ANCHORAGE WETLANDS ASSESSMENT METHODOLOGY

Explanation and Justification Narrative

This Anchorage wetlands assessment methodology is based on those Hydrological, Biological, Habitat, and Social functions deemed important for this region. Wetlands functions are based on characters that we have identified as unique and inclusive for this region.

This assessment method does not evaluate vulnerability of wetlands or wetlands species to fill activities, rather it represents our attempt to place relative overall values on each of the four major functions of a particular wetlands. Many of the species used to evaluate rarity or importance of certain wetlands are considered key indicator species of wetlands health and integrity. These species are especially vulnerable to disturbance.

Points values are assigned based on each component's importance to a wetlands function. Certain functions are of inherently higher value and are more sensitive than others and their points reflect this. This value assignment is the most subjective portion of this exercise. It is our belief that the final sum of points for each of the four components reduces the subjective nature of the process and allows for relative assessment for each site. The point spread for each category's sum (of minimum and maximum) is great enough to provide an accurate and relative evaluation of all values, including the minor ones.

Sources of Information

Information on the values, extent, and types of wetlands functions per site was obtained from a variety of sources. Most important however, was the field work that we did in the summer and fall of 1988 and especially 1991. All sites have been visited at least once. Municipal documents and reports, U. S. Fish and Wildlife reports, U. S. Geological Survey reports, private consulting firm reports, were all used at various stages to provide for background information on each site's functions. Such information greatly supplemented our field data.

The structure and content of this methodology was modelled after the Canadian Wildlife Service, Ontario Region's "An Evaluation System for Wetlands of Ontario" (1984). Of the several methodologies we reviewed, this was the most relevant to Alaska and northern wetlands and covered comparable wetlands functions to those we felt were most important to Anchorage. We did, however, alter this method and added many of our own questions and evaluations that were applicable to this region. Many of the categories are repeated in more than one section since these are relevant to each component's values. We also greatly modified the points system.

Time and personnel constraints precluded more extensive fieldwork or the application of a more in-depth evaluation method. But this methodology seemed most appropriate for the more simple subarctic wetlands of Anchorage. Many of the Ontario Method's questions were dropped because of their irrelevance to Anchorage or because they required difficult-to-measure parameters (e.g. aquifer recharge).

This methodology has been reviewed by biologists and other physical scientists from the Anchorage-based State and federal resource agency personnel. Separate reviews were conducted with the first versions in fall 1988 and again with the final drafts in spring 1991. A series of workshops was also conducted by habitat evaluation experts from the U.S. Fish and Wildlife Service in spring 1991. At these meetings, concentrated review of the habitat sections and questions was made. The Anchorage methodology, and especially the Species Occurrence Component, benefitted greatly from this review forum. The final structure and focus of the methodology were both developed in these reviews. Most questions within the Species Occurrence Component (Section Three) were formulated during the workshops where participants agreed to most of the species and number breakdowns used in that section's questions.

Shortcomings of the Anchorage Assessment Methodology

Although we felt that this modified methodology is relatively objective, there are recognizable shortcomings that should be identified. Chief among these is, arguably, the lack of verifiable data for several categories; answers in these sections are more subjective approximations or Best Professional Judgement. But even these subjective questions are based, wherever possible, on previous scientific references.

Many of the wetlands characters identified are generalized or simplified here, especially for the Hydrology section. Thus the level of detail and of our value assignments is potentially superficial. This is especially true for evaluations of parameters like water chemistry of wetlands waters, flow volumes of surface water through the wetlands, etc.

The other major shortcoming of this methodology is its lack of attention paid to cumulative impacts of previous disturbances to a subject parcel. Although previous disturbances are tallied and incorporated into the evaluation, no assessment is made of how past disturbances have modified a wetlands value or function.

HYDROLOGICAL COMPONENT

1.1 Type of Stormwater That Wetlands Detains

If the subject wetlands detains or receives stormwater then the type or quality of that water must be determined. A wetlands that detains or receives and filters poor quality waters or storm drain runoff is of more value to a basin's water quality than an area that receives no runoff or one that only receives natural and presumably cleaner flows. This is especially true for Anchorage where most stormwater systems dump runoff into stream channels and where water quality is a problem. Wetlands that act as snow disposal sites are considered of high value as are areas that receive direct runoff from storm drain culverts. Areas that receive storm runoff also provide flood abatement.

1.2 Position of Wetlands Within Watershed

The position of a subject wetlands within a drainage basin is most important to that parcel's value in flood attenuation and water quality in the watershed. It is generally felt that the higher up in the watershed a wetlands is the greater it's role is in flood control and water quality maintenance. Of course the size of a particular wetlands and its location relative to floodplains modify this function.

