2.0 Wetland Classification and Assessment Methods

The National Wetlands Inventory (NWI) maps, Duluth Area Wetlands Inventory (DAWI) maps, St. Louis County preliminary soil survey data, and current and historic aerial photographs were used as baseline information to help identify potential wetland areas on each UMD property. The presence of each potential wetland was verified in the field and detailed information from each wetland was collected to inventory and assess the wetland resources. The data collected for each wetland is explained in more detail in Section 3.0, but generally includes specific information regarding dominant vegetation, wetland classifications, hydrologic characteristics, general wetland quality, and susceptibility to degradation from stormwater impacts. This section describes the different wetland classification systems, hydrologic characteristics that were recorded, wetland quality assessment methodology used, and the stormwater susceptibility evaluation.

2.1 Wetland Classification

Dominant wetland types were classified by topographic setting, U.S. Fish and Wildlife Service (USFWS) Cowardin System (Cowardin et al. 1979), USFWS Circular 39 System (Shaw and Fredine 1959), and the wetland community classifications of Eggers and Reed (1997). A comparison of the latter three wetland classification systems with some common vegetation found in each wetland type is provided in Table 2. The following sections define these four classifications systems.

2.1.1 Topographic Setting

The Wetland Conservation Act (WCA) (Minnesota Rules Chapter 8420.0110) defines topographic settings for wetlands. Each wetland mapped on UMD properties was classified by its topographic setting as defined by the WCA.

Floodplain wetland: A floodplain wetland is a wetland located in the floodplain of a watercourse, with no well defined inlets or outlets, including tile systems, ditches, or natural watercourses. This may include the floodplain itself when it exhibits wetland characteristics.

Flow-through: A flow-through wetland has a well-defined outlet and one or more well defined inlets.

Isolated wetland: An isolated wetland is without a well-defined inlet or outlet.

Riverine wetland: A riverine wetland is a wetland contained in the banks of a channel that may contain moving water or that forms a connecting link between two bodies of standing water.

Shoreland wetland: A shoreland wetland is a wetland located along the shoreline of a lake or edge of a deepwater habitat.

Tributary wetland: A tributary wetland has a well-defined outlet but is lacking a defined inlet.

Other: A wetland that does not fit into one of the previously mentioned groups.

2.1.2 Circular 39 Wetland Classifications

The *Wetlands of the United States* was published by the U.S. Fish and Wildlife Service and is commonly referred to as "Circular 39" (Shaw and Fredine 1956). The Circular 39 Classification System was the first method that the U.S. Fish and Wildlife Service used to classify wetland basins in the U.S. It is composed of 20 wetland types, 9 of which are found in Minnesota, as described below.

2.1.2.1 Type 1: Seasonally Flooded Basin, Floodplain Forest

Soil is covered with water or is waterlogged during variable seasonal periods but usually is well-drained during much of the growing season. This type is found both in upland depressions and in overflow bottomlands. In uplands, basins or flats may be filled with water during periods of heavy rain or melting snow.

Vegetation varies greatly according to season and duration of flooding: from bottomland hardwoods to herbaceous plants. Where the water has receded early in the growing season, smartweeds, wild millet, fall panicum, redroot cyperus, and weeds (i.e. marsh elder, ragweed, and cockleburs) are likely to occur. Shallow basins that are submerged only very temporarily usually develop little or no wetland vegetation.

2.1.2.2 Type 2: Wet Meadow, Fresh Wet Meadow, Wet to Wet-Mesic Prairie, Sedge Meadow, and Calcareous Fen

Soil is usually without standing water during most of the growing season but is waterlogged within at least a few inches of the surface. Meadows may fill shallow basins, sloughs, or farmland sags, or these meadows may border shallow marshes on the landward side. Vegetation includes grasses, sedges, rushes and various broad-leaved plants. In the North, representative plants are sedges, rushes, redtop, reedgrasses, manna grasses, prairie cordgrass, and mints. Other wetland plant community types include low prairies, sedge meadows, and calcareous fens.

