November 3, 2009

Advocates for Herring Bay
C/o Kathy Gramp
404 Arundel Road
Fairhaven, Maryland

Dear Ms. Gramp:

At your request W. S. Sipple Wetland & Environmental Training & Consulting (WSS) conducted a field investigation of Fairhaven "Lake" and surrounding wetlands, the lower reaches of its feeder streams, and its immediately adjacent uplands on September 20 and October 1, 2009. The main purpose of the field investigation was to characterize the area and advise you on its ecological significance. In accordance with our agreement, I am submitting this report. The report presents WSS's field approach, findings, conclusions, and recommendations based upon field work at the site and information (e.g., historical maps/aerial photographs) that you sent me. Since the field investigation was conducted by me, I have also relied heavily on my knowledge of the Chesapeake Bay's wetlands gained over many years as an employee with the Maryland Department of Natural Resources and the U. S. Environmental Protection Agency, and subsequently as a private consultant. Three copies of this report are enclosed. I have also agreed to send you an electronic copy.

According to information you sent me, the Fairhaven residents highly prize this ecosystem for its aesthetic and fish and wildlife values and want to see it preserved. They also have a number of concerns, many of which were expressed in a series of questions that you recently sent me. In addition, you inquired about guidance on future environmental investigations for the area. I have addressed the majority of these questions within the body of this report. I could not answer some, however, because they were beyond my expertise. The guidance on future environmental investigations is presented in Exhibit F.

1.0 INTRODUCTION

On September 20, 2009, I met with members of the Advocates for Herring Bay (AHB) to discuss their concerns about the site and walk portions of the upland forest, palustrine emergent wetlands, and estuarine emergent wetlands. Subsequent discussions led to an agreement to have WSS conduct a more thorough field investigation of the area including at least the lower sections of the main feeder

streams (tributaries) and produce a report. Therefore, I visited the area again on October 1, 2009, to conduct more extensive field work. Subsequently, AHB submitted historical maps and aerial photographs to WSS For consideration in this report, including a composite map based upon a number of these photographs showing how the contours of the "Lake" have changed since 1952 (Exhibit D).[1] An additional photograph depicting the location of the South Estuarine Fork and the West Estuarine Fork, including the latter's North and South Stream Branches was also submitted by AHB (Exhibit E).

2.0 FIELD APPROACH

Field notes on the different vegetation types and wildlife were compiled during both site visits. However, the more thorough field investigation on October 1, 2009 involved traversing the entire periphery of the tidal wetlands (i.e., the South Estuarine Wetland Fork and the West Estuarine Wetland Fork), as well as any associated fresh tidal wetlands and non-tidal wetlands further up the drainages leading to these two Forks until defined stream channels were located. This investigation also included downstream portions of tributaries of these main stream channels. The purpose of inspecting the lower sections of the stream channels was to make a tentative assessment of the condition of the streams entering the Fairhaven Lake and its associated wetlands based upon geomorphologic evidence.

During my traverse of the area, wetland and floodplain habitats were examined, select physical features were noted, and dominant and representative vascular plant species were recorded by habitat (Exhibit C). Field sign of mammal use (e.g., tracks, droppings, cuttings) and bird sitings were recorded. Photographs were taken of representative habitats, specific plants, and other select features (Exhibit B). References cited are given in Exhibit A.

Although no agreement was made with AHB to assess the uplands, I collected similar plant data in select upland areas. To some extent, this information is also presented in the body of this report, as well as presented in Exhibit C.

3.0 FINDINGS

Seven wetland, floodplain, and upland habitats were found during this field investigation. They are listed below.[2]

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[1] Because this area is referred to locally as Fairhaven Lake, I have retained that designation here for that body of water. However, this brackish water body and its associated wetlands really constitute a subestuary of the Chesapeake Bay. Therefore, they are hydrologically connected to and predominantly influenced by the ebb and flow of tidal waters. I will refer to these associated brackish tidal wetlands in the upper part of Fairhaven Lake as the South Estuarine Wetland Fork and the West Estuarine Wetland Fork. They are quite similar to contiguous brackish tidal wetlands along the shoreline of the lower portion of the Lake.

[2] While traversing the wetlands, floodplains, and uplands, I didn't encounter any rare, threatened, or endangered (RTE) plants. Had I encountered some, they would have been

- Estuarine Emergent Wetlands (Brackish Tidal Marshes) (Exhibit B, Photos 1 and 2)[3]
- Palustrine Emergent Wetlands (Fresh Tidal Marshes) (Exhibit B, Photo 3)
- Palustrine Emergent Wetlands (Fresh Non-tidal Marshes) (Exhibit B, Photo 4 and 5)
- Palustrine Forested Wetlands (Fresh Non-tidal Swamps) (Exhibit B, Photos 6 and 7)
- Floodplain Forests and Lower Mesic Side Valleys (Exhibit B, Photo 8)
- Zeric Upland Forests (Ridges and Steep Slopes) [4]
- Mesic Upland Forests (More Gentle Slopes)

Representative examples of these habitats are described below starting with the lower Brackish Tidal Marshes surrounding Fairhaven Lake and continuing upstream following the above sequence to the Fresh Non-tidal Swamps. Next, representative areas of Floodplain Forests and Zeric and Mesic Uplands are described. Because of their close association, streams are considered in conjunction with their floodplains.