1.3 Land Use Along Waterway or Wetlands for .5 Miles Below the Wetland

Land use within .5 miles of the wetlands usually has a direct bearing on a subject wetlands' value to flood detention and on local water quality. Of particular interest in this category is the land use below or down gradient of a wetlands area. If land use below the wetlands is highly developed then the subject parcel is of inherently higher value to flood detention than it might be to undeveloped areas downstream. This category does not qualify the extent of additional detention areas downstream of the subject parcel.

1.4 SIZE Evaluation (Based on Ontario Method Table)

A given wetlands area will have inherent values to flood detention and water quality based simply on its size. This table, as developed in the Ontario method, attempts to place a value on a wetlands based on size. Larger wetlands are of inherently higher value because of their increased surface area and capacities to hold greater volumes of runoff.

1.5 Flow Retention/Flood Control

This section relates size of wetlands area to total size of the catchment basin within which the parcel is located. A table from the Ontario method is used to assign points based on the wetlands area as a percent of the total catchment basin size. The higher this percentage, the higher value a wetlands has to flood control in the system. This question makes the assumption that a wetland has inherent storage capacity within the basin. Many Anchorage area drainage plans call out the importance of undisturbed wetlands in the role of flood control.

1.6 <u>Subject Wetlands as a % of Total Wetlands Acreage in Catchment Basin</u>

Given the ability of wetlands sites, especially those within the upper two-thirds of a watershed, to attenuate high water flows, the relative size of a subject wetlands to the total wetlands coverage within a watershed is important. Although this question assumes that the wetland receives and/or contains runoff prior to it's entrance into a stream or drainageway, the larger the percentage the wetland represents the more potential and/or realized it's role in storm water attenuation. Novitski (1979) has shown that flood peaks are significantly lower in drainage basins with undisturbed wetland areas than in basins with little wetland area. Several studies have also strongly correlated wetlands coverage in watersheds to water quality issues, notably sediment retention (Hindall 1975). This function is important to both the entire basin and to more localized, small-scale drainage, glaciation, and other related high water situations.

1.7 <u>Site Type</u>

Site type is of value to water quality since runoff, storm flows, or groundwater presumably flow through and are detained in a subject wetlands. Wetlands that receive direct surface flows and are dominated by emergents and submergents are of more value in this category than isolated areas or wetlands that have little or no surface flows (Brown and Stark 1989). This section identifies a wetland's relative filtering capability. The original wetlands study in preparation for the Anchorage Wetlands Management Plan evaluated various wetland types for water quality and flood attenuation functions. Differences were noted per each wetlands type (Ertec 1981).

1.8 <u>Sensitive Areas Below Subject Wetlands</u>

The relative value of a subject wetland to water quality is in part based on what lies below the wetland and/or it's receiving waters. Many of Anchorage's smaller streams have few or no fish populations and empty into the silty waters of Knik Arm. Thus the wetland's position in the watershed, and the uses immediately downgradient, play the most significant role in this equation.

1.9 Actual Wetlands Area Dominated by Robust Emergents and Submergents

The efficiency of a wetlands to filter pollutants and to absorb nutrients depends to a great extent on the plant types within the wetlands. Emergent and submergent species are well known as providing efficient filtering and uptake of nutrients and pollutants in water (Greeson et al. 1978, Meyer 1985). Amounts and type of open water in a wetlands were not differentiated in this category, rather simply the presence of emergents or submergents was noted. Nutrient uptake is related to plant type which influences primary productivity.

1.10 Generalized Land Use in the Catchment Basin

The type of land use in a wetlands catchment basin is important to the water quality and flood potential for the drainage area. Undeveloped and fully vegetated areas within the drainage basin provide for greater water quality maintenance and flood control than for developed commercial or residential areas. However, the greater the development and the more industrial the use, the greater the possibility exists for introduction of polluted waters and increased runoff volumes. Thus a wetlands within a developed commercial or industrial area is of higher value to a watershed's water quality and local flood control.

1.11 Long Term Nutrient Trap

Organic soils hold nutrients longer and more effectively than mineral soils (Friedman and DeWitt 1978). Wetlands located at the inlet of a watercourse or that regularly receive nutrient-laden waters are of more value for nutrient buildup, nutrient recycling, and for primary productivity (Krebs 1978).

