Appendix D

# Wetlands Functional Assessment

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This appendix presents supplemental information about wetland types in the study area and provides further clarification about how the wetlands functional assessment was performed, including the type of data used, the rationale for the approach to assessing indirect impacts on wetland functions, and the method for scaling the variables used in the assessment models. As a result, this section reiterates some of the information presented in the Final EIS to provide context for the supplemental information.

In addition, this appendix presents a series of tables illustrating indirect impacts on wetlands in the study area by hydrogeomorphic (HGM) wetland class and wetland cover type, as well as impacts on wetland functions for each wetland class and cover type.

The following changes have been made to the text in this appendix since the Draft Supplemental EIS was published in December 2004.

- The number of mitigation credits (in functional capacity units [FCUs]) for each of the five wetland functions has been updated to reflect the entire Legacy Nature Preserve (see Table D-11).

- The description of the mitigation measures in Section D.4, *Mitigation Measures*, has been updated to reflect information specific to the Legacy Nature Preserve associated with Alternative E (Final Supplemental EIS Preferred Alternative).

- The number of species presented in Section D.2.2, *Wetland Functions, Flora and Fauna Habitat Support*, was incorrect in the Draft Supplemental EIS. It has been corrected.

## D.1 Wetland Classes and Cover Types

The area of wetlands within the proposed build alternative rights-of-way and proposed Legacy Nature Preserve (Preserve) that would be subject to direct and indirect effects encompasses 987 ha (2,439 ac) of wetlands in three HGM wetland classes (depressional, groundwater slope, lacustrine fringe) and seven wetland cover types (forested wetland, shrub-scrub, marsh, wet meadow, playa, unconsolidated shore, and open water).

The Final EIS based all discussion of wetland functions, impacts, and mitigation on the three wetland classes. These broad wetland classes were used rather than the more specific wetland cover types because the HGM models were too general to capture the differences between cover types. This document, however, separates wetland functions, impacts, and mitigation according to wetland cover types to provide additional ecological context by which to interpret the analysis. No new calculations were performed. Instead, the data for each wetland class were sorted according to the cover type of each wetland within that class and then summarized by each wetland class and cover type. Table D-1, which updates and supplements Table 3-30 in the Final EIS, presents the quantities and functional ratings that make up these wetland classes and cover types.

The following section presents information on the seven wetland cover types found in these wetland classed in the study area—forested wetland, shrub-scrub, marsh, wet meadow, playa, unconsolidated shore, and open water.

## D.1.1 Marsh

Marsh is a wetland plant community characterized by tall, emergent, perennial, herbaceous monocots. Plant species most commonly observed in marsh within the study area include hard stem bulrush (*Scirpus acutus*), alkali bulrush (*Scirpus maritimus*), three square bulrush (*Scirpus americanus* and *Scirpus pungens*), cattail (*Typha latifolia*), creeping spikerush (*Eleocharis palustris*), reed canary grass (*Phalaris arundinacea*), common reed (*Phragmites australis*), blister buttercup (*Ranunculus sceleratus*), water buttercup (*Ranunculus aquatilis*), and Nebraska sedge (*Carex nebrascensis*). Marsh is the second most abundant wetland type in the study area. There are 290 ha (716 ac) of marsh in the study area, most of which is associated with the lacustrine fringe of Great Salt Lake.

The hydrology of the marsh cover type is provided by groundwater and/or surface water. Water covers the ground surface for long periods of time during the growing season. Depths can range from a few centimeters to almost a meter, but they are not deep enough to restrict the growth of emergent plant species. Areas where marsh is supported primarily by groundwater are typically located in depressions where the ground surface drops below the level of the water table. During the spring months, when the water table is high due to snowmelt and precipitation, these areas are inundated. As the level of the water table drops in the summer months, the marsh areas may no longer be inundated, although the soils remain saturated.

**Table D-1** Wetland Cover Types, Quantities, and Functional Ratings for Study Area

| | | Quantity in Hectares (acres)* | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HGM Class | Wetland Cover Type | Total | | High | | High-to-Medium | | Medium | | Medium-to-Low | | Low | |
| Depressional | Forested Wetland | 0.0 | (0.0) | 0.0 | (0.0) | 0.0 | (0.0) | 0.0 | (0.0) | 0.0 | (0.0) | 0.0 | (0.0) |
| Groundwater Slope | | 0.2 | (0.4) | 0.0 | (0.0) | 0.0 | (0.0) | 0.2 | (0.4) | 0.0 | (0.0) | 0.0 | (0.0) |
| Lacustrine Fringe | | 0.0 | (0.0) | 0.0 | (0.0) | 0.0 | (0.0) | 0.0 | (0.0) | 0.0 | (0.0) | 0.0 | (0.0) |
| Depressional | Shrub-Scrub | 0.0 | (0.0) | 0.0 | (0.0) | 0.0 | (0.0) | 0.0 | (0.0) | 0.0 | (0.0) | 0.0 | (0.0) |
| Groundwater Slope | | 0.0 | (0.0) | 0.0 | (0.0) | 0.0 | (0.0) | 0.0 | (0.0) | 0.0 | (0.0) | 0.0 | (0.0) |
| Lacustrine Fringe | | 1.4 | (3.6) | 0.0 | (0.0) | 1.4 | (3.6) | 0.0 | (0.0) | 0.0 | (0.0) | 0.0 | (0.0) |
| Depressional | Marsh | 14.5 | (35.8) | 0.7 | (1.7) | 5.5 | (13.6) | 8.0 | (19.7) | 0.3 | (0.8) | 0.0 | (0.0) |
| Groundwater Slope | | 42.3 | (104.5) | 6.4 | (15.8) | 2.1 | (5.3) | 26.3 | (64.9) | 7.5 | (18.5) | 0.0 | (0.0) |
| Lacustrine Fringe | | 233.2 | (576.1) | 0.0 | (0.0) | 206.3 | (509.7) | 26.9 | (66.4) | 0.0 | (0.0) | 0.0 | (0.0) |
| Depressional | Wet Meadow | 115.3 | (284.9) | 2.6 | (6.5) | 84.0 | (207.6) | 26.7 | (66.0) | 1.9 | (4.8) | 0.0 | (0.0) |
| Groundwater Slope | | 152.4 | (376.6) | 80.8 | (199.6) | 18.2 | (45.1) | 48.9 | (120.9) | 4.5 | (11.1) | 0.0 | (0.0) |
| Lacustrine Fringe | | 148.1 | 366.0 | 0.0 | (0.0) | 98.9 | (244.5) | 49.2 | (121.5) | 0.0 | (0.0) | 0.0 | (0.0) |
| Depressional | Playa | 46.4 | (114.6) | 3.5 | (8.6) | 31.3 | (77.3) | 10.5 | (26.0) | 0.0 | (0.0) | 1.1 | (2.6) |
| Groundwater Slope | | 18.1 | (44.7) | 15.2 | (37.6) | 0.0 | (0.0) | 2.7 | (6.6) | 0.2 | (0.4) | 0.0 | (0.0) |
| Lacustrine Fringe | | 124.5 | (307.6) | 0.0 | (0.0) | 99.7 | (246.3) | 24.8 | (61.3) | 0.0 | (0.0) | 0.0 | (0.0) |

| | | Quantity in Hectares (acres)* | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HGM Class | Wetland Cover Type | Total | | High | | High-to-Medium | | Medium | | Medium-to-Low | | Low | |
| Depressional | Unconsolidated Shore | 0.0 | (0.0) | 0.0 | (0.0) | 0.0 | (0.0) | 0.0 | (0.0) | 0.0 | (0.0) | 0.0 | (0.0) |
| Groundwater Slope | | 0.0 | (0.0) | 0.0 | (0.0) | 0.0 | (0.0) | 0.0 | (0.0) | 0.0 | (0.0) | 0.0 | (0.0) |
| Lacustrine Fringe | | 38.9 | (96.2) | 0.0 | (0.0) | 36.5 | (90.1) | 2.5 | (6.1) | 0.0 | (0.0) | 0.0 | (0.0) |
| Depressional | Open Water | 2.5 | (6.2) | 0.0 | (0.0) | 1.4 | (3.5) | 1.1 | (2.7) | 0.0 | (0.0) | 0.0 | (0.0) |
| Groundwater Slope | | 0.1 | (0.2) | 0.0 | (0.0) | 0.0 | (0.0) | 0.1 | (0.2) | 0.0 | (0.0) | 0.0 | (0.0) |
| Lacustrine Fringe | | 49.4 | (122.1) | 0.0 | (0.0) | 25.1 | (62.0) | 24.3 | (60.1) | 0.0 | (0.0) | 0.0 | (0.0) |
| Total | | 987.2 | (2439.3) | 109.2 | (269.8) | 610.5 | (1508.5) | 252.1 | (622.9) | 14.4 | (35.5) | 1.1 | (2.6) |

*Definitions defined below

| Functional Rating | Average Functional Value |
|---|---|
| High | 0.88 to 1.0 |
| High-to-Medium | 0.63 to 0.87 |
| Medium | 0.38 to 0.62 |
| Medium-to-Low | 0.18 to 0.37 |
| Low | 0.00 to 0.17 |

## D.1.2 Wet Meadow

Wet meadow is a wetland plant community characterized by grasses and other low-growing, perennial monocots. Although the soil may be saturated for long durations, the vegetation is generally not emergent. Plant species most commonly observed in wet meadows in the study area include Baltic rush (*Juncus balticus*), creeping spikerush, clustered field sedge (*Carex praegracilis*), Nebraska sedge, rabbitfoot grass (*Polypogon monspeliensis*), foxtail barley (*Hordeum jubatum*), little barley (*Hordeum pusillum*), curly dock (*Rumex crispus*), and saltgrass (*Distichlis spicata*). Wet meadow is the most common wetland type in the study area. There are 416 ha (1028 ac) of wet meadow in the study area, distributed more or less evenly throughout all three HGM wetland classes.

The hydrology of the wet meadow cover type is provided primarily by groundwater, although surface water plays an important role in many of the areas. Wet meadow typically occurs in areas that are in close proximity to the water table. Early in the growing season the level of the water table may be higher than the ground surface, causing inundation. However, this inundation occurs less frequently and for a shorter duration than in marsh. Like marsh, wet meadows found in the study area typically occur in depressional wetlands, but unlike marsh, the water table level is just below to only slightly above the depression bottom. Because of this difference, wet meadows may be inundated only for brief periods, although the soils may be saturated at the surface for extended periods. As the water table drops in the summer months, the wet meadows become drier, and upland species may begin to grow by late summer.

## D.1.3 Playa

Vegetation in the playa cover type is usually sparse, typically between 5 and 30 percent aerial cover. The vegetation is not uniformly distributed across the playas but tends to be concentrated around the margins. Typical species include western seepweed (*Suaeda occidentalis*), slender seepweed (*Suaeda depressa*), pickleweed (*Salicornia europaea*), saltgrass, iodinebush (*Allenrolfea occidentalis*), fat-hen saltbush (*Atriplex patula*), and Nuttall alkali grass (*Puccinellia nuttalliana*). Playa soils are extremely saline/alkaline, which suppresses the growth of most plant species. There are 189 ha (467 ac) of playa in the study area. About 66 percent of the playa habitat is associated with the lacustrine fringe of Great Salt Lake, and about 25 percent occurs in depressional wetlands.

