Matanuska-Susitna Borough
Wetlands Management Plan

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Front and Back Cover Photos: Palmer Hay Flats, Kris Abshire

Executive Summary

Wetlands are a widespread feature of the Matanuska-Susitna Borough (Mat-Su when referring to the area or residents; MSB when referring to the local government) landscape, especially in the lower elevations. The MSB encompasses 24,000 square miles: an area comparable to the State of West Virginia. According to the MSB, approximately 25 percent of that area is wetlands. Residents, visitors, and outdoor enthusiasts from around the state enjoy the Mat-Su Valley for its scenery and pristine environment, which are interrelated and dependent on healthy wetlands and watersheds. Tourism, hunting, and fishing are major economic drivers for the Mat-Su. Unlike many developed areas in Alaska and the Lower 48 States, the fish and wildlife resources and related recreational opportunities of the Mat-Su are flourishing due in part to its pristine wetland and water resources.

Wetlands link land and water, and in doing so, afford the residents of Mat-Su with many lifestyle, environmental, and economic benefits. These benefits often include:

- Lifestyle Benefits: open space, clean water, and recreation opportunities
- Economic Benefits: tourism, hunting , fishing, skiing, snow machining, and other outdoor recreation activities; stormwater management; flood control; and clean water
- Environmental Benefits: clean water; flood reduction; erosion control; habitat for moose, salmon, and waterfowl; and groundwater recharge and purification

The MSB has developed this Wetlands Management Plan to help conserve and protect wetland resources throughout the Mat-Su for the lifestyle, economic, and environmental benefits they provide the residents of the Mat-Su and future generations. This plan was developed with input from a Wetlands Advisory Group (WAG) that included representatives from Mat-Su development, industrial, realty, conservation, land trust interests, and state and federal agency personnel. Public input was received on the draft plan at a public meeting.

The guiding principle of this plan can be summarized simply: healthy growth and wetlands conservation in the Mat-Su are interdependent.

This plan provides a framework for integrating wetland conservation and protection with community growth and development. The guiding principle of this plan is that wetland conservation and protection are interdependent with community growth and development within the Mat-Su.

Plan Purpose

This plan serves primarily as an educational tool and promotes coordination among all entities involved in wetland management. This plan does not propose or include any new regulations or permitting requirements. It encourages voluntary practices to conserve and protect wetland resources within the Mat-Su.

Wetland Definitions, Functions and Values

Wetlands are defined in many ways. This plan includes the regulatory definition from Section 404 of the Clean Water Act which guides national wetlands management policies implemented by the U.S. Army Corps of Engineers (USACE) and the Environmental Protection Agency (EPA). It also provides the similar MSB definition found in Borough Code which

provides a framework for wetlands management at the Borough level. Finally, the plan describes the parameters used by wetland scientists to define, identify, and classify wetlands. All of these definitions serve a purpose and contribute to an individual's understanding of what a wetland is and how they should be managed.

There are many different types of wetlands within Mat-Su. Each serves important functions and provides social, economic, and environmental value. For example, some wetlands have an economic value. By controlling flooding events, the community and government save money. This plan discusses wetland types, both as used by the USACE for regulatory /functional purposes and a proposed Mat-Su specific wetland classification developed from an ecosystem perspective. Understanding both approaches leads to more informed land use decisions.

Regulation of Wetlands, Wetland Projects and Plans

This plan identifies and explains the current regulatory framework for wetlands within the Mat-Su. Primarily, it addresses the federal Section 404 permit requirements, the MSB's required 75-foot setback for built structures from shorelines, and various non-code, voluntary Best Management Practices (BMPs) adopted by the MSB. It also provides context and intent for managing wetlands within the Mat-Su by citing recommendations, policies, and goals from the *MSB Comprehensive Plan 2005 Update*, the 2010 *MSB Economic Development Strategic Plan*, *Title 27 Platting Regulations* and the *MSB 2010 Natural Resources Unit Plan* as well as a variety of local community comprehensive plans which point to the value of wetlands in the Mat-Su.

Do I Need a Permit?
Any person, firm or government agency planning to place fill materials into wetlands or other waters must first obtain a permit from the Corps of Engineers. Contact USACE at 907-753-2712 or 800-478-2712.

See Appendix B for more information.

This plan includes descriptions of wetlands functions and values, where wetlands are located in the Mat-Su and how to find information on wetlands regulations and management practices. Several completed and ongoing wetland projects are occurring within the Mat-Su, including wetland inventories, mapping, and a landscape-level functional assessment of wetlands The plan recommends actions to make this and related information more accessible.

Relationship to Other MSB Wetland Projects and Plans

The MSB has undertaken a number of efforts in recent years that address aspects of wetland planning and management. The MSB produced the *MSB Comprehensive Development Plan 2005 Update* and over the last decade, produced other MSB community comprehensive plans and Borough-wide planning documents related to economic development, land management, emergency services, and public facilities. The MSB has also produced watershed atlases for Wasilla and Cottonwood Creeks, and is mapping wetlands throughout the Mat-Su. This wetlands management plan serves as a supplement to these efforts and provides greater detail for wetlands management in the Mat-Su.

Wetland Issues

Maintenance is less costly than restoration. Unlike many communities outside Alaska, communities in the Mat-Su can proactively maintain wetlands rather than wait and be forced to

use limited resources in an attempt to restore them. As many outside communities have discovered too late, maintenance would have been far less costly and more effective than restoration. Figure 1 identifies nine key issues affecting wetlands in the Mat-Su. These issues are either existing problems or issues that need to be addressed before they become problems. These are discussed in greater detail in Chapter 2.4, Wetland Issues.

Figure ES 1: Nine Key Wetland Management Issues

Goals and Actions

Five focus areas were identified to address nine key wetland issues to advance wetland management within the Mat-Su Valley. The focus areas are listed below. Each focus area consists of goals, and each goal contains implementation actions. The reader will find a more detailed discussion of these focus areas, goals, and actions in Chapter 3, Goals and Actions.

1. ***COORDINATION:*** A significant amount of information exists about Mat-Su wetlands. Coordination of existing efforts and better access to published materials will improve wetland management. Establishing an interagency working group and pursuing partnerships with other stakeholders will improve the effectiveness of each group and make use of existing resources more efficient.

2. ***EDUCATION:*** Education is a positive, non-regulatory approach to wetland conservation and protection. It is proactive and preventive, and in the long term, may give the highest return on investment. Education helps people understand the value of wetlands in their communities, as the benefits of wetlands may not be obvious. Information needs vary among groups. The audience is not just kids in classrooms, but also realtors, land developers, home and business owners, and others, such as recreationists. Because this is the first wetlands management plan for the MSB, education will be an important component to the plan's successful implementation.
3. ***CONSERVATION and PROTECTION*:** Conservation and protection promote the stewardship of wetland resources. This involves management of wetlands to prevent damages and losses, thus limiting negative impacts to the Mat-Su economy, lifestyle, and environment.
4. ***SCIENCE and RESEARCH:*** Wetland science continually evolves as the understanding of wetlands and wetland habitats expands. This focus area includes recommendations for further research and evaluation of Mat-Su wetlands to help residents understand how to prevent negative impacts to wetlands in the future.
5. ***PLAN IMPLEMENTATION and EVALUATION:*** This MSB Wetlands Management Plan serves as a supplement to the MSB Comprehensive Plan. Recommended actions found in this plan are the building blocks for a successful wetlands management program. It is important to reassess the effectiveness of this plan in the future to determine whether the recommended goals and actions are being accomplished and whether the outcomes are successful and beneficial.

Wetlands Management Requires a Community Effort

Finally, a basic premise of this plan is that successful wetland management requires a community-wide effort. The MSB is but a single player in wetland management. This plan's actions call upon residents, visitors, homeowners, businesses, educators, developers, local governments, trail users, outdoor recreationists, conservation groups, land trusts, state and federal agencies, and the MSB to work together to conserve and protect Mat-Su wetlands. By doing so, the Mat-Su community will maintain the lifestyle, economic, and environmental benefits that wetlands provide.

Finger Lake Restoration (MSB)

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1 Introduction

Wetlands link land and water, and by doing so, create some of Alaska's most valuable and diverse ecosystems. Wetlands are necessary for healthy salmon, trout, waterfowl, and wildlife habitats in Alaska and provide many lifestyle, environmental, and economic benefits to Mat-Su residents. Developing in wetlands is often difficult and expensive. Knowing wetland locations, functions, values allows individuals to make informed development decisions. Wetland issues in the Mat-Su are similar to those faced by other communities in Alaska and elsewhere in the United States. Addressing these issues today while the Mat-Su wetlands are still healthy will help ensure that the Mat-Su will continue to be great place to live, work, recreate, and visit well into the future.

The MSB encompasses more than 24,000 square miles of glacial valleys, mountain ranges, tundra, wetlands, rivers, and lakes. Mat-Su residents value their rural lifestyle, recreational opportunities, clean air and water, open space, and abundant fish and wildlife resources. The Mat-Su is often called Anchorage's playground because of its proximity to Anchorage and its abundant outdoor recreation opportunities. These attributes make the Mat-Su a great place to live, work, play, and visit. Wetlands contribute significantly to these attributes.

Healthy wetlands benefit Mat-Su residents and visitors in many ways including:

- Lifestyle Benefits: open space, clean water, and recreation opportunities
- Economic Benefits: tourism, hunting , fishing, skiing, snow machining, and other outdoor recreation activities; stormwater management; flood control; and clean water
- Environmental Benefits: clean water; flood reduction; erosion control; habitat for moose, salmon, and waterfowl; and groundwater recharge and purification

These benefits are interrelated and integral to each other.

The Mat-Su is one of the fastest growing areas in Alaska, with a 2010 census count of nearly 89,000 people. As the Mat-Su's population increases and developable land decreases, there will be increasing pressure to develop wetlands. Understanding the functions and values of the different types of wetlands will foster informed development decisions, minimize impacts to wetlands, and potentially reduce development costs.

Maintaining healthy, functioning wetlands will protect the high quality of life that Mat-Su residents enjoy now and in the future.

1.1 Plan Purpose

This Wetlands Management Plan is primarily an educational tool and promotes the coordination among all entities involved in wetland management. It will help guide the MSB, Mat-Su community and agency partners to best manage their valuable wetland resources. This plan recommends methods and actions to protect wetland functions and prevent wetland losses in the Mat-Su. The plan can be implemented by Mat-Su residents, homeowners, businesses, educators, developers, local governments, non-profits, trail groups, conservation organizations, state and federal agencies, and the MSB.

The goals and actions presented in this plan are the result of collaboration with a Wetlands Advisory Group (WAG) which was created specifically for this planning effort. This plan paints

the "big picture" regarding wetland management in the Mat-Su, provides information to decision-makers, and is intended to inform the general public about the importance of wetlands by outlining their functions and values. This plan consolidates a large amount of existing wetlands information to make it more accessible. Lastly, the plan presents several actions that community members, the MSB, and its partners can take to comprehensively manage wetlands now and for the future.

This plan does not present a new wetlands regulatory program or permitting process. The U.S. Army Corps of Engineers (USACE) already has regulatory responsibility as part of Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act (see Chapter 2.2). The intent of this plan is to provide recommendations to foster informed stewardship of the land and its resources within the Mat-Su.

In summary, this plan provides:

1. Information about the benefits and values of wetlands
2. A comprehensive look at wetland management in the Mat-Su
3. Goals and actions for wetland management
4. Additional wetland resources included as appendices

1.2 Guiding Principles

The following guiding principles are meant to provide the overall framework for the plan to:

1. Provide benefit to current and future generations of Mat-Su residents and visitors by minimizing the alteration of existing wetlands
2. Provide benefit to current and future generations of Mat-Su residents and visitors through community growth and economic development
3. Provide recommendations and actions demonstrating that principles 1 and 2 are integrated and mutually dependent through the development of the MSB Wetlands Management Plan

The Mat-Su has a great opportunity to encourage community economic growth and development while maintaining healthy wetlands. This plan is intended to show that wetlands conservation, protection, and community development within the Mat-Su are interrelated and dependent on each other.

The following assumptions provide the basis for this plan's recommended goals and actions:

1. Wetlands are an important component of the natural resources both regionally and within the Mat-Su.
2. Wetlands and the activities they support are key components of the Mat-Su's economy.
3. Wetlands within the Mat-Su should be conserved, protected and carefully managed with the goal of pursuing a no net loss of wetland functions and values.

4. The following MSB definition of wetlands will be used.

   Those areas that are inundated and saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions, including swamps, marshes, bogs, and similar areas (MSB Code 17.125.10 Definitions).

5. Voluntary actions and education as well as regulations are effective management tools.
6. Wetlands should not be managed in isolation, but integrated with other related resource issues such as stormwater management, water quality, flood control, recreation, and fish and wildlife management.

All wetlands are not created equal. While wetlands provide many ecologically important functions and benefits, not all wetlands perform all functions. The MSB Wetland Functional Assessment Method (see Appendix E will become the preferred method for determining which wetlands should receive priority protection.

7. Wetland management in the Mat-Su requires a community effort.

1.3 Plan Area

The Mat-Su has been Alaska's fastest growing region since the 1970s. According to the 2010 Census Bureau, the MSB has 88,995 residents, indicative of the continuing growth rate (Table 1). Rapid growth can often result in haphazard development and conflicting land uses. With proper management, environmental resources can be balanced with community development needs. The rapid growth is clearly depicted by comparing historical aerial photography of the Mat-Su to a modern image (Figure 1 and Figure 2).

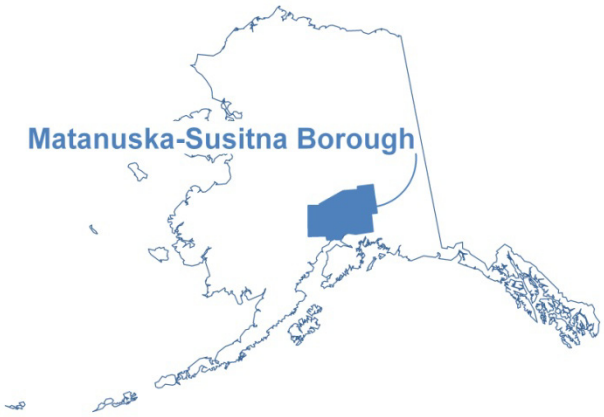


Table 1: MSB Population History, 1960–2010

Year	1960	1970	1980	1990	2000	2009*	2010
Population	5,188	6,509	17,816	39,683	59,322	84,314	88,995
Percent change from previous decade	--	25%	173%	122%	49%	42%	50%

Sources: U.S. Census Bureau 2010 data (http://live.laborstats.alaska.gov/cen/redistr.cfm). *Alaska Division of Community and Regional Affairs, Community Database (www.dced.state.ak.us/dca/commdb/CF_COMDB.htm).

The following two aerial images show the change in the Mat-Su Core Area between 1957 and 2004. The Matanuska River frames the right side of the images with Palmer adjacent to it on the left. Wasilla, along with the Parks Highway (only in the 2004 image because the highway did not exist prior to the 1960s), is located towards the middle-to-bottom left side of the image.

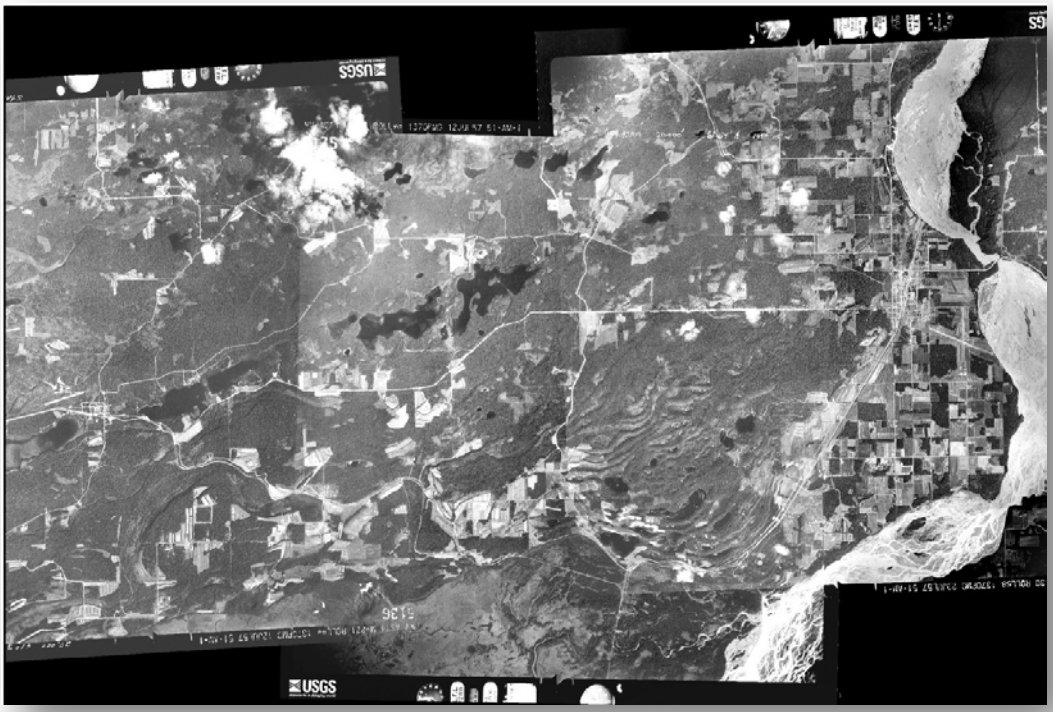


Figure 1: Mat-Su Core Area 1957 (USGS)

Figure 2: Mat-Su Core Area 2004 (NCRS)
Note the development north and south of the Parks Highway

1.4 Wetlands Planning Process

This plan was written under the guidance of a Wetlands Advisory Group (WAG) and is the product of public input and reviews. A public workshop and three WAG meetings were held from December 2010 through May 2011 in Wasilla. Agencies, groups, and individuals were provided with plan drafts in an effort to solicit comments. This final plan will be submitted to the MSB Planning Commission and Assembly for public hearings, review, and approval.

1.4.1 Wetlands Advisory Group

As part of the effort to prepare the MSB Wetlands Management Plan, a WAG was created to seek input from and provide feedback. Members represented a broad spectrum of interests, including land management agencies and other agencies, local government, real estate and development interests, non-profit organizations, and recreational interest groups.

These members were brought together because they share common interests related to wetlands and land management in the Mat-Su. In the early stages of this planning process, WAG members provided the planning team input on what they thought were important factors to include or consider in the MSB Wetlands Management Plan. Where feasible, these concepts and ideas have been incorporated into this plan.

Key ideas suggested by the WAG include:

- Education of the public, decision makers, property owners and developers of the functions and values of wetlands should be a key component of the plan
- Wetlands restoration and education are integral to each other; local student groups participate in stream restoration projects as part of a variety of salmon habitat projects
- The plan should be flexible because public needs are varied (e.g., certain communities, such as Willow, are very recreationally-minded and place a high value on trails) and it is important to manage wetland areas differently to reflect community values
- Foster working relationships with stakeholders
- Publish wetlands information
- Wetlands that have significant values, functions, and benefits should be identified and protected from development, though not all wetlands can or need to be protected
- Develop programs to implement protective measures
- Integrate consideration of wetland impacts into MSB decision-making
- Expand existing wetland studies and mapping

2 Background

2.1 Importance of Wetlands

Wetlands support economic activity within the Mat-Su including hunting, fishing, tourism, and other summer and winter outdoor recreation activities, all of which bring significant dollars to the local and regional economies. Wetlands are a key component of water management as they reduce public and private costs by reducing flooding and runoff; maintaining shallower well depths; enhancing water quality; and controlling erosion. Wetlands are critical to maintaining surface and ground water balance in the Mat-Su. Surface and groundwater levels are dependent on the water retention function provided by wetlands. Many individual and municipal water supplies within the Mat-Su are dependent on wetlands to replenish aquifers that supply well water. These benefits are among the many functions that wetlands provide Mat-Su residents and why wetlands are integral to the Mat-Su economic well being.