1.12 Water Quality Maintenance

This category correlates the quality of water that enters a wetlands with the length of detention time in the subject wetlands. Detention time can be estimated by variables such as size, soils, wetlands shape and distance from outlet waters, and plant types. A wetlands area is more valuable to water quality if it accepts poor quality water but also detains this water and filters out sediments (Boto and Patrick 1978). The presence of emergents and submergents enhances an area's filtering capabilities (Greeson et al. 1978, Meyer 1985). Low water flow through a wetland is essential for net accumulation of phosphorus in litter and plants (Van der Valk et al. 1979).

Wetlands that have little or no regular inflow generally have less potential to provide for a significant water quality function. Whether or not a wetland is successful in detaining runoff waters is based on information about the size, wetlands type, and plant types which were outlined in earlier questions in the assessment. There are several studies that address and predict sediment routing and deposition rates in especially deeper water wetland systems (Hickok et al. 1977). Approximately 80% of sediment entering a Wisconsin wetland at the head waters of a creek was retained in the wetlands (Novitski 1978).

1.13 Erosion Control/Erosion Buffer

Bailey et al. (1978) and Dean (1979) have quantified data that relates wetlands to shoreline protection and erosion control. Gray (1977) has shown that wetland vegetation controls terrestrial slope erosion by soil reinforcement with roots and by interception of surface water and depletion of soil water. If the subject wetlands is of Riverine type then its ability to reduce erosive forces is based on the principal vegetation form found in the parcel. Forms considered most valuable are trees, shrubs, emergents or submergents. For this category only the plant forms that come into regular contact with flowing or storm event waters are identified. Trees are known to provide efficient erosion protection because of deep and extensive root systems: riparian and wetlands trees and shrubs are known to also reestablish quickly after floods (Seibert 1968).

A similar evaluation is made for all Lacustrine wetlands. Lacustrine wetlands dominated by emergents are considered most valuable to erosion abatement.

HABITAT POTENTIAL COMPONENT

Habitat Structure and Function

2.1 Vegetation Community Structure

Vegetation community structure is a measure of diversity based on dominant plant forms. Plant forms were identified and counted per vegetation community and assigned different points based on complexity of community structure. A community is defined as an assemblage of species having similar vegetation forms. Form is the physical structure or shape of a plant. Minimum valid plant community size was .25 acres. Form definition follows that of the Ontario Wetlands Method. A form is considered valid within a community if it covers > 25% of the community.

The physical structure of plant vegetation strongly influences species richness and numbers of species that will use a habitat.

Kessel (1979) correlated bird species with known avian habitats throughout Alaska. Several studies found a positive correlation between foliage height (vertical stratification) and foliage diversity with bird species diversity (Karr and Roth 1971, Willson 1974, Short 1984).

The spatial distribution of vegetation also strongly influences species richness (Weller and Spatcher 1965, Roth 1976). There are numerous studies that have shown a positive correlation between species richness and the total number of vertical layers of vegetation. Other studies have found that foliage height diversity is positively correlated with bird species diversity (Karr and Roth 1971, Willson 1974). Such correlations would reveal the relative value of a particular wetlands for general diversity and habitat potential.

2.2 Number of Wetland Plant Communities

As another indicator of diversity, this category measures the number of plant communities found in a subject wetland. Communities are defined (and modified) based on those identified in Hogan and Tande's 1983 "Vegetation and Bird Use of Anchorage Wetlands". The more plant communities an area contains the greater the potential for higher wildlife and plant diversity. Productivity is generally higher in wetlands with multiple communities. An Anchorage area study found that wetland sites with greater number of plant communities generally had both higher bird diversity and densities than areas with few communities (Hogan and Tande 1983). Other studies found similar relations between the number of communities and bird species density and diversity (Golet 1976, Greeson et al. 1978).

2.3 Intraspersion/Community Edge Effect

Intraspersion is a measure of the shape and edge length of the various plant communities in a wetlands. Species numbers and diversity are closely tied to the total length and number of plant community edges (Golet 1976). The edge effect also defines the ability of a wetland to provide for a diversity of both nesting and feeding habitat (Golet and Larson 1974). An edge type is valid if the border between certain plant forms or plant communities is more than 100 meters. Most of the plant communities in Anchorage wetlands are of low to medium diversity. Intraspersion diversifies a habitat or an entire wetlands especially since most bird species depend upon more than one habitat type (Lensink and Derksen 1986).

