APPENDIX A: WETLAND REGULATION IN ALASKA AND NATIONWIDE

Historical Perspective on Alaskan Wetlands

Human settlement, commerce, and industry have affected wetlands throughout Alaska's post-aboriginal history. Although during the past two decades, Alaska's economy and population size have been greatly influenced by hydrocarbon exploration and development, not all human intervention in Alaska's wetlands has been recent or petroleum-related.

During the period of Russian ownership before 1867, most settlements were in coastal areas of Southeast Alaska, and after annexation by the United States logging, fish processing, and mining all locally affected coastal wetlands. Much of the early wetland disruption has been repaired by natural processes following abandonment of settlements and industrial sites.

At Dyea townsite near Skagway, for example, extensive clearing and construction occurred in coastal wetlands on the tidal flats at the mouth of the Dyea River during the Klondike gold rush beginning in 1898, when this site served as the primary offloading and staging area for prospectors arriving by ship from Seattle. Contemporary photographs show that plant life was nearly eradicated by construction and human activity. Yet at Dyea today, the coastal marshland appears undisturbed, and visitors must search to find remains of timbers, pilings, and other signs of the original townsite amidst the emergent vegetation (personal observation).

In the Aleutian Islands and on the lower Alaska Peninsula, World War II remains, including a large number and variety of wooden buildings, Quonset and Pacific huts, abandoned vehicles, and smaller World War II materiel of every variety, were well advanced in the process of being reclaimed by tundra vegetation when examined and inventoried in 1978 (personal observation; COE 1979).

Alaska's oil and gas potential was recognized early in the twentieth century. In 1923, President Harding established the Naval Petroleum Reserve No. 4 (later the National Petroleum Reserve Alaska, or NPRA) as one of four reserves controlled by the Navy as oil began to replace coal as the primary fuel for ships. The U.S. Geological Survey (USGS) conducted detailed petroleum exploration in the NPRA from 1944 through 1953, drilling 34 exploratory wells. Although natural gas was sometimes found in potentially useful quantities, no economically viable oil reserves were discovered.

With the Arab oil embargo of 1973, Congress appropriated funds for further geophysical surveys and exploratory drilling. Although USGS drilled 44 additional wells between 1964 and 1981, and completed 4,917 miles of seismic survey lines between 1978 and 1981, significant reserves were not found, and exploration ceased in the NPRA in 1981 (USGS 1983).

Oil Production in Alaska

Although oil was first produced commercially in Alaska from the Katalla field in shallow coastal waters of the Gulf of Alaska in 1902 (the field was abandoned in 1933) (Hanley et al. 1981), there are producing oilfields at present in two parts of the state, the Arctic Coastal Plain and the Cook Inlet region (Report Figure 1).

With regard to wetland coverage and in almost every other way (e.g., climate; extent of permafrost; groundwater regimes; soils, vegetation, and wildlife; land ownership; nature and extent of human settlement; recreational use), these regions are very different. The National Wetland Inventory (NWI) of the U.S. Fish and Wildlife Service (FWS) classifies over 99 percent of Alaska's Arctic Coastal Plain, or North Slope, as wetland, whereas land in the Cook Inlet region is estimated to be about 25 percent wetland (Jonathan V. Hall 1988, FWS, pers. comm.).

North Slope

Only oil is produced commercially on the North Slope, although large reserves of natural gas are present. The majority of produced natural gas is reinjected into oil-bearing formations, with a minor proportion being used to power and heat oilfield facilities and the first three pump stations of the Trans-Alaska Pipeline System. Natural gas from the small East and South Barrow gasfields is used locally to supply the city of Barrow, Alaska.

The North Slope oilfield area is located on the Alaskan Arctic Coastal Plain about 250 miles north of the Arctic Circle (Report Figure 2). The oilfields are located within 10 miles of the coast in a zone extending about 60 miles from the mouth of the Colville River in the west to the mouth of the Sagavanirktok River in the east.

The Prudhoe Bay oilfield was discovered in 1968, and production began in 1977 (Hanley at al. 1981), after construction of the 800-mile Trans-Alaska Pipeline System (TAPS) from Prudhoe Bay to a specially constructed terminal facility at Valdez, on Prince William Sound. North Slope onshore oilfields include the Prudhoe Bay West and Prudhoe Bay East units, the Kuparuk oilfield, and the Milne Point and Lisburne developments; offshore production began with initial completion of the Endicott Development in 1987.