2.1.2.3 Type 3: Shallow Marsh

Soil is usually waterlogged early during the growing season and may often be covered with as much as 6 inches or more of water. Shallow marshes may nearly fill shallow lake basins or sloughs, or may border deep marshes on the landward side. Seep areas on irrigated lands often develop as shallow marshes. Vegetation includes grasses, bulrushes, spikerushes, and various other marsh plants such as cattails, arrowhead, pickerelweed, and smartweeds. Common representatives in the North include reed, whitetop, rice cutgrass, sedges, and giant burreed.

2.1.2.4 Type 4: Deep Marsh

Soil is usually covered with 6 inches to 3 feet or more of water during the growing season. Deep marshes may completely fill shallow lake basins, potholes, limestone sinks and sloughs, or they may border open water in such depressions. Vegetation includes cattails, reeds, bulrushes, spikerushes and wild rice. In open areas, pondweeds, naiads, coontail, watermilfoils, waterweeds, duckweed, water lilies, or spatterdocks may occur.

2.1.2.5 Type 5: Shallow Open Water

Shallow ponds and reservoirs are included in this wetland type. Water is usually less than 10 feet deep and is fringed by a border of emergent vegetation similar to open areas of Type 4. Vegetation

(mainly at water depths less than 6 feet), includes pondweeds, naiads, wild celery, coontail, watermilfoils, muskgrass, waterlilies, and spatterdocks.

2.1.2.6 Type 6: Shrub Swamp; Shrub Carr, Alder Thicket

The soil is usually waterlogged during the growing season and is often covered with as much as 6 inches of water. Shrub swamps occur mostly along sluggish streams and occasionally on flood plains. Vegetation includes alders, willows, buttonbush, dogwoods and swamp-privet.

2.1.2.7 Type 7: Wooded Swamps; Hardwood Swamp, Coniferous Swamp

The soil is waterlogged at least to within a few inches of the surface during the growing season and is often covered with as much as 1 foot of water. Wooded swamps occur mostly along sluggish streams, on old riverine oxbows, on floodplains, on flat uplands, and in very shallow lake basins. Forest vegetation includes tamarack, arborvitae (cedar), black spruce, balsam fir, red maple, and black ash. Northern evergreen swamps usually have a thick ground covering of mosses. Deciduous swamps frequently support beds of duckweeds, smartweeds, and other herbs.

2.1.2.8 Type 8: Bogs; Coniferous Bogs, Open Bogs

The soil is usually waterlogged and supports a spongy covering of mosses. Bogs occur mostly in shallow lake basins, on flat uplands and along sluggish streams. Vegetation is woody or herbaceous or both. Typical plants are heath shrubs, sphagnum moss, and sedges. In the North, leatherleaf, Labrador-tea, cranberries, sedges, and cottongrass are often present. Scattered, often stunted, black spruce and tamarack may occur in northern bogs.

2.1.2.9 Type 90: Riverine

Riverine systems (rivers, creeks and streams) are contained in natural or artificial channels periodically or continuously containing flowing water. Upland islands or palustrine wetlands may occur in the channel, but they are not part of the riverine system.

2.1.3 Cowardin Wetland Classifications

The USFWS published the *Classification of Wetlands and Deepwater Habitats of the United States* in 1979 (Cowardin et al. 1979). This wetland classification methodology was used to classify wetlands in the development of the National Wetlands Inventory maps beginning in the late 1970's and early 1980's. The structure of the classification is hierarchical from general to specific by Systems, Subsystems, Classes, Subclasses, Water Regime, and sometimes, Special Modifiers. A comparison of Circular 39 and Cowardin wetland classifications along with the typical Cowardin classification symbols is provided in Table 3.