2.4 Diversity of Surrounding Habitat

Several major habitat types and landscape uses are listed and all that exist within .25 miles of the subject site are checked. The total number that is assignable to an area is then added to the Habitat points totals. The idea for this category is that no wetlands can be considered in isolation from surrounding habitats and land uses; habitat types are interconnected at least simply by their proximity. This category allows us to measure any connection that the subject wetlands might have to surrounding habitats. Many species within the subject wetlands may rely on surrounding areas or habitats for needs for some stage of their life cycle. Surrounding habitat types make a wetlands more or less valuable.

Surrounding communities and additional habitats may limit the suitability of the subject wetland if migratory corridors do not exist between areas necessary for a species or a group of species' life history requirements. Several studies address this migratory corridor theory and the importance of including surrounding landscape in habitat assessments (Noss and Harris 1986, Forman and Godron 1986).

2.5 Proximity to Other Wetland Habitats

This category attempts to evaluate habitat connectivity in terms of hydrology and vegetation. Points are awarded based on type of hydrological connection the subject wetlands has to another wetlands or waterbody and the distance between each. This is another measure of habitat diversity and it identifies migratory corridors for wildlife and indirectly shows connections for nutrient cycling. Smaller less diverse wetlands areas can thus be of higher value if they are connected by surface water, or if they are in close proximity to other wetlands.

Diversity and food and nutrient potential are maximized where a subject wetland is connected to a site with different wetland (or aquatic) communities. This was the key factor in a study of waterfowl use in Interior Alaska (Murphy et al. 1984). Such a relationship is also evident in other studies (Golet 1976), including aspects of fish populations (Elliot and Finn 1984). In Anchorage, freshwater wetlands adjacent to or in close proximity to the coastal flats have higher nesting densities and species diversity.

2.6 Open Water Types

This category measures the edge effect and configuration of open water areas and relates that to vegetated areas. The greater the variety of ponds or pool size and patterns in a wetlands, the greater the habitat is diversified. An area with open water in pools of varying sizes which are separated by numerous vegetated islands and plant communities is considered highly diverse and valuable to wildlife. This variable is more relevant for waterbird species and may be less germane for other species. Some authors have identified a 50:50 ratio of cover to open water as optimal for avian diversity (Weller and Spatcher 1965, Golet and Larson 1974). Primary productivity and carrying capacity for numerous species are greatly enhanced by the presence of high interspersion of ponds and plant communities. Most Anchorage area wetlands with ponds or other waterbodies have higher species diversities simply because they provide required rearing and molting habitats for waterfowl.

This question also addresses, at least indirectly, the total length of shoreline which has been shown to be a major determinant in waterfowl breeding density (Hochbaum 1944).

2.7 Hardiness Zones

Hardiness Zones were taken from a map devised for the Municipality's "Plant Selection Guide". This category attempts to measure a wetland's biological productivity based on growing conditions. Primary production (as affected by weather and growing conditions) is a good indicator of a wetlands' ability to support wildlife diversity. Productivity of primary producers in a community, as determined by hardiness zone, directly limits wildlife population sizes (Westman 1985). Hardiness zones directly affect patterns of primary productivity, nutrient and energy transfer, and biological functions of local food webs (Livingston and Loucks 1979). The longer and the better the growing conditions, the more productive a wetlands can be. Most wetlands were within the same hardiness zone. Hogan and Tande (1983) found reduced numbers of bird species richness in the Chugach foothills where they surmised cooler spring and late summer temperatures likely reduced productivity.

2.8 Soils Type

Soils content and type are well known components of a wetland's productivity and value. Most mineral soils are considered to be of more value to productivity than organic soils since nutrients are more readily available to a larger variety of plants and ground water levels fluctuate which allows a more diverse soils invertebrate fauna and plant assemblages. Determined by field examination and/or soils maps. In Anchorage, peat soils, especially in bogs, have a wide diversity of species but lower productivity and biomass than non-peat wetlands (Hogan and Tande 1983).

2.9 Type of Wetland

Wetlands type definitions follow standard descriptions under the U.S. Fish and Wildlife Service classification. Wetland type directly modifies a site's value to wildlife diversity, habitat potential, and biological productivity. Hogan and Tande (1983) found some correlation between certain wetlands types and habitat values for bird densities, diversities, and species richness. Biological productivity is generally higher along riverine wetlands where there is the greatest mix of habitat and potential for nutrient mixing. Productivity is also modified by dominant species, hardiness zone, and time in growing season. Richardson (1978) found that cattail, reed, and sedge stands had high net primary productivity while bog forests (e.g. isolated palustrine woods) were generally less productive.

