

FORT CLATSOP NATIONAL MEMORIAL WATER
RESOURCES SCOPING REPORT
Water Resources Division
and
Fort Clatsop National Memorial
Technical Report NPS/NRWRD/NRTR-94/19



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FORT CLATSOP NATIONAL MEMORIAL WATER RESOURCES SCOPING REPORT

National Park Service
Water Resources Division
Fort Collins, CO 80201

and

Fort Clatsop National Memorial
Astoria, OR 97103

Technical Report NPS/NRWRD/NRTR-94/xx

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EXECUTIVE SUMMARY

Fort Clatsop National Memorial (FOCL) is located in extreme northwestern Oregon within the Columbia River estuary. This small (125 acre) unit of the National Park System was established in order to commemorate the successful culmination of the 1805-1806 Lewis and Clark Expedition, who wintered at this location prior to their return to the United States during the spring of 1806.

In spite of its small size, Fort Clatsop National Memorial contains an exceptionally diverse array of water-related resources. The Memorial is bisected by the Lewis and Clark River, a relatively major tributary of the estuarine-influenced lower Columbia River. In addition, it is estimated that more than 50 percent of the land surface of the Memorial is comprised of estuarine, riverine, or palustrine wetlands. The Memorial also contains a number of springs, seeps, and small upland streams.

Because of its lower watershed location, the water-related resources at Fort Clatsop National Memorial are affected by adjacent land use activities. The construction of levees and dikes during the early 20th century significantly degraded estuarine wetlands throughout the lower Columbia River estuary. Intensive timbering activity within the Lewis and Clark River watershed have contributed to erosion and non-point source pollutant loading. The inputs of organic debris from log rafting activities as well as periodic dredging for navigational purposes have undoubtedly altered the channel characteristics and habitat potential of the Lewis and Clark River. Additionally park development and operational activities have affected both surface water resources and wetlands within the Memorial itself.

Water-related issues addressed within this report include:

- an assessment of potential water quality degradation from non-point source pollution related to land use within the adjacent watershed;
- an evaluation of water-related inventory and monitoring needs;
- the need for a wetlands restoration feasibility study; and,
- an overview of water resources-related aspects of park development and operational activities.

While the development of a Water Resources Management Plan is not presently warranted, this report provides five water resources-related Project Statements (Appendix A) strongly recommended for inclusion in the Fort Clatsop National Memorial Resources Management Plan (RMP).

INTRODUCTION

Fort Clatsop National Memorial is located near the terminus of the Lewis and Clark River in extreme northwest Oregon, six miles southwest of Astoria, OR (Figure 1). The memorial commemorates the 1804-1806 Lewis and Clark expedition across the uncharted northwestern portion of the North American continent. The memorial specifically emphasizes the 1805-1806 winter encampment of the expedition before their rapid spring return to the United States. Named by Lewis and Clark for the Clatsop Indians that inhabited the area at the time, the reconstructed fort is one component of a park unit that commemorates the various hazards and challenges the expedition faced and successfully overcame.

Initially administered by the Oregon Historical Society as a much smaller commemorative site, Fort Clatsop was reconstructed in 1955. In 1958, Fort Clatsop National Memorial was established as a 125 acre unit of the National Park system (72 Stat. 153). In 1979, it was expanded by 0.2 acres in order to include a small detached unit on the Pacific coast known as the "Salt Works". This site commemorates the ingenuity of the expedition in obtaining needed salt from seawater for the return trip to the east coast (NPS 1993).

The overall purpose for the memorial as specified in the 1958 legislation called for:

"...commemorating the culmination, and the winter encampment, of the Lewis and Clark Expedition following its successful crossing of the North American Continent."

From the time of original establishment until recent years, National Park Service (NPS) management has concentrated on the historical attributes of the fort itself and mostly ignored the integrity of the natural setting in which the fort was found. In recent years, the natural setting has also become a central theme of memorial management.

Setting

The natural environment of the area was an important aspect of Lewis and Clark's experience at Fort Clatsop. The natural features and wet climate shaped the explorers' experience during their winter encampment during 1805-1806. The NPS now protects and interprets this aspect of the expedition.

The main inland portion of the memorial is located on the banks of the Lewis and Clark River two miles upstream from Youngs Bay. At this location, the Lewis and Clark River is part of the Columbia River estuary system and is tidally affected by saltwater. The river bisects the memorial into eastern and western units consisting of 22 acres and 103 acres, respectively. The western unit includes the reconstructed fort

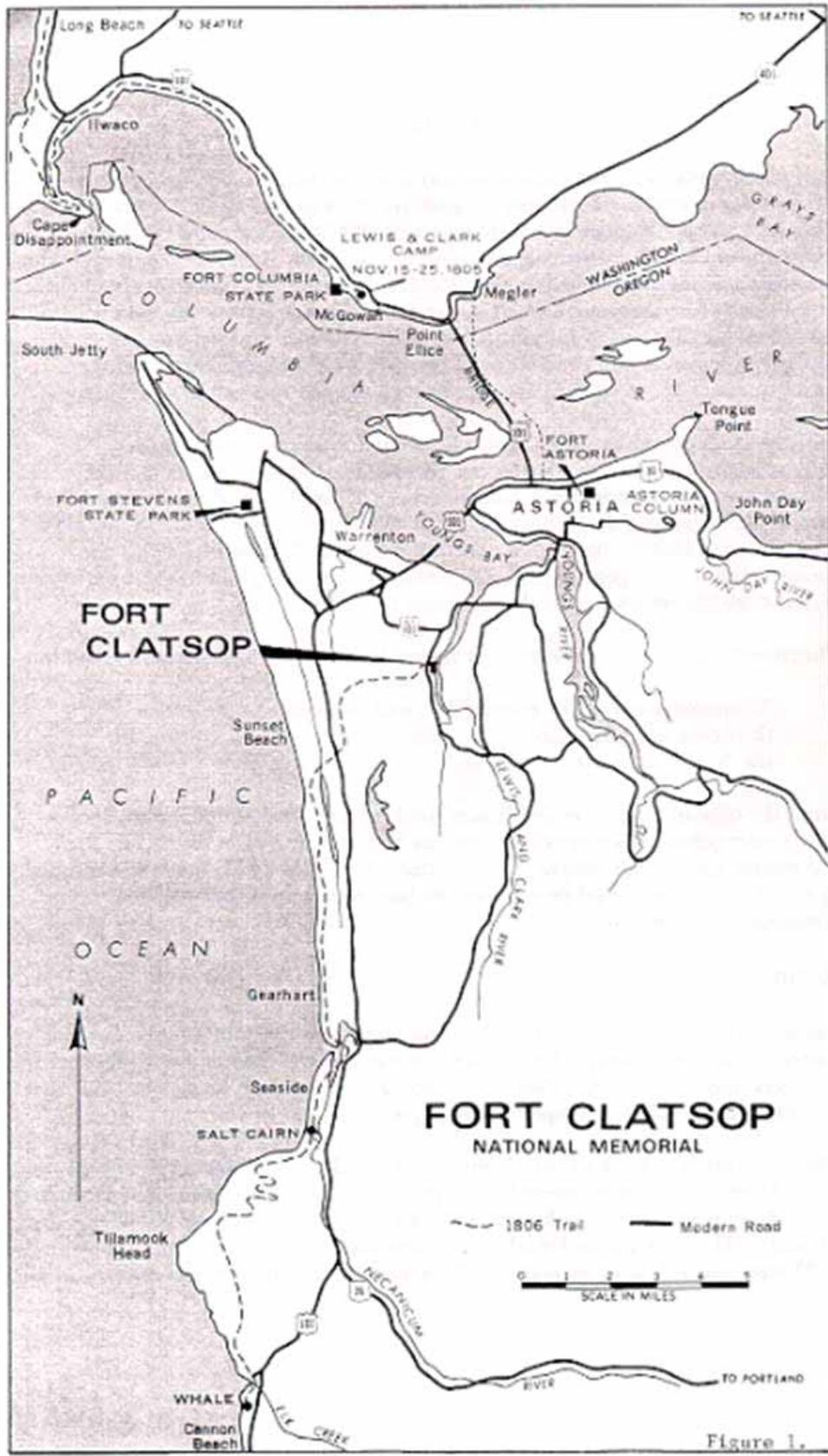


Figure 1.

APRIL 1981 THIS CONTAINS INFORMATION RE-PLANNED. THE RESULTS ARE APPROXIMATE ONLY. TOPOGRAPHY AND SITE FEATURES AT THE TIME. IS NOT A MEASURED DRAWING.

SOURCES:

- MP 404-1004C AERIAL PHOTOGRAPH, BAL PHOTOGRAMMETRY INC., EUGENE, OREGON
- MP 404-1004C OVERALL SITE PLAN
- MP 404-3008 FORT CLATSOP AREA ASTORIA, OR TOPOGRAPHIC SHEETS 1, 2, 3, 11
- MP 405-8000B SHEET 1/8, EXISTING CONDITIONS FIELD OBSERVATION JANUARY 1993

LEGEND:

- STRUCTURE
- ROAD
- SIDEWALK
- TRAIL
- TREE CANOPY
- LOW SPERM/TREE COVER
- CONTOUR LINE
- WATER WAY
- PARK BOUNDARY



SHEET CONTAINS MP SCALE APPROX. 1 INCH = 200 FEET

DESIGNED BY: M. STUBBS	DATE: 1/83	TITLE: FORT CLATSOP
DRAWN BY: M. STUBBS	DATE: 1/83	EXISTING: NATIONAL LIAISON LANDMARK MONUMENT
CHECKED BY: M. STUBBS	DATE: 1/83	ENCAMPMENT: FORT CLATSOP