Wetlands provide important benefits to the human, biological, and physical environment by what are called functions and values. Wetland functions are defined as the chemical, physical, and biological processes or attributes that contribute to the self-maintenance of a wetland and relate to the ecological significance of wetland properties without regard to subjective human values (ASTM 1999). Wetland values are the benefits to humans that are derived from a wetland's features, processes, or setting. If something has "value" it is deemed worthwhile, beneficial, or desirable. Wetland values are not easily measured, and no specific method exists for assessing values (Adamus et al. 1987).

When wetlands lose a function such as fish or wildlife habitat, it may not be replaceable. The consequences to wetlands values can lead to negative impacts on local recreation, tourism, hunting, and fishing industries. Avoiding negative impacts to wetlands through careful planning and management is vital to maintaining their functions and values.

2.1.1 Human Actions That Impact Wetlands

Human alterations to wetlands often result in negative effects to the functions and values of wetlands. Developing in wetlands is also more expensive than developing on uplands. Examples of human actions that can impact wetlands include:

- Draining wetlands
- Dredging, channelizing, or diverting streams
- Placing fill in wetlands
- Building dikes, dams, or levees
- Allowing untreated stormwater runoff from impervious surfaces
- Discharging harmful chemicals or pollutants into wetlands
- Introducing non-native plant species
- Clearing or removing existing vegetation

Housing Located in Uplands (USACE)

Housing Located in Wetlands (USACE)

The house in the photo above was built on higher ground than the adjacent wetlands. Notice the different vegetation and tree species in the photo, which indicates the difference between the uplands and wetlands.

Wetlands are generally not suitable for development. In the picture to the left, this Mat-Su house built in a wetland sunk into the wet ground.

2.1.2 Definitions of Wetlands

2.1.2.1 Regulatory Definition

Earlier in this report wetlands were defined as the "link between land and water". Since wetlands provide valuable functions relative to maintaining clean water within the United States, activities such as placing fill or dredged material in jurisdictional wetlands are regulated under the Clean Water Act. The definition most critical to Mat-Su's residents, landowners, and developers, is the regulatory definition found in Section 404 of the Clean Water Act. The USACE has adopted a wetlands definition under Section 404 of the Clean Water Act to determine whether or not is has jurisdiction over fill activities within a wetland. The following definition is presently used by the USACE to regulate activities in wetlands:

> *Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas. (40 CFR 230.3 and 33 CFR 328.3)*

2.1.2.2 How Scientists Define or Identify Wetlands.

There are three primary features that are used to identify and classify wetlands. These include the type of soil, the hydrology, and the vegetation.

- **Soil type**: specific soils that develop under depleted oxygen conditions, known as hydric soils.
- **Hydrology**: surface water or soils saturated near the surface for at least part of the growing season.
- **Vegetation**: plants that have adapted to life in wet environments, known as hydrophytic vegetation.

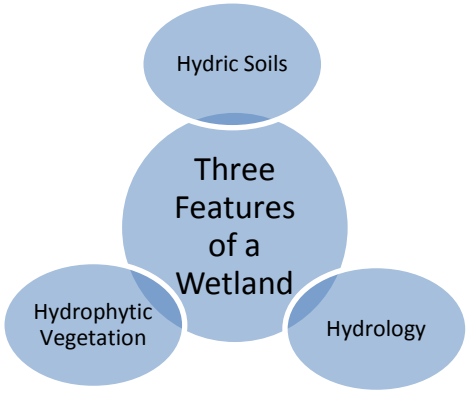


Figure 3: Three Wetland Features

2.1.3 Wetland Types

While all wetlands share the three features (hydric soils, hydrology characterized by saturation or inundation, and saturation-adapted vegetation), there are many different types of wetlands. Each wetland might have a variety of different functions and values.

2.1.3.1 U.S. Army Corps of Engineers Wetland Types

Historically, the USACE has recognized four general wetland types for the purposes of the USACE's national permitting program. These are based on the functionality of wetlands and help guide the USACE in issuing permits and establishing mitigation requirements (see Table 2). The USACE is reviewing this approach and may be altering its methodology in the future perhaps using a watershed focused approach. Even if its approach changes, the USACE will likely still make regulatory decisions based on whether the wetland is high functioning, degraded or some point in between. The different wetlands ecosystems are discussed later in this chapter.

Table 2: USACE Wetland Types	
Category I: High Functioning Wetlands	Category II: High to Moderate Functioning Wetlands
	
Category III: Moderate to Low Functioning Wetlands	Category IV: Degraded and Low Functioning Wetlands
	

2.1.3.2 Mat-Su Wetland Study

The MSB with funding assistance from the U.S. Fish and Wildlife Service (USFWS) and the USACE, hired a contractor to describe and map wetlands on a more relevant local scale, including field verification for the central region of the Mat-Su. This plan recognizes the rich diversity of wetland types found in the Mat-Su. As part of a concurrent and separate wetland mapping process, 11 major wetland types have been identified in the Mat-Su. Identifying wetlands based on their functions and values will lead to better land management and more informed land use decisions. Detailed descriptions with photos along with a link to the "Map of the Matanuska Susitna Valley Wetland Ecosystems" can be found in Appendix D. The 11 proposed Mat-Su specific wetland types are:

- Glacial Lakebed wetlands comprise large flats which are now filled with peat, but were once occupied by glacial lakes.
- Discharge Slope lie at the base of slopes where groundwater discharges at or near the surface. They are often forested, and, in contrast to most wetlands in the Mat-Su are not peatlands.
- Kettles are smaller peatlands formed when an underlying ice block melted out after the retreat of once extensive glaciers. They are connected by streams or other wetlands to Cook Inlet, or large lakes.

Discharge Slope Wetlands (M. Gracz)

- Depressions are similar to Kettles, but they are not connected by streams or other wetlands to Cook Inlet or large lakes.
- Spring Fens are like Depressions, except they occur where groundwater discharging from higher elevations supports wetlands in distinct landform positions that typically do not support wetlands.
- Headwater Fens are small peatlands, like Kettles, but they lie above treeline at the headwaters of small streams.
- Relict Drainageway wetlands are peatlands formed in valley features that once drained large glaciers. The modern features can either support small streams or be completely filled with peat.
- Ripple Trough Peatlands lie in the valleys of the Meadow and Beaver Lakes area. These valleys lie between a distinctive series of parallel hills which may have been formed in prehistoric times by the waters from a massive flood event. It is thought that the flood was generated when an ice dam holding back a gigantic lake failed at the top of Tahneta Pass, along the Glenn Hwy above Sheep Mtn.
- Riverine wetlands lie along rivers and streams.
- Tidal wetlands are influenced by the daily tidal cycle, and lie in the area affected by tidal flooding at least once per month.
- Tidal/Drainageway wetlands are also influenced by the tides, but only during the extreme tidal cycle. These wetlands are also fed by groundwater through the sediments underlying most of the valley, and river-water discharge through the sediments filling nearby glacial river valleys.

Kettle Wetlands (M. Gracz)

2.1.4 Functions of Wetlands

Historically, wetlands were deemed undesirable and were considered wastelands to be drained and filled. Science has long since demonstrated the value and importance of wetlands. Recent natural disasters in the Lower 48 including hurricanes and other major storm events have demonstrated the human and financial costs related to large scale destruction and development in wetlands. It is now recognized that wetlands provide abundant benefits, values, and functions not the least of which is their ability to absorb the impacts of storms and storm surges, and reduce the impacts of flooding.

Though wetlands perform a variety of functions, not all wetlands function equally and not all wetlands perform all functions. Factors affecting wetland function include location, size, vegetation diversity, hydrology, and disturbance level. Even though an individual wetland may not perform all wetland functions, the cumulative value of all wetlands in an entire watershed makes each important.

The following sections provide an overview of key functions the wetlands in the Mat-Su provide. The concurrent but separate MSB Wetland Functional Assessment, managed and funded by the USACE, describes these functions and values in greater detail. Appendix E of this report contains a summary of work to date on this Functional Assessment project.

USGS August 2006 Flooding Summary in the Matanuska-Susitna Borough, Alaska

Bill Roth/Anchorage Daily News. Willow Creek near Willow, AK

The flooding impacted 152 structures including dwellings and other buildings with an estimated $2.2-3 million in damages. Estimated costs of permanent repairs to Borough owned roads and bridges is $6 million with an additional $7.6 million needed for hazard mitigation. The Alaska Department of Transportation and Public Facilities (DOT&PF) spent an estimated $6 million on repairs to state owned roads and bridges in the first two weeks after the flood.

http://ak.water.usgs.gov/flood/2006August/index.php

Although MSB Wetland Functional Assessment currently identifies 12 wetland functions, this plan will focus on the following 6 functions:

- Flood control
- Water quality
- Groundwater recharge and discharge
- Erosion protection and shoreline stabilization
- Fish and wildlife habitat
- Recreation, education, cultural resources, and open space

Additionally, the economic functions and values of wetlands are repeatedly emphasized in this report.

2.1.4.1 Flood Control

Whether referred to as flood flow alteration, flood peak reduction, flood protection, or floodwater storage, wetlands help to regulate the flow of water. Although wetlands can not prevent major flood events they can serve to moderate impacts and they do serve to regulate stream flow during smaller, more common flood events. Wetlands often function like hydrologic sponges by slowing water or retaining it in underlying soils. Without wetlands, water would move much more quickly across the land and lead to flooding and erosion of valuable soil, stream banks, built structures, and fish habitat. By reducing the rate and amount of water entering into rivers or streams, wetlands lessen the destructiveness of flooding. Repair of flood damages is expensive, whereas wetland protection can be a relatively low-cost preventative measure.

According to the National Association of Counties an acre of wetlands can absorb 1.0 to 1.5 million gallons of flood water

Wetlands absorb stormwater, which slows runoff and reduces flooding. This function is particularly important in urban areas where there are large areas of impervious surface, such as parking lots, which can lead to more rapid runoff and high peak flows.

2.1.4.2 Water Quality

Wetlands help maintain water quality through filtration, purification, retention of sediment and toxic substances, and nutrient removal. Wetlands retain excess nutrients and filter sediments and other pollutants that may otherwise enter waterways. Examples of these pollutants include hydrocarbons, heavy metals, pesticides, and herbicides. Peatlands, a common Mat-Su wetland type, have a huge capacity to absorb sediments and pollutants. As water flows through wetlands, a large amount of suspended solids can be removed from the water.

Wetland vegetation also helps trap and filter suspended sediments. In urban and developing urban areas, trapping and retaining excess sediments, nutrients, and other pollutants is important, especially when a wetland is connected to groundwater or surface waterbodies important for fish habitat, clean drinking water, fishing, recreation, or other activities.

2.1.4.3 Groundwater Recharge and Discharge

Wetlands can function as both recharge and discharge areas for groundwater. Wetlands absorb and hold surface water and allow it to slowly move into the groundwater. The replenishing of groundwater is particularly important in the Mat-Su because most residents and municipalities depend on groundwater as a primary drinking source. This is especially the case in the Mat-Su Core Area, where wetlands help maintain the water quality and flow of a shallow, unconfined aquifer. Wetlands are generally not isolated pockets, but rather are outcroppings of the water table: the same water that is drawn upon for household use.

Figure 4: Wetland Diagram

This diagram depicts shallow groundwater flowing through relatively permeable sediments into and out of a wetland. Artwork by Conrad Field.

Many wetlands are created by groundwater discharge. Wetlands serve as the transition point between groundwater and surface water. The water exchange between groundwater aquifers and surface water provides a major pathway for the transfer of essential nutrients to plants. Discharged groundwater can serve as the primary source of water for wetlands, streams, lakes, and ponds. For example, wetlands can contribute to stream flow by allowing the groundwater to slowly be released into streams. This is an important function during dry periods of the year where the water levels of streams and water bodies may be low.

2.1.4.4 Erosion Protection and Shoreline Stabilization

Wetlands located along lakes, ponds, rivers, and streams help protect and stabilize the shoreline soils from erosion. Wetland plants can dissipate wave action and provide shoreline stability by binding the soil in place with their root systems. Wetland vegetation controls shoreline soil erosion adjacent to Mat-Su lakes, rivers and streams, and can collect soil that has eroded from upland areas preventing its entry into the waterbody.

Mat-Su Red Salmon Run
(C. Whittington-Evans)

2.1.4.5 Fish and Wildlife Habitat

Wetlands are among the most biologically productive habitats in the world, providing substantial biodiversity. Many fish and wildlife species rely on wetland habitat for a variety of reasons, including breeding, nesting, foraging, travel, and refuge. Wetlands are important transition areas between terrestrial and aquatic habitats and can support a great diversity of species. Moose and other wildlife feed and migrate through wetlands. Fish species rely on wetlands for food and protection from predators.

Wetlands also provide summer staging and breeding grounds for resident and migratory birds, including a variety of waterfowl and shorebird species.

2.1.4.6 Recreation, Education, Cultural Resources, and Open Space

Wetlands and areas adjacent to wetlands support a wide range of recreational activities including fishing, dog mushing, snow machining, hunting, hiking, canoeing and boating, skiing, and wildlife viewing.

These activities support our local economy and lifestyles. According to the MSB, resident Alaskans visit the Mat-Su an estimated 3 million times each year for recreational purposes.

As mentioned earlier, the sport fish industry is one of the key economic drivers in the Mat-Su. In addition to fishing, many residents and visitors hunt waterfowl and game species associated with wetlands further adding to the local economy. The quality of these experiences depends in a large measure on the health of the wetlands in the Mat-Su. In addition to these recreation opportunities, wetlands provide open space and educational and cultural resources opportunities.

Winter Biking Palmer Moose Range (P. Owens)

2.1.5 Values of Wetlands

Wetlands are one of the most valuable types of ecosystems. Because of the diversity of wetland types, their locations and sizes, and the varying functions they provide, measuring the benefits and values of a wetland can be difficult. The value of a wetland is generally based on its importance or worth to one or more of its functions to society.

According to the Matanuska-Susitna Borough Economic Development Strategic Plan *(2010), the following natural strengths of the MSB were identified: natural beauty (mountains, glaciers, rivers, etc.), outdoor recreation, hiking, snow machining, skiing, fishing (lake and river), hunting, and rafting.*

In terms of wetlands values, this plan primarily considers the values of wetlands to the economy, society, and the human environment. It is important to note that functions and values can be intertwined. For instance, flood control is a wetland function as well as a benefit to society and the economy because of the value it provides in preventing costly flood damages.

This plan describes the economic value of wetlands and as well as the six social values identified in the concurrent MSB Functional Assessment:

- Recreation
- Education
- Visual quality/aesthetics
- Culture/history
- Consumptive use
- Uniqueness

2.1.5.1 Economic

Wetlands provide economic value and benefits to the Mat-Su, its residents, and its businesses. Wetlands provide direct economic value in supporting commercial, sport, and personal use fishing; hunting; and, winter and summer outdoor activities. Millions of dollars are spent within the Mat-Su supporting these activities. For example, in 2007 there were 300,000 angler days in the Mat-Su resulting in $118.0 million dollars spent and $40.0 million in local Mat-Su income (Colt and Schwoerer 2009).

Salmon Fishing in the Mat-Su (H. McClausland)

Wetlands provide economic value by purifying water, reducing the impacts of stormwater runoff, controlling erosion, and slowing and absorbing flood waters. These economic benefits

are associated with avoiding the costs associated with not having a stormwater treatment facility, providing and maintaining erosion control, and avoiding flood damages.

2.1.5.2 Recreation

As cited earlier, wetlands are valued for providing recreation opportunities for activities including fishing, hunting, hiking, skiing, snow machining, canoeing, boating, and wildlife viewing. In this plan, while fishing and hunting are forms of recreation, they are also included under the Economic and Consumptive Use values.

Many of the recreational values of Mat-Su wetlands are associated with trail use. In the Mat-Su, trails are an important and abundant recreational and transportation resource. Trails in the Mat-Su can be used for snow machining, ATV use, dog mushing, skiing, skijoring, hiking, biking, and more. Winter trails are often routed through wetlands that have open areas with low-growing vegetation.

Other recreational values associated with wetlands and related waterbodies (e.g., lakes, rivers) include water sports such as water skiing, kayaking, swimming, boating or canoeing during the summer. In the winter, in addition to skiing, people skate, snow machine, and bike on frozen lakes and rivers. Several dozen lakes in the Mat-Su have individual lake management plans that have been adopted by the MSB Assembly, demonstrating the importance and value of Mat-Su lakes.

Field Education (F. Barker)

Bird and wildlife viewing are important forms of recreation in the Mat-Su and our wetlands provide valuable viewing locations. Indicating the importance of this activity, the *MSB Comprehensive Development Plan 2005 Update* (MSB 2005) contains a policy "to preserve opportunities for people to observe and enjoy wildlife and wildlife habitats" (Policy PO2-2).

2.1.5.3 Education

Under this value, the plan recognizes the public's use of wetlands for educational activities. Wetlands serve as outdoor classrooms, providing opportunities for children and the public to learn about science and nature. For example, the Palmer Hay Flats State Game Refuge provides opportunities for children and the public to learn about wetlands and other environmental resources. The refuge provides an outdoor classroom where the local non-profit group Alaskans for Palmer Hay Flats sponsors education programs where people can learn about fish and wildlife, biology, wetlands, Native history and culture, colony settlement history in the Mat-Su, and gain a greater awareness and respect for public lands.

2.1.5.4 Visual Quality/Aesthetics

Wetlands are dynamic and beautiful natural environments due to the richness and species diversity of the plant and animal communities found in them. The beauty of these natural areas

attracts both residents and visitors to the Mat-Su. Wetlands provide great locations for bird watching and wildlife viewing. Wetlands also afford mountain views for homeowners and people driving for pleasure along the many Mat-Su's national and state scenic byways. The value of neighboring properties may be enhanced due to the visual and aesthetic quality of the nearby wetlands.

2.1.5.5 Culture/ History

For a variety of reasons, wetlands have played an important role in shaping our society. Throughout history, humans have gathered around wetlands and associated watercourses because these ecosystems provide food, fresh water, and a source of transportation.

The Mat-Su has a rich history in prehistoric artifacts, Native culture, homesteading, mining, and trapping. Historic trails crisscross the Mat-Su and many pass through wetlands areas. The Iditarod National Historic Trail in the Mat-Su passes through many wetlands areas, and hundreds of miles of trails branch from this main trail.

Mushing through Mat-Su Wetlands (MSB)

2.1.5.6 Consumptive Use

Human consumptive use of plants, fish and wildlife and other resources found in wetlands is of great value to the residents of the Mat-Su. In a real sense, the consumptive use of wild plants, fish, and wildlife supplements an individual's income by saving money that would have otherwise been spent on store-bought food items. In the Mat-Su, popular consumptive uses that occur in or are supported by wetlands include berry picking, mushroom harvesting, sport or recreational fishing, personal use dip net fishing, wildlife and waterfowl hunting, and trapping. Sport and recreational fishing are extremely important consumptive uses in the Mat-Su and are important economic industries. According to Osland and Ivey, 2010, Recreation Fisheries of Northern Cook Inlet, "The public expends about 300,000 angler days annually fishing in the Mat-Su area primarily for Chinook and coho salmon. Over 80 lakes and three salmon fisheries are stocked by the Alaska Department of Fish and Game (ADF&G). Stock fisheries provide additional fishing opportunity and divert angling pressure from wild stocks."

Hunting and trapping are also of particular value to the Mat-Su because of their role in the economy. The sale of hunting licenses along with money spent on travel, lodging, guide services, equipment, and supplies associated with these activities have direct economic benefits to the Mat-Su. Visitors come to the Mat-Su due to its convenience compared to flying to other parts of the state to participate in these activities. Mat-Su wetlands also support commercial and personal use fisheries in Cook Inlet.

2.1.5.7 Uniqueness

This value describes wetlands or associated waterbodies that have unique attributes that cannot be found elsewhere. Uniqueness is defined as being "worthy of being considered in a class by itself, extraordinary." Applied to wetlands in the Mat-Su, this would mean that a particular wetland is unique if it is different from other wetlands in the area. A wetland can be unique by providing biological, geological, or other features that are rare. It can be unique because it is performing a function that other nearby wetlands to do not perform. A wetland may also be unique in that it may be the only open space afforded to a nearby community or residential area.

