FRESHWATER RESOURCES MANAGEMENT

TABLE OF CONTENTS

FRESHWATER RESOURCES MANAGEMENT

Fresh water is a particularly important and sensitive ecosystem component. Its physical availability

and quality are critical determinants not only of aquatic resources, but of a park's overall natural resource conditions. Surface water and groundwater are important in determining site suitability and uses, while also serving as important transport mechanisms. Depending upon watershed characteristics and the hydrologic cycle, water often connects park resources to resources outside park boundaries. Water may thus deliver pollutants generated by activities outside park boundaries to park waters, or transport pollutants generated within the park to waters outside its boundaries. Similarly, impacts on aquatic ecosystems due to alterations of natural populations or environments may cross park boundaries via the aquatic environment.

This section provides resource management guidance in three categories related to freshwater resources:

I. Water Resources Management discusses water quality management, water quantity management, and water resources planning.

II. Aquatic Biological Resources Management discusses management considerations that relate to aquatic organisms.

III. Aquatic Habitat Protection and Management provides principles and guidance relating to habitat protection, including wetland and floodplain management.

DEFINITIONS

Adjudicate To pass on judicially; to decide, settle, or decree; adjudge. An adjudication is the equivalent of a "determination" and contemplates that the claims of all parties have been considered and set to rest.

Appropriative water right An exclusive property right, acquired under procedures provided by state law, to apply water to beneficial uses in preference to all appropriative rights of later priority.

Aquatic ecosystem The stream channel (surface and subsurface), lake, spring, or wetland, and water resources, biotic communities, and habitat features that occur therein.

Base flood The flood level which has a one percent chance of occurring in any given year (also known as the 100-year flood).

Critical flood The flood level which has a 0.2 percent chance of occurring in any given year (also known as the 500-year flood).

Docket As used here, a file containing the documents associated with the legal establishment of a water right.

Doctrine of Prior Appropriation The principle in western water law that ascribes a preference right to the appropriator who first appropriates and beneficially uses water. Commonly described as "first in time, first in right."

Federal reserved water right As generally used, a judicially created water right originating in the U.S. Supreme Court decision in Winters v. United States 207 U. S. 564 (1908). In essence, when the federal government withdraws its land from the public domain and reserves it for a federal purpose, the government, by implication, reserves appurtenant water then unappropriated to the extent needed to accomplish the purpose of the reservation. This right vests on the date of the reservation and is superior to the rights of future appropriators. The **implied** reservation of water is inferred if the

previously unappropriated waters are necessary to accomplish the purposes for which the reservation was created. The amount of water reserved is only that amount of water necessary to fulfill the purpose of the reservation. Another form of the federal reserved water right results from an **expressed** reservation of appurtenant unappropriated water by Congress when it creates a new reservation and explicitly makes a reservation of water.

Floodplain Lowland and relatively flat areas adjoining inland and coastal waters including flood-prone areas of offshore islands, and, at a minimum, areas subject to a one percent or greater chance of flooding in any given year. Extent of 100-year floods designates the "base floodplain." Similarly, extent of 500-year floods designates the "critical action floodplain."

Floodplain values Beneficial attributes and uses of floodplains, including wildlife habitat, groundwater recharge, hydrologic balance/buffering of flood flows, maintenance of the channel's hydraulic integrity, outdoor education, and recreation.

Hydropattern Spatial and temporal characteristics of water conditions (quantity, depth, and coverage) in a specified geographic region.

Instream flow right A right to a fixed or minimum flow amount, or a defined flow regime for in-situ purposes such as fish habitat protection. Generally, these rights are held by a governmental entity and purposes are delimited by statute.

Property That which belongs exclusively to one, including the right of use and enjoyment for lawful purposes.

Reasonable Use The concept, included as part of the doctrine of riparian water right, which allows for water use if, subsequent thereto, water is delivered to other riparians without "unreasonable" diminishment in quantity and/or quality.

Riparian water right A water right which is a right of private property vested exclusively in the owner of the abutting land for use only on that land. It is identified with realty, and is a part thereof.

Water quality Physical, chemical, radiological, microbiological, and biological characteristics of a water resource.

Water quality monitoring Systematic evaluation of water quality specifically designed to answer management questions relative to management goals and objectives.

Water right The property interest established in state statute and state and federal judicial determinations that attaches to a use of water.

Wetland A general definition is: Lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. More specific definitions related to NPS wetland inventory requirements and regulation under Section 404 of the Clean Water Act are presented in Aquatic Habitat Protection and Management, Section G, Wetlands Management, below.

POLICY AND PROGRAM OBJECTIVES

Policy regarding aquatic resources management is provided in the NPS Management Policies. Broadly stated, these policies require management of natural resources of the National Park System to maintain, rehabilitate, and perpetuate the inherent integrity of water resources and aquatic

ecosystems. Specific management policies provide for protection of quality and quantity of surface water and groundwater (4:15-16), preservation of floodplains and wetlands (4:16-17), maintaining, protecting, and securing water rights (4:17), and protection of aquatic biological resources (4.5-14). Program objectives and specific guidance regarding these goals are presented in Program Guidance, below.

AUTHORITIES

In addition to the authorities discussed in Chapter 1, the primary federal laws governing aquatic resources management include the Clean Water Act, the National Environmental Policy Act, the Rivers and Harbors Act, the Endangered Species Act, the Wilderness Act, the Wild and Scenic Rivers Act, the Coastal Zone Management Act, and the Fish and Wildlife Coordination Act. Management of aquatic resources is further addressed in various provisions of the Estuary Protection Act, the Federal Power Act, the Resource Conservation and Recovery Act, the Comprehensive Environmental Response, Compensation, and Liability Act, the Safe Drinking Water Act, the Food Security Act of 1985, and the Coastal Barrier Resources Act.

Executive orders pertaining to the management of aquatic resources on federal lands include Executive Order 11988 (Floodplain Management), Executive Order 11990 (Protection of Wetlands), and Executive Order 12088 (Pollution Control Standards). A summary of the pertinent provisions of the major federal legislative and regulatory authorities governing the management of aquatic and other natural resources in NPS units is found in several other Appendix A of this Guideline.

Regarding water rights, the NPS, under the Reserved Water Rights and Prior Appropriation Doctrines, obtains and uses water for park (reservation) purposes. When the Reservation Doctrine or other federal law does not apply, water rights are obtained in accordance with applicable state laws and procedures.

States, counties, and local water management districts may have laws and regulations pertaining to aquatic resource management in NPS units. For example, most states have established criteria, standards, and guidelines for erosion and sediment control, and a few states have recently enacted groundwater management laws. In general, it is NPS policy to comply with these laws and regulations.

RELATIONSHIP TO OTHER GUIDANCE

National legislation, external influences, and specific park legislation present special concerns and provide direction for management relating to water resources. In some cases the enabling legislation establishing the NPS unit will provide objectives or guidance pertaining to specific water resources-related issues. Other guidance may be found in several other sections of this Guideline, as well as in NPS-12, the Environmental Compliance guideline.

PROGRAM GUIDANCE

I. Water Resources Management

A. Water Quality Management

1. Water Quality Issues

Many units of the National Park System are confronted with threats of water pollution from sources within, as well as external to, their boundaries. The 1987 NPS Servicewide natural resources assessment identified 480 water quality issues affecting or potentially affecting 170 parks. The scope and extent of these water quality issues varied greatly, but the majority were related to surrounding land-use activities such as oil and gas development, mining, encroaching urbanization, industrial activity, agricultural practices, or land development (including sewage effluent discharge and landfill leaching). The severity of water quality degradation (of both surface and groundwater) and the constituents affected depend upon the type and the extent of the activity, watershed and aquifer characteristics, and effectiveness of mitigative measures. It should be noted that the majority of water quality issues identified in the assessment were associated with nonpoint sources of pollution (as opposed to point sources of pollution such as pipes or other discrete sources). Information pertaining to constituents likely to be affected by specific types of activity can be found in Kunkle et al. (1987) and Galbraith (1980).

2. Policy and Objectives

Maintaining water in its natural condition, free of pollutants generated by human activity, is an important goal of NPS managers. The goal of the NPS as expressed in Management Policies is to preserve and protect entire ecosystems, an integral part of which are water and aquatic resources. In addition, the Clean Water Act, passed in 1972 and substantially amended in 1977 and 1987, was designed to restore and maintain the integrity of the nation's waters, including those of the National Park System.

The NPS Management Policies states that:

> The National Park Service will seek to perpetuate surface and groundwaters as integral components of park aquatic and terrestrial ecosystems....The National Park Service will seek to restore, maintain, or enhance the quality of all surface and groundwater within the parks consistent with the Clean Water Act (33 USC 1251 et seq.) and other applicable federal, state, and local laws and regulations. The quality of water originating within the boundaries of parks will be maintained through the following management actions:
>
> > Adequate sewage treatment and disposal will be provided for all public use and administrative facilities. Sewage treatment and disposal are subject to provision of Executive Order 12088, "Federal Compliance with Pollution Control Standards" (42 USC 4321).
> >
> > Human activities will be managed to control erosion.
> >
> > Direct pollution by livestock under commercial grazing permits will be prevented by eliminating streamside or lakeside corrals and pastures and associated watering sites on natural waters wherever possible.
> >
> > Fuel-burning watercraft and marina operations, placer mining, and other activities with high potential for water pollution will be regulated and controlled as necessary.
> >
> > Toxic substances, such as pesticides, petroleum products, and heavy metals, will be managed to minimize the risk of water contamination.
> >
> > The intensity of use will be regulated in certain areas and at certain areas and at certain times determined to be necessary based on water quality monitoring studies.

The following additional actions will be taken to protect the quality of water flowing through parks or along their boundaries:

> The National Park Service will enter into agreements or compacts with other agencies and governing bodies to secure their cooperation in avoiding degradation of water resources.
>
> Consistent with the rights of others, the Park Service will maintain a continuous vigilance by observing and monitoring upstream diversions, adjacent uses, and groundwater withdrawals and their effects on the occurrence, quantity, and quality of water necessary for the continued preservation of park biota and ecosystems.

The National Park Service will seek state support in helping to protect and enhance the quality of park water through special use classifications, such as outstanding resource waters. (4:15-16)

Managers should also petition (under section 1424(e) of the Safe Drinking Water Act) the EPA Regional Administrator for Sole Source Aquifer designation for aquifers supplying groundwater to park water supplies.

In addition to the Clean Water Act, water quality is protected by provisions of the Safe Drinking Water Act; the Resource Conservation and Recovery Act (RCRA); and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). For example, under the Safe Drinking Water Act, the Underground Injection Control Program prohibits the subsurface emplacement of fluids that could contaminate current or future underground sources of drinking water, and under RCRA, underground storage tanks are regulated to prevent leaking and possible contamination of the environment including surface and groundwater resources.

Section 319 of the Water Quality Act of 1987 requires the states to undertake studies to assess the status of nonpoint source pollution and to develop management programs for addressing this type of pollution. In most states, these management programs rely on the implementation of best management practices (BMPs), which are recommended practices to control nonpoint source pollution (e.g., erosion control practices) for agricultural, logging, and road construction activities. Of particular relevance to NPS managers, Section 319 also requires that federal development projects (e.g., park construction projects) be consistent with the states' nonpoint source pollution management programs. In order to minimize nonpoint source pollution in parks, BMPs should also be applied with respect to other NPS-administered land disturbing activities (e.g., agricultural, mining, and recreational activities).