The hydrology of playas in the study area is provided primarily by surface water. Playas are typically located in the lowest topographic positions of areas with internal drainage. They collect much of the runoff from adjacent areas following a precipitation event, and because of the high clay content of the soils, the water will pond. Following a precipitation event, playas may be inundated with several centimeters of water. Most of the standing water in playas is removed through evaporation, which deposits salts from the soils on the surface. Playas of the lacustrine fringe class were inundated during historic high lake levels recorded in 1987, but during normal and low lake levels, they are not supported by lacustrine hydrology.

## D.1.4 Scrub-Shrub

The scrub-shrub cover type is characterized by an overstory of woody shrubs, typically less than three meters in height. In some instances, this cover type is successional to forested wetlands. In the study area, the overstory of scrub-shrub wetlands is composed of tamarisk (*Tamarix ramosissima*), box-elder (*Acer negundo*), and/or coyote willow (*Salix exigua*). Understory plant species are similar to those found in wet meadow, including saltgrass, Baltic rush, common reed, reed canary grass, foxtail barley, and little barley. Only four small areas of scrub-shrub wetland are present in the study area, comprising 1.4 ha (3.6 ac).

The hydrology of scrub-shrub wetlands is provided by both surface and groundwater sources. Some of the scrub-shrub wetlands are adjacent to small streams, and their wetland hydrology is derived from the stream. Others are located in areas that are close to the water table and receive their moisture from groundwater.

### D.1.5 Forested Wetland

The forested wetland cover type is characterized by an overstory of large trees. The overstory of this forested wetland is composed of narrow-leaf cottonwood (*Populus angustifolia*) and Russian olive (*Elaeagnus angustifolia*). The understory plant species is reed canary grass. Forested wetland is found at only one location in the study area, comprising 0.2 ha (0.4 ac). Wetland hydrology for this wetland is provided by a nearby stream.

### D.1.6 Unconsolidated Shore

Within the study area, unconsolidated shore areas represent areas that have (1) unconsolidated substrates with less than 75 percent aerial cover of stones, boulder, or bedrock, and (2) less than 30 percent aerial cover of vegetation, other than pioneering plants. This is primarily an aquatic habitat but is included here because a small amount of vegetation may be present when water levels are low. This habitat is found along the fringe of depressional open water and/or lacustrine systems. There are 39 ha (96 ac) of unconsolidated shore in the study area.

### D.1.7 Open Water

Open water includes areas of surface water where the depth to bottom is unknown or there is standing water with no emergent vegetation present. These areas are less than 8.2 ha (20 ac) in size. This is an aquatic habitat but is included here because submerged aquatic vegetation may be present. These areas sometimes become dry during the summer, which allows emergent vegetation to grow for a short period. There are 52 ha (128 ac) of open water in the study area, most of which is associated with the lacustrine fringe of Great Salt Lake.

## D.2 Wetland Functions

### D.2.1 Wetlands Functional Assessment

As presented in the Final EIS, the wetlands functional assessment for the Legacy Parkway wetlands was a modification of the hydrogeomorphic (HGM) method for evaluating wetland functions initially developed by the Corps (Brinson 1993). The HGM method categorizes wetlands by their water sources, hydrodynamics, and geomorphic setting, and then evaluates wetland functions based on physical and biological attributes.

Under the HGM method, wetland functions are assessed by comparing the wetlands under investigation with a set of reference wetlands (Brinson and Rheinhardt 1996). Reference wetlands are sites within a specified geographic region chosen to encompass the range of variation within a group or class of wetlands. The sites with the highest level of wetland function are selected as the reference standards. Based on these reference wetlands, regional guidebooks are created, which provide protocols for collecting data and scaling the variables and mathematical models for determining numerical ratings for each wetland function.

No regional guidebooks have been created yet for wetlands in the Legacy Parkway study area. However, an interdisciplinary assessment team (A-Team) was developing draft regional HGM models for the State of Utah at the time the Final EIS was published. The A-Team developed low-resolution wetlands assessment models for the Legacy Parkway project. Low-resolution models require few variables and rely on indirect measures and indicators, which makes them more efficient, quicker, and less expensive to prepare than higher resolution models but somewhat reduces their accuracy and precision (Smith and Wakely 2001). At the time this Supplemental EIS was prepared, the state regional HGM model was not complete enough to offer the accuracy or precision needed to update the HGM model information presented in the Final EIS. As a result, the updated wetlands functional assessment analysis presented in this document continues to be based on the wetlands functional assessment conducted for the Final EIS. Information on this model is summarized below.

### *Application of Hydrogeomorphic Method*

The variables used for the Legacy Parkway wetlands assessment were based on indicators that correlate with wetland functions rather than measured wetland characteristics. The indicators were based on land use within and adjacent to the wetlands and on the presence of roads and other barriers; this information was determined from aerial photographs and field observations. Under the HGM approach, land use in the wetland watershed is an important variable in many wetland function indices. Because the wetland watershed is not always easily determined, some models use the adjacent land within a specific distance of the wetland as a surrogate for the watershed. For the Legacy Parkway project, adjacent land was defined as the land within 305 m (1,000 ft) of the wetland perimeter (see Section D.3 below for discussion of the 305-m [1,000-ft] distance).

The wetland function indicators were assigned numerical values using best professional judgment guided by data developed for a draft HGM regional guidebook for depressional wetlands in peninsular Florida (Trott et al. 1997). Although regional guidebooks are developed for specific regions and wetland classes (Clairain 2002), the A-Team judged that, based on the low resolution of the wetlands assessment models, the numerical values from the Florida model would be similar to those that would be expected for depressional wetlands in the Legacy Parkway study area. Also, broad wetland classes were used rather than the more specific wetland cover types because the models were too general to capture the differences between cover types.

Study area wetlands judged to have the highest level of wetland function were selected as the reference standards against which all wetland indicators were scaled. Under the HGM approach, reference standards are based on wetlands that have not been subject to long-term anthropogenic disturbance (Smith et al. 1995). However, because wetlands in the Legacy Parkway study area have been subject to long-term disturbance, selection of reference standards was limited to available wetlands (Findlay et al. 2002).

For each wetland in the study area, indicators were assigned and then entered into the models to calculate a functional capacity index (FCI) for five wetland functions. An FCI is a numerical estimate of the ability of a wetland to carry out a specific function. The FCI is not an assessment of the actual level at which the wetland performs the function but an assessment of the relative level of function compared to the reference standards. The FCI is scaled from 0 (no function) to 1 (highest function). Wetland functions were quantified as FCUs, a measure that incorporates both the size of a wetland and its ability to carry out wetland functions. The FCUs for each wetland function were calculated by multiplying the area of each wetland by each FCI.

In June 2000, the Corps approved the results of the wetlands functional assessment. A discussion of the development and use of indicators and models for the wetlands functional assessment is presented in the *Legacy Parkway Wetland Final HGM Technical Report* (Baseline Data Inc. 2000) and in Appendix B2 of the Final EIS.

## D.2.2 Wetland Functions

For this Supplemental EIS, the lead agencies reviewed the wetlands functional assessment conducted for the Final EIS and all available information pertinent to the nature and function of the wetlands in the study area. This section summarizes information from the Final EIS and provides, as appropriate, general information clarifying the particular functions being described. As described in Section 4.12, *Wetlands*, the Final EIS based all discussion of wetland functions on the three HGM wetland classes listed above (depressional, slope, and lacustrine fringe). The wetland functions were separated according to wetland cover types to provide additional ecological context by which to interpret the analysis.

Wetlands in the study area perform functions in the following three basic categories.

- Hydrology.
- Biogeochemistry.
- Flora and fauna habitat support.

Each of these categories includes specific functions, which are described below. Table D-2, which updates Table 3-29 in the Final EIS, lists specific functions that wetlands perform in the study area and shows how these functions pertain to the three HGM wetland classes. It was not feasible to assess all possible functions that wetlands perform in the study area. Therefore, the analysis in the Final EIS and in this document focuses on those functions that directly or indirectly affect the ecosystem. Other functions, such as the visual enjoyment and recreational value of wetlands are not discussed in this section.

**Table D-2** Wetland Functions

| Function | Groundwater Slope | Depressional | Lacustrine Fringe |
|---|---|---|---|
| Hydrology | | | |
| Surface Water Detention and Storage | − | + | + |
| Maintain Wetland Hydrology | + | + | + |
| Energy Dissipation | − | − | + |
| Biogeochemistry | | | |
| Particulate Retention | − | + | − |
| Elements/Compounds Retention, Conversion, and Release | + | + | + |
| Net Organic Compound Accumulation and Element Cycling | + | + | + |

| Function | Groundwater Slope | Depressional | Lacustrine Fringe |
|---|---|---|---|
| Organic Carbon Export | + | − | + |
| Flora and Fauna Habitat Support | | | |
| Maintain Characteristic Vegetation | + | + | + |
| Maintain Characteristic Invertebrate Food Webs | + | + | + |
| Maintain Characteristic Vertebrate Habitats | + | + | + |
| Maintain Landscape-Scale Biodiversity | + | + | + |
| Maintain Habitat Interspersion and Connectivity | + | + | + |

Notes:
+ carries out function
− does not carry out function to a substantial degree

Table D-3 lists the wetland functional capacity units for each HGM wetland class and cover type under existing conditions according to five different functions.

- Function 1: Wetland hydrology maintenance.
- Function 2: Dissolved elements and compounds removal.
- Function 3: Particulate retention.
- Function 4: Habitat structure.
- Function 5: Habitat connectivity, fragmentation, and patchiness.

The FCUs in Table D-3 are numerical representations of the capacity for wetlands in the study area to carry out wetland functions. FCUs provide little information, however, about how wetlands in the study area may function. Therefore, general information describing the five functions listed above and in Table D-3 is presented in the following sections.

This table provides the information on FCUs in this format for convenience only. Because functional capacity measures the degree to which a wetland performs a specific function, the functional capacities of different wetland functions are not equivalent or additive (Smith et al. 1995). FCUs do not represent a "common currency" that can be used to compare functions and impacts between different wetland categories or wetland types (Smith et al. 1995, Brinson and Rheinhardt 1996).