3.1 Estuarine Emergent Wetlands (Brackish Tidal Marshes)

These wetlands are associated with a relatively large area of shallow brackish water (i.e., Fairhaven Lake). As already pointed out, Fairhaven Lake and its associated brackish tidal wetlands constitute a subestuary of the Chesapeake Bay. Examination of historical aerial photographs suggests that this embayment was once partially closed by a sandy spit or natural baymouth barrier across much of its mouth. In fact, a major remnant floodtide delta (fan-like) is quite evident on a series of aerial photographs taken between 1952 and 2005.[5] Marsh vegetation eventually developed on this delta, which is located just west of Fairhaven Lake's tidal connection to Herring Bay. Another photograph taken in the 1940s shows a rather obvious ebb tide delta protruding into Herring Bay. These photographs also show how the tidal entrance to Fairhaven Lake has changed over the years due to both natural phenomena as well as man's influence in

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reported here and to the Maryland Department of Natural Resources. This does not mean that such species do not occur at the site. Adequately addressing the presence of RTE species would mean checking existing state RTE databases, assessing the various habitats for RTE potential, and systematically searching RTE habitats having potential using a system set up by WSS. This system calls for searches commensurate with the probability of occurrence of specific RTE species in suitable habitats. Such an investigation would involve searching for target species during their flowering/fruiting periods and was beyond the scope of this field investigation.

[3] Estuarine Emergent Wetlands and Palustrine Emergent Wetlands are terms used in the U.S. Fish and Wildlife Services wetland classification system (Cowardin, et. al., 1979). There are many local names for different wetlands. However, they all generally fall under one of the four generic wetland types: marshes, swamps, fens, and bogs (Sipple, 1999). In the United States, the term marsh is usually used for wetlands that are dominated by herbaceous plants, whereas the term swamp is used for wetlands dominated by woody plants.

[4] Other upland habitats, such as various forest types, scrub-shrub areas, and old fields, were also noted in the Fairhaven Lake watershed during my field work and by examining aerial photographs. Describing these, however, was well beyond the scope of this field investigation.

[5] An alternative, less likely, possibility is that this feature resulted from the deposition of dredge spoil material, assuming the entrance was dredged prior to the 1940s-1952 period.

protecting the shoreline and maintaining the tidal connection to Fairhaven Lake.[6] The remnant floodtide delta is strong evidence that a tidal entrance into Fairhaven Lake has existed since colonial if not in Pre-Columbian times. In its natural state, this spit or baymouth barrier no doubt had either a permanent or intermittent opening allowing for sand transported by longshore currents to accumulate along the shoreline and enter Fairhaven Lake via the tidal connection.

Sediments have also entered Fairhaven Lake over the years via its tributary streams. Such embayments are natural depositional areas that will tend to fill in over long periods of time, especially if total closure occurs due to spit and baymouth barrier formation.[7] However, this should be thought of as a natural process in response to sea level rise, shoreline erosion, longshore currents, and sand deposition in the lower end of Fairhaven Lake at Herring Bay; sediment deposition from inflowing streams from the upper end. These shoreline features experienced at Herring Bay are fairly common around the Chesapeake Bay proper and some of its major tributaries. Based upon years of conducting field work associated with Maryland's tidal wetlands, I visited many of these estuarine embayments in various stages of ecosystem succession and eventually described them in conjunction with a Geomorphologic Classification System of Maryland's Tidal Wetlands (Sipple, 1999). Some of these features have good tidal connections with ample open water and adjacent marsh vegetation. Others have partial or total baymouth barrier or spit closures and are in various stages of ecosystem succession with emergent marsh, shrub swamp, and/or forested swamp present, sometimes interspersed with open water.

Although it is difficult to say for sure due to the man-induced modifications that have occurred at the mouth of Fairhaven Lake, this site in its natural state would have best been described as either a Spit Marsh Wetland or a Baymouth Barrier Wetland under my classification. The former wetland type occurs landward of Chesapeake Bay spits at the mouths of small subestuaries, as well as along the Chesapeake's larger subestuaries at the mouths of their tributaries. The latter type occurs along the Chesapeake Bay proper and along its major tributaries where there has been complete spit closure of the small embayments due to sand deposition associated with littoral currents. Both of these can have varying amounts of open water and wetlands behind them, including both marsh and swamp. When and how often they are tidally flooded under natural conditions is contingent upon tidal influx, recipient inflow from feeder streams, and the accumulation of sand transported by longshore currents.

