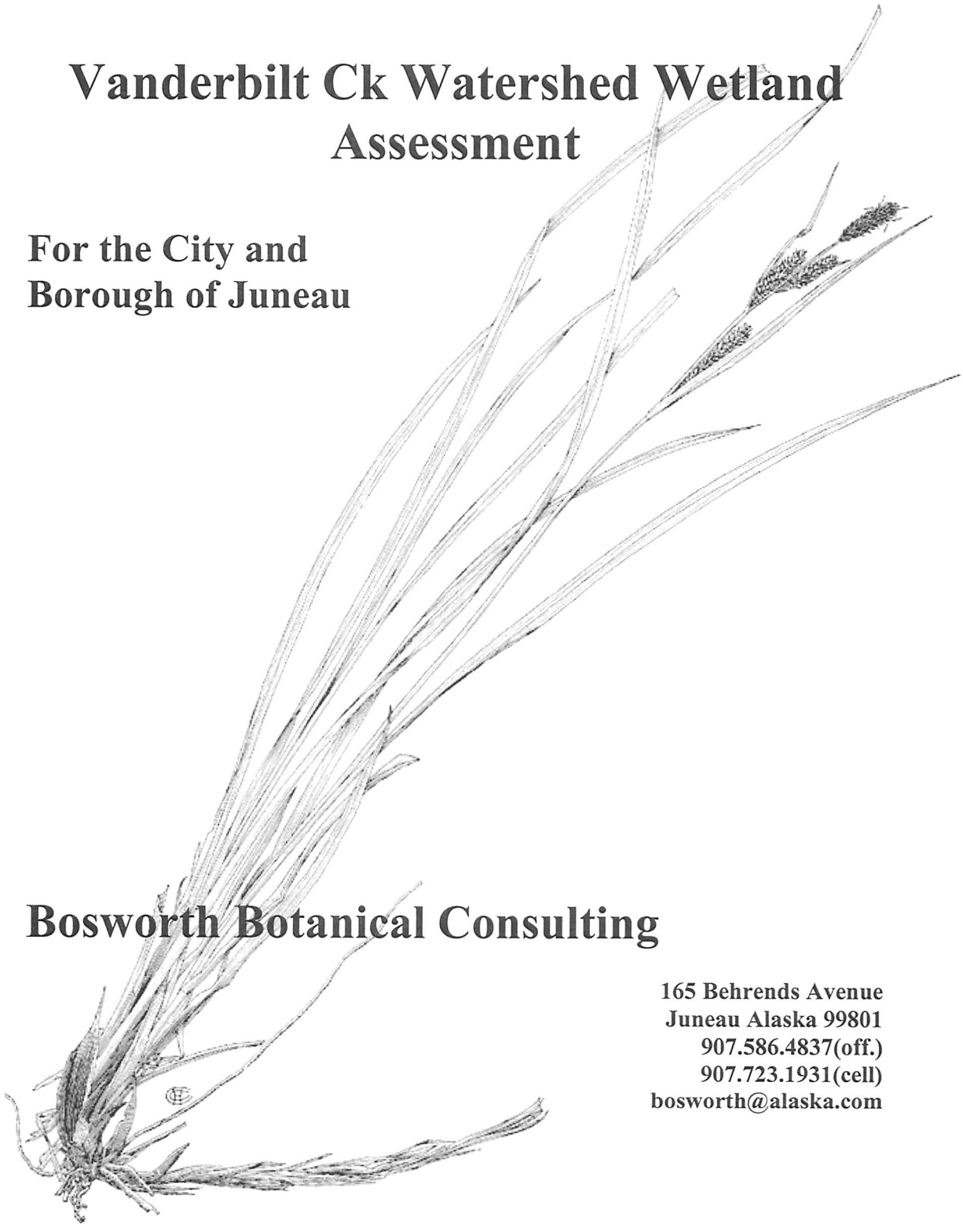
Vanderbilt Ck Watershed Wetland Assessment

For the City and Borough of Juneau



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Prepared for the City and Borough of Juneau

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Introduction

The City and Borough of Juneau is investigating construction of a second access route to the east Lemon Creek industrial and commercial area (Fig. 1). Five of the alternate routes (Alternatives 3,3A, 4, 4A, 4B, Lemon Ck. trail) fall within the Vanderbilt Creek watershed, which is located along the southeastern edge of the Lemon Creek Valley in Juneau, Alaska. This report provides mapping, description and evaluation of the wetlands found within the scope of these road alternatives. The work reported in this survey was done 9/29/08 – 10/1/08.

Figure 1 - Location map for Vanderbuilt Ck. study area including alternative routes, the Lemon Ck trail and the geomorphic transect.

Study Area Description

Geomorphology and Hydrology

The Vanderbilt Creek watershed drains the western slope of the 3,000 foot high section of Blackerby ridge and the eastern edge of the Lemon Creek Valley. The surficial geology of the watershed is complicated and over most of the area is related to its glacial history.

About 9,000 to 12,000 years ago Lemon Glacier was receding up the valley, leaving the land compressed from its weight. The Lemon Creek Valley at that time was an inlet, and sea level was more than 300 ft. higher than it is today, as evidenced by glaciomarine sediments deposited on the mountain slopes. Deep deltaic sediments were deposited in the upper part of the Lemon Creek Valley - across what is now the Costco/Lemon Creek Correctional Center area. As the ice retreated and the land rebounded, alluvial terrace sediments were deposited on the newly exposed floodplain of Lemon Creek and colluvial sediments were and are being deposited at the toe of the steep slopes of Blackerby ridge. As the land continues to rebound (approximately 0.6 - 0.8 inches per year), the tidelands of the lower Lemon Creek Valley are rising above tidal influence, leaving behind a layer of intertidal glacial silts.

A geomorphic transect oriented west-southwest from the steep bedrock slope of Blackerby Ridge to Glacier Highway (see Fig. 1) indicates:

- Steep bedrock (>50% slope) with shallow colluvial sediments (Blackerby slope)
- deeper colluvial sediments over older deltaic sediments at the toe of the slope (~500 feet)
- Shallow slope (< 5% slope) with small depth of colluvial/alluvial sediments over intertidal silt over deltaic sediments (~320feet)
- Shallow depth of flat alluvial terrace sediments over intertidal sediments over older deltaic sediments (~185 feet)
- Vanderbilt Creek
- Man-made fill over uplifted intertidal sediments (~170 feet)
- Flat, uplifted intertidal sediments over older deltaic sediments (~320feet)
- Fill – Glacier Highway over uplifted intertidal sediments

Present day drainage patterns in the upper part of Vanderbilt Creek, and 1948 and 1962 aerial photos, indicate that there was considerable flow to the creek from the current Costco/Home Depot/Shaune Drive filled and mined area. Toe-of-slope, forested and open wetland, discharge areas probably extended up along the valley edge to Lemon Creek canyon (Fig.3).

Today, the main branch of Vanderbilt Creek flows west-southwest off Blackerby Ridge and down to within 10 feet of the south edge of the Home Depot cut and the Shaune Drive fill. When it reaches the flat, uplifted, intertidal wetland meadows in the Jenkins homestead/Western Auto area it begins meandering in a more southerly direction and merges with the other drainages coming off Blackerby Ridge. At the time of the survey

20 surface drainages crossed the Alternative 3 road alignment and joined Vanderbilt Creek before it crosses under Glacier Highway. The water table was located within 12 inches of the surface along almost all of the road alignment distance (except the filled sections). This is probably caused by the presence of a relatively impermeable layer of intertidal silt at or near the surface, coupled with an active discharge area at the toe of the slope.

