APPENDIX I

WETLANDS

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1.0 PURPOSE AND GOALS OF THE APPENDIX

Wetlands constitute an important resource, in terms of impact assessment. Any project or activity with the potential to impact wetlands should fully characterize this resource as part of establishing baseline conditions and consider potential permit requirements in project planning. Accurately describing existing wetland conditions at a site and identifying sources of potential impacts should facilitate the development of alternatives and mitigation, including avoidance, minimization, and as necessary, compensation.

The purpose of this appendix is to provide guidance on determining data needs, identifying data gaps, collecting necessary baseline information and conducting an impact analysis for wetland resources. The subsequent sections discuss wetland terminology and issues; characterization of the affected environment; and impact analysis. A list of reference materials and contacts are provided in the final section. This appendix does not address in detail, the Clean Water Act Section 404 permitting process, a topic discussed in the main body of the source document.

2.0 TERMINOLOGY AND ISSUES

2.1 Terminology

Terminology surrounding wetland science is often confusing. Ambiguity results from the wide variety of disciplines (e.g., plant ecology, wildlife biology, soil science, and hydrology) involved as well as the fact that the terminology often has both regulatory and ecological connotations. The list of definitions that follows is based on terminology that is generally accepted in the wetland science community. The key point is that *wetland*, is a general term that applies to a type of feature or habitat occurring within the landscape; while *jurisdictional wetland* applies to specific wetlands under jurisdiction of the U.S. Army Corps of Engineers (COE), U.S. Environmental Protection Agency (EPA), and some state and local governments. To the untrained observer, the mere presence of certain features, such as standing water or aquatic vegetation, might warrant classification of an area as a wetland; however, these areas may or may not meet the regulatory definition of jurisdictional wetlands as defined below. All jurisdictional wetlands are wetlands while all wetlands are not jurisdictional. All discussions of wetlands in this Appendix refer to jurisdictional wetlands or other Waters of the United States.

Jurisdictional wetlands are wetlands that occur within jurisdiction of the COE and EPA authority under Section 404 of the Clean Water Act. Under normal circumstances, wetlands exhibit three criteria: hydrophytic vegetation; hydric soils; and wetland hydrology that must be identified in accordance with the COE 1987 Wetlands Delineation Manual (1987 Manual). Plants that grow in undrained hydric soils are referred to as *hydrophytes or hydrophytic vegetation*. These plants tolerate varying degrees of soil saturation or inundation and some species even continue to grow partially submerged. Undrained *hydric soils* are oxygen depleted soils, a condition attributable to the prolonged presence of water in the soil. *Wetland hydrology* is found where water saturates or inundates soils for an extended period during the plant growing season. “Atypical” or “problem” areas may still be classified as jurisdictional wetlands despite the absence of one or more of the aforementioned criteria.

A professional wetland scientist can be retained to make wetland determinations and to conduct wetland delineations as per the 1987 Manual. Wetland determinations only denote whether or not the land being assessed is a wetland. A wetland delineation defines the physical boundary of a wetland once it has been determined that one exists on the property. It should be noted that only the COE and EPA have regulatory authority to make jurisdictional determinations.

Waters of the United States is a regulatory phase that defines the limits of jurisdiction for the COE under the Clean Water Act. The term generally applies to ‘navigable waters’ and watercourses that possess a ‘bed and bank,’ including those that may be intermittent or ephemeral. Jurisdictional wetlands are considered a type of Waters of the United States and the Clean Water Act defines wetlands as “…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” (33 CFR Section 328.3). Where a question exists as to the designation of a Water of the United States, the local COE district office should be contacted for their interpretation.

Wetland functions. Wetlands may provide habitat for threatened or endangered species as well as numerous other plant, wildlife, and fish species. Wetlands may perform other functions, in addition to providing habitat, including: shoreline stabilization; storage of flood waters; and filtration of sediments, nutrients, and toxic chemicals from water; and serving as recharge and discharge areas for ground water. Destruction of wetlands specifically can result in higher downstream water treatment costs and the potential for property damage from increased flooding.

Wetland Values. Although often used in conjunction with “function,” wetland “value” refers to wetland attributes determined to be valuable to society. Examples of wetland values include education, recreation, esthetics, tribal harvest areas, scientific study, contribution to the economy and other social/cultural attributes.

Navigable waters of the United States are those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce (33 CFR § 328.3). A determination of navigability, once made, applies laterally over the entire surface of the waterbody, and is not extinguished by later actions or events which impede or destroy navigable capacity (33 CFR § 328.3).

The USFWS’s *National Wetland Inventory* (NWI) is a federal classification system for the nation’s wetlands and deepwater habitats (USFWS, 1998). USFWS publishes NWI maps for many areas of the country. NWI maps identify wetland and deepwater habitat and are often superimposed on U.S. Geological Survey (USGS) maps of various scales. USFWS produces these maps through interpretation of remote sensing data (i.e., aerial photography) and limited field investigations. NWI maps occasionally miss certain types of wetlands (e.g., forested wetlands) and in other cases these maps include water bodies (e.g., wastewater treatment lagoons) not under COE jurisdiction (Rolband, 1995; Stolt and Baker, 1995). Therefore, NWI maps should not be used as the only source of information to determine if an area contains wetlands.

Riparian is a term that refers to "plant communities contiguous to and affected by surface and subsurface hydrologic features of perennial or intermittent lotic and lentic water bodies (rivers, streams, lakes, or drainage ways). Riparian areas have one or both of the following characteristics: 1) distinctly different vegetative species than adjacent areas, and 2) species similar to adjacent areas but exhibiting more vigorous or robust growth forms. Riparian areas are usually transitional between wetland and upland" (USFWS, 1997). Riparian areas also often include wetlands.