Wetlands provide services, also referred to as ecosystem services

*"**Ecosystem services**" is a newer term that combines the ideas of functions and values describe above. The term came out of an effort sponsored by the United Nations within the last decade called the Millennium Ecosystem Assessment. The assessment looked at the conditions and trends of the world's ecosystems and identified about two dozen ecosystem services. These "ecosystem services" are similar to some of the functions and values identified in this planning document. Some of the identified ecosystem services include:*

- *"Provision services" such as providing food, fresh water, fuel, and fiber*
- *"Regulating services" such as climate, water, and pollination*
- *"Supporting services" such as soil formation and nutrient cycling*
- *"Cultural services" such as education, aesthetics, cultural, tourism, and recreation*

2.2 Regulation of Wetlands

The most important federal regulatory program affecting wetlands is Section 404 of the Clean Water Act. Section 404 of the Clean Water Act establishes a program that regulates the discharge of dredged and/or fill material into waters of the U.S., including wetlands. The USACE has the primary responsibility over this program and jointly administers the program with the Environmental Protection Agency (EPA). These agencies are responsible for developing environmental criteria that are used to evaluate proposed discharges into waters of the U.S. Other federal agencies, such as the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS), have advisory roles.

Section 404 of the Clean Water Act only protects wetlands from negative impacts associated with the disposal of dredged and/or fill materials into wetlands.

2.2.1 Jurisdictional wetlands

Wetland protection is normally accomplished through the regulation of jurisdictional wetlands. A jurisdictional wetland is a wetland that a government agency has jurisdiction or regulatory authority over. Not all wetlands are jurisdictional. The USACE determines whether it has jurisdiction over wetlands by determining their connection to navigable waters. If a wetland is jurisdictional, most activities involving the discharge of dredged or fill material into it must first be approved by the USACE.

> ***Navigable Waters***
>
> *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. 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. 33CFR Part 329*

The permitting process consists of three important ordered steps:

1. Avoidance: can the project be accomplished without filling a wetland.
2. Minimization: can the project be reasonably accomplished using less fill.
3. Mitigation: If fill can not be avoided, mitigation requires that wetlands be replaced by creating new wetlands or be compensated financially such as purchasing wetlands from a wetlands bank.

One way to avoid and minimize negative impacts to wetlands is by following Best Management Practices (BMPs). A variety of BMPs are contained in Appendix A.

2.2.2 Wetland Permits

The USACE issues two major types of Section 404 permits: Individual and General.

1. An Individual Permit is required for a specific fill activity by an individual, firm or government agency. A public notice is required during review of an individual permit application. In some cases, there is an opportunity for a public hearing to review the proposed activity depending on the complexity of the project and the level of public concern.
2. General Permits are either nationwide or regional in coverage and allow certain routine activities without requiring a public review, or in many cases, an application process.

2.2.3 MSB Wetlands-Related Ordinances

The MSB Assembly passed several ordinances related to wetlands conservation and protection:

- MSB 17.29 Flood Damage Prevention recognizes costly nature of flooding in the Mat-Su and indentifies methods to reduce losses and damages resulting from flooding.

17.29.030 (3), Methods of Reducing Flood Losses, specifically recognizes that "controlling the alteration of natural flood plains, stream channels, and natural protective barriers, which help accommodate or channel flood waters;" as an appropriate measure to reduce flood damage. Wetlands are considered natural protective barriers.

- MSB 17.55.020 established a mandatory 75-foot setback for habitable structures from the shorelines of waterbodies within the Borough.
- MSB Ordinance 05-023 called for adopting voluntary BMPs for development around waterbodies. These voluntary measures can help property owners protect the quality of lakes, streams, and wetlands.
- MSB 05-041 accepted the final report regarding the Su-Knik Wetlands Mitigation Bank. This ordinance established a new section in code creating a wetland mitigation bank and defining its purposes and operation. It authorized the MSB manager to create private conservation easements for wetlands mitigation banking.
- MSB Ordinance 05-042 amended the classification of watershed lands (MSB 23.05.100[A][15]) and adopted a new land classification of wetland bank land (MSB 23.05.100(A)(17).
- MSB 05-043 classified certain MSB-owned land as wetland bank property or agricultural lands to facilitate the creation of the Su-Knik Wetlands Mitigation Bank and to reserve MSB owned lands for agriculture.

Statewide Wetlands Comprehensive Planning in Alaska

In the late 1980s, at the request of the U.S. Environmental Protection Agency, the Conservation Foundation convened a group called the National Wetlands Policy Forum.

The byproduct of this Forum was the agreement that comprehensive statewide strategies were the best way to implement the no net loss policy. Some funding was made available for writing the statewide wetlands comprehensive plans. At this time, Alaska does not have a statewide wetlands management plan.

2.3 Relationship to Other MSB-Related Wetland Projects and Plans

The MSB has undertaken a number of planning efforts in recent years that address aspects of wetlands planning and management. The MSB produced the *MSB Comprehensive Development Plan 2005 Update* and over the last decade, produced other MSB community comprehensive plans and Borough-wide planning documents related to economic development, emergency services, and land management. This wetlands management plan document is a supplement to these documents and efforts.

Table 3: Chronology of Recent MSB Wetlands Projects	
2005	EPA provides grant to prepare a Big Lake Watershed Atlas
2007	USFWS provides grant for wetland mapping for the Wasilla and Cottonwood Creek watersheds
2007	MSB Wetlands Technical Committee established
2008—2011	USACE provides funding to continue MSB Wetland Mapping of "Greater Core Area"
2009	EPA provides Wetlands Development grant for Wetlands Management Plan
2010	USACE provides funding for MSB Functional Assessment of Wetlands effort
2010	Su-Knik Wetlands Mitigation Bank is certified
2010	*MSB Natural Resources Management Unit Plan*

2.3.1 MSB Wetlands Planning Context

The *MSB Comprehensive Development Plan 2005 Update* provides context and intent for managing Mat-Su's wetlands. It states that the natural environment, including wetland areas, provides many valuable amenities such as scenic landscape, community identity, and open space. The *Comprehensive Plan Update* recommends a number of goals and policies supporting wetlands management. A few of these are extracted below:

- Policy PO2-1 recommends the MSB to "work cooperatively with numerous resource management agencies, community councils, and citizens to care for lakes, wetlands, streams, rivers, and wildlife habitat and corridors while providing public access for recreational opportunities that have minimal impacts to such areas."
- Goal CQ-2 states that the MSB should "manage the natural and built environments to achieve minimal loss of the functions and values of all drainage basins; and, where possible, enhance and restore functions, values, and features. Retain lakes, ponds, wetlands, streams, and rivers and their corridors substantially in their natural condition."
- In support of Goal CQ-2, Policy CQ2-4 recommends the MSB to "develop a wetland banking and land trust program to provide property owners and developers alternatives when considering development strategies on environmentally sensitive lands."

MSB Code Title 27 Platting Regulations addresses wetlands under two sections:

- Title 27.15.050(A)(1)(d) Preliminary Plat Submittal states that a preliminary plat application needs to provide topographic information within a minimum of 100 feet of the proposed subdivision boundaries including the location of water bodies, proposed or existing watercourses, identified wetlands and probable wetland areas, erosion hazard areas, drainage courses, including the location of flood hazard areas, water body and

wetland crossings, and the location and nature of known areas susceptible to landslide, mud and earth flow, talus development, soil creep, solifluction or rock glaciation, avalanche chutes, and run-outs.

- Title 27.15.050(D)(1) Drainage management states: Permanent drainage management and erosion control systems shall be designed for all land within a proposed subdivision (as per the MSB Subdivision Construction Manual) and installed prior to recording. The applicant shall provide proposed mitigation measures for runoff around wetlands, watercourses, and water bodies, where such wetlands, watercourses, or water bodies exist. The drainage area shall be delineated on the preliminary plat.

The *MSB Economic Development Strategic Plan (2010)* is another plan that identifies other wetland-related goals, strategies, and actions. In this plan, Action 5E.3 recommends the protection and promotion of "Mat-Su Borough's green spaces and natural amenities." This plan cites Mat-Su business owners and professionals as concurring with the desire to preserve green space and protect the area's natural amenities. In support of this identified action, the plan recognizes that this desire is a "strong value held within the Mat-Su and it makes economic development sense."

The *MSB Natural Resources Management Unit Plan* was developed by the Land Management Section to provide management guidance for MSB owned properties. This plan recognizes that protection of water quality and quantity, watersheds, important riparian areas and critical wetlands is one, if not the most important goal, when managing public land.

A number of other MSB planning documents, such as the community comprehensive plans, support retaining these natural landscapes (see the MSB's website for a complete listing of these plans: www.matsugov.us/planning/borough-plans/comprehensive-plans).

- The *Big Lake Comprehensive Plan (2009*) states that that residents value the Big Lake natural environment for its natural beauty, dark night skies, and natural quiet and that retaining the landscape to reflect the natural beauty of the land, minimizing light pollution, and noise pollution is a public priority.
- The *Meadow Lakes Comprehensive Plan Update (2005)* states that public open space, waterways, and trails are important and the "natural feel" of the community should be retained. These natural landscapes include forests, wetlands, streams, wildlife, and views.

Other MSB area planning documents mirror these statements.

2.3.2 Wetlands Management Planning: Identify, Assess, and Protect.

The MSB Wetlands Management Plan is intended to pull these efforts together in preparation for looking at long-term wetlands management in the Mat-Su. This plan ties together the elements of a larger effort in the Mat-Su to **identify**, **assess**, and **protect** wetlands.

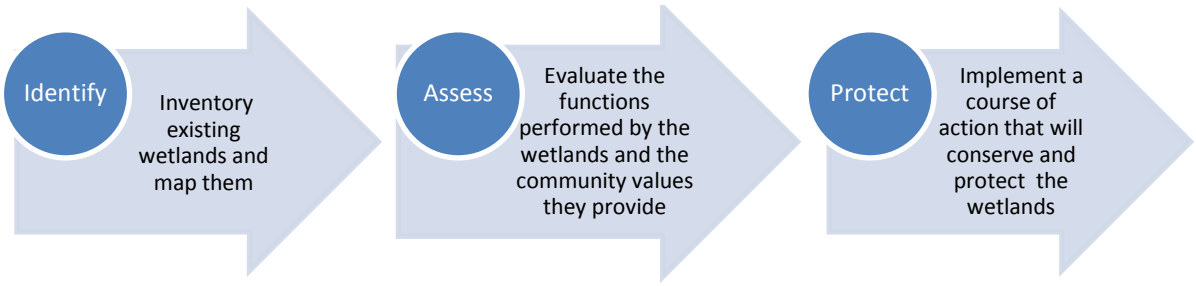
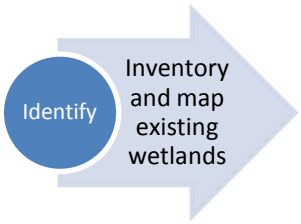


Figure 5: Goals of Existing Wetlands Protection Efforts in the MSB

Having information on wetlands types, sizes, locations, functions, and values allows for informed decision-making. With baseline information, development can be integrated with wetland conservation and protection.



Step 1: Identify, inventory, and map existing wetlands. Wetland mapping entails inventorying existing wetlands at a scale appropriate for planning level assessments. Wetland mapping includes determining the size, boundary, and type of the wetland, though additional detailed mapping would be need to address jurisdictional issues.

In 2007, the MSB began a borough-wide effort to collect data related to wetland functions and to delineate wetland boundaries with grant funding from USFWS.

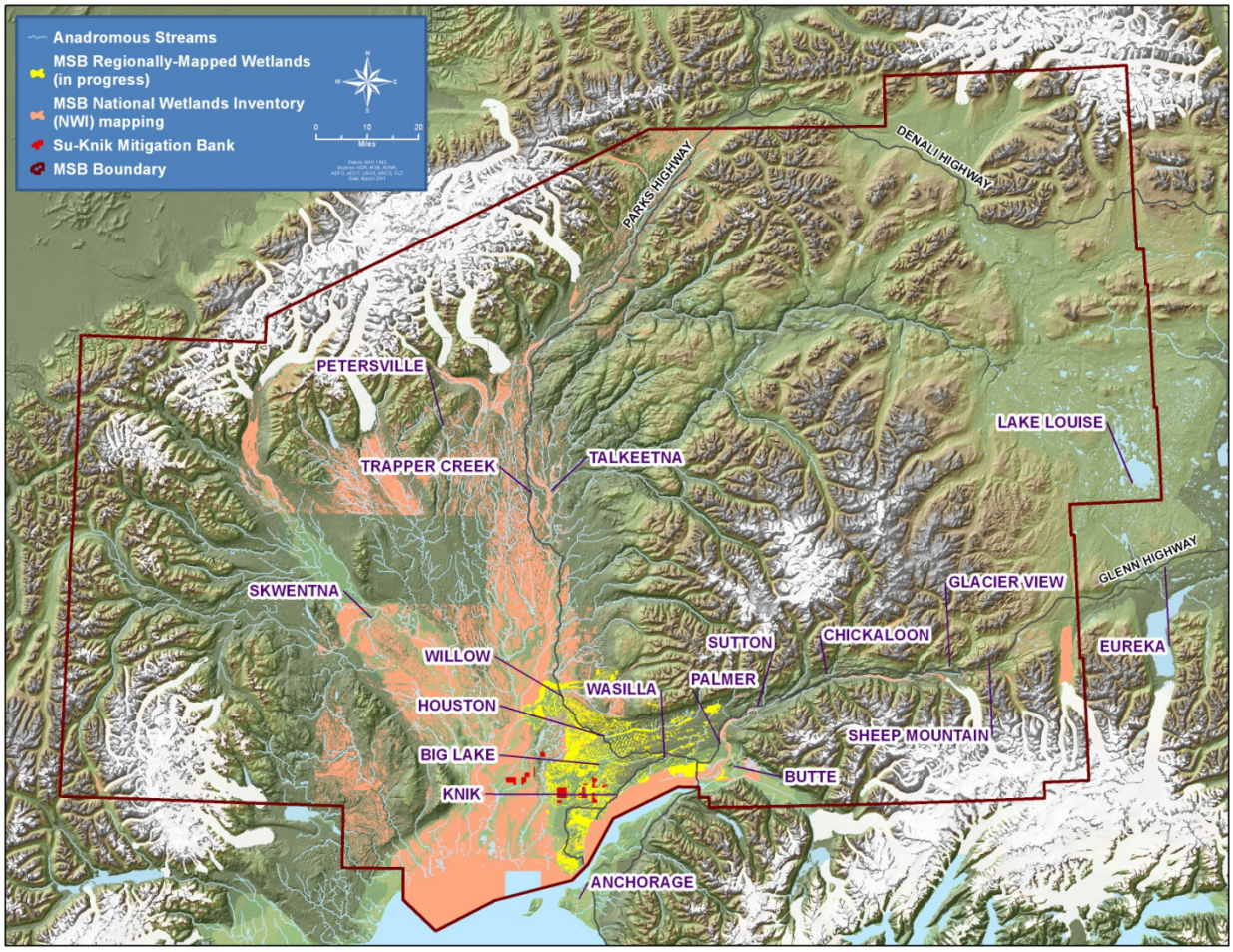


Figure 6: MSB Regionally Mapped and NWI Mapped Wetlands

National Wetlands Inventory: The MSB wetlands mapping effort is intended to supplement the existing National Wetlands Inventory (NWI) mapping. The USFWS began the NWI program in the 1970s to identify and map all wetlands in the United States. NWI mapping, particularly in Alaska, has limited detail and accuracy. In Figure 6, the NWI mapping is shown in orange. Much of Alaska has not been mapped for inclusion in the NWI due to the vast size of the state and the limited availability of detailed aerial photography required for this mapping effort. The available NWI mapping is not detailed enough for determining project-specific impacts. NWI mapping may misrepresent what is actually on the ground. NWI mapping should be used only at a planning level.

MSB Regional Mapping: The USACE has funded additional mapping from 2008 to present. The yellow areas on the figure show the wetlands mapped during this ongoing effort. The mapping effort initially focused on the greater Core Area of the Mat-Su, stretching from Palmer to Big Lake. As of 2011, more than 456,000 acres of the Mat-Su have been mapped using a variety of wetlands mapping tools, including stereoscopic photography, soils and geologic maps, and site visits involving sediment coring, water chemistry sampling, and vegetation descriptions. At the date of publication of this plan, Borough-wide wetland mapping is still ongoing.

NWI or MSB wetland maps are for planning purposes only and do not represent exact jurisdictional wetlands and do not replace the need for onsite delineation.

Wetlands mapping allows managers to track total wetland area over time, determine the best areas to develop, and avoid critical wetland areas. While the current MSB mapping effort serves as an update to, and is more detailed than, the previous NWI mapping, the MSB regional-wide mapping is intended for land use planning purposes. The accuracy of the MSB regional-wide mapping is much better than the earlier NWI mapping, but for projects requiring a Section 404 permit, a site visit and wetlands delineation may be required (Figure 7). During a site visit, a wetlands professional will examine the soils, document parcel-specific hydrology, inventory vegetation, and precisely mark the wetland boundaries.

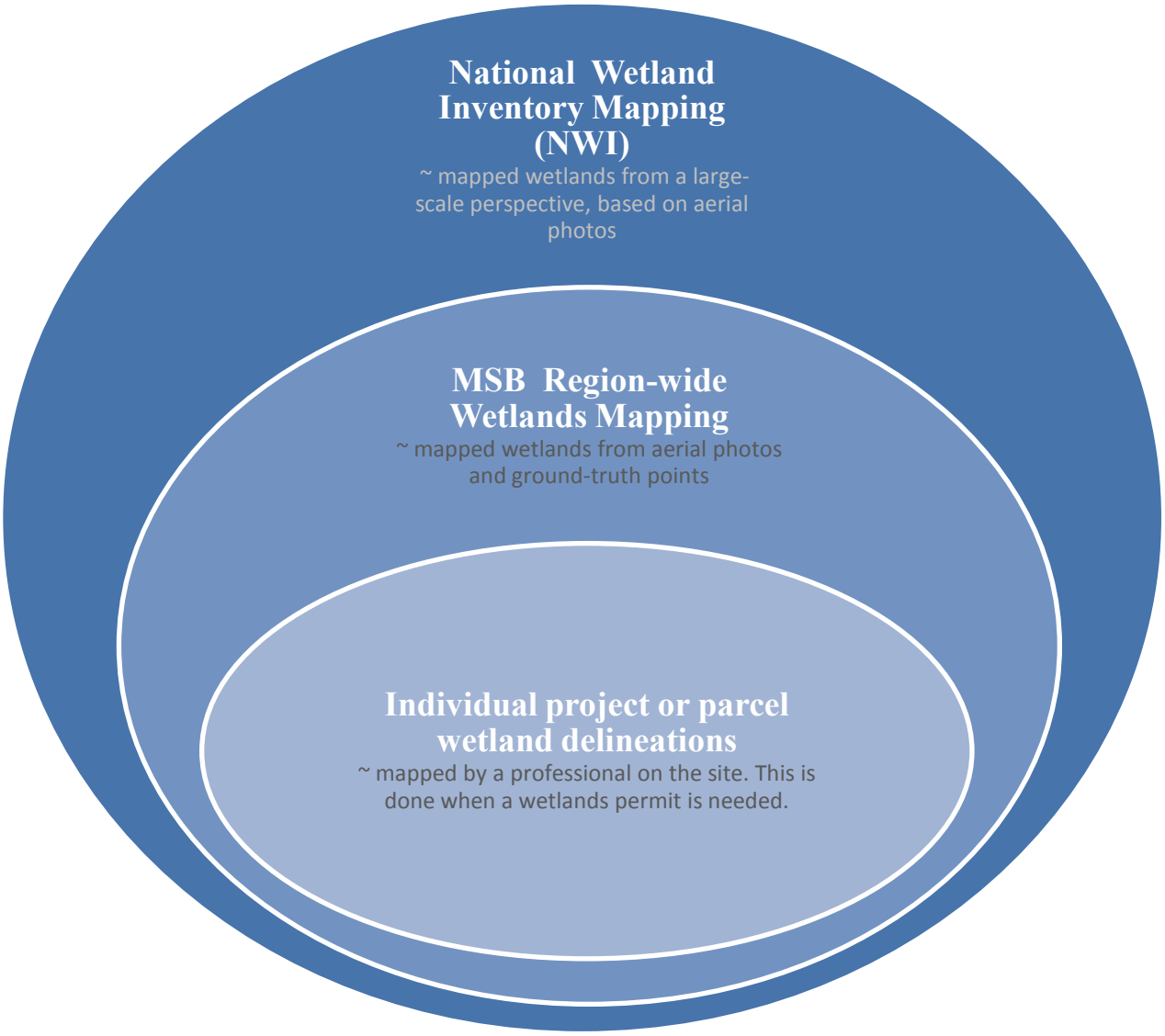
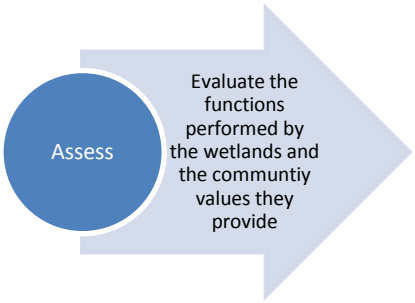
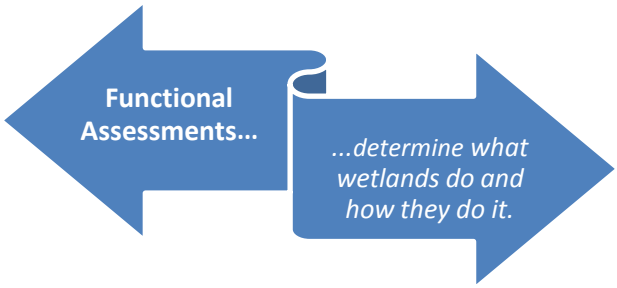


Figure 7: Levels of Detail of Wetland Mapping



Step 2: Assess and evaluate the functions and values performed by wetlands. The MSB is currently conducting a detailed assessment of the Mat-Su wetlands functions and values based on the proposed new classification and mapping. The project began in 2007 and is currently ongoing (as of the date of this plan). The USACE is a key partner along with several other resource agencies that have formed a technical working committee. This work will provide a tool for assessing Mat-Su wetland functions.

