

Warnock, 1983

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United States Department of the Interior

Redwood National Park - Redwood Creek Watershed
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IN REPLY REFER TO:

W1823

June 21, 1983

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Enclosed is an Environmental Assessment on Redwood National Park's proposed estuary management activities at the mouth of Redwood Creek. The alternatives described in the assessment are the same as those listed in Management Alternatives for the Redwood Creek Estuary which was available for review earlier this Spring. A combination of two short-term alternatives: dredging the embayment (alternative 3) and utilizing controlled breaching and drainage structures (alternative 7), are preferred by the National Park Service. Partial implementation of the preferred alternatives has begun, but a decision on their full implementation will follow public review of this assessment.

The assessment will be available for public review until July 15, 1983. Comments should be addressed to Douglas G. Warnock, Superintendent, Redwood National Park, 1111 Second Street, Crescent City, California, 95531.

Douglas G. Warnock
Douglas G. Warnock
Superintendent

Enclosure

HSU: HUMCO
Pamphlet File
Redwood CREEK WATERSHED

Redwood Creek Estuary Management
Environmental Assessment
June 1983

Purpose and Need

During late spring and early summer months, as water discharge in Redwood Creek decreases, a sand berm often builds at the mouth of the creek, forming an embayment east of the beach. By providing habitat for optimal growth and marine acclimation, the embayment is a critical element in the life history of anadromous salmonids, particularly Chinook salmon. However, the morphology and productivity of the embayment was adversely altered by the construction of a flood control project on the lower 3.2 miles of Redwood Creek in 1968. In addition as the embayment forms and water level exceeds 5.0 feet above mean sea level, adjacent private farm lands are flooded. Draining of the embayment to prevent flooding removes fish habitat and can prematurely wash fish into the ocean. The purpose of this Environmental Assessment is to analyze short- and long-term alternatives for maintaining an embayment at the mouth of Redwood Creek to provide critical fish habitat without flooding adjacent private lands. A detailed discussion of the problem and alternatives are discussed in Management Alternatives for the Redwood Creek Estuary, March 1983, Redwood National Park.

Alternatives

Short Term

1. No Action

Under the no action, short-term alternative, the park would not undertake any management actions at the estuary. Draining the embayment would occur under existing Fish and Game regulations which allows draining when adjacent lands are threatened with flooding.

2. Strict Enforcement of Management Policies

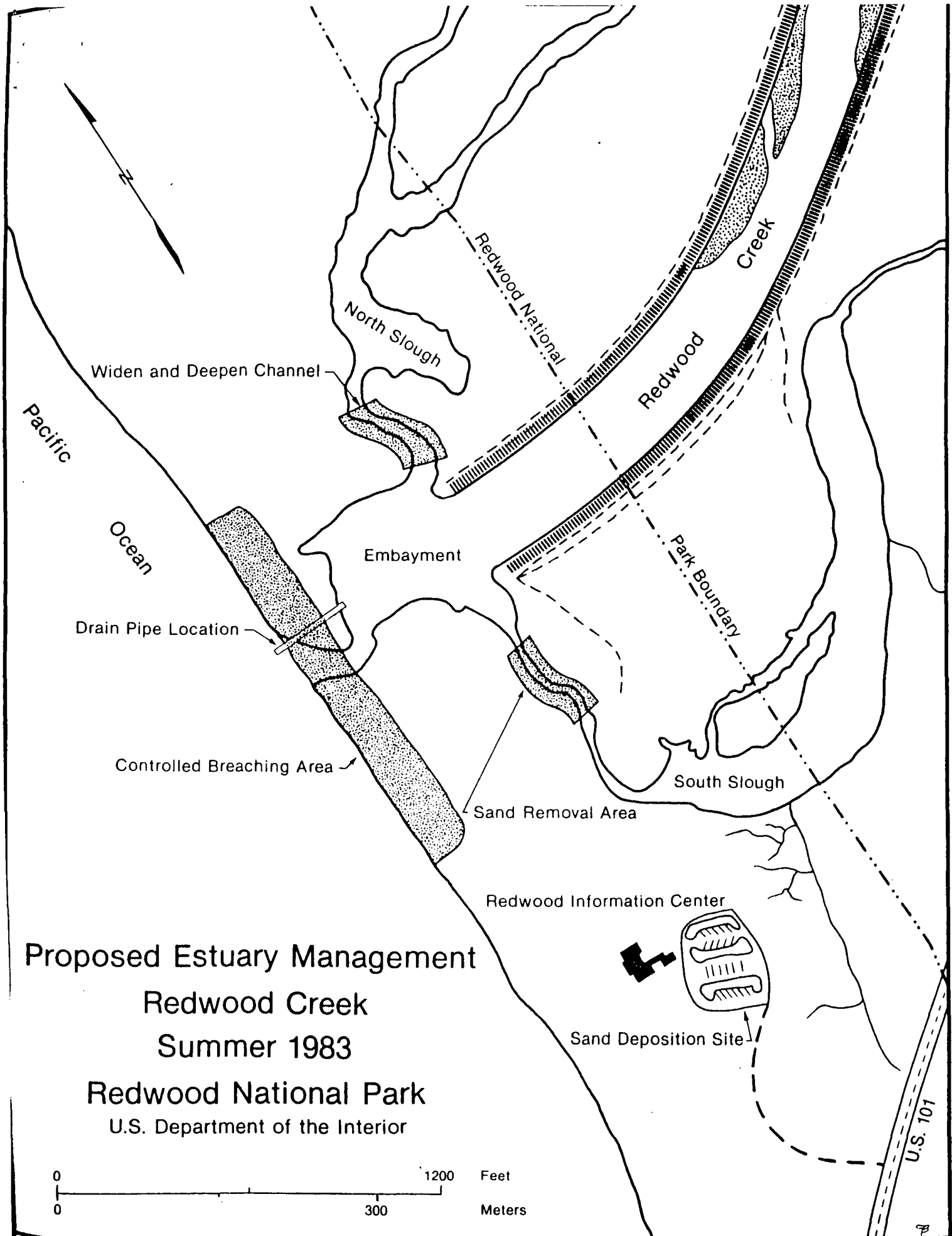
National Park Service management policies dictate that natural processes should continue unimpeded in the natural areas of national parks. Under this alternative the embayment water level would be allowed to regulate itself, even if flooding of adjacent land occurred.