3. Water Quality Standards

A primary means for protecting water quality under the Water Quality Act is the establishment of water quality standards. Generally, water quality standards are established by the states (though subject to federal approval) and consist of two components. The first component determines the appropriate use of the water within a specific stream segment. Once the appropriate use has been established, water quality criteria for a variety of physical and chemical constituents (e.g., water temperature, pH, nutrient concentrations) are assigned that will protect the assigned use. These uses and criteria are then adopted as water quality standards. These standards are applicable to surface waters and, depending on the state water quality program, may also apply to groundwaters.

Water quality criteria developed to protect specific uses are updated periodically by the Environmental Protection Agency (EPA). New and revised criteria are published in the Federal Register, and summarized periodically in Quality Criteria for Water (EPA, 1986). Quality Criteria for Water, also known as "the Gold Book," recommends criteria for a state's Water Quality Standards. It

is an important reference for natural resource managers dealing with water quality issues.

Water quality standards for drinking water are provided by the Safe Drinking Water Act. These National Primary Drinking Water Regulations (NPDWRs), for which states have primary enforcement responsibility, are updated periodically by EPA. New and revised standards are published in the Federal Register. As of January 1, 1989, the NPDWRs include 10 inorganic chemicals, 14 organic chemicals, turbidity, coliform bacteria, combined radium-226 and radium-228, gross alpha particle activity, and beta particle and photon radioactivity from manmade radionuclides. Additionally, secondary standards for various "non-toxic" chemicals are recommended. Additional information regarding water quality standards can be found in NPS-83, the Public Health Management guideline.

Because water quality standards vary from state to state, and constituent criteria vary from use to use, and use designations vary from water body to water body (and sometimes from reach to reach in a river or stream), NPS personnel at the park level should be familiar with specific state water quality standards pertaining to the water resources in and entering NPS parks. Specific actions include:

- participation in a state's required triennial review of water quality standards to assure that state standards adequately protect park aquatic resources,

- alerting the water resource coordinator, designated in each NPS region, to upstream point source discharge applications for National Pollutant Discharge Elimination System (NPDES) permits which could impact the quality of water within an NPS unit,

- encouraging states to apply effective anti-degradation standards and nonpoint source pollution policies to those stream segments most likely to affect park water resources,

- working with state, county, and local agencies to develop and implement appropriate nonpoint source pollution control practices on NPS lands and lands upstream from NPS units, and

- working with local, state, and federal agencies to implement applicable groundwater protection programs.

4. Water Quality Monitoring

Water quality monitoring is often required within NPS units in response to management concerns. An effective monitoring program requires initial planning efforts to identify potential water quality issues and precisely define park management objectives. Sampling design, data collection, data analysis, and reporting processes are strongly influenced by management's monitoring objectives. For NPS units, monitoring objectives almost always entail one or more of the following:

- evaluation of impacts caused by a particular water or land use or combination of water or land uses,

- evaluation of compliance with local, state, or federal standards or legal requirements, and

- gathering of baseline data to characterize existing water quality for general inventory, pre-existing (historical) conditions, or to establish long-term trends, using, for example, previous water gaging stations or groundwater monitoring wells.

When objectives are defined, water quality monitoring sampling design should proceed using the following six-step procedure (adapted from Sanders et al., 1983):

1.**Determine sampling site locations**. Carefully review all existing information, including the available literature, upstream land uses and associated point and nonpoint sources of pollution, delineation of watershed characteristics, and analysis of previously collected data, in order to determine the most appropriate sampling locations.

2.**Select water quality parameters and sampling frequencies**. Water quality parameters and sampling frequencies for NPS monitoring programs should be determined according to guidance provided by NPS-75, the Inventory and Monitoring Guideline (when completed), and with design consultation sought from water resource professionals familiar with monitoring programs in the local area. A further discussion of parameter selection has also been provided by Averett (1978).

3.**Choose methods needed to sample the selected parameters**. 40 CFR 136 provides a listing of methods approved by the EPA.

4.**Evaluate costs, logistics, quality control, and quality assurance needs**, and possible legal requirements (e.g., chain of custody if to be used for litigation) in order to select the most effective implementation strategy (i.e., via in-house, cooperative agreement, interagency agreement, contractor, certified laboratory, etc.).

5.**Determine methods of data analysis, storage, and retrieval** to be used. A discussion of this topic will be provided in the Natural Resource Data Management Handbook (when completed) and is also provided in Water Quality Surveys (UNESCO, 1978).

6.**Determine reports to be prepared** and how data will be used in decision-making.

Additionally, procedures for quality control should be incorporated in all monitoring plans. These procedures include the following:

□calibration of sampling equipment, recording field instruments, and flow measuring devices,

□selection of appropriate standard methods for sampling, preserving, storing, and transporting samples,

□assurance that the appropriate standard curves are completed to assure that the levels of detection and levels of accuracy are verified, and

□use of an inter-laboratory quality control program sufficient to meet EPA laboratory certification or the equivalent.

Recent changes brought about by the Water Quality Act of 1987 increase emphasis on the use of bioassays and biological monitoring. The appropriate use of bioassays and biological monitoring in units of the National Park System will be addressed in NPS-75, the Inventory and Monitoring guideline.

For surface water resources, most water quality monitoring programs should include concurrent discharge measurements. For groundwater resources, most water quality monitoring programs should include spring discharge measurements and periodic measurements of the depth to water in monitoring wells. When siting monitoring wells, it is important to identify the depth to and thickness of water-producing zones, the aquifer characteristics (geologic formation, transmissivity, and storage coefficient), other pertinent site characteristics (e.g., land surface elevation at well head), and well construction data. The constituent(s) for which water samples will be tested determines the type of

well casing and screen that should be used for monitoring wells.

5. Cooperation with Other Agencies

Monitoring, regulation, and protection of water quality is a responsibility shared by many local, state, and federal agencies which have mandates for land use planning, natural resource management, and/or environmental protection. The NPS should work actively with these agencies to enhance program cooperation, efficiency, and effectiveness. Cooperative activities include (but are not limited to) the following:

- consulting with federal (e.g., U.S. Geological Survey and EPA), state, local, and Native American agencies in the design of complementary and effective monitoring networks,

- providing water quality monitoring data to the EPA's STORET system, which serves as the primary national repository for stream and lake water quality data,

- providing regulatory agencies with information regarding NPS compliance with point source and nonpoint source pollution control programs, and

- consulting with appropriate Native American, local, state, and federal agencies regarding planned upstream activities, permit applications, and water quality issues of concern to the NPS.

B. Water Quantity Management

1. Water Quantity Issues

Numerous water quantity issues, concerns, and needs have been identified as natural resource management issues in many NPS units. The 1987 NPS Servicewide natural resources assessment identified several types of water quantity issues, concerns, and needs of NPS managers. These include:

- lack of adequate and secure water rights,

- alteration of natural flow regimes,

- increased erosion and sedimentation resulting from changing land use activities (e.g., deforestation and urbanization),

- lowering of natural groundwater levels, and potential land subsidence, due to increased groundwater pumping,

- protection of natural geothermal resources (see Chapter 2, Geological Resources Management),

- need to provide adequate water for park operations and visitor use,

- lowering of natural groundwater level by accelerated stream bed erosion, and

- lowering of groundwater level by exotic streambank plants.

As demands for water continue to increase, it is imperative that superintendents maintain a constant awareness of proposals concerning upstream diversions, groundwater withdrawals, water resources development projects, urbanization, stormwater control projects, changes in land use, and weather

modification (e.g., cloud seeding), which could affect park water resources.

2. Policy and Objectives

The NPS Management Policies states that:

> Water for the preservation, management, development, and use of the national park system will be obtained and used in accordance with legal authority and with due consideration for the needs of other water users. The National Park Service will generally obtain water rights by assertion of appropriative rights recognized under state law. Essential water rights will be purchased if unappropriated water is not otherwise available....The Service will assert claims to reserved federal water rights for water quantities determined to be the minimum amounts needed to protect the primary purposes of a given park. Where stated, primary purposes are those articulated in the legislation or proclamation establishing the park. Such legislation or proclamation establishes the priority date for the given park....The Park Service will use water efficiently, and in water-scarce areas, will use it frugally. (4:17)

NPS water delivery systems are to be designed to conserve water. (See Management Policies, 9:5)

3. Water Rights

a. Establishing Rights to Water

The NPS will establish rights to water in conformance with federal and state law and procedures. This includes, but is not limited to, the following:

> **Federal Reserved Water Rights.** The doctrine of federal reserved water rights was created with a decision of the U.S. Supreme Court in the 1907 case, Winters v. United States (207 U.S. 564 (1908)). Under this doctrine the government implicitly reserves sufficient amounts of water to carry out the purposes of a federal reservation. Federal reserved water rights have a priority as of the date of the reservation and are senior to the rights of future appropriators (Winters v. United States, supra.) Under this doctrine, what is reserved is only that amount necessary for the purposes of the reservation (Arizona v. California, 373 U.S. 546 (1963)); Winters v. United States, supra; Cappaert v. United States, 726 U.S. 128 (1976)). The doctrine has also been used by the Court to effect a permanent injunction to limit groundwater withdrawals that were adversely affecting the water level of a pool containing an endangered pupfish at Devil's Hole NM (Cappaert, supra).
>
> **Prior Appropriation and Riparian Water Rights.** Water rights under state water law (prior appropriation and riparian rights) shall be secured where appropriate to accomplish National Park Service mandates.

Water rights vary from state to state, but fall into two general categories, riparian and appropriative. Riparian rights, recognized by most of the eastern states, originate from land ownership and are dependent upon contiguity of land to a body of water. The appropriative rights doctrine, adopted by most western states, is based on the concept of "first in time, first in right."

All rights to the use of water diverted to or used on federal lands within the National Park System by the United States of America (U.S.) or its concessioners, lessors, or permittees will be perfected (i.e., made to meet all state water rights requirements) in the name of the U.S. Where permitted by state law, the priority date requested on applications shall be the date on which the water was put to beneficial use.

Valid existing water rights of concessioner and land-use permittees on federal lands will be acquired

by the U.S. as funds, legal authority, and management objectives permit. Water rights owned by inholders within parks will be acquired in connection with the acquisition of such private lands when practicable. Owners of land or interests in land within or adjacent to parks, under the NPS General Authorities Act of 1970, may be granted, by special use permit, the privilege of developing and using water or sources of water owned by the NPS only when it is administratively determined that the use of such water facilitates the management programs of the NPS. Such permits will not be issued if any other reasonable source of water is available. Specific conditions can be found in 16 USC 1a-2(e).

b. Determination of Water Rights and Needs

The water rights of a park are determined by federal and state law as described above. Until the U.S. is properly joined in a basin-wide general adjudication, federal reserved water rights are of undefined quantity and are not subject to loss due to nonuse. When properly joined, the United States must claim and defend its reserved rights in a court of competent jurisdiction or through negotiations either associated with the adjudication proceeding or in the development of a federal-state compact.

Appropriative rights are determined by state laws and procedures. The amount, purpose, location and place of use, and priority date associated with appropriative rights are included on the certificate or permit issued by the state. Riparian water rights are associated with land ownership and are dependent on contiguity of land to a body of water.