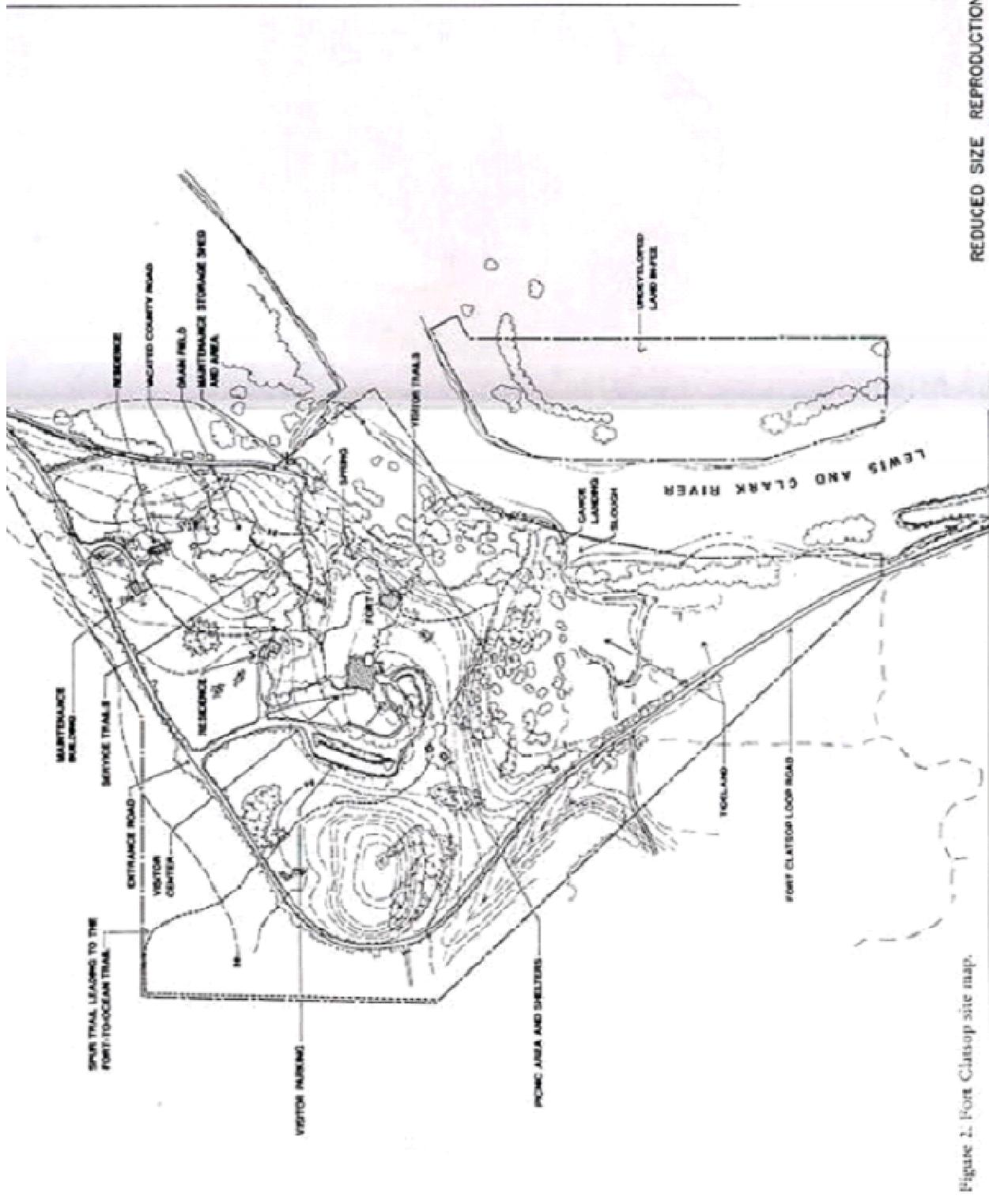


Figure 2. Fort Clatsop site map. REDUCED SIZE REPRODUCTION

and the visitor center/administrative complex, while the eastern unit is undeveloped. The river has been extensively diked in and near the memorial to control flooding and facilitate river navigation and farming (Figure 2).

The climate of Fort Clatsop National Memorial is continually mild and wet with annual precipitation averaging nearly 70 inches. Seasonal and daily temperature fluctuations are minimal. Average monthly maximum temperatures range from 47° to 67° F; average minimums range from 35° to 53° F (NPS 1993).

The geology of the Memorial is consistent with what is found elsewhere in extreme northwestern Oregon. Subsurface and surface geologic strata consist of older Cenozoic marine and estuarine sedimentary layers with minor volcanic intrusions overlain by post-early Miocene marine sedimentary layers. The sandstone and siltstone layers of the Astoria Formation is the predominant surface formation found in the Memorial (NPS 1993).

The main portion of the memorial consists of low-lying tidal wetland areas along the eastern and western banks of Lewis and Clark River. On the west side, these banks gradually transition into forested uplands where the reconstructed fort is located 40 to 50 feet above river level. The upland areas consist of rolling hills dissected by small streams that rise from sub-drainages within or just upslope of the Memorial. Soils are primarily silt loams, muck, and silty clay loams of the Coquille, Clatsop, Walluski, Chitwood and Terrace Escarpment series (Smith and Shipman 1988). The clay soils facilitate the ponding of water within the swale areas.

The soils, topography, climate, and proximity of the memorial to the Lewis and Clark River and the Columbia River Estuary system have encouraged the development of several types of wetlands. Currently, the National Wetland Inventory classifies approximately one-third of the Memorial within either brackish or freshwater wetland classes (USFWS 1989). Park management suspects, however, that a more thorough wetland survey would result in nearly one-half of the land area of the Memorial being classified as wetlands.

Fort Clatsop National Memorial and all of northwestern Oregon is located in the "Oregon coast range" physiographic province (Franklin and Dyrness 1973). While the "old growth" within the monument had been logged by 1900, current upland vegetation consists of a "second growth" sitka spruce community that includes sitka spruce (*Picea sitchensis*), western hemlock (*Tsuga heterophylla*), western red cedar (*Thuja plicata*), red alder (*Alnus rubra*), and Douglas fir (*Pseudotsuga menziessi*). The relative abundance of each species is dependent upon microclimate (Franklin and Dyrness 1973). Canopy cover is almost 100 percent within the forested portion of the memorial, producing low light conditions within the understory. Typical understory species consist of several varieties of shrubs (salal (*Gaultheria shallon*),

huckleberry (*Vaccinium ovatum*), salmonberry (*Rubus spectabilis*), ferns (deer and sword), mosses, lichens, fungi, grasses and herbs) (David Ek, Fort Clatsop National Memorial, personal communication).

Approximately one-third of the western unit and all of the eastern unit of the memorial lies within the 100-year floodplain of the Lewis and Clark River. Flooding potential has increased in recent years because of extensive logging over much of the watershed. All permanent NPS facilities are located outside of the 500-year floodplain (NPS 1993).

Approximately 35 percent of the land surrounding the memorial is undeveloped and owned and managed by the Hanson Natural Resources Corporation for rotational timber harvest. The remaining 65 percent is also in private ownership, but partially developed for residential subdivisions, ranches and farms, and mobile home courts. The economy of the local area primarily revolves around extractive industries such as timber harvest, with some farming and ranching as well as limited tourism (NPS 1993).

Significance of water to the memorial

The natural environment, in general, is integral to and an important component of Fort Clatsop National Memorial. Specifically, the water resources and wet climate were very important in shaping the experience of the explorers as well as providing information for their natural resource inventory. The Lewis and Clark River provided a convenient transportation corridor and sustenance for the explorers as well as a drowning hazard. Wetlands provided habitat for animals that were hunted for food and cataloged for scientific documentation. A spring and small stream found near the fort were used as a culinary water source by the expedition. The almost constant availability of water and consistently mild climate has facilitated the development of rich and varied animal and plant communities. The interpretation of these water dependent resources to the public is recognized by Fort Clatsop management as an important aspect to a visitors experience.

The use of certain water resources for recreation is also considered important. At this time, recreational boating (waterfowl hunting, canoeing, kayaking) on the Lewis and Clark River occur but have been limited somewhat due to restricted access to the shoreline. Both park management and local county planners are advocating that additional river access be provided. If accomplished, boating and canoeing on the river within the memorial could increase markedly. Recreational fishing on the Lewis and Clark River is also limited at this time but is recognized as a valuable activity that could increase greatly if access is increased.

Influences on water resources

Influences on water quality in and around Fort Clatsop have steadily increased since the area was first settled in the mid 19th century. However, because the area has remained relatively undeveloped and mostly used for agriculture and logging, many of the more severe influences related to urbanization and industrial development have been avoided. Most of the water quality influences now extant in and near Fort Clatsop are low-level chronic influences that have been ongoing for decades as the initial land use practices (logging, agriculture etc.) have continued to this day. As there appears an increasing demand in the local housing market with more and more land being converted from traditional land use towards residential development, different types of water quality issues might be expected in the future. Current management concerns relating to water quality in and around Fort Clatsop National Memorial include the following:

Unauthorized dumps and landfills

Unauthorized dumps and landfills in the watershed may have a localized effect on the surface and ground water resources of the memorial. Specifically, illegal public dumping in a small ravine to the west of the memorial is suspected of leaking waste oil (and other possible contaminants) into at least one small perennial stream that enters the memorial. Other more distant landfills could also be affecting the water quality of tributary streams to the Lewis and Clark River.

Farming and dairies

Several farms and dairies occur along the Lewis and Clark River upstream of Fort Clatsop National Memorial. Pesticides and fertilizers are used in agriculture and may enter the aquatic environment. In addition, dairy operations concentrate livestock, and their waste may also degrade water quality.

Timber harvest

Concentrated and wide-spread timber harvesting (including clear cutting) is pervasive on the privately owned timber lands within the watershed of the Lewis and Clark River. Because of the large size of timber land holdings within the watershed of the Lewis and Clark River, water quantity and quality may be affected by these operations. As these activities have been ongoing for more than a century, they are suspected to have altered the natural setting of the memorial as well as affecting the flow and water quality of the Lewis and Clark River and its tributary streams. Watershed-related attributes potentially affected by these activities include discharge patterns, erosion and sedimentation, water temperature, and possibly organic and

nutrient loading. Changes in these attributes may have profound effects on the diversity and dynamics of the natural flora and fauna of the river system.

Log booming and log transport on the Lewis and Clark River is the primary means of moving timber to market and has, over the years, defined the predominant character and use of the Lewis and Clark River near the memorial. As organic debris (primarily bark) decompose from this activity, several water quality parameters may be affected. Specifically, these may include dissolved oxygen concentration, biological oxygen demand (increased due to bark decomposition), chemical oxygen demand (increased due to soluble organic chemicals leaching from logs), and turbidity. Extensive bottom deposits of bark also are suspected to create a physical barrier to the development of a healthy community of benthic organisms. In addition, log booming and transport tends to dominate surface use of the river so much that recreational use and historic interpretation of the river is difficult (US Army Corps of Engineers 1973).

Dredging the Lewis and Clark River

To facilitate timber movement, periodic dredging of the Lewis and Clark River occurs. Such dredging can have a pronounced short term effect on several water quality constituents, such as, turbidity as well as a protracted influence on the benthic fauna.

Dikes and Levees on the Lewis and Clark River

Dikes and levees have been placed along the Lewis and Clark River almost continuously from river mile 0 (confluence with Youngs Bay) to river Mile 9 (limit of river lowlands). These structures are common along all the tributary systems to the Columbia River estuary and were constructed to provide additional farmland within the floodplain, to prevent flooding in settled areas, and as an aid to navigation for boat and commercial traffic. Most of the levee and dike systems in place today were constructed prior to 1925 and the biological consequences have been felt since that time.

Draining and filling has destroyed or greatly altered over 70 percent of the estuarine and riverine wetlands that once occurred within the lowlands along the Lewis and Clark River (Blanchard 1977). Surviving wetlands, some of which are found within the boundary of Fort Clatsop National Memorial, have been radically changed due to alterations in fresh and saltwater flows. Because of these changed flow patterns, plant and animal community structure and dynamics have changed as well. Overall water quality has likely changed due to the great reduction in the natural cleansing that wetlands typically afford and a disruption to the natural salinity concentration dynamics. All of these system changes have likely reduced overall aesthetic appeal to the public as well.

National Park Service operations

Certain park development and operational activities have also affected surface and ground water resources within the memorial. Construction of the new visitor center and parking lots necessitated the realignment and covering of a small stream that arises from within the memorial and discharges into the fort spring and ultimately the Lewis and Clark River. These construction activities caused several changes including the alteration of the natural channel in two locations which resulted in the elimination or modification of pristine wetlands. In addition, the parking lot and visitor center roof now drain into this stream potentially degrading the its overall water quality. Construction changes were apparently completed without a permit from the U.S. Army Corps of Engineers, who regulates wetland dredge or fill (Clean Water Act, Section 404). Further, there is no evidence in the record to suggest that construction followed the edicts of Executive Order 11990 and NPS wetland guidelines (NPS 1991).

Underground utility lines traverse or parallel several wetlands within the memorial. Initial construction of these lines necessitated the disturbance of wetlands that have subsequently regenerated once construction activities were completed. On-going maintenance needs, however, have required that portions of the corridor be disturbed and/or damaged periodically when repairs are necessary to the lines. In addition, the corridors above the lines are mowed on a continuous basis to facilitate access if maintenance is needed. It is expected that these influences will continue for the life span of the lines. These on-going activities have likely reduced overall wetland acreage and negatively influenced wetland species diversity and system dynamics within the memorial.