As part of the effort, a functional assessment methodology will be developed with the technical committee. The protocol will rate wetlands according to their principal function and apply this rating to mapped wetlands.



Step 3: Implement a course of action to conserve, protect, and minimize the alterations to existing wetlands. This plan will be used as a framework to conserve and protect existing wetlands. As part of this plan, the Wetlands Advisory Group (WAG) was established to integrate agency and non-agency input in the planning process. The MSB looked to the WAG to integrate the best professional judgment of the experts with the desires and values of the community members.

Implementing conservation and protection efforts include avoiding, minimizing or compensating impacts onsite, participating in an in-lieu fee program, and creating wetland banks. These are described below in greater detail. Lastly, a full listing of available mitigation ideas to protect wetlands is available from the USACE.

Avoid, Minimize, or Compensate impacts onsite: On April 10, 2008, the USACE and the EPA published a rule addressing the sequence for mitigating impacts to aquatic resources that result from work authorized by permit under the USACE regulatory program. Avoidance and minimization have always been part of the permitting process since its inception. The addition of requiring compensatory mitigation is new. Essentially, the mitigation sequence is first to **avoid** impacts onsite, then **minimize** the impacts onsite, and lastly **compensate** for those remaining impacts. Examples of compensatory mitigation options include in-lie fee mitigation and contributing to wetland banks, as described below.

- **In-lieu fee program**: An in-lieu fee program involves the restoration, establishment, enhancement, and/or preservation of aquatic resources through funds being paid to a governmental or non-profit conservation lands management organization to satisfy compensatory mitigation requirements for USACE wetlands permits. The Great Land Trust is an example of such an organization that receives in-lieu fees to preserve land and waterways in South-central Alaska under an agreement with the USACE.
- **Wetland banking**: Wetland mitigation banks provide mitigation opportunities for developers when compensatory mitigation is required for unavoidable impacts to wetlands. In 2010, the Su-Knik Mitigation Bank was established in the Mat-Su, through a partnership with the MSB; Sustainable Environments, LLC; and the Great Land Trust.

The preservation bank consists of 12,700 acres, which contains undisturbed wetland complexes that are owned by the MSB. The wetlands bank is made up of three different groups of lands within the Big Lake/Fish Creek, Lower Susitna, and Little Susitna watersheds. The Su-Knik Bank and its operation were established in MSB code (23.05.075). More details are available at www.su-knikmitigationbank.com.

The benefits of a wetland bank are twofold. First, the bank will protect and preserve the wetlands held by the bank. Secondly, the preserved land will offer landowners and developers an opportunity to purchase mitigation credits (banked wetlands), which will remain undeveloped, as compensatory mitigation for wetlands that will be developed within the permitting process. Identifying existing wetland issues and potential threats to wetlands in the Mat-Su helps us to shape the strategies that can be pursued and implemented to protect wetlands functions and prevent wetland impacts and losses in the future.

2.4 Wetland Issues

Like many communities, the Mat-Su faces many issues surrounding wetlands. Unlike most communities, the MSB has the ability to proactively address these issues since most Mat-Su wetlands and watersheds are viable and not impaired. To properly manage Mat-Su wetlands, this

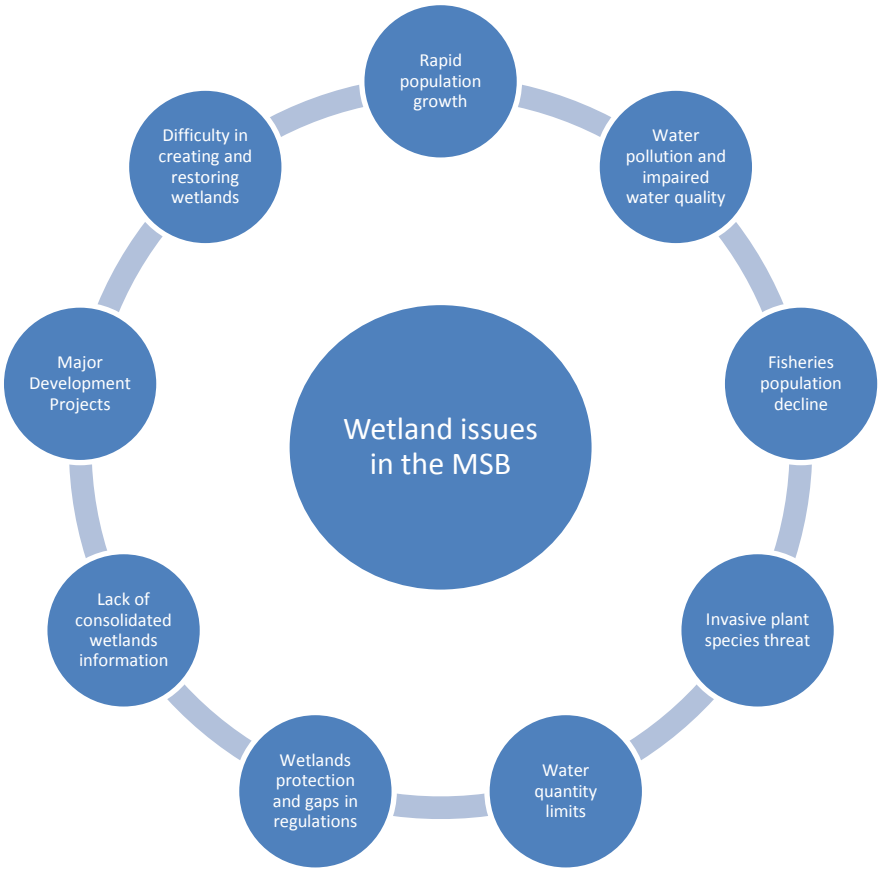


Figure 8: Issues that Impact Wetlands in the MSB

plan identifies nine issues to address (Figure 8). These nine issues are either existing issues or issues to proactively address before they occur.

Issue 1: Lack of consolidated wetlands information. This plan informs the public of the importance of wetlands, particularly wetlands in the Mat-Su. Another element of the plan is to direct the public, developers, and other interested stakeholders to existing and available information. A significant amount of information is already available, though it sometimes can be confusing or difficult to find. The coordination of different wetland management efforts and consolidation of existing information sources will make this information more accessible and easier to find.

Issue 2: Rapid population growth. Earlier in this plan, it was described how the Mat-Su has been one of the State's fastest growing regions. However, there are currently limited zoning and land use regulations in the MSB to guide the density and location of development. Lake shore, riverside, and other waterfront properties are highly valued and are often the first areas to be developed. An unknown acreage of wetlands has been drained and filled as the Mat-Su has grown over the last century. Implementing reasonable land use practices, regulations, and incentives should lead to informed decisions and designs that integrate wetlands into developments, resulting in minimizing costly wetland impacts.

Issue 3: Water pollution and impaired water quality. The Alaska Department of Environmental Conservation (ADEC) regulates water quality in major water bodies throughout the state and identifies water bodies that are not meeting surface water quality standards (18 AAC.70). A technical science advisory committee for the MSB convened in 2006 to discuss water quality issues. At that time, the group found that the ADEC listed four water bodies located in the Mat-Su as impaired, including Lake Lucille, Cottonwood Creek, Matanuska River, and Big Lake. Taking measures to conserve and protect wetlands will help address water quality issues in the Mat-Su and may prevent other waterbodies from becoming impaired. As lands are developed, wetland and riparian vegetation are cleared and converted to nonporous impervious surfaces which increase surface runoff and water pollution. Nationwide, stormwater discharges are one of the greatest causes of surface water quality impairment.

Issue 4: Fisheries population decline. The ADF&G is concerned that declining water quality in the Mat-Su may be negatively affecting fish stocks. Areas where fish stocks have declined include Big Lake and Cottonwood Creek which are ADEC Impaired Water Bodies. Fish populations can be negatively impacted by many factors in addition to water quality; for instance, undersized or damaged culverts often block fish passage, the damage of flooding and erosion often increases with the loss of riparian wetlands, and many other negative impacts to fish habitat occur by the loss of wetlands that at one time filtered water, buffered stream flow, limited sedimentation, and slowed runoff.

The most highly developed watersheds are seeing problems due to removal of riverine habitat and damage to wetlands on private property. Small modifications of habitat by individual landowners may ultimately lead to large-scale changes to fish habitat when multiplied throughout an area.

It should be noted that the habitat for the invasive Northern pike is integral with some wetlands. The unintentional facilitation of Northern pike introduction should be considered whenever wetlands are altered or developed. Northern pike have contributed significantly to the decline in

sockeye salmon in many Mat-Su lakes as well Chinook salmon in many Susitna Valley drainages.

Issue 5: Invasive plant species threat. Invasive plant species can cause a host of problems in wetland areas. Invasive species can drive out native plants that control runoff and cleanse water. They can cause fish passage issues and hinder access to streams for recreation. While this may not be a readily identified issue in the Mat-Su yet, Southcentral Alaska and especially Anchorage, non-native invasive plant species have begun to displace native vegetation. Preventing the spread of invasive plant species before they become widespread is one way to protect wetlands.

Issue 6: Water quantity limits. As development continues, the demands for groundwater and surface water will increase. In the Mat-Su, many wetlands and other surface water sources are linked to groundwater inputs. Groundwater resources face the potential to become contaminated over time or to be drawn down into less potable water. Surface water flows may be reduced by groundwater withdrawals and over-allocation of surface water rights. This may result in loss of aquatic habitat, loss of winter rearing habitat, and other water quality issues. Undisturbed wetlands are critical to maintaining water supplies, balances, and quality.

Issue 7: Major Development Projects. There are many public and private development projects proposed for construction in the next several years within the Mat-Su, making it more important to have proper wetland management practices in place. These projects include the Knik Arm Crossing, the continued development of Port MacKenzie, the Port MacKenzie Rail Extension, new highway corridors, mining developments, large commercial developments, and major residential subdivisions. These development projects may require filling or otherwise damaging wetlands. It will be important to ensure that these developments minimize their impacts through avoidance, mitigation, and/or compensation. Port MacKenzie, for example, is proposing to establish a wetlands bank within the Port District to mitigate wetland impacts. Highway, railroad, commercial development, and resource development activities should be planned or designed to minimize the impacts to wetlands if the wetlands can not be avoided. Commercial developments should incorporate wetlands conservation into their designs to avoid impacts which may lead to expensive mitigation costs.

Issue 8: Difficulty Creating and Restoring Wetlands. Creating and restoring wetlands are both difficult and expensive. Attempts have been met with marginal success in the Lower 48 States and in Alaska. Maintaining current wetland functions will be less expensive than fixing a degraded system by trying to it just as maintaining a sound vehicle is cheaper than allowing it to fall into disrepair. Conserving and protecting Mat-Su wetlands should be the primary method of addressing wetland issues within the Borough.

Issue 9: Wetlands Protection Gaps in Regulations.

In 1972 the Clean Water Act began to regulate activities involving the placement of fill into wetlands. The regulations encouraged states and municipalities to promulgate their own regulations, and this has occurred to a greater or lesser extent in some states. Twenty three states having wetland permitting programs and many local governments have ordinances regulating activities in wetlands. Alaska, however, has no statewide program regulating activities in wetlands, largely because most of the wetlands in Alaska are in relatively pristine condition. However, many wetland areas are beginning to degrade, especially in watersheds along densely

populated areas of the road system. The recognition that this degradation is beginning, along with the knowledge that maintenance is more effective than restoration has led areas such as the Mat-Su to begin to investigate wetland management.

Some non-jurisdictional wetlands that are important to Mat-Su residents, such as the Spring Fen wetlands which are important for wellhead protection between Palmer and Houston, are not currently protected under any Federal, State, or Local regulations. If the residents of the Mat-Su want their shallow groundwater quality maintained, they will need to develop some level of protections.

The reality of water quality and wetlands protection is different than that envisioned in the Clean Water Act. Currently there are no state wetlands regulations that apply to the Mat-Su and local conservation and protection practices and regulations are limited in scope. The lack of state regulations combined with the broad scope of federal regulations make the need for local conservation and protection efforts all the more important.

The watershed mapping project and the mitigation banking effort (Su-Knik Mitigation Bank) undertaken by the MSB represent the first steps towards local conservation and protection of wetlands. In addition, wetlands conservation and protection through local voluntary practices, regulation, education, acquisition, and other strategies will aid to conserve and protect wetlands from potentially being negatively impacted by development activities.

Addressing wetlands issues locally will help ensure that the Mat-Su continues to enjoy the benefits of their wetlands and the economic, lifestyle, and recreation benefits they provide.

Sand Hill Crane, Palmer Hay Flats State Game Refuge (K. Abshire)

3 Plan Goals, and Actions

The MSB Wetlands Management Plan identified five focus areas that have a number of associated goals and recommended actions. The focus areas outlined in this plan are: coordination; education; conservation and protection; science and research; and, implementation and evaluation. During the development of this plan, the WAG emphasized the importance of keeping the public and other relevant stakeholders informed. Implementing these goals and actions is the responsibility of not only the MSB officials but its residents, businesses, developers, local city governments, conservation groups, non-profits, trail groups, and state and federal agencies. Wetlands protection in the Mat-Su needs to be a collaborative and coordinated approach with all partners doing their part to implement elements of this plan.

3.1 Coordination

The large volume of existing wetland information may be difficult to locate and thoroughly examine. Coordination of existing efforts and better access to published materials will improve wetlands management. Establishing an interagency working group and pursuing partnerships with other stakeholders will improve the effectiveness of each group and make existing resources easier to access.

3.1.1 Goal 1: Promote interagency partnerships and coordination of wetlands management by discussion, information exchange, cooperation, and sharing of resources

Action C-1A: Establish a Mat-Su wetlands partnership, using the WAG as the basis, which includes residents, developers, business interests, trail users, fishing and hunting groups, non-profit conservation and land trust organizations, local governments, the MSB, ADF&G, Alaska Department of Natural Resources (DNR),USACE, EPA, USFWS, U.S. Geological Survey (USGS), and the Natural Resources Conservation Service (NRCS).

Action C-1B: Identify, pursue, and leverage the resources from partners for education and outreach efforts.

Action C-1C: Promote coordination between MSB staff and agencies for better cross-communication and sharing of in-house materials for evaluation of development projects.

3.1.2 Goal 2: Foster partnerships between public and private sectors

Action C-2A: Work with NRCS, USFWS,[1] University of Alaska Fairbanks Experiment Farm in Palmer, Cooperative Extension Service (CES), Soil and Water Conservation Districts, Plant Materials Center, Master Gardeners, and other public and private groups to make native plant materials available for use in restoring and

[1] The USFWS is currently funding a three-year effort with the Plant Material Center in Palmer to make more native and MSB-specific plants available for revegetation work in riparian areas.

enhancing wetlands. Develop programs with community groups associated with this effort.

Action C-2B: Use existing landowner networks, professional organizations, and community councils to disseminate information and provide technical assistance.

3.2 Education

Education is a positive, non-regulatory approach to wetlands conservation and protection. It is proactive and preventive, and in the long term may give the highest return on investment. Education helps people understand the value of wetlands in their communities since the benefits of wetlands are often not easily recognized. Recognition of wetland values can lead to voluntary actions that protect wetlands for the benefit of all. Information needs vary among groups. Identifying where wetlands are is often the first step in education, as some wetlands are difficult to identify. For example, many building projects have begun without the knowledge that wetlands were involved potentially resulting in higher development costs and resource loss. Because this is the first wetlands management plan for the MSB, education will be key to the plan's implementation.

3.2.1 Goal 1: Identify and/or develop wetlands outreach materials for landowners and developers

Action E-1A: Work with the MSB planning department to provide to the public an online parcel data viewer that is updated daily, and includes new wetland mapping information, along with other layers such as high-resolution satellite imagery and the newly acquired LIDAR. This resource will be widely accessed by the users most likely to impact wetlands and most likely to benefit from knowing the location of wetlands before projects are begun. The success of this form of outreach has already been demonstrated on the Kenai Peninsula Boroughs website.

Action E-1B: Identify wetlands information that is already available, update as necessary, and make it publically available.

Action E-1C: Use existing materials or develop new materials for landowners and developers that will help identify and avoid building on sites that might be expensive and adversely affect wetlands. Examples of topics, types of materials, and methods to disseminate the information include the following:

- Develop a user-friendly "Wetlands Assistance Guide" to describe the programs, regulations, restrictions, and conservation options that affect landowners or developers in the Mat-Su. The guide may summarize existing state, federal, and private programs that provide financial and technical assistance for wetlands protection and may include information on the potential cost savings of building on drier sites.

- Create a wetlands management presentation for local community service groups, outdoors groups, and public forums.

Action E-1D: Identify recreational and economic benefits of healthy wetlands. Collect existing information as to the value of wetlands, creeks, and riparian areas to the community. In concert with Action E-1B, distribute the information stakeholders via fact sheets, presentations, pamphlets, websites, social media, and other appropriate methods.

3.2.2 Goal 2: Conduct a public outreach effort, in cooperation with partners, to promote the implementation of the wetlands management plan

Action E-2A: Develop wetlands news releases for television and radio programs. Develop short news "fillers" and highlight local conservation efforts. Prepare public service announcements featuring a recognized spokesperson. Prepare and give presentation to interested groups.

Action E-2B: Identify or contact community groups to provide wetlands presentations.

3.2.3 Goal 3: Develop and promote wetlands education programs for schoolchildren

Action E-3A: Work with the MSB School District to develop a district-wide wetlands curriculum. Actions to support this may include:

- Identify existing available curricula on wetlands.
- Create regional wetlands curricula for specific grades and make them available to local schools and teachers.
- Create and provide these curricula to teacher training programs and promote curricula through teacher training days or continuing education.
- Have wetlands professionals talk about their work experiences as part of the wetlands curriculum.
- Identify field trip opportunities for local school children. Plan field trips during appropriate seasons to demonstrate specific concepts (e.g., migrating waterfowl stopover sites).