2.2 Issues

There are a number of issues that should be kept in mind when undertaking an assessment of wetlands. Four issues presented in this appendix are particularly relevant to mine projects: (1) wetland boundaries may vary over time; (2) local, state, and federal regulatory considerations; (3) 404(b)(1) Guidelines; and (4) compensatory mitigation.

2.2.1 Wetland Boundaries

Wetlands often occur as transitional zones between upland and aquatic habitats. Hydric soils persist over a relatively long period and, therefore may indicate that an area may still be a wetland even after it has been successfully drained. Hydrology, on the other hand, may vary significantly over both the short- (seasonally) and long-term (annually or longer), which is why one must rely on a "normal year" (i.e., 30 year period) cycle. Vegetation, depending on form (i.e., tree, shrub, or forb), may or may not reflect long-term conditions at the site because plants respond relatively quickly to changes in hydrology. Any mapping effort should, ideally, consider the conditions of a site over multiple seasons and preferably multiple years rather than relying solely on site conditions at a particular instant in time. Also, the easiest and most reliable time to delineate a wetland boundary is during the wettest period of the growing season.

2.2.2 Local, State, and Federal Regulatory Considerations

The need to conserve wetlands, and the benefits they provide, is reflected in the potential protections afforded jurisdictional wetlands established under the Clean Water Act and cross-cutting federal environmental statutes. Beyond federal requirements, some state and local governments may require permits for projects that may impact aquatic habitat and/or wetlands; or sometimes place additional restrictions on projects that could impact wetland habitat (e.g., setbacks or buffer zones around wetlands and other Waters of the United States). Therefore, once wetlands have been identified in a project area, early consultation with state, federal, local planning offices, and resource agencies can help to clarify all issues and concerns. Communications with interested agencies will help to focus data collection efforts and may improve the options for avoiding impacts through project design and mitigation.

2.2.3 404(b)(1) Guidelines

The regulatory requirements of permitting under Section 404 of the Clean Water Act are presented in the body of the source document. However, a brief acknowledgment of the 404(b)(1) Guidelines (Guidelines) may shed additional light on the subject of permitting and environmental impact analysis. Prior to issuance of a permit by the COE for unavoidable impacts to wetlands and other Waters of the United States, the Guidelines require the proponent to demonstrate that the selected project alternative is the least environmentally damaging practicable alternative. Often, the preferred alternative selected from the environmental impact analysis of the National Environmental Policy Act (NEPA) process, is not the least environmentally damaging practicable alternative because NEPA does not have the same requirement as the Guidelines. It is therefore important to avoid and/or minimize all impacts to wetlands to the fullest extent possible.

2.2.4 Mitigation

A Memorandum of Agreement (MOA), dated February 6, 1990, between the COE and the Environmental Protection Agency establishes the policy and procedure in determining the type and level of mitigation necessary to comply with Section 404(b)(1) Guidelines. The MOA sets 'no net loss' of wetland functions and values as a national goal and defines the types of mitigation, for practical purposes as minimization and compensatory. Although compensatory mitigation is often the focus of project proponents, from a regulatory perspective, avoidance and minimization should be the focus of any project with the potential to impact wetlands and other Waters of the United States. Due to their importance, avoidance and minimization are discussed here as they apply to the early stages of project planning and design. Compensatory mitigation will be discussed in Section 4.1 along with other aspects of impact assessment.

Avoidance addresses the portion of the Guidelines which states that no permit shall be issued if there is a practicable alternative to the proposed discharge which would have less adverse impact to the aquatic ecosystem including wetlands. The minimization aspect of the MOA addresses the requirement that all appropriate and practicable steps taken which minimize the potential adverse impacts of the discharge. Avoidance and minimization would typically be implemented during early phases of project design through such things as alternative siting of roads and infrastructure; minimizing the footprint of facilities that encroach on wetlands; and reducing or eliminating the amount of fill for stream and wetland crossings (e.g. using bridges instead of culverts where feasible).

A project description submitted as part of an environmental impact assessment or permit application should clearly demonstrate how avoidance and minimization have been addressed. Realize that avoidance and minimization are part of an iterative process that will begin at the earliest conceptual stages and continue through final designs. A pre-application meeting with the COE may facilitate the permit process by identifying less damaging alternatives. Optimizing avoidance and minimization may also be achieved by working with the COE, EPA and any other interested agencies once the basic design criteria have been developed. Failure to consider compliance with the Guidelines may result in project delays later in the permitting process or outright permit denial.

3.0 AFFECTED ENVIRONMENT

3.1 Introduction

Descriptions of the affected environment, as required in National Environmental Policy Act (NEPA) documentation, may require: (1) an initial inventory and classification; (2) a jurisdictional delineation; and (3) a functional assessment of wetland resources within the project area. Prior to any assessment of the wetland resource, however, the affected environment to be described must be established. Defining the affected environment and assessing wetland resources within this environment are discussed below.

The first step in describing the affected environment is to establish the study area or region of influence (ROI) in terms of the proposed action and potential direct and indirect effects to wetland resources. For wetlands, the ROI typically extends beyond the footprint of the proposed ground disturbance. A larger ROI ensures that potential indirect effects to wetland hydrology, water quality, and other functions are considered, including potential affects to down-gradient areas that may occur as a result of the wetland impacts.

Once the ROI is established, an initial inventory and classification of wetlands and other Waters of the United States is typically performed to determine the general nature and extent of these resources within the ROI and to facilitate impact avoidance and minimization through project design. Following refinement of alternatives, a delineation of wetlands within the ROI is conducted to provide a comparison of the effects of each alternative. A functional assessment of wetlands is also conducted to facilitate the comparison of effects between alternatives and between pre- and post-project conditions.

