STATUS AND TRENDS OF WETLANDS IN THE PALMER/WASILLA AREA, ALASKA (1978 to 1996)

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INTRODUCTION

The U.S. Fish and Wildlife Service's National Wetlands Inventory (NWI) project has produced large scale wetlands maps for approximately 90 percent of the conterminous United States and 35 percent of Alaska. The Clean Water Act of 1977 and the Emergency Wetlands Resources Act of 1986 mandate this mapping by the NWI program. In addition to developing hard-copy and digital wetland map products, the NWI produces local, regional, and national data on the status and trends of wetlands. The information on losses and gains of wetlands is important for reviewing the effectiveness of government programs and policies designed to protect wetlands.

In 1994, the NWI published data on the current status of wetlands in Alaska (Hall 1994). This report showed that 43.3 percent, or 174.7 million acres, of Alaska's surface area is classified as wetland. In comparison, wetlands only occupy 5.5 percent of the land surface of the lower 48 states (Dahl 2000). Alaska contains 63 percent of the nation's wetlands.

Although there is no statistically reliable data on statewide wetland losses, the USFWS estimates that Alaska had lost 200,000 acres, or less than one percent of the state's original wetland acreage (Dahl 1990). A 1989 report on the effects of petroleum operations in Alaska wetlands prepared by Senner (1989) for ARCO Alaska estimated cumulative wetland losses from human activity at 80,000 acres since the time of territorial accession in 1867. The report indicated that the loss estimates would be substantially higher if a complete and more accurate inventory were conducted. In most states, the destruction of wetlands through draining and filling has been much more dramatic. More than 80 percent of the wetlands have disappeared in California, Illinois, Indiana, Iowa, Kentucky, Missouri, and Ohio. As a whole, the conterminous United States have lost an estimated 53 percent of their original wetland acreage.

While total wetland losses relative to Alaska's vast wetland acreage have been small compared to other areas of the country, the loss of wetlands has been significant in specific areas. The rapid growth of urban centers and the expanding development of oil, gas, mineral, agricultural and timber resources have impacted wetlands in many locations.

Urban development and construction of transportation systems account for the greatest loss of wetlands in Alaska. The state's three largest cities (Anchorage, Fairbanks, and Juneau) are located in areas where wetland density is high. Many towns and villages in northern and western Alaska are built almost entirely on land classified as wetlands. In 1982, the potential for urban expansion to impact remaining wetlands in Anchorage led to the establishment of a local comprehensive wetland management plan. The NWI program conducted an analysis of the losses of wetlands in the Anchorage Bowl. In 1950 the Bowl contained 18,903 acres of wetland. By 1990, 52.7 percent (9,958 acres) of the 1950 wetland base was lost from draining and filling activities (U.S. Fish and Wildlife Service 1993).

The USFWS completed a wetlands trends analysis for the Juneau area in 1986 and included the data as part of the 1987 Juneau Wetland Management Plan (Adamus 1988). The 15,606-acre study area represented most of the developable land in Juneau and vicinity. Wetlands in 1948

comprised 59 percent, or 9,208 acres, of the study area. Based on the analysis of aerial photography, a total of 1,162 acres were filled between 1948 and 1984, representing a loss of about 13 percent of the wetland acreage present in 1948.

Rapid growth of residential and commercial development in the Palmer/Wasilla area of Alaska led the Environmental Protection Agency to fund the analysis of wetland trends presented in this report. The NWI project utilized the same standard procedures and methods that were used to conduct the local wetland trends studies in Anchorage, Juneau and other locations throughout the U.S.

STUDY AREA

The study area (Figure 1) includes the developed areas in the vicinity of Palmer and Wasilla. The eastern part of the study area also encompasses developed lands in the Big Lake and Houston areas. The study area has a land surface of 429 square miles, or 274,276 acres. Boundaries of the C-6, C-7 and C-8 1:63,360 scale USGS quads form the southern and western edges of the project area. The northern and eastern edges follow township and range grid lines on the outskirts of the more densely populated areas near Palmer and Wasilla.

The project area falls within the Cook Inlet-Susitna Lowland physiographic region, which also includes Talkeetna, Anchorage, Kenai, Soldotna, and Homer. This area is a long narrow basin between the Kenai, Chugach, and Talkeetna Mountains to the east and the Aleutian and Alaska Ranges to the west (Rieger et al. 1979). Hall (1994) determined that 28.0 percent of the land surface in the Cook Inlet-Susitna Lowland region is classified as wetland.

The study area has been glaciated several times. As a result, most of the bedrock is buried beneath thick deposits of glacial drift and alluvial sediments. These deposits are covered with a mantle of loess derived from the barren floodplains of glacier-fed streams (Schoephorster 1968). Low moraines in the area are interspersed with many bogs, fens, and lakes. A large portion of the tidally influenced Palmer Hay Flats falls in the south central part of the project area. The climate of the area around Palmer and Wasilla has both maritime and continental characteristics. The mean annual precipitation for Wasilla is approximately 18 inches. The mean temperature for January is 13.9° F, and the mean temperature for July is 57.3° F.