In the past, the memorial maintenance staff stored all tree cuttings and brush in a centralized open wetland area. When the material has dried sufficiently it was burned (approximately once a year). This burning has potentially added great amounts of elemental carbon to the wetland system as well as arresting succession and altering species diversity. A new non-wetland burning site has recently been identified and will be used in the future. The use of this new site will allow the old site to begin natural rehabilitation.

Wastewater systems now in use within the memorial consist of three separate septic tank/leachfield systems that service the headquarters/visitor center complex and two residences. Wastewater from these systems leaches into the near surface groundwater and may contaminate springs and surface waters within the memorial. Wastewater conveyance pipelines have been placed underground. Above these systems, the natural vegetation is mowed to facilitate repair and maintenance of the lines. Continual mowing potentially alters the species composition of the plant communities, some of which are wetlands.

Presently, the memorial stores fuel in an underground tank in the maintenance area. The age of this tank is unknown but is suspected to be near 30 years old. The integrity of this tank has been recently tested (1993) and found to be sound. The tank will continued to be tested on an annual basis until it is replaced (David Ek, Fort Clatsop National Memorial, personal communication).

WATER RESOURCES SCOPING REPORT

Water is an essential component of virtually every unit of the national park system. It sustains natural ecosystems and settings, and provides recreation water supply for park visitors and employees. To protect these uses, and to advance the overall purposes of the National Park Service, sound water resources management planning is needed. As part of this planning, it is important to know where all the significant water resources are located and what influences may affect them. Once known, the NPS strives to maintain natural high quality waters in accordance with applicable federal, state, and local laws and regulations. Wetlands and floodplains are maintained according to specific executive orders, regulations and guidelines. The NPS obtains and uses water within all units in accordance with legal authority and consideration of other water users.

Water resource planning must also be implemented within the appropriate local political environment. At Fort Clatsop National Memorial, municipal, county, and state planning agencies have attempted to formulate strategies to protect and make full use of the water resources found in and near the memorial. It is important that the NPS ensure that its water resource planning fits into this overall framework. Within the local political environment, the county and city planners have organized a taskforce centered around the Columbia River estuary. The Columbia River Estuary Study Taskforce (CREST) attempts to consolidate existing and needed ecosystem information and ensure that region-wide planning is organized such that existing and planned development minimizes risk to this resource. Comprised of most of the local city and county governments, CREST reviews planning and development proposals that might affect the estuary system. It is essential that CREST and the local planning agencies be involved with water resource management planning within the Lewis and Clark River watershed.

Water resources planning in the NPS can occur in various planning processes. Initially, general water related concerns are addressed in the resource management plan (RMP). If deemed appropriate, the RMP may recommend the preparation of more detailed water resources planning document. Where water resource issues are numerous and highly complex, a Water Resources Management Plan (WRMP) is often prepared. Such a plan reviews all water-related issues and proposes solutions in a comprehensive manner. The WRMP is similar to the RMP in structure and purpose. A water resources Scoping Report (WRSR) is a less formal process and is

prepared in instances where issues are less numerous, and relatively minor in effect. Project statements are developed in both the WRMP and WRSR that are incorporated into the RMP.

DESCRIPTION OF WATER RESOURCES

Because water is a plentiful resource in and near the memorial, a variety of water resource systems exist. Understanding the nature and scope of these resources is essential for their protection. The state of Oregon has been granted primacy with regard to the implementation of the edicts of the Clean Water Act. As such, specific regulations that affect water quality and management in the state have been developed which apply to the water resources found within Fort Clatsop National Memorial.

State water quality standards

The classification and quality of waters in Oregon is regulated by the Oregon Department of Environmental Quality (DEQ). To facilitate regulation, all waters have been grouped into basins or watersheds. Each grouping has designated beneficial uses and specific water quality standards that protect these uses (OAR Chapter 340, Division 41). The surface waters of the Lewis and Clark River watershed (including Fort Clatsop National Memorial) are located within the North Coast-Lower Columbia Basin unit.

Beneficial use classification

The recognized beneficial uses for the North Coast-Lower Columbia Basin unit are as follows:

- | | |
|------------------------------|-------------------------|
| - industrial water supply | - fishing |
| - anadromous fish passage | - boating |
| - salmonid fish rearing | - contact recreation |
| - salmonid fish spawning | - aesthetic quality |
| - resident fish/aquatic life | - commercial navigation |
| - wildlife & hunting | and transportation |

Water quality criteria

Water quality within the North Coast-Lower Columbia Basin unit must be managed to protect the recognized beneficial uses for the unit. In order to protect these beneficial uses, specific water quality criteria have been developed for a number of constituents by the Oregon DEQ. These water quality criteria may not

be violated except under very restrictive circumstances. Numeric water quality criteria for the North Coast-Lower Columbia Basin unit include:

Dissolved oxygen (freshwater) - dissolved oxygen values cannot be reduced below 90 percent of full saturation.

Dissolved oxygen (estuarine) - dissolved oxygen values must not be less than 6 mg/l.

Temperature (freshwater) - No increase in temperature is permitted in streams with water temperatures 58° F or greater; 0.5° F increase in streams with water temperatures 57.5° F or less; 2° F increase in streams with water temperatures 56° F or less.

Temperature (estuarine) - No significant increase above natural background temperatures.

Turbidity - No more than a 10 percent cumulative increase in natural stream turbidities (measured in Jackson Turbidity Units).

pH (estuarine and fresh waters) - pH values must not fall outside the 6.5 - 8.5 range.

Fecal coliform bacteria (estuarine) - No more than the log mean of 200 fecal coliform per 100 ml based on a minimum of 5 samples in a 30 day period with no more than 10 percent of the samples in the 30 day period exceeding 400 per 100 ml.

Fecal coliform bacteria (freshwater) - No bacterial pollution or other conditions that are deleterious to waters used for domestic purposes, livestock watering, irrigation, bathing, or shellfish propagation, or otherwise injurious to public health.

Total dissolved solids (all freshwater systems) - 100 mg/l.

Toxic substances - Toxic substances shall not be introduced above natural background levels and will not exceed the most recent criteria values for organic and inorganic pollutants established by US Environmental Protection Agency (USEPA 1986).

In addition there are narrative qualitative criteria that apply to bottom sludge, taste, aesthetics and fungi (OAR Chapter 340, Division 41).

Outstanding Resource Waters

In addition to these specific water quality criteria, the state of Oregon recognizes "Outstanding Resource Waters" protection. Such waters are nominated by Oregon DEQ as waters that deserve special recognition to protect water quality parameters that affect the "ecological integrity of critical habitat or special water quality values that are vital to the unique character of those water bodies." Priority nomination of water bodies to this status includes "National Parks." At this time Oregon DEQ has not determined if the national parks designation includes all units of the national park system or is limited exclusively to units designated as "national parks" (Greg Pettit, Oregon Department of Environmental Quality, personal communication). ORW designation for Fort Clatsop National Memorial could further emphasize the importance of the memorial as a mostly pristine control site. Once nominated to ORW status, Oregon DEQ would establish specific water quality criteria to be protected and designate specific activities that are appropriate within these waters.

Surface waters

The surface water resources of Fort Clatsop National Memorial are diverse, especially considering the limited land area of the memorial. One river, and several small streams, wetlands, and springs all occur here that arise either inside or outside memorial boundaries. All surface waters eventually flow into the Lewis and Clark River and Youngs Bay of the Columbia River. Descriptions of these resources are as follows:

Lewis and Clark River

The Lewis and Clark River arises at an elevation of 1,800 ft in the Coast Range in northwestern Oregon. It flows westerly and then northerly for about 27 mi before bisecting Fort Clatsop National Memorial (at River Mile 2) and entering Youngs Bay, an arm of the Columbia River estuary. The river drains a watershed of approximately 62 square miles and is located entirely within Clatsop County, Oregon (Figure 2). No concentrated industry and little overall development occurs within the watershed. Only two small settlements are located along the entire river (Melville and a lumber camp). The watershed of the Lewis and Clark River is actively managed for maximum timber production. The Army Corps of Engineers occasionally dredges the river to allow for the transportation of logs into Young's Bay. Dredged material is deposited outside memorial boundaries (NPS 1992).

The discharge of the Lewis and Clark River averages 255 cubic feet per second (cfs), with mean monthly discharges exceeding 600 cfs during the winter and generally less than 100 cfs during the summer (NPS 1993). Being close to the terminus of the

Columbia River and the Pacific Ocean, the river is affected by tidal fluctuations and salt water mixing. Two unequal tides occur each day with diurnal range averaging 8.6 feet and extreme tides exceeding 12 feet. With flow reversals common during high tide, the water in the river alternates between brackish and fresh.

Water quality data specific to the Lewis and Clark River in or near Fort Clatsop National Memorial is limited. Since 1969, the Oregon Department of Environmental Quality has sporadically monitored the Lewis and Clark River at two locations upstream (one-half mile upstream of Peterson Slough and at Stavebolt Lane), and one location downstream (old Highway 101 bridge) of Fort Clatsop National Memorial.

During the past year, the Oregon DEQ has initiated a more intensive water quality monitoring program (quarterly) at the Stavebolt Lane site in an effort to more fully characterize river water quality. The Stavebolt Lane location was selected for this characterization as it is located upstream of estuary influence. Summary evaluations of the water quality of the Lewis and Clark River at Stavebolt Lane are presented in Table 1. While data are very limited, available data indicate that water quality within the Lewis and Clark River is usually good and within state standards. However, turbidity has been observed to episodically increase during periods of high precipitation and is thought to be higher than would be natural for the river at this location (Greg Pettit, Department of Environmental Quality, personal communication).

Table 1. Summary water quality data (1969-1993) for the Lewis and Clark River at Stavebolt Lane (RM 7.5)

Parameter	EPA ID #	Mean	Max	Min	S.D.
Temperature (°C)	00010	11.1	22.0	5.5	4.5
Turbidity (FTU)	00076	3.3	9.0	1.0	2.2
Conductivity (µmho)	00094	93.7	535	49	114
Dissolved Oxygen (mg/L)	00300	10.3	12.4	5.4	1.8
pH	00400	7.0	7.6	6.6	0.2
Total Nitrogen (mg/L)	00610	0.04	0.10	0.01	0.02
Total Phosphorous (mg/L)	00665	0.05	0.10	0.02	0.03
Total Hardness (mg/L)	00900	34.8	277.0	12.0	69.8
Calcium (mg/L)	00915	4.1	5.1	2.9	0.7
Magnesium (mg/L)	00925	1.5	2.0	1.1	0.3
Sodium (mg/L)	00930	22.0	200.0	5.0	56.1
Potassium (mg/L)	00935	6.9	13.0	7.0	8.7
Sulfate (mg/L SO4-Tot)	00945	38.3	110.0	1.0	62.1
Coliform, Fecal (#/100ml)	31615	177	430	30	139

Data collected by the Oregon Department of Environmental Quality.

No summary data are available prior to 1969 preventing a quantitative understanding of the presettlement or pristine conditions of the river. It is suspected, however, that river water temperature and turbidity levels have generally increased (at least episodically) over the years since timber removal activities began removing forests and reducing upper watershed shading (ca. 1900). Increased turbidity is suspected to be somewhat transient when heavy rains cause excessive surface runoff from recently logged areas. These transient increases do not violate state water quality standards for the basin since timber harvest activities are not considered a regulated point source discharge. The generally high water quality for the Lewis and Clark River is due primarily to the lack of any other major pollutant sources along the upstream reaches of the river.

