff of 10 people. Chittenden had suboffices under his command at Tacoma and Hoquiam doing river and harbor work, and construction in progress at Forts Worden (at Port Townsend), Flagler (on Marrowstone Island), Casey (on Whidbey Island) and Whitman (on Goat Island). In addition to supervising construction, his staff at these posts procured and inspected lumber shipments to eastern Engineer Districts and to the Isthmian (Panama) Canal Commission. In 1908, the Major reported, "All fortifications in this district...completed and transferred to Artillery." These fortifications were expanded, rearmed and garrisoned 10 years later for World War I. In recent years they have been entirely deactivated and the areas largely disposed of. Fort Flagler is now a State park, but many of the buildings, gun emplacements, and ordnance have been preserved. At Fort Casey, the underground concrete gun and fire control chambers that extended just to the face of the high bluff commanding the Strait of Juan de Fuca and the entrance to Admiralty Inlet and lower Puget Sound now project out 30 feet or more in open air, revealing the progress of 60 years' erosion on the face of the bluff.

In 1911, the Chief of Engineers directed that all interested parties be notified in case the District Engineer must make an adverse report on a survey for a river and harbor project. Thus, the Corps' policy of consultation with local interests regarding civil works that affect them was established early and still is in effect. Many improvements desired by local interests were not, and still are not, recommended.

An early sidelight on the great hydroelectric power developments of more recent years in the Pacific Northwest is contained in a circular letter of 19 September 1910 from the Chief of Engineers to all District Engineers. The letter explained the provisions of Section 3, River and Harbor Act of 25 June 1910 "as to reports on water power...where coordinate development of waterpower or other use of waterway in connection with navigation was feasible and...might...make this expenditure justified by the resulting benefit to navigation." This early groping for economic justification of multipurpose water resources development indeed was prophetic. The sale of power from present Corps of Engineers dams on the Columbia River system not only justifies the collateral investments made for public navigation, flood control, irrigation and other economic benefits, but repays to the Government in cash, with interest, the entire cost of power development and much of the cost of the associated features.

In 1911, the Seattle District had two vessels in service--the snagboat SKAGIT, Captain Taylor's brainchild, and the steam tug WILSON. The surveyboat ORCAS was designed and built by the District in 1912. Ever since those early years, the District has maintained a variable "floating plant" to survey periodically the condition of channels and harbors; to remove snags, bars and rocks; and to transport men and supplies to construction jobs. Engineers of the District office prepared technical papers for, and attended the Sixth Congress of the International Association for Testing Materials at New York City in 1912. Major Cavanaugh made the trip via the Panama Canal, where he conferred with Army Engineer George W. Goethals regarding the design of canal locks. District people are still active in research and the many professional associations that promote technological progress. The District has had a program of stream gaging (measurement of flow) in cooperation with the United States Geological Survey since 1911.

The duty tour of Major (later Lt. Col.) Cavanaugh in Seattle District from 1911 to 1917 was unusually long and was remarkable for two major works: the Grays Harbor jetties, planned 16 years before by Taylor;7/ and the Government Locks of Lake Washington Ship Canal,8/ now named Hiram M. Chittenden Locks in memory of that earlier District Engineer.

The District staff of 10 people in 1907 had grown to 205 by 1912, as reported by Major Cavanaugh:

	Number of employees
Office force @ $1200 to $2400 per annum	15
Field force: Willapa River and Harbor, contract dredging	6
Grays Harbor jetty construction	77
Tug WILSON	12
Snagboat SKAGIT	10
Olympia Harbor, contract dredging	4
Lake Washington Locks construction	67
Columbia River, Bridgeport to Kettle Falls, rock removal	4
Forts Worden, Casey, Flagler, Whitman	10
Total	205

Lake Washington Ship Canal and Hiram M. Chittenden Locks 9/

The Chittenden Locks are an important factor in the maritime economy of the Puget Sound country. On busy days more than 1,000 craft of every conceivable description, from one-man kayaks to 10,000-ton ocean freighters, make the transit between the fresh waters of Lake Union or Washington and the salt water of Shilshole Bay. As of June 1967, more than 2-1/2 million vessels had done so. In 1962, the year of Seattle's World's Fair, 80,235 vessels passed through the locks and

7/Annual Report, Chief of Engineers, 1895, pp. 3517-3533. River and Harbor Comm. Docs. 2, 59th Cong. 2d Sess.; and 29, 61st Cong. 2d Sess.
8/H. D. 953, 60th Cong., 1st Sess.
9/Historical data are taken from a compilation by Robert R. Spearman for the Seattle Museum of History and Industry.

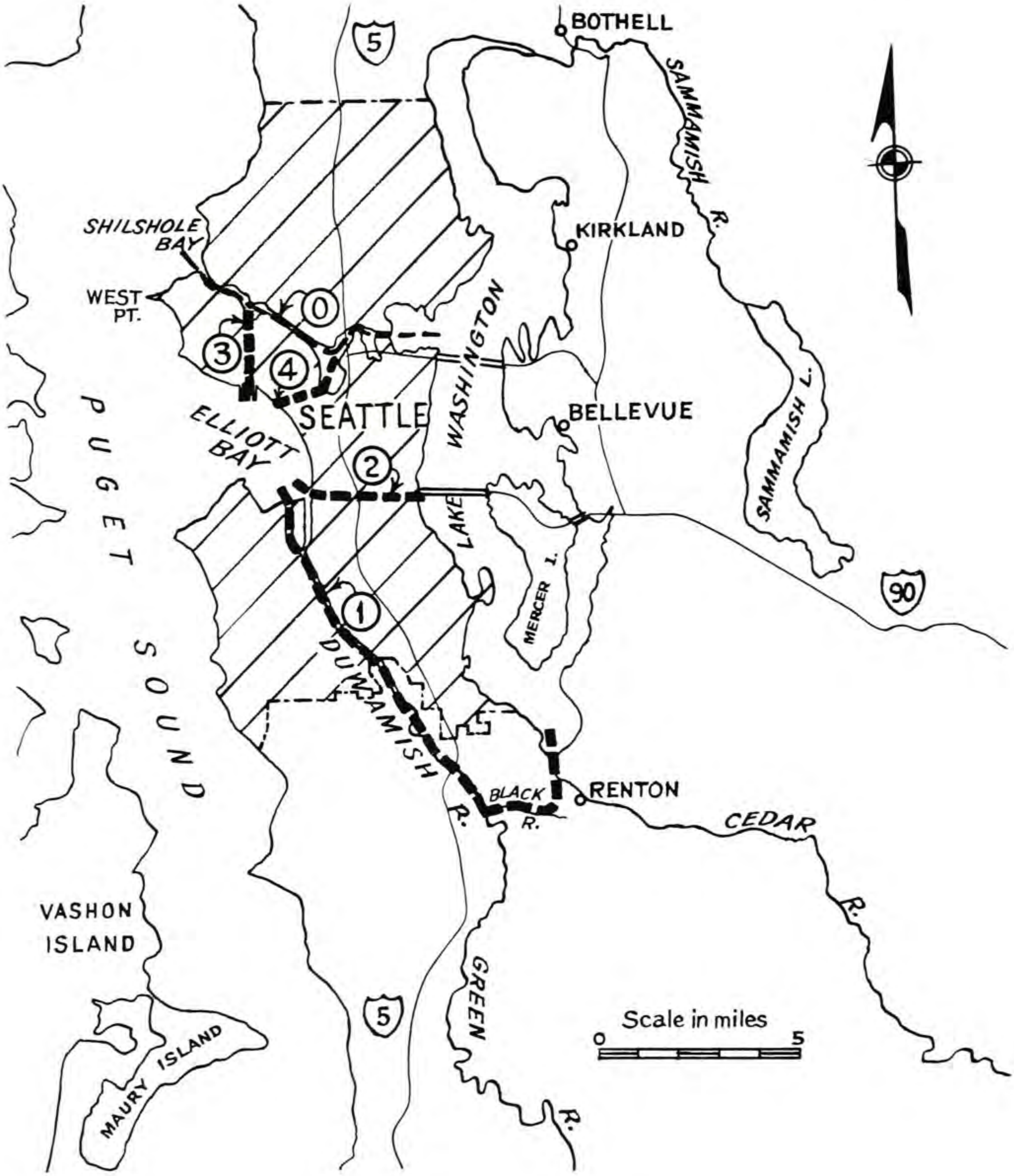
two million visitors gathered shoreside to watch. Commercial fishing boats, barge tows, log rafts; domestic, foreign and Government ships; and a host of pleasure yachts comprise the bulk of the traffic through the two single-step locks. The large lock is 80x825 feet, and the small lock, 28x150 feet. Additional details are in Appendix C.

The canal and lock project had a 57-year history of investigation, alternate plans and false starts from 1854 until actual construction began in 1911. The idea of joining Lakes Washington and Union with Puget Sound was proposed in 1854 by Thomas Mercer,10/ only three years after the first Seattle founders landed at Alki Point. Direct action was taken in 1860 by Harvey Pike,10/ who started to hand-dig a channel at The Portage--now Montlake--between the two lakes. He tired of the job and it was not until 1884 that work was resumed. Then, Lake Washington Improvement Company dug a small ditch and built a wooden lock between Lake Union and Salmon Bay, and completed Mr. Pike's ditch with a gate and log chute from Union Bay to Portage Bay. Logs could then be floated from the forests surrounding Lakes Sammamish and Washington to some 20 mills on Salmon Bay.

By this time various efforts had been made to interest the Federal Government in a ship canal and several routes were considered. One was the existing route to Salmon Bay, thence either to Shilshole Bay as eventually built, or into Smith Cove. Other routes proposed were from the south end of Lake Washington via Black and Duwamish Rivers into Elliott Bay, or a deep cut through Beacon Hill to the tideflats and Elliott Bay, as shown on exhibit 4. Routes 1 and 2 on the map are from a drawing entitled "Lake Washington and Vicinity - Ship Canal Route Between Duwamish Bay (now Elliott Bay) and Lake Washington, W.T., Made Under Direction of Board of Engineers for the Pacific Coast, 1871." The necessary rights-of-way and excavation of the 8-mile canal, as finally located, were furnished by King County and the State of Washington. The locks and spillway dam at tidewater were built by the Federal Government. Seattle District designed and supervised the whole project. On 22 June 1912, Major Cavanaugh reported that he was acting as agent for the State and County in administering four contracts covering excavation of the canal, a task he had "undertaken voluntarily in the public interest."

Construction of the ship canal changed the geography of Lake Washington and its vicinity in ways apart from the routing of the canal. The lake outlet formerly was at the south end through Black River slough and the Duwamish River. Cedar River, which entered Black River about one-half mile from the old lake outlet, was turned into the lake and the Black River was filled in. Before Montlake Channel was cut through to connect Lakes Union and Washington, the latter's elevation fluctuated between 29 and 33 feet above mean sea level and Lake Union was regulated at about 21 feet by spillway gates at its westerly end that discharged into Salmon Bay. Salmon Bay and Shilshole Bay were filled at high tide but were mudflats at low tide.

10/The Mercers and Pikes were among the first families that settled in Seattle. Their names are perpetuated in the names of streets and other features.

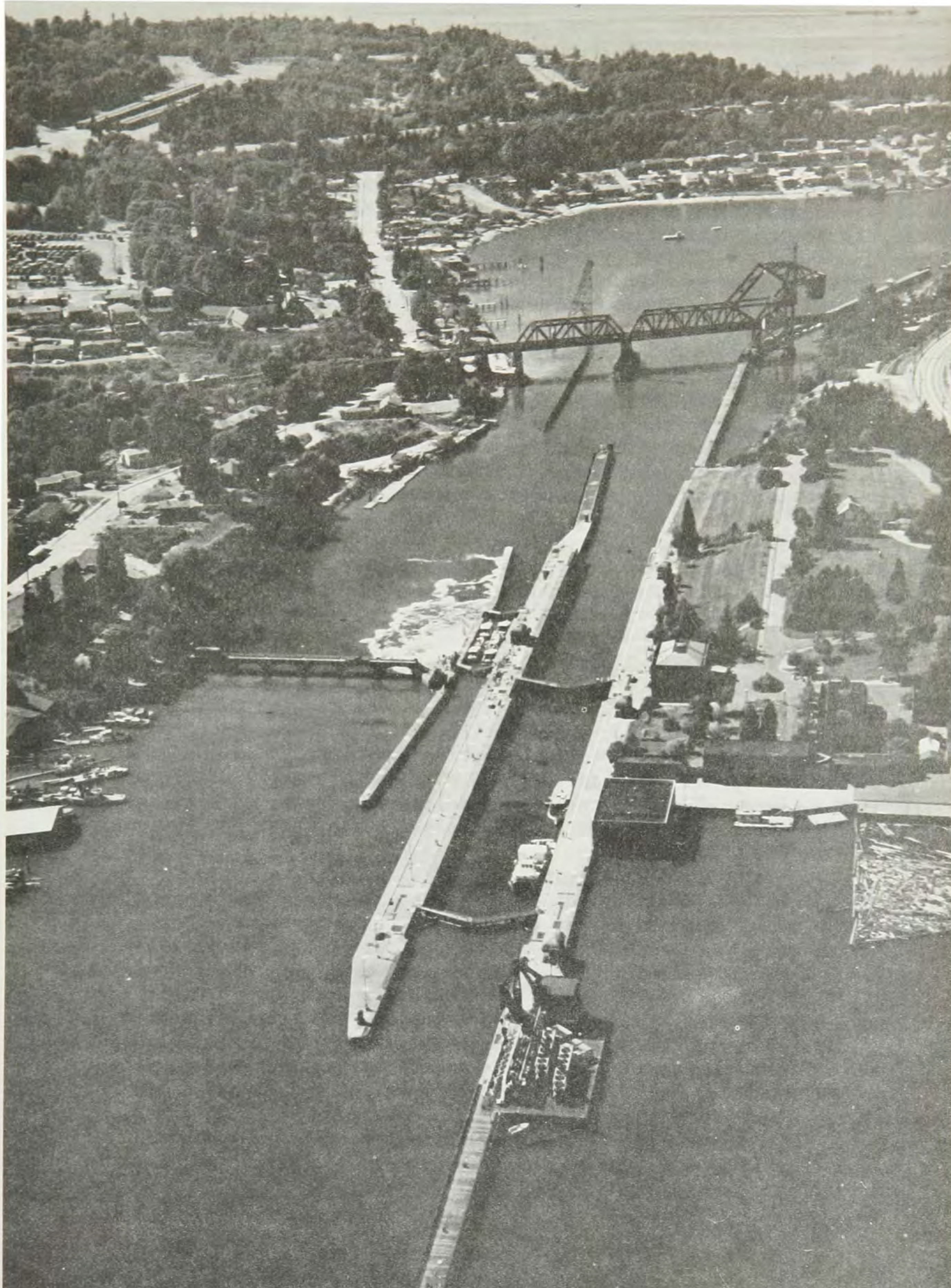


0. Lake Washington Ship Canal as built

Other routes considered:

1. Via Black and Duwamish Rivers
2. Deep Cut Through Beacon Hill
3. Entrance at Smith Cove - Salmon Bay
4. "Mercer's Farm" Line

Exhibit 4



Hiram M. Chittenden Locks Photo. 2

The canal excavation provided a seaward entrance channel through Shilshole Bay and lowered Lake Washington 8 feet, level with Lake Union. Salmon Bay was deepened, partly by excavation and partly by backwater from the locks and dam. Lowering Lake Washington 8 feet exposed a level, wave-formed, marginal terrace along much of the shore, as an accretion to the State-owned lakebed. Far-sighted Seattle planners acquired most of this terrace strip along the west shore from Union Bay to Seward Park and made of it the beautiful Lake Washington Boulevard and series of five waterfront parks. The terrace formation north of Union Bay was in wild land, outside the city, and occurred in disconnected parcels. These were bought from the State by individuals or real estate developers and now are occupied by waterfront homes.

World War I

Following completion of the Grays Harbor jetties and Lake Washington Ship Canal jobs--the latter in 1916--District activities and personnel were much reduced. During World War I, the Corps of Engineers as a whole encountered its first gigantic military construction and logistics operation. The character of war had changed. The construction of ports, troop and supply bases, power, water and sanitary utilities; hospitals; railroads, roads, bridges, and other means for transporting and supporting an overseas expeditionary force of 2 million men some 4,000 miles from home was a new and challenging experience. The war front in Europe was so remote from our Pacific Coast that the Seattle District had little direct part in the effort. However, the harbor defense fortifications of Puget Sound were expanded somewhat by construction of garrison facilities for the Coast Artillery crews. There was also increased activity in the procurement, inspection, and shipping of lumber for military construction in the U.S.A. and Europe. But the principal effect of World War I on Seattle District was the loss of personnel who went into the various armed services, shipyards and other war plants until only about a dozen people remained in the office.

The period of relative quiet continued into the 1920's. Reflecting the casual routines of those times, Appendix D reproduces the colorful reminiscences of Mr. Lester O. McCue who retired in 1958 after 36 years of service. He mentions the small office and staff of 1922, which was a drastic reduction from Major Cavanaugh's organization of 205 people. Contributing factors were the establishment of an Alaska District Office in Juneau in 1921 with transfer of work in the Territory that previously had been done by Seattle, and a postwar Government economy drive. The post-World War I lull quickened in 1925 with the start of broad civil works investigations, then became a frantic scramble for military preparation just before World War II, making this 15-year period one of great change and growth for Seattle District and the Corps.

The "308" Reports

A mighty stride in water resources development was taken by the Congress in the River and Harbor Act of 1925, which authorized the Secretary of War and the Federal Power Commission to report the cost of making surveys of the nation's navigable streams, "with a view to the formulation of general plans for the purposes of navigation and the prosecution of such improvement in combination with the most efficient development of the potential water power, the control of floods, and the needs of irrigation." Streams reported by Seattle District were the Columbia (jointly with Portland District and North Pacific Division), Skagit, Snohomish, Stillaguamish, Puyallup and Chehalis. Two years later, the Corps of Engineers was authorized to make comprehensive plans for multipurpose utilization of the nation's major rivers in accordance with House Document No. 308, 69th Congress, 1st Session.11/ The detailed investigations and reports that resulted commonly have been called the "308" Report. They necessitated the collection and analysis of all available physical and economic data relating to the streams and their watersheds. Although the three reports listed as Bibliography items 5, 6, and 7 urged the adoption of comprehensive river basin planning as national policy as early as 1908 during the administration of President Theodore Roosevelt, the Great Conservator, the Act of 1925 marked the first time Seattle District was specifically called upon to undertake comprehensive planning.

The resulting Columbia River "308" Report was an exceptionally massive document, involving one of the world's great rivers that drains 259,000 square miles of vastly varied topography and climate in the United States and Canada. The work was completed in 1932 and published as House Document 103, 73d Congress, 1st Session. Comprehensive plans for multiple-purpose development of the Columbia that were outlined in the "308" Report were the basis for construction during the 1930's of three of the 10 main-stem dams proposed: Rock Island Dam and powerplant by Puget Sound Power and Light Company; Bonneville Dam, navigation locks and hydroelectric plant by the Corps; and Grand Coulee Dam, with its associated twin powerplants and million-acre Columbia Basin Irrigation Project, by the Bureau of Reclamation.

The "308" investigations required expansion of all District departments and the work force to a peak of about 70 people. While that was in progress, the great economic depression of the 1930's began with the panic of 29 October 1929 on the New York Stock Exchange. President Franklin Roosevelt's efforts to restore the economy through make-work public construction spawned an array of "alphabet" agencies such as the CCC (Civilian Conservation Corps), WPA (Works Progress Administration), PWA (Public Works Administration), and SCS (Soil Conservation Service) that required more or less engineering organization and supervision. Some of the technical work fell to the Corps, further expanding the workload and personnel of its offices, including

11/River and Harbor Act approved 21 January 1927.

that of the Seattle District. Meanwhile, Alaska (Juneau) Engineer District was deactivated 14 July 1932 and its jurisdiction for both civil and military work was returned to the Seattle District.

Flood Control

In 1936 a third far-reaching addition to the Civil Works program of the Corps was made by the Congress in the Flood Control Act12/ of that year, which declared "flood control on navigable waters or their tributaries is a proper activity of the Federal Government in cooperation with States, their political subdivisions, and localities thereof." Although there had been several Federal flood control projects as far back as the 1850 13/ surveys on the Mississippi, they had been initiated primarily through special legislation to correct some specific local situation or were incidental to a navigation plan. The 1936 Act prepared the way for a general attack on the problem of recurring disastrous floods (such as that on the Mississippi in 1927 which aroused the nation to this action) as a broad national policy.

Mud Mountain Dam and Reservoir

A result of the new emphasis on flood control in Seattle District was the construction of Mud Mountain Dam on White River near Enumclaw, Washington, for the protection of the Puyallup River Valley and the city of Tacoma's industrial section. The project was authorized by the Flood Control Act of 1936. Construction began in 1940, but the dam was not completed until 10 years later because of delays occasioned by the distractions of war. Mud Mountain was then the world's highest earth and rockfill dam, rising 425 feet above channel bedrock. Appendix G carries a detailed description of the project. Construction was attended by some technical difficulties, the oddest of which was saturation of clay core materials during an extremely wet season. Usually, water must be added in precise amounts to obtain optimum compaction of core material. Not so at Mud Mountain! The contractor, Guy F. Atkinson Company, eventually solved the problem by drying the clay in a rotary kiln, then remoistening it to the desired consistency and placing it in the core under the protection of an enormous canvas cover similar to a circus tent. But this was no circus--nor was the dam actually named, as some claim, for the mass of too-sticky material that the resourceful engineers finally subdued. Actually, a proposal was made in 1939 to name the dam "Stevens" in honor of Washington's Territorial Governor,14/ but the outbreak of war in Europe diverted the Congress from action on such a minor matter and the local name of an adjoining hill, informally attached to the site by the first survey party, still sticks.

12/49 Stat. 1570 and 50 Stat. 876.
13/9 Stat. 523.
14/Proposed by retired employee Mr. Walter Spencer, who was directed by Captain Trudeau to suggest a proper name; also shown as "Stevens" on District organization chart dated 13 May 1939.

Photo. 3

War in Europe

Before Mud Mountain Dam was completed, Hitler's Wehrmacht had started World War II. The shattering successes of the German attacks in all directions foreboded a conflict of a magnitude never before imagined. That the United States would become involved seemed inevitable. Active participation became certain with the gift of 50 U.S. Navy destroyers to Great Britain for protection from German submarines, and with passage of the Lend-Lease Act15/ by which we undertook to supply the Allies with the vast armaments for worldwide land, sea, and air warfare.

The traditional military logistics and construction forces of the Corps of Engineers were mobilized again, as in World War I, but on a far more massive scale. The airplane had become a dominant factor in the European phases of this war. Therefore, the construction of airplanes and the facilities for their operation had high priority in the U.S. defense mobilization of 1940. Army Air Corps airfield design and construction was assigned to the Army Engineers. Seattle District immediately began the improvement of existing municipal and military airports, including Paine and McChord Fields. New air bases were started, many of which eventually were to be complete with land clearing and grading; paved runways, taxiways, and hardstands; roads, railway spurs; fuel storage, hangars, shops, warehouses; housing, hospitals, schools; heating, power, communication, water, and sewerage utilities; and all the other facilities to support a large military training, operation and maintenance community. The first of these was Sunset Field, now Geiger Field, Spokane's present commercial airport and Air National Guard base.

The multiplying, diverse duties that fell upon the small Seattle District organization from 1925 to 1940 had called for much expansion, specialization, reorganization and departmentalization of the work force. From about two dozen people in 1925, still located in the original quarters of the old Burke Building at Second Avenue and Marion Street, the office grew to three times that number during the "308" report studies, then momentarily declined during the latter part of the Hoover "depression economy" administration. With the advent of the Roosevelt "New Deal" in 1933, however, and the influence of "make-work" projects in the next few years, the District force again began to grow.

With the assumption of flood control work and the start of Mud Mountain Dam in 1937, the growing District evolved a more formal organization. By 6 August 1938, there were five divisions and Mr. Baker as Consultant, reporting directly to Lieutenant Colonel H. J. Wild, District Engineer: Administrative, Engineering (with Mr. Baker as Chief), Construction, Fortifications, and Lake

15/55 Stat. 31., approved 11 March 1941, authorized the President "to sell, transfer, exchange, lease, lend or otherwise dispose of any defense article..." First value limitation was $1.3 billion, later extended.

Washington Ship Canal. The first three were subdivided into functional or individual project sections. Work now done by Supply and Real Estate Divisions was then under the Administrative Division. Engineering Division handled the floating plant, condition surveys, plant and project maintenance (except locks operation, now in the Operations Division). From about 36 people in 1933, the force increased to 88 people in January 1939, and at least twice that number by the end of the year. Meanwhile, the office was moved from the old Burke Building to the new Federal Office Building on First Avenue for a brief time, then to the Central Building at Third and Marion to accommodate the expanding staff.

On 1 November 1939, the District had four office divisions: Engineering, under Messrs. Harold J.M. Baker and Eugene I. Pease; Construction (of civil works) under Captain Arthur G. Trudeau and James G. Truitt; Military, with as yet very little actual work underway, also under Captain Trudeau; and Administration, under Captain Peter P. Goerz. Lt. Arthur C. Welling, Area Engineer for Alaska, was in charge of flood control, river and harbor work in the Territory, reporting directly to the District Engineer, Lt. Colonel Layton E. Atkins. Mr. Arthur W. Sargent, the engineer in charge of operations at the Lake Washington Ship Canal, also reported directly to the District Engineer. See Appendix E for biographical notes. Some 34 branches and sections constituted the functional subgroups of the four divisions.

By the end of 1940, more military projects were underway: Aircraft Warning Stations (AWS); Yakutat, Annette Island and Elmendorf airfields in Alaska; and harbor defenses on Puget Sound. Construction of Mud Mountain Dam and other civil river, harbor and flood control activities also progressed during this last year of nominal peace.

The days of peace remaining were to be few. Hitler was sweeping across continental Europe and threatening to invade England. Mussolini was trumpeting the invincibility of his Black Shirts, who had overrun the primitive defenses of Abyssinia, while Japan, emboldened by her conquests in a China disrupted by internal strife, was plotting and arming toward the domination of the Pacific and all East Asia in a greater "co-prosperity" sphere.

National Defense, 1940-41

In retrospect, the fact is clear that a foreboding of war for the United States became active expectation during the national defense days of 1940-1941, and that expectation included war in the Pacific! Much of the military preparation at that time was concentrated in a belt along the Aleutian Island chain, Alaska, and the Pacific Northwest States. This belt included, both in length and breadth, the shortest great-circle routes between Japan and this country and all of the areas then comprising the Seattle District, Corps of Engineers. These areas were all of Alaska, most of the State of Washington, northern Idaho and western Montana, whose boundaries ended on the south at the Columbia River and the Snake River basin, and on the east at the Continental Divide, a total of 715,850 square miles. To guard this potential route of attack, a northern screen of aircraft warning stations (radar) and fighter-interceptor air transport staging fields was begun in 1940.

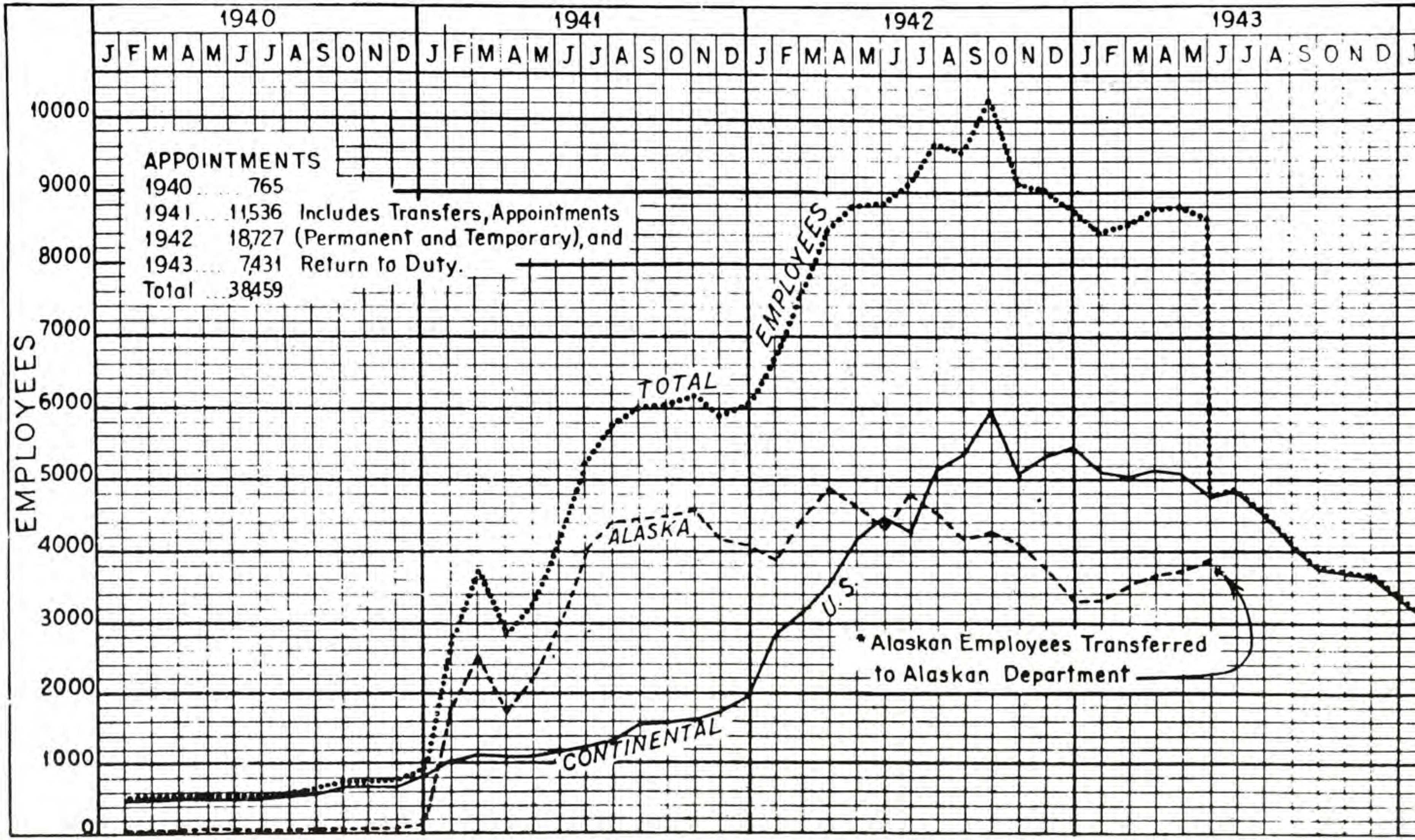
Through 1941, Alaska military preparations were accelerated. Great Army and Air Corps bases were begun at Ladd Field, Fairbanks; Fort Richardson, and Elmendorf Field near Anchorage. Work was in full swing on the Whittier cutoff for the Alaska Railroad; at Fort Raymond, Seward; Fort Mears, Unalaska; Cold Bay, Nome, and more aircraft warning sites. In Washington, a series of eight municipal and county airfields, originally intended by the Civil Aeronautics Administration for civil use, were taken over for improvement. These were: Boeing Field, Kitsap, Wenatchee, Ephrata, Felts Field (Spokane), Coeur d'Alene, Willapa Harbor, and Chehalis.

In the fall of 1940 as the National Defense Program was launched, the Seattle Engineer District was a busy Government construction agency with 700 persons engaged in a $16 million building program. Civil works in progress included Grays Harbor breakwaters, Goat Island dike, and Mud Mountain Dam in the States; Lowell Creek tunnel, Nome breakwater, Tanana River, and the Chena Slough dike and highway in Alaska, as well as a $750,000 WPA construction program under District supervision.

Army airbase construction by troops under Major George J. Nold and Captain Benjamin B. Talley at Annette Island and Yakutat was getting underway despite difficult terrain, shipping, and weather conditions. At Yakutat, the contant drizzle so interfered with finishing of runways that the famous "circus tent" from Mud Mountain was spread over new cement to preserve it until it "set." At Annette, there was friction regarding working hours between the troops and WPA and local Indian labor. As a result, the latter two were not used at Yakutat.

Colonel Beverly C. Dunn succeeded Lt. Colonel Layson E. Atkins as District Engineer on 23 July 1940, upon the latter's death. From that time, mushrooming of personnel, transfers of officers, and constant change in organization necessarily characterized administration of the expanding defense construction program. Colonel Dunn was in turn succeeded by Colonel Goerz on 14 April 1942. When the North Pacific and Mountain Engineer Divisions were consolidated with the South Pacific Division into one Pacific Engineer Division, Colonel Richard Park, North Pacific Division Engineer, became Seattle District Engineer on 1 December 1942. On 1 December 1943, he was relieved by the mandatory retirement age statute and was succeeded by Colonel Conrad P. Hardy. The number of field and office employees in the Seattle District had grown by December 1940 to 900 and tripled to 2,800 by February 1941. As shown by the chart on the following page,

SEATTLE DISTRICT, WORLD WAR II, CIVILIAN PERSONNEL STRENGTH



Seattle District employment continued to rise with augmented national defense construction and later with war construction, until a peak of 10,243 employees, including per annum and hourly, was reached in September 1942. Employment dropped back to 8,613 in May 1943, when the Alaska Defense Command assimilated all 3,865 employees in Alaska, leaving 4,748 in the Seattle District.

As shown above, much military construction was done by Seattle District during the two years preceding the official Declaration of War in December 1941. Another sidelight on the preparations for war before the attack on Pearl Harbor is revealed by the increasingly military complexion of this District's organization. Whereas peacetime military personnel of the District traditionally are limited to the District Engineer and one or two subordinate officers, 14 officer assistants headed the numerous military planning, design, supply and field construction elements of the District in March 1941. Obviously, the Corps of Engineers was well on the way to a war footing long before war came. At the height of military activity in the fall of 1943 (see exhibit 5), the District had 32 officers. Colonels Park and Hardy, the two ranking officers, were Regular Army. The two Lieutenant Colonels, 11 Majors, 13 Captains and 4 Lieutenants were about evenly divided between reserves called to active duty and officers with temporary wartime commissions.

Reasons for staffing the key executive posts with uniformed officers in time of national emergency are quite apparent. The District was engaged in many sensitive (classified, secret) projects. Direct chain-of-command discipline and staff responsibility were essential to the maintenance of tight military security and in the necessary liaison with officers of services that were to use the facilities. Staff responsibilities provided excellent training and testing of Engineer officers under trying conditions. There is also a suspicion among people who have survived the pressures of those days that the presence of uniformed officers in the front offices was intended to emphasize the emergent nature of the situation and, by example, to elicit employees' complete dedication to the work. Anyhow, that was one result.

A day's work generally ran 12 or more hours. Neither holidays nor weekends interrupted the drive to prevent "work completed" bars on the Control Division's ubiquitous and tyrannous progress charts from trespassing on the allotted "deadlines." Pay for overtime was yet to be enacted into law, and compensatory time was recorded but seldom if ever possible to use. Congress did permit accumulation of 90 days of annual leave, rather than the previous 60 days. This didn't help much, as old-time employees soon reached the new maximum and went back to forfeiting leave. Eventually, the accrued compensatory time was cancelled as impossible to grant.

On the other hand, long hours, war worries, and influenza made abnormal inroads on the sick leave privileges of less hardy constitutions. Perhaps there was also some abuse, by a few weak characters, that led to a program of checkups by the nurse's department on the actual condition of absentees who reported sick. This surveillance was dropped abruptly after a zealous young lady called at the home of Mr. Pease, Chief Civilian Engineer of the District, a man of impressive presence and probity, who then had nearly 40 years of faithful service with the Corps. Informed at the door that the gentleman was ill in bed, she had to see for herself and marched upstairs and into the sickroom. But she did not tarry. The spectacle of the outraged, nightshirted figure in the bed and the sound of his pointed lecture on privacy and propriety pursued her as she fled.

PART 3 - WORLD WAR II

The Big Job

From the breastworks of Bunker Hill to the harbor defenses of Puget Sound, the Engineers always had designed and built the Nation's fortifications. World War I had added temporarily all sorts of expedient missions in the fields of military supply, transportation and construction that traditionally were the responsibility of the Quartermaster General. Again, in 1940, the pre-Pearl Harbor national defense buildup threw such a load on the Quartermaster Corps that it was shared with the Corps of Engineers.1/ A year later, Congress on 1 December 1941, formally charged the Chief of Engineers with the direction of all construction, maintenance and repair of buildings, structures, and utilities for the Army; acquisition of all real estate in connection with Government reservations; and operation of utilities. The transfer included work for the Army Air Corps, which was not yet a separate Service. All funds, property, records, and officer and civilian personnel in the Construction Division of the Quartermaster Corps were transferred.2/ This act was approved by the President just six days before the debacle at Pearl Harbor that plunged us irrevocably and officially into World War II. For Seattle District, as for the entire Corps, the two events infinitely multiplied the scope and complexity of military work. Civil works were suspended where possible or were forced to limp toward completion with reduced funds, personnel, and materials.

The news of Pearl Harbor on Sunday, 7 December 1941, plunged the Seattle Engineer District into 24-hour military operation including Sundays, with officers on duty day and night. Engineer officers complied with the Secretary of War's order to Regular Army personnel and on 8 December appeared in uniform. No longer a routine Civil Service office, the District issued gas masks and metal helmets to military and key civilian personnel. Annual vacations and national holidays were immediately cancelled for all employees. The official workweek of 39 hours was increased to 48 and even 54. Unofficially, the only limits were physical endurance.

Japanese air attacks or troop landings on the West Coast were anticipated. People of Japanese descent, citizens and aliens alike,

1/ Letter dated 19 December 1940, from Commanding Officer, Western Defense Command, to Seattle District Engineer placing all Alaska construction under Seattle District, Seattle File 6282-114 (Airport) Folder 2

2/ 77th Congress, 1st Session (Public Law 326, 55 Stat. 787) were seized and interned in 1942 at the Puyallup State Fair Grounds, which Seattle District converted for the purpose, and a similar center near Toppenish. They were later sent to detention centers in Idaho and Utah for the duration of the war. The Western Defense Command sealed off the Pacific Coast, placing patrols, barbed-wire barricades, watchtowers and searchlights along the beaches. Blackouts were instituted in all communities west of the Cascades.

Defense units and equipment of every sort poured into the Northwest States and Alaska. Barrage balloon, searchlight, radio and radar, military intelligence, security, aircraft, antiaircraft, warehousing, stevedoring, processing, shipping, repair, and Women's Army Corps outfits had to be accommodated. The pressing question was: where and how quickly could food and shelter be obtained, and suitable facilities for their operations be set up? The task fell largely to Seattle District.

Administration

The magnitude of administrative duties for Seattle District's war program can be noted from the number of personnel appointments made to meet and maintain employee quotas, a number also indicating turnover due to inductions and the lure of war-plant salaries. In 1940, 765 appointments were made; in 1941, 11,536; in 1942, 18,727; and in 1943, 7,431. Appointments after 16 March 1942 were temporary war-service appointments under Civil Service regulations, which assured employment only for the duration of the war and not longer than six months thereafter, provided the employee's service remained necessary for that period.

Alaska construction was first handled by an Alaska Operations Section under the Engineering Division. This section was transferred to the Construction Division in June 1941. As the volume of Alaska assignments increased, the Alaska Operations Division was established 1 August 1942 under D. L. Evans, Chief, to prosecute Alaska projects for the District. Major George F. Tait became chief of this division 1 March 1943, serving until 5 June 1943 when he succeeded Lt. Colonel James D. Lang as Executive Officer for Alaska Services. Major Emil H. Rausch, Jr., became the next chief of the division, serving until 15 January 1944, when he was appointed Field Liaison Officer at the Seattle Port of Embarkation. Major Tait then returned to the position of chief of the division, the position of executive officer for Alaska Services having been abolished. To free Engineering and Operations Divisions for maximum effort on war projects, a separate River and Harbor Division was established in May 1942. Although normally a civil activity, considerable harbor and channel improvements were made in Alaska to support waterborne supply to military construction. Mr. Baker was the first division chief. In February 1944, the work of the River and Harbor Division was divided between the Engineering Division (new work) and Operations Division (condition surveys and maintenance).

To carry on camouflage studies, design and field applications for the District in close cooperation with Pacific Engineer Division and Western Defense Command headquarters, a Passive Defense Branch was organized in May 1942. Capt. John S. Detlie served as chief of this branch until 1 December 1942, when he was succeeded by Major Walter E. Church. Detlie succeeded Church on 24 March 1943, on the latter's transfer to the Ninth Service Command.

To direct the increasingly heavy traffic of Alaskan procurement, along with the special procurement of items for continental construction and complex attendant problems of priorities, controlled materials, allotments, inspection, storage, and shipping, a Supply Division was established in March 1943 with Major Ernest J. Riley as chief.

A coordinating and expediting organization, concentrating on completion schedules, was established in August 1942, when the Control Division was set up in accordance with a directive from the Chief of Engineers. Major Lang was chief of the division from its inception until he became Executive Officer for Alaska Services on 8 October 1942. Major Carl A. Anderson, next chief of the Control Division, was succeeded by Major Baker on 1 December 1942 and he was succeeded by Major Detlie on 7 July 1943.

Continental construction projects covered an expanse of territory ranging from Fort Lawton, only three miles from District Headquarters, to Glasgow Army Air Field in Montana, 1,060 road miles from the District Office. Immediately after Pearl Harbor, stateside construction grew to such volume that prosecution and administration of the work required establishment of area offices at Fort Lawton, Everett, Spokane, Fort Lewis, Yakima, and Port Townsend. Virtually full District authority was delegated to area engineers with the District Office acting primarily as a reviewing center. In September 1942, the Wenatchee Area was established to replace the Yakima Area, and in December 1942, with the addition to the Seattle District of all military construction in Montana, an area office was set up at Great Falls. This decentralized basis of field operation continued until May 1943, when work in some areas had been completed to such an extent that forces could be reduced. The reverse process of centralizing authority commenced gradually--first with reorganization from area to resident engineers and finally to project engineers, with full control maintained by the District Office.

Civilian contractors, working on fixed price contracts under the supervision of Engineer officers and civilian engineers, accomplished the major part of the District's construction in the United States. By order of the Chief of Engineers, for reasons of security and dispatch, the District had abandoned the procedure of advertising for bids after Pearl Harbor, substituting direct negotiation of contracts. Thus, it became possible to place contracts soon after receipt of construction directives, to distribute the work more widely among contractors, and to achieve better utilization of all organizations, managerial ability, construction plant, and specialized skills. Competition was obtained in all cases, except where urgency of the work or unusual conditions precluded competitive negotiation. In May 1944, contracting procedure reverted to the normal Corps policy of competitive bidding and award to the lowest bidder, although public advertising was still not permitted at that time.

Alaska construction, including Army, Air Corps, and harbor defense facilities, by troops and civilian contractors on a cost plus a fixed fee basis was under the jurisdiction of the Seattle Engineer District during 1940 and 1941--doubtless because Seattle was "closest" to Anchorage, only about 1,400 air miles. The Anchorage area office handled field studies, reconnaissance and administration of the resident engineers on Northern projects.

Jurisdiction over Alaska construction was transferred from the Corps of Engineers to Lt. General John DeWitt's Western Defense Command on 1 May 1942, and the Engineer field organization in Alaska was assimilated by the Alaska Defense Command (Major General Simon Bolivar Buckner). Subsequently, Seattle District acted as a service agency, designing fortifications, housing, utilities, fuel storage and technical facilities; procuring and shipping construction materials, equipment and supplies; and recruiting civilian engineering, clerical, and construction labor as requested by the Western Defense Command (WDC) or its delegated authority, the Alaska Defense Command. Fiscal and cost accounts were maintained in the District Office, although property records were transferred to Anchorage.

Colonel Talley, who had succeeded Lt. Welling as Alaska Area Engineer on 7 January 1941, became Officer-in-Charge of Alaska Construction under the Alaska Defense Command (ADC). The Alaskan Department, the succeeding organization to ADC, was established 1 November 1943 as the military authority for the North, charged with complete responsibility over construction and fiscal matters, and entirely separated from the WDC. However, the Seattle District continued to render design, procurement, and shipping services.3/ As Colonel Park commented, "Though our authority is theoretically nil, our responsibility remains about as before."4/ Such shifts in authority not only confused the commands involved, but simply could not be followed strictly by the men working at remote stations from which correspondence with any command

3/ Letter 26 Nov. 1943, Comanding General, Alaskan Department to Seattle District Engineer stating that latter will continue such services as were performed for ADC in connection with military construction in Alaska, 323.45 (Alaska) 21

4/ Memorandum from AC Project Section, Operations Branch Construction Division, Office, Chief of Engineers, to Operations and Training Section, 13 March 1942 headquarters might take a month or two by air, sea, or dogsled. At times they didn't know to whom they were supposed to report: DeWitt, Buckner, Park, or Talley. Sometimes that was a blessing. They could skip the paper work, get on with the real work, and let whoever thought he had authority at the moment come to see what was done; or, receiving conflicting orders, they could act on those best meeting their own sense of necessities.

Personnel Problems

To do the expanding military work of the District just preceding and during World War II required people--and more people. They were not found easily, because the economy of the country had revived from the depression of the 1930's. By strenuous recruiting, the civilian payroll of the Seattle District office force alone increased fourfold, in less than a year, from 246 in December 1940 to 1054 in October 1941.

It was not only the District personnel who were struggling to keep up with the growing workload; much of the professional engineering design work was contracted to consulting engineers and architects. A section was established to handle this work which involved contracting for services of engineering help, checking plans and specifications submitted, and negotiating fees. Initially, Captain Charles A. Jackson, Jr., was in charge, but the work was soon turned over to Samuel DeMoss, who was in charge as long as outside help was required. Several of the architectural and engineering firms deserve mention. Among those who shared the load were John L. Maloney, M. O. Sylliaasen, and the firm of Young and Richardson. Mr. Maloney was outstanding, not only in the quality of his work but in meeting all deadlines. Mr. DeMoss negotiated over half a million dollars in fees without reference to higher authority. It is interesting to note that after two years' work by a renegotiating team after the war, only $15,000 was considered as overpayment. Many millions of dollars in construction work were involved. Also, much preliminary field surveying and virtually all stateside construction work was done by contractors, with supervision and inspection by the Corps. Engineering and construction firms throughout the country assumed and accomplished formidable burdens. The highest tribute awarded by the Government, the big "E," was earned by those splendid people for their efforts in the face of tremendous difficulties.

Contractors were able to find sufficient construction labor in the Northwest to man jobs in the States and in Alaska through 1941. However, by early 1942 the accelerating war effort with its heavy manpower requirements for shipyards, aircraft plants, and supply contractors, plus the demands of Selective Service, were critically depleting the local labor supply. Competing in the labor market were Puget Sound industries that included Boeing Aircraft plants, 50 shipyards, tank and other armament manufacturers, logging and lumber mills, and arctic clothing concerns. Deferments from military service were not granted industrial workers at this time. In addition, numerous

Army and Navy installations and Government offices were steadily adding to civilian employee rosters.

In April 1942, the War Manpower Commission was established to control manpower distribution and to provide adequate labor in war material industries. The labor scarcity first became critical in the nonferrous metals, logging, and lumber industries. In September 1942, the War Manpower Commission presented its plan to prevent unnecessary migration within industries. A month later, the President issued Executive Order No. 9250 as a measure to curb inflation. This order froze wages at prevailing scales to be determined by the Department of Labor. Prevailing wage rates in localities with little construction prior to October 1942 were substantially lower than in regions where construction was booming with attendant conditions of competitive hiring, wage spiralling, and closed-shop operations. The executive order hampered the manning of jobs in isolated and low-pay areas. The District's airbases at Ephrata and Moses Lake and the fortifications and breakwater at Neah Bay were contract projects where low wages interfered with recruiting adequate manpower.

As labor recruiting proved difficult for continental work, recruiting for Alaska hired-labor projects proved nearly impossible. The lack of hazard pay scales for work in dangerous locations, high living costs and inadequate housing facilities, adverse terrain, and climatic conditions aggravated the difficulties of Alaska labor recruiting. A growing disparity in wages between Government defense projects in Alaska and the higher war plant wages in the States was a further handicap. To assist Government contractors in Alaska, the Wage Adjustment Board approved a uniform pay scale making it possible to transfer workers from one project to another at no cut in pay. However, as the Board soon began to issue supplemental decisions for various Alaskan localities, the uniform scale was completely nullified.

Executive Order No. 9301, effective 1 April 1943, established a minimum wartime workweek of 48 hours in designated areas which embraced the majority of the District territory. The Seattle-Tacoma-Bremerton area was included in "Group I, areas of current acute labor shortage," while Everett and Spokane were in "Group II, areas of labor stringency and those anticipating labor shortage within 6 months." Direct recruiting of any type for continental or Alaskan work was prohibited in these areas.

The first labor recruiting by Seattle District outside its own territory was in April 1942, when a team was sent into the Los Angeles area. Eventually, the District had 13 teams scouring the country for men. Contractors, industrial and engineering firms also were sending recruiters throughout the country, offering all sorts of inducements--transportation, per diem and expenses; bonuses, high wages, and overtime rates. Even so, the chances were great that a worker, successfully recruited and started toward the job, would be intercepted somewhere along the way and lured away by a rival employer.

To avoid such losses, employers were forced to extreme measures such as contract bonds with each man hired, escorted travel, and restricted liberty during stopovers. Most travel to Alaska was by way of Seattle, and it was here that the heaviest casualties among prospective workers occurred. The city was so congested that lodging for itinerants was nearly nonexistent, yet a considerable layover while awaiting transportation northward usually was necessary because of wartime pressures on carriers. In March 1943, Seattle District therefore built an Alaska labor camp on the Denny Regrade area north of the business center, complete with T O type barracks and a mess hall accommodating 650 men. Here labor recruits were contained, detained and entertained until they could be shipped north. The food was excellent and so plentiful, in contrast with civilian rationing, that hundreds of employees from District offices nearby enjoyed the privilege of dining there.

Throughout the period of war construction in Seattle District, personnel work reached unprecedented proportions, due to the rapid employment of thousands, high turnover rates, and the maze of new regulations laid down by burgeoning boards and commissions. The paperwork and counselling required in the processing of these thousands of new employees were formidable. The majority of them had no previous Civil Service experience and their orientation proved a problem. The District had not previously required much personnel management, but the confused wartime situation necessitated adding employee management to the usual administrative work.

Problems of conservation, rationing, transportation, and housing in an overcrowded region demanded administrative assistance. District employee participation in Red Cross, Community Fund, Army Relief, March of Dimes, and other civic and patriotic movements was organized under a Public Relations Section. Payroll deduction for purchase of war bonds was instituted under a War Bond Officer, Capt. Arvid K. Reed. The District was first in the Pacific Division to receive the Treasury Department "T" flag for more than 90 percent of employees pledging at least 10 percent of their income for the purchase of war bonds.

Educational programs were inaugurated under the War Manpower Commission, with courses in supervisory training. In line with the War Department's national "Ideas for Victory Campaign," a local suggestion committee was organized and cash awards were made for ideas that would promote work efficiency. Employee training and suggestion programs still are administrative practices in the District.

By fall of 1943, the District was able to pay wages to Alaska workers commencing on date at the point of hire and guaranteeing 240 hours of pay per month. This somewhat assisted field recruiting. In the meantime, available labor supply in the State of Washington was being heavily drawn upon by the Hanford Works project at Pasco, highest labor priority job in the Northwest. Projects in Canada and

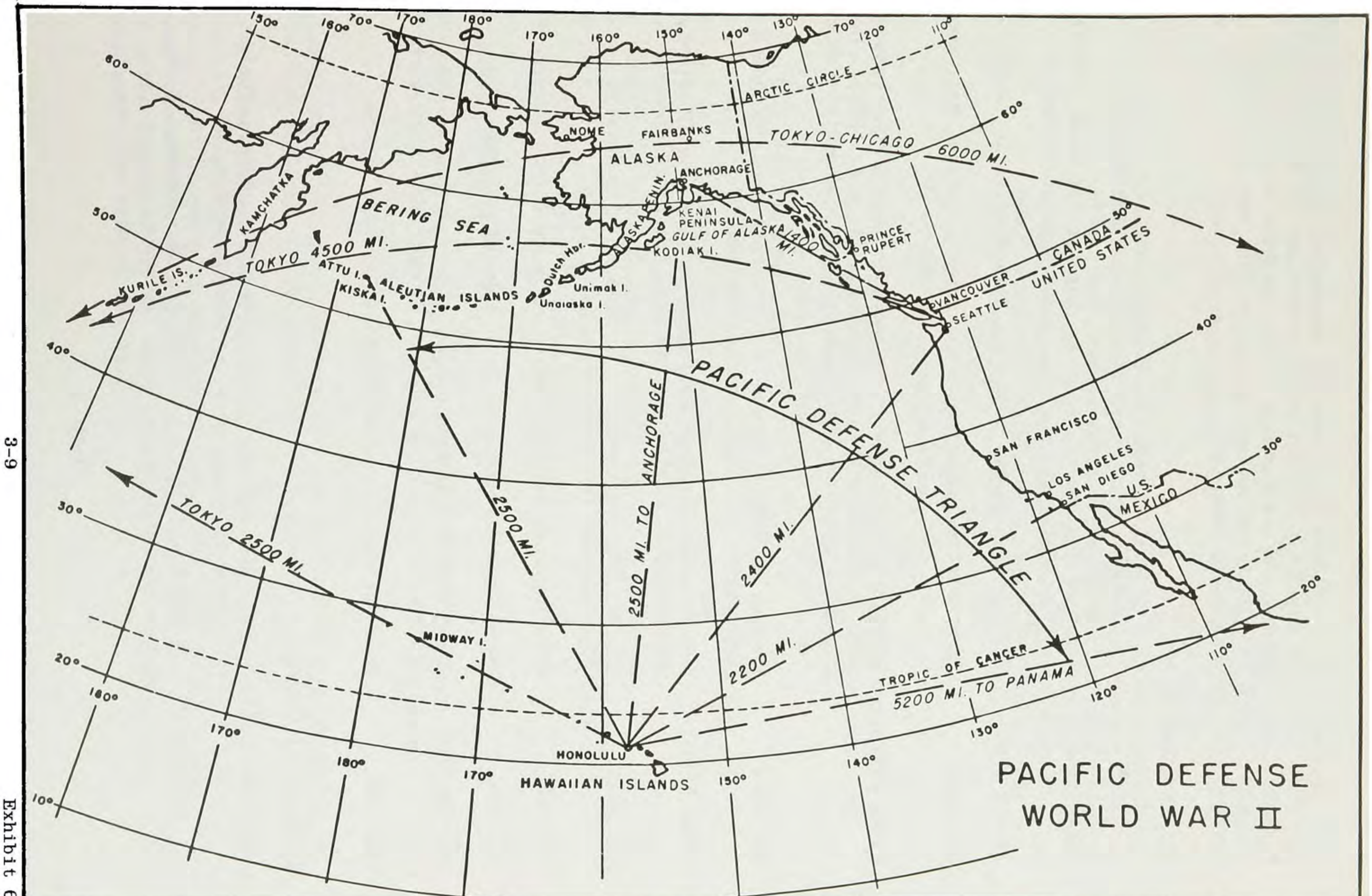
Alaska, principally the Canol project and the ALCAN Highway, presented keen competition not only in Seattle but in the Mid-West recruiting field. These jobs offered more attractive inducements to hourly workers than could Seattle District projects in the States in the way of higher wage rates, longer hours, more overtime pay, wages starting from point of hire rather than upon arrival, and a guarantee of 240-hours per month. Construction of the Auburn Holding and Reconsignment Point and the Fort Lewis station hospital addition both suffered from a high labor turnover and lack of common laborers. By using shipyard workers on Sundays and granting transportation expenses from both Tacoma and Seattle, these projects were completed on schedule.

