

APPENDIX C

Wetlands Functional Assessment at Mertarvik

Mertarvik Functional Assessment

1.0 Methods

Rapid assessment was employed to quantify the condition of Mertarvik wetlands, adapting the North Slope Rapid Assessment Methodology (NSRAM) developed by the Engineer Research and Development Center (ERDC) for the Alaska District using ArcMap 10.4.1. Three wetland data (WD) points were established based on general areas of development; WD1 is in the center of the town site located at longitude -164.497955, latitude 60.821286; WD2 is near the vertex of the runways located at longitude -164.504164, latitude 60.810319; and WD3 is en route to the quarry and landfill located at longitude -164.521752, latitude 60.815969. WD3 was moved east to avoid capturing the large areas of uplands proximal to the quarry and landfill. Eighty-meter and 800-meter buffers were drawn around the wetland data points using ArcMap's buffer geoprocessing tool. (Figure 1)

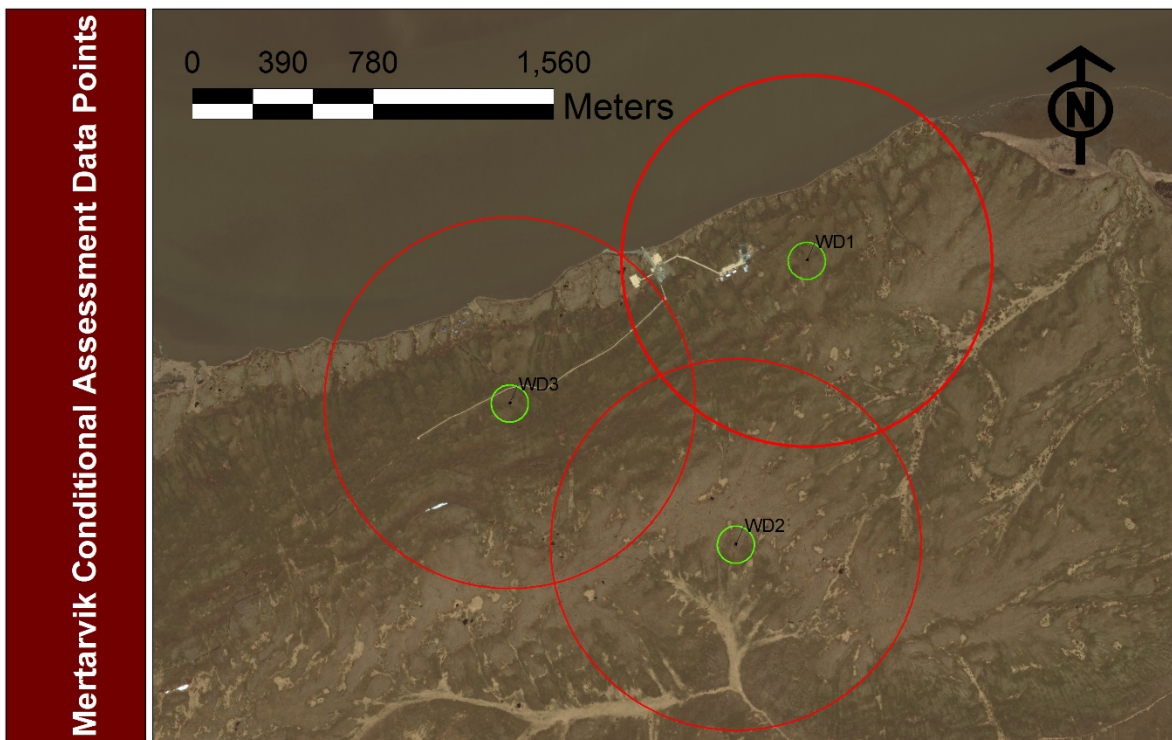


Figure 1. Mertarvik conditional assessment data points, 80m buffer (green), and 800m buffer (red).

The offsite protocols in accordance with the NSRAM were followed to develop numeric values for level of existing disturbance and post-project disturbance in order to quantify the conditional change due to construction of the Mertarvik Infrastructure Development project. All wetland

data points were evaluated as slope wetlands under the hydrogeomorphic classification system and assigned the foothills ecological region due to the geographic location and topographic setting. Open water of the Ninglick River and uplands were deducted from the area calculations of disturbance.

Existing impacts were calculated by analysis of imagery and survey data.

Geographical Information System (GIS) geometry supplied by the Alaska Native Tribal Health Consortium was applied to the wetland assessment areas to calculate the post project conditions. Best professional judgement was used to estimate post project effects of thermokarst and dust deposition.

2.0 Results

2.1 Wetland Assessment Area 1

Wetland assessment area #1 is situated in the center of the proposed town site development area. The area is fairly high gradient and the elevation changes from over 90 meters to 0 meter above sea level over about 1,100 horizontal meters. Some pioneering development exists within the assessment area: a few sheds, roads, evacuation center, barge landing, and staging areas. Trails throughout the assessment area are visible from aerial photography and about 25 percent of those trails contain anthropogenically derived surface water. (Figure 2)

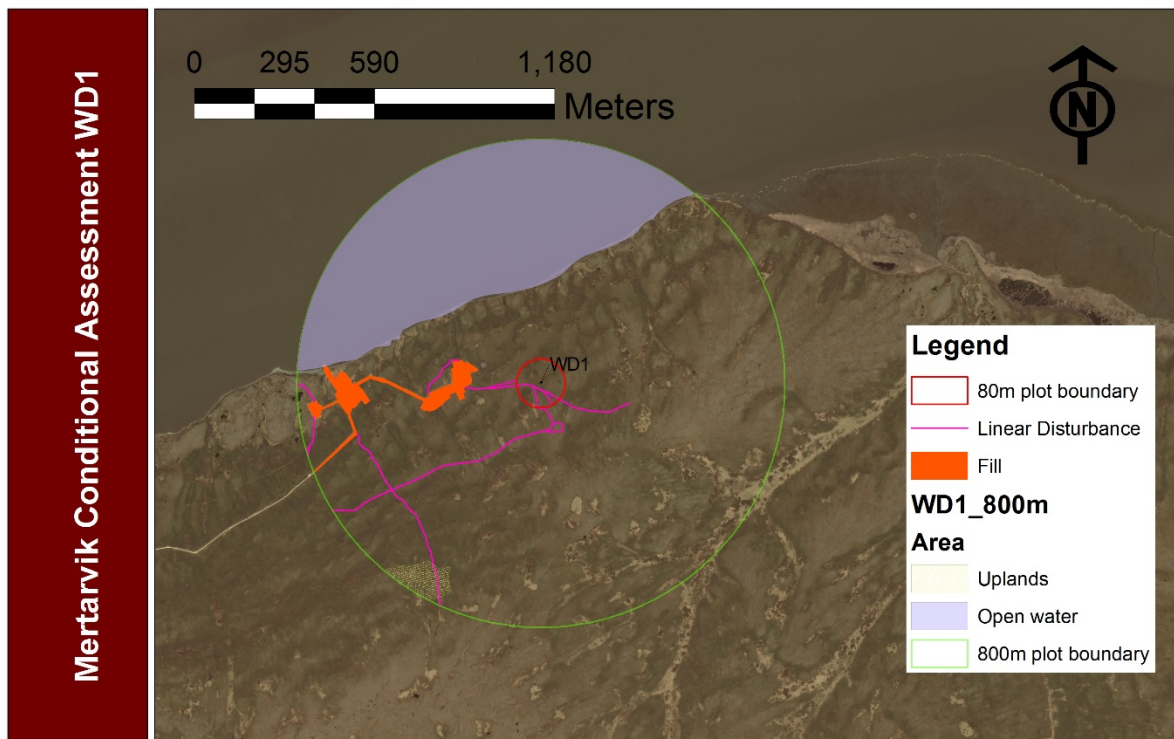


Figure 2. Wetland assessment area 1 pre-project condition

The majority of the development in this wetland assessment area is confined to the area west of plot center, but about 3,500 meters of trails visible from aerial photography intercross the 800-meter radius plot. Surface water is visible in about 25 percent of the trails. Within the 80-meter radius plot, 614 meters of linear disturbance averaging 4 meters wide was observed, creating 2456 m² of local landscape disturbance (LLD). Anthropogenically derived surface water (SW) was observed in about a quarter of the trail area for a total of 614m². No impediment to hydrology (IH) or evidence of dust accumulation (DD) was visible in the aerial photography. Within the 800 meter plot, 28,104m² of area disturbance and 2,857m of linear disturbance averaging 4m in width was measured. Total disturbance in the 800-meter plot (LD) was 40,596 m². Impediment to wildlife (IW) was present in two quadrants of the 800-meter plot and the plot center was 273 meters from plot center. No evidence of thermokarst was visible from aerial photography.

The relative conditional index for wetland assessment area is 0.85.