3. Dredging (Short-term alternatives 3, dredging, and 7, drainage structures and controlled breaching, are preferred by the National Park Service)

Dredging the necks of the sloughs to historic depths would increase the volume of habitat, and may also aid in preventing summertime flooding (see enclosed map). Heavy equipment would be used to push sand out of the neck of the slough. Excess sand would be deposited on the beach face or in the vicinity of the proposed Redwood Information Center. The volume of sand to be dredged has not been estimated.

4. Diking Pastures

Rock and gravel dikes would be constructed to separate the embayment from adjacent pastures. One-way drainage gates would be constructed to allow winter runoff.



Proposed Estuary Management
Redwood Creek
Summer 1983
Redwood National Park
 U.S. Department of the Interior



5. Controlled Breaching

Controlled breaching of the berm would be used to maintain an embayment water level of 5.0 feet above the mean sea level.. Controlled breaching would be accomplished by hand or heavy equipment and would maintain water levels to prevent flooding and to maintain habitat.

6. Temporary Installation of Drainage Structure(s)

A series of culverts would be laid across the sand berm to prevent flooding above 5 feet and to drain the embayment. Between one and nine culverts would be needed.

7. Drainage Structure(s) and Controlled Breaching (Short-term alternative 3, dredging, and 7, drainage structures and controlled breaching, are preferred by the National Park Service)

A combination of installing temporary drainage structures and performing controlled breaching would be used.

8. Flood Easements

The U.S. Government would purchase the right to flood a landowner's property. Easements would be purchased on between four and fifty-four acres of adjacent private land.

9. Land Acquisition

Private properties adjacent to the estuary would be acquired. As under short-term alternative eight, between four and fifty-four acres would be acquired.

Long-Term

1. No Action

Under the no action, long-term alternative, the park would not undertake any management action. Draining the embayment would occur under existing Fish and Game and Corps of Engineers regulations.

2. Levee Removal

The levees would be removed back to the first bend of the creek east of the estuary. The creek would be allowed to establish its own course.

3. Partial Levee Removal

The southern levee would be removed back to the first bend in the creek east of the estuary. This alternative may accomplish the same results as long-term alternative 2.

4. Breaching the Levees/Culvert Installation

The levees would be breached and culverts installed at the points where the south and north sloughs are closest to the mainstem. This alternative may accomplish the same results as long-term alternative 2.

5. Installation of Controlled Flood Gates

The levees would be breached and controlled flood gates would be installed at the points where the south and north sloughs are closest to the mainstem. This alternative is similar to long-term alternative 4 but would allow control of streamflow.

ENVIRONMENTAL CONSEQUENCES - SHORT TERM ALTERNATIVES

Impacts On	Alternate 1 No Action	Alternate 2 Unimpeded Natural Processes	Alternate 3 Dredging of Embayment (Preferred Alternative)	Alternate 4 Diking	Alternative 5 Controlled Breaching
Vegetation	No impact	No impact	No impact	Riparian, pasture vegetation would be removed	No impact
Wildlife	Uncontrolled draining of the embayment would periodically eliminate salmonid habitat and not assist in restoring fish runs	Increased habitat for salmonids and wetland-dependent wildlife	Same as 2, but may temporarily disrupt benthic organisms in dredged areas	Same as 2	Maintaining embayment will provide habitat for salmonids - may help to increase fish runs
Endangered/ Threatened Species	No impact	No impact	No impact	No impact	No impact
Soils	No impact	No impact	No impact	No impact	No impact
Water Resources	No impact	No impact	Temporarily produce high turbidity levels in embayment	No impact	No impact
Floodplain/ Wetlands	Reduction of wetlands has been occurring for the past 50 years through conversion to agricultural use - no change in wetland area or quality would occur	Floodplain would remain under water during summer months, and would eventually convert land from agricultural to high quality wetlands	Slight improvement in wetland quality due to better water circulation.	Same as 1	Same as 1
Noise Level/ Air Quality	No impact	No impact	No impact	No impact	No impact
Cultural Resources	No impact	No impact	No impact	No impact	No impact
Socioeconomic	Sport and offshore commercial salmon fishery would continue to be hindered by depressed fish runs	Income generated by commercial and sport fishing should increase with larger runs but conversion of floodplain agricultural-based land to wetlands would mean an economic loss to landowners	Income generated by commercial and sport fishing and related businesses should increase with larger fish runs. Would assist in maintaining water levels without flooding fields.	Same as 2; but pasture would be utilized for dike.	Income generated by commercial and sport and related businesses should increase with larger fish runs. Fields should not flood.

ENVIRONMENTAL CONSEQUENCES - SHORT TERM ALTERNATIVES (Continued)

Impacts On	Alternate 6 Drainage Structures	Alternate 7 Combination Controlled Breaching and Drainage Structure (Preferred Alternative)	Alternate 8 Flood Easements	Alternate 9 Land Acquisition
Vegetation	No impact	No impact	Riparian vegetation would be improved	Same as 8
Wildlife	Same as 2	Same as 2	Same as 2	Same as 2
Endangered/ Threatened Species	No impact	No impact	No impact	No impact
Soils	No impact	No impact	No impact	No impact
Water Resources	Unexpected flooding would wash structures away	Same as 6	No impact	No impact
9 Floodplain/ Wetlands	Same as 1	Same as 1	Improvement of wetland habitat	Same as 8
Noise Level/ Air Quality	No impact	No impact	No impact	No impact
Cultural Resources	No impact	No impact	No impact	No impact
Socioeconomic	Properly sized structures would minimize need for manual breaching; however, abnormal flows could flood fields and culverts are expensive	Fields would not flood; however, culverts are expensive to install and labor costs could be high	Same as 2 and economic base for affected landowners could change from self-generated agricultural-based income to government subsidy	Same as 2 and self-generated, agricultural-based income will be terminated and a lump-sum payment be given to property owners