Engineer Troops in the North 5/

As late as the winter of 1939-1940, there were no Engineer troops in Alaska. Army construction was still under the Quartermaster Corps and the only active Army installation was Chilkoot Barracks near Skagway. War Plan "Orange" as of 1938 visualized the Pacific Triangle (Alaska-Hawaii-Panama) as the bastion of western defense (see exhibit 6). This concept continued through Defense Plan "Rainbow" in 1941. The Navy had bases at Sitka, Dutch Harbor, and Kodiak, but they were far from meeting modern defense criteria, especially with respect to air attack or invasion by land forces. The Quartermaster Corps was planning to build Ladd Field at Fairbanks and Elmendorf Field at Anchorage. The Civil Aeronautics Authority had programmed a number of airfields, including Annette Island and Yakutat, to serve as essential refueling and servicing stops for propeller-driven aircraft between the States and the Territory. However, these four airbases as yet existed only on paper.

If the Alaskan apex of the strategic triangle were to justify any reliance, it needed strengthening greatly and speedily. General De Witt, Commanding Officer, Western Defense Command, was responsible for the entire continental and territorial Pacific Coast. He was gravely concerned over the lag in defense appropriations and construction progress along his landside of the triangle. De Witt had confidence in the construction abilities of the Corps of Engineers and from the beginning of the defense buildup had urged assignment of much of the Alaskan work to the Engineers. In fact, Lt. Colonel Atkins, Seattle District Engineer, already had started surveys for military work in the North. Just before his death, he ordered the only available Engineer combat and construction troops to Anchorage and assigned Captain Trudeau to the organization and training of additional units. De Witt waited no longer for official sanction from Washington. His letter of 19 December 1940, (reference 1/, page 3-1) put Alaska defense

5/ Data largely from Dod, Karl C., Corps of Engineers: The War Against Japan. Office of the Chief of Military History, United States Army, Washington, D.C., 1966. U.S. Government Printing Office, Superintendent of Documents.



PACIFIC DEFENSE
WORLD WAR II

Exhibit 6

work in the hands of Colonel Dunn, who had succeeded Atkins, and 1,400 Engineer troops on the job. The following chronology of Engineer unit organization, training and assignments in the northern sector was due largely to De Witt's decisive action, an action that may well have saved Alaska from Japanese conquest.

Before Pearl Harbor

Date	Unit	Assignment
Early 1940	Corps of Engineers, Seattle District	Surveys for Ladd, Annette and Yakutat airfields
27 Jun 1940	32d Engineer Combat Co.	Elmendorf Field, Anchorage
Jul 1940	28th Aviation Engineers	Annette Island; Maj. George J. Nold, CO
9 Sep 1940	Secretary of War authorized to transfer QM (Quartermaster) military construction to Engineers (54 Stat. 875). Only partial compliance until January 1942, when directed by P.L. 326/77.	
Oct 1940	Company B, 28th Aviation Engineers	Yakutat; Capt. Benjamin B. Talley, CO
4 Jan 1941	G-4 directed Corps of Engineers to take over QM Alaska construction. Talley became Area Engineer, Alaska.	
Apr 1941	Co. D., 29th Engineers Flight F, 1st Photo Sqdn.	Alaska site surveys
Jul 1941	802d Engineer Aviation Bn.	Annette Island construction
Jul 1941	807th Engineer Aviation Co.	Yakutat construction
Aug-Sep 1941	151st Combat Engineers 1st Bn.	Alaska. (Combat and casualties, Dutch Harbor).
Dec 1941	Total strength of above units in Alaska: 1,400.	

After Pearl Harbor

Jan 1942	2d Bn, 151st Combat Engineers	Cold Bay, CAA airfield construction
Feb 1942	42d Engineers General Service Regt.	1st Bn, Juneau, 2d Bn. Cordova

After Pearl Harbor (Cont'd)

Date	Unit	Assignment
Mar 1942	639th Engineer Camouflage Co.	Ft. Richardson and 11th Air Force Depot
11 Mar 1942	General Simon B. Buckner, Alaska Defense Command (ADC), relieved Colonel Dunn, Seattle District Engineer of Alaska real estate and field construction supervision in Alaska, but Seattle District retained all technical design, equipment and material supply, contract administration, fiscal and civilian personnel functions. Seattle District 1,330, Alaska 11.6/	
1 Jun 1942	4,500 Engineer troops, 3,000 civilian laborers in Alaska	
Jun 1942	Task Force #2600: 388th Engineers Bn., 89th and 90th Pontoon Bns. (Also, Signal, Medical, QM, Finance Units)	Waterways, Athabaska River, Alberta, for Canol Oil Project
Summer 1942	176th and 177th Engineer General Service Regts. and 714th Railroad Bn.	Alaska Railroad, Whittier cutoff
Aug 1942	468th Maintenance Co.	Dutch Harbor
Oct 1942	331st Engineer General Service Regt., 2d Bn.	Excursion Inlet

The ALCAN Highway 7/

Mar 1942	35th Combat Engineers, 74th Pontoon Co., Co. A, 648th Topog. Bn.	Fort St. John, B.C. for ALCAN Highway

6/ Letter dated 14 April 1942 from Commanding General, ADC, to North Pacific Division and Seattle District Engineers

7/ The ALCAN Highway was located and built by joint Canadian--U.S. Forces. U.S. Engineer troops were under the general command of Brig. Gen. Clarence L. Sturdevant, Assistant Chief of Engineers, and several subsidiary field commands, none of which included Seattle District; but the District supplied men, materials and equipment for much of the work.

The ALCAN Highway (Cont'd)

Date	Unit	Assignment
Apr 1942	18th Combat Engineers 73d Pontoon Co., 29th Topog. Bn., 340th General Service Regt., 93d Full Scale Regt. (Approx. 11,000 men)	Whitehorse, Y.T. and Fort St. John, B.C. for ALCAN Highway
May 1942	97th, 95th and 341st General Service Regts.	Dawson Creek

Aleutian Campaign

Date	Unit	Assignment
Jan 1943	468th Maint. Co., 2d Platoon	Dutch Harbor and Adak
Jan 1943	813th Aviation Bn.	Amchitka
May 1943	13th Engr. Combat Bn., 50th Engr. Combat Regt.	Battle of Attu, 29 dead, 47 wounded
Sep 1943	223d Engr. Combat Co., 521st Combat Co.	Kiska

NOTE: To ease manpower shortages, some work was done by troops of other Arms and Services under Engineer supervision.

Work in the North

Approximately one-half of the military construction was stateside. The other half was strung along the coastline of British Columbia and Alaska, from the Prince Rupert-Ketchikan area to Anchorage and Seward, over an air-line arc of nearly 1,000 miles; then across the interior from Anchorage to Fairbanks to Nome, nearly another 1,000 miles, brushing close to Mount McKinley, the highest peak on this continent; and to the Arctic Circle. Construction also extended from Anchorage-Seward along the Kenai and Alaska Peninsulas 800 miles to Unimak, the beginning of the Aleutian Chain. From Unimak, the United States defense perimeter extended 1,100 miles farther westward along the 52d parallel of latitude and across the International Dateline to the island of Attu, which lies some 300 miles within the Eastern Hemisphere and is less than half as far from Japan's Kurile Islands than is Anchorage from Seattle. The air-line length of the Pacific defense perimeter in Alaska from Ketchikan to Attu is 2,700 statute miles, all of it accessible only by air or water transportation. Thus is emphasized the problem of sheer distance and isolation in the building of these defenses.

Getting men, materiel, and equipment to remote job sites was only a prelude to further problems; viz., the short summer construction seasons, limited to about three months by winter darkness and bitter cold in the high latitudes; rough, intractable terrain in most areas; and water obstacles to be dealt with everywhere. Temperatures down to -60° F. in the interior froze men's feet, faces and fingers, burned their throats and lungs, and sapped their strength; solidified the lubricants in machinery, turned motor fuels to jelly, fresh concrete to hash, and metals to brittle junk. Alaskan weather, especially along the Aleutian Chain, is notorious for its Williwaws. These are cyclonic storms, similar in their origins and behavior to the line squalls and cyclones of the central United States. Sudden, violent winds seem to strike erratically in any and all directions, including, some claim, straight down to the surface of sea or land. The turbulence is caused by the clash of cold Arctic air fronts intruding on atmosphere that has been warmed and moistened over the Japan (Kuroshio) Ocean Current, which flows eastward all along the Aleutians. Added to the violent winds and seas, a formidable hazard to the miscellany of craft that operated in these waters was the accumulation of frozen spray in such masses topside as to swamp or capsize vessels.

Rain, snow, and fog prevail along the coast and island perimeter. Heavy brush and timber grow in mainland areas up to the latitudes or altitudes of the timber line. In open areas, deep, springy tundra mat or muskeg bogs are encountered, neither of which offers a dependable or durable base for construction or for travel. The Aleutians have no native timber. Where barren rock is not exposed, the island surfaces usually are tundra on the uplands and muskeg in depressions. Small water courses in many places run under the tundra, invisible until man or machine breaks through.

Much of the northerly part and the central interior of the Alaska mainland, such as the Nome and Fairbanks regions, are in the zone of permafrost. This permanently frozen ground forms an unstable foundation for any heated structure or utility line such as steam, water, or sewer pipe. Contact with a warmer surface or air gradually thaws the frost and creates a soft mud in which any applied load settles irregularly. Avoidance of such damage required much research and greatly impeded construction efforts.

Natural harbor and beach conditions, particularly in the Aleutians, were generally unfavorable to the protection of shipping or the delivery of cargoes. During the first stages of construction, materials and equipment had to be landed at many sites by lightering, rafting or simply by jettisoning and floating them ashore if they were buoyant. Site surveys detailing the topography, foundation conditions, weather exposures, and other local conditions that normally would be obtained for guidance in design, simply could not be made for many locations because of weather conditions, lack of men, or lack of time. The only recourse for the designers in the District office was to devise various "standard" layouts and prefabricated space inclosures, leaving to the ingenuity of the construction people the putting together of some combination of parts that would serve. Insulation from cold and rain; interior heating, drying and ventilation; exterior drainage and firming of miry traffic ways were constant problems.

Outside, there was usually snow or drizzle. Inside, one found the atmosphere saturated from wet clothing, surfaces damp with condensate that formed when the temperature dropped, and smoke blown back down the flue by erratic winds. Makeshift contrivances resulted from efforts of the men in the field to gain a bit of comfort. Stoves were hacked from gasoline drums--a variation of the design of the little conical Sibley that was used in the old pyramidal tents of the AEF in France a generation earlier. Double entrances were built, with a sort of air lock between the doors so that one door could be kept closed to exclude the weather. Very few windows were used, as they so often were fogged over. "Duck boards" were laid across the mud--another idea that originated in the American Expeditionary Forces. A variety of novel contraptions made from tin cans decorated the tops of the stovepipes: visors, vents, baffles, screens, or whatever the art and science of the experimenter might suggest as a means of deflecting the wind from the openings. Sometimes they worked.

An Aleutian Christmas Tree

The lack of timber on the Aleutian Islands, contrasting with the mainland coniferous forests that thrive under similar climatic conditions, was mentioned earlier. It is not strictly true, as sometimes claimed, that the islands have no trees. In 1958 there were still a few survivors of 1805 and 1835 Russian plantings.8/ At the instance of General Buckner, servicemen planted several thousand spruce on Umnak, Kodiak, and Adak during the war.9/

These official experiments were followed by an amusing, and wholly unofficial, wartime venture by a young crew member of P-512, an 85-foot air-sea rescue boat attached to the 11th Air Force, operating in the Aleutians. The crewman was and is the son of an engineer of Seattle District, now retired, who assisted with the compilation of this history. The father, having wrapped a Christmas package for the son in the fall of 1945, took it to the Army Post Office (APO) for mailing, where he encountered the Major in command. In the course of conversation, the

8/ Lutz, H. J., Sitka Spruce Planted in 1805 at Unalaska Island by the Russians. Northern Forest Experiment Station, Forest Service, U.S. Department of Agriculture, May 1963.

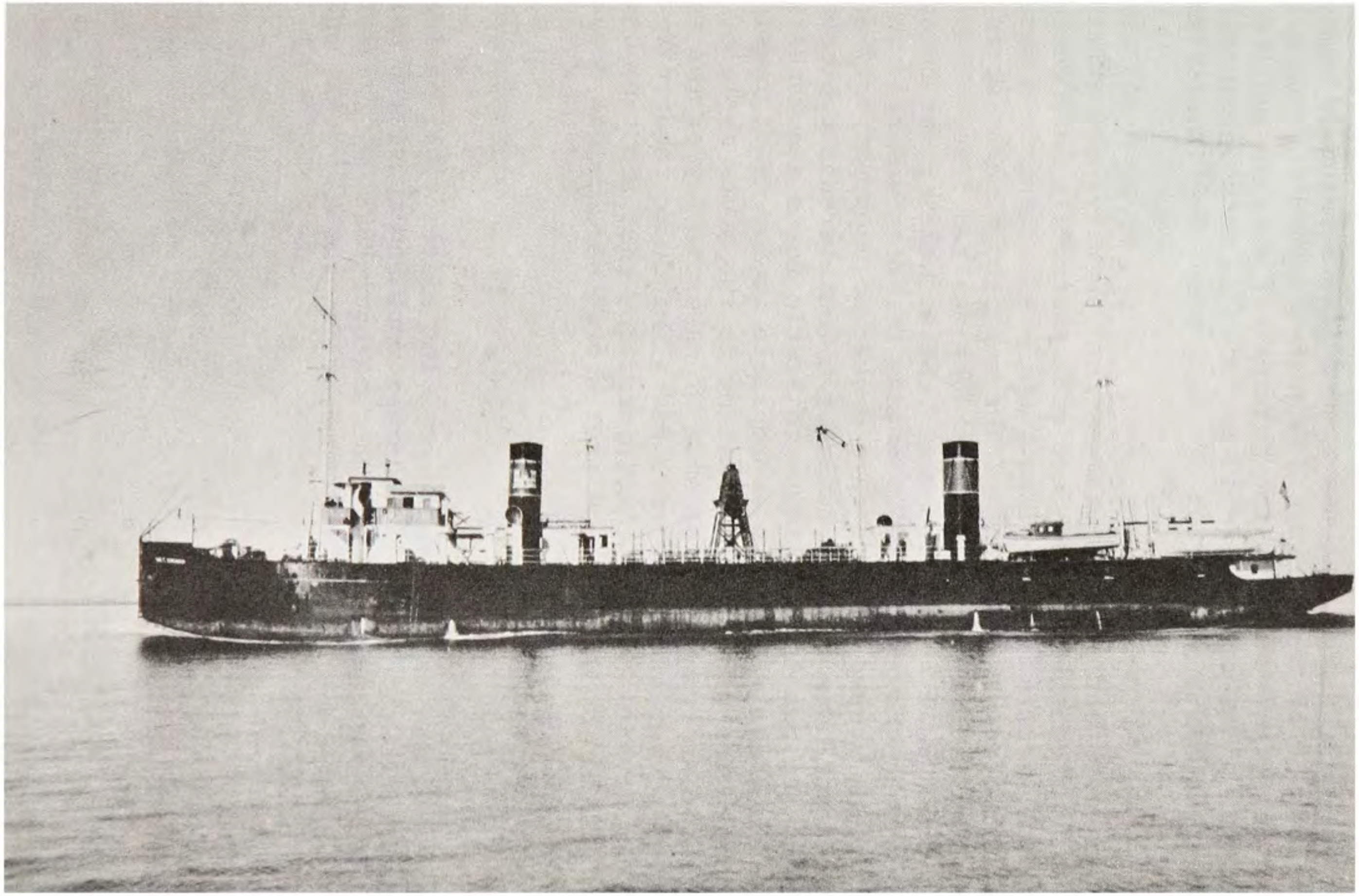
9/ Bruce, David and Court, Arnold. Trees for the Aleutians. The Geographical Review, Volume XXXV, No. 3, 1945, pp. 418-423, reproduced by U.S. Forest service.

Major learned that the package contained a tiny, synthetic Christmas tree. He suggested that the father send instead a real, live tree. The father conferred with the late Dr. John Hanley, emminent dendrologist and Director of the University of Washington Arboretum, who suggested a Colorado Blue Spruce as the species most likely to survive the rigors of Aleutian weather and supplied the specimen. The tree was elaborately packed for shipment and looked like a shrouded mummy. The size and appearance of the package somewhat dismayed the Major at the APO; however he accepted it "in the interest of science and the spirit of Christmas." The crew of P-512 was alerted with instructions for planting the tree and a photograph of the "mummy" for identificaion.

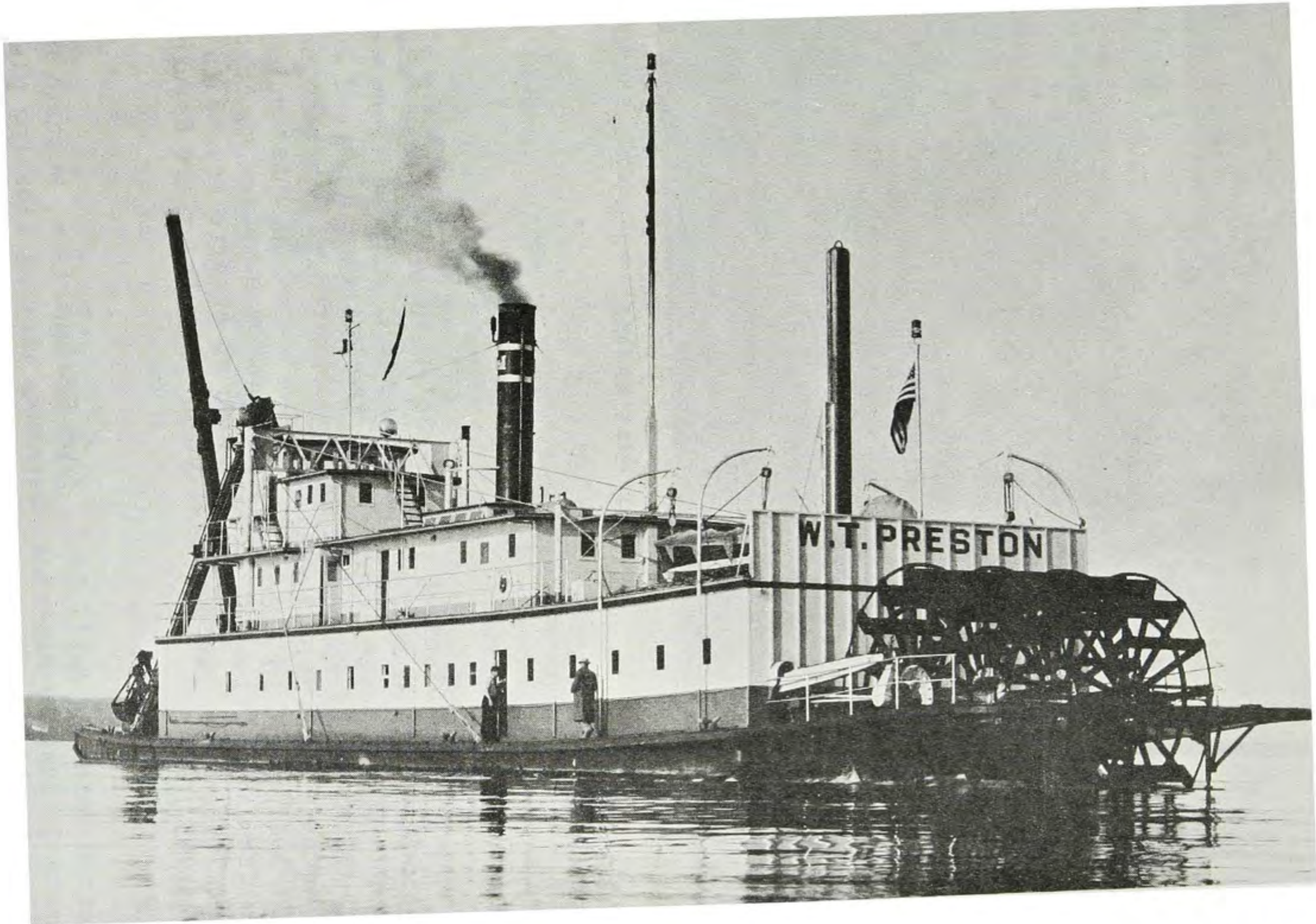
Christmas passed, then January and most of February, and still no tree was found at any of their infrequent mail ports. In late February 1946, P-512 touched at Attu for supplies. While searching in a warehouse for some item of deck gear, one of the men recognized a strange bundle as resembling the photograph of the long-awaited tree. The tree was so dried that survival seemed doubtful. Nevertheless, the delayed Yule toasts were drunk and the formal planting ceremony was held in an ancient Aleut burying ground where a rare pocket of comparatively deep, rich, well-drained soil was found. Building a fence around the tree was found necessary to put it off limits to Arctic foxes and wandering Aleut curs that immediately tried to appropriate it for traditional canine salutations. The site of the planting is the south shore of Casco Cove, which opens from the west side of Massacre Bay on the southeast end of Attu. A year after the tree was planted, an inquiry to the Commanding Officer at Attu brought the information that the tree was growing well, confirmed by photographs that showed new, bright "candle" growth at the tips of the branches.

Floating Plant

At the outset of the defense emergency, the District's floating plant was devoted to routine river and harbor work and consisted only of the seagoing hopper dredge KINGMAN, the snagboat PRESTON, the survey ships CAVANAUGH, MAMALA and ORCAS, the inspection boat SAN JUAN; and the motor tender CARPENTER.



Hopper Dredge DAN C. KINGMAN Photo. 4



Snag Boat W. T. PRESTON

Photo. 5

Survey Boat MAMALA Photo. 6

As the Seattle District pushed the chain of American bases from Annette to Yakutat, on to Umnak and westward, with numerous projects such as the Alaska Barge Terminal and the Whittier Railroad cutoff in between, the Corps of Engineers castle appeared on a heterogeneous fleet of supply vessels. These craft performed an outstanding and difficult assignment in carrying construction supplies to northern projects from initiation of construction on Annette Island in July 1940, until the fleet was transferred to Army Transport Service (ATS) in April 1943.10/

10/ Telegram dated 21 April 1943, from Headquarters, Western Defense Command to Seattle District Engineer, listing floating plant to be transferred to ATS effective 20 April 1943.

Few construction supplies were available in Alaska. The bulk of materials had to be transported from the States to the Territory and then to remote, often uninhabited job locations over long sea routes. Movements of supplies could not wait for favorable summer sailing weather, since construction was prosecuted around the clock, summer and winter. There was an early and acute shortage of craft of all types for Alaska shipments, and Engineer cargoes had to compete under severe handicaps for available space. Navy craft were intent on naval operations. Commercial and Army Transport vessels had more cargo than holds. To solve the sea transportation problem, Mr. Richard A. Davies, an engineer with 35 years of river and harbor experience in the District, was put in charge of floating plant. His group surveyed available vessels as to suitability for strenuous service in heavy Alaskan seas, recommended purchase or charter, designed repairs and alterations, and outfitted vessels by purchase or from stockpiles of marine equipment assembled in Engineer warehouses. For general use between Ketchikan and the airfield under construction at Annette Island two of the first craft obtained were HEATHER, a former lighthouse tender, and ATKINS, formerly the JUVENTUS and prior to that the U.S. Coast and Geodetic Survey ship EXPLORER.

With the beginning of the barge terminal at Excursion Inlet and additonal projects in southeast Alaska, fishing boats were chartered for out-of-season work. Also chartered for the use of the Officer in Charge of Alaska Construction were a number of oceangoing tugboats which made long distance, deep-sea tows to remote and critical, westward projects. These vessels included COMMISSIONER, NEPTUNE, EDITH FOSS, and SNOHOMISH.

A number of old sailing vessels were acquired and converted into seagoing barges, including SOPHIE CHRISTENSON, FANNY DUTARD, and JOHN A. Conversion consisted of removing masts and rigging; reconditioning hulls; enlarging hatches, holds, and deck spaces; and installing diesel-electric generators for cargo winches, booms, and swing gear.

Miscellaneous floating plants, such as pile drivers, derrick barges, barges for barrage balloon service, and oil scows, were acquired and repaired for Alaska use. As cargo tonnage increased, vessels were acquired until 350 tugboats, barges, and service craft were operated by the District at the peak of activities.

About half of all alteration and repair work was done by the District shops at the Government Locks. The other half was let by contract to civilian yards. Typical of rebuilding assignments was the survey ship CAVANAUGH, originally a luxurious private yacht purchased by the District in 1940 for fishtrap and survey inspection. The ship was altered for war service, provided with armament and gun crew, and outfitted for transporting construction personnel. In shuttle trips between Seward and Anchorage, the CAVANAUGH carried 70 men per trip at one-half the cost of commercial transportation, while her Oriental rugs, Sterling table service and embroidered linens rested in storage.

Due to the unprecedented heavy duty that Engineer craft faced on Alaska runs, they were returned, usually long overdue and then only reluctantly, for rebuilding or repairing. Major overhauls were accomplished on the S. D. MASON, ROBERT GRAY, HEATHER, CUDAHY, KLIHYAM, PORT OF BANDON, JOHN S. BUTLER, SIREN, PRINCESS PAT, and numerous power barges. The District served as a base not only for outfitting and maintaining its fleet, but also loading, dispatching, and recruiting crews.

The District undertook a large program of new construction to relieve the vessel shortage, and a number of designs considered significant in naval architecture were developed.

A 96-foot seagoing tugboat was designed by O. A. Seigley, District Naval Architect. Four were constructed at a cost of approximately $200,000 each. They were built of wood to utilize regional building facilities and to save critical materials, had seagoing lines and an unusual amount of freeboard, and were capable of withstanding North Pacific gales. All of them were readily saleable to commercial operators as general utility craft after the war.

Three crane barges, one of which was equipped with an 80-foot boom, were constructed. The versatile "Crane Barge 14" carried a 100-ton, 80-foot crane in 20-foot sections to permit maneuvering in any direction, began as the regulation type scow. The wooden hull was 118 feet 6 inches long, 40 feet wide, and 9 feet 9 inches deep. Six fuel tanks were incorporated in the hull as diesel fuel supply for the crane, which was fastened down with railroad track laid in the deck.

A power scow developed by the District was 86 feet x 26 feet, with a depth of 9 feet 6 inches. Sides and bow were 8-inch fir; bottom planking was 4 inches, and deck planking 3 inches. Six longitudinal bulkheads were each 6 inches thick. The craft could lie on the beach for loading and unloading, and stand much pounding due to the protection of steel bottom skegs. This scow was powered with twin diesel engines, and had partially covered deck space for freight and a raised house near the stern for pilothouse and quarters. A self-propelled power barge designed in cooperation with Maritime Service shipyards proved so successful that the original contract for 4 was extended to 30. In all, contracts for forty-six 300-ton and twenty 1,000-ton barges were let by the District.

To offset the shortage of deep-draft vessels and shorten the haul for those that could be obtained, Mr. Davies proposed, and Colonel Dunn adopted, a scheme of tug and barge transport over the first 1,000 miles in comparatively sheltered waters from Seattle to Excursion Inlet, where Icy Strait opens into the tempestuous Gulf of Alaska. Here a barge terminal was built, with piers, warehouses, and stevedoring facilities for transshipment of barge cargoes to oceangoing ships. Often, however, the tows found no ship waiting at Excursion Inlet to relieve them and simply continued across the Gulf and westward along the Aleutians to the ultimate destination.

Heavy cargo items had to be taken as close to the job as ships or barges could maneuver, then loaded on scows and towed to the beaches. The transfer of cargo in open water was difficult and dangerous because of the rolling and pitching of the craft, but was often necessary in the absence of docks or protected anchorages at construction sites. Mobile equipment sometimes could be rolled off the scows onto ramps in shallow water. Once such equipment was on land, subsequent loads could be handled by improvising roadways shoved out to meet the unloading scows. Where high tidal ranges required a floating dock, scows could be anchored off the beach and connected to the shore by a rockfill and a rolling ramp.

As essential to the District's mission as the vessels was the skill of the old-time tugboat operators and ship captains, long familiar with Inland Passage and Alaskan waters. These captains and their crews brought their vessels safely through conditions that would have cancelled peacetime voyages and sometimes through enemy attacks. Shoals and reefs, swift currents and gale winds, floating bergs, and ice on the vessels in Alaskan waters were constant threats to ships and cargo. After the attack on Dutch Harbor and the Japanese occupation of Kiska and Attu in June 1942, the menace of submarine and air attack was added to the natural hazards of Alaska piloting. Thereafter, craft sailing westward along the Aleutians were equipped with armament ranging from .30 and .50 caliber machine guns to 3-inch antiaircraft guns and depth charges.

Several District captains were commended by both the Army and the Navy for outstanding services. Captain Grant Evans of the KLIHYAM, which was bombed nine times in 22 days on one Aleutian trip, thus earned the star and chevron (denoting enemy fire) for the smokestack of his tug. Captain Martin Guchee of the PORT OF BANDON, whose crew one day watched four Japanese bombers pass over their ship followed by a squadron of American fighters which blasted the enemy into the sea, also added the star and chevron to the BANDON stack. For services in moving supplies from island to island in the Aleutians, and particularly for work in the Andreanof Armada landing on Adak, Captain Evans and Captain Guchee received letters of commendation from the Alaska Defense Command "for extraordinary fidelity and essential service" and both were recommended for the Legion of Merit. Captain Eugene Stitt of the ROBERT GRAY won Navy commendation for saving a destroyer from going on the rocks. Captain Spoorman of the MOONLIGHT MAID, an old converted sailing vessel, was cited for saving a Navy plane tender which had been torpedoed by a Japanese submarine.

In April 1943, by direction of the Western Defense Command and the Alaska Defense Command, responsibility for all Army floating plant was assigned to the newly activated Transportation Corps. Accordingly, most of the District fleet was transferred to the Seattle Port of Embarkation. The dredge KINGMAN was transferred to the Pacific Engineer Division office. The District retained only the snagboat

PRESTON, the survey boat MAMALA, and the inspection boat SAN JUAN to carry on its routine civil work of maintenance and surveys. The Floating Plant Section was headed by Mr. Davies until his retirement 31 March 1944 after 39 years of service, when he was succeeded by O. A. Seigley. Further details of some of the District vessels are contained in Appendix F.

Supply 11/

The supply missions of Seattle District were associated with air and ground logistics in all theaters of operation and were dual in nature; that is, they involved both troop and civilian construction supplies. The magnitude of the operation is implied only roughly by the following figures:

	1941	1942	1943
Number of purchase instruments issued	21,000+	64,000+	59,000+
Dollar totals	$14+ million	$52+ million	$65+ million
Supplies shipped North	182,500 Tons	585,400 Tons	750,000 Tons (Est.)

Purchases included everything that conceivably might be required to house, feed, clothe, and sustain men in remote environments of climatic extremes, plus the special materials, tools, and equipment with which to accomplish complex and often unprecedented construction, all on a scale that defies description. Imaginative improvisation, invoked by constant contact with field conditions, was the most essential ingredient of this work. The methods developed then were to become models for subsequent supply logistics in the Korean and Vietnam conflicts.

Reaching its peak in 1942-43, the Supply organization of Civil Service employees, assigned military personnel, contract longshoremen and other hourly-wage labor, numbered some 1,200 people. At the heart of the operation were 40 buyers and 80 inspectors, most of whom were located at Seattle headquarters. As autonomous area offices were established, they were provided with the necessary supply staffs--buyers, inspectors, property and records clerks, typists and warehousemen.

11/ From notes furnished by C. C. Templeton, Herbert J. Bray and Daniel R. Shea, who filled key posts in this work, and Richard H. Frank, who worked in Alaska.

When the national defense buildup started in 1940, there was no separate Supply Division in the District. Procurement was a minor activity, limited to office supplies and material for a few boats, civil works projects and Puget Sound fortifications--all handled by a Purchasing Section of five people under L. O. McCue as part of the general Administrative Division headed by Captain Goerz. With the transfer of all Air Corps field construction from the Quartermaster (QM) Corps to the Corps of Engineers in December 1940, Seattle District acquired 32 QM employees, most of whom were engaged in the supply business. The District also took over airfield work at McChord, Sunset (now Geiger), Snohomish (now Paine), Ladd, Annette, and Yakutat. The supply responsibilities of the District increased correspondingly and in December 1941 received additional impetus with the transfer of all Army QM construction to the Engineers. As defense work exploded into full-scale warfare, the supply function briefly was placed under the Engineering Division of the District, then reorganized as a principal division in 1942. Meanwhile the supply mission had developed along several lines that required special facilities, skills and expedients going far beyond the paperwork involved in the initial purchase of the hundreds of thousands of items needed.

All material and equipment purchased had to be inspected for compliance with specifications, either during manufacture at the plant or on arrival at the receiving point. Goods fabricated at plants outside Seattle District generally were inspected by arrangement with the Engineer district in whose territory the manufacturer was located. Most items had to be stored temporarily when received, and be properly packaged or otherwise prepared and protected against the hazards of shipment--moisture, mildew, corrosion, heat, freezing, shock, breakage, miscarriage, pilferage or whatever abuses they might suffer, depending on their particular vulnerabilities and the conditions to be encountered.

At first all Alaska cargo was received and inspected at Pier 90, in the Naval Supply Base, Smith Cove, Seattle. Overflow from the pier shed was stored in an adjacent outside area until it could be shipped. As the tempo and volume of shipments rose early in 1941, some of this activity spread to other piers. Piers at the Port of Embarkation, 1519 Alaskan Way South, were used until the declaration of war in December 1941 made it necessary for the Transportation Corps to use all space there. Then inspection of incoming material was moved to the old Stacy-Lander Street pier area and the former State Liquor Board building was converted to offices and warehouse. The adjacent Milwaukee Railroad pier also was used, Pier 90 having been taken over by the Navy.

Supply activities soon outgrew the Stacy-Lander facilities. One activity that urgently needed attention and new space was the preparation of cargo for ocean shipment. Vendors proved incapable of doing this. Indeed, much study and experimentation were required to devise adequate protective packaging methods in the face of the many hazards of wartime transport. A block-square industrial site at 4th Avenue

South and Lander Street was leased from the Union Pacific Railroad and a large, modern warehouse was built there. A Government packaging plant was installed and operated, first with Government hired labor and later by contractors. Approximately 160 contractor personnel became involved at the peak of this work. Early in 1943, the 4th and Lander warehouse became an Engineer spare parts depot, with some 150 people engaged in stock control, issuing, packing, and shipping 60,000 line items to support Engineer equipment in the North. After the Japanese withdrew from the Aleutians in May, the depot was deactivated and the parts were redistributed to other Engineer depots. Until its transfer to General Services Administration in 1947, the building served as general offices, warehouse and packing plant for the Supply Division.

Other special service facilities became necessary. A lumber stockpile of 20 million board feet was maintained at Weyerhaeuser's Mill B in Everett. As called for, lumber was barge-loaded and carried to shipside in Seattle and Everett Harbors.

A great materials storage yard of about 40 acres was set up at Argo, a railroad freight classification and switching yard south of Spokane Street in Seattle. This area contained lumber storage, as well as a tremendous amount of Engineer equipment and construction material. In addition to a civilian mechanical staff, two companies of engineer troops were detailed to Seattle District to operate this depot. Eventually (1944), the Argo yard became the site of a massive salvage, repair, and redistribution operation. Surplus or unserviceable Engineer materials and equipment from Alaska, Canada, the United States and some trans-Pacific bases were assembled, inspected and temporarily stored pending disposition. Usable standard stock items were repacked and shipped to Engineer depots for reissue. Reparable items were repaired and similarly redistributed. Others were junked or turned over to War Assets Administration for disposal.

An interesting sidelight on this operation was the use of 400 German prisoners of war from Rommel's North Africa Corps. They were quartered at Fort Lawton and transported daily by bus, under Military Police guard, to labor in the Argo yard. The yard was floodlighted, equipped with guard towers, and carefully supervised by the security force. Nevertheless, the prisoners managed to smuggle out some alcoholic solvent and have a big party at Fort Lawton. Many were sickened and two died as a result.

Other materials and equipment storage yards serving much the same functions as Argo, were set up at the Chittenden Locks in Ballard (Seattle), and at Spokane and Pasco. One particularly interesting salvage job was done at Pasco after the Japanese surrender. Quarters for MacArthur's occupying forces were being set up in Japan. Seattle District received orders for 20,000 space heaters. New heaters were unobtainable in time to meet the order; however, great numbers were salvaged from installations that were being deactivated in Alaska, Canada, and the U.S. These were collected, examined, repaired as necessary, packed, and shipped to Japan. Skilled repairmen were furnished by local electrical and heating contractors.

Seattle's location in the great Northwest timber country made it a principal source of supply for lumber shipped to war theaters throughout the world. The demands of the shipbuilding, vehicle and armament industries had created great scarcities in steel and, indeed, all metals. Therefore, wood construction was substituted for metal to the greatest possible extent. One expedient exploited by the District was prefabricated, portable buildings (Pacific Hut and Tropical Hut, plywood and timber variations of the Quonset Hut design). They had the advantages of assembly-line production, special insulation and reinforcement against extremes of weather, compact "nesting" of the panels for shipment, and rapid erection by any available labor, using a minimum of hardware that was packaged with each unit. Thousands of these buildings were produced in local shops and shipped to troops on all continents and island stations. They are still in demand for use at outposts such as the DEW (Distant early warning) line; Thule, Greenland, and Antarctica.

At the beginning of the national defense program in 1939-40, Western Defense Command had no engineer troops organized and equipped for duty. The two units sent to Alaska in June and July 1940 were under-strength and but partially equipped. Seattle District supplied these units, and those later organized, with construction equipment suitable to their missions. Engineers had first used heavy duty, powered equipment in World War I when four-wheel-drive trucks and crawler-mounted tractor units and tanks demonstrated their ability to cope with the mud of France. In subsequent years the diesel engine and caterpillar tread designs were much refined. Their application to bulldozers, mobile cranes, trucks, scrapers, loaders and numerous other materials-handling machines had, by World War II, revolutionized construction methods.

The difficult but indispensable roles of machines in the war, particularly in the far North, are illustrated by accounts of the men who used them. Lt. Colonel James Truitt, Executive Assistant to the District Engineer, Seattle, made the survey for a Trans-Canadian-Alaska rail route from Prince George, British Columbia, to Fairbanks, Alaska.12/ Survey crews and supplies were moved through the wilderness by tractor trains consisting of crawler power units pulling wagons or sledges, including "wanigans" (skid-mounted cook shacks and sleeping quarters). In swampy, muskeg areas the equipment broke through the surface and became mired. Stream and lake crossings were made on crude rafts, or

12/ Report dated 15 May 1942. File SE 7559 (Trans-Canadian Alaska Ry.) The railroad was not built, but much of the information supplied by Truitt was used in locating the pioneer ALCAN Highway.

rges built on the spot. Sometimes these were upset by rapids or orms with resulting loss, damage, or delay. Heaviest hauls were heduled, so far as possible, in freezing weather when ice and frozen ound might support the loads, but this also wrought special hardships men and machines.

An air compressor furnishing air to drive the rock drills in the ittier cutoff tunnel failed due to extreme cold weather. When bitter ld weather struck, the compressor was shut down by its governor. though compression heats the air, moisture from the air had condensed d frozen solid in the receiver tank and discharge line. Both heating d insulating of the machine, tank and pipe lines were necessary before rk could continue. In view of such experiences, normal practice was run diesel motors continuously when temperatures were low, whether not the machine was in use. To shut down was to invite trouble in starting, as the entire apparatus had to be carefully reheated to ften congealed lubricants and fuel, thaw the ice from running gear d raise cylinder temperatures to the firing point.

Efficient operation and maintenance of complex construction mach-ery under abusive conditions required thorough training and organized rvicing. An Engineer Mechanical Advisory Service was established by e Seattle District supply people at Fort Lewis and at the Aviation gineer School, Geiger Field. Twenty-five factory-trained instructors d approximately 1,000 units of powered equipment representing all pes used in the field were provided as training aids. Thirty-eight mmercial repair shops in Spokane, Seattle, Tacoma, and Olympia were ntracted as maintenance bases. As work proceeded at far-flung troop nstruction sites, mechanics trained by the Advisory Service performed e routine servicing, parts replacement, and minor repair of equipment the field. Machines requiring major overhaul beyond the capability field facilities were returned to the commercial contract shops for habilitation and redistribution to Engineer depots.

nouflage

Fortunately, the elaborate camouflage measures developed by the attle District never had to meet the test of enemy bombardment and erefore may be recalled only as an expensive but essential experiment. vever, in the dark days immediately after Pearl Harbor, it would have en worth many times the effort and funds expended on camouflage search to have had available the resulting knowledge of effective thods. As it was, the benefits of camouflage could not be fully alized due to the valuable time that necessarily was lost in develop-g the art.

The Camouflage Section of Seattle District was organized under the gineering Division in January 1942, when air attack on the Pacific ast seemed imminent. Pacific outer defenses of land, sea, and air re in ruins, enemy submarines were taking sporadic if inaccurate pot-ots at the coastline from Vancouver Island to Santa Barbara; convoys moving to Alaska and Hawaii were stalked by undersea raiders, and San Francisco and Los Angeles were subject to air-raid alarms. Puget Sound shipbuilding and Boeing airplane manufacture were hurrying desperately to restore combat capability. They could not be interrupted. Unfortunately, Seattle District military and industrial installations, like those of the entire West Coast from Alaska to Mexico, had been constructed in concentrated groups for training and peacetime operations only, rather than being dispersed for survival under fire. Protective concealment of these centers from aerial observation and attack therefore demanded urgent consideration.

The criteria adopted for development of camouflage techniques were: (1) that the characteristic features of critical areas and structures, including location, configuration and coloring, be so obscured or disguised as to prevent identification from the air; (2) that the materials used be light and strong enough to avoid overloading of structures, durable and consistent in appearance under the ambient conditions of exposure, readily procurable, and rapidly placeable.

From a nucleus of four (a structural engineer, two architects, and a landscape architect), the number of employees working on camouflage increased with the volume of work to a peak of 38. The diversified types of work required that personnel be selected from specialized fields. Eventually there were 13 architects and architectural draftsmen, eight commercial artists, seven landscape architects, five engineers, one agronomist and four clerk-stenographers in the Section.

Because air-camouflage was a comparatively new field, considerable time was required for development of techniques before actual work could be placed. Aside from initiating primary tonedown and blackout measures on vital military facilities and assisting or advising other agencies and industry, including the Federal Housing Administration, oil companies with storage tanks, and shipyards on matters pertaining to dispersal and concealment, efforts during the first year were of a training and experimental nature. Four members of the Camouflage Section attended the Corps of Engineers Camouflage School at Fort Belvoir, Virginia, and they in turn assisted Air Corps representatives in putting on short camouflage courses for District military and Area Engineer personnel. Members of the staff also participated in a 10-week camouflage course conducted by the Office of Civilian Defense at the University of Washington.

From the outset, the Boeing plant and airfield were recognized as the most critical areas in the District so far as danger from enemy attack was concerned, and should therefore have the highest priority in camouflage. For some time, the magnitude of the project appeared so discouraging that the District Engineer recommended to higher authority that the installation, which could not be completely concealed, have protective obscurement measures of the Boeing plant limited to "tonedown" only.

While awaiting decision as to the advisability of attempting concealment, the Camouflage Section proceeded with preliminary studies. On recommendation of Captain O. S. Larabee, whose services were requested from the Engineer Board at Fort Belvoir to assist in preparation of Boeing camouflage plans, a scale model of the plant was constructed by the Kai Jorgensen Studio of Los Angeles for use in the studies.

During this early stage, Captains John Detlie and M. F. Brown joined the District Camouflage Section. Both brought impressive qualifications to the job--Hollywood art directors' experience in the practice of visual deception, and engineering and architectural professional degrees. Detlie provided the necessary enthusiastic guidance and Brown the practical approaches to the Boeing problem. Once a workable plan was conceived, the energies of the entire section were devoted to developing the details.

The task of translating the scheme into contract drawings was divided among four phases: The Seattle firm of Young and Richardson, selected as architect-engineers to design structural camouflage work on the Boeing plant; a model shop, established to facilitate study of visual effects from all angles; an experimental field area devoted to techniques of application and construction; and a planning unit consisting of one group detailed to concentrate on the Boeing plant in collaboration with Young and Richardson, and another group to prepare general camouflage plans for airfields and military installations within a critical zone, assumed to extend 200 miles inland from the Coast.

Camouflage plans were completed for Boeing Field and plant, Paine Field, McChord Field, 9 other airfields, 11 aircraft warning stations and miscellaneous gun batteries, transmitter stations and cantonment areas. Due to improvement in the military situation, some of the plans were not fully implemented, but all permanent AWS stations were camouflaged, as were gun batteries at Partridge Point, Fort Casey, Fort Flagler and Point Brown. Secondary camouflage measures were completed at McChord Field and some camouflage work was accomplished at Paine Field, but most of the airfields received only tonedown treatment.

The major projects at Boeing plant and Field were approximately 75 percent completed as originally planned. As shown by photographs taken in November 1943, the extent of the work done at Boeing was sufficient to demonstrate that complete camouflage would have been entirely possible if conditions had warranted completion.

Several interesting techniques were developed in the course of the District's camouflage studies. It was necessary to devise various types of surface textural treatments that could be applied to simulate entirely different features. After considerable experimentation, five textures were adopted, of which two were particularly good for airfield use. The texture applied to paved areas subject to airplane traffic was made of finely crushed rock rolled into a bitumal adhesive, while a coarser texture used on nontraffic areas consisted of wood chips with some cement added to the bitumal. When painted with disguising colors and outlines, these textures proved highly convincing from the air.

Another effective development was installation of vertical wood slats, similar to venetian blinds, placed on four sides of the flat dummy buildings. The outside faces of the slats were painted the desired sidewall color, while the backs were painted to match ground colors, so that from oblique aerial observation, the sidewalls on the approach side appeared in third dimension, while those on the opposite side of the buildings simply appeared to merge into the surrounding landscape.

Also, a collapsible tree was devised for use in screening seacoast fortifications. Although never put to use because of the changed tactical situation, the design was perfected. The tree was a 30-foot pole with garnish that slipped up or down. The pole was hinged at the butt to fold out of the firing line.

Possibly the most effective tribute to District camouflage projects was the frustration experienced by incoming pilots in locating the runway at camouflaged Boeing Field.

Real Estate

When the construction functions of the Quartermaster General, including real estate acquisition, were transferred to the Engineers, the North Pacific Division at Portland fortunately had people trained and experienced in this business. They had bought the land for Bonneville Dam and Reservoir. The Division undertook extensive real estate operations for the entire jurisdiction of four Northwest States and Alaska. To Division real estate people were added those transferred from the Quartermaster Corps, and appraisers, negotiators, and title examiners recruited from Federal Land Banks, Federal Housing agencies, Bonneville Power Administration, and commercial agencies. A Division real estate suboffice was established in the Lloyd Building, Seattle, early in 1942 especially to acquire the leases, easements, and outright real estate titles necessary for Air Corps and other Army programs in Seattle District. Although the suboffice was not a direct part of the District, its work necessarily was directly associated with and dependent on District activities. The suboffice became a part of the District organization after the war; hence its brief inclusion in this narrative.

While the mad scramble of the using services for facilities continued into 1942, the Office, Chief of Engineers (OCE), prepared manuals of procedure for the planning, design, real estate acquisition, and construction of facilities. In bare outline, the procedures contemplated initial justification of need by the using service; joint planning by the latter and the Corps; detailed design by the Corps; then allotment of funds and issuance of concurrent directives by OCE for construction and for acquisition of the necessary real estate. The manual of regulations to govern the acquisition of property rights by the Corps was compiled by John Walker, a brilliant young title attorney who had done the same job for Bonneville Power Administration (BPA). Walker previously had been trained in the land acquisition program of the Tennessee Valley Authority, then was "borrowed" in 1940 by Dr. Paul J. Raver, Administrator of BPA, to untangle knots in transmission line right-of-way activities. The original real estate manual prepared for the Corps was a masterpiece of legal detail, but was more properly applicable to deliberate operations under normal conditions. Consequently, the manual was voluminous, rigid, and time-wasting in its requirements, allowing little local latitude to meet kaleidoscopic shifts in emergent situations. Additions and revisions of the regulations to fit all occasions followed in a flood so great that the suboffice staff could not even read them, much less absorb all their ramifications, if other work were to be accomplished. So an able secretary was assigned full time to the task of digesting the changes and daily briefing the staff on current ground rules.

For the greater part of 1942 and well into 1943, the real estate suboffice was swamped in the effort simply to stem the daily deluge of crises. Many of these were hardship cases arising from evictions without the compensation that would permit occupants to relocate. At times the District Engineer received construction directives without corresponding authorization for the suboffice to acquire necessary real estate rights. In these situations, shortcuts and individual discretion were necessary. As a rule, permits of entry were solicited by the real estate people pending formal conveyance in order that urgent work of the District not be delayed. Some notable incidents resulted.

On one bitter, wet, winter day just before Christmas, a young couple came into the real estate suboffice and announced their intention to stay while their baby was born because they had no other refuge or money. They had owned a small acreage adjoining a commercial radio station taken over and enlarged for the Alaska Communications System. The expansion had absorbed their property. Finding a suitable place nearby, they made a down payment and moved in while awaiting compensation for their former home. None came, and they were dispossessed for failure to meet contract installments. Twice more they relocated and were evicted for lack of funds, no payment for their first home having been received. With the last eviction and a baby coming, they were now in desperate plight. The Army was responsible, they announced, and they were its problem. Obviously they were--and soon would become a crisis. Quick consultation with the title attorney disclosed that all steps preliminary to payment could be accomplished rapidly, but the necessary voucher probably could not be obtained from OCE for weeks.

By recorded telephone call to Washington, D.C. the attorney obtained verbal (and explosive) authority to issue a voucher against "any...funds you can lay your hands on." He did so, called a cab, took mother to a hospital, father to a bank and then a hotel. Thus was averted a repetition of the first Christmas scene. George Coryell, later with the District and now retired, was the wise man who brought gold in homage to the infant.

This little drama illustrates the critical nature of the Government's public relations in wartime real estate operations. Although condemnation proceedings were avoided when possible, military necessity often required immediate action. Most friction with property owners resulted from sudden seizure and slow settlement during the early months of the war. That complaint largely was eliminated by the Second War Powers Act of 27 March 1942 (56 Stat. 176) which, with subsequent amendments, permitted the Government to file with the Federal Court a Declaration of Taking containing a perimeter description of the property (perhaps a block of many tracts), the imputed ownership of each tract involved, the appraised value of each right sought, and a statement of necessity (but not the reasons therefor) by the Secretary of War. The amount of the appraisals was deposited with the Court, after which the Court was to issue an Order of Possession and each owner could withdraw 80 percent of the amount deposited to his account. Procedure then moved through final perfection of the tract descriptions, proof of title, and negotiation or adjudication of the remaining just compensation.

The Second War Powers Act effectively expedited the acquisition of properties for military use while protecting the rights of owners, where price and reasonably prompt payment were the principal issues. But it was to be tested severely in cases involving properties that constituted operating bases for commercial enterprises claimed to be essential to the war effort. Among these were hotels and warehouses in Seattle, filled to overflowing with activities engendered by the war. Three hotels were taken over--the Frye as headquarters for the 4th Fighter Command of the Air Corps; the Stratford to house Women's Army Corps; and New Richmond, to become a base hospital in support of the Aleutian campaign following the Japanese invasion there. Numerous warehouses were taken; two were railroad transit sheds and another was a storage building adjoining the Seattle Port of Embarkation.

The latter became a famous test case. After Declarations of Taking were filed, the Federal Judge delayed issuing orders of possession while he weighed the relative necessity for use of the properties by the Army against the need for essential services to the community. The Army could not wait; it ordered immediate possession, by force if necessary. The owners having refused to yield, the chief of the real estate suboffice was detailed a squad of provost guards and moved in. There was no physical conflict, but the owners sought to have the responsible Army officials held in contempt of court for interfering with legal process. With mixed feelings of flattery and fear, the minor civilian official found himself named as a defendant, together with the illustrious Secretary of War, a General, and a Major. The U.S. Attorney General sent a brilliant young assistant to present the defense. His presentation consisted of such a fiery denunciation of the court "for impeding the war effort" that it nearly landed the attorney himself in jeopardy, along with the defendants. Eventually the Circuit Court of Appeals ruled for the Government and nobody went to jail. Meanwhile, the suboffice team that inventoried the warehouse when it was taken over found themselves divided on the original question, to wit: How essential to the service of the community was this warehouse? They found the contents largely to be choice bonded liquors!

A book could be filled with anecdotes of such adventures and misadventures. Some were dramatic, many merely comic, while some cannot be told, even now. Security leaks were discovered repeatedly. An appraiser, viewing property acquired for a secret installation, would find the whole neighborhood aware of the purpose. Classified material went astray in the mail--in one instance a complete layout of the harbor defenses of Puget Sound. On another occasion, an elaborate underground command post overlooking the Strait of Juan de Fuca was found to have been abandoned, left complete with fire control data, ranging instruments and all, wide open to casual entry.

Incidents with international ramifications attended the development at Prince Rupert, B.C., of a port through which military supplies, delivered by the Canadian National Railway system to its western terminus, could be transshipped to Alaska and the Pacific theaters of operation. A contract change order by Seattle District on a warehouse layout had extended construction across the village bowling green. The populace was greatly upset. Bowling on the green was about the only outdoor recreation left to them by the local conditions of climate, geography, and wartime restrictions. Furthermore, as learned by the investigator dispatched to the scene, the construction of a proper bowling green was a science and an art that required at least two generations of loving care to bring to perfect flower. The offending warehouse was foreshortened; the resident engineer and contractor received a quick indoctrination in bowling green restoration, but "losh mon, 'twere nivver sae guid as th'oud."

The civilian investigator en route to Prince Rupert had carried a list of additional lands needed for the District's port construction, for which he was to negotiate while there. He soon found himself confronted with a general reservation of lands for the use of a project called "Canol." Trying to ascertain the extent of conflict between the requirements of the port and Canol, he encountered a survey crew who readily showed him maps of the whole Canol scheme. Later he was visiting with Colonel Park, Division Engineer, and an officer whom the Colonel had brought to Prince Rupert to ensconce as Commanding Officer of a temporary district for port construction. The new officer had heard the name Canol and asked the Colonel about it. He got no reply then, nor when he repeated the question. Seeing his embarrassment, the civilian started to describe the Canol project, but got only as far as the word "oil" when the Colonel hissed, "Silence! That's top secret. Don't let it pass your lips again!" Melodrama and pathos, that strictest security could be penetrated so easily and so innocently. How easily it can be pierced by the intent of professionals has been demonstrated too often since. But enough of real estate reminiscences! Suffice it to close with the observation that thousands of transactions were completed in close cooperation with the District Office, without any really disastrous obstruction to the war effort or irreparable damage to public sensibilities. Soon after World War II, the real estate suboffice was transferred to the District organization, and has since efficiently disposed of war surplus properties for two hot wars and a cold one, and acquired extensive new requirements for civil works.

Fortifications, Strait of Juan de Fuca

Many harbor defense forts were incomplete when the Japanese withdrew from the Aleutians and altered the strategic situation. Most of the fortification work done in Alaska by the District was structural, in connection with Naval bases. The District's largest fortification job was in Washington along the Strait of Juan de Fuca, the sea entrance to Puget Sound.

The old forts on Puget Sound--Worden, Casey, Flagler, and Lawton--built during the first years of the District's existence, were of no value as harbor defenses against the weapons of World War II. As real estate, equipped with utilities and housing plus new, temporary-type structures, they served as training and staging bases for various troop units during the war. But General Cunningham, commanding Harbor Defenses of Puget Sound, wanted some BIG guns. He planned batteries of 16-inch Naval rifles--the biggest on any U.S. battleship--to be mounted underground in the bluffs of Striped Peak and Cape Flattery overlooking the Strait of Juan de Fuca.

