Additional Preliminary Comments from Dr. William McDowell on EPA's Integrated Science Assessment for Oxides of Nitrogen, Oxides of Sulfur, and Particulate Matter – Ecological Criteria (First External Review Draft)

Chapter 7

7-4 line 9 Flat Head Lake, MT = Flathead

7-26 line 23: "As a result of this widely observed pattern, surface water DOC concentration has become a more important indicator of acidification and chemical recovery since the 2008 ISA" This is true, to the extent that surface water recovery from acidification has been associated with increases in DOC at many sites. It is not strictly true that DOC concentration is an indicator of recovery, however. Recovery has been documented to occur in many sites without a change in DOC. This is a data and understanding gap – why are some sites showing increase in DOC with decreased acid deposition, and others show no change in DOC? At present there is no widely accepted mechanism to explain these observations, and few studies that assess the extent to which a regionally representative sample of lakes has increased in DOC concentration.

7-26 line 11: "The 2008 ISA reported widely observed increased concentrations of DOC in surface waters across North America and Europe and that these increases in DOC were at least partly related to changes in atmospheric deposition of S and N. Thus, it has been recognized for several decades that surface water DOC concentrations have decreased to some extent with water acidification and, therefore, would likely increase with recovery." The last sentence is incorrect. These increases and implications for recovery have been recognized for about a decade, not decades. The same text repeated in the Summary, and is incorrect there, as well.

7-27 line 2: "changes in DOC concentration {increases} might reduce the ability of inland waterways to remove reactive N from the aquatic ecosystem." This is not entirely correct. Other studies specifically address DOC and NO3 removal, and report an opposite conclusion: they show that NO3 removal is greater in systems with higher DOC concentrations and higher ratios of DOC:NO3 (Rodriguez-Cardona et al. 2016; Wymore et al. 2017), suggesting that complex interactions exist between DOC and N cycling.

Rodríguez-Cardona, B., A.S. Wymore, and W.H. McDowell. 2016. DOC:NO_3^- ratios and NO_3^- uptake in forested headwater streams. Journal of Geophysical Research Biogeosciences 121:205-217. doi:10.1002/2015JG003146

Wymore, A.S., A. Coble, B. Rodriguez-Cardona, and W.H. McDowell. 2016. Nitrate uptake across biomes and the influence of elemental stoichiometry: A new look at LINX II. Global Biogeochemical Cycles 30:1183-1191.

7-34 line 26: "The relationship between ultraviolet (UV) absorbance and DOC concentration has been shown to reflect changes in the proportion of DOC that is hydrophobic (aromatic,

recalcitrant) and thus resistant to biodegradation." While these relationships can hold true for some sites and circumstances, it is really only appropriate to say that UV absorbance reflects the aromaticity of the DOC components. Inferring other general attributes like biodegradability is not supported by the literature.

7-40 line 22: "Relatively modest increases over time in pH and ANC were commonly observed {in Europe} in response to decreased levels of acidic deposition." In the Czech Republic (Oulehle et al. 2008, Oulehle et al. 2016) responses have been quite large, so this broad generalization seems to be poorly supported. They also show unexpected interactions between N and P may also be affecting the trajectory of recovery (Oulehle et al. 2017).

Oulehle, F., W.H. McDowell, J.A. Aitkenhead-Peterson, P. Krám, J. Hruška, T. Navrátil, F. Buzek, and D. Fottová. 2008. Long-term trends in stream nitrate concentrations and losses across watersheds undergoing recovery from acidification in the Czech Republic. Ecosystems 11:410-425.

Oulehle, F., T. Chuman, J. Hruška, P. Krám, W.H. McDowell, O. Myška, T. Navrátil, and M. Tesař. 2017. Recovery from acidification alters concentrations and fluxes of solutes from Czech catchments. Biogeochemistry 132:251-272. DOI 10.1007/s10533-017-0298-9

Table 7.6: California NO3-N criteria of 45 mg/L seem suspect, as it is well above the WHO drinking water standard. Check units.

Chapter 8

Overall, Chapter 8 is well written and thorough. I have no line-specific edits, but instead offer the following observations:

It is apparent when comparing the biotic response to acidification in terrestrial and aquatic systems that there is a relative lack of information on aquatic biological response (beyond eutrophication). This should be noted, as it suggests that there is greater uncertainty in quantifying the magnitude of the biotic response in aquatic vs terrestrial systems.

For aquatic biota, biotic interactions are often important in driving community structure, and they can obscure or magnify the impacts of atmospheric deposition. For amphibians, the big issue globally for the last decade has been chytrid fungi. They should at least be mentioned, though it is possible that their prevalence or impacts in temperate, acid-sensitive surface waters are unknown. For fish in acid-sensitive surface waters, species introductions by anglers or state agencies can have large impacts on community structure. These issues should be acknowledged.