Action E-3B: Coordinate with public and private groups, such as the MSB School District, Ducks Unlimited, the local Soil and Water Conservation Districts and USFWS, to sponsor education outreach programs, comprehensive curricula on wetlands, and environmental education activities.

Action E-3C: Seek corporate and local community financial and logistical support for school wetland programs.

3.2.4 Goal 4: *Make wetlands mapping data easily accessible and available to the public:*

Action E-4A: Ensure wetlands information is available at the existing MSB Permit Center.

Action E-4B: Provide space at the MSB Permit Center for agency personnel (USACE) to be available to the public to provide information on the permitting process on a regularly scheduled basis.

Action E-4C: Edit or update MSB wetlands webpage so that it is user-friendly and provides comprehensive wetlands information.

3.3 Conservation and Protection

Conservation and protection are methods that promote and implement good stewardship of wetland resources. These methods involve the management of wetlands to prevent damages and losses, thus limit impacts to Mat-Su's economy, lifestyles, and environment.

3.3.1 Goal 1: *Identify, conserve and protect wetlands that are important for water quality; fish and wildlife habitats; flood control; stormwater retention; and recreation opportunities to the benefit of the Mat-Su's economy, lifestyle and environment*

Action CP-1A: Encourage development projects to address wetland protection and limit point and non-point sources of sedimentation and pollution to maintain water quality in wetlands, waterbodies, and groundwater.

Action CP-1B: Identify and assess wetlands for wildlife habitat to foster the health and diversity of wildlife populations as well as their related economic benefits.

Action CP-1C: Encourage the protection and conservation of riverine wetlands and woodlands and forested wetlands as they are of particular importance to salmon and fish populations.

Coordinate with groups such as the Mat-Su Salmon Partnership to prioritize and protect salmon and fish habitats including wetlands to ensure the continued health of fish populations and the positive recreational and economic impacts that the sport and commercial fishing provide the Mat-Su and region.

Action CP-1D: Institute wetland and watershed protections to limit the adverse economic costs of flooding and erosion and to enhance the retention and absorption of runoff.

Action CP-1E: Calculate the benefits and cost savings associated with incorporating wetlands into stormwater runoff management programs.

Action CP-1F: Demonstrate the importance of wetlands conservation and protection to year round outdoor recreation activities throughout

the Mat-Su and the tremendous economic and lifestyle benefits these activities bring to the Mat-Su.

Action CP-1G: Coordinate with groups like the Great Land Trust and other land trust organizations to purchase wetlands or establish conservation easements to the benefit of the Mat-Su's economy, lifestyle, and environment.

Action CP-1H: Prepare BMPs to address wetlands conservation and protection relative to water quality, fish and wildlife habitats, flood control, storm water management and recreation opportunities.

3.3.2 Goal 2: Use public outreach methods to enhance conservation and protection efforts

Action CP-2A: Identify appropriate locations to install interpretive signage about wetland functions and benefits. These signs could be installed at special or high-use wetlands complexes to let visitors know they should not travel through the area unless its soils or water are frozen. Interpretive signage could also discuss the benefits and functions of wetlands.

Action CP-2B: Establish an Adopt-A-Wetland Program that actively engages the public in wetland enhancement and increases awareness of wetland resources in the Mat-Su.

Action CP-2C: Identify present and future high-use motorized and non-motorized trails that are degrading wetlands throughout the Mat-Su. Coordinate with communities, user groups, and other interested stakeholders to protect, conserve or restore impacted areas.

Action CP-2D: Identify and promote wetland protection success stories using methods described in the Education Goal.

3.3.3 Goal 3: Work in concert with landowners and land developers to provide technical assistance to protect, conserve, enhance, and restore wetlands

Action CP-3A: Inform the landowners and developers of the importance and value of wetlands.

Action CP-3B: Conduct wetland workshops to provide landowners and developers with methods to protect and conserve wetlands on their property or within their developments.

Action CP-3C: Encourage the MSB Planning and Platting Divisions to work with developers to use Conservation or Clustered Development Subdivisions as a means to conserve wetlands as open space while allowing higher density development on the uplands.

Action CP-3F: In concert with public outreach, use volunteers and other community groups to manually remove invasive plant species.

Action CP-3G: Coordinate community creek cleanups in a Borough-wide creek cleanup program (e.g., Creek Day) as a tool to promote wetland awareness and education.

Action CP-3H: Consider establishing wetland trails and boardwalks where appropriate to minimize impacts to wetlands.

Action CP-3I: Continue to seek funds for demonstration projects to build rain gardens, construct boardwalks, enhance existing wetlands, integrate wetlands into storm water management systems, and restore streambanks and lakeshores.

3.3.4 Goal 4: Prioritize and implement protection and restoration of wetlands

Action CP-4A: Identify wetlands for priority conservation, protection, and restoration.

Action CP-4B: Identify existing practices that degrade wetlands. Identify and implement ways to change those practices

Action CP-4C: Develop management objectives with partners for specific wetlands types.

3.3.5 Goal 5: Investigate the possibility of establishing a local wetlands permitting structure for isolated and non-jurisdictional wetlands.

***Action CP-5A*:** Convene appropriate agency and MSB personnel to determine whether a local regulatory program is wanted or needed with special attention to areas currently meeting the definition of a wetland, but not under the jurisdiction of an agency. If so, determine steps for the MSB to establish this type of local regulatory program.

3.4 Science and Research

Wetlands science continually evolves as the understanding of wetlands and wetland habitats expands. This strategy recommends further research and evaluation of Mat-Su wetlands past, present, and future impacts to Mat-Su wetlands so that residents can better understand how to prevent negative impacts to wetlands.

3.4.1 Goal 1: Evaluate historic wetland changes and losses in the Mat-Su.

Action SR-1A: Create maps that show changes in wetlands over time.

Action SR-1B: Create maps that show changes in wildlife habitat, waterbodies, and wetlands functions and values.

Action SR-1C: Complete the mapping of all wetland areas in the Mat-Su to serve as a basis for future evaluations of successes and impacts.

Action SR-1D: Expand and update the Mat-Su "Status and Trends" report (Hall, JV, 2001. *Status and Trends of Wetlands in the Palmer/Wasilla*

Area, Alaska [1978–1996]. USF&WS Ecological Services Office, Anchorage, AK).

3.4.2 Goal 2: Evaluate current and future changes and losses to wetlands in the Mat-Su

Action SR-2A: Examine wetlands changes as they affect communities and watersheds.

Action SR-2B: Monitor duration and extent of stormwater flooding and correlate findings to wetlands (extent, landscape position, function, etc.) to determine critical areas for protection.

3.4.3 Goal 3: Continue research on wetlands functions, watershed-based management, and best available science to guide wetlands management

Action SR-3A: Research the most current available tools, techniques, and BMPs to maintain, restore, and construct wetlands. In particular, develop BMPs for linear transportation corridors and other major developments either crossing or impacting large wetlands in the Mat-Su.

Action SR-3B: Coordinate existing water quality monitoring efforts in Borough lakes and streams and implement water quality monitoring in wetlands.

Action SR-3C: Evaluate watershed-based wetland management strategies to ensure connectivity, corridors, and water quality are maintained.

Action SR-3D: Apply existing research on the benefits of wetland ecosystem services to management strategies, possibly using an economic model.

Action SR-3E: Identify human-induced stressors on wetlands and determine the stress threshold of the wetlands to guide management.

Action SR-3F: Determine which wetlands directly contribute to clean water habitat and maintenance of flow for anadromous fish streams and which wetlands, if developed, would have the greatest negative impact on these characteristics.

Action SR-3G: Determine if any water bodies are classified as “impaired” due to nutrient or toxicant release into waterways. Mitigate the migration of these contaminants through restoration or creation of wetlands.

Action SR-3H: Examine the relationship between wetlands management and septic system function, stormwater management plan (yet to be completed), transportation plan, and zoning plan to determine if any actions should be taken outside of wetlands to protect wetlands integrity.

Action SR-3I: Investigate the role that wetlands may play in maintaining healthy wildlife and waterfowl populations.

3.5 Plan Implementation and Evaluation

The MSB Wetlands Management Plan is a step-down plan from the MSB Comprehensive Plan's and its update. This plan is intended to be the catalyst for meaningful wetlands management in the Mat-Su. Recommended actions found in this plan are building blocks for a successful wetlands management program. It is important to reassess the effectiveness of this plan in the future to determine whether the recommended goals and actions are being accomplished and whether the results have lead to a successful wetlands management program.

3.5.1 Goal 1: Monitor the MSB Wetlands Management Plan for effectiveness

Action I-1A: Implement action items and goals.

Action I-1B: Publish future updates evaluating the plan's successes and failures.

3.5.2 Goal 2: Continue to seek grant funds, particularly to implement elements of the MSB Wetlands Management Plan

Action I-2A: Identify and develop funding sources to accomplish the plan's goals, actions, and recommendations.

Action I-2B: Pursue partnerships to provide funds, land, and education for wetlands conservation and protection.

Wetlands Management Requires a Community Effort

The management, conservation, and protection of wetlands within the Mat-Su will take a community effort to be successful. The goals and actions contained in this report provide community members a broad menu of actions that they can participate in to help conserve and protect these vital resources. Several small actions will add up to major leaps forward in wetland conservation within the Mat-Su. Voluntary actions combined with existing requirements may prevent the need for more regulation and costly restoration. By doing so, the Mat-Su community will also conserve and protect the lifestyle, economic and environmental benefits that wetlands provide to its residents.

Sunshine Creek Restoration (F. Barker)

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Appendices

Appendix A MSB Functional Assessment

Appendix B Examples of Wetlands Best Management Practices

Appendix C U. S. Army Corps of Engineers Permitting Information

Appendix D Resource Agency Information

Appendix E Matanuska-Susitna Borough Wetland Ecosystems Types

Appendix A

Examples of Wetlands Best Management Practices

Proposed MSB Voluntary BMPs for Wetland Protection by Developers

Why Protect Wetlands Using BMPs?

The MSB encourages the use of a variety of voluntary BMPs by developers to help protect and manage wetlands. Critical to protecting wetlands is developing an understanding their values and functions. Mat-Su wetlands resources enhance our environment, lifestyles and economic well being. Mat-Su wetland:

- Protect and improve water quality
- Manage stormwater
- Reduce flooding and flood damage
- Regenerate and purify groundwater resources
- Provide critical fish and wildlife habitat
- Reduce erosion
- Provide recreation opportunities and open space
- Enhance fishing and hunting opportunities
- Enhance tourism

What are Wetlands?

Simply put wetlands are the "link between land and water".

More formally, wetlands are defined in the MSB Code 17.125.10 as:

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

Voluntary Best Management Practices for Developers.

1. Conserve and Protect Wetlands by Avoiding Them
    - Wetlands are expensive to develop. Avoiding them will lower development and building costs
    - Incorporate wetlands into the design of a project to avoid wetland impacts and to maintain their functions and values related to open space, storm water management, erosion and flood control, clean water and habitat
    - Work with MSB Planning and Platting Divisions to develop Conservation/Open Space Subdivisions where wetland protection will be traded for higher density development.
    - Place structures and infrastructure in uplands to avoid disturbing wetlands.

2. Plan and Design to Protect Wetlands
    - Recognize wetlands as valuable assets
    - Incorporate Low Impact Development solutions such as rain gardens, vegetative buffers, pervious surfaces, vegetative drainage swales and other methods to protect wetlands and waterbodies
    - Take a watershed approach to plan and design your development; ask how your project will complement or impact the surrounding properties, wetland areas, and water bodies
3. Manage Runoff
    - Provide a minimum of a 50-foot vegetative buffer between wetlands and water bodies
    - Revegetate or mulch disturbed soil as soon as possible after clearing or construction
    - Store fuel, oil, fertilizers, solvents and other toxic or hazardous materials in a protected and covered structure at least 100-feet away from wetlands and waterbodies
    - Direct roof drains away from impervious surfaces and bare soils
    - Use alternative paving techniques to limit impervious areas and facilitate absorption
    - Use siltation fences, hay bale barriers, or other methods to protect wetlands and water courses during construction
    - Create vegetative drainage swales to start the cleansing process prior runoff to entering wetlands or water bodies
4. Maintenance
    - Maintain all drainage structures to ensure their functionality
    - Maintain septic systems
    - Maintain and clean oil water separators
    - Maintain silt fences, hay bale barriers and other siltation control methods

For More Information Contact:

Matanuska-Susitna Borough (MSB) Wetlands Home Webpage

The MSB has created a Wetlands Map Viewer webpage that contains NWI wetlands mapping and wetlands mapping conducted for the MSB region-wide effort.

Follow this link to view the Wetlands Map Viewer: http://maps.matsugov.us/Wetlands/

The MSB has additional wetlands information posted on the following MSB webpage:

http://maps.matsugov.us/Wetlands/

Further information on wetlands both in and beyond the Mat-Su can be found at:

http://cookinletwetlands.info

Proposed MSB Residential Voluntary BMPs for Wetland Protection

Why Protect Wetlands using BMPs?

The MSB encourages the use of a variety of voluntary BMPs by residents and homeowners to help protect and manage wetlands. Critical to protecting wetlands is developing an understanding their values and functions. Mat-Su wetlands resources enhance our environment, lifestyles and economic well being. Mat-Su wetland:

- Protect and improve water quality
- Manage stormwater
- Reduce flooding and flood damage
- Regenerate and purify groundwater resources
- Provide critical fish and wildlife habitat
- Reduce erosion
- Provide recreation opportunities and open space
- Enhance fishing and hunting opportunities
- Enhance tourism

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Simply put wetlands are the "link between land and water".

More formally, wetlands are defined in the MSB Code 17.125.10 as:

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Voluntary Residential Best Management Practices.

1. Avoid disturbance or construction in wetlands located on your property. Remember a federal permit is required for many activities in wetlands.
2. Wetlands are expensive to develop. Avoiding them may lower development and building costs and save you money.
3. Use a filter screen to prevent sedimentation of wetlands during construction activities on your property. Screens allow the passage of water but not the passage of sediments. Examples of simple filter screens are straw bales staked in place or silt fences.
4. Structure Setbacks
    - Maintain a minimum 75-foot setback from shorelines for structures as required in MSB Zoning Code 17.55.015 and voluntarily extend that setback adjacent to high functioning wetlands

- The Alaska Department of Environmental Conservation requires a 100 foot setback of septic systems from waterbodies. Voluntarily extend this to include wetlands.
- Keep septic systems and outhouses in good working order.

5. Landscaping Practices
    - Maintain a 30-foot minimum vegetative buffer around individual residential wetland areas
    - Minimize the use of fertilizers, herbicides, and pesticides adjacent to wetlands and waterbodies
    - Use boardwalks to cross wetlands in order to minimize disturbance of drainage patterns
    - Incorporate landscaping techniques to manage drainage, retain water, and reduce runoff such as rain gardens and infiltration areas
    - Incorporate wetlands as natural areas into your landscape designs. Conservation and protection can be more cost effective than constructed landscape designs for wetlands protection
    - Use only plant species native to your area

For More Information Contact:

Matanuska-Susitna Borough (MSB) Wetlands Home Webpage

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Follow this link to view the Wetlands Map Viewer: http://maps.matsugov.us/Wetlands/

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http://cookinletwetlands.info

Appendix B

U. S. Army Corps of Engineers Permitting Information

Corps of Engineers Wetland Permitting Program

Any person, firm or agency (including federal, state and local government) planning to place fill material into wetlands or other waters must first obtain a permit from the Corps of Engineers.

The Corps defines wetlands as "areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and normally do support, the prevalence of vegetation typically adapted for life in saturated soil conditions". Examples of other waters include streams, rivers, ponds, lakes, bogs, and wet tundra.

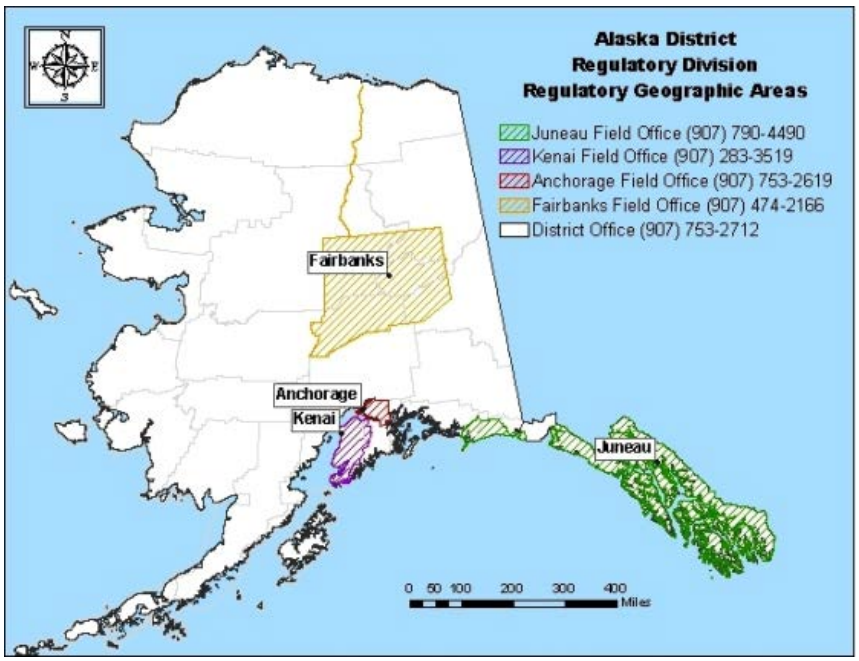
Determining whether an area is wetland under the Corps' jurisdiction includes a scientific process including the evaluation of soil, hydrology and plants to make an accurate determination. The Corps can make this determination upon request. Many of the resources used by the Corps staff are also available to interested persons and are described in 2.3.2 under the mapping resources.

The permitting process is initiated by contacting the Alaska District Corps of Engineers at 907 753-2711 (or 1 800 478-2712). After determining whether the proposed project area is a wetland or other water of the U.S. under the Corps' jurisdiction, a permit application can be downloaded from the internet, filled out and emailed or sent to the Corps. Staff then determines which type of permit is appropriate and undertakes any required coordination with other agencies and the public if required. Permitting for small projects normally takes between 60 and 90 days. More complex or controversial projects require more time.

USACE Contact Information:

Alaska District Regulatory website:

http://www.poa.usace.army.mil/reg/contactus.htm



Graphic obtained from USACE Alaska District:

Alaska District Office
P.O. Box 6898
JBER*, Alaska 99506-0898

(907) 753-2712

(800) 478-2712
Fax (907) 753-5567

Email:

CEPOA-RD-S@usace.army.mil

*Joint Base Elmendorf-Richardson

Appendix C

Resource Agency Information

In addition to the U.S. Army Corps of Engineers, which has regulatory authority over involvement in wetlands and waters of the U.S., there are a number of other resource agencies that support the effort to protect wetlands, below:

U.S. Environmental Protection Agency (EPA) Wetlands Webpage

The EPA devotes a website to wetlands. A number of topics can be found on the website, including status, trends, and a series of wetland fact sheets.

Follow this link to view these resources: http://water.epa.gov/type/wetlands/index.cfm

U.S. Fish and Wildlife Service (USFWS), National Wetlands Inventory (NWI)

The USFWS has developed a series of topical maps to show wetlands and deepwater habitats. The geospatial wetlands data can be viewed and downloaded through several methods.

Follow this link to view the Wetlands Mapper: http://www.fws.gov/wetlands/.

U.S. Department of Agriculture, Natural Resource Conservation Service (NRCS)

The NRCS provides an interactive soil survey map. The soil data and information is produced by the National Cooperative Soil Survey.

Follow this link to view the soil survey: http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

Kenai Watershed Forum:

For the most up-to-date information on the wetland classification and mapping project visit:

Wetland Classification and Mapping in the Cook Inlet Basin

http://cookinletwetlands.info

Matanuska-Susitna Borough

MSB Wetlands Home Page: The MSB has wetlands information posted on the following MSB webpage: http://wetlands.matsugov.us/

MSB Wetlands Map Viewer webpage that contains NWI wetlands mapping and wetlands mapping conducted for the MSB region-wide effort.