METHODS

Wetland trends analysis involves detecting changes in the extent of wetlands by comparing aerial photography from at least two time periods for a given area. For the present study, aerial photographs from 1978 and 1996 were used to determine the extent of wetland changes (losses, gains, or changes in wetland type).

National Wetlands Inventory (NWI) maps covering the study area were published in1981. These maps were based on the photo interpretation of 1978 color infrared (CIR) aerial photographs at a

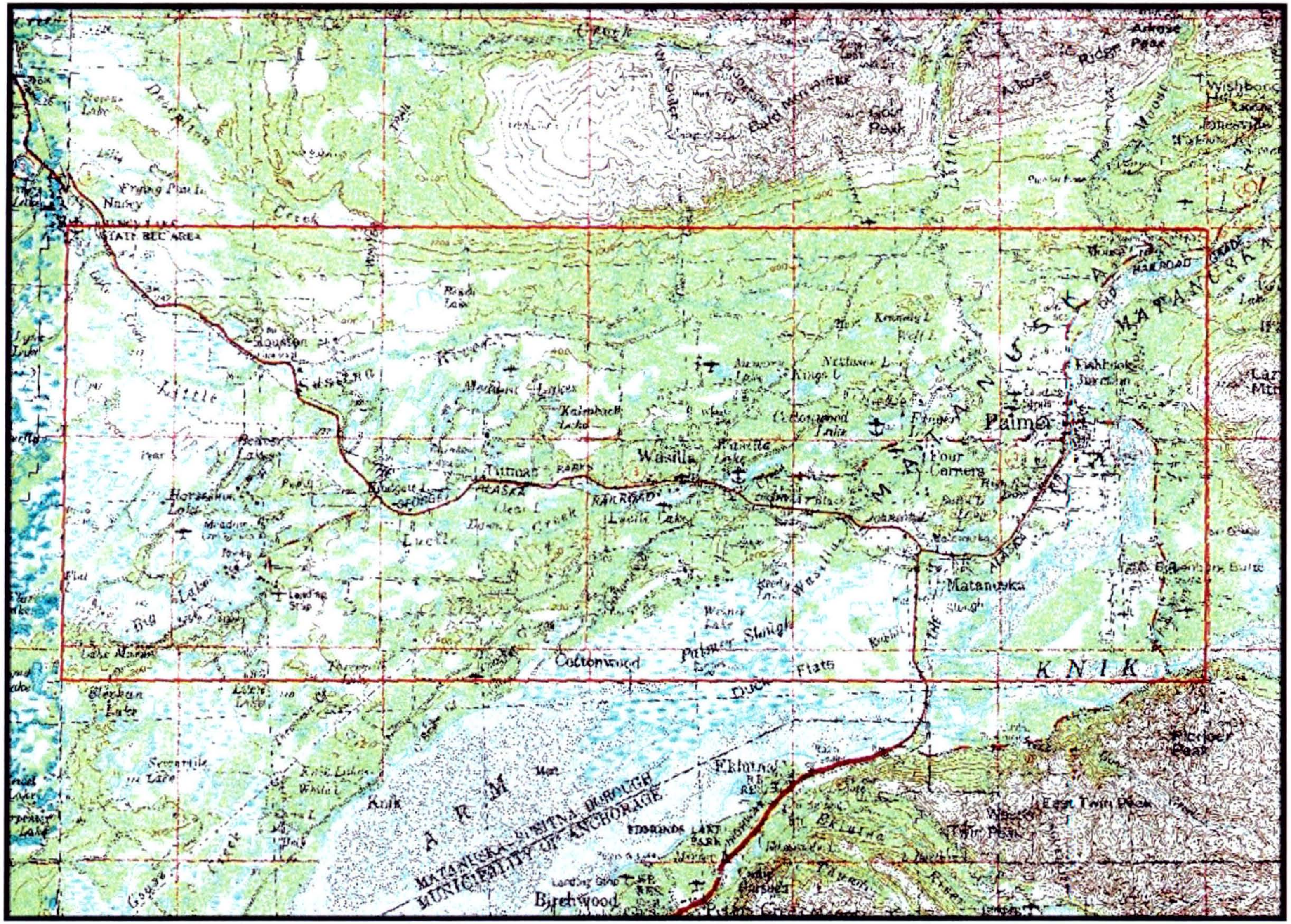

Figure 1. Palmer/Wasilla wetlands status & trends study area.

scale of 1:60,000. The digital file of the original NWI map data served as the starting point for the wetland trends study. Corrections were made to the 1978 base data if it was determined that the original mapping personnel made errors when interpreting the photos. Most of the corrections involved adding wetlands that were overlooked by the original interpreters. Other corrections included refinement of wetland boundaries, adjustment to wetland classifications, and deletion of non-wetland areas incorrectly classified as wetland.

The corrected digital data from 1978 was printed out on clear acetate sheets that matched the scale of the color 1996 imagery (1:24,000). Wetland changes (losses, gains, and major covertype changes) were annotated and labeled by a photo interpreter on the clear acetate sheets. The photo-interpretation was performed stereoscopically using a 5X power stereoscope. The change polygons were then transferred to a quad-sized clear film sheet corresponding to the 1;25,000 quarter-quads in the Anchorage C-6, C-7, and C-8 USGS quadrangles. This information was converted to a digital form and merged with the digital files of the 1978 data. The merged data set was used to produce the statistical information presented in this report.

