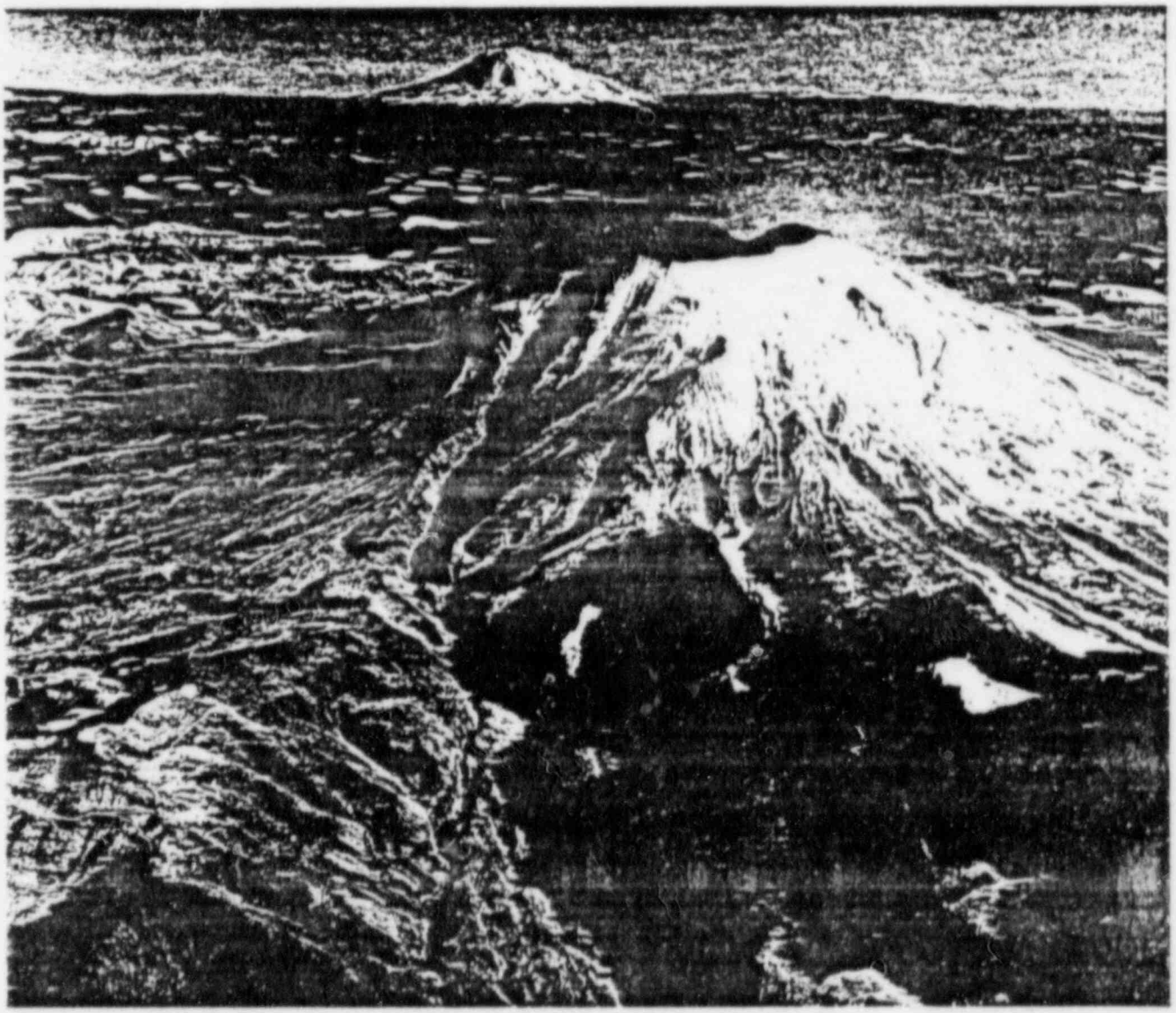
US Army Corps
of Engineers
Portland District



Mount St. Helens Eruption

The Challenge to Restore and Protect

October 1981

c/1

This publication generally summarizes the U. S. Army Corps of Engineers' participation in the Mount St. Helens eruption recovery effort. The Corps was just one member of a team consisting of federal, state, local agencies, private firms, and individuals that worked to re-establish and provide lasting security for the impacted areas. We are truly grateful for the extra effort by our staff, and for the positive and outstanding participation by our private contractors in contributing to the overall success of this massive program.

TERENCE J. CONNELL
Colonel, Corps of Engineers
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COVER - MOUNT ST. HELENS, 17 DEC 1980 (Jan Fardell, Longview Daily News)

FIGURES

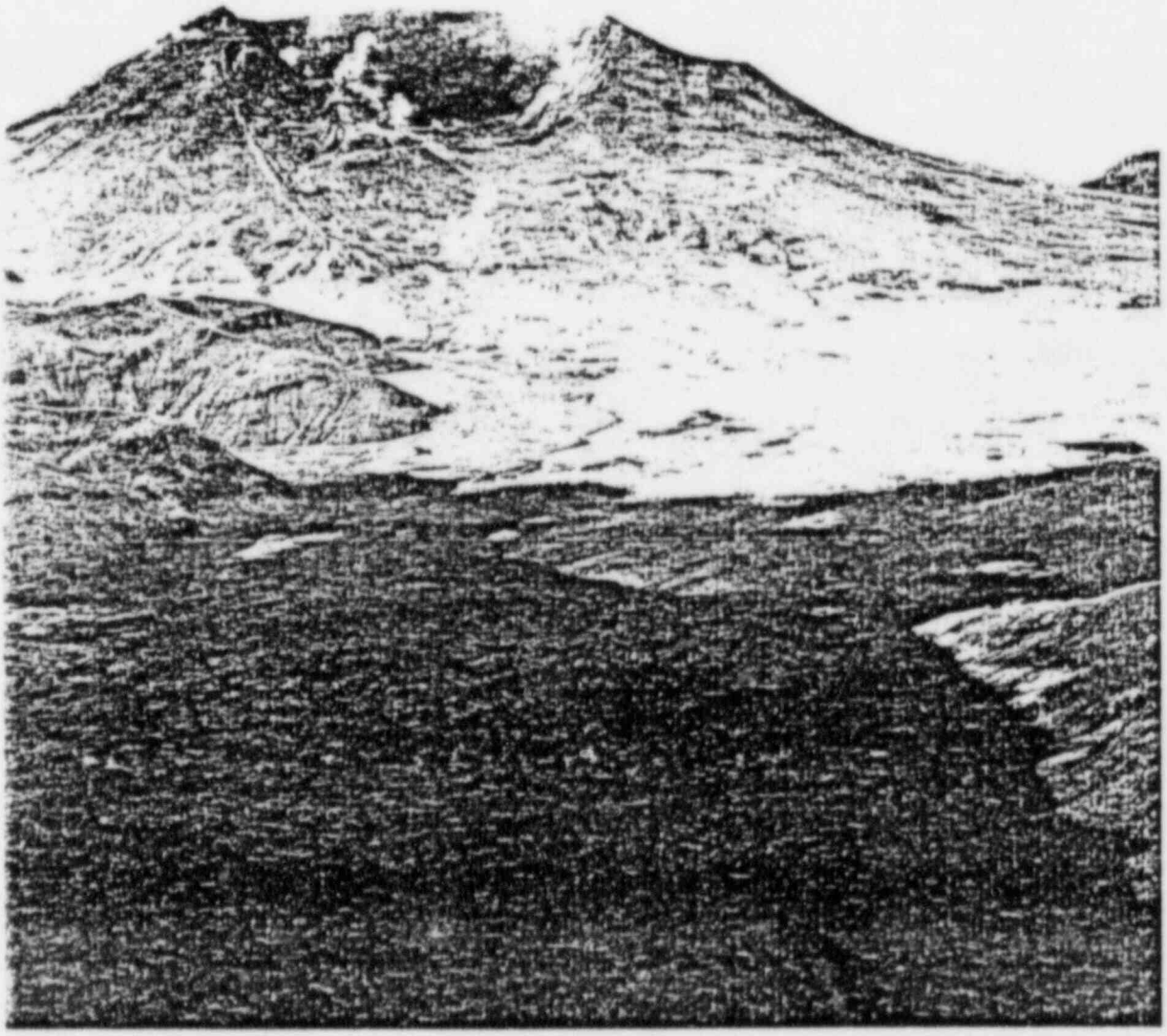
THE CHALLENGE TO RESTORE AND PROTECT

MOUNT ST. HELENS ERUPTION

1. GENERAL In late March 1980, Mount St. Helens in southwest Washington State began exhibiting earthquakes and minor steam and ash ejections, signaling a new era of activity for the 123-year dormant volcano. Minor eruptions continued, becoming larger and larger as the weeks passed, resulting in a massive and explosive eruption on Sunday morning, May 18, 1980. On that morning two magnitude 5 Richter scale earthquakes occurred at 8:32 and 8:34 Pacific Daylight Time. The upper north flank of the mountain, which for a few days previously had bulged outward as much as five feet per day, gave way in an immense landslide, instantaneously releasing the pressure of a plug of gas-charged magma that had risen within the crust below the volcano.

The eruption and blast disgorged an estimated four billion cubic yards of material from the top and center of the mountain, lowering its height by more than 1,200 feet and forming a huge crater more than a mile in diameter. It is estimated that approximately one quarter of the four billion cubic yards of material emerging from the mountain was dispersed into the atmosphere in the form of volcanic ash, which settled in varying thicknesses over hundreds of square miles to the northeast of the volcano. As much as two inches were recorded in some communities in eastern Washington, with thicknesses of 1/16 to 1/8 of an inch recorded in communities in Idaho, Montana and Wyoming.

Mount St. Helens and Spirit Lake before May 18, 1980 eruption. View is to the south.



Mount St. Helens and Spirit Lake after the eruption.

As shown on Figure 1, the blast and resultant mud and pyroclastic flows from the mountain's north side impacted the river basins of the Toutle, Cowlitz and Columbia rivers. It is estimated that approximately three billion cubic yards of material settled in the upper 14 miles of the north fork of the Toutle River, with a much smaller but still staggering 60 million cubic yards settling in the upper reaches of the south fork of the Toutle River. Mudflows in the following 24 hours, buoyed by melting mountain ice and waters displaced from upper Toutle River channels, carried more than 50 million cubic yards of material into 21 miles of the Cowlitz River from the mouth of the Toutle downstream and deposited an additional 45 million cubic yards in the Columbia River, upstream and downstream of the mouth of the Cowlitz River near Longview. Those flows and volumes occurred in less than a 12-hour period after the eruption. The Toutle and Cowlitz rivers experienced two successive flood crests, the second crest occurring early on May 19. At Castle Rock, it equaled a 250-year frequency flood. This flow came from less than one-fourth of the river basin's drainage area. Columbia River infill took place between the hours of midnight and 5:00 a.m. on May 19.

It is difficult to conceive of the tremendous volumes of material moving in the river channels in so short a period of time. Flood profiles did not exceed previous record flood levels in the Cowlitz and Columbia rivers, although they did approach major flood levels in the Cowlitz River above Longview and Kelso. Mudflows in the lower river did not build up at any one location, but resulted in uniform layers of sand and gravel and other debris deposits throughout the floodplain of the lower Toutle and lower Cowlitz River valleys. Instead of the normally stained high-water

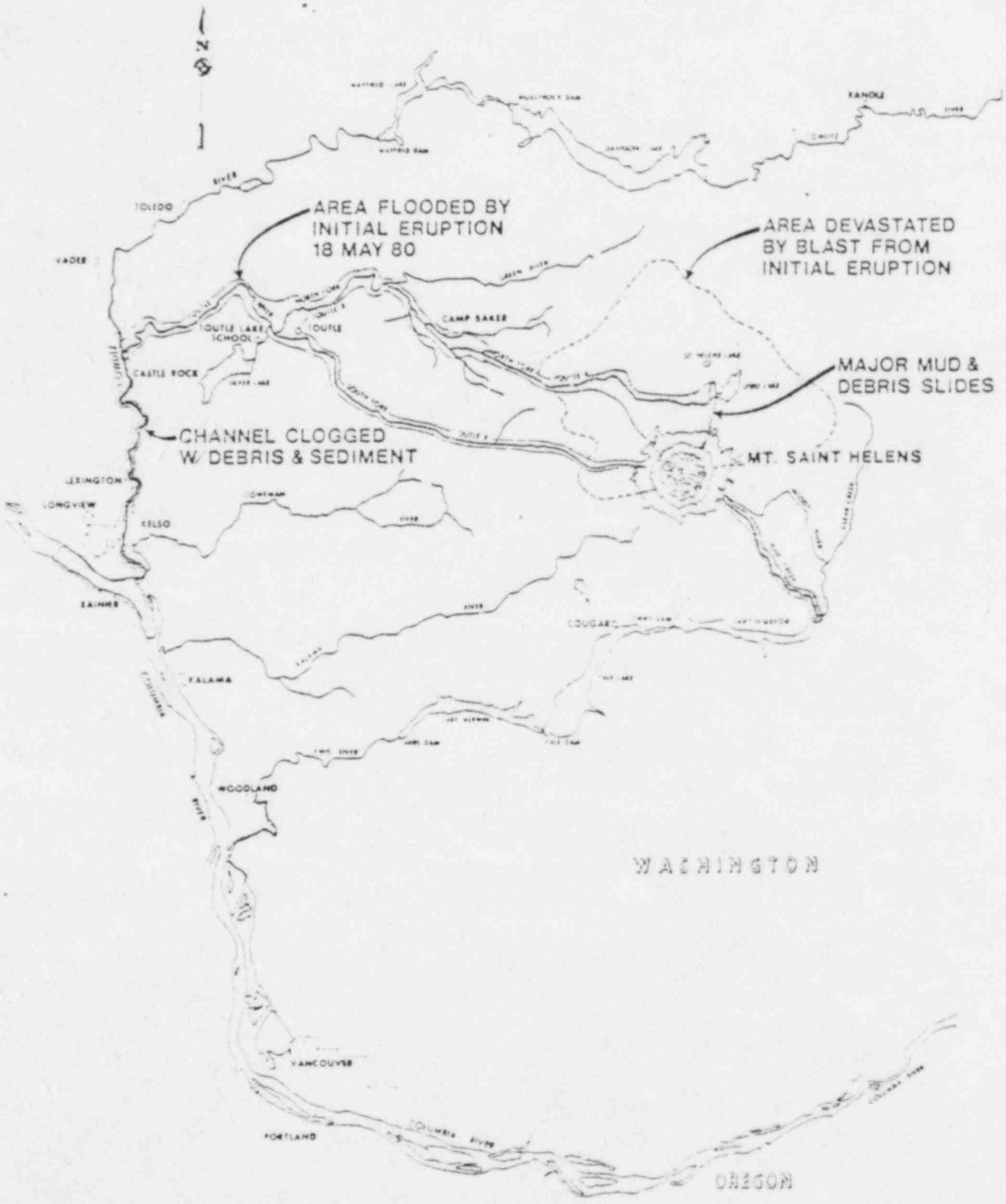
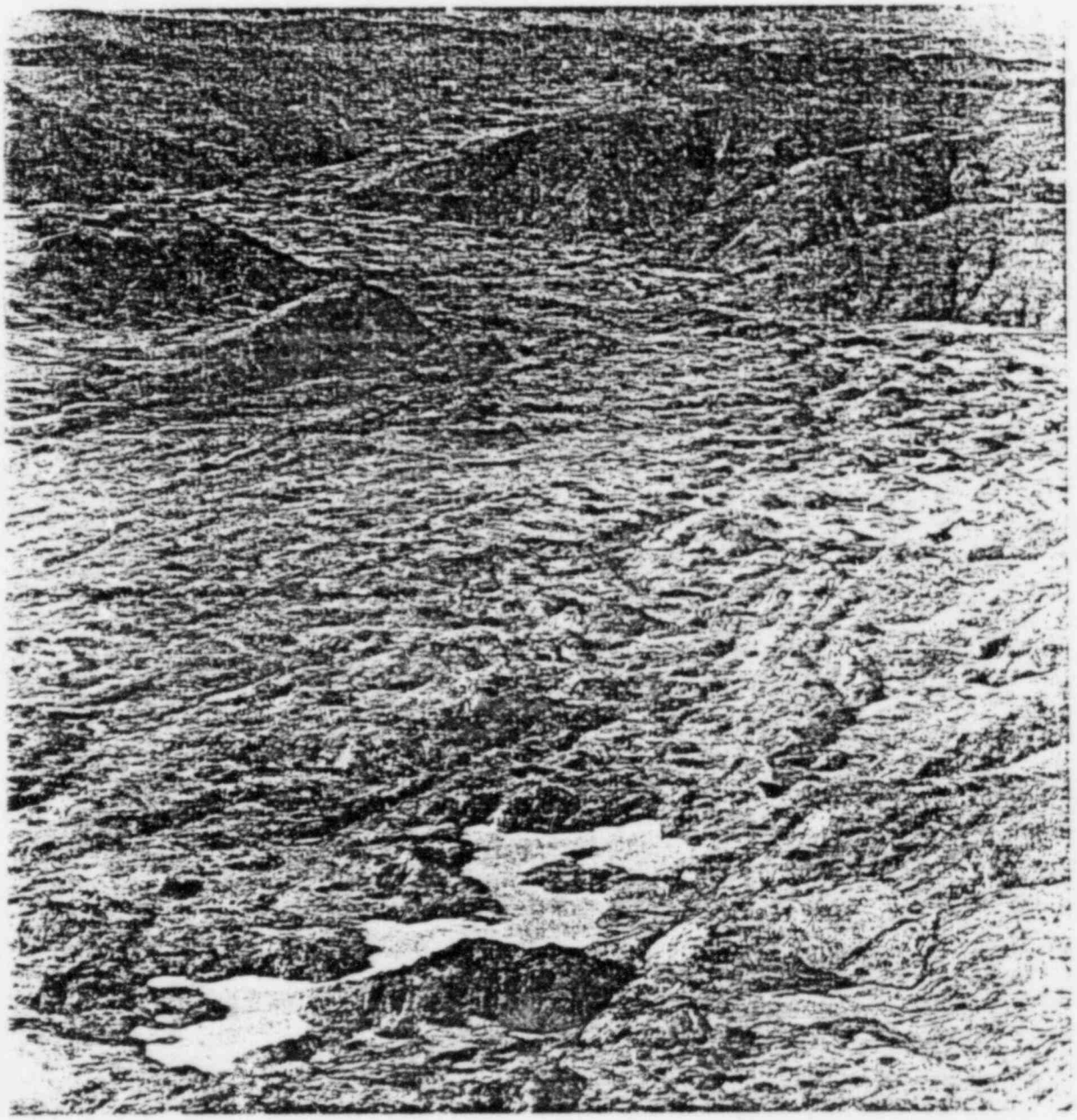
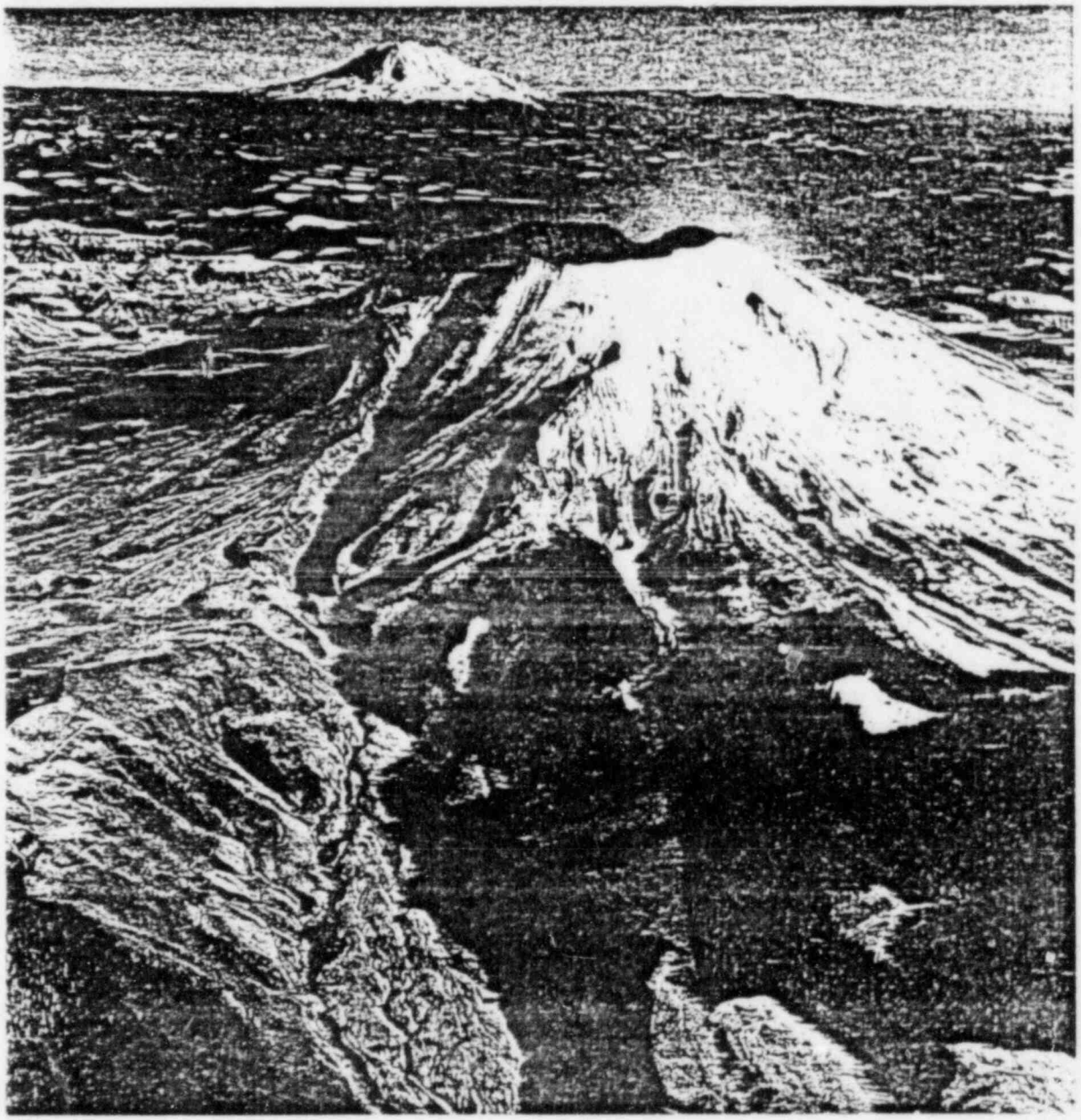

AREA FLOODED BY
INITIAL ERUPTION
18 MAY 80
AREA DEVASTATED
BY BLAST FROM
INITIAL ERUPTION
MAJOR MUD &
DEBRIS SLIDES
CHANNEL CLOGGED
W/ DEBRIS & SEDIMENT
MT. SAINT HELENS
TOLEDO
CASTLE ROCK
LEXINGTON
LONGVIEW
KELSO
KALAMA
WOODLAND
VANCOUVER
PORTLAND
WASHINGTON
OREGON

FIGURE 1

marks as experienced in rainfall floods, almost everywhere the water flowed in the lower Cowlitz and Toutle rivers a dense layer of ash, sand and gravel was left. What occurred could be likened to a large volume of material, with the consistency of "pancake batter," flowing at a high rate of speed along river valley floors and simply leveling out and settling as the flows continued downstream. Trees were caked with the material along their trunks. Tests on May 19 after the peak flows had passed still indicated 50 percent solids. Jackson Turbidity Unit levels of upwards of 55,000 (nearly immeasureable) were observed in the Cowlitz on May 19 (Schuster, USGS, 1981). Normal levels are 3 to 10 JTU's. Densities in-place ranged from 1801 grams/liter to 2086 grams/liter. Normal Columbia River sand densities are about 1850 to 1900 grams/liter. The volcanic infill material was very angular and clung together, resulting later in considerably less than normal daily dredging capacities and distances. Wear of dredge components would increase significantly. Gradation curves are shown on Figures 2 and 3.