ENVIRONMENTAL CONSEQUENCES - LONG TERM ALTERNATIVES

Impacts On	Alternate 1 No Action	Alternate 2 Remove Levees	Alternate 3 Remove South Levee	Alternate 4 Breach Levee at South and North Slough	Alternate 5 Install Controlled Flood Gates
Vegetation	No impact	No impact	Same as 2	Same as 2	Same as 2
Wildlife	Uncontrolled draining of the embayment would periodically eliminate salmonid habitat and not assist in restoring depressed fish runs	Recovery of riparian area will benefit riparian wildlife. More natural stream morphology should improve fish habitat	Same as 2	Stream morphology will improve providing habitat for fish	Same as 4
Endangered/ Threatened Species	No impact	No impact	No impact	No impact	No impact
Soils	No impact	High-water flooding will deposit silt onto floodplain, increasing soil fertility	Same as 2 (only southern floodplain)	Same as 2 (not as extensive)	No impact
7 Water Resources	No impact	No impact	No impact	No impact	No impact
Floodplain/ Wetlands	Reduction of wetlands has been occurring for the past 50 years through conversion to agricultural use - no change in wetland area or quality would occur.	Winter high flows will inundate restored floodplain and wetland quality should increase	Same as 2 (only southern floodplain)	Winter high flows not as likely to inundate floodplain; increase in wetland quality	Minor improvement in wetland habitat due to increased summer water circulation
Noise Level/ Air Quality	No impact	No impact	No impact	No impact	No impact
Cultural Resources	No impact	No impact	No impact	No impact	No impact
Socioeconomic	Sport and offshore commercial salmon fishery would continue to be hindered by depressed fish runs	Income generated by commercial and sport fishing and related businesses should increase with larger fish runs; however, agricultural land would be flooded in winter	Same as 2 (winter agricultural loss only to south side)	Same as 2	Increased income from fishing-related business should result from improved salmon runs. With properly operated gates, no additional field flooding should occur.

Compliance With E.O. 11988, "Floodplain Management," and E.O. 11990, "Protection Of Wetlands"

Water management through controlled breaching may not result in adverse impacts to the floodplain of Redwood Creek or to the wetlands surrounding the embayment at the mouth of the creek. Water levels will be maintained at or below the height necessary to avoid flooding adjacent pastures or a county road. In addition, during low water periods, water levels will be maintained at or above the height necessary to connect the north and south sloughs with the main channel of Redwood Creek. This should enhance the biological productivity of the embayment, especially during the summer months when the embayment could be fully drained. The National Park Service has applied for a Corps of Engineers permit under Section 404 of the Clean Water Act, as amended.

Federal Consistency With California Coastal Zone Management Policies

In 1979, during review of the Draft Environmental Impact Statement for the General Management Plan, the California Coastal Commission found that the GMP was not consistent with Section 30231 of the California Coastal Zone Management Act because the plan failed to address restoration of the Redwood Creek estuary. The National Park Service believes that the preferred alternative for this summer's estuary management [short-term alternatives 3 (dredging) and 7 (controlled breaching and drainage structure(s))] responds to the objections raised by the Commission in 1979 and would be consistent with the California Coastal Zone Management Act Policies. The following is a discussion of the preferred alternatives' consistency with the individual policies.

Coastal Zone Consistency

<u>COASTAL SECTION</u>	<u>POLICY</u>	<u>EVALUATION OF THE PROPOSAL</u>	<u>CONSISTENCY</u>
<u>Water and Marine Resources</u>			
30231	Biological productivity of estuaries shall be maintained or restored.	Water level management should maintain biological productivity. Dredging should provide short-term improvement in biological productivity.	Consistent
30233(a)	Diking, filling, and dredging of ocean waters shall be permitted when other alternatives are not available or when adverse impacts are minimized.	Dredging will enhance biological productivity of embayment.	Consistent
30233(b)	Dredging and spoils disposal shall avoid significant disruption to marine and wildlife habitats.	Spoils shall be disposed in an upland area near site, away from wetland and riparian habitats.	Consistent
30233(c)	Dredging in existing estuaries and wetlands shall maintain or enhance the functional capacity of the wetland.	Dredging will enhance biological productivity of embayment.	Consistent
<u>Commercial Fishing and Recreational Boating</u>			
30235	Existing marine structures (revetments, breakwaters, groins) causing water stagnation contributing to fish kills should be phased out or upgraded where feasible.	Water management should provide temporary mitigation for problems created by levees.	Consistent
303236	Alterations of waterways shall be limited to water supply, flood control, and habitat improvement projects.	Waterway alteration is for habitat improvement.	Consistent
<u>Environmentally Sensitive Habitat Areas</u>			
30240(a)	Sensitive habitat shall be protected.	Sensitive island, marsh, and sand dune habitats will be protected, enhanced, and/or rehabilitated.	Consistent
<u>Agriculture</u>			
30241	The maximum amount of prime agricultural land shall be maintained in production.	Prime agricultural land adjacent to embayments should not be impaired.	Consistent
30242	Suitable agricultural land shall not be converted nonagricultural uses.	Agricultural land will not be converted to wetland.	Consistent

Consultation and Coordination

During 1981 and 1982, consultations with local residents and interested agencies occurred during development of a research study for the mouth of the creek and during implementation of experimental water-level management. In addition two meetings were held with the Corps of Engineers. Copies of Management Alternatives for the Redwood Creek Estuary were sent to interested agencies and individuals requesting written comments on estuary management. Two public meetings held on April 18, 1983 in Arcata, California, and on April 20, 1983 in Orick, California. A summary of the public input received during the public comment period (March 30 - May 1, 1983) and at the two public meetings is available.

RNPark/WARNOCK(1987)

> 1986 FNP Comnts

Redwood Creek

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CRESCENT CITY, CALIFORNIA 95531

IN REPLY REFER TO:

W1823

May 1, 1987

Redwood National Park is proposing to resume its estuary management activities at the mouth of Redwood Creek this spring and summer. As in 1986, we expect to be controlling water levels in the estuary to maintain summertime habitat for rearing juvenile salmonids while preventing flooding of adjacent private property.


In addition to our summertime water level management activities, Redwood National Park is proceeding with implementation of a portion of the fisheries mitigation for the U. S. 101 Bypass construction project. As outlined in the final environmental impact statement for the highway, part of the fisheries mitigation will involve construction of culverts through the south levee of the Redwood Creek Flood Control Project to restore water circulation to the South Slough at the mouth of Redwood Creek. Construction is expected to begin in July.

In order to help you understand these proposals, we are enclosing a description of our Estuarine Management and Research Activities which were carried out in 1986 and a description and drawings of the proposed culverts.

