VEGETATION AND LAND COVER MAP OF THE PROPOSED BADAMI OIL DEVELOPMENT AREA

Final Report

Prepared by

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for

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P.O. Box 196612
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EXECUTIVE SUMMARY

Proposed construction for the Badami development includes a gravel pad, landing strip, short dock, gravel mine, and a 28-mile-long buried pipeline. To provide a basis for making decisions about placement of proposed structures, the vegetation in and around the potential development site was classified and mapped from aerial photographs. The vegetation in the proposed Badami pad area was classified using a hierarchical vegetation classification scheme designed specifically for the North Slope of Alaska. A preliminary map was constructed without ground reference data and was revised to reflect ground data collected in August 1994. Vegetation map units were digitized by AeroMap U.S., Inc., and map units were assigned colors depicting vegetation types. Because the vegetation map does not cover the entire buried pipeline route, wetlands along the pipeline route were assessed from U.S. Fish and Wildlife Service's National Wetland Inventory (NWI) maps, based on the NWI wetlands classification system. Wetlands along the proposed buried pipeline route were determined by measuring wetland types crossed on NWI maps by an overlay of the route.

The Badami pad area is characterized by large expanses of moist sedge and dwarf shrub dominated tundra (primarily by *Carex, Eriophorum*, and *Salix* spp.) which is interrupted by areas of drier, well-drained tundra, clusters of frost boils, thaw-lakes and ponds, drained lake basins, and streams. Along the coast are eroding bluffs and sand beaches alternating with lower tundra areas which receive occasional saltwater intrusions, small areas of sand dunes and sandy spits, and estuaries at the mouths of streams. The drier, well-drained tundra typically occurs along stream and river terraces and at the margins of drained lake basins. Clusters of frost boils occur in the southeast portion of the map area.

Moist sedge, dwarf shrub tundra and moist/wet sedge, dwarf shrub tundra complex dominate, comprising 7,809 acres or 52 percent of the vegetation map area. Saline-tolerant vegetation classes cover 166 acres or 1 percent of the mapped area. Total surface area for water is 3,644 acres or 24 percent of the mapped area. Freshwater covers 1,760 acres or 13 percent of the land surface area of 13,272 acres; and saltwater and estuaries cover 1,884 acres or 12 percent of the mapped area. The proposed pipeline route will impact predominantly wet sedge or graminoid tundra (PEM1E, 24 percent); wet or moist/wet sedge, dwarf shrub tundra (PEM/SS1E, 28 percent); and moist/wet or moist sedge/dwarf shrub tundra (PEM/SS1B, 37 percent).

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INTRODUCTION

To assist in the evaluation of the environmental impacts of developing the Badami oil field on Alaska's North Slope the vegetation of the Badami area was classified and mapped from aerial photographs. This vegetation mapping effort was conducted primarily to delineate wetland vegetation types which serve as preferred habitat for wildlife, especially waterbirds. The vegetation in the Badami area was classified using a hierarchical vegetation classification scheme designed specifically for the North Slope of Alaska (Walker 1983). This scheme was selected because it is the vegetation classification currently used by the U.S. Fish and Wildlife Service to delimit habitats of critical importance to waterbirds on the North Slope. In addition, because of its hierarchical nature, this scheme allows vegetation to be classified at various map scales and facilitates direct comparisons with vegetation maps of other regions on the North Slope. For example, Walker's (1983) classification scheme was used to map a large portion of the vegetation of the coastal plain in the Arctic National Wildlife Refuge (Walker et al. 1982, Walker and Webber 1983), at a 1:250,000 scale, and a modified version of the classification scheme was used to map the U.S.G.S. Beechey Point Quadrangle, encompassing the Prudhoe Bay area, at a 1:63,360 scale (Walker and Acevedo 1987). The vegetation of the Badami area was mapped at a substantially finer scale of resolution (1:6000).

A 27.9 mile long buried onshore pipeline from the Badami production facilities to the Endicott sales line is proposed for transport of oil to processing facilities at Endicott. To support the buried pipeline, nine valve pads at stream crossings and one heater pad have been proposed. Because the vegetation map does not cover the entire buried pipeline route, wetlands along the pipeline route were assessed from U.S. Fish and Wildlife Service's (USFWS) National Wetland Inventory (NWI) maps, based on the classification system described in Cowardin et al. (1979). To assess impacts to wetlands from the proposed pipeline and support structures, the wetland types crossed by an overlay of the proposed pipeline route were measured using the NWI mapping for the North Slope.

METHODS

Walker's (1983) vegetation and land cover classification scheme involves categorizing sites with respect to site moisture regime and dominant plant growth forms (and landform type when plant cover is very sparse or non-existent). The site moisture terms (dry, moist, wet, or aquatic) are subjective terms based on the soil moisture at the end of the growing season. Dominant plant growth forms are relatively straightforward and are dependent to a great degree

on the site moisture regime and landform type. Many areas on the North Slope consist of complexes of landforms which result in complexes of site moisture and vegetation types. In areas such as these, the classification scheme calls for combining site moisture and plant growth form terms to more accurately describe the character of the area. Walker's (1983) scheme is designed to describe vegetation at four levels: Level A--for very small scale maps, Level B--for units that can be consistently classified from multi-spectral satellite date, Level C--for vegetation units interpreted from aerial photographs, and Level D--for individual plant communities as determined from ground surveys (Table 1).

The vegetation of the Badami area was mapped using a series of 1:6000 photo enlargements of 1:18,000 natural color aerial photographs which were taken on 1 July 1993. A preliminary map was made without ground reference data, and when ground reference data were acquired in August 1994 the map was revised. Map units delimiting the vegetation types were drawn by hand on acetate overlays placed on top of the photos. The map units or polygons were then fitted and transferred to a topographic map (base map) of the area by matching water bodies and coastlines. A combination of the 1955 U.S.G.S. topographic map of the area, and a new (1994) digital topographic map produced by AeroMap U.S., Inc. (which covers most of the coastal portion of the Badami area) was used as the base map for the vegetation/land cover map. Map units or polygons were then digitized by AeroMap U.S., Inc. to produce Microstation and MapInfo® databases. Map units were assigned colors depicting vegetation types at Level B in Walker's (1983) hierarchical vegetation classification scheme (see map legend and Table 1). Actual vegetation types were mapped and labeled at a finer resolution, Level C, but for clarity map colors were assigned only at Level B. The exceptions to this were in the cases of saline influenced areas along the coast. The two types of wet saltmarsh vegetation (which occur separately in the wet tundra and partially vegetated Level B categories) were assigned the same map color to make these habitats easily identifiable on the map. Similarly, two categories of partially vegetated coastal sites were given colors to distinguish them from partially vegetated riparian areas which share the same Level B category.