Follow this link to view the Wetlands Map Viewer: http://maps.matsugov.us/Wetlands/

MSB Su-Knik Wetlands Mitigation Bank webpage:

http://www.matsugov.us/communitydevelopment/su-knik-mitigation-bank

MSB Natural Resources Management Unit Plan is found at:

http://www.matsugov.us/CommunityDevelopment/asset-management-plans/natural-resource-management-units-plan

Appendix D

Mat-Su Wetland Types

Mat-Su Wetland Types

The MSB with funding assistance from the U.S. Fish and Wildlife Service and the U.S. Army Corps of Engineers, hired a contractor to describe and map wetlands on a more relevant local scale, including field verification for the central region of the Mat-Su Borough. As of 2011, over 456,000 acres of the Mat-Su Borough have been mapped by Mike Gracz, an ecologist from the Kenai Watershed Forum and PhD student at the University of Minnesota.

The following table represents wetlands types that have been identified and mapped specifically in the Mat-Su. This table illustrates the 11 different types of wetlands found within the Mat-Su and allows managers, property owners, and developers to better understand their location, functions and values. The reader may access the actual map at http://www.cookinletwetlands.info/Downloads/MatSuPoster.pdf

Table 1: Mat-Su Wetland Types

	**Glacial Lakebed Peatlands** Relict Lakebed peatlands develop over the deposits of former glacial lakes. Eastward, where precipitation barely exceeds evapotranspiration, these peatlands are fens. Further west, where precipitation is ample, bogs begin to form. A layer of fen peat, fed by groundwater discharge, underlies incipient bog vegetation. The bog is fed by precipitation. Bogs are frequently forested by black spruce (*Picea mariana*) with an understory of leatherleaf (*Chamadaphne calyculata*) and a thick Sphagnum mat. Many burned in the 1996 Miller's Reach Fire.
	**Discharge Slopes** Discharge Slope wetlands occur over hydric mineral soils where shallow groundwater discharges at or near the surface. These wetlands often support only seasonally high water tables, and can be difficult to identify. In the area between Palmer and Houston, Discharge Slopes are frequently forested with paper birch and/or white spruce. Both of these trees are listed as facultative upland plants.

Table 1: Mat-Su Wetland Types

	**Kettles** Kettle Ecosystem wetlands are peatlands occupying depressions created when pockets of underlying ice melted at the end of the last glacial advance. They have a wetland or stream connection to Cook Inlet, unlike Depression and Spring Fen ecosystem wetlands. Depressions and Spring Fens are surrounded by uplands.
	**Depressions** Depression Ecosystem wetlands are surrounded by uplands. They are common as peatlands on the glacial outwash deposits around Palmer, and moraines south of Big Lake. Depression peatlands typically support lower pH and specific conductance, indicating bog, rather than fen conditions. Steep-sided depressions receive low solar insolation reducing evapotranspirational losses. These depressions are also underlain by slowly permeable material, further retaining rain and snow and supporting a high water table. Steep-sided depressions, such as those found in the Cravasse Moraine area, south of Palmer, can support permafrost. At least 30 cm of hard ice was encountered 27 cm below the surface under a black spruce canopy in one Depression in the Crevasse Moraine area late in the season, on 21 August 2007.
	**Spring Fens** Spring Fen Ecosystem wetlands are small peatlands surrounded by uplands. They occur between Butte and Houston below 1000 feet elevation, in a region of moisture deficit, where evapotranspiration generally exceeds precipitation. Wetlands in an area of moisture deficit must be driven by groundwater discharge. Spring Fens are connected to other wetlands and to streams through shallow, unconfined groundwater movement. The thick glacial sediments underlying the area of moisture deficit are well-sorted and coarse-grained, allowing ample groundwater discharge where low spots in surface topography intersect the relatively shallow water table. Spring Fens occur in these topographic low positions.

Table 1: Mat-Su Wetland Types	
	**Headwater Fens** Headwater Fens are small peatlands occupying headwater basins of firstorder streams. There are few Headwater Fens in the area mapped.
	**Relict Glacial Drainageways** Relict Glacial Drainageway wetlands are peatlands occupying relict, sometimes abandoned, drainageway features. These are linear features which drained once more extensive glaciers. Some may have formed during outburst flooding. Some support modern streams but these streams are underfit. Many are now filled with peat. These peatlands are fens, with a stable high water table supported by ample interflow that has had recent contact with mineral substrates.
	**RippleTrough Peatlands** Ripple Trough peatlands occur in the valleys in the Meadow and Beaver Lakes Area. These uniquely arranged hills and valleys are currently mapped as ribbed moraine, specifically Rogen. Rogen moraines are formed by deformation of till beneath a glacier. They have been reinterpreted as ripple features created by gigantic waves formed during catastrophic drainage of glacial Lake Atna (in the Copper River Basin) down the Matanuska Valley (Weidmer et.al. 2010). Ripple Trough peatlands segregate into both bogs and fens. Eastward, where precipitation barely exceeds evapotranspiration, fens dominate. Westward, Ripple Trough peatlands can support bogs atop fen peat. In the Matanuska-Susitna Valley, well-developed bogs are often forested by black spruce *Picea mariana*), with a dense shrubby understory of leatherleaf (*Camaedaphne calyculata*) and/or Labrador tea (*Ledum palustre* ssp. *Decumbens*). Many burned in the 1996 Miller's Reach Fire. Many Ripple Troughs support lakes, the largest of which is 230 acre Seymour Lake. Ripple trough lakes are of relatively uniform depth; all of them are about 20 feet deep. Lakes are defined as areas of standing water greater than 20 acres and deeper than 6 feet.

Table 1: Mat-Su Wetland Types

	**Riverine Wetlands** Riverine wetlands lie in valley bottoms adjacent to streams. They are maintained by both discharge through stream sediments, and by groundwater discharge at the toe of valley walls. The large wetland area along the Little Susitna River is the largest single wetland polygon mapped. It includes much area that does not meet wetland criteria. This system is dynamic, however. Over time, the stream course and adjacent wetland boundaries will change, Upland areas will become wet, wetlands will dry and the channel position will realign. Eventually, every place along the valley floor will be occupied by wetlands. Rosgen's classification has been modified to describe local streams. Many streams are 'E' streams, they occur on sediments deposited by larger processes. In the Cook Inlet Lowlands, these sediments were deposited by the extensive glaciers that were present at the end of the last glacial maximum.
	**Tidal Wetlands** Tidal wetlands are inundated by saltwater at least once per month. Frequency and duration of saltwater inundation creates distinct zones. Each zone supports a small number of characteristic salt-tolerant plants. Some zones within the tidally affected area are inundated only every couple of decades due to the 18.6 year tidal cycle. Those zones are mapped as Tidal-Drainageway wetlands.
	**Drainageway-Tidal Wetlands** Tidally-Influenced Drainageway wetlands occur along the shores of Knik Arm. These wetlands are influenced by an extreme tidal range mixing with large amounts of freshwater discharging from glacial sediments into already diluted saltwater. During some years the tide barely influences a zone from about 33 feet to 35 feet elevation. This two foot elevation distance covers a large surface area over the gentle gradients encountered along the shores of Knik Arm. This wetland ecosystem is divided into two major zones, one where tidal influence dominates, and the other where freshwater influence is predominant.

Appendix E

MSB Functional Assessment

MSB Wetland Functional Assessment

The U.S. Army Corps of Engineers is currently working with the MSB to develop an adapted functional assessment protocol to score all wetlands currently mapped in the Borough. This is an integrated process with a technical working committee comprised of multiple Local, State, and Federal Agencies. The protocol is designed to assess the principal functions and values of Mat-Su wetlands, and is meant to be accomplished in a reasonable period of time, simple and flexible to use, and produce repeatable results. Currently, the MSB Wetlands Functional Assessment Methodology is in the development phase and is being tested. Functions and values under evaluation include:

Wetland Functions:

- Contribution to groundwater
- Transmission of groundwater
- Storage of groundwater
- Streamflow moderation
- Floodflow alteration
- Sediment/toxicant/pathogen retention
- Sediment shoreline stabilization
- Food chain support
- Nutrient removal/ retention/transformation
- Habitat and maintenance of biodiversity
- Habitat for species of interest
- Anadromous fish habitat

Wetland Values:

- Recreation
- Education
- Visual quality/aesthetics
- Culture/history
- Consumptive uses
- Uniqueness

Mapped wetland polygons and wetland complexes will ultimately receive separate scores for each function and value based on criterion developed in the protocol. Once completed, the protocol scoring and rationale for scoring will be subject to a 30-day agency and public review comment period. The final document will describe each function and value, provide background information, and discuss the process used to develop the protocol along with the scientific basis for the protocol. This work is currently under development and is expected to be completed by the end of 2012.

The final report will be inserted as Appendix E when it is completed and adopted.

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Wetland Loss Assessment by Wetland Type and Watershed in an Expanded Core Area of the Matanuska-Susitna Borough

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SUMMARY

Comparison of historic aerial imagery to 2017 high-resolution imagery, identified 642 separate wetland fills covering 1305 acres of the Expanded Core Area of the Matanuska-Susitna Borough since the era of modern settlement began. Although this acreage represents less than 2% of the overall area of wetlands within the Expanded Core Area, in some watersheds many wetland types have been filled at a disproportionately higher rate. More than 10% of the area of seven geomorphic types of wetlands within three watersheds have been filled. Moreover, more than 10% of the area of all wetlands in the Lucile Creek watershed have been filled. In the most extreme example, fifty-five percent of Discharge Slope wetlands within the Lucile Creek watershed have been filled (139 of the 253 acres of this type of wetland).

Substantial declines in water quality may be expected after more than five percent of wetlands in a boreal watershed have been filled. Ten percent of all of the wetlands in the Lucile Creek Watershed have been filled; and in three other watersheds more than ten percent of seven different types of wetlands have been filled. Five percent of the wetlands of a total of 13 types have been filled in four watersheds. These different types of wetlands perform different functions that are valued by society. Therefore, some values have likely been lost in at least four watersheds: Meadow Creek, Lucile Creek, Wasilla Creek, and Cottonwood Creek.

Because some values have likely been lost, either no additional filling should be permitted, or compensatory mitigation should be required in the types of wetlands within the watersheds listed below:

- Wasilla Creek Watershed
  - Depressions, Discharge Slopes, Kettles, Spring Fens, and Riverine wetlands
- Cottonwood Creek Watershed
  - Depressions, Discharge Slopes, Kettles, and Wetland/Upland complexes
- Lucile Creek Watershed
  - Depressions, Discharge Slopes, Kettles, and Spring Fens
- Meadow Creek Watershed
  - Drainageways

Green infrastructure is the patchwork of natural areas providing services to society such as flood protection, clean water and habitat. Without careful management this green infrasturcture will continue to deteriorate until expensive measures will be required to maintain the quality and quantity of surface and ground water in these watersheds.

INTRODUCTION

Wetlands are important components of green infrastructure: the valuable services that the natural environment provides to society. Federal law protects some of these services by requiring that a permit be obtained before a wetland can be filled. An assessment of valuable services, which include wildlife habitat, streamflow quantities, and clean water, may be required before the permit can be obtained. An assessment should evaluate cumulative impacts to wetland functions throughout the watershed. The Matanuska-Susitna Fish Habitat Partnership also recognizes that the cumulative impacts of filling wetlands can reduce their value to fish, which are an important resource to the citizens of the Matanuska-Susitna Borough. To protect the value of wetlands to fish, the Partnership has formulated Conservation Strategies which state that: “Wetland fill will be avoided, minimized or mitigated”. If the wetland assessment identifies unavoidable impacts to functions, compensation to mitigate for the services lost due to the impacts may be required. The goal of compensatory mitigation is to maintain wetland functions, such as stream flow quantity and quality, which are important characteristics of fish habitat.

Different types of wetlands are often filled at different rates because development activity is concentrated in a subset of possible locations, such as along shorelines. These different types of wetlands in different locations function differently to provide differing degrees of services to society. Therefore, preventable losses of valuable services can occur even if less than two percent of wetlands are filled. Knowledge of cumulative impacts to different types of wetlands will inform managers when they are determining where and when compensation to mitigate for these preventable losses should be required. These types of determinations are currently being made in the absence of reliable estimates of wetland losses. Recently, for example, when compensation was proposed by the project proponent for unavoidable wetland losses along Wasilla Creek, an anadromous stream, it was determined to be unnecessary.

The amount of loss is an important component of a cumulative impacts analysis. Since July 1996, which was the baseline for the last assessment of wetland losses in the MSB, the population of the Matanuska-Susitna Borough has doubled from 50,367 to 104,166 (State of Alaska 2018). The assessment, published in 2001 but based on 1996 imagery, found that 200 acres of wetlands had been lost of the 59,994 acres of wetlands in the 274,276 acre area around Palmer, Wasilla, and Big Lake (Hall 2001). The 1996 assessment is clearly needs to be updated so that cumulative effects of issuing a permit to allow placement of fill without compensatory mitigation can be evaluated in the context of watershed-wide losses to wetland functions. If wetland losses due to filling have substantially increased, then compensation may need to be required more frequently so that wetland functions, including those related to fish habitat, may be adequately conserved.

Here I quantify the total acreage of wetland loss in an Expanded Core Area of the MSB, including losses by wetland type and watershed, since the era of modern settlement (figure 1). This Expanded Core Area is slightly smaller in size than the area studied by Hall using the 1996 imagery, but it avoids areas of change due to the natural migration

of the Matanuska River channels, a major change in wetland area reported by Hall (2001).

The type of wetlands that have been filled were classified according the Cook Inlet Classification (Gracz & Glaser 2016), a system that classifies wetlands by geomorphic type and seasonal variation of water levels. The analysis was performed by using wetland mapping that was completed in 2009, along with comparing high-resolution imagery acquired in 2017 to the oldest imagery available for the area, which was acquired in either 1939, 1949, or 1950. This updated assessment of wetland loss will help inform a cumulative impacts analysis as part of permitting decisions, and, if considered, should help slow or halt the loss of important characteristics of wetland fish habitat in the Matanuska-Susitna Borough.

Figure 1. The Expanded Core Area (outlined in blue- 246,946 acres).

METHODS

We used wetland mapping data, LiDAR, and time-series comparisons of aerial imagery to guide the creation of polygons surrounding areas of wetland fill. Wetlands mapped with the Cook Inlet Classification (Gracz & Glaser 2016) were used to help guide the comparisons among imagery acquired in 2017, 1939, 1949, and 1950. Typically, the resolution of the 2017 imagery was sufficient on its own to guide the creation of the polygons around filled areas. Occasionally, imagery from 1939 revealed previous wetlands that had been completely filled and showed no trace on the modern imagery. The linework and marsh symbols that had been drawn in 1939 by the soils mappers was especially useful in these instances.

The objective of these methods was to produce the most reliable calculation of the area of wetland lost due to placement of fill by human activity during the era of modern settlement. The newest imagery for the project area was acquired in May of 2017 at resolutions of one-foot and one-half-foot. The imagery acquired at one-half-foot resolution covers nearly the entire area to be assessed. The 2017 and older imagery were used with a hillshade created from a 2-foot resolution digital elevation model obtained in 2011 using Light Detection and Ranging (LiDAR). The hillshade was overlain on the imagery and made partially transparent, in order to better visualize the hydro-geomorphic setting of wetlands on the landscape.

The oldest imagery that covers the entire project area was acquired in three different years. Scanned aerial photos that were acquired in September and October of 1939 for use in a soil survey were obtained from the Matanuska-Susitna Borough GIS department. These photos covered the area around Palmer, and extended westward in a narrow band to the easternmost portion of Big Lake. However, the area to be assessed for wetland loss includes all of Big Lake, and a larger region than was covered by the 1939 photography. (The first aerial photographs ever acquired were taken from balloons and kites in the middle of the nineteenth century. Aerial photography was used in both the American Civil War and WWI. By the mid-1930's, aerial photography had been in use for a long enough time so that stereo-photography was well-understood, as was the high altitude and fast speed necessary for minimization of distortion and parallax. Therefore, the 1939 photos are of high quality for cartography).

To cover the area outside of the extent of the 1939 photography, scans of aerial photographs acquired in 1949 and 1950 were downloaded from the US Geological Survey at https://earthexplorer.usgs.gov. The 1949 photos, which were acquired on 14 August 1949, were used wherever possible, as they cover most of the remaining project area and are the oldest available. However, some of the 1949 imagery was unsuitable due to cloud cover, damage to the original photographs, and lack of coverage of the project area. Therefore, scanned aerial photos acquired in 1950 were used when needed. The imagery from 1950 was acquired on three different dates: 15 July, and 7 and 8 August. Almost all of it was acquired on 8 August 1950; only two small areas were acquired on the different dates. Those areas are in the NE corner (7 August) and the SW corner (15 July) of the Expanded Core Area.

Geo-rectification of older imagery

The scanned photos were geo-rectified, or more accurately, rubber-sheeted, into real-world coordinates using the geo-rectification tool in ArcGIS 10.1. This tool requires the user to accurately locate matching control features on both old and new imagery. The new imagery employed for this purpose was the seamless 2004 FSA aerial imagery projected into State Plane Alaska Zone 4 coordinates using the NAD 83 datum. It was almost entirely flown 6 June 2004, with the exception of the NE corner of the project area, which was flown 9 August. The 2017 imagery was not available before the rubber sheeting was completed.

At least three matching control points are required to use a linear transformation to align the old, un-rectified photo with real-world coordinates. A linear transformation may be sufficient when the topography is almost completely flat, and when the altitude of acquisition is high, such as imagery acquired from satellites. However, where hills are present and altitudes are sub-orbital, a more complex method of transformation is needed to produce an accurate alignment over the entire photo. Therefore, a second-order transformation was used, which requires at least six matching control points. Even higher-order transformations are feasible, but they were avoided, because they required more matching control points. There are at least two dangers in using too many control points: 1) the difficulty in locating points that reliably align between the years, thus the potential for introducing increasing amounts of error in positional accuracy, and 2) bias, if the points that do align are located in unrepresentative areas of the photo. This bias will produce excessive distortion in regions of the photo that are under-represented.

For the reasons described above, between 6-9 control points were used with a second-order transformation to rectify all of the scanned photos. Points were as evenly distributed as possible across the scanned photo, and points near the extreme edges were avoided. Common types of features used to match the scanned aerial photography to the satellite images were points along the margins of lakes and peatlands where the transition was steep (minimizing differences due to differing water levels); small upland tree islands in larger peatlands; small open depressions in the forest; bridge crossings of the Alaska Railroad; and the projected centerlines of road intersections. On the 1939 photos, the soil mappers created control points, which show as pin-pricks. These control points were occasionally matched with the same control point on an adjacent 1939 photo that had already been rubber-sheeted, especially in areas of relatively featureless forest east of the Matanuska River. Use of this technique was minimized to avoid perpetuating rectification errors on the initial photograph into larger ones on adjacent photos. Landslide margins on the hillside north of the Little Susitna River matched in a few instances, and buildings near Palmer were used in a couple of other cases. Points along stream and river courses were avoided because, upon careful examination, they were almost always in different locations between

images. Even with care, the aligning of control points was inexact, and precisely geo-rectified images were not obtained. However, the relatively small errors in geo-rectification should not be sufficient to substantially bias the calculation of the area of wetlands filled at the mapping scale of 1:18,000.

Each historic aerial photo was visually examined while control points were being selected so that distortion could be minimized before the transformation was committed to a geo-rectified file. Alignment was never perfect, and although points match very well over much of the area covered, errors of 10-20 meters in real-world units should be expected in some areas. After rectification, the 1949 and 1950 photos were clipped to discard edges and occasionally to the small area of the photo needed to fill a gap in coverage. Control points were distributed only around the area of the photo that was actually needed on these smaller images. The entire extent of each 1939 photo was retained, except for one photo near the Matanuska River. On that image, a small area that was just outside the extent of an adjacent photo was clipped to complete the coverage of the Expanded Core Area.