We are scheduling an information meeting in Orick on May 13, 1987 to discuss this year's activities. The meeting will be at 7:00 p.m. at the Redwood Information Center.

If you have any questions regarding the project, please contact Mr. Terry Hofstra, Fish and Wildlife Ecologist, Redwood National Park, 1125 16th Street, Arcata, California 95521. Telephone (707) 822-7611.

Sincerely,


Douglas G. Warnock
Superintendent

Enclosure

ESTUARINE MANAGEMENT AND RESEARCH ACTIVITIES
MOUTH OF REDWOOD CREEK
1986

Redwood National Park (RN Park)
Crescent City, California
May 1987

INTRODUCTION

Background

During late spring and early summer months, as water discharge in Redwood Creek decreases, ocean waves often build a sand berm at the mouth of the creek. By providing habitat for optimal growth and marine acclimation, the embayment is a critical element in the life history of anadromous salmonids, particularly chinook salmon. However, the morphology and productivity of the embayment were adversely altered by the construction of a flood control project on the lower 3.2 miles of Redwood Creek in 1968. In addition, as the embayment forms and water level exceeds 5.0 feet above mean sea level, adjacent private farmlands are flooded. Draining of the embayment to prevent flooding removes fish habitat and can prematurely wash fish into the ocean. A detailed discussion of the problem and alternatives are discussed in Management Alternatives for the Redwood Creek Estuary, March 1983, Redwood National Park.

The park has actively managed the remnant Redwood Creek embayment since 1982. Management actions were designed to maintain what little rearing habitat remained and to prevent flooding of private property resulting from natural embayment formation.

Summary Evaluation for 1986

The overall objective of activities undertaken in 1986 was to maintain summertime estuarine habitat for rearing juvenile salmonids while preventing flooding of adjacent private property. Management and research activities included topographic and bathymetric surveys, embayment water level control, water quality monitoring, and numbers and growth monitoring of juvenile salmonids utilizing the embayment.

Flooding of private property was prevented. Water levels fluctuated greatly and were generally marginal as far as fish habitat was concerned. However, tolerable embayment conditions were maintained so that some habitat was available for juvenile salmonids. Invertebrate production in the embayment and its value as salmonid rearing habitat is limited by unstable substrate. Bottom instability resulting from tidally influenced water level fluctuations was further aggravated by park water level control activities. Nevertheless, juvenile chinook salmon, steelhead, and cutthroat trout did spend an extended period in the embayment. During this period, rearing salmon and steelhead grew substantially. Such growth enhances their chances of survival during the ocean stage of their life cycle.

Slough necks excavated in 1983 to restore embayment volume and to improve fish access to the sloughs were resurveyed. The resurvey shows that sand deposition has occurred in the areas of excavation although the channel bottoms of the slough necks remain below pre-excavation levels.

Proposed Activities for 1987

1. It is proposed as a short term solution that embayment water levels be regulated by the NPS by controlled breaching.

Under certain summertime, low flow conditions, embayment water levels can be controlled to prevent flooding of private property while maintaining some juvenile fish habitat. Embayment water level control is an expensive and time consuming method of dealing with the flooding/fish habitat issue. However, as long as adjacent private property can not be permitted to flood by natural embayment formation, water levels must be controlled in a manner which also protects fish habitat as much as possible.

Water levels will be maintained as close to 5.0 feet above mean sea level as possible. This is the elevation which maximizes fish habitat without flooding adjacent pasturelands. If necessary for construction purposes (See number 6. below) water levels may be maintained below 5.0 feet above mean sea level.

2. It is proposed that the north and south slough necks be resurveyed.

A resurvey of the slough necks would identify the degree of winter sediment accumulation in excavated areas. An evaluation could then be made of fish accessibility to the sloughs during 1987.

3. It is proposed that the park continue to evaluate long range restoration alternatives for the estuary.

The park will work with other agencies and organizations in developing alternatives for the restoration of the estuary to a more naturally functioning, self-sustaining system.

4. It is proposed that estuarine water quality, and embayment fish numbers and growth rates be monitored.

5. It is proposed the park expand interpretation and public dissemination of information regarding park management activities at the estuary.

6. It is proposed that a controlled flood gate be installed through the south levee to allow Redwood Creek flows to enter the south slough.

Improving water circulation and quality in the south slough would improve this area as summer rearing habitat for juvenile salmonids. The project would be funded by the California Department of Transportation as mitigation for fisheries losses from construction of the U.S. Highway 101 Bypass project.

7. It is proposed that detailed studies of the patterns of water circulation in the south slough be conducted before and after the controlled flood gate is constructed.

Documenting patterns of circulation in the south slough will provide data necessary to evaluate the effectiveness of the culvert and will establish the new circulation patterns that will exist after the culvert is completed. These data will also be useful in the evaluation of long term restoration options.

MANAGEMENT, RESEARCH AND MONITORING ACTIVITIES IMPLEMENTED IN 1986

South and North Slough Resurvey

Accumulated sand was excavated from the slough necks to restore embayment volume and improve access for juvenile salmonids to the main slough areas in 1983. The areas excavated are shown in Figure 1. Profiles were surveyed across the neck areas before and after excavations to document the amount of material removed and to determine final channel configuration. Profile locations are shown in Figure 2.