The NPS will prepare and maintain water rights dockets for all valid water rights of private parties (alien water rights) within or adjacent to units of the National Park System and for water rights of the U.S. Dockets will be established and maintained in accordance with instructions found in Creation and Maintenance of Water Rights Dockets for the National Park Service, which may be obtained from the Water Resources Division. A master set of dockets will be maintained by the Water Resources Division and a companion set of dockets will be housed in the park.

Needs for water in a park include all water necessary to carry out the purposes for which the park was created as defined in the NPS Organic Act and the park's enabling legislation. Needs for water in the foreseeable future will be identified through the NPS planning process including the park's statement for management, general management plan, resource management plan, or water resource management plan.

c. Protecting Water Rights

In 1952, the U.S. Congress enacted the McCarran Amendment (43 USC 666) which consented to the U.S. becoming a party to state court adjudications relative to priority of water rights. The U.S. Supreme Court decision of March 24, 1971, confirmed that the U.S. is subject to adjudication proceedings in state courts, both as to reserved rights and acquired rights when the adjudication includes a river system. Therefore, the NPS must file and defend its water rights claims in a McCarran proceeding for each NPS unit located in the basin.

A limited waiver of Sovereign Immunity (McCarran Amendment, 66 Stat. 560, 43 USC 666) gives the consent of the United States to be joined as a defendant in any suit for the basin-wide general adjudication or administration of water rights. The Court has interpreted this consent to apply to water rights based on state water law and on the Doctrine of Federal Reserved Water Rights.

When properly joined, the United States must claim its water rights and offer proof to support this claim. In adjudication proceedings, the NPS must participate by supplying the Department of Justice with technical and other factual evidence as needed to protect claimed water rights.

Where the granting of a water right may now or in the foreseeable future conflict with NPS uses or needs for carrying out the purposes of the reservation, a protest will be made to the state agency

responsible for water rights, notifying it that the issuance of such water rights is in conflict with those of the U.S. for NPS purposes. Similarly, when the granting of a water right may conflict with or injure existing riparian or appropriative water rights held by the U.S., a protest will be made to the state agency responsible for water rights.

The NPS will, in consultation with legal counsel as necessary, protest to the appropriate state official any application for a right to make a new appropriation of water or to alter an existing water right where approval of such an application will presently or in the future result in injury to any of the following:

- NPS adjudicated or unadjudicated water rights under state law,
- NPS adjudicated or unadjudicated reserved water rights, and
- present or future needs for water to accomplish its mandate.

d. Instream and Standing Water Requirements

Where water rights of the United States for NPS purposes are, or may be, injured by surface or groundwater storage or use, a quantification of instream flows and natural standing water levels may be necessary. Quantification of these amounts will generally be essential in water rights adjudications. Quantification may also be necessary in the preparation of a response to state or federally mandated environmental studies for actions that affect the environment; for example, construction of impoundments or diversions, and Federal Energy Regulatory Commission dam licensing and relicensing.

In those instances where federal reserved water rights do not apply or otherwise do not guarantee instream flows or natural standing water levels, protection may still be possible under state law. Generally, in such cases early quantification is desirable because the degree of protection is directly related to the date of appropriation; the earlier the appropriation the better the protection.

Other opportunities to protect instream flows and natural standing water levels may be found through conversion of existing or purchase rights under state water law to in-situ uses such as instream flow. Opportunities to accomplish NPS objectives under state water law may also be created through cooperative actions with state agencies.

In Riparian Doctrine states, the need for the quantification of instream flows and natural standing water levels may also arise consequent to water developments or other man-caused alterations of surface or groundwater hydrologic conditions. In these states the "reasonableness" of both the proposal and its effect will be considered by the court. Therefore, quantification should be related to the objectives identified in NPS statements for management.

4. Alterations to Natural Flow

Water resources in many NPS units have been affected by human-induced alterations to natural flow conditions other than those normally associated with water rights issues. Examples include the influence of cloud seeding, of reservoir releases on recreational activities, the impact of flood releases on endangered species, the alteration of aquatic habitat due to reservoir storage/drawdown cycles, and the establishment of a non-native coldwater fishery downstream from reservoir release sites. In addition, many urban NPS units experience discharge, erosion, and sedimentation patterns which have been altered by increases in stormwater runoff, resulting from continued growth and inadequate stormwater management in the adjacent watersheds.

Alterations to natural flow conditions may be a major concern in aquatic resources management as

these changes often alter aquatic habitat. Issues and impacts relating to the influence of flow alteration on aquatic habitat is addressed in Aquatic Habitat Protection and Management, below. Natural resource managers are strongly encouraged to participate in the preparation and review of other agencies' watershed management plans, stormwater management plans, etc. for areas which may not be located within the park boundary, but which may impact park aquatic resources that are a downstream watershed component.

5. Groundwater Quantity Issues and Management

As with surface water, groundwater may be a primary resource of the park that supports all other resources and ecosystems. In parks where groundwater sustains lakes, playas, springs, and cavern systems, it is critical to the continued existence of natural systems and associated park values. This may be especially true in arid regions where groundwater is the primary water supply for wildlife and vegetation.

NPS Management Policies limits groundwater withdrawal and consumptive use in a park to the amount that is absolutely necessary for the use and management of the park, and only if necessary studies show that these withdrawals will not significantly alter natural processes and ecosystems. It is especially important that the effects of groundwater withdrawals on park resources such as wetlands and springs be evaluated during these studies. When feasible, and appropriate, groundwater sources will be developed for park water supplies in lieu of, or to replace, surface water diversions in parks. In addition, all groundwater withdrawn from a unit for domestic uses is to be returned to the park's watershed.

Groundwater withdrawals and appropriations that occur adjacent to park boundaries can have a significant impact on groundwater levels, as related to well yields and spring flow, and natural resources within a park. These impacts may be especially significant in areas adjacent to large agricultural or mining operations where large groundwater withdrawals can lower groundwater levels over a broad area through land subsidence.

Park personnel should maintain an awareness of local groundwater conditions and uses, and, when appropriate, work cooperatively with federal, state, and local agencies in order to protect these resources. In many cases, a well-developed position documenting NPS concerns can influence other entities to adopt a course of action acceptable to all parties involved. Agreements, memoranda of understanding, or possibly legislation are avenues that can be used to attain park objectives.

6. Water Quantity Inventory and Monitoring

A water quantity inventory, including an assessment of water rights and status, where appropriate, is an essential component for aquatic resources management within an NPS unit. The inventory and assessment may vary in scope and detail depending on management's needs, but should conform with guidance presented in NPS-75, the Inventory and Monitoring guideline (when completed). In addition, a water quantity inventory and assessment should be an integral part of a park's resource management activities and be identified in a park's resource management plan.

The NPS should cooperate with the USGS and other federal and state agencies in monitoring surface water available in rivers, streams, and other water bodies, and flow of artesian wells, springs, and water levels in wells. However, in many cases, the park will need to install and operate an appropriate monitoring system to measure water quantities if such issues are of concern. Information regarding the design of adequate water quantity monitoring programs is contained in NPS-75, the Inventory and Monitoring guideline (in draft).

C. Water Resources Planning

1. Water Resources Planning Process

Water resource planning in the NPS is part of the natural resource planning process. If water resources constitute only a minor component of a park's natural resources, and if issues are straightforward with no suspected significant impacts, water resources may be addressed as a component of the resource management plan (RMP). In many parks, however, water resources are sufficiently important and the issues so complex or controversial that a separate water resource management plan (WRMP) is warranted. In these situations, the WRMP may be prepared as a separate action plan which has been identified in the RMP.

2. Water Resource Management Plans

The WRMP supports NPS's decision-making process related to the protection, conservation, use, and management of a park's water resources. The WRMP structures and uses information about the park's hydrologic resources to assist management in evaluating alternatives concerning water resources issues. The WRMP is a dynamic document that is revised periodically. In general, the WRMP provides a blueprint for the resolution of park water resources issues over a three to five year period.

Each WRMP will contain three major sections. These include:

1. **Background and Authority**

   This section of the plan provides background information regarding the park and water resources issues, concerns, and needs that instigated preparation of the WRMP. In particular, this section provides information on laws, regulations, and policies applicable to the park, the status of NPS planning activities for the park, and land status and uses of lands adjacent to the park. This section also states objectives concerning use and management of water in the park and lists specific water resources issues identified for evaluation in the plan.

2. **Hydrologic Environment**

   This section of the plan provides sufficient information to characterize the hydrologic setting of the park and to describe the current condition and status of park water resources. Depending upon the hydrologic resources of the park and the water resources issues to be addressed, the description of the hydrologic environment may include information regarding physiography, climate, geology, surface water resources, groundwater resources, aquatic and riparian resources and habitat, water uses within the park, and water rights. Care should be taken to assure that information included on the hydrologic environment be properly cited. These references will provide a valuable source of water resources information that may later be used in project design and implementation.

3. **Water Resource Issues and Alternatives**

   This section of the plan represents the action program of the planning effort. It includes specific project statements describing day-to-day operational activities and special projects necessary to address water resources issues facing the park. These activities and projects may consist of management, monitoring, interpretation, law enforcement specifically directed toward water resources protection, program administration, research, management studies, and mitigation/treatment actions. Each water resources management activity or project is addressed in a separate project statement clearly stating a water resources issue, concern, or need, identifying alternative actions and their

probable impacts, assuring environmental compliance, and identifying a preferred alternative. The statement is sufficiently detailed to allow its incorporation into the resource management plan for subsequent funding and programming purposes.

Responsibility for preparation of the WRMP lies with the park. Specific direction, guidance, and technical support can be provided by regional offices and the Water Resources Division. It is strongly suggested that public review be incorporated as a component in the development of any action plan, as public support will generally be important in future plan implementation. Instructions for the Preparation of Water Resource Management Plans may be obtained from the Water Resources Division. (See also, Chapter 4, Resource Management Plan.)

II. Aquatic Biological Resources Management

A. Aquatic Biological Resource Issues

Freshwater systems are important reflections of the watersheds in which they are found. They can be characterized based on physical features, water quality, and biological attributes including species composition, diversity, distribution, abundance, and biomass. They include many types of habitats such as ponds,lakes, seeps, springs, streams, rivers, and wetlands.

In addition to community changes resulting from natural environmental and biological processes, aquatic systems can change because of impacts caused by human activities. For example, effects on water quality from contaminated atmospheric deposition or point and nonpoint pollution sources can result in reduced growth and reproductive success, and increased mortality of organisms. Simple changes in forest cover alter rates of movement of nitrogen, phosphorus, and other important materials in streams and influence downstream habitats. Changing watershed conditions can cause a lowering of the local groundwater table, which concurrently can cause perennial streams to become seasonally dry and a reduction or loss of spring flow. These changes may have far-reaching effects, including loss of riparian and wetland vegetation and associated riparian and aquatic habitat. Habitat destruction on lands adjacent to a park may seriously impact aquatic species if important local portions of species distribution are lost or reduced in reproductive potential, or if such impacts reduce the ability of migrating species to move freely through the area. Introductions of non-native species also are a potent force in changing populations of native species. Generally such changes are related to competitive interactions for food and space, but can also involve predation. Genetic contamination from hybridization with introduced fishes is another important consideration.