All changes were assigned a code according to the type of activity that caused the change. The categories used are listed below. Complete definitions of the wetland loss/gain categories are included in Appendix A.

1. Residential development
2. Commercial development
3. Industrial development
4. Public facilities
5. Road construction
6. Agriculture
7. Other development
8. Natural

Wetlands and deepwater habitats were classified using the Classification of Wetlands and Deepwater Habitats of the U.S. (Cowardin et al. 1979). Deepwater habitats in the study area include permanently flooded river channels, portions of lakes greater than 2 meters in depth, and estuarine subtidal areas.

RESULTS

Status: 1996

In 1996, the study area contained 59,994 acres of wetlands, or 21.9% of the total land surface (Figure 2). Deepwater habitats (limnetic portions of lakes, permanently flooded river channels, and estuarine subtidal areas) encompass 12,796 acres, or 4.7% of the project area. Over 73% of the lands in and around the Palmer/Wasilla area are classified as non-wetland (uplands).

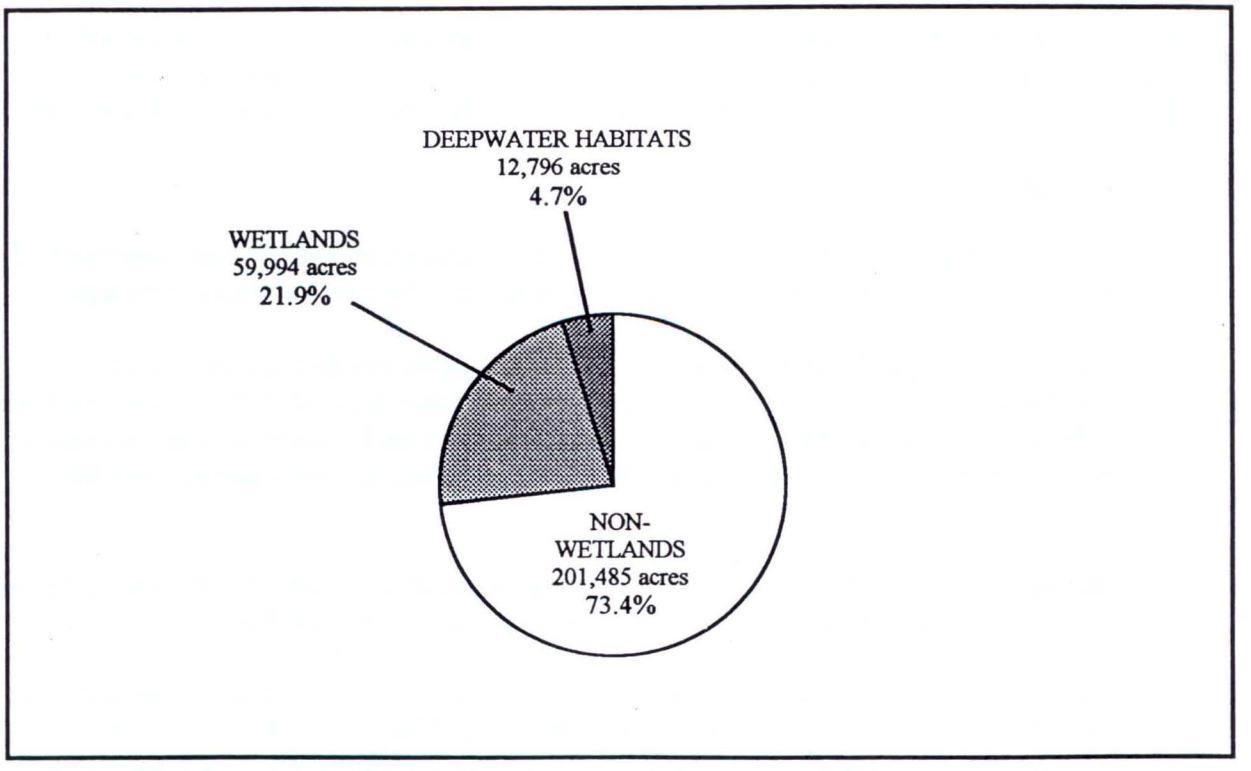

Figure 2. Distribution of wetlands, deepwater habitats and non-wetland areas in the Palmer/Wasilla study area – 1996.

Most of the wetlands in the study area are in the **palustrine** ecological system (Table 1). Four of the five systems described by Cowardin et al. (1979) are represented in the project area. The **estuarine** wetland areas (5,108 acres) are contained within the Palmer Hay Flats State Game Refuge. There are no **marine** wetlands in the upper Cook Inlet region.

Table 1. Classification of wetlands by ecological system in the Palmer/Wasilla study area – 1996

Ecological System *	Acres	Percent
Palustrine	51,160.3	85.3
Estuarine	5,107.8	8.5
Riverine	2,863.9	4.8
Lacustrine	862.4	1.4
Marine	0.0	0.0
Totals	59,994.4	100.0

* Ecological systems are described in the Classification of Wetlands and Deepwater Habitats of the U.S. (Cowardin et al. 1979).