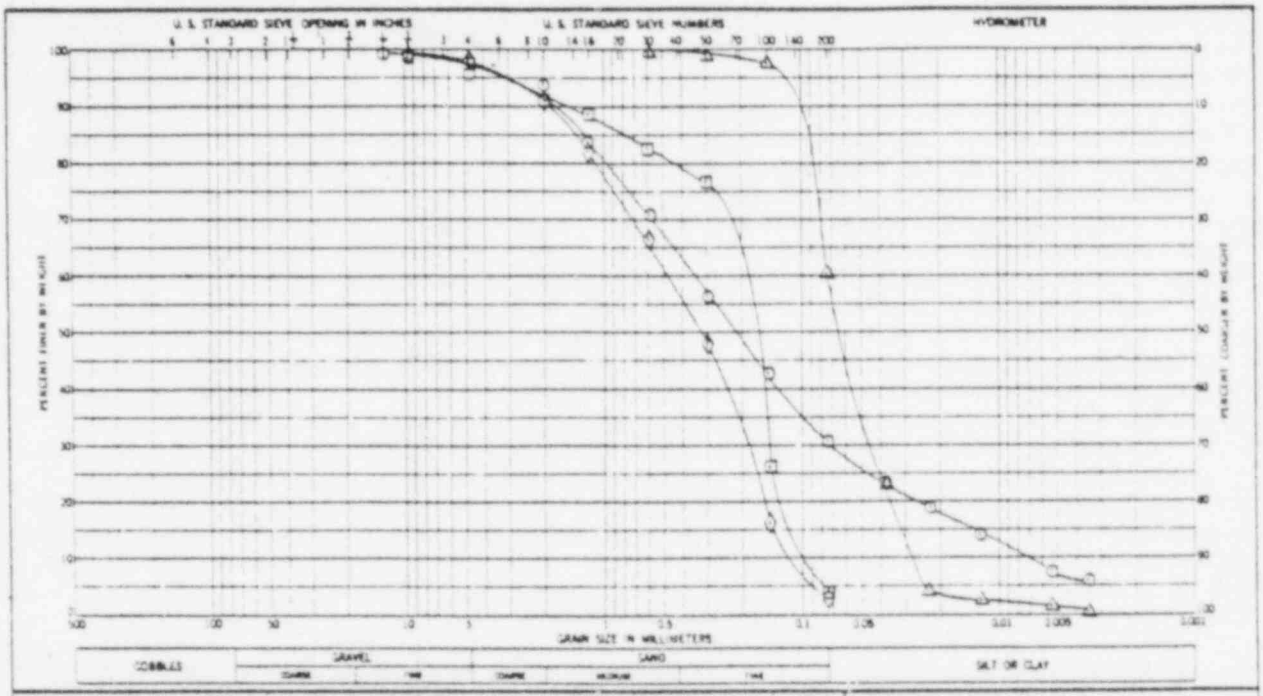


The resulting mudfill on the North Fork Toutle River. View is to the west.



Upper South Fork Toutle River, Mount Adams to the east in the background.

Toutle River showing impact of mudflows, their course and height evidenced by mud lines on trees.



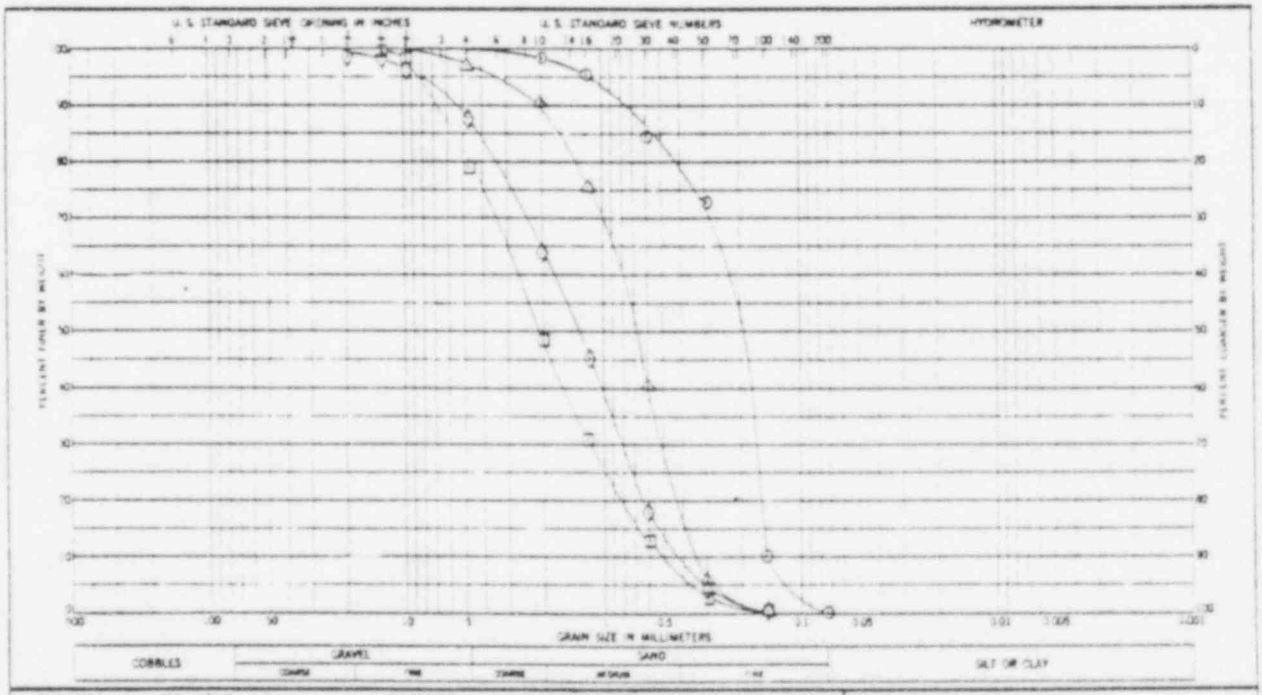
Sample No.	Elev. or Depth	Classification	Nat. w %	LL	PI	γd
River Mouth	20 May 80 ○	Silty SAND (SM)				
R.M. 0.2	20 May 80 △	Sandy SILT (ML)				
R.M. 2.9	20 May 80 □	SAND (SP)				
R.M. 6.5	20 May 80 ▽	SAND (SP)				

GRADATION CURVES NPD

RIVER SEDIMENT ANALYSIS
Cowlitz River, WA
Boring No.
Date 17 Jun 80 (80-S-649)

FIGURE 2

ENG FORM 2087



Sample No.	Elev. or Depth	Classification	Nat. w %	LL	PI	γd
CRM ○	57+05	SAND (SP)				
CRM △	57+40	SAND (SP)				
CRM □	58+10	Gravelly SAND (SP)				
CRM ▽	58+40	Gravelly SAND (SP)				

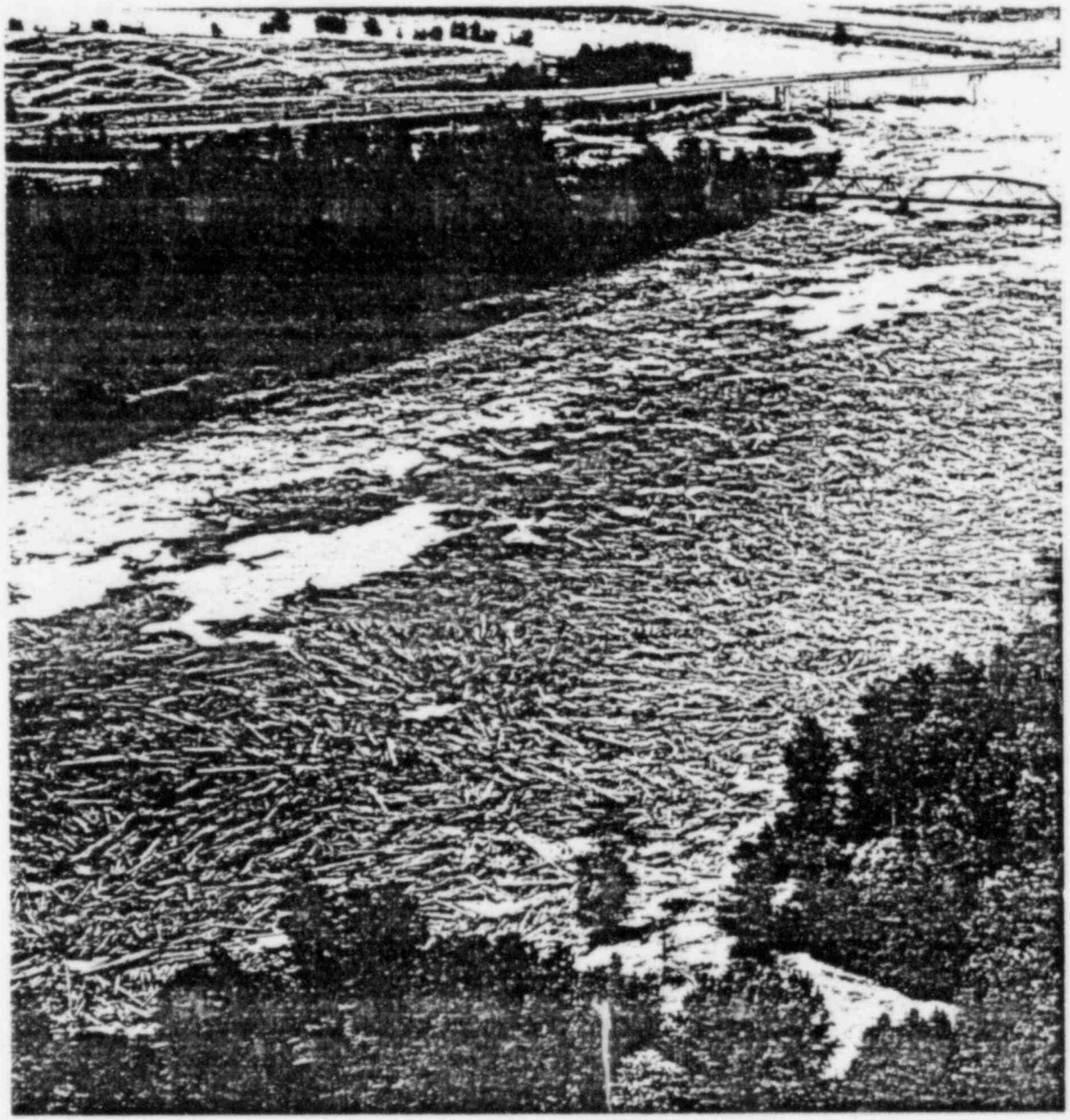
GRADATION CURVES NPD

RIVER SEDIMENT ANALYSIS
Area Columbia River
Boring No. Sampled 18 June 1980
Date 25 June 1980 (80-S-649)

FIGURE 3

ENG FORM 2087

Mudflows on the upper Cowlitz River. The dense material floated mobile homes and inundated fixed structures.



Debris on the lower Cowlitz River being carried to the Columbia River the day after the eruption.

2. FLOOD CONTROL IMPACT Twenty-one miles of the Cowlitz River from the mouth of the Toutle River downstream to the Columbia River were impacted with virtual elimination of natural channel capacities. Figure 5 illustrates profiles of the lower Cowlitz River before and after the mudflows. At the time of the eruption, lower Cowlitz River flows were about 6,100 cubic feet per second with a gage height of 30 feet. Those river flows after the mudflows on May 18 and 19 were essentially at bank-full capacity with a gage of 42.5 feet (12.5 foot rise). In addition, because mudflow materials remained in essentially all areas inundated, valley storage capacities for normal floods were severely reduced. The communities of Lexington and Castle Rock as well as the larger communities of Kelso and Longview (total population of about 45,000) were left virtually without flood protection. It was estimated that [illegible] million cubic yards of Columbia River material raised flood levels in the river upstream of the mouth area by more than 5 feet for several miles. There were no extensively developed areas in this reach.

The Cowlitz River channel from about 1.5 miles immediately above the mouth of the Toutle River downstream to the Columbia River, a distance of [illegible] miles, was filled with deposits of material varying from 5 to 15 feet. In addition, the mudflow material flowed into and settled into adjacent wetland areas along the Cowlitz River valley. This essentially eliminated valley storage areas normally able to absorb some of the high flows during flood periods. The lower reaches of tributary streams of the Cowlitz River were also infilled and blocked off by mudflow material. Drainage ditch outlets, storm sewer outlets, headwall structures, etc., were not only plugged but covered up

with several feet of material. An immediate and unusual flood impact caused by the mudflow material was local flooding in many of the tributary stream drainage areas during the summer low flow periods. As result of their entrances being dammed, residual flows from creeks and streams backed up and flooded buildings, roads and other developed areas.

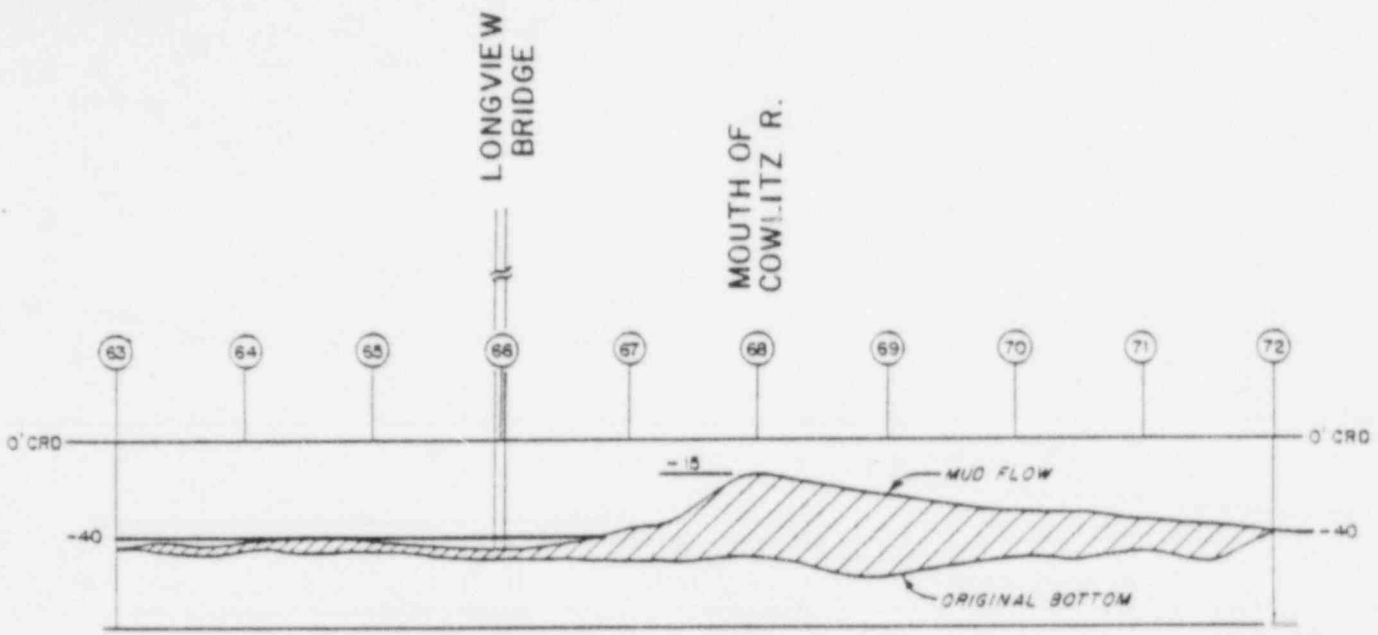
3. NAVIGATION IMPACT The Columbia River navigation channel from the mouth to Portland, Ore., and Vancouver, Wash., is maintained at a 40 foot depth, 600 foot width. The Cowlitz River enters the Columbia at River Mile 68, and the Williamette River, which serves the Portland Harbor area, enters the Columbia at Mile 101. There was also a routinely maintained navigation channel in the lower four miles of the Cowlitz River with dimensions of 8 by 150 feet. The Columbia River serves primarily tug and barge and deep draft vessel traffic with commerce in excess of 30 million tons per year in those reaches.

Maintenance of the 40 foot channel requires annual dredging of about five million cubic yards of primarily clean sand materials. In-place density of Columbia River sands is an average of 1,900 to 1,950 grams per liter. This yardage is normally removed from shoal areas existing throughout the 104 mile reach to the Portland area. Normal maintenance of the Cowlitz River channel was accomplished on a periodic basis about once every three years. Shoaling conditions usually required removal of only 150,000 to 250,000 cubic yards of gravely sand materials.

As reported by the Columbia River Pilots Association, a deep draft vessel traversed the Columbia River channel in the vicinity of River Mile 68 in an upstream direction without incident about 3:30 a.m. on May 19. However, at 5:30 a.m. on May 19 another vessel progressing upstream ran hard aground adjacent to the mouth of the Cowlitz River and had to be assisted off by tugs later in the day. Hydrographic surveys were taken late that day after turbidity levels subsided enough to allow penetration of sonic Fathometer signals. They revealed that navigation depths in the Columbia River had been reduced to 15 feet CRD (Low Water Datum) and navigation depths in the Cowlitz River were virtually nonexistent. Those depths essentially closed the Columbia River channel upstream of Longview to deep draft vessel traffic. Thirty-one deep draft vessels were trapped upstream in the Portland-Vancouver and Kalama harbors. An estimated 50 ships enroute to the area were forced to stand off or were diverted to other ports. The cost to ports, the communities and industry mounted to millions of dollars per day from the disruption of deep draft vessel traffic in the Columbia River.

Trojan at RM 72.5

[redacted] Figure 4 illustrates the distribution of the material in comparision with normal channel depths. Based on surveys, approximately 14 million of the 45 million cubic yards deposited in the river infilled the 40 by 600 foot navigation channel in this reach.



COLUMBIA RIVER LONGITUDINAL PROFILE RM 63 - RM 72

FIGURE 4

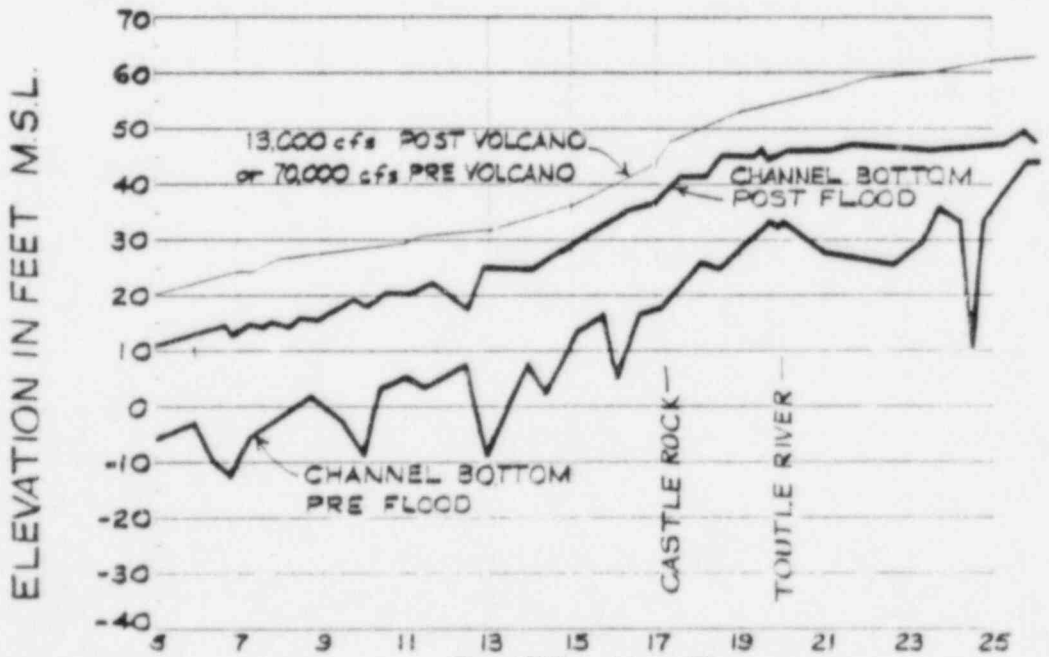


FIGURE 5

4. IMMEDIATE ACTIONS On May 19, as the magnitude of the impact of the eruption became known, the Corps of Engineers and other federal, state, and local agencies established a communications system to coordinate the recovery effort. The impacts to general populations, public utilities and other public and private facilities had to be realized in order to formulate plans of action from an immediate standpoint and for the longer range period. As a result of this intercommunication and initial onsite observations by field personnel, the Corps of Engineers' Portland District participated in emergency raising and strengthening of levees at Castle Rock and Lexington, and restoration of traffic flows around several blocked Cowlitz tributaries. The Corps also immediately ordered all federal dredge plant to the Columbia River to begin efforts to reopen the navigation channel.

5. PLAN FORMULATION In the days and weeks following the eruption key personnel from many separate branches of the Portland District began assessing the full impact of the eruption to determine where and how the Corps could help. By statute (Public Law 84-99), the Corps would be responsible for protective activities to preclude further flood damages and disruptions to navigation systems. As more information became available on the scope of damages from a flood control and navigation standpoint, restoration plans were formulated through coordination with higher authority, local interests, and other federal and state agencies. The planning process in the immediate period after the eruption was the most crucial and intense, resulting in consideration of many alternatives, some of which were shelved after more facts were known in later weeks.

The alternatives considered were aimed at two general purposes: restoration and protection. Regarding restoration, the areas requiring action included: the navigation channel of the Columbia and Cowlitz rivers; the flood control carrying capacity of the Cowlitz River; drainage channels and structures; water supply systems; and transportation routes. The major restoration measures would entail massive dredging operations in the Columbia River to restore navigation, and in the Cowlitz River to restore its flood carrying capacity. In addition, certain protective measures were formulated for the long-term future that would minimize continued impacts to the navigation channel and flood carrying capacities of the streams. Because the mudflow impacted the Cowlitz Valley storage capacity to a significant degree, and not all the mudflow materials could be removed, levees protecting populated areas were raised, lengthened and improved to completely restore the ability of the Cowlitz River to carry at least a 500-year frequency flood. A short-term protective measure included the purchase of hydropower storage space in upstream reservoirs on the Cowlitz River for additional flood control storage. Other short-term measures included stabilization of large reaches of the Toutle River to minimize erosion and the transport of further mudflow materials into the Cowlitz River prior to the 1980-1981 flood season. To some extent those stabilization measures will also provide long-term protection for the downstream areas. Other major protective measures included construction of debris retaining structures, or debris barriers, at the foot of mud slides in both the north and south fork valleys of the Toutle River, and emergency outlet channels at several small lakes that were formed from blocked tributaries on the north fork of the Toutle River.

Plans for major features of the recovery work were coordinated in detail with the Corps' North Pacific Division office in Portland, and with the Chief of Engineers' office in Washington, D.C. Congressmen from the impacted areas of the states of Oregon and Washington were also involved. In the ensuing weeks after the eruption, a coordinated plan of action evolved with assistance from other federal, state and local agencies. Public support by affected communities was vital, and the Portland District held more than a dozen public meetings to explain the recovery operations and gather comments and information. In September 1980 the Corps published a final Environmental Impact Statement addressing its Mount St. Helens involvement.

b. FUNDING Funds for navigation recovery of the Columbia River channel were initially available from operation and maintenance funds within the Portland District. Additional O&M funds were provided by higher authority to supplement District funds for fiscal years 1980 and 1981. In excess of $45 million was requested and provided in the early weeks after the eruption to extend over both fiscal years. This funding will be supplemented in future years as required depending on the stability of the situation and the success of measures accomplished to date.

Funding for flood control restoration and long-term protective measures were provided through Public Law 84-99. Under this statute, the Corps of Engineers, at the direction of the Chief of Engineers in Washington, D.C., has authority and funds to respond to floods or threats of floods to protect life and property. The cost of actions taken immediately following the eruption amounted to about $200,000. As more data became available and alternatives were selected for the restoration and recovery work, an initial funding program totaling more than $173 million was established. Additional funds required for future fiscal years were also estimated.

FUNDING PROGRAM (April 1981)

($ Millions)

PL-84-99 - Cowlitz - Toutle Rivers

Item	1980	1981
Cowlitz River Channel Excavation	117.9	19.0
Toutle River Sediment Stabilization Basins	2.9	5.0
Debris Retaining Structures	15.2	18.0
Toutle River Channel Constrictions	0	0
Seeding Disposal Areas	1.0	0
Green River Fish Hatchery Protection	0.3	0
Mossyrock Storage Agreement	8.0	0
Lake Outlets	0	1.0
Assistance to Resource Agencies	0.2	2.0
Flood Protection		
a. Levees	15.5	2.0
b. Bank Protection	4.0	5.0
c. Land Acquisition/Right-of-Way	4.3	0
d. Pump Stations	0	0
Engineering and Design	4.0	2.0
Miscellaneous/Studies	0	2.0
TOTAL	173.3	56.0
Operations & Maintenance - Columbia River		
Columbia River Channel	20.2	24.9

FIGURE 6

7. IMPLEMENTATION As a plan of action was initiated for both flood control and navigation, the Portland District established field offices to administer the large amount of work that would be required in the local area. Navigation Division set up a field office at Rainier, Ore., in early June. Construction Division field offices were established later in June at Castle Rock and Toutle. These offices served as residencies through which contract work was administered for the emergency operations and more prolonged recovery actions. Each of the offices had 20 to 30 field personnel supervised by an Area Engineer and several assistants. Key personnel in those field offices were reassigned from their normal duties at the Portland District and North Pacific Division offices. As much as possible, clerical personnel, construction inspectors and engineering technicians were recruited from the local area to provide the full staff required to administer the work. The three temporary offices were eventually closed, with the Toutle Field Office being phased out in November 1980 and the Castle Rock Field Office in April 1981. A permanent resident office has taken the place of the two offices for the Cowlitz and Toutle rivers, and is located at the junction of Interstate 5 and Highway 504 in Cowlitz County. This office, staffed with permanently assigned Corps of Engineers personnel, will operate for the next several years to oversee ongoing projects on the two rivers. Future navigation work in the Columbia River and lower Cowlitz River will be administered as part of normal workload by the District's Navigation Division. A small office for navigation hydrographic survey work will be retained at Rainier.