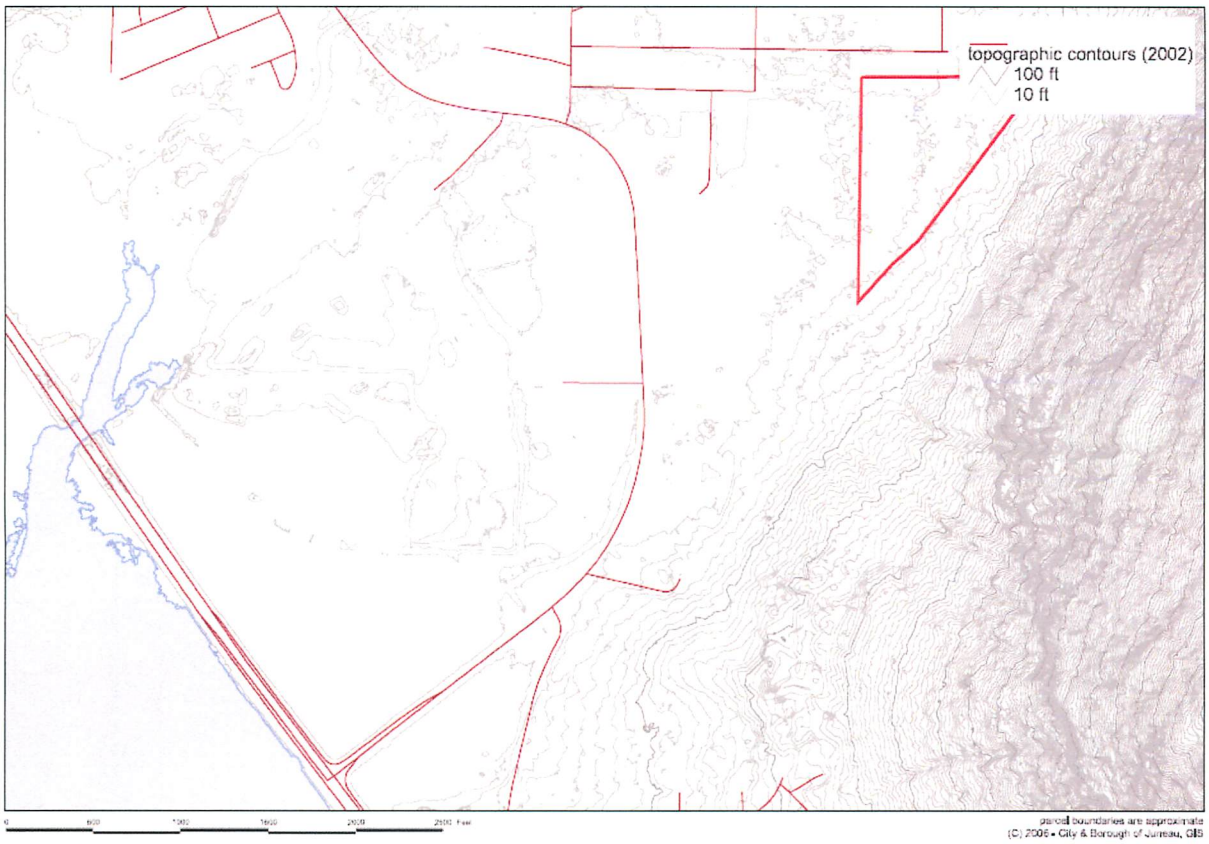

Figure 2 – Topographic contours developed from topographic spot elevations acquired by Lidar in 2002. (from Bosworth, 2007)

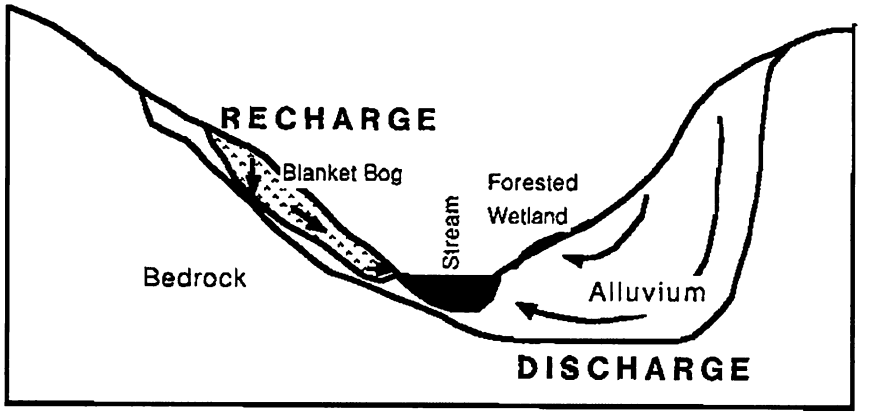

Figure 3 - Diagram of discharge and recharge in a valley system.

Soils

The soils of the study area vary with their position along a geomorphic and hydrologic catena, from the shallow-to-bedrock soils of the hillside to the flat, saturated, organic soils of the uplifted intertidal marsh and meadow.

Tolstoi Series - The Tolstoi series consists of shallow to bedrock, well and moderately well-drained soils that formed in colluvium and residuum on gently sloping to extremely steep slopes of mountains and valley sides. Slopes range from 5 to 120 percent. This type of soil is found on the steep slopes of Blackerby Ridge above the Lemon Creek Trail road.

Kupreanof Series - The Kupreanof series consists of deep, well-drained soils that formed in colluvium and glacial till. Kupreanof soils occur on moraines and mountain side slopes. Slopes range from 2 to 100 percent. This type of soil is found at the northern end of alternative 3 and just below and above the Lemon Creek trail road. This soil supports a forest of Sitka spruce, western hemlock and devils club.

Wadleigh Series – The Wadleigh series consists of somewhat poorly-drained soils that occur on lower slopes of hills and mountains. These soils are formed in very gravelly loamy material underlain by uplifted intertidal or marine glacial silt sediments (or firm glacial till) that impedes internal drainage. In this area this type of soil is found primarily on the hummocky parts of the central part of alternative 3 and below the Lemon Creek trail. This soil supports a forest of western hemlock and early blueberry.

Maybeso Series – The Maybeso series consists of very poorly-drained soils of nearly level to strongly sloping seepage areas, drainage ways and benches. These soils are made up of mucky peat 16 to 50 inches over glacial till or uplifted intertidal silts. This soil supports a forest of western hemlock, Sitka alder and skunk cabbage and is found in the study area along all but the very ends and the fill of alternative 3.

Kina Series – The Kina series consists of very poorly-drained peat soils that occur on benches and foot slopes. The peat materials are derived chiefly from sedges. In our area the Kina series soils are relatively young where they are found on the flat uplifted intertidal silt sediments under much of alternate 4A, 4 and 4B and the lower end of 3.

Kogish Series – very poorly drained nearly level to strongly sloping peat soils that occur in valleys and on broad benches. The peat materials are derived chiefly from sphagnum moss, which is the dominant vegetation. There is a small sphagnum bog on the west edge of the central part of alternative 3.

Figure 4 – Colluvial, shallow-to-bedrock soil just uphill of the Lemon Creek Trail .

Figure 5 - Soil with mixed colluvial material at the north end of alternative 3.

Figure 6 - Well-drained upland soil with silt layer from just below Lemon Ck. trail.

Figure 7 - Forested wetland soil - mucky peat -along alternative 3.

Vegetation

The steeper well drained, bedrock slopes above the Lemon Creek trail support a Sitka spruce/western hemlock forest with a relatively lush, tall shrub layer dominated by devils club and elderberry and an herb understory of ferns and foamflower (Fig. 8).

Figure 2 - Spruce/hemlock/skunk cabbage/elderberry/ferns on steep bedrock slope.

The toe of slope, colluvium deposits as are found below the Lemon Creek trail and above Alternative 3 support a red alder/Sitka spruce forest with a shrub layer dominated by devils club, elderberry and salmonberry and a herb understory of enchanters nightshade, ferns and foamflower (Figs. 9, 21).

Figure 9 - Upper Vanderbilt Ck. on colluvial soil with spruce/red alder/skunk cabbage/enchanters nightshade.

The very gently sloping deltaic sediments found along much of the central length of Alternative 3 supports a forested wetland dominated by western hemlock and skunk cabbage (Fig. 10) . This plant community transitions into another further down the slope, featuring flat alluvial sediments over a perching layer of uplifted intertidal sediments. This is a forested wetland or alder fen dominated by Sitka alder, western hemlock and skunk cabbage (Figs 11, 19, 22, 24). In the parts of this community that are found along Vanderbilt Creek, stringers of Sitka spruce are found.

Figure 10 - Hemlock/Skunk cabbage forest on mucky peat over gently-sloping deltaic deposits.

Figure 11 - Alder/skunk cabbage fen over uplifted intertidal silt.

The flat, uplifted, intertidal, silt sediments at the southwestern edge of the watershed support a complex of marsh, wet meadow and riparian plant communities whose composition is related to the depth of the water table and their proximity to Vanderbilt Creek and its tributaries. The dominant species in the marsh communities are sedges such as bulrush and cotton grass, grasses such as bluejoint and Bering hairgrass and wetland forbs such as skunk cabbage and lady fern (Figs 12, 13, 23, 26, 27, 31, 33, 36). There are remnant populations of intertidal and beach plants amongst the wetland sedges and grasses that are dominant in these communities. Alder fen becomes dominant in some of the riparian areas of this marsh (Figs 25, 29, 30, 34).

Figure 12 - Sedge /forb marsh along alternative 4A.

Figure 13 - Skunk cabbage/bulrush marsh on the southern end of alternative 4A.

