

Internship Report

by

Ronald D. Polvi

Submitted to

Marine Resource Management Program
School of Oceanography
Oregon State University

1978

in partial fulfillment of
the requirements for the
degree of

Master of Science

Internship: U.S. Army Corps of Engineers
Navigation Division
Waterways Maintenance Branch
Dredging Operations Section
Portland, Oregon

INTRODUCTION

An internship with a federal agency can be a rewarding and a frustrating experience at the same time. The four month internship I spent with the U.S. Army Corps of Engineers in Portland, Oregon strengthened my marine resource management program by providing actual work experience with marine related problems.

The internship position was a GS 5 level Civil Engineer in the Corps Navigation Division, Waterways Maintenance Branch, Dredging Operations Section. Mr. Greg Hartman was my immediate supervisor. Unfortunately Mr. Hartman departed on a three month position-exchange training program only two weeks after the internship commenced. The position consisted of a very broad range of duties related to dredging operation studies. Typical assignments included determination of dredge spoil disposal sites through on-site inspection, side scan sonar surveys, hydrographic surveys, sediment samples, and personal contact with local, state, and federal agencies and private and port authorities. The position was frustrating at times due to the fact there was not a specific goal outlined and the assignments could change weekly as warranted by priorities.

This paper will outline and discuss a number of specific work assignments and fieldwork participation experienced during the internship. Areas of exposure included sediment transport analysis, zero-base budgeting, harbor line modification, channel shoaling pattern analysis, dredging cost summaries, dredging workshops and various fieldwork assignments along Oregon's Coast.

WORK ASSIGNMENTS

Sediment Transport Analysis

The Corps of Engineers were concerned with investigating the bedload transport in the Pillar Rock-Brookfield reach of the Columbia River in view of a proposed realignment and widening of the ship channel. Columbia River Pilots reported and Corps hydrographic surveys confirmed a high degree of shoaling in this section of the river. The Pillar Rock-Brookfield reach is located approximately 27 miles upstream from the mouth of the Columbia River. The realigned channel would be 300 feet wider and would require removal of approximately 800,000 cubic yards of material. Since adequate disposal sites were not available on land in the immediate vicinity, it was proposed to dispose of the material inwater just south of the channel. Side scan sonar records, bottom current velocities and sediment samples were taken in an effort to predict where such a large quantity of dredged material would migrate after placement and what rate it would return to the river.

Based on analysis of the side scan sonographs to determine sand wave hieght and general direction of migration, an optimal inwater disposal site was selected. The site was selected to minimize the return of the dredge spoils back into the main shipping channel downstream. Post dredge hydrographic surveys were to follow the actual placement of the material to determine the effectiveness of the site selection. Unfortunately the internship terminated prior to the actual dredging of the channel and follow-up surveys have not been analyzed.

In conjunction with the side scan surveying techniques used to interpret sand wave characteristics, metallic reflectors were designed and anchored along the river bottom. These sonar reflectors were similar to radar reflectors typically mounted on sea surface buoys except they were suspended approximately ten feet above the river bottom. The function of the sonar reflector was to provide a fixed reference point on the bottom so that sand wave migration patterns could be identified.

Zero-base Budgeting

President Carter's Administration has introduced the concept of zero-base budgeting into the federal agencies. Zero-base budgeting provides a systematic process to evaluate and rank projects by priority, which is normally done informally in typical planning and budgeting procedures. There are two basic steps involved in zero-base budgeting:

1. Developing decision packages. This step involves analyzing and describing each discrete activity, current as well as new, in one or more decision packages.
2. Ranking decision packages. This step evaluates and ranks the decision packages in order of importance through cost/benefit analysis or subjective evaluation.

The purpose of the decision package is to communicate the analysis and recommendations made by each manager for his/her activities and operations to higher levels of management for review and ranking. Once decision packages are developed and ranked, management can allocate resources, funding the most important activity (decision package) both current and new.

Three packages were prepared for each dredging activity in the Portland District, Dredging Operation Section as follows:

1. Package 1 of 3 establishes a minimum level of dredging which may not completely achieve the authorized project depths for the channel. This package should, however, identify the most important elements. In most cases the minimum level will be between 50-70% of the current level of operation. An exception to this would be a new activity or an operation not up to full speed the preceding budget year. This minimum level package will be ranked higher than the packages (below) for additional levels of recommended activity.
2. Package 2 of 3 recommends the additional dredging activity necessary to continue at 100% maintenance of the current project depths.
3. Package 3 of 3 recommends the additional increments to further expand to approximately 110-120% of the current level of dredging activity. This package would provide improved services.

As an assigned duty, an analysis was completed for the Port of Umpqua, Port of Ilwaco, Port of Coos Bay, and the Columbia River Entrance to determine delay days encountered at various channel depths corresponding to three decision packages. Shipping data from the Waterborne Commerce Statistics of the United States for 1975 provided drafts and number of trips for vessels other than domestic fishing craft. Delay time was based on data obtained by analyzing the tides for each entrance bar and the limiting channel depths. An estimate of the total ton-hours delay was computed for each port and included in each decision package.

The decision packages are initially ranked by the managers preparing them. They are then submitted to the manager of the next level of the organization for a consolidation ranking. This consolidation procedure will be repeated by higher levels of management to prepare a final ranking. As a result of this procedure, all managers in the hierarchy become keenly aware of

the operations of the organization. The final consolidated ranking from the various organizational units are reviewed by top management in order to establish the funding levels by determining the cutoff level in each of the rankings. Some packages may ultimately be removed and others funded.

Harbor Line Modification

Historically the Corps of Engineers limited its jurisdiction through the establishment of harbor lines under Section 11 of the River and Harbors Act of 1899. These lines served to separate and protect navigable channels and harbor areas from water areas not essential to navigation. Once such lines were established the Corps allowed riparian owners to erect structures or provide solid fill construction up to the harbor lines without obtaining a permit. On May 27, 1970 the Corps revised the harbor line regulations to state in affect that all existing and future harbor lines are to guidelines only and that permits will be required for any work done shoreward of existing or future harbor lines.

The Port of Vancouver requested a harbor line change in view of proposals for new port pier construction. The extension of the existing harbor line to include their new waterfront docks would insure the Port of Vancouver inclusion in the Corps maintenance project within the turning basin. An investigation of historic records revealed that the original harbor line had never been approved even though for years it had been included on charts. Work was then initiated to bring the harbor line charts up to date for approval by the Office of the Chief Engineer in Washinton D. C.

SHOALING ANALYSIS

Organizational work was completed on an atlas of Oregon Coastal Hopper Dredge Operational Areas. Shoaling patterns over the past five years and approved dredge spoil disposal sites for the ten coastal estuaries within the Portland District were compiled and included in the atlas. Cross-hatched areas within the navigation channel as shown on photo mosaics indicated the portions of river that historically shoal. These shoal patterns represented the inclusive areas which have been known to require dredging during recent channel maintenance history. Each project was discussed in the atlas relative to past dredging operations and to present and future activity. The atlas is intended to be used as a planning tool by the Corps of Engineers, Navigation Division but is available to state and federal organizations concerned with dredging activities and dredged material disposal on the Oregon coastal navigation projects.