8. NAVIGATION RESTORATION

A. Dredging

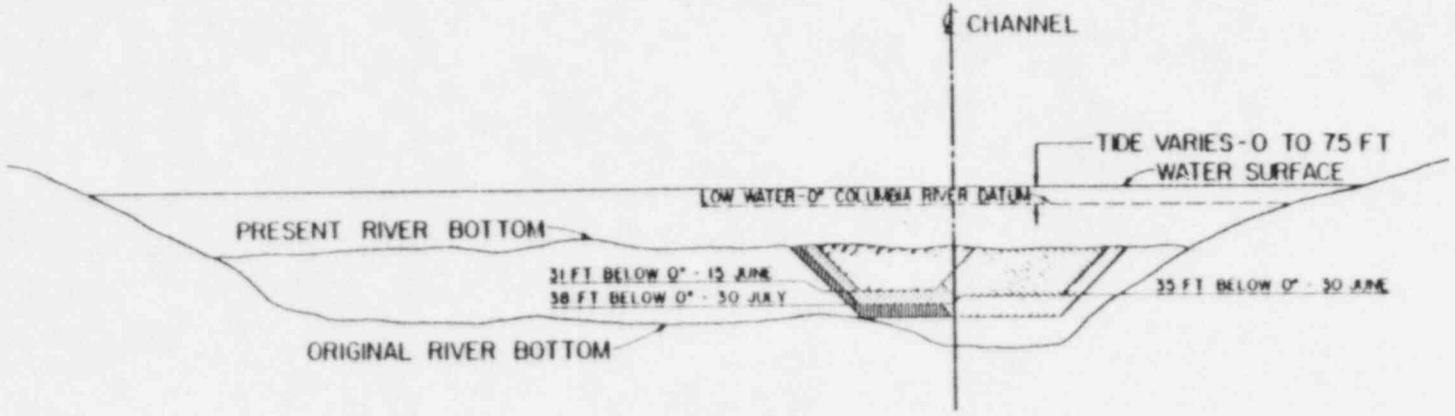
With preliminary data available early on May 19 after the grounding of the HEOGH MASCOT, the U.S. Coast Guard closed the Columbia River to navigation at Longview. This information was transmitted to the Portland District that day and the hopper dredge BIDDLE, working at the mouth of the Columbia River, was immediately ordered to proceed to the area to begin emergency dredging. The following day, the District's other two hopper dredges, HARDING and PACIFIC, were recalled from Eureka, Calif., and Coos Bay, Ore., respectively, to also begin work on the Columbia channel. The Port of Portland's pipeline dredge OREGON, working under contract for the Corps in the vicinity of Astoria, Ore., was ordered that day to mobilize at the site as soon as possible.

Representatives of the U.S. Coast Guard, the Columbia River Pilots Association and the Corps of Engineers met on May 19 to develop plans for restoration of the channel and resumption of river traffic. On May 20 the plan for dredging was established as indicated in Figure 7. The hopper dredge BIDDLE started work on the Columbia River channel on May 20. The BIDDLE started work on a 200-foot-wide emergency channel on the south edge of the 600-foot-wide authorized channel.

The U.S. Coast Guard established a safety zone through the blockade area. Deep draft vessels were restricted to passing through the area during a two hour "window" on the daylight high tide. This procedure provided the maximum depth available for deep draft vessels and minimized the interruption of dredging operations in the channel. Tug and barge traffic was ordered to use that portion of the river south of the emergency channel.

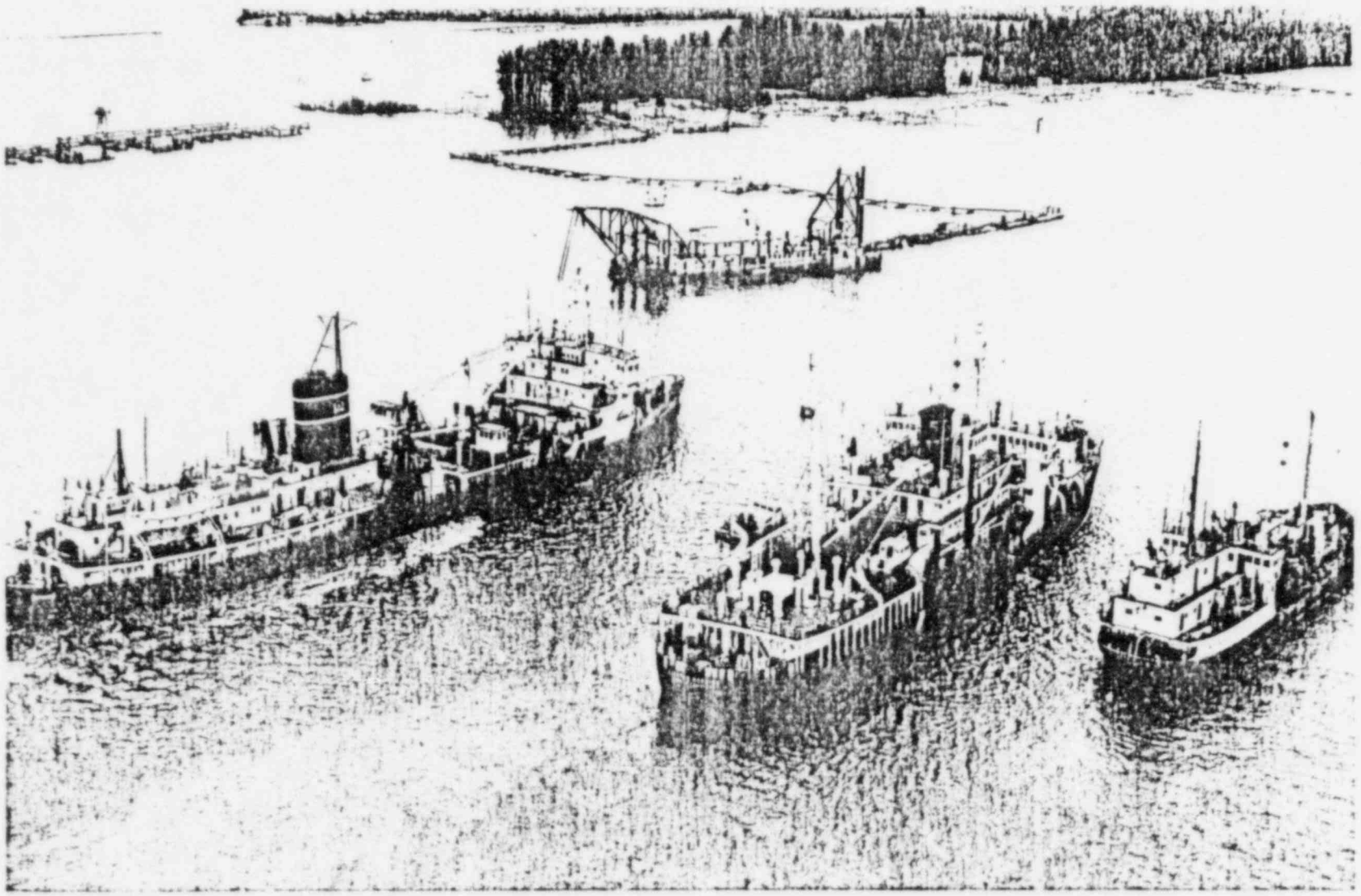
Marine contractors on the West Coast and throughout the nation were canvassed by telephone to determine the availability of large pipeline dredging plant. The first result of this solicitation was that the two largest West Coast dredging companies, General Construction Company of Seattle and Riedel International of Portland, agreed to the latter firm entering into a contract to furnish and operate equipment of both companies. Submission of preliminary cost and pricing data led to signing of the contract May 23. Five large pipeline dredges and two boosters would be furnished.

	PHASE I HOPPER DREDGES	200' CHANNEL - SOUTH SIDE, DEPTH 31 FT. BELOW 0º	15 JUNE
	PHASE II PIPELINE DREDGES	300' CHANNEL - NORTH SIDE, DREDGE TO 35 FT. BELOW 0º	30 JUNE
	PHASE III PIPELINE DREDGES	300' CHANNEL - SOUTH SIDE, DREDGE TO 38 FT. BELOW 0º	30 JULY
	PHASE IV PIPELINE DREDGES	300' CHANNEL - NORTH SIDE, DREDGE PROJECT DEPTH	30 SEPT
	PHASE V PIPELINE DREDGES	SOUTH SIDE - DREDGE FULL PROJECT DIMENSIONS	30 NOV
	PHASE VI PIPELINE DREDGES	RESTORE ADEQUATE RIVER CROSS-SECTION SOUTH OF NAVIGATION CHANNEL	31 MAR 1981

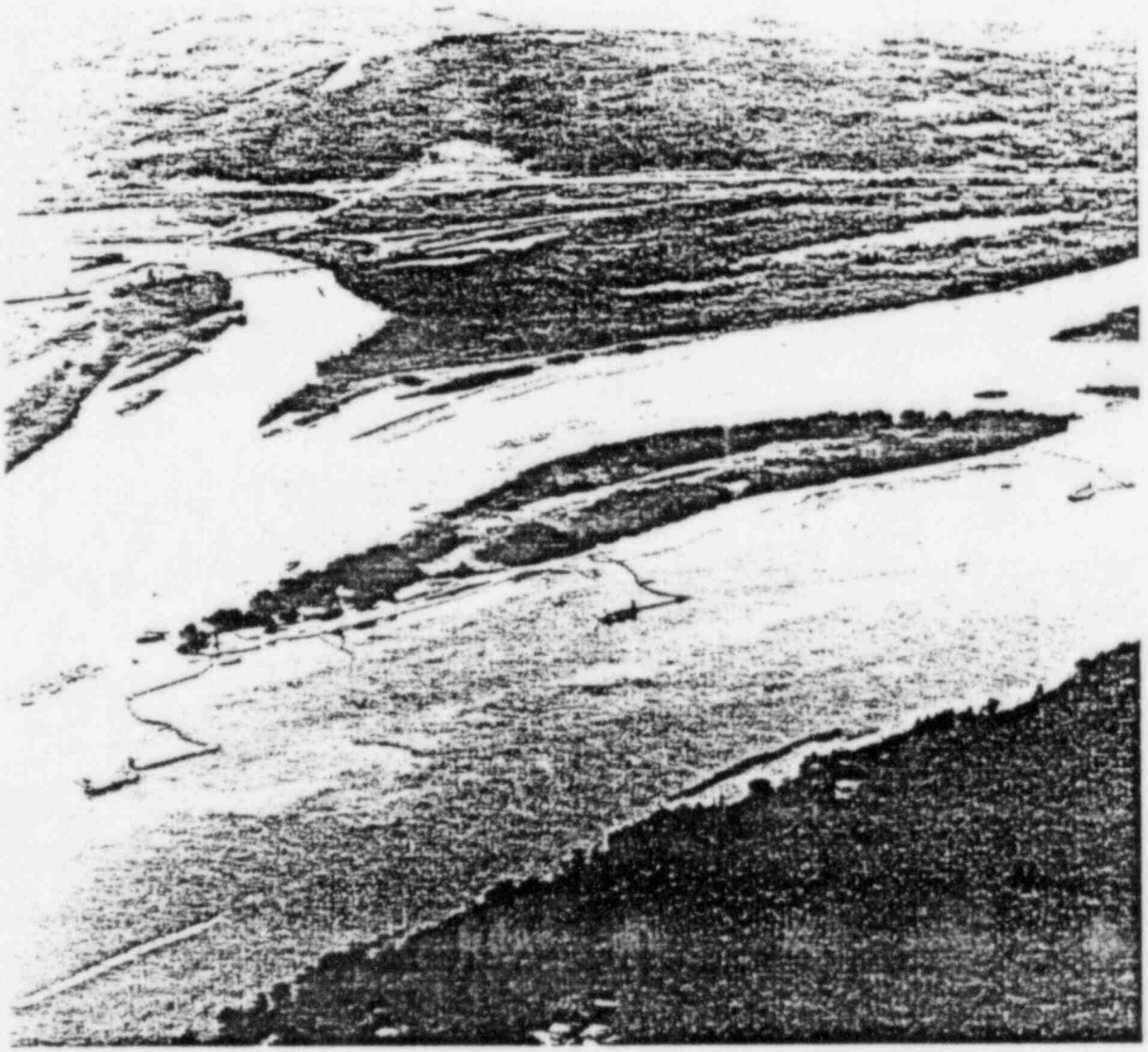


TYPICAL SECTION
COLUMBIA RIVER AT LONGVIEW

FIGURE 7



Hopper dredges BIDDLE, HARDING, and PACIFIC and pipeline dredge OREGON on the Columbia River near the mouth of the Cowlitz River.



Pipeline dredges OREGON, MCCURDY, and LOFGREN working in the Columbia River at the Cowlitz River confluence (smaller dredge barely visible between the bridges on the Cowlitz).

Notice to proceed was immediately issued for mobilizing the dredges MCCURDY and WASHINGTON from Puget Sound to the Longview area. Negotiations continued to permit a definitized contract establishing rates for rental of the fully operated dredge plant on an hourly rental basis, plus a fixed price for mobilization and demobilization. Terms included in the contract provided the Government the option to determine which and how equipment would be used on the project. Figure 8 lists the dredges ultimately utilized for Columbia River dredging.

Providing disposal areas required full cooperation between contractors, local authorities, environmental interests, and various federal, state and local agencies.

Because of the urgent nature of the emergency restoration, environmental requirements were relaxed as necessary by federal and state natural resource agencies, as long as all reasonable efforts to minimize impacts were pursued.

The 14 million cubic yards of infill in the channel project limits were removed generally on schedule and an unrestricted navigation channel was open to traffic by November 30, 1980.

DREDGES USED TO RESTORE THE COLUMBIA RIVER NAVIGATION CHANNEL

Name	Size	Type	Pump Horsepower	Owner	Date Start 4	Original Location	Approximate CY Removed
Hopper Dredges							
BIDDLE	3060 CY	Steam-Elec	-	A	20 May 80	Mouth of Columbia R	2,000,000
HARDING	2700 CY	Diesel	-	A	22 May 80	Eureka, CA	1,150,000
PACIFIC	500 CY	Diesel	-	A	21 May 80	Coos Bay, OR	325,000
Pipeline Dredges							
OREGON	30"	Diesel	4985	B	22 May 80	Astoria, OR	6,300,000
MCCURDY	24"	Diesel-Elec	3000	C	6 Jun 80	Puget Sound, WA	2,650,000
*WASHINGTON	24"	Diesel-Elec	2900	D	7 Jun 80	Puget Sound, WA	2,700,000
OLLIE KEIDEL	27"	Diesel	4200	C	7 Jun 80	Long Beach, CA	4,500,000
TILLAMOOK	12"	Diesel	600	E	15 May 81	Old Mouth of Col. R	23,000
* Purchased by Western Pacific - renamed LOFGREN							
Booster Pumps							
SUPER BOOSTER	24"	Electric	3500	C	23 Sep 80		Portland, OR
OREGON BOOSTER	30"	Diesel	3000	B	30 Jul 80		Portland, OR
SUPER SNOOSE	27"	Diesel	3600	C			

Owners

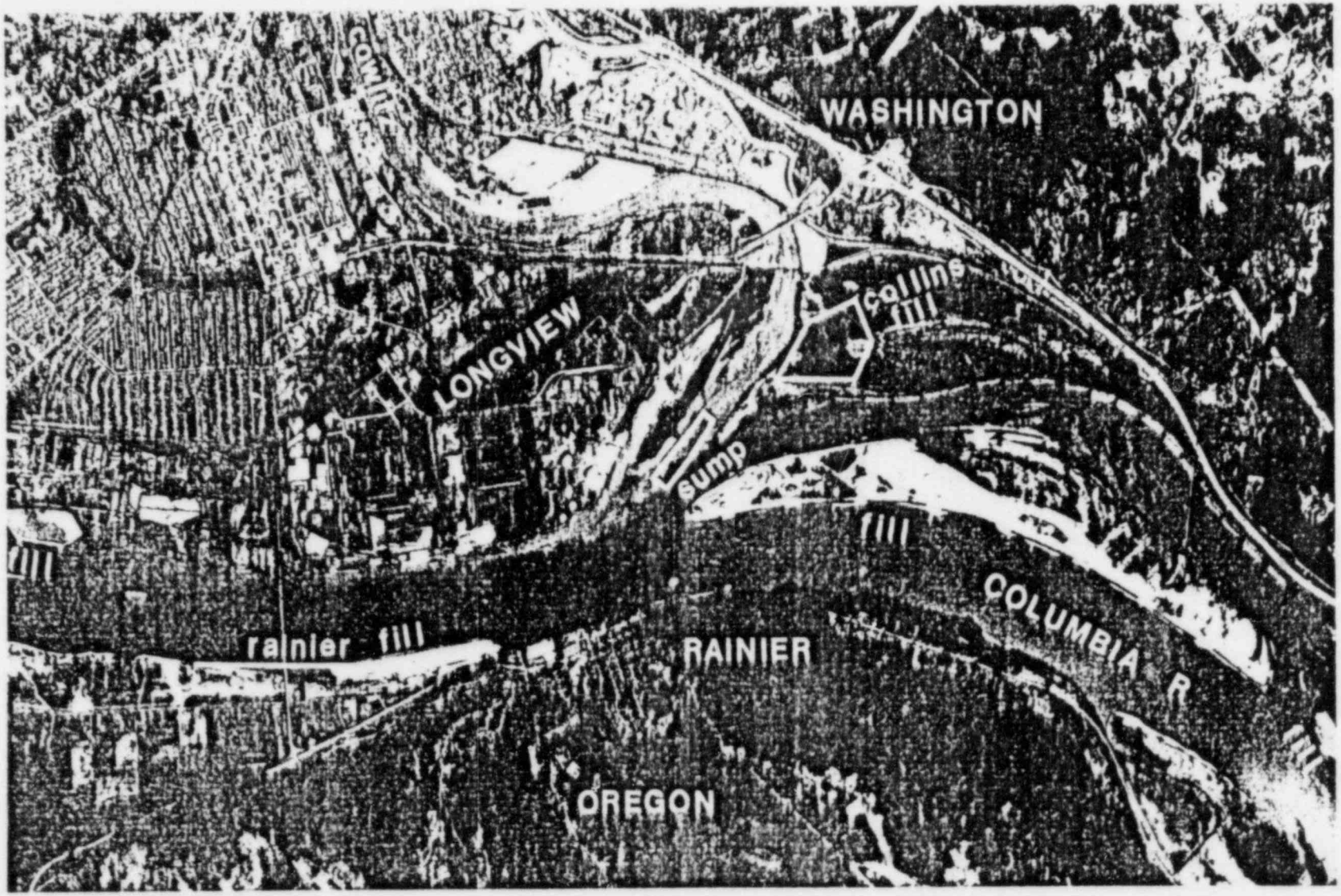
A - Portland District, Corps of Engineers
B - The Port of Portland, Portland, OR
C - Western Pacific Dredging Corp., Portland, OR
D - General Construction Co., Seattle, WA
E - Newport Dredging Co., Portland, OR

FIGURE 8

B. Rainier Fill

The Columbia River channel in the vicinity of Longview immediately downstream of the mouth of the Cowlitz River is naturally wider than required for hydraulic passage of river flows. This condition, when coupled with extensive dredging normally conducted in the area to provide both the federal navigation channel and the mooring basins for the Port of Longview industrial facilities, created an area where shoaling was accelerated because of the artificially deepened nature of the wide channel. The deepening of the navigation channel from 35 to 40 feet in the late 1960's and early 1970's along this location included a plan for possible artificial narrowing by pile dikes or fill. However, because of the concern of many local interests in the area, the narrowing program was never accomplished. This fact, together with the new condition of millions of cubic yards of mudflow infill immediately upstream, raised the question of future ability to keep adequate navigation depths consistent in the Port of Longview reach. Compounding the problem was the probable large volumes of material to be transported into the area from natural erosion of mudflow deposits in the Toutle River system.

The services of a consultant familiar with marine channel design were secured to assist Portland District personnel in the review of previous plans for artificial works in the Columbia River channel area. A primary concern was placement of dredged mudflow material in such a manner as to provide long-term stability of the channel area. The plan proposed by the consultant is illustrated as the Rainier Fill on Page 33. Federal and state agencies were apprised of the plan, and the landowner and the state



Aerial view of the lower Cowlitz and Columbia rivers showing disposal sites. Rainier Fill eliminated overwidth river section across from the Port of Longview.

of Oregon reached an agreement on transfer of ownership. The latter was made possible by timely action on the part of the State in establishing a fair value for covered river bottom and by the riparian owner in agreeing to make payment to the State and to replace his waterfront structures that would be covered by the fill.

In addition to providing an area to dispose of approximately six million cubic yards of mudflow material, it is anticipated that the engineering of the plan will save millions of dollars in dredging costs in future years by retarding the settling of eroding mudflow materials in the channel and Port of Longview mooring berths. It is expected the eroded mudflow materials will tend to continue on through the narrowed river area and deposit in areas less critical downstream. Dredging can then be scheduled on a more efficient basis and where disposal areas are more readily available.

C. BERMAN PLAN

Initial dredging efforts were directed toward restoration of the 40 by 600 foot navigation channel. In late June 1980, however, as sensitive hydrographic surveys fully outlined the magnitude and location of the total 45 million cubic yards of infill, it was realized that excavation of the channel project would not be enough to provide long-term stability. The remaining mudflow materials in the river would continue to erode until the river re-established its hydraulic section during high flow periods.

This eroded material would result in intermittent and unpredictable infill of the navigation channel downstream in future years. An engineering study was initiated to determine the extent of additional dredging required to provide a nearly stable hydraulic channel as soon as possible. A consultant was utilized to study these problems and recommend solutions to District personnel. Figure 10 illustrates the plan purposed by the consultant and adopted by the Portland District.

It was anticipated that a total of nine million cubic yards in addition to the 14 million already excavated from the channel would have to be removed to provide a 90 percent re-establishment of the hydraulic section. The "90 percent" effort is all that was practical and recommended because restoration of the remaining 10 percent would not be cost effective. Removal volume to improve the hydraulic capacity would involve increasingly greater volumes for each added percent of improvement. A contract for $10,386,000 was awarded in January 1981 for dredging of an additional six million yards. This would supplement continued excavation by the Port of Portland's dredge OREGON to provide the stable hydraulic section. This project will be complete by June 1982.