Construction of production and support facilities on the North Slope requires the placement of gravel pads and connecting roads to insulate the underlying permafrost. The gravel required to build roads and pads, which are generally about 5 feet thick, is excavated from permit-regulated material sites associated with inactive oxbows of the Putuligayuk and other rivers. It is the construction of these gravel roads and pads, regulated under Section 404 of the Clean Water Act, that produces petroleum-related direct losses of tundra wetland habitats on the North Slope (Walker et al. 1987a, 1986, 1980).

Cook Inlet Region

Oil and natural gas are extracted from onshore and offshore fields in the Cook Inlet region, where commercial production began in 1958 (Hanley at al. 1981) (Report Figure 3). There are two onshore oilfields, the Beaver Creek and Swanson River units, located on the northwestern Kenai Peninsula about 10 and 20 miles northeast of Kenai, respectively.

Producing onshore gasfields are on both sides of Cook Inlet. On the eastern (Kenai Peninsula) side, there is a single producing gasfield, the Kenai Unit. Three producing gasfields are located on the west side of Cook Inlet within 10 miles of the coast: the Beluga River, Pretty Creek, and Lewis River units) (ADNR 1988b; James D. Arlington 1988, Chevron U.S.A., pers. comm.; Donald Hartman 1988, Texaco, pers. comm.).

Production facilities, refineries, docks, pipelines, and other structures have been built to support Cook Inlet oil and gas production. There are two refineries near Nikiski on the east side of Cook Inlet, and associated with these are pipeline terminal and production facilities, a liquefied natural gas plant, an ammonia and urea manufacturing plant, five docks, and ancillary buildings (ADNR 1988b).

On the west side of Cook Inlet, there are production facilities at Trading Bay and Granite Point, a terminal at Drift River, and an electrical generating station near the Beluga River which powers a 138kV transmission line extending to Anchorage. There are pipelines on both sides of Cook Inlet, including the 20-inch diameter Enstar gas pipeline, completed in 1985, routed from the Beluga River Unit northward across the Susitna River to Anchorage (James D. Arlington 1988, Chevron U.S.A., pers. comm.; ADNR 1988b) .

Nationwide Wetland Regulation Affecting Alaska

Wetland regulation in Alaska originated in perceptions and attitudes that were formed in the conterminous United States and were legally institutionalized for uniform application nationwide (OTA 1984, 1983). Fill placement in wetlands is legally regulated on all public and private lands of the United States, regardless of ownership or geographic location [33 CFR 323.2(a)]. In Alaska, wetlands comprise an estimated 46 percent of the total land area (Jonathan V. Hall 1988, FWS, pers. comm.) [or 59 percent, using the 223 million acre estimate of OTA (1983)], and occupy a large proportion of lowland areas amenable to development and resource extraction.

Therefore, wetland regulation is an important issue in Alaska, in part because of public interest in wetland conservation, but also because wetland regulation imposes expense and delay on many public and private development projects. This includes petroleum-related activities on the North Slope, where virtually 100 percent of land and nearshore construction for exploration and development is on land and water classified and regulated as wetland (Hall 1988). In the Cook Inlet region, where NWI data indicate wetlands comprise about 25 percent of the

land area (Jonathan V. Hall 1988, FWS, pers. comm.), restrictions on wetland construction and operations also account for significant project cost components and schedule delays on the part of oil and gas producers (James D. Arlington 1988, Chevron U.S.A., pers. comm.).

The following discussions review some of the reasons why wetlands have become subject to federal and state regulation, and summarize the regulatory process as it applies nationwide and in Alaska. [For a thorough review of wetland regulation nationwide and in Alaska, see OTA (1984, 1983). Additional information regarding the regulation of Alaskan wetlands is provided in Trustees for Alaska (1986). Recent reviews of nationwide policy include the final report of the National Wetlands Policy Forum (The Conservation Foundation 1988a), addressed in Report Section 5.4.2, and a critique by the U.S. General Accounting Office (GAO 1988).]

Rationales for Wetland Protection

It has been estimated that at the time of European settlement, the region now comprising the conterminous United States contained about 200 million acres of wetlands -- about the same acreage currently present in Alaska (Hall 1988, OTA 1983, Kusler 1983). By 1975, wetlands in the conterminous United States had decreased to about 99 million acres (Kusler 1983). The rate of wetland loss over the two decades prior to 1975 was estimated to be 400,000 to 500,000 acres per year (Kusler 1983).