Ground reference data for the vegetation/land cover map were collected from 6-9 August 1994. A total of 133 points in the Badami area were visited and vegetation, site moisture regime, and landform data were recorded (see Appendix A). Species lists of the dominant vascular plants were also recorded at representative sites. No attempt was made to identify bryophyte or lichen beyond their Divisions. We carried aerial photos of the area with us in the field and a concerted effort was made to evaluate those vegetation and land cover types which were not clearly identifiable on the aerial photos, and to record data for each of the vegetation/land cover

Table 1. Hierarchical vegetation categories for the Badami Area Vegetation/Land Cover Map, based on Walker's (1983) vegetation classification. Vegetation types were mapped at Level C and are labeled with a roman numeral followed by a lower case letter (Level C vegetation category).

LEVEL A SMALL-SCALE UNITS	LEVEL B LANDSAT-SCALE UNITS	LEVEL C PHOTO-INTERPRETED MAP UNITS	LEVEL D TYPICAL PLANT COMMUNITIES
A. Water	I. Water	Ia. Water (ponds, lakes, rivers, streams, saltwater)	No vegetation
B. Wet Tundra	II. Very Wet Tundra	IIb. Aquatic Graminoid Tundra (emergent vegetation)	Aquatic *Arctophila fulva* Grass Tundra
			Aquatic *Carex aquatilis* Sedge Tundra
		IId. Water/Tundra Complex (pond complex with emergent vegetation)	Typical communities listed in IIb, IIIa, and Va
	III. Wet Tundra	IIIa. Wet Sedge Tundra	Wet *Carex aquatilis, Scorpidium scorpioides* Sedge Tundra (wettest facies of wet alkaline tundra)
			Wet *Carex aquatilis, Eriophorum angustifolium, Pedicularis sudetica, Drepanocladus brevifolius* Sedge Tundra (wet alkaline tundra)
			Wet *Eriophorum angustifolium, Dupontia fisheri, Campylium stellatum* Graminoid Tundra (wet acidic tundra, coastal areas)
		IIIb. Wet Graminoid Tundra (wet saline tundra, saltmarsh)	Wet *Carex subspathacea, Puccinellia phryganodes, Stellaria humifusa, Cochlearia officinalis* Sedge Tundra
		IIIc. Wet Sedge Tundra/Water Complex (pond complex, no emergent vegetation)	Typical communities listed in IIIa and Va
		IIId. Wet Sedge/Moist Sedge, Dwarf Shrub Tundra Complex (wet patterned-ground complex)	Typical communities listed in IIIa and Va, and sometimes IIb
C. Moist Tundra	IV. Moist/Wet Tundra Complex	IVa. Moist Sedge, Dwarf Shrub/Wet Graminoid Tundra Complex (moist patterned ground complex)	Typical communities listed in IIIa and Va
	V. Moist or Dry Tundra	Va. Moist Sedge, Dwarf Shrub Tundra	Moist *Carex bigelowii, Eriophorum angustifolium, Dryas integrifolia, Salix reticulata, Tomenthypnum nitens, Thamnolia subuliformis* Sedge, Dwarf Shrub Tundra (moist alkaline tundra)
			Moist *Luzula arctica, Poa arctica, Saxifraga cernua, Salix planifolia, Dicranum elongatum, Ochrolechia frigida* Graminoid, Dwarf Shrub, Crustose Lichen Tundra (moist coastal acidic tundra)
			Moist *Carex aquatilis, Eriophorum angustifolium, Salix planifolia, Campylium stellatum* Sedge, Dwarf Shrub Tundra (moist acidic tundra, wetter facies)

Table 1. Continued...

LEVEL A SMALL-SCALE UNITS	LEVEL B LANDSAT-SCALE UNITS	LEVEL C PHOTO-INTERPRETED MAP UNITS	LEVEL D TYPICAL PLANT COMMUNITIES
C. Moist Tundra (CONT'D)	V. Moist or Dry Tundra (CONT'D)	Vc. Dry, Dwarf Shrub, Crustose Lichen Tundra (*Dryas* tundra, pingos, river bars)	Dry *Dryas integrifolia, Carex rupestris, Oxytropis nigrescens, Salix reticulata, Ditrichum flexicaule, Lecanora epibyron* Dwarf Shrub, Forb, Crustose Lichen Tundra (*Dryas* tundra, pingos) Dry *Dryas integrifolia, Astragalus alpinus, Oxytropis borealis, Salix reticulata, Distichium capillaceum, Lecanora epibyron* Dwarf Shrub, Forb, Crustose Lichen Tundra (*Dryas* tundra, river bars)
		Vd. Dry, Dwarf Shrub, Fruticose Lichen Tundra (dry acidic tundra)	Dry *Salix rotundifolia, Pedicularis kanei, Luzula arctica, Ploytichum* sp., *Alectoria nigricans, Cetraria islandica* Dwarf Shrub, Fruticose Lichen Tundra (dry acidic tundra near coast)
		Ve. Moist Graminoid, Dwarf Shrub Tundra/Barren Complex (frost-scar tundra complex)	Typical communities listed in Va plus either completely barren frost scars or communities such as: Dry *Saxifraga oppositifolia, Dryas integrifolia, Chrysanthemum integrifolium, Juncus biglumis, Arctagrostis latifolia, Ochrolechia frigida* Barren (alkaline frost scars)
E. Partially Vegetated and Barren	IX. Partially Vegetated	IXb. Dry Barren/Dwarf Shrub, Forb Grass Complex (forb rich river bars)	Typical communities listed in Vc, and mixed forb, grass and dwarf shrub communities such as: Dry *Bromus pumpellianus, Festuca rubra, Astragalus alpinus, Androsace chamaejasme, Salix ovalifolia* Grass, Forb, Dwarf Shrub Tundra (forb rich river bars) Dry *Dryas integrifolia, Artemisia borealis, A. glomerata, Salix ovalifolia, Androsace chamaejasme* Dwarf Shrub, Forb Tundra (*Dryas* river bars near arctic coast)
		IXc. Dry Barren/Forb Complex (active river channels)	Dry Epilobium latifolium, Artemisia arctica, Wilhelmsia physodes Forb Barren (active river channels)
		IXe. Dry Barren/Grass Complex (coastal sand dune grassland)	Dry *Elymus arenarius* Grass Tundra (coastal sand dune grassland)
		IXh. Wet Barren/Wet Sedge Tundra Complex (barren/saline tundra complex, saltmarsh)	Typical communities listed in IIIb
		IXi. Dry Barren/Forb, Graminoid Complex (coastal barrens)	Dry *Cochlearia officinalis, Stellaria humifusa, Puccinellia phryganodes, P. andersonii, Salix ovalifolia, Potentilla pulchella* Forb, Graminoid Tundra (coastal saline barrens)
	X. Light- colored Barrens (ground cover <30%)	Xa. River Gravels	Completely barren or with communities listed under IXb and IXc.

Table 1. Continued...