This would be a big job. Seattle District designed and supervised the construction, as far as it went, of the whole project. Striped Peak was elaborately tunneled, galleried, and chambered to provide living quarters, ammunition magazines, and gun emplacements which opened on the face of the bluff above the water. All of this installation was completed, except for mounting the guns. Only one of them was in place when danger of a Japanese naval attack on Puget Sound had passed; the project was suspended. At this juncture, the gunners were making final adjustments preparatory to testing the gun. Whether they were officially apprised of the change in orders or disregarded them has not been revealed. Perhaps they thought the war was over and wanted to celebrate. Anyhow, they fired one round across the Strait toward Victoria on Vancouver Island, which was barely out of range. Victoria is said to have been considerably shaken by the explosion of the great shell just off the harbor entrance. There is no documentation of this affair--only verbal accounts from several "authoritative sources," as the newsmen say--so this parting shot must be considered just another interesting anecdote of the war.

A fully verified parting shot was taken by the construction crew at the Cape Flattery Fort. When the order came to terminate the work, they had just prepared to place the first concrete. Access roads, water supply, sewerage, and powerlines were in; deep excavation of the Cape's solid basalt rock was complete and ready for concrete lining; aggregates had been crushed, graded, and stockpiled beside the batch plant. To see their long dreary efforts aborted by the termination order, without any constructive evidence of their labors, was a frustration made tolerable only by the prospect of immediate release from Flattery's perpetual drizzle. This crew celebrated, and were inspired to erect an enduring monument to their sojourn. They knocked together a cubic-yard form in a prominent place by the Resident Engineer's shack, mixed and placed therein a small batch of concrete and added a free-form sculpture by seating the office stenographer firmly in the soft surface. Her personal impression of the proceedings is not recorded, but the very personal impression of her contours is a record that has interested visitors to the Cape ever since.

About midway between the proposed gun positions at Striped Peak and Cape Flattery, an underground fire control center was completed. This was the station mentioned earlier as having been found by a real estate official to be evacuated without removal of any of the fire control data or equipment. That probably didn't matter much from the standpoint of security, as the whole harbor defense plan was dropped shortly thereafter. But it certainly worried the young lieutenant who had been detailed to oversee the evacuation. The real estate man thought he should report the overseer's oversight to someone, so he confided what he had discovered to his friend, the Post Engineer Captain at Fort Worden. The Captain knew immediately that the culpable officer was a friend of his and excused himself briefly to impart the hideous facts to the lieutenant. The latter was reported to have blanched, mumbled thanks for the private tip, and streaked westward in a Jeep to salvage the remnants of his post and, hopefully, his career.

Another feature of this harbor defense scheme was a large communication and data transmission cable connecting all stations from Cape Flattery, 100 miles westward, to Fort Worden. The Signal Corps engineered this installation, using new equipment they had devised: a large plow pulled by a team of powerful crawler tractors. The plow opened a trench; a cable reel on the plow chassis fed cable into the trench and a pair of blades at the rear, mounted at ground level in a V form, scooped the windrows of loose dirt thrown up by the plow back into the trench, all in one continuous operation. This rig could move along at about the pace of a slow walk, except when stumps or rock interfered.

The Signal Corps requested the Corps of Engineers to obtain rights-of-way for the cable line in absolute secrecy. Obviously, secrecy could not be preserved if a multitude of easements, whose legal descriptions covered a continuous strip of land 100 miles long, were taken in the name of the United States and publicly recorded in the county courthouses. Therefore, the Pacific Division office of the Corps of Engineers made arrangements with a trust company to act as agent for the Government and be named as grantee on the easements. The plan was to record the easements to convey good title, backed by an unrecorded trust agreement under which the company would transfer the easement rights to the Government, and Corps real estate people would negotiate the easements in the name of the figurehead trustee. It was a grand plan, except that the negotiators drove conspicuously labelled Government cars; local landowners already were aware of fortification construction and cable laying in progress along the south coast of the Strait, and by consultation among their neighbors (as always when approached on a deal affecting many) soon had conjectured the whole layout.

The Corps real estate people realized that local secrecy was nonexistent, but they felt also that there was little likelihood of deliberate espionage by landowners. In any case, nothing could be done about that. However, something could be done about making a public record of the cable location. The easements were simply accumulated in the office and not recorded. Presently, the whole project was terminated and declassified. The cable system eventually was sold to a telephone company.

Termination in mid-course of the construction contracts for the Strait's fortifications required long negotiation with the contractors. Major William Hoy of the Seattle District staff spent about two years negotiating the settlement of millions of dollars in claims.

The Manhattan Project

Development of the atomic bomb and its devastating effects on the cities of Hiroshima and Nagasaki are generally credited with the Japanese conviction of defeat and their unconditional surrender. Construction of the vast Hanford Works at Richland, Washington, for the conversion of uranium ores to atomic explosives by Engineer officers of the Manhattan District under the direction of Major General Leslie Groves has become an epic of military history, in which the supporting role played by Seattle District merits mention.

Seattle District aided the Manhattan District in many areas of normal activity as well as in special areas of extreme importance. Assistance was given on the highest priority level in the planning, design and construction of the Hanford Works. Seattle District provided help in all phases of the initial site investigation, including topographic and foundation studies, transportation, water and power supply, communications, climatology and property ownership. During the design phase by the DuPont Company, assistance was given in the location and design of all structures in Area 100, including power, river intakes, cooling basins, effluent discharge, fish screens, and instrumentation.

During construction, regular progress and safety inspections were carried out from the air and ground, and reports were made to the Commanding Officer. Inspections continued into the plant operation phase to insure acceptable radiological conditions on the land, in the air, and in the water of the Columbia River. Monitoring of the Columbia River was supervised from 1943 to 1946, when the Atomic Energy Commission began operations.

A special research project at the University of Washington, with Dr. Lauren R. Donaldson as Director, was started in 1943 to determine the biological effects of gamma radiation insofar as it pertained to the Hanford project and the Columbia River basin and its population. A parallel laboratory project also was established in 1944 at the Hanford plant to accomplish similar objectives, plus studies of the effects of heated water and chemicals on fish and other river wildlife. All activities and reports on the University of Washington work were coordinated by, and programmed through, the Seattle District.

Assistance was given also in the following ways: land acquisition; procurement of labor, lumber, steel, and critical equipment; security surveillance; public relations; public health; meteorology; procurement of medical equipment and personnel; radiological research and microphotography. Mr. Hanford Thayer of the Seattle District served as a consultant to the Manhattan District from 1943 to 1946 and to the Atomic Energy Commission from 1946 to 1956. He was primarily responsible for all of the above activities, except initial site investigation, land acquisition, and routine procurement.

Interesting and colorful incidents occurred during the 1943-46 period when stringent secrecy was imposed on all significant project information. An embarrassing incident occurred as Colonel Hardy took command of the Seattle District. The Colonel naturally expected to see correspondence to or from Thayer regarding the project. The special security regulations imposed on the project forced referral of the Colonel's request to higher authority, namely, General Groves. He denied the request.

Mr. Thayer's first visit to the University of Chicago, and meeting with Dr. Arthur Holly Compton and his project staff, was an impressive experience. Called "Dr. Thayer" by his conferees (among whom a Ph.D. was about the minimum degree) he stayed at a nearby guarded apartment and dined at the Faculty Club, also under guard. He was met by an unknown security man at the Chicago railroad station, checked the man's identification, watched him switch license plates, rode to the University through back streets, then participated in a week of intense discussions on project planning, design, and theoretical analyses with Drs. Fermi, Church, Failla, Stone, Wigner, and Greenwalt and other eminent nuclear researchers and engineers who were experimenting with the first atomic reactor.

Incidental to this assignment was exposure to high level security matters and acceptance by Dr. Stafford L. Warren, Chief of the Medical Division, of the recommendations for instrumentation and research into further biological radiation studies, utilizing trout and salmon at the University of Washington School of Fisheries and at the Hanford Works. Mr. Thayer assisted with the design of test facilities at the University and presented the first lecture to Dr. Donaldson's staff on "The Biological Effects of Gamma Radiation on Animal Tissues." This laboratory has been involved to the present time in radiation studies from the inception of the first unclassified "fake" contract with the Office of Scientific Research and Development, whose head was Dr. Vannevar Bush. Mr. Thayer, Dr. Warren, and Dr. Wenzel met Dr. Donaldson at the Carnegie Institution, Washington, D.C., to arrange the contract which specified studies by "gamma radiation for the control of common fungus," which then troubled our servicemen in the tropics and in Alaska. This pseudonym provided a plausible "cover" for the real purpose of the studies.

Another colorful activity was the monthly aerial progress photography and inspection of the multimillion dollar construction project at Richland. Leonard Fell, the Seattle District photographer, would brace his feet on each side of the aircraft door, hold his camera firmly, and nonchalantly shoot pictures nearly straight down as the plane was rolled 90 degrees.

In the course of Manhattan Project construction, a small but vexing crisis arose through the lack of telephone wire. Thayer located wire intended for the ALCAN Highway project and diverted the entire amount to Hanford, exercising the highest priority held under executive order of the President.

Thayer reported that he was followed constantly by security personnel and in turn assisted them in preventing security leaks in the Seattle area. The Federal Bureau of Investigation even reported to him on the activities of his wife when she was seen in a classified area of the project.

Throughout the two and one-half years of construction before the bomb was dropped on Hiroshima 6 August 1945, the secret of Manhattan Project was elaborately protected and successfully preserved. Some of the incidents in this connection are remembered by Seattle District people. A rule having been imposed that no uniforms be worn to the University of Washington, Colonel Stafford L. Warren, en route by train, had changed to civilian clothes except for OD shirt and paratrooper's boots. These caused him to be stopped twice and interrogated by security men before he could reach the campus. District personnel who speculated too persistently or pointedly on the purpose of the great activity that was apparent to all were sternly warned off. On the other hand, the inevitable rumors that circulated among the general public were fed adroitly with misleading hints while libraries and the press throughout the allied nations were examined for any references to atomic fission. Any such literature found was quietly impounded. Persons whose unauthorized interest in the subject was revealed in library records, technical articles, or public comment were effectively discouraged. In two known cases, military people were transferred to distant posts.

Summary of Military Projects

The number and variety of military installations accomplished by the people of Seattle District and its contracting engineers and builders during World War II are almost impossible to visualize. Practical limitations to the scope of this narrative preclude any attempt to fully catalog the individual installations. Moreover, complete records do not exist now. Among papers sent to Central Archives, and there disposed of, were most of the construction drawings. Fortunately, shipping lists carefully prepared and preserved in the District showed the project location or code name, and the structural subject and date carried in the title block of each drawing. From these lists it was possible to identify most of the projects roughly by categories according to their locations and functions, to determine the chronology of the jobs, and to get an idea of their magnitude from the array of component drawings (often hundreds of sheets) that went into each. These data are condensed in the following summary:

SEATTLE DISTRICT MILITARY CONSTRUCTION PROJECTS IN WORLD WAR II

Alaska, including the Aleutian Island Chain

68 Airfields
20 Aircraft warning stations (radar and radio communication)
17 Port complexes (supply, holding, garrison, staging, embarkation)
__ Harbor defense forts (numerous, not all completed)

British Columbia and Yukon Territory, Canada

5 Airfields
1 Subport of embarkation
1 Reconsignment and holding depot
1 Troop staging area

Major Surveys, Canada and Alaska

Trans-Canada-Alaska Railway location, Prince George to Fairbanks
ALCAN Highway, initial location and logistics support
Telephone line, Fairbanks-Nome-Teller

Northwestern United States

49 Airfields, in four states
15 Aircraft warning stations (Washington only)
21 VHF Stations, fighter control and direction (Washington only)
30-40 Separate military housing projects (Washington only)
1 Major port complex (Seattle)
2 General depots (Auburn, Seattle)
2 Ordnance and repair depots (Spokane, Mt. Rainier)
3 Air service depots (Tacoma, Spokane, Ft. Lawton)
1 Ammunition depot and port (Mukilteo-Tulalip)
2 Separate general hospitals (Baxter, Madigan)
1 Base hospital (New Richmond Hotel, Seattle)
2 Artillery and bombing ranges (Yakima, Ritzville)
2 Major camouflage (Boeing Plants, Renton and Seattle)
20-30 Miscellaneous special facilities
__ Harbor defense forts (numerous, not all completed)

The above tally is not precise because it is the product of arbitrary classifications and forced generalizations. For example: What is implied in the designation of a "project"? In many cases a project embraced a whole community, conceived as a complex containing every facility for the care and comfort of thousands of people: military and civilian; resident and transient; men, women, and children. Like any city, it provided food and water; heat, light, and shelter; sanitation and hospitalization; education and recreation; transportation and communication; police and fire protection; and overall administration, operation, and physical maintenance of all these facilities. In addition to these conventional services, of course, specialized technical installations to serve the assigned missions of the establishment were provided. In our inventory a large complex might constitute only one "project." Such were the installations at Annette, Umnak, Yakutat, Fort Richardson, Adak, Amchitka, Nome, Fort Raymond (Seward), Kodiak, Shemya, and many others in Alaska or the Northwest States, in greater or lesser degree. In contrast with the great bases, ports, and depots, a designated project sometimes consisted of only one structure, for example, a general hospital; a minor, single-purpose outpost accommodating only a few men, such as a remote radar station or satellite air field; or a supplemental facility. An effort was made to avoid duplications and omissions, and the inventory is believed to be a fair approximation. Altogether, some 300 separate locations in Alaska, Canada, and the United States were designated on the construction drawings for World War II military projects engineered by Seattle District of the Corps.

In August 1943, the Japanese withdrew from Kiska Island, terminating their 14-month invasion of the Aleutians. In the South Pacific, MacArthur was steadily forcing them back toward home bases. When there was no further threat of major attacks on United States territory, the construction of defenses was curtailed. By the end of 1944 the work in progress had been substantially completed--some 900 construction directives from the Chief of Engineers to the District Engineer, Seattle, had been accomplished at a cost of about $250 million. This amount covered stateside military construction only and did not include Alaskan construction.

Testifying to the successful prosecution of Seattle District's military mission, just three years after Pearl Harbor former construction sites presented a striking montage of war activity. Lend-lease planes were taking off from the Great Falls Army Airbase for Russia via Alaska, after being winterized for trans-Arctic flights and having the Red Star added to the olive drab paint. Hundreds of bomber crews, trained on the 2-mile-long runways of Moses Lake Air Base, were weaving their feathery traceries of contrails over all the globe. More than 8,000 civilian and military workers at the Spokane Army Air Depot were repairing "Memphis Belle," "Suzy Q," "Wash's Tub," and their sister bombers for return to the flak of battle. Hundreds of freight cars bearing burdens addressed to cryptic coded destinations shuttled along the 41 miles of trackage and the rows of warehouses at the Auburn Holding and Reconsignment Point. From the Seattle Port of Embarkation's vast transit sheds and piers, troops, and combat supplies flowed aboard ship for European and Pacific theaters.

The Mt. Rainier Ordnance Depot was rebuilding and servicing heavy equipment, tanks, and artillery weapons for re-use at home and abroad. Fort Lewis, the largest Army post of its kind on the West Coast, served a multitude of functions ranging from an Axis prison camp to a training center for Army Service Forces. Madigan General Hospital at Fort Lewis received Army wounded from the Pacific engagements while Baxter General Hospital at Spokane was mending the more severe casualties whose homes were in the West but whose wounds were from every battle in the war. Air transport planes, fighters, and B17 flying fortresses roared away from the camouflaged Boeing Field with intermediate stops at Annette Island and Yakutat, while lines of B-29 superfortresses moved to final assembly in the Boeing plants nearby.

With the end of hostilities in sight as 1944 closed, preparations were being made throughout the Military Departments for an orderly transition from a wartime to a peacetime economy. In the Seattle District, a Contract Termination Unit was organized and activated in July 1945. This unit, by June 1946, had closed out and fairly reimbursed contractors and suppliers on 250 military contracts and purchase orders with an original face value of approximately $2 million, thus freeing the facilities for participation in the normal economy.

After cessation of hostilities, special needs of the Occupation Forces of the victorious Allied Forces did, however, occasion special efforts in the district of a military nature. Lumber, plumbing, electrical goods, space heaters, and miscellaneous building supplies were procured in great quantities on practically an emergency basis and shipped overseas in the last half of 1945, principally for and to Asiatic countries.

PART 4 - POSTWAR CIVIL WORKS

Broad Aspects

Civil Works constitute by far the greater part of Corps--and Seattle District--activities, both in time and money invested. During the 23 years since World War II, the District's program has been far more extensive than in all the preceding period. Before these later accomplishments are described, the legal and technical bases on which the program was founded are examined, together with some of the engineering, economic, political and administrative constraints under which it proceeds.

Civil Works of the Corps of Engineers are those intended primarily to serve normal, peacetime needs as distinguished from military facilities. This distinction often is a matter of form more than of substance, for many a project designated as civil has supported war efforts, while many military facilities still serve the general economy. Examples are civil hydroelectric, harbor, and channel developments on the one hand, and military seaport, airport, utility, and housing facilities on the other.

In the early colonial years, civil works consisted mainly of navigation facilities--harbor and channel improvements and canals--although always there have been special assignments such as public structures, roads, and railroads.1/ As the nation grew, new fields of public service were delegated to the Corps by the Congress, but these remained predominantly directed toward the development, use, and control of water resources. Today the Corps of Engineers civil works program includes also the prevention or control of floods, water pollution, and beach, bank, or shore erosion; water supply for all uses; land drainage and reclamation; water-related recreation and conservation; civil defense, rescue and restoration where disasters strike; and such incidental work as the Congress has assigned by law.

Technology

The variety and magnitude of these activities demands the application of nearly every physical science. When the Corps does not have among its own people specialists best qualified to solve a particular problem or needs the objectivity of independent judgment, outstanding

1/ Annual Report, Chief of Engineers, 1915, Washington Aqueduct, Public Buildings and grounds, Yellowstone National Park, Crater Lake National Park, etc., pp 1648-1727.

consultants are engaged. Numerous technical laboratories are maintained, each with a staff of researchers who constantly advance the engineering sciences through study and experiment. The knowledge developed through these means is published in engineering manuals that are used as texts throughout the world. Actual construction of civil works designed by the Corps normally is performed by contractors, with field supervision by staff engineers. The resulting association on the job furnishes mutual familiarity with modern construction techniques and capabilities to which engineering designs can be adapted. Such coordination of technical skills is a tenet of Corps philosophy that has contributed much to its professional stature.

Economic Feasibility

Added to the technical aspects of civil works engineering are economic considerations which determine the feasibility of any proposal in terms of value received versus cost.2/ This is expressed as a benefit-to-cost (B/C) ratio, or comparison of the public benefits to be derived from the project to the annual costs of operation, maintenance, and return on the investment. It is simply an attempt to answer the question that faces any prospective purchaser, i.e., "Is it worth the cost?" The nub of the matter lies, of course, in the evaluation of benefits and the estimation of costs, as the accuracy of these figures determines the validity of the B/C ratio and the answer to the question of economic feasibility.

The history of cost-benefit comparisons goes back some 60 years. At first they were based on rough estimates and arbitrary judgment of the engineers. The preliminary report of the Inland Waterways Commission in 1908 discussed public benefits and costs in general terms and the necessity of multiple-purpose development of water resources, but did not refer specifically to B/C comparisons (Bibliography item 5). Other early official studies contained similar comments (Bibliography items 6 and 7). Since the inception of the "308" report some 40 years ago, economic analyses have become more complex, always requiring detailed analysis of benefits and costs, and often demanding consideration of multiple-purposes to be served by a single project, the interrelationship of such projects in a coordinated system of water management, and the combined net effects on the life and economy of a large region. The Act of 21 January 1927, which authorized the "308" investigations, specifically required such multiple-purpose and multiple-project considerations.

2/ The Flood Control Act of 22 June 1936 made "...improvement...for flood control purposes if the benefits...are in excess of the estimated costs..." a continuing activity of the Federal Government.

The scope of the plans and the unprecedented magnitude of the works contemplated in the "308" report of the 1930's challenged the professional interest of economists and engineers. Because of the depression, the country was rife with debate concerning the relief of unemployment through Government public works on the one hand, and the reduction of Government taxation and spending on the other. President Franklin Roosevelt branded the private power companies as "economic royalists" and set the Government in competition with them through the Tennessee Valley Authority, the Rural Electrification Administration, public utility districts, the Bonneville Power Administration, the Corps of Engineers, and the Bureau of Reclamation. The utilities people fought back and controversy raged through all the media of public expression. Congressional committees, learned commissions, professional associations, academic circles, political aspirants, commercial interests, conservation societies, labor organizations, social workers, and journalists ad infinitum joined the fray. Mountains of paper and torrents of oratory were produced relative to Government public works in general, and the civil works of the Corps of Engineers in particular. A sampling of these discussions is listed in the Bibliography attached hereto, for reference by any who may wish to pursue the subject further.

Much opinion was brazenly biased, as is inevitable in any great public debate. But much of it brought constructive thought to the real problems that beset the economic analysis of public works programs. As a result, the Corps and other public works agencies at all levels of Government have striven diligently to define sound principles and refine the techniques of economic analysis in reporting prospective civil works to the Congress (See Bibliography, items 8 to 24, inclusive). Much of this activity has involved the Seattle District, and has been reflected in the economic analysis, planning, and design of its major civil works projects since World War II.

Political Aspects

Congressional action is the final and completely controlling phase in the construction of any civil works by the Corps of Engineers.

Exhibit 7 shows the route of a typical civil works proposal through successive stages of study and action preceding eventual approval or rejection. As indicated on the upper left of the chart, a proposal usually starts with a request from a local community through its congressmen. Federal consideration of a major project may be petitioned by local groups for many years before the Congress decides to look into the matter. Construction of the Lake Washington Ship Canal and Chittenden Locks was promoted locally and actually was started at several times and locations by Seattle people over a period of more than half a century before Congress authorized the Corps of Engineers to participate.

PATH OF PROGRESS ⟷ CORPS OF ENGINEERS CIVIL WORKS ⟷ FROM CONCEPTION TO CONSTRUCTION

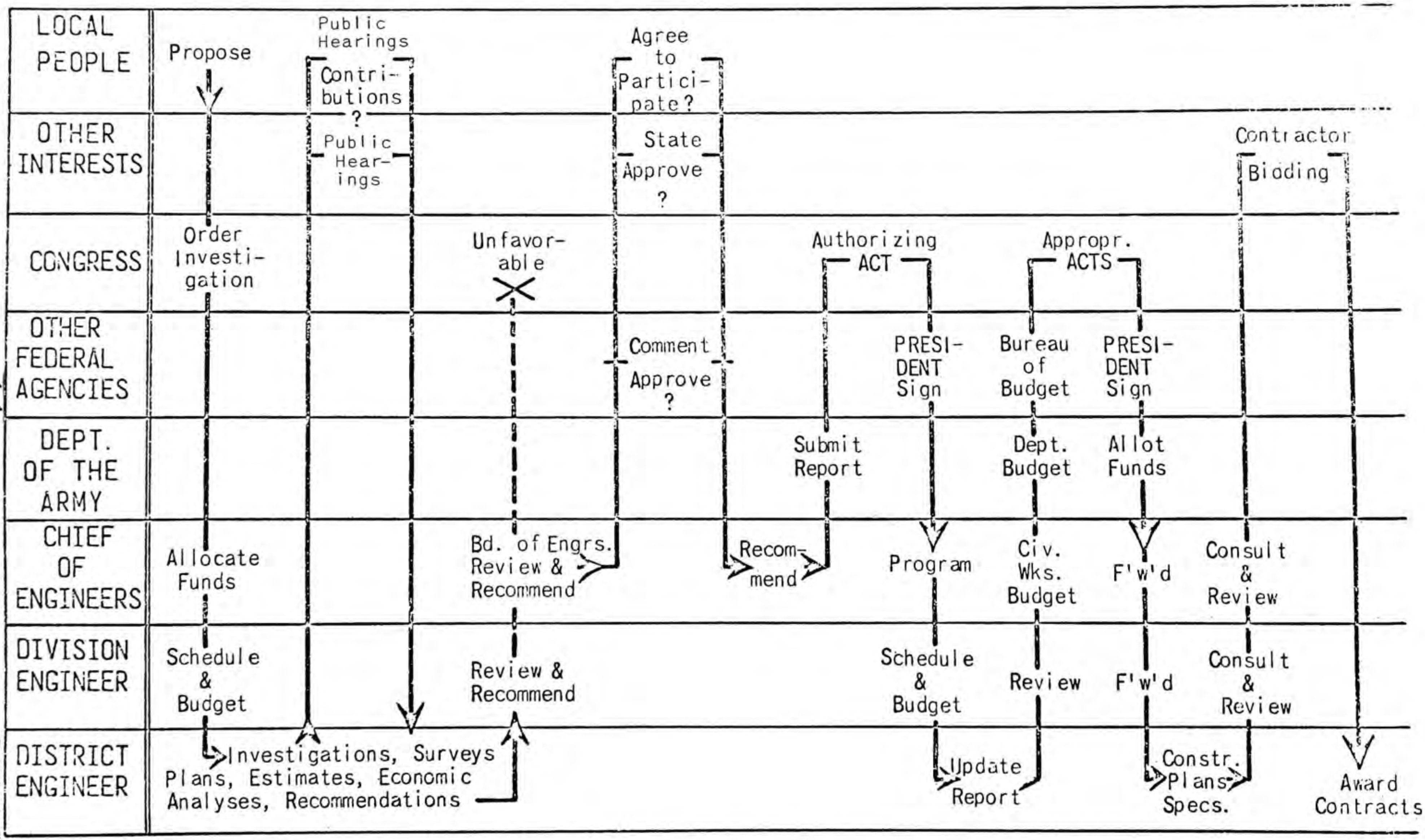


Exhibit 7

Of 248 published engineering reports on potential civil projects in the territory now served by Seattle District3/ during the 61 years from 1880 to 1941 4/ inclusive, only 70, or less than 30 percent, successfully ran the gauntlet from initial study by the District to actual construction. About half the investigations were dropped, without favorable action, on recommendation of the District. The other 20 percent of the casualties occurred during reviews by higher authorities--the Division Engineer, Chief of Engineers, Board of Engineers for Rivers and Harbors5/ or the Congress. Comparable figures cannot be drawn for more recent years, but it is safe to say that the ultimate survival rate among local requests for Federal civil works along the labyrinthine path from the initial proposal to actual construction still is low.

Administration

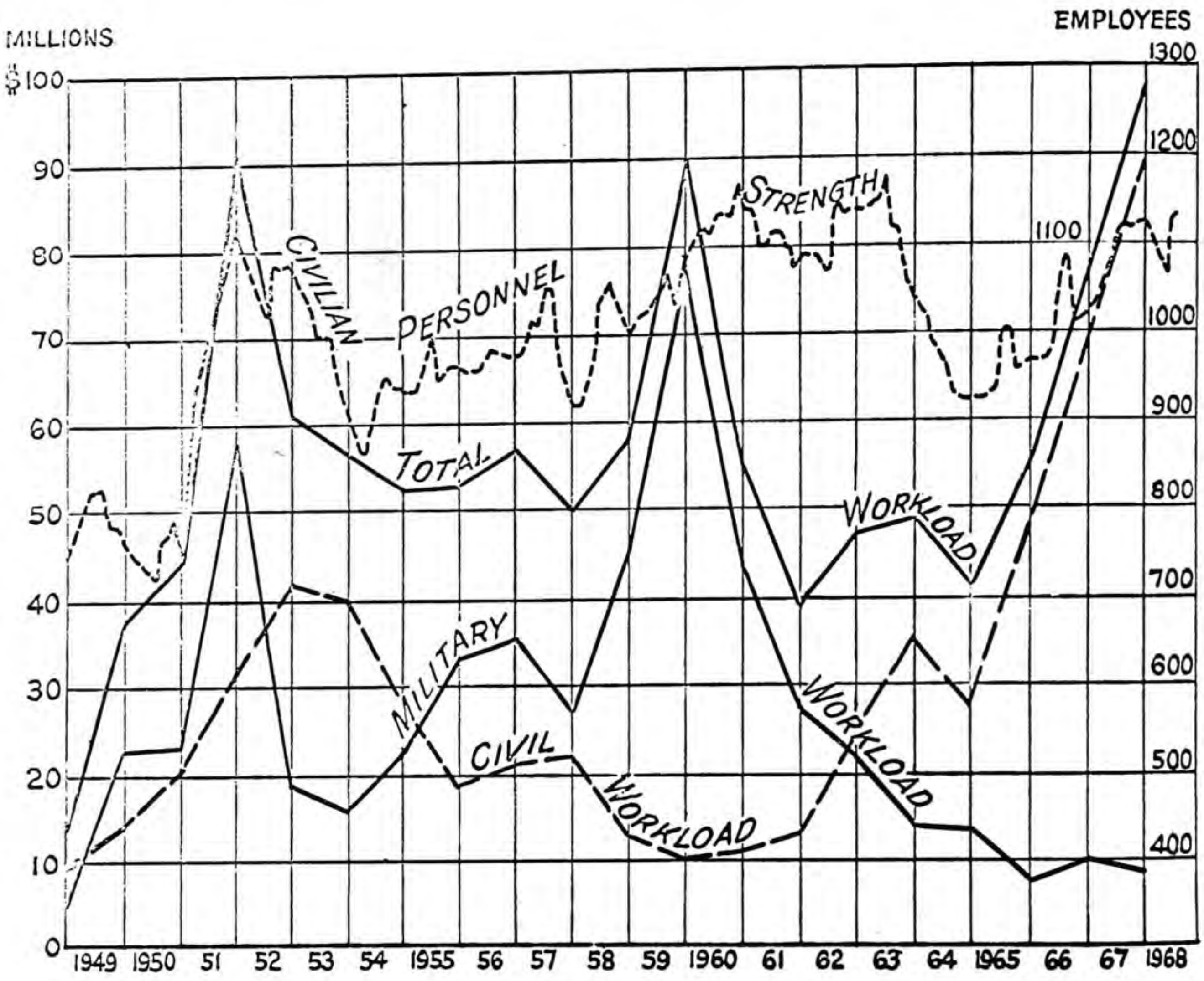
Corollary to the absolute control of Corps of Engineers civil works projects by the Congress and the President, firm planning much in advance of appropriations is difficult, either for the design or actual construction of a specific project. A firm schedule cannot be drawn with any assurance that it will hold, particularly if the project is large and requires several years to design and build. Even after such a project has been authorized by the Congress and approved by the President, no assumptions can be made about what times or in what amounts the funds for beginning construction or for successive stages of construction will be included in the President's budget, appropriated, and finally allocated to the local Engineer District for expenditure.

Nevertheless, while these necessary legislative and executive processes are pending, much planning and scheduling are essential, simply for the reason that a major construction project requires close coordination of effort among designers, contractors, subcontractors, manufacturers, transportation agencies, and all others who will contribute to the job. Such diverse factors as the manufacturers' minimum required fabrication times for component equipment; the probable times, durations and magnitudes of high water in a stream, or other limiting physical conditions; the vicissitudes anticipated in acquiring real estate; the responses of local interests, and a host of other considerations must be evaluated and integrated into schedules of time, manpower, and money, then constantly revised as events upset initial schedules.

3/ Excludes Alaska, which has been included in Seattle District during two periods of years, but now is not.

4/ Later years excluded, as formal reporting procedures have undergone transitions that do not permit carrying forward the early record.

5/ A technical review agency of eminent engineers, established by Act of Congress 13 June 1902. 32 Stat. 331.



CIVILIAN PERSONNEL STRENGTH

&

WORKLOAD

A crystal ball and dogged patience may become the planners' chief tools in this process. For example, at one early, critical period in the construction of Chief Joseph Dam, 24 alternative schedules, each involving interrelated operations of 104 construction contractors and equipment suppliers, had to be prepared in order to analyze the contingencies that would result from threatened, but unspecified, cutbacks in funds.

At Albeni Falls Dam, construction of the concrete spillway and powerhouse substructure was well along when an Executive Order threatened to suspend all work. Most of the mechanical and electrical machinery was under contract, either en route or soon to be delivered at dates firmly specified. Of course this raised large problems: whether and when work might be resumed; whether to terminate outstanding contracts with all the extra costs involved or to accept delivery of the machinery, then prepare it for indefinite storage, and build and operate suitable storage facilities. Careful cost estimates of the two alternatives showed that either would be far more expensive than going ahead with installation and completion of the project as previously scheduled. Fortunately, when these data were presented, the project was excepted from the stop order.

A significant consequence of the situation wherein work assignments of the Corps and each of its elements are determined almost entirely by external circumstances is a recurring "boom and bust" cycle. Exhibit 8 shows Seattle District's annual workload variations in dollars over the last 20 years. Average programs for the period were $26 million military and $29 million civil, or a total of $55 million for all work. However, annual programs have varied between extreme highs and lows by 28 percent of the mean for military work and by 27 percent of the mean for civil work. Although heavy and light programs for military and civil work did not coincide, and therefore somewhat balanced each other, the combined programs still swung through a variation of 152 percent of the mean. Expressed graphically, the chart shows peaks and valleys in Seattle District's total workload ranging from a low of $13 million in 1949 to $91 million in 1952 to $47 million in 1958; up to $89 million in 1960, $40 million two years later, and finally a high of $97 million for 1969.

Such wide fluctuations in the amount of work to be done from year to year would imply most undesirable--even unconscionable--corresponding cycles in hiring and firing of District employees to do the work, were it not for practices that substantially ameliorate such effects. The first, of course, is the practice of contracting construction and fabrication work to firms that bid, and have capacity, for the work. Another expedient is the "shopping out" of technical design work to competent consulting architects and engineers, or to other offices of the Corps, to meet peak workloads. Conversely, when its own workload permits, Seattle District performs engineering design and construction supervision for other Corps of Engineers offices. This interchange of jobs between units of the Corps permits all of them to match more nearly the technical capabilities and working strength of each to the work at hand, thus minimizing the hiring, firing, and disruption of organizations that otherwise would occur.

The total personnel strength of Seattle District through the last 20 years from 1949 to 1968 has been maintained at an average of 1,029 people, with a maximum of 1,190 or 16 percent above the mean in 1963 and a minimum of 730 or 29 percent below the mean in 1950. The extreme variation in personnel strength over 20 years, therefore, has been 45 percent of the average in contrast to the 152 percent variation in dollars of work accomplished.

Civil Work Done For and By Others

Among major engineering designs and related works accomplished by Seattle District for others are the following:

New England Division - The Hodges Village Dam on the French River, Massachusetts.

Huntington, West Virginia, District - Greenup Dam, Ohio River, and Design Memo for Big Darby Dam, Ohio River (never built).

Louisville, Kentucky, District - Markland Dam, Ohio River.

Far East District, Seoul, Korea - Rehabilitation of the Tidal Basin and Lock, Inchon Harbor, Korea.

Walla Walla, Washington, District:

80-mile relocation, nine bridges and station facilities, Seattle, Portland and Spokane Railway, and State Highway No. 8 along Columbia River, Washington, for John Day Dam;

All design, procurement, and supervision of construction on Lower Monumental Dam, Snake River, Idaho, except design of the powerhouse, fish ladder, and navigation lock; and 15-mile relocation, Union Pacific Railroad.

Panama Canal Commission - Alterations and rehabilitation of lock gates, conduits, valves, and appurtenances to permit periodic maintenance work without unwatering the locks.

North Pacific Division, Hydroelectric Design Branch - Architectural and structural designs of Little Goose Powerhouse on Lower Snake River, Walla Walla District.

Veterans Administration - Design, procurement, and construction supervision of veterans hospitals at Spokane and Seattle.

Portland, Oregon, District - Design Memo for Applegate Dam.

Alaska District:

Site feasibility studies, including geology, foundation and materials, for Rampart Dam, Yukon River.

Geology and seismology of the Seward, Valdez and Homer areas following the 1964 earthquake.

Grant County Public Utility District, Washington - Acquisition of real estate for Priest Rapids Dam, Columbia River.

British Columbia Government - Designed the successful method of removing, by tunneling and blasting, the dangerous, submerged top of Ripple Rock in Seymour Narrows.

Conversely, design work has been done by other elements of the Corps of Engineers for Seattle District. These jobs include design of the Federal Regional Center at Bothell by the Omaha District, the downstream fish facilities for Wynoochee Dam by Walla Walla District, and some of the highway relocations for Libby Dam by the Omaha District. Hydroelectric Design Branch of North Pacific Division designed Chief Joseph powerhouse on the Columbia and Libby powerhouse on the Kootenai River.

Review, Columbia River "308" Report

By 1944 the peak of the World War II effort was past. Anticipating the opportunity for other work that a decreasing workload might offer, the Chief of Engineers directed a review of civil works status. Many economists were predicting a severe postwar slump. Therefore, first attention was given those projects that promised the highest economic returns. As mentioned earlier, Bonneville and Grand Coulee Dams had been built on the Columbia just before the war, despite wide denunciation that they were extravagant folly. But time had proven their merits. From the beginning of their service, these great hydroelectric plants often operated above their rated capacities to generate sufficient power for the aluminum, ferro-alloy, shipbuilding, and other industries essential to the war effort that were drawn to the region by their special needs for abundant, cheap electricity. In view of transformation of the Northwest economy as a result of power development on the Columbia River during the war, the river's potential for further power development was selected as a promising field for study--specifically, a thorough review and updating of the old "308" report.

For the next few years, as engineers were released from military design duties, they were assigned to the Columbia River review study. After the war, there were up to 100 people engaged in this work in Seattle District alone. Seattle District was assigned the river and tributaries upstream from Pasco, and Portland District the lower river and tributaries. North Pacific Division coordinated the work between the districts, and with all State and Federal agencies and public or private interests that became involved in the planning. The Office, Chief of Engineers, furnished advisory assistance.

The original Columbia River "308" Report proposed a series of 10 dams on the main river between the Canadian boundary and tidewater, 5 on the upper reach and 5 on the lower. Of the 10, 3 already had been built: Bonneville Dam by the Corps of Engineers near Portland; Rock Island by the Puget Sound Power and Light Company near Wenatchee; and Grand Coulee, 85 miles west of Spokane, by the Bureau of Reclamation. Grand Coulee was the only prewar development that provided for seasonal water storage--about 5 million acre-feet. In the postwar review, the remaining seven of the original main stem sites were restudied and the plans revised. In addition, all tributary watersheds were studied, including the large segment of the Columbia Basin in Canada.

A prime objective in extending the studies was to locate favorable sites for storing floodwaters, the dominant importance of which, in any balanced plan of development, became increasingly clear as the study progressed. Pertinent to this study, therefore, is a brief description of the normal seasonal regimen of the Columbia, the resulting interrelationship of the various uses of water, and the mutual advantages to be gained from this relationship. These are fundamental to the economic feasibility that justifies comprehensive water resource development.

The Columbia drains a vast and varied region four times as large as the six New England states. The main stem descends through some 2,650 feet of elevation and travels 1,200 miles from its origin in Columbia Lake, British Columbia, Canada, on the western slope of the Continental Divide to the Pacific Ocean. The river discharges about 180 million acre-feet, or 8 trillion cubic feet, of water per year. This tremendous volume does not flow uniformly. Great floods occur in the spring when the accumulated snows of winter melt from Cascade and Rocky Mountain heights. At times, the spring flow of the lower Columbia has exceeded a million cubic feet per second. In winter, however, much of the precipitation over the drainage basin remains on the ground as snow. Normal runoff via the river system then decreases to as little as 50,000 cubic feet per second or less measured at the Dalles, trans-Cascade gateway to the Coast.

The natural, seasonal variation in flow severely restricts utilization of the water. This is where the benefits of storage reservoirs become evident. Excessive spring runoff can be impounded, thereby reducing the annual floods and their sometimes disastrous consequences. The stored water is retained through the summer, available in the reservoirs for irrigation, recreation, domestic, and industrial uses. As the natural flow of the stream decreases through the fall and winter, stored water is released to provide the desired flow downstream for power generation, navigation channel depths, fish and wildlife propagation, or other purposes requiring a controllable water supply. By the time the spring flood is expected, the reservoirs have been emptied sufficiently to contain the excess runoff and to repeat the cycle of storage and release for another year. Thus, regulation of Columbia River flow by means of storage reservoirs in a carefully coordinated system of river development serves several beneficial purposes to their mutual enhancement.

Work on the Columbia River Review Report proceeded for five years, 1944-48, inclusive. Before the full plan of development had been devised, studies showed that electric power shortages experienced in the Pacific Northwest during the war would continue and become more acute. No postwar business recession had occurred here. In fact, the influx of population and industry, with growing power demands persisted to the extent that the voluntary, wartime association of eleven private, municipal and Federal power systems in a Northwest Power Pool was continued. Through diversities in loads and generation characteristics, these producers are able to interchange their output over interconnections with the Bonneville Power Administration's regional transmission network and thus assist each other in meeting demands.

After the war, private utility companies investigated the possibilities of additional hydroelectric plants on tributaries of the Columbia, but they were not interested in developing further the main stem of the river. Neither the size of the commitments required for main stem dams nor large storage projects, whose benefits other than power production would bring them no revenue, were attractive to private capital at that time.

On the other hand, the Corps of Engineers review studies had brought forward several potential projects that would derive outstanding economic merits, from multipurpose functions. Two of these, Chief Joseph (originally Foster Creek) on the Columbia's main stem at Bridgeport, Washington, and Albeni Falls on the Pend Oreille River near the Idaho/Washington line, were in Seattle District. Chief Joseph would justify a generating installation of more than a million kilowatts. Albeni Falls, while having only small power potential at the site, would provide over a million acre-feet of storage capacity that would greatly increase the power output at 15 existing or proposed power sites downstream and also contribute substantial benefits to navigation, flood control, and recreation.

Accordingly, the District Engineer, with concurrence of higher authority, decided to submit interim reports recommending the Chief Joseph6/ and Albeni Falls7/ projects. Chief Joseph was authorized

6/ H. Doc. 693, 79th Cong., 2d sess.
7/ S. Doc. 9, 81st Cong., 1st sess.

by the River and Harbor Act of 1946 and Albeni Falls by the 1950 Flood Control Act. Final design of Chief Joseph was started immediately after authorization. By 1949, construction funds had been provided by Congress and the first contract had been awarded.

Chief Joseph Dam

Chief Joseph Dam was designed as a straight, gravity, concrete, overflow structure, the type and conformation of which were dictated rather definitely by the physical characteristics of the site. The left abutment of the dam (left riverbank, looking downstream) is a canyon wall of solid granite. The bed of the river is the same granite--excellent material for foundation. The right bank, however, is a high alluvial terrace composed of interbedded rocks, gravel, sand, and glacial till, which is a matrix of clay containing rocks and gravels. Such a mixture of nonsolids offered no adequate resistance to the lateral abutment-thrust of a thin arch dam--hence, the choice of a gravity section whose weight would be sufficient to hold it in place.

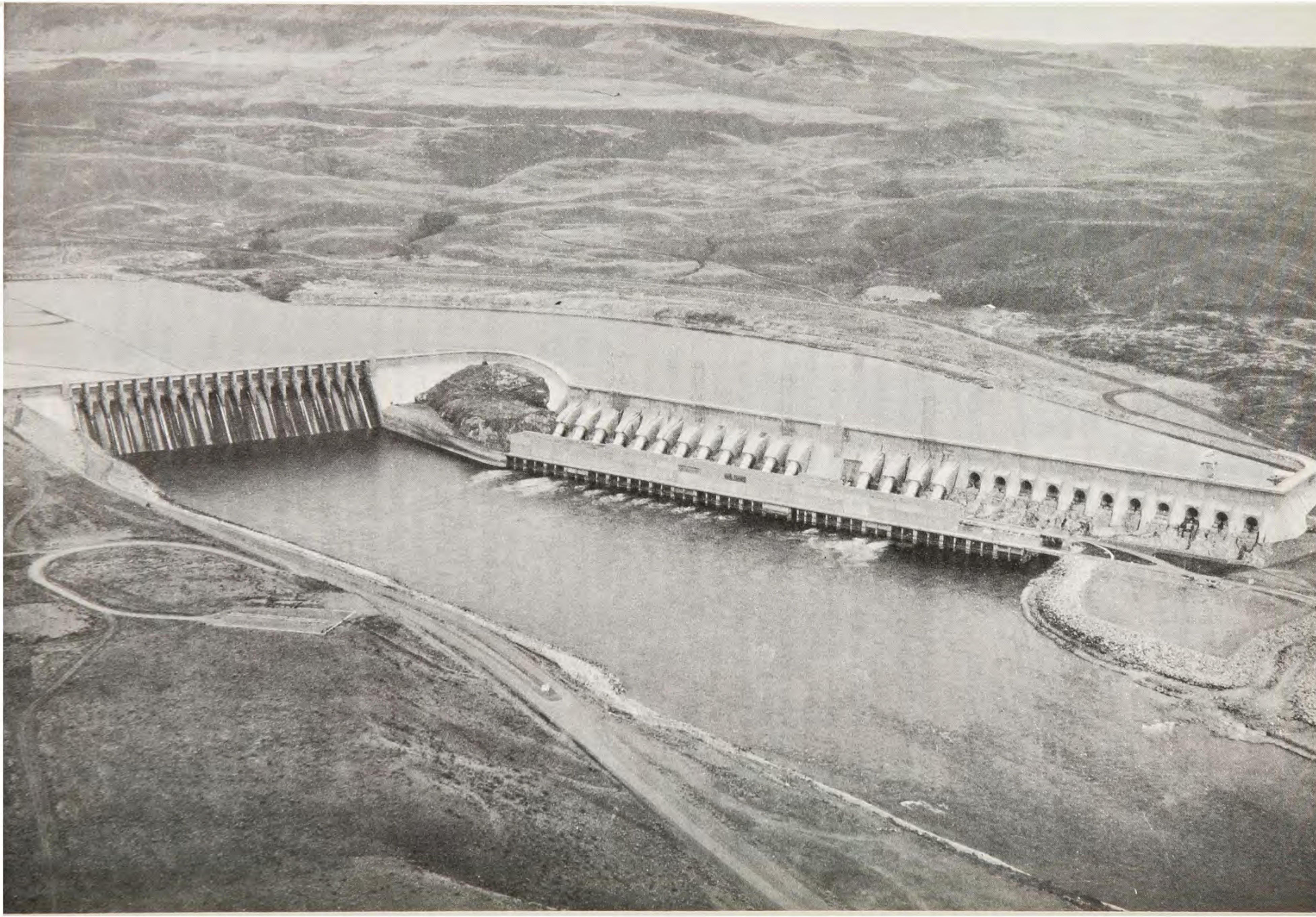
The right-bank mixed materials also were suspect because of the porous strata which might offer paths for excessive leakage around the end of the dam. To observe the amounts and routes of water movement through the right bank, many wells were drilled. Also, a horizontal tunnel was dug 1,020 feet into the bank at a point that would be just downstream from the dam, and a line of 22 relief wells was drilled from the tunnel floor to bedrock. Measurements of the water intercepted by the wells, i.e., water that flowed up into the tunnel and thence to the face of the riverbank, furnished data from which future leakage around that end of the dam could be estimated and means to reduce and/or control it, if necessary, could be devised. Sophisticated studies by the Foundations and Materials specialists and the Hydraulics people in the Engineering Division of the District office led to the design (approved by a board of consultants) of a so-called "wrap-around" seal of compacted, impervious material where the right end of the concrete dam joins the riverbank; and a massive blanket seal of compacted impervious material spread over the exposed face of the riverbank, extending from solid rock in the riverbed to the water surface elevation of the reservoir and upstream from the dam a distance of 4,000 feet. A record of the flow from the relief tunnel has been kept since the reservoir first was filled to operating level in 1955. The tunnel discharge has decreased gradually with time, from a maximum of 93 cubic feet per second to the present acceptable 34 cubic feet per second.

Obviously, the design of any great engineering work must embody unique features, adapted to certain situations that may never be repeated exactly in nature. This fact was illustrated again, in the case of Chief Joseph Dam, by the location of the powerhouse. The main spillway dam straight across the river was to be long enough and thick enough near the base to inclose the powerhouse with the 16 main generating units and necessary auxiliary equipment to be installed initially. Based on economically favorable recent experience at a few other projects around the world, consideration was given to locating Chief Joseph powerhouse inside the dam. Further study revealed a number of counter arguments such as sacrifice of weight essential to the gravity-stable dam if it contained a large hollow space for power equipment; complications in the respective hydraulics of the spillway and power tailrace (since demonstrated in Wells Dam, where the machinery hall is inside the dam structure); and finally, the probability that future development of storage reservoirs upstream would require the installation of additional generating units that could not be accommodated in the dam. The last situation has come to pass; plans are underway to add 11 more units to utilize dependable discharges from new Canadian reservoirs.

A good alternative to the powerhouse-in-dam idea was found on the left abutment. The granite wall here descends almost vertically to about the high-water elevation, then flattens in a rough shelf before descending again to the riverbed. The powerhouse, 1,546 feet long, was located on this shelf. The water-intake channel was cut into the top of the bluff, around the left (south) end of the spillway dam, terminated by a concrete closure wall at the west end, and inclosed by a high concrete intake wall along the north side parallel with the powerhouse. Gated openings in the intake wall let the water into steel penstocks that carry it down to the turbines in the base of the powerhouse. To assure the best efficiency attainable, the design of the intake channel, wall, and penstocks that lead the water around the circuitous route to the power units was determined only after careful hydraulic calculations and model testing in the North Pacific Division's hydraulic laboratory at Bonneville Dam. Photo 7, an aerial view of Chief Joseph project, illustrates the layout of principal features described above. A statistical summary of the project is provided in Appendix C.

The design and construction of Chief Joseph Dam involved many features that are noteworthy from a technical viewpoint, detailed descriptions of which are contained in formal design memoranda, construction files, and operations reports maintained in the project library. Several of these features are of historical significance, as they illustrate the evolution of new policies or practices by the Corps.

One such feature was the method employed in cooling the massive concrete structures. A fluid mixture of portland cement and concrete aggregates becomes a solid monolith through a chemical process of crystallization during which heat is generated. When concrete is placed in great masses, the heat of crystallization becomes excessive to the production of a strong monolith and must be tempered by some means of internal cooling. Prior to the construction of Chief Joseph Dam, the usual method of removing excess heat was to embed in the fresh concrete a system of pipes through which cooling water was circulated. In the great structures of Chief Joseph Dam, enormous



Chief Joseph Dam

quantities of piping would be required and its use would be both expensive and obstructive to the placing of concrete.

The contractors, with the encouragement of the Engineers, adopted a different cooling scheme: adding the proper proportions of water to the concrete in the form of ice so the concrete mixture would be precooled and its own internal heat would not raise the mass to damaging temperatures. The gravel aggregates going into the mix also were precooled with water sprays during hot weather. This cooling method produced concrete well exceeding the specification at substantial savings.

Another unusual feature of Chief Joseph project was the housing provided for Government and contractor employees. Consultations with the people in the town of Bridgeport, which adjoins the project, revealed quite clearly that no riproaring, ramshackle construction camp would be welcome. Such a situation certainly was not desired by the Corps, in view of previous unpleasant experiences with the parasitical shacktowns that sprang up around other projects during the construction period. Therefore, it was decided to build permanent homes as an addition to the town in sufficient number to accommodate Government people, both for construction and later project operation. The additional citizens would overload the town's water, sewerage, and school facilities. Fortunately, legislation had been enacted under which expansion of Bridgeport's facilities could be assisted with project funds.

Bridgeport's water and sewer systems were overhauled and expanded; a new school was built; Government people integrated thoroughly with the affairs of the community, joining the churches, lodges and other civic organizations, and sitting in the town council.

Construction contractors followed suit by building a permanent housing addition to the town. For the most part, their employees brought their families to the job and also settled into an orderly community life. Both Government and contractors' houses have been sold to individual families, many of whom are project operation and maintenance people. Altogether, this arrangement proved to be a model venture in community-employee relations, but took a lot of careful planning and reciprocal good will all around to succeed.

A lasting example, and, no doubt, one cause of the good will established at Bridgeport, is the fine park, playground, and swimming pool built by the joint efforts of the town and project people. Len Berryman, an employee during construction and still working at the project, conceived the park as his own contribution to the community. He worked for years with great energy and ingenuity, raising money and soliciting donations of labor, materials and equipment. One of his most productive ideas was the offer of pieces of drill core as souvenirs to visitors. These are the smooth, round sticks or rods of granite obtained by diamond drilling with a hollow, rotary, tubular bit during foundation explorations. Len put them on display at the visitors' vista house overlooking construction activities, with a deposit box in which visitors could leave a coin in exchange for a souvenir. The drill cores, nicely labelled and polished, were attractive as paper weights, desk ornaments, conversation pieces--or perhaps just as evidence of interest in a worthy cause. At any rate, they brought several thousand dollars to the park funds.

Construction of the large swimming pool, with bathhouses and water supply, was a big job. Engineers designed the pool. Contractors donated materials and the use of excavating machinery. Their skilled craftsmen and those of the Corps worked evenings and weekends building forms and placing concrete, piping, wiring, fencing, and all the other components. To permit use of the pool in the early and late season when weather is chilly at Bridgeport, a novel idea was developed. The big generators in the powerhouse are water-cooled. The warm water was wasted back to the river. Why not pipe a little of it over to the pool? That was done, and irrigation was also suppied for park lawns and gardens.

None of this could be done at Government expense under existing legal authorities. All was accomplished by community effort. Bridgeport appreciates its park, as people everywhere value that which they have worked hard to get. Len Berryman has received many honors, locally and nationally, for his leadership in this achievement. The one he values most is the name Berryman Park.

One slight exception to the spirit of harmony was introduced early in the planning stage when a jaunty individual appeared at the District office with a plot of a proposed subdivision he planned to promote adjacent to Bridgeport. As he described his plans, it became evident that he had in mind exactly the type of "tin-horn" exploitation that the townspeople and the Corps were anxious to avoid. The promoter's enterprise included a sporting establishment, and the proposed location was indicated on his plot. He requested assurance that land acquisition for the project would not conflict with acquisition of the land he desired. When informed, first, that the tract in question certainly would be included in the Government's land acquisition program if necessary to prevent its use for his purposes and, second, that town, county and State officials had pledged suppression of all such activities, the promoter abandoned his plans.

In view of several unique design features of Chief Joseph Dam, rather elaborate instruments were installed in the principal dam structures to permit later observation of the validity of some of these innovations and to contribute to engineering science. These included gages for measuring hydraulic uplift pressures in the contact zone between bedrock and the base of the dam; means for measuring leakage around, under, or through structural parts; piezometer wells in the right abutment; remote-reading thermometers embedded in the concrete; and precisely located reference points spanning joints and cracks, where readings with the Whittemore gage yield displacement, expansion, contraction and other significant stress data. Frequent recordings and analyses of the data derived from the instrumentation have been published for the information of Corps engineers and the advancement of the profession.

The instrument records also serve as useful guides in operation and maintenance of the dam. Any variation from normal behavior is promptly investigated and, if found to indicate a questionable condition, corrective action is taken. In 1956 and again in 1961, uplift pressure at one point under the spillway section of the dam was found to be increasing beyond that anticipated. This constituted no immediate threat to the structure, but did indicate a deviation in performance that demanded explanation. Some foundation drains were found to be filling with calcite. Those were cleaned and, on both occasions, additional drains and pressure gages were installed. Close observation to date shows no recurrence of the pressure rise. Project maintenance now includes periodic removal of calcite deposits from drains.

For Chief Joseph Dam, as for all major structures of the Corps, a supervisory maintenance service was established in 1965 by regulation of the Chief of Engineers8/ "...to insure their structural stability, safety and operational adequacy." A team of experts from the Office, Chief of Engineers, the Division and the District formally inspected and reported on Chief Joseph Dam in July 1967. Mr. Howard W. Goodhue, who directed the studies for the Columbia River Review Report at Seattle in the late 1940's and is now an internationally recognized authority on the design of high dams stationed at the Office, Chief of Engineers in Washington, D.C., headed the inspection team.

Soon after Chief Joseph Dam was authorized, Congress took new steps to broaden the multiple-purpose concept of public works by providing for facilities for public use and enjoyment, where appropriate.9/ Accordingly, four sites were selected for recreational development on the shores of Rufus Woods Lake.10/ One primary park site near the dam is in the process of improvement. One fully developed site near the upstream end of the lake at Elmer City has been eliminated

8/ Engineering Regulation 1110-2-10, Periodic Inspection and Continuing Evaluation of Civil Works Structures.