**Table D-3** Wetlands Functional Capacity Units—Existing Conditions

| HGM Wetland Class | Wetland Cover Type | Functional Capacity Units | | | | |
|---|---|---|---|---|---|---|
| | | Function 1 | Function 2 | Function 3 | Function 4 | Function 5 |
| Depressional | Forested Wetland | 0 | 0 | 0 | 0 | 0 |
| Groundwater Slope | | 0 | 0 | 0 | 0 | 0 |
| Lacustrine Fringe | | 0 | 0 | 0 | 0 | 0 |
| Depressional | Shrub-Scrub | 0 | 0 | 0 | 0 | 0 |
| Groundwater Slope | | 0 | 0 | 0 | 0 | 0 |
| Lacustrine Fringe | | 3 | 3 | 3 | 2 | 2 |
| Depressional | Marsh | 24 | 25 | 27 | 18 | 22 |
| Groundwater Slope | | 56 | 59 | 55 | 62 | 57 |
| Lacustrine Fringe | | 410 | 516 | 410 | 345 | 355 |
| Depressional | Wet Meadow | 217 | 203 | 229 | 154 | 188 |
| Groundwater Slope | | 302 | 253 | 277 | 279 | 283 |
| Lacustrine Fringe | | 236 | 283 | 236 | 199 | 204 |
| Depressional | Playa | 87 | 85 | 95 | 66 | 75 |
| Groundwater Slope | | 41 | 32 | 34 | 37 | 39 |
| Lacustrine Fringe | | 226 | 231 | 204 | 159 | 183 |
| Depressional | Unconsolidated Shore | 0 | 0 | 0 | 0 | 0 |
| Groundwater Slope | | 0 | 0 | 0 | 0 | 0 |
| Lacustrine Fringe | | 68 | 83 | 62 | 49 | 53 |
| Depressional | Open Water | 4 | 4 | 5 | 3 | 4 |
| Groundwater Slope | | 0 | 0 | 0 | 0 | 0 |
| Lacustrine Fringe | | 56 | 93 | 64 | 63 | 57 |

The occurrence and distribution of wetlands in the study area have been affected by grazing, drainage, irrigation, cropping, and/or urban and industrial development, and wetland functions have been degraded in many of the wetlands. The capacity of these wetlands to carry out wetland functions varies greatly, depending on the land use and proximity to existing large wetland complexes associated with Great Salt Lake, FBWMA, duck clubs, and other naturally occurring wetlands. The majority of wetlands found in agricultural areas are grazed and/or cropped. The more intensely these wetlands are subjected to agricultural activities, the lower their ability to perform their natural functions, including wildlife support. The presence of other development also reduces the ability of wetlands to perform their natural functions.

### Hydrology

Wetland hydrology comprises “all hydrologic characteristics of areas that are periodically inundated or have soils saturated to the surface at some time during the growing season” (Environmental Laboratory 1987). Hydrology is regarded as the most important category of wetland functions because wetland hydrology is the basis for all wetland functions. Although not all wetland categories provide the same functions or level of function, wetlands in the study area carry out three general hydrologic functions.

- Short- and long-term surface storage.
- Maintenance of wetland hydrology.
- Dissipation of the energy in moving water.

Depressional wetlands provide both short- and long-term surface water storage. This short-term water storage decreases the amount and velocity of runoff, reducing peak floods and distributing storm flows over longer periods. The stored water provides habitat for aquatic organisms and helps maintain the physical and biogeochemical processes. Water stored in wetland basins percolates into the soil or into the groundwater table, which helps maintain the wetland hydrology of both the depressional wetlands and other adjacent wetlands. The surface water storage function of lacustrine fringe wetlands varies with the rise and fall of the water level in Great Salt Lake. Because they are part of a larger lacustrine system, lacustrine fringe wetlands primarily provide long-term surface water storage. However, when lake levels are low, lacustrine fringe wetlands possessing a basin also provide short-term water storage. Because groundwater slope wetlands lack a basin, they have little or no surface water storage function.

Maintenance of wetland hydrology depends on the ability of wetlands to intercept groundwater and surface water. Groundwater slope wetlands are dependent primarily on groundwater. Groundwater recharge in the study area results from precipitation that percolates into the soil. Processes that either reduce the amount of precipitation, such as drought, or increase the tendency for water to run off rather than percolate lower the groundwater table and adversely affect the ability of wetlands to intercept groundwater. Depressional wetlands depend primarily on surface runoff. The amount of precipitation is important, but processes that reduce the amount of runoff or divert the runoff to other locations also affect the ability of depressional wetlands to intercept surface flows. Lacustrine fringe wetlands are dependent on floodwater from Great Salt Lake, and so maintenance of wetland hydrology is subject to the annual rise and fall of the lake level more than to short-term events. However, during an extended period of drought, when lake levels fall below a level capable of maintaining the wetland hydrology, the ability to intercept groundwater or surface runoff becomes important.

The dissipation of energy in moving water lessens its erosive impact and contributes to reducing downstream particulate loading. This function is provided primarily by vegetated wetlands associated with riverine, lacustrine, and tidal ecosystems. In the study area, lacustrine fringe wetlands vegetated by marsh or wet meadow provide this function, although the ability to carry out this function has been negatively affected by grazing, which removes the vegetation.

### Function 1: Wetland Hydrology Maintenance

The FCI for hydrologic functions is an estimate of the ability of the wetlands in the study area to maintain their characteristic wetland hydrology. This function was modeled on two indicators, land use adjacent to the wetlands and the presence of roads and other barriers within the wetlands. Land use affects both the amount of surface runoff that occurs and the amount of groundwater recharge. Decreases or increases in surface runoff attributable to changes in land use can degrade this wetland function. Barriers can prevent the movement of water into, through, or out of a wetland, which can also degrade wetland function by making all or part of the wetland drier or wetter.

In the study area, highly functional wetlands are surrounded by ungrazed rangeland, which has low runoff potential. Other land uses with low runoff potential, such as field crops or improved pasture with rotational grazing, are not expected to substantially alter the amount of surface runoff or groundwater recharge. In contrast, paved roadways and developed areas have high runoff potential, which have adverse effects on both surface runoff and groundwater recharge. Increased runoff adversely affects slope wetlands because it decreases groundwater recharge. In contrast, increased runoff may increase the depth or duration of inundation in depressional wetlands, altering the characteristic vegetation.

Highly functional wetlands also have no barriers to prevent groundwater or surface water from moving freely between all portions of the wetlands. Small modifications to the hydrology, such as unpaved roads or utility easements, are expected to lower the hydrologic functions to a moderate level, whereas extreme modifications, such as four-lane paved roads, large dikes, or large drainage channels, are expected to reduce the hydrologic functions to a low level.

The FCUs that represent how wetlands in the study area maintain wetland hydrology under existing conditions are provided above in Table D-2, and the functional ratings are shown in Figure 3-24a of the Final EIS.

## *Biogeochemistry*

The biogeochemistry function addresses the ability of wetland ecosystems to transport and transform chemicals. Wetlands remove dissolved substances from water through various mechanisms such as absorption, adsorption, solubilization, oxidation, biological transformation, and precipitation. Wetlands, by definition, are vegetated, and it is the vegetation that is responsible for a wide range of physical and biochemical processes. Vegetation slows the velocity of water, reducing the ability to hold particles in suspension. Growing vegetation removes dissolved nutrients and compounds from the water and soil, often metabolizing them and sometimes sequestering them within plant tissues. Bacteria growing in the soil or in plant roots also break down or alter these substances so that they are removed from the water, either by plants or as a gas. The nutrients and carbon fixed by the plants are cycled through the wetlands when the plants are eaten by herbivores or when the plants die and decompose. The flow of water through wetlands provides for the efficient movement and distribution of nutrients and energy throughout the entire ecosystem.

Watershed basins that have more wetlands tend to have lower specific conductance (a measure of the total concentration of dissolved substances) and lower concentrations of chloride, lead, inorganic nitrogen, suspended solids, and total and dissolved phosphorus than do watershed basins with fewer wetlands. Also, certain wetland vegetation is adept at removing heavy metals. Wetlands, therefore, improve water quality by removing both dissolved substances and suspended particulates. Two FCIs were generated for biogeochemical functions, one for removal of dissolved elements and compounds, and one for particulate retention.

### Function 2: Dissolved Elements and Compounds Removal

The FCI for removal of dissolved elements and compounds is an estimate of the ability of a wetland to remove dissolved substances from water. This function was modeled on two indicators, land use within the wetland and land use adjacent to the wetland. An individual wetland can process only a finite amount of dissolved elements and compounds before the functional capacity is degraded. Existing land use affects both the type and amount of dissolved elements and compounds released into wetlands, and land uses that increase the amount of dissolved elements and compounds are expected to adversely affect wetland function.

In the study area, highly functional wetlands are unaltered and ungrazed. Grazed wetlands have reduced functional capacity due to increased nutrient loading from animal waste and soil disturbance. Farmed wetlands have increased loading of dissolved substances due to use of farm chemicals and from soil disturbance. Both of these activities also change or remove the vegetation, which reduces the wetlands' ability to remove dissolved substances.

In the study area, highly functional wetlands are also surrounded by ungrazed rangeland. As land becomes developed or placed into agriculture, the amount of dissolved materials increases, as does the amount of runoff conveying the dissolved materials. Therefore, wetlands with a greater proportion of the surrounding land under development or agriculture are expected to have a correspondingly lower ability to remove dissolved substances. Different land use types have varying degrees of impact on this functional indicator; for example agriculture and low density development are expected have less effect than high density development or highways.

The FCUs for removal of dissolved elements and compounds by wetlands in the study area under existing conditions are provided in Table D-3, and the functional ratings are shown in Figure 3-24b in the Final EIS.

### Function 3: Particulate Retention

The FCI for particulate retention is an estimate of the ability of a wetland to remove particulates from the water column. The presence of vegetation is critical to this function, since it is the reduction in water flow velocity that causes particulates to drop out of suspension. By removing particulates from surface water flows, wetlands function as filters that improve water quality.

Wetlands generally have limited capacity to remove sediments. Unless inflow of particulates, such as sediment, is balanced by outflow, a wetland will eventually lose all wetland functions, including the ability to retain particulates, and become upland. As a result, for this function to be sustainable, a wetland must function in a way that slows the movement of particles through the ecosystem, changing a pulse of particulates (such as follows a rain storm) to a lower level of particulates released gradually over a longer period of time. In the study area, this function is carried out primarily in marsh and wet meadow in groundwater slope wetlands. Other wetland cover types are less able to carry out this function. Playa wetlands have low vegetation cover and do not have much capacity to carry out this function. In depressional wetlands, water flow is primarily one-way, flowing into the wetland. As a result, they can continue to function as wetlands only under very low levels of particulate inflow.

The models for depressional wetlands and groundwater slope wetlands used two indicators, land use adjacent to the wetland and the presence of roads and other barriers within the wetland. For lacustrine fringe wetlands, where water flows both into and out of the wetland, this function was modeled on three indicators, land use within the wetland, land use adjacent to the wetland, and the presence of roads and other barriers within the wetlands.

Existing land use affects both the type and amount of particulates released into wetlands, and land uses that increase or decrease the amount of particulates are expected to adversely affect wetland function. In the study area, highly functional wetlands are surrounded by ungrazed rangeland. As land becomes developed or placed into agriculture, the amount of particulates suspended in runoff increases, as does the amount of runoff conveying the particulates. Therefore, wetlands with a greater proportion of the surrounding land under development or agriculture are expected to have a correspondingly lower ability to remove particulates. Different land use types have varying degrees of impact on this functional indicator; for example, agriculture and residential development are expected to have less effect than commercial or industrial development.

