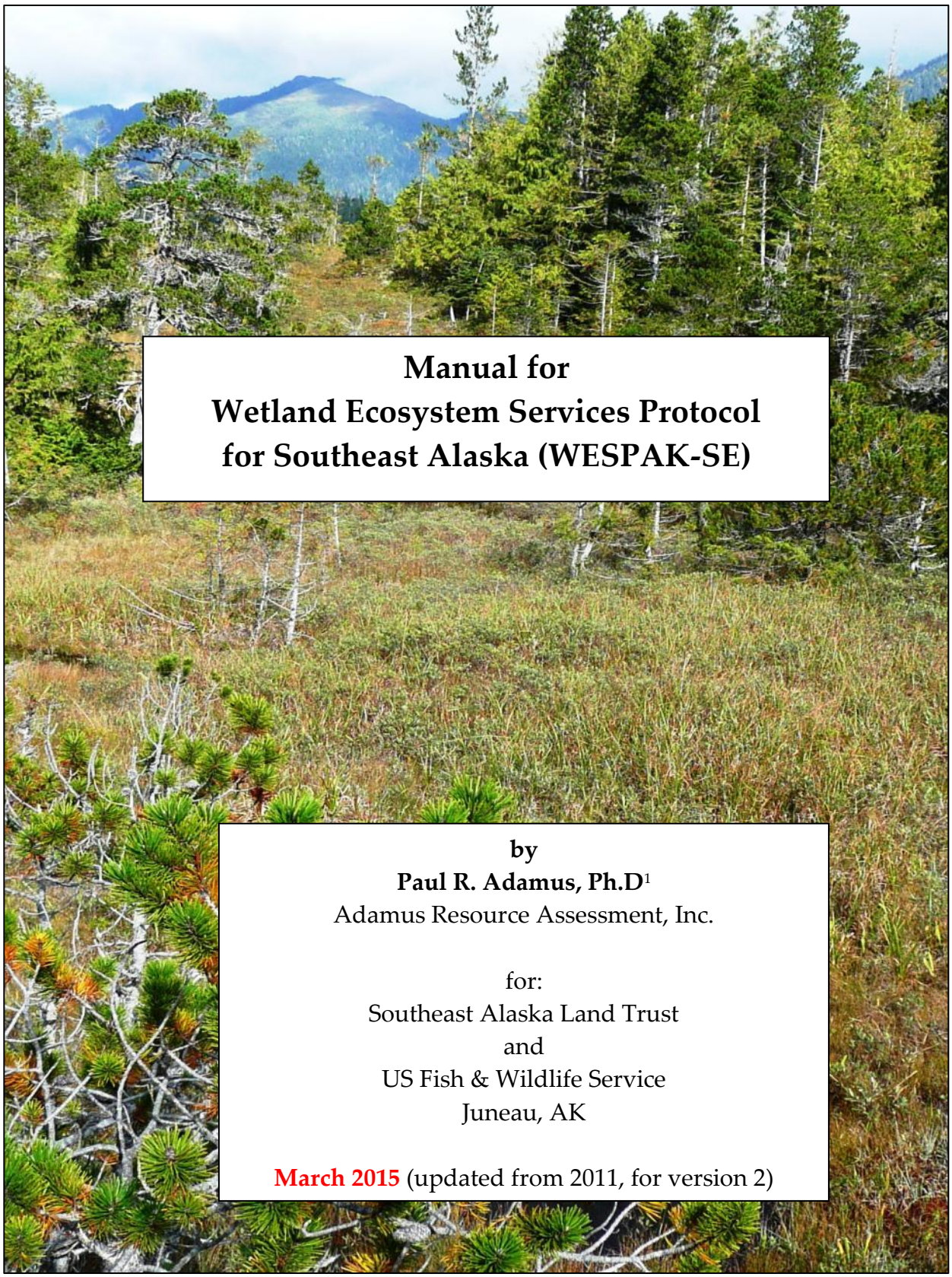

Manual for Wetland Ecosystem Services Protocol for Southeast Alaska (WESPAK-SE)

by
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for:
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March 2015 (updated from 2011, for version 2)

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Acknowledgments

I thank Diane Mayer of SEAL Trust and Hans Ehlert of CH2M Hill for initiating this effort with their recognition in 2010 of the importance of standardized practical tools for the field-based assessment of ecosystem services of wetlands, and for their support of what became WESPAK-SE. I am also grateful to the US Fish and Wildlife Service, and particularly to Steve Brockman and Neil Stichert of the Juneau Office, for recognizing the potential of this tool for their programs and responding with financial support and scientific information. I thank the City and Borough of Juneau (CBJ) for their support, long before that, of my 1986-87 wetlands study which resulted in their initial wetlands management plan and laid a foundation for the current efforts. For initiating and administering the contract supporting this updated refinement of WESPAK-SE, and her tireless efforts to ensure that wetland decisions are informed by the best available science, I particularly thank Teri Camery of the CBJ Community Development Department. For arranging logistics and accompanying me during collection of calibration data from 124 wetlands throughout Southeast Alaska, I thank Allison Gillum and Diane Mayer of SEAL Trust.

Many experts provided invaluable information which helped strengthen the WESPAK-SE models either during the structured peer review workshops or in separate correspondence during 2010 or 2013. I thank Bob Armstrong, Ellen Anderson, Koren Bosworth, Terry Brock, Richard Carstensen, Dave D'Amore, Chiska Derr, Jackie Foss, Lisa Hoferkamp, John Hudson, Dennis Landwehr, Steve Paustian, Andrew Piston, Deb Rudis, James Rypkema, James Ray, Mark Schwan, Neil Stichert, David Tallmon, Gus Van Vliet, Brenda Wright, Sadie Wright, and Johnny Zutz. Members of the CBJ Wetlands Review Board also made useful suggestions. A critical component of WESPAK-SE – the Southeast Alaska wetlands internet portal – was the masterpiece of Kim Homan, with help from Jason Seifert. The important task of testing the WESPAK-SE's repeatability was accomplished by Koren Bosworth, Matt Brody, Chiska Derr, Nena Horne, John Hudson, and Rod Lacey, with administrative help from Chrissy McNally of the CBJ Community Development Department.

1.0 Introduction

1.1 General Description

Nature is complex, and varies enormously from place to place. As natural systems, wetlands are no exception. Thus, the use of one word or phrase describing a wetland's type, or a short list of its characteristics, cannot meaningfully predict what a particular wetland does or the benefits it provides to human and biological communities. The roles of dozens of factors and their interactions must be considered and addressed systematically. Otherwise, assessments of what wetlands do-- and therefore policies based on those assessments-- will be on shaky scientific ground.

Fortunately, there is a growing capacity to illustrate and encode some of nature's complexity in computer models. This, along with the commonplace availability of powerful personal computers that make those models quick and easy to use, has made some types of models simple to apply in the support of decisions and policies, while at the same time reassuring users and decision-makers that assumptions in these models are transparent. The Wetland Ecosystem Services Protocol for Alaska: Southeast (WESPAK-SE) is one such attempt. It is a standardized method and decision support tool for rapidly assessing ecosystem services (functions and values) of tidal and non-tidal wetlands of Southeast Alaska. Input data are categorical choices that are based on observations (not measurements) made during a single half-day visit to a wetland, as well as from interpretation of generally available maps and existing resource information. The data are entered into an Excel spreadsheet that instantly generates scores for 18 functions and 20 other attributes of a non-tidal wetland, or 11 functions and attributes of a tidal wetland (**Table 1**). Tidal wetlands are considered to include all wetlands inundated by tidal surface water at least once annually, e.g., during "king tides" regardless of their salinity. WESPAK-SE is applicable to wetlands at all elevations of Southeast Alaska, from Yakutat south to the Canadian border. This Manual is not an operable version of WESPAK-SE. That is contained in accompanying Excel spreadsheets, one for non-tidal and one for tidal wetlands.

WESPAK-SE is intended to fill a need for rapid, standardized, field-based assessment of wetland ecosystem services such as provided because few agencies or organizations have sufficient personnel who can interpret the implications of wetland hydrology, soils, and biogeochemical interactions during a brief site visit, as well as having the skills to identify all of the region's wetland plants and animals. Moreover, biodiversity alone cannot validly be used to predict many of a wetland's ecosystem services that are valued by society.

WESPAK-SE uses assessments of weighted ecological characteristics (*indicators*) to generate scores for a wetland's functions and values. The number of indicators that is applied to estimate a particular wetland function or value depends on what the function or value is. The indicators are combined using mathematical formulas (models) to generate the score for each wetland function or value. The models are logic-based rather than deterministic. Together they provide a profile of "what a wetland does."

Each indicator has a suite of *conditions,* e.g., different categories of percent-slope. For each wetland function or value, ranks have been pre-assigned to all conditions potentially associated with each indicator used to predict the level of that function or value. The ranks can be viewed in column E of the individual worksheets.

Before indicators were combined into a score for a given function, they often were grouped by the underlying *processes* they inform. Weights were then assigned both to individual indicators within a process, and the processes that comprise a function. Indicator and process selection was based on the author's experience and review of much of the literature he compiled initially in an indexed bibliography of science relevant to Southeast Alaskan ecosystem services (available electronically from SEAL Trust or the author). WESPAK-SE indicators and models attempt to incorporate the best and most recent scientific knowledge available on the ecosystem services of wetlands. All the models were peer reviewed by subject experts during a series of workshops in Juneau during 2014, and that feedback informed the current version.

In addition, the repeatability of WESPAK-SE results was tested in 2013. Five non-tidal wetlands and three tidal wetlands were assessed by six persons who had attended a WESPAK-SE training but who otherwise had limited experience using the method. All traveled together in a group but upon arrival at a test site, they filled out data forms independently without sharing any information or asking questions. The boundary of each assessment area (AA) was depicted on an aerial image given to each tester and in addition, the author (who did not participate) verbally described that boundary before the assessment began. None of the testers had previously assessed any of the test wetlands. Repeatability of non-tidal wetland assessments averaged + or - 0.85. What this means is that when WESPAK-SE computes a function score of, say, 7.0 on its potential scale of 0 to 10, one can be 90% certain that the true value is likely somewhere between 6.14 (7 – 0.86) and 7.86 (7 + 0.86). Repeatability of tidal wetland assessments averaged + or - 0.45.

Table 1. Definitions of functions, values, and other attributes scored by WESPAK-SE.

Some of these functions are not scored by the tidal calculator spreadsheet due to insufficient scientific understanding or because tidal wetlands do not generally support the function to any significant degree.

Function or Attribute	Definition	Values
Water Storage & Delay	The effectiveness for storing runoff or delaying the downslope movement of surface water for long or short periods.	Flood control, maintain ecological systems
Stream Flow Support	The effectiveness for contributing water to streams during the driest part of a growing season.	Support fish and other aquatic life
Water Cooling	The effectiveness for maintaining or reducing temperature of downslope waters.	Support coldwater fish and other aquatic life
Water Warming	The effectiveness for increasing the temperature of downslope waters.	Maintain late-season ice-free conditions
Sediment Retention & Stabilization	The effectiveness for intercepting and filtering suspended inorganic sediments thus allowing their deposition, as well as reducing energy of waves and currents, resisting excessive erosion, and stabilizing underlying sediments or soil.	Maintain quality of receiving waters. Protect shoreline structures from erosion.
Phosphorus Retention	The effectiveness for retaining phosphorus for long periods (>1 growing season)	Maintain quality of receiving waters.
Nitrate Removal & Retention	The effectiveness for retaining particulate nitrate and converting soluble nitrate and ammonium to nitrogen gas while generating little or no nitrous oxide (a potent greenhouse gas).	Maintain quality of receiving waters.
Carbon Sequestration	The effectiveness for retaining both incoming particulate and dissolved carbon, and converting carbon dioxide gas to organic matter (particulate or dissolved), and then retaining that organic matter on a net annual basis for long periods while emitting little or no methane (a potent "greenhouse gas").	Reduce risk of global climate warming.
Organic Nutrient Export	The effectiveness for producing and subsequently exporting organic nutrients (mainly carbon), either particulate or dissolved.	Support food chains in receiving waters. Facilitate transfer of iron to marine waters.
Anadromous Fish Habitat	The capacity to support rearing or spawning habitat of fish species that migrate from marine waters into freshwater streams to spawn, e.g., coho and sockeye salmon.	Support commercial, subsistence, sport, and ecological values. Infuse uplands with marine nutrients.
Resident Fish Habitat	The capacity to support an abundance and diversity of native fish (both resident and visiting species) that are not anadromous, e.g., Dolly Varden, cutthroat trout.	Support commercial, subsistence, sport, and ecological values.
Invertebrate Habitat	The capacity to support or contribute to an abundance or diversity of invertebrate animals which spend all or part of their life cycle underwater or in moist soil. Includes dragonflies, midges, clams, snails, water beetles, shrimp, aquatic worms, and others.	Support salmon and other aquatic life. Maintain regional biodiversity.
Amphibian Habitat	The capacity to support or contribute to an abundance or diversity of native frogs, toads, and salamanders.	Maintain regional biodiversity.

Function or Attribute	Definition	Values
Waterbird Feeding Habitat	The capacity to support or contribute to an abundance or diversity of waterbirds that migrate or winter but do not breed in the region.	Support subsistence, sport, and ecological values. Maintain regional biodiversity.
Waterbird Nesting Habitat	The capacity to support or contribute to an abundance or diversity of waterbirds that nest in the region.	Maintain regional biodiversity.
Songbird, Raptor, & Mammal Habitat	The capacity to support or contribute to an abundance or diversity of native songbird, raptor, and mammal species and functional groups, especially those that are most dependent on wetlands or water.	Maintain regional biodiversity.
Pollinator Habitat	The capacity to support pollinating insects, such as bees, wasps, flies, butterflies, moths, and beetles.	Maintain forest productivity and food chains.
Native Plant Habitat	The capacity to support or contribute to a diversity of native, hydrophytic, vascular plant species, communities, and/or functional groups.	Maintain regional biodiversity and food chains.
Public Use and Recognition	Prior designation of the wetland, by a natural resource or environmental protection agency, as some type of special protected area. Also, the potential and actual use of a wetland for low-intensity outdoor recreation, education, or research.	Commercial and social benefits of recreation. Protection of prior public investments.
Wetland Ecological Condition	The integrity or health of a wetland, as defined operationally by its vegetation composition and richness of native species. More broadly, the similarity of a wetland's structure, composition, and function with that of reference wetlands of the same type and landscape setting, operating within the bounds of natural or historical disturbance regimes.	(this is a value, not a function)
Wetland Sensitivity	A wetland's lack of intrinsic resistance and resilience to human and natural stressors (higher score = more sensitive).	(this is an attribute, not a function or value)
Stress Potential	The degree to which a wetland is, or has recently been altered by or exposed to, risk from factors capable of reducing one or more of its functions and which are primarily human-related.	(this is an attribute, not a function or value)

1.2 Conceptual Basis

WESPAK-SE provides models for both functions and values. It is very important to understand the conceptual difference. *Functions* are what a wetland potentially does in a natural setting, such as store water. *Values* attempt to answer the "So What?" question, partly by considering where a wetland is positioned relative to people or features that might benefit from its services, and whether its species or habitats have special designations. For example, when wetlands retain or remove nutrients, this can be valuable for protecting the quality of downstream waters in some settings (e.g., urban runoff impacts to estuaries) but undesirable in others (e.g., salmon rearing streams, where nutrients are needed to support algae and invertebrate components of the salmonid food chain). The Value score that WESPAK-SE computes accounts for

these differences, and in most cases does so separately from the Function score. In concept, wetland ecosystem *services* are the combination of *functions* and the *values* of those functions, judged individually. Thus, for a wetland to be considered as providing a high level of services, *both* its functions and the values (or recognized potential value) of those functions should be high.

Fundamentally, the levels and types of functions that wetlands individually and collectively provide are determined by the processes and disturbances that affect the movement and other characteristics of water, soil/sediment, plants, and animals (Zedler & Kercher 2005, Carstensen et al. (1992, 2014 revised). In particular, the frequency, duration, magnitude and timing of these processes and disturbances shapes a given wetland's functions (Smith et al. 2008). Climate, geology, topographic position, and land use strongly influence all of these. Several analyses (e.g., Hansson et al. 2005, Adamus et al. 2009) have concluded that it is unlikely to have all functions occurring at a high level in a single wetland, even in the most pristine wetlands.

1.3 Background

WESPAK-SE is a regionalized modification of ORWAP[1], the Oregon Rapid Wetland Assessment Protocol, developed by the same author from 2006 to 2009, which built on indicator-function relationships first described by the author in the early 1980s and in several agency publications and methods since then, including the 1993 Juneau Wetlands Management Plan. The State of Oregon, in collaboration with the US Army Corps of Engineers Portland District, has required ORWAP assessments since 2009 for all major wetlands permitting and mitigation. The province of Alberta has also regionalized a generic version of the Oregon method for their needs, and Nova Scotia intends to begin such an effort in 2015. If interest is sufficient, WESPAK-SE could be modified for use elsewhere in Alaska.

In 2009, at the behest of an Interagency Review Team (IRT) and Southeast Alaska Land Trust (SEAL Trust), an independent consulting firm was contracted to review and critique 16 wetland rapid assessment methods potentially applicable to Southeast Alaska. They selected ORWAP/WESPAK-SE and recommended its adaptation and calibration in the region (CH2M Hill, 2010). The City and Borough of Juneau is using version 1.4 of WESPAK-SE to re-prioritize its wetlands, and SEAL Trust intends to use it in collaboration with the US Army Corps of Engineers for their In-Lieu Fee Mitigation

[1] http://oregonstatelands.us/DSL/WETLAND/or_wet_prot.shtml

program. As of October 2014, four training sessions for agency staff and consultants have been held, and more are anticipated.

WESPAK-SE is intended to help address a policy goal of "no net loss" of wetlands, as that goal pertains not only to wetland acreage but also to the ecosystem services (functions and values) that wetlands provide naturally. By providing these services, well-functioning wetlands can reduce the need for humans to construct alternative infrastructure necessary to provide those services, often at much higher cost (Costanza et al. 1997, Finlayson et al. 2005, Euliss et al. 2008). In addition, many laws and policies require compensation for wetland impacts, and further require that wetland functions and values be the basis for considering the adequacy of compensation.

Field-testing is an essential part of developing methods such as WESPAK-SE, both for improving the data forms and models, and for determining the range of scores that can be expected, i.e., the calibration or "normalization" process. Using draft versions of the data forms, the author assessed 32 wetlands throughout Southeast Alaska during September 2011. The wetlands were in four subregions: Juneau, Haines, Sitka, and Ketchikan. In each subregion, attempts were made to visit at least one fen, marsh, hillslope bog, hillslope forest, and riverine or tidal wetland.

However, the wetlands assessed in 2011 were not a random or systematically balanced sample of all wetlands currently mapped in Southeast Alaska. Thus, using the current version of WESPAK-SE, a new set of wetlands (119 non-tidal, 55 tidal; **Table 2**) was selected. The new non-tidal wetlands were selected using a robust statistical procedure (k-means clustering). The new tidal wetlands were selected opportunistically based on access.

The new calibration wetlands were visited and assessed in 2013-2014, with support from SEAL Trust and the US Fish and Wildlife Service. This provided a broader and more balanced basis for placing in a regional context the score from any single wetland. Appendix G includes the scores of the visited sites. **The wetland function scores from the more recent regional sample were not, and should not be, combined with those from the 32 wetlands assessed in 2011, or with scores from any other set of wetlands**, partly because a different version of WESPAK-SE was used then, but more importantly, because doing so would compromise the statistical balance of sites assessed in the 2013-2014 survey, by introducing geographic or other biases. That in turn would influence which wetlands are interpreted as being high- or low-performing in a relative sense for certain functions (as will be described in section 2.3.2).

Table 2. Locations of WESPAK-SE calibration wetlands assessed in 2013-2014.

See data form F for definitions of wetland types.

Wet_ID	Tidal/ Nontidal	Latitude	Longitude	Community	HUC12	Wetland Type	Eleva-tion
57748	non	55.8478	-133.0993	Coffman Cove	190101031002	ForestPeat	442
62902	non	55.9125	-132.8408	Coffman Cove	190101030103	OpenPeat	1015
87003	non	55.9733	-132.9869	Coffman Cove	190101030103	ForestPeat	0
99838	non	55.9245	-132.7323	Coffman Cove	190101030307	OpenPeat	1282
78122	non	55.8850	-132.8006	Coffman Cove 2	190101030307	OpenPeat	213
92528	non	55.9284	-132.7388	Coffman Cove 2	190101030307	ForestPeat	1408
131893	non	55.9300	-132.8474	Coffman Cove 2	190101030103	ForestPeat	635
40538	non	55.4969	-133.0804	Craig	190101031306	ForestPeat	217
21140	non	55.6891	-133.0097	Craig 2	190101031303	ForestPeat	256
89495	non	55.7164	-132.9288	Craig 2	190101031302	FenMarsh	555
12680	non	58.4069	-135.7011	Gustavus	190103021211	UpliftMead	0
36268	non	58.4520	-135.7804	Gustavus	190103021213	OpenPeat	47
41807	non	58.4512	-135.7886	Gustavus	190103021213	OpenPeat	39
100121	non	58.4180	-135.7263	Gustavus	190103021211	FenMarsh	13
102767	non	58.4424	-135.7205	Gustavus	190103021210	UpliftMead	17
111387	non	58.4408	-135.6807	Gustavus	190103021211	UpliftMead	20
38912	non	58.4329	-135.6445	Gustavus 2	190103021211	UpliftMead	0
100162	non	58.4513	-135.8844	Gustavus 2	190103021016	FenMarsh	20
20852	non	59.4328	-136.2181	Haines/Klukwan 2	190103031005	FenMarsh	499
51395	non	59.4369	-136.2978	Haines/Klukwan 2	190103031005	Floodplain	598
94960	non	59.4090	-135.9588	Haines/Klukwan 2	190103031005	FenMarsh	147
18036	non	55.3740	-132.7035	Hollis	190101030504	OpenPeat	1019
45304	non	55.3819	-132.5410	Hollis	190101030403	ForestPeat	2109
66290	non	55.3304	-132.6118	Hollis	190101030401	OpenPeat	1178
110419	non	55.3875	-132.5352	Hollis	190101030403	ForestPeat	2053
127040	non	55.3567	-132.5458	Hollis	190101030403	OpenPeat	1059
21861	non	55.3346	-132.6273	Hollis 2	190101031501	ForestPeat	1940
84069	non	55.4629	-132.7176	Hollis 2	190101030502	ForestPeat	187
121179	non	55.3712	-132.6802	Hollis 2	190101030504	OpenPeat	1127
18248	non	58.0693	-135.4700	Hoonah	190102110904	OpenPeat	133
37736	non	58.0821	-135.2475	Hoonah	190102111003	ForestPeat	167
68637	non	58.0665	-135.2014	Hoonah	190102111004	OpenPeat	151
76471	non	58.0469	-135.4768	Hoonah	190102110904	OpenPeat	228
76907	non	58.0721	-135.2127	Hoonah	190102111004	ForestPeat	8
106101	non	57.9693	-135.4667	Hoonah	190102110904	ForestPeat	165
107789	non	58.0811	-135.3070	Hoonah	190102111003	FenMarsh	27
122210	non	57.9873	-135.3725	Hoonah	190102110201	ForestPeat	595
109388	non	57.9215	-135.2193	Hoonah 2	190102110201	FenMarsh	83
13544	non	58.5203	-134.7923	Juneau	190103010502	ForestPeat	75
37494	non	58.3806	-134.7377	Juneau	190103010714	ForestPeat	198
90484	non	58.3672	-134.6156	Juneau	190103010606	UpliftMead	32
124532	non	58.4910	-134.7727	Juneau	190103010714	UpliftMead	70
6966	non	58.4345	-134.6339	Juneau 2	190103010603	FenMarsh	326

Wet_ID	Tidal/ Nontidal	Latitude	Longitude	Community	HUC12	Wetland Type	Eleva-tion
23845	non	58.3624	-134.5698	Juneau 2	190103010606	FenMarsh	88
65800	non	58.6464	-134.9323	Juneau 2	190103010402	OpenPeat	137
75418	non	58.5302	-134.8273	Juneau 2	190103010503	FenMarsh	11
88389	non	58.4411	-134.6461	Juneau 2	190103010603	ForestPeat	314
5386	non	55.3259	-131.7473	Ketchikan	190101020702	FenMarsh	360
38076	non	55.4904	-131.5985	Ketchikan	190101020508	ForestPeat	674
39948	non	55.4674	-131.6128	Ketchikan	190101020401	OpenPeat	589
42153	non	55.3533	-131.6220	Ketchikan	190101020402	ForestPeat	284
44253	non	55.4349	-131.7944	Ketchikan	190101020403	ForestPeat	40
59361	non	55.4095	-131.7023	Ketchikan	190101020401	FenMarsh	52
74378	non	55.3491	-131.6192	Ketchikan	190101020402	ForestPeat	215
86888	non	55.3602	-131.6185	Ketchikan	190101020402	ForestPeat	330
88953	non	55.4072	-131.7050	Ketchikan	190101020401	FenMarsh	98
105410	non	55.3203	-131.7491	Ketchikan	190101020702	OpenPeat	372
110778	non	55.4610	-131.6239	Ketchikan	190101020401	OpenPeat	442
114269	non	55.3132	-131.7530	Ketchikan	190101020702	OpenPeat	422
132435	non	55.4806	-131.6037	Ketchikan	190101020401	ForestPeat	713
22893	non	55.4720	-131.6142	Ketchikan 2	190101020401	ForestPeat	603
25780	non	55.2911	-131.7742	Ketchikan 2	190101020702	OpenPeat	207
32607	non	55.4906	-131.5979	Ketchikan 2	190101020508	FenMarsh	653
89804	non	55.6516	-132.9256	Klawock	190101031302	ForestPeat	139
128678	non	55.6060	-133.0123	Klawock	190101031303	FenMarsh	289
102784	non	59.4398	-136.3268	Klukwan	190103031005	FenMarsh	687
37381	non	56.7182	-132.8170	Petersburg	190102101002	OpenPeat	357
43367	non	56.7863	-132.9155	Petersburg	190102100102	Floodplain	309
53316	non	56.6943	-132.9218	Petersburg	190102101004	FenMarsh	494
101648	non	56.7688	-132.8334	Petersburg	190102100102	OpenPeat	499
109303	non	56.7866	-132.8175	Petersburg	190102100102	ForestPeat	163
58719	non	55.8477	-133.0992	Port Protection	190101030904	ForestPeat	157
63159	non	56.2760	-133.3831	Port Protection	190101030902	ForestPeat	1211
74723	non	56.3088	-133.5484	Port Protection	190101030904	FenMarsh	275
108596	non	56.2849	-133.3890	Port Protection	190101030902	ForestPeat	864
110335	non	56.2984	-133.4888	Port Protection	190101030904	FenMarsh	142
124736	non	56.3130	-133.5551	Port Protection 2	190101030904	FenMarsh	197
35658	non	57.9662	-134.9635	Tenakee Springs	190102110101	OpenPeat	102
83499	non	57.9180	-135.1994	Tenakee Springs	190102110201	OpenPeat	98
91971	non	57.9131	-134.9696	Tenakee Springs	190102110102	ForestPeat	75
96018	non	57.9918	-135.0540	Tenakee Springs	190102110101	OpenPeat	189
107769	non	57.8625	-135.1474	Tenakee Springs	190102110203	ForestPeat	112
7918	non	55.6731	-132.7330	Thorne Bay	190101030201	ForestPeat	32
30734	non	55.7449	-132.6294	Thorne Bay	190101030207	OpenPeat	1199
77466	non	55.7013	-132.6325	Thorne Bay	190101030206	ForestPeat	102
108361	non	55.6959	-132.5252	Thorne Bay	190101030310	FenMarsh	195
13877	non	56.0939	-133.1482	Whale Pass	190101030304	ForestPeat	89
32412	non	56.2394	-133.1199	Whale Pass	190101030302	OpenPeat	154
34397	non	56.2715	-133.2731	Whale Pass	190101030902	OpenPeat	1491