9/ Flood Control Acts of 1944, 1946(P.L.526), 1954(P.L.780), 1962(P.L.874).

10/ The backwater pool of Chief Joseph Dam extends 51 miles upstream. Named for the noted publisher and civic leader of Wenatchee, who was a foremost proponent of Columbia River development throughout his lifetime.

due to construction activities associated with the third powerhouse at Grand Coulee Dam. Two others will be developed at attractive intermediate locations. Campgrounds, water supply, sanitary facilities, boat launching ramps, swimming beaches, and landscaping are being provided as funds become available. The Washington State Parks Department is cooperating with the District in planning and development.

Chief Joseph Dam is by far the largest civil project completed to date by Seattle District of the Corps. Nine years were required for design and construction, from the date of authorization until the first unit started producing power, and three more years for completion. Additional capacity was urgently needed in the Northwest Power Pool during this period, and led to unusual haste on the job. Hydroelectric Design Branch of North Pacific Division designed the powerhouse, and prepared rather generalized drawings for the use of bidders. After more detailed drawings were received, some of the contractors claimed extra compensation for refinements that could not be foreseen at the time of bidding. In some instances, work went on for which there was insufficient detail in available construction drawings, such as precise locations of embedded piping and conduits that later created difficulties for the maintenance forces.

Plans and specifications were not always followed exactly, under the plea that exact compliance would be unduly restrictive and hold up the job. Most of these violations were minor and caused only minor difficulty in correction when the project was put into operation. A few were costly, including the failure of concrete slabs in the roadway of the highway bridge and the floor of the stilling basin. These are believed to have been caused by hasty placement of the concrete in very cold weather, without adequate protection against freezing. The worst case was the dumping of waste from rock excavation into the channel of Foster Creek instead of specified spoil areas that would have required longer hauls. A flash flood washed silt and tumbleweeds against the face of the "open" rockfill, effectively sealing it. The dammed water overtopped the fill, breached it, and carried some quarter of a million cubic yards of rock into the Columbia River just below the powerhouse tailrace. The rock bar had to be removed by dragline to avoid impairment of efficiency of the powerhouse. Although the increased Government revenue from earlier power sales offset the cost of these incidents, this could not entirely assuage the hurt pride of the engineers who observed them. The lessons were not lost, however. Thorough planning before and during construction; closer coordination between Engineering, Construction and Operations Divisions in all details of the work; and meticulous enforcement of contract provisions in the field have been observed on subsequent major projects.

The acquisition of real estate for Chief Joseph Dam was relatively simple. Only land near the damsite and a few developed, agricultural, bench tracts along the river were of high value and privately owned. Much of the land required along both sides of the river upstream from the dam was public domain that had been withdrawn from entry, years before, by the General Land Office specifically for eventual power development. Some north bank reservoir lands were in the Nespelem Indian Reservation and were obtained "en bloc" through the Tribal Council. Although Chief Joseph was a Nez Perce, he is buried at Nespelem and the people there feel a great kinship and respect for him. They are proud of the project and its name, as they demonstrated most colorfully and enthusiastically by participating in full regalia at the dedication ceremonies.

A few long-dormant placer mining claims, remnants of earlier gold prospecting along the river, were encountered, but these lands also were obtained rather easily. Altogether, 137 tracts in the construction area were acquired outright, 56 by negotiation and 81 by condemnation. Of the 212 reservoir flowage easements obtained from private owners, 127 were negotiated and 85 were condemned.

Both the Engineering and Real Estate people in the District office have additional work in connection with Chief Joseph project. Maximum utilization of the added dependable riverflow provided by new storage reservoirs in Canada calls for the addition of 11 generating units in the powerhouse and raising the elevation of Rufus Woods Lake. The higher pool level will necessitate acquisition of more land around the lake. Extension of the powerhouse requires new engineering plans now, and eventually another big procurement and construction program by Supply and Construction Divisions.

Emphasis on Storage Reservoirs

Much of the investigation for the review report, especially in Seattle District, was directed toward the provision of adequate regulatory storage in the Columbia River watershed. An estimated total reservoir capacity of 25 million acre-feet was needed, well distributed among the principal headwater tributaries, to control floods in the lower river within stages that could be contained by local protecting dikes and to assure optimum, economical power generating capacity for downstream hydroelectric plants. The ideal distribution of new reservoirs would be about 5 million acre-feet each on the lower Snake River (Hell's Canyon reach), the Clark Fork in Montana, the Kootenai in Montana and/or Kootenay in British Columbia, and either the main stem in British Columbia or several lesser tributaries in the United States.

Many sites that offered desirable physical features were studied in all these localities. As site investigations, preliminary layouts and economic analyses were accomplished for each site, consideration by local interests was invited by means of public hearings held in the locality. The only Seattle District storage projects that received general public support were Albeni Falls and Libby. Albeni Falls was endorsed by Idaho citizens and officials, contingent on a number of conditions, one of which required the inclusion of a powerplant.

In order to have the desired storage capacity, Libby Dam on the Kootenai would back water over the International Boundary into Canada. Essential concurrence and cooperation of the Canadians presumably could be secured through the International Joint Commission (IJC), which had jurisdiction of such matters under the Boundary Waters Treaty of 1909 with Canada. Anticipating the active interest of our Canadian neighbors in Columbia River developments, IJC had established a joint Columbia River Engineering Board to study and report to the Commission on proposals involving the river. The Seattle District Engineer, other U.S. officials, B.C. Provincial and Canadian Dominion people, comprised the Board. Board members in turn appointed engineers in their various offices as a working group to make technical studies. Joseph Buswell and Sherman Green of Seattle District; Fred Veatch, U.S. Geological Survey; Frank Banks, Bureau of Reclamation; and various other engineers represented the United States on this team from time to time. This group kept abreast of planning for the Columbia River system as it developed through the Corps of Engineers' review studies and reported to the Board, which in turn informed the Commission.

By early 1948, a comprehensive plan of development for the Columbia River had taken the form of a drafted report, in which every State, Federal, Provincial, Dominion and public agency or individual interested in the future of regional water resources had participated or was represented so far as possible. Concurrently, the Bureau of Reclamation had published an independent report recommending a plan of development differing somewhat and particularly emphasizing irrigation.

In May 1948, the unruly Columbia drew unprecedented attention with a flood that exceeded all known magnitudes since 1894. The consequences were far graver than in 1894 because vulnerable population and economic developments in the flood plain were so much greater. The community of Vanport at the north edge of Portland, Oregon, was destroyed. and an estimated 38 people were killed. The exact number is unknown, as some bodies were never recovered. Great losses also were suffered elsewhere along the river. The country reacted, as it had on previous occasions, with demands that measures be taken to prevent such disasters in the future.

The Main Control Plan

The Corps Columbia River Review Report offered measures for flood control consisting of six reservoirs with total usable storage of 23 to 24 million acre-feet which, with existing capacity in Hungry Horse, Grand Coulee and irrigation reservoirs on the Snake River, would regulate flood discharges on the Lower Columbia to stages that with recommended levee improvements, would prevent heavy damage in the future. The new reservoirs would be formed by either Glacier View or Paradise Dam on the Flathead or Clark Fork, Albeni Falls on the Pend Oreille, Libby on the Kootenai, Hell's Canyon on the Snake, Priest Rapids and John Day Dams on the Columbia mainstem, all of which also would have hydroelectric plants. This system would constitute the Main Control Plan. A seventh major hydroelectric dam, without storage capability, would be at The Dalles on the Lower Columbia. Exhibit 9 shows features of the Columbia River system, as visualized in the Main Control Plan. Many smaller, local flood protection, irrigation, navigation, recreation, and conservation projects also were recommended, supplementing the Main Control Plan.

Investigations for the review report covered all sites for water resource development that offered physical potential for use in a comprehensive system. Among these were some three hundred damsites throughout the Columbia River Basin. Selection of projects to accomplish the objectives of the Main Control Plan in meeting the imminent needs of the region left a great number of possibilities for future consideration if and when the expanding population and economy of the Northwest should demand further development. The report identified and discussed these potential projects in two categories: those proposed on the basis of their physical and economic merits, to be considered as first-phase additions to the Main Control Plan; and the more expensive, less beneficial projects that might merit consideration in later planning. The total investment to effectuate the recommended plan was estimated at $2 billion, annual costs about $90 million, and annual benefits $130 million. Professor Eugene Grant of Stanford University, an eminent engineer-economist, assisted Seattle District in developing sound procedures for the complex economic analyses of the individual projects and the comprehensive plan.

Before he would accept the review report, President Truman required that the reports of the Bureau and the Corps be reconciled. A joint committee of the two agencies accomplished this during the summer of 1948. The Corps report was submitted in the fall and was ordered printed by the Congress as House Document 531, 81st Cong., 2d Session. This 22-volume report represented one of the most meticulous and extensive engineering investigations undertaken anywhere up to that time, requiring approximately 500 man-years' effort and $5 million.

Congress moved promptly to authorize parts of the Columbia River Main Control Plan, including Albeni Falls, Priest Rapids and Libby Dams in Seattle District, by enacting the Flood Control Act of 17 May 1950. However, authorization for a Corps of Engineers project at Priest Rapids was withdrawn after the Grant County Public Utility District applied for and received from the Federal Power Commission a license to build a dam and powerplant at the site. Seattle District furnished the public utility district with all of the extensive engineering data obtained for the site, as the District also has done for many other agencies interested in other sites, thus exemplifying the Corps philosophy of public service. Moreover, Seattle District further assisted the public utility district by acquiring real estate for the project.

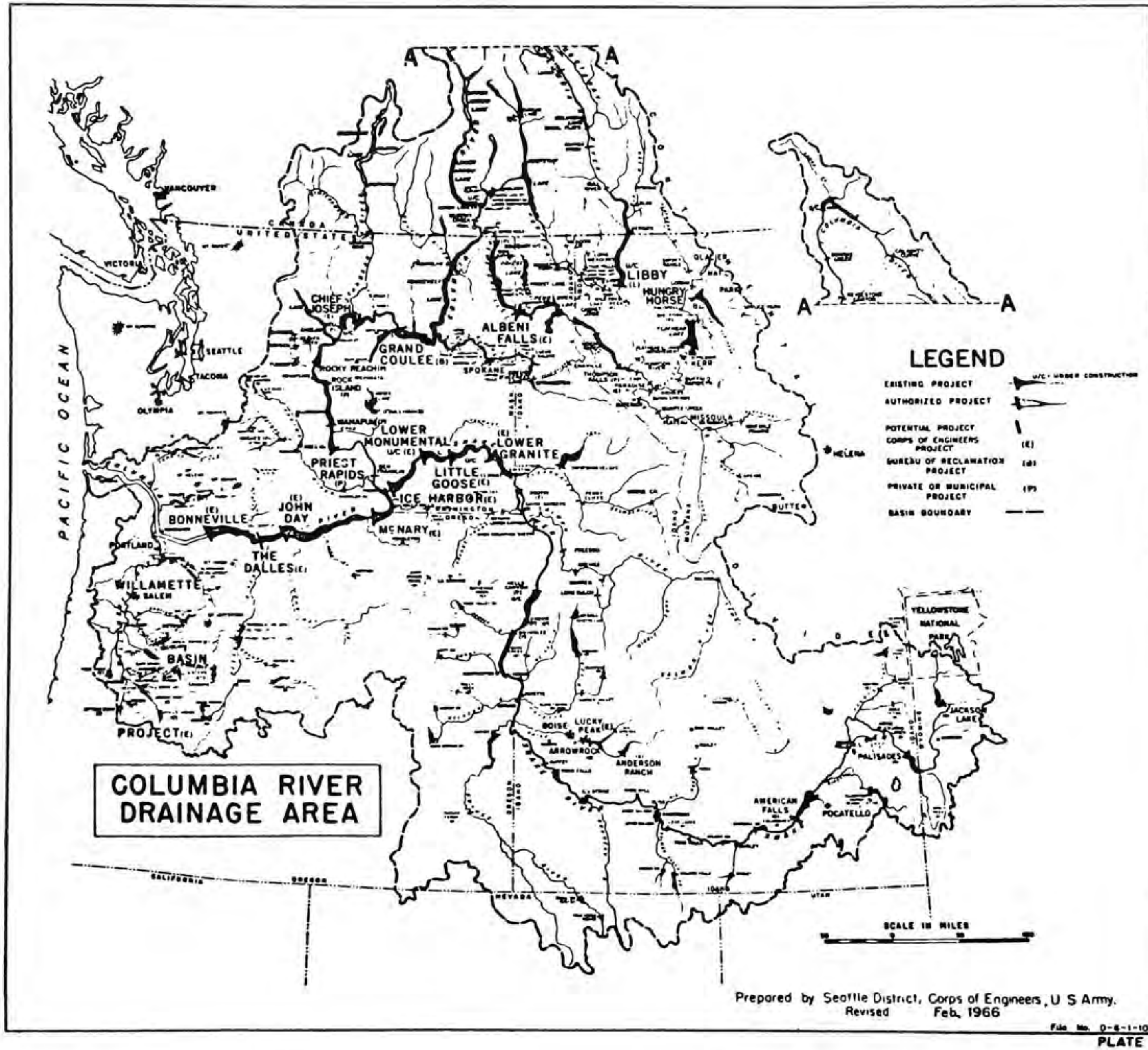

COLUMBIA RIVER
DRAINAGE AREA
LEGEND
PACIFIC OCEAN
VANCOUVER
VICTORIA
SEATTLE
TACOMA
OLYMPIA
PORTLAND
SALEM
SPOKANE
MISSOULA
HELENA
BUTTE
BOISE
POCATELLO
CANADA
UNITED STATES
CHIEF JOSEPH
GRAND COULEE (B)
ROCKY REACH
ROCK ISLAND
WANAPUM
PRIEST RAPIDS (P)
LOWER MONUMENTAL
U/C (E)
(E) LOWER GRANITE
LITTLE GOOSE (E)
ICE HARBOR (E)
MCNARY (E)
(E) JOHN DAY
(E) BONNEVILLE
THE DALLES (E)
WILLAMETTE BASIN PROJECT (E)
ALBENI FALLS (E)
LIBBY
HUNGRY HORSE
LUCKY PEAK (E)
ARROWROCK
ANDERSON RANCH
AMERICAN FALLS
PALISADES
JACKSON LAKE
YELLOWSTONE NATIONAL PARK
OREGON
CALIFORNIA
NEVADA
UTAH
SCALE IN MILES
Prepared by Seattle District, Corps of Engineers, U S Army.
Revised Feb. 1966
PLATE 1

Exhibit 9

The Public utility district's design for the Priest Rapids project differed from that presented in the Corps of Engineers review report. The Corps recommended one high dam at Priest Rapids that would create a reservoir with substantial capacity for emergency flood control and extend upriver to the foot of Rock Island Dam, but the public utility district broke this reach into two sections by building a lower dam at Priest Rapids and another low dam (Wanapum) at an intermediate site. Both dams are single-purpose power developments that provide no reservoir storage--another illustration of disinterest by public utilities in multipurpose storage developments that offer them no direct cash revenue.

Albeni Falls Dam and Reservoir

Albeni Falls Dam controls the elevation of the great, natural Pend Oreille Lake in northern Idaho. The lake has a surface area of 148 square miles, and a 1-foot variation in elevation represents the gain or loss of 94,600 acre-feet in water content. This storage potentiality made a control structure below the lake an obvious first choice for inclusion in planning the Columbia River Review. The Albeni Falls site was inspected by Captain Taylor in 1897, but not with its present use in mind. The original "308" report considered Albeni Falls as the site for a dam that would store water in Pend Oreille Lake and divert it via a canal to the Columbia Basin Irrigation project. That did not materialize, but Grand Coulee Dam now diverts water from the main stem of the Columbia by pumping.

A dam to control Pend Oreille Lake to various elevations was considered and discussed with people of the vicinity at public hearings in Sandpoint and Priest River. The maximum controlled elevation that would not require radical rail, highway, and community relocations was 2062.5 feet above mean sea level. The Idaho people rejected any idea of storage above this point and insisted that the project include power generation at the site. These criteria became the basis of design.

Seattle District Engineering Division designed the dam and all appurtenances except the powerhouse, which was assigned to the consulting firm of Sverdrup & Parcel. By the fall of 1950, following the authorization act, an initial appropriation for construction had been made by Congress and the District was busy preparing construction drawings, specifications, estimates and bid documents, with a target date of New Year's Day for start of construction. First material was moved by a blast in the right channel of Albeni Falls in a ceremony attended by Colonel Buehler, District Engineer, and Fred Wolff, banker and publisher of Newport, Washington, a long-time supporter of the project. The job got off to a flying start, literally. That first ground-breaking blast threw rocks far and wide, barely missing some of the less agile spectators. One, the contractor's Superintendent who was standing closest, didn't duck quite quickly enough. He dazedly felt of the top of his head to find out how much was left of it and found it all intact. His hard hat, however, had joined the general flight of rocks and, when recovered, was found to have been neatly sliced across the crown. The powderman was accused of overloading the holes, but later claimed exoneration when dragline excavation brought up a very old case of dynamite from the riverbed, where presumably it, and perhaps others, had been lost during reconstruction of the Great Northern Railway bridge nearby. Possibly the others had exploded in sympathy with the first blast, but the poor powderman compounded his first crime with a second. He dumped about 300 cubic yards of rock, with one over-enthusiastic shot, into the Great Northern Railway cut that adjoins the left spillway abutment, tying up rail traffic for several days. He was reported as last seen disappearing into the timber a jump ahead of his foreman at about the time his superintendent, the railway's division superintendent, and the Seattle District resident engineer were starting for St. Paul to pacify railway management.

Albeni Falls was barely worthy of the name in this country of truly spectacular mountain torrents. It was, rather, a steep rapid or chute that passed through two or three narrow channels around two islands and had a drop of some 10 to 20 feet, depending on the stage of the river. The islands, river bedrock and abutments at the Falls are excellent granite foundation material. The right channel was chosen for the powerhouse location because of its favorable configuration, including the deep hole just below which serves as a tailrace, and the small amount of rock excavation required. The two rock islands were incorporated advantageously in the spillway dam alinement, which introduced an angle of about 70 degrees between the powerhouse and spillway axes.

The cross section of the river channel at the site, the hydraulic characteristics of the channel extending upstream 25 miles to the outlet of Lake Pend Oreille, and the magnitude of the design flood (maximum possible river discharge) that must be passed freely through the spillway dictated the configuration of the latter to be only a low sill set in the riverbed to support piers in which vertical steel roller-train gates form the effective barrier by which the flow of the river is regulated. The maximum regulated elevation of the lake being 2062.5 feet and the minimum about 2050 feet, imposed by natural channel depth at the lake outlet, the usable storage capacity of the project is 1,155,000 acre-feet. The project yields benefits in flood control and navigation channel depths throughout the Columbia River system downstream, in addition to increased power generation at series of 14 hydroelectric plants on the Pend Oreille River and main stem of the Columbia River. Incidental benefits have been provided by a drift removal program at the Clark Fork inlet to Lake Pend Oreille: a fish hatchery and spawning grounds to support the commercial Kokanee (a landlocked Salmonoid) and sport fisheries in the lake; a splendid community swimming beach at Sandpoint; and a series of fine recreational camps and marine parks on the river and lake, all developed with project funds.

Albeni Falls (see photo 8) is a small project in comparison with the great dams on the Columbia River proper, costing about one-fifth as much as Chief Joseph for example. However, the project exemplifies, more than most, a happy combination of mutually beneficial public services. Albeni Falls has been a "happy" project in other respects: the total cost matched the advance estimate, construction was accomplished without a single fatality or other serious incident, and public and employee relations were excellent. The people who have worked on the project during construction or in subsequent operation and maintenance are proud of it and prompt to challenge any reference to its small size. Of course, this invites baiting by others, to which Kenneth Coffman, Project Engineer, invariably responds with the correction, "smaller but more important project!"

Actually, Albeni Falls Dam is important beyond all proportion to its structural size because of its storage capability. For example, during construction in the winter of 1951-52, the powerhouse (right) channel was closed by a cofferdam and the rest of the river could be controlled by the spillway only if the gates could be finished and installed before spring runoff. All steel fabrication had been halted the previous summer by a national strike in the plants. When the strike was settled in the fall, the contractors drove hard to complete the gates, secure quick delivery, and push installation. An extremely short water year for the Columbia River system was forecast on the basis of snow surveys in the mountain headwaters. By working dual 10-hour shifts 7 days a week, the steelworkers got the gates in just as the spring rise started. The water stored in the lake and released the following winter is estimated to have yielded over $2 million in additional power revenue to the Government and, more importantly, to have averted a "brown out" (curtailed customer service) in the Northwest Power Pool.

For technical data concerning the Albeni Falls project, please turn to Appendix C.

The procurement of necessary real estate rights for Albeni Falls Reservoir was much more complicated than it had been for Chief Joseph Dam. The reservoir includes Pend Oreille Lake and 25 miles of the river channel extending from the town of Sandpoint downstream to the damsite, in both of which spring floods have risen occasionally to elevations above the 2062.5 maximum to which the dam regulates the water level. The legal property line, or limit of private ownership along the shores, is the meander line established by the original Land Office surveys, which in turn is supposed to be the natural high waterline observed by the surveyors. The lake and river bottoms within this periphery belong to the State.

Since the retention of storage in the lake and river as a result of operation of the dam would not cause the water to rise above the natural high waterline onto private property, a nice question arose:

Albeni Falls Dam

Just what sort of property rights, if any, must be obtained from the owners? The question was threshed back and forth at considerable length among title attorneys of the Corps of Engineers and the Department of Justice. The matter was settled on a practical basis. As the annual spring runoff only brought the water to or above the meander line occasionally, and then for a brief period, the project would hold the water at elevation 2062.5 feet all summer and fall. Consequently, there might well be some damage to shoreline properties from saturation of the subsoil and from bank erosion caused by wave action. Some other damages were involved, such as denial of farming below the meander line and destruction of improvements placed there, which may have established private rights on the margins through long use and occupancy.

The decision was to seek a special form of flowage easement extending to a contour 5 feet above the maximum storage level of 2062.5. Contract appraisers were hired to establish the fair values of the easements, and a field real estate office was set up in Sandpoint. Upon negotiation with the owners, real problems accumulated. Just what rights were being purchased was difficult to explain. Along some shores there was valuable timber below the meander line. Nobody was sure who owned it, but the owners on the landward side of the meander line had access and use. The same was true of good pasture and hay land, summer homes, boat moorages, and beaches. The whole affair was confounded by successive changes in policy as to the language of the conveyances presented to property owners; by the fact that the old survey meander lines had been established only roughly and at considerable variance from the natural high waterlines; and by a lot of confusion in the handling of test court cases.

In many cases buying the land outright was found to be no more expensive than obtaining easements, and this was done. At some points, the Corps built bank protection works instead of buying the area being eroded. Eventually, prior owners of some lands bought outright were granted easements which enabled them to make some use of the land. Eventually, the whole real estate program was completed in one way or another, apparently with a minimum of inequities under the circumstances. Of 115 tracts acquired in fee, 47 were negotiated and 68 were through condemnation. Easements were negotiated on 686 tracts, and 454 tracts were condemned.

On the surface, this is not a good record. Much of the litigation was inevitable under the procedures laid down by the courts to clarify the interests of the owners and the position of the Government.

Howard A. Hanson Dam and Reservoir

James Grafton, Resident Engineer on the Albeni Falls job, finished there in 1955 and immediately moved on to the construction of Howard A. Hanson Dam. He took along an expert field organization, an opportunity that doesn't come often because big projects rarely follow in smooth sequence.

The 1950 Flood Control Act also authorized construction of a major reservoir, initially named the Eagle Gorge project, on the Green River in Washington. Seattle District's investigation of this project had proceeded concurrently with work on the Columbia River review. The Green's periodic winter floods frequently had overflowed its broad valley adjacent to Seattle's expanding south industrial district and posed a barrier to growth. Since completion of Howard A. Hanson Dam, named in memory of a Seattle man who promoted the project through many years, several potentially damaging floods have been controlled and the valley has become a busy scene of industrial plant and market construction. Technical details of Howard A. Hanson Dam are contained in Appendix C.

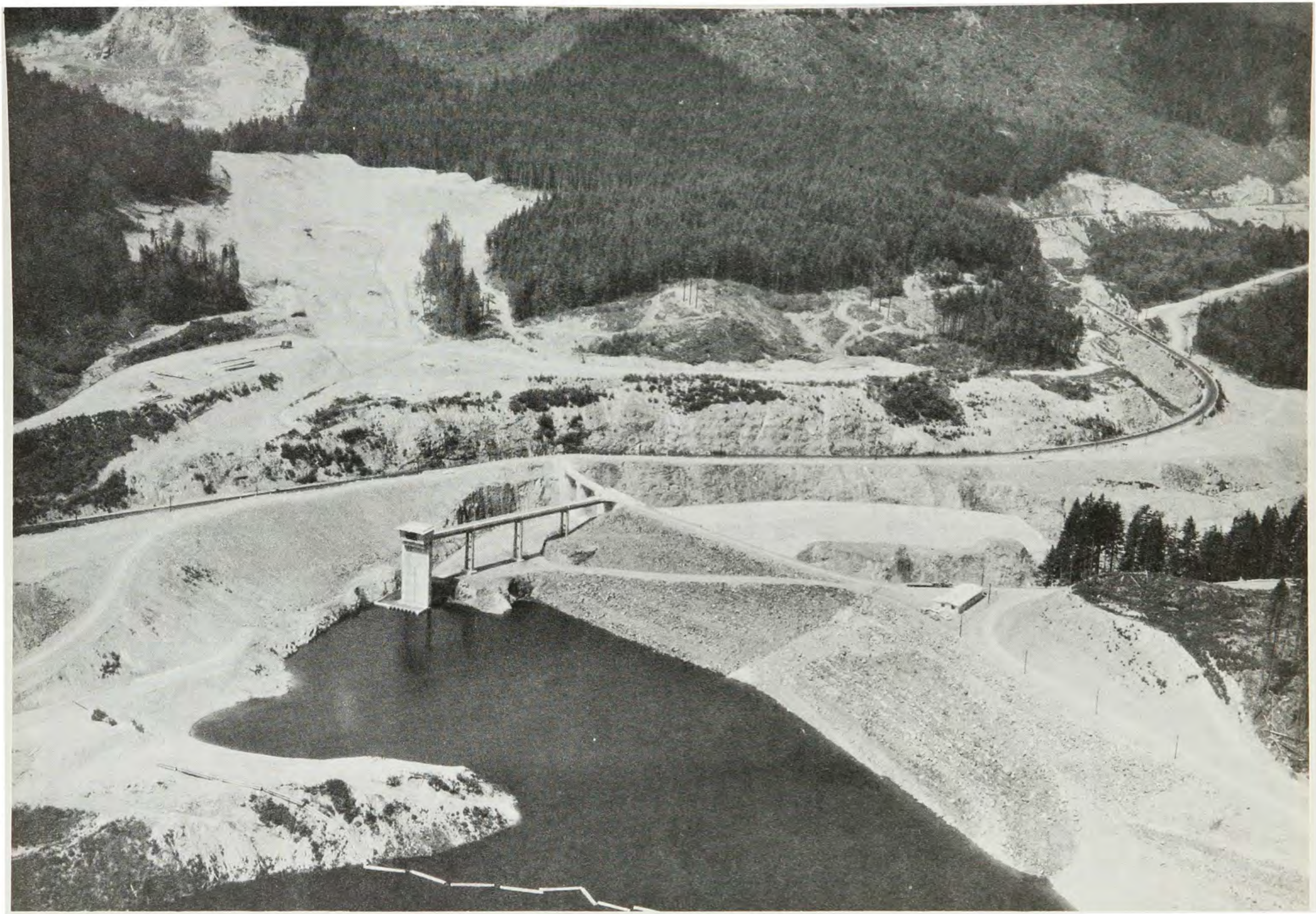
Hanson Dam (see photo 9) stands in a narrow canyon of Green River among the steep foothills of the Cascade Range. The topography is favorable for the purposes of the project, but the underlying geologic conditions have proven to be far from ideal for construction. The formations are so interbedded and the materials are so diverse that subsurface exploration by means of drilling and test pits could furnish only fragmentary sampling, rather than complete disclosure, of the conditions to be encountered. These therefore had to be dealt with, on occasion, as the job went forward. Several slide areas developed at the left abutment of the dam and in cut banks along the Northern Pacific Railway relocation. The unstable materials consisted of saturated clays, peat, and muck that required special drainage measures and, at some points replacement, to overcome. The problem never was very serious--just a nuisance--and simply illustrates an axiom of engineers: When one deals with Nature, he should expect the unexpected.

Lower Monumental Lock and Dam

Lower Monumental Dam is located on the lower Snake River in southeastern Washington, 41.6 miles upstream from where the Snake joins the Columbia in the Tri-City area of Pasco, Kennewick, and Richland, Washington. It is the second of a series of four dams to provide slackwater navigation from the Columbia River to Lewiston, Idaho. During the gold rush days in central Idaho, stern wheelers plied this reach of the river, taking men and supplies to Lewiston, Idaho, and the gold fields. The advent of the railroads put the stern-wheelers out of business but the dream of water commerce to central Idaho from the Pacific never faded. A plan consisting of 10 low dams was presented to the 75th Congress in 1937. More detailed studies completed in 1947, however, showed that the most advantageous plan for full development of the river was a series of four higher dams. The first of these, Ice Harbor Dam, was nearly completed when Lower Monumental began in 1961.

Bedrock in the area consists of nearly horizontal basalt lava flows. The canyon of the river was developed by erosion, into a depth of about 800 feet followed by deposition, during glacial time. The

Photo. 9



Howard A. Hanson Dam

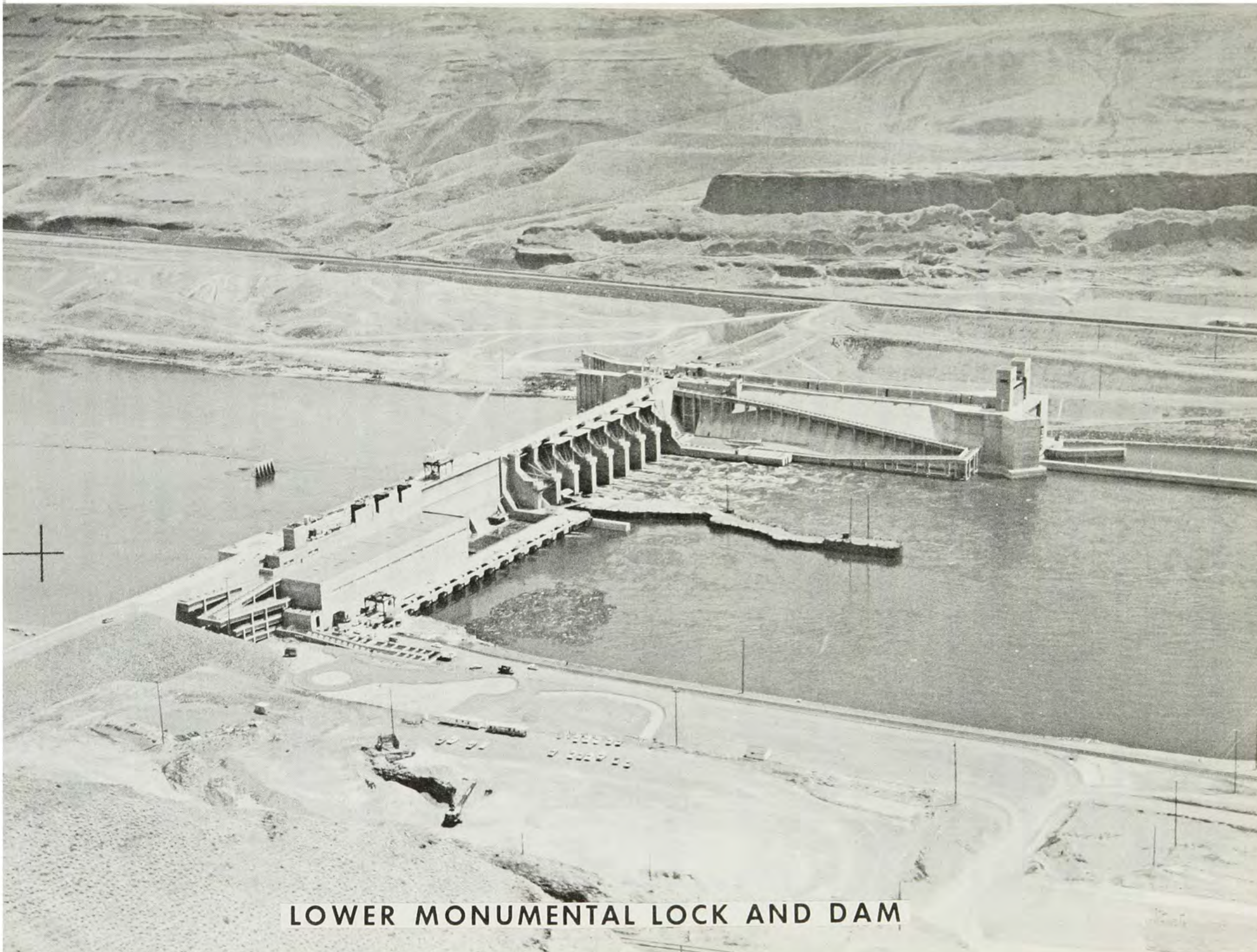
river occupies only a fraction of the canyon floor and flows in a westerly direction between terraces underlain by sand and gravel or basalt strata. On each bank of the river just above high water is a railroad--the Northern Pacific Railway on the north and the Union Pacific Railroad on the south.

The dam project extends from wall to wall of the canyon. The major components are a concrete nonoverflow dam, a six-unit powerhouse with an erection bay, an eight-bay overflow spillway dam, another concrete nonoverflow section, and the navigation lock. River diversion, fish passage, minimum interruption to navigation and railroad traffic, and annual spring floods were factors which controlled the construction sequence of the dam. To provide for minimum interruption to navigation, the lock was built before the powerhouse. The Union Pacific Railroad and its branch lines were relocated from the pool area without interruption to traffic. Relocation of the Northern Pacific was not considered economically justified. Northern Pacific traffic on this reach of the Snake River was diverted to the Union Pacific tracks. To permit passage of fish, it was necessary to provide a variety of temporary facilities each year around the currently active construction areas until early 1969, when the elaborate, permanent fish ladders could be put in service. As Snake River and its tributaries form a most important salmon spawning area, the successful passage of the fish was and is a constant concern.

Other complex problems were raised by the occurrence of large floods during the construction period in 1964 and 1967. The flood of December 1964 breached the north shore, second stage cofferdam and flooded the enclosure. Fortunately, this was just before the first truckload of workmen was about to go into the "hole," and nobody was drowned. Reconstruction of the cofferdam had to wait until the flood receded in late January 1965. Restoration and unwatering took three months and excavation inside was resumed when, on 23 April 1965, the cofferdam failed again and the enclosure had to be reflooded. All personnel and most equipment were evacuated. After further repairs and reinforcement, work in the cofferdam area was resumed in August.

The powerhouse construction was hampered by an unusually large amount of ground water. Excavation for the powerhouse draft tubes and the unwatering sumps extended about 120 feet below the river bottom. The first 90 feet or so was in one lava flow and was dry. The remaining 30 feet passed through a thin lava stratum and thus two contact zones. These contacts were denoted 15 and 16 and were water bearing with many free-flowing channels. A pumping capacity of nearly 30,000 gallons per minute was needed to keep the area unwatered.

Extremely high water was forecast in the Snake River during the 1967 spring run off, due to the late thaw. Flows over 225,000 cubic feet per second would overtop the upstream cofferdam. Construction progress at this time was such that even a delay of 30 days might cause



LOWER MONUMENTAL LOCK AND DAM

Photo. 9A

the pool raising date to be delayed a full year. To increase protection against flooding the cofferdam enclosure, the navigation lock was opened for diverting a part of the riverflow. The lock would pass about 40,000 cubic feet per second allowing a total flow of about 265,000 cubic feet per second before overtopping would occur. This gamble paid off as the flow did exceed 225,000 but not 265,000 cubic feet per second. Damage to the navigation lock was not extensive.

The north shore cofferdam enclosure was flooded in late December 1967 for removal of the cofferdam. The string of cells downstream of the spillway was saved to be made a part of the third step cofferdam. The third step cofferdam enclosed the spillway area for completion of the low spillway bays. This phase of construction had the tightest schedule of any work on the project. It consisted of building the cofferdam, completing the spillway bays and removing the cofferdam in less than 4 months' time. Cofferdam construction could not begin until after high water, and the original contract called for the work to be complete for pool raising by 15 October. All the rush proved to be unnecessary because, before the work was complete, pool raising was delayed 4 months for the construction of the Marmes Levee, of which more will be said hereafter.

The Lower Monumental Project was completed at an approximate cost of $191,000,000. Further data relating to the design and construction of the Lower Monumental Lock and Dam are listed in Appendix C. The project is within the geographic boundary of the Walla Walla District and the initial work was accomplished under that District. Shortly after the south shore contract work was underway, on 1 July 1962, the project was transferred to the Seattle District. All personnel assigned to the Lower Monumental Resident Office were also transferred. To the Resident Engineer, Leonard G. Estey, and the Assistant Resident Engineer, William P. Eng, this almost amounted to a homecoming as both began their Corps of Engineers careers in the Seattle District Office. Estey joined the Seattle District in 1942 and served there through World War II until transferring to the newly established Walla Walla District. After serving as Resident Engineer for Lucky Peak Dam and Boise Area Engineer, he joined The Dalles Dam staff in 1963 as Assistant Resident Engineer. In 1957 upon completion of The Dalles Dam he returned to the Walla Walla District and was assigned the Ice Harbor Project, becoming Resident Engineer in 1959. Mr. Eng joined the Seattle District in 1952 working as an assistant to the Albeni Falls Project Engineer in the Engineering Division. In 1953 he transferred to The Dalles Dam and was there until late 1956. After 6 months in the Construction Division in the Portland District Office he joined the Ice Harbor Dam staff as Chief of the Engineering Branch. He assumed the duties of Assistant Resident Engineer when Estey became Resident Engineer. Lower Monumental Dam was put under construction as Ice Harbor Dam was nearing completion. The Ice Harbor Resident Office was redesignated Ice Harbor-Lower Monumental Resident Office to assume supervision of Lower Monumental work. The Resident Office was moved to the Lower Monumental Damsite in April 1962. On 29 November 1966, while on an inspection of the relocations work, Estey and Jack Monarch, Chief of the Relocation Work, were killed in an automobile accident. Eng then became Resident Engineer.

Marmes Levee

The so-called Marmes levee construction was a last-minute, emergency phase of the Lower Monumental project that failed to prevent the flooding of an archaeological research site near the mouth of the Palouse River tributary to the Snake. The failure generated much public criticism of the Corps by persons not aware of the whole story, in which the elements of time and money were the controlling factors, to wit:

1935. The Congress declared a national policy to preserve, for public use, historic sites, buildings, and objects of national significance.

1945. The Congress authorized development of Lower Snake River for navigation from the mouth to Lewiston, Idaho, by a series of locks and dams. Also, field surveys along the river revealed prehistoric Indian campsites and burial grounds that might deserve investigation in compliance with the 1935 Act.

1947-48. Four sites for locks and dams on the Lower Snake were selected. These were included in the Main Control Plan for the Columbia River and Tributaries Review Report, described at page 4-9. In conferences with the National Park Service regarding this plan, it was recognized that sites of potential archaeological interest which might be disturbed or make inaccessible by the planned construction must be investigated under the supervision of that Service. The Snake River sites were discussed, among many others. Subsequently, the Service contracted with Washington State University to do some of the scientific exploration.

1953. Dr. Richard D. Daugherty, Anthropologist of WSU, discovered, among the ancient Indian habitations near the mouth of the Palouse, the site now known as the Marmes Rockshelter--named for the Marmes family, owners of the land.

1961. Construction started on Lower Monumental Lock and Dam.

1962. Excavation started at the Marmes site by WSU with $12,000 Park Service grant.

1963-64. Summer work continued, with Park Service grants of $15,000 and $18,000, supplemented by $30,000 from Corps of Engineers' Lower Monumental project funds, to expedite the work before the site would be submerged in 1968 by water behind the dam.

1965-67. Work continued intermittently, as meager funds permitted, revealing, in successively deeper strata, an unusually long and clear sequence of human occupation and burials dating back nearly 8,000 years.1/ At this point, it was thought that the excavation had about "bottomed out" as to production of valuable relics and the race against the scheduled inundation appeared to be virtually won,2/ until -

April, May 1968. Further digging revealed skull fragments which, by radiocarbon dating, appeared to be 11,000 to 13,000 years old. This find was considered of great importance to understanding of early prehistory of the American Indian and to knowledge of late Pleistocene geologic events. The Corps of Engineers, through the National Park Service, made available $120,000 for acceleration of the research.

August 1968. The Corps proposed a "Bare Minimum Temporary Levee Plan" to protect the Marmes site, as an alternative to a lengthy delay in raising the Lower Monumental pool, so the archaeological work could be completed.

September 1968. At the suggestion of Dr. Daugherty and Mr. Roald Fryxell, WSU leaders in the research, the Corps quickly revised the levee plan to make it a permanent structure which would preserve the site for future observation by scientists, students and tourists. The cost was established at $1-1/4 to 1-1/2 million dollars.

October 1968 was spent in an urgent drive to obtain necessary authorization and funds for the levee. On the 30th, a construction contract was negotiated with Peter Kiewit Sons' Company and assigned to Seattle District of the Corps for administration. Approval of State and Federal fisheries agencies was obtained to delay until 15 December and then 28 February, raising the pool to the elevation that would permit operation of the fish ladders at the dam.

November 1968. Levee construction proceeded on schedule. December 1968 and January 1969 subzero weather, heavy snows alternating with thaws and rising water in the rivers, impeded progress. Contracted commercial powerlines to drive unwatering pumps were not yet available, so diesel-electric generators were brought in.

February 1969. Pool raising started the 21st. Heavy seepage into the levee inclosure soon exceeded the capacity of pumps to remove. Work was rushed to cover the archaeological "digs" with plastic sheeting and gravel to preserve the formations from water damage. On the 22nd, the site was submerged. The Corps immediately started consideration of methods to control seepage, unwater and reexcavate the pits so the research eventually could be resumed. The archaeologists have some doubt, however, that the estimated expense of several million dollars might not better be devoted to investigation of numerous other sites known to exist along the Snake River.

1/Cave Life on the Palouse. National History, Vol. XXVI, No. 2, Feb. 1967.
2/Op.cit.

"Too little, too late" were the efforts made, first to discover, then to protect, the archaeological treasures of the Marmes Rockshelter. It lies in an area whose potential value was known at least 8 years before the site itself was recognized as a promising one. Nine more years passed before recovery work was started in 1962 to forestall the scheduled destruction by the Lower Monumental project, which was already underway. Six more years of intermittent work, hampered by inadequate funds and dispersal of effort among other locations, finally proved the outstanding significance of the rockshelter site - but the urgency of preserving it permanently for posterity was confirmed only a month before the site was scheduled to be submerged forever.

A very little longer time, a total of 5 months until February 1969, was gained for the design, authorization, funding and construction of the Marmes levee by reshuffling the complexly interrelated final construction sequences of the lock and dam project. In that brief time, thorough exploration and sealing of possible seepage channels lying 100 to 200 feet beneath the levee was out of the question. The integrity of the deep strata had to remain a calculated risk if any levee was to be attempted. This gamble was lost, but the site can be unwatered and permanently preserved if it is decided to be worthwhile. Meanwhile, the recovery of archaeological treasures at many other potential locations can be accomplished only by the prompt action of all participants - action which, unlike the case of the Marmes Rockshelter, will permit the prompt programming, adequate funding and timely prosecution of such research.

Libby Dam and Reservoir

The sanction of the International Joint Commission and an agreement with Canada concerning encroachment of the reservoir across the boundary were required before the Libby Dam and Reservoir project could be built. The Commission therefore took up questions with international aspects through a series of four public hearings in the region--two in Canada and two in the United States during March 1951, in which the District Engineer, as Chairman of the Columbia River Engineering Board, together with his technical working group, took a principal part. At the close of the last hearing in Helena, Montana, the Commission promised to reach a finding regarding Libby within the next 3 weeks, but the Commission did not act then, nor for nearly 10 years thereafter. Eventually, after diplomatic maneuvering, long bargaining over the sharing of cash and power proceeds of the project and the respective construction responsibilities of the parties, and changed Commission membership, a formula was agreed on.11/ The treaty embodying the agreement was finally ratified by both nations--Canada last, in June 1964.

11/ Treaty relating to international cooperation in water resource development of the Columbia River Basin. An agreement between Canada and the United States of America signed at Washington, D.C., 17 January 1961.

The Treaty committed Canada to provide 15-1/2 million acre-feet of storage at three sites in British Columbia and to operate those reservoirs for maximum mutual benefit in the integrated Columbia River system. The three Canadian reservoirs will accomplish needed regulation of the river that was sacrificed to local opposition and commercial power interests when reservoir projects in the United States were dropped from the original review report plan. The Duncan and Arrow projects are in operation, and Mica is scheduled to become operational in 1973. The Treaty with Canada finally cleared the way for construction of the Libby project, which now is underway.

Preliminary design of Libby Dam and Reservoir was started soon after it was authorized by Congress in 1950, but had to be suspended in 1954, when the IJC failed to act. Planning was reactivated in April 1961 after agreement had been reached with Canada on the terms of the Treaty. The multiple-purpose project will provide principal benefits in river regulation for the control of floods in the Kootenai and Creston Flats areas of the United States and Canada, and for hydroelectric power production at the site and at many plants downstream on the Kootenai and Columbia Rivers in Canada and the United States. Regulation of the river will provide additional benefits for navigation, irrigation, and conservation.

With growing national awareness of the impact of public works construction on natural beauty, the Seattle District engaged an architectural consultant familiar with the environmental planning problems of large public works. Mr. Paul Thiry, FAIA, was engaged to prepare a basic plan that would combine the beauty of the site with the forcefulness and simplicity of the dam structure. The objective was a structure that would be pleasing and functional, but not extravagant and costly. Mr. Thiry visited every major dam, both private and publicly owned, throughout the United States to learn how the structures had been integrated into the physical environment and what accommodations had been offered the public.

Inspired by the beauty, serenity and majesty of the setting for Libby Dam--mountains rise on every side, cut deep in the Kootenai River--Mr. Thiry formulated a plan and furnished sketches of architectual treatment of the dam and powerhouse, and for appurtenant features such as visitors' facilities and viewpoints, landscaping, parking areas, etc. From these, the Seattle District staff developed final designs and a comprehensive plan for the dam, its immediate vicinity, and the 3-1/2-mile reach of the Kootenai River downstream from the dam to the mouth of the Fisher River.12/ The impact of the project on its environment was minimized by integrating the architectural design of

12/ Steinborn, Sydney, Chief, Engineering Division, Seattle District, Fellow, ASCE, Aesthetic Factors in the Planning, Design and Construction for Libby Dam, Meeting Preprint 6999 for American Society of Civil Engineers meeting on environmental engineering, Chattanooga, Tennessee, May 13-17, 1968 the dam, powerhouse, and visitors' facilities into a single unit. The integration of structures with each other and with the environment required considerable care and coordination by the District's designers, including rigorous control of contractor operations in the damsite area.

Libby Dam will be a high, straight, gravity concrete structure with a gate-controlled central overflow spillway. The dam will back water into Canada and inundate several townsites, rail and highway locations, and other utilities that will require relocation. The largest relocations are about 60 miles of the Great Northern Railway main line, requiring a 7-mile tunnel through Elk Mountain, 52 miles of Montana State Highway 37, and Forest Service roads which now parallel the river almost to the Canadian border. The new highways will require many structures, including a major bridge across the reservoir.

Construction began the spring of 1966. Initial filling of the reservoir is scheduled for spring 1972; full storage will be provided in 1973 to meet the treaty commitment. First power on the line is scheduled for 1974. Completion of the entire project is aimed for 1975. Harvesting of merchantable timber within the reservoir area began in 1966 and will extend over about a 5-year period.

The project has required the importation of a large labor force to the sparsely populated northwest Montana region, which has resulted in the need for additional housing, service facilities, and schools. Most of the workers and their families are settled near the two large towns of Libby and Eureka, but the impact on the smaller towns of Trego, Troy, Fortine, and Rexford is no less severe because of their limited facilities. Mobile home settlements developed at nearly all of these towns as contractor and Government personnel arrived with their families. The Seattle District purchased and set up almost 100 new mobile homes for the large Government force required for the project.

The Seattle District began its largest school construction program when special legislation (Public Works Appropriation Act of 1967) allowed the use of project funds for support to schools in the region. The Seattle District's school support program for the 1,500 new students brought to the region as a result of the project will total about $3-1/2 million. Included in the program are construction of 72 classrooms, complete with furnishings and ancillary facilities such as gymnasiums, kitchens and libraries, the purchase of school buses, and housing for teachers at the more remote towns. Although portable classrooms would have provided satisfactory education facilities during the construction period, they would not have served the schools' post-project classroom needs that will result from normal enrollment increases and the necessity to replace existing classrooms. A vigorous cooperative program with the schools resulted in permanent-type construction of 62 of the 72 classrooms, providing modern schools for the local people long after completion of the project. Federal participation in permanent school facilities includes: a cash contribution toward construction of a new junior high school at Libby; a new music room for Libby Jr. High School built entirely with Federal funds; all costs for construction of additions to the senior high school and the Plummer and McGrade elementary schools at Libby; additions to the high school and the elementary school at Eureka, and a new elementary school at Trego; and a cash contribution toward an addition to the elementary school at Troy.

The project is Seattle District's largest civil works undertaking to date, estimated to cost about $383 million. Mr. Phillip L. Cole, Resident Engineer, is supervising construction. Additional data concerning the design and construction are contained in Appendix C.

Approximately 43,000 acres of land are required for all features of the project, such as damsite and construction areas, lands for the reservoir, and lands for the relocation of utilities, roads, highways, and the Great Northern Railway. Of this area, about 15,000 acres are Federally owned and the remainder are in State, County and private ownership. A large area of the latter is timberland purchased from a lumber company. All but a small reserve around the damsite will be transferred to the U.S. Forest Service for conservation management.

Corps of Engineers personnel first obtained and have renewed, as required, temporary rights from landowners in the project area for surveys and subsurface explorations. The reservoir area is being acquired by outright purchase to the full-pool elevation of 2,459 feet above mean sea level, plus a lateral distance of approximately 300 feet to provide for adverse effects of saturation, wave action, and bank erosion.

Actual purchase of lands began in 1966 and is nearly completed. Approximately 685 separate tracts are involved in the damsite, reservoir, and necessary road and railroad relocations. The majority lie in the reservoir area. Canadian authorities are handling real estate acquisition, relocations, and reservoir clearing in their part of the reservoir.

Another Columbia River Review

Of the three major Seattle District projects in the House Document 531 Main Control Plan authorized by the 1950 Flood Control Act, only Albeni Falls was built promptly. Libby was delayed by international complications. Priest Rapids, without storage provisions, eventually was licensed by the Federal Power Commission for construction by the Grant County Public Utility District. Glacier View and Paradise were never authorized because of local opposition to one and only marginal economic justification for the other. Hells Canyon on Snake River (in Portland District) went through protracted litigation and finally was built, to an entirely different plan with comparatively little storage, by Idaho Power Company. Thus, the greater part of the vital storage contemplated in the Main Control Plan could not be obtained. However, negotiations with Canadian authorities concerning Libby Dam meanwhile had developed the prospect of extensive reservoir construction by the Canadians on that part of the Columbia River in British Columbia. These and other rapidly changing circumstances so altered the concepts of the Main Control Plan as to necessitate restudy of the entire Columbia River system.

By resolution of 28 July 1955, the Congress requested the Chief of Engineers to review House Document 531 in order to keep planning in pace with the march of events. As in the previous two Columbia River comprehensive studies, the Engineer Districts furnished the basic data pertaining to their respective jurisdictions while North Pacific Division coordinated the work and wrote the resulting report.

Seattle District's part in the new review was an extensive restudy of the many possible projects that had been considered in previous work, especially storage reservoirs, to see how they would fit into the Columbia River Main Control Plan with the projects already existing or assured. Among the latter, the three Canadian reservoirs assured under the Treaty--Mica Creek, Arrow Lakes, and Duncan Lake, with their 15-1/2 million acre-feet capacity--would substantially alter the economics of subsequent additions to the system.

The Paradise project on the Clark Fork in western Montana was found to be inferior to a reservoir at the Knowles site on Flathead River, which therefore was recommended as a substitute. Knowles would provide about 3 million acre-feet of usable storage.

The Flathead River outlet of Flathead Lake in western Montana is shallow, limiting the extent to which storage in the lake can be released for use downstream. Improvement of the outlet channel would make available about 1-1/4 million acre-feet, and this project was recommended. Other Seattle District prospects failed the test of present economic justification: Long Meadows reservoir on Yaak River, a tributary of the Kootenai River; Ninemile Prairie reservoir on the Blackfoot, a tributary of the Clark Fork; and Enaville reservoir on the Coeur d'Alene. These and other sites were restudied in various combinations that might add desirable headwater storage to the Columbia River system.

The final report transmitted to the Congress recommended only the Knowles and Flathead Lake outlet improvements in Seattle District. The report was published as House Document 403, 87th Congress, 2d session, in May 1962. There has been no congressional authorization of the projects to date.

Interagency Activities

Extensive studies by official commissions and congressional committees looking toward crystallization of economic principles and public policies pertaining to development of water resources were mentioned previously. The subject deserves more attention here, as it has had important influence on the public works programs of Federal, State and local agencies. First emphasis, beginning with the Inland Waterways

Commission in 1908 and repeated by successive early investigators, was on the principles of comprehensive planning and multipurpose development. This concept was not implemented by legislation until the River and Harbor Act of 1925 made it the objective of the "308" investigations. When the economic depression of the 1930's sparked acrid controversy over the propriety of Federal public works in general, the learned investigating bodies directed their emphasis toward coordination of effort, nonduplication of work and uniform, conservative procedures among Government agencies in their economic analyses and reports to Congress.

The principal public works agencies early recognized the necessity of closer collaboration as witness their contributions to the Corps "308" reports in the 1930's. Formalizing this procedure in June 1939, the Departments of War, Agriculture, and Interior joined in a tripartite agreement to improve interagency cooperation. In 1943 the Federal Power Commission joined, and a year later a continuing organization was formed: the Interagency River Basin Committee (IARBC). In 1945 this became the Federal IARBC. Regional interagency committees were organized in the Missouri Basin in 1945 and the Columbia Basin in 1946. Other governmental agencies rapidly were added to the Federal and regional groups. The latter also took in representatives of the State governments in their regions. The Columbia Basin Interagency Committee (CBIAC), which consisted of representatives of six Federal departments, one Federal commission, and the governors of seven states, was replaced by the Pacific Northwest River Basins Commission(PNWRBC) in 1967.

The PNWRBC was established on 6 March 1967 under the terms of the Water Resources Planning Act of 1965 at the request of the Governors of Idaho, Montana, Oregon, Washington, and Wyoming. The Commission is composed of five members representing the states who formally requested it, members representing the eight Federal departments with definite interests in water and related land use planning, and a member representing the United States-Canada Columbia River Treaty. The chairman is appointed by the President of the United States. Through a permanent technical staff in offices at Vancouver, Washington, its technical subcommittees assemble, study, and publish to the membership and the public essential information pertaining to all aspects of water and related land resources of the basins and their utilization. Commanding, as it does, the combined expertise of specialists in these fields, the PNWRBC has become a most effective and authoritative guiding force in regional resource planning.