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[6] The aerial photographs and maps used for this report were supplied by the AHB.

[7] Being a tidal water body, Fairhaven Lake is at ultimate base level (sea level), which means sediments coming into it from its feeder streams would soon settle particularly in its upper end, except for some fines that would stay at least temporarily in suspension, adding to the slow, inexorable accumulation of fine sediments in the Lake.

With larger embayments, such as Fairhaven Lake, sometimes there are attempts to permanently keep them open by channelizing and stabilizing the natural tidal openings and preventing shoreline erosion. This shoreline management has occurred at Fairhaven Lake and has made interpreting past natural conditions more difficult. One thing is for sure, however: Fairhaven Lake has been slowly filling in for some time by natural processes occurring at both ends. Although sea level rise may offset this filling somewhat, it also results in more shoreline erosion, making additional sand available for transport by longshore currents. The process involved in moving such sediments is referred to as littoral drifting (Tuttle, 1970). To quote Tuttle: "Refracted waves hitting the points and headlands cause strong beach drifting and longshore currents that transport eroded debris from the headlands into the intervening bays, depositing sand and shingle on the bay heads. Theoretically, after the passage of enough time, an irregular coastline would be straightened, with the promontories cut back and the bays filled in."[8]

As should be expected, the Brackish Tidal Marshes at Fairhaven Lake have hydric soils (soils associated with wetlands). They have a peaty layer at the surface underlain by a black muck and readily give off a hydrogen sulfide odor (smell of rotten eggs) when the surface is broken. This rather odoriferous gas is typical of such waterlogged, anaerobic, and chemically reducing environments, especially in estuaries due to the abundance of sulfur in seawater. This smell should be considered characteristic of these areas.

The vegetation around Fairhaven Lake is also typical of other brackish tidal wetlands around the Chesapeake Bay. General descriptions of these ecologically important tidal wetlands are presented in Days Afield: Exploring Wetlands in the Chesapeake Bay Region (Sipple, 1999) and Wetlands of Maryland (Tiner & Burke, 1995), along with lists of characteristic plant species. As presented by Tiner & Burke (1995) brackish marshes are found over a wide range of salinities ranging from a high of 25 parts per thousand (ppt) to a low of 0.5 ppt. Salinities below that level are indicative of fresh tidal wetlands. On the average, however, salinities range from around 8 ppt in the spring to 14 ppt in the fall in the Herring Bay area (Lippson, 1973). Because many of the marshes around the Chesapeake Bay are classified as brackish, a number of vegetation types exist within the brackish salinity range cited above. Those dominating at Fairhaven Lake include narrow-leaf cattail (Typha angustifolia), smooth cordgrass/tidemarsh waterhemp (Spartina alterniflora /Amaranthus cannabinus), and common reed (Phragmites australis). The stands of narrow-leaved cattail and common reed are monotypic or nearly monotypic, supporting few if any other plant species. On the other hand, most of the wetland vegetation surrounding Fairhaven Lake is

[8] Headlands are promontories along shorelines where wave energy is concentrated due to wave refraction and erosion generally results. Bay heads are intervening areas along shorelines where wave energy is reduced and sand deposition occurs.

represented by the smooth cordgrass/tidemarsh waterhemp vegetation type, which also supports a number of non-dominant species. At least one area of saltmeadow cordgrass/saltgrass (Spartina patens /Distichlis spicata) occurs at the site. It is located near the mouth of the South Estuarine Fork. This vegetation type is typically located landward of (and at slightly higher tidal elevations) than the smooth cordgrass/tidemarsh waterhemp vegetation type, which is the case at Fairhaven Lake. See Exhibit C for a list of the vascular plants found in the Brackish Tidal Marshes at Fairhaven Lake.

Because of its invasive nature, the common reed commonly displaces other more diverse vegetation over time (Exhibit B, Photo 9). This has been well documented in the Chesapeake Bay Region and I have observed this over the years particularly in fresh and brackish tidal marshes that have been hydrologically disturbed. Two relatively large patches of the common reed occur in the Brackish Tidal Marsh at Fairhaven Lake (one on the South Estuarine Fork; the other on the West Estuarine Fork). A somewhat smaller area occurs in the Brackish Tidal Marsh near the junction of Fairhaven Road and James Avenue. Although the narrow-leaf cattail at Fairhaven Lake is also rather dense and monotypic, it is a native plant typical of such brackish estuarine settings and should not be thought of as undesirable.