Ninety-one wetland and deepwater habitat categories (Cowardin et al. 1979) were identified during the photo interpretation phase of the wetlands trends study. For data presentation purposes, these types were combined into 11 general classes. Descriptions of the classes follow:

Wetlands

Estuarine Mud Flat: Intertidal mud flats that are usually unvegetated and composed of silt and sand-sized particles. Some mud flat areas may be covered with sparse algae.

Estuarine Salt Marsh: Intertidal marsh that is alternately flooded and exposed by brackish tidal water. This class includes low marsh areas flooded daily by tidal water and high marsh zones that may only be flooded a few times each month. Common species include *Carex lyngbyei, Carex ramenskii, Triglochin maritimum, Plantago maritima, Potentilla anserina, and Elymus arenarius.*

Lacustrine Littoral: Shallow portions of lakes including unvegetated open water, aquatic beds (e.g., *Nymphaea tetragona and Potamogeton* sp.), and sand flats.

Palustrine Open Water: Small open water bodies (ponds). This class also includes: (1) ponds that may be vegetated with aquatic beds (e.g., *Nymphaea tetragona and Potamogeton* sp.), and (2) small basins that may only contain water on a seasonal basis. Some of the wetlands in this class are excavated basins in developed areas.

Palustrine Emergent: Wetlands dominated by herbaceous vegetation including sedges, grasses, and forbs. Includes wetlands commonly referred to as marshes and wet meadows.

Palustrine Scrub/Shrub: Wetlands dominated by woody vegetation less than 6 m (20 feet) tall. This category includes true shrubs such as willow (*Salix* spp.), young trees, and trees that may be stunted because of environmental conditions (e.g., *Picea mariana* in wet bogs). Other common species dominating scrub/shrub wetlands include *Vaccinium uliginosum, Betula nana, Empetrum nigrum, Potentilla fruticosa*, and *Almus crispa.*

Palustrine Forested: Wetlands dominated by woody vegetation greater than 6 m (20 feet) tall. *Picea mariana* dominates most of the forested wetlands in the study area. In some sites the black spruce is mixed with *Betula papyrifera* and *Picea glauca*. Forested wetlands dominated by *Populus trichocarpa* are found along rivers and streams.

Riverine Bars/Flats: This class includes unvegetated bars and flats contained within the channel banks of rivers, streams and creeks.

Deepwater Habitats

Estuarine Subtidal: Subtidal, low-energy brackish open water. This category is limited to tidal creeks (e.g., Palmer Slough) in portions of the Palmer Hay Flats.

Lacustrine Limnetic: This class includes portions of lakes that are greater than 2 meters in depth. Examples of this class include Big Lake, Lake Lucile and Wasilla Lake.

Riverine Channel: Permanently flooded channels of rivers and streams.

The acreage for each of the generalized wetland types in 1996 is presented in Table 2. Palustrine scrub/shrub wetlands predominate, accounting for over 64% (38,625 acres) of the total wetland acreage in the study area. The next two most extensive wetland classes are palustrine forested wetlands and riverine bars/flats, with 5,292 acres (8.8%) and 4,650 acres (7.8%), respectively. Appendix B shows a list of the 1996 acreage of all wetland types according to the NWI map codes used during the photo interpretation. The codes represent the Classification of Wetlands and Deepwater Habitats of the U.S. (Cowardin et al. 1979).

Table 2. Acreage of wetland types in the Palmer/Wasilla study area: 1996

Wetland Type	Acres	Percent
Estuarine Mud Flat	739.550	1.2
Estuarine Salt Marsh	4,368.250	7.3
Lacustrine Littoral	862.430	1.4
Palustrine Open Water	1,058.950	1.8
Palustrine Emergent	4,398.680	7.3
Palustrine Scrub/Shrub	38,624.550	64.4
Palustrine Forested	5,292.080	8.8
Riverine Bars/Flats	4,649.945	7.8
Total Wetlands	**59,994.435**	**100.0**

Most of the deepwater habitat acreage in 1996 consisted of lacustrine limnetic areas (Table 3). This category accounted for 76.2% of all deepwater habitat acreage. A total of 118 lakes were mapped in the study area. Estuarine subtidal and riverine channel areas covered 381.5 acres (3.0%) and 2,664.65 acres (20.8%), respectively.

Table 3. Acreage of deepwater habitat types in the Palmer/Wasilla study area: 1996		
Deepwater Habitat Type	Acres	Percent
Estuarine Subtidal	381.490	3.0
Lacustrine Limnetic	9,750.160	76.2
Riverine Channel	2,664.645	20.8
Total Deepwater Habitats	**12,796.295**	**100.0**

Trends: 1978 to 1996

Wetland Losses from Development Activities

Between 1978 and 1996, 208.6 acres of wetland in the study area were filled or drained by development activities (Table 4). Palustrine scrub/shrub wetlands were the most adversely impacted type with over 141 acres lost. In descending order of acreage lost, this is followed by 35.9 acres of palustrine forested wetland and 23.2 acres of palustrine emergent wetland. It appears, however, that no wetland type showed a significant disproportionate loss when compared to the original extent of the category in 1978. For example, 68.0% of the wetland losses were in palustrine scrub/shrub wetlands. This wetland class accounted for 65.4% of the wetlands at the beginning of the study period.