In the study area, highly functional wetlands are unaltered and ungrazed. Grazed and farmed wetlands have increased loading of particulates due to soil disturbance and vegetation removal. Soil disturbance, in conjunction with vegetation removal, increases the potential for particulate export and erosion. Similarly, in the study area, highly functional wetlands lack internal barriers to water flow. The presence of barriers within a wetland affects the ability for particulates to circulate within a wetland. For example, a barrier within a wetland may cause part of the wetland to infill, and part to erode.

The FCUs for particulate retention by wetlands in the study area under existing conditions are provided in Table D-3, and the functional ratings are shown in Figure 3-24b in the Final EIS.

### Flora and Fauna Habitat Support

Wetlands within the Legacy Parkway study area are located along the eastern edge of the GSLE (See Section 4.0.2, *Great Salt Lake Ecosystem*). This ecosystem is noteworthy because it is the largest inland saline lake in the nation. The wetlands around Great Salt Lake support millions of animals, including more than 220 species of birds, 50 species of mammals, 18 species of reptiles and amphibians, 12 species or subspecies of fish, and a host of diverse invertebrates including flies, mosquitoes, and brine shrimp. Great Salt Lake wetlands are a funneling point for migratory birds using the western half of the continent. Wetlands of Great Salt Lake have been identified in the Western Hemisphere Shorebird Reserve Network as a migratory habitat of hemispheric significance. These wetlands provide not only resting and staging areas for migratory birds, but also breeding and nesting areas for many waterfowl, shorebirds, and amphibians that stay in the area. Section 4.13, *Wildlife,* provides a more detailed discussion of wildlife habitat in the study area.

Wetlands are productive environments that provide diversity in the landscape. The flux of nutrients and energy in wetlands is relatively high because of the high growth rate and rapid turnover of the wetland vegetation. Nutrients and compounds in wetlands are broken down into organic compounds by bacterial action, which provides food for invertebrates. These invertebrates are the foundation of the food web that supports vast and varied numbers of wildlife species, from shorebirds to amphibians. Wetlands provide habitat where many plants and animals can fulfill one or more life cycle stages.

The ecotone along the eastern shore of Great Salt Lake is a mosaic of slope and depressional wetlands and upland habitats. This ecotone provides a large number of niches and habitats for organisms. These characteristics allow wetlands in the study area to provide a diverse array of trophic levels (i.e., feeding levels) within both the wetland and surrounding upland environments. Many species utilize the wetlands for feeding and uplands for nesting. The wetlands are also important to wildlife by virtue of their abundance and the combined functions they serve. Small isolated wetlands also provide value to different species during certain times of the year, such as resting places for migratory shorebirds and waterfowl. Connectivity between the wetlands and surrounding uplands is an important component of the habitat support function of wetlands.

Two FCIs were generated for flora and fauna habitat support functions, one for habitat structure and one for habitat connectivity, fragmentation, and patchiness. The models do not assess the extent to which the wetlands provide habitat or whether the habitat is even utilized by wildlife. Instead, the ability of wetlands to provide habitat for wildlife is assumed, and the models are intended solely to assess the quality of wetland habitat support that presently exists and to evaluate changes over time that can be predicted from landscape-level changes.

### Function 4: Habitat Structure

The FCI for habitat structure is an estimate of the ability of a wetland to maintain characteristic vegetation, invertebrate food webs, and vertebrate habitat. This function was modeled on two indicators, land use within the wetland and land use within the adjacent habitat. The more intensely land use disturbs the landscape, the more the characteristic vegetation can change. In the study area, wetlands that provide the highest level of habitat structure are unaltered and ungrazed. With disturbance from grazing, plowing, or grading, the characteristic vegetation can also be susceptible to invasive species (both native and exotic). When wetlands are farmed or overgrazed so that the existing wetland vegetation is removed from the soil surface, wildlife usage changes. Habitat for some species is diminished because there is insufficient vegetation to provide food, shelter or nesting opportunities. However, in some instances, the removal of vegetation results in open areas used by certain shore birds that frequent Great Salt Lake.

Many of the wetlands in the study area are surrounded by ungrazed rangeland. Life cycles of many wildlife species require both wetlands and uplands for feeding, loafing, nesting, and reproduction. Most of the species that utilize both wetlands and adjacent upland habitats fulfill much of their life cycles within 300 meters (1,000 feet) of the wetland perimeter. Changing land uses adjacent to wetlands alters their function as upland habitat.

The FCUs for habitat structure by wetlands in the study area under existing conditions are provided in Table D-3, and the functional ratings are shown in Figure 3-24c in the Final EIS.

### Function 5: Habitat Connectivity, Fragmentation, and Patchiness

The FCI for habitat connectivity, fragmentation, and patchiness is an estimate of the capability for wildlife movement within a wetland, and between the wetland and adjacent upland habitat. This function was modeled on four indicators, the presence of roads and other barriers within the wetland, land use adjacent to the wetland, the ability of the study area wetlands to maintain their characteristic wetland hydrology (Function 1), and land use within the wetland.

Wetlands in the study area that provide the highest level of capability for wildlife movement within a wetland, and between the wetland and adjacent upland habitat, are unaltered, ungrazed, and surrounded by ungrazed rangeland. Barriers between the wetlands and the adjacent uplands prevent some species from moving into or out of the wetlands, making them unable to reproduce or compete their life cycle. Animal species such as large mammals, birds, fish and flying insects are less affected by these barriers. Changing land uses adjacent to wetlands, in addition to altering their function as upland habitat, limit the ability of wildlife to move throughout that habitat. Maintaining the characteristic wetland hydrology is important to this function because many of the wetlands in the study area are part of larger wetland complexes that have hydrologic connections. Altering the wetland hydrology of part of a wetland complex may create a barrier that prevents some species from moving between the wetlands. Changing land uses within wetlands, in addition to altering their function as wetland habitat, limits the ability of wildlife to move throughout that habitat.

The FCUs for habitat connectivity, fragmentation, and patchiness by wetlands in the study area under existing conditions are provided in Table D-3, and the functional ratings are shown in Figure 3-24c in the Final EIS.

# D.3 Environmental Consequences

As described in the Final EIS, all the build alternatives would affect wetland resources in the study area. Two categories of wetland impacts would take place, direct and indirect, characterized according to which wetland functions are being affected. The Final EIS based all discussion of wetland impacts on the three HGM wetland classes described in Section 4.12.2.1. This section separates wetland impacts according to wetland cover types to provide additional ecological context by which to interpret the analysis.

## D.3.1 Direct Impacts

For the initial impact analysis calculations made for the Final EIS, it was assumed that direct impacts associated with the build alternatives would be limited to the area within the proposed action right-of-way and that all the area within the project right-of-way would be directly affected. The impact analysis was carried out by assuming that all wetlands within the project right-of-way would be filled, based on the preliminary design. A separate analysis was carried out for each proposed build alternative.

Fifty-eight wetlands were entirely or partially filled by the initial clearing and grading for the Legacy Parkway or by Legacy-related construction activities associated with the I-15/US-89 interchange in Farmington; the total extent of project-related fill was 19.4 ha (47.9 ac). Five other wetlands were partially filled by construction of temporary access roads in the Legacy Nature Preserve; the total extent of project-related fill in the Preserve was 0.1 ha (0.3 ac). Because these wetlands were filled in conjunction with the Legacy Parkway project, their condition prior to the construction activities was used for assessing baseline conditions.

Table D-4, which updates Table 4-20 in the Final EIS, summarizes the potential direct impacts in terms of the total area affected by each proposed build alternative. Figures 4-14a through 4-14d in the Final EIS show the wetland polygons that would be directly affected by the right-of-way of each build alternative, assuming a 100-m (328-ft) right-of-way.

**Table D-4** Direct Impacts on Wetlands by Wetland Class and Wetland Cover Type (for 100-m [328-ft] Right-of-Way

| | | Area in Hectares (Acres) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Wetland Class | Wetland Cover Type | Alternative A | | Alternative B | | Alternative C | | Alternative D | |
| Depressional | | 0 | (0) | 0 | (0) | 0 | (0) | 0 | (0) |
| Groundwater Slope | Forested Wetland | 0 | (0) | 0 | (0) | 0 | (0) | 0 | (0) |
| Lacustrine Fringe | | 0 | (0) | 0 | (0) | 0 | (0) | 0 | (0) |
| Depressional | Shrub-Scrub | 0 | (0) | 0 | (0) | 0 | (0) | 0 | (0) |
| Groundwater Slope | | 0 | (0) | 0 | (0) | 0 | (0) | 0 | (0) |

| Wetland Class | Wetland Cover Type | Area in Hectares (Acres) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Alternative A | | Alternative B | | Alternative C | | Alternative D | |
| Lacustrine Fringe | | 0 | (0) | 1 | (3) | 0 | (0) | 0 | (0) |
| Depressional | Marsh | 1 | (2) | 2 | (4) | 1 | (2) | 1 | (3) |
| Groundwater Slope | Marsh | 1 | (2) | 4 | (10) | 1 | (4) | 1 | (3) |
| Lacustrine Fringe | Marsh | 8 | (19) | 16 | (38) | 7 | (17) | 7 | (18) |
| Depressional | Wet Meadow | 17 | (43) | 15 | (38) | 17 | (42) | 17 | (42) |
| Groundwater Slope | Wet Meadow | 8 | (19) | 11 | (26) | 7 | (16) | 6 | (14) |
| Lacustrine Fringe | Wet Meadow | 4 | (9) | 7 | (16) | 9 | (23) | 4 | (9) |
| Depressional | Playa | 2 | (5) | 4 | (10) | 6 | (14) | 5 | (12) |
| Groundwater Slope | Playa | 0 | (0) | 2 | (5) | 1 | (4) | 1 | (2) |
| Lacustrine Fringe | Playa | 1 | (2) | 2 | (5) | 6 | (14) | 2 | (4) |
| Depressional | Unconsolidated Shore | 0 | (0) | 0 | (0) | 0 | (0) | 0 | (0) |
| Groundwater Slope | Unconsolidated Shore | 0 | (0) | 0 | (0) | 0 | (0) | 0 | (0) |
| Lacustrine Fringe | Unconsolidated Shore | 0 | (0) | 6 | (15) | 5 | (13) | 0 | (0) |
| Depressional | Open Water | 0 | (0) | 0 | (0) | 0 | (0) | 0 | (0) |
| Groundwater Slope | Open Water | 0 | (0) | 0 | (0) | 0 | (0) | 0 | (0) |
| Lacustrine Fringe | Open Water | 3 | (7) | 7 | (16) | 0 | (0) | 3 | (7) |
| Totals* | | 44 | (108) | 76 | (187) | 60 | (148) | 46 | (114) |

Note:
* Includes acreage of wetlands already filled during previous construction activities.

