**WESPAK-SE Author's Perceptions of Function Local *Relevance* and**

***Confidence* Associated With Each CBJ Model**

Paul Adamus, March 21, 2016

The 18 functions which WESPAK-SE scores are ones performed by a significant proportion of wetlands *nationally*, as recognized by most wetland scientists. The proportion of *Juneau* wetlands that perform any of these is unknown because WESPAK-SE, like all rapid methods, does not measure these functions in any *absolute* sense but rather estimates the *relative* degree to which a CBJ wetland is likely to perform them, and the relative degree to which performance of the function is likely to be valued by the local public and/or interrelated resources . Knowing *relative* importance is useful but even more useful is knowing absolute importance. Only then can we firmly answer a *relevance* question like, "If this wetland is destroyed, what are the actual consequences for people and resources?" To address functional *relevance*, in the section below, I've given my best guess as to how widely I suspect each function occurs (in an absolute sense) among the surveyed wetlands and whether it's likely to matter. I then offer an opinion regarding my *confidence* in WESPAK-SE's ability to rank the survey wetlands accurately given only the indicators and model structures it uses. Together, Relevance and Confidence may help inform decisions about the weights (if any) to assign wetland functions during any roll-up into a single score per wetland.

**Surface Water Storage (WS)**

Relevance: Low. Most flood damages in Juneau would be caused by glacier melt coinciding with high river levels. Almost none of the survey area wetlands had infrastructure downstream that could be damaged, and damages that could be attributed to partial loss of upslope wetlands would be negligible.

Confidence: Moderate. The indicators and model are conceptually sound but purposefully do not account for differences in wetland size (area).

**Stream Flow Support (SFS)**

Relevance: High. More sustained duration of flow, especially during normally dry periods, increases habitat space for fish and other aquatic organisms. The streamflow support function of some wetlands could be increasingly important if climate change leads to longer drier periods.

Confidence: Moderate. The indicators and model only partially account for the considerable influence of groundwater discharge rates on this function, and weakly account for evapotranspirative losses and gains from fog drip.

**Streamwater Cooling (WC)**

Relevance: Low-Moderate. Only a small proportion of the survey area streams are likely to ever encounter temperatures harmful to fish. However, the streamwater cooling function of some wetlands could be increasingly important if climate change leads to warmer periods.

Confidence: Moderate-High. The indicators and model appropriately address the beneficial influence of canopy cover and groundwater input.

**Streamwater Warming (WW)**

Relevance: Low. Warming might enhance the productivity of nearshore marine waters and support higher overwinter survival of coho, but data are lacking.

Confidence: Moderate. The indicators and model are probably sufficient to account for warming potential of a wetland during summer but not winter.

**Sediment & Toxicant Retention & Stabilization (SR)**

Relevance: High. Wetlands in the study area would undoubtedly help retain sediment and thus protect some anadromous spawning areas from excessive sediment if development and erosion were to occur upslope. Partly because many or most of the study area wetlands are flatter that surrounding uplands, they can act as catch basins for sediment and the toxic substances that often associate with sediment.

Confidence: High. The indicators and model are probably sufficient to generate an accurate relative ranking of the study area wetlands. The tidal model is less certain due to unknown marine currents and waves (probably Low confidence). Confidence in identifying differences in Value (based on likely sources of sediment runoff) among equally-functional wetlands is Moderate.

**Phosphorus Retention (PR)**

Relevance: Low. The concentrations at which phosphorus is beneficial vs. damaging to aquatic resources in the study area are unknown. Beneficial effects seem more likely except in very localized areas of stagnant water. In the study area, seawater and glacierwater are much larger sources of phosphorus than urban development.

Confidence: Low-Moderate. Phosphorus is predictably associated with sediment, and that wetland function has High confidence. However, adsorption-desorption processes also affect phosphorus and are very difficult to predict with rapid indicators. Confidence in identifying differences in Value among equally-functional wetlands (based on likely sources of phosphorus loading) is Low-Moderate.

**Nitrate Removal & Retention (NR)**

Relevance: Low-Moderate. The concentrations at which nitrate is beneficial vs. damaging to aquatic resources in the study area are unknown. Beneficial effects seem more likely except in very localized areas of stagnant water. Some data from Puget Sound suggests excessive nitrate can trigger oxygen deficits during die-offs of algae (which can reach severe levels when nitrate loading is great).

Confidence: High. Nearly all wetlands are more important than uplands for reducing nitrate export to streams and coastal waters. The indicators and model are likely sufficient to generate an accurate relative ranking of the study area wetlands. Confidence in identifying differences in Value (based on likely sources of nitrate loading) among equally-functional wetlands is Low-Moderate.

**Carbon Sequestration (CS)**

Relevance: Moderate. Disturbances in any of the study area wetlands will very likely cause a short-term increase in carbon emissions to the atmosphere and those contribute to global warming, probably more so than disturbance of most uplands. However, the effect of any single wetland on the global or local atmospheric carbon budget is miniscule.