Dredging Cost Summaries

Dredging costs for the Dredge Oregon were tabulated by estimating the total yardages of material to be removed from the Columbia River during the current field season. Due to abnormally low river run-off causing less shoaling in the channel, the beginning of the field season was delayed until July 1, 1977 for the Dredge Oregon.

Daily worksheets were reviewed for the Dredge Harding while operating in Pearl Harbor during April, May, and June 1977. Summary sheets were compiled and quarterly reports on costs and yardages removed were tabulated.

Dredging Workshops

A workshop entitled "Review of Environmental Impact Statements for Dredging Estuaries" was attended at Oregon State University. The primary objective of the workshop was to introduce and discuss the use of two manuals published by investigators at Oregon State University in March 1977. The "Technical Manual" was written as a reference document for the "Guides Manual." In the "Guides Manual," specific recommendations are made with respect to the minimum requirements for an EIS for dredging prepared in accordance with the National Environmental Policy Act. The purpose of the "Technical Manual" is to document the scientific and technical basis for the recommendations in the "Guides Manual." The workshop audience contained representatives from both private industry and governmental agencies concerned with dredging activities.

A two day dredging workshop was attended in Portland, Oregon sponsored by the U.S. Army Waterways Experiment Station of Vicksburg, Mississippi. Topics in the program included disposal operations, environmental impacts, productive uses of dredge material, and habitat development.

FIELDWORK DUTIES

Velocity Profiles
Astoria (April 19-20)

Set-up and collected current velocity data in the Pillar Rock-Brookfield reach at Columbia River Mile 28-29. The data was collected with an Ice Current Meter aboard the Survey Launch Fort Stevens. Velocity readings were taken at eight stations across the river. Velocity data was recorded at approximately

thirty minute intervals at each station. Velocities at three feet above the bottom, mid-depth and three feet below the surface were observed and recorded on prepared data sheets.

Obstruction Investigation
Columbia River (May 6)

Investigated a rock shoal reported by local gillnet fishermen as being an obstruction to their fish drifts. This obstruction was allegedly caused by Corps dredging activities. The shoal was never located despite numerous attempts to hang on it with snag nets.

Bottom Sample Collection
Lewis River (May 9)

Bottom samples were collected with a shovelnosed dredge sampler. These samples were taken to the Corps Troutdale testing laboratory for chemical and mechanical gradation analysis.

Dry Dock Repairs
Swan Island Shipyard, Portland, Oregon
(June 20)

Toured the dredge Pacific while in dry dock at Swan Island for hull repairs. A crack in a steel hull plate was being repaired as a result of a grounding while dredging the Coquille River bar at Bandon.

Dredge Material Sampling
Coos Bay (July 6-7)

Collected dredge material samples aboard the dredge Pacific while underway and dredging in the Coquille River. Also toured Willamette Western Corporation's "Super Booster" while working in Coos Bay. The Super Booster is a twin-powered 8,000 horsepower dredge pumping system mounted on a 260 foot hull. This unit used in conjunction with the pipeline suction dredge McCurdy

can provide extra power to pump material up to five miles from the dredge to the disposal area.

Side Scan Surveys

Astoria (July 20-21, August 11-12)

Side scan surveys of the mouth of the Columbia River were conducted at four disposal areas. Sonographs indicated that the sand wave patterns oriented in a seaward direction in all four disposal areas.

On August 9, 1977 the dredge Biddle collided with a container ship near disposal area "E" in the mouth of the Columbia River. During the collision the Biddle lost an anchor and a draghead from her starboard suction line. Side scan surveys of the collision area attempted to locate both objects. The sonographs revealed an object which appeared to be the missing draghead. A search of the area by divers could not locate the object on the bottom due to strong currents and reduced visibility. The draghead was later recovered by use of a magnetometer.

SUMMARY

An internship with the Corps of Engineers not only broadened my educational background but enhanced my professional career. Through the wide range of assigned duties I gained valuable knowledge from the interaction with personnel in both federal government and private industry.

A most valuable experience was observing how agencies like the Corps of Engineers, U.S. Fish and Wildlife Service and the U.S. Environmental Protection Agency work together with state and local authorities in pursuit of a public need such as waterways maintenance. Communication throughout all levels of

government is a necessity for a job to progress.

I strongly support the internship requirement as a valuable educational experience. The opportunity to realize weaknesses in ones academic program through actual fieldwork experience can not be over emphasized. The marine industry contacts established during my internship will be an asset throughout my career development.

APPENDIX

STANDARD FORM 50 Rev. Dec. 1961
U.S. CIVIL SERVICE COMMISSION
FPM Ch. 295

Approved
Exception

NOTIFICATION OF PERSONNEL ACTION

(EMPLOYEE - See General Information on Reverse)

(FOR AGENCY USE)

PB-G2A PL-56R1 UIC-WOYAAA

1. NAME (CAPS) LAST - FIRST - MIDDLE POLVI, RONALD D		MR. - MISS - MRS. MR.	2. (FOR AGENCY USE)	3. BIRTH DATE (Mo., Day, Year) 09-07-50	4. SOCIAL SECURITY NO. 541-52-3309
5. VETERAN PREFERENCE 1. NO 2. -5 PT. 3. -10 PT. DISAB. 4. -10 PT. COMP. 5. -10 PT. OTHER			6. TENURE GROUP 0	7. SERVICE COMP. DATE 04-02-73	
9. FEGLI 2 1. COVERED (reg. only-declined opt.) 2. INELIGIBLE 3. WAIVED 4. COVERED (reg. and opt.)			10. RETIREMENT 2 1. CS 2. FICA	3. -FS 4. -NONE	11. (FOR CSC USE)
12. NATURE OF ACTION 113 15 TEMPORARY APPT NTE 08-13-77 CODE			13. EFFECTIVE DATE (Mo., Day, Year) 04-04-77	14. CIVIL SERVICE OR OTHER LEGAL AUTHORITY REG 316.402 (A)	
15. FROM: POSITION TITLE AND NUMBER			16. PAY PLAN AND OCCUPATION CODE	17. (a) GRADE OR LEVEL (b) STEP OR RATE	18. SALARY
19. NAME AND LOCATION OF EMPLOYING OFFICE					

20. TO: POSITION TITLE AND NUMBER CIVIL ENGINEER 6427		21. PAY PLAN AND OCCUPATION CODE GS-0810	22. (a) GRADE OR LEVEL 05 (b) STEP OR RATE 01	23. SALARY PA \$9303.00
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24. NAME AND LOCATION OF EMPLOYING OFFICE
U S ARMY ENGINEER DISTRICT, PORTLAND
NAVIGATION DIVISION, WATERWAYS MAINTENANCE BRANCH, DREDGING OPERATIONS SECTION