The remainder of this section presents additional information on inventory, classification, delineation, and functional assessment of wetlands and how they relate to describing the affected environment.

3.2 Wetland Inventory and Mapping

Due to the typical large size of ROIs and the numerous and conceptual nature of project alternatives early stage in the review process, the initial inventory and classification of wetlands is generally performed by use of existing information (e.g., NWI maps, aerial photography, local and/or regional soil surveys). NWI maps are an effective starting point for inventorying and classifying potential wetlands. Aerial photography and satellite imagery (collectively referred to as remote sensing products) are interpretive tools, often used in conjunction with NWI maps, for identifying the location of wetlands in the field. Remote sensing products can be obtained from a variety of different sources including US Forest Service, USGS, COE, USDA Farm Services

Agency, USDA Natural Resource Conservation Service, state departments of transportation or natural resources, and private contractors.

Depending on the season and type of remote sensing products available, wetlands are often best identified using color infrared (CIR) aerial photography. However, wetlands can also be identified using panchromatic photography. When using remote sensing images it is helpful to obtain coverage for the same area over a period of years and seasons as the vegetation boundaries of wetlands may vary due to seasonal hydrologic changes. Where the use of a stereoscope is possible, photography should be ordered as stereo pairs in the largest scale available to enhance the ability to locate wetlands on the photographs. Wetlands observed on aerial photographs should be checked against the NWI maps recognizing that some wetlands appearing on NWI maps may not be evident in available aerial photography and vice versa.

Soil surveys and hydric soil lists obtained from the USDA Natural Resources Conservation Service can also be used to identify potential wetland areas. A soil survey map in conjunction with aerial photographs can be used to identify areas exhibiting hydric soil and hydrophytic vegetation respectively.

Once potential wetlands are identified using NWI maps and/or interpretation of remote sensing images and other resources, a field survey should be conducted to ground truth the information and other potential locations (e.g. topographic depressions and seeps) should be investigated during the field survey. Specific boundaries and NWI classification categories (e.g. PSSb) should be verified (or determined) in the field and a list of dominant plant species generated. A brief assessment of wetland functions (see below) may also be completed at this time. The data collected may then be used to draft descriptions of the resource.

A geographic information system (GIS) or other means may be used to add wetland locations to other mapped features of the project area. Attributes (descriptors) may be assigned to the different wetland ‘polygons’ occurring on the map. The locations and characteristics of these mapped wetlands may then be used as part of the description of the affected environment, for impact assessment, and for planning purposes. The usefulness of GIS, however, is limited by two factors. First, since wetland boundaries and conditions can change over the years, the GIS data represent only a snapshot in time. Second, the GIS is only as accurate as the input data (i.e., field surveys, NWI maps, or photo interpretation). Acknowledging its limitations, GIS is useful for generating *approximate* acreages by type of wetland, potential impact, or other descriptor.

3.3 Wetland Determination and Delineation

3.3.1 Delineation Criteria.

The COE of Engineers Wetlands Delineation Manual (1987 Manual) (Environmental Laboratory, 1987) defines how the three criteria – hydrophytic vegetation, hydric soils, and wetland hydrology – are used to delineate wetlands. Under normal circumstances, wetlands possess at least one positive wetland indicator for each of these parameters, for purposes of the CWA. The 1987 Manual identifies a number of indicators available for each parameter. This section presents an overall summary of the three criteria and some of their indicators; however, the reader is referred to the 1987 Manual for complete details. Wetland delineations may not necessarily be conducted for all wetlands within a study area. Due to practical matters and costs associated with intensive sampling, delineations may be focused only on wetlands that could be impacted by a proposed disturbance. Regardless of the jurisdictional status and whether or not a wetland boundary is established, there are other characteristics used to describe wetlands within a discussion of the affected environment. Other methods for describing wetland resources are discussed in Section 3.4.

Both EPA and COE accept the 1987 Manual as the standard document for wetland delineation, as of this writing. The reader should be aware that several manuals spelling out specific methodologies for wetland identification and delineation have been written or proposed which might someday replace the 1987 Manual if the federal government determine they are an acceptable substitute. Consultation with the COE or other relevant federal agency will help ensure that delineations are completed using the appropriate manual and techniques.

3.3.1.1 Hydrophytic Vegetation

The delineation process considers all of the dominant plant species occurring at a site when determining the presence or absence of hydrophytic vegetation. Hydrophytic vegetation refers to plants that are adapted to growing in anaerobic soil conditions, or those conditions that typically exist under prolonged soil inundation or saturation. The delineation process requires identifying the dominant plants occurring at a site and determining their ‘indicator status.’ The indicator status is established in USFWS’s *National List of Plant Species that Occur in Wetlands* (USFWS, 1988) and reflects the likelihood of a plant species occurring in wetlands. A site supports hydrophytic vegetation if more than 50 percent of the dominant plant species present at the site are more likely to occur in wetlands than in uplands. Other indicators include visual observations of plants growing in inundated/saturated conditions, morphological adaptations, physiological adaptations, and technical literature (Environmental Laboratory, 1987).

3.3.1.2 Hydric Soils

Soils exposed to prolonged periods of anaerobic conditions, such as those created by saturation or inundation, develop distinct characteristics. These characteristics result in particular soils being classified as hydric under US Department of Agriculture Soil Conservation Service (now Natural Resources Conservation Service [NRCS]) nomenclature. Hydric soil lists for particular areas are available through the NRCS. These lists identify hydric soils (or those with hydric inclusions) within a particular soil survey. Since all hydric soils within an area may not be mapped, or mapped at too small a scale to be useful, field studies are recommended to determine the presence of hydric soils. Common field indicators of hydric soil include a dark color or chroma, gleying (gray colors), and the presence of colored mottling or iron and manganese concretions (Environmental Laboratory, 1987).