LEVEL A SMALL-SCALE UNITS	LEVEL B LANDSAT-SCALE UNITS	LEVEL C PHOTO-INTERPRETED MAP UNITS	LEVEL D TYPICAL PLANT COMMUNITIES
E. Partially Vegetated and Barren (CONT'D)	X. Light- colored Barrens (ground cover <30%) (CONT'D)	Xe. Gravel Roads and Pads	Completely barren or partially vegetated with communities similar to IXb and IXc.
		BS. Barren Sand/Gravel (coastal beaches)	Completely barren or with patches of community IXe.
	XI. Dark-colored Barrens (ground cover <30%)	XIa. Wet Mud (drained lakes and ponds)	Completely barren or occasionally wtih colonizing species such as *Deschampsia caespitosa* and *Senecio congestus.*
		XIc. Bare Peat (mostly barren coastal areas caused by storm surges)	Completely barren or with sparse communities similar to IIIa, Va, and IXi.

categories represented on the preliminary map of the area. Many of these data points were of questionable designation on the preliminary vegetation/land cover map were also visited. Because field work was conducted on foot, not all vegetation types could be visited (two of 22 vegetation/land cover units were not visited). Ground reference data indicated errors in the preliminary vegetation/land cover map and necessitated changes. With these ground reference data and the same aerial photos used to produce the preliminary map, all vegetation classifications on the map were reevaluated and all map units redrawn. Vegetation/land cover categories on the aerial photographs were determined by fitting our field descriptions of plant communities and landforms at specific sites in the Badami area into the vegetation/land cover categories described for the North Slope as a whole by Walker (1983; 1985a,b) and Walker and Acevedo (1987).

Because the vegetation map does not cover the entire area crossed by the proposed buried pipeline, which extends from the Badami production facilities to the Endicott sales line, wetlands were assessed from NWI mapping. An overlay of the proposed pipeline route, valve pads and heater pad prepared by Aeromap, U.S., Inc. was fitted to NWI maps and wetland types crossed by the pipeline were measured. Measurements are accurate to the nearest 1/60th of an inch or 88 feet at the 1:63,360 map scale. Measurements were recorded and summed by wetland type. Wetland classification for NWI mapping follows Cowardin et al. (1979).

RESULTS

General Description of the Badami Area

The general area covered by the proposed Badami development (Fig. 1) lies approximately 33 miles east of Deadhorse, and is within what has been termed a gently rolling thaw-lake plain landscape (Walker and Acevedo 1987). Tundra in the area gradually rises 20 to 25 feet above the level of streams and river channels which gives the landscape a gently rolling appearance. This topographic relief also results in many areas being well-drained, and hence moist and dry tundra vegetation types are common throughout the area on high-centered ice wedge polygon terrain. Drainage is poor, however, away from these fluvial gradients and here low-centered ice-wedge polygons, strangmoor, thaw-lakes and ponds, and drained lake basins predominate. In many of these areas wet tundra vegetation types are common.

The Badami area (specifically the area covered by the Badami vegetation/land cover map) is characterized by large expanses of moist sedge and dwarf shrub tundra (primarily *Carex*, *Eriophorum*, and *Salix* spp.) These expanses of moist sedge and dwarf shrub tundra are

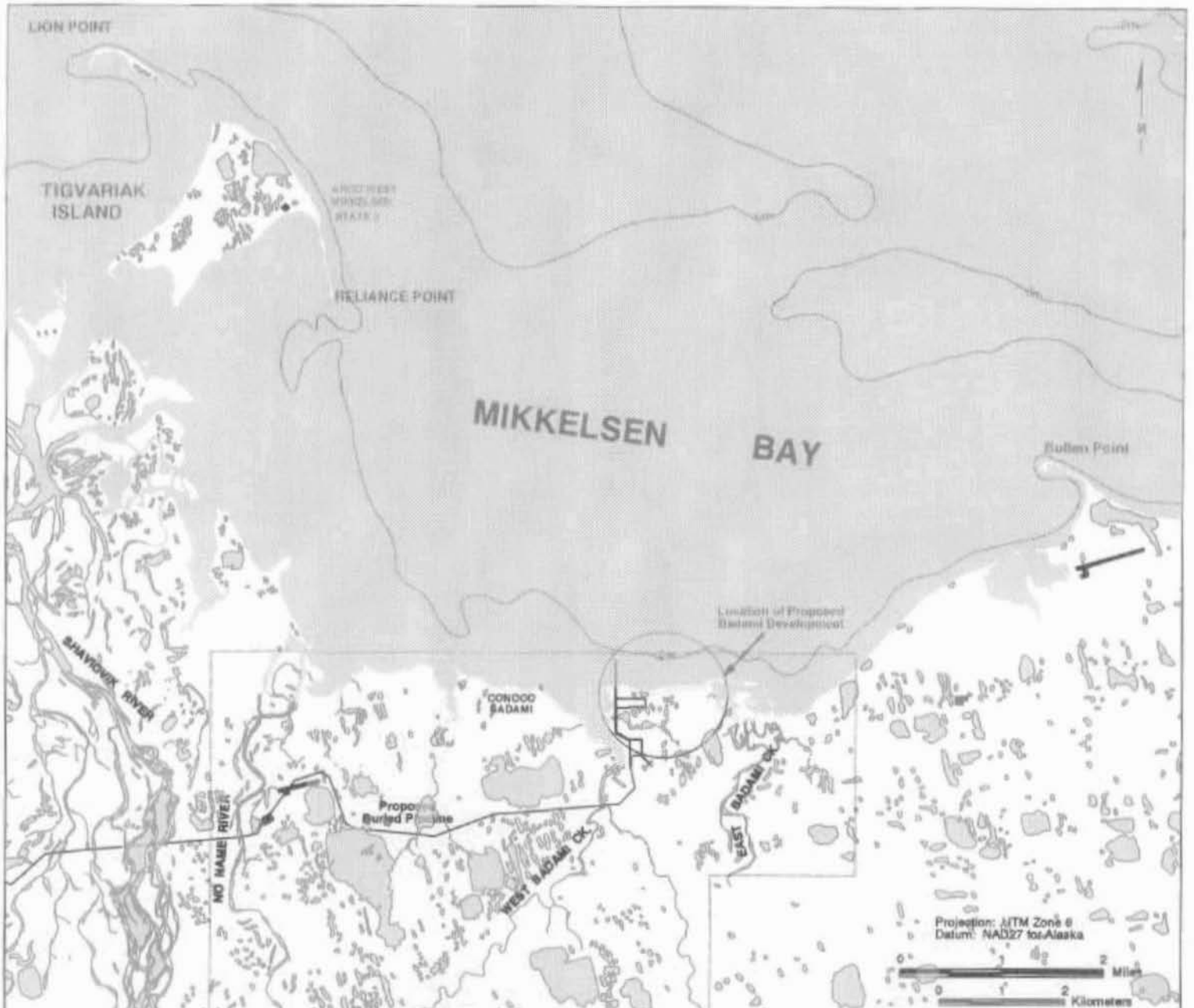

Figure 1. Area for the proposed Badami development, with part of the proposed pipeline route. The area covered by the Badami Vegetation/Land Cover Map is outlined by the dashed red line.