Table 4. Losses of wetlands (by class) due to development activities in the Palmer/Wasilla study area: 1978 - 1996		
Wetland Type	Acres	Percent
Estuarine Mud Flat	0.00	0.0
Estuarine Salt Marsh	0.00	0.0
Lacustrine Littoral	0.55	0.3
Palustrine Open Water	6.54	3.1
Palustrine Emergent	23.23	11.1
Palustrine Scrub/Shrub	141.82	68.0
Palustrine Forested	35.85	17.2
Riverine Bars/Flats	0.59	0.3
Total	**208.58**	**100.0**

A total of 252 development actions resulting in wetland loss were identified during the analysis of the aerial photography (Table 5). Definitions of the development types are shown in Appendix A. Residential development, with 114 locations identified, was the most common action resulting in wetland loss. The average loss per residential development action was 0.52 acres. Although road construction resulted in wetland loss in fewer cases (70), the average loss per action was higher (1.05 acres). A total of 73.56 acres of wetland was filled for road construction.

Development related to agriculture and construction of public facilities resulted in the smallest wetland losses, with 5.76 acres and 0.47 acres lost, respectively. The "Other" category was used where initial development had occurred (e.g., placement of a fill pad), but eventual use of the area could not be determined. This category also includes miscellaneous uses that do not fit into the other main categories (e.g., golf courses).

Table 5. Losses of wetlands (by development category) in the Palmer/Wasilla study area: 1978 - 1996

Development Type	Frequency	Percent of Total Development Actions	Acres Filled/Drained	Average Loss Per Action (acres)
Agriculture	5	2.0	5.76	1.15
Commercial	8	3.2	5.10	0.64
Residential	114	45.2	59.28	0.52
Industrial	31	12.3	50.00	1.61
Public Facilities	1	0.4	0.47	0.47
Roads	70	27.8	73.56	1.05
Other	23	9.1	14.41	0.63
Total	**252**	**100**	**208.58**	**0.82**

Natural Wetland Losses

In addition to wetland losses from human development activities, the study also identified and measured losses that resulted from natural changes (Table 6). All of the natural losses identified were the result of the shifting of river channels in the Matanuska River and Knik River floodplains. A major shift of the Matanuska River within its historic floodplain occurred in the early 1990s. A total of 220.34 acres of wetland that existed in 1978 were converted to non-wetland in the floodplain areas. Most of this wetland acreage (98.4%) was classified in the palustrine scrub/shrub class.

Wetland Gains from Development Activities

Human development activities resulted in some gains of wetland habitat. A total of 16.21 acres of wetland was created from 29 development actions during the 1978-1996 study period (Tables 7 and 8). Palustrine open water wetlands accounted for 68.7% of the gains. Examination of the data for wetland gains revealed that most of the gains (14.21 acres) were the result of wetlands being formed in excavated basins. The average gain was .56 acres.

Table 6. Conversion of wetland (by class) to non-wetland due to natural changes in the Palmer/Wasilla study area: 1978 - 1996		
Wetland Type	Acres	Percent
Estuarine Mud Flat	0.00	0.0
Estuarine Salt Marsh	0.00	0.0
Lacustrine Littoral	0.00	0.0
Palustrine Open Water	0.00	0.0
Palustrine Emergent	0.00	0.0
Palustrine Scrub/Shrub	216.83	98.4
Palustrine Forested	3.51	1.6
Riverine Bars/Flats	0.00	0.0
Total	**220.34**	**100.0**

Table 7. Gains of wetlands (by class) due to development activities in the Palmer/Wasilla study area: 1978 - 1996		
Wetland Type	Acres	Percent
Estuarine Mud Flat	0.00	0.0
Estuarine Salt Marsh	0.00	0.0
Lacustrine Littoral	0.38	2.4
Palustrine Open Water	11.14	68.7
Palustrine Emergent	4.69	28.9
Palustrine Scrub/Shrub	0.00	0.0
Palustrine Forested	0.00	0.0
Riverine Bars/Flats	0.00	0.0
Total	**16.21**	**100.0**

Table 8. Gains of wetlands (by development category) in the Palmer/Wasilla study area: 1978 - 1996				
Development Type	Frequency	Percent of Total Development Actions	Acres Gained	Average Gain Per Action (acres)
Agriculture	3	10.3	3.35	1.12
Commercial	0	0.0	0.00	-
Residential	9	31.1	4.70	0.52
Industrial	3	10.3	1.11	0.37
Public Facilities	3	10.3	2.21	0.74
Roads	0	0.0	0.00	-
Other	11	38.0	4.84	0.44
Total	**29**	**100**	**16.21**	**0.56**

Natural Wetland Gains

In addition to wetland gains resulting from human development activities, natural changes also caused the conversion of non-wetland areas to wetland during the 18-year study period (Table 9). All of the natural gains identified were the result of the shifting of river channels in the Matanuska River and Knik River floodplains. A major shift of the Matanuska River within its historic floodplain occurred in the early 1990s. A total of 574.36 acres of non-wetland that existed in 1978 were converted to wetland in the floodplain areas. Most of this new wetland acreage was classified as palustrine scrub/shrub (346.93 acres) and palustrine forested (157.99 acres).