Wet_ID	Tidal/ Nontidal	Latitude	Longitude	Community	HUC12	Wetland Type	Eleva-tion
65930	non	56.2402	-133.1138	Whale Pass	190101030302	OpenPeat	86
81987	non	56.2031	-133.0998	Whale Pass	190101030306	ForestPeat	1088
126043	non	56.2216	-133.2720	Whale Pass	190101030301	OpenPeat	508
2826	non	56.1655	-133.1656	Whale Pass 2	190101030303	FenMarsh	458
2626	non	56.2101	-132.1553	Wrangell	190102090204	ForestPeat	590
7671	non	56.3926	-132.2518	Wrangell	190102090103	ForestPeat	117
19784	non	56.4044	-132.2556	Wrangell	190102090103	ForestPeat	75
31302	non	56.3013	-132.2066	Wrangell	190102090101	ForestPeat	236
48204	non	56.3000	-132.2100	Wrangell	190102090101	OpenPeat	282
53364	non	56.2067	-132.1606	Wrangell	190102090204	ForestPeat	267
60352	non	56.3429	-132.2794	Wrangell	190102090205	OpenPeat	1508
75551	non	56.2900	-132.1426	Wrangell	190102090102	ForestPeat	319
79226	non	56.3894	-132.2426	Wrangell	190102090103	OpenPeat	119
79250	non	56.3019	-132.2078	Wrangell	190102090101	OpenPeat	359
81667	non	56.3620	-132.1994	Wrangell	190102090101	OpenPeat	925
89386	non	56.3332	-132.2734	Wrangell	190102090101	OpenPeat	1122
102584	non	56.2669	-132.0712	Wrangell	190102090701	Floodplain	146
110178	non	56.2803	-132.1233	Wrangell	190102090701	FenMarsh	650
113882	non	56.3229	-132.2548	Wrangell	190102090101	OpenPeat	415
115596	non	56.5967	-132.7488	Wrangell	190102101202	FenMarsh	333
122059	non	56.3189	-132.2504	Wrangell	190102090101	OpenPeat	497
123147	non	56.3516	-132.2882	Wrangell	190102090103	ForestPeat	703
86449	non	56.3086	-132.2356	Wrangell 2	190101031504	OpenPeat	18
12717	non	59.4882	-139.6478	Yakutat	190104051701	UpliftMead	13
32124	non	59.4710	-139.1401	Yakutat	190104051402	FenMarsh	69
34390	non	59.5788	-139.4579	Yakutat	190104051406	FenMarsh	88
67751	non	59.5857	-139.5060	Yakutat	190104051406	OpenPeat	59
71917	non	59.6274	-139.5159	Yakutat	190104051406	ForestPeat	135
76182	non	59.5031	-139.6778	Yakutat	190104051701	UpliftMead	17
95137	non	59.6283	-139.5168	Yakutat 2	190104051406	FenMarsh	149
71129	Tidal	55.8759	-132.5895	Coffman Cove 2	190101030309		
16425	Tidal	55.5531	-133.0906	Craig 2	190101031307		
83430	Tidal	58.4047	-135.7338	Gustavus 2	190103021210		
10076	Tidal	58.4292	-135.6529	Gustavus 2	190103021211		
50720	Tidal	58.4550	-135.8734	Gustavus 2	190103021016		
25985	Tidal	59.2171	-135.4511	Haines 2	190103031305		
127508	Tidal	59.1439	-135.3775	Haines/Klukwan 2	190103031305		
81607	Tidal	59.1600	-135.3596	Haines/Klukwan 2	190103030802		
55612	Tidal	59.2310	-135.4412	Haines/Klukwan 2	190103030802		
120860	Tidal	59.2354	-135.4763	Haines/Klukwan 2	190103031303		
91388	Tidal	59.3245	-135.5491	Haines/Klukwan 2	190103030801		
114011	Tidal	55.3537	-132.5154	Hollis 2	190101030403		
1743	Tidal	55.4861	-132.6666	Hollis 2	190101030503		
98636	Tidal	55.4912	-132.6236	Hollis 2	190101030504		

Wet_ID	Tidal/ Nontidal	Latitude	Longitude	Community	HUC12	Wetland Type	Eleva-tion
167	Tidal	57.9202	-134.9385	Hoonah 2	190102110102		
76507	Tidal	58.0579	-135.1014	Hoonah 2	190102111001		
36597	Tidal	58.0832	-135.2931	Hoonah 2	190102111003		
125169	Tidal	58.0859	-135.4587	Hoonah 2	190102110906		
131574	Tidal	55.1931	-132.7939	Hydaburg 2	190101031502		
40964	Tidal	55.2035	-132.8196	Hydaburg 2	190101031502		
116633	Tidal	55.2130	-132.8282	Hydaburg 2	190101031604		
72936	Tidal	57.9441	-133.6909	Juneau 2	190102060303		
3685	Tidal	58.3306	-134.6020	Juneau 2	190103010710		
9515	Tidal	58.3306	-134.6020	Juneau 2	190103010710		
31268	Tidal	58.3338	-134.6006	Juneau 2	190103010710		
3393	Tidal	58.3468	-134.4985	Juneau 2	190103010606		
108242	Tidal	58.3577	-134.5532	Juneau 2	190103010606		
85406	Tidal	58.3594	-134.6056	Juneau 2	190103010606		
19663	Tidal	58.3604	-134.6056	Juneau 2	190103010606		
22997	Tidal	58.3610	-134.6134	Juneau 2	190103010606		
109494	Tidal	58.4907	-134.7885	Juneau 2	190103010714		
7821	Tidal	58.4918	-134.7883	Juneau 2	190103010714		
58352	Tidal	58.4933	-134.7837	Juneau 2	190103010714		
132361	Tidal	58.5218	-134.8073	Juneau 2	190103010503		
52229	Tidal	58.5222	-134.8015	Juneau 2	190103010502		
26827	Tidal	58.5260	-134.8149	Juneau 2	190103010503		
9581	Tidal	58.5270	-134.8199	Juneau 2	190103010503		
132056	Tidal	58.5346	-134.8324	Juneau 2	190103010714		
88189	Tidal	55.3102	-131.6935	Ketchikan 2	190101020701		
81229	Tidal	56.5683	-132.7362	Petersburg 2	190102101202		
6064	Tidal	56.5742	-132.5700	Petersburg 2	190102070303		
112088	Tidal	56.8075	-132.9743	Petersburg 2	190102101004		
46464	Tidal	56.2640	-133.3318	Port Protection 2	190101030901		
110956	Tidal	57.1319	-135.3666	Sitka 2	190102121206		
43427	Tidal	55.7632	-132.4912	Thorne Bay 2	190101030309		
10920	Tidal	56.1194	-133.1446	Whale Pass 2	190101030303		
124204	Tidal	56.1633	-133.2928	Whale Pass 2	190101031102		
133009	Tidal	56.2115	-133.0706	Whale Pass 2	190101030306		
4449	Tidal	56.3448	-132.3462	Wrangell 2	190102090205		
88455.3	Tidal	56.4201	-132.3536	Wrangell 2	190102090205		
88455.2	Tidal	56.4433	-132.3782	Wrangell 2	190102090205		
88455.1	Tidal	56.4540	-132.3850	Wrangell 2	190102090205		
113216	Tidal	56.4679	-132.3278	Wrangell 2	190102090103		
62552	Tidal	59.5463	-139.8241	Yakutat 2	190104051302		
68549	Tidal	59.5593	-139.7450	Yakutat 2	190104051302		

1.4 Limitations

WESPAK-SE is not intended to answer all questions about wetlands. Users should understand the following important limitations:

1. WESPAK-SE does not change any current procedures for determining wetland jurisdictional status, delineating wetland boundaries, or requirements for monitoring wetland projects.

2. The intended users are wetland specialists for government agencies, natural resource organizations, and consulting companies, who are skilled in conducting jurisdictional delineations of wetlands. Users should be able to (a) recognize most common wetland plants, (b) determine soil texture, (c) understand wetland hydrology, (d) delineate wetland contributing area (catchment) boundaries from a topographic map, (e) access and acquire information from the internet, and (f) enter data in Microsoft Excel® (1997 or later version). For field application of WESPAK-SE, a multidisciplinary team is encouraged but not required. Training in the use of WESPAK-SE also is encouraged but not required.

Some of the requested information may not be accurately determinable during a single visit to a wetland, particularly if that visit occurs outside the growing season. Some wetland conditions vary dramatically from year to year and within a growing season. Thus, the accuracy of results will be greater if users are familiar with the changes in wetland conditions that typically occur locally, or consult landowners or others who know that.

3. For the portion of WESPAK-SE which incorporates existing digital data, it is understood that those data were originally created at scales much coarser than represented by the region's typically small wetlands. Consequently, when those data are interpolated to the scale of an individual wetland, some of the data are likely to be inaccurate. Also, some of the conditions described by the spatial data, such as for land cover, may have changed since the layer was created years ago. Nonetheless, it was decided that the advantages of judiciously using the existing spatial data, as just one component of each wetland's WESPAK-SE scores, outweighed the disadvantages.

4. The numeric estimates WESPAK-SE provides of wetland functions, values, and other attributes are *not actual measures* of those attributes, nor are the data combined using mechanistic models of ecosystem processes. Rather, WESPAK-SE scores are estimates of those attributes arrived at by using standardized criteria (models). The models

systematically combine well-accepted indicators in a logically sophisticated manner that attempts to recognize context-specific, functionally contingent relationships among indicators. As is true of all other rapid assessment methods, WESPAK-SE's scoring models have not been validated in the sense of comparing their outputs with those from long-term direct measurement of wetland processes. That is the case because the time and cost of making the measurements necessary to fully determine model accuracy would be exorbitant. Nonetheless, the lack of validation is not, by itself, sufficient reason to avoid use of any standardized rapid method, because the only practical alternative—relying entirely on non-systematic judgments (best professional judgment)—is not demonstrably better in many cases. When properly applied, WESPAK-SE's scoring models and their indicators are believed to adequately describe the *relative* effectiveness of a wetland for performing particular functions.

5. WESPAK-SE may be used to augment the interpretations of a subject professional (e.g., a fisheries biologist, plant ecologist, ornithologist, hydrologist, biogeochemist) when such expertise is available. WESPAK-SE outputs, like those of other rapid methods, are not necessarily more accurate than judgments of a subject expert, partly because WESPAK-SE's spreadsheet models lack the intuitiveness and integrative skills of an actual person knowledgeable of a particular function. Also, a model cannot anticipate every situation that may occur in nature. WESPAK-SE outputs should always be screened by the user to see if they "make sense." Nonetheless, WESPAK-SE's scoring models provide a degree of standardization, balance, and comprehensiveness that seldom is obtainable from a single expert.

6. WESPAK-SE's logic-based process for combining indicators has attempted to reflect currently-understood paradigms of wetland hydrology, biogeochemistry, and ecology. Still, the scientific understanding of wetlands is far less than optimal to support, as confidently as some might desire, the models WESPAK-SE and other rapid methods use to score wetland attributes. To provide transparency about this uncertainty, in the Rationales column of the WESPAK-SE worksheets for individual functions, some of the more significant alternative or confounding interpretations are noted for indicators used in that function's scoring model.

7. WESPAK-SE does not assess *all* functions, values, and services that a wetland might support. In particular, WESPAK-SE does not assess the suitability of a wetland as habitat for any individual wildlife or plant *species*. The 18 functions and 21 other attributes that WESPAK-SE assesses are those most commonly ascribed to wetlands.

8. If two wetlands have similar effectiveness scores for a function and its value, the larger wetland is usually more likely to provide a greater total level of the associated ecosystem service. However, the relationship between wetland size and the total level of a service delivered is not necessarily linear. For example, if its characteristics make a particular wetland ineffective for storing or purifying water, or for supporting particular plants and animals, then simply increasing its size by adding more wetland having the same characteristics will usually not increase the total amount of water stored or purified, or plants and animals supported. The threshold below which a wetland's characteristics make it completely ineffective is unknown in many cases. Where scientific evidence has suggested that wetland size may benefit a function in a greater-than-linear manner, WESPAK-SE has included wetland size as an indicator for that function. Those functions are Waterbird Feeding, Waterbird Nesting, Songbirds-Mammals, and Pollinators.

9. In some wetlands, the scores that WESPAK-SE's models generate may not be sufficiently sensitive to detect, in the short term, mild changes in some functions. For example, WESPAK-SE is not intended to measure small year-to-year changes in a slowly-recovering restored wetland, or minor changes in specific functions, as potentially associated with limited "enhancement" activities such as weed control. Nonetheless, in such situations, WESPAK-SE can use information about a project to predict the likely *direction* of the change for a wide array of functions. Quantifying the actual change will often require more intensive (not rapid) measurement protocols that are complementary.

10. WESPAK-SE outputs are not intended to address the important question, "Is a proposed or previous wetland creation or enhancement project in a *geomorphically appropriate* location?" That is, is the wetland in a location where key processes can be expected to adaptively sustain the wetland and the particular functions which those of its type usually support, e.g., its "site potential?" Although WESPAK-SE uses many landscape-scale indicators to estimate functions and values of a wetland, WESPAK-SE is less practical for identifying the relative influence of multiple processes that operate at a landscape scale to support a single wetland.

11. Science is constantly evolving as new studies refine, refute, or support what currently is known. It is incumbent that planning tools keep pace with new findings and their models be revised at regular intervals, perhaps every 5-10 years, to reflect that. This may pose challenges to wetland regulatory programs if necessary revisions to a method such as WESPAK-SE create a "moving target".

2.0 Procedures for Using WESPAK-SE

You will be completing three forms: an office form (OF); and two field forms (F and S). In a nutshell, the procedure is as follows:

1. Read this entire section (Section 2) before proceeding to complete the forms for the first time.
2. Download the most recent version of the *WESPAK-SE_ Calculator* (*Tidal* and *Non-tidal* versions) spreadsheet from the Southeast Alaska Land Trust web site: http://southeastalaskalandtrust.org/wetland-mitigation-sponsor/wespak-se/
3. Also download and print (from the same sites) the PDF versions of data form F and data form S. Do not print form OF or anything from the Excel spreadsheet at this point.
4. Complete the "office" component, which involves viewing aerial imagery and filling out the form OF worksheet in the *WESPAK-SE Calculator* file, mainly by obtaining map information from the University of Alaska's WESPAK-SE Wetlands Module web site described below.
5. Visit the wetland and complete the "field" component by filling out data forms F& S. Then refine your answers to questions on form OF if necessary.
6. View the results in the Scores tab of the spreadsheet and interpret them.

2.1 Office Procedures

Begin the office component of the assessment with the electronic version of form OF in the file *WESPAK-SE_Calculator_Nontidal.xls* or *WESPAK-SE_Calculator_Tidal.xls*. When you open that file, **you may get a message asking if you want to enable "macros."** Mark yes; the macros in this file will not harm your computer. They are necessary to automate the calculations.

2.1.1 Obtain Aerial Images

You will need a recent aerial image of the wetland of interest in order to answer several of the questions in form OF. There are many sources of aerial imagery that can be viewed for free online. Either of these will be adequate:

- Google Earth web site: http://earth.google.com/downloadearth.html

Easy to access and use, but image clarity is poor for some parts of Southeast Alaska.

- WESPAK-SE Wetlands Module web site: http://seakgis.alaska.edu/flex/wetlands/

2.1.2 Draw the Assessment Area (AA) Boundaries

A key term is **assessment area (AA).** That area is usually the same as that of an **entire wetland** polygon, with its boundary obtained from an existing map, a field delineation, or your own interpretation of aerial images and topography. The AA can never be substantially larger than a wetland -- only the same size or smaller. ***The AA preferably will consist of the entire wetland plus, in some cases, some or all of the directly adjoining unvegetated water*** (see below). However, in some cases you may draw the AA to encompass just part of a wetland, e.g., the part in which impacts or conservation actions are anticipated, or parts which are a different type (using the types defined by WESPAK-SE). Other situations where you might define an AA smaller than an entire wetland include instances where:

- The wetland extends across property lines and access permission to part of the wetland was not granted.
- The wetland is so large (e.g., >100 acres) and internally varied that an accurate assessment cannot be completed in a day.

Boundaries of the AA should be based mainly on ***hydrologic connectivity***. Depending on purposes of the assessment, they normally should not be based *solely* on property lines, fence lines, mapped soil series, vegetation associations, elevation zones, land use or land use designations. The AA boundaries may need to be adjusted during the field component, but for WESPAK-SE's purposes you don't need to delineate the AA boundary with the high level of precision customary for legal delineations. Nonetheless, *where* you draw the boundaries of the AA can dramatically influence the resulting scores. If you delimit an AA that does not occupy all of a wetland, you should report the approximate percent of the wetland it occupies. A space is provided for this at the top of the Scores worksheet (tab) in the calculator spreadsheet. Similarly, you should estimate and note the approximate percent of the mapped AA you were able to visit (taking into account both physical restrictions and private property restrictions).

Here are guidelines for delineating the AA in some specific situations:

a. **Dissected Wetland.** If a wetland that once was a contiguous unit is now divided or separated from its formerly contiguous part by a road or dike (Figure 1), assess the two units separately unless a functioning culvert, water control structure, or other opening connects them, and their water levels usually are simultaneously at about the same level.

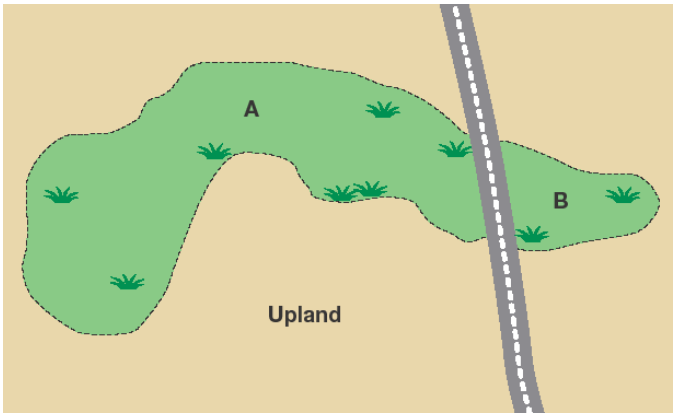


Figure 1. Dissected Wetland.

A wetland is crossed by a road or filled area. Separate the wetland into two AA's and assess separately if A and B have different water levels and circulation between them is significantly impeded.

b. **Fringe Wetland**. If a wetland is a fringe wetland (that is, it borders a bay, estuary, pond, or river in which the contiguous stretch of open water is >3x wider than the wetland), the AA should include the just the vegetated wetland, not the adjoining water (unless the method specifically directs you to answer a question about that). An exception is if the contiguous water body including the wetland is smaller than 20 acres, e.g., a pond. In that case, the water body itself (regardless of depth) should be included as well as the wetland (Figure 2).

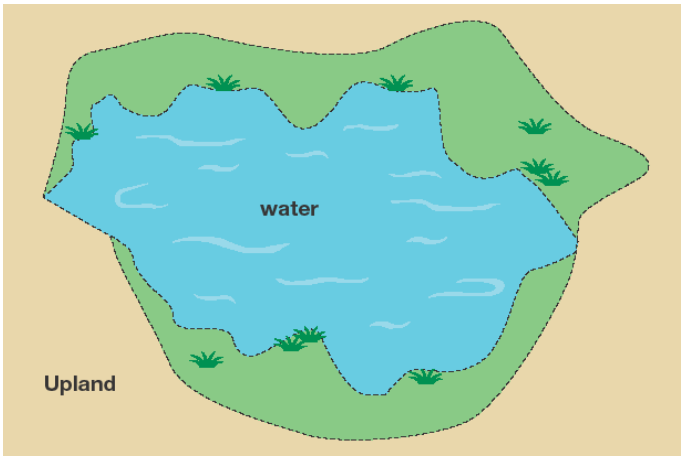


Figure 2. Fringe Wetland Type 1.

The average width of the open water area is more than 3x wider than the average width of the wetland, making this a fringe wetland. If the entire polygon is smaller than 20 acres, the AA should include the open water. If larger, the AA should include only the wetland.

c. **Fringe Wetland Patches**. If patches of fringe wetlands share the same margin of a river, lake, or estuary and are separated from each other by upland over a distance of greater than 100 ft, they should be assessed as separate AA's (Figure 3) unless they appear to be the same in nearly every aspect (dominant vegetation, soil texture, hydrology, landscape position, WESPAK-SE wetland type, adjoining land use, etc.) and are within 1000 ft. of each other.

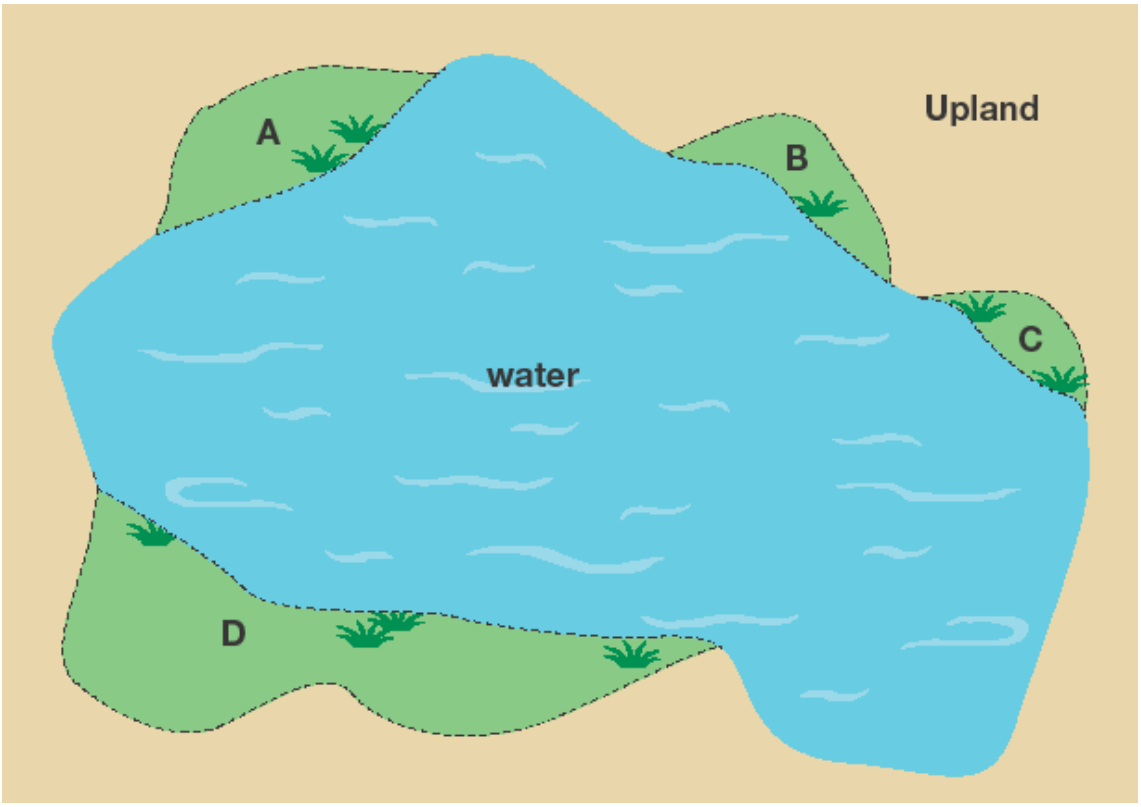


Figure 3. Fringe Wetland Type 2 (fringe wetland patches).

Wetland patches B and C would be included in the same AA if separated by no more than 100 ft. by water, bare substrate, algal flats, or upland. Wetland patches A and D would be in the same AA if separated by 100 ft or less, or if they are within 1000 ft of each other and their vegetation, soil texture, water regime, and adjoining land use is the same.

d. Lake Wetland With Tributary. If a lacustrine (lakeside) wetland is intersected by an inflowing stream, the wetland should be considered lacustrine except for the part that is more subject to seasonal overflow from the stream than from fluctuations in lake levels. That part should be assessed separately.

e. Wetland Mosaic. If the wetland is a patch in a mosaic of wetlands within uplands or other non-wetland waters (Figure 4) and none of the above rules apply, the entire mosaic should be considered and delimited as one AA if:

- Each patch of wetland is smaller than 1 acre, and
- Each patch is less than 50 ft from its nearest neighboring wetland and is not separated from them by impervious surface, and
- The areas of vegetated wetland are more than 50% of the total area. The total area is the wetlands plus other areas that are between the wetlands (such as uplands, open water, and mudflats).

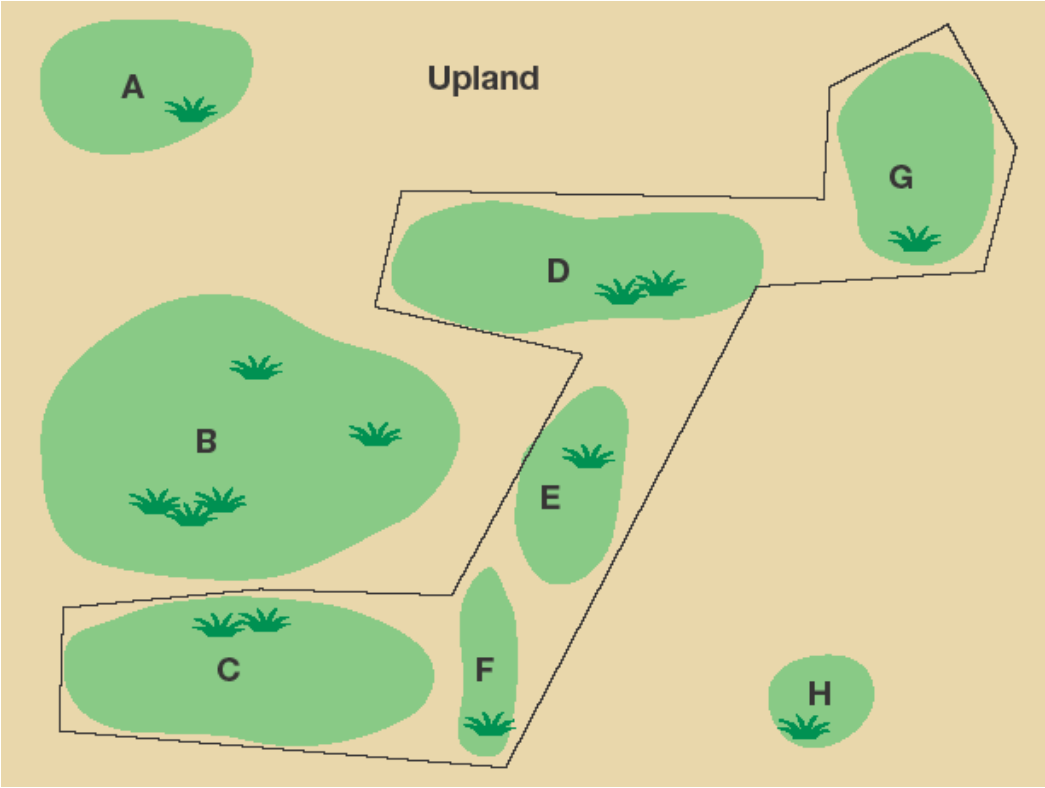


Figure 4. Wetland mosaic Assessment Area (AA).

The circles are wetlands and the areas between them are upland. Wetlands C, D, E, F, and G comprise a mosaic because they occupy more than 50% of the total area bounded by the dark line. Wetland B is excluded because it is larger than 1 acre. Wetlands A and H are excluded because each is >100 ft from its closest neighbor.

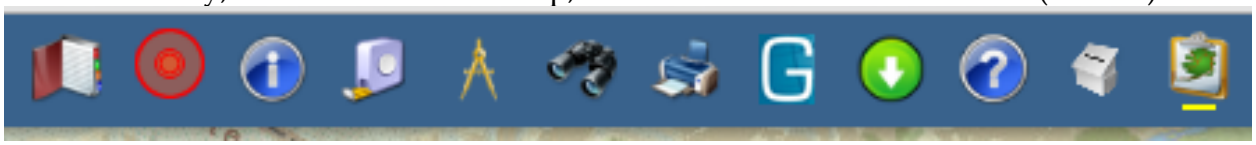
f. Tidal/Non-Tidal Wetland. If any vegetated part of the AA is tidal (receives tide-driven surface water on any day during an average year), assess that part separately from the non-tidal part, using the WESPAK-SE data form for Tidal Wetlands.

2.1.3 Determine the Geographic Coordinates

To expedite finding your AA in an aerial image, you may input its geographic coordinates (latitude and longitude). Determine the latitude and longitude of the AA's approximate center in decimal-degrees, e.g., 45.2434, -123.3425. For WESPAK-SE's purposes, the precision of the coordinates need not be any greater than about half of the width of the wetland. If the wetland's coordinates have not already been determined in the field using a GPS (NAD83 datum), determine them as follows:

Using Google Earth:
a. After downloading Google Earth (if you don't already have it) from the internet, go to the Tools dropdown menu and select Options. Select the 3D View tab, check decimal degrees, and hit Apply.
b. If you know the lat/long in degrees minutes seconds (rather than decimal degrees) you can type in that value and Google Earth will convert it and display in the bottom center of the window.
c. Alternatively, if you enter a street address, cross streets, or other information into the "Fly To" space, the map will zoom to that approximate location. Locate your wetland and move the cursor to the center of the part you wish to assess. The correct Lat / Long is displayed in the bottom left center of the window.

Using the WESPAK-SE Wetlands Module:
a. After accessing the web site, zoom to your AA and read the coordinates (latitude, longitude) in the lower left.
b. Alternatively, in the toolbar at the top, click on the red Find a Location (second) icon:



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Then in the pop-up menu, click on the pushpin icon and enter the lat/long, or click on the mailbox icon and enter an address.

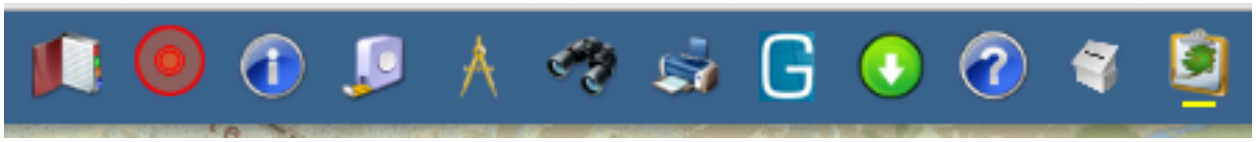
2.1.4 Interpret Aerial Images

You will use aerial images, zoomed at various scales, to answer WESPAK-SE questions OF1 through OF15 (non-tidal wetlands), as well as OF1-OF11 and T26-31 (tidal wetlands). Preferably, respond to these questions using the imagery before you visit the wetland. While in the office, record your responses directly in the spreadsheet (form OF worksheet tab at bottom of page), print the completed form, and take it with

you during the site visit. Upon visiting the site, modify your estimates if appropriate based on your observations.

First, zooming to its location, bring up an aerial of your AA. In the WESPAK-SE Wetlands Module, click on the left end of the "Select Your Basemap" menu in the upper left and select "Best Available Data Layer" or "Bing Imagery." Also, one WESPAK-SE question requires you to view a topographic map. To do so, select instead "Topographic" in the "Select Your Basemap" menu.