## D.3.2 Indirect Impacts

Indirect impacts are impacts that occur later and impacts that could affect the function of wetlands located outside the project footprint. The impact analysis determined the area of indirect effects on wetlands by assuming that all wetlands within 305 m (1,000 ft) of the right-of-way would be indirectly affected by a proposed build alternative. For the Legacy Parkway project, the distance of 305 m (1,000 ft) was selected based on the draft *Peninsular Florida Herbaceous Depressional Wetlands Hydrogeomorphic (HGM) Regional Guidebook* (Trott et al. 1997) and on other studies (Anderson and Ohmart 1986). The severity of each indirect impact would vary according to the type of effect and the distance from the road (Forman et al. 2003). In general, indirect impacts are greatest adjacent to the road and attenuate with distance. Some impacts, such as the effects of dissolved substances and suspended particles, may be manifested primarily within a few tens of meters of the road in uplands but up to 100 to 300 m (328 to 984 ft) in wetlands. Other indirect impacts may extend for thousands of meters, such as the introduction of invasive exotics or effects on wildlife use and movement through the wetland habitat. Although the effects of some indirect impacts may spread well beyond 305 m (1,000 ft), the strength of indirect effects, on average, was assumed to drop to undetectable levels at 305 m (1,000 ft). A separate analysis was carried out for each alternative. Table D-5 summarizes quantitatively the potential indirect impacts in relation to the total area affected under each proposed alternative.

**Table D-5** Area of Wetlands Indirectly Affected by Legacy Parkway

| | | Area in Hectares (Acres) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Wetland Class | Wetland Cover Type | Alternative A | | Alternative B | | Alternative C | | Alternative D | |
| Depressional | | 0 | (0) | 0 | (0) | 0 | (0) | 0 | (0) |
| Groundwater Slope | Forested Wetland | 0 | (0) | 0 | (0) | 0 | (0) | 0 | (0) |
| Lacustrine Fringe | | 0 | (0) | 0 | (0) | 0 | (0) | 0 | (0) |
| Depressional | | 0 | (0) | 0 | (0) | 0 | (0) | 0 | (0) |
| Groundwater Slope | Shrub-Scrub | 0 | (0) | 0 | (0) | 0 | (0) | 0 | (0) |
| Lacustrine Fringe | | 0 | (0) | 0 | (1) | 0 | (0) | 0 | (0) |
| Depressional | | 5 | (12) | 6 | (14) | 4 | (10) | 8 | (20) |
| Groundwater Slope | Marsh | 14 | (34) | 13 | (31) | 14 | (35) | 13 | (33) |
| Lacustrine Fringe | | 31 | (76) | 83 | (205) | 75 | (185) | 26 | (63) |
| Depressional | | 43 | (106) | 66 | (163) | 51 | (126) | 45 | (112) |
| Groundwater Slope | Wet Meadow | 45 | (112) | 78 | (193) | 61 | (150) | 45 | (111) |
| Lacustrine Fringe | | 24 | (60) | 64 | (159) | 58 | (143) | 31 | (78) |
| Depressional | | 17 | (42) | 22 | (55) | 17 | (41) | 13 | (32) |
| Groundwater Slope | Playa | 2 | (5) | 12 | (29) | 15 | (37) | 2 | (5) |
| Lacustrine Fringe | | 5 | (12) | 21 | (52) | 28 | (70) | 9 | (23) |
| Depressional | | 0 | (0) | 0 | (0) | 0 | (0) | 0 | (0) |
| Groundwater Slope | Unconsolidated Shore | 0 | (0) | 0 | (0) | 0 | (0) | 0 | (0) |
| Lacustrine Fringe | | 11 | (27) | 24 | (60) | 25 | (61) | 19 | (47) |
| Depressional | Open Water | 1 | (3) | 2 | (5) | 1 | (3) | 1 | (3) |
| Groundwater Slope | | 0 | (0) | 0 | (0) | 0 | (0) | 0 | (0) |

| | | Area in Hectares (Acres) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Wetland Class | Wetland Cover Type | Alternative A | | Alternative B | | Alternative C | | Alternative D | |
| Lacustrine Fringe | | 20 | (48) | 18 | (44) | 18 | (46) | 19 | (47) |
| Totals | | 218 | (539) | 409 | (1011) | 367 | (907) | 233 | (575) |

## D.3.3 Impacts on Wetland Functions

Impacts on wetland functions were quantified using the wetlands functional assessment models developed for the Final EIS (discussed in Section 4.12.1.2). These impacts were determined by using the wetlands functional assessment to calculate the changes in functional capacity index (FCI) for each wetland under both existing and post-build conditions. The change in wetland function was calculated as the difference between pre-build and post-build FCIs. The impact was calculated as the change in wetland function multiplied by the affected area of wetland. All wetland functions would be reduced to zero for wetlands or portions of wetlands that would be directly affected within the right-of-way. For indirect impacts, each wetland function would be reduced in proportion to the distance from the wetland to the right-of-way. This is because the wetlands functional assessment was based on land use change in the area adjacent to the wetland, and the closer the wetland is to the right-of-way, the greater the area that would be affected.

Because wetlands in the study area are connected hydrologically and are functionally integrated as part of a larger wetland ecosystem, adverse effects on one part of a wetland are expected to spread throughout each wetland complex. The wetlands functional assessment models, therefore, determined the change in each function for an entire wetland. Because the indirect impacts were assumed to drop to undetectable levels at 305 m (1,000 ft), only the area within 305 m (1,000 ft) of the right-of-way was included in the impact calculation. The indirect impact was calculated as the change in wetland function multiplied by the area of the wetland within 305 m (1,000 ft) of the project right-of-way.

Impacts on wetland functions were prepared for each wetland category and each wetland cover type and are summarized below by alternative. Tables D-6 to D-10, which update and supplement Tables 4-20 and 4-22 in the Final EIS, present these impacts quantitatively by wetland function. As noted in Section D.2.2, the information on indirect impacts is presented in this format for convenience only. The functional capacities of different wetland functions are not equivalent or additive.

It should be noted that the wetlands functional assessment models did not incorporate proposed measures for project design features to minimize or avoid project impacts, such as placement of culverts to allow surface flows between the east and west sides of the proposed highway. Because the location and efficacy of these features are not known, the models could not account for any reduction in the expected adverse project effects. Therefore, the results of the wetlands functional assessment represent a worst-case scenario. Additional details of the wetlands functional assessment are presented in the *Legacy Parkway Wetland Final HGM Technical Report* (Baseline Data Inc. 2000) and in Appendix B2 of the Legacy Parkway Final EIS.

**Table D-6** Impacts on Function 1—Maintain Wetland Hydrology

| | | Loss in Functional Capacity Units (FCUs) (Direct/Indirect Impact) | | | |
|---|---|---|---|---|---|
| Wetland Classes | Wetland Cover Type | Alternative A | Alternative B | Alternative C | Alternative D |
| Depressional | | 0/0 | 0/0 | 0/0 | 0/0 |
| Groundwater Slope | Forested Wetland | 0/0 | 0/0 | 0/0 | 0/0 |
| Lacustrine Fringe | | 0/0 | 0/0 | 0/0 | 0/0 |
| Depressional | | 0/0 | 0/0 | 0/0 | 0/0 |
| Groundwater Slope | Shrub-Scrub | 0/0 | 0/0 | 0/0 | 0/0 |
| Lacustrine Fringe | | 0/0 | 2/1 | 0/0 | 0/0 |
| Depressional | | 1/0 | 3/1 | 1/0 | 1/1 |
| Groundwater Slope | Marsh | 0/6 | 6/5 | 2/5 | 1/4 |
| Lacustrine Fringe | | 6/19 | 23/63 | 13/54 | 5/16 |
| Depressional | | 32/12 | 29/19 | 31/11 | 30/11 |
| Groundwater Slope | Wet Meadow | 11/19 | 19/50 | 10/28 | 8/14 |
| Lacustrine Fringe | | 3/12 | 12/53 | 16/37 | 4/13 |
| Depressional | | 2/3 | 8/7 | 8/4 | 6/3 |
| Groundwater Slope | Playa | 0/1 | 4/7 | 3/9 | 1/1 |
| Lacustrine Fringe | | 0/2 | 3/14 | 10/16 | 2/3 |
| Depressional | | 0/0 | 0/0 | 0/0 | 0/0 |
| Groundwater Slope | Unconsolidated Shore | 0/0 | 0/0 | 0/0 | 0/0 |
| Lacustrine Fringe | | 0/7 | 13/15 | 12/23 | 0/18 |
| Depressional | | 0/0 | 0/0 | 0/0 | 0/0 |
| Groundwater Slope | Open Water | 0/0 | 0/0 | 0/0 | 0/0 |
| Lacustrine Fringe | | 2/4 | 5/4 | 0/4 | 2/4 |

**Table D-7** Impacts on Function 2—Removal of Dissolved Elements and Compounds

| | | Loss in Functional Capacity Units (FCUs) (Direct/Indirect Impact) | | | |
|---|---|---|---|---|---|
| Wetland Class | Wetland Cover Type | Alternative A | Alternative B | Alternative C | Alternative D |
| Depressional | | 0/0 | 0/0 | 0/0 | 0/0 |
| Groundwater Slope | Forested Wetland | 0/0 | 0/0 | 0/0 | 0/0 |
| Lacustrine Fringe | | 0/0 | 0/0 | 0/0 | 0/0 |
| Depressional | | 0/0 | 0/0 | 0/0 | 0/0 |
| Groundwater Slope | Shrub-Scrub | 0/0 | 0/0 | 0/0 | 0/0 |
| Lacustrine Fringe | | 0/0 | 2/0 | 0/0 | 0/0 |
| Depressional | | 2/1 | 3/1 | 1/1 | 2/2 |
| Groundwater Slope | Marsh | 1/5 | 6/5 | 2/3 | 2/2 |
| Lacustrine Fringe | | 11/5 | 30/28 | 14/28 | 10/6 |
| Depressional | | 28/9 | 26/3 | 27/12 | 30/13 |
| Groundwater Slope | Wet Meadow | 11/19 | 18/39 | 10/12 | 8/16 |
| Lacustrine Fringe | | 6/2 | 14/17 | 20/9 | 4/3 |
| Depressional | | 3/2 | 7/1 | 8/3 | 6/2 |
| Groundwater Slope | Playa | 0/1 | 3/4 | 2/5 | 1/1 |
| Lacustrine Fringe | | 1/0 | 4/4 | 13/2 | 2/1 |
| Depressional | | 0/0 | 0/0 | 0/0 | 0/0 |
| Groundwater Slope | Unconsolidated Shore | 0/0 | 0/0 | 0/0 | 0/0 |
| Lacustrine Fringe | | 0/3 | 13/7 | 12/15 | 0/12 |
| Depressional | | 0/0 | 0/-1 | 0/0 | 0/0 |
| Groundwater Slope | Open Water | 0/0 | 0/0 | 0/0 | 0/0 |
| Lacustrine Fringe | | 4/0 | 9/0 | 0/1 | 4/0 |