By 1980, the rate of wetland reduction in the conterminous United States was estimated to have declined to 275,000 acres per year (OTA 1984), but the National Wetlands Policy Forum has stated that current losses may be higher than this (The Conservation Foundation 1988). Thus, *annual wetland reductions in the conterminous United States appear to be at least three and one-half times the estimated cumulative acreage of wetlands lost in Alaska since 1867* (Report Section 3.2, Table 5.).

Wetlands are generally recognized to provide public benefit through biological, hydrologic, water quality, recreational, and other values. Public awareness of the importance of wetlands began to grow perceptibly in the 1950s, when in 1952 FWS first used the term *wetland* to describe a diversity of biologically productive environments that shared characteristics intermediate between terrestrial and aquatic habitats (OTA 1984). In 1954, FWS conducted the first nationwide wetlands inventory, which focused on wetlands important to waterfowl. The results, published as "Circular 39" (Shaw and Fredine 1956) and used extensively by FWS, served as the basis for further wetland inventory and classification by that agency until it was supplanted by Cowardin et al. (1979) (Tiner 1984, Greenwalt 1979).

Circular 39 was influential in orienting the attention of FWS policy-makers towards the protection of wetlands rapidly being lost as a result of post-World War II agricultural, residential, and coastal development, including petroleum industry exploration and development in coastal wetlands in the Gulf of Mexico

region. Wetland losses through drainage and fill placement averaged about 550,000 acres per year in the conterminous United States between the mid-1950s and mid-1970s, but varied greatly in different parts of the country (OTA 1984).

Losses were especially high in California and led to obvious biological changes. FWS studies showed, for example, that population reductions in waterfowl using the Pacific flyway were directly correlated to the agricultural conversion of about 90 percent of California's wetlands (OTA 1984). Attention became focused on the need to acquire and protect wetland habitats serving as important waterfowl staging and wintering areas along the major migratory flyways, and impelled the growth of the National Wildlife Refuge System from the 1950s through the 1970s.

The environmental movement of the late 1960s and early 1970s was significant in fostering state and federal legislation. From 1963 through 1972, at least seven states, all in the east or southeast, passed laws protecting coastal wetlands. In 1974, recognizing the need to establish a systematic information base to support wetland policy, planning, and management, FWS initiated the National Wetlands Inventory (NWI) Project currently in effect (Tiner 1984). Development of the Cowardin et al. system, published five years later, was motivated by the need for an ecologically supportable, universally applicable classification system on which to base the NWI program and wetland policy determinations.

By 1977, wetland protection had become a subject of great interest to resource agencies, as evidenced by the National Wetland Protection Symposium sponsored by FWS in June 1977 (FWS 1978). That same year, Congressional amendment of the Federal Water Pollution Control Act of 1972 as the Clean Water Act provided an opportunity to achieve some protection for wetlands by regulating the placement of fill materials generally required for wetland construction or conversion. This, with the long-established Rivers and Harbors Act of 1899, serves as the current basis for federal regulation of wetland development in the United States. [See reviews by OTA (1984) and Tiner (1984).]

Legal Authority for Wetland Regulation

Regulation of development in wetlands is implemented nationwide through a permit program administered by the U.S. Army Corps of Engineers (COE). The legal basis for this regulatory authority derives from Section 10 of the Rivers and Harbors Act of 1899 (33 USC 403); Sections 301, 401, and 404 of the Clean Water Act of 1977 as amended (33 USC 1344); and Section 307 of the Coastal Zone Management Act of 1972 as amended (16 USC 1451). Additional federal protection is mandated by the Emergency Wetlands Resources Act of 1986 (16 USC 3901) and by Executive Orders 11988 (*Floodplain Management*, May 1977) and 11990 (*Protection of Wetlands*, May 1977) (FWS 1987, OTA 1984).

Because authority for review of Section 404 permit applications is extended by law to other federal agencies and to state and local governments, and because established review procedures depend on the nature and scope of a proposed development project, the permit application review process varies considerably

with respect to time frame and degree of complexity, and with respect to the geographic locations of the jurisdictions involved (Hall 1988).