A common but subtle form of habitat modification is cultural eutrophication. This process is based upon human-induced increases in the rate of supply of nutrients used in plant growth. Cultural eutrophication occurs when naturally occurring sources of essential growth compounds are supplemented by new sources such as septic tank effluent, soil erosion, fertilizer runoff, domestic animal wastes, landfill leachate, urban runoff, or any point or nonpoint sources which will stimulate plant growth. Park operations can contribute to this process, and training of park staff is appropriate in areas with potential for impacts on water resources and their biota.

The first indications of increased nutrient supply are usually increased algal growth and reduced water clarity. Changes in algal species often accompany new levels of nutrient influx; this species change often influences changes in the zooplankton community which is composed of very selective algal grazers. Changes in species of zooplankton in turn affect the diet of predatory fish, and so on. Some algae associated with high nutrient environments also exude toxins which further disturb the higher community structure (and can affect swimmers). Odors and extensive vegetation mats are common as are increased weed development in lakes and streams. Dense weed beds preclude swimming, boating, and fishing. Long-term implications are reduced lifespan of affected lake basins and weedy, turbid waters replacing clear-water habitats.

Long-term preservation dictates that great care be taken to limit any activities, operations, or developments which may increase the delivery of nutrients to natural waters and their inhabitants.

B. Management Needs and Actions

Human activities can decidedly alter natural patterns of variation, in populations of aquatic biota producing either artificially luxuriant growth or impaired survivorship. Although changes in some aquatic biological resources may be immediately evident (e.g., fish kills), others occur over many years. A major constraint in protecting aquatic systems is that changes are often gradual, occurring over periods often longer than the usual tenure of superintendents or resource managers. Therefore, a solid inventory and monitoring program coupled with sound documentation and data management practices are mandatory for successful management and preservation of resources.

1. Inventory and Assessment of Park Resources

Problems with aquatic resources are usually recognized by loss of some populations or overabundance of others. Generally, little historical information is available, which makes assessment of changes or prosecution for relief from disturbance difficult. Necessary components of prudent management include knowledge and understanding of the range of aquatic biological resources present, and detailed and replicable data, including reference collections, concerning presence and distribution of major species. Information pertaining to the design of inventory and monitoring programs for aquatic biological resources may be found in NPS-75, the Inventory and Monitoring guideline (when completed).

Knowledge of life histories, seasonal cycles, and interrelationships among major species is a major element of active management. Vulnerabilities and requirements of each life stage, especially critical events such as spawning, migration, and aestivation should be known, so that current park conditions that might influence species success or failure can be identified.

Structure and organization of natural communities can be altered severely by non-native species. Many superintendents have inherited a legacy of introduced aquatic species, the impacts of which are little known. Effects of fish introductions may be seen in changes in zooplankton communities, phytoplankton communities (which are grazed differentially by different-sized zooplankton--size being a factor in selection by fish), and macroinvertebrates, as well as in competition with native fish species. Similarly, removal of top native predators, as by fishing, results in other changes in the community structure (see also Chapter 3, Fishing).

2. Monitoring

Since aquatic biological resources are highly variable, distinguishing natural from human-induced changes requires solid information over long periods of time. Precise measurements of appropriate variables are required, a program that requires diligence, continuity, and sustained management support. Although all baseline data are priceless (in that historic levels can never be fully captured afterwards), great care in choosing species, diversity indices, or general monitoring protocol must be exercised. Frequent analyses of data are required to assure that information gained meets monitoring objectives and supports management needs. Monitoring generates new understanding and new questions, and can measure results of management actions when implemented.

3. Impact Assessment

Fluctuations in population levels through death, immigration, emigration, or changes in growth and reproductive success may occur for many reasons. These changes may be natural or human-induced. An impact assessment should include an evaluation of weather patterns, alterations in physical

habitat, changes in land use and management, changes in water quality (including nutrients, suspended solids, toxic chemicals, dissolved oxygen levels/temperature), changes in flow regime, and competition from introduced species. Pathogens may be responsible for, or indicative of, other stresses.

In conducting an assessment of an existing impact, the natural resource specialist should take care to provide proper documentation of all observations and events. Further analysis of an impact may require the early involvement of research or extension services provided by the park science program, the regional science program, and through the appropriate divisions of the Washington Office Natural Resources Directorate.

4. Research

Research can provide an understanding of aquatic biological resources and of the specific roles of individual species in aquatic communities. Information on life cycles and organism vulnerabilities often must be site-specific because of the powerful influence of habitat. Results from intense studies in one habitat may or may not be reliably applied to another. Often applicability of information from one population to another is a matter of professional judgment and sometimes litigation. Site specific data should be obtained to describe, understand, and protect aquatic biological resources.

III. Aquatic Habitat Protection and Management

A. Introduction

Objectives of this section are to inform superintendents and resource managers of the kinds of park aquatic habitats that must be protected, the ecological factors governing those habitats, and internal and external activities that impact aquatic systems. Wetlands and floodplains are aquatic habitats subject to specific executive and legislative mandates and NPS guidelines. Specific inventory, planning, and compliance requirements relating to these habitats are also discussed.

B. Policy and Objectives

With respect to aquatic habitats, the NPS seeks to:

- eliminate human-induced impacts on aquatic habitats,
- limit effects and mitigate damage if impacts are unavoidable,
- maintain and restore aquatic habitats to protect their ecological and aesthetic character and dependent animal and plant communities, and
- minimize economic costs to developments from flood hazards.

C. Aquatic Habitats

NPS units are located across a wide latitudinal gradient and within a broad range of physiographic regions. Aquatic habitats thus range from tundra ponds, which may be ice-free for only a few months each year, to subtropical marshes and swamps which never freeze. Lakes and rivers are obvious aquatic habitats to be protected, while other, less conspicuous, yet functionally important aquatic habitats may not receive the same consideration. Listed below are major classes of aquatic habitats included in NPS units.

- Lakes and ponds, including tundra pools, vernal ponds, inter-dune pools, caldera lakes, kettle lakes and tarns, oxbows and guts, pothole lakes, alkali or inland saline ponds, and

playas. Reservoirs created for flood control, water supply, or hydropower are manmade habitats included in some parks.

☐Permanent and intermittent rivers and streams, including sub-surface watercourses through caverns, and tidal freshwater and brackish water channels. Waterfalls along river courses create micro-habitats and attract visitor interest in many parks. Canals are manmade habitats included in some NPS parks.

☐Springs and seeps, which are driven by groundwater, include desert spring pools. Many are home to endemic aquatic taxa and some have historic (cultural) significance.

☐Geysers and hot springs driven by geothermal energy.

☐Floodplain/riparian habitats, such as bottomland hardwood swamps and cypress swamps.

☐Other wetlands with tree cover, such as cedar swamps, cypress domes, alder/willow thickets, and lakeshore swamps.

☐Fresh and brackish water marshes dominated by sedges and grasses, salt-marshes, tule marsh, and sloughs.

☐Northern peatlands (bogs, heaths, and fens), pocosins, and muskeg.

☐Glaciers and their associated subglacial flows.

☐Coastal floodplains and wetlands.

D. Physical and Ecological Factors

The nature of aquatic habitats and their biotic dependents is defined by the balance of water quantity and quality characteristics, physiographic and biotic factors, and episodic events such as fire and hurricanes. A shift in the balance of any major governing factors may lead to drastic changes in habitat type, with corresponding changes in the biotic community. The influence of water quality, water quantity, and other factors on aquatic habitats is discussed below.

Water quantity is a primary factor governing aquatic habitats. Hydrologic regimes, that is, the seasonality, quantity, and distribution of water amounts, vary according to changing patterns in rainfall in a watershed. Areal coverage, timing, and duration of inundation (hydropattern) are critical in maintaining marsh, swamp, bog, and lake systems. The water budget, that is, total input and losses of water within a habitat, is closely related to hydropattern. Flow velocity and seasonal water-level requirements must also be considered for river and stream habitats.

Water chemistry and related physico-chemical properties affect the capacity of aquatic habitats to support life. Nutrient and inorganic ion concentrations determine, in large part, the productivity of the system. Sediment load and turbidity affect rates of photosynthesis, quality of spawning sites, success of filter-feeding and sight-feeding organisms, etc. Salinity, pH, dissolved oxygen, and temperature are important in determining animal communities of a habitat. Many constituents are seasonally or annually variable, and many result from the unique combination of physical, geographical, and chemical characteristics of the drainage basin. Natural variability among aquatic habitat types is often extreme. For example, nutrient levels in bog waters are very low compared with a floodplain swamp; sediment load and turbidity are high in streams receiving glacial meltwaters compared with levels in Everglades marshes.

Physical aspects of aquatic habitats are shaped by geological and climatic influences. These influences may be prolonged (e.g., weathering or uplifting of landforms), or immediate (e.g., vulcanism, earthquakes, or hurricanes). Processes of stream-channel cutting, weathering and uplifting, storm disturbance, long-shore currents and tides create or influence habitat characteristics such as stream meanders or braids, riffle/pool complexes, substrate types and locations, and waterfalls. These physical aspects often determine composition of the aquatic biological community, distributions of the organisms, and their spawning, nursery, feeding, and wintering sites.

Biotic communities of aquatic habitats also alter habitat characteristics. The vegetation community often creates the substrate of the habitat (e.g., peat formed by Sphagnum in bogs or by sawgrass in the Everglades). Further, plants may also influence chemical components and fluxes in waters and soils. Animals such as the beaver and alligator modify wetland habitats by damming watercourses or lowering soil elevations, and thus influence other vegetation and animal species. The addition of animals or plants to an aquatic habitat in which they are not native (sometimes termed "species pollution") often changes the ecological balance of the habitat.

E. Impacts on Aquatic Habitats

Aquatic habitat characteristics must remain within a given range of natural variation to support biotic communities adapted to that range. Human activities which shift these characteristics outside the natural range of variability often cause habitat degradation and changes in species composition or abundance. In addition, recreational and aesthetic qualities of wetlands are related to many of the following factors and are an important contribution to a quality visitor experience. Waterfalls with too little flow because of upstream diversion, former white-water river rapids drowned by reservoirs, polluted waters, the use of ski boats and jet skis, or scenic views obscured by woody vegetation formerly suppressed by fires dampen visitor enjoyment of the park. This section discusses activities which affect aquatic systems, mechanisms by which they do so, and resultant changes in the system.

1. Water Quality: Nutrients

Nutrient additions within parks may issue from human waste from backcountry operations and campgrounds, sewage-treatment plants, soil erosion, lawn maintenance, garbage dumps, and fish-cleaning sites. External activities include deforestation, storm-sewer drainage, agricultural/urban runoff, sewage treatment outfalls, and landfill leaching. Nutrient additions change animal and plant communities, increase dissolved oxygen demand causing animal mortality, increase organic deposition, and affect aesthetics.

2. Water Quality: Pesticides

Some pesticides accumulate in aquatic habitats where they, or their breakdown products, undergo bio-amplification (i.e., increased concentration as they proceed up the food chain). Pesticides have been shown to cause dramatic declines in some top-level predator populations, and may be responsible for less obvious, chronic effects on wildlife.