2.1.3.1 System

The term System refers to a complex of wetlands and deepwater habitats that share the influence of similar hydrologic, geomorphologic, chemical, or biological factors. There are five major Systems defined by Cowardin et al. (1979): Marine (associated with the ocean), Estuarine (tidal wetlands), Riverine (associated with a channel), Lacustrine (open water, greater than 20 acres or deeper than 6.6 feet at low water), and Palustrine (all remaining wetlands). The latter three Systems are primarily found in Minnesota.

R: Riverine (rivers, creeks and streams) - Riverine wetlands are contained within natural or artificial channels that periodically or continuously contain flowing water or form a link between two bodies of standing water. Upland islands or palustrine wetlands may occur in the channel, but they are not part of the riverine system.

L: Lacustrine (lakes and deep ponds) – Lacustrine wetlands include wetlands and deepwater habitats with all the following three characteristics:

1. Situated in a topographic depression or a dammed river channel;

2. Lacking trees, shrubs, persistent emergents, emergent mosses or lichens with greater than 30 percent coverage;

3. Total area exceeds 20 acres.

Basins or catchments less than 20 acres in size are included if they have at least one of the following characteristics:

1. A wave formed or bedrock feature forms all or part of the shoreline boundary; or

2. The catchment has, at low water, a depth greater than 6.6 feet in the deepest part.

P: Palustrine (shallow ponds, marshes, swamps and sloughs) - Palustrine systems include all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens.

2.1.3.2 Subsystem

The term Subsystem refers to a further subdivision of Systems into more specific categories. The palustrine system does not have any Subsystems associated with it. Lacustrine systems have two Subsystems, while riverine systems have four Subsystems in Minnesota. Each Subsystem is unique for the System to which it applies.

Lacustrine

1: Limnetic – deepwater habitats. Many small lacustrine systems do not have a limnetic subsystem.

2: Littoral – wetland habitats. This subsystems extends from the shoreward boundary to 6.6 feet below low water or to the maximum extent of nonpersistent emergents, if they grow at depths greater than 6.6 feet.

Riverine

2: Lower Perennial – defined by low gradient, slow water streams with well developed floodplains.

3: Upper Perennial – includes high gradient, fast water streams with limited to no floodplain.

4: Intermittent – the channel only has flowing water for part of the year.

2.1.3.3 Class, Subclass

The wetland Class is the highest taxonomic unit below the Subsystem level. The Class code describes the general appearance of the habitat in terms of either the dominant vegetation or the physiography

and composition of the substrate. The dominant vegetation type (e.g. trees, shrubs, emergents) is used to define classes because they are easily recognizable, do not change distribution rapidly, and have traditionally been used to classify wetlands. If vegetation covers 30% or more of the substrate, the Class code differentiates to the uppermost type of dominant vegetation that has 30% or more cover. Further refinement in dominant vegetation type is recognized at the Subclass level.

Mixed classes are used as sparingly as possible, under two main conditions: (1) The wetland contains two or more distinct cover types each encompassing at least 30 percent areal coverage of the dominant vegetation type, but is too small in size to allow separate delineation of each cover type; and (2) The wetland contains 2 or more classes or subclasses each comprising at least 30 percent areal coverage so evenly interspersed that separate delineation is not possible at the scale used for classification. Mixed subclasses are also allowed and follow the same rules for mixed classes.

AB: Aquatic Bed - Includes wetlands and deepwater habitats dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years.

Subclasses include: 1 = Algal, 2 = Aquatic Moss, 3 = Rooted Vascular, and 4 = Floating Vascular.

EM: Emergent - Characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years.

Subclasses include: 1 = Persistent (plants that normally remain standing at least until the beginning of the next growing season) and 2 = Nonpersistent (plants which fall to the surface of the substrate or below the surface of the water at the end of the growing season).

FO: Forested - Woody vegetation greater than 20 feet tall.