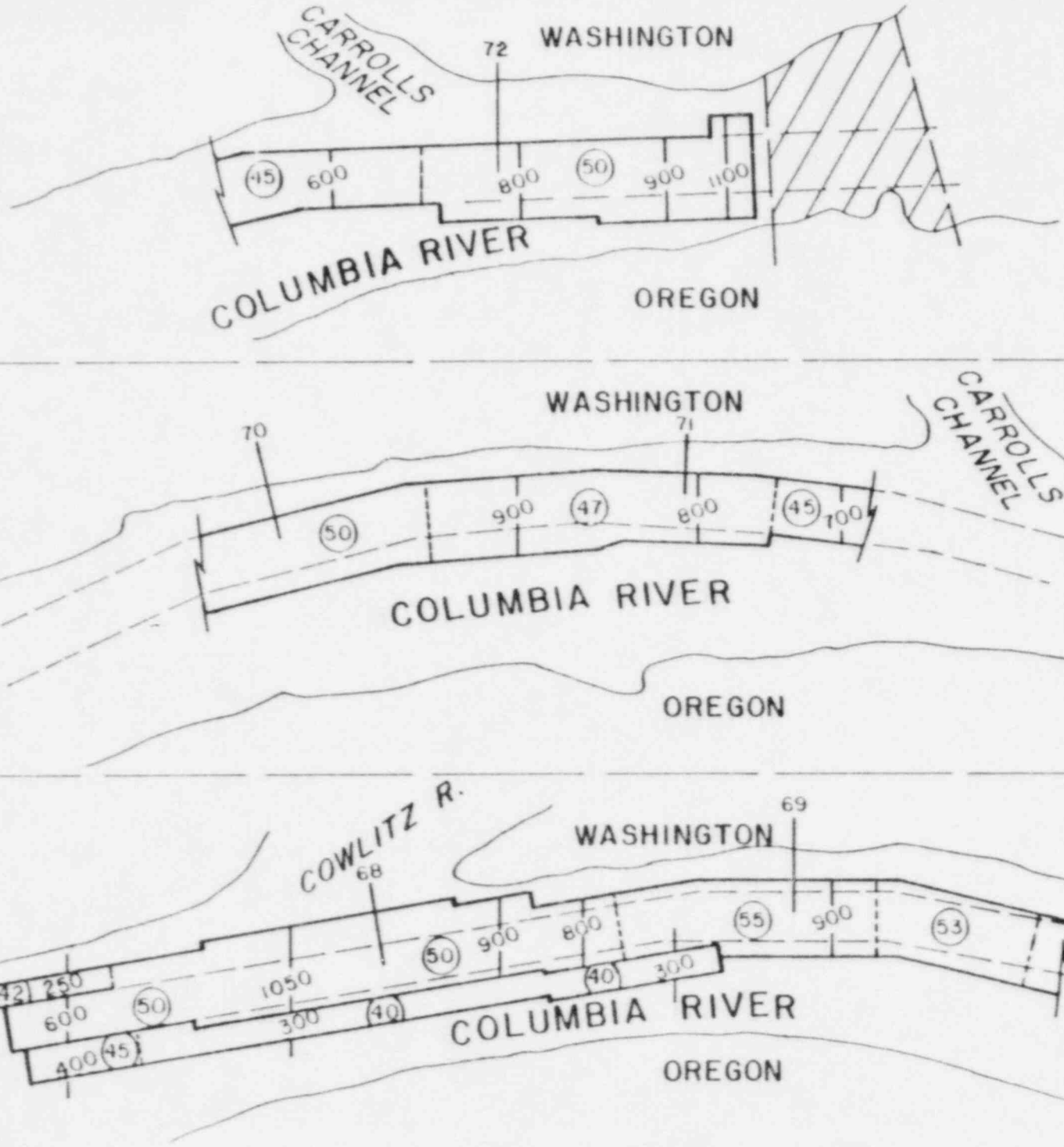
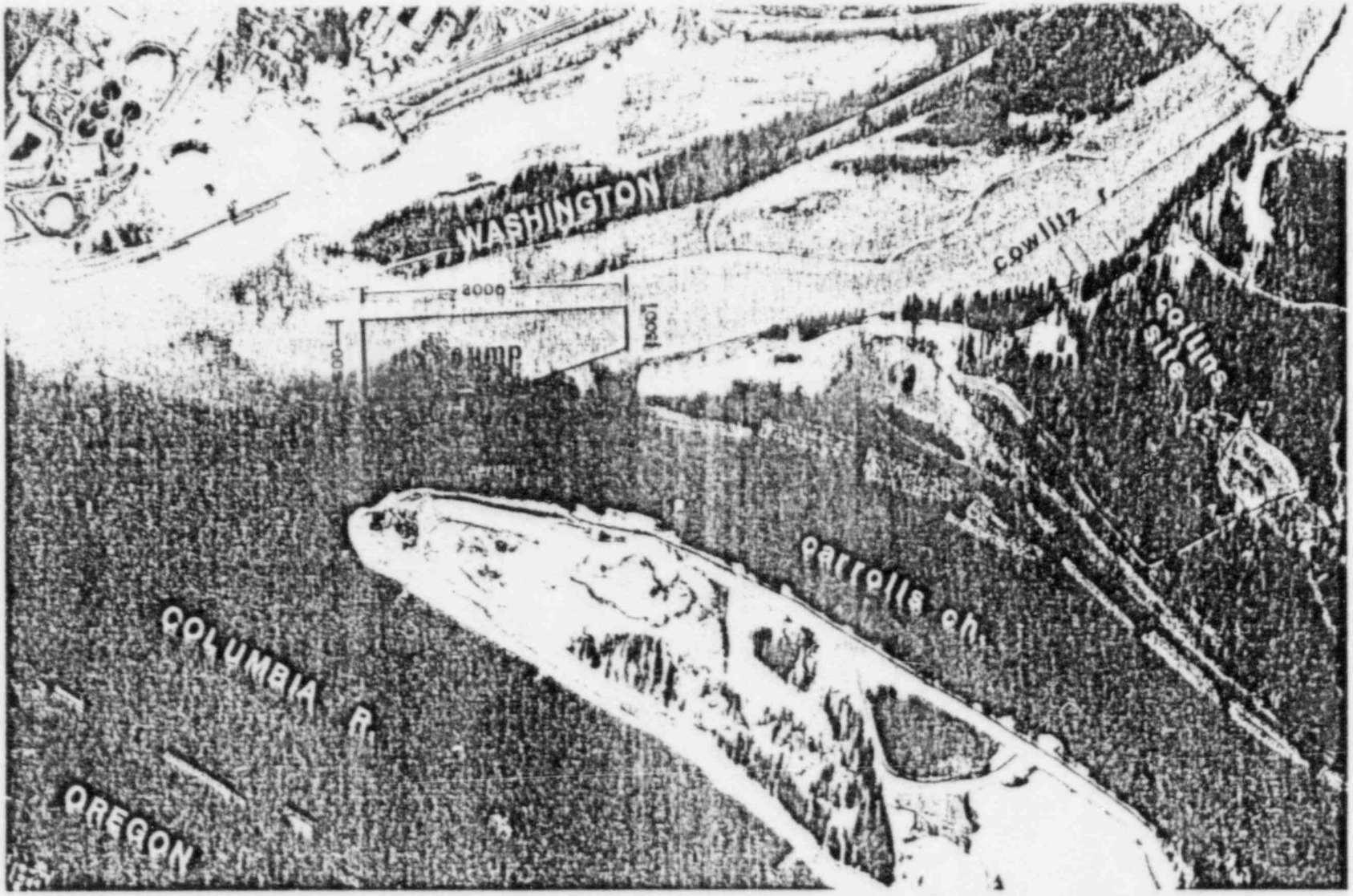

CARROLLS CHANNEL
72
WASHINGTON
45
600
800
50
900
1100
COLUMBIA RIVER
OREGON
WASHINGTON
CARROLLS CHANNEL
70
71
50
900
47
800
45
700
COLUMBIA RIVER
OREGON
COWLITZ R.
69
WASHINGTON
67
68
42
250
600
50
1050
50
900
800
55
900
53
400
45
300
40
300
40
COLUMBIA RIVER
OREGON

FIGURE 9

D. SUMP

In addition to the Rainier Fill and the additional hydraulic channel excavation as described above, measures were also considered to minimize future impacts of erosion of materials from the Toutle and Cowlitz River valleys and their transport into the Columbia River, resulting in possible disruption of navigation traffic. As part of the dredging operation accomplished in the first year, a sump was excavated at the mouth of the Cowlitz River to intercept material being transported down the Cowlitz. The purpose of the sump is to provide a location for a large dredge to remove the materials prior to their reaching the Columbia River channel. The sump currently being utilized is shown on Figure 10. Removal of up to two million cubic yards of additional material from the sump area was also provided as part of the contract discussed in paragraph C. The material removed from the sump is being placed in a disposal area known as the Collins Estate. The Collins Estate consists of a privately owned large acreage of land that includes considerable wetland areas. The Portland District has diked off a portion of the site and will expand it only as necessary in future years to minimize impacts to the surrounding wildlife habitat and wetland area.



Cowlitz Sump

Figure 10

d. FLOOD CONTROL RESTORATION

A. Lower Cowlitz

Approximately 11 million cubic yards of infill were removed by pipeline dredges from the lower Cowlitz River (R.M. 0 to 9) by November 1980. Work in the lower Cowlitz River by dredges was phased out over the months of February, March and April. Twenty million cubic yards total were removed from the lower Cowlitz. Figure 11 lists contractors and equipment utilized in this area.

With 85 percent of the flood carrying capacity eliminated by mudflow deposits as shown in Figure 5, it was clear that channel excavation was required at an early date. The lower nine miles of the Cowlitz River passes through an urban area where the majority of the communities are protected by flood control levees. A lack of adequate disposal areas, or the extensive work required to prepare them, led to a decision that all work in the lower nine miles would be accomplished by pipeline dredges which could pump dredged materials some distances, contracted on an hourly rental basis. Dredging was started in this reach of the river with (letter) contracts to the two firms owning the only three 20" pipeline dredges available on the West Coast. Subsequent contracts for dredges used along this reach were on the basis of competitive bids for specified minimum size dredges.

Disposal areas were sparse and frequently several hundred to several thousand feet from the river channel. Recognizing the threat of flooding from the flood season beginning in November, landowners were extremely cooperative in providing the use of their lands for disposal of material at no cost to the Government.

Early dredging activities in the lower two miles of the Cowlitz River indicated that sediment transport and deposition was continuing at a very high rate and that progress at moving upriver would be extremely time consuming. The major threat from flooding was in the reach of the river above Mile 5. Consequently, two 20" dredges, the ART REIDEL and HERB ANDERSEN, were taken overland from River Mile 1.5 to Mile 6 in order to accelerate arrival of dredging capacity in the needed area. Disassembly and reassembly methods for portable dredges, if normally followed, would require at least six weeks to accomplish. The owner, however, after extensive coordination with local police, utility companies and officials, suggested moving the dredges in essentially one piece. The moves were accomplished in one day with virtually hundreds of workmen, both public and private, involved. This spirit of cooperation and assistance by the communities and contractors was evident throughout the recovery effort and contributed significantly to its overall success.

The ART REIDEL was out of service a total of seven days, the HERB ANDERSON for fifteen days. The heavy hauling equipment used to move the 350 and 500 ton loads required 58 wheels and 72 wheels, respectively.

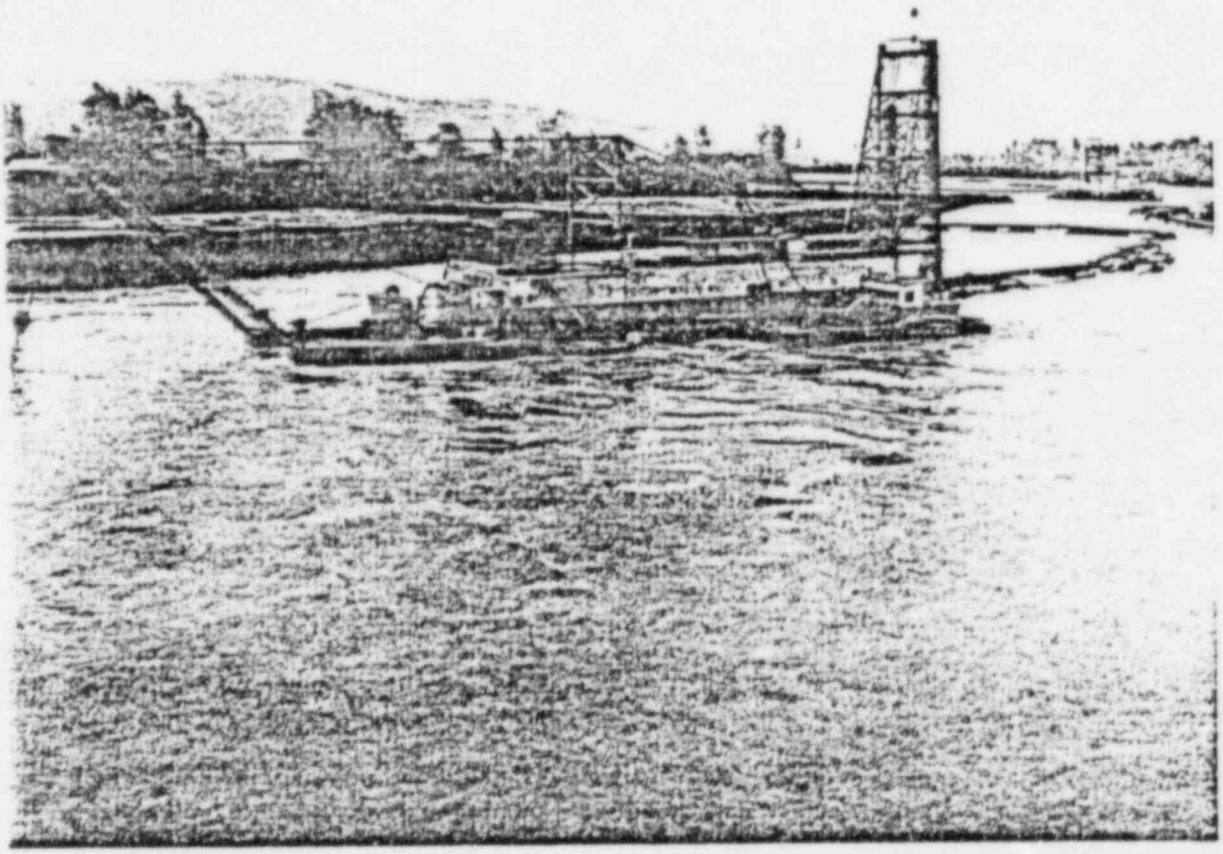
DREDGES USED TO RESTORE FLOOD CONTROL CHANNEL IN LOWER COWLITZ RIVER - RM 0 to 9

Name	Size	Type	Pump Horsepower	Owner	Date Started	Date Completed	Original Location	Approximate C.Y. Removed
Pipeline Dredges								
MISSOURI	22"	Diesel-Elec	2500	A	23 Jun 80	31 Jan 81	Puget Sound, WA	4,900,000
HUSKY	20"	Diesel	2800	B	18 Jun 80	19 Jan 81	Puget Sound, WA	3,595,596
ART RIEDEL	20"	Diesel	1850	C	9 Jun 80	3 Apr 81	San Francisco, CA	4,000,000
H. ANDERSON	20"	Diesel	1850	C	19 Jun 80	11 Mar 81	Portland, OR	2,600,000
CORNELIA B.	20"	Diesel	1900	D	13 Sep 80	4 Apr 81	Northern Alberta, Can.	1,800,000
MR. GUS	16"	Diesel	900	C	20 Aug 80	3 Apr 81	Corvallis, OR	1,500,000
HOWARD	16"	Diesel	2700	E	7 Sep 80	18 Apr 81	Minnesota	2,000,000
Boosters								
#1	20"	Electric	1000	C	17 Aug 80			
#2	20"	Electric	1500	C	10 Oct 80			
#3	20"	Electric	2500	C	19 Oct 80			

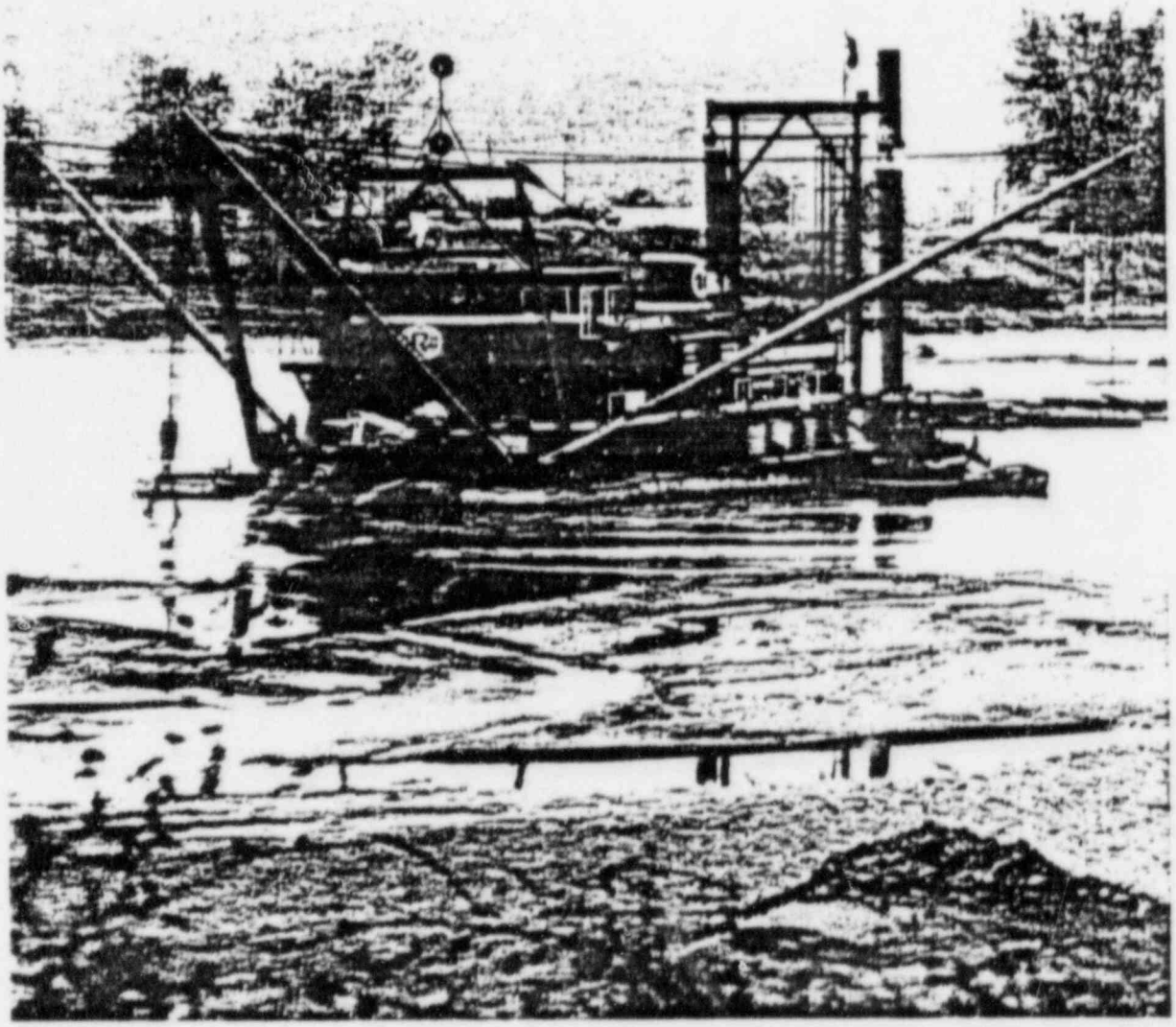
Owners

A - General Construction Co., Seattle, WA
B - Manson-Osberg Construction Co., Seattle, WA
C - Western Pacific Dredging Corp., Portland, OR
D - Coast Marine Construction Co., Portland, OR
E - Robers Dredge, Inc., La Crosse, WI

FIGURE 11



Pipeline dredges HUSKY and MISSOURI (background) in the Cowlitz River.



Pipeline dredge ART REIDEL, SR., working in the Cowlitz River.

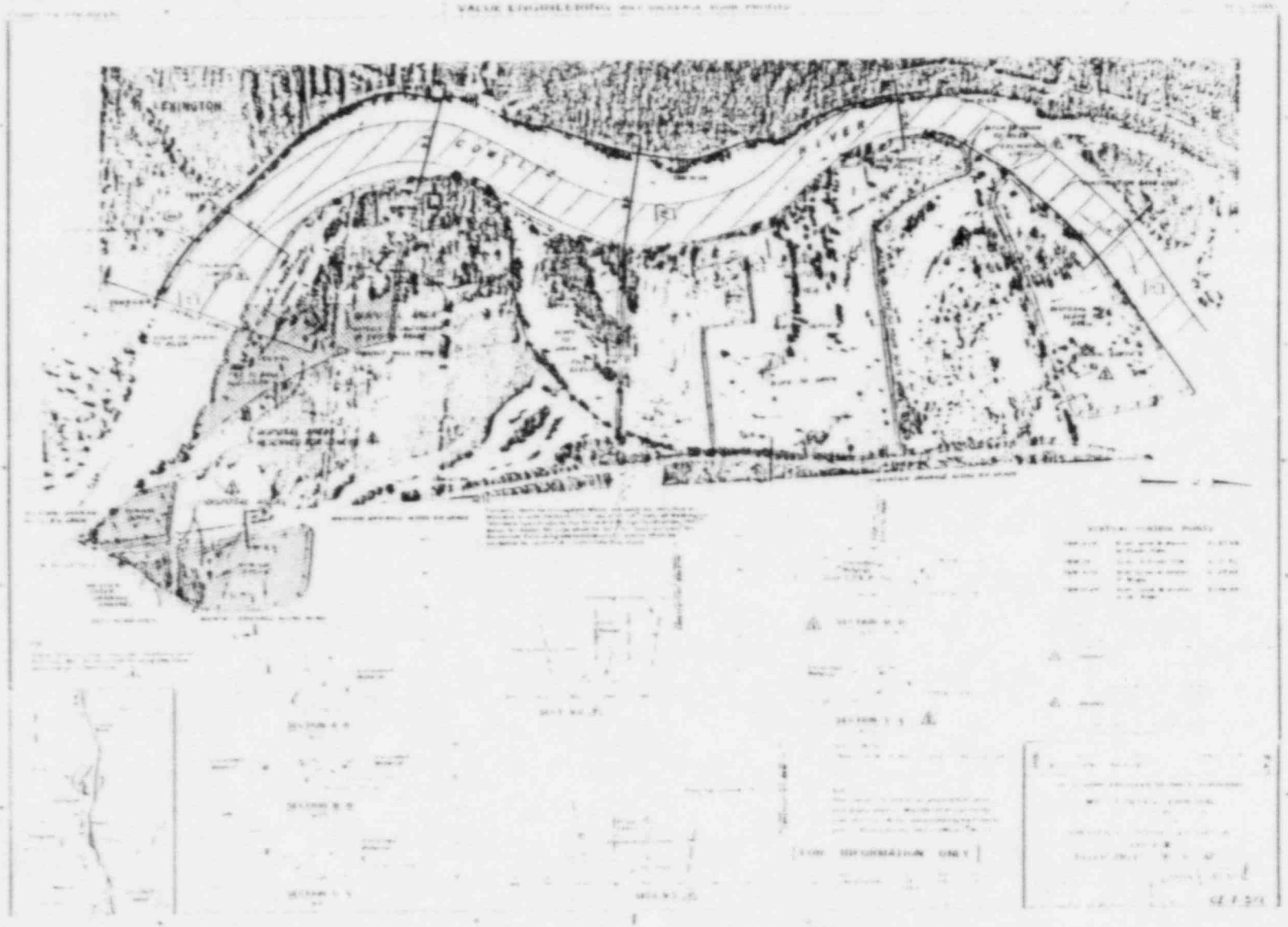
Overland move of 350-ton ART REIDEL, SR.

Pipeline dredges at launching site in the Cowlitz River. Islands in the shoaled riverbed and the mudfill outside the riverbank show impact of eruption mudflows.

B. Upper Cowlitz

On the reach of the Cowlitz from Mile 9 to 22.5, the mudflow had deposited material over the majority of the valley floor for a width of about one mile. Landowners in this reach were willing to receive fill material on their lands to raise the area above flood level. It was determined that contracts for excavating the channel in this reach be on a fixed price basis by measurement of material in the disposal area. An option for establishing settlement markers removed one of the concerns to bidders. The river was broken into contract sections of one to three miles so that multiple contractors and maximum resources could be devoted to the work, providing the best likelihood of completion by late 1980. Specifications for the work in restoring the river channel were written for the opportunity of not only dredging contractors, but also contractors more accustomed to road building. Competion was keen with as many as 16 bids submitted on some jobs. Figure 12 shows a typical contract drawing used for the upper Cowlitz work.

By November, approximately 16 million cubic yards of material were removed from the Cowlitz River between miles 9 and 21. By the time work was phased out in the summer of 1981, a total of nearly 56 million cubic yards had been removed from the Cowlitz River. A 50,000 cfs channel capacity was achieved earlier in December. Figure 13 lists contractors and equipment utilized on the Cowlitz.