3.2 Palustrine Emergent Wetlands (Fresh Tidal Marshes)

Fresh Tidal Marshes are located upstream from the Brackish Tidal Marshes, although there usually isn't a sharp boundary between the two types in the field because transitional zones exist where plants from both systems intermingle. Locally at Fairhaven Lake, however, some remnant beaver dams prevent or partially prevent tidal influx resulting in more discrete vegetation breaks at the fresher end. Furthermore, this wetland type is not that extensive at Fairhaven Lake.

Generally, as one moves up estuarine systems, including the Chesapeake Bay proper and any of its major the tributaries, there tends to be an inverse relationship between the number of vascular plant species and the degree of salinity (i.e., as salinity decreases the number of plant species increases) (Odum, et. al.,1984; Sipple, 1999). Thus, Fresh Tidal Marshes are usually more diverse than Brackish Tidal Marshes. However, marshes in the lower brackish range tend to have many similar species as fresh tidal marshes. Based upon the tentative lists that I compiled, the Fresh Tidal Marsh is only slightly more diverse at Fairhaven Lake than the Brackish Tidal Marsh (21 species verses 19), although the extent of the former is much less than the latter. Also, the common reed (totally) and narrow-leaf cattail (for the most part) vegetation types, both of which cover large areas at Fairhaven Lake, are confined to the Brackish Tidal Marshes.

Tidal streams in these wetlands are totally or partially blocked in both the South Estuarine Fork and the West Estuarine Forks by remnant beaver dams (Exhibit B, Photo 10). Another Fresh Tidal Marsh, this one not associated with a beaver dam, is just

downstream from one of the small tributaries mentioned in Section 3.5. It is dominated by rice cutgrass (Leersia oryzoides) and arrow-leaved tearthumb (Polygonum sagittatum). The transition to Fresh Non-tidal Marshes occurs at these locations, or with dam breaches, further upstream.

3.3 Palustrine Emergent Wetlands (Fresh Non-tidal Marshes)

These wetlands are located above the Fresh Tidal Marshes on both Estuarine Forks of Fairhaven Lake. As pointed out above, their location is usually above remnant beaver dams. For the most part, there is a different suite of species in the Fresh Non-Tidal marshes than the Fresh Tidal Marshes. These areas owe their origin to the beaver dams which, because of flooding, have killed most trees and allowed for emergent plant invasion on silty sediments accumulated behind the dams. Sediment accumulation appears to be quite significant and the substrate is difficult to traverse. Two examples, one from each Estuarine Fork, are described below. They both have hydric soils.

The Fresh Non-tidal Marsh above the first remnant beaver dam on the South Estuarine Wetland Fork has a good mix of species as well as some open water due to the impoundment (Exhibit B, Photo 11). The lower end is dominated by rice cutgrass, hemp vine (Mikania scandens), and Walter's millet (Echinochloa walteri). However, lizard's tail (Saururus cernuus) dominates the upper end. This area eventually grades into a Fresh Non-tidal Swamp. On the other hand, a much larger Fresh Non-tidal Marsh far up the West Estuarine Fork is located in a quite old, vegetation filled, relic beaver pond dominated by rice cutgrass (Exhibit B, Photo 4). Two stream branches merge at this densely vegetated beaver pond and its substrate is quite wet.

3.4 Palustrine Forested Wetlands (Fresh Non-tidal Swamps)

The Fresh Non-Tidal Swamps occur on the drainages (floodplains) leading to Fairhaven Lake. Those along both Estuarine Wetland Forks are quite muddy and have hydric soils. The drainages are braided, shallow streams having little if any beds and banks. It is obvious that substantial fine sediments have accumulated in many of these wetlands and some are most likely relic beaver impoundments that have undergone ecological succession to forested swamps. They are dominated in the canopy by green ash (Fraxinus pennsylvanica), and in some areas red maple (Acer rubrum), with lizard's tail and small-spike false-nettle (Boehmeria cylindrica) in the understory (Exhibit B, Photo 6). One swamp area on the West Estuarine Fork also has an abundance of cardinal flower (Lobelia cardinalis), as well as wood reed grass (Cinna arundinacea) and

Virginia dayflower (Commelina virginica) (Exhibit B, Photo 12).[9] Burreed (Sparganium sp.) is essentially filling the shallow, silt-filled stream.

3.5 Floodplain Forests and Lower Mesic Side Valleys

These forested floodplains occur up both Estuarine Forks of Fairhaven Lake and are associated with more obvious streams that have well defined beds and banks.[10] On the South Estuarine Fork, this area occurs above the Fresh Non-tidal Swamp. I followed it upstream to the first gravel road that crosses the floodplain. On the West Estuarine Fork, two tributaries (north and south stream branches), both having beds and banks, merge in the vicinity of the large relic beaver impounded area mentioned in Section 3.3.