3. Water Quality: Atmospheric Deposition

Parks are often located in areas where water resources have low buffering capacity, and are subject to damage if acidic atmospheric deposition depletes the natural buffering capability. In the eastern United States, many parks containing significant water resources have received increasing acidic atmospheric loading over the last 40 years, leading to decreased pH and increased sulfate and heavy metals concentrations. In the western United States, many parks contain large numbers of low-alkalinity lakes and streams which often occur in glaciated, high elevation alpine and subalpine zones. In these areas, slopes are typically steep, watersheds are small, soils are often thin and acidic,

and the water resources subsequently are sensitive to increasing acidic atmospheric deposition. Acidification not only changes ambient water quality, but may also have far-reaching biological impacts, including reduced fecundity and the elimination of acid-sensitive species in affected waters.

4. Water Quality: Hydrocarbons and Toxics

Other hydrocarbons and toxic chemicals are used in fueling and maintenance operations, and result from minerals development. Leaking underground fuel tanks and marina operations may pollute surface and groundwater. Oil spills and acid drainage from mineral-mining sites also cause mortality of plants and wildlife in wetlands and floodplains. Chemicals, including solvents, paints, tars, wood preservatives, and detergents, used in maintenance, are often toxic.

5. Water Quality: Physico-chemical Constituents

Physico-chemical factors in aquatic habitats, such as pH, temperature, dissolved oxygen, and turbidity are affected by human activities. Activities that increase nutrient input may also result in increased turbidity, as do developments that remove riparian vegetation, such as logging, grazing, road-building, construction, placer mining, and farming. Irrigation in arid areas increases soil salinity and often concentrates chemicals at toxic levels. Park wildlife may be affected when using such areas. Related to removal of riparian vegetation and tree cover on slopes are increases in average water temperatures and sediment loads, and changes in dissolved ion concentrations and photosynthetic rates. Even when those activities are external, but occur within the watershed of park aquatic habitats, problems should be anticipated.

6. Water Quantity: Hydropattern Alterations

Water removal from park aquatic habitats results mainly from external activities. Withdrawals from municipal and agricultural wells may lower area groundwater levels, with subsequent wetland impacts, flow reductions in springs or seeps, or similar impacts in other aquatic habitats. Flow pattern changes may also occur because of land use alterations (e.g., deforestation, development) within a watershed, potentially causing more flash-flooding, less groundwater recharge, and sometimes seasonal changes in water availability. In coastal areas, removal of fresh water may allow salt water to intrude into groundwater and soils. Reservoirs in park watersheds withhold and divert waters from parks, change natural flooding cycles, and alter downstream nutrient regimes. Thermal-energy developments near park boundaries may impact timing and degree of geyser displays and hot-spring flows.

Reservoirs, water-control structures, and hydroelectric dams may provide flows to the park at inappropriate times of year or in inadequate or overwhelming quantities, with temperatures or other factors outside of the natural range. Areal distribution of these flows may also be unnatural, thereby affecting inundation patterns, and the flows may even be directed to areas outside of normal drainage basins. Delivery schedules may be maintained such that natural water fluctuations in marshes, swamps, and rivers are stifled, or in the case of lakes, may be exaggerated beyond normal limits.

Internal park activities such as bridge, roadway, and building projects may upset the balance of water flow and hydropattern in aquatic habitats by reducing connections between wetland areas, by direct mortality of wetland animals crossing roadways, by impeding migrations, and by changing current patterns and siltation.

All of these impacts can affect parks and have been shown to cause changes in aquatic communities; some changes have been subtle, and others dramatic, as in the direct mortality of the biota or effects on animal nesting success. Many communities depend upon the predictability of seasonal and annual environmental conditions, so that any activity that interferes with that predictability decreases the ability of the community to respond properly.

7. Physical Modifications

Physical modifications of aquatic habitats issue from actions like streambed channelization, dredge or fill operations, gravel removal and mining, and jetty construction. Those actions produce changes in the physical parameters of aquatic habitats, including water depths, current speed, sediment transport, and turbidity. The results are reduced habitat and species diversity, shifts in organismal abundance and distribution, and changes in the rates and locations of beach-building and erosion. Mineral development in and near parks physically alters floodplain and wetland habitats or changes water flow or circulation patterns by the construction of drilling pads, coffer dams, and placer operations. Timbering along park streams often results in streambed obstruction by fallen trees and slash, which can disrupt fish spawning and migration patterns. Unregulated or improperly placed culverts, dams, and weirs have similar impacts.

8. Biotic Factors

Animal harvest by fishing, hunting, and trapping occurs in many parks. These topics are discussed in Chapter 3. However, removal of animals from aquatic systems may affect ecosystem function and structure.

Related to harvesting is the purposeful introduction of animals for sport. Exotic sport fishes and foraging species stocked into waters outside parks by state or federal agencies have often colonized park habitats. Many have been shown to displace native fish species and to disrupt planktonic communities and food webs. A common practice in the past, fish stocking still occurs in a few parks, most commonly where special use zones (often reservoirs) are designated by park legislation for "active fisheries management." Some non-native species introduced outside of park waters to control aquatic plants have also colonized parks.

9. Other Impacts

The use of recreational vehicles in wetland and riparian habitats disturbs the physical and vegetational structure and often causes direct animal mortality. Disturbances in aquatic habitats may remain visible for decades, affecting habitat aesthetics and function.

Inholdings and structures, such as hunting camps in Big Cypress National Preserve, modify their surroundings and may add sewage and other wastes to aquatic habitats. Access to these areas may impact park habitats and wildlife.

F. Floodplain Management

Floodplains are flood-prone lands that border inland and coastal waters and are created primarily by the transport and deposition of bedload, sediment, and organic materials during high waters. In the United States there are more than 50,000 square miles of flood-prone land (Dunne and Leopold, 1978).

Floodplains can be divided into three general descriptive categories: riverine, coastal, and special areas (43 FR 6030). Riverine floodplains are valley areas that are periodically inundated by floodwater from adjacent perennial or intermittent streams or rivers of any size. Flooding in river floodplain areas can result from excessive precipitation and runoff, natural or manmade channel obstruction, or reservoir releases. Riverine floodplains are subject to frequent flooding; generally floods that overtop river banks occur every 1 to 2 years (Leopold et al., 1964).

In addition to conventional flooding in riverine floodplains, changes in floodplains from debris flows in steep gradient ephemeral channels of some western parks present special situations in floodplain

management. Debris flows are not generally predictable using normal flood forecasting procedures, yet they can sometimes exceed floods from runoff in both peak volume and destructiveness. Recent research by Webb et al. (1987) indicates that the occurrence of debris flows in Grand Canyon National Park (and presumably other western parks) are more frequent than previously thought.

Stream channels located in glacial outwash areas or in aggrading landscapes such as alluvial fans present additional problems. Streams in these areas often transport enormous sediment bedloads and can rapidly inundate or undermine a site through rapid lateral erosion. Problems with locating roads or facilities near such streams occur in both desert parks (alluvial fans) and in Alaska (glacial outwash).

Coastal floodplains border lakes, estuaries, or oceans. Flooding in coastal floodplains is due to landward flows caused by unusually high tides, waves created from high winds, storm surges, or tsunamis.

Special floodplain areas include sheet flow or shallow flooding areas and wetlands in which the paths of flooding are unpredictable and indeterminate.

Floodplains are valuable yet often overlooked components of park ecosystems. They serve important functions such as natural moderation of floods, water quality maintenance associated with filtration of waters through vegetation and gravel, sediment control, groundwater recharge, habitat for biota, areas for outdoor recreation and education, and natural beauty.

1. Mandates and Guidance

Mandates and guidance for National Park System floodplain protection is found in Executive Order 11988, Floodplain Management (42 FR 26951; May 24, 1977). In addition, floodplain guidance is found in the Coastal Zone Management Act, which has certain requirements for consistency with approved state coastal zone management programs; Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act, which require U.S. Army Corps of Engineers permits for construction and disposal of dredged material in waters of the United States; the Fish and Wildlife Coordination Act, which requires that equal consideration be given to wildlife when proposing to impound, divert, deepen, control, or modify any stream or other water; the Wild and Scenic Rivers Act and the Endangered Species Act. Procedures for compliance with these laws is presented in NPS-12, the Environmental Compliance guideline.

Executive Order 11988 was issued in furtherance of the National Environmental Policy Act, the National Flood Insurance Act of 1968, as amended (42 USC 4001 et seq.), and the Flood Disaster Protection Act of 1973. Executive Order 11988 emphasizes the environmental aspects of floodplain management. The Order requires that all federal agencies avoid, to the extent practicable, the adverse impacts associated with the occupancy and modification of floodplains and avoid direct and indirect support of floodplain development if there is a practicable alternative. The preferred method for satisfying this requirement is to avoid actions on the base floodplain (100-year floodplain). If an action must occur on the base floodplain, the Order requires that agencies minimize potential harm to people and property and to natural and beneficial floodplain values.

Guidelines for implementing Executive Order 11988 were published by the Water Resources Council in 1978 (43 FR 6030). These guidelines provide broad guidance in the interpretation of the Executive Order to assist each agency in developing its own procedures for compliance with the Order. Each agency is to reflect the conceptual framework of floodplain management as set out in the Unified National Program for Floodplain Management (1976) prepared by the Water Resources Council. The NPS published Floodplain Management and Wetland Protection Guidelines (hereafter, "NPS Floodplain and Wetland Guidelines") in 1980, with revisions in 1982 (45 FR 35916, May 28, 1980; 47 FR 36718, Aug. 23, 1982). These guidelines set forth NPS procedures for implementing Executive

Order 11988 for Floodplain Management within the National Park System.

In addition to the NPS Floodplain and Wetland Guidelines, other NPS guidelines describe activities and procedures associated with floodplain management. These include:

□NPS-2, the Planning Process guideline. Provides guidance on the preparation of general management plans and other park planning documents. In many cases, the actions proposed in park planning documents require floodplain evaluation.

□NPS-12, the Environmental Compliance guideline. Includes the final procedures concerning compliance with legislative and executive requirements which relate to NPS planning activities, including compliance with Executive Order 11988.

□NPS-18, the Fire Management guideline. Provides guidance on fire management which can affect floodplains and freshwater resources.

□NPS-28, the Cultural Resources Management guideline. Provides direction for the management of cultural resources, including guidance for management of cultural resources in floodplains, and flood loss protection for storage of cultural artifacts.

□NPS-40, the Dams and Appurtenant Work, Maintenance, Operation and Safety guideline. Provides an outline of responsibilities of the NPS in the planning, design, construction, and maintenance of dams and a related discussion on floodplain management.

□NPS-75, the Inventory and Monitoring guideline (in preparation). Provides guidance on inventorying and monitoring park natural resources, including water resources.

2. Responsibilities

A detailed listing of NPS responsibilities in regard to floodplain management is presented in 45 FR 35916, Section 9.

3. Floodplain Planning and Compliance Procedures

The goal of NPS floodplain management is to protect riverine, coastal, and special types of floodplains and floodplain functions, and the natural and beneficial values associated with floodplains. A brief summary of procedures outlined in the NPS Floodplain Guidelines is provided below. The NPS will identify floodplain and flood hazard areas in parks that are subject to public use or development and where the hazard or impact of human activities would be greatest (Section 6.B). The NPS will delineate base floodplains for the areas of concern identified in the preceding paragraph. Data on base floodplains are available from a variety of sources. A general listing of these sources is presented below.