Upper Cowlitz River

Figure 12

COWLITZ RIVER DREDGING AND EXCAVATION

Contractor	Original Contract Amount
LaDuke Construction & Krumdieck Inc., Portland, OR	$ 67,702
Harry Claterbos Co., Astoria, OR	14,764,000
M. A. Segali, Inc., Tukwila, WA	7,440,000
Canonie Construction Co., South Haven, MI	15,711,000
Capitol Development Co,. Lacy, WA	7,958,000
Blickle Co., Portland, OR	396,356
Ross Island Sand & Gravel, Portland, OR	1,449,890
Robers Dredge Inc., LaCrosse, WI	1,197,133
Coast Marine Construction, Portland, OR	1,146,250
Canonie Bultema Pacific Corp., South Haven, MI	3,377,000
Marine Leasing Co. of North West, Vancouver, WA	122,440
LaDuke Construction, Eugene, OR	188,994
Coast Marine Construction, Portland, OR	121,640
Pepiot Forest Construction, Sutherline, OR	91,145
Oregon Paiute Construction, Burns, OR	86,020
Manson-Osberg, Seattle, WA	3,562,676
Western Pacific Dredging-Riedel Int'l., Portland, OR	6,127,644
General Construction Co., Portland, OR	2,234,966
Pepiot Forest Construction, Sutherlin, OR	170,508
Jim Winston & Sons, Battleground, WA	1,317,948
White Buffalo Construction, Aumsville, OR	79,674

FIGURE 13

Contractor	Original Contract Amount
White Buffalo Construction, Aumsville, OR	$ 79,674
Martinez General Construction, Oregon City, Or	77,455
C. Mourer Construction, Puyallup, WA	493,500
Jim Winston & Sons, Battleground, WA	99,925
Pacific Pump, Portland, OR	230,000
Jim Winston & Sons, Battleground, WA	360,514
Jerry Carter Company, Carson, WA	431,562
Ross Island Sand & Gravel, Portland, OR	1,449,890
Jim Winston & Sons, Battleground, WA	286,730
Grady Construction, Kelso, WA	288,150
Robert Robles and Associates, Tigard, OR	650,107
Ostrander Rock and Construction Co. Kelso, WA	444,600

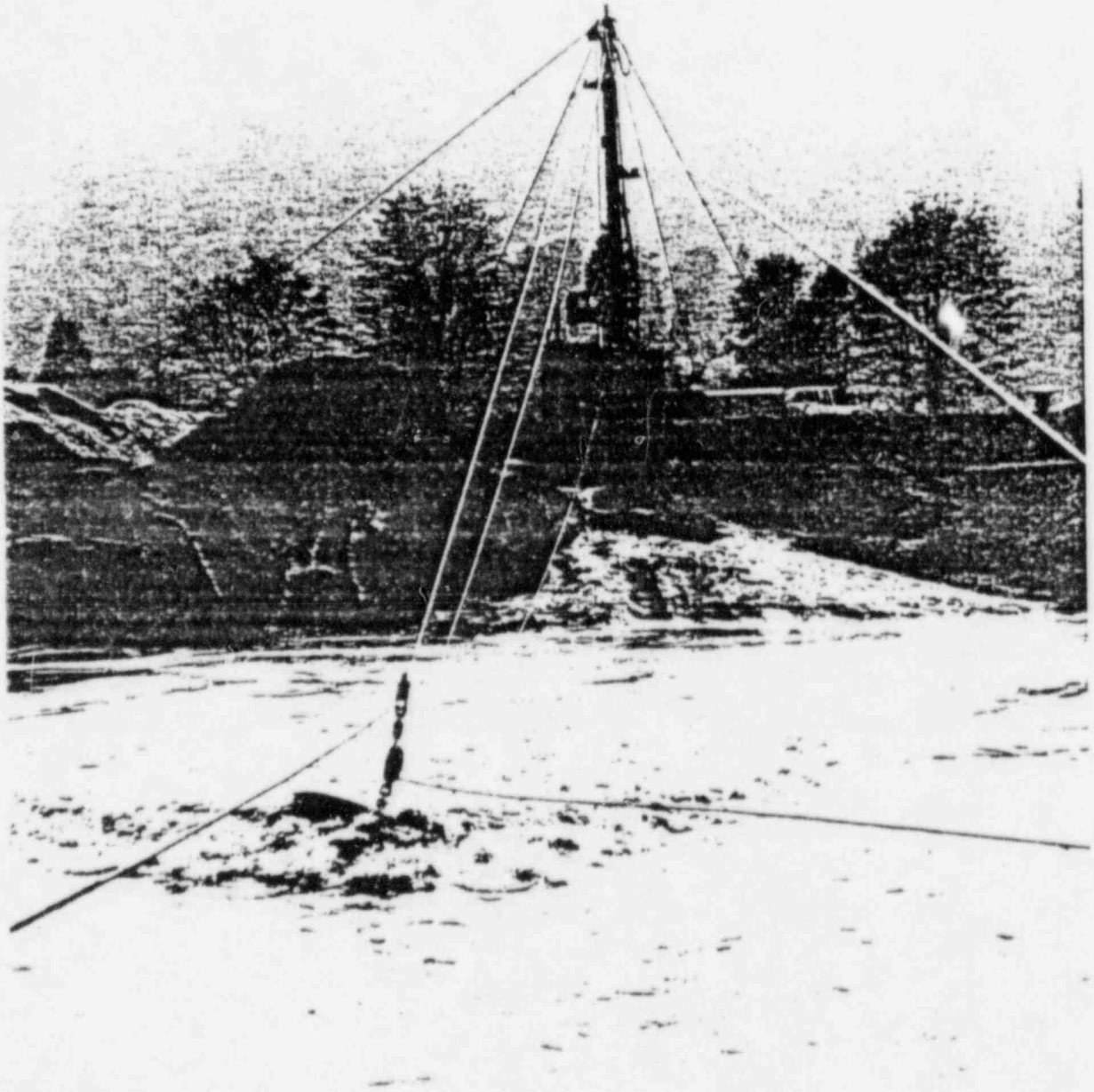
FIGURE 13

TOUTLE RIVER DREDGING

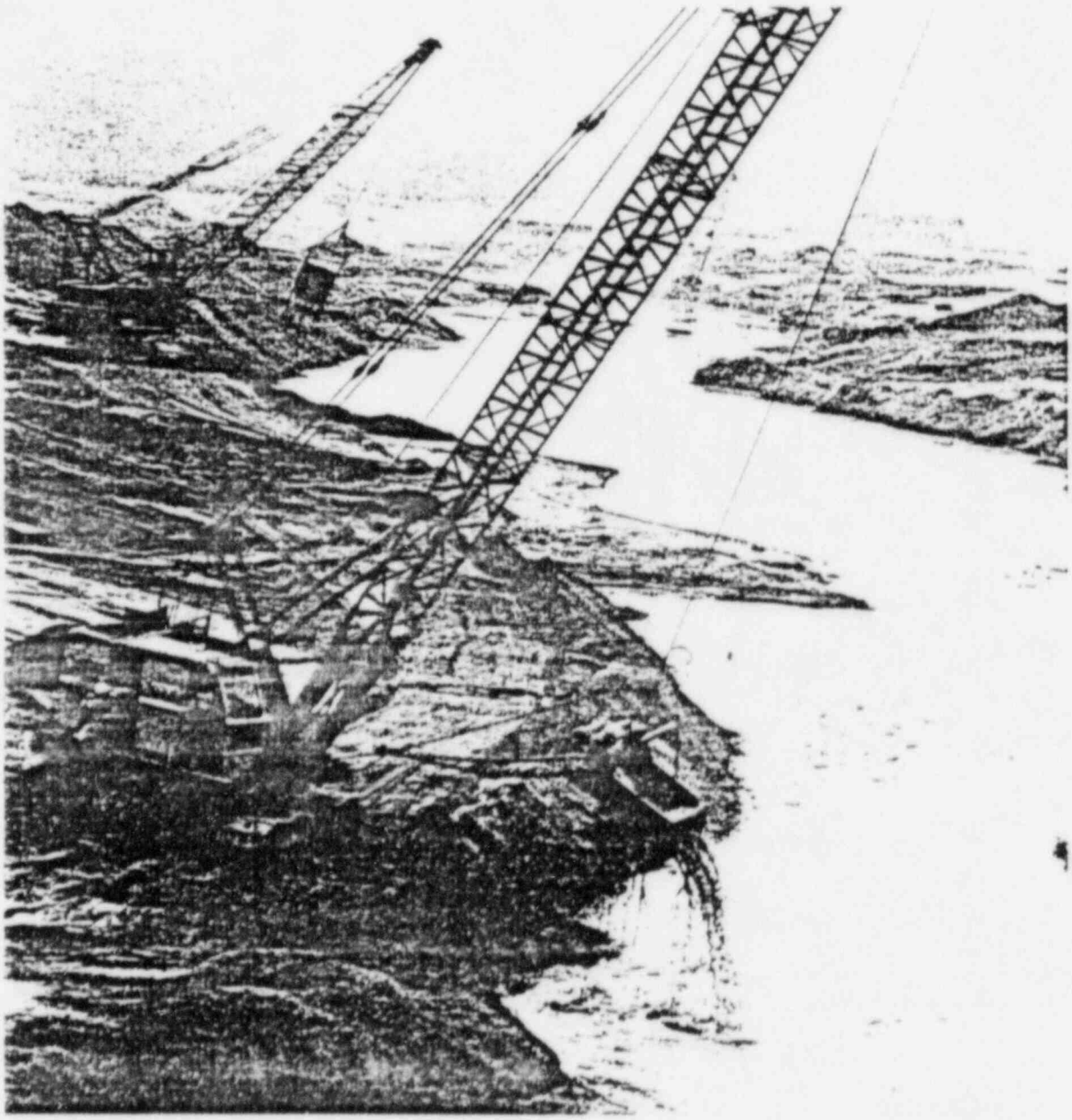
Contractor	Original Contract Amount
Brusco Booming and Dredging, Longview, WA	$ 984,000
Canonie Bultema Pacific Corp., South Haven, MI	1,577,000
Wilber Peterson and Sons, Inc., Pleasant Hill, OR	837,850
C. Mourer Construction, Puyallup, WA	2,645,000
Mountain Engineering and Construction, Bozeman, MT	803,000
Elting, Inc., Clackamas, OR	966,800
Chris Hale Construction, Unalaska, WA	143,000
* Nestaval Corp., Kelso, WA	1,493,000
* Robert Robles and Associates, Tigard, OR	30,990
* Claterbos Co. & Wayne Construction, Astoria, OR	37,842,000

* Contracts for maintenance of debris retaining structures, not including contracts for construction.

FIGURE 13

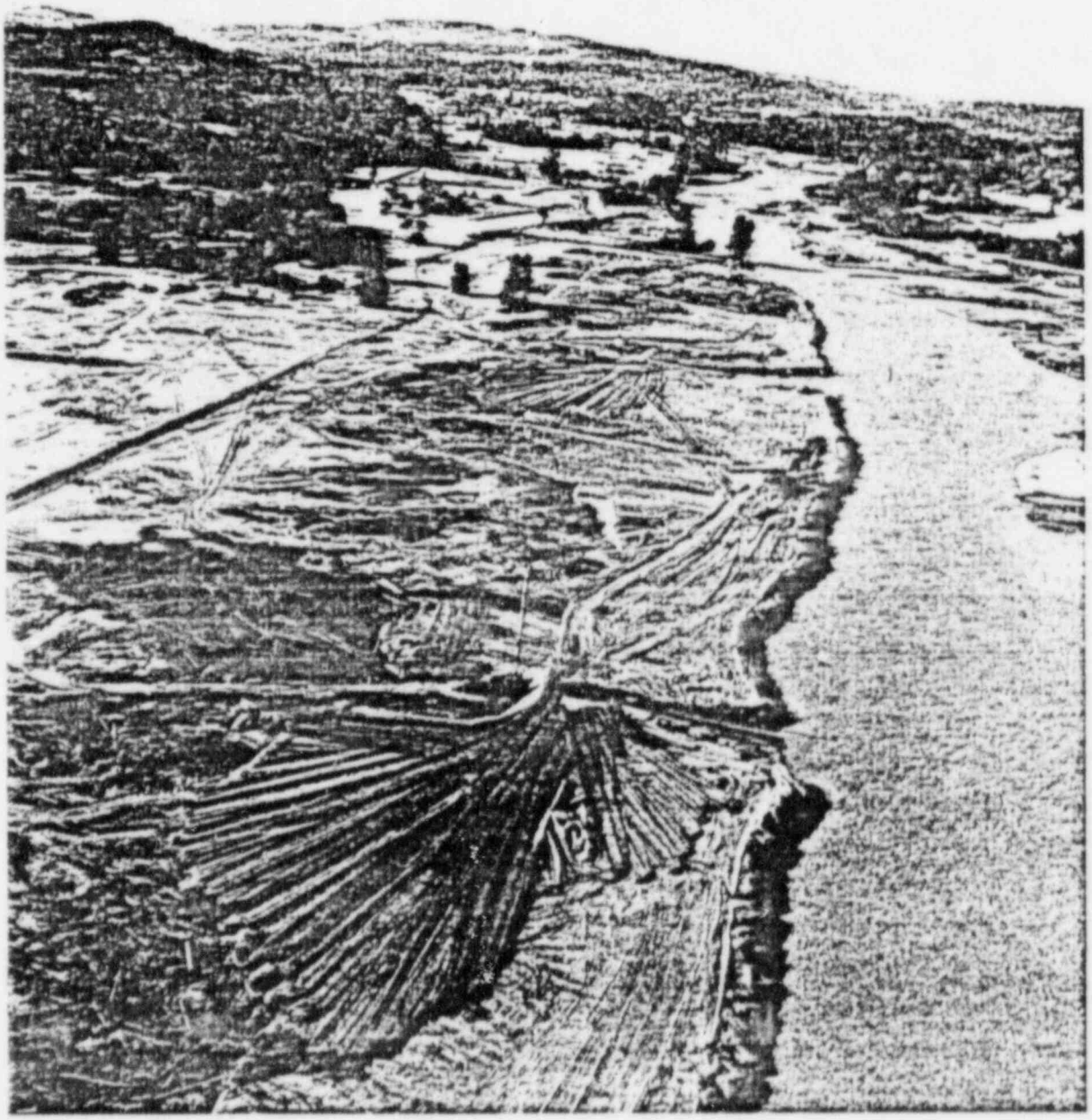


Highlines on the upper Cowlitz River.



Draglines on the lower Toutle River.

Disposal sites (open-space areas) available along sections of the lower Cowlitz River.



Lexington disposal sites after dredging.

C. Levees

After determining that the target to be accomplished by the fall of 1980 was restoration of a 50,000 cfs flood control channel, it was recognized that larger floods could occur and a long-range plan was needed for additional flood protection for the urbanized areas. A system of levee improvements was designed to provide 500-year protection for all urbanized areas along the Cowlitz downstream of the Toutle River. Figure 14 shows the levee rebuilding plan. Approximately seven miles of levee were raised and extended during the winter and spring of 1980-1981.

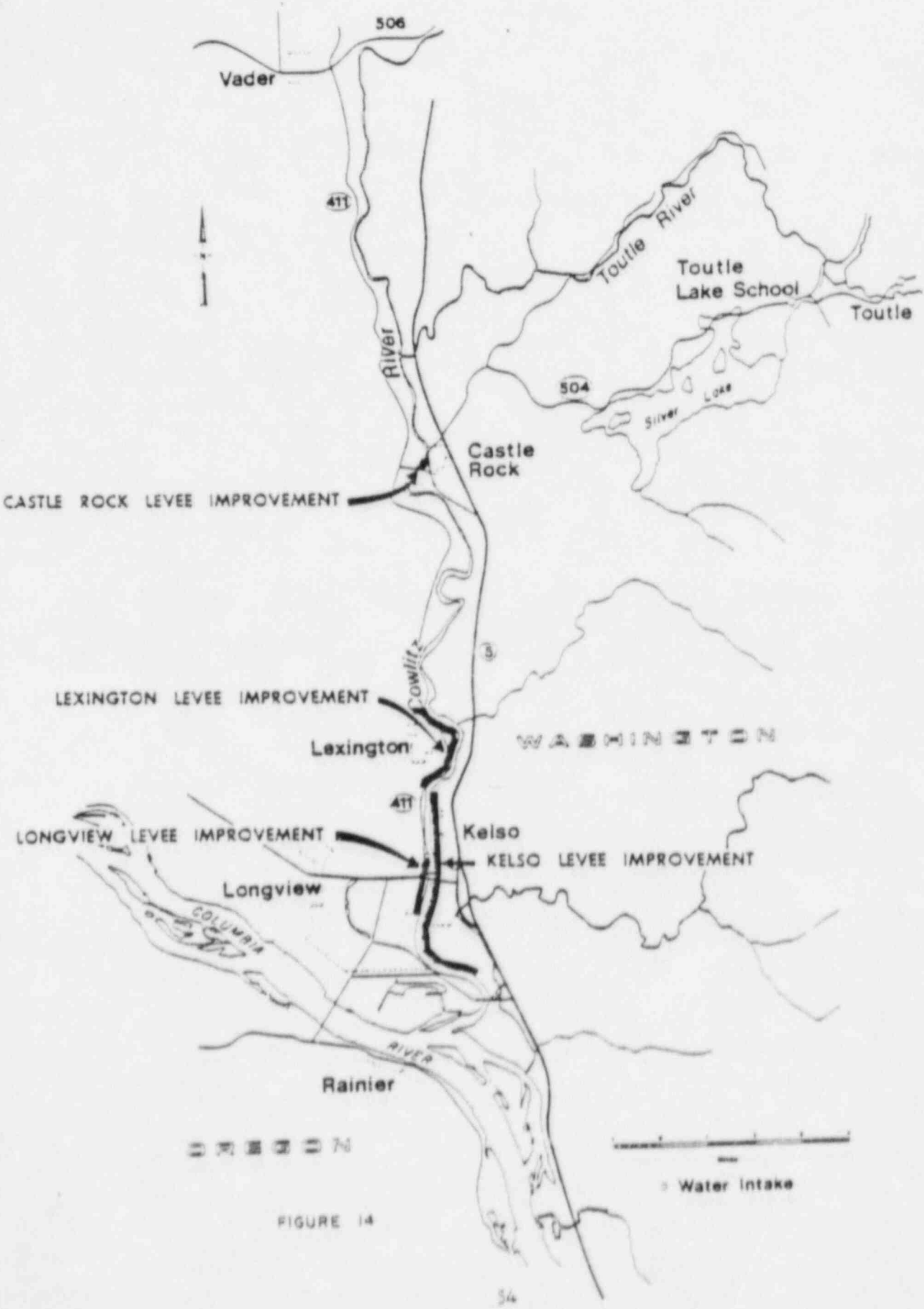

506
Vader
411
Toutle River
Toutle
Lake School
Toutle
River
504
Silver Lake
Castle
Rock
CASTLE ROCK LEVEE IMPROVEMENT
Cowlitz
5
LEXINGTON LEVEE IMPROVEMENT
Lexington
WASHINGTON
411
LONGVIEW LEVEE IMPROVEMENT
Kelso
KELSO LEVEE IMPROVEMENT
Longview
COLUMBIA
RIVER
Rainier
OREGON
Water Intake

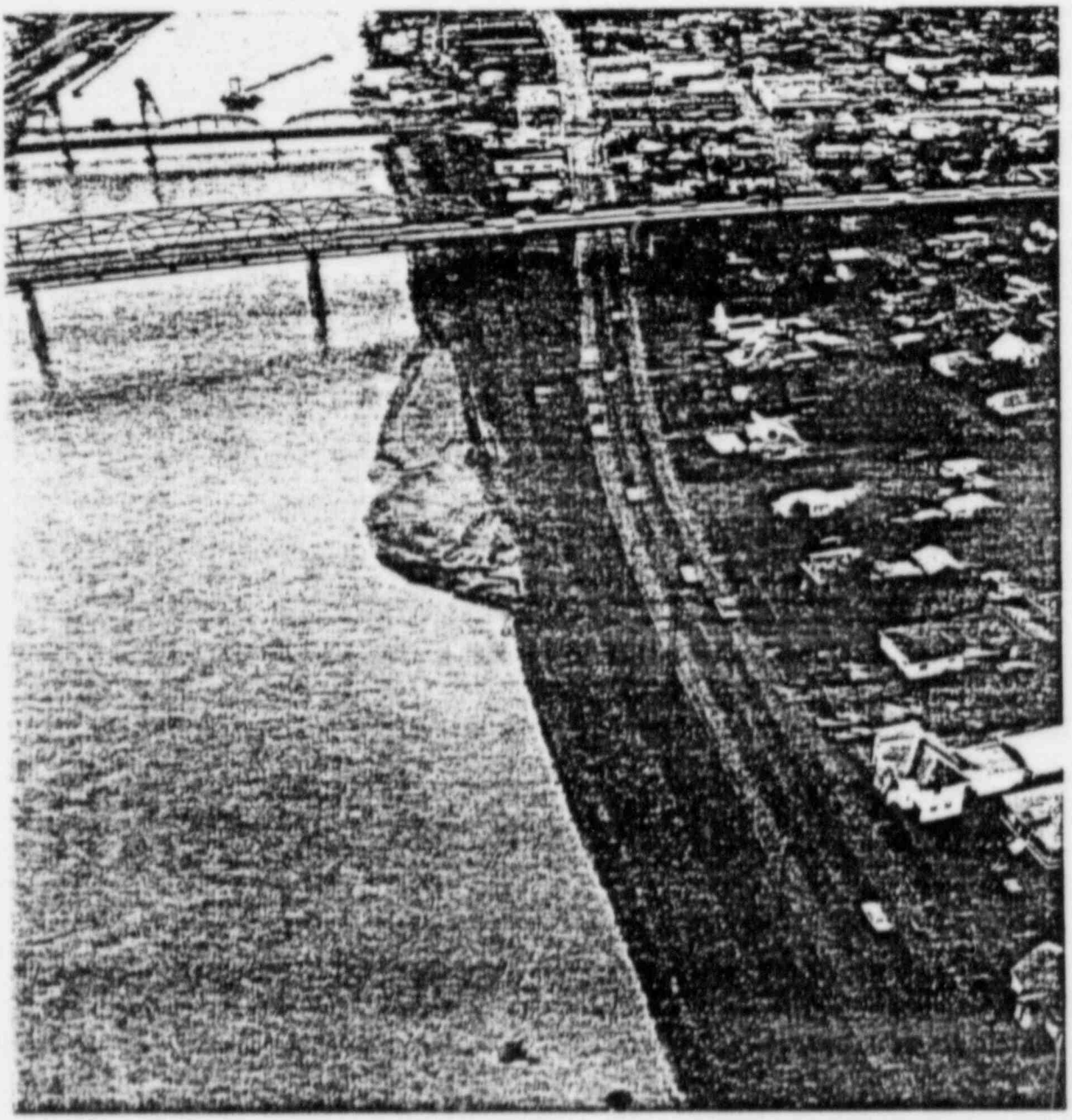
FIGURE 14

CONTRACTORS FOR COWLITZ LEVEE PROJECTS

Location	Contractor	Amount	Award Date	Completion Date
Castle Rock	Kerco, Inc Lakeview, OR	$ 659,700	19 Sep 1980	Dec 1980
Lexington	Peter Kiewit & Sons Co. Vancouver, WA	5,730,000	15 Sep 1980	May 1981
Longview	Grady Constr. Co. Longview, WA	582,000	8 Oct 1980	Dec 1980
Kelso	Eldridge Constr. Co.	4,245,000	27 Oct 1980	May 1981

FIGURE 15

Levee improvements at Lexington.



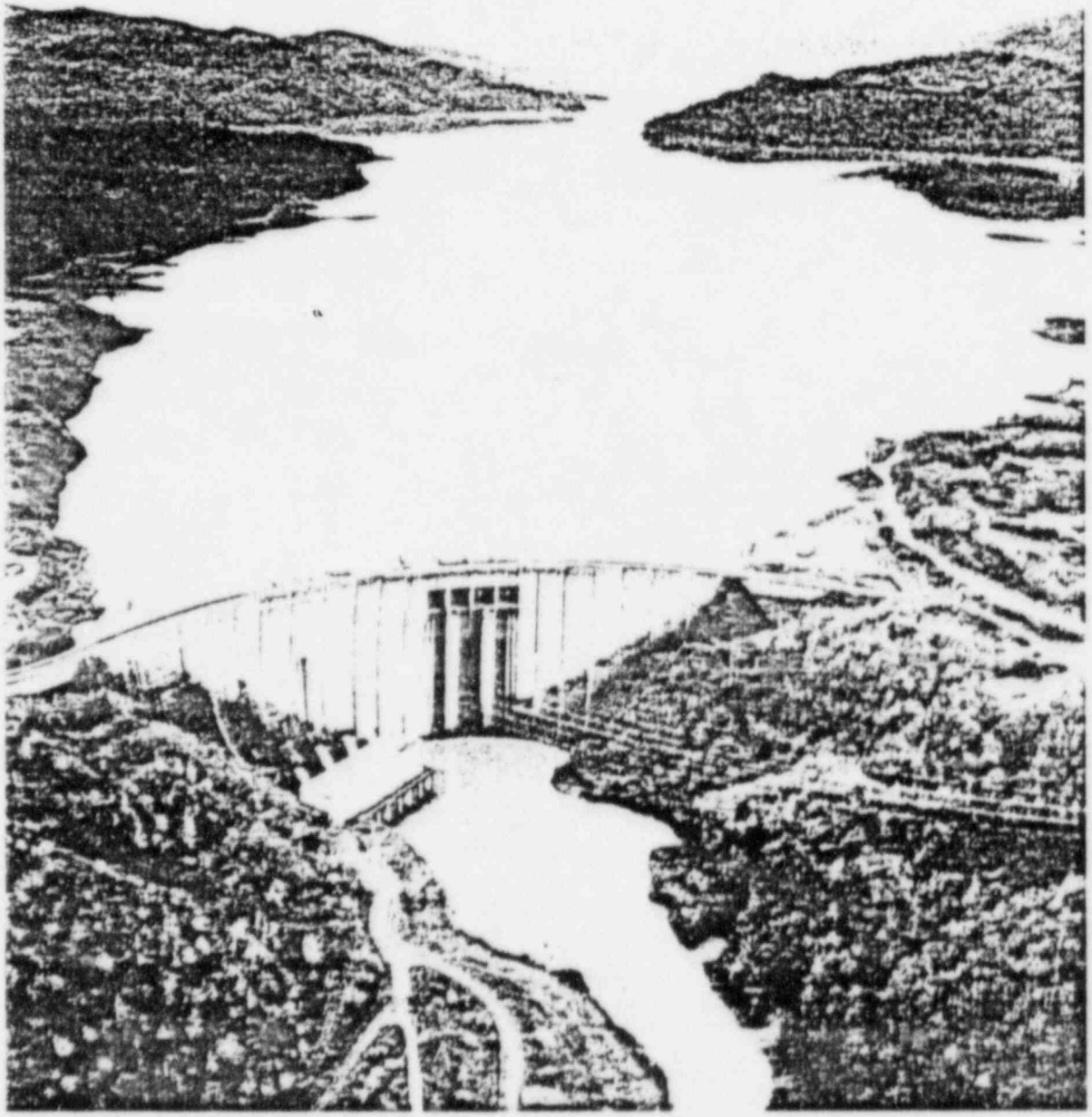
Levees under construction at Kelso.