25. DUTY STATION (City-State) PORTLAND, OREGON	26. LOCATION CODE 41-1650-051
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27. APPROPRIATION 085031230000	28. POSITION OCCUPIED 1 - COMPETITIVE SERVICE 2 - EXCEPTED SERVICE 1	29. APPORTIONED POSITION (FROM:) (TO:) STATE 1 - PROVED 2 - WAIVED
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30. REMARKS: A. SUBJECT TO COMPLETION OF 1 YEAR PROBATIONARY (OR TRIAL) PERIOD COMMENCING
 B. SERVICE COUNTING TOWARD CAREER (OR PERM) TENURE FROM:
SEPARATIONS: SHOW REASONS BELOW, AS REQUIRED. CHECK IF APPLICABLE: C. DURING PROBATION

INELIGIBLE FOR HEALTH BENEFITS
TOTAL WORK UNDER THIS APPOINTMENT NTE 700 HOURS
ND-77-48

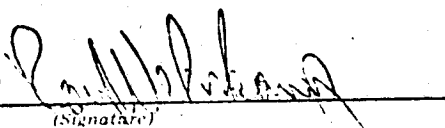
LEQ-DATE=04-04-77
WRK-SCHD=F PAY-DET=0 S-PROG=00 ED LVL=P FLSA NON-EXEMPT

31. DATE OF APPOINTMENT AFFIDAVIT (Accessions only) 04-04-77	34. SIGNATURE (Or other authentication) AND TITLE FOR THE APPOINTING OFFICER <i>Beatrice H. Williams</i> BEATRICE H. WILLIAMS CHIEF, TECHNICAL SERVICES BR 04-04-77
32. OFFICE MAINTAINING PERSONNEL FOLDER (If different from employing office)	2101
33. CODE CE EMPLOYING DEPARTMENT OR AGENCY AR 00 DEPARTMENT OF THE ARMY	35. DATE

2. INSTALLATION OR HEADQUARTERS OFFICE Corps of Engineers Portland District	3. ORGANIZATIONAL LOCATION (Complete on organization copy only) Navigation Division Waterways Maintenance Branch						
4. CITATION TO APPLICABLE STANDARD AND THE DATE OF ISSUANCE PCS GS-810 Civil Engineer Part I Dated Dec 1964	5. TITLE Civil Engineer						
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">6. PAY SCHEDULE GS</td> <td style="width: 33%;">7. OCC CODE 810</td> <td style="width: 33%;">8. GRADE 05</td> </tr> <tr> <td colspan="2">9. FAIR LABOR STANDARDS ACT <input type="checkbox"/> EXEMPT <input checked="" type="checkbox"/> NONEXEMPT</td> <td>10. COMP LEVEL</td> </tr> </table>	6. PAY SCHEDULE GS	7. OCC CODE 810	8. GRADE 05	9. FAIR LABOR STANDARDS ACT <input type="checkbox"/> EXEMPT <input checked="" type="checkbox"/> NONEXEMPT		10. COMP LEVEL
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9. FAIR LABOR STANDARDS ACT <input type="checkbox"/> EXEMPT <input checked="" type="checkbox"/> NONEXEMPT		10. COMP LEVEL					

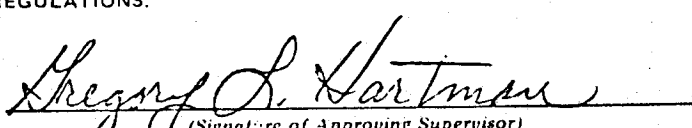
11. EVALUATION APPROVAL

TITLE, PAY SCHEDULE, OCC CODE, AND GRADE OF THIS JOB HAVE BEEN FIXED IN ACCORDANCE WITH OFFICIAL POLICY AND GRADE LEVEL STANDARDS

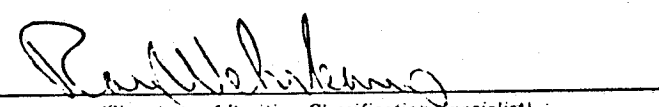
ROY WEHRKAMP  23 March 1977
(Signature) (Date)

12. JOB CONTENT APPROVAL (COMPLETE ON ORGANIZATION COPY ONLY)

a. I CERTIFY THAT THIS IS AN ACCURATE STATEMENT OF THE MAJOR DUTIES AND RESPONSIBILITIES OF THIS POSITION AND ITS ORGANIZATIONAL RELATIONSHIPS AND THAT THE POSITION IS NECESSARY TO CARRY OUT GOVERNMENT FUNCTIONS FOR WHICH I AM RESPONSIBLE. THIS CERTIFICATION IS MADE WITH THE KNOWLEDGE THAT THIS INFORMATION IS TO BE USED FOR STATUTORY PURPOSES RELATING TO APPOINTMENT AND PAYMENT OF PUBLIC FUNDS AND THAT FALSE OR MISLEADING STATEMENTS MAY CONSTITUTE VIOLATIONS OF SUCH STATUTES OR THEIR IMPLEMENTING REGULATIONS.

 23 March 77
(Signature of Approving Supervisor) (Date)

b. THIS JOB DESCRIPTION WITH SUPPLEMENTAL MATERIAL IS ADEQUATE FOR PURPOSE OF EVALUATION.

 23 March 1977
(Signature of Position Classification Specialist) (Date)

13. STATEMENT OF DUTIES AND RESPONSIBILITIES

SUPERVISORY CONTROLS

Works under the direct supervision of group leader, receives assignments involving a part of dredging studies. Supervisor furnishes guidance as to extent of data required, methods to use and applicable regulations. Supervisor reviews finished work for compliance with instructions.

MAJOR DUTIES

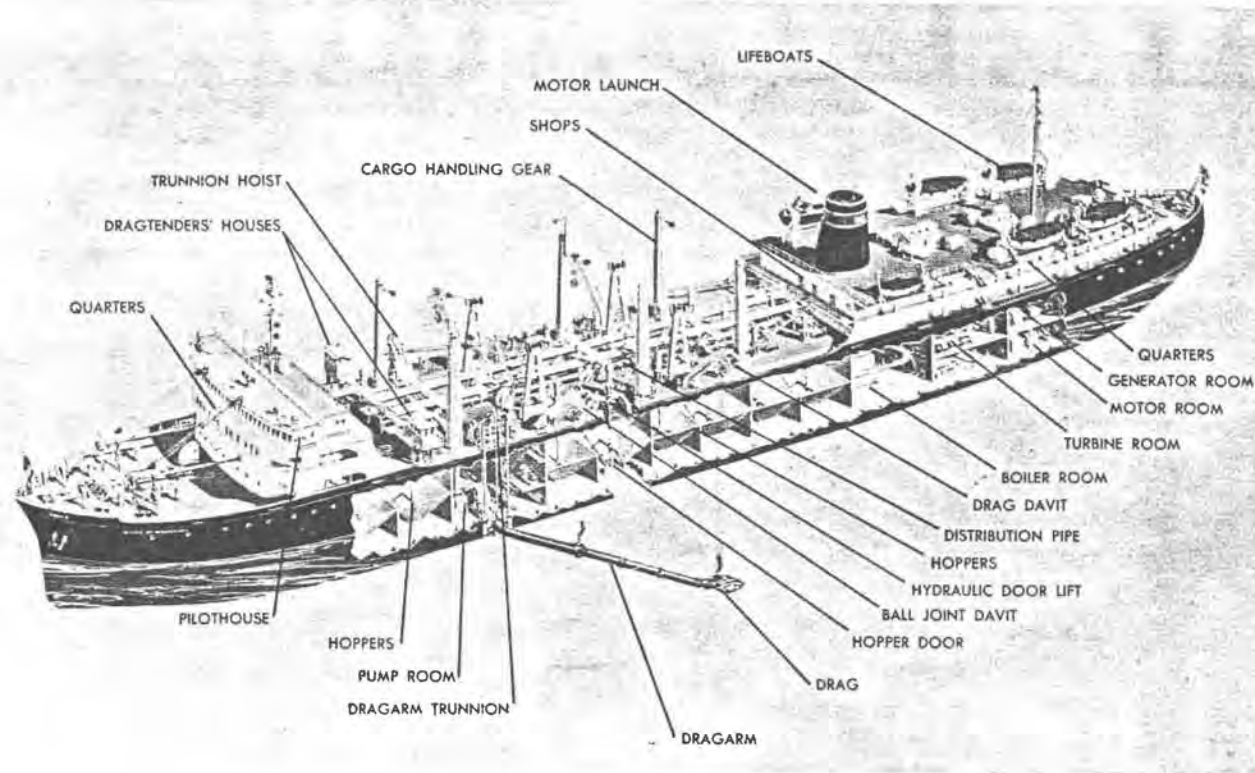
Works as a Civil Engineer responsible for applying the skills and knowledge of a professional engineer to perform duties related to dredging operations studies.