Floodplain maps

and profiles

Tec

Ass

Agency_____Riverine_____Coastal_____Sevices

Department of Agriculture:	X	X
Soil Conservation Service		
Department of the Army:	X	X
Corps of Engineers		
Department of Commerce:		X
National Oceanic and		
Atmospheric Administration		
Department of Housing and	X	X
Urban Development: Federal		
Housing Administration		
Department of the Interior:	X	X
Geological Survey		
Bureau of Land Management	X	X
Bureau of Reclamation	X	
Federal Emergency Management Agency	X	X
Tennessee Valley Authority	X	
Delaware River Basin Commission	X	X

Susquehanna River Basin Commission States (Varies from state to state)	X	

If base floodplain information is inadequate or not available, the NPS or contractors will develop data sufficient to determine the base floodplain (see Flood Monitoring and Mapping, below).

Proposed actions that might affect park floodplains for which there are no floodplain data will be addressed on a case by case basis. It must be determined if a proposed action is located in or could affect a floodplain. For many small projects, the cost of determining precise base floodplain boundaries is prohibitive in relation to the action. For such actions, the NPS can choose to use a worst case analysis by assuming the project is in or will affect the base floodplain. Steps for determining if a proposed action is in or could affect a floodplain are outlined in Section 6.D.1.

All NPS actions subject to compliance with Executive Order 11988 will be evaluated in an appropriate environmental document (Environmental Assessment or Environmental Impact Statement). The NEPA process ensures opportunities for public participation in decisions concerning floodplains. Requirements for the public review process are outlined in Section 6.D.2.

Certain day-to-day, NPS administrative and operational activities may be categorically excluded or require modified approaches to compliance with Executive Order 11988. NEPA categorical exclusions are listed in the Departmental Manual (516 DM 2, Appendix 1 and 516 DM 6, Appendix 7). Certain NPS actions may also be excepted from compliance with the Executive Order, for example, scenic overlooks and foot trails (Section 5.B.2).

When the NPS takes emergency actions essential to protect property and public health and safety, a modified application of the Executive Order is required. All possible steps to mitigate potential impacts of such emergency actions will be taken, considering the need for rapid action in emergency situations. (See also, Chapter 4, Emergency Management.)

The NPS will identify and evaluate practicable alternatives to locating in the base floodplain. If a proposed action involves adverse impacts on a floodplain, a Statement of Findings (Section D.3.c) must be prepared documenting the rationale for the determination that there is no practicable alternative to locating in or causing impact on the floodplain. Section 6.D.3 describes the requirements of identifying and evaluating alternatives for actions involving floodplains.

The environmental documents prepared for proposed actions and alternatives to each action located in floodplains will identify potential impacts associated with occupation and modification of floodplains. Both flood hazard factors and natural value factors will be analyzed in these environmental documents. A description of the factors to be analyzed and the approach to discussing floodplain impacts is presented in Section 6.D.4.

In addition to following the NPS Floodplain and Wetland Guidelines, NPS managers must also comply with other applicable federal, state, and local regulations governing floodplains.

Where activities in floodplains cannot be avoided, compliance with both EO 11988 and NPS Floodplain Management and Wetland Protection Guidelines can be met by either (1) structural mitigation using berms, dikes, and placement of buildings on pillars, which effectively places the activity outside the floodplain, or (2) nonstructural mitigation such as flood warning systems which will allow sufficient warning time to fully evacuate personnel and allow removal of artifacts. It is

recognized that NPS property will someday be lost in the latter case and may be lost under structural mitigation efforts, depending upon the flood frequency design of the structures. In all cases where activities in floodplains cannot be avoided, NPS actions to be taken will minimize harm to or within the floodplain and preserve natural and beneficial floodplain values.

The NPS will minimize potential harm to the investment at risk from the 100-year flood and minimize potential impacts the action may have on life and property and on floodplain values. For critical actions that the NPS undertakes (e.g., storage of irreplaceable artifacts, major fuel storage facilities), the NPS will minimize potential flood harm to the investment at risk from the 500-year flood (Section 7.B). Minimization of risk will be in accord with The Standards and Criteria of the National Flood Insurance Program in 44 CFR 60 et seq.

Where floodplain values have been harmed by previous human activity, NPS resource management plans will include actions to reestablish an environment in which the natural ecological systems of the floodplain can function. Where actions must unavoidably occur in floodplains, the NPS will make every possible effort to maintain the integrity of the natural ecosystem to preserve it and its attendant organisms and physical processes. When the opportunity exists, the NPS will not simply preserve, but will enhance the value of floodplains by using them for their educational, recreational, scientific, and similar purposes that are not disruptive of natural ecological conditions. Resource management plans will include inventory and monitoring programs as necessary to evaluate floodplain mitigation and restoration efforts.

In general, cultural resources located in floodplains will be managed to assure their on-site preservation (NPS-28). Floodproofing measures taken to protect the cultural property from the hydraulic and erosive forces of flooding will be designed so as not to adversely affect the integrity of the site. See Section 7.A for a discussion on cultural resources management in floodplain areas.

High hazard areas are subject to flooding events which are so unexpected, violent, or otherwise devastating that human lives are placed in immediate and grave danger. High hazard areas include, but are not limited to, areas subject to flash flooding, areas below dams known to be structurally unsound, the floodway, and coastal high hazard areas. Section 7.C gives the requirements and restrictions for structures and facilities to be placed in high hazard areas and the responsibilities and authority of the superintendent in managing high hazard areas.

If property used by the general public has suffered flood damage or is located in an identified flood hazard area, the responsible agency shall provide on structures and other places, where appropriate, conspicuous delineation of past and probable flood heights in order to enhance public awareness of and knowledge about flood hazards (U.S. Water Resources Council, page 15).

Portions of floodplains are classified as wetlands by the FWS (Cowardin et al. 1979). Further information on this classification system, on-site evaluation procedures, wetlands compliance and the National Wetlands Inventory is presented under Wetlands Management, below.

4. Managing Floodplain Threats From External Sources

Activities outside park boundaries can cause impacts on park coastal, riverine, and special area floodplains. The superintendent will work to minimize potential floodplain impacts through active coordination and involvement in the planning and implementation of actions external to, yet affecting, park floodplain values.

Activities external to the park will often require EISs or EAs because major federal actions, including permitting by federal agencies, are part of the activity. In these cases the NEPA process would occur and the NPS would be involved in the process through scoping, as a cooperating agency, as a consultant, or through comment and public hearings (NPS-12). Nonfederal actions, for the most part,

will also trigger some type of review according to state or local zoning or permit requirements.

Some external actions might occur that would threaten park floodplain systems, but which NPS might not discover until after the fact. Examples include an action that is categorically excluded for NEPA compliance by another agency; inadequate public notice during the NEPA process or state or local review processes; actions on private or Native lands that do not trigger NEPA or other public review processes; and illegal activities. For these reasons, it is important that NPS managers be alert for actions external to the park that would threaten the natural floodplain values or the health and safety of NPS visitors and facilities.

NPS managers will monitor park floodplain values subject to external threats. Monitoring programs will be developed in resource management plans or water resource management plans. These monitoring programs should measure and evaluate appropriate parameters associated with the floodplain threats such as waterbody morphometry, floodplain topography, floodplain vegetation, water quality and quantity, scenic values, and hazard aspects.

5. Flood Monitoring and Mapping

Most floodplain mapping in the U.S. has been done near major population centers to provide information for the protection of life and property. For the most part, parks are located far from these urban centers and therefore very little floodplain mapping has been completed in or near parks.

An engineering survey and the subsequent development of a floodplain map can be a time-consuming and expensive project. And when complete, these detailed floodplain maps still contain a degree of uncertainty; the boundary of a 100-year flood may be in error by a hundred to several thousand feet in a horizontal direction (Dunne and Leopold, 1978).

Yet, there are several simpler, less expensive methods to collect some basic floodplain data for use in initial identification of areas of concern, in small projects where project cost does not justify a full engineering survey, or where floodplain information is needed for interpretation or backcountry recommendations.

NPS staff, in association with other state and federal agency specialists, can collect some of this basic floodplain information. Floods can be mapped using a combination of fieldwork and aerial-photography interpretation of various topographic, soil, and botanical features; these features can be correlated with known floods (Wolman, 1971). Hydrograph analysis, historical flood records, historical photographs, and analysis of stage and precipitation records can also indicate the extent of flooding and floodplain boundaries.

In evaluating these flood indicators consideration needs to be given to changes in flood hydrology that have occurred because of urbanization, water control projects, and other alterations in the watershed or coastal area. Other factors to consider in evaluating indicators of flood boundaries are natural, catastrophic events that may have caused flooding in the past, such as volcanic activity, earthquakes, hurricanes, and glacial outburst events.

Park staff can gather useful information immediately after a flood event such as records of debris lines on the ground, trees, and stable reference points; records of high-water marks at stable surveyed reference points where water velocity was low; photo-documentation of post-flood effects, and interviews with people knowledgeable about the flood.

G. Wetlands Management

Scientists, natural resource managers, and regulatory agencies have developed many definitions of "wetlands" to suit their particular focuses. One of the most comprehensive and widely accepted

wetland definitions is that used by the U.S. Fish and Wildlife Service (FWS) as outlined in "Classification of Wetlands and Deepwater Habitats of the United States" (Cowardin et al., 1979):

> "...lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification, wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year."

That is, a site is a wetland if it meets at least one of three diagnostic vegetation, soil, or hydrologic characteristics. This definition includes the well-known vegetated wetland types such as marshes, bogs, and swamps. In addition, it includes wetlands without soil such as "rocky shores" or streambeds and nonvegetated wetlands such as mudflats or some gravel-beach systems. (See Definitive Wetland Delineation, below, for a definition of "jurisdictional wetlands.")

Wetlands are crucial components of most ecosystems managed by the NPS. For example, many wetlands generate high levels of net primary production (plant tissue) compared with upland systems.

Grazing and decomposition processes in wetlands convert this plant tissue into nutrients and detritus usable as food by higher organisms. Nutrients and detritus may also be flushed from wetlands into downstream systems, thereby increasing riverine and estuarine productivity. Additional beneficial functions and values of wetlands include fish and wildlife habitat, flood control, erosion control, and maintenance of water quality. Wetlands also constitute significant aesthetic, recreational, archeological, and historical resources (Sather and Smith, 1984).

Wetlands are an imperiled natural resource, with less than half the acreage now that existed in the lower 48 states prior to European settlement. Although some regulatory measures have been instituted to slow the decline, losses continue at a rate of 300,000-450,000 acres annually (Feierabend and Zelzany, 1987).

1. Authorities and Guidance

Specific authorities for protection of NPS wetland resources are found primarily in the NPS Organic Act, the Clean Water Act, the National Environmental Policy Act, and Executive Order 11990, Protection of Wetlands. The NPS Floodplain Management and Wetland Protection Guidelines provide guidance for compliance with Executive Order 11990. In addition, the Rivers and Harbors Appropriation Act, the Endangered Species Act, the Wild and Scenic Rivers Act, the Coastal Zone Management Act, the Fish and Wildlife Coordination Act, the Food Security Act of 1985 (Swampbuster), the Coastal Barrier Resources Act, Executive Order 11988, Floodplain Management, and other federal, state, and local laws and regulations affect NPS wetlands management and compliance.