Study Area Wetland Indicator Status List

Scientific name/ common name/ indicator status

Alnus rubra/red alder/FAC
Alnus sinuata/Sitka alder/FAC
Aruncus dioica/goatsbeard/UPL
Athyrium felix-femina/lady fern/FAC
Calamagrostis canadensis/bluejoint grass/FAC
Caltha palustris/ marsh marigold/OBL
Carex macrochaeta/long-awned sedge/FACW
Carex sitchensis/Sitka sedge/OBL
Cicuta douglasii/water hemlock/OBL
Circaea alpina/enchanters nightshade.FACW
Coptis asplenifolia/spleenleaf goldthread/FAC
Cornus canadensis/dwarf dogwood/FACU
Dryopteris dilatata /shield fern/FACU
Equisetum arvense/ common horsetail/FACU
Equisetum fluviatile/water horsetail/OBL
Gymnocarpium dryopteris/ oak fern/ FACU
Ledum palustre/Labrador tea/FACW
Lysichiton americanum/ skunk cabbage/OBL
Malus fusca /crabapple/FACU
Menyanthes *trifoliata*/buckbean/OBL
Oplopanax horridum / devils club/FACU
Picea sitchensis/Sitka spruce/FACU

Potentilla palustris/marsh cinquefoil/OBL
Ranunculus repens/creeping buttercup/FAC
Ribes bracteosum/skunk currant/NI
Rubus arcticus/nagoonberry/FAC
Rubus pedatus/trailing raspberry/FAC
Rubus spectabilis/ salmonberry/FACU
Salix sitchensis/Sitka willow/FAC
Sambucus racemosa/ red elderberry/FACU
Scirpus microcarpus/small-flowered bulrush/OBL
Tierella trifoliata/ foamflower/FAC
Tsuga heterophylla /Western hemlock/FAC
Vaccinium ovalifolium/ early blueberry/FAC
Viburnum edule/highbush cranberry/FACU

Wetlands

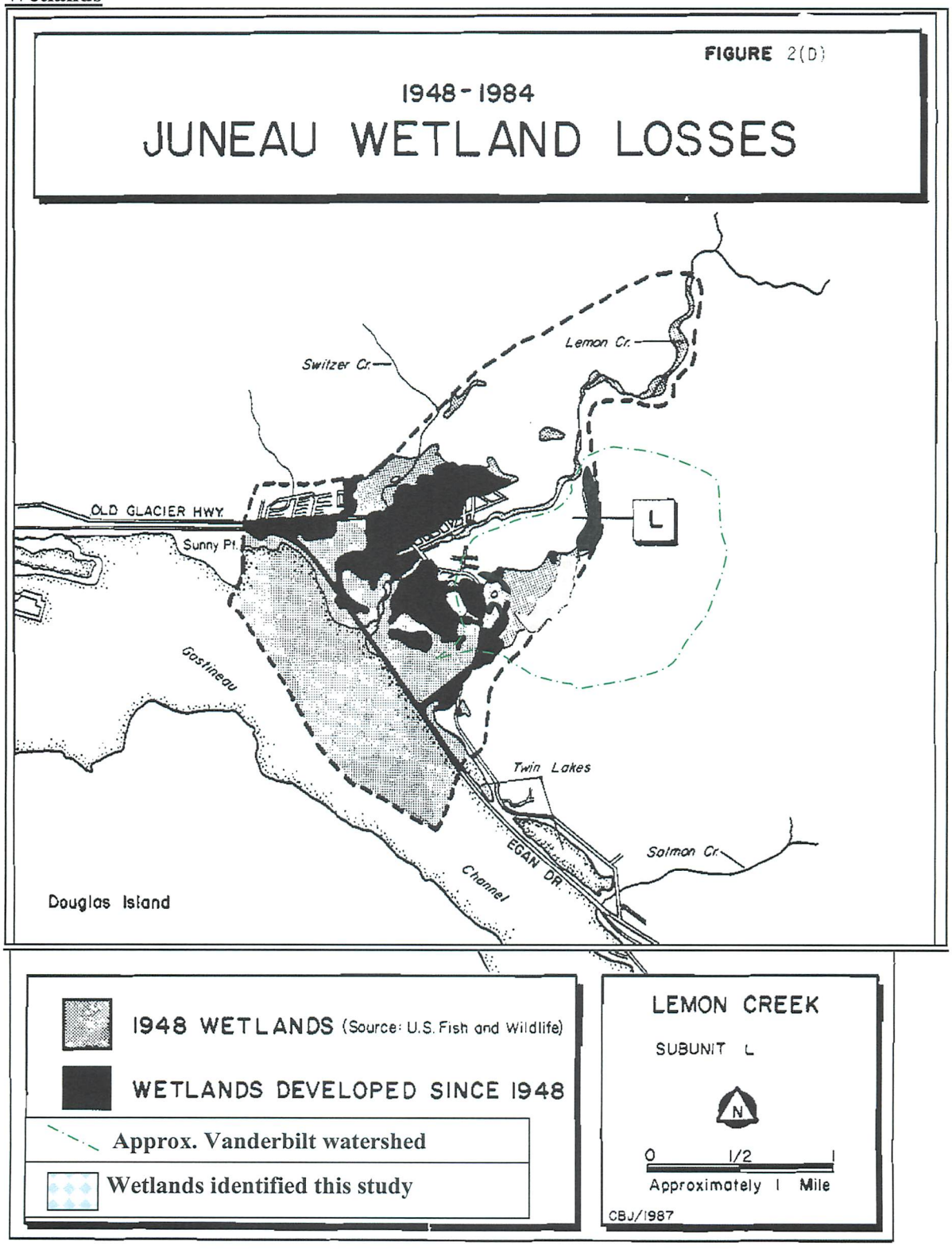

Figure 14 - Wetland Loss Map for the 1948-1984 with Vanderbilt Ck area updated to 2008 (from Adamus, 1987).

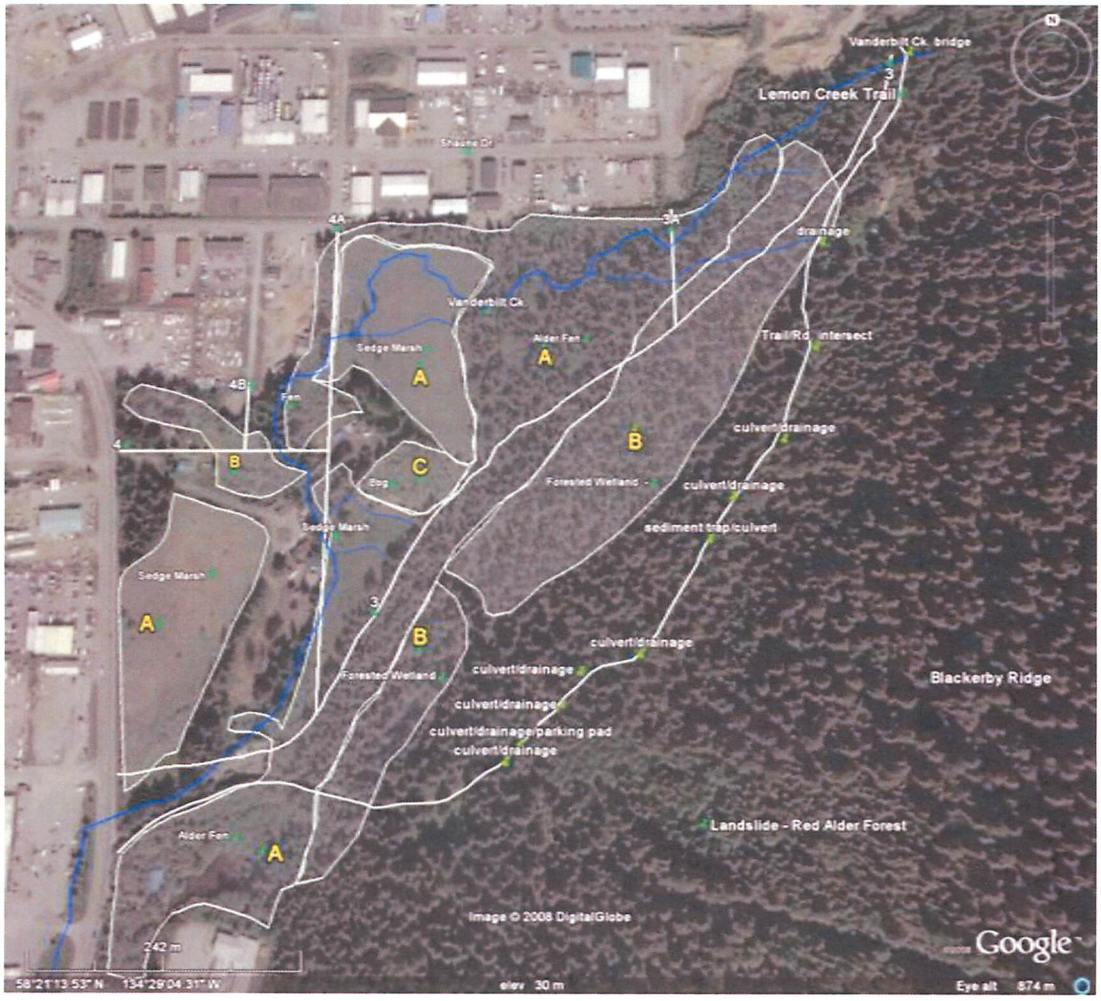

Figure 15 - Vanderbilt Ck. area wetland map with road alternatives included (altered from Google Earth).