The Corps of Engineers was authorized by the 1962 Flood Control Act to make a comprehensive study of Puget Sound and Adjacent Waters (PS&AW). As other agencies were engaged in related work, the Federal Interagency River Basin Committee requested CBIAC to coordinate the various efforts to avoid duplication. Accordingly, a Puget Sound Task Force was established in March 1964, including representation from a wide range of pertinent professional disciplines in State and Federal agencies. In 1967, the comprehensive study came under the aegis of the Pacific Northwest River Basins Commission. The study area embraces Puget Sound, with 2,500 square miles of inland sea and 10 major ocean ports; 12 counties having a land area of 13,500 square miles; the bulk of the State's industry and two-thirds of its population; and 10 major and 12 minor streams flowing into the Sound, Georgia Strait, Hood Canal or the Strait of Juan de Fuca. As the entire study area lies within Seattle District's sphere of activity, District personnel are prominent participants. The total budget for the PS&AW study is nearly $3-1/4 million, of which Seattle District will use about 40 percent. A report and 15 appendices on the study are scheduled for completion by mid-1970.

The Seattle District also is participating in a broader PNWRBC study of the entire Columbia-North Pacific Region, complying with recommendations of the Senate Select Committee on National Water Resources (see Bibliography, item 20). The program, which has been approved and partially funded by Congress, provides for a group of 18 framework studies covering major river basins. The Columbia-North Pacific Region Comprehensive Framework Study began in Fiscal Year 1966. The purpose of this study is to develop a comprehensive and rational plan for the development, use, and management of water and related land resources of the region to insure the best use and development for all purposes.

The Columbia-North Pacific study area includes all of the Columbia River Basin in the United States, that part of the Great Basin in Oregon, and all of the coastal streams of Oregon and Washington. This is an area of about 275,000 square miles, encompassing most of what is commonly referred to as the Pacific Northwest. The area includes all of the State of Washington, most of the States of Oregon and Idaho, and portions of the States of Montana, Nevada, Wyoming, and Utah.

Floods - Occurrence, Losses and Remedies

Since the Congress in 1936 declared flood control to be a proper activity of the Federal Government, this nation has spent billions of dollars on public works for that purpose. Most of that work has been done through the Corps of Engineers and has involved two general lines of attack. The first, and most broadly effective, has been flood prevention through the storage of excessive runoff in reservoirs to reduce flood stages downstream within tolerable limits. As pointed out earlier, reservoir sites that are suitable with respect to location, topography and hydrology often do not exist. Where they do, economic and political considerations are likely to prevent their use. Therefore, the most frequent recourse has been to local flood protection works--levees, floodwalls, bypass channels, or improvement of the natural channels--to restrain high flood stages from overflowing adjacent areas.

Flood control projects of either type, preventive or protective, come about only as the result of bitter experience. This is so because they can be justified and undertaken as Federal projects only when the average annual flood damages exceed the average annual costs of corrective works; in other words, there must be a history of flood sufferance before a remedy can be prescribed.

As the great program of public works for flood control proceeded throughout the nation, the Engineers intently gathered and studied pertinent facts: the frequency and severity of floods at specific points on each stream, the resulting damages, and the effectiveness of complete works in preventing damages that otherwise would have occurred. It was gratifying to find that, in general, the work done was an economic success in that the losses that would have been sustained without the work well exceeded the costs of prevention. But it also became evident that, while individual battles were being won, the general war to reduce flood losses was being lost. Despite the investment of billions of dollars in flood control, overall flood losses were mounting. In estimates of annual flood losses from 1903 to 1958, Gilbert F. White and associates of the University of Chicago (see Bibliography, item 27) reported that total losses for 34 years preceding 1936 were about $4.1 billion, whereas the losses during the succeeding 22 years, 1937-1958, amounted to about $6.6 billion.

Use and Abuse of Flood Plains

The root of this dilemma lies in the acceleration of economic development on valley floors, or flood plains. These are the low lands, the level lands, the rich lands. They offer the best soils to the farmer; easy grades and gateways to the railroad or highway locator; good terrain and often valuable clay, sand and gravel deposits to the builder. The stream may furnish power for industry or constitute an advantageous route for transportation. It supplies the ground and surface waters essential to any community and usually becomes a convenient conveyance for disposing of sanitary and industrial wastes. With all such favorable factors, valley locations inevitably attract expanding populations, enterprises, and their attendant investments. When these developments encroach, as they increasingly do, on the flood plains of the streams, they incur increasing losses from floods. The greater the investment, the greater the loss from a flood of damaging magnitude.

Flood plains are exactly what the term signifies. They are the bottom lands along a stream that are periodically overflowed when the stream rises over its banks. That streams will overflow in the course of time unless artificially restrained is as certain as any law of nature. Valleys were created primarily by the action of flowing waters. Flood plains on the valley floors are the current domains of the streams that periodically occupy them. They are formed and reformed, filled and cut and refilled by the runoff and the materials transported from the upland watershed. The process of eroding the highlands and filling the lowlands guarantees the gradual degradation of a normal stream channel. As the channel slope declines, so also will the water velocity and consequent discharge capacity in any given section. To accommodate high discharges, the stream must increase its channel cross section, which it does by rising out of its banks and occupying as much of the flood plain as it needs.

It has been well said (though perhaps oversimply) that however great a flood may have been in any stream, time will bring greater ones. The calculation of flood probability in terms of frequency and magnitude at any point has been a fundamental factor in the planning of hydraulic structures such as dams, levees, bridges, and channels. The idea that the same type of information, translated into terms of flood plain overflows and widely disseminated, might aid people in avoiding the hazards of flood plain encroachment gained wide recognition among engineers about 10 years ago. Although the problem of flood plain occupancy and various proposals to regulate it had been discussed here and there for 20 years past, little had been done about it on a national scale.

Mr. Francis C. Murphy, hydrologist with the Seattle District of the Corps of Engineers, in 1958 applied for and received from the Secretary of the Army a Research and Study Fellowship grant that enabled him to review and report all aspects of the subject "Regulating Flood Plain Development" (see Bibliography, item 26) with Gilbert F. White at the University of Chicago. Mr. Murphy's work has become definitive in this field. Unfortunately, he died soon after returning to Seattle, without seeing the fruits of his work.

Flood Plain Management

The Senate Select Committee, in its Print No. 15, 1960, recommended the regulation of flood plain use. The Flood Control Act of the same year authorized "the Secretary of the Army through the Corps of Engineers to compile and disseminate information on floods and flood damages, including identification of areas subject to inundation by floods of various magnitudes and frequencies, and general criteria for guidance in the use of flood plain areas; and to provide engineering advice to local interests for their use in planning to ameliorate the flood hazard." Accordingly, a Flood Plain Information Program was initiated in Seattle District in 1961. Under this program, studies are made and reports prepared that present information regarding flood heights and inundation contours of past and probable future floods. Five such reports were completed as of 1967 covering the Stillaguamish, Nooksack, Skagit, Snohomish, and Sumas River Basins.

Recently the Flood Plain Information Program has been expanded by the following official actions:

Executive Order 11296, August 1966, directed that uneconomic, hazardous or unnecessary use of flood plains be avoided in locating Federally-owned or financed construction.

Task Force Report (House Document 465, 89th Congress, 2d Session, 1966) recommended encouragement and guidance at all Governmental levels toward wise use of the nation's flood plains.

Chief of Engineers Directive, the fall of 1966, instructed Districts and Divisions to establish full-time flood plain management services to comply with the above Executive Order and Task Force recommendation.

Flood Hazard Evaluation Guidelines, drafted July 1967 by representatives of 25 Federal executive agencies that build or sponsor any type of public facilities, defined specific conditions and criteria that should be observed with reference to potential flood exposure.

Public Law 448, 90th Congress, 2d Session, approved 1 August 1968, provided that flood insurance be made available only to states and areas that evidence positive interest in the flood insurance program, and that assure the adoption by 30 June 1970 of permanent land use and control measures consistent with the criteria developed and the enforcement of such measures as soon as technical information is available.

Seattle District's Flood Plain Management Service is headed by Mr. George A. Lemke, who coordinates the program with Federal, State and local governments and furnishes them the information necessary for compliance with the propoundments mentioned above. Pursuant to the expanded program, Lemke's unit thus far has issued three community reports concerning Missoula, Bucoda and Centralia-Chehalis, plus a report for Benton County on the Yakima River. Hopefully, effective application of this cooperative program may ultimately check heedless encroachment on the natural flood plain domains of rivers in Seattle District and relieve the taxpayer of some of the mounting burden of local stopgap flood protection work.

Special Continuing Authorities

In post-war years, Congress made certain exceptions to its previous requirement that each civil works project be individually authorized before it could be programmed for construction. Authority and responsibility for selection and funding of certain urgently needed small projects have been delegated by the Congress to the Secretary of the Army and the Chief of Engineers. The authorities and responsibilities so delegated are continuous in nature and have general, nationwide application. Special continuing authority programs now in effect are:

a. Emergency snagging and clearing projects for flood control (Sec. 2, Flood Control Act 1937 as amended by Sec. 208, Flood Control Act of 1954) - Limited to $100,000 and certain types of emergency work.

b. Small flood control projects not specifically authorized by Congress (Sec. 205, Flood Control Act of 1948, as amended) - Monetary limitation is $1 million, and local participation is required.

c. Emergency bank protection projects (Sec. 14, Flood Control Act of 1946) - Limited to $50,000 and protection of existing public works.

d. Emergency flood preparation, flood fighting, and rescue operations; repair and restoration of existing control works (Public Law 99, 84th Congress 1955) - No monetary limitation. Established emergency fund. Also permits emergency use of other appropriations. Authorizes rental of extra equipment.

e. Emergency snagging and clearing for navigation (Sec.3, River and Harbor Act, 1945) - Monetary limitation $300,000 nationwide.

f. Small navigation projects not specifically authorized by Congress (Sec. 107, River and Harbor Act of 1960, as amended) - Monetary limitation $500,000. Applicable only to general navigation improvements, under same rules as applied in specific congressional authorizations.

g. Small beach erosion control projects not specifically authorized by Congress (Sec. 103a, River and Harbor Act of 1962) - Monetary limitation $500,000. Local cost-sharing required.

Detailed regulations have been laid down by the Congress and/or the Chief of Engineers governing the formulation and prosecution of work under the special continuing authorities. In general, these provide that each project shall be complete in itself and not overlap, merge with, or be a part of some other project; that it be investigated, justified economically and technically, reported and recommended by the Engineer District; and reviewed and approved by higher authority, according to the procedures applicable to major projects that require congressional authorization. These are rigid controls that preclude any careless use of the continuing authorities by the Corps. Indeed, Corps responsibility is accentuated in that control of all work done is retained by the Congress through its annual review thereof, preceding the appropriation of funds. In this respect, such special projects are in the same position of budgetary and congressional review as appropriations for administration, operation, and maintenance always have been.

The projects undertaken by the Corps under these special authorities constitute a very small part of its overall civil works program. For example, Seattle District reported for its 1967 Fiscal Year 11 "Section 205" projects (b above) at an average cost of a little over $10,000; 5 "Section 14" projects (c above) at a little over $28,000; 10 "P.L. 99" projects (d above) averaging $40,600, of which one emergency flood fight cost $269,000; and 15 "Section 207" projects (f above) averaging about $5,000.

Flood Fighting

The most important of the continuing authorities, in point of direct public service, are those that enable the Corps to respond promptly to emergencies. In Seattle District, most emergencies are caused by floods and P.L. 99 (d above) is invoked. Engineers and technicians throughout the organization are on call, in whatever force the circumstances require, to go into the field. These people have been organized as emergency teams, assigned in advance to specific valley areas where floods occur. They are thoroughly acquainted with the flood problems that may be encountered there through periodic inspections, conferences with local authorities, and practice mobilizations. A District Flood Manual provides guidance in methods, while a Disaster Control Center in Operations Division monitors the probabilities, and mobilizes and dispatches appropriate forces to the scene when rising waters approach damaging stages.

The longest, most arduous and most expensive flood fight in District history was that of May and June 1961 on the Kootenai River at Bonners Ferry, Idaho. The town lies at the head of a broad, very flat valley that extends northward into Canada and contains the great Kootenay Lake of British Columbia. The entire valley floor, in ages past, was covered by the lake and is composed of sediments that subsequently have been reworked by the meandering and frequently overflowing river. This rich agricultural land has been extensively developed behind levees, both in the Kootenai Flats area in Idaho and the adjacent Creston Flats of British Columbia, and is a classic example of imprudent encroachment on the flood plain. On the United States side of the border, over 100 miles of levees partition some 36,000 acres into 21 adjoining enclosures.

Some of the embankments, particularly along the river channel where they are most exposed to attack by currents, waves, and floating debris, are 15 feet high. Some stand on pervious strata through which dangerous seepage occurs. All of the areas within the United States have had their levees overtopped, breached, eroded or undercut with consequent damage at one time or another. The experience in Canada has been comparable.

During the last 20 years, Seattle District has assisted local people and other agencies in fighting 10 spring floods at a cost of about $7 million. Half of that was spent in 1961, when 9 districts were flooded; and about one-fourth in 1956, with 10 districts flooded.

The 1961 Kootenai Flood

Seattle District's Disaster Control Center was activated 22 May 1961. The area flood engineer, his assistant, and the Chiefs of the Operations and Intelligence Branches, with radio communications personnel, were dispatched to Bonners Ferry. A week later, two levees had been breached and the flood was classified as one of major proportions (see photo 10). Five more diked acres were flooded during

Kootenai Flats Flood, 1961 Photo. 10

the next week. Altogether 6,237 acres south of the border were flooded. This represented only about one-fifth of the diked lands, although the flood crest was nearly 2 feet above that of 1948 when all districts were flooded. Many thousand additional acres would have been inundated in 1961 if the Seattle District had not organized the flood fight and provided a staff of 76 people and 39 pieces of Corps-owned equipment. Two chartered helicopters were used to locate danger spots and take technical people and small equipment to them. A maximum of 2,181 temporary laborers, with 1,005 on one shift, were hired. One hundred seventy one pieces of rented equipment and 651,700 sand bags were used. The Fourth Air Force Rescue Unit furnished two 5-place helicopters from Fairchild Air Force Base.

An Idaho National Guard Unit of 54 men with 19 radio jeeps, 10 trucks and 2 amphibious vehicles arrived simultaneously with the Corps of Engineers force. Other agencies assisting were:

Agency	No. of people	Pieces of equipment
Diking Districts	651	224
Boundary County	50	50
State of Idaho	51	37
Great Northern Railway	15	5
U.S. Forest Service	16	16

The town of Bonners Ferry and various other Federal agencies helped with men and equipment, the numbers of which are not known. Corps of Engineers costs for this flood fight were $1,081,000, the largest in our experience. The flood damages sustained were estimated at $3,439,000. Additional damages that would have been sustained, if the flood fight had not prevented inundation of all the other levee districts, were estimated at approximately $3 million. Completion of Libby Dam, with its great flood control reservoir, will relieve both our own and the Canadian people of this perennial burden.

Floods in Other River Basins

Other river basins in which Seattle District has fought floods are numerous. On the west slope of the Cascade Mountains are the Nooksack, Skagit (also severely constricted by levees on the flood plain), Stillaguamish, Snohomish, Green and Puyallup (the latter two now protected by the Hanson and Mud Mountain flood control reservoirs). East of the Cascades, all tributaries of the Columbia and many smaller creeks have reaches subject to destructive flooding. Among these are the Yakima, Wenatchee, Entiat, Methow, Okanogan, Spokane, Coeur d'Alene, St. Maries and Clarks Fork Rivers; Wilson Creek, Lightning Creek and Placer Creek. Many streams have been improved by control works of the Corps, but many also remain to be protected adequately, pending which emergency measures under the continuing authorities previously cited still become necessary. As this page is written, the Disaster Control Center is in action and District flood fighting teams are working on the Nooksack and Snohomish Rivers.

As implied by its title, the Disaster Control Center of the District has a scope of responsibilities beyond its own flood problems. Along with other Districts of the Corps, the Center is prepared to act and does so in any disaster area designated by the President upon request by the local Engineer District and State governor. The most recent instance was the dispatch of assistance to Alaska after the earthquake of Good Friday, 27 March 1964. Teams from Seattle have joined the Kansas City District during Missouri River flood disasters on two occasions and also have helped northern California districts twice during floods on the Feather and Russian Rivers. New England hurricane and flood disasters have brought our engineers to the scene. Engineer troops with special training and equipment--portable bridges, heavy earth moving machinery, amphibious and airborne vehicles and field communication facilities--have been called into action in this District and elsewhere in the nation, thus demonstrating again the dual versatility of the Corps military and civil organization.

River and Harbor Maintenance

As related previously, the responsibilities of Seattle District in the early years centered mainly on the improvement of harbors and navigation channels. The completion of each such improvement imposed continuing responsibility for its maintenance. Once a certain channel depth and alignment is established, published, and utilized by shipping, it must be maintained.

Every major port in which this District has made harbor improvements is on a river estuary where the deposition of riverborne sediments and snags from forested watersheds build shoals, to the detriment of port facilities and the shipping that serves them. In addition, those harbors that face the open sea, such as Willapa Harbor and Grays Harbor, must contend with the formation and constant shifting of sandbars by ocean waves at their seaward entrances. The great rock jetties that protect the entrance to Grays Harbor serve two purposes. They provide some protection from incoming ocean waves that break violently over the entrance bar, and deflect or block the littoral movement of waveborne sand into the entrance channel.

No jetty construction can be fully and permanently effective. Indeed, the jetties are gradually (and sometimes quickly) damaged during especially severe storms and require extensive repairs from time to time. Regular inspection and survey of all river and harbor works is necessary to discover the extent of deterioration and the maintenance work required. For many years the surveyboat MAMALA, especially designed and equipped for the rough waters of the Willapa and Grays Harbor bars, has been stationed on the coast to furnish condition reports as a basis for planning channel dredging or other necessary repair work.

At the inland harbors this work has been done by smaller survey boats such as the 30-foot SYMONS, replaced by the DAVIES in 1958, or by work skiffs.

The removal of snags has been a continuous task, performed originally (1885) by the SKAGIT; then the shallow draft stern-wheeler SWINOMISH and, since 1915, by the venerable W. T. PRESTON.

Periodic channel dredging on the Pacific Coast usually has required the use of seagoing hopper dredges, based in Portland or San Francisco Districts and assigned to work in Seattle District as needed. Among these ships are the 216-foot DONALD A. DAVISON, 720 cubic yard capacity; the BIDDLE, 352 feet, 3,060 cubic yards; the HARDING, 308 feet, 2,682 cubic yards; and the PACIFIC, 180 feet, 500 cubic yards. The COL. P. S. MICHIE, an older hopper dredge built at Seattle in 1913, had a notable history. Like the others, she operated in many Pacific Coast harbors--Coos and Siletz Bays, Oregon; the Lower Columbia River; San Diego Harbor, San Francisco Bay and Sacramento River, California; Willapa and Grays Harbor, Washington; and Ketchikan, Alaska. She was working in the Hawaiian Islands in December 1941, moored at Pearl Harbor on Sunday the 7th. Japanese bombs fell all around, but none made a direct hit and neither ship nor crew was hurt. MICHIE was sold in 1954 for work in Lake Maracaibo, Venezuela.

ROSSELL, a 268-foot, 1,450-yard hopper dredge operated in Willapa and Grays Harbors in June 1957. The following September she was entering Coos Bay, Oregon, after discharging her hoppers at sea, while the Norwegian freighter THORSHALL was outbound for Seattle. The freighter suddenly turned to port and sliced into ROSSELL's port side. The dredge sank immediately. Most of the crew were able to clamber to safety by means of the protruding masts. Colonel Jackson Graham, Portland District Engineer, was making an aerial inspection of the Coos Bay work by helicopter at the time. He and his pilot rescued 15 crewmen from the rigging. Coast Guard and other boats picked up some of the others, but three crewmen died, one was missing and six were injured. No one on the THORSHALL was hurt, but the vessel's bow was badly damaged. Seattle District's own hopper dredge, the 244-foot DAN C. KINGMAN, was decommissioned and sold to the Government of Thailand in 1954 for work on the Mekong River.

The seagoing hopper dredge is a unique development of the Corps of Engineers that deserves description. Interior cargo space consists of large bins with doors in the bottom that can be swung open to jettison the contents. The vessels are equipped with powerful dredge pumps. Suction pipes or drag arms are connected at the upper end to the ship by trunnions and at the lower ends have drags for contact with the bottom. The drag arms are raised and lowered by winches. The hopper dredge, while working, moves along at 2 to 3 knots with the drags in contact with the bed material. The mixture of water and solids is hydraulically lifted by the pumps through the drag arms and discharged into the hoppers. Solid materials settle to the bottom of the hoppers while the water is allowed to spill back overboard. When the hoppers are loaded, the ship steams out to deep water, opens the bottom doors, and drops its load.

Hopper dredges are operated by the Corps in many of the principal harbors of the nation. Some are very large ships. The ESSAYONS, based on the east coast, is the world's largest--525 feet long, with a load capacity of 8,000 cubic yards.

Most of the dredging done by the District inland has been by contract, with pipeline dredges. These are barge-mounted pumps with suction pipes and revolving cutter heads that loosen the bottom materials and draw the watery mud up through the pumps. The excavated slurry is discharged through float-supported pipes to fill areas on shore. Much of Seattle's south end industrial area is land built up from the original tideflats by pipeline dredging of the Duwamish River ship channels and turning basins.

Operations Organization

During the first 40 years of the District's existence, while it was a small organization, little formal internal departmentalization was necessary. A few clerical people in the office handled what today would be called the administrative and supply functions. A few engineers made office designs, wrote technical reports, and often did their own field survey work and drafting. They also supervised construction in the field. Of course, there were special crews to operate the Government Locks and the floating plant. The assignments of these simple working groups often overlapped, as directed by the District Engineer or his chief assistant, to distribute the load. The Chief Clerk was the ranking civilian in the office during the early years that the District Engineer did his own engineering work. Later, an engineer became the head civilian. This was the era of Mr. H. J. M. Baker, and it is said of him that there was only one department in the office and field--his. He had great diplomacy and tact. His father was an Episcopalian minister and also a medical doctor. Mr. Baker was fond of quoting him. Mr. Baker personally trained, sometimes taught, and always supervised in detail the other employees and their work, whether in performance, deportment, dress or language. He was a great educator, well remembered, and still quoted by the few old-timers remaining.

As national defense and World War II activities of the District multiplied, the organizational format was revised frequently. Through the war years, many new units were created to handle the diverse jobs of that period, but it was not until February 1944 that an Operations Division, functioning essentially as now, was set up. Captain George F. Hopkins was Chief of the Civil Works Branch, which corresponded to today's entire Operations Division. Mr. Karel Smrha was senior assistant in the division until mid-1950, when he became Chief and remained so until his retirement in 1965.

As major civil projects were completed, they were added to the Operations Division for operation and maintenance. These now include Mud Mountain and Howard A. Hanson flood control reservoirs and the Chief Joseph and Albeni Falls multiple-purpose projects. As Chief Joseph and Albeni Falls were the first Seattle District projects with hydroelectric power installations, they required the inauguration of new methods to staff, equip, operate and maintain the plants. The personnel strength of the Operations Division was considerably increased when power generation commenced in 1955 by the addition of about 140 powerhouse operators, maintenance craftsmen, security and supervisory people for the two projects. There were not enough trained operators, electricians, and mechanics available in the labor market to man the projects by direct hiring. The deficiency was remedied by the institution of classroom and job training courses at both projects. Several unskilled laborers at the projects upgraded themselves through this instruction, while others were selected for training through Civil Service examination. During the last 10 years, automation of equipment and streamlining of procedures have permitted a reduction of project crews by about one-third. The reductions were effected without dismissals, by nonreplacement of normal withdrawals.

Meanwhile, normal attrition by deaths, retirements, and transfers necessitated renewed training in 1967 to replace powerhouse operators, electricians, and mechanics. This program, involving a curriculum of International Correspondence School technical courses, on-the-job training under the supervision of foremen, and special applications instruction by staff engineers, is in effect Divisionwide to provide a mobile reserve of expert people for any project in any district needing them. The lessons learned in operation and maintenance of the four existing dams of the District have been passed on to Engineering Division and applied to good effect in the design and current construction of the Wynoochee and Libby projects.

Worthy of note is that in 13 years of operation the Albeni Falls and Chief Joseph projects, from their respective starts in April and August 1955 through 1968, have produced approximately 73 billion kilowatt hours of energy and earned $94 million in revenue.14/ If Albeni Falls were credited with the added generation at plants downstream that has been derived from use of its storage, the earnings of the Albeni Falls and Chief Joseph projects to date would exceed their total costs of construction, operation, and maintenance.

Navigation Regulations and Statistics

Operations Division performs several regulatory functions incidental to the broader responsibilities of the Corps for improvement of rivers and harbors. They derive from Article I of the Constitution, which authorizes Congress "...to regulate Commerce with Foreign Nations and among the several States...," and Article III, which "...extends

14/ Federal Power Commission, Annual Reports the judicial Power of the United States...to all cases of admiralty and maritime jurisdiction...." These authorities and powers have been further defined through the years by the Congress in numerous River and Harbor Acts.

Specific responsibilities of Seattle District have been the promulgation of regulations governing the establishment of, and navigation in, restricted areas, danger areas and anchorages; construction and operation of bridges or other structures affecting navigable waters; removal of obstructions, including wrecks or abandoned vessels; enforcement of Federal Oil Pollution Acts, and collection of statistics relating to waterborne commerce.

In 1966, enforcement of the 1924 and 1961 Oil Pollution Acts was transferred to the Department of the Interior. The promulgation of anchorage and bridge regulations, including the approval of plans and locations, recently was transferred to the new Department of Transportation.

Statistics of waterborne commerce long have been important factors in Federal works for the improvement of navigation. The River and Harbor Act of 1866 (14 Stat. 70) said in part, "...the Secretary of War shall state what amount of commerce and navigation would be benefited by the completion of each port under work...." and required that periodic reports thereof be made. The River and Harbor Act of 1891 (26 Stat. 766) was the first that required "...that the owner, agent, master or clerk of vessels arriving or departing from localities where works of river and harbor improvement are carried on shall furnish comprehensive statements of vessels, passengers, freight and tonnage."

The Act of 1902 established the Board of Engineers for Rivers and Harbors and made that Board responsible for compilation and publication of the statistics. However, field collection and first office tabulation is done by Seattle District Operations Division for both the District and Alaska. Thus, Seattle District gathers statistics on the most shippers, the largest area, the longest waterfront, and the most ports of any reporting District.

Mr. John Carmody worked with waterborne commerce for 30 years until he retired in 1952. His was a colorful and choleric character in this respect, matching any to be found on the waterfronts in his day. In 1947, Rolla Radley joined Carmody and three others in the statistical section. Today, retirements and lack of funds have reduced the force to Radley alone. The commercial statistics are in wide demand by economists, port officials, and industry, as well as engineers within the Corps. To the latter, they furnish indispensable information with which to weigh the economic merits of navigation improvements and to project the needs of the future.

PART 5 - WAR AGAIN, HOT AND COLD

Korea

The interval of primary attention to civil works following World War II soon was interrupted. Within 5 years the United States again was embroiled in active conflict--this time officially as a member of the United Nations expeditionary force to Korea, but in fact forced by the weakness of other members to be the dominant participant.

Between World War II and the Korean War, Seattle District's military construction consisted largely of converting existing structures to uses required by planned, permanent, peacetime forces at certain postwar installations, and scheduled construction of permanent structures to house and provide for the training of Army, Air Force, National Guard, and Organized Reserve Corps units.

Such work was done at Paine Field near Everett; Mukilteo Air Force Station at Mukilteo; Fort Lewis, Madigan General Hospital, Mount Rainier Ordinance Depot, and McChord Air Force Base, all near Tacoma; Auburn General Depot at Auburn; Portland Air Force Base at Portland; Fairchild and Geiger Air Force Bases at Spokane; Great Falls Air Force Base, and Gore Field Air National Guard Base, Montana; and a number of miscellaneous Army, Air Force, and Antiaircraft stations in the states of Washington, Oregon, Idaho, and Montana.

With the beginning of the Korean conflict--as with other wars in which the Nation has been involved--the Corps' military program was greatly accelerated and expanded. The program included the design and construction of facilities required for newly developed weapons and for the defense of the northwestern sector of the United States, such as troop housing, additional airfields for defense units, training camps, petroleum storage and dispensing installations, enemy-detection and interception nets, and ground defense systems. Indicating the magnitude of the work in Seattle District alone was the report at the end of Fiscal Year 1952, which showed under construction, or in the design stage, military programs totaling more than $54 million. Supply Division had most of the overseas action for the District--purchase, inspection, export preparation and dispatch of materials across the Pacific. The inventories of supplies that were handled corresponded in most respects to those of World War II, but the quantities were much less. Supply Division also procured and processed Government-furnished materials for domestic military construction. Engineering Division had little to do with design or construction overseas, as Corps units in Hawaii and Japan were more accessible to the front. Nor was there necessity for Seattle District to assemble and operate a fleet of supply vessels, as that responsibility had been passed to the Army Transportation Corps along with most of the floating plant some years earlier.

The major effects on the District of the Korean War were manifested afterward. The brutal communist invasion of South Korea was only the prelude to a series of red maneuvers that unmistakably threatened to disrupt the world. Review of the moves and counter moves of the Cold War is in order here only to the extent that the East-West arms race channeled the work of the District. This it did to great extent, through the obvious necessity for the United States to devise defenses against potential Russian attack. This potentiality already existed in the form of long-range bombing planes, and was growing to the proportions of a deadly menace with Soviet progress in the development of atomic weapons and intercontinental rockets to carry them directly across the Arctic.

Aircraft Warning and Interception Programs

To cope with these threats, a succession of ever more sophisticated defensive works was undertaken in the northern United States and Canada. There already existed a substantial legacy of radar aircraft warning and direction finder stations from World War II. To these were added more powerful "Gap Filler," ACW (Air Control and Warning), DEW (Distant early warning) line and BMEWS (Ballistic missile early warning stations) in great numbers. Some fifty of the ACW and Gap Filler Stations were built by Seattle District in the five Northwest states. Many DEW line sites were in the far north, accessible to heavy construction materials and maintenance supplies only via the Bering Sea and Arctic Ocean. Seattle District accumulated and packaged these goods through the winter months, with contractor forces, on Pier 37 in operations reminiscent of World War II. The shipping deadline was critical--it had to be timed to coincide with the breakup of arctic ice so the chartered vessels and barges could get through, and still allow time for unloading and return during the very brief open-water season in those latitudes. Delivery was at once a delicate enterprise in point of planning, and arduous in execution--usually, but not always, successfully consummated. The story of this battle against the rigors of the far north rivals that of the Aleutian campaign, lacking only the hazards of enemy attack but involving forces equally fearsome--the arctic floes.

Simultaneously with the expansion of aircraft detection and warning screens, fighter-interceptor and SAC (Strategic Air Command) bases were built or converted from older facilities, accounting for much of the District design and construction work mentioned as just preceding and during the Korean conflict.

Civil Defense

There was no positive assurance of complete, active defense even against bombers during the decade 1950-60 despite the elaborate detection and interception programs. Therefore, a nationwide civil defense program was initiated. The Government would place some of its vital communication and command centers underground. Seattle District did considerable work in this phase. Also, existing structures in population centers would be examined, and classified as to their capability for shelter. Suitable places would be designated and stocked to sustain refugees. This District conducted such surveys and preparations.

The third phase was encouragement of individual action such as construction of private shelters, development of procedures for orderly evacuation of threatened areas, and manning of civil defense warning, direction and action centers. In this the District was active, too. Engineers attended courses in shelter design, detection and prevention of nuclear radiation hazard, and the organization of teams to aid stricken areas. Such instruction was, in turn, passed on to others.

Nike and Bomarc

A wholly new weapon, the Nike ground-to-air guided rocket for use against enemy aircraft, also came to the fore in the 1950's. Seattle District acquired the sites, designed, and supervised construction of base facilities for 14 Nike-Ajax and/or Nike-Hercules launcher and control facilities in the vicinities of Seattle and Spokane before the program was superseded by the Atlas, Titan and Minuteman series of missiles designed for retaliation against hostile intercontinental ballistic missiles (ICBM's).

Bomarc installations were nearly completed at Paine Field, Washington, and Camp Adair, Oregon, before the program was suspended. Seattle District performed essentially the same functions for these guided rocket installations as it had for Nike, i.e., acquisition of real estate, physical feasibility studies, ground surveys, foundation and materials explorations, and the design of base facilities such as housing, feeding and storage structures; utilities, roads, parking and security accessories, together with supervision of contract construction in the field.

Atlas

Meanwhile, missile science, both in this country and Russia, had moved on to the development of rockets capable of intercontinental flight and the accurate delivery of nuclear warheads in a matter of minutes. Against such weapons no physical defense seemed possible. The only recourse was a psychological defense--a capability of like retaliation so swift and dreadful that it should deter any attack. Thus, in 1958, the Atlas E program was started, with Seattle District developing nine sites in the vicinity of Fairchild AFB and Spokane.

District functions were much the same as in the previous Nike and Bomarc projects, i.e., site feasibility studies, surveys and subsurface exploration; design and construction of utilities and living facilities. But the work was more complex and exacting because it involved deep underground construction, on a huge scale, of multiple living quarters and utilities, including duplicate power generators, at each location. The technical equipment, some of which was designed--and all installed--under District supervision, required most meticulous control and safeguards.

The Spokane Area Engineer Office was established at Fairchild AFB in 1959 to supervise construction of the dispersed missile sites. Lt. Colonel Don D. DeFord, the first Area Engineer, completed all heavy underground construction and installation of complex mechanical equipment. Lt. Colonel Robert W. Fritz, the second Area Engineer, supervised the famous "peek-and-probe" pipe cleaning exercise in which surgical cleanliness was obtained in the piping and fuel transfer systems.

Highly inflammable fuel in combination with oxygen provided the fiery thrust of the Atlas rocket. Both ingredients were stored underground in great volume and had to be pumped rapidly into the rockets prior to firing. The oxygen was liquid, at extremely low temperature and high pressure. The selection and installation of equipment and materials that could handle liquid oxygen (LOX) safely called for techniques of a new science--cryogenics. The material for pipe and fittings, tanks and pumps--anything in contact with the oxygen--must be stainless alloys of special design and great strength. Mr. Gerald Bletcher, Resident Engineer for the District, supervised construction of Atlas support facilities, including a liquid oxygen plant at Fairchild Air Force Base. At his office this writer once noted a massive 3/4-inch stainless steel valve resting on Bletcher's desk. Bletcher said it had been rejected for an invisible flaw revealed by Gamma-ray photography and added, "that item cost $1,500." The assembled LOX systems must be absolutely leakproof and chemically clean, as any contact with inflammable matter would start combustion instantly. Even a greasy fingerprint or a drop of pipecutting oil left in the system could start a holocaust. This danger was demonstrated tragically on 27 January 1967, when three astronauts were cremated by a flash fire in the oxygen-pressurized Apollo I spacecraft at Cape Kennedy.

Every component of the Atlas oxygen systems was inspected and tested minutely and repeatedly. The completed circuits were purged elaborately before oxygen was admitted. Nothing was accepted on faith, and all who had access to the work were drilled to perfection in safety precautions. A visiting engineer once demonstrated his thorough indoctrination in the safety code at the oxygen extraction and compression plant just completed by the District on Fairchild AFB. A large vacuum-jacketed tank truck stopped by the LOX plant; the driver connected his delivery hose to a receiving line, opened the valve, and casually lighted a cigarette as white vapor swirled around him. The horrified engineer dashed to the truck driver shouting warnings, only to learn that the truck carried noncombustible liquid nitrogen to be used in purging and the white vapor was only moisture condensed in the air around the chilled delivery hose, rather than oxygen which would have "lighted" the cigarette and probably the man.

Minuteman

The Atlas ICBM program with its complex liquid and gaseous piping system was part of the District design and construction program for four years, to 1962. Meanwhile, the Minuteman solid fuel ICBM had been developed. A crash program of Minuteman launching site construction 1/ was instituted under CEBMCO (Corps of Engineers Ballistic Missile Construction Office), a national task force organized for the purpose. Seattle District did the advance engineering and real estate acquisition for 15 Minuteman control sites and 150 launch sites in Montana, including site feasibility studies, surveys, soils and foundation investigations, and utilities such as the 15 water supply wells at the control sites. The most critical need at the start was for the District Real Estate Division to secure all the land rights necessary for construction and operation of the whole complex. The physical components of the missile launching and control facilities had not been designed when Seattle District received its groundwork assignments in the summer of 1959. The assignments therefore were in very general terms and subject to numerous mid-course revisions and refinements to conform with layouts and designs as these came from the many engineering firms that were retained by CEBMCO. Thus, field investigations and real estate work proceeded concurrently with engineering design and the determination of detailed requirements.

Real Estate

The land acquisition program 2/ was the largest for any single project ever undertaken by the Corps, involving some 5,200 tracts scattered through an area of 20,000 square miles in north-central Montana. Tract ownership data were obtained from local title companies for land that might eventually be involved. People experienced in real estate work were recruited from all available sources. Appraisers, negotiators, title searchers, and office help were obtained from other Districts, Government and commercial real estate organizations to staff field offices established at Malmstrom Air Force Base, Great Falls, and Conrad, Montana. The force numbered up to 80 people at the peak of work.

1/Authorized by Public Law 149, 84th Congress, 10 August 1959
2/Wheeler, Morgan, Acquisition of Land Interests for Nation's First Minuteman Missile Installation in Montana, American Right of Way Association. Mr. Wheeler, the former Chief, Great Falls Real Estate Suboffice, U.S. Army Corps of Engineers, Seattle District, is now Chief, Real Estate Division, Alaska District.

Due to the concurrency of the design and real estate phases, no one ever knew very far ahead exactly what properties or interests would be required. The first phase therefore was devoted to gaining legal access for site investigations and selection through permits-of-entry from landowners. Approximately 1,378 ownerships were involved in the sites under consideration for the 165 control and launcher bases. Subsequently, an additional 642 rights-of-entry were obtained for base construction.

The second phase was the acquisition of entry rights and, later, easements for a communication and fire control cable line connecting all the base sites. The line was to run cross-country underground, and required 1,800 miles of right-of-way that, so far, had been located only roughly. The initial entry permits on 5,000 tracts under 3,500 ownerships allowed contractors to proceed, with the understanding that the Government would pay for any damages and would later negotiate a permanent easement. By the time the cable line was definitely located and installed, the original entry rights were expiring and had to be renewed.

Meanwhile, new land requirements had emerged from the technical planning; viz, two line-of-sight clearance zones to be covered by easements extending from each launcher site a distance of 1,200 to 1,800 feet and at the ends of these strips azimuth marker monuments; easements for security and safety zones comprising circular areas with a 1,200-foot radius around each base site; easements for innumerable access roads and helicopter landing pads at each site. As these directives were received successively over a period of 4 years, it was necessary to return time and again--in all, not less than 12 trips and usually many more--to each of the thousands of owners; first to get each type of entry right, next to appraise, then to negotiate the final easement, lease or fee purchase with execution of an offer by the owner, and eventually to have the record documents executed and notarized. There also were trips to view, discuss and appraise damages as provided in the entry permits, or to resolve complaints of various kinds.

Because much of the land was under joint interests, such as farm or mineral leases and mortgages, estates and trusteeships, the negotiations often were protracted, multiparty affairs. Many titles were so clouded that they required much effort by office and fieldmen to clear title by obtaining the execution of appropriate documents. Others could not be secured satisfactorily by these means and required condemnation proceedings. Some owners could not be located, and a few would not deal at the appraised prices. These also required condemnation suits. However, less than 3 percent of the tracts ultimately went to court. This record, together with the general willingness of owners to grant entry for purposes that could not be divulged in detail, stands as a high tribute to both the spirit of the Montana people and the considerate conduct of the real estate personnel who dealt with them.

There were some exceptions to the local spirit of cooperation. Because of the urgent construction schedule, land was entered during seasons that were extremely inconvenient to farmers. Fences were cut, trenches were left open in cattle pastures, crops were destroyed, timber was removed, water and power supplies were interrupted, and so on. It was not uncommon for the negotiator to encounter a very irate landowner. One erected a sign pictured in photo 11. The Lewistown Daily News of 7 October 1960 carried this picture on its front page with the following comment: "Someone is Messin' with the Missiles--This sign, erected on a proposed Minuteman missile site...is causing considerable discussion.... A tourist...suggested that...the sign forgot to add the punch line, 'unstoppable'."

Other difficulties attended the work that went on winter and summer, in blizzard and dust storm, in temperatures from 40° below zero to over 100° F. The distances covered by fieldmen are suggested by the 1,800 miles of cable line between the base sites. Owners were even more widely dispersed. Sometimes fieldmen scouted cross-country over miles of rough range land or great, dry-farmed wheat ranches by car, saddle, or foot, as the terrain permitted, to locate the person sought. Several fieldmen helped herd stock or did other ranch chores while securing interviews. One assisted in the difficult birth of a calf.

By the middle of 1963, after 4 years' effort, virtually all land interests had been acquired and settlements made for the first Minuteman project. Signatures had been obtained on some 15,000 various types of instruments by a field crew whose average strength was 18 men, not including the staff appraisers. The office clerical and supervisory staff averaged 35 people. During the peak of the work in 1962, there were 25 fieldmen, 10 appraisers and 45 people in the office. The generators for the Atlas sites at both Fairchild, Washington, and Forbes, Kansas, Air Force Bases were furnished under a Seattle District supply contract. The skid assemblies used in fueling Atlas missiles were on a Pittsburgh District supply contract, and administration of those for Fairchild was the responsibility of the Supply Division.

The Minuteman real estate program described above was designated "MOB I." "MOB II" followed shortly. In December 1964, Seattle District was directed to acquire real estate for additional sites. Involved were: 55 launcher and control sites; 420 acres in 753 tracts, purchased outright, with restrictive easements on 5,300 acres at 50 of the sites; 320 miles of cable easements on 675 acres in 885 tracts; special easements or permits for roads and work areas on 1,150 acres.

The construction schedule, as before, required that advance rights-of-entry be obtained--520 in all. Only 37 tracts, or 2 percent, required condemnation in MOB II. The Conrad field office which handled this job finished and was closed in May 1968.

"Messin' With The Missiles:" Lewistown, Montana Daily News Photo. 11

Supply

Seattle District supply activity in connection with the various missile site construction programs was of an incidental and supportive nature, including the discovery of sources, the expediting of deliveries and the inspection of components on delivery to assure compliance with specifications. On 1 July 1963, near the close of the MOB I Minuteman project in Montana, the military supply mission of Seattle District and many of its expert people were transferred to Army Materiel Command.

PART 6 - PEOPLE OF THE DISTRICT

This account has dealt primarily, thus far, with the physical functions and accomplishments of an organization. However, the organization is people, on whose individual personalities and performance all accomplishment by the group ultimately depends. Perhaps the most difficult part of a historical retrospect lies in the selection of those persons for mention who have most significantly influenced the course of events. The space accorded each reflects only the extent of biographical material available.

Officers

Obviously significant in a military organization is the roster of commanding officers, each of whom during his tenure molded the organization in form, function, and philosophy to accomplish his assignments from higher authority. Appendix A lists chronologically the District Engineers and their officer staff assistants. Appendix E contains condensed biographical notes.

Except in wartime, the Corps of Engineers usually limits the uniformed personnel of districts and divisions to a few officers assigned for brief periods of 2 to 4 years. These are picked men in whom the Corps desires to broaden skills in management, personnel and public relations, logistics, supply, engineering sciences, and construction methods that will be required of them during military emergencies. The rotation of outstanding officers through the field offices also provides those offices with the advantage of highest quality supervisory talent. Seattle District has been especially fortunate in this respect, as evidenced in the following narrative sketches of some of its commanding officers:

CAPTAIN HARRY TAYLOR

Immediately on establishing the new district office at Seattle in 1896, Captain Taylor undertook surveys of navigable waters in the Pacific Northwest and the Territory of Alaska--inland rivers as well as coastal estuaries, sounds and harbors--to determine their potentialities and needs for improvement to accommodate the growing commerce of the area. He investigated the waterway that connects Puget Sound with Lakes Union and Washington, which was completed 20 years later and still is in operation. He planned the jetties that now protect Grays Harbor from the fury of the Pacific; and started clearing harbors and estuaries of the snags that flooding rivers and lumbering operations leave behind, using a shallow-draft snag boat rebuilt to his own design--the precursor to our stern wheeler steamboat, the W. T. PRESTON. The first sheet of the advertisement for bids to rebuild the old snagboat SKAGIT is reprinted in exhibit 10. With these and the many other activities enumerated earlier, Captain Taylor laid a groundwork of policy and procedure that is still evident in today's work of the District.

After transfer from Seattle, Captain Taylor built fortifications in New England, New York, and the Philippines. He established the Supply Division and purchasing procedures of the Corps; received the Distinguished Service Medal and the French Legion of Honor as Chief Engineer, American Expeditionary Forces (AEF), 1917-1918; and was Chief of Engineers 1924-1926. Wilson Dam was completed while he was Chief. Major General Taylor retired in June 1926 and died 27 January 1930. He is buried at Arlington National Cemetery.

COLONEL JOHN MILLIS

Colonel Millis was Seattle's second District Engineer 1900-1905. He was a brilliant student at West Point, graduating first in his class. For the next 19 years he had a varied succession of military and civil works duties at home and abroad, including combat in Cuba, delegation to scientific congresses in Paris, and a survey for the Nile River Aswan Dam and irrigation system. Following his tour in Seattle, he fortified the Philippine Islands, including Corregidor, and the East Coast of the United States. As Division Engineer, Southeast, and Department Engineer, Great Lakes, his career reverted to major civil works and carried him upward in the Corps chain of command. Officers 60 years old in the small peacetime Corps of those days rarely attained flag rank. Millis retired as Colonel in 1922. However, his professional career continued. For another 30 years, Millis was a consulting engineer in notable projects. Among other achievements, he devised the emergency measures that saved the city of New Orleans from the great Mississippi flood of 1927. Always a profound scholar, he published scientific treatises on navigation and naval architecture, astronomy, meteorology, geology, seismic phenomena, pure physics, engineering design and construction methods. Rich in years and service to his country, John Millis died in 1952 at the age of 94.

MAJOR HIRAM M. CHITTENDEN

Major Chittenden, for whom the Government locks are named, was District Engineer 1906-1908. He came to Seattle with a background of 22 years' study and experience in river and harbor work on the Platte and Missouri Rivers and in canal design. The latter included the Louisville-Portland and the Lake Erie-Ohio River Canals, which qualified him well for design of the Lake Washington Ship Canal and Locks. Just prior to his Seattle assignment, Major Chittenden laid out the fine road system of Yellowstone National Park and wrote a most interesting history and description of that area. On leaving Seattle, he was promoted to Lt. Colonel and, in 1910, Brigadier General, but retired soon afterward with partial paralysis suffered during an arduous saddle trip. Chittenden continued active, however, as a consulting engineer in the Seattle area. The District historical files contain a reprint from the Engineering

News, 16 November 1916, of General Chittenden's article (proposing) "A 30-mile railway tunnel under the Cascade Mountains" extending from Leavenworth to Skykomish. He was President of the Port of Seattle and promoted many of its fine harbor facilities. He was consultant to the Miami Conservancy District in its great Ohio River flood control and inland navigation development. The General wrote extensively for the journals of the American Society of Civil Engineers until his death in 1917.

BRIGADIER GENERAL C. W. KUTZ

General Kutz commanded engineer regiments in France during World War I.

LT. COLONEL J. B. CAVANAUGH

Colonel Cavanaugh, who was District Engineer during construction of the Lake Washington Ship Canal and Locks, commanded an engineer regiment in the AEF and won the Distinguished Service Medal.

MAJOR GENERAL J. A. WOODRUFF

General Woodruff saw combat in the Philippines and again in France before his tour as District Engineer. Later he became the distinguished Commandant of the Engineer School.

COLONEL E. H. SCHULZ

Colonel Schulz served as Commandant of the Engineer School after service in World War I and in the Seattle District.

COLONEL W. J. BARDEN

Colonel Barden saw action both in Mexico and France prior to his 4 years in Seattle.

JOHN S. BUTLER

Colonel Butler had an unusual career of long serivce as a civilian engineer of the Corps, followed by a Regular Army commission in which he supervised the construction of many notable engineering works and the extensive "308" reports of the Seattle District.

MAJOR GENERAL C. L. STURDEVANT

General Sturdevant was District Engineer twice, for a total of 5 years. Later, as Assistant Chief of Engineers, he planned and executed the tremendous ALCAN Highway and Canol Projects of World War II, then moved on to the New Guinea campaign and high awards.

ADVERTISEMENT

U.S. ENGINEER OFFICE

Burke Building, Seattle, Wn., July 21, 1896

Sealed proposals in triplicate will be received here until 12 o'clock noon, standard time, August 11, 1896, for REBUILDING SNAG BOAT SKAGIT, TRANSFERRING MACHINERY FROM OLD TO NEW HULL, AND HOUSING SAME.

All information furnished on application.

HARRY TAYLOR, Capt., Engrs.

SPECIFICATIONS

GENERAL INSTRUCTIONS FOR BIDDERS

1. The attention of bidders is especially invited to the acts of Congress approved February 26, 1885, and February 23, 1887, as printed in vol. 23, page 332, and vol. 24, page 414, United States Statutes at Large, which prohibit the importation of foreigners and aliens, under contract or agreement, to perform labor in the United States or Territories of the District of Columbia.

2. Preference will be given to articles or materials of domestic production, conditions of quality and price being equal, including in the price of foreign articles the duty thereon.

3. Maps of the localities may be seen at this office. Bidders, or their authorized agents, are expected to visit the place and to make their own estimates of the facilities and difficulties attending the execution of the work, including the uncertainty of weather and all other contingencies.

4. No proposal will be considered unless accompanied by a guaranty in manner and form as directed in these instructions.

5. All bids and guaranties must be made in triplicate, upon printed forms to be obtained at this office.

6. The guaranty attached to each copy of the bid must be signed by two responsible guarantors, to be certified as good and sufficient guarantors by a Judge or Clerk of United States Court, United States District Attorney, United States Commissioner, or Judge or Clerk of a State Court of record, with the seal of said court attached.

7. A firm as such will not be accepted as surety, nor a partner for a co-partner or firm of which he is a member. Stockholders who are not officers of a corporation may be accepted as sureties for such corporation. Sureties must be citizens of the United States.

8. Each signature to guaranties and bonds shall be affixed to it an adhesive seal. All signatures to proposals, guaranties, contracts, and bonds should be written out in full, and each signature to guaranties, contracts, and bonds should be attested by at least one witness, and, when practicable, by a separate witness to each signature.

COLONEL H. J. WILD

Colonel Wild received his first commission in the Corps from World War I officer training camp. After several troop and teaching assignments he served 4 years as Seattle District Engineer. He then became Colonel Park's Executive Officer in the Division Office at Portland, returned to Seattle District as Park's Deputy, and served ably here another 4 years through national defense and World War II activities. Oldtimers around the District still comment on Colonel Wild's direct, sometimes gruff manner but usually add a sincere tribute to his abilities. This writer best remembers the Colonel for the kind assistance received in obtaining technical data for an investigation of West Coast floods while with another agency.

COLONEL BEVERLY C. DUNN

Colonel Dunn put Seattle District into high gear for the epochal achievements before and after Pearl Harbor. A top administrator was needed in those frenetic days to rebuild and greatly expand the organization; to devise ingenious solutions for daily crises, and to command efficiently a Division-sized, heterogeneous conglomeration of military-civilian personnel scattered over a million and a half square miles of territory. Dunn was the man for that time and place, as the World War II chapter of this narrative demonstrates.

LT. COLONEL PETER P. GOERZ

Colonel Goerz briefly succeeded Colonel Dunn, whose able assistant he had been. "Pete" Goerz was a dynamic, very human type of officer. As Assistant District Engineer he had accumulated a wide personal acquaintance with the great numbers of new people who were being blended into the wartime matrix of the District. As District Engineer he continued Colonel Dunn's constructive work and his own close personal contacts. He seemed always ready with encouragement or active assistance to solve individual dilemmas. It is remarkable that, despite a lapse of nearly 30 years, Colonel Goerz is still remembered so generally and warmly by the people who served with him.

COLONEL RICHARD PARK

When North Pacific Division at Portland was merged with the South Pacific and Mountain Divisions in December 1942, Colonel Richard Park, Division Engineer, took over Seattle District. He brought with him a number of his staff officers and civilians including his Executive, Colonel H. J. Wild; Captain/Major C. C. Templeton, Major Walter E. Church, Lt. Arthur C. Satre, and Messrs. C. Ben Peterson, Mason H. Roberts, and C. W. Hansen.

Colonel Park was strictly a "book" man. Everything he did impressed his associates as "regulation--by the numbers." His bearing was as military as that of a West Point cadet at guard mount; his figure was trim, his mental processes concise, and his speech precise. Park's high voltage personality galvanized the District. On any of his endless field inspections, his small, energetic figure could be seen striding straight and fast, with much younger staff men pressed to keep the pace. The Colonel, a dedicated perfectionist, demanded, and usually obtained, only the best performance from his people; but he always demanded more of himself. Colonel Park reached retirement after a year in the District.

COLONEL CONRAD P. HARDY

Colonel Hardy succeeded Colonel Park, and had the difficult task of transition from the peak of war effort at the end of 1943 to resumption of the civil works role in the next 2-1/2 years. The drastic contraction process went smoothly under his careful direction. Simultaneously, the District's part of the great Columbia River review study was started.

Inevitably with the sudden end of the war, there was a distinct sense of physical and emotional anticlimax among people in the District office. To deal with this and to shake down the organization, so to speak, to the stable, more deliberate basis of scientific study; to retrench in matters of money, space, and people; to revoke temporary wartime commissions of numerous staff officers and reduce Civil Service grades of civilians, made for a time of hard adjustment for many, and probably was hardest for the Colonel. In addition to internal adjustments, Hardy had to preside at numerous public hearings, at which were discussed the projects that were becoming prospective in the review studies. Local opposition often was vehement. Also, the whole civil works assignment of the Corps was under bitter attack nationally, as described hereinbefore.

Colonel Hardy was essentially a reserved, intellectual type of person, but not at all vacillating in support of well-reasoned positions. On one occasion, a civilian engineer preparing the exhibits for a public hearing on one of the Montana reservoir projects then under study complained of the misinformation published by a utility company concerning the project and suggested to the Colonel that some kind of rebuttal be published by the District. The Colonel explained that the Corps of Engineers was neither a propaganda nor promotional agency; it was a public service agency, acting as impartial, professional consultant to the people. As such, it would present the facts, without passion, prejudice, or contention of any kind. The weight of reason must prevail. The Colonel's philosophy of pure reason did not prevail at that particular hearing, but it certainly did in relations with the public, other Government offices reviewing the Columbia River studies, and his staff. The Colonel's friends were saddened to learn of his death 2 December 1968.

COLONEL LELAND H. HEWITT

Colonel Hewitt came to the District as a stranger to the Northwest in the same year that Chief Joseph, our first big dam on the upper Columbia, was authorized. Being automatically a member of the Columbia River Engineering Board, the new District Engineer immediately was plunged into joint studies with Canada and the complexities of the review report. During his tour, there also were a series of formal public hearings concerning the Columbia held by the full Board of Engineers for Rivers and Harbors throughout the Northwest, and the final design and start of construction of Chief Joseph Dam. By intensive study he mastered the ramifications of these matters, handling them with finesse that won him appointment by the President to the United States-Mexico International Boundary and Water Commission. This was a technical and diplomatic assignment in which he successfully negotiated the thorny Rio Grande settlement before his death in 1964 at the age of 70.

LT. GENERAL EMERSON C. ITSCHNER

The second Seattle District Engineer who became Chief of Engineers was Lieutenant General Itschner, Corps of Engineers (Retired). Affectionately called "Em" by his fellow officers, he is equally esteemed by civilian professional associates. This historian recalls bright hours of his company in the "riding pool" of five men who drove their cars to work in rotation, including the then Colonel, on one day of the week. Itschner would not permit the other drivers to detour from the shortest route in order to pick him up or drop him at his home. He seemed to enjoy the brisk walk through winter darkness and rain, over the Laurelhurst hills.