3.3.1.3 Wetland Hydrology

The term 'wetland hydrology' applies to characteristics that demonstrate or imply a site is periodically inundated or the soils are saturated to the surface for an extended period during the growing season. Indicators of wetland hydrology often appear through the characteristics of the site's vegetation and soils – vegetation adapted to saturated conditions and soils exhibiting hydric indicators. However, direct indicators of wetland hydrology include recorded data (e.g. gauging stations, floodplain maps) and field data (e.g. visual observations, watermarks, drift lines) (Environmental Laboratory, 1987). The reader is referred to Appendix A, *Hydrology,* for a discussion of hydrological analyses and methodology.

3.3.2 Delineation Methods

The 1987 Manual establishes three approaches to completing a wetland delineation. The first, *onsite inspection unnecessary*, may be used when sufficient information is available about the site to make a wetland determination. This approach is usually not used, as all the necessary information is seldom available. The other two methods, which are typically employed, are the *routine onsite* and *comprehensive* determinations (Environmental Laboratory, 1987).

3.3.2.1 Routine

The routine onsite approach to delineating wetlands begins with a review of existing data including US Geological Survey (USGS) quadrangle maps, NWI maps, soil surveys, gauge data, and aerial photography. Resource management agencies (local, state, or federal) may also be sources for additional information on a particular area. The site must also be evaluated to determine whether an 'atypical situation' exists, that is, have vegetation, soils, and/or hydrology been altered by recent human-activity (e.g., land clearing, farming, water diversions, filling, diking/ditching, etc.) or natural conditions changing the area from having wetland characteristics to non-wetland characteristics. An atypical situation requires the completion of additional analytical procedures, which will not be summarized here (see Section F of the 1987 Manual).

There are two procedures for field delineation depending on the size and complexity of the assessment area. The delineation process for areas five acres or less and thought to be relatively homogeneous with respect to vegetation, soils, and hydrologic regime, involves sketching locations of individual plant communities on a map and characterizing each community type by establishing sample points in representative locations (see Figure I-1). Sampling involves collecting data for vegetation, soils, and hydrology and completing a data form for each sample point. Dominant plant species are identified and their indicator status determined to establish whether the site is dominated by (more than 50 percent) hydrophytic vegetation. Soil pits are excavated to determine if soils exhibit hydric characteristics. Soil pits are also used to demonstrate the presence of and if present, depth to saturated soil. This observation can also be used in support of a wetland hydrology determination. Sample locations demonstrating positive results for all three criteria are considered wetlands. After sample points have been established in each plant community, boundaries must be established between upland and wetland communities. Where boundaries between the vegetation types are unclear, additional sample points are completed to ascertain the absolute boundary. A map is then completed depicting the locations of wetlands within the study area. From a practical standpoint, the boundaries should be staked or flagged and surveyed in order to have adequate location data for use in permitting and when detailed project designs are being drafted (Environmental Laboratory, 1987).

Areas greater than five acres require the establishment of a baseline and transects to frame the sampling regime (see Figure I-2). The length of the baseline, number of transects, and spacing of transects depend upon the size of the study area. Each community type must be sampled within at least one transect. Under this approach, sampling occurs within each plant community along each transect, and a data form is completed for each sample location. Boundaries between uplands and wetlands are established as described in the preceding paragraph (Environmental Laboratory, 1987).

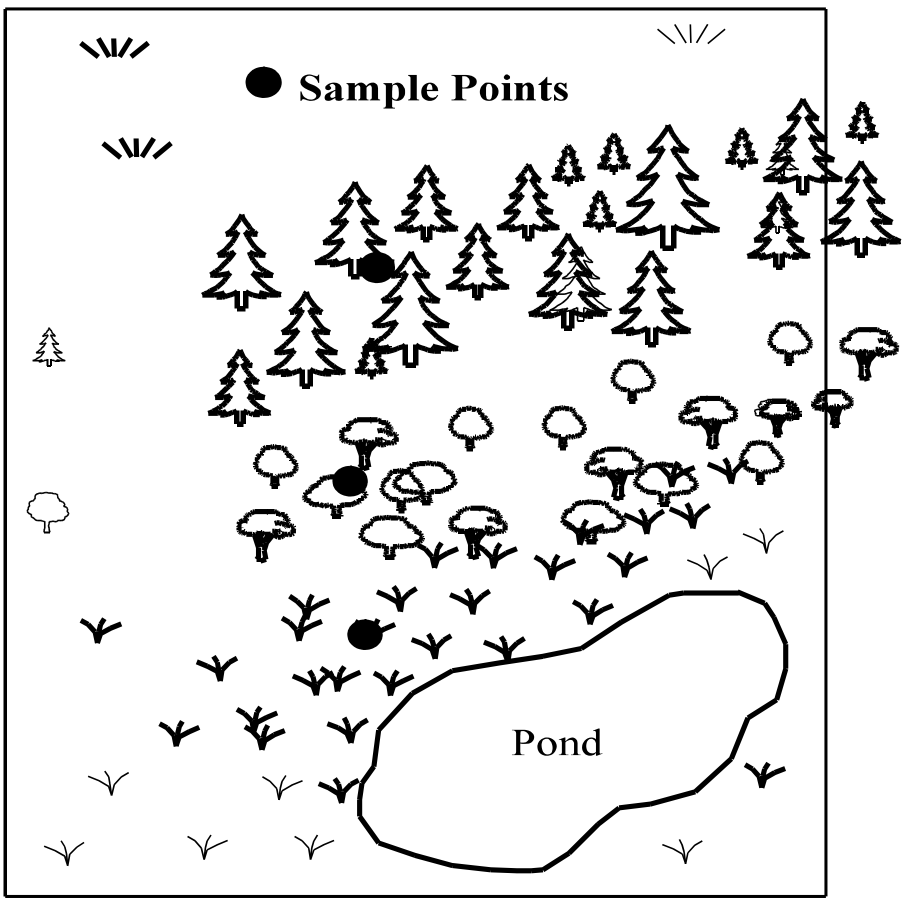

Figure I-1. Routine wetland determination for areas 5 acres or less and with relatively homogeneous vegetation, soils and hydrology