ALASKA NORTH SLOPE REGION RAPID WETLAND ASSESSMENT			
Section A: Offsite Data			
Site Name/Location:	Mertarvik Infrastructure Development	Latitude/UTM Northing:	60.821286
Date:	3/3/2017	Longitude/UTM Easting:	-164.437355
Arctic Region:	Foothills	Coordinate System:	NAD83 5008
HGM Class:	Slope	Imagery Source (Year):	6/3/2015
Investigator(s):	M. Ferguson		
Determine values for variables 1-4 using an 80 meter radius plot.			
1	V _{11B}	Local Landscape Disturbance - percent of the plot (0 - 100) occupied by anthropogenic disturbance and/or man-made features.	5
		V _{11B} Subindex Score	0.88
2	V _{2W}	Anthropogenically Derived Surface Water - percent of the plot (0 - 100) occupied by surface water derived from human activities, including thermokarst if directly associated, and conspicuously linked.	1
		V _{2W} Subindex Score	0.34
3	V _{3H}	Impediment to Hydrology - number of quarter segments (0 - 4) assignable in any direction that have hydrologic impediments.	0
		V _{3H} Subindex Score	1.00
4	V _{4D}	Evidence of Dust - accumulation of sediment on vegetation, appearing as areas of discoloration.	No
Determine values for variables 5-8 using an 800 meter radius plot.			
5	V _{5L}	Landscape Disturbance - percent of the plot (0 - 100) occupied by anthropogenic disturbance and/or man-made features.	3
		V _{5L} Subindex Score	1.00
6	V _{6W}	Impediment to Wildlife - number of quarter segments (0 - 4) assignable in any direction with impediments to the free movement of wildlife.	2
		V _{6W} Subindex Score	0.50
7	V _{7R}	Distance to Roadway - minimum distance in meters (0 - 800) to a roadway of any size, class, or condition.	273
		V _{7R} Subindex Score	0.55
8	V _{8T}	Evidence of Thermokarst	No
		Habitat Score	0.72
		Hydrology Score	0.95
		Biogeochemical Cycling Score	0.88
Remarks: Majority of development confined to western extent of 800m plot. Numerous ATV trails meander through southern portion of 800m plot, anthropogenic surface water estimated to occupy 14 of trails. 614 meters of linear disturbance within 80m plot x 4m avg width=1064m² linear disturbance within 80m plot. 800m plot areal disturbance=28104m². 800m linear disturbance 2857m x 4m avg width=11428 Total disturbance=40536. 433168m² open water, 16700m² UPL, wetland terrestrial plot area: 1500417m².			
Off-Site Variable Subindex Scores			
V _{11B}	Local landscape disturbance	0.88	
V _{2W}	Anthropogenically derived surface water	0.34	
V _{3H}	Impediment to hydrology	1.00	
V _{4D}	Evidence of dust	No	
V _{5L}	Landscape disturbance	1.00	
V _{6W}	Impediment to wildlife	0.50	
V _{7R}	Distance to roadway	0.55	
V _{8T}	Evidence of thermokarst	No	
Assessment Scores			
		Habitat	0.72
		Hydrology	0.95
		Biogeochemical Cycling	0.88
		On-site Modifier Score	
		AVERAGE SCORE	0.85

Figure 3. Wetland assessment area 1 data form

2.1.1 Wetland assessment area 1 post project

This wetland assessment area would host the majority of the Mertarvik town site, to include the house pads, school, offices, considerable amount of roads, and all the trails (Figure 4). Construction of the school, playground, and a section of road would add 1,665 m² of impacts to the 80-meter plot, contributing to a total of 2,729 m² of local land disturbance. Anthropogenic surface water would likely increase by 1 percent as a result of the hydraulic impediment created by the road construction in the northern portion of the 80-meter plot. Construction of the road

in the northern portion of the 80-meter plot would also create a hydrologic impediment in two quarter sections of the 80-meter plot.

Landscape disturbance within the 800-meter plot would increase to 137,978 m². Roads, house pads, a school, playground, office buildings, and other features would create an impediment to wildlife in four quarter sections of the 800-meter plot and the road would be 50 meters from plot center.

The conditional multiplier for the post construction wetland assessment area 1 is 0.59, a difference of 0.26 from the pre-project condition of 0.85.

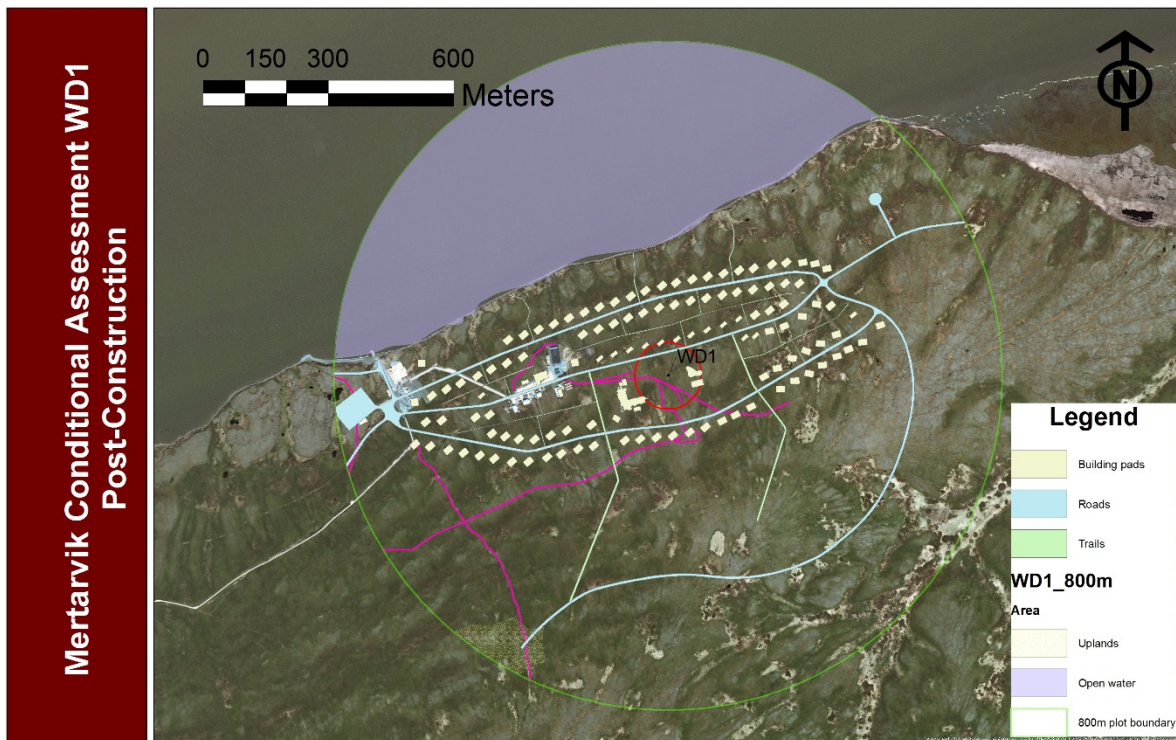


Figure 4. Wetland assessment area 1 post project condition

ALASKA NORTH SLOPE REGION RAPID WETLAND ASSESSMENT				
Section A: Offsite Data				
Site Name/Location:	Mertarvik Infrastructure Development WAA1	Latitude/UTM Northing:	60.821286	
Date:	9/17/2017	Longitude/UTM Easting:	-164.497955	
Project Purpose:	Impact	Assessment Type:	Post construction	
Arctic Region:	Foothills	Coordinate System:	NAD83 5008	
HGM Class:	Slope	Imagery Source (Year):	6/3/2015	
Investigator(s):	M. Ferguson			
Determine values for variables 1-4 using an 80 meter radius plot.				
1	V _{LLD}	Local Landscape Disturbance - percent of the plot (0 - 100) occupied by anthropogenic disturbance and/or man-made features.	14	
			V_{LLD} Subindex Score	0.65
2	V _{SW}	Anthropogenically Derived Surface Water - percent of the plot (0 - 100) occupied by surface water derived from human activities, including thermokarst if directly associated, and conspicuously linked.	2	
			V_{SW} Subindex Score	0.88
3	V _{IH}	Impediment to Hydrology - number of quarter segments (0 - 4) assignable in any direction that have hydrologic impediments.	2	
			V_{IH} Subindex Score	0.50
4	V _{DD}	Evidence of Dust - accumulation of sediment on vegetation, appearing as areas of discoloration.	No	
Determine values for variables 5-8 using an 800 meter radius plot.				
5	V _{LD}	Landscape Disturbance - percent of the plot (0 - 100) occupied by anthropogenic disturbance and/or man-made features.	9	
			V_{LD} Subindex Score	0.91
6	V _{IW}	Impediment to Wildlife - number of quarter segments (0 - 4) assignable in any direction with impediments to the free movement of wildlife.	4	
			V_{IW} Subindex Score	0.00
7	V _{DR}	Distance to Roadway - minimum distance in meters (0 - 800) to a roadway of any size, class, or condition.	50	
			V_{DR} Subindex Score	0.10
8	V _{TK}	Evidence of Thermokarst	No	
			Habitat Score	0.39
			Hydrology Score	0.73
			Biogeochemical Cycling Score	0.65
<p>Remarks: 1026m² additional local land disturbance from school and playground+639m² from road intercrossing 80m plot; total V_{LD}= 2729m²/20106m²=14%. Assume no additional anthropogenic surface water from areal disturbance because additional impacts would be non-linear; additional 1% anthropogenic surface water associated with road. Landscape disturbance from roads at 800m scale=44056m², trails=9517m², building pads=43809m². Total V_{LD}=97382+40596m²=137978m²/1500417m²=9%</p>				
Off-Site Variable Subindex Scores				
V _{LLD}	Local landscape disturbance	0.65		
V _{SW}	Anthropogenically derived surface water	0.88		
V _{IH}	Impediment to hydrology	0.50		
V _{DD}	Evidence of dust	No		
V _{LD}	Landscape disturbance	0.91		
V _{IW}	Impediment to wildlife	0.00		
V _{DR}	Distance to roadway	0.10		
V _{TK}	Evidence of thermokarst	No		
Assessment Scores				
	Habitat	0.39		
	Hydrology	0.73		
	Biogeochemical Cycling	0.65		
	On-site Modifier Score			
	AVERAGE SCORE	0.59		

Figure 5. Wetland assessment area 1 post project data form

2.2 Wetland assessment area 2

Wetland assessment area 2 is centered on a ridgeline near the vertex of the proposed main runway and crosswind runway, at about 325m above sea level. The elevation increases to 106m in the west, but drops off in all other directions. The area is currently undeveloped, but a few trails intercross the 800m radius plot boundary (Figure 6).