Table 2. Summary of area by Level C vegetation categories (Walker 1983) for the Badami Vegetation/Land Cover Map.

VEGETATION CATEGORY	TOTAL POLYGONS	TOTAL AREA (acres)	TOTAL AREA (percent)
BS	21	63.6	0.4%
Ia	1140	3643.7	24.0%
IIb	273	94.0	0.6%
IId	36	42.0	0.3%
IIIa	58	321.3	2.1%
IIIb	40	88.5	0.6%
IIIc	9	132.2	0.9%
IIId	41	1270.9	8.4%
IVa	79	3466.9	22.9%
Va	73	4342.1	28.6%
Vc	1	1.0	0.0%
Vd	115	791.8	5.2%
Ve	16	199.6	1.3%
IXb	47	196.9	1.3%
IXc	23	56.1	0.4%
IXe	6	6.7	0.0%
IXh	25	22.5	0.1%
IXi	17	54.8	0.4%
Xa	88	36.9	0.2%
Xe	6	15.7	0.1%
XIa	12	297.6	2.0%
XIc	12	10.8	0.1%
TOTAL	2138	15155.6	100.0%

drained lake basins, and streams. Along the coast there are eroding bluffs and sand beaches alternating with lower tundra areas which receive occasional saltwater intrusions, small areas of sand dunes, sandy spits, and estuarine areas at the mouths of streams and rivers. The drier, well-drained tundra vegetation typically occurs along stream and river terraces, and at the margins of drained lake basins, but also occurs in smaller patches throughout the area where drainage is good. Clusters of frost boils are particularly common in the southeast portion of the Badami area. Thaw-lakes and ponds are scattered throughout the area and these often support emergent vegetation (dominated by *Arctophila fulva* and *Carex aquatilis*) in the shallow water margins, especially in lakes and ponds with complex, irregular shorelines. Drained lake basins occur throughout the area and are characterized by non-patterned ground, low-centered ice wedge polygons, and strangmoor in complexes with smaller thaw-lakes and ponds within the basins. These areas are dominated by wet sedge tundra.

Clusters of small ponds and extensively thermokarsted polygon troughs often occur over broad areas within a matrix of mixed moist and wet tundra. These areas are characterized by mixed high- and low-centered ice wedge polygons and strangmoor. Along the streams and rivers are both typical wet and moist tundra types as well as dry, partially vegetated river bars and mostly barren river gravels in active channels. The stream mouth directly west of the proposed development, commonly called West Badami Creek (Fig. 1), supports wet, arctic saltmarsh vegetation. The two stream mouths, commonly called No Name River and East Badami Creek (Fig. 1), support a complex mix of wet, arctic saltmarsh vegetation, drier coastal barrens, salt-killed tundra, typical moist and wet tundra, and dry, partially vegetated river bars. Vascular plant species diversity is typically highest in the drier tundra habitats, especially in river bar and river terrace areas (Walker 1985a).

Streams within the entire Badami development area are primarily classified as tundra streams (Craig and McCart 1975), which are generally small meandering streams, 30-65 km long, that drain into larger streams or the Beaufort Sea. For the most part, they are confined to a single channel, although the largest tundra streams have braided channels. Many tundra streams are "beaded" or occur as a series of small ponds. During spring flooding, banks often overflow with runoff which is moderated by the surrounding tundra, lakes, ponds, and marshy areas. Tundra streams are usually acidic, with pH ranging from 6.5-8.5, have low conductivity and calcium, and are often stained yellow-brown from the surrounding peat (Craig and McCart 1975).

Preliminary Map Accuracy and Revisions

In order to quantify the accuracy of the preliminary vegetation map, we constructed an error matrix for ground data points (Table 3). Accuracy for the map is calculated by comparing the agreement between vegetation categories for ground sites for these locations on the preliminary map to vegetation categories for ground sites derived from the field data. At Level C, 23 of 133 (17.3 percent) of the ground points were correctly classified on the preliminary map (Table 3). Accuracy improved at Level B, as 44 of 133 (33.1 percent) of the ground points were correctly classified. In selecting ground points, areas of questionable classification were intentionally selected to clarify a specific area or vegetation category. Also, some vegetation categories were underrepresented because ground points were concentrated in the vicinity of the proposed Badami pad structures. Therefore map accuracy calculations (17.3 percent at Level C, and 33.1 percent at Level B) are likely to be biased downwards due to the selection and distribution of ground data points.

Table 3. Error matrix for ground reference sites comparing preliminary photo interpreted vegetation classification (Walker 1983) and field determined classification for vegetation data collected 6-9 August 1994 in the vicinity of the proposed Badami development. Rectangles enclose Level B vegetation categories. See Figure A-1, Table A-1 and Table A-2.

PRELIMINARY MAP CATEGORY	FIELD DETERMINED CATEGORY																					TOTAL
	BS	Ia	IIa	IIb	IIIa	IIIb	IIId	IVa	Va	Vc	Vd	Ve	IXb	IXc	IXe	IXh	IXi	Xa	Xe	XIa	XIc	
BS	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	3
Ia	0	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
IIa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IIb	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
IId	0	0	0	2	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	4
IIIa	0	0	0	1	1	2	1	13	7	0	2	0	0	0	0	0	0	0	0	0	0	27
IIIb	0	0	0	0	0	1	0	0	2	0	0	0	1	0	0	0	2	0	0	0	0	6
IIIc	0	0	0	0	0	1	5	0	2	0	1	1	0	0	0	0	0	0	0	0	0	10
IVa	0	0	0	0	0	1	6	4	7	0	3	0	0	0	0	1	1	0	0	0	0	23
Va	1	0	0	0	0	0	0	0	10	2	1	0	0	0	0	0	0	0	0	0	0	14
IXb	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	2
IXh	0	0	0	0	1	2	0	0	2	0	0	0	0	0	0	1	4	1	0	1	1	13
IXi	0	0	0	0	0	0	0	3	12	0	0	0	0	0	0	1	0	1	0	1	0	18
Xa	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Xe	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
XIa	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3
XIc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2
TOTAL	2	2	3	4	4	7	13	21	42	2	8	1	2	1	1	4	7	2	1	5	1	133
Agreement Level C	1	2	0	0	1	1	0	4	10	0	0	0	1	0	0	1	0	0	1	1	0	23 [1]
Agreement Level B	1	2	2			11		4		13					7			1		3		44 [2]

[1] Agreement Level C = (23/133) or 17.3%.

[2] Agreement Level B = (44/133) or 33.1%.

Based upon the field data, map revisions involved a complete reevaluation of all photo-interpreted classifications. In general, classifications were shifted to less wet categories (Table 4), with some III categories changing to IV, and some IV categories changing to V. Also, some areas of category V vegetation were changed to drier categories. These changes were due in part to the topographic relief in the area, which enhances drainage. Relief is more pronounced than was apparent from the photos and previous base map. Other changes were as follows: Category IIa (shallow water) was renamed so that all open water falls within the Ia category, because shallow and deep water were difficult to distinguish. Sites with areas of aquatic vegetation (IIb) within lakes were not identified on the preliminary map, however new polygons of IIb were included in the map revision. Saline influenced areas were initially delimited using strand lines with visible driftwood. However this method greatly over estimated the area of saline influenced vegetation (especially categories IXh and IXi). On the revised map saline influenced areas were delimited by using ground reference data.