The combination of:

- flat and gently sloping layers of impermeable, uplifted intertidal and marine silt
- the watersheds position at the toe of the Blackerby slope and the discharge of fluctuating amounts of water into the wetlands
- the presence of a dense cover of 2 species of nitrogen-fixing alder in the forest and fen
- the presence of a slow deep current, numerous undercut banks for coho and dolly varden rearing and coho, chum and pink spawning in Vanderbilt Ck (ADF&G Nomination records)
- the fact that the watershed is contiguous on at least one side with large, undeveloped , forested and alpine tracks
- the presence of surface layers of at least 16 inches of peat over all of the wetland areas

has made the Vanderbilt Creek watershed a complex and rich mosaic of wetlands and wetland function support areas.

Road Alignment Alternatives -

Alternative 3

Survey Distance (Ft.)	Description	Status
80+00	Glacier Hwy centerline	Upland(was wetland before fill)
80+50 – 80+60	**Glacier Hwy road edge**	**Upland(was wetland before fill)**
80+60 – 80+70	**Roadside ditch**	**Wetland**
80+70 – 81+50	**Mesic beach meadow – ½ on old road bed, ½ on stream floodplain**	**Upland (within 50ft of Vanderbilt Ck.)**
81+50 – 82+30	**½ Mesic beach meadow on old road bed, ½ stream and stream floodplain**	**½ upland, ½ wetland (within 50ft of Vanderbilt Ck.)**
82+30 - 84+00	**½ Sitka spruce forest on old road bed, ½ stream and stream floodplain**	**½ upland, ½ wetland (within 50 ft .of Vanderbilt Ck.)**
84+00 – 85+00	**Vanderbilt Ck and floodplain**	**Wetland (within 50ft of Vanderbilt Ck.)**
85+00 – 86+20	**Fill**	**Upland (was wetland before fill)**
86+40	Medium drainage	Wetland/Waters of the US
86+20 – 87+20	**Alder/bulrush sedge/skunk cabbage**	**Wetland**
87+20 – 88+40	**Spruce Hemlock forest**	**Upland**
87+00	Medium perennial drainage	Wetland/Waters of the US
88+00	Medium perennial drainage	Wetland/Waters of the US
88+50	Medium perennial drainage	Wetland/Waters of the US
89+00	Large perennial drainage	Wetland/Waters of the US
90+20	Small seasonal drainage	Wetland/Waters of the US
91+50	Small seasonal drainage	Wetland/Waters of the US
92+10	Medium perennial drainage	Wetland/Waters of the US
92+50	Small seasonal drainage	Wetland/Waters of the US
93+00	Small seasonal drainage	Wetland/Waters of the US
88+40 – 93+00	**Alder fen - W. hemlock/Sitka alder/skunk cabbage**	**Wetland**
93+00 – 95+00	**½ bog, ½ w. alder fen**	**Wetland**
95+70	Medium perennial drainage	Wetland/Waters of the US
95+00 – 96+20	**½ sedge marsh, ½ alder fen**	**Wetland**
96+20 – 103+00	**Alder fen - western hemlock/S. alder/skunk cabbage forest**	**Wetland**
98+20	Small seasonal drainage	Wetland/Waters of the US
102+30	Large perennial drainage	Wetland/Waters of the US
107+70	Medium perennial drainage	Wetland/Waters of the US

108+00	Medium perennial drainage	Wetland/Waters of the US
109+30	Medium seasonal drainage	Wetland/Waters of the US
111+00	Small seasonal drainage	Wetland/Waters of the US
103+00 – 109+30	**W. hemlock/red alder/skunk cabbage forest**	**Wetland**
109+30 – 113+00	**Sitka spruce/red alder/devils club forest**	**Upland**
113+00	Vanderbilt Creek upper branch	Waters of the US
114+00?	End of survey line – above Home Depot	Not surveyed

Figure 16 – Southern section of alternative 3 near Glacier Hwy. - alignment goes down an old road bed fill covered now with the invasive species, creeping buttercup and some other beach forbs.

Figure 17 - Old road bed along Vanderbilt Ck. with spruce forest.

Figure 18 - Vanderbilt Ck. with skunk cabbage and bulrush in floodplain with fill in background.

Figure 19 - Edge of alder fen and bulrush/skunk cabbage marsh just north of fill on alternative 3.

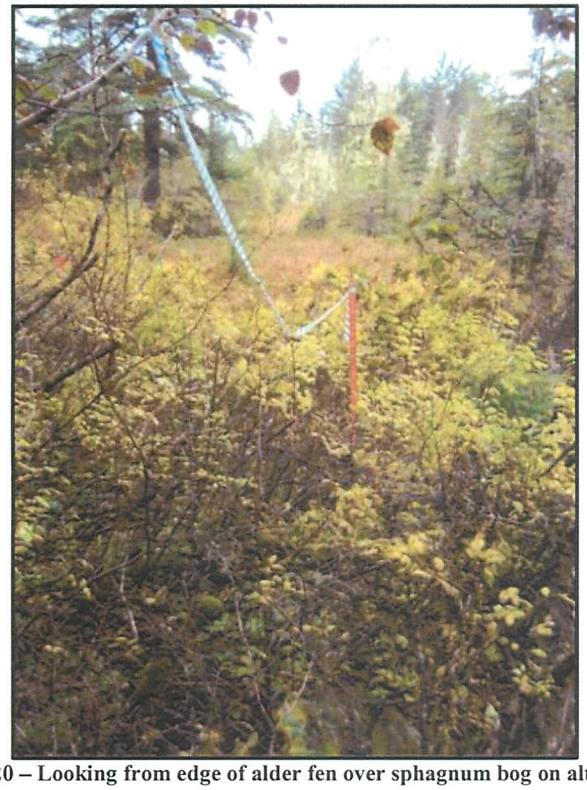

Figure 20 – Looking from edge of alder fen over sphagnum bog on alternative 3.

Figure 21 - Spruce/red alder/ skunk cabbage/elderberry forest at the north end of alternative 3.

Alternative 3A (exclusive of alt. 3)

Survey Distance (Ft.)	Description	Status
142+38	Intersection with alt. 3	Wetland/Waters of the US
142+38	Large perennial drainage	Wetland/Waters of the US
142+38– 147+00	**W. hemlock/skunk cabbage forest/alder fen**	**Wetland**
143+90	Large perennial drainage – Vanderbilt Ck. branch	Waters of the US
146+50	Large perennial drainage – Vanderbilt Ck. branch	Waters of the US
147+00	End of survey line - fill	Upland

Figure 22 - Alder/skunk cabbage fen along alternative 3A.

Figure 23 - North end of alternative 3A - looking out from alder fen to Shaune Dr. fill.

Alternative 4A (exclusive of alternative 3)

Survey Distance (Ft.)	Description	Status
187+00 – 188+10	**Western hemlock/S. alder/skunk cabbage forest**	**Wetland**
188+10	Small seasonal drainage	Wetland/Waters of the US
188+10 – 192+60	**Bull-rush sedge/skunk cabbage**	**Wetland**
190+50	Vanderbilt Ck. trib.	Wetland/Waters of the US
192+70	Vanderbilt Ck. trib.	Waters of the US
192+60 – 193+80	Vanderbilt Ck. banks – spruce/ hemlock/crabapple	Waters of the US
193+80 – 194+40	**½ willow/skunk cabbage/bluejoint - ½ creeping buttercup and dandelion**	**Wetland**
194+40 – 195+60	**Fill**	**Upland (was wetland)**
195+60	Vanderbilt Ck. tributary	Waters of the US
198+30 – 199+00	**Willow/bulrush sedge/creeping buttercup**	**Wetland**
198+30	Vanderbilt Ck.	Waters of the US
199+00 – 199+40	**Marsh – marsh cinquefoil/bluejoint**	**Wetland**
199+40 – 200+00	**Bluejoint/cotton grass**	**Wetland**
200+00 – 201+10	**Skunk cabbage/bulrush sedge/road berm edge**	**Wetland**
201+10 – 202+19	**Fill**	**Upland (was wetland)**
202+19	End of survey	Upland (was wetland)

Figure 24 - Alder fen and bulrush/skunk cabbage edge at southern end of 4A.

Figure 25 - Riparian alder/willow fen along Vanderbilt Ck. and alternative 4A.

Figure 26 - Vanderbilt Ck. tributary along alternative 4A.

Figure 27 - Riparian bulrush/spruce community along alternative 4A.

Figure 28 - homestead fill in the middle of alternative 4A - Vanderbilt Ck. is just to the right of the truck.

Figure 29 - Vanderbilt Ck. tributary along alternative 4A.

Figure 30 - Vanderbilt Ck. and riparian zone along alternative 4A.

Figure 31 - Marsh dominated by bluejoint grass and skunk cabbage at the northern end of alternative 4A.