2.10 Nutrient Status of Surface Water

Measured as Total Dissolved Solids (TDS). Water with charged dissolved solids and nutrients is more fertile and can produce more biomass than nutrient poor waters. Wetlands with TDS measurements of 100-500 are considered of highest value and most productive. Wetlands with little or no surface inflow are of generally lower value in this category. Murphy et al. (1984) found that several limnological variables were directly influenced by waterbody connectedness and that especially ions and inorganic nutrients affected the biotic content of the ponds. They directly correlated pond nutrient levels and duck use.

2.11 Surface Water Persistence

The persistence of open water through the breeding bird season (April-July) is the most important factor that influences an area's suitability for waterbird nesting and brood rearing (Lensink and Derksen 1986, Bergman et al. 1977). Many Anchorage area wetlands are seasonal and dry out by mid June. Sites in Anchorage and on the Kenai Peninsula that have persistent ponds or pools provide suitable nesting habitat beyond the critical period for waterfowl (especially island nesters) and shorebirds (Hogan and Tande 1983, Rosenberg 1986) . Red-necked Phalaropes and Short-billed Dowitchers require shallow ponded areas with sedge fringes for nesting for instance. Even shallow pond persistence into the growing season can influence plant diversity and productivity. Surface water persistence was found to be a key variable for many water-dependent species in most USFWS Habitat Suitability Index models.

2.12 Water Body Size

A water body's size directly correlates with species richness. Larger waterbodies are usually able to provide feeding and nesting habitat for several bird species. The largest waterbodies also provide adequate room and edge for waterfowl brood rearing and migratory habitat. During the Anchorage Wetlands Assessment Methodology Task Group meetings (May 22-23, 1991) it was agreed that certain breaks in waterbody size could be based on needs of certain species: 400 sq ft of surface area was sufficient for

Red-necked Phalarope nesting; .5 acres of surface was sufficient for Mallard and other dabbling ducks' nesting needs; and 4 acres was the minimum required for nesting Pacific Loons and Red-necked Grebes. These sizes were then used as cutoffs for this question. Waterbody size has similar correlations to species density and diversity as does general wetlands size.

2.13 Wetland Contiguity With Stream or Lake

Wetland areas contiguous with flowing streams or lakes are considered of higher habitat value than isolated sites. Such a connection can positively correlate with nutrient flow, flow maintenance, fish habitat, and other hydrologic components. Several studies found this correlation for both fish and birds (Elliot and Finn 1984, Hogan and Tande 1983, Murphy et al. 1984, Rosenberg 1986). Wetlands with streams or lakes within them were considered higher value since the wetland likely contributes to base flow or recharges the waterbody and it serves as a nutrient contributor. There is also evidence that the continuous changes brought on by storm event inflows to wetlands, especially adjacent to creeks, are necessary for wetlands' consistently high productivity (Livingston and Loucks 1978).

2.14 Wetland Size

The overall size of an area is one of the key determinants of species richness and habitat value. This relationship was first revealed in biological studies of islands (MacArthur and Wilson 1967) and later applied to uplands (Robbins 1979) and wetlands (Brown and Dinsmore 1986). In Anchorage, Hogan and Tande (1983) found a positive relationship between wetland size and number of bird species found there. Studies have also found that larger wetlands contain species which also occur in smaller sites but not the reverse.

Several rare bird species that nest in Anchorage wetlands require large nesting territories (Hudsonian Godwit, Northern Harrier) and these only occur in the largest wetlands complexes. Larger wetlands have both more unique species and greater numbers of individuals. Generally species that require larger wetland acreages are more sensitive to disturbance and less adaptable to change and disturbance. Larger wetlands nearly always contain a higher diversity of plant and open water regimes and are inherently of greater biological value.

SPECIES OCCURRENCE COMPONENT

This section contains two subcategories, Rarity/Scarcity, and Significant Features. The second category is included to account for and evaluate an area's importance based on the presence of significant wildlife or plant species. Much of this section is subjective but the output is related fairly directly to the probability that certain important features will occur in a wetland. One outcome of this section is the identification of "red flag species". These are rare or significant species that are found in a subject wetland and elevate the site's value because of their presence. Much of the information (and the species used) in this section is based on results from the working group workshop and unpublished information gathered during our own field assessments and related work.

Many of the species used here are similar to "indicator species' as used by other authors in habitat assessments. These species represent "healthy" or ideal communities. Habitats in varying stages of disturbance usually lose these sensitive species first. Species included for this section include those that are endangered, rare, endemic, high visual/public quality, or at the limits of their range. None of these questions, and therefore the presence of species from these lists, will garner enough points to alone raise the score for a particular wetland artificially. Rather it is more important that the presence of a species from these lists be called out in the assessment so that management decisions can be made accordingly. Species on these lists are found in Appendix G.