Creation of wetland fill polygons

Once the older imagery was rubber-sheeted, it was layered in ArcGIS 10.1 underneath the high-resolution imagery acquired in 2017, along with the hillshade of the 2011 LiDAR data, and the 2009 wetland mapping. The extent of the project area was systematically examined at a scale of 1:4000 or greater (i.e. higher zoom level) to identify fill that had been placed in wetlands. Typically, the high-resolution imagery was sufficient by itself to show areas that had been filled. Often, the LiDAR hillshade aided evaluation of wetland extent by revealing sharp breaks in slope. The areas of fill were primarily road crossings, airstrips, house pads, and parking areas that were located inside of mapped wetland boundaries.

Polygons surrounding the fill were created heads-up (clicking with a mouse while viewing a screen), typically at a scale of 1:2000 or greater (zoomed-in). Digitizing heads-up is more time-consuming than automated techniques using LiDAR and the color signatures on aerial imagery, but allows intervening human judgement. The boundaries of these fill polygons were digitized separately from the boundaries of the wetland polygons; i.e. the fill boundaries were not snapped to the boundaries of existing wetland polygons. Surface water surrounding the fill was usually visible, and its extent often exceeded the mapped wetland boundaries. In many instances, small areas of wetland fill lying completely outside of mapped wetland polygons could be observed on the high-resolution 2017 imagery. These areas were also digitized heads-up.

The wetland area that the fill covered was digitized regardless of the extent of the 2009 wetland mapping. Because the mapping of the fill extent was performed at a different scale (1:2000 or less), and with higher resolution digital imagery than the wetland mapping (which was completed at a scale of 1:18 000), a mismatch in boundary locations between the fill and the wetlands should be expected.

In other instances, the extent of the original wetland was difficult to determine because the boundary between wetland and upland was obscured by the fill material. In these instances, the display of the high-resolution 2017 imagery was turned off to reveal the underlying older imagery, which was used to guide the mapping of the boundary of the historic wetland. Moreover, to be certain that all filled wetlands were

Figure 2. A wetland (red outline) in 1939 (left-hand photo) is indicated by marsh symbols drawn as part of a soils map. The same wetland has been completely filled by gravel mining activity in 2017 (right-hand photo). The Old Glenn Highway south of Palmer is visible crossing the upper left-hand corner of both photos. The braidplain of the Matanuska River covers the lower right corner of both photos.

identified, the display of the 2017 imagery layer was also turned off to reveal the older imagery underneath for each extent at 1:4000. In a few cases, the underlying imagery revealed an historic wetland that had been completely obscured by fill. These historic wetlands were particularly apparent on the 1939 imagery where marsh symbols had been drawn to indicate wet soils (Figure 2). In other instances, the fill was sufficiently recent that the slightly older LiDAR hillshade helped guide the mapping of the boundary of the original wetland.

Analysis

An analysis of the acres of wetlands filled by the type of wetland was performed. A single fill polygon might cross several different geomorphic types of wetlands. Therefore, the wetland fill polygons were merged with the 2009 wetland mapping polygons that they intersected so that the fill polygons could be subdivided into wetlands of the same type (Figure 3). These smaller polygons were further clipped to the boundaries of the 12-digit HUCs for four watersheds: Big Lake, Cottonwood Creek, Wasilla Creek, Meadow Creek, and Lucile Creek. This merging and clipping guided an analysis of wetlands filled by type and by watershed. The wetland types used for the analysis were the geomorphic components of the Cook Inlet Classification; the classification system that was employed in the 2009 wetland mapping and which has been found to group wetlands more similarly than other widely used classification systems (Gracz & Glaser 2016). Areas outside of the wetland mapping were assigned to a geomorphic class based on adjacent polygons and/or by interpretation using the imagery and the LiDAR hillshade.

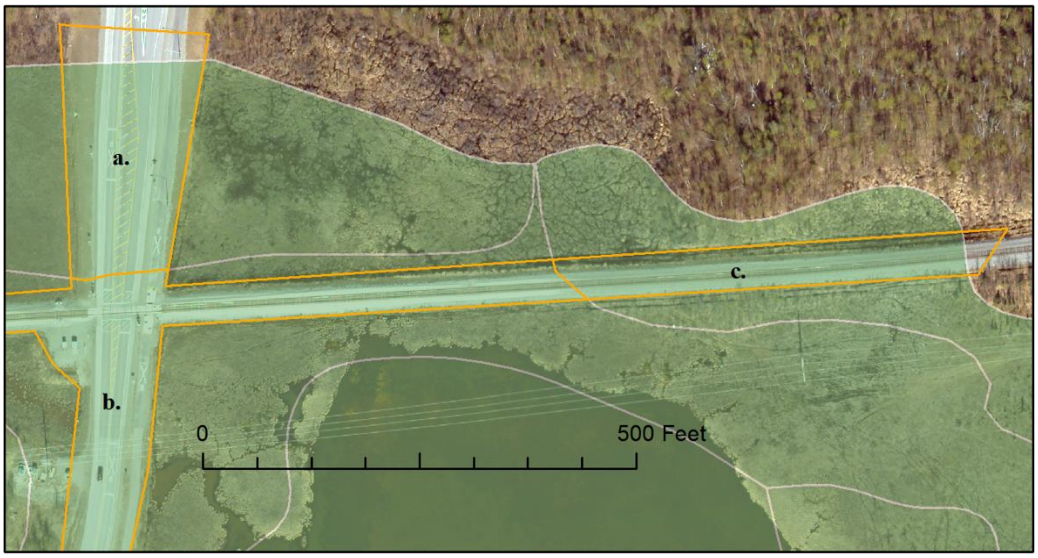

Figure 3. The single fill polygon (orange outline; near Big Lake) has been subdivided into three parts, labeled **a.** **b.** and **c.** based on geomorphic categories of the 2009 wetland mapping (transparent green with white outlines). The finer scale and higher resolution of the 2017 imagery show that portions of polygons **a.** and **c.** should extend beyond the 2009 mapping.

RESULTS

A total of 642 wetland fill polygons cover 1305 acres of the 69,054 acres of wetlands in the 246,946 acre Expanded Core Area (Figure 4). This acreage is a 6.5-fold increase

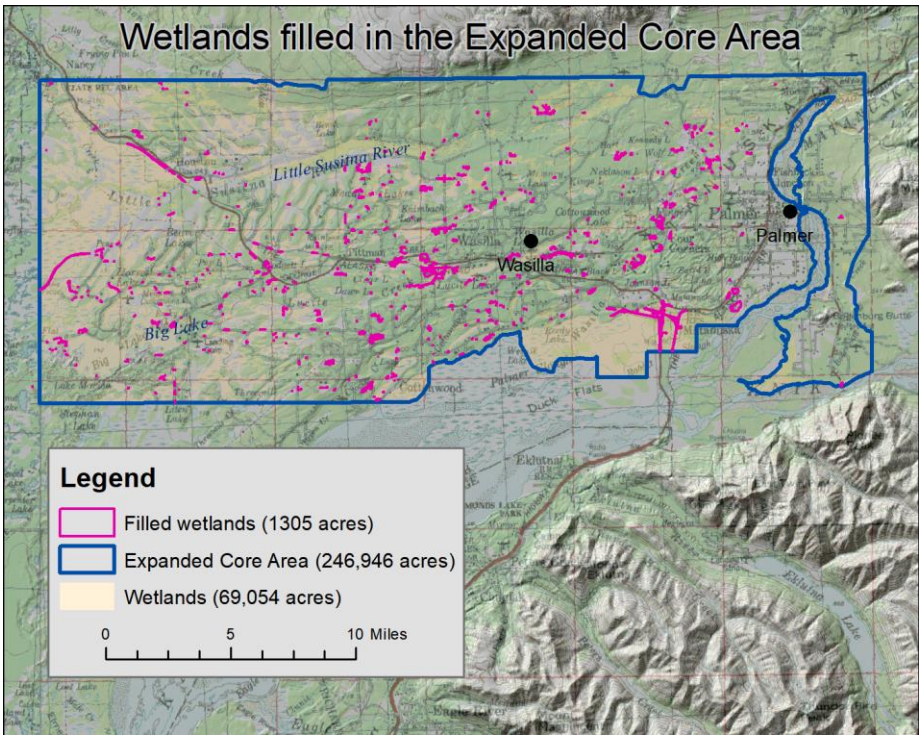

Figure 4. Wetland fill (pink) in the Expanded Core Area (blue). The wide pink borders of the filled wetland polygons exaggerate their area.

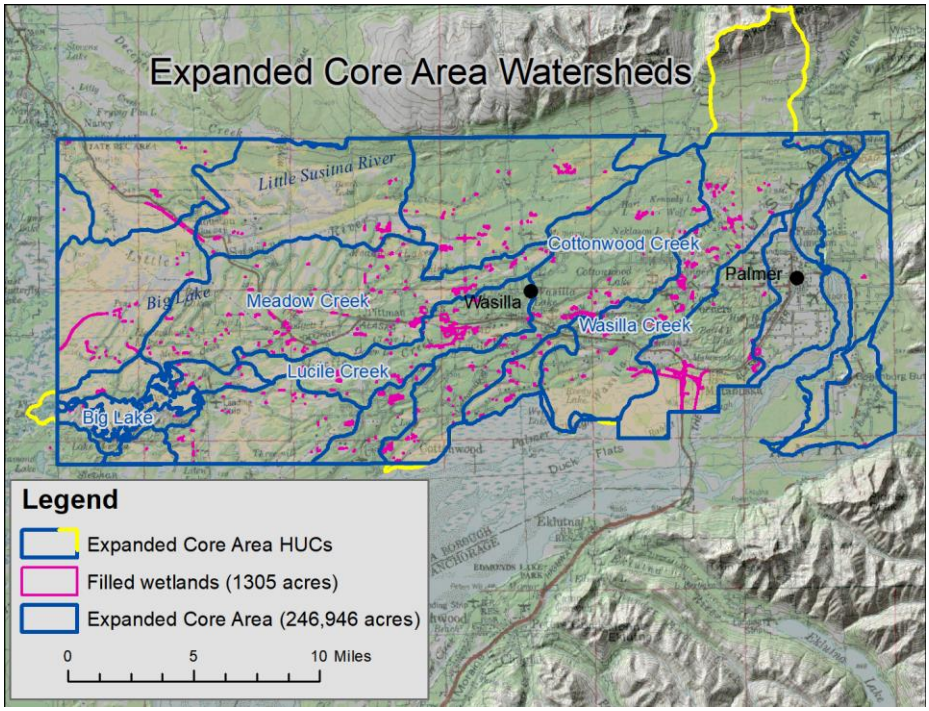

Figure 5. The location of the five 12-digit HUCs in the Expanded Core Area (ECA) that were used to analyze wetland fill by location (named in blue). Portions of the Wasilla Creek (29%), Big Lake (6%) and Cottonwood Creek (0.7%) HUCs lie outside of the ECA (yellow). The wide pink borders of the filled wetland polygons exaggerate their area.

from the area reported in 1996 over a similar area. The acreage of wetlands filled is two percent of all of the wetland acreage in the Expanded Core Area. Although only two percent of wetlands in the expanded core area have been filled, the wetlands that have been filled are not uniformly distributed by location or by geomorphic type. Some areas of the Expanded Core Area have had few wetlands filled, while some types of wetlands have been disproportionately filled within some watersheds. The geomorphic types described in the Cook Inlet Classification (Gracz & Glaser 2016) were used along with the watersheds delineated by 12-digit Hydrologic Units to analyze the variability of wetlands that have been filled by type and location (Figure 5).

The five 12-digit HUC watersheds with the most fill activity were analyzed. Within the five watersheds, or portions thereof that were examined (Figure 5), more than ten percent of the area of seven types of wetlands has been filled (Figure 6). More than

Figure 6 **a. - f**. Percentage of wetlands filled by type within each of the five watersheds examined (**a. - e.**), and the percent of all wetlands filled within each watershed (**f.**). The red horizontal line emphasizes wetland types filled at or above the 10% level. Wetland types with no fill were omitted from figures **a. - e.**.

25% of Depressions have been filled in the Wasilla Creek watershed (Figure 6a); greater than ten percent of Depression, Kettle and Wetland/Upland complex wetlands

have been filled in the Cottonwood Creek watershed (Figure 6b); and more than ten percent of Depressions and Kettles, and nearly 55% of Discharge Slopes have been filled in the Lucile Creek watershed. (Figure 6c). In the Lucile Creek watershed, ten percent of all wetlands have been filled (Figure 6f). Within the Big Lake and Meadow Creek watersheds generally fewer than five percent of wetlands of any type have been filled (Figure 6d & e).

DISCUSSION

A comparison of early aerial imagery to 2017 high-resolution imagery identified 642 separate wetland fills covering 1305 acres of the Expanded Core Area of the Matanuska-Susitna Borough. Although this value represents less than two percent of the overall area of wetlands within the Expanded Core Area, some wetland types have been filled within some watersheds at a disproportionately higher rate. Ten percent of seven geomorphic types of wetlands have been filled in three different watersheds. In the Lucile Creek Watershed ten percent of all wetlands have been filled. In the most extreme example, 139 of the 253 acres of Discharge Slope wetlands within the Lucile Creek watershed have been filled (55%).

Estimating wetland loss by comparing modern and historical aerial imagery has limitations. Wetland filling has typically progressed greatly by the time of the earliest imagery, and the interpretation of wetlands on the historical imagery is impossible to ground-truth today. Even with modern, high-resolution imagery, interpretation of wetland extent without ground-truthing can lead to over- or under-mapping of wetland fill polygons. In the Expanded Core Area of the Matanuska-Susitna Borough that was examined here, those limitations are minimized because aerial imagery is available from a time when the footprint of wetland fill was almost completely absent. Moreover, some ground-truthing of wetland boundaries was performed for the 1939 aerial imagery as part of an early soil mapping survey. Marsh symbols were drawn in some of the polygons mapped using the 1939 imagery (Figure 2). Finally, the author has extensive experience mapping wetlands in the project area, including extensive ground-truthing, which minimizes errors of interpretation on the modern imagery. However, the boundaries of the fill polygons are inexact, and a fine-grained, site-specific analysis of any individual fill polygon would certainly lead to a different calculation of the total area filled. However, these limitations are expected to be minor for the purposes of a general assessment of watershed-wide cumulative impacts.

Reporting losses as percentages can be misleading when the absolute acreage is small (e.g. a loss of a half-an-acre of a wetland for a type that only covers a total of one acre is a 50% loss of wetlands over a small total area). However, in many of the watersheds the percentage losses were of types of wetlands covering relatively large areas. For example, Kettles in the watersheds of Cottonwood Creek and Lucile Creek, and Discharge Slopes in Lucile Creek Watershed all cover more than 250 acres. The summary data by percentage and by acres is tabulated in Appendix A.

Filling wetlands compromises their function, which decreases their value to society. The percentage of wetlands that can be filled before functions are substantially compromised is unknown. However, it has been widely reported that water quality decreases rapidly once impervious cover in a watershed reaches ten percent (Schueler 1994; Booth & Jackson 1997; Schueler et al. 2009; Loperfido et al. 2014). In Alaska, this decrease in water quality may be seen with impervious cover values as low as five percent (Ourso and Franzel 2000). It can be assumed that wetlands are covered by impervious surfaces (i.e. filled) at a lower rate than uplands because building is less desirable and more expensive on wetlands. Therefore, if more than ten percent of wetlands are filled, it may be reasonable to assume that an even larger percentage of the surrounding uplands are covered by impervious cover. If this assumption is true, and if water quality of streams is more sensitive to impervious cover in the boreal climate of Alaska, then filling of more than five percent of wetlands in a boreal watershed probably will cause substantial declines in at least some wetland functions. More work is required to test these two key assumptions.

A substantial portion of the Big Lake (6%) and Wasilla Creek (29%) HUCs lie outside of the Expanded Core Area, as does a minor portion of the Cottonwood creek HUC (0.7%) (yellow lines in Figure 5). This choice of scale of the twelve-digit HUC is somewhat arbitrary, and should not greatly change the interpretation in those watersheds. For example, a substantial amount of clean water is contributed to Wasilla Creek from the large, relatively undisturbed wetland area in the headwaters of the Wasilla Creek HUC that lies outside the Expanded Core Area. However, if smaller watershed areas around wells or groups of wells are considered, the amount of fill in the middle and lower portion of the HUC probably will affect wellhead water quality in those smaller areas.

Scale is important. Even as less than two percent of the area of wetlands in the Expanded Core Area are filled, some wetland function has already been lost. Four water bodies in the area, Cottonwood Creek, Fish Creek, Lake Lucile and Big Lake. are listed as Impaired Waters in the State of Alaska (http://dec.alaska.gov/water/water-quality/impaired-waters/). The rate of wetland fill over the entire Expanded Core Area appears to be irrelevant to the amount of function that wetlands have retained with the increasing urbanization of the Expanded Core Area. The finding here that more than ten percent of many types of wetlands in local HUCs have been filled, including in Cottonwood Creek and Lucile Creek (which flows into Big Lake), suggests that the relevant scale may be the types of wetlands that have been filled compared to their prevalence in local watersheds. Careful management will be required to prevent additional waters from being added to the impaired waters list and to allow those already on the list to recover.

Management Recommendations

Wetland losses of more than five percent by area in boreal watersheds may cause declines in water quality. Ten percent of the wetland area has been filled in the Lucile Creek Watershed, and more than ten percent of the area of many types of wetlands in other watersheds have been filled. These different types of wetlands have different functions that are valued by society. Some of these waters are listed on the State of

Alaska's Impaired Waterbody list demonstrating that valuable wetland functions have already been substantially compromised in the Expanded Core Area. Because wetland functions have been compromised, additional filling should either cease altogether or compensatory mitigation should be required to replace lost values if unavoidable impacts are to be permitted in any of the following types of wetlands in the following watersheds:

- Wasilla Creek Watershed
  - Depressions, Discharge Slopes, Kettles, Spring Fens, and Riverine wetlands
- Cottonwood Creek Watershed
  - Depressions, Discharge Slopes, Kettles, and Wetland/Upland complexes
- Lucile Creek Watershed
  - Depressions, Discharge slopes, Kettles, and Spring Fens
- Meadow Creek Watershed
  - Drainageways

LITERATURE

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APPENDIX A

Wetland losses by type and watershed in units of acres and percentages.