10. PROTECTIVE PROGRAM

A. Storage

Besides excavation of the Cowlitz channel to attain a 50,000 cfs capacity and the improvements to existing levees, an additional degree of flood protection was provided by buying flood control storage from hydro-power reservoirs on the upper Cowlitz River. This was made possible through a cooperative agreement with Tacoma City Light. The target capacity to be available at the Mossyrock Dam reservoir by October was about 620,000 acre feet. It was anticipated that the cost for this storage could amount to $8 million for the 1980-1981 season. The final cost, however, was $467,000. The large savings were realized through a complex system of power trading worked out through cooperation with other utilities of the region. Extra power generated by early releases to make room for flood control storage was given to those utilities in return for power from their surplus flows in different months. The photo on page 59 shows the importance of this storage in controlling a major flood in late December 1980. It shows the Randle area, at the headwaters of the Cowlitz River, inundated by heavy flows. The photo on page 60 shows Mossyrock Dam at the same time, illustrating zero outflow at full reservoir. The storage greatly assisted the lower Cowlitz River area in reducing high flows and minimizing damages from several such flood periods during the winter of 1980-1981.

Headwaters of the Cowlitz River near Randle, Wash., during December 1980 flood.



Mossyrock Dam on the Cowlitz River during December 1980 flood with zero outflow to protect lower river areas.

B. Stabilization

Much of the mudflow material deposited in the main Toutle River valley below the north and south forks was left in heavy layers along the narrow valley. Because the Toutle River falls rapidly, future flows would erode this material at an accelerated rate with subsequent deposition in areas excavated downstream in the Cowlitz and Columbia rivers. Therefore, a plan was undertaken for stabilizing several reaches of the Toutle River by channelizing the river through the mudflow material to minimize erosion. Although this program was only partially effective in some areas, observations have concluded that it did reduce significantly the impacts of erosion of mudflow sediments downstream during the winter of 1980-1981. Continued channelization in the spring of 1981 was directed toward minimizing the impact of river flows until natural vegetation and other measures could stabilize the shoreline material.

Typical bank stabilization work on the Toutle River.

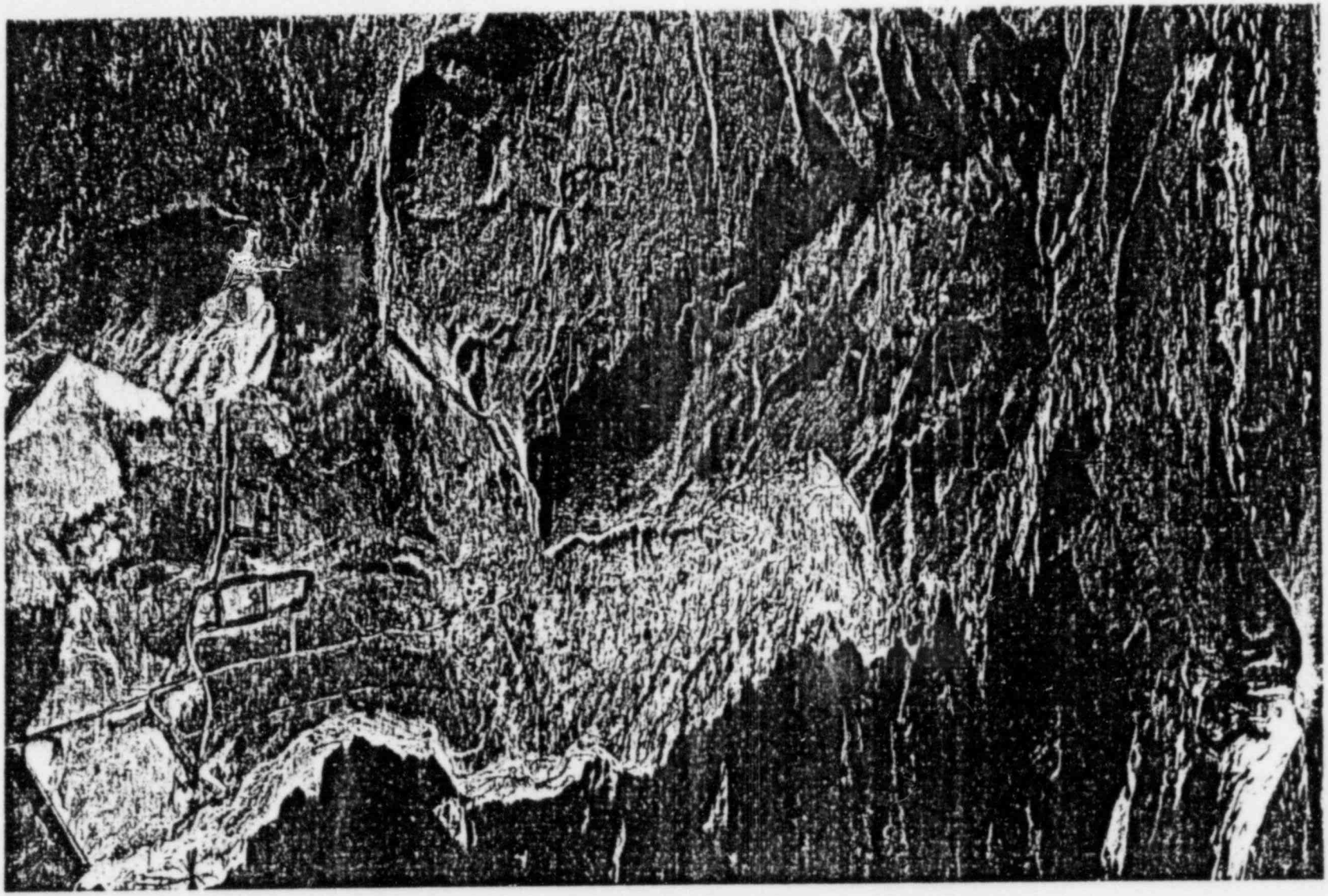
C. Debris Retaining Structures

As described earlier, a major amount of the mudflow material remains in the upper reaches of the north and south forks of the Toutle River. An estimated three billion cubic yards fill the 14 mile reach of the north fork of the Toutle River immediately northwest of the mountain. Continued infill from this material, especially during heavy runoff periods, could reclog the restored downstream channels. Control of this material for the long-term future involves measures to stabilize the sediment in place to minimize erosion transport downstream. Of the various alternatives considered, it was decided that construction of rock, weir-like debris retaining structures, or debris dams, would provide a sound solution to quickly hold the mudfill upstream. The plan selected resulted in construction of a 1.5-mile-long dam immediately downstream of the main mudflow deposit on the north fork, and a smaller dam at the lower end of deposits on the south fork. The north fork structure, constructed with rock from a nearby quarry, is approximately 43 feet high and 6,100 feet long. The south fork structure was constructed similarly to a 20 foot height and 500 foot length. Spillways were provided in both dams by using gabion wire baskets filled with rock and covered with several inches of concrete mortar. The structures would restrain and impound the material eroded from the mudfills upstream, allowing removal by excavation equipment to nearby spoils areas. Both debris dams were completed by October 1980 in time for the fall rainy season. Their expeditious completion was accomplished by rapid planning and design, followed by quick advertisement for bids and award of contract. Bids were advertised for the north fork structure on July 1 and a contract was let on July 8. Fourteen companies

submitted bids for the project, with proposals ranging from $10.5 million to $22.7 million. The Government estimate was $16,303,530. The contract was awarded to Washington Construction Co., Missoula, Montana.

Both debris dams withstood several high flows during the fall and winter of 1980. In December 1980 ,however, a large freshet destroyed one of two spillways on the north fork structure. It was restored by a separate contract for $2,118,500 to Mountain Engineering and Construction, Bozeman, Mont. in January and February 1981. The new spillway was constructed of roller compacted concrete adjacent to the damaged spillway, and the entire structure was raised five feet. In addition, a contract was awarded in January 1981 to Claterbos Construction, Astoria, Ore., for $37.8 million for excavation of sediments deposited behind the north fork dam. This contract provides for removal of 15,000 to 80,000 yards per day. A total of about eight million cubic yards had been excavated by August 1981. It is anticipated that both debris dams will be valuable tools in controlling future sediment transport downstream to the Toutle and Cowlitz River channels. They will also ultimately provide benefits by reducing sediment deposition in the Columbia River navigation channel.

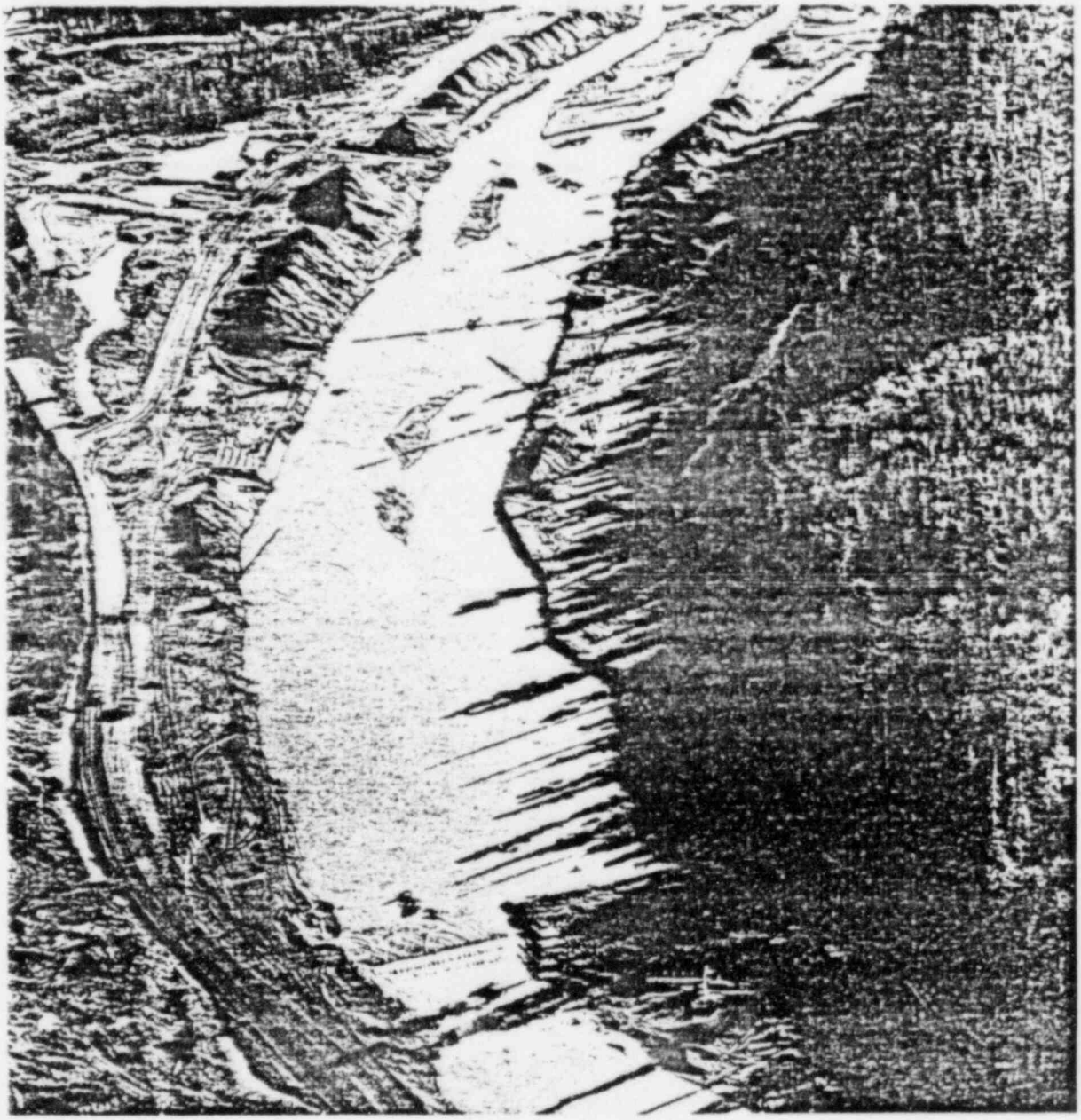
The south fork structure bids were also advertised on July 1 and a contract was awarded on July 9 for $1,656,000 to Mountain Engineering and Construction. Another contract was awarded for $1,493,000 early in 1981 to Nestavel Corp., Kelso, Wash., for excavation of materials deposited behind the south fork structure. Excavation is underway at a rate of 6,000 to 12,000 yards per day. A total of about 1.7 million cubic yards were removed by August 1981.



North Fork Toutle River mudfill with debris retaining structure in lower foreground. Sectioned disposal sites shown on the toe of the mudfill. View is to the east.

North Fork Toutle River debris retaining structure showing breached spillway caused by flood waters. New spillway under construction in foreground.

Heavy equipment removing impounded sediment from ettlement area behind North Fork Toutle River debris retaining structure.



South Fork debris retaining structure showing sediment excavation upstream and fish trap construction in right foreground.

D. Lake Outlets

The 14-mile-long mudfill and debris avalanche covering the upper north fork of the Toutle River just below the base of Mount St. Helens consisted of nearly three billion cubic yards of material. This mass of disgorged material filled the valley from wall to wall and reached depths varying from 200 to 600 feet. In areas of the mudfill close to the mountain, where thickness was greatest, the openings of many side valleys were blocked. Where these natural drainage paths were dammed, ponds or small lakes began to form. Several ponds at the mouths of smaller valleys filled rapidly in late summer of 1980, two of which eventually overtopped, sending a surge of water downstream in September and October. Those events caused minor flooding and rapid erosion of the mudfill. It was evident that more serious floods could occur later if any of the larger lakes overtopped. It was anticipated that the next lake to overtop would be Jackson Lake on the south side of the mudfill at the mouth of Jackson Creek. Equipment was mobilized to the site and an artificial channel was cut through the blockage to control total lake size and discharge. Meanwhile, similar planning was underway to address lakes developing at Coldwater Canyon and Castle Creek Canyon to ensure control and prevention of more severe instantaneous flooding. Observations of these larger lakes indicated that, under normal rainfall conditions, Coldwater and Castle Creek lakes would probably overtop during the winter of 1981-1982.

After foundation explorations and design were accomplished in the spring of 1981, a $2,222,000 contract was awarded for construction of an outlet channel to Coldwater Lake. This outlet was constructed during the summer months of 1981. Foundation explorations and design of a similar outlet to Castle Creek Lake were also undertaken, and construction was planned for early fall 1981. Spirit Lake will be monitored and necessary work planned as required in future years. Figure 16 shows approximate lake locations and sizes as they existed in the spring of 1981.

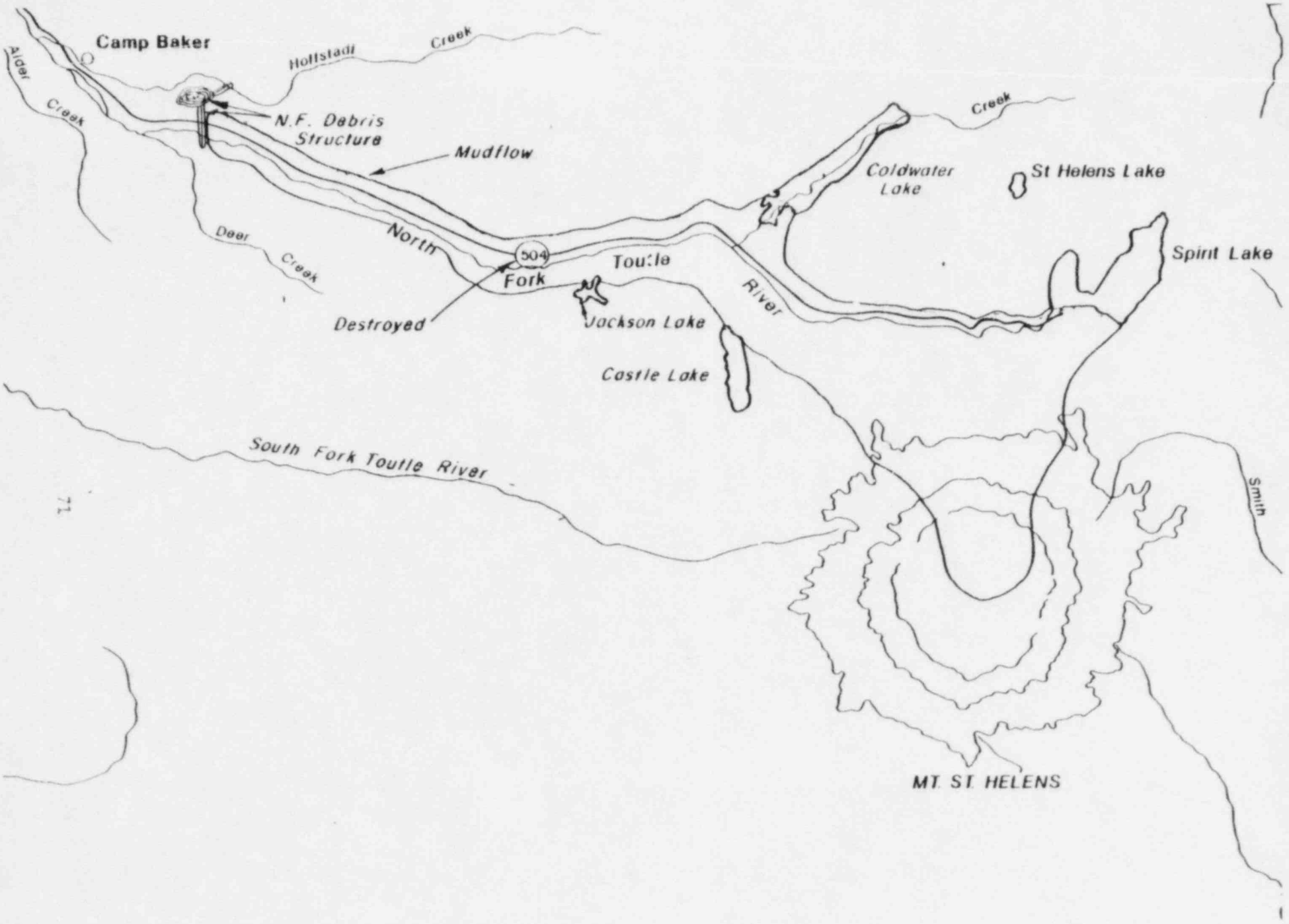
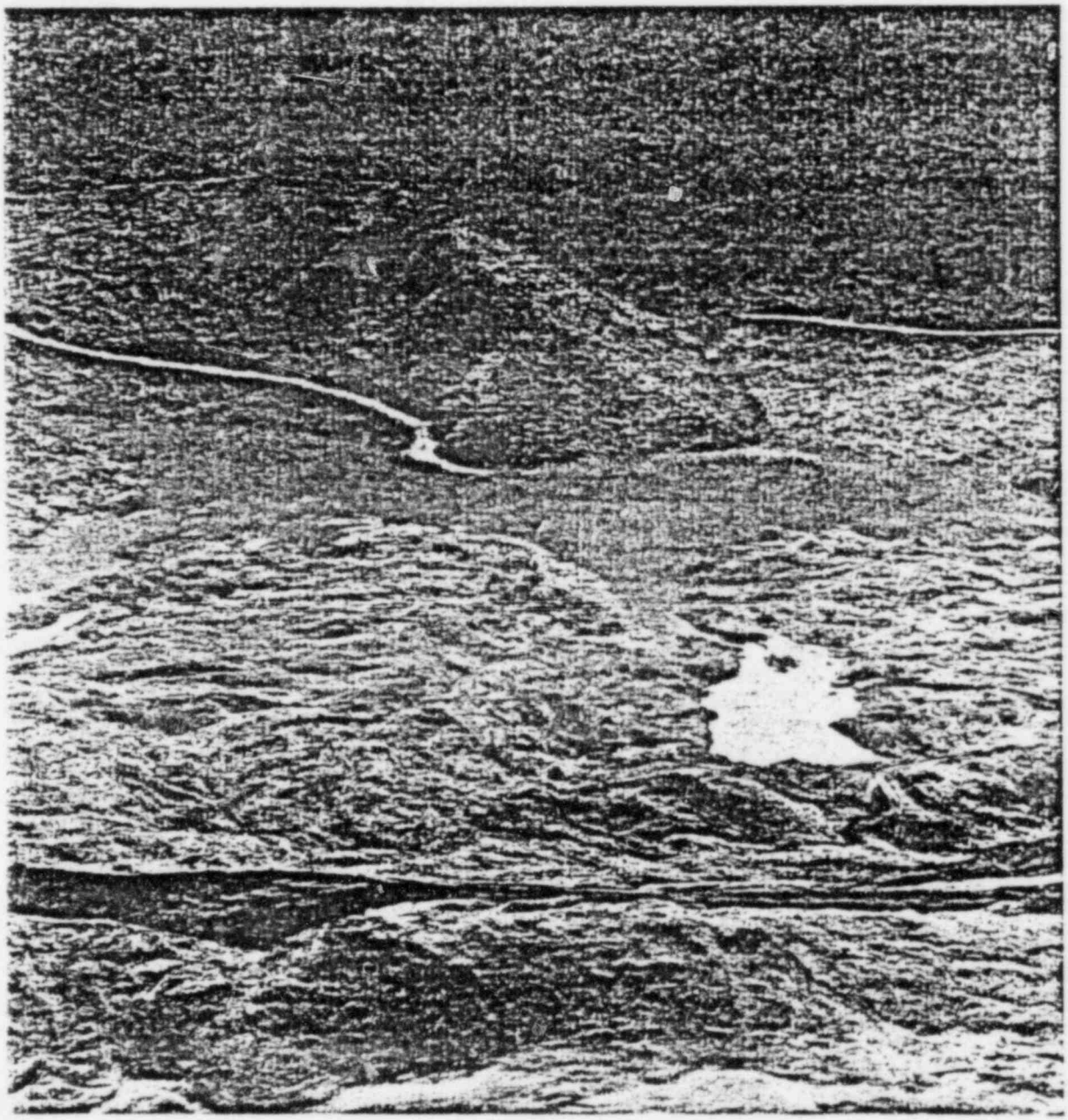
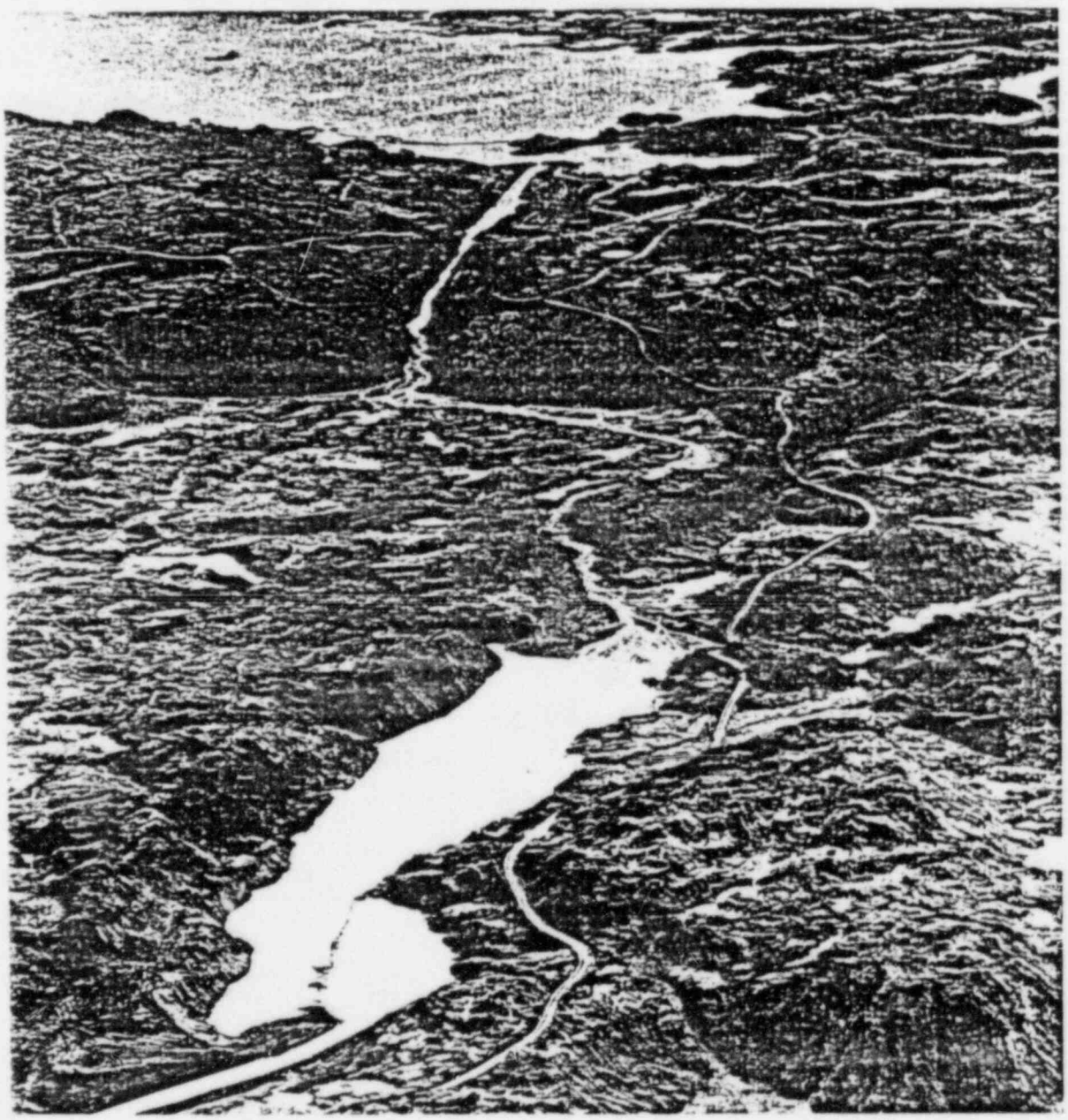

Camp Baker
Alder Creek
Hoffstadt Creek
N.F. Debris Structure
Mudflow
Deer Creek
North Fork
504
Toutle River
Destroyed
Jackson Lake
Castle Lake
Coldwater Lake
Creek
St Helens Lake
Spirit Lake
South Fork Toutle River
Smith
MT. ST. HELENS

FIGURE 16



Outlet channel work at Jackson Lake (bulldozer in front of ponding area).