3.3.2.2 Comprehensive

The comprehensive approach is used for complex projects or when a project requires more documentation than would typically be necessary. A comprehensive study may be undertaken for example, where there is a likelihood of litigation at some point in the future or where a wetland may be suspected of providing habitat for threatened or endangered species. Under the comprehensive method, the preliminary work is completed as in a routine survey. The vegetation must be characterized to determine the number and location of plant communities that need to be sampled. A baseline and transects are then established, based on the size of the area. Sample data are collected on a different form than that used in routine delineations. In this case, the information is recorded in greater detail and includes species composition and density data for the different vegetation layers (trees, saplings/shrubs, grasses/forbs, and woody vines). Vegetation data are then summarized on a second data form in making a determination on the presence/absence of hydrophytic vegetation. Soils and hydrology data are recorded similarly to the process used in the routine approach. Boundaries between wetland communities and non-wetland communities are determined by observing distinct changes in vegetation or topography, or completing additional sampling points. Boundaries between transects may be developed based on surveying a contour between sample points across transects or again conducting additional sampling (Environmental Laboratory, 1987).

The results of wetland delineations should be summarized in a report that includes a map and copies of the data forms. The report may then be used to support a Section 404 permit application and/or environmental impact analysis.

3.4 Describing Wetlands

Wetlands represent a transitional zone between uplands and aquatic habitats and tend to occupy a relatively small percentage of the landscape (Mitsch and Gosselink, 1993). However, in some areas, such as portions of Alaska and within floodplains, wetlands may encompass large areas. Different classification schemes may be used to describe wetland resources in each of these cases. The so-called Cowardin system is one method of classifying wetlands and deepwater habitats; this method is used to describe wetlands on NWI maps (see Section 2.0). In some cases, vegetation classification schemes, such as *The Alaska Vegetation Classification* (Viereck et al., 1992), may be more appropriate than the Cowardin system. For example, in Alaska, the *Alaska Vegetation Classification* is tailored to local conditions and plant species and therefore allows the user to be more specific in the description of wetland resources. Other descriptors, in addition to a classification scheme, include wetland functions (see below). The descriptions that result from gathering this information provide a basis for comparing the types of
wetlands present and will aid in assessing the potential impacts (Section 4.0). The approaches to classifying and describing a project's wetlands will be discussed in more detail below. Note that all wetlands, regardless of jurisdictional status should be described.

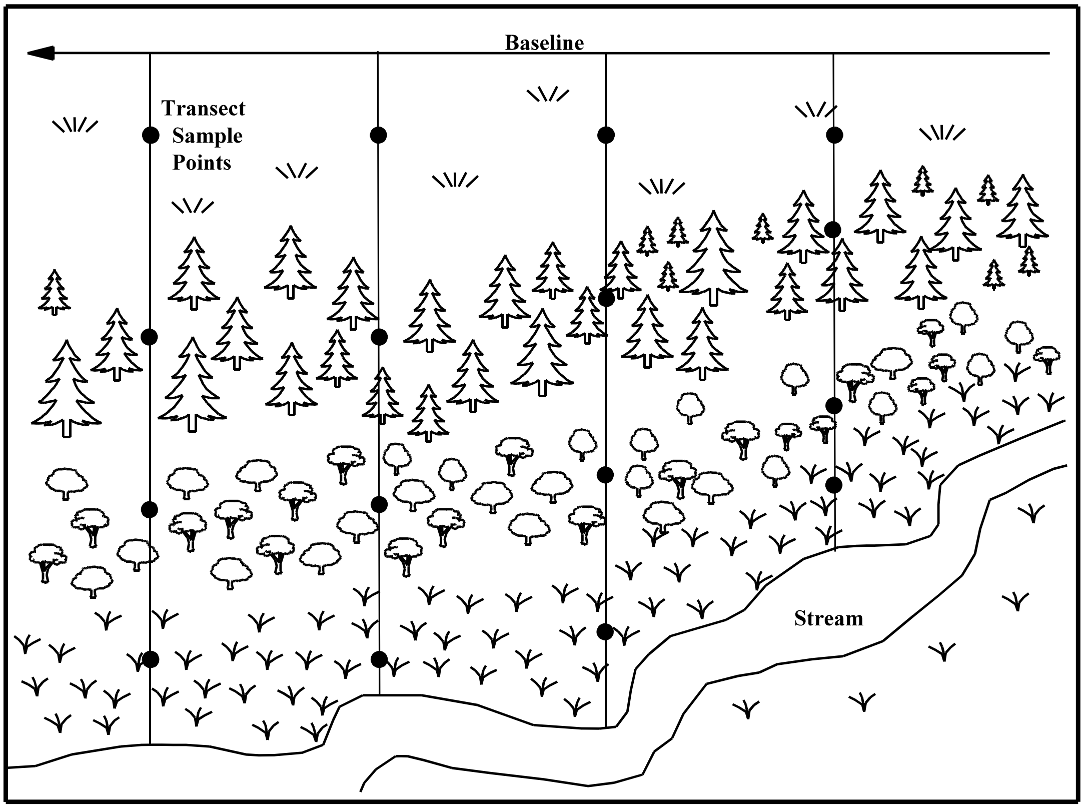

Figure I-2. Routine wetland determination for assessment areas greater than 5 acres and/or with complex vegetation, soils and hydrology

3.4.1 Cowardin System

The Cowardin classification scheme characterizes both wetlands and deepwater habitats using a hierarchical approach (Cowardin et al., 1979). The Cowardin scheme does not include nor should it be used to determine jurisdictional status of wetlands and other waters of the United States. Indeed, the Cowardin classification scheme does not use the same definition for wetlands as used by the COE and EPA in accordance with the CWA. Under this classification scheme, *systems* represent the first tier followed by *subsystems, classes,* and *subclasses*. *Dominance type* and *modifier* constitute the lowest tiers of the scheme. Each successive tier provides a greater level of detail for individual wetlands. Classifying wetlands using the Cowardin system facilitates comparisons with wetlands exhibiting similar characteristics both within and outside the project area.