Description of the Vegetation and Land Cover Categories

The hierarchical vegetation and land cover categories for the Badami area vegetation/land cover map (pocket) are listed in Table 1 and on the map legend. Vegetation types were mapped at Level C. Twenty-one Level C categories were identified on the photos of the Badami area. Coastal beach sand/gravel was delimited as additional category (bringing the total to 22) since this land cover type had no equivalent in Walker's (1983) classification system. Detailed information for all ground reference sites in the Badami area is presented in Appendix A. Plant nomenclature follows Hultén (1968). A description of the landforms and dominant vascular plant taxa which are commonly found in each of these categories in the Badami map area is given below.

Ia. Water

The water category depicts all the open water that could be reasonably mapped at the 1:6000 scale including ponds, lakes, rivers, streams, and saltwater. This category includes water of all depths, usually without emergent vegetation (see IIb below). Water covers 3,644 acres or 24 percent of the mapped area. Fresh water covers 1,760 acres or 13 percent of the land surface area of 13,272 acres; and saltwater and estuaries cover 1,884 acres or 12 percent of the mapped area (Table 2).

Table 4. Summary of Level C map vegetation category (Walker 1983) polygons and ground site data used to revise the Badami Vegetation/Land Cover Map. Ground site data were collected in the vicinity of the proposed Badami development (Figure A-1) on 6-9 August 1994. Site descriptions and plant taxa are presented in Tables A-1 and A-2, respectively.

	PRELIMINARY MAP				FINAL MAP			
VEGETATION CATEGORY	TOTAL POLYGONS	TOTAL AREA (acres)	TOTAL AREA (percent)	GROUND SITES	TOTAL POLYGONS	TOTAL AREA (acres)	TOTAL AREA (percent)	GROUND SITES
BS	21	97.4	0.6%	3	21	63.6	0.4%	2
Ia	400	3135.9	20.7%	2	1140 [2]	3643.7 [1]	24.0%	5
IIa	783	352.4	2.3%	3				
IIb	14	13.1	0.1%	1	273	94.0	0.6%	4
IId	30	705.1	4.7%	4	36	42.0	0.3%	
IIIa	44	2339.5	15.4%	27	58	321.3	2.1%	4
IIIb	16	84.3	0.6%	6	40	88.5	0.6%	7
IIIc	44	916.4	6.0%	10	9	132.2	0.9%	
IIId					41	1270.9	8.4%	13
IVa	39	4214.7	27.8%	23	79	3466.9	22.9%	22
Va	39	2163.7	14.3%	14	73	4342.1	28.6%	42
Vc					1	1.0	0.0%	2
Vd					115	791.8	5.2%	8
Ve					16	199.6	1.3%	1
IXb	24	250.3	1.7%	2	47	196.9	1.3%	2
IXc					23	56.1	0.4%	1
IXe					6	6.7	0.0%	1
IXh	15	173.7	1.1%	13	25	22.5	0.1%	4
IXi	13	127.5	0.8%	18	17	54.8	0.4%	6
Xa	72	218.8	1.4%	1	88	36.9	0.2%	2
Xe	3	16.5	0.1%	1	6	15.7	0.1%	1
XIa	192	330.2	2.2%	3	12	297.6	2.0%	5
XIc	7	16.3	0.1%	2	12	10.8	0.1%	1
TOTAL	1756	15155.6 [3]	100.0%	133	2138	15155.6 [3]	100.0%	133

[1] Water Surface Area = 3,643.7 acres (Freshwater = 1,759.7 acres; Saltwater and Estuaries = 1,884.0 acres)

[2] Class IIa was combined with Class Ia.

[3] Area calculations for the preliminary map are subject to 0.4 percent error due to errors in the MapInfo version of the map, total map areas are identical.

IIb. Aquatic Graminoid Tundra

This category depicts areas of permanent fresh water where there is emergent vegetation. In deeper water these simple plant communities are dominated by *Arctophila fulva*, and in shallower water by *Carex aquatilis* with lesser amounts of *Eriophorum angustifolium* and *E. scheuchzeri*. This category grades continuously into wet sedge tundra vegetation (IIIa), but is distinguished by the presence of permanent water. Aquatic graminoid tundra is common in the shallow waters of ponds and lakes, and slow moving streams, and it is especially common in lakes and ponds with complex, irregular shorelines. It also occurs in very wet low-centered polygon basins. On aerial photographs aquatic graminoid tundra is often difficult to distinguish from both open water (when the density of plants is low), and from very wet, wet sedge tundra (at the edges of ponds and lakes). For this reason only the relatively obvious and large occurrences of this vegetation type were mapped covering 94 acres or 0.6 percent of the mapped area (Table 2).

IId. Water/Tundra Complex

This category depicts areas where ponds/lakes are interconnected to form a complex of water and intervening tundra. Water is the dominant land cover category and there are large areas of emergent vegetation in the water bodies. Intervening tundra is usually wet, but moist microsites also exist. Plant communities present are primarily those listed in (IIb), with lesser amounts of those listed in (IIIa) and (Va). The few occurrences of this vegetation type in the Badami area occur in the western half of the mapped area covering 42 acres or 0.3 percent of the mapped area (Table 2). These sites were not visited during the gathering of ground reference data.

IIIa. Wet Sedge Tundra

This category depicts tundra areas which have poor drainage and standing water during the early part of the summer that drains or evaporates by the end of the season leaving saturated soils. (Note that some standing water may remain in abnormally wet summers). These areas are dominated by sedges such as *Carex aquatilis*, *C. rotundata*, *C. saxatilis*, *Eriophorum angustifolium*, and *E. russeolum*. Along the coast the grass *Dupontia fischeri* is a dominant taxon along with the sedges. Common forbs include *Pedicularis sudetica*, *Saxifraga hirculus*, and *Melandrium apetalum*. Wet sedge tundra commonly occurs on non-patterned ground, in low-centered polygon basins, and in troughs between strangmoor ridges. It is common at the edges of ponds and lakes, along streams, in drained lake basins, and on river terraces. As a

mapped unit wet sedge tundra was used only in areas where patterned ground is non-existent or poorly developed (i.e., where moist microsites are not prominent in the unit). Wet sedge tundra covers 321 acres or 2 percent of the mapped area (Table 2).