**Table D-8** Impacts on Function 3—Particulate Retention

| | | Loss in Functional Capacity Units (FCUs) (Direct/Indirect Impact) | | | |
|---|---|---|---|---|---|
| Wetland Class | Wetland Cover Type | Alternative A | Alternative B | Alternative C | Alternative D |
| Depressional | | 0/0 | 0/0 | 0/0 | 0/0 |
| Groundwater Slope | Forested Wetland | 0/0 | 0/0 | 0/0 | 0/0 |
| Lacustrine Fringe | | 0/0 | 0/0 | 0/0 | 0/0 |
| Depressional | | 0/0 | 0/0 | 0/0 | 0/0 |
| Groundwater Slope | Shrub-Scrub | 0/0 | 0/0 | 0/0 | 0/0 |
| Lacustrine Fringe | | 0/0 | 2/0 | 0/0 | 0/0 |
| Depressional | | 1/1 | 3/0 | 1/0 | 1/2 |
| Groundwater Slope | Marsh | 0/6 | 5/4 | 2/3 | 1/3 |
| Lacustrine Fringe | | 8/13 | 24/47 | 12/32 | 7/9 |
| Depressional | | 31/15 | 29/6 | 30/15 | 30/12 |
| Groundwater Slope | Wet Meadow | 10/20 | 19/43 | 9/13 | 8/10 |
| Lacustrine Fringe | | 4/6 | 12/36 | 17/18 | 5/6 |
| Depressional | | 2/7 | 8/4 | 8/6 | 6/5 |
| Groundwater Slope | Playa | 0/2 | 3/5 | 2/4 | 1/1 |
| Lacustrine Fringe | | 1/1 | 3/10 | 11/7 | 2/1 |
| Depressional | | 0/0 | 0/0 | 0/0 | 0/0 |
| Groundwater Slope | Unconsolidated Shore | 0/0 | 0/0 | 0/0 | 0/0 |
| Lacustrine Fringe | | 0/7 | 11/10 | 10/15 | 0/14 |
| Depressional | | 0/0 | 0/0 | 0/0 | 0/0 |
| Groundwater Slope | Open Water | 0/0 | 0/0 | 0/0 | 0/0 |
| Lacustrine Fringe | | 3/0 | 7/4 | 0/1 | 2/0 |

**Table D-9** Impacts on Function 4—Habitat Structure

| | | Loss in Functional Capacity Units (FCUs) (Direct/Indirect Impact) | | | |
|---|---|---|---|---|---|
| Wetland Class | Wetland Cover Type | Alternative A | Alternative B | Alternative C | Alternative D |
| Depressional | | 0/0 | 0/0 | 0/0 | 0/0 |
| Groundwater Slope | Forested Wetland | 0/0 | 0/0 | 0/0 | 0/0 |
| Lacustrine Fringe | | 0/0 | 0/0 | 0/0 | 0/0 |
| Depressional | | 0/0 | 0/0 | 0/0 | 0/0 |
| Groundwater Slope | Shrub-Scrub | 0/0 | 0/0 | 0/0 | 0/0 |
| Lacustrine Fringe | | 0/0 | 2/0 | 0/0 | 0/0 |
| Depressional | | 1/1 | 2/1 | 1/0 | 1/2 |
| Groundwater Slope | Marsh | 1/5 | 7/5 | 2/4 | 2/3 |
| Lacustrine Fringe | | 8/-1 | 21/39 | 9/27 | 8/8 |
| Depressional | | 19/6 | 19/11 | 19/7 | 18/7 |
| Groundwater Slope | Wet Meadow | 12/15 | 19/37 | 11/18 | 9/10 |
| Lacustrine Fringe | | 4/-2 | 10/27 | 13/17 | 4/5 |
| Depressional | | 2/2 | 5/2 | 5/2 | 4/1 |
| Groundwater Slope | Playa | 0/1 | 3/4 | 3/5 | 1/1 |
| Lacustrine Fringe | | 1/-1 | 3/8 | 9/8 | 2/1 |
| Depressional | | 0/0 | 0/0 | 0/0 | 0/0 |
| Groundwater Slope | Unconsolidated Shore | 0/0 | 0/0 | 0/0 | 0/0 |
| Lacustrine Fringe | | 0/0 | 7/12 | 7/12 | 0/9 |
| Depressional | | 0/0 | 0/0 | 0/0 | 0/0 |
| Groundwater Slope | Open Water | 0/0 | 0/0 | 0/0 | 0/0 |
| Lacustrine Fringe | | 3/-4 | 7/1 | 0/1 | 3/0 |

**Table D-10** Impacts on Function 5—Habitat Connectivity, Fragmentation, and Patchiness

| | | Loss in Functional Capacity Units (FCUs) (Direct/Indirect Impact) | | | |
|---|---|---|---|---|---|
| Wetland Class | Wetland Cover Type | Alternative A | Alternative B | Alternative C | Alternative D |
| Depressional | | 0/0 | 0/0 | 0/0 | 0/0 |
| Groundwater Slope | Forested Wetland | 0/0 | 0/0 | 0/0 | 0/0 |
| Lacustrine Fringe | | 0/0 | 0/0 | 0/0 | 0/0 |
| Depressional | | 0/0 | 0/0 | 0/0 | 0/0 |
| Groundwater Slope | Shrub-Scrub | 0/0 | 0/0 | 0/0 | 0/0 |
| Lacustrine Fringe | | 0/0 | 2/0 | 0/0 | 0/0 |
| Depressional | | 1/2 | 2/2 | 1/0 | 1/2 |
| Groundwater Slope | Marsh | 1/6 | 6/4 | 2/5 | 2/4 |
| Lacustrine Fringe | | 7/7 | 20/44 | 10/29 | 7/9 |
| Depressional | | 26/15 | 24/22 | 25/15 | 24/15 |
| Groundwater Slope | Wet Meadow | 11/20 | 19/44 | 10/34 | 8/16 |
| Lacustrine Fringe | | 4/2 | 10/34 | 14/23 | 4/8 |
| Depressional | | 2/4 | 6/5 | 6/3 | 5/3 |
| Groundwater Slope | Playa | 0/1 | 4/7 | 3/11 | 1/1 |
| Lacustrine Fringe | | 1/0 | 3/9 | 9/12 | 2/2 |
| Depressional | | 0/0 | 0/0 | 0/0 | 0/0 |
| Groundwater Slope | Unconsolidated Shore | 0/0 | 0/0 | 0/0 | 0/0 |
| Lacustrine Fringe | | 0/3 | 9/10 | 8/12 | 0/12 |
| Depressional | | 0/0 | 0/1 | 0/0 | 0/0 |
| Groundwater Slope | Open Water | 0/0 | 0/0 | 0/0 | 0/0 |
| Lacustrine Fringe | | 2/-1 | 6/1 | 0/2 | 2/1 |

# D.4 Mitigation Measures

The Final SEIS identifies Alternative E as the Final Supplemental EIS Preferred Alternative; the following section compares impacts and mitigation measures for that alternative. Accordingly, the following discussion of the Legacy Nature Preserve is based on impacts that would be associated with Alternative E. If the lead agencies were to authorize construction of a build alternative other than Alternative E, a mitigation package commensurate with the package proposed for Alternative E (i.e., based on a comparable analysis, the same principles, and the same mitigation ratios) would be proposed, with input from the Corps and other regulatory agencies. The *Analysis of the Adequacy of Wetland and Wildlife Mitigation Technical Report* (Appendix E of the Final Supplemental EIS), which was prepared subsequently to this appendix, provides a history of the Legacy Nature Preserve; an evaluation of proposed mitigation measures; and a detailed accounting of impacts relative to mitigation in a variety of formats, including functional capacity units, vegetation cover types, and wildlife habits. The following discussion is based on the 849-ha (2,098-ac) Legacy Nature Preserve, as described in Section 4.12.3.4, *Mitigation Measures*, of the Final Supplemental EIS. Consequently, the mitigation credits, acres of mitigation, and mitigation ratios are higher than those presented in the Final EIS because the impacts associated with Alternative E (Supplemental EIS Preferred Alternative) are less than those associated with Alternative D (Final EIS Preferred Alternative), and because additional lands were added to the Legacy Nature Preserve after completion of the Final EIS Record of Decision.

### D.4.1 Credit for Preservation

To determine the benefits of preservation on wetland functions, the Final EIS calculated preservation credits by calculating the difference between FCUs under existing conditions and FCUs under the No-Build Alternative (future 2020 conditions). The future conditions No-Build Alternative described in the Final EIS was based on the assumption that future development could proceed without filling wetlands or land below the FEMA floodplain elevation of 4,212 feet, but that there would be a substantial loss of wetland functions resulting from development of adjacent uplands. The wetlands functional assessment models were used to predict the level of loss of wetland functions; these predictions were based on the assumption that at the current rate of development, all the developable uplands[1] in the study area would be developed by 2020. Under the No-Build Alternative, most wetland functions in the preserve areas would be reduced from 30 to 50 percent by indirect impacts by 2020, even if no wetlands were filled. The prevention of this loss of wetland functions would be the benefit conferred by preservation.

In the Final EIS, the number of preservation credits counted for mitigation was discounted by one-half because future development would not be expected to occur all at once and would be distributed between the present and the expected 2020 build-out. The net benefit of preservation would be proportional to the pace of development; i.e., the sooner that development would occur, the greater the benefit would be provided by preservation. If all the development were expected to occur immediately, then the preservation benefit would be realized immediately. If no development were expected to occur by 2020, then no benefit of immediate preservation would be realized. Assuming that development would proceed at a linear pace, the benefit would be intermediate between these two extremes, or about one-half that which would be expected if all the development were to occur immediately.

[1] The term *developable uplands* does not include any jurisdictional wetlands or land below the FEMA floodplain elevation of 4,212 feet.

### D.4.2 Credit for Restoration

As described in the Final EIS, the wetlands functional assessment models were used to analyze the restoration potential of wetlands in the Preserve. Restoration credits were determined by calculating the difference between FCUs under restored conditions and FCUs under existing conditions. The Final EIS recognized that, because some wetlands in the Preserve were within 305 m (1,000 ft) of Legacy Parkway, indirect impacts caused by the proposed action would reduce the effectiveness of the mitigation measures. Accordingly, the mitigation credits were debited by the amount of FCUs that would be lost due to the influence of the Parkway, as determined in the wetlands functional assessment. The assessment of indirect impacts did not reflect highway design features (e.g., vegetated filter strips, surface water conveyance structures) designed to minimize indirect impacts on wetland functions.

### D.4.3 Credit for Creation

After evaluating the mitigation contained in the Final EIS Record of Decision, the Corps added a condition to the Section 404 permit requiring that UDOT create slope wetlands by drilling a minimum of two groundwater wells. Accordingly, two artesian wells would be drilled in the Legacy Nature Preserve to create the wetland hydrology necessary to support wetland habitat. Approximately 4.9 ha (12 ac) of groundwater slope wetlands would be created within the Preserve. The 4.9 ha (12 ac) of created wetlands are not included in Table D-11 because the level of wetland function has not been determined.