The gradual changes in salinity from the mouth of the Columbia River to the upper part of the estuary is the primary factor to which all forms of estuarine life responds. Maximum salinity penetration up the Lewis and Clark River extends upstream to approximately River Mile 6. Specific data on the biota of the Lewis and Clark River is limited to sporadic surveys conducted as part of larger Columbia River estuary research projects. However, inferences can be drawn from these data as to what might be expected regarding system dynamics and species diversity of macroinvertebrates, macrophytes, decapods, oligochaetes, polychaetes, amphipods, algae, mammals, amphibians, reptiles etc. The Lewis and Clark River likely supports a typical assemblage of estuarine species found throughout the Columbia River estuary (Good and Potter 1977, Good 1977, Buchanan 1977).

The limited fishery data specific to the Lewis and Clark River indicates that the river now supports populations of (hatchery raised) chinook salmon (*Oncorhynchus tshawytscha*) and coho salmon (*Oncorhynchus kisutch*), cutthroat trout (*Salmo clarki*), steelhead trout (*Oncorhynchus mykiss*), eulachon (*Thaleichthys pacificus*), and American shad (*Alosa sapidissima*) that spawn at various times during the year. Missing are native populations of the two salmon species. However, there is some question whether such populations ever existed within the watershed.

The wetlands associated with the Lewis and Clark River (riverine and palustrine) provide habitat for a large assemblage of plant species due to the abundance of water and the influence of salinity. Floristic surveys conducted over the years within the memorial have concentrated on the upland vegetation. As a consequence, little is known of the floristic composition of the near-river wetlands.

Streams

Fort Clatsop National Memorial contains several small, unnamed streams which arise either within the boundary of the memorial or within the local sub-drainages. However, a definitive map depicting the location of these systems does not now exist, making it difficult to locate them within the local geographic setting or to place them in perspective relative to internal and external influences.

At least two small streams arise outside the memorial in small drainages originating on private lands. Another two streams originate in small wetland areas within the memorial. Because of the limited drainages, surface water discharge can terminate entirely at certain times of year (David Ek, Fort Clatsop National Memorial, personal communication). Discharge estimates for these streams range from 0 to 1 cfs, with all the streams eventually entering the Lewis and Clark River. Because these systems were not considered important to the primary mission of the memorial until recent years, their location and information regarding discharge patterns, water quality, and biota is largely unknown. Riverine and palustrine wetlands and riparian areas adjoin these streams along much of their extent.

Springs

Several ephemeral or perennial springs are known to exist within Fort Clatsop National Memorial. At least one serves as the source of a small stream that flows within the memorial. As with the streams, no inventory or monitoring data exist regarding spring locations and overall water quality, quantity, and biota, or the extent and nature of the adjoining wetlands.

Wetlands

Wetlands are found throughout Fort Clatsop National Memorial along the Lewis and Clark River, adjacent to streams and springs, and in isolated pockets within upland swale depressions.

Wetlands are thought to cover at least half of the land surface within the memorial and range in size from a few square feet to many acres. A preliminary wetlands survey was completed for the memorial as part of the National Wetlands Inventory program (NWI) conducted by the US Fish and Wildlife Service (Cowardin et al. 1979). Completed in 1989, the NWI inventory for the Fort Clatsop area utilized high elevation infrared aerial photography (1:58,000 scale) to locate and delineate wetlands on the Warrenton and Astoria 7 1/2 minute U.S.G.S. quadrangles.

Areas within the memorial identified as wetlands were classified into systems, subsystems, and classes. Class modifiers are also used to further separate class types. As a result, ten wetland types within three systems (estuarine, riverine and palustrine) were identified within the memorial. Because of the relatively small

aerial scale of the survey, together with the fact that certain memorial wetland types are typically small and hidden beneath a dense forest canopy, many of these wetlands have been either reduced in overall acreage or overlooked entirely. As a result, a more detailed wetland inventory may be necessary for specific resource management and development planning purposes .

The NWI program not only inventoried wetlands but developed standard definitions and a hierarchical classification system (including systems, subsystems, classes and subclasses). The system is comprehensive enough to accommodate existing and newly discovered wetlands within the memorial. The NWI program was adopted by CREST as the system it will use to inventory and classify wetlands for the entire Columbia River estuary system (Barnes and Rushmore 1991). Similarly, the NPS has adopted the NWI program as the basis for all NPS wetlands inventories nationwide. Because of this universal acceptance, Fort Clatsop will utilize the NWI program for wetlands classification purposes.

The NWI wetland systems and classes identified for Fort Clatsop include the following:

Estuarine wetlands

Estuarine wetlands are those that occur adjacent to deep-water tidal habitats and are usually semi-enclosed by land but have open, partly obstructed, or sporadic access to the open ocean, and in which ocean water is at least occasionally diluted by freshwater runoff from the land. At Fort Clatsop estuarine wetlands are found along the Lewis and Clark River. Approximately 5 acres of the memorial is comprised of this wetland type (USFWS 1989). The two classes of estuarine wetlands found within the memorial are:

- 1) estuarine, subtidal, unconsolidated bottom, subtidal wetlands;
- 2) estuarine, intertidal, emergent, regularly flooded wetlands.

Because of the influence of both fresh and salt water on this habitat, the biological productivity can potentially be very high. Once covering vast areas of all the tidally influenced tributaries of the Columbia River estuary, such wetlands have been reduced over 70 percent due to diking and filling for agriculture and development. Many have not only been drained but filled to accommodate agriculture (Blanchard 1977). Those that remain (including those in Fort Clatsop) have been modified due to major and minor alterations in fresh and saltwater flow as well as degraded water quality. The overall health of the estuarine wetlands within Fort Clatsop has not been studied to determine the exact nature of these changes.

Riverine wetlands

Riverine wetlands generally include all wetlands and deep-water habitats within Fort Clatsop National Memorial contained within a channel not dominated by trees, shrubs, or persistent emergent vegetation (water mostly flows and salinities less than 0.5 parts per thousand). At Fort Clatsop, this includes only the "riverine, tidal, unconsolidated bottom (permanent tidal)" wetland class that which is located along the lower portion of streams that flow through the memorial and enter the estuarine system. According to the NWI, this wetland class covers only 1-2 acres of the memorial (USFWS 1989).

Additional riverine system acreage and classes are known to exist within the memorial, but were overlooked by the NWI because of the dense forest cover in the western half of the memorial.

Palustrine wetlands

The palustrine wetland system includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses and lichens where salinity due to ocean-derived salts is less than 5 parts per thousand. Also included within the palustrine system are those wetlands not dominated by the above vegetation if they are relatively small in extent (less than 20 acres in area and 2 meters in water depth).

Classes of palustrine wetlands found within Fort Clatsop National Memorial include:

- 1) palustrine, emergent/scrub-shrub (seasonal tidal) wetlands;
- 2) palustrine, forested/scrub-shrub (seasonal tidal) wetlands;
- 3) palustrine, scrub-shrub/emergent (seasonal tidal) wetlands;
- 4) palustrine, scrub-shrub (seasonally flooded) wetlands;
- 5) palustrine, scrub-shrub (seasonal tidal) wetlands;
- 6) palustrine, emergent (temporarily flooded) wetlands;
- 7) palustrine, emergent (seasonally flooded) wetlands.

These classes of palustrine wetlands make up over 80 percent of the known wetland acreage within Fort Clatsop National Memorial. Additional acreage of the above wetland types is expected once a more comprehensive wetland survey is conducted.

Groundwater resources

The groundwater hydrology within Fort Clatsop National Memorial and the adjacent watershed has not been studied nor has groundwater pumping in the vicinity of the memorial has not been quantified.

In past years, the memorial obtained its drinking water supply from a single well which was drilled in 1955 to a depth of approximately 44 feet. This water supply source was abandoned in 1966 when the memorial began utilizing municipal water from the Lewis and Clark Water District. The former drinking water supply well has not been formally abandoned under state regulations which likely requires that the well be sealed to prevent future contamination of the aquifer.

Wastewater systems

Fort Clatsop National Memorial disposes of wastewater through septic tank/leach field systems. Three such systems currently are used for two residences and the visitor center/administration complex. Liquids from these systems percolate into the ground potentially affecting shallow groundwater resources. In addition, lawns are maintained above all components of the wastewater system to facilitate maintenance (pipelines, tanks, and leach fields). Such maintenance may, in some instances, prevent natural wetland or upland vegetation from becoming established.

Water rights

There is no record of water rights held by the United States for Fort Clatsop National Memorial. The park's water is supplied by the Lewis and Clark Water District.

WATER RESOURCE PLANNING ISSUES

Water resource issues at Fort Clatsop National Memorial have partially been identified in the Resource Management Plan (NPS 1994), General Management Plan (NPS 1993), and Statement for Management (NPS 1992). In addition, at least two technical assistance evaluations of water resource issues have been made by Water Resource Division (WRD) professionals (Memorandum dated May 13, 1992 between Mark Flora, Planning and Evaluation Branch, Water Resources Division and Superintendent, Fort Clatsop National Memorial; and memorandum dated February 2, 1994 between Joel Wagner, Planning and Evaluation Branch, Water Resources Division and Superintendent, Fort Clatsop National Memorial). This scoping report builds from these past summaries, incorporating those issues that are still valid and evaluating any new issues identified as a result of the review conducted for this scoping report. A general summary of each issue is presented in this section

along with feasible and appropriate solution alternatives. Each issue evaluation relates to a specific project statement which can be found in Appendix A and which will be incorporated into the Fort Clatsop National Memorial Resource Management Plan during its annual revision.

Specific water resource issues identified for consideration in this scoping effort are as follows:

Development of Topographic Base Map

A map of a scale adequate to delineate the micro-topography of the memorial and the surrounding area (including the adjacent sub-drainages) is critically needed. Such a map should be prepared in digital format for input into the memorial's GIS. The resource management staff at Fort Clatsop has access to high speed PC's and could make use of a digital map with a GIS software package such as Atlas Graphics or ARC/VIEW. The map would provide an adequate framework on which to locate and describe all resource management data and features, and especially those related to the surface water resources.

A large scale topographic map (1" = 40' scale and 2-foot contour intervals) was prepared in 1959 for the part of the memorial developed at that time. These data can now be used as a basis for a more expanded effort at the same scale for the remainder of the memorial and the surrounding sub-drainages. All other maps prepared for the memorial are of insufficient scale to be of much use for watershed delineation and planning purposes. Without the proposed map, the surface water resources of Fort Clatsop will be difficult to locate or delineate accurately due to their complexity, small size, and high numbers. Consequently, the influences and threats to these systems can not be accurately located and evaluated. In the future, the GIS utilizing this map will provide a geographically oriented storage and retrieval system for all water resource attribute data and digital imagery. The map will become invaluable in all aspects of resource management within Fort Clatsop.

The proposed map should be prepared to such a scale that the micro relief of the memorial and surrounding area can be shown and the freshwater wetlands can be accurately located and depicted (2-5 feet contour intervals; 1" = 40' scale). Such a scale will be necessary to identify and locate all maintenance and operations facilities since many of these influence memorial water resources. Project Statement FOCL-I-117.002 (Appendix A) more specifically discusses the need and recommended activity for development of the necessary topographic map.