1. Assignments consist of portions of all of selected dredging studies to determine disposal sites. Through on-site inspection, side scan sonar surveys, hydrographic surveys, sediment samples personal contact with other local, state and federal agencies and private and port authorities determines best areas of disposal of dredging material.

2. Collects and reviews data to determine disposal analysis of estuary disposal sites, impacts of commercial dredging, economic justification, sediment transport rates and preparation of disposal plans.
3. Assists in drafting correspondence, reviewing and checking technical reports, computations for areas of disposal and dredging sites. Attends public meetings as section representative.

Performs other duties as assigned.

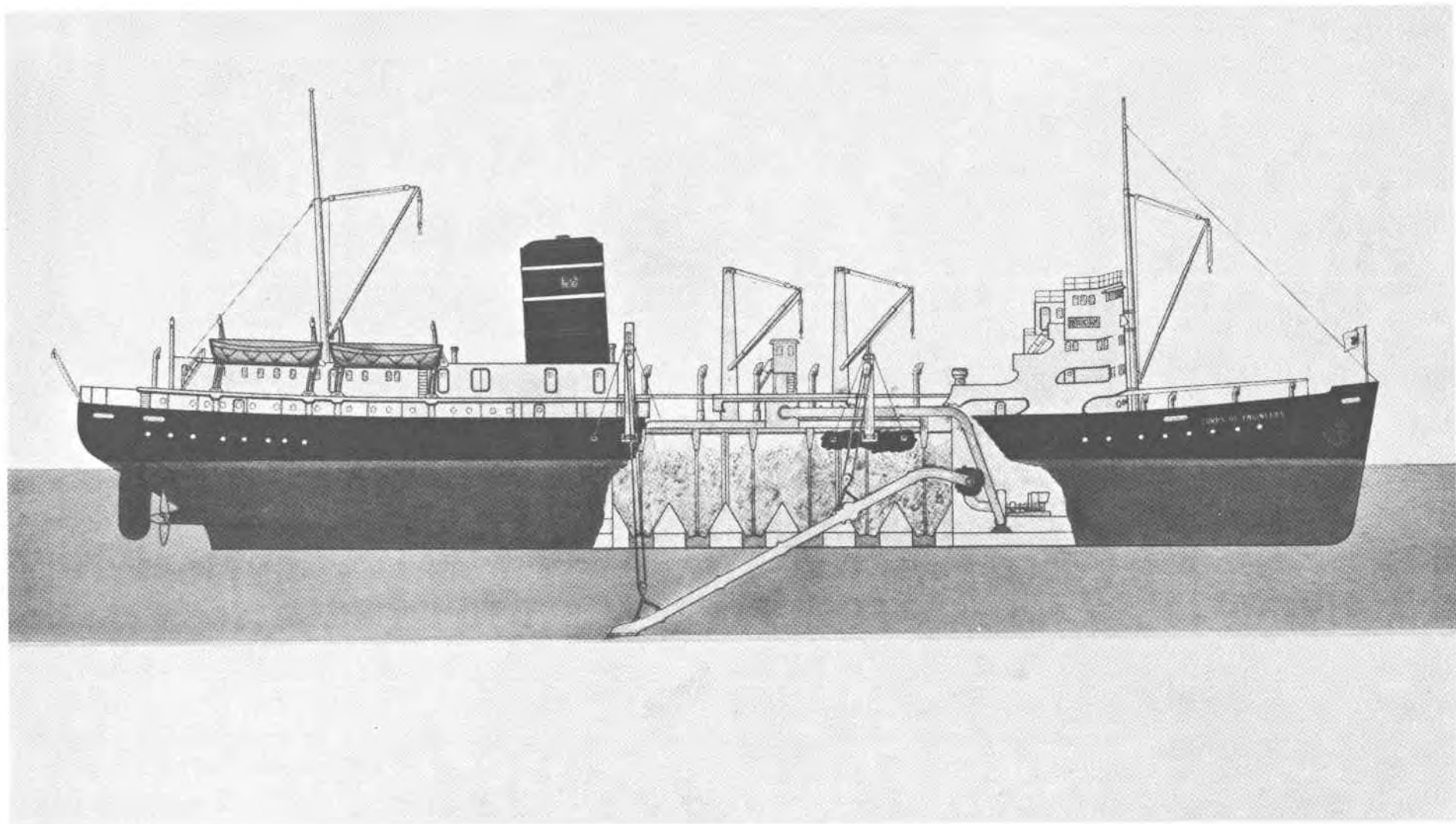
TYPICAL HOPPER DREDGE COMPONENTS (DREDGE ESSAYONS)