IIIb. Wet Graminoid Tundra

This category depicts the low-growing, arctic saltmarsh vegetation that occurs along the immediate coast. The vegetation is dominated by saline tolerant graminoid species such as *Puccinellia phryganodes*, *Carex subspathacea*, and *C. ursina*. The forbs, *Stellaria humifusa* and *Cochlearia officinalis*, are also common, and the grass *Dupontia fischeri* is common in less wet microsites. Wet graminoid tundra is most commonly found at the mouths of streams and rivers, but it also occurs in low lying areas which are frequently inundated by saltwater and covers 88 acres or 0.6 percent of mapped area (Table 2).

IIIc. Wet Sedge Tundra/Water Complex

This category is similar to (IId), as it also depicts areas where ponds/lakes are interconnected to form a complex of water and intervening tundra. It differs, however, in that wet sedge tundra (IIIa) is the dominant land cover category, and there is typically little or no emergent vegetation in the water bodies. Intervening tundra is primarily wet, but moist sites also occur. Plant communities present are primarily those listed in (IIIa), but lesser amounts of those listed in (Va) also occur. Small patches of vegetation type (IIb) may also occur sporadically. This complex covers 132 acres or 0.9 percent of the mapped area (Table 2).

IIId. Wet Sedge/Moist Sedge, Dwarf Shrub Tundra Complex

This category depicts areas which are dominated by wet sedge tundra (IIIa), but because of prominent patterned ground features such as low-centered polygons and strangmoor there are abundant moist sites within the unit. The moist sites are the more well-drained polygons rims and strangmoor ridges, and these are dominated by moist sedge, dwarf shrub tundra (Va). In the Badami map area there are occasionally small patches of aquatic graminoid tundra (IIb) in this category as well, many of these too small to map at the 1:6000 scale. This vegetation type is very common in drained lake basins and on poorly-drained river terraces, covering 1,271 acres or 8 percent of the mapped area (Table 2).

IVa. Moist Sedge, Dwarf Shrub/Wet Graminoid Tundra Complex

This category depicts areas of significant ground patterning which are dominated by moist sedge, dwarf shrub tundra (Va), but abundant low lying areas dominated by wet sedge tundra (IIIa) are also present. In the Badami map area this category delineates large areas of mixed high- and low-centered polygons often with extensively thermokarsted polygon troughs, occurring amidst numerous small ponds and lakes. It also refers to areas of weakly developed strangmoor where the moist ridges are dominant. There are often areas of high-centered polygons within this category that have vegetation dominated by dry, dwarf shrub, fruticose lichen tundra (Vd), especially among clusters of ponds and lakes. As in category (IIId) there are occasionally small patches of aquatic graminoid tundra (IIb) in this category. This vegetation type covers large expanses of open tundra in the Badami map area, and is common in the drier portions of drained lake basins, and on relatively poorly-drained river terraces. This complex covers 3,467 acres or 23 percent of the mapped area (Table 2).

Va. Moist Sedge, Dwarf Shrub Tundra

This category depicts areas of typical high-centered polygons with distinct polygon troughs, as well as areas of rather subtle high-centered and low-centered polygons with very little development of the polygon troughs (i.e. flat-topped polygons). There are often wet microsites in the polygon troughs, but overall drainage is good throughout the entire unit and the dominant landform is the moist polygon centers. In the Badami area these sites are dominated by the sedges *Eriophorum angustifolium*, *Carex misandra*, *C. aquatilis*, *C. bigelowii*, and *C. atrofusca*. The tussock forming *Eriophorum vaginatum* occurs sporadically, especially inland, but not commonly enough to give the unit a tussock sedge designation. The common dwarf shrubs are *Salix pulchra*, *S. arctica*, *S. reticulata*, and *Dryas integrifolia*. Common forbs include *Polygonum viviparum*, *Pedicularis kanei*, *Stellaria laeta*, and *Saxifraga hirculus*. Towards the coast a different community occurs with dominants such as *Poa arctica*, *Eriophorum angustifolium*, *Carex aquatilis*, *Luzula arctica*, *Salix rotundifolia* x *phlebophylla*[1], *S. pulchra*, and *Saxifraga cernua*. Moist sedge, dwarf shrub tundra typically occurs across broad expanses of open tundra above the level of water bodies and drained lake basins, and covers 4,342 acres or 29 percent of the mapped area (Table 2).

[1] In the Badami area the two taxa *Salix rotundifolia* and *S. phlebophylla* appear to be hybridizing, as a continuous sequence of types between the two taxa was clearly evident. These two species hybridize commonly in Alaska (Viereck and Little 1972). The designation, *Salix rotundifolia* x *phlebophylla*, denotes this suspected hybridization.

Vc. Dry Dwarf Shrub, Crustose Lichen Tundra

This category depicts areas of very good drainage which are often blown free of snow during the winter. This vegetation type occurs on just one pingo in the Badami area (which was not visited during the gathering of ground reference data). The vegetation on other pingos on the North Slope is characterized by a conspicuous mat of *Dryas integrifolia*, with other dominants such as *Salix rotundifolia*, *S. phlebophylla*, *S. reticulata*, *Carex rupestris*, *Oxytropis nigrescens*, *Saxifraga oppositifolia*, *Papaver lapponicum*, *Astragalus umbellatus*, *Pedicularis kanei*, and *Silene acaulis* (Walker and Acevedo 1987). There are many other common forbs and graminoids giving this vegetation type high species diversity. There is also typically a large proportion of exposed mineral soil covered with crustose lichens.

Vd. Dry Dwarf Shrub, Fruticose Lichen Tundra

This category depicts areas of well-drained, dry, high-centered polygons with well developed polygon troughs. There are often moist and wet microsites in the polygon troughs, but the dominant landform is the dry polygon centers. The category also refers to well-drained sloping banks with reticulate patterned ground. These acidic sites in the Badami area are dominated by the dwarf shrubs *Salix rotundifolia* x *phlebophylla*, *S. reticulata*, *S. pulchra*, *Dryas integrifolia*, *Cassiope tetragona*, and *Vaccinium vitis-idea*. Common graminoids include *Carex misandra*, *C. membranacea*, *C. bigelowii*, *Eriophorum angustifolium*, *Luzula arctica*, and *Poa arctica*. There are numerous common forbs including *Saxifraga punctata*, *S. hieracifolia*, *Pedicularis kanei*, *Polygonum bistorta*, *Pyrola grandiflora*, *Papaver macounii*, and *Senecio atropurpureus*. Like category (Vc) these sites show both high species diversity, and a large proportion of exposed soil covered with lichens. In this category, however, the exposed soil is mainly peat and many of the lichens are fruticose. In the Badami area this category grades continuously into typical moist sedge, dwarf shrub tundra (category Va), but in general (Vd) occurs in the more well-drained and drier sites. The vegetation type (Vd) is very common on tundra plateaus above stream and river channels, at the margins of drained lake basins, and on reticulate patterned slopes where snowbanks build up during the winter, covering 792 acres or 5 percent of the mapped area (Table 2). It also occurs scattered throughout the Badami area, especially among clusters of ponds and lakes within category (IVa).