Inventory and Mapping of Surface Water Resources

Once the topographic base map has been developed, a sub-drainage map should be prepared. General watershed features in and around the memorial can be acquired from USGS DEM data (1:24,000 scale). Within the memorial and immediate vicinity detailed surface water features must be included at a much larger scale. This will necessitate more detailed analysis of the large scale aerial photography utilized to prepare the topographic base map described above. Ground surveys will locate and measure all streams and springs, and any known influences to these systems, i.e., landfills. A survey of associated wetlands is conducted as part of another issue description. See also Project Statement FOCL-I-117.002 (Appendix A) for a specific discussion of the recommended activity for development of the water resources/sub-drainage features map discussed above.

Classification and Mapping of Wetland Resources

Ten classes of wetlands have, thus far, been identified by the NWI within Fort Clatsop (USFWS 1989). They include those associated with the Lewis and Clark River, the small streams and springs, and the depression wetlands found throughout the memorial. However, a more thorough wetlands inventory should be conducted that identifies and locates all memorial wetlands.

The NWI located those that were distinguishable from the air and included most of the estuarine wetlands and some riverine wetlands. The palustrine wetlands were mostly excluded because they occur in hidden swale areas under a dense forest canopy. A land inventory for these wetlands needs to be completed that locates and measures these systems. Accurate location on the ground is essential due their small size and great numbers. All information gathered as part of this process should be digitized and placed on the memorial GIS base map at such a scale that is useful to park management in the future. To accommodate this goal, both GPS and GIS technology should be used. The classification system to be used for this inventory is the one developed by the USFWS for the NWI.

There are several different methods to acquire an adequate wetlands survey. A cooperative agreement might be developed with local wetlands specialists with the USFWS. They would be very familiar with the classification system and delineation methods. A cooperative agreement or small contract with a local university for the completion of this work may also be possible. Again, local experts are likely to be available at these schools who could complete the needed work. Existing resource management personnel could also be used to complete the survey if appropriately trained. Due to the small size of the memorial, existing staff may have sufficient time to conduct the needed survey. The recommended activity for the completion

of the wetlands classification and mapping is provided in Project Statement FOCL-N-320.000 (Appendix A).

The availability of wetlands maps, coupled with an assessment of potential threats, could then be used to formulate wetland management goals. These management goals will dictate the need for more intensive mapping or monitoring efforts.

Wetlands Restoration Feasibility Study

The National Wetlands Inventory survey identified over one-third of Fort Clatsop National Memorial lands as wetlands (USFWS 1989). A 31-acre tract adjacent to the northern boundary of the memorial has been purchased by the Fort Clatsop Historical Association and will be donated to Fort Clatsop National Memorial if congressional approval is obtained. Other estuarine wetlands are being considered for inclusion into the memorial as part of the new Fort Clatsop National Memorial General Management Plan (NPS 1993). All of the estuarine wetlands either now within the memorial or proposed for inclusion are found immediately adjacent to the Lewis and Clark River. These wetlands display varying degrees of biological integrity and wetland functioning depending on the amount of alteration they have received over the years since settlement (diking, sedimentation, topsoil addition etc.).

Impacted estuarine wetlands have potential for restoration if actions are taken to restore the natural hydrologic regime, remove non-hydric topsoil, and eliminate exotic species. However, the feasibility of success must be fully assessed before actions are initiated.

First, an appropriate evaluation will require that an accurate inventory be completed for all estuarine wetlands affected by the Lewis and Clark River levees and dikes. Such a survey must delineate not only the extent of the existing wetlands but also those that may have been covered but are potentially recoverable. An inventory of extant wetlands has been proposed in an above section. A survey of historic or potential could be accomplished via an assessment of soil surveys and historic photographs. An accurate base map must be developed on which to place all identified estuarine wetlands such that the surface water hydrology can be assessed. This will necessitate that topographic resolution be to two foot contour intervals. Such a base map has been proposed in an earlier section.

Once identified and mapped, a feasibility study is needed that will determine whether estuarine wetlands can be recovered and, if so, how such a recovery should take place. Such a study conducted by a qualified hydrologist or wetlands expert, would likely determine that wetland recovery may not be as simple as breaching the

dikes that have existed for several decades since several other wetland factors have changed.

An important factor to wetland recovery is the determination of whether sufficient water is now available to support the wetlands that once existed (quantity and quality). It appears that water from the Lewis and Clark River is sufficiently similar to original conditions that the same expanse of wetlands bordering the river can again be naturally supported. This may not be the case, however. Existing water levels in the river may have changed to the point that sufficient inundation may not be possible.

The recovery of hydric soils is also critical to wetland restoration. Many areas still contain surface hydric soils in place while other areas are now covered with imported topsoil layer of varying thickness that will likely need to be removed before complete recovery of the system can occur. The extent of this influence is not known and will need to be determined before the feasibility of rehabilitation can be determined. The possibility of utilizing existing topsoil to reestablish wetlands must also be evaluated.

Further, it is suspected that some of the tributary stream channels that once entered the Lewis and Clark River within the memorial have been dredged, channelized, or moved. The location of these natural channels should be located and a determination made as to whether they are critical to wetland recovery. In certain instances these channels served as wetlands themselves and may be critical to total wetland recovery.

The return of hydrophytic vegetation is the final stage to the process. It is assumed that if the soils and hydrological regime are reestablished that the vegetation would naturally follow, mostly on its own. This assumption should be fully evaluated utilizing guidance from professional wetlands experts.

Project Statement FOCL-N-323.000 (Appendix A) provides specific recommendations for the study necessary to assess the feasibility of restoring estuarine wetland systems within Fort Clatsop National Memorial.

Monitoring Surface Water Quality

Water quality is one of the central components necessary for maintaining water resources and water-dependent environments in a healthy condition so that the natural and historic integrity of the memorial is maintained. Sampling designs for monitoring water quality within and affecting Fort Clatsop National Memorial should be undertaken in accordance with the following seven-step procedure recommended by Kunkle et al. (1987):

- 1- **Define the objectives of the monitoring program.** Identify management objectives, all potential sources of pollution, and other needs for monitoring.
- 2- **Determine sampling site locations.** Carefully review all existing information and try to link monitoring sites to any existing sites of other monitoring locations.
- 3- **Select water quality parameters, analytical techniques, and sampling frequencies.** Appropriate water quality parameters, analytical techniques, and sampling frequencies should be selected based upon impacts resulting from land common land uses and State water quality standards. See Kunkle et al. (1987) and McDonald et al. (1991) for a discussion of appropriate monitoring parameters for Fort Clatsop National Memorial.
- 4- **Decide on methods needed to sample the selected parameters** in order to determine those parameters most appropriately measured by NPS personnel and those more appropriate for contract laboratory analysis.
- 5- **Calculate costs** for the monitoring program including initial capital expenditures and recurring sampling costs. If a long-term program is necessary to establish water quality trends, consideration needs to be given to "base-funding" the monitoring effort.
- 6- **Determine the methods of data analysis** and the system of data storage and retrieval to be used.
- 7- **Determine the types of data interpretative reports to be prepared and how they will be presented.** These reports should meet the stated objectives of the monitoring program as well as the information needs of park management.

The need for implementing a water quality monitoring program and recommended activities are discussed in Project Statement FOCL-N-332.000. Because of the differing hydrological characteristics of the Lewis and Clark River and the smaller streams and springs found throughout the monument, different monitoring approaches should be considered. These are as follows:

Lewis and Clark River

The Lewis and Clark River and associated wetlands are the most extensive water resources, in total acreage, within the memorial. Even though only a small segment of the river itself is bounded by the memorial, river water does enter the associated riverine and estuarine wetlands that are within memorial boundaries. As such, the water quality of the Lewis and Clark River can have a

direct effect on memorial wetland resources. Because the Lewis and Clark River stretches over 20 miles, the park needs to continue to cooperate with state regulatory agencies and local land use planning entities to communicate the park's river-related management goals and to participate in on-going monitoring programs on the Lewis and Clark River to ensure that water quality is maintained.

For the past year, the Oregon DEQ has monitored the Lewis and Clark River for several regulated constituents on a quarterly basis. Prior to this, more sporadic sampling took place (since 1969). The more recent quarterly sampling program was initiated in an effort to develop a better characterization of the river to serve as a baseline for future impacts related to nonpoint pollution sources (Greg Pettit, Oregon Department of Environmental Quality, personal communication). Past analyses conducted with the collected data as well as general observations by field professionals have indicated that the Lewis and Clark River is affected by nonpoint sources of pollution (timber removal and livestock grazing) that have probably elevated water temperatures, resulted in episodic high turbidity events, and lowered dissolved oxygen levels (DEQ 1988). At this time, the Lewis and Clark River is relatively unimpacted by serious point sources of pollution and has no regulated point sources along its entire 20 mile length.

DEQ regulations acknowledge that national park waters are more sensitive than many other waters of the state. Given this, Oregon DEQ officials have indicated a willingness to cooperate with the NPS to ensure that a routine monitoring program is maintained (Greg Pettit, Oregon Department of Environmental Quality, personal communication). Since Fort Clatsop resource management personnel are on-site, they might be used to gather samples to be submitted to the state for analysis. Given this help, the frequency of sampling might be increased or the quarterly schedule now in place might be maintained for an extended period. Data from Oregon DEQ sampling should be acquired by the park resource management staff and stored on-site for analysis and future reference.

Given the existing situation, it is not recommended that the memorial resource management staff develop an independent water quality monitoring program for the Lewis and Clark River. Such an attempt would be expensive and likely not to yield additional tangible results that could be used to protect park resources any more efficiently than could be accomplished with a cooperative program with Oregon DEQ. As such, management should develop a comprehensive water quality monitoring program for all surface waters of the memorial. A cooperative monitoring program should be developed with Oregon DEQ for the Lewis and Clark River.

Streams and Springs

No water quality data are available for the small streams and springs of the memorial, many of which have not been accurately located or measured. If impacts to water quality are occurring, they could go unnoticed because of this overall lack of data. A water quality data baseline does not exist to evaluate future changes.

Once potential influences have been identified and located, an appropriate monitoring program should be considered to ascertain the magnitude of the threat and whether NPS action is warranted. At a minimum, a monitoring program should establish a water quality and quantity base line to be used to identify changes and impacts to these systems in the future. Any program implemented should consider monitoring water quality constituents that are sensitive to, and directly affected by upstream activities of concern (see MacDonald et al. 1991). The NPS could develop and implement its own monitoring for the small surface water resources of the memorial, focussed especially on those constituents that are directly influenced by NPS management activities or those activities occurring just outside memorial boundaries. Such a surface water monitoring program should be considered after a complete water resource inventory has been completed. The Oregon DEQ has indicated a willingness to train the memorial staff in the development of the monitoring program and use of necessary field equipment. Excellent examples of project planning necessary to successfully implement small park water quality initiatives can be found in study plans prepared to implement similar programs in other small parks within the National Park System (see Zubricki 1993).

All water quality data collected as part of this program should be organized and stored properly so that future evaluations can be made. The development of an appropriate data base structure and the maintenance of the data base once initiated, is the responsibility of the memorial resource management staff. Oregon DEQ and the WRD would likely be able to help with such development as part of a technical assistance request.

Water resources biotic inventory

The aquatic biota associated with the water systems of the memorial are directly influenced by water quality. Without a basic understanding of what resources exist and their basic health, it is impossible to understand how changes in water quality may be influencing these systems. To address this problem, the following resource inventories are suggested:

Summarize fauna data on the Lewis and Clark River

The Fort Clatsop resource management staff should locate, gather, organize, and store in permanent files all existing inventory data and research on the water-related fauna of the Lewis and Clark River in and near the memorial. Much of the information can be gathered from previous CREST research. It is not recommended that the memorial resource management staff conduct intensive inventories of the river biota outside those that are relatively easy to implement, i.e., bird surveys. Rather, management at Fort Clatsop should work cooperatively with state and local governments to support additional research efforts on the Lewis and Clark River to more fully define the faunistic component of the river.