2. Responsibilities

A detailed listing of NPS responsibilities in regard to wetland protection are presented in the NPS Floodplain Management and Wetland Protection Guidelines, 45 FR 35916, Section 9.

3. Wetland Planning and Compliance Procedures

Parks must comply fully with the wetlands planning, compliance, and management guidance found in the NPS Floodplain Management and Wetland Protection Guidelines. The following material should be viewed as supplemental to those guidelines.

NPS managers must strive to achieve a goal of "no-net-loss of wetlands" as defined by both acreage and function. The Floodplain and Wetland Guidelines outline a multi-faceted strategy for wetlands protection and management that contains many of the elements of a no-net-loss program.

1.Parks are required to inventory wetland resources as part of the planning process.

2.Parks are required to avoid any action with the potential for adversely impacting wetlands where there is a "practicable alternative." (Such adverse impacts may result from actions in wetlands, from actions outside wetlands but still having impacts upon them, or from actions which otherwise, directly or indirectly, support wetland development.)

3.Where no such practicable alternatives exist (including "no action"), proposed actions must be designed or modified so as to preserve and enhance natural and beneficial values of wetlands and must minimize, through mitigation, their destruction, loss, or degradation.

4.Through the natural resource management plan process, parks are required to restore wetland functions and values where they have been harmed by previous human actions.

5.NPS resource management plans and/or water resource management plans must specify requirements for monitoring programs and other actions to ensure protection, enhancement, or successful restoration of wetland values to the greatest extent feasible.

At this writing (2/91), NPS wetlands guidance does not fully address a no-net-loss strategy in that there is no direct link between impacts associated with a project and requirements to compensate for those impacts via wetlands restoration, creation, or other methods. Such strategies are currently being developed at the Departmental level, and will be incorporated into revised NPS wetlands guidelines in the future. Meanwhile, parks should make every effort to incorporate direct compensation for wetland impacts into plans. Such compensation should place a priority on restoration of degraded wetland areas on NPS lands which served equivalent functions in the same wetland system or watershed. This effort should also emphasize greater than acre-for-acre compensation to assure that wetland functions are fully preserved and to contribute to overall net gain of wetlands within the National Park System. The NPS Water Resources Division and the FWS are available for consultation regarding implementation of these objectives.

NPS managers must fully comply with all other applicable wetland laws and regulations:

Compliance with Section 404 of the Clean Water Act is mandatory for all actions with the potential to discharge dredged or fill materials into waters of the United States, including wetlands. NPS managers should contact the appropriate U.S. Army Corps of Engineers (COE) District Office early in the project planning process regarding necessary permits for such actions. As part of the permit process, the COE may require direct compensation for unavoidable wetland impacts. In such cases, NPS managers should strive to further the no-net-loss of wetlands goal by working with the COE in identifying potential wetlands restoration projects.

Compliance with the National Environmental Policy Act (NEPA) as outlined in NPS-12 is modified by the Floodplain and Wetland guidelines. In particular, the public review process is expanded (45 FR 35916 Sec. 6(D)(2)) and an Executive Order 11990 "Statement of Findings," including justification for any impacts upon wetlands, mitigation measures to be implemented, and other pertinent documentation, is required (45 FR 35916 sec. 6(D)(3)).

FWS recommendations under the Fish and Wildlife Coordination Act (generally made as part of the 404 permit/NEPA coordination process) must be considered and implemented to the maximum extent practicable. The FWS has the authority to require mitigation measures as appropriate under the Endangered Species Act.

Parks must comply with state laws and regulations in wetland and other water resources matters where states have jurisdiction. For example, parks are required to fully comply with state water quality standards. Parks are also required by the Coastal Zone Management Act (16 USC 1451 et seq.) to assure that proposed actions are consistent with state coastal zone management plans "to the maximum extent feasible." Even in matters where state and local governments do not have jurisdiction, superintendents should endeavor to assure consistency with state and local laws and regulations related to wetlands protection.

4. Managing Wetland Impacts from External Sources

Virtually all upstream actions that affect park water resources, including wetlands, must go through some form of zoning, permitting, or similar process. NPS managers should investigate and, where possible, actively participate in area planning processes affecting water resources management, development, agriculture, and land management. This is accomplished by coordinating with other federal agencies such as the EPA, the COE, the Bureau of Land Management, the U.S. Forest Service, state and local environmental regulatory and planning agencies, water boards, and so on. It is particularly important to be informed about and involved in the NEPA process for federally funded projects, National Pollution Discharge Elimination System (NPDES) permitting, Clean Water Act Section 404 permitting, and Section 319 nonpoint source pollution control plans.

The EPA conducts an "advanced identification" program in which it identifies critical wetland areas where 404 permits are unlikely to be granted. NPS superintendents should contact the applicable EPA regional office to inquire about and, as appropriate, offer assistance in identifying wetlands outside park borders which, if adversely impacted, may affect park resources.

Consistent with the Clean Water Act, superintendents should assure that the highest possible water quality standards are in place to protect waters entering parks. If possible, Outstanding National Resource Waters (ONRW) or equivalent designation should be attained for high quality park waters, and appropriate nondegradation standards will be established. In most cases these water quality standards and "use designations" are developed and implemented by the state or by interstate commissions.

Where water quantity/water rights is an issue (volume, timing, spatial distribution of inflows, or impacts due to withdrawals or drainage), superintendents should use the appropriate planning, regulatory, and legal means to preserve or attain hydrologic conditions necessary to meet NPS management mandates for preservation and protection of wetland ecosystems.

Superintendents should assure that properly designed water resources monitoring stations (quantity and quality) are in place at sites where waters potentially impacted by external sources cross park boundaries into wetland areas.

5. Wetland Inventory Procedures

Superintendents should normally use the FWS wetland definition and classification system (Cowardin et al., 1979) as the basis for wetland inventories. This widely accepted system was developed for the purpose of mapping wetlands for the FWS National Wetlands Inventory (NWI). For the NWI, the FWS classifies and maps wetlands on 7.5-minute U.S. Geological Survey topographic maps (15-minute for Alaska). Resolution varies from region to region, with some maps

identifying wetlands as small as 0.1 acre. The state FWS field office or the FWS regional wetland coordinator should be contacted to determine if NWI maps have been completed for the area of concern. Where NWI maps are available, they will serve as the "base wetland inventory" for parks. If it is determined that the accuracy or resolution of the NWI is not adequate for management purposes, then more detailed wetland inventory studies should be conducted to supplement the base inventory information.

Because of limitations in border resolution, minimum detectable wetland size, and so on, the NWI wetland mapping will be considered approximate. Thus, while use of the base inventory is sufficient for avoiding wetland impacts in initial project planning, a more detailed on-site evaluation will be conducted for each project to locate any unmapped wetlands, to determine wetland borders more accurately, and to otherwise assure that projects will not impact wetlands adversely. Guidance for conducting the required field evaluations is found below in On-site Wetland Evaluations at Proposed Development Sites.

As part of the wetland inventory process, any known degradation of NPS-managed wetlands and the likely causes of this degradation (e.g., drainage, filling, mining, nutrient enrichment) should be recorded and used in developing restoration plans.

Some states have had the NWI maps digitized. Parks wishing to use the digitized data for geographic information systems or other computer applications should contact the appropriate FWS regional wetland coordinator for information about availability of the data and potential applications.

If the park has not yet been mapped for the NWI, the FWS regional wetland coordinator should be contacted to obtain an estimated date of completion. Several options are available if this date is not sufficiently close to meet NPS wetland compliance requirements. First, some interim sources of wetland inventory information are listed below (in cases where the NWI maps are available, these sources may supplement the existing inventory):

- Departments of Natural Resources (or equivalent agencies) in some states have developed such inventories to support their wetland regulations or other natural resources programs.

- Higher resolution wetland identification and mapping programs may exist in local areas where threats to wetlands and other critical aquatic areas are particularly acute. County and city regulatory and zoning offices should be contacted regarding existence of higher resolution wetland surveys.

- Considerable interim wetland information can be obtained if U.S. Soil Conservation Service (SCS) soil surveys are available for the park. Once the soil "map units" comprising the area are determined from the soils maps, a list of "hydric soil map units" (available from the SCS county agent) can be used to make an initial determination of where wetland soils occur. It must be noted, however, that such classification is general. That is, there may be sufficient nonwetland soil "inclusions" within a hydric soil mapping unit to allow a project to proceed without wetland impacts. Conversely, there may be hydric soil inclusions within map units that do not appear on the hydric soils map unit lists. Therefore, a field check is necessary to determine actual conditions at the proposed site (see following section). SCS personnel are trained to identify wetlands and will conduct a field check on request as time permits.

A second option for situations when the NWI maps are unavailable is to explore a joint effort with the FWS to expedite completion of the NWI. Parks should contact the Water Resources Division regarding an interagency agreement between the NPS and the FWS to facilitate wetland classification and mapping, which is often on a fifty-fifty cost sharing basis. Through such relationships, a park

may be able to increase accuracy by assisting in ground-truthing, map verification, or other phases of the inventory process. Other advantages include high project priority and savings associated with equipment and trained personnel offered by the FWS. (The NPS would normally be responsible for 100% of costs for digitizing these maps or for reclassifying and mapping most areas already completed in the NWI.)

A third option is to have appropriately trained staff (or consultants) familiar with the resource conduct aerial photo- or satellite imagery-based wetland inventories. This option has the potential for yielding very high resolution, accurate inventory results geared specifically to the resource management needs of the park. However, it is the most labor intensive and costly of these options, and thus may not be practical for conducting most park-wide wetland inventories. This option may, however, be appropriate at sites where the probability of wetland impacts from a proposed project is high, where restoration plans for degraded wetland systems are being developed, or where the need for a very high resolution park-wide wetland inventory justifies the cost.

6. On-site Wetland Evaluations at Proposed Development Sites

The park's wetland inventory should be used in the initial stages of project planning to avoid wetland impacts. However, on-site wetland analysis at proposed development sites should always be conducted to verify that wetland impacts will, in fact, be avoided or to develop appropriate mitigation measures if the project has no practicable alternatives. First, a preliminary wetland analysis is performed, followed (where necessary) by definitive wetland delineation.

a. Preliminary On-site Wetland Analysis

Preliminary analyses should be conducted by park resource management specialists, other NPS professionals, or consultants trained in plant identification, ecology, hydrology, environmental science, or closely related fields. The NPS Water Resources Division can provide guidance for conducting the analysis.

The preliminary analysis begins with three initial steps:

Step 1. Any wetlands or other waters near or at the site that were identified in the wetland inventory should be located in the field. The preliminary evaluation for these areas should focus on assuring that the actual wetland borders do not extend onto the proposed site and that no wetlands will otherwise be impacted by the project.

Step 2. The site should be evaluated for areas where wetlands which may have been missed in the NWI or other inventories are most likely to occur (e.g., small isolated depressions, poorly defined drainages in headwaters areas such as mountain meadows, or areas not readily visible from aerial photography). In many cases, the existence of such wetlands will be immediately clear based upon knowledge of local wetland types or obvious presence of wetland characteristics. (Such areas lying adjacent to or downstream from the proposed site should also be noted, and potential impacts should be considered.)

Step 3. An assessment of disturbance at the site should be made, such as drainage, filling, farming, or other factors which may have altered the soil, hydrology, or vegetative features at the site. Awareness of such disturbance not only will help avoid erroneous interpretation of wetland field characteristics, but will also help identify impacted areas that should be considered for restoration under the directives of the NPS Floodplain and Wetland Guidelines.