Note that several questions ask you to measure distances from your AA of specified features or in a few cases, the area of a feature. To do so, go online to this toolbar in the WESPAK-SE Wetlands Module and click on the Measure icon:



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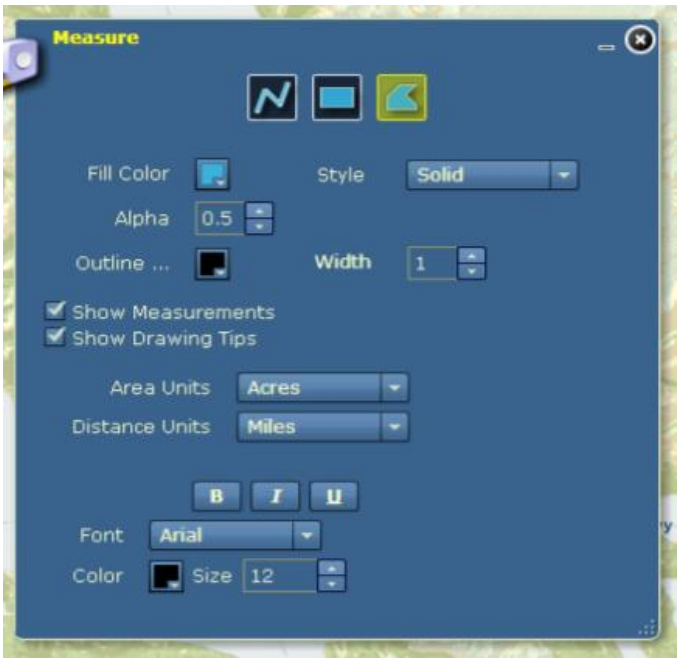
The following menu pops up:

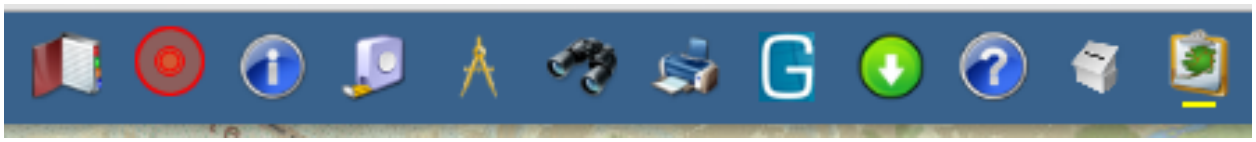


To measure **distance**, click on the jagged line symbol in the top left and then halfway down the menu where it says Distance Units click on Miles or Feet. Then go to the website's main map or aerial, place your cursor on the AA, click it, drag it to the feature

being measured, and double-click. The distance measurement will appear on the map. If it's hard to read, go back to the bottom of the pop-up menu and change the Color.

To measure **area**, click on the polygon symbol in the top right and then halfway down the menu where it says Area Units click on Acres. Then go to the website's main map or aerial, place your cursor on one point along the edge of the AA, click it, move to another point on the edge, click it, and so forth until you've enclosed the entire polygon. Then double-click and the area measurement (as well as the length of the polygon's perimeter) will appear on the map.

Also note that several questions ask you to estimate conditions within a landscape **(buffer) of radius 0.5 mile or 2 miles** centered on your AA. To create a circle of that radius, go online to this toolbar in the WESPAK-SE Wetlands Module and click on the Buffer/Range icon:



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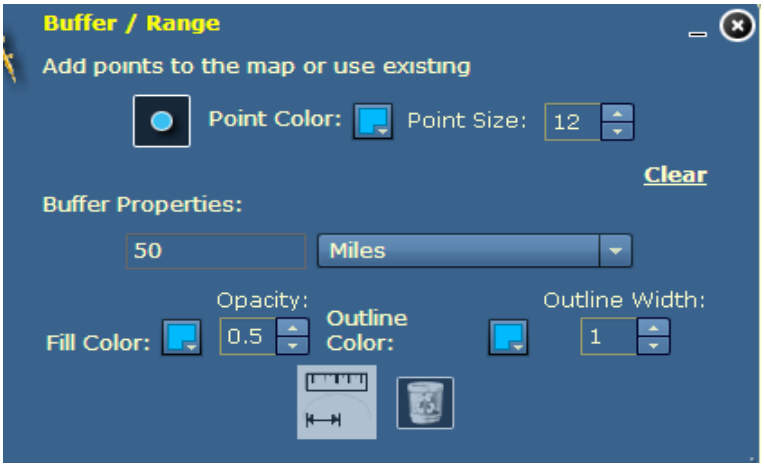
The following menu pops up:



Click on the point (solid circle) in the upper left of the above menu, then place your cursor in the center of the AA, click, and return to the Buffer/Range menu. Under the heading "Buffer Properties" click the buffer radius desired (0.5 or 2 miles), then click the white box in the lower middle of the menu. A buffer of that size should appear on the map, surrounding the point you placed. Don't be concerned that the buffer isn't perfectly round – it is accounting for geographic and elevational distortion. If the buffer

is too dense to adequately view features beneath it, decrease the Opacity in the above menu. When you're done, click Clear and then the trash can symbol to the right of the buffer icon at the bottom of the above menu.

To estimate the *percentages* of a given land cover within the buffer circle, imagine all the patches of that type being "squeezed together" and determine the approximate fraction of the circle they would occupy. Note that the questions for "natural land cover" and "herbaceous open land" ask the percentage of the ***land* area** of the circle that is occupied by the specified land cover, whereas the questions for "ponded water" use the entire circle, including large lakes but not ocean.

2.1.5 Draw the Wetland's Contributing Area (CA)

The CA is the drainage area, catchment area, or contributing upland that feeds the wetland (Figure 5). It includes the AA plus all areas uphill from the AA until a ridge or topographic rise is reached, often many miles away, beyond which water would travel in a direction that would not take it to the AA. The water does not need to travel on the land surface; it may reach the AA slowly as shallow subsurface seepage[2]. The lowest point of a CA is the lowest point in the AA. The CA's highest point will be along a ridgeline or topographic mound. Although it is possible that roads, tile drains, and other diversions that run perpendicular to the slope may interfere with movement of runoff or groundwater into a wetland (at least seasonally), it is virtually impossible to determine their relative influence without detailed maps and hydrologic modeling. Therefore, in most cases draw the CA as it would exist *without* existing infrastructure, i.e., based solely on natural topography as depicted in the topographic map. The only exception is where maps, aerial images, or field inspections show artificial ditches or drains that *obviously* intercept and divert a *substantial* part of the runoff before it reaches the wetland, or where a runoff-blocking berm, dike, or elevated road adjoins all of a wetland's uphill perimeter.

[2] There are often situations where subsurface flow (especially deep groundwater), that potentially feeds a wetland, ignores such topographic divides. However, due to the limitations imposed by rapid assessment, no attempt should be made to account for that process.

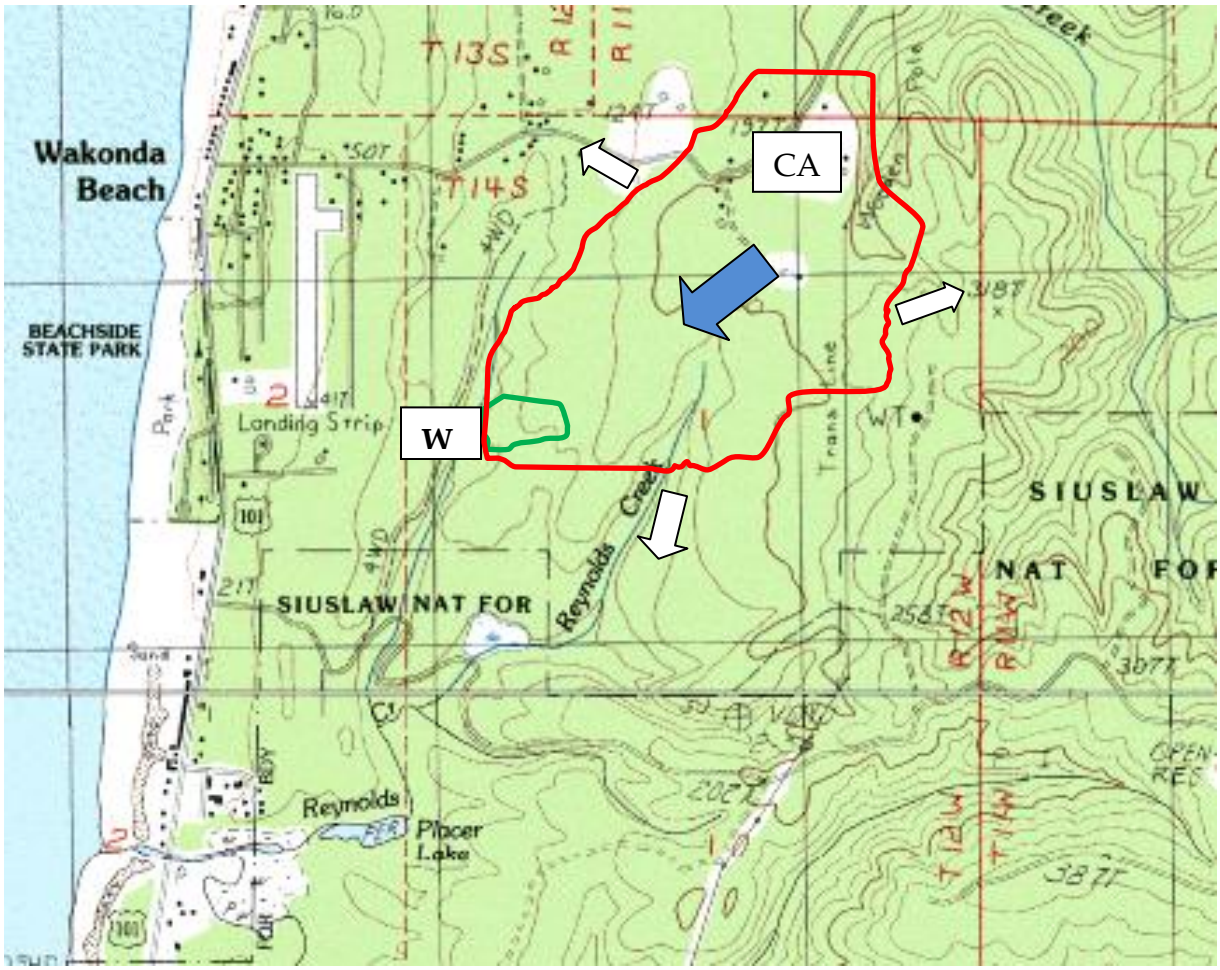


Figure 5. Delimiting a wetland's contributing area (CA).

Wetland (to the right of the "W") is fed by its Contributing Area (CA) whose boundary is represented by the red line. The dark arrow denotes flow of water downgradient within the CA. The light arrows denote the likely path of water away from the CA and into adjoining drainages, as interpreted from the topography. Note that the CA boundary crosses a stream at only one point, that being the outlet of the wetland.

The CA may include other wetlands and ponds, even those without outlets, if they're at a higher elevation. Normally, the boundary of a CA will *cross a stream at only one point*— at the CA's and AA's outlet, if it has one. Do not include contiguous perennial deep waters at the same elevation (such as a lake, river, or bay) unless requested by the question. Especially in urban areas and areas of flat terrain, the CA boundaries can be somewhat subjective and estimation in the field may be preferable. However, for WESPAK-SE's purposes a high degree of precision is not needed.

2.1.6 Obtain Required Information from Appendices and the WESPAK-SE Web Site

To complete the office phase of WESPAK-SE (form OF), you must obtain specific information primarily from a Wetlands Module web site created and hosted by the UAS's Southeast Alaska GIS Library: http://seakgis.alaska.edu/flex/wetlands/

Instructions for finding the needed information on this web site are provided in the individual questions on WESPAK-SE form OF. As you look for particular layers (maps) in the web site's Table of Contents, note that you can expand the list shown by dragging the bottom right corner. Also, the web site also has a short tutorial that provides helpful guidance – click on the "?" icon in the toolbar on the top of the main page.

For just a few questions, you also will need to extract information from maps and tables in Appendices A and B.

Note that if information from the Module or appendices conflicts with your field observations, the field observations should usually control.

2.1.7 Search for Other Useful Information

While completing a WESPAK-SE assessment, you should ask the land owner, land manager, or neighbors about the annual extent and depth of high and low water, as well as the annual duration of surface-water connection with streams and other wetlands. Even where flood marks are pronounced, such characteristics are difficult to estimate visually during a single wetland visit. Local offices of municipal, state, tribal, and federal agencies should also be contacted for information that will improve the accuracy of your assessment. An online search of the name of a nearby feature can sometimes be productive. Also, for some areas, you can go online and easily view aerial images from other seasons and/or years. To do so, open GoogleEarth, zoom to your location, and click on the sundial icon in the toolbar in the middle top of the page. Finally, note that soils information from wider parts of the region will eventually become available online at http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm . This can be used as an aid in identifying wetlands and wetland contributing areas with high risk of landslides or soil erosion.

2.2 Instructions for Field Component

The field component involves visiting as much of the AA as possible, filling out the two field forms (F and S), and verifying, as needed, answers previously given on form OF.

This component will generally require fewer than three hours (large or complex sites may take longer). If circumstances allow, visit the AA during both the wettest and driest times of year (if tidal, also during high and low tide). If you cannot, you must rely more on the aerial imagery, maps, other office information, field indicators, and discussions with the landowner and other knowledgeable sources.

2.2.1 Items to Take to the Field

Take the following with you into the field:
___Blank data forms F and S, preferably printed on write-in-rain paper
___Completed data form OF (to verify answers)
___Lists and explanatory illustrations from this report's appendices, if you need them
___Aerial images (to verify AA if no wetland delineation map available). If you have a smart phone and anticipate having cell phone coverage at the wetland location, load the Google Earth app onto the phone and it will show your location directly as you walk to and through it.
___Topographic map with the CA boundary you drew tentatively (to verify)
___Soil maps if available (to determine if your field determinations match)
___Hand trowel for grabbing surface soil for texturing
___Shovel or tile probe for determining peat depth, if soils are peaty
___Tape measure, or 16 marks on your shovel spaced 1 inch apart
___Clip board, pencil, other items you'd normally take in the field

If available:
___Wetland delineation map
___Soils map
___GPS, if needed to locate the wetland from a set of coordinates

2.2.2 Conduct the Field Assessment

Step 1. Review the questions on the F and S forms to refresh your memory of what to observe during the field visit. Also review data Form OF to see which questions you may have flagged during the office phase for checking during the field visit.

Step 2. Before answering all questions on the data forms, walk as much of the AA and wetland as possible. Plan your visit beforehand to visit each major vegetation type (these may be evident on the aerial imagery if the AA is large), each different soil map unit (if known), each area with different topography, the wetland/upland edges and all wetland/water feature edges (e.g., ponds, lakes, streams).

Step 3. Generally note the extent of invasive and non-native plant cover within the AA and along its upland edge, as well as any plants you don't often encounter (i.e., are marked as Rare in the PlantList worksheet), and other indicators described on the field forms.

Step 4. If you have access to the entire wetland, look for inlets and outlets, even ones that may flow only for a few days each year.

Step 5. Read the instructions at the beginning of forms F and S and then fill out these forms, paying attention to all the explanatory notes and definitions in the last column. As you answer the questions dealing with "percent of the area," pay particular attention to the spatial context (area) which the question is addressing. For example, in regard to a type of vegetation or land cover, be careful to note if it's asking what percentage is occupied within the:

- open water area, or
- vegetated area *of that type* (e.g., compare only with total wooded area), or
- total vegetated area, or
- upland edge, or
- assessment area (AA), or
- entire wetland, or
- contributing area (CA), or
- circle of specified radius
- circle of specified radius but excluding any water area (e.g., ocean)

Step 6. Use a trowel to scoop a small amount of the top-most layer of soil, just beneath any loose plant matter. Do this from at least 3 widely-spaced locations within the AA. Those locations may be chosen to represent different vegetation types or elevations. Determine the soil composition for question F46 (T11 if a tidal wetland) by using the WESPAK-SE *Soil Composition by Feel* diagnostics flow chart at the end of Appendix C. When viewing that chart, roll a small ball of soil (about half the size of a golf ball) in your palms after first wetting it slightly, and then see how far you can extend the "ribbon" you attempt to create by squeezing the soil between your thumb and forefinger. Do not use soil that already is oversaturated, i.e., dripping wet.

Step 7. Look uphill of the wetland to see if any artificial feature that adjoins the wetland *unmistakably* diverts *most* of the surface runoff away from it (e.g., high berm) during normal runoff events. If such is found, redraw the CA to exclude all areas that drain to that feature and not into the wetland.

2.2.3 Shortcuts for Assessing Multiple Wetlands Rapidly

If you are tasked with assessing hundreds of wetlands in a short period of time and/or with limited resources – as is often the case with road and pipeline projects, or when a need exists to prioritize all wetlands in a large watershed or municipality – it may be impractical to spend 1-3 hours assessing each wetland. Although not generally recommended, you may use the following strategy:

1. Begin by going online to the WESPAK-SE web site hosted by UAS and filling out form OF for every wetland along the corridor or other analysis area. Then for each wetland attempt to answer as many of the questions as possible on form F and S using the maps and aerial imagery on that web site. In particular, on form F use the maps to answer questions about wetland inlets (question F24) and outlets (F28).

2. Conduct a cluster analysis of the data to identify groups of wetlands with mostly similar characteristics. "Cluster analysis" is a statistical procedure based on a wetland's characteristics which you can implement using free software available on the internet. Unless your wetlands as a whole are extremely diverse, the number of clusters you attempt to define should be no more than about 5% of all the wetlands that need to be assessed, e.g., for a corridor with 500 wetlands, you could specify 25 clusters and the cluster analysis might show each cluster containing anywhere from 2 to (say) 100 wetlands.

3. Select at least one wetland from each cluster, visit it, and fill out completely forms F and S to determine the scores for that wetland. Assume that the resulting scores are representative of all other wetlands in that cluster. You might verify that with a second round of visits, assessing another wetland in each cluster and comparing the scores.

2.3 Dealing With Data and Results

2.3.1 Enter the Data

Enter data from the data forms (OF, F, S) into the corresponding Excel worksheets of the WESPAK-SE calculator. For tidal wetlands, data form T replaces data form F in the calculator and forms OF and S have been modified. The discussion in this section applies to both the version of WESPAK-SE for non-tidal wetlands and the version for tidal wetlands.

After reading instructions in the data form header, enter your data (answers to questions) and check to be sure a number was entered or intentionally left zero for **every** question in all three forms (worksheets), except where directed to skip one or more questions. Also be sure to fill out the documenting information requested at the top of the Scores worksheet. Once you've entered all your data, view the results (which compute instantly) in the Scores worksheet. Finally, rename the file in a manner that describes your particular wetland and hit Save.

2.3.2 Automated Scoring

First, in the WESPAK-SE spreadsheet calculator, look at the left side of the Scores worksheet. This example shows just the first two rows (two functions):

Table 3. Partial results from a wetland shown in left portion of the Scores worksheet.

Specific Functions or Values:	Raw Function Score	Raw Value Score	**Function Score (normalized)**	**Value Score (normalized)**
Surface Water Storage (WS)	3.67	9.61	3.64	10.00
Stream Flow Support (SFS)	6.88	8.92	10.00	8.95

Next, focus on the normalized scores in the two right-hand columns. Normalizing helps address the question, "How does this wetland compare with a large set of others in the study region?" In that sense, normalized scores are like percentiles. Normalization is necessary because, although each WESPAK-SE scoring model has a *theoretical* minimum score of 0 and a maximum of 10, the *actual* range across all the wetlands for any given function was often found to be narrower. Thus, to facilitate more neutral comparisons among functions, all raw scores were converted mathematically to place them on the 0 to 10 scale. This means that, among the 119 non-tidal wetlands that were assessed, the wetland with the highest *raw* score for a given function was given a *normalized* score of 10, and the wetland with the lowest *raw* score for a given function was given a *normalized* score 0, and wetlands with raw scores in between were given normalized scores proportional to the highest and lowest scoring wetlands. This conversion was done for all wetlands and each function using the simple, commonly-used normalization formula, programmed into the Excel spreadsheet:

$$\frac{\text{raw score of } \textbf{"wetland } x\textbf{"} - \textbf{minimum} \text{ score from all wetlands in the region}}{\textbf{maximum} \text{ score of all wetlands in region - } \textbf{minimum} \text{ score of all wetlands in region}}$$

A few other things to note:

- In the future, if a WESPAK-SE user assesses a wetland whose raw score for a given function turns out to be higher for that function than in any of the 119 wetlands encountered in the recent regional survey and used in the normalization formula, the spreadsheet calculator will automatically set the score to 10. Likewise, if a wetland is found whose raw score turns out to be lower than in any of the 119 wetlands, the spreadsheet calculator will automatically set the score to 0. In this way, a 0-to-10 scale is maintained in all future applications of WESPAK-SE. And keeping in mind that all the generated scores are relative, do not always assume that a function score of 0 means a wetland completely *lacks* the named function.
- Any time a WESPAK-SE model generates a raw score of 0 for a Function, the WESPAK-SE calculator automatically sets the Value score to 0. That is because a *current* value cannot be assigned to a function if the function is not performing at least minimally.
- Although not shown in the tables in this section, some cells in the Function Score column are shaded with gray. That is because the item named in the left column is not a wetland function -- it describes a value or other wetland attribute. In the Value Score column, one cell (for Carbon Sequestration function) is gray. That is because it was not possible to create a model that fairly describes the *value* of sequestered (stored) carbon of a single wetland.

Next, in the Scores worksheet scroll down to the table located below the one just described.

Table 4. Group score results for a wetland as shown in part of the Scores worksheet.

Summary Scores for Groups:	Raw Function Score	Raw Value Score	**Function Score (normalized)**	**Value Score (normalized)**
HYDROLOGIC GROUP (max of WS, SFS, WC, WW)	10.00	10.00	10.00	10.00
WATER QUALITY GROUP (max of SR, PR, NR)	10.00	3.38	10.00	5.24
CARBON GROUP (max of CS, OE)	8.01	0.00	9.76	0.00
FISH GROUP (max of FA, FR)	3.98	2.50	2.01	3.66
AQUATIC SUPPORT (max of INV, AM, WBF, WBN)	7.19	4.00	5.11	6.72
TERRESTRIAL SUPPORT (max of SBM, POL, PH)	4.41	5.00	5.78	4.21
SOCIAL GROUP (max of PU, Subsis)		4.14		7.12
WETLAND CONDITION (same as EC)		3.50		2.17
WETLAND RISK (average of Sens & STR)		4.56		7.86

This table does not provide new information. It simply condenses the initial list of 23 functions, values, and attributes into a shorter list of 9 by putting them in thematic groups, as requested by some users. This is only one of many ways the individual functions, values, and attributes might have been grouped. Grouping is not an essential part of WESPAK-SE. A group scores table is not provided in the tidal calculator because, due to the reduced number of functions that are scored by that calculator, it was considered unnecessary.

As is shown in the parentheses following each group's name, the score for that group is the highest score from among the group's members, which are identified by the abbreviations found in the first part of the Scores worksheet. WESPAK-SE could have instead used the average of the scores of each group's component functions to represent that group, but averaging will obscure a wetland's exceptional performance for just one of the functions in a group. It is widely recognized that few wetlands perform well for all functions -- indeed, some functions are inversely correlated. Use of the "maximum" as the decision rule for grouping functions recognizes that in a local or regional context some wetlands should be protected because they are exceptional for Water Storage, others for Carbon Sequestration, others for Anadromous Fish Habitat, etc. Averaging alone would not accomplish that.

Now, look at the right side of the Scores worksheet (in **Table 5** just the part dealing with Functions is shown, although the following description applies equally to the Values part).

Table 5. Partial results as shown in the right portion of the Scores worksheet.

	FUNCTION			
	Median of 119 SE Alaska wetlands	*Thresholds for Function Rating (normalized score)*		**Function Rating**
Specific Functions or Values:		Low	High	
Surface Water Storage (WS)	2.83	<2.7	>6.3	Moderate
Stream Flow Support (SFS)	3.33	<2.6	>6.1	Moderate

The column that is headed "Median" is purely informational, i.e., not used in calculating any scores. It indicates that, for the Water Storage function, half of the statistical sample of 119 non-tidal wetlands had a normalized function score less than 2.83 on the 0-to-10 scale, and for the other half it was higher. In other words, for this function, the scores were strongly skewed towards the lower end of the 0-to-10 scale. That could be due to most wetlands not performing at a relatively high level in this region for this function in

the way we defined it, or to predictive bias among the only indicators available for rapidly assessing this function, or to the structure of the model used to predict the function, or various other factors. In some scoring models, conditions of most of the indicators used (e.g., vegetation percent cover) are easily met in many wetlands thus leading to a higher median score, whereas in the models for other functions, conditions of many of the indicators used tend to occur less commonly or are difficult to identify (e.g., evidence of springs) and lead to a lower median score. In summary, for various reasons the statistical distributions of scores across the 0-10 range is not the same for all the scored functions (or values). *For these and other reasons, the scores of **tidal** wetlands, as calculated by WESPAK-SE, should normally **not** be compared with the scores of non-tidal wetlands.*

In the last column of Table xx ("Function Rating"), the spreadsheet calculator evaluates the normalized function score that was reported for each function and automatically categorizes that score as Low, Moderate, or High relative to the set of 119 wetlands. The middle two "Thresholds" columns of this segment of the table give the numeric boundaries that define Low and High, with any score in between being classified as Moderate. ***At the time of this writing, those specific thresholds have not been finalized for any function or value***. There are multiple ways they could be derived. Thus, ***these thresholds and the categorical ratings should not be reported or used to inform decisions until further notice.*** Check back regularly at:

http://southeastalaskalandtrust.org/wetland-mitigation-sponsor/

2.3.3 Determining How the Scores Were Derived

For a full, non-technical description of how each raw function or value score is calculated, please read Appendix F. The following paragraph only summarizes the main features.

If you wish to see which indicators (questions) contributed to each function or other attribute, once you finish entering all the requested data for a wetland into the calculator spreadsheet, click on the worksheet tab for a particular function (WS, SR, etc.) and you will see both the indicators and in column D, your responses. Larger numbers (on a scale of 0-**to-1**) in the green cells in column G tentatively suggest which indicators may have had the most effect on the function or value score. Empty green cells usually denote questions that were inapplicable in the context of the type of wetland you had assessed; see italicized sentences in column H for explanation. The indicator scores in the green cells were not simply averaged or summed to generate a function's raw score. The formulas used to combine them can be found in the last green cell in column G (for

raw function score) and the blue cell just below that (for raw value score). For some functions, intermediate mathematical operations were performed and are documented in the beige cells in a section above the final raw scores.

2.3.4 Rolling Up Functions and Values

At present, the calculator does not combine any function and its related value into a single score or rating, or combine all the functions and/or all the values into a single "overall" score or rating. Southeast Alaska Land Trust will soon be presenting options or recommendations for the mathematical procedures to be applied in doing that, but ultimately the decisions about how that is done will rest with the regulatory agencies. WESPAK-SE users should check the SEAL Trust web site regularly for updates.

2.3.5 Thinking Beyond Numbers and Ratings

Before accepting the scores or ratings that the calculator reports, think carefully about those results. From your knowledge of wetland functions, do they make sense for this wetland and/or AA? If not, review the worksheet for that function or other attribute, as well as Appendix F to understand how the score was determined. If you want to reconsider one of your responses (perhaps because you weren't able to see part of the AA, or view it during a preferred time of year), change the 0 or 1 you entered on *Form OF*, *F,* or *S*. Then check the Scores worksheet to see what effect that had. You may do the same (changing various 0's and 1's) if you'd like to simulate the potential effect of an enhancement or restoration measure on function scores, or the impact on those scores from some controllable or uncontrollable alteration or management activity within the AA or wetland, its contributing area, or surrounding landscape out to within 2 miles. However, understand that WESPAK-SE is not intended to predict changes to an AA – only to estimate the likely direction and relative magnitude of those changes, <u>if</u> they occur, on various functions and other attributes.

If you disagree with some of the assumptions that led to that score, or were unable to answer some of the questions with as much certainty as you felt they warranted, write a few sentences explaining your reasoning when you submit the assessment to regulatory agencies. Remember, WESPAK-SE is just one tool intended to help the decision-making process, and other important tools are your common sense and professional experience with a particular function, wetland type, or species. Review again the caveats given in the Limitations section (Section 1.4).

The *scarcity* of a wetland "type" (as WESPAK-SE defines those in question F1, or using the NWI classification, the hydrogeomorphic system, size class, and/or other classification) has often been proposed as an indicator of an individual wetland's value. However, it remains a challenge to find agreement among those who would split wetlands into finer and finer types (raising the odds of many of those being judged "rare"), and those persons who would lump wetlands into just a few types. Ultimately, the best classification or typing system will be one that is truest to the key differences in functions among the classes it defines -- not just one that classifies wetlands based on the finest distinctions that can be made using aerial imagery. WESPAK-SE focuses on wetland functions, and does not presume that relative differences in those can be captured adequately by any existing classification system. Instead, it augments classification with dozens of other indicators. That allows WESPAK-SE to provide a foundation for assessing the scarcity of a particular level of wetland *function* at local and regional scales, and thus to carry the scarcity concept to a more refined level than allowed by simple classification alone.

2.3.6 Document the Assessment

If you are a consultant submitting the assessment to a regulatory agency in support of a permit application, you should submit not just the Scores worksheet, but the entire spreadsheet file containing your answers to questions, along with a short report, aerial and ground-level photos, and lines on the aerial showing where you defined the AA boundary to be. Ultimately, it is up to regulatory agencies or other decision-makers to determine how much documentation to require for routine WESPAK-SE assessments submitted in support of wetland permit applications.