Vegetative inventory of the Lewis and Clark River wetlands

It is recommended that the memorial staff conduct a complete vegetative survey of these wetland resources. Such a survey could be conducted by memorial staff, or with the support of local universities, environmental groups and volunteer organizations.

Biotic inventory of streams and springs

Limited general knowledge and cursory surveys have been conducted in and near the memorial in the past. This information should be acquired and placed into a permanent memorial biotic data base. In addition, due to their limited nature and easy access, it is practical for the Fort Clatsop resource management staff to conduct more intensive inventories of these resources. Such inventories can be conducted by the park resource management staff themselves on a time available basis or through small contracts to specialists at local universities. Data acquisition should adhere to NPS inventory and monitoring protocols. The biotic resources of interest are the following:

- a. aquatic macroinvertebrates
- b. reptiles
- c. amphibians
- d. wetland flora

Project Statement FOCL-N-330.001 (Appendix A) provides a discussion and recommended course of action for addressing the biotic inventory needs identified at Fort Clatsop National Memorial.

Water Resource Issues related to Park Development and Operations

Various activities related to park development and operations appear to have had effects upon both the water and wetland resources of Fort Clatsop National Memorial

(see memorandum from Joel Wagner, Water Resources Division to Superintendent, Fort Clatsop National Memorial dated February 22, 1994).

The expansion of park visitor center in 1991 required the partial relocation of a stream channel. This type of activity is regulated by the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act, yet the appropriate compliance does not appear to have been completed.

In addition, a number of operational/maintenance related activities including utility line backfills within wetlands, mowing activities within intermittent stream courses, and the temporary placement of fill (sand and gravel) within wetland areas are activities which require permits issued under Section 404 of the Clean Water Act or compliance with the NPS wetland management guidelines.

Fort Clatsop National Memorial needs to work closely with the Water Resources Division's Wetlands Protection Program in order to resolve past and on-going compliance issues.

Abandonment of water well

The status and need for the former water supply well at Fort Clatsop needs to be evaluated. If the well is of use for fire protection, as a groundwater observation well, or for other management purposes, the rationale for maintaining the well needs to be documented. If, however, no immediate or future use is likely, the well should be sealed and formally abandoned according to state regulations.

SUMMARY AND RECOMMENDATIONS

For its limited size, Fort Clatsop National Memorial contains an exceptionally diverse array of water resources and wetlands. It is estimated that more than 50% of the land surface of the memorial consists of estuarine, riverine, or palustrine wetlands. The memorial is bisected by a one-half mile section of the Lewis and Clark River, a tributary of the Lower Columbia River Estuary. In addition, the memorial contains a number of small streams, springs, and seeps. These water-related resources are historically relevant as the Lewis and Clark River was the corridor by which the Lewis and Clark expedition reached Fort Clatsop and a historical spring on the grounds of the memorial provided the expedition's drinking water supply.

Because of its small land base and its lower watershed location, the water resources at Fort Clatsop National Memorial are affected by adjacent land use activities. The construction of a series of levees and dikes in the early 20th century destroyed over 70% of the estuarine wetlands in the Columbia River estuary and significantly altered the floodplain hydrology. Intensive

timber harvest activities, the predominant land use within the Lewis and Clark River watershed, has affected both watershed erosion and river water quality. The inputs of organic debris from log rafting activities as well as disturbances from periodic dredging for navigational purposes have undoubtedly altered the channel characteristics and fish spawning habitat of the river.

Impacts associated with NPS development and operations activities have also impacted the water resources of the memorial. The construction of the visitor center and parking areas necessitated the re-routing of a small surface stream, and storm water runoff from developed facilities and parking areas contributes to water quality degradation. Park operations and maintenance activities have also affected wetlands within the memorial.

Perhaps the greatest water resources-related problem facing Fort Clatsop National Memorial management is the lack of an adequate water resources baseline. Wetland resources within and adjacent to the memorial have only been partially inventoried and mapped. Surface water features within the memorial have neither been adequately mapped nor properly characterized. Water quality and biological resource information for the Lewis and Clark River is limited, and generally not adequate to assess non-point source pollution impacts associated with episodic storm events.

This water resources scoping report recommends five resource management project statements developed to enhance water resources management activities within Fort Clatsop National Memorial (Appendix A). These project statements recognize the status of the memorial as a small land owner within the Lewis and Clark River watershed and strongly encourages increased cooperation with state and local regulatory and planning agencies in identifying and achieving joint objectives for water resources protection and wetlands management.

Project Statement FOCL-I-117.002 assesses the need for developing a large scale topographic/sub-drainage map for the memorial. This base map is crucial to overall resource inventory and management activities within the memorial. It would be especially critical in assessing the feasibility of potential wetlands restoration activities.

Project Statement FOCL-N-320.000 recognizes the need for a thorough and complete wetlands inventory for the memorial. The National Wetlands Inventory mapping accomplished to date provided inadequate resolution and ground-truthing to accurately depict the wetland resources of the memorial at a scale adequate for proper resource management activity. The small scale, coupled with dense canopy cover led to a significant underestimation of the wetland resources contained within the Memorial.

Project Statement FOCL-N-323.000 calls for the completion of an estuarine wetlands restoration feasibility study. Since the beginning of the 20th century, more than 70% of the estuarine wetlands of the Columbia River estuary have been destroyed or degraded by human-related activities. The memorial is interested in exploring a possible future opportunity to restore estuarine wetlands both within the memorial and on proposed addition lands. Once project feasibility is documented, restoration efforts may qualify for external "wetlands mitigation bank" funding through a cooperative program with the State of Oregon.

Project Statement FOCL-N-332.000 addresses the development and implementation of a cooperative water quality monitoring program with the Oregon Department of Environmental Quality. Water quality data for the Lewis and Clark River are limited, and data for the springs and small streams within the memorial is virtually non-existent. Fort Clatsop National Monument staff needs to explore the possibility of a cooperative program with the Oregon DEQ, which if successfully implemented, would provide an initial water quality inventory/characterization of the surface waters within the memorial as well as provide resources for sustaining a more adequate long-term monitoring program at key sites along the Lewis and Clark River.

Project Statement FOCL-N-330.001 describes a necessary biotic inventory for water resources within Fort Clatsop National Memorial.

The management priority for each of these project statements, as well as appropriate funding strategies, will be developed as part of the Fort Clatsop National Memorial Resource Management Plan (RMP).

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APPENDIX A

Proposed Water Resource-related Project Statements

FOCL-I-117.002	Construct a Topographic/Sub-drainage Base Map
FOCL-N-320.000	Classification and Mapping of Wetlands
FOCL-N-323.000	Wetlands Restoration Feasibility Study
FOCL-N-332.000	Development & Implementation of a Water Quality Monitoring Program
FOCL-N-330.001	Biotic Inventory of Fort Clatsop Water Resources

PROJECT STATEMENT SHEET

PROJECT NUMBER: FOCL-I-117.002

TITLE: CONSTRUCT A TOPOGRAPHIC/SUB-DRAINAGE BASE MAP

FUNDING STATUS: U FUNDED: 0 UNFUNDED: 20.0

SERVICEWIDE ISSUES:

CULTURAL RESOURCE TYPE CODE: N/A

10-238 PACKAGE NUMBER:

PROBLEM STATEMENT:

Fort Clatsop National Memorial, a 125 acre historical unit of the National Park System located in extreme northwestern Oregon, contains a wide diversity of water-related resources.

The memorial is bisected by a one-half mile segment of the Lewis and Clark River, which arises in the Oregon Coast Range approximately 27 miles south of the memorial and empties into Youngs Bay on the lower Columbia River approximately 2 miles below the memorial. Being in close proximity to the Pacific Ocean, the lower six miles of the Lewis and Clark River, including the segment within Fort Clatsop National Memorial, is influenced twice daily by tides that average 8.6 feet. The watershed of the Lewis and Clark River includes approximately 62 square miles, most of which is used for intensively managed timber harvest and limited agriculture.

In addition to the Lewis and Clark River, a number of small streams and springs occur within the memorial. These streams are small, with discharge ranging from 0 - 1 cubic feet per second, and typically arise outside of the memorial's boundary where they are potentially affected by timber harvesting activities and potential pollution from illegal dump sites.

Fort Clatsop National Memorial also contains fairly extensive palustrine, riverine, and estuarine wetlands. While the National Wetland Inventory, relying exclusively upon aerial photos, classified over one-third of the memorial as wetlands, the dense canopy masked many of the palustrine (forested) wetlands. In actuality, over one-half of the land area of Fort Clatsop National Memorial is thought to be wetlands. An area adjacent to the memorial, currently owned by a cooperating association, is thought to be a former wetland that has been diked and converted

to agricultural use. The memorial is also interested in examining the feasibility of restoring this tract to its natural wetland function.

The Lewis and Clark River is well known and easily visible on most existing maps of the area. USGS topographic maps (1:24,000) clearly show general watershed boundaries. As a consequence, these maps are also usable to delineate the more extensive near-river impacts associated with agriculture and logging. The small surface water features that make up the larger watershed are not fully depicted on such small-scale watershed boundary maps. Upland microtopography defines the location and size of these smaller drainage features and they, in turn, provide various types of habitat for wildlife.

Without knowing the location or extent of these microtopographic features, critical or needed habitat could be overlooked and inadvertently impacted and lost. As a result, species diversity could possibly be reduced and community dynamics altered to the point that ecosystems would suffer. Accurate topographic data for the memorial is also essential in order to determine the feasibility of restoring wetland hydrology in certain areas, as well as assuring that wetland areas are not impacted by park development or operational activities.

Being small in size and well downstream in the watershed, Fort Clatsop has a high potential of being affected by upstream influences. Only by knowing, in detail, sub-drainage features and microtopography can unacceptable impacts be located and evaluated.

DESCRIPTION OF RECOMMENDED PROJECT OR ACTIVITY:

The Fort Clatsop National Memorial Water Resources Scoping Report (1994) recommends that a large scale topographic/sub-drainage map be prepared for the memorial. Such a map should be prepared of sufficient scale to depict all the surface water features (streams and springs) and micro-habitat. The recommended scale should be at a minimum 1" = 40' with 2' contour intervals. Six-inch contour intervals are needed in the open estuarine wetland areas adjacent to the Lewis and Clark River. The map should include the area outside the memorial such that the origin of all surface water features can be depicted. The map should be digitally rendered for use in the memorial GIS. GIS software such as ARCVIEW and Atlas GIS can be utilized to make full use of these data to the point that high quality maps and analyses can be produced. Once such a system is in place, it can be used for long-term organization and storage of attribute data for all natural and cultural resources. In addition, it can be used to depict and analyze park structures and facilities.

The map proposed above can likely be developed from existing aerial photography. Approximately half the memorial has been previously mapped to the recommended scale as part of original memorial development in 1959. Use of this data could greatly reduce the overall cost of map development.

In addition to the detailed topographic/sub-drainage map described above, the scoping report recommends that a Lewis and Clark River watershed map be produced. To facilitate this, the memorial should obtain relevant USGS DEM data. As part of the USFWS National Wetlands Inventory has obtained and processed DEM data for part of the watershed. They would likely be able to provide this information to the NPS at little or no cost. Once placed in the memorial GIS, this data will be useful to locate and analyze more distant and insidious influences to the Lewis and Clark River that might significantly affect water quality.