Colonel Itschner commanded here in 1949 and 1950 during the great dam construction program that resulted from the first Columbia River Review Report. Shop talk concerning that work often occupied the one- to two-hour trip to and from the District's World War II temporary office in Seattle's south end industrial area. The riding pool included Walter Truesdell, Chief of Real Estate, who was engaged in the touchy task of acquiring the flowage rights around Pend Oreille Lake in Idaho for Albeni Falls Dam. This writer (and rider) was Project Engineer, organizing the design work, specifications and contracts, and field construction forces for the job. R. Wayne Lincoln (now deceased), one of the most brilliant engineers in the office--and in the whole profession as well--had been a key man in both the structural design concept and the hydroelectric power studies basic to the review report. In physique and manner, Lincoln much resembled his forebear, the great President. Hanford Thayer, District liaison man with the Hanford Atomic Works among many other professional activities, was the fifth man in the group. He is now retired from the Corps, but not from work; he heads the Seattle branch of Quinton Engineers, an international consulting firm.

Discussions enroute were lively: Truesdell's human interest stories; Lincoln's dry wit; Thayer's wide-ranging interests in the engineering and scientific world. All these were enriched by the Colonel's participation, with his own incisive insights and colorful experiences which were leavened, however, with a characteristic, quiet humor and kindly manner.

Colonel Itschner's tour in Seattle was abruptly terminated by the urgent call to duty on the Korean warfront, where he served with distinction and received high honors. On returning from Korea, he became Division Engineer, North Pacific, and gained flag rank; then went to the Office, Chief of Engineers, in charge of civil works, with a second star. In 1956, General Itschner was selected by President Eisenhower to be Chief of Engineers. He commanded for 5 years of intensive military and civil construction activity, retiring in 1961 with the rank of Lt. General. He continues a distinguished career of administrative and engineering achievement at Portland, Oregon.

District Engineers of Later Years

Engineer officers who serve in high District and Division positions are products of rigorous selection. They must be well qualified professionally as engineers to supervise the design and construction of major engineering works; as administrators, to manage large business organizations, and as representatives of the Government, to conduct broad public relations.

As matters of policy and convenience, this narrative sketch of Seattle District Engineers is closed with the year 1950, omitting the seven men who have succeeded them, and who are still building distinguished careers: Lt. Colonel John P. Buehler, Colonel N. A. Matthias, Colonel R. J. B. Page, Colonel Robert P. Young, Colonel Ernest L. Perry, Colonel C. C. Holbrook, and Colonel Richard E. McConnell. Their biographies to date appear in Appendix E, but more complete treatment must wait for a later edition and a broader perspective.

Distinguished Civilians

The working forces of the district and division offices--and largely of the Chief of Engineer's office in Washington, D.C.--are composed of civilians, most of whom are career specialists in their fields. Backed by long experience, intimate knowledge of the business and their own professional resources, these people furnish the stability of direction and continuity of effort necessary to accomplish the work of the Corps. A few civilians, through long service and outstanding contributions, have been recognized by election to Seattle District's "Hall of Fame," where their portraits and service records are displayed. The records of these distinguished civilians, including Mr. William T. Preston, the only civilian who served as Seattle District Engineer, are given in Appendix E.

PART 7 - SEATTLE DISTRICT TODAY

Accommodations

The District office, one of the oldest, and certainly for the last 30 years one of the largest, Federal agencies in the Northwest, has never had a specifically designed nor otherwise adequate headquarters location. Starting in 1896 with a couple of rooms in the old Burke Building, the small office existed quietly there until 1933, when it was bounced into, and 3 years later out of, the then new Federal Office Building. In 1936, space was rented in the Central Building for a staff that had begun to grow with the accession of flood control work and construction of Mud Mountain Dam. The great wartime expansion spread various sections of the office into whatever spaces could be found about the city. Most sections converged early in 1944 on the Textile Tower, a 16-story loft-type (without interior partitioning) building at Seventh and Olive. The District remodeled the building extensively and expensively for office use and occupied it for 3 years, until displaced by the Veterans Administration (VA). This required termination of the Army lease; a handsome settlement to the owners in lieu of restoration to the property's prior, untenable condition (a lease provision that could not conceivably have been desired or invoked), and a new lease to the VA at increased rental rates based on the improvements the Government had installed.

The District searched elsewhere for quarters, and in August 1947 moved its headquarters offices to a temporary flat-roofed, two-story frame building on the former Ford assembly plant at 4735 East Marginal Way. Supply Division, Equipment Section and several other Government units disposed themselves as best they could in old warehouses of the plant, which then was designated Seattle General Depot. The Depot soon became known more familiarly by less euphemistic interpretations of the same initials, SGD.

This was a time of reckoning and ruthless retrenchment. Wartime extravagances were renounced and District personnel, like good soldiers, made do with what was available. That wasn't much. All the buildings were frigid in winter, so the central boilers were overhauled and unit space heaters were hung here and there. The office building was stifling in summer, so central ventilation was installed just before the District offices were moved again. This employee will never forget the combination of sights, sounds and smells pervading his particular cubbyhole. A cloak closet opening from this office was cloaked with mold on the walls and an assortment of fungi sprouting from the floor that might have delighted a mycologist. A leaky steam line underneath provided the right environment of decay, moisture, and warmth. A row of Post Restaurant garbage cans stood just under the office windows, emitting effluvia when filled and cacophonies when emptied, reminiscent of a Caribbean banana port. Early model jet planes thundered over on takeoff from Boeing Field, overwhelming all voice and thought. At intervals, switching crews played at bowls with boxcars, the clash of couplings reverberating in the narrow alley between the office window and the opposite warehouse wall.

After 11 years, the District and its companions at SGD were requested by Air Force to evacuate because Boeing needed the long warehouse buildings for Bomarc guided missile fabrication. Seattle Army Terminal (SAT), the wartime Port of Embarkation, having been deactivated in 1957, was available. Some of the displaced agencies went there--the District on the first weekend of June 1958. In a press release at the time, Colonel R. J. B. Page, District Engineer, was said to regard the move to SAT as temporary because the facilities and location were not considered well suited to Army Engineers functions. The Colonel's statement regarding unsuitability certainly seems sound to any business visitor or employee who must use a poor public bus service or search vainly for a place to park his car, then walk half a mile out-of-doors, through and around the Port of Seattle's barriers, to reach remote units of the District. Parts of the organization are dispersed through a half-dozen buildings that are separated by other buildings, puddles, roadways, fences and/or shiploads of goods awaiting reshipment by sea or land. The Colonel's prediction of temporary occupancy may prove to have been sound, although perhaps not in a way he could foresee. The space available to Federal agencies has been repeatedly compressed in favor of Port activities through some sort of camel-and-tent process. Several agencies have left the premises and the Engineer District is so fragmented and crowded that early removal seems inevitable. This would conform with past experience of retrogressive relocations at average intervals of about 10 years.

This situation represents, to employees, the most serious deficiency in Seattle District's long history. Probably the fault is not in this office, but farther up. In either case, while the Engineers have built fine establishments for many Federal units through the years, and have seen others far-sightedly planning and acquiring plants to facilitate their work, they have remained vagrant, never able to fulfill their own need for a permanent, efficient base of operations. As a consequence, the District through the years has lost the services of many good people who decried the working conditions.

Work in Progress

In Fiscal Year 1968, the District workload, in terms of total dollars committed ($97 million, figure 8), was the heaviest in its history, except only the World War II period. Military work constituted less than 9 percent, an unusually small proportion. It included permanent buildings and utility improvements at Army and Air Force bases in Washington, Montana, Idaho, and Oregon; the fine Civil Defense permanent headquarters building at Bothell, and a few miscellaneous small jobs.

The current preponderance of civil work is mainly due to heavy engineering and construction schedules for Libby and Lower Monumental Dams. The latter, although a part of Walla Walla District's four-dam Lower Snake River navigation and power project, was "shopped out" to Seattle District for most of its design, construction, and procurement requirements.

Other major components in Seattle District's present civil budget of $88 million are the comprehensive "Puget Sound and Adjacent Waters" and "Columbia-North Pacific" basin studies, and investigation of the Ben Franklin damsite on the main stem of Columbia River between Priest Rapids and McNary Dams. Also in progress are several individual river basin studies (Chehalis, Snohomish, Snoqualmie, Clark Fork, Flathead, Spokane and Upper Columbia), and harbor surveys. The more important harbor surveys concern Willapa and Grays Harbors on the Pacific Coast. An interesting phase of the Grays Harbor Study is recent construction of a working tidal model at the Corps of Engineers' Vicksburg, Mississippi, hydraulic laboratory that will facilitate analysis of hydraulic problems involved in the design of harbor improvements.

Wynoochee Dam and Reservoir

Design is completed and contracts for preliminary work were let in 1968, for a dam in Grays Harbor County, Washington, on the Wynoochee River, 51.8 miles upstream from its confluence with Chehalis River. The dam will be a 175-foot-high concrete gravity structure to impound 70,000 acre-feet of storage primarily for flood control, and for industrial and domestic water supply to mills and communities in the Grays Harbor area. Substantial additional benefits will accrue through enhancement of commercial and sport fisheries, general water-oriented and forest-based recreation and, eventually, irrigation.

Local impetus for a flood control project stemmed from the fact that the Wynoochee goes out of its banks about once in 2 years, damaging valley agricultural lands. Congress was asked to assist in 1954 and 4 years later appropriated funds for the Corps of Engineers to study the problem. A Seattle District survey report was submitted in 1960 and a flood control reservoir was authorized in 1962.

Meantime, the city of Aberdeen was studying its future water supply problems with the assistance of engineering consultants. The city already was under contract to the Rayonier and Weyerhaeuser mills to supply 127 cubic feet per second (c.f.s.) and anticipated that this demand would more than double in the next 20 years because of planned pulp mill expansions. The dependable flow of the river and the city's intake, storage and supply line from the stream can not support such a demand. Accordingly, Aberdeen asked that the Corps project be planned to provide a 300 c.f.s. supply and, on 16 August 1967, signed a contract to repay the Government about $13 million of the $16 million estimated project cost. This gives the project a financial boost, improving its economic justification beyond that found in the 1960 survey report for flood control only. The city is supported in its commitment by five local governmental bodies--Grays Harbor County, the Port of Grays Harbor, the Grays Harbor County Public Utility District, and the towns of Montesano and Cosmopolis--to share any deficit in water revenues sufficient to meet the annual payments on the Government contract.

The project will include devices for collecting and transporting salmon and steelhead migrating upstream to spawn, and fingerlings passing downstream to the sea. Also, the State fish hatchery at Aberdeen will be expanded to increase the release of young fish into the river.

Visitor facilities and recreation areas are planned at the damsite and at two locations on the west shore of the reservoir. In addition, nearly the whole east shoreline, about 4 miles long, is reserved for future recreational development in cooperation with the Forest Service.

Neither hydroelectric power units nor irrigation works will be involved initially, but both can be added if and when they are economically justified.

Real estate for the Wynoochee project has been acquired, consisting mainly of a dozen or so large tracts owned by a timber company and the U.S. Forest Service. Completion of the basic structures is scheduled for summer of 1973. Mr. Vernon Cook is supervising Project Engineer in the District office. Mr. R. B. Kramer, the Resident Engineer, is supervising construction.

Other Work

A typical list of assignments in minor flood control, river and harbor jobs, general investigations, maintenance work, real estate and materiel procurement round out the present programs of Seattle District's Engineering, Construction, Operations, Supply and Real Estate Divisions, those elements of the organization that deal directly with the primary missions of the Corps (see exhibit 11). District elements that perform incidental advisory and administrative functions--personnel, fiscal, legal, security, safety, data processing, public information, and office services--also have heavy commitments at this time, their output being geared directly to the needs of the five primary divisions.

Employee Training and Development

The first formal employee training courses were instituted during the great personnel expansion of World War II, as a means of orienting people, particularly new employees, in Civil Service procedures and the objectives of the Corps. These were rather elementary courses aimed toward self-improvement through motivation, work performance, and cooperation with associates.

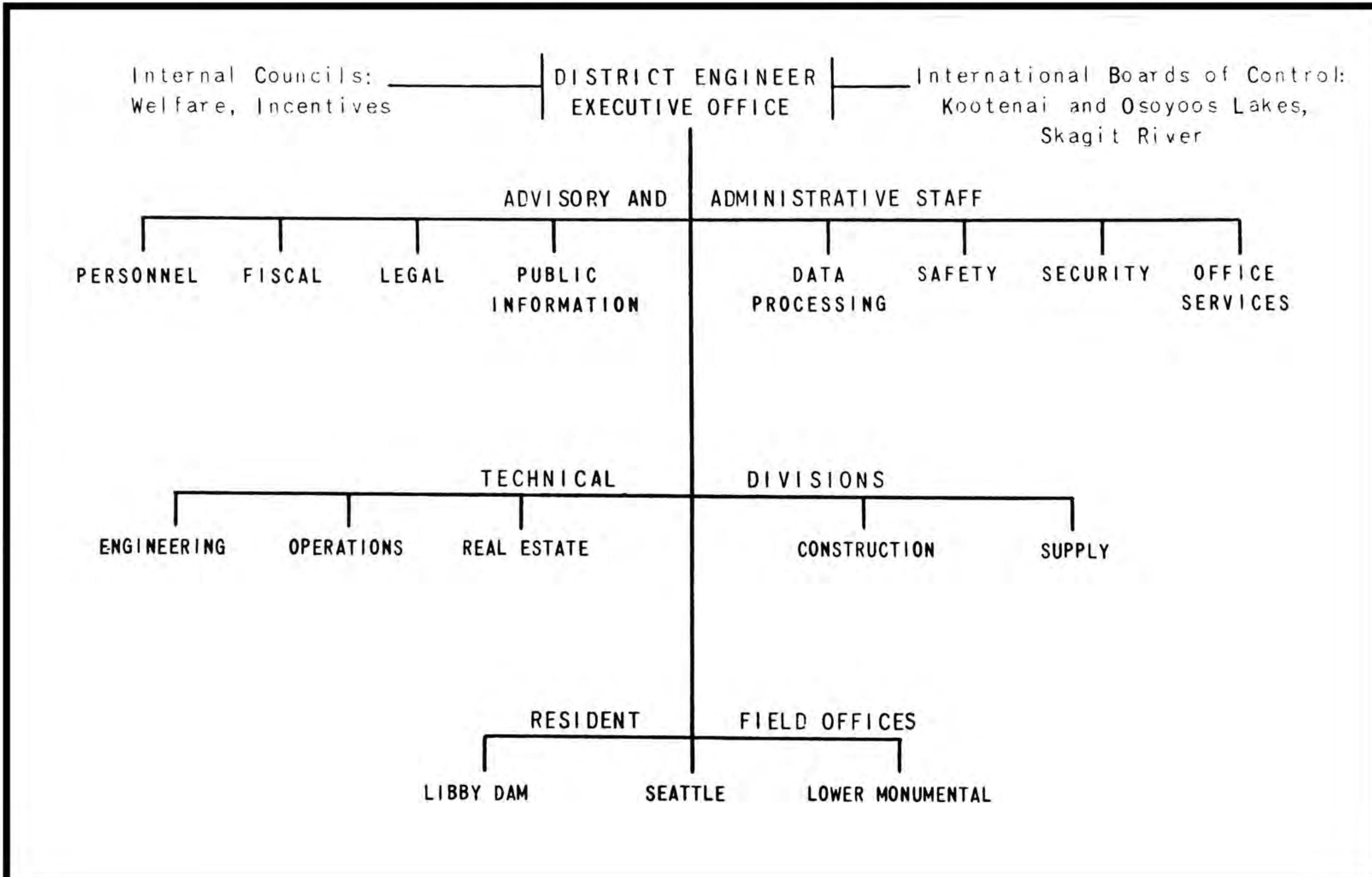
From time to time more specialized instruction relating to their work was offered selected employees, in fields ranging from malarial (anopheles) mosquito control to gamma radiation hazards and detection, to executive administration. Less technical but highly effective education--or perhaps more accurately, indoctrination--was and is conducted on safety. Attendance of all employees at periodic lectures on safe driving (illustrated by gory examples of the consequences of carelessness) is mandatory. A rigid test of driving ability is given all who are issued permits to operate Government vehicles and boats. "Lunch box" safety meetings are held among all project employees in the field. Branch and Division Chiefs of Engineering, Construction, and Operations are rotated through membership on an inter-District Safety Council where accident causes are analyzed and preventive measures devised. A safety score is maintained for each field activity and awards are made annually to those with good records. Indeed, the emphasis on safety goes so far that all contractors on District construction are required to equip their machines with safety devices, to employ a safety engineer, and to submit their layouts for construction such as shoring, scaffolding, hoists, and cofferdams to the District Safety Engineer or Resident Engineer.

Until 1958, the District's employee training and development programs had evolved from personnel management policies of the Corps of Engineers and the United States Civil Service Commission. Ten years ago, Congress gave statutory recognition to civilian employee training by passage of Public Law 85-507 declaring "...it is necessary and desirable in the public interest that self-education, improvement, and...training of employees be supplemented and extended by Government-sponsored programs...for development of skills, knowledge, and abilities...continuous...leading to improved public service... savings...building and retention of permanent, skilled and efficient employees..." Subsequently Presidential Executive Order No. 10800 and several Defense Department directives amplified the objectives and have made "command and management responsible for the development of the individual to his top potentiality on the job."

As a result of these propoundments, training and development has become an important function under the direction of the Civilian Personnel Officer, Mr. James H. Pratt. At first, short courses in supervision and management were given intermittently at the District Office by Mr. Rolla Reedy, Employee Development Officer for North Pacific Division. His efforts were supplemented by courses conducted by employees of the Personnel Branch. During 1960-61, Mr. Larry Parks was employed as the Employee Development Officer for the District. In March 1963, Mr. Robert Ryan joined the Seattle District as Employee Development Officer and currently occupies the position.

Through Dr. Charles H. Norris, Dean of the College of Engineering, evening classes in engineering subjects were established at the University of Washington, enabling engineers of the District to keep

SEATTLE DISTRICT, CORPS OF ENGINEERS, FUNCTIONAL ORGANIZATION, 1968



abreast of technical developments. In many instances, course content and outlines were developed in cooperation with personnel of the District. Beginning in 1963, the District paid the tuition costs of enrollments in technical evening classes and that year 102 employees attended courses in Critical Path Methods of Construction Scheduling, Reinforced and Prestressed Concrete, Quality Control of Concrete, and Railway Engineering. Since then, additional courses have been offered and the District has provided several hundred attendances. Numerous enrollments also have been made in other local institutions, particularly at Seattle University and Seattle Community College.

Seattle District pioneered in use of computer-based automatic data processing (ADP) systems to provide organizational unit breakdowns of items previously impractical to obtain manually. As an extension of this ADP system, Pratt developed a compatible system for producing and storing records of training activities that was put into operation in Fiscal Year 1965 and proved to be so efficient that descriptions of the system were sent to other Government agencies and the Office, Chief of Engineers at their request. Computer printouts provide historical records of previous training received by each employee, and of training requested for the next fiscal year. Along with a considerable amount of other information, the printouts show course title, course hours, location of training site, and costs, broken down by salary, tuition, and travel. This system provided the first known computerized means for analysis of individual training progress and costs. Other useful data concerning the training program are derived quickly and economically from the system.

A District Training Committee was appointed in 1964 by Colonel C. C. Holbrook, District Engineer, to establish criteria, review nominations, and make selections for a series of executive development seminars. The seminars were conceived by the Colonel to train incumbents and potential incumbents of highly responsible positions in updated administrative techniques. Colonel Holbrook counseled the Committee in selection of personnel and instructors, as well as in course content. Mr. Edwin Derrick, Chief of Design Branch, conducted two March 1965 sessions, Mr. Robert Gedney, Chief of Planning Branch, instructed two April sessions on the subject, "Streamlining the Executive Workload." Two groups of 32 employees each participated.

Beginning also in April 1965, instructors were obtained from the Graduate School of the University of Washington. Professors Preston P. LeBreton and Robert C. Meier led the April and May 1965 sessions, respectively, on the subject "Planning and Decision Making."

The seminars became a continuing activity of the Seattle District. One hundred twenty eight employees have completed the 2-year course, and 64 are presently enrolled. Insofar as the District has been able to ascertain, this series of developmental seminars is unique in the Corps of Engineers. They constitute, along with extensive reading assignments

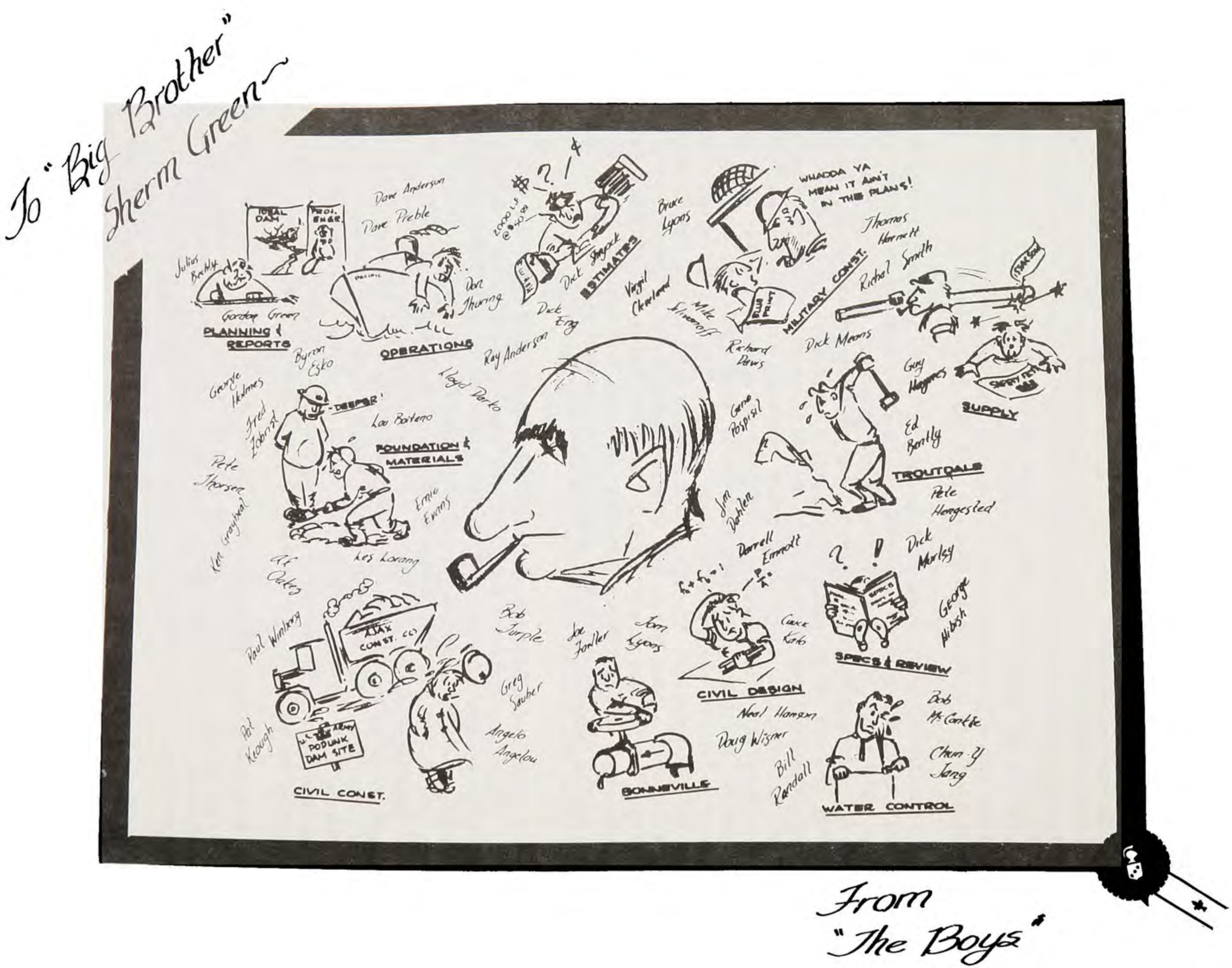


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Exhibit 12

from texts provided each participant, a thorough study of recent findings and research in decision-making, effective administration, and competent utilization of human resources.

The following table, showing total training manhours during the past 5 years, indicates the scope of the activity in Seattle District.

SEATTLE DISTRICT RECENT EMPLOYEE TRAINING PROGRAM

Fiscal year	District strength	Manhours of training given	Average manhours of training per employee
1964	1,056	50,658	48.1
1965	1,118	52,898	50.2
1966	1,206	62,336	52.7
1967	1,177	96,647	82.0
1968	1,178	102,017	83.9

Engineer Recruitment and Training

For the past 18 years, the Corps has engaged in active campus recruitment and job training of young engineers graduating from universities. Several considerations necessitated adoption of such a program in 1950. Many engineers who joined the Corps during World War II were, or soon would be, reaching retirement age and retirement was being accelerated by improved Civil Service pension and health insurance plans. Also, many capable young engineers were getting discouraged by the growing disparities between the pay of Government professional people and the salaries paid outside of Federal Service, or by their low seniority and consequent vulnerability to several arbitrary reductions in force that were ordered about that time.

Recruitment was difficult at first. Teams of recruiters for industries were competing for interviews with graduating seniors. When Ted Wall of Seattle District Personnel Branch went to the University of Washington, Professor James Southard, Engineering Student Placement Officer, handed him a "score card" on which the salaries available to the preceding class were listed. The Federal pay scale was lowest--about two-thirds of the industry average. This disadvantage could be overcome only partially by the more generous fringe inducements to Federal service such as sick leave, annual leave, retirement, and health insurance.

Several pay increases at intervals improved the Federal recruitment position until it became more nearly competitive with industry.

The "classes" of junior engineer trainees ranged from a low of 1 in 1953 to 25 in 1966. Altogether, 182 have been employed over a period of 18 years and 97 of these remain in the District, establishing professional careers in responsible positions. Some have transferred to other offices of the Corps and some are in military service, but the majority of those who left the District have profited by their training here to join commercial consulting, construction, or manufacturing firms.

The training period is 18 months, during which the junior engineer is assigned to work successively in each element of the District that pertains to his own professional discipline. A senior staff engineer supervises the assignments, advises the trainees, receives performance reports from heads of units with which they train and, when the course is completed, assists each man to select a regular assignment in line with his demonstrated interests and talents (see exhibit 12).

The junior engineer training program has been eminently beneficial to both the men and the organization. The men gain rapid and wide personal acquaintance with the people, structure, aims and methods of the District. Through participation in a variety of technical work they are able to learn their individual capacities and preferences. The process has almost invariably led "the right man to the right job," a situation satisfactory to the man and, most certainly, to the organization.

Computer Technology

Seattle District first began using punched card data processing in 1954, when some financial applications were put on the Electric Accounting Machine (EAM) equipment of the Alaska Communications System. Later, as the applications grew in number and volume, they were transferred in 1958 to data processing equipment in the North Pacific Division office in Portland, Oregon. The Division's equipment included an IBM 650 Computer which also was used for certain engineering computations until 1962, when the 650 was replaced by a second generation computer.

The Seattle District began its own data processing operation in earnest July 1961 when a Series 50 EAM System was justified by Messrs. James Palumbo and Joseph Kranak of the Comptroller's office. This equipment was used primarily for financial and personnel work and included an IBM 402 Accounting Machine, IBM 602 Calculator, IBM 085 Collator, IBM 082 Sorter, IBM 514 Reproducer, IBM 548 Interpreter, two card punches, and one verifier. The EAM unit was headed by Mrs. Betty Salmon, who now is a systems analyst in the Automatic Data Processing Center.

At this time a digital scale for transferring cross-section data onto punched cards from contour maps and a digital line plotter were purchased for use by the Relocations Branch of the Engineering Division.

This equipment produced cards for computer input to design many miles of highway and railroad relocation in connection with the construction of multipurpose projects, with the plotter providing graphs of the relocation designs.

As the need for more engineering data processing continued to grow, a data processing unit was established within the Civil Works Design Section of the Engineering Division. Its function was to perform computer programming and coordinate data processing activities within the District. The unit was manned by Ed Gates, James Dahlen, and Douglas Wisner. Initial programming effort was for an IBM 1920 Computer system, which in January 1962 was to replace the IBM 650 at North Pacific Division.

As more applications were developed and computer utilization requirements increased, a computer was acquired by Seattle District. An IBM 1620, with 40,000 digits of core storage, was installed in January 1963. Simultaneously, data processing became a separate branch of the Engineering Division, called the "Digital Computer Center," with a staff of five people. Besides the IBM 1620, other new equipment included an IBM 407 Accounting Machine, IBM 047 Tape-to-Card Converter, and a card verifier. Richard Shryock also joined the Center at this time.

In the spring of 1965 the Digital Computer Center and the EAM unit of the Comptroller's office were combined as the Automatic Data Processing Center in a separate office directly under the District Engineer. The Center had a force of nine people headed by James Dahlen, successor to Ed Gates, who had transferred to the North Atlantic Division.

Applications and utilization grew to the point where a second shift was added in September 1966. A new computer study began with all of the Districts and the Division office participating. A joint data automation plan was developed, approved, and specified to consist of a third generation computer system, with computer terminals at each of the Districts and a large central computer at the Division office. An IBM S/360 Model 50, with 512,000 positions of core storage, was installed early in 1968 as the central computer. This also has a large amount of disk storage and five tape drives attached. Each District has an S/360 Model 20 computer terminal with 12,000 positions of core storage, an on-line printer, and two magnetic tape drives. For the first time, the Districts had computer capability with on-line printers and magnetic tape storage.

The District terminal is connected to the central computer at the Division office via a telephone line. Input data are transmitted to the central computer and the results are received telephonically. The results can be printed, punched, or put onto magnetic tape for storage. Magnetic tape data also can be produced for input to the tape-driven digital plotter now located in the Automatic Data Processing Center.

The Automatic Data Processing Center now has a staff of 19 persons and operates two shifts five days a week. There are 300 to 400 programs available through the central computer program library. Engineering computations account for most of the computer utilization, although considerable work also is done in financial and personnel accounting. Major areas of engineering computations are: structural, hydraulic, hydrology, reservoir regulation, earthwork, geodesy and surveying, soil mechanics, concrete technology, engineering economics, network analysis, and plotting routines.

The time is past when engineers must spend day after tedious day cranking out the sheaves of figures required for a structural stress analysis, flood routing, reservoir storage, release and routing, power output study, or other long, involved calculation traditionally involved in their work. They still must use their brains and training to understand the principles involved in a particular problem and to define the mathematical processes that will lead to the correct solution in order to program (instruct) the computer properly. In fact, the lightning speed of the machine permits far more complex and precise methods than were possible in precomputer days, when the number of variable quantities to be dealt with often forced engineers to accept approximations or assumptions that could not be fully verified.

The electronic data processing equipment does not replace the engineer, accountant or other professional data manipulator. On the contrary, it greatly extends the scope of his capability for intellectual analysis and his opportunity to exercise this faculty. At the same time, it demands that he know exactly what he is doing, because a good computer program includes built-in checks that instantly reveal discrepancies in the data or contradictions in the instructions put into the machine. If the machine encounters an anomaly, it simply stops and signals "error," saying in effect, "Look friend, you've goofed. You do the thinking right and I'll do the work right."

The versatility, speed, and accuracy of modern data processing equipment, in short, free the engineer of much mechanical work that is slow, repetitive and expensive to his employer. Low-production drudgery is especially expensive nowadays because salaries are going up and good technical brains are hard to find; they are much better employed at the job they are hired to do--thinking.

Command

Direction of all elements in this organization of 1,100 people stems directly from the Executive Office of the District Engineer. It is significant that three District Engineers of recent years--Colonels Perry, Holbrook and McConnell--hold Masters' Degrees in Engineering, Management, or Administration. Their special interest in this field is evidenced by the application of enlightened business methods throughout the District organization. Electronic data processing in the office and the automation of tedious, time-wasting mechanical operations at field projects promote economy and efficiency. Progressive personnel programs offer employees both the opportunity to improve their talents through training and the incentive to apply those talents to their own advantage--a process that benefits the organization as well.

Status

If this writer may be permitted a last personal note as an editorial privilege: The collection of material for this volume necessitated extensive reexamination of the District's organization, structure and capabilities, involving innumerable contacts with its people, both old friends and new acquaintances. The attitudes, activities and atmosphere observed during these encounters leave the strong impression that Seattle District today is in good shape, well equipped in substance and spirit to meet the challenges of a changing world.

"ESSAYONS"

EPILOGUE

It is Christmas morning 1968 as the final words of this story are penned. From the next room a radio floods the house with carolling voices magically caught and cast abroad by mysterious forces. As this day's dawn rayed upward, silhouetting the snowy Cascades on a sky of rose and gold, television projected the voices and visages of three humans happily homeward bound to Mother Earth from a voyage around the Moon.

Incredible Day! Incredible Age of which to speak so sparsely as do these poor pages--a span of some three score and ten years--the biblical allotment of mortal man, and approximately the term, thus far, of the organization of builders whose work is chronicled here. One lifetime is hardly a pulse beat in the vast rhythms of Nature. It is little more in the history of all men born to Earth who have striven to understand and adopt Her laws to their needs. But of all the generations of men, surely this one has probed the deepest, built the mightiest and mastered his environment the most.

The story of one small segment of this generation has been told falteringly, but with great admiration for the people who participated, and with pride in the privilege of sharing their aspirations and the achievements they have brought to the service of their fellow men.

ACKNOWLEDGEMENTS

Grateful appreciation is owed the many District people who have helped in collecting and arranging material: Arthur Weis and Betty Lou Chase of the Executive Office; Agnes Hagan and Cecilia Mullen, Librarians; Harold Imbery and Margaret Gorman, Office of Administrative Services; other members of the District Historical Committee--Harry Erickson, Tom Doyle, William Alguard, Ted Wall and Gilbert Bean. Often through the efforts of the Committee, and constantly through the unofficial good will of friends in the District, essential research has been provided. Among the host of helpers, these deserve particular mention: Jim Dahlen on Computer Technology; H. S. Bardsley and Bob Pearse on Foundations and Materials work; George Lemke on Flood Plains; Charles Brown, Dan Shea, Ray Unrath and Herb Bray on Supply; Bob Spearman, Rolla Radley, Frank West, Ray Latta, Sam Skordal and Don Thuring on Operations; Nadine Mullen, Sid Knutson, Ell Gullidge and Dick Sellevold on Civil Projects; Ed Derrick and Paul Werle on Military Projects; Jim Pratt, Ted Wall, Betty DesJarlais and Bob Ryan on Personnel subjects; Warren Erlwein on Current Programs; James Main and Leo Johnson on Organization and Fiscal matters; Richard Frank on Alaska conditions; Paul Rickard and Al McIntosh, who worked up the charts and maps; Westina O'Hearon, who furnished enough data concerning Real Estate to have filled a separate volume. Mary Childs, Judy Eggum, Lynn Fletcher, Doris Jackson, and Ola Beale worked many days typing manuscript and correcting the errors of an unskilled writer. Geneva Graham and Earline Buford edited the manuscript and final copy for accuracy and grammar. Laverne VanHorn and the crew in Reproduction Branch handled the printing and binding of the finished volume.

Retired officers and civilians have contributed richly to the material on which this work is based, because of their long service in, and direct knowledge of, earlier times. Also they, like this writer, have managed through the years to preserve memorabilia from the relentless "records clearance" campaigns that have destroyed many papers of historical value. Chief among these contributors are C. C. Templeton, Samuel DeMoss, Walter Spencer, Lester McCue and Hanford Thayer.

Mrs. Ammie Bennett Ford, long-time secretary to a succession of District Engineers, furnished biographical data concerning officers. Roy Scheuffle, retired Administrative Assistant to North Pacific Division Engineers at Portland, not only supplied drafts of his manuscript on the history of the Division for reference but kindly reviewed my drafts and offered valuable comment, as did Dr. Jesse A. Remington, Chief of the Historical Division, Office of the Chief of Engineers.

The establishment by the General Services Administration of Regional Archives in Seattle was most timely in facilitating direct research; especially because of the foresight evinced by the management. Mr. Robert E. Cornell, Manager of the Federal Records Center

and Mr. Elmer W. Lindgard, Regional Archivist, already had obtained from the National Archives much of the early historical material on which this account is based. Their efforts and professional counsel were most helpful.

The list of contributors, in time and patience, is long. Yet there must be others, both active and retired, whom I have overlooked because their assistance was given indirectly or anonymously. To them, my apologies. To all, my thanks and hope that they will find the fruits of their efforts reflected faithfully in this volume.

SHERMAN GREEN

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APPENDIX A

HISTORICAL RECORD
DISTRICT ENGINEERS AND MILITARY ASSISTANTS
ASSIGNED TO SEATTLE DISTRICT

The Seattle Engineer District came into being 1 May 1896. The area was included in the Portland Engineer District prior to that date.

Alaska was taken from the Seattle Engineer District and made a separate engineer district on 2 April 1921, and returned to the Seattle Engineer District 14 July 1932. On 1 May 1942, Alaska was transferred to the Alaska Defense Command. Alaska District was reestablished at Anchorage for military work only on 9 April 1946, and civil work was added 1 July 1949.

Name	Rank	Assignment	Tour of duty	
			From	To
Harry Taylor	Capt.	District Engineer	1 May 1896	14 Nov 1898
	"	" "	15 Dec 1898	30 Nov 1900
M. L. Walker	Lt.	Assistant Dist. Engr.	15 Jan 1897	14 Nov 1898
	"	District Engineer	15 Nov 1898	14 Dec 1898
	"	Assistant Dist. Engr.	15 Dec 1898	19 Jan 1901
John Millis	Maj./Lt. Col.	District Engineer	1 Dec 1900	31 Aug 1905
F. A. Pope	1st Lt.	Assistant Dist. Engr.	18 Jul 1905	31 Aug 1905
	"	District Engineer	1 Sep 1905	12 Apr 1906
	1st Lt./Capt.	Assistant Dist. Engr.	13 Apr 1906	15 Aug 1906
	Capt.	Assistant Dist. Engr.	15 Jan 1911	22 Aug 1911
H. M. Chittenden	Maj.	District Engineer	13 Apr 1906	5 Sep 1908
C. W. Kutz	Maj.	District Engineer	6 Sep 1908	31 Jul 1911
J. H. Earle	1st Lt.	Assistant Dist. Engr.	1 Feb 1909	28 Jan 1911

Name	Rank	Assignment	Tour of duty	
			From	To
Arthur Williams	Capt.	Assistant Dist. Engr.	11 Jul 1910	13 Apr 1912
J. B. Cavanaugh	Maj./Lt. Col.	District Engineer	1 Aug 1911	10 May 1917
A. R. Ehrnbeck	Capt.	Assistant Dist. Engr.	17 Oct 1912	1 Jul 1916
E. J. Dent	Maj.	District Engineer	11 May 1917	7 Sep 1917
A. H. Acher	Maj.	District Engineer	8 Sep 1917	13 Dec 1917
Geo. A. Zinn	Col.	District Engineer	14 Dec 1917	14 Jan 1918
W. T. Preston	Civilian	District Engineer	15 Jan 1918	24 Jan 1919
C. L. Sturdevant	Col.	District Engineer	25 Jan 1919	8 Sep 1919
	"	" "	21 Aug 1931	7 Feb 1935
J. A. Woodruff	Lt. Col.	District Engineer	9 Sep 1919	11 Aug 1920
E. H. Schulz	Col.	District Engineer	12 Aug 1920	16 May 1923
K. M. Moore	Capt./1st Lt.	Assistant Dist. Engr.	27 Sep 1921	16 May 1923
	1st Lt.	Acting Dist. Engr.	17 May 1923	18 Jun 1923
	1st Lt.	Assistant Dist. Engr.	19 Jun 1923	21 Jul 1924
W. J. Barden	Col.	District Engineer	19 Jun 1923	10 Jun 1927
R. C. Crawford	Maj.	Assistant Dist. Engr.	10 Sep 1924	26 Aug 1926
T. D. Simkins	Maj.	Assistant Dist. Engr.	25 Nov 1926	10 Jun 1927
	"	Acting Dist. Engr.	11 Jun 1927	19 Jul 1927
	"	Assistant Dist. Engr.	20 Jul 1927	14 Dec 1929
John S. Butler	Maj.	District Engineer	20 Jul 1927	20 Aug 1931

Name	Rank	Assignment	Tour of duty From	To
A. G. Matthews	1st Lt.	Assistant Dist. Engr.	2 Dec 1929	16 Dec 1931
C. L. Sturdevant	Maj./Lt. Col.	District Engineer	21 Aug 1931 25 Jan 1919	7 Feb 1935 8 Sep 1919
W. W. Milner	2nd Lt.	Assistant Dist. Engr.	11 Sep 1931	1 Jul 1933
R. J. Burt	1st Lt.	Assistant Dist. Engr.	12 Jan 1932	21 Jul 1934
J. R. Noyes	1st Lt.	Assistant Dist. Engr.	14 Jul 1932	3 Feb 1934
D. M. Shearer	Capt. Maj.	Assistant Dist. Engr. " " "	15 Feb 1934 12 Sep 1935	15 May 1934 10 Jun 1939
D. M. Dunne	1st Lt./Capt.	Assistant Dist. Engr.	29 Apr 1934	15 Jul 1936
H. J. Wild	Lt. Col./Col. Col. (RA)	District Engineer Assistant Dist. Engr.	8 Feb 1935 1 Dec 1942	10 Aug 1939 1946
G. J. Zimmerman	1st Lt./Capt.	Assistant Dist. Engr.	12 May 1936	12 Sep 1936
A. G. Trudeau	Capt.	Assistant Dist. Engr.	23 Sep 1936	8 Jul 1940
J. D. Lang	1st Lt./Capt./Maj. Lt. Col. (RA)	Assistant Dist. Engr.	22 Sep 1938	5 Jun 1943
Peter P. Goerz	Capt./Maj./Lt. Col. Lt. Col./Col.(RA)	Assistant Dist. Engr. District Engineer	14 Feb 1939 15 Apr 1942	14 Apr 1942 6 Dec 1942
A. C. Welling	1st Lt./Capt.	Assistant Dist. Engr.	22 Jun 1939	3 Jul 1941
L. E. Atkins	Lt. Col.	District Engineer	11 Aug 1939	22 Jul 1940

Name	Rank	Assignment	Tour of duty From	Tour of duty To
J. B. W. Corey, Jr.	2d Lt./1st Lt.	Assistant Dist. Engr.	25 Apr 1940	29 Sep 1941
D. P. Booth	Capt./Maj./Lt. Col.(RA)	Assistant Dist. Engr.	7 Jun 1940	8 Oct 1942
B. C. Dunn	Col. (RA)	District Engineer	23 Jul 1940	14 Apr 1942
G. J. Nold	Maj./Lt. Col.	Assistant Dist. Engr. 1/	1 Aug 1940	26 Sep 1941
B. B. Talley	Capt./Maj./Lt. Col.	Assistant Dist. Engr.	16 Oct 1940	30 Apr 1942
	Lt. Col./Col.(RA)	Assistant Dist. Engr. 1/	1 May 1942	
F. S. Blinn	Capt./Maj./Lt. Col.	Assistant Dist. Engr. 1/	29 Nov 1940	30 Apr 1942
F. J. Loomis	Capt. (RA)	Assistant Dist. Engr.	18 Jan 1941	30 Apr 1942
Carl A. Anderson	Capt./Maj.(Res)	Assistant Dist. Engr.	30 Jan 1941	20 Mar 1945
Arthur B. Smith	1st Lt./Capt./Maj.(Res)	Assistant Dist. Engr.	30 Jan 1941	25 Jan 1944
Robert C. Moffitt	Capt./Maj. (Res)	Assistant Dist. Engr.	5 Feb 1941	28 Nov 1942
Caleb B. Burgoyne	Capt. (Res)	Assistant Dist. Engr.	22 Feb 1941	30 Apr 1942
James D. Bush, Jr.	1st Lt./Capt. (Res)	Assistant Dist. Engr.	27 Feb 1941	30 Apr 1942
B. M. Tanner	Capt. (Res)	Assistant Dist. Engr.	28 Apr 1941	30 Apr 1942
Craig Smyser	Capt./Maj. (RA)	Assistant Dist. Engr.	31 May 1941	30 Apr 1942
John C.H. Lee, Jr.	2d Lt./1st Lt.	Assistant Dist. Engr.	16 Jul 1941	30 Apr 1942
John W. Baum	2d Lt./1st Lt. (Res)	Assistant Dist. Engr.	1 Aug 1941	30 Apr 1942

1/In addition to other duties. These officers were carried on the rosters of their basic assignments, not

Name	Rank	Assignment	Tour of duty	
			From	To
Abraham A. Dessler	Maj. (Res)	Assistant Dist. Engr. 1/	11 Oct 1941	30 Apr 1942
David G. Hammond	Capt.	Assistant Dist. Engr. 1/	20 Oct 1941	30 Apr 1942
R. J. McKinney	Capt. (Res)	Assistant Dist. Engr.	17 Nov 1941	30 Apr 1942
Arthur C. Nauman	Capt./Maj. (Res)	Assistant Dist. Engr.	3 Dec 1941	6 Jul 1943
C.H. Whitesell, Jr.	Capt. (RA)	Assistant Dist. Engr.	15 Dec 1941	30 Apr 1942
Harold L. Morian	Capt./Maj. (Res)	Assistant Dist. Engr.	5 Jan 1942	7 Sep 1943
Geo. L. Barkhurst	1st Lt./Capt./Maj.(Res)	Assistant Dist. Engr.	5 Jan 1942	19 Dec 1942
Arvid K. Reed	1st Lt./Capt. (Res)	Assistant Dist. Engr.	5 Jan 1942	30 Jan 1946
Ralph L. Hubach	1st Lt./Capt. (Res)	Assistant Dist. Engr.	5 Jan 1942	21 Mar 1942
Edward D. Lownes	1st Lt./Capt. (Res)	Assistant Dist. Engr.	5 Jan 1942	20 Oct 1942
Robert S. Harrison	2d Lt./1st Lt. (Res)	Assistant Dist. Engr.	5 Jan 1942	18 Jun 1942
Merrill A. Pimentel	Maj. (Res)	Assistant Dist. Engr.	16 Jan 1942	21 Mar 1942
Homer L. McLaughlin	Maj. (Res)	Assistant Dist. Engr.	16 Jan 1942	2 Apr 1942
Anton W. Van Stockum	Maj. (Res)	Assistant Dist. Engr.	16 Jan 1942	14 Apr 1942
Sedric A. Payette	Capt./Maj. (Res)	Assistant Dist. Engr.	16 Jan 1942	20 Oct 1942
Everett E. Martin	Capt. (Res)	Assistant Dist. Engr.	16 Jan 1942	21 Mar 1942

1/In addition to other duties. These officers were carried on the rosters of their basic assignments, not on the Seattle District roster.

Name	Rank	Assignment	Tour of duty	
			From	To
Adellon H. Hogan	Capt./Maj. (Res)	Assistant Dist. Engr.	16 Jan 1942	21 Jan 1944
Ira E. Buckholtz	1st Lt./Capt. (Res)	Assistant Dist. Engr.	16 Jan 1942	4 Feb 1944
George E. Hollister	1st Lt./Capt. (Res)	Assistant Dist. Engr.	16 Jan 1942	22 Jul 1942
Louis C. Crouch	1st Lt./Capt. (Res)	Assistant Dist. Engr.	16 Jan 1942	14 Jul 1944
Leonard W. Bindon	1st Lt./Capt. (Res)	Assistant Dist. Engr.	16 Jan 1942	15 Nov 1945
Emil F. Gehri	1st Lt./Capt. (Res)	Assistant Dist. Engr.	16 Jan 1942	30 Apr 1942
Grant P. Gordon	1st Lt./Capt./Maj.(Res)	Assistant Dist. Engr.	16 Jan 1942	30 Jan 1946
Frank S. Hale	1st Lt./Capt. (Res)	Assistant Dist. Engr.	16 Jan 1942	27 Jul 1943
Douglas M. Pelton	1st Lt. (Res)	Assistant Dist. Engr.	24 Feb 1942	30 Apr 1942
Edwin W. Jones	Col. (Res)	Assistant Dist. Engr. 1/	28 Feb 1942	30 Apr 1942
William H. McCreary	Capt. (Res)	Assistant Dist. Engr. 1/	26 Feb 1942	30 Apr 1942
Robert L. Taylor	1st Lt. (Res)	Assistant Dist. Engr. 1/	26 Feb 1942	30 Apr 1942
Nathan Schwartzman	Capt. (Res)	Assistant Dist. Engr. 1/	26 Feb 1942	30 Apr 1942
Thomas E. Ormiston	Maj. (Res)	Assistant Dist. Engr. 1/	26 Feb 1942	30 Apr 1942
Virgil L. Womeldorff	Maj. (Res)	Assistant Dist. Engr. 1/	26 Feb 1942	30 Apr 1942
Dodson O. Givens	Capt./Maj. (Res)	Assistant Dist. Engr.	28 Feb 1942	30 Apr 1942

1/In addition to other duties. These officers were carried on the rosters of their basic assigments, not on the Seattle District roster.

Name	Rank	Assignment	Tour of duty From	Tour of duty To
George P. Bennett	2d Lt. (Res)	Assistant Dist. Engr.	7 Mar 1942	30 Apr 1942
Charles F. Rose	2d Lt. (Res)	Assistant Dist. Engr.	9 Mar 1942	30 Apr 1942
Thurston E. Benson	1st Lt./Capt. (Res)	Assistant Dist. Engr.	9 Mar 1942	30 Apr 1942
Anthony J. Giardina	2d Lt. (Res)	Assistant Dist. Engr.	9 Mar 1942	30 Apr 1942
Allen E. Haberle	2d Lt. (Res)	Assistant Dist. Engr.	10 Mar 1942	30 Apr 1942
Emil W. Colli	2d Lt. (Res)	Assistant Dist. Engr.	16 Mar 1942	30 Apr 1942
Leon D. Curtis	2d Lt. (Res)	Assistant Dist. Engr.	20 Mar 1942	30 Apr 1942
Charles R. Doherty	2d Lt. (Res)	Assistant Dist. Engr.	23 Mar 1942	30 Apr 1942
Ambrose A. Ryan	1st Lt. (Res)	Assistant Dist. Engr.	23 Mar 1942	30 Apr 1942
Byron J. Clark	2d Lt. (Res)	Assistant Dist. Engr.	25 Mar 1942	30 Apr 1942
E. D. Tracy	2d Lt. (Res)	Assistant Dist. Engr.	4 Apr 1942	30 Apr 1942
William H. Baker	Maj. (Res)	Assistant Dist. Engr.	7 Apr 1942	25 Aug 1942
	Maj.	" " "	1 Dec 1942	7 Jul 1943
James G. Truitt	Lt. Col./Col. (Civ)	Assistant Dist. Engr.	11 Apr 1942	29 Sep 1943
Milton A. Lagergren	1st Lt. (Res)	Assistant Dist. Engr.	11 Apr 1942	30 Apr 1942
John S. Wilfley	Capt./Maj. (Res)	Assistant Dist. Engr.	16 Apr 1942	16 Oct 1942
George F. Tait	Capt./Maj. (Res)	Assistant Dist. Engr.	19 Apr 1942	1 Jun 1943
Emil H. Rausch, Jr.	1st Lt./Capt. (Res)	Assistant Dist. Engr.	19 Apr 1942	30 Jan 1946

Name	Rank	Assignment	Tour of duty From	Tour of duty To
Harry L. Hart	1st Lt. (Civ)	Assistant Dist. Engr.	24 Apr 1942	25 Oct 1942
William L. White	2d Lt. (Res)	Assistant Dist. Engr.	28 Apr 1942	30 Apr 1942
William B. Matlock	2d Lt./1st (Res)	Assistant Dist. Engr.	4 May 1942	1 Aug 1944
Fred G. Erie	Maj. (Civ)	Assistant Dist. Engr.	12 May 1942	5 Jan 1945
Ernest J. Riley	Maj. (Civ)	Assistant Dist. Engr.	15 May 1942	29 May 1944
John S. Detlie	Capt. (Civ)	Assistant Dist. Engr.	28 May 1942	16 Oct 1945
Edward K. Mahlum	2d Lt./1st (Res)	Assistant Dist. Engr.	1 Jun 1942	23 Aug 1942
Ernest J. Simons, Jr.	2d Lt./1st (Res)	Assistant Dist. Engr.	5 Jun 1942	19 Apr 1945
William J. NePage	1st Lt./Capt. (Res)	Assistant Dist. Engr.	14 Jun 1942	15 Oct 1945
Clark O. Bowen	Capt. (Res)	Assistant Dist. Engr.	22 Jun 1942	19 Oct 1943
Winfield S. Mortimer	2d Lt. (Res)	Assistant Dist. Engr.	1 Jul 1942	20 Oct 1942
Edward L. Pine	1st Lt. (Civ)	Assistant Dist. Engr.	14 Aug 1942	9 Mar 1943
William E. Hoy	Maj. (Civ)	Assistant Dist. Engr.	23 Aug 1942	6 Dec 1943
Cyril L. Slown	Capt. (Res)	Assistant Dist. Engr.	26 Aug 1942	14 Dec 1942
Ora F. Roberts	Maj. (Sig. Corps)	Assistant Dist. Engr. 1/	1 Sep 1942	
George F. Hopkins	Capt. (Civ)	Assistant Dist. Engr.	2 Sep 1942	20 Feb 1946

1/In addition to other duties. This officer was carried on the roster of his basic assignment, not on the Seattle District roster.