Confidence: Low-Moderate. The indicators may credibly account for physical retention processes but probably are insufficient to rank the study area wetlands with regard to historical accumulation (carbon stocks). The model also considers methane generation potential but lacks an acceptable way of combining these three factors into one estimate of relative Carbon Sequestration.

**Organic Nutrient Export (OE)**

Relevance: Moderate-High. Nutrients (mainly carbon) are essential to instream and marine food webs, and wetlands in the study area are very likely to be the largest source on a per-unit-area basis.

Confidence: Moderate. The indicators may credibly account for physical export processes but probably are insufficient to rank the study area wetlands with regard to availability of historical accumulation (carbon stocks) for export and immediate usability for aquatic food webs of the forms of carbon that are exported.

**Anadromous Fish Habitat (FA)**

Relevance: Moderate-High. Anadromous fish are undoubtedly of high economic, ecological, and cultural importance, though only about one-quarter of the study area wetlands are accessible to these species, and of those wetlands, it is likely that only a fraction provide regionally exceptional habitat. Because this function represents only a few species, its contribution to overall biodiversity is much smaller than that from the Songbird-Raptor-Mammal Habitat function or the Native Plant Habitat function.

Confidence: Low-Moderate for distinguishing differences in habitat quality among study area wetlands that have fish access, Moderate-High for distinguishing ones that do not have access from those that do. Confidence in identifying differences in Value among equally-functional wetlands is Low-Moderate.

**Resident & Other Fish Habitat (FR)**

Relevance: Low-Moderate. Resident fish are probably of lesser economic, ecological, and cultural importance, and a minority of the study area wetlands are likely to support these species. Because this function represents only a few species, its contribution to overall biodiversity is much smaller than that from the Songbird-Raptor-Mammal Habitat function or the Native Plant Habitat function.

Confidence: Low-Moderate for distinguishing differences in habitat quality among study area wetlands that have fish access, Moderate-High for distinguishing ones that do not have access from those that do.

**Aquatic Invertebrate Habitat (INV)**

Relevance: Moderate. All study area wetlands support this function to some degree. Invertebrates are a large contributor to biodiversity and to both instream and terrestrial (songbird, amphibian) food webs.

Confidence: Moderate for distinguishing differences in habitat quality among study area wetlands, Moderate-High for distinguishing ones where invertebrate production is important to fish (thus higher Value) vs. ones where less so.

**Amphibian Habitat (AM)**

Relevance: Moderate-High. Many study area wetlands support this function. Amphibians in Juneau are mostly at the northern edge of their range and thus highly sensitive to impacts. Also, local habitat could become more essential to these species as global warming occurs.

Confidence: Moderate for distinguishing differences in habitat quality among study area wetlands, Low for distinguishing Values (due to very limited geographic coverage of prior surveys intended to document species presence).

**Waterbird Feeding Habitat (WBF)**

Relevance: Low (non-tidal wetlands) to High (tidal wetlands). Only a very few nontidal wetlands in the study area are likely to support this function. Non-tidal wetlands in regions farther north and west are of much greater continental importance. However, most tidal wetlands in the study area provide important and regionally scarce stopover habitat for migratory and wintering waterbirds.

Confidence: High for distinguishing differences in habitat quality among study area wetlands, High for distinguishing Values.

**Waterbird Nesting Habitat (WBN)**

Relevance: Low. Only a very few nontidal wetlands in the study area are likely to support this function. Non-tidal wetlands in regions farther north and west are of much greater continental importance.

Confidence: High for distinguishing differences in habitat quality among study area wetlands, Moderate-High for distinguishing Values.

**Songbird, Raptor, & Mammal Habitat (SBM)**

Relevance: High. All nontidal wetlands in the study area are likely to support this function. Several species, some rare, occur almost exclusively in wetlands.

Confidence: High for distinguishing differences in habitat quality among study area wetlands, Moderate-High for distinguishing Values.

**Pollinator Habitat (POL)**

Relevance: Moderate. All nontidal wetlands in the study area are likely to support this function to some degree, but the degree to which uplands may do so equally is unknown. Pollination is critical to many fruit-bearing shrubs as well as flowers.

Confidence: Low. There apparently are no research studies on habitat needs of local pollinators as a group or their importance to different plants important for subsistence or for ecological roles. Indicators and models are drawn from research elsewhere.

**Native Plant Habitat (PH)**

Relevance: High. Compared to uplands, local wetlands are of almost exclusive importance to several native plants important for subsistence or ecological roles, e.g., crowberry, blueberry. Moreover, many plants occur only in wetlands and thus are large contributors to overall regional biodiversity.

Confidence: Moderate for distinguishing differences in habitat quality among study area wetlands, Low for distinguishing Values.

**Public Use & Recognition (PU)**

Relevance: Moderate-High. Some of the wetlands in the study area (especially tidal ones) provide a segment of the local population with favorable opportunities for hunting, fishing, berry-collecting, and open space enjoyment.

Confidence: Low for distinguishing differences in use/value among study area wetlands.