3.1 <u>Habitat for Plant Species of Statewide Significance</u>

This question refers to species listed in a University of Alaska publication on threatened or endangered plant species (Murray and Lipkin 1987). These species garner points because of their extreme scarcity and need for protection. The presence of one of these species in a subject wetland would make that site of outstanding value. It is not likely that species on this list would be found with any regularity in the Anchorage area. This section does not include bird or mammal species since no endangered bird or mammal species breed in the Anchorage area.

3.2 <u>Breeding, Feeding, Spawning, or Rearing Habitat for Bird or Anadromous Fish Species Significant to the Municipality of Anchorage</u>.

This question aims at identifying the presence of certain bird or fish species in a subject wetlands. This list is more subjective since there is no official list of threatened or endangered bird or fish list for Anchorage. Species are included here if: the species requires large breeding territories and there is a history of local decline to a point of near extirpation (Hudsonian Godwit, N. Harrier, Short-eared Owl): if the species reaches it's extreme edge of range and is found in very small numbers and is therefore locally vulnerable (Gadwall, Blue-winged Teal, Killdeer, Song Sparrow, Am. Tree Sparrow, Red-winged

Blackbird): if the species is particularly sensitive, specialized in it's habitat requirements, and generally very localized (loons, Red-necked and Horned Grebe, Trumpeter Swan, Sandhill Crane, Solitary Sandpiper, Short-billed Dowitcher, Red-necked Phalarope, Belted Kingfisher, Am. Dipper). Most of these species are indicators of high value wetlands.

Reviewers of this methodology from the State and federal resource agencies agreed with these species lists. A species can be included if it has used the subject wetlands for one or more stages of it's lifecycle within the previous five years. This is valid since many of these species do not nest annually and recruitment of new individuals is not always automatic to known habitats. Most of these species are considered of unique public value as well and are sought after by local and visiting birders or natural history enthusiasts.

The Alaska Department of Fish and Game biologists felt that the three salmonids on the list (Chinook, Coho, Sockeye) are the key fish species that fit the criteria of rarity and scarcity and public importance in this category. If one or more of these species are present in a subject wetland, then the area is presumed to support some stage of the species' lifecycle.

3.3 Habitat for Plant Species Rare or Unique in the Municipality of Anchorage

Similar to the previous question this identifies the presence of rare or significant plant species from a subject wetland. This list includes species of public interest such as Sundew and Ladyslipper as well as species that either reach their Alaska distribution limits here or are more or less endemic to Upper Cook Inlet. Many of these species are restricted to the region and to specific plant communities. This section for plants receives fewer points than the previous since most of these species are more widespread than most of the bird species and birds have a higher public recognition value.

3.4 Scarcity Value

This question measures the subject wetland type as a percent of that wetland type in the catchment basin. The rarer the wetlands type in the basin the greater its importance in a local perspective, i.e. if it were filled what would be the resultant change in the total acreage of that type in the Municipality. This question attempts to identify the cumulative losses of each wetlands type in a catchment basin. The Municipality recognizes that each basin has its own unique biodiversity based in part on which wetland types are present. The value of a wetland within its catchment basin is at least partially based on total coverage.

3.5 Nesting of Colonial Waterbirds

Colonial waterbirds are those water-dependent species that nest in colonies or aggregations, or in association with other species. We have identified Red-necked Grebe, Canada Goose, several gull species, and Arctic Tern as the local colonial species. Colonial species require specific habitat types and sizes that are fast diminishing in the region. These colonies are also quite vulnerable to disturbance, and habitat loss quickly reduces a population. Some wetlands are traditional feeding or molting sites of significance and this aspect is recognized in this category. Colonial nesting species are highly visible to the public and are of additional value for this.

3.6 Waterfowl Staging

Some wetlands serve as major staging areas for migrant waterbirds. This value may be on a statewide basis for large numbers or for a large portion of a particular population, or a wetlands may provide staging value for species on a very localized level. This level is considered of highest importance if species of statewide significance (Snow Goose, "Tule" White-fronted Goose) or if very large numbers of individuals and several species utilize an area. Studies in Anchorage show that roughly 6 to 14 species of waterfowl utilize Anchorage area wetlands in migration regularly. Known high use wetlands like Connors Bog (Hogan and Tande 1983), Potter Marsh (AK Dept. of Fish and Game unpubl. reports), Business Park Wetlands provide migratory habitat for 8+ species in good numbers annually: this constitutes a rational for a "high importance" site.