Alternative 4 (exclusive of 4A)

Survey Distance (Ft.)	Description	Status
160+00	Centerline Glacier Hwy	Upland (was wetland)
160+00 – 163+00	**Fill**	**Upland (was wetland)**
163+00 – 164+00	**Creeping buttercup – old garden**	**Wetland**
164+00 – 164+80	**Marsh – bulrush sedge**	**Wetland**
164+80 – 165+20	**Alsi/Pisi/bulrush/skunk cabbage**	**Wetland**
165+20 – 165+30	Vanderbilt Ck	Waters of the US
165+30 – 165+90	**Spruce/salmonberry forest**	**Upland**
165+90 – 166+50	**Vanderbilt slough – alder/skunk cabbage**	**Wetland**
166+50 – 166+98	**Fill – homestead driveway**	**Upland (was wetland)**

Figure 32 - Driveway and homestead fill just off Glacier Hwy on alternative 4 and 4B.

Figure 33 - edge of fill and disturbed garden area with native marsh in the background - the stake is where 4B turns north.

Figure 34 - Vanderbilt Ck. riparian zone alder fen along alternative 4.

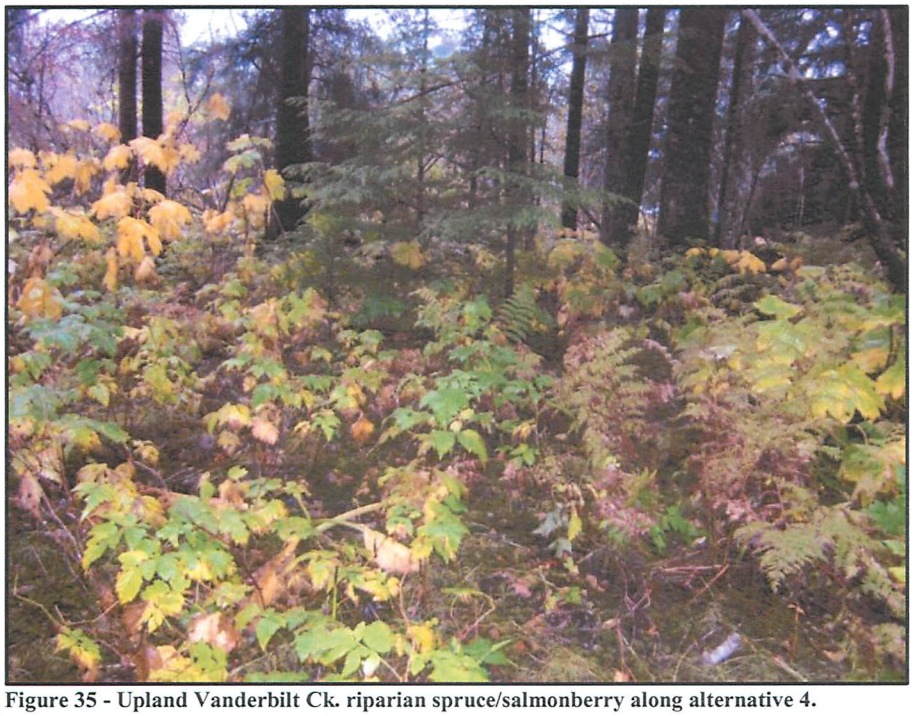

Figure 35 - Upland Vanderbilt Ck. riparian spruce/salmonberry along alternative 4.

Alternative 4B (exclusive of 4 and 4A)

Survey Distance (Ft.)	Description	Status
224+00 - 225+00	**Marsh – bulrush sedge**	**Wetland**
225+00	Slough/old ditch? – skunk cabbage	Waters of the US
225+00 – 226+00	**Riparian spruce forest**	**Upland**
226+00 – 232+00	Fill (Allen Ct.)	Upland (probably used to be wetland)

Figure 36 - Sedge/grass/forb wet meadow along alternative 4B.

Figure 37 - Allen Ct. fill edge - alternative 4B.

Lemon Creek Trail Alternative

Distance (Ft.)*	Description	Status
0-4	Vanderbilt Ck.	Waters of the US
4-472	Toe of slope, spruce/devils club	**Upland**
422	Drainage	Waters of the US
472-660	Forested wetland, w. hemlock/skunk cabbage	**Wetland**
660-995	Toe of slope, spruce/devils club	**Upland**
660	Drainage	Waters of the US
995	Trail/rd. intersection	**Upland**
995-1259	Very steep uphill edge	**Upland**
1259	culvert/drainage	Waters of the US
1499	culvert/drainage	Waters of the US
1637	Large sediment trap/drainage	Waters of the US
2020	culvert/drainage	Waters of the US
2180	culvert/drainage	Waters of the US
2180-2502	Red alder forest/landslide area	**Upland**
2272	culvert/drainage	Waters of the US
2405	culvert/drainage/parking pad	Waters of the US
2502	culvert/drainage	Waters of the US
2899-3058	Forested wetland – w. hemlock/skunk cabbage	**Wetland**

3058-3673	Alder fen	**Wetland**
3200-3397	Fill on north side	**Wetland**
3397-3673	Vanderbilt Ck on north side	**Wetland**
3673	Glacier Hwy	**Upland fill**

*distances from Google Earth measurements and GPS locations.

Figure 38 - Upland Sitka spruce/devils club forest along middle of Lemon Ck. Trail Rd.

Figure 39 - Red alder landslide path above Lemon Creek Trail Rd.

Data Summary

Alt.	Upland dist.(ft.)	Wetland dist.(ft.)	Total dist.(ft.)	% Wetland	*Distance w/in Vanderbilt Ck. 50'buffer
3	360 fill on wetland 590 upland spruce/hemlock forest	2550	3500	72%	600'
3A	360 fill on wetland	2340	2700	87%	700'
4	360 fill on wetland	1140	1500	76%	500'
4A	480 fill on wetland	1720	2200	78%	1200'
4B	300 fill on wetland 100'riparian spruce forest	200	600	33%	100'
Lemon Ck. Trail	2717 - upland spruce/devils club forest	956	3673	26%	326'

*approximate distance – not surveyed

Environmental Functions Assessment[1]

Forested Wetland found on alternatives 3, 3A,
Alder Fen found on alternatives 3, 3A, and small parts of 4, 4A
Sedge Marsh found on alternatives 4, 4A, 4B and small parts of 3, 3A
Sphagnum Bog found on very small part of alternatives 3, 3A
(for plant community and alternative locations see Fig.17)

Aquatic Support Category

WETLAND FUNCTION	FORESTED WETLAND	ALDER FEN	SEDGE MARSH	SPHAGNUM BOG
Groundwater Discharge	Mod. High	High	High	Mod. High
Sediment/toxicant retention	Mod. High	High	High	High
Nutrient export	High	High	High	Moderate
Riparian support	Mod. High	High	High	Moderate
Salmonid habitat	Moderate	Very High	Very High	Low
Erosion	Low	Low	Low	Low

Human Use Category

WETLAND FUNCTION	FORESTED WETLAND	ALDER FEN	SEDGE MARSH	SPHAGNUM BOG
Recharge	Low	Low	Low	Moderate
Recreation potential	High	High	Mod. High	Moderate
Recreation actual	?	Mod. High	Mod. High	?
Surface hydrologic control	Moderate	Moderate High	Moderate High	Mod. Low
Detention Value	Moderate	Moderate	Moderate	Moderate

Terrestrial Support Category

WETLAND FUNCTION	FORESTED WETLAND	ALDER FEN	SEDGE MARSH	SPHAGNUM BOG
Wildlife Support	Mod. High	High	High	High

Wetland Assessment Category

	FORESTED WETLAND	ALDER FEN	SEDGE MARSH	SPHAGNUM BOG
Wetland Assessment Category	**B**	**A**	**A**	**C**