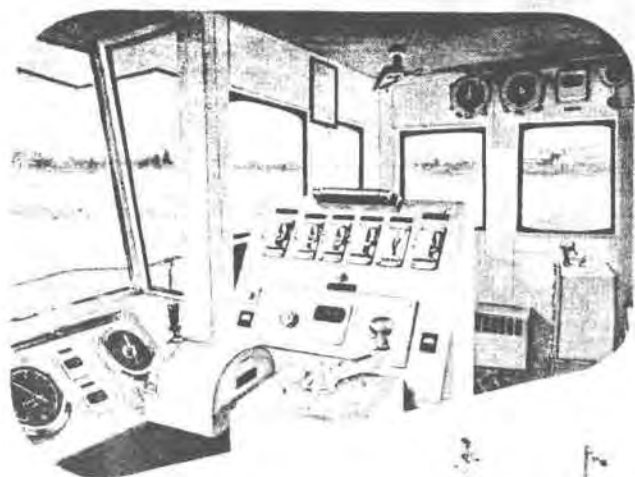


THE HOPPER DREDGE

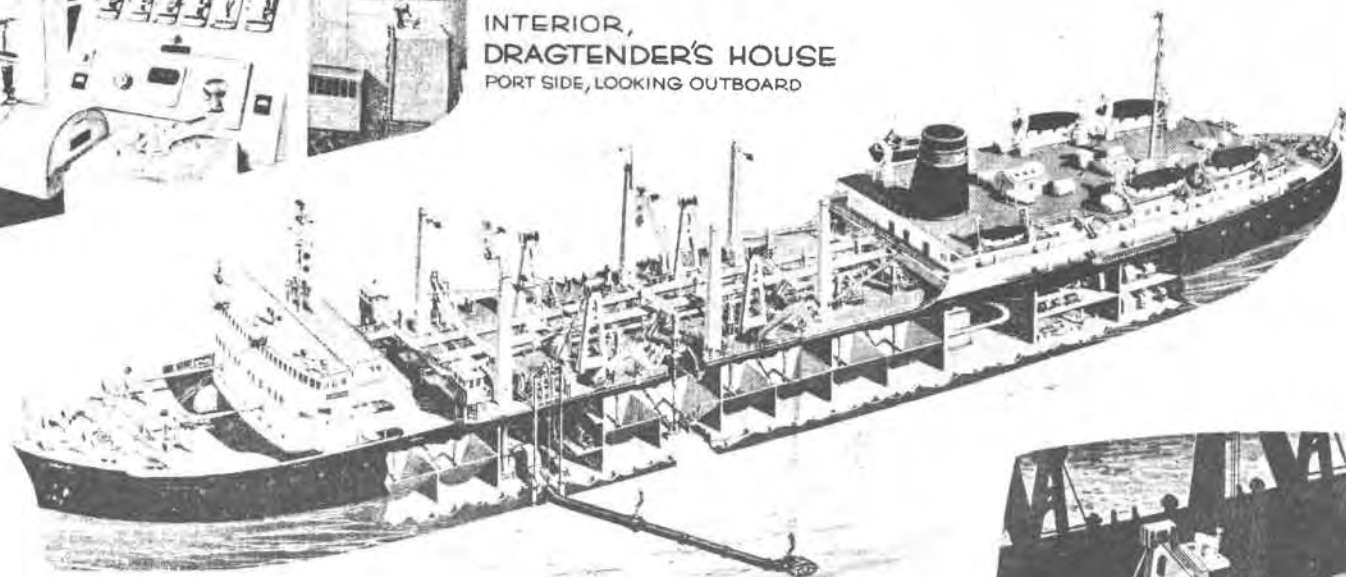
Hopper dredges are self-propelled, oceangoing vessels designed to dredge and transport dredged materials to open-water disposal areas. The dredging equipment works in much the same manner as the tank-type vacuum cleaners used in many American homes. Dragarms (counterpart of vacuum wands) with dragheads (vacuum attachments) extend from each side of the dredge's hull. These are lowered to the channel bottom and slowly pulled over the area to be dredged. Pumps create suction. As the dragheads pass over a shoal, the bottom materials are vacuumed up through the arms and deposited in hopper bins (vacuum dust bag) in the mid-section of the vessel. When the bins are full, the dredge sails to the designated disposal area where the dredged material is emptied through large doors in the bottom of the ship's hull.

Hydrographic survey vessels using electronic equipment survey the dredged area to determine when the desired channel depth has been reached.





INTERIOR,
DRAGTENDER'S HOUSE
PORT SIDE, LOOKING OUTBOARD



DREDGE ESSAYONS

SEAGOING HOPPER DREDGE
CAPACITY-8,270 CUBIC YARDS

U.S. ARMY ENGINEER DISTRICT PHILADELPHIA
CORPS OF ENGINEERS

DRAG AND
TRUNNION
- OPERATION
AND STOWAGE



DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, PHILADELPHIA DISTRICT
HOPPER DREDGE ESSAYONS

The seagoing hopper dredge ESSAYONS is the largest hopper dredge owned by the Corps of Engineers, U. S. Army. She is normally assigned to improving and maintaining Federal navigation projects between New York and Norfolk.

	<u>Feet</u>	<u>Inches</u>	<u>Draft</u>	<u>Feet</u>	<u>Inches</u>
Length Overall	525	2	Light - Fwd.	13	0
Length between Perp's	499	0	Light - Aft	20	6
Beam, molded	72	0	Loaded - Fwd.	29	2
Depth, molded amidship	40	5	Loaded - Aft	30	7½
Displacement, Light (Long Tons)	9,516	Tons			
Displacement, Loaded (Long Tons)	22,410	Tons			

Hopper Capacity: 12 Hoppers, 8,270 Cubic Yards total capacity

Material of Hull: Steel

Material of Superstructure: Steel

Construction Started: 15 December 1947

Vessel Commissioned: 16 January 1950

Number in Crew: 114

Accommodations for 155: 34 officers, 115 crew, 6 dispensary

Propulsion Power: Turbo-Electric, D.C., 8,000 H.P., twin screw

Horsepower per motor: 4,000 at 92-110 r.p.m.

Reduction Gear: Ratio 9.055 to 1

Propellers: Two, 4 bladed, 16 ft. 0 in. diameter; pitch 15.2 ft.

Pumping Power: Total 3700 H.P., 2 motors

Horsepower per motor: 1850 at 150-180 r.p.m.

Dredge Pumps (2): 150-180 r.p.m.

No. of Vanes: 4

Suction Pipe I.D.: 36 in.

Discharge Pipe I.D.: 32 in.

Discharge Pipe Velocity: 20 ft./sec.

Boilers: 2 water tube-single pass boilers operate at 600 lb/sq. in. pressure; heating surface 9,050 sq. ft. each boiler

Fuel: Bunker C; capacity 7,000 barrels; type of burner, steam-mechanical; cruising radius, approximately 7,700 statute miles

Speed in Statute Miles: Light 17.3 M.P.H. Loaded 16.0 M.P.H.