Cowardin's scheme includes three freshwater 'systems' – palustrine, lacustrine, and riverine. Palustrine systems are commonly referred to as marshes, swamps or bogs. They encompass all non-tidal wetlands and tidal area wetlands where ocean-derived salinity is below 0.5% that are dominated by trees, shrubs, and persistent emergents. Lacustrine systems include lakes and reservoirs. Lacustrine systems are generally larger than 20 acres in size; situated in a topographic depression or dammed river channel; and lack trees, shrubs, and persistent emergents. If smaller than 20 acres, lacustrine systems are generally defined by depth. Riverine systems include wetlands and deepwater habitats that are contained within a channel. Riverine systems exclude wetlands dominated by trees, shrubs, or persistent emergent, which would be considered palustrine. Classes within each system describe the substrate or dominant life form of the plant species within an individual wetland. Examples of classes include forested, scrub-shrub, aquatic bed, and unconsolidated bottom. Dominance type refers to the plant species that dominate an individual wetland. A modifier may provide insight to the individual wetland's hydrology (e.g. excavated, diked, and beaver). An example of a willow thicket classified under the Cowardin system would be a willow-dominated palustrine scrub-shrub (PSS). A beaver pond could be described as a palustrine aquatic bed (PAB) with a beaver modifier (PABb).

3.4.2 Alaska Vegetation System

The Alaska Vegetation System also uses a hierarchical approach to classification but applies to vegetation communities rather than wetlands in particular (Viereck et al., 1992). This system identifies plant communities with wetland characteristics to a limited extent in its second and third tiers and more so in its fourth tier. The first two tiers (Levels I and II) describe the life form of the dominant community. Level I consists of Forest, Shrub, and Herbaceous; Level 2 includes descriptors of these life forms – such as broadleaf or needleleaf; tall or low scrub; and graminoid or forb communities. Level III describes the degree of canopy closure and, in some cases whether it occurs in wet areas. Levels IV and V describe the dominant species and the associated vegetation, respectively. Examples of descriptions based on the Alaska Vegetation System include Closed (canopy) Sitka Spruce Forest and Open Tall Alder-Willow Shrub. Using this classification as a basis for the description of the environment can include vegetation in general and also wetlands, particularly where wetlands encompass a large portion of the project area. The Cowardin system may be applied on top of the plant associations described using the Alaska classification system. For example, an Open (canopy) Tall Alder-Willow Shrub vegetation community that occurs in wet conditions would be consistent with Cowardin's Palustrine Scrub-Shrub class.

Where wetlands cover a large portion of the landscape, a routine delineation may be undertaken using these vegetation units as the basis for the delineation. Since this method could potentially over- or under-represent the extent of wetlands at a site, an agreement should be reached with the COE and lead agency if this approach is proposed. The COE will require that a field delineation be performed for all wetlands potentially impacted by the project.

3.4.3 Function Assessment

Wetland functions are physical, biological or chemical processes that occur in wetlands. Examples of wetland functions include but are not limited to, fish and wildlife habitat, groundwater recharge/discharge, or flood storage. Wetland functions, as physical, biological, and/or chemical processes or conditions, are not always easily quantifiable and are often described qualitatively. Wetland functional assessment provides a basis for comparing wetlands, a necessary component of wetland analysis. A common, early approach to assessing wetland functions is the Federal Highway Administration's (FHWA) Wetland Evaluation Technique (WET) or some modification thereof. The Hydrogeomorphic (HGM) method is a quantitative approach to wetland functional assessment currently under development. HGM assesses the functional level for individual wetlands within different wetland 'classes' wetlands. Analyses completed using HGM are not directly comparable with WET analyses. These two methods or modifications thereof, are the typical methods used to assess and describe wetland function; however, there is no required method for describing wetland function.

3.4.3.1 Wetland Evaluation Technique (WET)

The FHWA method for wetland functional assessment, WET, provides a procedure for converting typical wetland field observations (e.g., wildlife, plant species, recreation) into preliminary statements regarding the wetlands probable functional value (FHWA, 1983a). WET rates a broad range of functional attributes and values on a scale of high, moderate, and low (Mitsch and Gosselink, 1993).[1] Each wetland function is rated on three attributes: social significance; effectiveness; and opportunity (Mitsch and Gosselink, 1993; FHWA, 1983b). Social significance assesses the societal value of a wetland in terms of economic value, strategic location, or special designation (Mitsch and Gosselink, 1993). Effectiveness relates to the wetland's capacity to carry out a function because of its physical, chemical, or biological characteristics (Mitsch and Gosselink, 1993). The degree to which a wetland functions at its level of capability is assessed for the opportunity rating (Mitsch and Gosselink, 1993). WET has some limitations including its limited transferability from site-specific to landscape level analysis (Mitsch and Gosselink, 1993) and comparability with analyses completed using other techniques. The WET manual often uses the terms function and value inter-changeably. See Section 2.1 for a discussion of these terms.