The forested floodplain on the South Estuarine Fork has firm hydric soil and is dominated in the tree canopy by green ash, although a fair amount of sweet gum is also present. Spicebush (Lindera benzoin) dominates the shrub layer, along with pawpaw (Asimina triloba); small-spike false-nettle dominates the ground layer. Wood nettle (Laportea canadensis) is also present in the ground layer, as are two undesirable invasive plants, the Nepal microstegium (Eulalia viminea) and Asiatic tearthumb (Polygonum perfoliatum).

Presently, the stream appears to be fine from a geomorphologic perspective. Its banks are less than 1 foot high and generally only 4-6 inches. Thus, channel down cutting is not evident (i.e., the stream is not incised). Although the stream has a silty appearance in the channel, some small gravel is present. Thus, sorting of the sediments by particle size is occurring. Discarded debris and flotsam are not evident in the stream or on its floodplain. Some fine sand from overwash is present on the stream bank, which indicates overbank flooding is occurring. Such flooding is typical of floodplains and is important for trapping sediments and nutrients beneficial to vegetation on the floodplain and keeping them from moving downstream to enter the estuary.

Immediately upstream of the large relic beaver impoundment (Fresh Non-tidal Mash) on the West Estuarine Fork is a small area of Fresh Non-tidal Swamp which gives way to a more firm forested floodplain. Because of the dense vegetation in the marsh and given the obvious sheet flow in the area, it may be that a defined channel doesn't exist in the marsh (perhaps it is braided). A very shallow channel (south stream branch) is present, however, where it passes through the forested swamp . This forested floodplain supports red maple, American elm (Ulmus americana), ironwood (Carpinus caroliniana), and sycamore (Platanus occidentalis) in the canopy; mostly spicebush in the dense shrub layer. The thick shrub layer is indicative of shorter duration flooding than that which occurs downstream in the Fresh Non-tidal Swamps.

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[9] The abundance of the cardinal flower was utterly amazing. In all of my career, I have never seen so many plants in one area.

[10] One of WSS's goals was to walk up both Estuarine Forks until streams with definite beds and banks were located in order to assess the geomorphologic condition of these streams. Specifically, to determine if they were badly incised and/or had severe lateral bank erosion.

Presently, the south stream branch appears to be fine from a geomorphologic perspective. It is about 2-3 feet wide and 2-3 inches deep, has a definite bed and bank with the bed comprised of sorted silt and small gravel. Overbank flooding is evident, but the channel is not down cut (incised). There is no evidence of discarded debris.

The other larger (perhaps mainstem) north stream branch was walked upstream to and about 100 feet beyond a small man-made wooden bridge. This stream branch is well defined from at least the large Fresh Non-tidal Marsh (old beaver pond) mentioned in Section 3.3. From here, the stream parallels the east side of the marsh to eventually courses through the floodplain as a well-defined stream with obvious bed and bank. In the vicinity of the wooden bridge and beyond, this branch is somewhat down cut (incised) and some tree roots are exposed. However, the bank erosion does not appear to be severe at this point. This meandering perennial stream is about 4-5 feet wide with banks varying from 1.5 to 3 feet high. It also has some riffles and pools. The average water depth at the time of my visit was about 6 inches (Exhibit B, Photos 13 and 14).

At least two other smaller tributary streams were noted during this visit (Exhibit B, Photo 8). Both are located on or near the West Estuarine Fork, have beds and banks, and are at least intermittent streams with densely vegetated floodplains. They are only a couple of feet wide and shallow with no evidence of down cutting.

3.6 Zeric Upland Forests (Ridges and Steep Slopes)

An examination of a topographic map readily shows how markedly dissected the landscape is in the watershed surrounding Fairhaven Lake. Associated with this dissection are steep zeric (drier) ridges. Valleys and ravines associated with some of these ridges support the streams and wetlands that were traversed during this field investigation. One example is the steep forested ridge to the east of the South Estuarine Fork, which supports trees such as tulip poplar (Liriodendron tulipifera), loblolly pine (Pinus taeda), Virginia pine (Pinus virginiana), northern red oak (Quercus rubra), American beech (Fagus grandifolia), red maple (Acer rubrum), and black cherry (Prunus serotina). Another good example is the promontory between the South Estuarine Fork and the West Estuarine Fork, which supports chestnut oak (Quercus prinus), white oak (Quercus alba), American beech, and red maple, as well as a dense area of mountain laurel (Kalmia latifolia) on its north slope. A third ridge examined occurs further up the South Estuarine Fork opposite one of the large common reed patches. Many of the trees listed above, as well as some sweet gum, occur at this ridge. A lower zone of mountain laurel is also present. All of these areas have sparse herbaceous cover and tend to have sandy and gravelly soils.