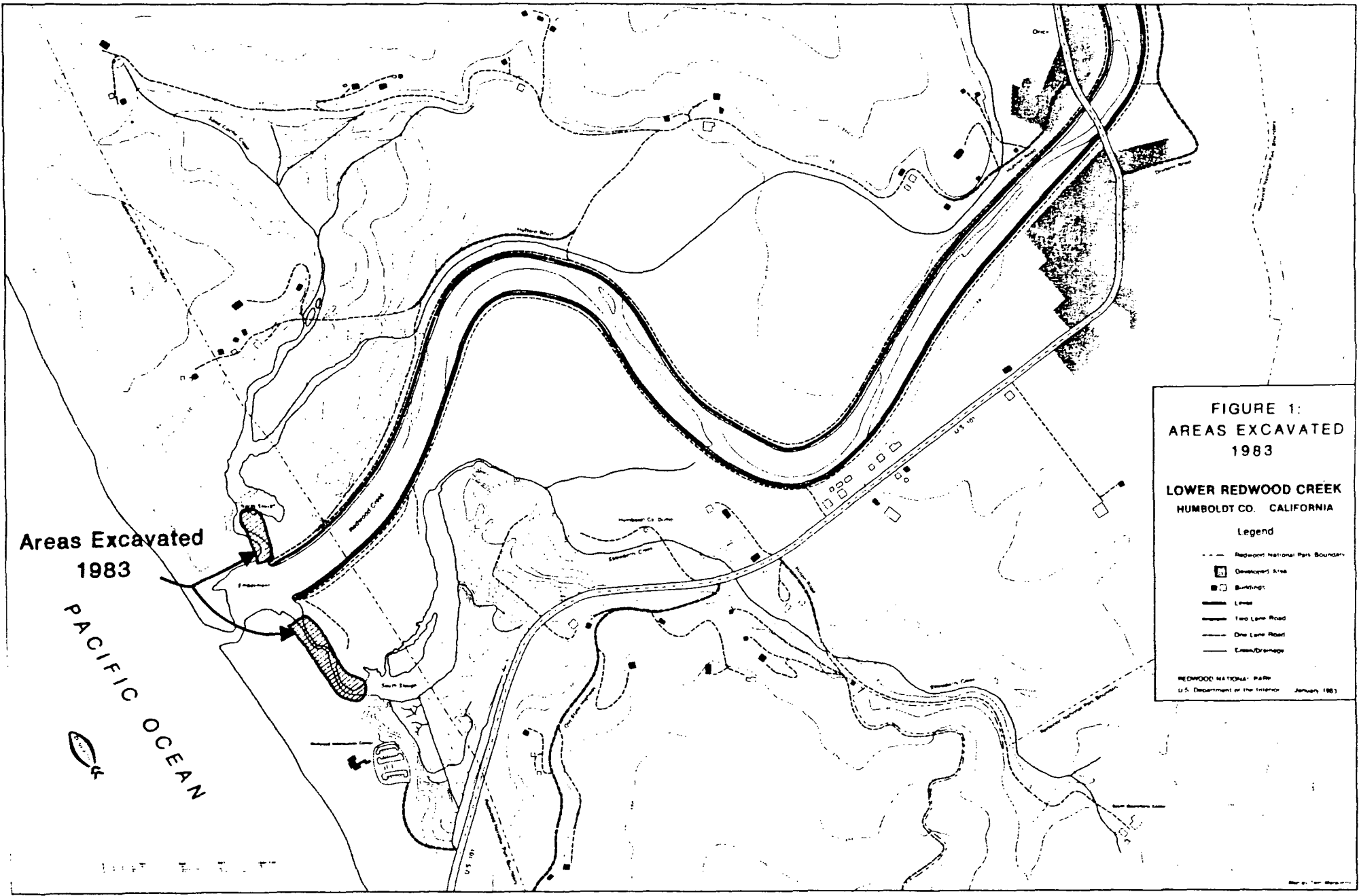
The resurvey shows the excavated channels have undergone readjustment and filling with sand in most areas. Circulation between each slough and the mouth of Redwood Creek is controlled by the highest channel-bottom elevation in the connecting neck. This "limiting elevation" prevents circulation and fish movement when the backwater of Redwood Creek falls near or below pre-excavation levels:

Limiting Elevations (above mean sea level)

	Before (1983)	After (1983)	1 Yr. (1984)	2 Yrs. (1985)	3 Yrs. (1986)
North Slough	6.58	3.10	2.17	2.36	3.68
South Slough	2.85	.07	1.24	1.24	1.97

Embayment Water Level Control

The objective was to maintain embayment water levels to protect adjacent private lands from flooding while retaining sufficient water to provide habitat for juvenile salmonids. Water levels were to be maintained as high as possible without exceeding 5.0 feet above mean sea level, when pastures begin to flood. An operations plan was developed by Resource Management Division outlining objectives, methods, and responsibilities.