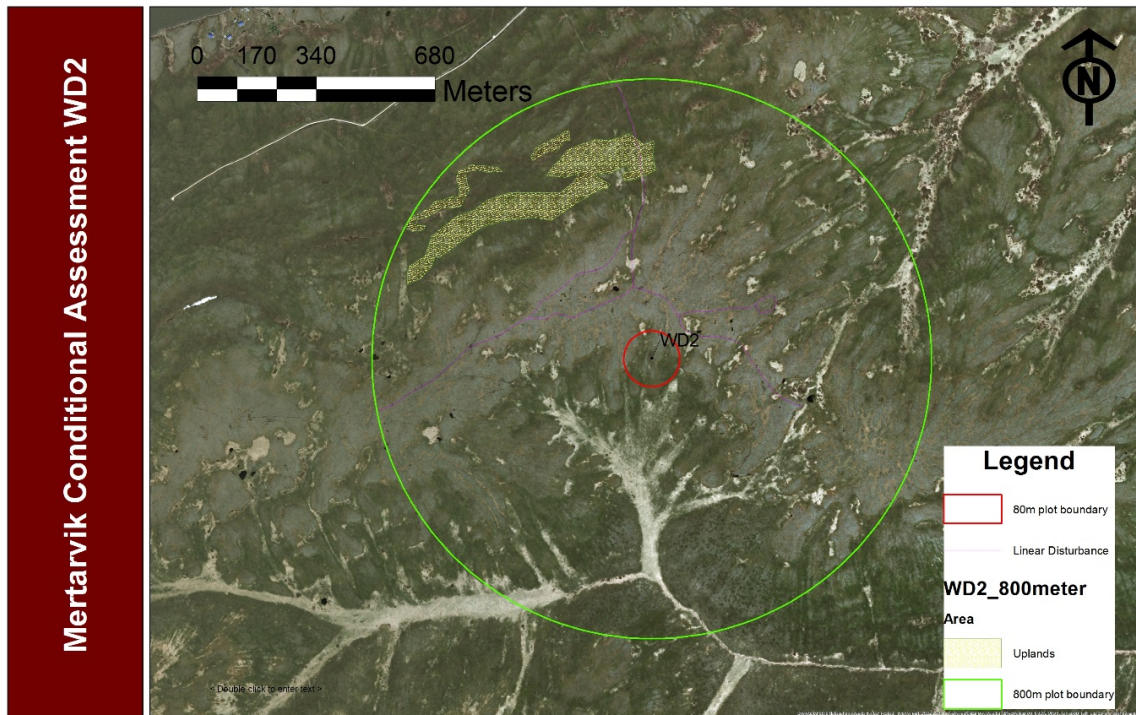


Figure 6. Wetland assessment area 2

This wetland assessment area is near the site of the proposed airport, which would consist of a main runway, crosswind runway, and apron. It is currently undeveloped, but about 2,900 meters of trails intercross the 800-meter plot. These trails are about 4 meters wide and create an areal disturbance of about 11,590 m² within the 800-meter radius plot (LD). There is no disturbance, anthropogenically derived surface water, evidence of dust, or impediment to hydrology within the 80-meter radius plot.

Upland area of 77,999 meters was deducted from the 2,010,285 m² 800-meter radius, leaving 1,932,286 m² of wetlands. A trail entered the 800-meter plot due north of plot center, passing within 203 meters of center, and exiting the plot to the west, but about 3,500 meters of trails visible from aerial photography intercross the 800-meter radius plot. Surface water is visible in about 25 percent of the trails. Within the 80-meter radius plot, 614 meters of linear disturbance averaging 4 meters wide was observed, creating 2456 m² of local landscape disturbance (LLD). Anthropogenically derived surface water (SW) was observed in about a quarter of the trail area, a total of 614 m². There was no impediment to hydrology (IH) or evidence of dust accumulation (DD) visible in the aerial photography. Within the 800-meter plot, 28,104 m² of area disturbance and 2,857 meters of linear disturbance averaging 4 meters in width was measured. Total disturbance in the 800-meter plot (LD) was 40,596 m². Impediment to wildlife (IW) was

present in two quadrants of the 800-meter plot and the plot center was 273 meters from plot center. There was no evidence of thermokarst visible from aerial photography.

The relative conditional index for wetland assessment area 2 is 0.97.

ALASKA NORTH SLOPE REGION RAPID WETLAND ASSESSMENT			
Section A: Offsite Data			
Site Name/Location:	Mertarvik Infrastructure Development	Latitude/UTM Northing:	60.810319
Date:	9/9/2017	Longitude/UTM Easting:	-164.504164
Arctic Region:	Foothills	Coordinate System:	NAD83 5008
HGM Class:	Slope	Imagery Source (Year):	6/3/2015
Investigator(s):	M. Ferguson		
Determine values for variables 1-4 using an 80 meter radius plot.			
1	V _{LLD}	Local Landscape Disturbance - percent of the plot (0 - 100) occupied by anthropogenic disturbance and/or man-made features.	0
		V _{LLD} Subindex Score	1.00
2	V _{SW}	Anthropogenically Derived Surface Water - percent of the plot (0 - 100) occupied by surface water derived from human activities, including thermokarst if directly associated, and conspicuously linked.	0
		V _{SW} Subindex Score	1.00
3	V _{IH}	Impediment to Hydrology - number of quarter segments (0 - 4) assignable in any direction that have hydrologic impediments.	0
		V _{IH} Subindex Score	1.00
4	V _{DD}	Evidence of Dust - accumulation of sediment on vegetation, appearing as areas of discoloration.	No
Determine values for variables 5-8 using an 800 meter radius plot.			
5	V _{LD}	Landscape Disturbance - percent of the plot (0 - 100) occupied by anthropogenic disturbance and/or man-made features.	1
		V _{LD} Subindex Score	1.00
6	V _{IW}	Impediment to Wildlife - number of quarter segments (0 - 4) assignable in any direction with impediments to the free movement of wildlife.	0
		V _{IW} Subindex Score	1.00
7	V _{DR}	Distance to Roadway - minimum distance in meters (0 - 800) to a roadway of any size, class, or condition.	406
		V _{DR} Subindex Score	0.81
8	V _{TK}	Evidence of Thermokarst	No
		Habitat Score	0.91
		Hydrology Score	1.00
		Biogeochemical Cycling Score	1.00
Remarks: 203m to 4wheeler trail NW of plot center; doubled distance to reduce weight in subindex valuation for low traffic. 800m plot 2897m linear disturbance * 4m width=11590m ² . Three upland polygons combined area 77,999m ² -2010285=1932286m ² .			
Off-Site Variable Subindex Scores			
V _{LLD}	Local landscape disturbance	1.00	
V _{SW}	Anthropogenically derived surface water	1.00	
V _{IH}	Impediment to hydrology	1.00	
V _{DD}	Evidence of dust	No	
V _{LD}	Landscape disturbance	1.00	
V _{IW}	Impediment to wildlife	1.00	
V _{DR}	Distance to roadway	0.81	
V _{TK}	Evidence of thermokarst	No	
Assessment Scores			
		Habitat	0.91
		Hydrology	1.00
		Biogeochemical Cycling	1.00
		On-site Modifier Score	
		AVERAGE SCORE	0.97

Figure 7. Wetland assessment area 2 data form

2.2.1 Wetland Assessment Area 2 post-project

Wetland assessment area 2 was centered near the vertex of the proposed main and crosswind runways on the ridge top south of the Mertarvik townsite (Figure 8). No local landscape disturbance, anthropogenic surface water, or impediments to hydrology would occur within the 80-meter plot, but it is likely dust deposition would be observed due to the quantities of gravel required for the construction of the two runways.

Roads and runways would create 110,413 m² of landscape disturbance within the 800-meter plot, impede wildlife in three quarter segments, and would be constructed within 100 meters of the plot center.

The conditional multiplier for the post construction wetland assessment area 1 is 0.80, a difference of 0.17 from the pre-project condition of 0.97.