Rivers and Harbors Act of 1899

Section 10 of the Rivers and Harbors Act of 1899 (33 USC 403) regulates construction in navigable waters. Such construction can include artificial islands, causeways, bridges, docks, piers, breakwaters, river training structures, shoreline stabilization structures, buoys, and any other type of structure, along with virtually any associated work, including fill placement and dredging, provided navigable waters are involved (Kyle 1982). *Navigable waters* are defined by regulation to be:

> ...waters subject to the ebb and flow of the tide shoreward to the mean high water mark and/or those waters that are presently used, or have been used in the past, or may be susceptible to use in the future for transport of interstate or foreign commerce (33 CFR 329.4).

The Section 10 permit program is administered by COE. Its original intent was to prevent interference with navigation by ships engaged in interstate or foreign commerce in marine or inshore waters of the United States (Kyle 1982). However, since 1968 COE has considered other factors in addition to navigation in its Section 10 permitting decisions (Kyle 1982), extending jurisdiction of the program to some wetlands and other shallow-water situations beyond the original intent of the legislation.

For example, public guidelines of the Alaska Department of Environmental Conservation (ADEC) explaining the Section 10 program in Alaska state:

> In general, if you can float a canoe on the waterbody, it usually is a navigable water (ADEC 1982).

Thus, the Section 10 permit program has been expanded during the past 20 years to allow regulation of construction in shallow waters not typically involved in interstate or foreign commerce, including some wetlands. Unlike the Section 404 program, described below, it is not limited to fill placement, but covers any type of construction activity. Hence the Section 10 program can provide a degree of regulatory versatility beyond the limits of Section 404 permitting. Between 1981 and 1985 inclusive, 697 out of a total 1,474 Section 404 permits granted by COE, or 47 percent, included Section 10 authority (Faris et al. 1987).

Clean Water Act of 1977 as Amended

Section 404 of the Clean Water Act requires permits for the discharge or placement of dredged or fill material in all waters of the United States, including wetlands. As with the Section 10 permit system, Section 404 permitting is administered by COE, which often processes both permits concurrently for the same proposed project (OTA 1984).

Federal regulations implementing Section 404 (33 CFR 323) require COE to follow a procedure of public review and interagency consultation before granting a permit. For minor projects the process is streamlined to some extent, and a letter of permission is sent in lieu of granting a formal permit (ADEC 1982). Potential environmental effects of proposed wetland projects are evaluated in accordance with guidelines prepared by the Environmental Protection Agency (EPA) under the authority of Section 404(b)(1). Under the provisions of Section 404(c), EPA has final review authority over COE's decision and is empowered to veto the granting of permits.

COE is further required by the Fish and Wildlife Coordination Act of 1958 as amended (1965) (16 USC 661) to consult FWS, the National Marine Fisheries Service (NMFS), and pertinent state agencies for evaluation of proposed wetland developments. If FWS or NMFS object to a project, COE cannot at that point issue a Section 404 permit, but must elevate the review and decision to higher administrative levels which also involve interagency consultation (Kyle 1982). In Alaska, the state agency principally involved is the Habitat Division of the Alaska Department of Fish and Game (ADFG), which reviews permit applications to evaluate potential effects on fish and wildlife habitats. By statute, ADFG must approve any work potentially affecting anadromous fish streams (AS 16.05.870).

Section 401 of the Clean Water Act provides for state and local review of Section 404 permit applications to determine whether proposed projects are likely to violate state water quality standards, in states where such standards are in effect. The Clean Water Act allows transfer of regulatory authority over water quality to the state level if the state has established EPA-approved water quality standards which are equal to or higher than the federal standards. In Alaska, a state with approved water quality standards stricter in some categories than federal standards, the Alaska Department of Environmental Conservation (ADEC) performs this review and must issue a certification that the Section 404 permit would not violate state (and therefore federal) water quality standards (Kyle 1982). Where state standards have precedence, as in Alaska, federal (EPA) water quality certification is not required.

Coastal Zone Management Act of 1972 as Amended

Section 307 of the Coastal Zone Management Act (16 USC 1451) requires that federal actions, including issuance of Section 404 permits, be as consistent as practicable with federally approved state coastal management programs. The Alaska Coastal Management Program (ACMP), which received federal approval in 1979, incorporates Coastal Management Districts that define the regional boundaries of ACMP jurisdiction.