Watershed	Wetland Type	Wetland acres	Filled acres	% Wetlands
Wasilla Creek	Depression	16.4	4.2	25.61%
	Drainageway	43.6	1.9	4.36%
	Discharge Slope	1298.7	106.2	8.18%
	Kettle	228.2	12.8	5.61%
	Spring Fen	370.2	19.9	5.38%
	D'way / Tidal	209.0	0.9	0.43%
	LAKE	101.9	0.003	0.00%
	Riverine	596.2	33.1	5.55%
	Wetland / Upland	4.4		0.00%
	Tidal	132.3		0.00%
	Tidal / Drainageway	2807.4		0.00%
	Total	5808.3	179.003	3.08%
Cottonwood Creek	Depression	52.1	7.7	14.78%
	Drainageway	102.8	0.7	0.68%
	Discharge Slope	447.8	26.3	5.87%
	Kettle	521.9	63.6	12.19%
	Spring Fen	403.0	6.5	1.61%
	LAKE	1489.7	1.6	0.11%
	Riverine	241.0	7.3	3.03%
	Wet/Up	165.8	17.1	10.31%
	Tidal	349.8		0.00%
	Tidal / Drainageway	397.3		0.00%
	Total	4171.2	130.8	3.14%
Lucile Creek	Depression	90.9	11.7	12.87%
	Drainageway	581.9	13.6	2.34%
	Discharge Slope	253.2	139.2	54.98%
	Kettle	330.7	35.2	10.64%
	Spring Fen	156.9	9.3	5.93%
	LAKE	427.4	0.03	0.01%
	Riverine	305.4	5.6	1.83%
	Total	2146.4	214.6	10.00%
Meadow Creek	Depression	106.1	4.3	4.05%
	Drainageway	609.4	38.2	6.27%
	Discharge Slope	1122.3	27.1	2.41%
	Kettle	1014.9	39.8	3.92%
	Spring Fen	604.0	10.1	1.67%
	LAKE	2205.1	1.6	0.07%
	Riverine	864.0	21.3	2.47%
	Lakebed	430.6	3.3	0.77%
	VLD Trough	2179.8	27	1.24%
	Floating Island	2.3		0.00%
	Wetland / Upland	5.4		0.00%
	Total	9136.2	172.7	1.89%
Big Lake	Depression	129.3	1.8	1.39%
	Drainageway	129.2	2.9	2.24%
	Discharge Slope	50.0	1.6	3.20%
	Kettle	291.1	6.6	2.27%
	Lakebed	1410.7	18.1	1.28%
	Spring Fen	1.8		0.00%
	LAKE	3359.2		0.00%
	Riverine	10.6		0.00%
	Total	5381.9	31.0	0.58%

Main Tenets:

1. **Utilize existing 2008 Federal Rule on Compensatory Mitigation, the 2009 PAO Regulatory Guidance Letter, and the revised 2018 EPA/Corps MOA for Alaska.**
2. **No mitigation is required for impacts smaller than half an acre in size unless the impacts occur to difficult-to-replace resources or riparian wetlands adjacent to salmon bearing waters (case-by-case determination).**
3. **All information based on existing required Corps Section 404 Permit Process.**
4. **Limited MSB oversite required. Review permit submittal (again information taken from 404 permit) and follow flow chart (below).**
5. **It is the MSB decision (based on case-by-case determination) as to what impacts are required to be mitigated. Some examples may include:**
    a. **no compensatory mitigation for impacts related to residential development for low functioning wetlands;**
    b. **no compensatory mitigation for impacts smaller than one acre in size for non-residential impacts (see caveat above under item 2);**
    c. **compensation ratios based on wetland functions and landscape position (e.g. lower ratios for lower functioning and common wetlands)**

Permitting Flow Chart

1. Complete and submit and Borough Wetland Permit Application, in similar format to ENG form 4345 http://www.poa.usace.army.mil/Portals/34/docs/regulatory/engform_4345_2014dec.pdf
   Package should include supporting documents as would accompany a 404 application:
   a. Wetland Delineation and functional assessment
   b. Mitigation Document (i.e. Mitigation Plan or Bank Use Plan)

2. Application is reviewed for completeness by Borough.

3. Borough will conduct a site review, if necessary (can request to accompany PAO if a site visit is deemed necessary by Corps).

4. Borough will send a Request for Additional Information, if needed.

5. Once the permit application is administratively and technically complete, Borough issues their permit (conditional use; construction; grading; etc. outlining the Borough's compensatory mitigation requirements) .

6. Permit is valid for five (5) years (unless otherwise specified).

Most language below is taken directly from the PAO 2009 Mitigation RGL. Additional information has been added to clarify or edited for specific compliance with the 2008 Federal Rule.

PREAMBLE: All development in wetlands and their buffers, whether on public or private property, shall comply with the requirements of Title 6: Environmental Protection. http://www.codepublishing.com/AK/MatanuskaSusitnaBorough/

[*There currently is no code in this Title, it was repealed in 1994. Suggest to model code after Pierce County, WA* http://www.codepublishing.com/WA/PierceCounty/#!/PierceCounty18E/PierceCounty18E30.html#18E.30 *and follow RGL 2009 assessment methods and mitigation ratios*.] Procedures described below are consistent with the Memorandum of Agreement between the EPA and Corps (June 2018).

PROCEDURES: The following are flow chart procedures for evaluating project related aquatic resource impacts and compensatory mitigation proposals that accompany grading permit requests. [*All application materials (i.e. reports and mitigation plans) as part of a standard 404 permit application can be submitted for review to the Borough. This will save the applicant time and money by not having to duplicate documents. Would recommend recreating ENG FORM 4345 as a template for Borough's Wetland Permit Application.* http://www.poa.usace.army.mil/Portals/34/docs/regulatory/engform_4345_2014dec.pdf]

A. Receipt of Application

1. Review permit request (applies to all permit requests)

   a. The application does not contain any information pertaining to existing conditions, impacts, mitigation sequencing and compensation for impacts (incomplete application). Request this information from the applicant.

OR

   b. The application contains the required information including, wetland/aquatic resource delineation and functional assessment, impact analysis and compensatory mitigation plan documentation* of mitigation sequencing (avoidance, minimization, then -compensation). Proceed to Section B.

   * *The Borough per the Federal Rule requirements considers compensatory mitigation options in the following order: (1) purchase of credits from an approved mitigation bank; (2) purchase of credits from an approved in-lieu fee program; and (3) completion of a permittee-responsible mitigation project. The applicant must provide a case why options (1) and (2) are not feasible before considering option (3).*

B. Determination of Mitigation Requirements for all Permit Requests

Mitigation requirements are determined by following the Alaska District Regulatory Guidance Letter (RGL ID No. 09-01) (2009 RGL). It is critical to document the evaluation process, whether compensatory mitigation is required or not; by following the sequencing outlined in the regulations above and taking

into consideration the nation's "no net loss" goal. See Table 1 for examples of projects that will require compensatory mitigation and may or may not require compensatory mitigation.

1. The proposed project does not require compensatory mitigation beyond avoidance and minimization:

    a. The applicant must document avoidance and minimization measures;

    b. The applicant must provide rationale as to why they are not proposing compensatory mitigation for their proposed project; and

    c. In the administrative record (i.e., memorandum for record (MFR), decision document, etc.), Borough permit reviewer must document acceptance of avoidance and minimization measures and rationale for not requiring compensatory mitigation (use existing Corps documentation if Borough agrees with Corps that no compensatory mitigation is required for impacts within Borough).

OR

2. The proposed project requires compensatory mitigation, but the applicant does not think so, nor proposes any:

    a. The applicant must document avoidance and minimization measures; and

    b. Items the Borough permit reviewer should discuss with the applicant during the review period:

        Are there any opportunities for on-site compensatory mitigation? If so, is it ecologically preferable and practicable (e.g. will it be self-sustaining, low risk, address temporal losses, etc.).

        Is the proposed project within a service area for an established bank or ILF Program? Are there compensatory mitigation opportunities within the impacting project's watershed/ecoregion, which might be applicable and/or of which the applicant is unaware?

    c. Proceed to Section C.

OR

3. The proposed project is submitted with a compensatory mitigation plan**:

    a. The applicant must document avoidance and minimization measures;

    b. Review the plan for adequacy, as outlined in Section C;

    c. If inadequate, work with the applicant to get the plan refined until it is adequate; and

    d. Proceed to Section C.

    ***If using a mitigation bank, the applicant shall prepare a Bank Use Plan*

    https://www.lummi-nsn.gov/userfiles/210_IRT%20Mitigation%20Bank%20Use%20Plan%20Guidance.pdf

C. Reviewing Compensatory Mitigation Plans and General Considerations

If compensatory mitigation is required beyond what the Corps is requiring, for Borough permits, the Borough may approve a conceptual or detailed compensatory mitigation plan, but a final mitigation plan (as described in Section D) must be approved before work commences.

1. Is mitigation proposed in-kind or out-of-kind? On-site or off-site? The administrative record needs to include ecological rationale for out-of-kind compensatory mitigation proposals (e.g. very rarely would a resource trade-off for a marine impact proposed to be compensated at a fresh-water site be acceptable but the opposite may be easily justified). If off-site, can all impacted functions be mitigated adequately at an off-site-location? If not, how is the applicant addressing water quality and quantity functions on-site?

2. What option has the applicant determined would be environmentally preferable and why (e.g. in-kind, out-of kind, temporal concerns, etc.)?

    a. If mitigation bank credits - go to item (i) below (applicant completes Mitigation Bank Use Plan)

    b. If ILF program credits - go to item (ii) below (applicant completes ILF Use Plan)

    c. If permittee-responsible mitigation - go to item (iii) below

        i. Mitigation bank credits

            1) The applicant must provide a rationale for using a mitigation bank (why the bank is an environmentally preferable compensation choice);

            2) Confirm that the impact occurs in the service area of the mitigation bank and that credits are available;

            3) Baseline information and determination of credits as described in D. 4. and D. 5. below; and

            4) In the administrative record (i.e., MFR, decision document, etc.), Borough Permit Reviewer must document acceptance of avoidance and minimization measures and rationale for compensatory mitigation requirements.

        ii. In-lieu fee program credits

            1) The applicant must provide a rationale for using an in-lieu fee (why the in-lieu fee is an environmentally preferable compensation choice);

            2) Confirm that the impact occurs in the Service Area of the in-lieu fee sponsor's program;

            3) Baseline Information and Determination of Credits as described in D. 4. and D. 5. below; and

4) In administrative record (i.e., MFR, Decision Document, etc.), the Borough Permit Reviewer must document acceptance of avoidance and minimization measures and rationale for compensatory mitigation requirements.

iii. Permittee-responsible mitigation

1) Type of compensatory mitigation

a) Preservation only (go to Section E)

b) Restoration, establishment, enhancement (go to Section D)

c) Stream compensatory mitigation projects (go to Section D)

2) Was a functional assessment provided for the impacted area, and was it related to the proposed compensatory mitigation? See Appendix A (Wetland Functions Information and Tools)

3) Was the functional assessment an approved methodology or is it based upon best professional judgment? See item 4.

4) Does the functional assessment adequately describe the impacts to all aquatic resource/wetland functions - water quantity; water quality; habitat? Does the Borough agree with the conclusions of the assessment?

5) Overall, is the wetland being impacted of high, medium, or low functions and services (Category I - IV - see Appendix A)?

6) Has the applicant or consultant included wetland and upland buffer impacts?

7) Are there indirect and/or secondary adverse effects from the project?

8) The Borough Permit Reviewer must document findings and rationale of items 2-7 above to support their conclusions.

D. Final Mitigation Plan Requirements for Permittee-Responsible Mitigation (meeting Federal Rule requirements; 33 CFR 332.4(c)(2) through (c)(14))

1. Objectives:

a. method of compensation (restoration, establishment, enhancement and/or preservation);

b. description of resource types (i.e., U.S. Fish and Wildlife Service Cowardin Class - PFO, PSS, PEM, riverine, lacustrine, etc. and/or Hydrogeomorphic (HGM) Class: Depressional, Riverine, Slope, or Flats) provided by plan (see Appendix A);

c. the amount of each resource type provided by plan; and

d. does the compensation project address the needs of the watershed, ecoregion, or other geographic area of interest?

2. Site Selection:

a. will the compensation project be self-sustaining;

b. did the applicant consider on-site alternatives where practicable; and

c. were watershed needs considered by applicant?

3. Site Protection Instrument:

a. what legal arrangements and instrument is the applicant proposing to ensure long-term protection of the mitigation site:

i. Conservation Easement

ii. Restrictive Covenant/Deed Restriction - See examples in O:\RD\Private\Library\Mitigation

4. Baseline Information:

For applicants planning on securing credits from a mitigation bank, baseline information only needs to be submitted for the impact site, not the mitigation bank project site. Information should be documented in a Bank Use Plan, See B.3.

Baseline information includes the following for both the impact site and the mitigation project site (if applicable). The list may not be inclusive of other information that may be needed on a case-by-case basis.

a. descriptions of historic and existing plant communities and hydrology (including any monitoring well data);

b. soil conditions (including any soil boring data);

c. a map showing the locations of the impact and mitigation site(s) or the geographic coordinates; and

d. delineation of wetlands (in accordance with the 1987 wetland delineation manual and the 2007 Alaska Regional Supplement) for both the impact and mitigation project site

5. Determination of Credits (See Appendix B):

A description of the number of credits to be provided, including a brief explanation of the rationale for this determination. (See Section 332.3(f).)

a. For permittee-responsible mitigation, this should include an explanation of how the compensatory mitigation project will provide the required compensation for unavoidable impacts to aquatic resources resulting from the permitted activity; and

b. For permittees intending to secure credits from an approved mitigation bank or in-lieu fee program, it should include the number and resource type of credits to be secured and how these were determined.

Example - DO NOT USE MONETARY CONVERSIONS - that is between the bank sponsor and the applicant!!! Using Appendix B: If the impact is 5 acres of moderate functioning wetland (Category II or III)

and the applicant proposes preservation (Mitigation Bank) as their compensatory mitigation type, then according to the ratio table, the applicant would need to compensate at a 2: 1 ratio, which would translate to 10 credits (or acres) of preservation. The price for purchasing 1O credits from a bank sponsor will be determined by the sponsor, NOT by the Borough.

6. Mitigation Work Plan:

The applicant needs to include the following details (using all available information, but not limited to):

For Wetland Projects

a. geographic boundaries of the project;

b. construction methods, timing, and sequence;

c. source(s) of water, including connections to existing waters and uplands;

d. methods for establishing the desired plant community (including plant species, number of individuals and spacing - e.g. trees will be planted 10-foot on center);

e. plans to control invasive plant species; proposed grading plan, including elevations and slopes of substrate;

f. soil management; and

g. erosion control measures

For Stream Projects - includes the above list, plus:

h. planform geometry;

i. channel form (e.g. typical channel cross-sections);

j. watershed size;

k. design discharge; and

I. riparian area planting plan (including species, number of individuals, and spacing)

7. Maintenance Plan:

a. description and schedule of maintenance requirements once initial construction is completed

8. Performance Standards (See Appendix C for examples):

a. used to determine whether the project is achieving objectives - must be meaningful, measurable and achievable, as well as enforceable;

b. must be objective and verifiable;

c. may be based on variables or measures of functional capacity described in functional assessment methodologies, measurements of hydrology or other aquatic resource characteristics, and/or comparisons to reference aquatic resources of similar type and landscape position.

9. Monitoring Requirements:

a. applicant should submit a description of parameters to be monitored in order to determine if the mitigation project is on track to meet performance standards and if adaptive management is needed - includes parameters to be monitored, the length of the monitoring period, party responsible for monitoring and submittal of reports, the frequency for submittal of reports; and

b. content and detail is commensurate with scale and scope of mitigation project

10. Long-term Management Plan:

a. how will mitigation project be managed to ensure long-term sustainability of the resource;

b. party responsible for ownership and all long-term management of the mitigation project;

c. long-term management responsibilities can be transferred to another entity, such as a public agency, non-governmental organization, or private land manager;

d. should include description of long-term management needs, annual cost estimates for these needs, and funding mechanism that will be used to meet those needs;

e. financing mechanisms include: non-wasting endowments, trusts, contractual arrangements with future responsible parties and other appropriate financial instruments; and

f. public authority or government agency responsible for long-term management, must include plan for long-term financing of the mitigation site

11. Adaptive Management Plan:

a. includes a strategy to address unforeseen changes in site conditions or other components of the mitigation project;

b. must include party responsible for implementing adaptive management measures;

c. adaptive management measures may include: site modification, design changes, revisions to maintenance requirements, and revised monitoring requirements

12. Financial Assurances:

a. need to assess whether financial assurance is required;

b. government agencies or public authorities with a formal documented commitment do not need to post financial assurances;

c. is another regulatory entity requiring financial assurances;

d. amount is based on the size and complexity of the mitigation project, likelihood of success, past performance of project sponsor, the degree of completion of the project at the time of project approval

e. financial assurances may be in the form of performance bonds, escrow accounts, casualty insurance, letters of credit, legislative appropriations for government sponsored projects, or other appropriate instruments

f. rationale for determining the amount of the required financial assurances, or not requiring any, must be documented in the administrative record

E. Required Criteria for using ONLY Preservation as Compensatory Mitigation (33 CFR 332.3(h))

1. The resources to be preserved provide important physical, chemical, or biological functions for the watershed;

2. The resources to be preserved contribute significantly to the ecological sustainability of the watershed. In determining the contribution of those resources to the ecological sustainability of the watershed, the district engineer must use appropriate tools, where available;

3. Preservation is determined by the Borough Permit Reviewer to be appropriate and practicable;

4. The resources are under threat of destruction or adverse modifications; and

5. The preserved site will be permanently protected through an appropriate real estate or other legal instrument (e.g., easement, title transfer to state resource agency or land trust).

F. Tables and Appendices

The tables and appendices were taken from the POA 2009 RGL and compiled using multiple resources and are to be utilized as tools and resources to assist in the permit reviewer's evaluation. Every project needs to be evaluated based on its own merit, and the tools are generalizations that may need adjusting or further analysis, which should be determined by the permit reviewer on a case-by-case basis. Edits were made for clarity.

Table 1: Examples of projects that will require compensatory mitigation and examples of projects that <u>may</u> or <u>may not</u> require compensatory mitigation.

Notes:

1. These are examples. Every project must be reviewed on a case-by-case basis to determine if compensatory mitigation is required.

2. This table assumes that avoidance and minimization has occurred for the project to the regulator's satisfaction and been documented. The decision whether to require compensatory mitigation must also be well documented in the project's administrative record.

3. The table does not mean that applicants proposing to utilize a Mitigation Bank or ILF Program for compensatory mitigation obligations would not have additional mitigation requirements (e.g. specific requirements outlined in the ESA consultation or another agencies' mitigation requirements or providing on-site or nearby mitigation for aquatic resource impacts that cannot be adequately mitigated off-site at a Mitigation Bank or ILF site).

WILL REQUIRE
The project occurs in degraded, rare, difficult to replace, or threatened wetlands, areas of critical habitat, 303(d) waters, etc.
The project, even if minimally impacting, occurs in a watershed where cumulative impacts are a concern (i.e., urban areas, transportation corridors, etc.)
Fill placed in intertidal waters associated with special aquatic sites, streams, rivers, lakes and/or riparian areas.
Fill placed in anadromous fish streams and wetlands adjacent to anadromous fish streams.
The project is federally funded, so compensatory mitigation is required under Executive Order 11990 (no net loss of wetlands).
MAY OR MAY NOT REQUIRE
The impacting project requires an IP or permanently impacts more than ½ acre of wetlands and/or other waters of the U.S.
The impacts from the project are so small (e.g. loss of 1/2 acre of forested wetlands in a remote, relatively undisturbed watershed) that they cannot be effectively compensated
There is no opportunity within the watershed for compensatory mitigation AND the impacts are so small that an ILF or Bank Sponsor could not sell a credit that would be worth the money to process (cost/benefit analysis does not add up)
The project impacts are minimal or in a watershed with large expanses of wetlands that are not at risk of being cumulatively degraded.

[The following sections below are kept as is]

Appendix A: Functional Assessment Information and Tools

Appendix B: Sample Ratios for Compensatory Mitigation

Appendix C: Performance Standards

Appendix D: Glossary

Gail Terzi – Bio

Gail Terzi worked for the U.S. Army Corps of Engineers (Corps) for over 27 years, predominantly with the Seattle District. She retired from the Corps in April 2017. Her experience with the Corps was vast and diverse and she worked as Project Manager, Environmental Analyst, and lastly as Compensatory Mitigation Program Manager, for approximately 20 years to the time of retirement. Gail led the Seattle District in setting up and implementing a successful and legally sound mitigation program that is held up as the gold standard for the Corps.

Her main duties as program manager consisted of reviewing, commenting, processing, negotiating, and permitting of Mitigation Banks and In-lieu-fee Programs and mitigation sites. Gail coordinated closely with Seattle District's Office of Counsel and all the legal parameters for permittee responsible mitigation sites, banks, and ILFs, including real estate, site protection, Long-term Management and Financial Assurances and is considered an expert in these fields as well. She was instrumental in developing district policy and guidance, reviewing and providing comments on a variety of functional assessment tools and is considerably knowledgeable in the field of federal regulations (especially the 2008 Federal Rule on Compensatory Mitigation), Endangered Species Act (ESA) and all components of compensatory mitigation, including development of "fish credits" under the ESA. Gail was actively sought out for public presentations and participated and presented at many conferences and other venues over the years. Gail chaired or co-chaired the Interagency Review Team for banks and ILF programs and is a respected leader and expert among her sister agencies, colleagues, and Native American Tribes.

She also received many awards during her time with the Corps including Scientist of the Year and Employee of the Year for her work in the compensatory mitigation realm.