Subclass determination is based on which type represents more than 50 percent of the areal canopy coverage during the leaf-on period. Subclasses include: 1 = Broad-leaved Deciduous, 2 = Needle-leaved Deciduous, 3 = Broad-leaved Evergreen, 4 = Needle-leaved Evergreen, and 5 = Dead.

ML: Moss-Lichen - Includes wetlands with mosses or lichen covering substrates other than rock and have less than 30 percent of emergents, shrubs or trees.

Subclasses include: 1 = Moss and 2 = Lichen.

RB: Rock Bottom - Characterized by wetlands and deepwater habitats with substrates of stones, boulders, or bedrock 75 percent or more and vegetative cover less than 30 percent.

Subclasses include: 1 = Bedrock and 2 = Rubble.

RS: Rocky Shore - Includes wetlands having a cover of 75 percent or more of bedrock, stones, or boulders and less than 30 percent vegetative cover.

Subclasses include: 1. Bedrock and 2 = Rubble.

SS: Scrub-Shrub - Woody vegetation less than 20 feet tall. The species include true shrubs, young trees (saplings), or trees that are small or stunted because of environmental conditions.

Subclass determination is based on which type represents more than 50 percent of the areal canopy coverage during the leaf-on period and include: 1 = Broad-leaved Deciduous, 2 = Needle-leaved Deciduous, 3 = Broad-leaved Evergreen, 4 = Needle-leaved Evergreen, and 5 = Dead.

UB: Unconsolidated Bottom - Includes all wetlands and deepwater habitats with at least 25 percent cover of particles smaller than stones (less than 6-7 cm.), and a vegetative cover less than 30 percent.

Subclasses include: 1 = Cobble-Gravel, 2 = Sand, 3 = Mud, and 4 = Organic.

US: Unconsolidated Shore - Wetlands with the following characteristics: 1) unconsolidated substrates with less than 75 percent coverage of stones, boulders, or bedrock, and 2) less than 30 percent coverage of vegetation other than pioneering plants.

Subclasses include: 1 = Cobble-Gravel, 2 = Sand, 3 = Mud, 4 = Organic, and 5 = Vegetated.

2.1.3.4 Water Regime

A description of hydrologic characteristics requires detailed knowledge of the duration and timing of surface inundation, both yearly and long-term, as well as an understanding of groundwater fluctuations. Because such information is seldom available, the water regimes that, in part, determine characteristic wetland and deepwater plant and animal communities are described here in only general terms (Cowardin, et al. 1979). Water regimes are grouped under two categories: Tidal and Non-Tidal. The Tidal Water Regime does not occur in Minnesota so is not described here.

A: Temporarily Flooded - Surface water present for brief periods during the growing season, but the water table usually lies well below the soil surface. Plants that grow both in uplands and wetlands are characteristic of this water regime. The temporarily flooded regime also includes wetlands where water is present for variable periods without detectable seasonal periodicity. Weeks, months, or even years may intervene between periods of inundation. The dominant plant communities under this regime may change as soil moisture conditions change.

B: Saturated - The substrate is saturated to the surface for extended periods during the growing season, but surface water is seldom present.

C: Seasonally Flooded - Surface water is present for extended periods especially early in the growing season, but is absent by the end of the growing season in most years. When surface water is absent, the water table is often near the land surface. The water table after flooding ceases is highly variable, extending from saturated to a water table well below the ground surface.

F: Semipermanently Flooded - Surface water persists throughout the growing season in most years. When surface water is absent, the water table is usually at or very near the land surface.

G: Intermittently Exposed - Surface water is present throughout the year except in years of extreme drought.

H: Permanently Flooded - Water covers the land surface throughout the year in all years. Vegetation is composed of obligate hydrophytes.