Table 9. Conversion of non-wetland (by class) to wetland due to natural changes in the Palmer/Wasilla study area: 1978 - 1996

Wetland Type	Acres	Percent
Estuarine Mud Flat	0.00	0.0
Estuarine Salt Marsh	0.00	0.0
Lacustrine Littoral	0.00	0.0
Palustrine Open Water	0.00	0.0
Palustrine Emergent	0.00	0.0
Palustrine Scrub/Shrub	346.93	60.4
Palustrine Forested	157.99	27.5
Riverine Bars/Flats	69.44	12.1
Total	**574.36**	**100.0**

Deepwater Habitat Losses and Gains

No conversions of deepwater habitat to upland were identified during the study. Two instances of gains in deepwater habitat were documented:

- 0.37 acres of upland converted to lacustrine limnetic (residential development)
- 43.55 acres of upland converted to riverine channel (natural change)

Wetland and Deepwater Habitat Classification Changes

Although the measurement of wetland losses and gains was the primary focus of this study, changes in classification were also identified during the analysis of the aerial photography (Tables 10 and 11). These changes involved the conversion from one wetland or deepwater habitat class to another as a result of development activities or natural events. The most common development scenarios that caused a change in classification included the clearing of woody vegetation in wetlands, partial draining of wetlands, and construction of structures (e.g., roads and fill pads) that modified hydrologic regimes in adjacent wetland areas. There were 34 development actions that caused a classification change between 1978 and 1996 (Table 10).

Table 10. Wetland and deepwater habitat classification changes caused by development activities: 1978 – 1996.

1978 Classification ↓	Acres of 1978 wetland and deepwater habitat classes that changed to other classes. The number of changed areas is shown in parentheses.												
	Estuar. Mud Flat	Estuar. Salt Marsh	Lacust. Littoral	Palust. Open Water	Palust. Emerg	Palust. Scrub/ Shrub	Palust. Forest.	River. Flats/ Bars	Estuar. Sub-tidal	Lacust. Limnet-ic	River. Chan-nel	Total Acres Changed	Total Number of Areas
Estuarine Mud Flat	-	0	0	0	0	0	0	0	0	0	0	0	0
Estuarine Salt Marsh	0	-	0	0	0	0	0	0	0	0	0	0	0
Lacustrine Littoral	0	0	-	0	0	0	0	0	0	0	0	0	0
Palustrine Open Water	0	0	0	-	2.99 (1)	0	0	0	0	0	0	2.99	1
Palustrine Emergent	0	0	0	0	-	0	0	0	0	0	0	0	0
Palustrine Scrub/Shrub	0	0	3.37 (4)	16.81 (10)	18.44 (9)	-	0	0	0	1.12 (2)	0	39.74	25
Palustrine Forested	0	0	0	1.10 (2)	2.48 (1)	8.36 (5)	-	0	0	0	0	11.94	8
Riverine Bars/Flats	0	0	0	0	0	0	0	-	0	0	0	0	0
Estuarine Subtidal	0	0	0	0	0	0	0	0	-	0	0	0	0
Lacustrine Limnetic	0	0	0	0	0	0	0	0	0	-	0	0	0
Riverine Channel	0	0	0	0	0	0	0	0	0	0	-	0	0
											Total	**54.67**	**34**

Table 11. Wetland and deepwater habitat classification changes caused by natural events: 1978 – 1996.

1978 Classification ↓	Acres of 1978 wetland and deepwater habitat classes that changed to other classes. The number of changed areas is shown in parentheses.												
	Estuar. Mud Flat	Estuar. Salt Marsh	Lacust. Littoral	Palust. Open Water	Palust. Emerg	Palust. Scrub/ Shrub	Palust. Forest.	River. Flats/ Bars	Estuar. Sub-tidal	Lacust. Limnet-ic	River. Chan-nel	Total Acres Changed	Total Number of Areas
Estuarine Mud Flat	-	0	0	0	0	0	0	0	0	0	0	0	0
Estuarine Salt Marsh	0	-	0	0	0	0	0	0	0	0	0	0	0
Lacustrine Littoral	0	0	-	0	0	0	0	0	0	0	0	0	0
Palustrine Open Water	0	0	0	-	24.99 (4)	0	0	0	0	0	0	24.99	4
Palustrine Emergent	0	0	0	0	-	16.02 (9)	0	0	0	0	0	16.02	9
Palustrine Scrub/Shrub	0	0	0	0	0	-	0	183.71 (18)	0	0	121.80 (13)	305.51	31
Palustrine Forested	0	0	0	0	0	0	-	52.61 (1)	0	0	52.61 (1)	105.22	2
Riverine Bars/Flats	0	0	0	0	730.65 (3)	258.05 (8)	0	-	0	0	92.40 (3)	1,081.10	14
Estuarine Subtidal	0	0	0	0	0	0	0	0	-	0	0	0	0
Lacustrine Limnetic	0	0	0	0	0	0	0	0	0	-	0	0	0
Riverine Channel	0	0	0	0	712.15 (1)	19.48 (3)	0	210.10 (1)	0	0	-	941.73	5
											Total	**2,474.57**	**65**

The conversion of palustrine scrub/shrub areas to other classes accounted for 25 of these changes. The most common conversion was a change from scrub/shrub to palustrine open water (10 areas; 16.81 acres). Nine scrub/shrub areas totaling 18.44 acres were converted to the palustrine emergent class.