[1] **based on the Adamus methodology**

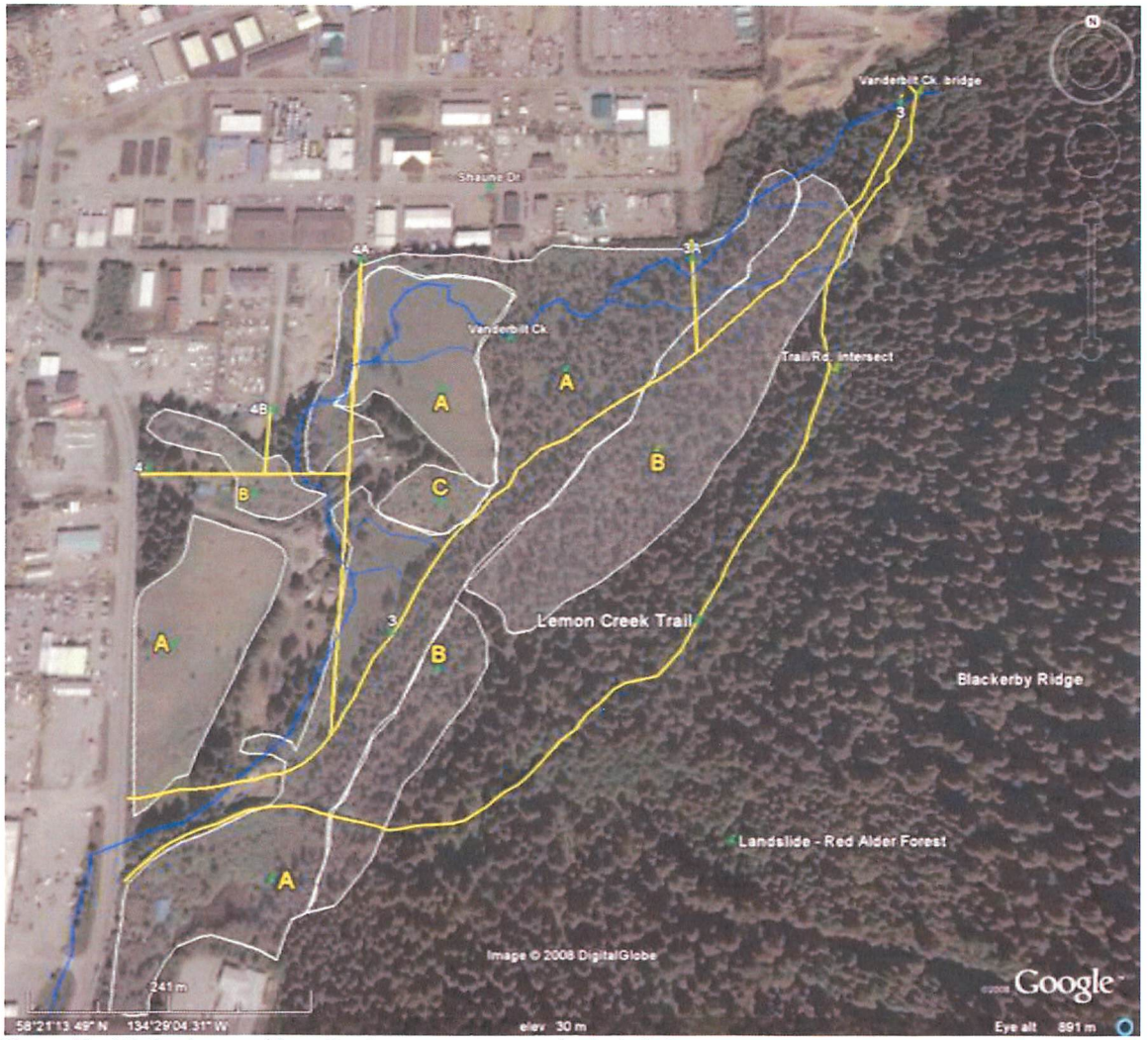

Figure 40 – Wetland map with wetland assessment categories included.

"Adamus Methodology" criteria used for assessing relative level of each function

Ratings in column 2 are VH (very high, 7), H (high, 6), MH (moderately high, 5), M (moderate, 4), ML (moderately low, 3), L (low, 2), or VL (very low). C1, C5, etc. refer to cell addresses in the accompanying spreadsheet where the data can be found (see Appendix A for data categories). The weight shown for each function is the one recommended by the CDD (1997) report.
Important Note: When scoring each function, begin with its top row and then proceed downward row by row only if the criteria in the row being examined are not met. Only one rating (the highest applicable one) should be assigned per function per wetland.

Function	Rating	Criteria
Groundwater Discharge	**H (6) if**	**1) Wetland is non-tidal (C9=0) AND** **2) either is at the toe of a steep slope (C5= TS) or is on a slope of greater than 15% (C6= H) or in an alluvial fan or avalanche chute (C4= AC) or is intersected by a perennial stream or is within 50 ft of one (C11= PI).**
	L if	**Wetland is tidal (C9= Y) and is not intersected by a perennial stream or within 50 ft of one (C11= not PI & not P50) and is not at toe of a steep slope (C5= not TS) and not in alluvial fan (C4= not AF) and is on a slope of less than 7% (C6= L)**
	M if	**not H and not L**
Sediment/ Toxicant Retention **(weight= 6)**	**H (6) if**	**1) Wetland is at toe of a steep slope or on a flat (C5= TS or F) and has a slope of less than 15% (C6= M or L) and its soil is predominantly peat (C7= Y), OR** **2) Wetland is not intersected by a perennial or ephemeral stream (C11= not PI & not Ei) and is on a slope of less than 7% (C6= L)**
	MH (5) if	**Wetland is not intersected by a perennial or ephemeral stream (C11= not PI & not Ei) and its gradient is less than 15% (C6= not H) and its soil is predominantly peat (C7=Y)**
	L (2) if	**Wetland gradient is greater than 15% (C6= H) and pit-mound topographic variation is not extensive or great (C17= 0 or T1L)**
	ML (3) if	**not H and not MH and not L**

Function	Rating	Criteria
Nutrient Export **(weight= 7)**	**H (6) if**	**1) Wetland is tidal (C9= Y) OR**
		2) Wetland is intersected by a perennial stream (C11= PI) AND ANY of 2a, 2b, or 2c
		2a) its surface water levels experience large fluctuation (C13= H) or
		2b) its area covered only seasonally by surface water is extensive (C15= H)
		2c) it is dominated by trees (C18= T50) or deciduous shrubs (C19= D50)
	L (2) if	**1) There is no perennial stream within 200 ft of the wetland and not intersected by ephemeral stream (C11= not PI & not P50 & not P200 & not Ei), and any of the following:**
		2a) is mostly covered by wetland moss (C21= M50) or
		2b) the wetland's surface water levels experience little or no fluctuation (C13= L) or
		2c) the area covered only seasonally by surface water is very limited (C15= S)
	M (4) if	**not H and not L**
Riparian Support **(weight= 10)**	**H (6) if**	**1) Wetland is intersected by a perennial stream (C11= PI) or is within an annual floodplain (C12= FP) AND EITHER**
		1a) alder shrub covers at least half of the wetland's vegetated area or stream bank (C19= A50 or A90), or
		1b) deciduous shrubs/trees cover more than 90% of the wetland's vegetated area or stream bank (C20= D90).
		OR
		2) Wetland is intersected by an ephemeral stream (C11= Ei) and
		2a) alder shrub covers more than 90% of the wetland's vegetated area or stream bank (C19= A90) or
		2b) deciduous shrubs/trees cover more than 50% of the wetland's vegetated area or stream bank (C20= D50).
	MH (5) if	**1) Wetland is intersected by a perennial stream (C11= PI) or is within its annual floodplain (C12= FP) AND EITHER**
		1a) alder shrub covers at least 1% of the wetland's vegetated area or stream bank (C19= A1), or
		1b) deciduous shrubs/trees cover more than 50% of the wetland's vegetated area or stream bank (C20= D50).
		OR
		2) Wetland is intersected by an ephemeral stream (C11= Ei) or is within 50 ft of a perennial stream (C11= PI) AND
		2a) alder shrub covers more than 50% of the wetland's vegetated area or stream bank (C19= A50) or
		2b) deciduous shrubs/trees cover more than 1% of the wetland's vegetated area or stream bank (C20= D1).
	L (2) if	**There is no perennial or ephemeral stream within 50 ft of the wetland (C11= not PI & not Ei & not P50 & not Ei), and the wetland contains less than 1% deciduous shrubs/trees (C20= 0)**
	ML (3) if	**not H and not L and not MH**

Function	Rating	Criteria
Salmonid Habitat **(weight= 11)**	**VH (7) if**	**1) Wetland is tidal (C9= Y), OR**
		2) salmonid fish can access part of the wetland year-round (C10=P) and habitat quality (pools, undercut banks, wood, etc.) is good (C14= H)
	H (6) if	**Salmonid fish can access part of the wetland year-round (C10= P) and habitat quality is moderate (C14=H)**
	MH(5) if	**Salmonid fish can access part of the wetland year-round (C10= P) and habitat quality is low (C14= M or L).**
	ML (3) if	**Salmonid fish can access part of the wetland seasonally (C10= S) and habitat quality is moderate or high (C14= M or H).**
	L (2) if	**Salmonid fish can access part of the wetland seasonally (C10= S) and habitat quality is low (C14=L).**
	VL (1) if	**Salmonid fish cannot access the wetland at any time (C10= 0)**
Erosion Sensitivity **(weight= 7)**	**H (6) if**	**Wetland is on a slope of greater than 15% (C6= H) and its predominant soil is peat (C7= Y)**
	MH(5) if	**Wetland is on a slope of greater than 15% (C6= H) and its predominant soil is not peat (C7= 0)**
	ML (3) if	**Wetland is on a slope of greater than 7% (C6= M or H) and its predominant soil is peat (C7= Y)**
	L (2) if	**Not H and not ML and not MH**
Groundwater Recharge **(weight= 7)**	**H (6) if**	**Wetland is not in an alluvial fan or avalanche chute (C4= not AF & not AC) or tidal area (C9= 0) AND**
		Wetland is not intersected by a perennial stream or within 50 ft of one (C11= not PI & not P50) and is either on a plateau (C5= P) or has a slope of mostly less than 7% (C6= L)
	L (2) if	**Wetland is tidal (C9= Y) or is intersected by a perennial stream (C11= PI)**
	M (4) if	**Not H and not L**