2.1.3.5 Special Modifiers

Many wetlands and deepwater habitats are man-made and natural ones have been modified to some degree by the activities of man or beavers. Since the nature of these modifications often greatly influences the character of such habitats, special modifying terms have been included here to emphasize their importance (Cowardin et al. 1979).

b: Beaver – Created or modified by a beaver dam.

d: Partly Drained – The water level has been artificially lowered, but he area is still classified as wetland because soil moisture is sufficient to support hydrophytes. Drained areas are not considered wetland if they can no longer support hydrophytes.

f: Farmed – The soil surface has been mechanically or physically altered for production of crops, but hydrophytes will become reestablished if farming is discontinued.

h: Diked/Impounded – Created or modified by a barrier or dam which purposefully or unintentionally obstructs the outflow of water. Both man-made and beaver dams are included.

r: Artificial – Refers to substrates classified as Rock Bottom, Unconsolidated Bottom, Rocky Shore, and Unconsolidated Shore that were emplaced by humans, using either natural materials such as dredge spoil or synthetic materials such as discarded automobiles, tires, or concrete.

s: Spoil – Refers to the placement of spoil materials which have resulted in the establishment of wetland.

x: Excavated – Lies within a basin or channel excavated by humans.

2.1.4 Eggers and Reed Wetland Community Classifications

Wetland Plants and Plant Communities of Minnesota and Wisconsin: Second Edition was published in 1997 by the U.S. Army Corps of Engineers, St. Paul District (Eggers and Reed 1997). This book is best known for the authors, Steve Eggers and Donald Reed, who classified the wetlands of Minnesota and Wisconsin into 15 different plant communities based on water permanence and depth, and degree of saturation. These factors control the nature of the dominant plant groups that characterize the wetland type. A general description of each wetland type, taken from Eggers and Reed (1997), is provided below.

2.1.4.1 Shallow, Open Water

Water depths are less than 6.6 feet and very rarely fluctuate; therefore emergent aquatic vegetation cannot become established. This wetland type is characterized by submergent, floating and floating-leaved aquatic plants including pondweeds, water-lilies, water milfoil, coontail, and duckweed. Size varies from a one-quarter acre pond, to a long oxbow of a river or shallow bay of a lake.

2.1.4.2 Deep Marsh

Standing water depths are typically between 6 inches and 3 or more feet during the growing season and fluctuate in depth throughout the year. This wetland type is characterized by herbaceous emergent, floating, floating-leaved, and submergent vegetation including cattail, hardstem bulrush, pickerelweed, giant bur-reed, Phragmites, wild rice, pondweeds, and water-lilies. Emergent aquatic plants typically become established and spread when water levels are low, and persist when water levels rise.

2.1.4.3 Shallow Marsh

Water depths are typically less than 6 inches and may only consist of enough to saturate the soil throughout the growing season. Herbaceous emergent vegetation characterize this wetland type, such as cattails, bulrushes, arrowheads, and lake sedges. Emergent aquatic plants typically become

established and spread when water levels are low or soil becomes exposed, and persist when water levels rise.

2.1.4.4 Sedge Meadow

Saturated soils dominated by sedge communities distinguish this wetland type. Sedge species typically dominate sedge meadows, but spike-rushes, bulrushes, and nut-grasses may also be present. Grasses and forb species likely are present, adding diversity to the vegetative community, although forbs may flower poorly due to intense competition with the sedges. Soils usually consist of peat or muck.

2.1.5.5 Fresh (Wet) Meadow

Saturated soils dominated by grasses and forbs differentiate this wetland type. Grasses may consist of redtop grass, reed canary grass, and Kentucky bluegrass. Forbs likely consist of the aster (Compositae) family. Fresh (wet) meadows often consist of less competitive, short-lived species, but may persist for extended periods of time once established.

2.1.4.6 Wet to Wet-Mesic Prairie

True grasses make up at least half of the vegetative cover in these open, herbaceous plant communities. This wetland type is similar to fresh (wet) meadows, but the native grasses, grass-like species and forbs are associated with prairies, such as prairie cord-grass, big bluestem, gayfeather, New England aster, culver's root, prairie dock, and sawtooth sunflower. This vegetation community only occurs in western and southern Minnesota and southern Wisconsin.