Most freshwater Anchorage wetlands provide only moderate importance to staging waterfowl; their value comes from their support of a diversity of species. For this question the following should serve as a guideline for the three categories:

* High importance within the Municipality-supports high numbers of several species = > 8 species and > 150 individuals can be seen regularly at one time in migration (1 April-1 June, and 1 September-freeze-up). These numbers appear to represent repeatable counts from known high use wetlands in Anchorage.

* Moderate importance within the Municipality = 4 to 8 species and 75 to 150 individuals can be seen regularly at one time in migration.

* Very local importance = < 4 species and < 75 individuals can be seen regularly or sporadically at one time in migration.

3.7 Waterbird Production

Certain wetlands are important to production of young and those that support populations of breeding waterfowl are identified in this category. Wetlands where rare species nest or where waterfowl nest in numbers that are significant on a regional level are of highest value. The categories are as follows:

* High importance = produces several broods of >6 species.
* Moderate importance = produces broods of 2 to 6 species.
* Minimal or no significance = produces broods occasionally of 1 or 2 species.

These numbers reflect findings of bird studies of Anchorage and Kenai wetlands (Hogan and Tande 1983, Rosenberg 1986). The higher value sites had at least 6-8 waterbird species nesting regularly.

3.8 Breeding Bird Diversity

We have added this category to reflect the relative value of a wetlands for breeding habitat for obligate wetlands species and total species of all groups of birds combined. In Southcoastal AK the most significant areas are those where 8+ obligate wetlands species and/or >15 total species are known to nest or probably nest (Hogan and Tande 1983, Rosenberg 1986). Most sites fit the moderate category (nesting of 4-8 obligates and 8-15 total). The most common obligate species nesting in Anchorage wetlands are Mallard, Canada Goose, Lesser Yellowlegs, Common Snipe, Least Sandpiper, Lincoln's Sparrow, Rusty Blackbird.

3.9 Migratory Bird Staging Area

This category provides for evaluation of a subject wetland's role in supplying migratory or staging habitat for non-waterfowl species. Most freshwater wetlands in the Anchorage area provide only moderate such habitat. But many wetlands in Anchorage represent the only available local migratory habitat to passage birds. Significance is determined by number of total species known to use an area regularly. There are roughly 65 species that regularly migrate through the Anchorage area. Of this group of regular migrants, roughly 25-30 species are common and widespread in good numbers. A high significance site is one that is used annually (in spring and/or in fall) by > 25 species, or a site that supports numbers of all of the most regular species. Although few data exist for migrant bird use of Anchorage wetlands, it is easy to obtain such information especially in spring: some degree of extrapolation may be required.

3.10 Significance for Fish Spawning

Many wetlands or waterbodies adjacent and connected to a subject wetlands are important to spawning activities of several fish species. In Anchorage, the following fish species are known to spawn: Dolly Varden, Grayling, Rainbow Trout (introduced), Stickleback, Coho, Chinook, Sockeye, Chum, Pink Salmon. Wetlands or their adjacent waterbodies that provide spawning habitat for more than 5 species (or the majority of the nine species known to occur in Anchorage) of fish are considered of significant value and these receive the highest points. No distinction was made for large concentrations of one or a few species of fish versus an area with low numbers of many species.

3.11 Significance for Fish Rearing

Many Anchorage area wetlands have interconnected channels and ponds as tributaries to larger creeks and streams. Many of these areas are utilized by salmonids and Dolly Varden juveniles in summer as rearing habitat. Potentially some areas are deep enough that overwintering activity can also occur. This rearing activity is fairly well documented for many of the Anchorage wetlands. Rearing habitat is equally as important to fish populations as spawning habitat. The same numerical breakdown is used here as for the previous question.

SOCIAL COMPONENT

Past wetland assessment methodologies have aimed to evaluate social values based mostly on actual monetary valuations. These valuations concentrated on wetlands' worth to society by, for instance, production of crops and other commercial by-products (Gosselink et al. 1973). This Anchorage method rather, pursues wetlands social functions based on non-economic uses such as passive recreation and public benefits. For Anchorage these are more realistic parameters since there is little commercial or monetary benefit generated from local wetlands.

4.1 Existing Recreational Activities

This category outlines all recreation uses of a wetlands and measures each based on intensity of use. The measure of intensity is subjective since little of this is documented. An attempt is made to restrict uses to water dependent or water related activities only. Use intensities are defined as follows:

* High = used in several seasons by numerous individuals and/or groups.
* Moderate = used in one or two seasons by a few individuals and/or by a single group.
* Low = used irregularly by a very few individuals.