Outlet channel releasing water from Coldwater Lake. Released water collects in lower ponding before draining downstream.

Upper mudfill in North Fork Toutle River. Castle Lake forming in center right canyon.

Spirit Lake showing mudfill across former outlet to North Fork Toutle River. View is to the south.

11. MISCELLANEOUS

A. Seeding

Seeding of mudflow materials and disposal areas was accomplished at varying intervals during the recovery effort. A small seeding contract was awarded in the summer of 1980 to Marmolejo - Hewson Co., Estacada, Ore., to seed approximately 1,400 acres at the toe of the mudfill on the north fork of the Toutle River. The purpose was to stabilize the mudfill immediately upstream of the north fork debris retaining structure. Seeding was accomplished by helicopter dropping grass seed incased in an adhesive-like mixture of fertilizer, which allowed the seed to germinate and grow a certain amount until it could find root in the surrounding material. This seeding program was highly successful and in the fall of 1980 grass several inches high existed in most of the areas seeded. An additional fertilizer application was applied in the spring of 1981. The Cowlitz River excavation contracts between River Mile 9 and 21 included provisions for final cleanup and seeding of disposal sites upon completion of the work. This seeding was accomplished in the spring of 1981. Another seeding contract was issued for Cowlitz disposal areas between River Mile 0 and 9 and for other sites not included in the work mentioned above. The contract was awarded to Jim Winston and Sons, Battleground, Wash., for approximately $300,000. It included substantial site preparation and grading prior to actual seeding. This work was accomplished in May 1981.

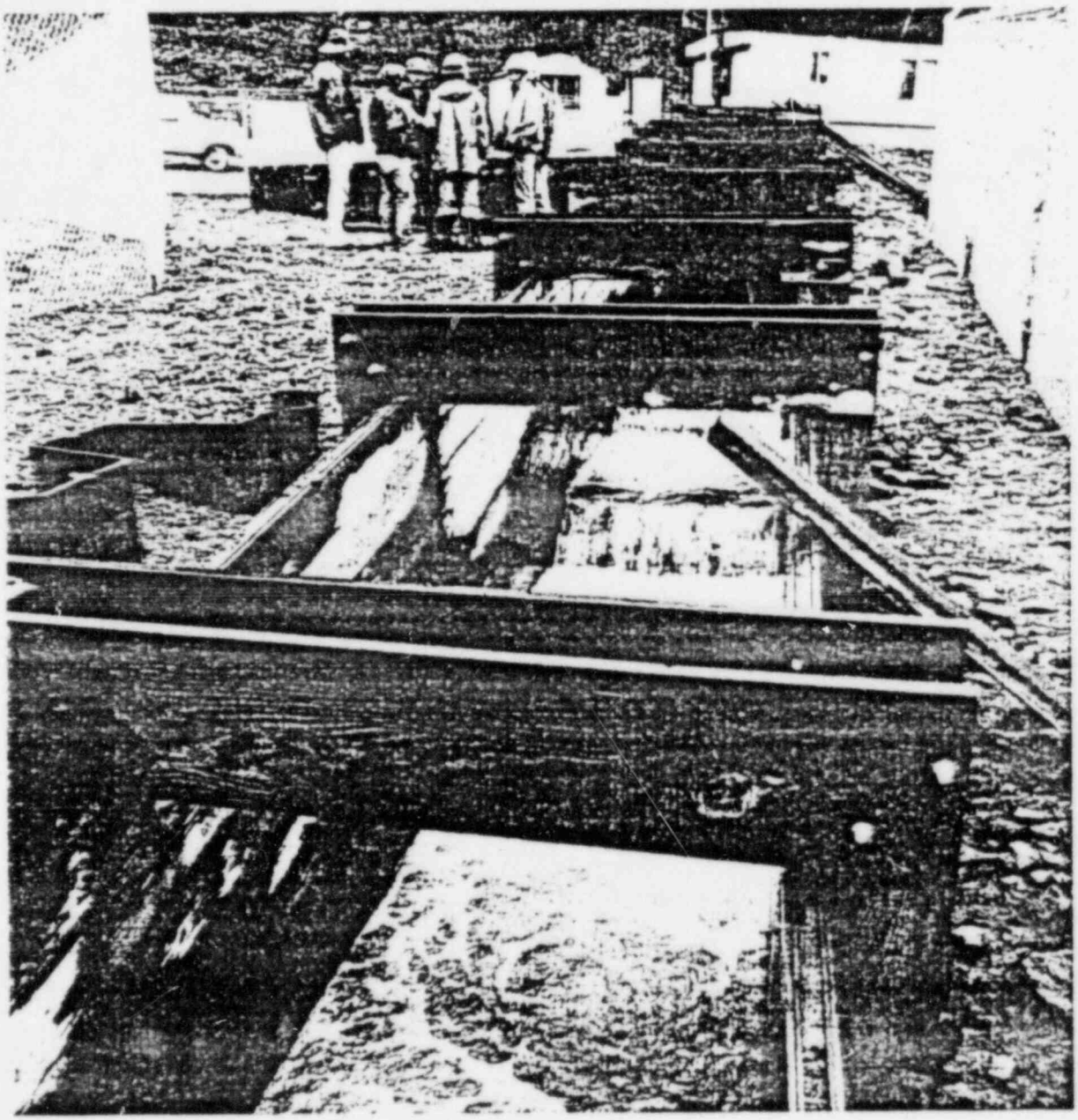
B. Fish Trap

A separate contract for $363,000 was awarded to Kerco, Inc., Lakeview, Ore., in December 1980 for construction of a fish trap facility at the south fork debris retaining structure. The facility, completed in May 1981, is being operated by the Washington State Game Department. It is designed primarily to trap steelhead trout for transfer to upriver tributaries or other more suitable undamaged streams. The facility includes a wooden fish ladder, attraction pond, approach channel, and collecting pond.

C. Riprap

Several areas on the Cowlitz River developed serious erosion problems as the river channel adjusted from the impact of massive infill. Bank protection work was undertaken where erosion problems threatened to cause substantial losses to developed property. Two small projects at River Mile 13 and 13.5 were accomplished in the months of April and May 1981. Overall cost of the work was about $700,000. Other areas of erosion are developing and are under observation. Pending availabilty of funds and the severity of those erosion problems, additional corrective measures may be taken.

Bank stabilization on the Cowlitz River.



Fish ladder at South Fork Toutle River debris retaining structure.

D. Consultants

In addition to consultants hired to assist in restoration plans for the Columbia River channel, Corps of Engineers consultants from the U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss., visited the Toutle - Cowlitz area to assess and analyze sediment transportation and geologic information compiled by other federal and state agencies. Professor Vita A. Vanonie of the California Institute of Technology, a world renowned expert on sediment transport, was enlisted to provide further review of sediment transport problems and solutions in the Cowlitz and Toutle River basins. A request by the Federal Emergency Management Agency resulted in a contract with the consulting firm of Hanner, Ross, and Sporeseen to assess problems related to the water systems for the Longview - Kelso area. Another contract with scientists from Oregon State University and the University of Washington was utilized to study potential water quality hazards of lakes where outlet channels were constructed or planned.

E. Real Estate

Real estate for disposal areas required for dredging of the Cowlitz River was secured at no cost to the Government from public and private property owners. Real estate for sediment stabilization work and the debris structures on the Toutle River were also similarly secured. Primary owners in the upper Toutle River area were the state of Washington and Weyerhaeuser Company. Land easements were obtained on a cost-free basis because they

were short-term in nature. Real estate for levee improvement projects, however, required long-term commitments and the property owners were reimbursed for the easements obtained. Official local sponsors for the levee projects were normally required to provide all lands, easements and rights-of-way to the Corps of Engineers. However, the bonding capacity of local sponsers for the Castle Rock, Lexington, Kelso and Longview levee improvements were overtaxed by the costs for the levee projects and the Corps of Engineers provided financial assistance to purchase the rights-of-way easements for the levee work.

F. Small Contracts

In addition to the work described previously, many other small contractors were involved in the restoration and recovery activities. Some were for service contracts to provide rock, pumps or other products, while other contractors were utilized to provide equipment such as draglines, trucks, front-end loaders, etc., to do work on an a rental basis for short-term periods.

12. ENVIRONMENTAL IMPACT STATEMENT Immediately after the eruption, the Portland District staff began preparation of an Environmental Impact Statement (EIS) for the Mount St. Helens recovery operations. This was to provide the public, federal and state agencies an opportunity to review the alternatives considered and probable impacts to the environment from actions underway or proposed. A preliminary draft EIS was completed on July 25, 1980, and sent to interested federal, state and local agencies for review. The final draft EIS was submitted to the Environmental Protection Agency on Sept. 19, 1980. The time frame for production of the initial draft was only 20 days, therefore, many procedural steps were abbreviated. Time did not permit a detailed and in-depth review of each topic discussed. The EIS will be supplemented in the future with updated information clarifying current options or new alternatives as conditions develop.

In addition to the EIS, early plan formulation for the restoration effort included an environmental task force of principal federal, state and local agencies. The task force continues to meet periodically to review current programs and future plans. The Corps of Engineers is attempting to accomplish the recovery work with strong consideration to recommended environmental protective measures proposed by the task force.

13. FUTURE The program for restoration of flood protection successfully protected the communities along the Cowlitz River valley during the 1980-1981 winter season. The shoaling which occurred in the Columbia River was alleviated, though some additional channel maintenance continues. Next year and future years will be a learning process as the result of additional volcanic activity and sediment transport from mudflow deposits become known. Future involvement will be directed toward minimizing damaging impacts and protecting the population and economy of the region.

14. CORPS OF ENGINEERS ORGANIZATION

A. Portland District

The Portland District boundaries include most of the state of Oregon with the exception of the upper Klamath River drainage in southeast Oregon, and that part of Washington which comprises the drainage into the Columbia River below Richland. The District currently consists of a staff of over 1,200 employees, of which about 800 are considered field personnel operating multipurpose water storage projects in the Columbia and Willamette River valleys, supervising construction sites throughout the District and operating and maintaining the District's dredge plant.

B. North Pacific Division

The North Pacific Division office, also located in Portland, provides the next higher authority in the chain-of-command for the Portland, Seattle, Walla Walla and Alaska districts. The Division office reviewed the plans formulated by the Portland District and submitted to higher authority for approval and funding.

C. Office, Chief of Engineers

The headquarters of the Corps of Engineers, under the Department of the Army, is located in Washington, D.C. This office reviewed the plans submitted by the District and Division offices and authorized the expenditure of funds for the restoration program.

~~FILE DPF 2.5~~

CT

STATE OF WASHINGTON

DEPARTMENT OF EMERGENCY SERVICES

4220E Martin Way • Olympia, Washington 98504 • [redacted] 206-459-9191

December 22, 1982

MEMORANDUM

TO: ALL CONCERNED (SEE DISTRIBUTION)

FROM: NATIONAL WEATHER SERVICE, SANDPOINT, WASHINGTON
WASHINGTON STATE DEPARTMENT OF EMERGENCY SERVICES
OLYMPIA, WASHINGTON

SUBJ: SPIRIT LAKE, COLDWATER AND SOUTH CASTLE DEBRIS STRUCTURE FAILURE ALERT/WARNING PROCEDURES

Please find enclosed the latest subject procedures.

JRH:bf
Enclosure

DISTRIBUTION

WASHINGTON STATE PATROL, OLYMPIA DISPATCH
WASHINGTON STATE PATROL LIAISON
COWLITZ COUNTY DEPARTMENT OF EMERGENCY SERVICES
CLARK/SKAMANIA COUNTY DEPARTMENT OF EMERGENCY MANAGEMENT
LEWIS COUNTY DEPARTMENT OF EMERGENCY SERVICES
NATIONAL WEATHER SERVICE, SANDPOINT
NATIONAL WEATHER SERVICE, PORTLAND
RIVER FORECAST CENTER, PORTLAND
NATIONAL WEATHER SERVICE, OLYMPIA
FEDERAL EMERGENCY MANAGEMENT AGENCY, REGION X
USFS/USGS, CASCADE VOLCANO CENTER, VANCOUVER
CORPS OF ENGINEERS, CASTLE ROCK
GIFFORD PINCHOT NATIONAL FOREST
OREGON DEPARTMENT OF ENERGY
WEYERHAEUSER COMPANY
U.S. GEOLOGICAL SURVEY, TACOMA

C/V

SPIRIT LAKE, COLDWATER AND/OR SOUTH CASTLE DEBRIS STRUCTURE FAILURE ALERT & WARNING PROCEDURES

A. GENERAL INFORMATION

There are two aspects of communications flow relating to a failure of any of the subject structures regardless of the cause; 1) alarm via telemetry, and 2) alert and warning. The National Weather Service (NWS) receives initial alarms via telemetry from select gauges and triggers response action. Three flag words or terms will be used to define an event and subsequent response action.

They are:

1. Unusual Event: The NWS has experienced the loss of or an indication of a degraded monitoring system to the point of no confidence in the data being received. NWS notifies on NAWAS only (not for public release).

2. Code Yellow: NWS has initial alarm with verification requested from sources able to do so and return to the NWS. A failure may be happening. Be on the alert - NWS notifies on NAWAS only (not for public release).

3. Flash Flood Warning: An event is taking place. Take established precautionary measures.

B. PROCEDURES

The National Weather Service will issue warning information under one of the Three Flag words or terms as follows:

1. Unusual Event: NWS will call on NAWAS and advise all concerned of the monitoring system deficiency. Visual observations are critical and should be relayed to the NWS by the most expeditious means.

2. Code Yellow: NWS will initiate on NAWAS if alarms indicate an event may be beginning and verification from other soures is desired. This alerts other people to get ready, in case.

3. Flash Flood Warning: Initiate on NAWAS according to established criteria.

C. NAWAS OPERATING STEPS (FOR NWS)

1. To issue a bulletin on NAWAS, the NWS will:

   a. Ring bell for five seconds.

   b. Say: "THIS IS THE NATIONAL WEATHER SERVICE, THIS RING IS FOR WASHINGTON WARNING POINT, KELSO, CASCADE VOLCANO CENTER, CASTLE ROCK, VANCOUVER, SKAMANIA S.O., AUBURN WEATHER, AND OLYMPIA WEATHER, ALL OTHER STATIONS MAY MONITOR. WE HAVE A CODE YELLOW SITUATION FROM (SAY WHICH STRUCTURE) AS OF _____ PDT."

c. Then do a roll-call of the called stations for acknowledgement. Ensure all stations polled, copied message and answered. Ask Washington Warning Point for assistance if necessary. End with, "NATIONAL WEATHER SERVICE STANDING BY."

d. Each station called should acknowledge and inititate local procedures either to try to verify or dispute a code yellow. Responses of visual or known conditions should be relayed back to the NWS via NAWAS.

D. WASHINGTON WARNING POINTS

DES Weekdays from 0800-1700 Except Holidays
WSP All Other Times

1. Acknowledge NAWAS warning message from NWS.

2. Ensure roll call of NAWAS stations is complete.

3. Notifies DES duty officer (WSP use 753-5990 if after office hours).

4. If the message is an "unusual event" or a Code Yellow, stop here, but monitor NAWAS for further information from NWS and Cowlitz County or stations reporting observations back to NWS.

5. If flash flood, implement normal flood warning procedures.

E. CANCELLATION OR TERMINATION

1. NWS, Seattle will downgrade or terminate alerts according to normal procedures.

2. A code yellow will be terminated or canceled jointly by state DES duty officer and NWS.

3. Unusual event will be terminated by NWS.

SPIRIT LAKE, COLDWATER OR SOUTH CASTLE
DEBRIS STRUCTURE FAILURE ALERT/WARNING ✔

VIA NAWAS ✔

Seattle NWS ✔

- Wash. Warning Point
  - Other Counties
  - State Agencies
  - Federal
- Cascade Volcano Center ✔
  - USGS
  - USFS
  - Weyerhaeuser
- Kelso Cowlitz County ✔
  - Local
  - Weyerhaeuser
- Castle Rock COE
  - COE
  - Private Contractors
  - 24 hours as long as pumping action going on - in radio contact with pump station
- Vancouver Clark County
  - Local
- Skamania S.O.
  - Local
- Olympia Weather
  - NOAA RADIO
- Auburn Weather
  - FAA
- Portland Weather ✔
  - ORE (STATE)

Cascade Volcano Center

CALL DOWN

DIRECTORY

For

COLDWATER BREACH

And

OTHER DAM FAILURES

INSTRUCTIONS: The call down directory is "HIGHLIGHTED" in [illegible] or pink. You call only the numbers "HIGHLIGHTED" on your sheet. Unless there is an A-B-C, etc., beside the number, call only one number.

The Vancouver telephone lines (696-7853 thru 696-7859) are to be used for FTS and 1-800 numbers only. These are centrex numbers and "9" must be dialed before calling a commercial number.

All other numbers are to be called on Portland telephone lines (285-4600 thru 285-4609 and 285-4346 thru 285-4348).

Area code for Washington is 206
Area code for Oregon is 503

DATE THIS CALL DOWN DIRECTORY WAS ISSUED_____

WANG 2958C/326A

9/92

CALL DOWN DIRECTORY FOR COLDWATER BREACH OR OTHER DAM FAILURES

NOTIFY		PERSON CONTACTED	DATE	TIME	INITIALS
1. PGE (Load Dispatcher	1-503-226-8343 24 hour phone ✓				
2. Washington State Department of Transportation	DAY / NIGHT				
Dick Coffman	1-206-696-6761				
Ed Blodgett	1-206-696-6376				
Ed Ferguson	1-206-696-6621				
3. Burlington Northern (Railroad Division)					
Chief Dispatcher:					
Vancouver	1-206-696-5760, or 5761, or 5762				
Portland	285-5095				
Gen. Yardmaster					
Vancouver	1-206-696-5733				
4. Department of Natural Resources					
Castle Rock	1-206-577-2025 - IF NO ANSWER, CALL				
Olympia	9-1-800-562-6010				
	DAY / NIGHT				
Jan Gano	1-206-696-6644				
Russ Kastberg	1-206-696-6644				
Wimpy Clark	1-206-696-6644				
Bob Flye	1-206-696-6644				
5. U.S. Coast Guard (Portland)					
	FTS 8-422-0301 24 hour phone				

CALL DOWN DIRECTORY FOR COLDWATER BREACH OR OTHER DAM FAILURES

NOTIFY			PERSON CONTACTED	DATE	TIME	INITIALS
6. Oregon Emergency Services Division	503-378-4124 24 hour phone	✓				
7. PP&L (Portland)	243-7023 24 hour phone	228-7098 Emergency				
8. International Paper Longview						
Office Hours (0700 - 1730)	1-206-247-5411					
NIGHT Frank Pumphrey Bill Akre	[redacted]					
9. Burlington Northern (Woods Division)						
	DAY	NIGHT				
Dick Frohne	1-206-636-2650	[redacted]				
Roger Wimer	1-206-636-2650					
Greg Swanson	1-206-636-2650					
10. Army Corps of Engineers						
Larry Magura	FTS 8-423-6099					
After 1800 & Weekends	636-9989					
OR Sid Stecker	[redacted]					
11. A. Clark County	911 (Ask for Dispatcher)					
B. Cowlitz County Sheriff	1-206-577-3130	✓				
C. Skamania County Sheriff	1-509-427-5047					
D. Lewis County Sheriff	1-206-748-8887					

CALL DOWN DIRECTORY FOR COLDWATER BREACH OR OTHER DAM FAILURES

NOTIFY	PERSON CONTACTED	DATE	TIME	INITIALS
12. Seattle Weather 1-206-527-6086 24 hour phone 1-206-527-6083 24 hour phone FTS 8-446-6083 Emergency Only				
13. Army Corps of Engineers: Call only if could not contact by Hot Line A. Mt. St. Helens Resident Office (0700-1630) 1-206-274-6656 After hours Lloyd Staats Linda Togo 				
14. NIGHTS ONLY If needed - Second Night Aerial Observer Pager 1-206-699-7541 NIGHTS ONLY If needed - Backup Night Flight - Western Skyways 665-1181				

CALL DOWN DIRECTORY FOR COLDWATER BREACH OR OTHER DAM FAILURES

NOTIFY		PERSON CONTACTED	DATE	TIME	INITIALS
15. FAA (Seattle)	1-206-833-6814 24 hour phone 1-206-767-2540 Office Phone FTS 8-390-1222				
16. Regional Office (Fire Phone)	221-2931				
17. FEMA Region 10/Bothell, WA	1-206-481-8800				

UPDATED
MAINTAINED BY COPY HOLDER

PORTLAND GENERAL ELECTRIC COMPANY

TROJAN NUCLEAR PLANT

January 10, 1983

SAFETY-RELATED

Revision 5

OFF-NORMAL INSTRUCTION - ONI-15

Loss of Service Water

APPROVED BY C P Lundt DATE 1/13/83

PURPOSE

This instruction describes the procedures for operating the service water system after any of the following occur:

SECTION I	FAILURE OF ONE SERVICE WATER PUMP
SECTION II	MAJOR RUPTURE IN ONE SERVICE WATER TRAIN
SECTION III	FAILURE OF BOTH SERVICE WATER TRAINS
SECTION IV	LOSS OF INTAKE COINCIDENT WITH LOSS OF PREFERRED POWER

I. FAILURE OF ONE SERVICE WATER PUMP

A. Symptoms

Any one of the following symptoms may indicate a loss of one service water (SW) pump:

1.0 PUMP AUTO TRIP Annunciator, plus any combination of the following:

2.0 SW low pressure and SW booster pump auto trip.

3.0 CCW HX WEST SW INLET LO PRESS or CCW HX EAST SW INLET LO PRESSURE

4.0 Running current indicated for the pump(s) selected for standby status and a change in pump breaker position lights.

5.0 SW pump auto start.

C13

B. Probable Causes

1.0 SW pump breaker 152-103 and 152-203 trips due to any of the following:

1.1 A fault in the pump motor or breaker.

1.2 A pump seizure.

C. Automatic Actions

1.0 The standby SW train starts on the affected pump low discharge pressure.

2.0 A standby component cooling water (CCW) train starts.

D. Immediate Operator Actions

*1.0 Verify the standby SW and CCW train is operating properly.

E. Subsequent Operator Actions

1.0 STOP the affected train's CCW pump.

2.0 Replace the affected SW pump with the spare pump per OI-4-3, Service Water System, Section III.

3.0 Observe the Technical Specifications requirements of Paragraph 3.7.4.1.

II. MAJOR RUPTURE IN ONE SERVICE WATER TRAIN

A. Symptoms

Any of the following symptoms may indicate a major rupture in one of the SW trains:

1.0 A decrease in flow indicated by the discahrge and dilution structure flow recorder.

2.0 One of the SW pumps trip due to a high level in the CCW heat exchanger dike.

3.0 SW train low pressure.

4.0 High running current indicated on either of the SW pumps' ammeters.

*Required to be memorized.