2.1.4.7 Calcareous Fen

This is the rarest of the wetland plant communities in Minnesota, Wisconsin, and likely all of North America. These wetlands have a groundwater component rich in calcium and magnesium bicarbonates, and sometimes calcium and magnesium sulfates, which precipitate out at the surface, creating a harsh, alkaline soil condition. Only certain plants can tolerate these conditions. Typical vegetation includes shrubby cinquefoil, sterile sedge, wild timothy, beaked spike-rush, Ohio goldenrod, common valerian and lesser fringed gentian. Calcareous fens often have a disproportionate number of rare, threatened, and endangered plant species compared to other plant communities in the Great Lakes Region. Trout streams and active springs are often associated with calcareous fens.

2.1.4.8 Open Bog

A carpet of living sphagnum moss growing over a layer of saturated, acid peat soils low in nutrients are typical of open bogs. Herbs and low shrubs of the heath (Ericaceae) family often colonize the moss layer. Scattered immature or stunted (diameter at breast height [dbh] less than 6 inches) black spruce or tamarack may be present. Most bogs are found in northeastern Minnesota and northern Wisconsin.

2.1.4.9 Coniferous Bog

Mature black spruce, tamarack, or northern white cedar trees (dbh greater than 6 inches) over a carpet of living sphagnum moss are characteristic of this wetland type. The heath (Ericaceae) family is typically well represented, and sedges, orchids, and pitcher plant are often present in shaded areas.

Most bogs are found in northeastern Minnesota and northern Wisconsin. Black spruce and heath family shrubs are characteristic of wetlands with acid peat soils. Tamarack and northern white cedar are typically present where there are calcareous peat soils.

2.1.4.10 Shrub-Carr

This is a shrub swamp wetland plant community dominated by tall, deciduous shrubs growing on saturated to seasonally flooded soils. Woody vegetation is typically less than 20 feet in height with a dbh of less than 6 inches. Willows, red-osier dogwood, or silky dogwood generally dominate the shrub layer with a groundlayer of ferns, sedges, grasses and forbs. The diversity of the groundlayer is dependent on the openness of the shrub canopy, degree of disturbance, and water source.

2.1.4.11 Alder Thicket

Like shrub-carr wetlands, this is a shrub swamp wetland plant community dominated by tall, deciduous shrubs growing on saturated to seasonally flooded soils, although this wetland type is dominated by speckled alder. These plant communities are found in northeastern Minnesota and northern Wisconsin. Speckled alder may occur as a monotype, or it could have a diversity of other shrubs such as high-bush cranberry, sweet gale, and common winterberry holly. The groundlayer may be composed of ferns, sedges, grasses, and forbs depending on the openness of the shrub canopy, degree of disturbance, and water source.

2.1.4.12 Hardwood Swamp

This plant community consists of wetlands dominated by deciduous hardwood trees and soils that are saturated or inundated by as much as a foot of water. The tree layer may consist of black ash, red maple, yellow birch, silver maple, northern red cedar, or American elm. The shrub layer likely consists of shrub-size individuals of the dominant tree species along with dogwoods and alder. The groundlayer may also include ferns, sedges, grasses and forbs. These wetlands are commonly found in ancient lake basins. This wetland classification frequently includes vernal pools.

2.1.4.13 Coniferous Swamp

Lowland conifers, such as northern white cedar and tamarack, dominate this wetland type on soils that are saturated or inundated by as much as a foot of water. Soils are usually organic and can vary from acidic and nutrient-poor, to fertile and neutral to alkaline. Tamarack dominates the former soils, and northern white cedar dominates the latter. Continuous sphagnum moss is not usually present. Most coniferous swamps are found in northeastern Minnesota and northern Wisconsin, although several large tamarack swamps occur in other areas of the states.