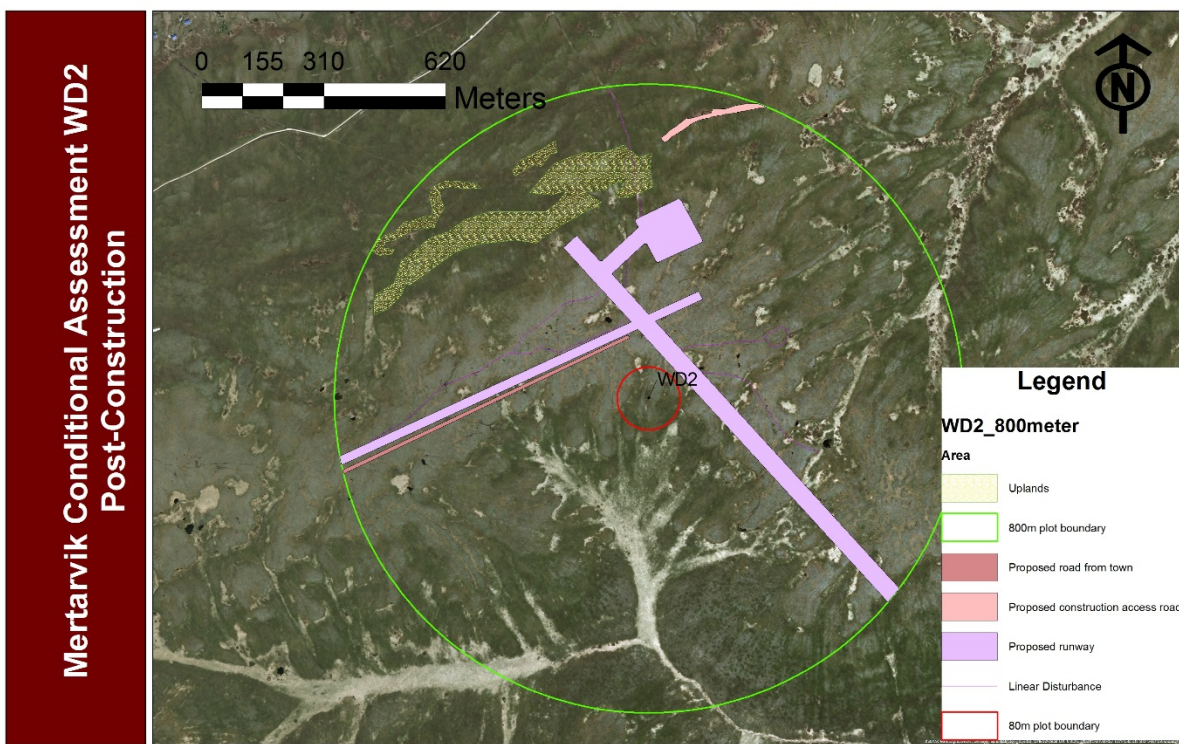


Figure 8. Wetland Assessment Area 2 post project condition

ALASKA NORTH SLOPE REGION RAPID WETLAND ASSESSMENT			
Section A: Offsite Data			
Site Name/Location:	Mertarvik Infrastructure Development WAA2	Latitude/UTM Northing:	60.810319
Date:	9/17/2017	Longitude/UTM Easting:	-164.504164
Project Purpose:	Impact	Assessment Type:	Post construction
Arctic Region:	Foothills	Coordinate System:	NAD83 5008
HGM Class:	Slope	Imagery Source (Year):	6/3/2015
Investigator(s):	M. Ferguson		
Determine values for variables 1-4 using an 80 meter radius plot.			
1	V _{LLD}	Local Landscape Disturbance - percent of the plot (0 - 100) occupied by anthropogenic disturbance and/or man-made features.	0
		V_{LLD} Subindex Score	1.00
2	V _{SW}	Anthropogenically Derived Surface Water - percent of the plot (0 - 100) occupied by surface water derived from human activities, including thermokarst if directly associated, and conspicuously linked.	0
		V_{SW} Subindex Score	1.00
3	V _{IH}	Impediment to Hydrology - number of quarter segments (0 - 4) assignable in any direction that have hydrologic impediments.	0
		V_{IH} Subindex Score	1.00
4	V _{DD}	Evidence of Dust - accumulation of sediment on vegetation, appearing as areas of discoloration.	Yes
Determine values for variables 5-8 using an 800 meter radius plot.			
5	V _{LD}	Landscape Disturbance - percent of the plot (0 - 100) occupied by anthropogenic disturbance and/or man-made features.	6
		V_{LD} Subindex Score	0.98
6	V _{IW}	Impediment to Wildlife - number of quarter segments (0 - 4) assignable in any direction with impediments to the free movement of wildlife.	3
		V_{IW} Subindex Score	0.25
7	V _{DR}	Distance to Roadway - minimum distance in meters (0 - 800) to a roadway of any size, class, or condition.	100
		V_{DR} Subindex Score	0.20
8	V _{TK}	Evidence of Thermokarst	No
		Habitat Score	0.59
		Hydrology Score	0.99
		Biogeochemical Cycling Score	0.80
Remarks: 100m to runway, 98886m2 runway footprint, 4168m2 access road, 7359m2 road from town. Total disturbance 110,413m2 within 800m radius. Three upland polygons combined area 77,999m2-2010285=1932286m2. Vld 110,413/1,932,286=5.7%. Dust deposition expected due to gravel quantities required for runway			
Off-Site Variable Subindex Scores			
V _{LLD}	Local landscape disturbance	1.00	
V _{SW}	Anthropogenically derived surface water	1.00	
V _{IH}	Impediment to hydrology	1.00	
V _{DD}	Evidence of dust	Yes	
V _{LD}	Landscape disturbance	0.98	
V _{IW}	Impediment to wildlife	0.25	
V _{DR}	Distance to roadway	0.20	
V _{TK}	Evidence of thermokarst	No	
Assessment Scores			
	Habitat	0.59	
	Hydrology	0.99	
	Biogeochemical Cycling	0.80	
	On-site Modifier Score		
	AVERAGE SCORE	0.80	

Figure 9. Wetland assessment area 2 post construction data form

2.3 Wetland assessment area 3

Wetland assessment area 3 is centered along the route from the townsite to the quarry and landfill. The plot center was shifted east to avoid capturing a large area of uplands in the vicinity of the quarry and landfill. The topography in the 800-meter plot slopes 375 meters in the southern extent of the 800-meter plot boundary to sea level in the north, over a distance of about 1,200 meters. A road extend from the townsite through the plot about 1,250 meters towards the quarry, then converts to a trail for the remaining 388 meters before exiting the plot. Several trail systems intercross the plot, primarily in the northern half. Three homes occupy about 240 m² along the bank of the Ninglick River in the northern half of the 800-meter plot and there is another 160 m² of disturbance in proximity to the houses. The barge terminal complex occupies 2,063 m² of the 800-meter plot. A total of 6,439 meters of roads and trails intercross the 800-meter plot area (Figure 10).

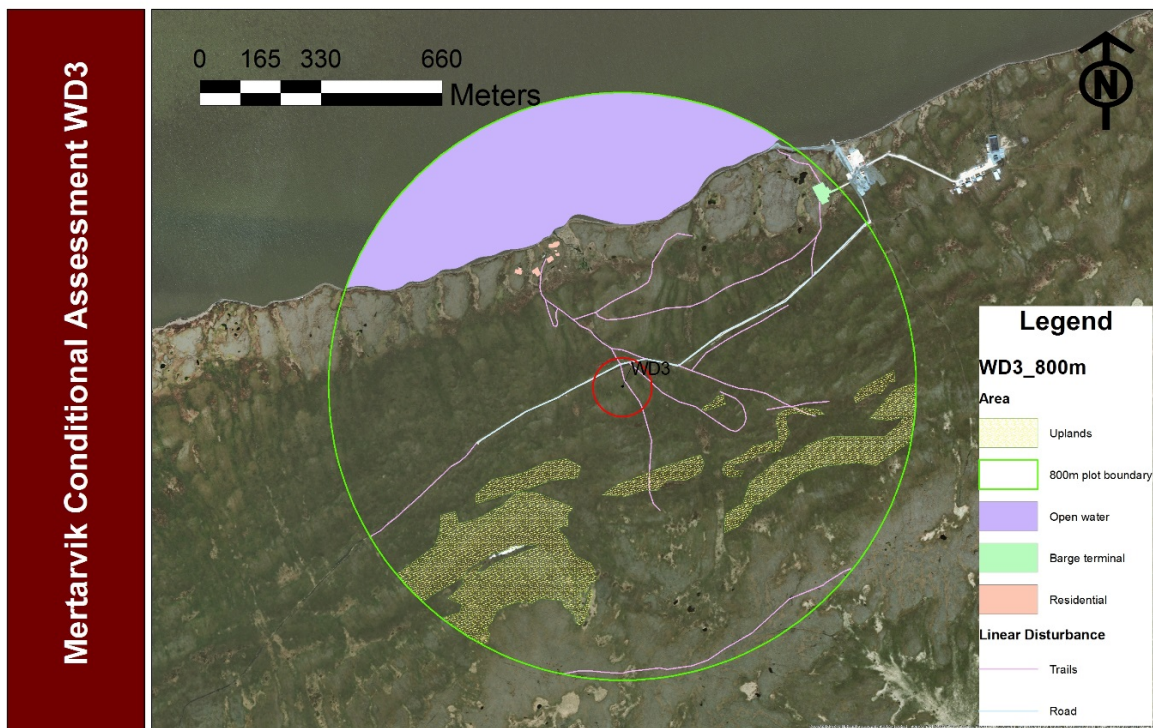


Figure 10. Wetland assessment area 3

This wetland assessment area includes the road and trail extending from the townsite to the quarry and landfill. Uplands covering 175,127 m² and 350,534 m² of open water fall within the 800-meter plot. Three houses and some attendant disturbance are in the northern portion of the assessment area. Approximately 6,439 meters of roads and trails cross the wetland assessment area; the trails and roads have a 4-meter average width of disturbance. Total disturbance from linear features is 1,432 m² inside the 80-meter plot and 25,756 m² inside the 800-meter plot.