Ve. Moist Graminoid, Dwarf Shrub Tundra/Barren Complex

This category depicts areas of typical moist sedge, dwarf shrub tundra (Va) in which there is a preponderance of frost boils or frost scars. Plant species data were not recorded for this

vegetation type in the Badami area. In other areas on the North Slope plant taxa are similar to those in category (Va), but within the frost boils there are either completely barren areas or dry partially vegetated communities dominated by species such as *Saxifraga oppositifolia*, *Dryas integrifolia*, *Chrysanthemum integrifolium*, *Petasites frigidus*, and *Arctagrostis latifolia* (Walker and Acevedo 1987). This vegetation type is very common in the southeast corner of the Badami area, especially in open tundra near stream and river terraces covering 200 acres or 1 percent of the mapped area (Table 2).

IXb. Dry Barren/Dwarf Shrub, Forb Grass Complex

This category depicts partially vegetated river bars with gravel substrates that are elevated slightly from the active river channels. They are probably only very infrequently flooded. These areas are very floristically diverse, perhaps even surpassing the species diversity found in the dry vegetation types (Vc) and (Vd). Common taxa in the Badami area include *Dryas integrifolia*, *Salix rotundifolia* x *phlebophylla*, *S. reticulata*, *S. ovalifolia*, *Astragalus alpinus*, *Potentilla biflora*, *Arnica frigida*, *Artemisia arctica*, *Papaver lapponicum*, *Epilobium latifolium*, *Aster sibiricus*, *Deschampsia caespitosa*, *Alopecurus alpinus*, *Poa glauca*, *Arctagrostis latifolia*, and *Trisetum spicatum*. This vegetation type occurs commonly along the No Name River and East Badami Creek and in the western fork of West Badami Creek, covering a total of 197 acres or 1 percent of the mapped area (Table 2). The threatened vascular plant, *Thlaspi arcticum*, occurs in this vegetation type along the Kuparuk River to the west of Prudhoe Bay (Walker 1985b).

IXc. Dry Barren/Forb Complex

This category depicts partially vegetated gravel bars in active river channels. These areas are regularly flooded during spring breakup. Species diversity is relatively low as compared to vegetation type (IXb). Common taxa in the Badami area include *Artemisia arctica*, *A. borealis*, *A. glomerata*, *Epilobium latifolium*, *Sagina intermedia*, *Wilhelmsia physodes*, and *Deschampsia caespitosa*. This vegetation type occurs within the No Name River and East Badami Creek channels, covering 56 acres or 0.4 percent of the mapped area (Table 2).

IXe. Dry Barren/Grass Complex

This category depicts small pockets of sand dunes dominated by *Elymus arenarius*, which occur along the immediate coast. Dry barren/grass complex covers 7 acres of the mapped area (Table 2).

IXh. Wet Barren/Wet Sedge Tundra Complex

This category depicts the same vegetation type as (IIIb), arctic saltmarsh, except in this case the vegetative cover is only partial. There are typically large patches of open wet mud interspersed among the saline tolerant plants. This complex covers 23 acres or 0.1 percent of the mapped area (Table 2).

IXi. Dry Barren/Forb, Graminoid Complex

This category depicts areas along the immediate coast which are subject to intermittent inundation by saltwater. The original tundra vegetation has been killed and these sites are now dominated by a sparse cover of saline tolerant species such as *Stellaria humifusa*, *Cochlearia officinalis*, *Puccinellia andersonii*, *P. phryganodes*, and *Carex ursina*. Other species typical of disturbed tundra sites are also commonly present, such as *Salix ovalifolia*, *Sedum rosea*, and *Artemisia arctica*. This vegetation type is found commonly in close association with arctic saltmarsh (vegetation types IIIb and IXh), but is typically on higher more well-drained ground. This complex covers 55 acres or 0.4 percent of the mapped area (Table 2).

Xa. River Gravels

This category depicts unvegetated river gravels in active channels. There can, however, be a very sparse cover (< 30 percent) of vegetation type (IXc). This category grades continuously into category IXc, and covers 37 acres or 0.2 percent of the mapped area (Table 2).

Xe. Gravel Roads and Pads

This category refers to the gravel associated with the Mikkelsen Bay State #1 airstrip in the western portion of the Badami area and the Badami #1 wellsite. Gravel covers 16 acres or 0.1 percent of the mapped area (Table 2). The Mikkelsen Bay site was not visited during the collection of ground reference data.

BS. Barren Sand and Gravel

This category depicts mostly unvegetated coastal beaches and spits covering 64 acres or 0.4 percent of the mapped area (Table 2). There are occasional patches of *Elymus arenarius*.

XIa. Wet Mud

This category depicts drained lakes and ponds. In some areas the mud surface is actually dry. These areas are usually unvegetated but there can be scattered individuals of species such as *Deschampsia caespitosa* and *Senecio congestus*. Wet mud covers 298 acres or 2 percent of the mapped area (Table 2).

XIc. Bare Peat

This category depicts areas along the immediate coast where the tundra vegetation has been killed by storm surges. These sites are probably only very infrequently inundated by saltwater. These areas are typically very barren, but colonizing individuals of *Salix ovalifolia*, *Puccinellia andersonii*, *Braya pilosa*, and other species typical of moist and wet tundra often occur. Bare peat covers 11 acres or 0.1 percent of the mapped area (Table 2).

Wetlands Along the Proposed Buried Pipeline

As plans changed during formulation of the Badami development, LGL was requested to calculate the wetlands affected for several different buried pipeline routes at several different impact widths. The results presented here are current as of January 1995, and are those included in the permit applications submitted by BPX in mid-January 1995. Throughout the route and width revisions, the predominant wetland types affected have remained constant: PEM/SS1B (Palustrine, emergent, persistent/scrub shrub, broad-leaved deciduous, saturated), PEM/SS1E (Palustrine, emergent, persistent/scrub shrub, broad-leaved deciduous, seasonally flooded/ saturated), and PEM1E (Palustrine, emergent, persistent, seasonally flooded/saturated). These NWI wetlands classes are roughly equivalent to wet and moist sedge, dwarf shrub tundra (classes IIIa, IVa and Va in Walker's [1983] classification).

Table 5 presents the area disturbed by the proposed buried pipeline based on a potential impact width of 15 feet. Table 6 lists the valve pads by river crossings and lists the area for the proposed pad and the wetland class covered by each pad, with totals by wetland class at the bottom of the table. Table 7 presents the definitions of the NWI wetland codes and gives equivalent Walker (1983) categories.

Table 5. Summary of wetland types along the proposed Badami pipeline route, 10 January 1995. Disturbance area based on 15-foot width.