3.0 Literature Cited

Adamus, P., J. Morlan, and K. Verble. 2009. Oregon Rapid Wetland Assessment Protocol (ORWAP): calculator spreadsheet and manual. Oregon Dept. of State Lands, Salem, OR.

Andres, B.A. 1999. Landbird Conservation Plan for Alaska Biogeographic Regions. Boreal Partners In Flight Working Group, US Fish & Wildlife Service, Anchorage, AK.

Brock, M. and P. Coiley-Kenner. 2009. A compilation of traditional knowledge about the fisheries of Southeast Alaska. Technical Paper No. 332. Division of Subsistence, Alaska Dept.of Fish & Game, Juneau.

Carstensen, R., R. H. Armstrong, and R. M. O'Clair. 1992 (2014 revised). The Nature of Southeast Alaska: A Guide to Plants, Animals, and Habitats (Alaska Geographic).

CH2M Hill. 2010. Evaluation of wetland assessment methods and credit-debit systems for in-lieu fee mitigation of coastal aquatic resources in Southeast Alaska. Report to Southeast Alaska Land Trust, Juneau, AK. http://southeastalaskalandtrust.org/wetland-mitigation-sponsor/

Costanza, R., R. d'Arge, R. d. Groot, S. Farberk, M. Grasso, B. Hannon, K. Limburg, S. Naeem, R. V. O'Neill, J. Paruelo, R. G. Raskin, P. Suttonkk, and M. van den Belt. 1997. The value of the world's ecosystem services and natural capital. Nature 387(6630):253-260.

Euliss , N.H., L.M. Smith, D.A. Wilcox, and B.A. Browne. 2008. Linking ecosystem processes with wetland management goals: charting a course for a sustainable future. Wetlands 28(3):553-62.

Finlayson, C. M., R. D'Cruz, and N. Davidson. 2005. Ecosystems and Human Well-being: Wetlands and Water: Synthesis. World Resources Institute, Washington, DC.

Hansson, L., C. Bronmark, P.A. Nilsson, and K. Abjornsson. 2005. Conflicting demands on wetland ecosystem services: nutrient retention, biodiversity or both? Freshwater Biology 50(4):705-14.

Schoen, J.W. and E. Dovichin (editors). 2007. The Coastal Forests and Mountains Ecoregion of Southeastern Alaska and the Tongass National Forest: A Conservation Assessment and Resource Synthesis. Audubon Alaska and The Nature Conservancy, Anchorage, Alaska.

Smith, L.M., N.H. Euliss, D.A. Wilcox, and M.M. Brinson. 2008. Application of a geomorphic and temporal perspective to wetland management in North America. Wetlands 28:563-77.

Zedler, J. and S. Kercher. 2005. Wetland resources: status, trends, ecosystem services, and restorability. Annual Review of Environment and Resources 30:39-74.

Appendix A. Maps Required to Answer Selected Form OF Questions

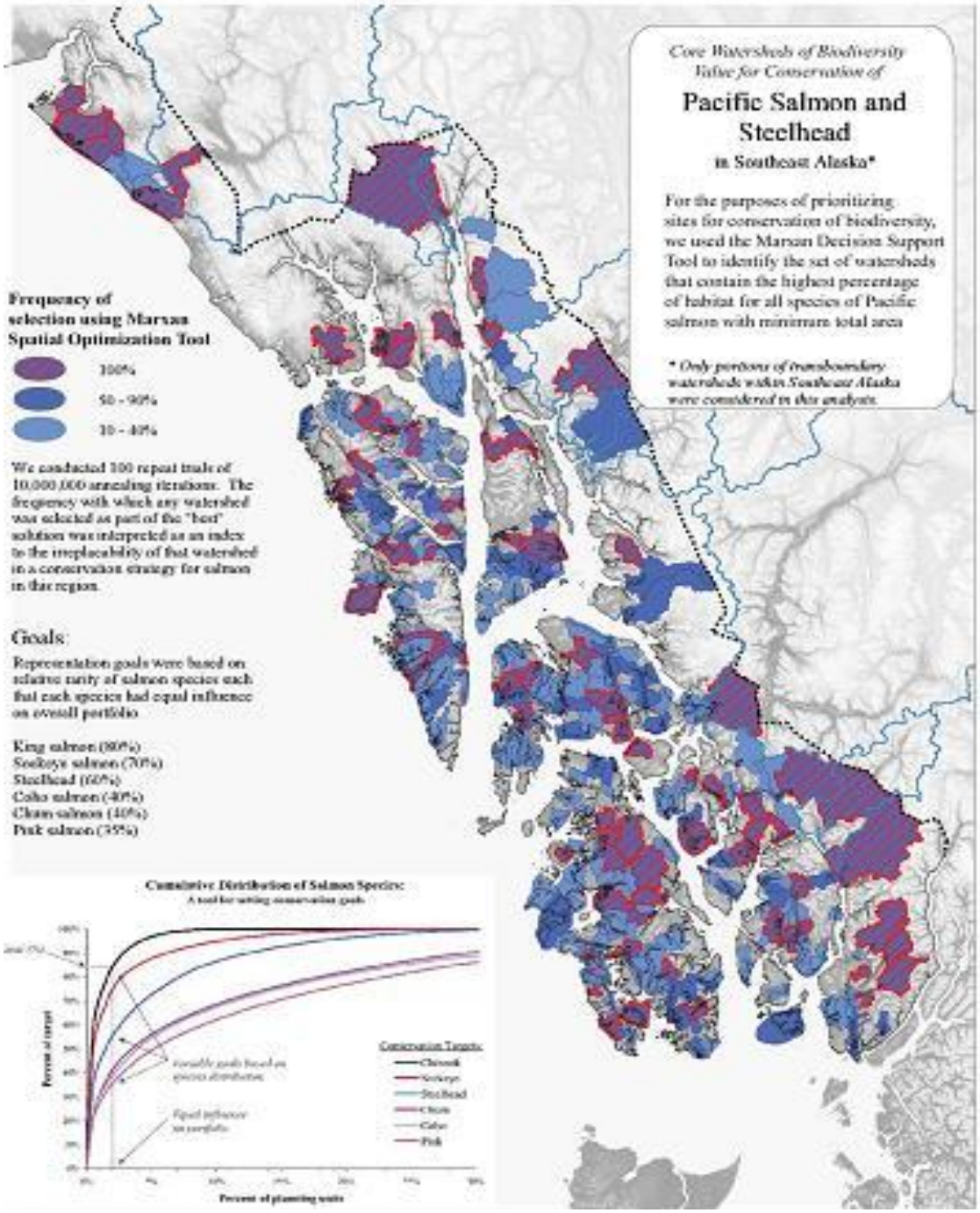


Figure A-1. Salmonid watersheds prioritized for Southeast Alaska (from: Schoen & Dovichin 2007)

Use this for question OF38 in the Non-tidal and OF33 in the Tidal WESPAK-SE. A more readable version of this map may be posted on the UAS web site.

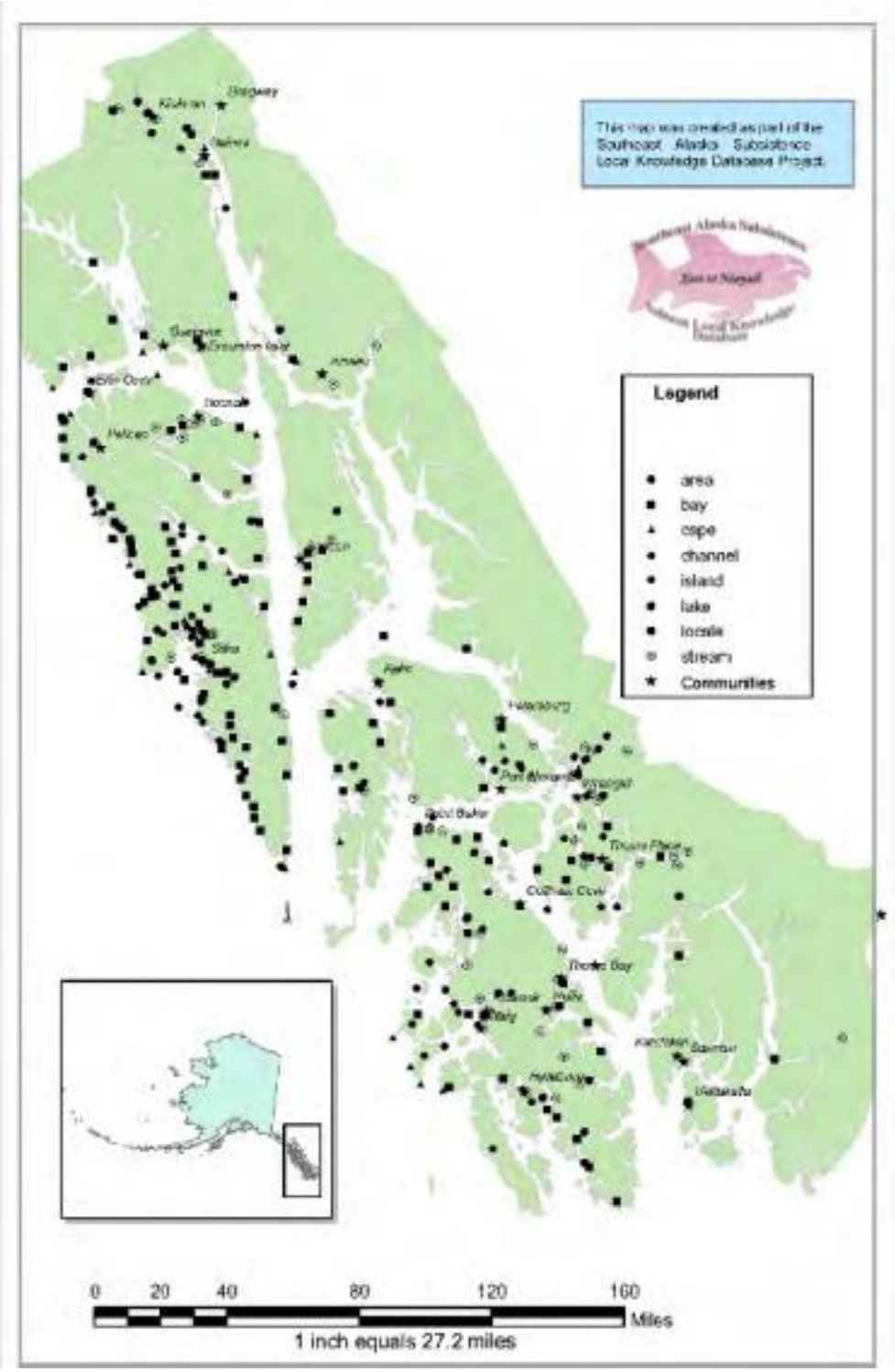


Figure A-2a. Identified subsistence fisheries harvest and use areas. (from: Brock & Coiley-Kenner 2009)

Use this for question OF39 in the Non-tidal, OF34 in the Tidal WESPAK-SE. See next page.

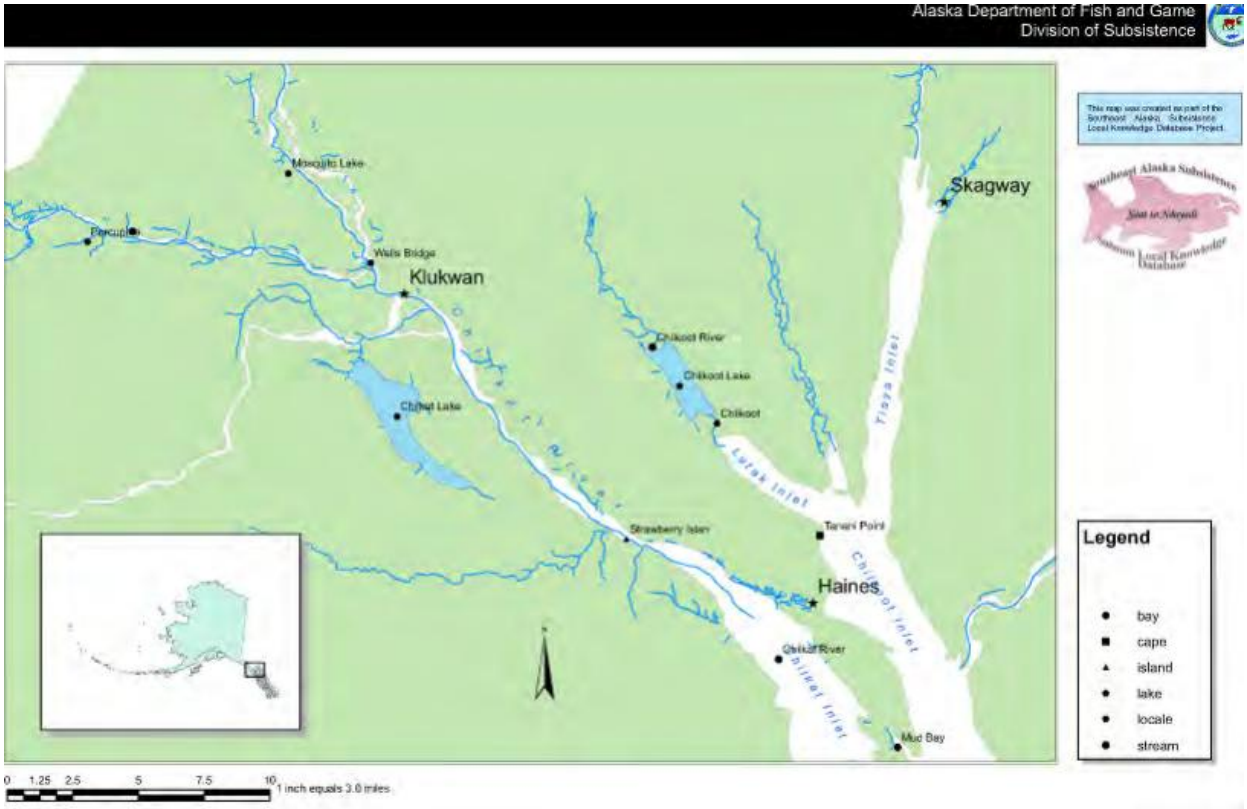


Figure A-2b. Identified subsistence fisheries in the Haines, Chilkat, Chilkoot, and Klukwan Rivers, in smaller font. (from: Brock & Coiley-Kenner 2009)

Figure A-2c. Identified subsistence fisheries areas in the Hoonah and Angoon vicinity, in smaller font. (from: Brock & Coiley-Kenner 2009)

Appendix B. Tabular Information Required to Answer Selected WESPAK-SE Questions

Table B-1. Most Extensive Estuaries Within Their Biogeographic Provinces (PU_IDs)
(from: Schoen & Dovichin 2007)
Use this for WESPAK-SE question OF31 on Tidal data form OF.

Top-ranked (score=3)

Location	Biogeographic Province	PU_ID
Ahrnklin River Estuary	Yakutat Forelands	428
Alsek Dry Bay / E. Alsek	Fairweather IceS	1029
Annette - Crab Bay	Revilla Island / Cleveland Peninsula	93
Appleton Cove	E. Baranof Island	336
Bartlet River / Beardslee Is.	Glacier Bay	64
Davidson Glacier	Chilkat River Complex	18
Fish Bay	W. Baranof Island	329
Gambier Bay	Admiralty Island	184
Hidden Inlet	South Misty Fjords	992
Lower Chikamin River	North Misty Fjords	922
Mendenhall Valley	Lynn Canal / Mainland	1027
Neka Bay	E. Chichagof Island	224
Port Bazan	Dall Island Complex	770
Rocky Pass	Kupreanof / Mitkof Islands	492
S Arm Moira Sound	South Prince of Wales Island	808
Salmon Bay Lake (downriver from)	North Prince of Wales Complex	619
Security Bay	Kuiu Island	459
Slocum Arm	W. Chichagof Island	313
Stikine Delta - South	Stikine River / Mainland	569
Taku River	Taku River / Mainland	528
Thoms Lake	Etolin Zarembo Island Complex	550
Warm Chuck Inlet	Outside Islands	659

Second-ranked (score= 2)

Location	Biogeographic Province	PU_ID
Akwe Beach	Yakutat Forelands	439
Baker Is	Outside Islands	667
Berners Bay	Lynn Canal / Mainland	174
Big John Bay	Kupreanof / Mitkof Islands	490
Bobs Bay	Dall Island Complex	750
Cape Spencer	Fairweather IceS	83
Carroll Cr Revilla	Revilla Island / Cleveland Peninsula	866
Farugut Bay - S. Arm	Stikine River / Mainland	1017
Ferebee River	Chilkat River Complex	48

Location	Biogeographic Province	PU_ID
Gustavus Forelands	Glacier Bay	68
Juneau / Gastineau Channel	Taku River / Mainland	366
Kadashan River	E. Chichagof Island	262
Kitkun Bay	South Prince of Wales Island	793
Klawock Lake / Inlet	North Prince of Wales Complex	716
McHenry Inlet Etolin	Etolin Zarembo Island Complex	543
Nakwasina Passage	W. Baranof Island	345
Pybus Bay	Admiralty Island	198
Saginaw Bay	Kuiu Island	456
Saook Bay	E. Baranof Island	337
Stag Bay	W. Chichagof Island	294
Unuk River	North Misty Fjords	914
Upper Fillmore Inlet	South Misty Fjords	995

Third-ranked (score= 1)

Location	Biogeographic Province	PU_ID
Cannon Beach	Yakutat Forelands	427
Excursion River	Glacier Bay	54
Fools Inlet	Etolin Zarembo Island Complex	552
Hood Bay	Admiralty Island	186
Idaho Inlet	E. Chichagof Island	208
Kadake Cr	Kuiu Island	484
Kelp Bay - South Arm	E. Baranof Island	360
Lower Castle River	Kupreanof / Mitkof Islands	500
Moira Sound - N. Arm	South Prince of Wales Island	797
N Fork Bradfield River	Stikine River / Mainland	591
Port Houghton Salt Chuck	Taku River / Mainland	918
Port Althorp	W. Chichagof Island	206
Port Refugio	Outside Islands	746
Port Stewart	Revilla Island / Cleveland Peninsula	838
Soule River	North Misty Fjords	938
St. James Bay	Lynn Canal / Mainland	117
Staney Estuary	North Prince of Wales Complex	687
Sukoi Inlet / N. Krestof Sound	W. Baranof Island	348
Taiya River	Chilkat River Complex	1
Vesta Bay	Dall Island Complex	766

Table B-2. Least Extensive Estuaries Within Their Biogeographic Provinces
(from: Schoen & Dovichin 2007)
Use this for WESPAK-SE Tidal data form OF, question OF32.

Location	Biogeographic Province	PU_ID
916 Lake	E. Chichagof Island	277
Annette - Red Mtn	Revilla Island / Cleveland Peninsula	87
Apex-el Nido	E. Chichagof Island	296
Betton Island	Revilla Island / Cleveland Peninsula	1007
California Cove - Revilla	Revilla Island / Cleveland Peninsula	883
Cann Creek	E. Chichagof Island	297
Cholmondeley - Monie Lake	North Prince of Wales Complex	724
Cholmondeley Sound	North Prince of Wales Complex	790
Edna Bay	North Prince of Wales Complex	638
False Bay	E. Chichagof Island	234
False Island	E. Chichagof Island	274
First No. 2	E. Chichagof Island	231
Flicker Creek	North Prince of Wales Complex	608
Goose View	E. Chichagof Island	248
Gypsum Cr	E. Chichagof Island	236
Holbrook Arm	North Prince of Wales Complex	640
Hoonah	E. Chichagof Island	229
Karheen	North Prince of Wales Complex	658
Kasaan	North Prince of Wales Complex	707
Kasaan Island	North Prince of Wales Complex	727
Kennel Cr	E. Chichagof Island	241
Loon Lakes	E. Chichagof Island	214
Manzanita Bay E Rev	Revilla Island / Cleveland Peninsula	902
Mills Bay	North Prince of Wales Complex	706
Moser Is	E. Chichagof Island	328
Mt Francis	North Prince of Wales Complex	631
Nadzaheen Cove	Revilla Island / Cleveland Peninsula	88
Naukati Bay	North Prince of Wales Complex	670
New Tokeen	North Prince of Wales Complex	653
Pleasant Island	E. Chichagof Island	201
Port Estrella	North Prince of Wales Complex	741
Port Protection	North Prince of Wales Complex	605
Pt. Adolphus	E. Chichagof Island	216
Pt. Cannery	E. Chichagof Island	243
Red Lake	North Prince of Wales Complex	616
S Sukkwan Is	North Prince of Wales Complex	784
Salt Chuck N Karta	North Prince of Wales Complex	701
Sarheen Cove	North Prince of Wales Complex	644

Location	Biogeographic Province	PU_ID
SE Skowl Arm	North Prince of Wales Complex	722
Sea Otter Sound	North Prince of Wales Complex	652
Seal Creek	E. Chichagof Island	238
Settlers Cove SW Rev	Revilla Island / Cleveland Peninsula	1008
Shaheen Creek	North Prince of Wales Complex	690
Shipley Bay	North Prince of Wales Complex	632
Slide Creek	North Prince of Wales Complex	685
South Passage	E. Chichagof Island	266
Squaw Creek	North Prince of Wales Complex	630
Steelhead River	E. Chichagof Island	298
Sunny Cove SE POW	North Prince of Wales Complex	789
Tarn Mountain	E. Chichagof Island	283
Tolstoi Bay	North Prince of Wales Complex	702
Tracodero Bay	North Prince of Wales Complex	735
Trap Bay	E. Chichagof Island	265
Tuxekan NE	North Prince of Wales Complex	654
Twelvemile - Outer Pt	North Prince of Wales Complex	720
Ward Cove	Revilla Island / Cleveland Peninsula	873

Table B-3. Invasive Plants Sometimes Found in Southeast Alaska Wetlands
Use this for WESPAK-SE Non-tidal questions F53 and F54.

Scientific Name	Common Name
Capsella bursa-pastoris	Shepherd's-Purse
Cerastium fontanum	Common (Big) Mouse-ear Chickweed
Cirsium arvense	Canadian Thistle
Elymus repens	Creeping Wild Rye
Fallopia japonica	Japanese Black-bindweed
Leucanthemum vulgare	Ox-eye Daisy
Matricaria discoidea	Pineapple-weed
Phalaris arundinacea	Reed Canary Grass
Phleum pratense	Common Timothy
Poa annua	Annual Blue Grass
Ranunculus repens	Creeping Buttercup
Sonchus arvensis	Field Sow-Thistle
Sorbus aucuparia	European Mountain-ash
Trifolium dubium	Suckling Clover
Trifolium hybridum	Alsike Clover
Trifolium repens	White Clover

Table B-4. Non-native Plants Sometimes Found in Southeast Alaska Wetlands

Scientific Name of Non-native Species	Common Name
Agrostis capillaris	Colonial Bent
Agrostis gigantea	Black Bent
Agrostis stolonifera	Spreading Bent
Aira caryophyllea	Common Silver-Hair Grass
Alliaria petiolata	Garlic-Mustard
Alopecurus geniculatus	Marsh Meadow-Foxtail
Alopecurus pratensis	Field Meadow-Foxtail
Amaranthus albus	Tumbleweed
Amaranthus retroflexus	Red-Root
Anthemis cotula	Stinking Chamomile
Anthoxanthum odoratum	Large Sweet Vernal Grass
Arrhenatherum elatius	Tall Oat Grass
Atriplex patula	Halberd-Leaf Orache
Bidens frondosa	Devil's-Pitchfork
Brassica juncea	Chinese Mustard
Brassica rapa	Rape
Bromus hordeaceus	Soft Brome
Bromus inermis	Smooth Brome
Bromus vulgaris	Columbia Brome
Calystegia sepium	Hedge False Bindweed
Camelina sativa	Gold-of-Pleasure
Capsella bursa-pastoris	Shepherd's-Purse
Cerastium fontanum	Common (Big) Mouse-Ear Chickweed
Cerastium glomeratum	Sticky Mouse-Ear Chickweed
Chenopodium album	Lamb's-Quarters
Chenopodium leptophyllum	Narrow-Leaf Goosefoot
Cirsium arvense	Canadian Thistle
Cirsium vulgare	Bull Thistle
Collomia linearis	Narrow-Leaf Mountain-Trumpet
Conyza canadensis	Canadian Horseweed
Cotula coronopifolia	Common Brassbuttons
Crepis capillaris	Smooth Hawk's-Beard
Dactylis glomerata	Orchard Grass
Deschampsia danthonioides	Annual Hair Grass
Deschampsia elongata	Slender Hair Grass
Digitalis purpurea	Purple Foxglove
Elymus repens	Creeping Wild Rye
Fallopia convolvulus	Black-Bindweed
Fallopia japonica	Japanese Black-Bindweed
Fallopia sachalinensis	Giant Black-Bindweed
Geranium richardsonii	Richardson's Geranium
Glechoma hederacea	Groundivy

Scientific Name of Non-native Species	Common Name
Gnaphalium uliginosum	Marsh Cudweed
Hesperis matronalis	Mother-of-the-Evening
Holcus lanatus	Common Velvet Grass
Hordeum jubatum	Fox-Tail Barley
Hypericum perforatum	Common St. John's-Wort
Hypochaeris radicata	Hairy Cat's-Ear
Impatiens glandulifera	Ornamental Jewelweed
Lapsana communis	Common Nipplewort
Lepidium densiflorum	Miner's Pepperwort
Lepidium virginicum	Poorman's-Pepperwort
Leucanthemum vulgare	Ox-Eye Daisy
Lolium perenne	Perennial Rye Grass
Lotus corniculatus	Bird's-foot Trefoil
Lupinus polyphyllus	Blue-Pod Lupine
Madia glomerata	Mountain Tarplant
Marrubium vulgare	White Horehound
Matricaria discoidea	Pineapple-Weed
Medicago lupulina	Black Medick
Medicago polymorpha	Toothed Medick
Medicago sativa	Alfalfa
Melilotus officinalis	Yellow Sweet-Clover
Mentha spicata	Spearmint
Microsteris gracilis	Annual-Phlox
Myosotis asiatica	Asian Forget-Me-Not
Myosotis scorpioides	True Forget-Me-Not
Myosotis sylvatica	Woodland Forget-me-not
Nepeta cataria	Catnip
Nymphaea odorata	American White Water-Lily
Persicaria maculosa	Lady's-Thumb
Phalaris arundinacea	Reed Canary Grass
Phalaris canariensis	Common Canary Grass
Phleum pratense	Common Timothy
Plagiobothrys figuratus	Fragrant Popcorn-Flower
Plantago lanceolata	English Plantain
Plantago major	Great Plantain
Poa annua	Annual Blue Grass
Poa compressa	Flat-Stem Blue Grass
Poa pratensis	Kentucky Blue Grass
Poa trivialis	Rough-Stalk Blue Grass
Polygonum aviculare	Yard Knotweed
Polygonum persicaria	Spotted Ladysthumb
Polygonum ramosissimum	Yellow-Flower Knotweed
Polypogon monspeliensis	Annual Rabbit's-Foot Grass
Prunus padus	European Bird Cherry

Scientific Name of Non-native Species	Common Name
Puccinellia distans	Spreading Alkali Grass
Ranunculus acris	Tall Buttercup
Ranunculus repens	Creeping Buttercup
Raphanus sativus	Garden Radish
Rosa rugosa	Rugosa Rose
Rubus idaeus	Common Red Raspberry
Rumex acetosella	Common Sheep Sorrel
Rumex crispus	Curly Dock
Rumex longifolius	Door-Yard Dock
Rumex obtusifolius	Bitter Dock
Sagina procumbens	Bird-Eye Pearlwort
Senecio jacobaea	Tansy Ragwort
Senecio vulgaris	Old-Man-in-the-Spring
Sisymbrium altissimum	Tall Hedge-Mustard
Solanum nigrum	European Black Nightshade
Sonchus arvensis	Field Sow-Thistle
Sonchus asper	Spiny-Leaf Sow-Thistle
Sonchus oleraceus	Common Sow-Thistle
Sorbus aucuparia	European mountain-ash
Spergularia rubra	Ruby Sandspurry
Stellaria media	Common Chickweed
Symphytum asperum	Prickly Comfrey
Tanacetum vulgare	Common Tansy
Taraxacum officinale	Common Dandelion
Thlaspi arvense	Field Pennycress
Trifolium dubium	Suckling Clover
Trifolium hybridum	Alsike Clover
Trifolium pratense	Red Clover
Trifolium repens	White Clover
Vaccaria hispanica	Cowcockle
Veronica anagallis-aquatica	Blue Water Speedwell
Veronica arvensis	Corn Speedwell
Veronica chamaedrys	Germander Speedwell
Veronica peregrina	Neckweed
Veronica serpyllifolia	Thyme-Leaf Speedwell
Vicia sativa	Garden Vetch

Table B-5. Uncommon or At-Risk Wetland Plant Species of Southeast Alaska
These are species with a wetland indicator status of OBL, FACW, or FAC; are designated by the Alaska Natural Heritage Program as S1, S2, or S3; and have been reported at least once from the region. Use this for WESPAK-SE Non-tidal question OF46 and WESPAK-SE Tidal question OF40.