2.1.4.14 Floodplain Forest

Alluvial soils associated with riverine systems dominated by mature, deciduous hardwood trees are characteristic of this wetland type. Soils are usually somewhat well-drained for much of the growing season, although they are often inundated during flood events. The most characteristic feature is the alluvial soil that is constantly being deposited in some locations and eroded in other areas. Northern and southern wet-mesic hardwood forest associations are included in this wetland type. Dominant hardwoods could include silver maple, green ash, river birch, eastern cottonwood, American elm, and black willow. The groundlayer may consist of jewelweed and nettles. The shrub layer, if present, is typically quite sparse.

2.1.4.15 Seasonally Flooded Basin

This wetland type includes poorly drained, shallow depressions that typically have standing water for a few weeks but dry the remainder of the year. This includes kettles on glacial deposits, low spots on outwash plains, or depressions in floodplains. Typical species include smartweed, beggarticks, nut-grasses, and wild millet. Perennial plants generally cannot become established due to the periods of flooding and drought, so annual species usually dominate this community.

2.2 Hydrologic Characterization

The hydrologic regime needs to be characterized for classification of the wetland as described in Section 2.1. For the purposes of this inventory, hydrologic characteristics have been recorded at each wetland as follows: typical water depth, range of natural water level fluctuations, and relative contribution of storm water to each wetland. Many of these characteristics are directly related to the water regime for the wetland classification, but any identified variances were documented.

2.3 Wetland Quality Assessment Methodology

The general wetland quality was characterized using the vegetative diversity/integrity rating system in the state-approved *Minnesota Routine Assessment Method for Evaluating Wetland Functions (MNRAM), Version 3.0* (Appendix A). This methodology considers the diversity of the dominant vegetation in the wetland compared to an undisturbed condition for that wetland type. Diversity measures the species richness or number of plant species, while integrity refers to the condition of the plant community. The degree and type of disturbance, in this case manmade disturbance, determine the degree of wetland quality. An exceptional rating results from one of the following conditions: 1) highly diverse wetlands with virtually no non-native species, 2) rare or critically impaired wetland communities in the watershed, or 3) the presence or previous siting of rare, threatened, or endangered plant species. A high rating indicates the presence of diverse, native wetland species and a lack of non-native or invasive species, or a community characteristic of an undisturbed wetland of that type. Wetlands that rate low are primarily dominated by non-native and/or invasive species.

2.4 Wetland Susceptibility to Stormwater Input Evaluation

Stormwater runoff carries soil particles, nutrients, and contaminants which can change the ecological balance of the receiving water body. Changes in the volume or rate of stormwater entering or discharging from the water body can also change the ecological balance. Alterations to the ecological balance of a wetland often results in changes in the water quality and animal and fish habitat, replacement of native vegetation with invasive and tolerant plant species, and/or other impacts to the wetland's functions and values.

Storm-Water and Wetlands: Planning and Evaluation Guidelines for Addressing Potential Impacts of Urban Storm-Water and Snow-Melt Runoff on Wetlands (State of Minnesota Storm Water Advisory Group, 1997) developed a methodology for determining the susceptibility of wetlands to degradation by stormwater input. This methodology relates wetland type to a level of susceptibility as shown in Table 4. This susceptibility is based on tolerable hydrologic change in terms of bounce (difference between the peak flood elevation and the normal water level), inundation period (time that flood waters temporarily stored in the wetland exceed the wetland elevation), and runout control (elevation of the outlet). Wetlands such as bogs and fens can be easily degraded by changes in the stormwater inflows and are designated as exceptionally susceptible. On the other hand, floodplain forests can

tolerate relatively significant changes in the chemical and physical characteristics of stormwater inflow without degradation and are therefore moderately susceptible. Commonly observed shallow marshes and wet meadows dominated by cattail and reed canary grass (respectively) have a moderate susceptibility to stormwater fluctuations. Wetland types and vegetative quality were assessed to determine the wetland susceptibility classification for each wetland. The results are shown on Table 1 and discussed in Section 3.0.