3.4.3.2 Hydrogeomorphic Method (HGM)

HGM represents a new approach for evaluating wetland function. The HGM approach focuses on comparisons among wetlands with similar characteristics (i.e., within the same wetland class) and includes methods for assessing human induced changes to wetland functions (Brinson, 1996; Brinson, 1993). HGM uses indicators from the literature and field measurements in describing measurable properties of a particular function within a particular wetland class. These measurements and models are calibrated on regional reference wetlands and then used to develop an index of functionality for each wetland function. This information

[1] Functional attributes include: groundwater recharge and discharge; flood storage and desynchronization; shoreline anchoring and dissipation of erosive forces; sediment trapping; nutrient trapping and removal; food chain support; habitat for fisheries and wildlife; active and passive recreation; and heritage value (FHWA, 1983).

can be used not only to describe the extent to which a particular wetland is performing specific functions but also to establish mitigation goals, evaluate the mitigation potential for different sites, and monitor progress of mitigation activities (Rheinhardt et al., 1997).

HGM focuses on comparing wetlands within particular classes (e.g. depressional or riverine) rather than trying to compare characteristics across classes. For example, a fish habitat may be rated for riverine wetlands but might not be considered at all for certain types of seasonal wetlands within the depressional class. The HGM approach is still in development but may be available for broader use within the foreseeable future.

4.0 IMPACT ASSESSMENT AND COMPENSATORY MITIGATION

4.1 Impact Assessment

Impact assessment is the description of impacts to wetland resources from all aspects of mine construction, operation, and closure. While there are many sources of impacts that may occur to wetlands, the two general categories of impacts are direct and indirect. Direct impacts result from a discrete action and occur at a particular point in time and at a particular location. Filling a wetland to construct a road would be considered a direct impact. Indirect impacts on the other hand, result at a time or location removed from the point of disturbance. The change in species composition of downstream wetlands over a period of years in response to changes in hydrology upstream would be considered an indirect impact.

4.1.1 Direct and Indirect Impacts

A number of mining-related activities may result in direct or indirect impacts to wetlands. These activities include exploration, geotechnical drilling, construction and operation of facilities; excavation, heap leaching, surface water diversions; withdrawal of groundwater; and accidental and permitted discharges. The results of these types of activities include direct wetland loss through filling or draining; changes to the hydrologic regime with subsequent changes in flora and fauna; habitat fragmentation due to human encroachment; and changes in sedimentation patterns. Identifying, attributing, and describing the short- and long-term range of environmental impacts to individual resources is the key to impact assessment.

Impact assessment relates to a wide range of questions and while many would be applicable to most projects others will depend on the specific conditions related to each individual project. Some of the relevant questions include:

- How many acres of wetlands will be directly and/or indirectly impacted by fill activities?
- To what extent will changes in surface water flows affect wetlands within (and outside) the project area?
- Will groundwater withdrawals influence wetlands and if so, to what extent?
- Will sediment loading to particular wetlands be increased?

- To what degree would mining-related activities affect habitat values?
- To what degree would mining-related activities affect water quality (i.e., temperature, toxins, etc.) within wetlands?

Descriptions of potential impacts to wetlands are usually presented in terms of absolute loss (acres filled or drained) and in loss of function. The former analysis is quantitative and relatively straight forward and tends to only address direct impacts while the latter is significantly more complicated but necessary to adequately address indirect impacts. For example, wetlands tend to be greater than the sum of their parts and, thus, a 1:1 relationship does not necessarily exist between wetland acreage and functions. Therefore, filling 50 percent of a wetland may have either a greater or lesser effect on the functions demonstrated by the wetland than simply halving them. This situation needs to be considered in describing potential impacts to wetland functions. Likewise, the loss of all or part of a wetland can impact the functions of other wetlands and other aquatic areas, and even nonwetland areas, beyond its boundary.

The most practical approach to determining the extent of impacts to wetlands is to assess each type of activity that could cause impacts. This 'checklist' should go from the obvious to the subtle. Obvious items include calculating the number of wetland acres that will be filled to construct and operate the various facilities and determining of the extent to which surface water diversions and groundwater withdrawals will affect wetlands. Less obvious items might include determining the affect of human encroachment on habitat values, assessing the potential for long-term changes to the local hydrology; and projecting the results of permitted discharges over the long-term. The duration of wetland impacts should also be considered and discussed. Some impacts may only occur during construction (e.g., noise from construction equipment), while others could continue throughout the life of the project or longer. For example, fill used to construct a wetland crossing may only be needed during mining operations and could be removed upon closure. Such an impact would be considered temporary compared to a wetland permanently buried under a waste rock dump. For example, impacts to a forested wetland would likely require more time to recover than impacts to an emergent marsh. This aspect also requires consideration during the mitigation process.

Ultimately, the analysis should summarize the impacts that are anticipated by class or category of wetland. The direct impacts may be presented in tabular form, similar to that presented in Table I-1. Indirect impacts should be clearly described and include the type of wetland impacted, size of impact area, description of functions to be impacted, and the source of the potential impact. All of the discussions should indicate whether the impacts would be temporary (e.g., noise during summer construction), short-term (e.g., mowing of herbaceous vegetation), long-term (e.g., sedimentation from erosion of exposed soil), or permanent (e.g., wetlands buried by construction of buildings).