Most classification changes resulting from natural events occurred in portions of river floodplains where channels had shifted (Table 11). For example, 1,081.10 acres of riverine bars/flats converted to the following classes: palustrine emergent (730.65 acres), palustrine scrub/shrub (258.05 acres) and riverine channel (92.40 acres). There were a total of 65 areas that had undergone a change in classification due to natural events during the 18-year study period. The total acreage of these changes was 2,474.57 acres

Net Changes: 1978 to 1996

Table 12 shows the acreage of the wetland and deepwater habitat classes in 1978 and 1996. The data represents net losses and gains. For example, the palustrine open water class decreased in coverage from 1,064.42 acres in 1978 to 1,058.95 acres in 1996. This net loss of 5.47 acres is derived from:

- Loss of 6.54 acres: palustrine open water to non-wetland due to development (Table 4).
- Gain of 11.14 acres: non-wetland to palustrine open water due to development (Table 7)
- Gain of 16.81 acres: change from palustrine scrub/shrub to palustrine open water due to development (Table 10).
- Gain of 1.10 acres: change from palustrine forested to palustrine open water due to development (Table 10).
- Loss of 2.99 acres: change from palustrine open water to palustrine emergent due to development activities (Table 10).
- Loss of 24.99 acres: change from palustrine open water to palustrine emergent due to natural events (Table 11).

There was a net gain of 835.4 acres of wetland during the 18-year study period. Most of this gain is attributable to the major shifting of the Matanuska River channel in the early 1990s. Over 500 acres (Table 9) that were non-wetland in 1978 became scrub/shrub or forested wetland. Additional gains in wetland acreage occurred when deepwater habitats (riverine channel) became temporarily flooded wetlands (riverine bars/flats, palustrine scrub/shrub and palustrine emergent). These gains were partially offset by accompanying conversions of wetland habitats to non-wetland in areas that were no longer flooded.

The large gain (1,058.9) in acreage for the palustrine emergent class is also the result of changes in the Matanuska River floodplain. Over 730 acres of unvegetated riverine bars/flats changed to the palustrine emergent wetland class (Table 11). These areas were colonized with pioneer herbaceous plants when flooding became less frequent. An additional 712.2 acres of riverine channel changed to palustrine emergent when the channels shifted to a different part of the wide floodplain.

Table 12. Net acreage change for wetland and deepwater habitat classes in the Palmer/Wasilla study area: 1978 – 1996				
Class	Acres 1978	Acres 1996	Change in Acres	Percent Change
Estuarine Mud Flat	739.550	739.550	0.000	0.0
Estuarine Salt Marsh	4,368.250	4,368.250	0.000	0.0
Lacustrine Littoral	859.230	862.430	+3.200	+0.4
Palustrine Open Water	1,064.420	1,058.950	-5.470	-0.5
Palustrine Emergent	2,930.820	4,398.680	+1,467.860	+50.1
Palustrine Scrub/Shrub	38,690.350	38,624.550	-65.800	-0.2
Palustrine Forested	5,290.610	5,292.080	+1.470	+0.1
Riverine Bars/Flats	5,215.770	4,649.945	-565.825	-10.8
TOTAL WETLANDS	**59,159.000**	**59,994.435**	**+835.435**	**+1.4**
Estuarine Subtidal	381.490	381.490	0.000	0.0
Lacustrine Limnetic	9,748.670	9,750.160	+1.490	+0.1
Riverine Channel	3,296.000	2,664.645	-631.355	-19.2
TOTAL DEEP-WATER HABITATS	**13,426.160**	**12,796.295**	**-629.865**	**-4.7**
TOTAL WETLANDS & DEEPWATER HABITATS	**72,585.160**	**72,790.730**	**+205.57**	**+0.3**

There was a net loss of 629.9 acres of deepwater habitat in the study area. This was due primarily to the conversion of riverine channels to wetland classes (palustrine emergent, palustrine scrub/shrub and riverine bars/flats). The total acreage for all wetland and deepwater habitat classes increased from 72,585.2 acres in 1978 to 72,790.7 acres in 1996. This represents a net gain of 0.3% during the 18-year study period.

SUMMARY

In 1996, the 429 square-mile study area had 21.9% of its land surface covered by wetlands. An additional 4.7% consisted of deepwater habitats. Palustrine scrub/shrub wetlands accounted for 64.4% of the total wetland acreage.

Between 1978 and 1996, the study area lost 208.6 acres of wetland from development activities. There were 252 development sites that contributed to this loss. Over 45% of these sites were recorded as residential development.

A major shift in the primary channels of the Matanuska River resulted in significant changes in the extent and distribution of wetlands and deepwater habitats. These types of changes are common in wide riverine systems that consist of a network of channels interspersed with

vegetated and unvegetated gravel bars. Sites can convert from non-wetland to wetland in short time periods and then revert back to non-wetland depending on channel locations. The current study documented the extent of wetlands and deepwater habitats in these riverine areas in 1978 and 1996. If a different end-date had been used (e.g., 1993 or 1999), significantly different data on natural losses and gains would be expected. In contrast to the dynamic nature of the floodplain systems, the wetlands outside of floodplains remained stable during the study period. No natural losses or gains were recorded for these wetlands.