Scientific Name of Uncommon Plant	Wetland Indicator Status 2011	Common Name
Agoseris aurantiaca	FAC	Orange-Flower Goat-Chicory
Agoseris glauca	FAC	Pale Goat-Chicory
Aphragmus eschscholtzianus	FACW	Aleutian-Cress
Arnica mollis	FACW	Cordilleran Leopardbane
Asplenium trichomanes	FAC	Maidenhair Spleenwort
Astragalus robbinsii	FAC	Robbins' Milk-Vetch
Brasenia schreberi	OBL	Watershield
Cardamine bellidifolia	FAC	Alpine Bittercress
Carex atherodes	OBL	Wheat Sedge
Carex athrostachya	FAC	Slender-Beak Sedge
Carex atratiformis	FACW	Scabrous Black Sedge
Carex bebbii	OBL	Bebb's Sedge
Carex crawfordii	FAC	Crawford's Sedge
Carex interior	OBL	Inland Sedge
Carex leptalea	OBL	Bristly-Stalk Sedge
Carex phaeocephala	FAC	Mountain Hare Sedge
Carex stipata	OBL	Stalk-Grain Sedge
Castilleja parviflora	FACW	Small-Flower Indian-Paintbrush
Cirsium edule	FAC	Edible Thistle
Crassula aquatica	OBL	Water Pygmyweed
Crataegus douglasii	FAC	Black Hawthorn
Cryptogramma stelleri	FAC	Fragile Rockbrake
Cypripedium parviflorum	FACW	Yellow Lady's-Slipper
Dulichium arundinaceum	OBL	Three-Way Sedge
Eleocharis kamtschatica	FACW	Kamchatka Spike-Rush
Eleocharis quinqueflora	OBL	Few-Flower Spike-Rush
Erigeron glacialis	FACW	Glacier Fleabane
Eriophorum viridicarinatum	OBL	Tassel Cotton-Grass
Glyceria leptostachya	OBL	Slender-Spike Manna Grass
Hymenophyllum wrightii	FAC	Wright's Filmy Fern
Isoetes occidentalis	OBL	Western Quillwort
Juncus articulatus	OBL	Joint-Leaf Rush
Juncus nodosus	OBL	Knotted Rush
Juncus tenuis	FACW	Lesser Poverty Rush
Lobelia dortmanna	OBL	Water Lobelia
Luzula comosa	FAC	Pacific Wood-Rush

Scientific Name of Uncommon Plant	Wetland Indicator Status 2011	Common Name
Lycopus uniflorus	OBL	Northern Water-Horehound
Maianthemum racemosum	FAC	Feathery False Solomon's-Seal
Maianthemum stellatum	FAC	Starry False Solomon's-Seal
Malaxis paludosa	OBL	Bog Adder's-Mouth Orchid
Mimulus lewisii	FACW	Great Purple Monkey-Flower
Mitella nuda	FAC	Bare-Stem Bishop's-Cap
Mitella trifida	FAC	Pacific Bishop's-Cap
Montia bostockii	FACW	Bostock's Candy-Flower
Myriophyllum verticillatum	OBL	Whorled Water-Milfoil
Penstemon serrulatus	FACW	Cascade Beardtongue
Physocarpus capitatus	FAC	Pacific Ninebark
Piperia unalascensis	FAC	Alaska Rein Orchid
Plantago major	FAC	Great Plantain
Platanthera chorisiana	OBL	Choriso Bog Orchid
Platanthera orbiculata	FAC	Lesser Round-Leaf Orchid
Poa leptocoma	FAC	Marsh Blue Grass
Primula tschuktschorum	FACW	Chukchi Primrose
Ranunculus gelidus	FACW	Arctic Buttercup
Rorippa curvisiliqua	FACW	Curve-Pod Yellowcress
Salix candida	OBL	Sage Willow
Salix hookeriana	FACW	Coastal Willow
Salix planifolia	FACW	Tea-Leaf Willow
Salix prolixa	FACW	Mackenzie's Willow
Salix reticulata	FAC	Net-Vein Willow
Salix setchelliana	FAC	Setchell's Willow
Saussurea americana	FACW	American Saw-Wort
Saxifraga rivularis	OBL	Alpine-Brook Saxifrage
Schizachne purpurascens	FAC	False Melic Grass
Schoenoplectus subterminalis	OBL	Swaying Club-Rush
Spiraea douglasii	FACW	Douglas' Meadowsweet
Thuja plicata	FAC	Western Arborvitae
Tiarella trifoliata	FAC	Three-Leaf Foamflower

Only a particular subspecies or variety of these is considered uncommon or imperiled:

Scientific Name	Wetland Indicator Status 2011	Common Name
Carex brunnescens ssp. alaskana	FAC	Brownish Sedge
Carex echinata ssp. echinata	OBL	Star Sedge
Erigeron acris ssp. kamtschaticus	FAC	Bitter Fleabane
Pinus contorta var. latifolia	FAC	Lodgepole (Shore) Pine

B-6. Major Locations for Salmon Subsistence or Personal Use Harvest, 1996-2006

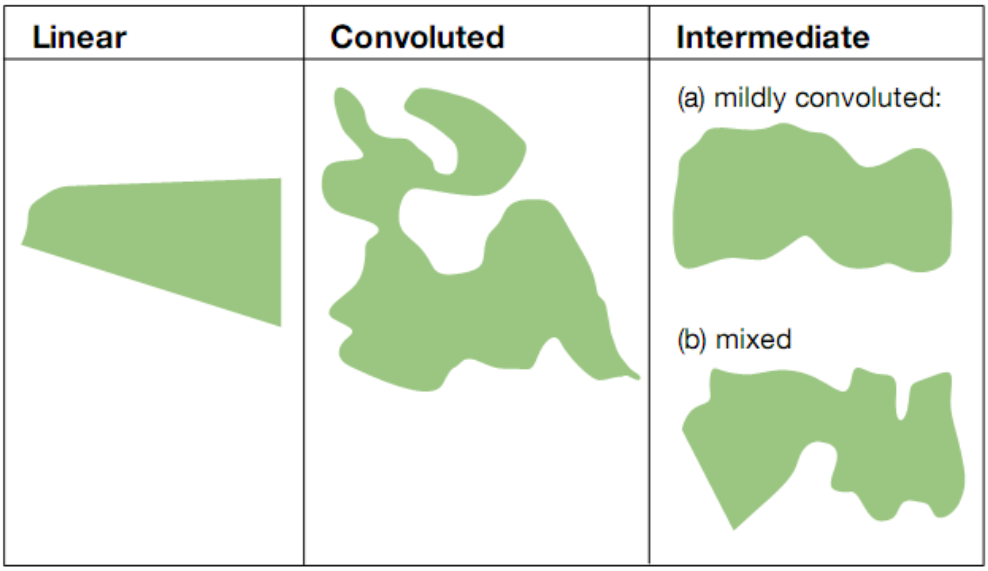
Use this for question OF38. These water bodies were in the 80th percentile or higher for average or maximum annual harvest of one or more species. Source: ADF&G Division of Commercial Fisheries - Region I, Integrated Fisheries Database (IFDB).

		AVERAGE Annual Subsistence & Personal Use Harvest						MAXIMUM Annual Subsistence & Personal Use Harvest					
District	**Water Body**	Chinook	Sockeye	Coho	Chum	Pink	**Total**	Chinook	Sockeye	Coho	Chum	Pink	**Total**
Haines	Chilkat Inlet	60	2288	67	250	164	2830	153	3097	183	437	352	3707
Haines	Chilkat River	24	2610	240	470	319	3662	57	3862	472	637	469	4740
Haines	Chilkoot Inlet	2	345	1	8	126	482	8	927	5	32	335	1279
Haines	Lutak Inlet	3	1083	6	27	325	1445	8	2376	31	64	609	2752
Haines	Taiya River	0	0	0	42	6	49	0	3	1	83	13	96
Haines	Tsirku/Big Salmon R	4	827	37	135	8	1012	4	827	37	135	8	1012
Juneau	Admiralty Creek	0	30	0	14	18	62	0	58	0	95	126	221
Juneau	Bear Creek Stephens Passage	0	0	0	55	0	55	0	0	0	129	0	129
Juneau	Excursion River	0	6	2	814	8	829	0	23	11	1923	54	1923
Juneau	Favorite Creek	0	8	4	49	9	69	0	54	26	69	63	126
Juneau	Gartina Creek	0	0	21	26	1	49	0	0	56	69	6	81
Juneau	Hasselborg Creek	0	70	207	4	7	288	0	139	635	35	35	816
Juneau	Kanalku Bay	0	1153	56	18	34	1260	0	2296	227	71	124	2429
Juneau	Kook Lake Outlet	0	537	24	5	22	588	0	1463	66	35	64	1491
Juneau	Little Basket Bay	0	309	0	0	0	309	0	563	0	0	0	563
Juneau	Neka River	0	3	16	15	5	39	0	23	28	87	37	144
Juneau	Neva Creek	0	236	6	271	56	569	0	580	39	1460	305	2115
Juneau	Pavlof River	0	0	8	26	55	89	0	0	40	91	122	214
Juneau	Seagull Creek	0	0	0	38	0	38	0	0	0	38	0	38
Juneau	Sweetheart Creek	0	3933	2	1	59	3996	3	7457	8	5	212	7504
Juneau	Taku River	27	1606	101	13	237	1984	49	1936	209	42	784	2384
Juneau	Whitestone E Side	0	0	0	59	53	112	0	0	0	105	105	210
Ketchikan	Coco Harbor Head	0	0	0	99	82	181	0	0	0	151	164	315
Ketchikan	Deweyville	0	86	0	0	2	88	0	197	0	0	18	197

		AVERAGE Annual Subsistence & Personal Use Harvest						MAXIMUM Annual Subsistence & Personal Use Harvest					
District	**Water Body**	Chinook	Sockeye	Coho	Chum	Pink	**Total**	Chinook	Sockeye	Coho	Chum	Pink	**Total**
Ketchikan	Dog Salmon Creek	0	15	1	35	15	65	0	51	5	252	59	287
Ketchikan	Eek Creek	0	425	5	0	5	436	1	969	34	2	27	981
Ketchikan	Herring Cove	159	9	0	9	2	179	294	62	1	34	5	338
Ketchikan	Hetta Inlet	0	1462	3	1	37	1503	1	3055	14	4	111	3134
Ketchikan	Karta River	0	816	19	14	8	857	1	1609	94	88	50	1661
Ketchikan	Kegan Cove	0	189	0	0	2	192	0	514	2	1	10	518
Ketchikan	Klakas Lake Creek	0	79	0	0	2	81	0	202	0	0	16	202
Ketchikan	Klawock River	1	4195	60	150	154	4560	2	7284	147	351	818	7490
Ketchikan	Maybeso Creek	0	2	1	14	197	215	0	13	12	39	541	576
Ketchikan	Old Tom Creek	0	0	0	30	60	90	0	0	0	30	60	90
Ketchikan	Red Creek	0	46	0	0	0	46	0	166	0	0	0	166
Ketchikan	Saint Nicholas N Side	0	0	0	28	68	96	0	0	0	62	207	210
Ketchikan	Sarkar	0	1244	13	0	13	1270	0	2113	95	1	57	2113
Ketchikan	Steelhead Creek	0	0	0	0	126	126	0	0	0	0	126	126
Ketchikan	Thorne River	0	251	21	1	12	285	4	641	53	2	34	651
Ketchikan	Wolverine Creek	17	6109	37	1117	879	8159	53	9225	86	2178	1901	11368
Petersburg-Wrangell	Alecks Creek	0	124	0	1	0	125	0	283	0	4	1	283
Petersburg-Wrangell	Crystal Creek	0	2	270	10	11	294	1	18	466	39	49	545
Petersburg-Wrangell	Hatchery Creek Sweetwater	0	946	4	0	2	952	2	1938	42	0	9	1939
Petersburg-Wrangell	Irish Creek/Rocky Pass	0	0	23	0	0	23	0	0	23	0	0	23
Petersburg-Wrangell	Kutlaku Creek	0	480	0	4	7	492	1	1092	0	29	26	1092
Petersburg-Wrangell	Mill Creek	27	377	3	109	18	533	90	816	10	384	65	1010
Petersburg-Wrangell	Port Camden S Head	0	0	14	12	0	26	0	0	54	25	0	54
Petersburg-Wrangell	Red Lake Creek	0	120	0	1	0	122	0	302	3	5	3	305
Petersburg-Wrangell	Salmon Bay Creek	0	925	6	7	20	959	2	2189	22	46	74	2252
Petersburg-Wrangell	Security Bay/Salt Chuck	0	3	4	168	9	185	0	22	21	373	58	373
Petersburg-Wrangell	Shipley Bay Lake Creek	0	65	0	0	0	66	0	192	2	1	3	192
Petersburg-Wrangell	Thoms Creek	1	310	0	13	27	352	6	536	0	39	224	546
Sitka	Falls Creek Baranof Island	3	1515	4	45	40	1606	8	2544	12	77	102	2679
Sitka	Fish Camp/Klag Bay	0	2255	8	12	24	2299	1	4371	29	39	98	4424
Sitka	Gut Bay Head	2	463	1	8	3	478	6	833	6	38	20	839

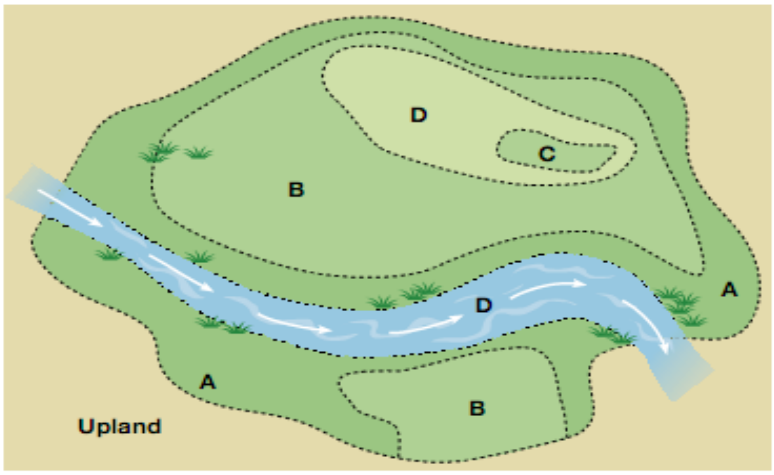
		AVERAGE Annual Subsistence & Personal Use Harvest						MAXIMUM Annual Subsistence & Personal Use Harvest					
District	**Water Body**	Chinook	Sockeye	Coho	Chum	Pink	**Total**	Chinook	Sockeye	Coho	Chum	Pink	**Total**
Sitka	Hanus Bay	0	72	0	1	0	73	0	180	0	9	2	180
Sitka	Hoktaheen Cove	0	1105	4	25	28	1163	2	1993	23	156	69	2173
Sitka	Lake Stream Ford Arm	0	574	0	3	3	581	0	1312	1	15	7	1326
Sitka	Leo Lake Fortuna Straits	0	96	1	1	4	102	1	323	10	6	21	352
Sitka	Lisianski River	0	0	0	32	20	52	0	0	0	32	20	52
Sitka	Nakwasina River	0	10	14	8	26	58	0	47	82	37	169	206
Sitka	Necker Bay Lake	0	6957	0	4	46	7009	1	11246	3	17	173	11425
Sitka	Redfish Bay Head	0	753	1	0	2	756	0	1184	6	1	7	1185
Sitka	Redoubt Lake Outlet	1	5542	10	19	43	5615	3	14240	50	86	194	14403
Sitka	Salmon Lake Stream	6	141	2	20	35	204	18	297	19	41	178	422
Sitka	Sitkoh Bay Head	0	78	10	0	0	88	0	119	21	0	0	140
Sitka	Sitkoh Lake Creek	0	274	2	15	49	340	0	1062	24	60	187	1189
Sitka	Starrigavin Creek	0	0	29	0	0	29	0	0	29	0	0	29
Sitka	Surge Bay	0	143	0	0	2	145	1	660	0	1	16	663
Sitka	Takanis Bay	0	72	1	1	0	74	0	146	4	7	4	157
Yakutat	Ahrnklin River	8	59	31	0	0	98	33	185	104	0	0	218
Yakutat	Akwe River	17	74	25	1	0	117	42	139	62	6	0	207
Yakutat	Alsek River	51	184	33	0	0	268	77	317	52	1	0	400
Yakutat	Ankau Creek	29	15	19	0	1	64	67	69	53	3	11	125
Yakutat	Dangerous River	2	77	15	1	2	98	21	121	107	11	21	278
Yakutat	East Alsek River	2	68	11	5	1	87	9	189	54	16	5	197
Yakutat	Icy Bay	0	0	35	0	0	35	0	0	35	0	0	35
Yakutat	Italio River	0	10	24	0	0	34	2	50	45	0	2	52
Yakutat	Lost River	2	7	39	0	0	48	7	40	89	0	0	89
Yakutat	Situk River	481	3495	1040	4	108	5128	701	4410	1513	18	201	6314
Yakutat	Tawah Creek	0	2	64	0	0	65	0	12	99	0	0	99
Yakutat	Tsiu River	0	0	64	0	0	64	0	0	174	0	0	174
Yakutat	Yakutat Bay	420	206	50	3	2	680	817	616	121	15	13	1292

Appendix C. Illustrations for Assessing Wetland Functions Using WESPAK-SE



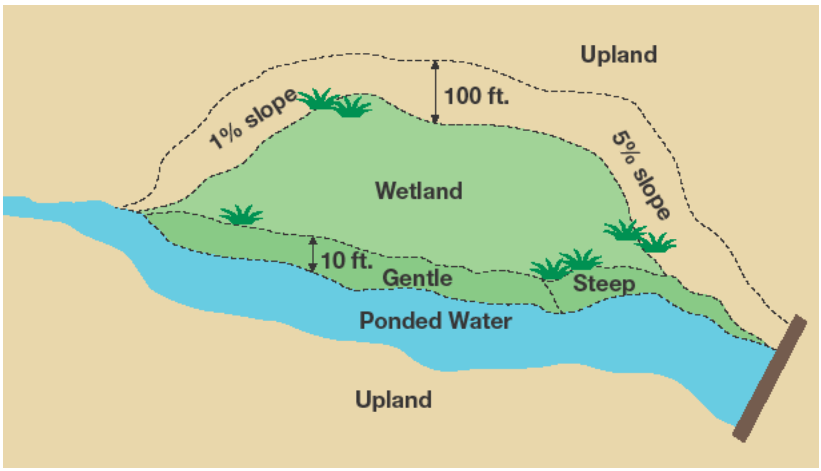
Upland Edge Complexity. Use this for Non-tidal question OF14 and Tidal question T28.

F9 **Predominant Depth Class and Depth Class Distribution**



The depth in most of this AA is Class B during most of the time surface water is present. No depth class comprises > 90% of the AA's inundated area, but Class B comprises > 50%.

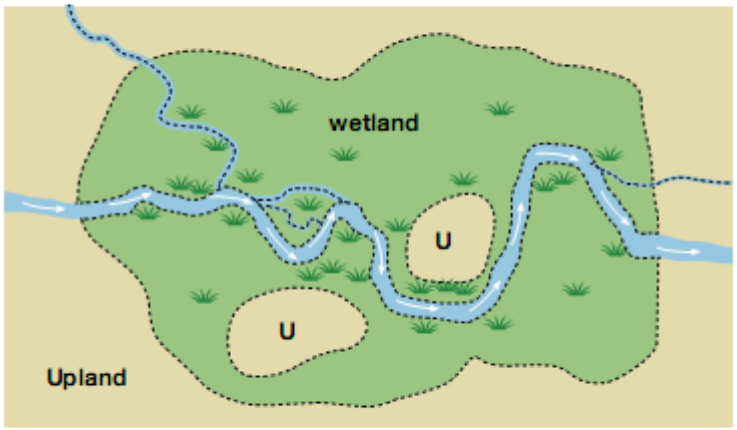
Use this for Non-tidal question F9.



Use this for Non-tidal question F12.

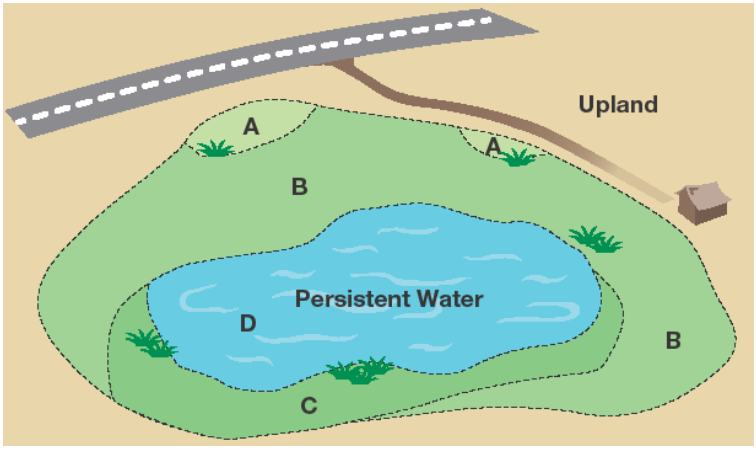
In this example, flat or gentle (<5%) slope comprises about 75% of the wetland-water edge or shoreline.

F27 **Throughflow Complexity**

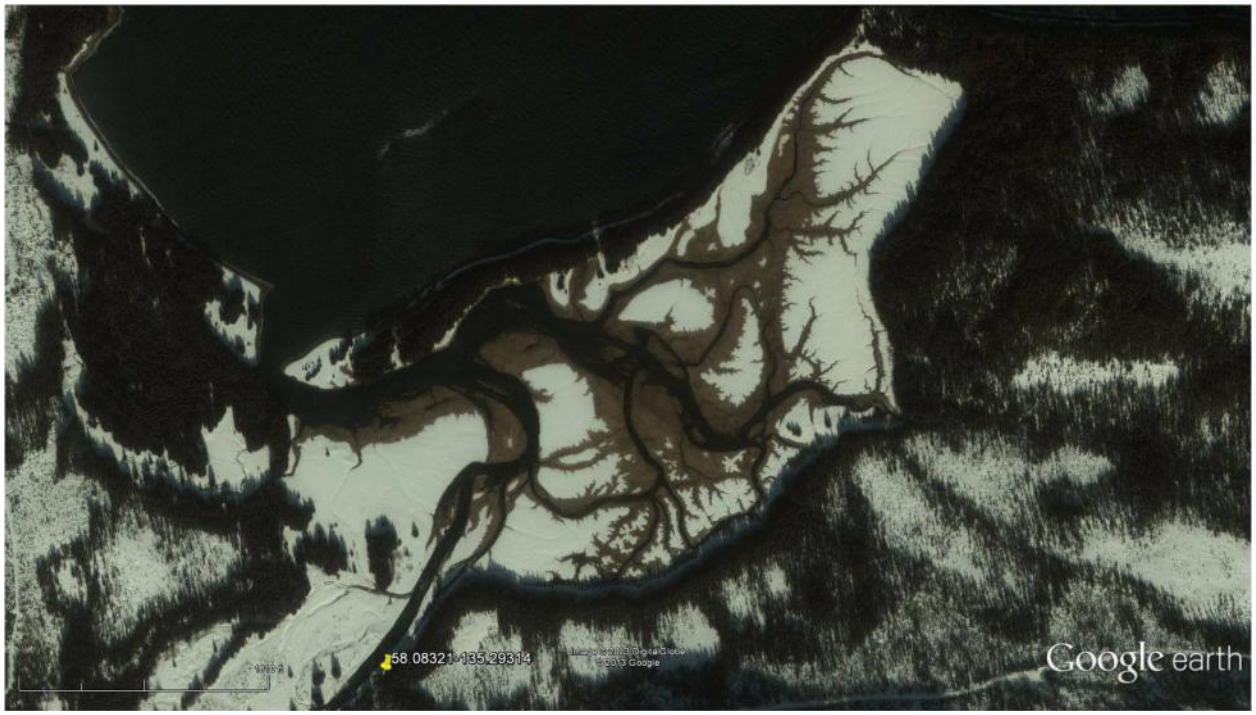


Throughflow complexity in this example is great (sinuous and braided channel, indirect flow path). U = upland inclusion.

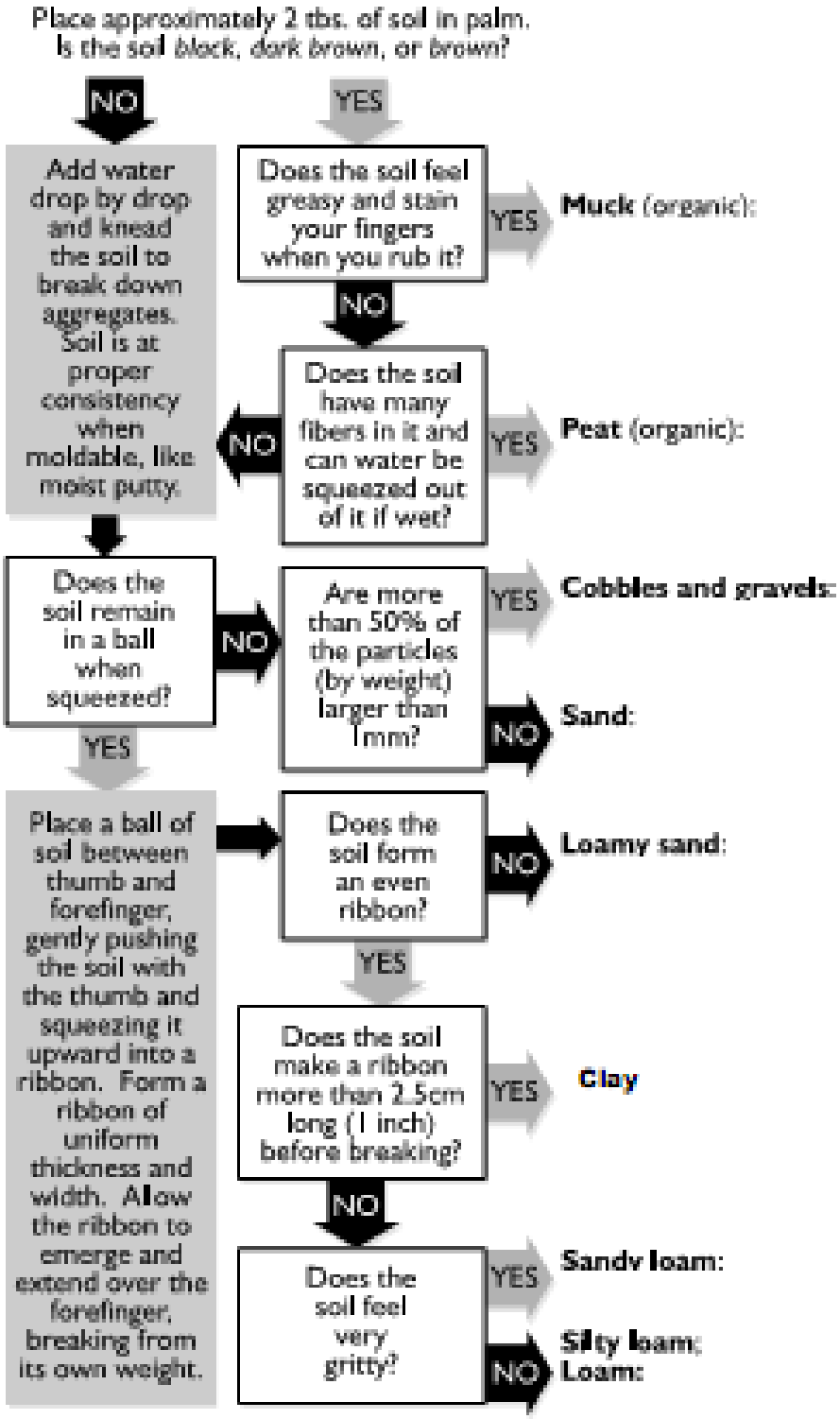
Use this for Non-tidal question F27.



Use this for Non-tidal questions F63 and F64 and Tidal questions T19 and T20.
Both wetland areas denoted "A" are visited almost daily for several weeks of the year because they are near a road and soil is saturated-only (never any standing water). Area D is almost never visited because water is too deep and inaccessable by boat. Area C is almost never visited because it is too distant from roads and trails, and vegetation is very dense. Area B fits neither category. Although A and B together comprise <5% of the AA, note that an inhabited building is within 300 ft of the AA.



This aerial of an Alaskan tidal marsh was fortuitously taken at low tide after a recent snow. Snow-covered areas are high marsh, brown is low marsh. Channel networks are clearly visible. This is useful for answering questions several "Form T" questions.



Flow Chart for Identifying Soil Texture (from: Washington Dept. of Ecology 2004). *This should be used to diagnose the soil texture. However, you need only determine if the soil is Loam (including Sandy Loam, Silty Loam), Coarse (including Loamy Sand, Sand, Cobbles & Gravels), Organic (Peat or Muck), or Fines (Clay).*

Appendix D. Non-tidal Wetland: Data Forms F and S

Site Name:

Form F. Non-tidal Wetland Data Form. WESPAK-SE version 2.0.

DIRECTIONS: Conduct an assessment only after reading the accompanying Manual and explanations in column E below. In the Data column, change the 0 (false) to a 1 (true) for the best choice, or for multiple choices where allowed and so indicated. Answer these questions primarily based on your onsite observations and interpretations. Do not write in shaded parts of this data form. Answering some questions accurately may require conferring with the landowner or other knowledgable persons, and/or reviewing aerial imagery. For most wetlands, completing this field data form require 1-2 hours on a site. For a listing of functions to which each question pertains, see bracketed codes in column E. For detailed descriptions of each WESPAK-SE model, see Appendix F of the accompanying Manual. Codes for functions and values are: WS= Water Storage, SFS= Stream Flow Support, WC= Water Cooling, WW= Water Warming, SR= Sediment Retention, PR= Phosphorus Retention, NR= Nitrate Removal, CS= Carbon Sequestration, OE= Organic Export, INV= Invertebrates, FA= Anadromous Fish, FR= Resident Fish, AM= Amphibians, WBF= Feeding Waterbirds, WBN= Nesting Waterbirds, SBM= Songbirds, Mammals, & Raptors, POL= Pollinators, PH= Plant Habitat, PU= Public Use & Recognition, Subsis= Subsistence, EC= Ecological Condition, Sen= Sensitivity, STR= Stressors.

