Responses and relevant information for questions posed by the Legislative Study Committee on Wetlands during oral testimony on October 9, 2019

Phil Huffman, Director of Government Relations and Policy
The Nature Conservancy in Vermont

1. **Questions related to small wetlands and their outsized importance**
   - The 2017 scientific paper entitled "Biogeochemical hotspots: Role of small water bodies in landscape nutrient processing" published in *Water Resources Research* that I submitted with my written statement on October 18, 2019 highlights the importance of wetlands **as small as 10 m^2** in its analysis of hundreds of sites around the world (mostly from temperate sites in North America and Europe). (p.5041)
   - The authors state "Results suggest that **small wetlands play a disproportionately large role in landscape-scale nutrient processing – 50% of nitrogen removal occurs in wetlands smaller than $10^{2.5}$ m^2** in our example." They continue "Based on a synthesis of data from lakes, reservoirs, and wetlands worldwide, we found that smaller water bodies tend to have higher nutrient removal rates. We applied our findings to the landscape scale and found that for the same wetland area lost, the **loss of small wetlands corresponds to a greater loss in wetland nutrient removal potential**." (p.5038) [emphasis added]
   - As a result, the authors note that "given the same loss in wetland area, the nutrient retention potential lost is greater when smaller wetlands are preferentially lost from the landscape" (p.5038) They conclude "Our study for the first time quantifies the **disproportionately larger role smaller wetlands can play in landscape nutrient processing, and highlights the need for valuing and protecting these smaller, often ignored landscape features**." (p.5053) [emphasis added]
   - The recent research conducted by UVM's Gund Institute for Environment in partnership with The Nature Conservancy that I cited in my testimony focused on 3,606 restorable wetlands in the Champlain Basin ranging in size from about 3-750 acres. The map I provided with my written statement on October 18, 2019 shows the locations of these wetlands. These sites, which are from the Department of Environmental Conservation's database, are part of the broader suite of wetlands around the state that have been "lost" due to various human activities since Western settlement, i.e., part of the roughly 35% of wetlands that DEC and others state have been lost over the past several centuries.

- The Gund study found that **restoring smaller wetlands, close to stream networks, offers the greatest potential reduction in nutrient pollution in relation to cost**. In their published paper, the Gund researchers stated that their "results indicate that **smaller wetlands, if well-located, can be equally or more important than the larger wetlands in retaining P [phosphorus]. Our results support those recent studies showing that P retention capacity is substantially higher for smaller wetlands**." (p.6) [emphasis added]
- In addition, Ellen Wohl, a nationally recognized scientific expert on freshwater systems, highlighted the importance of small wetlands and streams in a January 30, 2019 piece in *The Conversation* entitled Small streams and wetlands are key parts of river networks - here's why they need protection. She uses the analogy of these small, often unseen, landscape features being like the capillaries of our own circulatory systems. Without the chemical and physical processes that occur in capillaries our bodies would cease to function. Small wetlands and streams play a similar role in nutrient processing in watersheds, and also play a vital part in flood control and providing habitat to a wide range of species.

2. Questions related to wetland restoration

- Broadly speaking, wetland restoration is very site-specific depending on the type and degree of prior alteration, the wetland area and type involved, the landscape setting, and other factors. It may involve the removal of man-made features (buildings, pavement, fences, etc.) if any are present, as well as vegetative restoration, hydrological restoration, and potentially other types of restoration (e.g. wildlife habitat).
- As the US Environmental Protection Agency describes it in their Wetlands Restoration Definitions and Distinctions, restoration is the "return of an ecosystem to a close approximation of its condition prior to disturbance." The objective is "to emulate a natural, self-regulating system that is integrated ecologically with the landscape in which it occurs. Often, restoration requires one or more of the following processes: reconstruction of antecedent physical conditions; chemical adjustment of the soil and water; and biological manipulation, including the reintroduction of absent native flora and fauna."
- Good Vermont-specific information on wetland restoration is found in the Department of Environmental Conservation's 2007 Lake Champlain Wetland Restoration Plan. Hydrological restoration techniques are described on p. 65-70, and considerations for vegetative restoration are discussed on p. 53-65.
- Other helpful sources include information from the USDA Natural Resources Conservation Service and a landowner guide to restoration techniques from the Michigan Department of Natural Resources.

3. **Questions related to the impact of wetlands loss and birds**
    - We are still looking into this issue. Audubon Vermont may also be a good source of information on it.

4. **Question about whether Vermont is seen as a leader in wetland protection compared to other states**
    - We do not have information on this question at this time. Staff from the USEPA and Army Corps of Engineers who work with multiple states on wetlands issues might be good sources for an informed perspective, or academic wetland experts with a broad geographic view.

5. **Questions on wetland protection in states that rely solely on the Army Corps of Engineers for regulation and have no state-level regulatory framework**
    - We do not have information on this question at this time. Staff from USEPA and the Army Corps and academic experts might be helpful sources of perspective on this as well.

6. **Additional information on carbon sequestration and storage in wetlands (wetlands as "carbon sinks"**
    - A good summary of the significant benefits of wetlands provide by absorbing carbon from the atmosphere and helping to slow climate change is found here. The author highlights that "Wetlands have a **remarkable capacity to sequester carbon despite covering less land area than other ecosystems**, like forests. One reason why these ecosystems accumulate carbon so effectively is that they are water-logged, dark, and very productive, which creates conditions for highly stable carbon content. They store carbon in vegetation above ground and underground, in sediment beneath live plants, and in dead plants, such as leaf litter." In addition, "**Poorly managed wetlands can be, and often are, sources of carbon when they are destroyed, drained, or encroached upon by development. It can take years for a newly constructed wetland to fully mature, and even then it will never sequester as much carbon as a natural wetland. That's why we need to preserve the wetlands that we have.**" [emphasis added]
    - The US Global Change Research Program's exhaustive "state-of-the-science" publication 2nd State of the Carbon Cycle Report (SOCCR2) released in 2018 has detailed information on wetlands as carbon sinks / sources (among a wealth of other valuable information on carbon in the environment and climate change). The section on wetlands can be found on p.523 - 546.