The implementation of this project will require coordination with the regional GIS coordinator, USFWS NWI representatives, and a contractor to develop the actual map and GIS data files. Funding requested here will support the development of the map, GIS database, and park software sufficient to utilize the data once derived.

BUDGET AND FTEs

-----UNFUNDED-----

	Source	Act Type	Budget (\$1000s)	FTEs
Year 1:	RG-RM-NAT	RES	20.0	0.1
Year 2:				
Year 3:				
Year 4:				
			Total:	0.1
			20.0	0.1

PROJECT STATEMENT SHEET

PROJECT NUMBER: FOCL-N-320.000

TITLE: CLASSIFICATION AND MAPPING OF WETLANDS

FUNDING STATUS: U FUNDED: 0 UNFUNDED: 10.0

SERVICEWIDE ISSUES:

CULTURAL RESOURCE TYPE CODE: N/A

10-238 PACKAGE NUMBER:

PROBLEM STATEMENT:

Wetlands are found throughout Fort Clatsop National Memorial along the Lewis and Clark River, adjacent to streams and springs, and as isolated entities within upland swale depressions. They are thought to comprise at least half the land area of the memorial and can range in size from a few square feet to many acres. A preliminary wetlands survey was conducted in the memorial by the USFWS as part of the National Wetlands Inventory program (Cowardin et al. 1979). Completed for the memorial in 1989, the inventory utilized high elevation infrared aerial photography (1:58,000 scale) to locate and delineate wetlands on 7 1/2 minute (1:24,000 scale) base maps (USFWS 1989).

Areas within the memorial that were identified as wetlands through this survey were placed in a hierarchical classification system that includes wetland systems, subsystems, classes and subclasses. Within Fort Clatsop ten different wetland types were identified within three systems (estuarine, riverine, palustrine). Because of the relatively small scale of the initial NWI survey, together with the fact that certain memorial wetland types are typically small and hidden beneath the dense forest canopy, it is suspected that wetland locations and acreage have been significantly underestimated (see memorandum from the NPS Water Resources Division to Superintendent Fort Clatsop National Memorial dated February 22, 1994). It is estimated that approximately one-half of the memorial has not been properly inventoried and extensive wetland areas are yet to be properly inventoried and classified.

Wetland manipulations in and near the memorial have been ongoing for decades. The most profound effects are due to the dikes and levees along the Lewis and Clark River which have greatly modified much of the estuarine and riverine wetland environment. Adjacent land use

practices can affect wetland areas within the memorial via changes in drainage patterns or impacts of possible water quality contamination. In addition, internal NPS development and maintenance activities have previously impacted wetlands and can continue to affect wetlands when wetland locations and functions are not adequately known. For example, the long-standing practice of mowing and burning in small wetland areas has likely changed species diversity and community dynamics. Development has altered or eliminated some through filling and ditching. Many of these influences have occurred because of a general lack of knowledge of where wetlands occur and how they function. For the same reason, environmental compliance and the application of NPS policy regarding wetlands (Section 404 of the Clean Water Act, NPS policies, and Executive Order 11990) has not occurred.

DESCRIPTION OF RECOMMENDED PROJECT OR ACTIVITY:

The Fort Clatsop National Memorial Water Resources Scoping Report (1994) recommends that a thorough wetlands inventory be completed for Fort Clatsop National Memorial and adjacent lands (if possible). The proposed wetland inventory will utilize the USFWS wetland classification system (Cowardin et al. 1979). New wetland types will be added to this system if needed using new subclass types or modifiers.

The wetland survey proposed for the memorial would be conducted using ground survey techniques. Aerial photography analysis is not useful in this detailed survey because of the dense forest canopy that obscures much of the upland habitat and the small size of some of the palustrine wetlands (few square feet). Low level aerial photography may be useful to help delineate the larger more exposed estuarine and riverine wetlands next to the Lewis and Clark River. All location information will be digitally rendered using USGS DEM data, orthophoto quads, or GPS UTM grid points. Digital material will be directly input into the park GIS for use with analysis software such as ARCVIEW and Atlas GIS. Attribute information (wetland type, flora, fauna) will be developed as part of this inventory and included with the GIS data base for a complete resource summary.

It is recommended that this survey be conducted under contract with a local university or consulting firm that has the proper background and expertise. This project will be developed and completed in consultation with the USFWS NWI representatives in Portland along with input from the Columbia River Estuary Taskforce. All information gained will be provided to these organizations to facilitate regional planning. It may even be possible to conduct a more extensive wetlands inventory with help from these organizations.

It should be noted, however, that a complete survey such as this can only be undertaken after a satisfactory base map is available on which to place the new information. It is essential therefore,

PROJECT STATEMENT SHEET

PROJECT NUMBER: FOCL-N-323.000

TITLE: WETLANDS RESTORATION FEASIBILITY STUDY

FUNDING STATUS: U FUNDED: 0 UNFUNDED: 45.0

SERVICEWIDE ISSUES:

CULTURAL RESOURCE TYPE CODE: N/A

10-238 PACKAGE NUMBER:

PROBLEM STATEMENT:

In 1989, the US Fish and Wildlife Service conducted a survey of wetlands within Fort Clatsop National Memorial as part of the National Wetland Inventory (USFWS 1989). This inventory identified and mapped those wetlands decipherable from high elevation aerial photography (1:58,000 scale). Through this inventory, much of the lowlands adjacent to the lower reaches of the Lewis and Clark River (to river mile 6) were classified as estuarine wetlands. Within Fort Clatsop National Memorial, approximately 40 acres was classified as wetlands (approximately one-third of the total land area). Exact boundaries and acreage of these wetlands were impossible to determine through this initial evaluation due to the relatively small scale of the effort. Once more exact surveys are completed wetland acreage totals will likely increase to perhaps more than one-half of the memorial's total land area (see FOCL-N-002.000).

All estuarine wetlands within Fort Clatsop National Memorial and within the entire lowland area along the Lewis and Clark River have been affected to some degree by near-river dikes and levees. Constructed early in the 20th century to prevent inundation during high tides and high river flows, they have altered, to varying degrees, the natural hydrologic regime. In some instances, the dynamics of brackish and freshwater flow have been so altered or the sites filled and drained so completely that wetland plant communities no longer exist. Outside the memorial, many wetlands have been converted entirely to farmland (mostly for pastures). Within the memorial, it is believed that estuarine wetlands have only been partially eliminated due to an incomplete dike and levee system that accommodates various tributary sloughs. In addition, recent maintenance of the system has been spotty,

which has allowed more natural estuarine water flows to become reestablished and wetland areas to return to a more natural state.

Fort Clatsop National Memorial management believes that removal of the existing dikes and levees along the Lewis and Clark River in the memorial may facilitate the return of a natural estuarine wetland system. However, there are several other factors that could influence and confound the recovery process. Certain system components, other than the restriction of surface hydrology, may have changed to the point that merely removing the structures themselves will have limited effect on overall wetland recovery. For example, topsoil may have been placed in certain areas to facilitate agriculture that will prevent the reestablishment of a native plant community, or exotic or aggressive native species may have invaded and are now firmly established to the point of inhibiting the reestablishment of natural species diversity. The extensive dike and levee system along the entire length of the lower river may have changed the overall river hydrology to the point that near natural flows will be impossible in small dike-removal areas. The removal of existing dikes and levees could cause inundation of adjacent private lands that would need to be protected. And finally, levee and dike removal will require spoil disposal which may necessitate a costly transportation program. All of the above factors must be considered and estimated prior to any decision being made on the feasibility of initiating a wetland recovery project.

Local and state governmental agencies have interest in increasing the size of estuarine wetlands within Fort Clatsop National Memorial (State Department of Environmental Quality and the Columbia River Estuary Taskforce). This because over 70 percent of these wetland types in the Columbia River estuary system have been lost due to development and agriculture. Further, these entities have expressed a desire to increase a wetlands landbank for future development projects in the Columbia River estuary system. Such a landbank will help these entities meet compliance mandates (Section 404 of the Clean Water Act and Executive Order 11990).

DESCRIPTION OF RECOMMENDED PROJECT OR ACTIVITY:

The Fort Clatsop National Memorial Water Resources Scoping Report (1994) recommends that the NPS conduct a study to assess the feasibility of restoring estuarine wetland systems within the memorial. A prerequisite to the initiation of this feasibility study, is the availability of a detailed topographic base map (see FOCL-I-117.002). The scale of this map must allow for the expression of six-inch contour intervals in potential and existing estuarine wetland areas. This study will consider potentially restorable lands now within the memorial and those being considered for inclusion in the future (as proposed in the existing GMP). All influences thought to confound restoration efforts (and the associated costs) will be

evaluated. Additional influences (and costs) identified during this study will be evaluated and a set of restoration alternatives will be provided.

Given the above considerations, the initial feasibility study must include the following components:

- 1) A determination of the extent of the potential estuarine wetlands within Fort Clatsop National Memorial. This assessment will evaluate the extent of buried or artificially drained hydric soils in the lowland areas adjacent to the Lewis and Clark River.
- 2) The potential for restoring a near natural hydrologic regime through the removal of existing dikes and levees along the Lewis and Clark River within Fort Clatsop National Memorial.
- 3) The feasibility and cost of removing fill material deposited in FOCL estuarine wetlands. An inventory will initially be needed to determine the amount of this material that now exists in the memorial. Once estimated, removal must be evaluated along with associated costs, including fill disposal.
- 4) An assessment of measures needed to protect adjacent land owners from flooding, including the costs of constructing any necessary levees or other structures?
- 5) An evaluation of the impact of exotic and/or aggressive native species to existing estuarine wetlands. Is the existence and abundance of these species at such a level to completely prohibit the reestablishment of near-natural species diversity? What are the methods and costs involved in restoring a natural plant community?
- 6) Under each alternative option identified, evaluate the potential types and acreage of wetlands that will likely develop.
- 7) The feasibility of Fort Clatsop National Memorial cooperating with local and state agencies to participate in a land bank for wetland areas that might serve as restoration mitigation for development projects. A cooperative effort such as this might provide the funds needed for restoration.

Expertise needed to conduct the proposed feasibility study can likely be obtained from professionals at a local university. The study outlined above is expected to last two years.

LITERATURE CITED

US Fish and Wildlife Service. 1989. US Fish and Wildlife Service. National Wetlands Inventory (Astoria and Warrenton quadrangle maps). Portland, OR.

BUDGET AND FTE

-----UNFUNDED-----

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	Source Act Type	Budget (\$1000s)	FTEs
Year 1:	WATER-RES RES	45.0	0.1
Year 2:			
Year 3:			
Year 4:			
-			
	Total:	45.0	0.1

PROJECT STATEMENT SHEET

PROJECT NUMBER: FOCL-N-332.000

TITLE: DEVELOPMENT & IMPLEMENTATION OF A WATER QUALITY MONITORING PROGRAM

FUNDING STATUS: U FUNDED: 0 UNFUNDED: 51.0

SERVICEWIDE ISSUES:

CULTURAL RESOURCE TYPE CODE: N/A

10-238 PACKAGE NUMBER:

PROBLEM STATEMENT:

Lewis and Clark River - The Lewis and Clark River and associated wetlands are the most extensive water resources, in total acreage, within Fort Clatsop National Memorial. Even though only a small segment of the river actually is adjacent to the memorial, river water enters the associated riverine and estuarine wetlands that are within memorial boundaries. As a consequence, river water quality can directly affect the health of these resources.