B. Probable Causes

A valve, flange, or pipe failure.

C. Automatic Actions

1.0 The operating SW pump will trip if a high level signal is received from the CCW heat exchanger dike.

2.0 The standby SW pump, SW booster pump, and CCW pump will start on low discharge pressure of the operating SW pump.

D. Immediate Operator Actions

If the operating SW pump tripped, or a report of the rupture is received, perform the following:

*1.0 Stop the affected SW pump and/or ensure standby SW train starts automatically.

*2.0 Perform SW system train separation as follows:

2.1 CLOSE domestic water isolation valves CV-3803 and CV-3804.

2.2 CLOSE SW to the non-essential room coolers isolation valve CV-3720A or CV-3720B from the affected train.

2.3 CLOSE SW to bearing cooling water heat exchanger train isolation valve CV-3725 or CV-3714 from the affected train.

E. Subsequent Operator Actions

1.0 Place the affected SW pump, SW booster pump, and CCW pump control switch in the PULL TO LOCK position.

2.0 Verify sufficient cooling water flow to the components supplied.

3.0 Observe the Technical Specifications requirements of Paragraph 3.7.4.1.

III. FAILURE OF BOTH SERVICE WATER TRAINS

A. Symptoms

Any of the following symptoms may indicate a loss of SW:

1.0 Low pressure on SW Train A and Train B.

*Required to be memorized.

2.0 SW pump auto trip.

3.0 SW booster pump auto trip.

4.0 Abnormal or zero current indications on SW pump ammeters.

B. Probable Causes

1.0 Structural damage to the intake structure which results in SW pump failure.

2.0 Blockage of the intake structure.

C. Automatic Actions

The SW booster pumps trip on low SW pump discharge pressure.

D. Immediate Operator Actions

*1.0 Trip the reactor.

*2.0 CLOSE circulating water (CW) blowdown valve CV-3400.

3.0 Carry out required actions of EI-0, Reactor Trip, Safety Injection and Diagnosis.

4.0 Carry out required actions of ONI-1, Reactor Trip.

E. Subsequent Operator Actions

1.0 Place the following pump switches in the PULL TO LOCK position:

1.1 SW pumps A and B.

1.2 SW booster pumps A, B, C and D.

2.0 START the electric-driven fire pump.

3.0 STOP and PULL TO LOCK the jockey fire pump.

4.0 CLOSE the jockey fire pump discharge regulator outlet valve FP-054.

5.0 CLOSE SW outlet valve SW-248 to the steam generator blowdown steam vent condenser.

6.0 STOP the west CW pump if both pumps are running.

*Required to be memorized.

7.0 Perform a valve lineup to supply SW from the circulating water system as follows:

7.1 Close CCW heat exchanger (Hx) outlet valves SW-043 and SW-044 to the discharge and dilution structure.

7.2 Check closed CCW Hx water box and high point vent valves SW-034, SW-036, SW-035, SW-033, SW-040 and SW-039.

NOTE: After the CW flow has been established through the CCW Hx, venting will be required to ensure the Hx is full.

7.3 Open CWS supply valve SW-046 to the SW system, CW supply valves SW-031 and SW-032 to SW Train A and B respectively.

7.4 Open CCW Hx return valve SW-045 to the Cooling Tower and the A and B CCW Hx outlet valves to the Cooling Tower SW-042 and SW-041 respectively.

8.0 Perform a plant shutdown from hot shutdown to a cold shutdown condition per GOI-4.

9.0 Place the SW strainer backwash control to OFF.

10.0 Valve in supply of cooling water to the service and instrument air compressors from the fire main as follows:

10.1 Attach hose to drain between sprinkler valves FP-43 and FP-44. Attach other end of hose to air compressor bearing cooling water drain valve BC-041 or BC-042 or BC-043.

10.2 Shut bearing cooling water supply valves BC-032 and BC-038 and return valve BC-044 on "A" air compressor or BC-033 and BC-039 and BC-045 on "B" air compressor or BC-034 and BC-040 and BC-046 on "C" air compressor.

10.3 Open bearing cooling water drain to floor by BC-044 or BC-045 or BC-046, then open fire main drain and bearing cooling water supply.

11.0 Start the service and instrument air compressors as required.

NOTE: It may be required to throttle the CW condenser C outlet valve in order to provide sufficient flow through the CCW heat exchanger to meet design cooldown requirements.

12.0 Close A and B train SCI/SCII isolation valves on service water.

13.0 START the A and B SW booster pumps.

NOTE: It may be necessary to defeat the low suction pressure contacts of PS-3745A and PS-3745B to allow starting SW booster pumps A and B. Refer to OI-4-3 for steps required to do this.

14.0 In order to throttle CW condenser C outlet valve MO-3444 from the Control Room, perform the following valve and circuitry changes:

14.1 CLOSE CW condenser C outlet valve MO-3444.

14.2 Open and tag CW condenser C outlet valve breaker 52-2919.

14.3 At MCC B-29 scheme NB-2919 place a jumper from terminal 5R to terminal 2R. Log this in the temporary modifications status log.

NOTE: This allows moving of MOV-3444 in closed direction while pump is running.

14.4 Also, at MCC-B-29, scheme NB-2919 lift SIS wires 2F and 2R going to motor controller (Ref. E-405). Log this in the temporary modifications status log.

14.5 Clear the tag and CLOSE CW condenser C outlet valve breaker 52-2919.

14.6 Pull and tag the control power fuses for CW pump P-107A.

14.7 At panel C14, place a jumper from terminal P2A to terminal P2B on terminal block NH108. Log this in the Lifted Leads and Jumper Log.

14.8 Clear the tags and replace the control power fuses for CW pump P107A.

14.9 Open CW condenser C outlet valve MO-3444.

15.0 STOP the east CW pump.

16.0 CLOSE CW condenser outlet valve MO-3446.

17.0 OPEN the CW pump discharge cross-connect valve MOV-3442.

18.0 START the west CW pump.

19.0 Throttle CW and condenser C outlet valve MO-3444 as necessary to maintain CCW heat exchanger outlet temperature at 95°F or less and to maintain the condensers water box pressure less than 75 psig.

20.0 Start a cooling tower makeup pump to refill the cooling tower basin as required.

21.0 Provide a portable supply of water to the SW system or CW system at the following locations to make up for losses in the CW system.

21.1 SW emergency hose connection supplied from a fire truck pump, portable pump, or the fire pumps if operable.

21.2 Cooling Tower makeup section of the discharge and dilution structure by using the same as above.

22.0 Observe the Technical Specifications requirements of Paragraph 3.7.4.1.

IV. LOSS OF INTAKE COINCIDENT WITH LOSS OF PREFERRED POWER

A. Symptoms

Any of the following symptoms may indicate a loss of intake coincident with loss of preferred power.

1.0 Any of the symptoms listed in Section III.

2.0 Startup transformer #1 and #2 feeder undervoltage.

3.0 Startup transformer #1 and #2 fault.

4.0 Bus H1 and H2 fault.

5.0 Bus H1 and H2 negative sequence.

6.0 Bus H1 and H2 voltage 80%.

B. Probable Causes

1.0 Structural damage to the intake structure which results in SW pump failure.

2.0 Blockage of the intake structure.

3.0 230 kV line faults.

4.0 Mud flows from volcanic eruption.

C. Automatic Actions

1.0 The affected 230 kV bus is cleared by the automatic tripping of all oil circuit breakers and the circuit switchers connected to the busses.

D. Immediate Operator Actions

*1.0 Trip the reactor.

*2.0 Stop both EDGs.

*3.0 Close circulating water (CW) blowdown valve CV-3400.

4.0 Carry out required actions of EI-0, Reactor Trip, Safety Injection and Diagnosis.

5.0 Carry out required actions of ONI-1, Reactor Trip.

E. Subsequent Operator Actions

CAUTION: Until the SW booster pumps are running, there is not cooling water for the EDGs; therefore, the valve lineup and starting the SW booster pumps should be completed as fast as possible.

1.0 Place the following pump switches in the PULL-TO-LOCK position:

1.1 SW pumps A and B.

1.2 SW booster pumps A, B, C, and D.

2.0 STOP and PULL-TO-LOCK the jockey fire pump.

3.0 CLOSE the jockey fire pump discharge regulator outlet valve FP-054.

4.0 CLOSE SW outlet valve SW-248 to the steam generator blowdown steam vent condenser.

5.0 Place the circ. water pump switches in the PULL-TO-LOCK position.

6.0 Perform a valve lineup to supply SW from the cooling tower as follows:

*Required to be memorized.

6.1 Verify closed CCW heat exchanger (Hx) water box and high point vent valves, SW-033, 034, 035, 036, 039 and 040.

NOTE: After the CW flow has been established through the CCW Hx, venting will be required to ensure the Hx is full.

6.2 Close SW strainer blowdown to the D and DS valves CV-3722A and CV-3722B.

6.3 Open CW supply valve to the SW system SW-046, CW supply valves to SW train A and B SW-031 and SW-032.

NOTE: This lineup will provide a flow path from the cooling tower basin and is sufficient for maintaining the plant in a hot standby condition approximately 10 to 18 hours, depending on basin temperature and connected heat loads.

7.0 Close A and B train SCI/SCII isolation valves from service water.

8.0 Start the EDG(s).

9.0 Start the A and B booster pumps.

NOTE: It may be necessary to defeat the low suction pressure contacts of PS-3745A and PS-3745B to allow starting SW booster pumps A and B. Refer to OI-4-3 for steps required to do this.

10.0 Provide a portable supply of water to the SW system or CW system at the following locations to makeup for losses in the CW system.

10.1 SW emergency hose connection supplied from a fire truck pump or portable pump.

10.2 Start a cooling tower makeup pump to refill the cooling tower basin as required.

11.0 Clear intake structure to service.

12.0 Correct faults with 230 kV system and return to service.

2/16/73

Dick Dannon 396-0721

no evacuation now of Kelso/Longview

Siren system augmented river valleys.

21 additional sirens

Colitz/Toutle River valleys. Trojan big help

7 hrs. lead time.

16 + gauges on lake

crew: pumping lake down, (6" a week)

(currently not in op. siren / since alert)

rising .1'/day, 13' below critical level (below ...).

~~no impact~~ beyond Cold, — (in Columbia)

~~...~~ ...

final ... - ... by breach ...

Spirit Lk Feb 7 ... ... (no substantial rise in Lake)

c|4

1983

Enclosure 2

Routing Slip — Priority 1

TRANSMITTAL OF DIVISION OF LICENSING WORK REQUEST

SPECIAL HANDLING - PROCESS WITHOUT DELAY

TAC#-Plant Name-Title 49636 - TROJAN - MT. ST. HELENS - SPIRIT LAKE DAM

Description of review requested:
1. Review draft USGS / FEMA report on possible hazards posed by failure of Spirit Lake dam. (to be provided by PM about 2-22-83).
2. Review may involve site visit and further review depending on safety assessment of 1. above.

Requested target date "Quick Look" at USGS report by ~ March 1, 1983.

Basis for request date:

SEQUENCE	NAME	DATE
1. Originator	~~C. Trammell~~ CAT	2-17
2. OR Branch Chief	R.A. Clark	2-17-83
3. OR A/D	G. Lainas	2-17-83

☐ This action is requested to be added to the review branch's current commitments

☐ This action is requested to be completed in lieu of TAC# _____ for _____ (Plant Name)

4. Review Branch Chief (SGEB)	G. Lear	2/22/83
5. A/D	JP Knight	2/23/83
6. Division Director	R. Vollmer	2/23/83

☒ This action is accepted for completion with a target date of 3/10/83 for Quick Look verbal report to DSI

☐ This action is accepted for completion with a target date of _____ in lieu of completing TAC# _____ in this fiscal year

✓ 7. Return to Review Branch Chief for assignment of reviewer and retention of work package

R. Pichumani (Reviewer's Name) XAP (RAMS Initials)

✓ 8. Return routing slip to originator

FROM	MAIL STOP	PHONE
C Trammell	422	27389

C/S

2/17/83.

Enclosure 2

Routing Slip priority 1

TRANSMITTAL OF DIVISION OF LICENSING WORK REQUEST

SPECIAL HANDLING - PROCESS WITHOUT DELAY

TAC#-Plant Name-Title 49636 - TROJAN - MT. ST. HELENS - SPIRIT LAKE DAM

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Basis for request date:

SEQUENCE	NAME	DATE
1. Originator	~~C. Trammell~~	CMT 2/17
2. OR Branch Chief	R.A. Clark	2/17/83
3. OR A/D	G. Lainas	2/17/83

☐ This action is requested to be added to the review branch's current commitments

☐ This action is requested to be completed in lieu of TAC# _____ for _____ (Plant Name)

4. Review Branch Chief	(SAB) W. Regan	
5. A/D	W. Johnston	
6. Division Director	R. Vollmer	

☐ This action is accepted for completion with a target date of _____

☐ This action is accepted for completion with a target date of _____ in lieu of completing TAC# _____ in this fiscal year

✓ 7. Return to Review Branch Chief for assignment of reviewer and retention of work package

K. M. CAMPE _____
(Reviewer's Name) (RAMS Initials)

✓ 8. Return routing slip to originator

FROM C Trammell	MAIL STOP 422	PHONE 57367

cb

2/17/83

NRC FORM 197 (10-80)

U.S. NUCLEAR REGULATORY COMMISSION

TECHNICAL ASSIGNMENT CONTROL FORM

TACS NUMBER: 49636

/ NEW ASSIGNMENT | NEW INFORMATION

SECTION I REQUEST DATA

PREPARED BY: C. Trammell, R.A. Clark

(AD) DATE PREPARED: MO DAY YR 2 17 83

(AE) AF/FACILITY NAME AND ASSIGNMENT TITLE (Limit to 120 characters): Trojan - MOUNT ST. HELENS - SPIRIT LAKE DAM

(AZ) PLANNED ACCOMPLISHMENT NUMBER: 1775

(AG) REQUEST CONTACT: Trammell

(AX) REQUESTER'S INITIALS: CMT

(AB) REQUESTING ORGANIZATION: ORB-3

(AH) REQUESTING TARGET DATE: MO DAY YR

(AJ) AA) REQUESTING REMARKS (Limit to 120 characters):

(AL) MULTI PLANT ACTION NUMBER: N/A

SECTION II SYSTEMS CONTROL DATA

A OPERATING REACTOR ACTIONS

PRIORITY: 1 ✓ 2 ☐ 3 ☐

(BA) DOCKET: 50-344

(AR) INITIATION DATE: MO DAY YR 2 17 83

(AV) AMENDMENT FEE CLASS: N/A ✗ I ☐ II ☐ III ☐ IV ☐ V ☐ VI ☐

B TOPICAL REPORT REVIEWS

VENDOR'S NAME:

REPORT IDENTIFICATION SYMBOL:

(DA) PROPRIETARY P

(AR) REPORT DATE: MO DAY YR

(AS) ADDITIONAL INFORMATION REQUEST DATE: MO DAY YR

(EA) NON PROPRIETARY VERSION NP

(AT) SUBMIT DATE: MO DAY YR

(AU) LETTER TO VENDOR DATE: MO DAY YR

(AV) ACCEPTED ☐ NOT ACCEPTED ☐ WITHDRAWN ☐

(FA) NON PROPRIETARY REPORT

SECTION III REVIEW DATA

REVIEWER'S SURNAME	(CA) REVIEWER'S INITIALS	(CB) ESTIMATED HOURS	COMPLETION DATE (CC) ESTIMATED MO DAY YR	COMPLETION DATE (CD) ACTUAL MO DAY YR
Trammell	CMT			

C/7

(AT) SUBMIT DATE

(AU) LETTER TO VENDOR DATE

2/17/83

Enclosure 2

Routing Slip priority 1

TRANSMITTAL OF DIVISION OF LICENSING WORK REQUEST

SPECIAL HANDLING - PROCESS WITHOUT DELAY

TAC#-Plant Name-Title 49636 - TROJAN - MT. ST. HELENS - SPIRIT LAKE DAM

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2. Review may involve site visit and further review depending on safety assessment of 1. above.

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Basis for request date:

SEQUENCE	NAME	DATE
1. Originator	~~C. Trammell~~ CHT	2/17
2. OR Branch Chief	R.A. Clark TAC	2/17/83
3. OR A/D	G. Lainas Conc/07	2/17/83

☐ This action is requested to be added to the review branch's current commitments

☐ This action is requested to be completed in lieu of TAC# _____ for _____ (Plant Name)

4. Review Branch Chief (SAB) W. Regan _____
5. A/D W. Johnston _____
6. Division Director R. Vollmer _____

☐ This action is accepted for completion with a target date of _____

☐ This action is accepted for completion with a target date of _____ in lieu of completing TAC# _____ in this fiscal year

7. Return to Review Branch Chief for assignment of reviewer and retention of work package

_____ (Reviewer's Name) _____ (RAMS Initials)

8. Return routing slip to originator

FROM C Trammell	MAIL STOP 422	PHONE 27389

48

Enclosure 2

Routing Slip

TRANSMITTAL OF DIVISION OF LICENSING WORK REQUEST

SPECIAL HANDLING - PROCESS WITHOUT DELAY

TAC#-Plant Name-Title 49636 - TROJAN - MT. ST. HELENS - SPIRIT LAKE DAM

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1. Originator	~~C. Trammell~~ CHT	2-17
2. OR Branch Chief	R.A. Clark /lee	2/17/83
3. OR A/D	G. Lainas /lee for	2/17/83

☐ This action is requested to be added to the review branch's current commitments

☐ This action is requested to be completed in lieu of TAC# _____ for _____ (Plant Name)

4. Review Branch Chief	(ASB) O. Parr	
5. A/D	L. Rubenstein	
6. Division Director	R. Mattson	

☐ This action is accepted for completion with a target date of _____

☐ This action is accepted for completion with a target date of _____ in lieu of completing TAC# _____ in this fiscal year

7. Return to Review Branch Chief for assignment of reviewer and retention of work package

_____ (Reviewer's Name) _____ (RAMS Initials)

8. Return routing slip to originator

FROM	MAIL STOP	PHONE
C Trammell	422	27389

Enclosure 2

Routing Slip Priority 1

TRANSMITTAL OF DIVISION OF LICENSING WORK REQUEST

SPECIAL HANDLING - PROCESS WITHOUT DELAY

TAC#-Plant Name-Title 49636 - TROJAN - MT. ST. HELENS - SPIRIT LAKE DAM

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Basis for request date:

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1. Originator	~~C. Trammell~~ CMT	2/17
2. OR Branch Chief	R.A. Clark RAC	2/17/83.
3. OR A/D	G. Lainas GL/for	2/17/83.

☐ This action is requested to be added to the review branch's current commitments

☐ This action is requested to be completed in lieu of TAC# _____ for _____ (Plant Name)

4. Review Branch Chief	(GSB) R. Jackson	
5. A/D	JP Knight	
6. Division Director	R. Vollmer	

☐ This action is accepted for completion with a target date of _____

☐ This action is accepted for completion with a target date of _____ in lieu of completing TAC# _____ in this fiscal year

7. Return to Review Branch Chief for assignment of reviewer and retention of work package

_____ (Reviewer's Name) _____ (RAMS Initials)

8. Return routing slip to originator

FROM C Trammell	MAIL STOP 422	PHONE 27389

Enclosure 2

Routing Slip Priority 1

TRANSMITTAL OF DIVISION OF LICENSING WORK REQUEST

SPECIAL HANDLING - PROCESS WITHOUT DELAY

TAC#-Plant Name-Title 49636 - TROJAN - MT. ST. HELENS - SPIRIT LAKE DAM

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2. OR Branch Chief	R.A. Clark	2-17-83
3. OR A/D	G. Lainas Rai/for	2-17-83

☐ This action is requested to be added to the review branch's current commitments

☐ This action is requested to be completed in lieu of TAC# _____ for _____ (Plant Name)

4. Review Branch Chief (SGEB)	S. Lear	
5. A/D	JP Knight	
6. Division Director	R. Vollmer	

☐ This action is accepted for completion with a target date of _____

☐ This action is accepted for completion with a target date of _____ in lieu of completing TAC# _____ in this fiscal year

7. Return to Review Branch Chief for assignment of reviewer and retention of work package

_____ (Reviewer's Name) _____ (RAMS Initials)

8. Return routing slip to originator

FROM C Trammell	MAIL STOP 422	PHONE 27389

Enclosure 2

Routing Slip — priority 1

TRANSMITTAL OF DIVISION OF LICENSING WORK REQUEST

SPECIAL HANDLING - PROCESS WITHOUT DELAY

TAC#-Plant Name-Title 49636 - TROJAN - MT. ST. HELENS - SPIRIT LAKE DAM

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Basis for request date:

SEQUENCE	NAME	DATE
1. Originator	~~C. Trammell~~ CHT	2-17
2. OR Branch Chief	R.A. Clark - for	2-17/83.
3. OR A/D	G. Lainas for	2/17/83.

☐ This action is requested to be added to the review branch's current commitments

☐ This action is requested to be completed in lieu of TAC#_____ for _____ (Plant Name)

4. Review Branch Chief	(METB) W. Gammill	_____
5. A/D	D. Muller	_____
6. Division Director	R. Mattson	_____

☐ This action is accepted for completion with a target date of _____

☐ This action is accepted for completion with a target date of _____ in lieu of completing TAC# _____ in this fiscal year

7. Return to Review Branch Chief for assignment of reviewer and retention of work package

_____ (Reviewer's Name) _____ (RAMS Initials)

8. Return routing slip to originator

FROM C Trammell	MAIL STOP 422	PHONE 27369

Enclosure 2

Routing Slip

Priority 1

TRANSMITTAL OF DIVISION OF LICENSING WORK REQUEST

SPECIAL HANDLING - PROCESS WITHOUT DELAY

TAC#-Plant Name-Title 49636 - TROJAN - MT. ST. HELENS - SPIRIT LAKE DAM

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1. Originator	~~C. Trammell~~ CMT	2-17
2. OR Branch Chief	R.A. Clark	
3. OR A/D	G. Lainas	

☐ This action is requested to be added to the review branch's current commitments

☐ This action is requested to be completed in lieu of TAC# _____ for _____ (Plant Name)

4. Review Branch Chief	(EHEB) R. Ballard	
5. A/D	W. Johnston	
6. Division Director	R. Vollmer	

☐ This action is accepted for completion with a target date of _____

☐ This action is accepted for completion with a target date of _____ in lieu of completing TAC# _____ in this fiscal year

7. Return to Review Branch Chief for assignment of reviewer and retention of work package

_____ (Reviewer's Name) _____ (RAMS Initials)

8. Return routing slip to originator

FROM C Trammell	MAIL STOP 422	PHONE 27389

2/17/83

Enclosure 2

Routing Slip

Priority 1

TRANSMITTAL OF DIVISION OF LICENSING WORK REQUEST

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TAC#-Plant Name-Title 49636 - TROJAN - MT. ST. HELENS - SPIRIT LAKE DAM

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1. Review draft USGS/FEMA report on possible hazards posed by failure of Spirit Lake dam. (to be provided by PM about 2-22-23).
2. Review may involve site visit and further review depending on safety assessment of 1. above.

Requested target date "Quick Look" at USGS report by ~ March 1, 1983.

Basis for request date:

SEQUENCE	NAME	DATE
1. Originator	~~C. Trammell~~ CHH	2-17
2. OR Branch Chief	R.A. Clark Rac	2/17/83
3. OR A/D	G. Lainas Rac for	2/17/83

☒ This action is requested to be added to the review branch's current commitments

☐ This action is requested to be completed in lieu of TAC#_____ for _____ (Plant Name)

4. Review Branch Chief (EHEB)	R. Ballard	2/22/83
5. A/D	W. Johnston	
6. Division Director	R. Vollmer	

☒ This action is accepted for completion with a target date of 3/1/83. (Quick Look)

☐ This action is accepted for completion with a target date of _____ in lieu of completing TAC# _____ in this fiscal year

7. Return to Review Branch Chief for assignment of reviewer and retention of work package

Myron Fliegel (Reviewer's Name) MLF (RAMS Initials)

8. Return routing slip to originator

FROM C Trammell	MAIL STOP 428	PHONE 27329

C/9

2/17/83

Mt. St. Helens

Site (SAB)

DE
- ~~Safety~~ Analysis Br. – Bill Kiefer (L. Johnston) AD
- Geoscience Br. (GSB) – Bob Jackson (JF Knight)
- ~~Structural & Geotechnical Engr (SEB)~~ Soils / Structures – Geo. Lear (JF Knight)
- ~~EEB (Meteorology~~ ~~EEB (Hydrology~~ Env & Hydrologic Engr Br. (EHEB) – Ken Ballard (Johnston)

DSI
- Meteorology (METB) – Bill Gimmill – (Ken Wallace)
- ASB – Olan Parr (Rubenstein)

d/o