#	Indicator	Conditions	Data	Explanation/ Definitions
F1	Wetland Type	Most of the vegetated part of the AA (wetland Assessment Area) is a (select ONE):		[AM, CS, FA, FR, INV, NR, OE, PH, SEN, SFS, WBF, WBN]
F1.1		Forested Peatland	0	Nearly all the AA is moss-covered and/or the soils to a depth of at least 4 inches are organic (sometimes deeper if not rocky). More tall (>3 ft) woody cover than herbaceous. Trees often hemlock or cedar. Often with skunk cabbage (at least in seasonal channels), blueberries. Little or no open water. Includes shrubby fringes of open peatlands and fens. Not in active floodplain.
F1.2		Open Peatland	0	Nearly all the AA is moss-covered. Peat depth usually > 16 inches except where bedrock near surface. Tree cover is <5% and cover of tall (>3 ft) shrubs is <30%. Shore pine, Labrador tea, crowberry often occur. Often with small (<25 sq ft) scattered stair-step pools with acidic, stained water. Some examples are flat bogs, floating bogs, and sloping muskeg.
F1.3		Fen/ Marsh	0	Surface water is more extensive, at least seasonally. More emergent than tall (>3 ft) woody plant cover. Often sedges, deer cabbage, marsh marigold, horsetail, burreed, pond lily. If ground is moss-covered, it is mostly obscured by sedges or other herbaceous plants. Soils often muck or peat, seldom coarse unless created by excavation. Often beaver-created, or at base of steep slopes, or in depressions or adjoining larger water bodies.
F1.4		Floodplain Wetland	0	At least once annually, surface water in a channel that flows through or adjoins the AA causes the width of surface water in the AA (perpendicular to the channel) to more than double. The increased width is due mainly to that channel inflow, not to hillslope seepage or runoff. Soils are silt or coarser (little or no organic soil or peat). Vegetation can be woody or herbaceous: often alder, willow, devil's club. Includes some (not all) wetlands in mapped floodplains. Consult municipal maps of floodplains if available, and the online WESPAK-SE Wetlands Module: SEAK Hydro Stream.
F1.5		Uplift Meadow	0	Within a few miles of tidewatter or a glacier, but nontidal, and mostly within 100 miles of Glacier Bay National Park. Little or no persistent surface water except in channels, which may be strongly downcut. Mostly sweetgale and/or herbaceous vegetation, e.g., silverweed, iris, Lyngbye's sedge. Tree cover usually <30%. Peat depth usually <16 inches. Resulted from uplift following isostatic rebound as a glacier receded within recent centuries.
F1.6		Tidal Marsh or Tidal Swamp. Do not continue. Use other spreadsheet.	0	Inundated by tide at least once annually and dominated by emergent herbaceous or woody plants. The level of surface water fluctuates every ~6 hours on a daily basis in response to tides. Do not include areas of beachgrass (*Leymus* or *Elymus mollis,* also called ryegrass) unless they are inundated at that frequency. Do not include areas that are entirely eelgrass or seaweeds.

F2	% Saturated **Only**	The percentage of the AA that **lacks** surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:		This is the cumulative acreage of all areas lacking surface water in the AA. [AM, FA, FR, INV, NR, PH, PR, SBM, SEN, SRv, WBF, WBN, WC, WW]
		less than 1%, or <0.01 acre (about 20 ft on a side) never has surface water. In other words, **all or nearly all of the AA is inundated permanently or at least seasonally.**	0	
		1-25% of the AA never contains surface water.	0	
		25-50% of the AA never contains surface water.	0	
		50-99% of the AA never contains surface water.	0	
		>99% of the AA never contains surface water, except for water flowing in channels and/or in pools that occupy <1% of the AA. **SKIP to F30.**	0	
		>99% of the AA never contains surface water, and AA is not intersected by channels that have flow, not even for a few days per year. **SKIP to F30.**	0	
F3	% with **Persistent** Surface Water	The percentage of the AA that has **surface** water (either ponded or flowing, either open or obscured by vegetation) during **all** of the growing season during most years is:		0.01 acre is about 20 ft on a side if square. This is the cumulative acreage of all areas that have surface water. Sites fed by glaciers, or by unregulated streams that descend on north-facing slopes, tend to remain wet longer into the summer. Indicators of persistence may include fish, some dragonflies, beaver, and muskrat. In the local soil survey, the NRCS descriptions of the predominant soil types may include information on saturation persistence. [AM, CS, FA, FR, INV, NR, POL, PR, SBM, WBF, WBN]
		less than 1%, or <0.01 acre (whichever is less). **SKIP to F7.**	0	
		1-25% of the AA, and mostly in narrow channels and/or small scattered pools.	0	
		1-25% of the AA, and mostly in a single large pool, pond, and/or channel.	0	
		25-50% of the AA	0	
		50-95% of the AA	0	
		>95% of the AA	0	
F4	Summertime Shading of Water	At mid-day during the warmest time when surface water is present, the area of water within the AA that is shaded by vegetation, incised channels, streambanks, or other features also present within the AA is:		Consider the aspect and surrounding topographic relief as well as vegetation height and density. [FA, FR, WC, WW]
		<5% of the water is shaded	0	
		5-25% of the water is shaded	0	
		25-50% of the water is shaded	0	
		50-75% of the water is shaded	0	
		>75% of the water is shaded	0	
F5	Fringe Wetland	The AA adjoins a lake, stream, or river whose wetted width (not counting the AA's wetland) during mean annual conditions is greater than 50 ft and also more than 5 times the vegetated wetland's average width (measured perpendicular to upland). If true, enter "1" and continue. If false, leave the 0 and continue.	0	[SBM, WBF, WBN, WCv, WWv]
F6	Lacustrine Wetland	The AA borders a body of ponded open water whose size (not counting the AA's wetland) exceeds 20 acres during most of the growing season. Enter "1" if true, "0" if false.	0	The "vegetated areas" should not include submersed or floating-leaved aquatics. [FA, FR, PR, WBF, WBN]

F7	% Flooded **Only** Seasonally	The percentage of the AA soil that is covered by surface water **only** during the wettest time of year, and for >2 continuous weeks during that time, is:		0.01 acre is about 20 ft on a side if square. This is the cumulative acreage of all areas in the AA that flood ONLY seasonally. Flood marks (algal mats, adventitious roots, debris lines, ice scour, etc.) are often evident when not fully inundated. Also, such areas often have a larger proportion of upland and annual (vs. perennial) plant species. In riverine systems, the extent of this zone can be estimated by multiplying by 2 the bankful height and visualizing where that would intercept the land along the river. Although useful only as a general guide, the NWI's water regime modifier code and NRCS soil survey descriptions of the predominant soil types usually include information on flooding frequency and saturation persistence. The wettest times in Southeast Alaska typically occur during late fall, during rain events after the ground is frozen, and/or during spring snowmelt. Near melting glaciers, surface water may be present mainly in summer. [CS, FA, INV, NR, OE, PH, SR, WBF, WBN, WS]
		<1% or <0.01 acre, whichever is less. **SKIP to F9.**	0	
		1-25%	0	
		25-50%	0	
		50-95%	0	
		>95%	0	
F8	Annual Water Fluctuation Range	Where surface water is present in the AA at least seasonally, its annual fluctuation in most of that area is:		[AM, CS, INV, NR, OE, PH, PR, SR, WBN, WS]
		<0.5 ft	0	
		0.5 - 1 ft	0	
		1-3 ft	0	
		> 3 ft	0	
F9	Predominant Depth Class	During most of the growing season, surface water depth in **most** of the area where it is present is: [*Note: This is not asking for the maximum depth.*]		If a boat is unavailable, estimate this by considering wetland size and local topography. Or if timing and safety allow, depths may be measured by drilling through winter ice.This question is asking about the spatial median depth that occurs during most of that time, even if inundation is only seasonal or temporary. If inundation in most but not all of the wetland is brief, the answer will be based on the depth of the most persistently inundated part of the wetland. Include surface water in channels and ditches as well as ponded areas. [CS, FA, FR, INV, OE, PH, PR, SEN, SFS, SR, WBF, WBN, WC, WW]
		<0.5 ft deep (but >0)	0	
		0.5 - 1 ft deep	0	
		1-2 ft deep	0	
		2-6 ft deep	0	
		>6 ft deep. True for many fringe wetlands.	0	
F10	Depth Class Distribution	When present, surface water in most of the AA usually consists of (select one):		Estimate these proportions by considering the gradient and microtopography of the site. See diagram in the manual. [FR, INV, WBF, WBN]
		One depth class that comprises >90% of the AA's inundated area (use the classes in the question above).	0	
		One depth class that comprises 50-90% of the AA's inundated area.	0	
		Neither of above. Multiple depth classes; none occupy more than 50% of the AA.	0	
F11	Open Water - Extent	During most of the growing season, the largest patch of **open** water that is in or bordering the AA is **>1 acre and mostly deeper than 1 ft.** If true enter "1" and continue, If false, enter "0" and **SKIP to F15.**	0	**Open water** is water that is not obscured by vegetation in aerial ("duck's eye") view. It includes vegetation floating on the water surface or entirely submersed beneath it. It may be flowing or ponded.

F12	Flat Shoreline Extent	The length of the AA's shoreline (along its ponded open water) that is bordered by areas that are **nearly flat** (a slope less than about 5%) is:		See diagram in the manual. If several isolated pools are present in early summer, estimate the percent of their collective shorelines that has such a gentle slope. [SR, WBN]
		<1% of the shore length	0	
		1-25%	0	
		25-50%	0	
		50-75%	0	
		>75%	0	
F13	Width of AA's Vegetated Zone	At the driest time of year (or lowest water level), the width of vegetated area in the AA that separates adjoining uplands from **most of** the open water within or adjoining the AA is:		"Vegetated area" does not include underwater or floating-leaved plants, i.e., aquatic bed. Width may include wooded riparian areas if they have wetland soil or plant indicators. For most sites larger than 10 acres and with persistent water, measure the width using aerial imagery rather than estimate in the field. [AM, CS, NR, OE, PH, PR, SBM, SEN, SR, WBN]
		1-5 ft	0	
		5-25 ft	0	
		25-100 ft	0	
		100-300 ft	0	
		>300 ft	0	
F14	Non-vegetated Aquatic Cover	The cover for fish, aquatic invertebrates, and/or amphibians that is provided by horizontally incised banks, water deeper than 2 ft, and/or partly-submerged accumulations of wood thicker than 4 inches (NOT by living vegetation) is:		For this question, **do not consider herbaceous plants**. Consider only the wood that is at or above the water surface. Estimates of underwater wood based only on observations from terrestrial viewpoints are unreliable so should not be attempted. [AM, FA, FR, INV]
		Little or none, or all water is shallower than 2 ft most of the year.	0	
		Intermediate, e.g., 500 - 2500 cu. ft of instream wood per 1000 ft of channel.	0	
		Extensive	0	

F15	All Ponded Water - Extent	During most of the growing season, the percentage of the AA that has **ponded** surface water (stagnant, or flows so slowly that fine sediment is not held in suspension) which is **either open or shaded by emergent vegetation** is:		**Nearly all wetlands with surface water have some ponded water**. [CS, FA, FR, INV, NR, OE, SEN, SR, WBF, WBN, WC, WS, WW]
		<1% or none, or occupies <100 sq. ft cumulatively. Enter "1" and **SKIP to F20.**	0	
		1-25% of the AA, and mainly in small fishless pools. **Enter "1" and SKIP to F20.**	0	
		1-25% of the AA, and mainly in a single large pool or pond, with or without fish access.	0	
		5-30% of the AA.	0	
		30-70% of the AA.	0	
		70-95% of the AA.	0	
		>95% of the AA.	0	
F16	Open Ponded Water - Extent	The percentage of the ponded water that is **open** (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:		**Open water** may have floating aquatic vegetation provided it does not usually extend above the water surface. [AM, CS, FA, FR, INV, NR, OE, PR, SR, WBF, WBN, SBM, WC, WW]
		<1% or none, or largest pool occupies <100 sq. ft. Enter "1" and **SKIP to F20.**	0	
		1-5% of the ponded water. Enter "1" and **SKIP to F20.**	0	
		5-30% of the ponded water.	0	
		30-70% of the ponded water.	0	
		70-99% of the ponded water.	0	
		100% of the ponded water. **SKIP to F18.**	0	
F17	Emergent Vegetation - Distribution	During most of the growing season, the spatial pattern of herbaceous vegetation that has s**urface** water beneath it (emergent vegetation -- NOT floating-leaved plants) is mostly:		[AM, FA, FR, INV, NR, OE, PH, PR, SBM, SR, WBF, WBN]
		scattered in small clumps, islands, or patches throughout the surface water area.	0	
		intermediate	0	
		clumped along the margin of the surface water area, or mostly surrounds a channel or central area of open water, or such vegetation covers <100 sq ft and <1% of the AA.	0	
F18	Floating Algae & Duckweed	At some time of the year, mats of algae and/or duckweed cover most of the AA's otherwise-unshaded water surface or blanket the underwater substrate. If true, enter "1" in next column. If untrue or uncertain, enter "0".	0	[EC, PR, WBF]
F19	Ice Cover	Ice (not just snow) covers nearly all of the AA's water surface for more than 4 continuous weeks during most years, potentially altering the air-water exchange. If true, enter "1" in next column. If untrue, enter "0".	0	Available data suggest this ranking from shortest to longest ice duration based on location: Ketchikan, Annette, Sitka, Little Port Walter, Juneau, Yakutat, Annex Creek. However, local factors such as elevation, water body depth, and flow velocity should be considered. [AM, CS, FR, NR, OE, PR, SEN, SFS, SR, WBF, WS]

F20	Stained Surface Water	Most surface water is tea-colored (from tannins, not iron bacteria), and/or its pH is usually <5.5. If surface water not observed, enter "1" if organic soil depth exceeds 6 inches and vegetation is mostly moss and/or evergreens.	0	[FR, OE, AM, WBN]
F21	Isolated Island	The AA contains (or is part of) an island within a lake, pond, or river, and is isolated from the shore by **water depths >3 ft** on all sides during an average June. The island may be solid, or it may be a floating vegetation mat suitable for nesting waterbirds.	0	[WBN]
F22	Beaver	Use of the AA by beaver during the past 5 years is (select most applicable ONE):		[FA, FR, PH, SBM, SEN, WBF, WBN]
		evident from direct observation or presence of gnawed limbs, dams, tracks, dens, lodges, or extensive stands of water-killed trees (snags).	0	
		likely based on known occurrence in the region and proximity to suitable habitat, which may include: (a) a persistent freshwater wetland, pond, or lake, or a perennial low or mid-gradient (<10%) channel, and (b) a corridor or multiple stands of hardwood trees and shrubs in vegetated areas near surface water.	0	
		unlikely because site characteristics above are deficient, and/or this is a settled area or other area where beaver are routinely removed. But beaver occur in the region (i.e., within 10 miles, or on same island).	0	
		none. Beaver are absent from the region and/or the island.	0	
F23	Flowing Water - Extent	The percentage of the AA that has **flowing** water (flowing with enough force to keep sediment in suspension, and >1 inch deep and either open or shaded by emergent vegetation) **for >2 continuous weeks at the wettest time** of a typical year is:		
		None. (Topographic maps also show no intersecting channels or floodplains. However, if the AA is entirely a lake or pond, enter a "1" regardless of whether maps show a channel intersecting it).	0	
		1-25% of the AA (topo maps show one or more channels). Their wetted width does not expand >2x their width at annual low flow, e.g., many strongly incised or headwater channels.	0	
		1-25% of the AA, and in (or adjoining) one or more channels whose wetted width expands >2x their width at annual low flow. Typically not in headwaters. SEAK Hydro Process maps may show "Flood Plain" channel.	0	
		5-30% of the AA.	0	
		30-70% of the AA.	0	
		70-95% of the AA.	0	
		>95% of the AA.	0	
F24	Inflow	At least once annually, surface water moves into the AA from a tributary stream or ditch that is at least 300 ft long, or from a lake or river. Often shown as a channel on a topo map (consult the SEAK Hydro Streams layer of the WESPAK-SE web site). If true, enter 1 and continue. If false, enter 0 and **SKIP to F30.**	0	[NRv, PH, PRv, SRv]

F25	**Input** Water Temperature	Based on lack of shade upstream or source characteristics, the inflow is likely to be warmer than the AA's surface water during part of most years. Enter 1= yes, 0= no.	0	[WCv, WWv]
F26	Input Stream Gradient	The gradient of the tributary with the largest inflow, averaged up to 300 ft from the AA (excluding any portion of the distance where water travels through a pipe) is:		Estimate gradient by dividing the elevation difference by horizontal distance over 300 ft. [PRv, SRv]
		<1%	0	
		1-5%	0	
		5-30%	0	
		>30%	0	
F27	Throughflow Complexity	During its travel through the AA at the time of peak annual flow, **most** of the flowing water [select ONE]:		[FA, FR, INV, NR, OE, PR, SR, WBF, WBN, WS]
		Does not bump into plant stems. Nearly all the water travels in unvegetated (often incised) channels that have little contact with wetland vegetation, or through a zone of open water such as an instream pond or lake.	0	
		bumps into **herbaceous** vegetation and follows a fairly **straight** path from entrance to exit (branched channels few or none, meandering slight or none).	0	
		bumps into **herbaceous** vegetation and follows a fairly **indirect** path from entrance to exit (meandering, multi-branched, or braided)	0	
		bumps into **tree trunks and/or shrub stems** and follows a fairly **straight** path from entrance to exit (branched channels few or none, meandering slight or none).	0	
		bumps into tree trunks and/or shrub stems and follows a fairly **indirect** path from entrance to exit (meandering, multi-branched, or braided)	0	
F28	Outflow Duration	The **most persistent** surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the **AA** and the closest off-site downslope water body is:		**Path length** is the length of a wetland measured in a straight line from inlet to outlet, or from highest to lowest elevation within the wetland (i.e., in the direction of predominant downhill surface flow) -- see OF35. Consult the hydrography layer of the WESPAK-SE web site if uncertain if AA is intersected by or near a channel. A channel is defined as an observably incised landform that transports surface water in a downhill direction during some part of a normal year. A larger difference in elevation between the wetland-upland boundary and the bottom of the wetland outlet (if any) indicates shorter outflow duration. The frequencies given are only approximate and are for a "normal" year. The connection need not occur during the growing season. [CS, FA, FR, NR, OE, PR, SEN, SFS, SR, WCv, WS, WWv]
		persistent (>9 months/year); almost always shown on stream maps, or determine from your dry-season observation.	0	
		seasonal (14 days to 9 months/year, not necessarily consecutive); sometimes shown on stream maps.	0	
		temporary (<14 days, not necessarily consecutive); seldom shown on stream maps.	0	
		none -- but maps show a stream or other water body that is downslope from the AA and within a distance that is less than the AA's *path length* (see definition, OF35). If so, mark "1" here and **SKIP TO F30.**	0	
		no surface water flows out of the wetland except possibly during extreme events (less than once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. If so, mark "1" here and **SKIP TO F30.**	0	

F29	Outflow Confinement	During major runoff events, in the places where surface water in a channel exits the AA or connected waters nearby, it:		"Major runoff events" would include biennial high water caused by storms and/or rapid snowmelt. [CS, NR, OE, PR, SEN, SR, STR, WS]
		mostly passes through a pipe, culvert, narrowly breached dike, berm, beaver dam, or other partial obstruction (other than natural topography) that does not appear to drain the wetland artificially during most of the growing season.	0	
		leaves through natural exits, not mainly through artificial or temporary features	0	
		exported more quickly than usual due to ditches or pipes within the AA (or connected to its outlet or within 10 m of the AA's edge) which drain the wetland artificially, or water is pumped out of the AA.	0	
F30	Groundwater: Strength of Evidence	Select first applicable choice. In the AA:		Consult topographic maps to detect breaks in slope described here. Localized orange coloration associated with groundwater seeps may be most noticeable in ice formations along streams during early winter. [AM, CS, FA, FR, INV, NR, OE, PH, PRv, SFS, WC, WS, WW]
		(a) springs are observed, OR (b) water is markedly cooler in summer and warmer in winter (e.g., later ice formation) than in other wetlands nearby, OR (c) water level measurements from shallow wells, or high salinity/conductivity in undisturbed wetlands distant from potential marine influence, suggest substantial groundwater discharge to the AA.	0	
		(a) the upper end of the AA is located very close to the base of (but mostly not ON) a natural slope much steeper (usually >15%) than that within the AA and longer than 300 ft, OR (b) rust deposits ("iron floc"), colored precipitates, or dispersible natural oil sheen are prevalent in the AA, OR (c) AA water is remarkably clear in contrast to naturally stained or glacially-clouded waters typical in nearby wetlands, OR (d) AA is located at a geologic fault.	0	
		Neither of above is true, although some groundwater may discharge to or flow through the AA, or groundwater influx is unknown.	0	
F31	Woody Cover Extent	**Within** the entire vegetated part of the AA, the percentage occupied by **woody plants taller than 3 feet** (shrubs, trees) is:		Do not count trees or shrubs if they merely hang into the wetland. They must be **rooted in soils that are saturated** for several weeks of the growing season. The "vegetated part" should not include floating-leaved or submersed aquatics. [NR, WBF, WBN]
		<5% of the vegetated AA, or there is no woody vegetation in the AA. **SKIP to F41.**	0	
		5-25%.	0	
		25-50%	0	
		50-75%	0	
		>75%	0	

F32	Tall Woody Cover Extent	Within the vegetated part of the AA, just the woody plants (**trees)** that are taller than 20 ft occupy:		Do not count trees if they merely hang into the wetland. They must be rooted in soils that are saturated for several weeks of the growing season. The "vegetated part" should not include floating-leaved or submersed aquatics. [PH, SBM, SEN]
		<1% of the vegetated AA, or the AA lacks trees. Enter "1" and **SKIP to F38.**	0	
		1-25% of the vegetated AA	0	
		25-50% of the vegetated AA	0	
		50-95% of the vegetated AA	0	
		>95% of the vegetated part of the AA	0	
F33	Deciduous Trees	Within the vegetated part of the AA, just the **deciduous trees** that are taller than 20 ft occupy:		Do not count trees if they merely hang into the wetland. They must be rooted in soils that are saturated for several weeks of the growing season. The "vegetated part" should not include floating-leaved or submersed aquatics.
		<1% of the vegetated AA	0	
		1-25% of the vegetated AA	0	
		25-50% of the vegetated AA	0	
		50-95% of the vegetated AA	0	
		>95% of the vegetated part of the AA	0	
F34	Woody Diameter Classes	Mark all the classes of woody plants within the AA, but only IF they comprise **more than 5%** of the woody canopy within the AA. Do not count trees that adjoin but are not within the AA.		The trees and shrubs need not be wetland species. Measurements are the d.b.h., the diameter of the tree measured at 4.5 ft above the ground. [AM, CS, POL, SBM, SEN, WBN]
		evergreen 1-4" diameter and >3 ft tall	0	
		deciduous 1-4" diameter and >3 ft tall	0	
		evergreen 4-9" diameter	0	
		deciduous 4-9" diameter	0	
		evergreen 9-21" diameter	0	
		deciduous 9-21" diameter	0	
		evergreen >21" diameter	0	
		deciduous >21" diameter	0	
F35	Snags	The number of large snags (**diameter >8"**) in the AA plus the area within 100 ft uphill of the closest upland to the wetland edge is:		Snags are standing trees at least 10 ft tall that are mainly without bark or foliage. [POL, SBM, WBN]
		Several (>2/acre) and a pond or lake of at least 1 acre is within 1 mile.	0	
		Several (>2/acre) but above not true.	0	
		Few or none	0	
F36	Downed Wood	The number of downed wood pieces **longer than 6 ft** and with diameter **>6",** and **not persistently submerged**, is:		Exclude temporary "burn piles." [, AM, INV, POL, SBM]
		Several (>5 if AA is >10 acres, or >2 for smaller AAs)	0	
		Few or none	0	

F37	**Exposed** Shrub Canopy	Woody vegetation 3 to 20 ft tall that is not under the drip line of trees is:		The "vegetated part" may include moss, but it should not include floating-leaved or submersed aquatics. [AM, PH, SBM]
		<5% of the vegetated AA and (if a fringe wetland) <5% of its water edge. Or <0.01 acre. **SKIP to F41.**	0	
		5-25% of the vegetated AA or (if a fringe wetland) 5-25% of the water edge -- whichever is greater.	0	
		25-50% of the vegetated AA or the water edge, whichever is greater.	0	
		50-95% of the vegetated AA or the water edge, whichever is greater.	0	
		>95% of the vegetated part of the AA or the water edge, whichever is greater.	0	
F38	Shrub Species Dominance	Determine which two native shrub species (3 to 20 ft tall) comprise the greatest portion of the native shrub cover. Then choose one:		[EC, PH, SBM, SEN]
		those species together comprise **> 50%** of the areal cover of native shrub species.	0	
		those species together do **not** comprise > 50% of the areal cover of native shrub species.	0	
F39	Woody-Herbaceous Interspersion	In "ducks-eye view", the distribution pattern of woody vegetation (including low shrubs) VS. unshaded herbaceous/moss vegetation within the AA is:		In larger forested wetlands, patchiness is best interpreted from aerial imagery. Images that show "coarse-grained" forests indicate presence of multiple age classes and/or numerous small openings, whereas those that show "fine-grained" forests suggest more even-aged, even-sized forest with little interspersion. [SBM, SEN]
		(a) Woody cover and herbaceous/moss cover EACH comprise **30-70%** of the **vegetated part** of the AA, AND (b) There are <u>many</u> patches of woody vegetation scattered widely within herbaceous/moss vegetation, or many patches of herbaceous vegetation scattered widely within woody vegetation.	0	
		(a) Woody cover and herbaceous/moss EACH comprise 30-70% of the vegetated AA, AND (b) There are <u>few</u> patches ("islands") of woody vegetation scattered widely within herbaceous vegetation, or few patches of herbaceous/moss vegetation ("gaps") scattered widely within woody vegetation.	0	
		(a) Woody cover **OR** herbaceous/moss comprise **>70%** of the vegetated AA, AND (b) There are several patches of the other scattered within it. (e.g., forested AAs with patches -- not limited to corridors -- of skunk cabbage, or muskeg with scattered shrubs).	0	
		(a) Woody over OR herbaceous/moss comprise >70% of the vegetated AA, AND (b) The other is absent or is mostly in a single area or distinct zone with almost no intermixing of woody and unshaded herbaceous/moss vegetation.	0	
F40	Deciduous Shrubs	Woody vegetation in the 3 to 20 ft height class which is **deciduous** (e.g., blueberry, menziesia, alder) comprises:		Select only the first true statement. The trees or shrubs do not have to be wetland species, as long as they are in the AA or overhang its water. Deciduous shrubs are especially likely to occur on mineral soils with little moss ground cover, such as burns, clearcuts, landslides, avalanche paths, abandoned beaver flowages, areas of recent glacial rebound or deglaciation, heavily grazed or drained lands, and floodplains. [CS, INV, OE, PH, SBM]
		<1% of the AA's vegetated area, or largest patch occupies less than 400 sq. ft	0	
		1-25% of the vegetated area	0	
		25-50% of the vegetated area	0	
		50-75% of the vegetated area	0	
		>75% of the vegetated area	0	

F41	N Fixers	The percent of the AA's shrub plus ground cover that is nitrogen-fixing plants (e.g., alder, sweetgale, arctic rush, lupine, clover, other legumes) is:		"Ground cover" includes both moss and herbaceous vegetation. Do not include N-fixing algae or lichens. Select only the first true statement. [FA, FR, INV, NRv, OE, PH, SBM, SEN]
		<1% or none	0	
		1-25% of the shrub plus ground cover, in the AA or along its water edge (whichever has more).	0	
		25-50% of the shrub plus ground cover, in the AA or along its water edge (whichever has more).	0	
		50-75% of the shrub plus ground cover, in the AA or along its water edge (whichever has more).	0	
		>75% of the shrub plus ground cover, in the AA or along its water edge (whichever has more).	0	
F42	Moss Extent	The cover of peat-forming moss is:		Exclude moss growing on trees or rocks. [CS, PH]
		<5% of the vegetated ground cover.	0	
		5-25% of the vegetated ground cover.	0	
		25-50% of the vegetated ground cover.	0	
		50-95% of the vegetated ground cover.	0	
		>95% of the vegetated ground cover.	0	
F43	Bare Ground & Accumulated Plant Litter	Consider the parts of the AA that lack surface water at some time of the year. Viewed from 6 inches above the soil surface, the condition in the part of that area that is most likely to be exposed to flowing water, runoff, or wind near the end of the growing season, or is otherwise more likely to erode (e.g., due to slope, land use practices) is:		Thatch is dead plant material (stems, leaves) resting on the ground surface. Bare ground that is present under a tree or shrub canopy should be counted. [AM, EC, INV, NR, OE, POL, PR, SBM, SEN, SR]
		Little or no (<5%) *bare ground* is visible between erect stems or under canopy and ground surface is extensively blanketed by moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	0	
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise **more than** 5% of the unflooded parts of the AA.	0	
		Mostly (>50%) bare ground or ground covered mainly with thatch at that time.	0	
		Not applicable. Surface water (either open or obscured by emergent plants) covers all of the AA all the time.	0	
F44	Ground Irregularity (microtopography)	Consider the parts of the AA that lack surface water at some time of the year. Excluding slash from logging, the number of small pits, raised mounds, hummocks, boulders, upturned trees, animal burrows, gullies, natural levees, wide soil cracks, and microdepressions is:		"Microtopography" refers mainly to the patchiness of vertical relief of >6 inches and is represented only by inorganic features, except where living plants have created depressions or mounds (hummocks) of soil. Do not count incised channels and other "macro" features. If parts of the AA are flat but others have substantial microtopography, base your answer on which condition predominates in the parts of the AA that lack persistent water. [AM, EC, INV, NR, PH, POL, PR, SBM, SR, WS]
		Few or none (minimal microtopography; <1% of that area)	0	
		Intermediate	0	
		Several (extensive micro-topography)	0	