Name	Rank	Assignment	Tour of duty	
			From	To
Elmer H. Elwin	1st Lt. (Civ)	Assistant Dist. Engr.	2 Sep 1942	5 Dec 1943
Noble A. Bosley	1st Lt. (Civ)	Assistant Dist. Engr.	3 Sep 1942	29 Dec 1945
John V. Story	Capt. (Civ)	Assistant Dist. Engr.	4 Sep 1942	16 Oct 1942
Walter B. Little	1st Lt. (Civ)	Assistant Dist. Engr.	10 Sep 1942	1 Sep 1944
Charles A. Jackson, Jr.	Capt. (Civ)	Assistant Dist. Engr.	14 Sep 1942	26 Nov 1945
Sidney C. Dean	Capt. (Civ)	Assistant Dist. Engr.	21 Sep 1942	12 Mar 1943
John X. Stark	1st Lt. (Civ)	Assistant Dist. Engr.	22 Sep 1942	1 Aug 1944
Alvin E. Ahlberg	Capt. (ASC/Civ)	Assistant Dist. Engr.	5 Oct 1942	31 Dec 1945
Howard A. Wilson	Capt. (Civ)	Assistant Dist. Engr.	10 Oct 1942	18 Nov 1942
Harold L. Martin	1st Lt.(ASC)2d Lt.(Civ)	Assistant Dist. Engr.	12 Oct 1942	10 Jul 1943
Harry R. Powell	Capt. (ASC)	Assistant Dist. Engr.	15 Oct 1942	15 Jan 1943
Harold M. Sather	2d Lt./1st Lt. (Civ)	Assistant Dist. Engr.	22 Oct 1942	10 Apr 1944
Malcolm F. Brown	Capt. (ASC/Civ)	Assistant Dist. Engr.	14 Nov 1942	1 Aug 1944
Richard Park	Col. (RA)	District Engineer	1 Dec 1942	30 Nov 1943
Walter E. Church	Maj. (Civ)	Assistant Dist. Engr.	1 Dec 1942	28 Jul 1943
Cecil C. Templeton	Capt./Maj. (Civ)	Assistant Dist. Engr.	1 Dec 1942	28 Dec 1945
Arthur C. Satre	1st Lt. (Res)	Assistant Dist. Engr.	1 Dec 1942	11 May 1944

Name	Rank	Assignment	Tour of duty	
			From	To
Sidney C. Stern	Capt. (Res)	Assistant Dist. Engr.	16 Dec 1942	22 Jan 1944
Martin K. Barrett	1st Lt. (Res)	Assistant Dist. Engr.	16 Dec 1942	26 May 1943
Emil H. Rausch	Maj.	Assistant Dist. Engr.	19 Apr 1942	30 Jan 1946
Ernest J. Riley	Lt. Col.	Assistant Dist. Engr.	15 May 1942	29 Mar 1944
Wm. B. Matlock	Capt.	Assistant Dist. Engr.	11 Aug 1942	1 Aug 1944
Frank S. Hale	Capt.	Assistant Dist. Engr.	25 Aug 1942	27 Jul 1943
Arthur B. Smith	Maj.	Assistant Dist. Engr.	1 Oct 1942	25 Jan 1944
Newton D. Smith	Capt.	Assistant Dist. Engr.	16 Feb 1943	1 Mar 1943
Elso DiLuck	Maj.	Assistant Dist. Engr.	1 Apr 1943	17 Aug 1943
Alexander S. Wyner	1st Lt.	Assistant Dist. Engr.	31 Mar 1943	
Byron J. Clark	1st Lt.	Assistant Dist. Engr.	26 May 1943	1 Sep 1944
James H. Corke	2d Lt.	Assistant Dist. Engr.	24 May 1943	10 Jan 1946
Conrad P. Hardy	Col.	Assistant Dist. Engr.	14 Oct 1943	1 Dec 1943
Sydney Adeska	1st Lt.	Assistant Dist. Engr.	22 Oct 1943	26 Nov 1943
James M. Wild	Lt. Col.	Assistant Dist. Engr.	20 Nov 1943	2 Sep 1944
Conrad P. Hardy	Col.	District Engineer	1 Dec 1943	1 Jul 1946
Wm. E. Hoy	Maj.	Assistant Dist. Engr.	10 Dec 1942	6 Dec 1943

Name	Rank	Assignment	Tour of duty From	Tour of duty To
Elmer H. Elwin	Capt.	Assistant Dist. Engr.	2 Sep 1942	5 Dec 1943
Douglas M. Pelton	Capt.	Assistant Dist. Engr.	12 Dec 1943	1 Nov 1945
Rex J. Allan	Maj.	Assistant Dist. Engr.	15 Jan 1944	16 Jan 1945
George C. Butler	2d Lt.	Assistant Dist. Engr.	12 Jun 1944	31 Jan 1946
Joseph Miller	1st Lt.	Assistant Dist. Engr.	29 Dec 1944	22 Dec 1945
George W. Groves	Capt.	Assistant Dist. Engr.	20 Aug 1942	19 Aug 1945
Robert F. Lafrenz	Capt.	Assistant Dist. Engr.	14 May 1945	4 Sep 1945
Roy A. Krows	Capt.	Assistant Dist. Engr.	28 May 1945	28 Sep 1945
George J. Ditchie	2d Lt.	Assistant Dist. Engr.	23 Jul 1945	27 Oct 1945
Paul C. McClement	1st Lt.	Assistant Dist. Engr.	1 Aug 1945	28 Sep 1945
James G. Gibbs	Capt.	Assistant Dist. Engr.	3 Aug 1945	28 Sep 1945
Norman W. Haner	Lt. Col.	Assistant Dist. Engr.	9 Nov 1945	27 Dec 1945
James G. Truitt	Col.	Assistant Dist. Engr.	12 Nov 1945	20 Jan 1946
Donald MacDonald	Capt.	Assistant Dist. Engr.		6 Mar 1946
Donald C. Howkins	Col.	Assistant Dist. Engr.	26 Mar 1946	9 Jul 1946
L. H. Hewitt	Col.	District Engineer	2 Jul 1946	11 Jul 1949
Robert E. Snetzer	Lt. Col.	Assistant Dist. Engr.	9 Aug 1946	1 Jun 1947

Name	Rank	Assignment	Tour of duty From	To
Wm. R. Shuler	Col.	Assistant Dist. Engr.	28 Oct 1946	2 Nov 1948
J. H. Beddow	Lt. Col.	Assistant Dist. Engr.	7 Jul 1947	10 Jun 1949
Joseph G. Grygiel	Maj.	Assistant Dist. Engr.	13 Jun 1947	15 Apr 1950
Paul H. Symbol	Lt. Col.	Assistant Dist. Engr.	22 Jul 1948	23 Jul 1950
Daniel F. O'Conner	1st Lt.	Assistant Dist. Engr.	16 Nov 1948	10 Nov 1949
Fayette L. Worthington	1st Lt.	Assistant Dist. Engr.	1 Jun 1949	17 Aug 1950
Paul H. Symbol	Lt. Col.	Acting Dist. Engr.	12 Jul 1949	31 Jul 1949
E. C. Itschner	Col.	District Engineer	1 Aug 1949	24 Aug 1950
Walter P. Leber	Lt. Col.	Assistant Dist. Engr.	20 Aug 1949	11 Dec 1949
Alfred J. D'Arezzo	Lt. Col.	Assistant Dist. Engr.	17 Jul 1950	31 Jul 1952
John T. Harper	1st Lt.	Assistant Dist. Engr.	11 Nov 1949	1 Oct 1950
Amos L. Wright	1st Lt.	Assistant Dist. Engr.	23 Jun 1950	31 Aug 1952
John P. Buehler	Lt. Col.	District Engineer	25 Aug 1950	14 May 1952
Sidney Shelley	Maj.	Assistant Dist. Engr.	11 Aug 1950	2 Jan 1952
Clayton A. Rust	Lt. Col.	Assistant Dist. Engr.	25 Aug 1950	16 Apr 1951
A. J. D'Arezzo	Lt. Col.	Acting Dist. Engr.	15 May 1952	30 Jun 1952

Name	Rank	Assignment	Tour of duty From	To
N. A. Matthias	Col.	District Engineer	1 Jul 1952	30 Jun 1956
Lloyd L. Rall	Lt. Col.	Assistant Dist. Engr.	4 Aug 1952	3 Aug 1954
David D. Joy	1st Lt.	Assistant Dist. Engr.	21 Sep 1953	19 Jul 1954
George E. Pickett	Col.	Assistant Dist. Engr.	5 Oct 1953	2 Jun 1955
Thomas A. Stumm	1st Lt.	Assistant Dist. Engr.	20 Oct 1953	7 Aug 1954
Richard M. Wells	1st Lt.	Assistant Dist. Engr.	20 Oct 1953	23 Aug 1954
Wm. T. Bradley	Lt. Col.	Assistant Dist. Engr.	1 Aug 1954	30 Jun 1956
Rolla S. Lush	1st Lt.	Assistant Dist. Engr.	27 Aug 1954	15 Aug 1955
Alfred F. Lawrence, Jr.	1st Lt.	Assistant Dist. Engr.	20 Sep 1954	31 Jul 1955
Clarence D. Gilkey	1st Lt.	Assistant Dist. Engr.	8 Jun 1954	31 Jul 1955
Wm. D. Jones	1st Lt.	Assistant Dist. Engr.	24 Jun 1955	13 Mar 1957
Alarich L. E. Zacherle	Lt. Col.	Assistant Dist. Engr.	13 Sep 1955	20 Aug 1957
Jack H. King	2d Lt.	Assistant Dist. Engr.	26 Apr 1956	24 Apr 1957
James B. Newman, III	Lt. Col.	Executive Officer	11 Jul 1956	20 Aug 1957
	" "	Deputy Dist. Engr.	21 Aug 1957	5 May 1958
Reginald J. B. Page	Col.	District Engineer	1 Jul 1956	21 Jun 1959
Henning E. Drugge	1st Lt.	Assistant Dist. Engr.	29 Oct 1956	20 Aug 1957

Name	Rank	Assignment	Tour of duty From	Tour of duty To
Robert R. Lacy	2d Lt.	Assistant Dist. Engr.	3 Jun 1957	30 Nov 1958
Charles M. Spink	2d Lt.	Assistant Dist. Engr.	5 Jun 1957	30 Nov 1958
Ulrick H. Mettler	2d Lt.	Assistant Dist. Engr.	12 Sep 1957	25 Sep 1958
Robert P. Young	Col.	Assistant Dist. Engr.	31 Jul 1958	
	"	Deputy Dist. Engr.	1 Aug 1958	21 Jun 1959
	"	District Engineer	22 Jun 1959	15 Oct 1961
Roy L. Kackley	Maj.	Executive Officer	7 Jan 1958	21 Jun 1959
	"	Deputy Dist. Engr.	22 Jun 1959	16 Jul 1960
Don DeFord	Lt. Col.	Spokane Area Engr.	14 Jan 1959	30 Apr 1960
Robert C. Pool	2d Lt.	Asst. to Spokane Area Engr.	22 Aug 1960	17 Mar 1961
Robert B. Kemp	Lt. Col.	Assistant Dist. Engr.	23 Aug 1960	
James H. Harper	Lt. Col.	Assistant Dist. Engr.	7 Sep 1960	18 Dec 1960
	" "	Deputy Dist. Engr	19 Dec 1960	15 Oct 1961
	" "	Acting Dist. Engr.	16 Oct 1961	30 Oct 1961
	" "	Deputy Dist. Engr.	31 Oct 1961	27 Jul 1962
Sterling R. Nichols, Jr.	1st Lt.	Assistant Dist. Engr.	7 Sep 1960	13 Apr 1963
Robert W. Fritz	Lt. Col.	Spokane Area Engr.	18 Sep 1960	30 Apr 1961
Marion H. May	Lt. Col.	Spokane Area Office	18 Sep 1960	9 Mar 1961
Michael W. Gallagher	1st Lt.	Asst., Great Falls Area	26 Sep 1960	2 Jul 1962

Name	Rank	Assignment	Tour of duty From	Tour of duty To
Clifford C. McMullen	1st Lt.	Asst., Great Falls Area	19 Oct 1960	8 Apr 1962
Bernard H. Rogers	1st Lt.	Asst., Great Falls Area	26 Oct 1960	30 Nov 1960
Ernest L. Perry	Col.	District Engineer	31 Oct 1961	1 Jul 1964
Clarence B. Drennon, III	1st Lt./Capt.	Deputy Chief, Great Falls Real Estate Field Office;	1 Jun 1962	30 Nov 1962
	" " "	Asst., Resident Office Lower Monumental	1 Dec 1962	Nov 1963
Lewis A. Pick, Jr.	Maj.	Assistant Dist. Engr.	5 Aug 1962	28 Apr 1964
	"	Acting Dist. Engr.	6 Aug 1962	7 Aug 1962
Hobart E. Dewey	Lt. Col.	Assistant Dist. Engr.	22 Feb 1963	
	" "	Acting Dist. Engr.	1 Mar 1963	3 Mar 1963
	" "	Deputy Dist. Engr.	13 May 1963	16 Nov 1964
	" "	Acting Dist. Engr.	1 Jul 1964	26 Aug 1964
James R. Hoffman	Capt.	Construction Engr. Lower Monument Resident Office	12 Jun 1964	5 May 1966
C. C. Holbrook	Col.	District Engineer	27 Aug 1964	1 Sep 1967
Sammy J. Black	Maj.	Assistant Dist. Engr.	14 Jun 1964	5 Jul 1965
	"	Deputy Dist. Engr.	6 Jul 1965	22 Apr 1966
Allan P. Nesbitt	Lt. Col.	Assistant Dist. Engr.	22 Aug 1966	30 Aug 1966
	" "	Deputy Dist. Engr.	31 Aug 1966	31 Aug 1967
	Civ.	Assistant	12 Jul 1968	30 Nov 1968

Name	Rank	Assignment	Tour of duty From	Tour of duty To
Richard E. McConnell	Col.	District Engineer	2 Sep 1967	Present
Lowell B. Dezarn	Lt. Col.	Assistant Dist. Engr.	1 Jul 1967	31 Aug 1967
	" "	Deputy Dist. Engr.	1 Sep 1967	9 Sep 1968
Hugh W. Munson, Jr.	Maj./Lt. Col.	Deputy Dist. Engr.	8 Dec 1968	Present

APPENDIX B
CIVIL WORKS - MULTIPLE-PURPOSE
Seattle District, Corps of Engineers

Project	Features	Authority	Status	Costs through 30 June 1968 Construction	Costs through 30 June 1968 Oper. Maint. Rehab.
Albeni Falls Dam and Reservoir Pend Oreille River, Idaho	Spillway dam, 1,155,000 acre-feet storage; 42,600 kw hydroelectric plant	Flood Control Act of 1950	Completed * Operating	31,244,827 -	4,789,770 -
Chief Joseph Dam Columbia River, Wash.	Spillway dam, intake for 27 units 1,024,000 kw hydroelectric plant	River & Harbor Act of 1946	Completed * Operating	145,103,876 -	12,787,511 -
Libby Dam and Reservoir Kootenai River, Mont.	Spillway dam, 4,965,000 acre-feet storage; 420,000 kw hydroelectric plant	Flood Control Act of 1960	Under Construction	98,055,532 1/ 2,200 2/	- -
Lower Monumental Lock and Dam Snake River, Wash.	Spillway dam, 376,000 acre-feet storage; navigation locks; 405,000 kw hydroelectric plant	Flood Control Act of 1945	Completed ** Operating	147,961,543 -	- - -

1/Estimated cost when completed $373 million.
2/For Kelley Flats Airport; $202,849 contributed by local interests, of which $2,200 has been expended.

* Except Recreation Facilities.
** Except Recreation Facilities and Landscaping.

CIVIL WORKS - FLOOD CONTROL
Seattle District, Corps of Engineers

Project	Features	Authority	Status	Costs through 30 June 1968 Construct. 1/	Oper. Maint. Rehab.
		Flood Control Acts			
Howard A. Hanson Dam and Reservoir, Wash.	Rockfill Dam 235 feet high 106,000 acre-feet storage	1950	Completed Operating	37,048,061 2,000,000	970,786 -
Mud Mountain Dam and Reservoir White River, Wash.	Rockfill Dam 425 feet high 106,000 acre-feet storage	1936	Completed * Operating	13,238,531 -	3,076,009 3,928
Sammamish River, Wash.	15 mile channel enlargement and rectification	1958	Completed Operating	2,528,438 686,210	None
Tacoma, Puyallup River, Wash.	Channel rectification, levees revetments, bridges	1936	Completed Operating	3,942,818 -	58,408 -
Wynoochee Dam and Reservoir Wash. (Wynoochee River)	Dam and reservoir 70,000 acre-feet storage	1962	Under construction	2,233,424 4/ 5/	- -
Columbia River Basin 3/ Local Protection Works	Various bank protection, levees, channel work	1950	Part Compl. Continuing	419,446 -	None
Minor Projects, US, (excluding Alaska) 2/	65 bank protection, levee, snagging and channel works	1936-65	Part Compl. Continuing	2,944,071 154,689	523,995 -

1/First line, Corps of Engineers funds; 2d line, local cash contribution
2/Each costing less than $1 million
3/Includes 9 locations, of which Lightning Creek at Clark Fork, Idaho, and Clark Fork at Missoula, Montana, are complete. One is deferred, 5 are inactive, and 1 has expired.
4/Estimated total project costs, Federal, $17,400,000 (July 1968)
5/Cost allocated to water supply $13,183,000 (July 1968 estimate) will be repaid by local interests.
6/In addition, $994,852 was expended on planning 35 additional projects.

NOTE: Above does not include approximately $12,607,000 expended under various authorizations for flood fighting and emergency repairs (excluding Alaska) at numerous locations.
* Except Recreation Facilities.

CIVIL WORKS - NAVIGATION

Seattle District, Corps of Engineers

Project	Features	Authorities No. of Acts First-last Acts	Status 1/	Costs through 30 June 1968 Construct. 2/	Costs through 30 June 1968 Oper. Maint. Rehab.
		River and Harbor Acts			
ellingham Harbor, Wash.	Dredged channels, basins and rock breakwaters	6 1902-1958	Completed Active	$1,566,840 31,581	$ 269,559 3/
Everett Harbor and and Snohomish River, Wash.	Dikes, basins, channels	6 1894-1960	Completed Active	1,723,744 5,618	1,013,743 3/
Grays Harbor and Chehalis River, Wash.	North & South rock jetties; channels, basins, breakwaters	17 1882-1954	Completed Active	5,030,851 35,834	25,956,007 47,889 3/
Lake Washington Ship Canal, Wash.	Two locks, spillway dam	8 1894-1935	Completed Active	4,024,297 -	14,075,180 -
Puget Sound & Tributary Waters, Wash.	Dredging, snagging, debris removal, maintenance	2 1882-1892	Continuous Active	43,337 -	4,365,510 -
Quillayute River, Wash.	Jetty, dike, channel, basin	3 1930-1954	Completed Active	521,850 20,000	1,249,135 3/
Swinomish Channel, Wash.	11-mile inland cutoff canal. Dredging, dikes, rock excav.	3 1892-1962	Completed Active	808,332 -	2,095,819 3/
Tacoma Harbor, Wash.	Large channels, turning basins, training walls	8 1902-1962	Completed Active	2,434,475 559,581	523,616 -
Willapa River & Harbor and Naselle River, Wash.	Channels, dike, basins, breakwater	12 1892-1954	Completed Active	1,579,269 71,775	6,600,694 3/

1/First line, status of new work; 2d line, use and maintenance.
2/First line, Corps of Engineers funds; 2d line, required cash contribution.
3/Excludes Navy and Coast Guard dredging.

CIVIL WORKS - NAVIGATION (Cont'd)

Project	Features	Authorities No. of Acts First-last Acts	Status 1/	Costs through 30 June 1968 Construct. 2/	 Oper. Maint. Rehab.
		River and Harbor Acts			
Neah Bay, Washington	Rock breakwater and revetment	2 1938-1954	Completed Active	$2,057,266	$ 253,307
Seattle Harbor, Wash.	Dredging East, West and Duwamish Waterways	4 1919-1935	Completed Active	170,335 69,333	2,115,537 -
Shilshole Bay, Seattle, Wash.	Rock breakwater and dredging for small-boat basin	1 1954	Completed Active	2,575,092 -	5,167 4/
Minor U.S. Projects 3/	21 Navigation Projects	1880-1966	Various	3,265,675 5/ 266,712	711,836
Nome Harbor, Alaska	Jetties, channel, basin revetment, seawall, dredging	3 1917-1948	Trans. 1951 to Alaska District	272,950	1,052,673 67,500
Wrangell Narrows, Alaska	Channel improvement	2 1921-1935	Trans. 1951 to Alaska District	1,700,307	209,212
Minor Alaska Projects 3/	21 harbors and channels	1907-1950	Trans. 1951 to Alaska District	3,420,237	164,484

1/First line, status of new work; 2d line, use and maintenance.
2/First line, Corps of Engineers funds; 2d line required cash contribution.
3/Each costing less than $1 million
4/Excludes Navy and Coast Guard dredging.
5/In addition, $249,037 was expended on planning on 22 additional projects.

NOTE: Above does not include $71,071 Federal funds and $1,750 contributed funds expended under authority of Section 3 of the R&H Act approved 2 March 1945 on 4 projects.

APPENDIX C

MAJOR CIVIL WORKS, PERTINENT DATA

Lake Washington Ship Canal

Lake Washington Ship Canal was first considered for construction in 1853. Subsequent studies were made during an interim period lasting until 1910, at which time the existing project with permanent masonry locks was adopted by the U.S. Congress. Construction began in 1911 and was completed in 1916. The small and large locks were opened the summer of 1916, and the navigable channel between Lake Union and Lake Washington was opened in May 1917.

Lake Washington Ship Canal is within the city of Seattle, Washington. The canal connects Shilshole Bay on Puget Sound to the west with Salmon Bay, Lake Union, Portage Bay, and Union Bay on Lake Washington, 8 miles to the east. A 30-foot-deep channel at low lake level is provided. One and one-half miles east of the Shilshole Bay entrance are a spillway dam which regulates the lake level, a fish ladder for salmon passage on the south abutment of the dam, and a pair of navigation locks on the right bank (north end of the dam) for the passage of ships, barges and small craft.

In 1956 Congress renamed the locks the Hiram M. Chittenden Locks. A catch and a mechanical barrier at the upstream end of the locks reduce salt water intrusion through the locks from Puget Sound into Salmon Bay. Approximately 80,000 vessels of all types and an average of over 2,000,000 tons of cargo pass through the locks annually. More than a million people visit the locks from shoreside each year. Visitor facilities include modern comfort stations, a vista house, and a 7-acre botanical garden. Improvements now under construction include a centralized control system closed circuit television to reduce manpower requirements for operation of the locks, electric spillway gate hoists, and additional beautification of the facility.

Canal

Location	Shilshole Bay to Union Bay, Seattle
Project cost	\$3,539,295 (Federal); \$742,071 (King County); \$246,567 State of Washington
Project construction time	5 years
Year placed in operation	1916

Canal (Continued)

Canal dimensions	
Length	8 miles
Minimum channel depth at low lake level	30 feet
Minimum channel width	75 feet

Large lock

Type of construction	Concrete masonry, gravity
Length	825 feet
Width	80 feet
Wall height	55 feet
Minimum depth over upper miter sill (salt water barrier)	33.75 feet
Minimum depth over lower miter sill	29 feet
Lift, maximum (depends on tide)	26 feet
Lift, minimum (depends on tide)	6 feet
Mooring bits, type	Fixed
Gates, upper and guard - miter, electrically operated	46 feet 4 inches x 55 feet
Gates, middle and lower - miter, electrically operated	46 feet 4 inches x 55 feet

Large lock can be divided into two chambers by middle gates.

Small lock

Type of construction	Concrete masonry, gravity
Length	150 feet
Width	28 feet
Wall height	42 feet
Minimum depth over upper miter sill	16 feet
Minimum depth over lower miter sill	16 feet
Lift, maximum (depends on tide)	26 feet
Lift, minimum (depends on tide)	6 feet
Mooring bits, type	Floating
Gates, upper - miter, electrically operated	18 feet 2 inches x 22 feet 1-1/2 iches
Gates, lower guard - miter, electrically operated	18 feet 2 inches x 22 feet 1-1/2 inches
Gates, upper guard - miter electrically operated	18 feet 2 inches x 32 feet 6 inches
Gates, lower - miter, electrically operated	18 feet 2 inches x 42 feet 1 inch

Spillway dam

Length	240 feet
Height	63 feet
Gates, number and size	Six tainter, 32 feet wide x 12 feet high
Gates, lifting method	Portable electric hoist device
Spillway crest elevation	13.75 feet at mean lower low water
Capacity of spillway	16,000 cubic feet per second

Salt water catch basin

Size	2,000 feet long x 250 feet wide
Location	Upstream from large locks. Drain returns entrapped salt water to Puget Sound

Salt water barrier (Downstream guard gate)	80 feet wide x 20 feet high. Hinged at base, bulkhead raised and lowered by compressed air flotation. Provides for 15-foot vessel draft at normal low water in raised position; 33 foot vessel draft at normal low water in lowered position.

Fish ladder

Annual passage	Approximately 190,000 salmon (majority pass through locks, balance through fish ladder).

Mud Mountain Dam and Reservoir

Mud Mountain Dam was authorized by the Flood Control Act of 1936. This single-purpose flood control project is located on White River, 28 miles above the mouth and five miles southeast of Enumclaw, Washington. The project was constructed primarily to alleviate flooding in the lower Puyallup Valley. Construction was initiated with river diversion accomplished in September 1940. Work on the dam was halted in July 1942 because of war, resumed in 1947, and was essentially complete in 1948. Fish-trapping facilities at Buckley and a hydrologic radio network were completed in 1949.

Mud Mountain Dam is an earth and rockfill embankment 425 feet in height from bedrock to the top of the dam, and has a crest length, excluding spillway, of 700 feet. A free-overflow chute-type spillway, 315 feet wide at the crest and 1,200 feet long, is on the right abutment. The outlet works consist of an intake structure on the right abutment, a 9-foot tunnel with downstream control by a radial gate, and a 23-foot tunnel containing three 8-1/2-foot-diameter steel penstocks that discharge through 8-foot Howell-Bunger valves.

Hydrology

Drainage area	402 square miles
Discharge, mean annual	1,312 cubic feet per second
Flood peak, historical (1933)	32,000 " " " "
Flood peak, maximum recorded (1933)	32,000 " " " "
Spillway design flood	139,000 " " " "
Project cost	$13,238,500
Project construction time	8 years
Year placed in operation	1948

Storage and principal elevations

Reservoir gross capacity	106,000 acre-feet
Maximum spillway design pool elevation	1,241 feet, mean sea level
Maximum regulated pool elevation	1,215 " " " "
Maximum full pool elevation	1,215 " " " "

Reservoir

Area, maximum pool	1,200 acres
Maximum length of reservoir	5.5 miles

Dam

Elevation, top of dam	1,250 feet, mean sea level
Length of crest (excluding spillway)	700 feet
Width at crest	50 feet
Height of dam above bedrock	425 feet
Volume of fill (including rock shell and impervious core)	2,300,000 cubic yards
Width of fill at base	1,600 feet
Volume of concrete used in entire project	60,000 cubic yards

Spillway

Location	Right abutment
Type	Concrete free-overflow chute
Elevation, crest	1,215 feet, mean sea level
Chute length	1,200 feet
Chute, width at crest	315 feet
Design capacity	139,000 cubic feet per second

Outlet works

Intake tower, location	Upstream from right abutment
Combined capacity	17,700 cubic feet per second
9-foot tunnel	
Type	Concrete, horseshoe
Location	Right bank
Length	1,800 feet
Intake invert elevation	895 feet, mean sea level
Control (upstream)	9-foot radial gate
23-foot tunnel	
Type	Concrete, circular
Location	Right bank
Length	2,000 feet
Intake elevation, invert	970 feet, mean sea level
Control (downstream)	See penstocks
Penstocks	In 23-foot tunnel
Number	3
Length	852.5 feet
Diameter	8.5 feet
Regulating valves	Three Howell-Bunger
Diameter of valves	8 feet

Chief Joseph Dam

Chief Joseph Dam is a hydroelectric power installation at river mile 545 from the mouth of Columbia River, Washington. The project was authorized as Foster Creek Dam and Powerhouse by the River and Harbor Act of 24 July 1946, and redesignated Chief Joseph Dam by the River and Harbor Act of 30 June 1948. Construction was essentially completed in 1958. It consists of a gated concrete gravity spillway which abuts the right bank and connects to the intake structure and powerhouse with a curved, nonoverflow concrete section founded on a mid-channel rock outcropping. The intake structure and powerhouse follow the downstream alignment and connect with the left abutment, a curved concrete gravity nonoverflow dam. The powerhouse encloses indoor-type Francis turbines and power generating facilities, and two station service units. Substructure has been provided at the downstream end of the powerhouse for 11 additional units.

Hydrology

Drainage area	75,000 square miles
Discharge, mean annual	108,900 cubic feet per second
Flood peak, historical (1894)	725,000 " " " "
Flood peak, maximum recorded (1948)	638,000 " " " "
Flood peak, minimum recorded (1941)	170,000 " " " "
Mean annual unregulated flow	371,700 " " " "
Spillway design flood	1,250,000 " " " "

Total project cost	$145,103,876
Year placed in operation	First unit on line 20 Aug 55

Storage and principal elevations

Reservoir gross capacity (non-usable)	480,000 acre-feet
Power pondage (for 5-foot diurnal drawdown)	36,000 acre-feet
Maximum spillway design pool elevation	957.0 feet, mean sea level
Maximum regulated pool elevation (surcharge)	948.0 " " " "
Normal full pool elevation	946.0 " " " "
Minimum pool elevation	930.0 " " " "
Normal tailwater elevation	760.0 " " " "
Elevation of top of dam	960.0 " " " "

Reservoir

Area, maximum pool (elevation 948 feet)	8,000 acres
Area, normal full pool (elevation 946 feet)	7,150 acres
Area, minimum pool	6,800 acres
Length of reservoir	51 miles
Shoreline of reservoir	106 miles

Dam

Length:	
Spillway	922 feet
Abutments	1,342 feet
Intake structure	2,036 feet
Total length of dam	4,300 feet
Height, foundation to roadway	230 feet
Volume of concrete (dam only)	945,328 cubic yards

Spillway

Type	Gated ogee, gravity
Elevation, top of gate	946.0 feet, mean sea level
Control gates, type	Tainter
Control gates, number	19
Control gates, size	40 feet x 46.08 feet
Crest elevation	901.5 feet, mean sea level

Stilling basin

Length	211 feet
Width	915 feet 3 inches
Apron elevation	743.0 feet, mean sea level
Baffles	43 - one row 13 feet 6 inches wide, 11 feet high
End sill	11 feet high, two steps
Training wall, top elevation	810 feet
Tailwater, 1948 flood	Elevation 805.5 feet, mean sea level
Tailwater, spillway design flood	Elevation 826.5 feet, mean sea level

Intake structure

Number of units	27
Length	2,036 feet
Height	150 feet
Deck elevation	960.0 feet, mean sea level
Gates (24 feet x 56 feet)	20, plus two emergency
Penstocks, number	16 initially 27 ultimately
Penstocks, size	25-foot diameter

Generators

Number	16 initially 27 ultimately
Rated capacity per unit (0.95 power factor)	64,000 kilowatts
Total rated capacity	1,024,000 kw. initially 1,728,000 kw. ultimately

Albeni Falls Dam and Reservoir

Albeni Falls Dam and Reservoir were authorized by the Flood Control Act of 17 May 1950 (Public Law 516, 81st Congress, Second Session). This multiple-purpose project is on the Pend Oreille River, in Bonner County, Idaho, 2-1/2 miles east of Newport, Washington, and was essentially complete on 31 December 1955. The dam is a 90-foot-high concrete gravity, gate-controlled structure with a spillway 472 feet long. The overall length, including the nonoverflow abutment section, is 755 feet. The 10 spillway gates are of vertical lift roller-train type. A gate-controlled log chute 440 feet long is located in the right abutment tunnel. A powerhouse 200 feet wide by 301 feet long houses three Kaplan turbine-powered generators with a total rated capacity of 42,600 kw. Albeni Falls Dam is operated in the interest of power generation, navigation, flood control, recreation, and fish and wildlife conservation.

Hydrology

River mile above mouth	90.3 miles
Drainage area	24,200 square miles
Discharge, mean annual (1903-56)	25,520 cubic feet per second
Flood peak, historical (1894)	195,000 " " " "
Flood peak, maximum recorded (1948)	168,000 " " " "
Discharge, minimum recorded (June 1941)	30,100 " " " "
Mean annual unregulated flow	90,100 " " " "
Spillway design flood (headwater elevation 2097 feet)	420,000 " " " "
Project cost	$31,244,827
Project construction time	4 years
Year placed in operation	1952 - Flood control 1955 - Power

Storage and principal elevations

Reservoir usable storage, normal full pool	1,155,000 acre-feet
Maximum regulated pool elevation	2,062.5 feet, mean sea level
Maximum recorded lake elevation	2,075.9 " " " "
Minimum lake elevation (18,000 cubic feet per second)	2,049.7 " " " "
Normal tailwater elevation	2,031.0 " " " "
Minimum tailwater elevation	2,025.0 " " " "

Reservoir

Area maximum pool	94,600 acres
Length of reservoir	68 miles
Shoreline of reservoir	226 miles

Dam

Elevation of top of dam	2,097 feet, mean sea level
Spillway	472 feet
Abutments	383 feet
Intake structure and powerhouse	301 feet
Total length of dam and powerhouse	1,056 feet

Spillway

Type	Gated, concrete gravity ogee
Elevation, top of gate	2,065 feet, mean sea level
Control gates, type	Caterpillar, 2-leaf, vertical lift
Control gates, number	10
Control gates, size	
Upper	19 feet x 40 feet
Lower	13 feet x 40 feet
Overall	32 feet x 40 feet
Crest elevation	2,033 feet, mean sea level

Howard A. Hanson Dam and Reservoir

Howard A. Hanson Dam was authorized by the Flood Control Act of 17 May 1950 (Public Law 516, 81st Congress, Second Session). The project was authorized as Eagle Gorge Dam, but the name was changed by an Act of Congress in August 1958 to Howard A. Hanson Dam. The multiple-purpose project was authorized in the interests of flood control, fish conservation, pollution abatement, domestic water supply, irrigation, and industrial expansion. Hanson Dam is on the Green River in King County, Washington, 64 miles above the mouth, 45 miles southeast of Seattle, and 45 miles east of Tacoma. Construction of road, railroad and utility relocations was initiated in 1955, and actual dam construction in February 1959. The dam was completed in April of 1962.

Howard A. Hanson Dam is of rockfill construction, with inclined impervious core and filters. Outlet works on the left bank consist of an approach channel, intake structure providing upstream control, 19-foot diameter horseshoe concrete-lined tunnel, stilling basin, and auxiliary 48-inch diameter bypass pipe. A gated spillway on the left abutment with two 45 foot x 30 foot tainter gates permits reservoir storage to elevation 1,206 without spillway discharge. The paved spillway chute is 656 feet long.

Hydrology

Drainage area	225 square miles
Discharge, mean annual (Palmer Gage)	1,087 cubic feet per second
Flood peak, historical	No data available
Flood peak, maximum recorded (November 1959)	25,800 cubic feet per second
Discharge, minimum recorded (September 1934)	81 cubic feet per second
Spillway design flood, inflow	161,000 cubic feet per second

Project cost	$37,048,060 Federal; $2,000,000 King County
Project construction time	7 years (main dam, 3 years)
Year placed in operation	1962

Storage and principal elevations

Reservoir storage capacity at elevation 1206 feet	106,000 acre-feet
Conservation gross storage	26,000 acre-feet
Maximum spillway design pool	Elevation 1222.4 feet, mean sea level
Storage and spillway design pool	137,000 acre-feet
Maximum regulated pool	Elevation 1206 feet, mean sea level
Maximum full pool	Elevation 1206 feet, mean sea level
Conservation pool	Elevation 1141 feet, mean sea level

Reservoir

Area, maximum pool	2,000 acres
Maximum length of reservoir at top of gates, elevation 1206 feet	7 miles

Dam

Elevation, top of dam	1,228 feet
Width at crest	23 feet
Length of crest, including abutment and spillway	675 feet
Height of dam above bedrock	235 feet
Volume of fill (including rock shell and impervious core)	1,502,000 cubic yards
Width of fill at base	960 feet
Volume of concrete used in entire project	48,000 cubic yards

Spillway

Elevation, crest	1,176 feet, mean sea level
Design capacity (outflow)	107,000 cubic feet per second

Outlet works

Intake tower, location	Left bank
Capacity, total	54,000 cubic feet per second
Tunnel gates	Two - 10 foot x 12 foot tainter
Emergency gate	One tractor type, 16 feet 8 inches x 20 feet high
Bypass gates	One 9 feet 5 inches x 9 feet 6 inches slide gate
Stilling basin	40 feet 10 inches wide x 172 feet long

Libby Dam and Reservoir

The Libby Project on the Kootenai River, Montana, was authorized by the Flood Control Act of 1950, but could not be planned definitely until Canadian cooperation was assured. A treaty consummated 16 September 1964 provided for the United States to commence construction of Libby Dam within 5 years from the treaty's effective date; for Canada to handle the acquisition of reservoir lands in British Columbia; and for the operation of Libby storage to start within 7 years after beginning construction. The dam is 17 miles upstream from the town of Libby.

Within the United States, the project requires relocation of about 60 miles of Great Northern Railway's main transcontinental line, including a 7-mile tunnel, and 52 miles of Montana State Highway 37; construction of 50 miles of Forest Service roads, and relocation or adjustment of other roads, facilities, utilities and services affected by the reservoir. Warland and Rexford will be flooded by the reservoir. In Canada, a few communities, roads, and sections of a branch line railroad will be affected by the reservoir.

Initially, the project will regulate streamflow to produce about 540,000 kilowatt hours of prime power at the dam and at existing and future installations on the Columbia River in the United States. This flow regulation will also increase power production of existing and future plants on the Kootenai River between Nelson and Castlegar, British Columbia.

Hydrology

Drainage area	9,070 square miles
Pool reservoir length	90 miles (48 U.S., 42 Canada)
Gross storage	5,850,000 acre-feet
Usable storage	4,965,000 acre-feet
Normal full pool (above sea level)	Elevation 2,459 feet
Minimum regulated pool	Elevation 2,287 feet

Dam

Length of dam crest	3,055 feet
Height, maximum, bedrock to top	420 feet
Height, above streambed	370 feet
Total concrete	3,760,000 cubic yards
Excavation	5,658,000 cubic yards

Spillway

No. of spillway bays	2
Spillway tainter gates, size	48 feet x 53 feet

Powerhouse

No. of units	4 initially 8 ultimately
Unit capacity, each	105,000 kilowatts
Plant capacity	420,000 kilowatts initially 840,000 kilowatts ultimately

Flathead tunnel (Great Northern Railway)

Section, concrete lined	Horseshoe, 25 feet high, 18 feet wide
Length	36,970 feet
Ventilation	Fans, two each, 2,000 horsepower Capacity, 307,000 cubic feet, minimum
Schedule	Holed through 21 June 1968, after 650 days. Completion 1969. In service 1970.
Total project cost	$383 million (Estimated)

LOWER MONUMENTAL LOCK AND DAM

PERTINENT DATA

1. GENERAL

Stream miles from mouth of Snake River	41.6
River miles upstream from Ice Harbor Dam	31.9
Drainage area, square miles	108,500
Length of crest, feet	3,800
Normal height headwater to tail water, feet	100
Discharges in cubic feet per second:	
Minimum of record, natural	9,000
Mean monthly low flow	11,000
Dependable minimum mean monthly flow	13,000
Average annual low flow	15,200
Mean annual flow	48,950
Average annual peak flow	187,000
Maximum of record, June 1894	409,000
Standard project flood	340,000
Spillway design flood	850,000
Tail water elevations, Ice Harbor Pool Elevation 440:	
50,000 cfs	441
225,000 cfs, maximum for fishway criteria	448
340,000 cfs, standard project flood	453
850,000 cfs, spillway design flood	471

2. RESERVOIR

Elevation, normal pool	540
Elevation, minimum pool	537
Length, miles	28.7
Area at normal pool (flat), acres	6,590
Pondage below pool elevation 540, acre-feet	376,000
Pondage below pool elevation 937, acre-feet	356,000
Relocations, miles:	
Northern Pacific Railway	26.2
Union Pacific Railroad	14.0
Camas Prairie Railroad	10.7
Railroad Branch Lines	12.2
County Roads	4.2
Access Roads	15.5

3. SPILLWAY

Number of bays	8
Bay width, feet	50
Pier width, feet	12
Overall width, feet	508
Overall length, feet	352
Crest elevation	483

3. SPILLWAY (Continued)

Gate size, width by height above crest	50 x 59
Stilling basin length, feet	180
Deck elevation	553
Deck width, clear, feet	30.25

4. POWERHOUSE

Length overall, feet	695
Width overall (transverse section), feet	267
Intake deck elevation	553
Tailrace deck elevation	456
Maximum height (draft tube invert to intake deck), feet	226
Spacing - feet:	
Units, No. 1 through 5	90
Unit No. 6	96
Erection bay	88
Service bay	61
Turbines:	
Type:	Kaplan 6-blade
Runner diameter, inches	288
Revolutions per minute	92.3
Rating, horsepower	190,360
Generators:	
Rating (nameplate), kilowatts	121,000
Power factor	0.95
Kilo-volt ampere rating	127,400
Overload capability at 0.95 power factor, kilowatts	139,150
Units installed complete initially	3
Skeleton units provided initially	3
Total number of units definitely provided for	6
Initial plant capacity, nameplate rating, kilowatts	363,000
Initial plant capacity, overload capability, kilowatts	417,450
Ultimate plant capacity, nameplate rating, kilowatts	726,000
Ultimate plant capacity, overload capability, kilowatts	834,900

5. NAVIGATION LOCK & CHANNELS

Net clear length of lock, feet	675
Net clear width of lock, feet	86
Minimum water depth over sills	15
Maximum upper water surface elevation in chamber	540
Minimum water surface elevation in chamber	437
Top of lock walls, elevation	548
Upstream sill block elevation	522
Downstream sill block elevation	422
Upstream Gate:	
Type	Submergible lift
Height, effective, feet	20

5. NAVIGATION LOCK & CHANNELS (Continued)

Downstream gate:	
Type	Lift
Height, effective, feet	83
Maximum possible lift, feet	103
Lift with standard project flood, feet	87
Length of guard walls, feet	700
Permanent downstream channel:	
Width, feet	250
Bottom elevation	421

6. CONCRETE NON-OVERFLOW SECTIONS

Clear deck width, feet:	
Right abutment	30.25
Between powerhouse and spillway	45.20
Between spillway and lock	30.25
Deck elevation	553

7. ABUTMENT EMBANKMENTS

Embankment elevation	558
Embankment top width, feet	43
Material	Rock and earth fill with impervious core
Slopes, upstream and downstream	1 on 2

8. FISH FACILITIES

Maximum design river flow, cfs	225,000
Slope	1 on 10
Ladder clear width, feet	16
Regulation for pool fluctuation	Orifice flow
Weir height, feet	6
Normal ladder flows, cfs	66
Diffusion chambers:	
Number in North ladder	8
Number in South ladder	7
Velocity through gratings fps:	
Gross area	0.25
Net area	0.50
Powerhouse collection channel:	
Optimum transportation velocity, fps	2
Entrances, number:	
Submerged orifices	12
Overflow weirs	3
Velocities, fps:	
Through orifices	8
Over weirs	8
Diffusion chambers, number	12

APPENDIX D

REMINISCENCES OF EARLY TIMES, LESTER O. McCUE

C O P Y

TAMARAK MOTEL
AND APARTMENTS

102 - 4th Street Southwest Puyallup, Washington 98371
Area Code - 845-0466

April 30, 1968

Mr. Arthur A. Weis
Chairman
Seattle District Historical Committee

Dear Mr. Weis -

Sorry to have waited so long before writing this diatribe. But believe it or not, I've been busy. Don't get the idea that an old retiree has time on his hands. Life has been very good to me and am keeping happily busy.

I want you to know that I enjoyed our little chit-chat in January, and the following is submitted in that vein.

Of course, as the records show, I started to work in the Seattle District Engineer Office on March 6, 1922, coming from Everett on the old trolley line, and at the age of 19 getting lost in the "big city."

At that time the District Engineer was Colonel E. H. Schulz (in civilian clothes). I was hired as a steno-typist and took dictation from Mr. Silas Finch, the Chief Clerk. I also was the telephone operator at times, answering all incoming calls on a "huge" switchboard, which I recall had four locals.

The office was divided into two sections, the Engineering and Clerical sections. The clerical section, headed by Silas Finch (a veteran of the Spanish-American War) consisted of a bookkeeper, a steno-typist-telephone operator (me), a file clerk (also doubling as shorthand reporter for all River & Harbor hearings), a purchasing and property clerk, and a messenger.

The Engineering Section, headed by Mr. H. J. M. Baker, consisted of six personnel, assistant engineers, draftsmen, blueprint operator, and chauffeur.

The messenger also doubled as the blueprint operator, with help from everyone, including the chauffeur (when not on duty driving the District Engineer), and also myself.

Within three or four months, the Purchasing and Property Clerk, whose maiden name escapes me, became married and was Mrs. Harrington and decided to quit.

I was given her position after a two week's break-in period. This was in the summer of 1922.

The office occupied approximately one fourth or third of the top floor of the Burke Building at 2nd and Marion, facing south. Across Marion Street we had a grand stand seat watching the erection of the Exchange Building.

Purchasing & Property Section - oh yes. The job consisted of buying all supplies for the district, and keeping account of all property. Also handling shipping and traffic.

Purchases were made of every conceivable item, from food to safety pins, medical supplies and steam engines.

Everything of an estimated cost of $25.00 or more went out on formal bids! These bids were issued on a light weight paper, making as many carbons as possible. Carbon copies were the only method of duplicating. Ditto or mimeographing were unknown. (Of course we came to those methods in later years.)

The original was typed with a special copying-ink ribbon, and was press-copied for the records. These records were leather-bound books of high quality Japaneze thin rice paper. The original document was placed in the book, a moist cloth placed on the other side of the page and pressed in a press. This press was an iron contraption with a large wheel above, which screwed down a flat plate upon the book. It made an inviolable record, but was sure a messy process.

Purchases were made for the Dredge "Oregon" on Willapa Harbor, dredges in Grays Harbor, the Government Locks, the Snagboat "Swinomish," the launch "Orcas," field survey parties, and our own office.

Two other purchasing chores were lumber and spars for eastern Engineer Districts, and supplies for the Alaska Road Commission. In winter months, work was slack except for the lumber purchases.

Our section was also the inspection section for shipments to the Panama Canal. We inspected continuous ship-loads of lumber for Panama, and Alfalfa Hay (which was inspected while being compressed on the dock) for the mules which at that time were still pulling the ships thru the canal.

Then in the spring, requisitions piled in from the Alaska Road Commission for supplies to be shipped on the first boat to Nome and

Yukon River ports, after the ice broke. Places such as Tanana, Ruby, Galena, Holy Cross, Bethel on the Kuskokwim River were familiar names to us. General Steele headed the Alaska Road Commission then, and he visited us in Seattle many times.

It was a placid and easy going office in those days -- everyone on friendly terms and going out of their way to help one another.

Then the "308" Report broke and the office enlarged. I and my crew (three of us now) moved across the hallway to enlarged quarters. This office was on a northwest corner of an ell of the Burke Building, overlooking the water, where we later watched the construction of the Federal Office Building below us, at First & Madison.

Also during this period, the Denny Regrade project was in progress, and we had an unobstructed view of the operations, with a large conveyor belt passing over the waterfront and 1st, 2nd, and 3rd avenues. The dirt was dumped into barges on the waterfront, hauled out into the middle of the bay and dumped. These were ingenious barges, floating either face up. When out in the bay, by some method they were capsized and came back for another load on the reserve deck. It provided much entertainment.

So much for purchasing.

Property was another deal and in those days I did all the personal counting myself, with jaunts to the Government Locks, the Dredge "Oregon" on Willapa Harbor, the Snagboat "Swinomish" up some river, and dredges in Grays Harbor. These were the days before the common use of automobiles, so all my trips were by train or street car. Believe it or not, passenger trains ran to both Grays and Willapa Harbors, with a freight car or two tacked on behind.

Everyone was extremely cooperative and I made many friends. I always looked forward to my stay on the "Swinomish." The Master was Capt. Siegel and later on my good friend Capt. George Murch. But the finest person aboard was Fritz 1/. Don't remember his last name. He was the cook, and the meals were superb!

Later on I spent a week aboard the ocean-going Dredge "Culebra" at Grays Harbor. Capt. Flanagan was her master. I could have checked her out in two or three days, but spent a week aboard in a private stateroom, as she took the full week dredging and going out over the bar to dump, and docking at the Port Docks only on the week-end.

Again the food was something that I had not experienced before. Here I was a clerk drawing well under $2,000 per year wages, on which

1/ Fritz Rydberg.

I had to watch my food budget. Then aboard the "Culebra," with a private stateroom, and steaks the principle item on all menus! I wasn't used to this and the steaks were too huge. So I thought I had it solved when I had a choice of veal cutlets, which to me meant not so large a portion. But was I wrong! I received only one delicious veal cutlet, covering the whole 16" platter on which it was served. I gave up.

I worked industriously each forenoon and sunbathed on deck in the afternoon, in order to spend the full week aboard.

Lumber purchases. The Seattle District at that time bought and shipped all lumber required by all eastern Engineer Districts - that is in the Fir, Hemlock, Pine & Cedar categories. These went out on bids to mills and brokers all over Washington, Oregon and Idaho. I had three experienced lumber inspectors who were hired on a day to day basis.

One contract was let to a mill at Liberty Bond, Washington, which they were ready to ship out in two days. All three of the inspectors were busy elsewhere. So I took my problem to Silas Finch, who said why don't I go down and inspect it myself? Realize I was 19 at the time, no inspection experience, but I had read the grading rules thoroughly, so I went.

By train to Vancouver, Wash., where I transferred to the S.P. & S. and got off at Lyle, Washington, where I got a hotel room for the night. No regular transportation to Liberty Bond, which I found out was 20 miles up into the hills. Upon inquiry found out the mail went up there once a day, so inveigled a ride on the rural route. Arrived, inspected the lumber piece by piece, while being loaded on a flat car, had a tremendous meal with the lumberjacks in the cookshack and wanted to start back to civilization. No transportation available, so I started walking.

Some minutes later a buckboard came up beside me, driven by a teen-age boy, going to Lyle. So I had a very pleasurable and slow ride back.

In those days (the 1920's) the office was purely a <u>civil</u> works organization, with one exception. The purchasing section was saddled with supplying the Artillery Engineer with arms components for Forts Worden, Ward, Flagler and Casey, all of which I visited in connection with property accounting. At that time the defense emplacements and large guns were still kept in readiness.

In the 1920's there was a program instituted call C.M.T.C. (Citizens Military Training Camp). I became interested, obtained leave of absence from the office, and attended in the fall of 1923, at age of 20. We were at Fort Lewis for 30 days with marching drills, firing practice and indoctrination in all Army procedures. During this period, President Harding died and a funeral parade was held for him in Seattle. I was one of the group selected to march in the parade and we practiced for hours marching to the very difficult pace of the dirge. It was a tiresome chore on a very hot day in Seattle.

Upon return to the office after my tour of duty at Fort Lewis, I found out to my disgust that my leave at C.M.T.C. was taken out of my annual leave. So then and there ended any more camp attendance.

In December of 1930, Bill Webb came into the office as a new employee, an adept Steno-type operator, needed for the splurge of work entailed by reason of the "308" report. He eventually joined me in Purchasing, Property & Traffic.

The one thing that I remember most of those days was the difference in the general attitude of all employees in contrast to what it was when the office started to balloon in the 1939 National Defense Days.

In the 1920's and 1930's we were a small office, six in the main office clerical section when I was first employed. We knew each other and cooperated with each other in furtherance of the aims of the district. Of course this same pleasant cooperative attitude existed between us clerks -- yes, we were just clerks -- and all the engineers under Mr. H. J. M. Baker. There was truly an "entente cordiale" throughout the office. Everyone of the engineers, including Mr. Baker and Eugene Pease, never refused time to explain and satisfy the curiosity of a clerk who was interested in the "whys" or "wherefors" of certain actions. Our work was not just a job to do in order to receive our monthly stipend. Everyone was truly interested in the final result. By the way, my starting salary was $80.00 plus a bonus of $20.00 per month.

These were the days when I was invited by the Chief Clerk (the High Lord and Super Boss over us lowly clerks) to go on an overnight camping trip with him. So we did. We brought our sacks and sleeping bags to the office one Friday. And after work that afternoon, went out on the great adventure. We caught a Green Lake trolley car in front of the Burke Building and rode out to Green Lake, a wilderness area. We walked into the woods, made camp, built a fire and spent the night, and came home the next day.

When I first started work in the Burke Building, Judge Burke was still alive. He had offices in the Burke Building, and came and left in a very shiny black carriage, drawn by two beautiful and spirited horses. I think there is a statue of him someplace - believe in Volunteer Park.

Just realize this is all about the 1920's and I did work for the Engineers until March 1958. You say you are very well documented from 1940 on. That leaves the hiatus of 1930-1940.

Well the "308" Report broke around 1930-32 (please realize dates are hazy to me now) and the office enlarged. We moved to quarters in the newly built Federal Office Building on First Avenue, and with W.P.A. and P.W.A. in effect at that time, we entered into our first real experience with red tape, with Federal and State funds.

Then a few years later, we expanded again and moved to and around in the Central Building, during which period the National Defense days came upon us. During our various moves the Procurement Branch, Purchasing Section, Supply Division, whatever you may call it, always seemed to be in the van. This was true on our moves from the Burke Building to the Federal Office Building, to the Central Building, to the Security Building, to the Textile Tower, to the old Ford plant and to the Port of Seattle, at which time I retired.

That just about covers my 36 years with the Engineers. Don't know if this will be of use to you or not. I have avoided personalities. Of course I could fill you in with personal happenings (not mine) that would make "Valley of the Dolls" tame in comparison, but that is all a sealed book with me.

I wish you success with your historical program and will be interested to see the final result. How will I be able to obtain a copy? And when do you plan to issue it?

Sincerely yours,

LESTER O. McCUE

APPENDIX E

BIOGRAPHICAL NOTES, OFFICERS AND DISTINGUISHED CIVILIANS

Officers Who Served as Seattle District Engineer, Six Months or More

HARRY TAYLOR

Born 1862. West Point, Class of 1884. Selected Corps of Engineers. East Coast fortifications and harbor work 1884-93. West Coast river and harbor surveys 1893-96. Captain, First Seattle District Engineer, 1896-1900. Fortification, river and harbor projects, Philippine Islands and North Atlantic until 1917. Established OCE Supply Division, Chief Engineer Officer, AEF 1917-18. Chief of Engineers, 1924-1926. Retired, Major General 1926. Awards: Legion of Honor; Distinguished Service Medal. Died 1930.

JOHN MILLIS

Born 1858. West Point, No. 1 in Class of 1881. Selected Corps of Engineers. First Lieutenant 1882, Captain 1892, Major 1900, Lt. Colonel 1907, Colonel 1910. Lighthouse duty 1883-90. Designed and installed electric lighting, Statue of Liberty and other landmarks. Mississippi River and Harbor works 1890-94. Chief Engineer, United States Lighthouse Board 1894-98. Engineer Combat Bn., Cuba, 1898-1900, Seattle District Engineer, 1900-05. Philippine Fortifications, 1905-07. East Coast and Great Lakes 1908-11. Division Engineer, Southeast Division, 1916-18. Deputy Division Engineer, Central Division, 1918-22. Retired 1922. Consulting practice, scientific research and writing for next 30 years. Died 1952 at age 94.

FRANCIS AMORY POPE

Born 1875. West Point, Class of 1900. Selected Corps of Engineers. First Lieutenant, Assistant Seattle District Engineer, 1905. District Engineer 1905-06. Instructor, West Point, 1906-08. Captain, Assistant Seattle District Engineer, 1911. Engineer, 76th and 90th Divisions, AEF, 1917-18. Colonel, retired 1934. Died 1953.

HIRAM MARTIN CHITTENDEN

Born 1858. West Point, Class of 1884. Selected Corps of Engineers. Three years Engineer School, Willetts Point. Engineer officer, Department of the Platte 1887-89. Missouri River and Yellowstone Park, 1889-93. Executive Officer, Board of Engineers for Rivers and Harbors, 1894-96. Secretary, Missouri River Commission, 1896-98 and 1900-04. Lt. Colonel and Chief Engineer, 4th Corps, Spanish-American War. Seattle District Engineer, 1906-08. Brigadier General, retired, 1910. Consulting Engineer, 1910-17, and Seattle Port Commission, 1911-15. Died 1917.

CHARLES WILLAUER KUTZ

Born 1870. West Point, Class of 1893. Selected Corps of Engineers. Instructor, West Point, 1906-08. Major, Seattle District Engineer, 1908-11. Brigadier General, commanding Engineer regiments, AEF, 1918. Retired 1930. Returned to active duty as Engineer Commissioner, District of Columbia, 1941-46. Died 1951.

JAMES BATES CAVANAUGH

Born 1870. West Point, Class of 1893. Selected Corps of Engineers. Assigned to torpedo defenses Mobile, Alabama, 1898-1900. Served Philippine Islands. Assigned Seattle District Engineer, as Colonel, 1911-17. Commanded Engineer regiment, AEF, 1918. Award: Distinguished Service Medal. Retired 1922. Died 1927.

JAMES ALBERT WOODRUFF

Born 1877. West Point, Class of 1899. Selected Corps of Engineers and served in Philippine Insurrection. Instructor, West Point, 1903-07. Commanding Officer, 10th Forestry Engineers, AEF, 1917-18. Seattle District Engineer, 1919-20. Commandant, Engineer School, 1921-24. Major General, 1938. Commanded Coast Artillery, 1939-41. Retired 1941 and returned to active duty 1941-43.

EDWARD HUGH SCHULZ

Born 1873. West Point, Class of 1905. Selected Corps of Engineers. River and Harbor works at various posts until World War I. Organized Engineer regiments, 1917-18. Assigned Seattle District Engineer as Colonel, 1920-23. Commandant, Engineer School, 1929-33. Retired as Colonel, 1937. Died 1951.

WILLIAM JONES BARDEN

Born 1870. West Point, Class of 1894. Selected Corps of Engineers. Engineer Office, Vera Cruz Expedition. Chief Engineer, 6th Corps, AEF, 1917-18. Assigned Seattle District Engineer as Colonel, 1923-27. Retired 1934. Returned to active duty as District Engineer, District of Columbia, 1940-42. Thereafter practiced as consultant. Died 1956.