The ACMP requires a comprehensive review of Section 404 permits by State of Alaska agencies including the Alaska Department of Natural Resources (ADNR), ADEC, and ADFG, and provides for participation in the permit review process by local governments within the affected districts. On the North Slope, the

Coastal Management District is the North Slope Borough, while in the Cook Inlet region, the Coastal Management District includes extensive portions of the Kenai Peninsula Borough. The Office of the Governor, Division of Governmental Coordination, administers the permit review process.

Emergency Wetlands Resources Act of 1986

The Emergency Wetlands Resources Act of 1986 (16 USC 3901) is the most recent significant legislation affecting nationwide wetland management. This law, which establishes a mandate for the systematic identification and public acquisition of wetlands determined to have high functional values, is based on the realization that:

> While...land-use activities in wetlands may require a Federal permit in accordance with section 404(a) of the Clean Water Act, the regulatory program has not halted all wetland losses or degradation (FWS 1987).

Concern is expressed that:

> Wetlands losses are continuing throughout the U.S. in spite of increased Federal, State, and local efforts to protect these areas (FWS 1987);

and that:

> The primary regulatory mechanism for Federal involvement in the use of wetlands is section 404 of the Clean Water Act. However, wetlands protection afforded by this program is not comprehensive and additional losses of the Nation's wetlands continue. Wetlands acquisition, therefore, often may be a desired option to best serve the public interest when other means for wetlands protection or use have been less effective (FWS 1987).

Among the main provisions of the Emergency Wetlands Resources Act are (FWS 1987):

- Requires the Department of the Interior (DOI) to establish a National Wetlands Priority Conservation Plan (NWPCP) that specifies the types and locations of, and interests in, wetlands that should be given priority for federal and state acquisition;

- Authorizes the Secretary of the Interior to purchase wetlands or interests in wetlands consistent with the NWPCP;

- Amends the Land and Water Conservation Fund Act to require that for Fiscal Year 1988 and thereafter, each Statewide Comprehensive Outdoor Recreation Plan (SCORP) mandated by that law will specifically address wetlands or, alternatively, allows a state to

submit annually a State Wetlands Priority Plan (see Report Section 3.1) developed in consultation with that state's fish and wildlife agency, and consistent with the NWPCP;

- Directs FWS to continue the NWI project and update the FWS status and trends report (Tiner 1984) beyond that report's cutoff, the mid-1970s, and specifically directs FWS to "produce, as soon as practicable, National Wetlands Inventory maps for Alaska and other noncontiguous portions of the United States" (Section 401(a)(3);

- Authorizes entrance fees at designated national wildlife refuges;

- Raises the price of the Migratory Bird Hunting and Conservation Stamp to increase funding for wetland acquisition; and

- Requires DOI to report to Congress on the status, condition, and trends of wetlands in selected regions of the United States.

FWS has prepared a Draft NWPCP (FWS 1987) explaining provisions of the Emergency Wetlands Resources Act and outlining wetland assessment criteria and land acquisition strategies to be considered for inclusion in the Final NWPCP. Each of the seven FWS regions, including the Alaska Region (Hall 1988), is currently preparing a Service Wetlands Concept Plan to complement the SCORPs or State Wetlands Priority Plans prepared by the states within each region.

The Alaska Division of Parks is currently preparing a SCORP that will specifically address Alaskan wetlands and will include an Alaska Region Resource Assessment for wetlands (Report Section 3.1; Jonathan V. Hall 1988, FWS, pers. comm.).

The Draft NWPCP notes that where indicated by application of the Fish and Wildlife Service Mitigation Policy, wetlands included in the Concept Plans should be evaluated and recommended for acquisition as compensatory mitigation for unavoidable habitat losses resulting from development projects (FWS 1987).

FWS is continuing to map Alaskan wetlands under the NWI program and to develop regional and statewide estimates of wetland acreages. However, a reliable estimate of the total extent of North Slope wetlands is not yet available (Jonathan V. Hall 1988, FWS, pers. comm.). Estimates are based on data from 2,500 sample plots selected randomly in 23 physiographic regions of Alaska. NWI uses 1:60,000-scale color-infrared photography obtained from the Alaska High-Altitude Photography Program. Detailed wetland mapping is possible with a minimum areal delineation of 1-3 acres.