NWI Classification	Acres Disturbed for Buried Pipeline Route	Percent Disturbed for Buried Pipeline Route
Estuarine		
E1OWL	0.1	0.1%
Riverine		
R2OW/EM2H	0.1	0.2%
R2OWH	0.3	0.6%
R2US/OW	1.2	2.4%
Palustrine		
PEM1B	0.2	0.4%
PEMIE	12.4	24.0%
PEMIF	1.7	3.4%
PEM1/OWH	0.1	0.2%
PEM1/SS1A	1.0	1.9%
PEM1/SS1B	18.9	36.7%
PEM1/SS1E	14.6	28.3%
PEM1/USB	0.2	0.4%
POWH	0.2	0.5%
Non-Wetland		
U	0.4	0.9%
Total	51.4	100.0%

Table 6. Summary of wetlands covered by gravel for proposed valve pads and the proposed heater pad along the Badami pipeline route, 10 January 1995.

Pad Location	NWI Classification	Acres Covered By Gravel Pads
	Palustrine	
Heater Pad - Junction with Endicott Pipeline	PEM1/OWH	0.830
Valve Pads		
Sagavanirktok Crossing (2 pads)	PEM/SS1B	0.550
Kadleroshilik Crossing (2 pads)	PEM/SS1E	0.550
Shaviovik Crossing (2 pads)	PEM/SS1B	0.550
No Name Crossing (2 pads)	PEM/SS1B	0.275
	PEM/SS1E	0.275
West Badami Creek Crossing (1 pad)	PEM/SS1B	0.275
Summary--All Pads	PEM1/OWH	0.830
	PEM/SS1B	1.650
	PEM/SS1E	0.825
Total		3.305

Table 7. Definition of NWI map codes and equivalent Walker (1983) categories for wetland types crossed by the proposed Badami buried pipeline route as of January 1995.

TYPE	NWI DESCRIPTION[1]	WALKER (1983) EQUIVALENTS
	Estuarine (E) System	
E1OWL	Subtidal, open water, subtidal	Ia; Water
	Riverine (R) System	
R2OW/EM2H	Lower perennial, open water/emergent, nonpersistent, permanently flooded	IIb: Aquatic Graminoid Tundra
R2OWH	Lower perennial, open water, permanently flooded	Ia; Water
R2US/OW	Lower perennial, unconsolidated shore/open water	Ia; Water
	Palustrine (P) System	
PEM1B	Emergent, persistent, saturated	IVa, Va, Ve; Moist Sedge or Graminoid Tundra
PEM1E	Emergent, persistent, seasonally flooded/saturated	IIIa, IIIc, IIId; Wet Sedge or Graminoid Tundra
PEM1F	Emergent, persistent, semipermanently flooded	IIb, IId; Aquatic Graminoid Tundra, Pond Complexes
PEM1/OWH	Emergent, persistent/open water, permanently flooded	IIb, IId; Aquatic Graminoid Tundra, Pond Complexes
PEM/SS1A	Emergent, persistent/scrub shrub, broad-leaved deciduous, temporarily flooded	IXb; Dry Barren/Dwarf Shrub, Forb Grass Complex
PEM/SS1B	Emergent, persistent/scrub shrub, broad-leaved deciduous, saturated	IVa, Va, Ve; Moist/Wet, Moist or Dry Sedge/Dwarf Shrub Tundra
PEM/SS1E	Emergent, persistent/scrub shrub, broad-leaved deciduous, seasonally flooded/saturated	IIIa, IVa; Wet or Moist/Wet Sedge/ Dwarf Shrub Tundra
PEM1/USB	Emergent, persistent/unconsolidated shore, saturated	IIIa, IIIc, IIId; Wet Sedge or Graminoid Tundra
POWH	Open water (less than 20 acres), permanently flooded	Ia; Water
	Non-Wetland	
U	Upland	Vc, Vd; Dry Dwarf Shrub Tundra

[1] National Wetlands Inventory, U.S. Fish and Wildlife Service, Cowardin et al. (1979)
NOTE: The pipeline alternatives are generally located in the shaded types.

IMPORTANCE TO WILDLIFE

Away from the immediate coast those map units classified as I, II or III are probably the most important for waterfowl and shorebirds (Troy 1992). These include lake margins, shallow ponds with or without emergent vegetation, pond/tundra complexes, areas of aquatic graminoid tundra, and areas of wet sedge tundra. These are critical areas for feeding birds, and in some cases also serve as nesting habitat, especially for waterfowl (Troy 1992). Most tundra nesting bird species, however, and especially shorebirds, tend to select nest sites in areas drier than those that they prefer to feed in (Troy 1992). Thus the drier habitats in the Badami area (map unit V [all types], and to a lesser extent IXi), although less important for feeding, probably provide nesting habitat for some species. The vegetation complexes, IIId and IVa, are likely to be very important bird habitats as these areas provide both moist sites suitable for nesting as well as wet sites nearby favored for feeding. This is especially the case when these vegetation types encompass clusters of lakes and ponds. On the immediate coast, the map units IIIb and IXh (arctic saltmarsh and partially barren arctic saltmarsh vegetation, respectively) are particularly important feeding areas for post-breeding migrant birds, especially Brant (*Branta bernicla*) (Bergman et al. 1977, Martin and Moitoret 1981) and shorebirds (Martin and Moitoret 1981, TERA 1994 and references within). The other vegetation/land cover categories on the map refer to sparsely vegetated areas such as gravel bars along rivers, open river gravels, artificial gravel on the tundra, coastal sand/gravel beaches, open wet mud, and barren peat. Most of these areas are probably less important habitats for birds (personal observations), and river gravels in particular have been documented as such (Pollard et al. 1990).

CONCLUSIONS

The preliminary Badami Vegetation/Land Cover Map was based solely on photo interpretation. Vegetation/land cover classifications were constructed using knowledge of vegetation in the Prudhoe Bay area, photographs of vegetation types in Walker et al. (1982) and Walker (1985a, b), and 1993 field data for the proposed Yukon Gold Transportation Corridor. Although the 1993 Yukon Gold Transportation Corridor field notes were useful in interpreting vegetation for the Badami area, none of these sites fell within the map area. To assess the accuracy of the preliminary map and collect data for map revisions, field data for 133 ground sites, located in the vicinity of the proposed Badami development (Figure A-1), were collected 6-9 August 1994.

We should also note that Walker's (1983) classification scheme specifies that moisture categories are to be assessed at the end of the growing season (late August). Aerial photography

used to construct the map was taken on 1 July 1993, at the beginning of the growing season. Areas with open water, or flooded vegetation in the photograph may have been dry by the end of the growing season. And, in fact sites 77 and 103 (Table A-1) while dry during site visits (6-9 August 1994) were clearly covered by open water in the photographs.

The preliminary map was revised based upon the ground reference data. The entire map was reviewed and corrected to reflect the ground data. It should be noted that accuracy calculations for the preliminary map (Table 3) do not reflect the accuracy of the revised map. Accuracy of the revised map is unknown, although it is undoubtedly better than the accuracy of the preliminary map. In order to assess accuracy of the current vegetation map, additional ground data are necessary. Due to the revisions based on 1994 field data, the current map is, by definition, more accurate than the preliminary map, but we cannot quantify accuracy of the current map without additional field data. Walker (1983) stresses that "the critical element for accurate vegetation maps is extensive ground reference data."

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