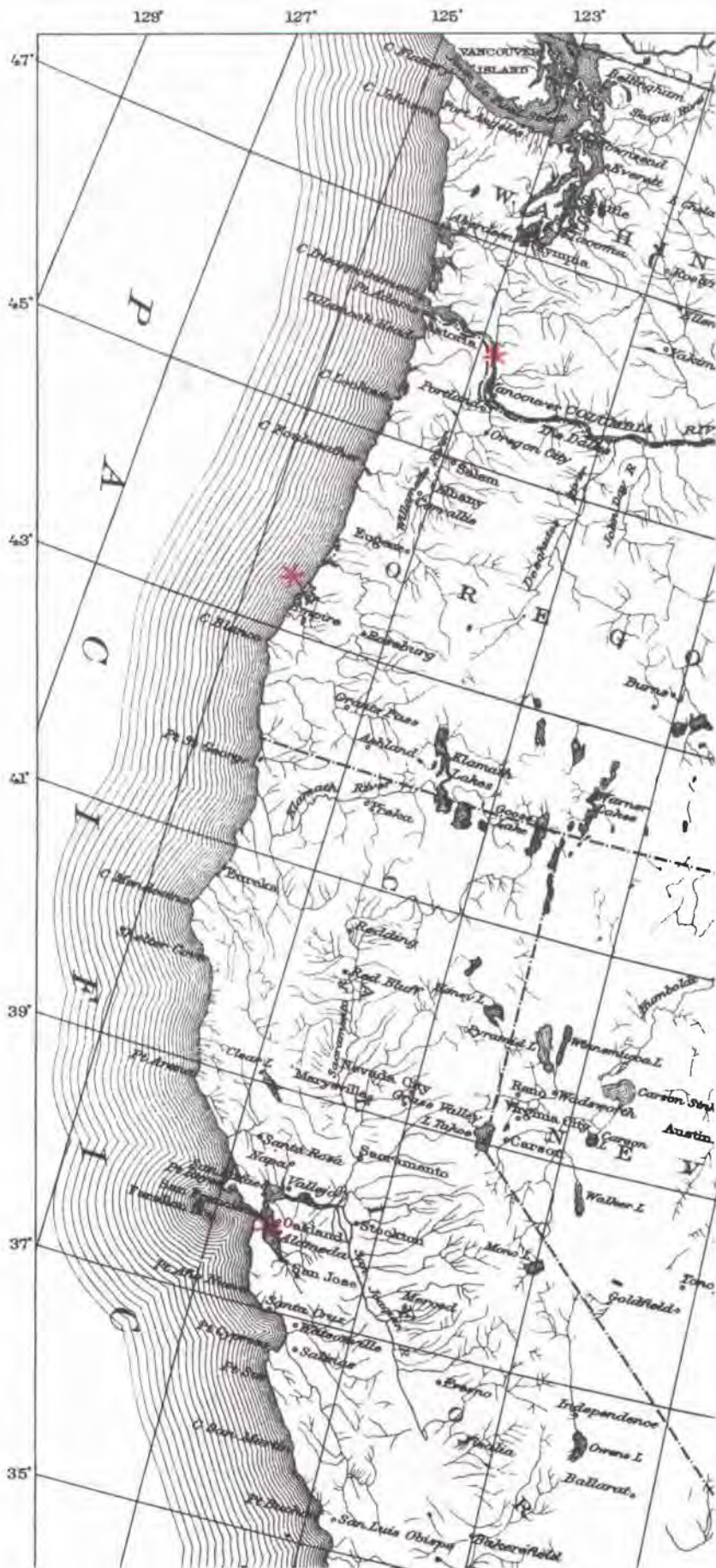
CORPS OF ENGINEERS

Hopper Dredge

BIDDLE



DREDGE BIDDLE. - Hopper Type; Capacity, 3,060 Cubic Yards; Built in 1947; Turbo-Electric Powered; Propulsion H.P.; 6,000; Pump H.P.; 2-1,150; Suction, 30 Inches; Discharge, 28 Inches; Maximum Dredging Depth, 75 Feet; Minimum Dredging Depth, 22'; Estimated Average Capacity per Hour, 3,000 Cubic Yards; Steel Hull; Length Overall, 351'-8-3/4"; Beam, 60'-0"; Depth, 30'-0"; Draft Maximum, 24'-3-3/4"; Minimum 22'-0"; Bunker Capacity, 4,400 Bbls. Fuel Oil; Cruising Range, 4,000 Miles; Top Speed, 17.3 Statute Miles Per Hour; Personnel, Total Crew 93 Officers and Men.



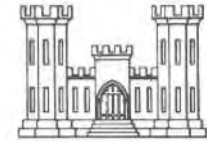
Biddle:

A major civil works responsibility of the Corps of Engineers, U.S. Army, is the dredging of ports and ship channels to accommodate water-borne traffic as authorized by Congress.

The Dredge BIDDLE is the largest of four hopper type dredges assigned to the Portland District, and is used at various locations in the Columbia River from Portland to the mouth of the river, in San Francisco area, The Hawaiian Islands, and at various coast ports indicated by the stars shown on the map at the left.

The Biddle was built by the Ingalls Shipbuilding Corporation of Pascagoula, Mississippi to the specifications prepared by the Corps of Engineers. She is named after Major General John Biddle, Superintendent of the U.S. Military Academy, West Point during 1916-17.