Most of the wetland assessment area is currently undeveloped, but the trails and roads passing through the 80-meter plot result in 7 percent local land disturbance (LLD) and 2 percent anthropogenically derived surface water (SW). Hydrology is impeded by the road (IH) in two quadrants of the 80-meter plot, and there is no evidence of dust deposition (DD) visible in the aerial photography.

After removing the surface water of the Ninglick River and uplands from the area of the 800-meter plot, 1,484,339 m² of wetlands remain in the assessment area. The combined percentage of disturbance to the wetlands in the 800-meter plot is 2 percent; there is no impediment to the free movement of wildlife, the road is 55 meters from plot center, and no evidence of thermokarst is visible from aerial photography.

The relative conditional index for wetland assessment area 3 is 0.71

ALASKA NORTH SLOPE REGION RAPID WETLAND ASSESSMENT			
Section A: Offsite Data			
Site Name/Location:		Mertarvik Infrastructure Development	Latitude/UTM Northing: 60.815363
Date:		8/16/2016	Longitude/UTM Easting: -164.521752
Arctic Region:		Foothills	Coordinate System: NAD83 5008
HGM Class:		Slope	Imagery Source (Year): 6/3/2015
Investigator(s):		M. Ferguson	
Determine values for variables 1-4 using an 80 meter radius plot.			
1	V _{11b}	Local Landscape Disturbance - percent of the plot (0 - 100) occupied by anthropogenic disturbance and/or man-made features.	7
		V_{11b} Subindex Score	0.83
2	V _{21b}	Anthropogenically Derived Surface Water - percent of the plot (0 - 100) occupied by surface water derived from human activities, including thermokarst if directly associated, and conspicuously linked.	2
		V_{21b} Subindex Score	0.88
3	V _{31b}	Impediment to Hydrology - number of quarter segments (0 - 4) assignable in any direction that have hydrologic impediments.	2
		V_{31b} Subindex Score	0.50
4	V _{41b}	Evidence of Dust - accumulation of sediment on vegetation, appearing as areas of discoloration.	No
Determine values for variables 5-8 using an 800 meter radius plot.			
5	V _{51b}	Landscape Disturbance - percent of the plot (0 - 100) occupied by anthropogenic disturbance and/or man-made features.	2
		V_{51b} Subindex Score	1.00
6	V _{61b}	Impediment to Wildlife - number of quarter segments (0 - 4) assignable in any direction with impediments to the free movement of wildlife.	0
		V_{61b} Subindex Score	1.00
7	V _{71b}	Distance to Roadway - minimum distance in meters (0 - 800) to a roadway of any size, class, or condition.	55
		V_{71b} Subindex Score	0.11
8	V _{81b}	Evidence of Thermokarst	No
		Habitat Score	0.51
		Hydrology Score	0.79
		Biogeochemical Cycling Score	0.83
Remarks: Uplands cover 175127m² and open water occupies 350534m² of 800m plot. Trails and roads 4m x 6439=25756m² linear disturbance. 2463m² areal disturbance from houses and barge terminal. Road 55m from plot center.			
Off-Site Variable Subindex Scores			
V _{11b}	Local landscape disturbance	0.83	
V _{21b}	Anthropogenically derived surface water	0.88	
V _{31b}	Impediment to hydrology	0.50	
V _{41b}	Evidence of dust	No	
V _{51b}	Landscape disturbance	1.00	
V _{61b}	Impediment to wildlife	1.00	
V _{71b}	Distance to roadway	0.11	
V _{81b}	Evidence of thermokarst	No	
Assessment Scores			
		Habitat	0.51
		Hydrology	0.79
		Biogeochemical Cycling	0.83
		On-site Modifier Score	
		AVERAGE SCORE	0.71

Figure 11. Wetland assessment area 3 data form

2.3.1 Wetland Assessment Area 3 post-project

Wetland assessment area 3 is situated between the town site and the quarry (Figure 12). No additional features would be constructed within the 80-meter plot. Dust deposition is not expected to occur within the plot.

Landscape disturbance within the 800-meter plot would double to 4 percent as a result of the 26,074 m² associated with the construction of a road though the northern portion of the plot. Construction of the road would add impediment to the movement of wildlife through three quarter segments of the 800-meter plot. Thermokarst features are likely to develop

along the south margin of the road due to the impoundment potential created by its perpendicular to the gradient path across the entire 800-meter radius plot.

The conditional multiplier for the post construction wetland assessment area 3 is 0.64, a difference of 0.07 from the pre-project condition of 0.71.

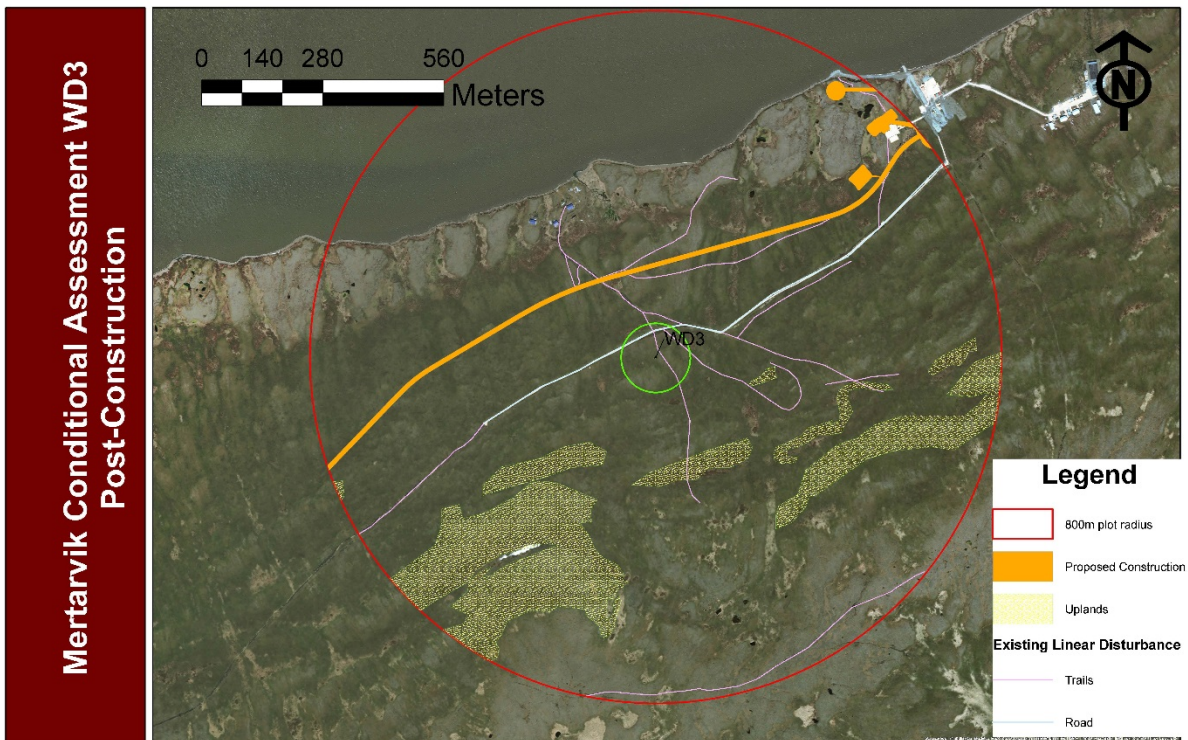


Figure 12. Wetland assessment area 3 post project condition

ALASKA NORTH SLOPE REGION RAPID WETLAND ASSESSMENT			
Section A: Offsite Data			
Site Name/Location:		Mertarvik Infrastructure Development WAA3	Latitude/UTM Northing: 60.815969
Date:		9/17/2017	Longitude/UTM Easting: -164.521752
Project Purpose:		Impact	Assessment Type: Post-construction
Arctic Region:		Foothills	Coordinate System: NAD83 5008
HGM Class:		Slope	Imagery Source (Year): 6/3/2015
Investigator(s):		M. Ferguson	
Determine values for variables 1-4 using an 80 meter radius plot.			
1	V _{LLD}	Local Landscape Disturbance - percent of the plot (0 - 100) occupied by anthropogenic disturbance and/or man-made features.	7
		V_{LLD} Subindex Score	0.83
2	V _{SW}	Anthropogenically Derived Surface Water - percent of the plot (0 - 100) occupied by surface water derived from human activities, including thermokarst if directly associated, and conspicuously linked.	2
		V_{SW} Subindex Score	0.88
3	V _{IH}	Impediment to Hydrology - number of quarter segments (0 - 4) assignable in any direction that have hydrologic impediments.	2
		V_{IH} Subindex Score	0.50
4	V _{DD}	Evidence of Dust - accumulation of sediment on vegetation, appearing as areas of discoloration.	No
Determine values for variables 5-8 using an 800 meter radius plot.			
5	V _{LD}	Landscape Disturbance - percent of the plot (0 - 100) occupied by anthropogenic disturbance and/or man-made features.	4
		V_{LD} Subindex Score	1.00
6	V _{IW}	Impediment to Wildlife - number of quarter segments (0 - 4) assignable in any direction with impediments to the free movement of wildlife.	3
		V_{IW} Subindex Score	0.25
7	V _{DR}	Distance to Roadway - minimum distance in meters (0 - 800) to a roadway of any size, class, or condition.	55
		V_{DR} Subindex Score	0.11
8	V _{TK}	Evidence of Thermokarst	Yes
		Habitat Score	0.51
		Hydrology Score	0.70
		Biogeochemical Cycling Score	0.70
Remarks: Road construction would add 26074m ² disturbance within the 800m plot radius. 54,393m ² /1484339m ² =3.6% VLD			
Off-Site Variable Subindex Scores			
V _{LLD}	Local landscape disturbance	0.83	
V _{SW}	Anthropogenically derived surface water	0.88	
V _{IH}	Impediment to hydrology	0.50	
V _{DD}	Evidence of dust	No	
V _{LD}	Landscape disturbance	1.00	
V _{IW}	Impediment to wildlife	0.25	
V _{DR}	Distance to roadway	0.11	
V _{TK}	Evidence of thermokarst	Yes	
Assessment Scores			
		Habitat	0.51
		Hydrology	0.70
		Biogeochemical Cycling	0.70
		On-site Modifier Score	
		AVERAGE SCORE	0.64

