1 SUMMARY

The goal of the Ship Creek Dam Removal Feasibility Study is to improve fish passage to the upper areas of Ship Creek. This report is a segment of the overall project; to assess the structural condition of two dam structures on the creek, one at Elmendorf Air Force Base, and the other on Fort Richardson Army Post.

The dam at Elmendorf Air Force Post consists of steel sheet piling driven to form two weirs about 50 feet apart. The sheet piles are heavy hot-rolled steel sections, and after being in service for 23 years, they are in very good condition. The rock sill below the last weir has disintegrated allowing the water level to drop below the bottom weir. As a result, the fish-pass at the lower weir is about 2 feet above the present water level making it unusable.

The dam on Fort Richardson Army Post consists of a concrete slab placed or cast in the streambed. The slab slopes upward from the creek bed at about 1/2-inch per foot until the crest is about 4 feet above the present downstream water level. The slab and supporting timbers appears to be in satisfactory condition. The fish-pass structure on the Fort Richardson Dam is not functional as a result of accumulated debris and sediments.

Given the nature of the construction details for this dam and the condition of the fish pass structure, the best solution for enhancing fish passage at the Fort Richardson Dam site from a purely structural viewpoint would be to bypass this dam structure with a new channel, or to remove this structure.

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2 SHIP CREEK DAM REMOVAL FEASIBILITY STUDY STRUCTURAL ASSESSMENT

The goal of the Ship Creek Dam Removal Feasibility Study is to improve fish passage to the upper areas of Ship Creek. This report is a segment of the overall project; to assess the structural condition of two dam structures on the creek, one at Elmendorf Air Force Base, and the other on Fort Richardson Army Post.

2.1 Elmendorf Dam

The Elmendorf Dam is located on the boundary of Elmendorf Air Force Base (EAFB) just outside the Post Road gate. It was originally constructed around 1959, and later re-constructed about 1983 after the original construction failed.

The original structure was built to divert water from Ship Creek into a cooling pond for use in the power plant on EAFB. Later, a fish hatchery was built below the cooling pond and the water for the hatchery was withdrawn from the creek.

The dam appears to be essentially as depicted in the as-built drawings. Evidence of the first weir construction (shown on the drawings) was discovered between the upper and lower weirs during our site visit on May 16, 2006. Photographs of the dam are included in Appendix A.

2.1.1 Description

The dam consists of two weirs about 50 feet apart. The tops of the two weirs are separated vertically by 6 feet; the total drop from the upstream pool to the water level below the second weir is about 13 feet. Refer to Photographs 1, 2, and 3 in Appendix A.

Both weirs are 125 feet long with a 100-foot wide crest. The crest in the upstream weir is 4 feet deep; the crest in the downstream weir is 5 feet deep. The crest in each weir is offset 4 feet to the south from the centerline of the weir so the fish pass structure could be attached to the north end of each weir as shown in Photograph 1.

The new weirs (new being the 1983 construction) are constructed of CZ141 sheet pile sections driven to a constant elevation, to elevation 51 feet for the upstream weir, and to elevation 45 feet for the downstream weir. The crests of the weirs are at elevations 96 feet and 91 feet respectively for the upstream and downstream weirs.

The wing walls on both ends of the upstream weir were reinforced with the new CZ141 sections driven on the streamside of the old sheet pile sections for the first 21 feet downstream of the weir. The remainder of the wing wall structure is the original sheet piles from the 1950's construction. The downstream weir butts into the old, unreinforced wing wall.

2.1.2 Condition

In general, the sheet pile weirs are in very good condition. The weirs are still plumb which indicates the pile sections are not failing laterally from the soil and water pressure. The top of the weir is level which indicates the piles are neither settling nor heaving.

USKH, Inc. (USKH) probed the scour pools to determine how much of each soldier pile cantilevers above the streambed. The upper pool had a maximum scour depth of 8 feet; the lower pool had a maximum scour depth of 5.7 feet. In the worst scour condition, 32 feet of sheet pile still remains embedded in the soil below the scour pool if the drawings are accurate. A general guideline for driven sheet pile retaining walls is 2 feet of embedment for every foot of cantilevered wall above. The embedded portion of the sheet piles for both of these weirs exceeds the 2:1 ratio, so the weirs are stable and should remain so.

USKH attempted to inspect the surface of the sheet piles at the top of the gravel in the scour pool to determine if abrasion had reduced the structural section. No significant loss of section was evident in those areas that could be inspected. USKH has no reason to believe that the sheet pile sections have lost any strength due to abrasion.