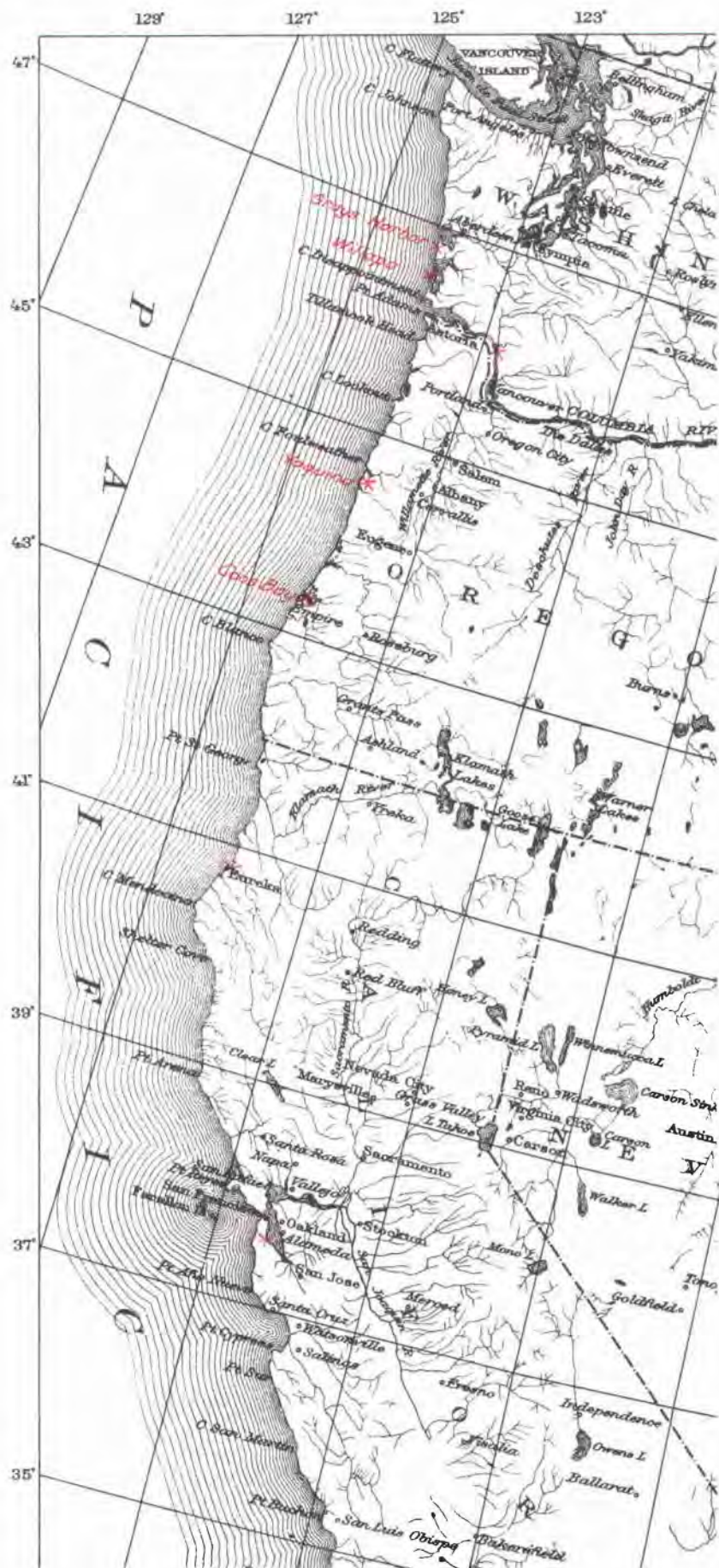
CORPS OF ENGINEERS



Hopper Dredge HARDING



DREDGE HARDING. -- Hopper Type; Capacity, 2,682 Cubic Yards; Built in 1939; Diesel Powered; Propulsion H. P. 2-2,120 Pump H. P. 2-1,000; Suction Pipe Diameter 22 inches; Maximum Dredging Depth, 62 Feet; Minimum Depth, 20 Feet; Estimated Capacity per hour, 2,200 Cubic Yards; Steel Hull; Length Overall, 308'-2"; Beam, 56'; Depth, 29'; Maximum Draft 20'-8-1/2"; Minimum, 13'-4"; Cruising Radius, 2,200 Miles; Top Speed, 14.6 Statute Miles per hour; Personnel, 10 Officers, 55 Men.



Harding:

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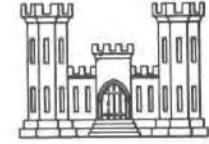
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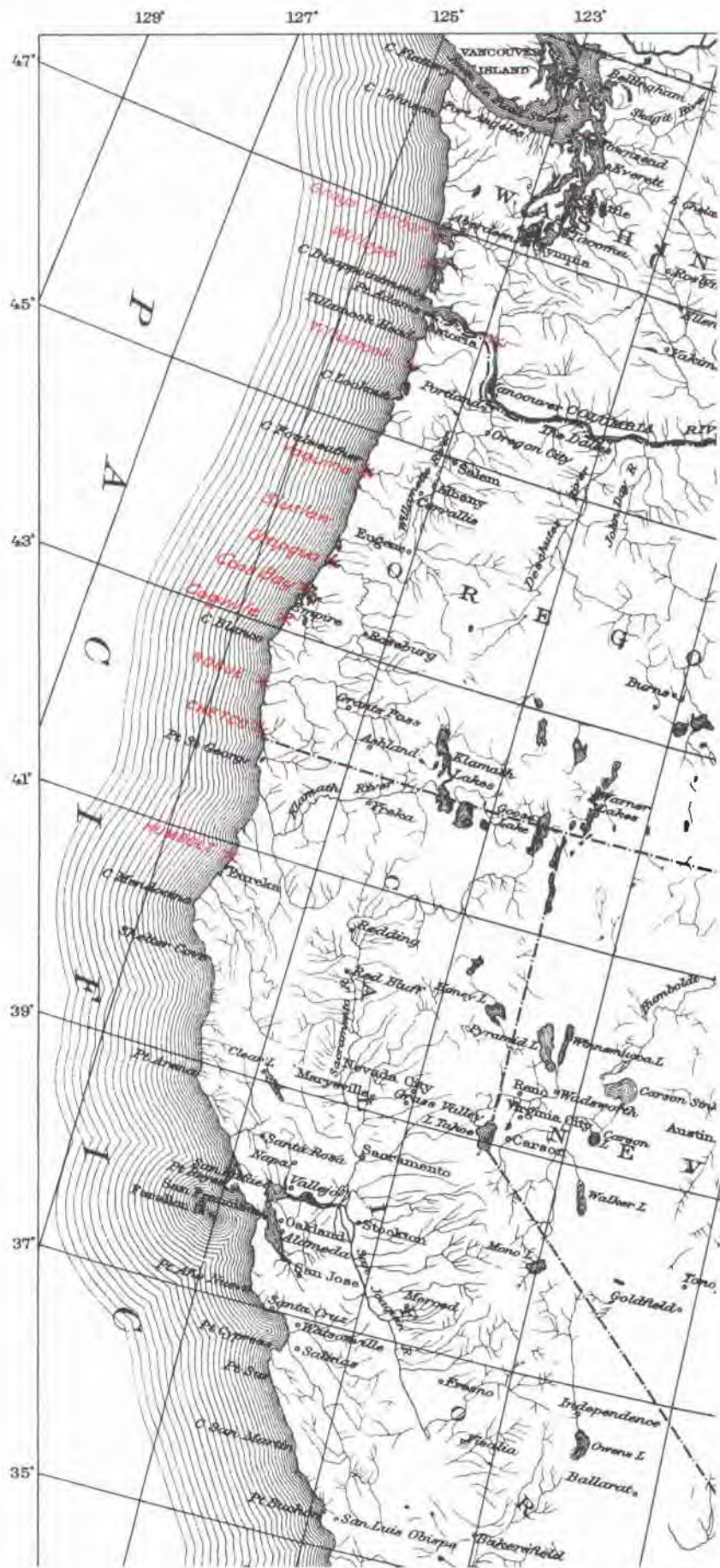