The 1996 end-date of the study was used because more recent aerial photography was not available. Significant growth in the Palmer and Wasilla areas has continued from 1996 to the present. It is anticipated that the National Wetland Inventory program will update the trends study when more recent imagery is acquired.

While this report documents recent trends in the project area, it does not address changes in the quality of the remaining wetlands. As development increases, the quality of wetlands and the functions they provide can be expected to deteriorate. This deterioration comes from increased runoff from commercial and residential developments, increased sedimentation, fragmentation of wetland systems, and modification to natural hydrologic regimes.

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APPENDIX A

Wetland Loss/Gain Categories
Palmer/Wasilla Study Area

Residential Development: Construction of single-family homes, condominiums, apartment buildings, etc. This category includes the roads and driveways associated with the residential development.

Commercial Development: Construction of buildings, fill pads, and access roads associated with the development of commercial establishments such as retail stores, restaurants, motels and private office buildings.

Industrial Development: Construction of light industrial facilities including warehouses and heavy equipment/large vehicle storage yards. This category also includes airport/airstrip development, construction of airport related facilities (e.g., air cargo businesses), and gravel mining.

Public Facilities: Schools, public recreation (e.g., playgrounds and ball fields), sewage treatment facilities and government buildings (federal, state and local). The category also includes the roads, driveways and parking lots built specifically for the public facilities.

Other Development: This category is used where initial development had occurred (e.g., placement of a fill pad), but eventual use of the area could not be determined. The category also includes miscellaneous uses that do not fit into the other main categories (e.g., golf courses and RV camper parks).

Agriculture: Cropland, pasture, nurseries and other related land uses. The category includes associated development such as farm roads, farm ponds and buildings (e.g., barns).

Roads: Public roads not specifically built for one of the development types listed above.

Natural: Changes caused by natural phenomena such as meandering river channels and beaver activity.

APPENDIX B

List of NWI Map Codes: 1996 Data

NWI MAP CODES	FREQUENCY	ACRES
E2EM1/UBN	18	1764.32
E2EM1/USN	10	1312.81
E2EM1N	5	932.19
E2EM1P	2	358.93
E2SBN	1	20.16
E2USN	13	719.39
L2AB3/UBH	2	52.69
L2AB3H	52	706.16
L2EM2H	1	0.39
L2UBH	4	99.44
L2UBHx	5	3.75
PAB3/UBH	6	22.9
PAB3F	1	2.81
PAB3H	22	93.19
PAB3Hx	2	2.58
PEM1/SS1C	1	1.98
PEM1/SS1Cb	3	10.66
PEM1/UBF	4	501.24
PEM1/UBFb	1	10.72
PEM1/UBFh	1	1.72
PEM1/UBHx	1	2.19
PEM1/UBH	5	73.15
PEM1/USA	4	1450.32
PEM1A	9	10.27
PEM1Ad	2	2.95
PEM1B	208	1129.35
PEM1C	38	129.68
PEM1Cb	2	17.77
PEM1Cx	7	7.05
PEM1F	120	1010.18
PEM1Fb	1	0.86
PEM1Fh	3	5.2
PEM1H	1	3.59
PEM1R	3	29.8

PFO1/EM1B	2	6.82
PFO1/EM1C	1	18.51
PFO1/SS1A	2	153.67
PFO1/SS1B	7	32.28
PFO1/SS1C	10	275.78
PFO1/SS1R	2	8.3
PFO1A	2	6.01
PFO1B	1	5.7
PFO1C	2	4.1
PFO4/1B	8	69.19
PFO4/EM1B	33	577.11
PFO4/SS1B	118	2272.97
PFO4/SS1C	1	67.75
PFO4/SS4B	2	26.86
PFO4B	265	1684.7
PFO5/SS1C	2	26.26
PFO5/SS1F	1	33.62
PFO5C	1	2.23
PFO5Cb	1	6.52
PFO5H	1	13.7
PSS1/4B	64	388.3
PSS1/EM1A	4	180.45
PSS1/EM1B	1072	21179.85
PSS1/EM1C	29	1395.12
PSS1/EM1Cb	3	10.83
PSS1/EM1F	62	4821.66
PSS1/EM1Fb	1	11.34
PSS1/EM1R	1	4.47
PSS1/FO4B	1	5.88
PSS1/UBH	1	5.46
PSS1/USA	11	421.32
PSS1A	36	1364.05
PSS1B	44	631.3
PSS1C	80	1750.08
PSS1R	7	31.57
PSS4/1B	347	5019.78
PSS4/1C	4	5.03
PSS4/1Cd	1	3.76
PSS4/EM1B	70	1147.92
PSS4B	53	246.38
PUBFx	1	0.2
PUBH	265	888.09

PUBHb	2	2.57
PUBHh	5	9.85
PUBHx	38	34.83
PUSA	1	1.93
R1USR	10	191.59
R3SBC	7	117.36
R3US/UB	24	1756.745
R3USA	8	777.07
R3USC	40	1807.18
TOTAL	**3312**	**59994.435**