3.7 Mesic Upland Forests (More Gentle Slopes)

These upland areas occur on more gentle slopes associated with both Estuarine Forks and their smaller side valleys. A good example is the first side valley on the South Estuarine Fork adjacent to the upper end of the first forested ridge described in Section

3.6. This side valley supports sweet gum, sycamore, and substantial pawpaw (Asimina triloba). The gently sloping ridge just above it has tulip poplar in the canopy with an abundance of spicebush. Both of these areas have much richer, loamy soils and denser understory vegetation.

Another mesic (moist) area on the west side of the main valley leading to the South Estuarine Fork supports tulip poplars and a very dense subcanopy of pawpaw. Some large tree trunks are present, apparently from oaks, which is evidence of past selective timber harvesting. Likewise, some very large tulip poplars occur in a side valley of this slope near the location of the beaver impounded area mentioned in Section 3.3 (Exhibit B, Photo 15). Substantial patches of two invasive exotic plants, the Asiatic tearthumb (Polygonum perfoliatum) and Nepal microstegium (Eulalia viminea), occur along the lower parts of this slope near the same beaver impounded area (Exhibit B, Photos 16 and 17).

3.8 Wildlife Observations and Commentary

While conducting my field investigations for this project, I noted animal observations and wildlife sign in the wetlands, floodplains, and uplands and assessed the ecological significance of the various habitats for wildlife. Some of the birds that I saw or heard, such as two bald eagles on my first visit, were associated with Fairhaven Lake. That same day, snowy egrets and great blue herons were also spotted over the Lake. Great blue herons were again observed on my second visit. Another bird, the red-shouldered hawk, was heard while I was in the area of the promontory between the two Estuarine Forks. This raptor is typically associated with bottomland forests. While in the area of the Fresh Tidal Marsh on the South Estuarine Fork, I heard a flicker and cardinal, as well as some common crows. I found an adult black rat snake basking on matted rice cutgrass in the large remnant beaver pond mentioned in Section 3.3.

Evidence of mammals noted includes an abundance of old beaver sign (dams and cuttings), raccoon and deer tracks, and otter scat (recognized by the abundance of fish scales). Beaver may still be present in the area, but if they aren't now, they will likely return given the current abundance of new food sources (e.g., sapling trees and dense rhizomatous herbaceous vegetation). Raccoons would be expected and otter are characteristic of Maryland's tidal wetlands and can be found along stream valleys as well. Muskrats should be present in at least the Fresh Tidal Marshes and Fresh Non-tidal Marshes. Abundant deer sign (tracks) were noted in both wetland and non-wetland areas.

Many other small mammals and many more bird species would be expected to occur in the watershed associated with Fairhaven Lake. There is substantial upland forest area for interior nesting birds, such as thrushes, tanagers, vireos, warblers and other song birds. A likely warbler for the upland forest would be the ovenbird; for the forested swamp or floodplain, the hooded warbler; for the fresh tidal or non-tidal marsh,

the yellowthroat. Raptors like the red-tailed hawk would be expected along the upland forest edges and soaring overhead; the barred owl in its bottomland floodplain forests. The remnant beaver impounded areas supporting dead standing trees are very important for cavity nesters, such as tree swallows, chickadees, titmice, flickers, and bluebirds and those holding standing water are beneficial to wood ducks, mallards, green herons, and great blue herons. The Brackish and/or Fresh Tidal Marshes no doubt are utilized by red-winged blackbirds, marsh wrens, Virginia rails, and other marsh birds. Likewise, various waterfowl (ducks, geese, and swans) surely utilize the protected embayment (Fairhaven Lake) along with terns and gulls.

What is particularly significant about Fairhaven Lake and its watershed is the ample variety of habitats it supports, such as those described above. This has been augmented by past, if not also present, beaver activity. Because of their feeding and house and dam building activities, beaver serve as biological community structuring agents. The dam building with its consequent flooding, for example, creates openings in forested floodplains that over time result in a series of remnant beaver ponds in various stages of ecosystem succession. Not only does greater spatial heterogeneity result, which is a benefit to wildlife, the dams also establish local base levels that trap sediments and nutrients entering them via streams. This benefits estuarine systems by decreasing sediment and nutrient transport further downstream. Although impounding the water will kill trees, the dead trees then become habitat for various animals, including cavity nesting birds. Beaver impoundments are also utilized by various reptiles such as skinks and snakes as basking and feeding areas. Over time, the open water areas disappear, like most of the remnant beaver pond sites encountered in this field work, and become marshes, then shrub swamps, and eventually forested wetlands. At various points in the process, the beaver may emigrate elsewhere due to the depletion of its food resources, which includes not only woody plants, but also the rhizomes of many aquatic herbaceous species. However, when food sources return, so might the beaver. Likewise, a given beaver population may be eliminated during legal fur trapping seasons.