CORPS OF ENGINEERS

Hopper Dredge PACIFIC



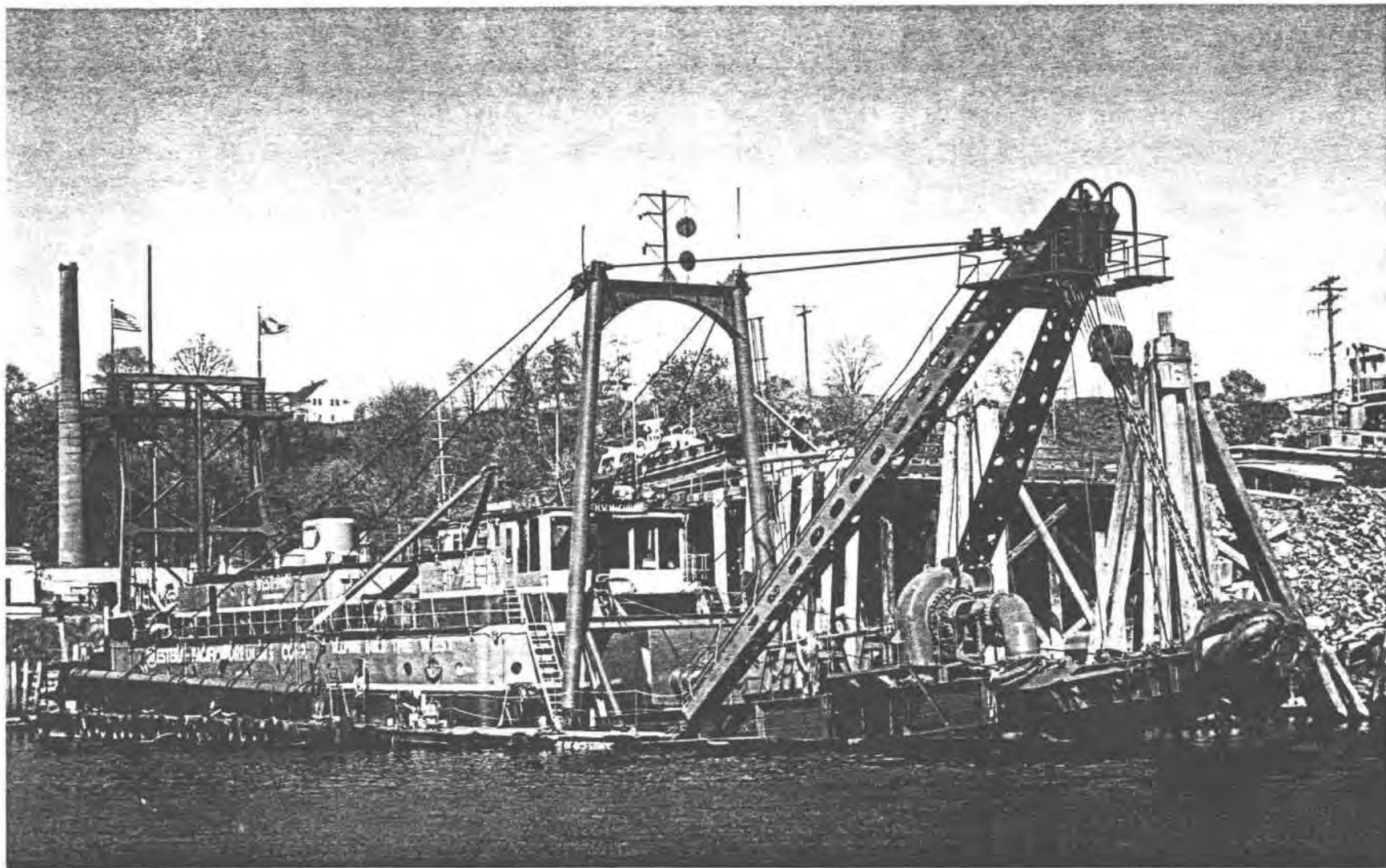
DREDGE PACIFIC. -- Hopper Type; Capacity, 500 Cubic Yards; Built in 1937; Diesel Powered; Propulsion H.P. 2-600; Pump H.P. 340; Suction and Discharge Diameter, 18"; Maximum Dredging Depth, 45 Feet; Minimum Dredging Depth, 12 Feet; Estimated Capacity per Hour, 350 Yards; Steel Hull; Length Overall, 180'-3"; Beam, 38'-0"; Depth, 14'-0"; Maximum Draft, 11'-3"; Minimum Draft, 7'-5"; Cruising Radius, 5,000 Miles; Speed 11 Knots; Personnel, 10 Officers, 34 Men.



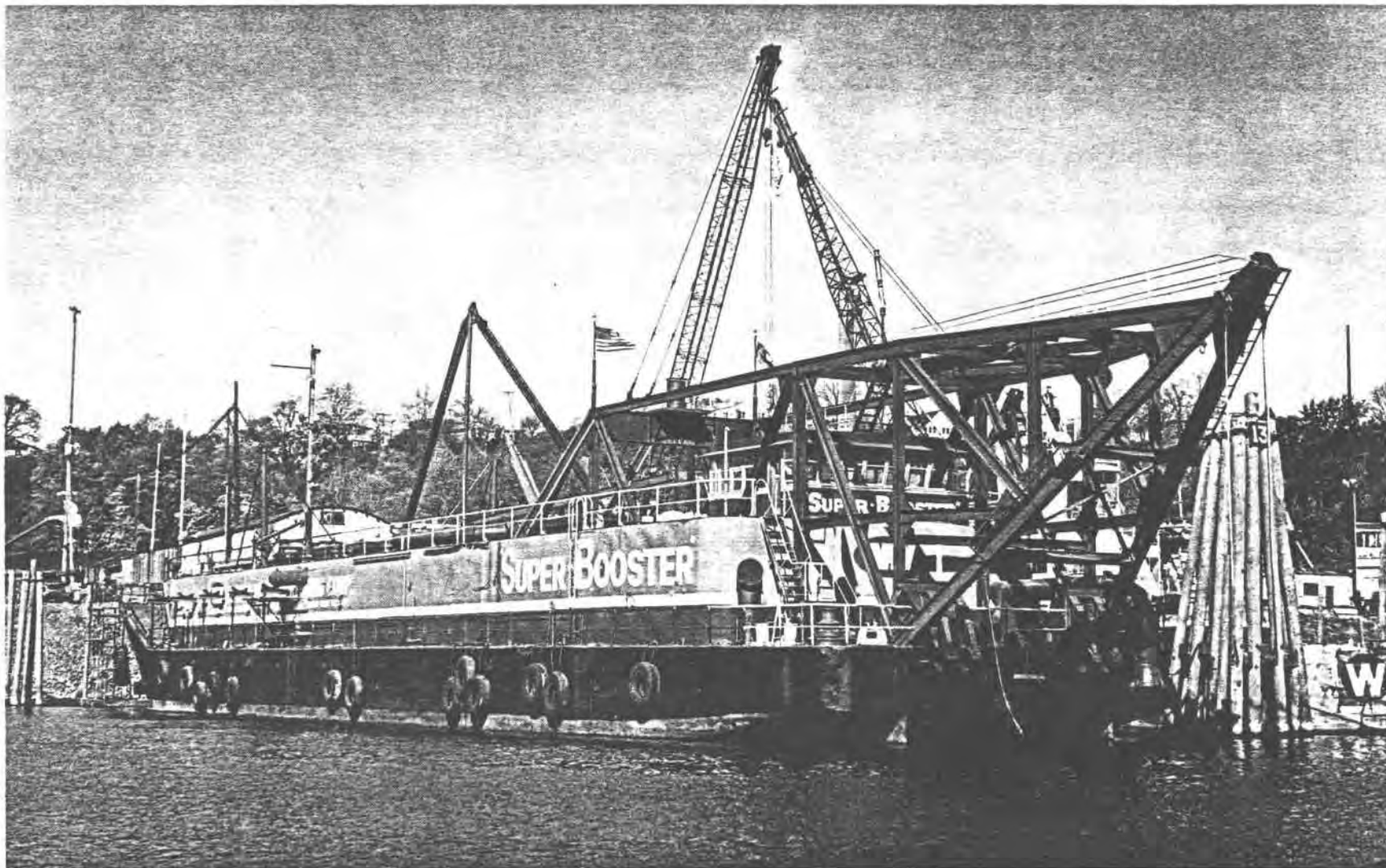
Pacific

A major civil works responsibility of the Corps of Engineers, U.S. Army, is the dredging of ports and ship channels to accommodate waterborne traffic as authorized by Congress.

The dredge Pacific is one of four hopper type dredges assigned to the Portland District, and is used at various locations in the Columbia River from Portland to the mouth of the river and at various coast ports indicated by the stars shown on the map at the left.



THE "THE McCURDY"



THE "SUPER BOOSTER"