**FIGURE 1:
AREAS EXCAVATED
1983**

**LOWER REDWOOD CREEK
HUMBOLDT CO. CALIFORNIA**

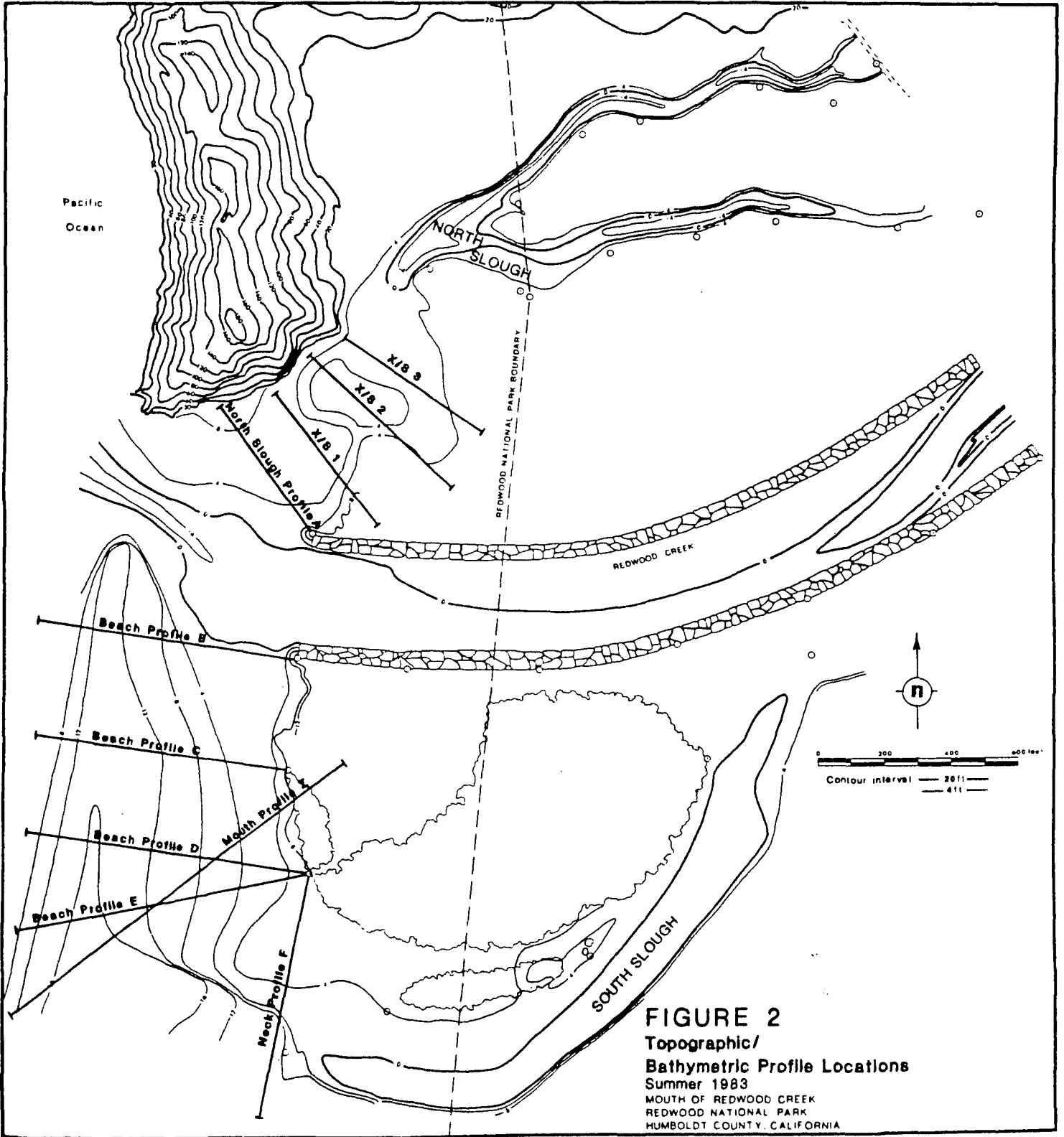
Legend

- - - Redwood National Park Boundary
- Developer's Area
- Buildings
- Line
- == Two Lane Road
- One Lane Road
- Creek/Drainage

REDWOOD NATIONAL PARK
U.S. Department of the Interior January 1983

Areas Excavated
1983

PACIFIC OCEAN



Water levels were manipulated by controlled breaching a total of seven times from July 22 through September 18. Flooding of private property was prevented.

Water Quality Studies

Monitoring was conducted to determine if and when estuarine (embayment and sloughs) water quality was a limiting factor for juvenile salmonids. Parameters measured at twelve sites in the north and south sloughs and the embayment included conductivity, temperature, salinity, and dissolved oxygen. A vertical profile from surface to bottom was determined for each parameter, at each station, four different times from June 23 to August 28. Poorest water quality was observed in the north slough where temperature and dissolved oxygen levels were limiting at certain times and depths. In the south slough water quality was generally better than in previous years, but temperatures were elevated early in the summer. In the embayment, neither water temperature nor dissolved oxygen was limiting.

The embayment alternated between a fresh and brackish water system. High tides and ocean overwash caused short periods when brackish conditions prevailed. A dense salt water layer remained on the slough bottoms throughout the summer. A salt water layer also existed at times on the embayment bottom, but its depth varied with tides, ocean conditions, and mouth configuration.

Fish Monitoring

This program was directed at determining numbers and growth of juvenile salmonids utilizing the embayment.

Embayment fish populations were estimated by seining and marking captured fish. The ratio of marked versus unmarked fish captured two days later was utilized in calculating population estimates. Three estimates were made from June 23 through August 11. Growth was monitored five times by seining and measuring each fish captured from June 23 through September 11. Scales were collected from 30 individuals of each species.

The major area utilized by juvenile salmonids was the embayment. Fish avoided the saltwater layer on the embayment bottom and area adjacent to the ocean berm during periods of overwash, preferring water of lower salinity. Few fish utilized the sloughs.

Population estimates and growth for juvenile chinook salmon and steelhead trout are shown in the following table that shows downstream

migrating salmonids found favorable habitat in the estuary as soon as an embayment began to form.

Date	<u>CHINOOK SALMON</u>		<u>STEELHEAD TROUT</u>	
	Estimated Population	Fork Length (mm)	Estimated Population	Fork Length (mm)
6/22/86	4,533	82.6	19,914	115.3
7/ 9/86	1,215	90.9	13,289	120.8
7/21/86	2,025	94.1	25,404	107.3
8/12/86	-	100.8	-	103.9
9/11/86	-	104.4	-	121.7

Juvenile salmon growth in the estuary during the summer was substantial. Fork length averaged 82.6 mm on June 23 and 104.4 mm on September 11. The low number of juvenile chinook salmon in the estuary, as compared to other years, was probably due to scouring of spawning beds by extremely high flows that occurred in Redwood Creek and tributaries in February.

Patterns of estuarine use by juvenile steelhead trout were similar to that of salmon. That is, when habitat was available, steelhead spent an extended period in the estuary. The decrease in calculated average fork length of steelhead on July 21 and August 12 was due to an increase in the number of smaller size juveniles entering the embayment. The influx of smaller fish may have been due to reduced upstream flows and/or elevated stream temperatures in Redwood Creek and tributaries causing the fish to move downstream.

1986 Cost Summary

Management and Monitoring Activities

Water Level Control	\$1,631
Resurvey of Excavated Areas	1,000
Water Quality Monitoring	600
Fish Population and Growth Monitoring	<u>3,300</u>
Total	\$6,531

SOUTH SLOUGH INTAKE STRUCTURE
PROJECT DESCRIPTION

The proposed culverts are intended to partially offset the fisheries losses resulting from construction of the U.S. 101 Bypass project. By diverting a portion of Redwood Creek's flow through the former main channel of the creek (now the South Slough), summer rearing habitat for juvenile steelhead and chinook salmon will be improved (see attached drawings).

Through an agreement with the National Park Service, the culverts will be designed and constructed by the Corps of Engineers. The National Park Service is responsible for obtaining necessary permits and the Service will also own and operate the culverts when construction is complete. The California Department of Transportation is obtaining the rights-of-way and is funding the project.