4.1.2 Cumulative Impacts

Aspects of the direct and indirect impact analyses should also be considered and described in terms of a cumulative impact analysis. Cumulative impacts are defined as the sum of all individual impacts occurring over time and space, including those of the foreseeable future

(EPA, 1992). Proposed changes to the nationwide permitting process by the COE resulted in part, because of cumulative impacts to small isolated wetlands, through permitted and unpermitted activities. In their rationale for proposing these changes, the COE stresses that the "only

Table I-1. Example of Direct Impacts Table for Wetlands

Wetland Class[1]	*Acres*						
	Within Study Area		*Short-Term Impacts*		*Long-Term Impacts*		
	Jurisdictional	*Non-Jurisdictional*	*Jurisdictional*	*Non-Jurisdictional*	*Jurisdictional*	*Non-Jurisdictional*	*Total Impacts*
Palustrine Aquatic Bed	12.3	0.6	1.4	0	1.4	0	12.9
Palustrine Emergent	28.8	0	2.3	N/A	1.5	N/A	28.8
Palustrine Forested	4.2	3.5	0	1.5	0	1.5	7.7
Palustrine Scrub-Shrub	12.8	0	3.2	N/A	2.4	N/A	12.8
Total	58.1	4.1	6.9	1.5	5.3	1.5	62.2

[1]Cowardin et al. 1979.

technically sound approach" to cumulative impact assessment is on a watershed basis (Federal Register, 1998).

A cumulative impact analysis should consider impacts to the resource in the context of what other projects have occurred or could foreseeably occur in the area. For example, a proposed action could result in the loss of half of the forested wetlands in a study area. The cumulative impact analysis may indicate that a different project, also in the planning stages or already occurring/completed, would also cause the loss of a large portion of the same forested wetland. In this case, the cumulative impact may be much more significant that the impact caused by either project individually. Cumulative impacts to wetlands may be addressed by considering the extent of impacts on wetland classes and function within a particular area – the boundaries may include a drainage basin, watershed, or some other land management unit. The boundaries of the cumulative impact area and the sources of potential cumulative impacts are typically identified in conjunction with the lead agency at the beginning of the actual environmental impact assessment process.

4.2 Compensatory Mitigation

Section 2.2 introduced the concept of mitigation in terms of the Guidelines and the COE/EPA MOA. Within this framework, mitigation usually refers to avoidance, minimization, and compensatory mitigation. The two former terms were discussed previously while this section focuses on the latter. Compensatory mitigation refers to the restoration, enhancement, or creation of wetlands to restore or replace functions of unavoidable and/or accidental wetland impacts by a particular project. No net loss of resource value requires that an ecological assessment of wetland functions and wetland delineation be performed as mentioned previously. A description of wetland functions and delineation of boundaries identifies resources that could be impacted and catalogues what will need to be replaced if compensatory mitigation is required.

Compensatory mitigation is an important component of impact assessment. After an applicant demonstrates avoidance and minimization of impacts to the extent practicable, some type of compensatory mitigation will generally be required in order to obtain CWA 404 authorization from the COE.

Compensatory mitigation requirements vary by location and are determined by the COE on an individual project basis, usually in conjunction with public comment. The extent of mitigation often relates to the size of the project, nature of impacted wetlands, and the degree and amount of wetland impacts expected. The relative level of success or failure (i.e., level of risk and temporal rate of replacement) of mitigation efforts to replace impacted functions are also considerations in determining required mitigation. Some districts require compensatory mitigation in excess of a one for one ratio (loss to replacement) other areas (such as Alaska), may not necessarily require any compensatory mitigation.

Frequently, the preferred approach to mitigation is termed *on site, in kind* mitigation, which equates to replacing the specific characteristics of an impacted wetland within the project area. *Off site, in kind* mitigation may be an alternative when no on site options are available or practicable. Likewise, *on site, out of kind* may also be possible, particularly when the functions and values of such an undertaking would surpass those of the impacted wetland and where in-kind is not practicable and/or desirable based on identified regional or watershed wetland functional priorities. *Off site, out of kind* mitigation is generally the last choice when other options are unavailable or regionally less desirable. The success of mitigation projects often relates directly to the type of mitigation undertaken. Restoration tends to be more predictable than wetland creation as some wetland characteristics already exist (or existed) at the site. Establishing an adequate hydrologic regime is one of the keys to successful wetland mitigation; this can be a difficult task for wetland creation projects, but relatively much easier for wetland restoration. Enhancement of degraded wetlands is often a more practical approach than creation because again, the site presumable already possesses some wetland characteristics. A qualified professional, with experience in designing and implementing wetland mitigation projects, should be consulted prior to the development of any mitigation plan. Likewise it is often important to confer with the regulatory and resource agencies through a pre-application consultation process before finalizing mitigation plans/design.

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6.0 CONTACTS AND OTHER INFORMATION SOURCES

Code of Federal Regulations - http://law.house.gov/4.htm

Natural Resources Conservation Service (http://www.nrcs.usda.gov/) – information available through Web page or state and district offices.

Society of Wetland Scientists - http://www.sws.org/

U.S. Army COE of Engineers (http://www.usace.army.mil/) Note that Sacramento District (http://www.spk.usace.army.mil/cespk-co/regulatory/) has information specifically related to jurisdictional wetland delineations and 404 permitting:

U.S. Environmental Protection Agency, Office of Water (http://www.epa.gov/owow/wetlands/) provides information on wetlands as well as a wetland Hotline Number: 1-800-832-7828, email to wetlands-hotline@epamail.epa.gov

U.S. Fish and Wildlife Service (http://www.fws.gov/) – provide National Wetland Inventory maps; may be a source for information regarding potential mitigation opportunities.

USFWS NWI maps are available as paper copies, mylar overlays, and occasionally as digital layers. The USFWS NWI homepage (http://www.nwi.fws.gov) contains information on NWI products, available maps, and ordering information.

USFWS endangered species home page-http://www.fws.gov/~r9endspp

U.S. Geological Survey's EROS data center (http://edcwww.cr.usgs.gov/eros-home.html) serves as a clearinghouse for aerial photography compiled by federal agencies and allows on-line searches by location.