The primary products of the NWI program are large-scale (1:63,360) maps showing Cowardin et al. (1979) covertypes. Most completed mapping has been

for the eastern half of the North Slope, Southcentral Alaska, Southeast Alaska, portions of the Yukon-Kuskokwim Delta, and Kodiak (Jonathan V. Hall 1988, FWS, pers. comm.).

APPENDIX B: WETLAND DEFINITIONS AND CLASSIFICATION SYSTEMS

Introduction

Wetland definitions used by federal agencies for research, inventory, and regulatory applications are similar in wording and derive largely from a single source, Cowardin et al. (1979). These authors developed a systematic classification system for wetlands of the United States for the U.S. Fish and Wildlife Service (FWS) Office of Biological Services. FWS officially adopted the system in 1979 and encouraged other federal and state agencies to convert to it (Greenwalt 1979). This has led to a high degree of consistency among agencies with jurisdictional responsibilities for wetlands, as well as the continuing development of a nationwide data base, the National Wetlands Inventory (NWI), which includes ongoing mapping of Alaska in a manner which is consistent with the much more extensive mapping of wetlands already accomplished for the conterminous United States.

Recent agency interest in expanding wetland classification to include functions and values has resulted in the development of an evaluative system designed to be superimposed on the basically descriptive Cowardin system (Adamus 1983, Adamus and Stockwell 1983). Studies of Alaskan wetlands, based on the Cowardin, Adamus, and other systems, have been conducted for regulatory applications in conjunction with many proposed or completed construction projects, and by local governments to support urban and regional planning.

Although agencies sometimes disagree with regard to wetland determinations, use of similar wetland definitions and a single wetland classification system generally facilitates uniform application of wetland regulatory policy in Alaska (Jonathan V. Hall 1988, FWS, pers. comm.). Disagreements do exist among agencies, however, primarily because wetland definitions are interpreted and applied in different ways, as discussed below. (See GAO 1988.)

Definitions

In their paper establishing a consistent basis for defining and classifying wetland attributes for inventory, evaluation, and management purposes, Cowardin et al. (1979) note that "There is no single, correct, indisputable, ecologically sound definition for wetlands, primarily because of the diversity of wetlands and because the demarcation between dry and wet environments lies along a continuum." Accordingly, these authors define wetlands using general terminology as follows:

> Wetlands are 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.

A *hydrophyte* is "Any plant growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content (plants typically found in wet habitats)" (Cowardin et al. 1979). For Alaska, these include the species listed by Reed (1986). *Hydric soil* is "a soil that in its undrained condition is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic vegetation" (SCS 1985). *Nonsoil substrates* to which the third element of the above definition applies include, for freshwater applications, shores, lakebeds, streambeds, or floodplains composed of bedrock, boulders, stones, rubble, cobble, or gravel (NWI 1986, Cowardin et al. 1979).

The essential elements of a wetland therefore involve *vegetation type* (the presence of hydrophytes), *hydrology* (flooded or saturated condition), and *soil type* (hydric soil, where soil is present). These three attributes first achieved legal precedence as wetland criteria in a 1978 federal court case in Louisiana, where their presence resulted in a determination of wetland consistency in accordance with Section 404 of the Clean Water Act (Scott 1979). Since that first case, many other legal determinations of wetland status have been made on the basis of some or all of these three characteristics, with the majority of precedent-setting cases involving coastal wetlands in the Gulf of Mexico region (Tiner 1984, Livaudais 1982).

The wetland definition used by COE and EPA is contained in the regulations establishing COE's permitting jurisdiction under Section 404 of the Clean Water Act. Wetlands are:

> Those areas that are inundated or saturated by surface or ground water 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 [33 CFR 323.2(c)].

Although the wording differs from that of Cowardin et al. (1979), the same essential elements are present: hydrology, vegetation, and soil. The differences in wording do not alter the meaning.

The wetland definition used by the U.S. Department of Agriculture (USDA) is almost identical to that found in the Section 404 regulations:

> Land that has a predominance of hydric soil and that is inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and under normal circumstances does support, a prevalence of hydrophytic vegetation typically adapted for life in saturated soil conditions [7CFR 12.2(e)(26)].