The side walls and wing walls are all in good condition with the exception of a storm drain penetration on the north bank down stream of the lower weir as shown in Photograph 4. The storm drain passes through the sheet pile wall where the old (1950's) sheet piles were installed. The wall has bulged at the storm drain, but has not failed.

The rock sill that is shown on the drawings is no longer intact, so the water level below the lower weir has diminished. As a result, the lower fish pass structure terminates about 2 feet above the water so it is no longer functional (see Photograph 5).

In summary, the Elmendorf Dam is in very good condition and it should remain functional for many years to come barring a catastrophic flood event. Even in a catastrophic flood, the most likely damage would be that the creek flows around the dam washing out the banks on either end of the dam. The steel sheet pile structure would likely remain standing. The sheet pile structures are embedded deep enough to resist a substantial amount of scour at the dam site. The steel sections do not appear to have any structural loss due to gravel abrasion, hence they are not in danger of failing.

Because the weirs are constructed of steel sheet piles, the Elmendorf Dam can be retrofitted with other types of fish pass structures or otherwise modified as necessary to improve fish passage. The good condition of the sheet piles will also allow them to be withdrawn if the study determines that solution is best.

The upper basin is full of sediment, to the top of the upper weir. The scour below the downstream weir has removed a significant amount of the creek bottom so the water elevation below the dam is significantly lower than it was when it was constructed 23 years ago. The diminished water level is not detrimental to the structure, but it has caused the fish pass structure to become inoperable.

2.2 Fort Richardson Dam

The Fort Richardson Dam is located on Fort Richardson Army Post, downstream of the Glenn Highway crossing. This structure was constructed to provide cooling water for the power plant (now decommissioned) on the Post.

No as-built drawings are available for the Fort Richardson Dam, so many of the construction details remain unknown. The report below is based only on field observations. Photographs taken during the site visit are included in Appendix B.

2.2.1 Description

The dam (see Photograph 6 in Appendix B) appears to be a 16-inch thick concrete slab placed on the creek bed, sloped about 1/2-inch per foot opposite of the natural fall of the creek. As shown in Photograph 7 in Appendix B, the downstream edge of the slab is supported on at least one 12-inch by 12-inch timber; however, the exact details of the timber supports could not be determined during the inspection.

The concrete apron slab extends about 40 feet upstream of the crest, and we were able to determine that it is reinforced. The crest of the dam is about 100 feet wide excluding the fish pass structure on the north end. The crest of the dam is about 4 feet above the water level in the scour pool.

USKH probed the scour pool during our site visit and determined the pool is about 5 feet deep near the north end of the dam. It is quite likely that the scour pool extends back under the edge of the slab, but the exact limits have not been determined.

2.2.2 Condition

The slab has been eroded on a portion of the upstream side and the reinforcing is exposed but only on a very small area. The top half of several reinforcing bars are exposed; the bottom half of those bars are still well bonded to the concrete. A surface repair is possible if deemed necessary.

The timbers under the crest of the dam appeared to be sound where we could view them. If the need arises in the future, we can perform additional site investigation where we stop the flow over a portion of the crest in combination with underwater photography to get more detailed information regarding the configuration and condition of the timbers.

In general, the dam is in very good condition and it should remain serviceable for many years. If the dam is to remain, the owner of the dam should consider patching the small area where the concrete has been eroded from the surface of the slab.

The fish pass structure, shown in Photograph 8, is not functioning due to deposits of sediments and debris. The structure is constructed of steel making it very easy to modify if necessary, however a new channel that bypasses the existing dam may be a better solution.

The nature of the construction details for the Fort Richardson Dam makes it difficult to modify in terms of enhancing fish passage. The existing structure can be altered, but the alteration would be challenging. Options that bypass the dam structure, such as a new channel to the south of the existing dam, are recommended based solely on structural considerations.

Appendix A – Photographs of the Elmendorf Dam

Photograph 1 - The upper weir.

Photograph 2 - The lower weir.

Photograph 3 - The lower weir with a height reference.

Photograph 4 - A storm drain penetration through the old sheet pile wing wall.

Photograph 5 - The bottom end of the lower fish pass structure.

Appendix B – Photographs of the Fort Richardson Dam

Photograph 6 - The dam at Fort Richardson.

Photograph 7 - A view of the edge of the slab and the concrete timber.

Photograph 8 - The fish pass structure.