Attachment 1

Comments from Joe Beaman, Senior Scientist, ERAB/HECD/OST, U.S. EPA

1. It seems to me that the document “Definition and Assessment of Great Salt Lake Health”, prepared for Great Salt Lake Advisory Council by SWCA Environmental Consultants Applied Conservation January 2012 is a very comprehensive compilation of information and data that could provide useful information for delineating existing uses, designated uses, and biological expectations for the Great Salt Lake (GSL) and its diverse assortment of aquatic ecosystem subcategories. The Science Panel (Panel) selected for the definition and assessment project consisted of a group of prominent scientists with extensive experience and knowledge of the varied GSL ecosystems and species. The Panel reflected a wide range of academic and research disciplines, including hydrology and circulation, biogeochemistry, water quality, population dynamics, brine shrimp, migratory birds, and wetland science. Since this document was developed by an expert panel with many years of academic and field experience studying the GSL and it seems like the information in this document could go a long way in developing draft designated uses as well as serving as the information base for a UAA that may be needed to subcategorize the uses found in the GSL. Indeed, the eight ecological targets identified by the Panel - [1) system-wide lake and wetlands, 2) open water of bays, 3) unimpounded marsh complex4) impounded wetlands, 5) mudflats and playas, 6) isolated island habitat for breeding birds, 7) alkali knolls, and 8) adjoining grasslands and agricultural lands] collectively capture the full biological diversity of the lake ecosystem and could be used separately or in combination to delineate subcategorized designated uses. Similar types of information were compiled for the development of subcategorized uses for the Chesapeake Bay, as well as the Bay UAA (http://water.epa.gov/scitech/swguidance/standards/uses/uaa/chesapeake.cfm#references). Use of the Science Panel document and other existing documents may allow the for a reduction in the type and amount of some of the monitoring and research described in the GSL Monitoring and Research plan (Core Component 2) and still result in a scientifically defensible proposal.

2. Contaminants of Concern, and more specifically toxic contaminants, as described in Section 2.3 of the monitoring and research plan, should be described in more detail in Core Component 1. In addition, Core Component 2 focuses on nutrients, metals, selenium, and mercury, yet the numeric criteria framework document does not discuss these; rather, it speaks more generally to the entire list of EPA priority pollutants, and acknowledges that many of them are likely to be found in the GSL. There are 25 ambient WQC for aquatic life (http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm), for priority pollutants (e.g. metals, pesticides [mostly banned/restricted], arsenic, cyanide mercury and selenium). There are many other priority pollutants for human health, which are based on fish and/or drinking water consumption, and would not likely apply to the GSL since the GSL does not support these beneficial uses. Given the relatively limited number of priority pollutants which have aquatic life criteria, the focus should be on toxic contaminants of concern, rather than the larger list of EPA priority pollutants. If monitoring data indicates that other priority pollutants are present that do not have aquatic life criteria, perhaps the human health criteria can be used as a conservative screen to acknowledge the presence of that priority pollutant and warrant additional studies.

3. Comment regarding lines 424-427 of Core Component 1.

> “Readily available toxicity benchmarks are estimates of no-effects concentrations and will be compared to existing lake concentrations. These benchmarks will be summarized by a range of values (when available) that define concentrations that could adversely affect Great Salt Lake species. Readily available benchmarks may include regulatory

numeric criteria, values from the primary literature, and bioassays (toxicity tests). **If the lake concentrations are less than the benchmarks divided by 10, the pollutant will be classified as high priority.** The high priority pollutants will be the focus of initial efforts to derive numeric criteria."

Figure 2 identifies low, high and top priority pollutants, with the top priority pollutants having the least assimilative capacity in the lake (i.e., concentrations are > 0.1x potential effect concentrations). Should the top priority pollutants be the initial focus of the efforts to derive the numeric criteria rather than the high priority pollutants since existing concentrations are closer to potential effect concentrations?

4. Comment regarding lines 529-533 of Core Component 1.
UDWQ proposes to derive ***interim criteria*** if at least one technically sound toxicology study is available and by **applying uncertainty factors (Eastern Research Group, Inc., 2005)** to reduce the probability of underestimating the potential effects on untested organisms. The specific methodology for deriving interim and final criteria will be developed after the existing toxicity database is complete for the highest priority pollutants.

- How does UDWQ define interim criteria? How will the "interim criteria" be implemented? For what WQ management purposes will the interim criteria be used for? 305(b) monitoring and assessment? 303(d) listing/TMDLs? Permits?

- I am unfamiliar with the document (Eastern Research Group, Inc., 2005) referenced in the framework, but I was able to download a copy online. To date, I do not believe that we have used the methodology detailed in this 2005 document in any type of aquatic life WQC application. The only application or uncertainty factors that I am aware of having been implemented in aquatic life WQC are those from the Great Lakes initiative. While they may have limited utility in this situation, they were derived from empirical data and a scientifically defensible peer reviewed and withstood public comment via the APA process.

5. The GSL is a very unique ecosystem, with areas of very limited biodiversity. Gilbert Bay is dominated by brine shrimp, *Artemia fransicana*, a commercially important aquaculture product, and brine flies (*Ephydridae;* 3 species), which serve as an important source of forage for birds inhabiting the area as well as migratory bird species that use the GSL for part of their life cycle. There are also herbivorous aquatic insects - corixids ("water boatmen") found widely in freshwater, but also tolerate a wide range of salinity, from pure seawater to mildly brackish water, as well as some fish species that are found in Bays with significant freshwater inputs.

Given the uniqueness of the proposed hypersaline class, the limited native aquatic life, and the commercial importance of brine shrimp, it seems as though toxicity testing with *Artemia spp* should play a prominent role in any site specific criteria developed for Gilbert Bay. *Artemia* species are generally not considered in the development of ambient water quality criteria since they are not typical of either freshwater or marine habitats. However, *Artemia* species have been used in many scientific experiments for acute toxicity testing of toxic materials including pesticides leachates dental materials fungal toxins and antifouling biocides (Koutsaftis 2007). In addition, several studies have specifically focused on the impact of metals on brine shrimp. Kissa et al. (1984) as well as Gajbhiye and Hirota (1990) have demonstrated that the lethality of these species is dependent on the concentration of heavy metals in water. Sarabia et al. (2002) investigated the effects of cadmium on different populations of *Artemia*. Furthermore, MacRae and Pandey (1991) as well as Brix et al. (2006) have researched the relation between water toxicity and hatching success of *Artemia* species. *Artemia* have some important advantages including constant commercial availability all year round, cost efficiency, ease of culture, short life-cycle, no feeding required during the assay and great offspring production. This information may be used as a starting point in assessing the toxicity of some contaminants of concern, particularly heavy metals, on brine shrimp.

Brine flies, also an important part of the GSL ecosystem, have not been the subject of toxicity testing. Other Dipterans, particularly chironomids, have been used extensively as a toxicity test organism, with data for many types of pollutants, including some of the GSL contaminants of concern such as divalent metals (Brix et al 2011). Since chironomids serve as surrogates for other untested Dipterans and more generally aquatic insects, perhaps they can serve as a surrogate for the brine fly either as an interim data point or more permanently if it is determined that brine flies and chironomids are of similar sensitivity.

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MacRae, T.H.; Pandey, A.S. Effects of metals on early life stages of the brine shrimp, *Artemia*: A developmental toxicity assay. *Arch. Environ. Contam. Toxicol*. **1991**, *20*, 247-252.

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