Thus, federal agencies use almost identical wetland definitions, a practice intended to facilitate interagency review of Section 404 permit applications as required by the Fish and Wildlife Coordination Act, shared use of a common NWI data base, and coordination of planning for resource management. However, agencies differ in their interpretation and regulatory application of wetland definitions. For example, COE requires that all three factors in the Section 404 definition -- hydrology (flooded or saturated condition), vegetation type (hydrophytic plants), and soil type (hydric soils) -- be present in order for a terrain unit to be classified as a wetland, whereas FWS takes the position that the presence of any one parameter qualifies the area as a wetland (Jonathan V. Hall 1988, FWS, pers. comm.).

Thus, although they use similar wetland definitions, federal agencies follow different guidelines in implementing those definitions for regulatory purposes. Also, detailed interpretations of terms such as *hydrophytic vegetation* vary among agencies, a factor that could lead to large areal differences in wetland determinations. In Alaska, however, "differences in boundary determinations have not been significant" (Hall 1988).

The State of Alaska and local jurisdictions in Alaska generally accept the wetland definition contained in the Section 404 regulations and have not formally adopted their own separate definitions. State and local regulatory involvement in Fish and Wildlife Coordination Act consultation on wetlands, Section 401 water quality reviews, and coastal management consistency determinations are all driven by Section 404 requirements and therefore implicitly follow the Section 404 regulatory definition. (See Kyle 1982.)

Systems for Wetland Classification, Inventory, and Evaluation

FWS and other federal agencies use the system developed by Cowardin et al. (1979) for wetland classification and inventory. For example, the FWS Draft NWPCP specifically requires its use (FWS 1987). The Cowardin system is based on the wetland definition explained above and is descriptive rather than functional: that is, it classifies wetland types by descriptors relating to plants, substrates, and frequency of flooding, but not by their potential for providing wildlife habitat, groundwater recharge, water quality maintenance, flood control, recreation, or other recognized functions and values.

The Cowardin system is hierarchical, consisting of five systems at the broadest level, *Marine, Estuarine, Riverine, Lacustrine* (relating to lakes greater than 20 acres in area), and *Palustrine* (relating to freshwater marshlands and lakes or ponds smaller than 20 acres), and proceeding through subsystem, class, and subclass, with additional detail added at each successive level. It incorporates modifiers relating to water regime (e.g., permanently flooded, intermittently exposed), water chemistry (e.g., salinity, pH), soil (e.g., mineral, organic), and site-specific modifications (e.g., excavated, impounded).

Modifiers are not used with systems or subsystems, but at least one water regime modifier, one water chemistry modifier, and one soil modifier must be used

when a wetland is identified to the class or subclass level (Cowardin et al. 1979). The National Technical Committee for Hydric Soils, which consists of federal and academic soil scientists, has prepared its own hierarchical classification of hydric soils of the United States, including Alaska, which can serve as soil modifiers for use with the Cowardin system (SCS 1985).

Functions and values is a topic of growing interest among federal and state agencies with management responsibilities for wetlands (Report Chapter 2). Those functions and values are, after all, the very reason that wetlands have received special regulatory attention. In fact, interest in functions and values as a current topic of resource management is not confined to wetlands, but extends also to wildlife (Steinhoff et al. 1987).

As discussed above, the Cowardin system of wetland classification is descriptive; it does not assign values to wetlands in terms of the public benefits they provide, or prioritize wetlands with respect to those values. Agencies recognize that some wetlands are more valuable than others in terms of functions that are important to society, and that a system of evaluating wetlands, as well as describing them, is necessary so that regulatory and funding priorities can be allocated for their management and protection.

Soon after passage in 1977 of the Clean Water Act amendments and Executive Order 11990, the COE Institute for Water Resources began developing guidelines for evaluating "the physical, biological and human use characteristics of wetlands" (Reppert et al. 1979). A more complex and comprehensive system for assessing wetland functions and values, the Wetland Evaluation Technique (WET), was developed by Adamus and others (Adamus 1983, Adamus and Stockwell 1983) and adapted for in-house use by COE (1987).

Because it is compatible with and complementary to the Cowardin system (Jonathan V. Hall 1988, FWS, pers. comm.), the Adamus method has received attention from EPA, COE, and the Federal Highway Administration as a rapid assessment procedure for wetland functions and values, and has been streamlined and "regionalized" for specific application to eastern bottomland hardwood wetlands (Adamus 1987). In Alaska, the Adamus approach was first used for a comprehensive study of Juneau wetlands (Adamus et al. 1987).

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