F45	Upland Inclusions	Within the AA, inclusions of upland that individually are >100 sq. ft. are:		Inclusions are slightly elevated "islands" or "pockets" dominated by upland vegetation and soils. Do not count as inclusions the elevated roots of trees or logs unless supported by a mound of mineral soil meeting the size threshold. Upland inclusions may sometimes be created by fill. [AM, NR, SBM]
		Few or none	0	
		Intermediate (1 - 10% of vegetated part of the AA).	0	
		Many (e.g., wetland-upland "mosaic", >10% of the vegetated AA).	0	
F46	Soil Texture	In **most** parts of the AA that lack persistent water, the texture of soil in the uppermost layer is: [*To determine this, use a trowel to check in at least 3 widely spaced locations, and use the soil texture key in Appendix C of the Manual. If organic, use shovel to dig down to 16" depth or until hitting mineral soil, whichever is first, then measure.]*		"Organic" includes muck, mucky peat, peat, and mucky mineral soils that comprise the "Oi" horizon. These soils are much less common in floodplains. Do not include duff (loose organic surface material, e.g., dead plant leaves and stems). If texture varies greatly, base your answer on which texture predominates in the parts of the AA that lack persistent water. [CS, NR, OE, PH, PR, SEN, SFS, WS]
		Loamy: includes loam, silty loam, sandy loam	0	
		Fines: includes silt, glacial flour, clay, clay loam, silty clay, silty clay loam, sandy clay, sandy clay loam.	0	
		Organic, from surface to within 4 inches of surface only. Exclude live roots unless from moss.	0	
		Organic, from surface to within 16 inches of surface only. Exclude live roots unless from moss.	0	
		Organic, from surface to greater than 16 inch depth. Exclude live roots unless from moss.	0	
		Coarse: includes sand, loamy sand, gravel, cobble, stones, boulders, fluvents, fluvaquents, riverwash.	0	
F47	Shorebird Feeding Habitats	Within the AA, the extent of mudflats, and/or non-acidic ponded areas shallower than 2 inches, and/or unwooded shortgrass areas that meet the definition of shorebird habitat (column E) is usually:		This addresses needs of many but not all migratory sandpipers, plovers, and related species. [WBF]
		none, or <100 sq. ft within the AA.	0	
		100-1000 sq. ft. within the AA.	0	
		1000 – 10,000 sq. ft. within the AA.	0	
		>10,000 sq. ft within the AA.	0	
F48	Largest Herbaceous Patch	The **area** of the largest patch of herbaceous vegetation (e.g., sedges, grasses, skunk cabbage & other forbs -- **excluding mosses** and submerged and floating aquatics) **within** the AA is: [*Note: Do not include areas where the herbaceous canopy is so thin that moss is visible beneath it during the peak of the growing season*].		0.1 acre is about 66 ft on a side if square. If the AA is smaller than the wetland within which it is located, extend the patch to include contiguous herbaceous vegetation in the same wetland (but a different AA) and revise the area estimate. Include herbaceous patches that are under a forest canopy as well as those visible in aerial imagery. [PH, SBM, Sens, WBF, WBN]
		<0.1 acre. **SKIP to F54.**	0	
		0.1 - 1 acre	0	
		1 to 10 acres	0	
		10 to 100 acres	0	
		100 to 1000 acres	0	
		>1000 acres	0	

F49	Unshaded Herbaceous Extent	As visible in **birds-eye view**, herbaceous vegetation (**excluding** mosses and submerged and floating aquatics) comprises:		"Birds-eye view" means vertical view from about 500 ft above the wetland surface, and thus excludes herbaceous vegetation hidden beneath a tree or shrub canopy. [WBF, WBN, POL]
		<5% of the vegetated part of the AA (including moss-covered parts). Mark "1" here and **SKIP to F54.**	0	
		5-25% of the vegetated AA	0	
		25-50% of the vegetated AA	0	
		50-95% of the vegetated AA	0	
		>95% of the vegetated AA	0	
F50	Forb Cover	The percent of the vegetated ground cover that is **forbs** (e.g., skunk cabbage, buckbean, wildflowers) reaches an annual maximum of:		**forbs** = flowering non-woody vascular plants (excludes grasses, sedges, ferns, mosses). Exclude horsetail (*Equisetum*) even though technically it is a forb. [POL, CS]
		<5% of the vegetated ground cover	0	
		5-25% of the vegetated ground cover	0	
		25-50% of the vegetated ground cover	0	
		50-95% of the vegetated ground cover	0	
		>95% of the vegetated ground cover. **SKIP to F52.**	0	
F51	Sedge Cover	Sedges (*Carex* spp.) and/or cottongrass (*Eriophorum angustifolium)* occupy:		[CS]
		<5% of the vegetated ground cover, or <0.01 acre	0	
		5-50% of the vegetated ground cover	0	
		50-95% of the vegetated ground cover	0	
		>95% of the vegetated ground cover	0	
F52	Herbaceous Species Dominance	Determine which two native herbaceous (forb, graminoid, fern) species comprise the greatest portion of the herbaceous cover that is unshaded by a woody canopy. Then choose one:		[EC, INV, PH, POL, SEN]
		those species together comprise **> 50%** of the areal cover of **native** herbaceous plants at any time during the year.	0	
		those species together do **not** comprise > 50% of the areal cover of native herbaceous plants at any time during the year.	0	
F53	Invasive Plant Cover	Invasive plants in this region may include (for example): creeping buttercup, reed canary grass, orange hawkweed, annual blue grass, timothy grass, Canadian thistle, field sow-thistle, Japanese knotweed, European mountain ash, white clover, alsike clover, others noted in PlantList worksheet.		[EC, PH, POL, SEN]
		apparently no invasive species are present **in** the AA.	0	
		Invasive species are present but comprise <5% of the herbaceous and <5% of the shrub cover.	0	
		Invasive species comprise 5-20% of the herb or shrub cover.	0	
		Invasive species comprise 20-50% of the herb or shrub cover.	0	
		Invasive species comprise >50% of the herb or shrub cover.	0	

F54	Weed Source Along Upland Edge	Along the wetland-upland boundary, the percent of the upland edge (within 10 ft of wetland) that is occupied by plant species that are considered invasive is: (see list in preceding question or in Table B-3 of the manual)		If the wetland has no upland edge, or upland edge is <10% of wetland's perimeter, then answer for the portion of the upland closest to the wetland. If a plant cannot be identified to species (e.g., winter conditions) but its genus contains an invasive species, assume the unidentified plant to also be invasive. If vegetation is so senesced that invasive species cannot be identified, answer "none". [PH, STR]
		none of the upland edge (invasives apparently absent)	0	
		some (but <5%) of the upland edge	0	
		5-50% of the upland edge	0	
		most (>50%) of the upland edge	0	
F55	Natural Cover in Buffer	Along the wetland-upland edge and extending 100 ft upslope, the percentage of the upland that contains **natural** (not necessarily native -- see column E) land cover taller than 6 inches is:		**Natural** land cover includes wooded areas, peatlands, vegetated wetlands, and most other areas of perennial vegetation. It does **not** include water, glaciers, annual crops, residential areas, golf courses, recreational fields, fields mowed >1x per year, pavement, bare soil, rock, bare sand, or gravel or dirt roads. Natural land cover is not the same as native vegetation. **It can include areas with invasive plants.** If the AA does not adjoin upland, base your answer on the closest upland. [AM, FA, FR, INV, NRv, PH, PRv, SBM, SEN, SRv, STR, WBN]
		<5%	0	
		5 to 30%	0	
		30 to 60%	0	
		60 to 90%	0	
		>90%. **SKIP to F58**.	0	
F56	Type of Cover in Buffer	Within 100 ft upslope of the wetland-upland edge closest to the AA, the upland land cover that is NOT unmanaged vegetation or water is mostly (mark ONE):		[AM, FA, INV, NRv, PH, SBM, STR, WBN]
		impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	
		bare or nearly bare pervious surface or managed vegetation, e.g., lawn, mostly-unvegetated clearcut, landslide, unpaved road, dike.	0	
F57	Upland Slope	The average percent slope of the land, measured from the AA's wetland-upland edge and extending uphill 100 ft, or to the greatest source of pollution (whichever is closer), is:		**Disturbance feature** = building, paved area, recently cleared area, dirt road, lawn, annually-harvested row crops. Use judgment to decide if extent or proximity is more influential for a noted disturbance. If the AA is only part of a wetland and does not have an upland edge, evaluate this along the upland edge closest to the AA. Estimate slope by dividing the elevation difference (between the wetland and disturbed area) by their horizontal distance apart. [NRv, PRv, SEN, SRv]
		<1% (flat -- almost no noticeable slope)	0	
		2-5%	0	
		5-30%	0	
		>30%	0	
F58	Cliffs, Banks, Beaver, Muskrat	In the AA or within 300 ft, there are (a) muskrat houses or beaver lodges, or (b) mineral licks, or (c) elevated terrestrial features such as cliffs, talus slopes, stream banks, or excavated pits (but not riprap) that extend at least 6 ft nearly vertically, are unvegetated, and potentially contain crevices or other substrate suitable for nesting or den areas. Enter 1 (yes) or 0 (no).	0	Do not include upturned trees as potential den sites. [POL, SBM]

F59	New Wetland	The AA is (or is within, or contains) a "new" wetland resulting from human actions (e.g., excavation, impoundment) or debris or lava flows, receding glacier, sea level rise, or other factors affecting what once was **upland (non-hydric) soil.**		Do not include wetlands created by beaver dams except for the part where flooding affected uplands (not just existing wetlands and streams). Determine this using historical aerial photography, old maps, soil maps, or permit files as available [CS, NR, OE, PH, PRv, SEN, SRv]
		No	0	
		yes, and most recently created, deglaciated, or uplifted 20 - 100 years ago	0	
		yes, and most recently created, deglaciated, or uplifted 3-20 years ago	0	
		yes, and most recently created, deglaciated, or uplifted within last 3 years	0	
		yes, but time of origin unknown	0	
		unknown if new within 20 years or not	0	
F60	Visibility	The maximum percent of the AA that is visible from the best vantage point on public roads, public parking lots, public buildings, or well-defined public trails that intersect, adjoin, or are within 300 ft of the wetland (select one) is:		[PU, STR, WBFv]
		<25%	0	
		25-50%	0	
		>50%	0	
F61	Ownership	Most of the AA is (select one):		In the online WESPAK Wetlands Module, generalized ownership category can be viewed but consult local tax maps if possible. [PU, STR]
		publicly owned **conservation** lands that exclude new timber harvest, roads, mineral extraction, and intensive summer recreation (e.g., off-road vehicles).	0	
		publicly owned **resource use** lands (allowed activities such as timber harvest, mining, or intensive recreation), or unknown.	0	
		owned by non-profit conservation organization or lease holder who allows public access.	0	
		other private ownership, including Tribes.	0	
F62	Non-consumptive Uses - Actual or Potential	Assuming access permission was granted, select **ALL** statements that are true of the AA as it currently exists:		Some trails, roads, and Interpretive centers are shown in the online WESPAK Wetlands Module. Enable the Recreation layer > Recreation Facilities. [PU, STR]
		Walking is physically possible in (not just near) >5% of the AA during most of year, e.g., free of deep water and dense shrub thickets.	0	
		Maintained roads, parking areas, or foot-trails are within 30 ft of the AA, or the AA can be accessed part of the year by boats arriving via contiguous waters.	0	
		Within or near the AA, there is an interpretive center, trails with interpretive signs or brochures, and/or regular guided interpretive tours.	0	
		The AA contains or adjoins a **public** boat dock or ramp, or is within 0.5 mile of a ferry terminal, airstrip, public lodge, campsite, snowmobile park, or picnic area.	0	

F63	Core Area 1	The percentage of the AA almost never visited by humans during an average growing season probably comprises: [*Note: Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 100 ft of the wetland edge. In that case add **only** the area occupied by the trail.*]		Include visits by foot, canoe, kayak, or any non-motorized mode. Judge this based on proximity to population centers, roads, trails, accessibility of the wetland to the public, wetland size, usual water depth, and physical evidence of human visitation. Exclude visits that are not likely to continue and/or that are not an annual occurrence, e.g., by construction or monitoring crews. [AM, FAv, FRv, PH, PU, SBM, STR, WBF, WBN]
		<5% and no inhabited building is within 300 ft of the AA	0	
		<5% and inhabited building is within 300 ft of the AA	0	
		5-50% and no inhabited building is within 300 ft of the AA	0	
		5-50% and inhabited building is within 300 ft of the AA	0	
		50-95%	0	
		>95% of the AA	0	
F64	Core Area 2	The percentage of the AA visited by humans almost daily for several weeks during an average growing season probably comprises: [*Note: Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 100 ft of the wetland edge. In that case add only the area occupied by the trail*].		Include visits by foot, canoe, kayak, or any non-motorized mode. Exclude visits that are not likely to continue and/or that are not an annual occurrence, e.g., by construction or monitoring crews. [AM, PH, PU, SBM, STR, WBF, WBN]
		<5%. If F64 was answered ">95%", **SKIP to F67.**	0	
		5-50%	0	
		50-95%	0	
		>95% of the AA	0	
F65	BMP - Soils	Boardwalks, paved trails, fences or other infrastructure and/or well-enforced regulations appear to effectively prevent visitors from walking on unfrozen soils within nearly all of the AA. Enter "1" if true.	0	[PH, PU]
F66	BMP - Wildlife Protection	Fences, observation blinds, platforms, paved trails, exclusion periods, and/or well-enforced prohibitions on motorized boats, off-leash pets, and off road vehicles appear to effectively exclude or divert visitors and their pets from the AA at critical times in order to minimize disturbance of wildlife (except during hunting seasons). Enter "1" if true.	0	[AM, PU, WBF, WBN]
F67	Consumptive Uses (Provisioning Services)	Recent evidence was found within the AA of the following potentially-sustainable consumptive uses. Select all that apply.		"Low impact" means adherence to Best Management Practices such as those defined by certification groups. Evidence of these consumptive uses may consist of direct observation, or presence of physical evidence (e.g., recently cut stumps, fishing lures, shell cases), or might be obtained from communication with the land owner or manager. [FAv, FRv, PHv, Subsis, WBFv]
		Low-impact commercial timber harvest (e.g., selective thinning)	0	
		Commercial or subsistence-based harvesting of native plants or mushrooms	0	
		Hunting	0	
		Furbearer trapping	0	
		Fishing	0	
		None of the above	0	
F68	Domestic Wells	Wells or water bodies that currently provide drinking water are:		If unknown, assume this is true if there is an inhabited structure within the specified distance and the neighborhood is known to not be connected to a municipal drinking water system (e.g., is outside a densely settled area). [NRv]
		Within 500 ft of the AA	0	
		500-1000 ft away	0	
		>1000 ft away, or no information	0	

Site Name:	Investigator & Date:

Stressor (S) Data Form. Non-tidal WESPAK-SE version 2.0

S1

Wetter Water Regime - *Internal* Causes

In the last column, place a check mark next to any item that is likely to have caused a part of the wetland to be inundated more extensively, more frequently, more deeply, and/or for longer duration than it would be without that item or activity. (The items you check are not used automatically in subsequent calculations. They are included simply so they may be considered when evaluating the factors in the table beneath them). [CS, STR]	Check Marks
an impounding dam, dike, levee, weir, berm, or road fill -- within or downgradient from the wetland, or raising of outlet culvert elevation.	
excavation within the wetland, e.g., artificial pond, dead-end ditch	
excavation or reflooding of upland soils that adjoined the wetland, thus expanding the area of the wetland	
plugging of ditches or drain tile that otherwise would drain the wetland (as part of intentional restoration, or due to lack of maintenance, sedimentation, etc.)	
vegetation removal (e.g., logging) within the wetland	
compaction (e.g., ruts) and/or subsidence of the wetland's substrate as a result of machinery, livestock, or off road vehicles	

If any items were checked above, then for each row of the table below, you may assign points (3, 2, or 1 as shown in header) in the last column. However, if you believe the checked items had no measurable effect in making any part of the AA wetter, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present. The sum and final score will compute automatically. If this is a created or restored wetland, only consider changes occurring since the creation/restoration.

	Severe (3 points)	**Medium (2 points)**	**Mild (1 point)**	Points
Spatial extent of resulting wetter condition	>95% of wetland or >95% of its upland edge (if any)	5-95% of wetland or 5-95% of its upland edge (if any)	<5% of wetland and <5% of its upland edge (if any)	0
When most of wetland's wetter condition began	<3 yrs ago	3-9 yrs ago	10-100 yrs ago	0
Score the following 2 rows only if the wetter conditions began within past 10 years, and only for the part of the wetland that got wetter.				
Inundation now vs. previously	persistent vs. seldom	persistent vs. seasonal	slightly longer or more often	0
Average water level increase	>1 ft	6-12"	<6 inches	0

S2

Wetter Water Regime - *External* Causes

*In the last column, place a check mark next to any item occurring in the wetland's **contributing area** (CA) that is likely to have caused a part of the wetland to be inundated more extensively, more frequently, more deeply, and/or for longer duration than it would be without that item or activity. [STR]*

subsidies from stormwater, wastewater effluent, or septic system leakage	
pavement, ditches, or drain tile in the CA that incidentally increase the transport of water into the wetland	
removal of timber in the CA or along the wetland's tributaries	
removal of a water control structure or blockage in tributary upstream from the wetland	

If any items were checked above, then for each row of the table below, you may assign points (3, 2, or 1 as shown in header) in the last column. However, if you believe the checked items had no measurable effect in making any part of the AA wetter, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.

	Severe (3 points)	Medium (2 points)	Mild (1 point)	
Spatial extent of resulting wetter condition	>20% of the wetland	5-20% of the wetland	<5% of the wetland	0
When most of wetland's wetter condition began	<3 yrs ago	3-9 yrs ago	10-100 yrs ago	0
Score the following 2 rows only if the wetter conditions began within past 10 years, and only for the part of the wetland that got wetter.				
Inundation now vs. previously	persistent vs. seldom	persistent vs. seasonal	slightly longer or more often	0
Average water level increase	>1 ft	6-12"	<6 inches	0

S3

Drier Water Regime - Internal Causes

In the last column, place a check mark next to any item located within or immediately adjacent to the wetland, that is likely to have caused a part of the wetland to be inundated less extensively, less deeply, less frequently, and/or for shorter duration that it would be without that item. [STR]

ditches or drain tile in the wetland or along its edge that accelerate outflow from the wetland	
lowering or enlargement of a surface water exit point (e.g., culvert) or modification of a water level control structure, resulting in quicker drainage	
accelerated downcutting or channelization of an adjacent or internal channel (incised below the historical water table level)	
placement of fill material	
withdrawals (e.g., pumping) of natural surface or ground water directly out of the wetland (not its tributaries)	

If any items were checked above, then for each row of the table below, you may assign points in the last column. However, if you believe the checked items had no measurable effect in making any part of the AA drier, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.

	Severe (3 points)	Medium (2 points)	Mild (1 point)	
Spatial extent of wetland's resulting drier condition	>95% of wetland or >95% of its upland edge (if any)	5-95% of wetland or 5-95% of its upland edge (if any)	<5% of wetland and <5% of its upland edge (if any)	0
When most of wetland's drier condition began	<3 yrs ago	3-9 yrs ago	10-100 yrs ago	0
Score the following 2 rows only if the drier conditions began within past 10 years, and only for the part of the wetland that got drier.				
Inundation now vs. previously	seldom vs. persistent	seasonal vs. persistent	slightly shorter or less often	0
Water level decrease	>1 ft	6-12"	<6 inches	0

S4

Drier Water Regime - External Causes

In the last column, place a check mark next to any item within the wetland's CA (including channels flowing into the wetland) that is likely to have caused a part of the wetland to be inundated less extensively, less deeply, less frequently, and/or for shorter duration that it would be without those. [STR]

a dam, dike, levee, weir, berm, or tidegate that interferes with natural inflow to the wetland	
relocation of natural tributaries whose water would otherwise reach the wetland	
instream water withdrawals from tributaries whose water would otherwise reach the wetland	
groundwater withdrawals that divert water that would otherwise reach the wetland	

If any items were checked above, then for each row of the table below you may assign points that describe the combined maximum effect of those items in creating a drier water regime in the AA. To estimate that, contrast it with the condition if checked items never occurred or were no longer present. However, if you believe the checked items had no measurable effect on the timing of water conditions in any part of the AA, then leave the "0's" for the scores in the following rows.

	Severe (3 points)	Medium (2 pts)	Mild (1 point)	
Spatial extent of wetland's resulting drier condition	>20% of the wetland	5-20% of the wetland	<5% of the wetland	0
When most of wetland's drier condition began	<3 yrs ago	3-9 yrs ago	10-100 yrs ago	0
Score the following 2 rows only if the drier conditions began within past 10 years, and only for the part of the wetland that got drier.				
Inundation now vs. previously	seldom vs. persistent	seasonal vs. persistent	slightly shorter or less often	0
Water level decrease	>1 ft	1-12"	<1 inch	0

S5

Altered Timing of Water Inputs

*In the last column, place a check mark next to any item that is likely to have caused the **timing** of water inputs (but not necessarily their volume) to shift by hours, days, or weeks, becoming either **more muted** (smaller or less frequent peaks spread over longer times, more temporal homogeneity of flow or water levels) **or more flashy** (larger or more frequent spikes but over shorter times). [FA, FR, INV, PH, STR]*

flow regulation in tributaries or water level regulation in adjoining water body, or tidegate or other control structure at water entry points that regulates inflow to the wetland	
snow storage areas that drain directly to the wetland	
increased pavement and other impervious surface in the CA	
straightening, ditching, dredging, and/or lining of tributary channels in the CA	

If any items were checked above, then for each row of the table below, you may assign points. However, if you believe the checked items had no measurable effect on the timing of water conditions in any part of the AA, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.

	Severe (3 pts)	Medium (2 points)	Mild (1 point)	
Spatial extent within the wetland of timing shift	>95% of wetland	5-95% of wetland	<5% of wetland	0
When most of the timing shift began	<3 yrs ago	3-9 yrs ago	10-100 yrs ago	0
Score the following 2 rows only if the altered inputs began within past 10 years, and only for the part of the wetland that experiences those.				
Input timing now vs. previously	shift of weeks	shift of days	shift of hours or minutes	0
Flashiness or muting	became very flashy or controlled	intermediate	became mildly flashy or controlled	0

S6 **Accelerated Inputs of Contaminants and/or Salts**

In the last column, place a check mark next to any item -- occurring in either the wetland or its CA -- that is likely to have accelerated the inputs of contaminants or salts to the AA. [FA, NRv, PRv, STR]

stormwater or wastewater effluent (including failing septic systems), landfills, industrial facilities	
metals & chemical wastes from mining, shooting ranges, snow storage areas, oil/ gas extraction, other sources (see: http://map.dec.state.ak.us/apps/)	
oil or chemical spills (not just chronic inputs) from nearby roads	
spraying of pesticides, as applied to lawns, croplands, roadsides, or other areas in the CA	

If any items were checked above, then for each row of the table below, you may assign points. However, if you believe the checked items did not cumulatively expose the AA to significantly higher levels of contaminants and/or salts, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.

	Severe (3 points)	Medium (2 points)	Mild (1 point)	
Usual toxicity of most toxic contaminants	industrial effluent or 303d* for toxics	active mine, mid-sized town, cropland	mildly impacting (reclaimed minie, low density residential)	0
Frequency & duration of input	frequent and year-round	frequent but mostly seasonal	infrequent & during high runoff events mainly	0
AA proximity to main sources (actual or potential)	0-50 ft	50-300 ft or in groundwater	in other part of the CA	0

S7 **Accelerated Inputs of Nutrients**

In the last column, place a check mark next to any item -- occurring in either the wetland or its CA -- that is likely to have accelerated the inputs of nutrients to the wetland. [STR]

stormwater or wastewater effluent (including failing septic systems), landfills	
fertilizers applied to lawns, ag lands, or other areas in the CA	
livestock, dogs	
artificial drainage of upslope lands	

If any items were checked above, then for each row of the table below, you may assign points. However, if you believe the checked items did not cumulatively expose the AA to significantly more nutrients, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.

	Severe (3 points)	Medium (2 points)	Mild (1 point)	
Type of loading	high density of unmaintained septic, some types of industrial sources	moderate density septic, cropland, secondary wastewater treatment plant	livestock, pets, low density residential	0
Frequency & duration of input	frequent and year-round	frequent but mostly seasonal	infrequent & during high runoff events mainly	0
AA proximity to main sources (actual or potential)	0-50 ft	50-300 ft or in groundwater	in other part of the CA	0

S8

Excessive Sediment Loading *from Contributing Area*

In the last column, place a check mark next to any item present in the CA that is likely to have elevated the load of waterborne or windborne sediment reaching the wetland from its CA. [FA, INV, SRv, STR]

erosion from plowed fields, fill, timber harvest, dirt roads, vegetation clearing, fires	
erosion from construction, in-channel machinery in the CA	
erosion from off-road vehicles in the CA	
erosion from livestock or foot traffic in the CA	
stormwater or wastewater effluent	
sediment from road sanding, gravel mining, other mining, oil/ gas extraction	
accelerated channel downcutting or headcutting of tributaries due to altered land use	
other human-related disturbances within the CA	

If any items were checked above, then for each row of the table below, you may assign points (3, 2, or 1 as shown in header) in the last column. However, if you believe the checked items did not cumulatively add significantly more sediment or suspended solids to the AA, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.

	Severe (3 points)	Medium (2 points)	Mild (1 point)	
Erosion in CA	extensive evidence, high intensity*	potentially (based on high-intensity* land use) or scattered evidence	potentially (based on low-intensity* land use) with little or no direct evidence	0
Recentness of significant soil disturbance in the CA	current & ongoing	1-12 months ago	>1 yr ago	0
Duration of sediment inputs to the wetland	frequent and year-round	frequent but mostly seasonal	infrequent & during high runoff events mainly	0
AA proximity to actual or potential sources	0-50 ft, or farther but on steep erodible slopes	50-300 ft	in other part of the CA	0

* **high**-intensity= extensive off-road vehicle use, plowing, grading, excavation, erosion with or without veg removal; **low**-intensity= veg removal only with little or no apparent erosion or disturbance of soil or sediment

S9

Soil or Sediment Alteration *Within the Assessment Area*

In the last column, place a check mark next to any item present in the wetland that is likely to have compacted, eroded, or otherwise altered the wetland's soil. If the AA is a created or restored wetland or pond, exclude those actions. [CS, INV, NR, PH, STR]

compaction from machinery, off-road vehicles, or mountain bikes, especially during wetter periods	
leveling or other grading not to the natural contour	
tillage, plowing (but excluding disking for enhancement of native plants)	
fill or riprap, excluding small amounts of upland soils containing organic amendments (compost, etc.) or small amounts of topsoil imported from another wetland	
excavation	
ditch cleaning or dredging in or adjacent to the wetland	
boat traffic in or adjacent to the wetland and sufficient to cause shore erosion or stir bottom sediments	
artificial water level or flow manipulations sufficient to cause erosion or stir bottom sediments	

If any items were checked above, then for each row of the table below, you may assign points. However, if you believe the checked items did not measurably alter the soil structure and/or topography, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.

	Severe (3 points)	Medium (2 points)	Mild (1 point)	
Spatial extent of altered soil	>95% of wetland or >95% of its upland edge (if any)	5-95% of wetland or 5-95% of its upland edge (if any)	<5% of wetland and <5% of its upland edge (if any)	0
Recentness of significant soil alteration in wetland	current & ongoing	1-12 months ago	>1 yr ago	0
Duration	long-lasting, minimal veg recovery	long-lasting but mostly revegetated	short-term, revegetated, not intense	0
Timing of soil alteration	frequent and year-round	frequent but mostly seasonal	infrequent & mainly during a single or scattered events	0

Appendix E. Tidal Wetland: Data Forms T and S

Site Name:	Investigator & Date:

Tidal (T) Wetland Data Form. WESPAK-SE version 2.0

DIRECTIONS: Conduct an assessment only after reading the accompanying Manual and explanations in last column below. Except where instructed otherwise, in the Data column change the 0 (false) to a 1 (true) for the best choice, or for multiple choices where allowed and so indicated. Answer these questions primarily based on your onsite observations and interpretations. Do not write in shaded parts of this data form. Answering some questions accurately may require conferring with the landowner or other knowledgable persons, and/or reviewing aerial imagery. For most wetlands, completing this field data form require 1-2 hours on a site. For a listing of functions to which each question pertains, see bracketed codes in column E. For detailed descriptions of each WESPAK-SE model, see Appendix F of the accompanying Manual. Codes for functions and values are: SR= Sediment Retention, CS= Carbon Sequestration, OE= Organic Export, FA= Anadromous Fish, WBF= Feeding Waterbirds, SBM= Songbirds, Mammals, & Raptors, PH= Plant Habitat, PU= Public Use & Recognition, Subsis= Subsistence, Sens= Sensitivity, STR= Stressors.