4.2 Educational Use--Known or Potential

This category recognizes the public's use of a wetlands site for educational activities. Points are given based on the frequency of use by groups of people. Minor points are assigned to an area if that site is in close proximity to a school(s) and therefore has educational potential.

4.3 Facilities and Programs

Wetland areas with official or formal educational programs, staff, or brochures and interpretive trails have higher public value than sites that have no developed or organized educational activity. Few Anchorage wetlands actually have such programs.

Wetlands Recreation Potential

4.4 Landscape Distinctness

If a wetlands is notably distinct within its surrounding environment then it is considered to have more social value than typical landscapes. The public is always more aware of distinct landscapes than more uniform appearing sites. From an ecological aesthetics perspective, it is clear that wetlands can be visually and educationally "rich" environments (Smardon 1978). Most Anchorage wetlands provide a unique addition to local viewsheds. We have attempted to allow for differentiation of landscapes within rural and urban areas.

4.5 Types of Disturbance

All significant or detracting disturbances within a wetlands are to be identified. The total number is then subtracted from the points addition for the Social Component. All of the disturbances listed are considered as detriments to a wetlands area: disturbances are known to reduce species diversity, increase undesirable species, increase contamination and lowered water quality, and reduce public values (Jaworski and Raphael 1978). Disturbance must be interpreted by the the field user of this method since quantification is difficult. A disturbance must be recognizable to be included.

4.6 Degree of Disturbance/Aesthetic Values

This category attempts to identify the degree to which a wetlands is disturbed. The emphasis is placed on water quality and water pollution in a wetlands. The less the disturbance the more points an area will receive.

4.7 Public Use/Open Space

This section awards points to a wetlands based on its distance to subregions within the Municipality where parklands are deficient by Municipal standards. A wetland immediately within a region of the Municipality where park space is currently below standards has potential or recognized value to the public. Since little remaining land is available for future park expansion, undeveloped wetlands often represent the only possibilities for new parks. Points are assigned based on distance from known deficient areas. Value is attributed to a subject wetlands if it also provides direct access to existing parkland.

4.8 Land Use Identification as Parkland

This category awards points to a wetlands if it has been identified in a Municipal document as having future or potential public values mainly as parkland. We felt it was necessary to give points to an area if that area is officially identified for public use. These points are minimal and are acknowledged simply to differentiate between areas of public value and those wetlands slated for development or in private ownership. For planning purposes and in the public's eye such sites are of high value.

4.9 Research and Studies

A wetlands that has reports or articles written about it is of value to the public since some aspect of the area has been portrayed in a public forum. Thus the public, and specifically the local neighborhoods, can better relate to an area and can better understand the values onsite. Such articles also contribute to management, planning decisions, and educational values.

4.10 Ownership/Accessibility

This section matches accessibility of a wetlands parcel with the current ownership patterns. Points are awarded based on ease of access and restriction by ownership. Ownership and accessibility have a direct bearing on the value of a wetlands to the Anchorage public. Benefits of use by the public of a particular wetlands vary from direct access for active recreation, to open space, to public health and safety. Private ownership and difficult access are direct public use restrictions of a wetlands and render such sites of lower value. This category highlights a wetlands value to the public only and does not consider private owner's benefits. Easily accessed wetlands are of more social value than any restricted areas.

SIGNIFICANT FEATURES

All significant features from Sections 3.1 to 3.11 should be listed at the end of the work sheets. These "red flags" are considered of highest value and management efforts should include methods to protect these significant species or features. The presence of a "red flag" species within a wetland will automatically elevate the value of that site in management scenarios.

Some wetlands evaluation systems identify significant species and require that should a significant species be identified for a site, that site should be immediately preserved. Virtually all wetlands evaluation systems contain sections for high value, or significant species. Some systems also include outstanding or significant public use features within the significant features components. In Anchorage wetlands there are essentially no significant public use features, whether commercial or otherwise, so we did not include such a reference.

The level of significance used in this Anchorage evaluation is on a more local or regional scale: i.e. none of the species are endangered. The species listed under this section are rather a combination of locally threatened species and unique or of high public interest. Where a particular wetland has a "red flag" species, then it should be considered of outstanding value and remaining scores from other sections of the assessment become less important. Most of the species listed in Appendix G. are extremely sensitive and cannot simply move to a new site should a subject wetlands be filled. Most of the bird species require unique nesting habitat and/or large territory size.

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