Function	Rating	Criteria
Hydrologic Control **(weight= 9)**	**H (6) if**	**1) Wetland non-tidal (C9= 0) and is on a slope of less than 7% (C6= L) and is not intersected by a stream (either perennial or ephemeral) (C11= not PI & not Ei) OR**
		2) Wetland is not in a mid-slope or toe-slope position (C5= not TS & not MS) and is in a floodplain (C12= FP) or has extensive seasonal ponding of surface water (C15= H) or has extensive and large pit-mound topography (C17= T25H)
	MH(5) if	**Wetland is non-tidal (C9= 0) and has moderate-extensive seasonal ponding of surface water (C15= M) or moderate water level fluctuations (C13= M) or extensive but mild pit-mound topography (C17= T25L)**
	L (2) if	**Wetland is tidal (C9= Y)**
	ML (3) if	**Not H and not MH and not L**
Detention Value* **(weight= 9)**	**H (6) if L(2) if**	**Wetland is non-tidal (C9= 0) and uphill areas have peat soils (C8= Y) and relatively extensive development (C26= H)**
		Wetland is tidal (C9= Y) and uphill areas have little or no development (C26= L)
	M (4) if	**Not H and not L**
Recreational Use Potential **(weight= 5)**	**H (6) if**	**Developed hiking trails go to or near (within 100 ft of) wetland and wetland is within 0.5 mile of trailhead (C30= H) and wetland is on public land (C31= C)**
	MH (5) if	**Developed hiking trails go to or near the wetland but wetland is farther than 0.5 mile from trailhead (C30= M) and wetland is on public land (C31= C)**
	L (2) if	**No hiking trails go to or near the wetland and wetland is more than 0.5 mile from road (C30= 0) and wetland is on private land (C31= P)**
	ML (3) if	**No trails are within 100 ft of wetland but the wetland is within 0.5 mile of a road (C30= L) and wetland is on public land (C31= C)**
Recreational Use Actual **(weight= 6)**	**H (6) if**	**Results of a 1987 recreational survey indicated relatively high use of this wetland or the closest one (C32= H)**
	MH (5) if	**Results of a 1987 recreational survey indicated moderately high use of this wetland or the closest one (C32= MH)**
	L (2) if	**Results of a 1987 recreational survey indicated relatively low use of this wetland or the closest one (C32= L)**
	ML (3) if	**Results of a 1987 recreational survey indicated relatively moderately low use of this wetland or the closest one (C32= ML)**

Function	Rating	Criteria
Wildlife Support* **(weight= 11.5)**	**H (6) if**	**1) Wetland is tidal (C9= Y) or contains or adjoins at least 1 acre of perennially ponded non-tidal water (C16= PW) OR**
		2) Wetland is contiguous to a large forested tract and not separated from it by roads (C25= C) and has little or no uphill development (C26= L), and has not been altered by nearby ditches or roads (C28= 0), and has less than 10% cover of non-native plants (C29= 0), and 2a or 2b:
		2a) creates a gap in the canopy of an extensive surrounding forest (C23= CC) and is not primarily wetland moss (C21= 0 or M1) and is (2a1) distant from the nearest residence (C27= F) or (2a2) has many vegetation structural forms (C22= H), OR
		2b) does not create such a gap (C25= 0) and is not within 100 ft of a residence (C27= M or F), and has more than 90% total tree cover (C18=T90) or more than 50% deciduous tree/shrub cover (C20= D50), or has salmonid access (C10= S or P), or at least one large-diameter tree (C24= BT), or extensive pit-mound topography (C17= T25L or T25H), or many vegetation forms (C22= H)
	MH (5) if	**Wetland is contiguous to a large forested tract and not separated from it by roads (C25= C) and has less than 10% cover of non-native plants (C29= 0), and EITHER**
		a) creates a gap in the canopy of an extensive surrounding forest (C23= CC) and is not within 100 ft of a residence (C27= M or F) and has some diversity of vegetation structural forms (C22= not L) OR
		b) has more than 50% deciduous tree/shrub cover (C18= T50 or C20= D50) or is intersected by or within 50 ft of a perennial stream (C11= PI or P50) or is more than 0.5 mile from a road and lacks developed trails (C30= 0)
	L (2) if	**1) Wetland does not create a gap in the canopy of an extensive surrounding forest (C23= 0), and is not tidal (C9= 0), and is not within 500 ft of perennially ponded non-tidal water (C16= 0), and does not have salmonid access (C10= 0), and has no large-diameter trees (C24= not BT & not MT), and has little or no pit-mound topography (C17= 0 or T1L), and has 1a or 1b:**
		1a) >90% moss cover (C21= M90) or more than 10% cover of non-native plants (C29= Y) or only a few vegetation structural forms (C22= L), OR
		1b) is not contiguous to a large forested tract (C25= 0) and has any of the following: extensive development in uphill areas (C26= H) or is close to a residence (C27= N) or has been altered by nearby ditches or roads (C28= Y) or has developed trails and a trailhead nearby (C30= H).
	ML (3) if	**Not H and not ML and not L**

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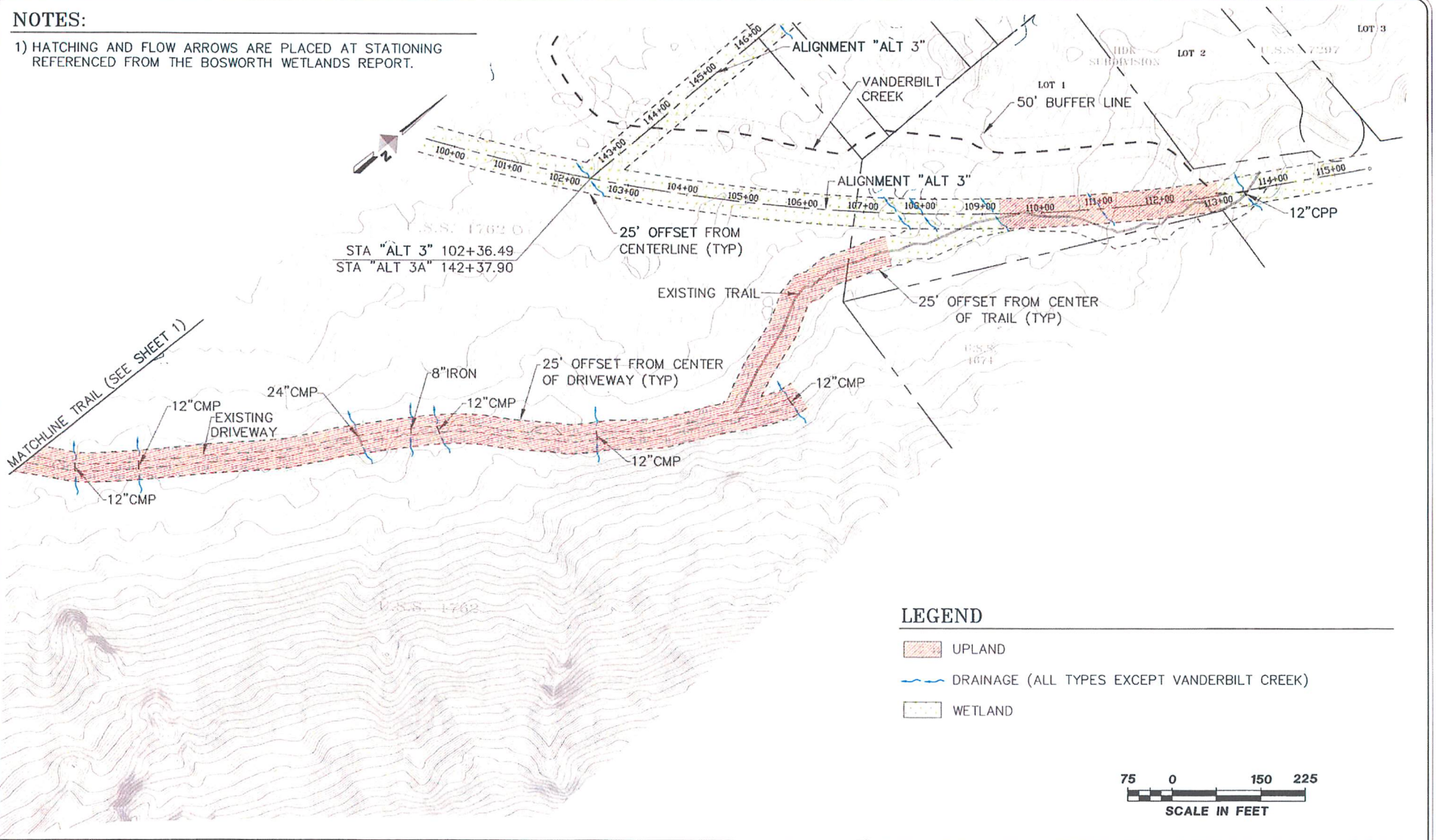
NOTES:

1) HATCHING AND FLOW ARROWS ARE PLACED AT STATIONING REFERENCED FROM THE BOSWORTH WETLANDS REPORT.