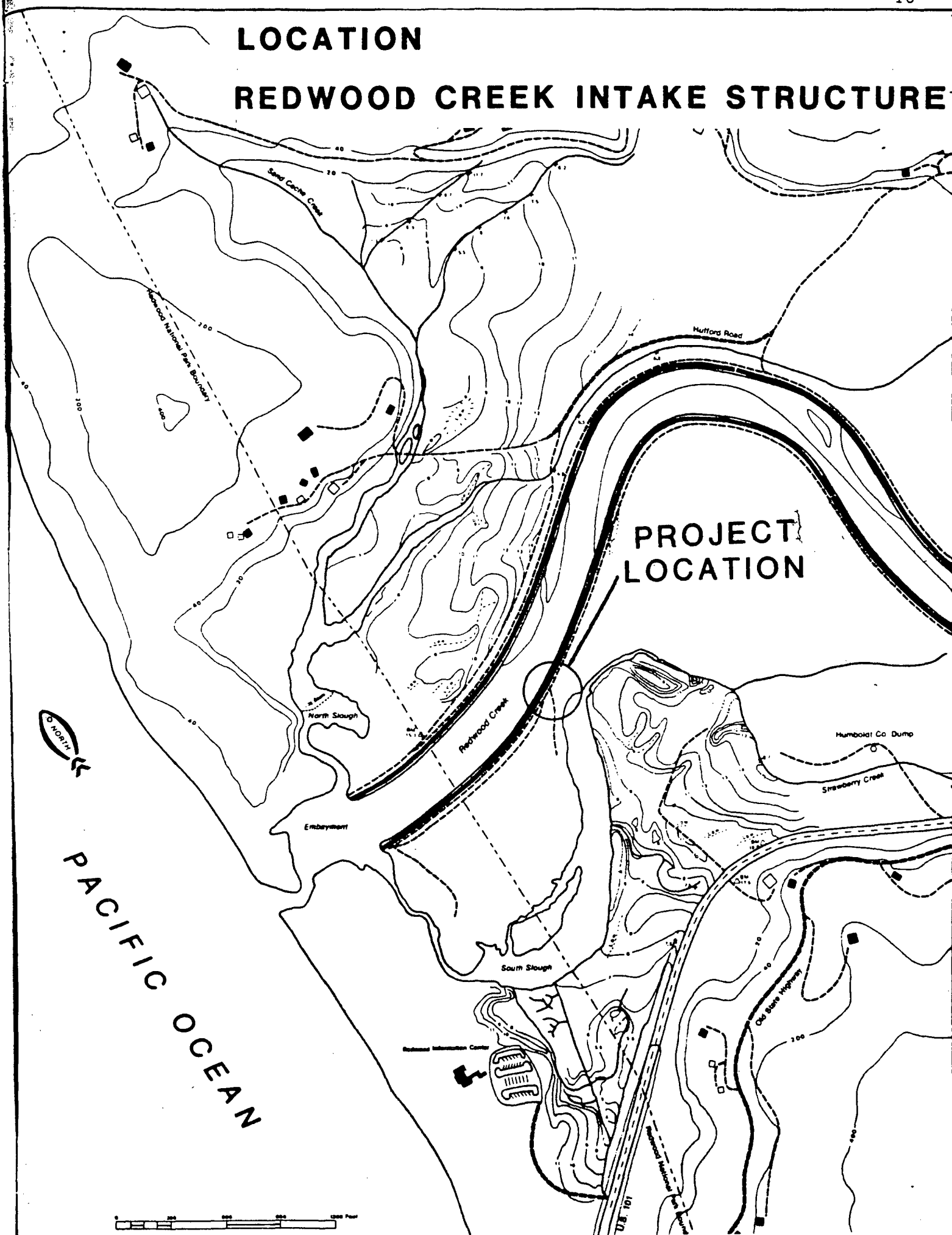
The culverts will consist of three, eight-foot by nine-foot concrete boxes with manually operated gates on each culvert. The culverts will be approximately 83 feet long, with a trash screen on the upstream end and an apron and rip-rap channel on the downstream end to direct discharge. The culverts will require approximately 2.2 acres while temporary storage of equipment and material will require an additional 3.8 acres.

Construction of the culverts will require removal of a portion of the existing levee at the upper end of the South Slough. The existing levee material, which consists of rock and soil, will be sorted on-site and partially reused during construction. Cofferdams will be constructed in Redwood Creek and the South Slough to prevent backwater flooding from interfering with construction. The culverts will be built in place and the levee material will be placed on the sides and over the top of the boxes, and used as fill material on the access road to the park's South Operation Center. At the conclusion of the work, the rip rap channel extending from the culverts to the South Slough, will be an obvious change in the existing levee configuration.

After the project is completed, water level management activities will continue at the mouth of Redwood Creek to maintain rearing habitat for juvenile salmonids while preventing flooding of adjacent private property. If necessary, a small (2-3 foot high), seasonal gravel berm will be created in Redwood Creek to divert the low summer flow into the South Slough. The berm would be pushed up using heavy equipment in early summer and allowed to wash away with winter rains.