### D.4.4 Applying the Mitigation Credits

In the Final EIS, the total wetland mitigation credits were calculated by adding the preservation credits to the restoration credits and subtracting credits that would be lost due to the influence of the Parkway. However, the Final EIS erred by summing the mitigation credits for all wetland functions and for all wetland classes and cover types. As noted in Section D.2, FCUs are not equivalent or comparable for different functions, nor are they equivalent or comparable between different wetland classes and wetland cover types. It is incorrect to assert that mitigation credits for one function offset impacts on another function. For example, a 100-acre concrete-lined water detention basin would have a very high water storage capacity (100 FCUs of water storage function) but very little habitat function, and a highly functional 100-acre wet meadow would have little water storage function but would provide very high-quality habitat (100 FCUs of habitat structure function). Clearly, creating 100 FCUs of water storage function in a detention basin would not be comparable to nor would it compensate for the loss of 100 FCUs of wet meadow habitat function.

To compare wetland impacts with the mitigation credits generated through preservation and restoration, for the Supplemental EIS, the mitigation credits were summarized for wetland function by wetland class and cover type (Table D-11). The net effect for each wetland class and cover type was calculated by adding FCUs for the mitigation credits to the FCUs that would be lost by project construction. If the mitigation credits would offset the impact, the net effect would be 0. If the mitigation credits would not offset the impact, the net effect is a negative number. If the mitigation credits would exceed the impact, then the net effect is a positive number.

**Table D-11** Mitigation by Wetland Function

| Wetland Cover Type | Wetland Class | Impact Direct/Indirect | Mitigation | | | |
|---|---|---|---|---|---|---|
| | | | Preserve | Restore | Hwy Influence | Net Effect |
| ***Function 1— Maintain Wetland Hydrology*** | | | | | | |
| Forested Wetland | Depressional | 0/0 | 0 | 0 | 0 | 0 |
| | Slope | 0/0 | 0 | 0 | 0 | 0 |
| | Lacustrine Fringe | 0/0 | 0 | 0 | 0 | 0 |
| Shrub-Scrub | Depressional | 0/0 | 0 | 0 | 0 | 0 |
| | Slope | 0/0 | 0 | 0 | 0 | 0 |
| | Lacustrine Fringe | 0/0 | 0 | 0 | 0 | 0 |
| Marsh | Depressional | -1/-1 | 0 | 0 | 0 | -2 |
| | Slope | -1/-4 | 1 | 0 | 0 | -4 |
| | Lacustrine Fringe | -5/-16 | 14 | 13 | -4 | 2 |
| Wet Meadow | Depressional | -30/-11 | 7 | 10 | -3 | -28 |
| | Slope | -8/-14 | 22 | 0 | -9 | -8 |
| | Lacustrine Fringe | -4/-13 | 27 | 33 | -8 | 35 |
| Playa | Depressional | -6/-3 | 8 | 14 | -3 | 10 |
| | Slope | -1/-1 | 8 | 0 | 0 | 6 |
| | Lacustrine Fringe | -2/-3 | 14 | 23 | -2 | 30 |
| Unconsolidated Shore | Depressional | 0/0 | 0 | 0 | 0 | 0 |
| | Slope | 0/0 | 0 | 0 | 0 | 0 |
| | Lacustrine Fringe | 0/-18 | 3 | 1 | -10 | -24 |
| Open Water | Depressional | 0/0 | 0 | 0 | 0 | 0 |
| | Slope | 0/0 | 0 | 0 | 0 | 0 |
| | Lacustrine Fringe | -2/-4 | 1 | 1 | 0 | -4 |
| ***Function 2—Removal of Dissolved Elements and Compounds*** | | | | | | |
| Forested Wetland | Depressional | 0/0 | 0 | 0 | 0 | 0 |
| | Slope | 0/0 | 0 | 0 | 0 | 0 |
| | Lacustrine Fringe | 0/0 | 0 | 0 | 0 | 0 |
| Shrub-Scrub | Depressional | 0/0 | 0 | 0 | 0 | 0 |
| | Slope | 0/0 | 0 | 0 | 0 | 0 |
| | Lacustrine Fringe | 0/0 | 0 | 0 | 0 | 0 |
| Marsh | Depressional | -2/-2 | 0 | 0 | 0 | -4 |
| | Slope | -2/-2 | 0 | 2 | 0 | -3 |
| | Lacustrine Fringe | -10/-6 | 5 | 28 | -4 | 13 |

| Wetland Cover Type | Wetland Class | Impact Direct/Indirect | Mitigation | | | |
|---|---|---|---|---|---|---|
| | | | Preserve | Restore | Hwy Influence | Net Effect |
| Wet | Depressional | -30/-13 | 0 | 18 | -2 | -28 |
| Meadow | Slope | -8/-16 | -5 | 25 | -4 | -9 |
| | Lacustrine Fringe | -4/-3 | -1 | 52 | -2 | 42 |
| Playa | Depressional | -6/-2 | 1 | 18 | -2 | 9 |
| | Slope | -1/-1 | -1 | 9 | 0 | 6 |
| | Lacustrine Fringe | -2/-1 | 0 | 28 | -1 | 24 |
| Unconsolidated | Depressional | 0/0 | 0 | 0 | 0 | 0 |
| Shore | Slope | 0/0 | 0 | 0 | 0 | 0 |
| | Lacustrine Fringe | 0/-12 | 3 | 6 | -10 | -14 |
| Open Water | Depressional | 0/0 | 0 | 0 | 0 | 0 |
| | Slope | 0/0 | 0 | 0 | 0 | 0 |
| | Lacustrine Fringe | -4/0 | 0 | 2 | 0 | -2 |
| ***Function 3— Particulate Retention*** | | | | | | |
| Forested Wetland | Depressional | 0/0 | 0 | 0 | 0 | 0 |
| | Slope | 0/0 | 0 | 0 | 0 | 0 |
| | Lacustrine Fringe | 0/0 | 0 | 0 | 0 | 0 |
| Shrub-Scrub | Depressional | 0/0 | 0 | 0 | 0 | 0 |
| | Slope | 0/0 | 0 | 0 | 0 | 0 |
| | Lacustrine Fringe | 0/0 | 0 | 0 | 0 | 0 |
| Marsh | Depressional | -1/-2 | 0 | 0 | 0 | -3 |
| | Slope | -1/-3 | 1 | 1 | 0 | -2 |
| | Lacustrine Fringe | -7/-9 | -1 | 36 | -3 | 16 |
| Wet | Depressional | -30/-12 | 14 | 9 | -4 | -22 |
| Meadow | Slope | -8/-10 | 14 | 16 | -3 | 9 |
| | Lacustrine Fringe | -5/-6 | 21 | 46 | -3 | 53 |
| Playa | Depressional | -6/-5 | 15 | 13 | -4 | 12 |
| | Slope | -1/-1 | 5 | 6 | 0 | 9 |
| | Lacustrine Fringe | -2/-1 | 12 | 29 | -1 | 37 |
| Unconsolidated | Depressional | 0/0 | 0 | 0 | 0 | 0 |
| Shore | Slope | 0/0 | 0 | 0 | 0 | 0 |
| | Lacustrine Fringe | 0/-14 | -4 | 8 | -9 | -19 |
| Open Water | Depressional | 0/0 | 0 | 0 | 0 | 0 |
| | Slope | 0/0 | 0 | 0 | 0 | 0 |
| | Lacustrine Fringe | -2/0 | 0 | 2 | 0 | -1 |

| Wetland Cover Type | Wetland Class | Impact Direct/Indirect | Mitigation | | | |
|---|---|---|---|---|---|---|
| | | | Preserve | Restore | Hwy Influence | Net Effect |
| ***Function 4— Habitat Structure*** | | | | | | |
| Forested Wetland | Depressional | 0/0 | 0 | 0 | 0 | 0 |
| | Slope | 0/0 | 0 | 0 | 0 | 0 |
| | Lacustrine Fringe | 0/0 | 0 | 0 | 0 | 0 |
| Shrub-Scrub | Depressional | 0/0 | 0 | 0 | 0 | 0 |
| | Slope | 0/0 | 0 | 0 | 0 | 0 |
| | Lacustrine Fringe | 0/0 | 0 | 0 | 0 | 0 |
| Marsh | Depressional | -1/-2 | 0 | 0 | 0 | -3 |
| | Slope | -2/-3 | 1 | 1 | 0 | -3 |
| | Lacustrine Fringe | -8/-8 | 10 | 70 | -3 | 62 |
| Wet | Depressional | -18/-7 | 6 | 28 | -2 | 8 |
| Meadow | Slope | -9/-10 | 16 | 12 | -4 | 5 |
| | Lacustrine Fringe | -4/-5 | 15 | 81 | -3 | 83 |
| Playa | Depressional | -4/-1 | 6 | 30 | -1 | 30 |
| | Slope | -1/-1 | 6 | 5 | 0 | 8 |
| | Lacustrine Fringe | -2/-1 | 7 | 53 | -1 | 56 |
| Unconsolidated | Depressional | 0/0 | 0 | 0 | 0 | 0 |
| Shore | Slope | 0/0 | 0 | 0 | 0 | 0 |
| | Lacustrine Fringe | 0/-9 | 3 | 22 | -8 | 7 |
| Open Water | Depressional | 0/0 | 0 | 1 | 0 | 1 |
| | Slope | 0/0 | 0 | 0 | 0 | 0 |
| | Lacustrine Fringe | -3/0 | 0 | 3 | 0 | 1 |
| ***Function 5— Habitat Connectivity, Fragmentation, and Patchiness*** | | | | | | |
| Forested Wetland | Depressional | 0/0 | 0 | 0 | 0 | 0 |
| | Slope | 0/0 | 0 | 0 | 0 | 0 |
| | Lacustrine Fringe | 0/0 | 0 | 0 | 0 | 0 |
| Shrub-Scrub | Depressional | 0/0 | 0 | 0 | 0 | 0 |
| | Slope | 0/0 | 0 | 0 | 0 | 0 |
| | Lacustrine Fringe | 0/0 | 0 | 0 | 0 | 0 |
| Marsh | Depressional | -1/-2 | 0 | 0 | 0 | -4 |
| | Slope | -2/-4 | 2 | 0 | 0 | -3 |
| | Lacustrine Fringe | -7/-9 | 12 | 43 | -4 | 36 |
| Wet | Depressional | -24/-15 | 10 | 20 | -3 | -12 |
| Meadow | Slope | -8/-16 | 25 | 6 | -9 | -2 |

| Wetland Cover Type | Wetland Class | Impact Direct/Indirect | Mitigation | | | |
|---|---|---|---|---|---|---|
| | | | Preserve | Restore | Hwy Influence | Net Effect |
| Playa | Lacustrine Fringe | -4/-8 | 18 | 59 | -6 | 59 |
| | Depressional | -5/-3 | 10 | 23 | -2 | 23 |
| | Slope | -1/-1 | 9 | 2 | 0 | 9 |
| Unconsolidated Shore | Lacustrine Fringe | -2/-2 | 8 | 37 | -2 | 40 |
| | Depressional | 0/0 | 0 | 0 | 0 | 0 |
| | Slope | 0/0 | 0 | 0 | 0 | 0 |
| Open Water | Lacustrine Fringe | 0/-12 | 3 | 11 | -9 | -7 |
| | Depressional | 0/0 | 0 | 0 | 0 | 0 |
| | Slope | 0/0 | 0 | 0 | 0 | 0 |
| | Lacustrine Fringe | -2/-1 | 1 | 2 | 0 | 0 |

### *D.4.5 Mitigation Ratios*

The ratio of mitigation area to impact area is often used as a surrogate for evaluating wetland impacts, when information on wetlands functions is lacking or incomplete. The Final EIS stated that mitigation for each project alternative would include preservation at a mitigation ratio of 10:1 (10 times as much area preserved as wetland area lost). However, this statement is only partially correct. As clarified in the Wetland Mitigation Plan (Appendix B3 of the Final EIS), the proposed ratio of wetlands preserved to wetlands lost was between 3 and 4 to 1 (wetland area preserved to wetland area lost). This ratio rose to 6.8:1 with the additional mitigation lands proximate to the FBWMA added to the Legacy Nature Preserve associated with Alternative D (Final EIS Preferred Alternative) at the request of USFWS. This preservation ratio does not address indirect impacts on wetlands. Table D-12 summarizes the area of wetlands directly affected, indirectly affected, and preserved under Alternative E. Because wetland functions are not equivalent or comparable between different wetland classes and wetland cover types, the wetlands are separated according to wetland class and cover type.