Having open water, of course, is very important not only for wildlife but also for people who, like wildlife, tend to gravitate to such areas. From a waterfowl perspective at least, it is best to maintain 50-60% open water in emergent marsh vegetation (Weller & Fredrickson, 1974). This management suggestion should be applicable to Fairhaven Lake as well as the beaver impounded areas up the two Estuarine Forks. It is also important to consider the structure of a wetland plant community. For example, a marsh with a given number of herbaceous species would be much less structurally diverse than one with the same number of species but containing various-sized herbs, but also containing shrubs and trees (Beecher, 1942; Sipple, 1999).To be more specific, a remnant beaver pond with three strata (emergent herbs, shrubs, and trees) would be structurally more diverse than a beaver pond with only emergent vegetation, even

though they both had the same number of species. This is particularly important for birds given their species-specific nesting requirements.

4.0 CONCLUSIONS AND RECOMMENDATIONS

Overall, the various wetland areas traversed during this field investigation appear to be viable ecological communities similar, at least structurally, to other wetlands in the Chesapeake Bay Region. This is particularly true of the Brackish Tidal Marshes at Fairhaven Lake, given that many such wetlands around the Chesapeake Region support similar vegetation. On the other hand, it should be noted that the wetlands along the Western Shore of the Chesapeake Bay from the mouth of Rockhold Creek in Anne Arundel County south to Drum Point in Calvert County occur in a much different topographic setting than those further north along the Chesapeake Bay, where a substantially more dissected shoreline with large subestuaries exist (e.g., West, Rhode, South, and Severn Rivers). South of Rockhold Creek, the Chesapeake Bay shoreline is more cliff-like in nature with fewer and smaller estuarine intrusions, including a limited number of interesting Baymouth Barrier Wetlands and Spit Marsh Wetlands, one of which is Fairhaven Lake.

In terms of ecological viability, the same can be said for the few upland communities I traversed, although admittedly I didn't spend as much time in them.[11] There is every reason to expect that wildlife species typical of such habitats are present in Fairhaven Lake, either permanently or during seasonal migrations.

From an examination of the aerial photographs cited earlier, my onsite field work, and conversations I had with people from AHB, it is obvious that both natural and man-made changes have impacted the tidal connection at Fairhaven Lake. Under natural conditions, such changes will continue to occur due to sea level rise, sand accumulation at the mouth of the Lake transported by longshore currents, and the deposition of finer sediments entering the Lake from feeder streams. Changes in the Lake can be seen, for example, on the composite photograph shown in Exhibit D. Although the existing hydrologic connection under the bridge appears adequate to maintain the ecological integrity of the estuarine marshes of Fairhaven Lake, the Lake will no doubt continue to naturally accrue sediments from both ends (i.e., sand from the mouth and silt from the tributary streams) (Exhibit B, Photo 18). Such filling, however, should be thought of as long term (i.e., occurring over decades if not centuries). Furthermore, dredging the Lake would not only be monetarily costly, but also ecologically damaging to benthic animals and any submerged aquatic vegetation (SAV). In fact, most SAV requires shallow depths, especially in murky estuaries, due to

[11] It should be noted that there was no attempt by this field investigation to examine the water quality of Fairhaven Lake or any of the tributary streams entering the system. Assessments were made of the physical integrity of the habitats in the Fairhaven Lake area, associated vegetation, and ecological succession that is occurring. Likewise, this investigation did not address fresh or estuarine fish, aquatic macro-invertebrates, or submerged aquatic vegetation (SAV).

light requirements.[12] Murky water, whether from suspended sediments or algae, limits the depths to which SAV can grow and persist.

Submerged aquatic vegetation represents one of the more diverse community types in the Chesapeake Bay and its tributaries. For example, it supports many aquatic macro-invertebrates, which serve as waterfowl and fish food sources. Moreover, SAV itself serves directly as food for certain waterfowl, specifically puddle ducks, such as mallards, black ducks, pintails and others that feed from the water surface by tipping over, which is another good reason for maintaining shallow water. In addition, SAV tends to reduce turbidity by trapping suspended sediments. Shallow water, of course, is also desirable for herons and egrets; exposed mudflats are preferred by shorebirds like willets, yellowlegs, and various sandpipers. Dredging would also require spoil disposal, a costly measure, and appropriate spoil disposal sites are not easy to come by from a regulatory perspective. Consequently, I would not recommend dredging Fairhaven Lake for these reasons, as well as from a fishery perspective.

Although only the lower parts of the streams entering Fairhaven Lake were examined during this investigation, they appear to be fine from a geomorphologic perspective. This includes the stream feeding the South Estuarine Fork and the two stream branches (north and south) feeding the West Estuarine Fork, albeit the north stream branch is somewhat incised. Conditions upstream of these stream reaches cannot be addressed in this report given that they were not examined during this field examination. More than likely, these streams are fine given that the downstream reaches are in good condition. A thorough ecological assessment of Fairhaven Lake's watershed would entail walking the entire drainage system to evaluate the physical and biological condition of its streams and their tributaries.