LOCATION

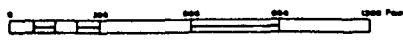
REDWOOD CREEK INTAKE STRUCTURE

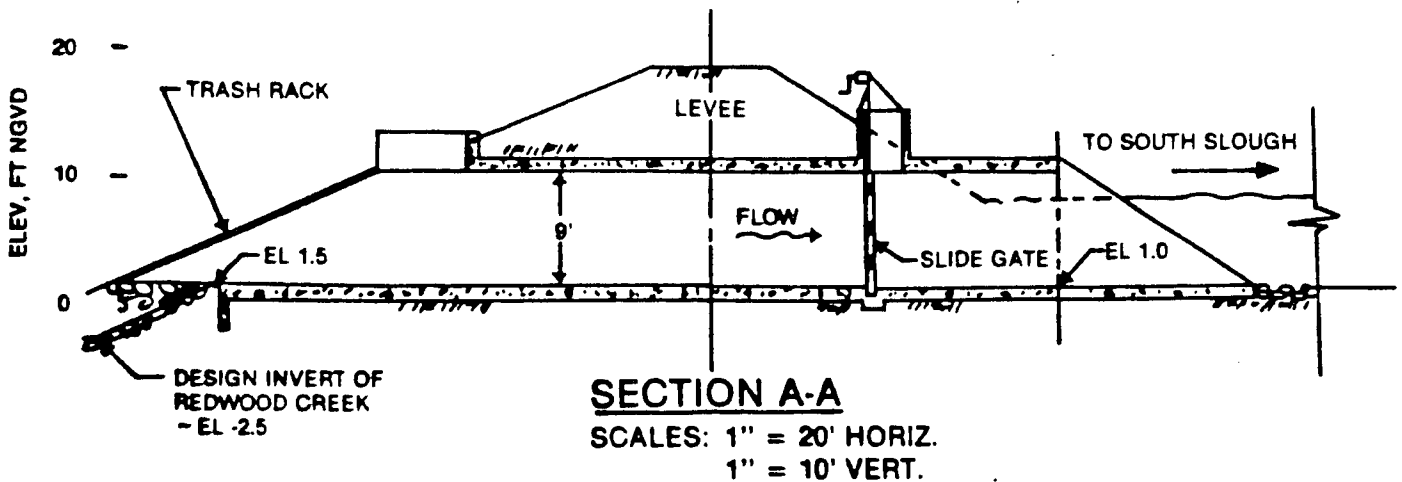
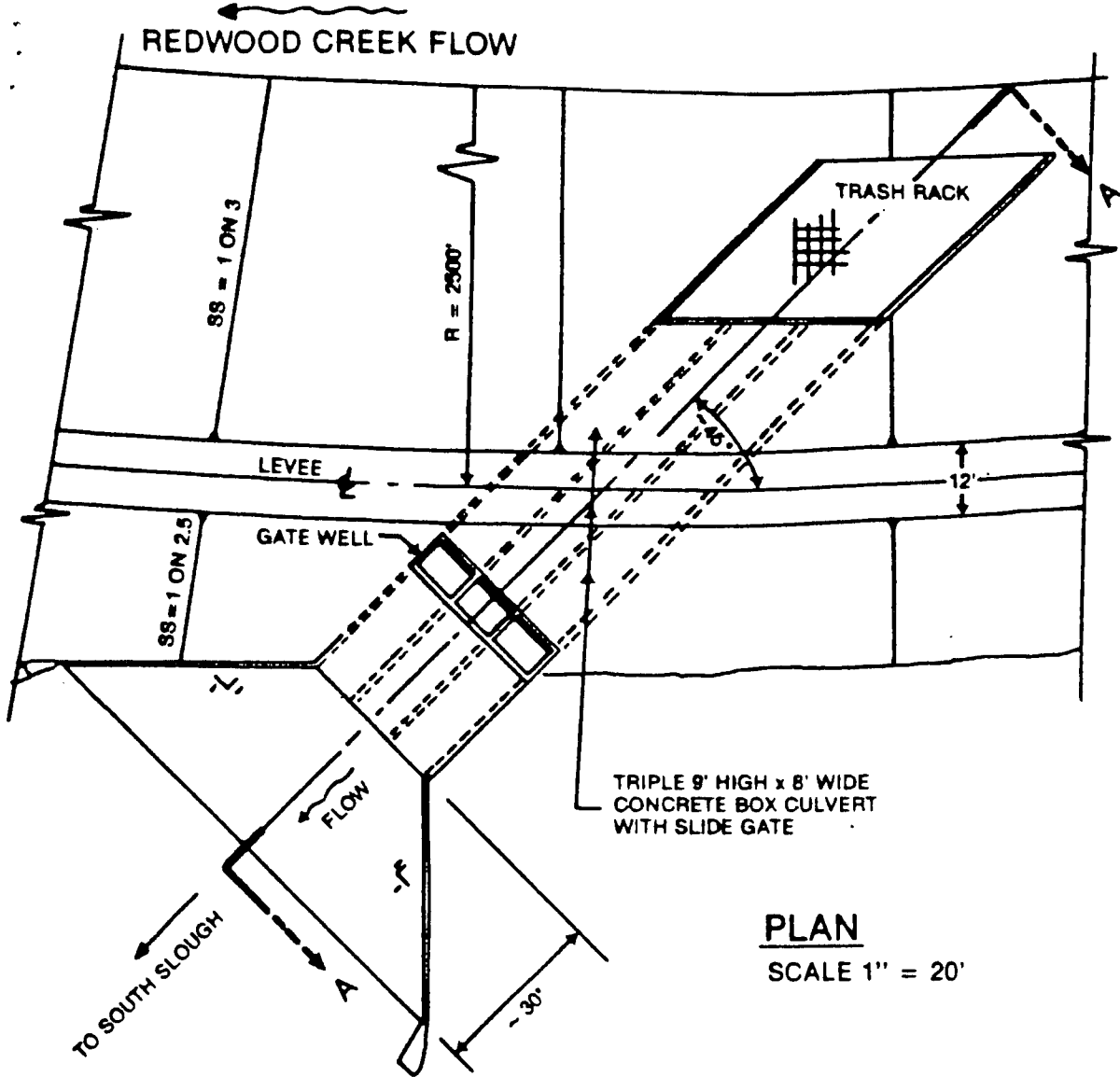


**PROJECT
LOCATION**



PACIFIC OCEAN





SOUTH SLOUGH INTAKE STRUCTURE ON REDWOOD CREEK, ORICK, CA.



IN REPLY REFER TO:

W1823

May 11, 1988

United States Department of the Interior

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CRESCENT CITY, CALIFORNIA 95531

Redwood National Park is proposing to resume its estuary management activities at the mouth of Redwood Creek this spring and summer. As in 1987, we expect to be controlling water levels in the estuary to maintain summertime habitat for rearing juvenile salmonids while preventing flooding of adjacent private property.

In addition to our summertime water level management activities, Redwood National Park will be operating the culverts installed through the south levee of the Redwood Creek Flood Control Project. The culverts were constructed last year as part of the fisheries mitigation for the U.S. 101 Highway Bypass Project. The culverts were designed to restore water circulation to the South Slough at the mouth of Redwood Creek.

In order to help you understand these proposals, we are enclosing a description of our Estuarine Management and Research Activities which were carried out in 1987.

We are scheduling an information meeting in Orick on May 25, 1988 to discuss this year's proposed activities. The meeting will be at 7:00 p.m. at the Redwood Information Center.

If you have any questions regarding the project, please contact Mr. Terry Hofstra, Fish and Wildlife Ecologist, Redwood National Park, 1125 16th Street, Arcata, California 95521. Telephone (707) 822-7611.

Sincerely,


Douglas G. Warnock
Superintendent

Enclosure

RN Park/WARNOCK, (1988)

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