Under Alternative E, 45 ha (113 ac) of wetlands would be lost, and wetland functions would be reduced in another 233 ha (575 ac) of wetlands. Mitigation for these impacts would be to preserve and restore 315 ha (778 ac) of wetlands, for a preservation/restoration to loss ratio of 6.8:1. The mitigation ratios vary according to the wetland class and cover type. Wet meadow in depressional wetlands, which has the greatest amount of direct impacts, is mitigated at a ratio of 1.8:1. Playa in lacustrine fringe wetlands, which is subject to a low level of direct impact, has the highest mitigation ratio at 26.8:1.

**Table D-12** Comparison of Wetland Impacts vs. Wetlands Restored and Preserved (hectares [acres])

| Wetland Cover Type | Wetland Class | Direct Impacts | Indirect Impacts | Restored / Preserved | Mitigation Ratio (Preserved:Direct) |
|---|---|---|---|---|---|
| Forested Wetland | Depressional | 0 (0) | 0 (0) | 0 (0) | – |
| | Slope | 0 (0) | 0 (0) | 0 (0) | – |
| | Lacustrine Fringe | 0 (0) | 0 (0) | 0 (0) | – |
| Shrub-Scrub | Depressional | 0 (0) | 0 (0) | 0 (0) | – |
| | Slope | 0 (0) | 0 (0) | 0 (0) | – |
| | Lacustrine Fringe | 0 (0) | 0 (0) | 0 (0) | – |
| Marsh | Depressional | 1 (3) | 8 (20) | 0 (1) | 0.3:1 |
| | Slope | 1 (3) | 13 (33) | 3 (6) | 2:1 |
| | Lacustrine Fringe | 7 (18) | 26 (63) | 57 (140) | 7.8:1 |
| Wet | Depressional | 17 (42) | 45 (112) | 30 (74) | 1.8:1 |
| Meadow | Slope | 6 (14) | 45 (111) | 40 (99) | 7.1:1 |
| | Lacustrine Fringe | 4 (9) | 31 (78) | 73 (179) | 19.9:1 |
| Playa | Depressional | 5 (12) | 13 (32) | 33 (81) | 6.8:1 |
| | Slope | 1 (2) | 2 (5) | 15 (36) | 18:1 |
| | Lacustrine Fringe | 2 (4) | 9 (23) | 43 (107) | 26.8:1 |
| Unconsolidated | Depressional | 0 (0) | 0 (0) | 0 (0) | – |
| Shore | Slope | 0 (0) | 0 (0) | 0 (0) | – |
| | Lacustrine Fringe | 0 (0) | 19 (47) | 19 (47) | – |
| Open Water | Depressional | 0 (0) | 1 (3) | 0 (1) | – |
| | Slope | 0 (0) | 0 (0) | 0 (0) | – |
| | Lacustrine Fringe | 3 (7) | 19 (47) | 3 (6) | 0.9:1 |
| Totals | | 46 (114) | 233 (575) | 315 (778) | 6.8:1 |

Mitigation ratios for wetland functions (Table D-13) were determined using the FCIs determined by the wetlands functional assessment performed for the Final EIS. These ratios were determined by comparing the changes in FCIs for direct and indirect impacts with the changes in FCIs for wetland restoration on the basis of the areas of impact and restoration (Clairain 2003). The FCI ratios of mitigation wetlands to wetland impacts by wetland class vary by wetland function. They range from 1.2:1 to 6.3:1 for lacustrine fringe wetlands, from 0.5:1 to 1.5:1 for depressional wetlands, and from 1.3:1 to 2.4:1 for groundwater slope wetlands.

**Table D-13** Comparison of Wetland impacts and Mitigation

| | Direct Impacts (56.34 acres) | | Indirect Impacts (167.61 acres) | | Mitigation Preserve (156.89 acres) | | Mitigation Ratio |
|---|---|---|---|---|---|---|---|
| Depressional | Pre-Project | Post-Project | Pre-Project | Post-Project | Pre-mitigation | Post-Mitigation | |
| FCI 1 | 0.68 | 0.00 | 0.72 | 0.62 | 0.79 | 0.95 | 0.45 |
| FCI 2 | 0.66 | 0.00 | 0.72 | 0.62 | 0.78 | 1.00 | 0.62 |
| FCI 3 | 0.68 | 0.00 | 0.74 | 0.63 | 0.82 | 0.99 | 0.48 |
| FCI 4 | 0.46 | 0.00 | 0.51 | 0.45 | 0.62 | 0.97 | 1.50 |
| FCI 5 | 0.57 | 0.00 | 0.61 | 0.49 | 0.68 | 0.97 | 0.86 |
| | Direct Impacts (37.84 acres) | | Indirect Impacts (257.34 acres) | | Mitigation Preserve (480.56 acres) | | Mitigation Ratio |
| Lacustrine | Pre-Project | Post-Project | Pre-Project | Post-Project | Pre-mitigation | Post-Mitigation | |
| FCI 1 | 0.54 | 0.00 | 0.58 | 0.39 | 0.57 | 0.74 | 1.21 |
| FCI 2 | 0.74 | 0.00 | 0.80 | 0.74 | 0.73 | 0.95 | 2.44 |
| FCI 3 | 0.58 | 0.00 | 0.60 | 0.52 | 0.57 | 0.79 | 2.38 |
| FCI 4 | 0.51 | 0.00 | 0.53 | 0.46 | 0.47 | 0.95 | 6.30 |
| FCI 5 | 0.49 | 0.00 | 0.51 | 0.41 | 0.48 | 0.80 | 3.40 |
| | Direct Impacts (19.79 acres) | | Indirect Impacts (149.64 acres) | | Mitigation Preserve (140.99 acres) | | Mitigation Ratio |
| Slope | Pre-Project | Post-Project | Pre-Project | Post-Project | Pre-Mitigation | Post-Mitigation | |
| FCI 1 | 0.48 | 0.00 | 0.49 | 0.36 | 0.70 | 1.00 | 1.52 |
| FCI 2 | 0.54 | 0.00 | 0.56 | 0.46 | 0.76 | 1.00 | 1.33 |
| FCI 3 | 0.44 | 0.00 | 0.46 | 0.38 | 0.72 | 1.00 | 1.87 |
| FCI 4 | 0.60 | 0.00 | 0.61 | 0.51 | 0.56 | 1.00 | 2.41 |
| FCI 5 | 0.52 | 0.00 | 0.52 | 0.41 | 0.60 | 1.00 | 2.09 |

FCIs presented are the average for all wetlands within each wetland class.

### D.4.6 Determining the Adequacy of Mitigation

This section summarizes the assessment provided in Appendix E on the potential for the proposed mitigation to offset the effects of Alternative E on wetlands. As described above, Appendix E provides a history of the Legacy Nature Preserve; an evaluation of proposed mitigation measures; and a detailed accounting of impacts relative to mitigation in a variety of formats, including functional capacity units, vegetation cover types, and wildlife habits.

Wetland mitigation ratios for projects permitted by the Corps in Salt Lake and Davis Counties for the past 12 years ranged from 0:1 to 7.1:1; for Davis County, the average was 1.9 acres created for each acre of wetland affected. The 6.8:1 mitigation ratio proposed for Legacy Parkway is on the high end of this range. The results of mitigation for most wetlands and wetland functions would be a substantial net gain in wetland functions or only a small net loss of wetland functions (Table D-11). Mitigation ratios by wetland class would be 2.8:1 for depressional wetlands, 7.4:1 for groundwater slope wetlands, and 12.6:1 for lacustrine fringe wetlands. Overall, only wet meadow in depressional wetlands would have a substantial net loss of wetland functions, which would be compensated for by mitigating at higher ratios in the lacustrine fringe wetland class. Using a different wetland class to compensate for the loss of another type is considered out-of-kind mitigation.

Federal wetlands mitigation guidelines generally require in-kind replacement when the affected resource is locally important. Although mitigation for Legacy Parkway would be carried out on site (the Legacy Nature Preserve is contiguous with or adjacent to the impact area), only part of the mitigation would be in kind. Mitigating all of the wetland impacts in kind is not feasible because wetland types and functions are not uniform across the study area. The Legacy Nature Preserve is located on the west side of the study area and consists primarily of lacustrine fringe wetlands, whereas Alternative E would primarily affect wetlands along the east side of the study area, most of which are depressional and groundwater slope wetlands. In addition, not all wetland functions would respond to the proposed restoration and enhancement to the same degree. For example, wildlife habitat functions would gain substantially more from the restoration measures than would wetland hydrology or water quality functions.

Federal guidelines allow out-of-kind mitigation when the environmental benefit it provides is greater than that provided by in-kind mitigation. For example, the Legacy Nature Preserve undermitigates impacts on wet meadows in the depressional class but, as shown in Tables D-11 and D-12, overmitigates for impacts on playa habitats across all functions and wetland classes. Playa wetlands are uncommon compared to marsh or meadow wetlands, and preserving and restoring playa wetlands provides greater benefit than preserving and restoring marsh or meadow wetlands. The Corps could view the proportionally higher level of mitigation for impacts on playa than on meadow wetlands as acceptable because playas are important and unique. Because the wildlife habitat function of Great Salt Lake and its wetland ecosystem is highly valued, restoration of wildlife habitat functions provides greater benefit than restoring hydrology or water quality functions, which may already be functioning at high levels. Moreover, many of the wetlands classified as lacustrine fringe wetlands function as depressional wetlands except when lake levels are very high. Because they are not frequently inundated and therefore are dependant on precipitation, their hydrology and the vegetation cover are similar to depressional wetlands. Therefore, viewing the mitigation as out-of-kind may be overstating the differences between the two wetland classes. See subsection *Summary Comparison of Wetland Impacts to Mitigation* in Section 2.1.3 of Appendix E for detailed discussion of how lacustrine fringe wetlands function as depressional wetlands.

# D.5 References Cited

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