As pointed out in the Findings, the Fresh Non-tidal Marshes and Fresh Non-tidal Swamps on both Estuarine Forks have either braided streams, weakly defined streams, or no streams (only sheet flow) associated with them.[13] To a large extent, this appears to be a consequence of historic occupation of the area by beaver. Beaver dams serve as local base levels reducing the stream gradient and causing stream sediments to settle out and become trapped. Any streams entering the area tend to braid and eventually manifest mostly sheet flow. With a series of these dams along a stream in different stages of ecological succession, the entire reach becomes sluggish with soft substrate. This appears to have been the case on both the South and West Estuarine Forks. This is fine ecologically in that the beaver habitation over the years has resulted in a diversity of habitats along the floodplain, which supplanted what once was probably a rather

[12] AHB may want to do some soundings of Fairhaven Lake over a period of years to determine average depths. I suspect that it is not filling in that quickly, however, and as pointed out shallow waters and mud flats are very important to SAV, aquatic life, and certain groups of birds such as waterfowl, wading birds, and shorebirds.

[13] Well-defined stream channels occur much further upstream and are associated with more firm floodplains.

uniform floodplain forest or forested swamp (something typical of many stream systems absent the beaver). It has resulted in the accumulation of substantial fine sediments upstream of these dams.[14]

There is the potential that, if the watershed develops, additional sediments would be introduced to these stream systems due to the erosion of steep slopes present. More importantly, excessive storm water runoff associated with major development could result in stream incisement and the transport of massive sediment loads downstream. With severe down cutting, even beaver dams could be breached. This would be critical to downstream areas and represents a major potential threat to the ecology of Fairhaven Lake, just as significant, if not more so, than any manipulations of the tidal connection.

Albeit not as significant as the potential threat cited above, another threat to the Fairhaven Lake area is the presence and likely spread of exotic plants. As cited in the Findings, the common reed occurs in three major areas and elsewhere in lesser amounts. Other than chemical treatment, there is not much that can be done about this aggressive rhizomatous species. Although physical controls, like deep flooding in conjunction with stem cutting or flooding in conjunction with herbicides, can be effective in controlling the common reed, this generally means that infested areas need to be impounded by dikes and flooded, something that could be quite costly and is generally not practicable. Such an effort is usually only implemented in existing diked areas (e.g., wildlife management areas) that are already supporting an aggressive invader. Therefore, I would not recommend it for Fairhaven Lake. One suggestion would be to monitor the three main populations by emplacing a series of PVC pipes around their peripheries and examine the populations each year to determine whether they are expanding. Likewise, good quality low altitude aerial photographs taken ever few years would also help monitor these populations. If AHB determines that the common reed is expanding, then it should decide whether or not to have herbicides applied. Given the tidal connection, there is the possibility that the common reed will not expand, but I suspect that the opposite is more likely. If the tidal connection is closed naturally or by man, such that the system becomes fresh, expansion is highly likely. I say this because in examining many areas of common reed in the Chesapeake Bay Region I have noted that the common reed has invaded many estuarine marshes, particularly when they were cut off from tidal action or were otherwise disturbed.

Two other invasive plant species noted during this investigation are the Nepal microstegium and Asiatic tearthumb. Both occur sparingly on the floodplains and also on some upland near the edge of the wetland at the first beaver dam on the South Estuarine Fork. These invasive species can also occur in uplands and some Nepal

[14] Historically, runoff from farming practices probably also contributed substantial sediments to these drainages.

microstegium was noted growing along a forest road on the northern side of Fairhaven Lake. Both species have been extremely aggressive in Maryland. Over time, they can dominate drier floodplains. It would be best to attempt to rid this site of them using volunteer groups to root them out if possible. If that doesn't work, herbicide application would be necessary.

Thank you for the opportunity to conduct the field investigation at Fairhaven Lake. I enjoyed meeting the folks from AHB, conducting the field work, and writing the report. Please let me know if you need any clarification of the findings, conclusions, or recommendations in the report.

If in the future AHB is in need of additional environmental services that are within my company's purview, please don't hesitate to contact me. My full contact information, company description, resume, and other pertinent information can be found on my web page: http://www.sippleenvironmental.com.

Sincerely,

W. S. Sipple

Ecologist and Principal

EXHIBIT A

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EXHIBIT B

PHOTOGRAPHS ASSOCIATED WITH THE ENVIRONMENTAL FIELD INVESTIGATION OF FAIRHAVEN LAKE

Photo 1. View of Brackish Tidal Marsh in Fairhaven Lake looking east from promontory at the junction of the South and West Estuarine Forks.

Photo 2.View of Brackish Tidal Marsh from the north side of Fairhaven Lake looking towards the back at the West Estuarine Fork. A population of narrow-leaf cattail is in the foreground.