The preliminary wetland analysis continues with a search for "indicators" of the soil, vegetation, and hydrologic characteristics outlined in the FWS wetland definition. Part III of "The Federal Manual for Identifying and Delineating Jurisdictional Wetlands" (Federal Interagency Committee for Wetland Delineation, 1989), hereafter referred to as the "Federal Manual," provides a thorough discussion of field indicators for each of the three characteristics. Evidence of any one of these indicators is reason to avoid the site for the proposed action and to seek alternative sites where wetlands would not be adversely impacted.

In the rare situation where no practicable alternatives exist for a project and the preliminary evaluation has indicated the possibility of wetland impacts, the COE must be contacted to assure compliance with Section 404 of the Clean Water Act. Even if the COE determines that a Section 404 permit is not required, full compliance with other directives of the NPS Floodplain and Wetland Guidelines may still be necessary. In either case, definitive wetland delineation must be performed at the site as discussed in the following section.

b. Definitive Wetland Delineation

(1) "Jurisdictional" wetlands

The COE uses the Federal Manual to determine if a site is a "jurisdictional wetland" (one which meets the regulatory definition of a wetland under COE guidelines for implementing Section 404 of the Clean Water Act). Under the regulatory definition, wetlands are:

> ... those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Only about 85% of the habitats classified as wetlands under the FWS definition and classification system are also "jurisdictional wetlands." This is because the FWS definition is more comprehensive, requiring that only one of the three diagnostic soil, hydrology, and vegetation characteristics be present while the regulatory definition requires confirmation of all three characteristics.

The COE district office will determine the need for sending staff to delineate jurisdictional wetland borders at the site of the proposed project, and can provide other siting advice that may help eliminate wetland impacts. However, backlogs at COE district offices for field evaluations may cause unacceptable delays in NPS project planning and implementation. In such cases, park staff (or a qualified contractor) may wish to apply the methods outlined in the Federal Manual and have the results approved by the COE. In such cases, it is essential that the park consult with the COE before carrying out the evaluation to assure both parties that the user understands and is qualified to apply the method.

(2) Actions not subject to Section 404 of the Clean Water Act

Even when the preliminary analysis indicates the possibility of wetland impacts at a site, the COE may determine that a 404 permit is not required. This may occur either because the wetland does not meet the regulatory definition or because the action is exempt from 404 regulation. In such cases, the broader wetland protection requirements of E.O. 11990 and the NPS Floodplain and Wetland Guidelines still apply. Delineation methods outlined in the Federal Manual are still applicable, if modified such that verification of any one of the three diagnostic wetland characteristics (soil, vegetation, hydrology) identifies the site as a wetland. This assures that "non-jurisdictional wetlands" will still be protected as required under the NPS Floodplain and Wetland Guidelines compliance process.

Definitive delineation for nonjurisdictional wetlands will be conducted by park resource management specialists, other NPS professionals, FWS staff, or consultants trained in applying the Federal Manual method. Advice or assistance in delineation for E.O. 11990 compliance can be obtained from the NPS Water Resources Division.

7. Final Siting

In the final siting process, the park should assure that sufficient buffer areas adjacent to wetlands are preserved to protect against direct or indirect adverse impacts. Considerations in determining adequate buffer zones include such matters as introduction of pollutants via runoff, groundwater drainage effects, and maintenance of wildlife corridors.

H. Restoration and Mitigation

Recognizing that part of the directive to the NPS under the Organic Act of 1916 is to provide for public enjoyment, development impacts from internal activities sometimes are inevitable. Many facilities to serve visitors were constructed decades ago when managers were less aware as to how the activity would impact park habitats. Cessation of other activities, such as stocking of non-native fish species, reflects the changing attitudes of society and better ecological understanding by the NPS.

The intent of NPS policy is clear regarding habitat impacts from changes in water quantity, water quality, introduction of non-native species, development, and human-related activities (see NPS Management Policies.) These activities should not result in changes to aquatic habitats or their inhabitants in natural zones. The NPS management policies that direct superintendents to "plan to phase out, relocate, or provide alternative facilities for park developments located in hazardous areas that cannot be reasonably protected", are particularly pertinent to shoreline and floodplain development.

IV. Environmental Review and Compliance

Documents reviewed or prepared for compliance with the National Environmental Policy Act (NEPA) in accordance with guidance provided by NPS-12, the Environmental Compliance guideline, should include an appropriate assessment of aquatic resources issues. Such assessments should identify and evaluate water quality, water quantity, aquatic biological resources, and aquatic habitat (including floodplains and wetlands) implications of the preferred and alternative proposals. Further guidance is found in NPS-12.

When aquatic resources may potentially be impacted, planning activities undertaken in accordance with NPS-2, the Planning Process guideline, should consider the water quality, water quantity, aquatic biological resources, and aquatic habitat (including floodplains and wetlands) implications of the proposed project or activity. Such planning activities include general management plans, development concept plans, natural resource management plans, and resultant action plans including, but not limited to, water resource management plans, fisheries management plans, air quality management plans, and fire management plans.

ROLES AND RESPONSIBILITIES

Aquatic resources management in the NPS is a responsibility shared among staffs of the parks, regional offices, and the Washington Office Natural Resources Directorate.

I. Park

The **superintendent** is responsible for water resources management within the park. The superintendent:

□identifies internal and external activities that may affect the park's aquatic resources or water rights,

□includes aquatic resources information and assessments in all appropriate resources management and planning activities,

□develops management alternatives and a preferred course of action in response to water resource issues,

□implements required or necessary inventory and monitoring activities, and water resources projects (as funded) which are identified in the park's natural resource management plan,

□coordinates park operational plans and activities with water quality management planning and implementation efforts of state and area-wide water quality management agencies to assure that park facilities, operations, and activities are in compliance with applicable federal and state water pollution and water resources planning requirements,

□complies with all state laws and procedures regarding state created water rights for the use of water on NPS lands, and

□cooperates with federal and state agencies in area-wide water management activities that may affect a park's water resources.

II. Region

The **Regional Director**, through the **regional water resource coordinator**:

□maintains current information pertaining to the status of water resources, water rights, and water resource issues affecting parks within the region,

□manages the regional water resources program, including coordinating water resource funding requests, technical assistance requests, and project prioritization for water resources projects which require Washington Office or regional support,

□participates in and, if necessary, coordinates the development of water resource management plans and the water resource component of natural resource management plans, and

□coordinates with the regional environmental compliance officer to assure that water resources have been adequately addressed in required environmental compliance activities and document review.

III. Washington Office

The **Associate Director, Natural Resources**, through the Water Resources Division, is responsible for program development and Servicewide initiatives involving aquatic resource policy, planning, resource management, and research. In addition, the Associate Director, Natural Resources provides and oversees Servicewide natural resource funding that has been allocated to address aquatic resource issues.

The **Water Resources Division**, acting under the direction of the Associate Director, Natural Resources:

- formulates water resource policy recommendations,
- provides planning assistance and regulatory review,
- provides technical support in the identification, evaluation, and mitigation of existing and potential threats to park water quantity and water quality,
- secures and protects NPS water rights and water resources,
- maintains an updated water rights docket system for the National Park System,
- assists in floodplain and flood hazard analysis and delineation,
- provides guidance in the protection of aquatic and riparian habitats and in erosion and sediment control,
- locates and tests surface and groundwater sources for potable water needs,
- develops hydrologic methods and conducts watershed monitoring and research, and
- develops and implements hydrologic and related physical and biological projects and studies in support of water resource needs,
- provides guidance and training in water resource management to regional and park personnel.

The **Wildlife and Vegetation Division**, acting under the direction of the Associate Director, Natural Resources:

- formulates Servicewide policy and plans, coordinates, evaluates, and implements wildlife, vegetation, and natural resources programs of broad Servicewide importance, including programs relating to aquatic wildlife and vegetation resources,
- provides expert scientific, planning, implementation, and evaluation assistance and technical support to management actions at the park, regional or Servicewide levels on projects relating to aquatic wildlife, vegetation, and related natural resources management, and
- formulates policy and develops programs relating to NPS fisheries management and effects on native aquatic biota, and effects of exotics and pest management treatments on native aquatic biota.

REFERENCES

Averett, R.C. 1978. Selecting Water-Quality Parameters for the Specified Program or Study Goals. Paper presented at the North Dakota - Montana District Conference, U.S. Geological Survey, Billings, MT.

Black, H.C. 1979. Black's Law Dictionary. West Publishing Company, St. Paul, MN.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. Report FWS/OBS-79/31. U.S. Fish and Wildlife Service, U.S. Department of the Interior, Washington, D.C.

Dunne, T. and L.B. Leopold. 1978. Water in Environmental Planning. W.H. Freeman and Company, New York.

Feierabend, J.S. and J.M. Zelzany. 1987. Status Report on Our Nation's Wetlands. National Wildlife Federation. Washington, D.C.

Galbraith, Alan F. 1980. Water Quality and Wildland Resource Management. Proceedings of the Symposium on Watershed Management '80, ASCE, Boise, ID.

Hutchins, W.A. 1972. Water Rights Laws in the Nineteen Western States, Miscellaneous Publication No. 1206, U.S. Government Printing Office.

Kunkle, Sam, W. Stephen Johnson, and Mark D. Flora. 1987. Monitoring Stream Water for Land-Use Impacts: A Training Manual for Natural Resource Management Specialists. Water Resources Division, National Park Service, Fort Collins, CO.

Kusler, J.A. 1983. Our National Wetland Heritage: A Protection Guidebook. Environmental Law Institute, Washington, D.C.

Leopold, L.B., M.G. Wolman, and J.P. Miller. 1964. Fluvial Processes in Geomorphology. W.H. Freeman and Company, San Francisco.

National Park Service. 1988. Management Policies. Office of Policy, NPS. Washington, D.C.

Sanders, T.G., R.C. Ward, J.C. Loftis, T.D. Steele, D.D. Adrian, and V. Yevjevich. 1983. Design of Networks for Monitoring Water Quality. Water Resources Publications, Littleton, CO.

Sather, J.H. and R.D. Smith. 1984. An Overview of Major Wetland Functions. Report FWS/OBS-84/18. U.S. Fish and Wildlife Service. U.S. Department of the Interior, Washington, D.C.

United Nations Educational, Scientific, and Cultural Organization (UNESCO). 1978. Water Quality Surveys: A Guide for the Collection and Interpretation of Water Quality Data. IHD-WHO Working Group on the Quality of Water, Paris, France.

U.S. Department of Agriculture. 1984. Forest Service Handbook, Chapter 2540 - Water Uses and Development.

U.S. Environmental Protection Agency. 1986. Quality Criteria for Water. Office of Water Regulations and Standards. Report EPA 440/5-86-001. Washington, D.C.

Webb, R. H., P. T. Pringle, and G. R. Rink. 1987. Debris Flows from Tributaries of the Colorado River in the Grand Canyon National Park. USGS Open-File Report 87-118. Glen Canyon Environmental Studies Technical Report. U.S. Bureau of Reclamation, Salt Lake City, UT.

Wolman, M.G. 1971. Evaluating alternative techniques of floodplain mapping. Water Resources Research. Vol.7, 1383-1392.