#	Indicators	Condition Choices	Data	Explanations, Definitions
T1	Outflow Confinement	Enter "1" for all that are true:		It is believed that many such pools were excavated by early settlers and Native Americans to trap salmon. [OE, FA]
		Due to impassible culverts, tidegates, or other physical infrastructure barriers (not glacial uplift or other natural factors), anadromous fish cannot access part of the AA **that currently is tidal.**	0	
		Due to impassible culverts, tidegates, or other physical infrastructure barriers (not glacial uplift or other natural factors), anadromous fish cannot access a **contiguous non-tidal wetland or stream** which can be assumed to have been tidally connected within the past 100 years.	0	
		Neither is true, or unknown.	0	
T2	Tidal Regime	For each condition listed in the rows in the table below, estimate how much of the AA's area (including its internal tidal channels) is likely to be accessible to small fish. Then select one number from each row, and sum the four numbers and enter the sum in the column to the right.	0	When visiting at low tide, look for wrack lines indicating elevation and extent of high tide, and consider topography Also consult series of aerial images which might show the same wetland or nearby areas at different tidal heights. The treeline often indicates the approximate maximum height of the highest monthly or annual tide (although under some conditions mature Sitka spruce but not hemlock or cedar will tolerate daily flooding by tidal waters with fresh or brackish salinity).[SR, CS, OE, FA, WBF, SBM, PH]

	Percent of AA that is Fish-Accessible:				
during:	0%	1-10%	10-50%	50-90%	>90%
Monthly low tide	0	4	5	6	7
Daily low tide	0	3	4	5	6
Daily high tide	0	2	3	4	5
Monthly high tide	0	1	2	3	4

T3	Low Marsh	The percent of the vegetated part of the AA that is "low marsh" (covered by tidal water for part of almost every day) is:		When visiting at low tide, look for wrack lines indicating elevation and extent of high tide, and consider topography Also consult series of aerial images which might show the same wetland at different tidal heights. [SR, CS, OE, FA, WBF, SBM, PH]
		none, or <1%	0	
		1-10%	0	
		10-25%	0	
		25-50%	0	
		50-75%	0	
		75-90%	0	
		>90%	0	
T4	Width of Vegetated Zone at Daily Low Tide	At daily **low** tide, the average width of vegetated area in the AA that separates adjoining uplands from most open subtidal water within or adjoining the AA, or from the largest intersecting river or tributary (whichever is less), is:		If the AA is only part of a wetland and does not have an upland and/or subtidal edge, measure the distances between those edges that are closest to the AA. For most sites larger than 10 acres, measure the width using aerial imagery rather than in the field. [SR, CS, OE, FA, WBF]
		1-5 ft	0	
		5-25 ft	0	
		25-100 ft	0	
		100-300 ft	0	
		>300 ft	0	
T5	Width of Vegetated Zone at Daily High Tide	At daily **high** tide, the average width of vegetated area in the AA that separates adjoining uplands from most open subtidal water within or adjoining the AA, or from the largest intersecting river or tributary (whichever is less), is:		For most sites larger than 10 acres, measure the width using aerial imagery rather than in the field. When visiting at low tide, look for wrack lines indicating elevation and extent of high tide, and consider topography Also consult series of aerial images which might show the same wetland or nearby areas at different tidal heights. [SR, CS, WBF, SBM]
		1-5 ft	0	
		5-25 ft	0	
		25-100 ft	0	
		100-300 ft	0	
		>300 ft	0	
T6	Aquatic Cover	Within the part of the AA and its internal channels that remain underwater during daily low tide, the extent of fish cover provided at that time by partly submerged vegetation, inchannel pools, horizontally incised banks, and pieces of wood (thicker than 6 inches and longer than 4 feet, or smaller pieces in dense accumulations) is:		[FA]
		Little or none	0	
		Intermediate	0	
		Extensive	0	

T7	Bare Ground & Accumulated Plant Litter	Consider the parts of the AA that are **not inundated by tides** on most days, i.e., high marsh. Viewed **from 6 inches above the soil surface**, the condition in **most** of this area is:		Estimates of "plant litter" cover should include only the litter and woody debris that would be visible from a height of 6 inches above the soil surface. Emphasis should be on plant litter that has remained from prior years ("thatch"), not recent. Erect plant stems should not be counted as plant litter, even if dead. [SR, CS, PH]
		little or no (<5%) *bare ground* or plant litter (thatch) is visible between erect stems or under canopy. This can occur if ground surface is extensively blanketed by graminoids with great stem densities, or plants with ground-hugging foliage.	0	
		some (5-20%) bare ground or litter is visible. Herbaceous plants have moderate stem densities and do not closely hug the ground.	0	
		much (20-50%) bare ground or plant litter is visible. Low stem density and/or tall plants with little near-ground foliage.	0	
		mostly (>50%) bare ground or accumulated plant litter.	0	
T8	Groundwater Seeps	Select one:		[FA, PH]
		Part of the AA contains **strong evidence** of fresh groundwater discharges at the marsh surface: (a) Springs are observed, or (b) measurements from shallow wells indicate groundwater is discharging to the wetland.	0	
		Part of the AA has **less definitive evidence** of discharging groundwater during summer. Wetland is on organic, sandy, or gravelly soil AND is at the base of a natural slope of >5% (as averaged over a distance of 1000 ft or until the first opposing break in elevation occurs).	0	
		Neither of above is true, although some groundwater may discharge to or flow through the wetland, or groundwater influx is unknown.	0	
T9	Forb Cover	In parts of the AA that don't flood daily (i.e., "high marsh"), the areal cover of **forbs** reaches an annual maximum of:		**forbs** = flowering non-woody vascular plants (excludes grasses, sedges, ferns, mosses). Do not include non-wetland forb species (i.e., rating of FACU or UPL). [PH]
		<5% of the herbaceous cover, or the AA contains no high marsh	0	
		5-25% of the herbaceous cover	0	
		25-50% of the herbaceous cover	0	
		50-95% of the herbaceous cover	0	
		>95% of the herbaceous cover.	0	
T10	Herbaceous Species Dominance	Of just the herbaceous (non-woody) plant species:		Do not include eelgrass or seaweeds. [PH]
		One or two species together comprise **>50%** of the areal cover of herbaceous plants at any time during the year, and one or both are **non-native** species (see PlantList worksheet).	0	
		One or two species together comprise **>50%** of the areal cover of herbaceous plants at any time during the year, and both are **native** species.	0	
		There are **several** herbaceous species, **including some non-natives**, but **no species is dominan**t. That is, no two of the species together comprise >50% of the areal cover of herbaceous plants.	0	
		There are **several** herbaceous species but **no species is non-native or dominan**t. No two of the native species together comprise >50% of the areal cover of herbaceous plants.	0	

T11	Soil Texture	In parts of the AA that are not flooded at low tide, the texture of soil or sediment in the uppermost layer in **most** of that area is:		See chart in Appendix C of the Manual. Determine by examining soil in at least 3 widely-spaced locations within the AA. "Organic" includes muck, mucky peat, peat, and mucky mineral soils that comprise the "Oi" horizon. Duff layer= fallen leaves, woody material, live or dead roots, moss that has undergone partial decomposition. [CS, PH]
		Loamy: includes loam, sandy loam.	0	
		Fines: includes silt, glacial flour, clay, clay loam, silty clay, silty clay loam, sandy clay, sandy clay loam.	0	
		Organic, from surface to within 4 inches of surface only. Exclude live roots.	0	
		Organic, from surface to within 16 inches of surface only. Exclude live roots.	0	
		Organic, from surface to greater than 16 inch depth. Exclude live roots.	0	
		Coarse: includes sand, loamy sand, gravel, cobble, stones, boulders, fluvents, fluvaquents, riverwash.	0	
T12	Large Woody Debris	Large woody debris that rises at least 3 ft above the marsh terrace or is present in tidal channels is:		[SBM]
		none or few (<1 per 10 acres)	0	
		intermediate	0	
		many (>5 pieces per 10 acres or per 10 channel widths)	0	
T13	Driftwood	On or near the AA's edge with upland (or the upper edge of tidal influence), the percent of the edge occupied by driftwood is:		If the AA is only part of a wetland and does not have an upland edge, measure this along the upland edge closest to the AA. [SBM]
		none	0	
		1-25%	0	
		25 - 50%	0	
		50 - 75%	0	
		>75%	0	
T14	N Fixers	The cover of nitrogen-fixing plants (e.g., alder, sweetgale, legumes) along the AA's upland edge is:		Do not include algae. If the AA is only part of a wetland and does not have an upland edge, measure this along the upland edge closest to the AA. [CS, Sens]
		<1% or none, or AA has no upland edge	0	
		1-25%	0	
		25-50%	0	
		50-75%	0	
		>75%	0	
T15	Natural Cover in Buffer	Within **100 ft upslope** of the AA's wetland-upland edge, the percentage of the upland that contains ***natural*** (**not necessarily native**) land cover is:		**Natural land cover** includes wooded areas, peatlands, vegetated wetlands, and most other areas of perennial cover. It also includes low-intensity timber harvest areas. It does not include water, glaciers, annual crops, residential areas, golf courses, recreational fields, fields mowed >1x per year, pavement, bare soil, rock, bare sand, or gravel or dirt roads. Natural land cover is not the same as native vegetation. **It can include areas with invasive plants**. If the AA is only part of a wetland and does not have an upland edge, measure this along the upland edge closest to the AA. [FA, SBM, SRv, PH, Sens]
		<5%	0	
		5 to 30%	0	
		30 to 60%	0	
		60 to 90%	0	
		>90%. **SKIP to T17.**	0	

T16	Type of Cover in Buffer	Within **100 ft upslope** of the AA's wetland-upland edge, the upland cover that is NOT natural or water is mostly:		[FA, SBM, PH]
		impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	
		bare or semi-bare pervious surface, e.g., dirt road, dike, dunes, lawn, recent clearcut, landslide.	0	
T17	Slope from Disturbed Lands	Along the AA's wetland-upland edge and extending 100 ft uphill, or to the most potentially impacting **disturbance feature** (whichever is closer), the slope of the land averages:		**Disturbance feature** = building, paved area, recently cleared area, dirt road, lawn,annually-harvested row crops. Use judgment to decide if extent or proximity is more influential for a noted disturbance. If no disturbances are present, select the slope that predominates in the 100-ft zone, not the maximum slope. If the AA is only part of a wetland and does not have an upland edge, evaluate this along the upland edge closest to the AA. [OE, Sens]
		<1% (flat -- almost no noticeable slope)	0	
		2-5%	0	
		5-30%	0	
		>30%	0	
T18	Cliffs or Banks	In the AA or within its wetland or within 100 ft of the AA, there are elevated terrestrial features such as cliffs, stream banks, excavated pits, or pumice walls (but not riprap) that extend at least 6 ft nearly vertically, are unvegetated, and potentially contain crevices or other substrate suitable for nesting or den areas.	0	[SBM]
T19	Core Area 1	The percentage of the AA almost never visited by humans during an average growing season probably comprises: [*Note: Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 100 ft of the wetland edge. In that case include only the area occupied by the trail*].		Judge this based on proximity to population centers, roads, trails, accessibility of the AA to the public, wetland size, usual water depth, and physical evidence of human visitation. Exclude visits that are not likely to continue and/or that are not an annual occurrence, e.g., by construction or monitoring crews. See diagram in the Manual. [WBF, PH, PU, STR]
		<5% and no inhabited building is within 300 ft of the AA	0	
		<5% and inhabited building is within 300 ft of the AA	0	
		5-50% and no inhabited building is within 300 ft of the AA	0	
		5-50% and inhabited building is within 300 ft of the AA	0	
		50-95%	0	
		>95% of the AA	0	
T20	Core Area 2	The part of the AA visited by humans **almost daily for several weeks** during an average year probably comprises: [*Note: Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 100 ft of the wetland edge. In that case include only the area occupied by the trail]*.		[WBF, PH, PU, STR]
		<5%	0	
		5-50%	0	
		50-95%	0	

T21	Visibility	The maximum percent of the wetland that is visible from the best vantage point on public roads, public parking lots, public buildings, or public maintained trails that intersect, adjoin, or are within 300 ft of the AA (select one) is:		[WBFv, PU, STR]
		<25%	0	
		25-50%	0	
		>50%	0	
T22	Ownership	Most of the AA's upland edge is (select one):		[PU, Subsis]
		publicly owned (federal, state, municipal) and leases are mostly excluded.	0	
		other publicly owned or unknown.	0	
		owned by non-profit conservation organization or lease holder who allows public access.	0	
		other private ownership, including Tribes.	0	
T23	Non-consumptive Uses - Actual or Potential	Assuming access permission was granted, select <u>all</u> statements that are true of this AA as it currently exists:		[PU]
		Walking is physically possible in >5% of the AA during most of year, e.g., free of deep water and dense shrub thickets.	0	
		Maintained roads, parking areas, or foot-trails are within 30 ft of the AA, or the AA can be accessed most of the year by boat.	0	
		Within or near the AA, there is an interpretive center, trails with interpretive signs or brochures, and/or regular guided interpretive tours.	0	
		The AA adjoins or is within 0.5 mile of a **public** boat dock or ramp, ferry terminal, or airstrip -- or public lodge, campsite, snowmobile park, or picnic area.	0	
T24	BMP - Wildlife Protection	Fences, observation blinds, platforms, paved trails, exclusion periods, and/or well-enforced prohibitions on motorized boats, off-leash pets, and off road vehicles appear to effectively exclude or divert visitors and their pets from the AA at critical times in order to minimize disturbance of wildlife (except during hunting seasons). Enter "1" if true.	0	[WBF]
T25	Consumptive Uses (Provisioning Services)	Recent evidence was found within the AA of the following potentially-sustainable consumptive uses. Select all that apply.		Evidence of these consumptive uses may consist of direct observation, or presence of physical evidence (e.g.,fishing lures, shell casings), or might be obtained from communication with the land owner or manager. [Subsis]
		subsistence-focused harvesting of native plants, their fruits, or mushrooms	0	
		waterfowl hunting or furbearer trapping	0	
		fishing (including shellfish harvest)	0	
		None of the above	0	

The following (except T32-33) are best assessed by first reviewing aerial imagery, e.g., Google Earth, and then if possible confirming during a site visit.				
T26	Blind Channel Presence & Complexity	The AA contains one or more branching internal (blind) channels. These are channels that do not connect to streams originating in the uplands, except where those streams themselves are tidal. Do not count channels that merely loop around and rejoin their source channel. If blind channels present, enter 1. If not, enter 0 and **SKIP to T28.**	0	[OE, FA, WBF]
T27	Internal Channel Network Complexity	The largest number of visible channel junctions (forks where two channels join) belonging to any **single** blind channel network within the AA's wetland is:		If a channel loops around and rejoins its source channel, count this as only one junction. [OE, FA, WBF]
		<3	0	
		3-6	0	
		7-14	0	
		>14	0	
T28	Upland Edge Shape Complexity	Most of the edge between the AA's wetland and upland is (select one):		If the AA is only part of a wetland and does not have an upland edge, measure this along the upland edge closest to the AA. [SBM]
		Linear: a significant proportion of the wetland's upland edge is straight, as in wetlands bounded partly or wholly by dikes or roads.	0	
		Convoluted: many times longer than maximum width of the wetland, with many alcoves and indentations ("fingers").	0	
		Intermediate: either (a) only mildly convoluted, or (b) mixed -- contains about equal lengths of linear and convoluted segments.	0	
T29	Nearby Fresh Ponded	A pond, lake, or **non-tidal** wetland **larger than 1 acre** and **with >30%** open water in summer is **within 1 mile** of the AA. If so, enter "1" and continue, otherwise END HERE.	0	[FA, WBF]
T30	Distance to Any Nontidal Pond or Wetland	The distance to the non-tidal ponded water identified above is:		[FA, WBF]
		<300 ft	0	
		300-1000 ft	0	
		1000 ft - 1 mile	0	
T31	Vegetation Connectivity to Non-tidal Wetland	On a direct overland route between the AA and the feature described in T29, there is (select ONE):		[SBM]
		mostly water, pavement, rock, glacier, or other unvegetated surfaces.	0	
		mostly natural vegetation, uninterrupted by water, pavement, rock, ice, or other unvegetated feature.	0	
		mostly natural vegetation, but interrupted by water, pavement, rock, ice, or other unvegetated feature.	0	
		mostly non-natural vegetation (lawn, landscaping, or invasive plants).	0	
T32	Water Connectivity to Non-tidal Wetland	The AA and the feature described in T29 above:		[FA]
		are connected by a channel or ditch that flows into the AA for at least 9 months annually.	0	
		are connected by a channel or ditch that flows into the AA less than 9 months annually.	0	
		are not connected by any visible channel or ditch. **END.**	0	
T33	Water Flow Restriction	Water exchange (not nececessarily fish access) via the connection described above is:		[FA]
		unrestricted by an artificial feature such as a berm, culvert, or tidegate	0	
		restricted by an artificial feature, at least during extreme water events	0	
		unknown if any artificial water restriction is present	0	

Site Name:	Investigator & Date:

Stressor (S) Data Form for Tidal Wetlands. WESPAK-SE version 2

S1

Wetter Water Regime - *Internal* Causes

In the last column, place an X next to any item that is likely to have caused a part of the wetland to be inundated more extensively, more frequently, more deeply, and/or for longer duration than it would be without that item or activity. (The items you check are not used automatically in subsequent calculations. They are included simply so they may be considered when evaluating the factors in the table beneath them).

an impounding dam, dike, levee, weir, berm, road fill, or tidegate -- within or downgradient from the wetland, or raising of outlet culvert elevation.	
excavation within the wetland, e.g., artificial pond, dead-end ditch	
excavation or reflooding of upland soils that adjoined the wetland, thus expanding the area of the wetland	
plugging of ditches or drain tile that otherwise would drain the wetland (as part of intentional restoration, or due to lack of maintenance, sedimentation, etc.)	
vegetation removal (e.g., logging) within the wetland	
compaction (e.g., ruts) and/or subsidence of the wetland's substrate as a result of machinery, livestock, or off road vehicles	

If any items were checked above, then for each row of the table below, you may assign points (3, 2, or 1 as shown in header) in the last column. However, if you believe the checked items had no measurable effect in making any part of the AA wetter, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present. The sum and final score will compute automatically. If this is a created or restored wetland, only consider changes occurring since the creation/restoration.

	Severe (3 points)	Medium (2 points)	Mild (1 point)	Points
Spatial extent of resulting wetter condition	>95% of wetland or >95% of its upland edge (if any)	5-95% of wetland or 5-95% of its upland edge (if any)	<5% of wetland and <5% of its upland edge (if any)	0
When most of wetland's wetter condition began	<3 yrs ago	3-9 yrs ago	10-100 yrs ago	0
Score the following 2 rows only if the wetter conditions began within past 10 years, and only for the part of the wetland that got wetter.				
Inundation now vs. previously	persistent vs. seldom	persistent vs. seasonal	slightly longer or more often	0
Average water level increase	>1 ft	6-12"	<6 inches	0

S2

Wetter Water Regime - *External* Causes

*In the last column, place an X next to any item occurring in the wetland's **contributing area** (CA) that is likely to have caused a part of the wetland to be inundated more extensively, more frequently, more deeply, and/or for longer duration than it would be without that item or activity.*

subsidies from stormwater, wastewater effluent, or septic system leakage	
pavement, ditches, or drain tile in the CA that incidentally increase the transport of water into the wetland	
removal of timber in the CA or along the wetland's tributaries	
removal of a water control structure or blockage in tributary upstream from the wetland	

If any items were checked above, then for each row of the table below, you may assign points (3, 2, or 1 as shown in header) in the last column. However, if you believe the checked items had no measurable effect in making any part of the AA wetter, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.

	Severe (3 pts)	Medium (2 pts)	Mild (1 pt)	Points
Spatial extent of resulting wetter condition	>20% of the wetland	5-20% of the wetland	<5% of the wetland	0
When most of wetland's wetter condition began	<3 yrs ago	3-9 yrs ago	10-100 yrs ago	0
Score the following 2 rows only if the wetter conditions began within past 10 years, and only for the part of the wetland that got wetter.				
Inundation now vs. previously	persistent vs. seldom	persistent vs. seasonal	slightly longer or more often	0
Average water level increase	>1 ft	6-12"	<6 inches	0

S3

Drier Water Regime - Internal Causes

In the last column, place an X next to any item located within or immediately adjacent to the wetland, that is likely to have caused a part of the wetland to be inundated less extensively, less deeply, less frequently, and/or for shorter duration that it would be without that item.

ditches or drain tile in the wetland or along its edge that accelerate outflow from the wetland	
lowering or enlargement of a surface water exit point (e.g., culvert) or modification of a water level control structure, resulting in quicker drainage	
accelerated downcutting or channelization of an adjacent or internal channel (incised below the historical water table level)	
placement of fill material	
withdrawals (e.g., pumping) of natural surface or ground water directly out of the wetland (not its tributaries)	

If any items were checked above, then for each row of the table below, assign points in the last column. However, if you believe the checked items had no measurable effect in making any part of the AA drier, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.

	Severe (3 pts)	Medium (2 pt)	Mild (1 pt)	Points
Spatial extent of wetland's resulting drier condition	>95% of wetland or >95% of its upland edge (if any)	5-95% of wetland or 5-95% of its upland edge (if any)	<5% of wetland and <5% of its upland edge (if any)	0
When most of wetland's drier condition began	<3 yrs ago	3-9 yrs ago	10-100 yrs ago	0
Score the following 2 rows only if the drier conditions began within past 10 years, and only for the part of the wetland that got drier.				
Inundation now vs. previously	seldom vs. persistent	seasonal vs. persistent	slightly shorter or less often	0
Water level decrease	>1 ft	6-12"	<6 inches	0

S4

Drier Water Regime - External Causes

In the last column, place an X next to any item within the wetland's CA (including channels flowing into the wetland) that is likely to have caused a part of the wetland to be inundated less extensively, less deeply, less frequently, and/or for shorter duration that it would be without those.

a dam, dike, levee, weir, berm, or tidegate that interferes with natural inflow to the wetland	
relocation of natural tributaries whose water would otherwise reach the wetland	
instream water withdrawals from tributaries whose water would otherwise reach the wetland	
groundwater withdrawals that divert water that would otherwise reach the wetland	

If any items were checked above, then for each row of the table below assign points that describe the combined maximum effect of those items in creating a drier water regime in the AA. To estimate that, contrast it with the condition if checked items never occurred or were no longer present.

	Severe (3 pts)	Medium (2 pts)	Mild (1 pt)	Points
Spatial extent of wetland's resulting drier condition	>20% of the wetland	5-20% of the wetland	<5% of the wetland	0
When most of wetland's drier condition began	<3 yrs ago	3-9 yrs ago	10-100 yrs ago	0
Score the following 2 rows only if the drier conditions began within past 10 years, and only for the part of the wetland that got drier.				
Inundation now vs. previously	seldom vs. persistent	seasonal vs. persistent	slightly shorter or less often	0
Water level decrease	>1 ft	1-12"	<1 inch	0

S5

Altered Timing of Water Inputs

In the last column, place an X next to any item that is likely to have caused the **timing** of water inputs (but not necessarily their volume) to shift by hours, days, or weeks, becoming either **more muted** (smaller or less frequent peaks spread over longer times, more temporal homogeneity of flow or water levels) **or more flashy** (larger or more frequent spikes but over shorter times).

flow regulation in tributaries or water level regulation in adjoining water body, or tidegate or other control structure at water entry points that regulates inflow to the wetland	
snow storage areas that drain directly to the wetland	
increased pavement and other impervious surface in the CA	
straightening, ditching, dredging, and/or lining of tributary channels in the CA	

If any items were checked above, then for each row of the table below, assign points. However, if you believe the checked items had no measurable effect on the timing of water conditions in any part of the AA, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.

	Severe (3 pts)	Medium (2 pts)	Mild (1 pt)	Points
Spatial extent within the wetland of timing shift	>95% of wetland	5-95% of wetland	<5% of wetland	0
When most of the timing shift began	<3 yrs ago	3-9 yrs ago	10-100 yrs ago	0
Score the following 2 rows only if the altered inputs began within past 10 years, and only for the part of the wetland that experiences those.				
Input timing now vs. previously	shift of weeks	shift of days	shift of hours or minutes	0
Flashiness or muting	became very flashy or controlled	intermediate	became mildly flashy or controlled	0

S6

Accelerated Inputs of Contaminants

In the last column, place an X next to any item -- occurring in either the wetland, its CA, or nearby tidal waters -- that is likely to have accelerated the inputs of contaminants to the AA.

stormwater or wastewater effluent (including failing septic systems), landfills, industrial facilities	
metals & chemical wastes from mining, shooting ranges, snow storage areas, oil/ gas extraction, other sources (see: http://map.dec.state.ak.us/apps/)	
oil or chemical spills (not just chronic inputs) from nearby roads	
spraying of pesticides, as applied to lawns, croplands, roadsides, or other areas in the CA	

If any items were checked above, then for each row of the table below, assign points. However, if you believe the checked items did not cumulatively expose the AA to significantly higher levels of contaminants and/or salts, then leave the "0's" for the scores in the following rows.

	Severe (3 pts)	Medium (2 pts)	Mild (1 pt)	Points
Usual toxicity of most toxic contaminants	industrial effluent or 303d* for toxics	active mine, mid-sized town, cropland	mildly impacting (reclaimed mine, low density residential)	0
Frequency & duration of input	frequent and year-round	frequent but mostly seasonal	infrequent & during high runoff events mainly	0
AA proximity to main sources (actual or potential)	0-50 ft	50-300 ft or in groundwater	in other part of the CA	0

S7

Accelerated Inputs of Nutrients

In the last column, place an X next to any item -- occurring in either the wetland, its CA, or nearby tidal waters -- that is likely to have accelerated the inputs of nutrients to the wetland.

stormwater or wastewater effluent (including failing septic systems), landfills	
fertilizers applied to lawns, ag lands, or other areas in the CA	
livestock, dogs	
artificial drainage of upslope lands	

If any items were checked above, then for each row of the table below, assign points. However, if you believe the checked items did not cumulatively expose the AA to significantly more nutrients, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.

	Severe (3 pts)	Medium (2 pts)	Mild (1 pt)	Points
Type of loading	high density of unmaintained septic, some types of industrial sources	moderate density septic, cropland, secondary wastewater treatment plant	livestock, pets, low density residential	0
Frequency & duration of input	frequent and year-round	frequent but mostly seasonal	infrequent & during high runoff events mainly	0
Proximity to main sources (actual or potential)	0-50 ft	50-300 ft or in groundwater	in other part of the CA	0

S8

Excessive Sediment Loading *from Contributing Area (CA)*

In the last column, place an X next to any item present in the CA that is likely to have elevated the load of waterborne or windborne sediment reaching the wetland from its CA.

erosion from plowed fields, fill, timber harvest, dirt roads, vegetation clearing, fires	
erosion from construction, in-channel machinery **in the CA**	
erosion from off-road vehicles in the CA	
erosion from livestock or foot traffic in the CA	
stormwater or wastewater effluent	
sediment from gravel mining, other mining, oil/ gas extraction	
accelerated channel downcutting or headcutting of tributaries due to altered land use	
other human-related disturbances within the CA	

If any items were checked above, then for each row of the table below, assign points (3, 2, or 1 as shown in header) in the last column. However, if you believe the checked items did not cumulatively add significantly more sediment or suspended solids to the AA, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.

	Severe (3 pts)	Medium (2 pts)	Mild (1 pt)	Points
Erosion in CA	extensive evidence, high intensity*	potentially (based on high-intensity* land use) or scattered evidence	potentially (based on low-intensity* land use) with little or no direct evidence	0
Recentness of significant soil disturbance in the CA	current & ongoing	1-12 months ago	>1 yr ago	0
Duration of sediment inputs to the wetland	frequent and year-round	frequent but mostly seasonal	infrequent & during high runoff events mainly	0
AA proximity to actual or potential sources	0-50 ft, or farther but on steep erodible slopes	50-300 ft	in other part of the CA	0

* **high**-intensity= extensive off-road vehicle use, plowing, grading, excavation, erosion with or without veg removal; **low**-intensity= veg removal only with little or no apparent erosion or disturbance of soil or sediment

S9

Soil or Sediment Alteration *Within the Assessment Area*

In the last column, place an X next to any item present in the wetland that is likely to have compacted, eroded, or otherwise altered the wetland's soil.

compaction from machinery, off-road vehicles, or mountain bikes, especially during wetter periods	
leveling or other grading not to the natural contour	
tillage, plowing (but excluding disking for enhancement of native plants)	
fill or riprap, excluding small amounts of upland soils containing organic amendments (compost, etc.) or small amounts of topsoil imported from another wetland	
excavation	
dredging in or adjacent to the wetland	
boat traffic in or adjacent to the wetland and sufficient to cause shore erosion or stir bottom sediments	
artificial water level or flow manipulations sufficient to cause erosion or stir bottom sediments	

If any items were checked above, then for each row of the table below, assign points (3, 2, or 1 as shown in header) in the last column. However, if you believe the checked items did not measurably alter the soil structure and/or topography, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.

	Severe (3 pts)	Medium (2 pts)	Mild (1 pt)	Points
Spatial extent of altered soil	>95% of wetland or >95% of its upland edge (if any)	5-95% of wetland or 5-95% of its upland edge (if any)	<5% of wetland and <5% of its upland edge (if any)	0
Recentness of significant soil alteration in wetland	current & ongoing	1-12 months ago	>1 yr ago	0
Duration	long-lasting, minimal veg recovery	long-lasting but mostly revegetated	short-term, revegetated, not intense	0
Timing of soil alteration	frequent and year-round	frequent but mostly seasonal	infrequent & mainly during a single or scattered events	0

END.