Figure 13. Wetland assessment area 3 post project data form

3.0 Functional Assessment

3.1 Methods

A functional assessment was performed to quantify the functions provided by the six Cowardin classes of wetlands that would be impacted by the construction of the Mertarvik Infrastructure Development Project. The Alaska Regulatory Best Professional Judgement Characterization (ARBPJC) methodology presented in Regulatory Guidance Letter (RGL) 09-01 was used, absent a more appropriate method. No implication of compensatory mitigation was included in the assessment. Data forms from the 2005 wetland delineation conducted by USACE Regulatory were used to complete the ARBPJC forms. The functional assessment multipliers for each Cowardin class were applied to the acreage of impact associated with each infrastructure feature. The product was multiplied by the pre and post project conditional assessment in order to generate a functional differential between pre and post project conditions, expressed as a functional capacity unit.

3.2 Assumptions and caveats

Wetlands with six or more plant species are considered to have high plant diversity. Breakup falls outside the growing season, so is not considered inundation during the growing season. Water detention was assumed high if the soils was overlain by 8 inches or more of organic material. Aerial cover greater than 50% was considered dense. In the event requisite data was not included on the 2005 wetland delineation data forms, that subindex was removed from consideration; e.g., the palustrine emergent persistent data form 2b did not include soils data due to the presence of primary hydrology indicators and obligate wetland plant species, so subindex C5 was removed from the total calculation and reduced the potential score from 43 to 42.

3.3 Results

3.3.1 Palustrine Emergent Persistent

Palustrine emergent persistent (PEM1) wetlands represent about 12 percent of the total delineated area. They are usually located in drainage ways and in depressions where snow persists until late spring. The communities are typically dominated by bluejoint grass with few herbs and almost no willows. Herbs within these communities include *Petasites frigidus*, *Equisetum sp.*, *Athyrium filix-femina*, dwarf dogwood (*cornus suecica*), and *Angelica lucida*. They are well distributed within the delineated area but are usually common near willow thickets. Palustrine emergent persistent wetlands also include wet sedge meadow tundra dominated by *Carex aquatilis*, *Potentilla palustris*, and green sphagnum. Wet sedge meadow tundra is usually found in areas with standing water along drainages that cross the bottom hills, lake fringes, and crisscross the top plateau tundra.

These wetlands would be impacted primarily by the construction of the runways, which would cause the loss of 5.3 acres including the apron. Roads would destroy 1.2 acres and the quarry would remove .2 acres (Figure 14). These wetlands received a functional score of 21/42 (0.5) and function at a high level in terms of nutrient and toxicant removal, production and export of organic material, and educational or scientific value. Moderate scores were returned in flood flow alteration, sediment removal, general habitat suitability, and native plant richness. This class

provides low uniqueness and heritage functions. Erosion control, shoreline stabilization, and general fish habitat were not evaluated.

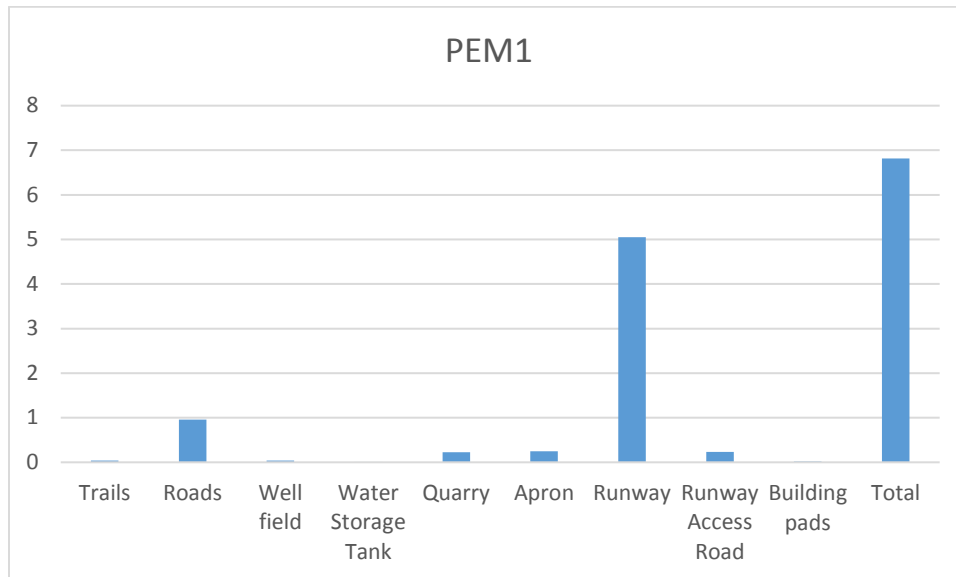


Figure 14. Acreage of impacts to palustrine emergent wetlands arranged by feature type

Wetland assessment area 2 (WAA2) was selected as the most appropriate conditional multiplier to calculate functional capacity differential because most of the impacts to this wetland type would result from the construction of the runway. Palustrine emergent persistent wetlands totaling 6.8 acres would be impacted by the project, applying the pre-project conditional multiplier of 0.97 for WAA2 equals 6.6 conditional units. Subtract the pre-project condition from the post project conditional value (6.8 acres multiplied by post-project conditional multiplier of 0.8); 5.4, to calculate the 1.2 conditional differential. This value is multiplied by the functional score of 0.5 provided by the ARBPJC to derive -0.6 functional capacity units from the impact of the proposed activity on palustrine emergent persistent wetlands in the project area.

3.3.2 Palustrine scrub-shrub

The palustrine scrub-shrub wetlands represent about 58 percent of the delineated area and were separated into the following subclasses depending on the habitat of the dominant species: palustrine scrub-shrub evergreen wetlands dominated by crowberry tundra and birch-ericaceous shrub communities (937 acres), palustrine scrub-shrub/moss peat wetlands where sphagnum and low growing shrubs are the main component of the vegetation community (580 acres), and palustrine scrub-shrub broad leaved-deciduous dominated by willow (*Salix pulcha*) (324 acres). Palustrine scrub-shrub evergreen wetlands were found within the proposed village townsite location. The palustrine scrub-shrub/moss peat wetlands are located at a slightly higher elevation, usually on mounds of about 1 foot in height. Palustrine scrub-shrub broad-leaved deciduous wetlands are well spread out in the general sampled area along several drainage ways and depressions.

3.3.2.1 Palustrine emergent persistent/scrub-shrub

Palustrine emergent persistent/scrub-shrub wetlands represent approximately 16 percent of the total delineated area. They were divided into two groups: palustrine emergent persistent/scrub-shrub evergreen/moss (255 acres) and palustrine emergent persistent/scrub-shrub broad-leaved deciduous (240 acres). Palustrine emergent persistent/scrub-shrub/moss are wetlands located at the foot hills, with a similar component of low growing evergreen species as the palustrine scrub-shrub evergreen wetlands (top plateau), but with a conspicuous cover of tussock cottongrass (*Eriophorum vaginatum*). These wetlands also have a large component of rust-color sphagnum, which gives this community a rusty color and a deep 16-foot peat layer. Palustrine emergent persistent/scrub-shrub deciduous wetlands are dominated by bluejoint grass, but have about 25 percent of willow cover. The vegetation community seems to be an intermediate state between willow-dominated communities and bluejoint grass meadows. They are found along drainage ways, depressions and slopes, and have a large component of wildflowers, herbs, and ferns.

Palustrine emergent persistent/palustrine scrub-shrub wetlands would be impacted primarily by the construction of the runways, which would cause the loss of 4 acres including the apron. Roads would destroy 0.7 acres (Figure 15). These wetlands received a functional score of 20/43 (0.47) and function at a high level in terms of production and export of organic material, general habitat suitability, and educational or scientific value. Moderate scores were returned in nutrient and toxicant removal, flood flow alteration, sediment removal, and native plant richness. This class provides low uniqueness and heritage functions. Erosion control, shoreline stabilization, and general fish habitat were not evaluated.