LEGEND

- UPLAND
- DRAINAGE (ALL TYPES EXCEPT VANDERBILT CREEK)
- WETLAND

75 0 150 225

SCALE IN FEET

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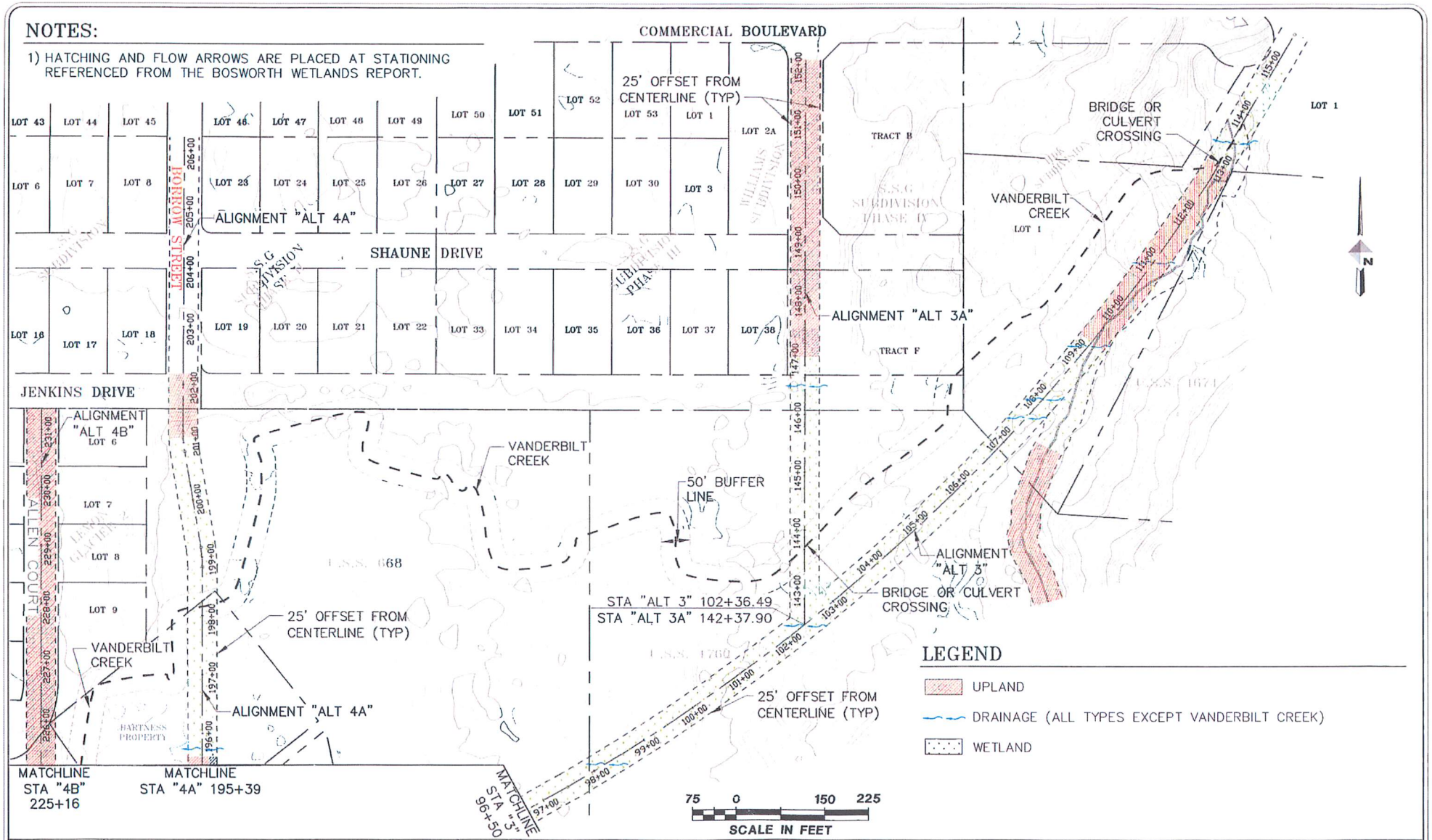
VANDERBILT CREEK WATERSHED WETLAND ASSESSMENT

SHEET NO.
3 of 3

NOTES:

1) HATCHING AND FLOW ARROWS ARE PLACED AT STATIONING REFERENCED FROM THE BOSWORTH WETLANDS REPORT.



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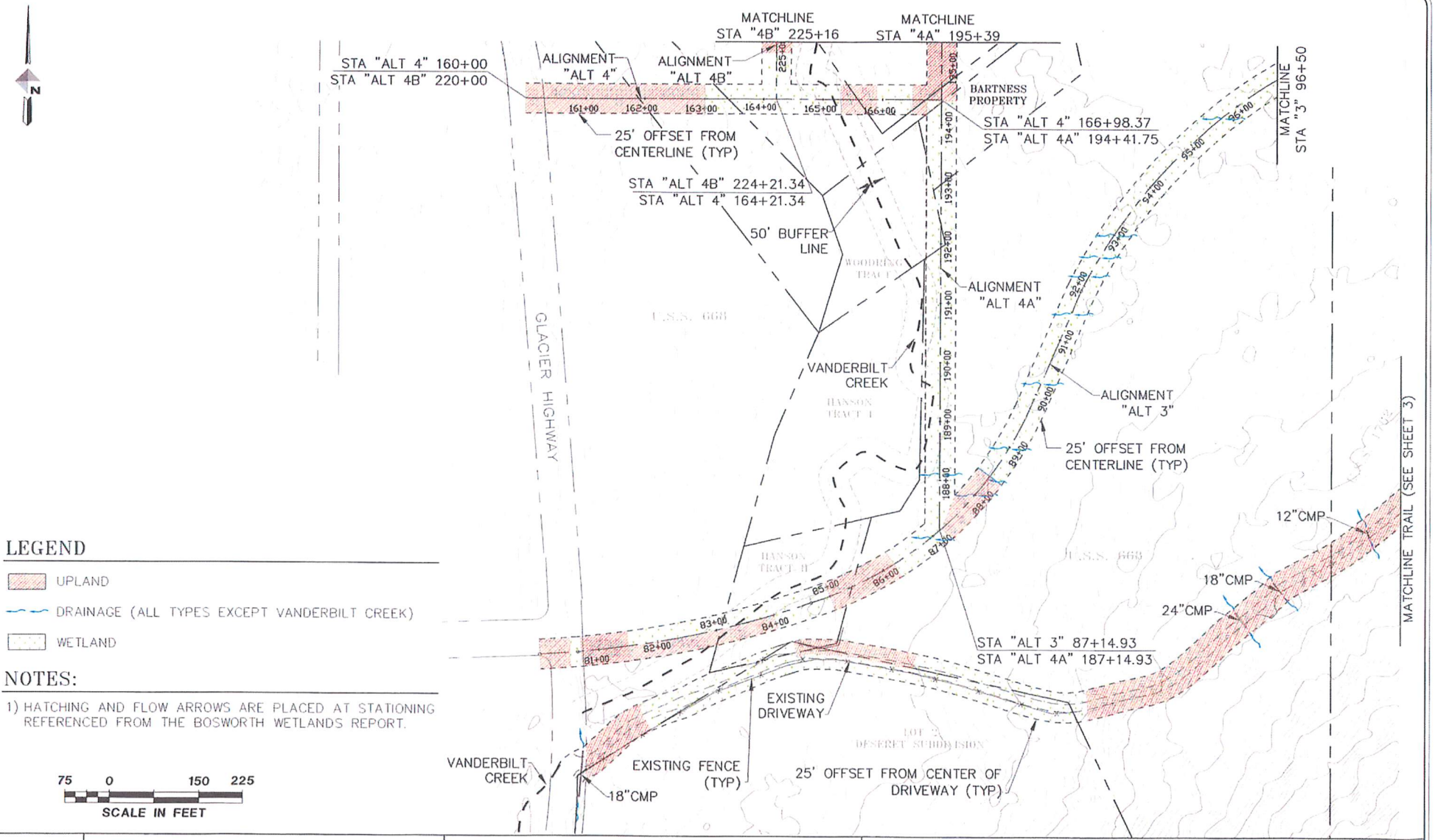

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