Several activities within the Lewis and Clark River watershed can have an effect on water quality. Concentrated and wide-spread timber harvesting is pervasive on the privately owned timber lands in the watershed. This activity has been ongoing for a century or more and is suspected to have affected surface water quality parameters, such as, water temperature, sedimentation, and possibly nutrients. Log booming and transport activities on the Lewis and Clark River are also suspected to have affected other water quality parameters, such as, biological oxygen demand, chemical oxygen demand, turbidity, and toxic chemical concentrations. Dredging to facilitate log transport will episodically increase sedimentation. Upstream dairy and farming activities are also suspected of affecting water quality parameters such as sedimentation and bacteriological levels.

Beginning in 1993, the Oregon Department of Environmental Quality (DEQ) has monitored the Lewis and Clark River for several regulated constituents on a quarterly basis. Prior to this, sporadic sampling took place (since 1969). The quarterly monitoring program was initiated in order to establish a more credible water quality baseline to assess future impacts related to nonpoint pollution sources.

While the limited available monitoring data indicates that water quality within the Lewis and Clark River is usually good, the monitoring is not frequent enough to assess the non-point source pollution impacts associated with runoff and erosion from episodic events on timbered watersheds. Though data are limited, the Oregon Department of Environmental Quality lists the Lewis and Clark River as one of the waterbodies within the state where non-point source pollution problems are known to exist or have been reported without challenge (Oregon Department of Environmental Quality 1988).

Upland streams and springs - Several streams and springs occur within Fort Clatsop National Memorial that flow into the Lewis and Clark River. Small streams arise from springs within the memorial itself or just outside the memorial in the upper part of the sub-basin. Various potential impacts to water quality of these systems have been identified. Dumps and landfills near the memorial are suspected to be leaching waste oil and other toxins into at least one stream (on the southwestern side). Internal NPS operations may also be contributing to water quality degradation through stormwater runoff from roads and parking areas, as well as septic field leachate from the memorial's visitor center and employee housing.

No water quality data are available for the small streams and springs within the memorial, many of which have not even been accurately located or measured. If suspected impacts are occurring, they may go unnoticed because of this deficiency. Long term changes to these systems can not be analyzed because of a lack of a reliable baseline database.

DESCRIPTION OF RECOMMENDED PROJECT OR ACTIVITY:

The Fort Clatsop National Memorial Water Resources Scoping Report (1994) recommends that a comprehensive water resources monitoring program be implemented at Fort Clatsop. This program should, where appropriate, be conducted in conjunction with water quality monitoring efforts implemented by the Oregon Department of Environmental Quality. Initially, the detailed topographic/sub-drainage map described in FOCL-I-117.002 should be prepared. Only with this geographical baseline can the small water resource features of the memorial be accurately located and described. This information will also provide a good foundation on which to store all water quality data collected as part of the "recommended activity" of this project statement. Specific water quality inventory and monitoring activities are the following:

Lewis and Clark River - The Lewis and Clark River extends for approximately 29 miles from the Oregon Coast Range highlands to the Columbia River estuary. The river flows past the memorial for only about one-half mile of this total length. The pervasive influences of timber harvest and transport occur along the

entire upstream reach. NPS ability to influence these long-established activities is minimal at this time, both because of the relatively short length of the river flowing through the memorial combined with a situation where the water quality influences originate mostly from non-point sources that are not directly regulated through specific water quality standards. The Oregon DEQ has an ongoing limited water quality monitoring program for the Lewis and Clark River. In fact, they have recently increased their sampling frequency of this program in order to establish a more credible water quality baseline, though frequency is still not adequate to detect non-point source impacts associated with episodic major runoff events.

Given this situation, the Fort Clatsop National Memorial Water Resources Scoping Report recommends that the memorial resource management staff cooperate with the Oregon DEQ to facilitate the continuation of the current monitoring program. Representatives from DEQ have indicated interest in cooperating with the NPS to ensure the continuation of the program and possibly increasing the frequency of sampling (Greg Pettit, Oregon Department of Environmental Quality, personal communication). The advantages of the NPS cooperating with DEQ are several. First, the DEQ program has been in place for several years. Attempting to develop an NPS program independent of would be time consuming and waste limited resources. Second, the DEQ program has been carefully developed to fit into an overall statewide program with strict standards for quality control and assurance (QA/QC). The NPS may not have the ability at Fort Clatsop National Memorial (with the limited resource management resources) to develop a program to provide an adequate independent QA/QC program. Third, a coordinated program, run cooperatively with the Oregon DEQ could be implemented in a more cost effective manner than an independent program. Through an expanded cooperative program, the NPS will likely obtain, at a limited cost, the data needed to effectively monitor the Lewis and Clark River for potential and existing impacts. In addition, this direct participation with the state will gradually allow the NPS to become a partner in managing the river for the betterment of all water-related resources.

To this end, the resource management staff should develop a specific cooperative agreement with DEQ that could include them directly participating in the collection of water samples and sending them to the state DEQ laboratory. Certain measurements might be taken in the field (dissolved oxygen, temperature, conductivity etc.) depending on the requirements of DEQ. DEQ would train NPS resource personnel to take the needed measurements. Specific study objectives could be jointly developed with DEQ such that suspected impacts will be properly evaluated.

All water quality data collected as part of this cooperative program must be obtained and stored by the resource management staff at Fort Clatsop National Memorial. Analysis of these data should be part of a yearly summary report that

assesses water quality within the watershed and identifies potential impacts. Otherwise, these data must be stored in a format such that long-term changes to the watershed can be analyzed in the future.

Upland streams and springs - The Fort Clatsop National Memorial Water Resources Scoping Report further recommends that a water quality inventory/monitoring program be developed and implemented for the small streams and springs flowing within the memorial. As with the river proposal, the first step must be the preparation of the detailed topographic/sub-drainage map (FOCL-I-117.002). Such a map will provide an accurate base on which to accurately locate the resources as well as place a place to store water quality data.

Following map development, a two year inventory study should be undertaken that will establish an accurate water quality baseline for the small water resource features flowing through the memorial. The proposed study will identify critical water quality constituents that should be measured to evaluate suspected ongoing internal and external threats. In addition, the inventory will establish a water quality baseline on which to measure more protracted changes in the watershed. As part of this initial baseline inventory process, the rapid bioassessment technique will be assessed. It utilizes an indirect method of assessing stream health with macroinvertebrate population levels. Following the inventory, the study will develop a program proposal to monitor sensitive water quality constituents.

The recommended monitoring program will be developed in conjunction with Oregon DEQ to ensure that data obtained is compatible with their basin-wide monitoring effort. DEQ staff specialists may participate with program development by reviewing study designs and providing training. It is intended, however, that necessary field equipment and training will be acquired through study implementation.

Various implementation options are potentially feasible for a FOCL water quality monitoring program for small surface water systems. The monitoring program recommended by the study will be implemented in various ways depending on objectives and needs. It is suspected that either the park staff will conduct actual monitoring and analysis, or a recommendation will be made to implement routine but infrequent monitoring by an outside entity (contractor or DEQ). In all cases the park will receive and store all relevant water quality data obtained as part of the inventory and monitoring program. A yearly water quality summary should be prepared.

Expertise in the Water Resources Division (WRD) will likely be needed to develop the objectives and scope-of-work for the proposed inventory-characterization study. They should be involved with the development of the monitoring program developed through this study.

LITERATURE CITED

Oregon Department of Environmental Quality. 1988. 1988 Oregon statewide assessment of nonpoint sources of water pollution. Department of Environmental Quality technical report. Portland, OR.

BUDGET AND FTEs

-----UNFUNDED-----

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	Source Act Type	Budget (\$1000s)	FTEs
Year 1:	WATER-RES RES PKBASE-NR MON0.1	25.0	0.1
Year 2:	WATER-RES RES20.00.1 PKBASE-NR MON	2.0	0.1
Year 3:	PKBASE-NR MON	2.0	0.1
Year 4:	PKBASE-NR MON	2.0	0.1

	Total:	51.0	0.6

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PROJECT STATEMENT SHEET

PROJECT NUMBER: FOCL-N-330.001

TITLE: BIOTIC INVENTORY OF FORT CLATSOP WATER RESOURCES

FUNDING STATUS: U FUNDED: 0 UNFUNDED: 15.0

SERVICEWIDE ISSUES:

CULTURAL RESOURCE TYPE CODE: N/A

10-238 PACKAGE NUMBER:

PROBLEM STATEMENT:

Until recently, the management of Fort Clatsop National Memorial focused, almost entirely, on the historical aspect of the memorial. Now, however, overall resource management is being emphasized that includes consideration of the memorial setting and the natural environment. Water and water-related resources are a key component of this environment due to the wet climate and the proximity of the memorial to the Columbia River estuary system. This marine influence has likely increased the overall diversity of resources within the memorial (flora and fauna). Because of previous management emphasis on history, a comprehensive inventory of water related biotic resources was not considered important and consequently not completed. As a result, impacts to these resources could have occurred that went unnoticed including the complete elimination of certain species. Partial floristic surveys were conducted through the years as class projects at universities. These, however, concentrated mostly on terrestrial habitat and are of limited usefulness.

Being a small unit, Fort Clatsop National Memorial is surrounded entirely by private land. Several types of water resources are found within or adjacent to the memorial. These include springs, streams, wetlands, and one river. Impacts to these resources have likely occurred through the years and are suspected now from both internal and external sources. The overall effect of these impacts is mostly unknown at this time. Other project statements have proposed that the chemical and physical characteristics of these resources be defined. It is suspected that the biological resources may be the best indicator of the overall health of the habitats within the memorial.

The Fort Clatsop National Memorial Water Resources Scoping Report (1994) proposes that extensive estuarine wetland areas be restored. Without an extensive biotic inventory in these areas, the success of this project will be difficult to ascertain. The species diversity and density of the plant communities is especially important both before and after any restoration treatments.

DESCRIPTION OF RECOMMENDED PROJECT OR ACTIVITY:

The Fort Clatsop National Memorial Water Resources Scoping Report (1994) recommends that a biotic inventory be conducted for all the water resources of the memorial. The inventory will include following resource types: vegetation, macroinvertebrates, amphibians and reptiles. Prior to initiating these inventories, it is suggested that an adequate base map be developed prior to the initiation of this proposal (FOCL-I-117.002). A digitally rendered base map will also provide a geographically referenced vehicle to store inventory information. In addition, a complete wetlands delineation map should be prepared so that biotic surveys can be properly stratified over all wetland types (FOCL-N-320.000). Initial efforts should concentrate on a floristic survey of the estuarine and riverine wetlands that are being proposed for restoration. Such an inventory will provide information to evaluate the success of this effort. Subsequent vegetative surveys should concentrate on all other wetland types. Macroinvertebrate surveys will be conducted on upland surface water systems (springs and streams). The rapid bioassessment evaluation technique will be used to both inventory and assess the health of these systems. The amphibians and reptiles would best be inventoried utilizing a stratified transect and quadrat methodology.

Once the proposed inventories are completed a monitoring program is necessary to determine if changes to these resources are occurring. Such evaluations will determine impacts to the memorial. To this end, a monitoring methodology will be developed as part of the inventory process for each identified resource. Monitoring programs will be developed that can be implemented by the memorial staff on a continuing basis.

The inventory and the development of the monitoring protocols will be developed through contract with a local university or the National Biological Survey. The specific scope-of-work and objectives of the project should be developed with staff specialists from the Water Resources Division in Fort Collins.

BUDGET AND FTEs

-----UNFUNDED-----

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	Source Act Type	Budget (\$1000s)	FTEs
Year 1:	WATER-RES RES	15.0	0.1
Year 2:			

Total:	15.0	0.1
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