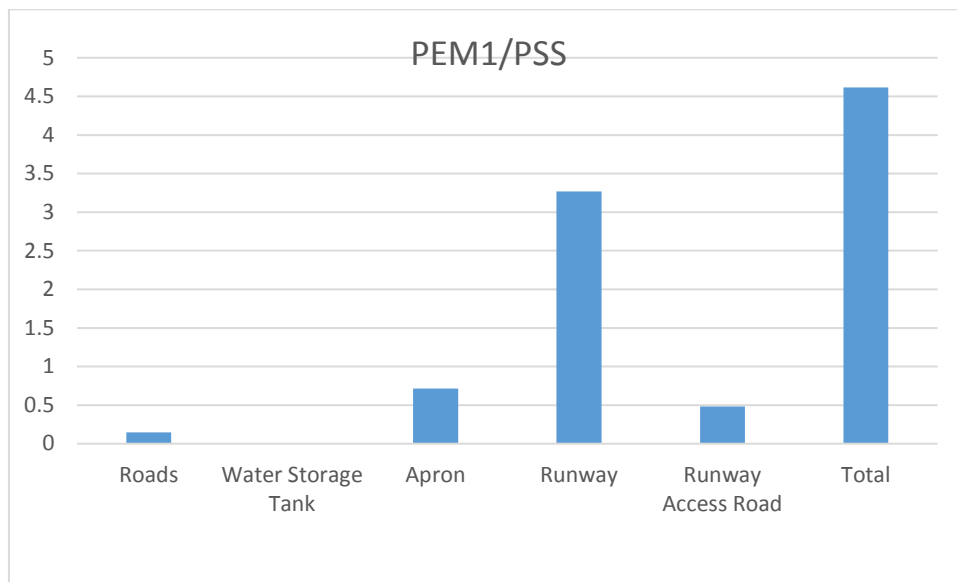


Figure 15. Acreage of impacts to palustrine emergent/scrub-shrub wetlands arranged by feature type

Wetland assessment area 2 (WAA2) was selected as the most appropriate conditional multiplier to calculate functional capacity differential because most of the impacts to this wetland type would result from the construction of the runway. Palustrine emergent persistent/scrub-shrub wetlands totaling 4.6 acres would be impacted by the project, applying the pre-project conditional

multiplier of 0.97 for WAA2 equals 4.5 conditional units. Subtract the pre-project condition from the post-project conditional value (4.6 acres multiplied by post-project conditional multiplier of 0.8); 3.7, to calculate the 0.8 conditional differential. This value is multiplied by the functional score of 0.47 provided by the ARBPJC to derive -0.0376 functional capacity units from the impact of the proposed activity on palustrine emergent persistent/scrub-shrub wetlands in the project area.

3.3.2.2 Palustrine scrub-shrub broad leafed deciduous

Palustrine scrub-shrub broad leafed deciduous wetlands would be impacted primarily by the construction of the roads, which would cause the loss of 3.4 acres. Building pads would destroy 2.8 acres, the lagoon would fill 1.8 acres, and trails would cover 0.6 acres (Figure 16). These wetlands received a functional score of 17/43 (0.395) and function at a high level in terms of production and export of organic material, general habitat suitability, and educational or scientific value. Moderate scores were returned in nutrient and toxicant removal, flood flow alteration, sediment removal, and native plant richness. This class provides low uniqueness and heritage functions. Erosion control, shoreline stabilization, and general fish habitat were not evaluated.

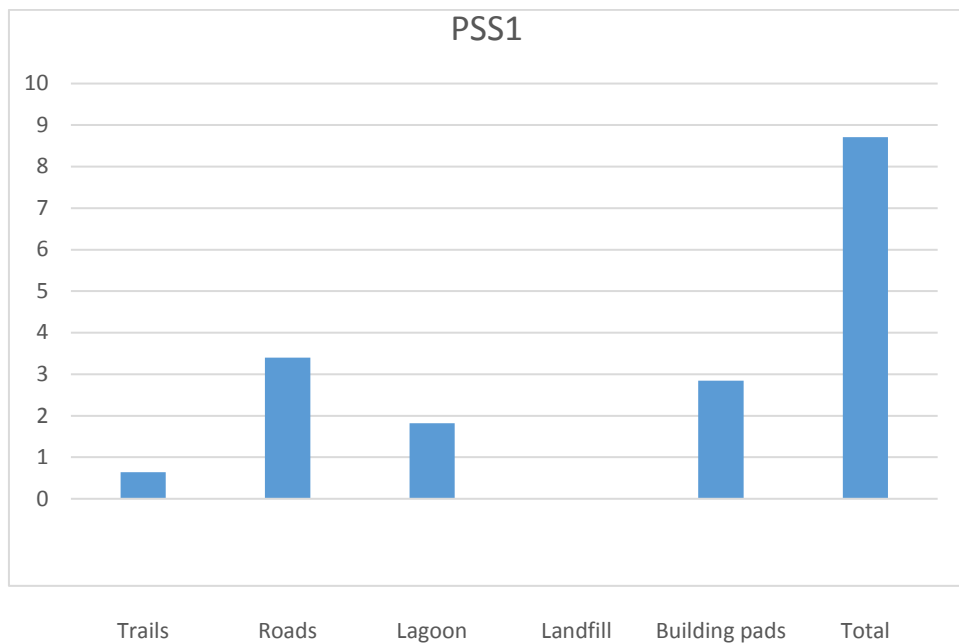


Figure 16. Acreage of impacts to palustrine scrub-shrub broad leafed deciduous wetlands arranged by feature type

Wetland assessment area 1 (WAA1) was selected as the most appropriate conditional multiplier to calculate functional capacity differential because most of the impacts to this wetland type would result from the construction of the townsite. Palustrine scrub-shrub broad leafed deciduous wetlands totaling 8.7 acres would be impacted by the project; applying the pre-project conditional multiplier of 0.85 for WAA1 equals 7.4 conditional units. Subtract the pre-project condition from the post-project conditional value (8.7 acres multiplied by post-project conditional multiplier of 0.59); 5.1, to calculate the 2.3 conditional differential. This value is

multiplied by the functional score of 0.395 provided by the ARBPJC to derive -0.9085 functional capacity units from the impact of the proposed activity on palustrine emergent persistent/scrub-shrub wetlands in the project area.

3.3.2.3 Palustrine scrub-shrub evergreen

Palustrine scrub-shrub evergreen wetlands would be impacted primarily by the construction of the roads, which would cause the loss of 13.5 acres. Building pads would destroy 7.9 acres, the lagoon would fill 3.2 acres, trails would cover 1.6 acres, the quarry would impact 1.6 acres, and the well field and water storage tanks would displace 0.9 acres (Figure 17). These wetlands received a functional score of 14/43 (0.326) and function at a high level in terms of educational or scientific value. Moderate scores were returned in flood flow alteration, sediment removal, nutrient and toxicant removal, production and export of organic matter, general habitat suitability, and native plant richness. This class provides low uniqueness and heritage functions. Erosion control, shoreline stabilization, and general fish habitat were not evaluated.

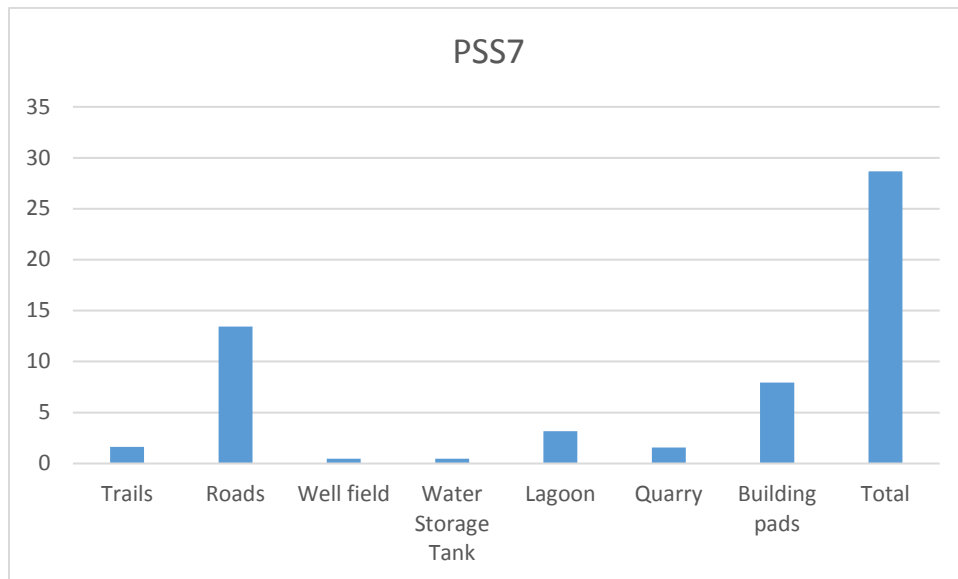


Figure 17. Acreage of impacts to palustrine scrub-shrub evergreen wetlands arranged by feature type

Wetland assessment area 1 (WAA1) was selected as the most appropriate conditional multiplier to calculate functional capacity differential because most of the impacts to this wetland type would result from the construction of the townsite. Palustrine scrub-shrub evergreen wetlands totaling 28.7 acres would be impacted by the project; applying the pre-project conditional multiplier of 0.85 for WAA1 equals 24.4 conditional units. Subtract the pre-project condition from the post-project conditional value (28.7 acres multiplied by post-project conditional multiplier of 0.59); 16.9, to calculate the 7.5 conditional differential. This value is multiplied by the functional score of 0.395 provided by the ARBPJC to derive -2.445 functional capacity units from the impact of the proposed activity on palustrine scrub-shrub evergreen wetlands in the project area.