JOHN SOULE BUTLER

Born 1872. Graduate of Vanderbilt University 1894, B.S., C.E. Civilian employee, Corps of Engineers, Nashville District, for 23 years on river and harbor construction. Commissioned Major, Engineer Officers Reserve Corps.

National Army, 1917. Assigned General Engineer Depot and Port, Washington, D.C. Commissioned Major, Regular Army, 1918. Chief of Construction, Wilson Dam, to 1923. Eleventh Engineers and District Engineer, Fortifications, Panama Canal, 1924-27. Seattle District Engineer, 1927-31, supervised "308" reports. Engineer, VII Corps, 1931-34. Lt. Colonel. Died 1934.

CLARENCE LYNN STURDEVANT

Born 1885. West Point, Class of 1908. Selected Corps of Engineers. Served with Engineer Training Units 1918. Assigned Seattle District Engineer as Colonel briefly in 1919 and again 1931-35. In the interval, served in Office, Chief of Engineers and as Instructor, Coast and Geodetic Service. Brigadier General, Assistant Chief of Engineers, 1940-44, in charge of troop operations, including ALCAN Highway and CANOL project construction. Commanding General, New Guinea Base Sector SOS, 1944-45. Awards: Legion of Merit, Distinguished Service Medal, Bronze Star. Retired as Major General 1946. Died 1958.

HERBERT J. WILD

Graduate Pennsylvania Military College and Army Industrial College. Degrees: C.E., MCE., B.M.Sc. Postgraduate work: Railroad construction. Resident Engineer, Holter Dam construction, Montana. Professor of Engineering, Pennsylania Military College. Prior to World War I, Colonel Wild was on the engineering faculty of Pennsylvania State College. He was also the recipient of a prize awarded to juniors of the American Society of Civil Engineers for a paper entitled "The Substructure for the Marsh River Bridge" (Vol LII, Transactions). Commissioned in Corps of Engineers from Plattsburgh Officers Training Camp in 1917. Served with 3d Engineer Regiment, Ft. Lee. Commanding Officer, 2d Bn, 220th Engineer Regiment, Panama. Professor, Military Science, Missouri School of Mines. Commanding Officer, 6th Engineer Regiment, Camp Lewis. Office, Chief of Engineers. Seattle District Engineer, 1935-39. Executive Officer, North Pacific Division and Assistant Seattle District Engineer, 1939-43.

LAYSON ENSLOW ATKINS

Born 1893. West Point, Class of 1915. Selected Corps of Engineers. Served on punitive expedition to Mexico 1916 and AEF with British Forces 1917-18. Professor of Military Science, University of Illinois, 1920-24. Assistant Engineer; Commissioner, District of Columbia, 1926-30. Lieutenant Colonel, Seattle District Engineer one year, until death in 1940.

BEVERLY CHARLES DUNN

Born 1888. West Point, Class of 1910. Selected Corps of Engineers. Colonel, World War I. Assigned Seattle District Engineer, World War II, 1940-42. North Atlantic Division Engineer 1942. Brigadier General 1943. Chief Engineer, Supreme Headquarters, AEF, 1944-45. Retired 1948. Award: Distinguished Service Medal. Chairman of Board, Jas. King and Co., New York City 1951. Director, secretarial school, New York City, 1956.

PETER PAUL GOERZ

Born 1895. West Point, Class of 1918. AEF, France and England, 1918-19. Assistant Boston District Engineer. Third Engineer Regiment, Hawaii, to 1932. Second Engineer Regiment to 1939. Captain; Major; Lt. Colonel, Assistant to Seattle District Engineer, 1939-42 as Chief, Military Construction United States and Alaska. Colonel, Seattle District Engineer, 1942. Retired 1949. Awards: Legion of Merit, Bronze Star, two Oak Leaf Clusters.

RICHARD PARK

Born 1883. West Point, Class of 1907. Selected Corps of Engineers. Vancouver Barracks, 1909. Captain, commanding Engineer troops in Philippines. Colonel, commanding Camp Humphreys, 1918. Major, Portland District Engineer, 1920-24. Army Engineer School, Army Industrial College, Command and General Staff School, Army War College. Commanding Officer, Ft. Belvoir. Service in Panama. Boston District Engineer; Office, Chief of Engineers. Division Engineer, North Pacific Division, 1941-42. Seattle District Engineer, 1942-43. Retired 1943 as Colonel. Returned to active duty briefly in 1944. Award: Distinguished Service Medal. Colonel Park now lives at 39 Alexander Zaimi St., Athens, Greece.

CONRAD PALMER HARDY

Born 1892. Colonel, Seattle District Engineer, 1943-46. Commander, 3d Engineer Regiment, Germany, 1946-49. Pittsburgh District Engineer, 1949-52. Retired 1952. Award: Legion of Merit. Died 2 December 1968.

LELAND HAZELTON HEWITT

Born 1894. West Point, Class of 1918. Selected Corps of Engineers. Air Engineer, 5th Air Force, Pacific, 1943-44. Chief, Engineer Far East Air Force, 1944-46. Seattle District Engineer, 1946-49. Division Engineer, New England Division, 1952-54. United States Commissioner, International Boundary and Water Commission, United States-Mexico, 1954. State Department representative, United States Secretary, International Park and Forestry Commission, United States-Mexico, 1956. Died El Paso, Texas, 1964.

EMERSON CHARLES ITSCHNER

Born 1903. Entered West Point on 17th birthday, minimum admittance age. Class of 1924. Selected Corps of Engineers. Civil Engineer degree, Cornell University, 1926. Army Engineer School. Alaska Road Commission, 1927-29. ROTC instructor, Missouri School of Mines, 1932-36. Design and construction of Mississippi River dams and locks, 1936-39. Command and General Staff School, 1939-40. Air Corps construction, 1941-42. Chief Engineer, Advance Section, Europe, 1943-45. Commanded, United States Army bases Philippine Islands, 1945-46. Chief, Military Construction; Office, Chief of Engineers, 1946-49. Seattle District Engineer, 1949-50. Engineer I Corps, Korea, 1951-52. Division Engineer, North Pacific Division, 1952-53. Assistant Chief of Engineers for Civil Works, 1953-56. Chief of Engineers 1956-61. Retired as Lieutenant General, 1961. Degrees: B.S., C.E., Ph.D. (Hon.) Awards: Distinguished Service Medal; Legion of Merit (3); Purple Heart; Office of the British Empire and Commander of the British Empire; Croix de Guerre, France; Order of Leopold, Belgium; Distinguished Service Award, Korea; Star of Distinction, Pakistan. Following his retirement, General Itschner served as Consultant to the Government of Pakistan to organize the great Indus River development in that country. He is now Vice President of Portland General Electric Company, Portland Oregon.

JOHN PAGE BUEHLER

Born 1910. West Point, Class of 1934. Selected Corps of Engineers. M.S. degree, MIT, 1938. Colonel 1945. Training Division, Army Service Forces, 1942-44. Engineer Section G Headquarters, Southwest Pacific, 1944-47. Civilian Affairs Division, General Staff, Special Staff, Department of the Army, Washington, D.C., 1947-49. North Pacific Division, 1949. Seattle District Engineer 1950-52. Awards: Legion of Merit, two Oak Leaf Clusters. Retired 1955 to become Vice President of Bechtel Corporation, international consulting engineers.

NORMAN ARTHUR MATTHIAS

Born 1903. West Point, Class of 1926. Selected Corps of Engineers. University of California, B.S., C.E., 1929. Seattle District Engineer, 1952-56. Retired as Colonel, 1956. Award: Bronze Star. Engineer for international consulting firm at Ankara, Turkey, supervising construction of four hydroelectric projects and large irrigation scheme, 1956-61. Manager, Saigon, South Vietnam, office of same firm in charge of design and construction of ports and military land bases, 1961-62. Manager, Dacca, East Pakistan, office on planning and design of Ganges River project, 1962-63. Executive Engineer, Western States Water Council, Portland, Oregon, 1966-67.

REGINALD JOSEPH BEAUREGARD PAGE

Born 1913. West Point, Class of 1936. Selected Corps of Engineers. Engineer Section, 1st Army, World War II in Europe 1944-45. Office, Chief of Engineers 1948-50. U.S. Engineer Department, Ft. Lincoln, North Dakota 1950-53. Seattle District Engineer, Colonel, 1956-59. Deputy Engineer, United States Army, Pacific, 1960-63. Office, Chief of Engineers, 1963. Retired 1966. Engineer, Department of Water Resources, State of North Carolina, Raleigh, 1967-68.

ROBERT PAUL YOUNG

Born 1919. West Point, Class of 1942. Selected Corps of Engineers, Commanded 887th Airborne Engineer Company, NATO, 1942-43. M.S., C.E., Harvard University, 1948. Air Force Special Weapons Project (Nuclear) 1948-52. Office, Assistant Chief of Staff, Department of the Army, 1952-55. Seattle District Assistant, Deputy and District Engineer, 1958-61. Executive Officer, NASA, 1961-64. Deputy Chief of Staff, V Corps, 1964-66. Commanded 7th Engineer Brigade, Europe, 1966.

ERNEST LEROY PERRY

Born 1919. B.S., C.E., University of Missouri, 1940, commissioned 2d Lieutenant, Corps of Engineers. Served as Platoon Leader, Company Commander and Bn. Commander, 90th Infantry Division, Europe, World War II. Command and construction assignments, United States and Pacific. Division Engineer, 25th Infantry Division, Korea. M.S.I.E., New York University. Staff, research and civil works, Corps of Engineers. Seattle District Engineer, 1961-64. Retired, Colonel, 1964. Now General Manager, Port of Tacoma.

CHARLES CHILTON HOLBROOK

Born 1916. University of Maryland, B.S., C.E., 1939. World War II, Europe, Lt. Colonel. Award: Bronze Star. Advance Graduate Army War College, Coast and Geodetic Survey College, 1948. Lt. Colonel, 24th Infantry Division, Korea. Master in Engineering Administration, 1960. MA, International Affairs, George Washington University, 1961. Colonel and Seattle District Engineer, 1964-67. Active duty Far East, 1968.

RICHARD EDWARD MCCONNELL

Born 1923. West Point, Class of 1945. Selected Corps of Engineers. Engineer Combat Units, World War II, Europe 1945-46. Special Weapons Project, 1946-47. Master in Engineering Management, New York University, 1949. Instructor, United States Engineer School, Germany and West Point, 1953-56. Eastern Ocean District, Iceland.

Command and General Staff College, 1957. Office, Deputy Chief of Staff for Military Operations, 1958-62. Commanded 14th Engineer Bn., Ft. Bragg, 1962-63. Staff, Supreme Headquarters Allied Powers Europe, 1963-64. Army War College, 1964-65. M.A. International Relations, George Washington University, 1965. Member of U.S. Element, Standarization Group, Ottawa, Canada. Commanded 159th Engineer Group, Far East, 1966. Colonel and Seattle District Engineer 1967 to present.

Other Distinguished Officers

AUTHUR GILBERT TRUDEAU

Born 1902. West Point, Class of 1924. Selected Corps of Engineers. Engineer School and University of California, Master in Civil Engineering. Captain, Chief of Construction Division, Seattle District, 1936-40. Assigned Seattle 1936, in charge of construction, Mud Mountain Dam; later all construction from Nome, Alaska, to Montana, and Unit Instructor of Engineer troops. Transferred to 13th Engineers, 7th Division, 1940. Developed Engineer Amphibious Brigades for Southwest Pacific island hopping tactics, 1942-43. Brigadier General 1944. Awards: Army Commendation Medal, Legion of Merit, Bronze Star. Major General, commanding 1st Cavalry Division, Japan, 1952-53. Commanding General, 7th Division, Korean War, 1953. Awards: Distinguished Service Medal (2), Silver Star (2), Air Medal. Chief, Research and Development, Department of the Army, 1958-62. Lieutenant General. Retired 1962. President, Gulf Research and Development Company, Pittsburgh.

BENJAMIN BRANCHE TALLEY

Born 1903. Commissioned 2d Lieutenant, Corps of Engineers, 1926. Served in Nicaragua, New York City, Ohio, and came to West Coast in 1937. Portland District, 1939. Seattle District 1940. Captain, Company B, 28th Engineer Regiment, on airfield construction Annette Island and Yakutat, Alaska. Area Engineer for Alaska; Seattle District, Major 1941. Colonel, in charge of Alaska construction for Western Defense Command, 1942-43. Commander, 1st Engineer Brigade, in combat on Okinawa April-June 1945, and Iwo Shima April 1945. Retired as Brigadier General, 1956. Awards: Distinguished Service Cross, Distinguished Service Medal, Legion of Merit (2), Bronze Star.

ALVIN CHARLES WELLING

Born 1910. West Point, Class of 1933. Selected Corps of Engineers. M.S., C.E., MIT, 1938. Executive Assistant, Seattle District, 1939. Area Engineer, Alaska Projects, 1939-41. Executive Officer, ALCAN Highway Construction, 1942-43. Award: Legion of Merit. Colonel 1944. Award: Legion of Merit (2), 1946. Baltimore District Engineer, 1948-51. Executive, Office, Chief of Engineers, 1951-55. Commanding General, Corps of Engineers, Ballistic Missile Construction Office (CEBMCO), 1960-61. Award: Distinguished Service Medal, 1963. Retired, Major General, 1965. Vice President, Wyandotte Chemical Corporation, Grosse Ile, Mich.

JAMES G. TRUITT

Born 1895. Attended University of Washington. Enlisted 6th Division Engineers, AEF, 1918. Commissioned 2d Lieutenant, Corps of Engineers Reserve, 1919. Engineer with Alaska Railroad Commission (Army) 1920. Alaska District, Corps of Engineers, 1925-32. Seattle District, 1932-43. (Active Duty 1942 as Colonel on Alaska military construction and location of projected railroad from Prince George, British Columbia, to Fairbanks, Alaska.) Burma campaigns, 1943-45, located Ledo Road. Assistant Engineer, 8th Army, Japan, 1946-47. Assistant to Division Engineer, Missouri River Division, 1947-49. North Pacific Division, 1949-51. District Engineer, Port District, Bordeaux, France, 1951-52. Assistant Seattle District Engineer, 1952-53. Retired Colonel, 1953. Awards: Legion of Merit, 1942 and 1945; Cloud and Banner Medal, Order of Yeun Hwei, Chinese Nationalist Government.

Distinguished Civilians

WILLIAM T. PRESTON

Government Service: 1896 to 15 May 1919

Few men had a greater share in the engineering problems and the development of the Northwest than Mr. Preston. He came to the Canadian Northwest in 1880 as a Civil Engineer in charge of important work in driving the Canadian Pacific Railroad through the mountains to the coast, and had a leading part in mastery of the Fraser River Canyon.

He took part in the construction work of the Seattle, Lake Shore and Eastern Railroad during 1887 to 1889.

From 1896 to his death, Mr. Preston was Chief Engineering Assistant in the Seattle District. For 3 years, beginning in 1898, he was in charge of fortifications at Fort Warden. Mr. Preston saw the Lake Washington Ship Canal grow from a mere runway of logs to the present nationally known maritime highway. He was personally engaged in the development and construction of this project.

During World War I, from 15 January 1918 to 24 January 1919, Mr. Preston served as the only civilian District Engineer ever to head the Seattle District. Our snagboat, W. T. PRESTON, which operates in Puget Sound and tributary waters, is named in his honor.

SAMPSON DOUGLAS MASON

Government Service: 1896 to 20 Feb 1923

Mr. Mason was graduated from the Massachusetts Institute of Technology, Boston, in 1870 in the third graduating class of the institute, majoring in civil engineering. He was first employed by a private contractor on railroad surveys and construction, and later was Chief Engineer and Treasurer of the Detroit, Eel River and Indiana Railroad. From 1879 to 1896, he served with the Northern Pacific Railroad as Principal Assistant Engineer and Assistant Purchasing Agent.

In 1896, at the age of 47, Mr. Mason entered Government service with the Seattle District as an inspector. His abilities soon were recognized and he became in turn Superintendent, Junior Engineer and Assistant Engineer, holding the last position until his retirement in 1923. During this period of service, Mr. Mason was engaged in fortification work at Fort Casey, Fort Flagler and Fort Warden, Washington.

EUGENE RICKSECKER

Government Service:	1890 to 1898; 1899 to 1911

Mr. Ricksecker was employed in 1890 by the Portland District, and supervised harbor improvements at Yaquina Bay, Oregon. He transferred to the Seattle District after its establishment in 1896, did preliminary work on a proposed survey of the Lake Washington Ship Canal, and later supervised a detailed survey of the Canal and compiled the final survey report. He also made topographic surveys of the proposed Forts Flagler, Warden and Casey, and assisted in preliminary planning for gun emplacements at Fort Flagler. In 1898 Mr. Ricksecker returned to private practice, and his work included the preparation of plans and estimates for development of Everett Harbor.

In 1899 Mr. Ricksecker returned to Government service in the Seattle District as Assistant Engineer assigned to river and harbor improvement work. During a period of service with the National Park Service, he conducted surveys and supervised construction of the Government road from the park boundary to Paradise Valley. Ricksecker Point, a promontory on this road from which an unobstructed panorama of Mt. Rainier may be viewed, was named in his honor. Mr. Ricksecker died 2 June 1911.

CHARLES A. D. YOUNG

Government Service:	6 Aug 1905 to 21 Apr 1909 27 Apr 1909 to 14 Jan 1918 18 Nov 1919 to 1 Sep 1920 6 Dec 1920 to 31 Mar 1921 23 Dec 1921 to 25 Apr 1923 26 Apr 1923 to 31 Mar 1926 25 Sep 1926 to 31 Oct 1930

Mr. Young was appointed by the Detroit District, Corps of Engineers, as inspector of dredging on 6 August 1905. He was promoted to junior engineer and assisted in lock design and the design of lock gates and machinery until his transfer to the Seattle District during April 1911.

Mr. Young designed the Lake Washington Ship Canal Lock and Dam, including the operating equipment, then prepared specifications and supervised erection of the gates and machinery. In addition, he designed several items for the construction plant. The lock and dam were constructed by hired labor under the general supervision of Mr. Arthur W. Sargent. Prior to World War II, this was the principal project constructed by Seattle District. It now stands as a monument to the design and construction ability of Messrs. Young and Sargent.

Mr. Young left the Seattle District in January 1918 to take a position with the North Pacific Shipbuilding Company, Seattle, Washington, and was rehired by this office in November 1919 to design an emergency dam for the Lake Washington Ship Canal Lock and Dam. He completed this on 1 September 1920 and was reemployed on 6 December 1920 to redesign the emergency dam on an entirely different principle. The redesign was completed during March 1921. Mr. Young was again reemployed from 23 December 1921 until 25 April 1923 to check contractor's drawings for the emergency dam.

Mr. Young transferred in May 1923 to the Florence, Alabama, Engineer District as Chief of the Engineering Division, where he supervised the design and construction of Lock and Dam No. 1 on the Tennessee River. In March 1926, he left the Florence District to work with a private contractor on the construction of jetties at the mouth of the Rio Magdalena, Colombia. He was reemployed by the Florence District in September 1926 to make power and economic studies of Wilson Dam. On 31 October 1930 Mr. Young left the Corps of Engineers to accept a position with the Bureau of Reclamation at Denver, Colorado.

SILAS E. FINCH

Government Service:

Civilian	Military
1 Sep 1902 to 9 Oct 1918	26 Apr 1898 to 31 Oct 1898
21 Jan 1919 to 31 Oct 1933	25 Sep 1918 to 4 Jan 1919

Mr. Finch was a veteran of the Spanish-American War and World War I. In the Spanish-American War, he served as an enlisted man with Company L, 5th Illinois Infantry. During World War I, he served as a Second Lieutenant and First Lieutenant with the Chemical Corps in France.

Mr. Finch entered Government service as a civilian with the Corps of Engineers, Duluth, Minnesota District on 1 September 1902. He was employed as a stenographer, general clerk and voucher clerk in the Duluth District until 1910, when he transferred to the Office of the

Chief of Engineers, Washington, D.C., for a short time and then to Portland District, Portland, Oregon. He worked as a clerk in the Portland District Office until July 1917, when he was selected for a position as clerk and then as chief clerk with the Corps of Engineers in France.

After the war, he returned to the Portland District where he worked as a clerk until November 1921, at which time he transferred to the position of Chief Clerk of the Seattle District. He remained in that position until his retirement on 31 October 1933.

During his service as Chief Clerk in the Seattle District, Mr. Finch supervised all administrative work in the District. As there were no specialists in law, real estate, or personnel employed at that time, he performed all work of that nature in addition to the handling of mail, preparation of reports; reading and applying all laws, rules and regulations pertaining to river and harbor and fortification works; and supervision of the office force. Mr. Finch was also responsible for the purchase and shipment of lumber for other Districts and for the procurement of all classes of supplies for the Seattle District and the Alaska Road Commission. Mr. Finch's excellent performance of his many and varied duties contributed much to the outstanding reputation of the Seattle District.

EDWARD L. CARPENTER

Government Service:	10 Sep 1892 to 22 Oct 1892
	12 Apr 1893 to Oct 1894
	1 Jan 1895 to 18 Nov 1895
	6 May 1896 to 10 Nov 1897
	4 Apr 1898 to 18 Jan 1932

Mr. Carpenter started his Government service with the Portland District, Corps of Engineers, as a recorder on a survey party at Yaquina Bay, Oregon. Except for about one year's service with the Quartermaster Corps on the inspection of docks and survey of the Government reservation at Vancouver, Washington, he worked almost continuously for the Corps of Engineers from 1892 until his death on 18 January 1932. Thirteen years of his life were spent as resident engineer at Grays Harbor, during construction of the jetties and the dredging of Grays and Willapa Harbors. He was well known in other sections of the Northwest coastline, having been connected with the first jetty work at Coos Bay, Oregon. He spent considerable time in Alaska on the improvement of Wrangell Narrows and Nome Harbor.

During the time Mr. Baker was assigned to the Columbia "308" work, Mr. Carpenter had charge of all river and harbor work in the District except the Lake Washington Ship Canal. His long experience and knowledge of seagoing hopper dredging rendered his services extremely valuable to the District. In his many contacts with State and local agencies on this work, he represented this office in an outstanding manner. This, together with his thorough knowledge of river and harbor work, did much to strengthen the position of the Corps of Engineers in the Pacific Northwest.

Because of Mr. Carpenter's deep love of the sea and his deep interest in Grays Harbor, his ashes were spread on the sea near Grays Harbor from the U.S. Dredge CULEBRA.

ARTHUR W. SARGENT

Government Service:	29 Oct 1903 to 30 Jun 1941 5 May 1942 to 30 Jun 1942

Mr. Sargent was employed as a junior engineer in the Chicago, Illinois, Engineer District from 29 October 1903 to 15 March 1905, at which time he transferred to the Seattle District. During his 38 years of service with the Corps of Engineers, Mr. Sargent held many important assignments.

Prior to World War II the largest works completed by this District were harbor defenses of Puget Sound and the Lake Washington Ship Canal and Locks. These projects were vital to the security and economic development of the Pacific Northwest. They were constructed largely by hired labor.

Mr. Sargent supervised the construction of Fort Whitman, one of the harbor defense units of Puget Sound, and the Lake Washington Ship Canal and Locks. The locks were largely designed by Mr. Charles A. D. Young. Mr. Sargent's outstanding construction ability and devotion to duty and Mr. Young's outstanding designing skill resulted in the construction of an installation of which the Corps of Engineers is justly proud. The project is visited by many thousands of people each year.

HAROLD J. M. BAKER

Government Service:	7 Jul 1902 to 13 Jan 1903 11 Jul 1903 to 2 Oct 1943

Mr. Baker was first employed in July 1902 by the Constructing Quartermaster, Port Townsend, Washington, as a rodman during the construction of Fort Flagler, one of the harbor defenses of Puget Sound. He was later employed by the Corps at the same fort. From 11 July 1903 he was continuously employed in the Seattle District until his death on 2 October 1943.

From 1903 until 1910, Mr. Baker was in charge of surveys, design and construction of Fort Ward. From 1910 to 1918, he was Assistant Engineer in charge of construction of fortifications at Grays Harbor and

Willapa Harbor and improvements on the Columbia River above Pasco; during this period, he made the first detailed survey of the river between Wenatchee and Pasco.

From 1918 to 1943, except as indicated below, Mr. Baker was the principal assistant to the District Engineer on all river and harbor work. This included the preparation of engineering reports on proposed projects, as well as the design and construction of authorized projects.

From 1929 to 1931, Mr. Baker was divorced from his regular duties and placed in charge of preparation of the Columbia River "308" report for the Seattle District. This report presented for the first time a completely integrated and coordinated plan for the development of flood control, navigation, irrigation and hydroelectric power in this great river basin. Some of the far-reaching economic results of the work can be seen in the completed Grand Coulee Dam and its resultant Columbia Basin Project, as well as Chief Joseph Dam and Albeni Falls Dam.

During World War II, Mr. Baker, as the chief civilian engineer in the District, assisted with the planning, design, and preparation of specifications for landing fields, fortifications and other military construction projects.

RICHARD A. DAVIES

Government Service: 16 Jan 1905 to 31 Mar 1944

Mr. Davies worked as a draftsman and junior engineer during the construction of harbor defenses for Puget Sound at Fort Casey and Fort Warden from 1905 to 1911. He was then transferred to Seattle and assigned to the District Office as chief draftsman and assistant engineer on river and harbor work. This included the design of dredging machinery and structures, and the preparation of plans, specifications and engineering reports. In 1926, Mr. Davies was given added responsibility of issuing permits for all structures in navigable waters, including fish traps in Alaska. He also had supervision of the establishment of harbor lines at major ports in the District; this work required day-to-day contact with the public and local governmental agencies. His contacts reflected favorably on this office.

During the early part of World War II, Mr. Davies supervised the construction and repair of a large number of steel and wooden vessels for the Armed Services. Most of the privately-owned vessels within the boundaries of the District which were suitable for use by the Government were inspected, appraised, and either purchased or commandeered. As there was urgent need for these vessels, their acquisition and placement in wartime service had to be expedited. Great care in evaluating the craft was essential to avoid heavy monetary losses through overevaluation by the owners. After acquisition, many of these vessels required alterations and repairs to place them in first-class operating condition. Under Mr. Davies' supervision, all of these very difficult tasks were accomplished with exemplary efficiency.

FRANK S. GREELY

Government Service: 7 Nov 1903 to 30 Oct 1943

Mr. Greely was appointed by Seattle District as a surveyman on 7 November 1903. He served nearly 40 years as surveyman, inspector, and superintendent. From 1921 to 1925 he was Captain of the District's Pipeline Dredge OREGON, which performed most of the dredging in Willapa Harbor. Later, he carried the title of Chief Inspector and had charge of all hydrographic surveys, dredging, and river and harbor construction. In the performance of this work Mr. Greely represented the Seattle District in contacts with contractors, individuals, and local governmental agencies. The high quality of his standards reflected favorably on the District.

The most important projects constructed under Mr. Greely's supervision during the last few years of his service were the North Jetty at Grays Harbor, and the breakwater at Neah Bay. Mr. Greely was asked to defer his retirement to take charge of these projects, and it was largely through his efforts that they were successfully completed.

FRANCIS C. MURPHY

Government Service: 1 Jun 1938 to 31 Oct 1938
1 Feb 1939 to 1 Sep 1959

Mr. Murphy was born on 31 December 1914 at Napa, California. He was graduated from the University of California at Berkeley in May 1938 with a B. S. Degree in Civil Engineering (Hydraulics). After periods of service in the Los Angeles, Sacramento, and San Francisco Districts, Mr. Murphy found his final niche in the Seattle District in August 1944.

"Murph" made outstanding contributions to the field of hydrology, both in general and in relation to the many projects studied and constructed during his period of service. Of special note was his activity in the field of snow hydrology studies and research. He was a member of the Executive Committee, Western Snow Conference, and Chairman of the North Pacific Area at the time of his death. He was especially active in promoting the Upper Columbia Snow Laboratory.

His most outstanding contribution to the Corps was his 8-month research into "Regulating Flood Plain Development." This study was made under the guidance of G. F. White at the University of Chicago, and is recognized in Government and private circles as an outstanding contribution to a new field. Mr. Murphy was one of the first in the Corps of Engineers, and first in the North Pacific Division to receive a Secretary of the Army Fellowship Award, under which the study was carried out.

"Murph" succumbed to a heart attack on 1 September 1959.

EUGENE I. PEASE

Government Service:	21 Mar 1910 to 27 Apr 1910 3 Jul 1910 to 26 Oct 1910 4 Jun 1911 to 15 Sep 1911 12 Aug 1912 to 31 Mar 1952 Total: Over 40 years, 3 months

Mr. Pease initially was employed by the Seattle District during summer vacations while a student at the University of Washington, as a surveyor and inspector of improvements for St. Michael Canal and the Apoon mouth of the Yukon River. He was graduated from the University in 1912 with a degree of B.S., E.E.

For about 5 years, Mr. Pease worked on the design and installation of electrical machinery and power distribution facilities at the Lake Washington Ship Canal. From 1917 to 1927, he was employed at Fort Warden on the rehabilitation of harbor defenses of Puget Sound, including Forts Warden, Flagler, Casey, Whitman and Ward. From 1924 to 1942 Mr. Pease was responsible, in addition to his other duties, for preparation of the annual electrical power survey of all operating power companies, transmission lines, interconnections, system loads, etc., in the States of Washington, Oregon, Idaho, Montana, Wyoming, and Utah.

From 1932 to 1941, Mr. Pease was responsible for river and harbor and flood control investigations. From 1946 until 1948, he was in charge of the Engineering Division, with responsibility for planning and designing all military and civil projects in the District. From 1948 until his retirement in 1952, he served as consultant to the District Engineer on special engineering problems, especially in connection with the International Joint Commission for control of water resources and the integration of studies by the United States and Canadian Governments for the utilization of international streams.

Of the many varied and interesting projects handled by Mr. Pease during his 40 years of service with the Seattle District, the most important and far-reaching were preparation of the original and review Columbia River "308" Reports. The "308" report presented for the first time a completely integrated and coordinated system of many projects in a great river basin. It included studies on flood control, navigation, irrigation, and hydroelectric power. Many of the projects recommended have been authorized by Congress, and some of them already have been constructed. Mr. Pease was Mr. Baker's principal assistant on the original report from its inception until it was completed in 1932. He was in charge of the Seattle District's portion of the "308" Review Report and was largely responsible for its successful completion.

BERYL BROOKS

Government Service:

Civilian	Military
14 May 1923 to 26 May 1923	19 Feb 1917 to 27 Feb 1919
29 May 1923 to 31 Dec 1924	4 Aug 1941 to 27 Nov 1945
21 Jul 1927 to 3 Aug 1941	
28 Nov 1945 to 30 Nov 1954	

Mr. Brooks was born in Jackson County, Indiana, on 25 April 1896. His young manhood included service in World War I, in which he reached the rank of 1st Sergeant; employment with private firms from Indiana to Texas, in fields ranging from cutting and hauling logs to clerical work; and a tour to South America as a seaman.

In 1923 he began what was to be his life's work with the Corps of Engineers, in the Louisville, Kentucky, District as head clerk in the field office on lock and dam construction. After another short period of private employment, he rejoined the Corps for the remainder of his working life.

He served successively in the Louisville, Kentucky; Vicksburg, Mississippi; and Fort Peck, Montana, Districts, rising to Chief Administrative Assistant. In August 1940 he became Chief Administrative Assistant in the North Pacific Division, Portland, Oregon.

In August 1941, he was called to active duty in World War II as a Captain in the Corps of Engineers. He served at the San Francisco Port of Embarkation and under the Chief Engineer, European Theater of Operations, where he was Chief, Real Estate and Labor Divisions. He was returned to inactive status after the war as a Colonel.

After a short tour as Chief, Office Service Branch, South Pacific Division, San Francisco, California, Mr. Brooks became Executive Assistant of the Seattle District, where he served with distinction until his retirement in 1954. He always was alert to serve the best interests of his Government.

CAPTAIN GEORGE S. MURCH

Government Service: 10 Apr 1920 to 30 June 1962

Captain George S. Murch began his Federal career with the Portland District of the Corps of Engineers on 10 April 1920, when he accepted a temporary appointment as Chief Engineer on the steam pipeline dredge

OREGON operating at Bandon, Oregon. The appointment was made permanent three months later. In August 1920, the OREGON was transferred to the Seattle District for work on the Willapa River. Mr. Murch continued as Chief Engineer of the OREGON until completion of navigation improvement of the Willapa River in 1925. The OREGON then was inactivated and Mr. Murch was made Chief Engineer of the Snagboat SWINOMISH. He continued in this position on the Snagboat W. T. PRESTON, which replaced the SWINOMISH in 1929.

In September 1935 he became Mate of the PRESTON, and in February 1936 was promoted to Master. He continued in this position until his retirement in 1962. During all his years as Master of the PRESTON he retained his Engineer's license; this made him one of the select individuals licensed to command either the deck or engineroom of a steamship.

During his 42 years with the Corps of Engineers, Captain Murch established an outstanding record in improving navigation channels in the Seattle District. His relations with the public he served were exemplary. Engaged in a hazardous operation, his almost perfect safety record will long be remembered.

NOBLE A. BOSLEY

Government Service:

Civilian	Military
8 Nov 1938 to 5 Nov 1942	6 Nov 1942 to 7 Jan 1946
8 Jan 1946 to 25 Jul 1962	

Mr. Noble A. Bosley entered Government service in 1938. He joined the Seattle District on 10 February 1941 as an Associate Engineer. During the ensuing 24 years he served both as a civilian and an officer in the Corps of Engineers. During World War II, as a Captain, Corps of Engineers, U.S. Army, he served the Seattle District as Executive Officer. Following his release from active duty he became Chief of the General Engineering Branch, Engineering Division, which later became the Design Branch.

On 14 September 1952 he was appointed Chief, Engineering Division. Both as Chief, Design Branch, and as Chief, Engineering Division, he was a key engineer in directing and prosecuting the Seattle District's multimillion dollar post-Korea defense program. He also directed the District's engineering efforts on such major Federal missile programs as BOMARC, NIKE-AJAX, HERCULES, ATLAS, and MINUTEMAN. He supervised the planning and design of Howard A. Hanson Dam on the Green River, Washington, and initiated the planning of major multiple-purpose projects on the Kootenai River, Montana (Libby Dam); and on the Wynoochee River (Wynoochee Dam) and at the Ben Franklin damsite on the Columbia River, Washington.

During Mr. Bosley's tenure as Chief, Engineering Division until succumbing to a heart attack on 25 July 1962, he served several temporary assignments as Acting Deputy District Engineer. The numerous executive responsibilities assigned to Mr. Bosley testify to his expertise as an administrator and organizer. The high quality of engineering achieved under his supervision and the economy with which it was accomplished are an enduring record of his dedication and excellent performance.

GERALD D. BLETCHER

Government Service: Oct 1935 to 11 Nov 1964

Mr. Bletcher was born 24 December 1900 in Grand Rapids, Michigan. He first became engaged in the construction industry with his father, who was a contractor in Michigan. In 1935 he began his Federal career with the Construction Quartermaster, U.S. Army, at Fort Custer, Michigan.

In June 1942 he began his 22 years of service with the Seattle District, at the Area Office at Spokane, Washington. In October of 1948 he was assigned as Resident Engineer for construction of the Veterans Hospital at Seattle. His outstanding work here earned him many commendations. After completion of the hospital he was assigned as Resident Engineer at Paine Field. Here, as at the Veterans Hospital, he received a commendation each year from the District Engineer for an outstanding safety record.

In December 1952, he transferred to the Spokane Resident Office, where he served the balance of his career with the Corps of Engineers, the first year as Assistant Resident Engineer and the last 11 as Resident Engineer. His performance in this position reflected credit on the entire Corps. His work in promoting safety was outstanding and, in 1962, he received the North Pacific Division award for superior achievement in accident prevention. Some of the major facilities constructed under his supervision included runways, taxiways and parking aprons at Geiger Field and Fairchild Air Force Base; nine large nose docks at Fairchild Air Force Base; all NIKE installations in the Spokane area; AC&W stations in northern Washington, Idaho, and Montana; and numerous support facilities at both Geiger and Fairchild. In addition, he supervised restoration of flood control structures and levees in the Bonners Ferry area after major floods. In 1961 a major runway paving contract was completed in the incredible time of 105 days. His effort in organizing, supervising and expediting this contract was recognized by U.S. Air Force and resulted in commendations from the Air Force and the Chief of Engineers. His work in effecting emergency repairs to Titan facilities in 1962 again brought a commendation from the Air Force.

During Mr. Bletcher's career as Resident Engineer, he gained the respect of the construction industry in the Northwest and the unswerving loyalty of his employees. He would not compromise on quality or performance and was known both within the Government and the construction industry as a supervisor with very high standards for himself and those he worked with.

KAREL F. SMRHA

Government Service: 19 Jun 1929 to 15 Dec 1929
17 Jan 1930 to 30 Dec 1965

Mr. Karel F. Smrha was born 2 December 1907 in Milligan, Nebraska. He attended grade school and high school in Milligan, and was graduated from the University of Nebraska in June 1929 with a Bachelor of Science degree in Civil Engineering.

Mr. Smrha entered Federal service in June 1929 with the Bureau of Public Roads, working in Iowa, Arizona and California. In January 1930 he received an appointment as Junior Engineer with the Seattle District, where he worked on designs and cost estimates for hydraulic structures considered in the "308" report for the Columbia River Basin Irrigation Project. From September 1931 through 1937, he was party chief on surveys and inspections of river and harbor and flood control projects, then held various assignments involving surveys, survey reports, project designs, and the preparation of specifications and cost estimates.

During the ensuing years he rose steadily in the organization and in 1950 became Chief of the Operations Division, a position which he held until his retirement on 30 December 1965. In this assignment he was responsible for the operation and maintenance of all completed civil works projects in the Seattle District, including navigation, flood control and multipurpose projects. He also supervised District-owned floating plant, motor vehicles and mechanical equipment, and was responsible for the supervision of regulatory activities of the Seattle District as they pertained to navigable waters of the United States, and the collection and compilation of statistics on waterborne commerce. In addition, he served as Field Operations Officer for the District Disaster Control Center and was responsible for the training of Flood Engineers and the inspection of flood fighting activities.

In recognition of a high level of achievement, Mr. Smrha was awarded the Meritorious Civilian Service Award, the highest token of recognition within the purview of the Chief of Engineers.

APPENDIX F

SOME NOTED SEATTLE DISTRICT VESSELS

Pre-War

Class A Seagoing Hopper Dredge DAN C. KINGMAN

Hull, steel, 268 feet 5 inches x 46 feet x 22 feet 6 inches. Displacement, 3,400-5,275 tons.

Propulsion, twin screw, 1,000 hp., diesel-electric each.

Pump, 26-inch centrifugal, 1,000 hp., diesel drive.

Built by Sun Shipbuilding and Drydock Company, Chester, Pa., 1924, to replace the dredge CULEBRA of the Panama Canal Commission. Used by Seattle District to maintain channels in Grays and Willapa Harbors, and by other districts in Columbia River and California harbors.

Snagboat W. T. PRESTON

Hull, steel, 163.5 feet x 34.7 feet x 5.5 feet. Superstructure, wood.

Propulsion, stern paddle-wheel, 16-foot diameter, 18 feet long; 32 paddles, 18 inches wide.

Steam engines, 170 hp. each, 14-inch bore, 72-inch stroke, 20-26 r.p.m. Oil fired locomotive boiler.

Derrick, 65.5-foot boom, 55-foot radius. Bucket, 1-1/4 yd. clamshell.

Hoist, 50 hp., steam. Pile driver, steam, 8,000 lbs. @ 110 blows/min.

Built originally with wood hull in 1915 and engines removed from predecessor SWINOMISH. New hull in 1929. Again rebuilt with new hull, boiler and house in 1940. Original engines, now around 70 years old, are still in continuous operation snagging, removing debris and doing light dredging in rivers and harbors of Puget Sound and in Lake Washington and the Ship Canal. PRESTON is the last remaining in service of the many stern-wheelers that have plyed these waters.

Motor Yacht J. B. CAVANAUGH

Hull, steel, 146 feet 4 inches x 24 feet 10 inches x 12 feet 6 inches. Displacement, 373 tons.

Propulsion, twin screw, 400 hp., diesel each.

Builder, Bath Iron Works, Bath, Maine, 1931.

Formerly HELENE, purchased from Sorensen, V. P. Ford Motor Company for use as inspection boat. Made one trip to Alaska on survey of fish traps, at that time operated under District permits. Converted to troop and personnel transport for war service to Alaska by removal or covering of luxury fittings and installation of triple-deck steel bunks. She made numerous trips from Seattle to and between Alaska-Aleutian bases, including the convoy to recapture Adak.

Survey Boat MAMALA

Hull, wood, 65 feet x 15 feet 7 inches x 7.5 feet.

Propulsion, twin screw, 80 hp., diesel each.

Built by Berg Shipbuilding Company, Seattle, 1931, for Honolulu District.

Transferred to San Francisco District 1935; Seattle District 1937.

Based at Aberdeen, Washington, for marine surveys of Willapa and Grays Harbors. Has made surveys of Hawaii, Alaska and Pacific Coast for 37 years, and still in service.

Equipped 1941 with depth recorder to graph continuous soundings.

Motorship ORCAS

Hull, wood, 70 feet 6 inches x 13 feet 8 inches x 7 feet 4 inches. Displacement, 43 tons.

Propulsion, twin screw, 175 hp., diesel each.

Built by Hall Bros., Winslow, Washington, 1912.

Inspection Boat SAN JUAN

Hull, wood, 36 feet x 10 feet x 5.5 feet.

Propulsion, single screw, 180 hp., gasoline.

Built by Fremont Boat Works, Seattle, 1937

Tug CARPENTER

Hull, wood, 51 feet 6 inches x 11 feet 6 inches x 4 feet 9 inches. Displacement, 19-21 tons.

Propulsion, single screw, 75 hp., diesel.

Builder, Marine Construction Company, Seattle, 1924.

Served as tender to dredge ARCTIC on Nome harbor maintenance.

Acquired for World War II Alaska Supply Service
(Partial List)

Tug ALBERT

Hull, wood, 61 feet x 17 feet x 7 feet.

Propulsion, single screw, 240 hp., diesel.

Built at Port Angeles, Washington, 1914.

Rebuilt 1943 for Alaska war service.

Tug PORT OF BANDON

Hull, wood, 87 feet x 20.6 feet x 8 feet.

Propulsion, single screw, 500 hp., diesel.

Bucket Dredge ARCTIC

Hull, wood, 50 feet x 22 feet 6 inches x 4 feet 7 inches. Builder, Johnson Shipbuilding Company, Seattle, Washington, 1933.

Propulsion, none.

Dredging equipment accessories installed by Government at Nome, Alaska, to complete construction of the dredge. With tug CARPENTER and two sidedump scows, ARCTIC served at Nome under direction of William Brown to maintain the channel between jetties.

Tug ATKINS

Hull, wood, 147 feet x 27 feet x 15 feet 6 inches. Displacement, 450 tons.

Propulsion, single screw, 320 hp., stream, coal-fired.

Builder, Pusey & Jones, Wilmington, Delaware, 1904.

Formerly EXPLORER of U.S. Geological Survey, then JUVENTUS, extensively repaired 1933-34 and rebuilt 1941 for Alaska war service.

Tug JOHN S. BUTLER

Hull, wood, 89 feet 6 inches x 20 feet x 13 feet, 100 gross tons.

Propulsion, single screw, 300 hp., diesel.

Built at San Francisco, 1889.

Formerly AFOGNAK. Repaired and renamed 1941, assigned to West Construction Company, Alaska wartime co-venture of contractors.

Crane Barge No. 14

Hull, wood, 118 feet 6 inches x 40 feet x 9 feet 9 inches.

Propulsion, none.

Crane, rail traveling, 80-foot boom, capacity 55,000 lbs. @ 30-foot radius athwartship, 100-ton fore and aft. Diesel hoist, 175 hp.

Builder, Port of Bandon, Oregon, 1942. Crane and auxiliary equipment, Government-furnished.

Tug CUDAHY

Hull, wood, 85 feet 6 inches x 21 feet x 10 feet.

Propulsion, single screw, 1,000 hp., diesel.

Built at Ballard, Washington, 1900, for Pacific American Fisheries.

Bought by Seattle District as HENRY FOSS and rebuilt 1942 at Foss Company yards in Tacoma for barge tows to Alaska and Aleutians.

U.S.S. HEATHER

Hull, steel, 178 feet 6 inches x 29 feet 8 inches x 14 feet 11 inches. Displacement, 631-847 tons.

Propulsion, single screw, 750 hp., steam, coal-fired (later oil).

Builder, Moran Bros. Company, Seattle, 1902.

Formerly a U.S. Coast and Geodetic Survey ship, acquired by Seattle District in December 1941; refitted with oil burners and used for Alaska and westward island supply and personnel transport. Estimated cargo capacity in holds, 6,700 cu.ft; lumber on deck, 6,000 cu.ft.

Tug ROBERT GRAY

Hull, steel, 117 feet x 25 feet x 12 feet. Displacement, 284 tons.

Propulsion, single screw, twin 360 hp., diesel-electric drive.

Built 1936 by Lake Washington Shipyard for U.S. Engineer Department.

Served in Alaska-Aleutian campaigns, then transferred to Portland District.

Moored at Chittenden Locks 1968 pending transfer to Bureau of Fisheries.

Tug KLIHYAM

Hull, wood, 94 feet x 22 feet x 9 feet. Built 1908.

Propulsion, single screw, 650 hp., diesel.

Motor Ship S. D. MASON

Hull, wood, 109 feet x 22 feet x 9 feet 5 inches.

Propulsion, single screw, 300 hp., diesel.

Built by Hall Bros., at Winslow, 1908.

Motor Ship FERN

Hull, wood, 109 feet x 22 feet x 9 feet 5 inches.

Propulsion, single screw, 300 hp., diesel.

Built at Winslow, 1915.

Tug MOONLIGHT MAID

Hull, iron, 191.5 feet x 33 feet x 22.3 feet.

Propulsion, single screw, steam, 690 hp., 2 oil-fired boilers.

Built by Cramp & Sons, Philadelphia, 1890.

Tug NEPTUNE

Hull, steel, 109 feet x 23 feet x 11 feet 4 inches.

Propulsion, single screw, 1,050 hp., diesel.

Built in Baltimore, 1904.

Formerly Government Tug R. M. WOODWARD. Purchased 1937 from Puget Sound Tug and Barge Company. Rebuilt 1938, Todd Shipyard, Seattle.

Motor Vessel PRINCESS PAT

Hull, wood, 58 feet x 13 feet x 6.5 feet.

Propulsion, single screw, 88 hp., diesel.

Built 1919 at Wrangell, Alaska.

Motor Vessel SIREN

Hull, wood, 55.6 feet x 15.3 feet x 7 feet.

Propulsion, single screw, 80 hp., diesel.

Built 1918 at Tacoma.

Motor Vessel BOXER

Hull, wood, 125 feet x 30 feet x 16.7 feet.

Propulsion, single screw, 450 hp., diesel.

Built 1904 at Portsmouth, N. H., for Annapolis Naval Academy as sailer.

Bought 1922 by Department of Interior and converted to power.

APPENDIX G

PAGES FROM SYMONS REPORT

47TH CONGRESS, 1st Session. | SENATE. | EX. DOC. No. 186.

Hjm Baker

REPORT

OF

AN EXAMINATION

OF THE

UPPER COLUMBIA RIVER

AND

THE TERRITORY IN ITS VICINITY

IN

SEPTEMBER AND OCTOBER, 1881,

TO DETERMINE ITS NAVIGABILITY, AND ADAPTABILITY TO STEAMBOAT TRANSPORTATION.

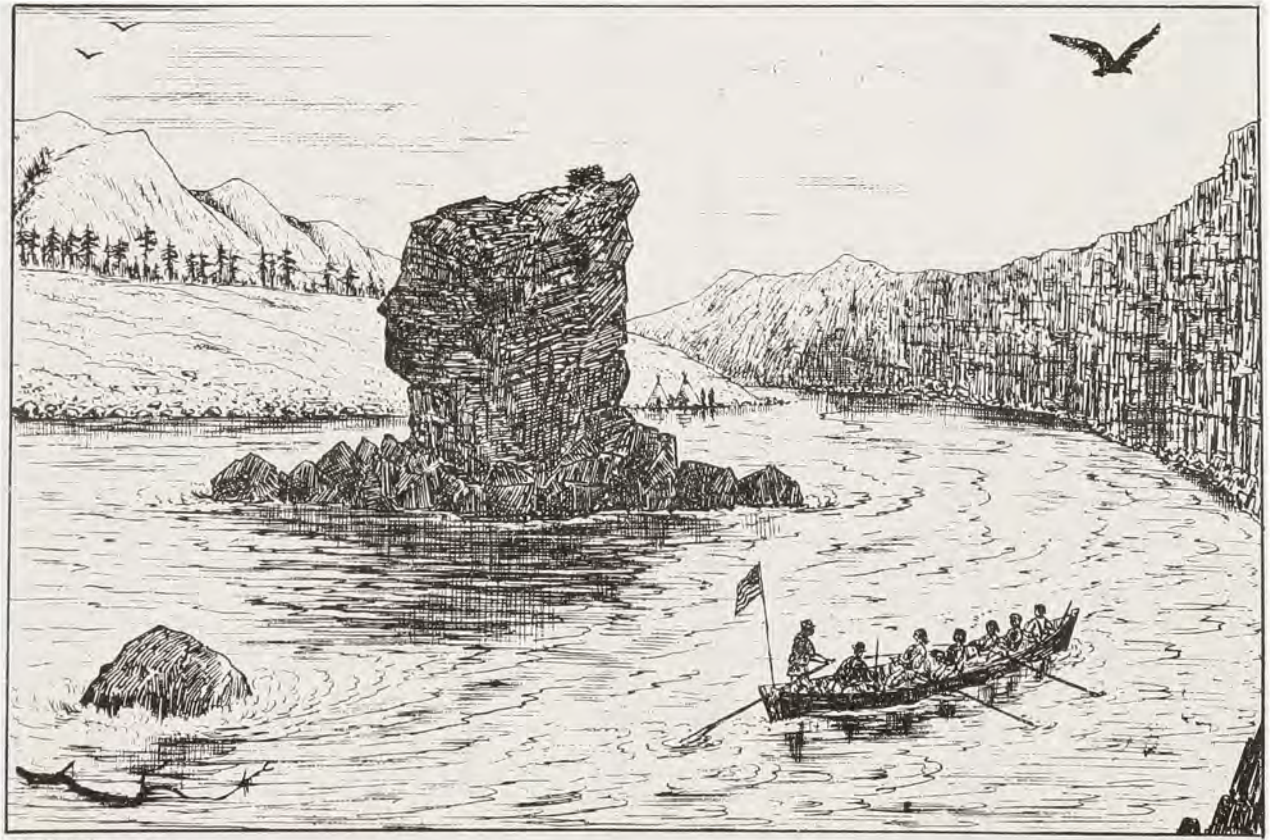
MADE BY DIRECTION OF THE

COMMANDING GENERAL OF THE DEPARTMENT OF THE COLUMBIA,

BY

Lieut. THOMAS W. SYMONS,
CORPS OF ENGINEERS, U. S. ARMY,
CHIEF ENGINEER OF THE DEPARTMENT OF THE COLUMBIA.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1882.



Lieut. T.W. Symons and A. Downing } del.

SEN. EX. DOC. No. 186, 1st SESS., 47th CONG.

VICTORIA ROCK

Lieutenant Symons on The Upper Columbia River

47TH CONGRESS, } 1st *Session.* } SENATE. { EX. DOC. { No. 186.

LETTER

FROM

THE SECRETARY OF WAR,

TRANSMITTING

In response to Senate Resolution of April 5, 1882, a letter from the Chief of Engineers of yesterday's date, and the accompanying copy of a report from Lieut. T. W. Symons, Corps of Engineers, embracing all the information in this Department respecting the navigable waters of the Upper Columbia River and its tributaries, and of the country adjacent thereto.

APRIL 24, 1882.—Referred to the Committee on Printing.

WAR DEPARTMENT,
Washington City, April 21, 1882.

The Secretary of War has the honor to transmit to the United States Senate, in response to the resolution of that body of the 5th instant, calling for information on the subject, a letter from the Chief of Engineers of yesterday's date, and the accompanying copy of a report from Lieut. T. W. Symons, Corps of Engineers, embracing all the information in this department respecting the navigable waters of the Upper Columbia River and its tributaries, and of the resources of the country adjacent thereto.

ROBERT T. LINCOLN,
Secretary of War.

The PRESIDENT *pro tem.*
of the United States Senate.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., April 20, 1882.

SIR: I have the honor to return herewith the resolution of the Senate of the 5th April, 1882, directing the Secretary of War to report to the Senate of the United States—

Any and all information in his possession respecting the navigable waters of the Upper Columbia River and its tributaries, and the resources of the country through which such navigable waters pass, and the character and cost of improvements required to render said Upper Columbia and its tributaries available for purposes of transportation; and, particularly, such information and data as has been collected upon said subjects by Lieut. T. W. Symons, Chief Engineer of the Department of the Columbia.

And in response to transmit a copy of the report of Lieut. T. W. Symons, Corps of Engineers, which embraces all the information in this office respecting the navigable waters of the Upper Columbia River and its tributaries, and of the resources of the country adjacent thereto.

The examination by Lieutenant Symons was made by direction and under the instructions of the commanding general, Department of the Columbia.

Very respectfully, your obedient servant,

H. G. WRIGHT,

Chief of Engineers, Brig. and Bvt. Maj. Gen.

Hon. ROBERT T. LINCOLN,

Secretary of War.

WASHINGTON, D. C., *April* 3, 1882.

SIR: During the months of September and October, 1881, in compliance with orders from Brig. Gen. Nelson A. Miles, commanding Department of the Columbia, I made an examination of the Columbia River, to determine its navigability and the advisability of putting steamboats on it to be used in the transportation of troops, stores, supplies, &c.

In the prosecution of this duty I examined the river at the Little Dalles, Kettle Falls, and Grand Rapids, and traversed the river in a small boat from the last-named rapids, near the mouth of the Colville River, to the mouth of the Snake River, making as careful a survey as possible with the time and means at my disposal.

I have the honor to transmit herewith a report on the examination made, with a map of the river on a scale of 1 inch to 2 miles, and maps on a larger scale of several of the obstructions in the river.

The report embraces a description of the portion of the river examined and the lands in its vicinity, and also of the other portions of the Upper Columbia and the country drained by it and its tributaries, derived from my observations and travels during the past four years, and from a careful study of the reports and writings of others.

I have sought to show the economical relations of the Columbia to the surrounding country, and the importance of making that portion of it lying within the territory of the United States navigable as far as practicable, and have suggested a plan for so doing.

I have added to this a historical and geological account of the Columbia, and have endeavored to give a clear idea of the fertile and extensive

Great Plain composing the northern portion of the interior basin of the Columbia.

It is believed that the maps and information contained in this report will be of value in the navigation of the Columbia, in any questions which may arise in connection with the improvement of the river, to all persons who take an interest in the development and prosperity of the Northwest, and to all the civil and military agents of the government whose duties require of them a knowledge of the country embraced.

With the approval of General Miles I submit this report to you, with the request that it be published, and that 300 copies may be furnished for use in the Department of the Columbia.

Very respectfully, your obedient servant,

THOMAS W. SYMONS,
First Lieutenant Corps of Engineers.

Brig. Gen. H. G. WRIGHT,
Chief of Engineers, U. S. Army, Washington, D. C.

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Not "SAILING, SAILING, OVER THE BOUNDING MAIN," as the rollicking sea chantey says, but passing through the Hiram M. Chittenden Locks on 28 June 1962 was the majestic BOUNTY, modern replica of the famous legendary old sailing ship linking the over two million other vessels of almost every known kind that had preceded it since the locks were opened to traffic in the summer of 1916.