3.3.2.4 Palustrine scrub-shrub/moss-lichen

Palustrine scrub-shrub/moss-lichen wetlands would be impacted primarily by the construction of the runway, which would cause the loss of 18.4 acres. The runway access road would impact 1.8 acres and infrastructure roads would fill another 0.2 acres (Figure 18). These wetlands received a functional score of 21/43 (0.488) and function at a high level in terms of nutrient and toxicant removal, general habitat suitability, native plant richness, and educational or scientific value. Moderate scores were returned in flood flow alteration, sediment removal, and production and export of organic matter. This class provides low uniqueness and heritage functions. Erosion control, shoreline stabilization, and general fish habitat were not evaluated.

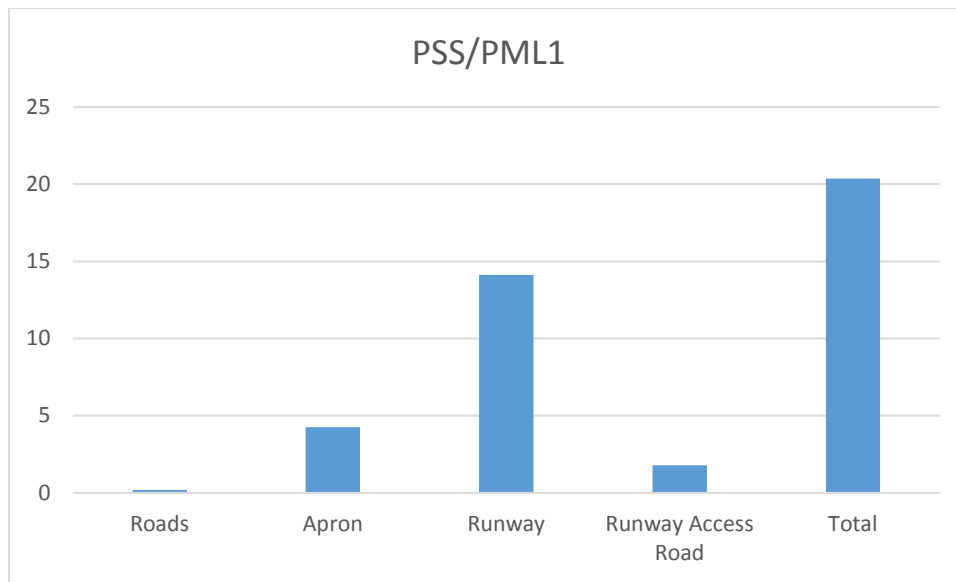


Figure 18. Acreage of impacts to palustrine scrub-shrub/moss-lichen wetlands arranged by feature type

Wetland assessment area 2 (WAA2) was selected as the most appropriate conditional multiplier to calculate functional capacity differential because most of the impacts to this wetland type would result from the construction of the runways. Palustrine scrub-shrub/moss lichen wetlands totaling 20.4 acres would be impacted by the project; applying the pre-project conditional multiplier of 0.97 for WAA2 equals 19.8 conditional units. Subtract the pre-project condition from the post-project conditional value (28.7 acres multiplied by post-project conditional multiplier of 0.8); 16.3, to calculate the 3.5 conditional differential. This value is multiplied by the functional score of 0.488 provided by the ARBPJC to derive -1.698 functional capacity units from the impact of the proposed activity on palustrine scrub-shrub evergreen wetlands in the project area.

3.3.2.5 Palustrine emergent persistent/scrub-shrub/moss-lichen

Palustrine emergent persistent/scrub-shrub/moss-lichen wetlands would be impacted primarily by the construction of the roads, which would cause the loss of 2.7 acres. Trails and building pads would cumulatively impact 0.05 acres (Figure 19). These wetlands received a functional score of 23/43 (0.534) and function at a high level in terms of nutrient and toxicant removal,

production and export of organic matter, general habitat suitability, native plant richness, and educational or scientific value. Moderate scores were returned in flood flow alteration, and sediment removal. This class provides low uniqueness and heritage functions. Erosion control, shoreline stabilization, and general fish habitat were not evaluated.

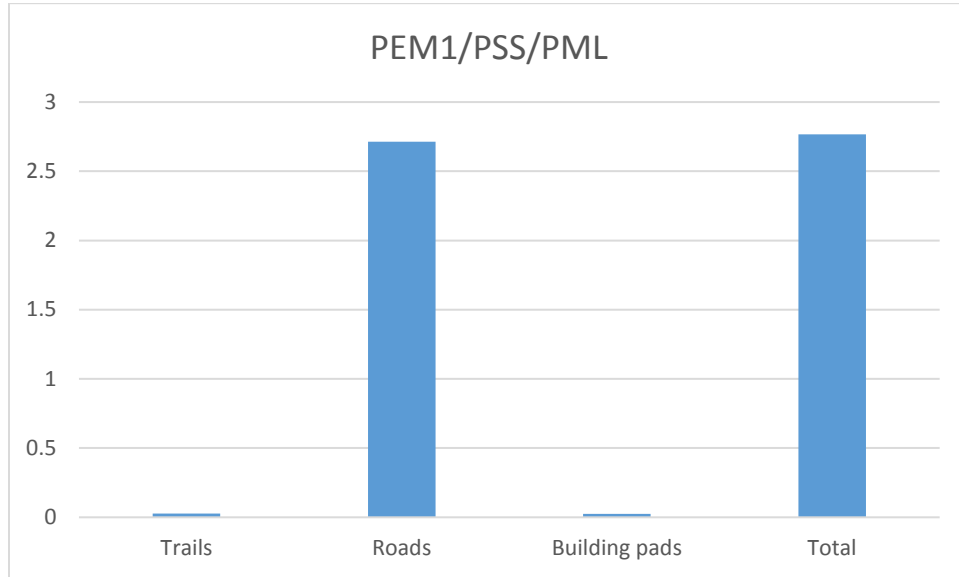


Figure 19. Acreage of impacts to palustrine emergent persistent/scrub-shrub/moss-lichen wetlands arranged by feature type

Wetland assessment area 3 (WAA3) was selected as the most appropriate conditional multiplier to calculate functional capacity differential because most of the impacts to this wetland type would result from the construction of the roads. Palustrine emergent persistent/scrub-shrub/moss lichen wetlands totaling 2.8 acres would be impacted by the project; applying the pre-project conditional multiplier of 0.71 for WAA2 equals 2.0 conditional units. Subtract the pre-project condition from the post-project conditional value (2.8 acres multiplied by post project conditional multiplier of 0.64); 1.8, to calculate the 1.0 conditional differential. This value is multiplied by the functional score of 0.534 provided by the ARBPJC to derive -0.534 functional capacity units from the impact of the proposed activity on palustrine emergent persistent/scrub-shrub/moss-lichen wetlands in the project area.

4.0 Summary

The construction of the Mertarvik Infrastructure Development project has the potential to impact 72 acres of wetlands. These wetlands have varying degrees of intrinsic value, as expressed by the functional assessment performed in the previous sections. The functions provided by the wetlands in the project area would be degraded to a certain extent by the construction of the proposed project through direct impact, hydrologic disruption, habitat fragmentation, and other anthropogenic influences (Figure 20). The assessment in the preceding sections quantifies those impacts in a repeatable and objective way in order to determine the significance of the proposed action.

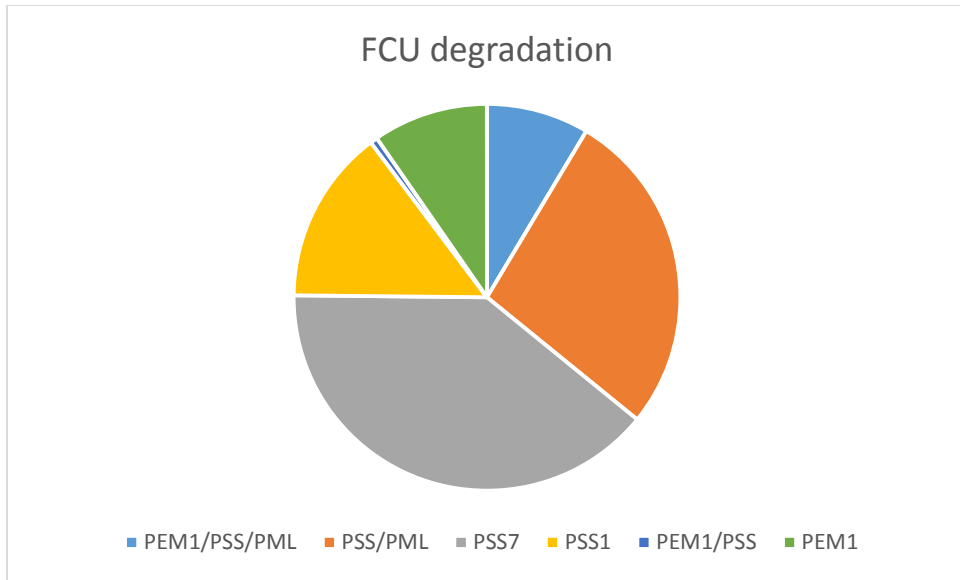


Figure 20. Functional capacity unit degradation arranged by wetland class

This page left intentionally blank.